Attachment C

Geotechnical Report

REPORT

GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS

Permanente Quarry Reclamation Plan Update
Santa Clara County, California

Submitted To: Lehigh Southwest Cement Company
24001 Stevens Creek Boulevard
Cupertino, California 95014

Submitted By: Golder Associates Inc.
425 Lakeside Drive
Sunnyvale, CA 94085

Golder Associates Inc.
1000 Enterprise Way
Sacramento, CA 95678

Golder Associates Inc.
595 Double Eagle Court, Suite 1000
Reno, NV 89521

May 2010

Project 063-7109

A world of capabilities delivered locally

Golder Associates

EXECUTIVE SUMMARY

Golder Associates Inc. (Golder) is submitting this report to Lehigh Southwest Cement Company (Lehigh) documenting the results of geotechnical investigations and slope stability evaluations completed for Lehigh's Permanente Quarry (the Quarry) located in Santa Clara County, California. The slope stability evaluations were completed to verify that the proposed reclamation of these areas complies with the applicable slope stability-related provisions of the Surface Mining and Reclamation Act (SMARA) and to assist Lehigh with on-going development of the quarry.

The Permanente Quarry is located at the west end of Stevens Creek Road southwest of Cupertino, CA near the southern portion of the San Francisco Peninsula. Lehigh excavates limestone from the quarry for the production of cement and aggregate at the production facilities located on site. Limestone that is of suitable grade is used for cement production; lower grade limestone is used for aggregate. Unsuitable rock materials (overburden) excavated from the quarry are placed in permanent stockpiles that are referred to as material Storage areas.

The bedrock materials exposed in the quarry are part of the Permanente Terrane of the Franciscan Assemblage. The Franciscan Assemblage is comprised of highly-deformed and variably metamorphosed, marine sedimentary rocks with submarine basalt (greenstone), chert, and limestone. The Franciscan is considered a tectonic mélange which was formed in the subduction zone between the Pacific tectonic plate and the North American plate. This plate boundary is now a transform, strike-slip plate boundary defined by the San Andreas Fault zone located about two miles southwest of the quarry.

The lithology and highly sheared and deformed character of the rocks has affected the overall mass strength of the bedrock materials creating localized conditions susceptible to potential slope instabilities. In addition, the major discontinuities within the mélange – such as shear zones, faults and in the case of the limestone units, bedding planes – serve as potential planes of weakness which are potentially susceptible to slope instability given adverse orientations with respect to the quarry cutslopes.

Proposed reclamation activities for the Quarry include, but are not limited to, grading and revegetation of five main areas:

- The main quarry, referred to as the "North Quarry"
- The "South Quarry", which is a newly proposed quarry located south of Permanente Creek, and
- The West Materials Storage Area (WMSA) located at the west end of the Quarry
- The East and Central Materials Storage Areas (EMSA/CMSA) located near the Quarry entrance to the east
- The Topsoil Storage Area, where stripped topsoil materials from the South Quarry will be temporarily stockpiled for future reclamation activities

The proposed end use of the reclaimed areas is undeveloped open space. Proposed reclamation work and requirements for each of these areas vary and are discussed in more detail in the following sections of this summary.

Golder's primary task for each of the reclamation areas was to evaluate the stability conditions of the proposed final slope configurations under static conditions and also under seismic loading. The geologic and geotechnical conditions of each area were evaluated so that the existing stability, or Factor of Safety (FOS), for each area could be determined. The Factor of Safety is defined as the ratio of forces resisting failure to those driving failure. Under static conditions (i.e. no earthquake loading), a FOS of 1.0 indicates the forces are equal, and the slope is at the point of failure; a FOS greater than 1.0 indicates the slope is stable. Following the evaluation of the current FOS, the FOS for each area following the proposed reclamation was calculated to confirm compliance with the requirements of SMARA. The seismic stability for each area was also evaluated for the post-reclamation condition by evaluating the potential for seismically-induced displacements in accordance with industry standard methods and procedures.

North Quarry

The North Quarry has been mined since the late 1930's resulting in cutslopes up to approximately 800 to 1000 feet in height. The quarry has historically experienced areas of localized instability in the excavated pit walls. These areas include landslides, or slope failures, referred to as the:

- Main Slide (1987)
- Scenic Easement Slide
- Mid-Peninsula Slide

Each of the above areas was evaluated by Golder for the purposes of developing options for stabilizing the slides as part of reclamation. The proposed reclamation of the North Quarry entails backfilling of the quarry with approximately 80 million tons of overburden rock derived from mining of the proposed South Quarry. The resulting rockfill will form a large buttress, hundreds of feet thick, stacked at a slope angle of 2.5 horizontal to 1 vertical maximum (21.8 degrees) against the west, north, and east walls of the quarry. The placement of the rockfill buttress provides a robust increase in the FOS for all the landslide areas – generally in the range of 1.5 or greater. Calculated seismic deformations are all less than 1 foot indicating acceptable performance under seismic conditions.

South Quarry

The South Quarry is a proposed extraction area located south of Permanente Creek directly across the Creek from the existing North Quarry. The quarry will create an 800- to 1000-foot tall, north-facing cutslope excavated into the steep hillside above the Creek. Slope angles for the proposed quarry are generally 3 horizontal to 1 vertical above elevation 1240 amsl and steepen to approximately 1 horizontal to 1 vertical below this elevation where limestone is encountered. The reclamation plan for the South

Quarry entails backfilling of the bottom of the quarry up to elevation 1110 feet msl, and revegetation of the relatively gentle quarry cutslopes above this elevation. The rock backfill will fill the bottom 200 feet of the pit. Stability analyses indicate that following the backfill, the post-closure FOS is greater than 1.5 for static conditions, and estimated permanent seismic displacements are less than one inch which is considered acceptable.

West Materials Storage Area

The WMSA is currently approaching maximum elevations as depicted in the current reclamation plan and will undergo re-grading to achieve final reclamation slopes and manage drainage from the area. In general, the northern slopes of the WMSA are near final configuration, while the west and southern slopes will be re-graded to slightly gentler slope angles. The existing eastern flank of the WMSA will be covered by and merge with the proposed backfill of the North Quarry. Pre-SMARA fill slopes exist below the main access road to the WMSA and have been evaluated as part of the overall stability evaluation of the WMSA.

The reclaimed slopes of WMSA are proposed to be 3H:1V (or 18.4 degrees) or flatter. The FOS varies slightly for each of the primary slopes (i.e., north-, west-, and south-facing), however, the minimum FOS of 1.56 as determined for the south-facing slope meets the design criteria and is considered acceptable. The mean estimated seismically-induced deformation is less than 1 foot and considered acceptable.

East and Central Materials Storage Areas

The EMSA/CMSA is a rockfill comprised of overburden materials from mining of the North Quarry. The EMSA/CMSA was designed with stable slopes that will not require significant regrading prior to revegetation. The overall slopes are 2.6H:1V with interbench slopes of 2H:1V. An initial geotechnical investigation for the EMSA was previously provided to the County in April 2009. Since then, the fill plan for the EMSA has been modified to incorporate a separate, but contiguous, rockfill described as the Central Materials Storage Area, and Golder has completed supplemental analyses of the revised grading plan. This supplemental work is included in a separate companion report, however, the results of the stability analyses are summarized here for convenience. The static FOS for global stability (crest of slope to toe of slope) is approximately 1.7. The static FOS for interbench slopes is 1.4 which is considered acceptable. Seismically-induced displacements are estimated to range from 3- to 13-inches which is considered acceptable.

Topsoil Storage Area

The Topsoil Storage Area is a temporary fill (20 year project life) that will be removed and used during the reclamation process. The proposed Topsoil Storage Area is located in a canyon directly south of the Quarry's existing aggregate processing facility (Rock Plant). The Topsoil Storage Area will be comprised of up to 540,000 cubic yards of topsoil stripped from the ground surface of the proposed South Quarry

and reserved for future reclamation of slopes. The proposed Storage Area grading plan includes 2H:1V inter-bench slopes and 2.9H:1V to 3.0H:1V overall slopes. An investigation was performed to provide design recommendations for development and construction of the temporary stockpile. Reclamation of the area will entail removal of the Storage Area, restoration of the original topographic contours, and revegetation. Because the area will be reclaimed to its original condition, no stability analyses are necessary for the final reclamation condition.

Conclusions

Golder has performed geotechnical investigations and slope stability evaluations of the various proposed elements of the reclamation plan prepared for the Permanente Quarry. The slope stability evaluations were completed to verify that the proposed reclamation of these areas complies with the applicable slope stability-related provisions of the Surface Mining and Reclamation Act (SMARA) and to assist Lehigh with on-going development of the quarry. The evaluations indicate that proposed final slopes, including both cutslopes and fill slopes, have an acceptable FOS under static conditions and acceptable performance under seismic loading.

PROFESSIONAL CERTIFICATION

GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS

PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

MAY 2010

Submitted To: Lehigh Southwest Cement Company
24001 Stevens Creek Boulevard
Cupertino, California 95014

Prepared By: Golder Associates Inc.
425 Lakeside Drive
Sunnyvale, CA 94085

Golder Associates Inc.
1000 Enterprise Way
Sacramento, CA 95678

Golder Associates Inc.
595 Double Eagle Court, Suite 1000
Reno, NV 89521

This report has been reviewed and approved by:

PROFESSIONAL GEOLOGIST
WILLIAM L. FOWLER
No. 1401
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

William L. Fowler, P.G., C.E.G.
Associate/Program Leader

REGISTERED PROFESSIONAL ENGINEER
KENNETH G. HASKELL
No. C052290
Exp. 6/30/11
CIVIL
STATE OF CALIFORNIA

Kenneth G. Haskell, P.E.
Principal/Practice Leader

Golder Associates

Table of Contents

EXECUTIVE SUMMARY ES-1
1.0 INTRODUCTION 1
1.1 Purpose 1
1.2 Project Background 1
1.2.1 Existing Operations 1
1.2.2 Proposed Project 2
1.3 Scope of Work 3
1.4 Project Team 4
2.0 PROPOSED RECLAMATION PLAN 6
2.1.1 North Quarry 6
2.1.2 South Quarry 6
2.1.3 WMSA 6
2.1.4 EMSA/CMSA 6
2.1.5 Topsoil Storage Area 7
3.0 REGIONAL SETTING 8
3.1 Topography 8
3.2 Geologic Setting 8
3.2.1 Franciscan Terrane 9
3.2.2 Santa Clara Terrane 9
3.2.3 Surficial Deposits 10
3.2.3.1 Alluvium 10
3.2.3.2 Colluvium 10
3.2.3.3 Landslide Deposits 10
3.3 Structural Setting 10
3.4 Seismic Setting 11
4.0 NORTH QUARRY CONDITIONS 13
4.1 Quarry Development Plan 13
4.2 Geology of North Quarry 13
4.3 Groundwater Conditions 14
4.4 Slope Performance 15
5.0 MAIN SLIDE (1987) 17
5.1 History 17
5.2 Geologic Conditions and Contributing Factors 17
5.3 Current Conditions 18
5.4 Likely Behavior of Slide Without Mitigation 19
5.5 Available Supporting Data 20
5.5.1 Characterization Data from Previous Studies 20
5.5.2 Initial Material and Groundwater Characterization Based on Available Data 21

5.5.3 2009 Characterization 21
5.5.3.1 Geotechnical Logging 22
5.5.3.2 Groundwater Pressure Monitoring 23
5.5.3.3 Laboratory Testing 23
5.5.4 Updated Greenstone Rock Mass Characterization Based on 2009 Quarry Investigation 24
5.5.4.1 Rock Mass Quality 24
5.5.4.2 Material Properties 25
5.5.4.3 Hydrogeological Conditions 25
5.6 Stability Analyses 26
5.6.1 Analysis Methods and Models 26
5.6.2 Generic Greenstone Analyses 26
5.6.3 Initial Analyses of the Main Slide (1987) and Underlying Greenstone 27
5.6.4 Updated Analysis of Stability of Main Slide (1987) and Underlying Greenstone 27
5.6.5 Stability of Main Slide (1987) After Backfilling 29
5.6.6 Seismic Stability 31
6.0 SCENIC EASEMENT SLIDE 32
6.1 History 32
6.2 Geologic Conditions 32
6.3 Supporting Data 32
6.4 Stability Evaluation 33
7.0 MID-PENINSULA SLIDE 36
7.1 History 36
7.2 Geologic Conditions 36
7.3 Supporting Data 37
7.3.1 Mid-Pen Slide Field Investigation 40
7.3.1.1 Mapping 40
7.3.1.2 Test Pits 40
7.3.1.3 Laboratory Testing Program 40
7.4 Stability Evaluation 41
8.0 EAST WALL DESIGN 44
8.1 Geology of the East Wall Area 44
8.2 Current East Wall Configuration 44
8.3 Ultimate East Wall Configuration 45
8.4 Stability Analyses 46
9.0 SOUTH WALL DESIGN 49
9.1 Geologic Conditions 49
9.1.1 Geology of the South Wall Area 49
9.1.2 Hydrogeology 50
9.2 Current South Wall Configuration 50
9.3 Proposed Final South Wall Cut and Reclaimed South Wall Configuration 50

9.4 Rock Mass Stability Analysis 51
9.4.1 Geologic Model 51
9.4.2 Rock Mass Properties, Section 9A 52
9.4.3 Rock Mass Properties, Section 9B 53
9.4.4 Rock Mass Stability Analysis of Ultimate South Wall Configuration 54
9.4.5 Stability of South Slope After Backfilling 54
9.4.6 Conclusions — Rock Mass Stability Analysis 54
9.5 Kinematic Stability Analysis 55
9.5.1 Televiewer Data 55
9.5.2 Structural Characterization 56
9.5.3 Analysis 56
9.5.4 Conclusions — Kinematic Stability Analysis 57
10.0 WEST MATERIALS STORAGE AREA 58
10.1 Introduction 58
10.2 Previous Geotechnical Evaluations 58
10.3 GOLDER INVESTIGATIONS 59
10.3.1 Aerial Photograph Review 59
10.3.2 Subsurface Exploration 59
10.3.3 Geologic Materials 60
10.3.4 Geotechnical Laboratory Testing 60
10.4 Slope Stability Evaluations 61
10.4.1 Methods 61
10.4.2 Modeling Inputs and Assumptions 61
10.4.2.1 Model Geometries 61
10.4.2.2 Material Properties 61
10.4.2.3 Groundwater 63
10.4.2.4 Seismic Parameters 64
10.4.2.5 Cross Sections 64
10.4.3 Static Analyses 64
10.4.4 Seismic Analyses 65
10.4.5 Sensitivity Study 66
10.4.5.1 Groundwater conditions 66
10.4.5.2 Presence of Fine Waste 66
11.0 TOPSOIL STORAGE AREA 67
11.1 Background 67
11.2 Site Conditions 67
11.3 Subsurface Investigation and Geotechnical Laboratory Testing 67
11.4 Earth Materials Properties 68
11.4.1 Topsoil Fill 68
11.4.2 Existing Fill 68

11.4.3 Foundation Soil 69
11.4.4 Santa Clara Formation 69
11.5 Design Considerations 69
12.0 SOUTH QUARRY STABILITY EVALUATIONS 71
12.1 Site Conditions 71
12.1.1 Current Topography 71
12.1.2 Quarry Plans 71
12.1.3 South Quarry Geological Conditions 72
12.1.3.1 Lithology 72
12.1.3.2 Structure 72
12.1.3.3 Landslides 73
12.1.4 Hydrogeological Conditions 74
12.2 Available Data 74
12.3 Geological Engineering Characterization 77
12.3.1 Geological Model 77
12.3.2 Structure 79
12.3.3 Rock Fabric 79
12.3.4 Material and Rock Mass Properties 79
12.3.5 Hydrogeological Conditions 81
12.4 Stability Analyses and Quarry Slope Design Recommendations 82
12.4.1 Limestone 82
12.4.1.1 Kinematic Analyses 82
12.4.2 Rock Mass Stability 85
12.4.2.1 Quarry Slope Design Recommendations for Limestone 85
12.4.3 Footwall Fault Breccia and Graywacke 86
12.4.3.1 Analysis Results 86
12.4.3.2 Quarry Slope Design Recommendations, Footwall Fault Breccia and Graywacke 86
12.4.4 Overall Slope Stability 87
12.5 Post-Reclamation Slope Stability 88
13.0 REFERENCES 89

List of Tables

Table 5.1 Material Properties Used for Initial Stability Analyses Based on Available Data
Table 5.2 2009 Geotechnical Corehole Locations
Table 5.3 Piezometers Installations and Groundwater Levels
Table 5.4 Summary of Laboratory Testing Results
Table 5.5 Greenstone Rock Quality, 2009 Geotechnical Coreholes
Table 5.6 FOS for Various Groundwater Conditions
Table 5.7 Summary of Main Slide Stability Evaluations
Table 6.1 Material Properties for Scenic Easement Stability Analyses
Table 6.2 Summary of Scenic Easement Slide Stability Evaluation
Table 7.1A Material Properties Used in 2002 CNI Mid-Pen Stability Studies

Table 7.1B Material Properties Used in 2003 CNI Mid-Pen Stability Study
Table 7.2 Summary of Laboratory Testing on Sample of the Mid-Pen Investigation
Table 7.3 Material Properties for Mid-Pen Stability Analyses
Table 7.4 Summary of Scenic Easement Slide Stability Evaluation
Table 8.1 Material Properties for Mid-Pen Stability Analyses
Table 8.2 Summary of East Wall Stability Evaluation
Table 9.1 2008 Geotechnical Drillhole Details
Table 9.2 Uniaxial Compressive Strengths, Section 9A
Table 9.3 RMR Ratings, Section 9A
Table 9.4 Parameters of Hoek-Brown Failure Criterion, Section 9A
Table 9.5 Mohr-Coulomb Strength Parameters
Table 9.6 Summary of Rock Mass Stability Analysis Results
Table 9.7 Televiewer Survey Intervals
Table 9.8 Design Structural Sets for Kinematic Analysis
Table 10.1 Material Properties for WMSA Stability Analyses
Table 10.2 Summary of WMSA Stability Analyses
Table 11.1 Material Properties for Topsoil Storage Area Stability Analyses
Table 12.1 Available Geotechnical Data from Coreholes
Table 12.2 Intersections of Modeled Lithologies in Coreholes
Table 12.3 Distribution of Rock Types within Model Rock Masses
Table 12.4 Material Properties
Table 12.5 Rock Mass Properties
Table 12.6 Hydraulic Conductivity Scenarios
Table 12.7 Systematic Discontinuity Sets, North Wall Limestone
Table 12.8 Systematic Discontinuity Sets, South Wall Limestone, Domain 1
Table 12.9 Systematic Discontinuity Sets, South Wall Limestone, Domain 2
Table 12.10 Summary of South Quarry Stability Analyses

List of Figures

Figure 1.1 Regional Location Map
Figure 1.2 Project Overview
Figure 2.1 Final Reclamation Plan
Figure 3.1 Topographic Setting
Figure 3.2 Regional Geologic Map
Figure 3.3 Quarry Geologic Compilation Map
Figure 3.4 Regional Geotectonic Map
Figure 3.5 Peak Ground Acceleration Map (10-Percent Probability/50 Years)
Figure 4.1 North Quarry Current Configuration
Figure 4.2 North Quarry Slope Conditions in June 2007
Figure 4.3 North Quarry Ultimate Quarry Design
Figure 4.4 North Quarry Backfill, Final Reclamation Plan
Figure 4.5 North Quarry Geology
Figure 4.6 North Quarry Structural Control in Limestone
Figure 5.1 Stability Model for Initial Failure in 1987
Figure 5.2 Azimuth 120°, Section 1200
Figure 5.3 Main Slide (1987)
Figure 5.4 Slope Heights and Slope Angles in Greenstone
Figure 5.5 Main Slide (1987) Area Detail and Stability Section Locations
Figure 5.6 Slope Stability Section
Figure 5.7 Greenstone Slope Design Charts
Figure 5.8 Stability Models, Main Slide (1987) Area
Figure 5.9 Groundwater Conditions in Stability Analyses
Figure 5.10 Stability Sections after Backfilling
Figure 5.11 Pseudo-Static Stability Analyses After Backfilling
Figure 5.12 Pseudo-Static Yield Acceleration Stability Analyses After Backfilling

Figure 6.1 Quarry Layout Scenic Easement and Mid-Pen Area
Figure 6.2 Current Topography – Scenic Easement Area
Figure 6.3 Ultimate Reclamation Plan for Scenic Easement Area
Figure 6.4 Geologic Map Scenic Easement and Mid-Pen Areas
Figure 6.5 Cross-Section SE1 for Scenic Easement Slide
Figure 7.1 Cross-Section MP1 for Mid-Pen Slide
Figure 7.2 Cross-Section MP2 for Mid-Pen Slide
Figure 7.3 Mid-Pen Surface Mapping
Figure 8.1 Cross-Section EW1 for East Wall
Figure 8.2 Cross-Section EW2 for East Wall
Figure 9.1 Current South Wall Topography
Figure 9.2 Final South Wall Cut
Figure 9.3 Final Reclaimed Topography of South Slope
Figure 9.4 Stability Analysis Results, Static Analysis, South Wall Section 9A After Ultimate Quarry Excavation
Figure 9.5 Stability Analysis Results, Static Analysis, South Wall Section 9B After Ultimate Quarry Excavation
Figure 9.6 Stability Analysis Results, Static Analysis, South Wall Section 9A After Reclamation
Figure 9.7 Stability Analysis Results, Pseudo-Static Analysis, South Wall Section 9A after Reclamation
Figure 9.8 Design Structural Sets
Figure 10.1 Current Topography – West Storage Area Materials Area
Figure 10.2 Phase 1 Reclamation Topography – West Materials Storage Area
Figure 10.3 Ultimate Reclamation Topography – West Materials Storage Area
Figure 10.4 Geologic Map West Materials Storage Area
Figure 10.5 Cross-Section W1 for the West Material Storage Area
Figure 10.6 Cross-Section W2 for the West Material Storage Area
Figure 10.7 Cross-Section W3 for the West Material Storage Area
Figure 10.8 Cross-Section W4 for the West Material Storage Area
Figure 11.1 Proposed Topsoil Storage Area Design
Figure 12.1 South Quarry Existing Topography
Figure 12.2 South Quarry Ultimate Quarry Plan
Figure 12.3 South Quarry Backfill, Final Reclamation Plan
Figure 12.4 South Quarry Geology
Figure 12.5 South Quarry Representative Geological Sections
Figure 12.6 South Quarry Structure Data from Televiewer Logging
Figure 12.7 South Quarry, Modeled Faults
Figure 12.8 South Quarry, Rock Fabric in Limestone
Figure 12.9 South Quarry, Kinematic Analyses, North Wall Limestone
Figure 12.10 South Quarry, Kinematic Analyses, Limestone, West Half of South Wall
Figure 12.11 South Quarry, Kinematic Analyses, Limestone, East Half of South Wall
Figure 12.12 South Quarry, Rock Mass Stability, South Wall Limestone
Figure 12.13 South Quarry, Generic Greenstone/Fault Breccia Stability Analyses
Figure 12.14 South Quarry, Kinematic Analyses, South Wall Greenstone/Fault Breccia
Figure 12.15 South Quarry, Kinematic Analyses, South Wall Overall Slope Stability

List of Appendices

Appendix 4.A Updated 2004 Geologic Cross Sections
Appendix 5.A Geotechnical Core Log Summary Plots and Photographs (MS-01 and MS-02)
Appendix 5.B Laboratory Testing Data
Appendix 5.C Seismic Displacement Calculations
Appendix 6.A Scenic Easement - Slope Stability Output
Appendix 7.A Mid-Pen – Test Pit Logs
Appendix 7.B Mid-Pen – Lab Test Results
Appendix 7.C Mid-Pen – Slope Stability Output

Appendix 8.A East Wall – Slope Stability Output
Appendix 9.A Geotech Core Logs 2008 Drilling
Appendix 9.B Point Load 2008 Drilling
Appendix 9.C Lab Results 2008 Drilling
Appendix 9.D Stereonets
Appendix 10.A WMSA Boring Logs
Appendix 10.B WMSA Laboratory Test Results
Appendix 10.C WMSA Slope Stability Output
Appendix 11.A Topsoil Storage Area Boring Logs
Appendix 11.B Laboratory Test Results
Appendix 12.A South Quarry Core Logs and Photos
Appendix 12.B Laboratory Testing Data
Appendix 12.C Seismic Displacement Calculations

1.0 INTRODUCTION

1.1 Purpose

Golder Associates Inc. (Golder) is submitting this report to the Lehigh Southwest Cement Company (Lehigh) documenting the results of geotechnical investigations and slope stability evaluations completed for the Permanente Quarry located in Santa Clara County, California (Figure 1.1). The slope stability evaluations were completed to verify that the proposed reclamation of these areas complies with the applicable slope stability-related provisions of the Surface Mining and Reclamation Act (SMARA) and to assist Lehigh with ongoing development and operation of the quarry.

1.2 Project Background

1.2.1 Existing Operations

The Permanente Quarry (Quarry) is a limestone and aggregate mining operation in the unincorporated foothills of western Santa Clara County, approximately two miles west of the City of Cupertino. The Quarry occupies a portion of a 3,510-acre property owned by Hanson Permanente Cement, Inc., and is operated by Lehigh Southwest Cement Company (collectively, Lehigh).

The Quarry currently comprises over 600 acres of operational areas, which consist of surface mining excavations, overburden stockpiling, crushing and processing facilities, access roads, administrative offices and equipment Storage Area. The Quarry also includes other predominantly undisturbed areas, either held in reserve for future mining or which buffer operations from adjacent land uses. The main operational areas of the Quarry are shown on Figure 1.2 and described below:

- North Quarry: The North Quarry is where mineral extraction currently occurs and has historically taken place. The North Quarry features a large mining pit with elevations that currently range from approximately 750 feet to 1,750 feet above mean sea level (amsl). Limestone and greenstone mined from the North Quarry are crushed and either processed into aggregate products at Lehigh's on-site Rock plant or for used for cement manufacture at Lehigh's adjacent cement plant.
- East and Central Materials Storage Area (EMSA/CMSA): The EMSA/CMSA is located to the east of the North Quarry and is currently the primary Storage Area for overburden and waste rock. Elevations at the EMSA/CMSA range from 550 feet at the eastern end of the EMSA up to 1,270 feet amsl at the west end of the CMSA.
- West Materials Storage Area (WMSA): The WMSA is a second overburden and waste rock Storage Area, located west of the North Quarry. Elevations in the WMSA range from 1,500 to 1,975 feet amsl. The WMSA is approaching the final elevation and contours described in the Quarry's existing reclamation plan.
- Rock Plant: The Rock Plant is located in the southeast portion of the Quarry, and processes mined material into aggregate products. The Rock Plant occupies gentle slopes with elevations ranging from 580 to 770 feet amsl.

Mining operations take place subject to California's Surface Mining and Reclamation Act (SMARA). SMARA mandates that surface mining operations have an approved reclamation plan that describes how

mined lands will be prepared for alternative post-mining uses, and how residual hazards will be addressed. Santa Clara County acts as lead agency under SMARA. The County approved the Quarry's current reclamation plan in March 1985, covering 330 acres. This represents a portion of the existing mining disturbance at the Quarry.

A cement manufacturing plant lies adjacent to the Quarry on the east. The cement plant also is owned and operated by Lehigh. The cement plant is a separately-permitted industrial use which is not considered part of the Quarry and is not subject to SMARA's requirements.

1.2.2 Proposed Project

The proposed project is the approval of an amendment to the Quarry's reclamation plan. The proposed amendment would broaden the reclamation plan, and associated reclamation requirements, to include all areas that are currently disturbed by mining activities, and lands scheduled to be disturbed by mining over approximately the next 20 years. The amendment would incorporate 1,105 acres of Lehigh's 3,510-acre ownership representing mostly existing mining disturbance, and address the reclamation of mining activities over approximately the next 20 years. Under the amendment, areas disturbed by mining would be reclaimed for open space uses.

The project also is the approval of a conditional use permit (CUP) for certain mining operations at the Quarry. The CUP would authorize the continuation of mineral extraction in a portion of the planned extraction area south of Permanente Creek known as the South Quarry. Rock mined at the South Quarry would be transported to existing facilities for processing. The South Quarry is included in the proposed reclamation plan amendment and would be reclaimed according to the requirements therein.

The proposed reclamation plan amendment and CUP would result in the following conditions and changes at the Quarry:

- South Quarry: The project would approve a CUP and amend the reclamation plan to provide for concurrent mining and reclamation at the South Quarry. Operations would occur over a period of approximately 20 years, depending on market demands. The South Quarry will be mined in five phases with reclamation following mining within each phase. Mined limestone and greenstone would be transported to existing Quarry facilities for crushing and processing.
- Topsoil Storage Area: The project would amend the reclamation plan to provide for the reclamation of the Topsoil Storage Area, an area located to the south of the Rock Plant. The Topsoil Storage Area would serve to temporarily store topsoil material removed from the South Quarry until such material is needed for reclamation.
- North Quarry: The project would amend the current reclamation plan for the North Quarry to reflect the use of the North Quarry as a permanent Storage Area for overburden and waste rock extracted from the South Quarry. The placement of fill will serve to support and stabilize existing slope instabilities. Reclamation activities would establish final slopes and vegetation in the North Quarry consistent with the surrounding topography.

- EMSA/CMSA: The project would amend the reclamation plan to provide final grading contours and revegetation for this area. The Central Materials Storage Area (CMSA) is an overburden storage area located immediately west of the East Materials Storage Area. The CMSA includes approximately 52 acres of overburden storage area and ranges in elevation from approximately 775 feet amsl to 1270 feet amsl. Overall slope angles will be 2.6(H):1.0(V) or flatter. The CMSA will accept overburden materials during Phase 1 of the project and subsequently will be reclaimed according to the proposed Amendment. The CMSA's eastern edge connects to the flat pad at the west end of the EMSA. This connection results in an approximately 11-acre overlap of the CMSA on the top of the EMSA's western edge. The majority of the overlap covers the flat pad at the western edge of the EMSA and is designed to minimize any interference with reclamation activities in the EMSA.
- WMSA: The project would amend the current reclamation plan for the WMSA to reflect the transition of the adjacent North Quarry reclaimed fill slopes and tie in these slopes to the WMSA's east side. The project also would update the current WMSA revegetation design.
- Rock Plant: The project would amend the reclamation plan to provide a reclamation design for the Rock Plant.

1.3 Scope of Work

Golder was retained in September 2006 by Hanson Permanente Cement, Inc. (prior to acquisition by Lehigh) to perform a review of existing geotechnical data for the main quarry, and to assist with preparation of a proposed Reclamation Plan Amendment that was submitted to the County of Santa Clara in March 2007 (EnviroMINE Inc., 2007). As part of this review process, recommendations for additional investigative work were developed to address comments provided by the County of Santa Clara resulting from SMARA inspections of the Quarry, and to address changing requirements associated with Lehigh's evolving conceptual development plan for the Quarry.

The scope of work summarized below describes the main investigative tasks performed for each area (as applicable) of the overall project:

- Review of existing geologic and geotechnical studies
- Compilation and review of published and unpublished geologic data for the area
- Field reconnaissance and supplemental mapping as needed to define the geologic domains and structural controls influencing slope stability conditions
- Evaluation of aerial photographs and preparation of engineering geologic maps
- Preparation of geologic cross sections for slope stability analyses
- Review of rock core, core photography, and core logs for exploratory borings completed in the South Quarry area
- Geotechnical logging of select rock cores for evaluation of discontinuities, rock structure, rock quality, and compressive strength
- Geophysical logging of select core holes
- Instrumentation of core holes with vibrating wire transducers and data loggers for long-term evaluation of pore pressure conditions
- Installation of piezometers, pressure transducers and data loggers for long-term evaluation of pore pressure conditions

- Sampling and laboratory testing of representative rock materials and discontinuities to define material index properties and strength characteristics of anticipated quarry pitslope rock materials
- Drilling and logging of foundation conditions in proposed overburden and topsoil storage areas
- Sampling and laboratory testing of representative foundation and soil materials to define material index properties and strength characteristics of foundation areas
- Sampling and laboratory testing of select overburden rock materials and aggregate wash fines
- Review and evaluation of seismic design criteria
- Analysis of potential slope stability failure modes and risks
- Static and pseudo-static analyses of critical cross sections for quarry slopes, and overburden fill slopes
- Recommendations to modify slope designs based on geotechnical evaluations
- Optimization of slope angles, bench designs, etc. to address safety considerations during operations
- Evaluation and phasing of potential final slopes to address buttressing of known areas of instability
- Review and confirmation that modified project designs, if required, comply with the recommendations of our reports
- Preparation of this summary report documenting findings, conclusions and recommendations of the overall geotechnical campaign performed for the reclamation project

The above tasks describe the general scope of work performed for the project, the details of the specific tasks for each area of the project are provided, as necessary, in their respective sections.

1.4 Project Team

The team for the Permanente Quarry geotechnical project is comprised of geologists and engineers from Golder's Sunnyvale, Sacramento and Reno offices. The primary professionals associated with this project included:

- Kenneth Haskell, P.E. (California) – Lead Civil Engineer and Engineer-Of-Record
- William L. Fowler, P.G., C.E.G. (California) – Project Manager and Lead Engineering Geologist
- Graeme Major, P.E. (Colorado, Nevada) – Lead Rock Mechanics and Pitslope Stability Engineer
- Tom Byers, P.G, P.E. (Washington) – Project Geological Engineer
- Peter Yuan, P.E.(California) – Project Civil Engineer
- Rhonda Knupp – Project Geological Engineer

The above individuals were supported by numerous staff geologists and engineers from several Golder offices for assistance with various office tasks (e.g., data compilation and analysis, cross sections, map

preparations, etc.) and field tasks (e.g., mapping, borehole logging, data collection, etc.) performed in support of the geotechnical characterization and engineering evaluations.

0 2.5 5 10 15
Miles

REFERENCES

Spatial Reference:
NAD 1983 StatePlane California III FIPS 0403 feet Aerial
background: http://services.arcgisonline.com/arcgis/services
1) ESRI_ShadedRelief_World_2D
2) 13_Imagery_Prime_World_2D

PROJECT

GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE

REGIONAL LOCATION MAP

Golder Associates

PROJECT No.		063-7109	FILE No.	
DESIGN	DLM	1/28/2010	SCALE: AS SHOWN	REV. 0
GIS	DLM	1/28/2010		
CHECK	AK	1/28/2010		
REVIEW	BF	1/28/2010		

FIGURE 1.1

G:\GIS\Sites\Lehigh_Permanente_Quarry\mxd\SiteLocationMap.mxd

LEGEND

Disturbance Area Boundary

REFERENCES

Spatial Reference:
NAD 1983 StatePlane California III FIPS 0403 feet Aerial background:
http://services.arcgisonline.com/arcgis/services
(13_Imagery_Prime_World_2D)

0 600 1,200 2,400
Feet

N

PROJECT
GEOTECHNICAL EVALUATION AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
PROJECT OVERVIEW

Golder Associates

PROJECT No.		063-7109	FILE No.		
DESIGN	DLM	2/1/2012	SCALE: AS SHOWN	REV.	0
GIS	DLM	2/1/2012			
CHECK	GW	2/1/2012			
REVIEW	WLF	2/1/2012			

FIGURE 1.2

G:\GIS\Sites\Lehigh_Permanente_Quarry\mxd\RP_Project_Overview.mxd

2.0 PROPOSED RECLAMATION PLAN

The proposed Final Reclamation Plan project and associated slopes are illustrated in Figure 2.1. A detailed discussion of the Reclamation Plan is provided in the Application for Reclamation Plan Amendment prepared by EnviroMINE and to which this report is attached. A brief summary of the main elements of the project is provided here for background to the geotechnical investigation. As outlined above, the Reclamation Plan addresses five distinct areas of the overall Quarry: North Quarry, South Quarry, WMSA, EMSA/CMSA, and Topsoil Storage Area. Each of these is described briefly in the following sections.

2.1.1 North Quarry

The North Quarry is the area of primary historical limestone mining activity on the property resulting in a quarry with approximately 1000 feet of vertical relief from pit crest to ultimate quarry depth and areal dimensions of 5000 feet long by 2600 feet wide. The proposed reclamation of the quarry entails backfilling of the quarry with approximately 80 million tons of overburden derived from mining of the proposed South Quarry. The backfill will fill the base of the quarry and then be placed up against the west, north and east walls of the quarry to provide a rock buttress for these slopes thereby improving the long term stability of the quarry.

2.1.2 South Quarry

The South Quarry is a proposed extraction area to supply Lehigh with cement-grade limestone and aggregate materials and allow for a transition from mining in the North Quarry. The South Quarry is located south of Permanente Creek, directly across the Creek from the North Quarry, on the north facing slope overlooking Permanente Creek. Golder evaluated and provided recommendations for development of stable mining slopes and reclamation of the quarry. The reclamation plan for the South Quarry entails backfilling of the bottom of the quarry up to elevation 1100 feet msl, and revegetation of the slopes above this elevation.

2.1.3 WMSA

The WMSA is currently near capacity and will undergo re-grading to achieve final reclamation slopes and manage drainage from the area. In general, the northern slopes of the WMSA are near final configuration while the west and southern slopes will be re-graded to slightly gentler slope angles. The existing eastern flank of the WMSA will be covered by and merge with the proposed backfill of the North Quarry. Pre-SMARA fill slopes exist below the main access road to the WMSA and have been evaluated as part of the overall stability evaluation of the WMSA.

2.1.4 EMSA/CMSA

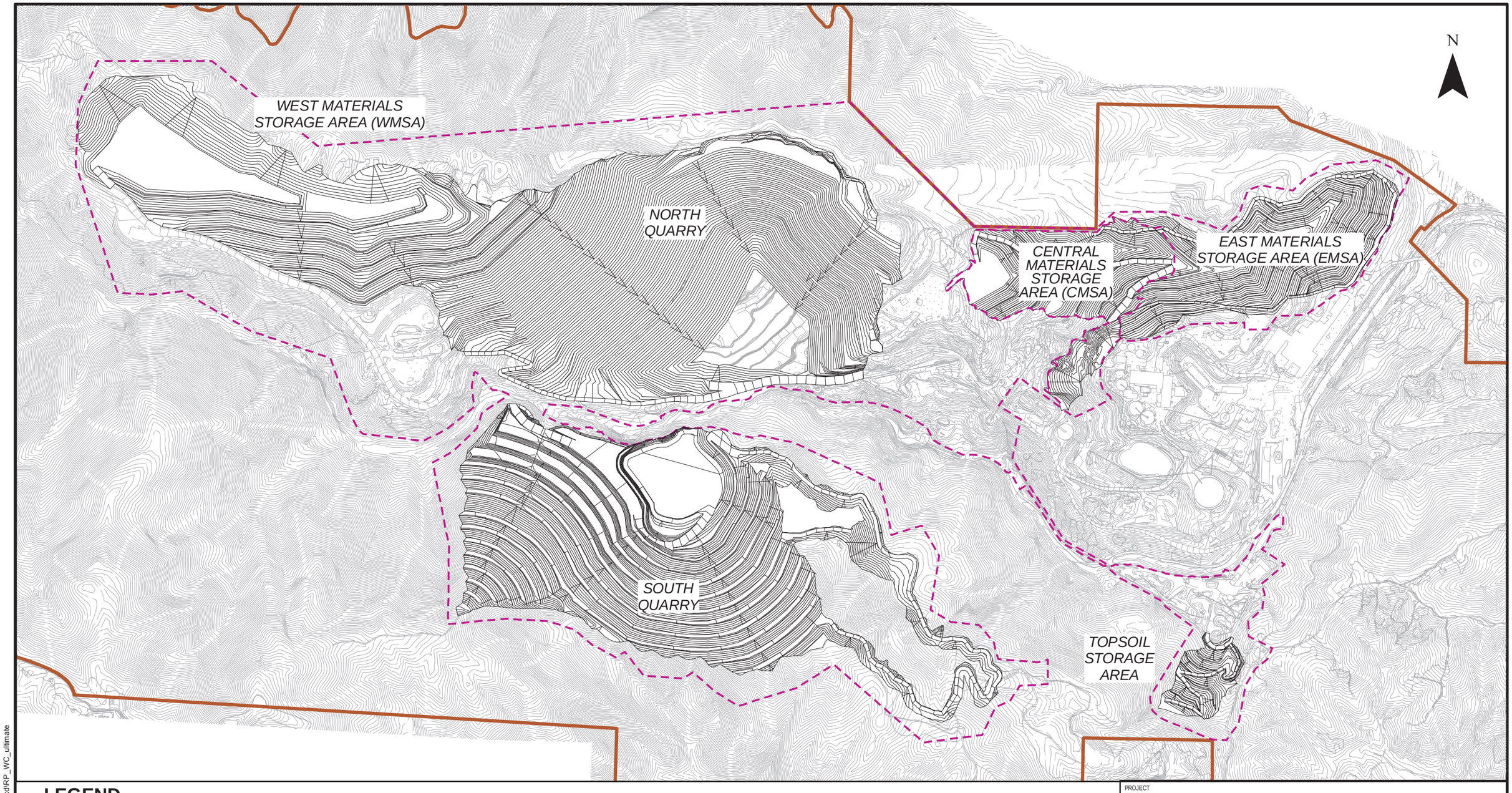
Geotechnical investigations and recommendations for the EMSA were previously provided to the County under separate cover and are not included as part of this report. Prior submittals for the EMSA included:

- Slope Stability Evaluation for Compliance with SMARA, East Materials Storage Area, Permanente Quarry, California. April 2009.
- Keyway Construction Drawing (Letter Transmittal and attached Drawing), East Materials Storage Area, Permanente Quarry, California. July 27, 2009.

The April 2009 EMSA report referenced above has been updated to address revisions to the grading plan which identify a separate, but contiguous, rockfill termed the Central Materials Storage Area (CMSA). The report will be submitted under separate cover as part of the reclamation plan submittals.

2.1.5 Topsoil Storage Area

The Topsoil Storage Area is located in a canyon area directly south of the aggregate processing facility (Rock Plant) (Figure 2.1). The Topsoil Storage Area will be comprised of up to 540,000 cubic yards of topsoil stripped from the ground surface of the proposed South Quarry and reserved for future reclamation of slopes. Golder evaluated design considerations and surface water management for this area. Reclamation of the area will entail removal of the Storage Area, restoration of the original topographic contours, and revegetation.



LEGEND

- Reclamation Plan Boundary
- Lehigh Property Boundary

REFERENCES

From Enviromine (2010).
Spatial Reference:
NAD 1983 StatePlane California III FIPS 0403 Feet

0 500 1,000 1,500 2,000
Feet

PROJECT

GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE

RECLAMATION PLAN (ULTIMATE)

Golder Associates

PROJECT No.		063-7109	FILE No.		
DESIGN	DLM	10/27/2008	SCALE: AS SHOWN	REV.	0
GIS	DLM	10/27/2008			
CHECK	WLF	10/27/2008			
REVIEW	XXX	10/27/2008			

FIGURE 2.1

G:\GIS\Sites\Lehigh_Permanente_Quarry\mxd\RP_WC_ultimate

3.0 REGIONAL SETTING

3.1 Topography

The Quarry is situated in the foothills of the rugged, northwest-trending Santa Cruz Mountains segment of the California Coast Ranges (Figure 3.1). The overall project site is bisected by the east-flowing Permanente Creek. Topography in the area consists of moderately to steeply-sloped terrain with rounded ridges and drainages (Figure 3.1). Relief at the project site ranges from about 2000 feet along the higher ridge crests to less than 500 feet msl along the eastern portions of Permanente Creek. Average overall slope angles are typically around 25˚. The steepest natural slopes are on the order of 40˚ over smaller slope heights (100-200 feet) and generally correspond to limestone outcrops.

3.2 Geologic Setting

The majority of the project site addressed by this report is underlain by complexly deformed and faulted rocks of the Franciscan Assemblage (Figure 3.2). The eastern portion of the Quarry, including portions of the Plant and the EMSA/CMSA, are underlain by Plio-Pleistocene rocks of the Santa Clara Formation. Overlying the bedrock are modern alluvial deposits associated with Permanente Creek (restricted to the eastern portion of the property, and relatively shallow surficial deposits comprised of soil and colluvium. Several large, ancient landslide deposits have been mapped by various investigators along the slopes flanking Permanente Creek. The geology of the area has been mapped in various levels of detail for published maps by the following:

- Rogers and Armstrong (1973)
- Sorg and McLaughlin (1975)
- Vanderhurst (1981)
- Brabb, Graymer, *and* Jones (2000)

In addition, site-specific mapping at various scales, and utilizing both surface outcrop and subsurface drill core data, has also been completed by various geologists including:

- E. Mathieson (unpublished internal mapping,1982)
- J. Foruria (unpublished internal mapping, 2004)
- R. Fousek (unpublished internal mapping, 2009)
- Mine Reserves Associates (Surpac 3-D Model, 2007)
- TerraSource Software (Surpac 3-D Model, 2009)

For the purposes of this report, all the available sources in addition to supplemental mapping by Golder have been utilized to create a compilation geologic map for the Quarry (Figure 3.3). Detailed descriptions of geologic conditions are provided as needed in each specific chapter. The following provides an overview of the primary geologic units at the Quarry.

3.2.1 Franciscan Terrane

The following information regarding the Franciscan rocks as exposed in the North Quarry has been excerpted from Foruria (2004) who performed detailed geologic mapping for Hanson Permanente Cement.

Cement-grade limestone and aggregate are extracted from the intricately folded and faulted limestones and metabasalts (greenstones) in the quarry. These rocks are part of the Permanente Terrain of the Jurassic-Cretaceous age Franciscan Assemblage. The Franciscan Assemblage represents a subduction zone assemblage of highly deformed, variably metamorphosed, marine sedimentary rocks with oceanic crust-related submarine basalt (greenstone), chert, and limestone. This limestone-metabasalt assemblage reaches a minimum total thickness of approximately 1,100 feet and is moderately inclined to the southeast.

All major stratigraphic horizons within the Franciscan rocks of the quarry are separated by low-angle faults forming a structurally imbricated thrust stack of layered and folded rock units (Figure 3.3). The Franciscan rocks are tectonically juxtaposed against an overlying section of undated, continentally-derived graywackes, shales, and argillites. The deformed thrust stack is a gently folded, northeast-trending, southeast dipping sequence in the eastern area of the North Quarry and transitions southwestward to a series of en-echelon, northwest-trending, southeast-plunging, anticlinal and synclinal folds in the western area of the Quarry, and beyond. High angle, brittle faults crosscut the Franciscan rocks, dissecting the rocks along prominent north-south and northwest-southeast orientations. A major through-going regional fault, the northwest strand of the Berrocal fault, crosses through the western end of the quarry. Figure 3.4 shows the major faults in the Quarry vicinity.

3.2.2 Santa Clara Terrane

The Santa Clara Formation overlies a portion of the Franciscan Complex rocks in the north-central portion of the property (Figure 3.3). The Santa Clara Formation is a continental fluvial and alluvial deposit that is composed of unconsolidated to slightly consolidated conglomerate, sandstone, siltstone, and claystone (Vanderhurst, 1981). The age of the Santa Clara Formation ranges from late Tertiary to Pleistocene. Uplift of the Coast Ranges during this time resulted in increased erosion of the mountains and deposition of the Santa Clara Formation. The contact between the Franciscan rocks and Santa Clara Formation is considered to be unconformable, with the Santa Clara Formation deposited on an eroded Franciscan terrain (Rogers and Armstrong, 1973).

Subsequent uplift of the nearby foothills along the Monte Vista fault, which lies along the margin of the valley floor to the east of the Quarry, has resulted in deformation of the Santa Clara Formation. In addition, faulting within the uplifted geologic terrane between the Monte Vista and Berrocal faults has juxtaposed the Santa Clara formation in fault contact with older Franciscan rocks in the western portion of the EMSA/CMSA (Figure 3.3). To the east of the unnamed fault, the deformed Santa Clara formation

overlies the Franciscan with south-southwest trending dips of up to 50 degrees (Rogers and Armstrong, 1973). As mapped by Golder, a large erosional window east of the unnamed fault in the EMSA/CMSA exposes greenstone, Graywacke and limestone of the Franciscan Assemblage.

3.2.3 Surficial Deposits

3.2.3.1 Alluvium

This includes modern unconsolidated alluvial deposits along the active stream channel of Permanente Creek. These deposits are comprised of a poorly-sorted mixture of cobbles, gravels, sand, silt and clay. Deposits range from a few inches thick in the upper reaches of the watershed where erosion has cut the channel down into bedrock, to tens of feet thick where the channel widens and deepens as it approaches the flatter terrain of the Santa Clara Valley.

3.2.3.2 Colluvium

Colluvial deposits exist throughout the Quarry on natural slopes including areas underlying existing older overburden fills (i.e. WMSA), in areas of current and proposed overburden fills (i.e., EMSA/CMSA and Topsoil Storage Area), and in the proposed South Quarry area. The natural slopes in general are overlain with approximately one to two feet of soil and colluvial materials, which thickens to several feet or more in the larger natural swales in the region.

Where colluvial materials were encountered in exploratory activities they were described as predominantly clayey sand with gravel to clayey gravel, with some gravelly clay. Gravel size was up to 3-inches. The colluvium was dry and dense to very dense. In general, the colluvium was dry and ranged from loose to very stiff or dense.

3.2.3.3 Landslide Deposits

Several large, ancient landslides have been mapped by various investigators in various areas of the 3510- acre Lehigh property, and throughout the broader foothills region. These landslides are generally described as possible old landslides, generally considered to be early Holocene or possibly late-Pleistocene features, and are identified on the basis of geomorphic features such as eroded scarps and irregular topography. Boundaries are generally subtle and poorly defined, and there is little to no evidence of modern activity. Along the south flank of Permanente Creek, on the hillside east of the proposed South Quarry, two large landslides are identified by Sorg and McLaughlin (1975) while Rogers and Armstrong (1973) map only one of the landslide features. The possible presence of these landslides does not affect development of the South Quarry. This is discussed in more detail in Section 13.

3.3 Structural Setting

The San Andreas Fault zone is located approximately 2 miles southwest of the quarry (Figure 3.4). The Sargent-Berrocal Fault Zone (SBFZ), part of the Santa Cruz Mountains front-range thrust fault system,

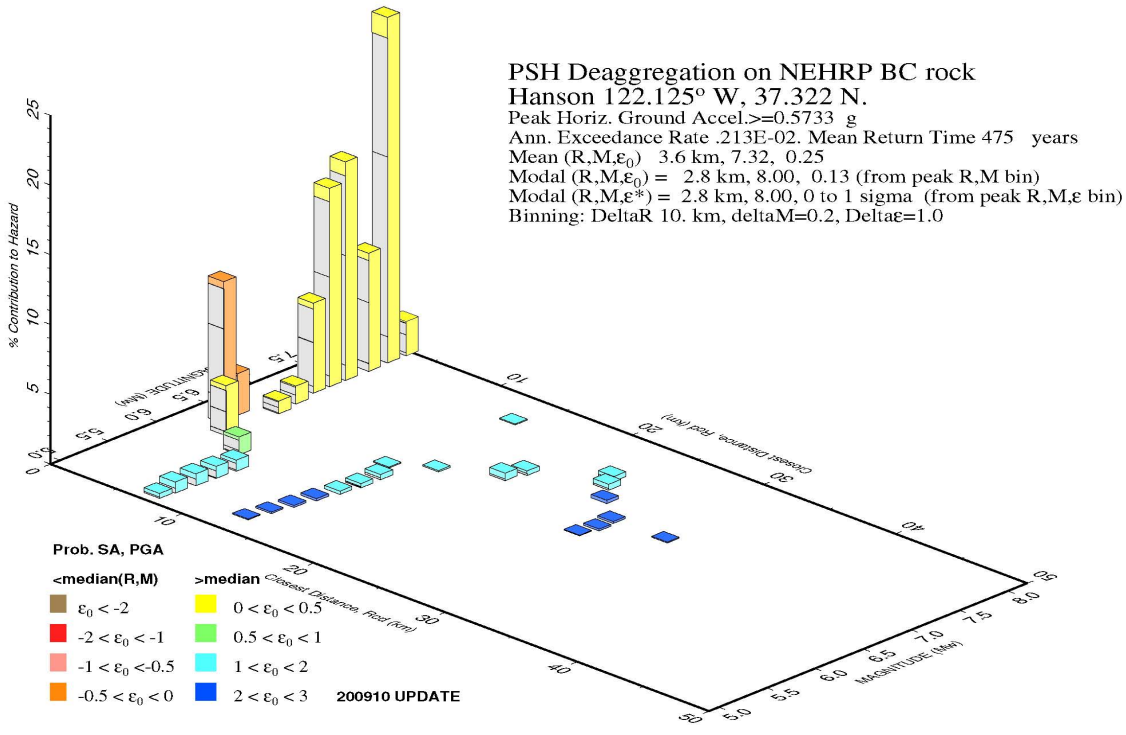
parallels the San Andreas to the east and forms the eastern-most structural boundary to the Permanente Terrain.

Near the quarry, the SBFZ consists of two northwest-trending, sub-parallel faults, namely the northeastern-most Monta Vista Fault Zone and the southwestern-most Berrocal Fault Zone (Sorg and McLaughlin, 1975) (Figure 3.4). The Monta Vista Fault Zone is located approximately 1 mile to the northeast of the quarry. A strand of the Berrocal Fault Zone lies beneath the Permanente Cement Plant area to the south of the EMSA/CMSA, and extends west to other portions of the quarry (Mathieson, 1982; Sorg and McLaughlin, 1975).

3.4 Seismic Setting

The Permanente Quarry is located within the San Francisco Bay Area, which is a region characterized by relatively high seismicity. SMARA does not specify a minimum seismic design event that should be used for slope stability analyses. However, SMARA does specify that the final slopes shall be flatter than the critical gradient, which is defined at the maximum stable slope inclination of a unsupported slope under the most adverse conditions (i.e. seismic loading) that it will likely experience, as determined by current engineering technology.

Accordingly, Golder evaluated potential seismic impacts for the project resulting from an earthquake event associated with 10 percent probability of exceedance (POE) in a 50-year period. Golder has used the 10 percent POE in a 50-year event to evaluate seismic impacts for other quarry reclamation projects



in California, which has been accepted by regulatory agencies.

Using the 2008 Update of the United States National Seismic Hazard Maps (Peterson, et.al., 2008), which incorporates the findings of the Next Generation Attenuation Relation Project, Golder estimates that design peak ground accelerations should be approximately 0.57g for the site (Figure above and Figure 3.5).

N

Half Moon Bay
Atherton
SAN FRANCISCO BAY
ALAMEDA COUNTY
SANTA CLARA COUNTY
Woodside
West Menlo Park
SAN MATEO COUNTY
Ladera
Sky Londa
Portola Valley
Los Altos Hills
SANTA CLARA VALLEY
Los Trancos Woods
San Gregorio
PACIFIC OCEAN
Redwood Terrace
La Honda
Monta Vista
Cupertino
San Jose
SANTA CRUZ MOUNTAINS
Loma Mar
Pescadero
Monte Sereno
SANTA CRUZ COUNTY
Lexington Hills
Boulder Creek

LEGEND

Facility boundary

REFERENCES

ESRI:World_Shaded_Relief
(http://services.arcgisonline.com/arcgis/services)
Spatial Reference:
NAD 1983 StatePlane California III FIPS 0403 Feet

0 5 10
Miles

PROJECT

GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE

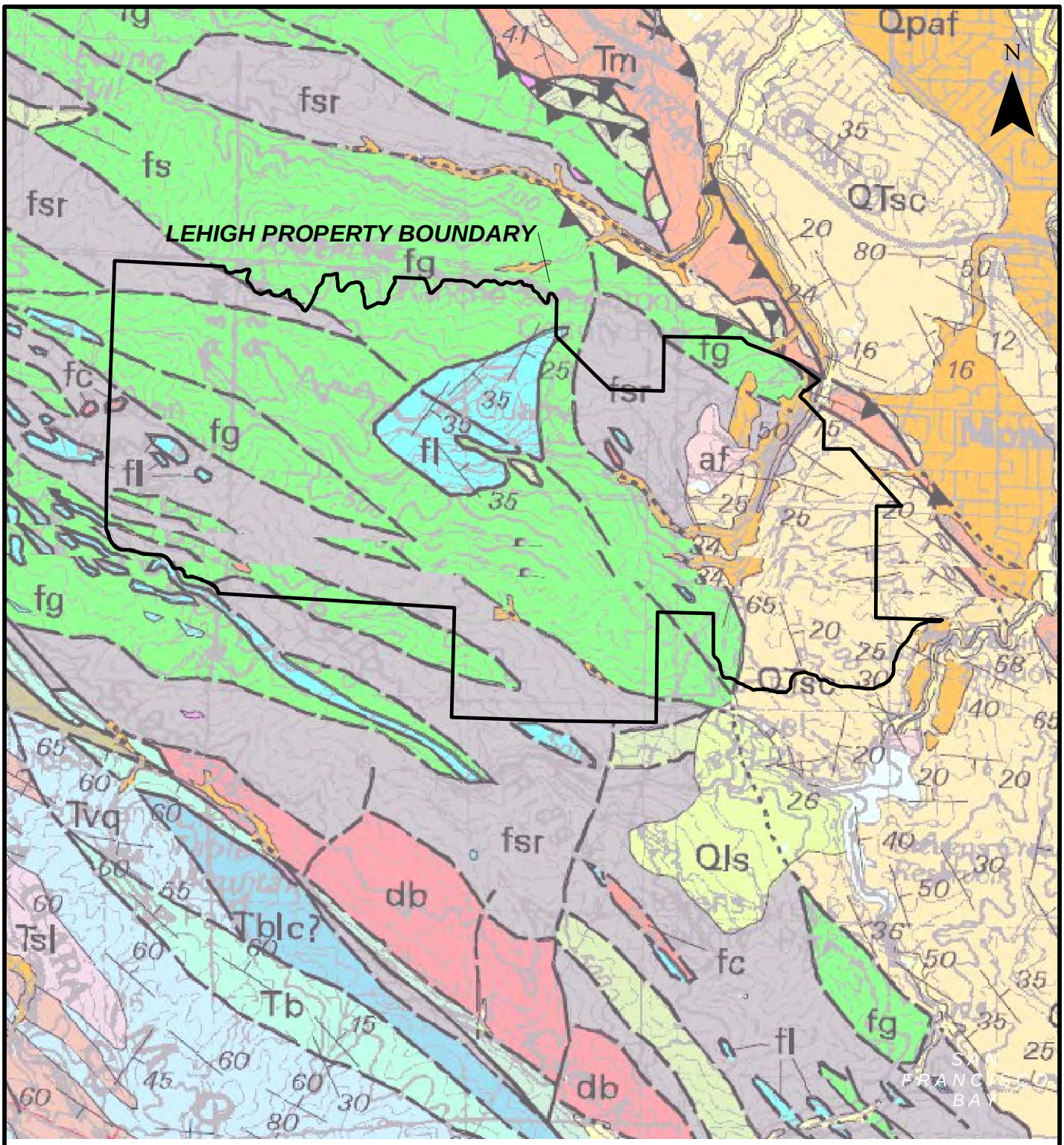
TOPOGRAPHIC SETTING

Golder Associates

PROJECT No.		063-7109	FILE No.	
DESIGN	DLM	10/27/2008	SCALE: AS SHOWN	REV. 0
GIS	DLM	10/27/2008		
CHECK	WLF	10/27/2008		
REVIEW	XXX	10/27/2008		

FIGURE 3.1

G:\GIS\Sites\Lehigh_Permanente_Quarry\mxd\RP_regional_relief



REFERENCES

US Geological Survey, Geologic Map and Map Database of the Palo Alto 30' x 60' Quadrangle, California; Brabb, E.E., R.W.Graymer, and D.L., Jones, 2000. MF Studies Map MF-2332.
(http://pubs.usgs.gov/mf/2000/mf-2332/mf2332m.pdf)

PROJECT

GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATA
SANTA CLARA COUNTY, CALIFORNIA

TITLE

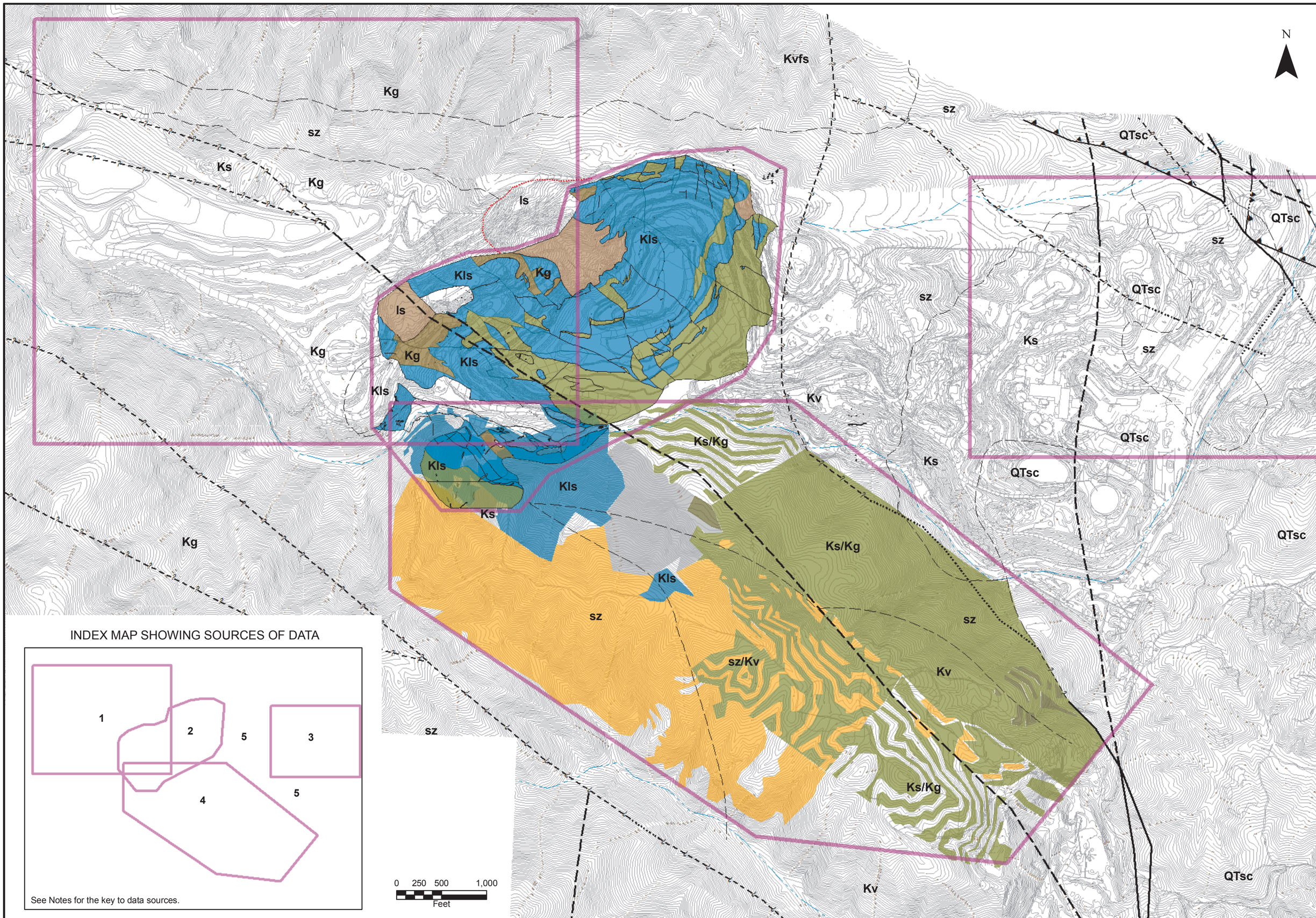
REGIONAL GEOLOGIC MAP

Golder Associates

PROJECT No.		063-7109	FILE No.	
DESIGN	DLM	1/28/2010	SCALE: AS SHOWN	REV. 0
GIS	DLM	1/28/2010		
CHECK	WLF	1/28/2010		
REVIEW	WLF	1/28/2010		

FIGURE 3.2

G:\GIS\Sites\Lehigh_Permanente_Quarry\mxd\RP_RegionalLocationMap.mxd



LEGEND

- Geologic contact, certain
- Geologic contact, approximate
- Geologic contact, concealed
- Landslide

Rock Type (Surpac Model):

- Fault breccia/metabasalt (sz/Kv)
- Graywacke (Ks)
- Graywacke/greenstone (Ks/Kg)
- Greenstone (Kg)
- Greenstone/metabasalt (Kg)
- Limestone (Kls)

Rock Type (Fouria, simplified):

- Landslide (ls)
- Greenstone; all types
- Limestone; all types
- Metabasalts
- Alteration

NOTES

1) Modified after Rogers, T.H. and Armstrong, C.F., CDMG Preliminary Report 17 (1973) and Fouria, J. Geology of the Pemanente Limestone and Agrregate Quarry (2004).
2) Fouria, J. Geology of the Pemanente Limestone and Agrregate Quarry (2004).
3) Modified after Rogers, T.H. and Armstrong, C.F (1973).
4) Gemcom SURPAC results of geologic model.
5) Modified after Rogers, T.H. and Armstrong, C.F (1973).

REFERENCES

Topography (2007, 2008, 2009 composite; Chang Consultants (2010).

Spatial Reference:
NAD 1983 StatePlane California III FIPS 0403 Feet

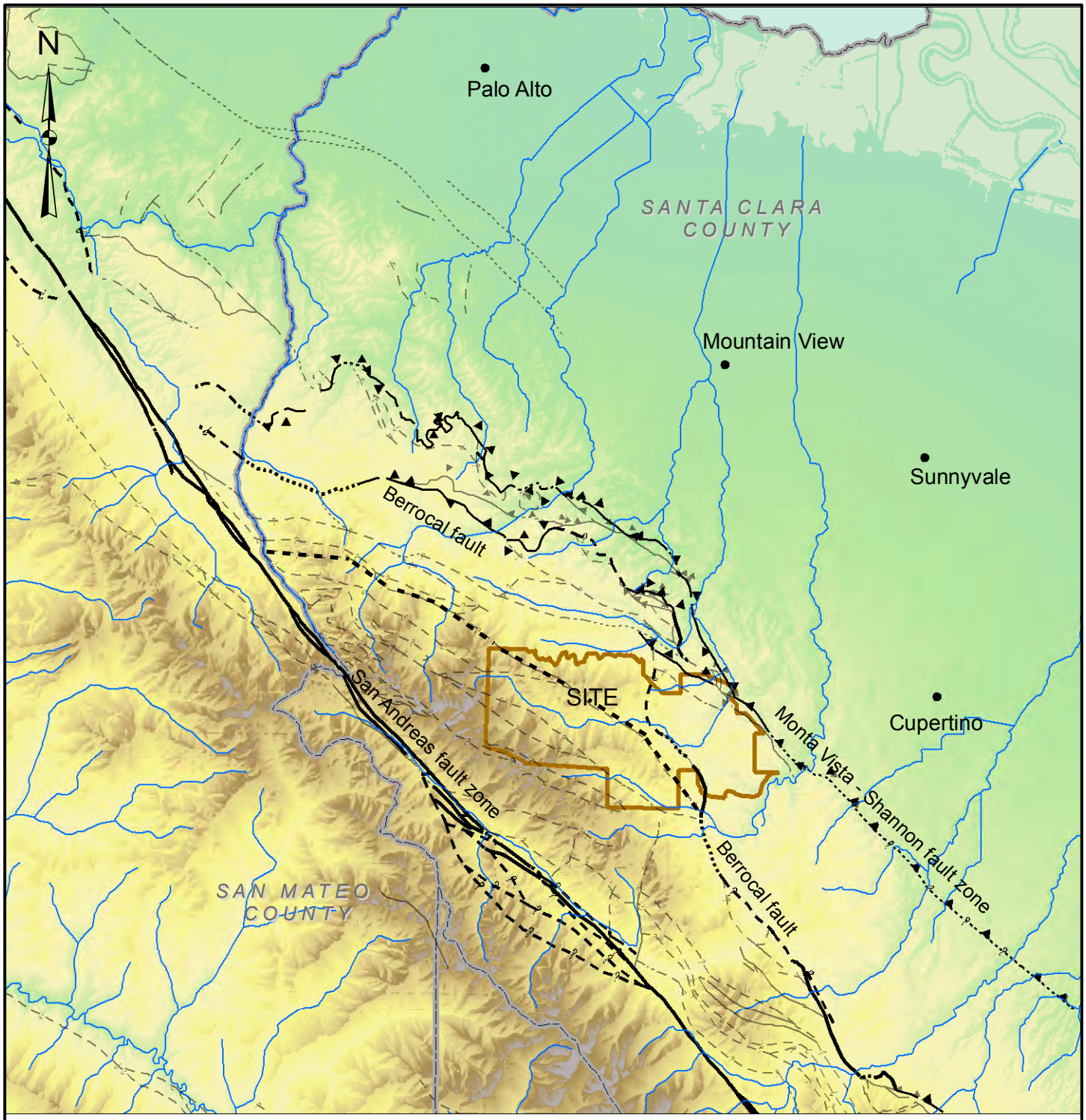
PROJECT
GEOTECHNICAL EVALUATION AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
SITE GEOLOGIC COMPILATION MAP

Golder Associates

PROJECT No.		063-7109	FILE No.
DESIGN	DLM	2/27/2010	SCALE: AS SHOWN REV. 0
GIS	DLM	2/27/2010	
CHECK	WLF	2/27/2010	FIGURE 3.3
REVIEW	WLF	2/27/2010	

Map Document: 00_Hanson_BASEMAP_SEPT2009.mxd / Modified 9/18/2009 2:49:53 PM / Plotted 11/11/2009 11:39:31 AM by DMason



Legend

- Stream
- *Fault (surface expression):*
- Certain
- Concealed
- Inferred
- Thrust (teeth in dip direction)

Dashed where approx., querried where uncertain; dotted where concealed.

Fault source: Brabb, et. al. (2000)

0 1 2 Miles

REV.	DATE	DES	REVISION DESCRIPTION	GIS	CHK	RVW

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

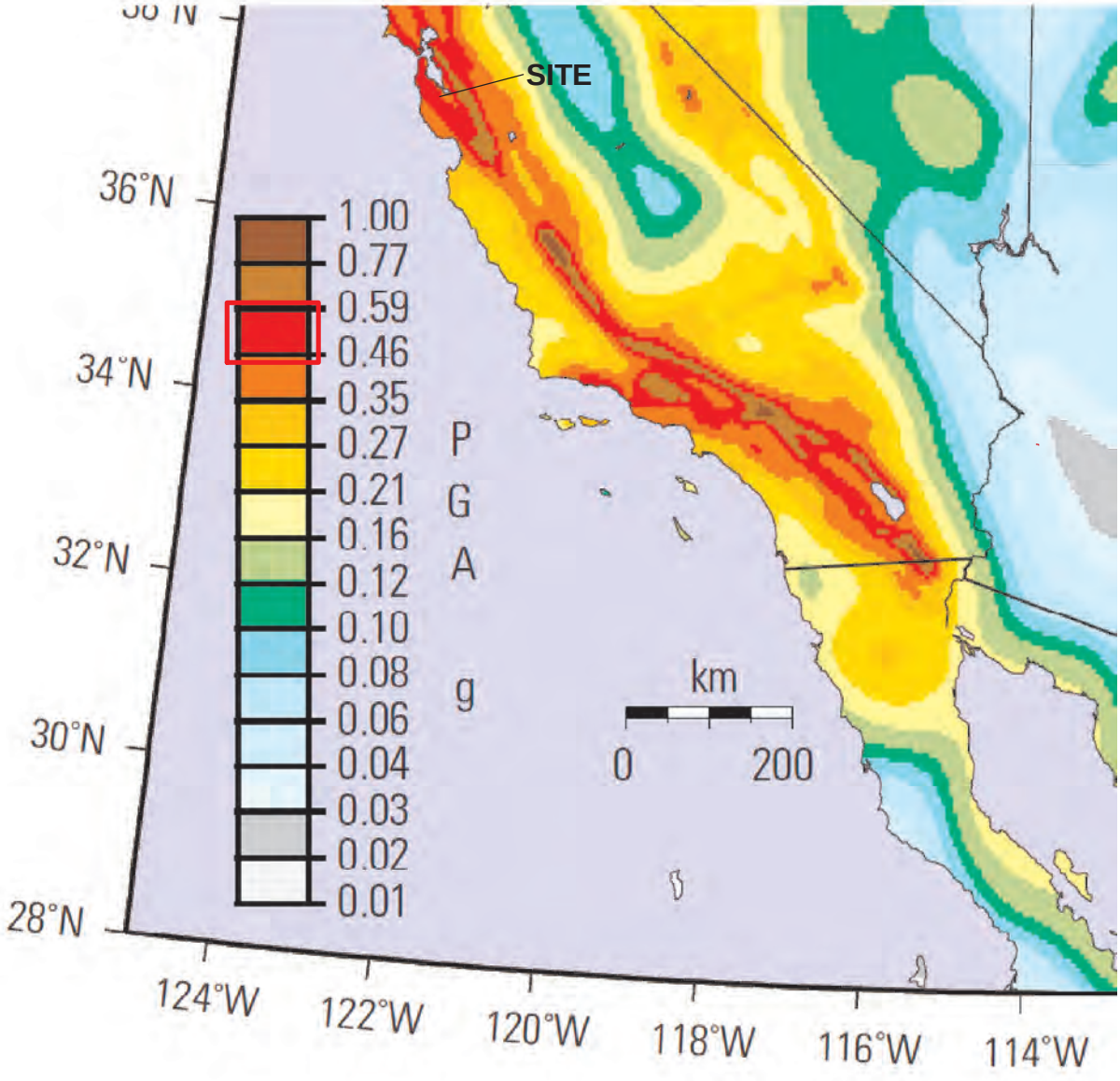
TITLE
REGIONAL GEOTECTONIC MAP

Golder Associates
Sunnyvale, CA

PROJECT No.		063-7109	FILE No.	
DESIGN	DLM	3/13/2009	SCALE: AS SHOWN	REV. 0
GIS	DLM	3/13/2009		
CHECK	WLF	3/25/2009		
REVIEW	WLF	3/25/2009		

FIGURE 3.4

G:\Projects\063-7109 (Hanson Permanente Quarry\GIS\Hanson_geotectonic_map_20Mar2009.mxd



REFERENCES

US Geological Survey, 2008, Documentation for the 2008 Update of the United States National Seismic Hazard Maps; Open-File Report 2008-1128; figure 39. (http://pubs.usgs.gov/of/2008/1128/pdf/OF08-1128_v1.1.pdf)

NOTES

Units = Standard gravity (g)

PROJECT

GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE

PEAK GROUND ACCELERATION MAP (10-PERCENT PROBABILITY/50 YEARS)

Golder Associates

PROJECT No.		063-7109	FILE No.	
DESIGN	DLM	1/28/2010	SCALE: AS SHOWN	REV. 0
GIS	DLM	1/28/2010		
CHECK	WLF	1/28/2010		
REVIEW	WLF	1/28/2010		

FIGURE 3.5

G:\GIS\Sites\Lehigh_Permanente_Quarry\mxd\RP_PGAMap.mxd

4.0 NORTH QUARRY CONDITIONS

4.1 Quarry Development Plan

The current (September 2009) configuration of the North Quarry is shown in Figure 4.1, which also shows the following areas of historic slope instability within and immediately adjacent to the North Quarry:

- Main Slide (1987)
- Scenic Easement Slide
- Mid-Peninsula Slide
- West Area Slides (west of Main Slide between el. 1400 and 1700 ft msl)

The condition of the quarry slopes in June, 2007 is shown in Figure 4.2. The current North Quarry bottom at elevation 710 feet mean sea level (msl) was established during the previous phase of mining (Foruria, 2004). Historically, the North Quarry has filled with water to an approximate elevation of 775 feet msl except when the North Quarry is being actively dewatered.

The final phase of mining in the North Quarry (Figure 4.3) (i.e., the "ultimate" design), will push back the southwest, south, and east sector walls, and will establish a final North Quarry floor at elevation 440 feet. The Mid-Peninsula Slide and portion of the West Area Slides will be mined out. The ultimate design is based 45º to 50º inter-ramp angles (i.e., a line defined by the top-of-bench face to top-of-bench face, or crest-to-crest) in the more competent rocks (limestone, unweathered greenstone), and flatter slope angles in the weaker, weathered rocks near the ground surface.

At present, production in the North Quarry is from the south and west walls, above elevation 800 feet. The current final phase of mining will create new walls along the full depth of the south, southwest, and east sides of the North Quarry. The East sector slope mining and re-grading will remove the Mid-Peninsula Slide. The North and Northwest sector slopes, below the Main Slide (1987) and Scenic Easement Slides, will remain unchanged above elevation 800 feet by the ultimate North Quarry development.

Following completion of mining, the North Quarry will be backfilled with overburden. The final reclamation backfill configuration is shown in Figure 4.4, and includes filling the North Quarry to minimum elevation 990, and backfilling against all North Quarry slopes with overburden constructed with a minimum overall slope of 2.5(H):1(V) to the Scenic Easement ridge line. This will encapsulate the West Area, Main Slide (1987), and Scenic Easement Slide and buttress these slopes to stabilize them against additional potential landsliding.

4.2 Geology of North Quarry

The geologic model for the North Quarry is comprised of a geologic map based on North Quarry exposures as of 2004 (Figure 4.5, which is based on North Quarry topography at the time of mapping), and sets of geologic sections along a grid oriented at azimuths 030º and 120º (Appendix 4.A). The

following paragraphs briefly describe geologic conditions in the North Quarry; the plan, sections, and a detailed description of the geologic model are presented by Foruria (2004). As detailed in subsequent sections, geologic conditions play an important role in slope performance throughout the North Quarry.

The North Quarry is developed in rocks that form part of the Permanente Terrane of the Jurassic-Cretaceous age Franciscan Complex, which represents a subduction zone assemblage of folded, variably metamorphosed, marine clastic and carbonate rocks, and oceanic crust-related submarine igneous rocks. Major lithologic units consist of light gray or dark gray limestones and greenstones (metamorphosed mafic volcanic rocks). Within this assemblage, all major stratigraphic horizons occur along low-angle faults that dip south-southeast, resulting in an imbricated thrust stack of layered and folded limestone and greenstone blocks. The thrust stack is cut by sets of steeply dipping faults that strike dominantly north-south and northwest. Sets of steeply-dipping faults also strike east-west and northeast, although these faults are less frequent. The east-west set includes the northwest strand of the Berrocal Fault, which strikes along the south wall at mid-height.

Specific aspects of North Quarry geology that are significant for the purposes of evaluating slope stability include:

- Bedding is well-developed in the limestone, and although it roughly parallels the thrust faults, bedding orientations can change abruptly due to small-scale folding, or across the contacts between adjacent limestone blocks. Bedding is overturned near the Northwest Berrocal Fault strand. Bedding is involved in the control of bench face angles along the west and north walls; and in the development of slides two to three benches high in the north wall, west of the Main Slide (1987), below elevation ~1500 feet.
- Surface weathering affects rock mass strength of all lithologies to some extent, but particularly greenstones, which are pervasively oxidized, and reduced to a clay-rich residual soil within 50 to 100 feet of the original ground surface. Low rock mass strength in weathered greenstone is the main contributing factor in development of the Scenic Easement Slide.
- Thrust contacts along the north wall dip to the south, toward the North Quarry. A greenstone/limestone contact is implicated in development of the Main Slide (1987).

4.3 Groundwater Conditions

The water level in the North Quarry in 2007 was at an elevation of approximately 754 feet, which correlates well with the likely static groundwater level of approximately 775 feet based on groundwater occurrence in exploratory borings, the location of groundwater seepage within the North Quarry walls, and the location of the adjacent Permanente Creek. The North Quarry receives groundwater inputs that may affect flow in Permanente Creek, as suggested by a dry creek bed adjacent to the North Quarry, while surface water flows occur both upstream of and downstream from the North Quarry (CNI, 1998). Groundwater seepage in the North Quarry has been recognized for decades and was described in the 1985 reclamation plan. A relatively large surface flow of groundwater seepage was observed during North Quarry visits in May and June 2007 on a wide bench at approximate elevation 1,050 feet in the

southwest corner of the North Quarry. This water flowed eastward across the bench, then drained to the North Quarry bottom via the haul ramp along the lower north wall.

Golder understands that seepage has been observed along the Main Slide (1987) headscarp between elevations 1400 and 1600 feet, and we observed seepage from the reclaimed slope between the Main Slide (1987) Slide and the West Materials Storage Area, above elevation 1350 feet, during field mapping in June 2007. These observations support the concept of localized groundwater occurrence in the greenstone above the regional static groundwater level, due to low permeability of the greenstone compared to the limestone and/or clay-rich gouge along thrust contacts.

Groundwater conditions were evaluated in more detail as part of Golder's investigation of the Main Slide and are discussed further in Section 5.

4.4 Slope Performance

Slope performance varies across the North Quarry area, largely as a reflection of engineering geologic factors, and perhaps in some areas because of surface water drainage. Areas of instability that will require consideration in the reclamation plan include the Main Slide (1987); the Scenic Easement Slide, the Mid-Peninsula Slide; and the West Area slope, along which cracking has developed in a reclaimed slope in greenstone above approximate elevation 1550 feet.

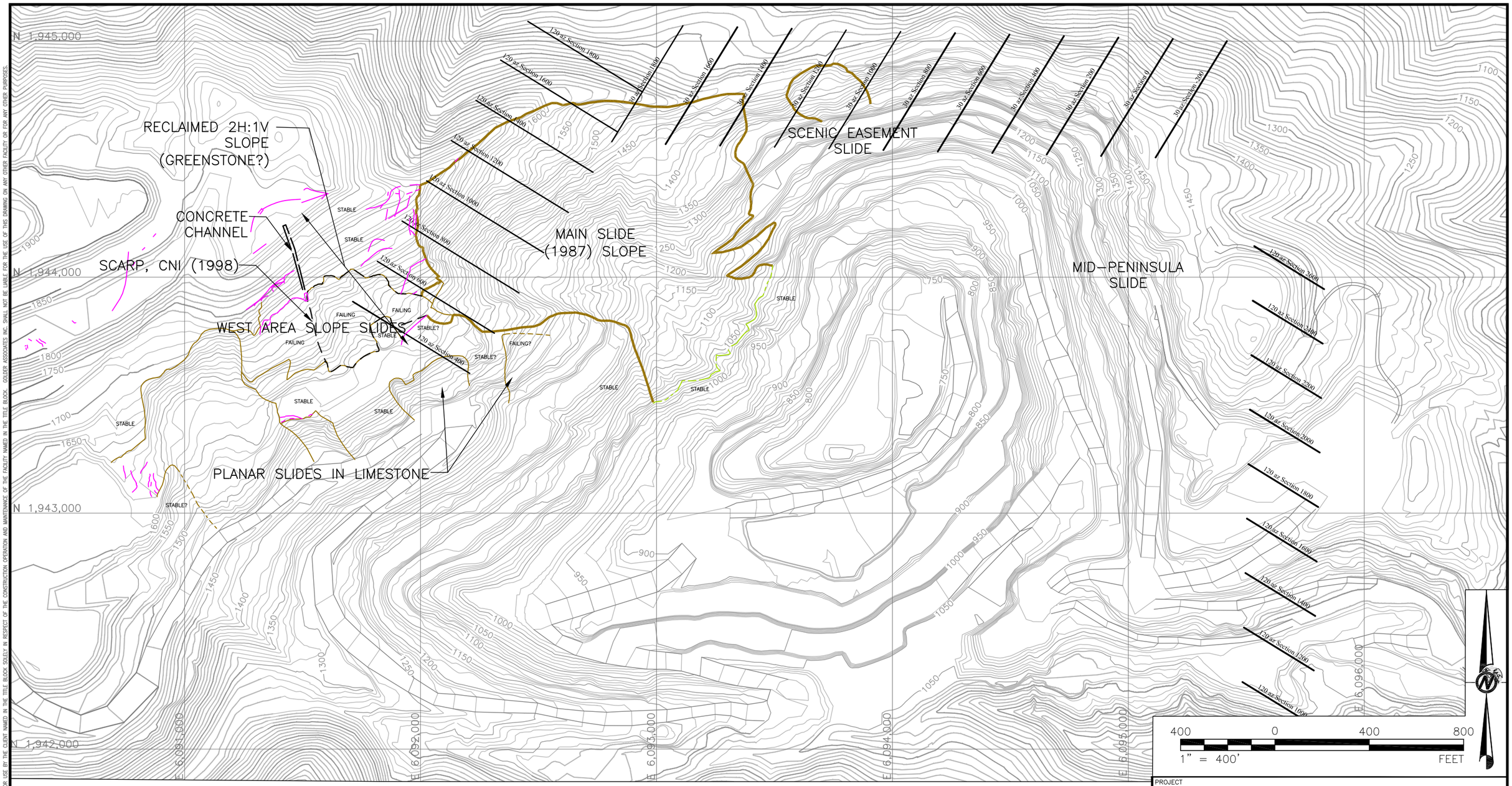
Limestone generally stands well at the design inter-ramp angle (IRA) of 45-50º across most of the North Quarry, with steep bench faces and functional catch benches. However, adversely-oriented structure within the limestone blocks has affected slope performance in the following areas (Figure 4.6):

- North wall, below the Main Slide (1987) Slide, and in the area west of the Main Slide (1987) below elevation ~1500 feet – planar control of bench and multiple-bench slopes along bedding, bedding-controlled wedges, and/or contacts between greenstone and limestone;
- Lower west wall – bench faces are broken back to in-dipping bedding;
- East end of south wall – bench-scale toppling where bedding is overturned (sub-vertical, east-west strike) near the Northwest Berrocal Fault strand.

Upper benches throughout most of the North Quarry are developed in weathered greenstone, with design slope angles that range from 26º (2H:1V) to 34-38º. Over limited heights, and outside of the areas of instability listed above, slopes developed in the weathered greenstones stand reasonably well at these overall angles, although steep bench faces (50 feet high at 60º-70º) tend to degrade and slough with time.

At depth in the North Quarry, non-oxidized greenstone is exposed in slopes mined at a 45º IRA. These exposures are typically more degraded, and "looser" than the non-oxidized limestone exposures mined at the same angle. With a few exceptions, the consequences of less favorable engineering geologic conditions in the greenstone compared to the limestone have been limited to small-scale rock fall. The

exceptions are the Mid-Peninsula Slide, the Main Slide (1987), and some of the areas west of the Main Slide (West Area Slides).



LEGEND

- LIMIT OF SLOPE SLIDE (APPROXIMATE)
- SCARP MAPPED BY GOLDER IN 2007
- CRACK MAPPED BY GOLDER IN 2007

NOTES

1. EXISTING TOPOGRAPHY OUTSIDE THE NORTH QUARRY BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC. EXISTING TOPOGRAPHY INSIDE THIS BOUNDARY IS FROM SEPTEMBER 2009 SURVEY PROVIDED BY LSCC.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
NORTH QUARRY CURRENT CONFIGURATION

Golder Associates

PROJECT No. 063-7109 800			FILE No.		Figure 4.1
DESIGN	--	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	GM	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 4.1

FILE: S:\Honson\Permanente\Plt 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 4.1.dwg TAB NAME \SITE LAYOUT
Thursday, April 29, 2010 - 2:14pm
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.

LOOKING NORTH-NORTHWEST

EAST WALL

LOOKING SOUTHEAST

LEGEND

- Kg–3 BLOCK (BELOW MAIN SLIDE (1987))
- LIMITS OF MAIN SLIDE (1987) (APPROXIMATE)

NOTES

1. PHOTOGRAPHS TAKEN JUNE, 2007.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

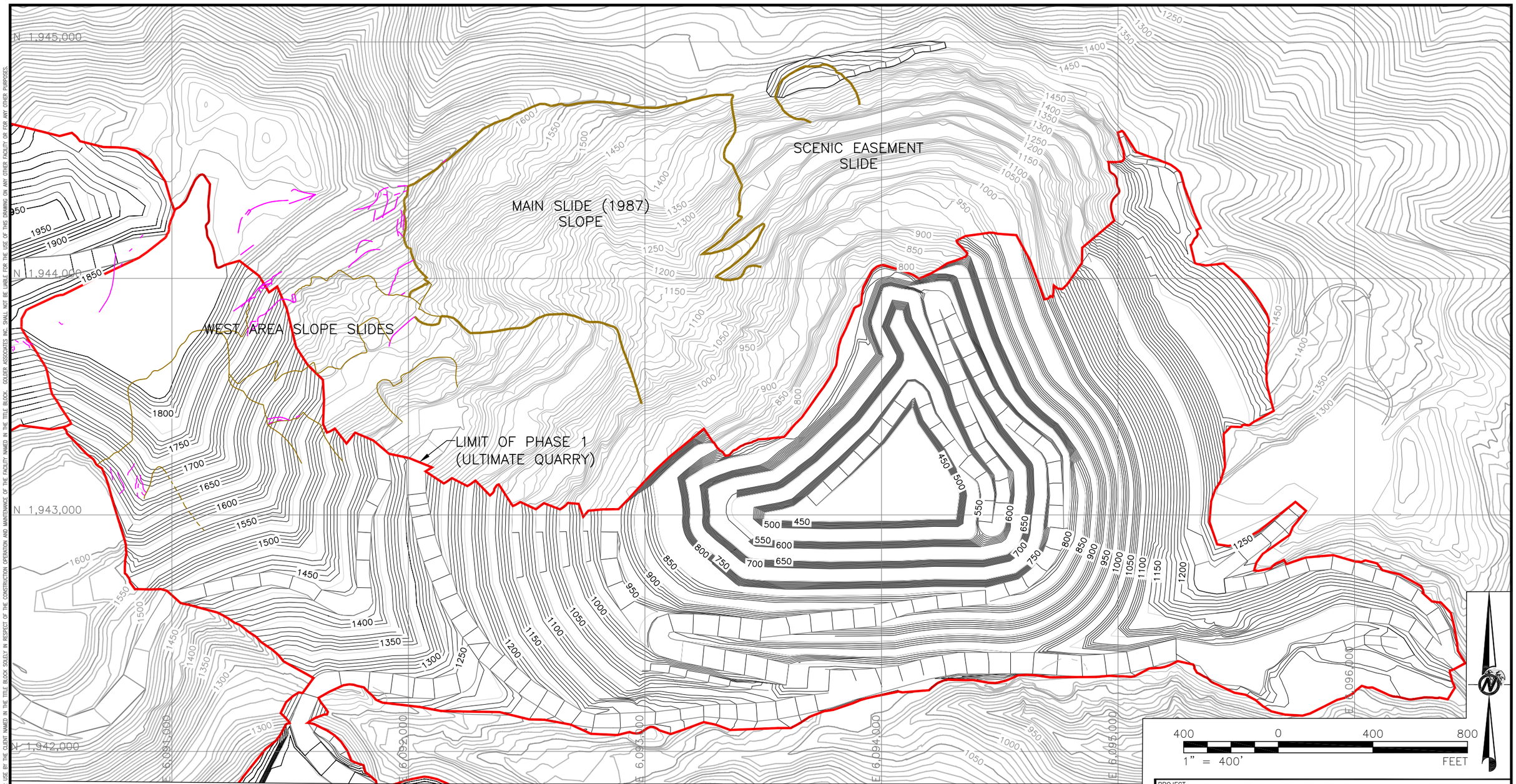
TITLE
NORTH QUARRY SLOPE CONDITIONS IN JUNE 2007

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 4.2
DESIGN	--	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	GM	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 4.2

Thursday, April 29, 2010 - 2:06pm FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 4.2.dwg TAB NAME: \SITE LAYOUT
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



LEGEND

- LIMIT OF PHASE 1
- LIMIT OF SLOPE SLIDE (APPROXIMATE)
- SCARP MAPPED BY GOLDER IN 2007
- CRACK MAPPED BY GOLDER IN 2007

NOTES

1. PROPOSED TOPOGRAPHY INSIDE THE PHASE 1 NORTH QUARRY BOUNDARY PROVIDED BY LSCC IN DECEMBER 2009. TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

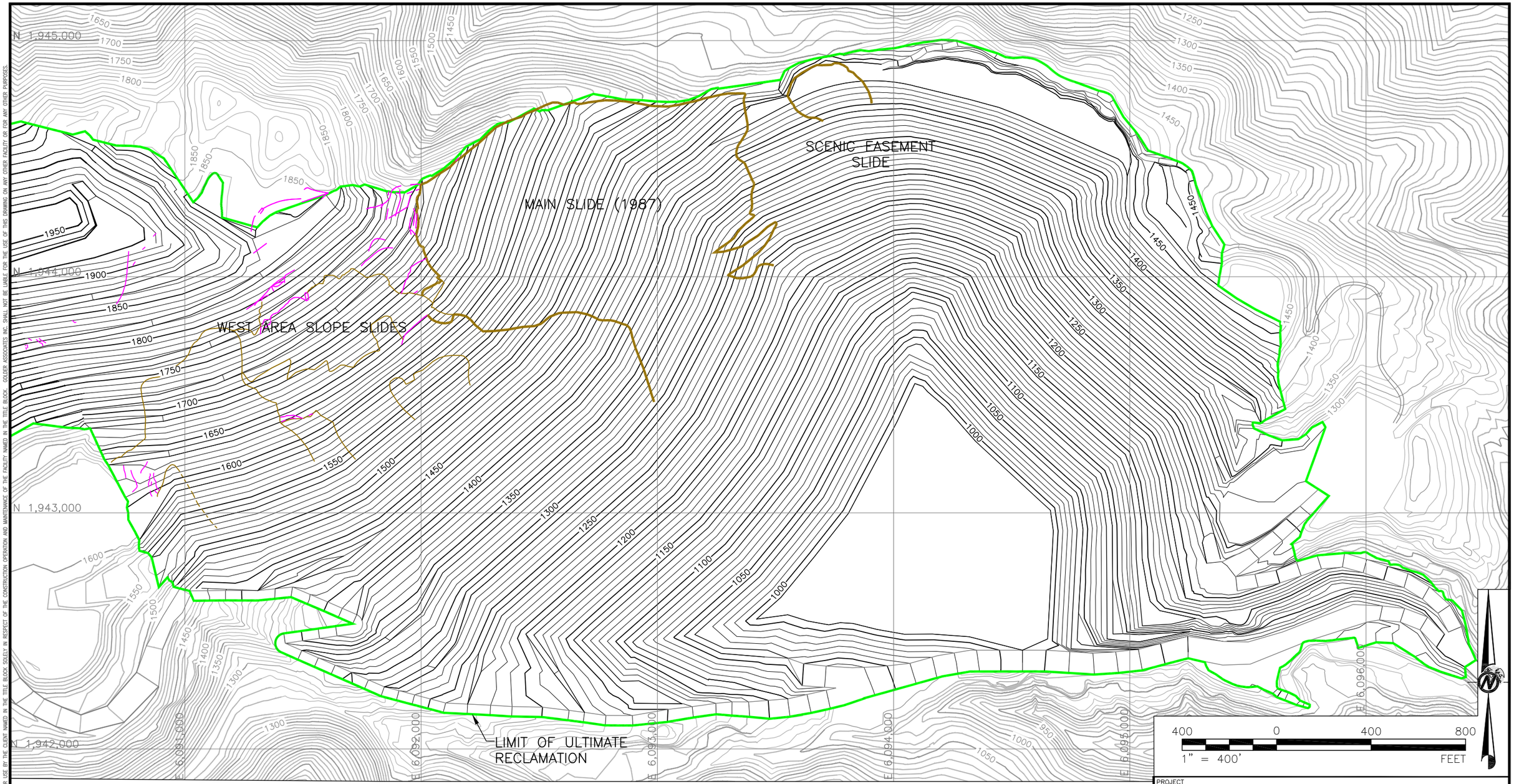
TITLE
NORTH QUARRY ULTIMATE DESIGN

Golder Associates

PROJECT No. 063-7109 800			FILE No.		Figure 4.3
DESIGN	--	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	GM	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 4.3

FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 4.3.dwg TAB NAME \SITE LAYOUT
Thursday, April 29, 2010 - 1:42pm
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES. IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK SOLELY



LEGEND

- LIMIT OF ULTIMATE RECLAMATION
- LIMIT OF SLOPE SLIDE (APPROXIMATE)
- SCARP MAPPED BY GOLDER IN 2007
- CRACK MAPPED BY GOLDER IN 2007

NOTES

1. PROPOSED ULTIMATE RECLAMATION TOPOGRAPHY INSIDE THE PHASE 1 NORTH QUARRY BOUNDARY PROVIDED BY LSCC IN MAY 2010. TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

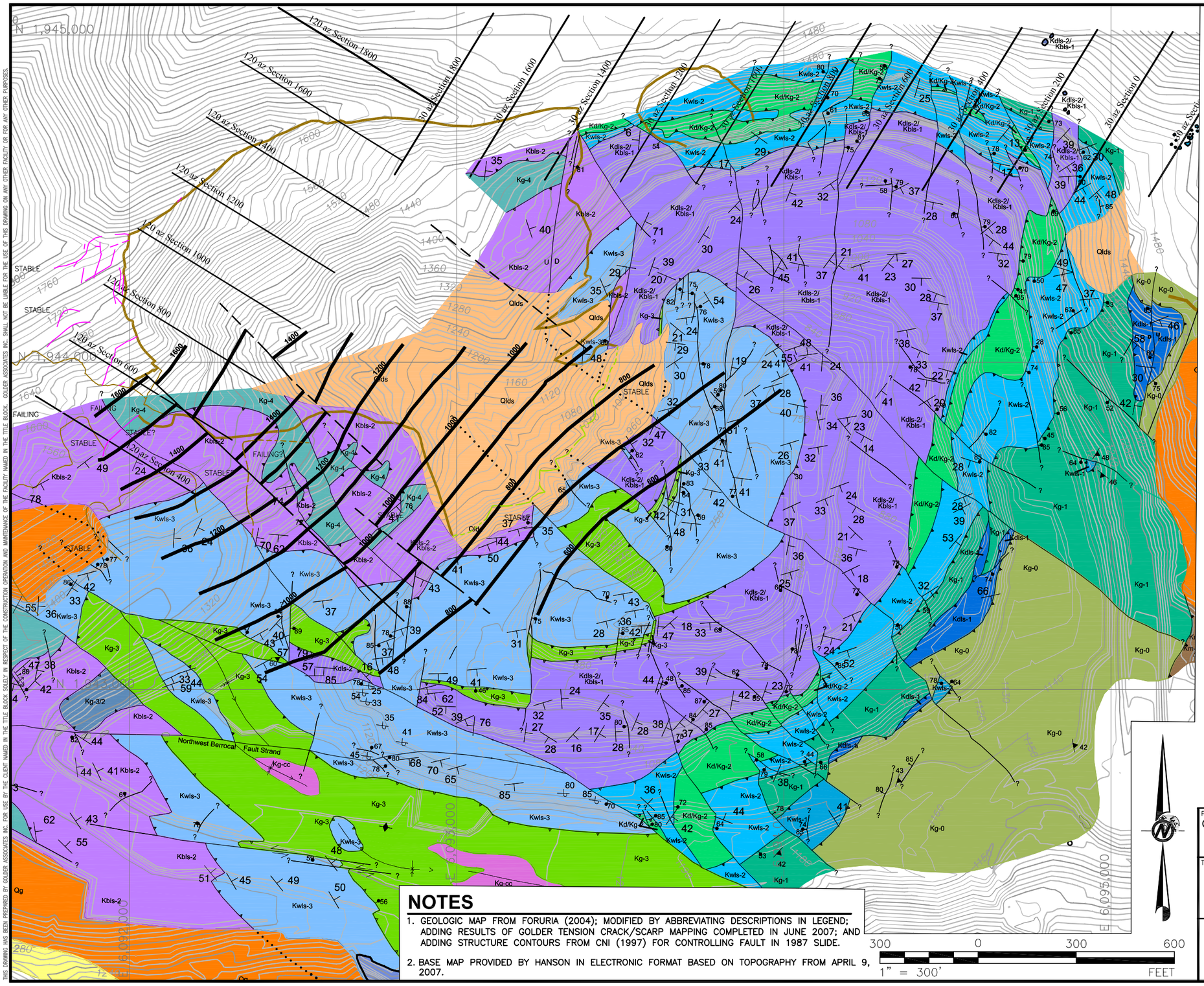
TITLE
NORTH QUARRY BACKFILL FINAL RECLAMATION PLAN

Golder Associates

PROJECT No. 063-7109 800			FILE No.		Figure 4.4
DESIGN	--	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	GM	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 4.4

FILE: S:\HansonPermanente\Plt 1 North East Wells\Reclamation Study - 2010\Reporting\Figures R1\Figure 4.4.dwg TAB NAME \SITE LAYOUT
Monday, May 10, 2010 - 1:01pm
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



LEGEND

- LIMIT OF SLOPE SLIDE (APPROXIMATE)
- SCARP MAPPED BY GOLDER IN 2007
- CRACK MAPPED BY GOLDER IN 2007

QUATERNARY DEPOSITS

- Qlds — QUARRY LANDSLIDE DEPOSITS (WITHIN SURFACE OPERATION)
- Qg — DUMP MATERIAL
- Qal — QUATERNARY AND RECENT UNCONSOLIDATED ALLUVIUM AND GRAVEL DEPOSITS

METAMORPHOSED IGNEOUS AND SEDIMENTARY ROCKS

- Km-1 — GREYWACKE, SHALE AND ARGILLITE

EARLY TO MIDDLE CRETACEOUS

- Kg-0 — METABASALTS (GREENSTONES)
- Kdls-1 — DARK GREY LIMESTONE WITH INTERBEDDED CHERT
- Kwls-1 — LIGHT GREY LIMESTONE WITH INTERBEDDED CHERT
- Kg-1 — METABASALT (GREENSTONE)
- Kwls-2/Kd/Kg-2 — LIGHT GREY LIMESTONE WITH THINLY INTERBEDDED, VARIABLY COLORED CHERT
  Kd/Kg-2 DIORITE SILL WITH MINOR MAFIC METAVOLCANIC FLOWS
- Kdls-2/ Kbls-1 — GREY LIMESTONE WITH MINOR THINLY INTERBEDDED DARK GREY TO BLACK CHERT: GRADATIONAL CONTACT.
  DARK GREY TO BLACK LIMESTONE:
- Kg-3 (Kg-cc) — METABASALTS (GREENSTONES) WITH LESSER LIMESTONE, GREYWACKE, CHERT, AND MUDSTONE
- Kwls-3 — LIGHT GREY LIMESTONE WITH INTERBEDDED CHERT
- Kg-3/2 — METABASALTS (GREENSTONES)
- Kbls-2 — DARK GREY TO BLACK LIMESTONE WITH MINOR BLACK CHERT
- Kg-4 — METABASALTS (GREENSTONES)
- Kbls-3 — BLACK LIMESTONE

ALTERATION

- BLEACHING (DECALCIFICATION?)

SYMBOLS

- CONTACT, DASHED WHERE APPROXIMATELY LOCATED, SHOWING DIP.
- FAULT (HIGH ANGLE), SHOWING DIP AND RELATIVE SEPARATION.
- FAULT (LOW ANGLE), SAWTEETH ON UPPER PLATE SHOWING DIP
- SYNCLINE (INCLINED), SHOWING INCLINATION OF AXIAL PLANE AND PLUNGE OF FOLD.
- ANTICLINE (INCLINED), SHOWING INCLINATION OF AXIAL PLANE AND PLUNGE OF FOLD.
- STRIKE AND DIP OF BEDDING.
- STRIKE OF VERTICAL BEDDING.
- STRIKE AND DIP OF OVERTURNED BEDDING.
- STRIKE AND DIP OF FOLIATION.
- STRIKE OF VERTICAL FOLIATION.
- STRUCTURE CONTOURS, CONTROLLING FAULT FOR 1987 FAILURE (CNI, 1998)

NOTES

1. GEOLOGIC MAP FROM FORURIA (2004); MODIFIED BY ABBREVIATING DESCRIPTIONS IN LEGEND; ADDING RESULTS OF GOLDER TENSION CRACK/SCARP MAPPING COMPLETED IN JUNE 2007; AND ADDING STRUCTURE CONTOURS FROM CNI (1997) FOR CONTROLLING FAULT IN 1987 SLIDE.
2. BASE MAP PROVIDED BY HANSON IN ELECTRONIC FORMAT BASED ON TOPOGRAPHY FROM APRIL 9, 2007.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
NORTH QUARRY PIT GEOLOGY

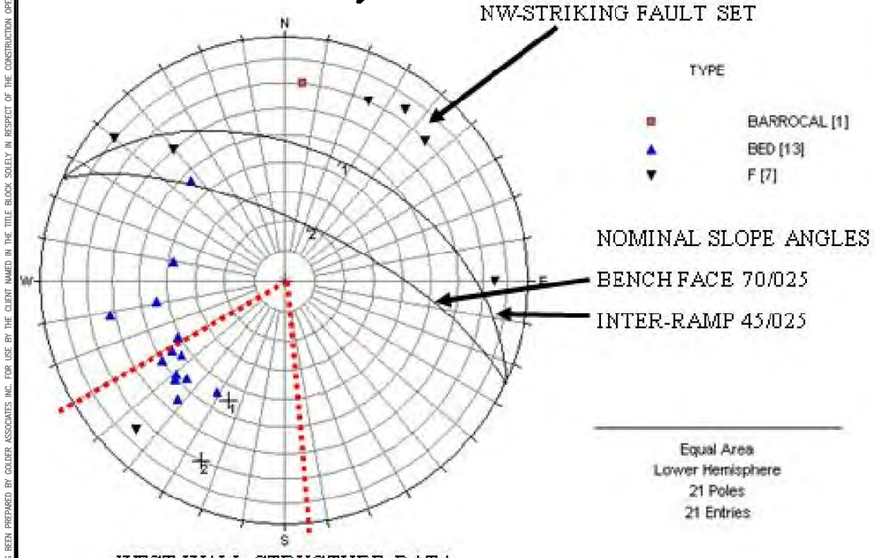
Golder Associates

PROJECT No. 063-7109 800			FILE No.		Figure 4.5
DESIGN	--	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	GM	01/22/10			
REVIEW	BF	01/22/10			

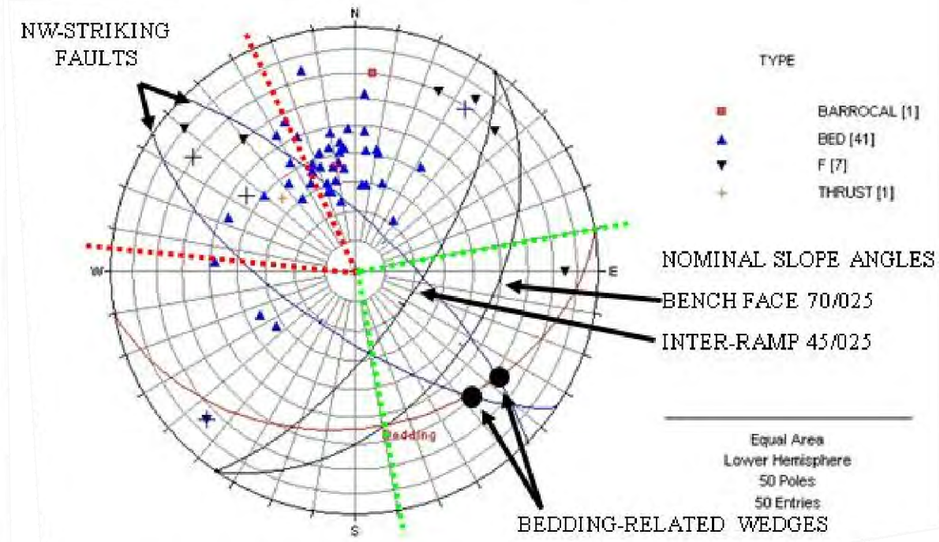
FIGURE 4.5

Thursday, April 29, 2010 - 1:36pm
FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 4.5.dwg TAB NAME: \SITE LAYOUT
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.

BEDDING CONTROL OF BENCH FACE ANGLES



WEST WALL STRUCTURE DATA



LOWER NORTH WALL STRUCTURE DATA

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
NORTH QUARRY STRUCTURAL CONTROL IN LIMESTONE

Golder Associates
RENO, NEVADA

PROJECT No. 063-7109 800			FILE No.	Figure 4.6
DESIGN	--	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	GM	01/22/10	**FIGURE 4.6**	
REVIEW	BF	01/22/10		

FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 4.6.dwg TAB NAME \SITE LAYOUT
Thursday, April 29, 2010 - 2:25pm
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.

5.0 MAIN SLIDE (1987)

5.1 History

The Main Slide (1987) in the North Quarry currently involves a slope length of about 750 feet in the central section of the northwest wall, and extends vertically over heights between 500 to 700 feet, from approximate elevation 1050 feet to the ridge crest. The slide developed in a greenstone rock mass that extends into the area of the 2H:1V slope that forms the upper northwest wall. The reference to "1987" reflects when the first very large slope movements occurred. However, slope instability and smaller slope movements are evident before 1987.

The Main Slide (1987), and precursor slope instability, has been recorded and studied for an extended period.

- Instability of the north slope was observed as early as 1974 in connection with pre-SMARA mining activities. Observed slides were at that time limited to relatively shallow, localized slides of the greenstone which subsequently mobilized as mud flows to the base of the slope.
- Later records and slope studies prior to 1987 show a slide in the upper northwest wall, above elevation 1500 feet, along the west side of the area that would become involved in a much larger slide in the spring of 1987. This older slide may be visible on air photos from April 1975, and is clearly visible in photos from April 1981.
- In the spring 1987, quarry personnel noticed a slide that involved a block of limestone that extended from a wide bench at elevation 1500 feet down to elevation 1200 feet. Between these benches, the overall slope was mined at between 47º and 50º. Above the bench at elevation 1500 feet, the quarry slope extended up to approximate elevation 1680 feet at an approximate overall slope angle of 32º (topography from WCA [1988]), and most of this slope was evidently developed in greenstone. The quarry floor elevation at this time was about 950 feet, but the slope angle below elevation 1200 feet was relatively flat due to ramps and catch benches.
- The period of 1987 through the present is marked by numerous slope stability studies and attempts to improve slope stability through regrading. Despite these efforts, slope movement has continued, with ongoing incipient sliding of the steep headscarp terrain and intermittent debris flow activity to the lower elevations of the quarry.

Subsurface explorations were completed during the first quarter of 2009 in order to better characterize the geologic and hydrogeologic conditions to support the evaluations of reclamation alternatives for the North Quarry. These explorations are discussed further in Section 5.5.3.

The following sections document the North Quarry conditions and stability evaluation based on all available information.

5.2 Geologic Conditions and Contributing Factors

The Main Slide (1987) is structurally-controlled along a southeast-dipping thrust contact between greenstone in the footwall, and fractured limestone in the hanging wall. A stability model developed by CNI (1998) to back-analyze the initial slide is shown in Figure 5.1. According to this model, the contact is oriented at approximately 37º/130º (dip/dip direction), and the quarry wall was developed on the hanging

wall side of the contact, with limestone in place between the face and the contact. When the toe of the wall reached elevation 1200 feet, a slip surface developed along the contact, and broke through the limestone rock mass at the toe. The lateral limits of the slide coincided with northwest-striking faults according to CNI (1998), although subsequent degradation of the rock mass along the sides of the slide now obscures these structures.

Geologic sections by Foruria (2004) largely support the interpretation of contact-related instability, although the geometry of the contact indicated in the sections may be more affected by faulting and folding than in the CNI model (Figure 5.2). Undulations in the contact as it is shown on the sections likely brought the contact closer to the face, allowing the slip surface to break through a narrower zone of limestone, but could also have daylighted the contact.

The stable overall slope to the east of the slide is either a reflection of the wall diverging from the contact as it changes orientation, or a fault-related offset of the contact such that it does not occur close enough to the wall to affect stability. Azimuth 120º geologic sections show that the contact extends west of the main limits of the slide, at least into the area of Sections 400 and 600 (Figures 4.A1 and 4.A2).

A fault intersection described as a “failure zone” in corehole CNI-1 was logged as fine to coarse gravel in medium- to high-plasticity sandy clay matrix (depth interval 66.5-71.5 feet). This may be an intersection of the controlling fault, but even if it is a different structure, the description is typical of fault intersections in the greenstone described in other CNI core logs; and of some greenstone/limestone contacts observed elsewhere in the Quarry.

5.3 Current Conditions

At present, the slope profile within the Main Slide (1987) features a headscarp in the upper slope that has progressed into the ridgecrest; slide debris accumulated in the lower elevations of the slide area, and steeper slopes developed in intact limestone at the toe of the slide (Figure 5.3). The headscarp exposure is greenstone along its full length and is typically inclined at slope angles between about 30° and 40°. Greenstone extends from the crest downward over the full height of the slide or more than 500 feet. Golder understands that instability has been limited to slumping and surficial movement since early 1999. However, instability during the winter of 2007-2008 included regression of the headscarp into the ridgecrest through failure of crack-bounded blocks; weather-related degradation of the headscarp; and generation of debris flows from the lower section of the slide that has been on going through 2008 to the present. The debris flows were observed throughout the dry months of 2008.

The limestone rock mass below elevation 1050 feet has remained intact, and does not appear to be involved in the slide. However, a wedge of greenstone within the limestone that was largely intact during the summer of 2007 is completely broken up in the slope immediately above the ramp between elevations 940 and approximately 1050 feet. Below the ramp, the wedge is partially intact, but continues to break up,

particularly along the east margin. An uneven slope developed in slide debris extends from the base of the headscarp to this intact rock mass. The vertical thickness of slide debris, the geometry of the top of intact rock in the slide area, and the relative amounts of greenstone vs. limestone in the slide debris are all uncertain.

Intact limestone benches interspersed with angle of repose debris slopes define a ragged northeast boundary of the slide, which appears to have changed little from the November 1998 event. The southwest margin of the slide is also similar to the November 1998 limit, but Golder mapping completed in 2007 indicates that cracking has developed since CNI (1999) completed their work at the west end of the headscarp between approximate elevations 1740 and 1780 feet, and along the slope west of the slide between elevations 1380 and 1500 feet.

Shallow drainages have developed in the slide debris at the base of the headscarp, and these drainages were flowing during Golder field work in June 2007. Seeps have been observed by others in this area between elevations 1400 and 1600 feet.

5.4 Likely Behavior of Slide Without Mitigation

Observations between 2006 and 2009 indicate that instability in the Main Slide involves a process of recession of the over-steepened slopes in the headscarp; debris accumulation in the "bowl" area of the slide; and migration of slide debris out of the bowl due to debris flow generation, particularly during precipitation events. If slide debris did not migrate out of the bowl area, the accumulation of the debris in the bowl area would tend to buttress the headscarp. This may be occurring to some extent, but over more than 20 years after the initial slide, the heights of over-steepened slopes along the headscarp remain significant.

Without mitigation, instability along the headscarp will continue, with on-going impacts to the ridgeline north of the quarry until the slope overall reaches a stable configuration. The headscarp will erode and generate debris due to failure of crack-bounded blocks and weathering-related degradation, and will migrate further into the ridge. The rate of erosion and the stability of the slide will depend on the degree of saturation that results from precipitation or groundwater discharge. The lower section of the slide will likely continue to generate debris flows even in dry weather due to likely groundwater seepage along the fault-bounded margins of the slide.

Figure 5.4 shows a summary of the heights and angles of selected greenstone slopes in the North and South Quarry areas. The height/angle data points include the following:

- Unstable slopes along the Main Slide (1987) headscarp
- The marginally-stable 2H:1V slope to the west of the Main Slide (1987) headscarp
- A slide scarp in the South Quarry area

- Native slopes in the South Quarry area that are apparently stable, and located outside of interpreted slide limits

For the range of heights along the Main Slide (1987) headscarp, we expect that greenstone slopes would be marginally stable at a slope angle of about 25˚. However saturation and degradation of the greenstone would tend to decrease shear strength along the slope face with time, and some degree of instability could be expected even at a slope angle of 25˚. The existing 2H:1V slope west of the Main Slide (1987) demonstrates that instability in a 25˚ to 27˚ slope occurs at a slower rate compared to the existing headscarp; and is less likely to impact the ridgeline. At a slope angle of 20˚, instability in the Main Slide headscarp would likely be negligible, and limited to surface erosion.

Over time and with no mitigation, Golder expects the Main Slide (1987) to slowly fail back to overall slope angles between 20˚ and 25˚. Actual slope profiles would likely be irregular, with steep, remnant sections of the scarp at the crest, and the lower sections of the scarp buttressed by slide debris. Note that the slide debris has accumulated at the base of the scarp to some extent since the Main Slide (1987) occurred, but this process has been offset by generation of debris flows that exit the south end of the bowl. In order to limit the migration of slide debris out of the bowl, stabilization by grading and vegetation of the slide debris within the bowl or by other means would be necessary.

The engineering geologic conditions that contributed to the slide in 1987, i.e., a thrust contact with a large greenstone mass on the footwall side behind the quarry wall, also exist in the area west of the Main Slide (1987)(West Area). These conditions likely contribute to instability in the West Area, and present the potential for the Main Slide (1987) to expand to the west.

5.5 Available Supporting Data

Relevant information additional to the geologic model, slope performance observations, and groundwater conditions discussed previously is summarized in the following sections.

5.5.1 Characterization Data from Previous Studies

Characterization data from previous studies include:

- Laboratory testing data, particularly the data specific to the Main Slide (1987) area from CNI (1998) and (2001)
- Back-analyzed shear strengths for weathered greenstone from CNI (2001 and 2003); the greenstone in the headscarp of the Main Slide (1987) area from CNI (1999); and the white limestone and the fault zone involved in the Main Slide (1987) from CNI (1998)
- Rock mass ratings based on geotechnical core logging by CNI for coreholes in the area of the Main Slide (1987)

5.5.2 Initial Material and Groundwater Characterization Based on Available Data

The following material properties were used for initial analysis purposes based on the data listed above, and our back analysis of the initial Main Slide (1987) .

TABLE 5.1
MATERIAL PROPERTIES USED FOR
INITIAL STABILITY ANALYSES BASED ON AVAILABLE DATA

Material	Geology	Unit Weight, pcf	Cohesion, psi	Φ, º	Comment
White Limestone	Klw	165	87	30	CNI (1998) characterization, back analysis of initial 1987 Slide
Black Limestone	Klds	165	87	30	CNI (1998) characterization; back analysis of initial 1987 Slide
Fault	Kg4	155	0	20	Golder back analysis of initial 1987 Slide; discontinuity shear strength data from direct shear testing of greenstone breccia (CNI, 1998)
Greenstone	Kg4	155	10	23	Weathered Greenstone; c,Φ from back analysis of 1987 Slide headscarp in CNI (1999), and Scenic Easement Slide
Slide Debris	-	135	0	22	"Poor quality" greenstone from CNI (1999)

The known static groundwater level at about elevation 750 to 775 feet does not account for seepage observed above elevation 1350 feet, or groundwater seepage observed in the past from the Main Slide (1987) area between elevations 1400 and 1600 feet. Given a lack of hard data for groundwater occurrence in the greenstone, various groundwater conditions were initially incorporated into stability models of the Main Slide (1987) to evaluate sensitivities, including a discrete piezometric surface above the static groundwater level; and pore pressures generated based on an R_u coefficient (pore pressure as a fraction of vertical earth pressure).

5.5.3 2009 Characterization

The greenstone in the Main Slide (1987) headscarp tends to degrade rapidly on exposure, but there is a question as to the character of the greenstone in the rock mass behind the headscarp, and the 2H:1V slope adjacent to the west. This question was addressed through a program of geotechnical core drilling, groundwater measurement, and laboratory testing completed in 2009 to evaluate the rock mass and hydrogeological conditions in the "undisturbed" greenstone near the Main Slide (1987). The field investigation included geotechnical coreholes MS-01 and MS-02, which were drilled on the 1795 bench

just west of the Main Slide (1987) (Figure 5.5). Collar coordinates, orientations, and lengths of the coreholes are summarized in Table 5.2.

TABLE 5.2
2009 GEOTECHNICAL COREHOLE LOCATIONS

ID	Collar, ft			Length, ft	Azimuth°	Inclination, °
	Easting	Northing	Elevation			
MS-01	6091731	1944326	1790	500	-	-90
MS-02	6091742	1944321	1790	157	080	-60

5.5.3.1 Geotechnical Logging

Golder field staff completed geotechnical logs of the core from MS-01 and MS-02 during drilling. The logging format included separate "rock mass" and "detailed discontinuity" sections. In the rock mass section, the following were recorded for each core run:

- Lithology
- depth interval
- core recovery
- Rock Quality Designation (RQD)
- fracture count (value of 50 used for rubble intervals; and 100 for "matrix" or gouge zones)
- rubble and gouge zone depths
- ISRM Strength Index, and
- ISRM Weathering Index

The detailed discontinuity section of the log focused on properties of individual discontinuities observed in the core. Note that rock quality in the greenstone was poor, and core recovery often consisted of "matrix" with no discrete discontinuities, or broken core/rubble. As such, discrete discontinuities were often either not present, or obscured by the condition of the recovered core. However, for discrete discontinuities that were observed, the data collected for each included:

- Depth
- structure type
- dip with respect to the core axis (α)
- discontinuity shape and roughness
- infilling type and thickness
- Joint Condition Rating (JCR, Bieniawski, 1976).

Plots of RQD, ISRM Strength Index, and Bieniawski's (1976) Rock Mass Rating (RMR) are included in Appendix 5.A. Core photographs are also included in Appendix 5.A.

5.5.3.2 Groundwater Pressure Monitoring

Vibrating wire piezometers were installed in coreholes MS-01 and MS-02 in order to improve the understanding of hydrogeological conditions in the greenstone rock mass. Piezometer installations involved attaching transducers and their cables to a string of PVC pipe as it was inserted in a hole; and then fully-grouting the hole, using the PVC string as a tremmie pipe. Piezometers were installed at three depths in corehole MS-01, and a single piezometer was installed in corehole MS-02. Piezometer depths and recent groundwater levels are summarized in Table 5.3; groundwater levels in the piezometers installed in corehole MS-01 are illustrated in Figure 5.6.

TABLE 5.3

PIEZOMETER INSTALLATIONS AND GROUNDWATER LEVELS

Corehole	Collar El., ft	Piezometer			Groundwater, ft		Date
		ID	Depth, ft	Elev., ft	Depth	Elev.	
MS-01	1790	Shallow	85	1705	80.9	1709.1	1/5/10
MS-01	1790	Mid	280	1510	125.7	1664.3	1/5/10
MS-01	1790	Deep	480	1310	168.8	1621.2	1/5/10
MS-02	1790	-	111	1679	82.3	1707.8	1/5/10

5.5.3.3 Laboratory Testing

A limited program of laboratory testing was completed on representative samples of greenstone from coreholes MS-1 and MS-2. The purpose of the testing was to provide information to augment core logging observations; and a basis for comparison with previous laboratory testing of the greenstone (CNI, 1998; see Figure 5.5 for the locations of the CNI coreholes). The program included:

- Two unconfined compressive strength (UCS) tests
- Five point load strength tests (completed on samples that were not long enough for UCS testing)
- Two direct shear tests on remolded greenstone "matrix" with rock fragments. Samples for direct shear testing were taken from intervals that were logged as highly weathered (ISRM W4), and consisted of core that was not well-indurated. The samples were prepared in the laboratory by screening with a No. 4 sieve, and then re-compacting the remainder to the approximate field moisture content and density

Test results are summarized in Table 5.4, and presented in more detail in Appendix 5.B.

TABLE 5.4
SUMMARY OF LABORATORY TESTING RESULTS

Corehole	Depth, ft	Lithology	UCS, psi	Is50, psi	c, psi	Φ, ˚	Unit Weight, pcf
MS-1	250	Greenstone	400	-	-	-	173.5
MS-1	128.3	Greenstone	530	-	-	-	175
MS-1	26.1	Greenstone	-	51.4	-	-	-
MS-1	159	Greenstone	-	32.3	-	-	-
MS-1	264	Greenstone	-	3.7	-	-	-
MS-2	134.1	Greenstone	-	5	-	-	-
MS-1	319	Greenstone	-	11.5	-	-	-
MS-1	338.7	Greenstone	-	-	-	40	-
MS-1	358	Greenstone	-	-	-	34	-

Notes:

1. Zero cohesion assigned for direct shear tests, as the tests were completed on re-compacted samples, and lab values are not considered to be representative of cohesion of greenstone in-situ
2. Is50 can be converted to UCS by multiplying a factor that lies between 15 and 50. The value of this factor is commonly taken to be 24.

5.5.4 Updated Greenstone Rock Mass Characterization Based on 2009 Quarry Investigation

5.5.4.1 Rock Mass Quality

CNI (1998) reported the following rock quality characterization for the greenstone based on coreholes located within what is now the Main Slide (1987) (Figure 5.5):

- Average UCS – 436 psi
- Average RQD – 26%
- Joint Condition Rating – 6
- Average RMR – 29 (based on 1989 version of RMR)

Greenstone rock quality in the 2009 geotechnical coreholes is summarized in Table 5.5:

TABLE 5.5

GREENSTONE ROCK QUALITY, 2009 GEOTECHNICAL COREHOLES

Corehole	Length, ft	% Recovery	ISRM Strength Index		Avg RQD, %	Avg RMR
			Range	Typical		
MS-1	500	85	S1-R3	R1	17	34
MS-2	157	73	S2-R3	R1	13	30

Notes:

1. Average values are based on core runs for which there was core recovered. Intervals of no recovery were not included in calculations.

Overall, the rock quality data for the greenstone from the recent holes correlates well with the data from previous geotechnical coreholes in the Main Slide (1987) area. These data indicate poor quality rock in the undisturbed greenstone rock mass behind the Main Slide (1987) headscarp and the 2H:1V slope to the west.

5.5.4.2 Material Properties

The UCS values, and the compressive strengths indicated by the point load testing of samples from the 2009 coreholes are comparable to UCS results from previous studies (CNI, 1998 and 2003). The previous data consist of ten UCS tests, with a minimum value of 72 psi, a maximum of 1229 psi, and an average of 479 psi.

Friction angles determined from 2009 direct shear testing are comparable to CNI (1998) values for "fault gouge" (~37˚), but these values are high considering the generally poor slope performance in the greenstone. CNI (2002 and 2003) completed direct shear testing on re-compacted samples of greenstone, and "undisturbed" samples taken with Shelby tubes, and these tests indicated friction angles between 20˚ and 21˚. This range is consistent with back analyses of the original Main Slide (1987) and other landslides in the North Quarry, and we consider the ϕ=20˚-23˚ range to be appropriate for rock mass strength in the greenstone in this area of the quarry.

5.5.4.3 Hydrogeological Conditions

Groundwater levels indicated in the piezometers installed in 2009, and past observations of seepage in the headscarp between elevations 1400 and 1600 feet allow a general understanding of hydrogeological conditions in the greenstone rock mass. This is summarized in the following points (Figure 5.6):

- Pore pressures appear to be minimal in the intact rock mass immediately behind the 2H:1V slope face, and by inference behind the headscarp. The rock mass in this zone is not permanently saturated, but likely becomes temporarily saturated near the ground surface during precipitation events.

- Despite the presence of the quarry and the bowl of the Main Slide (1987) to the north and east of the piezometer locations, the greenstone slope is not drained overall. A groundwater table exists in the rock mass behind the 2H:1V slope and the headscarp (Figure 5.6).
- Pore pressure increases with depth below the groundwater table. However, the vertical pressure gradient is somewhat less (80% to 85%) than the hydrostatic gradient. This is characteristic of an inclined groundwater table (i.e., inclined toward the quarry). The successively lower groundwater elevations in deeper piezometers in corehole MS-01 reflects head loss as groundwater flows toward the quarry, or the "bowl" of the Main Slide (1987) .

Tension cracks occur in a zone immediately behind the headscarp. These cracks are above the groundwater table, but surface water inflow into the cracks during precipitation events likely contributes to instability along the headscarp.

5.6 Stability Analyses

5.6.1 Analysis Methods and Models

Initially, stability of the Main Slide (1987) was analyzed for "generic" conditions using the material properties in Table 5.1 to evaluate stability for simple models consisting of single material types (overburden waste rock and greenstone). These initial analyses were completed to evaluate a range of stabilization alternatives during the reclamation plan development.

Detailed analyses of stability of the Main Slide (1987) were subsequently performed using limit equilibrium methods and Slide (Rocscience, 2006) software to calculate a Factor of Safety (FOS) for potential slip surfaces. Detailed stability analyses were used to evaluate the following conditions:

- Current slope configuration and stability conditions
- Backfilling of the North Quarry with overburden materials to the final reclamation plan backfill configuration

Each model included the following basic elements:

- Slope profile based on current topography and final reclamation plan
- Distribution of materials in which the slope is formed
- Material properties (unit weight, shear strength characterization) per Table 5.1
- Groundwater conditions
- External loading (seismic loading through pseudostatic coefficient)

5.6.2 Generic Greenstone Analyses

Greenstone is exposed in the headscarp of the Main Slide (1987) above approximate elevation 1200 feet, and in the reclaimed slope west of the slide above approximate elevation 1500 feet. These exposures appear to involve a single material type, so simple stability models were used to evaluate the effect on

Factor of Safety (FOS) of re-grading options. The models represent slopes of varying heights and angles developed entirely in greenstone, and although they do not contain the detail of the geologic sections, they are valid tools for predicting performance of greenstone slopes of different configurations, including evaluating slope configurations for re-grading alternatives.

The results of these analyses are shown in Figure 5.7 as plots of FOS vs. slope height for 2H:1V and 2.5H:1V slope angles, and a range of groundwater conditions. Groundwater was incorporated into the models by using an R_u factor, which assigns groundwater pressures along a potential slip surface equal to a specified percentage of the overburden pressure. The design curves shown in Figure 5.7 include the drained condition (R_u=0), and R_u factors of 0.05, 0.1, and 0.2.

Greenstone slope heights in the Main Slide (1987) area and the reclaimed slope west of the slide vary from about 300 to 500 feet. The analyses suggest that in order to stabilize the slope, the maximum height of a 2H:1V slope would be about 385 feet under drained conditions, and the maximum height decreases to about 200 feet with an R_u of 0.2. For a 2.5H:1V slope, the maximum height under drained conditions is greater than 500 feet, decreasing to about 350 feet for an R_u of 0.2.

5.6.3 Initial Analyses of the Main Slide (1987) and Underlying Greenstone

Azimuth 120º geologic section 1000 is reasonably representative of geologic conditions in the Main Slide (1987) area, and was used as the geologic framework for stability models developed to evaluate mitigation options for the slide. The stability model that represents existing conditions along this section is shown in Figure 5.8. This model includes intact greenstone above approximate elevation 1200 feet, with a 35º to 40º slope angle in the headscarp; an accumulation of slide debris at the toe of the headscarp; and an intact rock mass below. The intact rock mass is mainly limestone, but the thrust-bounded greenstone block described previously occurs at the slope face below approximate elevation 1000 feet (Figure 4.2) and based on the geological model is indicated to extend down to approximately elevation 700 feet (Figure 4.A4). Field observations are that the headscarp slope in greenstone is unstable, but that the Main Slide (1987) toes out above the intact rock mass. Analyses using material properties from Table 5.1 and circular slip surfaces are consistent with these observations, as the minimum FOS slip surfaces for the slope are confined to the upper greenstone section, where FOS values are below 1.0, even under drained conditions. Minimum FOS for slip surfaces that cut through the intact limestone in the lower slope are in the range of 1.1 to 1.2.

5.6.4 Updated Analysis of Stability of Main Slide (1987) and Underlying Greenstone

Groundwater monitoring data from coreholes MS-01 and MS-02 was used to assess the groundwater assumptions that were applied in the initial analyses (Section 5.6.3). This involved the use of a two-dimensional slope stability model developed along a section line perpendicular to the north wall at the location of corehole MS-01, with geological conditions that are simplified from those shown in Foruria

(2004) azimuth 120˚ sections 600 and 800 (Figure 4.1). The stability model features the following (Figure 5.9):

- A 2H:1V greenstone exposure that extends from the slope crest at approximate elevation 1875 feet to elevation 1550 feet; and a limestone slope below.
- Rock mass shear strength for the greenstone defined by ϕ=20˚ and 10 psi cohesion (slightly lower than assumed in the initial analyses).
- A groundwater surface that is consistent with the observations in the upper-most piezometer in corehole MS-01; and with observations of seepage in the "bowl" area of the slide between elevations 1400 and 1600 feet.

A circular surface search was run for this model, with slip surfaces confined to the greenstone. The slip surface with the minimum Factor of Safety from this analysis was then used for a series of analyses with various groundwater scenarios defined in terms of R_u and H_u factors.

R_u is a representation of groundwater pressure along the base of a potential slip surface based on a percentage of the overburden pressure on the slip surface (i.e., an. R_u of 0.10 is equal to a groundwater pressure of 10% of the overlying overburden).

In contrast to R_u, groundwater pressure with the H_u factor is based on a defined phreatic surface (i.e., where the groundwater surface has been defined with instrumentation). H_u is defined as a factor between 0 and 1 by which the vertical distance between the groundwater surface and the slip surface is multiplied in order to obtain the groundwater water pressure on the slip surface. An H_u factor of 1 represents hydrostatic conditions; observations in the corehole MS-01 piezometer indicate an H_u between 0.8 and 0.9 (i.e., slightly less than hydrostatic head).

Figure 5.9 summarizes the Factor of Safety (FOS) and the distribution of pore pressure along the slip surface for the various groundwater conditions. FOS values are also listed in Table 5.6:

TABLE 5.6

FOS FOR VARIOUS GROUNDWATER CONDITIONS

Groundwater Condition	Factor of Safety	Comment
H_u Auto	1.04	
H_u=0.8	1.07	
H_u=0.85	1.06	
H_u=0.9	1.05	
H_u=1	1.03	Hydrostatic

Groundwater Condition	Factor of Safety	Comment
R_u=0	1.23	Drained
R_u=0.1	1.12	
R_u=0.15	1.07	
R_u=0.2	1.01	

In general, these stability analyses confirm the marginal current stability of the Main Slide (1987). They confirm the requirement for positive stabilization measures to ensure the long-term stability of the area if continued upslope migration of the headscarp toward the ridgecrest is to be prevented. Practical re-grading options would all require effective de-pressurization of the greenstone in order to obtain calculated safety factors indicative of long-term stability.

With regard to the stability analyses and evaluation of mitigation options, the groundwater level monitoring data from corehole MS-01 supports the following conclusions:

- For stability modeling purposes, groundwater conditions in the greenstone are more realistically represented by H_u factors with a defined groundwater surface, than by R_u factors.
- Groundwater monitoring data indicate that an H_u factor of 0.8 to 0.85 is appropriate for the greenstone.
- Ground surface cracks along the existing 2H:1V slope, even outside of the immediate area of the Main Slide (1987) headscarp, indicate that the FOS for this slope is not particularly high. Based on these observations, the FOS calculated with an H_u of 0.8 to 0.85 is considered to be reasonable.
- The FOS calculated with an H_u of 0.8 to 0.85 is equivalent to the FOS calculated with an R_u of 0.15.

5.6.5 Stability of Main Slide (1987) After Backfilling

The final reclamation plan backfill configuration, which includes backfilling the quarry to the ridgecrest in the area of the Main Slide (1987) and completely encapsulating existing shallow slides west of the Main Slide (1987), will stabilize existing headscarps and small-scale instability. The effect of the backfilling on large-scale stability of these slides was assessed using stability analyses of the same sections and material properties used previously to evaluate stability conditions of current slopes.

The final reclaimed stability of the Main Slide (1987) area was assessed using the stability sections presented in Figures 5.6 and 5.8. The stability section presented in Figure 5.6 is west of the Main Slide (1987), and the stability section presented in Figure 5.8 (azimuth 120° section 1000) lies on the Main

Slide (1987) area shown in Figure 4.1. The stability models after backfilling are presented in Figure 5.10 and feature the following:

- Conservative groundwater level approximately 0 to 20 feet below the quarry design slopes before backfill
- Material properties as shown in Table 5.1
- Geologic boundaries in sections generated using the geologic map from Foruria (2004)
- Static analysis with circular failure surfaces

For the stability section presented in Figure 5.6, the calculated minimum FOS against a large scale slide after quarry backfilling is 1.52 under static conditions. For the azimuth 120° section 1000 stability analysis, the calculated minimum FOS against a large scale slide after quarry backfilling is 1.56 under static conditions. These factors of safety exceed the requirements for reclamation under static conditions. The FOS values for the two analyzed sections are summarized in Table 5.7 below.

TABLE 5.7
SUMMARY OF MAIN SLIDE STABILITY EVALUATIONS

Sections	Conditions	Description	Calculated FOS
Azimuth 120	Existing	Static	FOS = 0.93
		Seismic – pseudo-static (k = 0.15)	NE
		Seismic: displacement under design seismic event (16-84 percentile range)	NE
	Final Reclaimed Slope	Static	FOS = 1.56
		Seismic – pseudo-static (k = 0.15)	FOS = 1.04
		Seismic: displacement under design seismic event	< 12 inches
Stability Section	Existing	Static	FOS = 1.07
		Seismic – pseudo-static (k = 0.15)	NE
		Seismic: displacement under design seismic event (16-84 percentile range)	NE
	Final Reclaimed Slope	Static	FOS = 1.52
		Seismic – pseudo-static (k = 0.15)	FOS = 1.01
		Seismic: displacement under design seismic event	< 12 inches

NA = Not Evaluated

The seismic stability of the Main Slide (1987) was evaluated with both pseudo-static and seismic permanent displacement analyses during the design earthquake.

5.6.6 Seismic Stability

Pseudo-static analyses were performed as an initial evaluation of slope performance under earthquake loading. In a pseudo-static limit equilibrium analysis, a lateral force is added to a potential failure mass, with magnitude equal to some fraction of the weight of the slide mass. The fraction is defined in the form of a seismic coefficient, which is typically assumed to be less than the peak ground acceleration and is expressed as a percentage of gravity. Selection of a seismic coefficient for this initial evaluation was based on the recommendations by Seed (1979), i.e., k_s = 0.10 for earthquakes of magnitude 6-1/2 or less, and k_s = 0.15 for earthquakes of magnitude as great as 8-1/4. However, due to the close proximity of significant faults to the quarry, dynamic deformation analyses were also completed to quantify the magnitude of potential permanent slope deformations.

Pseudo-static analyses presume that the slope deformations are "acceptably small" if the computed pseudo-static FOS is greater than the specified threshold value (i.e. usually between 1.0 and 1.15). The dynamic deformation analyses provide an estimate of the permanent deformations so that they can be confirmed to be "acceptably small."

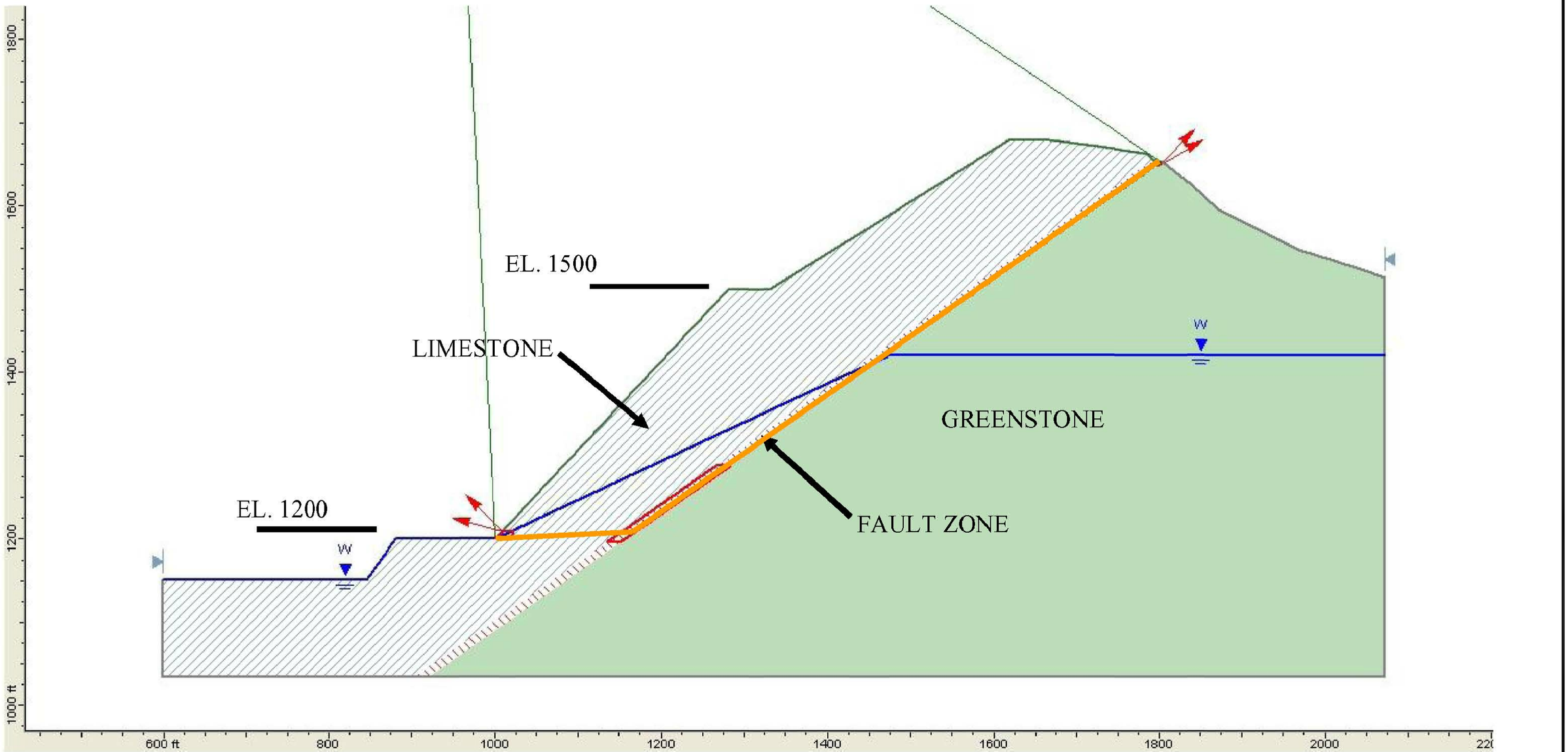
Golder performed dynamic deformation analyses using a predictive model recently developed by Bray and Travasarou (2007). The Bray and Travasarou model is a semi-empirical simplified model for estimating permanent displacements due to earthquake-induced deviatoric deformations. The Bray and Travasarou model can also be implemented within a fully probabilistic framework or be used deterministically to evaluate seismic displacement potential. The following equation is used by Bray and Travasarou (2007) to predict the seismic displacement (D) assuming potential slide mass is a rigid sliding block:

$$\ln(D) = -0.22 - 2.83 \ln(k_y) - 0.333 (\ln(k_y))^2 + 0.566 \ln(k_y) \ln(PGA) + 3.04 \ln(PGA) - 0.244 (\ln(PGA))^2 + 0.287 (M - 7) \pm \varepsilon$$

Where,

D	=	seismic displacement in cm
k_y	=	yield coefficient
PGA	=	peak ground acceleration
M	=	moment magnitude
ε	=	normally distributed random variable with zero mean and standard deviation σ of 0.67.

Figure 5.11 shows the results of pseudo-static analyses of the stability sections presented in Figures 5.6 and 5.8, which indicate that the minimum FOS against global failure range from 1.01 to 1.04 assuming a seismic coefficient of 0.15g. Using the Bray and Travasarou Method (2007), the mean estimated deformation was estimated to be less than 1 foot for both sections (Table 5.7), and is considered acceptable for the proposed reclamation. The seismic displacement calculation is attached in Appendix 5.C.



NOTES

1. MATERIAL IN THE HANGINGWALL OF THE FAULT ABOVE EL. 1500 FEET IS SHOWN AS LIMESTONE, AS INDICATED IN CNI (1998). BASED ON DISCUSSIONS IN WCA REFERENCES THAT CONCERN MASS GRADING BETWEEN 1987 AND 1990, THIS MATERIAL MAY HAVE BEEN GREENSTONE. HOWEVER, FOR THIS ANALYSIS, WITH STABILITY CONTROLLED IN PART BY SHEAR STRENGTH ALONG A DISCRETE STRUCTURE, A DISTINCTION BETWEEN LIMESTONE AND GREENSTONE IN THE HANGINGWALL OF THE FAULT ABOVE EL. 1500 FEET DOES NOT AFFECT RESULTS.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
STABILITY MODEL FOR INITIAL SLIDE IN 1987

Golder Associates

PROJECT No. 063-7109 800			FILE No.		Figure 5.1
DESIGN	--	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10	**FIGURE 5.1**		
CHECK	GM	01/22/10			
REVIEW	BF	01/22/10			

Thursday, April 29, 2010 - 2:27pm FILE: S:\HonsonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 5.1.dwg TAB NAME \Figure 5.1
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK. SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.

THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.

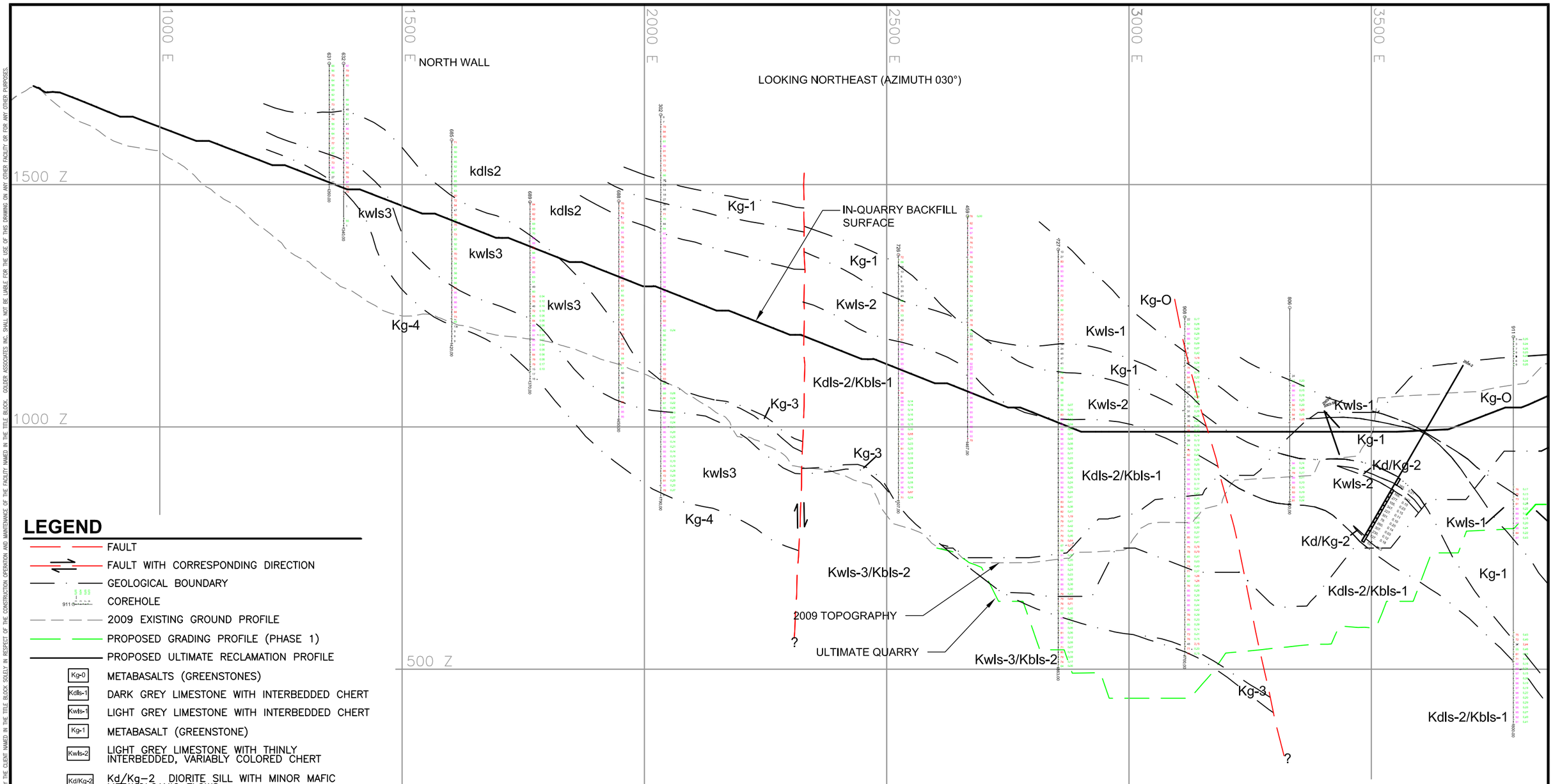
FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study – 2010\Reporting\Figures R1\Figure 5.2.dwg TAB NAME: \Figure 5.2
Thursday, April 29, 2010 – 2:33pm

1000 E | 1500 E | 2000 E | 2500 E | 3000 E | 3500 E

1500 Z | 1000 Z | 500 Z | 0 Z

NORTH WALL

LOOKING NORTHEAST (AZIMUTH 030°)



LEGEND

- FAULT
- FAULT WITH CORRESPONDING DIRECTION
- GEOLOGICAL BOUNDARY
- COREHOLE
- 2009 EXISTING GROUND PROFILE
- PROPOSED GRADING PROFILE (PHASE 1)
- PROPOSED ULTIMATE RECLAMATION PROFILE
- Kg-0 — METABASALTS (GREENSTONES)
- Kdls-1 — DARK GREY LIMESTONE WITH INTERBEDDED CHERT
- Kwls-1 — LIGHT GREY LIMESTONE WITH INTERBEDDED CHERT
- Kg-1 — METABASALT (GREENSTONE)
- Kwls-2 — LIGHT GREY LIMESTONE WITH THINLY INTERBEDDED, VARIABLY COLORED CHERT
- Kd/Kg-2 — Kd/Kg–2 DIORITE SILL WITH MINOR MAFIC METAVOLCANIC FLOWS
- Kdls-2/ Kbls-1 — GREY LIMESTONE WITH MINOR THINLY INTERBEDDED DARK GREY TO BLACK CHERT: GRADATIONAL CONTACT. DARK GREY TO BLACK LIMESTONE:
- Kg-3 / Kg-cc — METABASALTS (GREENSTONES) WITH LESSER LIMESTONE, GREYWACKE, CHERT, AND MUDSTONE
- Kwls-3 — LIGHT GREY LIMESTONE WITH INTERBEDDED CHERT
- Kg-3/2 — METABASALTS (GREENSTONES)
- Kbls-2 — DARK GREY TO BLACK LIMESTONE WITH MINOR BLACK CHERT
- Kg-4 — METABASALTS (GREENSTONES)

NOTES

1. SEE FIGURE 4.1 FOR SECTOIN LOCATION

200 0 200 400
1" = 200' FEET

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
AZIMUTH 120°, SECTION 1200

Golder Associates

PROJECT No. 063-7109 800			FILE No.		Figure 5.2
DESIGN	--	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	GM	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 5.2

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE

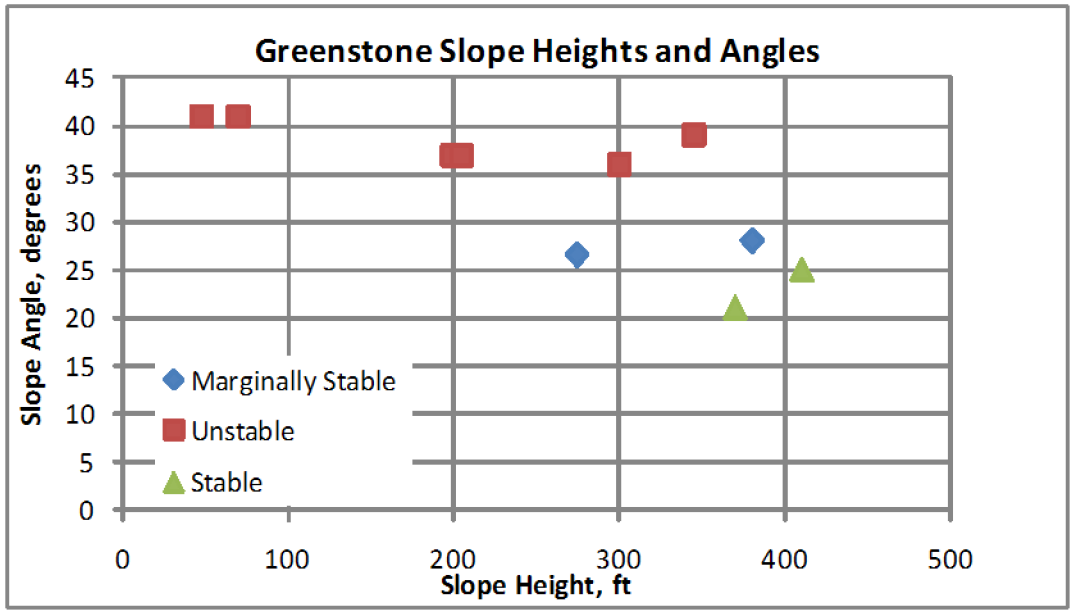
MAIN SLIDE (1987)

Golder Associates

PROJECT No. 063-7109 800			FILE No.		Figure 5.3
DESIGN	--	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	GM	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 5.3

Thursday, April 29, 2010 - 2:37pm FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 5.3.dwg TAB NAME: \Figure 5.3
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



Section	Height	Angle	Stable	Comments
North Quarry 2H:1V Slope	275	26.6	M	metastable 2H:1V slope, west of Main Slide
South Quarry Area	380	28	M	Slide scarp
1	345	39	U	
2	300	36	U	
3	70	41	U	
3	200	37	U	
4	205	37	U	
5	48	41	U	
South Quarry Area	370	21	S	
South Quarry Area	410	25		

PROJECT

GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE

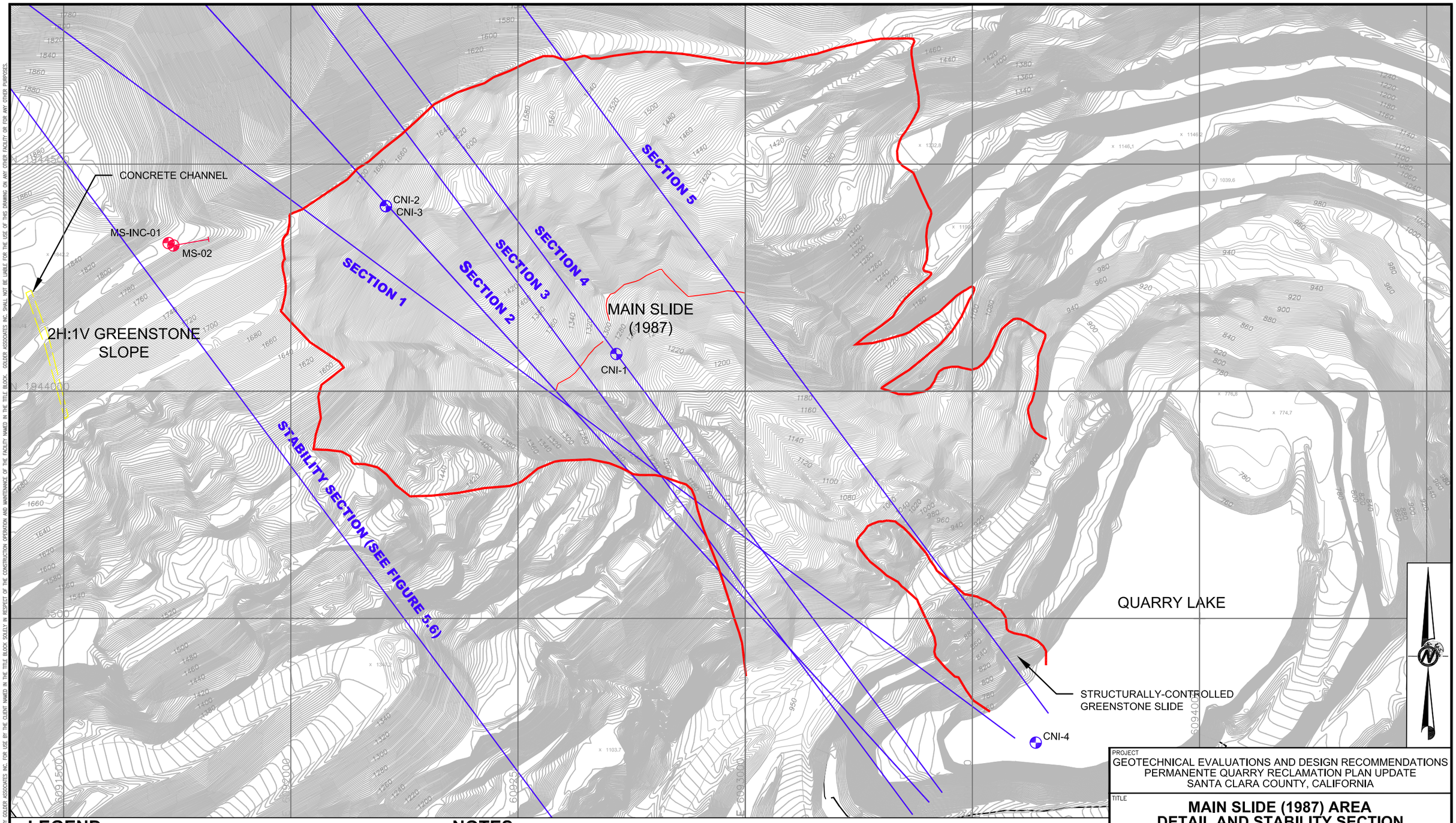
SLOPE HEIGHTS AND SLOPE ANGLES IN GREENSTONE

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 5.4
DESIGN	--	01/22/10	SCALE AS SHOWN	REV. 0
CADD	AJS	01/22/10		
CHECK	GM	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 5.4

Friday, January 29, 2010 - 3:57pm FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures\Figure 5.4.dwg TAB NAME \Figure 5.4
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



LEGEND

MS-02	2009 GEOTECHNICAL COREHOLE
CNI-4	GEOTECHNICAL COREHOLE, PREVIOUS STUDY
SECTION 1	TOPOGRAPHIC PROFILE LOCATION

NOTES

1. BASE MAP PROVIDED BY HANSON IN ELECTRONIC FORMAT BASED ON TOPOGRAPHY FROM APRIL 9, 2007.

200 0 200 400
1" = 200' FEET

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

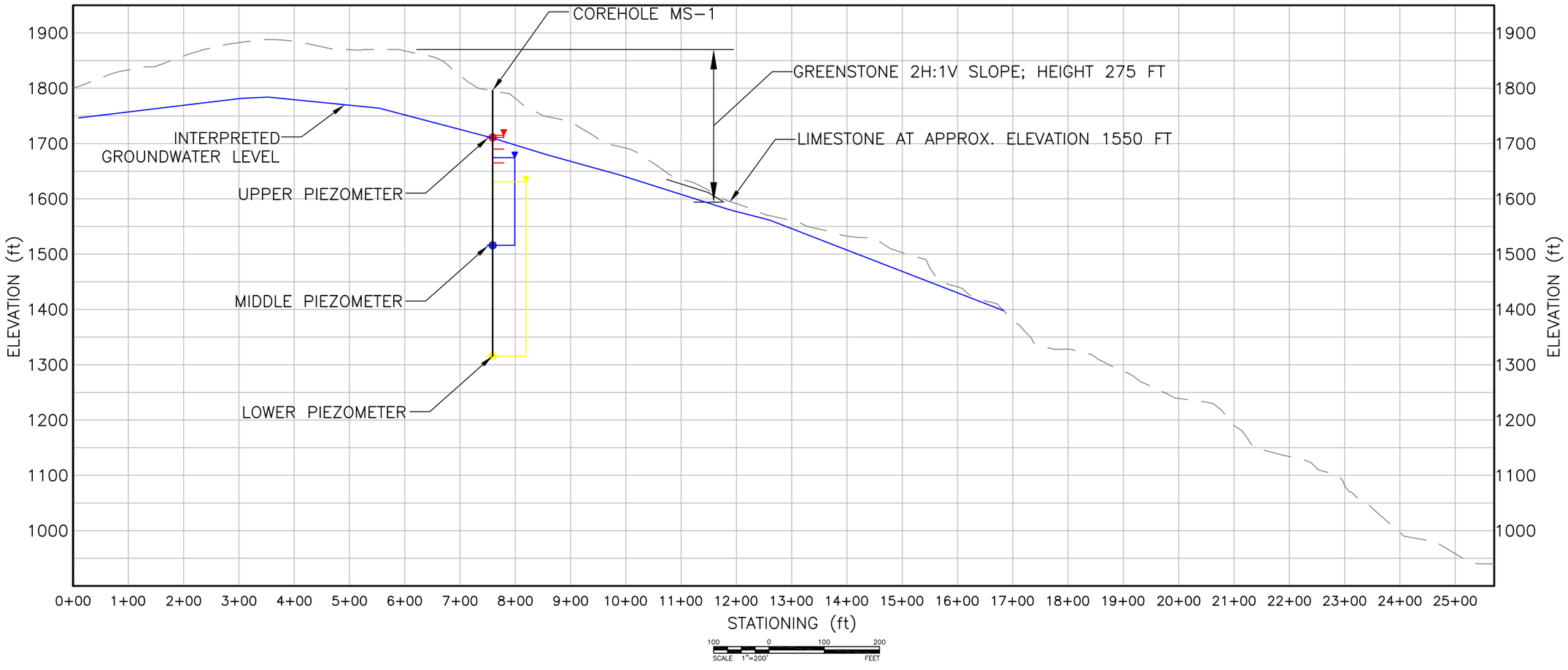
TITLE
MAIN SLIDE (1987) AREA DETAIL AND STABILITY SECTION LOCATIONS

Golder Associates

PROJECT No. 063-7109 800			FILE No.		Figure 5.5
DESIGN	--	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	GM	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 5.5

THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.
FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 5.5.dwg TAB NAME: \Figure 5.5
Thursday, April 29, 2010 - 1:33pm



NOTES

1. GEOLOGIC MAP FROM FORURIA (8/26/04).

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

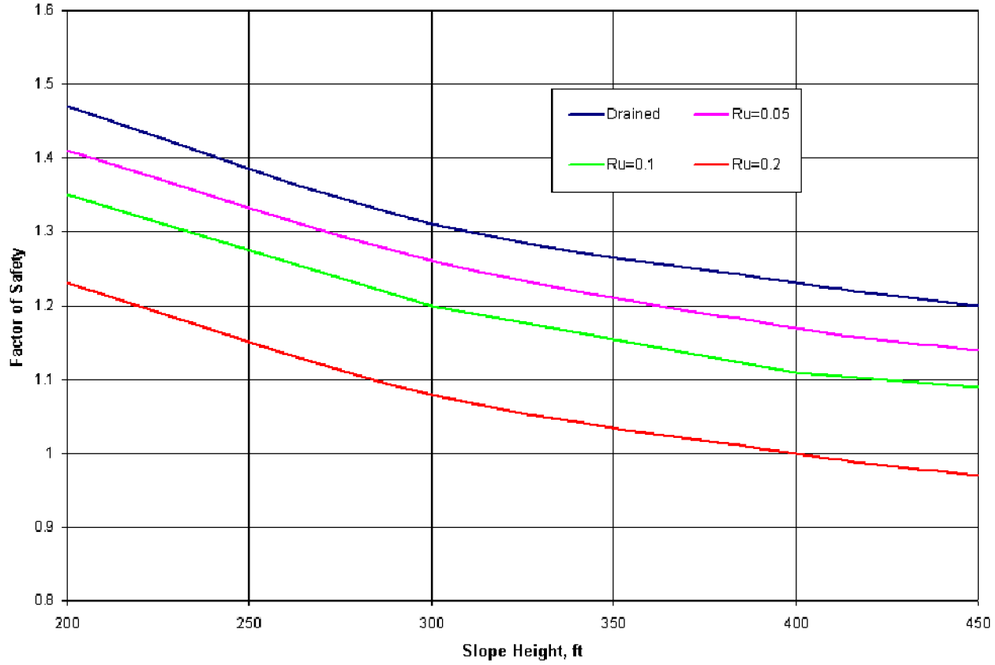
TITLE

SLOPE STABILITY SECTION

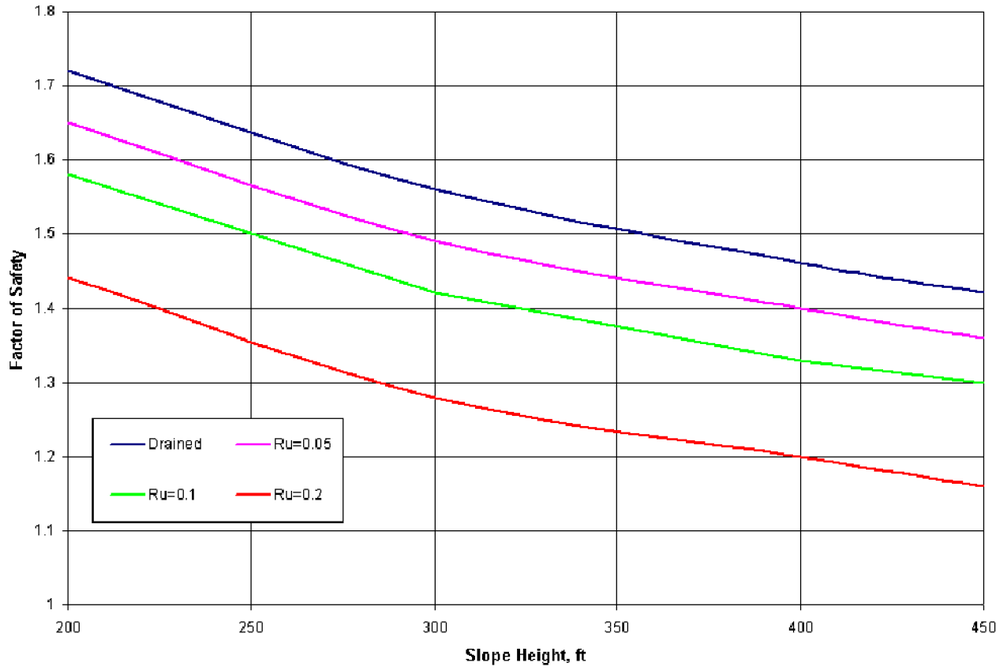
PROJECT No. 063-7109 800			FILE No.		Figure 5.6
DESIGN	--	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	GM	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 5.6

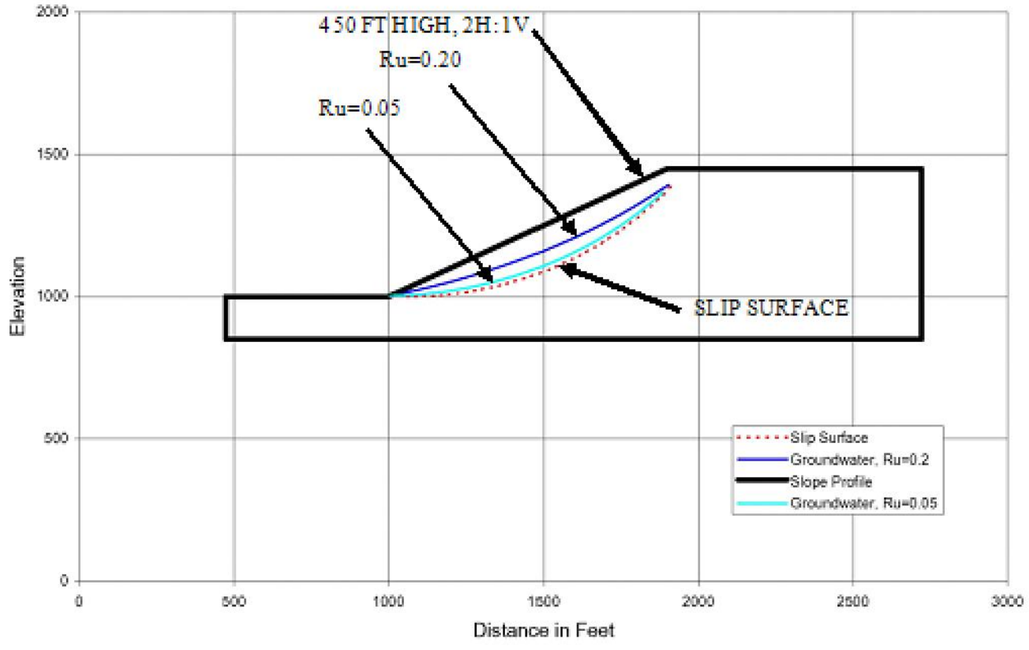
FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 5.6.dwg TAB NAME \Figure 5.6
Tuesday, May 04, 2010 - 11:23am
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



2H : 2V SLOPE



2.5H : 1V SLOPE



EXAMPLE GROUNDWATER CONDITIONS BASED ON Ru

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE

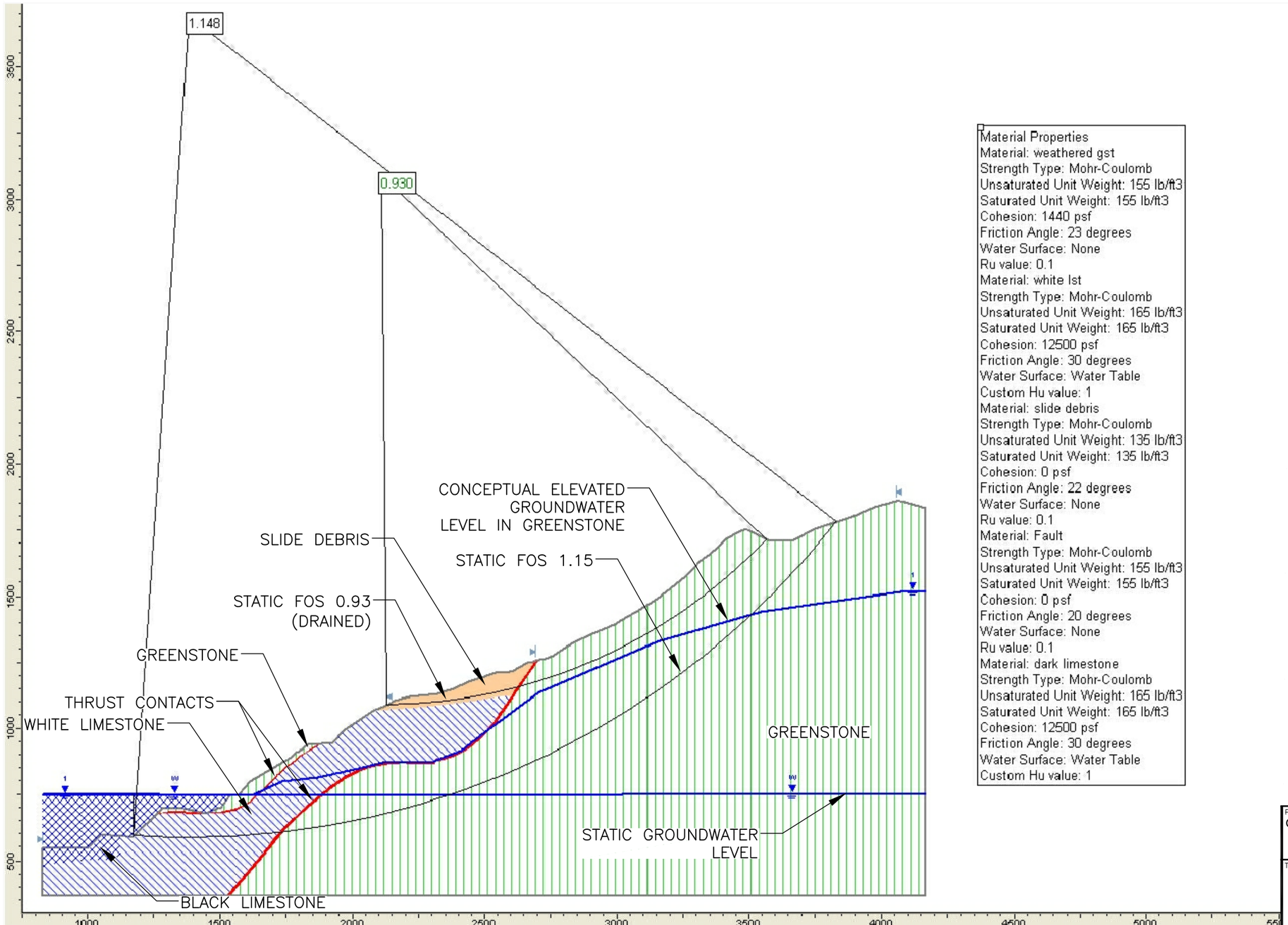
GREENSTONE SLOPE DESIGN CHARTS

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 5.7
DESIGN	--	01/22/10	SCALE AS SHOWN	REV. 0
CADD	AJS	01/22/10		
CHECK	GM	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 5.7

Friday, January 29, 2010 - 3:58pm FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures\Figure 5.7.dwg TAB NAME: \Figure 5.7
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES. IN RESPECT OF THE CONSTRUCTION, OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK, SOLELY



Material Properties
Material: weathered gst
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 155 lb/ft3
Saturated Unit Weight: 155 lb/ft3
Cohesion: 1440 psf
Friction Angle: 23 degrees
Water Surface: None
Ru value: 0.1
Material: white lst
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 165 lb/ft3
Saturated Unit Weight: 165 lb/ft3
Cohesion: 12500 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1
Material: slide debris
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 135 lb/ft3
Saturated Unit Weight: 135 lb/ft3
Cohesion: 0 psf
Friction Angle: 22 degrees
Water Surface: None
Ru value: 0.1
Material: Fault
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 155 lb/ft3
Saturated Unit Weight: 155 lb/ft3
Cohesion: 0 psf
Friction Angle: 20 degrees
Water Surface: None
Ru value: 0.1
Material: dark limestone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 165 lb/ft3
Saturated Unit Weight: 165 lb/ft3
Cohesion: 12500 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Custom Hu value: 1

AZIMUTH 120° SECTION 1000
STATIC ANALYSIS

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

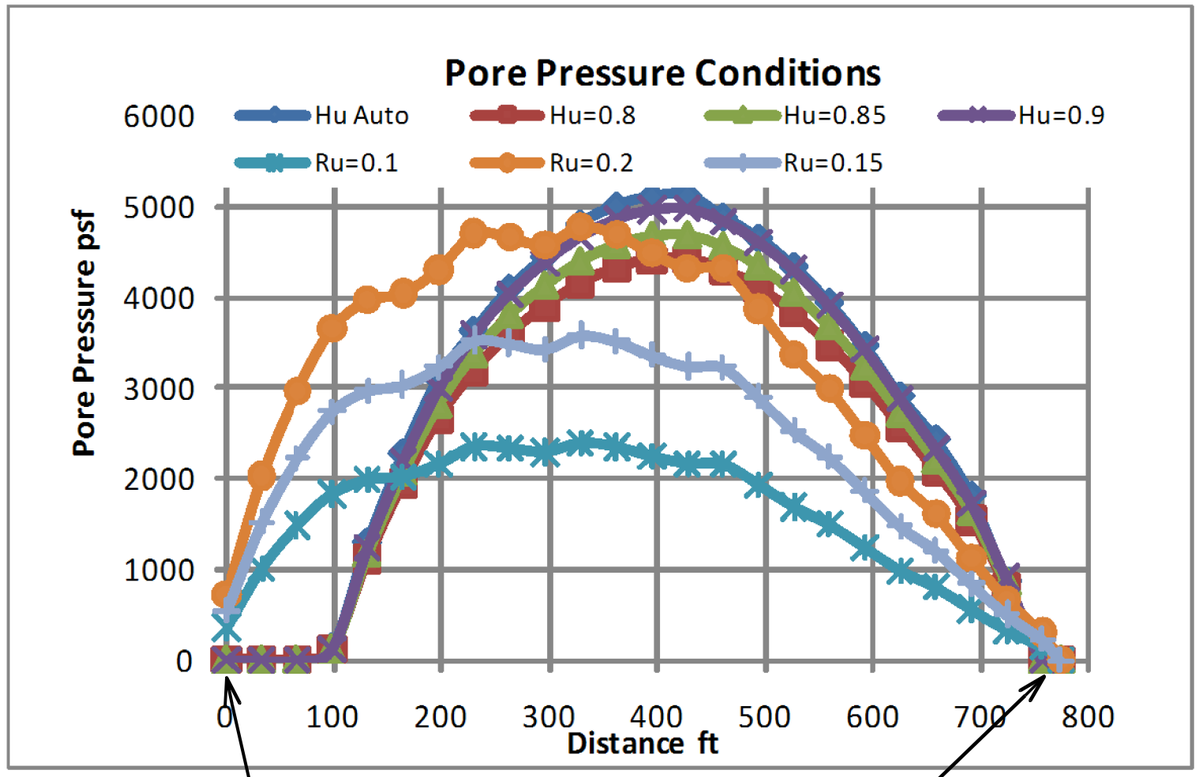
TITLE
STABILITY MODELS, MAIN SLIDE (1987) AREA

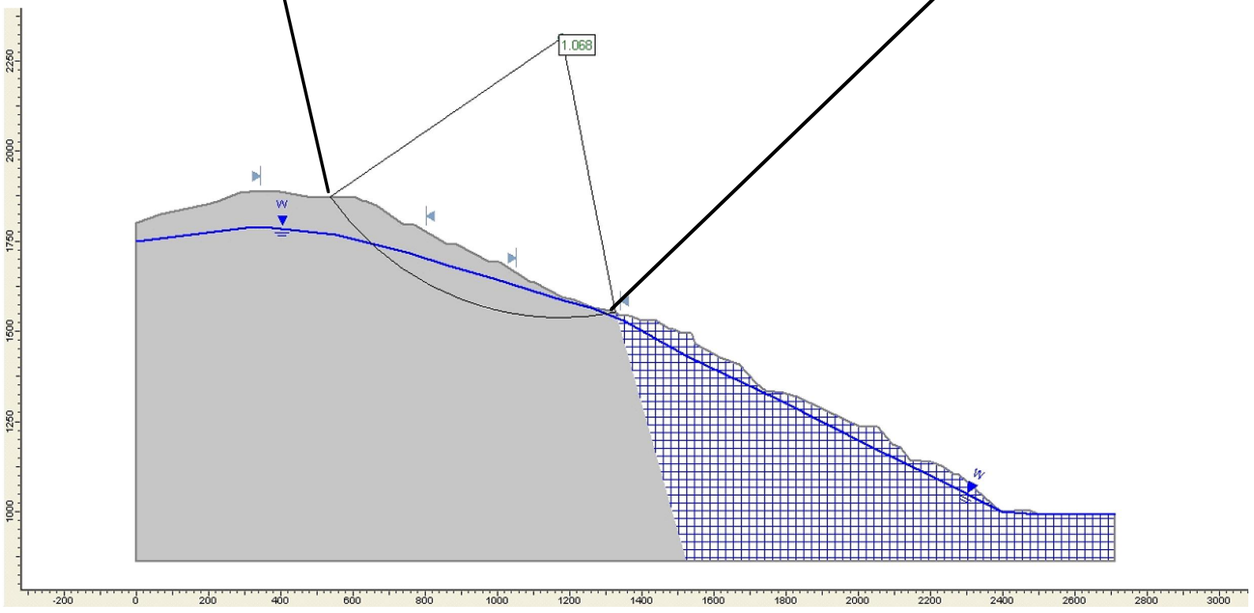
Golder Associates

PROJECT No. 063-7109 800			FILE No.		Figure 5.8
DESIGN	--	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	GM	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 5.8

Thursday, April 29, 2010 - 1:30pm FILE: S:\HonsonPermanente\Plt 1 North East Wells\Reclamation Study - 2010\Reporting\Figures R1\Figure 5.8.dwg TAB NAME \Figure 5.8
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.





Condition	Factor of Safety	Comment
Hu Auto	1.04	
Hu=0.8	1.07	
Hu=0.85	1.06	
Hu=0.9	1.05	
Hu=1	1.03	Hydrostatic
Ru=0	1.23	Drained
Ru=0.1	1.12	
Ru=0.15	1.07	
Ru=0.2	1.01	

NOTES

1. GROUNDWATER TABLE IN GREENSTONE IS CONSISTENT WITH MONITORING DATA AT THE LOCATION OF COREHOLE MS–1; OUTSIDE OF THIS LOCATION, THE GEOMETRY OF THE GROUNDWATER TABLE IS ASSUMED.

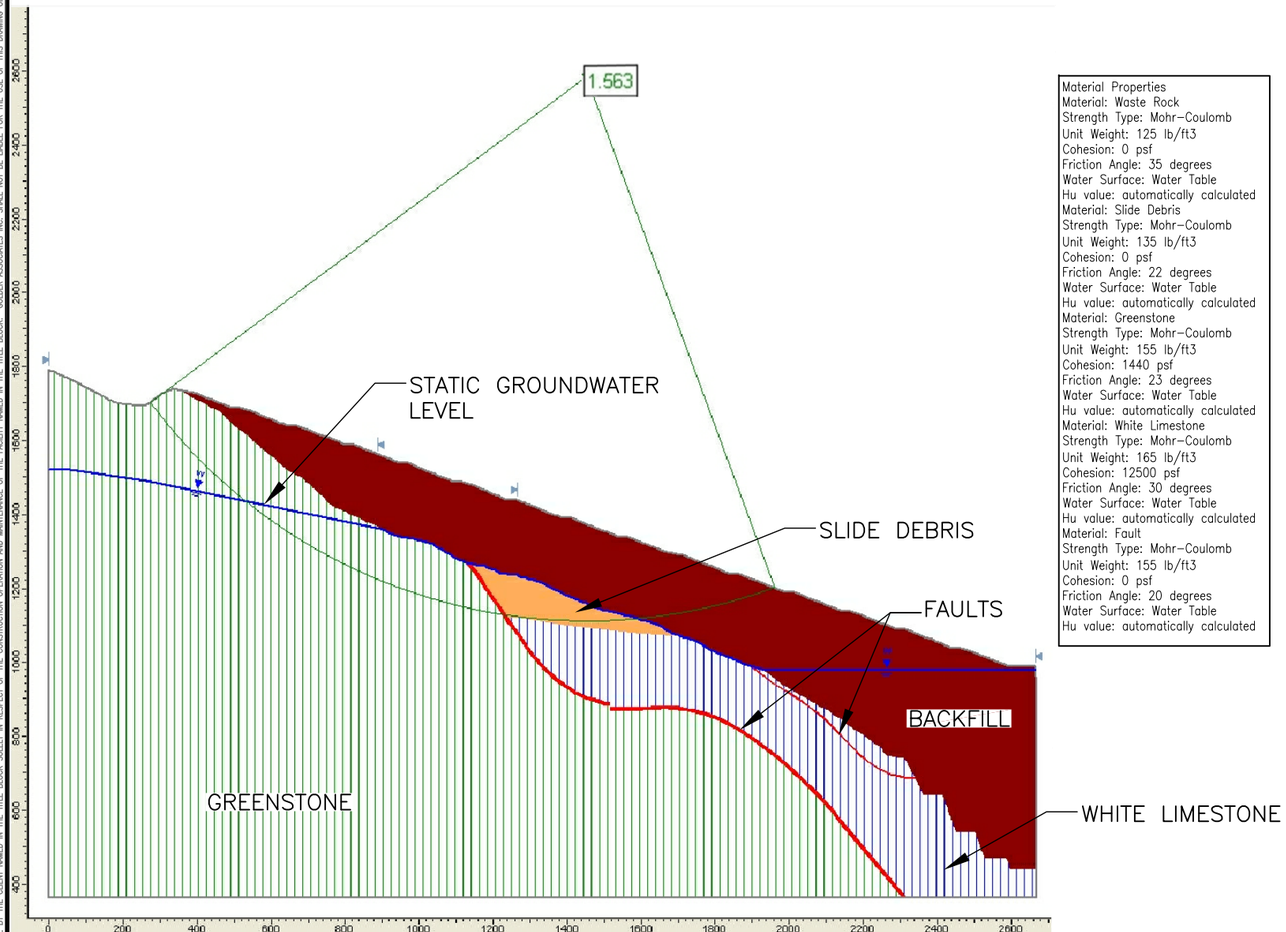
PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
GROUNDWATER CONDITIONS IN STABILITY ANALYSES

Golder Associates

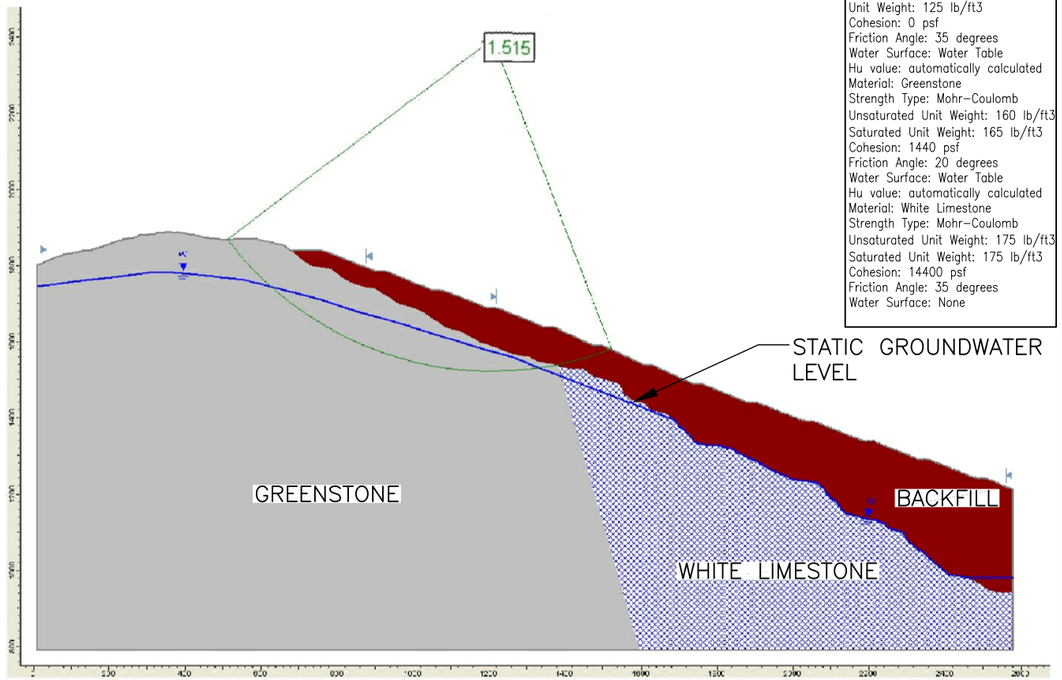
PROJECT No. 063-7109 800			FILE No.		Figure 5.9
DESIGN	--	01/22/10	SCALE	AS SHOWN	REV. 0
CADD	AJS	01/22/10	**FIGURE 5.9**		
CHECK	GM	01/22/10			
REVIEW	BF	01/22/10			

Friday, January 29, 2010 - 3:59pm FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures\Figure 5.9.dwg TAB NAME \Figure 5.9
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.
ANCE OF THE FACILITY NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FA
gures\



Material Properties
Material: Waste Rock
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Hu value: automatically calculated
Material: Slide Debris
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 0 psf
Friction Angle: 22 degrees
Water Surface: Water Table
Hu value: automatically calculated
Material: Greenstone
Strength Type: Mohr-Coulomb
Unit Weight: 155 lb/ft3
Cohesion: 1440 psf
Friction Angle: 23 degrees
Water Surface: Water Table
Hu value: automatically calculated
Material: White Limestone
Strength Type: Mohr-Coulomb
Unit Weight: 165 lb/ft3
Cohesion: 12500 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Hu value: automatically calculated
Material: Fault
Strength Type: Mohr-Coulomb
Unit Weight: 155 lb/ft3
Cohesion: 0 psf
Friction Angle: 20 degrees
Water Surface: Water Table
Hu value: automatically calculated

AZIMUTH 120° SECTION 1000
STATIC ANALYSIS



Material Properties
Material: Backfill
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Hu value: automatically calculated
Material: Greenstone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 165 lb/ft3
Cohesion: 1440 psf
Friction Angle: 20 degrees
Water Surface: Water Table
Hu value: automatically calculated
Material: White Limestone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 175 lb/ft3
Saturated Unit Weight: 175 lb/ft3
Cohesion: 14400 psf
Friction Angle: 35 degrees
Water Surface: None

STABILITY SECTION
STATIC ANALYSIS

NOTES

1. SEE FIGURES 5.5 AND 5.6 FOR STABILITY SECTION LOCATION AND PROFILE.
2. SEE FIGURE 4.1 FOR AZIMUTH 120° SECTION 1000 LOCATION.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

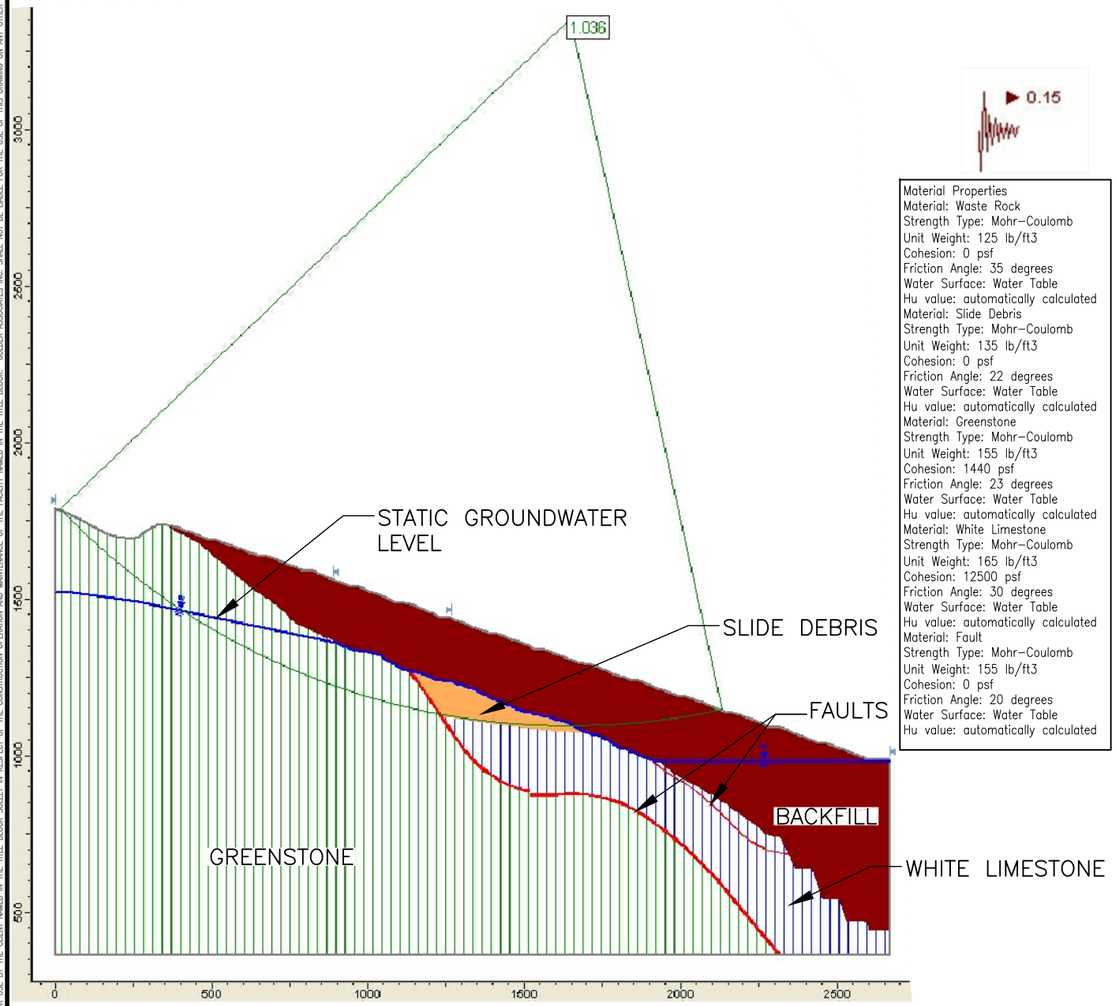
TITLE
STABILITY SECTIONS AFTER BACKFILLING

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 5.10-5.12
DESIGN	--	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	GM	01/22/10		
REVIEW	BF	01/22/10		

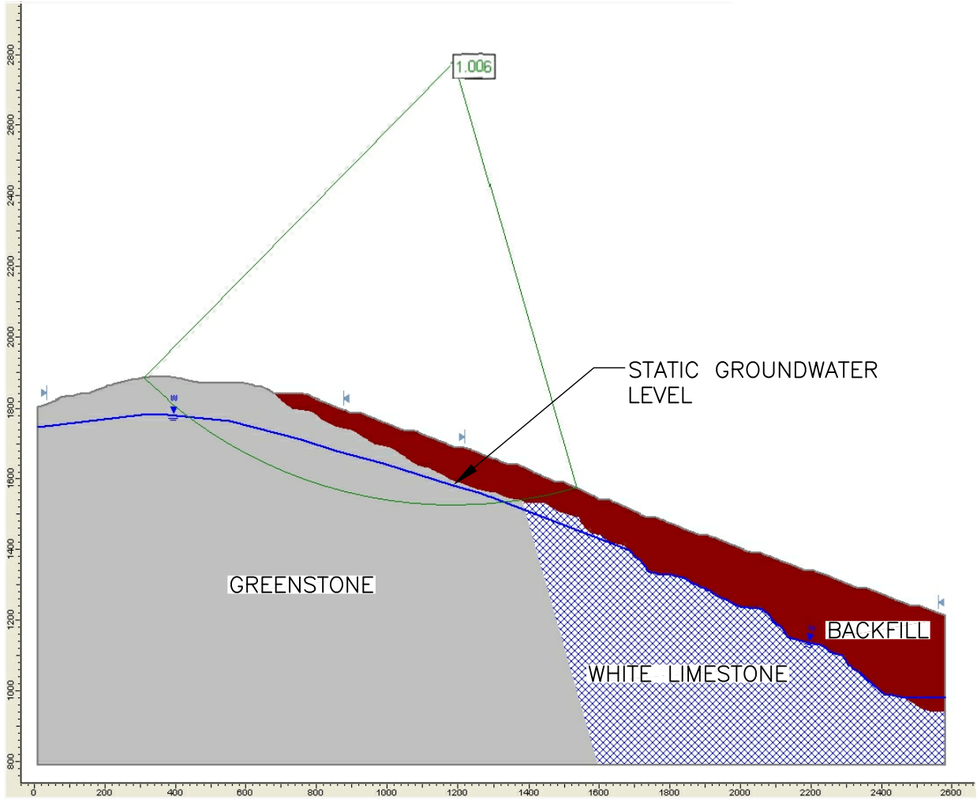
FIGURE 5.10

FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 5.10-5.12.dwg TAB NAME \Figure 5.10
Monday, May 10, 2010 - 1:48pm
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES. USE OF THE DRAWING IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK SOLELY



Material Properties
Material: Waste Rock
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Hu value: automatically calculated
Material: Slide Debris
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 0 psf
Friction Angle: 22 degrees
Water Surface: Water Table
Hu value: automatically calculated
Material: Greenstone
Strength Type: Mohr-Coulomb
Unit Weight: 155 lb/ft3
Cohesion: 1440 psf
Friction Angle: 23 degrees
Water Surface: Water Table
Hu value: automatically calculated
Material: White Limestone
Strength Type: Mohr-Coulomb
Unit Weight: 165 lb/ft3
Cohesion: 12500 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Hu value: automatically calculated
Material: Fault
Strength Type: Mohr-Coulomb
Unit Weight: 155 lb/ft3
Cohesion: 0 psf
Friction Angle: 20 degrees
Water Surface: Water Table
Hu value: automatically calculated

AZIMUTH 120° SECTION 1000
PSEUDO-STATIC ANALYSIS (K=0.15)



Material Properties
Material: Backfill
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Hu value: automatically calculated
Material: Greenstone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 165 lb/ft3
Cohesion: 1440 psf
Friction Angle: 20 degrees
Water Surface: Water Table
Hu value: automatically calculated
Material: White Limestone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 175 lb/ft3
Saturated Unit Weight: 175 lb/ft3
Cohesion: 14400 psf
Friction Angle: 35 degrees
Water Surface: None

STABILITY SECTION
PSEUDO-STATIC ANALYSIS (K=0.15)

NOTES

1. SEE FIGURES 5.5 AND 5.6 FOR STABILITY SECTION LOCATION AND PROFILE.
2. SEE FIGURE 4.1 FOR AZIMUTH 120° SECTION 1000 LOCATION.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

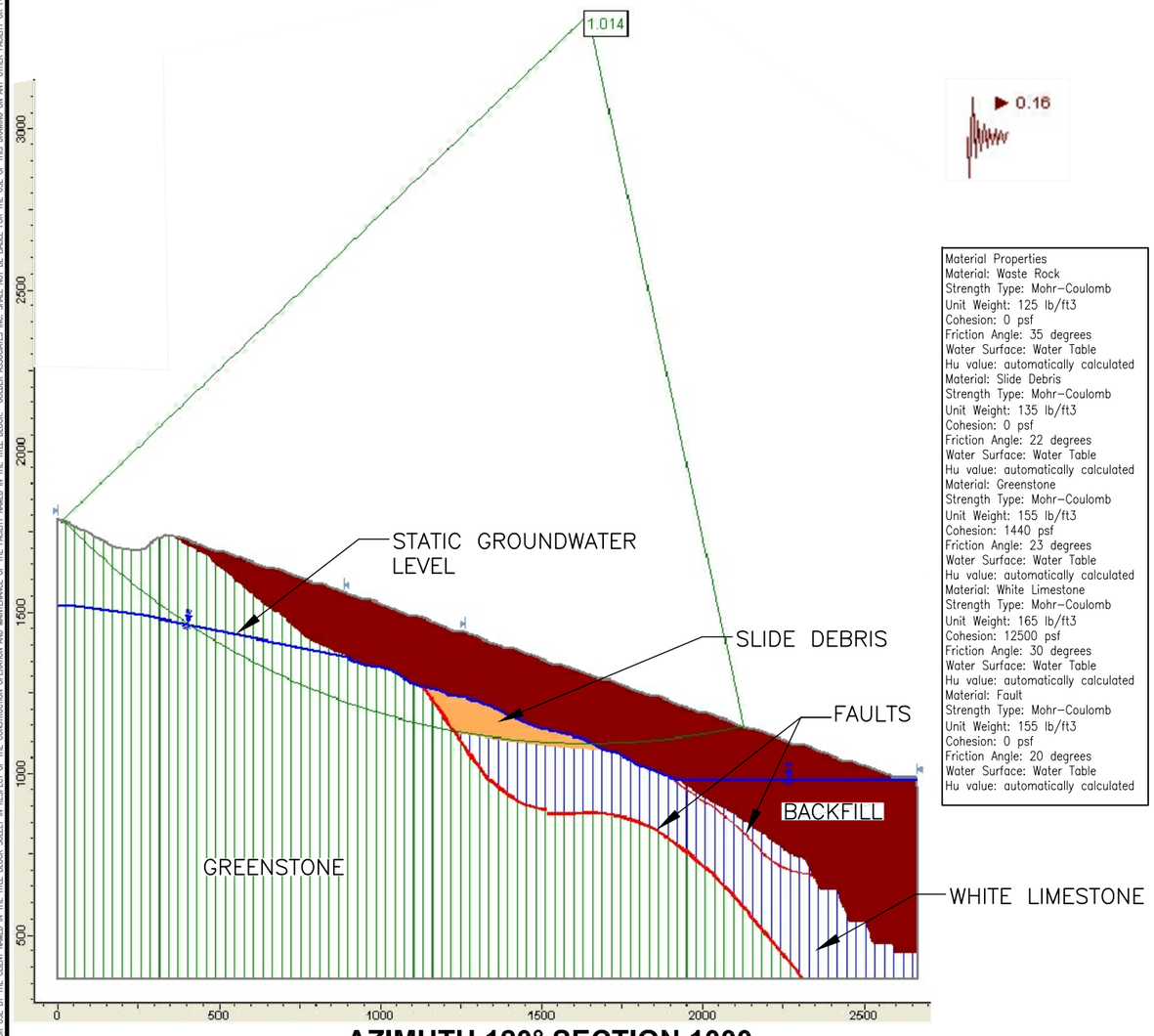
TITLE
PSEUDO-STATIC STABILITY ANALYSES AFTER BACKFILLING

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 5.10-5.12	
DESIGN	--	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	GM	01/22/10			
REVIEW	BF	01/22/10			

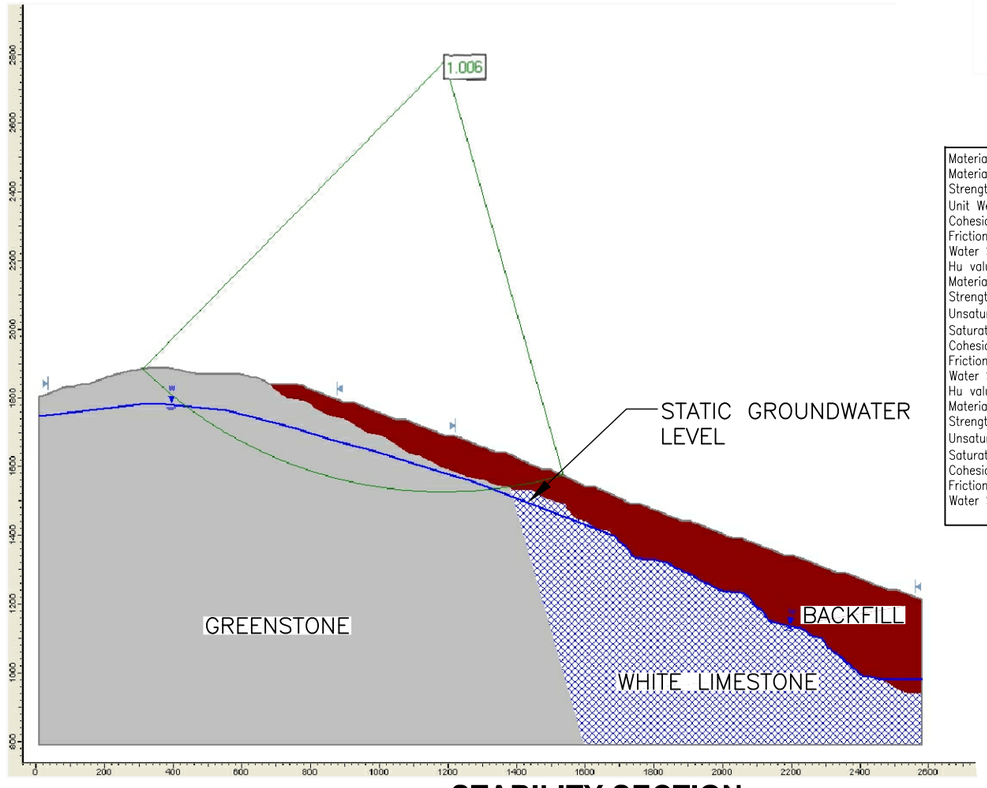
FIGURE 5.11

FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 5.10-5.12.dwg TAB NAME \Figure 5.11
Monday, May 10, 2010 - 1:49pm
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



Material Properties
Material: Waste Rock
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Hu value: automatically calculated
Material: Slide Debris
Strength Type: Mohr-Coulomb
Unit Weight: 135 lb/ft3
Cohesion: 0 psf
Friction Angle: 22 degrees
Water Surface: Water Table
Hu value: automatically calculated
Material: Greenstone
Strength Type: Mohr-Coulomb
Unit Weight: 155 lb/ft3
Cohesion: 1440 psf
Friction Angle: 23 degrees
Water Surface: Water Table
Hu value: automatically calculated
Material: White Limestone
Strength Type: Mohr-Coulomb
Unit Weight: 165 lb/ft3
Cohesion: 12500 psf
Friction Angle: 30 degrees
Water Surface: Water Table
Hu value: automatically calculated
Material: Fault
Strength Type: Mohr-Coulomb
Unit Weight: 155 lb/ft3
Cohesion: 0 psf
Friction Angle: 20 degrees
Water Surface: Water Table
Hu value: automatically calculated

AZIMUTH 120° SECTION 1000
PSEUDO-STATIC ANALYSIS (YA=0.16)



Material Properties
Material: Backfill
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Hu value: automatically calculated
Material: Greenstone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 160 lb/ft3
Saturated Unit Weight: 165 lb/ft3
Cohesion: 1440 psf
Friction Angle: 20 degrees
Water Surface: Water Table
Hu value: automatically calculated
Material: White Limestone
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 175 lb/ft3
Saturated Unit Weight: 175 lb/ft3
Cohesion: 14400 psf
Friction Angle: 35 degrees
Water Surface: None

STABILITY SECTION
PSEUDO-STATIC ANALYSIS (YA=0.15)

NOTES

1. SEE FIGURES 5.5 AND 5.6 FOR STABILITY SECTION LOCATION AND PROFILE.
2. SEE FIGURE 4.1 FOR AZIMUTH 120° SECTION 1000 LOCATION.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
PSEUDO-STATIC YIELD ACCELERATION STABILITY ANALYSES AFTER BACKFILLING

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 5.10-5.12
DESIGN	--	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	GM	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 5.12

FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 5.10-5.12.dwg TAB NAME \Figure 5.12
Monday, May 10, 2010 - 1:49pm
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.

6.0 SCENIC EASEMENT SLIDE

6.1 History

The "Scenic Easement Slide" occurred near the crest of the north slope of the North Quarry in January 2001 (Figure 6.1). The slide contained approximately 175,000 tons of weathered rock material and extended between elevations 1,340 and 1,500 ft msl. The slope movements encroached into the scenic easement defined by the County of Santa Clara that exists along the ridge top above the North Quarry (Figure 6.2). Based on review of the existing topography, the landslide appears to be up to 400 feet wide.

The Scenic Easement Slide is interpreted to be a rotational slide in the upper weathered greenstone. The debris has been subjected to erosion and weathering in the past few years. The height of the remaining failed landslide mass is estimated to be approximately 90 to 100 feet.

Reclamation includes backfilling with overburden up to elevation 1,440 feet, with minor regrading to flatten the upper 60 feet of the slide mass and headscarp to a slope of 3H:1V. The backfill provides a buttress to stabilize the lower portion of the slide. Figure 6.3 shows the limit and grading of the buttress.

6.2 Geologic Conditions

The upper north slope of the North Quarry is generally comprised of limestone underlying a layer of clay-altered greenstone. The greenstone (mapped as Kg-1) was characterized by Foruria (2004) as generally altered to clayey materials with cohesion. When it is dry, the Kg-1 rocks can stand as high as 60-ft at 70 to 75 degrees. Figure 6.4 summarize the geological mapping performed by Foruria in 2004.

No additional field mapping was performed by Golder to characterize the Scenic Easement Slide due to access restrictions and safety considerations. From a distance, Golder's observation of the landslide generally concurs with the CNI's conclusions regarding the mode and extent of the slide. The Scenic Easement Slide appears to be a rotational slump through the Kg-1 rocks, although the toe of the slide could be along the contact of Kg-1 and the underlying limestone. The slide is laterally bounded by stronger limestone to the east and west. Figure 6.5 shows a typical geological section with our interpretation of the slide based on the mapped geology and the past stability studies by CNI (2001, 2002c).

6.3 Supporting Data

Golder generally concurs with CNI on the geological characterization and interpretation of the failure. The key aspects of the CNI stability evaluation (CNI, January, 2001; CNI, October, 2002c) include the following:

- The Scenic Easement Slide is characterized as a shear failure through the weak, clay-altered volcanic material, which was mapped by Foruria (2004) as weathered greenstone (Kg-1) (CNI, 2001)

- The material properties used in the stability models include the following (CNI, 2002c):
  - Intact Kg-1: moist unit weight = 165 pcf; cohesion = 1600 psf; internal friction angle = 23 degrees
  - Displaced Kg-1 (or Slide Debris): moist unit weight = 165 pcf; cohesion = 700 psf; internal friction angle = 23 degrees
- Although the clays are moist and pore pressures may have existed within the clay materials to varying degrees, there was no phreatic surface within the slide material
- The slide head scarp as mapped by CNI (2002c) was at the 1483 ft elevation coinciding with the crest of the ridge

In the absence of a large backfill, CNI noted that mitigation measures to prevent or limit future encroachment are severely limited by the restricted access and topography of the quarry. Any remedial or preventative measures would probably require regrading of the ridge top to facilitate access. Regrading to create access and repair the slide would likely have more of a visual impact than the slide itself.

6.4 Stability Evaluation

Section SE-1 shown on Figure 6.5 was used as a typical section for stability evaluation of the Scenic Easement Slide area. This section was developed based on the current topographic map, proposed North Quarry grading designs, as well as Golder's recent investigations of the North Quarry. No groundwater was assigned in stability models as the permanent groundwater table is below the potential instability influence zone.

The material properties used for stability modeling are summarized in Table 6.1. The strengths presented below are effective stress parameters for long-term stability evaluation.

TABLE 6.1
MATERIAL PROPERTIES FOR SCENIC EASEMENT STABILITY ANALYSES

Material	Unit Weight pcf	Cohesion psf	ϕ, °	Comments
Residual Soil	120	200	30	Based on the 2007 Golder investigation for the adjacent West Materials Storage Area
Slide Debris	135	300	23	CNI (2002c); confirmed with stability evaluation of existing conditions
Greenstone	165	1,400	23	Golder (2007); confirmed with back analyses on "Scenic Easement Slide" (pre-failure)
Limestone	165	12,500	30	Golder (2007); confirmed with back analyses on "Scenic Easement Slide" (pre-failure)

For the slide debris shear strength parameters, the internal friction angle was assumed to be limited by that of the parent greenstone materials. Back analysis of the existing slope yielded a cohesion of 300 psf

to calculate a factor of safety of approximately 1.0. However, it is likely that the actual cohesion along the slide plane is near zero, indicating that the internal friction angle of the slide debris may be higher than assumed or the slide plane has a more favorable geometry than assumed.

Golder completed static and seismic slope stability analyses to evaluate stability conditions under pre-failure conditions for the back analyses, under the existing conditions and on proposed reclaimed slopes. The computer program SLIDE 5.0 (Rocscience, 2003) was used to calculate the factors-of-safety against potential slope slides. This program uses two-dimensional, limit-equilibrium theory to calculate safety factors (FOS) for slope stability problems. This program allows both circular and noncircular sliding surfaces to be either defined or generated automatically. Spencer's Method was used for FOS calculations. Pseudo-static analyses and dynamic deformation analyses were performed to evaluate slope stability under earthquake loading (as discussed in Section 5.7.1)

The results of stability modeling for the Scenic Easement Slide are summarized in Table 6.2. All the modeling results are included in Appendix 6.A.

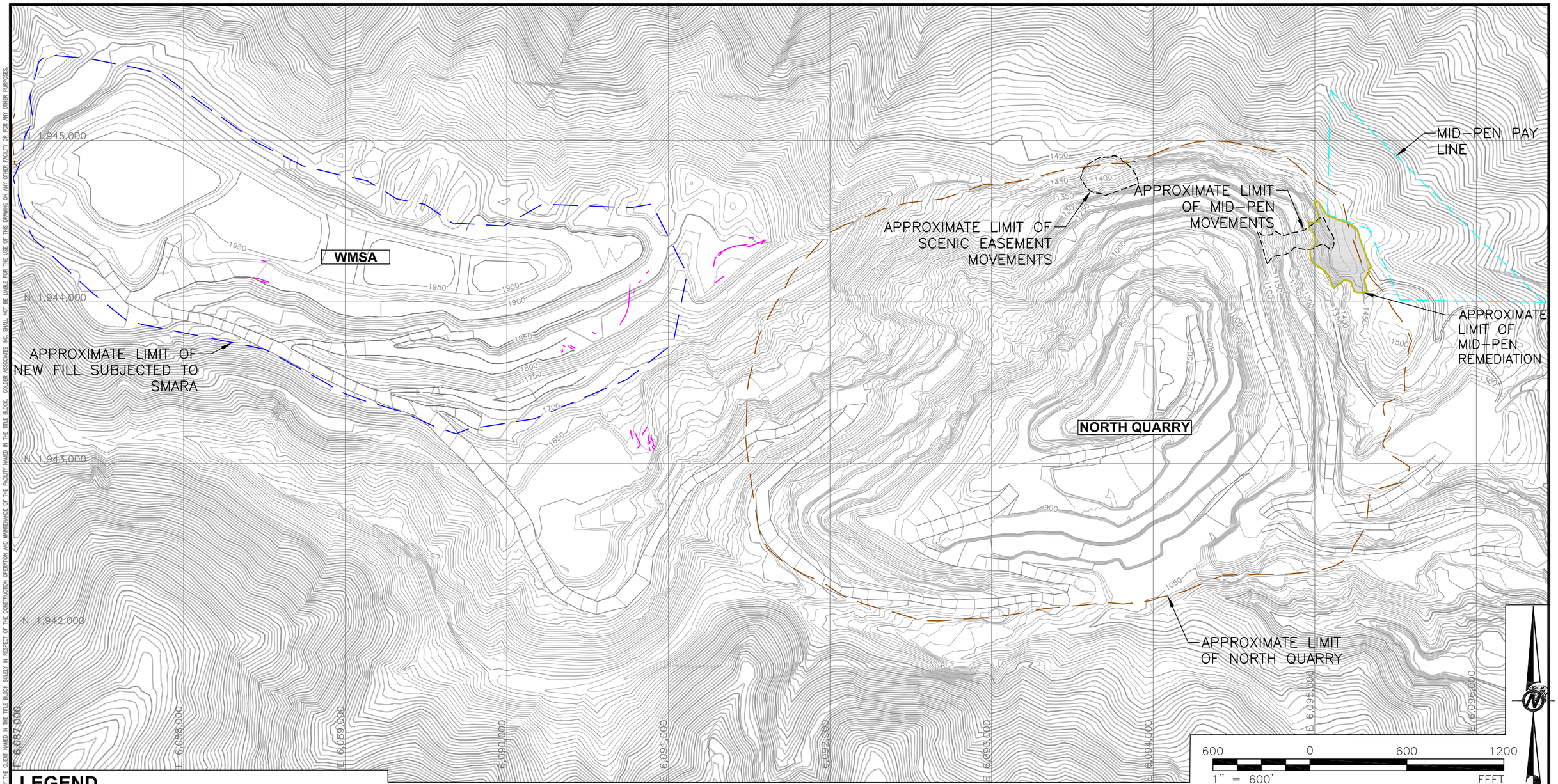
TABLE 6.2
SUMMARY OF SCENIC EASEMENT SLIDE STABILITY EVALUATION

Sections	Conditions	Description	Calculated FOS
SE1	Existing	Static	FOS = 1.05
		Seismic – pseudo-static (k = 0.15)	FOS = 0.8
		Seismic: displacement under design seismic event (16-84 percentile range)	2.5 to 10 feet (average 5 feet)
	Final Reclaimed Slope	Static	FOS = 2.3
		Seismic – pseudo-static (k = 0.15)	FOS = 1.5
		Seismic: displacement under design seismic event	< 3 inches

For the existing conditions, the static factor of safety (FOS) for a localized failure in the slide debris is approximately 1.0. The pseudo-static FOS for a localized failure in the slide debris is approximately 0.8. Estimated displacement from seismic loading is estimated at 2.5 to 10 feet (Table 6.2).

As discussed, the final reclamation involves placing overburden against the lower portion of the Scenic Easement Slide to elevation 1440 msl and regrading of the remaining slope above this elevation (Figure 6.3). This backfilling will significantly improve the stability of the Scenic Easement Slide area as indicated by the computed static FOS of 2.3, the pseudo-static FOS of 1.5, and estimated permanent seismic

displacements of less than 3 inches. In addition, the upper portion of the slide debris will be regraded through a combination of minor cuts and fills to flatten the slope to 3H:1V (18.4^0). This will prevent minor slumping and sloughing within the upper slide debris and headscarp area.



LEGEND

- 1550 — EXISTING TOPOGRAPHY (10 FT INTERVAL)
- APPROXIMATE LIMIT OF NORTH QUARRY
- APPROXIMATE MOVEMENT LIMITS
- MID-PEN PAY LINE
- LIMIT OF NEW FILL SUBJECTED TO SMARA
- APPROXIMATE LOCATIONS OF EXISTING CRACKS ON OR ADJACENT TO WMSA

NOTES

1. EXISTING TOPOGRAPHY OUTSIDE THE WMSA BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC. EXISTING TOPOGRAPHY INSIDE THIS BOUNDARY IS FROM JANUARY 2010 SURVEY PROVIDED BY LSCC.
2. EXISTING TOPOGRAPHY OUTSIDE THE NORTH QUARRY BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC. EXISTING TOPOGRAPHY INSIDE THIS BOUNDARY IS FROM SEPTEMBER 2009 SURVEY PROVIDED BY LSCC.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

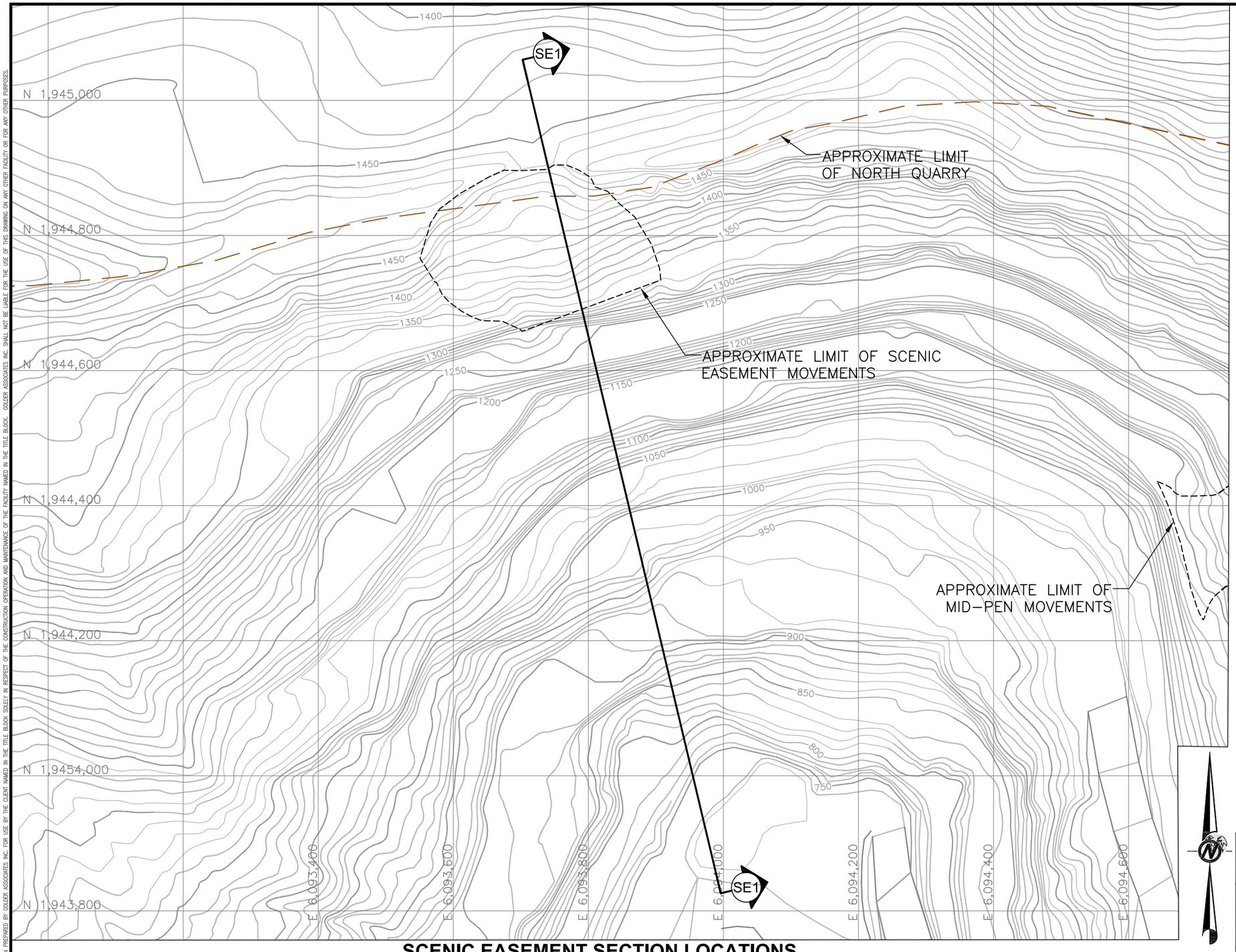
TITLE
SITE LAYOUT
SCENIC EASEMENT AND MID-PEN AREA

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 6.1
DESIGN	PHY	01/22/10	SCALE AS SHOWN	REV. 0
CADD	AJS	01/22/10		
CHECK	KH	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 6.1

Wednesday, February 03, 2010 - 10:20am FILE: S:\HansonPermanente\Plt 1 North East Wells\Reclamation Study - 2010\Reporting\Figures\Figure 6.1.dwg TAB NAME \SITE LAYOUT
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



SCENIC EASEMENT SECTION LOCATIONS

150 0 150 300

1" = 150' FEET

LEGEND

- 1450 — EXISTING TOPOGRAPHY (10 FT INTERVAL)
- APPROXIMATE LIMIT OF NORTH QUARRY
- APPROXIMATE MOVEMENT LIMITS
- SE1 — SECTION ID

NOTES

1. EXISTING TOPOGRAPHY OUTSIDE THE NORTH QUARRY BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC. EXISTING TOPOGRAPHY INSIDE THIS BOUNDARY IS FROM SEPTEMBER 2009 SURVEY PROVIDED BY LSCC.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

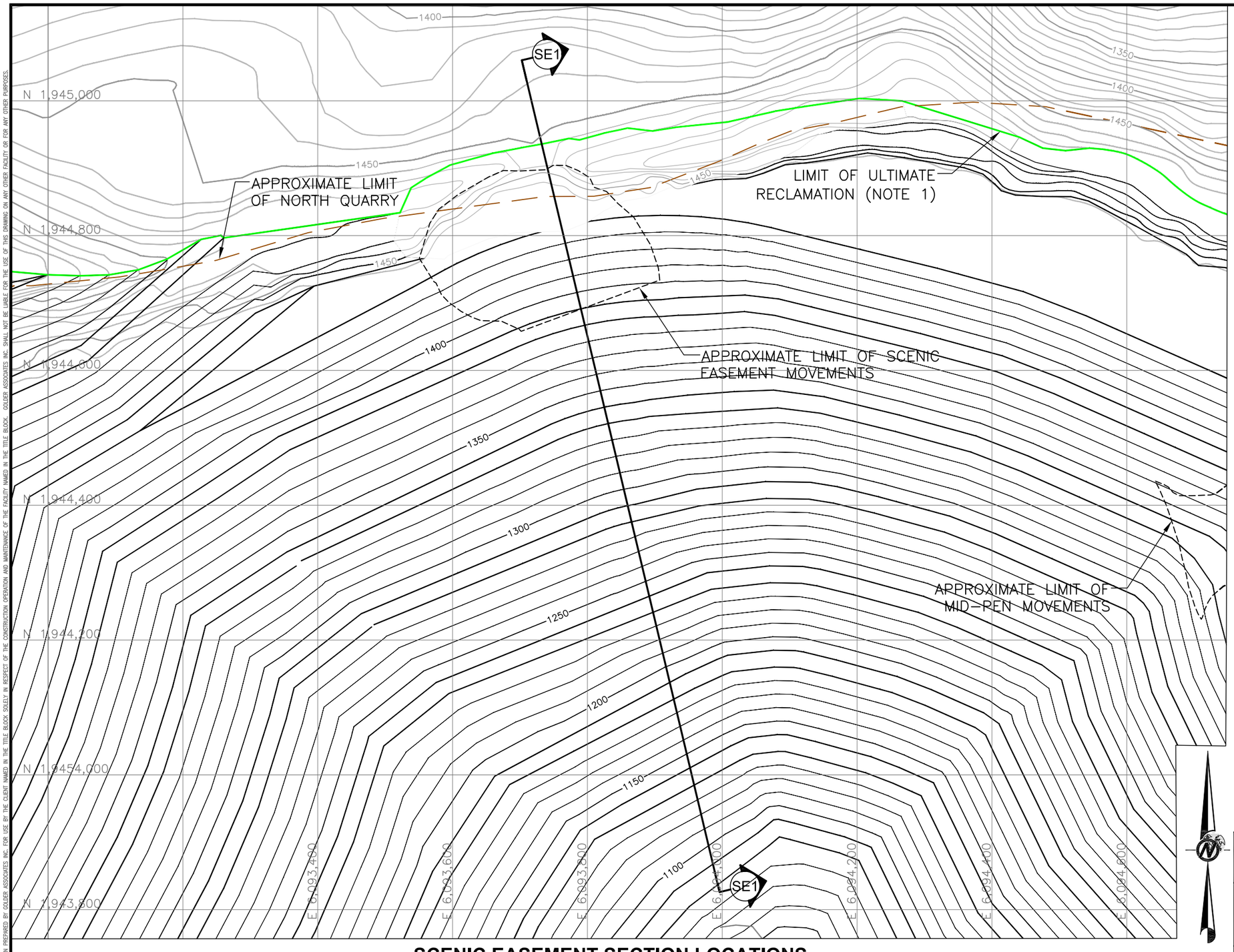
TITLE
**CURRENT TOPOGRAPHY-
SCENIC EASEMENT AREA**

Golder Associates

PROJECT No. 063-7109 800			FILE No.		Figure 6.2
DESIGN	PHY	01/22/10	SCALE	AS SHOWN	REV. 0
CADD	AJS	01/22/10			
CHECK	KH	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 6.2

Wednesday, February 03, 2010 - 10:22am FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures\Figure 6.2.dwg TAB NAME \PH 0
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



SCENIC EASEMENT SECTION LOCATIONS

150 0 150 300

1" = 150' FEET

LEGEND

- 1450 — EXISTING TOPOGRAPHY (10 FT INTERVAL)
- 1450 — PROPOSED TOPOGRAPHY (10 FT INTERVAL)
- LIMIT OF ULTIMATE RECLAMATION
- APPROXIMATE LIMIT OF NORTH QUARRY
- APPROXIMATE MOVEMENT LIMITS
- SE1 — SECTION ID

NOTES

1. PROPOSED TOPOGRAPHY INSIDE THE ULTIMATE RECLAMATION BOUNDARY PROVIDED BY LSCC IN DECEMBER 2009. TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

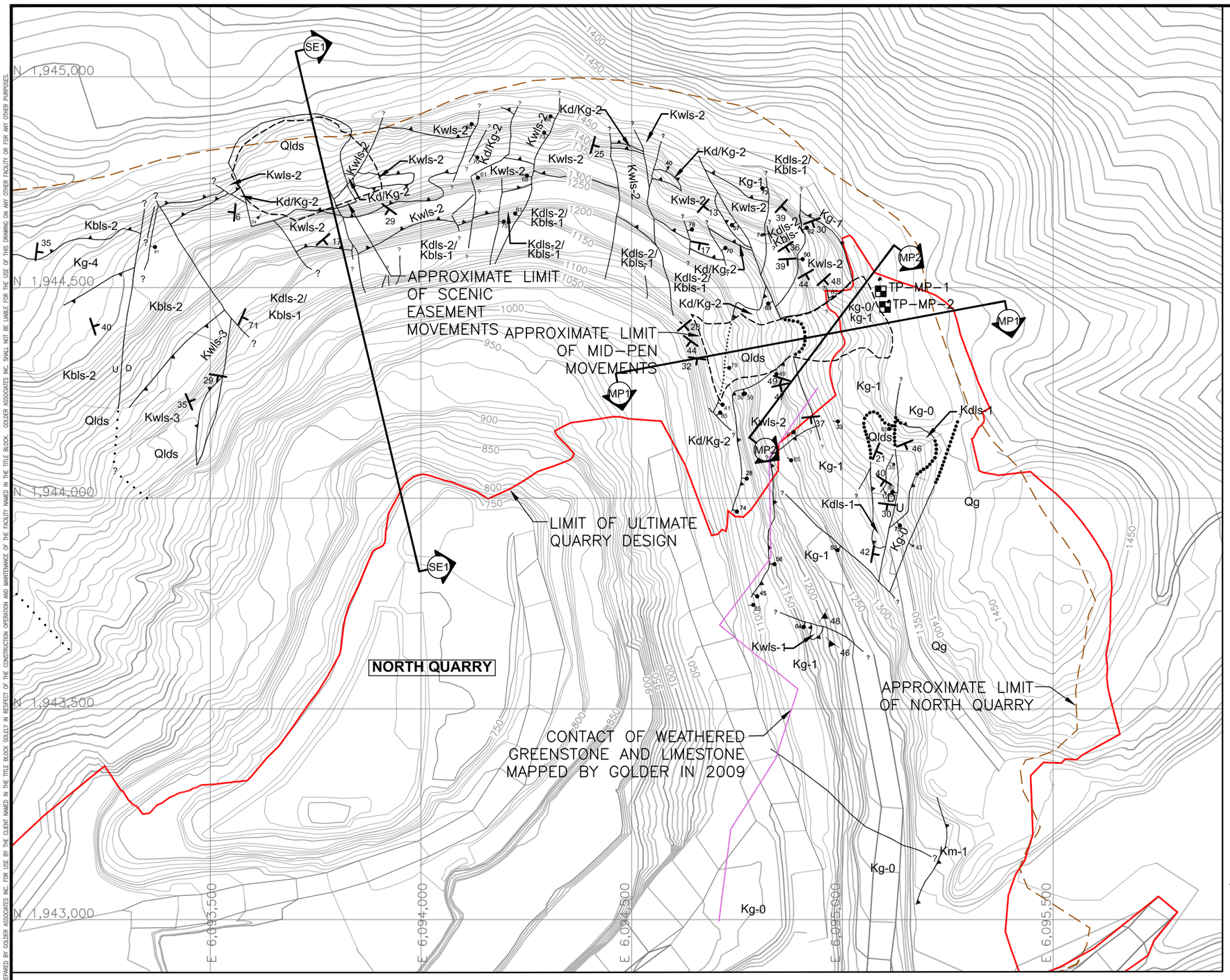
TITLE
ULTIMATE RECLAMATION PLAN FOR SCENIC EASEMENT AREA

Golder Associates

PROJECT No. 063-7109 800			FILE No.		Figure 6.3
DESIGN	PHY	01/22/10	SCALE	AS SHOWN	REV. 0
CADD	AJS	01/22/10			
CHECK	KH	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 6.3

Wednesday, February 03, 2010 - 10:23am FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures\Figure 6.3.dwg TAB NAME \PH Ult
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



SCENIC EASEMENT AND MID-PEN GEOLOGIC MAP

250 0 250 500

1" = 250' FEET

LEGEND

1450	EXISTING TOPOGRAPHY (10 FT INTERVAL)
	LIMIT OF ULTIMATE QUARRY DESIGN
	APPROXIMATE LIMIT OF NORTH QUARRY
	APPROXIMATE LIMITS OF MOVEMENT
	GEOLOGIC CONTACT
	GEOLOGIC CONTACT, APPROXIMATE
	FAULT CONTACT, THRUST FAULT
TP–MP–1	GOLDER 2009 TEST PIT LOCATION
SE1	SECTION ID
35	STRIKE AND DIP OF BEDDING
41	FAULT DIP
Kg-0	GREENSTONE, PREHNITE–PUMPELLYITE TO LOWER GREENSCHIST GRADE
Kg-1	GREENSTONE, PERHNITE–PUMPELLYITE GRADE
Kwls-1	LIGHT GREY LIMESTONE WITH INTERBEDDED CHERT
Kwls-2	LIGHT GREY LIMESTONE WITH THINLY INTERBEDDED CHERT
Kwls-3	LIGHT GREY LIMESTONE WITH INTERBEDDED CHERT
Kdls-1	DARK GREY LIMESTONE WITH INTERBEDDED CHERT
Kdls-2/ Kbls-1	GREY LIMESTONE WITH MINOR BLACK CHERT
Kd/Kg-2	DIORITE SILL WITH MINOR MAFIC METAVOLCANIC FLOWS
Kbls-2	DARK GREY TO BLACK LIMESTONE WITH MINOR BLACK CHERT
Qlds	QUARRY LANDSLIDE DEPOSITS
Qg	QUARRY GRAVEL DEPOSITS

NOTES

1. EXISTING TOPOGRAPHY OUTSIDE THE NORTH QUARRY BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC. EXISTING TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM SEPTEMBER 2009 SURVEY PROVIDED BY LSCC.
2. GEOLOGIC UNITS UPDATED AFTER 2004 GEOLOGIC MAP PROVIDED BY J. FORURIA

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

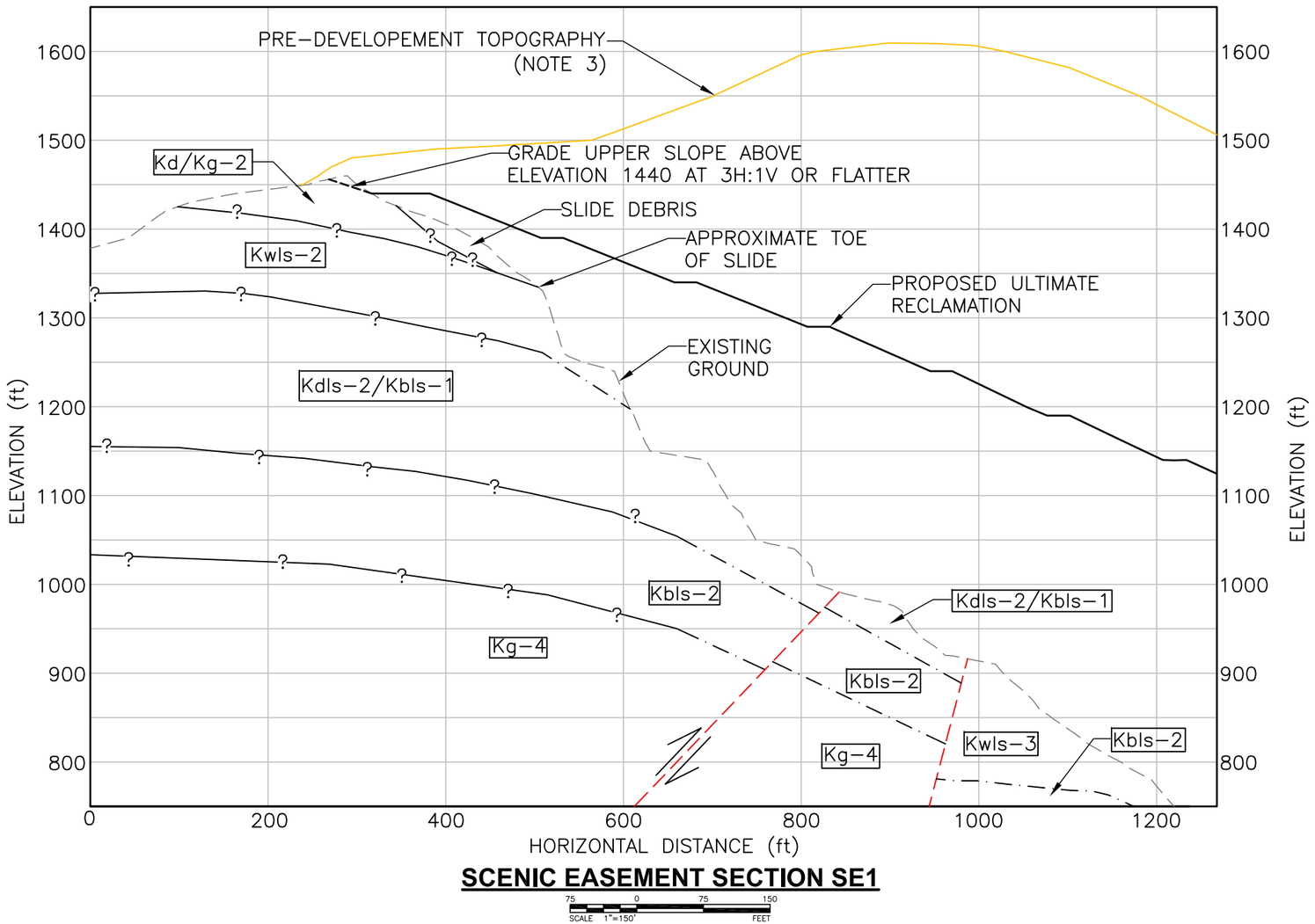
TITLE
GEOLOGIC MAP
SCENIC EASEMENT AND MID-PEN AREAS

Golder Associates

PROJECT No. 063–7109 800			FILE No.		Figure 6.4
DESIGN	PHY	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	KH	01/22/10			
REVIEW	BF	01/22/10			

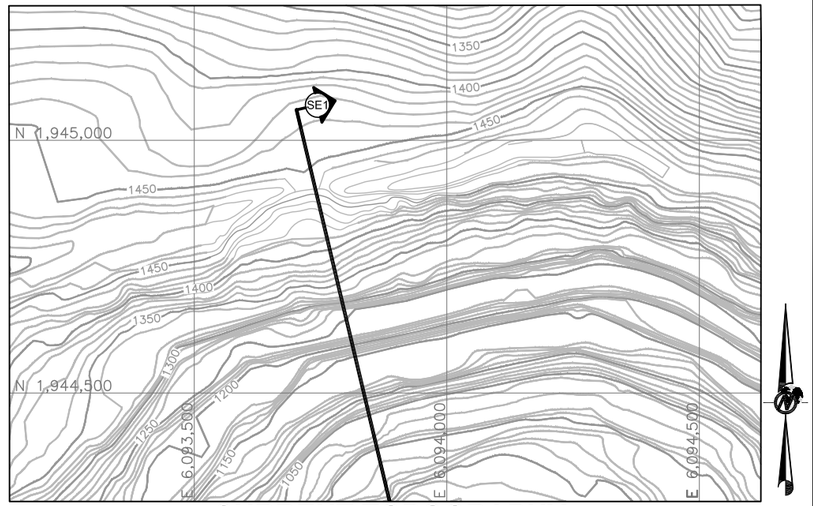
FIGURE 6.4

FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study – 2010\Reporting\Figures R1\Figure 6.4.dwg TAB NAME: \NORTH QUARRY GEOLOGY
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES. USE OF THIS DRAWING BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK.
Friday, April 30, 2010 – 8:09am



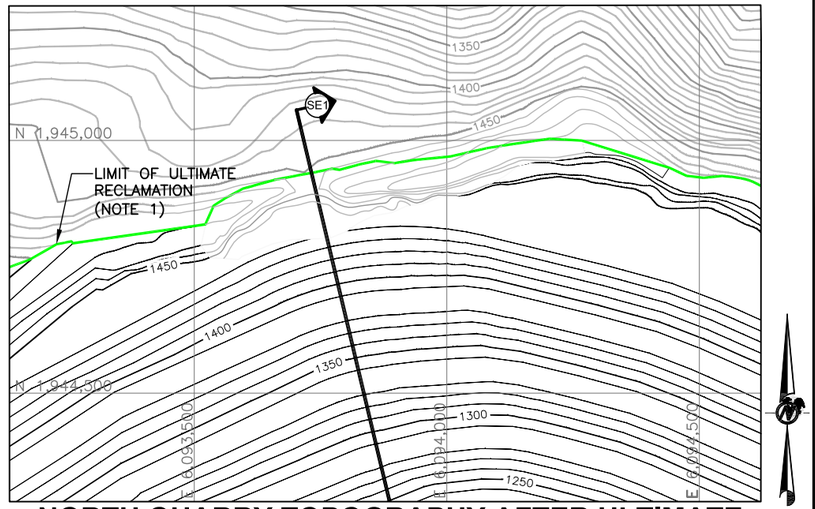
SCENIC EASEMENT SECTION SE1

75 0 75 150
SCALE 1"=150' FEET



CURRENT TOPOGRAPHY

150 0 150 300
SCALE 1"=300' FEET



NORTH QUARRY TOPOGRAPHY AFTER ULTIMATE RECLAMATION

150 0 150 300
SCALE 1"=300' FEET

LEGEND

- EXISTING TOPOGRAPHY (10 FT INTERVAL)
- PROPOSED TOPOGRAPHY (10 FT INTERVAL)
- LIMIT OF ULTIMATE RECLAMATION (PLAN VIEW)
- MID-PEN PAY LINE
- SECTION ID
- EXISTING GROUND PROFILE
- PROPOSED ULTIMATE RECLAMATION PROFILE
- APPROXIMATE PRE-DEVELOPEMENT PROFILE
- GEOLOGIC CONTACT PROFILE
- APPROXIMATE GEOLOGIC CONTACT PROFILE
- FAULT WITH CORRESPONDING MOVEMENTS
- FAULT

NOTES

1. PROPOSED ULTIMATE RECLAMATION TOPOGRAPHY INSIDE THE NORTH QUARRY RECLAMATION BOUNDARY PROVIDED BY LSCC IN JANUARY 2010. TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC.
2. EXISTING TOPOGRAPHY OUTSIDE THE NORTH QUARRY BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC. EXISTING TOPOGRAPHY INSIDE THIS BOUNDARY IS FROM SEPTEMBER 2009 SURVEY PROVIDED BY LSCC.
3. PRE-DEVELOPMENT TOPOGRAPHY PROVIDED BY LSCC IN 2010.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
CROSS-SECTION SE1 FOR SCENIC EASEMENT SLIDE

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 6.5
DESIGN	PHY	01/22/10	SCALE AS SHOWN	REV. 0
CADD	AJS	01/22/10		
CHECK	KH	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 6.5

Wednesday, February 03, 2010 - 10:34am FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures\Figure 6.5.dwg TAB NAME \SE1
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.

7.0 MID-PENINSULA SLIDE

7.1 History

The Mid-Peninsula landslide (Mid-Pen Slide) occurred during very heavy rainfall in the winter of 2001. The upper limits of the slide encroached upon the southeast portion of the Mid-Peninsula Regional Open Space District's Rancho San Antonio Preserve (MPROSP). Lehigh negotiated with the MPROSP for a land swap and took possession of the encroachment area. The landslide is referred to as the "Mid-Pen Slide" in this report. Figure 6.1 shows a layout of the North Quarry with mapped limits of the slide. No mitigation has been implemented since the movements occurred.

7.2 Geologic Conditions

The Mid-Pen Slide is a narrow wedge-shaped slide that occurs within highly weathered greenstone bounded by faults, and juxtaposing better quality and higher shear strength bedrock on either side of the slide. The southeast margin of the slide may also be bounded by a fault, however, the occurrence of the fault has not been confirmed due to limited exposure of the rock in this area. The slide occurred predominantly in highly weathered greenstone (designated as Kg-0/Kg-1 on the geologic maps) in the upper part of the slope, although highly weathered greenstone in the Kd/Kg-2 unit below also failed, possibly due to scouring by the runoff from the upper part of the slope. Figures 7.1 and 7.2 are typical geological sections with Golder's interpretation of the slide.

It is important to note that Golder's interpretation of the slide varies dramatically from that by CNI (2002b), which may be due to better exposures that exist today than immediately after the slide. CNI estimated the slide to be more than 500 feet wide and extending below an elevation of 1300 feet. Golder believes that the slide is actually narrower, as shown in the photograph in Figure 7.3. The 1260 and 1330 benches appear intact and in place on both sides of the slide, indicating that the slide did not extend south of approximately Northing 1,944,300 (California State Plane Coordinates). The landslide rupture surface appears to daylight at about elevation 1280 amsl in a very narrow area. Accumulation of slide debris/talus appears to start at about elevation 1350 and extends down to the 1150 bench which appears to be intact. The slope behind the quarry crest was inspected by Golder for tension cracks that might indicate larger-scale instability and none were found.

There is bench-scale instability in the slopes south of approximately Northing 1,944,330 in the areas designated by CNI (2002b) as being part of the Mid-Pen slide, although the instability is actually unrelated to the Mid-Pen Slide. A small slide was identified immediately south of the large oak tree at the quarry crest (Figure 7.3). This slide appears to toe out above the road leading from the 1350 bench. Additionally, slumping is evident in the highly sheared and weathered greenstone slopes in the vicinity of the small slide, and also in many of the weathered greenstone slopes below and to the south of this area.

This smaller slide is similar in style and geometry to the larger Scenic Easement Slide as it is a rotational slump entirely within highly weathered greenstone materials.

7.3 Supporting Data

Call & Nicholas Inc (CNI) performed a number of geotechnical evaluations of slope stability issues in the North Quarry in the early 2000's. These studies are summarized herein.

CNI (2002b) evaluated the Mid-Pen Slide that occurred in the upper portion of the east wall of the main Quarry. CNI concluded in the report that the slide occurred within the mapped Km-1 unit (recently mapped as Kg-0, Foruria, 2004) – sedimentary-greenstone mélange, which was described as highly oxidized soil that weathered to clay. The Km-1 unit and similar units at the quarry are commonly located near the original ground surface, confined by stronger units, and are susceptible to slope instability. The Km-1 unit involved in the Mid-Pen Slide is bounded to the northwest by limestone (Kwls-2) and greenstone, Kg-1. The Kg-1 greenstone is less altered and more competent than the Km-1 altered sedimentary-greenstone mélange involved in the landslide.

Based on laboratory testing, CNI assumed the following soil parameters for the Km-1 unit:

- Unit weight = 125 pcf
- Cohesion = 1,500 psf
- Internal friction angle = 18.7°

The results of CNI's slope stability analyses indicated that the slope, re-graded at the proposed 2H:1V, would have a FOS of greater than or equal to 1.4 under static conditions. These material properties resulted in a critical failure surface in the central section that toed at the top of the Lower Units above approximate elevation 1300 feet msl.

CNI (2002c) issued an addendum to their earlier report to include additional information requested during a site meeting, and in correspondence from the Mid-Pen Open Space District (transmitting comments from Cotton Shires and Associates). The pre-landslide conditions were estimated to have a FOS of approximately 1.0. The pre-landslide conditions were evaluated using the previously reported laboratory test data and by back-calculating from the limit-equilibrium slope stability analyses in the CNI (2002b) report. The physical parameters of the Kwls-2 and Kg-1 units were adjusted from the previous estimates, so that the failure surface approximated the field conditions. The adjusted physical properties were then used to re-evaluate the slope stability of a potential 2H:1V slope regrade. This resulted in a failure surface for the back analysis, and for the analysis of the re-grades, extending into the lower units and exiting the slope at an elevation below 1200 feet msl. The FOS for the 2H:1V slope, using the adjusted physical properties, was determined to be approximately 1.4.

CNI estimated the thickness of the slide to be approximately 80 feet, based on the back calculation of the pre-slide geometry.

CNI (2003) developed recommendations for re-grading of the upper slopes of the quarry within: (1) the potentially unstable greenstone/sedimentary mélange (Km-1), and (2) the overburden Storage Area at the top of the east quarry wall. In addition, the study looked at the overall stability of the ultimate quarry slopes, including the lower more competent limestone units, as related to the proposed mine plan. This report is based on a geologic model developed from detailed mapping and core drilling and provides slope design recommendations for the "Phase IV Quarry Plan" North, East, and South slopes, including the Scenic Easement.

Based on the logging of seven geotechnical core holes, testing of rock core samples for engineering properties, reviewing surface and core hole geology and sections, and completing additional slope stability analyses, CNI concluded that the final slopes for Km-1 mélange and overburden rock Storage Areas above the quarry wall should be graded to 2H:1V. The analyses indicated that the FOS would be approximately 1.15 to 1.30 under static conditions for various portions of the upper east slope. They also indicated that permanent displacements of several feet might occur during a large earthquake event.

In these analyses, CNI revised the density and mean shear strength parameters of the Km-1 unit to the following:

- Unit weight = 162 pcf
- Cohesion = 2,150 psf
- Internal friction angle = 20.1°

CNI assumed the following density and shear strength parameters for the Kg-1 unit:

- Unit weight = 175 pcf
- Cohesion = 1,000 psf
- Internal friction angle = 31.3°

CNI assumed the following density and shear strength parameters for the overburden:

- Unit weight = 125 pcf
- Cohesion = 144 psf
- Internal friction angle = 38°

CNI also estimated the mean minus one standard deviation shear strengths in their 2003 report, provided estimates of the shear strength of good quality and poor quality greenstone, and estimated the shear strengths for other geologic materials.

Based on the laboratory testing and core logging, CNI computed Hoek-Brown shear strength envelopes for disturbed and undisturbed rock for each of the geologic units. However, CNI then computed alternative shear strength envelopes using a percent of intact rock (PIR) approach. Golder assumes that this is a CNI proprietary system. We note that this approach results in linear or near-linear shear strength envelopes that are substantially lower than undisturbed Hoek-Brown shear strength envelopes but slightly

higher than the disturbed Hoek-Brown shear strength envelopes. Although it is not clearly stated in the report, it appears that CNI used the mean minus one standard deviation shear strength parameters for the Km-1 material, based on the PIR approach.

The following summarizes the geological units and strengths that had been used in the previous slope stability studies by CNI for the Mid-Pen Slide in 2002 and subsequently revised in 2003:

TABLE 7.1A
MATERIAL PROPERTIES USED IN 2002 CNI MID-PEN STABILITY STUDY

Material	Unit Weight pcf	Cohesion psf	ϕ, °
Upper Unit (Km-1)	125	1,500	18.7
Lower Unit (Kwls)	135 to 155	900 to 2,500	25.3 to 36

TABLE 7.1B
MATERIAL PROPERTIES USED IN 2003 CNI MID-PEN STABILITY STUDY

Material	Linear Shear Strength Parameters				Unit Weight pcf	Comment
	Mean		Mean minus One Std. Dev.			
	Cohesion Psi	ϕ deg	Cohesion psi	ϕ deg		
Km-1	14.9	20.1	9.7	19	162	Rock Mass Strength
Kwls-1, 2, or 3	162	32.4	82.7	27.1	167	Rock Mass Strength
Kg-1	7	31.3	4.6	25.5	175	Rock Mass Strength
Kdls/Kbls	90	30.7	46.7	26.2	167	Rock Mass Strength
Kg-2, 3, or 4	5.9	24.6	3.5	22.1	153	Rock Mass Strength
Faults	5.4	38	3.5	36.6	160	Apply along vertical faults
Kg Bedding/ Thrust	4.2	19.7	1.7	19.2	163	Apply at any Kg contact
Lms Bedding/ Thrust	3.5	21.7	2.9	19.2	167	Apply at Lms contact w/o any Kg units
End-Dumped Overburden	1	38	0.5	36	125	Estimated

Golder reviewed CNI's investigations described above for the Mid-Pen and performed an independent stability evaluation of the Mid-Pen Slide, including a field investigation, described below, as well as engineering analyses, which are discussed in Section 7.4.

7.3.1 Mid-Pen Slide Field Investigation

On January 14, 2009, Golder conducted a focused field investigation of the Mid-Pen Slide. The field investigation included geological mapping of the slide area, and excavation, logging, and sampling of two test pits behind the headscarp of the slide.

7.3.1.1 Mapping

Areas accessible for mapping include the 1250 bench and the 1330 bench south of approximately Northing 1,944,350, and the slope behind the east quarry crest. The geologic map of the Mid-Pen Slide area completed by Foruria (2004) was supplemented and updated with our mapping, and is included in Figure 6.4.

Foruria's geologic mapping at the time CNI completed their studies on the Mid-Pen Slide indicated that the upper part of the east wall consisted of the mélange unit Km-1. Since then, Foruria has revised the map to show greenstone units Kg-0 and Kg-1 in that area instead (Foruria, 2004). Because the Kg-0 and Kg-1 units are very similar, especially when highly weathered and disrupted, Golder mapped the highly weathered greenstone in the movement area as Kg-0/Kg-1. A photograph of the Mid-Pen Slide with our geologic structural interpretations is attached in Figure 7.3.

7.3.1.2 Test Pits

Two test pits were excavated approximately 25 feet behind the existing headscarp of the Mid-Pen Slide, at the locations shown in Figure 7.1. The test pits encountered topsoil to a depth of approximately 1.5 feet, and residual soil or colluvium to a depth of approximately 2.5 to 4 ft; then highly weathered metavolcanic rock to the terminal depths of 12.5 feet and 14 feet. Test pit logs are included in Appendix 7.A. Bulk samples were collected from each test pit and sent to the Cooper Testing Laboratory in Palo Alto, California. The laboratory testing results are summarized in Section 7.3.1.3 below.

7.3.1.3 Laboratory Testing Program

The laboratory testing program consists of six sieve analysis tests on bulk samples and one Atterberg Limits test:

TABLE 7.2
SUMMARY OF LABORATORY TESTING ON SAMPLE OF THE MID-PEN INVESTIGATION

CLASSIFICATION TEST RESULTS								
Test Pit ID	Depth (ft)	Sieve Analysis (% Passing)			Atterberg Limits			U.S.C.S. Class.
		3/4 Inch	#10	#200	LL	PL	PI	
TP-MP-1	3.5	77.3	20.8	5	-	-	-	GW-GP
	10	88.8	31.9	9.3	-	-	-	GW-GP
	14	43.1	12.9	3.6	-	-	-	GP
TP-MP-2	0-0.5	90.7	80.5	49.9	46	25	21	SC
	10	72.9	30.7	8.2	-	-	-	GW-GP
	12.5	60.6	16.4	6.3	-	-	-	GW-GP

The samples collected from the surface (TP-MP-2, 0-0.5 ft) were classified as a clayey sand according to the Unified Soil Classification System (USCS). The rest of the samples are well graded to poorly graded gravels, with 13-32% sand and 9% or less fines.

A consolidated, undrained (CU) triaxial test was performed on remolded samples with minus-3/4-inch materials collected from TP-MP-2@3.5 feet and TP-MP-2@14 feet; the sample was remolded to 94% of the in-situ density determined from a block sample.

More details regarding the laboratory testing results are presented in Appendix 7.B.

7.4 Stability Evaluation

Sections MP-1 and MP-2 shown in Figures 7.1 and 7.2 were used as typical sections for stability evaluation of the Mid-Pen Slide. The sections were developed based on the current topographic map, review of the past investigation by CNI, as well as our recent characterization of surface geological and instability conditions. Limited hydrogeological data are available but the past stability studies by CNI indicated that the phreatic level is likely below the currently observed movements.

The material properties used by Golder for stability modeling are summarized in Table 7.3. All strengths presented are effective stress parameters for long-term stability evaluation. The geological units and strength properties are generally consistent with the CNI studies summarized in Section 7.1.; some properties; however, were revised based on our recent investigation as well as review of the slope performance data.

TABLE 7.3
MATERIAL PROPERTIES FOR MID-PEN STABILITY ANALYSES

Material	Unit Weight pcf	Cohesion psf	ϕ, °	Comments
Slide Debris – Mid-Pen	135	700	20	CNI (2002a,2002b); confirmed with evaluation of existing stability conditions
Greenstone (Kg-0)	165	1,400	20	Based on back analyses of Mid-Pen Slide
Greenstone (Other)	165	1,400	23	Golder (2007a); confirmed with back analyses on Mid-Pen Slide
Limestone	165	12,500	30	Golder (2007a)
Overburden	125	0	35	Golder (2007b)

The same methodology as discussed in Section 6.4 was used to complete static and seismic slope stability analyses. Section MP1 was used for back analyses to support development of strengths of pertaining materials under pre-slide conditions; both Sections MP1 and MP2 were used for evaluate existing conditions and final reclamation slopes. The stability modeling results are presented in Appendix 7C and summarized in the following table.

TABLE 7.4
SUMMARY OF MID-PEN SLIDE STABILITY EVALUATION

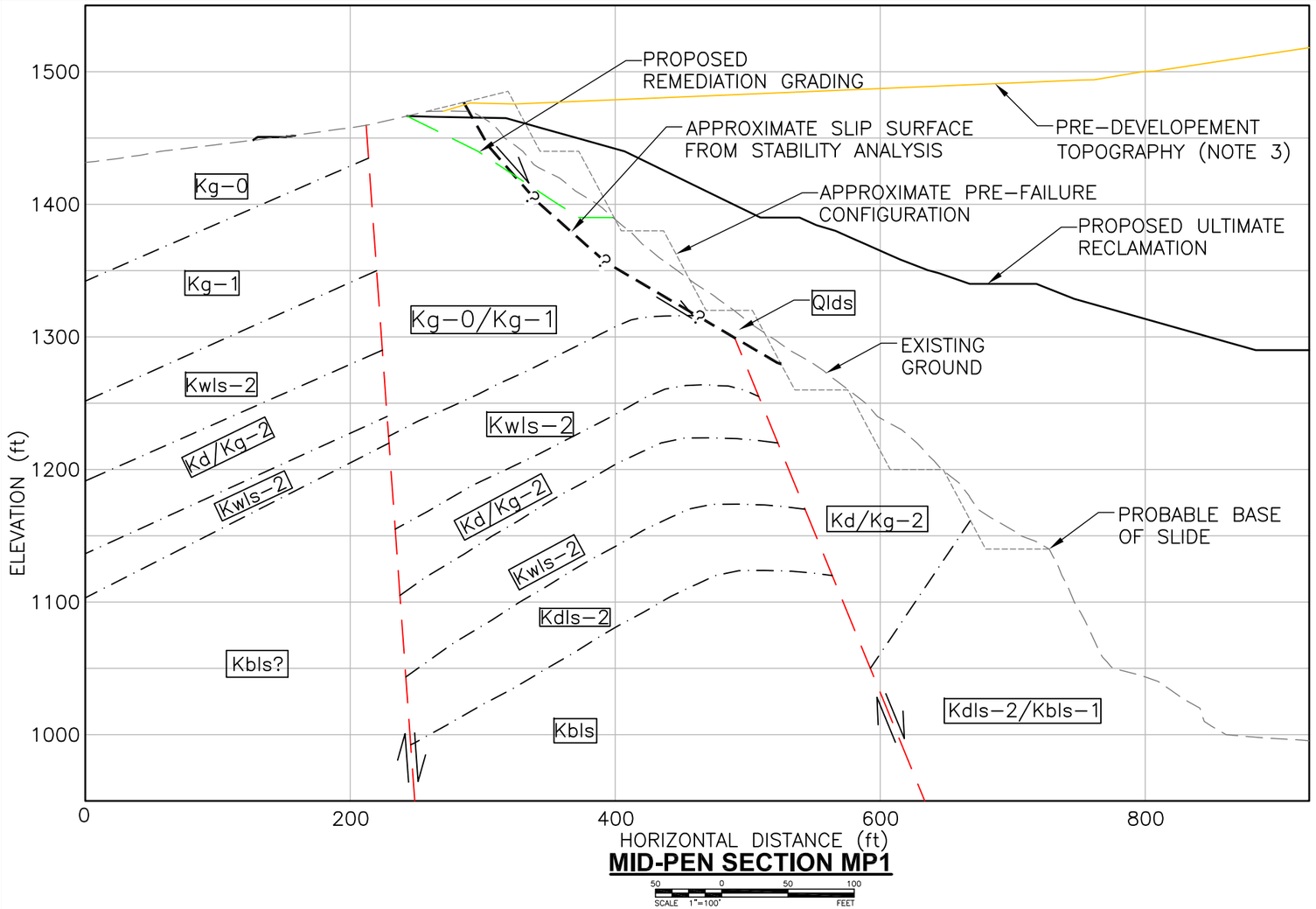
Sections	Conditions	Description	Calculated FOS
MP1	Existing	Static	FOS = 1.03
		Seismic – pseudo-static (k = 0.15)	FOS = 0.84
		Seismic: displacement under design seismic event	> 10 feet
	Final Reclaimed Slope	Static	FOS = 1.81
		Seismic – pseudo-static (k = 0.15)	FOS = 1.29
		Seismic: displacement under design seismic event (15-85 percentile range)	< 3 inches
	Existing	Static	FOS = 1.11
		Seismic – pseudo-static (k = 0.15)	FOS = 0.88
		Seismic: displacement under design seismic	1 to 5 feet

MP2		event	(average 2 ft)
	Final Reclaimed Slope	Static	FOS = 2.23
		Seismic – pseudo-static (k = 0.15)	FOS = 1.43
		Seismic: displacement under design seismic event (15-85 percentile range)	< 3 inches

Under the existing conditions, the slope in the Mid-Pen Slide area is marginally stable with the static FOS as low as 1.03. The pseudo-static FOS for a global failure in the slide debris is approximately 0.8 to 0.9, which indicates that the slide will move substantially due to large seismic loading (greater than several feet to possibly tens of feet).

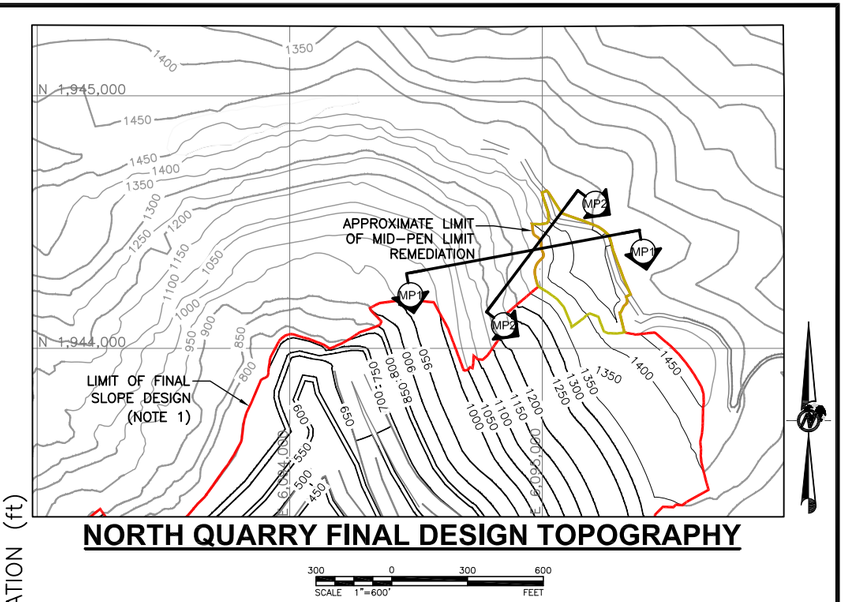
The final reclamation plan calls for backfilling against most of the Mid-Pen Slide up to elevation 1450 feet msl as shown in Figure 7.1. The proposed backfilling provide a very robust buttress that effectively establishes relatively high factors of safety as indicated in Table 7.4. For a failure surface extending through the native materials, the computed static factors of safety exceed 1.8, the pseudo-static factors of safety exceed 1.29, and seismic deformations are less than 3-inches. These FOS and values and estimated seismic displacements are considered acceptable for the Reclamation Plan.

Until reclamation is completed, there is continued risk that ongoing erosion of the headwall, or saturation by rainfall, or a seismic event will result in headward migration of the Mid-Pen Slide. Because of this risk, Lehigh may elect to implement remedial grading of the Mid-Pen Slide as part of on-going operations at the quarry prior to reclamation to prevent further headwall migration. These measures are expected to consist of minor excavation to reduce the slope of the headscarp, and to re-establish benches to direct surface water away from the headwall area. This grading is shown on Figures 7.1 and 7.2



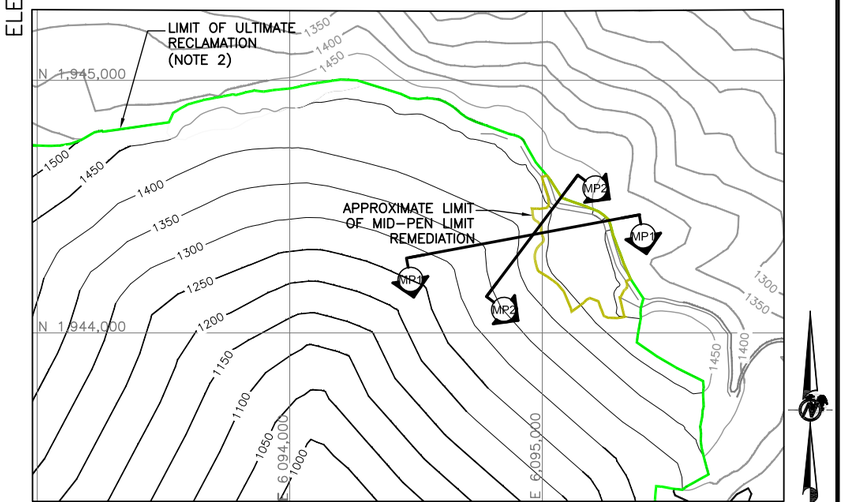
MID-PEN SECTION MP1

SCALE 1"=100' (50 0 50 100 FEET)



NORTH QUARRY FINAL DESIGN TOPOGRAPHY

SCALE 1"=600' (300 0 300 600 FEET)



NORTH QUARRY TOPOGRAPHY AFTER ULTIMATE RECLAMATION

SCALE 1"=600' (300 0 300 600 FEET)

LEGEND

- EXISTING TOPOGRAPHY (50 FT INTERVAL)
- PROPOSED TOPOGRAPHY (50 FT INTERVAL)
- LIMIT OF FINAL DESIGN TOPOGRAPHY (PLAN VIEW)
- LIMIT OF ULTIMATE RECLAMATION (PLAN VIEW)
- LIMIT OF REMEDIATION
- SECTION ID
- EXISTING GROUND PROFILE
- PROPOSED REMEDIATION GRADING PROFILE
- PROPOSED ULTIMATE RECLAMATION PROFILE
- APPROXIMATE PRE-DEVELOPEMENT PROFILE
- APPROXIMATE PRE-FAILURE CONFIGURATION
- GEOLOGIC CONTACT PROFILE
- APPROXIMATE SLIP SURFACE FROM STABILITY ANALYSIS
- FAULT WITH CORRESPONDING MOVEMENTS

NOTES

1. PROPOSED FINAL DESIGN TOPOGRAPHY TOPOGRAPHY INSIDE THE NORTH QUARRY BOUNDARY PROVIDED BY LSCC IN DECEMBER 2009. TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC.
2. PROPOSED ULTIMATE RECLAMATION TOPOGRAPHY INSIDE THE NORTH QUARRY RECLAMATION BOUNDARY PROVIDED BY LSCC IN MAY 2010. EXISTING TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC.
3. PRE-DEVELOPMENT TOPOGRAPHY PROVIDED BY LSCC IN 2010.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

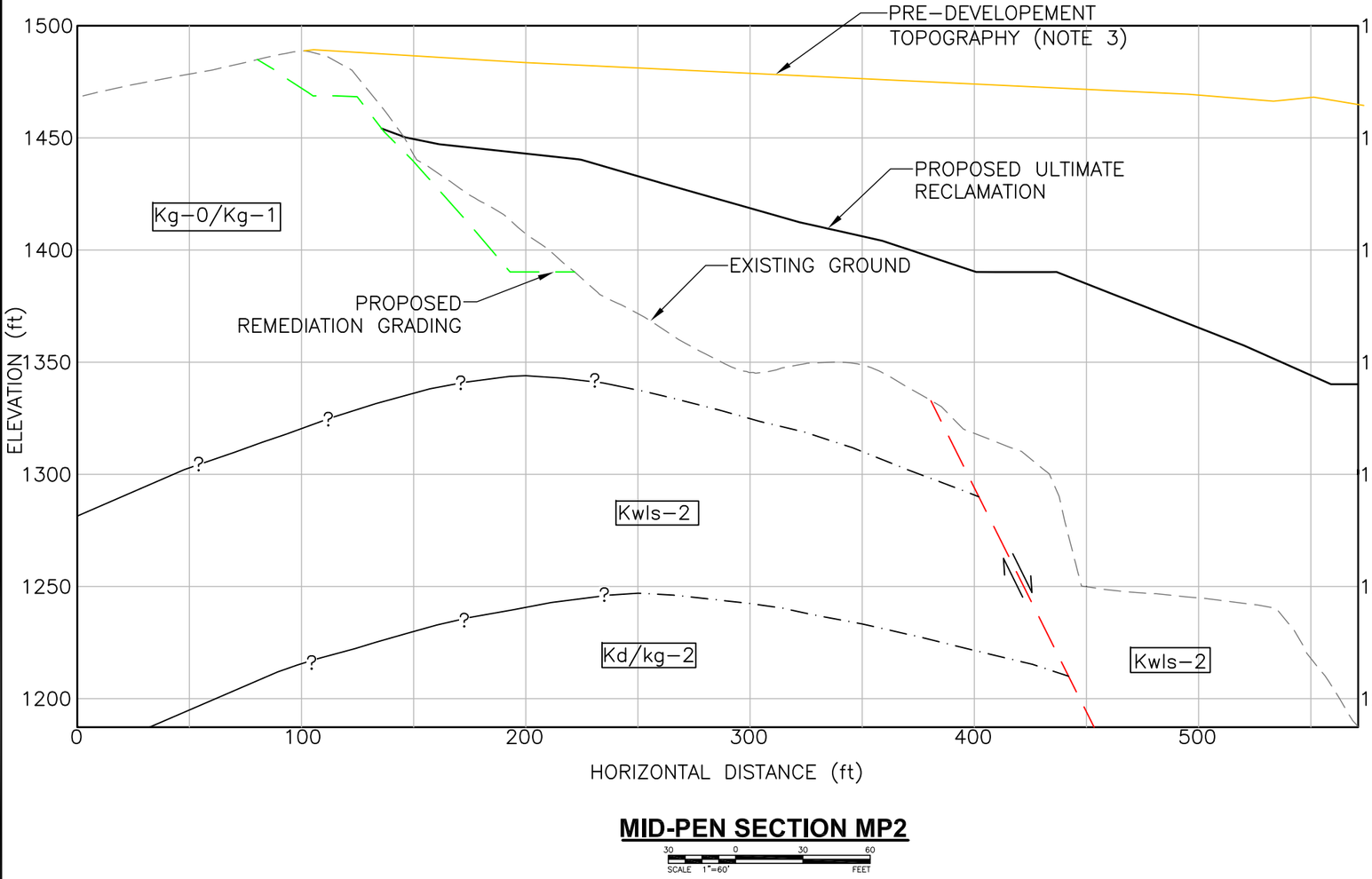
TITLE
CROSS-SECTION MP1 FOR MID-PEN SLIDE

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 7.1
DESIGN	PHY	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	KH	01/22/10		
REVIEW	BF	01/22/10		

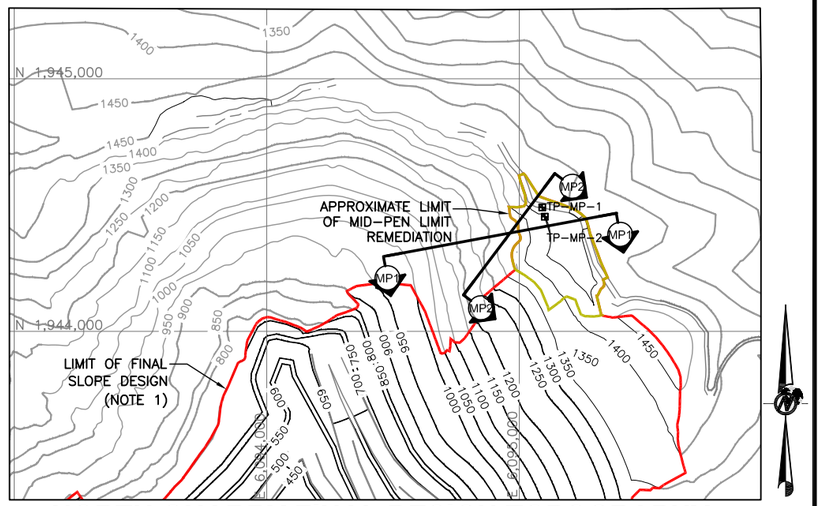
FIGURE 7.1

FILE: S:\HonsonPermanente\Plt 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 7.1.dwg TAB NAME \MP1
Monday, May 10, 2010 - 2:12pm
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES. IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK SOLELY



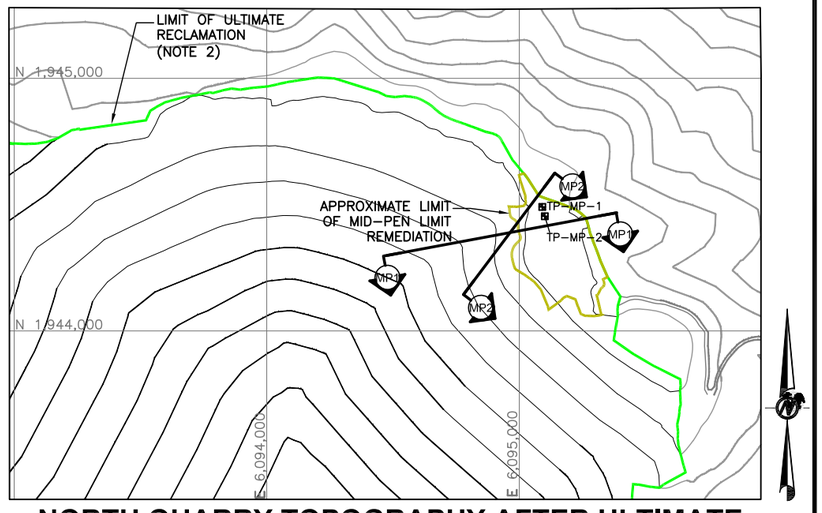
MID-PEN SECTION MP2

SCALE 1"=60' (30 0 30 60 FEET)



NORTH QUARRY FINAL DESIGN TOPOGRAPHY

SCALE 1"=600' (300 0 300 600 FEET)



NORTH QUARRY TOPOGRAPHY AFTER ULTIMATE RECLAMATION

SCALE 1"=600' (300 0 300 600 FEET)

LEGEND

- EXISTING TOPOGRAPHY (50 FT INTERVAL)
- PROPOSED TOPOGRAPHY (50 FT INTERVAL)
- LIMIT OF PHASE 1 (PLAN VIEW)
- LIMIT OF ULTIMATE RECLAMATION (PLAN VIEW)
- LIMIT OF REMEDIATION
- SECTION ID
- EXISTING GROUND PROFILE
- PROPOSED REMEDIATION GRADING PROFILE
- PROPOSED ULTIMATE RECLAMATION PROFILE
- APPROXIMATE PRE–DEVELOPEMENT PROFILE
- APPROXIMATE PRE–FAILURE CONFIGURATION
- GEOLOGIC CONTACT PROFILE
- APPROXIMATE SLIP SURFACE FROM STABILITY ANALYSIS
- FAULT WITH CORRESPONDING DIRECTION
- TP–MP–1 GOLDER 2009 TEST PIT LOCATION

NOTES

1. PROPOSED FINAL DESIGN TOPOGRAPHY INSIDE THE NORTH QUARRY BOUNDARY PROVIDED BY LSCC IN DECEMBER 2009. TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC.
2. PROPOSED ULTIMATE RECLAMATION TOPOGRAPHY INSIDE THE NORTH QUARRY RECLAMATION BOUNDARY PROVIDED BY LSCC IN MAY 2010. EXISTING TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC.
3. PRE–DEVELOPMENT TOPOGRAPHY PROVIDED BY LSCC IN 2010.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

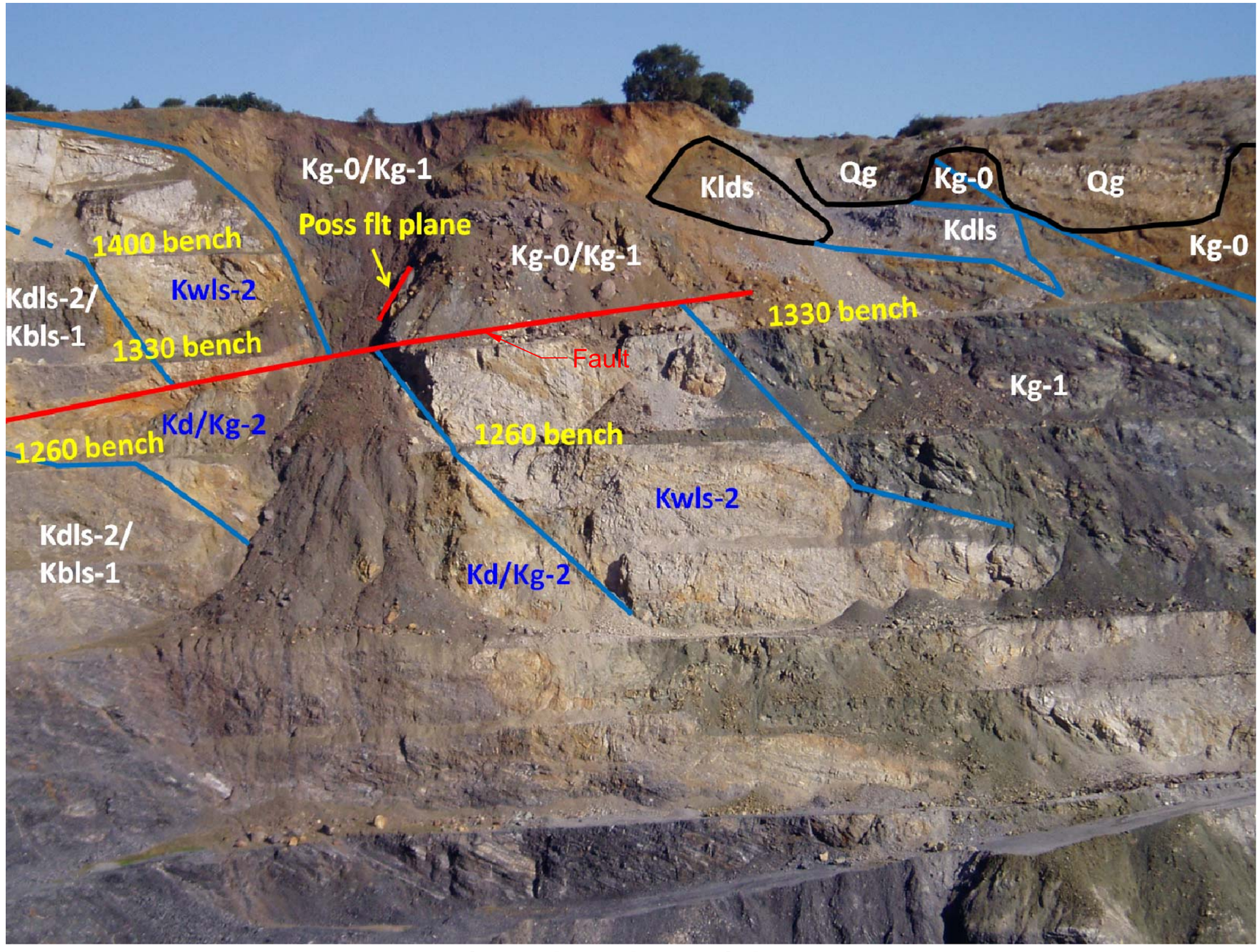
TITLE
CROSS-SECTION MP2 FOR MID-PEN SLIDE

Golder Associates

PROJECT No.		0637109800	FILE No.		Figure 7.2
DESIGN	PHY	01/15/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/15/10			
CHECK	KH	01/15/10			
REVIEW	BF	01/15/10			

FIGURE 7.2

FILE: S:\HansonPermanente\Plt 1 North East Walls\Reclamation Study – 2010\Reporting\Figures R1\Figure 7.2.dwg TAB NAME: \MP2
Monday, May 10, 2010 – 2:24pm
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



MID-PEN SURFACE MAPPING
NTS

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
MID-PEN SURFACE MAPPING

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 7.3
DESIGN	PHY	01/22/10	SCALE AS SHOWN	REV. 0
CADD	AJS	01/22/10		
CHECK	KH	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 7.3

Wednesday, February 03, 2010 - 10:57am FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures\Figure 7.3.dwg TAB NAME \MID-PEN SURFACE MAPPING
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.

8.0 EAST WALL DESIGN

This section presents a stability review of the existing conditions, the proposed ultimate design, and the reclamation plan for the east side of the North Quarry (herein referred to as the east wall). The main references for this stability review are the past investigations by CNI in the early 2000's, including CNI (2002a, 2002b, and 2003) which include structural mapping, geotechnical drilling, laboratory testing, and stability modeling. Golder performed field mapping in January 2009 to verify some information associated with the past CNI investigations and the latest geological mapping provided by Foruria (2004). The following section summarizes our interpretation of the local geology in the east wall area.

8.1 Geology of the East Wall Area

As described in Foruria (2004), the thrust stack in the east wall is a generally homoclinal sequence of interlayered limestones and greenstones that trends northeast and dips southeast. Dip angles range from 10 degrees to 70 degrees, with an average of about 35 degrees. This sequence is gently folded, and is offset by high angle faults that are oriented north-south and northwest-southeast. Foruria interprets this homoclinal sequence as being situated within the northeast limb of a southeast-plunging syncline located in the south part of the North Quarry.

For stability analysis, Sections EW1 and EW2 (Figures 8.1 and 8.2) were developed to illustrate the geological conditions at the east wall area. The geological model shown in these sections is based on that of CNI (2003), but has been modified with the current topographic map and the surface geological mapping by Foruria (2004), as well as the findings from our recent quarry reconnaissance in 2009 (Section 7.3.1).

The sections show basal limestones structurally overlain by interlayered limestones and greenstones. The limestones and greenstones generally dip southeast, into the slope, at about 10-35 degrees. In Section EW1, several major northwest-trending vertical faults offset the units in the lower half of the slope. In Section EW2, high angle faulting offsets the units in both the upper and lower parts of the slope, and a moderately east-dipping fault truncates the high angle faults in the upper part of the slope.

The hydrogeological interpretation is based on the past CNI investigation (CNI, 2003), as well as visual observations of seeps and standing water in the quarry.

8.2 Current East Wall Configuration

Figure 6.4 shows the existing topographic conditions as of 2009. Slope movements have occurred near the north end of the east wall sector, i.e., the Mid-Pen Slide, which is discussed in Section 7.

The toe of the existing east wall is generally at elevation 750 to 800 feet msl. As discussed in Section 8.1, the lower slope of the existing east wall consists of relatively more competent rocks, predominantly limestone and greenstone that is less weathered than the greenstone in the upper part of the slope. The

upper slope is mostly highly degraded greenstone with some limestone. Figure 6.4 shows the approximate contact between the weathered greenstone and the limestone and more competent greenstone that was mapped by Golder in 2009; this contact generally falls along elevation 1000 to 1100 feet msl.

Overall slope angles in the limestone (lower) portion of the slope are relatively low, generally about 38-40 degrees; this portion of the slope contains an abandoned ramp and several wide benches. Existing bench face angles in the limestone are on the order of 50-60 degrees. Overall slope angles in the weathered greenstone (upper) part of the slope are approximately 35-40 degrees. Overall slope angles from toe to crest range from about 34 to 40 degrees. Localized slides have been observed at multiple locations in the upper slope as shown in Figure 6.4.

There is an overburden Storage Area immediately above the east wall. This overburden Storage Area is approximate 100 feet high and appears to have been constructed at angle-of-repose. Visual observation of the Storage Area surface indicates that the materials are highly variable in gradation, but generally consist of coarse rock, mainly greenstone, metabasalt, and graywacke.

8.3 Ultimate East Wall Configuration

The proposed east wall design at the end of mining is shown in Figure 8.1 and involves laying back the east wall slope, including a portion of the overburden Storage Area at the crest, and lowering the bottom of the quarry from the existing level to approximate elevation 440 feet msl. In addition, the proposed change in quarry floor elevations, the major changes to the slope configuration include:

- Removal of a portion of the overburden Storage Area at the crest and grading the remaining Storage Area to a 2H:1V (26.6 degrees) slope
- Leaving a 110-ft wide bench between the crest and the overburden Storage Area.
- Flattening the upper slope (weathered greenstone) to an Inter-Ramp Angle (IRA) of approximately 35 degrees;
- Developing the lower slope (limestone and less-weathered greenstone) at an IRA of approximately 43 degrees.

The bench configuration in the limestone consists of 71-degree bench face angles and 50-foot catch benches, for an inter-ramp angle of 50 degrees. However, there is a ramp with two switchbacks in the limestone portion of the slope, resulting in an overall angle of 43 degrees within the limestone.

The greenstone immediately overlying the limestone is developed using a hybrid bench design, with bench face angles of 54 degrees and alternating catch bench widths of 30 feet and 65 feet, for an inter-ramp angle of 21 degrees over the four benches.

The weathered greenstone immediately above the hybrid benches is regraded in a 140-foot high bench with a 37.5 degree outslope. The next bench up is 110 feet high with a 40 degree outslope. A 50-foot catch bench is designed between the two regraded benches. A 110-ft wide bench is designed between

the crest of this upper regraded bench and the overburden Storage Area, which is regraded with 26.6 degree outslopes.

The ultimate reclamation plan (Figure 8.1) calls for backfilling against the entire east wall with overburden fill. The in-quarry fill is to be developed at an overall slope of 2.5H:1V or flatter (or 22 degrees or less).

8.4 Stability Analyses

Sections EW1 and EW2 (Figures 8.1 and 8.2) were used as typical sections for stability evaluation of the east wall area under different scenarios, including existing conditions, proposed east wall design, and final reclamation slopes.

The material properties used for stability modeling are summarized in Table 8.1. All strengths presented are effective stress parameters for long-term stability evaluation. The geological units and strength properties are generally consistent with the strength properties for the greenstone units and overburden and are the same as those used for the Mid-Pen stability analysis in Section 7. The limestone was modeled with the Hoek-Brown strength criterion (Hoek, et.al., 2002), which is commonly used for studying large-scale rock slopes; the design parameters of the Hoek-Brown model were derived primarily based on the CNI investigation (2003).

TABLE 8.1

MATERIAL PROPERTIES FOR EAST WALL STABILITY ANALYSES

MATERIAL	UNIT WEIGHT PCF	COHESION PSF	ϕ DEG.	COMMENTS
Greenstone (Kg-0)	165	1,400	20	Based on back analyses of Mid-Pen Slide in Section 7
Greenstone (Other)	165	1,400	23	Confirmed with back analyses on Mid-Pen Slide (Section 7)
Overburden Rock	125	0	35	Golder (2008)
Limestone (KWLS)	165	Hoek-Brown Model: UCS = 8,296 psi GSI = 49; mi = 10, D=0.7		Golder interpretation of CNI (2003) data
Limestone (KDLS/KBLS)	165	Hoek-Brown Model: UCS = 8,296 psi GSI = 49; mi = 10, D=0.7		Golder interpretation of CNI (2003) data

The above assumed shear strength parameters for Greenstone (other) in Table 8.1 correlates well to areas of weathered greenstone with previous slope instability (e.g. Main (1987) Slide, Scenic Easement Slide, and Mid-Pen Slide). These shear strengths are expected to be conservative for more competent (less weathered) greenstone that occurs throughout the quarry including the greenstone observed in the lower portion of the North Quarry East Wall.

The same methodologies as discussed in Section 5 and 6 were used to complete static and seismic slope stability analyses. The stability modeling results, including the seismic displacement analyses, are presented in Appendix 8.A and summarized in Table 8.2 below.

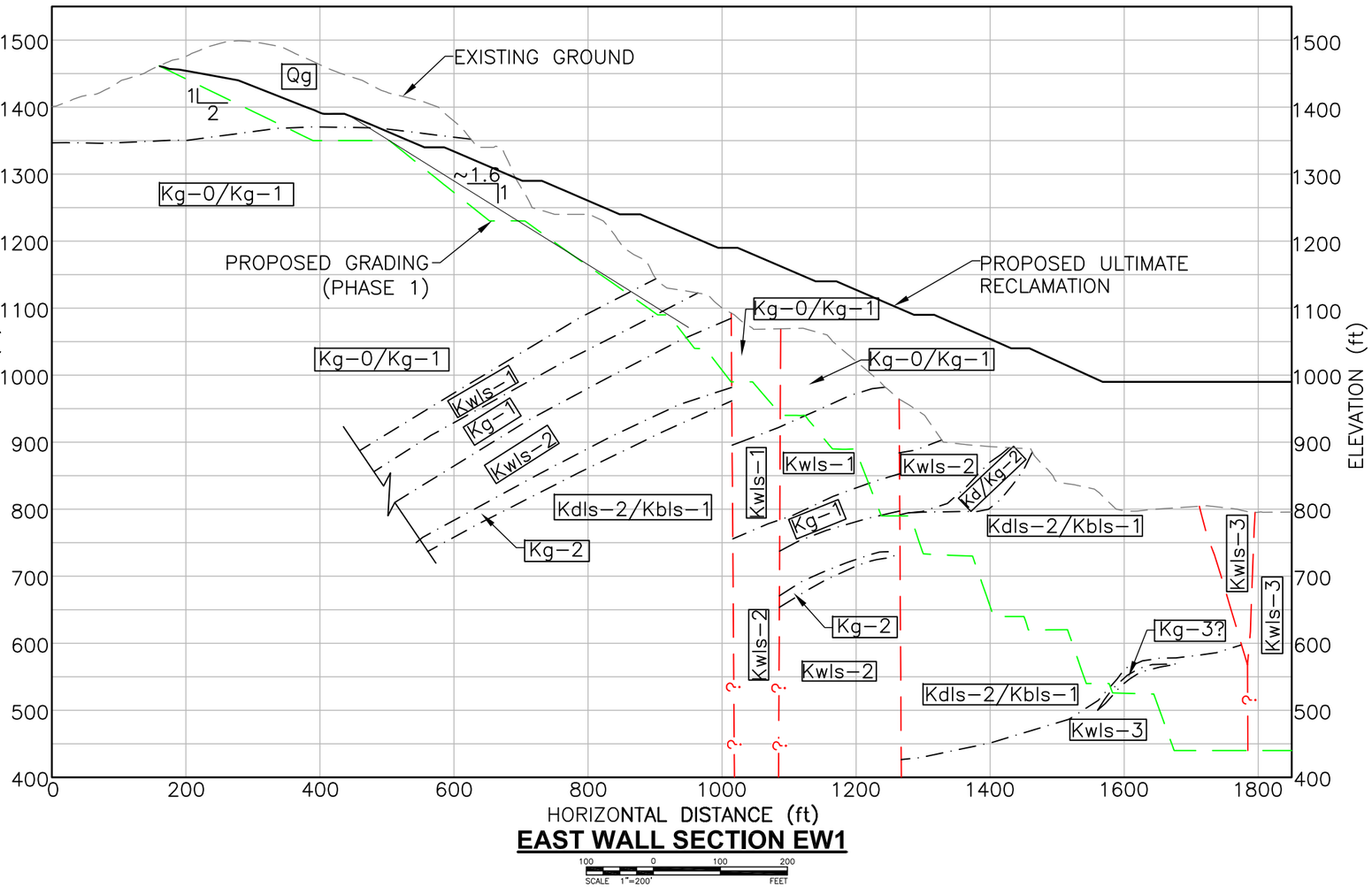
TABLE 8.2
SUMMARY OF EAST WALL STABILITY EVALUATION

Sections	Conditions	Description	Calculated FOS
EW1	Proposed Ultimate Slope Excavation Prior to Reclamation	Static: potential large failure	1.25
		Seismic – pseudo-static (k = 0.15)	0.94
		Seismic: displacement under design seismic event along a potential large failure (16-84 percentile range)	6 to 24 inches (average 12 in)
	Final Reclaimed Slope	Static	1.80
		Seismic – pseudo-static (k = 0.15)	1.20
		Seismic: displacement under design seismic event	< 6 inches
EW2	Proposed Ultimate Slope Excavation Prior to Reclamation	Static: potential large failure	1.21
		Seismic – pseudo-static (k = 0.15): potential large failure	0.93
		Seismic: displacement under design seismic event along potential large failure (16-84 percentile range)	6 to 24 inches (average 12 in)
	Final Reclaimed Slope	Static	1.79
		Seismic – pseudo-static (k = 0.15)	1.22
		Seismic: displacement under design seismic event (14-86 percentile range)	< 6 inches

The ultimate quarry development (maximum excavation depth) is shown on the sections in Figures 8.1 and 8.2, which reflect a significant layback of the existing slope as well as lowering of the quarry floor to elevation 440 feet msl. For both Sections EW1 and EW2, the static factors of safety against a global slide along the east wall are greater than 1.2; the calculated average permanent displacements under a design earthquake event are estimated to be about 12 inches. Reclamation includes the construction of a large overburden fill that effectively buttresses the east wall. For both Sections EW1 and EW2, the calculated

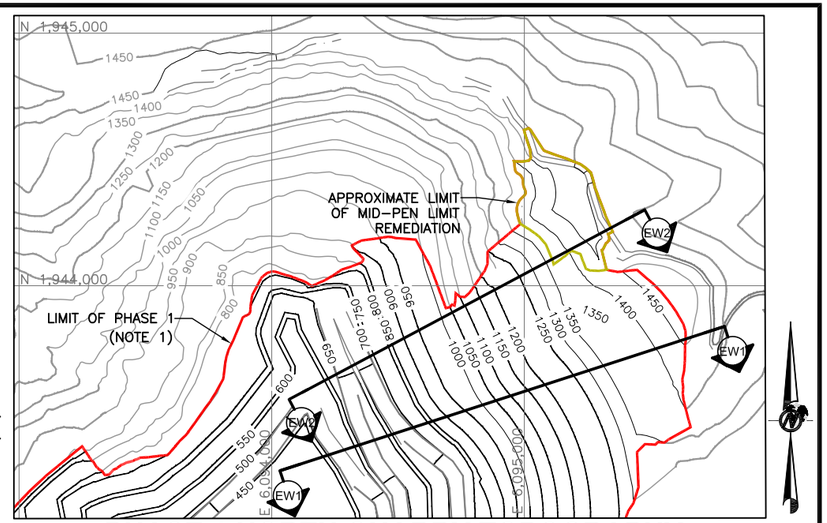
minimum factor of safety against a large-scale slide along the reclaimed east wall is approximately 1.8 with the critical failure surface occurring within the backfill instead of through the excavated pit walls. The calculated pseudo-static factor of safety (with a seismic coefficient of 0.15 g) is above 1.20. Therefore, permanent displacement of the slope under the design seismic event is considered a negligible hazard (<6 inches).

Golder considers the above computed FOS values and estimated permanent seismic displacements to be appropriate for reclamation.



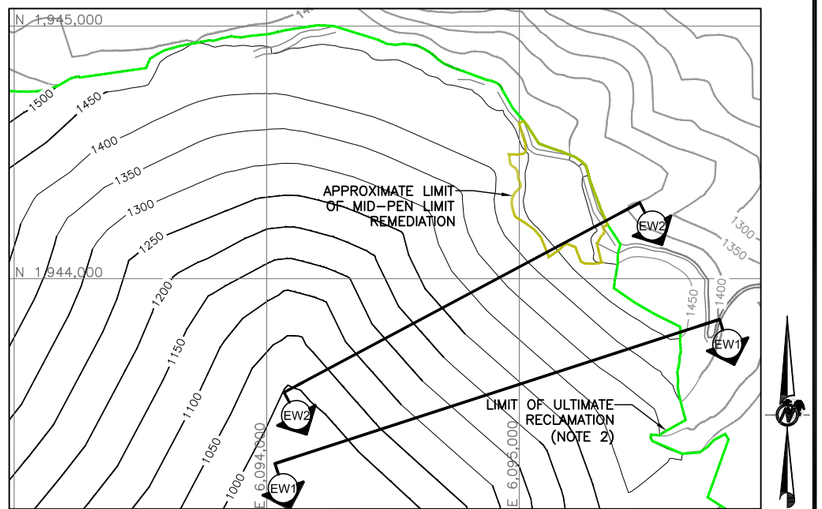
EAST WALL SECTION EW1

SCALE 1"=200' (100 0 100 200 FEET)



PHASE 1 NORTH QUARRY TOPOGRAPHY

SCALE 1"=600' (300 0 300 600 FEET)



NORTH QUARRY TOPOGRAPHY AFTER ULTIMATE RECLAMATION

SCALE 1"=600' (300 0 300 600 FEET)

LEGEND

- EXISTING TOPOGRAPHY (50 FT INTERVAL)
- PROPOSED TOPOGRAPHY (50 FT INTERVAL)
- LIMIT OF PHASE 1 (PLAN VIEW)
- LIMIT OF ULTIMATE RECLAMATION (PLAN VIEW)
- LIMIT OF REMEDIATION
- SECTION ID
- EXISTING GROUND PROFILE
- PROPOSED GRADING PROFILE (PHASE 1)
- PROPOSED ULTIMATE RECLAMATION PROFILE
- GEOLOGIC CONTACT PROFILE
- FAULT
- APPROXIMATE FAULT

NOTES

1. PROPOSED TOPOGRAPHY INSIDE THE NORTH QUARRY FINAL DESIGN BOUNDARY PROVIDED BY LSCC IN DECEMBER 2009. TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC.
2. PROPOSED ULTIMATE RECLAMATION TOPOGRAPHY INSIDE THE NORTH QUARRY RECLAMATION BOUNDARY PROVIDED BY LSCC IN MAY 2010. TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

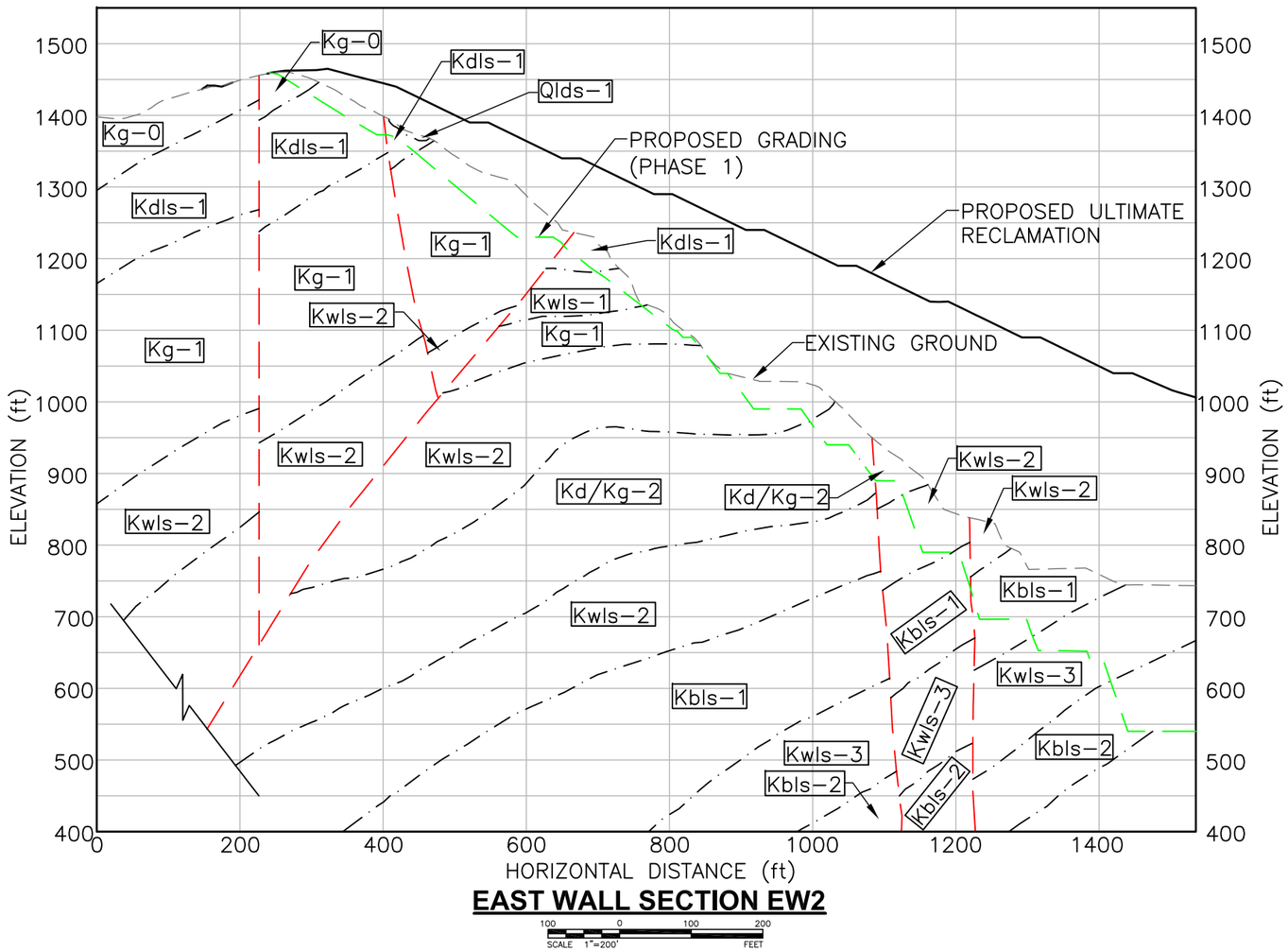
TITLE
CROSS-SECTION EW1 EAST WALL

Golder Associates

PROJECT No. 063–7109 800			FILE No.		Figure 8.1
DESIGN	RK	01/15/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/15/10			
CHECK	PHY	01/15/10			
REVIEW	KH	01/15/10			

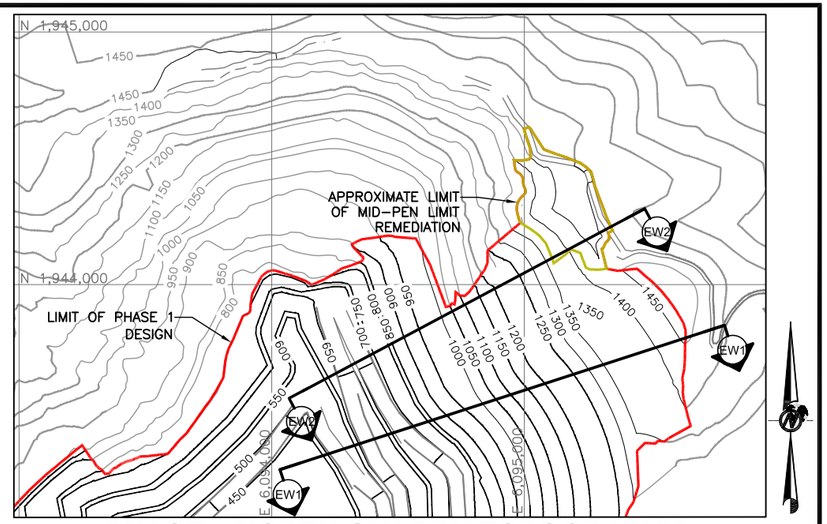
FIGURE 8.1

FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study – 2010\Reporting\Figures R1\Figure 8.1.dwg TAB NAME: \EW1
Monday, May 10, 2010 – 2:29pm
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



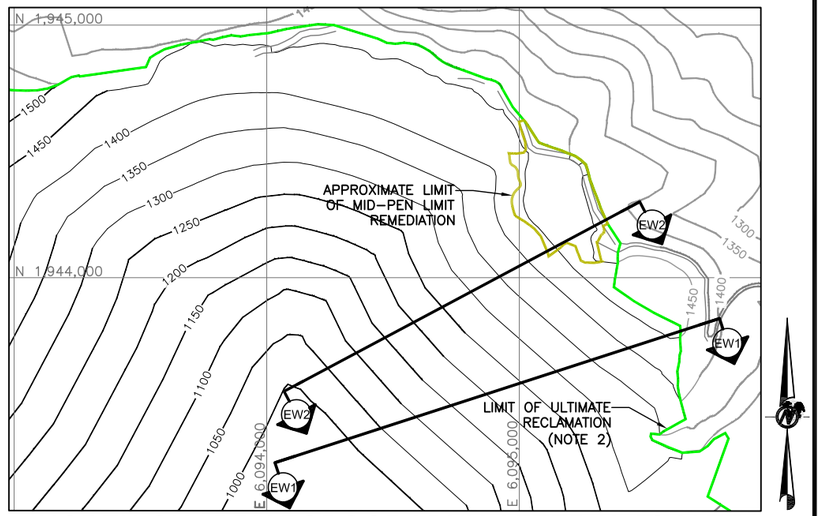
EAST WALL SECTION EW2

SCALE 1"=200' (100 0 100 200 FEET)



PHASE 1 NORTH QUARRY TOPOGRAPHY

SCALE 1"=600' (300 0 300 600 FEET)



NORTH QUARRY TOPOGRAPHY AFTER ULTIMATE RECLAMATION

SCALE 1"=600' (300 0 300 600 FEET)

LEGEND

- EXISTING TOPOGRAPHY (50 FT INTERVAL)
- PROPOSED TOPOGRAPHY (50 FT INTERVAL)
- LIMIT OF PHASE 1 (PLAN VIEW)
- LIMIT OF ULTIMATE RECLAMATION (PLAN VIEW)
- LIMIT OF REMEDIATION
- SECTION ID
- EXISTING GROUND PROFILE
- PROPOSED GRADING PROFILE (PHASE 1)
- PROPOSED ULTIMATE RECLAMATION PROFILE
- GEOLOGIC CONTACT PROFILE
- FAULT

NOTES

1. PROPOSED TOPOGRAPHY INSIDE THE NORTH QUARRY FINAL DESIGN BOUNDARY PROVIDED BY LSCC IN DECEMBER 2009. TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC.
2. PROPOSED ULTIMATE RECLAMATION TOPOGRAPHY INSIDE THE NORTH QUARRY RECLAMATION BOUNDARY PROVIDED BY LSCC IN MAY 2010. TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
CROSS-SECTION EW2 FOR EAST WALL

Golder Associates

PROJECT No.		0637109800	FILE No.		Figure 8.2
DESIGN	RK	01/15/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/15/10			
CHECK	PHY	01/15/10			
REVIEW	KH	01/15/10			

FIGURE 8.2

Monday, May 10, 2010 – 2:34pm FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study – 2010\Reporting\Figures R1\Figure 8.2.dwg TAB NAME: \EW2
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.

9.0 SOUTH WALL DESIGN

9.1 Geologic Conditions

9.1.1 Geology of the South Wall Area

The south wall area, like the rest of the North Quarry, was mapped in detail by Foruria (2004), and consists of an imbricated thrust stack of interlayered limestone, greenstone, graywacke, and metabasalt. The Northwest Berrocal Fault Strand strikes east-west through the south wall area, and dips 70º south to vertical. West of the Northwest Berrocal Fault Strand, the thrust stack is folded into a syncline that plunges southeast to east and is weakly overprinted with smaller folds. The west limb of the syncline dips 40º-45º to the northeast in the west part of the south wall. The east limb is sub-vertical and locally overturned. Bedding in the limestones is generally parallel or sub-parallel to the limbs of the syncline.

East of the Northwest Berrocal Fault Strand the thrust stack is generally homoclinal, dipping southeast at an average of 35°. This homoclinal sequence is warped by gentle, large-scale folds. The homoclinal sequence is believed to be the northeast limb of the syncline exposed west of the Northwest Berrocal Fault Strand.

Actual movement along the Northwest Berrocal Fault Strand is interpreted to be oblique (reverse) right-lateral (Sorg and McLaughlin, 1975), with the most recent movement being purely strike-slip (Foruria, 2004). The fault bifurcates in the middle benches of the final south wall, sending a splay to the northwest. This splay dips 80º southwest to vertical.

East-west-striking high angle faults are present in the west and central parts of the south wall area, dipping moderately to steeply south. A series of northwest-striking, steeply-dipping faults slice into the east part of the south wall, north of the Northwest Berrocal Fault Strand. A few north-south-striking and northeast-striking high angle faults are also present in the south wall area.

Previous reports grouped metabasalt and graywacke intervals in the south wall west of the Northwest Berrocal Fault Strand into the greenstone unit, generally due to their limited occurrence. However, geotechnical core drilling in early 2008 indicated that significant thicknesses of metabasalt and graywacke are present in the west part of the south wall. Due to their distinct geotechnical characteristics and their significant thicknesses above the limestone in the west part of the south wall, the metabasalt and graywacke have been separated out as discrete geotechnical units. No core has been drilled in the south wall east of the Northwest Berrocal Fault Strand since Foruria's 2004 mapping and geologic interpretation, and the geologic model for that area in Foruria (2004) has not changed.

The thrust faults separating the main lithologic units range in (corehole-parallel) thickness from 5 to 35 feet. The fault zones are generally characterized by fault breccia that may be clast or matrix supported, with a matrix content varying from as low as 5-10% to as high as 80-90%. The matrix is composed of soft,

clayey, fine-grained fault gouge. The breccia is commonly sheared, and locally cemented with milky calcite. Similar fault zones are also present within most lithologic units.

9.1.2 Hydrogeology

Permanente Creek is hydraulically connected to the North Quarry, as suggested by historical observations of a dry creek bed adjacent to the Quarry while surface water flows occur in the creek both upstream and downstream of the North Quarry (CNI, 1998), and by recent hydrogeologic analyses and monitoring conducted by Golder which shows a response in piezometric head between the creek and the quarry sump in response to pumping activity (Golder, 2010). For the purpose of the South Wall evaluations, data from piezometer GT1-4-08 was utilized to estimate water levels in the south wall bedrock located between the quarry bottom and Permanente Creek. During 2008-2009, the quarry sump at the bottom of the North Quarry was pumped to maintain an elevation of approximately 720 to 750 feet. The water level measured in piezometer installed in GT1-4-08 peaked at approximately 1075 in March 2009, and has since declined to approximately 1065 feet elevation in late 2009. The elevation of Permanente Creek, which is located approximately 150 feet south of GT1-4-08, is 1060 feet. These observations were used to define a water surface for stability analyses that declined in elevation from the elevation of Permanente Creek and the adjacent ridgecrest to just below the quarry bottom.

9.2 Current South Wall Configuration

The south wall is currently being mined and the slopes laid back. Production benches are 50 feet high, with wide catch benches for maneuvering of equipment (Figure 9.1). Achieved bench face angles in limestone in accessible production benches are on the order of 45°-65°. For limestone benches in the south wall higher than 50 feet, bench face angles were measured from 2007 topography provided by Hanson, and include 58° over 140 vertical feet and 62° over 90 vertical feet. Bench widths range from 38-60 feet.

In the west part of the south wall, benches in limestone were planned at 50 feet high but the catch benches have been lost due to planar slides along bedding in the limestone. The resulting slope angles range from 37º over 230 vertical feet to 42º over 190 vertical feet.

In January 2009, achieved bench face angles were measured in the south wall overburden during structural mapping by Golder. The bench face angles were measured from 50-foot high production benches and ranged from 40º - 65º, but were generally on the order of 45º - 50º.

9.3 Proposed Final South Wall Cut and Reclaimed South Wall Configuration

The proposed final south wall excavation will push the south slope back toward Permanente Creek, and lower the crest to 1000-1150 feet elevation (Figure 9.2). A haul road is planned along the crest of the south wall, separating Permanente Creek from the quarry. The quarry bottom elevation is 440 feet. A ramp with a switchback is designed in the south wall, resulting in a design overall slope angle of 44.5º.

Production bench height is 50 feet. The slope between the upper and lower parts of the ramp in the graywacke and metabasalt is designed with a single bench configuration, with 50 feet vertically between catch benches, and a design inter-ramp angle of 44º. The slope in limestone is designed with a double bench configuration, with 100 feet vertically between catch benches, and an inter-ramp slope angle of 54º. Design bench face angles are 71º in the limestone and 51º - 55º in the overburden units between the upper and lower ramp. Design catch bench widths are 50 feet in the limestone and 24 feet in the overburden.

After mining in the North Quarry is completed, the quarry will be backfilled with overburden from the South Quarry to a minimum elevation of 990 feet. Backfill above this elevation will be re-graded to a uniform outslope angle of 2.5(H):1(V) as shown in Figure 9.3. The reclaimed south slope of the North Quarry is a maximum of 110 feet high, and decreases in height to the east.

9.4 Rock Mass Stability Analysis

9.4.1 Geologic Model

Two cross-sections perpendicular to the south wall were used for slope stability analysis (Figure 9.2). The geology in Section 9A is based on Foruria's 2004 surface geological mapping (Foruria, 2004), and on four geotechnical coreholes drilled in the area in early 2008 (Figure 9.2). Drillhole coordinates, orientations, and lengths are included in Table 9.1, and geotechnical core logs are included as Appendix 9A.

TABLE 9.1
2008 GEOTECHNICAL DRILLHOLE DETAILS

Drillhole ID	Easting	Northing	Elevation (ft)	Azimuth[1] (°)	Inclination[1] (°)	Length (ft)
GT1-1-08	6093149.8	1942452.4	1048.0	-	-90	473.0
GT1-2-08	6093514.6	1942384.4	1044.0	0	-60	476.5
GT1-3-08	6093738.1	1942382.0	1051.0	-	-90	436.5
GT1-4-08	6093435.2	1942125.2	1109.0	-	-90	268.0

[1]Nominal

In Section 9A, a steeply south-dipping fault separates metabasalt overlying limestone within the syncline in the south part of the section from graywacke overlying limestone immediately to the north. A moderately south-dipping fault separates the graywacke and the white limestone underlying it from the dark limestone comprising the lower half of the slope (Figure 9.4).

The geology in Section 9B was based on Foruria's 2004 surface mapping and cross-sections (Figure 9.5). In this part of the south wall, the thrust contacts separating the greenstone and limestone units dip into the wall. They are offset by two high-angle faults that also dip into the wall, at steeper angles than the thrust contacts.

In both sections, the water table was assumed to decline in elevation from the elevation of Permanente Creek to just below the Quarry bottom.

9.4.2 Rock Mass Properties, Section 9A

The rock mass properties used for Section 9A were developed from geotechnical core logging, point load testing, and laboratory testing of the core drilled in early 2008 (Appendices 9A, 9B, and 9C, respectively). Due to their similarities in geotechnical properties, the white and dark limestones have been combined into a single unit, "Limestone." The design parameters are tabulated below.

Design UCS and unit weight were based on point load testing and laboratory test results:

TABLE 9.2
UNIAXIAL COMPRESSIVE STRENGTH AND UNIT WEIGHT, SECTION 9A

Unit	UCS (psi)[1]	Unit Weight (pcf)[2]
Metabasalt	3,650	163.1
Graywacke	9,350	166.9
Limestone	11,300	164.8

[1]Based on point load testing data
[2]Averaged from laboratory test results

Rock Mass Ratings (RMR) were calculated from the point load testing data and the core logging data according to Bieniawski (1976):

TABLE 9.3
RMR_{76} RATINGS, SECTION 9A

Unit	Strength Rating*	RQD Rating	Fracture Frequency Rating	Joint Condition Rating	Ground-water Rating	Total RMR	Feet of Core Logged
Metabasalt	3	12	13	12	10	**50**	163.0
Graywacke	7	6	9	13	10	**45**	133.5
Limestone	8	12	14	15	10	**59**	780.3

*Based on point load testing data

Rock mass strengths were calculated using the Hoek-Brown Failure Criterion (Hoek and Brown, 1988), and m_i was estimated from published values (Hoek and Karzulovic, 2000).

TABLE 9.4
PARAMETERS FOR HOEK-BROWN FAILURE CRITERION, SECTION 9A

Unit	m_i	m	s	Disturbance
Metabasalt	15	0.42173	0.0002404	100%
Graywacke	13	0.25573	0.0001045	100%
Limestone	7	0.37431	0.0010773	100%

For consistency with the analysis of the east part of the south wall completed in CNI (2003), Mohr-Coulomb strengths for the rock units were estimated from the Hoek-Brown strengths for the normal stress range 0-400 psi using the computer program RocData (Rocscience, 2007a). Mohr-Coulomb strengths were required for the overburden and a thrust fault, as described subsequently, and are consistent with those used previously in this report. Assumed unit weights for the overburden and thrust fault are 125 pcf and 155 pcf, respectively.

TABLE 9.5
MOHR-COULOMB STRENGTH PARAMETERS

Unit	Friction Angle (Degrees)	Cohesion (psi)
Metabasalt	30	45
Graywacke	34	50
Limestone	40	84
Overburden	35	0
Thrust Fault	20	0

9.4.3 Rock Mass Properties, Section 9B

Section 9B is situated close to the east wall, and is located less than 300 feet west of Section E from CNI (2003). Due to its proximity to the east wall, and because no additional drilling has been completed in that area since the work by CNI (2003), the rock mass properties derived from CNI (2003) that were used

for the east wall stability analysis (Table 8.1) were used for analysis of Section 9B. The parameters for Greenstone (other) in Table 8.1 were conservatively used for the Greenstone in Section 9B. As with Section 9A, the limestones were combined into a single geotechnical unit due to their similar geotechnical characteristics.

9.4.4 Rock Mass Stability Analysis of Ultimate South Wall Configuration

The slope stability analyses were carried out using Slide software (Rocscience, 2009) and the Spencer method. For Section 9A in the final excavated south wall, Slide calculated a minimum FOS of 1.7 for circular failure and 2.3 for a slide partially along a thrust fault separating Graywacke from Limestone in the upper portion of the slope (Figure 9.4). For Section 9B, Slide calculated a minimum FOS of 1.4 for circular failure of the overall slope and 1.3 for circular failure within the greenstone portion of the slope (Figure 9.5).

9.4.5 Stability of South Slope After Backfilling

A slope stability analysis of the reclaimed south wall was also performed for Section 9A. Section 9B was not analyzed because the quarry in that area will be completely backfilled (Figure 9.3). Slide calculated a minimum FOS of 2.1 against circular failure in the reclaimed slope in Section 9A (Figure 9.6). Following reclamation, permanent slope displacements are estimated to be less than 6-inches within the overburden backfill.

Pseudostatic analyses were carried out to evaluate the seismic stability of the reclaimed south wall using a seismic load coefficient of 0.15g. For the reclaimed south slope in Section 9A, Slide calculated a minimum FOS of 1.4 under seismic loading (Figure 9.7). The reclaimed slope in Section 9B was not analyzed because the quarry will be completely backfilled in that area.

9.4.6 Conclusions — Rock Mass Stability Analysis

Rock mass stability analysis results are summarized below.

TABLE 9.6
SUMMARY OF ROCK MASS STABILITY ANALYSIS RESULTS

Section	Analysis Type	Condition	FOS
9A	Static	Final Excavated South Wall, circular failure	1.7
	Static	Final Excavated South Wall, failure along thrust fault	2.3
9B	Static	Final Excavated South Wall, circular failure overall slope	1.4
	Static	Final Excavated South Wall, circular failure in greenstone	1.3
9A	Static	Final Reclaimed South Wall (within backfill)	2.0

9A	Pseudostatic	Final Reclaimed South Wall (within backfill)	1.3
9A	Seismic Displacements	Final Reclaimed South Wall (within backfill)	<6 in

Calculated static FOS for the final excavated south wall are greater than 1.2, a common industry standard for quarry wall stability. The static FOS against failure of the reclaimed slope is 2.0. The critical failure mode is circular failure within the backfill. Following reclamation, permanent slope displacements are estimated to be less than 6-inches within the overburden backfill.

Computed static FOS values for a slide extending back into the native bedrock is considerably greater than 2.1 and associated permanent displacements are less than 3 inches.

9.5 Kinematic Stability Analysis

Structural data available for kinematic analysis includes data collected from televiewer images of the 2008 geotechnical drillholes, and from structural mapping of prominent structures and discontinuity sets in all of the safely accessible limestone slopes in the south wall benches in January 2009.

9.5.1 Televiewer Data

Optical and acoustic televiewer surveys of the 2008 geotechnical coreholes were completed by Norcal Geophysics of Petaluma, California. Discontinuities identified in the televiewer logs were correlated with structures in the core when possible. Where the core had been split, the discontinuities were correlated using core photographs. Norcal Geophysics was not able to survey the upper portions of GT1-1-08, GT1-2-08, and GT1-3-08 due to corehole instability. The intervals surveyed for each drillhole are tabulated below.

TABLE 9.7
TELEVIEWER SURVEY INTERVALS

Data Source	Drillhole Length (ft)	Optical Televiewer		Acoustic Televiewer	
		From (ft)	To (ft)	From (ft)	To (ft)
GT1-1-08	473.0	-	-	119.8	471.5
GT1-2-08	476.5	-	-	325.6	476.0
GT1-3-08	436.5	56.7	267.6	268.3	435.7
GT1-4-08	268.0	-	-	19.9	265.8

9.5.2 Structural Characterization

The intervals that were not surveyed in the upper parts of coreholes GT1-1-08, GT1-2-08, and GT1-3-08 due to drillhole instability intersected mainly metabasalt and graywacke, with some greenstone. These lithologies will therefore be under-represented in the televiewer structural data.

The televiewer and mapping structural data were plotted on stereonets using an equal-area, lower hemisphere projection, and contoured using the Schmidt method. The structural trends identified from the concentrations of poles in the stereonets are tabulated below. The stereonets are included as Appendix 9D.

The majority of the structural data is from the limestone, mainly because instability in the corehole precluded televiewer surveys in portions of the other units. The absence of a structural set from a given lithology may be due to corehole orientation or an inability to collect data from that lithology, and may not truly reflect the absence of the structures themselves from that lithology. For this reason, all structural sets identified were used for the kinematic analysis.

TABLE 9.8
DESIGN STRUCTURAL SETS FOR KINEMATIC ANALYSIS

Set ID	Dip°/Dip Direction°	Comments
1a	58/051	Parallel to NW-striking regional trend and N. Berrocal Fault Strand
1b	70/236	Same as 1a.
2	63/301	Northeast-trending high angle faults described in Foruria (2004)
3	48/177	East-west-striking faults described in Foruria (2004)?
4	72/016	Steep NNE-dipping veins and joints
5	43/081	Bedding and bedding-parallel veins and joints

9.5.3 Analysis

The design for the final excavated south wall is shown in Figure 9.2. The dip direction of the south wall is generally about 0°, but ranges from 350° to 010°. Inter-ramp slope angles (i.e., crest-to-crest) are 45-50° in the limestone and 38 to 42° in the slope above the limestone.

Kinematic analyses for drained conditions in the south wall indicate the following (Figure 9.8):

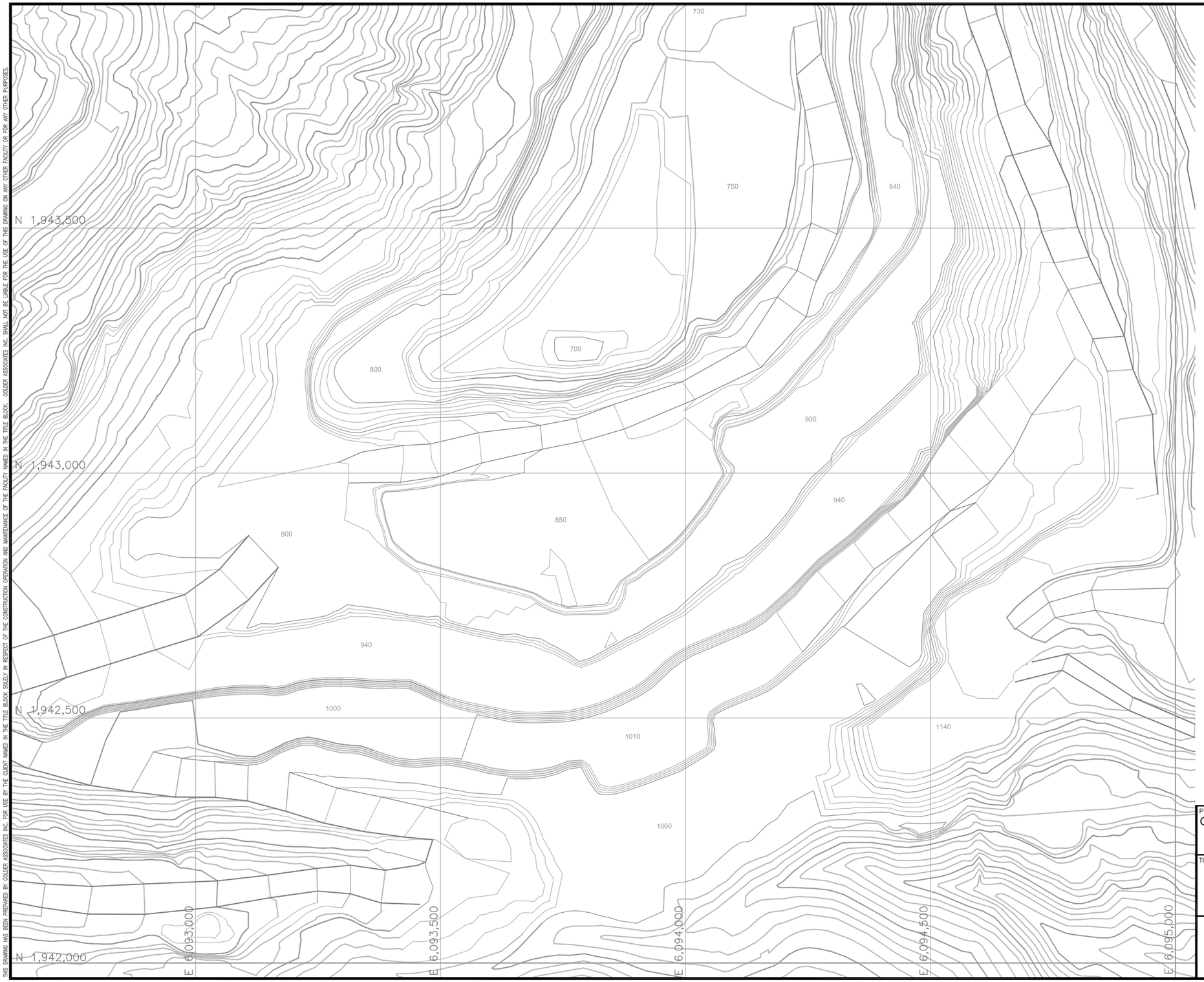
- No structural control of the overall slope angle;
- No planar or toppling control of inter-ramp slope angles;

- Wedges with nominal trend/plunge 000°/45° may form by the intersection of Set 1a and Set 2. These wedges have FOS < 1, and will affect bench stability should they occur;

The plunge of the wedges formed by Set 1a and Set 2 is the same as the inter-ramp angle in the overburden, and the line of intersection is oriented directly out of the slope. There is potential for the wedges to encompass more than one bench, although it is unlikely they would expand beyond one bench. Despite the low indicated FOS, no wedges have been observed in the current south wall. These wedges are therefore not expected to be problematic unless geological conditions change.

9.5.4 Conclusions — Kinematic Stability Analysis

While failures in the weaker greenstone unit in the east part of the south wall may be more likely to occur through the rock mass or along major structures, structurally-controlled failures may develop in the more competent jointed overburden rock such as metabasalts and graywacke,. Based on the kinematic analysis of the available data, structure in the south wall is generally favorable, and no structural control of slope angles is anticipated. Wedges may form locally, but structurally-controlled instability should be limited to bench crests and faces, particularly where blasting practices are not well controlled, and rockfall should be captured by the catch benches. The proposed backfill of the south wall will eliminate the risk of structural instability from these wedges in the reclaimed slope.



NOTES

1. EXISTING TOPOGRAPHY OUTSIDE THE NORTH QUARRY BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC. EXISTING TOPOGRAPHY INSIDE THIS BOUNDARY IS FROM SEPTEMBER 2009 SURVEY PROVIDED BY LSCC.

N

200 0 200 400

1" = 200' FEET

PROJECT

GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE

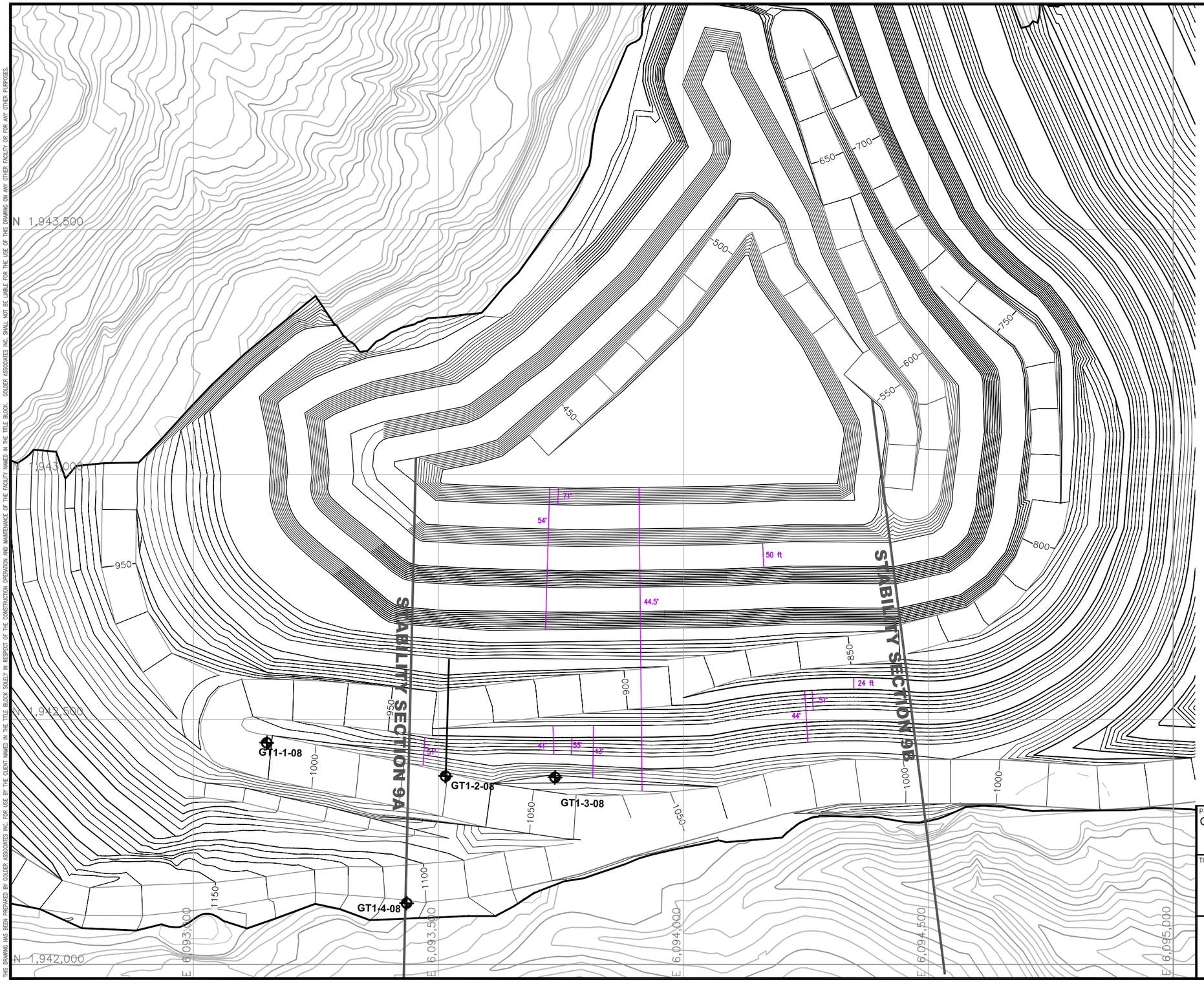
CURRENT SOUTH WALL TOPOGRAPHY

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 9.1-9.5	
DESIGN	RK	01/22/10	SCALE	AS SHOWN	REV. 0
CADD	AJS	01/22/10			
CHECK	KH	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 9.1

Thursday, February 04, 2010 - 10:21am FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures\Figure 9.1-9.5.dwg TAB NAME \Figure 9.1
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



LEGEND

GT1-4-08 ⊕ 2008 GEOTECHNICAL COREHOLE.

NOTES

1. PROPOSED FINAL DESIGN TOPOGRAPHY INSIDE THE NORTH QUARRY BOUNDARY PROVIDED BY LSCC IN DECEMBER 2009. TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC.

200 0 200 400

1" = 200' FEET

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE

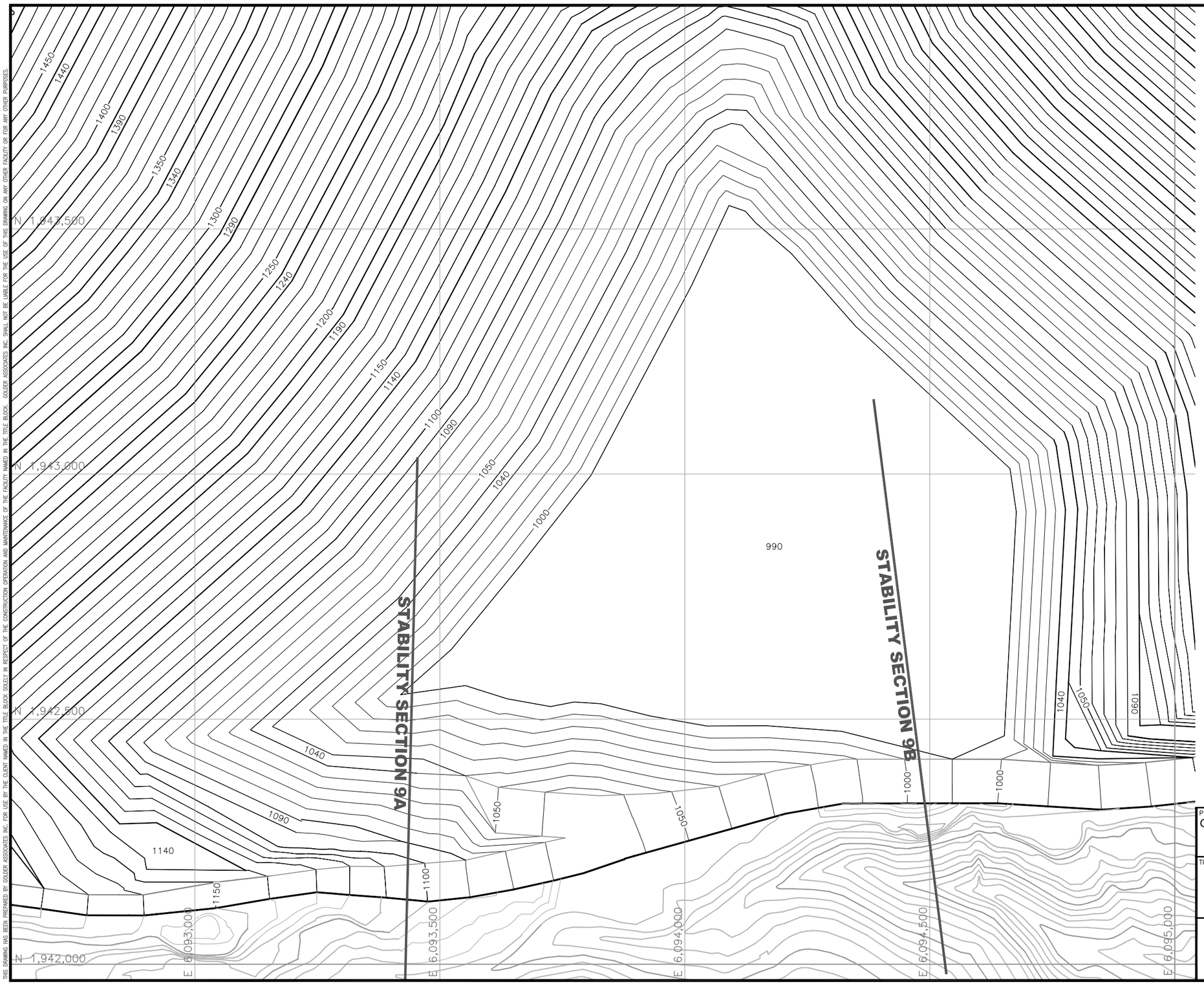
FINAL SOUTH WALL CUT

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 9.1-9.9	
DESIGN	RK	01/22/10	SCALE	AS SHOWN	REV. 0
CADD	AJS	01/22/10			
CHECK	KH	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 9.2

Sunday, February 07, 2010 - 8:44pm FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures\Figure 9.1-9.9.dwg TAB NAME \Figure 9.2
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



NOTES

1. PROPOSED ULTIMATE RECLAMATION TOPOGRAPHY INSIDE THE NORTH QUARRY RECLAMATION BOUNDARY PROVIDED BY LSCC IN MAY 2010. EXISTING TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC.

200 0 200 400

1" = 200' FEET

PROJECT

GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE

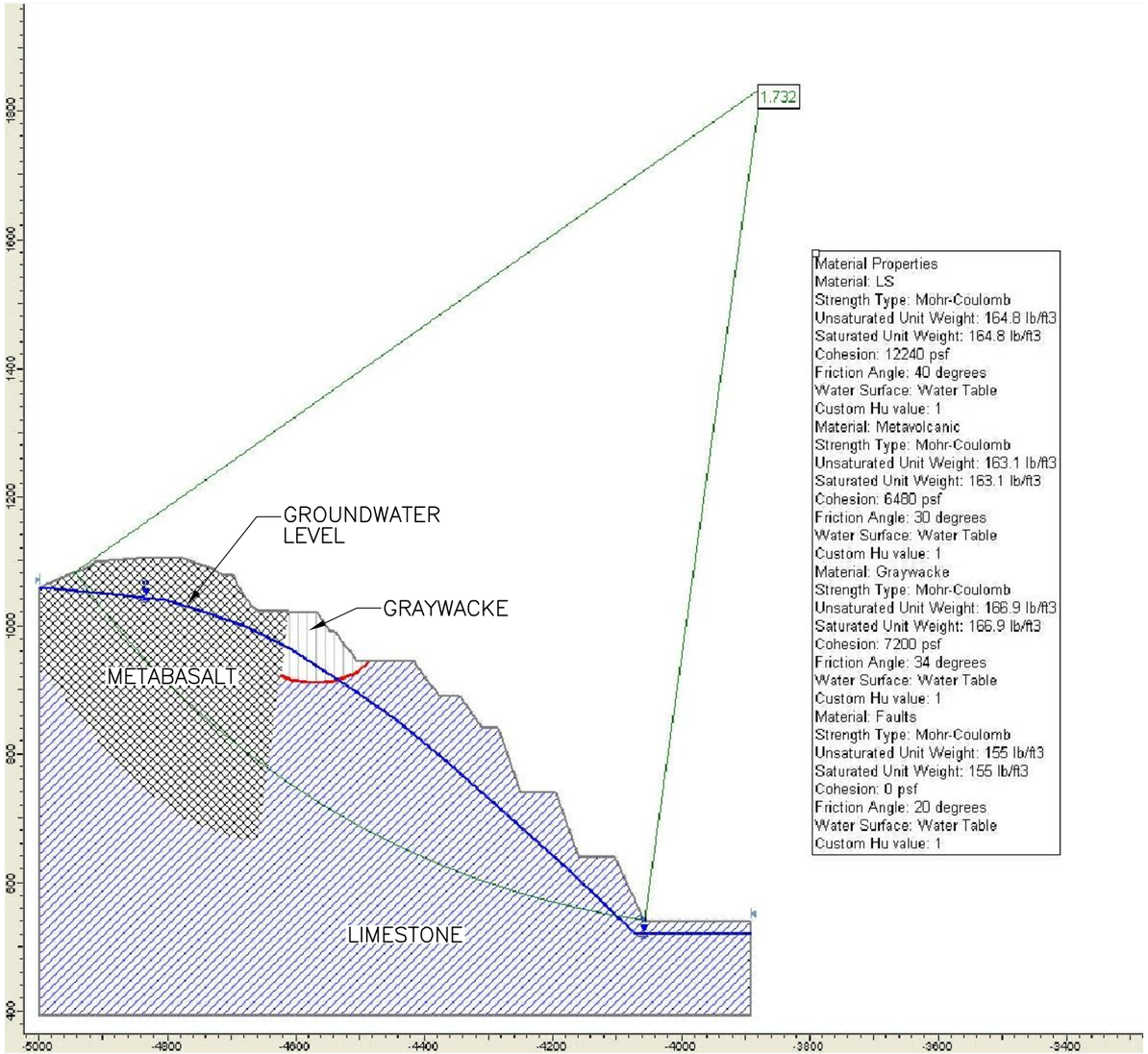
FINAL RECLAIMED TOPOGRAPHY OF SOUTH SLOPE

Golder Associates

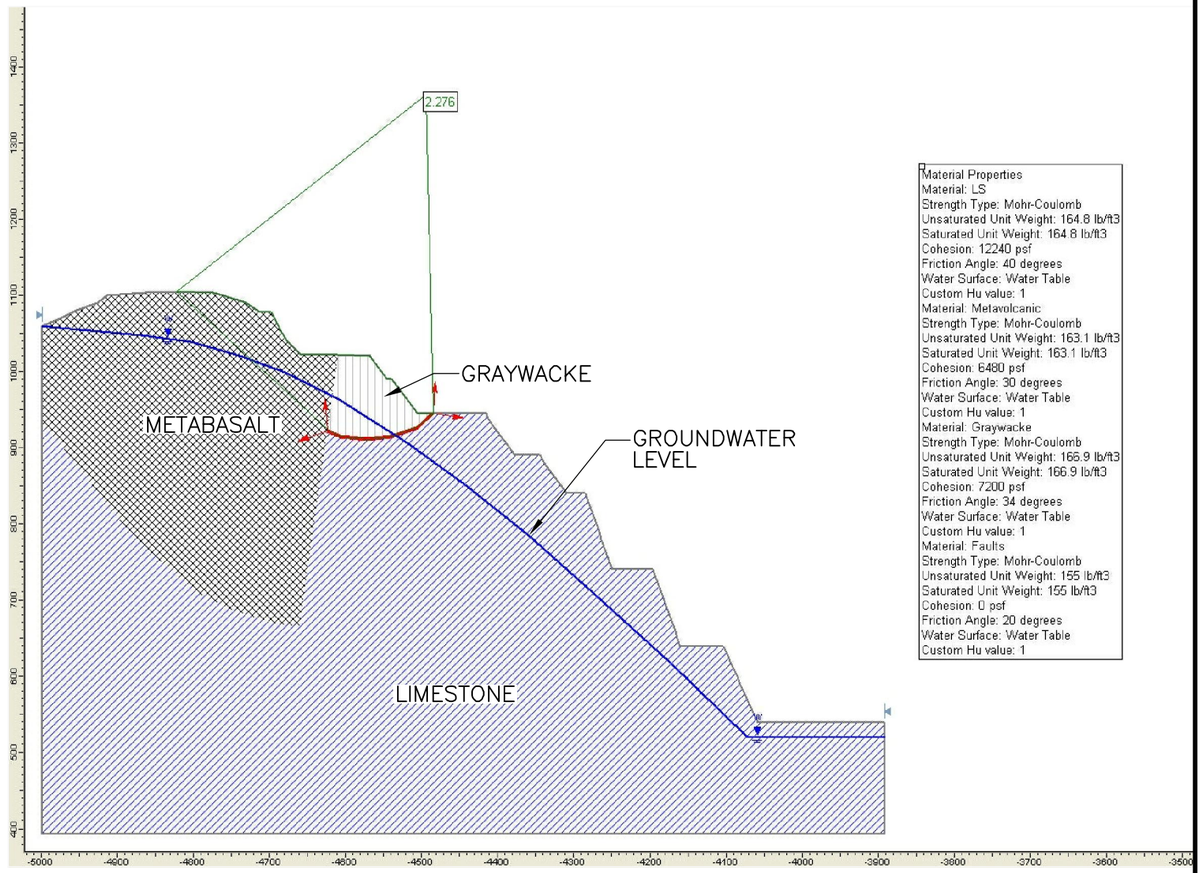
PROJECT No. 063-7109 800			FILE No.	Figure 9.1-9.7	
DESIGN	RK	01/22/10	SCALE AS SHOWN	REV.	1
CADD	AJS	01/22/10			
CHECK	KH	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 9.3

FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 9.1-9.7.dwg TAB NAME \Figure 9.3
Monday, May 10, 2010 - 4:02pm
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



STABILITY SECTION 9A
STATIC ANALYSIS (CIRCULAR FAILURE)



STABILITY SECTION 9A
STATIC ANALYSIS (BLOCK FAILURE)

NOTES

1. SEE FIGURE 9.2 FOR SECTION LOCATION.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

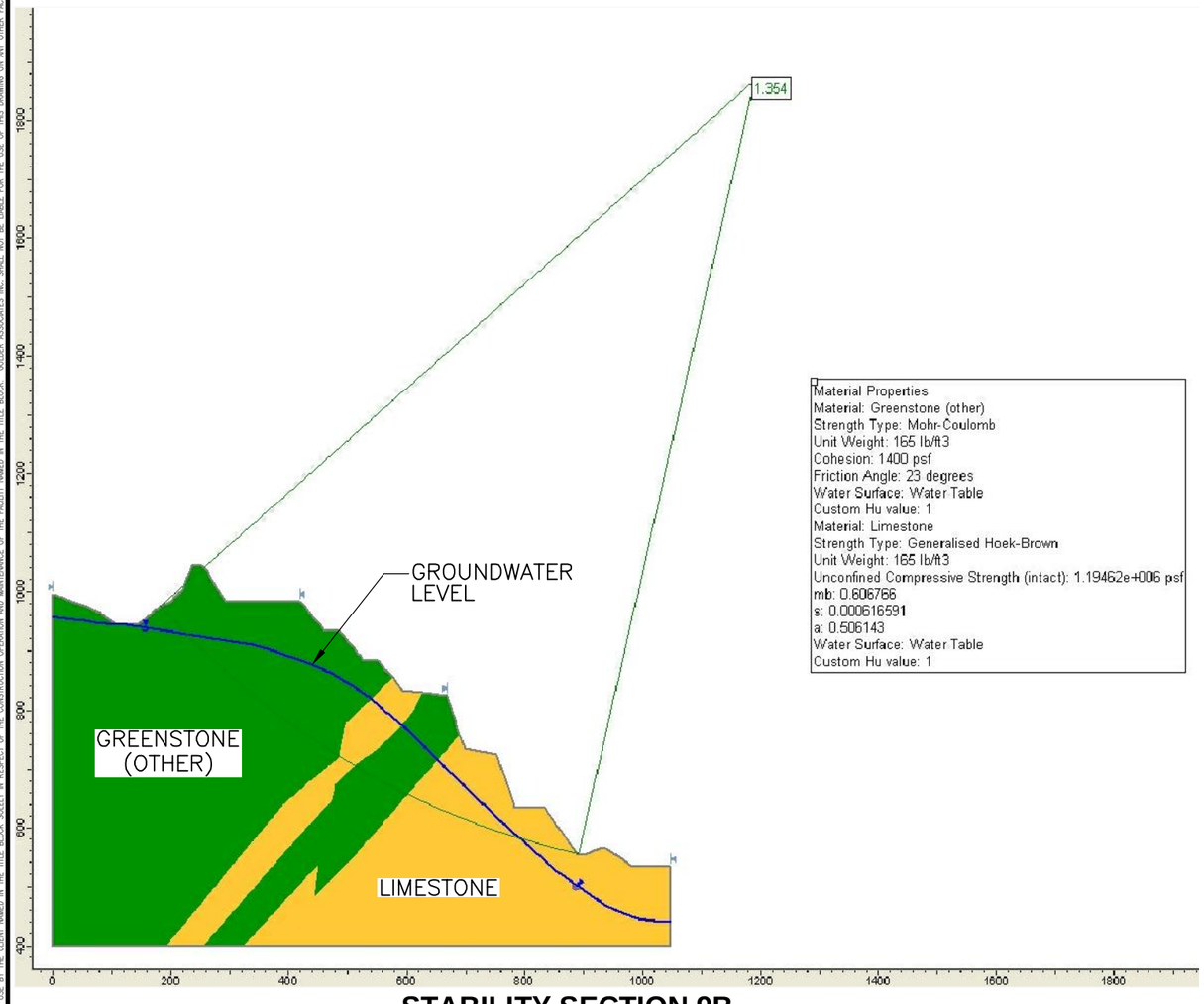
TITLE
STABILITY ANALYSIS RESULTS, STATIC ANALYSIS, SOUTH WALL SECTION 9A AFTER ULTIMATE QUARRY EXCAVATION

Golder Associates

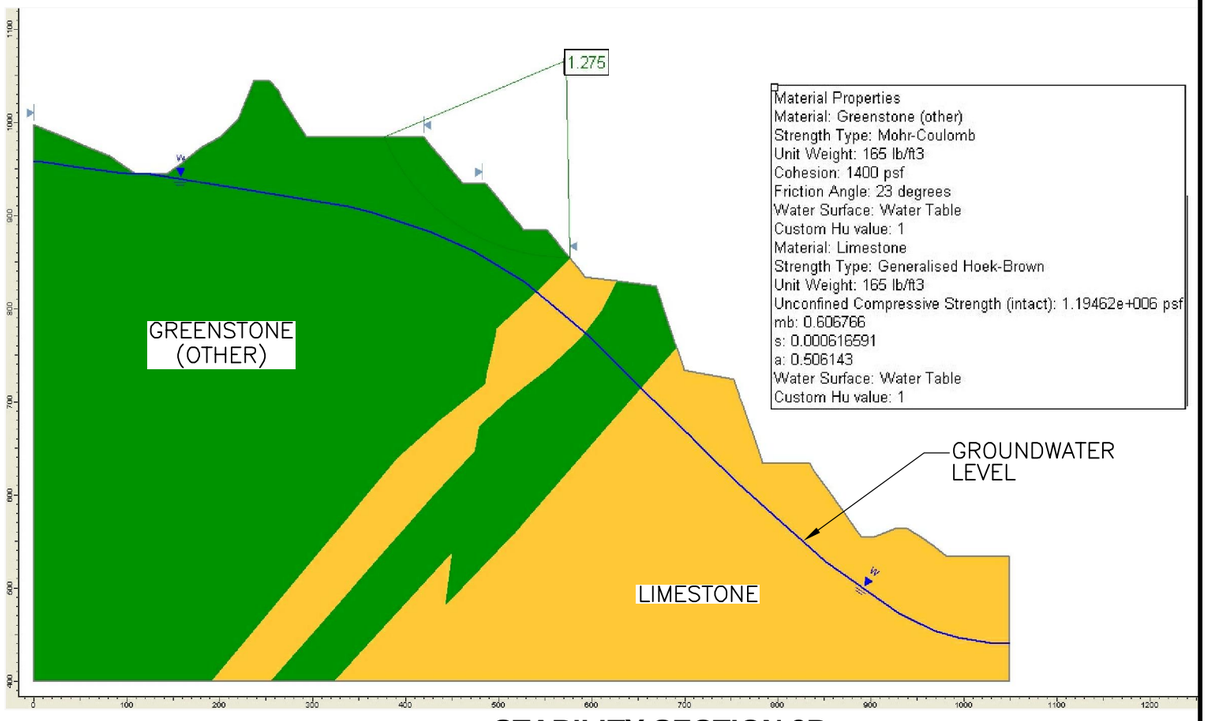
PROJECT No. 063-7109 800			FILE No.	Figure 9.1-9.7	
DESIGN	RK	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	KH	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 9.4

FILE: S:\HansonPermanente\Plt 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 9.1-9.7.dwg TAB NAME: \Figure 9.4
Friday, April 30, 2010 - 8:33am
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES. IN RESPECT OF THE CONSTRUCTION, OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK SOLELY



STABILITY SECTION 9B
STATIC ANALYSIS (GLOBAL FAILURE)



STABILITY SECTION 9B
STATIC ANALYSIS (LOCAL GREENSTONE FAILURE)

NOTES

1. SEE FIGURE 9.2 FOR SECTION LOCATION.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

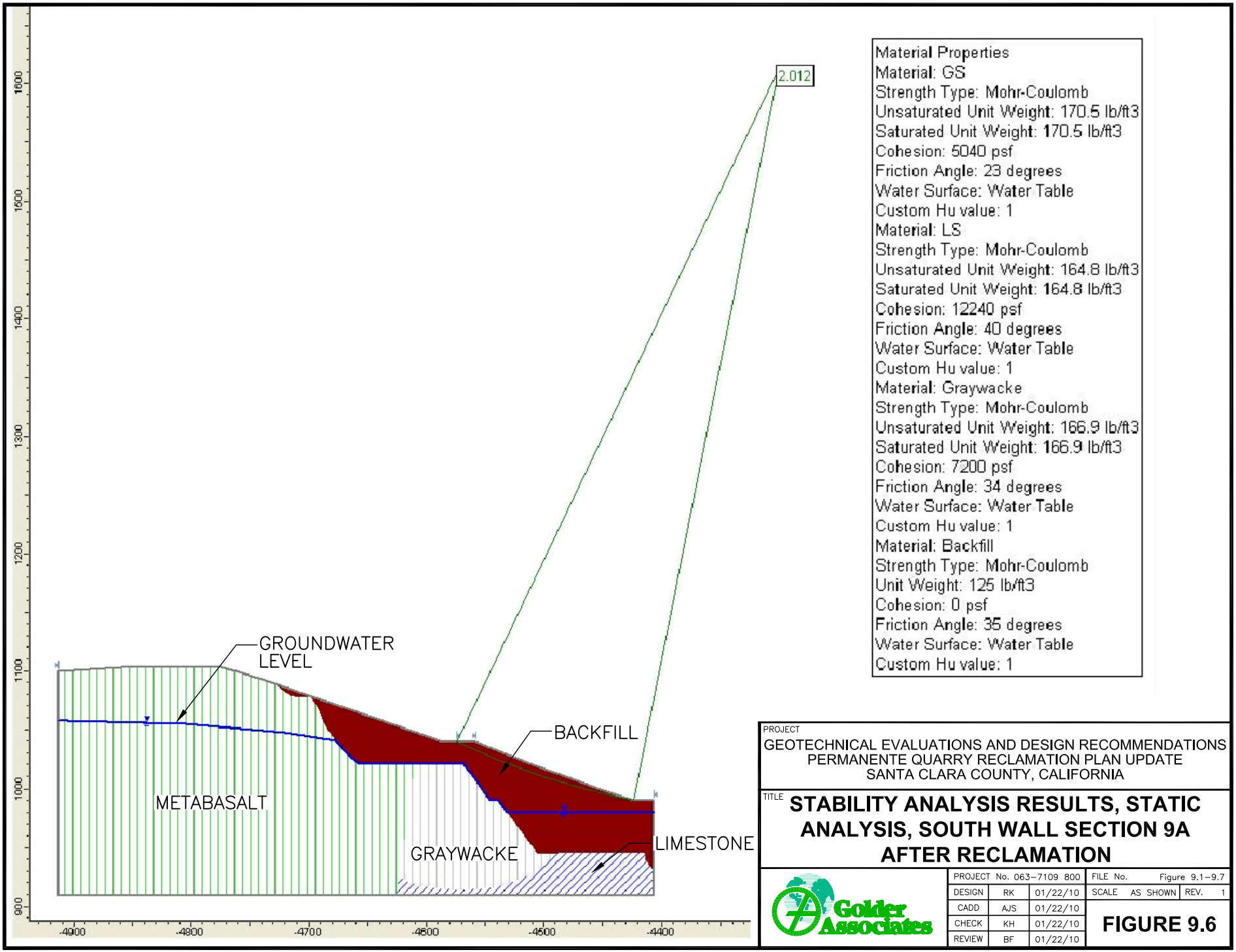
TITLE
STABILITY ANALYSIS RESULTS, STATIC ANALYSIS, SOUTH WALL SECTION 9B AFTER ULTIMATE QUARRY EXCAVATION

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 9.1-9.7
DESIGN	RK	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	KH	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 9.5

FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 9.1-9.7.dwg TAB NAME: \Figure 9.5
Friday, April 30, 2010 - 8:32am
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



Material Properties
Material: GS
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 170.5 lb/ft3
Saturated Unit Weight: 170.5 lb/ft3
Cohesion: 5040 psf
Friction Angle: 23 degrees
Water Surface: Water Table
Custom Hu value: 1
Material: LS
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 164.8 lb/ft3
Saturated Unit Weight: 164.8 lb/ft3
Cohesion: 12240 psf
Friction Angle: 40 degrees
Water Surface: Water Table
Custom Hu value: 1
Material: Graywacke
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 166.9 lb/ft3
Saturated Unit Weight: 166.9 lb/ft3
Cohesion: 7200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1
Material: Backfill
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

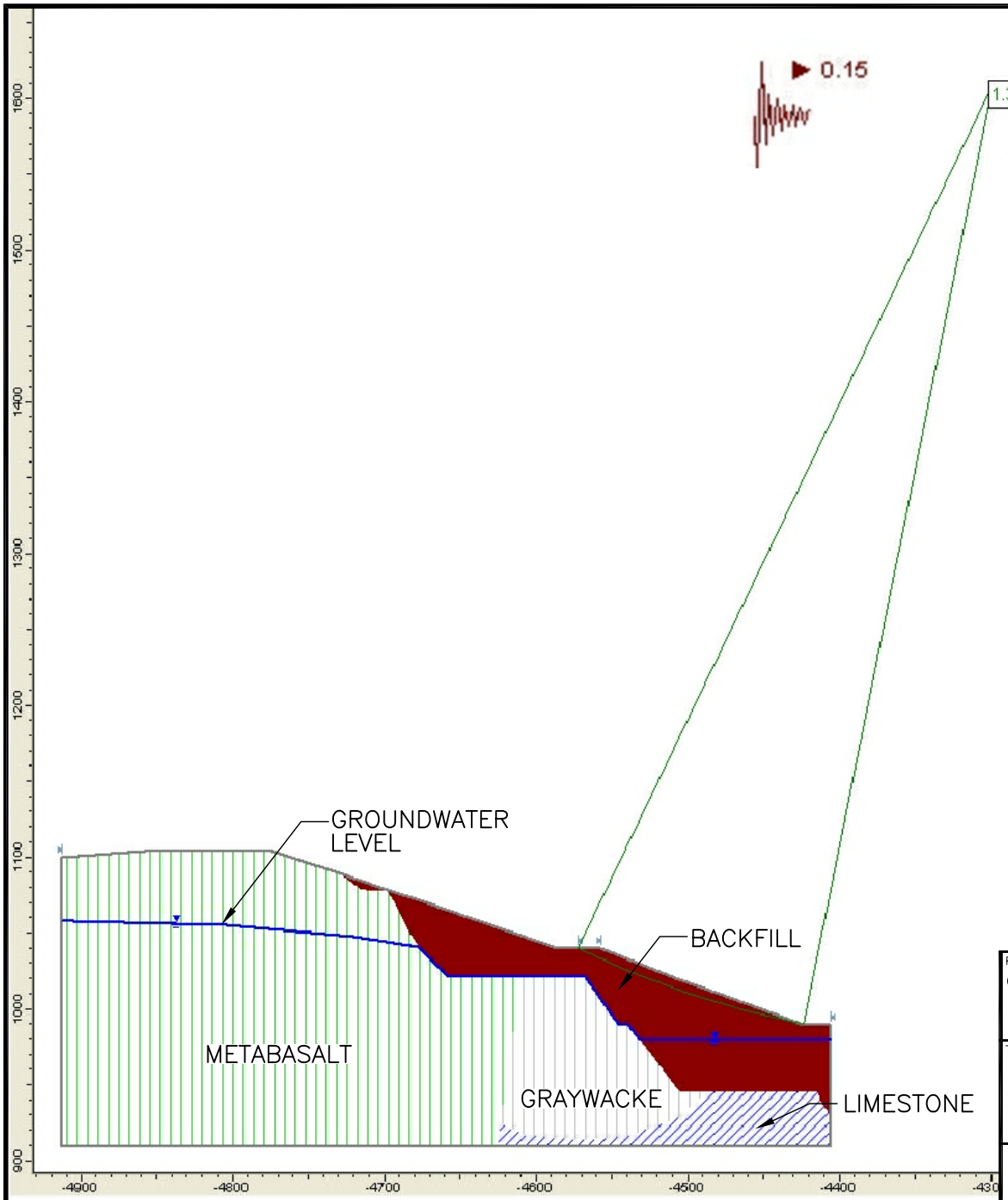
TITLE
STABILITY ANALYSIS RESULTS, STATIC ANALYSIS, SOUTH WALL SECTION 9A AFTER RECLAMATION

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 9.1-9.7
DESIGN	RK	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	KH	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 9.6

Monday, May 10, 2010 - 4:03pm FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 9.1-9.7.dwg TAB NAME: \Figure 9.6
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



Material Properties
Material: GS
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 170.5 lb/ft3
Saturated Unit Weight: 170.5 lb/ft3
Cohesion: 5040 psf
Friction Angle: 23 degrees
Water Surface: Water Table
Custom Hu value: 1
Material: LS
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 164.8 lb/ft3
Saturated Unit Weight: 164.8 lb/ft3
Cohesion: 12240 psf
Friction Angle: 40 degrees
Water Surface: Water Table
Custom Hu value: 1
Material: Graywacke
Strength Type: Mohr-Coulomb
Unsaturated Unit Weight: 166.9 lb/ft3
Saturated Unit Weight: 166.9 lb/ft3
Cohesion: 7200 psf
Friction Angle: 34 degrees
Water Surface: Water Table
Custom Hu value: 1
Material: Backfill
Strength Type: Mohr-Coulomb
Unit Weight: 125 lb/ft3
Cohesion: 0 psf
Friction Angle: 35 degrees
Water Surface: Water Table
Custom Hu value: 1

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

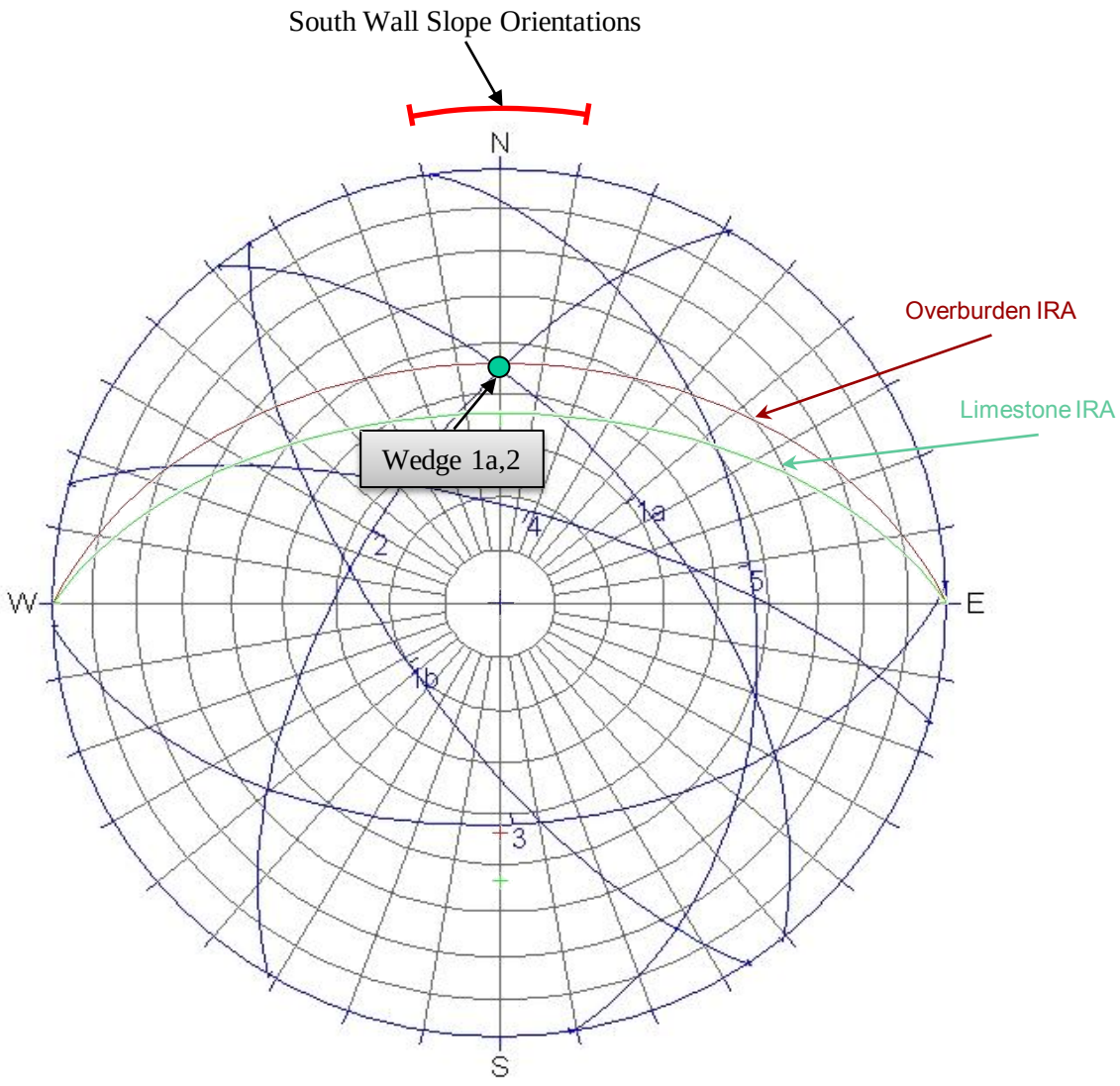
TITLE
STABILITY ANALYSIS RESULTS, PSEUDO-STATIC ANALYSIS, SOUTH WALL SECTION 9A AFTER RECLAMATION

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 9.1-9.7
DESIGN	RK	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	KH	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 9.7

Monday, May 10, 2010 - 4:03pm FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 9.1-9.7.dwg TAB NAME: \Figure 9.7
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



South Wall

Set	Dip/Dip Direction
1a	58 /051°
1b	70 /236°
2	63 /301°
3	48 /177°
4	72 /016°
5	43 /081°

South Wall Dip Direction: 350°-010°

PROJECT
GEOTECHNICAL EVALUATION AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE

DESIGN STRUCTURAL SETS

Golder Associates

PROJECT No.	063-7109 800		FILE No.	Figure 9.8
DESIGN	RLK	02/07/10	SCALE AS SHOWN	REV. 0
CADD	RLK	02/07/10		
CHECK	KH	02/07/10		
REVIEW	BF	02/07/10		

FIGURE 9.8

10.0 WEST MATERIALS STORAGE AREA

10.1 Introduction

Overburden materials (sometimes referred to as waste rock) excavated from the quarry area are placed in permanent Storage Areas. Overburden materials include low-grade limestone and non-limestone materials. Historically, the majority of the overburden materials from the North Quarry have been placed in the WMSA, which is located to the west of the North Quarry.

Golder previously submitted a slope stability evaluation for the West Materials Storage Area in compliance with County requirements dated November 2008 (Golder 2008). This section provides an update to that report that addresses additional modifications made to the final grading plan for the WMSA to further enhance the stability of the reclamation plan.

The WMSA area measures approximately 153 acres in plan area (Figure 10.1). Approximately 38 acres consists entirely of fill materials placed prior to the promulgation of SMARA in 1975, which is located along the southern boundary of the WMSA near Permanente Creek. The remaining portion of the WMSA is fill material placed after the promulgation of SMARA and is founded either on native materials, or in some cases, founded on portions of the pre-SMARA fill. As of January 2010, the WMSA had reached its maximum crest elevation of 1,975 feet msl. At reclamation, the WMSA will reach a maximum thickness of approximately 350 feet.

Golder completed static and seismic slope stability analyses to evaluate existing stability conditions of the post-SMARA WMSA to evaluate stability of the proposed reclaimed slopes.

10.2 Previous Geotechnical Evaluations

A number of geotechnical studies have been completed by others to address slope stability of the North Quarry (Call and Nicolas, Inc., or CNI) and the WMSA (The Mines Group, Inc., or MGI) that have relevance to the stability evaluation of the WMSA. The investigations by CNI have previously been described in detail in Section 7.3. The investigation by MGI specific to the WMSA is summarized below.

MGI reviewed the reclamation design for one portion of the overburden fill located at the northwest corner of the WMSA and developed conceptual drainage and sediment control design for the remainder of the waste fill facility in 2001 (MGI, 2001). An evaluation of the slope stability was performed with the following model inputs and design criteria:

- Material Shear Strengths: all materials were modeled with Mohr-Coulomb criteria with the following strength parameters:
  - Overburden Rock: cohesion (c') = 0 psf; internal friction (ϕ') = 36°;
  - Fine Muds: c' = 50 psf; ϕ' = 26°;
  - Colluvial Soil: c' = 500 psf; ϕ' = 28°

- Greenstone Bedrock: c' = 1,882 psf; ϕ' = 27°

- Groundwater Level: for stability modeling purposes, MGI conservatively assumed the Greenstone Bedrock and most of the colluvial soils contained groundwater, and that the precipitation at the quarry supported a perched water table above the Colluvial Soil/Greenstone interface that eventually discharged to the ground surface.

- Stability Criteria: MGI used a minimum design static FOS of 1.3 and a minimum pseudo-static (or seismic) FOS of 1.0 as the stability design criteria; for pseudo-static analyses, a seismic load coefficient of 0.15 was used.

Based upon the stability analyses performed with the above inputs and assumptions, MGI concluded that the design 3H:1V overall slopes of overburden rock were expected to be stable under both static and seismic loading. MGI also indicated the presence of fine-grained muds from the aggregate washing operations do not appear to control the stability of the overburden rock slopes, even when placed within 10 feet horizontally of the final reclaimed slope face.

10.3 GOLDER INVESTIGATIONS

Golder completed additional investigations of the WMSA consisting of the following:

- Aerial Photograph review;
- Subsurface drilling; and
- Geotechnical Laboratory Testing.

The following sections provide additional detail on these investigations.

10.3.1 Aerial Photograph Review

Aerial photographs of the WMSA area prior to the construction of the WMSA were examined to evaluate native foundation conditions and specifically to determine if there were pre-existing areas of instability or landslides. Based on a review of the photographs, no obvious areas of instability, or dormant landslides were identified in the footprint of the yet to be constructed WMSA. The area is characterized by a large, north-south trending drainage that reports to Permanente Creek. Within the drainage basin, the hillsides have a well-developed network of first-order drainages separated by angular to semi-rounded ridgecrests. Colluvial deposits, estimated on the order of five to ten feet thick, were observed along the axes of the drainage channels. Overall the topography appears characteristic of relatively sound bedrock being modified by the processes of sheetwash and erosion.

10.3.2 Subsurface Exploration

Five borings (WMSA-2 through -6) were drilled in the WMSA with a rotary-sonic drilling rig (see Figure 10.1 for borehole locations). The borings were located to minimize the thickness of overburden rock fill drilled through prior to reaching the native underlying materials. In addition, the borings were located to provide aerial coverage throughout the WMSA. One boring, WMSA-3 was located near the thalweg of the former drainage underlying the southwest-facing slope that extends down to Permanente Creek. One boring (WMSA-2) was drilled at the top of the northeast-facing slope. Two borings (WMSA-5 and WMSA-

6) were drilled near the thalweg of the former drainage underlying the southeast-facing slope that extends down toward the current quarry. One boring (WMSA-4) was drilled in an area of potential instability to the southeast of the WMSA fill area.

The borings were drilled under the supervision of a Golder geologist and logged and sampled using Golder's procedures and methods that follow industry standards (see Appendix 10.A for logs of the borings). The borings were continuously sampled with 5-foot to 10-foot long coring runs using the 10-foot long core barrel. Because of the nature of the materials encountered, gravel-sized waste rock and bedrock, intact core recovery was rare. Where possible, intact core samples were wrapped in the field and stored in boxes to maintain sample integrity.

All boreholes were advanced at least 8 feet into the bedrock materials underlying the overburden rock fill. No groundwater was encountered in the borings. Borings were backfilled with cement and/or bentonite chips to the ground surface. The geotechnical samples were sent to Cooper Testing Laboratory in Palo Alto, California for laboratory testing.

10.3.3 Geologic Materials

The general bedrock geology of the quarry, including the WMSA, was discussed previously in Section 3.2. Figure 10.4 provides a geologic map in the vicinity of the WMSA. The general character of the surficial materials and bedrock units encountered in the field investigations is discussed below.

- Colluvium - Colluvial deposits were encountered beneath the fill materials in the WMSA borings. The colluvial materials encountered were predominantly clayey sand with gravel to clayey gravel, with some gravelly clay. Gravel size was up to 3-inches. The colluvium was dry and dense to very dense.
- Bedrock - The bedrock materials encountered in WMSA included greenstone and limestone. Limestone was only encountered in boring WMSA-4 and in a thin layer in WMSA-3. The greenstone was moderately to highly weathered, while the limestone was generally less weathered.

10.3.4 Geotechnical Laboratory Testing

Geotechnical testing consisted of grain-size distribution and Atterberg limits (Appendix 10.B). Attempts were made to obtain intact samples of the clayey portion of the overburden fill and the native foundation soil at the base of the overburden fill, however, the samples contained abundant gravel and larger rock fragments that were not suitable for use in laboratory shear strength testing.

The samples obtained of the WMSA fill ranged from sand and gravel to gravelly and sandy clay. Atterberg limits were completed on the finer portion of the overburden materials with Plastic Indices ranging from 7 to 15.

The samples obtained of the native foundation soils (i.e. colluvium) beneath the WMSA fill materials ranged from sand and gravel to gravelly and sandy clay. Atterberg limits were completed on the finer

portion of the overburden materials with Plasticity Indices ranging from 7 to 18, but generally between 12 and 15.

In all cases, the Plastic Indices were measured on the finer portion of the soil materials that were sampled. These Atterberg limits results are representative of individual soil samples and not necessarily of all of the soil materials sampled. Laboratory test results are included in Appendix 10.B.

10.4 Slope Stability Evaluations

10.4.1 Methods

Static and pseudostatic slope stability evaluations were performed using the methods previously described in Section 5.

10.4.2 Modeling Inputs and Assumptions

10.4.2.1 Model Geometries

The three sections (Sections W1 through W3) shown in Figures 10.5 through 10.7 were used as typical sections for stability evaluations. These sections were developed based on pre-fill and current topographic maps, and proposed reclamation designs, as well as on the subsurface investigations performed by Golder. In addition, one section (Section W4; Figure 10.8) was developed crossing tension cracks observed on the south slope of the existing WMSA for back analyses of existing overburden fill slope performance. The cracks occur near the top of the existing slope and are associated with the temporary angle-of-repose slopes, and therefore, offer an opportunity to back-analyze the strength of the fill materials.

10.4.2.2 Material Properties

The material properties used for stability modeling are summarized in Table 10.1 and are discussed below. All strengths presented are effective stress parameters for long-term stability modeling.

TABLE 10.1
MATERIAL PROPERTIES FOR WMSA STABILITY ANALYSES

Material	Unit Weight pcf	Cohesion psf	ϕ, °	Comments
Coarse Overburden	125	0	35	Design values assumed based on back analyses
Foundation Soil – WMSA	120	200	30	Design values based on laboratory testing data and correlation recommendation in some literature
Greenstone	165	1,800	27	Design values based on review of past studies
Limestone	165	12,500	30	Design values based on review of past studies

10.4.2.2.1 Coarse Overburden Fill

For cohesionless rock materials characteristic of the coarse overburden at the quarry, the angle-of-repose of end-dumped fill slopes is often used to approximate the shear strength of a rock material. Based on review of existing dump topographic maps, the angle-of-repose of the WMSA overburden generally ranged from 34 degrees to 37 degrees and averaged around 35 degrees. Assuming a cohesion value of zero, this corresponds with an internal friction angle of approximately 35 degrees. Accordingly, coarse overburden fill was assigned average strength parameters based on an internal friction angle of 35 degrees and no cohesion. This friction angle is slightly lower than the value of 36 degrees that Mines Group used (MGI, 2001). A moist unit weight of 125 pcf was assumed for stability modeling.

10.4.2.2.2 WMSA Foundation Soil

The description of “Foundation Soil” was used to represent colluvial soils and/or residual soils above the weathered bedrock, which were encountered in most of Golder’s geotechnical borings in the WMSA. The Foundation Soil was typically characterized as “dense to very dense Clayey Sand, Clayey Gravel, Sandy Gravel or Gravelly Clay” during the field investigation and by laboratory testing. A nominal cohesion of 200 psf and a friction angle of 30 degrees were used to characterize the strength of Foundation Soil with the Mohr-Coulomb Model. It is noted that the cohesion portion of the strength is generally considered unreliable and could decrease significantly due to changes in conditions such as saturation and disturbance. It is therefore usual practice to reduce the cohesion or even to use a value of zero for cohesive soils to model long-term stability. Considering most Foundation Soil samples were observed to have moderate to significant cementation after years of consolidation under high overburden pressures, a nominal cohesion of 200 psf was assumed. The friction angle was determined based on review of the laboratory index testing data and correlation recommendation in the literature (FHWA, 1997, and Gibson,

1953). The thickness of Foundation Soil varies across the quarry and an average of 10 ft was assumed for stability modeling. A moist unit weight of 120 pcf was assumed.

10.4.2.2.3 Bedrock Materials

Our subsurface investigation program indicated that a significant portion of the WMSA was founded on greenstone and foundation soil derived from greenstone. As discussed in previous sections, the shear strength of greenstone varies significantly depending on the amount of shearing and fracturing of the rock mass, and the degree of weathering. Estimates of internal friction angles generally range from 23 degrees to 31 degrees with the lower limit correlating to areas where past slope instability has been observed. Based on the absence of observed slope failures along the steeper portions of the pre-existing native slopes discussed in Section 10.3.1, Golder considers it prudent to assume that the WMSA is generally underlain by greenstone that is more competent than that observed in the areas of past failures (e.g., the Main Slide (1987), the Scenic Easement Slide, the Mid Pen Slide). This is further supported by absence of slope failures in the pre-SMARA waste rock fill founded on greenstone and inclined at the angle of repose (approximately 36 degrees).

An internal friction angle of 27 degrees was assumed (mid-point of the range of estimated values) with a cohesion of 1,800 psf to reflect a likely higher intact rock strength than that assumed for the more weathered greenstone associated with previous slope failures. This shear strength also correlates well with that previously assumed by MGI (2001) for the WMSA. A total unit weight of 165 pcf was assumed.

For limestone, a cohesion of 87 psi (12,500 psf) and a friction angle of 30 degrees were used in stability models based on review of past characterization data.

10.4.2.3 Groundwater

Water was not encountered in any of the five borings Golder performed at WMSA, which penetrated 10 to 20 feet into native ground. Furthermore the encountered foundation soils were generally dry. Therefore, it is unlikely that permanent perched water exists in the overburden fill materials, although temporary perched water may occur locally due to variations in the overburden fill gradations.

Deeper groundwater information in the native soils or rocks in the area of the WMSA is limited. Review of the past studies at the WMSA indicated ground water could pond behind the limestone-greenstone fault contact above elevation 1300 ft (MSL) and could be captured allowing Permanente Creek to dry up below 1300 ft (MGI, 2001). Seepage supported by groundwater has been observed along the west side of the North Quarry at elevation between 1400 and 1600 ft. For stability modeling purposes, permanent groundwater level at WMSA was conservatively assumed to be shallow in bedrock and at the creek level, corresponding to an elevation ranging from 1700 feet MSL down to 1400.

10.4.2.4 Seismic Parameters

Consistent with previous discussions, the overburden fill reclamation stability modeling was based on the following seismic parameters:

- Horizontal seismic load coefficient of 0.15;
- Design Moment Magnitude: M_w = 6.8~7.1; and
- Peak horizontal ground acceleration (a_{max}) = 0.6 g (Golder, 2007).

10.4.2.5 Cross Sections

Four sections were developed at the WMSA to evaluate existing stability conditions and to back-analyze the strengths of mine overburden. These sections are described below:

- Section W1 (Figure 10.5): This section is located along the east slope of WMSA, adjacent to the west wall of the quarry where a historic quarry wall failure had occurred. The quarry wall failure appeared to be progressing upslope and cracks have been observed on the lowest benches of the overburden Storage Area. Although subsurface conditions in this area have not been well defined, review of developed cracks in this area indicated the currently observed indications of instability are more likely associated with structure-controlled failures in quarry walls, instead of rock mass failures or single-lift overburden fill failure shown in Figure 10C-1 of Appendix 10.C.
- Section W2 (Figure 10.6): This section was developed along the south slope of WMSA. As shown in Figure 10.6, the existing overburden consists of two types of overburden fills with the old pre-SMARA fill below the Access Ramp corresponding to elevation 1,730 feet and facing Permanente Creek, and the new fill above elevation 1730 ft that is subjected to SMARA regulations. The stability results shown in Figure 10C-2 of Appendix 10C indicated that the minimum factors of safety against global failures is slightly less than 1.5 for existing conditions.
- Section W3 (Figure 10.7): The section is located along the north slope of the WMSA, where part of the fill slope has been reclaimed at 3H:1V slope. The stability modeling results in Figure 10C.3 of Appendix 10.C indicate that the static stability of the existing reclaimed slope has a minimum FOS greater than 2.0.
- Section W4 (Figure 10.8): Cracks have been observed in the upper portion of the south WMSA with the locations shown in Figure 10.1. These cracks occur along interim, angle-of-repose slopes for individual lifts that have not been graded to the final reclamation slope. The crack on the top lift of the WMSA is about 10 ft long and was measured about 15 ft away from the safety berm. On the second-highest bench, multiple cracks as wide as 6 inches were measured up to 25 ft away from the berm. As indicated in the back analyses shown in Figure 10C-4 of Appendix 10C, and as verified by field inspection, these cracks are related to single-lift failures, not deep global failures. As shown in Figure 10C-4, the minimum FOS against multi-lift failures through SMARA fill is greater than 1.6. All the above discussed failures will be more likely in circular mode, rather than in block mode.

10.4.3 Static Analyses

The reclaimed slopes of WMSA are proposed to be 3H:1V (or 18.4 degrees) or flatter as shown in Figure 10.2. Section W2 was selected as a typical section to represent stability conditions of the proposed reclaimed slopes. The modeling results are attached in Appendix 10.C and summarized in Table 10.2 below.

TABLE 10.2
SUMMARY OF WMSA STABILITY ANALYSES

Location	Stability Section	Description	Calculated Minimum FOS		Seismic Deformation (14-86 percentile range)
			Static – Mult-Lift	Pseudo-Static – Multi-Lift [2]	
WMSA – Proposed Reclaimed	W2	South Slope	1.56	1.1	5 to 18 inches (16% to 84% exc.)
	W3	North Slope	2.17	1.43	< 3 inches

[1] "NE" - Not Evaluated;
[2] Pseudo-static analyses performed with a horizontal seismic coefficient of 0.15g

Compared with the existing slope configuration, the reclaimed slopes appear to be more stable with a higher FOS against multi-lift failures. The risk of single-lift failures is reduced by grading the entire overburden Storage Area to smooth faces and is not as significant as that of multi-lift failures. As shown in the table, the minimum FOS is 1.56 and is considered acceptable. The stability of the reclaimed slope of Section W3 was also reviewed. No significant grading is required since the existing slope of Section W3 is close to 3H:1V. As discussed in the above section, the 3H:1V slope configurations meet the design stability criteria.

The stability of the east slope (Section W1) is associated with the adjacent west quarry wall, therefore reclamation of the east WMSA fill slope will be addressed by the backfilling of the North Quarry. Since the east slope of the WMSA is to be covered by overburden rock in accordance with proposed reclamation plans (Figures 10.2 and 10.3), the reclamation stability of the east slope will be significantly improved over the existing conditions and meet the stability requirements under SMARA.

10.4.4 Seismic Analyses

The seismic stability of WMSA was initially evaluated using a pseudo-static analyses. Figure 10C-6 of Appendix 10.C shows the results of pseudo-static analyses of Section W2, which indicated that the minimum FOS against global failure was approximately 1.1. The Bray and Travasarou Method (2007) was also used to estimate potential seismic deformation from the design event as discussed in Section 5. The mean estimated deformation was estimated to be less than one (1) foot, and considered acceptable for reclamation. The seismic stability of Section W3 was also reviewed and the potential displacement under the design earthquake event is negligible for this section. The seismic displacement calculation is also included in Appendix 10.C.

10.4.5 Sensitivity Study

10.4.5.1 Groundwater conditions

As previously discussed, limited groundwater information is available for the WMSA. Groundwater tables in the stability models were primarily based on the subsurface investigation and observed absence of water in those borings. We recognize that actual groundwater levels could differ from that shown in our stability models. In addition, we expect groundwater could be subject to long-term seasonal fluctuation and significant short-term increase due to heavy precipitation. Therefore, the groundwater level in Section W2 was conservatively raised by 50 feet to assess the impact of such changes. Figure 10C-11 of Appendix 10C indicates although the stability conditions could be sensitive to groundwater changes, permanent groundwater changes may not result in significant deterioration of overall stability (FOS = 1.43). This is because most of the critical failures are relatively deep, and the pore pressure developed along the critical failure path is relatively small compared with the large overburden pressure above the critical failure surface. Moreover, some of the critical failure paths shown in Appendix 10.C are above the water levels, and therefore the change of groundwater level will not impact critical stability conditions.

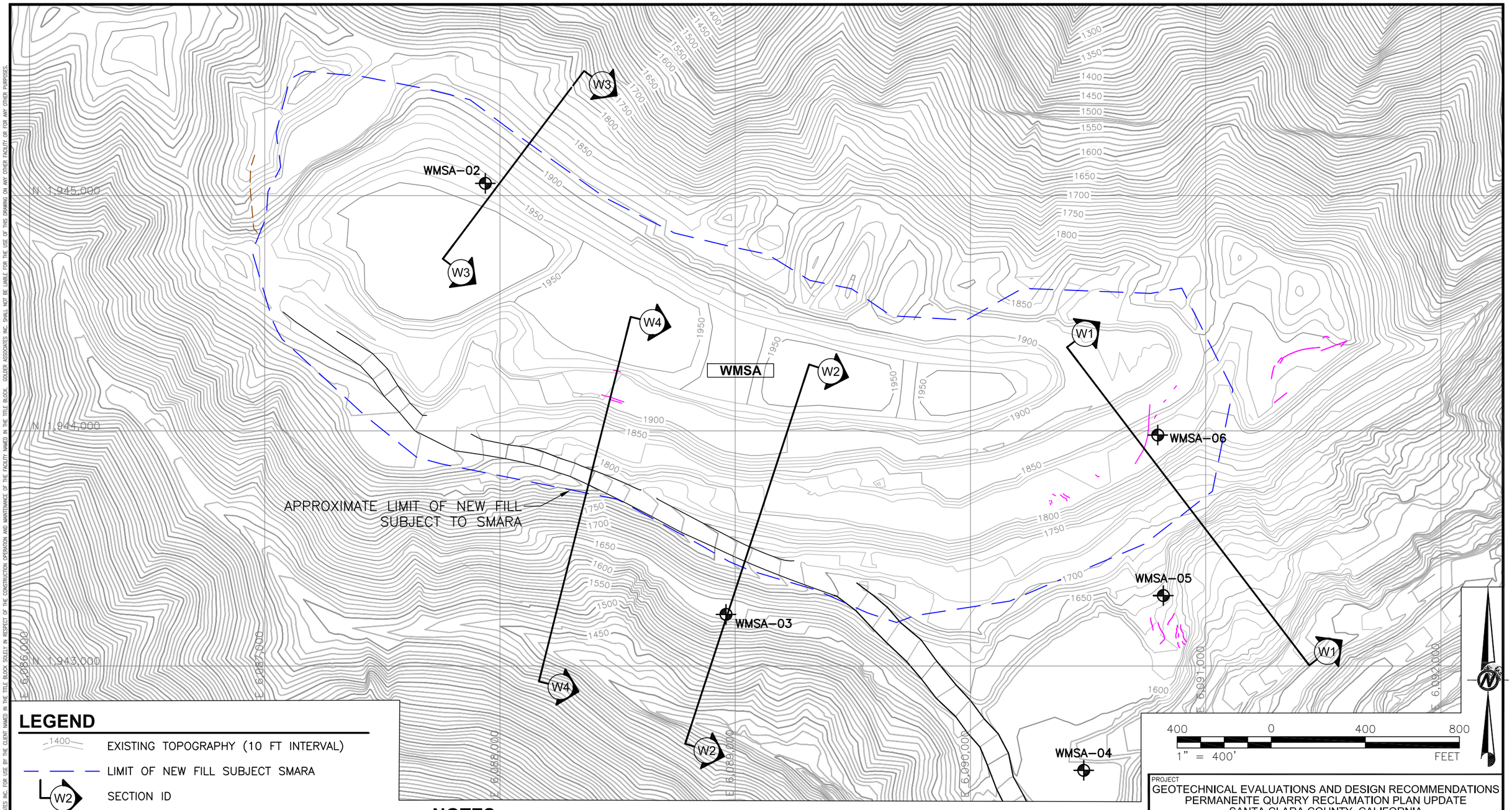
10.4.5.2 Presence of Fine Waste

The WMSA includes localized layers of fine muds derived from aggregate washing operations. These materials are comprised of unconsolidated saturated clayey silt and silty clay. Based on current operations, the fine muds are dumped in approximately 3 to 5 foot-thick horizontal lifts and kept at least 50 ft away from the existing edge of the overburden fills. It is Golder's assumption the fine muds has been placed using the same practice throughout the WMSA.

To evaluate the impact of the fine muds on overall slope stability, Section W2 was revised to incorporate a 10 ft thick mud layer with a perched water table above the layer. The mud layer was also modeled using Mohr-Coulomb criteria with zero cohesion and a 24 degree friction angle. Considering future reclamation construction could lay back the existing reclamation fill slopes and expose the fine mud layer on the slope, two cases were modeled: 1) the mud layer was assumed to be placed 50 ft away from the slope face; and 2) the mud layer was daylighted at the reclaimed slope. The modeling results shown in Figures 10C-12 and 10C-13 of Appendix 10C indicate that block failures through the fine mud are unlikely to become critical or controlling failure paths provided the muds remain drained (FOS from 1.4 to 1.9). Depending on loading rates, there is the potential for the fine mud material to experience some short-term, partially undrained conditions that result in shear strengths lower than that used in our analyses. For this reason, we recommend maintaining the fine mud placement at least 50 feet from the slope face during operations.

THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.

FILE: S:\HansonPermanente\Plt 1 North East Walls\Reclamation Study – 2010\Reporting\Figures R1\Figure 10.1-3.dwg TAB NAME \ph0
Thursday, April 29, 2010 – 4:07pm



LEGEND

- 1400 — EXISTING TOPOGRAPHY (10 FT INTERVAL)
- LIMIT OF NEW FILL SUBJECT SMARA
- W2 — SECTION ID
- APPROXIMATE LOCATIONS OF EXISTING CRACKS ON OR ADJACENT TO WMSA
- WMSA–01 — GEOTECHNICAL BOREHOLE – GOLDER, 2007

NOTES

1. EXISTING TOPOGRAPHY OUTSIDE THE WMSA BOUNDARY IS FROM APRIL 2007 FLYOVER PROVIDED BY LSCC. EXISTING TOPOGRAPHY INSIDE THIS BOUNDARY IS FROM JANUARY 2010 SURVEY PROVIDED BY LSCC.
2. EXISTING TOPOGRAPHY OUTSIDE THE NORTH QUARRY BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC. EXISTING TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM SEPTEMBER 2009 SURVEY PROVIDED BY LSCC.

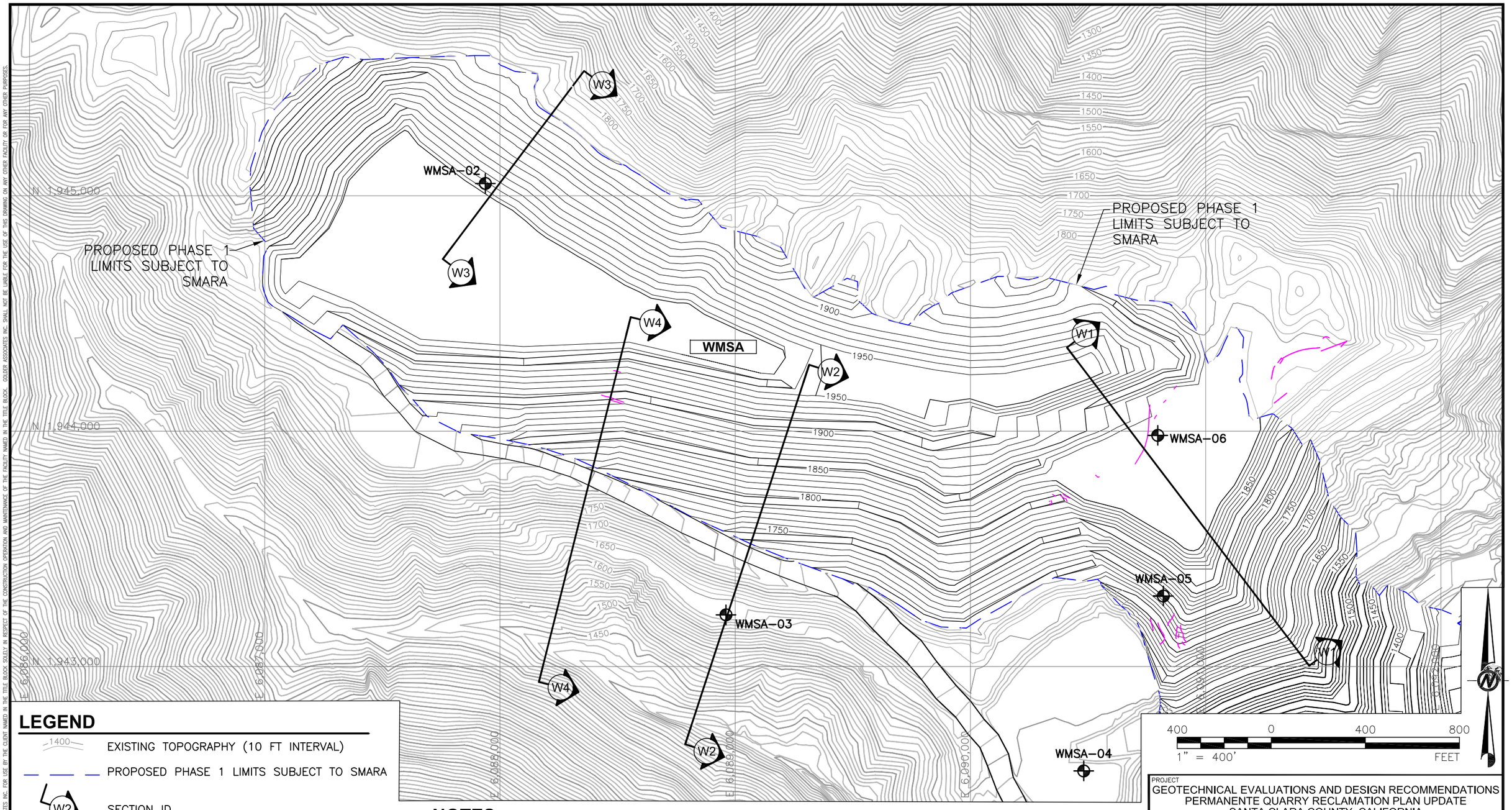
PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
CURRENT TOPOGRAPHY- WEST MATERIALS STORAGE AREA

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 10.1-3
DESIGN	PHY	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	KH	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 10.1



LEGEND

- 1400 — EXISTING TOPOGRAPHY (10 FT INTERVAL)
- PROPOSED PHASE 1 LIMITS SUBJECT TO SMARA
- W2 — SECTION ID
- APPROXIMATE LOCATIONS OF EXISTING CRACKS ON OR ADJACENT TO WMSA
- WMSA–01 — GEOTECHNICAL BOREHOLE – GOLDER, 2007

NOTES

1. EXISTING TOPOGRAPHY OUTSIDE THE WMSA BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC.
2. PROPOSED TOPOGRAPHY INSIDE THE WMSA GRADING DESIGN BOUNDARY PROVIDED BY LSCC IN DECEMBER 2009. TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2007 FLYOVER PROVIDED BY LSCC.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
FINAL GRADING DESIGN TOPOGRAPHY- WEST MATERIALS STORAGE AREA

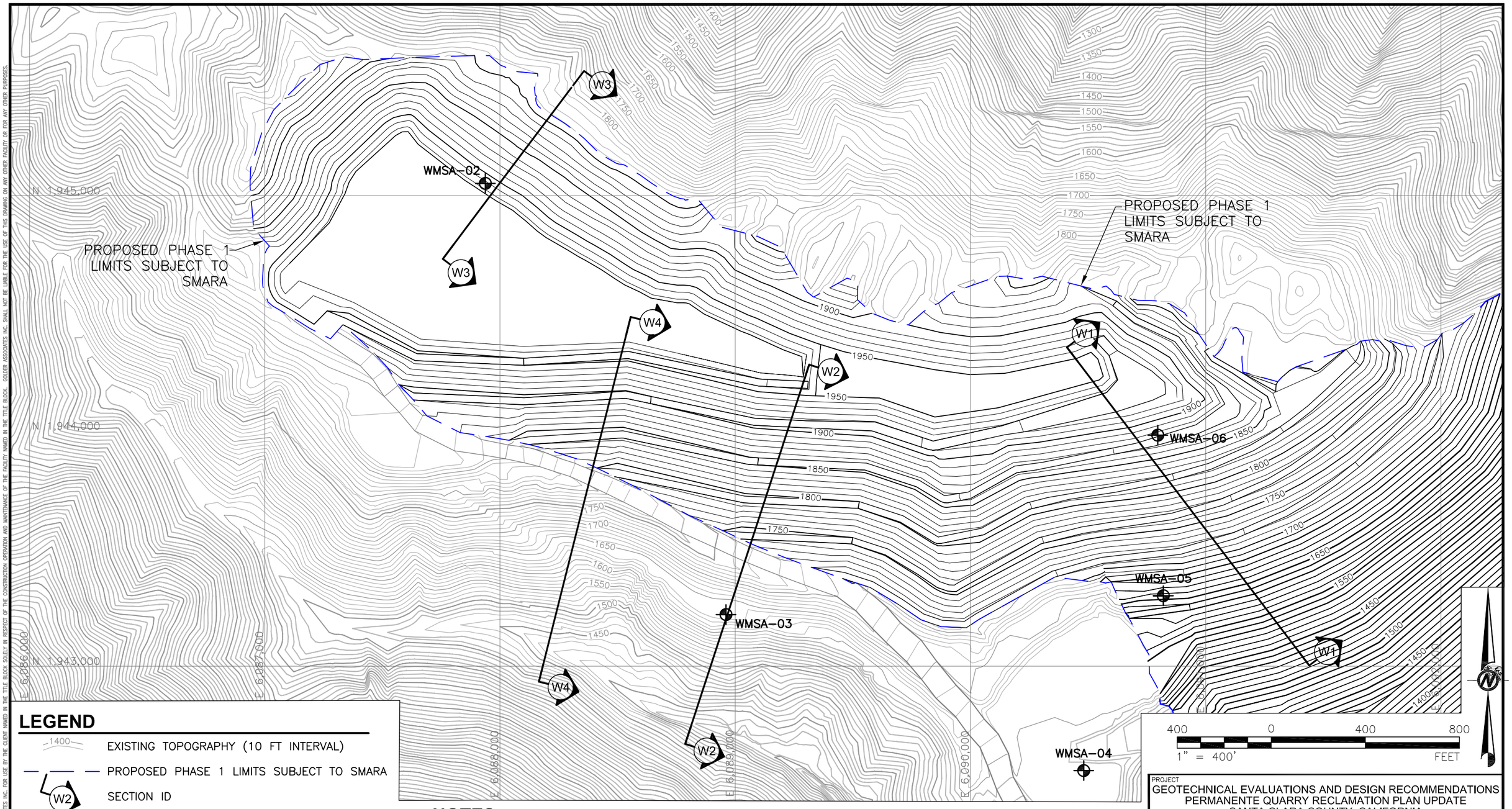
Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 10.1-3
DESIGN	PHY	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	KH	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 10.2

FILE: S:\HansonPermanente\Plt 1 North East Walls\Reclamation Study – 2010\Reporting\Figures R1\Figure 10.1-3.dwg TAB NAME \ph1
Thursday, April 29, 2010 – 4:13pm
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.

THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.
Monday, May 10, 2010 - 11:20am FILE: S:\HonsonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 10.1-3.dwg TAB NAME \ph UH



LEGEND

- 1400 — EXISTING TOPOGRAPHY (10 FT INTERVAL)
- PROPOSED PHASE 1 LIMITS SUBJECT TO SMARA
- W2 — SECTION ID
- WMSA-01 — GEOTECHNICAL BOREHOLE – GOLDER, 2007

NOTES

1. EXISTING TOPOGRAPHY OUTSIDE THE WMSA BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC.
2. PROPOSED ULTIMATE RECLAMATION TOPOGRAPHY INSIDE THE WMSA RECLAMATION BOUNDARY PROVIDED BY LSCC IN MAY 2010. EXISTING TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2007 FLYOVER PROVIDED BY LSCC.

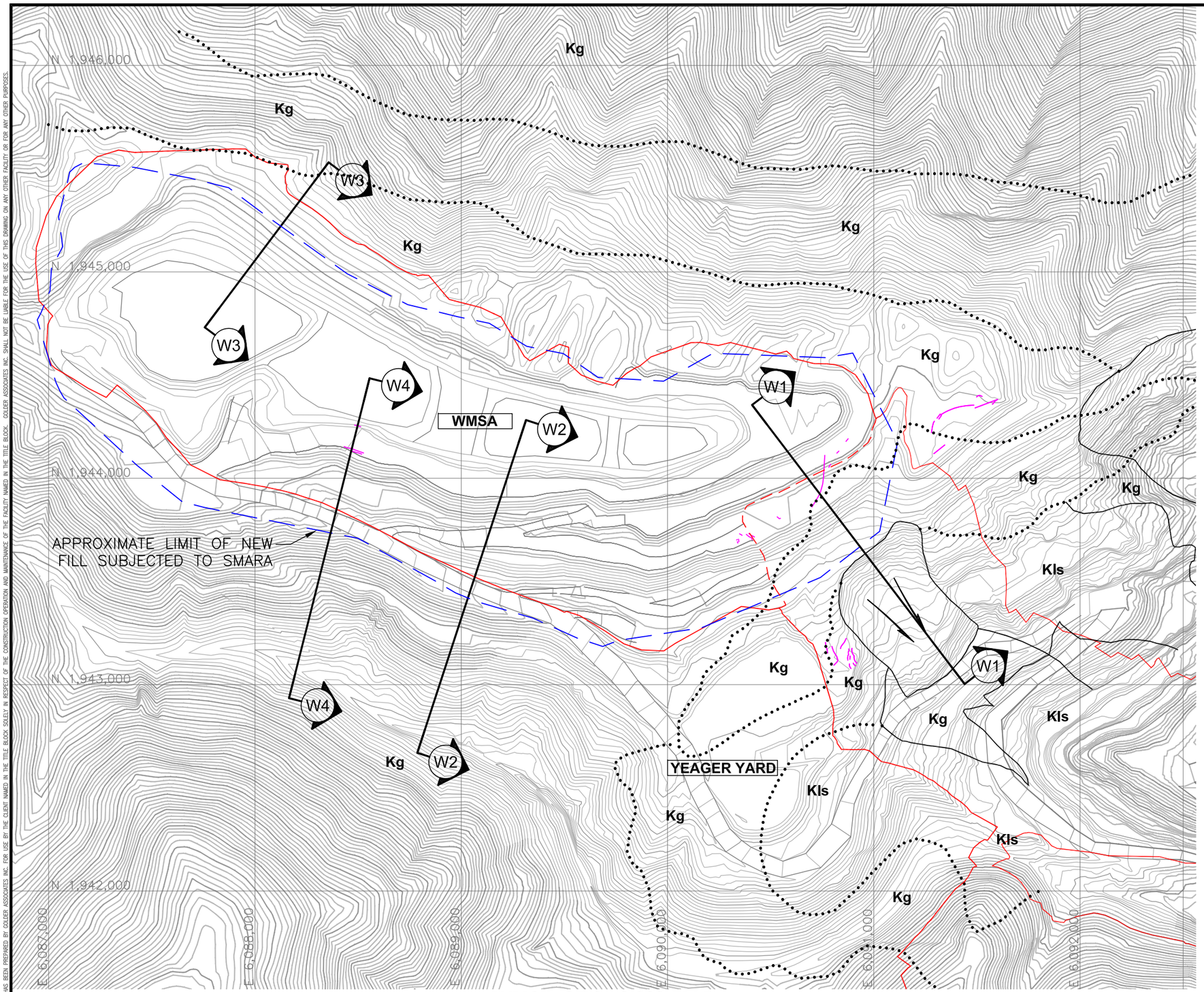
PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
ULTIMATE RECLAMATION TOPOGRAPHY-WEST MATERIALS STORAGE AREA

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 10.1-3	
DESIGN	PHY	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	KH	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 10.3



WMSA GEOLOGIC MAP

LEGEND

- EXISTING TOPOGRAPHY (10 FT INTERVAL)
- LIMITS OF PHASE 1
- WMSA/NORTH QUARRY RECLAMATION BOUNDARY
- LIMITS OF NEW FILL SUBJECT TO SMARA
- APPROXIMATE LOCATIONS OF EXISTING CRACKS ON OR ADJACENT TO WMSA
- W1 — SECTION ID
- GEOLOGIC CONTACT, CERTAIN
- GEOLOGIC CONTACT, APPROXIMATE
- Kls — FRANCISCAN COMPLEX LIMESTONE
- Kg — FRANCISCAN COMPLEX GREENSTONE
- LANDSLIDE DIRECTION OF MOVEMENT

NOTES

1. EXISTING TOPOGRAPHY OUTSIDE THE WMSA BOUNDARY IS FROM APRIL 2007 FLYOVER PROVIDED BY LSCC. EXISTING TOPOGRAPHY INSIDE THIS BOUNDARY IS FROM JANUARY 2010 SURVEY PROVIDED BY LSCC.
2. GEOLOGY FROM ROGERS, T.H. AND ARMSTRONG, C.F., 1973, ENVIRONMENTAL GEOLOGIC ANALYSIS OF THE MONTE BELLO RIDGE MOUNTAIN STUDY AREA, SANTA CLARA COUNTY, CALIFORNIA, CALIFORNIA DIVISION OF MINES AND GEOLOGY PRELIMINARY REPORT 17 AND FORURIA, J., 2004, GEOLOGY OF THE PERMANENTE LIMESTONE AND AGGREGATE QUARRY.

500 0 500 1000
1" = 500' FEET

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

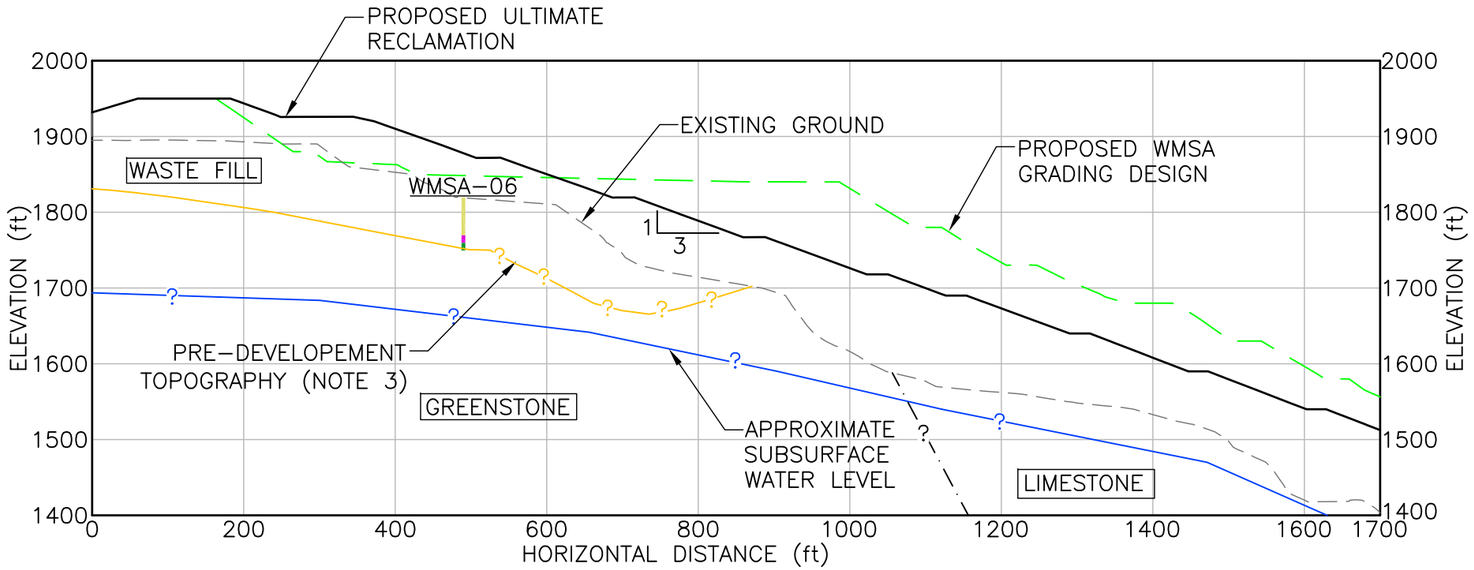
TITLE
GEOLOGICAL MAP
WEST MATERIALS STORAGE AREA

Golder Associates
RENO, NEVADA

PROJECT No. 063-7109 800			FILE No.	Figure 10.4	
DESIGN	PHY	01/22/10	SCALE AS SHOWN	REV.	1
CADD	AJS	01/22/10			
CHECK	KH	01/22/10			
REVIEW	BF	01/22/10			

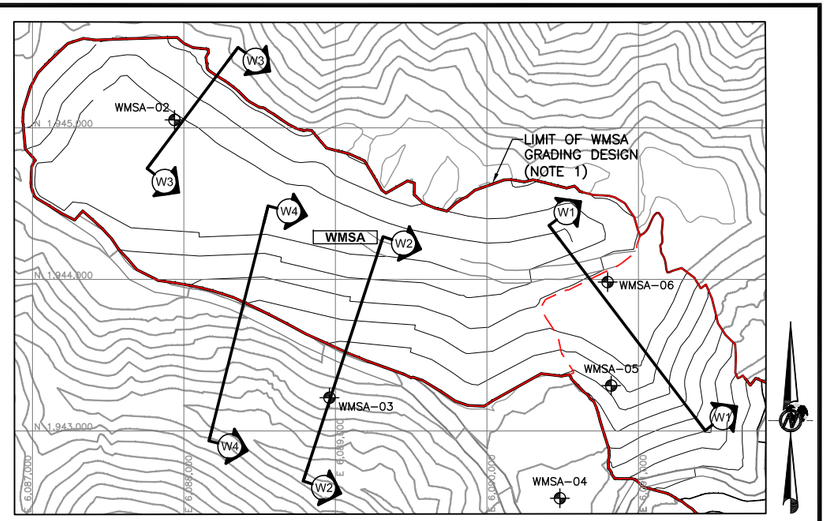
FIGURE 10.4

Friday, April 30, 2010 - 9:07am FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 10.4.dwg TAB NAME: \WMSA GEOLOGY
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES. THE FACILITY NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF



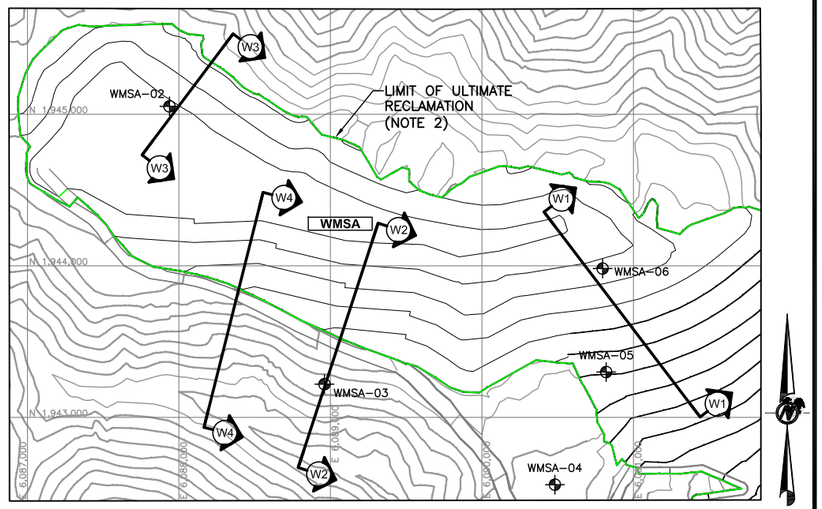
WMSA SECTION W1

SCALE 1"=200' (100 0 100 200 FEET)



WMSA GRADING DESIGN TOPOGRAPHY

SCALE 1"=1000' (500 0 500 1000 FEET)



WMSA TOPOGRAPHY AFTER ULTIMATE RECLAMATION

SCALE 1"=1000' (500 0 500 1000 FEET)

LEGEND

- EXISTING TOPOGRAPHY (50 FT INTERVAL)
- PROPOSED TOPOGRAPHY (50 FT INTERVAL)
- WMSA–02 — GEOTECHNICAL BOREHOLE – GOLDER, 2007
- W1 — SECTION ID
- EXISTING GROUND PROFILE
- PROPOSED WMSA GRADING PROFILE
- PROPOSED ULTIMATE RECLAMATION PROFILE
- APPROXIMATE PRE–DUMP TOPOGRAPHY PROFILE
- ?—?— APPROXIMATE SUBSURFACE WATER LEVEL PROFILE
- COARSE WASTE ROCK IN BOREHOLE
- NATIVE SOIL IN BOREHOLE
- BEDROCK IN BOREHOLE

NOTES

1. PROPOSED TOPOGRAPHY INSIDE THE WMSA GRADING DESIGN BOUNDARY PROVIDED BY LSCC IN DECEMBER 2009. TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2007 FLYOVER PROVIDED BY LSCC.
2. PROPOSED ULTIMATE RECLAMATION TOPOGRAPHY INSIDE THE WMSA RECLAMATION BOUNDARY PROVIDED BY LSCC IN MAY 2010. EXISTING TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2007 FLYOVER PROVIDED BY LSCC.
3. PRE–DEVELOPMENT TOPOGRAPHY PROVIDED BY LSCC IN JANUARY 2010.

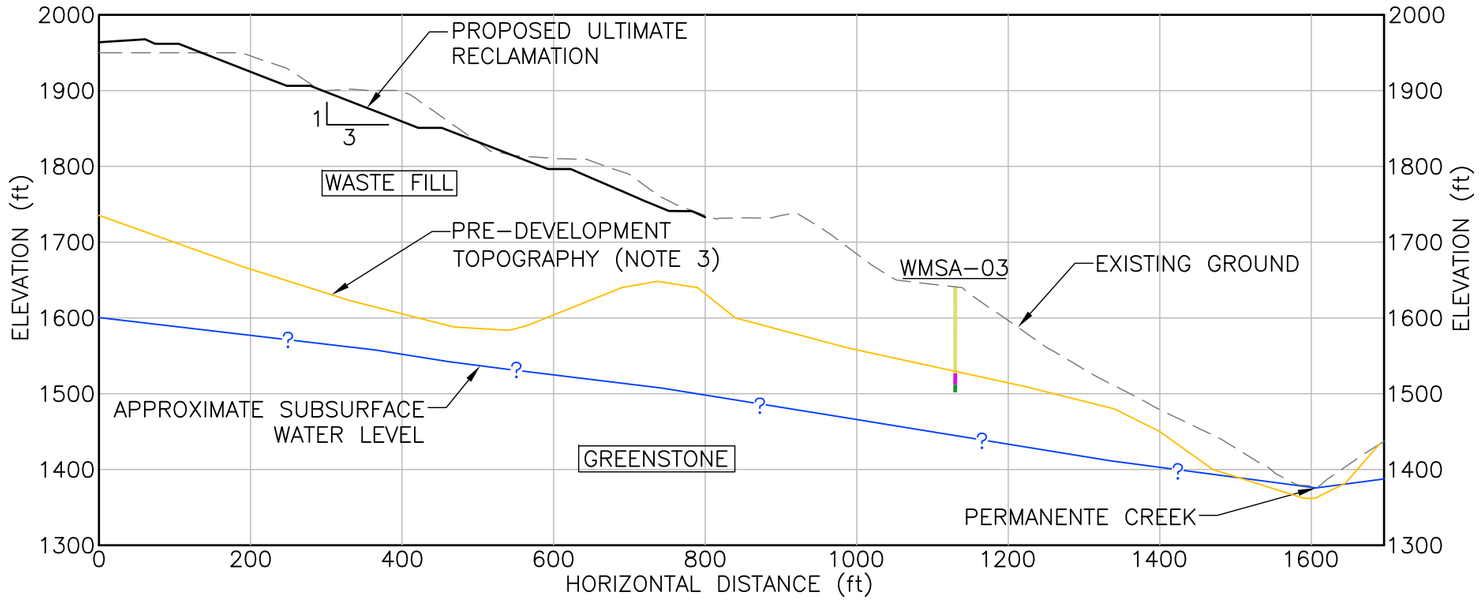
PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
CROSS-SECTION W1 FOR THE WEST MATERIALS STORAGE AREA

Golder Associates

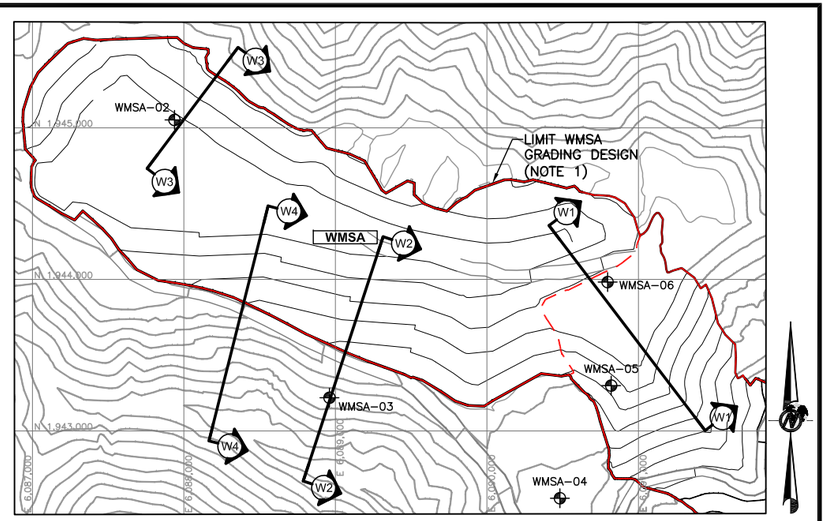
PROJECT No. 063–7109 800			FILE No.	Figure 10.5	
DESIGN	PHY	01/22/10	SCALE AS SHOWN	REV.	1
CADD	AJS	01/22/10	FIGURE 10.5		
CHECK	KH	01/22/10			
REVIEW	BF	01/22/10			

FILE: S:\HansonPermanente\Plt 1 North East Walls\Reclamation Study – 2010\Reporting\Figures R1\Figure 10.5.dwg TAB NAME \W1
Monday, May 10, 2010 – 11:01am
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.
PERFORMANCE OF THE FACILITY NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY.



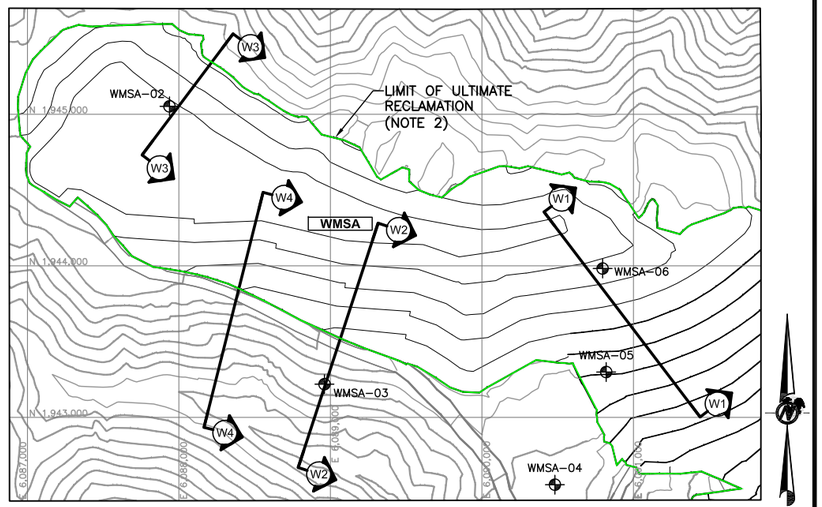
WMSA SECTION W2

100 0 100 200
SCALE 1"=200' FEET



WMSA GRADING DESIGN TOPOGRAPHY

500 0 500 1000
SCALE 1"=1000' FEET



WMSA TOPOGRAPHY AFTER ULTIMATE RECLAMATION

500 0 500 1000
SCALE 1"=1000' FEET

LEGEND

- EXISTING TOPOGRAPHY (50 FT INTERVAL)
- PROPOSED TOPOGRAPHY (50 FT INTERVAL)
- WMSA–02 — GEOTECHNICAL BOREHOLE – GOLDER, 2007
- W1 — SECTION ID
- EXISTING GROUND PROFILE
- PROPOSED ULTIMATE RECLAMATION PROFILE
- APPROXIMATE PRE–DUMP TOPOGRAPHY PROFILE
- APPROXIMATE SUBSURFACE WATER LEVEL PROFILE
- COARSE WASTE ROCK IN BOREHOLE
- NATIVE SOIL IN BOREHOLE
- BEDROCK IN BOREHOLE

NOTES

1. PROPOSED TOPOGRAPHY INSIDE THE GRADING WMSA DESIGN BOUNDARY PROVIDED BY LSCC IN JANUARY 2010. TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2007 FLYOVER PROVIDED BY LSCC.
2. PROPOSED ULTIMATE RECLAMATION TOPOGRAPHY INSIDE THE WMSA RECLAMATION BOUNDARY PROVIDED BY LSCC IN MAY 2010. EXISTING TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2007 FLYOVER PROVIDED BY LSCC.
3. PRE–DEVELOPMENT TOPOGRAPHY PROVIDED BY LSCC IN 2007.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

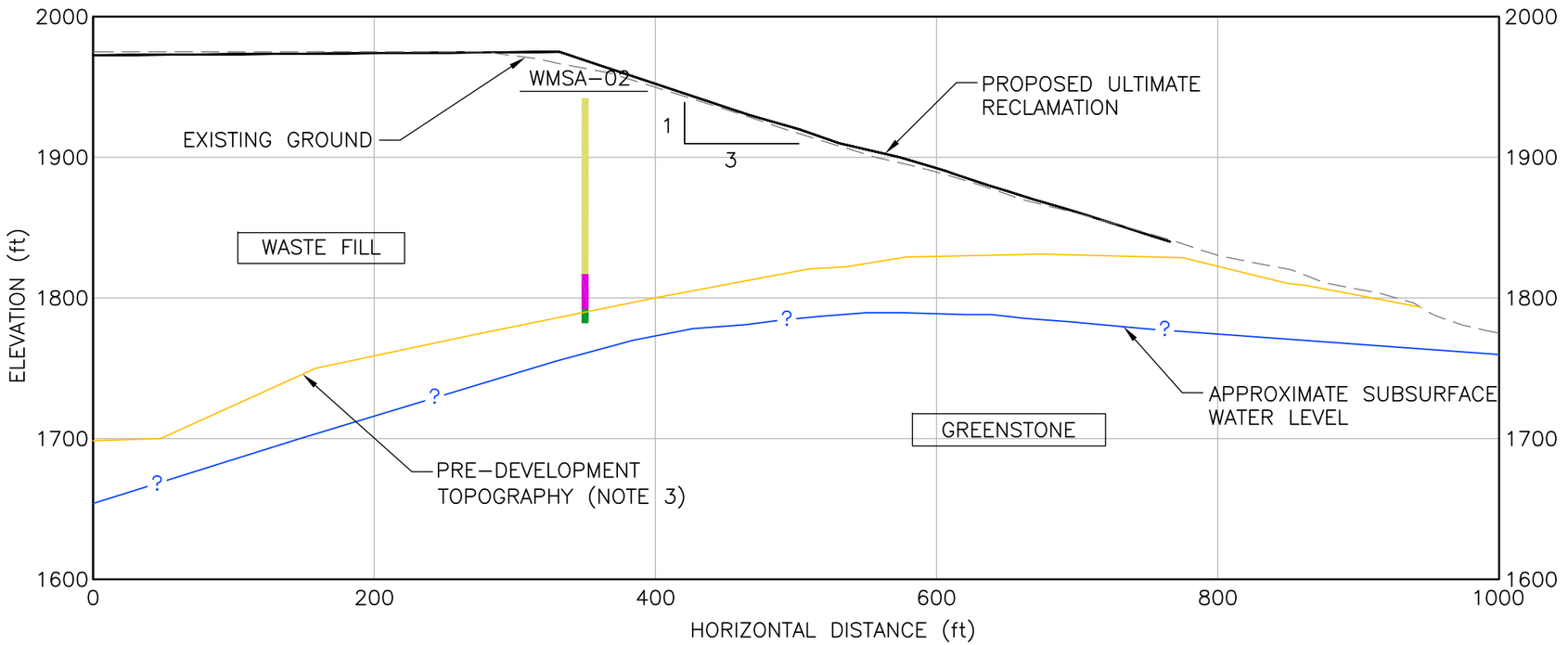
TITLE
CROSS-SECTION W2 FOR THE WEST MATERIAL STORAGE AREA

Golder Associates

PROJECT No. 063–7109 800			FILE No. Figure 10.6	
DESIGN	PHY	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	KH	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 10.6

FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study – 2010\Reporting\Figures R1\Figure 10.6.dwg TAB NAME \W2
Monday, May 10, 2010 – 11:07am
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING BY ANY PARTY OTHER THAN THE CLIENT NAMED IN THE TITLE BLOCK, SOLELY IN RESPECT OF THE CONSTRUCTION, OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK.

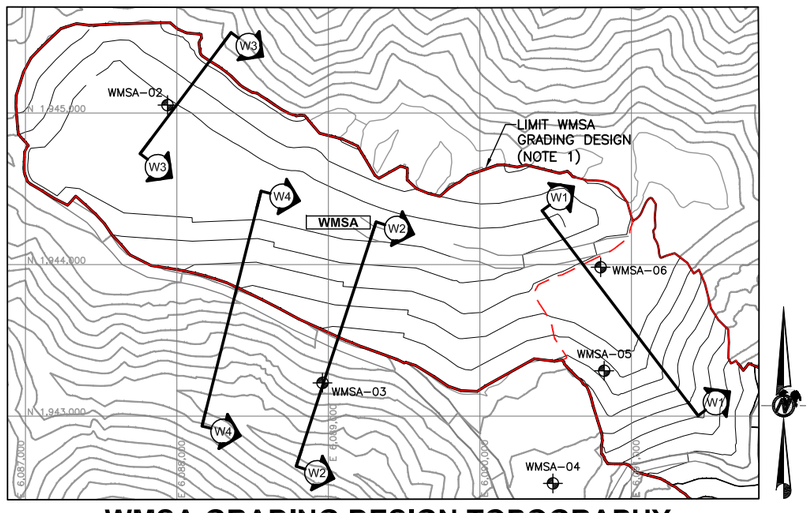


WMSA SECTION W3

SCALE 1"=100' FEET (50 0 50 100)

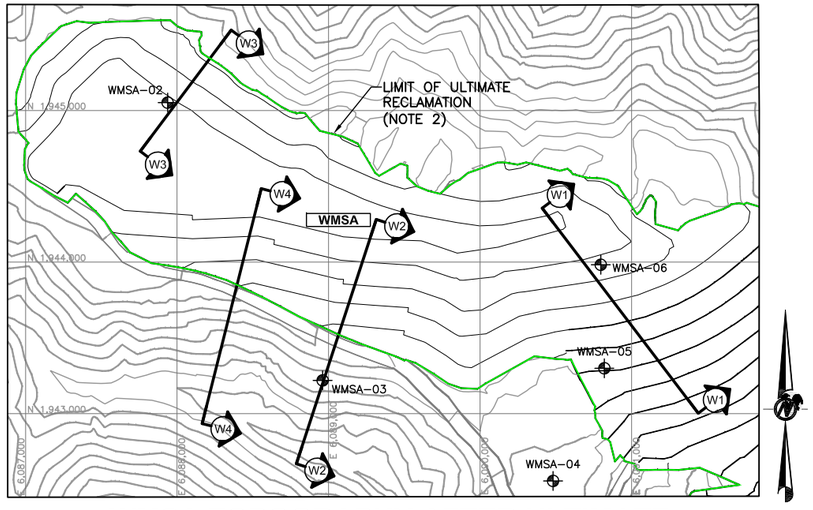
LEGEND

- EXISTING TOPOGRAPHY (50 FT INTERVAL)
- PROPOSED TOPOGRAPHY (50 FT INTERVAL)
- WMSA–02 — GEOTECHNICAL BOREHOLE – GOLDER, 2007
- W1 — SECTION ID
- EXISTING GROUND PROFILE
- PROPOSED ULTIMATE RECLAMATION PROFILE
- APPROXIMATE PRE–DUMP TOPOGRAPHY PROFILE
- APPROXIMATE SUBSURFACE WATER LEVEL PROFILE
- COARSE WASTE ROCK IN BOREHOLE
- NATIVE SOIL IN BOREHOLE
- BEDROCK IN BOREHOLE



WMSA GRADING DESIGN TOPOGRAPHY

SCALE 1"=1000' FEET (500 0 500 1000)



WMSA TOPOGRAPHY AFTER ULTIMATE RECLAMATION

SCALE 1"=1000' FEET (500 0 500 1000)

NOTES

1. PROPOSED TOPOGRAPHY INSIDE THE WMSA GRADING DESIGN BOUNDARY PROVIDED BY LSCC IN JANUARY 2010. TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2007 FLYOVER PROVIDED BY LSCC.
2. PROPOSED ULTIMATE RECLAMATION TOPOGRAPHY INSIDE THE WMSA RECLAMATION BOUNDARY PROVIDED BY LSCC IN MAY 2010. EXISTING TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2007 FLYOVER PROVIDED BY LSCC.
3. PRE–DEVELOPMENT TOPOGRAPHY PROVIDED BY LSCC IN JANUARY 2010.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

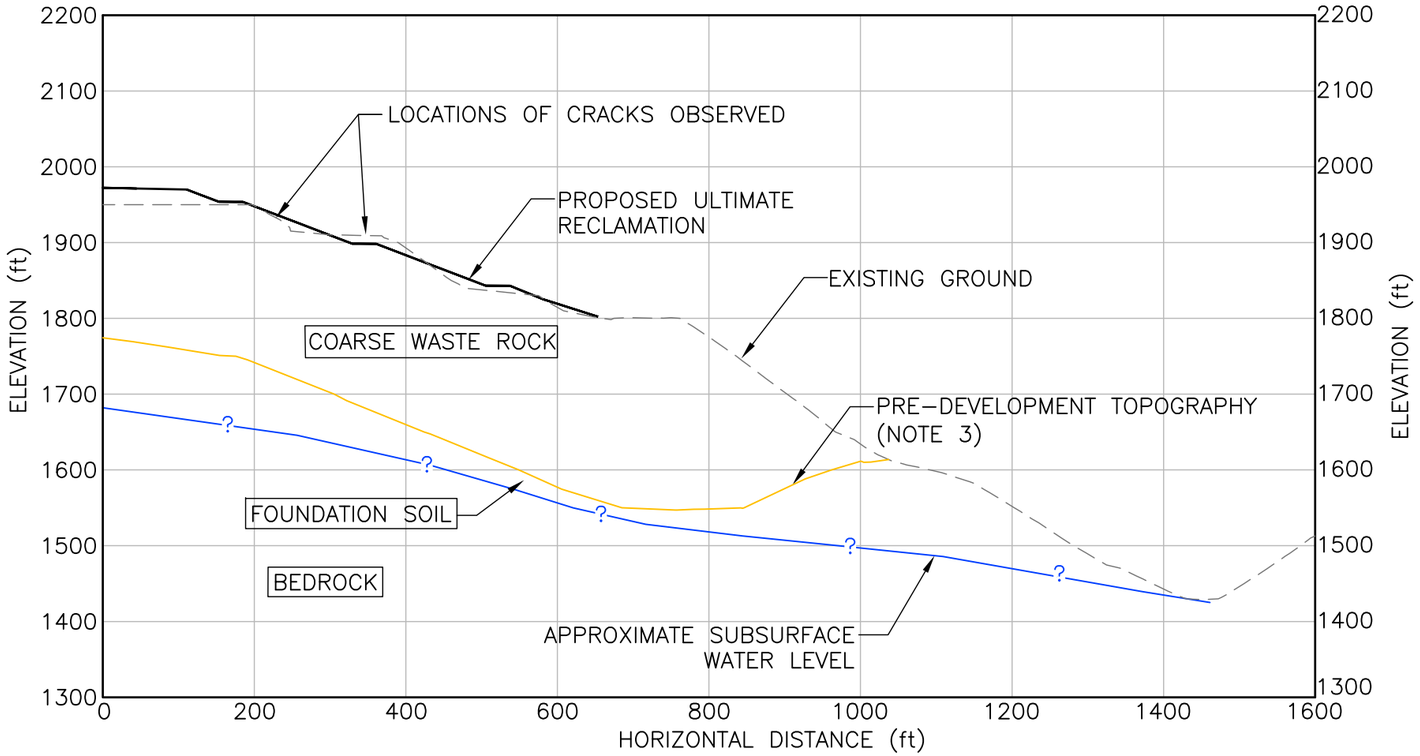
TITLE
CROSS-SECTION W3 FOR THE WEST MATERIALS STORAGE AREA

Golder Associates

PROJECT No. 063–7109 800			FILE No.	Figure 10.7
DESIGN	PHY	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	KH	01/22/10		
REVIEW	BF	01/22/10		

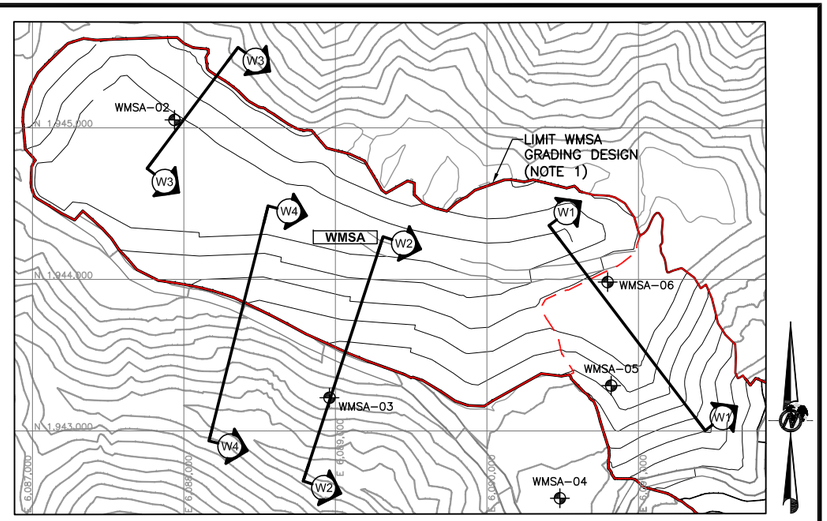
FIGURE 10.7

FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study – 2010\Reporting\Figures R1\Figure 10.7.dwg TAB NAME \W3
Monday, May 10, 2010 – 11:11am
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



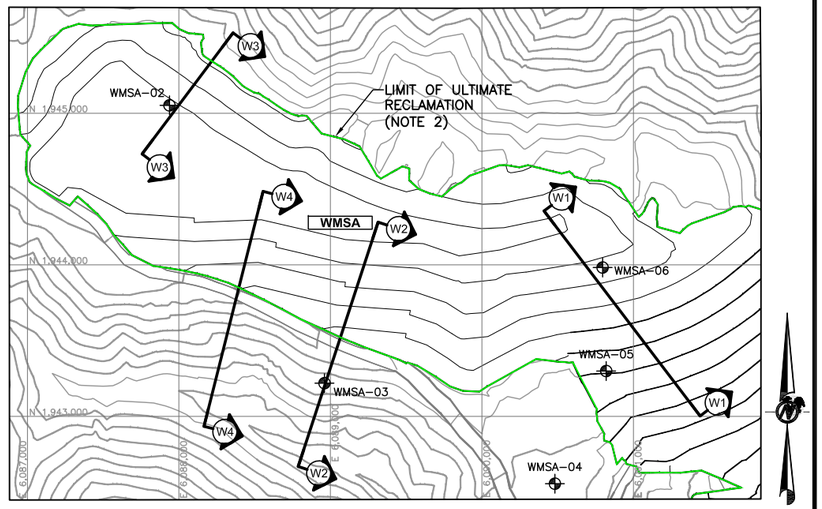
WMSA SECTION W4

100 0 100 200
SCALE 1"=200' FEET



WMSA GRADING DESIGN TOPOGRAPHY

500 0 500 1000
SCALE 1"=1000' FEET



WMSA TOPOGRAPHY AFTER ULTIMATE RECLAMATION

500 0 500 1000
SCALE 1"=1000' FEET

LEGEND

- EXISTING TOPOGRAPHY (50 FT INTERVAL)
- PROPOSED TOPOGRAPHY (50 FT INTERVAL)
- WMSA-02 — GEOTECHNICAL BOREHOLE – GOLDER, 2007
- W1 — SECTION ID
- EXISTING GROUND PROFILE
- PROPOSED ULTIMATE RECLAMATION PROFILE
- APPROXIMATE PRE-DEVELOPMENT PROFILE
- ?—?— APPROXIMATE SUBSURFACE WATER LEVEL PROFILE

NOTES

1. PROPOSED TOPOGRAPHY INSIDE THE WMSA GRADING DESIGN BOUNDARY PROVIDED BY LSCC IN JANUARY 2010. TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2007 FLYOVER PROVIDED BY LSCC.
2. PROPOSED ULTIMATE RECLAMATION TOPOGRAPHY INSIDE THE WMSA RECLAMATION BOUNDARY PROVIDED BY LSCC IN MAY 2010. EXISTING TOPOGRAPHY OUTSIDE THIS BOUNDARY IS FROM APRIL 2007 FLYOVER PROVIDED BY LSCC.
3. PRE-DEVELOPMENT TOPOGRAPHY PROVIDED BY LSCC IN JANUARY 2010.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
CROSS-SECTION W4 FOR THE WEST MATERIALS STORAGE AREA

Golder Associates

			PROJECT No. 063-7109 800	FILE No.	Figure 10.8
DESIGN	PHY	01/22/10		SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	KH	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 10.8

Monday, May 10, 2010 - 11:15am FILE: S:\HansonPermanente\Pit 1 North East Wells\Reclamation Study - 2010\Reporting\Figures R1\Figure 10.8.dwg TAB NAME \W4
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.

11.0 TOPSOIL STORAGE AREA

11.1 Background

Golder completed geotechnical investigations for the proposed temporary Topsoil Storage Area located on the south side of Permanente Creek in the side canyon above the Rock Plant (Figure 11.1). The proposed Topsoil Storage Area will be used to store topsoil strippings resulting from the development of South Quarry. This Storage Area is temporary and the topsoil material will be removed and used to reclaim South Quarry and potentially other related areas of mining. This geotechnical engineering investigation was performed in support of the temporary Storage Area design.

The scope of work for this evaluation included: a review of published geologic maps, site reconnaissance, aerial photograph review, three subsurface borings, geotechnical laboratory testing, and slope stability analyses.

11.2 Site Conditions

The review of published literature and site reconnaissance indicated that the site is underlain by Santa Clara Formation bedrock materials overlain by a significant existing, but older and heavily vegetated Storage Area of fill materials. The fill materials are likely related to the historical operations of the aggregate plant and are comprised primarily of sand and gravel-sized materials with abundant clay fines that were likely out of specification. The limit of the fill materials was mapped in the field and on aerial photographs. Sorg and McLaughlin (1975) show a suspected landslide in the area of the fill; but based on the field reconnaissance it is Golder's opinion that they mistook the fill prism for the morphology of an older landslide, or perhaps were mapping colluvium. No landslide is mapped in the same area by Rogers and Armstrong (1973) in their larger scale investigation and Golder saw no evidence for a landslide when reviewing aerial photographs of the site, although there are significant colluvial deposits evident in areas of the canyon not overlain by the old fill.

11.3 Subsurface Investigation and Geotechnical Laboratory Testing

Three geotechnical boreholes were drilled to investigate the foundation conditions at the locations shown in Figure 11.1 in August 2009. All boreholes were performed with a truck-mounted drill rig equipped with hollow stem auger drilling tools and logged by a Golder field engineer. Standard Penetration Tests (SPT) were performed in accordance with ASTM D1586 to provide an estimate of in-situ properties of soils. Soil samples were collected using a split-spoon sampler then capped and placed in sealed bags for laboratory testing. The drilling depths range from 35 ft to 60 ft below ground surface (bgs). Upon completion of drilling, all boreholes were backfilled with grout. The boring logs are provided in Appendix 11.A.

Selected soils samples were hand delivered to Cooper Testing Laboratory in Palo Alto, California, for testing. The testing program consisted of the following:

- Moisture and Density Determination (ASTM D2937): Four tests were performed on the relatively undisturbed soils sampled using brass liners to characterize the in-place conditions of soils
- Sieve Analysis (ASTM D421) and Atterberg Limits (ASTM D 4318): Sieve analyses and Atterberg limit testing were completed on eleven soil samples for soil index testing
- Direct Shear Testing (ASTM D 3080): Four direct shear tests were performed, with each test consisting of three points, to determine the undrained strength of the soils under consolidated conditions.

The findings of these investigations indicate that most of the eastern portion of the proposed Topsoil Storage Area is underlain by an existing aggregate rock fill with varying thickness; underneath the fill material are a thin layer of native soils and the Santa Clara Formation bedrock. The remaining Storage Area is underlain by the Santa Clara Formation bedrock comprised of consolidated sand, silt, gravel and clay. No unfavorable conditions were identified in the fill such as loose, saturated conditions, or clay-rich fine-grained soil/fill was encountered in any of the three boreholes. The subsurface investigation generally indicates favorable foundation conditions for Storage Area development. The results of the laboratory tests are included in Appendix 11.B.

Among the three boreholes drilled, two boreholes (TSS-1 and TSS-3) encountered groundwater at approximately 30 and 50 ft bgs respectively. Although the drilling program indicates a relatively high groundwater level below the native ground surface, the existing fill and native soils appear to be above the permanent groundwater table.

11.4 Earth Materials Properties

The properties of the earth materials encountered at the site are summarized below.

11.4.1 Topsoil Fill

The strength of the topsoil fill is expected to vary significantly with the degree of saturation. When it is dry, organic soil usually has a good strength (Terzarghi et. al. 1996) with organics possibly acting as “reinforcement” which may enhance shear strength locally. However this “reinforcement” effect is unreliable and could deteriorate over time. Moreover, due to its high compressibility, we expect significant disturbance to the fill during construction which may reduce the strength of fill from its peak value. Review of the index testing performed on near-surface soil samples collected in the vicinity indicate that a friction angle of 26 degrees is appropriate for representing the drained strength of the topsoil fill that could experience disturbance during construction.

11.4.2 Existing Fill

The field log indicates that the existing fill is a mixture of clay, sand and gravel but primarily sand and gravel according to the laboratory testing data. The SPT blow counts ranged from 9 to sampler refusal, but mostly between 9 and 12, indicating this unit is loose to medium dense. No lab strength testing was performed on this unit. Review of past research on the density-strength correlation (Peck, et al, 1974)

indicates that an average drained strength of zero cohesion and a 30-degree friction angle is appropriate for long-term stability evaluation.

11.4.3 Foundation Soil

We assume all vegetation will be removed prior to the placement of new fill. This material unit includes the in-place topsoil and underlying native soils above the Santa Clara Formation both under the existing fill unit and outside the limits of the existing fill. The foundations soils are generally characterized as Sandy Clay/Clayey Sand/Clayey Gravel/Silty Sand. Two direct shear tests performed on this unit resulted in an undrained strength characterized with cohesion of 900-1250 psf and a friction angle of 17 to 37 degrees. The blow counts vary widely from 9 to 74, averaging about 29. The measured PI values range from 3 to 19 averaging at 12. Review of literature and Golder's engineering judgment indicate that zero cohesion and an average friction angle of 30 degrees is an appropriate assumption for the drained strength of this unit.

11.4.4 Santa Clara Formation

The split spoon samplers collected dense to very dense sandy and gravelly soils in this unit. A drained strength with zero cohesion and an internal friction angle of 36 degrees appears to be a conservative assumption to model this rock unit.

Table 11.1 summarizes the material properties discussed above.

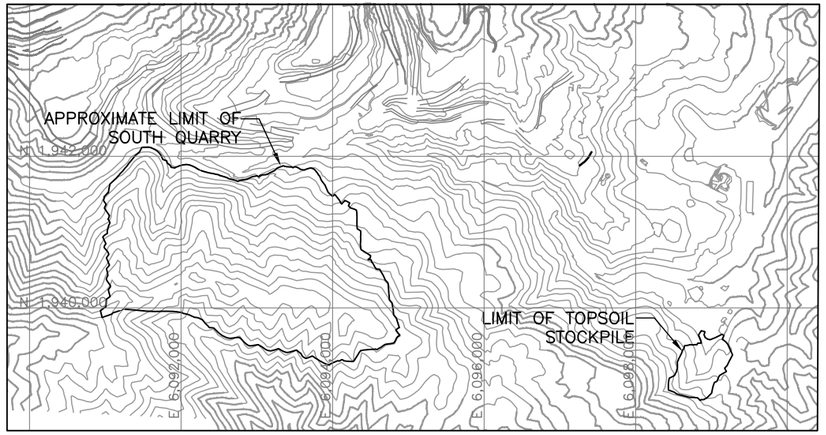
TABLE 11.1
MATERIAL PROPERTIES FOR TOPSOIL STORAGE AREA STABILITY ANALYSES

Material	Unit Weight, pcf	Cohesion, psf	ϕ Degree
Topsoil Fill	110	0	26
Existing Fill	125	0	30
Foundation Soil	120	0	30
Santa Clara Formation	135	0	36

11.5 Design Considerations

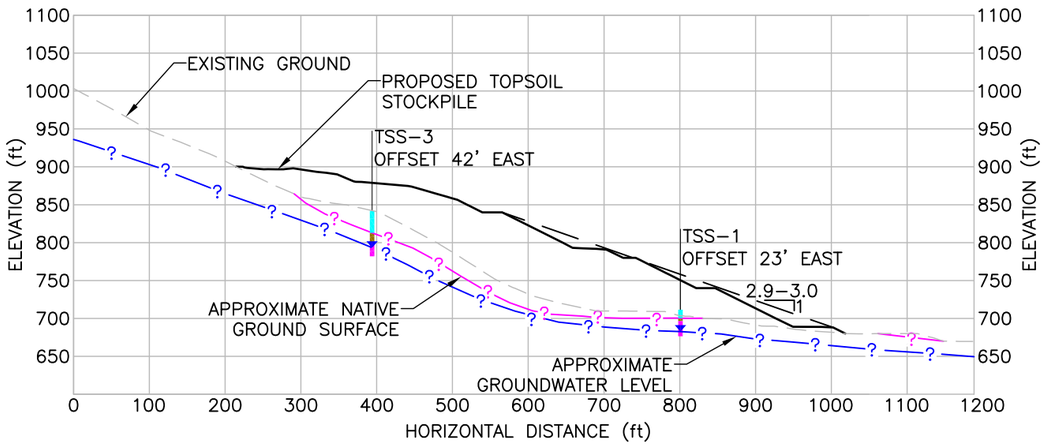
The proposed Topsoil Storage Area grading plan includes 2H:1V inter-bench slopes and 2.9H:1V to 3.0H:1V overall slopes. Figure 11.1 shows the proposed design layout and a typical section with our interpretations of the geological conditions and groundwater level. The following summarize Golder's findings and recommendations regarding the proposed temporary Storage Area.

- The proposed fill has adequate stability and acceptable seismic performance given the temporary nature of the Storage Area. It is recommended that Lehigh conduct an inspection following strong earthquake ground motions and promptly repair any damaged slopes and/or surface drainage conveyances.
- Proper foundation preparation is required prior to placement of the topsoil fill including: stripping of vegetation, and removal of soft and/or loose soils from beneath the outer 25 feet of the toe of the fill (i.e., preparation of a 25-foot wide keyway of sufficient depth estimated at three to five-feet minimum).
- The topsoil fill should be adequately drained (i.e. no pore pressure build-up within the fill). Adequate surface drainage conveyance structures should be included in the final design of the fill to prevent saturation of the fill. A subdrain system should be installed within the thalweg of the current drainage channel to collect potential subsurface seepage that could saturate the lower portions of the fill.
- Final design by Lehigh should incorporate facilities to convey existing surface drainage in the natural drainage channel either (1) around the perimeter of the fill, or (2) underneath the fill in an appropriately sized culvert.



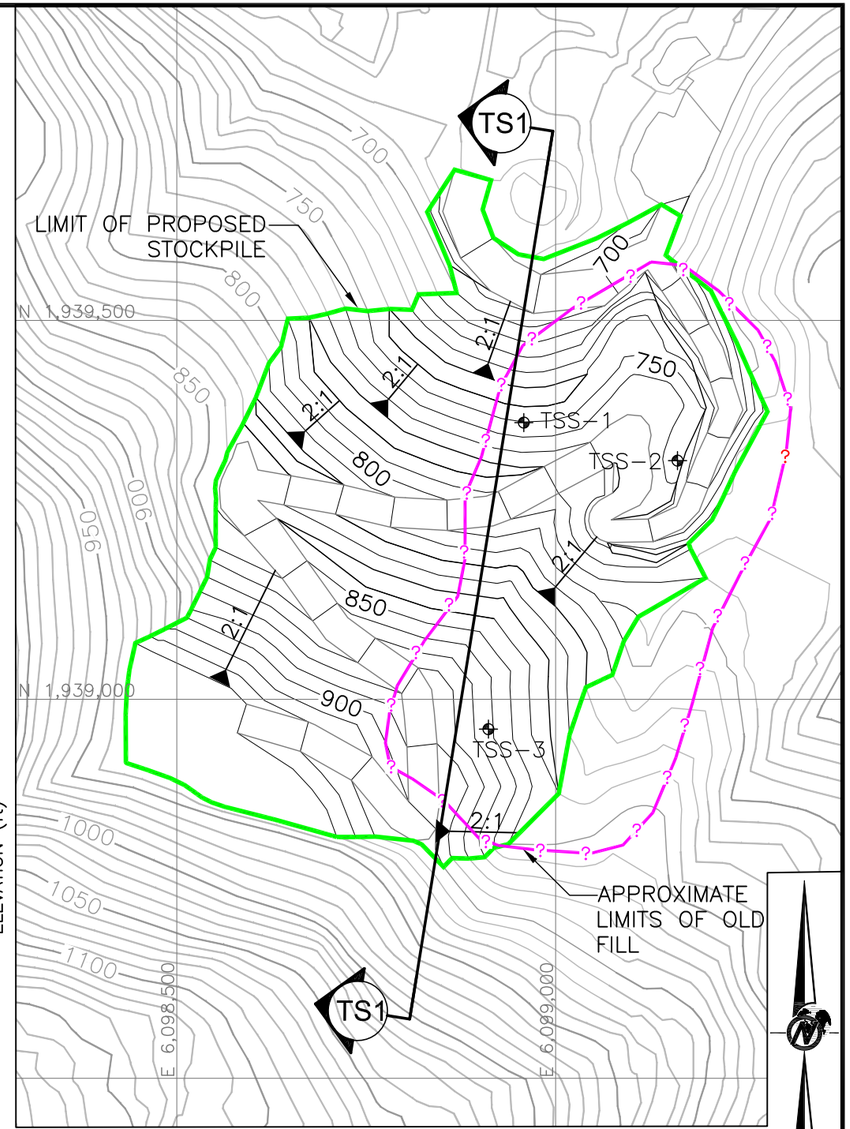
SITE LAYOUT

1000 0 1000 2000
SCALE 1"=2000' FEET



TOPSOIL STOCKPILE SECTION TS1

100 0 100 200
SCALE 1"=200' FEET



PROPOSED TOPSOIL STOCKPILE DESIGN

100 0 100 200
SCALE 1"=200' FEET

LEGEND

- EXISTING TOPOGRAPHY (10 FT INTERVAL)
- PROPOSED TOPOGRAPHY (10 FT INTERVAL)
- LIMIT OF PROPOSED STOCKPILE
- TS1 SECTION ID
- APPROXIMATE LIMIT OF OLD FILL
- TSS–1 AUGUST 2009 BOREHOLE LOCATION
- PROPOSED TOPSOIL STOCKPILE PROFILE
- APPROXIMATE NATIVE GROUND SURFACE
- APPROXIMATE GROUNDWATER LEVEL
- FILL
- TOPSOIL
- SANTA CLARA FORMATION

NOTES

1. THE PROPOSED TOPSOIL STOCKPILE DEVELOPMENT PLAN WAS PROVIDED BY LSCC IN DECEMBER 2009.
2. EXISTING TOPOGRAPHY OUTSIDE THE NORTH QUARRY BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
PROPOSED TOPSOIL STOCKPILE DESIGN

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 11.1
DESIGN	PHY	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	GM	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 11.1

FILE: S:\HonsonPermanente\Pit 1 North East Walls\Reclamation Study – 2010\Reporting\Figures R1\Figure 11.1.dwg TAB NAME \Figure 12.1
Thursday, April 29, 2010 – 3:54pm
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES. IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK, SOLELY

12.0 SOUTH QUARRY STABILITY EVALUATIONS

12.1 Site Conditions

The South Quarry will be located south of Permanente Creek, in undeveloped ground about 500 feet south of the crest of the North Quarry (Figure 1.2).

12.1.1 Current Topography

The South Quarry will be developed into a west-northwest-trending ridge, just south of Permanente Creek (Figure 12.1). With the exception of pioneered roads associated with historic and current exploration activities, the area is undeveloped.

Within the limits of the ultimate quarry, elevations range from approximately 2000 feet along the ridge in the southwest corner, to 1100 feet in the northeast corner near the creek. Average overall slope angles are typically around 25˚. The steepest natural slopes are on the order of 40˚ over limited heights (100-200 feet) and generally correspond to limestone outcrops.

12.1.2 Quarry Plans

The South Quarry will be developed in five phases over a period of about 20 years. The approximate quarry limits for each phase are shown in Figure 12.1, but for current purposes only the “ultimate” quarry design representing the maximum excavation prior to backfill, as shown in Figure 12.2, is considered in detail. The ultimate quarry floor in the east half of the quarry will be at elevation 925 feet, approximately 150 feet below Permanente Creek. By the end of Phase 5, the lower benches of the quarry will be backfilled to elevation 1110-1120 feet, above the level of Permanente Creek (Figure 12.3).

Designs for all phases are based on a production bench height of 50 feet, and bench configurations that vary by lithology. Limestone slopes are designed with a nominal inter-ramp (i.e., crest-to-crest) slope angle of 45-50˚. Other lithologies comprise weaker, more variable rock masses, and slopes in these units are designed according to the following parameters:

- Bench face angle 2H:1V (over 50 ft vertical height);
- Nominal catch bench width -- 50 feet;
- Nominal overall slope angle – 3H:1V;
- Benches graded to provide positive drainage from quarry benches to topography around quarry perimeter.

The inter-ramp slope angle for these lithologies is based in part on slope performance experience in the North Quarry, particularly with respect to the low-strength rocks involved in the Main Slide (1987) and Scenic Easement Slides in the north wall; and the Mid-Peninsula slide in the east wall.

12.1.3 South Quarry Geological Conditions

The description of general geological conditions for the North Quarry in Section 4.2 applies to the South Quarry as well. Geological conditions for the South Quarry detailed in the following sections draw on the discussions from Section 4.2, but also incorporate details that are based on field investigations and geological interpretation specific to the South Quarry.

12.1.3.1 Lithology

The major lithologic units that occur in the South Quarry area include limestone, greenstone, Graywacke, fault breccia, and metabasalt. These are described briefly as follows:

- Metabasalt is medium to dark gray and fine-grained, and commonly contains abundant milky calcite veins and scattered pyrite crystals. Vesicles are present locally and occasionally filled with calcite. Chlorite content is variable but generally low.
- Greenstone developed from the same parent lithologies as metabasalt but has higher chlorite content. It is greenish-gray and contains scattered pyrite crystals and opaque minerals. Vesicles, calcite-filled vesicles, and milky calcite veins occur locally.
- Graywacke ranges from yellowish brown to black, and is generally very fine grained to fine grained, although local conglomeratic intervals exist. Slickensides are common, and may be coated with graphite. Scattered milky calcite veins and pyrite occur locally.
- Limestone is light gray to medium dark gray, and fine to medium grained. Stylolites (contacts marked by irregular interlocking penetrations of the two sides) are common, and black chert nodules are usually present in concentrations of 15% or less. The limestone is locally dolomitic, and commonly emits a strong bituminous odor when broken.
- Fault breccia is dark gray to black and may be clast- or matrix-supported. The matrix consists of soft, very fine fault gouge. Clasts are limestone, greenstone, Graywacke, or metabasalt, or some combination thereof. This unit may be highly sheared and deformed, and well-developed slickensides are common. Milky calcite veins and scattered pyrite occur locally.

12.1.3.2 Structure

The rocks within the quarry consist of an imbricate thrust stack of layered, folded and faulted limestones, greenstones, and metabasalts. Contacts between these units are typically thrust faults. This thrust stack is tectonically overlain by continentally-derived Graywackes, shales, and argillites.

In the area of the North Quarry, the limestone-metabasalt sequence is folded into an upright to steeply inclined synform that plunges gently to the southeast. The Graywacke-limestone-metabasalt sequence in the area of the South Quarry occurs in the southwest limb of the synform, and appears to dip gently to the northeast.

A segment of the Northwest Berrocal Fault Strand strikes west-northwest, just north of Permanente Creek, through the south wall of the North Quarry. Within the limits of the South Quarry, fault locations

and orientations are not well known, although preliminary geologic mapping and interpretation indicates a series of steep faults that strike north-south to north-northeast.

12.1.3.3 Landslides

A large, ancient landslide has been mapped along the east side of the South Quarry, with approximate limits as shown in Figure 12.1 and 12.2. This feature has been mapped at a regional scale, and was also mapped through aerial photo interpretation as part of this study. The geomorphology is typical of large landslides in the region, with relatively gentle unit surfaces, drainages developed along lateral margins, and a wide toe that causes a northward deflection in the course of Permanente Creek. Note, however, that the mapped Northwest strand of the Berrocal fault extends through the upper margin of the mapped slide, separating two fundamentally different rock units, which may also account for the slope morphology.

The postulated landslide extends along Permanente Creek for approximately 2000 feet, and up-slope for about 1400 feet. The landslide is estimated to be several hundred feet thick. Borehole Geo4-20A logs interbedded sequence of fault breccia, metabasalt and Graywacke to 425 feet bgs; with no obvious lithologic change diagnostic of a transition from landslide to intact bedrock. Borehole GT4-29A logs approximately the upper 100 feet of the boring as landslide debris, which is underlain by interbedded fault breccia and metabasalt to a depth of 450 feet.

The postulated landslide occupies a relatively low slope position and given the position and morphology of the feature, is considered to be an ancient landslide that likely occurred in the late Pleistocene during a period of lower sea level and downcutting of Permanente Creek. The toe of the landslide is now effectively buttressed by its position against the opposite south-facing creek bank of Permanente Creek.

With respect to quarry development, Phases 1, 2, 3, 4 and 5 are west of the mapped boundary of the main landslide, although each phase will expand the South Quarry toward the landslide boundary. The east limit of the Phase 5 quarry extends just within the mapped boundary of the main landslide. The presence of the landslide, does not affect development of the South Quarry although the access road for the quarry does traverse the suspected landslide terrane. No fills are planned for the road, however, several cuts are proposed along the upslope side of the road. These cutslopes are temporary features associated with development of the South Quarry and will be reclaimed following the completion of the South Quarry. It would be prudent to assume that some engineering measures (i.e., drainage control, soil nailing, retaining walls, etc.) may be required in some areas of the cutslopes to provide temporary stabilization during the life of the South Quarry. Stability of the cutslopes, and recommendations for supplemental stabilization if necessary, should be evaluated following development of the access road, grading of the cutslopes, and engineering geologic mapping.

12.1.4 Hydrogeological Conditions

Monitoring across the South Quarry indicates that groundwater levels increase from approximate elevation 1000 feet at Permanente Creek, to elevation 1600 feet at the ridge near the crest of the planned south wall. Groundwater occurs approximately 50 to 100 feet below the existing ground surface in the South Quarry area, so most of the rock mass that will be exposed in the quarry walls is currently saturated.

Groundwater levels within and near the South Quarry will be affected by quarry development, with different conditions during and after quarry operations. These conditions were evaluated with groundwater flow modeling based on the hydrogeological characterization data listed in Section 12.2.

12.2 Available Data

Data that are available to support the quarry pitslope design evaluation for the South Quarry include:

- Geotechnical core logging and field point load testing for coreholes in the South Quarry area, including 15 exploration coreholes that were located for both resource estimation and geotechnical characterization, and five drilled for resource estimation (Figure 12.1 and Table 12.1);
- A lithology block model developed by TerraSource;
- A geological model developed by TerraSource from the block model, which includes 3-dimensional solids for the Footwall Fault Breccia, Graywacke, and three grades of limestone as listed in Table 12.2;
- Corehole televiewer logging to evaluate rock structure conditions in limestone intervals in four coreholes;
- Televiewer logging data from four coreholes in the south wall area of the North Quarry (these are north of the South Quarry area, but in some cases provide data that are useful in interpreting the televiewer logging data from the South Quarry coreholes);
- A limited program of laboratory testing that included unconfined compressive strength (UCS) and triaxial compressive strength of intact samples of rock core; and direct shear, sieve analyses, and Atterberg limits testing of disturbed samples of fine-grained fault breccia;
- Laboratory testing data from previous slope design studies completed for the North Quarry;
- Rock mass shear strength estimates from back analyses of landslides in the North Quarry (these are considered to be relevant because rock quality in the South Quarry lithologies other than limestone appears to be comparable to the poor quality rock masses involved in these slides).
- Hydrogeological characterization data:
  - Groundwater level monitoring in piezometers and monitoring wells installed in the South Quarry area.
  - Aquifer properties from packer testing completed in selected intervals of some geotechnical coreholes.
  - Aquifer properties from slug testing of monitoring wells installed in the South Quarry area.

- Aquifer properties from a pump test completed in September 2009.

TABLE 12.1
AVAILABLE GEOTECHNICAL DATA FROM COREHOLES

Hole ID	Easting ,ft	Northing, ft	Elev, ft	TD, ft	Azimuth	Inclination	Geotech Core Logging	TV Data	Primary Purpose
GEO4-20A	6095219	1941148.921	1224.83	453		-90	x		Resource
GEO4-27A	6093654	1941603.248	1244.39	799	200	-55	x		Resource
GEO4-31B	6094435	1940253.766	1629.93	350	135	-60	x		Resource
GEO4-38B	6093852	1940867.674	1482.36	850		-90	x		Resource
GEO4-40A	6092618	1941332.864	1517.45	479.5	20	-80	x		Resource
GT1-1	6093150	1942455.696	1048.3	473		-90	x	x	Geotech
GT1-2	6092795	1942407.132	1044.3	476.5	360	-60	x	x	Geotech
GT1-3	6093738	1942384.099	1051.3	436.5		-90	x	x	Geotech
GT1-4	6093435	1942128.249	1109.3	268		-90	x	x	Geotech
GT3-2A	6091302	1941218.744	1661.3	514		-90	x		Geotech
GT3-3A	6091495	1941697.141	1538.5	451	15	-70	x	x	Geotech
GT3-3B	6091495	1941697.141	1538.5	549	305	-70	x		Geotech
GT3-4	6092268	1940864.47	1729.3	513		-90	x	x	Geotech
GT3-4A	6092268	1940864.47	1729.3	204.5	180	-45	x		Geotech
GT3-5A	6092289	1941172.825	1684.98	700	270	-55	x		Geotech
GT3-6A	6092215	1940564.121	1808.9	500	200	-75	x		Geotech
GT4-25A	6093649	1940546.839	1661.72	392.2		-90	x	x	Geotech
GT4-25B	6093649	1940546.839	1661.72	352	200	-55	x	x	Geotech
GT4-29A	6094934	1940559.59	1418.55	498	180	-45	x		Geotech
GT4-29B	6094934	1940559.59	1418.55	500	245	-45			Geotech
GT4-30A	6094240	1939995.521	1775.66	713	340	-60	x		Geotech
GT4-30B	6094240	1939995.521	1775.66	683	260	-60			Geotech
GT4-33A	6093377	1940237.45	1812.37	700		-90	x		Geotech
GT4-33B	6093377	1940237.45	1812.37	678	315	-60			Geotech

TABLE 12.2
INTERSECTIONS OF MODELED LITHOLOGIES IN COREHOLES

Hole ID	Quarry Shell Intersection, ft	Overburden		Landslide Debris		FW_Green-Stone_Fault Breccia		Hanging Wall Greywacke		FW_Med Grade Limestone		High Grade Limestone		HW_Med Grade Limestone	
		From, ft	To, ft	From , ft	To, ft	From, ft	To, ft	From, ft	To, ft	From , ft	To, ft	From , ft	To, ft	From, ft	To, ft
GT3-2a	140	0	35			100	514								
GT3-3b	230	0				375	549			300	375	175	300	25	175
GT3-3a	270	0	20							330	451	200	330	0	200
GT3-5a	360	0	50			664	700	0	457.5	457.5	664				
GEO4-40a	300	0	15							438	479.5	203	438	0	203
GT3-4	300	0	35			478	513	20	76	280	478	260	280	76	260
GT3-4a	all above	0	35			125	204.5	0	105.2					105.2	125
GT3-6a	295	0	63			25	500								
GT4-33b	650	0	95			0	678								
GT4-33a	480	0	30			0	700								
GT4-25a	all above	0	31					295	392.2					0	295
GT4-25b	all above	0	23					300	352					0	300
GEO4-38b	270	0	80					0	619					619	699
GEO4-27a	170	0	39					45	300			700	799	300	700
GEO4-20a	outside	0	26			304	453	30	304						
GT4-30a	400	0	95			0	713								
GT4-30b	300	0	84			0	683								
GEO4-31b	150	0	36			0	350								
GT4-29b	outside	0	53	53	116.3	75	500	0	75						
GT4-29a	outside	0	20	20	105.9	0	498								

Notes
1 Pit shell intersection depths based on ultimate Quarry design
2 Three limestone lithologies combined for engineering geological characterization purposes

12.3 Geological Engineering Characterization

An engineering geological model was developed from the data sources listed above to provide the engineering framework for evaluating slope designs for the South Quarry. The model consists of the following:

- Geological model
- Large-scale geological structure (faults, contacts)
- Rock fabric in the limestone
- Material properties (unconfined compressive strength, discontinuity shear strength, Hoek-Brown mi, and unit weight)
- Rock mass properties (RMR, rock mass shear strength)
- Groundwater conditions

12.3.1 Geological Model

The TerraSource geological model is the foundation for the engineering geological characterization. The model includes the five 3-dimensional lithology solids representing the lithological units described previously, but based on similar material and rock mass properties, the three limestone grade shapes were combined for stability analysis purposes. Therefore, the engineering geological characterization was developed in terms of the following, which are referenced subsequently as “model rock masses”:

- Hanging Wall Graywacke (includes Greenstone and Conglomerate)
- Footwall Fault Breccia (includes Greenstone)
- Limestone (all grades)

The estimated exposures of the model rock masses in the ultimate South Quarry are shown in Figure 12.4. Geotechnical core logging and televiewer data were assigned to these units based on data from the intervals summarized in Table 12.2.

Lehigh contract geologists logged five general rock types in South Quarry coreholes, namely Graywacke, greenstone, metabasalt, limestone, and fault breccia. The occurrence of these rock types is complex, and developing the 3-dimensional shapes for the geological model required some grouping of rock types. For the South Quarry area coreholes summarized in Table 12.1, Lehigh geological logging indicates the breakdown of rock types within the model rock masses listed in Table 12.3

TABLE 12.3
DISTRIBUTION OF ROCK TYPES WITHIN MODEL ROCK MASSES

Lithology	Footwall Fault Breccia		Hanging Wall Graywacke		Limestone	
	Footage	% of Total	Footage	% of Total	Footage	% of Total
Metabasalt	14	0.5%	11	1%	0	0%
Fault Breccia	1188	40%	572	45%	66	2%
Graywacke	24	1%	472	37%	56	2%
Limestone	318	11%	25	2%	2927	94%
Greenstone	1364	46%	183	15%	69	2%

It is significant that “fault breccia” was logged in 40% of the combined intersections of the Footwall Fault Breccia rock mass; and 45% of the combined intersections in the Hanging Wall Graywacke rock mass. Geotechnical core logging data indicates widely variable rock mass quality in both, with the lowest quality rock in “fault breccia” intersections; and somewhat better rock quality in intersections logged as greenstone, Graywacke, and metabasalt. However, the occurrence of the better quality rock within the Footwall Fault Breccia and Hanging Wall Graywacke rock masses is not predictable, and given the high proportion of poor quality rock, slope performance within these rock masses is likely to be controlled by the poor quality rock. A mélange can be described as a mappable body of rock that includes fragments and blocks of all sizes, both exotic and native, embedded in a fragmented and generally sheared matrix. The occurrence of lithologies in the South Quarry is consistent with this description.

The dominant thrust contact in the TerraSource model is the hanging wall contact of the Footwall Fault Breccia. The model indicates an overall dip to the northeast for this contact, with sections that dip about 20˚ in the north and south parts of the South Quarry, separated by a steeper section. From the steeper section toward the north, limestone overlies the Footwall Fault Breccia (Figure 12.5). The steep section may represent offset along an east-northeast-striking fault, likely the Northwest strand of the Berrocal Fault, or a fold in the thrust.

The 20˚ dip for this thrust extends across the quarry floor, and into the north wall area. This general pattern is reflected in televiewer-based bedding orientations in the limestone that overlies the contact. In particular, bedding dip is northeast at 20˚ to 40˚ in coreholes GT4-25a/b; and in corehole GT3-3a (Figure 12.6). In corehole GT3-4, which lies on the intervening, steeper section of the contact, bedding dip

averages about 55˚ (note bedding dips steeper than about 70˚ fall within the "blind zone" for this corehole, so bedding may be steeper than indicated by the corehole GT3-4 data).

Geological sections developed along Azimuth 030˚ by Foruria (2004) for the North Quarry extend into the floor area of the South Quarry. These sections are generally consistent with the flat-dipping thrust contacts in the quarry floor and the north wall of the South Quarry. However these sections indicate that the steeper section of the Footwall Fault Breccia occurs farther to the north than is indicated in the TerraSource model; they also indicate tight folding in the mélange sequence south of the steep section. For the purposes of this evaluation, the TerraSource model is considered to be the most valid model for the north wall, as it incorporates drilling data that were not available during preparation of the Foruria sections.

12.3.2 Structure

Large-scale structure across the South Quarry area includes steeply-dipping faults; and the thrust faults that form mélange contacts. The orientations of modeled faults and the hanging wall contact of the Footwall Fault Breccia are shown in Figure 12.7.

12.3.3 Rock Fabric

Rock fabric data from televiewer logging of limestone intersections in the North and South Quarry areas are shown in Figure 12.6. With respect to the variations in these data, the thrust contact on the hanging wall side of the Footwall Fault Breccia can be used as a basis for defining the following structural domains in the limestone (Figure 12.8).

- Domain 1 – north area of quarry, where thrust contact appears to dip moderately to the northeast; the data that are most relevant to this domain are from coreholes GT-1, GT-2 and GT3-3a
- Domain 2 – steep section of the thrust; data that are relevant to this domain are from corehole GT3-4
- Domain 3 – south of the steep section, where the thrust contact appears to dip moderately to the northeast; the data that are characteristic of this domain are coreholes GT4-25a/b

Note that these structural domains may also apply to the more competent blocks of graywacke, greenstone, and metabasalt within the Hanging Wall Graywacke and Fault Breccia rock masses. However, for these units, the overriding considerations for quarry slope designs is rock mass strength, and the high proportion of fault breccia, rather than rock fabric orientations.

12.3.4 Material and Rock Mass Properties

Material properties developed from field and laboratory testing, and rock mass properties estimated from rock mass characterizations for the modeled rock masses and back analyses, are summarized in Tables 12.4 and 12.5.

TABLE 12.4
MATERIAL PROPERTIES

Model Rock Mass	UCS, psi	Discontinuity		Unit Weight, pcf
		ϕ,°	c, psi	
Footwall Fault Breccia	580	21	0	168
Hanging Wall Graywacke	580	21	0	170
Limestone	5000	26	0	168

TABLE 12.5
ROCK MASS PROPERTIES

Model Rock Mass	RMR	m_i	mb	s	a	ϕ, °	c, psi
Footwall Fault Breccia	30	7	-	-	-	23	10
Hanging Wall Graywacke	30	7	-	-	-	23	10
Limestone	47	10	0.544	0.0005	0.507	-	-

The Limestone is a fractured rock mass, but geological logging indicates that it lacks the high proportion of fault breccia that occurs in other lithologies. Material and rock mass shear strength parameters for the limestone were based on geotechnical core logging for the intersections summarized in Table 12.2, laboratory testing completed for this evaluation, previous laboratory testing from North Quarry slope design studies, and field point load testing.

Rock quality in the Footwall Fault Breccia and Hanging Wall Graywacke rock masses varies widely, and the wide spacing of coreholes in the South Quarry area does not allow detailed definition of the distribution of better quality vs poor quality rock. However, it would appear likely that the high proportions of poor quality rock will control slope performance in both of these units. We believe that the most reliable rock mass shear strengths for the poor quality, non-limestone rocks in the South Quarry area are the

back-analyzed strengths for similar materials involved in past landslides in the North Quarry. These are reflected in the above characterizations.

12.3.5 Hydrogeological Conditions

The pre-mining groundwater conditions will be affected by quarry development. Groundwater conditions during mining, and post-closure were analyzed by 2-dimensional modeling with SEEP/W software (Geo-Slope, 2007). The modeling was based on a section that represents the west-central south wall, where the maximum vertical exposure in the Footwall Fault Breccia will be developed; and the limestone exposure in a 45˚ slope below elevation 1240 feet will also be highest.

Basic model parameters included:

- Initial head conditions defined by pre-mining water table
- Recharge 4 inches/year
- "Instantaneous" excavation of South Quarry, and constant head boundary during mining at elevation 925 feet in the quarry floor area
- Constant head along the ridge at the crest of the south wall at elevation 1800 ft
- Seepage faces allowed on South Quarry slopes
- Footwall Fault Breccia (includes Graywacke) and limestone material types

Modeling was completed for the following hydraulic conductivity scenarios:

TABLE 12.6
HYDRAULIC CONDUCTIVITY SCENARIOS

Scenario	Hydraulic Conductivity, ft/day		Notes
	Greenstone	Limestone	
1	0.01	0.2	Kh:Kv for both material types = 50
2	0.05	0.4	
3	0.1	0.8	

Results from the SEEP/W modeling were in the form of contours of total head and pressure head. These contours were imported directly into slope stability models to account for pore pressure distributions.

12.4 Stability Analyses and Quarry Slope Design Recommendations

12.4.1 Limestone

12.4.1.1 Kinematic Analyses

12.4.1.1.1 North Wall

The most significant highwall exposure of limestone on the north side of the South Quarry will occur along a wall segment with nominal dip direction 160˚ (Figure 12.4). This area lies within Structural Domain 1, where the thrust contact is indicated to dip to the northeast in this area, and other modeled, major faults in the South Quarry area are steeply-dipping. As such, large-scale structures in the geological model do not present viable kinematic failure modes for the north wall limestone.

Televiewer data from coreholes GT3-03, GT1-1, and GT1-2 are considered to be representative of rock fabric in the limestone in this domain. Well-developed concentrations in contoured stereoplots of these data indicate that the following represent systematic discontinuity sets:

TABLE 12.7
SYSTEMATIC DISCONTINUITY SETS, NORTH WALL LIMESTONE

ID	Dip	Dip Direction	Comment
1	36	075	bedding, joints
2	36	010	mainly bedding at <90 feet, GT3-03
3	73	018	Joints
4	68	203	Joints; same set as #3, but with opposite dip direction
5	69	300	
6	43	272	

Kinematic analyses based on these design sets do not indicate significant potential for planar, wedge, or toppling failures in the north wall (Figure 12.9). Note that scattered, south-dipping structure occurs in the televiewer data, but the structure does not appear to be systematic (i.e., they occur in low concentrations), and it does not include faults that would daylight at the planned inter-ramp angle. The occurrence of these structures points out that the slope design in the north wall is not without risk, but the risk is considered to be low and the occurrence of these structures is not considered to be a controlling factor for the slope design.

12.4.1.1.2 West Half of South Wall

Limestone exposure in the south wall will occur below approximate elevation 1470 feet in the west half of the South Quarry, and in the lower benches below approximate elevation 1240 feet in the east half of the South Quarry.

In the west half of the South Quarry, the inter-ramp angle for the limestone will be 3H:1V. As shown in Figure 12.4 and 12.8, this slope will be developed in Structural Domains 1 and 2. Systematic discontinuity sets that are indicated in the televiewer data for these domains are:

TABLE 12.8

SYSTEMATIC DISCONTINUITY SETS
SOUTH WALL LIMESTONE, STRUCTURAL DOMAIN 1

ID	Dip	Dip Direction	Comment
1	36	075	bedding, joints
2	36	010	mainly bedding at <90 feet, GT3-03
3	73	018	Joints
4	68	203	Joints; same set as #3, but with opposite dip direction
5	69	300	
6	43	272	

TABLE 12.9

SYSTEMATIC DISCONTINUITY SETS
SOUTH WALL LIMESTONE, STRUCTURAL DOMAIN 2

ID	Dip	Dip Direction	Comment
1	55	360	dominant concentration; bedding, joints (note that concentration may be truncated by blind zone in vertical corehole GT3-4)
2	44	270	relatively weak concentration
3	70	093	relatively weak concentration

With the relatively flat slope angle in the limestone on the west side of the south wall, kinematic analyses based on rock fabric do not indicate significant potential for structural controls in the proposed design (Figure 12.10). The same conclusion applies to kinematic analyses based on large-scale structures in light of the following:

- The quarry shell will remain well above the modeled thrust contact at the top of the Footwall Fault Breccia. Therefore, this contact should not present a risk of instability with respect to slopes developed in the limestone.
- Modeled faults other than the thrust faults are steeply-dipping, and do not present viable failure modes with respect to the design inter-ramp angle.
- Shallow-dipping contacts between the Hanging Wall Graywacke and the limestone; and between the different grades of limestone occur in Structural Domain 1. These appear to parallel the hanging wall contact of the Footwall Fault Breccia, and will dip into the quarry. The design inter-ramp angle corresponds approximately with the dip of these contacts (Figure 12.8). This configuration is intended to minimize contact-related instability, and to allow any instability that may develop to be managed and mitigated operationally during mining, or during reclamation.

12.4.1.1.3 East Half of South Wall

Limestone slopes in the east half of the South Quarry extend below elevation 1240 feet, and lie within Structural Domain 1. These slopes are designed with an inter-ramp angle of 45-50˚, and a nominal dip direction of 055˚.

Design discontinuity sets for Structural Domain 1 are listed in Table 12.8, and kinematic analyses based on these discontinuity sets, and modeled faults are shown in Figure 12.11. These analyses and the geological model as shown in Figures 12.4 and 12.8 indicate the following:

- The hanging wall thrust contact of the Footwall Fault Breccia occurs well below the quarry floor. As such, this contact should not affect stability of the limestone slope.
- Other modeled faults dip steeply, and do not present viable kinematic controls for the proposed design.
- Modeled contacts between limestone grades do not daylight in the slope, but parallel structures, if present, could daylight in the slope.
- Bedding and joints in discontinuity Set 1 will dip into the quarry at 20˚ to 40˚, and present a risk of planar slide. Set 1 structures could also form wedges with Set 3 joints, but these wedges would be largely controlled by Set 1.

Mitigating the kinematic risks associated with Set 1 in the design would require re-orienting the wall, or reducing the inter-ramp angle. Both of these approaches would affect the targeted reserve. Another approach would be to proceed with the current design, and manage instabilities during the South Quarry life operationally, and/or with short-range design changes. Aspects of the current design and geological model that are favorable for this type of approach include:

- Limestone will be encountered in this area of the South Quarry at elevations above the final wall exposures. Observation in the initial limestone exposures should improve the understanding of the orientations and continuity of the Set 1 structures, and the extent to which these structures are likely to control slope angles. Given this information, a decision on the configuration of the final wall in this area can be made prior to establishing the initial benches in limestone. Note that if modifications to the design are considered to be necessary to address instability in the limestone slopes during operations, these would not affect the overall footprint of the South Quarry.

- Starting from the current toe, a flatter slope could be mined while keeping the slope below elevation 1240 feet solidly within the limestone, and above the hanging wall thrust contact of the Footwall Fault Breccia. The overall angle of a line projected from the toe of the slope at elevation 925 feet to the up-slope limit of the limestone at elevation ~1400 feet is about 30˚. This provides an indication of the degree of flattening that could occur in this slope without changing the position of the toe.

12.4.2 Rock Mass Stability

Rock mass stability in the limestone was evaluated with a stability model that represents conditions in the west half of the south wall, where the highest 45-50˚ slope in limestone will be developed (Figure 12.4 and 12.12). The analyses were carried out with SLIDE Software (Rocscience, 2007), and 2-dimensional, limit equilibrium solutions.

At the conclusion of mining, the limestone exposure in the south wall will extend from approximate elevation 1380 feet to the final South Quarry floor at elevation 925 feet. The slope profile in the limestone will feature a 3H:1V slope angle between elevations 1400 and 1240 feet; and a 45-50˚ degree inter-ramp angle from elevation 1240 feet to the South Quarry floor at elevation 925 feet. As shown in Figure 12.2, the overall slope in this area will extend up to ~2000 feet, with Footwall Fault Breccia exposed above elevation 1400 feet.

The calculated minimum FOS values for this slope were 1.80 for static loading; and 1.14 for pseudostatic loading, assuming a pseudostatic coefficient of 0.15. Yield acceleration was 0.43g. Using the method of Bray and Travasarou (2007), displacements of this slope during the design seismic event were estimated at one inch or less (Appendix 12.C). The static FOS and estimated seismic displacements are considered acceptable.

12.4.2.1 Quarry Slope Design Recommendations for Limestone

It is recommended that the current slope designs in the limestone be maintained, with a 3H:1V slope above elevation 1240 feet in the greenstone and fault breccia materials; and a 45˚ to 50˚ inter-ramp angle in the lower north and south walls in the east half of the quarry. A single bench configuration should be applied throughout, with the following bench configuration in the 45˚ to 50˚ areas:

- Typical production bench height – 50 ft (Note: North wall to be locally double benched with 50˚ inter-ramp angle)
- Catch bench width – 26 ft
- Bench face angle – 65˚
- Inter-ramp angle – 45˚ to 50˚.

12.4.3 Footwall Fault Breccia and Graywacke

12.4.3.1 Analysis Results

Given the overall poor rock quality indicated for Footwall Fault Breccia and the Graywacke rock masses, stability analyses for these units focused on rock mass failure. These analyses included:

- Development of a generic slope height vs slope angle design chart for wall heights up to 1100 feet, and pore pressures calculated with a range of R_u factors; and
- Overall stability of the Footwall Fault Breccia /Graywacke rock mass with pore pressures defined by SEEP/W modeling.

The slope height vs slope angle design chart shown in Figure 12.13 shows the allowable slope angles for the Graywacke and Footwall Fault Breccia for a FOS of 1.2, and a range of slope heights and groundwater conditions. Groundwater conditions were represented by pore pressure coefficients termed R_u values, which are a convenient method of accounting for groundwater pressures along a potential failure surface when actual groundwater conditions are not well defined. R_u is defined as the pore pressure divided by the overburden pressure.

The slope design chart was applied by Lehigh during South Quarry design iterations between March and June 2009, prior to pump testing and groundwater modeling. Each South Quarry design cut the geological model shapes differently, resulting in different wall heights in the Footwall Fault Breccia and Graywacke. Given the uncertainty in the pore pressure distribution in the highwall, the iteration process concluded with the application of a 3H:1V slope in the Footwall Fault Breccia and Graywacke, based on the expected vertical exposure of these units, and R_u values in the 0.1 to 0.2 range.

In the current ultimate South Quarry design, the maximum vertical exposure of Footwall Fault Breccia and Graywacke will be about 550 to 600 feet in the west-central south wall. The stability of this wall was analyzed with the model shown in Figure 12.14, which incorporates groundwater conditions as contours of total head. The pitslope profile along this section features a 3H:1V slope in Footwall Fault Breccia/ Graywacke between the crest of the quarry at elevation 1990 feet; limestone exposure below elevation 1435 feet; and a natural slope above the quarry crest to the top of the ridge at elevation 2090 feet.

The calculated minimum static FOS for this slope was 1.53. For pseudostatic loading, the analyses indicate a FOS of 1.02 for a pseudostatic coefficient of 0.15; and a yield acceleration 0.16g. Using the method of Bray and Travasarou (2007), estimated displacement of the Footwall Fault Breccia/Greenstone slope during the design seismic event was three to thirteen inches (Appendix 12.C). The static FOS and estimated seismic displacements meet the stability criteria discussed in Section 1.2.

12.4.3.2 Quarry Slope Design Recommendations, Footwall Fault Breccia and Graywacke

It is recommended that the current slope designs for the Footwall Fault Breccia and Graywacke be maintained. The static FOS for the 3H:1V slope is high compared to the acceptance criterion that are

often applied for mining quarry slopes, and suggest that a slightly steeper slope angle could be applied; however, given the variability of these rock masses, the impact of pore pressures on stability, and the potential for high seismic loading, a relatively conservative static FOS is considered appropriate at this time. The potential for steepening the Footwall Fault Breccia and Graywacke slopes can be revisited during final design assuming additional hydrogeologic data will be available from design level resource investigations.

12.4.4 Overall Slope Stability

The stability analyses discussed in the previous sections focus on the upper and lower slope sections of an overall slope profile comprised of Footwall Fault Breccia/Graywacke and Limestone, respectively. Additional analyses were completed to determine a global FOS for the complete profile from ridge crest to floor of the South Quarry (Figure 12.15). The minimum static FOS for this case was 1.5. These results are essentially the same as those for the analyses of the Footwall Fault Breccia/Graywacke slope, and emphasize the role of these lower-strength units in overall slope stability.

TABLE 12.10
SUMMARY OF SOUTH QUARRY STABILITY EVALUATION

Sections	Conditions	Description	Calculated FOS
Global Stability Section (crest-to-toe)	Ultimate Slope Excavation	Static	1.5
	Final Reclaimed Slope	Static	1.71
		Seismic: Pseudo-static	NE
		Seismic: displacement under design seismic event (16%-84% percentile exceedance)	NE
Lower Limestone Slope	Ultimate Slope Excavation	Static	1.80
		Seismic: Pseudo-static (0.15)	1.14
		Seismic: displacement under design seismic event (16%-84% percentile exceedance)	<1 inch
	Final Reclaimed Slope	Static	>1.8
		Seismic: Pseudo-static	>1.14
		Seismic: displacement under design seismic event (14-86 percentile range)	<1 inch
Upper Footwall Fault Breccia/ Greenstone Slope	Ultimate Slope Excavation	Static	1.53
		Seismic: Pseudo-static	1.02
		Seismic: displacement under design seismic event (16%-84% percentile exceedance)	3-13 inches
	Final Reclaimed	Static	1.53

	Slope	Seismic: Pseudo-static	1.02
		Seismic: displacement under design seismic event (14-86 percentile range)	3 – 13 inches

12.5 Post-Reclamation Slope Stability

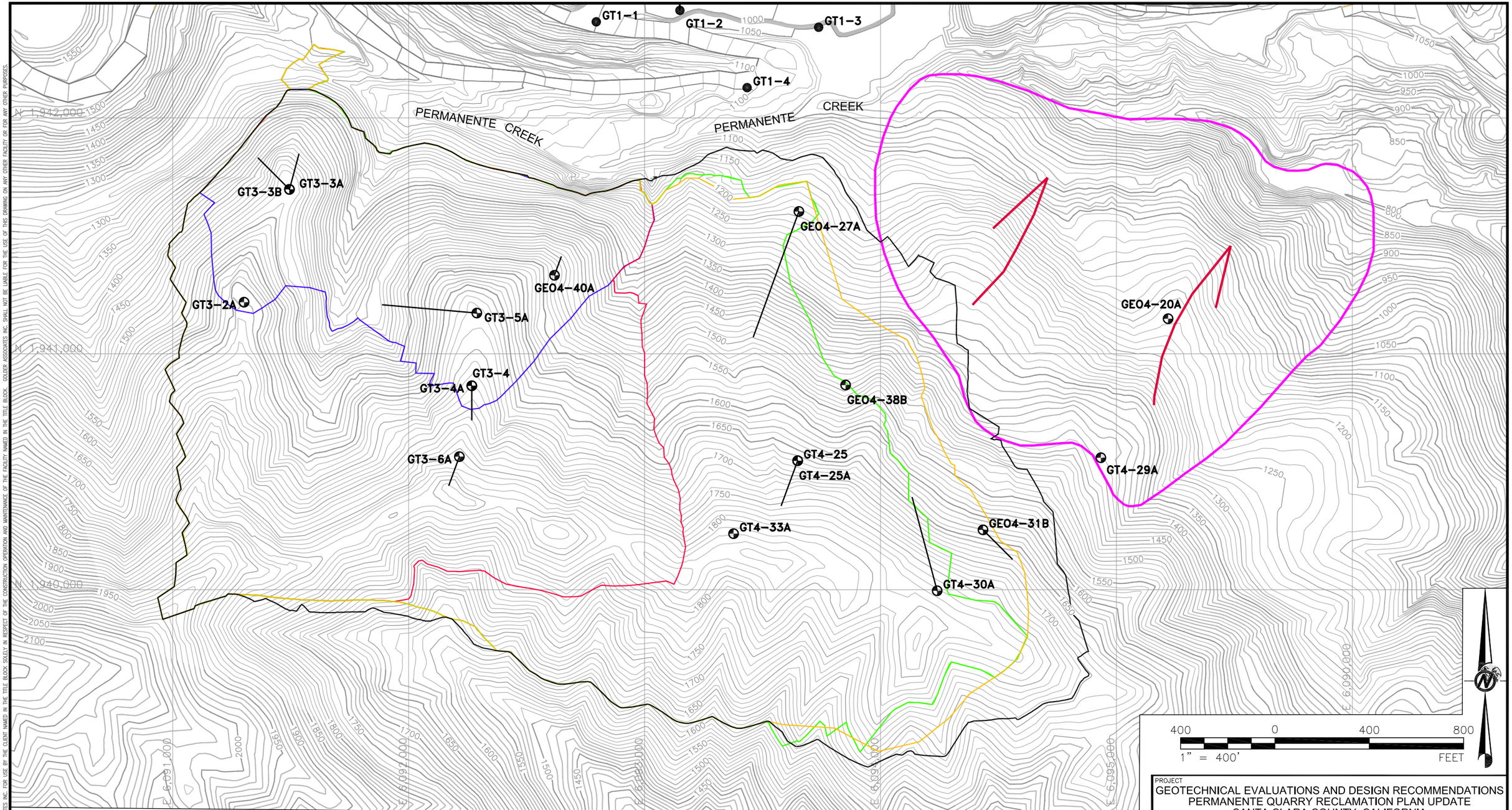
During reclamation, the South Quarry will be backfilled to a minimum elevation of 1110 feet and the surface of the backfill will be graded to drain toward the north (Figure 12.3.). The backfilling will not affect the highest slopes developed in Footwall Fault Breccia and Graywacke. However, it will partially cover the 45-50˚ limestone slopes; and the lower slopes developed in Graywacke along the lower east wall.

During mining, it will be necessary to manage groundwater levels such that the floor of the South Quarry is dewatered. As described previously, this was accounted for in the SEEP/W modeling by maintaining a constant head boundary in the South Quarry floor at elevation 925 feet. After the South Quarry is backfilled, the groundwater levels will rebound in the lower part of the South Quarry. However, the distribution of total heads in the South Quarry slopes above the backfill after closure is not expected to change significantly from the distribution developed during mining.

The backfill plan and the above discussion suggest the following with respect to post-closure slope stability:

- In terms of FOS and predicted displacements during the design seismic event, stability analysis results for the Footwall Fault Breccia and the Graywacke described previously are applicable after closure, as well as during mining. Following reclamation, the lowest static FOS (FOS = 1.53) and pseudo-static FOS (FOS = 1.02) for the quarry slopes occurs in these materials. The estimated permanent seismic displacements range from 3 to 13 inches.
- During operations, a global static FOS of 1.5 is computed for a failure surface that extends from the upper Footwall Fault Breccia and the Graywacke down through the lower limestone. The static FOS for this failure mode increases to 1.71 once the backfill is completed.
- Backfilling will reduce the height of the 45-50˚ slopes, leaving a maximum vertical exposure of about 100 feet high along the south wall. With the lower section of this slope buttressed by the backfill, the effect of groundwater rebound after closure on the stability of the limestone slope will not be significant. Prior to backfilling, the 45-50˚ slope in limestone will be about 300 feet high, and the static FOS for this slope was about 1.8. Reducing the slope height to 100 feet will further increase the static FOS against rock mass failures.
- To the extent that kinematic controls of slope performance develop in the limestone along the south wall, these may be independent of slope height. As such, if instability develops in the slope above elevation 1120 feet, it may not be mitigated by the planned backfill. However, as discussed previously, should instability develop in the limestone above elevation 1120 feet, it could be mitigated by modifying the backfill plan; or by flattening the 45-50˚ slope angle.

The above FOS values for static and pseudo-static conditions and estimated seismic displacements are appropriate for the proposed reclamation.



LEGEND

- PHASE 1 QUARRY LIMIT
- PHASE 2 QUARRY LIMIT
- PHASE 3 QUARRY LIMIT
- PHASE 4 QUARRY LIMIT
- ULTIMATE QUARRY LIMIT
- INTERPRETED LANDSLIDE BOUNDARY
- GT4-33A SOUTH QUARRY GEOTECH COREHOLE
- GT1-4 NORTH QUARRY GEOTECH COREHOLE

NOTES

1. EXISTING TOPOGRAPHY OUTSIDE THE NORTH QUARRY BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC. EXISTING TOPOGRAPHY INSIDE THIS BOUNDARY IS FROM SEPTEMBER 2009 SURVEY PROVIDED BY LSCC.

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

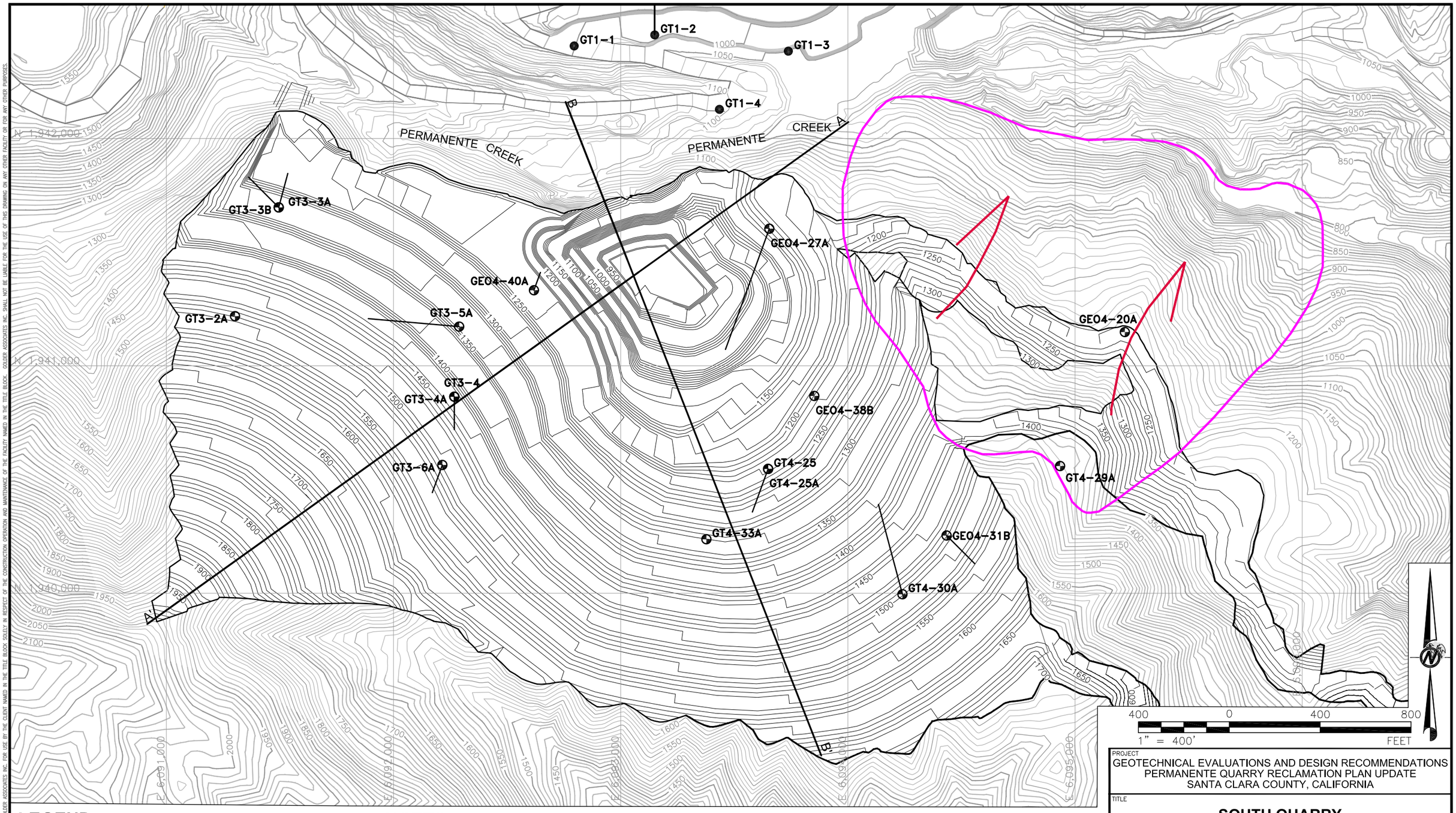
TITLE
SOUTH QUARRY EXISTING TOPOGRAPHY

Golder Associates

PROJECT No. 063-7109 800			FILE No.		Figure 12.1
DESIGN	---	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	GM	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 12.1

FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 12.1.dwg TAB NAME \Layout2
Friday, April 30, 2010 - 8:04am
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



LEGEND

- INTERPRETED LANDSLIDE BOUNDARY
- GT4-33A SOUTH QUARRY GEOTECH COREHOLE
- GT1-4 NORTH QUARRY GEOTECH COREHOLE

NOTES

1. EXISTING TOPOGRAPHY OUTSIDE THE NORTH QUARRY BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC. EXISTING TOPOGRAPHY INSIDE THIS BOUNDARY IS FROM SEPTEMBER 2009 SURVEY PROVIDED BY LSCC.
2. ULTIMATE QUARRY PLAN PRIOR TO BACKFILLING PROVIDED BY LEHIGH AS AN ELECTRONIC FILE DATED JANUARY 22, 2010; FILENAME "topo_total_rec_plan_before_backfill_submittal7_clipped.dxf".

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE

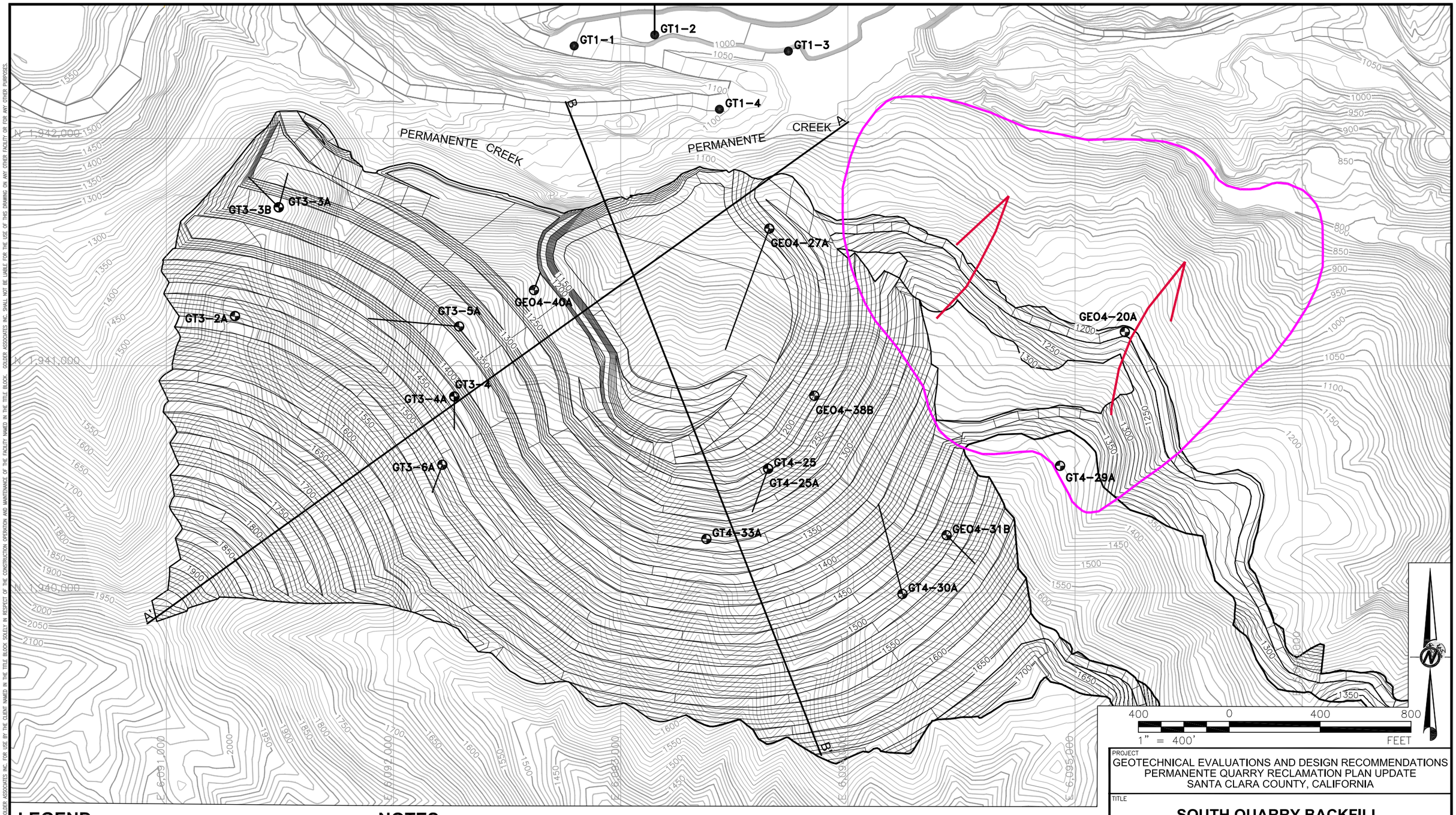
SOUTH QUARRY ULTIMATE QUARRY PLAN

Golder Associates

PROJECT No. 063-7109 800			FILE No.		Figure 12.2
DESIGN	--	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	GM	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 12.2

FILE: S:\HansonPermanente\Plt 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 12.2.dwg TAB NAME \Layout2
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.
Friday, April 30, 2010 - 8:06am



LEGEND

- INTERPRETED LANDSLIDE BOUNDARY
- GT4-33A SOUTH QUARRY GEOTECH COREHOLE
- GT1-4 NORTH QUARRY GEOTECH COREHOLE

NOTES

1. EXISTING TOPOGRAPHY OUTSIDE THE NORTH QUARRY BOUNDARY IS FROM APRIL 2008 FLYOVER PROVIDED BY LSCC. EXISTING TOPOGRAPHY INSIDE THIS BOUNDARY IS FROM SEPTEMBER 2009 SURVEY PROVIDED BY LSCC.
2. ULTIMATE QUARRY PLAN AFTER BACKFILLING PROVIDED BY LEHIGH AS AN ELECTRONIC FILE DATED JANUARY 22, 2010; FILENAME "topo_total_rec_plan_submittal7_clipped.dxf".

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

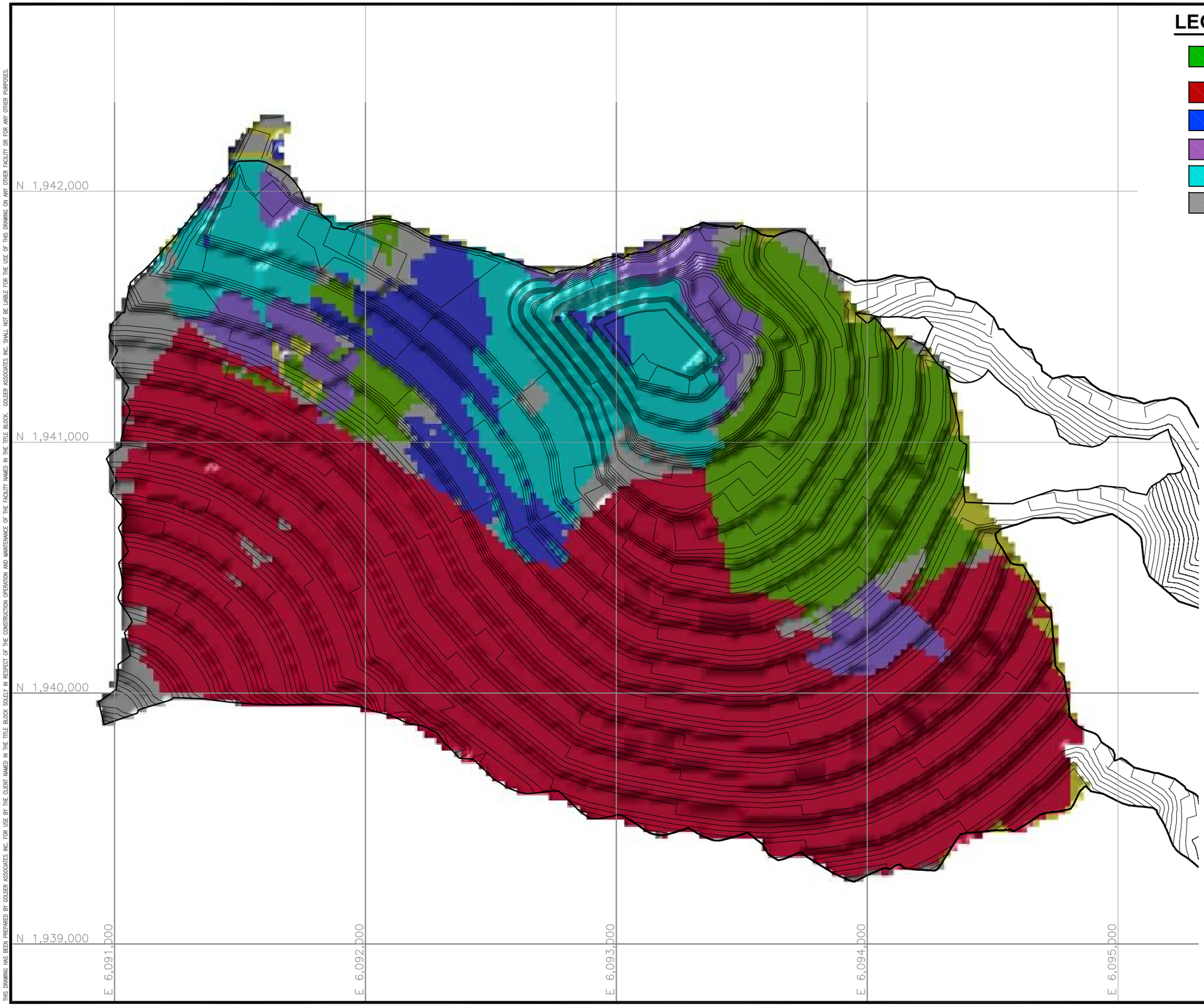
TITLE
SOUTH QUARRY BACKFILL, FINAL RECLAMATION PLAN

Golder Associates

PROJECT No. 063-7109 800			FILE No.		Figure 12.3
DESIGN	--	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	GM	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 12.3

FILE: S:\HansonPermanente\Plt 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 12.3.dwg TAB NAME \Layout2
Friday, April 30, 2010 - 9:08am
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



LEGEND

- HANGING WALL GREYWACKE, (INCLUDES GREENSTONE AND CONGLOMERATE)
- FOOTWALL FAULT BRECCIA (INCLUDES GREENSTONE)
- LOW TO MEDIUM GRADE LIMESTONE
- LOW TO MEDIUM GRADE LIMESTONE
- HIGH GRADE LIMESTONE
- NO DATA

NOTES

1. ULTIMATE QUARRY PLAN PRIOR TO BACKFILLING PROVIDED BY LEHIGH AS AN ELECTRONIC FILE DATED JANUARY 22, 2010; FILENAME "topo_total_rec_plan_before_backfill_submittal7_clipped.dxf".
2. DISTRIBUTION OF LITHOLOGIES IS BASED ON CUTTING LITHOLOGY BLOCK MODEL PROVIDED BY TERRASOURCE TO ULTIMATE QUARRY CONTOURS.

400 0 400 800

1" = 400' FEET

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE

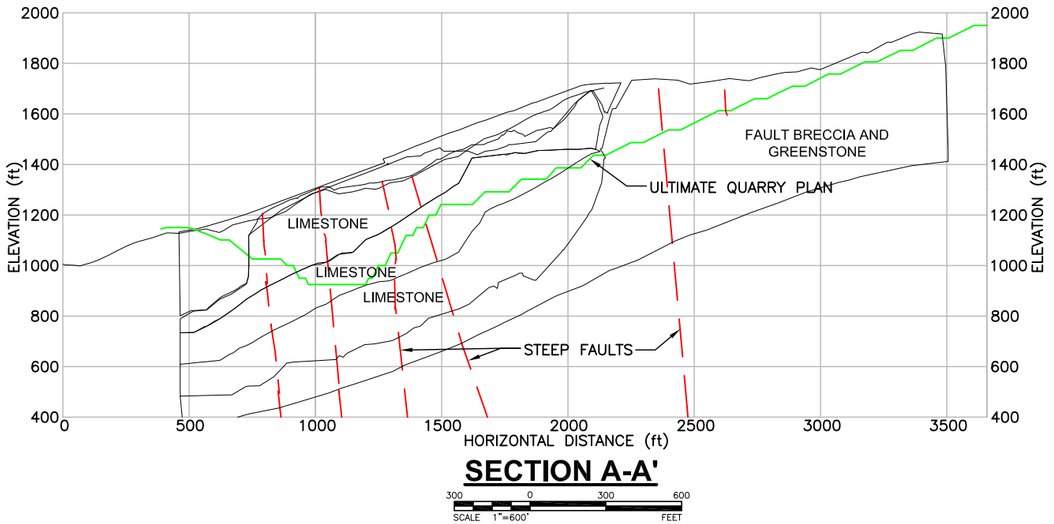
SOUTH QUARRY GEOLOGY

Golder Associates

PROJECT No. 063-7109 800			FILE No.	Figure 12.4	
DESIGN	--	01/22/10	SCALE AS SHOWN	REV.	1
CADD	AJS	01/22/10			
CHECK	GM	01/22/10			
REVIEW	BF	01/22/10			

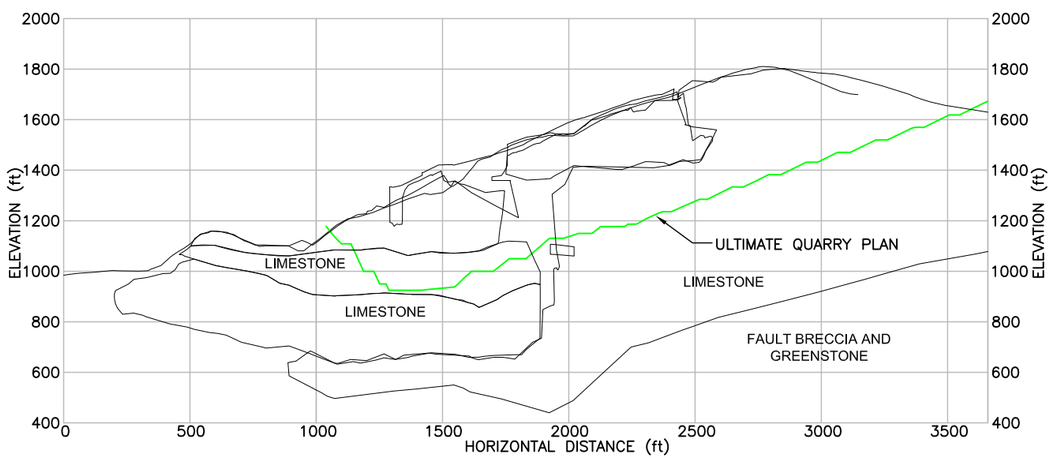
FIGURE 12.4

Thursday, April 29, 2010 - 4:29pm FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 12.4.dwg TAB NAME \Figure 13.4
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.



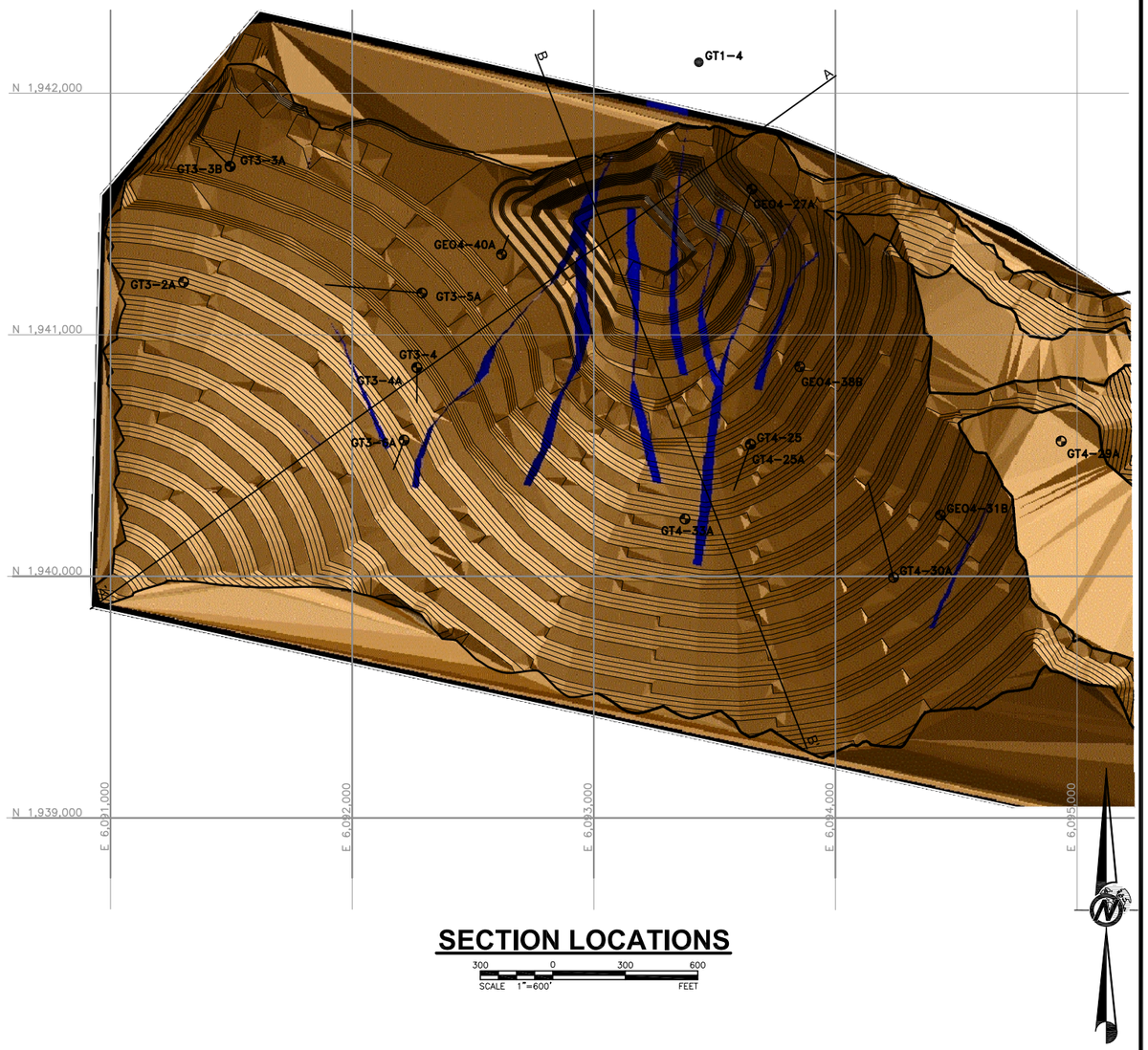
SECTION A-A'

SCALE 1"=600' FEET



SECTION B-B'

SCALE 1"=600' FEET



SECTION LOCATIONS

SCALE 1"=600' FEET

NOTES

1. ULTIMATE QUARRY PLAN PRIOR TO BACKFILLING PROVIDED BY LEHIGH AS AN ELECTRONIC FILE DATED JANUARY 22, 2010; FILENAME "topo_total_rec_plan_before_backfill_submittal7_clipped.dxf".

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

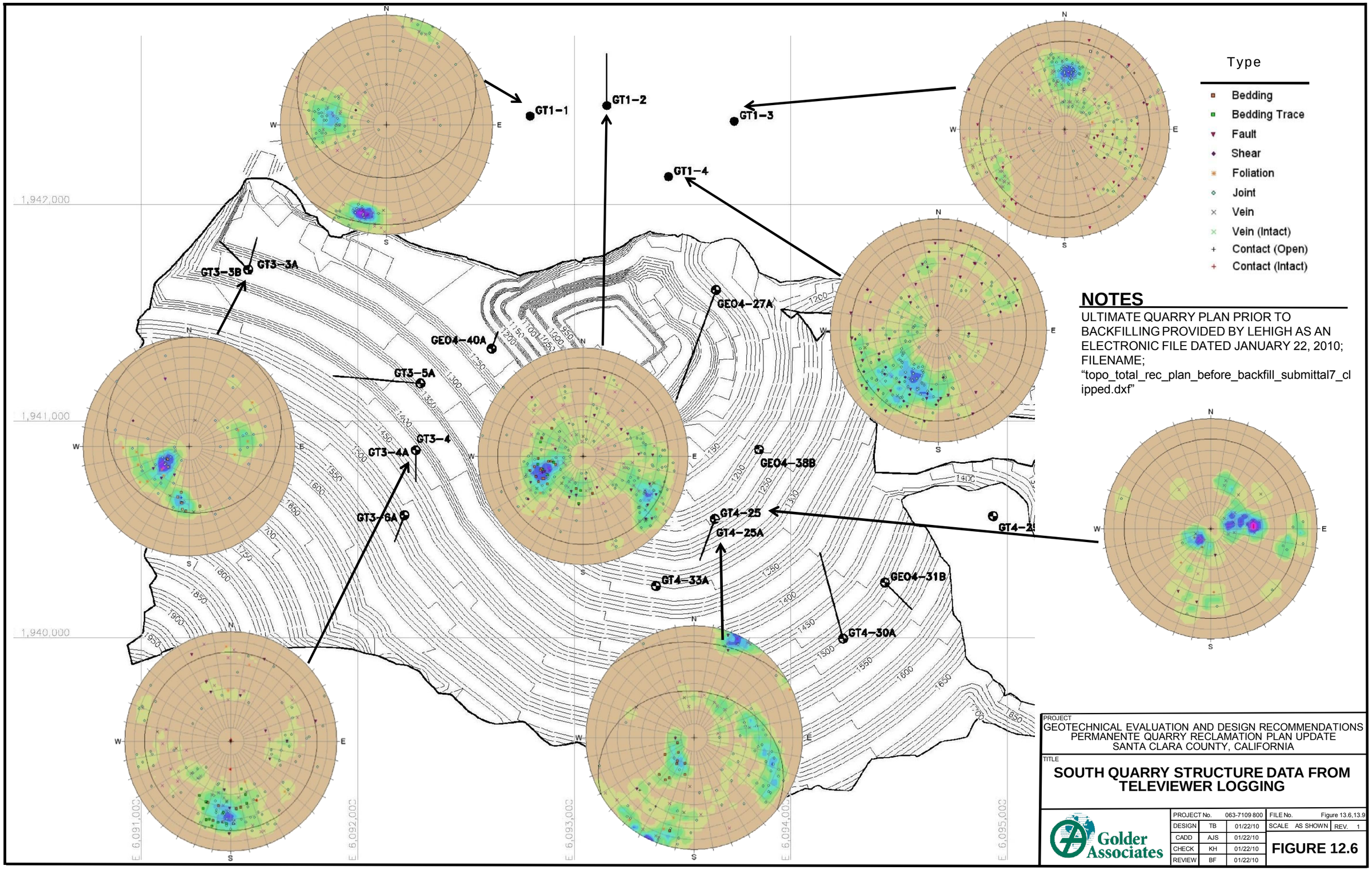
TITLE
SOUTH QUARRY REPRESENTATIVE GEOLOGICAL SECTIONS

Golder Associates

PROJECT No. 063-7109 800			FILE No. Figure 12.5,12.7,12.8	
DESIGN	--	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	GM	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 12.5

Thursday, April 29, 2010 - 5:11pm FILE: S:\HansonPermanente\Plt 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 12.5,12.7,12.8.dwg TAB NAME \Figure 12.5
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES. THE USE OF THIS DRAWING IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK SOLELY



NOTES

ULTIMATE QUARRY PLAN PRIOR TO BACKFILLING PROVIDED BY LEHIGH AS AN ELECTRONIC FILE DATED JANUARY 22, 2010; FILENAME; "topo_total_rec_plan_before_backfill_submittal7_clipped.dxf"

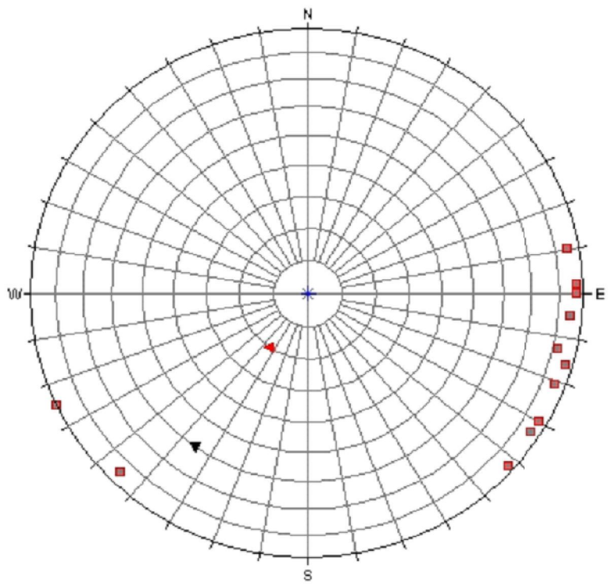
PROJECT
GEOTECHNICAL EVALUATION AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
SOUTH QUARRY STRUCTURE DATA FROM TELEVIEWER LOGGING

Golder Associates

PROJECT No.		063-7109 800	FILE No.		Figure 13.6,13.9
DESIGN	TB	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	KH	01/22/10			
REVIEW	BF	01/22/10			

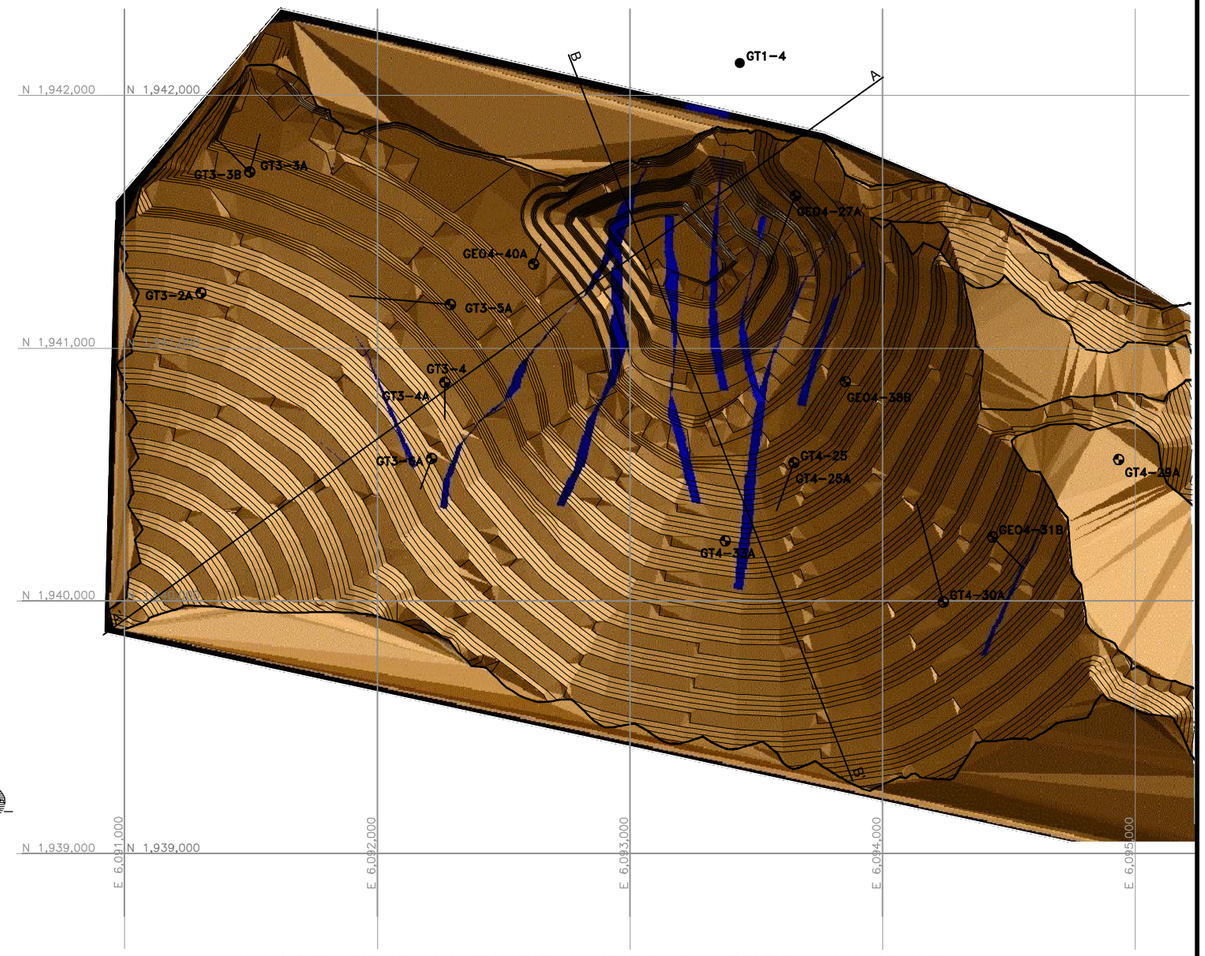
FIGURE 12.6



MODELED FAULT

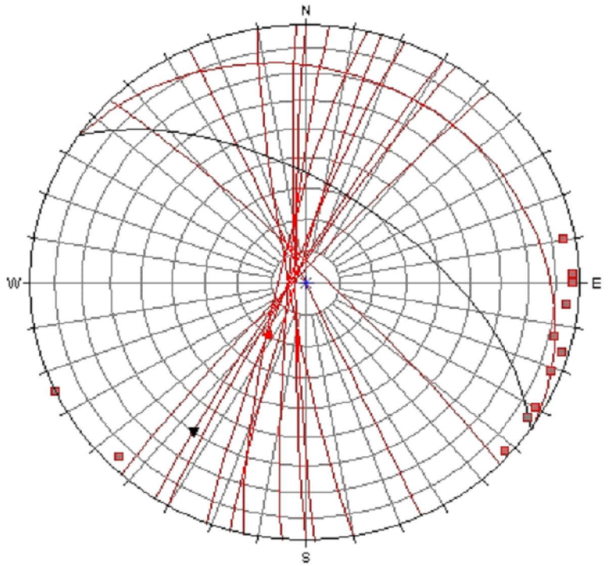
MODELED FAULT [12]
STEEP THRUST CONTACT [1]
THRUST CONTACT [1]

Equal Area
Lower Hemisphere
14 Poles
14 Entries



MODELED FAULTS PROVIDED BY TERRASOURCE

SCALE 1"=600' (300 0 300 600 FEET)



MODELED FAULT

MODELED FAULT [12]
STEEP THRUST CONTACT [1]
THRUST CONTACT [1]

Equal Area
Lower Hemisphere
14 Poles
14 Entries

NOTES

1. ULTIMATE QUARRY PLAN PRIOR TO BACKFILLING PROVIDED BY LEHIGH AS AN ELECTRONIC FILE DATED JANUARY 22, 2010; FILENAME "topo_total_rec_plan_before_backfill_submittal7_clipped.dxf".

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
SOUTH QUARRY, MODELED FAULTS

Golder Associates

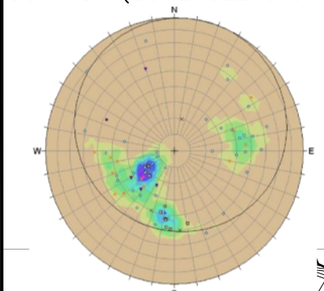
PROJECT No. 063-7109 800			FILE No. Figure 12.5,12.7,12.8	
DESIGN	--	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	GM	01/22/10		
REVIEW	BF	01/22/10		

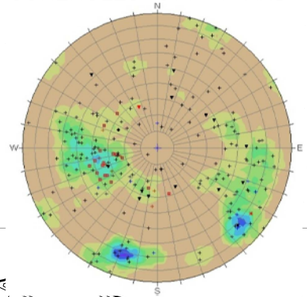
FIGURE 12.7

Thursday, April 29, 2010 - 5:17pm FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study - 2010\Reporting\Figures R1\Figure 12.5,12.7,12.8.dwg TAB NAME \Figure 12.7
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.

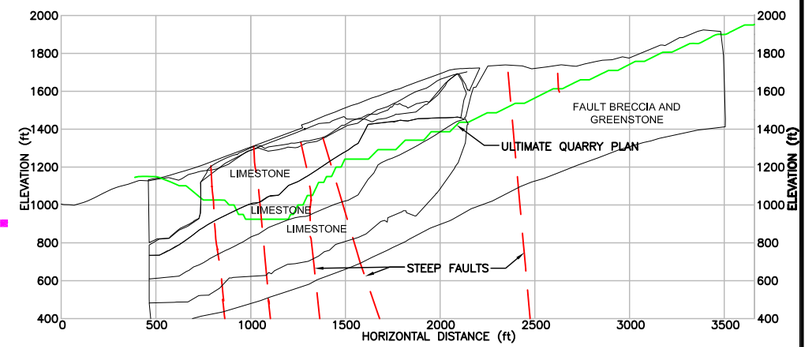
MODERATE–DIPPING THRUST CONTACT (COREHOLE GT3–3A)

MODERATE–DIPPING THRUST CONTACT (LIMESTONE IN SOUTH QUARRY) COREHOLES GT1–1 AND GT1–2





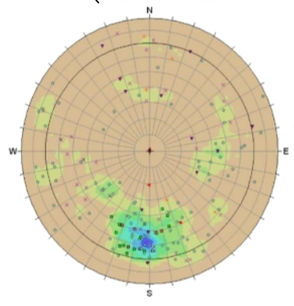
GT1–1
GT1–2
GT1–3
GT1–4
GT3–3B
GT3–3A
GEO4–27A
GEO4–40A
GT3–2A
GT3–5A
GT3–4
GT3–4A
GT3–6A
GEO4–38B
GT4–25
GT4–25A
GT4–29A
GT4–33A
GEO4–31B
GT4–30A
GEO4–20A
STRUCTURAL DOMAIN 1
STRUCTURAL DOMAIN 2
STRUCTURAL DOMAIN 3
A
A'
B
B'
950
1000
1050
1100
1150
1200
1250
1300
1350
1400
1450
1500
1550
1600
1650
1700
1750
1800
1850
N 1,941,000
N 1,940,000
N 1,939,000
E 6,091,000
E 6,092,000
E 6,093,000
E 6,094,000
E 6,095,000



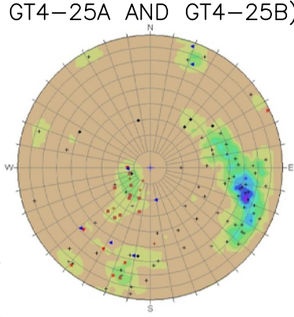
SECTION A-A'

400 0 400 800
SCALE 1"=800' FEET

MODERATE–DIPPING THRUST CONTACT (COREHOLE GT3–4)



MODERATE–DIPPING THRUST CONTACT (COREHOLES GT4–25A AND GT4–25B)



LEGEND

- APPROXIMATE LIMITS, STEEP SECTION OF THRUST CONTACT
- INTERPRETED LANDSLIDE BOUNDARY
- INTERPRETED LANDSLIDE DIRECTION

Type

- Bedding
- Bedding Trace
- Fault
- Shear
- Foliation
- Joint
- Vein
- Vein (Intact)
- Contact (Open)
- Contact (Intact)

NOTES

1. ULTIMATE QUARRY PLAN PRIOR TO BACKFILLING PROVIDED BY LEHIGH AS AN ELECTRONIC FILE DATED JANUARY 22, 2010; FILENAME "topo_total_rec_plan_before_backfill_submittal7_clipped.dxf".

400 0 400 800
SCALE 1"=400' FEET

PROJECT
GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

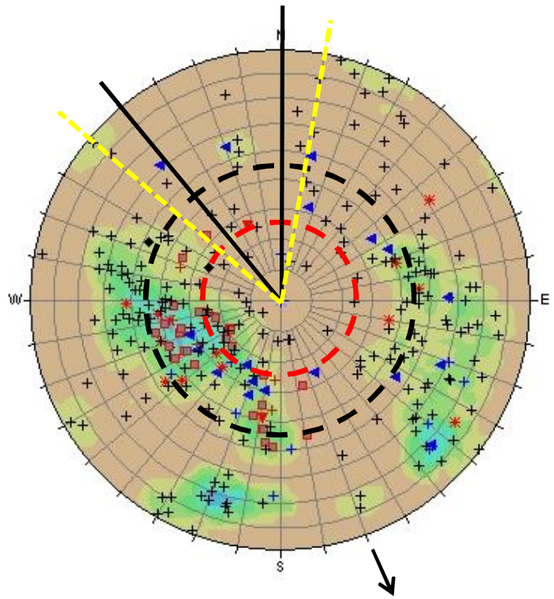
TITLE
SOUTH QUARRY, ROCK FABRIC IN LIMESTONE

Golder Associates

PROJECT No. 063–7109 800			FILE No. Figure 12.5,12.7,12.8		
DESIGN	---	01/22/10	SCALE AS SHOWN	REV.	1
CADD	AJS	01/22/10			
CHECK	GM	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 12.8

FILE: S:\HansonPermanente\Pit 1 North East Walls\Reclamation Study – 2010\Reporting\Figures R1\Figure 12.5,12.7,12.8.dwg TAB NAME: \Figure 12.8
Thursday, April 29, 2010 – 5:18pm
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.

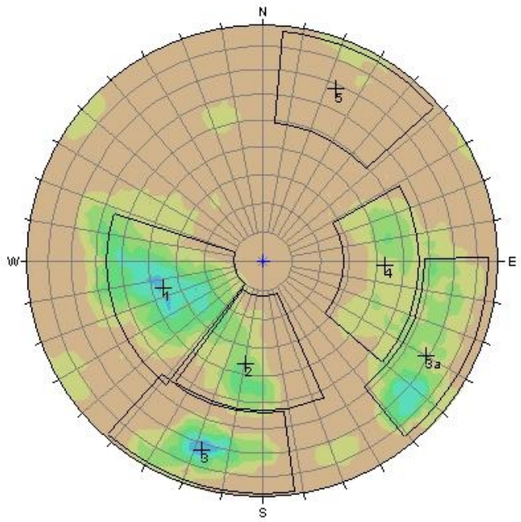


FEATURE_TYPE

- Bedding [42]
- Bedding Trace [8]
- Contact [3]
- Fault [27]
- Foliation [22]
- Joint [410]
- Shear [2]
- Vein [26]

Equal Area
Lower Hemisphere
542 Poles
297 Entries

STRUCTURAL DOMAIN 1 DATA



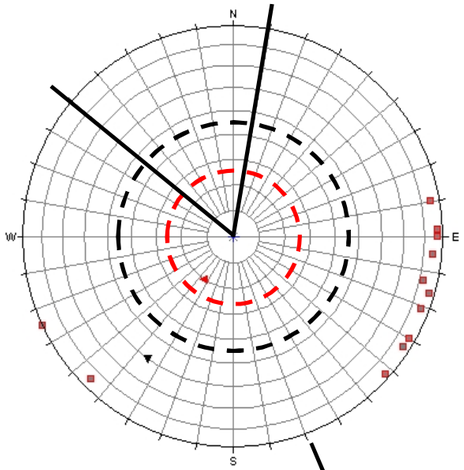
Schmidt
Concentrations
% of total per 1.0 % area

- 0.00 ~ 1.00 %
- 1.00 ~ 2.00 %
- 2.00 ~ 3.00 %
- 3.00 ~ 4.00 %
- 4.00 ~ 5.00 %
- 5.00 ~ 6.00 %
- 6.00 ~ 7.00 %
- 7.00 ~ 8.00 %
- 8.00 ~ 9.00 %
- 9.00 ~ 10.00 %

No Bias Correction
Max. Conc. = 5.6368%

Equal Area
Lower Hemisphere
542 Poles
297 Entries

DESIGN DISCONTINUITY SETS

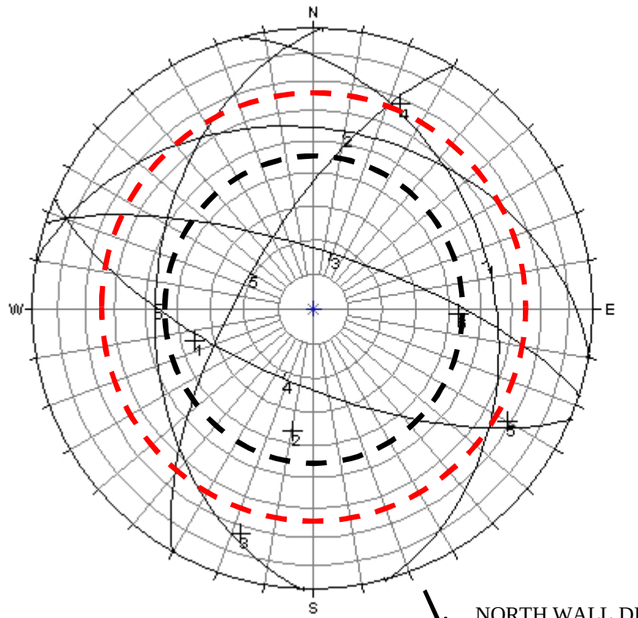


MODELED FAUL

- MODELED FAULT [12]
- STEEP THRUST CONTACT [1]
- THRUST CONTACT [1]

NORTH WALL DIP
DIRECTION 160

KINEMATIC ANALYSIS (MAJOR FAULTS)



Orientations

ID	Dip / Direction
1	36 / 075
2	36 / 010
3	73 / 018
4	68 / 203
5	69 / 300
6	43 / 272

Equal Area
Lower Hemisphere
542 Poles
297 Entries

NORTH WALL DIP DIRECTION 160

KINEMATIC ANALYSIS (TELEVIEWER DATA)

26 DEGREE FRICTION ANGLE

46 DEGREE INTER-RAMP ANGLE

SOUTH QUARRY DATA SET BASED ON TELEVIEWER LOGGING OF LIMESTONE INTERSECTIONS IN COREHOLES GT3-3A, GT1-1, AND GT1-2)

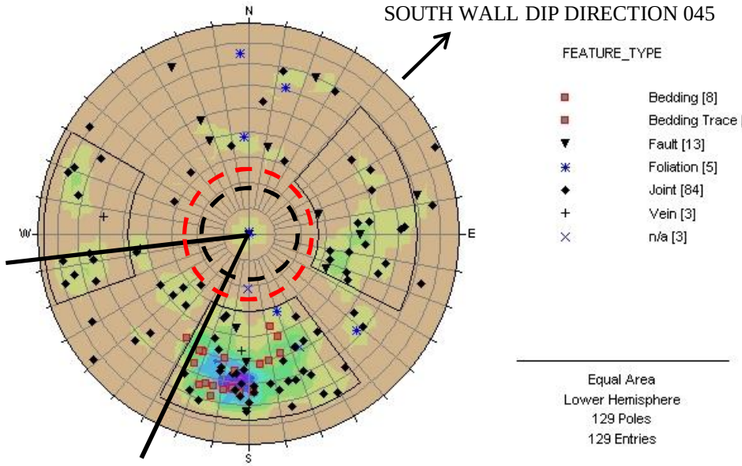
PROJECT
GEOTECHNICAL EVALUATION AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
SOUTH QUARRY, KINEMATIC ANALYSES, NORTH WALL LIMESTONE

Golder Associates

PROJECT No.		063-7109 800	FILE No.	Figure 12.9_to_12.15
DESIGN	TB	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	KH	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 12.9



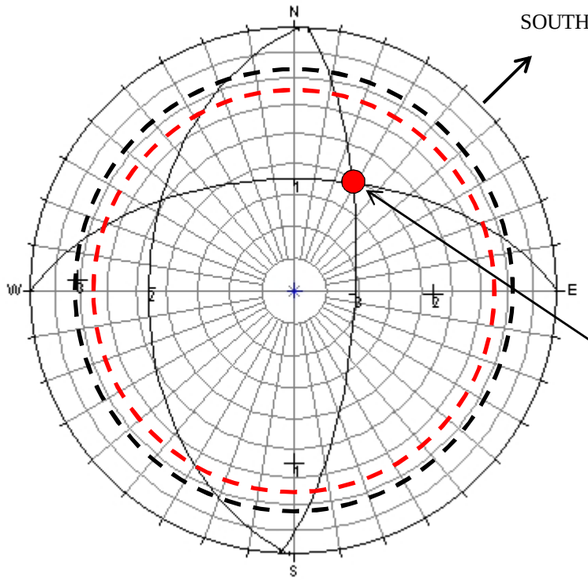
SOUTH WALL DIP DIRECTION 045

FEATURE_TYPE

- Bedding [8]
- Bedding Trace [13]
- Fault [13]
- Foliation [5]
- Joint [84]
- Vein [3]
- n/a [3]

Equal Area
Lower Hemisphere
129 Poles
129 Entries

DISCONTINUITY SETS, LIMESTONE IN STRUCTURAL DOMAIN 1



SOUTH WALL DIP DIRECTION 045

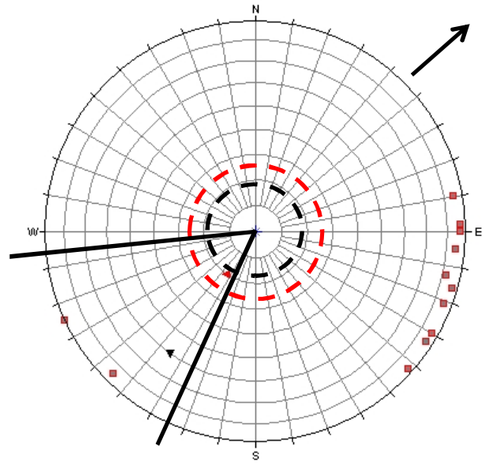
Orientations

ID	Dip / Direction
1	55 / 360
2	44 / 271
3	71 / 093

I1,3 PLUNGE/TREND 51/029

Equal Area
Lower Hemisphere
129 Poles
129 Entries

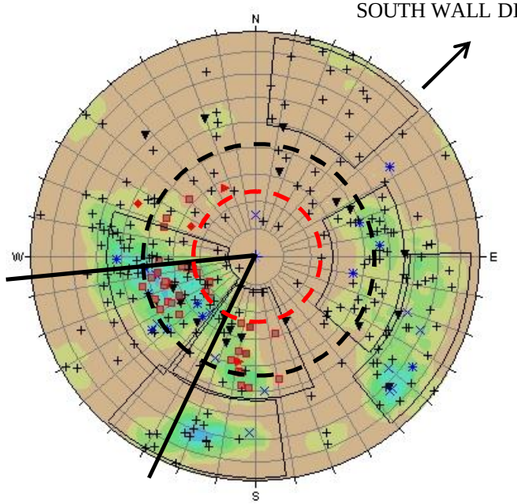
KINEMATIC ANALYSIS, LIMESTONE IN STRUCTURAL DOMAIN 1 (TV DATA)



KINEMATIC ANALYSIS,
MODELED FAULTS

MODELED FAULT

- MODELED FAULT [12]
- STEEP THRUST CONTACT [1]
- THRUST CONTACT [1]



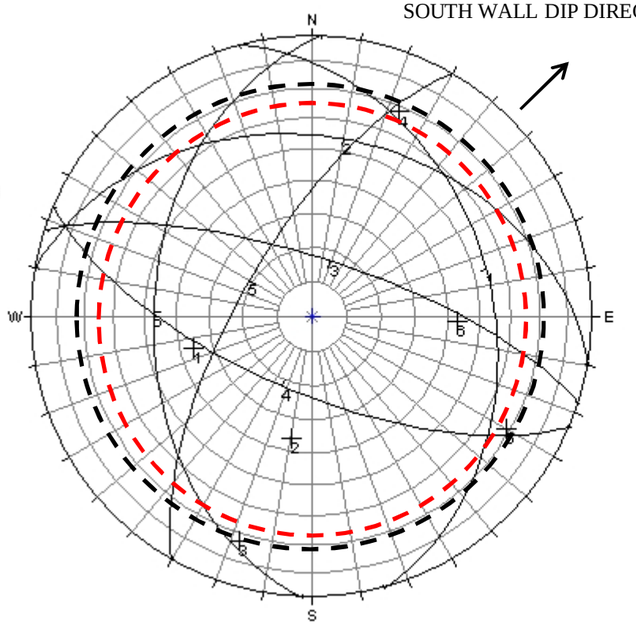
SOUTH WALL DIP DIRECTION 045

FEATURE_TYPE

- Bedding [42]
- Bedding Trace [8]
- Contact [3]
- Fault [27]
- Foliation [22]
- Joint [410]
- Shear [2]
- Vein [26]

Equal Area
Lower Hemisphere
542 Poles
297 Entries

DISCONTINUITY SETS, LIMESTONE, STRUCTURAL DOMAIN 2



SOUTH WALL DIP DIRECTION 045

Orientations

ID	Dip / Direction
1	36 / 075
2	36 / 010
3	73 / 018
4	68 / 203
5	69 / 300
6	43 / 272

Equal Area
Lower Hemisphere
542 Poles
297 Entries

KINEMATIC ANALYSIS, LIMESTONE, STRUCTURAL DOMAIN 2

26 DEGREE FRICTION ANGLE

18 DEGREE INTER-RAMP ANGLE

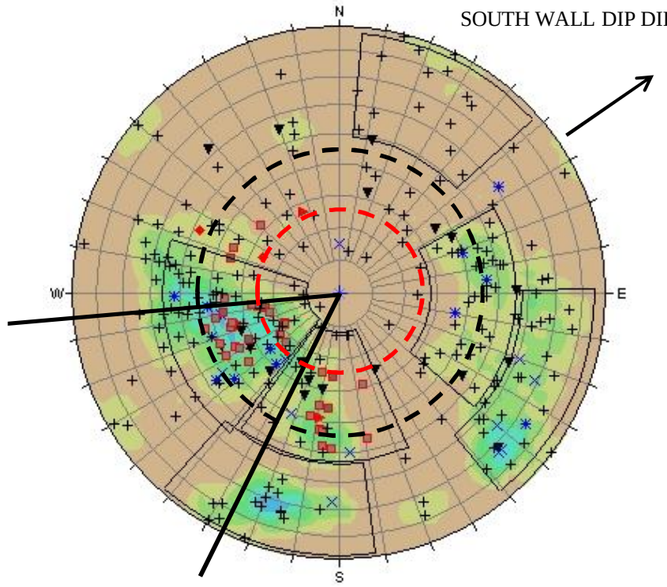
PROJECT
GEOTECHNICAL EVALUATION AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
SOUTH QUARRY, KINEMATIC ANALYSES, LIMESTONE, WEST HALF OF SOUTH WALL

Golder Associates

PROJECT No.		063-7109 800	FILE No.	Figure 12.9_to_12.15
DESIGN	TB	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	KH	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 12.10



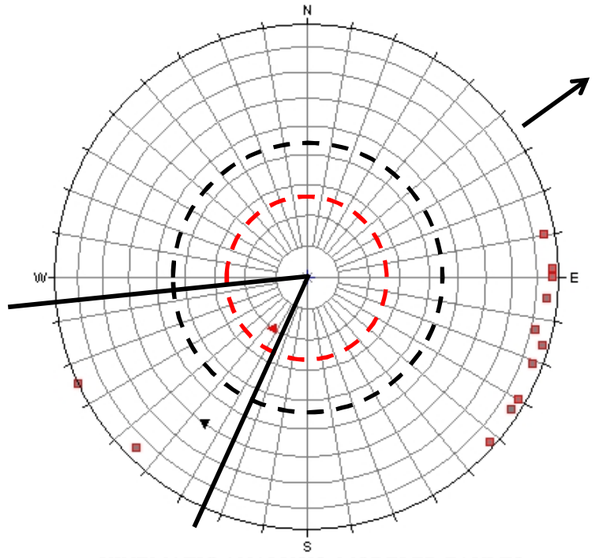
SOUTH WALL DIP DIRECTION 055

FEATURE_TYPE

- Bedding [42]
- Bedding Trace [8]
- Contact [3]
- Fault [27]
- Foliation [22]
- Joint [410]
- Shear [2]
- Vein [26]

Equal Area
Lower Hemisphere
542 Poles
297 Entries

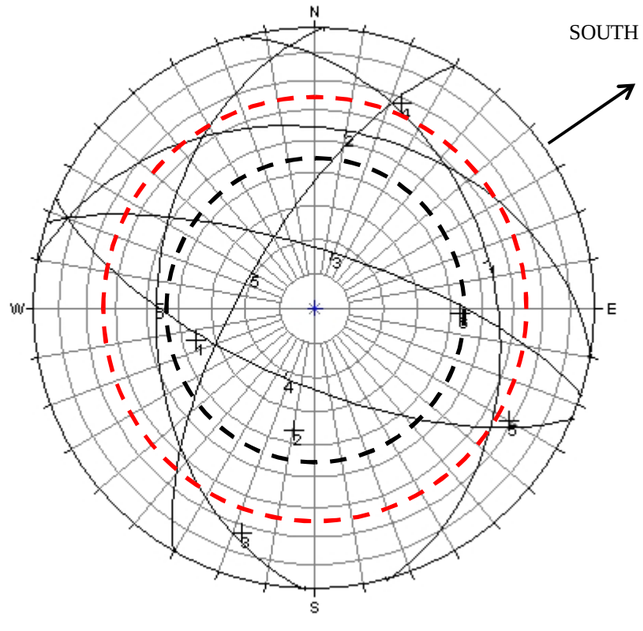
DISCONTINUITY SETS, LIMESTONE, STRUCTURAL DOMAIN 1



KINEMATIC ANALYSIS, MODELED FAULTS

MODELED FAULT

- MODELED FAULT [12]
- STEEP THRUST CONTACT [1]
- THRUST CONTACT [1]



SOUTH WALL DIP DIRECTION 055

Orientations

ID	Dip / Direction
1	36 / 075
2	36 / 010
3	73 / 018
4	68 / 203
5	69 / 300
6	43 / 272

Equal Area
Lower Hemisphere
542 Poles
297 Entries

26 DEGREE FRICTION ANGLE

45 DEGREE INTER-RAMP ANGLE

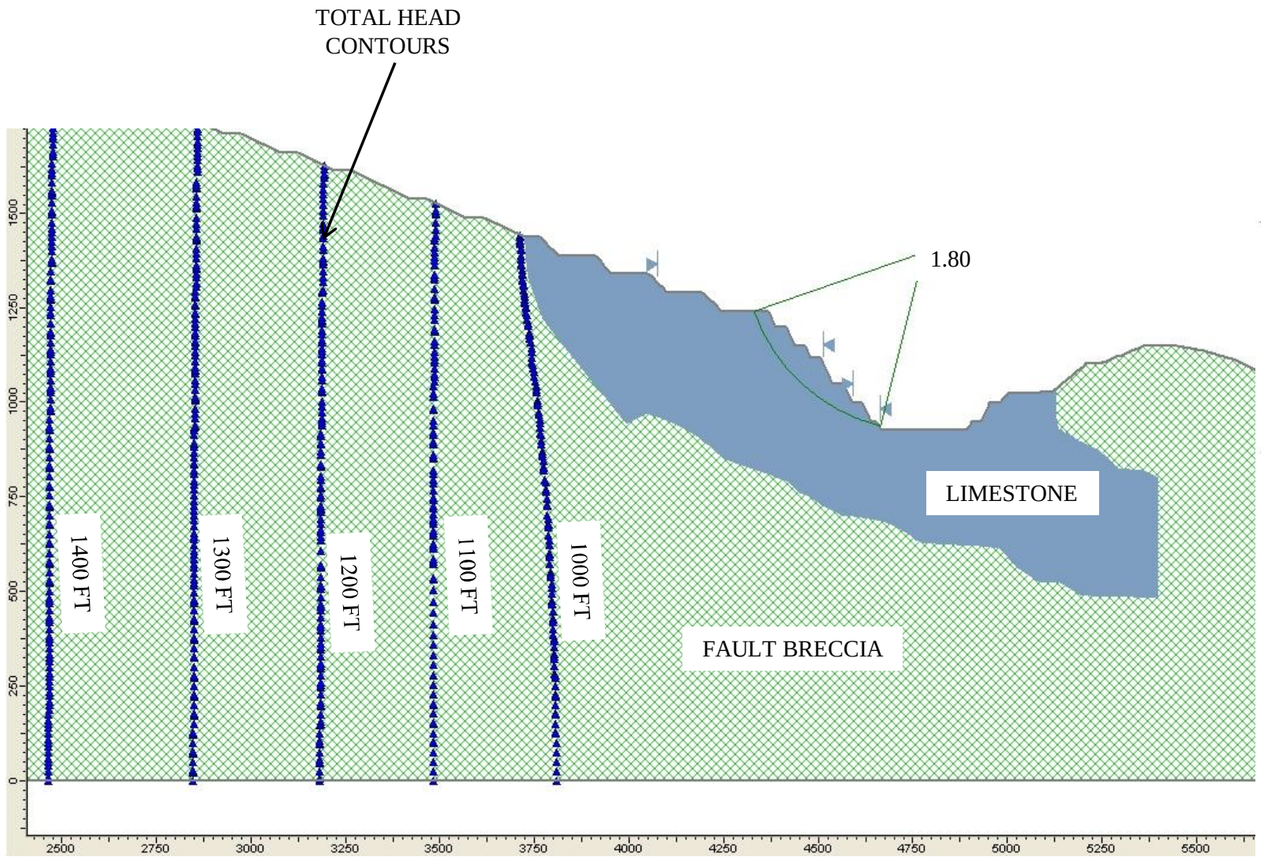
PROJECT
GEOTECHNICAL EVALUATION AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
SOUTH QUARRY, KINEMATIC ANALYSES, LIMESTONE, EAST HALF OF SOUTH WALL

Golder Associates

PROJECT No.		063-7109 800	FILE No.	Figure 12.9_to_12.15
DESIGN	TB	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	KH	01/22/10		
REVIEW	BF	01/22/10		

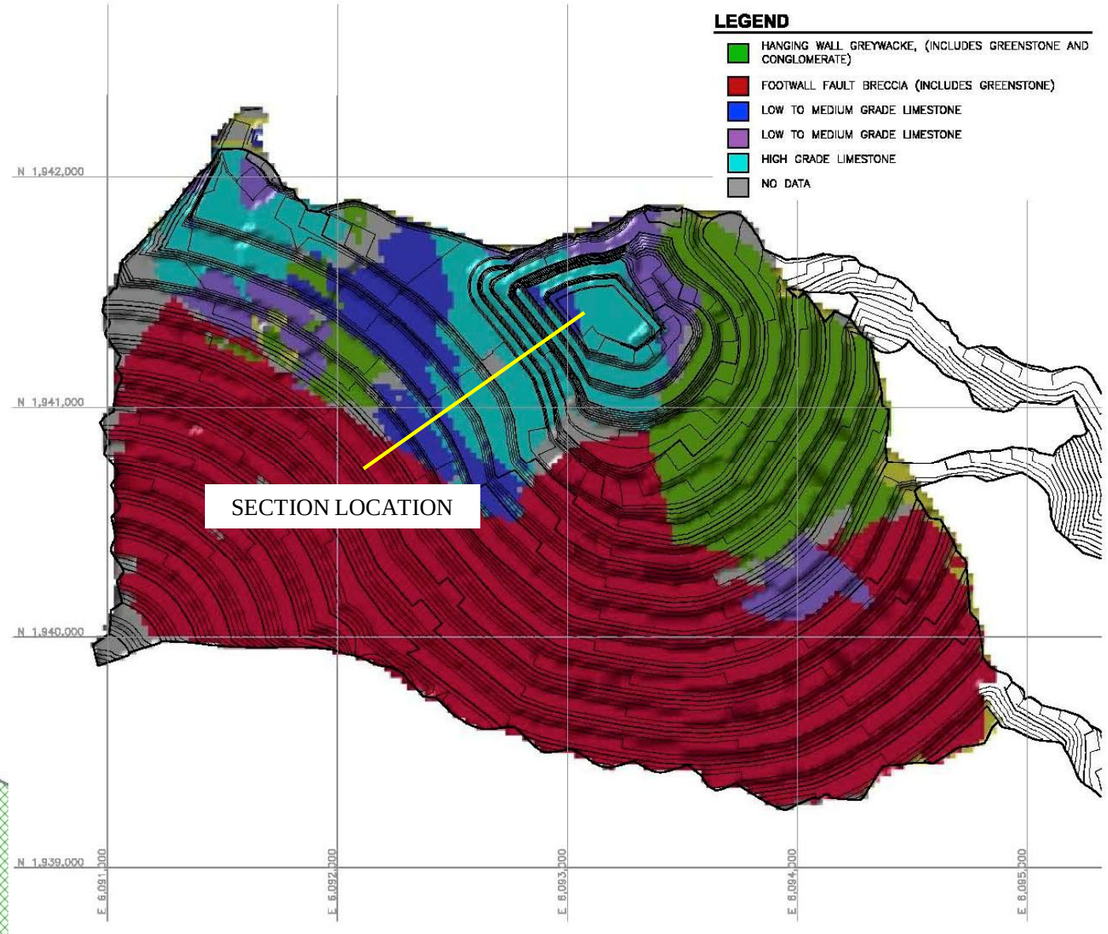
FIGURE 12.11



SOUTH WALL LIMESTONE, ROCK MASS STABILITY ANALYSIS

NOTES:

1. "Fault Breccia" material type includes modeled Footwall Fault Breccia and Hangingwall Graywacke shapes.
2. Total head contours are based on conditions during mining.



SECTION LOCATION

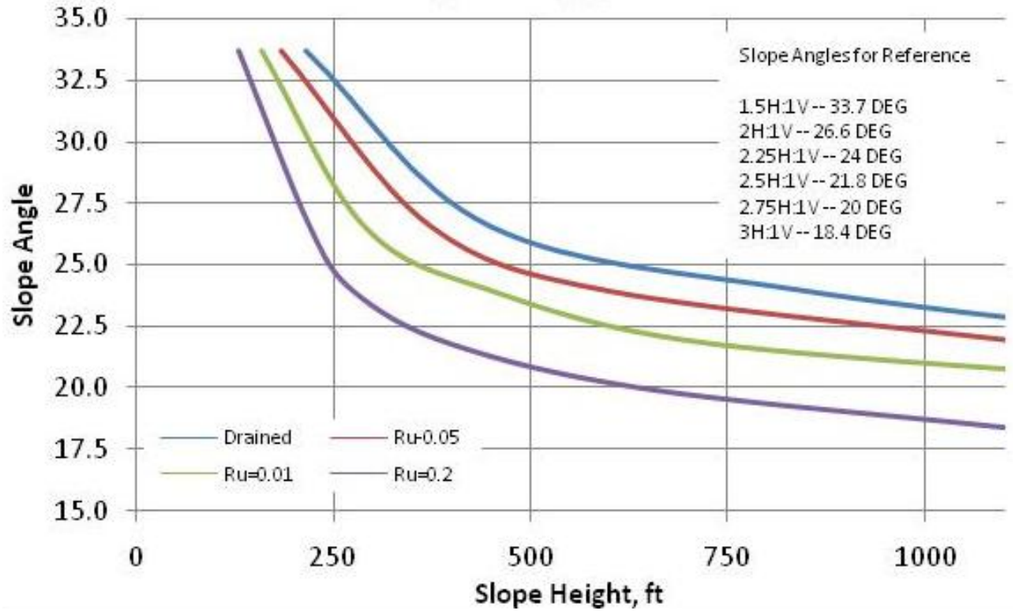
PROJECT
GEOTECHNICAL EVALUATION AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
SOUTH QUARRY, ROCK MASS STABILITY, SOUTH WALL LIMESTONE

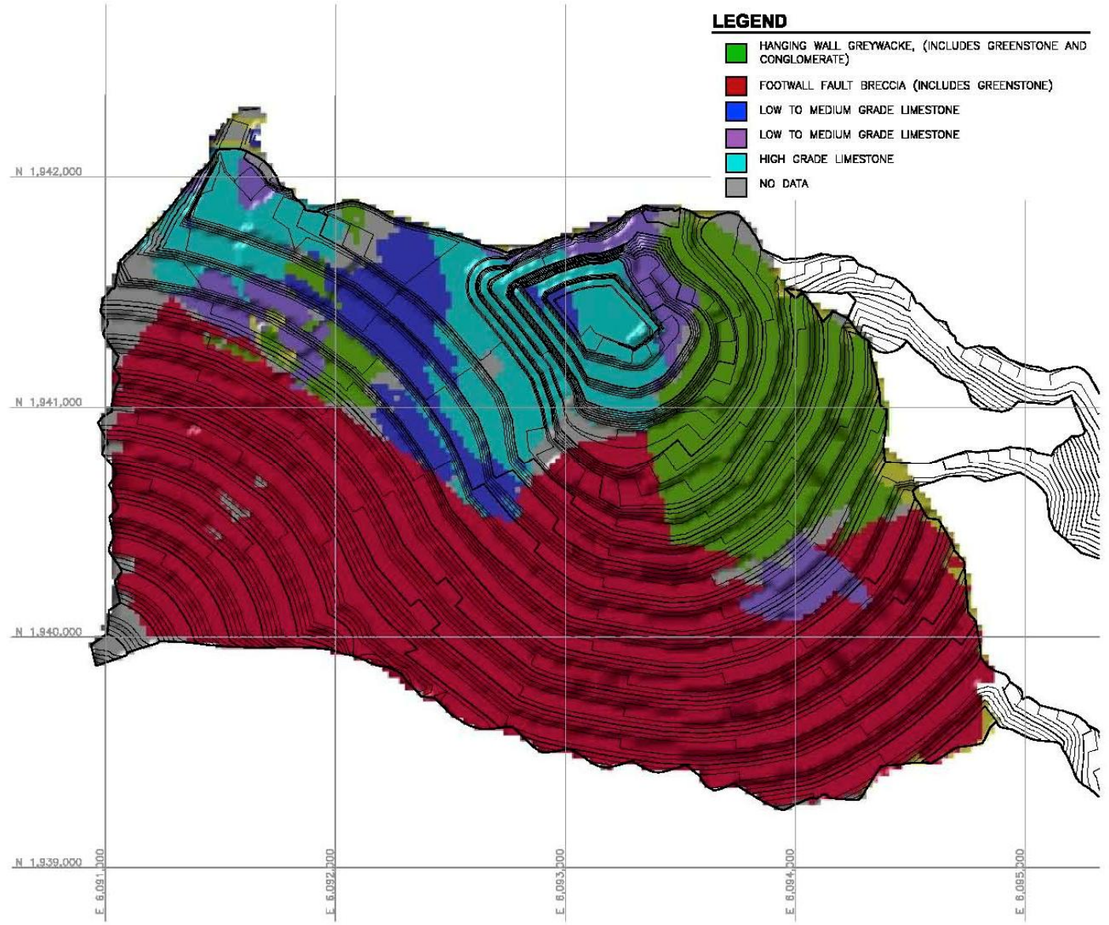
Golder Associates

PROJECT No.		063-7109 800	FILE No.	Figure 12.9_to_12.15
DESIGN	TB	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	KH	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 12.12



SLOPE DESIGN CHART FOR FACTOR OF SAFETY 1.2



ESTIMATED ULTIMATE QUARRY GEOLOGY

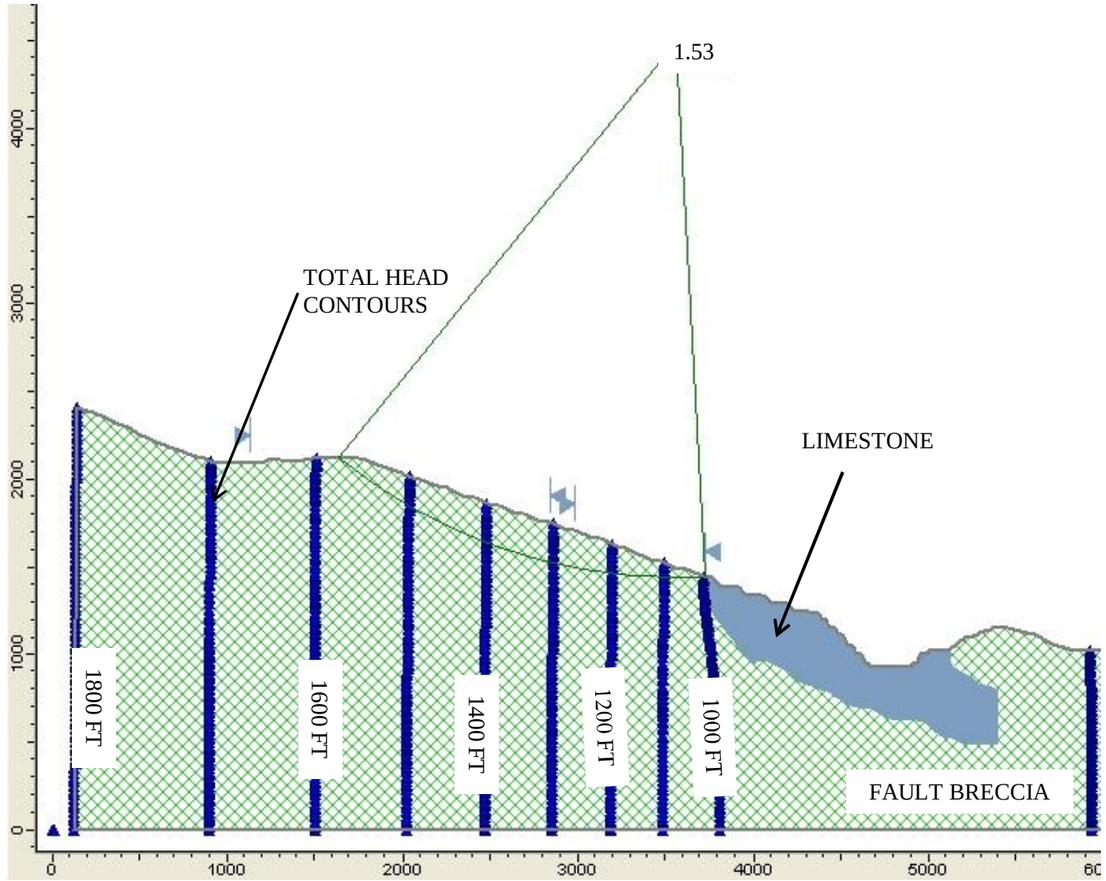
PROJECT
GEOTECHNICAL EVALUATION AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

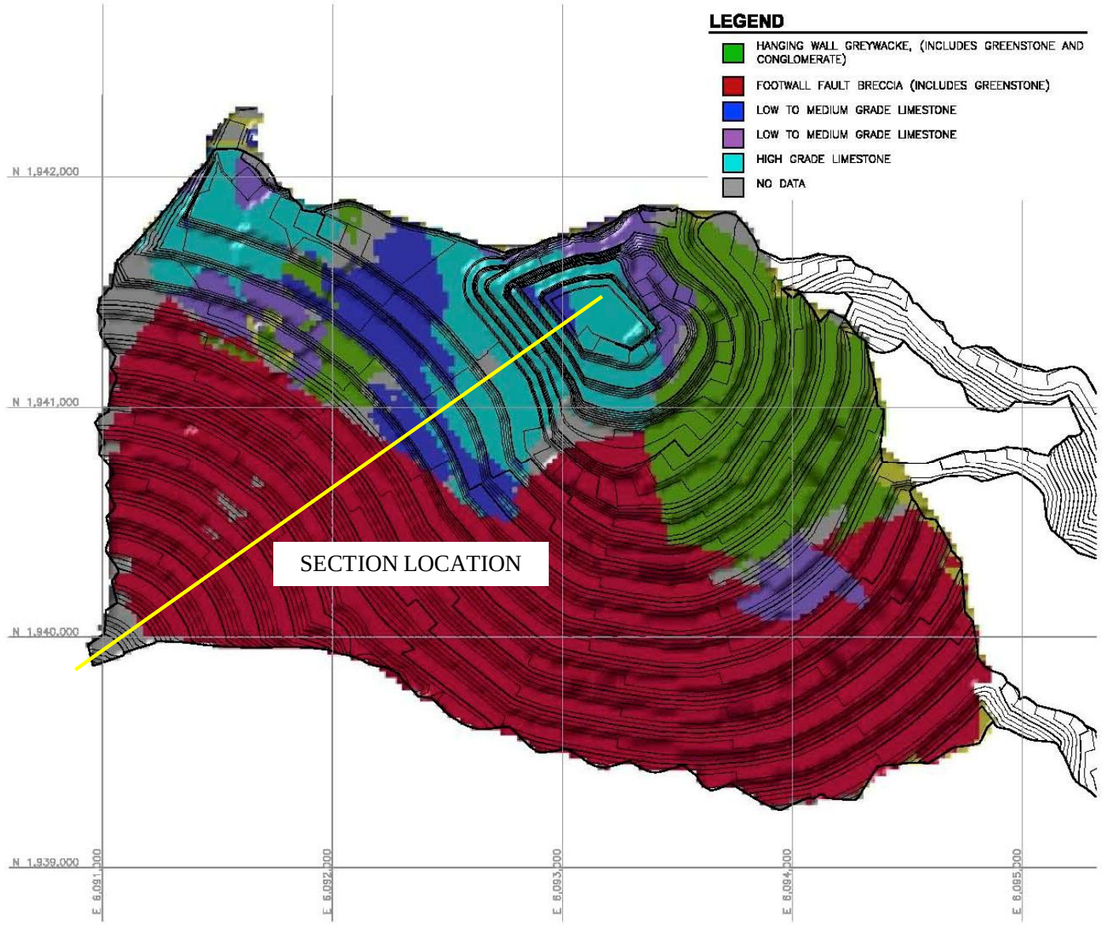
TITLE
SOUTH QUARRY, GENERIC GREENSTONE/ FAULT BRECCIA STABILITY ANALYSES

Golder Associates

PROJECT No.		063-7109 800	FILE No.	Figure 12.9_to_12.15
DESIGN	TB	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	KH	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 12.13





NOTES:

1. "Fault Breccia" material type includes modeled Footwall Fault Breccia and Hangingwall Graywacke shapes.
2. Total head contours are based on conditions during mining.

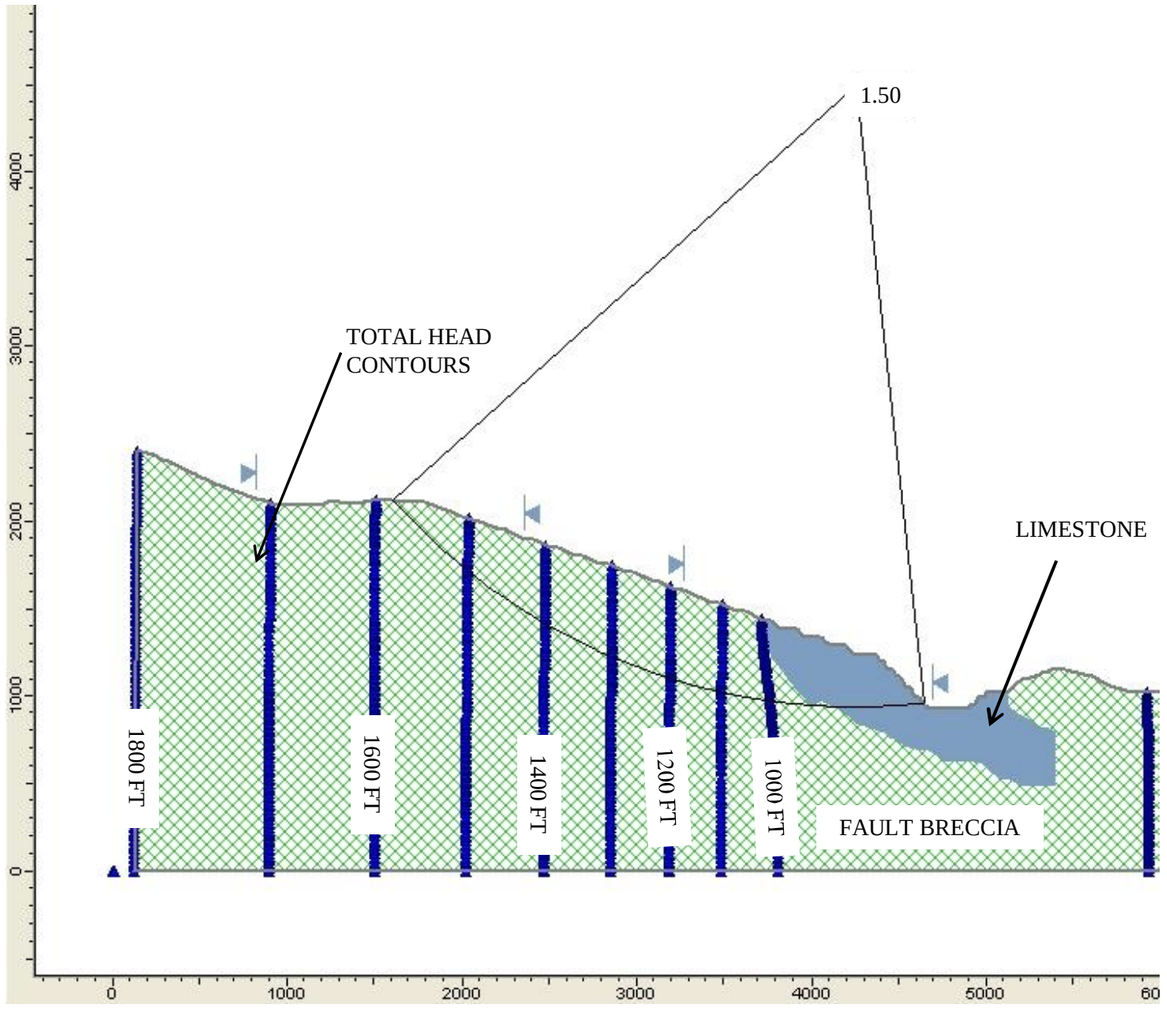
PROJECT
GEOTECHNICAL EVALUATION AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

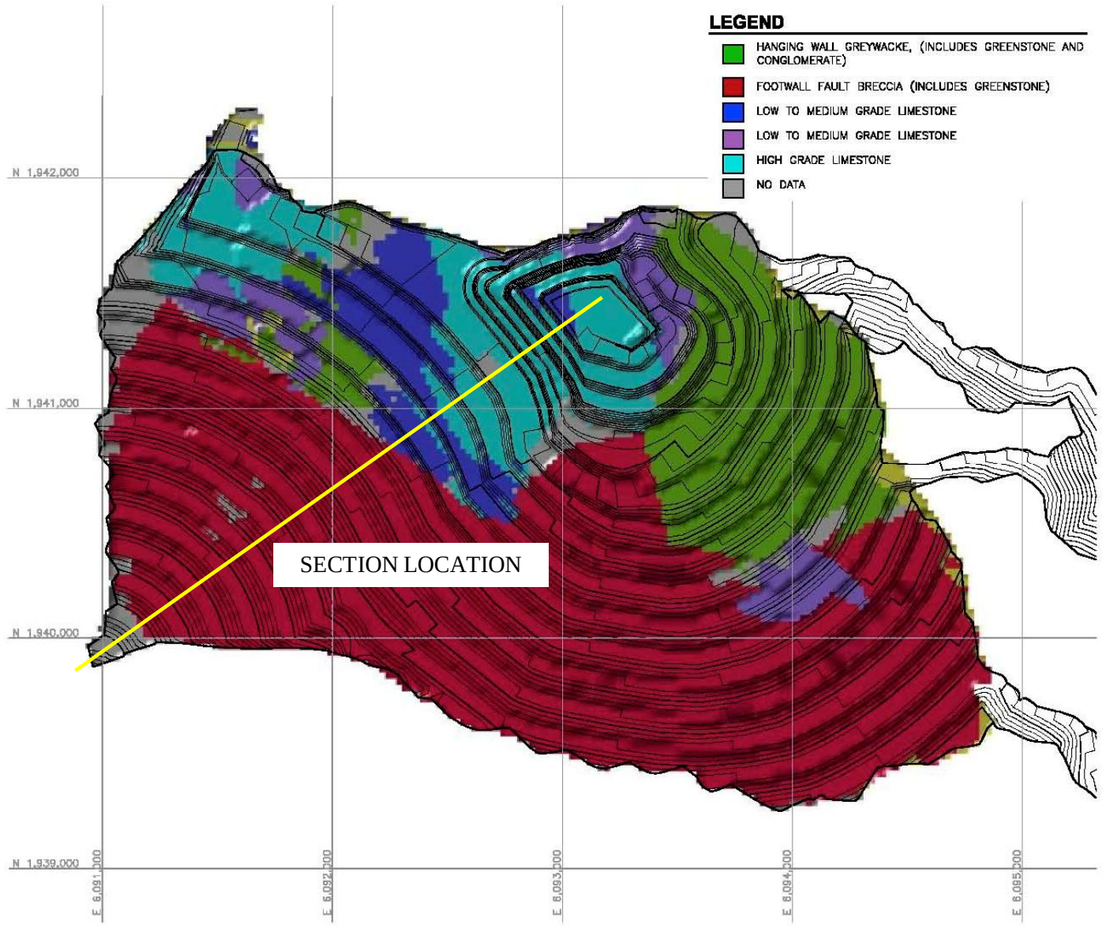
TITLE
SOUTH QUARRY, KINEMATIC ANALYSES, SOUTH WALL GREENSTONE/FAULT BRECCIA

Golder Associates

PROJECT No.		063-7109800	FILE No.	Figure 12.9_to_12.15
DESIGN	TB	01/22/10	SCALE AS SHOWN	REV. 1
CADD	AJS	01/22/10		
CHECK	KH	01/22/10		
REVIEW	BF	01/22/10		

FIGURE 12.14





NOTES:

1. "Fault Breccia" material type includes modeled Footwall Fault Breccia and Hangingwall Graywacke shapes.
2. Total head contours are based on conditions during mining.

PROJECT
GEOTECHNICAL EVALUATION AND DESIGN RECOMMENDATIONS
PERMANENTE QUARRY RECLAMATION PLAN UPDATE
SANTA CLARA COUNTY, CALIFORNIA

TITLE
SOUTH QUARRY, KINEMATIC ANALYSES, SOUTH WALL OVERALL SLOPE STABILITY

Golder Associates

PROJECT No.		063-7109 800	FILE No.	Figure 12.9_to_12.15	
DESIGN	TB	01/22/10	SCALE	AS SHOWN	REV. 1
CADD	AJS	01/22/10			
CHECK	KH	01/22/10			
REVIEW	BF	01/22/10			

FIGURE 12.15

13.0 REFERENCES

Bieniawski, Z. T., 1976. Rock Mass Classification in Rock Engineering. In Exploration for Rock Engineering (ed. Z. T. Bieniawski), vol. 1, pp. 97-106. Balkema, Cape Town.

Brabb, E.E., Graymer, R.W. and Jones D.L.. 2000. Geologic Map and Map Database of the Palo Alto 30' x 60' Quadrangle, California. U.S. Geological Survey Miscellaneous Field Studies Map MF-2332 ,U.S. Department of the Interior, U.S. Geological Survey

Bray, J. D., and Travasarou, T., 2007. "Simplified Procedure for Estimating Earthquake-Induced Deviatoric Slope Displacements", Journal of the Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 133, No. 4, pp. 381-392.

Brown, E.T. (ed.), 1981. Rock Characterization Testing and Monitoring: ISRM Suggested Methods, Pergamon Press, for the International Society for Rock Mechanics.

Call and Nicholas, Inc. (CNI), 1998. Slope Stability Analysis Northwest Wall of the Permanente Quarry: Report Prepared for Hanson Permanente Cement Company, dated February 1998.

Call and Nicholas, Inc., 1999. Quarry Visit Report and Recommendations for Slide Cleanup, Permanente Quarry. Memo to Dan Howard dated 8 January, 1999.

Call and Nicholas, Inc., 1999. Summary Report: Scenic Easement Grading Plan Update. Memo to George Lesnikoff dated 11 June, 1999.

Call and Nicholas, Inc. 1999., Hanson Permanente Pit, Scenic Easement Grading Plan. Report prepared for Hanson Permanente Cement Company, dated October, 1999.

Call and Nicholas, Inc., 2002a. Permanente Quarry, Slide at -5000 East: Report Prepared for Hanson Permanente Cement Company, Dated January 24, 2002.

Call and Nicholas, Inc., 2002b. Slope Stability Study, East Wall of Hanson Permanente Quarry, prepared for Hanson Permanente Cement, dated August, 2002.

Call and Nicholas, Inc., 2002c. Addendum 1, Slope Stability Study East Wall of Hanson Permanente Quarry. Letter report to David Disbrow dated October 14, 2002.

Call and Nicholas, Inc., 2002d. Geotechnical Investigation of Displacement at Permanente Quarry. Report prepared for Permanente Cement, dated October, 2002.

Call and Nicholas, Inc. 2003. Slope Stability Study for the East Side of the Permanente Limestone Quarry. Report prepared for Hanson Permanente Cement, Inc., dated June, 2003.

Deere, D. U., 1989. Rock Quality Designation (RQD) After Twenty Years. Final contract report GL-89-1 prepared for US Army Corps of Engineers under Contract No. DACW39-86-M-4273.

EnviroMINE, Inc., 2007. Hanson Permanente Cement, Permanente Quarry, California, Mine ID # 91-43-0004, Application for Reclamation Plan Amendment, March 2007.

FHWA. 1997. "Geotechnical Engineering Circular No.3, Design Guidance: Geotechnical Earthquake Engineering for Highways, Vol I – Design Principles," Publication No. FHWA-SA-97-076, May, 1997.

Foruria, J., 2004. Geology of the Permanente Limestone and Aggregate Quarry, Santa Clara County, California: Report prepared for Hanson Permanente Cement dated September 24, 2004.

Geo-Slope, 2007. SEEP/W Software.

Gibson, R. E., 1953. "Experimental Determination of the True Cohesion and True Angle of Internal Friction in Clays", Proceedings, 3rd Internal Conference on Soil Mechanics and Foundation Engineering, Zurich, Switzerland, pp. 126-130.

Golder Associates Inc., 2007. Geotechnical Recommendations for Updated Mine Reclamation Plan Amendment, Hanson Permanente Quarry, Cupertino, California: Report prepared for EnviroMine Inc., dated January 4, 2007.

Golder Associates Inc., 2008. "Slope Stability Evaluation for Compliance with SMARA, West Materials Storage Area, Permanente Quarry, Santa Clara County, California", Report prepared for Hanson Aggregates, dated November 2008.

Golder Associates Inc., 2009. Slope Stability Evaluation for Compliance with SMARA, East Materials Storage Area, Permanente Quarry, California. April 2009.

Golder Associates Inc., 2009. Keyway Construction Drawing (Letter Transmittal and attached Drawing), East Materials Storage Area, Permanente Quarry, California. July 27, 2009.

Golder Associates Inc., 2010. Slope Stability Evaluation for Compliance with SMARA, Revised Grading Plan Update, East Materials Storage Area, Permanente Quarry, California. February 2010.

Golder Associates Inc., 2010. Slope Stability Evaluation for Compliance with SMARA, Revised Grading Plan Update, East Materials Storage Area, Permanente Quarry, California. April, 2010.

Golder Associates, 2010 (in progress). Hydrogeologic Investigation, Permanente Quarry Reclamation Plan Update, Santa Clara County, California

Hoek, E., and Brown, E.T., 1980. Underground Excavations in Rock: London, Institute of Mining and Metallurgy.

Hoek, E., and Karzulovic, A., 2000. Rock Mass Properties for Surface Mines in Slope Stability in Surface Mining: Society for Mining, Metallurgy, and Exploration, Littleton, Colorado.

Hoek, E., Carranza-Torres, C., Corkhum, B., 2002. Hoek-Brown Failure Criterion, 2002 Edition: Proceedings, 5th North American Rock Mechanics Symposium, Toronto, p. 267-273.

Lindquist, E.S. and Goodman, R.E., 1994. The Strength and Deformation Properties of a Physical Model Melange: Proceedings, 1st North American Rock Mechanics Conference (NARMS), Austin, TX 9 (Nelson, P.P., and Laubach, S.E. editors; Balkema, 1994).

Makdisi, F. I. and Seed, H. B., 1978. "Simplified Procedure for Estimating Dam and Embankment Earthquake-Induced Deformation", Journal of the Geotechnical Engineering Division, ASCE, Vol. 104, No. GT7, pp. 849-867.

Makdisi, F. I., 1978, Performance and Analyses of Earth Dams During Strong Earthquakes, Ph.D. dissertation, University of California, Berkeley.

Mathieson, E. L., 1982, Geology of the Permanente Property, Kaiser Corporation, Permanente, California, unpublished Kaiser Permanente Cement Company report, 34 p.

Peck, R. B, Hansen, W. E.,, and Thornburn , T. H. (1974), "Foundation Engineering", John Wiley and Sons, Inc., New York.

Petersen, Mark D., Frankel, Arthur D., Harmsen, Stephen C., Mueller, Charles S., Haller, Kathleen M., Wheeler, Russell L., Wesson, Robert L., Zeng, Yuehua, Boyd, Oliver S., Perkins, David M., Luco, Nicolas, Field, Edward H., Wills, Chris J., and Rukstales, Kenneth S., 2008. Documentation for the 2008 Update of the United States National Seismic Hazard Maps: U.S. Geological Survey Open-File Report 2008–1128, 61 p.

Rocscience, 2003. "SLIDE 5.0", Manual and Software.

Rocscience, 2006. Slide Software, v. 5.027.

Rocscience, 2009. Slide Software, v. 5.043.

Rogers, T.H. and Armstrong, C.F., 1973. Environmental Geologic Analysis of the Monte Bello Ridge Mountain Study Area, Santa Clara County, California, California Division of Mines and Geology Preliminary Report 17.

Seed, H. B., 1979. "Considerations in the Earthquake-Resistant Design of Earth and Rockfill Dams," Geotechnique, vol. 29, No. 3, pp. 215-263.

Sierra Geotechnical, 2002. Letter to David Disbrow Re: Emergency Grading Request to Santa Clara County. Dated October 4, 2002.

Sorg, D.H., and McLaughlin, R.J., 1975. Geologic Map of the Sargent-Berrocal Fault Zone Between Los Gatos and Los Altos Hills, Santa Clara County, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-643, scale 1:24,000

SRK Consulting, 2005. Draft Engineering Evaluation of the Slope Stability Design, Hanson Permanente Limestone Quarry, Cupertino, California. November, 2005.

Terzaghi K., Peck, R. B., Mesri, G., 1996. "Soil Mechanics in Engineering Practice (Third Edition)", John Wiley and sons, Inc., New York.

The Mines Group, 2001. Hanson Permanente Cement Waste Rock Dump, Conceptual Drainage, Sediment Control, and Reclamation Plan. Project No. 012001 dated November 19, 2001.

Transportation Research Board (TRB), 2002. Design and Construction of Transportation Facilities in Melange and Other Block-in-Matrix Rocks: Special Session, 53rd Highway Geology Symposium, San Luis Obispo, August 13, 2002; Powerpoint Presentation by Dr. Edmund Medley titled Simple Guidelines to the Characterization of the Chaos of Mélanges and Other Bimrocks.

United States Department of Agriculture, Forest Service, "Level I Stability Analysis Documentation for Version 2.0," General Technical Report INT-285, April 1992.

United States Department of Agriculture, Forest Service, 1994. "Slope Stability Reference Guide for National Forests in the United States, Volume II," EM 7170-13, August 1994.

Vanderhurst, W., (1981), The Santa Clara Formation and Orogenesis of Monte Bello Ridge, 114 p.

Wakabayashi, J., 1999, The Franciscan Complex, San Francisco Bay Area: a record of subduction complex processes, in Geologic field trips in northern California: California Division of Mines and Geology Special Publication, vol. 119, p 1-21.

William Cotton & Associates, 1988. Progress Report Number 6, Emergency Grading Authorization 87-3, Kaiser Permanente Quarry Rockslide, Permanente, California. Letter report G1177D to Mr. James Sirr, County of Santa Clara, February 29, 1988.

William Cotton & Associates, 1990. Status of Rockslide Activity and Proposed Geotechnical Services, Permanente Quarry Rockslide, May 11, 1990.

William Cotton & Associates, 1994. 1994 Summary of Slope Monitoring, Permanente Quarry Rockslide, Santa Clara County, California. Letter report G3191 to Mr. Daniel Howard dated March 23, 1995.

William Cotton & Associates, 1995. 1995 Summary of Slope Monitoring, Permanente Quarry Rockslide, Santa Clara County, California. Letter report G3191 to Mr. Daniel Howard dated November 28, 1995.

Woodward-Clyde Consultants 1992. Kaiser Cement Company Quarry Landslide. Cupertino, California. Letter report to Mr. James Liddiard dated July 24, 1992.

Wylie, D.C., 1992. Foundations on Rock. Chapman and Hall, London.

.

DRAFT APPENDICES

GEOTECHNICAL EVALUATIONS AND DESIGN RECOMMENDATIONS

Permanente Quarry Reclamation Plan Update
Santa Clara County, California

Volume II – Appendices

Submitted To: Lehigh Southwest Cement Company
24001 Stevens Creek Boulevard
Cupertino, California 95014

Submitted By: Golder Associates Inc.
425 Lakeside Drive
Sunnyvale, CA 94085

Golder Associates Inc.
1000 Enterprise Way
Sacramento, CA 95678

Golder Associates Inc.
595 Double Eagle Court, Suite 1000
Reno, NV 89521

May 2010

Project 063-7109

A world of capabilities delivered locally

Golder Associates

Table of Contents - Appendices

Appendix 4.A Updated 2004 Geologic Cross Sections
Appendix 5.A Geotechnical Core Log Summary Plots and Photographs (MS-01 and MS-02)
Appendix 5.B Laboratory Testing Data
Appendix 5.C Seismic Displacement Calculations
Appendix 6.A Scenic Easement - Slope Stability Output
Appendix 7.A Mid-Pen – Test Quarry Logs
Appendix 7.B Mid-Pen – Lab Test Results
Appendix 7.C Mid-Pen – Slope Stability Output
Appendix 8.A East Wall – Slope Stability Output
Appendix 9.A Geotech Core Logs 2008 Drilling
Appendix 9.B Point Load 2008 Drilling
Appendix 9.C Lab Results 2008 Drilling
Appendix 9.D Stereonets
Appendix 10.A WMSA Boring Logs
Appendix 10.B WMSA Laboratory Test Results
Appendix 10.C WMSA Slope Stability Output
Appendix 11.A Topsoil Storage Area Boring Logs
Appendix 11.B Laboratory Test Results
Appendix 12.A South Quarry Core Logs and Photos
Appendix 12.B Laboratory Testing Data
Appendix 12.C Seismic Displacement Calculations

APPENDIX 4.A

Updated 2004 Geologic Cross Sections

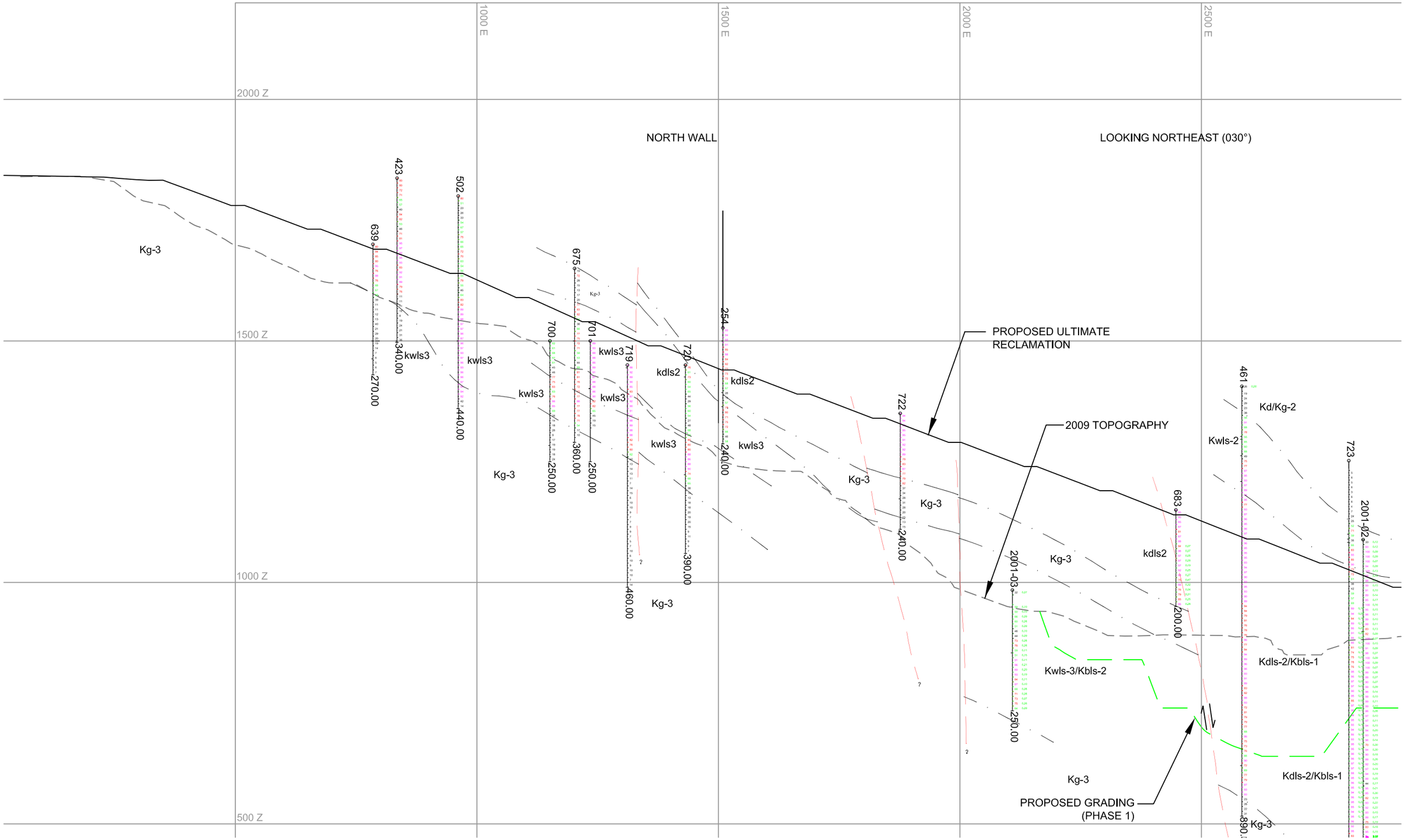
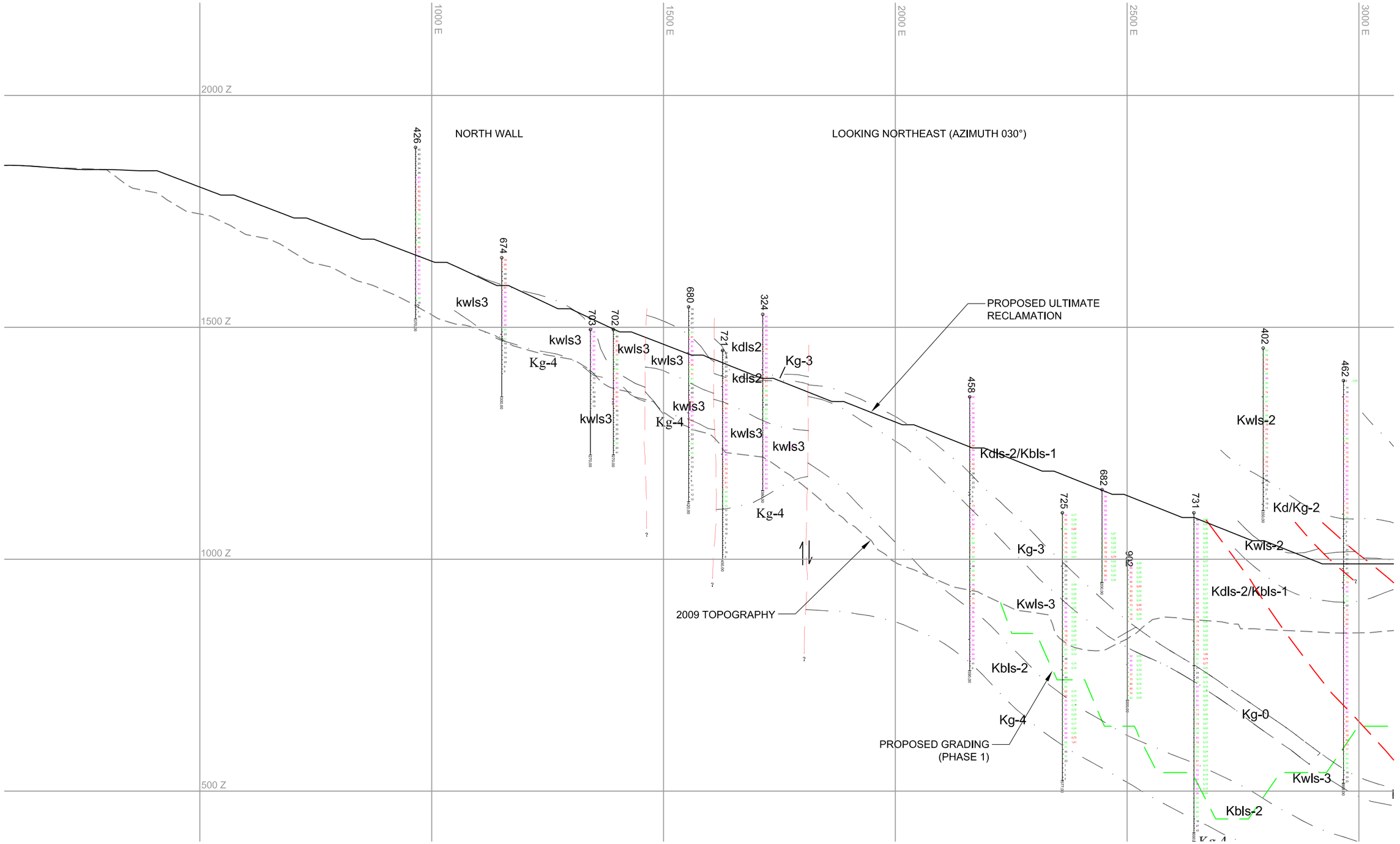


FIGURE **4.A1**

AZIMUTH 120°, SECTION 400

Lehigh Permanente Quarry/CA

Golder Associates



0 200 400

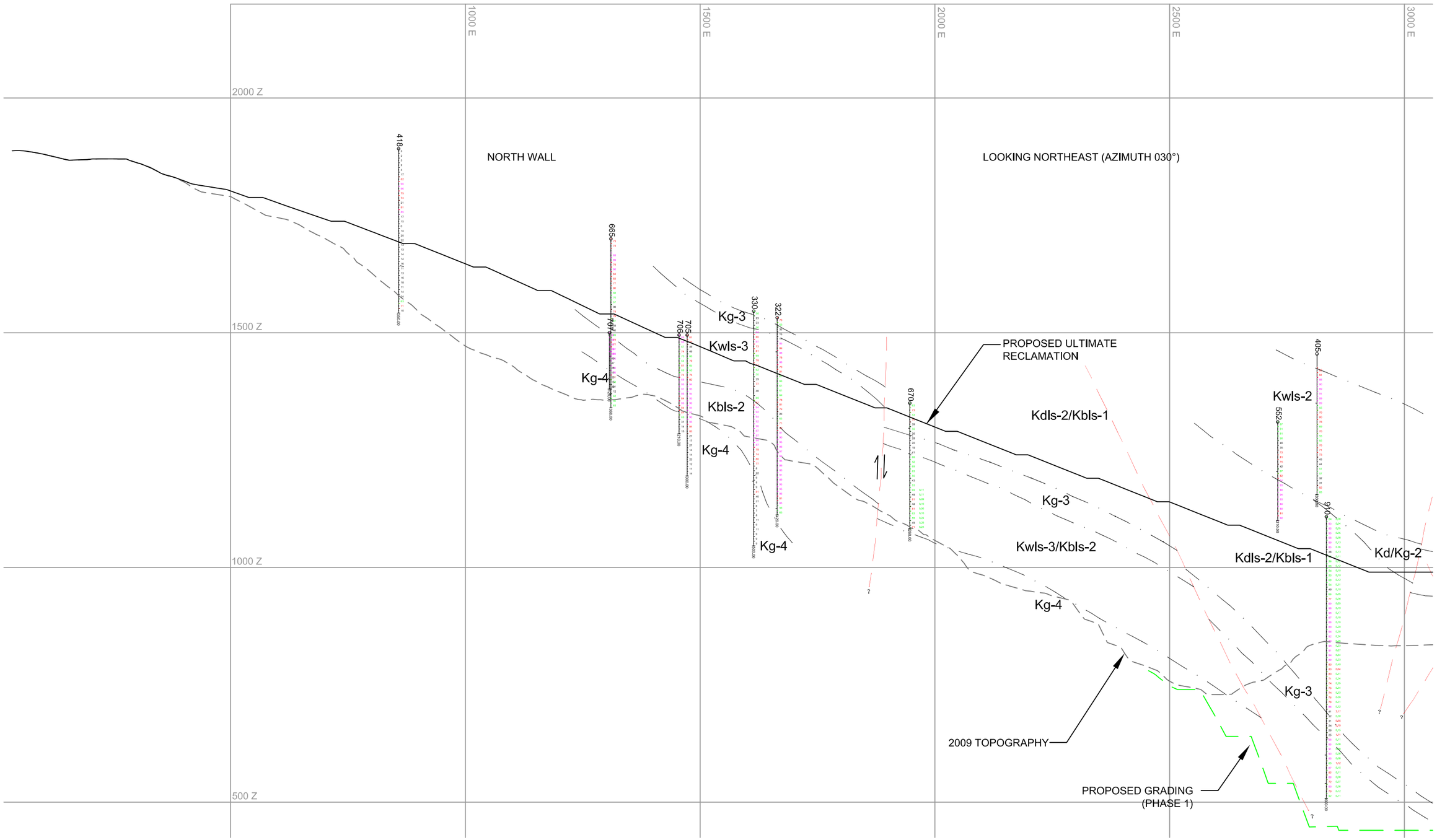
FEET

FIGURE **4.A2**

AZIMUTH 120°, SECTION 600

Lehigh Permanente Quarry/CA

Golder Associates



0 200 400
FEET

FIGURE **4.A3**
AZIMUTH 120°, SECTION 800
Lehigh Permanente Quarry/CA

Golder Associates

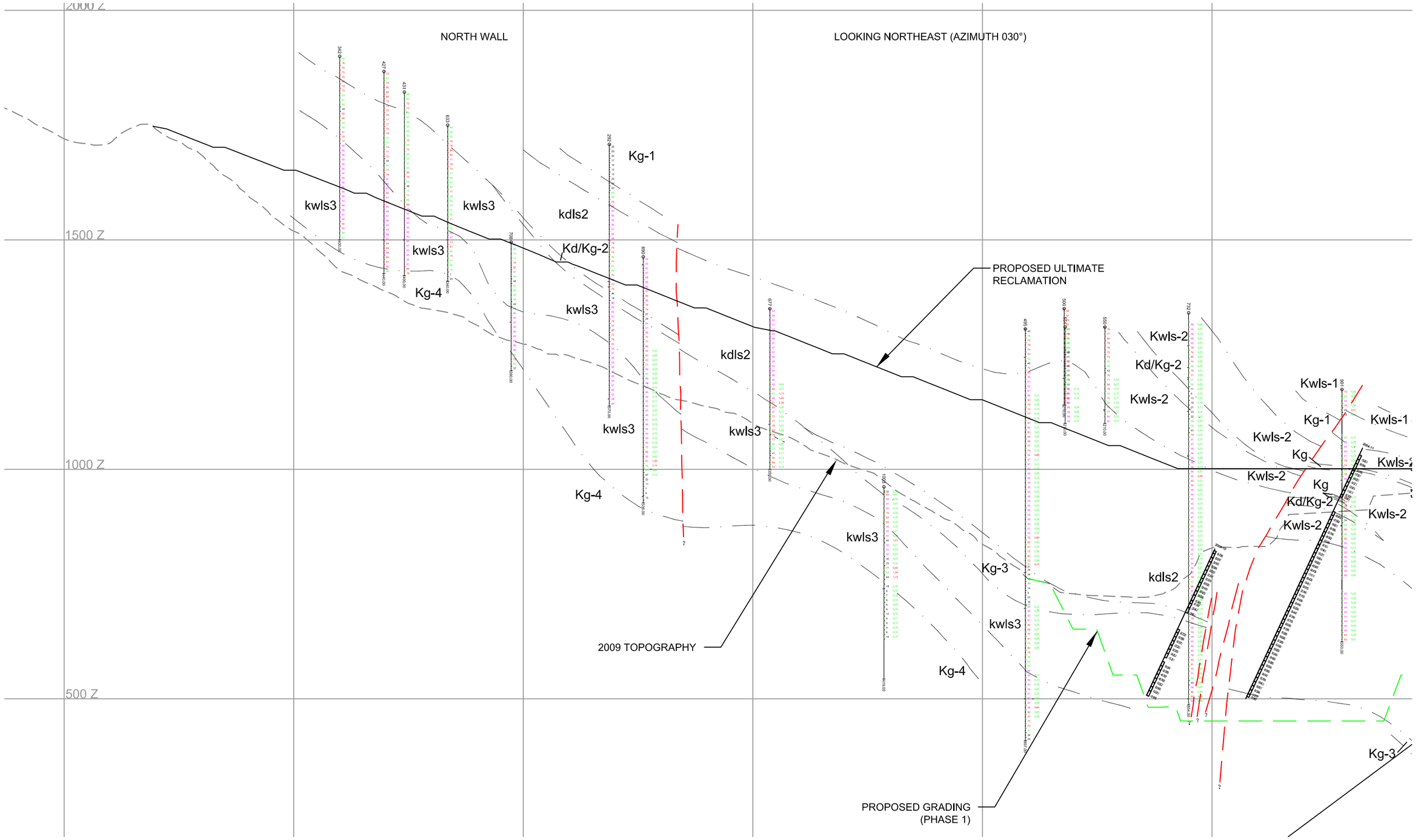


FIGURE **4.A4**

AZIMUTH 120°, SECTION 1000

Lehigh Permanente Quarry/CA

Golder Associates

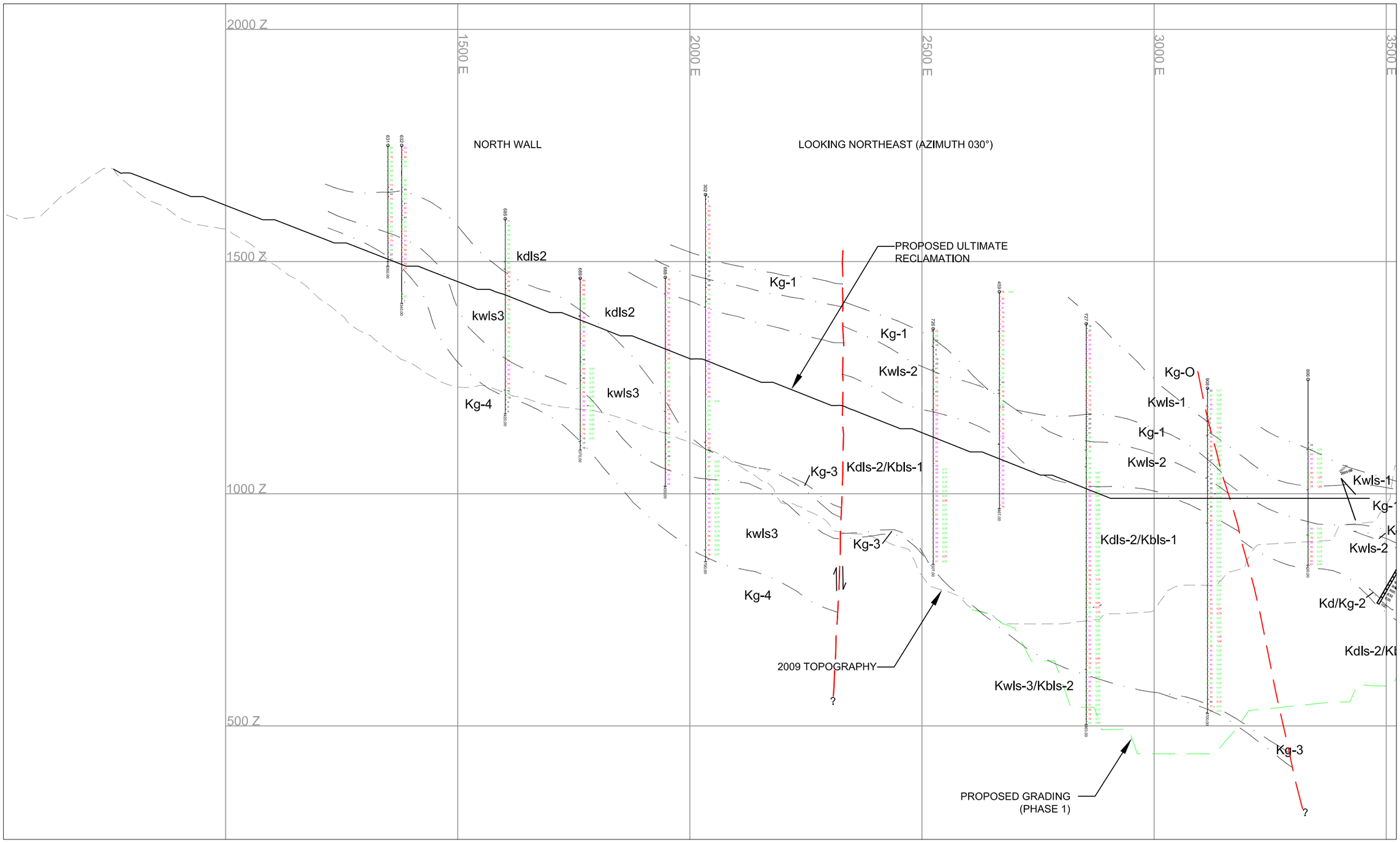


FIGURE **4.A5**

AZIMUTH 120°, SECTION 1200

Lehigh Permanente Quarry/CA

Golder Associates

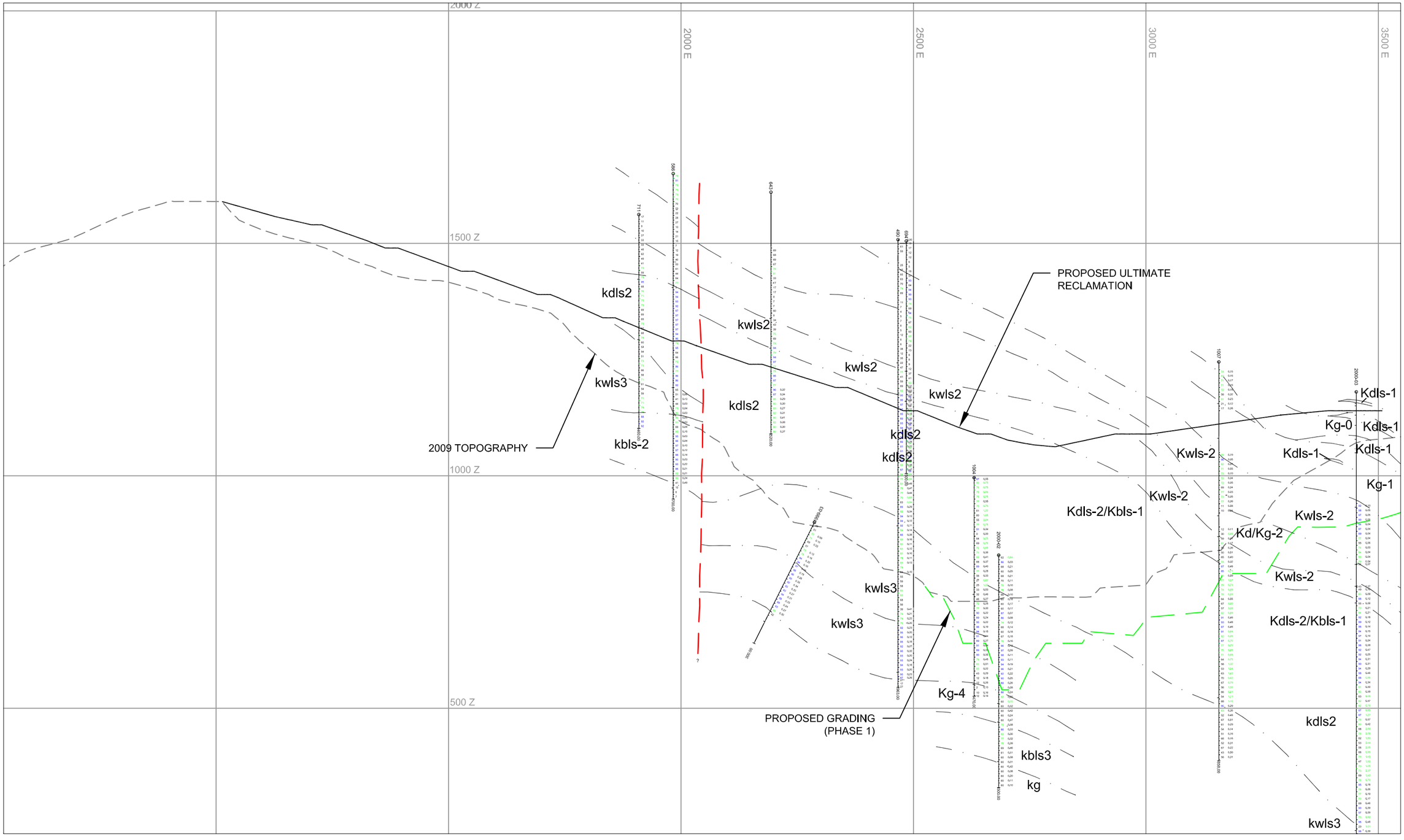
1000 E
1500 E
2000 E
2500 E
3000 E
2000 Z
1500 Z
1000 Z
500 Z
NORTH WALL
LOOKING NORTHEAST (AZIMUTH 030°)
Kg-4
Kdls-2/Kbls-1
Kg-1
Kwls-2
Kdls-2/Kbls-1
Kwls-3
Kbls-2
Kg-4
?
?
Kg-1
Kwls-2
Kdls-2/Kbls-1
Kg-1
Kwls-2
Kdls-2/Kbls-1
Kwls-3
Kg-1
Kwls-2
Kd/Kg-2
Kdls-2
Kwls-3
PROPOSED ULTIMATE RECLAMATION
2009 TOPOGRAPHY
PROPOSED GRADING (PHASE 1)
0
200
400
FEET

FIGURE **4.A6**

AZIMUTH 120°, SECTION 1400

Lehigh Permanente Quarry/CA

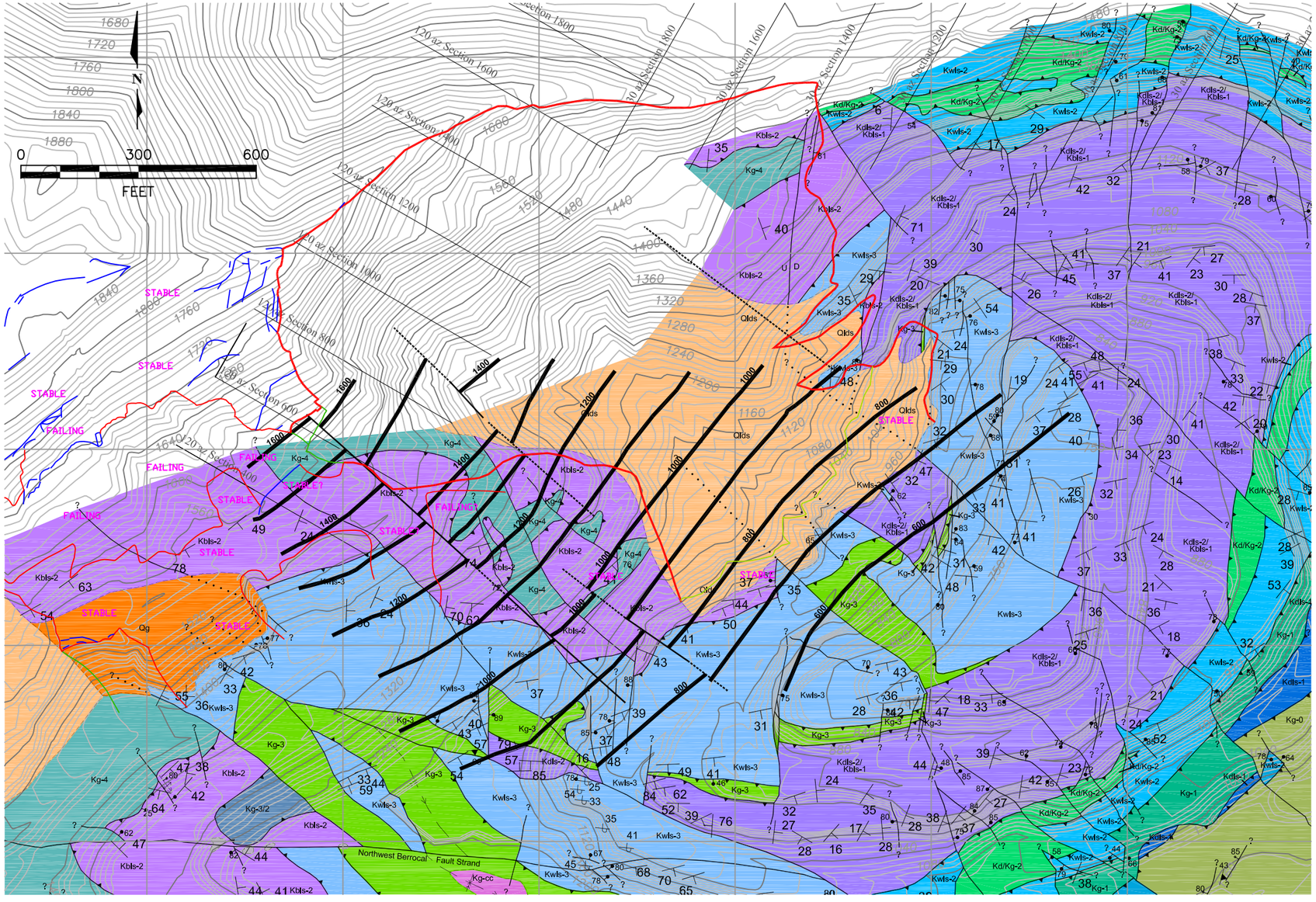
Golder Associates



0 200 400
FEET

FIGURE **4.A7**
AZIMUTH 120°, SECTION 1600
Lehigh Permanente Quarry/CA

Golder Associates



LEGEND

Quaternary Deposits

- Qlds — Quarry landslide deposits (within surface operation)
- Qg — Waste Material
- Qal — Quaternary and Recent unconsolidated alluvium and gravel deposits

Metamorphosed Igneous and Sedimentary Rocks

? Km-1 — Greywacke, shale, and argillite

Early to Middle Cretaceous

- Kg-0 — Metabasalts (Greenstones)
- Kdls-1 — Dark grey Limestone with interbedded Chert
- Kwls-1 — Light grey Limestone with interbedded Chert
- Kg-1 — Metabasalts (Greenstone)
- Kwls-2 / Kd/Kg-2 — LIght grey Limestone with thinly interbedded, variably colored Chert; Kd/Kg-2 Diorite sill with minor mafic metavolcanic flows
- Kdls-2/ Kbls-1 — Grey Limestone with minor thinly interbedded dark grey to black Chert: Gradational contact. Dark grey to black Limestone:
- Kg-3 / Kg-cc — Metabasalts (Greenstones) with lesser Limestone, Greywacke, Chert, and Mudstone
- Kwls-3 — Light grey Limestone with interbedded Chert
- Kg-3/2 — Metabasalts (Greenstones)
- Kbls-2 — Dark grey to black Limestone with minor black Chert
- Kg-4 — Metabasalts (Greenstones)
- Kbls-3 — Black Limestone

ALTERATION

Bleaching (decalcification?)

SYMBOLS

- Contact, dashed where approximately located, showing dip.
- Fault (high angle), showing dip and relative separation.
- Fault (low angle), sawteeth on upper plate showing dip
- Syncline (inclined), showing inclination of axial plane and plunge of fold.
- Anticline (inclined), showing inclination of axial plane and plunge of fold.
- Strike and dip of bedding.
- Strike of vertical bedding.
- Strike and dip of overturned bedding.
- Strike and dip of foliation.
- Strike of vertical foliation.

- Structure Contours, Controlling Fault for 1987 Failure (CNI, 1998)
- Approx. Limits of 1987 Failure
- Crack (Blue) or Scarp (Red) Mapped iby Golder in 2007

NOTES:
1. Geologic map from Foruria (2004); modified by abbreviating descriptions in legend; adding results of Golder tension crack/scarp mapping completed In June 2007; and adding structure contours from CNI (1997) for controlling fault in 1987 Failure.

FIGURE **4.A8**

NORTH WALL GEOLOGY

Lehigh Permanente Quarry/CA

Golder Associates

APPENDIX 5.A

Geotechnical Core Log Summary Plots and Photographs (MS-01 and MS-02)

PERMANENTE QUARRY RMR SYSTEM - RECORD OF GEOTECHNICAL PARAMETERS

Golder Associates

Project No.	063-7109-400 phase 2			**Drilling Method**	From / To
Borehole #	ms-inc-1	**Azimuth**	N80E	**Sheet**	of
Elevation		**Inclination**	90	**Logged by**	JL
N	**E**	**Ref. Point**		**Drill Rig**	

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	SANDY SILT WITH GRAVEL	1	0.0	2.0	2.0	N	0.0	N/A			S5	W4																
	GREENSTONE WITH SANDY SILT AND GRAVEL	2	2.0	5.0	2.6	N	0.0	N/A			S6	W4																silty greenstone with iron oxides causing discoloration
	GREENSTONE	3	5.0	7.0	2.0	N	0.0	N/A			R1	W4																muddy layers starting to develop
	GREENSTONE	4	7.0	10.0	2.9	N	0.0	10			R3	W3																sampled 8-8.5
	GREENSTONE	5	10.0	12.5	2.3	N	0.0	6			R2	W3.5	11.6	J2	1	45	IR	R	CLAY	1-2	10	15						gougy zones and decreasing iron oxide to ~15'
	GREENSTONE	6	12.5	14.0	1.2	N	0.0	3			R2	W3																
	GREENSTONE	7	14.0	16.0	2.0	N	0.0	10			R2	W3																
	GREENSTONE	8	16.0	18.0	1.2	N	0.0	0			R2/S4	W4																17.3 - distinct contact between R2 greenstone and S4 gouge
	GREENSTONE	9	18.0	21.5	3.6	N	0.0	5			R2	W4																
	GREENSTONE	10	21.5	24.0	2.5	N	0.0	10			R2	W4																
	GREENSTONE	11	24.0	25.0	1.0	N	1.0	0			R3	W4																only unnatural fractures
	NO RECOVERY	12	25.0	25.5	0.0	N		N/A			N/A	N/A																
	GREENSTONE	13	25.5	29.0	3.6	N	3.0	2			R4	W3	26.5	J1	1	48	IR	R	CLAY	1-2	7	8						sampled 26.1-26.8
													28.6	J2	1	51	IR	R	CLAY	2-3	10	12						small recoveries are assumed to be from the top of the run
	GREENSTONE	14	29.0	34.0	4.9	N	0.0	2			R2.5	W3	28.5	J2	1	53	IR	R	CLAY	1	15	16						soft, gougy, irregular
													28.8	J2	1	50	IR	R	CLAY	1	15	21						
	GREENSTONE	15	34.0	36.5	0.9	N	0.0	N/A			R1	W4																
	GREENSTONE	16	36.5	38.0	1.4	N	0.0	N/A			R1	W4																
	GREENSTONE	17	38.0	39.0	1.0	N	0.0	N/A			R1	W4																
	GREENSTONE	18	39.0	41.5	2.3	N	1.0	0			R3	W3																sampled 41.3-41.7
	GREENSTONE	19	41.5	44.0	2.4	N	0.0	1			R2.5	W3	43	J2	1	44	IR	R	CLAY	2	15	15						
	GREENSTONE	20	44.0	44.5	0.5	N	0.0	0			N/A	N/A																loose redrill fragments on top of soft gouge
	GREENSTONE	21	44.5	47.5	3.0	N	0.0	0			R2	W4																
	GREENSTONE	22	47.5	50.5	2.8	N	0.0	25			R2	W4																
	GREENSTONE	23	50.5	52.0	1.3	N	0.0	10			R2	W4																no loggable joints or fractures, but multiple small, irregular cracks are
	NO RECOVERY	24	52.0	52.5	0.0	N		N/A			N/A	N/A																common throughout the rock
	GREENSTONE	25	52.5	53.5	0.8	N	0.0	N/A			S2	W5																
	NO RECOVERY	26	53.5	54.0	0.0	N		N/A			N/A	N/A																greenstone gravel suspended in a soft gouge matrix
	NO RECOVERY	27	54.0	55.0	0.0	N		N/A			N/A	N/A																
	GREENSTONE	28	55.0	59.0	3.8	N	0.9	2			R3	W3	56.2	J2	1	55	IR	R	CLAY	1-3	9	8						
													57.1	J3	2	49	IR	R	CLAY	1-4	18	8						

PERMANENTE QUARRY RMR SYSTEM - RECORD OF GEOTECHNICAL PARAMETERS

Golder Associates

Project No. 063-7109-400 phase 2

Borehole # ms-inc-1

Elevation

N **E**

Azimuth N80E

Inclination 90

Ref. Point

Drilling Method From To

Sheet of

Logged by JL

Drill Rig

Core Dia: Depth	ROCK TYPE	RUN	Run Data: Recovery & Other Basic Information: From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	JCR: Average	JCR: Minimum	Strength Index: Strength Index	Weathering Index	Detailed Discontinuity Data: Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	Rubble/Gouge: Gouge: From	To	Type	Broken Core: From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	NO RECOVERY	29	59.0	60.5	0.0	N		N/A			N/A	N/A																redrill, rubble, mud and gouge
	GREENSTONE	30	60.5	61.5	0.9	N	0.0	N/A			S1	W5																sampled 60.5-61.5
	GREENSTONE	31	61.5	62.5	0.5	N	0.0	N/A			N/A	N/A																
	GREENSTONE	32	62.5	64.0	1.1	N	0.0	N/A			S1	W5																
	GREENSTONE	33	64.0	67.5	0.6	N	0.0	N/A			S1	W5																
	GREENSTONE	34	67.5	68.5	0.7	N	0.0	0			S4	W4																getting a bit more competent greenstone
	GREENSTONE	35	68.5	74.0	1.1	N	0.0	N/A			S1	W4.5																
	GREENSTONE	36	74.0	76.5	0.8	N	0.0	N/A			S1	W5																back to greenstone gouge and loose angular fragments
	GREENSTONE	37	76.5	79.0	2.2	N	0.0	N/A			S2	W4.5																washed greenstone fragments (mud matrix assumed to have been
	GREENSTONE	38	79.0	80.0	0.7	N	0.0	N/A			S2	W4																washed and suspended in the mud into the sump)
	GREENSTONE	39	80.0	81.0	1.0	N	0.0	N/A			S2/R1	W4																
	GREENSTONE	40	81.0	82.0	0.2	N	0.0	N/A			N/A	N/A																washed greenstone cobble
	GREENSTONE	41	82.0	83.0	0.1	N	0.0	N/A			N/A	N/A																
	GREENSTONE	42	83.0	84.0	0.1	N	0.0	N/A			N/A	N/A																
	GREENSTONE	43	84.0	87.0	2.8	N	0.0	N/A			R1	W4																sampled 84.5-85
	GREENSTONE	44	87.0	87.5	0.5	N	0.0	N/A			N/A	N/A																washed greenstone fragments
	GREENSTONE	45	87.5	88.5	0.8	N	0.0	N/A			S3	W5																greenstone gouge with greenstone rock fragments
	GREENSTONE	46	88.5	91.0	2.3	N	0.0	N/A			S3	W4																
	NO RECOVERY	47	91.0	91.5	0.0	N		N/A			N/A	N/A																
	NO RECOVERY	48	91.5	94.0	0.0	N		N/A			N/A	N/A																
	GREENSTONE	49	94.0	98.0	4.0	N	1.2	25			R2	W3.5	96.5	J2	1	34	IR	R	CLAY	50	7	0-2						sampled 97.7-98
	GREENSTONE	50	98.0	100.0	1.9	N	0.6	25			R3	W3	98.9	J3	2	54	PL	SM-R	CLAY	2-6	5	6						
	GREENSTONE	51	100.0	102.5	2.5	N	1.1	25			R2.5	W3																
	GREENSTONE	52	102.5	104.0	1.0	N	0.0	N/A			N/A	N/A																90% washed greenstone fragments with some clay at the bottom
	GREENSTONE	53	104.0	106.5	2.4	N	0.0	25			R3	W3																of the run
	GREENSTONE	54	106.5	109.5	1.3	N	0.0	N/A			R3	N/A																
	GREENSTONE	55	109.5	113.0	3.2	N	0.0	50			R2.5	W4																greenstone fragments in a weathered greenstone gouge matrix
	NO RECOVERY	56	113.0	114.0	0.0	N		N/A			N/A	N/A																
	GREENSTONE	57	114.0	116.5	2.1	N	0.0	25			R3	W3																
	GREENSTONE	58	116.5	119.0	1.8	N	0.0	N/A			S4	W4																60% greenstone gouge, 40% greenstone fragments. Rock that
	GREENSTONE	59	119.0	120.0	1.2	N	0.0	50			R3	W3																remains is heavily weathered/fractured

PERMANENTE QUARRY RMR SYSTEM - RECORD OF GEOTECHNICAL PARAMETERS

Project No. 063-7109-400 phase 2
Borehole # ms-inc-1 **Azimuth** N80E
Elevation **Inclination** 90
N **E** **Ref. Point**

Drilling Method From To
Sheet of
Logged by JL
Drill Rig

Core Dia: Depth	ROCK TYPE	RUN	Run Data: Recovery & Other Basic Information: From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	JCR: Average	Minimum	Strength Index: Strength Index	Weathering Index	Detailed Discontinuity Data: Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	Rubble/Gouge: Gouge: From	To	Type	Broken Core: From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	GREENSTONE	60	120.0	122.5	2.0	N	0.5	25			R3	W3	121	J2	1	71	PL	R	CLAY	1-2	7	18						
													121.6	J3	1	21	PL	R	CLAY	1-3	3	18						
	NO RECOVERY	61	122.5	124.0	0.0	N		N/A			N/A	N/A																
	GREENSTONE	62	124.0	125.0	1.0	N	0.0	N/A			S3	W4																60% gouge
	GREENSTONE	63	125.0	127.5	1.5	N	0.0	25			R3	W3	126.7	J2	2-3	60-75	IR	R	CLAY	1-2	10	15						
	GREENSTONE	64	127.5	130.0	2.1	N	0.4	25			R2	W3.5	128.4	J2	1	62	IR	R	CLAY	1-3	6	15						
	GREENSTONE	65	130.0	130.5	0.8	N	0.0	25			R2	W3.5																sampled 128.3-129
	GREENSTONE	66	130.5	132.0	1.5	N	0.0	25			R2	W3.5	131.1	J1	1	66	IR	R	CLAY	5	12	6						gouge filled incomplete, unloggable fractures throughout
	GREENSTONE	67	132.0	134.0	1.0	N	0.0	N/A			R2	W4																80% washed greenstone fragments 20% gouge
	NO RECOVERY	68	134.0	137.0	0.0	N		N/A			N/A	N/A																
	GREENSTONE	69	137.0	138.0	0.7	N	0.0	25			R2.5	W3.5																15% gouge
	GREENSTONE	70	138.0	140.0	1.5	N	0.5	N/A			R2.5	W3.5	139.1	J2	1	28	PL	R	CLAY	1-2	5	20						heavily fractured gougy lower part of core.
	GREENSTONE	71	140.0	140.5	0.9	N	0.0	10			R2.5	W4																15% gouge mostly on the outside of the core
	GREENSTONE	72	140.5	143.0	2.4	N	0.0	50			R3	W4																
	GREENSTONE	73	143.0	144.0	0.9	N	0.0	25			R2.5	W3.5																
	GREENSTONE	74	144.0	146.5	2.5	N	0.0	50			R2	W4																
	GREENSTONE	75	146.5	150.5	3.6	N	0.0	25			R2	W3	148.8	J2	1	61	PL	R	CLAY	2-4	15	5						sampled 150-150.5
													149.7	J2	2	56	PL	R	CLAY	1-3	15	5						
	GREENSTONE	76	150.5	154.0	3.5	N	1.0	25			R1.5	W3.5	153.2	J2	1	25	PL	R	CLAY	2-4	12	5						
	GREENSTONE	77	154.0	159.0	5.0	N	0.9	50			R2	W3	157.2	J2	1	31	PL	S	ALCIT	1-2	2	20						
													156.8	J2	1	39	PL	S-R	CLAY	1-2	6	15						
													156.4	J2	1	38	PL	S-R	CLAY	1-2	8	15						
	GREENSTONE	78	159.0	162.0	2.7	N	0.0	50			R2.5	W3																rock is darker in color, and increased calcite veining
	GREENSTONE	79	162.0	162.5	0.5	N	0.0	25			R2.5	W3																sampled 159-159.5
	GREENSTONE	80	162.5	164.0	0.4	N	0.0	N/A			N/A	N/A																heavily fractured, some redrill
	GREENSTONE	81	164.0	165.0	0.5	N	0.0	N/A			R2.5	W3.5																washed greenstone fragments, redrill, rubble.
	GREENSTONE	82	165.0	166.5	1.0	N	0.0	10			R2	W3.5	165.9	J2	1	53	PL	R	CLAY	1-2	5	15						50% washed greenstone fragments
	GREENSTONE	83	166.5	168.0	1.5	N	1.0	10			R3	W3																
	GREENSTONE	84	168.0	170.5	2.5	N	0.4	25			R2	W3.5	168.4	J2	1	31	PL	S	CLAY	1-2	3	18						
													169.6	J3	1	35	PL	R	CLAY	1-3	7	15						
	NO RECOVERY	85	170.5	171.0	0.0	N		N/A			N/A	N/A																

PERMANENTE QUARRY RMR SYSTEM - RECORD OF GEOTECHNICAL PARAMETERS

Project No. 063-7109-400 phase 2
Borehole # ms-inc-1 **Azimuth** N80E
Elevation **Inclination** 90
N **E** **Ref. Point**

Drilling Method From To
Sheet of
Logged by JL
Drill Rig

			Run Data																				Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	GREENSTONE	86	171.0	171.5	0.5	N	0.0	N/A			N/A	N/A																
	GREENSTONE	87	171.5	172.0	0.5	N	0.0	N/A			N/A	N/A																
	GREENSTONE	88	172.0	174.0	1.4	N	0.0	25			R1	W3.5																
	GREENSTONE	89	174.0	177.0	2.3	N	0.5	25			R2	W3.5	175	J2	1	30	PL	R	CLAY	1-2	5	15						sampled 174.7-175.2
													176.2	J2	5-10	54	IR	R	CLAY	4-5	15	2						
	GREENSTONE	90	177.0	181.0	3.9	N	0.0	25			R2	W3.5	178.4	J1	1	59	CURVE	R	CLAY	2-3	10	18						other fractures throughout the core are unnatural
													178.7	J2	1	50	PL	R	CLAY	1-2	6	15						
	NO RECOVERY	91	181.0	181.5	0.0	N		N/A			N/A	N/A																
	GREENSTONE	92	181.5	183.0	1.1	N	0.0	N/A			N/A	N/A																washed greenstone fragments
	GREENSTONE	93	183.0	184.0	0.1	N	0.0	N/A			N/A	N/A																
	GREENSTONE	94	184.0	186.5	2.3	N	0.0	25			R3	W3	185.2	J1	1	26	PL	R	CLAY	8-10	7	2						
	GREENSTONE	95	186.5	190.0	3.3	N	0.5	25			R2	W3.5	ALL	J2	10	35-45	PL	R	N/A	1	6	20						clean, rough fractures throughout with <1mm separation are
	GREENSTONE	96	190.0	191.0	1.0	N	0.0	N/A			R1	W4																suspected unnatural, although true origination is unknown
	GREENSTONE	97	191.0	192.5	1.5	N	0.0	N/A			R1	W4																
	GREENSTONE	98	192.5	193.0	0.5	N	0.0	N/A			N/A	N/A																>50% washed greenstone fragments and redrill
	GREENSTONE	99	193.0	194.0	0.7	N	0.0	N/A			R1	W4																
	GREENSTONE	100	194.0	199.0	5.0	N	0.0	0			R1	W4																sampled 198.6-199
	GREENSTONE	101	199.0	200.5	1.4	N	0.0	N/A			RS4	W4																intact 5' core is very soft and weathered. No distinct natural fractures
	GREENSTONE	102	200.5	203.0	2.5	N	1.2	1			R3	W3	201.2	J2	1	38	PL	R	CLAY	1	8	19						
	GREENSTONE	103	203.0	205.5	2.2	N	0.0	25			R2.5	W3																
	GREENSTONE	104	205.5	207.5	1.8	N	0.0	N/A			S3	W4																
	GREENSTONE	105	207.5	209.0	2.2	N	0.0	10			R1.5	W3.5																60% greenstone fragments in a greenstone gouge matrix
	GREENSTONE	106	209.0	211.5	2.5	N	0.0	25			R2.5	W3																multiple randomly oriented fractures with unknown origins
	GREENSTONE	107	211.5	212.5	0.8	N	0.0	0			S5	W4																
	GREENSTONE	108	212.5	213.0	0.0	N	0.0	N/A			N/A	N/A																washed fragments
	NO RECOVERY	109	213.0	214.0	0.0	N		N/A			N/A	N/A																
	GREENSTONE	110	214.0	215.0	0.2	N	0.0	N/A			R2	W3.5																
	GREENSTONE	111	215.0	216.0	0.7	N	0.0	N/A			S4	W4																
	GREENSTONE	112	216.0	216.5	0.3	N	0.0	N/A			R1/S4	W4																
	GREENSTONE	113	216.5	217.5	0.5	N	0.0	N/A			S4	W4																
	NO RECOVERY	114	217.5	218.5	0.0	N		N/A			N/A	N/A																

PERMANENTE QUARRY RMR SYSTEM - RECORD OF GEOTECHNICAL PARAMETERS

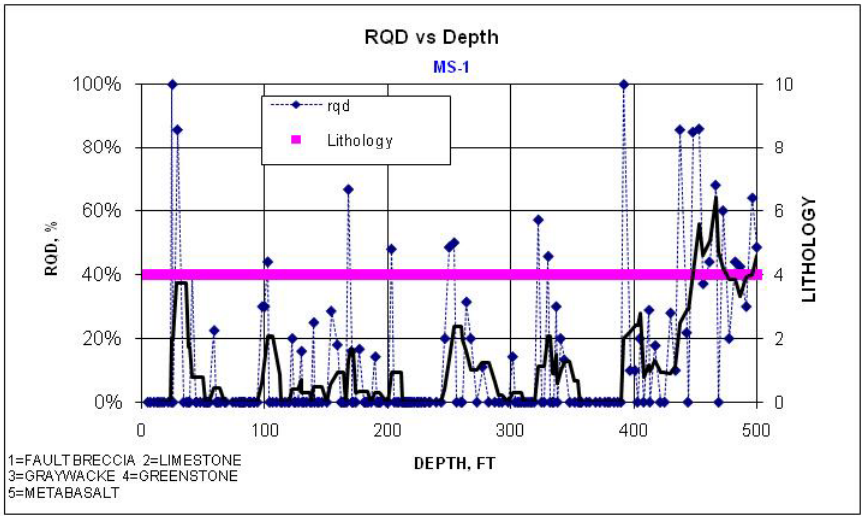
Project No. 063-7109-400 phase 2
Borehole # ms-inc-1
Elevation
N **E**

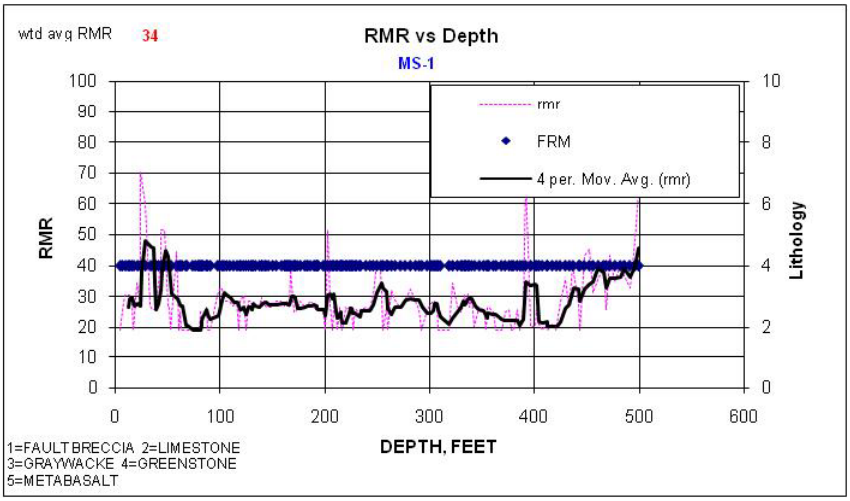
Azimuth N80E
Inclination 90
Ref. Point

Drilling Method From To

Sheet of
Logged by JL
Drill Rig

			Run Data																				Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	GREENSTONE	115	218.5	220.0	1.1	N	0.0	N/A			N/A	N/A																60% washed fragments 40% gouge
	GREENSTONE	116	220.0	221.5	1.3	N	0.0	N/A			R1.5	W3.5																
	GREENSTONE	117	221.5	223.5	2.0	N	0.0	25			R2	W3																more competent rock, but still no loggable fractures
	GREENSTONE	118	223.5	224.5	0.4	N	0.0	N/A			R2	W3.5																
	GREENSTONE	119	224.5	226.0	0.9	N	0.0	N/A			R2	W3.5																
	GREENSTONE	120	226.0	227.5	1.3	N	0.0	N/A			S3/R2	W4																
	GREENSTONE	121	227.5	229.5	2.0	N	0.0	50			R1	W3.5																
	GREENSTONE	122	229.5	230.5	0.7	N	0.0	N/A			R1.5	W4																calcite veins and inclusions
	GREENSTONE	123	230.5	233.5	3.0	N	0.0	50			R1	W3.5																
	GREENSTONE	124	233.5	234.5	1.0	N	0.0	50			R1	W3																heavily fractured, slightly washed, some redrill
	GREENSTONE	125	234.5	239.5	5.0	N	0.0	50			R2	W3	235.9	J2	2	37	PL	R	CLAY	1-2	9	12						sampled 234.5-235
													236.2	J1	1	39	PL	R	CLAY	2-3	6	8						
	GREENSTONE	126	239.5	243.5	4.0	N	0.0	50			R1.5	W3.5	242.5	J2	1	60	PL	R	CLAY	2-3	15	12						
	GREENSTONE	127	243.5	246.5	2.8	N	0.6	10			R2.5	W3	243.9	J2	1	31	PL	R	CLAY	1-2	10	15						
													244.3	J2	1	42	PL	R	CLAY	1-2	10	15						
													244.7	J1	1	47	PL	R	CLAY	2-4	7	5						
													244.9	J1	1	47	PL	R	CLAY	2-4	7	5						
	GREENSTONE	128	246.5	250.0	3.3	N	1.7	5			R3	W2.5	249.1	J1	1.5	29	PL	R	CLAY	2-4	6	15						possibly lithic fragments (argillic?) in greenstone matrix.
	GREENSTONE	129	250.0	254.0	4.0	N	2.0	10			R3	W3	252.7	J1	1	36	PL	R	CLAY	1-3	5	12						sampled 250-250.5
	GREENSTONE	130	254.0	256.0	1.5	N	0.0	N/A			S4/R1	W4																washed greenstone fragments and gouge





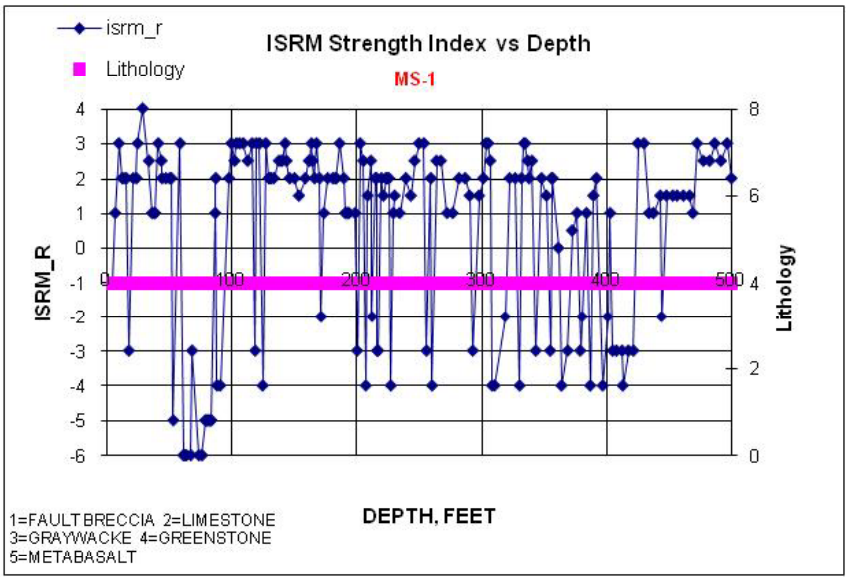


FIGURE **A1**

GEOTECHNICAL CORE LOGGING DATA, COREHOLE MS-1

LEHIGH HANSON/MAIN SLIDE/CA

PERMANENTE QUARRY RMR SYSTEM - RECORD OF GEOTECHNICAL PARAMETERS

Project No. 063-7109-400 phase 2
Borehole # MS-2 **Azimuth** N80E
Elevation **Inclination** 60
N **E** **Ref. Point**

Drilling Method From To
Sheet **of**
Logged by
Drill Rig

			Run Data																				Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	SANDY SILT	1	0.0	1.8	0.9	N	0.0	100			S4	W4																fine pebbles in coarse sandy silt material
	GREENSTONE	2	1.8	5.0	2.2	N	0.0	50			S6	W5																highly weathered greenstone, going to clay, hard but very friable.
	GREENSTONE	3	5.0	10.0	4.7	N	0.0	50			S5	W5																highly weathered to sandy silt with solid chunks and visible structures
	GREENSTONE	4	10.0	13.0	1.1	N	0.0	50			S3	W5																sandy silt with coarse pebbles, no preserved structures
	GREENSTONE	5	13.0	18.0	3.1	N	0.0	50			S3	W5																coarse fragments in sandy silt, color change from olive drab green
	GREENSTONE	6	18.0	21.0	0.0	N	0.0																					to pistachio green at 16.7
	GREENSTONE	7	21.0	22.0	0.5	N	0.0	50																				greenstone gravel recovered, little to no fines
	GREENSTONE	8	22.0	23.5	1.5	N	0.0	50			S4	W5																solid greenstone fragments in minimal sandy silt
	GREENSTONE	9	23.5	26.5	1.8	N	0.0	25			R1	W4	24.6	J2	1	35	PL	SM	CLAY	2	6.0	6						increasingly intact, but weathered
													25.7	J2	1	40	PL	R	CLAY	1	10.0	6						
	GREENSTONE	10	26.5	29.0	3.2	N	0.0	15			R1	W4	26.3	J2	1	35	PL	R	CLAY	1	10.0	12						
													26.7	J2	1	40	PL	R	CLAY	8	10.0	0						weak, broken but solid greenstone
													27.3	J2	1	50	C	R	CLAY	1	8.0	6						
													27.8	J2	1	45	PL	R	CLAY	1	6.0	12						
													28.3	J2	1	45	PL	R	CLAY	1	4.0	6						
	GREENSTONE	11	29.0	33.0	3.9	N	0.0	25			R1	W4																heavily fractured, friable greenstone
	GREENSTONE	12	33.0	35.0	1.9	N	1.9	0			R1	W4																weak, friable, highly weathered greenstone
	GREENSTONE	13	35.0	37.5	2.5	N	2.5	2			R1	W4	36.2	J2	1	45	IR	VR	OX	0	16.0	6						very weak, highly fractured, weathered
													36.6	J1	1	30	PL	R	CLAY	2	10.0	6						
	GREENSTONE	14	37.5	40.0	2.2	N	0.0	25			R0	W4																greenstone pieces in thin clay infill, falls apart into rubble
	GREENSTONE	15	40.0	43.0	1.4	N	0.9	10			R1	W4																weak, friable.
	GREENSTONE	16	43.0	45.0	0.0	N	0.0																					rubble recovered
	NO RECOVERY	17	45.0	46.5	0.0	N																						
	NO RECOVERY	18	46.5	48.0	0.0	N																						
	GREENSTONE	19	48.0	49.0	0.0	N	0.0																					rubble recovered
	GREENSTONE	20	49.0	51.0	1.8	N	1.8	0			R2	W3																highly fractured but solid core, crumbles with moderate effort
	GREENSTONE	21	51.0	52.5	1.1	N	0.0	100			S4	W4																greenstone gouge with coarse gravel
	GREENSTONE	22	52.5	55.0	2.5	N	2.5	0			R2	W3																highly fractured but solid core, crumbles with moderate effort
	GREENSTONE	23	55.0	56.5	1.4	N	0.0	50			R1	W4																solid pieces in gougy soft material
	GREENSTONE	24	56.5	58.5	2.0	N	0.0	10			R1	W4																solid pieces in gougy soft material
	GREENSTONE	25	58.5	61.0	0.9	N	0.0	100			S5	W4																solid pieces in gougy soft material

PERMANENTE QUARRY RMR SYSTEM - RECORD OF GEOTECHNICAL PARAMETERS

Golder Associates

Project No. 063-7109-400 phase 2
Borehole # MS-2
Azimuth N80E
Elevation
Inclination 60
N **E** **Ref. Point**
Drilling Method From To
Sheet of
Logged by
Drill Rig

Core Dia: Depth	ROCK TYPE	RUN	Run Data – Recovery & Other Basic Information: From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	JCR: Average	JCR: Minimum	Strength Index: Strength Index	Weathering Index	Detailed Discontinuity Data: Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	Rubble/Gouge – Gouge: From	To	Type	Broken Core: From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	NO RECOVERY	26	61.0	63.0	0.0	N																						
	GREENSTONE	27	63.0	64.0	0.8	N	0.0	50			S5	W4																firm gravelly gouge
	GREENSTONE	28	64.0	66.5	2.2	N	0.5	25			R1	W4																heavily fractured, but solid core
	GREENSTONE	29	66.5	68.5	2.0	N	0.0	50			R1	W4																heavily fractured, clay cemented greenstone
	GREENSTONE	30	68.5	69.5	0.7	N	0.0	50			S5	W4																gouge with gravel pieces
	GREENSTONE	31	69.5	70.0	0.4	N	0.0	10			R2	W4																highly fractured, but solid core
	GREENSTONE	32	70.0	71.0	0.3	N	0.0	10			R2	W4																
	GREENSTONE	33	71.0	73.0	0.8	N	0.0	10			S6	W4																
	GREENSTONE	34	73.0	73.5	0.5	N	0.0	5			R1	W4																
	GREENSTONE	35	73.5	75.0	1.5	N	0.0	10			R1	W4																
	GREENSTONE	36	75.0	76.5	1.4	N	0.0	10			R1	W4																
	GREENSTONE	37	76.5	79.0	2.7	N	0.0	25			R1.5	W4																
	GREENSTONE	38	79.0	83.0	0.7	N	0.0	10			R1.5	W4																
	GREENSTONE	39	83.0	84.0	0.5	N	0.0	10			R1.5	W4																
	GREENSTONE	40	84.0	86.0	0.6	N	0.0	50			R1.5	W4																
	NO RECOVERY	41	86.0	87.5	0.0	N																						
	NO RECOVERY	42	87.5	89.0	0.0	N																						
	GREENSTONE	43	89.0	91.0	1.5	N	0.0	50			R1	W4																
	GREENSTONE	44	91.0	93.0	2.0	N	0.0	0			R2	W4																
	GREENSTONE	45	93.0	95.5	2.5	N	2.5	0			R2	W4																solid, highly weathered, breaks apart easily
	GREENSTONE	46	95.5	97.0	0.8	N	0.7	0			R3	W4																lost circulation at 97'
	GREENSTONE	47	97.0	99.5	2.7	N	2.2	10			R2	W4																
	GREENSTONE	48	99.5	102.0	1.8	N	0.0	25			R2	W4																
	GREENSTONE	49	102.0	103.0	0.8	N	0.0	25			R2	W4																
	GREENSTONE	50	103.0	107.5	1.8	N	0.0	50			R2	W4																
	NO RECOVERY	51	107.5	108.5	0.0	N																						
	GREENSTONE	52	108.5	110.0	0.0	N	0.0	50			R1	W4																
	GREENSTONE	53	110.0	111.0	1.0	N	0.0	0			R1	W4																
	GREENSTONE	54	111.0	113.0	2.0	N	0.0	0			R2.5	W4																gray clasts, subrounded within greenstone
	GREENSTONE	55	113.0	118.0	4.9	N	4.9	0			R3	W3																soft, easily broken up by hand, greenstone fragments
	GREENSTONE	56	118.0	119.5	1.0	N	0.0	50			S4	W4																

PERMANENTE QUARRY RMR SYSTEM - RECORD OF GEOTECHNICAL PARAMETERS

Project No. 063-7109-400 phase 2

Borehole # MS-2 **Azimuth** N80E

Elevation **Inclination** 60

N **E** **Ref. Point**

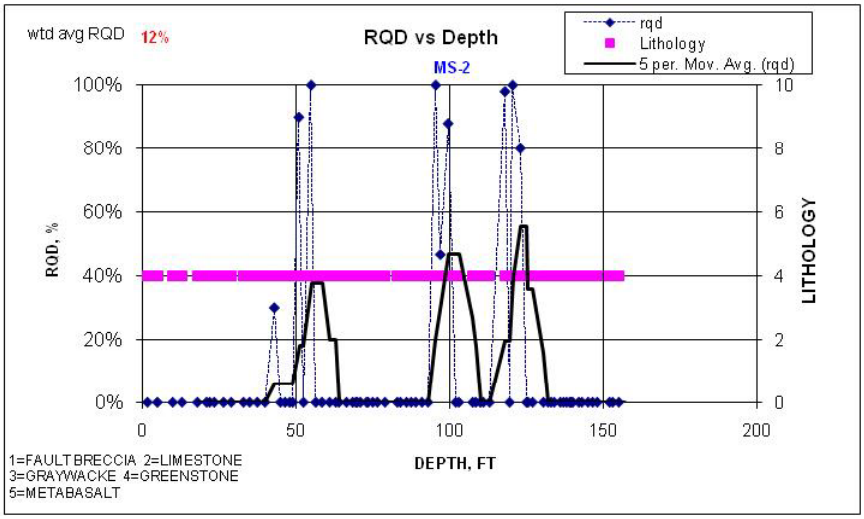
Drilling Method From To

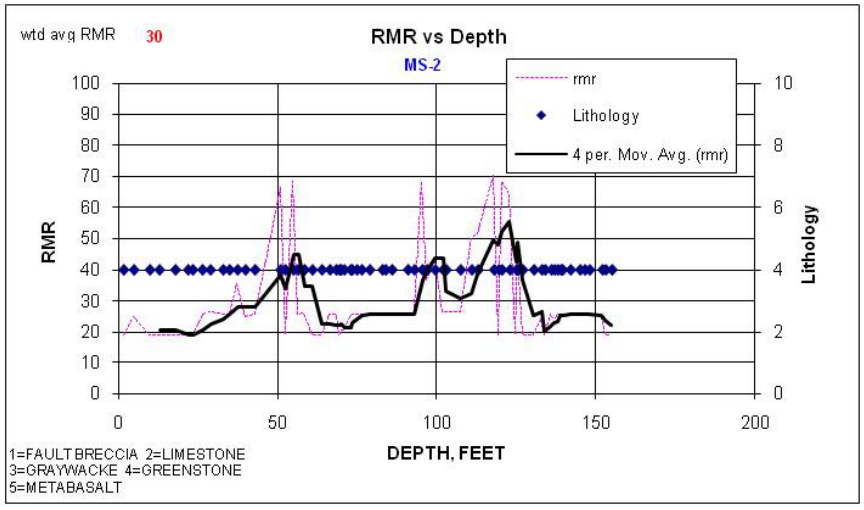
Sheet of

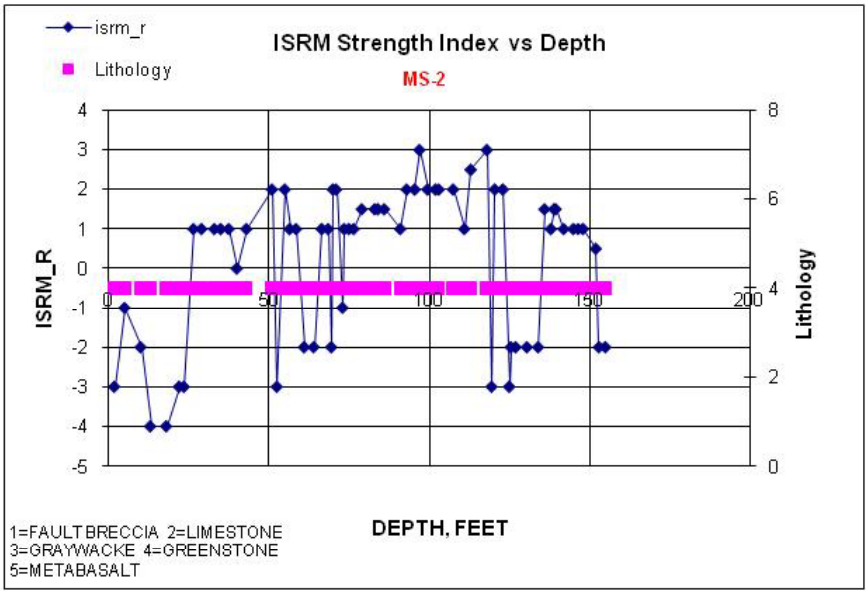
Logged by

Drill Rig

			Run Data																				Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	GREENSTONE	57	119.5	120.5	1.0	N	1.0	0			R2	W4																
	GREENSTONE	58	120.5	123.0	2.7	N	2.0	0			R2	W4																
	GREENSTONE	59	123.0	125.0	0.9	N	0.0	20			S4	W4																
	GREENSTONE	60	125.0	125.5	0.5	N	0.0	0			S5	W4																
	GREENSTONE	61	125.5	127.0	1.1	N	0.0	20			S5	W4																
	GREENSTONE	62	127.0	130.5	1.4	N	0.0	25			S5	W4																soft, rubbly greenstone gouge material
	NO RECOVERY	63	130.5	132.0	0.0	N																						hole collapsing
	GREENSTONE	64	132.0	133.0	0.3	N	0.0	0																				
	GREENSTONE	65	133.0	134.0	0.6	N	0.0	25			S5	W4																soft gougy greenstone with solid breccia
	GREENSTONE	66	134.0	136.0	1.9	N	0.0	50			R1.5	W4																sampled 134.1-134.8
	GREENSTONE	67	136.0	137.0	0.1	N	0.0																					gravelly mud recovered
	GREENSTONE	68	137.0	138.0	0.8	N	0.0	50			R1	W4																
	GREENSTONE	69	138.0	139.0	0.3	N	0.0	0			R1.5	W4																
	GREENSTONE	70	139.0	139.5	0.3	N	0.0	0			R1.5	W4																
	NO RECOVERY	71	139.5	140.0	0.0	N																						
	GREENSTONE	72	140.0	142.0	1.4	N	0.0	0			R1	W4																
	NO RECOVERY	73	142.0	143.0	0.0	N																						
	GREENSTONE	74	143.0	145.0	0.7	N	0.0	25			R1	W4																some redrill on top of soft gougy greenstone
	GREENSTONE	75	145.0	146.5	0.8	N	0.0	0			R1	W4																
	GREENSTONE	76	146.5	148.0	0.4	N	0.0	0			R1	W4																75% redrill
	GREENSTONE	77	148.0	152.0	1.6	N	0.0	0			R0.5	W4																50% redrill
	GREENSTONE	78	152.0	153.0	1.0	N	0.0	0			S5	W4																
	GREENSTONE	79	153.0	155.0	1.2	N	0.0	0			S5	W4																
	NO RECOVERY	80	155.0	157.0	0.0	N																						







Golder Associates

FIGURE **A2**

GEOTECHNICAL CORE LOGGING DATA1, COREHOLE MS-2

LEHIGH HANSON/MAIN SLIDE/CA

MS-INC-1 CORE PHOTOS

MS-NC-1 0-10 Box 1 of 46
BOTTOM

MS-NC-1 10-20.5 Bot 2 of 46
top
bottom

MS-inc-1 20.5-29.5 Box 3 of 46
Top
21.5
24
25
25.5
29

MS-inc-1 29.5-40 Box 4 of 46
TOP
37
38
39

MS-inc-1 40-49.3 Box 5 of 46
TOP
41.5
44
44.5
42.5
Bottom

MS-inC-1 49.3-67.5 Box 6 of 46

top

MS-inc-1 67.5-87 Box 7 of 46
TOP
76.5
79
80
81
82
82
A-1
83
83
A-1
84
87

MS-INC-1 87-99.1 Box 8 of 46
Top
87.5
88.5
91.5
94
98

MS-nc-1 991-109.5 Box 9 of 46
TOP
100
102.5
104
109.5
D-3

MS-MC-1 109.5-121 Box 10 of 46
top
113
114
116.5
119
120
121

MS-inc-I 121-134 Box 11 of 46
TOP
122.5
124
125
127.5
130
130.5
132

MS-MC-1 134-145.6 Box 12 of 46
TOP
137
138
140
140.5
143
D-1

MS-inc-1 145.6-155.9 Box 13 of 46
146.5
150.5
154

MS-inc-1 155.9-167.3 Box 14 of 46
TOP
154
162.5
164
166.5

MS-inc-7 167.3 - 177.8 Box 15 of 46
TOP
168
170.5
172.5
174
175
177

MS-inc-1 177.8-189.7 Box 16 of 46

TOP

Bottom

183

181.5

181

186.5

184

MS-mc-1 189.7-198.6 Box 17 of 46
top
190
191
192.5
193
193
D-5

MS-inc-1 198.6-208.5 Box 18 of 46

Top

199

203

205.5

208.5

MS-inc-I 208.5-222 Box 19 of 46
TOP
209
211.5
212.5
213
214
215
216
216.5
217.5
218.5
220
221.5

MS-inc-1 222-232.5 Box 20 of 46
TOP
224.5
226
227.5
229.5

MS-INC-1 Q32.5-242.3 Box 21 of 46

TOP

234.5

233.5

239.5

MS-inc-1 242.3-251.5 Box 22 of 46
TOP
243.5
246.5
250

MS-inc-1 251.5-261.5 Box, 23 of 46
TOP
254
254
256
256.5
260.5

MS-inc-1 261.5-271.5 Box 24 of 46
TOP
264
267.5

MS-inc-1 271.5-280.4 Box 25 of 46
Top
272.5
277
Bottom

MS-INC-1 280.4-290.3 Box 26 of 46
287
282
Bottom

MS-inc-1 290.3- 300.3 Box 27 of 46
290.5
293
298

MS-inc-1 300.3-320.2 Box 28 of 46
303.5
305.5
307
308.5
310.5
312
314
316
317
319

MS-inc-1 320.2-330.9 Box 29 of 46
TOP
322.5
325
327
330.5
Bottom

MS-inc-1 330.9-340.8 Box 30 of 46
TOP
332
334
335
340.5

Bottom

343.5

348

MS-INC-1 340.8-351.7 Box 31 of 46

Top

MS-inc-1 351.7-364.9 Box 32 of 46
TOP
352
355
356
357
357.5
361.5
364

MS-inc-1 364.9-374.3 Box 33 of 46

TOP

Bottom

373

369

MS-inc-1 374.3 - 387.2 Box 34 of 46
TOP
376.5
379
380.5
384
387
Bottom

MS-Inc-1 387.2-397 Box 35 of 46
Top
Bottom
389.5
392
397

MS-inC-1 397-408.4 Box 36 of 46

TOP

403

405

408

MS-inc-1 408.4-418.2 Box 37 of 46
413
417.5

MS-inc-1 418.2-427.7 Box 38 of 46
Top
421.5
425
Bottom

MS-inc-1 427.7-439.1 Box 39 of 46
TOP
430
434
435

MS-inc-I 439.1-449.1 Box 40 of 46
Top
442
444
448
Bottom

MS-inc-1 449.1-458.5 Box 41 of 46
TOP
453
456.5
Bottom

MS-inc-1 458.5-467.5 Box 42 of 46
TOP
461.5

MS-inc-1 467.5-476.6 Box 43 of 46
TOP
469
472.5
Bottom

MS-inc-1 476.6-486.5 Box 44 of 46
TOP
477.5
482.5
486.5
Bottom
MS-inc-1

TOP
Ms-inc 1 496.5-496.5 Box 45 of 46
491.5
496.5
496.5
Bottom

MS-inc-I 496.5-500 Box 46 of 46
MS-inc-I 45 of 46

MS-INC-2 CORE PHOTOS

MS-2 Box 1 of 12
Top
Sample
10
5
13

MS-2 Box 2 of 12
18
21
22
22.5
26.5

MS-2 Box 3 of 12
Top

MS-2 Box 4 of 12
37.5
40
43
49
51
48
46.5
45

MS-2 Box 5 of 12
56.5
52.5
Top

69.5
68.5
64.5
70
MS-2 Box 6 of 12
MS-2 Box 5 of 12
TOP

MS-2 Box 7 of 12
83
89
87.5
Top

MS-2 Box 8 of 12
97
99.5
95.5

MS-2 Box 9 of 12
Top
111
102
115
103

MS-2 Box 10 of 12
TOP
1199
1205
118

MS-2 Box 11 of 12
TOP
135
132
134
137

MS-2 Box 12 of 12

APPENDIX 5.B

Laboratory Testing Data

Unconfined Compressive Strength Testing

UNCONFINED COMPRESSIVE STRENGTH
ASTM D 7012; Method C (Previously ASTM D 2938)

CLIENT: Golder Associates JOB NO.: 2003-125

LOCATION: DATE TESTED: 4/20/09 HN

PROJECT: Hanson Permanente Main Slide

Specimen ID Boring, Depth(ft.), Rock type	Diameter (in.)	Length (in.)	Mass (gms)	Wet Density (pcf)	Failure Load (lb)	Failure Types **	Compressive Strength (psi)
MS-INC-1, 250.0-250.5, Greenstone	2.399	4.954	1020.00	173.5	1,803	C	400
MS-INC-1, 128.3-129.0, Greenstone	2.398	3.972	824.00	175.0	2,453	C	*530

Notes and Comments:

* Indicates regardless of ASTM D 7012 method C, sample with L/D < 2.0.
was tested and correction factor for short sample was applied to the calculation.
C=Ca/[0.88+0.24b/h]
Ca = Failure Load / Surface Area
b = Sample Diameter
h = Sample Length

** Failure types S: Shear Failure, M: Matrix Failure, F: Failure due to Fracture/Bedding, V: Void Failure, C: Combination

Data Entered By: HN Date: 04/20/2009
Data Checked By: CW Date: 04/21/09
Filename: GOUCS125

ADVANCED TERRA TESTING, Inc. ATT

Point Load Testing

AXIAL PCINT LOAD TEST
ASTM D 5731

CLIENT: Golder Associates JOB NO.: 2003-125

PROJECT: Hanson Permanente Main Slide DATE TESTED: 4/15/09 BL

Specimen ID Boring, Depth, Rock type	Length (in.)	Diameter (in.)	De^2 (in^2)	Gauge Failure Load (psig)	P (lb)	Is	F	Is(50)	C	Compressive Strength (psi)	Loading with respect to Fracture	Failure Mode
MS-Inc-1, 26.1-26.8, Greenstone	1.775	2.406	5.438	126	260.8	48.0	1.1	51.4	25.0	1,280	Parallel	F
MS-Inc-1, 159.0-159.5, Greenstone	1.931	2.385	5.864	84	173.9	29.7	1.1	32.3	24.9	800	Parallel	C
MS-Inc-1, 264.0-264.5, Greenstone	2.257	2.395	6.883	11	22.8	3.3	1.1	3.7	24.9	90	Parallel	F

Notes:

L: Sample Length
D: Sample Diameter
De^2: Exquivalent Diameter = 4*L*D/pi
Piston Area (in^2): 2.07
P: Gauge Failure Load * Piston area (2.07 in^2)
Is: Point Load Index Strength = P/De^2
F: Size Correction Factor to 2.0 in = (De/2.0)^0.45
Is(50): Size Corrected Index Strength = F* Is
C: Factor to Estimate Compressive Strength related to Core Diameter
Compressive Strength in psi = C * Is(50)

Failure Modes:
F: Fracture Controlled
S: Substance Controlled
C: Combination Substance & Fracture

Data Entered By: BKL Date: 04/15/2009
Data Checked By: HV Date: 4/15/2009
Filename: GOPA125A

ADVANCED TERRA TESTING, INC. ATT

DIAMETRAL POINT LOAD TEST
ASTM D 5731

CLIENT: Golder Associates JOB NO.: 2003-125

PROJECT: Hanson Permanente Main Slide DATE TESTED: 4/17/09 BL

Specimen ID Boring, Depth, Rock Type	Length (in.)	Diameter (in.)	De^2 (in^2)	Gauge Failure Load (psig)	P (lb)	Is	F	Is(50)	C	Compressive Strength (psi)	Loading with respect to Fracture	Failure Mode
MS-2, 134.1-134.8,Greenstone	3.155	2.418	5.847	13	26.9	4.6	1.1	5.0	25.0	130	N/A	S
MS-Inc-1, 319.2-319.7,Greenstone	3.725	2.380	5.664	29	60.0	10.6	1.1	11.5	24.8	280	N/A	S

Notes:

L: Sample Length
D: Sample Diameter
De^2: Exquivalent Diameter = D^2
Piston Area (in^2): 2.07
P: Gauge Failure Load * Piston area (in^2)
Is: Point Load Index Strength = P/De^2
F: Size Correction Factor to 2.0 in = (De/2.0)^0.45
Is(50): Size Corrected Index Strength = F* Is
C: Factor to Estimate Compressive Strength related to Core Diameter
Compressive Strength in psi = C * Is(50)

Failure Modes:
F: Fracture Controlled
S: Substance Controlled
C: Combination Substance & Fracture

Data Entered By: BKL Date: 04/17/2009
Data Checked By: HN Date: 4/17/09
Filename: GOPDMS2A

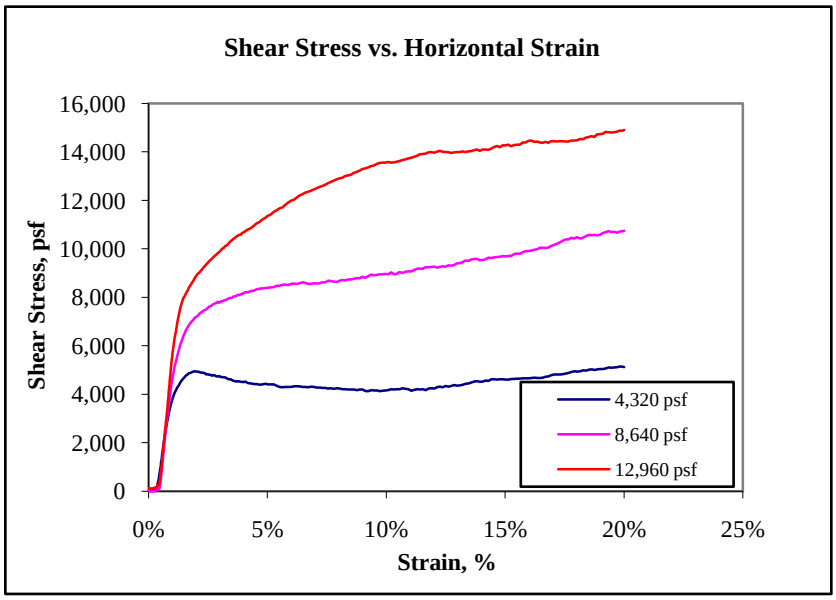
ADVANCED TERRA TESTING, INC. ATT

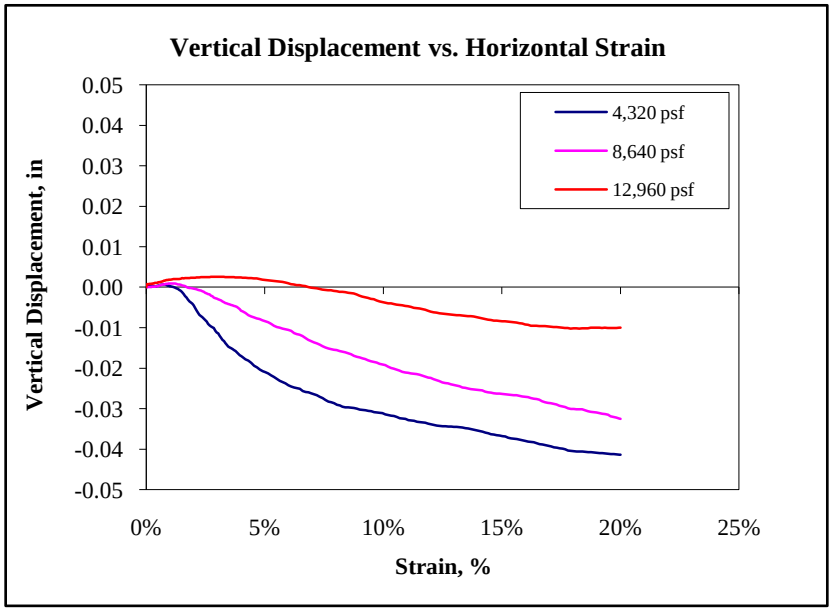
Direct Shear Testing

Sample # =	MS-INC-1 Greenstone @ 338.7-339.2'		Sample # =	MS-INC-1 Greenstone @ 338.7-339.2'		Sample # =	MS-INC-1 Greenstone @ 338.7-339.2'	
Point #	1		Point #	2		Point #	3	
Load =	30	psi	Load =	60	psi	Load =	90	psi
	Initial			**Initial**			**Initial**	
Height =	2.982	cm	Height =	2.982	cm	Height =	2.982	cm
Diameter =	6.350	cm	Diameter =	6.350	cm	Diameter =	6.350	cm
Wet Weight =	213.90	g	Wet Weight =	213.90	g	Wet Weight =	213.90	g
Area =	31.7	cm^2	Area =	31.7	cm^2	Area =	31.7	cm^2
Sample Area =	4.91	in^2	Sample Area =	4.91	in^2	Sample Area =	4.91	in^2
Sample Area =	0.03	ft^2	Sample Area =	0.03	ft^2	Sample Area =	0.03	ft^2
Volume =	94.4	cm^3	Volume =	94.4	cm^3	Volume =	94.4	cm^3
Moisture Content =	6.4%		Moisture Content =	6.4%		Moisture Content =	6.4%	
Specific Gravity =	-		Specific Gravity =	-		Specific Gravity =	-	
Dry Weight of Solids =	201.03	g	Dry Weight of Solids =	201.03	g	Dry Weight of Solids =	201.03	g
Wet Density =	2.27	g/cm^3	Wet Density =	2.27	g/cm^3	Wet Density =	2.27	g/cm^3
Dry Density =	2.13	g/cm^3	Dry Density =	2.13	g/cm^3	Dry Density =	2.13	g/cm^3
Wet Density =	141.3	pcf	Wet Density =	141.3	pcf	Wet Density =	141.3	pcf
Dry Density =	132.8	pcf	Dry Density =	132.8	pcf	Dry Density =	132.8	pcf
Initial Normal Stress =	4,320	psf	Initial Normal Stress =	8,640	psf	Initial Normal Stress =	12,960	psf
Failure Normal Stress =	4,426	psf	Failure Normal Stress =	9,203	psf	Failure Normal Stress =	14,843	psf
Failure Shear Stress =	4,953	psf	Failure Shear Stress =	8,378	psf	Failure Shear Stress =	13,553	psf
Failure Strain =	1.9%		Failure Strain =	4.9%		Failure Strain =	10.0%	
Normal Stress at Large Disp. =	5,785	psf	Normal Stress at Large Disp. =	11,568	psf	Normal Stress at Large Disp. =	17,353	psf
Large-Disp. Shear Stress =	5,134	psf	Large-Disp. Shear Stress =	10,746	psf	Large-Disp. Shear Stress =	14,903	psf
Strain at Large Disp.=	20.0%		Strain at Large Disp.=	20.0%		Strain at Large Disp.=	20.0%	

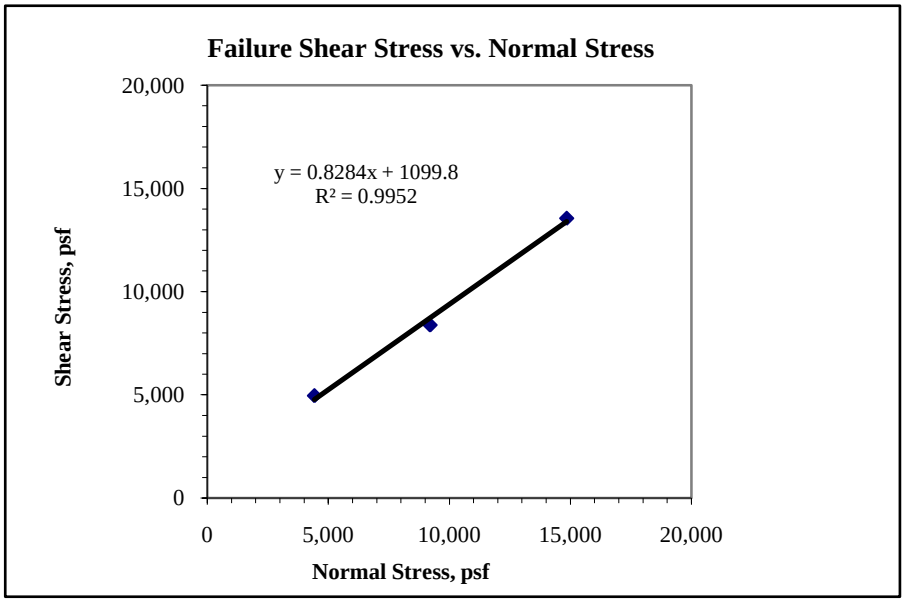
Notes: -Samples were remolded to "dense" condition at "appropriate moisture," per Rhonda Knupp's instruction.
-Samples were inundated after consolidation and before shearing.
-There was only enough material to make one specimen. For Samples 1 and 2, the material was remolded, sheared, then dried back to recompact to the same initial moisture and density.

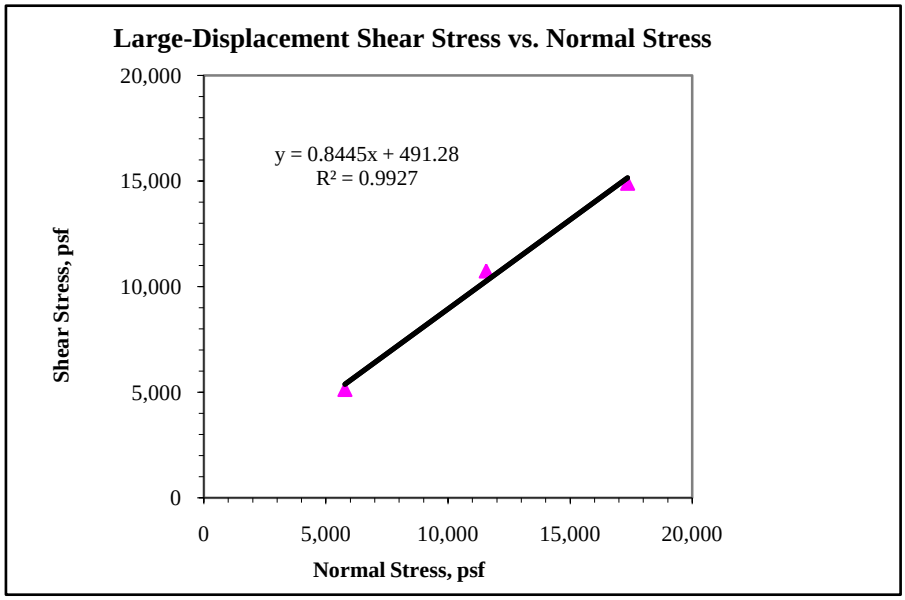
Golder Associates, Inc. Denver, Colorado	**Title:** **DIRECT SHEAR TEST REPORT SAMPLE DATA AND CALCULATIONS**			
Job Short Title: **Permanente**				
Sample Number: **MS-INC-1 Greenstone @ 338.7-339.2'**	**Reviewed:** **JEO**	**Date:** **04/17/09**	**Job Number:** **063-7109.100**	**Figure:** **1**





Golder Associates, Inc. **Denver, Colorado**				**Title:** **STRESS AND VERTICAL DISPLACEMENT VS. STRAIN**
Job Short Title: **Permanente**				
Sample Number: **MS-INC-1 Greenstone @ 338.7-339.2'**	**Reviewed:** **JEO**	**Date:** **04/17/09**	**Job Number:** **063-7109.100**	**Figure:** **2**





Failure		Large-Displacement	
ϕ =	39.6 degrees	ϕ =	40.2 degrees
c =	1,100 psf	c =	491 psf

Golder Associates, Inc. **Denver, Colorado**	**Title:** **DIRECT SHEAR TESTING** **FAILURE ENVELOPES**
Job Short Title: **Permanente**	

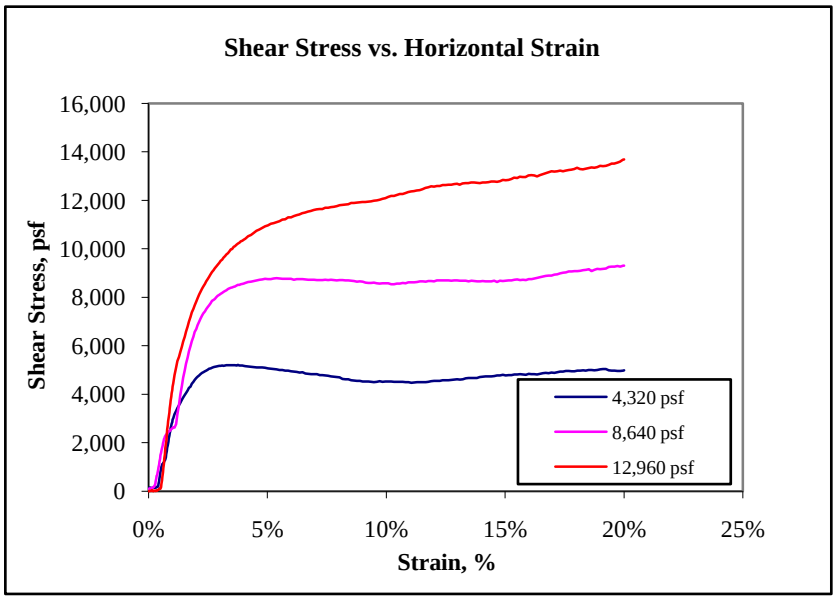
Sample Number:	Reviewed:	Date:	Job Number:	Figure:
MS-INC-1 Greenstone @ 338.7-339.2'	JEO	04/17/09	063-7109.100	3

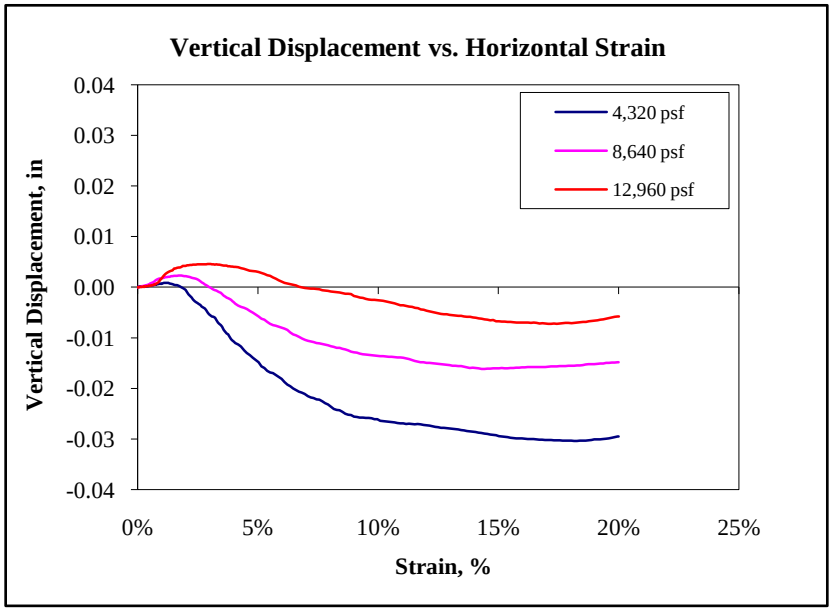
GOLDER ASSOCIATES INC.
DATE post-shear JOB NO. 063-7119
PROJECT PERMANENTE ~~DRY~~ 90 psi
SAMPLE NO. MS-INC-1 GREENSTONE @ 338.7-339.2
PROCTOR 698 1557 METHOD A B C
ATTERBERG SPG SIEVE HYDRO

Sample # =	MS-INC-1 Greenstone @ 358.0-358.5'		Sample # =	MS-INC-1 Greenstone @ 358.0-358.5'		Sample # =	MS-INC-1 Greenstone @ 358.0-358.5'	
Point #	1		Point #	2		Point #	3	
Load =	30	psi	Load =	60	psi	Load =	90	psi
	Initial			**Initial**			**Initial**	
Height =	2.982	cm	Height =	2.982	cm	Height =	2.982	cm
Diameter =	6.350	cm	Diameter =	6.350	cm	Diameter =	6.350	cm
Wet Weight =	228.00	g	Wet Weight =	228.00	g	Wet Weight =	228.00	g
Area =	31.7	cm^2	Area =	31.7	cm^2	Area =	31.7	cm^2
Sample Area =	4.91	in^2	Sample Area =	4.91	in^2	Sample Area =	4.91	in^2
Sample Area =	0.03	ft^2	Sample Area =	0.03	ft^2	Sample Area =	0.03	ft^2
Volume =	94.4	cm^3	Volume =	94.4	cm^3	Volume =	94.4	cm^3
Moisture Content =	8.2%		Moisture Content =	8.2%		Moisture Content =	8.2%	
Specific Gravity =	-		Specific Gravity =	-		Specific Gravity =	-	
Dry Weight of Solids =	210.72	g	Dry Weight of Solids =	210.72	g	Dry Weight of Solids =	210.72	g
Wet Density =	2.41	g/cm^3	Wet Density =	2.41	g/cm^3	Wet Density =	2.41	g/cm^3
Dry Density =	2.23	g/cm^3	Dry Density =	2.23	g/cm^3	Dry Density =	2.23	g/cm^3
Wet Density =	150.7	pcf	Wet Density =	150.7	pcf	Wet Density =	150.7	pcf
Dry Density =	139.2	pcf	Dry Density =	139.2	pcf	Dry Density =	139.2	pcf
Initial Normal Stress =	4,320	psf	Initial Normal Stress =	8,640	psf	Initial Normal Stress =	12,960	psf
Failure Normal Stress =	4,576	psf	Failure Normal Stress =	9,281	psf	Failure Normal Stress =	14,929	psf
Failure Shear Stress =	5,210	psf	Failure Shear Stress =	8,798	psf	Failure Shear Stress =	12,093	psf
Failure Strain =	3.8%		Failure Strain =	5.4%		Failure Strain =	10.0%	
Normal Stress at Large Disp. =	5,783	psf	Normal Stress at Large Disp. =	11,568	psf	Normal Stress at Large Disp. =	17,474	psf
Large-Disp. Shear Stress =	4,987	psf	Large-Disp. Shear Stress =	9,314	psf	Large-Disp. Shear Stress =	13,697	psf
Strain at Large Disp.=	20.0%		Strain at Large Disp.=	20.0%		Strain at Large Disp.=	20.0%	

Note: -Samples were remolded to "dense" condition at "appropriate moisture," per Rhonda Knupp's instruction.
-Samples were inundated after consolidation and before shearing.

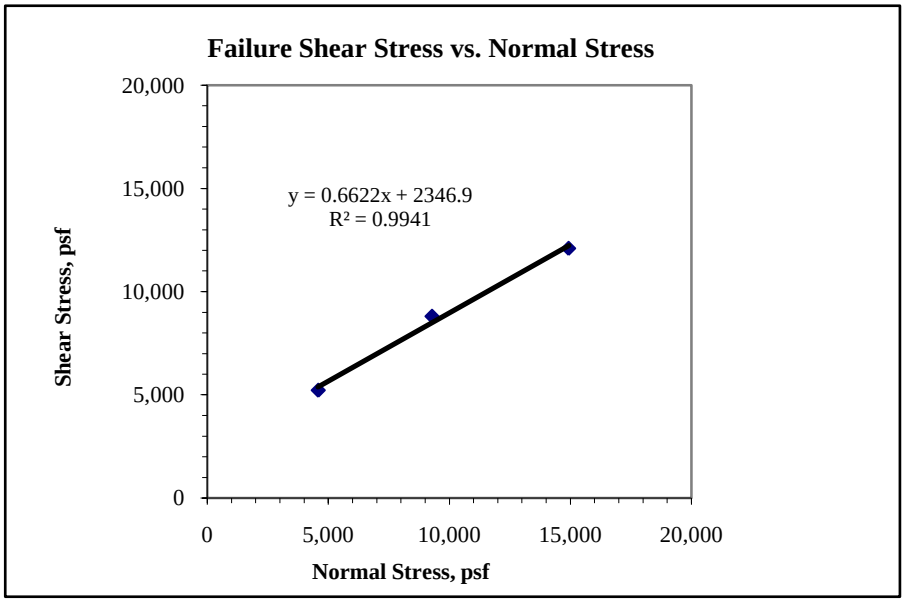
Golder Associates, Inc. **Denver, Colorado**	**Title:** **DIRECT SHEAR TEST REPORT** **SAMPLE DATA AND CALCULATIONS**			
Job Short Title: **Permanente**				
Sample Number: **MS-INC-1 Greenstone @ 358.0-358.5'**	**Reviewed:** **JEO**	**Date:** **4/15/2009**	**Job Number:** **063-7109.100**	**Figure:** **1**

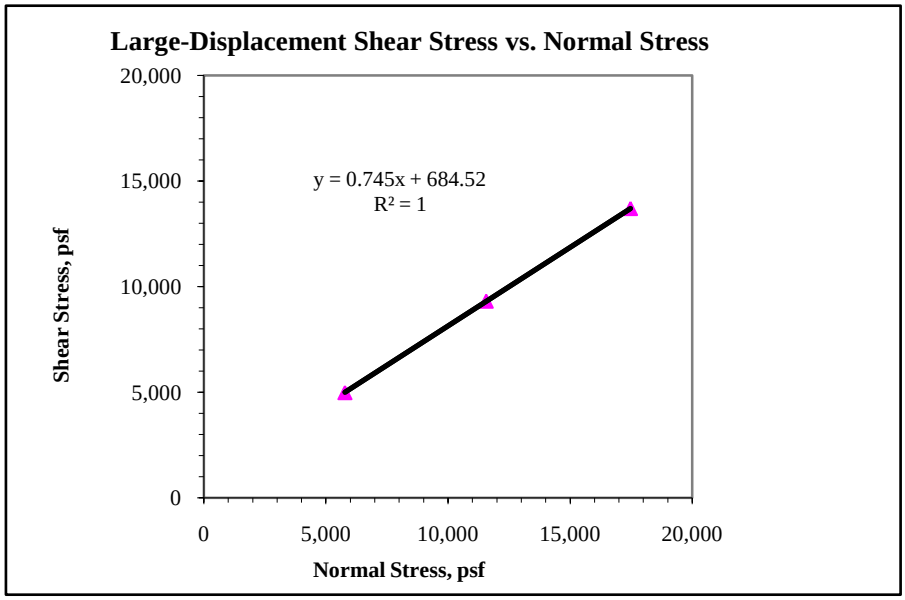




Golder Associates, Inc. **Denver, Colorado**	**Title:** **STRESS AND VERTICAL DISPLACEMENT VS. STRAIN**
Job Short Title: **Permanente**	

Sample Number:	Reviewed:	Date:	Job Number:	Figure:
MS-INC-1 Greenstone @ 358.0-358.5'	JEO	04/15/09	063-7109.100	2





Failure		Large-Displacement	
ϕ =	33.5 degrees	ϕ =	36.7 degrees
c =	2,347 psf	c =	685 psf

Golder Associates, Inc. **Denver, Colorado**		**Title:** **DIRECT SHEAR TESTING** **FAILURE ENVELOPES**		
Job Short Title: **Permanente**				
Sample Number: **MS-INC-1 Greenstone @ 358.0-358.5'**	**Reviewed:** **JEO**	**Date:** **04/15/09**	**Job Number:** **063-7109.100**	**Figure:** **3**

GOLDER ASSOCIATES INC.
* post-shear
DATE
JOB NO. 063-7109
PROJECT PERMANENTE
SAMPLE NO. MS-INC-1 GREENSTONE @ 358-358.5
PROCTOR 698 1557 - METHOD A B C
ATTERBERG SPG SIEVE HYDRO

APPENDIX 5.C

Seismic Displacement Calculations

Summary of Dynamic Deformation Analysis

Selected Notations			
M_w =	Moment magnitude	k_y =	Yield acceleration
a_{brk} =	Peak Horizontal Acceleration at the bedrock	U =	Dynamic deformation along critical slide surface
a_{max} =	Peak Horizontal Acceleration at the crest of slope		

Earthquake Characterization		
M_w	a_{brk}	a_{max} (Reference 1)
	g	g
7.1	0.60	0.60

Deformation Calculation (Reference 2)							
SITE	Section	Failure Description	k_y	k_y/a_{max}	Slope Deformation, U (in) (Bray and Travasarou)		
			g		84% Exc.	16% Exc.	50% Exc.
Main Slide	Az 120° Section 1000	Ultimate Backfill	0.16	0.27	3	13	6
Main Slide	Stability Section	Ultimate Backfill	0.15	0.25	4	14	7

References:

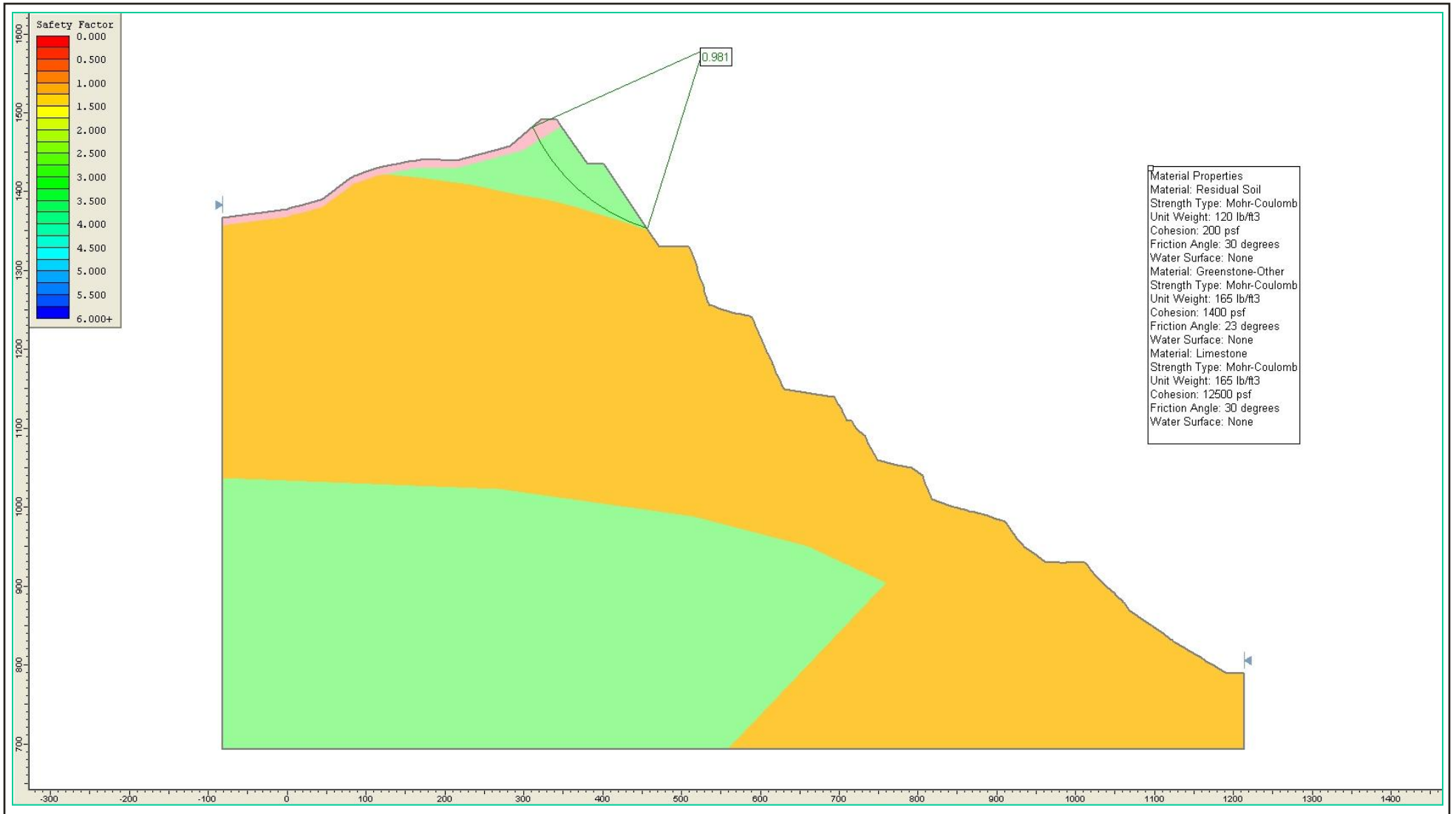
1. Seed, H. B. and Idriss, I. M. (1982), Ground Motions and Soil Liquefaction During Earthquakes Monograph No. 5, Earthquake Engineering Research Institute, Berkeley, California.
2. Bray, J. D. and Travasarou, T. (2007), Simplified Procedure for Estimating Earthquake-Induced Deviatoric Slope Displacements Journal of the Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 133, No. 4, pp. 381-392.

Note: This spreadsheet is only intended to estimate seismic deformation under the above shown earthquake events and sections.

APPENDIX 6.A

Scenic Easement - Slope Stability Output

PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 05-12-10 FILE LOCATION:

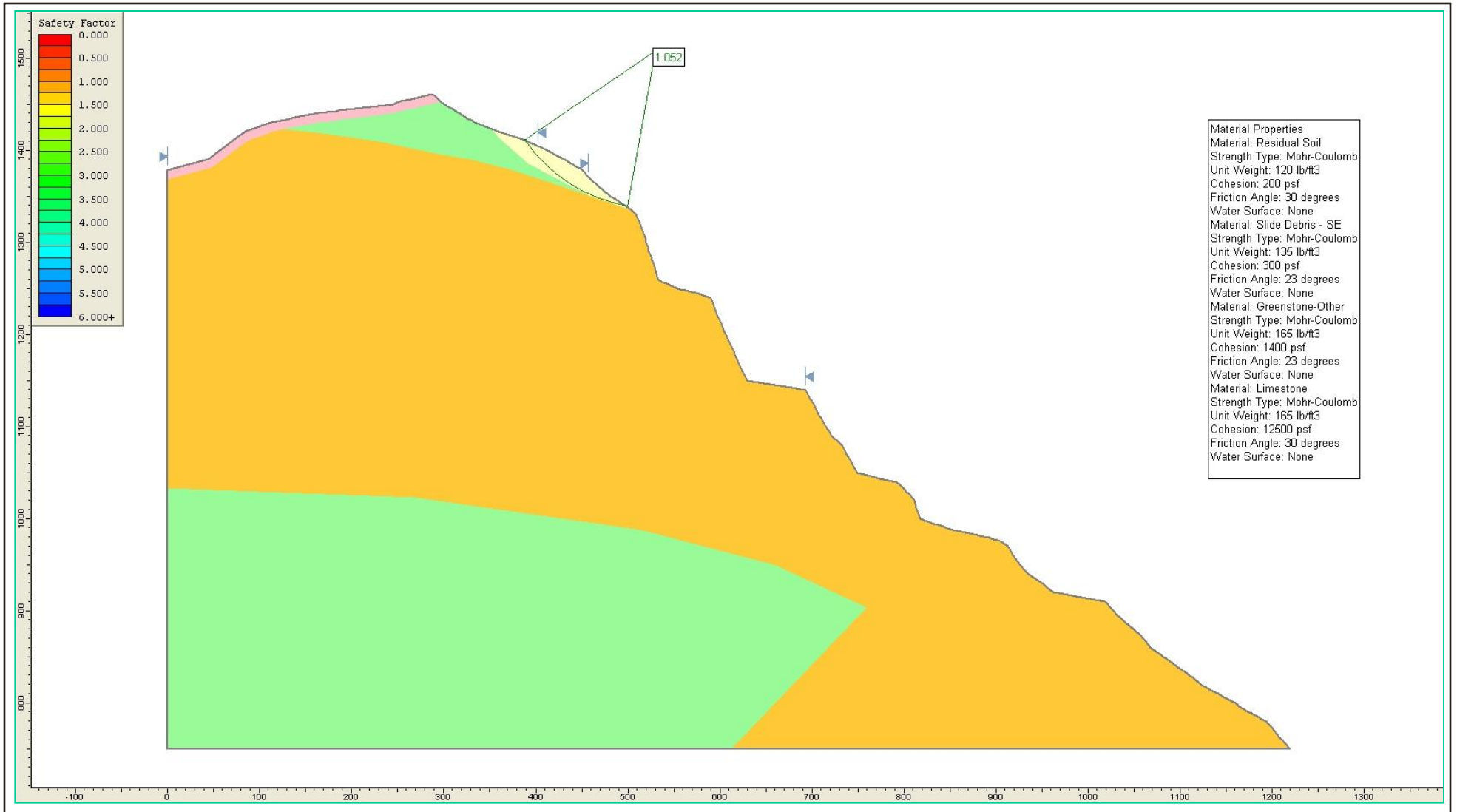


SECTION SE1 – PRE-FAILURE/BACK ANALYSIS
CONDITION: STATIC
FAILURE MODE: CIRCULAR
BACK CALCULATED Kg-1 STRENGTH: c = 1400 psf; ϕ = 23 degrees

Golder Associates		**PRE-FAILURE CONDITION SCENIC-EASEMENT SLIDE LEHIGH SOUTHWEST CEMENT COMPANY, CA**	
Drawn: PHY	App'd: KGH	Date: MAY, 2010	Figure: **6A-1**

Project No.: 063-7109 Revision No.: 1

PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 05-12-10 FILE LOCATION:



SECTION SE1 – EXISTING
CONDITION: STATIC
FAILURE MODE: CIRCULAR
MIN. FOS = 1.05

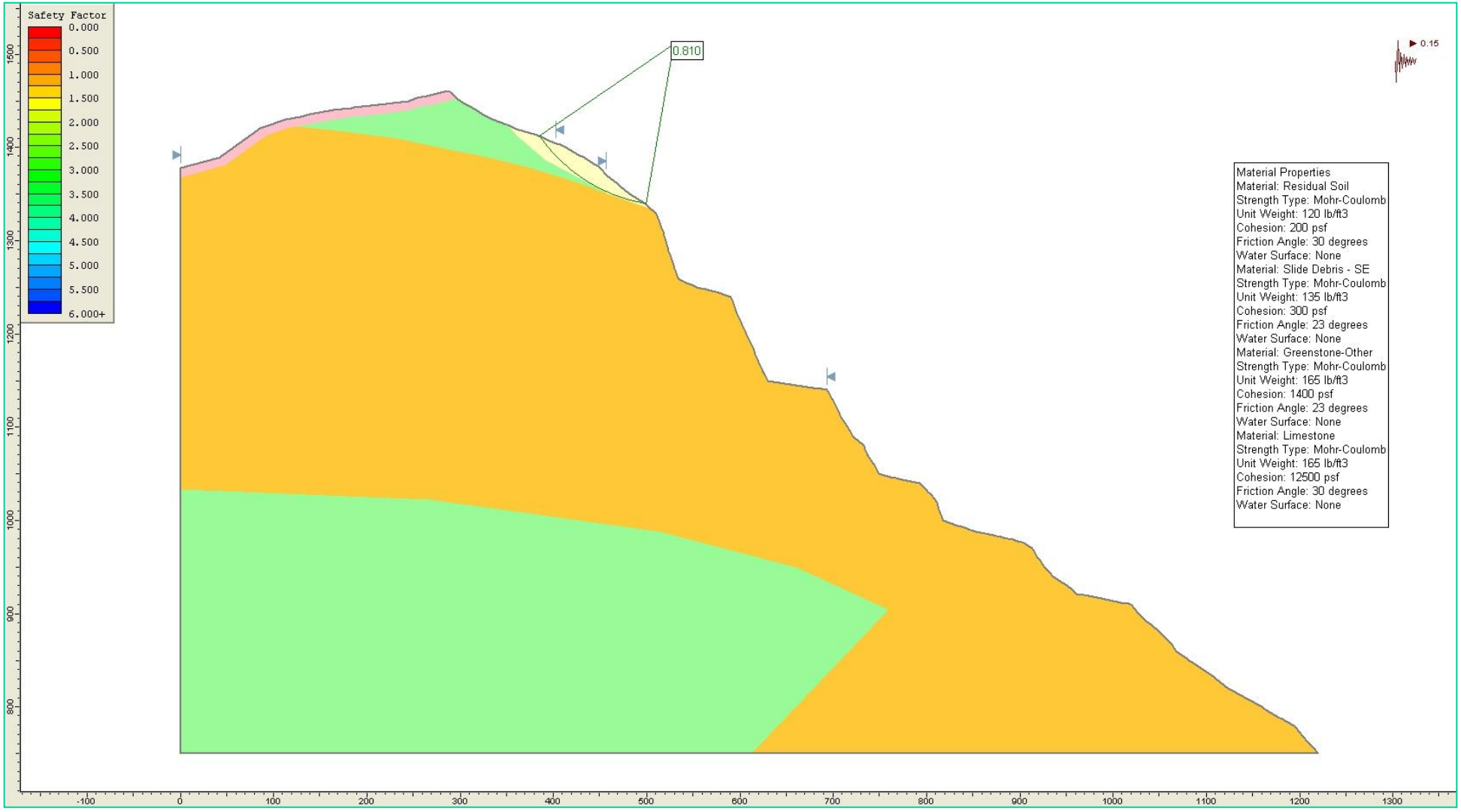
Golder Associates

EXISTING CONDITION
SCENIC-EASEMENT SLIDE
LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: MAY, 2010	Figure: **6A-2**

Project No.: 063-7109 Revision No.: 1

PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 05-12-10 FILE LOCATION:



SECTION SE1 – EXISTING
CONDITION: PSEUDO-STATIC (WITH K = 0.15)
FAILURE MODE: CIRCULAR
MIN. FOS = 0.81

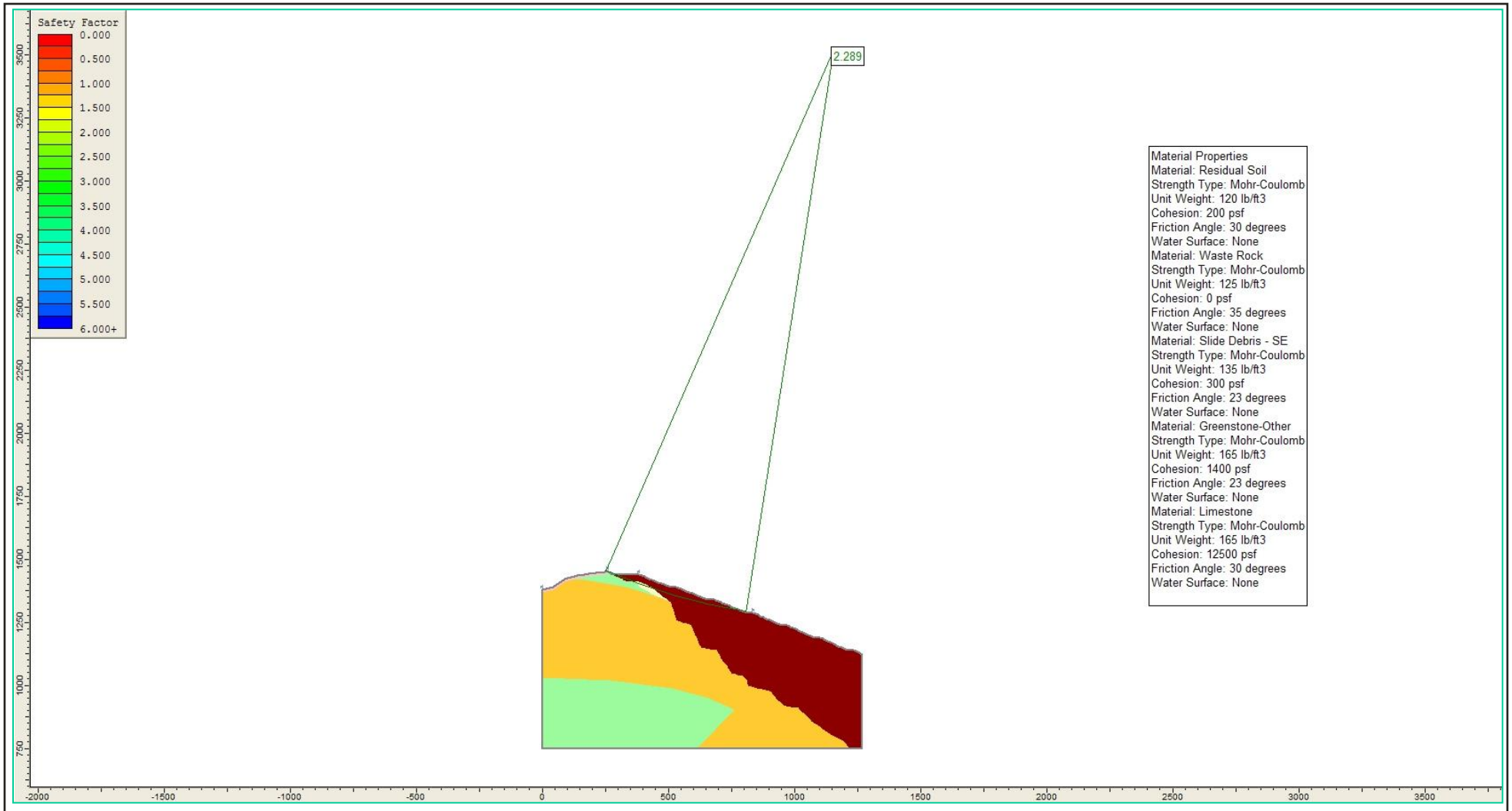
Golder Associates

EXISTING CONDITION SCENIC-EASEMENT SLIDE LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: MAY, 2010	Figure: 6A-3

Project No.: 063-7109 Revision No.: 1

PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 05-12-10 FILE LOCATION:



SECTION SE1 – ULTIMATE RECLAMATION
CONDITION: STATIC
FAILURE MODE: CIRCULAR
MIN. FOS = 2.29

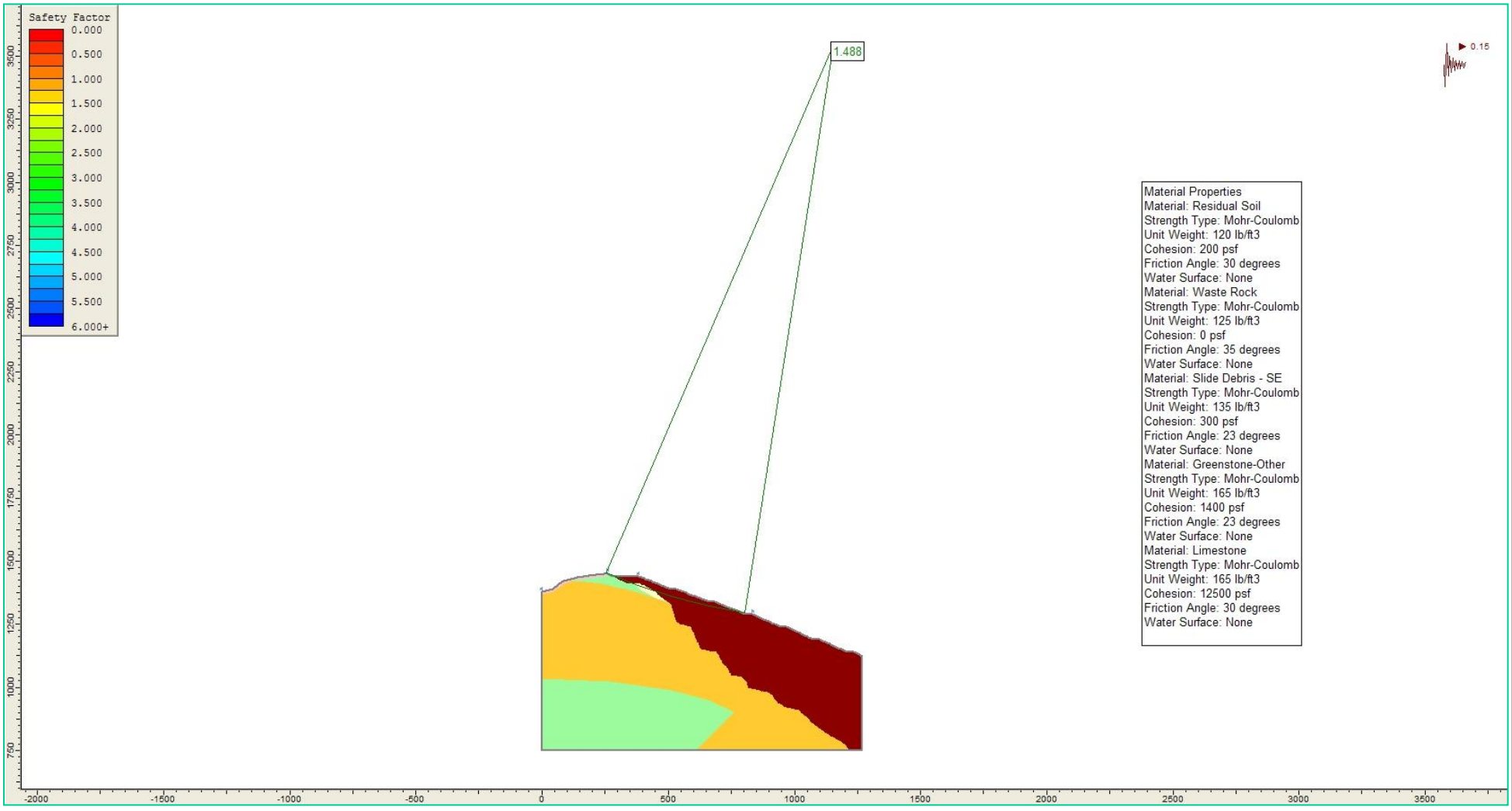
Golder Associates

PROPOSED GRADING SCENIC-EASEMENT SLIDE LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: MAY, 2010	Figure: 6A-4

Project No.: 063-7109 Revision No.: 1

PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 05-12-10 FILE LOCATION:



SECTION SE1 – ULTIMATE RECLAMATION
CONDITION: PSEUDO-STATIC (K=0.15)
FAILURE MODE: CIRCULAR
MIN. FOS = 1.49

Golder Associates

PROPOSED GRADING SCENIC-EASEMENT SLIDE LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: MAY, 2010	Figure: 6A-5

Project No.: 063-7109 Revision No.: 1

TABLE

Summary of Dynamic Deformation Analysis

Selected Notations			
M_w =	Moment magnitude	k_y =	Yield acceleration
a_{brk} =	Peak Horizontal Acceleration at the bedrock	U =	Dynamic deformation along critical slide surface
a_{max} =	Peak Horizontal Acceleration at the crest of slope		

Earthquake Characterization		
M_w	a_{brk}	a_{max} (Reference 1)
	g	g
7.1	0.60	0.60

Deformation Calculation (Reference 2)							
SITE	Section	Failure Description	k_y	k_y/a_{max}	Slope Deformation, U (in) (Bray and Travasarou)		
			g		84% Exc.	16% Exc.	50% Exc.
Scenic	SE1	Existing	0.03	0.05	31	118	60

References:

1. Seed, H. B. and Idriss, I. M. (1982), Ground Motions and Soil Liquefaction During Earthquakes Monograph No. 5, Earthquake Engineering Research Institute, Berkeley, California.
2. Bray, J. D. and Travasarou, T. (2007), Simplified Procedure for Estimating Earthquake-Induced Deviatoric Slope Displaceme Journal of the Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 133, No. 4, pp. 381-392.

Note: This spreadsheet is only intended to estimate seismic deformation under the above shown earthquake events and sections.

APPENDIX 7.A

Mid-Pen – Test Pit Logs

TEST PIT LOG

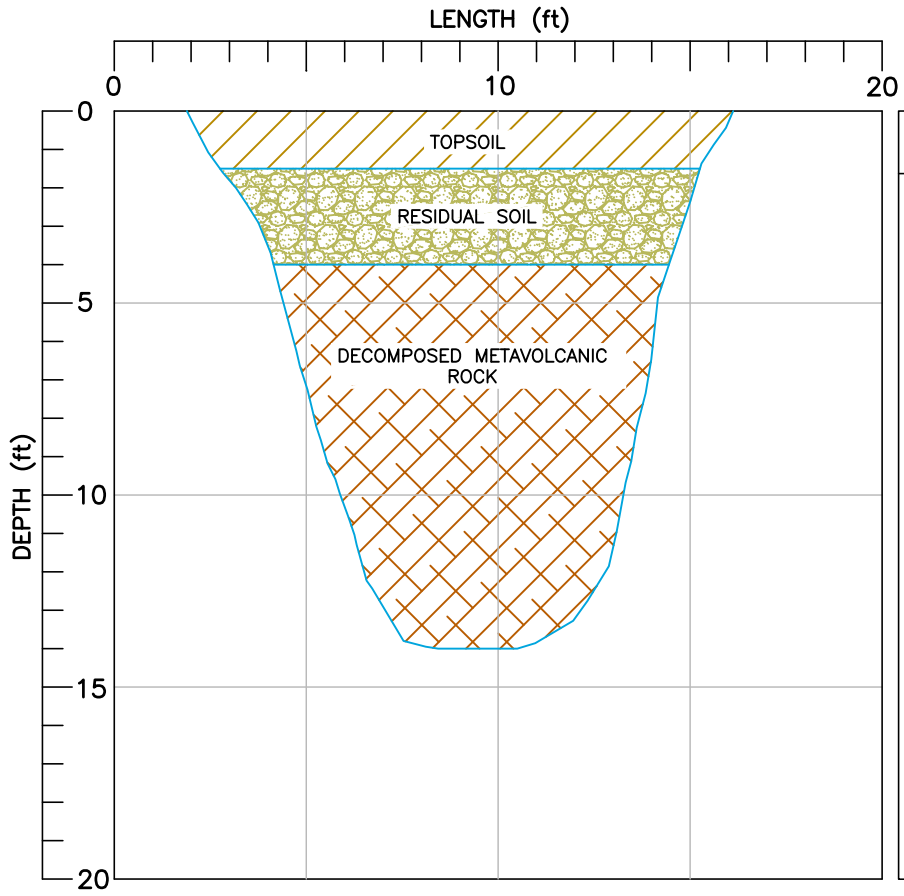
No. TP–MP–1

TEMP 50°F WEATHER SUNNY ENGINEER RHONDA KNUPP OPERATOR

EQUIPMENT SMALL CAT TRACK EXCAVATOR CONTRACTOR LEHIGHHANSON PERMANENTE DATE 01/15/09

COORDINATES N 1944491 E 6095091 ELEV. 1485 DATUM UTM JOB 063–7109.100

LOCATION PERMANENTE PIT 1



LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES

0–1.5' TOPSOIL: SOFT, DARK BROWNISH–BLACK CLAY, SOME SAND, TRACE GRAVEL, DAMP. SAND AND GRAVEL ANGULAR. ABUNDANT ROOTS.

1.5'–4' RESIDUAL SOIL TO COMPLETELY WEATHERED ROCK: DENSE TO VERY DENSE, MOTTLED TAN–BROWN GRAVEL, AND SAND, TRACE CLAY, DAMP. GRAVEL AND SAND ARE ANGULAR METAVOLCANIC ROCK FRAGMENTS WITH MnO ON MANY SURFACES. THESE WILL BREAK DOWN TO CLAY, BECAUSE CLAY IS SMEARED ON THE SIDES OF THE PIT WHERE THE BUCKET HAS RUBBED AGAINST THE WALLS. SAMPLE AT 3.5'.

4'–14' DECOMPOSED METAVOLCANIC ROCK: DENSE TO VERY DENSE, MOTTLED TAN–BROWN GRAVEL, AND SAND, LITTLE CLAY. PROBABLY SAME AS OVERLYING MATERIAL, JUST BROKEN DOWN MORE BY BUCKET AS DIGGING BECOMES MORE DIFFICULT. SAMPLE AT 10'.

EXCAVATOR REFUSAL AT 14'. SAME MATERIAL AS ABOVE, BUT ROCK FRAGMENTS ARE BIGGER – MANY ARE COBBLE–SIZED. MAY BE MORE CLAY IN THIS – "SOME" INSTEAD OF "LITTLE". SAMPLE AT 14'.

PHOTOGRAPHIC LOG

SAMPLES

NO.	DEPTH (ft)
1	3.4
2	10
3	14
4*	UNKNOWN

SPECIAL NOTES

LAB TEST RESULTS**

SIEVE SIZE	% PASSING
3/4"	--
#4	--
#200	--

LL=XX; PL=XX: PI=XX

MC=XX%

*CHUNK SAMPLE COLLECTED FROM SPOILS PILE
**LAB TEST RESULTS PROVIDED IN APPENDIX B.

Friday, May 21, 2010 – 11:52am FILE: S:\HansonPermanente\Pit 1 North East Walls\Mid Pen Regrade – 2009 files\RLK Site Visit 1–15–09\Test Pits\TEST PIT LOG.dwg TAB NAME \MP–1
THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.

TEST PIT LOG

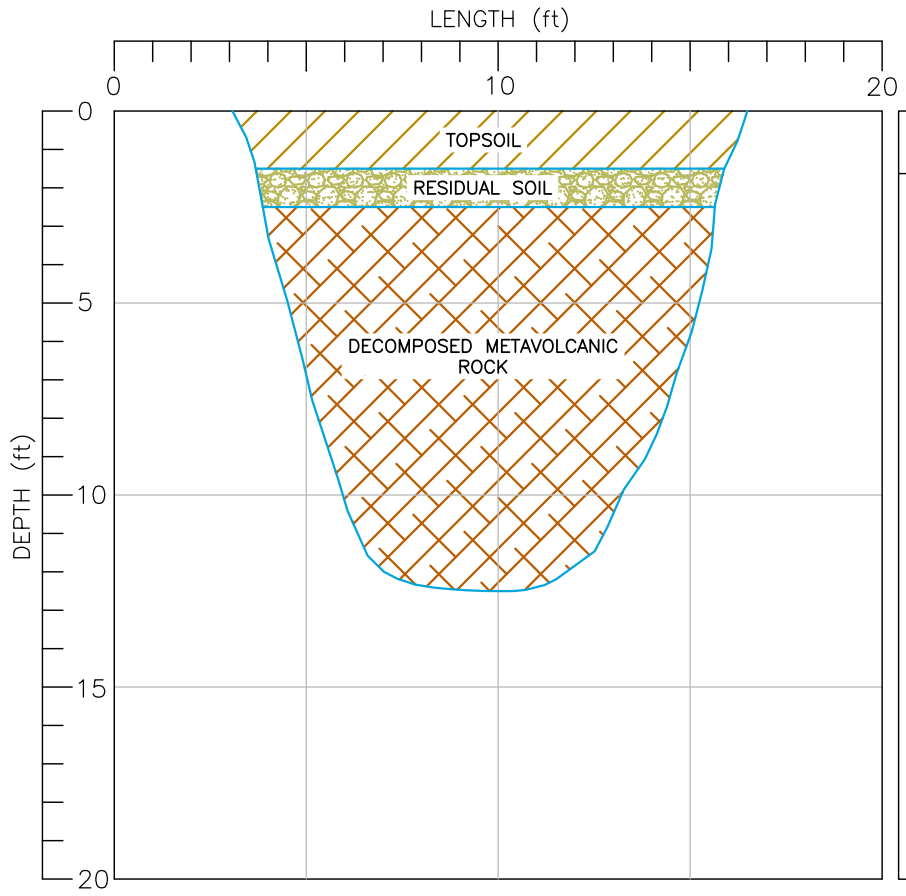
No. TP-MP-2

TEMP 50°F WEATHER SUNNY ENGINEER RHONDA KNUPP OPERATOR

EQUIPMENT SMALL CAT TRACK EXCAVATOR CONTRACTOR LEHIGHHANSON PERMANENTE DATE 01/15/09

COORDINATES N 1944454 E 6095101 ELEV. 1485 DATUM UTM JOB 063-7109.100

LOCATION PERMANENTE PIT 1



LITHOLOGIC DESCRIPTIONS AND EXCAVATION NOTES	
0–1.5'	TOPSOIL: SOFT, DARK BROWNISH-BLACK CLAY, SOME SAND, TRACE GRAVEL, DAMP. SAND AND GRAVEL ANGULAR. ABUNDANT ROOTS.
1.5'–2.5'	RESIDUAL SOIL TO COMPLETELY WEATHERED ROCK: DENSE TO VERY DENSE, MOTTLED TAN-BROWN GRAVEL, AND SAND, TRACE CLAY, DAMP. GRAVEL AND SAND ARE ANGULAR METAVOLCANIC ROCK FRAGMENTS WITH MnO ON MANY SURFACES.
2.5'–12.5'	DECOMPOSED METAVOLCANIC ROCK: DENSE TO VERY DENSE, MOTTLED TAN-BROWN GRAVEL, AND SAND, LITTLE CLAY. GRAVEL AND SAND ARE ANGULAR MV ROCK FRAGMENTS AND PROBABLY SMALLER FRAGMENTS WILL BREAK DOWN TO CLAY, AS DESCRIBED IN PREVIOUS PIT. ABUNDANT MnO ON FRAGMENT SURFACES. SAMPLE AT 10'.
EXCAVATOR REFUSAL AT 12.5 FT. SAMPLE AT 12.5 FT.; MATERIALS LOOK THE SAME AS SAMPLE AT 10'.	

PHOTOGRAPHIC LOG

SAMPLES	
NO.	DEPTH (ft)
5	10
6	12.5

SPECIAL NOTES

LAB TEST RESULTS*

SIEVE SIZE	% PASSING
3/4"	--
#4	--
#200	--
LL=XX; PL=XX: PI=XX	
MC=XX%	

*LAB TEST RESULTS PROVIDED IN APPENDIX B.

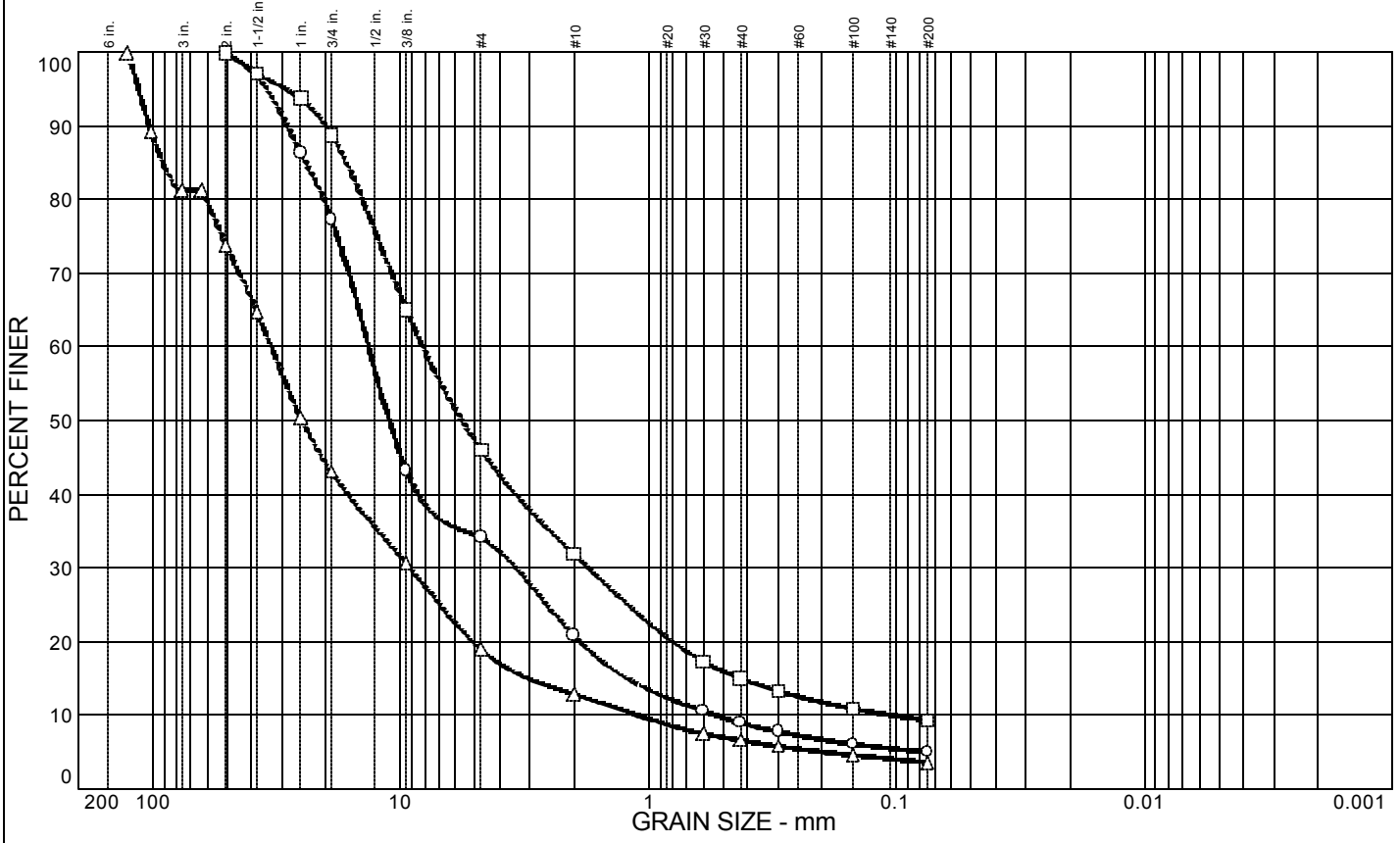
Friday, May 21, 2010 - 11:52am FILE: S:\HansonPermanente\Pit 1 North East Walls\Mid Pen Regrade - 2009 files\RLK Site Visit 1-15-09\Test Pits\TEST PIT LOG.dwg TAB NAME \MP-2

THIS DRAWING HAS BEEN PREPARED BY GOLDER ASSOCIATES INC. FOR USE BY THE CLIENT NAMED IN THE TITLE BLOCK SOLELY IN RESPECT OF THE CONSTRUCTION OPERATION AND MAINTENANCE OF THE FACILITY NAMED IN THE TITLE BLOCK. GOLDER ASSOCIATES INC. SHALL NOT BE LIABLE FOR THE USE OF THIS DRAWING ON ANY OTHER FACILITY OR FOR ANY OTHER PURPOSES.

APPENDIX 7.B

Mid-Pen – Lab Test Results

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		65.9	29.1	5.0					
□		54.0	36.7	9.3					
△	18.8	62.2	15.4	3.6					

SIEVE inches size	PERCENT FINER ○	□	△
5			100.0
4			89.2
3			81.2
2.5			81.2
2	100.0	100.0	73.9
1.5"	96.9	97.1	64.8
1"	86.4	93.8	50.4
3/4"	77.3	88.8	43.1
3/8"	43.2	65.1	30.7
	GRAIN SIZE		
D_{60}	13.5	8.17	33.3
D_{30}	3.43	1.75	9.15
D_{10}	0.531	0.104	1.10
	COEFFICIENTS		
C_c	1.64	3.60	2.28
C_u	25.47	78.56	30.28

SIEVE number size	PERCENT FINER ○	□	△
#4	34.1	46.0	19.0
#10	20.8	31.9	12.9
#30	10.6	17.3	7.5
#40	9.0	15.0	6.6
#50	7.8	13.3	5.8
#100	6.1	10.9	4.6
#200	5.0	9.3	3.6

SOIL DESCRIPTION

○ Brown Well-Graded GRAVEL w/ Silt & Sand

□ Brown Poorly Graded GRAVEL w/ Silt & Sand

△ Gray Well-Graded GRAVEL w/ Sand

REMARKS:

○

□

△

○ Source: TP-MP-1 Elev./Depth: 3.5'

□ Source: TP-MP-1 Elev./Depth: 10'

△ Source: TP-MP-1 Elev./Depth: 14'

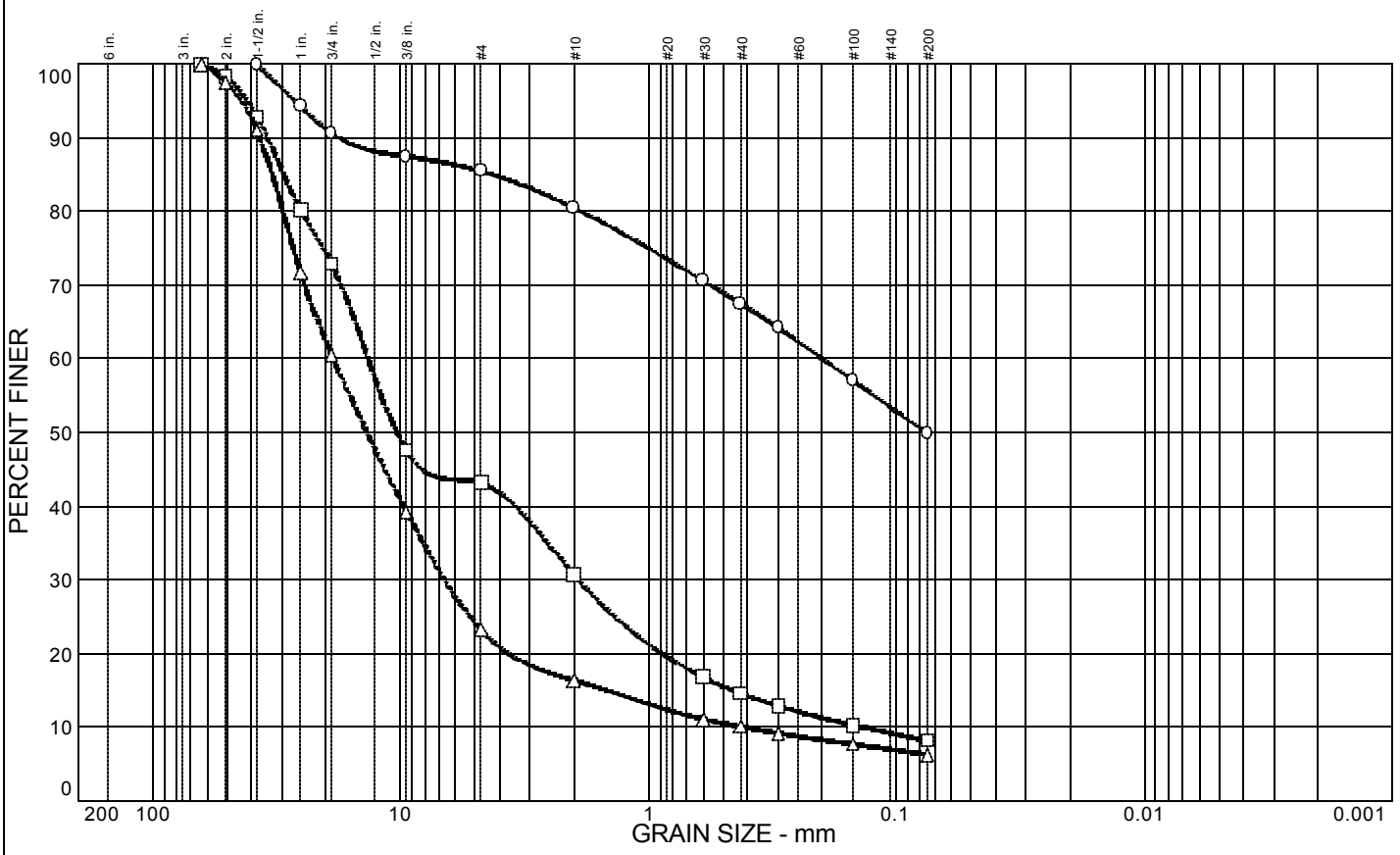
COOPER TESTING LABORATORY

Client: Golder Associates

Project: Hanson - 063-7109.100

Project No.: 287-038 Figure

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		14.5	35.6	49.9		SC		25	46
□		56.8	35.0	8.2					
△		76.8	16.9	6.3					

SIEVE inches size	PERCENT FINER ○	□	△
2.5		100.0	100.0
2		98.4	97.6
1.5"	100.0	92.9	91.0
1"	94.3	80.2	71.7
3/4"	90.7	72.9	60.6
3/8"	87.5	47.6	39.3
	GRAIN SIZE		
D_{60}	0.198	13.6	18.7
D_{30}		1.92	6.67
D_{10}		0.137	0.409
	COEFFICIENTS		
C_c		1.98	5.81
C_u		99.27	45.72

SIEVE number size	PERCENT FINER ○	□	△
#4	85.5	43.2	23.2
#10	80.5	30.7	16.4
#30	70.6	16.8	11.1
#40	67.5	14.6	10.1
#50	64.2	12.9	9.2
#100	57.1	10.3	7.7
#200	49.9	8.2	6.3

SOIL DESCRIPTION

○ Dark Reddish Brown Lean Clayey SAND

□ Brown Well-Graded GRAVEL w/ Clay & Sand

△ Brown Poorly Graded GRAVEL w/ Clay & Sand

REMARKS:

○

□

△

○ Source: TP-MP-2 Elev./Depth: 0-0.5'

□ Source: TP-MP-2 Elev./Depth: 10'

△ Source: TP-MP-2 Elev./Depth: 12.5'

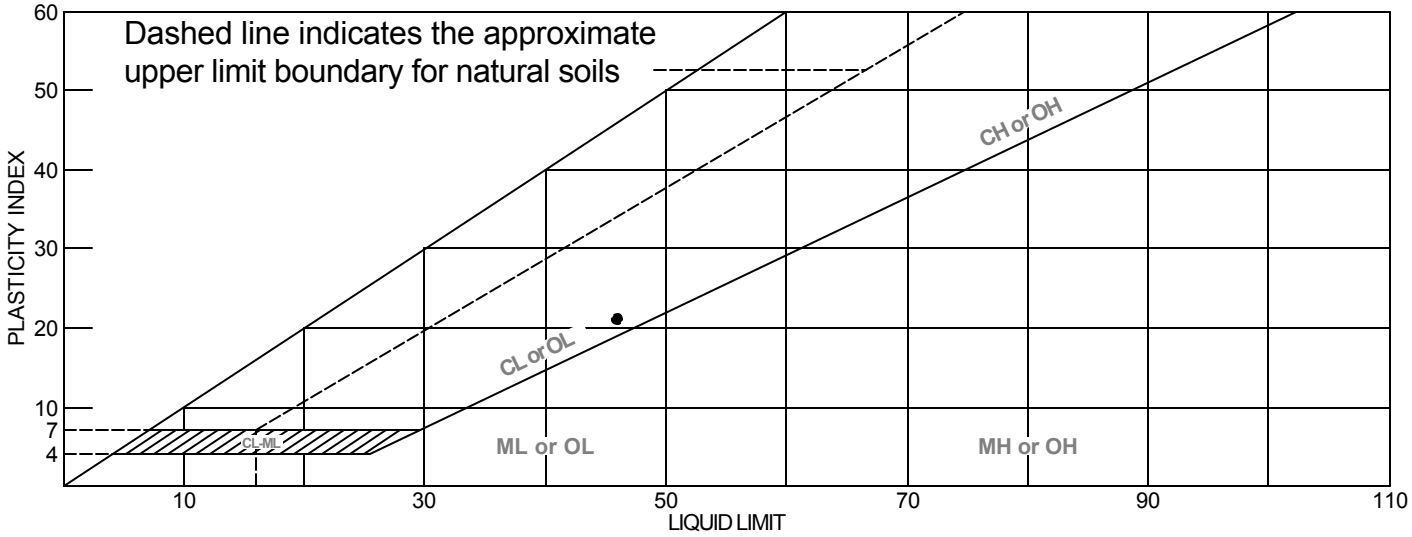
COOPER TESTING LABORATORY

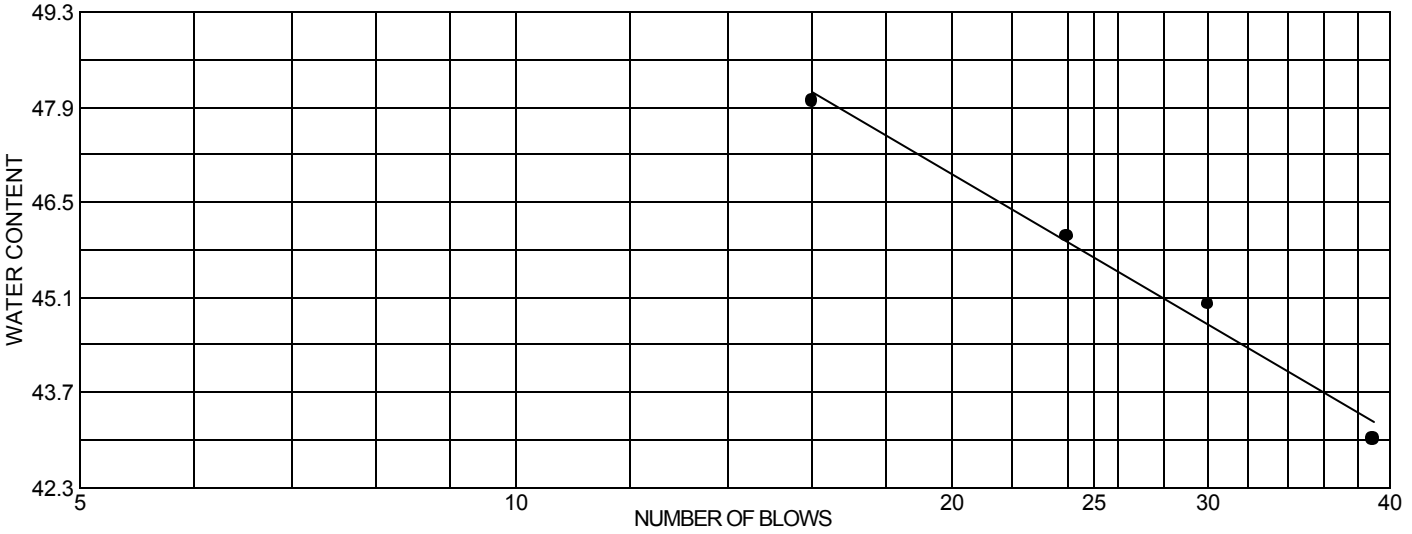
Client: Golder Associates

Project: Hanson - 063-7109.100

Project No.: 287-038 Figure

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark Reddish Brown Lean Clayey SAND	46	25	21	67.5	49.9	SC

Project No. 287-038 **Client:** Golder Associates

Project: Hanson - 063-7109.100

● **Source:** TP-MP-2 **Elev./Depth:** 0-0.5'

Remarks:

●

LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

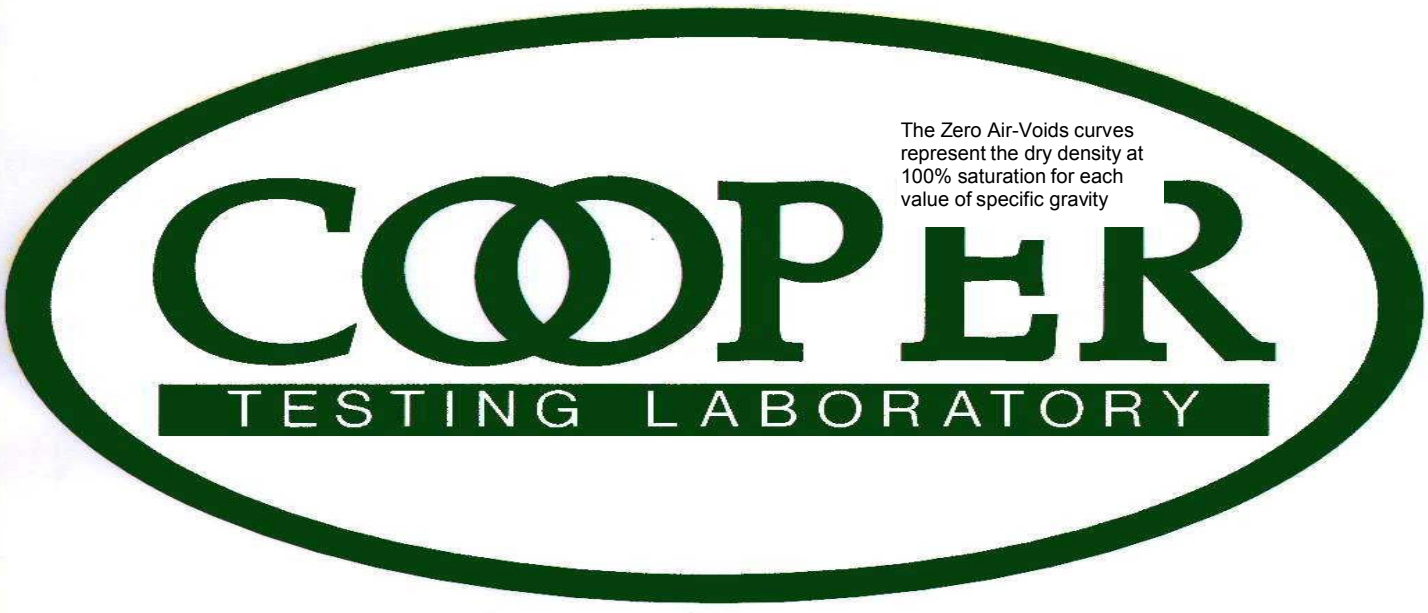
Figure

Chunk Density
(USACE - Displacement method)

CTL Job No: 287-038 **Project No.:** 063-7109.100
Client: Golder Associates **Date:** 1/26/09
Project Name: Hanson **By:** PJ

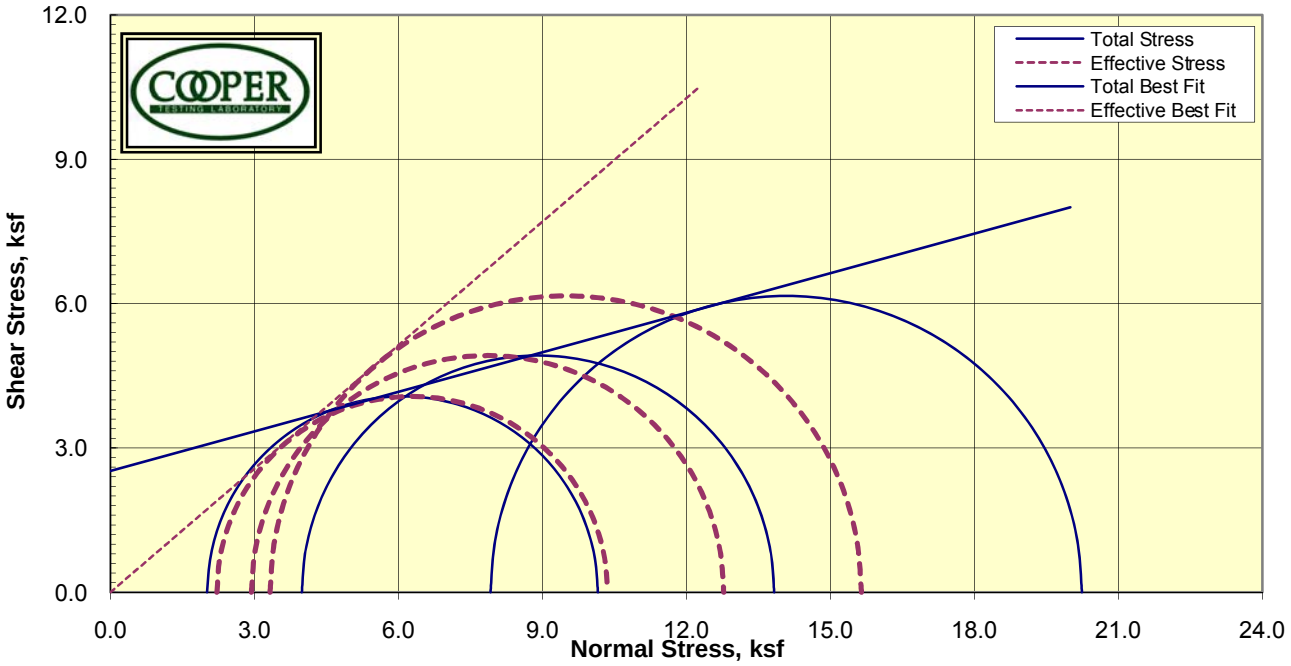
Boring: **Sample:** **Depth, ft:**	Franciscan chunk 1	Franciscan chunk 2	Franciscan chunk 3					
Visual Description:	Reddish Brown Weathered Rock	Reddish Brown Weathered Rock	Reddish Brown Weathered Rock					
Actual G_s								
Assumed G_s	2.70	2.70	2.70					
Total Vol cc	231.28	441.70	553.53					
Vol Solids,cc	188.15	355.25	449.75					
Vol Voids,cc	43.13	86.46	103.78					
Moisture, %	5.0	5.9	5.4					
Wet Unit wt, pcf	143.9	143.4	144.2					
Dry Unit wt, pcf	137.1	135.5	136.9					
Saturation, %	58.7	64.9	62.8					
Porosity, %	18.6	19.6	18.7					
Void Ratio	0.229	0.243	0.231					
Series	1	2	3	4	5	6	7	8

Note: If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.

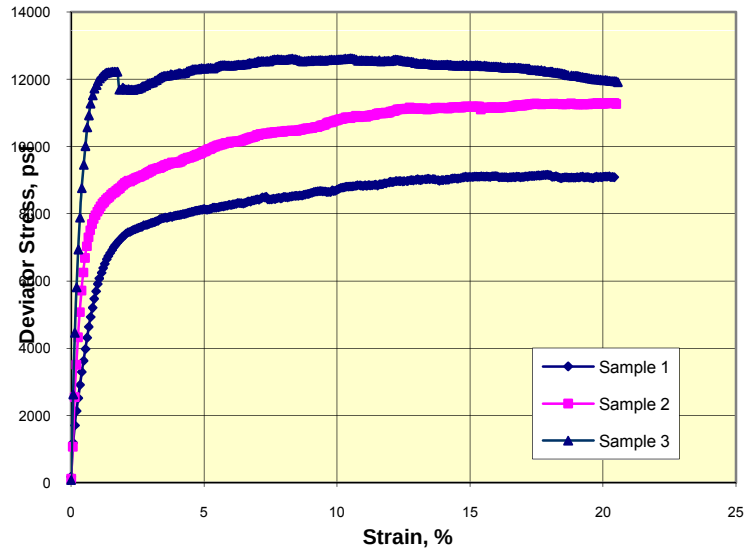


Triaxial Consolidated Undrained

(ASTM D4767)



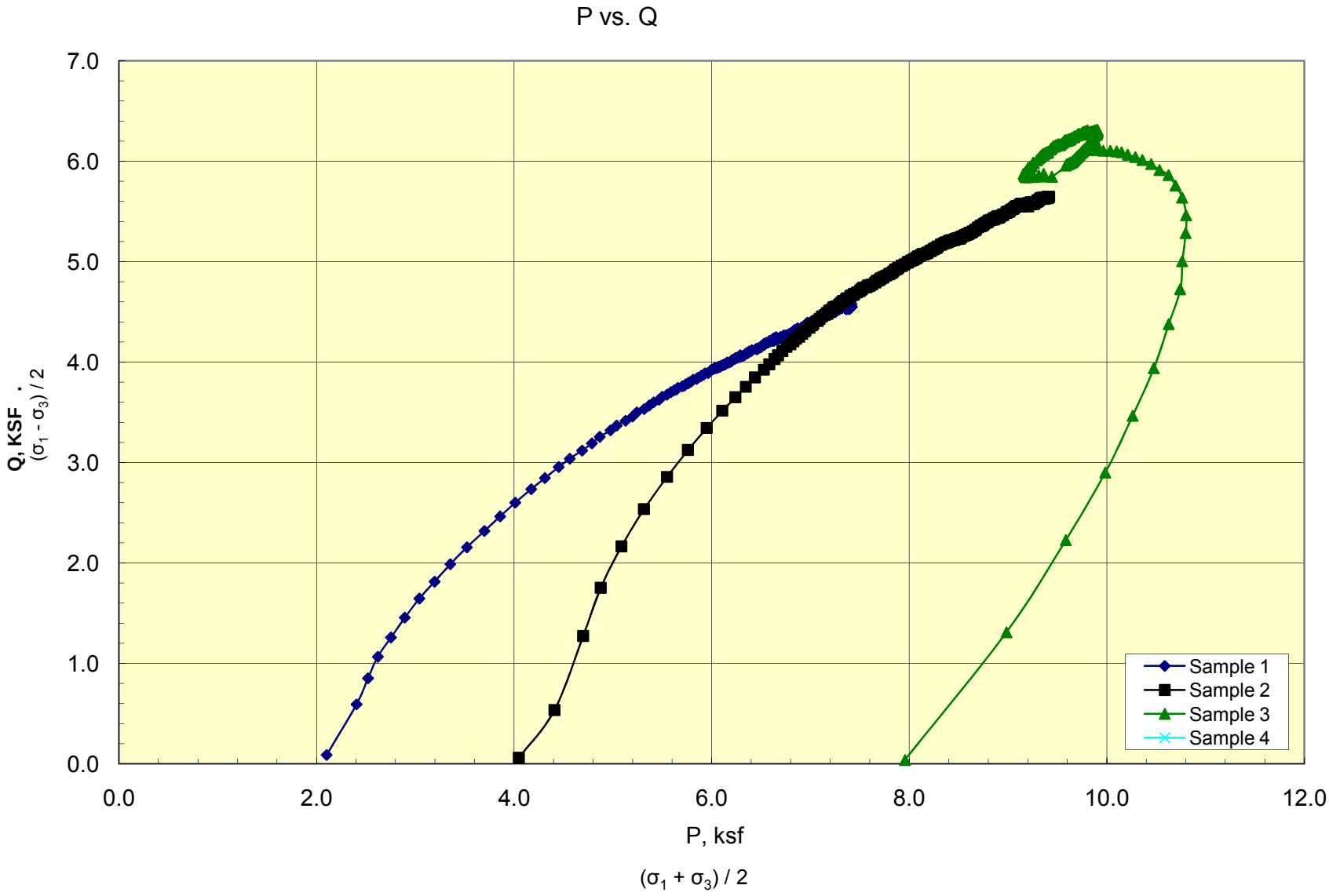
Stress-Strain Response



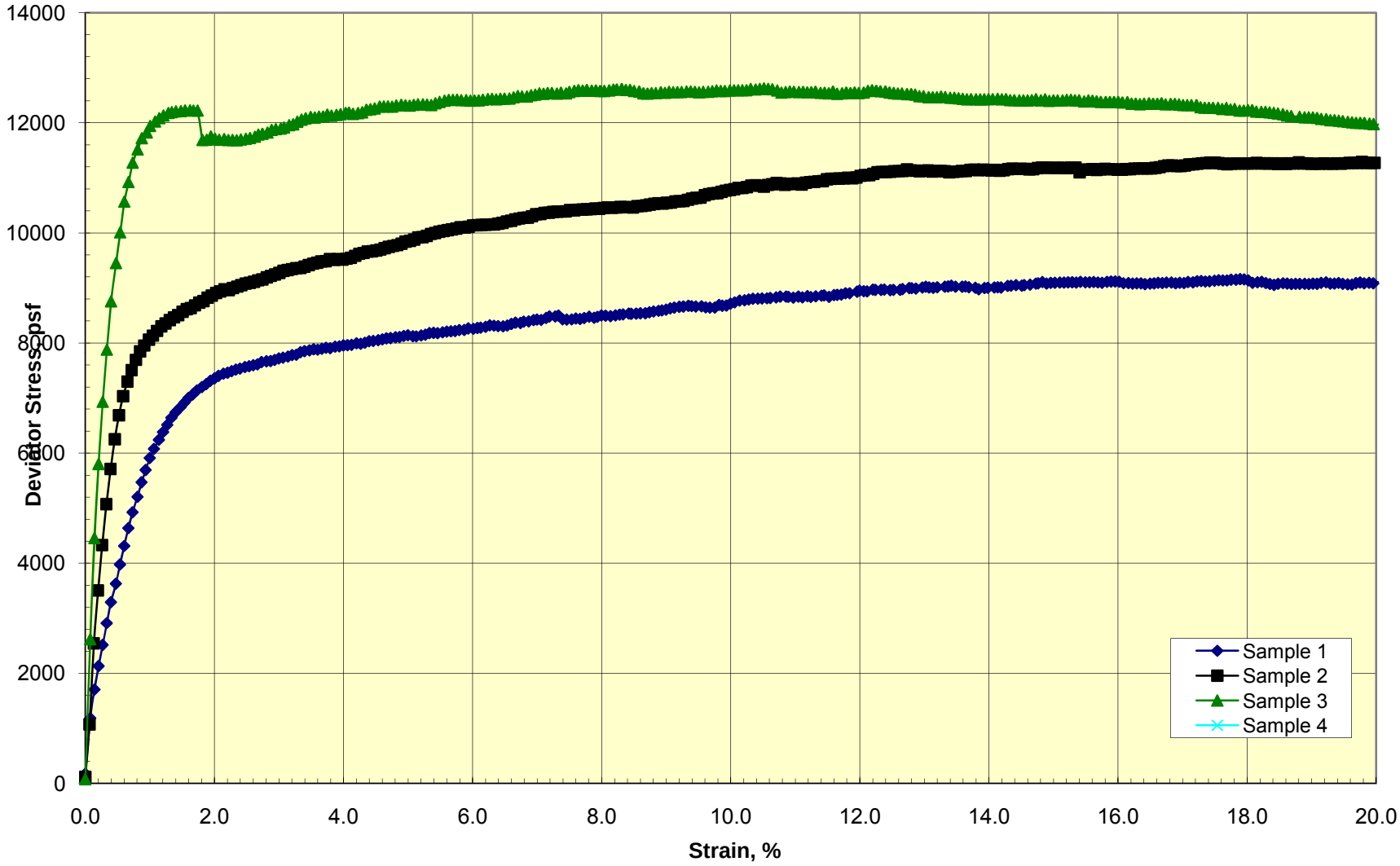
Sample:	1	2	3	4
MC, %	8.4	8.4	8.1	
Dry Dens, pcf	127.8	128.3	128.7	
Sat. %	71.0	72.4	71.1	
Void Ratio	0.319	0.314	0.309	
Diameter in	3.97	3.97	3.97	
Height, in	8.00	8.00	8.00	
	Final			
MC, %	11.8	11.4	11.1	
Dry Dens, pcf	127.8	128.8	129.6	
Sat. %	100.0	100.0	100.0	
Void Ratio	0.319	0.308	0.300	
Diameter, in	4.02	4.02	4.02	
Height, in	7.80	7.77	7.76	
Cell, psi	52.4	66.3	94.1	
BP, psi	38.4	38.6	39.1	
	Effective Stresses At:			
Strain, %	5.0	5.0	5.0	
Deviator ksf	8.140	9.840	12.320	
Excess PP	-0.202	1.051	4.594	
Sigma 1	10.358	12.778	15.646	
Sigma 3	2.218	2.938	3.326	
P, ksf	6.288	7.858	9.486	
Q, ksf	4.070	4.920	6.160	
Stress Ratio	4.671	4.350	4.704	
Rate in/min	0.001	0.001	0.001	
Total C	2.5	ksf		
Total Phi	15.3	Degrees		
Eff. C	0.0	ksf		
Eff. Phi	40.6	Degrees		

Job No.:	287-038	**Date:**	2/5/2009
Client:	Golder Associates		BY:MD/DC
Project:	Hanson - 063-7109.100		
Sample 1)	TP-MP-1 @ 3.5-14' Reddish Brown Weathered Rock		
Sample 2)	TP-MP-1 @ 3.5-14' Reddish Brown Weathered Rock		
Sample 3)	TP-MP-1 @ 3.5-14' Reddish Brown Weathered Rock		
Sample 4)			

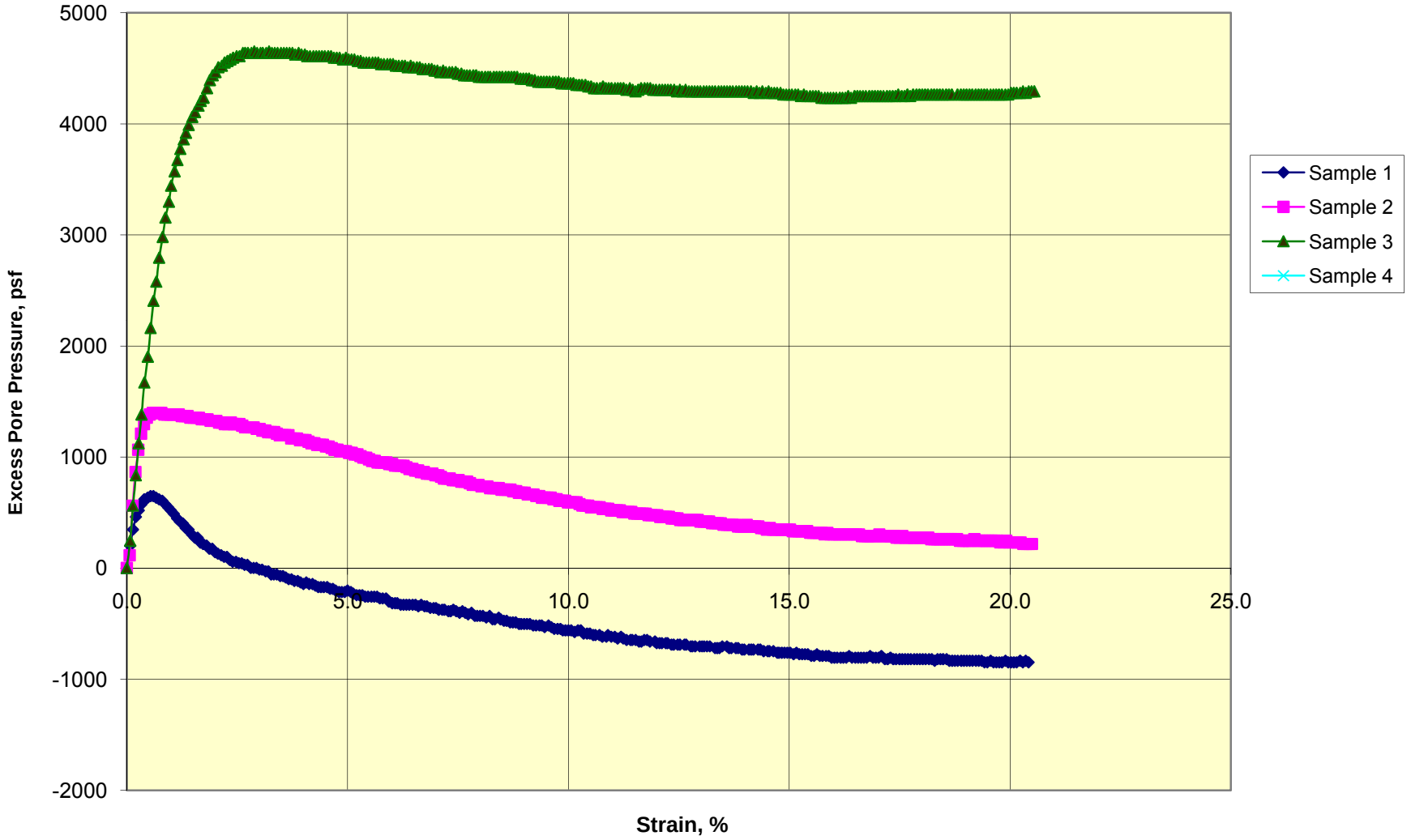
REMARKS: Strengths picked at 5% strain. Remolding target: 100% of 136.5 pcf @ 9.2%. Unable to achieve over 94% of the in-situ density as determined by chunk density testing. Tested -3/4" material.

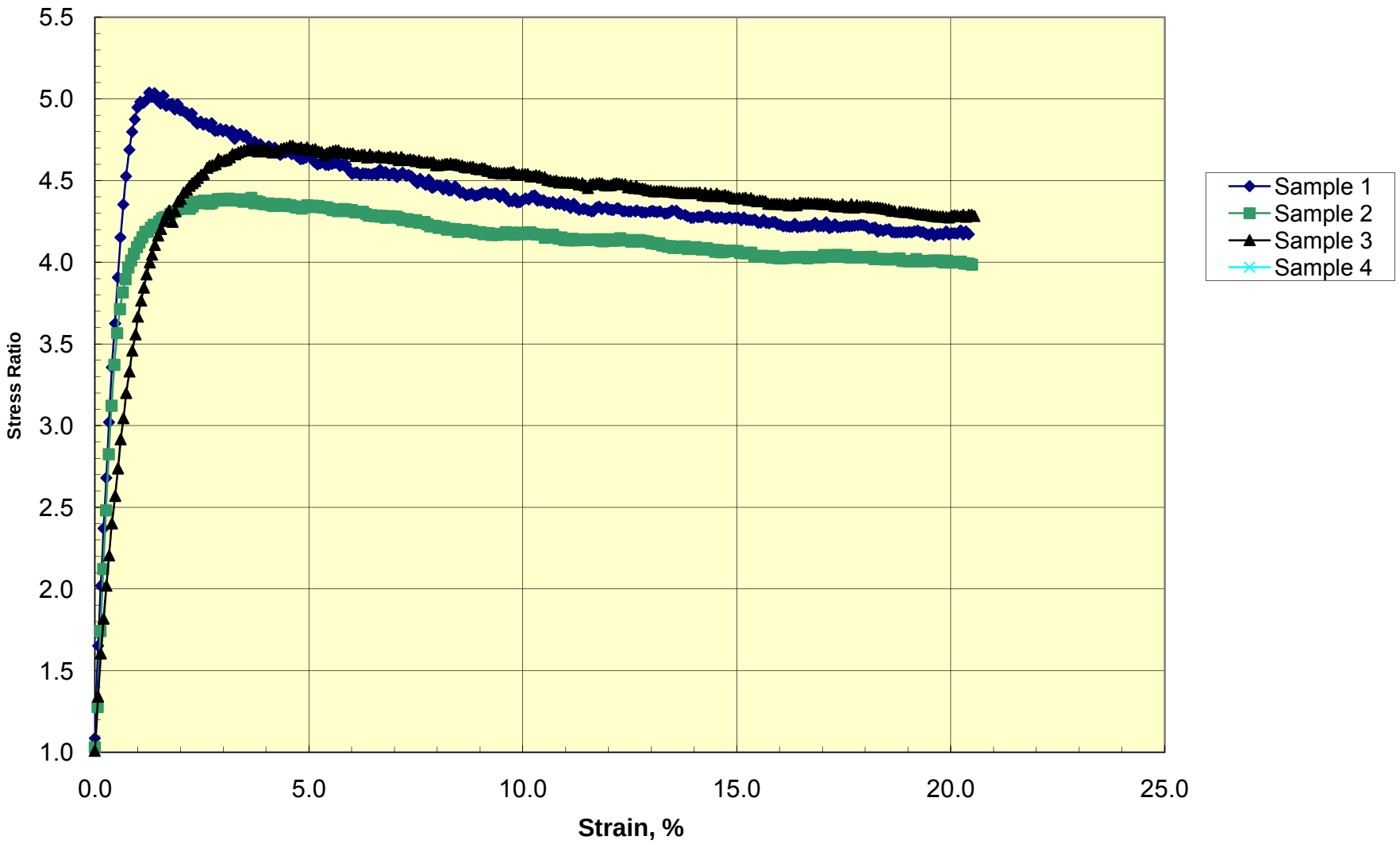

P vs. Q
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Q, KSF
(σ1 - σ3) / 2
0.0
2.0
4.0
6.0
8.0
10.0
12.0
P, ksf
(σ1 + σ3) / 2
Sample 1
Sample 2
Sample 3
Sample 4

Stress-Strain Curves



Pore Pressure Response

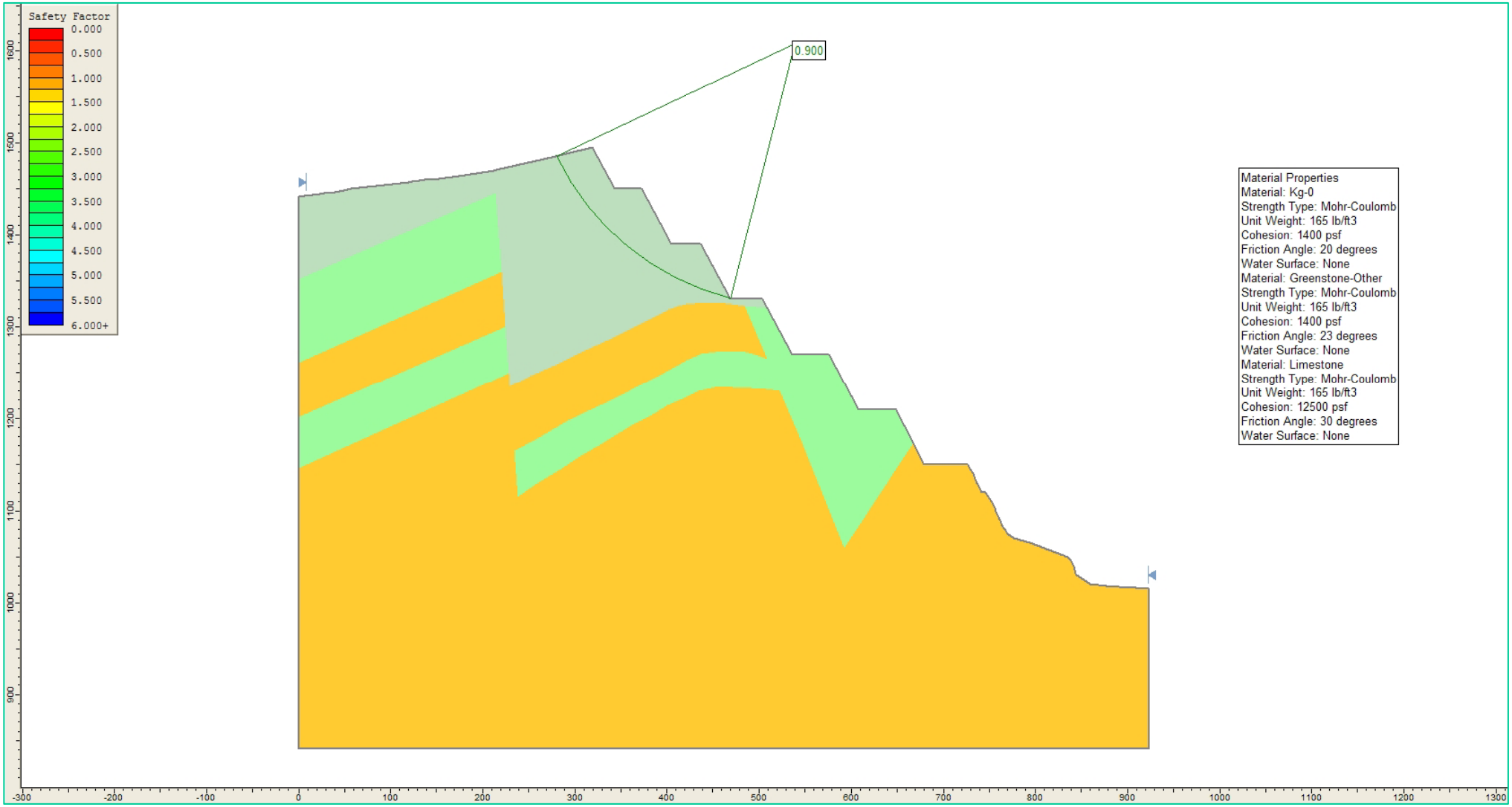



Stress Ratio Sigma1/Sigma3
Stress Ratio
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.0
5.0
10.0
15.0
20.0
25.0
Strain, %
Sample 1
Sample 2
Sample 3
Sample 4

APPENDIX 7.C

Mid-Pen – Slope Stability Output

PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION MP1 – PRE-FAILURE/BACK ANALYSIS
CONDITION: STATIC
FAILURE MODE: CIRCULAR
BACK CALCULATED Kg-0 STRENGTH: c = 1400 psf; ϕ = 20 degrees

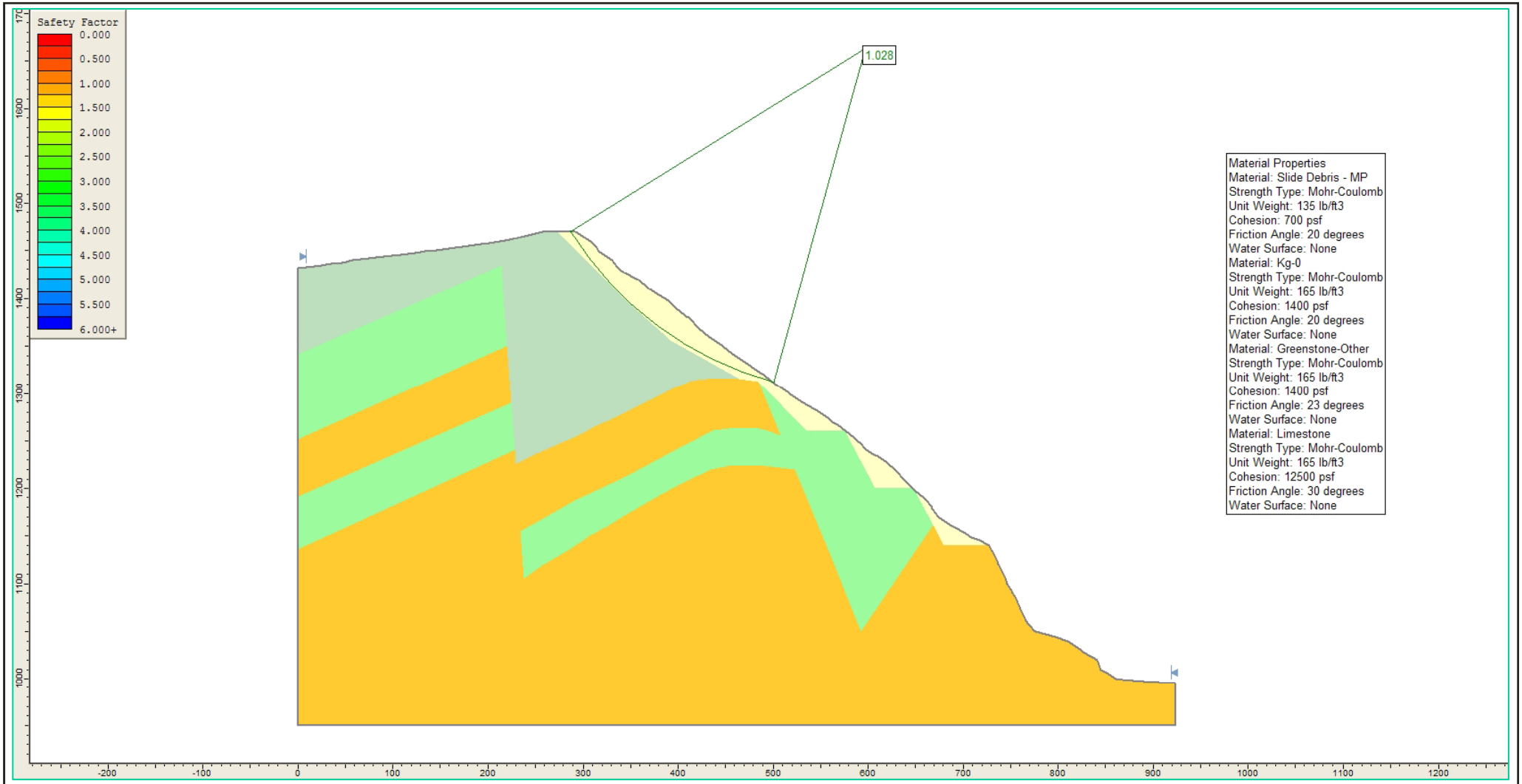
Golder Associates

PRE-FAILURE CONDITION MID-PEN SLIDE (SEC MP1) LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: JAN, 2010	Figure: 7C-1

Project No.: 063-7109 Revision No.: A

PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION MP1 – EXISTING
CONDITION: STATIC
FAILURE MODE: CIRCULAR
MIN. FOS = 1.03

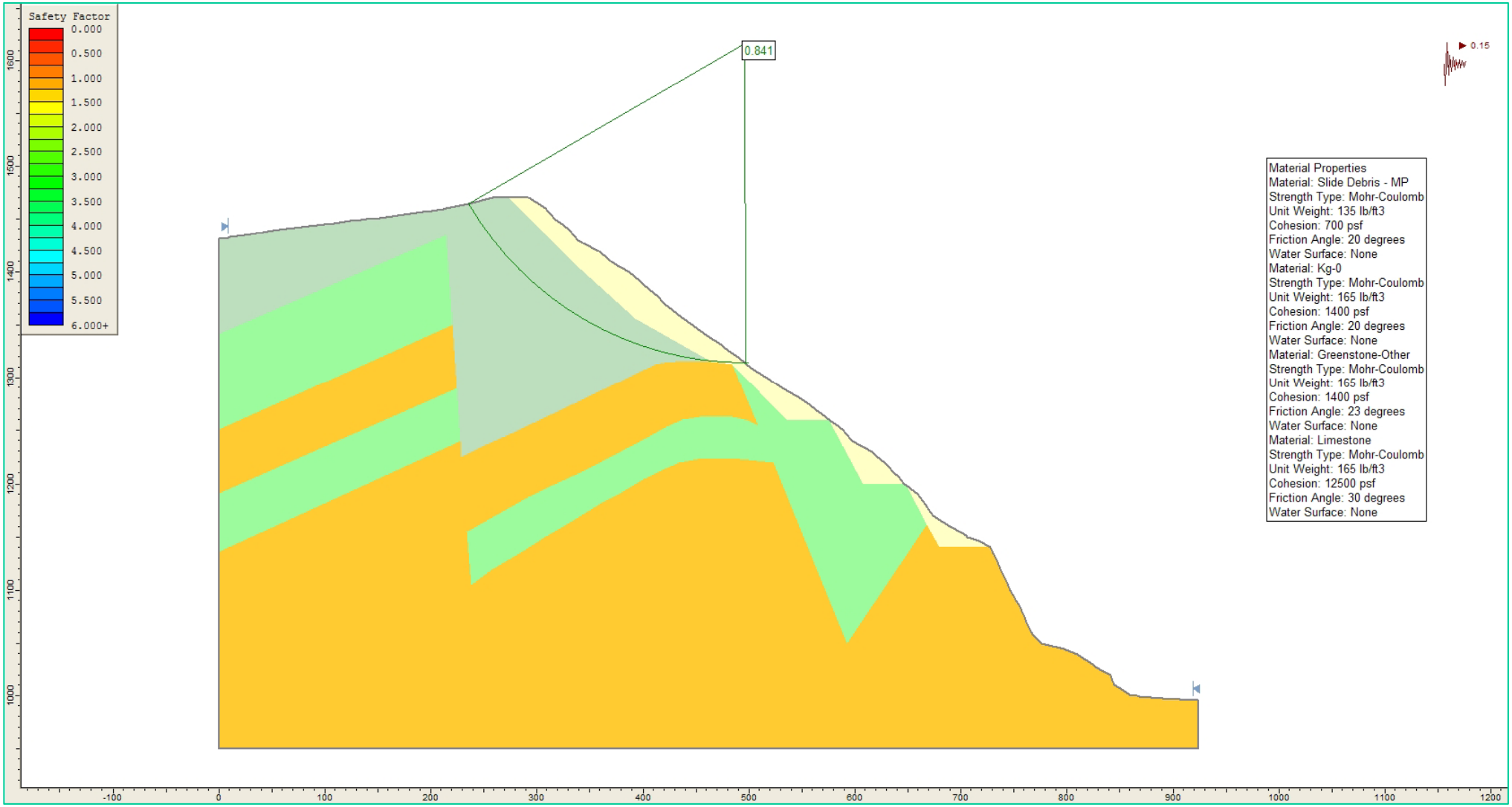
Golder Associates

EXISTING CONDITION
MID-PEN SLIDE (SEC MP1)
LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: JAN, 2010	Figure: 7C-2

Project No.: 063-7109 Revision No.: A

PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION MP1 – EXISTING
CONDITION: PSEUDO-STATIC (WITH K = 0.15)
FAILURE MODE: CIRCULAR
MIN. FOS = 0.84

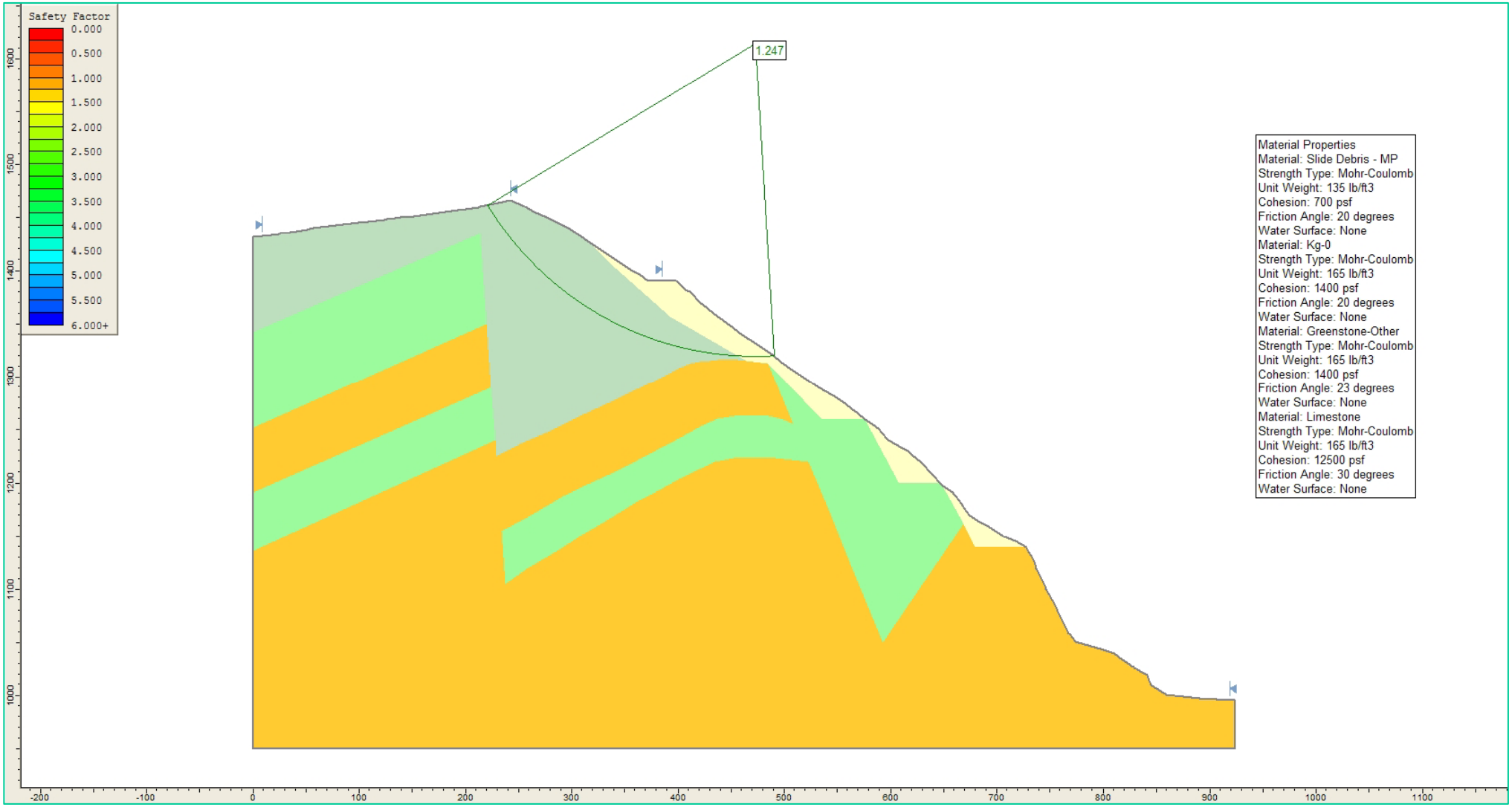
Golder Associates

EXISTING CONDITION
MID-PEN SLIDE (SEC MP1)
LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: JAN, 2010	Figure: 7C-3

Project No.: 063-7109 Revision No.: A

PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION MP1 – PROPOSED GRADING (PHASE 1)
CONDITION: STATIC
FAILURE MODE: CIRCULAR
MIN. FOS = 1.25

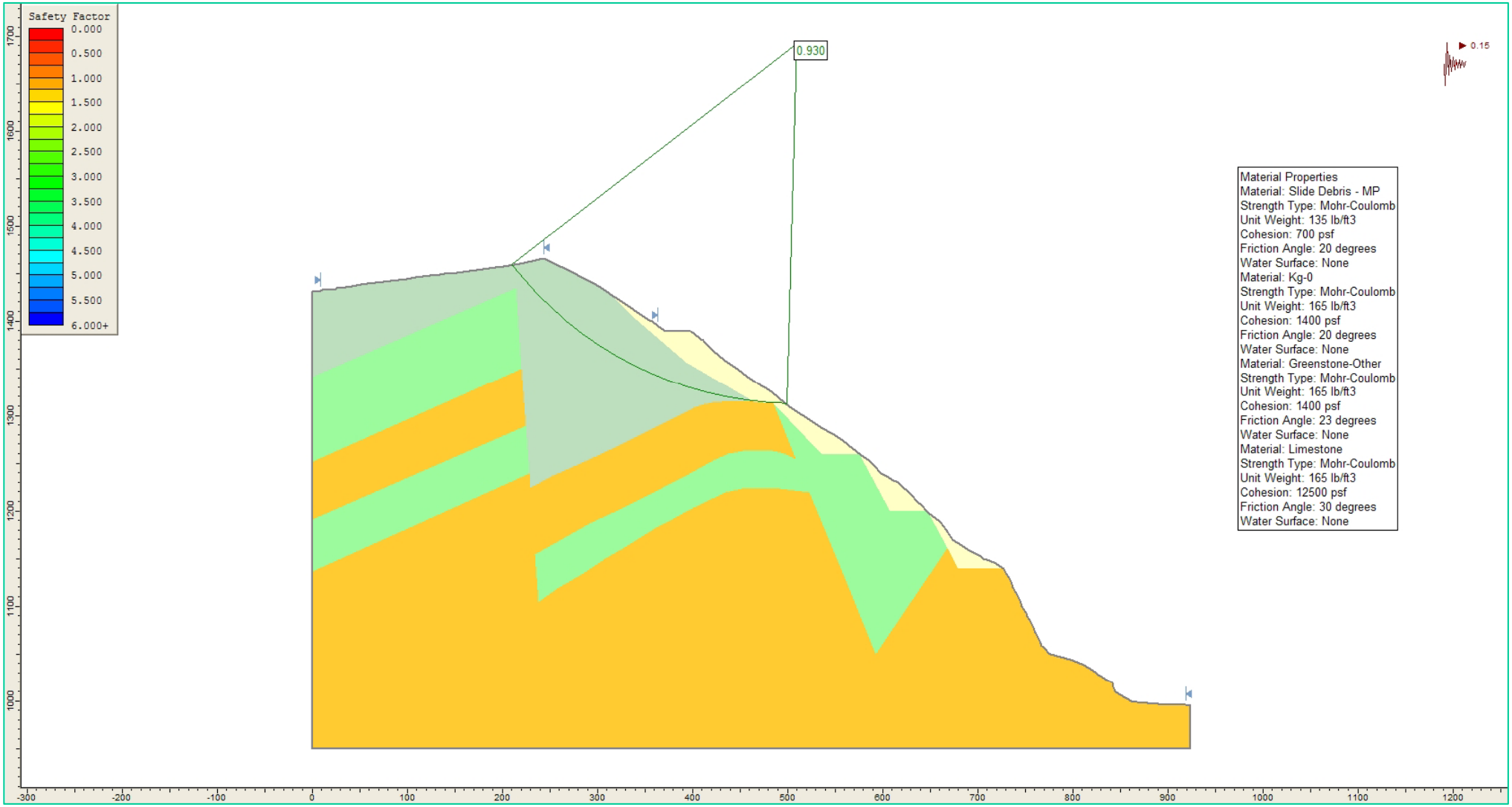
Golder Associates

PROPOSED GRADING
MID-PEN SLIDE (SEC MP1)
LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: JAN, 2010	Figure: 7C-4

Project No.: 063-7109 Revision No.: A

PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION MP1 – PROPOSED GRADING (PHASE 1)
CONDITION: PSEUDO-STATIC (K = 0.15)
FAILURE MODE: CIRCULAR
MIN. FOS = 0.93

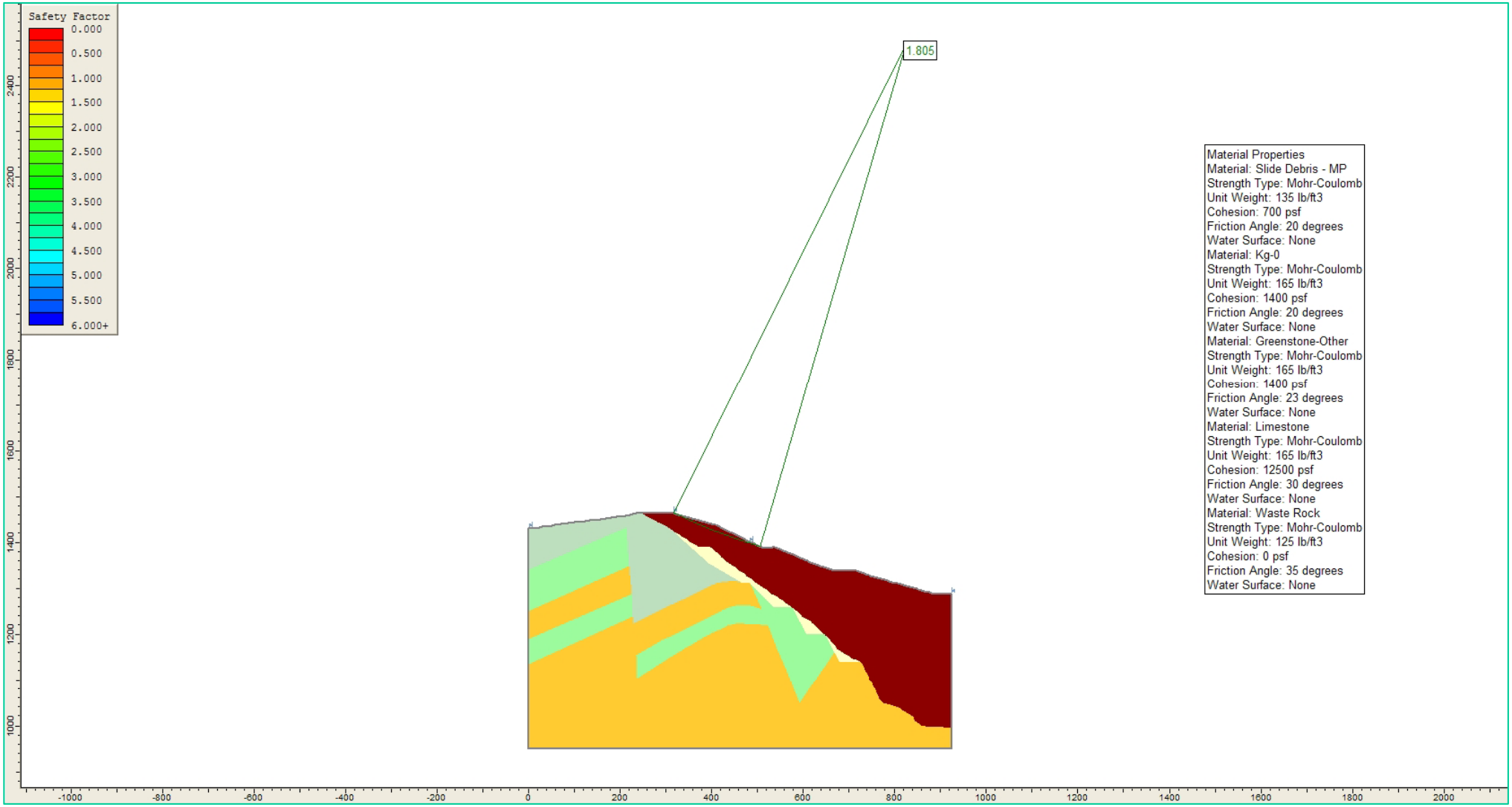
Golder Associates

PROPOSED GRADING
MID-PEN SLIDE (SEC MP1)
LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: JAN, 2010	Figure: 7C-5

Project No.: 063-7109 Revision No.: A

PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION MP1 – PROPOSED GRADING
CONDITION: STATIC
FAILURE MODE: CIRCULAR
MIN. FOS = 1.81

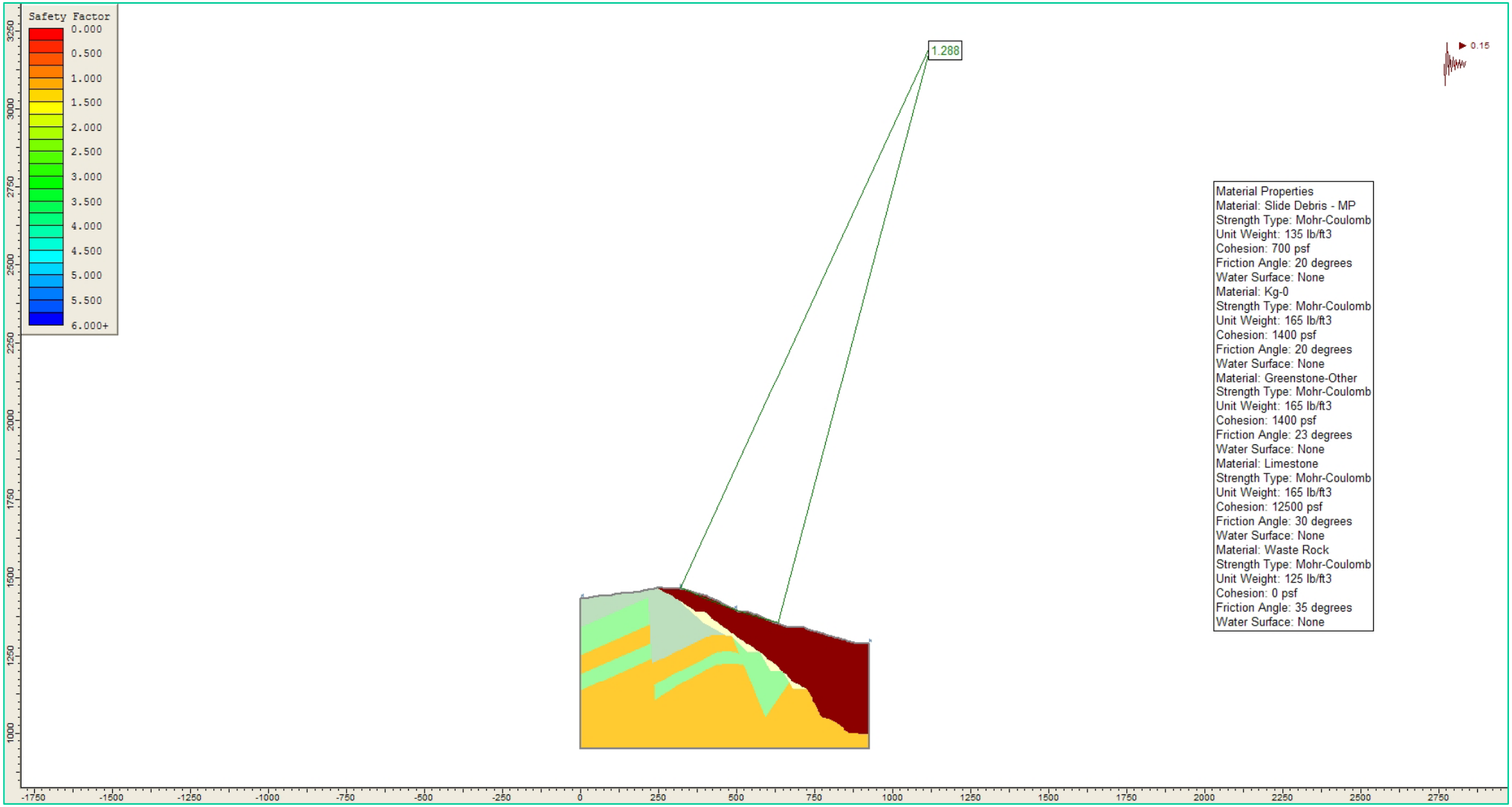
Golder Associates

ULTIMATE RECLAMATION MID-PEN SLIDE (SEC MP1) LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: JAN, 2010	Figure: 7C-6

Project No.: 063-7109 Revision No.: A

PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION MP1 – PROPOSED GRADING
CONDITION: PSEUDO-STATIC (K=0.15)
FAILURE MODE: CIRCULAR
MIN. FOS = 1.29

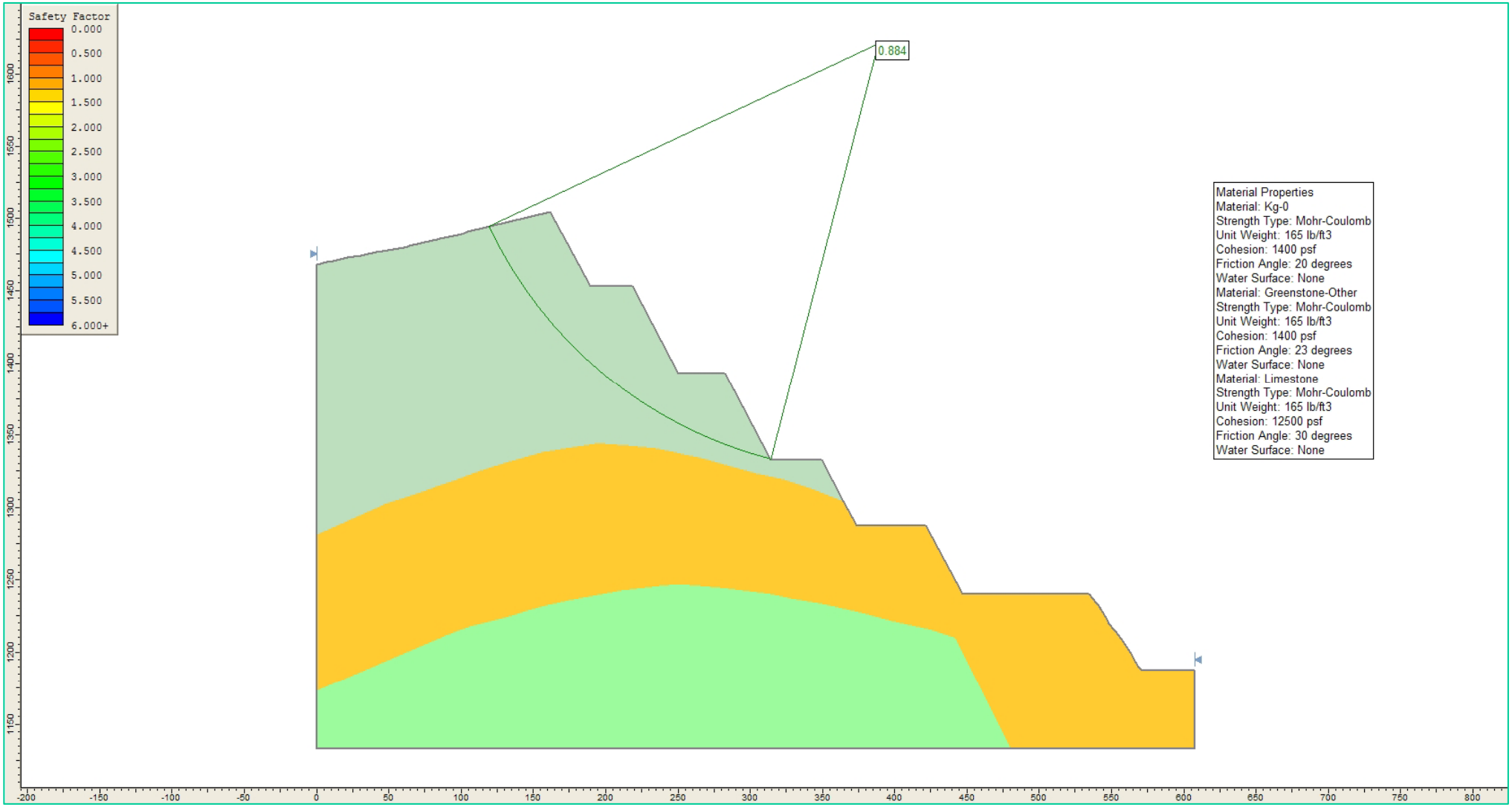
Golder Associates

ULTIMATE RECLAMATION
MID-PEN SLIDE (SEC MP1)
LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: JAN, 2010	Figure: 7C-7

Project No.: 063-7109 Revision No.: A

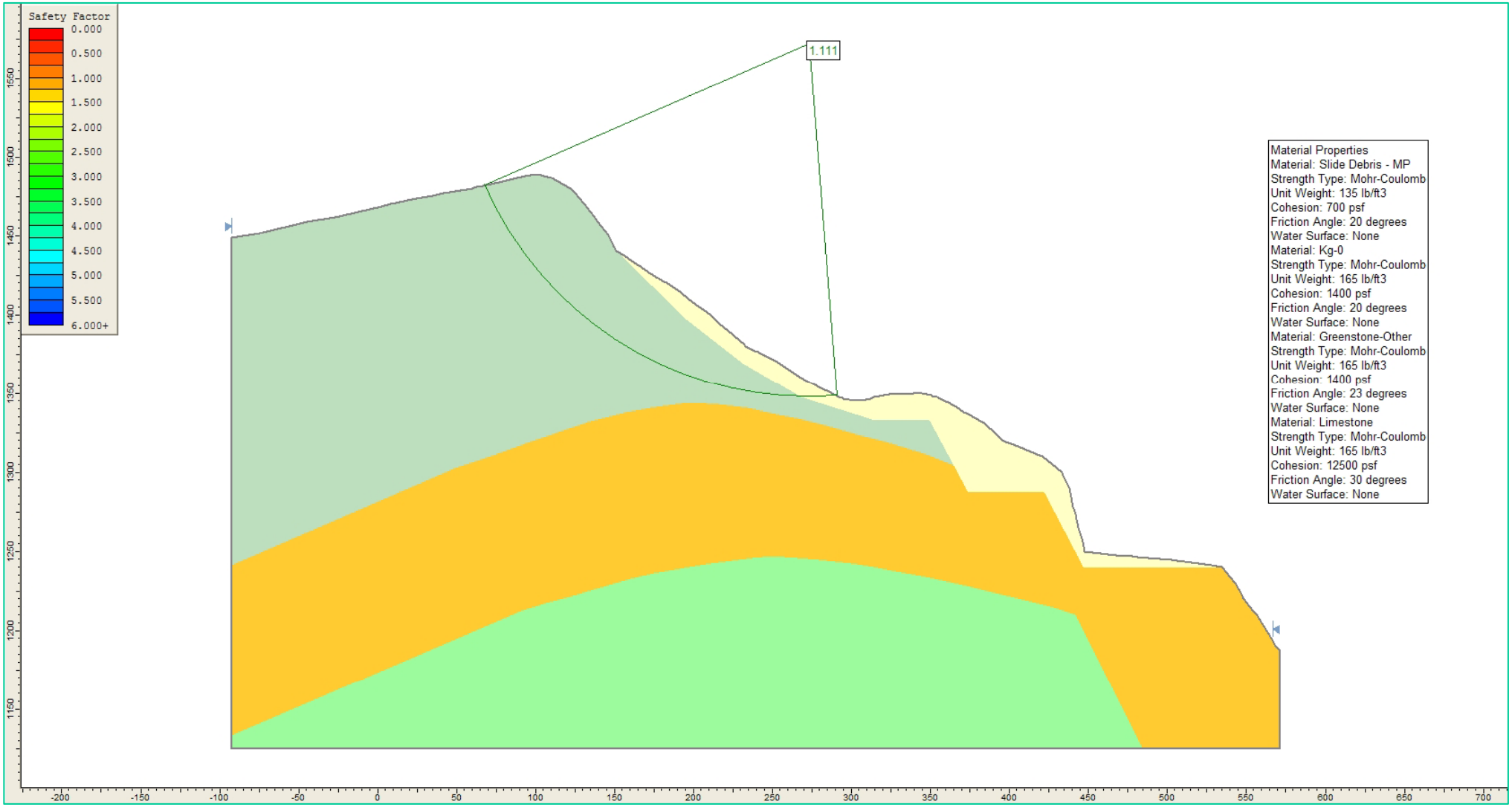
PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION MP2 – PRE-FAILURE/BACK ANALYSIS
CONDITION: PSEUDO-STATIC (K=0.15)
FAILURE MODE: CIRCULAR
BACK CALCULATED Kg-0 STRENGTH: c = 1400 psf; ϕ = 20 degrees

Golder Associates		**PRE-FAILURE CONDITION MID-PEN SLIDE (SEC MP2) LEHIGH SOUTHWEST CEMENT COMPANY, CA**	
Drawn: PHY	App'd: KGH	Date: JAN, 2010	Figure: **7C-8**
Project No.: 063-7109			Revision No.: A

PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION MP2 – EXISTING
CONDITION: STATIC
FAILURE MODE: CIRCULAR
MIN. FOS = 1.11

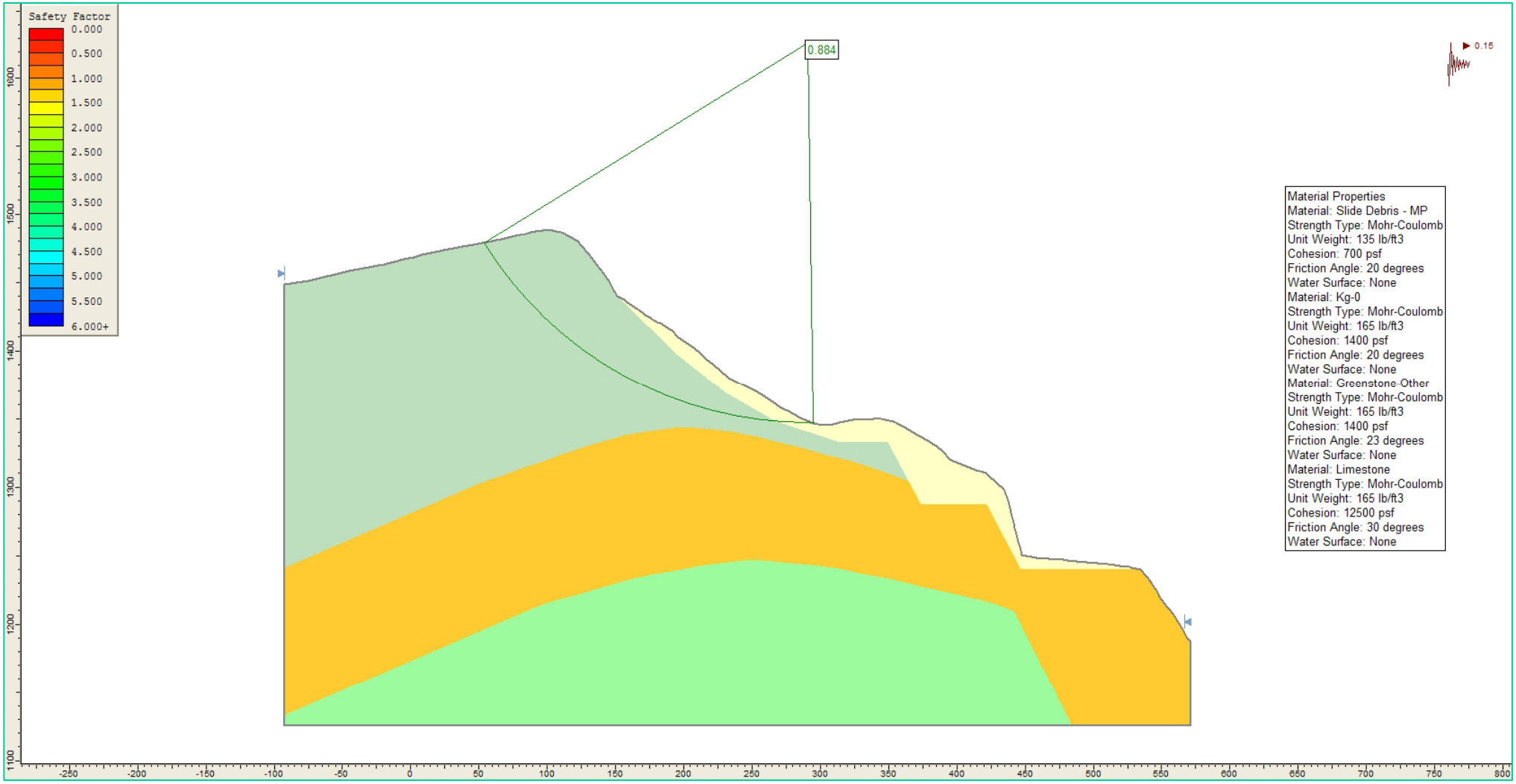
Golder Associates

EXISTING CONDITION
MID-PEN SLIDE (SEC MP2)
LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: JAN, 2010	Figure: 7C-9

Project No.: 063-7109 Revision No.: A

PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION MP2 – EXISTING
CONDITION: PSEUDO-STATIC (WITH K = 0.15)
FAILURE MODE: CIRCULAR
MIN. FOS = 0.88

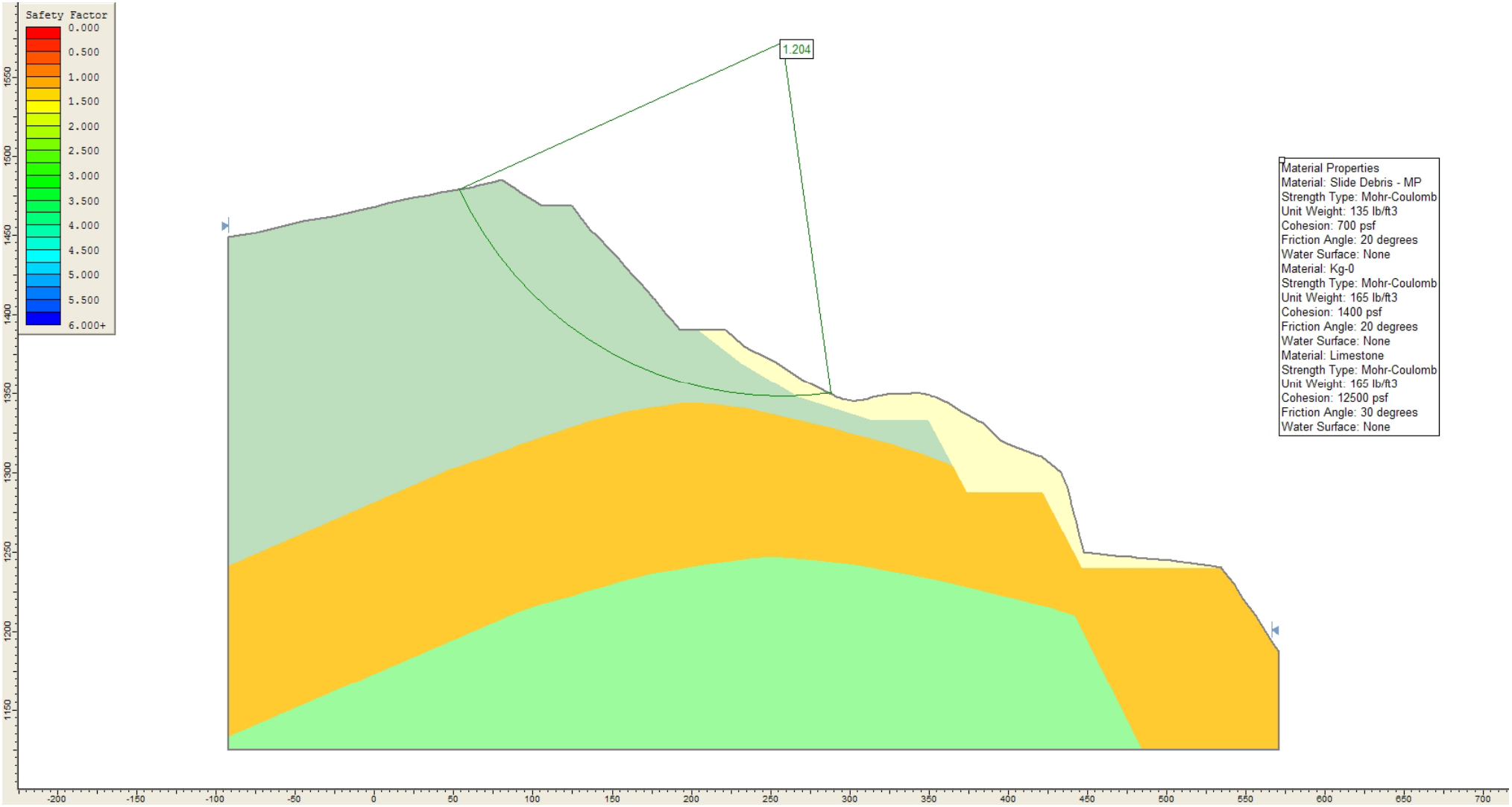
Golder Associates

EXISTING CONDITION
MID-PEN SLIDE (SEC MP2)
LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: JAN, 2010	Figure: 7C-10

Project No.: 063-7109 Revision No.: A

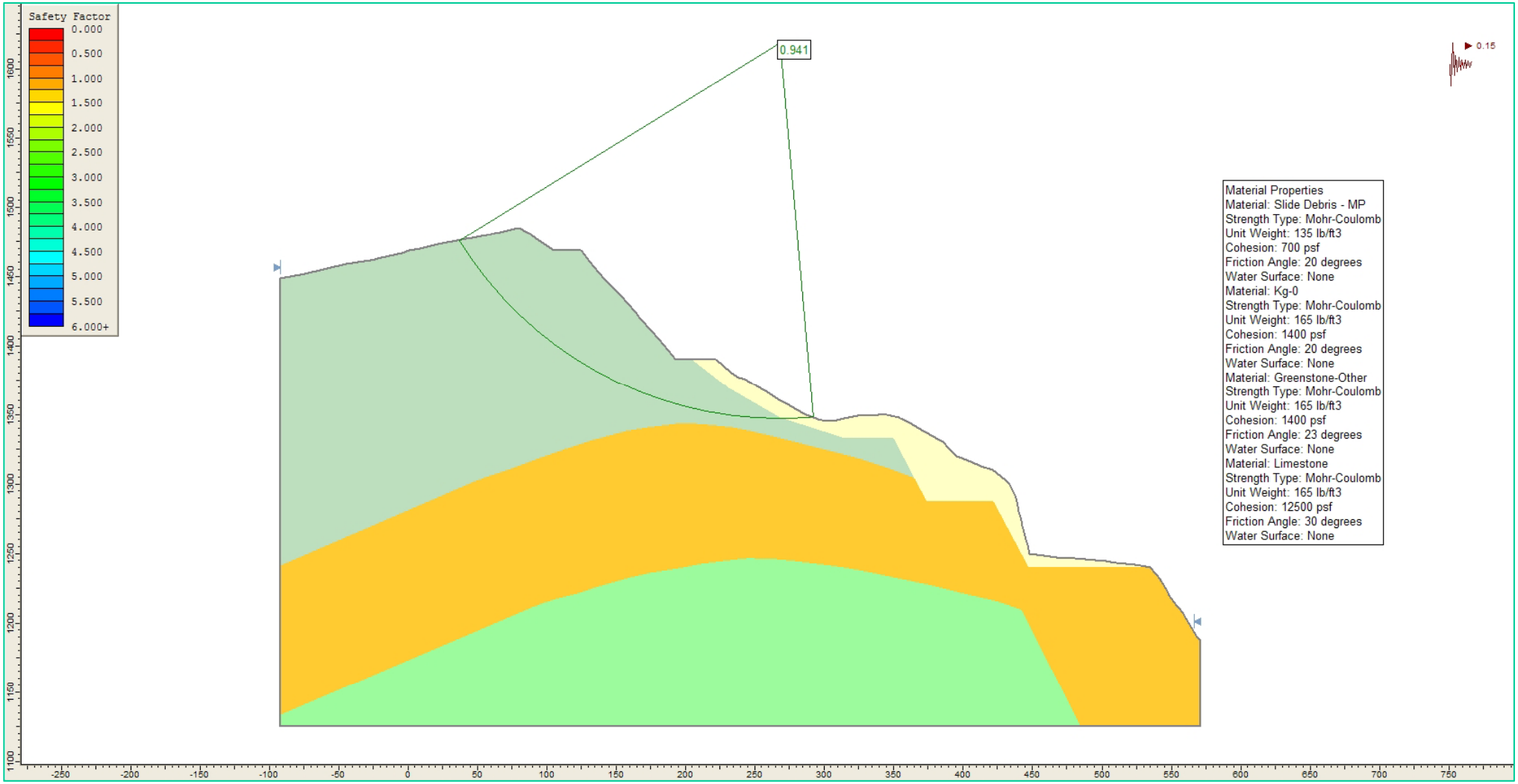
PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION MP2 – PROPOSED GRADING (PHASE 1)
CONDITION: STATIC
FAILURE MODE: CIRCULAR
MIN. FOS = 1.20

Golder Associates		**PROPOSED GRADING MID-PEN SLIDE (SEC MP2) LEHIGH SOUTHWEST CEMENT COMPANY, CA**	
Drawn: PHY	App'd: KGH	Date: JAN, 2010	Figure: **7C-11**
Project No.: 063-7109			Revision No.: A

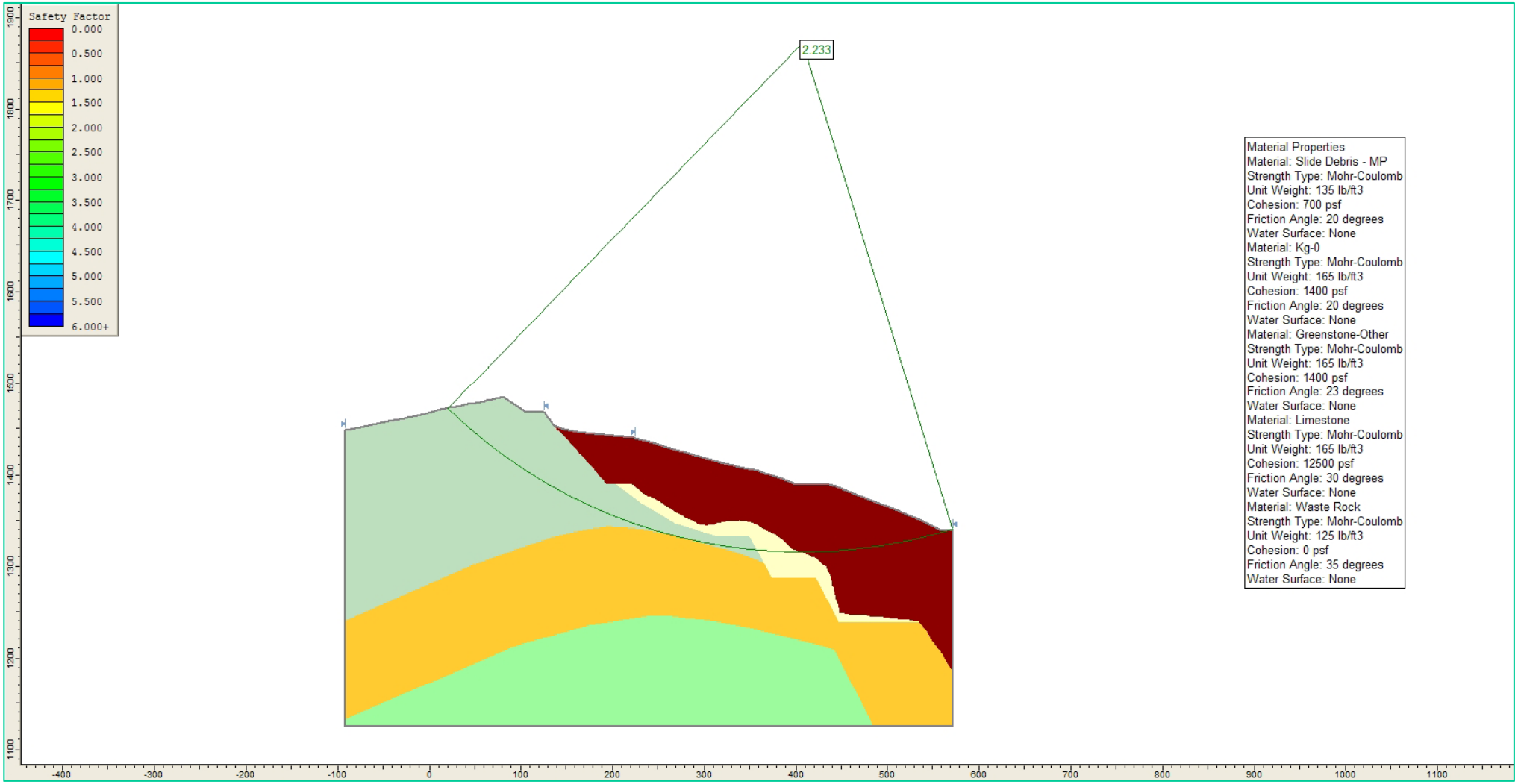
PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION MP2 – PROPOSED GRADING (PHASE 1)
CONDITION: PSEUDO-STATIC (K = 0.15)
FAILURE MODE: CIRCULAR
MIN. FOS = 0.94

Golder Associates		PROPOSED GRADING MID-PEN SLIDE (SEC MP2) LEHIGH SOUTHWEST CEMENT COMPANY, CA	
Drawn: PHY	App'd: KGH	Date: JAN, 2010	Figure: 7C-12
Project No.: 063-7109			Revision No.: A

PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION MP2 – PROPOSED GRADING
CONDITION: STATIC
FAILURE MODE: CIRCULAR
MIN. FOS = 2.23

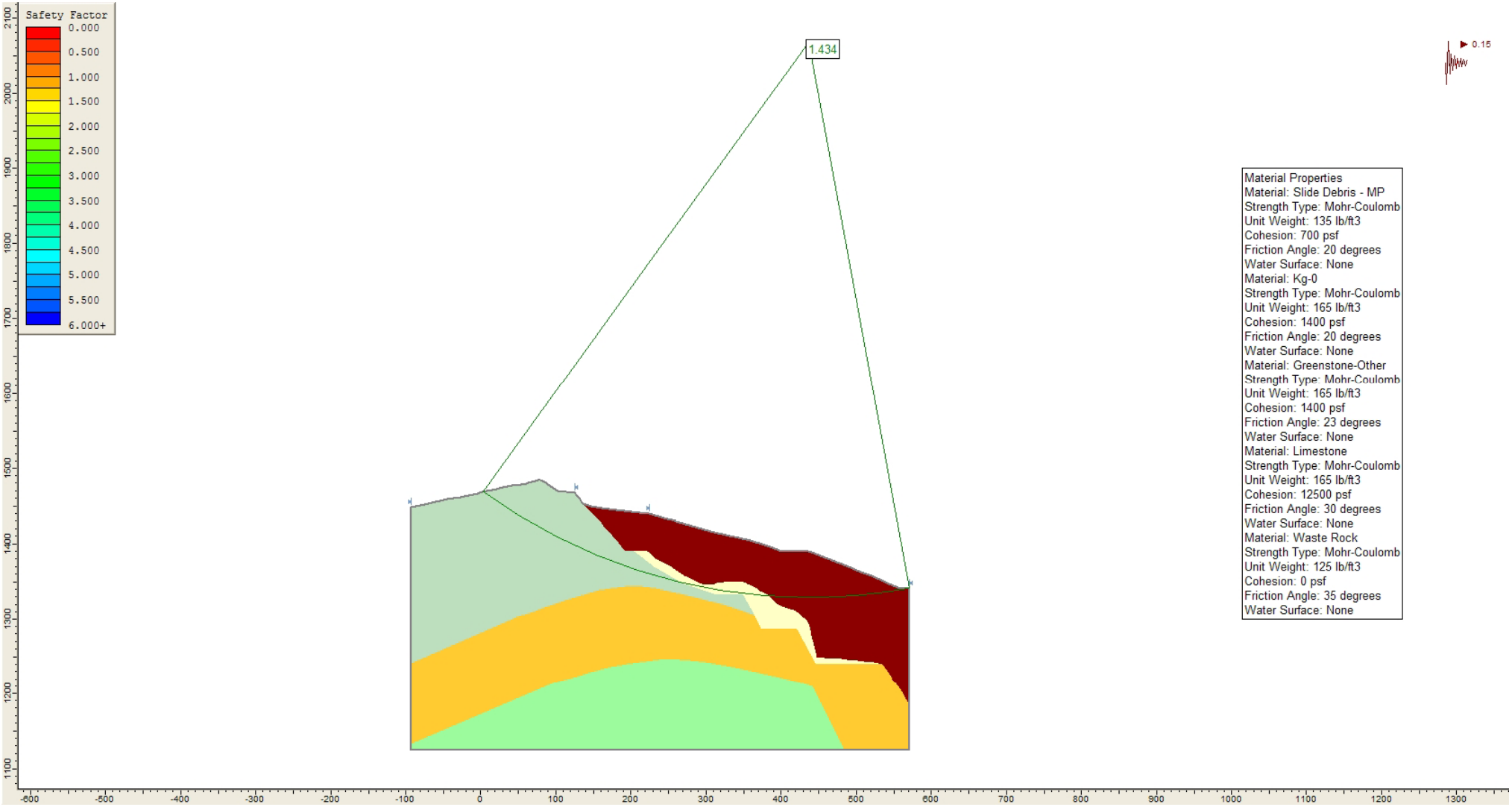
Golder Associates

ULTIMATE RECLAMATION MID-PEN SLIDE (SEC MP2) LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: JAN, 2010	Figure: 7C-13

Project No.: 063-7109 Revision No.: A

PROJECT NO. 063-7109800 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION MP2 – PROPOSED GRADING
CONDITION: PSEUDO-STATIC (K = 0.15)
FAILURE MODE: CIRCULAR
MIN. FOS = 1.43

Golder Associates

ULTIMATE RECLAMATION MID-PEN SLIDE (SEC MP2) LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: JAN, 2010	Figure: 7C-14

Project No.: 063-7109 Revision No.: A

TABLE

Summary of Dynamic Deformation Analysis

Selected Notations			
M_w =	Moment magnitude	k_y =	Yield acceleration
a_{brk} =	Peak Horizontal Acceleration at the bedrock	U =	Dynamic deformation along critical slide surface
a_{max} =	Peak Horizontal Acceleration at the crest of slope		

Earthquake Characterization		
M_w	a_{brk}	a_{max} (Reference 1)
	g	g
7.1	0.60	0.60

Deformation Calculation (Reference 2)							
SITE	Section	Failure Description	k_y	k_y/a_{max}	Slope Deformation, U (in) (Bray and Travasarou)		
			g		84% Exc.	16% Exc.	50% Exc.
Mid-Pen	MP1	Existing	0.02	0.03	40	154	79
	MP1	Regraded	0.09	0.15	9	33	17
	MP2	Existing	0.07	0.12	13	48	25
	MP2	Regraded	0.11	0.18	6	24	12

References:

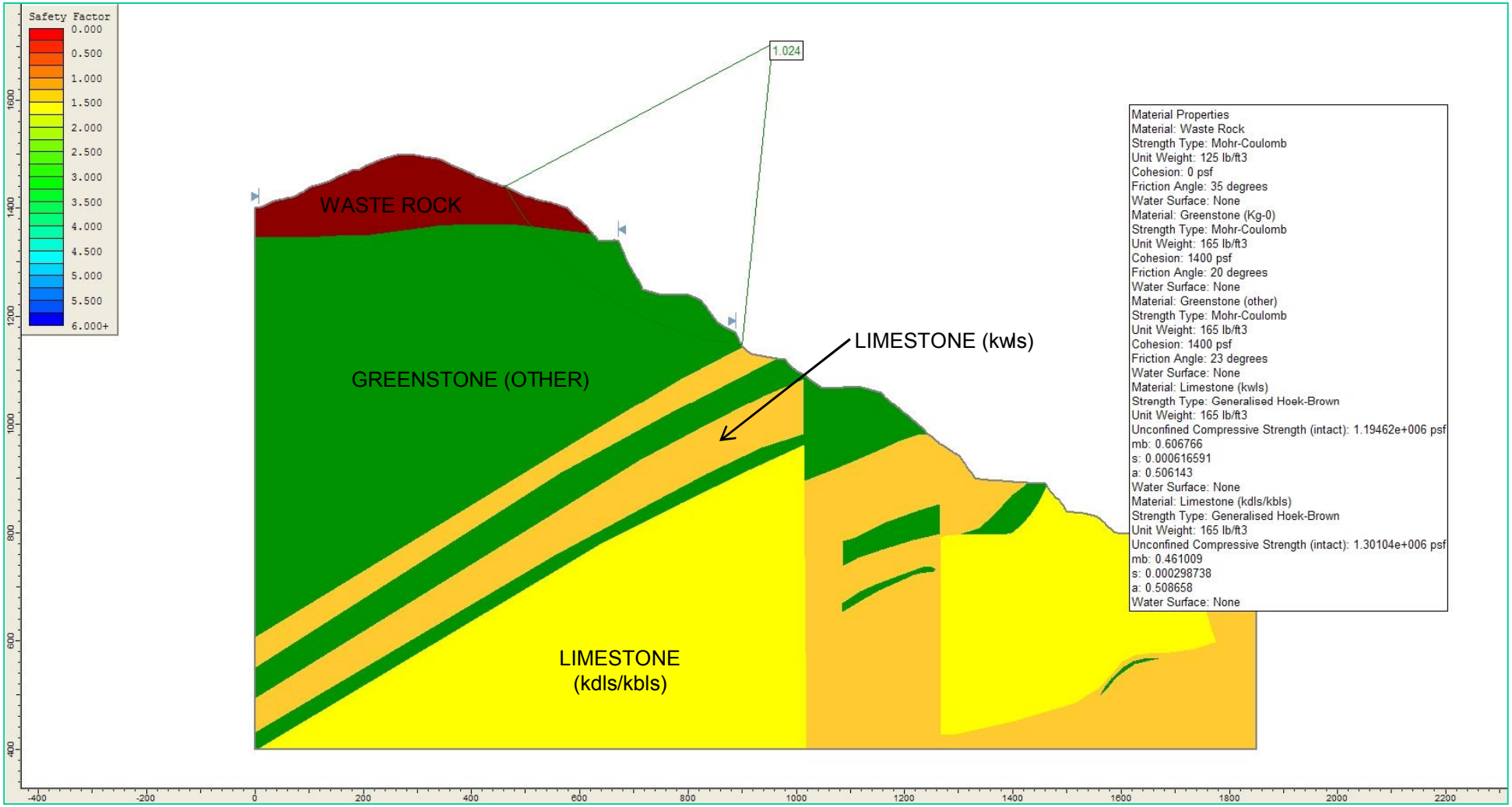
1. Seed, H. B. and Idriss, I. M. (1982), Ground Motions and Soil Liquefaction During Earthquakes Monograph No. 5, Earthquake Engineering Research Institute, Berkeley, California.
2. Bray, J. D. and Travasarou, T. (2007), Simplified Procedure for Estimating Earthquake-Induced Deviatoric Slope Displaceme Journal of the Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 133, No. 4, pp. 381-392.

Note: This spreadsheet is only intended to estimate seismic deformation under the above shown earthquake events and sections.

APPENDIX 8.A

East Wall – Slope Stability Output

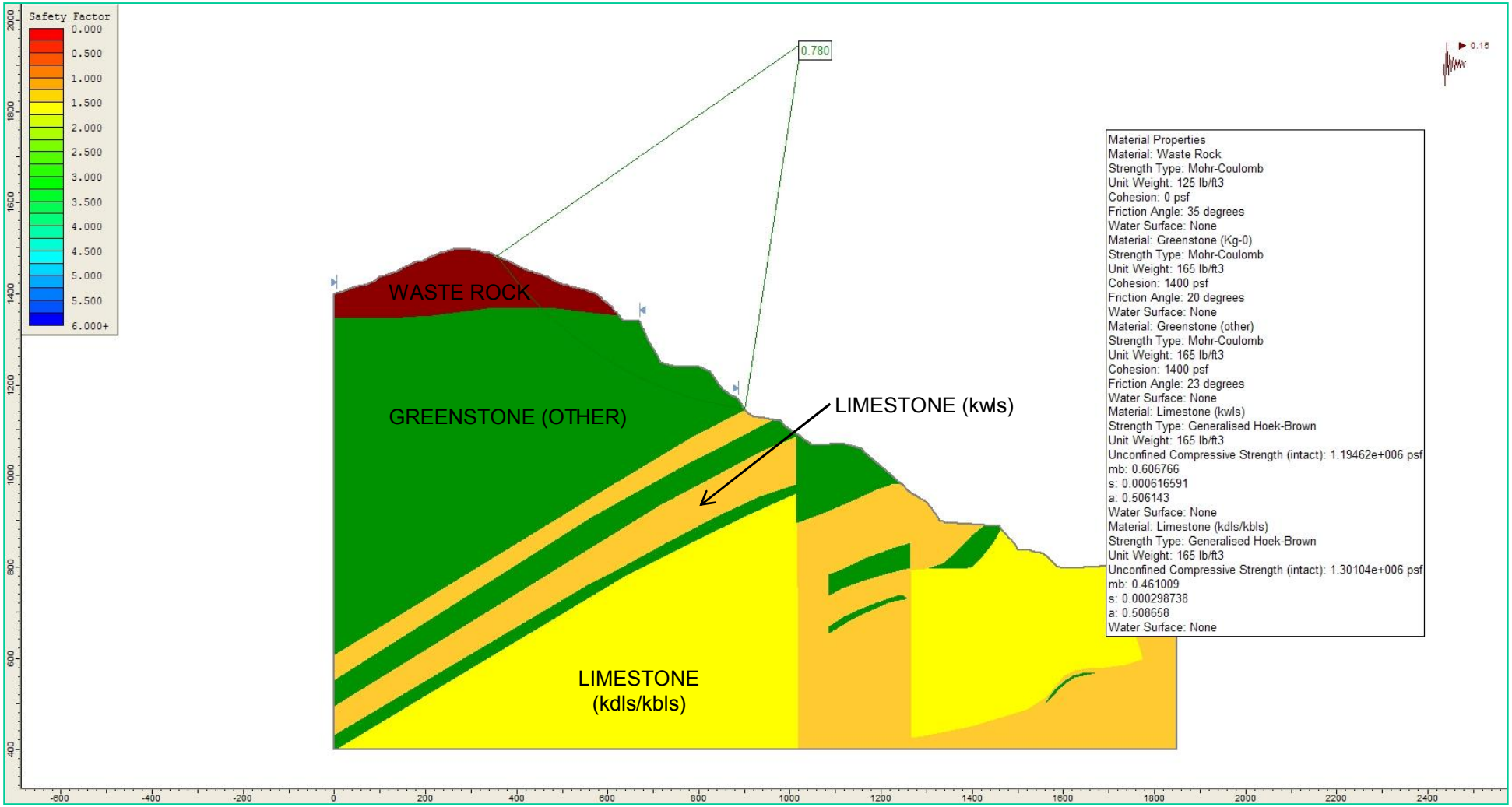
PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION EW1 – EXISTING EAST WALL
CONDITION: STATIC
FAILURE MODE: CIRCULAR

Golder Associates			EXISTING SLOPE STABILITY SECTION EW1 – EAST WALL LSCC PERMANENTE, CA
Drawn: PHY	App'd: KGH	Date: JUNE, 2007	Figure: 8A-1
Project No.: 063-7109			Revision No.:

PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION EW1 – EXISTING EAST WALL
CONDITION: PSEUDO-STATIC (k = 0.15g)
FAILURE MODE: CIRCULAR

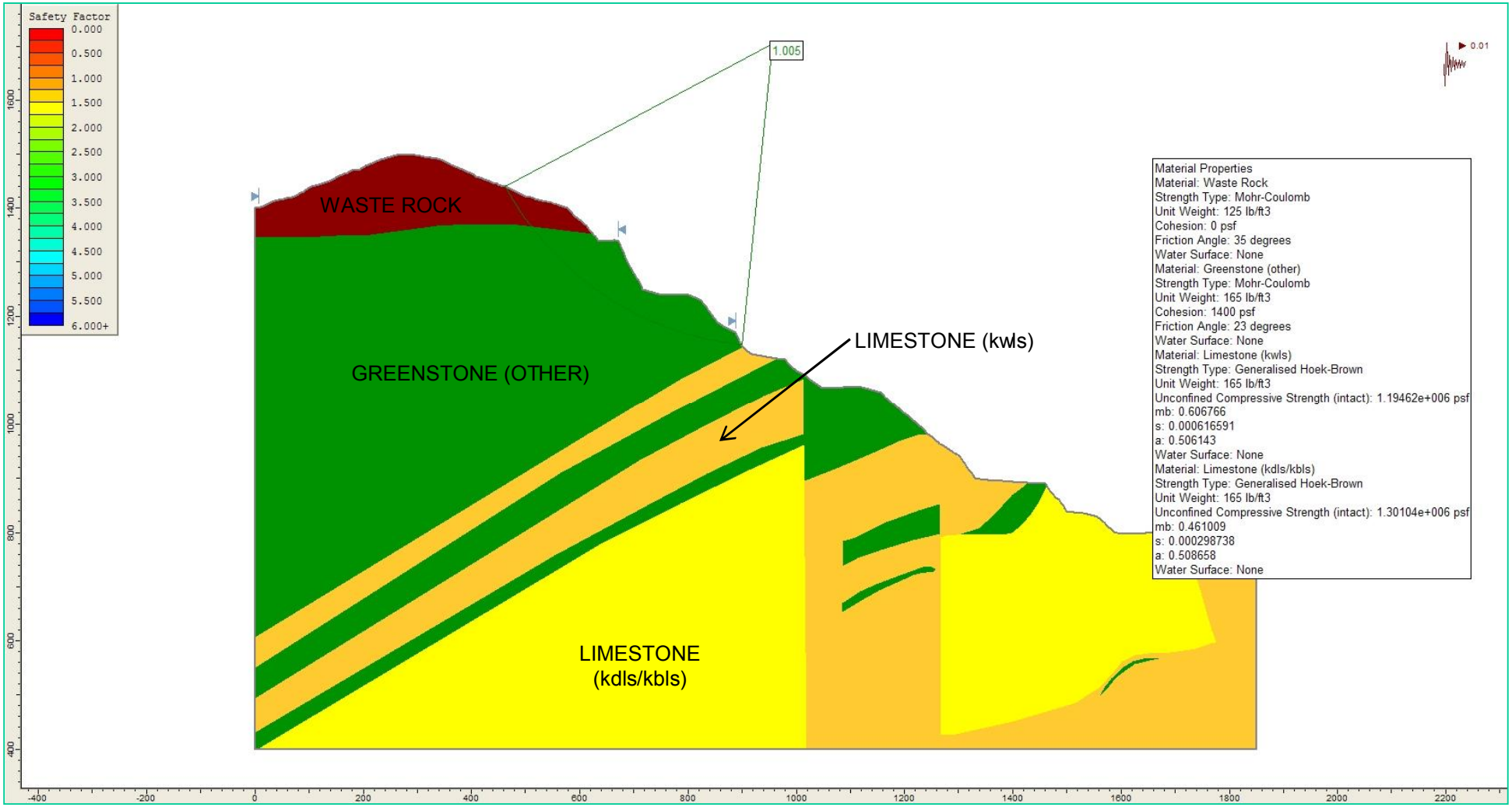
Golder Associates

EXISTING SLOPE STABILITY
SECTION EW1 – EAST WALL
LSCC PERMANENTE, CA

Drawn:	App'd:	Date:	Figure:
PHY	KGH	JUNE, 2007	8A-2

Project No.: 063-7109 Revision No.:

PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION EW1 – EXISTING EAST WALL
CONDITION: YIELD ACCELARATION CALCULATION
FAILURE MODE: CIRCULAR

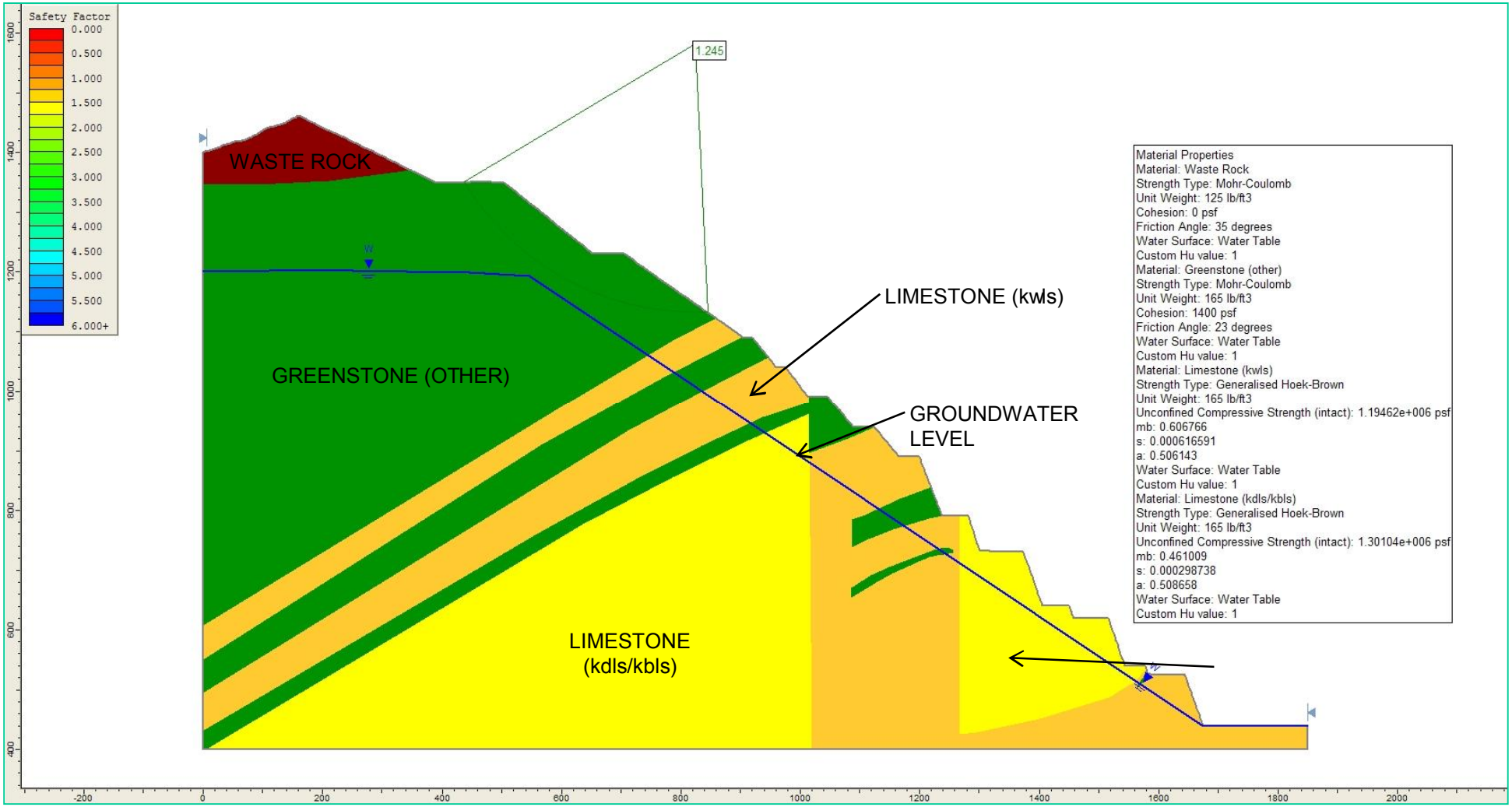
Golder Associates

EXISTING SLOPE STABILITY
SECTION EW1 – EAST WALL
LSCC PERMANENTE, CA

Drawn:	App'd:	Date:	Figure:
PHY	KGH	JUNE, 2007	8A-3

Project No.: 063-7109 Revision No.:

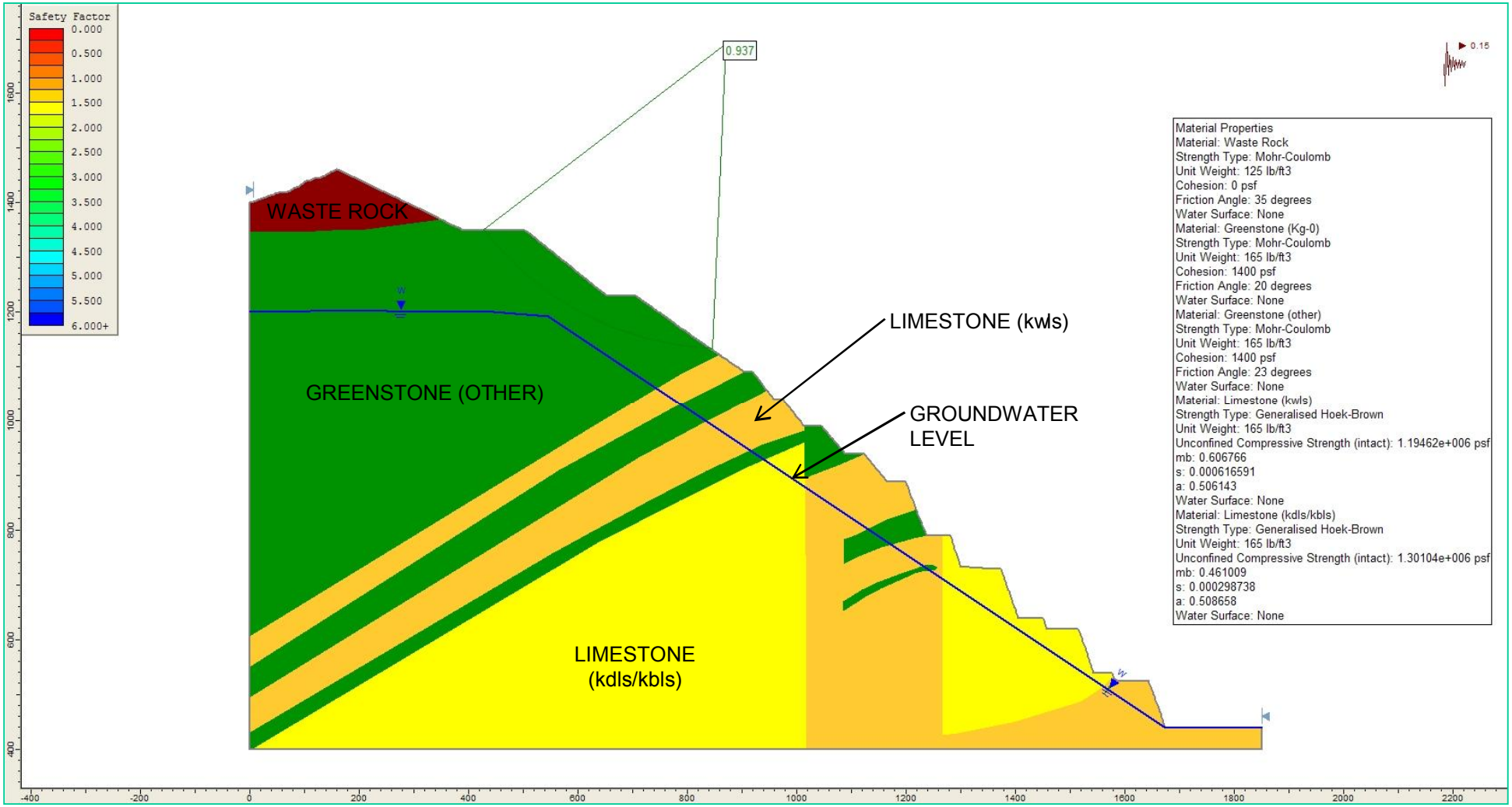
PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION EW1 – EAST WALL FINAL DESIGN
CONDITION: STATIC
FAILURE MODE: CIRCULAR

Golder Associates			FINALSLOPE DESIGN SECTION EW1 – EAST WALL LSCC PERMANENTE, CA
Drawn: PHY	App'd: KGH	Date: JUNE, 2007	Figure: 8A-4
Project No.: 063-7109			Revision No.:

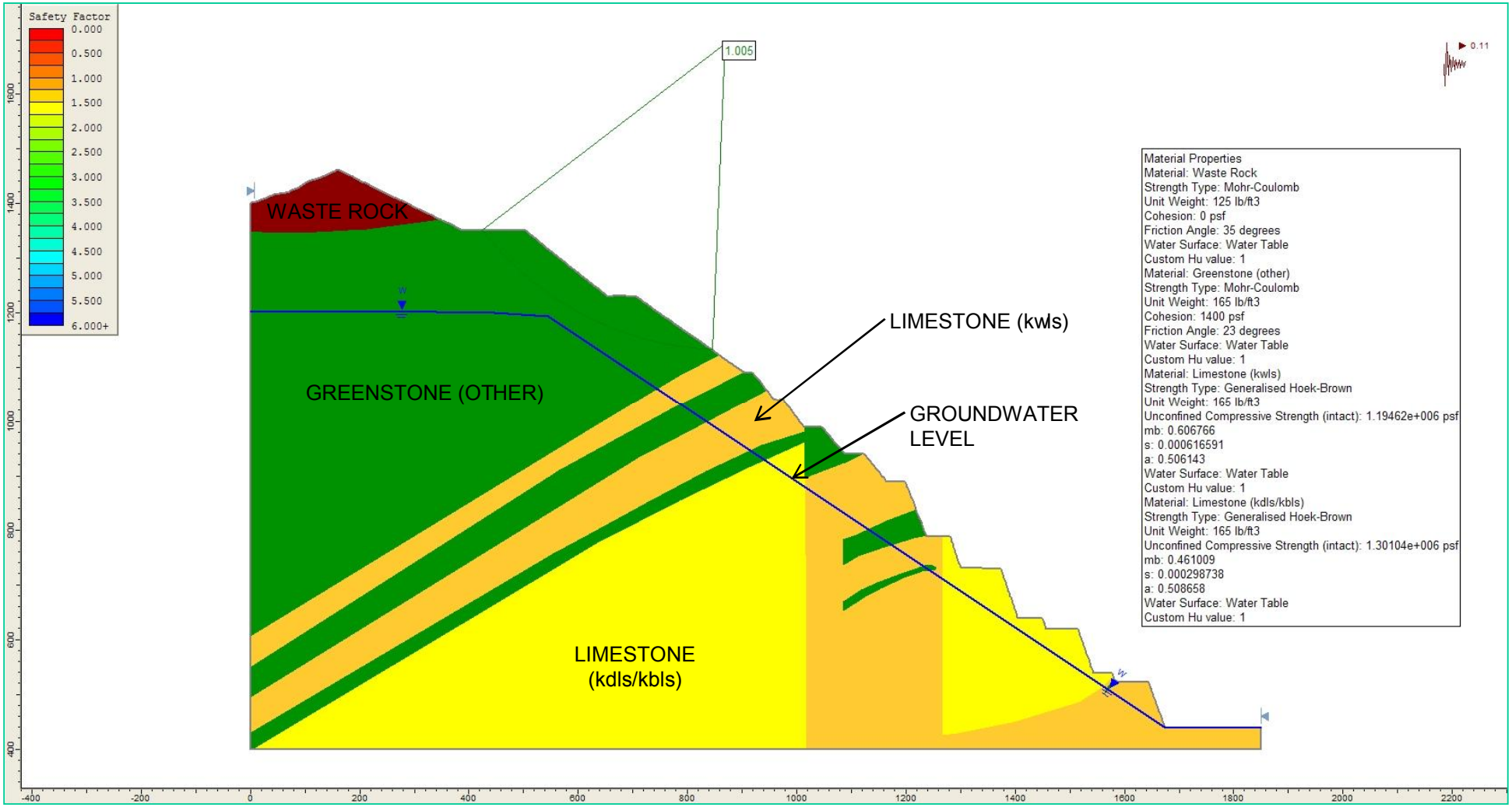
PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION EW1 – EAST WALL FINAL DESIGN
CONDITION: PSEUDO-STATIC (k = 0.15g)
FAILURE MODE: CIRCULAR

Golder Associates		FINALSLOPE DESIGN SECTION EW1 – EAST WALL LSCC PERMANENTE, CA	
Drawn: PHY	App'd: KGH	Date: JUNE, 2007	Figure: 8A-5
Project No.: 063-7109			Revision No.:

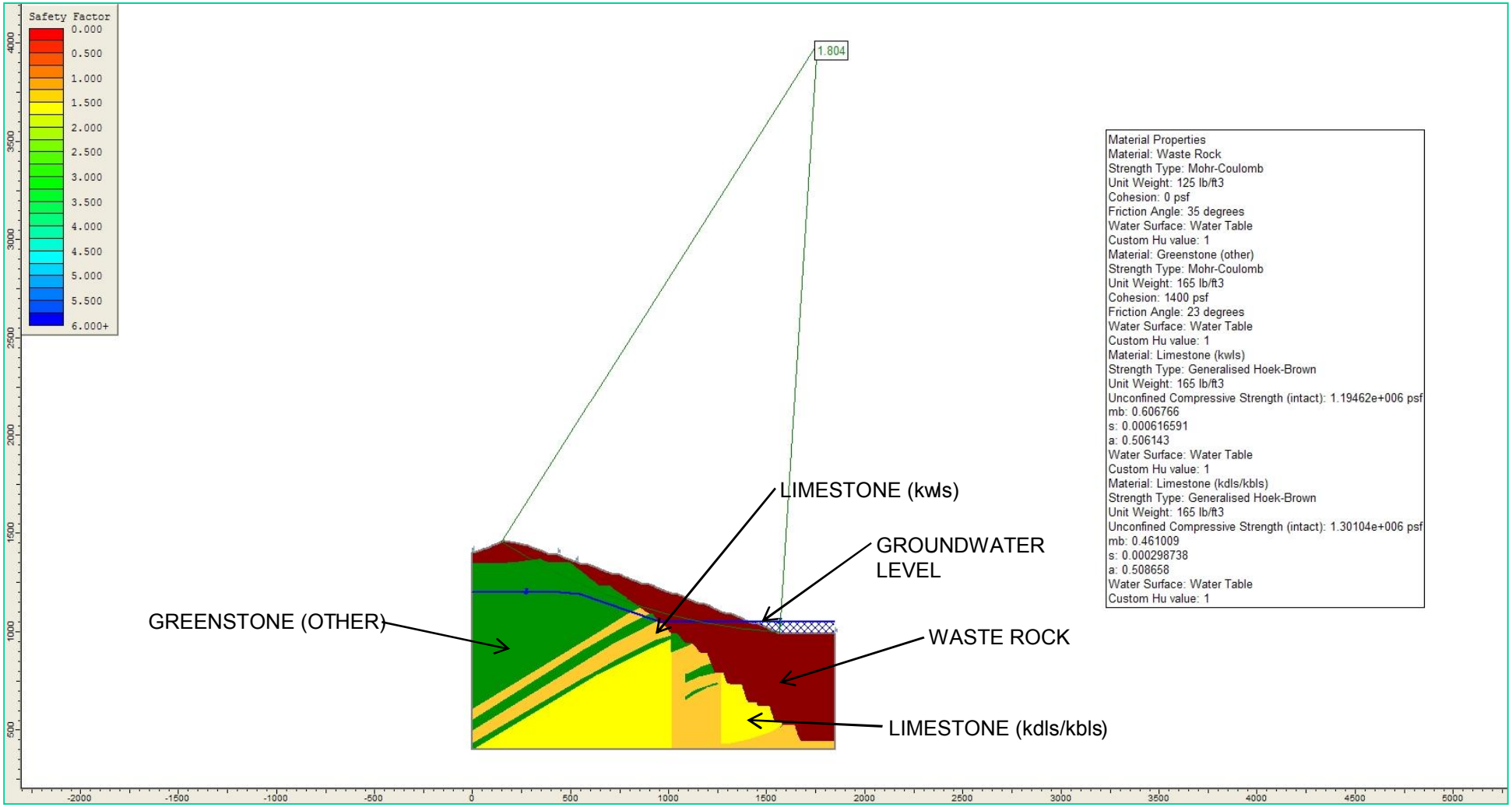
PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION EW1 – EAST WALL FINAL DESIGN
CONDITION: YIELD ACCELARATION CALCULATION
FAILURE MODE: CIRCULAR

Golder Associates		FINALSLOPE DESIGN SECTION EW1 – EAST WALL LSCC PERMANENTE, CA	
Drawn: PHY	App'd: KGH	Date: JUNE, 2007	Figure: 8A-6
Project No.: 063-7109			Revision No.:

PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION EW1 – EAST WALL FINAL RECLAMATION
CONDITION: STATIC
FAILURE MODE: CIRCULAR

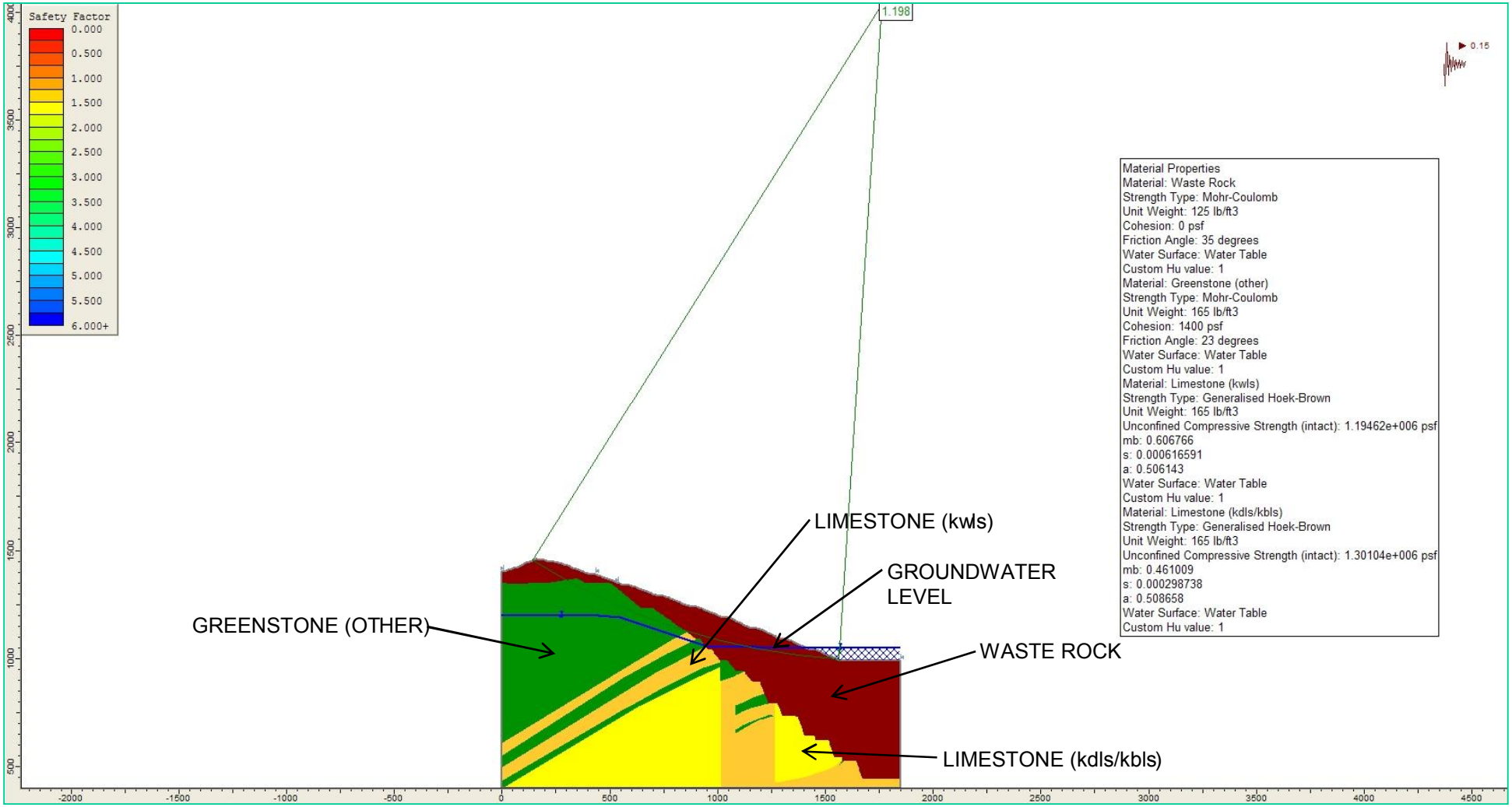
Golder Associates

FINAL RECLAMATION PLAN
SECTION EW1 – EAST WALL
LSCC PERMANENTE, CA

Drawn: PHY	App'd: KGH	Date: JUNE, 2007	Figure: 8A-7

Project No.: 063-7109 Revision No.:

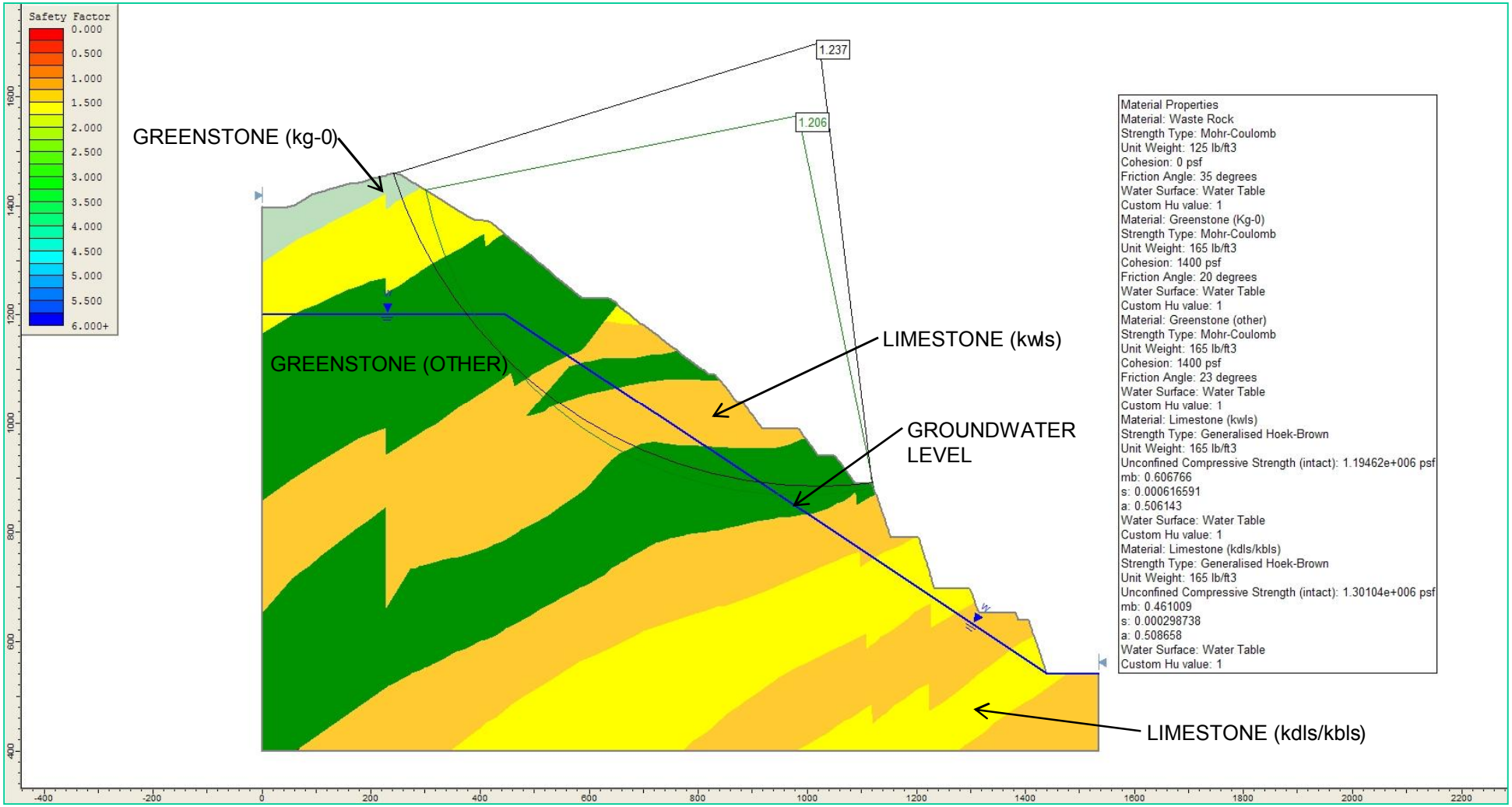
PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION EW1 – EAST WALL FINAL RECLAMATION
CONDITION: PSEUDO-STATIC (k = 0.15g)
FAILURE MODE: CIRCULAR

Golder Associates		FINAL RECLAMATION PLAN SECTION EW1 – EAST WALL LSCC PERMANENTE, CA	
Drawn: PHY	App'd: KGH	Date: JUNE, 2007	Figure: 8A-8
Project No.: 063-7109			Revision No.:

PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION EW2 – EAST WALL FINAL DESIGN
CONDITION: STATIC
FAILURE MODE: CIRCULAR

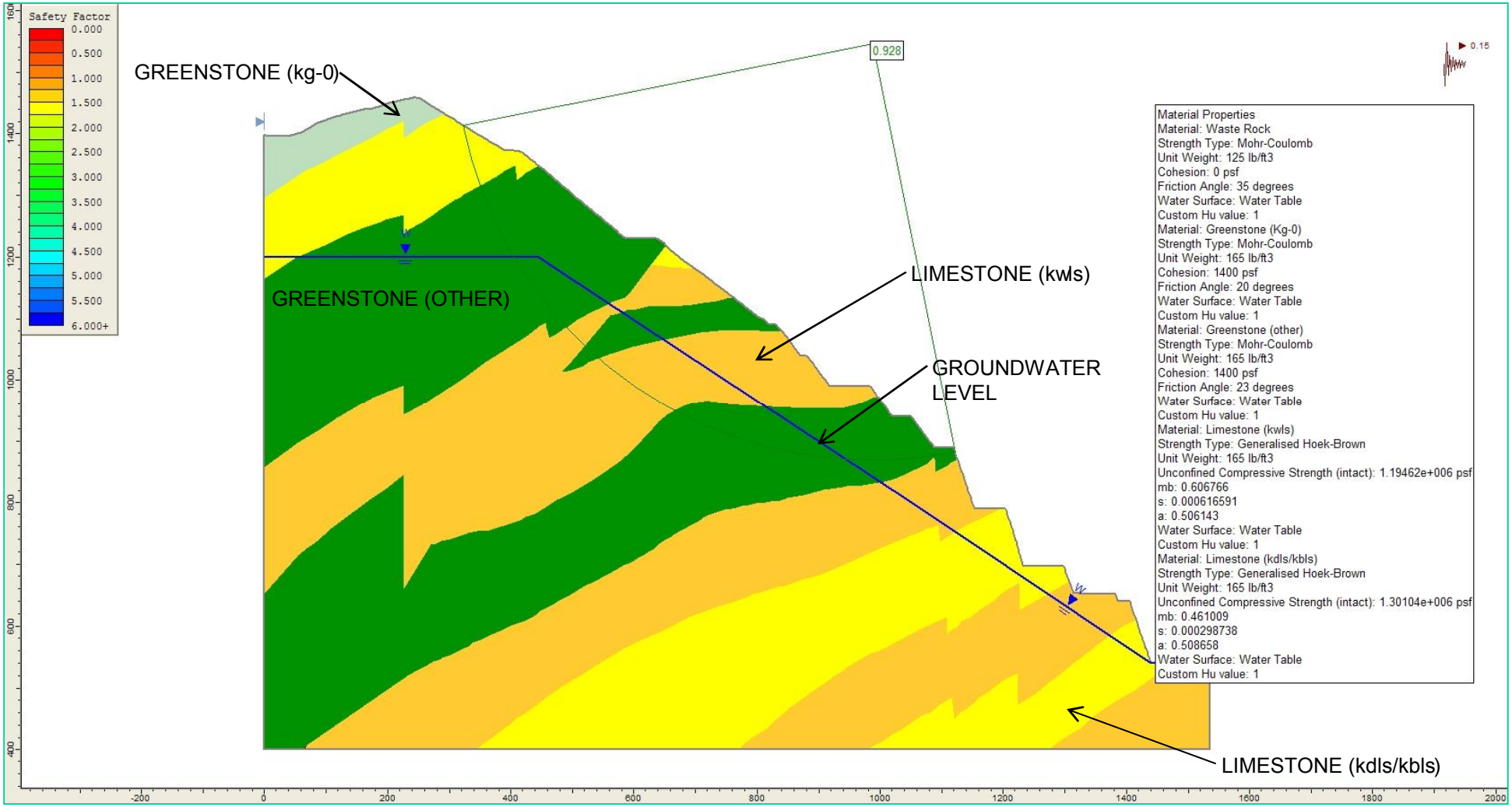
Golder Associates

FINALSLOPE DESIGN
SECTION EW2 – EAST WALL
LSCC PERMANENTE, CA

Drawn: PHY	App'd: KGH	Date: JUNE, 2007	Figure: 8A-9

Project No.: 063-7109 Revision No.:

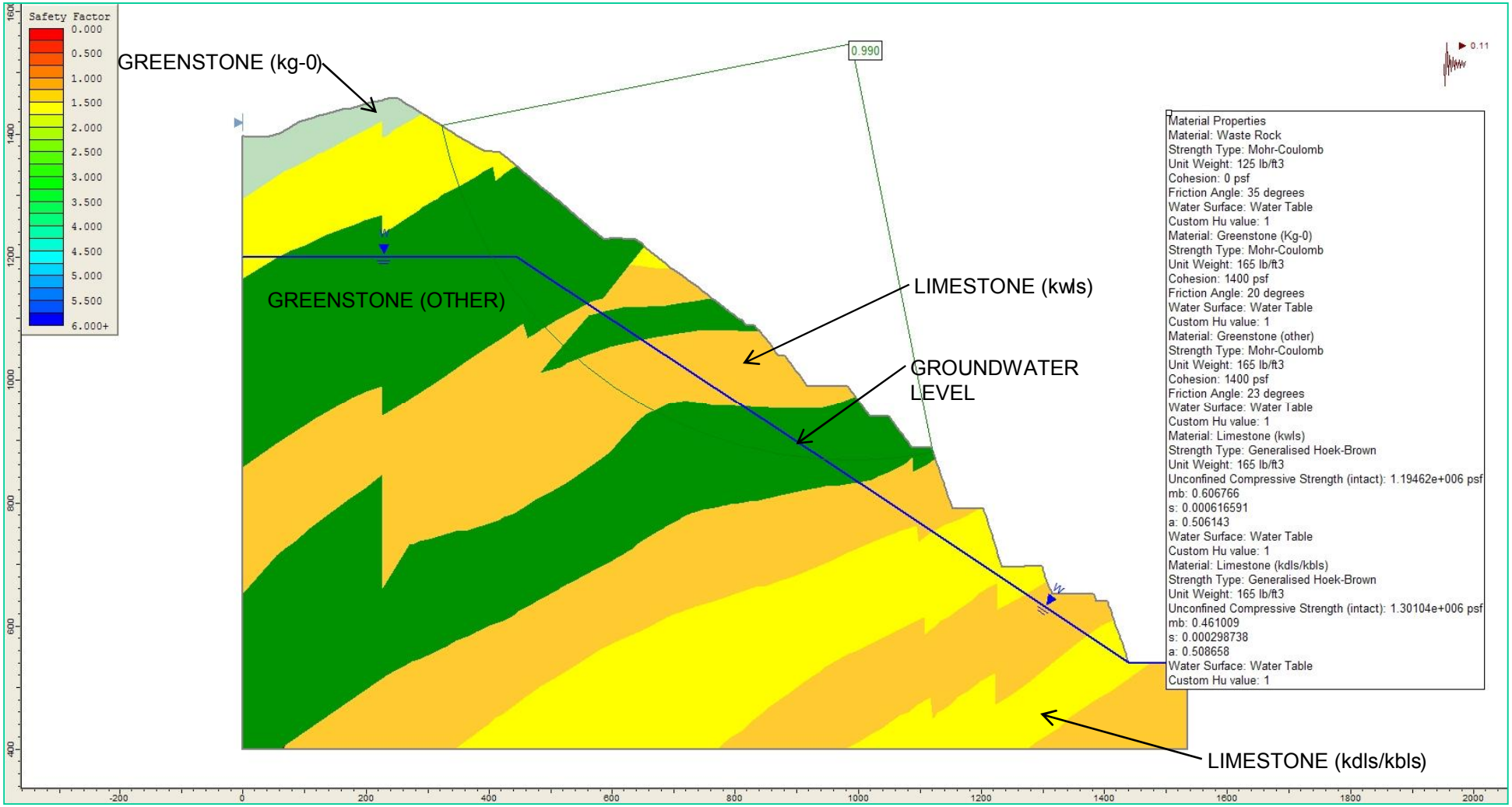
PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION EW2 – EAST WALL FINAL DESIGN
CONDITION: PSEUDO-STATIC (k = 0.15g)
FAILURE MODE: CIRCULAR

Golder Associates		FINALSLOPE DESIGN SECTION EW2 – EAST WALL LSCC PERMANENTE, CA	
Drawn: PHY	App'd: KGH	Date: JUNE, 2007	Figure: 8A-10
Project No.: 063-7109			Revision No.:

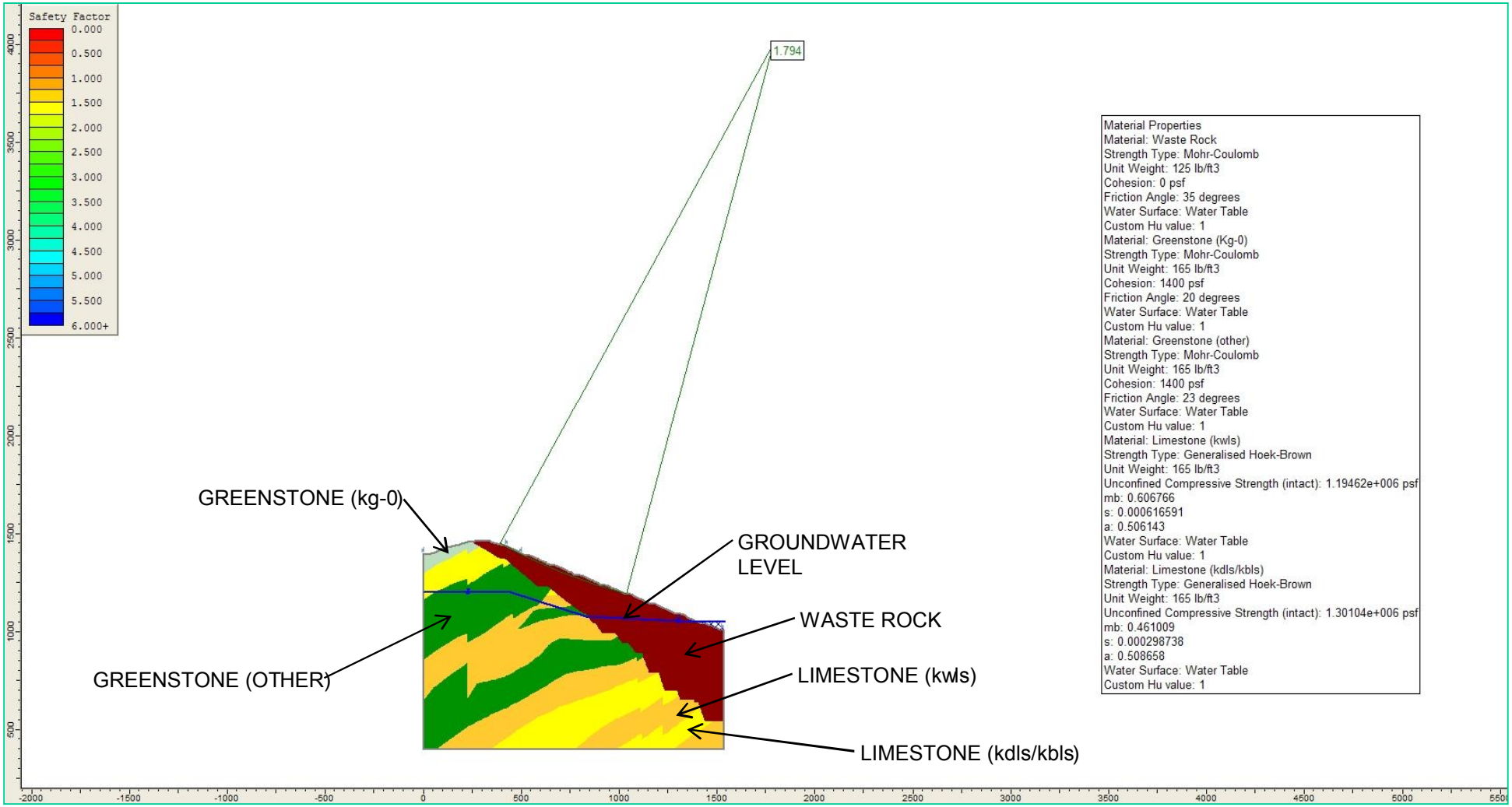
PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION EW2 – EAST WALL FINAL DESIGN
CONDITION: YIELD ACCELARATION CALCULATION
FAILURE MODE: CIRCULAR

Golder Associates		FINALSLOPE DESIGN SECTION EW2 – EAST WALL LSCC PERMANENTE, CA	
Drawn: PHY	App'd: KGH	Date: JUNE, 2007	Figure: 8A-11
Project No.: 063-7109			Revision No.:

PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION EW2 – EAST WALL FINAL RECLAMATION
CONDITION: STATIC
FAILURE MODE: CIRCULAR

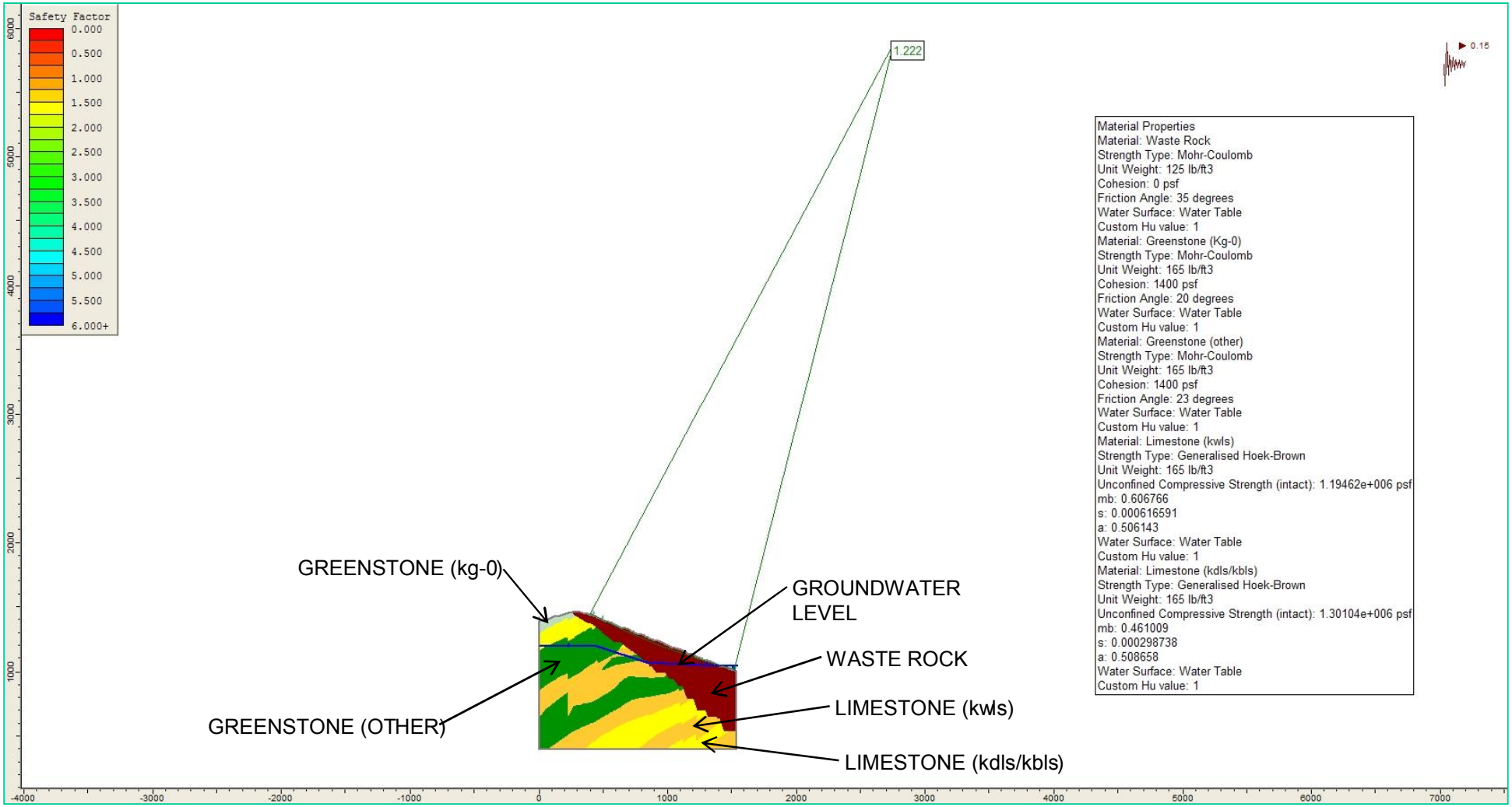
Golder Associates

FINAL RECLAMATION PLAN
SECTION EW2 – EAST WALL
LSCC PERMANENTE, CA

Drawn:	App'd:	Date:	Figure:
PHY	KGH	JUNE, 2007	8A-12

Project No.: 063-7109 Revision No.:

PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION EW2 – EAST WALL FINAL RECLAMATION
CONDITION: PSEUDO-STATIC (k = 0.15g)
FAILURE MODE: CIRCULAR

Golder Associates			FINAL RECLAMATION PLAN SECTION EW2 – EAST WALL LSCC PERMANENTE, CA
Drawn: PHY	App'd: KGH	Date: JUNE, 2007	Figure: 8A-13
Project No.: 063-7109			Revision No.:

APPENDIX 9.A

Geotech Core Logs 2008 Drilling

PERMANENTE QUARRY RMR SYSTEM - RECORD OF GEOTECHNICAL PARAMETERS

Project No. 063-7109.100		Drilling Method	From 10.0 To 473	Sheet 1 of 19
Borehole # GT1-1-08	Azimuth NA	HQ3		Logged by IT/ALH/SW
Elevation 1058	Inclination -90 (Vertical)			Drill Rig Ruen
N 106.3 E -5449	Ref. Point			

Core Dia: Depth	ROCK TYPE	RUN	Run Data: Recovery & Other Basic Information: From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	JCR: Average	JCR: Minimum	Strength Index: Strength Index	Weathering Index	Detailed Discontinuity Data: Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	Rubble/Gouge: Gouge: From	To	Type	Broken Core: From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt	1	10.0	13.0	2.5	N	2.1	0	25		R3	W4																Extensive Ca filling
	Metabasalt	2	13.0	16.0	3.0	N	2.7	0	25		R3	W4																
	Metabasalt	3	16.0	21.0	4.6	N	4.5	0	25		R2	W4																Sample 20.1' to 20.6'; soft, gougy
	Metabasalt	4	21.0	23.0	2.0	N	2.0	0	25		R2	W4																
	Metabasalt	5	23.0	28.0	5.0	N	5.0	1	0	0	R2	W4	23.8	F	1	30	P	R	Cl	15	8.0	0						
	Metabasalt	6	28.0	33.0	5.0	N	5.0	0	25		R2	W4																
	Metabasalt	7	33.0	38.0	5.0	N	5.0	1	20	20	R2 W4		34.7	J	1	60	P	R	Cl	C	14.0	20						
	Metabasalt	8	38.0	43.0	5.0	N	4.8	3	15		R2	W4														39.5	39.7	Sample 41.4' to 41.9'
	Metabasalt	9	43.0	48.0	4.9	N	4.7	3	12	12	R2	W4	44.1	J	1	20	P	VR	Cl	2	16.0	12						
																										45.2	45.4	Gc broken core
	Metabasalt with 0.8 feet of limestone at top of run	10	48.0	53.0	4.7	N	4.3	6	6	6	R3	W4	48.8	F	1	60	ST	VR	Cl	1	18.0	6						Stepped, slicked fault
																										48.2	48.5	Milled gravelly gouge
	Metabasalt	11	53.0	58.0	4.5	N	3.7	10	12	12	R4	W4	55.5	J	1	30	p	VR	Cl	1	16.0	12						
																							56.4	58.0	Sc			Milled greenstone gouge
	Greenstone	12	58.0	63.0	5.0	N	3.7	8	12	12	R3	W4														58.3	58.8	Rubbley pieces
													59.6	J	1	40	P	VR	Cl	1	16.0	12						Sample 61.9' to 62.6'
																										62.6	63.0	
	Greenstone	13	63.0	64.5	1.1	N	0.9	8	12		R2	W4											64.3	64.5	Sc			
	Greenstone	14	64.5	67.0	2.7	N	1.9	15	12		R2	W4											64.5	65.4	Sc			Milled gouge; str: S4
	Metabasalt	15	67.0	72.0	4.8	N	3.3	20	0	0	R2	W4	69.4	F	1	50	P	VR	Cl	40	18.0	0						
																							70.1	71.3	Sc			Gouge with thin sections of more solid core
	Limestone	16	72.0	77.0	4.8	N	4.8	0	25		R3	W3																Top 1.6' cemented breccia
		17	77.0	79.7	2.7	N	2.7	0	25		R3	W3																Extensive Ca infilling
	gouge	17	79.7	82.0	2.3	N	0.0	25	0		S4	W3																Gouge
	Limestone	18	82.0	87.0	4.7	N	3.1	20	12		R0.5	W3											82.0	83.2	Sc			
																							86.4	87.0	Sc			
	gouge	19	87.0	92.0	4.5	N	0.0	50	6		S4	W3																Entire run milled clayey gouge
	Greywacke	20	92.0	96.5	4.0	N	1.3	35	12		R0.5	W3											92.0	92.9	Gc			Clay gouge with solid pieces suspended
																							93.8	94.5	Gc			
	gouge	21	96.5	101.5	4.9	N	0.0	50	0		S4	W3																Entire run milled gouge
	Fault Breccia	22	101.5	105.5	3.7	N	0.0	50	0		R0	W3																
	Greenstone	23	105.5	110.5	5.0	N	5.0	2	12	12	R3	W3	108	J	1	20	P	R	Cl	3	14.0	12						
													109.9	J	1	50	P	R	Cl	2	12.0	12						

				Run Data																										
				Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																								Gouge			Broken Core			
	Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
		Greenstone	24	110.5	113.0	2.3	N	2.3	0	15																			
		Greywacke	25	113.0	118.0	5.0	N	0.0	50	4		R1	W4																Entire run soft, friable, gougy rock
		Graywacke	26	118.0	123.0	4.2	N	3.4	20	12	12	R2	W4											118.0	118.4	Sc			
														122.5	J	3	30	P	S	Cl	1	6.0	12						
																								122.5	123.0	Sc			
		Greywacke with calcite veins	27	123.0	128.0	4.5	N	0.0	2	0	0	R1	W4	126	F	1	11	C	S	G		2.0	0	123.0	127.0	Sc			mostly gougy rock
														127.3	F	1	59	P	S	G		2.0	0	127.0	127.4	Sc			
		Greywacke with calcite veins	28	128.0	133.0	4.4	N	1.5	6	14	14	R2	W3	129.7	J	1	43	P	VR	Cl/Ca	1	16.0	14						
														130.2	J	1	70	P	R	Cl/Ca	0.5	14.0	14						
														131.3	J	3	49	P	R	Cl/Ca	0.5	14.0	14						
														132.5	J	1	43	I	VR	Ox/Ca	<0.5	17.0	15						
		Greywacke/Greenstone	29	133.0	138.0	4.7	N	2.2	5	12	0	R2	W3	133.8	J	1	50	P	R	Ox	<0.5	15.0	18						
														134.3	J	1	76	P	VR	Ox	<0.5	18.0	22						
														135	F	1	55	P	S	G		2.0	0	134.7	135.2	Sc			Greywacke/greenstone contact at 134.75 feet
														136.7	F	1	30	P	S	G		2.0	0	136.5	136.9	Sc			
														137.5	J	1	66	P	VR			16.0	18						
		Greenstone	30	138.0	143.0	2.6	N	1.2	13	12	0	R2	W3	140.6	J	1	64	C	SR			6.0	16						
														141.5	J	1	83	P	VR			16.0	20						>10 fractures/foot 141.7' to 142.6'
														141.6	F	1	39	P	S	G		2.0	0	142.6	143.0				Fault at 141.5' - greywacke/greenstone contact
		Greenstone	31	143.0	146.5	3.1	N	1.7	3	5	0	R2	W3	144	J	1	76	U	R	Cl	<0.5	14.0	15						
														144.7	F	1	36	P	S	G		2.0	0	144.3	144.9	Bx/Cl			
														146	F	1	43	P	S	G		2.0	0	143.6	145.9	Bx/Cl			
		Greenstone/Limestone	32	146.0	151.5	5.0	N	2.5	3	11	0	R2.5	W3	148.5	F	1	67	P	S	G		2.0	0	146.5	148.6	Sc			Greenstone/Limestone contact at 148.5 feet
														149.5	J	1	50	P	VR	Ca/Ox	<0.5	18.0	20						
														151.2	J	1	8	P	R			14.0	12						
		Limestone with chert and calcite veins,	33	151.5	156.5	5.0	N	4.1	7	11	6	R3	W2	152.9	J	1	62	P	R			12.0	16						
		some greywacke												153.5	J	1	68	P	R			12.0	16						Limestone/greenstone contact at 153.5 feet
														154.4	J	1	58	P	SR	Ca/Cl	20	4.0	6						
														155	J	1	54	P	R	Ca/Cl	0.5	8.0	12						
														155.5	J	3	66	P	SR	Ca/Cl	1	4.0	6						
		Limestone	34	156.5	159.5	2.8	N	2.8	3	14	14	R3	W3	157.3	J	1	55	P	VR	Ox	<0.5	16.0	14						
														158.3	J	1	70	P	VR	Ox	<0.5	16.0	14						
														158.8	J	1	81	P	VR	Ox	<0.5	16.0	14						
		Limestone with chert, calcite veins	35	159.5	163.0	3.4	N	2.6	5	20	14	R2	W2	160	J	1	82	P	VR	Ca/Bx	1	14.0	20						
														160.3	J	1	70	P	VR	Bx	1	18.0	22						
														161	J	1	61	P	SR	Ca	<0.5	6.0	14						
														161.9	J	1	59	P	VR	Ca	<0.5	18.0	22						

				Run Data										Detailed Discontinuity Data									Rubble/Gouge					
				Recovery & Other Basic Information						JCR		Strength Index											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													162.6	J	1	80	P	VR	Ca	<0.5	18.0	22						
	Limestone	36	163.0	168.0	4.7	N	2.5	3	7	6	R2	W2	165	F	1	57	P	R	G		14.0	6	163.0	165.0	Bx/Cl			
													165.9	J	1	81	P	R	Cl/Bx	1	14.0	10						
													167.2	J	1	33	P	SR	Cl/Bx	10	6.0	6						
	Graywacke/Limestone	37	168.0	173.0	5.0	N	4.2	3	15	10	R2	W3	170.5	J	1	35	P	SR	Bx	2	8.0	10						Fracture along calcite vein
													172.2	J	1	43	P	R	Bx	1	12.0	14						
													172.6	J	1	50	P	VR	Ca	<0.5	18.0	20						
	Limestone/Graywacke	38	173.0	178.0	5.0	N	4.0	6	17	14	R2	W2	174.1	J	1	38	P	VR	Ca	<0.5	18.0	20						Limestone/greywacke contact at 176.7 feet
													175.2	J	3	80	P	VR	Ca/Bx	0.5	18.0	20						
													176.7	F	1	55	U	R	Cl	0.5	12.0	14						
													177.5	J	1	81	P	R	Ca/Bx	0.5	13.0	15						
	Limestone	39	178.0	183.0	5.0	N	5.0	2	20	20	R2	W2	178.4	J	1	70	P	VR	Cl	<0.5	19.0	20						
													181.9	J	1	78	P	R	Ca/Bx	<0.5	16.0	20						
	Limestone	40	183.0	188.0	5.0	N	4.6	5	17	14	R2	W2	184.6	J	1	88	P	VR			19.0	22						
													185.2	J	1	83	P	R	Cl	1	10.0	18						
													185.8	J	1	34	P	SR			8.0	14						
													187	J	1	84	P	R			12.0	16						
													187.3	J	1	63	P	R			12.0	16						
	Limestone	41	188.0	193.0	5.0	N	4.4	3	13	6	R2	W2	189.9	J	1	50.0	P	R			12.0	16						
													191.2	F	1	77.0	ST	R	G		14.0	6	191.2	193.5	Sc			
													191.9	J	1	54.0	P	VR	Bx	2	16.0	17						
	Limestone w/calcite veins, some	42	193.0	198.0	5.0	N	4.1	5	5	0	R2	W3	194.6	F	1	58	P	SR	Cl	10	4.0	0						
	chert												195.7	F	1	58	P	S	Cl	30	2.0	0						
													196	J	1	80	P	VR	Bx	1	16.0	14						
													196.8	J	1	84	P	VR	Bx	2	18.0	12						
													197.6	F	1	61	P	SR	Bx	30	10.0	0						
	Limestone	43	198.0	203.0	5.0	N	5.0	6	20	17	R2	W2	199.5	J	2	70	P	VR			14.0	18						
													200.1	J	1	79	P	R			12.0	17						
													200.8	J	1	60	P	VR	Cl	<0.5	20.0	23						
													201.7	J	2	48	P	VR	Cl	<0.5	17.0	20						
	Limestone	44	203.0	208.0	5.0	N	4.2	7	20	19	R2	W2	203.7	J	1	77	P	VR	Ca	1	17.0	20						
													204.5	J	2	64	P	VR	Ca	<0.5	15.0	19						
													205.8	J	1	73	P	VR	Ca	<0.5	18.0	20						
													206.1	J	1	36	P	VR	Ca	<0.5	17.0	20						
													206.6	J	1	75	P	VR	Ca	<0.5	17.0	20						
													207.7	J	1	47	C	R	Ca	<0.5	13.0	21						
	limestone/brecciated limestone	45	208.0	213.0	5.0	N	5.0	6	14	4	R2	W2	208.5	J	1	74	P	VR			16.0	18						Brecciated limestone

				Run Data																												
				Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge								
																								Gouge			Broken Core					
	Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
														209.3	J	1	76	P	R			12.0	16						
														210.2	J	1	48	P	SR	Cl	<0.5	4.0	12						
														211.2	J	1	86	P	VR			16.0	18						
														211.8	F	1	40	ST	S	Cl	<0.5	2.0	4						
														212.8	J	1	56	P	R	Cl	0.5	10.0	13						
		Limestone	46	213.0	218.0	5.0	N	5.0	5	18	10	R2	W2	214	J	1	85	P	SR	Ca	15	8.0	10						
														214.9	J	1	84	P	VR	Cl	<0.5	19.0	21						
														215.8	J	1	73	P	VR	Cl	<0.5	16.0	20						
														216.5	J	1	55	P	VR	Cl	<0.5	16.0	20						
														217.1	J	1	86	P	VR			17.0	20						
		limestone	47	218.0	223.0	5.0	N	5.0	0	25		R2	W2																Extensive Ca veining/infill
		Limestone breccia, Ca cemented	48	223.0	228.0	5.0	N	5.0	1	20	20	R2	W2	224.4	J	1	20	P	R	Cl	1	8.0	20						Extensive Ca veining throughout
		Limestone	49	228.0	233.0	5.0	N	5.0	0	25		R3	W2																Breccia in upper 0.4 feet, Ca cemented - unbrecciated limestone below
		Limestone	50	233.0	237.5	4.1	N	2.1	10	20	20	R3	W2	237.2	J	1	70	C	VR	Gc	2	16.0	20						Run moderately fractured though subrounded chert inclusions
		Limestone	51	237.5	242.5	5.0	N	4.7	5	12	12	R3	W2	238.3	J	1	30	P	R	Gc	3	14.0	12						Sample 239.8' to 240.3'
																								241.4	241.6	Gc			
		Limestone	52	242.5	247.6	4.8	N	4.8	1	20	20	R3	W2	245.9	J	1	30	P	VR	Cl	C	16.0	20						
		Limestone	53	247.6	252.9	5.2	N	4.9	4	17																	250.5	250.7	Run brecciated limestone, Ca cemented - frequent void spaces between limestone breccia
		Limestone	54	252.9	258.0	4.9	N	4.9	1	20	20	R3	W2	254.7	J	1	70	P	R	Ca	C	12.0	20						
		Limestone	55	258.0	261.5	3.4	N	1.3	15	12		R3	W2											258.0	260.0	Bx			Cemented fault breccia
		Limestone	56	261.5	262.1	0.6	N	0.6	0	25		R3	W2																
		Greenstone gouge	56	262.1	263.0	1.1	N	0.0	20	2		R1	W4																Solid limestone - Greenstone gouge contact at 262.1 feet
		Gouge	57	263.0	268.0	4.9	N	0.9	50	0	12	S4	W4	263.6	J	1	50	P	R	Cl	2	8.0	12						Breakthrough limestone piece
																								264.8	268.0	Gc			Greenstone gouge with few rounded greywacke pebbles
		greenstone gouge	58	268.0	273.0	5.0	N		50	0		S5	W4																Entire run weak, friable milled rock
		Greenstone gouge	59	273.0	277.0	3.7	N	0.0	40	2		S4	W4																Entire run clay gouge with some greywacke clasts
		Milled greenstone	60	277.0	279.0	0.9	N	0.0	20	2		S4	W4																Milled greenstone with greywacke clasts
		Milled clay	61	279.0	281.0	1.3	N	0.0	20	0		S4	W4																Dark gray clay
		Milled greywacke	62	281.0	283.0	1.8	N	0.0	20	2		S5	W4																Dark gray clay with increasing greywacke pebbles
		Greywacke	63	283.0	286.0	3.0	N	0.0	30	0		S5	W4																Greywacke clasts increasing in size down run in gray clay
		Graywacke	64	286.0	291.0	4.7	N	4.1	15	9	0	R3	W3											286.0	286.9	Milled greenstn.			
														287.3	J	1	70	P	R	Cl	2	8.0	12						
														288.6	J	2	50	P	R	Cl	1	10.0	12						
														289.2	J	1	60	P	R	Cl	5	8.0	0						
														290	J	1	70	P	VR	Cl	2	16.0	12						

				Run Data										Detailed Discontinuity Data										Rubble/Gouge					
				Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Graywacke	65	291.0	293.0	1.7	N	1.7	2	20	20	R3	W3	291.5	J	1	50	P	R	Cl	C	8.0	20						
													291.9	J	1	35	P	R	Cl	C	8.0	20						
	Graywacke	66	293.0	297.0	4.6	N	4.6	3	12	12	R3	W3	293.58	J	1	60	P	R	Cl	1	10.0	12						Possible run length error
													295.1	J	1	50	P	R	Cl	1	14.0	12						
													296.2	J	1	75	P	R	Cl	1	10.0	12						Limestone contact at 295.8 feet
	Limestone	67	297.0	302.0	4.7	N	3.3	10	12	12	R2	W3											297.6	297.8	Sc			Milled greenstone
													298	J	2	60	P	R	Cl	1	10.0	12						Sample 297' to 297.6'
													300.7	J	1	75	P	R	Cl	2	12.0	12						
													300.9	J	2	75	P	R	Cl	3	14.0	12						
	Limestone	68	302.0	306.0	3.6	N	3.3	8	16	12	R2	W3	303.6	J	2	60	P	R	Cl	C	8.0	20						Run highly fractured - large chert nodules decrease rock strengtl due to brittle nature
													304	J	1	45	P	R	Cl	1	10.0	12						
	Limestone	69	306.0	308.0	1.9	N	1.2	1	12	12	R2	W3	307.4	J	1	50	P	VR	Gc	2	18.0	12						
	Limestone	70	308.0	313.0	5.0	N	4.5	6	12	12	R2	W3	308.6	J	1	50	P	R	Cl	2	8.0	12						Significant chert nodules
																										309.5	310.0	Shattered chert clasts
													310.6	J	1	50	C	S	Ca	2	6.0	12						
	Limestone with Ca veins	71	313.0	318.0	4.7	N	3.5	12	18	3	R3	W1	313.2	F	1	62	C	SR	Sc	5	4.0	3						Ca veins
													313.4	V	1	40	ST	SR	Ca	2	8.0	22						Point load test
													314.5	J	1	45	U	S			2.0	18						
													315	V	1	60	ST	SR	Ca	1.5	8.0	22						
													315.5	V	1	60	P	R	Ca	1.5	8.0	23						
													315.9	S	1	65	P	SR/K	Ca	0.5	6.0	15						
													317.2	V	1	25	P	SR	Ca	0.5	5.0	22						
													317.5	V	1	25	P	SR	Ca	0.5	5.0	22				317.0	318.0	
	Highly fractured limestone with	72	318.0	322.0	4.0	N	0.0	30	19	2	R3	W2	318.2	J	1	30	P	VR			10.0	23						Highly fractured limestone with calcite veins and chert nodules Estimated 10% is chert, Str: R4
	veins and chert nodules												318.4	J	4	65	P	R			10.0	22						
													318.6	J	1	25	U	SR			12.0	23						
													319.2	J	2	45	IR	SR			6.0	23						
													319.5	J	2	60	IR	SR			8.0	22						
													319.6	J	2	35	P	VR			10.0	20						
													320.2	J	2	30	U	SR			8.0	20						
													320.7	J	2	24	P	SR			8.0	20						
													321.2	F	1	25	P	SR	Bx	150	6.0	2	321.2	322.0	Bx/Sc			
	highly fractured limestone with	73	322.0	324.0	1.4	20.0	0.0	6	24	24	R3	W2	322.2	V	2	35	C	VR	Ca	3	14.0	25						Estimated 20% is chert, Str: R4
	chert nodules												322.6	J	1	40	P	VR			12.0	24						
													322.9	J	1	41	ST	VR			12.0	24						
	highly fractured Limestone with	74	324.0	327.0	2.8	N	0.4	35	17	11	R3	W2	324.2	J	3	25	P	R	Ca	1	9.0	24						Highly fractured limestone; chert nodules up to 3" thick (~20%)
	Chert nodules (20%)												324.8	J	1	27	U	SR	Ca	0.2	4.0	16						>10 fractures/foot 324' - 326'

			Run Data										Detailed Discontinuity Data									Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													325	J	2	35	C	SR			4.0	16						
													325.5	J	2	48	P	SR			4.0	16						
													325.2	J	1	24	P	SR			4.0	16						
													326.5	J	1	47	P	SR	Sc	1	5.0	11						
	Brecciated Limestone (fault breccia)	75	327.0	330.5	3.4	N	0.0	100	11	2	R3	W3	327.6	J	2	50	P	R			10.0	20						Brecciated limestone (fault breccia); ~10% chert nodules
	w/chert nodules (10%)												327.7	J	3	40	P	R			10.0	20				327.0	327.5	>10 fractures/foot entire run
													328.4	F	1	45	P	R	Bx		12.0	2	328.4	328.6	Bx			R3 chert clasts, very little gouge; clasts fit together, most aroun 0.1 to 2 cm in diameter, very angular, and smooth sided
													328.6	F	1				Bx		6.0	2	328.6	330.5	Sx/Sp			Core breaks down to gravel with sand
	Brecciated Limestone (fault breccia)	76	330.5	331.0	0.5	N	0.0	50	2	2	R3	W3	330.5	F	1		IR					2	330.5	331.0	Bx/Sp	330.5	331.0	>10 fractures/foot; entire run R3 clasts
		77	331.0	332.0	0.8	N	0.0	50	2	2	R3	W3	331	F	1		IR					2	331.0	332.0	Bx			>10 fractures/foot entire run
	faulted Limestone	78	332.0	333.0	1.5	N	0.5	3	5	2	R3	W3	332	F	1	40	IR		Bx	30		2	332.0	332.2	Bx			Faulted limestone
													332.8	F	1	55	P	VR	Bx	20		2	332.8	332.9	Bx			
													332.9	J	1	47	C	SR			6.0	12						
	Brecciated Limestone	79	333.0	336.0	3.0	N	0.0	50	18	8	R3	W2	333	J	50	5-60	P	SR	Sc	C	4.0	15						Brecciated limestone; >10 fractures/foot entire run
													333.9	J	1	45	P	VR			14.0	20						Core breaks down to GS (UCS) gravel with sand 2.5-0.1 inches ir diameter
	Limestone (10% chert)	80	336.0	340.0	4.0	N	0.5	39	13	0	R2	W2	336	J	30	0-80	P/IR	SR			6.0	0						Heavily fractured; ~10% chert
													336.4	J	1	20	P	VR			10.0	15						>10 fractures/foot 336' to 337.3'
													337.1	V	1	65	P	R			8.0	15						Most joints JCR ~8, R3
													337.4	J	1	35	P	R			10.0	20						
													337.6	J	1	75	P	S	Sc	C	3.0	10						
													338	J	1	40	IR	VR			4.0	20						
													338.4	J	2	40	P	R	Sc	1	8.0	12						
													339	J	1	35	C	R	Gp	2	10.0	10						
													339.2	J	1	35	P	S	Sc	C	4.0	12				339.6	340.0	>10 fractures/foot 339.6' to 340'
	Limestone	81	340.0	342.5	2.4	N	0.0	30	17	15	R3	W3	341	J	2	39	C	SR			18.0	17						Fault breccia; ~20% chert
													341.2	J	2	42	P	SR			6.0	15						>10 fractures/foot entire run; most joints JCR ~15, only major joints logged
													342	J	1	65	P	R			8.0	18						
													342.1	J	1	30	P	R			10.0	18						
													342.3	J	1	55	P	SR			6.0	18						
	Brecciated limestone	82	342.5	347.0	4.3	N	0.9	40	11	9	R2	W3	342.5	J	20							12						Brecciated limestone; >10 fractures/foot 342.5' to 343.6'
													343.8	J	9	65	P	SR			4.0	12						Joint set spaced 2-6" entire run
													345.5	J	1	42	P	SR	Sc	0.5	6.0	10						>10 fractures/foot 344.3' to 345.7'
													346	J	1	33	P	SR	Sc	0.5	4.0	9						
	Brecciated limestone/fault breccia	83	347.0	348.5	1.5	N	0.0	15	2	2	R2	W3	347.6	F	1					80		2	347.6	348.0	Bx/Sc			>10 fractures/foot entire run; joints average JCR 13
	Limestone and chert	84	348.5	350.0	1.5	N	0.9	4	11	8	R3	W2	349	J	3	30	P	R	Sp	6	10.0	8						
													349.6	J	1	44	C	SR			5.0	13						
	Limestone and chert (40%)	85	350.0	351.5	1.5	N	0.8	4	9	2	R3	W2	350.5	F	1	50	P	SR	Bx/Sp	40	6.0	2	350.5	350.6	Bx/Sp			~40% chert; heavily veined with calcite

				Run Data																												
				Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge								
																								Gouge			Broken Core					
	Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
														351	J	1	34	C	SR			6.0	16						
		Limestone/chert (30%)	86	351.5	353.0	1.5	N	0.0	2	9	2	R2	W2	352	F	1		IR		Bx/Sc	60	8.0	2	352.0	352.3		351.5	352.0	~30% chert
														352.4	J	1	40	P	SR			7.0	15						
		Limestone and chert(40%)	87	353.0	358.0	5.0	N	2.9	13	15	10	R3	W2	355	J	2	25	P	SR			6.0	18						~40% chert; calcite veins
		with Ca veins												355.4	J	1	20	P	VR			11.0	18						
														355.8	J	7	20	U	VR			10.0	15						>10 fractures/foot 355.8' to 356.1'
														356.5	J	1	24	P	VR	Sc	3	12.0	10						
														357.4	J	2	50	C	SR			6.0	14						
		highly fractured Limestone	88	358.0	363.0	4.8	N	0.7	36	12	8	R2	W3	358.4	J	1	68	C	R			10.0	18						Highly fractured; ~20% chert
		and chert(20%)												358.9	J	1	30	P	SR			7.0	17						
														359.8	J	2	42	C	SR	Cl	C	7.0	12						
														360.2	J	3	58	U	SR			8.0	12						
														360.7	J	2	55	P	SR	Cl	C	5.0	12						
														361	J	3	45	P	SR	Cl	C	5.0	12						
														361.6									8				361.6	363.0	>10 fractures/foot 361.6' to 363'; some breccia present but hard to distinguish between weak broken core and fault (Bx)
														362.5	J	1	28	P	SR	Sc	1.5	6.0	8						
		Limestone and Chert	89	363.0	367.0	3.4	N	0.0	12	13	2	R3	W2		J	3							15				363.0	364.5	
														364.7	F	1	65	P	R	G	65	5.0	2	364.6	364.9	Bx/Sc			
														365.3	F	1	60	P	SR	Bx	15	6.0	5						Point load
														365.5	J	1	60	U	R			10.0	20						
														365.7	J	1	50	U	SR			6.0	20						
														366.3	J	1	41	P	R			4.0	11						
																3							15				366.6	367.0	
		Limestone and chert (15%)	90	367.0	372.0	4.2	N	1.4	15	12	6	R3	W2	368	J	1	51	P	S	Cl	0.5	3.0	10						~15% chert; extensive calcite veins
														368.4	J	1	40	C	K	Cl	C	3.0	6						All joints roughly parallel to each other
														368.7	J	1	51	P	R			10.0	18						Chert in 3 areas ~2" thick; Srt:R4
														369.2	J	1	42	U	R	Sc	0.5	8.0	15						
														369.5	J	3	42	P	R	Sc	0.5	8.0	12						
														370.5	J	1	45	P	R	Sc	3	8.0	10						Point load
														371.2	J	4	40	P	SR			9.0	13						
		Limestone	91	372.0	373.0	1.0	N	0.0	6	20	20	R3	W2	372.1	J	1	60	C	R			6.0	20						
														372.9	J	3	50	P	SR			5.0	20						
		Limestone	92	373.0	374.0	1.0	N	0.0	3	19	19	R3	W2	373.2	J	1	50	C	R			10.0	20						
														373.4	J	1	50	C	R			8.0	19						Point load
														373.7	J	1	37	P	SR	Cl	C	7.0	19						
		Limestone with chert nodules	93	374.0	379.0	5.0	N	1.9	20	14	11	R3	W2	374.8	J	1	28	P	SR	Cl	C	7.0	14						~10% chert nodules; lower end R3
														375.6	J	1	35	ST	SR			8.0	14						Healed fractured (~8)

				Run Data																												
				Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge									
																								Gouge			Broken Core					
	Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
														375.9	J	1	55	IR	SR			6.0	15						
														376.1	J	1	70	U	R			8.0	15						
														376.4	J	2	23	U	SR			7.0	14						
														377.3	J	2	75	P	SR	Sc	1	6.0	11						
														377.6	J	1	60	P	SR	Sc	0.5	5.0	12						
														378	J	1	40	P	SR	Cl	C	6.0	15						
														378.3	J	2	85	IR	R	Sc	0.5	10.0	12						
														378.5	J	1	35	ST	R			8.0	15						
														378.7	J	1	45	C	SR	Cl	C	6.0	12						
		Limestone and chert (~5%)	94	379.0	383.0	4.4	N	1.7	18	13	10	R3	W2	379.5	J	1	35	P	SR	Ca	C	6.0	15						~5% chert; over recovery not accounted for
														380	J	1	25	P	R			8.0	18						
														380.5	J	2	30	P	R			10.0	12						R2 section 380.5' to 380.7'; spun core
														381	J	1	24	ST	SR			6.0	12						R2 section 380.7' to 380.9'
														381.5	J	2	30	P	R	Sc	1	8.0	10						
														382	J	2	45	P	SR			6.0	12						
														382.5	J	1	50	P	SR			8.0	14						
														382.8	J	2	58	ST	R			10.0	12				382.8	383.0	
		Limestone and chert nodules	95	383.0	387.0	4.0	N	2.4	15	15	10	R3	W2	383.2	J	1	60	P	SR			6.0	18						~20% chert nodules
														383.7	J	1	42	ST	R			10.0	19						
														384.5	J	1	35	P	SR	Sc	1	7.0	12						
														385	J	1	54	P	SR	Sc	2	9.0	10						Healed joint set (5) parallel to 385 joint; spaced 2-1" apart from 385' to 385.7'
														385.7	J	2	35	ST	SR			8.0	14						
														386	J	2	54	P	S			3.0	12						
														386.4	J	2	50	P	R			10.0	17				386.0	386.2	Many healed joints (~20) in run; break if handled
		Limestone	96	387.0	387.5	0.35	N	0.35	0	25		R3	W2																2 healed joints (52 degrees)
		Limestone and chert	97	387.5	391.0	3.5	N	0.9	10	18	14	R3	W2	387.2	J	1	30	P	SR			8.0	20						~25% chert
														388.7	J	1	50	P	SR			6.0	19						
														389.5	J	1	55	P	R			14.0	20						
														389.9	J	1	50	P	SR			13.0	18						
														390	J	1	42	P	R	Cl	C	10.0	18						
														390.4	J	2	34	P	SR	Sc	C	7.0	14						
														390.7	J	1	52	P	SR			7.0	17						
		Limestone and chert	98	391.0	393.0	1.5	Y	0.0	7	13	6	R3	W2	391.6	J	1	32	P	SR			6.0	19				391.0	392.0	~20% chert
														392.3	B	2	45	P	S	Cl	0.5	3.0	8						
														392.4	J	1	25	P	R			9.0	19						
														392.7	B	1	60	P	S	Cl	2	3.0	6				392.7	393.0	
		Limestone and chert	99	393.0	398.0	5.0	Y	2.3	26	11	6	R3	W2	393.8	B	2	40	P	S	Cl	C	1.0	6						~20% chert; Str: R4

				Run Data										Detailed Discontinuity Data									Rubble/Gouge						
				Recovery & Other Basic Information						JCR		Strength Index											Gouge			Broken Core		
	Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
		chert str:R4												394.1	J	2	38	P	R	Sc	0.5	9.0	15						>10 fractures/foot 394.1' to 394.5'
														394.5	J	1	20	C	R	Sc	1	8.0	11						
														394.8	J	1	40	P	R			8.0	18						
														395.4	B	3	13	P	SR	Sc	0.5	7.0	12						>10 fractures/foot 395.2' to 395.4'
														395.9	B	2	42	P	S	CH	1	3.0	6						
														396.2	B	1	39	P	S	CH	3	3.0	5						
														397.2	J	1	25	P	R			8.0	18						Point load
		Limestone and chert	100	398.0	401.0	2.5	N	1.2	10	10	0	R3	W2	399.1	J	1	25	P	SR			6.0	18						~20% chert; Str: R4
		chert str:R4												399.4	J	1	27	P	SR	Sc	1	6.0	13						Healed fractures along bedding (51 degrees)
														400.2	F	1	47	P	S	G	20	3.0	0	400.1	400.2	CH/Sc	400.0	401.0	Fault is likely along bedding; point load
		Limestone (20%)	101	401.0	403.0	1.8	N	0.0	20	17	14	R3	W2	401.8	J	1	55	P	SR	CH	C	5.0	14				401.0	401.5	~20 % chert
														402	V	1	58	C	SR			6.0	18				402.0	402.6	
														402.7	J	1	58	C	SR			5.0	20						
		Limestone and chert	102	403.0	408.0	5.0	N	0.5	40	12	8	R3	W2	403.5	J	1	51	P	R			7.0	20						
														404.9	Bc					Bx/ Sp	30						404.8	404.9	Fault?; Bx 2" thick
														404.3	J	1	48	C	R			10.0	18						
														404.7	J	1	42	P	SR			8.0	17						Highly fractured rock; many non-continuous joints
														404.9	J	2	55	P	R	Sp	1	9.0	11						
														405.3	J	1	65	C	SR	Sc	1.5	8.0	10						
												R2		405.6	J	1	22	P	SR			8.0	14						Str: R2 from 405.6' to end of run
														405.8	J	1	30	P	R	Sc	1.5	8.0	8						>10 fractures/foot 405.7' to 405.9'
														406.2	B	1	62	P	SR	Sc	1	6.0	8						
														406.7	J	1	30	C	SR	Sc	0.5	6.0	8						Point load
														407	B	1	55	P	SR	Sc	0.5	6.0	8						
		Limestone and chert beds (20%)	103	408.0	413.0	4.8	N	1.9	22	15	12	R3	W2	408.5	J	1	50	C	SR	Sc	0.5	8.0	12				408.0	408.5	~20% chert; many healed joints
														408.9	J	1	15	U	SR			6.0	15						>10 fractures/foot 408' to 409'
														409.1	J	1	50	C	SR			9.0	18						
														409.2	J	1	60	C	SR			5.0	17						
														410	B	3	55	P	SR	Sc	C	6.0	15						
														410.8	J	1	50	C	R	Cl	0.5	10.0	13						
														411.5	J	1	30	C	VR	Sc	0.5	14.0	17						
														411.9	J	1	42	P	R	Sc	0.5	8.0	12						
		Limestone with chert beds	104	413.0	418.0	5.0	N	1.6	35	10	6	R3	W2	413	J	30							~15						>10 fractures/foot 413' to 416'
														414.8	B	1	50	P	S	Cl	0.5	3.0	10						
														417	B	1	50	P	S	Cl	2	3.0	6						
														417.7	B	1	51	P	S	Cl	1.5	3.0	7						
		Brecciated limestone and chert (altered)	105	418.0	423.0	4.9	N	0.0	15	12	10	R2	W3	419	J	1	50	U	SR	Carb	2	8.0	10						Carbon infilled joints; Carb = carbon

				Run Data																												
				Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge								
																								Gouge			Broken Core					
	Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
														419.2	J	1	35	U	R	Carb	1	8.0	11						
														419.7	J	1	40	P	R	Carb	1	10.0	12						Extensive fluid alteration
														420.3	J	2	50	P	SR	Carb	2	7.0	10						
														421	J	2	60	C	SR	Carb	1	6.0	11						
														421.5	B	1	70	P	S	Carb	1	4.0	18						
														422	B	1	70	P	VR	Carb	0.5	12.0	12						Sample 422.5' to 423'
		Limestone (altered)	106	423.0	428.0	5.0	N	2.1	16	14	11	R3	W3	423.7	J	1	60	P	SR	Cl	C	6.0	17						
														424	J	1	68	C	R	Cl	C	8.0	17						Lower end R3
														424.6	B	2	58	P	SR	Carb	C	6.0	15						
														424.9	V	1	45	P	S	Carb	3	4.0	12						Point load
														425.3	J	1	58	P	SR	Carb	C	8.0	15						
														426.2	J	1	50	P	S	Carb	0.5	4.0	12						Breaks easily along carbon filled joints
														426.7	J	7	58	P	S	Carb	1	4.0	11						
		altered limestone (bedded)	107	428.0	433.0	5.0	Y	2.9	12	10	10	R3	W3	428.5	B	10	60	P	S	Carb	0.5	4.0	10				428.0	429.0	Joint set along bedding every 4-6" entire run; Point load - breaks along bedding
		altered bedded limestone	108	433.0	438.0	5.0	Y	4.2	9	14	8	R3	W3	433.5	J	1	35	P	SR	Cl	C	8.0	17						Alteration along bedding
														434.2	J	1	35	P	SR			5.0	12						
														434.4	B	1	68	P	SR	Carb	0.5	7.0	15						
														435	B	1	70	P	R			12.0	19						
														435.8	B	1	68	ST	SR	Carb	0.5	5.0	18						
														436.4	B	1	50	P	S	Carb	1.5	3.0	8						Point load at 436'
														436.8	B	1	55	C	R	Carb	1	7.0	12						Sample at 434.4' to 435'
														437.3	J	1	50	C	R			10.0	19						
														437.8	J	1	60	P	S	Carb	0.5	3.0	10						
		Limestone	109	438.0	443.0	4.9	N	3.3	8	18	11	R3	W2	439.2	J	1	35	P	R	Carb	C	8.0	18						
														441.5	J	1	60	P	VR			14.0	20						
														443.5	J	1	60	P	SR	Carb	1.5	6.0	17						
														443.9	J	1	60	ST	R	Carb	1.5	8.0	19						Point load
												R2		442.2	J	1	44	P	SR	Carb	1.5	5.0	17						442.2' to 443' str: R2
		Limestone	110	443.0	448.0	5.0	N	3.7	11	17	12	R3	W2	443.3	J	1	55	P	VR	Carb	C	14.0	18						
														444	J	1	43	P	VR	Carb	C	16.0	20						
														444.3	J	1	60	ST	R			10.0	19						
														444.7	J	4	48	P	R			8.0	14						
														445.8	J	1	36	C	R			10.0	17				446.3	446.7	
														447	J	1	65	IR	SR	Carb	1	6.0	12						
		Limestone	111	448.0	453.0	5.0	N	2.5	12	16	10	R3	W2	448.2	J	1	60	IR	R	Carb	1	8.0	14				448.4	448.6	
														449.2	J	1	30	V	VR	Carb	1	12.0	16						Point load
														450	J	1	70	C	VR	Carb	1	10.0	14						2 distinct joint sets

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													450.2	J	1	55	P	VR			10.0	18						
													450.6	J	1	30	P	R			10.0	18						
													451	J	1	67	C	SR	Carb	0.5	8.0	15						
													451.5	J	1	25	P	R			9.0	18						
													451.9	J	2	50	P	SR			8.0	18						
													452.3	J	1	65	C	S	Carb/H	1	4.0	10				452.5	453.0	
	Limestone with chert (30%)	112	453.0	458.0	5.0	N	3.9	7	12	10	R3	W2	453.6	J	1	30	P	SR	Graph	C	5.0	10						Graphite joint infill
	Qtz veins(?) no fizz												454.4	J	2	65	P	SR	Carb	1	6.0	12						~30 % chert; quartz and calcite veins
	+ Ca veins												455.7	J	2	60	P	R	Carb	0.5	8.0	14						
													456.5	J	1	75	P	SR	Carb	0.5	7.0	14						
													457.5	J	1	70	C	SR	Carb	C	6.0	12						
	Limestone altered by veins and fluid	113	458.0	463.0	5.2	N	4.0	15	17	13	R3	W2	459.4	J	1	25	P	VR			14.0	16						Limestone altered by veins and fluid
													460.2	J	3	55	P	R	Carb	0.5	8.0	14						Intense veins and stylolites
													460.7	J	1	38	P	R	Carb	C	10.0	17						
													461.4	J	1	40	V	R			12.0	21						
													462	J	1	30	P	R			14.0	21						Point load
													462.4	J	3	55	P	R	Carb	1	10.0	13						
	Limestone/Greenstone	114	463.0	468.0	4.8	Y	3.9	5	16	10	R3	W2	463.4	C		25												Limestone 463' to 463.4'
													464.6	C		65												Greenstone 463.4' to 464.6'
													465.5	J	2	25	P	R			9.0	22						Limestone 464.6' to end of run
													466	J	1	54	P	R	Carb	0.5	8.0	15						Intense veins and stylolites
													467.2	B	1	65	ST	S	Carb	C	3.0	10						Weakness planes along bedding (467' to 468')
	Limestone	115	468.0	473.0	5.0	N	2.9	12	17	13	R3	W2	468.4	J	2	45	P	R	Carb	C	5.0	18						
													469.3	J	1	30	P	SR	Carb	C	8.0	19						
													469.6	J	1	50	P	SR	Carb	1	8.0	15						
													470.2	J	1	20	P	R			10.0	20						Point load
													470.9	J	3	80	P	SR	Carb	1	6.0	13						Spaced ~6" the rest of run
													471.9	V	2	25	P	SR	Carb	C	8.0	14						

PERMANENTE QUARRY RMR SYSTEM - RECORD OF GEOTECHNICAL PARAMETERS

Project No.	063-7109.100		**Drilling Method**	From 10.0	To 476.5	**Sheet**	1 **of** 25
Borehole #	GT1-2-08	**Azimuth** 000	HQ3			**Logged by**	AH, IT
Elevation	1054	**Inclination** -60				**Drill Rig**	Ruen
N 47.8	**E** -5082	**Ref. Point**					

Core Dia: Depth	ROCK TYPE	RUN	Run Data: Recovery & Other Basic Information: From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	JCR: Average	JCR: Minimum	Strength Index	Weathering Index	Detailed Discontinuity Data: Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	Rubble/Gouge: Gouge: From	To	Type	Broken Core: From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Graywacke with Ca veins	1	10.0	13.0	3.0	N	0.5	9	13	6	R5	W2	11	J	1	57	P	SR	Cl	0.5	8.0	16						
													14.4	J	1	68	P	R	Cl	0.5	14.0	20						
													14.6	J	1	22	ST	SR	Cl	0.5	8.0	12						slickensided surface
													12.1	J	1	69	P	VR	Cl	0.5	16.0	22						
													12.3	J	1	39	P	SR	Cl	1	4.0	7						
													12.6	J	2	44	P	R	Cl	1	8.0	12						
													12.7	J	1	58	U	SR	Cl	0.5	10.0	16						
													12.8	J	1	55	P	S	Cl	1	2.0	6						
	Graywacke with Ca veins	2	13.0	18.0	5.0	N	0.8	32	14	6	R5	W2	13	J	20	27	P	R			8.0	12						<10 FRACTURES/FT 13-14.5 FEET
													14.5	J	2	38	P	R			8.0	12						
													15.2	J	1	31	P	SR			8.0	12						
													15.8	J	2	50	P	SR			10.0	6						SLICKENSIDED SURFACE
													16.4	J	1	57	U	R			10.0	16						
													16.8	J	3	49	P	VR			14.0	20						
													17.2	J	1	8	P	R			12.0	22						
													17.5	J	1	76	P	R			14.0	23						
													17.9	J	1	60	ST	SR	Cl	1.5	2.0	12						
	Graywacke with Ca veins	3	18.0	21.5	3.3	N	0.5	12	14	6	R5	W2	18.4	J	1	54	P	VR			14.0	20						
													18.5	J	1	12	U	R	Ca	2	12.0	12						
													18.7	J	1	72	P	R	Cl	0.5	10.0	6						Slickensided surfaces
													19.3	J	1	63	P	R			10.0	10						
													19.4	J	1	35	P	VR			16.0	20						
													19.5	J	1	58	P	R	Cl	2	9.0	10						
													19.6	F	1	73	P	R	Cl	250	6.0	8	19.8	19.9	Gc			
													20.3	J	2	33	P	R	Cl	2	10.0	12						
													20.5	J	1	18	C	VR	Cl	1	14.0	22						
													21.1	J	2	45	P	VR	Cl	5	14.0	22						
	Graywacke with Ca veins	4	21.5	25.5	3.4	N	0.5	10	16	0	R5	W2	22.1	J	2	61	P	R	G	150	8.0	11	21.3	21.4	Bx			
													22.8	J	1	24	P	VR	Ca		14.0	18						
													23.1	J	1	47	P	R			12.0	17						
													23.3	J	1	24	P	VR			16.0	20						
													23.4	J	1	51	P	R	Cl	0.5	10.0	14						
													23.5	J	1	51	C	R	SC	0.5	10.0	16						
													23.7	F	1	45	P	SR	Cl	400	6.0	0	23.7	23.9	Sc			
													24	J	1	74	P	R		0.5	10.0	14						
													24.4	J	1	62	P	SR			6.0	10						

			Run Data										Detailed Discontinuity Data									Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Graywacke with Ca veins	5	25.5	30.5	5.0	N	2.9	19	19	6	R5	W2	27.2	J	14	53	P	R			14.0	18						<10 fractures per foot 26.3 to 27.3
													27.7	J	1	78	P	VR			18.0	23						
													28.3	J	1	60	P	R	Ca	0.5	9.0	16						
													28.9	J	1	20	ST	R			8.0	15						
													29	J	1	60	P	R	Bx	3	10.0	6						
													29.4	J	1	70	I	R			11.0	24						
	Graywacke with Ca veins	6	30.5	33.0	2.7	N	1.3	5	17	14	R5	W2	31.5	J	2	25	P	VR	Ca	0.5	16.0	20						
													32	J	1	62	P	SR			6.0	16						
													32.2	J	2	46	P	R	Cl	0.5	12.0	18						
	Graywacke with Ca veins	7	33.0	37.0	3.0	N	0.0	33	16	13	R5	W2	34	J	1	60	P	R			10.0	13						
													34.4	J	1	68	P	R			11.0	14						
													34.6	J	1	42	V	R			12.0	20						Some Chlorite alteration
																							34.7	37.0	Gc			Highly sheared zone
	Graywacke with Ca veins	8	37.0	39.0	2.0	N	0.0	8	17	0	R3	W2	37.3	J	1	49	P	VR	Cl	<.5	16.0	20						
													37.3	J	1	61	P	SR	Cl	0.5	2.0	7						
													37.4	J	1	36	P	VR			14.0	18						
													37.6	J	1	43	P	VR			18.0	22						
													37.8	F	1	69	P	S	G	300	6.0	0	37.8	37.9	Bx/Cl			
													38.2	J	1	70	P	VR	Ca	<.5	12.0	16						
													38.4	J	1	41	P	VR	Ca	<.5	16.0	20						
													38.5	J	1	5	P	VR	Cl	<.5	12.0	18						<10 fractures/ft 39-39.5
	Graywacke with Ca veins	9	39.0	43.0	4.0	N	1.6	14	13	7	R4	W2	39	J	7	78	P	SR	SR	Cl	4.0	7						<10 fractures/ft 39-39.5
													39.8	J	1	89	P	SR	SR	Cl	4.0	8						
													40.2	J	1	43	U	R	R		18.0	23						
													40.8	J	3	46	P	VR	VR	Cl	17.0	20						
													41.3	J	2	50	P	R	R	Ca	16.0	14						
	Graywacke with Ca veins	10	43.0	48.0	5.0	N	1.7	14	13	12	R4	W2	43.8	J	1	10	U	R			16.0	16						
													44.4	J	4	55	P	R			9.0	12						
													45	J	1	40	P	R			10.0	12						
													45.9	J	1	48	P	R			9.0	12						
													46.3	J	1	36	P	VR			13.0	14						
													47.4	J	6	50	P	R	Ca	<.5	10.0	14						
	Graywacke with Ca veins	11	48.0	53.0	5.0	N	3.1	12	14	12	R4	W2	48.5	J	3	55	P	VR			12.0	14						
													49.5	J	3	46	P	VR	Cl	0.5	10.0	12						
													50.9	J	1	77	P	R			10.0	13						
													51	J	2	28	P	R	Cl	<.5	8.0	12						
													51.6	J	1	54	P	VR	Cl	<.5	12.0	14						
													52	J	1	34	P	VR	Ca	0.5	16.0	18						
													52.9	J	1	59	P	R			14.0	17						
	Graywacke with Ca veins	12	53.0	57.0	4.0	N	2.7	9	16	0	R3	W1	53.8	J	1	62	P	VR	Ca	2	14.0	22						

			Run Data										Detailed Discontinuity Data									Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													54.4	J	1	15	P	VR	Ca	<.5	13.0	22						
													55	J	3	43	P	VR	Cl	<.5	14.0	22						
													55.8	F	1	55	P	R	G	10	8.0	0	55.8	55.9	Ca/Cl			
													56.3	J	1	60	C	R	Cl	<.5	10.0	20						
													56.5	J	1	35	P	S	Cl	<.5	2.0	10						
													56.8	J	1	27	P	S	Cl	<.5	2.0	10						
	Graywacke with Ca veins	13	57.0	62.0	5.0	N	3.8	6	21	19	R3	W1	58	J	1	43	P	VR	Ca	<.5	14.0	22						
													58.6	J	1	64	P	R	Ca	<.5	10.0	20						
													59.7	J	1	78	P	R	Ca	<.5	10.0	20						
													61.3	J	2	18	P	R	Cl	<.5	10.0	19						
													61.8	J	1	67	P	VR	Ca	<.5	14.0	22						
	Graywacke with Ca veins	14	62.0	67.0	5.0	N	0.0	29	11	0	R3	W2	63	J	1	52	U	R	Ca	<.5	14.0	20						
													63.4	J	1	55	ST	R			10.0	22						
																										63.9	65.7	
													65.9	F	1	38	P	SR	G	590	8.0	0	65.7	68.0	BX/CL			
													66.3	F	1	92	P	SR	BX/G	380	8.0	0						
	Graywacke with Ca veins	15	67.0	70.0	1.7	N	0.0	2	12	2	R1	W4	68.6	J	1	57	I	R			10.0	21						
													68.9	J	1	59	P	SR	Cl	5	6.0	2						
																							69.1	70.0	SC/CHL			Chlorite altered gouge
	Graywacke gouge	16	70.0	73.0	2.2	N	0.0	50	0	0	S4	W3											70.0	73.0	SC			entire run gouge, highly fractured
	Graywacke	17	73.0	75.5	1.8	N	0.0	30	0	0	R1.5	W3	74.2	J	2	29	P	SR	BX	100	8.0	0						
																							74.5	75.5	BX/CL			
	Graywacke	18	75.5	76.0	0.4	N	0.0	15	12		R2	W2														75.5	76.0	entire run broken core
	Graywacke	19	76.0	78.0	0.5	N	0.0	15	12		R2	W2														76.0	78.0	entire run broken core
	Graywacke	20	78.0	79.0	1.0	N	0.0	15	12		R2	W2														78.0	79.0	entire run broken core
	Graywacke	21	79.0	79.5	0.4	N	0.0	15	12		R2	W2														79.0	79.5	entire run broken core
	Graywacke with Ca veins	22	79.5	80.0	0.5	N	0.0	2	18	18	R3	W2	79.6	J	2	66	P	SR			6.0	18						
	Graywacke with Ca veins	23	80.0	83.0	2.8	N	0.0	14	6	0	R2.5	W2											80.0	81.4	GC			>10 fractures/ft
																							81.4	82.2	bx			
													82.6	J	1	50	P	VR	Cl	0.5	10.0	12						
													82.8	F	1	25	P	S	Cl/BX	600	4.0	0						
																							82.7	83.0	Bx/Cl			
	Graywacke with Ca veins	24	83.0	85.5	1.2	N	0.0	10	0	0	R2	W3	86.5	F	1	10	P	S	Cl/G	400	2.0	0	84.0	84.7	Bx/Cl			
													86.9	F	1	28	P	SR	Cl/G	200	6.0	0						
	Graywacke with Ca veins	25	85.5	86.0	0.5	N	0.0	8	12		R2	W3														85.5	86.0	entire run broken core

Core Dia: Depth	ROCK TYPE	RUN	Run Data: Recovery & Other Basic Information: From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	JCR: Average	Minimum	Strength Index: Strength Index	Weathering Index	Detailed Discontinuity Data: Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	Rubble/Gouge: Gouge: From	To	Type	Broken Core: From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Graywacke with Ca veins	26	86.0	87.0	0.4	N	0.0	8	12		R2	W3															86.0	87.0	entire run broken core
	Graywacke with Ca veins	27	87.0	87.5	0.3	N	0.0	8	12		R2	W3															87.0	87.5	entire run broken core
	Graywacke with Ca veins	28	87.5	88.0	0.3	N	0.0	8	12		R1	W3															87.5	88.0	entire run broken core
	Graywacke with Ca veins	29	88.0	88.5	0.5	N	0.0	10	12		R1	W2															88.0	88.5	entire run broken core
	Graywacke with Ca veins	30	88.5	89.0	0.4	N	0.0	10	12		R2	W2															88.5	89.0	entire run broken core
	Graywacke with Ca veins	31	89.5	92.5	3.0	N	0.0	16	12		R3	W2	89.7	J	1	40	P	R	Cl	0.5	10.0	14							
													90	J	2	68	P	R	Cl	0.5	10.0	14							
													90.4	J	2	44	P	R	Cl	0.5	6.0	12							
													90.7	J	1	71	C	R			8.0	16							
													91	J	2	49	P	R	Cl	0.5	12.0	14							
													91.1	J	1	64	I	VR	Ca	0.5	14.0	18							
													91.1	J	1	30	P	R	Ca	0.5	8.0	14							
													91.6	J	2	45	P	R	Ca/Cl	0.5	12.0	14							
													91.8	J	1	23	P	VR	Ca/Cl	0.5	14.0	20							
													92.3	J	3	54	P	VR	Cl	1	14.0	18							
	Graywacke with Ca veins	32	92.5	95.5	2.4	N	0.8	6	10	0	R3	W2	93.2	J	2	34	V	R			12.0	20							
													94.1	J	2	51	P	SR	Cl	1	6.0	10							
													94.6	J	1	22	P	R	Cl	0.5	10.0	12							
													95	F	1	59	I	S	G	1200	1.0	0							sample from 93.2 to 93.8
																							95.0	95.5	Bx/Cl			slickensided surface
	Graywacke with Ca veins	33	95.5	100.5	4.4	N	0.7	9	22	20	R3	W2	96.5	J	2	51	P	R			8.0	22							
													97.1	J	1	35	P	R	Cl	0.5	8.0	20							
													97.4	J	2	50	P	VR	Cl	0.5	12.0	22							
													98	J	1	41	P	VR	Cl	0.5	16.0	22							
													99	J	1	34	P	VR			14.0	22							
													99.6	J	2	41	P	VR			14.0	22							
	Graywacke with Ca veins	34	100.5	103.0	2.5	N	0.0	4	12	0	R3	W2	100.7	J	1	63	P	S	Ca	0.5	14.0	20							
																										100.7	101.3	
													101.5	F	1	12	P	S	Cl	8	2.0	0							slickensided surface
													102.2	J	2	52	P	R	Cl	1	10.0	15							
																							102.6	102.9	Bx/Cl				
	Graywacke with Ca veins	35	103.0	106.5	2.4	N	0.0	4	3	0	R3	W2	104.3	F	1	49	P	S	G	250	2.0	0	104.2	104.4	Bx/Cl			slickensided surface
													105	F	1	60	P	SR	G	900	6.0	0	104.7	105.2	Bx/Cl			
													105.8	J	2	65	P	SR	Cl	1	4.0	8							
																							105.8	106.5	Bx				
	Graywacke with Ca veins	36	106.5	109.0	1.7	N	0.0	10	14	4	R3	W2	107.5	J	1	45	C	VR	Cl	1	14.0	4	107.0	107.5	Bx				
													107.8	J	1	77	ST	R	Cl	0.5	10.0	16							
													108	J	1	23	P	VR	Cl	0.5	18.0	18							
													108.3	J	1	26	P	VR	Cl	0.5	18.0	18				108.5	109.0		
	Graywacke with Ca veins	37	109.0	113.0	3.3	N	0.0	27	20	19	R3	W2	110	J	1	15	P	R	Ca	0.5	12.0	20							

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													110.9	J	1	58	P	R	Cl	0.5	10.0	19						
																							111.2	113.0	Bx			>10 fractures per foot
	Graywacke with Ca veins	38	113.0	114.0	0.7	N	0.0	8	10	10	R2	W3	113.5	J	8	54	P	R	Cl	0.5	12.0	10						<10 fractures/foot 113 to 114
	Graywacke with Ca veins	39	114.0	117.5	3.5	N	0.8	5	6	0	R2.5	W3	114.4	J	1	72	C	VR	Cl	0.5	14.0	20						
													115.4	F	1	63	P	R	G	1100	10.0	0	115.1	115.6	Bx			slickensided surface
													115.8	J	1	49	P	SR	Cl	0.5	6.0	0						slickensided surface
													116.3	J	1	40	U	R	Cl	0.5	10.0	12						
													116.6	F	1	79	P	R	G	500	10.0	0	116.5	116.7	Bx			
	Graywacke with Ca veins	40	117.5	119.0	1.7	N	0.0	4	17	12	R2	W3	117.5	J	1	46	P	VR			18.0	20						
													117.8	J	1	62	P	VR			18.0	20						
													118.1	J	1	40	P	R			10.0	16						
													118.7	J	1	20	P	SR	Cl	0.5	6.0	12						
																							118.7	119.0	Bx			
	Graywacke with Ca veins	41	119.0	121.5	1.9	N	0.8	10	18	16	R2	W3	120	J	3	55	P	VR			16.0	20						
													120.8	J	4	40	P	VR	Cl	0.5	16.0	18						
													121	J	1	59	P	R	Cl	0.5	8.0	16						
													121.2	J	2	45	P	VR			16.0	20						
	Graywacke with Ca veins	42	121.5	123.0	0.6	N	0.6	1	6	6	R3	W3	122.7	J	1	65	V	S	Cl	1	4.0	6						slickensided surface
	Graywacke with Ca veins	43	123.0	126.5	3.5	N	1.5	4	2	0	R2	W2	124.6	J	1	36	P	S	Cl	1	4.0	0						slickensided surface
													124.1	J	1	20	I	S	Cl	1	4.0	0						slickensided surface
													125.2	J	1	38	I	SR	Cl	0.5	8.0	7						
													125.7	J	1	19	P	S	Cl	0.5	4.0	0						slickensides
	Graywacke with Ca veins	44	126.5	129.5	2.5	N	0.6	3	8	0	R2	W2											126.5	127.2	Cl			
													127.2	F	1	35	P	S	Cl	160	4.0	0						
																										127.4	127.9	
													128	J	1	36	P	SR	Bx	8	6.0	8						
													128.7	J	1	35	P	R	Ca	0.5	11.0	16						
	Graywacke with Ca veins	45	129.5	130.0	0.3	N	0.0	10			R2.5	W2														129.5	130.0	entire run broken core
	Graywacke with Ca veins	46	130.0	132.5	1.3	N	0.0	6	15	14	R3	W2	131.5	J	1	35	P	R	Cl	0.5	10.0	16						
													131.6	J	1	59	P	R	Cl	0.5	10.0	16						
													132.1	J	1	35	P	R	Cl	0.5	8.0	14						
	Graywacke with Ca veins	47	132.5	137.5	4.3	N	1.1	8	14	6	R3	W2	133.8	J	1	71	P	R			10.0	16						
													133.9	J	1	59	P	R			10.0	16						
													135.6	J	1	28	P	R	Ca	0.5	8.0	16						
													136	J	1	32	P	SR	Bx	6	4.0	6						
													136.8	J	2	25	P	R	Cl	1	8.0	12						
	Graywacke with Ca veins	48	137.5	139.0	1.5	N	0.0	8	17	0	R2.5	W3	137.5	J	1	10	P	VR			14.0	20						
													137.8	J	1	46	P	VR	Ca	0.5	16.0	22						
													138.1	J	2	62	P	VR	Ca	0.5	16.0	22						

Core Dia: Depth	ROCK TYPE	RUN	Run Data: Recovery & Other Basic Information: From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	JCR: Average	Minimum	Strength Index	Weathering Index	Detailed Discontinuity Data: Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	Rubble/Gouge: Gouge: From	To	Type	Broken Core: From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													138.6	F	1	40	P	SR	G	95	4.0	0						
																							138.6	139.0	Bx			
													138.3	J	1	58	P	VR	Ca	0.5	16.0	22						
	Graywacke with Ca veins	49	139.0	143.0	3.6	N	1.2	8	17	0	R2.5	W2	139.8	J	1	43	P	VR	Ca	0.5	18.0	23						
													140.4	J	1	83	P	VR	Ca	0.5	18.0	23						
													140.8	J	1	48	V	R	Cl	0.5	14.0	20						
													141.1	J	1	52	P	SR	Cl	0.5	6.0	16						
													141.3	J	1	60	P	SR	Cl	0.5	5.0	0						slickensides
													141.7	J	1	66	I	R			14.0	20						
													142.3	J	2	68	P	SR	Cl	0.5	6.0	14						
	Greenstone with Ca veins	50	143.0	148.0	5.0	N	1.3	5	7	0	R3	W3	143.5	J	1	44	P	R			14.0	14						
													144	J	2	45	P	R			14.0	14						
													144.3	J	1	17	P	SR	Cl	0.5	4.0	0						slickensides
													145.2	F	1	50	P	SR	G	150	2.0	0						slickensides
																							145.2	146.9	Bx			
																							147.3	147.8	Bx			
	Greenstone with Ca veins	51	148.0	153.0	3.4	N	0.0	50	6		R1	W3											149.5	153.0	Bx			Chlorite alteration
	Greenstone with Ca veins	52	153.0	155.5	2.5	N	2.5	4	12	0	R1	W2	153.4	J	1	71	P	SR	Cl	0.5	8.0	14						
													154.1	J	1	85	P	VR	CW	0.5	18.0	16						
													154.4	J	1	58	P	SR	Chl	0.5	8.0	0						slickensides
													155	J	1	79	U	VR	Chl	0.5	14.0	16						sample 155 to 155.5
	Greenstone with Ca veins	53	155.5	156.5	0.9	N	0.9	0	25	25	R1.5	W2																no fractures
	Highly weathered greenstone, limestone, chert (low grade)	54	156.5	161.5	4.7	N	1.7	6	5	0	R1.5	W2	157.4	J	3	67	P	S	Chl	10	2.0	0						limestone contact at 158.8 ft
																							157.7	158.5	Chl			greenstone highly fractured gouge
													158.8	F	2	61	P	R	Chl	1	10.0	0						contact
													159.5	J	1	43	P	R			10.0	14						chert from 159 to 159.2
	Limestone w/some chert	55	161.5	163.0	1.5	N	1.4	1	20	20	R1	W1	162.7	J	1	78	I	VR	Cl	0.5	16.0	20						
	Limestone with some chert	56	163.0	165.0	2.0	N	1.8	2	19	18	R1	W1	164.2	J	1	30	P	R	Ca	0.5	12.0	18						sample 163.7 to 164.4
													164.9	J	1	60	P	R	Ca	0.5	20.0	20						
	Limestone with some chert	57	165.0	168.5	3.3	N	2.8	4	20	20	R1	W1	166	J	1	40	P	VR	Ca	0.5	16.0	20						
													167	J	1	82	P	VR			18.0	20						
													167.6	J	1	50	P	VR	oxides		18.0	20						
													168.3	J	1	54	P	VR	oxides		20.0	22						
	Limestone with some chert	58	168.5	173.0	4.3	N	2.9	9	21	20	R1	W1	168.7	J	2	43	P	VR	Ca	0.5	16.0	20						
													169.5	J	1	57	P	VR			20.0	22						
													170	J	1	64	P	VR			20.0	22						
													170.4	J	1	81	P	VR	oxides	0.5	18.0	20						
													170.9	J	2	31	P	VR			20.0	22						
													171.9	J	1	65	U	VR	oxides	1	18.0	20						
													172.2	J	1	96	P	R			14.0	20						

Core Dia: Depth	ROCK TYPE	RUN	Run Data: Recovery & Other Basic Information: From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	JCR: Average	Minimum	Strength Index: Strength Index	Weathering Index	Detailed Discontinuity Data: Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	Rubble/Gouge: Gouge: From	To	Type	Broken Core: From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone with some chert	59	173.0	176.5	3.3	N	1.3	4	16	12	R1	W1	173.3	J	1	49	P	VR			14.0	20						
													173.9	J	1	70	SR\T	R			10.0	16						
													174.4	J	1	42	P	SR			6.0	12						
																										175.2	175.7	
													175.3	J	1	84	ST	SR			6.0	14						
	Limestone with some chert	60	176.5	181.5	4.5	N	1.2	23	14	14	R1	W1	177	J	1	65	ST	SR			6.0	14						
													177.7	J	17													
													179.5	J	1	75	P	R			8.0	15						
													180.3	J	1	69	P	R	Cl	0.5	8.0	14						
													180.5	J	1	69	P	R	Ca	0.5	10.0	15						
													180.8	J	1	79	P	R	Ca	0.5	10.0	15						sample 179.5 to 180.3
													181.2	J	1	14	C	SR			6.0	14						
	Limestone with some chert	61	181.5	186.5	4.5	N	2.3	5	18	16	R1	W1	182.3	J	1	44	P	R			14.0	20						
													182.9	J	1	28	P	SR			8.0	16						
													183.7	J	1	37	I	VR	Ca	0.5	18.0	22						
													185.3	J	1	74	P	R	Cl	0.5	16.0	18						
													185.7	J	1	57	P	R			14.0	18						
	Limestone w/ 1.5ft of greenstone	62	186.5	191.5	4.7	N	2.0	5	12	0	R1	W2	187.4	J	2	64	I	VR			16.0	22						
													188.4	J	1	55	P	VR	Ca	0.5	18.0	22						
													1890	J	1	72	P	VR			18.0	22						
													189.8	F	1	70	P	S	G	55	2.0	0	189.7	189.9	Chl			
																							191.0	191.3				greenstone contact at 189.8 and 191.3
													191.3	F	1	61	P	S	G	70	2.0	0						
	Limestone w/ some chert and Ca veins	63	191.5	194.0	2.5	N	1.9	4	18	16	R2	W1	191.6	J	1	59	P	R			12.0	18						
													191.8	J	1	62	P	R			10.0	16						
													193.1	J	1	23	P	VR	oxides	0.5	14.0	18						
													193.7	J	1	41	P	VR	oxides	0.5	14.0	18						
	Limestone w/some chert and Ca veins	64	194.0	199.0	4.7	N	1.9	4	15	14	R2	W1	194.4	J	1	57	P	VR			12.0	16						
													195.4	J	1	81	P	VR			12.0	16						
													196	J	1	45	P	R			8.0	14						
													196.6	J	1	69	P	R			9.0	14						
													196.8	J	1	82	P	R			9.0	14						
													197.3	J	1	63	P	VR			13.0	16						
													198.4	J	1	83	P	R			8.0	14						
	Limestone w/some chert and Ca veins	65	199.0	203.0	4.0	N	2.1	5	17	14	R2	W1	199.7	J	1	81	V	VR			14.0	18						From 200.9 to end higher grade limestone, dark grey
													200.4	J	1	60	P	SR			6.0	14						
													200.8	J	1	56	P	VR			14.0	20						
													201.8	J	1	29	P	R			10.0	14						
													202.2	J	1	63	I	VR			16.0	21						
	Limestone w/some chert and Ca veins	66	203.0	208.0	5.0	N	3.6	7	22	20	R2	W1	203.7	J	1	70	P	VR	Ca	0.5	18.0	22						

Core Dia: Depth	ROCK TYPE	RUN	Run Data: Recovery & Other Basic Information: From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	JCR: Average	Minimum	Strength Index	Weathering Index	Detailed Discontinuity Data: Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	Rubble/Gouge: Gouge: From	To	Type	Broken Core: From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													204.8	J	1	69	P	VR			20.0	24						
													205.9	J	2	61	P	VR			18.0	22						
													206.5	J	1	63	P	VR			18.0	22						
													207.2	J	1	69	P	VR			17.0	22						
													207.4	J	1	50	P	VR	Cl	0.5	16.0	20						
	Limestone (low grade) w/some chert	67	208.0	213.0	5.0	N	1.8	8	21	20	R2	W1	208.9	J	1	35	V	VR			14.0	22						
													209.6	J	2	36	P	R			12.0	20						
													209.9	J	1	67	P	VR			16.0	22						
													210.3	J	1	61	P	VR	Cl	0.5	16.0	20						
													210.9	J	1	30	P	VR			16.0	22						
													211.3	J	1	79	P	VR			14.0	22						
													211.6	J	1	48	P	VR			16.0	22						
	Limestone/Ca w/chert, qtz	68	213.0	218.0	5.0	N	3.8	8	14	11	R3	W1	213.2	J	1	77	P	R			10.0	14						
													214.4	J	1	68	P	R	Bx	4	10.0	11						
													214.6	J	1	60	P	VR			14.0	16						
													215.1	J	1	70	P	R			12.0	14						
													215.5	J	1	54	P	VR			16.0	16						
													215.9	J	1	73	P	VR			16.0	16						
													216.9	J	1	42	P	R			10.0	12						sample 215.6 to 216.1
													217.5	J	1	70	P	R			10.0	12						
	Limestone/qtz	69	218.0	222.0	3.6	N	1.9	8	15	0	R3	W1	218.8	J	1	72	P	VR			16.0	20						
													219.2	J	2	62	P	R			10.0	14						
													219.7	J	1	41	P	VR			14.0	18						
													220.2	J	1	63	P	VR			14.0	18						
													220.5	J	2	78	P	R			12.0	16						
													221.3	F	1	65	P	SR	G	140	4.0	0						
																							221.4	222.0	Bx/Cl			slickensides
	Greenstone	70	222.0	227.0	5.0	N	3.6	7	5	0	R1	W3	222.7	J	1	63	P	R	Cl	1	10.0	10						
													223.2	F	1	54	P	SR	G	35	5.0	0						
													224.1	F	1	33	P	S	Cl	1	3.0	0						slickensides
													225	J	1	59	P	SR	Cl	10	6.0	4						
													225.5	J	1	55	P	S	Cl	3	2.0	0						slickensides chert 225.8 to 226.3
													225.9	F	1	26	P	SR	G	30	6.0	0						greenstone/chert contact at 226.3 limestone
													226.6	J	1	74	P	VR			16.0	20						
	Limestone (medium grade)	71	227.0	229.5	2.5	N	2.5	1	20	20	R2	W1	229.2	J	1	80	P	VR			16.0	20						
	w/ calcite veins																											
	Limestone (low to med grade)	72	229.5	233.0	2.9	N	2.4	2	16	14	R2	W1	232	J	1	59	U	R			12.0	18						
													232.3	J	1	35	P	R			10.0	14						
	Limestone	73	233.0	238.0	4.9	N	4.9	3	17	12	R4	W2	233.7	J	1	30	C	R	Ca	C	8.0	20						
													235.9	J	1	60	P	R	Ca	C	14.0	20						

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													237.5	J	1	25	P	R	Ca	1	8.0	12						
	Limestone w/extensive Ca veins	74	238.0	243.0	4.7	N	4.7	1	12	12	R4	W2	238.3	J	1	70	P	R	Ca	3	14.0	12						
	Limestone with many chert nodules	75	243.0	247.5	3.7	N	2.4	8	12	12	R4	W2														243.0	243.7	
													244.3	J	1	75	P	VR	Ca	1	18.0	12						
													246.4	J	1	70	IR	VR	Ca	1	18.0	12						break through Ca vein
	Limestone	76	247.5	250.5	3.0	N	1.7	8	12	12	R4	W2	249.6	J	1	50	P	VR	Cl	1	16.0	12						
	Limestone	77	250.5	252.5	1.8	N	1.8	2	20	20	R4	W2	251.1	J	1	80	IR	R	Cl	C	12.0	20						
													251.9	J	1	75	P	R	Ca	C	14.0	20						
	Limestone	78	252.5	253.0	0.6	N	0.6	0			R4	W2																
	Limestone	79	253.0	258.0	4.5	N	4.2	3	0	0	R3	W2	254.7	F	1	40	P	R	Cl	40	8.0	0						thick clay gouge zone
	Limestone - some chert	80	258.0	263.0	5.0	N	5.0	0			R4	W2																
	Limestone	81	263.0	268.0	5.0	N	4.5	5	0	0	R3	W2	266.6	F	4	60	P	S	Cl	8	2.0	0						
																							267.4	267.6	Gc			
	Limestone	82	268.0	269.5	1.5	N	0.0	6	20	20	R3	W2	268.3	J	6	60	P	R			10.0	20						series of parallel breaks throughout run
	Limestone	83	269.5	270.0	1.0	N	0.8	0			R3	W2																extra recovery
	Limestone some Ca veins some chert	84	270.0	273.0	2.9	N	2.9	3	16	8	R2	W2	270.8	J	1	69	P	R	CL	1.5	8.0	8						
													271.9	J	1	63	ST	VR	Ca	0.5	14.0	20						
													272.9	J	1	44	P	VR	Ca	0.5	16.0	20						
	Limestone with some chert	85	273.0	278.0	4.8	N	4.3	4	21	20	R2	W2	273.7	J	1	48	P	VR	Ca	0.5	18.0	22						
													274.9	J	1	47	C	VR	Ca	0.5	16.0	22						
													275.9	J	1	73	P	VR	Ca	0.5	19.0	22						
													276.6	J	1	77	P	VR	Ca	0.5	17.0	20						
	Limestone	86	278.0	283.0	4.6	N	4.5	2	18	16	R2	W2	279.6	J	1	43	P	VR	Ca	0.5	18.0	20						
													281	J	1	70	P	R	Ox	0.5	12.0	16						
	Limestone	87	283.0	288.0	5.0	N	4.1	5	8	0	R2	W2	283.1	J	1	74	U	VR	G	0.5	14.0	20						
													283.5	F	1	19	P	S	G	27	2.0	0	283.3	283.7	Cl			Slickensides
													284.6	F	1	68	P	SR	G	3	4.0	2						
													287	J	1	74	U	R	G	0.5	10.0	18						
													288	F	1	18	P	S	G	1	2.0	0						slickensides
	Limestone	88	288.0	293.0	5.0	N	2.1	7	6	0	R1	W4	288.3	F	1	15	P	S	Cl	0.5	2.0	0						slickensides
													288.6	F	1	29	U	S	Cl	0.5	3.0	0						slickensides
													289.2	J	1	61	P	R	Ox	0.5	8.0	14						
													289.6	F	1	53	P	SR	Ox	0.5	6.0	0						slickensides
													290.5	F	1	58	P	SR	G	195	4.0	0	290.5	291.5	Bx			slickensides
													290.8	J	1	62	P	R	Cl	0.5	10.0	12						
													292.4	J	1	54	P	VR	Cl	0.5	14.0	20						
																										293.2	293.6	
	Limestone	89	293.0	298.0	4.7	N	2.8	6	11	0	R2	W3	294	F	1	45	P	SR	Cl	1	6.0	0						slickensides
													294.4	J	1	72	P	R	Cl	0.5	10.0	12						
													295	J	1	74	P	R	Cl	0.5	8.0	12						

Core Dia: Depth	ROCK TYPE	RUN	Run Data: Recovery & Other Basic Information: From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	JCR: Average	Minimum	Strength Index	Weathering Index	Detailed Discontinuity Data: Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	Rubble/Gouge: Gouge: From	To	Type	Broken Core: From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													295.4	J	1	78	P	R	Cl	0.5	10.0	12						
													296.4	J	1	54	P	VR	Cl	0.5	14.0	16						
													296.8	J	1	70	P	R	Cl	0.5	12.0	14						
	Limestone	90	298.0	303.0	3.9	N	0.8	19	11	0	R3	W3	299.3	J	1	56	U	R	Cl	0.5	10.0	14						brecciated, very brecciated from 301.5
													299.7	J	1	58	P	VR	Cl	0.5	14.0	18						
													300.5	J	1	13	P	S	Cl	0.5	0.0	0						
													301.2	J	1	26	P	R	Cl	0.5	10.0	14						
																										301.5	303.0	more than 10 fractures/foot
	Limestone	91	303.0	305.0	1.6	N	0.0	15			R3	W3														303.0	305.0	
	Limestone	92	305.0	307.0	1.6	N	0.0	6	12	12	R3	W3														305.0	305.4	
													305.8	J	6	29	P	R	Cl	0.5	8.0	12						series of parallel fractures 305.4 to 306.3
																										306.3	307.0	
	Limestone	93	307.0	309.0	1.2	N	0.0	22	16	16	R3	W3	308.3	J	22	16	P	VR	Ox	0.5	14.0	16				307.0	308.1	<10 fractures/ft 307-309
	Limestone	94	309.0	310.0	1.0	N	0.0	1	12	12	R3	W3	309.6	J	1	11	P	SR	Ca	0.5	6.0	12				309.0	309.4	
																										309.7	310.0	
	Limestone	95	310.0	313.0	2.6	N	0.4	17	15	12	R3	W3	310.8	J	1	52	ST	R	Cl	0.5	8.0	17						
													311.3	J	1	55	U	R	Cl	0.5	12.0	17						
													311.4	J	1	52	ST	R	Cl	0.5	8.0	17						
													311.5	J	2	30	P	SR	Cl	0.5	6.0	14						
													311.7	J	2	25	P	SR	Cl	0.5	6.0	14						
																										312.3	313.0	
	Limestone	96	313.0	315.5	2.2	N	0.0	27	15	14	R3	W3	314.1	J	24	33	P	R	Cl	0.5	10.0	16						at 315.1 some chert; entire run >10 fractures/ft
													314.6	J	3	46	P	R	Cl	0.5	8.0	14						
	Limestone w/some Ca veins	97	315.5	318.0	1.6	N	0.0	6	11	10	R3	W3											316.2	316.8	Bx			
													317.1	J	1	43	P	R	Cl	1	12.0	10						
													317.3	J	3	59	P	SR	Ca	4	6.0	10						break along Ca veins
													317.6	J	2	39	U	R	Ca	9	12.0	12						break along Ca veins
	Limestone	98	318.0	320.0	2.0	N	0.0	7	11	8	R3	W2	318.2	J	3	43	P	SR	Cl	0.5	5.0	12						
													318.6	J	1	7	P	R	Ca	0.5	10.0	14						
													318.8	J	1	34	P	R	Bx	43	10.0	8						
													319.2	J	1	65	U	VR	Ca	0.5	14.0	16						
													319.8	J	1	18	P	SR	Ca	1	6.0	8						
	Limestone	99	320.0	323.0	2.5	N	0.0	9	14	12	R3	W2	320.8	J	1	25	U	R	Cl	0.5	12.0	14						
													321.1	J	2	63	P	VR	Ca	0.5	16.0	18						
													321.9	J	1	14	P	R	Cl	0.5	12.0	13						
													322.2	J	2	24	P	R	Ca	0.5	10.0	13						
													322.4	J	3	32	P	SR	Cl	0.5	6.0	12						
	Limestone w/calcite veins	100	323.0	324.0	0.9	N	0.0	10			R3	W3														323.0	324.0	entire run broken core
	Mostly chert w/some limestone	101	324.0	327.0	1.6	N	0.0	3			R3	W3	325.6	J	1	53	P	VR	Cl	0.5	15.0	14						
													326.1	J	1	61	P	SR	Cl	2	4.0	6						

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													326.3	J	1	34	P	R	Cl	0.5	12.0	13						
													326.7	F	1	35	I	R	G	82	10.0	0	326.7	327.0	Bx			
	Limestone w/some chert and Ca veins	102	327.0	330.0	3.0	N	0.0	17	13	12	R3	W3	327.4	J	2	73	P	R	Cl	0.5	12.0	14						
													327.9	J	2	29	P	R	Cl	0.5	10.0	13						
													328.2	J	1	77	P	R	Cl	0.5	10.0	13						
													328.6	J	2	29	P	SR	Cl	0.5	6.0	12						
													329	J	9	54	P	R	Cl	0.5	10.0	14						
													329.6	J	1	50	P	R	Cl	0.5	11.0	14						
	Limestone	103	330.0	333.0	3.0	N	0.6	4	19	14	R2	W2	330.5	J	1	81	C	VR	Ca	0.5	18.0	20						
													330.9	J	1	70	ST	VR	Ca	0.5	19.0	22						very brecciated
													331.6	J	1	78	P	R	Ox	0.5	11.0	14						
													332.4	J	1	42	P	VR	Ca	0.5	20.0	22						
	Limestone	104	333.0	338.0	5.0	N	2.0	4	15	14	R2	W2											333.4	334.3	Bx			very brecciated
													335.9	J	1	36	U	R	Ox	0.5	10.0	14						
													336.5	J	1	53	P	VR	Cl	0.5	16.0	15						
													337	J	2	42	P	R	Cl	0.5	12.0	15						
	Limestone w/some chert, Ca veins	105	338.0	343.0	5.0	N	0.5	28	18	14	R2	W3	338.5	J	1	49	P	VR	Cl	0.5	18.0	20						
													339.4	J	1	54	P	R	Cl	0.5	13.0	18						
													339.7	J	1	28	P	R	Cl	0.5	16.0	18						
													339.8	J	1	67	P	VR	Cl	0.5	16.0	19						
													340.3	J	4	53	P	R	Cl	0.5	12.0	14						
																							341.4	343.0	Bx			40 fractures/ft
	Limestone w/some chert, Ca veins	106	343.0	348.0	5.0	N	2.2	6	13	6	R2	W3	343.4	J	1	50	P	VR	Cl	0.5	16.0	20						
													345.3	J	1	52	P	VR	Cl	0.5	15.0	19						
													346.3	F	1	64	P	R	Bx	20	14.0	6						
													346.7	J	1	53	P	SR	Cl	0.5	8.0	6						
													347.3	J	1	58	P	VR	Cl	0.5	19.0	20						
													347.8	J	1	69	U	R	Cl	0.5	10.0	14						
	Limestone	107	348.0	353.0	5.0	N	2.8	11	7	0	R2	W3	348.7	F	2	61	P	R	Cl	0.5	12.0	0						slickensides (very deep)
													349.1	J	2	71	P	R	Cl	0.5	16.0	16						
													350.1	J	2	75	C	R	Cl	0.5	16.0	16						
													350.9	F	1	55	P	SR	Bx	65	8.0	0						slickensides
													352.4	J	4	37	P	R	Cl	0.5	10.0	14						
	Limestone	108	353.0	357.5	3.8	N	0.0	41	5	0	R2	W3	353.5	J	40	60	P	VR	Cl	0.5	12.0	10						<10 fractures/ft (353.5 to 356.7)
													356.8	F	1	39	P	SR	Bx	115	8.0	0						
																										356.6	357.5	
	Limestone	109	357.5	360.0	2.2	N	0.0	2.7	16	10	R1.5	W3	359	J	27	87	P	VR	Cl	0.5	20.0	23						<10 fractures/ft
	Limestone	110	360.0	363.0	2.6	N	0.0	16	20	20	R1.5	W3	361.5	J	16	84	I	SR	Cl	0.5	6.0	20						<10 fractures/ft 361.5 to 362.7
	Limestone	111	363.0	368.0	5.0	N	3.9	1	0	0	R2	W3	364.7	F	1	44	P	R	Bx	190	14.0	0						
	Limestone	112	368.0	373.0	5.0	N	4.5	1	2	2	R2	W2	371.8	J	1	5	P	S	Cl	0.5	1.0	2						several healed fractures, slickensides

Core Dia: Depth	ROCK TYPE	RUN	Run Data: Recovery & Other Basic Information: From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	JCR: Average	Minimum	Strength Index: Strength Index	Weathering Index	Detailed Discontinuity Data: Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	Rubble/Gouge: Gouge: From	To	Type	Broken Core: From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	113	373.0	378.0	5.0	N	5.0	3	13	0	R2	W2	373.9	J	1	72	C	R	Cl	0.5	12.0	18						
													375	J	1	83	P	SR	Cl	1	6.0	0						slickensides
													376.6	J	1	88	P	VR	Cl	0.5	19.0	22						
	Limestone	114	378.0	383.0	4.8	N	4.4	3	20	20	R2	W2	378.2	J	1	40	U	R	Cl	1	12.0	20						
																							380.5	380.7	Gc			
	Limestone	115	383.0	388.0	5.0	N	2.8	8	16	12	R2	W2	383.7	J	1	45	I	VR	Cl	1	16.0	20						
													375.7	J	1	75	I	VR	Cl	2	16.0	12						
																										386.5	388.0	intact but highly fractured - drill induced?
	Limestone	116	388.0	393.0	4.8	N	3.7	5	20	20	R2	W2	388.7	J	1	10	P	S	Cl	1	6.0	20						
																							388.7	389.1	Gc			thick clayey gouge, preserving original structures str:S4
																							390.4	390.7	Cl			thick gouge str: S4
													391.6	J	1	10	P	S	Cl	3	6.0	12						
													392.3	J	1	25	P	S	Cl	C	6.0	20						
	Limestone	117	393.0	398.0	5.0	N	4.5	1	12	12	R2	W2	394.3	J	1	10	P	R	Cl	1	10.0	12						
	Limestone	118	398.0	403.0	4.3	N	3.4	3	16	12	R2	W2														398.0	398.6	highly broken
													399.7	J	1	40	P	R	Cl	1	8.0	20						
													400.1	J	1	50	P	R	Ca	1	8.0	12						break along Ca vein
	Limestone	119	403.0	406.0	2.7	N	0.0	10	17	12	R2	W2	404	J	1	40	P	R	Ca	C	8.0	20						
													404.8	J	1	50	P	R	Ca	C	10.0	20						
													405.4	J	1	20	P	R	Ca	1	12.0	12						
	Limestone	120	406.0	408.0	2.0	N	1.7	2			R2	W2																highly broken core, few Ca veins
	Limestone	121	408.0	412.0	3.7	N	1.3	7	17	12	R2	W2	408.5	V	1	70	P	R	Ca	3	10.0	12						
													410	J	1	40	P	S	Ca	C	6.0	20						
													410.1	J	1	40	P	R	Ca	1	8.0	20						
													410.7	J	1	40	P	R	Cl	2	10.0	12						
	Limestone	122	412.0	417.0	5.0	N	4.3	5	10	6	R2	W2	412.5	V	1	70	P	S	Ca	4	6.0	6						
													414.3	J	1	40	P	R	Cl	1	12.0	12						
													415.6	J	1	40	P	R	Cl	1	8.0	12						
													416.2	J	1	40	P	S	Cl	1	6.0	12						
	Limestone	123	417.0	420.5	3.2	N	2.2	4	12	12	R2	W2	418.1	J	1	35	P	R	Cl	1	10.0	12						
													419.7	J	1	30	P	R	Cl	1	8.0	12						
	Limestone	124	420.5	423.0	2.0	N	0.4	4	20	20	R2	W2	421.4	J	2	45	P	R	Cl	C	14.0	20						
	Limestone	125	423.0	428.0	4.4	N	3.3	5	17	12	R2	W2	423.3	J	1	50	P	R			12.0	20						many non-continuous fractures in core, clay filled
													423.7	J	3	60	P	R	Cl	1	8.0	20						
													424.5	J	1	35	P	R	Cl	1	8.0	12						
													425	J	1	40	P	R	Cl	2	12.0	12						
	Limestone	126	428.0	430.0	2.0	N	1.5	2	12	12	R2	W2	428.3	J	1	30	P	S	Ca	2	6.0	12						
													429.9	J	1	50	P	R	Ca	1	10.0	12						
	Limestone	127	430.0	433.0	3.0	N	0.6	5	10	0	R2	W2	430.6	J	1	60	P	R	Cl	1	8.0	20						
													431.4	F	1	40	P	R	Gc	15	10.0	0						

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
																							431.5	432.5	Ca			thick Ca vein
	Limestone	128	433.0	438.0	4.7	N	4.4	6	13	0	R2	W2	434.6	J	1	40	P	S	Ca	2	6.0	12						break along vein
													436	J	1	70	P	R	Ca	8	10.0	0						
													436.5	J	1	25	P	R	Cl	1	8.0	20						
													436.8	J	3	40	P	R	Cl	C	8.0	20						
	Limestone	129	438.0	441.0	2.7	N	1.1	5	14	12	R2	W2	438.8	J	1	40	P	R	Cl	C	8.0	20						
													439.4	J	1	45	P	R	Cl	1	10.0	12						
													439.9	J	1	45	P	R	Cl	1	8.0	12						
	Limestone	130	441.0	443.0	1.6	N	0.5	4	12	12	R2	W2	441.8	J	4	30	P	R	Cl	1	10.0	12						parallel breaks throughout run
	Limestone	131	443.0	445.0	2.0	N	1.6	2	12	12	R3	W2	443.3	J	1	35	P	R	Ca	1	8.0	12						
													444.7	J	1	60	P	R	Ca	1	8.0	12						
	Limestone	132	445.0	448.0	3.0	N	3.0	1	12	12	R3	W2	446.2	J	1	45	P	R	Ca	3	10.0	12						
	Limestone	133	448.0	451.5	3.2	N	3.0	2	12	12	R3	W2	448.3	J	1	20	P	R	Cl	1	14.0	12						
													449.7	J	1	45	P	VR	Cl	1	18.0	12						sample 450.3-451.0
	Limestone	134	451.5	456.5	4.8	N	4.1	2	12	12	R3	W2	455.2	J	1	65	P	R	Ca	1	8.0	12						
	Limestone	135	456.5	461.5	4.9	N	4.5	2	12	12	R3	W2	460.5	J	2	40	P	R	Cl	1	12.0	12						
	Limestone	136	461.5	466.5	5.0	n	4.4	3	14	12	R3	W2	463.5	J	1	40	P	R	Cl	1	8.0	12						
													464.1	J	1	30	P	R	Cl	1	10.0	12						
													465.4	J	1	40	P	R	Cl	C	8.0	20						
	Limestone	137	466.5	471.5	5.0	N	5.0	0			R3	W2																
	Limestone	138	471.5	476.5	5.0	N	4.6	3	12	12	R3	W2	472.8	J	1	30	P	S	Cl	1	4.0	12						
													474	J	1	60	P	R	Cl	1	10.0	12						

PERMANENTE QUARRY RMR SYSTEM - RECORD OF GEOTECHNICAL PARAMETERS

Project No. 063-7109.100		**Drilling Method**	From 16.5 To 436.5	**Sheet**	1 of 15
Borehole # GT-1-3-08	**Azimuth** NA	Core		**Logged by**	DSF/IT
Elevation 1061.03	**Inclination** -90			**Drill Rig**	Ruen
N 51.25 **E** -4859	**Ref. Point**				

Core Dia: Depth	ROCK TYPE	RUN	Run Data: Recovery & Other Basic Information: From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	JCR: Average	JCR: Minimum	Strength Index: Strength Index	Weathering Index	Detailed Discontinuity Data: Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	Rubble/Gouge: Gouge: From	To	Type	Broken Core: From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt	1	16.5	18.0	1.5	N	0.0				R3	W2														16.5	18.0	
	Metabasalt	2	18.0	22.0	0.5	N	0.0				R3	W2														18.0	22.0	
	Fault gouge	3	22.0	23.0	0.0	N	0.0				R2	W3											22.3	23.0	CL/Chl.	22.0	22.3	
	Fault gouge	4	23.0	25.0	1.5	N	0.0				R2	W3											23.0	24.5	CL/Chl.			
	Greywacke/Metabasalt	5	25.0	27.0	1.0	N	0.0				R3	W2														25.0	26.0	
	Fault gouge	6	27.0	28.5	1.0	N	0.0				R2	W3											27.0	28.0	CL/Chl.			
	Greywacke/Metabasalt	7	28.5	30.5	0.5	N	0.0				R3	W2														28.5	29.0	
	Greywacke	8	30.5	32.0	1.5	N	0.0	5	17	15	R3	W2	31	J	1	59	U	R	CL/Ch	<1	13.0	15						
											R3	W2	31.3	J	1	36	PL	R	CL/Ch	<1	6.0	18						
											R3	W2	31.5	J	1	21	U	R	Chl.	<1	10.0	20						
											R3	W2	31.7	J	3	19	PL	R	Chl.	<1	8.0	17						
	Greywacke/Fault breccia	9	32.0	34.0	2.0	N	0.5	4	12	6	R3	W2/W3	32.9	J	1	18	C	R	Chl.	1	12.0	15						Sample @ 32.3'
											R3	W2/W3	33.1	J	3	20	U	R	CL/Ch	5	14.0	6						
	Graywacke/Fault breccia	10	34.0	36.0	2.0	N	0.0	>10	16	14	R3	W2/W3	34.5	J	4	36.0	P	R	Chl.	<1	9.0	14						
											R3	W2/W3	35.7	J	1	39.0	U	R	Chl.	<1	12.0	18						
	Greywacke	11	36.0	38.5	1.5	N	0.0	4	13	11	R3	W2	36.7	J	2	40	U	R	Chl.	<1	10.0	15				36.0	36.7	Calcite veins
											R3	W2	37.3	J	1	21	P	R	Chl.	<1	8.0	12				38.0	38.5	
											R3	W2	38	J	1	42	P	R	Chl.	<1	8.0	11						
	Graywacke	12	38.5	42.0	3.5	N	0.6	>10	15	12	R3	W2	39	J	2	40	P	R	Chl.	<1	8.0	12						Calcite veins
											R3	W2	39.5	J	1	63	U	R	Chl.	<1	12.0	18						Sample @39.5'
											R3	W2	40.6	J	3	10	ST	R	Chl.	<1	16.0	20						
											R3	W2	40.8	J	1	53	U	R	Chl.	<1	11.0	15						
											R3	W2	41	J	1	24	C	R	Chl.	<1	10.0	12						
											R3	W2	41.5	J	1	36	U	R	Chl.	<1	12.0	15						
	Greywacke/Fault breccia	13	42.0	45.0	2.4	N	0.0	4	11	8	R2	W3											43.2	43.4	bx	42.0	42.4	
											R3	W3	42.9	J	3	57	P	R	CL/Ch	3	12.0	8						
											R3	W2	43.8	J	1	65	ST	R	Chl.	<1	14.0	14						
											R2	W3											44.0	44.4	bx			
	Fault breccia/gouge	14	45.0	47.0	1.7	N	0.0	>10			R2	W3											45.0	46.7	bx			Fault breccia w/ thick infill/gouge
	Greywacke	15	47.0	50.0	2.8	N	0.0	7	12	10	R3	W2	47.7	J	1	55	U	R	Chl.	<1	10.0	18				47.0	47.4	
											R3	W2	48.1	J	1	67	P	R	Chl.	<1	8.0	12						
											R3	W2	48.4	J	3	61	C	R	Chl.	<1	9.0	15						
											R3	W2	48.8	J	1	65	P	R	Chl.	<1	8.0	12						

Core Dia: Depth	ROCK TYPE	RUN	Run Data: Recovery & Other Basic Information: From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft)	Natural Fracture Count	JCR: Average	JCR: Minimum	Strength Index: Strength Index	Strength Index: Weathering Index	Detailed Discontinuity Data: Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	Rubble/Gouge: Gouge: From	To	Type	Broken Core: From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
											R3	W2	49.2	J	1	64	P	R	Chl.	<1	6.0	10						
	Fault breccia/gouge	16	50.0	52.0	2.0	N	0.0	5	8.5	8	R2	W3	50.4	J	4	56	U	R	Chl.	3	12.0	8						
											R3	W2	51.4	J	1	41	U	R	Chl.	2	16.0	9						
											R2	W4														51.6	51.9	
	Graywacke/fault breccia	17	52.0	56.0	3.3	N	0.0	>10	8	8	R3	W2/W3	53	J	5	36	U	R	Chl.	2	10.0	8	52.7	53.0	Chl.			Some greenstone/chlorite gouge
	Greywacke	18	56.0	58.5	2.5	N	0.0	6	9	8	R3	W3														56.0	56.7	
											R3	W3	57	J	3	49	U	R	CL/Ch	3	9.0	8						
											R3	W3	57.5	J	2	75	P	R	Chl.	<1	7.0	10						
											R3	W3	57.9	J	1	17	P	R	Chl.	<1	5.0	9						
	Fault gouge/breccia	19	58.5	63.0	2.3	N	0.0	>10			R2	W3											58.5	60.8	bx			breccia intermixed with gouge
	Fault gouge	20	63.0	64.0	1.0	N	0.0	0															63.0	64.0	CL/Chl.			
	Fault breccia/gouge	21	64.0	65.0	0.8	N	0.0	0			R3	W3											64.3	64.7	bx			
	Greywacke	22	65.0	67.0	2.0	N	0.4	2	13.5	12	R3	W2	65.7	J	1	50	U	R	Chl.	<1	8.0	15						
											R3	W2	66.4	J	1	45	U	R	CL/Ch	2	10.0	12						
	Graywacke	23	67.0	70.0	3.0	N	1.0	8	7	0	R3	W3	67.3	J	1	74	U	R	CL/Ch	1	11.0	10						
											R3	W3	67.6	J	1	50	U	R	CL/Ch	1	12.0	10						
											R3	W3	68	J	2	43	U	R	CL/Ch	4	12.0	7						
											R3	W3	68.4	J	3	70	U	R	CL/Ch	7	10.0	0						
											R3	W3	69	J	1	48	P	SM	Chl.	<1	6.0	7						
	Greywacke/fault gouge/breccia	24	70.0	72.0	1.6	N	0.0	>10			R2	W3											70.1	70.4				
																							71.2	71.5				
	Greywacke	25	72.0	73.0	1.0	N	0.0																			72.0	73.0	
	Graywacke	26	73.0	77.0	4.0	N	1.3	>10	13	11	R3	W3	73.1	J	1	58	P	VR	Chl.	10	15.0							Calcite veins, some brecciation
											R3	W3	74	J	11	45	P	R	Chl.	8	11.0							
	Graywacke	27	77.0	81.5	4.5	N	1.5	>10	6	6	R2/R3	W3	77.4	J	7	61	P	R	Chl.	1-4	10.0	6						
	Graywacke	28	81.5	84.0	2.0	N	0.0	>10															82.4	82.7	CL/Chl.	81.9	83.5	some gouge
	Greenstone/ greywacke	29	84.0	85.0	1.0	N	0.0	3	10	8	R3	W2	84.3	J	1	55	U	R	Chl.	<1	10.0	8						
											R3	W2	84.5	J	1	38	C	VR	Chl.	<1	12.0	15						
											R3	W3	84.8	J	1	56	U	R	Chl.	2	10.0	8						
	Fault gouge	30	85.0	86.5	1.5	N	0.0				R2	W4											85.0	86.5	CL/Chl.			Chlorite gouge
	Fault breccia	31	86.5	90.5	4.0	N	0.0	>10	13	8	R3	W3	87.5	J	1	43	U	R	Chl.	<1	10.0	15				86.5	87.0	Calcite and chlorite clasts
											R3	W4	88	J	8	49	P	R	Chl.	2	8.0	8						
	Greywacke	32	90.5	93.0	2.5	N	0.0	>10	10	13	R3	W3	87.5	J	7	58	U	R	Chl.	1	10.0	13						
											R3	W2	88	J	2	28	U	R	Chl.	<1	12.0	16						
	Greywacke/gouge	33	93.0	97.0	4.0	N	0.0	>10			R2	W3											94.8	95.1	CL/Chl.			Mostly broken core
																							95.6	95.9	CL/Chl.			

Core Dia: Depth	ROCK TYPE	RUN	Run Data: Recovery & Other Basic Information: From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	JCR: Average	Minimum	Strength Index: Strength Index	Weathering Index	Detailed Discontinuity Data: Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	Rubble/Gouge: Gouge: From	To	Type	Broken Core: From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
																							96.7	97.0	CL/Chl.			
	Graywacke/gouge	34	97.0	100.5	3.0	N	0.0	5	13	13	R3	W3	98	J	3	45	P	R	Chl.	2	10.0	13	97.5	98.0	CL/Chl.	97.0	97.5	
											R3	W3	98.1	J	2	30	U	R	Chl.	2	10.0	13	98.3	98.7	CL/Chl.			
	Greywacke	35	100.5	103.0	2.5	N	0.0	6	19	15	R3	W2	100.7	J	5	53	P	R	Chl.	<1	10.0	15						
											R3	W2	101.3	J	1	38	I	R	Chl.	<1	16.0	22						
	Graywacke	36	103.0	108.0	5.0	N	2.0	>10	12	8	R3	W2	103.4	J	4	50	U	R	Chl.	<1	10.0	15						Calcite veins
											R3	W2	103.7	J	5	54	P	R	Chl.	<1	6.0	8						Sample @ 106.5'
											R3	W2	104.8	J	4	78	P	R	Chl.	<1	10.0	15						
	Graywacke	37	108.0	111.0	2.5	N	0.0	5	13	6	R3	W3	108.5	J	2	55	I	R	CL/Ch	<1	15.0	18	109.0	109.3	CL/Chl.			Some fault breccia
											R3	W3	109.9	J	2	74	P	R	Chl.	<1	10.0	6						
											R3	W3	110.3	J	1	71	U	R	CL/Ch	1	16.0	15						
	Graywacke	38	111.0	113.0	2.0	N	0.8	1	15	15	R3	W2	112	J	1	30	U	R	Chl.	<1	10.0	15						
	Graywacke	39	113.0	118.0	5.0	N	0.0	12	13	10	R3	W2	113.2	J	1	50	U	R	Chl.	<1	12.0	18	113.6	113.9	Bx/Chl.			
											R3	W2	113.4	J	7	55	U	R	CL/Ch	1	10.0	10						
											R3	W2	116.6	J	1	65	P	VR	CL/Ch	1	10.0	13						
											R3	W2	117.3	J	1	40	P	VR	Chl.	<1	8.0	15						
	Graywacke	40	118.0	123.0	5.0	N	1.5	6	15	15	R3	W3	118.2	J	1	60	U	R	Chl.	<1	10.0	15						
											R3	W3	118.6	J	5	75	U	R	Chl.	<1	14.0	15						
	Greywacke/breccia	41	123.0	126.0	3.0	N	0.0	6	8	4	R2	W3	123.6	J	5	65	U	R	Chl.	1	12.0	12						
											R2	W3	124.6	J	1	65	U	R	CL/Ch	5	16.0	4						
	Greywacke	42	126.0	129.0	3.0	N	0.5	2	11	10	R2	W3											126.0	126.9	Bx/Chl.			
											R3	W2	127.3	J	1	42	P	R	Chl.	<1	8.0	12	128.0	128.4	Bx/Chl.			
											R3	W2	127.8	J	1	55	P	R	Chl.	<1	6.0	10						
	Greywacke/breccia	43	129.0	133.0	3.8	N	0.0	3	12	12	R1	W4											129.0	131.7	Bx/Chl.			
											R3	W3	131.7	J	2	34	P	R	Chl.	2	10.0	12						
											R3	W3	132.2	J	1	74	P	VR	Chl.	<1	11.0	12						
	Greywacke	44	133.0	137.5	4.1	N	1.0	9	8	4	R2	W4	133.7	J	2	25	P	R	CL/Ch	1	4.0	4						
											R3	W3	134	J	4	58	U	R	Chl.	<1	12.0	12						
											R3	W3	135.6	J	3	31	P	R	Chl.	<1	10.0	10						
	Fault gouge/breccia	45	137.5	142.5	5.0	N	0.0	10	4	0	R1	W4	138.7	J	6	37.0	U	R	Chl./B	7	8.0	0	137.5	140.2	Bx/Chl.			Multiple clay filled fractures
											R2	W4	140.8	J	2	50.0	P	S	CL/Ch	3	4.0	4						
											R3	W3	141	J	2	16.0	U	R	Chl.	1	10.0	8						
	Greywacke	46	142.5	145.5	2.8	N	0.0	5	10	9	R3	W2	142.7	J	2	68	U	R	Chl.	<1	10.0	12						
											R3	W3	144	J	3	60	U	R	Chl.	2	12.0	9						
	Fault gouge/breccia	47	145.5	147.5	1.8	N	0.0	3	2	2	R3	W3														145.5	146.0	
											R1	W4											146.3	147.3	CL/Chl.			
											R3	W3	146	J	3	47	U	VR	CL/Ch	5	12.0	2						

				Run Data																										
				Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																								Gouge			Broken Core			
	Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
		Greywacke	48	147.5	149.5	2.0	N	0.0	3	6	4	R3	W3														147.5	148.8	
												R3	W3	148.8	J	2	61	U	R	CL/Ch	5	10.0	4	149.3	149.5	Bx/Chl.			
												R3	W2	149	J	1	36	P	VR	Chl.	<1	12.0	8						
		Greywacke/fault breccia	49	149.5	153.0	3.5	N	0.0	7	14	12	R3	W2																
												R3	W2	149.9	J	5	50	U	R	Chl.	1	14.0	12						
												R3	W2	152	J	2	75	U	R	Chl.	<1	10.0	15						
		Fault breccia	50	153.0	158.0	5.0	N	0.0	5	2	2	R1	W4											153.0	154.5	Chl./Bx			Slickensides; fault
												R2	W4	154.5	J	3	65	U	R	Chl.	2	12.0	2						Fault breccia, greenstone/chlorite melange
												R3	W3	156	J	2	25	U	R	Chl.	2	12.0	2						
		Fault breccia	51	158.0	163.0	5.0	N	2.0	2	5	2	R3	W3	158.8	J	1	54	U	R	Chl.	1	10.0	8	162.4	163.0	Chl./Bx			Slickensides; fault
												R3	W3	160.1	J	1	37	P	SM	Chl.	1	6.0	2						Fault breccia, greenstone/chlorite melange
		Greywacke/fault breccia	52	163.0	168.0	3.4	N	0.0	7	4.5	4	R2	W3/W4	163.5	J	5	58	P	R	Chl.	1	10.0	4	163.0	163.5	Chl./Bx			Slickensides; fault
												R2	W3/W4	164.8	J	2	38	U	R	Chl.	1	12.0	5						Fault breccia, greenstone/chlorite melange
		Fault breccia/graywacke	53	168.0	173.0	5.0	N	0.0	3	10	4	R2	W3	169	J	1	20	U	SM	Chl.	1	10.0	4						Slickensides
												R3	W3	169.8	J	1	58	U	R	Chl.	<1	12.0	14						
												R2	W4	172.7	J	1	51	U	R	Chl./Fe	3	12.0	12						
		Limestone	54	173.0	178.0	5.0	N	1.0	10	14	2	R3	W3	173	J	1	50	U	R	Chl./Fe	3	10.0	2						Limestone contact @173'
												R3	W2	173.2	J	2	61	U	R	Ca	1	12.0	18						Low to medium grade
												R3	W2	174.2	J	2	58	U	R	Ca	1	12.0	18						
												R3	W2	174.5	J	5	67	U	R	Ca/Fe	1	8.0	15						
												R3	W2	175.8	J	1	51	U	R	Ca	1	8.0	15						
		Limestone	55	178.0	183.0	5.0	N	1.5	7	18	15	R3	W2	178.2	J	3	55	U	VR	Ca/Fe	1	13.0	20						Sample @ 180-181'
												R3	W2	179.2	J	1	60	U	R	FeOx	<1	10.0	18						Low to medium grade
												R3	W2	179.8	J	1	60	I	R	Ca/Fe	1	16.0	20						
												R3	W2	181.5	J	1	52	I	R	Ca/Fe	<1	13.0	18						
												R3	W2	182	J	1	36	U	R	Ca/Fe	1	10.0	15						
		Limestone	56	183.0	185.5	2.5	N	1.0	2	18	18	R3	W2	183	J	2	61	U	R	Ca	<1	12.0	18						Low grade
		Limestone	57	185.5	186.0	0.5	N	0.0	1	14	14	R3	W2	185.8	J	1	64	U	R	Ca/Fe	<1	9.0	14						Low grade
		Limestone	58	186.0	188.0	1.5	N	0.6	1	15	15	R3	W2	187.2	J	1	68	U	R	Ca/Fe	<1	10.0	15						Low grade
		Limestone	59	188.0	193.0	4.5	N	1.0	5	14	13	R3	W2	188.9	J	4	43	U	R	Ca/Fe	<1	10.0	15						Low to medium grade
												R3	W2	192	J	1	38	U	R	Ca/Fe	<1	11.0	13						
		Limestone	60	193.0	197.5	4.5	N	0.5	5	15	14	R3	W2	195.4	J	2	41	U	R	Ca/Fe	<1	10.0	15						Low grade
												R3	W2	195.8	J	1	68	U	R	Ca	<1	11.0	14						
												R3	W2	196.3	J	2	73	U	R	Ca/Fe	<1	8.0	15						
		Limestone	61	197.5	201.0	3.5	N	0.5	1	15	15	R3	W2	198	J	1	64	P	R	Ca	<1	8.0	15						
		Limestone	62	201.0	203.0	2.0	N	0.7	1	20	20	R3	W2	202.7	J	1	61	ST	R	Ca	<1	14.0	20						
		Limestone	63	203.0	203.5	0.5	N	0.0	0			R3	W2																

				Run Data																											
				Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge							
																								Gouge			Broken Core				
	Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
		Limestone	64	203.5	204.0	0.5	N	0.0	1	15	15	R3	W2	203.8	J	1	55	P	R	Ca	<1	8.0	15						
		Limestone	65	204.0	208.0	4.0	N	0.0	6	15	15	R3	W2	205.3	J	4	67	I	R	Ca/Fe	<1	16.0	18						Calcite veins
												R3	W2	206.8	J	1	58	U	R	Ca	<1	14.0	15						
												R3	W2	207.6	J	1	75	U	R	Ca	<1	13.0	15						
		Limestone	66	208.0	209.0	1.0	N	0.0	1	14	14	R3	W2	208.7	J	1	55	P	VR	Ca/Fe	<1	9.0	14						
		Limestone	67	209.0	210.5	1.5	N	0.0	2	15	15	R3	W2	209.8	J	2	72	P	VR	Ca/Fe	<1	10.0	15						
		Limestone	68	210.5	213.0	2.5	N	0.0	5	16	14	R3	W2	211.1	J	4		U	R	Ca	<1	10.0	18						
												R3	W2	212.2	J	1		P	R	Ca	<1	8.0	14						
		Limestone	69	213.0	218.0	5.0	N	1.5	4	15	15	R3	W2	213.9	J	4	70	U	R	Ca/Fe	<1	10.0	15						
		Limestone	70	218.0	222.5	4.5	N	0.5	7	16.5	15	R3	W2	219.3	J	5	67	U	VR	Ca	<1	14.0	18						
												R3	W2	219.9	J	2	65	U	R	Ca	<1	12.0	15						
		Limestone	71	222.5	224.0	1.5	N	0.0	1	15	15	R3	W2	222.9	J	1	66	U	R	Ca	<1	10.0	15						
		Limestone	72	224.0	224.5	0.5	N	0.0	0			R3	W2														224.0	224.5	
		Limestone	73	224.5	226.5	2.0	N	0.0	0			R3	W2														224.5	226.5	Drilling induced fractures
		Limestone	74	226.5	229.0	2.5	N	0.5	4	15	14	R3	W2	227.1	J	4	53	P	R	Ca	<1	9.0	15						
												R3	W2	228.1	J	1	58	U	R	Ca	<1	11.0	18						
		Limestone	75	229.0	229.5	0.5	N	0.0	0																				
		Limestone	77	233.0	234.5	1.5	N	0.0	3	14	12	R3	W2	233.3	J	1	68	P	R	Ca/Fe	<1	8.0	12						
												R3	W2	233.5	J	1	60	P	VR	Ca	<1	10.0	15						
												R3	W2	233.8	J	1	62	P	VR	Ca	<1	11.0	14						
		Limestone	80	240.5	243.0	2.0	N	1.6	1	15	15	R3	W2	242.2	J	1	78	U	R	Ca	<1	10.0	15						High grade with calcite veins
		Limestone	81	243.0	244.5	1.5	N	0.5	2	18	18	R3	W2	243.2	J	1	43	U	R	Ca	<1	12.0	18						
		Limestone	82	244.5	249.5	5.0	N	3.5	2	19	18	R3	W2	247.5	J	1	68	U	R	Ca	<1	12.0	18						Medium grade, calcite veins
												R3	W2	248.8	J	1	57	U	R	Ca	<1	14.0	20						
		Limestone	76	229.5	233.0	3.5	N	1.0	5	16.5	15	R3	W2	330.1	J	4	53	P	R	Ca	<1	9.0	15						
												R3	W2	332.1	J	1	58	U	R	Ca	<1	11.0	18						
		Limestone	78	234.5	235.5	1.0	N	0.7	1	18	18	R3	W2	335.2	J	1	50	U	VR	Ca	<1	12.0	18						
		Limestone	79	235.5	240.5	5.0	N	0.0	6	18	15	R3	W2	335.7	J	2	61	P	R	Ca	<1	10.0	15						
												R3	W2	336.8	J	3	48	U	R	Ca	<1	12.0	18						Bottom 2': a lot of calcite infill/veins
												R3	W2	339	J	1	46	U	R	Ca	<1	13.0	20						Point load test @ 237'
		Limestone	83	249.5	250.0	0.5	N	0.0	0			R3	W2																
		Limestone	84	250.0	253.0	3.0	N	1.5	5	16	15	R3	W2	250.1	J	1	42	ST	R	Ca	<1	14.0	18						
												R3	W2	250.6	J	3	40	U	R	Ca	<1	10.0	15						
												R3	W2	250.8	J	1	65	U	R	Ca	<1	10.0	15						
		Limestone	85	253.0	258.0	5.0	N	2.0	4	16.5	15	R3	W2	256.1	J	2	73	U	R	Ca/Fe	<1	11.0	15						
												R3	W2	257.1	J	2	44	ST	R	Ca	<1	15.0	18						
		Limestone	86	258.0	263.0	5.0	N	3.0	4	16.5	15	R3	W2	259.5	J	3	67	P	R	Ca	<1	9.0	15						

Core Dia: Depth	ROCK TYPE	RUN	Run Data: Recovery & Other Basic Information: From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	JCR: Average	JCR: Minimum	Strength Index	Weathering Index	Detailed Discontinuity Data: Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	Rubble/Gouge: Gouge: From	To	Type	Broken Core: From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
											R3	W2	260	J	1	60	U	R	Ca/Fe	<1	12.0	18						
	Limestone	87	263.0	268.0	5.0	N	2.5	2	16	15	R3	W2	263.4	J	1	68	P	R	Ca	<1	10.0	15						
											R3	W2	267	J	1	46	U	R	Ca	1	12.0	17						
	Limestone	88	268.0	273.0	5.0	N	2.0	8	14	12	R3	W2	268.3	J	5	30	U	R	Ca	<1	10.0	15						High grade to 271'
											R3	W2	270.8	J	1	63	C	R	Ca	3	10.0	12						Low grade from 271' to 273'
											R3	W2	271.5	J	2	38	U	R	Ca	<1	8.0	15						
	Limestone	89	273.0	278.0	5.0	N	0.5	8	15	14	R3	W2	273.2	J	5	66	U	R	Ca	<1	10.0	15						
											R3	W2	273.6	J	1	57	U	R	Ca	<1	10.0	17						
											R3	W2	276.3	J	2	46	U	R	Ca	<1	8.0	14						
	Limestone	90	278.0	283.0	5.0	N	3.5	4	15	14	R3	W2	280	J	2	48	U	R	Ca	<1	10.0	15						
											R3	W2	281.2	J	1	68	P	R	Ca	<1	9.0	14						
											R3	W2	281.7	J	1	43	U	R	Ca	<1	9.0	15						
	Limestone	91	283.0	285.5	2.5	N	1.9	1	17	17	R3	W2	285	J	1	64	U	R	Ca	<1	11.0	17						
	Limestone	92	285.5	290.5	5.0	N	1.0	6	16.5	15	R3	W2	286.3	J	3	52	U	R	Ca/Fe	<1	14.0	18						Medium to high grade
											R3	W2	287.3	J	3	59	P	VR	Ca/Fe	<1	10.0	15						Point load test @ 290'
	Limestone	93	290.5	291.5	1.0	N	0.6	0			R3	W2														290.5	291.0	
	Limestone	94	291.5	292.0	0.5	N	0.0	0			R3	W2														291.5	292.0	
	Limestone	95	292.0	293.0	1.0	N	0.0	0			R3	W2																Calcite veins
	Limestone	96	293.0	298.0	5.0	N	3.3	5	17	16	R3	W2	294	J	3	57	U	R	Ca	<1	11.0	18						High grade with calcite veins
											R3	W2	297.4	J	2	55	P	VR	Ca	<1	10.0	16						
	Limestone	97	298.0	303.0	5.0	N	3.4	3	16	16	R3	W2	300	J	3	41	U	R	Ca/Fe	<1	10.0	16						Medium to high grade
	Limestone	98	303.0	308.0	5.0	N	0.0	1	15	15	R3	W2														303.0	304.0	Medium to high grade
											R3	W2	304.7	J	1	42	U	R	Ca/Fe	<1	10.0	15						
	Limestone	99	308.0	313.0	5.0	N	1.0	1	15	15	R3	W2	310	J	1	40	U	R	Ca/Fe	<1	10.0	15						Intermittent soft chlorite infill with pyrite from 310.5' to 313'
																												Medium to high grade
	Limestone	100	313.0	318.0	5.0	N	2.0	5	16	15	R3	W2	313.3	J	3	65	U	R	Ca/Fe	<1	10.0	15						
											R3	W2	315.5	J	2	48	U	R	Ca/Fe	<1	11.0	17						
	Limestone	101	318.0	323.0	5.0	N	4.0	5	17	15	R3	W2	320	J	1	38	U	R	Ca	<1	10.0	15						
											R3	W2	321.2	J	4	49	U	R	Ca/Fe	<1	12.0	19						
	Limestone	102	323.0	325.5	2.5	N	1.5	0			R3	W2																
	Limestone	103	325.5	326.5	1.0	N	1.0	0			R3	W2																Low grade
	Limestone	104	326.5	328.0	1.5	N	1.2	0			R3	W2																
	Limestone	105	328.0	333.0	4.4	N	1.6	7	18	12	R3	W2	328.6	J	1	50	P	R	Cl	C	14.0	20						
														J	1	40	P	R	Cl	C	10.0	20						
														J	2	60	P	VR	Cl	1	16.0	20						
														J	1	45	P	R	Ca	1	10.0	12						
	Limestone	106	333.0	338.0	5.0	N	2.9	6	10	6	R3	W2	333.7	J	1	55	P	R	Ca	1	10.0	12						

				Run Data																										
				Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																								Gouge			Broken Core			
	Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
														335.2	V	1	20	P	R	Ca	2	8.0	6						
														336.9	J	1	65	P	R	Ca	1	14.0	12						
		Limestone	107	338.0	339.0	0.9	N	0.9	0			R3	W2																Solid recovery
		Limestone	108	339.0	343.0	4.0	N	2.5	6	14	6	R3	W2	339.3	J	1	50	P	R	CL	2	10.0	6						
														339.8	J	1	60	P	VR	CL	C	16.0	20						
														340.1	J	1	70	P	R	CL	C	14.0	20						
														340.8	J	1	70	P	VR	Ca	1	16.0	12						
														342.6	J	1	50	P	R	Ca	1	14.0	12						
		Limestone	109	343.0	348.0	4.7	N	3.4	4	17	12	R3	W2	343.5	J	1	40	P	R	CL	1	10.0	25						Healed fracture
														344.9	J	2	60	P	R	CL	1	10.0	12						
														345.8	J	1	40	P	R	CL	C	8.0	20						
																											346.9	347.4	
														347.6	J	1	50	P	R	CL	1	10.0	12						
		Limestone	110	348.0	350.0	2.3	N	1.7	2	16	12	R3	W2	348.1	J	1	60	P	R	CL	2	8.0	12						Extra recovery
														349	J	1	40	P	R	CL	C	10.0	20						
		Limestone	111	350.0	353.0	2.8	N	2.8	2	20	20	R3	W2	350.9	J	1	35	ST	R	Ca	1	10.0	20						Re-broken previously healed joint
														351.5	J	1	55	P	R	Ca	1	12.0	20						
		Limestone	112	353.0	358.0	5.0	N	4.6	5			R3	W2														356.1	356.5	Rubble recovered, rest of run solid with no natural fractures
		Limestone/chert	113	358.0	363.0	4.7	N	3.3	0.7	12	12	R4	W2											361.5	261.8	Gc			Large chert nodules in run
														362.3	J	1	30	C	R	CL	2	8.0	12						
		Limestone	114	363.0	367.0	4.0	N	3.0	6	6	6	R3	W2	364.7	J	1	70	IR	R	CL	3	12.0	6						
																											366.7	367.0	broken core with clay infilling
		Limestone	115	367.0	368.5	1.2	N	0.6	0			R3	W2																Core substantially milled, no natural breaks
		Limestone	116	368.5	371.0	2.3	N	2.3	0			R3	W2																Run mechanically broken, no natural fractures
		Limestone	117	371.0	373.0	2.0	N	1.3	0	20	20	R3	W2	371.3	J	1	60	P	S			6.0	20						
																											371.6	371.9	Run mechanically fractured, no natural fractures
		Limestone	118	373.0	378.0	5.0	N	5.0	0			R3	W2																
		Limestone	119	378.0	383.0	5.0	N	5.0	0			R3	W2																
		Limestone	120	383.0	388.0	5.0	N	4.4	6	17	12	R3	W2	384	J	1	70	P	VR	CL	2	16.0	12						
														385.2	V	1	30	P	R	Ca	1	8.0	12						
														386.4	J	1	60	IR	VR	CL	3	18.0	12						
														387.2	J	1	50	IR	VR	CL	2	16.0	12						
														387.5	J	1	50	P	R	CL	1	14.0	20						
		Limestone	121	388.0	393.0	4.7	N	1.7	7	12	6	R3	W2	389.3	J	1	50	P	VR	CL	2	16.0	12						Run highly fractued
														390.1	J	1	60	P	VR	Gc	4	18.0	12						
														391.2	J	1	45	P	VR	Gc	8	16.0	6						
														392	J	1	50	P	R	CL	1	8.0	20						

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	122	392?	393.0	0.7	N	0.7	0			R3	W2																
	Limestone	123	393.0	398.0	4.7	N	4.4	2	3	0	R3	W2	395.9	J	1	P	R	CL	3	14	6.0							
													396.9	J	1	P	R	CL	6	10	0.0							
	Limestone	124	398.0	403.0	5.0	N	3.4	6	9	6	R3	W2	399.8	J	1	50	U	R	CL	1	14.0	12						
													400.5	J	1	50	P	VR	Gc	8	18.0	6						
	Limestone	125	403.0	408.0	5.0	N	5.0	0			R3	W2																
	Limestone	126	408.0	413.0	5.0	N	5.0	0			R3	W2																
	Limestone	127	413.0	418.0	4.6	N	4.1	2	16	12	R3	W2	413.4	J	1	50	IR	VR	CL	1	16.0	12						
													414.8	J	1	45	P	R	CL	C	12.0	20						
	Limestone	128	418.0	423.0	4.9	N	3.8	7	13	6	R3	W2														419.2	419.4	
													420.7	J	1	70	P	R	CL	C	10.0	20						Break through chert nodule
													421.5	J	1	30	P	R	Gc	8	8.0	6						
																										422.2	422.3	
	Limestone w/ frequent chert bands	129	423.0	428.0	5.0	Y	3.5	10			R3	W2	423.3	J	1	50	P	R	CL	3	10.0	6						
													424.2	J	1	40	P	R	CL	2	12.0	6						
													427.5	J	1	50	P	R	Ca	3	10.0	12						
	Limestone	130	428.0	432.0	4.0	N	1.8	5	6	6	R3	W2	429.2	J	1	50	P	R	Sc	2	12.0	6						
																										430.1	430.3	
	Limestone	131	432.0	433.0	1.0	N	1.0	0			R3	W2																
	Limestone	132	433.0	435.0	1.3	N	1.1	2	12	12	R3	W2	434.4	J	R	50	P	R	Ca	1	14.0	12						Milled rubble recovered at top of run
	Limestone	133	435.0	436.5	1.5	N	1.5	1	12	12	R3	W2	435.9	J	1	40	P	VR	CL	1	16.0	12						

Golder Associates

PERMANENTE QUARRY RMR SYSTEM - RECORD OF GEOTECHNICAL PARAMETERS

Project No.	063-7109.100	Drilling Method	From 15.0 To 268
Borehole #	GT 1-4	Triple Tube HQ	
Elevation	1119	Sheet	1 of 8
N -213	E -5155	Logged by	IT
Azimuth	NA	Drill Rig	Ruen
Inclination	-90		
Ref. Point			

Core Dia: Depth	ROCK TYPE	RUN	Run Data: Recovery & Other Basic Information: From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	JCR: Average	Minimum	Strength Index: Strength Index	Weathering Index	Detailed Discontinuity Data: Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	Rubble/Gouge: Gouge: From	To	Type	Broken Core: From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
HQ	MetaBasalt	1	15.0	17.0	1.3	NO	0.0	10	0	0	R3	W4																Pieces of basalt in clay
	MetaBasalt	2	17.0	18.0	0.8	NO	0.0	10	0	0	R3	W4																
	MetaBasalt	3	18.0	20.5	2.2	NO	0.8	2	18	16	R3	W4	18.2	J	1	70	P	VR	CL	2	16.0	16						Solid recovery
													18.8	J	1	40	P	R	CL	C	10.0	20						
	MetaBasalt healed fault zone-fine breccia	4	20.5	23.0	2.5	NO	2.1	3	19	16	R3	W4	21.7	J	1	75	C	R	CL	C	12.0	20						
													22.3	J	1	65	P	R	CL	2	8.0	16						
													22.4	J	1	45	P	R	CL	C	14.0	20						
	MetaBasalt - Ca healed breccia	5	23.0	27.5	2.3	NO	1.5	10	20	20	R3	W4	23.5	J	1	50	P	S	CL	C	6.0	20						Below 24.7 clay supported fragments
	MetaBasalt	6	27.5	30.0	0.0																							no recovery
	MetaBasalt	7	30.0	33.0	1.1	NO	0.6	1	6	6	R2	W4	32.6	J	1	40	P	R	CL	10	8.0	6						Cay below break may be drill related? Clay to end of Run
	MetaBasalt	8	33.0	38.0	4.2	NO	2.0	10	15	12	R2	W4	34.5	J	1	15	P	R	CL	1	8.0	12						Break not quite continuous throughout, truncated on lower end b other break at 34.7
													34.7	J	1	50	P	R	CL	2	10.0	12						
													36	J	1	35	P	R	CL	C	8.0	20						Below 36.9 highly weathered clayey basalt
	Weathered Basalt	9	38.0	43.0	3.8	NO	0.0	50	2	0	S4	W4																Basalt in run highly weathered into clay, Ca veins remain solid i soft matrix
																												Run extensively weathered to clay except places where Ca veinin is so extensive that rock held together
	Weathered Basalt	10	43.0	48.0	4.6	NO	1.1	20	2	0	R2	W4																Some greenstone clasts appearing toward end, greenstone dominant below 47.2
	Fault Breccia	11	48.0	53.0	4.2	NO	0.8	50	12	12	R2	W4	51.3	V	1	30	C	R	CA	1	12.0	12	48.0	49.5	CL			Greenstone clay gouge at top of run S4
	Fault Breccia	12	53.0	54.0	0.5	NO	0.0		12	12	R2	W4																Entire recovery broken up
	Greenstone	13	54.0	57.0	2.3	NO	0.8	10	5	0	R2	W4											56.3	57.0	CL			Fault gouge below 56.3, top of run solid but weak
	Greenstone	14	57.0	59.0	1.5	NO	0.0	10	5	0	R2/S4	W4	58.7	B	3	70	P	S	\	\	6.0	12	57.0	57.8	CL			Greenstone fault gouge, some solid fragments suspended, breaks along bedding?
	Greenstone	15	59.0	63.0	4.0	NO	3.7	2	12	12	R3	W3	60.5	V	1	30	P	R	CA	1	8.0	12						Core solid but weak, top .3 ft fault gouge
													61.9	V	1	30	P	R	CA	2	12.0	12						
	Fault Breccia	16	63.0	65.0	2.0	NO	0.0	10	6	0	R2	W3																Entire run brecciated, gouge in places
	Fault Breccia	17	65.0	68.5	3.5	NO	0.0	40	0	0	S4	W4											65.0	68.5	GC			Entire run soft clayey gouge, original structures visible but a converted to soft clay
	Greenstone gouge	18	68.5	71.0	1.8	NO	0.0	20	0	0	S4	W4											68.5	71.0	GC			Entire run clayey gouge w/ gravels
	Metabasalt/greenstone	19	71.0	75.0	3.7	NO	0.8	10	12	12	R2	W4	72.6	J	4	60	P	R	CL	1	10.0	12						Breaks through thin greenstone clay bands within metabasalt
													72.9	J	1	20	P	R	CL	1	12.0	12						
													73.3	J	1	30	P	R	CL	2	14.0	12						Breaks along greenstone clay flow bands .
													74	J	1	30	P	R	CL	2	14.0	12						Below 74.3 gouge gc metabasalt
	Metabasalt	20	75.0	80.0	4.9	NO	3.6	10	6	0	R3	W4											75.8	76.4	CL			Solid core except for gouge zones
																							78.2	78.4	GC			
																							78.7	79.6	CL			sample for point load testing 77.4-77.9
	Metabasalt	21	80.0	82.0	1.4	NO	1.3	10	6	0	R2	W4											81.1	82.0	GC			Weak gougy rock

				Run Data																												
				Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge								
																								Gouge			Broken Core					
	Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
		Greenstone/metabasalt	22	82.0	85.5	3.5	NO	2.1	10	12	6	R2	W4	82.8	J	1	30	P	S	CA	2	12.0							Increasing gouge below 83.8
		MetaBasalt/Greenstone	23	85.5	90.0	4.5	NO	1.8	25	6	0	R1	W4																Entire run very weak, friable, varyingly gougy
		Greenstone/Metabasalt 24		90.0	93.0	3.0	NO	3.0	0	25	25	R3	W3	92.7	C														Solid unbroken run, point load 91.4-91.7
		Metabasalt	25	93.0	97.5	4.3	NO	3.4	8	15	12	R3	W3	93.9	J	1	25	P	R	GRE ENST	1	14.0	12						bottom, of break enters brecciated zone 0.3 ft
														95.2	J	1	20	P	R	CA	2	8.0	12						
														96.5	J	1	50	P	S	CL	C	6.0	20						back into soft greenstone below 96.5
		Greenstone	26	97.5	102.5	5.0	NO	0.0	25	6	0	R2	W4																run composed of solid clasts within clayey matrix usually in thi bands, sample 98.4-98.9
		Metabasalt	27	102.5	107.0	4.2	NO	2.8	5	12	12	R2	W4	104.4	J	1	50	IR	R	CL	1	10.0	12						
														105.6	J	1	30	P	R	CA	1	8.0	12						
		Metabasalt run fractured clayey gouge	28	107.0	110.5	3.4	NO	1.2	10	6	6	R2	W4	1090	J	1	30	P	R	CL	3	14.0	6						Contact between relatively solid section above and clayey gouge below
		Metabasalt	29	110.5	113.0	2.3	NO	1.4	8	6	6	R2	W4	112.1	J	5	40	P	R	GC	2	8.0	6						Sample 110.5-111 break through weak brittle rock ;gougy
		Metabasalt	30	113.0	118.0	4.7	NO	2.4	15	12	12	R2	W4	116	J	1	30	P	R	CA	1	8.0	12						
														117	J	1	30	P	R	CA	1	8.0	12						
		Metabasalt	31	118.0	123.0	4.7	NO	1.9	20	16	12	R2	W4	119.1	J	1	40	P	S	CL	1	6.0	20						preexisting separation, obvious crack but only came apart upon handling
														120.2	J	1	50	P	VR	CA	1	18.0	12				122.0	123.0	entire run brittle but bottom entirely broken
		Metabasalt 32		123.0	128.0	5.0	NO	4.5	5	6	6	R2	W4	127.5	J	1	30	P	S	CL	3	6.0	6	127.5	128.0	cl			
		Metabasalt gouge	33	128.0	132.5	2.8	NO	0.0	25	6	6	S4	W4											128.0	132.5	gc			entire run milled gravely clay
		Metabasalt gouge	34	132.5	136.0	1.0	NO	0.4	10	0	0	S4	W4																
		Fault Breccia	35	136.0	138.0	1.3	NO	0.0	10	12	12	R2	W4	137.6	J	1	40	P	R	CL	C	8.0	12						
		Fault Breccia	36	138.0	140.0	2.0	NO	1.5	3	6	6	R2	W4	138.3	J	1	60	P	R	CL	3	10.0	6						sample 139.4-140
		Metabasalt	37	140.0	142.5	2.3	NO	2.2	1	6	6	R2	W4	141.9	J	1	40	P	VR	CL	2	16.0	6						run appears like welded gouge-soft sed deformation features throughout
		Metabasalt	38	142.5	146.0	3.2	NO	1.6	25	6	0	R1	W4																run solid but rock either friable or tight s6 clay
		Metabasalt	39	146.0	149.0	1.6	NO	0.0	10	12	12	R2	W4	147.9	J	3	45	P	R	CL	1	12.0	12	148.7	149.0	GC			several similarly oriented breaks throughout "solid" upper portion of run
		Metabasalt	40	149.0	150.0	1.0	NO	0.0	10	6	6	R2	W4																run broken up- weak brittle rock
		Greenstone/MetaBasalt	41	150.0	151.5	1.5	NO	0.6	20	20	20	R2	W4	130.7	J	1	50	P	S	\	\	6.0	20	150.5	151.5	GC			milled greenstone gouge becoming increasingly rich toward end of run
		Greenstone/ MetaBasalt	42	151.5	153.0	1.5	NO	0.0	10	6	0	R1	W4																entire run gouge/clay rich fractured/ weak
		Metabasalt	43	153.0	155.0	1.6	NO	0.0	20	6	0	R1	W4																entire run milled gravel/ clay, core barrel holds together in split
		Metabasalt	44	155.0	157.0	1.6	NO	0.0	10	6	6	R2	W4	155.5	J	1	40	P	R	GC	3	10.0	6						break along contact with clayey greenstone bit - one of several gouge areas
		Metabasalt	45	157.0	160.0	3.0	NO	1.4	10	25	25	R1	W4	157.3	J	1	40	P	S	CL	1	6.0	25						run extensively broken due to weakness but no natural break observable, thin clay infill common but not extensive
		Metabasalt	46	160.0	163.0	3.0	NO	0.0	10	25	25	R1	W4																no observable breaks through core, entire run fragmented
		Metabasalt	47	163.0	166.0	3.0	NO	2.0	10	16	16	R1	W4																entire run brittle fragmented
		Metabasalt	48	166.0	169.0	2.8	NO	0.0	10	18	16	R1	W4	167	J	1	10	P	R	CL	0.5	10.0	20						brittle, fragmented
														168.3	J	1	35	P	R	CL	1	8.0	16						
		Metabasalt	49	169.0	171.0	1.8	NO	0.0		20	20	R1	W4	171.2	J	1	45	P	R	CL	0.5	12.0	20						brittle, fragmented
		Metabasalt	50	171.0	174.5	2.5	NO	0.4	20	0	0	R1	W4	173	J	1	60	P	S	CL	40	6.0	0	173.8	174.5	GC			clayey gouge between solid material, entire run highly fractured
		Metabasalt	51	171.0	174.5	2.5	NO	0.4	20	9	6	R1	W4	174.9	J	1	55	P	S	CL	80	6.0	0	175.0	175.8				
														176.2	J	1	67	P	SR	CL	1	8.0	6						

				Run Data										Detailed Discontinuity Data									Rubble/Gouge					
				Recovery & Other Basic Information						JCR		Strength Index											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt	52	178.0	183.0	4.2	NO	0.0	10	0	0	R1	W4	178.5	J	1	65	P	S	CL	10	6.0	0						breaks along clay gouge layers
													179.1	J	2	50	P	R	CL	5	8.0	0						entire run highly fractured
	Fault Breccia	53	183.0	186.0	2.3	NO	0.6	25	0	0	R2	W4											183.6	186.0	Gc			
	Fault Breccia	54	186.0	188.5	2.3	NO	0.0	25	0	0	S4	W4											186.0	188.5	Gc			entire run gouge
	Fault Breccia	55	188.5	192.0	3.3	NO	1.2	25	0	0	S4	W4	190.5	J	1	50	P	VR	CL	4	20.0	6	1885.5	190	GC			
													190.7	J	1	40	P	R	CL	3	8.0	6						complete break through brecciated core
	Fault Breccia	56	192.0	194.0	1.2	NO	0.0	10	6	6	R2	W4	193.6	J	1	60	P	S	CL	2	2.0	6	192.8	194.0	GC			run either shattered rock or milled gouge
	Fault Breccia	57	194.0	199.0	4.1	NO	0.0		13	6	R1	W4	197.9	J	1.0	60	P	S	CL	2	8.0	6						sample 196.6-197.3
													198.8	J	1.0	65	S	SR	CL	1	8.0	20	195.0	196.5	GC			
	Fault Breccia	58	199.0	203.0	4.0	NO	0.5	30	25	25	R1	W4	202.5	C	1	45	P					25						metabasalt gouge/ greenstone contact sample 201.6-202.4
	Fault Breccia	59	203.0	208.0	4.9	NO	0.7	40	25	25	S4	W4	203.7	C	1	30	5					25	203.7	208.0	GC			greenstone/ metabasalt contact- other end of unit at bottom of previous run
																												solid gravely clay containing some large >6" clasts, run falls apar easily
	Greenstone	60	208.0	213.0	5.0	NO	5.0	0	25	12	R1	W4																very soft, easily broken into pieces but removed intact
	Greenstone	61	213.0	218.0	5.0	NO	5.0	0	6	0	R1	W4																
	Greenstone	62	218.0	221.5	3.7	NO	2.8	1	6	6	R2	W4	220.4	J	1	35	P	S	CL	4	6.0	6						harder, mostly intact/ sample 218-218.3
	Greenstone	63	221.5	223.0	1.5	NO	1.5	1	12	12	R2	W2	221.9	j	1	40	P	S	CL	1	6.0	12						
	Greenstone	64	223.0	228.0	4.2	NO	3.9	10	8	6	R1	W4	224.9	J	1	65	P	R	CA	1	14.0	6				224.1	224.6	
													225.1	J	1	50	P	VR	CL	1	16.0	12						highly fractured basalt inclusion, fracture angles average 60 degrees
													227.2	J	1	20	U	R	CA	2	8.0	6						
	Greenstone/ metabasalt	65	228.0	231.0	2.8	NO	0.7	25	12	12	S4	W4	230.1	C	1	60	C	R	CL	1	10.0	12	228.0	230.2				contact between gougy material above and solid graywacke? Below . Sample 230.3-231
	Metabasalt	66	231.0	233.0	1.7	NO	1.2	6	12	12	R2	W3	231.8	J	3	30	P	R	CA	C	12.0	12						multiple fractures, maybe drill induced through brittle rock
	Metabasalt	67	233.0	235.5	2.2	NO	0.4	5	4	0	R2	W3	233.6	J	1	30	P	R	CL	3	10.0	6						entire run brittle, highly fractured
													234.2	J	1	70	P	R	CL	5	8.0	0						
													234.6	J	1	30	P	S	CL	2	6.0	6						
	Metabasalt	68	235.5	239.5	3.9	NO	3.4	4	10	6	R2	W3	236	J	1	35	P	R	CL	1	8.0	12						
													237.1	J	1	40	P	S	CA	C	6.0	12						
													238.1	J	1	40	P	R	CL	2	10.0	6						sample 238.5-239.1 break along edge of thick ca vein
													239.2	J	1	40	P	R	CA	1	10.0	12						
	Metabasalt	69	239.5	240.5	0.7	NO	0.0	2	12	12	R2	W3																broken run
	Metabasalt	70	240.5	243.0	2.0	NO	1.1	3	6	0	R2	W3	241.1	J	1	50	P	S	CL	C	6.0	12						
													241.6	J	1	40	P	R	GC	15	12.0	0						
													243.5	J	1	60	P	S	CL	C	6.0	12						
	MetaBasalt	71	243.0	248.0	4.8	NO	2.1	10	12	12	R2	W3	243.9	J	1	30	P	R	L	C	8.0	12						transition between relatively unbroken core and highly fractured 245.9
													244.7	J	1	55	P	S	GC	2	6.0	12						sample 244-244.7
	Metabasalt	72	248.0	250.0	1.8	NO	0.0	0.7	6	0	R2	W3	248.7	J	1	40	P	R	CA	2	8.0	12						
													249.6	J	1	30	P	S	CL	100	6.0	0						contact between solid rock and clay gouge
	Metabasalt	73	250.0	252.5	2.4	NO	0.0	10	8	6	R2	W3	250.9	J	1	30	P	R	CL		10.0	6						

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													251.5	J	1	30	P	R	CA		12.0	6						
													252	J	1	40	P	R	\	\	8.0	12						
	Metabasalt	74	252.5	255.5	3.0	NO	1.9	4	12	12	R2	W4	253.1	J	2	60	P	R	\	\	10.0	12						brittle rock moderately fractured, few Ca veins
													255	J	2	70	P	R	CL	1	10.0	12						
	Metabasalt	75	255.5	260.0	4.3	NO	2.3	15	10	6	R2	W4	255.7	J	1	25	P	R	CA	2	8.0	12						
													257.8	J	1	40	P	R	CL	1	12.0	12						
													258	J	1	40	P	R	CL	2	10.0	6	258.7	260.0	GC			gouge at bottom of run
	Metabasalt	76	260.0	263.0	3.0	NO	0.0	25	6	6	R2	W4											260.0	261.3	GC			gouge with some large solid clasts
																							261.7	262.1	GC			
	Metabasalt	77	263.0	266.0	2.5	NO	1.2	15	6	6	R2	W4	264.7	J	2	40	P	R	CL	2	14.0	6	264.1	264.4				
																							265.2	266.0				
	Metabasalt	78	266.0	268.0	1.7	NO	1.7	25	6	6	R2	W4											267.0	268.0				

APPENDIX 9.B

Point Load 2008 Drilling

Hole Number	Depth	Lithology	Test Type	Gauge Load	Failure Type	Is_{50}
	m		(D or A)	(lbf)	1, 2, 3, 4 or 5	(lbf/in^2)
GT1-1-08	14.0	Metabasalt	D	1210	1	216
GT1-1-08	14.0	Metabasalt	A	1195	4	171
GT1-1-08	15.5	Metabasalt	D	1250	1	231
GT1-1-08	19.0	Metabasalt	D	1800	1	333
GT1-1-08	27.0	Metabasalt	D	2000	1	370
GT1-1-08	32.0	Metabasalt	D	1900	1	351
GT1-1-08	41.0	Metabasalt	D	1400	1	259
GT1-1-08	41.5	Metabasalt	A	2000	4	292
GT1-1-08	42.5	Metabasalt	A	2000	1	448
GT1-1-08	55.0	Metabasalt	D	3600	1	683
GT1-1-08	59.3	Greenstone	D	1205	1	228
GT1-1-08	59.3	Greenstone	A	970	4	170
GT1-1-08	59.5	Greenstone	D	1500	4	277
GT1-1-08	66.5	Metabasalt	D	460	3	85
GT1-1-08	67.4	Metabasalt	D	1270	4	308
GT1-1-08	68.0	Metabasalt	D	1000	1	185
GT1-1-08	69.0	Metabasalt	D	1600	1	296
GT1-1-08	71.0	Limestone	D	3000	4,3	555
GT1-1-08	73.0	Limestone	D	3000	1	555
GT1-1-08	74.0	Limestone	D	4500	4	832
GT1-1-08	77.0	Limestone	D	2800	1	531
GT1-1-08	84.0	Metabasalt	D	400	1	74
GT1-1-08	93.5	Graywacke	D	5400	1	998
GT1-1-08	106.5	Greenstone	D	200	2	37
GT1-1-08	109.0	Greenstone	D	1900	4	351
GT1-1-08	112.0	Greenstone	D	75	2	14
GT1-1-08	130.0	Graywacke	D	850	1	157
GT1-1-08	133.0	Graywacke	D	3500	1	647
GT1-1-08	151.0	Limestone	D	3000	1	1346
GT1-1-08	152.0	Limestone	D	3800	1	1386
GT1-1-08	165.0	Limestone	D	1000	1	412
GT1-1-08	171.5	Limestone	D	1100	1	493
GT1-1-08	178.0	Limestone	D	1200	1	494
GT1-1-08	186.0	Limestone	D	600	1	237
GT1-1-08	190.0	Limestone	D	3500	1	1183
GT1-1-08	198.0	Limestone	D	1250	1	561
GT1-1-08	210.5	Limestone	D	900	1	487
GT1-1-08	219.0	Limestone	D	3200	1	1374
GT1-1-08	228.0	Limestone	D	1100	1	453
GT1-1-08	231.0	Limestone	D	600	1	360
GT1-1-08	242.0	Limestone	D	100	1	38
GT1-1-08	252.5	Limestone	D	2500	1	1289
GT1-1-08	264.0	Limestone	D	1100	1	203
GT1-1-08	294.0	Graywacke	D	1100	4	203
GT1-1-08	299.0	Limestone	D	1150	1	213
GT1-1-08	312.0	Limestone	D	3300	1	1303
GT1-1-08	317.0	Limestone	D	1200	1	233
GT1-1-08	322.0	Chert	L	2000	2	236
GT1-1-08	332.0	Limestone	D	1800	1	350
GT1-1-08	349.5	Chert	D	1000	1	190

Hole Number	Depth	Lithology	Test Type	Gauge Load	Failure Type	Is_{50}
	m		(D or A)	(lbf)	1, 2, 3, 4 or 5	(lbf/in^2)
GT1-1-08	359.0	Limestone	D	1100	2	209
GT1-1-08	368.5	Chert	D	25	2	5
GT1-1-08	373.5	Limestone	D	3800	1	721
GT1-1-08	382.7	Limestone	D	3000	1	584
GT1-1-08	383.0	Limestone	D	3500	1	664
GT1-1-08	398.0	Chert	D	4000	1	758
GT1-1-08	399.0	Chert	D	5000	1	924
GT1-1-08	408.0	Limestone	A	500	2	75
GT1-1-08	422.0	Limestone	D	1000	1	190
GT1-1-08	423.5	Limestone	D	500	2	95
GT1-1-08	432.0	Limestone	D	1500	2	284
GT1-1-08	436.0	Chert	D	2200	1	417
GT1-1-08	442.0	Metabasalt	D	150	2	28
GT1-1-08	446.0	Limestone	D	600	2	114
GT1-1-08	452.0	Limestone	D	1500	2	284
GT1-1-08	462.5	Limestone	D	2000	4	379
GT1-1-08	467.0	Limestone	D	1000	2	190
GT1-1-08	470.0	Limestone	D	4500	1	853
GT1-2-08	16.0	Graywacke	D	4000		740
GT1-2-08	24.0	Graywacke	D	7000	1	1294
GT1-2-08	27.0	Graywacke	D	5500	1	1017
GT1-2-08	30.0	Graywacke	D	7500	1	1387
GT1-2-08	42.0	Graywacke	D	2000	1	370
GT1-2-08	48.5	Graywacke	D	4000	1	740
GT1-2-08	56.0	Graywacke	D	1000	2	185
GT1-2-08	91.0	Graywacke	D	2700	1	499
GT1-2-08	100.0	Graywacke	D	3200	1	656
GT1-2-08	116.0	Graywacke	D	4000	4	740
GT1-2-08	129.0	Graywacke	D	4500	1	832
GT1-2-08	133.0	Graywacke	D	1500	1	277
GT1-2-08	144.0	Graywacke	D	800	1	156
GT1-2-08	154.0	Greenstone	D	100	2	18
GT1-2-08	154.5	Greenstone	D	600	1	111
GT1-2-08	161.0	Limestone	D	2700	1	1211
GT1-2-08	171.0	Limestone	D	2200	1	1081
GT1-2-08	186.0	Limestone	D	1500	1	773
GT1-2-08	195.0	Limestone	D	1300	1	558
GT1-2-08	200.0	Limestone	D	2000	1	859
GT1-2-08	212.0	Limestone	D	750	2	406
GT1-2-08	214.0	Chert	D	300	2	55
GT1-2-08	218.0	Chert	D	500	1	92
GT1-2-08	230.0	Limestone	D	4000	1	740
GT1-2-08	232.5	Limestone	D	4000	1	721
GT1-2-08	237.5	Limestone	D	2000	2	370
GT1-2-08	245.0	Limestone	D	2000	1	897
GT1-2-08	253.5	Limestone	D	2500	1	1121
GT1-2-08	261.5	Limestone	D	1500	2	704
GT1-2-08	268.5	Limestone	D	4500	1	1467
GT1-2-08	275.0	Limestone	D	1000	1	449

Hole Number	Depth	Lithology	Test Type	Gauge Load	Failure Type	Is_{50}
	m		(D or A)	(lbf)	1, 2, 3, 4 or 5	(lbf/in^2)
GT1-2-08	287.0	Limestone	D	2100	1	985
GT1-2-08	292.0	Limestone	D	1400	2	473
GT1-2-08	298.0	Limestone	D	2700	1	948
GT1-2-08	329.0	Limestone	D	1000	3	258
GT1-2-08	336.0	Limestone	D	500	2	258
GT1-2-08	350.0	Limestone	D	700	1	276
GT1-2-08	362.0	Limestone	D	1000	1	395
GT1-2-08	371.0	Limestone	D	1100	1	417
GT1-2-08	376.0	Limestone	D	2200	1	802
GT1-2-08	382.8	Limestone	D	730	1	222
GT1-2-08	394.0	Limestone	D	1800	1	773
GT1-2-08	404.5	Limestone	D	2000	1	676
GT1-2-08	409.6	Limestone	D	2100	1	398
GT1-2-08	413.0	Limestone	D	2500	1	987
GT1-2-08	423.5	Limestone	D	500	2	235
GT1-2-08	429.0	Limestone	D	2000	1	1083
GT1-2-08	440.0	Limestone	D	3000	1	1346
GT1-2-08	446.0	Limestone	D	2200	1	668
GT1-2-08	448.8	Limestone	D	3500	1	664
GT1-2-08	448.8	Limestone	A	1200	4	290
GT1-2-08	461.0	Limestone	D	3500	1	1063
GT1-2-08	471.0	Limestone	D	2200	1	945
GT1-2-08	474.0	Limestone	D	3500	1	1276
GT1-2-08	476.5	Limestone	D	3400	1	645
GT1-2-08	476.5	Limestone	A	1160	1	269
GT1-3-08	40.0	Graywacke	D	2600	1	493
GT1-3-08	49.0	Graywacke	D	2500	1	462
GT1-3-08	69.0	Graywacke	D	6000	1	1138
GT1-3-08	84.5	Graywacke	D	500	2	92
GT1-3-08	89.0	Graywacke	D	1900	3	351
GT1-3-08	104.0	Graywacke	D	4200	1	777
GT1-3-08	121.0	Graywacke	D	4500	1	832
GT1-3-08	137.0	Graywacke	D	1000	2	185
GT1-3-08	142.0	Graywacke	D	5500	1	1017
GT1-3-08	151.0	Graywacke	D	6500	1	1202
GT1-3-08	174.0	Limestone	D	2000	1	983
GT1-3-08	177.0	Limestone	D	3500	1	1642
GT1-3-08	184.0	Limestone	D	2000	1	1031
GT1-3-08	191.0	Limestone	D	3200	1	1264
GT1-3-08	200.0	Limestone	D	2300	1	947
GT1-3-08	205.0	Limestone	D	3000	1	1346
GT1-3-08	217.0	Limestone	D	1500	3	547
GT1-3-08	222.0	Limestone	A	3200	1	782
GT1-3-08	223.5	Limestone	D	2000	1	823
GT1-3-08	229.5	Limestone	D	3000	1	978
GT1-3-08	238.0	Limestone	D	2600	1	1116
GT1-3-08	245.0	Limestone	D	3500	1	1570
GT1-3-08	258.0	Limestone	D	3800	1	1285
GT1-3-08	266.0	Limestone	D	3500	1	1570

Hole Number	Depth	Lithology	Test Type	Gauge Load	Failure Type	Is_{50}
	m		(D or A)	(lbf)	1, 2, 3, 4 or 5	(lbf/in^2)
GT1-3-08	279.0	Limestone	D	3400	1	1290
GT1-3-08	288.0	Limestone	D	900	2	355
GT1-3-08	294.0	Limestone	D	2800	1	1021
GT1-3-08	305.0	Limestone	D	3000	1	1346
GT1-3-08	314.0	Limestone	D	2200	1	802
GT1-3-08	320.0	Limestone	D	2000	1	823
GT1-3-08	323.5	Limestone	D	2200	1	987
GT1-3-08	334.0	Limestone	D	3800	1	1386
GT1-3-08	352.0	Limestone	D	2500	1	987
GT1-3-08	361.0	Limestone	D	2600	1	1220
GT1-3-08	369.0	Limestone	D	1900	1	852
GT1-3-08	382.0	Limestone	D	3500	1	1276
GT1-3-08	390.5	Limestone	D	3000	1	1288
GT1-3-08	398.0	Limestone	D	2200	1	987
GT1-3-08	402.0	Limestone	D	1800	1	1081
GT1-3-08	415.0	Limestone	D	3800	1	1386
GT1-4-08	22.0	Metabasalt	D	550	1	102
GT1-4-08	35.0	Metabasalt	D	450	1	83
GT1-4-08	44.5	Metabasalt	D	300	1	57
GT1-4-08	60.0	Greenstone	D	3500	1	647
GT1-4-08	90.5	Metabasalt	D	800	1	148
GT1-4-08	95.8	Metabasalt	D	3800	1	703
GT1-4-08	105.5	Metabasalt	D	1100	1	203
GT1-4-08	117.0	Metabasalt	D	3000	1	555
GT1-4-08	122.0	Metabasalt	D	4000	2	740
GT1-4-08	137.0	Metabasalt	D	200	2	37
GT1-4-08	159.0	Metabasalt	D	10	2	2
GT1-4-08	183.5	Metabasalt	D	3000	1	569
GT1-4-08	223.5	Greenstone	D	350	3	65
GT1-4-08	236.0	Metabasalt	D	2500	1	462
GT1-4-08	245.5	Metabasalt	D	2000	1	370
GT1-4-08	253.5	Metabasalt	D	400	2	76
GT1-4-08	264.5	Metabasalt	D	420	2	80

APPENDIX 9.C

Lab Results 2008 Drilling

UNCONFINED COMPRESSIVE STRENGTH
ASTM D 7012; Method C (Previously ASTM D 2938)

CLIENT: Golder Associates JOB NO.: 2003-118

LOCATION: DATE TESTE[5/5/08 HN

PROJECT: Hanson Permanente

Specimen ID Boring, Depth(ft.), Rock type	Diameter (in.)	Length (in.)	Mass (gms)	Wet Density (pcf)	Failure Load (lb)	Failure Types *	Compressive Strength (psi)
GT1-1-08, 41.4-41.9, Metabasalt	2.397	5.172	1046.40	170.8	20,790	F/S	4,610
GT1-1-08, 61.9-62.6, Greenstone	2.401	5.070	1027.10	170.5	6,965	F/S	1,540
GT1-1-08, 422.5-423.0, Limestone	2.400	5.136	981.10	160.9	7,815	F	1,730
GT1-2-08, 163.7-164.4, Limestone	2.388	5.308	1053.00	168.7	52,159	F	11,650
GT1-4-08, 196.6-197.3, Metabasalt	2.400	4.993	921.10	155.4	384	F/S	80

Notes and Comments: * Failure types S: Shear Failure, M: Matrix Failure, F: Failure due to Fracture/Bedding, V: Void Failure, C: Combination

Data Entered By: HN Date: 05/05/2008
Data Checked By: Date: 05/06/08
Filename: GOUCSRC7

ADVANCED TERRA TESTING, INC. ATT

Moisture & Density Determinations
ASTM D 2216 & D 2937

CLIENT: Golder & Associates JOB NO.: 2003-118
LOCATION: Hanzen Permanente Project Site

BORING	GT1-1-08	GT1-1-08	GT1-1-08	GT1-2-08
SAMPLE DEPTH	41.40-41.90'	61.90-62.90'	422.50-423.00'	163.70-164.40'
SAMPLE NO.				
DATE SAMPLED				
DATE TESTED	05-01-08 HN	05-01-08 HN	05-01-08 HN	05-01-08 HN
ROCK DESCRIPTION	Metabasalt	Greenstone	Limestone	Limestone
DENSITY DETERMINATIONS				
Sample Height (IN)	5.172	5.070	5.136	5.308
Sample Diameter (IN)	2.397	2.401	2.400	2.388
Wt of Wet Rock (GMs)	1046.40	1027.10	987.70	1053.00
Sample Volume (CU Ft)	0.01351	0.01328	0.01345	0.01376
WET DENSITY (PCF)	170.8	170.5	161.9	168.7
DRY DENSITY (PCF)	167.7	166.7	161.4	168.7
MOISTURE DETERMINATIONS				
Wt. of Wet Rock & Dish (gms)	179.20	494.41	260.17	776.09
Wt. of Dry Rock & Dish (gms)	176.08	483.71	259.37	775.79
Net Loss of Moisture (gms)	3.12	10.70	0.80	0.30
Wt. of Dish (gms)	6.76	8.29	8.23	6.80
Wt. of Dry Rock (gms)	169.32	475.42	251.14	768.99
Moisture Content (%)	1.8	2.3	0.3	0.0

BORING	GT1-4-08	GT1-1-08	GT1-1-08	GT1-1-08
SAMPLE DEPTH	196.60-197.30'	20.10-20.60'	297.00-297.60'	434.40-435.00'
SAMPLE NO.				
DATE SAMPLED				
DATE TESTED	05-01-08 HN	05-01-08 HN	05-01-08 HN	05-01-08 HN
ROCK DESCRIPTION	Metabasalt	Metabasalt	Limestone	Limestone
DENSITY DETERMINATIONS				
Sample Height (IN)	4.993	5.431	5.119	5.337
Sample Diameter (IN)	2.400	2.394	2.430	2.398
Wt of Wet Rock (GMs)	927.00	1046.20	1045.30	1033.30
Sample Volume (CU Ft)	0.01307	0.01415	0.01374	0.01395
WET DENSITY (PCF)	156.3	163.0	167.7	163.3
DRY DENSITY (PCF)	148.9	154.6	167.4	162.8
MOISTURE DETERMINATIONS				
Wt. of Wet Rock & Dish (gms)	382.49	85.56	348.74	482.16
Wt. of Dry Rock & Dish (gms)	364.51	81.48	348.00	480.62
Net Loss of Moisture (gms)	17.98	4.08	0.74	1.54
Wt. of Dish (gms)	6.73	6.65	8.29	8.34
Wt. of Dry Rock (gms)	357.78	74.83	339.71	472.28
Moisture Content (%)	5.0	5.5	0.2	0.3

Data entered by: SR Date: 05/06/2008
Data checked by: W Date: 05/06/08
FileName: GOMDHANA

ADVANCED TERRA TESTING, INC. ATT

Moisture & Density Determinations
ASTM D 2216 & D 2937

CLIENT: Golder & Associates JOB NO.: 2003-118
LOCATION: Hanzen Permanente Project Site

BORING	GT7-2-08	GT7-4-08
SAMPLE DEPTH	179.50-180.30'	201.60-202.40'
SAMPLE NO.		
DATE SAMPLED		
DATE TESTED	05-01-08 HN	05-01-08 HN
ROCK DESCRIPTION	Limestone	Metabasalt

DENSITY DETERMINATIONS		
Sample Height (IN)	5.301	5.473
Sample Diameter (IN)	2.398	2.418
Wt of Wet Rock (GMs)	1016.70	977.40
Sample Volume (CU Ft)	0.01385	0.01454
WET DENSITY (PCF)	161.8	148.2
DRY DENSITY (PCF)	161.6	140.0

MOISTURE DETERMINATIONS		
Wt. of Wet Rock & Dish (gms)	402.62	729.99
Wt. of Dry Rock & Dish (gms)	402.29	690.02
Net Loss of Moisture (gms)	0.33	39.97
Wt. of Dish (gms)	8.27	6.63
Wt. of Dry Rock (gms)	394.02	683.39
Moisture Content (%)	0.1	5.8

Data entered by: SR Date: 05/06/2008
Data checked by: D Date: 05/06/08
FileName: GOMDHANB

ADVANCED TERRA TESTING, INC. ATT

UNCONFINED COMPRESSIVE STRENGTH
ASTM D 7012; Method C (Previously ASTM D 2938)

CLIENT: Golder Associates Inc.

JOB NO.: 2003-119

LOCATION: Hanson Permanente Project Site

DATE TESTED: 6/10/08 HN

PROJECT: 063-7109x100

Specimen ID Boring, Depth(ft.), Rock type	Diameter (in.)	Length (in.)	Mass (gms)	Wet Density (pcf)	Failure Load (lb)	Failure Types **	Compressive Strength (psi)
GT1-2-08, 116.7-117.4, Graywacke	2.399	5.765	1131.30	165.4	809	F	180
GT1-2-08, 30.5-31.1, Graywacke	2.390	4.855	958.40	167.6	56,355	F	12,560
GT1-2-08, 59.2-59.7, Graywacke	2.388	4.956	976.70	167.6	20,140	F	4,500

Notes and Comments:

* Failure types S: Shear Failure, M: Matrix Failure, F: Failure due to Fracture/Bedding, V: Void Failure, C: Combination

Data Entered By: HN Date: 06/10/2008
Data Checked By: Date: 06/10/08
Filename: GOUCSRC2

ADVANCED TERRA TESTING, INC. ATT

Moisture & Density Determinations
ASTM D 2216 & D 2937

CLIENT: Golder Associates Inc. JOB NO.: 2003-119
LOCATION: Hanson Permanente, Project # 063-7109x100 Site

BORING	GT1-1-08	GT1-2-08	GT1-2-08	GT1-2-08
SAMPLE DEPTH	116.7-117.4'	30.5-31.1'	59.2-59.7'	25.5-26.4'
SAMPLE NO.				
DATE SAMPLED				
DATE TESTED	06/10/08 HN	06/10/08 HN	06/10/08 HN	06/10/08 HN
ROCK DESCRIPTION	Graywacke	Graywacke	Graywacke	Graywacke
DENSITY DETERMINATIONS				
Sample Height (IN)	5.765	4.855	4.956	5.391
Sample Diameter (IN)	2.399	2.390	2.388	2.389
Wt of Wet Rock (GMs)	1131.30	958.40	976.70	1062.70
Sample Volume (CU Ft)	0.01508	0.01260	0.01285	0.01398
WET DENSITY (PCF)	165.4	167.6	167.6	167.5
DRY DENSITY (PCF)	162.8	167.2	166.6	167.3
MOISTURE DETERMINATIONS				
Wt. of Wet Rock & Dish (gms)	485.78	227.20	229.98	791.45
Wt. of Dry Rock & Dish (gms)	478.41	226.69	228.58	790.22
Net Loss of Moisture (gms)	7.37	0.51	1.40	1.23
Wt. of Dish (gms)	8.21	6.73	6.69	8.26
Wt. of Dry Rock (gms)	470.20	219.96	221.89	781.96
Moisture Content (%)	1.6	0.2	0.6	0.2

BORING	GT1-3-08	GT1-4-08
SAMPLE DEPTH	74.8-75.5'	61.0-61.7'
SAMPLE NO.		
DATE SAMPLED		
DATE TESTED	06/10/08 HN	06/10/08 HN
ROCK DESCRIPTION	Graywacke	Greenstone
DENSITY DETERMINATIONS		
Sample Height (IN)	4.578	4.723
Sample Diameter (IN)	2.401	2.398
Wt of Wet Rock (GMs)	898.10	1027.70
Sample Volume (CU Ft)	0.01200	0.01234
WET DENSITY (PCF)	165.1	183.5
DRY DENSITY (PCF)	164.3	182.7
MOISTURE DETERMINATIONS		
Wt. of Wet Rock & Dish (gms)	550.23	422.87
Wt. of Dry Rock & Dish (gms)	547.59	420.90
Net Loss of Moisture (gms)	2.64	1.97
Wt. of Dish (gms)	8.39	8.29
Wt. of Dry Rock (gms)	539.20	412.61
Moisture Content (%)	0.5	0.5

Data entered by: DPM/HN Date: 06/12/2008
Data checked by: CJ Date: 06/13/08
FileName: GOMDHPS

ADVANCED TERRA TESTING, INC. ATT

UNCONFINED COMPRESSIVE STRENGTH
With Stress / Strain Measurements
ASTM D 7012; Method D (Previously ASTM D 3148)

CLIENT: Golder Associates, Inc. JOB NO.: 2003-119

LOCATION: Hanson Permanente, Project #063-7109x100 Site DATE TESTED: 6/11-12/08 HN

Specimen ID			Diameter (in.)	Length (in.)	Mass (gms)	Wet Density (pcf)	Failure Load (lb)	Failure Type **	Compressive Strength (psi)	Young's Modulus (X10^6 psi)	Poisson's Ratio
Boring	Depth (ft.)	Rock type									
GT1-2-08	25.5-26.4	Graywacke	2.389	5.391	1062.70	167.5	56,750	S/F	12,660	6.63	0.108
GT1-3-08	74.8-75.5	Graywacke	2.401	4.578	898.10	165.1	16,750	S/F	*3680	5.13	0.276
GT1-4-08	61.0-61.7	Graywacke	2.398	4.723	1027.70	183.5	36,000	F/S	*7960	8.17	0.231

Notes and Comments:

* Indicates regardless of ASTM D 7012 method D, sample with L/D < 2.0.
was tested and correction factor for short sample was applied to the calculation.
C=Ca/[0.88+0.24b/h]
Ca = Failure Load / Surface Area
b = Sample Diameter
h = Sample Length

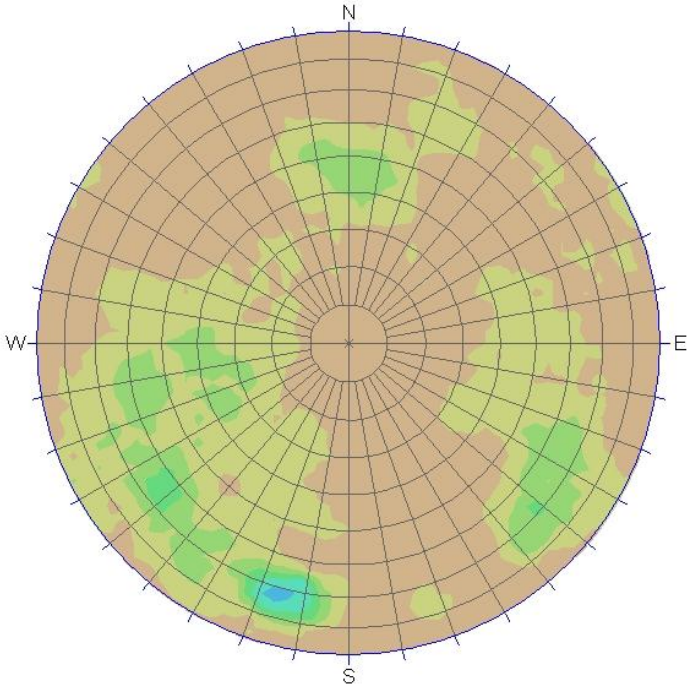
** Failure Type:
S: Shear Failure, M: Matrix Failure, F/V Fracture, Bedding/Void Collapse, C: Combination

Data Entered By: HN Date: 06/12/2008
Data Checked By: CJ Date: 06/13/08
Filename: GOUCSSR1

ADVANCED TERRA TESTING, INC. ATT

APPENDIX 9.D

Stereonets

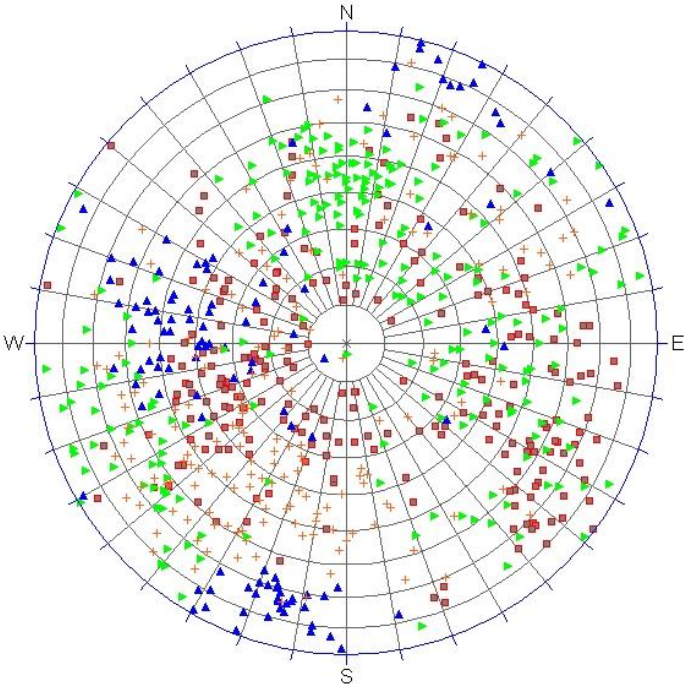


Schmidt
Concentrations
% of total per 1.0 % area

0.00 ~ 1.00 %
1.00 ~ 2.00 %
2.00 ~ 3.00 %
3.00 ~ 4.00 %
4.00 ~ 5.00 %
5.00 ~ 6.00 %
6.00 ~ 7.00 %
7.00 ~ 8.00 %
8.00 ~ 9.00 %
9.00 ~ 10.00 %

Terzaghi Correction
Min. Bias Angle = 15 deg
Max. Conc. = 5.5395%

Equal Area
Lower Hemisphere
756 Poles
756 Entries



DHID

GT1-1-08 [235]
GT1-2-08 [115]
GT1-3-08 [231]
GT1-4-08 [175]

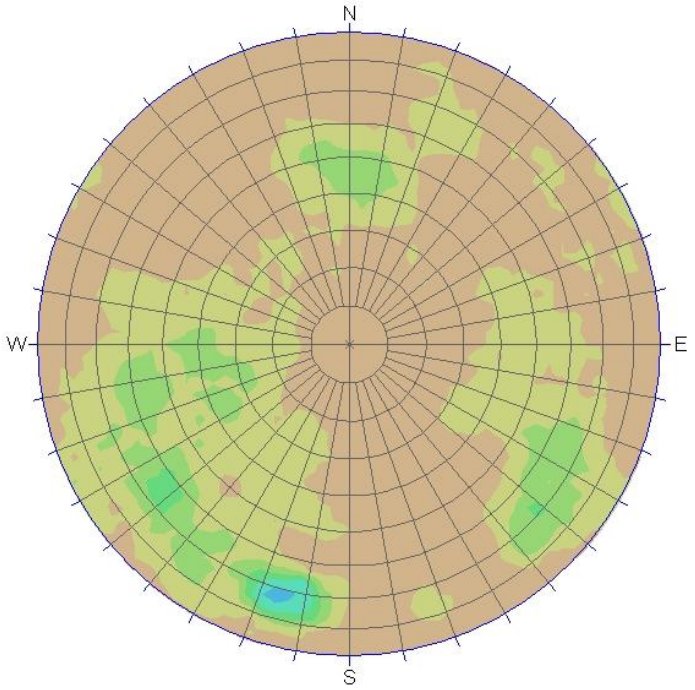
Equal Area
Lower Hemisphere
756 Poles
756 Entries

TITLE

ALL ORIENTED CORE DATA

Golder Associates

PROJECT No.	063-7109		FILE No.	
DESIGN	RLK	02/07/10	SCALE AS SHOWN	REV. 0
CADD	RLK	02/07/10	APPENDIX 9D	
CHECK	GM	02/08/10		
REVIEW	KH	02/08/10		

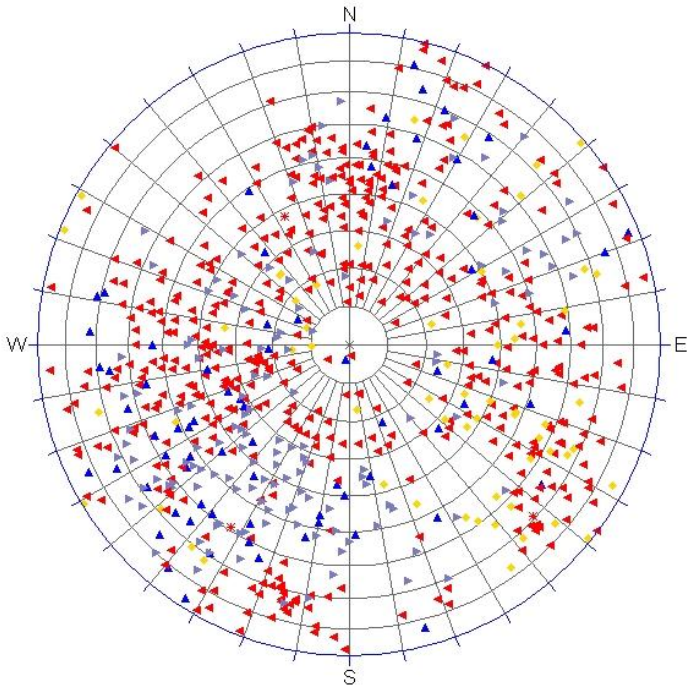


Schmidt
Concentrations
% of total per 1.0 % area

0.00 ~ 1.00 %
1.00 ~ 2.00 %
2.00 ~ 3.00 %
3.00 ~ 4.00 %
4.00 ~ 5.00 %
5.00 ~ 6.00 %
6.00 ~ 7.00 %
7.00 ~ 8.00 %
8.00 ~ 9.00 %
9.00 ~ 10.00 %

Terzaghi Correction
Min. Bias Angle = 15 deg
Max. Conc. = 5.5395%

Equal Area
Lower Hemisphere
756 Poles
756 Entries



LITH

- Dolomitic Limeston [4]
- Fault Breccia [2]
- Fault Breccia (Gra [20]
- Fault Breccia (Gre [35]
- Fault Breccia (Met [16]
- Graywacke [61]
- Greenstone [3]
- Limestone [476]
- Metabasalt [139]

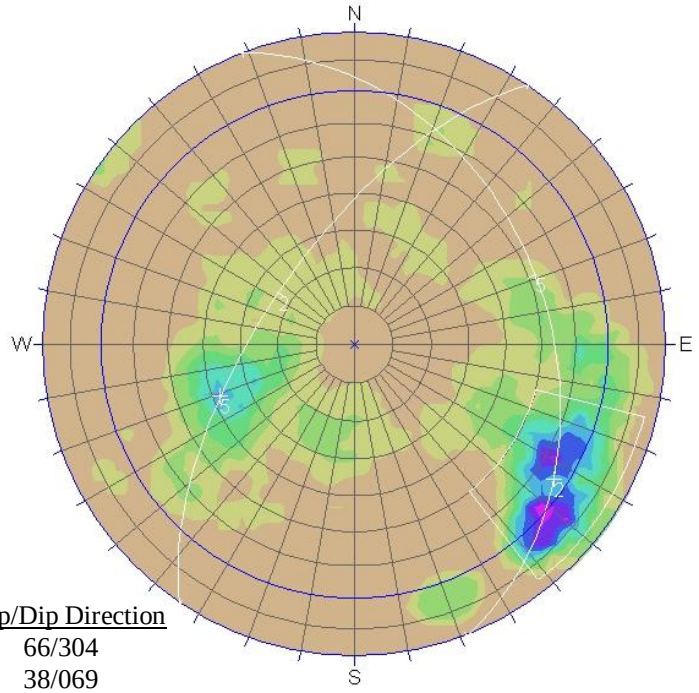
Equal Area
Lower Hemisphere
756 Poles
756 Entries

TITLE

ALL ORIENTED CORE DATA

Golder Associates

PROJECT No.	063-7109		FILE No.	
DESIGN	RLK	02/07/10	SCALE AS SHOWN	REV. 0
CADD	RLK	02/07/10	APPENDIX 9D	
CHECK	GM	02/08/10		
REVIEW	KH	02/08/10		



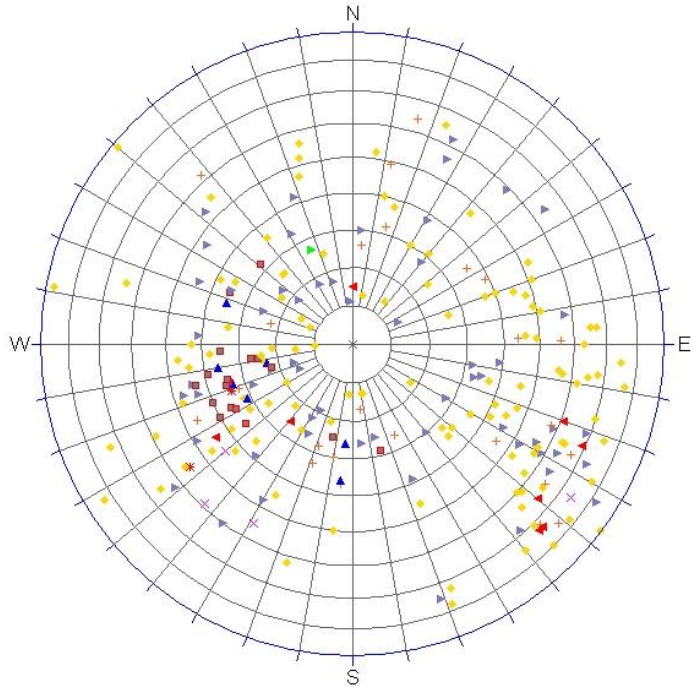
Schmidt
Concentrations
% of total per 1.0 % area

0.00 ~ 1.00 %
1.00 ~ 2.00 %
2.00 ~ 3.00 %
3.00 ~ 4.00 %
4.00 ~ 5.00 %
5.00 ~ 6.00 %
6.00 ~ 7.00 %
7.00 ~ 8.00 %
8.00 ~ 9.00 %
9.00 ~ 10.00 %

Terzaghi Correction
Min. Bias Angle = 15 deg
Max. Conc. = 8.8357%

Equal Area
Lower Hemisphere
235 Poles
235 Entries

Set	Dip/Dip Direction
2	66/304
5	38/069



TYPE

Bedding [18]
Bedding Trace [7]
Contact (Open) [1]
Fault [24]
Foliation [4]
Joint [113]
Shear [2]
Vein [8]
Vein (Intact) [58]

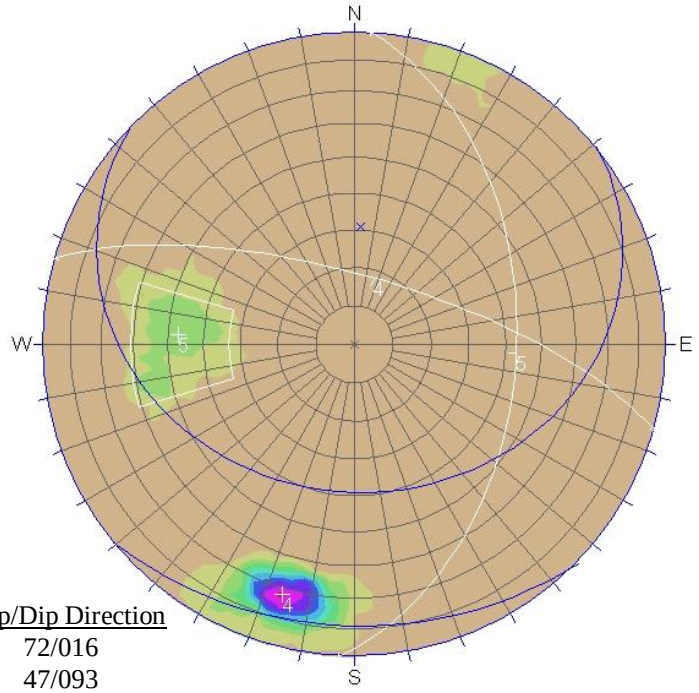
Equal Area
Lower Hemisphere
235 Poles
235 Entries

TITLE

GT1-1-08

Golder Associates

PROJECT No.	063-7109		FILE No.	
DESIGN	RLK	02/07/10	SCALE AS SHOWN	REV. 0
CADD	RLK	02/07/10	APPENDIX 9D	
CHECK	GM	02/08/10		
REVIEW	KH	02/08/10		



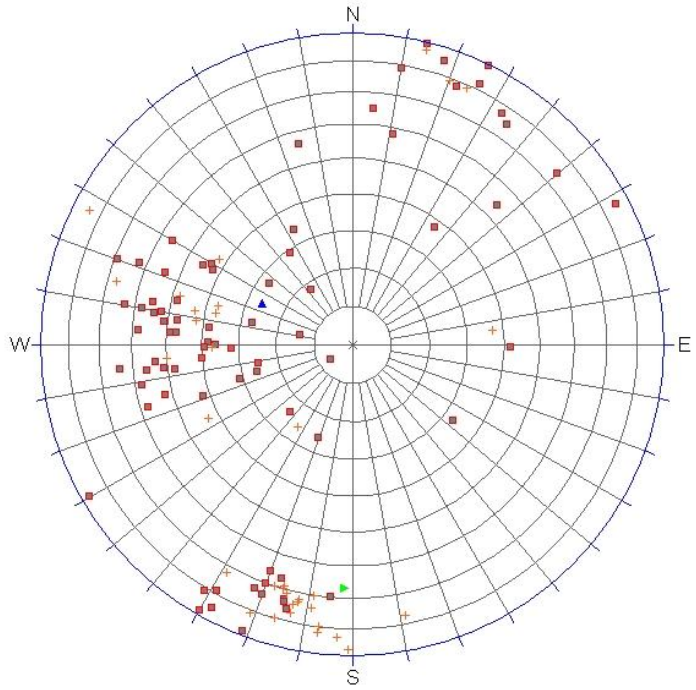
Schmidt
Concentrations
% of total per 1.0 % area

0.00 ~ 3.00 %
3.00 ~ 6.00 %
6.00 ~ 9.00 %
9.00 ~ 12.00 %
12.00 ~ 15.00 %
15.00 ~ 18.00 %
18.00 ~ 21.00 %
21.00 ~ 24.00 %
24.00 ~ 27.00 %
27.00 ~ 30.00 %

Terzaghi Correction
Min. Bias Angle = 15 deg
Max. Conc. = 27.8299%

Equal Area
Lower Hemisphere
115 Poles
115 Entries

Set	Dip/Dip Direction
4	72/016
5	47/093



TYPE

Joint [78]
Shear [1]
Vein [1]
Vein (Intact) [35]

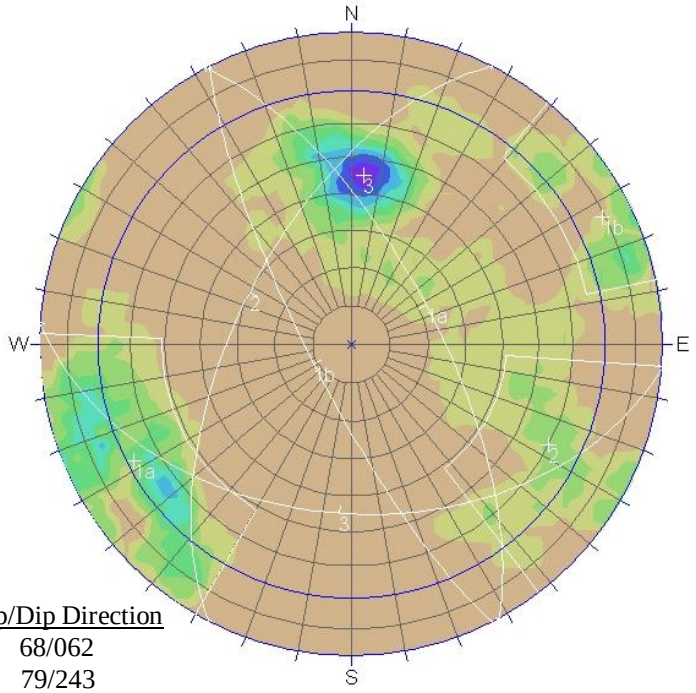
Equal Area
Lower Hemisphere
115 Poles
115 Entries

TITLE

GT1-2-08

Golder Associates

PROJECT No.	063-7109		FILE No.	
DESIGN	RLK	02/07/10	SCALE AS SHOWN	REV. 0
CADD	RLK	02/07/10	APPENDIX 9D	
CHECK	GM	02/08/10		
REVIEW	KH	02/08/10		



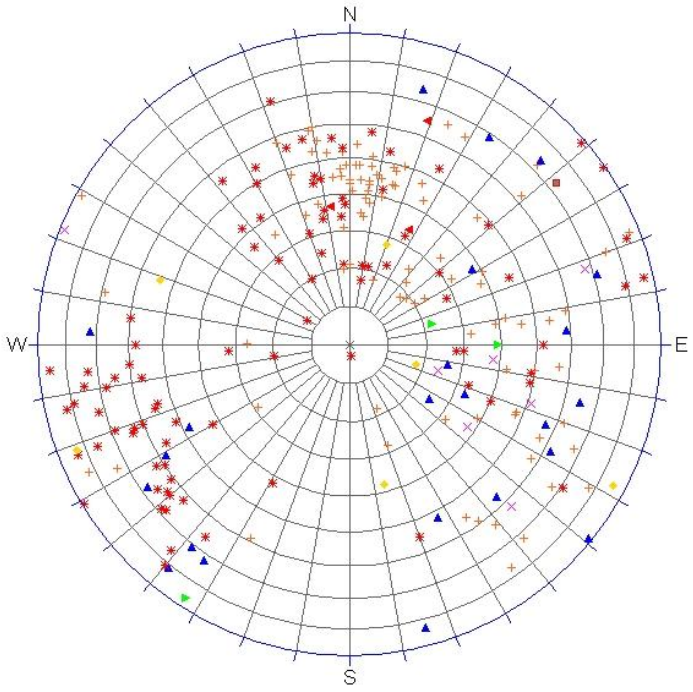
Schmidt
Concentrations
% of total per 1.0 % area

0.00 ~ 1.00 %
1.00 ~ 2.00 %
2.00 ~ 3.00 %
3.00 ~ 4.00 %
4.00 ~ 5.00 %
5.00 ~ 6.00 %
6.00 ~ 7.00 %
7.00 ~ 8.00 %
8.00 ~ 9.00 %
9.00 ~ 10.00 %

Terzaghi Correction
Min. Bias Angle = 15 deg
Max. Conc. = 8.0485%

Equal Area
Lower Hemisphere
231 Poles
231 Entries

Set	Dip/Dip Direction
1a	68/062
1b	79/243
2	60/297
3	45/184



TYPE

Contact (Open) [1]
Fault [23]
Foliation [3]
Joint [96]
Shear [7]
Vein [6]
Vein (Intact) [92]
n/a [3]

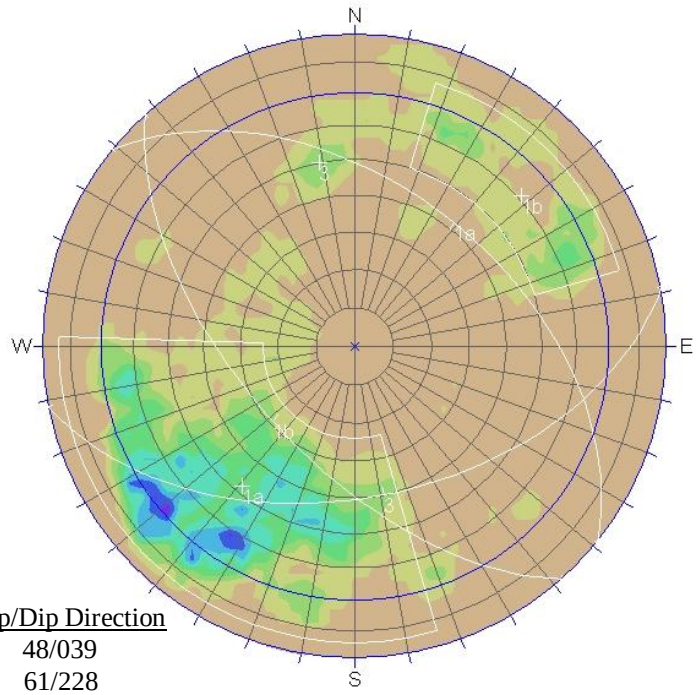
Equal Area
Lower Hemisphere
231 Poles
231 Entries

TITLE

GT1-3-08

Golder Associates

PROJECT No.	063-7109		FILE No.	
DESIGN	RLK	02/07/10	SCALE AS SHOWN	REV. 0
CADD	RLK	02/07/10	APPENDIX 9D	
CHECK	GM	02/08/10		
REVIEW	KH	02/08/10		



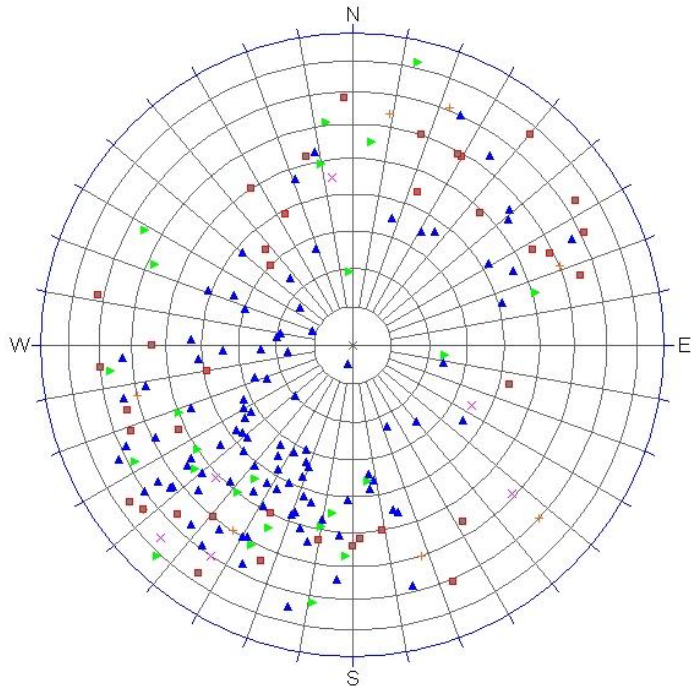
Schmidt
Concentrations
% of total per 1.0 % area

0.00 ~ 1.00 %
1.00 ~ 2.00 %
2.00 ~ 3.00 %
3.00 ~ 4.00 %
4.00 ~ 5.00 %
5.00 ~ 6.00 %
6.00 ~ 7.00 %
7.00 ~ 8.00 %
8.00 ~ 9.00 %
9.00 ~ 10.00 %

Terzaghi Correction
Min. Bias Angle = 15 deg
Max. Conc. = 7.9623%

Equal Area
Lower Hemisphere
175 Poles
175 Entries

Set	Dip/Dip Direction
1a	48/039
1b	61/228
3	50/169



TYPE

Fault [38]
Joint [98]
Shear [24]
Vein [8]
Vein (Intact) [7]

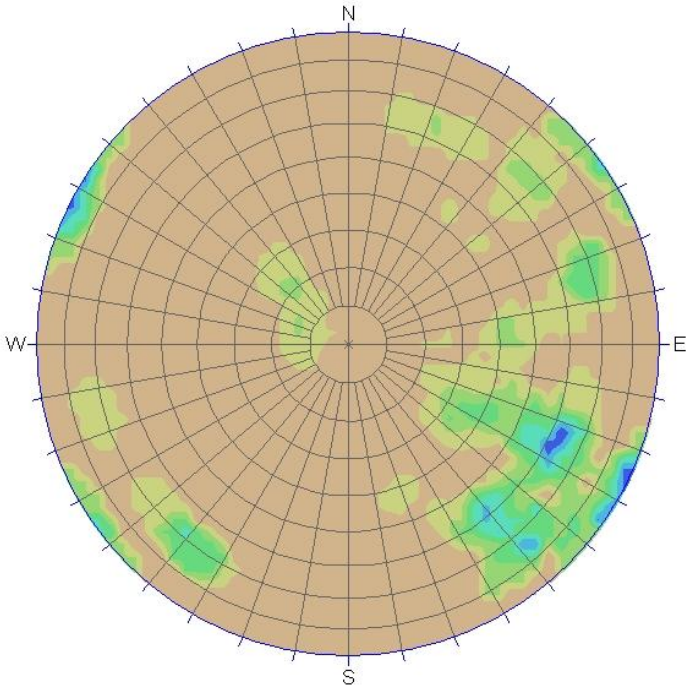
Equal Area
Lower Hemisphere
175 Poles
175 Entries

TITLE

GT1-4-08

Golder Associates

PROJECT No.	063-7109		FILE No.	
DESIGN	RLK	02/07/10	SCALE AS SHOWN	REV. 0
CADD	RLK	02/07/10	APPENDIX 9D	
CHECK	GM	02/08/10		
REVIEW	KH	02/08/10		

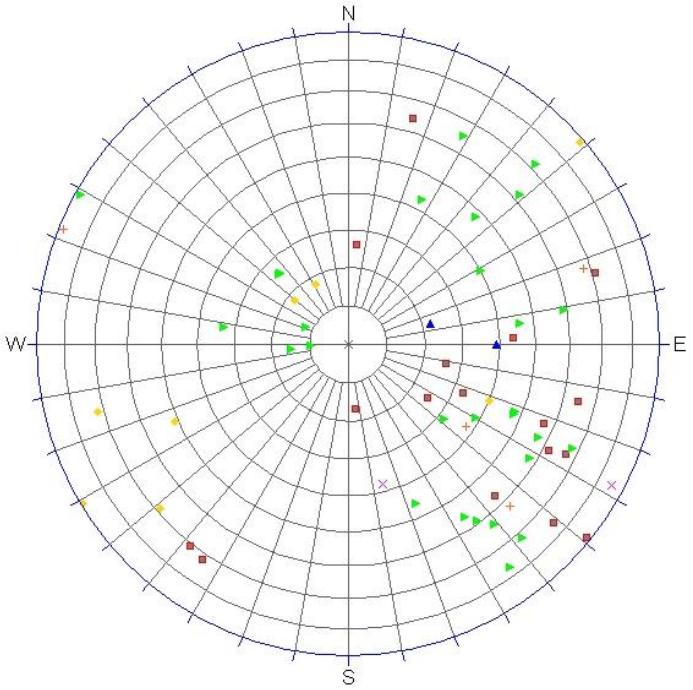


Schmidt
Concentrations
% of total per 1.0 % area

0.00 ~ 1.50 %
1.50 ~ 3.00 %
3.00 ~ 4.50 %
4.50 ~ 6.00 %
6.00 ~ 7.50 %
7.50 ~ 9.00 %
9.00 ~ 10.50 %
10.50 ~ 12.00 %
12.00 ~ 13.50 %
13.50 ~ 15.00 %

Terzaghi Correction
Min. Bias Angle = 15 deg
Max. Conc. = 10.6999%

Equal Area
Lower Hemisphere
61 Poles
61 Entries



TYPE

Fault [17]
Foliation [2]
Joint [28]
Shear [4]
Vein [2]
Vein (Intact) [8]

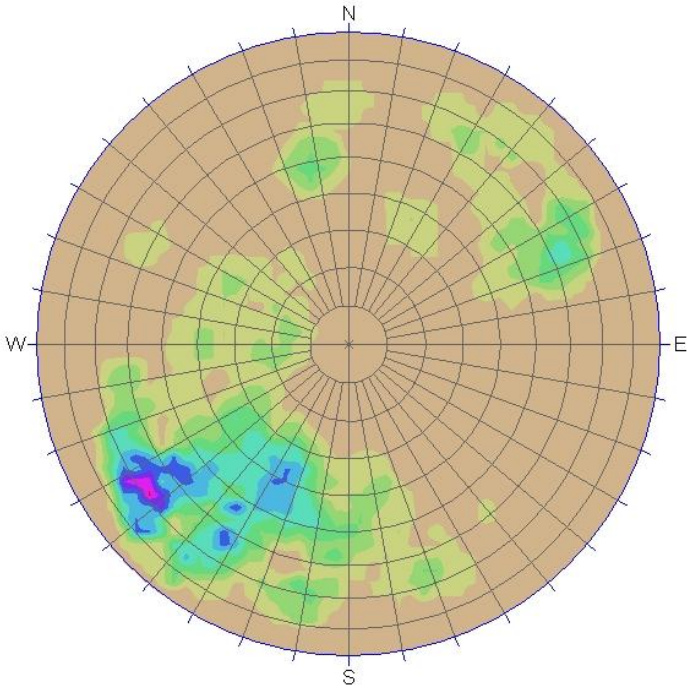
Equal Area
Lower Hemisphere
61 Poles
61 Entries

TITLE

GRAYWACKE, ORIENTED CORE DATA

Golder Associates

PROJECT No.	063-7109		FILE No.	
DESIGN	RLK	02/07/10	SCALE AS SHOWN	REV. 0
CADD	RLK	02/07/10	APPENDIX 9D	
CHECK	GM	02/08/10		
REVIEW	KH	02/08/10		

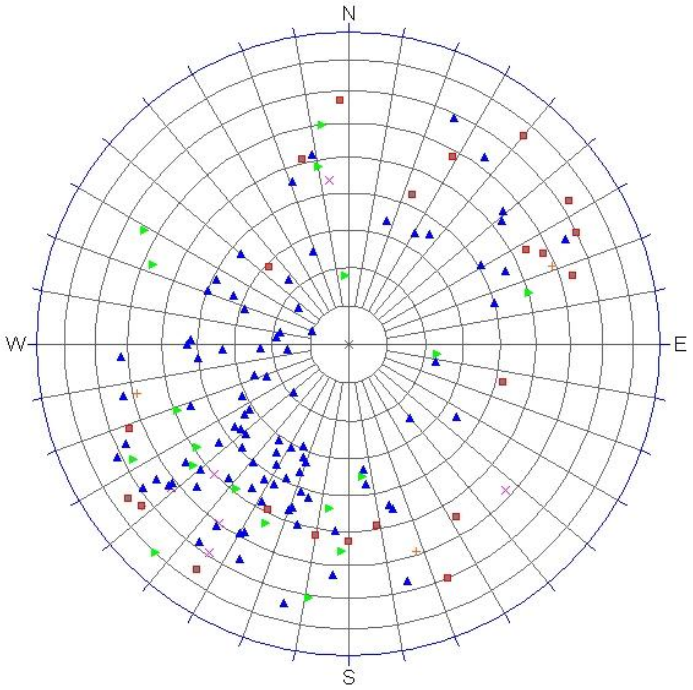


Schmidt
Concentrations
% of total per 1.0 % area

0.00 ~ 1.00 %
1.00 ~ 2.00 %
2.00 ~ 3.00 %
3.00 ~ 4.00 %
4.00 ~ 5.00 %
5.00 ~ 6.00 %
6.00 ~ 7.00 %
7.00 ~ 8.00 %
8.00 ~ 9.00 %
9.00 ~ 10.00 %

Terzaghi Correction
Min. Bias Angle = 15 deg
Max. Conc. = 9.1724%

Equal Area
Lower Hemisphere
139 Poles
139 Entries



TYPE

Fault [22]
Joint [89]
Shear [18]
Vein [4]
Vein (Intact) [6]

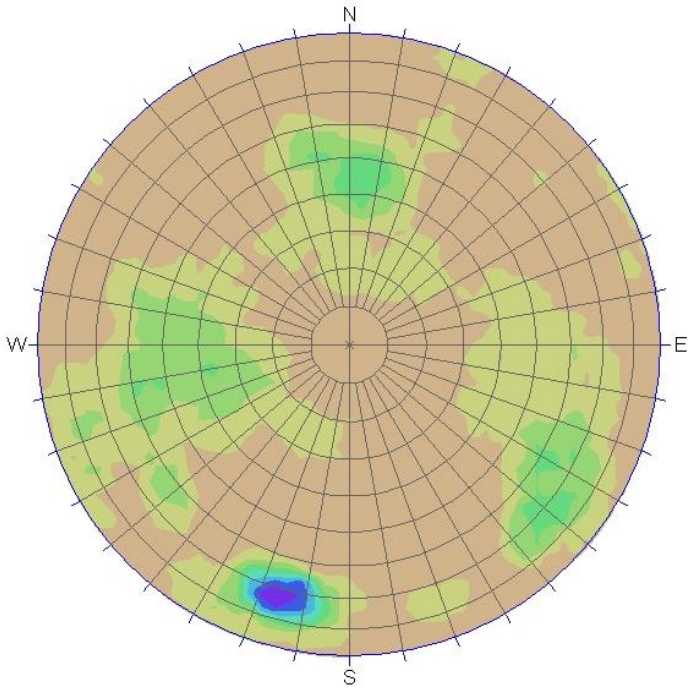
Equal Area
Lower Hemisphere
139 Poles
139 Entries

TITLE

METAVOLCANIC ROCK, ORIENTED CORE DATA

Golder Associates

PROJECT No.	063-7109		FILE No.	
DESIGN	RLK	02/07/10	SCALE AS SHOWN	REV. 0
CADD	RLK	02/07/10	APPENDIX 9D	
CHECK	GM	02/08/10		
REVIEW	KH	02/08/10		

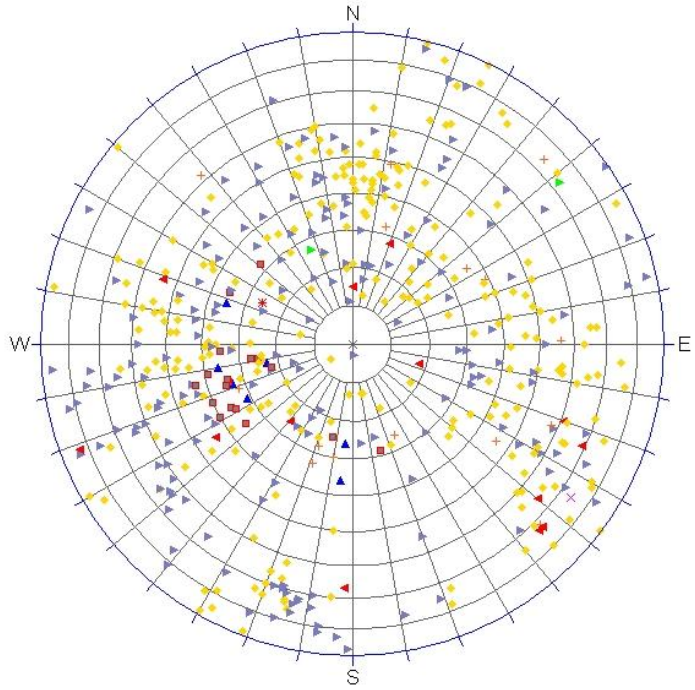


Schmidt
Concentrations
% of total per 1.0 % area

0.00 ~ 1.00 %
1.00 ~ 2.00 %
2.00 ~ 3.00 %
3.00 ~ 4.00 %
4.00 ~ 5.00 %
5.00 ~ 6.00 %
6.00 ~ 7.00 %
7.00 ~ 8.00 %
8.00 ~ 9.00 %
9.00 ~ 10.00 %

Terzaghi Correction
Min. Bias Angle = 15 deg
Max. Conc. = 8.0157%

Equal Area
Lower Hemisphere
480 Poles
480 Entries



TYPE

Bedding [18]
Bedding Trace [7]
Contact (Open) [2]
Fault [15]
Foliation [1]
Joint [248]
Shear [1]
Vein [13]
Vein (Intact) [175]

Equal Area
Lower Hemisphere
480 Poles
480 Entries

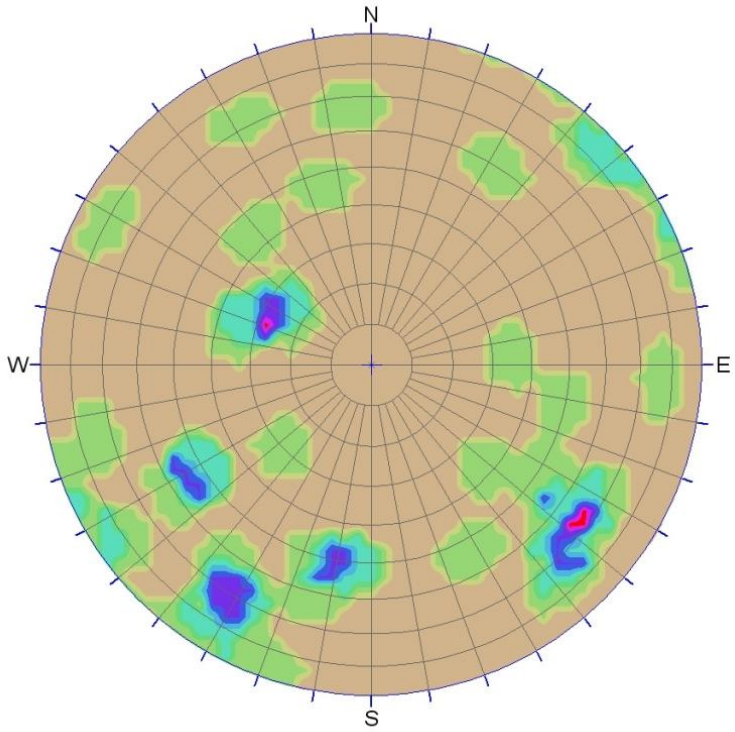
TITLE

LIMESTONE, ORIENTED CORE DATA

Golder Associates

PROJECT No.	063-7109		FILE No.	
DESIGN	RLK	02/07/10	SCALE AS SHOWN	REV. 0
CADD	RLK	02/07/10		
CHECK	GM	02/08/10		
REVIEW	KH	02/08/10		

APPENDIX 9D

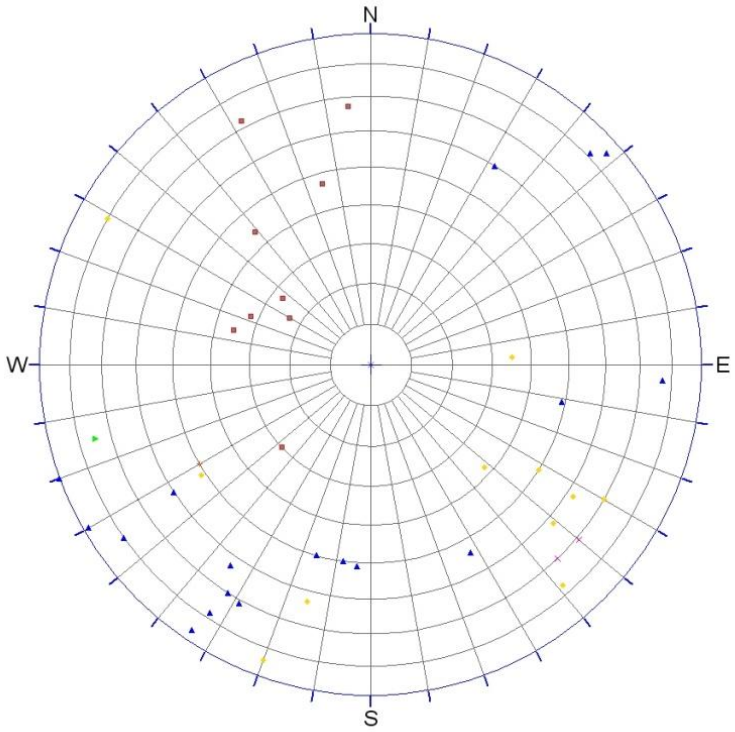


Schmidt
Concentrations
% of total per 1.0 % area

0.00 ~ 1.00 %
1.00 ~ 2.00 %
2.00 ~ 3.00 %
3.00 ~ 4.00 %
4.00 ~ 5.00 %
5.00 ~ 6.00 %
6.00 ~ 7.00 %
7.00 ~ 8.00 %
8.00 ~ 9.00 %
9.00 ~ 10.00 %

No Bias Correction
Max. Conc. = 9.5238%

Equal Area
Lower Hemisphere
42 Poles
42 Entries



TYPE

B [9]
F [18]
F/C [1]
F/V [1]
J [2]
JS [11]

Equal Area
Lower Hemisphere
42 Poles
42 Entries

TITLE

SOUTH WALL MAPPING

Golder Associates

PROJECT No.	063-7109		FILE No.	
DESIGN	RLK	02/07/10	SCALE AS SHOWN	REV. 0
CADD	RLK	02/07/10	APPENDIX 9D	
CHECK	GM	02/08/10		
REVIEW	KH	02/08/10		

APPENDIX 9.E

SEISMIC DISPLACEMENT CALCULATIONS

Summary of Dynamic Deformation Analysis

Selected Notations			
M_w =	Moment magnitude	k_y =	Yield acceleration
a_{brk} =	Peak Horizontal Acceleration at the bedrock	U =	Dynamic deformation along critical slide surface
a_{max} =	Peak Horizontal Acceleration at the crest of slope		

Earthquake Characterization		
M_w	a_{brk}	a_{max} (Reference 1)
	g	g
7.1	0.60	0.60

Deformation Calculation (Reference 2)							
Slope Description	Comment	Failure Description	k_y	k_y/a_{max}	Slope Deformation, U (in) (Bray and Travasarou)		
			g		84% Exc.	16% Exc.	50% Exc.
South Wall Section 9A		circular	0.28	0.47	1	4	2

References:

1. Seed, H. B. and Idriss, I. M. (1982), Ground Motions and Soil Liquefaction During Earthquakes Monograph No. 5, Earthquake Engineering Research Institute, Berkeley, California.
2. Bray, J. D. and Travasarou, T. (2007), Simplified Procedure for Estimating Earthquake-Induced Deviatoric Slope Displacements Journal of the Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 133, No. 4, pp. 381-392.

Note: This spreadsheet is only intended to estimate seismic deformation under the above shown earthquake events and sections.

APPENDIX 10.A

WMSA Boring Logs

SUMMARY: BORING NO. WMSA-2 SHEET 1 OF 4

COORDINATES:

DATE DRILLED: 4/26/07 - 4/26/07
DRILLING METHOD: Prosonic (Boart Longyear), Rotosonic
SURFACE CONDITIONS: Grass, some underlying gravel up to 5" ELEVATION:

DEPTH IN FEET	SAMPLE NO.	RECOVERY	LAB TESTING	SAMPLE TYPE	LAB MOISTURE % OF DRY WEIGHT	DRY DENSITY PCF	LITHOLOGY	DESCRIPTION	SYMBOL	MOISTURE	CONSISTENCY	DEPTH IN FEET
0								SANDY GRAVEL (GP) w/ little low plasticity fines, gray, trace cobbles up to 5" diameter, waste rock--greenstone, dry	GP	dry	medium dense	0
5												5
10								GRAVELLY CLAY (CL) w/ some fine to coarse sand (waste rock--greenstone), dark yellowish brown, gravel to 1.5 " diameter, moderate cementation, moist	CL	dry	very dense	10
15								SANDY GRAVEL (GP) w/some fines , dark yellowish brown, gravel to 3" diameter, trace cobbles to 5" diameter, waste rock--greenstone, dry	GP	dry	dense	15
20								GRAVELLY CLAY (CL) w/ some sand, dark yellowish brown, dry, increasing limestone, waste rock	CL			20
25								SANDY GRAVEL (GP) w/ some moderate plasticity fines, very dark grayish brown, gravel to 3" diameter, moderate cementation, waste rock ~60% greenstone, ~40% limestone, dry	GP	dry	very dense	25
30								SANDY CLAY(CL) to CLAYEY SAND (SC) w/some gravel to 1" diameter, dark yellowish brown, dry, waste rock	CL/SC			30
35								SANDY GRAVEL (GP) w/ some low plasticity fines, very dark gray, gravel to 3" diameter, trace cobbles, waste rock ~90% low to medium grade limestone, ~10% greenstone, dry @33': Increasing greenstone	GP			35
40								@37': ~70% greenstone, ~30% limestone @38': Pale green, ~95% greenstone		dry	medium dense	40

Continued Next Page

A. 2" O.D. SPLIT-SPOON SAMPLER
B. 3" O.D. THIN WALL SAMPLER
C. 3-1/4" O.D. x 2-1/2" LINER
D. 3-1/2" O.D. SPLIT-BARREL SAMPLER
E. 2" I.D. SPLIT-SPOON SAMPLER
X. SAMPLE NOT RECOVERED
A. - ATTERBERG
G. - GRAIN SIZE
C. - CONSOLIDATION
DS - DIRECT SHEAR
T - TRIAXIAL
P - PERMEABILITY
▽ WATER LEVEL - ATD
▼ WATER LEVEL - AD

Golder Associates

Lehigh Permanente Cement Quarry

Job No 063-7109
Engr D.S.F. and P.Y.
Date 7/24/07

Lehigh Permanente Cement Quarry
Cupertino, CA
West Materials Storage Area

BOREHOLE LOG HANSON WMSA 063-7109.GPJ GLDR_OAK.GDT 7/24/07

SUMMARY: BORING NO. WMSA-2 SHEET 2 OF 4

COORDINATES:

DATE DRILLED: 4/26/07 - 4/26/07
DRILLING METHOD: Prosonic (Boart Longyear), Rotosonic
SURFACE CONDITIONS: Grass, some underlying gravel up to 5"

ELEVATION:

DEPTH IN FEET	SAMPLE NO.	RECOVERY	LAB TESTING	SAMPLE TYPE	LAB MOISTURE % OF DRY WEIGHT	DRY DENSITY PCF	LITHOLOGY	DESCRIPTION	SYMBOL	MOISTURE	CONSISTENCY	DEPTH IN FEET
40												40
								@42': Light reddish brown, increasing gravel to cobbles, ~95% limestone waste rock	GP			
45								GRAVELLY CLAY (CL) w/ some sand, very dark grey, gravel to 1.5" diameter, moderate cementation, waste rock~95% greenstone, very stiff, dry	CL			45
								CLAYEY GRAVEL (GC) w/ some sand, brown/greenish gray, gravel to 4" diameter, cementation, waste rock limestone and greenstone, dry		dry	dense	
50									GC			50
55								CLAYEY GRAVEL (GC) w/ some sand, very dark gray, cementation, mostly limestone waste rock, dry		dry	very dense	55
60	WMSA-2-8		A, G	Bag	23-26			@62': Light yellowish brown, moderate cementation				60
65								@66': Very dark gray	GC			65
70								@72': Predominantly greenstone				70
75										dry	very dense	75
80												80

Continued Next Page

A. 2" O.D. SPLIT-SPOON SAMPLER
B. 3" O.D. THIN WALL SAMPLER
C. 3-1/4" O.D. x 2-1/2" LINER
D. 3-1/2" O.D. SPLIT-BARREL SAMPLER
E. 2" I.D. SPLIT-SPOON SAMPLER
X. SAMPLE NOT RECOVERED
A. - ATTERBERG
G. - GRAIN SIZE
C. - CONSOLIDATION
DS - DIRECT SHEAR
T - TRIAXIAL
P - PERMEABILITY
▽ WATER LEVEL - ATD
▼ WATER LEVEL - AD

Golder Associates

Lehigh Permanente Cement Quarry

Job No 063-7109
Engr D.S.F. and P.Y.
Date 7/24/07

Lehigh Permanente Cement Quarry
Cupertino, CA
West Materials Storage Area

BOREHOLE LOG HANSON WMSA 063-7109.GPJ GLDR_OAK.GDT 7/24/07

SUMMARY: BORING NO. WMSA-2 SHEET 3 OF 4

COORDINATES:

DATE DRILLED: 4/26/07 - 4/26/07
DRILLING METHOD: Prosonic (Boart Longyear), Rotosonic
SURFACE CONDITIONS: Grass, some underlying gravel up to 5"

ELEVATION:

DEPTH IN FEET	SAMPLE NO.	RECOVERY	LAB TESTING	SAMPLE TYPE	LAB MOISTURE % OF DRY WEIGHT	DRY DENSITY PCF	LITHOLOGY	DESCRIPTION	SYMBOL	MOISTURE	CONSISTENCY	DEPTH IN FEET
80								@81': Dark yellowish brown, gravel to 6"				80
								@83': Increasing gravel				
85									GC	dry	very dense	85
90								CLAYEY GRAVEL (GC) w/little sand, weak red, cobbles to 6" diameter, limestone waste rock, very stiff, dry				90
								@94': Very dark greenish gray, greenstone	GC			
95												95
								GRAVELLY CLAY (CL) w/some sand, very dark gray, gravel to 2" diameter, very cemented, limestone and greenstone waste rock, dry		dry	dense	
100												100
105									CL	dry	dense	105
110								CLAYEY GRAVEL (GC) w/ some sand, dark gray, gravel to 3", limestone waste rock, dry				110
115									GC			115
120										dry	dense	120

Continued Next Page

A. 2" O.D. SPLIT-SPOON SAMPLER
B. 3" O.D. THIN WALL SAMPLER
C. 3-1/4" O.D. x 2-1/2" LINER
D. 3-1/2" O.D. SPLIT-BARREL SAMPLER
E. 2" I.D. SPLIT-SPOON SAMPLER
X. SAMPLE NOT RECOVERED
A. - ATTERBERG
G. - GRAIN SIZE
C. - CONSOLIDATION
DS - DIRECT SHEAR
T - TRIAXIAL
P - PERMEABILITY
▽ WATER LEVEL - ATD
▼ WATER LEVEL - AD

Golder Associates

Lehigh Permanente Cement Quarry

Job No 063-7109
Engr D.S.F. and P.Y.
Date 7/24/07

Lehigh Permanente Cement Quarry
Cupertino, CA
West Materials Storage Area

BOREHOLE LOG HANSON WMSA 063-7109.GPJ GLDR_OAK.GDT 7/24/07

SUMMARY: BORING NO. WMSA-2 SHEET 4 OF 4

COORDINATES:

DATE DRILLED: 4/26/07 - 4/26/07
DRILLING METHOD: Prosonic (Boart Longyear), Rotosonic
SURFACE CONDITIONS: Grass, some underlying gravel up to 5"

ELEVATION:

DEPTH IN FEET	SAMPLE NO.	RECOVERY	LAB TESTING	SAMPLE TYPE	LAB MOISTURE % OF DRY WEIGHT	DRY DENSITY PCF	LITHOLOGY	DESCRIPTION	SYMBOL	MOISTURE	CONSISTENCY	DEPTH IN FEET
120									GC			120
								SANDY GRAVEL (GP) w/ some high plasticity clay (native ground underlying fill), yellowish brown, gravel to 2", very cemented, greenstone, dry	GP			
125	WMSA-2-13		A	Bag	35-39							125
								CLAY (CL) w/ some gravel and sand, dark grayish brown, signficant cementation, occasional weathered rock fragments (greenstone), mottled, hard, dry		dry	hard	
130	WMSA-2-15		A, G	Bag	30-34				CL			130
135												135
								CLAYEY GRAVEL (GC) w/ some sand, dark yellowish brown, weathered rock fragments, mottled, greenstone, dry	GC	dry	very dense	
140												140
								SANDY GRAVEL (GP) w/ some low plasticity clay, dark grayish brown, gravel to 1.5", cemented, limestone and a little greenstone, very dense, dry	GP			
145								GREENSTONE, dark yellowish brown, mottled, fine grained, subangular, medium to highly weathered w/ oxidized rock fragments, RQD = 0, hard, dry				145
										dry	very dense	
150									IGNSFG			150
155								@155': Dark gray, powder (greenstone) due to drilling				155
								Terminate borehole @ 158' bgs No water encountered				
160												160

A. 2" O.D. SPLIT-SPOON SAMPLER
B. 3" O.D. THIN WALL SAMPLER
C. 3-1/4" O.D. x 2-1/2" LINER
D. 3-1/2" O.D. SPLIT-BARREL SAMPLER
E. 2" I.D. SPLIT-SPOON SAMPLER
X. SAMPLE NOT RECOVERED
A. - ATTERBERG
G. - GRAIN SIZE
C. - CONSOLIDATION
DS - DIRECT SHEAR
T - TRIAXIAL
P - PERMEABILITY
▽ WATER LEVEL - ATD
▼ WATER LEVEL - AD

Golder Associates

Lehigh Permanente Cement Quarry

Job No 063-7109
Engr D.S.F. and P.Y.
Date 7/24/07

Lehigh Permanente Cement Quarry
Cupertino, CA
West Materials Storage Area

BOREHOLE LOG HANSON WMSA 063-7109.GPJ GLDR_OAK.GDT 7/24/07

SUMMARY: BORING NO. WMSA-3 SHEET 1 OF 4

COORDINATES:

DATE DRILLED: 4/28/07 - 4/29/07
DRILLING METHOD: Prosonic (Boart Longyear), Rotosonic
SURFACE CONDITIONS: Short grass, fine to coarse gravel to 3" (mostly limestone) ELEVATION:

DEPTH IN FEET	SAMPLE NO.	RECOVERY	LAB TESTING	SAMPLE TYPE	LAB MOISTURE % OF DRY WEIGHT	DRY DENSITY PCF	LITHOLOGY	DESCRIPTION	SYMBOL	MOISTURE	CONSISTENCY	DEPTH IN FEET
0								SANDY GRAVEL (GP) w/ some low plasticity fines, yellowish brown, gravel to 3", low grade limestone waste rock, dry	GP	dry	medium dense	0
5	WMSA-3-1		A, G	Bag	34-38			@4': Brown CLAYEY SAND (SC) w/ some gravel, yellowish brown, gravel to 2", mostly limestone w/ some weathered greenstone, cemented waste rock, dry				5
10								@8': Dark yellowish brown, increasing cementation @12': Very dark grayish brown	SC	dry	very dense	10
15								SILTY SAND (SM) w/ some gravel, yellowish brown, gravel to 3", mostly limestone waste rock, dry				15
20								@19': Very dark grayish brown @21': White, went through ~7' diameter limestone boulder, mostly powder, trace cobbles 3" to 6" diameter		dry	medium dense	20
25								@27': Very dark grayish brown, greenstone @28': Brown, mostly medium grade limestone	SM	dry	medium dense	25
30								@32': Very dark grayish brown, mostly greenstone @33': Yellowish brown, mostly limestone				30
35	WMSA-3-4		A, G	Bag	32-36			@38': Very pale brown				35
40												40

Continued Next Page

A. 2" O.D. SPLIT-SPOON SAMPLER
B. 3" O.D. THIN WALL SAMPLER
C. 3-1/4" O.D. x 2-1/2" LINER
D. 3-1/2" O.D. SPLIT-BARREL SAMPLER
E. 2" I.D. SPLIT-SPOON SAMPLER
X. SAMPLE NOT RECOVERED
A. - ATTERBERG
G. - GRAIN SIZE
C. - CONSOLIDATION
DS - DIRECT SHEAR
T - TRIAXIAL
P - PERMEABILITY
▽ WATER LEVEL - ATD
▼ WATER LEVEL - AD

Golder Associates

Lehigh Permanente Cement Quarry

Job No 063-7109
Engr D.S.F.
Date 7/24/07

Lehigh Permanente Cement Quarry
Cupertino, CA
West Materials Storage Area

BOREHOLE LOG HANSON WMSA 063-7109.GPJ GLDR_OAK.GDT 7/24/07

SUMMARY: BORING NO. WMSA-3 SHEET 2 OF 4

COORDINATES:

DATE DRILLED: 4/28/07 - 4/29/07
DRILLING METHOD: Prosonic (Boart Longyear), Rotosonic
SURFACE CONDITIONS: Short grass, fine to coarse gravel to 3" (mostly limestone) ELEVATION:

DEPTH IN FEET	SAMPLE NO.	RECOVERY	LAB TESTING	SAMPLE TYPE	LAB MOISTURE % OF DRY WEIGHT	DRY DENSITY PCF	LITHOLOGY	DESCRIPTION	SYMBOL	MOISTURE	CONSISTENCY	DEPTH IN FEET
40								@42': Increasing fines, limestone, cemented	SM			40
45								@45': Very pale brown, ~70% low to medium grade limestone, ~30% greenstone @47': Yellowish brown				45
								SANDY GRAVEL (GP) w/ trace fines, yellowish brown, cobbles to 8" diameter, greenstone waste rock, very dense, cemented, dry		dry	very dense	
50									GP			50
								CLAYEY GRAVEL (GC) w/ some sand, yellowish brown, gravel to 2", greenstone w/ some limestone, cemented, moderately stiff, dry	GC			
55								SANDY GRAVEL (GP) w/ some low plasticity fines, brown, gravel to 3" diameter, greenstone waste rock, cemented, dense, dry @58': Increasing cobbles to 7" diameter, greenstone, harder drilling		dry	dense	55
60												60
65								@67': ~80% greenstone, ~20% low grade limestone	GP			65
70								@72': Yellowish brown				70
75												75
80												80

Continued Next Page

A. 2" O.D. SPLIT-SPOON SAMPLER
B. 3" O.D. THIN WALL SAMPLER
C. 3-1/4" O.D. x 2-1/2" LINER
D. 3-1/2" O.D. SPLIT-BARREL SAMPLER
E. 2" I.D. SPLIT-SPOON SAMPLER
X. SAMPLE NOT RECOVERED
A. - ATTERBERG
G. - GRAIN SIZE
C. - CONSOLIDATION
DS - DIRECT SHEAR
T - TRIAXIAL
P - PERMEABILITY
▽ WATER LEVEL - ATD
▼ WATER LEVEL - AD

Golder Associates

Lehigh Permanente Cement Quarry

Job No 063-7109
Engr D.S.F.
Date 7/24/07

Lehigh Permanente Cement Quarry
Cupertino, CA
West Materials Storage Area

BOREHOLE LOG HANSON WMSA 063-7109.GPJ GLDR_OAK.GDT 7/24/07

SUMMARY: BORING NO. WMSA-3 SHEET 3 OF 4

COORDINATES:

DATE DRILLED: 4/28/07 - 4/29/07
DRILLING METHOD: Prosonic (Boart Longyear), Rotosonic
SURFACE CONDITIONS: Short grass, fine to coarse gravel to 3" (mostly limestone) ELEVATION:

DEPTH IN FEET	SAMPLE NO.	RECOVERY	LAB TESTING	SAMPLE TYPE	LAB MOISTURE % OF DRY WEIGHT	DRY DENSITY PCF	LITHOLOGY	DESCRIPTION	SYMBOL	MOISTURE	CONSISTENCY	DEPTH IN FEET
80									GP			80
85								CLAYEY GRAVEL (GC) w/ some sand, dark yellowish brown, gravel to 2", limestone and greenstone, well cemented, mottled, dry	GC	dry	very dense	85
90								SANDY GRAVEL (GP) w/ some low plasticity fines, brown, gravel to 3" diameter, greenstone, cemented, dense, dry	GP			90
								CLAYEY GRAVEL (GC) w/ some sand, dark yellowish brown, gravel to 2", mostly limestone, cemented, dry	GC			
95								SANDY GRAVEL (GP) w/ some low plasticity fines, gravel to 3", mostly greenstone, cemented, dry	GP			95
								CLAYEY GRAVEL (GC) w/ some sand, dark yellowish brown, gravel to 2", mostly limestone, cemented, dry Harder drilling	GC	dry	medium dense	
100								SANDY GRAVEL (GP) w/ some fines, gravel to 3", low grade limestone, dry @102': Very pale brown, trace chert	GP			100
105										moist	very dense	105
110								GRAVELLY CLAY (CL) w/ little sand (native ground underlying fill), greenish black, colluvium, tree roots, very dense, cemented, moist	CL			110
	WMSA-3-9		A, G	Bag	45-51			LIMESTONE, low to medium grade, yellowish brown, fine grained, sub angular, medium to highly weathered, some oxide staining, dense, moist	LS	moist	very dense	
115												115
								GREENSTONE, mottled (green, red, yellow, brown), fine grained, subrounded, highly to completely weathered, medium	IGNSFG	dry	very dense	
120												120

Continued Next Page

A. 2" O.D. SPLIT-SPOON SAMPLER
B. 3" O.D. THIN WALL SAMPLER
C. 3-1/4" O.D. x 2-1/2" LINER
D. 3-1/2" O.D. SPLIT-BARREL SAMPLER
E. 2" I.D. SPLIT-SPOON SAMPLER
X. SAMPLE NOT RECOVERED
A. - ATTERBERG
G. - GRAIN SIZE
C. - CONSOLIDATION
DS - DIRECT SHEAR
T - TRIAXIAL
P - PERMEABILITY
WATER LEVEL - ATD
WATER LEVEL - AD

Golder Associates

Lehigh Permanente Cement Quarry

Job No 063-7109
Engr D.S.F.
Date 7/24/07

Lehigh Permanente Cement Quarry
Cupertino, CA
West Materials Storage Area

BOREHOLE LOG HANSON WMSA 063-7109.GPJ GLDR_OAK.GDT 7/24/07

SUMMARY: BORING NO. WMSA-3 SHEET 4 OF 4

COORDINATES:

DATE DRILLED: 4/28/07 - 4/29/07
DRILLING METHOD: Prosonic (Boart Longyear), Rotosonic
SURFACE CONDITIONS: Short grass, fine to coarse gravel to 3" (mostly limestone)

ELEVATION:

DEPTH IN FEET	SAMPLE NO.	RECOVERY	LAB TESTING	SAMPLE TYPE	LAB MOISTURE % OF DRY WEIGHT	DRY DENSITY PCF	LITHOLOGY	DESCRIPTION	SYMBOL	MOISTURE	CONSISTENCY	DEPTH IN FEET
120								hard, loose, RQD = 0, dry				120
125									IGNSFG			125
130												130
								Terminated borehole @ 133' bgs No water encountered				
135												135
140												140
145												145
150												150
155												155
160												160

A. 2" O.D. SPLIT-SPOON SAMPLER
B. 3" O.D. THIN WALL SAMPLER
C. 3-1/4" O.D. x 2-1/2" LINER
D. 3-1/2" O.D. SPLIT-BARREL SAMPLER
E. 2" I.D. SPLIT-SPOON SAMPLER
X. SAMPLE NOT RECOVERED
A. - ATTERBERG
G. - GRAIN SIZE
C. - CONSOLIDATION
DS - DIRECT SHEAR
T - TRIAXIAL
P - PERMEABILITY
▽ WATER LEVEL - ATD
▼ WATER LEVEL - AD

Golder Associates

Lehigh Permanente Cement Quarry

Job No 063-7109
Engr D.S.F.
Date 7/24/07

Lehigh Permanente Cement Quarry
Cupertino, CA
West Materials Storage Area

BOREHOLE LOG HANSON WMSA 063-7109.GPJ GLDR_OAK.GDT 7/24/07

SUMMARY: BORING NO. WMSA-4 SHEET 1 OF 2

COORDINATES:

DATE DRILLED: 4/24/07 - 4/24/07
DRILLING METHOD: Prosonic (Boart Longyear), Rotosonic
SURFACE CONDITIONS: Sporadic brush, gravel up to 2", dry

ELEVATION:

DEPTH IN FEET	SAMPLE NO.	RECOVERY	LAB TESTING	SAMPLE TYPE	LAB MOISTURE % OF DRY WEIGHT	DRY DENSITY PCF	LITHOLOGY	DESCRIPTION	SYMBOL	MOISTURE	CONSISTENCY	DEPTH IN FEET
0								SANDY GRAVEL (GP) w/ some low plasticity fines, very dark brown, loose, dry, limestone and greenstone waste rock		dry	loose	0
5								@4': Increasing gravel, medium dense	GP	dry	medium dense	5
10								CLAYEY GRAVEL (GC) w/ some sand, gravel to 3" diameter, mostly limestone waste rock, very dark brown, dense, moist to wet		moist to wet	dense	10
15										moist	dense	15
20												20
25									GC			25
30										moist to wet	dense	30
35								@36': 2' of GRAVELLY CLAY (CL) w/ some sand, gray, very stiff, significant cementation, dry	CL	dry	very stiff	35
40										moist	very dense	40

Continued Next Page

A. 2" O.D. SPLIT-SPOON SAMPLER
B. 3" O.D. THIN WALL SAMPLER
C. 3-1/4" O.D. x 2-1/2" LINER
D. 3-1/2" O.D. SPLIT-BARREL SAMPLER
E. 2" I.D. SPLIT-SPOON SAMPLER
X. SAMPLE NOT RECOVERED
A. - ATTERBERG
G. - GRAIN SIZE
C. - CONSOLIDATION
DS - DIRECT SHEAR
T - TRIAXIAL
P - PERMEABILITY
▽ WATER LEVEL - ATD
▼ WATER LEVEL - AD

Golder Associates

Lehigh Permanente Cement Quarry

Job No 063-7109
Engr D.S.F. and P.Y.
Date 7/24/07

Lehigh Permanente Cement Quarry
Cupertino, CA
West Materials Storage Area

BOREHOLE LOG HANSON WMSA 063-7109.GPJ GLDR_OAK.GDT 7/24/07

SUMMARY: BORING NO. WMSA-4 SHEET 2 OF 2

COORDINATES:

DATE DRILLED: 4/24/07 - 4/24/07
DRILLING METHOD: Prosonic (Boart Longyear), Rotosonic
SURFACE CONDITIONS: Sporadic brush, gravel up to 2", dry

ELEVATION:

DEPTH IN FEET	SAMPLE NO.	RECOVERY	LAB TESTING	SAMPLE TYPE	LAB MOISTURE % OF DRY WEIGHT	DRY DENSITY PCF	LITHOLOGY	DESCRIPTION	SYMBOL	MOISTURE	CONSISTENCY	DEPTH IN FEET
40									GC			40
45								@47': 1' of GRAVELLY SAND (SP) w/ little clay, grayish brown, very dense, dry	SP	dry	very dense	45
									GC	dry to moist	very dense	
50												50
55								@55': 2' of GRAVELLY SAND (SP) w/ little clay, grayish brown, very dense, dry	SP	dry	dense	55
	WMSA-4-11		A, G	Bag	22			CLAYEY SAND w/ some gravel (native ground underlying fill), reddish brown, very stiff, moderate cementation, moist	SC	moist	very dense	
60	WMSA-4-12		A, G	Bag	37-42			GRAVELLY SAND (SP) w/ some fines, grayish brown, dense, dry	SP	dry	dense	60
65								LIMESTONE, gray, fine grained, subangular to subrounded, some calcite filled fractures, hard, RQD = 0, dense, dry	LS	dry	dense	65
70										dry	very dense	70
75												75
80								Terminate borehole @ 78' bgs No water encountered				80

A. 2" O.D. SPLIT-SPOON SAMPLER
B. 3" O.D. THIN WALL SAMPLER
C. 3-1/4" O.D. x 2-1/2" LINER
D. 3-1/2" O.D. SPLIT-BARREL SAMPLER
E. 2" I.D. SPLIT-SPOON SAMPLER
X. SAMPLE NOT RECOVERED
A. - ATTERBERG
G. - GRAIN SIZE
C. - CONSOLIDATION
DS - DIRECT SHEAR
T - TRIAXIAL
P - PERMEABILITY
▽ WATER LEVEL - ATD
▼ WATER LEVEL - AD

Golder Associates

Lehigh Permanente Cement Quarry

Job No 063-7109
Engr D.S.F. and P.Y.
Date 7/24/07

Lehigh Permanente Cement Quarry
Cupertino, CA
West Materials Storage Area

BOREHOLE LOG HANSON WMSA 063-7109.GPJ GLDR_OAK.GDT 7/24/07

SUMMARY: BORING NO. WMSA-5 SHEET 1 OF 3

COORDINATES:

DATE DRILLED: 4/24/07 - 4/25/07
DRILLING METHOD: Prosonic (Boart Longyear), Rotosonic
SURFACE CONDITIONS: Greenstone and limestone waste rock up to 5" diameter, dry ELEVATION:

DEPTH IN FEET	SAMPLE NO.	RECOVERY	LAB TESTING	SAMPLE TYPE	LAB MOISTURE % OF DRY WEIGHT	DRY DENSITY PCF	LITHOLOGY	DESCRIPTION	SYMBOL	MOISTURE	CONSISTENCY	DEPTH IN FEET
0								SANDY GRAVEL (GP) w/ some fines, cobbles to 6" diameter, low to medium grade limestone waste rock, trace chert, loose, dry	GP	dry	loose	0
5												5
10	WMSA-5-2		A	Bag	35-38			CLAYEY GRAVEL (GC) w/ some sand, yellowish brown, gravel waste rock to 3" diameter, medium dense, moist	GC	moist	medium dense	10
15								SANDY GRAVEL (GP) w/ trace clay, gravel waste rock to 2" diameter, some iron oxide staining, medium dense, dry	GP	dry	medium dense	15
20												20
25								@24': Dark gray, ~60% low to medium grade limestone, ~40% high grade limestone waste rock		dry	loose	25
30								SANDY SILT (ML) w/ trace cobbles to 6" diameter, greenish black, greenstone waste rock, loose, dry	ML			30
								SANDY GRAVEL (GP) w/ trace clay, brown, gravel to 2.5" diameter, loose, dry	GP	dry	medium dense	
								CLAYEY GRAVEL (GP) w/ some sand, dark yellowish brown, trace cobbles to 6" diameter, greenstone waste rock, medium dense, dry	GP	moist	dense	
								GRAVELLY CLAY (CL) w/ some sand, dark brown, gravel to 1.5" diameter, low grade limestone waste rock, dense, moist	CL	dry	loose	
35								SILTY GRAVEL (GM) w/ some sand, pale brown, gravel to 2" diameter, loose, dry	GM			35
40								SANDY GRAVEL (GP) w/ some fines, pale prown, gravel to 3", loose, dry	GP			40

Continued Next Page

A. 2" O.D. SPLIT-SPOON SAMPLER
B. 3" O.D. THIN WALL SAMPLER
C. 3-1/4" O.D. x 2-1/2" LINER
D. 3-1/2" O.D. SPLIT-BARREL SAMPLER
E. 2" I.D. SPLIT-SPOON SAMPLER
X. SAMPLE NOT RECOVERED
A. - ATTERBERG
G. - GRAIN SIZE
C. - CONSOLIDATION
DS - DIRECT SHEAR
T - TRIAXIAL
P - PERMEABILITY
▽ WATER LEVEL - ATD
▼ WATER LEVEL - AD

Golder Associates

Lehigh Permanente Cement Quarry

Job No 063-7109
Engr D.S.F. and P.Y.
Date 7/24/07

Lehigh Permanente Cement Quarry
Cupertino, CA
West Materials Storage Area

BOREHOLE LOG HANSON WMSA 063-7109.GPJ GLDR_OAK.GDT 7/24/07

SUMMARY: BORING NO. WMSA-5 SHEET 2 OF 3

COORDINATES:

DATE DRILLED: 4/24/07 - 4/25/07
DRILLING METHOD: Prosonic (Boart Longyear), Rotosonic
SURFACE CONDITIONS: Greenstone and limestone waste rock up to 5" diameter, dry

ELEVATION:

DEPTH IN FEET	SAMPLE NO.	RECOVERY	LAB TESTING	SAMPLE TYPE	LAB MOISTURE % OF DRY WEIGHT	DRY DENSITY PCF	LITHOLOGY	DESCRIPTION	SYMBOL	MOISTURE	CONSISTENCY	DEPTH IN FEET
40								@40' - 42': Greenish brown, significant cementation				40
45								@46': Very pale brown	GP	dry	very dense	45
50								@50': Yellowish brown		dry	dense	50
55								GRAVELLY SAND (GP) w/ trace fines, gravel to 1.5", loose dry	GP	dry	loose	55
	WMSA-5-11		A, G	Bag	25-28			CLAYEY SAND (SC) w/ some gravel (native ground underlying fill), black/green, mottled, greenstone, cementation, very dense, dry		dry	very dense	
60									SC			60
65												65
70								GREENSTONE, some fines, green/pale brown, mottled, to 4" diameter, fine grained, subangular, medium weathered, RQD = 4, hard, dry		dry	hard	70
75									IGNSFG			75
80												80

Continued Next Page

A. 2" O.D. SPLIT-SPOON SAMPLER
B. 3" O.D. THIN WALL SAMPLER
C. 3-1/4" O.D. x 2-1/2" LINER
D. 3-1/2" O.D. SPLIT-BARREL SAMPLER
E. 2" I.D. SPLIT-SPOON SAMPLER
X. SAMPLE NOT RECOVERED
A. - ATTERBERG
G. - GRAIN SIZE
C. - CONSOLIDATION
DS - DIRECT SHEAR
T - TRIAXIAL
P - PERMEABILITY
▽ WATER LEVEL - ATD
▼ WATER LEVEL - AD

Golder Associates

Lehigh Permanente Cement Quarry

Job No 063-7109
Engr D.S.F. and P.Y.
Date 7/24/07

Lehigh Permanente Cement Quarry
Cupertino, CA
West Materials Storage Area

BOREHOLE LOG HANSON WMSA 063-7109.GPJ GLDR_OAK.GDT 7/24/07

SUMMARY: BORING NO. WMSA-5 SHEET 3 OF 3

COORDINATES:

DATE DRILLED: 4/24/07 - 4/25/07
DRILLING METHOD: Prosonic (Boart Longyear), Rotosonic
SURFACE CONDITIONS: Greenstone and limestone waste rock up to 5" diameter, dry

ELEVATION:

DEPTH IN FEET	SAMPLE NO.	RECOVERY	LAB TESTING	SAMPLE TYPE	LAB MOISTURE % OF DRY WEIGHT	DRY DENSITY PCF	LITHOLOGY	DESCRIPTION	SYMBOL	MOISTURE	CONSISTENCY	DEPTH IN FEET
80												80
									IGNSFG			
85								Terminate borehole @86' bgs No water encountered				85
90												90
95												95
100												100
105												105
110												110
115												115
120												120

A. 2" O.D. SPLIT-SPOON SAMPLER
B. 3" O.D. THIN WALL SAMPLER
C. 3-1/4" O.D. x 2-1/2" LINER
D. 3-1/2" O.D. SPLIT-BARREL SAMPLER
E. 2" I.D. SPLIT-SPOON SAMPLER
X. SAMPLE NOT RECOVERED
A. - ATTERBERG
G. - GRAIN SIZE
C. - CONSOLIDATION
DS - DIRECT SHEAR
T - TRIAXIAL
P - PERMEABILITY
WATER LEVEL - ATD
WATER LEVEL - AD

Golder Associates

Lehigh Permanente Cement Quarry

Job No 063-7109
Engr D.S.F. and P.Y.
Date 7/24/07

Lehigh Permanente Cement Quarry
Cupertino, CA
West Materials Storage Area

BOREHOLE LOG HANSON WMSA 063-7109.GPJ GLDR_OAK.GDT 7/24/07

SUMMARY: BORING NO. WMSA-6 SHEET 1 OF 2

COORDINATES:

DATE DRILLED: 4/27/07 - 4/27/07
DRILLING METHOD: Prosonic (Boart Longyear), Rotosonic
SURFACE CONDITIONS: Small patches of vegetation, gravel up to 3", trace cobbles

ELEVATION:

DEPTH IN FEET	SAMPLE NO.	RECOVERY	LAB TESTING	SAMPLE TYPE	LAB MOISTURE % OF DRY WEIGHT	DRY DENSITY PCF	LITHOLOGY	DESCRIPTION	SYMBOL	MOISTURE	CONSISTENCY	DEPTH IN FEET
0								SANDY GRAVEL (GP) w/ little fines, dark yellowish brown, gravel to 3" (mostly greenstone waste rock w/ some limestone), moderately dense		dry	medium dense	0
5									GP			5
										dry	very dense	
10								CLAYEY GRAVEL (GP) w/ some sand, yellowish brown, gravel to 3", trace cobbles, mostly greenstone waste rock, trace chert, well cemented, very dense, dry				10
								@12': Very dark gray, highly weathered greenstone waste rock				
15												15
								@18': Yellowish brown, increasing gravel size, some cobbles to 5", mostly limestone waste rock				
20												20
								@23': Very dark gray, mostly greenstone waste rock, increasing sand				
25									GP			25
										dry to moist	dense	
30	WMSA-6-4		A, G	Bag	24-27							30
35												35
40												40

Continued Next Page

A. 2" O.D. SPLIT-SPOON SAMPLER
B. 3" O.D. THIN WALL SAMPLER
C. 3-1/4" O.D. x 2-1/2" LINER
D. 3-1/2" O.D. SPLIT-BARREL SAMPLER
E. 2" I.D. SPLIT-SPOON SAMPLER
X. SAMPLE NOT RECOVERED
A. - ATTERBERG
G. - GRAIN SIZE
C. - CONSOLIDATION
DS - DIRECT SHEAR
T - TRIAXIAL
P - PERMEABILITY
▽ WATER LEVEL - ATD
▼ WATER LEVEL - AD

Golder Associates

Lehigh Permanente Cement Quarry

Job No 063-7109
Engr D.S.F.
Date 7/24/07

Lehigh Permanente Cement Quarry
Cupertino, CA
West Materials Storage Area

BOREHOLE LOG HANSON WMSA 063-7109.GPJ GLDR_OAK.GDT 7/24/07

SUMMARY: BORING NO. WMSA-6 SHEET 2 OF 2

COORDINATES:

DATE DRILLED: 4/27/07 - 4/27/07
DRILLING METHOD: Prosonic (Boart Longyear), Rotosonic
SURFACE CONDITIONS: Small patches of vegetation, gravel up to 3", trace cobbles

ELEVATION:

DEPTH IN FEET	SAMPLE NO.	RECOVERY	LAB TESTING	SAMPLE TYPE	LAB MOISTURE % OF DRY WEIGHT	DRY DENSITY PCF	LITHOLOGY	DESCRIPTION	SYMBOL	MOISTURE	CONSISTENCY	DEPTH IN FEET
40								@40': Yellowish brown, cobbles to 7", mostly low grade limestone		dry	dense	40
45								@43: Very dark gray	GP			45
50								CLAYEY SAND (SC) w/ some gravel (native ground underlying fill), limestone to 3" diameter, mottled (red, yellow, green, brown), subrounded, hard, dense, dry		dry	dense	50
55	WMSA-6-6		A, G	Wrap	22-25				SC			55
60								GREENSTONE, dark green/gray, mottled, fine grained, subangular, hard, RQD = 3, dry				60
65									IGNSFG			65
70								Terminate borehole @ 68' bgs No water encountered				70
75												75
80												80

A. 2" O.D. SPLIT-SPOON SAMPLER
B. 3" O.D. THIN WALL SAMPLER
C. 3-1/4" O.D. x 2-1/2" LINER
D. 3-1/2" O.D. SPLIT-BARREL SAMPLER
E. 2" I.D. SPLIT-SPOON SAMPLER
X. SAMPLE NOT RECOVERED
A. - ATTERBERG
G. - GRAIN SIZE
C. - CONSOLIDATION
DS - DIRECT SHEAR
T - TRIAXIAL
P - PERMEABILITY
▽ WATER LEVEL - ATD
▼ WATER LEVEL - AD

Golder Associates

Lehigh Permanente Cement Quarry

Job No 063-7109
Engr D.S.F.
Date 7/24/07

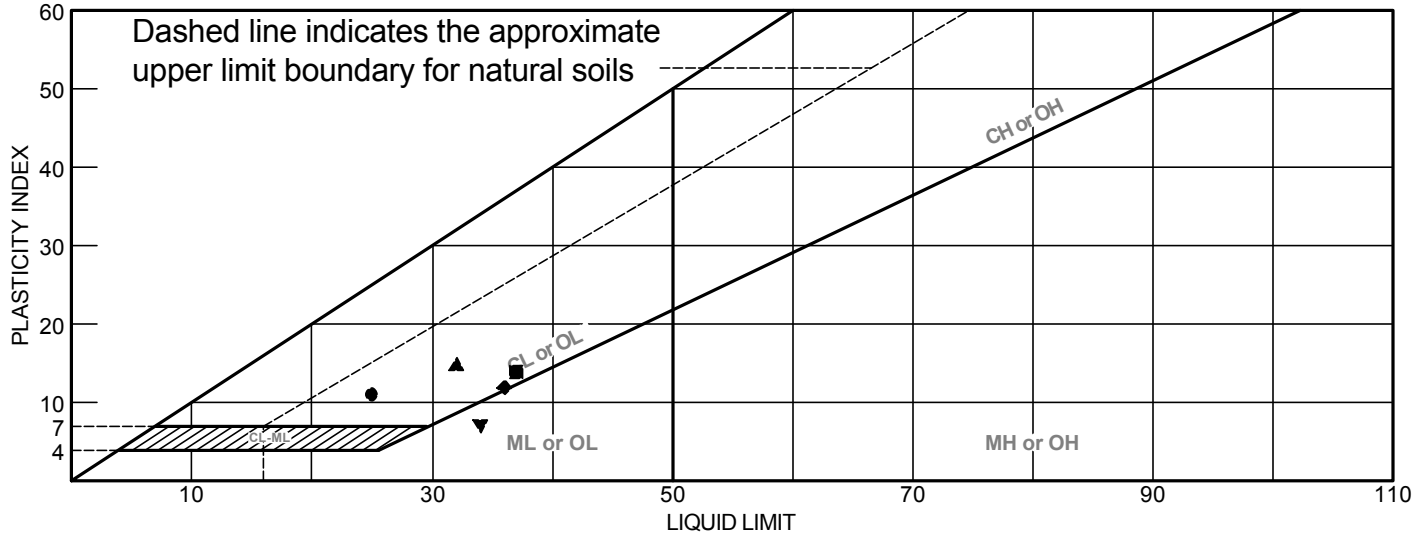
Lehigh Permanente Cement Quarry
Cupertino, CA
West Materials Storage Area

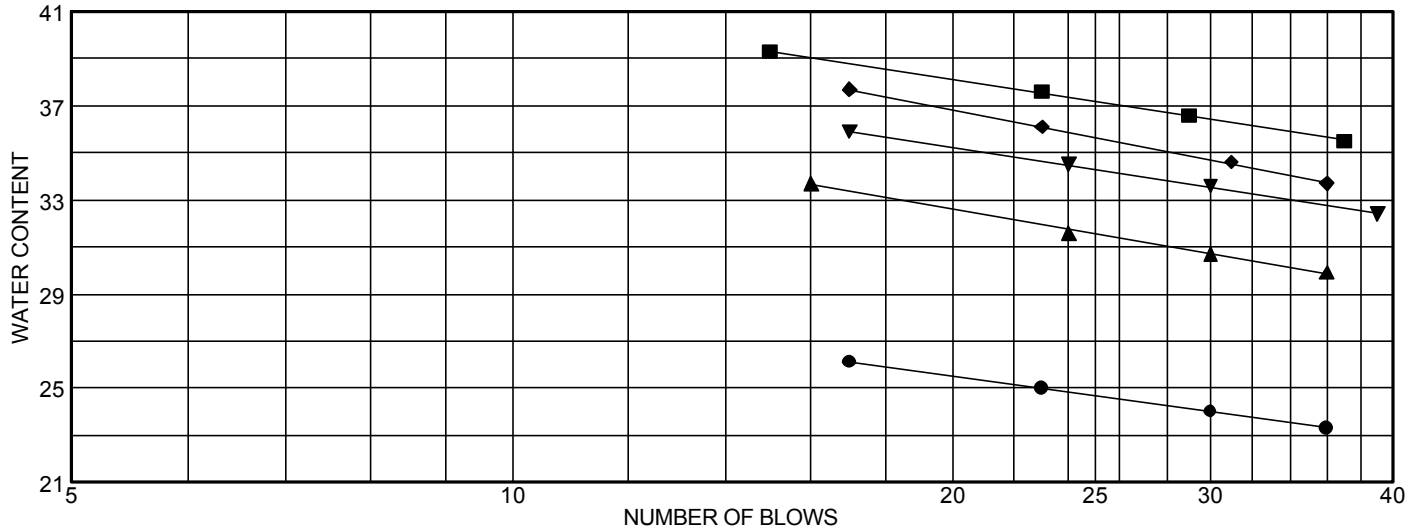
BOREHOLE LOG HANSON WMSA 063-7109.GPJ GLDR_OAK.GDT 7/24/07

APPENDIX 10.B

WMSA Laboratory Test Results

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Black Lean Clayey GRAVEL w/ Sand	25	14	11			
■	Brown Sandy Lean CLAY w/ Gravel	37	23	14			
▲	Green & Gray Lean CLAY w/ Sand	32	17	15			
◆	Brown Lean Clayey SAND w/ Gravel	36	24	12			
▼	Brown Silty SAND w/ Gravel	34	27	7			

Project No. 287-030 **Client:** Golder Associates

Project: Hanson/ West Materials Storage Area - 003-7109.008

●	**Source:** WMSA-2	**Sample No.:** 2-8	**Elev./Depth:** 61'
■	**Source:** WMSA-2	**Sample No.:** 2-13	**Elev./Depth:** 125'
▲	**Source:** WMSA-2	**Sample No.:** 2-15	**Elev./Depth:** 131'
◆	**Source:** WMSA-3	**Sample No.:** 3-1	**Elev./Depth:** 6'
▼	**Source:** WMSA-3	**Sample No.:** 3-4	**Elev./Depth:** 35'

LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Remarks:

●

■

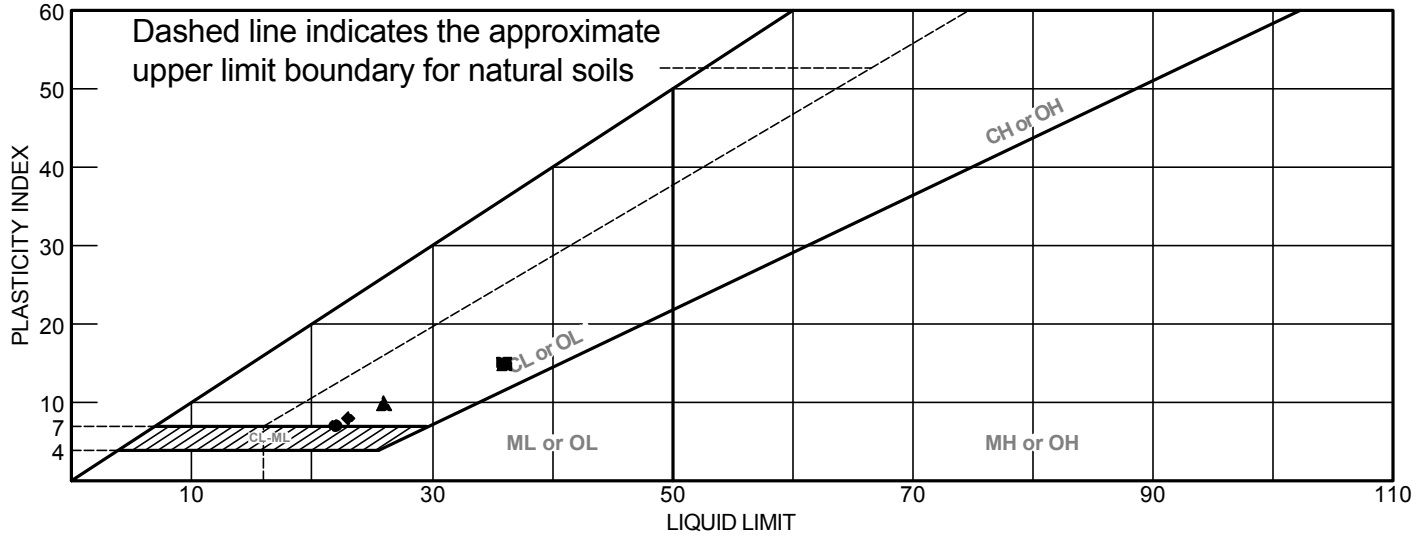
▲

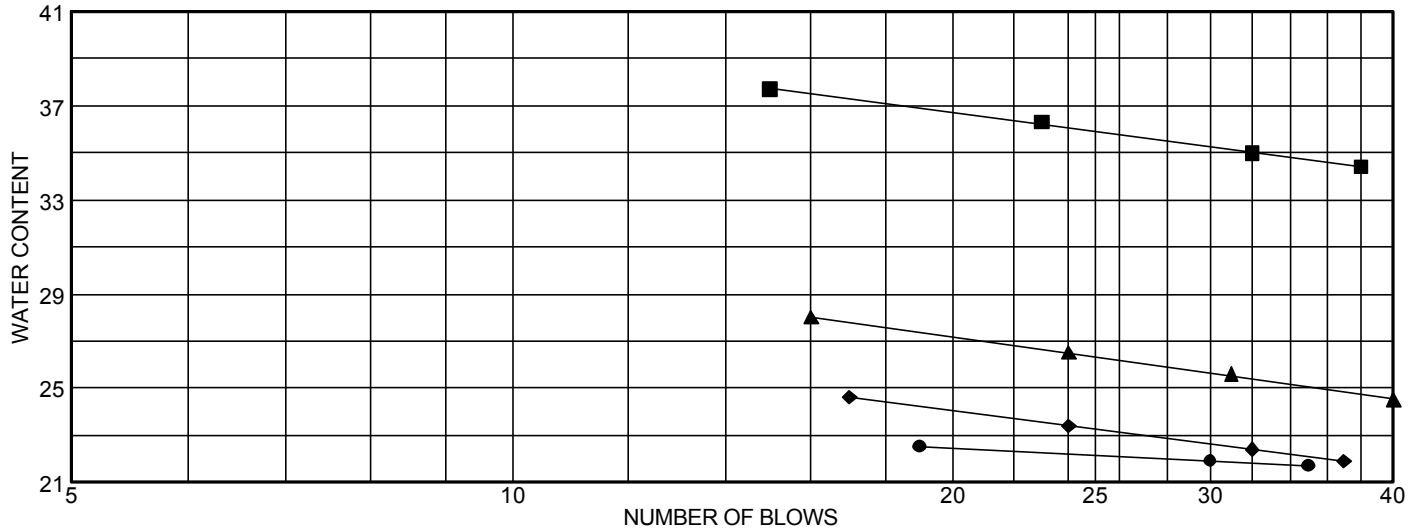
◆

▼

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown Silty, Clayey GRAVEL w/ Sand	22	15	7			
■	Brownish Yellow Lean Clayey SAND w/ Gravel	36	21	15			
▲	Black & Green Lean Clayey SAND w/ Gravel	26	16	10			
◆	Black Lean Clayey SAND w/ Gravel	23	15	8			

Project No. 287-030 **Client:** Golder Associates

Project: Hanson/ West Materials Storage Area - 003-7109.008

●	**Source:** WMSA-4	**Sample No.:** 4-11	**Elev./Depth:** 58'
■	**Source:** WMSA-5	**Sample No.:** 5-2	**Elev./Depth:** 13'
▲	**Source:** WMSA-5	**Sample No.:** 5-11	**Elev./Depth:** 58'
◆	**Source:** WMSA-6	**Sample No.:** 6-6	**Elev./Depth:** 54'

Remarks:

●

■

▲

◆

LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Figure

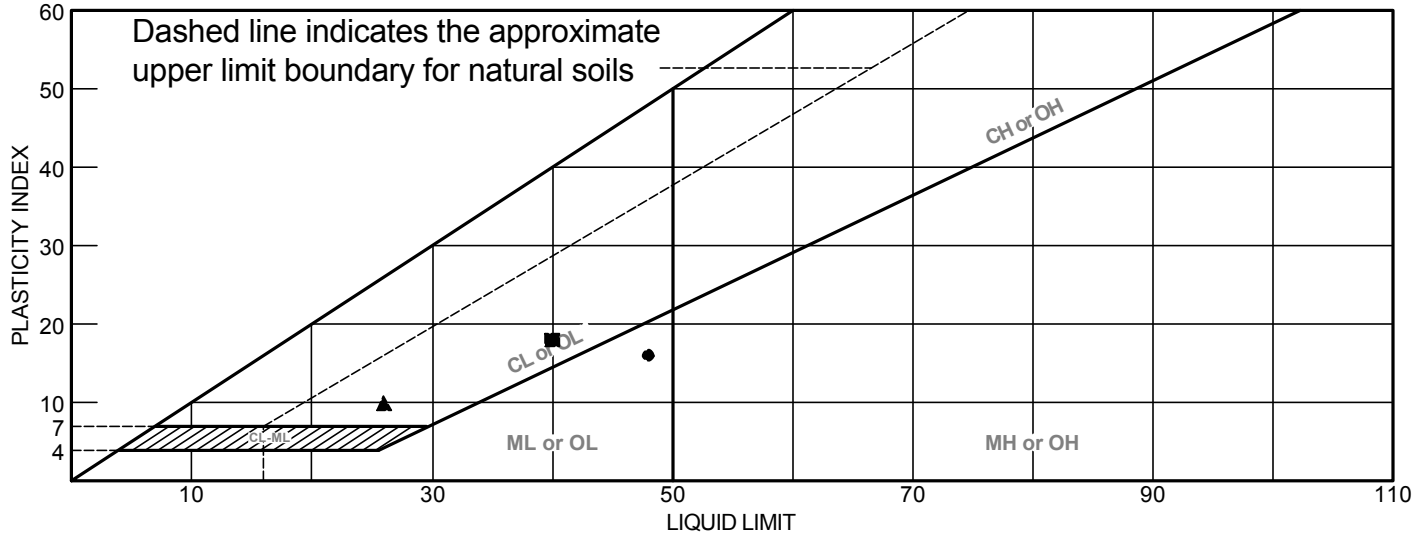
#200 Sieve Wash Analysis
ASTM D 1140

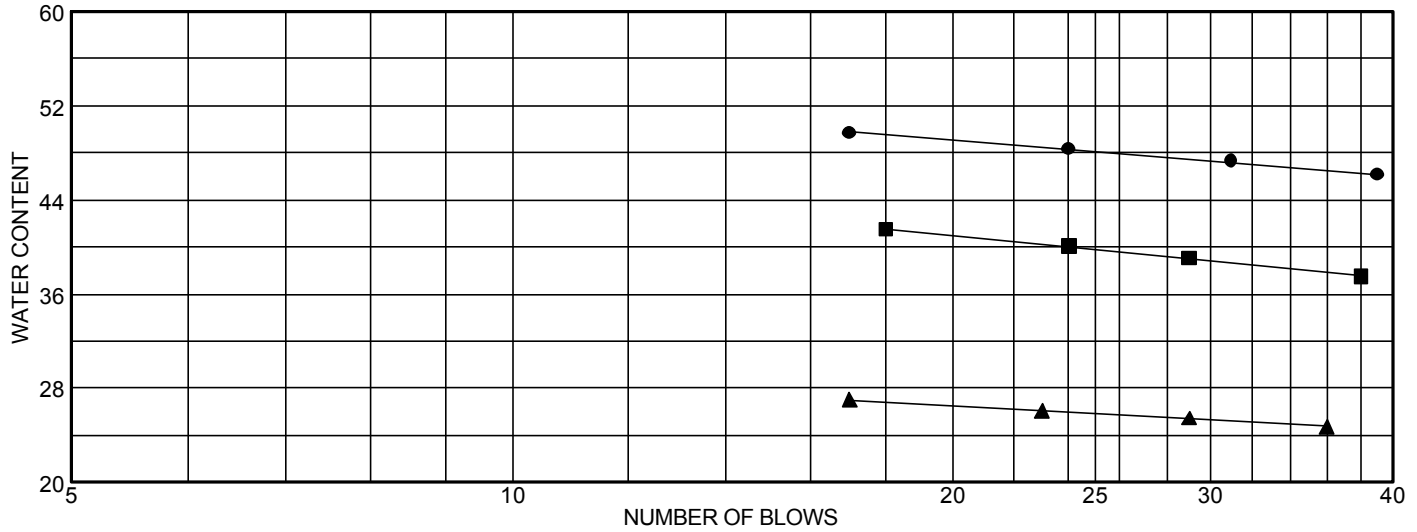
Job No.:	287-030	**Project No.:**	003-7109.008	**Run By:**	MD
Client:	Golder Associates	**Date:**	5/31/2007	**Checked By:**	DC
Project:	Hanson/West Materials Storage Area				

Boring:	WMSA-2	WMSA-2	WMSA-3	WMSA-3	WMSA-4	WMSA-5	WMSA-6	
Sample:	2-8	2-15	3-1	3-4	4-11	5-11	6-6	
Depth, ft.:	61	131	6	35	58	58	54	
Soil Type:	Black Lean Clayey GRAVEL w/ Sand	Green & Gray Lean CLAY w/ Sand	Brown Lean Clayey SAND w/ Gravel	Brown Silty SAND w/ Gravel	Brown Silty,Clayey GRAVEL w/ Sand	Black & Green Lean Clayey SAND w/ Gravel	Black Lean Clayey SAND w/ Gravel	
Wt of Dish & Dry Soil, gm	717.7	945.8	860.4	879.1	907.1	829.0	920.4	
Weight of Dish, gm	84.5	309.8	278.2	82.9	80.2	96.4	174.3	
Weight of Dry Soil, gm	633.2	636.0	582.2	796.2	826.9	732.6	746.1	
Wt. Ret. on #4 Sieve, gm	294.5	75.3	132.6	175.8	318.3	124.4	276.2	
Wt. Ret. on #200 Sieve, gm	533.9	178.4	416.9	612.9	627.6	463.4	603.7	
% Gravel	**46.5**	**11.8**	**22.8**	**22.1**	**38.5**	**17.0**	**37.0**	
% Sand	**37.8**	**16.2**	**48.8**	**54.9**	**37.4**	**46.3**	**43.9**	
% Silt & Clay	**15.7**	**71.9**	**28.4**	**23.0**	**24.1**	**36.7**	**19.1**	

Remarks: As an added benefit to our clients, the gravel fraction may be included in this report. Whether or not it is included is dependent upon both the technician's time available and if there is a significant enough amount of gravel. The gravel is always included in the percent retained on the #200 sieve but may not be weighed separately to determine the percentage, especially if there is only a trace amount, (5% or less).

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Dark Brown Silty GRAVEL w/ Sand	48	32	16			
■	Brownish Yellow Lean Clayey SAND w/ Gravel	40	22	18			
▲	Dark Reddish Gray Lean Clayey GRAVEL w/ Sand	26	16	10			

Project No. 287-032 **Client:** Golder Associates

Project: Hanson/West Materials Storage Area - 063-7109.008

● **Source:** WMSA-3 **Sample No.:** 3-9 **Elev./Depth:** 113'

■ **Source:** WMSA-4 **Sample No.:** 4-12 **Elev./Depth:** 59'

▲ **Source:** WMSA-6 **Sample No.:** 6-4 **Elev./Depth:** 33'

Remarks:

●

■

▲

LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Figure

#200 Sieve Wash Analysis
ASTM D 1140

Job No.:	287-032		**Project No.:**	063-7109.008		**Run By:**	MD	
Client:	Golder Associates		**Date:**	6/26/2007		**Checked By:**	DC	
Project:	Hanson/West Materials Storage Area							

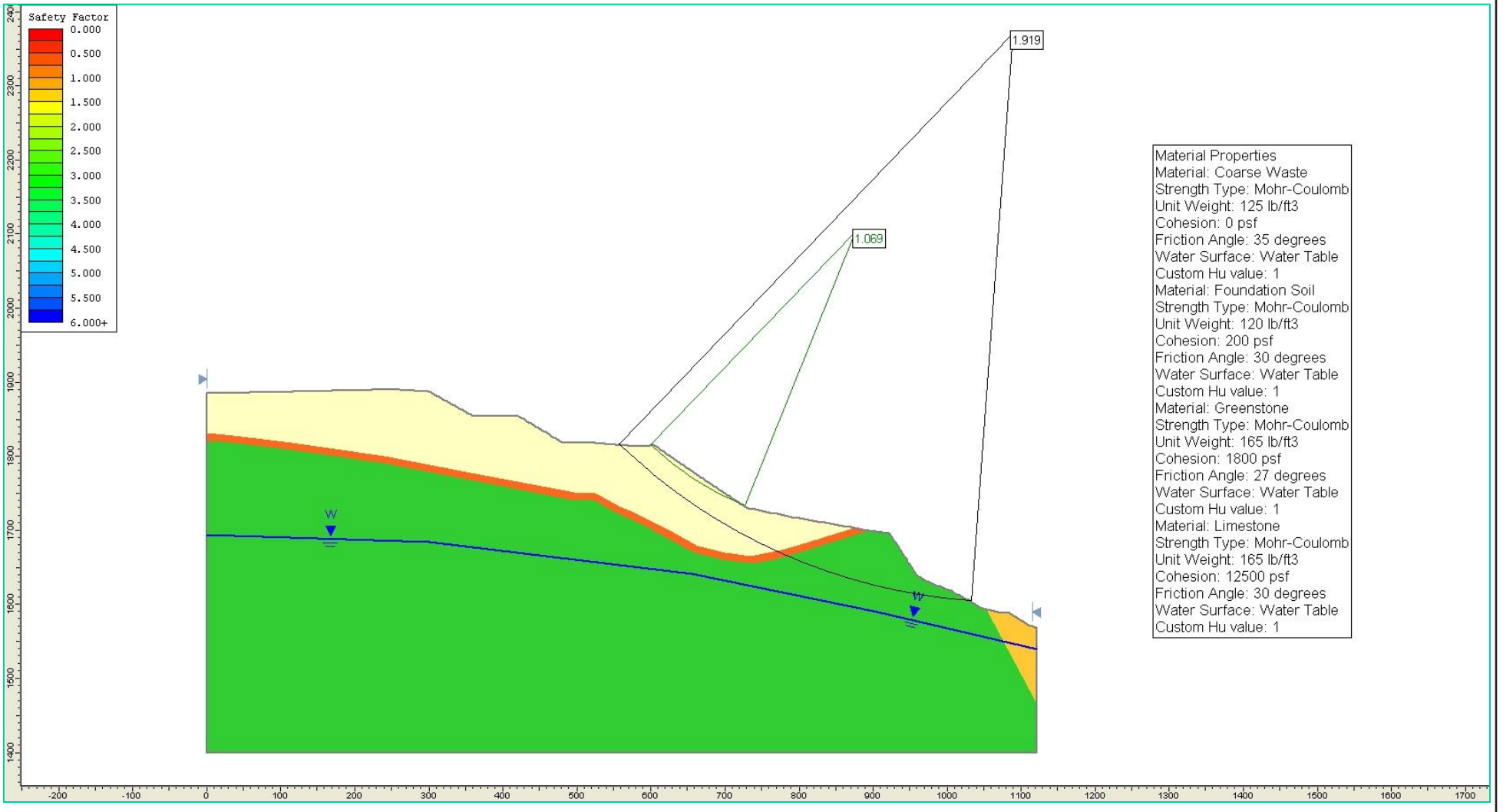
Boring:	WMSA-3	WMSA-4	WMSA-9					
Sample:	3-9	4-12	6-4					
Depth, ft.:	113	59	33					
Soil Type:	Dark Brown Silty GRAVEL w/ Sand	Brownish Yellow Lean Clayey SAND w/ Gravel	Dark Reddish Gray Lean Clayey GRAVEL w/ Sand					
Wt of Dish & Dry Soil, gm	783.0	568.5	750.1					
Weight of Dish, gm	83.7	84.4	82.9					
Weight of Dry Soil, gm	699.3	484.1	667.2					
Wt. Ret. on #4 Sieve, gm	289.7	94.1	300.0					
Wt. Ret. on #200 Sieve, gm	477.1	245.3	543.2					
% Gravel	**41.4**	**19.4**	**45.0**					
% Sand	**26.8**	**31.2**	**36.4**					
% Silt & Clay	**31.8**	**49.3**	**18.6**					

Remarks: As an added benefit to our clients, the gravel fraction may be included in this report. Whether or not it is included is dependent upon both the technician's time available and if there is a significant enough amount of gravel. The gravel is always included in the percent retained on the #200 sieve but may not be weighed separately to determine the percentage, especially if there is only a trace amount, (5% or less).

APPENDIX 10.C

WMSA Slope Stability Output

PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION W1 – EXISTING EAST SLOPE OF WMSA
CONDITION: STATIC
FAILURE MODE: CIRCULAR

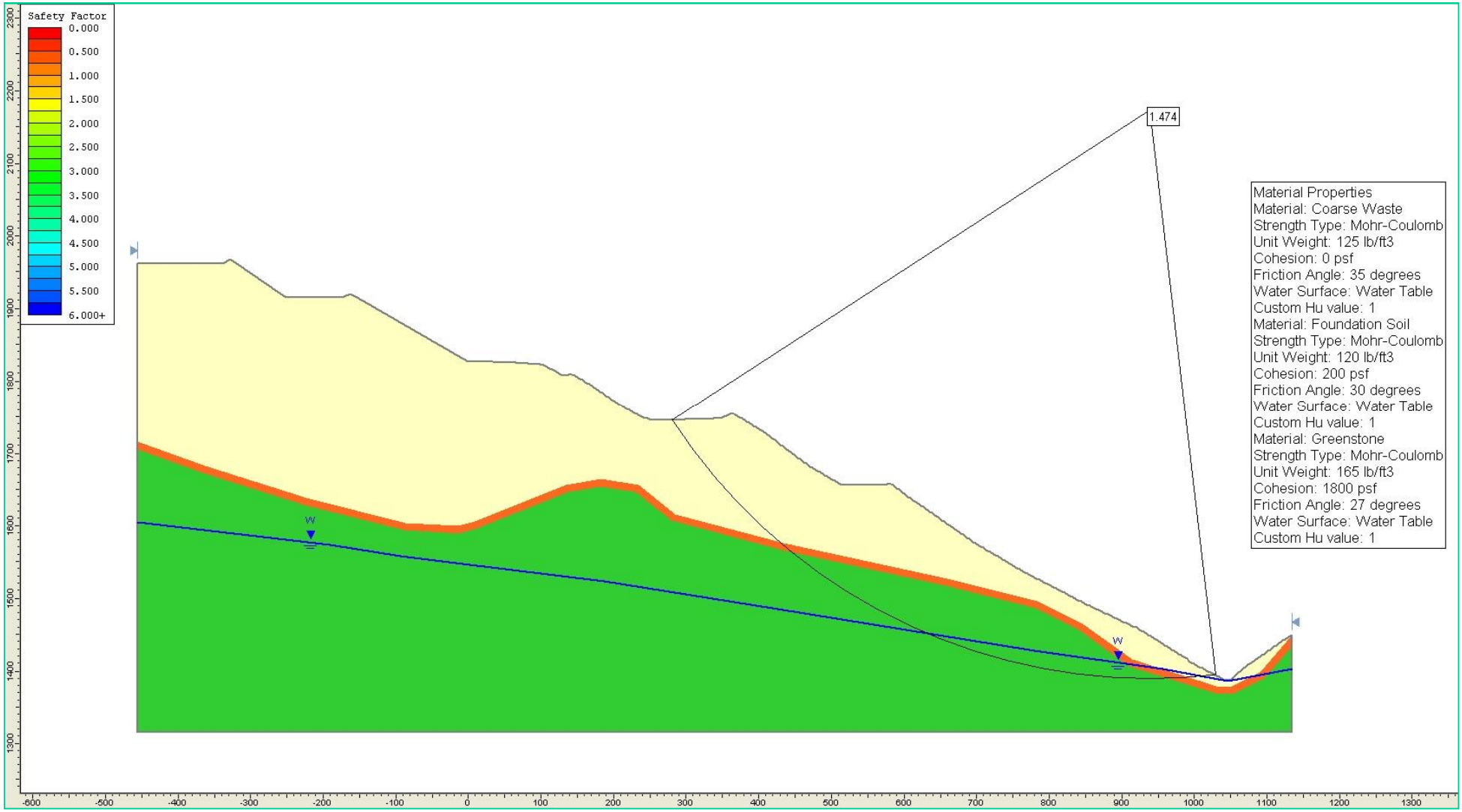
Golder Associates

EXISTING SLOPE STABILITY SECTION W1 – WMSA LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: MAY, 2010	Figure: 10C-1

Project No.: 063-7109 Revision No.: 1

PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION W2 – EXISTING SOUTH SLOPE OF WMSA
CONDITION: STATIC
FAILURE MODE: CIRCULAR

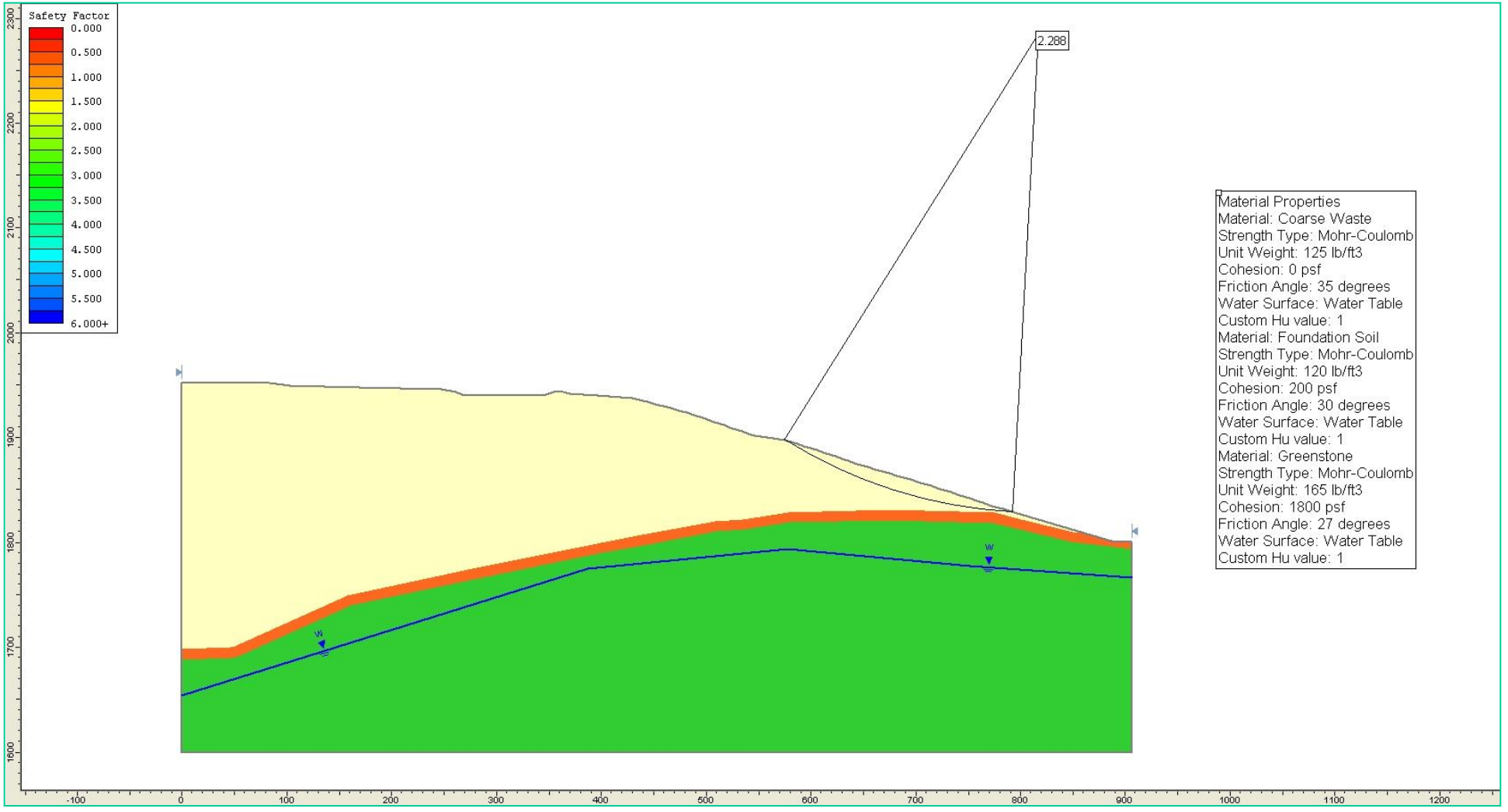
Golder Associates

EXISTING SLOPE STABILITY
SECTION W2 – WMSA
LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: MAY, 2010	Figure: 10C-2

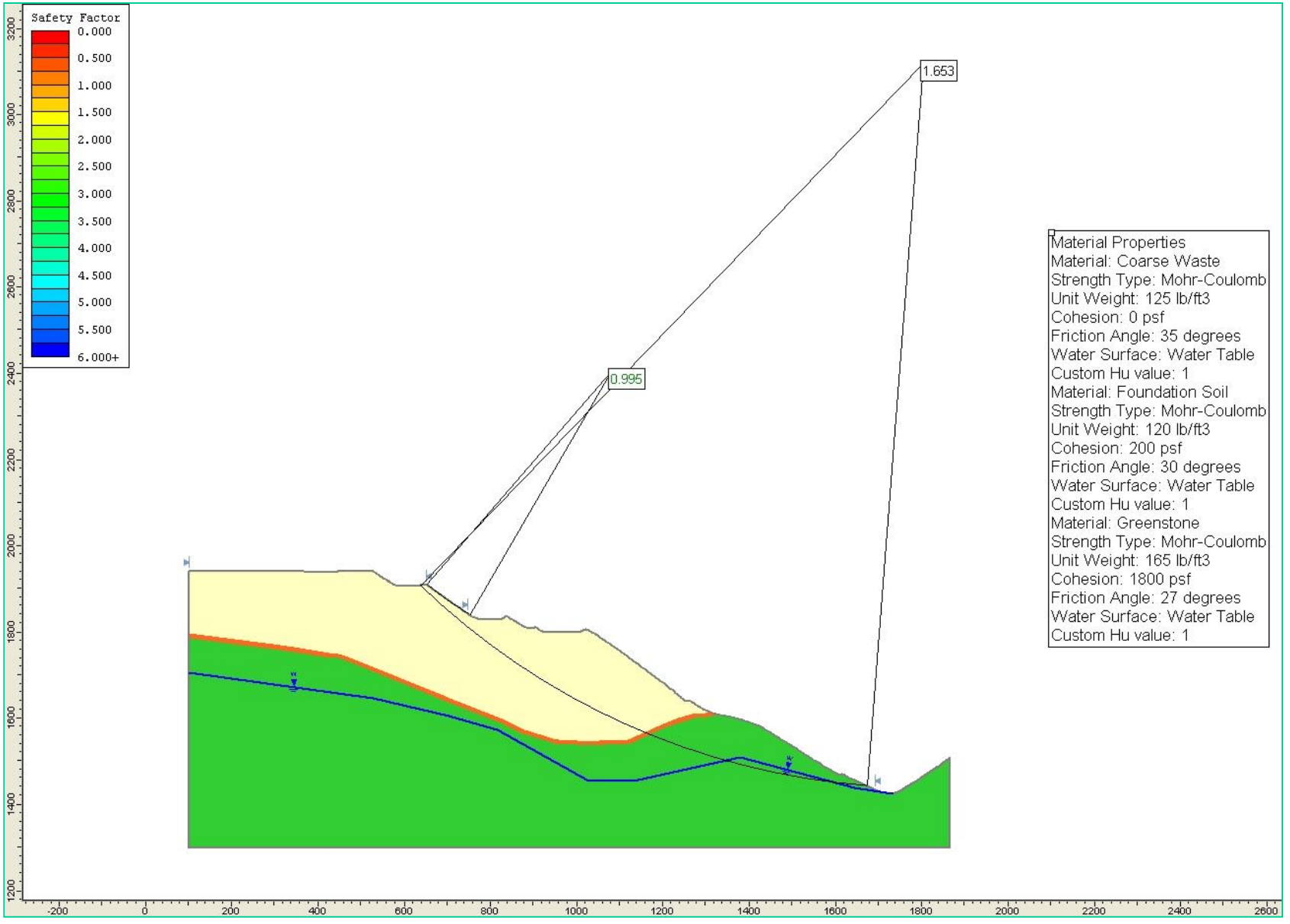
Project No.: 063-7109 Revision No.: 1

PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION W3 – EXISTING NORTH SLOPE OF WMSA
CONDITION: STATIC
FAILURE MODE: CIRCULAR

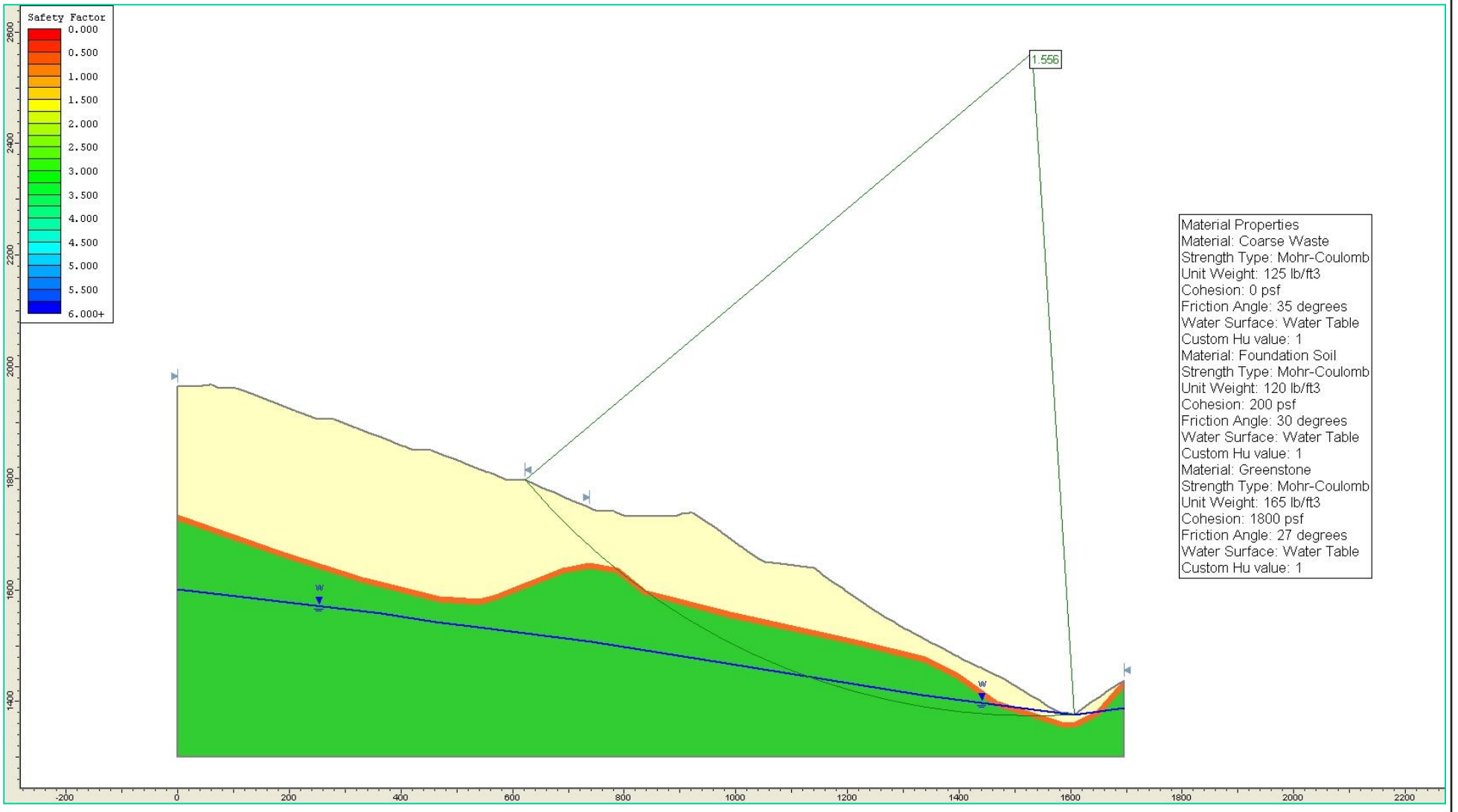
Golder Associates			EXISTING SLOPE STABILITY SECTION W3 – WMSA LEHIGH SOUTHWEST CEMENT COMPANY, CA
Drawn: PHY	App'd: KGH	Date: MAY, 2010	Figure: 10C-3
Project No.: 063-7109			Revision No.: 1



BACK ANALYSE SECTION W4
CONDITION: STATIC
FAILURE MODE: CIRCULAR

Golder Associates			BACK ANALYSES OF SECTION W4 – UPPER DUMP LEHIGH SOUTHWEST CEMENT COMPANY, CA
Drawn: PHY	App'd: KGH	Date: MAY, 2010	Figure: 10C-4
Project No.: 063-7109			Revision No.: 1

PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION W2 – PROPOSED SLOPE
CONDITION: STATIC
FAILURE MODE: CIRCULAR

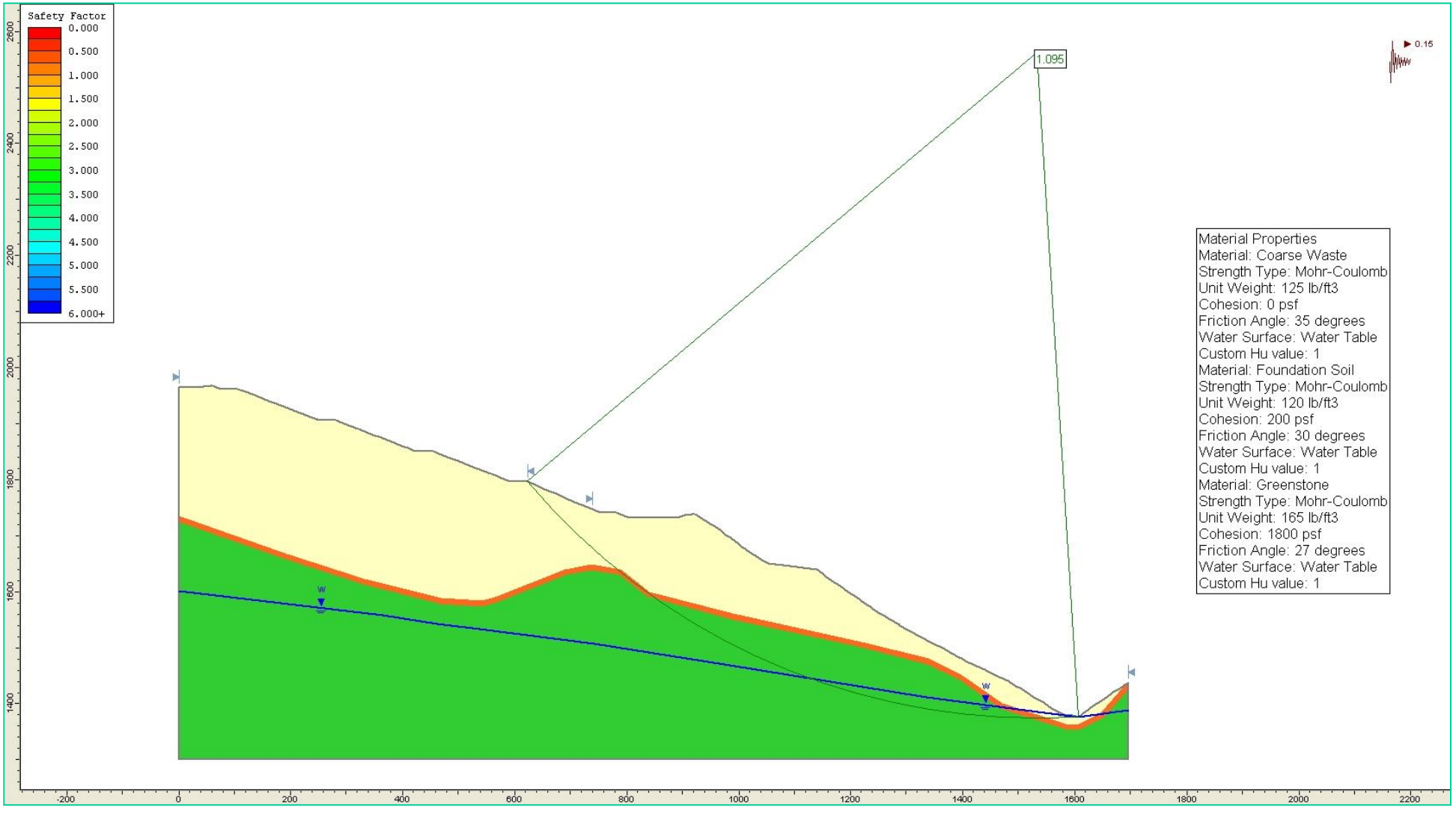
Golder Associates

STATIC CONDITION
PROPOSED SEC W2, WMSA
LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: MAY, 2010	Figure: 10C-5

Project No.: 063-7109 Revision No.: 1

PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:

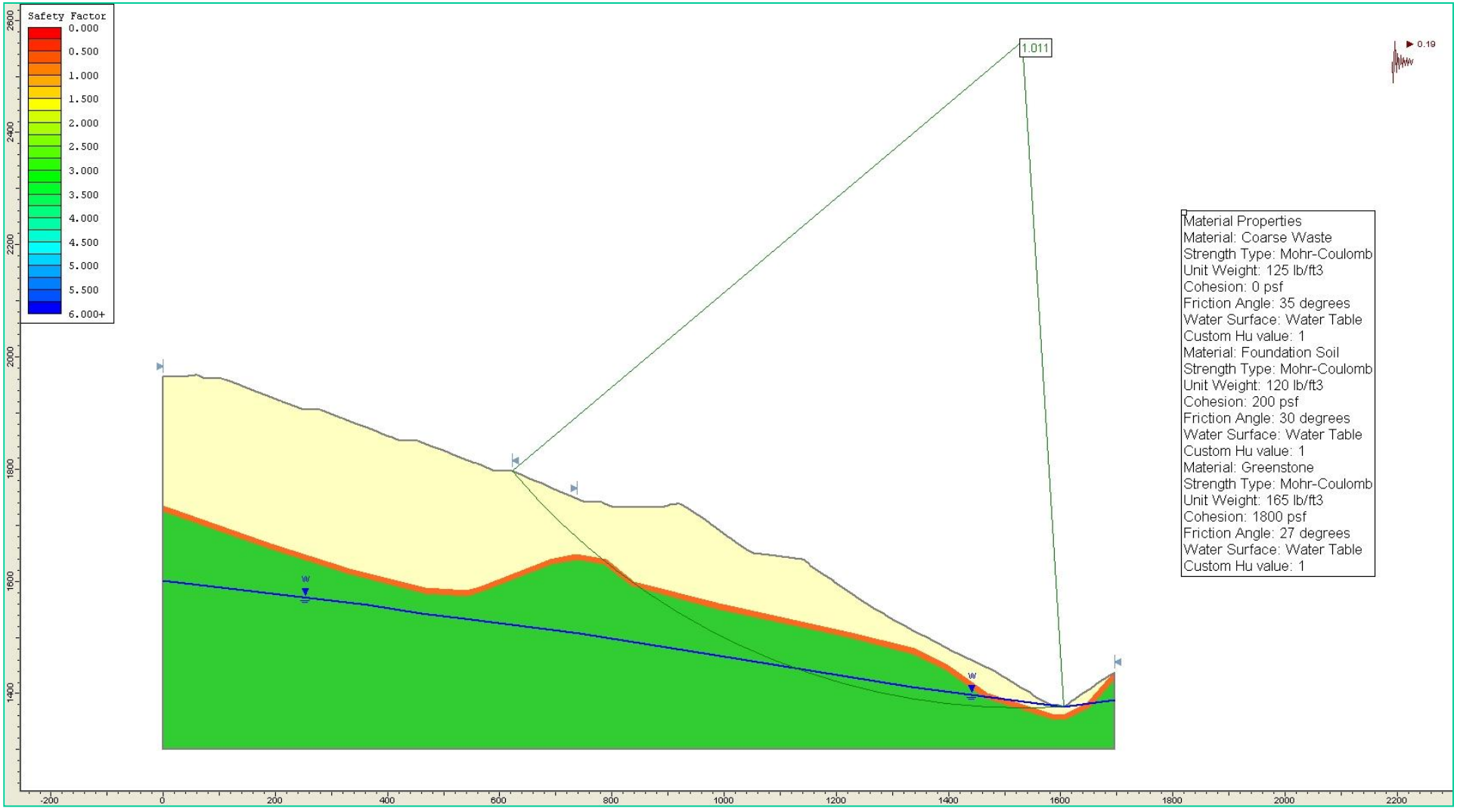


SECTION W2 – PROPOSED SLOPE
CONDITION: PSEUDO-STATIC (Ks = 0.15)
FAILURE MODE: CIRCULAR

Golder Associates			**PSEUDO-STATIC ANALYSES PROPOSED SEC W2, WMSA LEHIGH SOUTHWEST CEMENT COMPANY, CA**
Drawn: PHY	App'd: KGH	Date: MAY, 2010	Figure: **10C-6**

Project No.: 063-7109 Revision No.: 1

PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



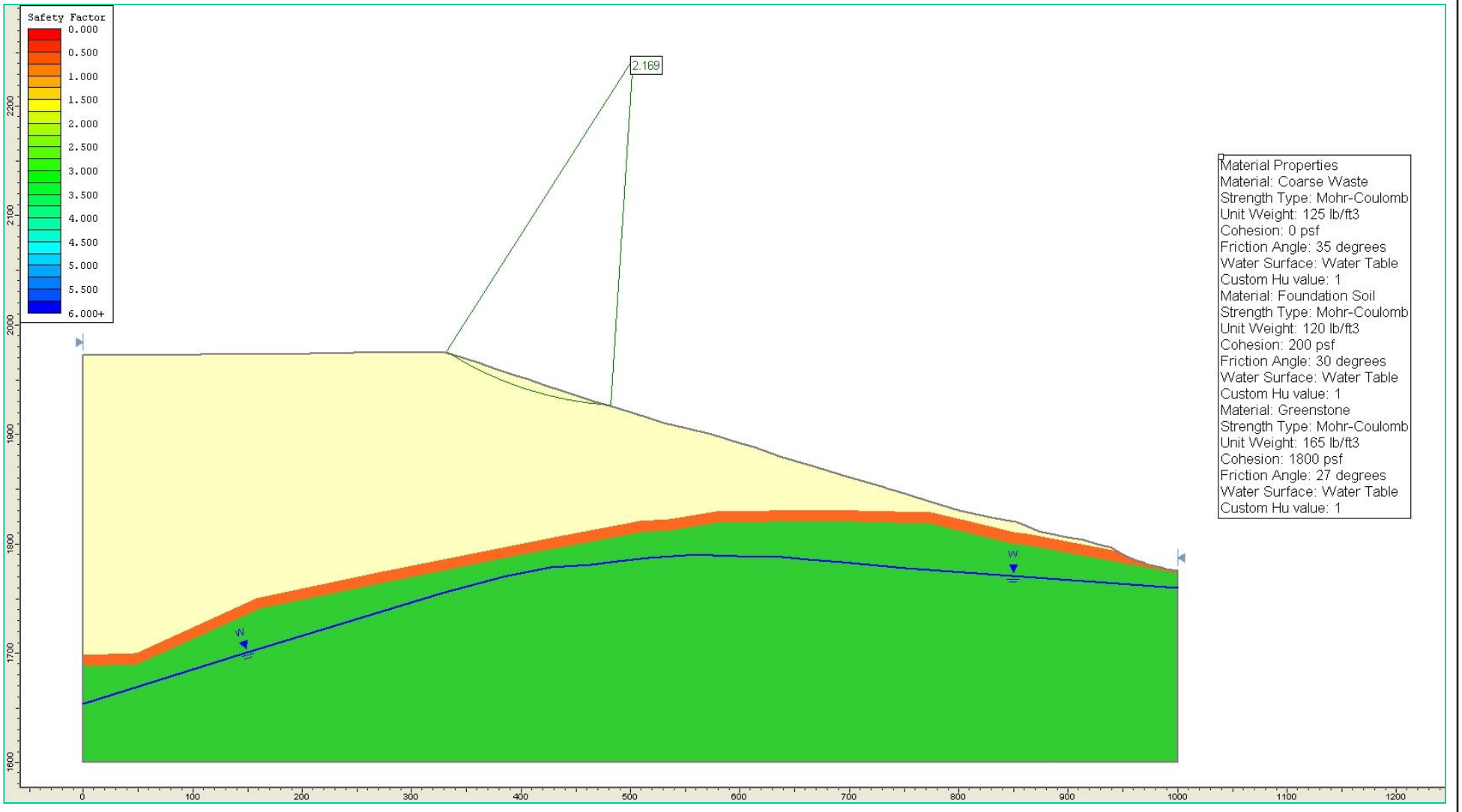
SECTION W2 – PROPOSED SLOPE

DETERMINE Ky CORRESPONDING TO FOS = 1.0:

Ky = 0.19g

Golder Associates		Ky CALCULATION PROPOSED SEC W2, WMSA LEHIGH SOUTHWEST CEMENT COMPANY, CA	
Drawn: PHY	App'd: KGH	Date: MAY, 2010	Figure: 10C-7
Project No.: 063-7109			Revision No.: 1

PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION W3 – PROPOSED SLOPE
CONDITION: STATIC
FAILURE MODE: CIRCULAR

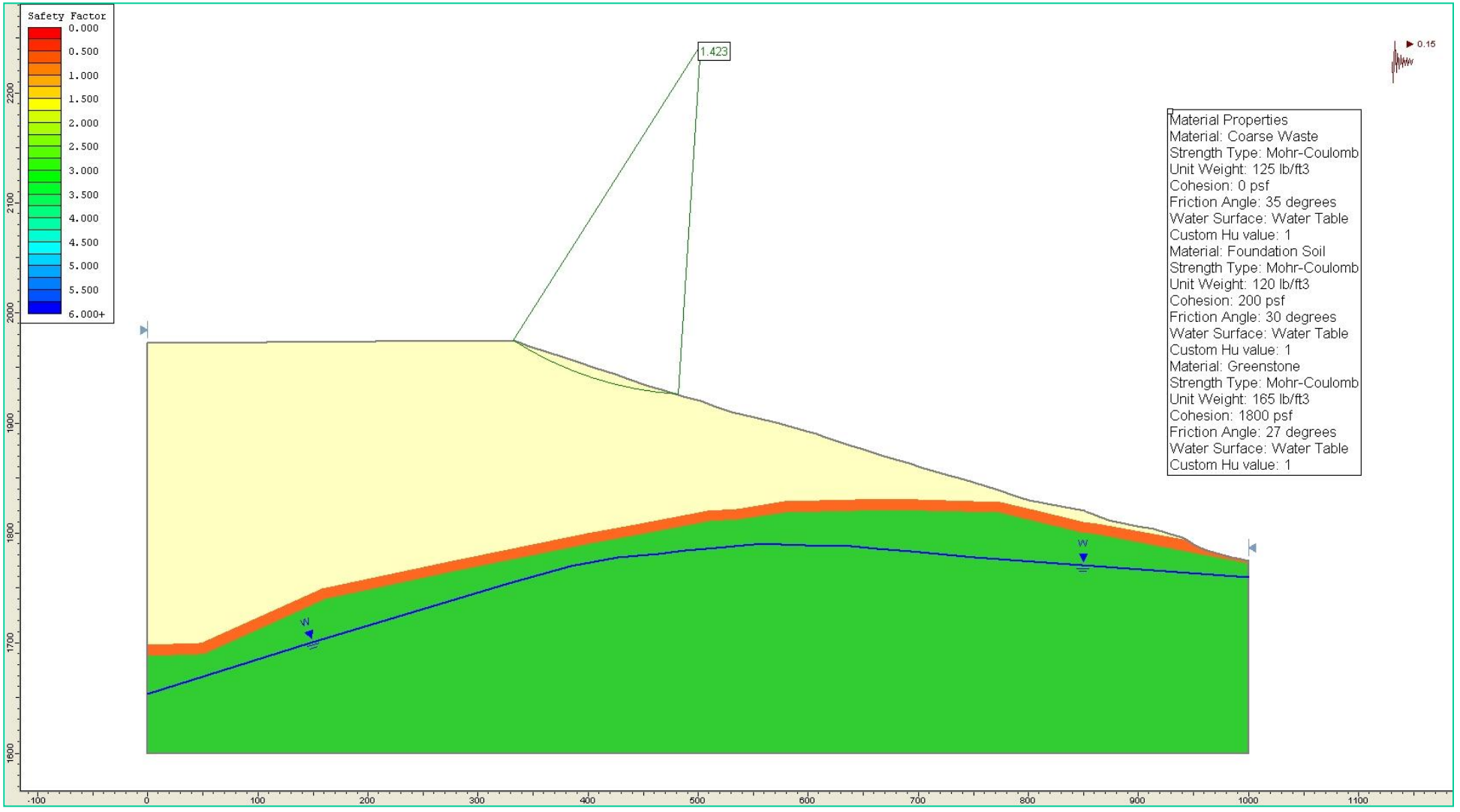
Golder Associates

STATIC CONDITION
PROPOSED SEC W3, WMSA
LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: MAY, 2010	Figure: 10C-8

Project No.: 063-7109 Revision No.: 1

PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION W3 – PROPOSED SLOPE
CONDITION: PSEUDO-STATIC
FAILURE MODE: CIRCULAR

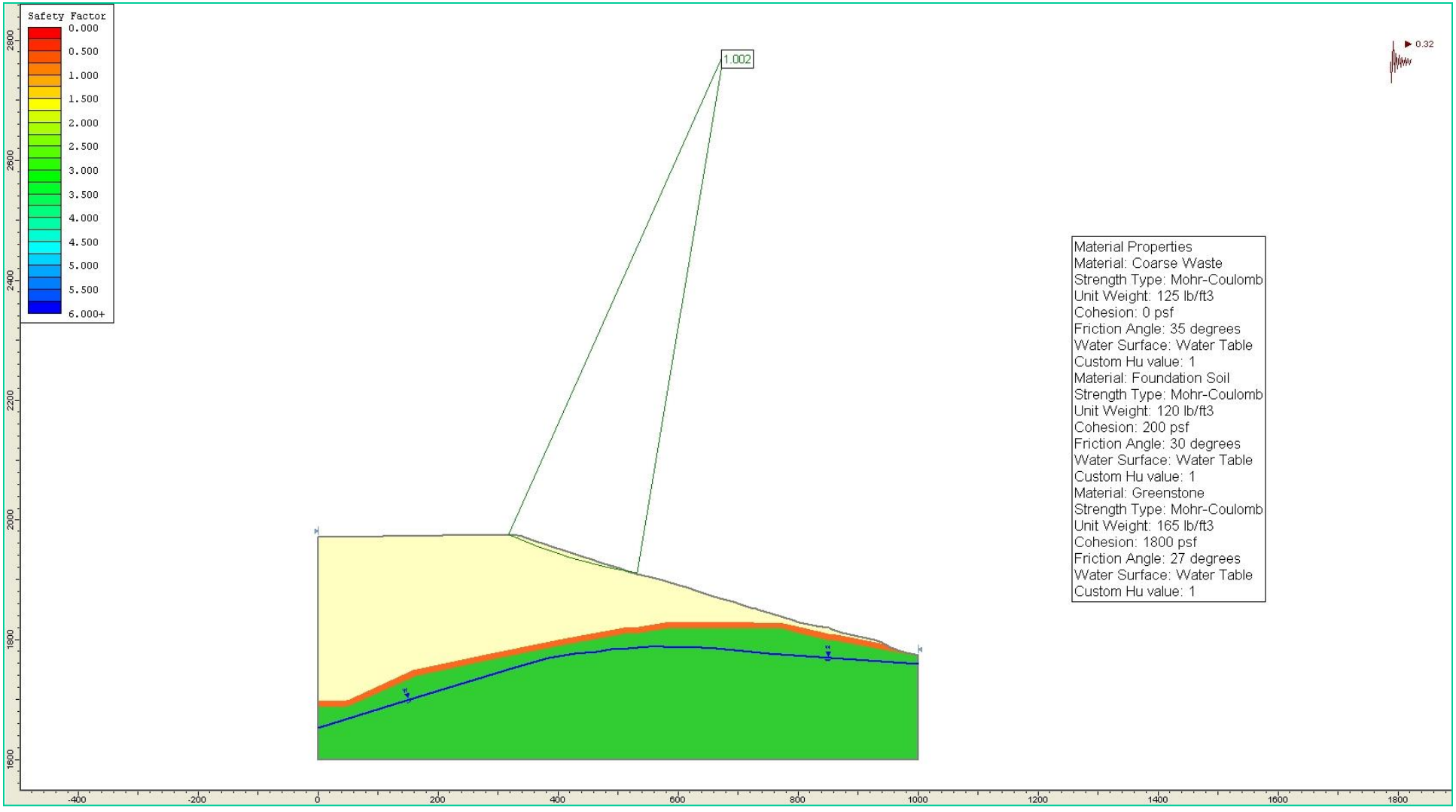
Golder Associates

PSEUDO-STATIC ANALYSES PROPOSED SEC W3, WMSA LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: MAY, 2010	Figure: 10C-9

Project No.: 063-7109 Revision No.: 1

PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



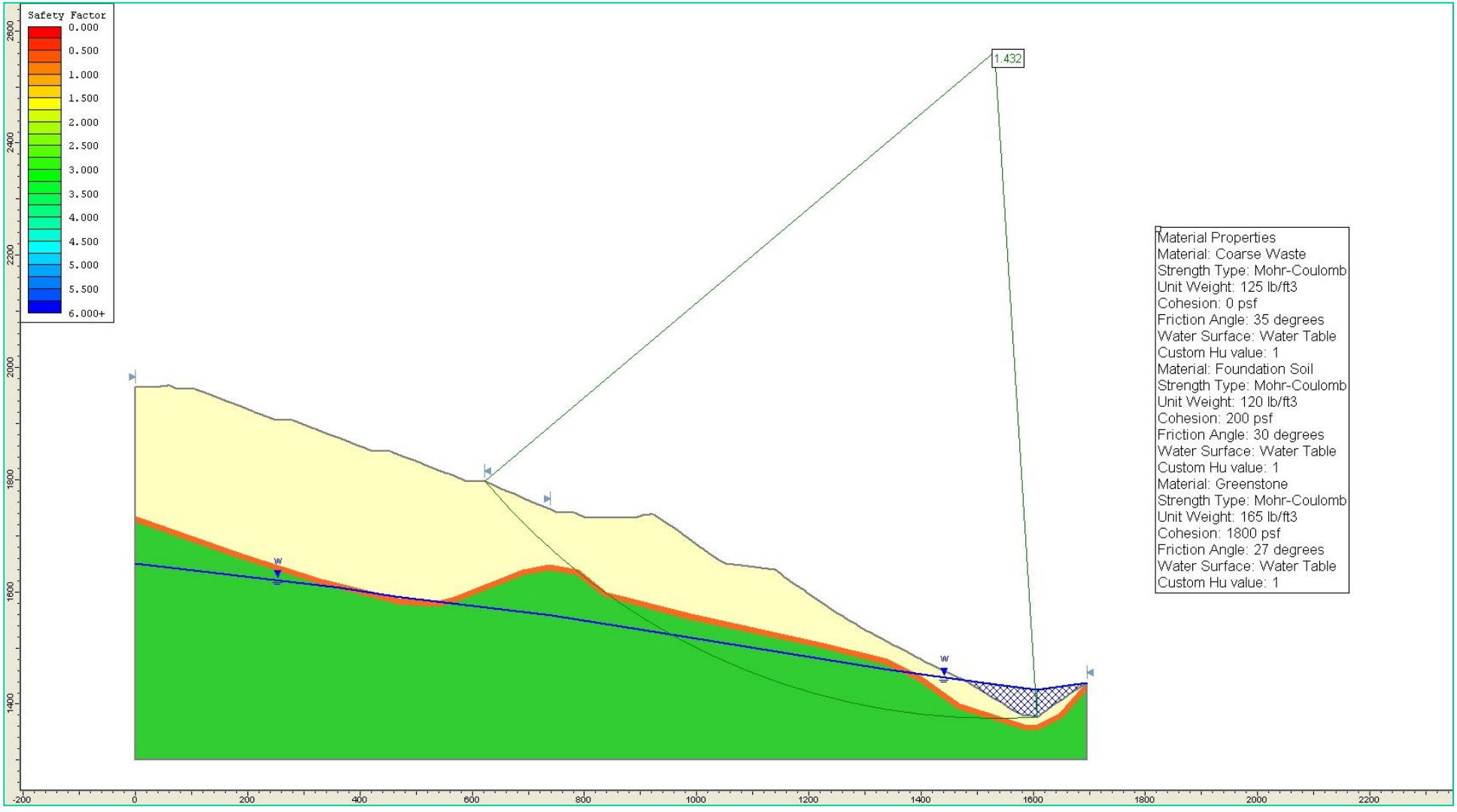
SECTION W3 – PROPOSED SLOPE

DETERMINE Ky CORRESPONDING TO FOS = 1.0:

Ky = 0.32g

Golder Associates		Ky CALCULATION REVISED SEC W3, WMSA LEHIGH SOUTHWEST CEMENT COMPANY, CA	
Drawn: PHY	App'd: KGH	Date: MAY, 2010	Figure: 10C-10
Project No.: 063-7109			Revision No.: 1

PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION W2 – PROPOSED SLOPE
CONDITION: STATIC
SENSITIVITY STUDY: WATER LEVEL CHANGE (+50FT)

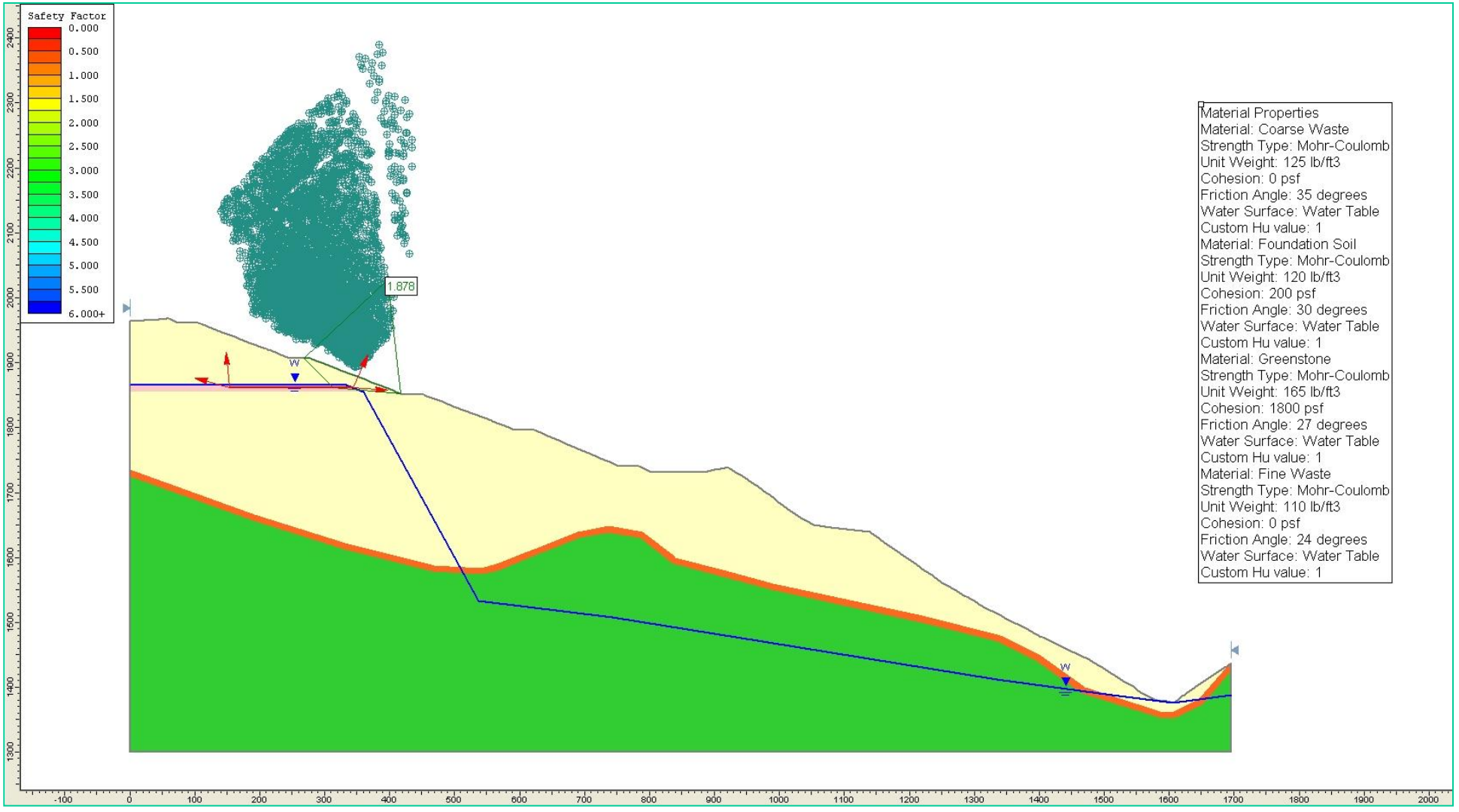
Golder Associates

SENSITIVITY – WATER LEVEL REVISED SEC W2, WMSA LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: MAY, 2010	Figure: 10C-11

Project No.: 063-7109 Revision No.: 1

PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION W2 – PROPOSED SLOPE
CONDITION: STATIC
SENSITIVITY STUDY: FINE WASTE (50FT FROM SLOPE)

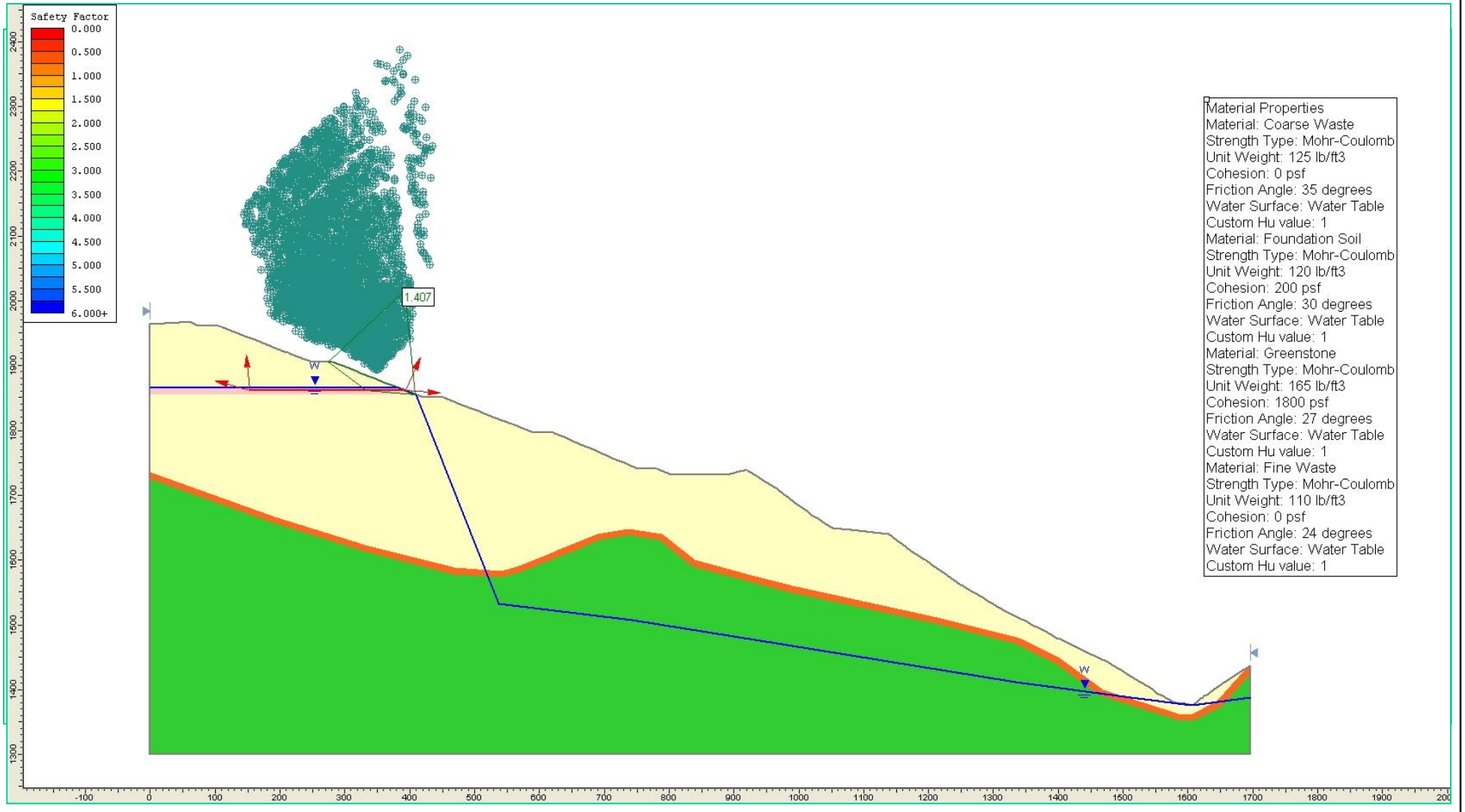
Golder Associates

SENSITIVITY – FINE WASTE REVISED SEC W2, WMSA LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn:	App'd:	Date:	Figure:
PHY	KGH	MAY, 2010	10C-12

Project No.: 063-7109 Revision No.: 1

PROJECT NO. 063-7109, task #008 DRAWN: PHY REVIEWED BY: KGH DATE: 01-22-10 FILE LOCATION:



SECTION W2 – PROPOSED SLOPE
CONDITION: STATIC
SENSITIVITY STUDY: FINE WASTE (EXPOSED ON SLOPE)

Golder Associates

SENSITIVITY – FINE WASTE
REVISED SEC W2, WMSA
LEHIGH SOUTHWEST CEMENT COMPANY, CA

Drawn: PHY	App'd: KGH	Date: MAY, 2010	Figure: 10C-13

Project No.: 063-7109 Revision No.: 1

TABLE

Summary of Dynamic Deformation Analysis

Selected Notations			
M_w =	Moment magnitude	k_y =	Yield acceleration
a_{brk} =	Peak Horizontal Acceleration at the bedrock	U =	Dynamic deformation along critical slide surface
a_{max} =	Peak Horizontal Acceleration at the crest of slope		

Earthquake Characterization		
M_w	a_{brk}	a_{max} (Reference 1)
	g	g
7.1	0.60	0.60

Deformation Calculation (Reference 2)							
SITE	Section	Failure Description	k_y	k_y/a_{max}	Slope Deformation, U (in) (Bray and Travasarou)		
			g		84% Exc.	16% Exc.	50% Exc.
WMSA	W2	grading design	0.19	0.32	2	9	5
	W3	grading design	0.32	0.53	1	3	1

References:

1. Seed, H. B. and Idriss, I. M. (1982), Ground Motions and Soil Liquefaction During Earthquakes Monograph No. 5, Earthquake Engineering Research Institute, Berkeley, California.
2. Bray, J. D. and Travasarou, T. (2007), Simplified Procedure for Estimating Earthquake-Induced Deviatoric Slope Displaceme Journal of the Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 133, No. 4, pp. 381-392.

Note: This spreadsheet is only intended to estimate seismic deformation under the above shown earthquake events and sections, assuming potential failure mass is a Newmark rigid sliding block.

APPENDIX 11.A

Topsoil Storage Area Boring Logs

Golder Associates
425 Lakeside Drive
Sunnyvale, CA 94085
Telephone: (408) 220-9223

BORING NUMBER TSS-1

PROJECT NUMBER 0637109
PROJECT NAME Lehigh Permanente
LOCATION Cupertino, ca
DRILLING METHOD HSA with blow counts
SAMPLING METHOD split spoon
GROUND ELEVATION Bill Fowler
TOP OF CASING ----
LOGGED BY JL
REMARKS Blow counts with 140-lb hammer

DATE STARTED 8/21/09
DATE COMPLETED 8/21/09
CASING TYPE/DIAMETER ----
SCREEN TYPE/SLOT ----
GRAVEL PACK TYPE ----
GROUT TYPE/QUANTITY ----
DEPTH TO WATER 29.0
REVIEWED BY Bill Fowler

BLOW COUNTS	RECOVERY (inches)	SAMPLING METHOD	EXTENT	DEPTH (ft. BGL)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	Water Level
6 7 7	36	GRAB-SS		5	SM		ARTIFICIAL FILL. Silty Sand with gravel. Moderate yellowish brown 10YR 5/4. 60% fine sands, 30% silt, 10% gravel. Dry, loose.	
3 5 6	36	GRAB-SS		10	ML		SOIL/COLLUVIUM. Sandy Silt. Grayish olive green 5GY 3/2. 90-95% fines, 5-10% fine sand, 1-2% gravel. Moist, stiff, 2-4% organic material.	
6 24 50	36	GRAB-SS		15			SANTA CLARA FORMATION. Claystone/Siltstone with gravel. Moderate olive brown 5Y 4/4. 40% fine sand, 30% gravel, 30% silt. Dry, hard, minor mottling and iron oxidation.	
40 54	13	GRAB-SS		20				
13 44 50	30	GRAB-SS		25	GM			▼
42 50	24	GRAB-SS		30				
19 38 50	30	GRAB-SS		35				

Bottom of borehole at 38.0 feet.

FOXWORTHY_TEMPLATE BORING_LOGS.GPJ LOG A EWNN01.GDT 2/5/10

Golder Associates
425 Lakeside Drive
Sunnyvale, CA 94085
Telephone: (408) 220-9223

BORING NUMBER TSS-2

PROJECT NUMBER 0637109
PROJECT NAME Lehigh Permanente
LOCATION Cupertino, ca
DRILLING METHOD HSA with blow counts
SAMPLING METHOD split spoon
GROUND ELEVATION Bill Fowler
TOP OF CASING ----
LOGGED BY JL
REMARKS Blow counts with 140-lb hammer

DATE STARTED 8/20/09
DATE COMPLETED 8/20/09
CASING TYPE/DIAMETER ----
SCREEN TYPE/SLOT ----
GRAVEL PACK TYPE ----
GROUT TYPE/QUANTITY ----
DEPTH TO WATER
REVIEWED BY Bill Fowler

BLOW COUNTS	RECOVERY (inches)	SAMPLING METHOD	EXTENT	DEPTH (ft. BGL)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	Water Level
15 50	4	GRAB-SS		5	GM		ARTIFICIAL FILL. Sandy Gravel with silt. Moderate yellowish brown 10YR 5/4. 80% gravel, 15% fine sand, 5% silt. Dry, loose.	
5 9 4	12	GRAB-SS		10	ML		SOIL/COLLUVIUM. Sandy Silt. Dark brown 10YR 4/2. 90-95% fines, 5-10% fine sand, 1-2% gravel. Moist, soft, 5% organic material.	
5 8 9	24	GRAB-SS		15	ML		SOIL/COLLUVIUM. Clayey silt with sand. 90% fines, 10% fine sand. Yellowish brown 10YR 5/4. Damp, firm.	
8 12 15	36	GRAB-SS		20	GM		SANTA CLARA FORMATION. Claystone/Siltstone with gravel. Yellowish brown 5Y 5/6. 40% fine sand, 30% gravel, 30% silt. Damp, hard, minor mottling and iron oxidation.	
12 21 21	36	GRAB-SS		25				
16 28 33	36	GRAB-SS		30				
15 20 24	36	GRAB-SS		35				
13 26 34	36	GRAB-SS		40				
22 48 50	3	GRAB-SS		45				

Bottom of borehole at 48.0 feet.

FOXWORTHY_TEMPLATE BORING_LOGS.GPJ LOG A EWNN01.GDT 2/5/10

Golder Associates
425 Lakeside Drive
Sunnyvale, CA 94085
Telephone: (408) 220-9223

BORING NUMBER TSS-3

PROJECT NUMBER 0637109
PROJECT NAME Lehigh Permanente
LOCATION Cupertino, ca
DRILLING METHOD HSA with blow counts
SAMPLING METHOD split spoon
GROUND ELEVATION Bill Fowler
TOP OF CASING ----
LOGGED BY JL
REMARKS Blow counts with 140-lb hammer

DATE STARTED 8/20/09
DATE COMPLETED 8/20/09
CASING TYPE/DIAMETER ----
SCREEN TYPE/SLOT ----
GRAVEL PACK TYPE ----
GROUT TYPE/QUANTITY ----
DEPTH TO WATER 47.5
REVIEWED BY Bill Fowler

BLOW COUNTS	RECOVERY (inches)	SAMPLING METHOD	EXTENT	DEPTH (ft. BGL)	U.S.C.S.	GRAPHIC LOG	LITHOLOGIC DESCRIPTION	Water Level
5 5 4	36	GRAB-SS		5			ARTIFICIAL FILL. Sandy Silt with gravel. Dark yellowish brown 10YR 4/2. 60% fines, 30% fine sand, 10% gravel. Moist, soft.	
4 6 6	36	GRAB-SS		10				
3 4 5	36	GRAB-SS		15	ML		@15' color change to greyish olive 10Y 4/2.	
3 4 5	36	GRAB-SS		20				
4 5 5	36	GRAB-SS		25				
4 4 5	36	GRAB-SS		30	SM		SOIL/COLLUVIUM. Silty Sand with gravel. Greenish black 5G 2/1. Moist, loose, 2-4% organic material.	
6 14 21	36	GRAB-SS		35	ML		SOIL/COLLUVIUM. Sandy Silt. Moderate yellowish brown 10YR 5/4. Very hard, dry.	
13 27 35	36	GRAB-SS		40			SANTA CLARA FORMATION. Claystone/Siltstone with gravel. Moderate olive brown 10YR 5/4. 40% fine sand, 30% gravel, 30% silt. Dry, hard, minor mottling.	
9 18 20	36	GRAB-SS		45				▼
5 11 18	36	GRAB-SS		50	GM			
30 35 50	36	GRAB-SS		55			@58' Santa Clara Formation. Wet.	
27 31 50	36	GRAB-SS		60				

Bottom of borehole at 63.0 feet.

FOXWORTHY_TEMPLATE BORING_LOGS.GPJ LOG A EWNN01.GDT 2/5/10

APPENDIX 11.B

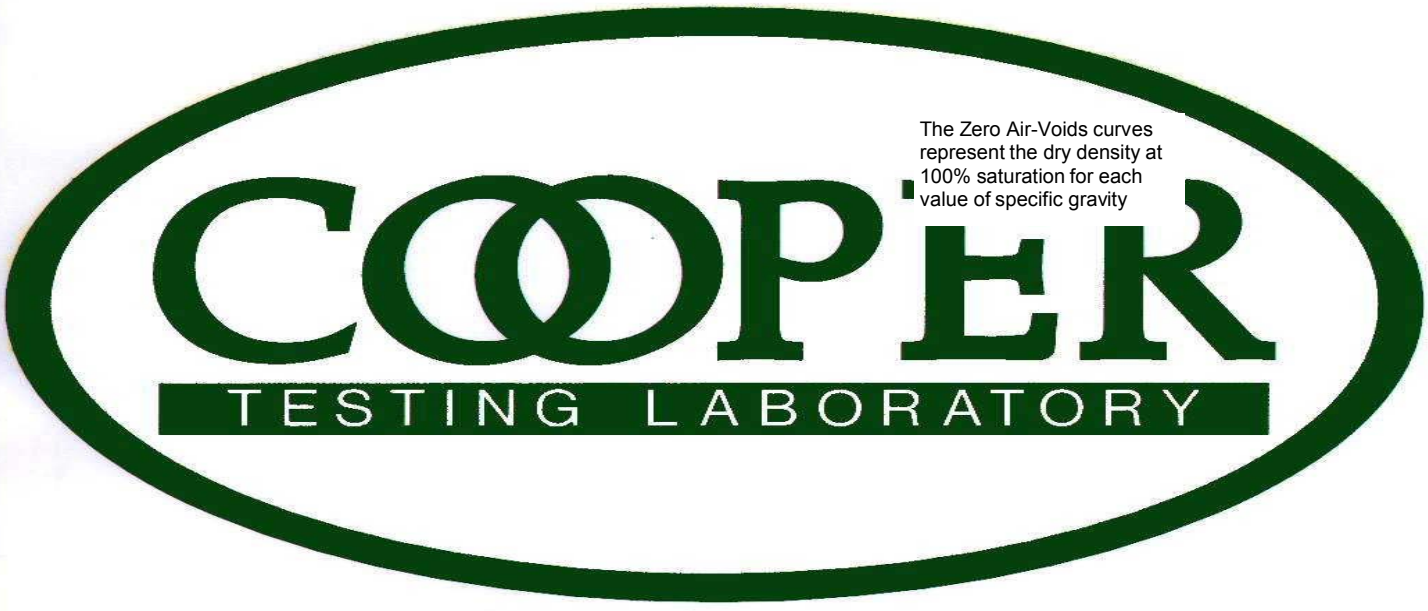
Laboratory Test Results

Moisture-Density-Porosity Report
Cooper Testing Labs, Inc. (ASTM D 2937)

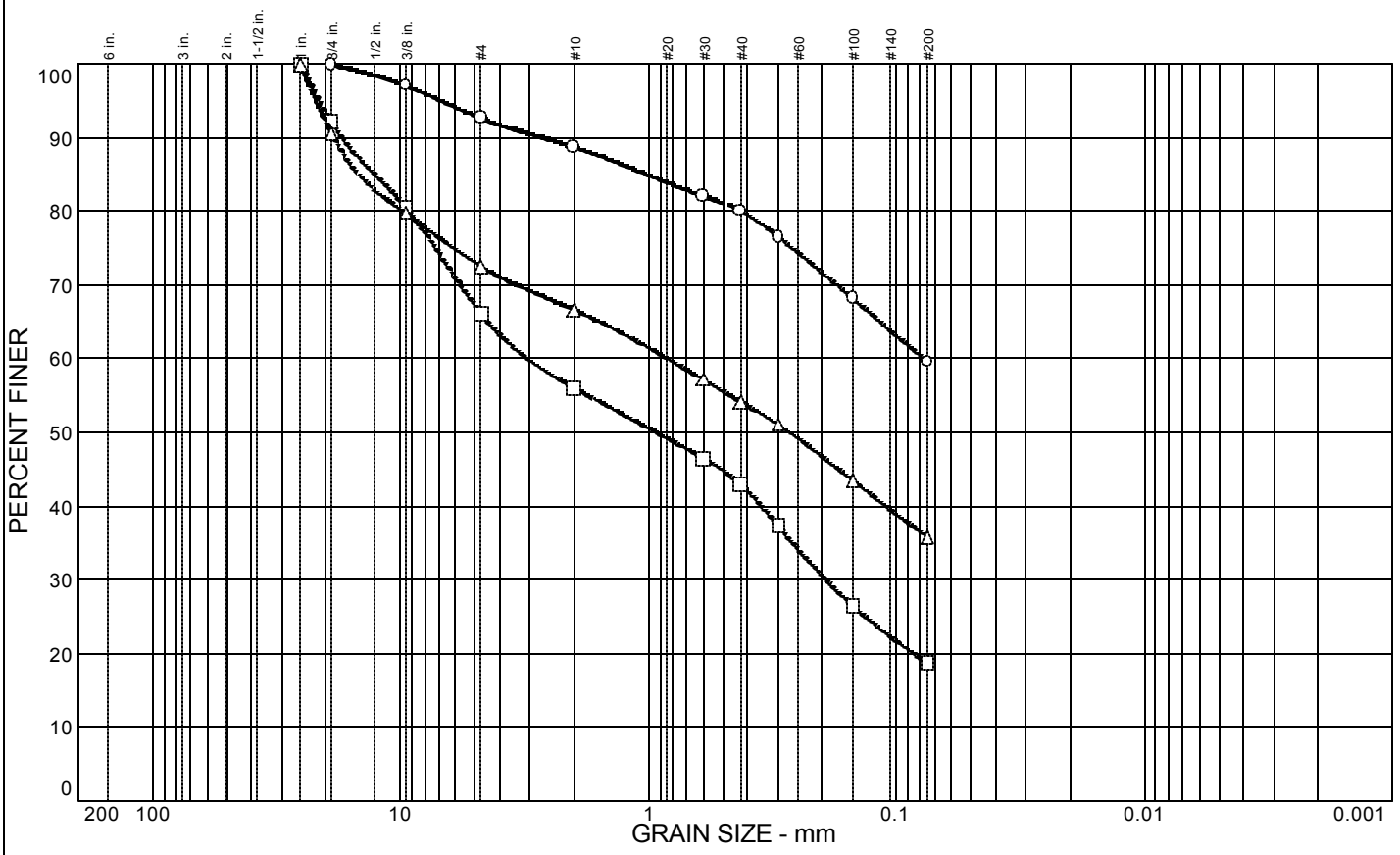
Job No:	287-044	**Date:**	08/28/09
Client:	Golder Associates	**By:**	RU
Project:	Hanson - 063-7109-400	**Remarks:**	

Boring:	TSS-1	TSS-1	TSS-2	TSS-3				
Sample:								
Depth, ft:	10	15	20	10				
Visual Description:	Gray Sandy Lean CLAY	Brown Lean Clayey SAND w/ Gravel	Brown Lean Clayey SAND	Reddish Brown & Gray Sandy Lean CLAY				
Actual G_s								
Assumed G_s	2.70	2.70	2.70	2.70				
Total Vol cc	230.1	286.6	269.7	229.6				
Vol Solids,cc	145.3	199.7	180.8	139.3				
Vol Voids,cc	84.8	86.9	88.9	90.3				
Moisture, %	20.4	7.1	11.0	20.4				
Wet Unit wt, pcf	128.2	125.9	125.5	123.2				
Dry Unit wt, pcf	106.5	117.5	113.1	102.3				
Saturation, %	94.3	44.1	60.4	85.1				
Porosity, %	36.8	30.3	33.0	39.3				
Air filled Poros.,%	2.1	16.9	13.0	5.9				
Water filled Poros.,%	34.7	13.4	19.9	33.5				
Void Ratio	0.58	0.44	0.49	0.65				
Series	1	2	3	4	5	6	7	8

Note: If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.



Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		7.3	33.1	59.6		CL		18.9	37.2
□		33.8	47.5	18.7		SC		16.1	24.9
△		27.4	36.8	35.8		SM		31.9	36.6

SIEVE inches size	PERCENT FINER ○	□	△
1"		100.0	100.0
3/4"	100.0	92.2	90.6
3/8"	97.1	80.6	79.8
	GRAIN SIZE		
D_{60}	0.0775	3.07	0.831
D_{30}		0.192	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	92.7	66.2	72.6
#10	88.8	56.1	66.7
#30	82.1	46.5	57.2
#40	80.1	43.0	54.2
#50	76.6	37.3	51.1
#100	68.2	26.5	43.5
#200	59.6	18.7	35.8

SOIL DESCRIPTION

○ Gray Sandy Lean CLAY

□ Brown Lean Clayey SAND w/ Gravel

△ Pale Brown Silty SAND w/ Gravel

REMARKS:

○

□

△

○ Source: TSS-1 Elev./Depth: 10'

□ Source: TSS-1 Elev./Depth: 15'

△ Source: TSS-2 Elev./Depth: 10'

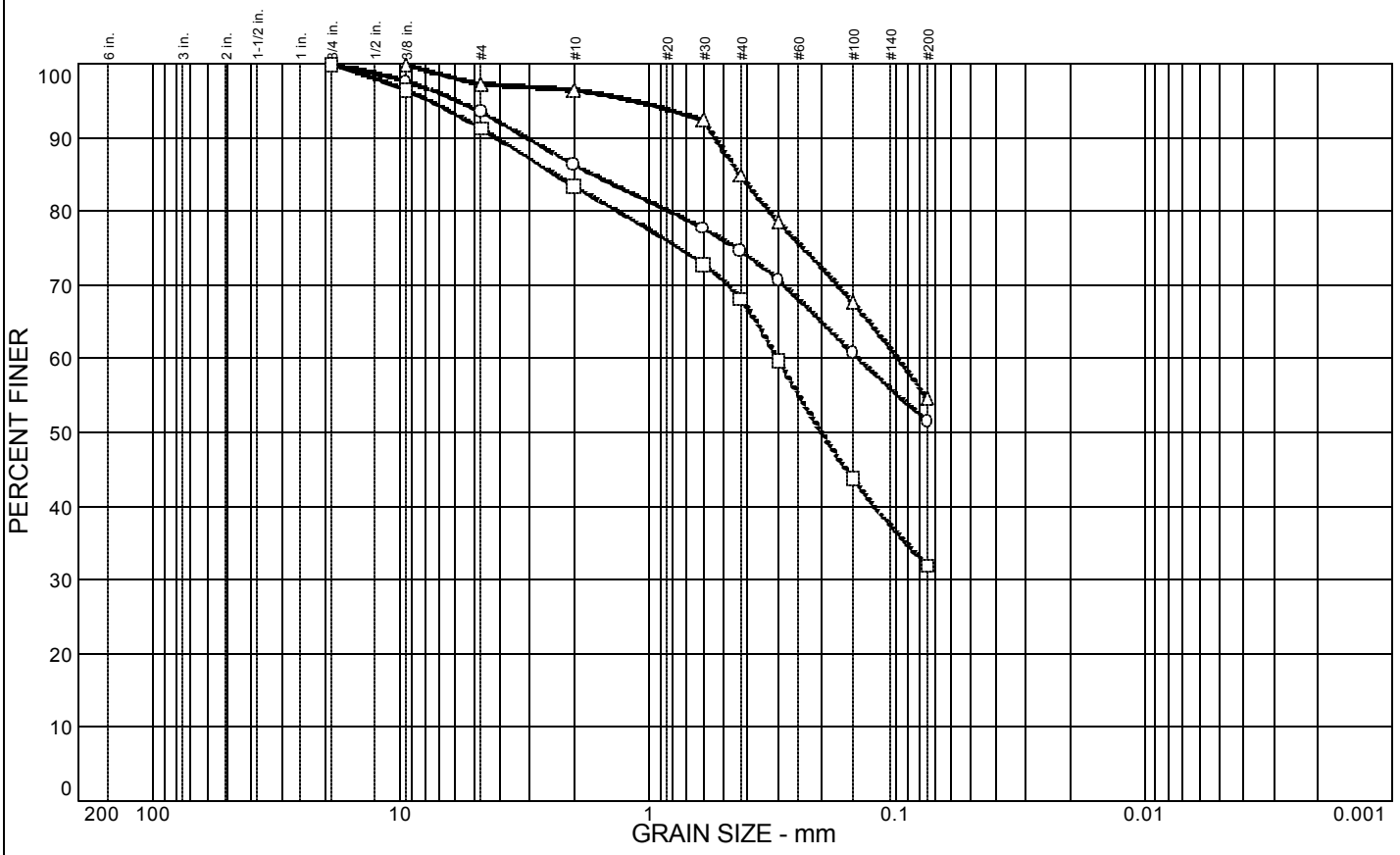
COOPER TESTING LABORATORY

Client: Golder Associates

Project: Hanson - 063-7109-400 Phase 9

Project No.: 287-044 Figure

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		6.5	42.0	51.5		CL		19.3	43.8
□		8.7	59.4	31.9		SC		17.5	29.2
△		2.7	42.7	54.6		CL		22.0	41.2

SIEVE inches size	PERCENT FINER ○	□	△
3/4"	100.0	100.0	
3/8"	97.7	96.5	100.0
	GRAIN SIZE		
D_{60}	0.142	0.302	0.0987
D_{30}			
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	93.5	91.3	97.3
#10	86.4	83.5	96.5
#30	77.7	72.8	92.4
#40	74.7	68.1	84.9
#50	70.7	59.8	78.7
#100	60.8	43.7	67.7
#200	51.5	31.9	54.6

SOIL DESCRIPTION

○ Olive Sandy Lean CLAY

□ Brown Lean Clayey SAND

△ Reddish Brown & Gray Sandy Lean CLAY

REMARKS:

○

□

△

○ Source: TSS-2 Elev./Depth: 15'

□ Source: TSS-2 Elev./Depth: 20'

△ Source: TSS-3 Elev./Depth: 10'

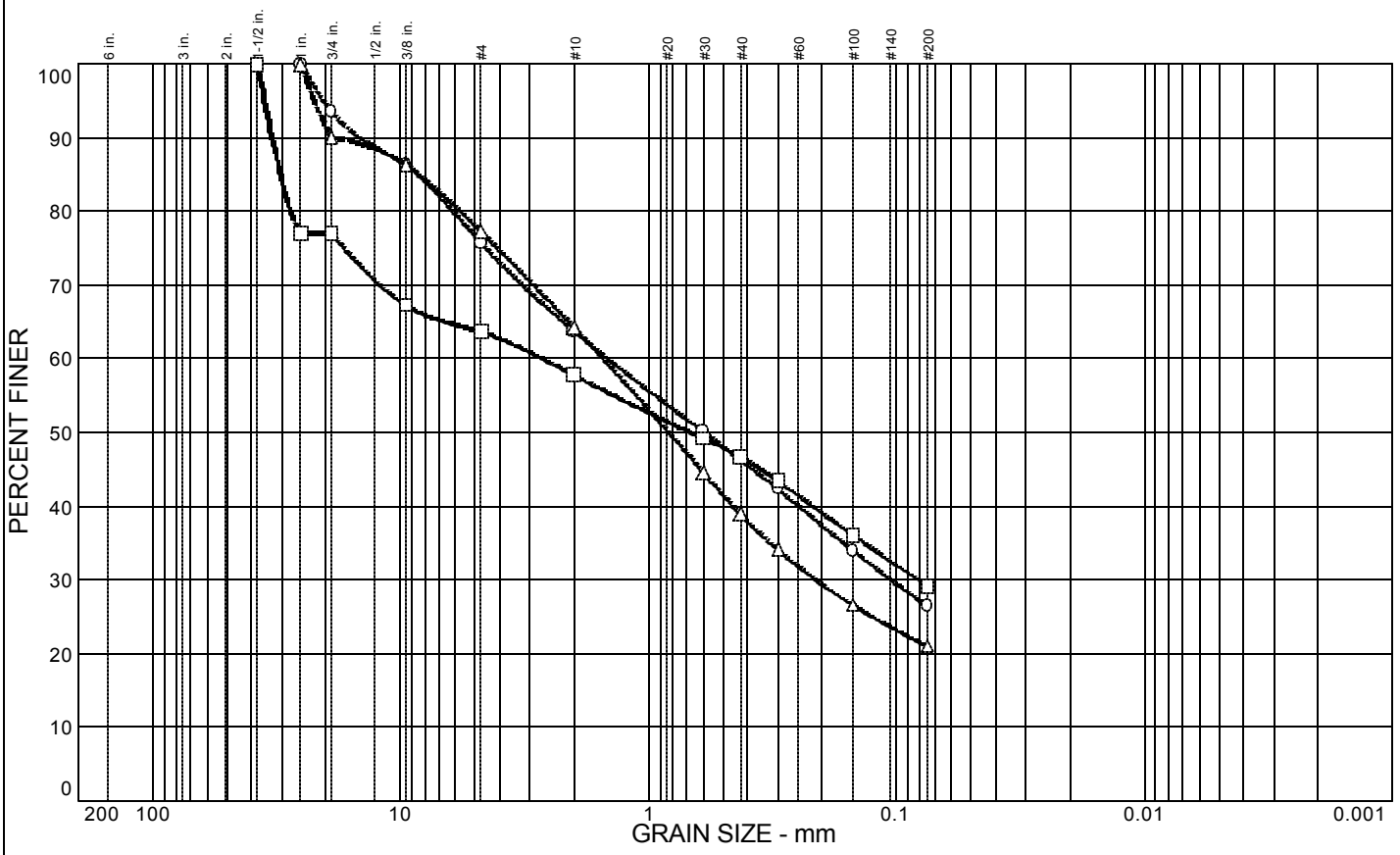
COOPER TESTING LABORATORY

Client: Golder Associates

Project: Hanson - 063-7109-400 Phase 9

Project No.: 287-044 Figure

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		24.2	49.4	26.4		SC		21.8	38.5
□		36.3	34.5	29.2		GC		22.2	40.6
△		22.7	56.3	21.0		SM		16.3	19.4

SIEVE inches size	PERCENT FINER ○	□	△
1.5"		100.0	
1"	100.0	77.0	100.0
3/4"	93.6	77.0	90.0
3/8"	86.3	67.3	86.4
	GRAIN SIZE		
D_{60}	1.46	2.66	1.52
D_{30}	0.105	0.0814	0.211
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	75.8	63.7	77.3
#10	63.8	57.8	64.3
#30	50.1	49.2	44.6
#40	46.3	46.7	38.9
#50	42.3	43.4	34.1
#100	34.0	36.1	26.6
#200	26.4	29.2	21.0

SOIL DESCRIPTION

○ Brown Lean Clayey SAND w/ Gravel

□ Brown Lean Clayey GRAVEL w/ Sand

△ Gray Silty SAND w/ Gravel

REMARKS:

○

□

△

○ Source: TSS-3 Elev./Depth: 20'

□ Source: TSS-3 Elev./Depth: 25'

△ Source: TSS-3 Elev./Depth: 30'

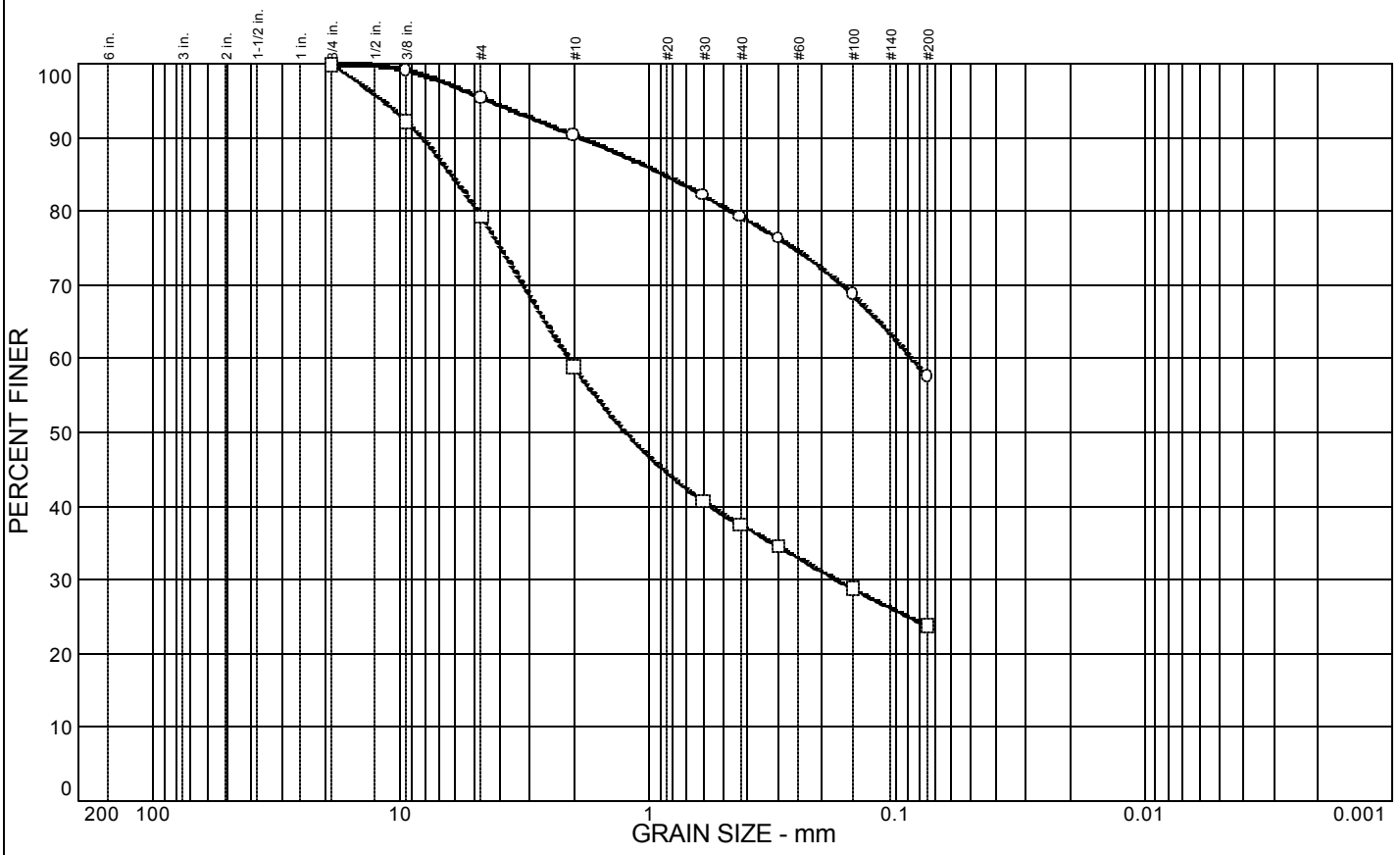
COOPER TESTING LABORATORY

Client: Golder Associates

Project: Hanson - 063-7109-400 Phase 9

Project No.: 287-044 Figure

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		4.5	37.9	57.6		CL		19.5	38.8
□		20.7	55.5	23.8		SC		17.8	28.7

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □
3/4"	100.0	100.0
3/8"	99.2	92.3
GRAIN SIZE		
D_{60}	0.0863	2.09
D_{30}		0.174
D_{10}		
COEFFICIENTS		
C_c		
C_u		

SIEVE number size	PERCENT FINER ○	PERCENT FINER □
#4	95.5	79.3
#10	90.4	59.0
#30	82.2	40.7
#40	79.3	37.5
#50	76.4	34.6
#100	68.7	28.8
#200	57.6	23.8

SOIL DESCRIPTION

○ Greenish Gray Sandy Lean CLAY

□ Brown Lean Clayey SAND w/ Gravel

REMARKS:

○

□

○ Source: TSS-3 Elev./Depth: 35'

□ Source: TSS-3 Elev./Depth: 40'

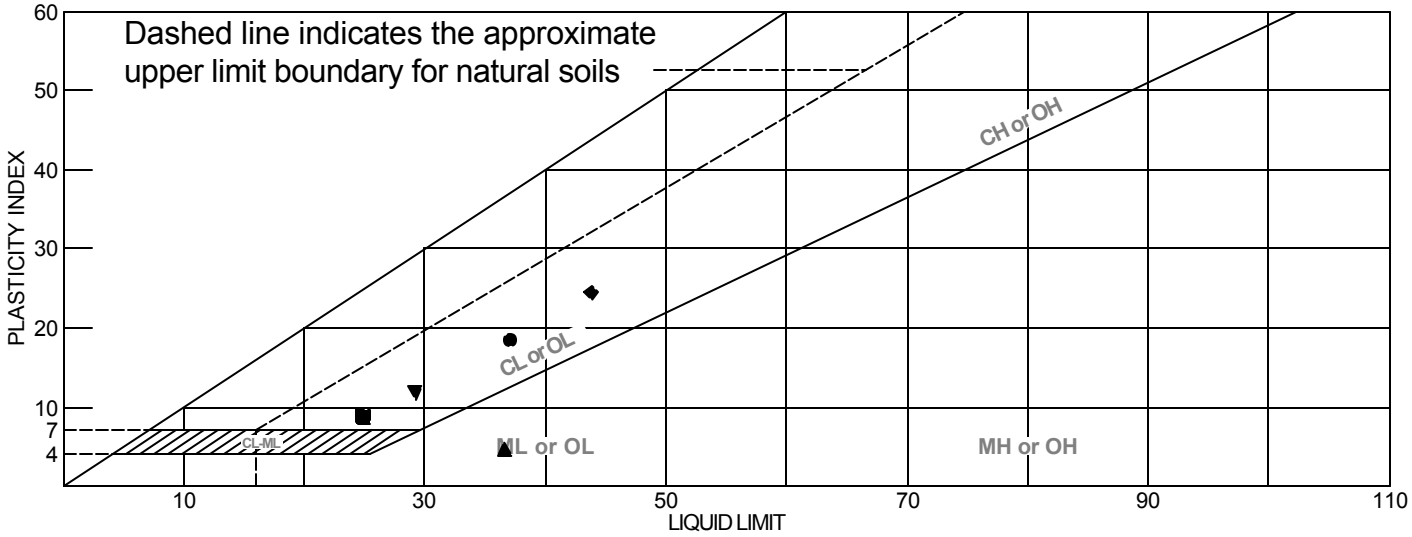
COOPER TESTING LABORATORY

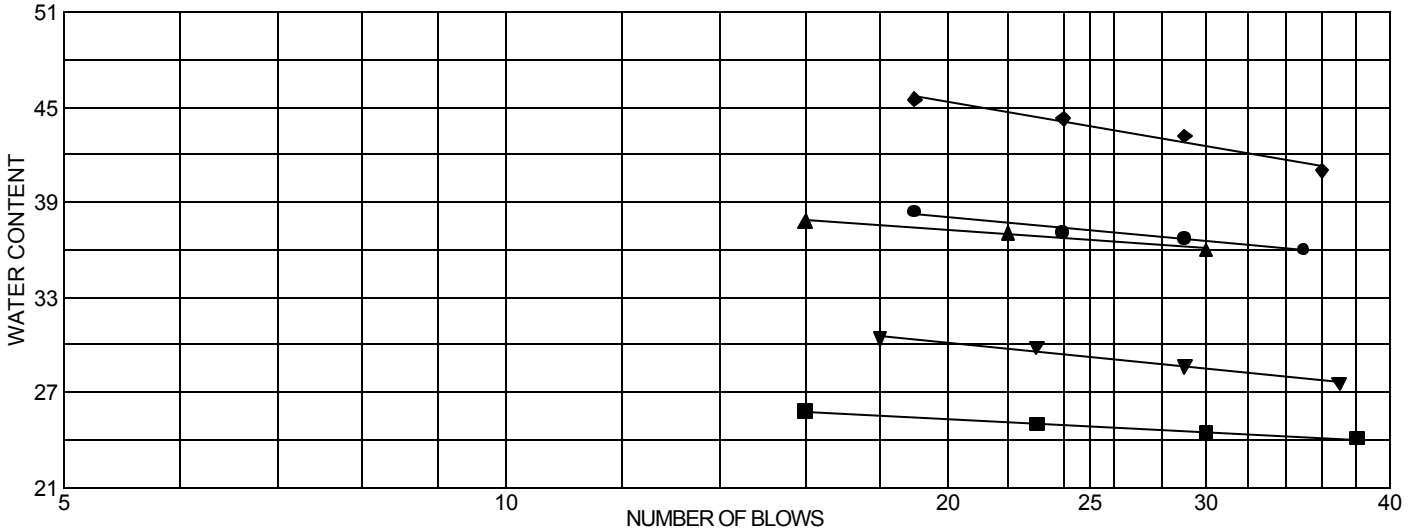
Client: Golder Associates

Project: Hanson - 063-7109-400 Phase 9

Project No.: 287-044 Figure

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Gray Sandy Lean CLAY	37.2	18.9	18.3	80.1	59.6	CL
■	Brown Lean Clayey SAND w/ Gravel	24.9	16.1	8.8	43.0	18.7	SC
▲	Pale Brown Silty SAND w/ Gravel	36.6	31.9	4.7	54.2	35.8	SM
◆	Olive Sandy Lean CLAY	43.8	19.3	24.5	74.7	51.5	CL
▼	Brown Lean Clayey SAND	29.2	17.5	11.7	68.1	31.9	SC

Project No. 287-044 **Client:** Golder Associates

Project: Hanson - 063-7109-400 Phase 9

● **Source:** TSS-1 **Elev./Depth:** 10'
■ **Source:** TSS-1 **Elev./Depth:** 15'
▲ **Source:** TSS-2 **Elev./Depth:** 10'
◆ **Source:** TSS-2 **Elev./Depth:** 15'
▼ **Source:** TSS-2 **Elev./Depth:** 20'

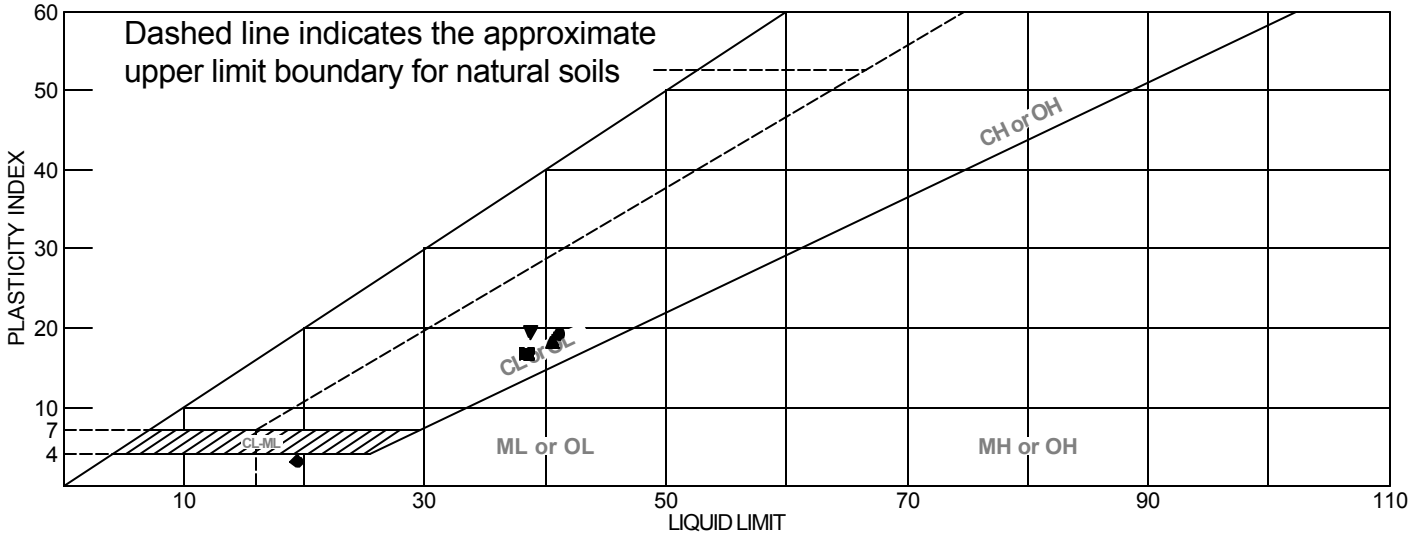
Remarks:
●
■
▲
◆
▼

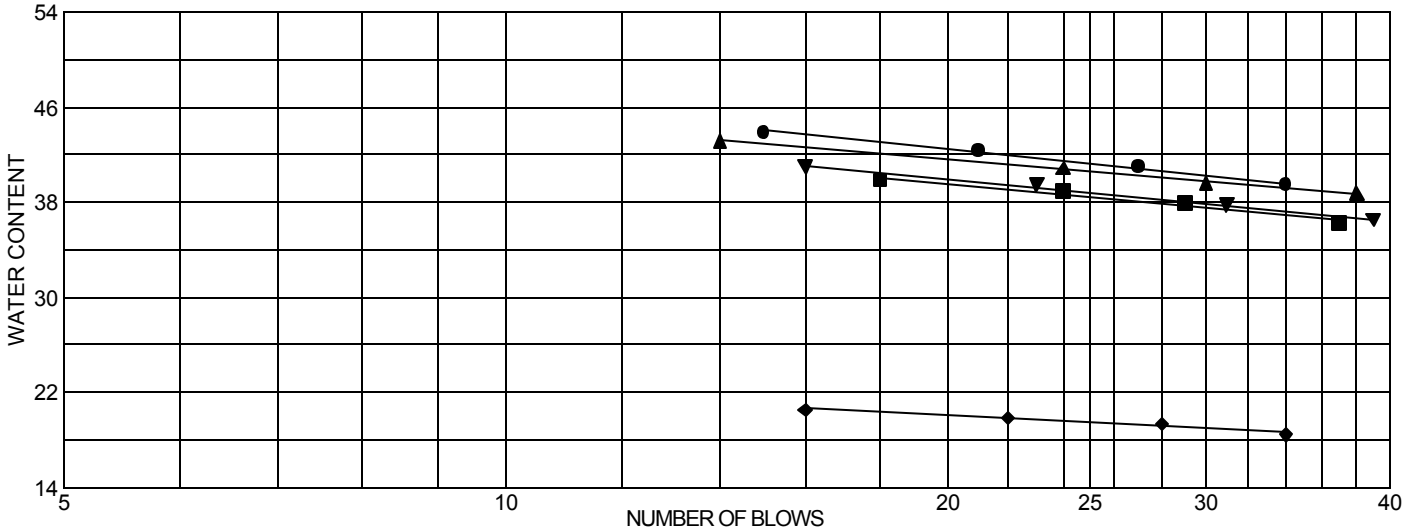
LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Reddish Brown & Gray Sandy Lean CLAY	41.2	22.0	19.2	84.9	54.6	CL
■	Brown Lean Clayey SAND w/ Gravel	38.5	21.8	16.7	46.3	26.4	SC
▲	Brown Lean Clayey GRAVEL w/ Sand	40.6	22.2	18.4	46.7	29.2	GC
◆	Gray Silty SAND w/ Gravel	19.4	16.3	3.1	38.9	21.0	SM
▼	Greenish Gray Sandy Lean CLAY	38.8	19.5	19.3	79.3	57.6	CL

Project No. 287-044 **Client:** Golder Associates

Project: Hanson - 063-7109-400 Phase 9

● **Source:** TSS-3 **Elev./Depth:** 10'
■ **Source:** TSS-3 **Elev./Depth:** 20'
▲ **Source:** TSS-3 **Elev./Depth:** 25'
◆ **Source:** TSS-3 **Elev./Depth:** 30'
▼ **Source:** TSS-3 **Elev./Depth:** 35'

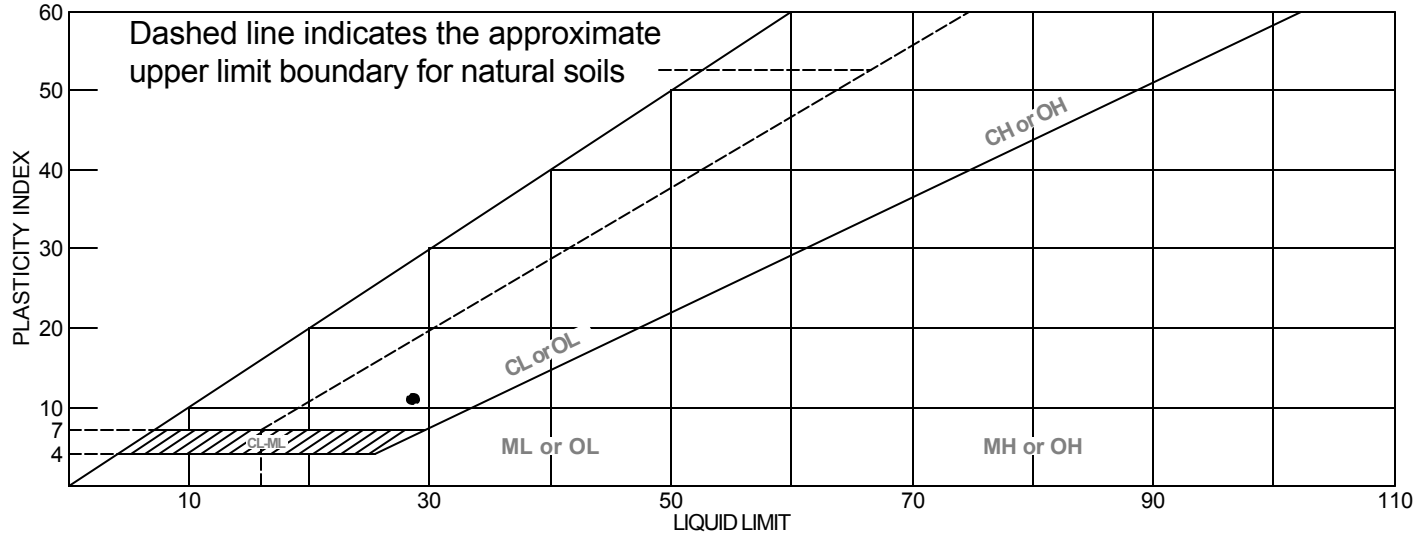
Remarks:
●
■
▲
◆
▼

LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Figure

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown Lean Clayey SAND w/ Gravel	28.7	17.8	10.9	37.5	23.8	SC

Project No. 287-044 **Client:** Golder Associates

Project: Hanson - 063-7109-400 Phase 9

● **Source:** TSS-3 **Elev./Depth:** 40'

Remarks:

●

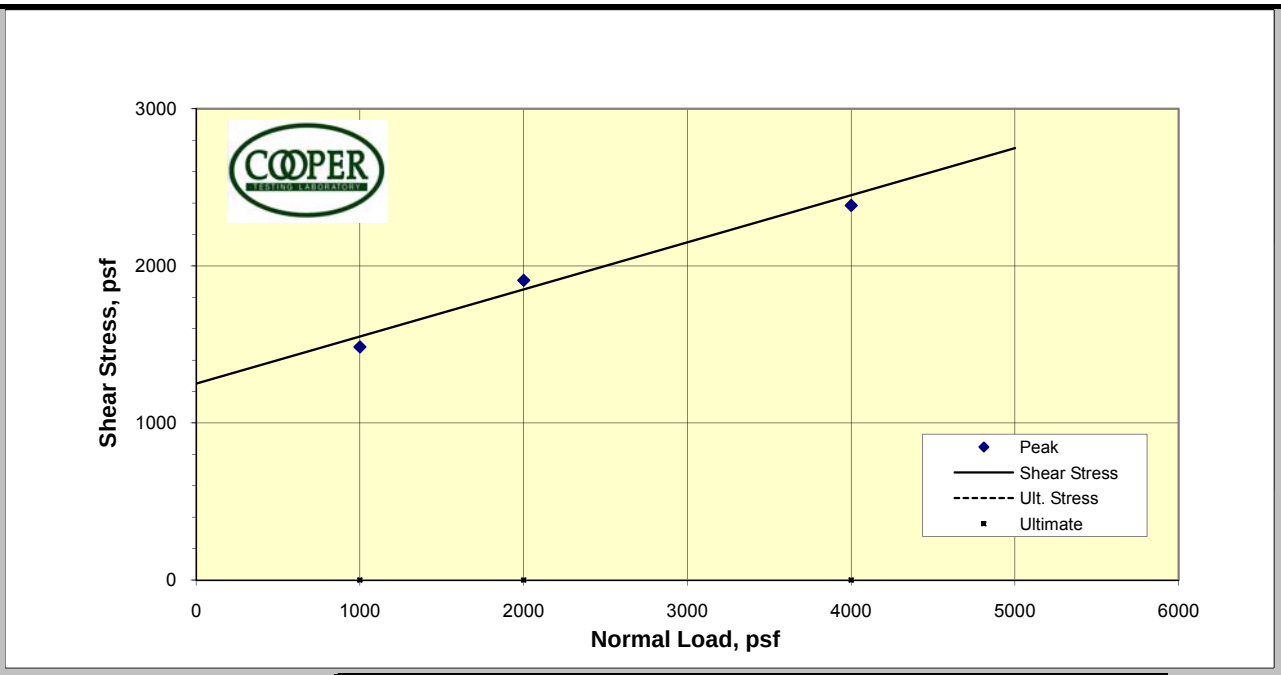
LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

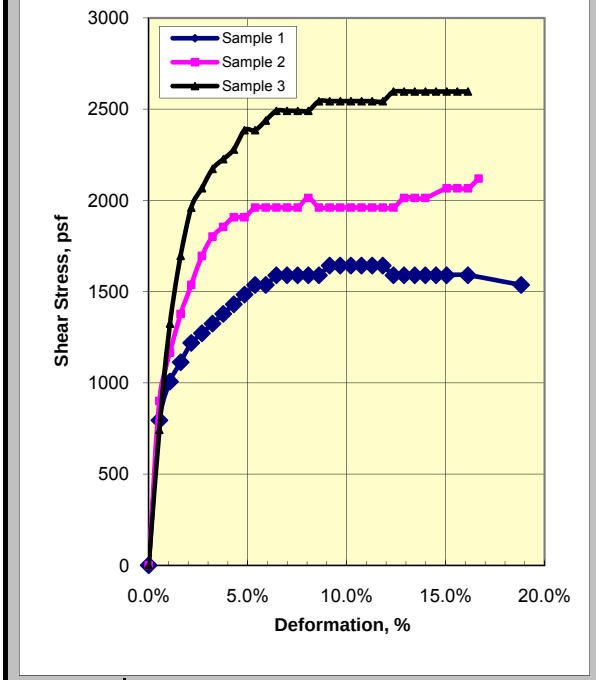
Figure

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)	16.7	Ult. Phi (degrees)	
P. Cohesion (psf)	1250	Ult. Cohesion (psf)	



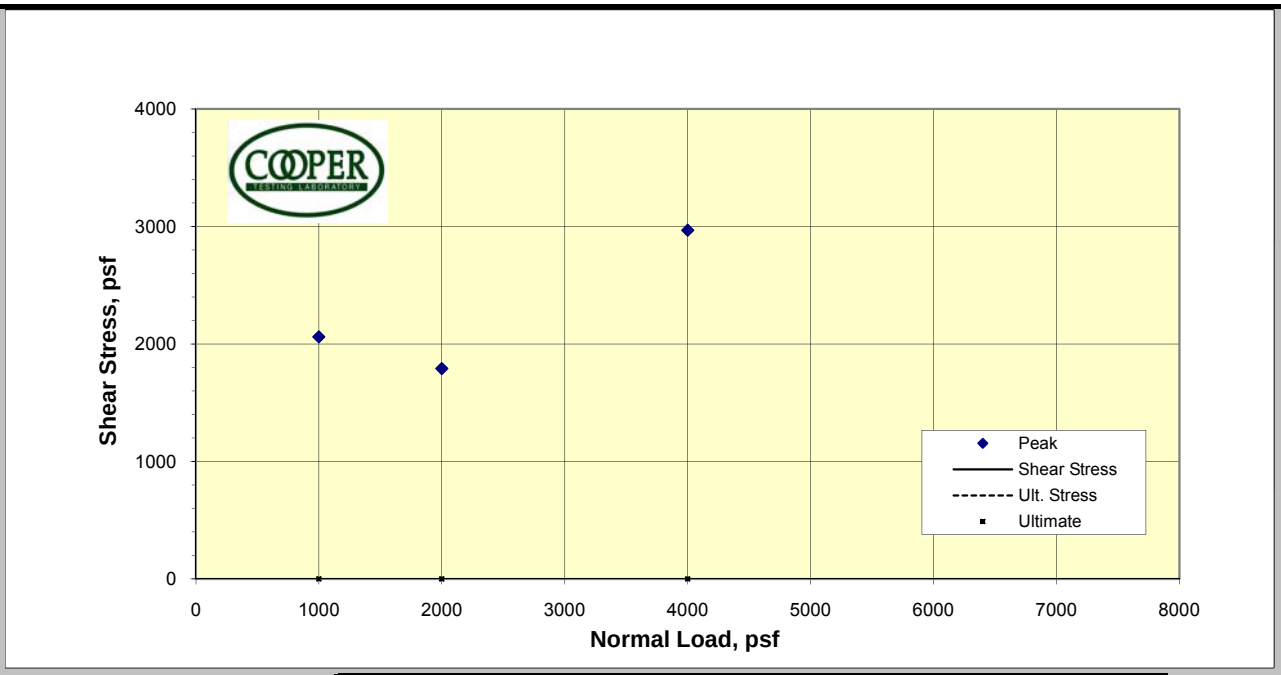
	Sample Data: Initial			
	1	2	3	4
Moisture %	19.5%	17.5%	18.1%	
Dry Dens., pcf	107.0	109.2	106.8	
Void Ratio	0.575	0.544	0.579	
Saturation %	91.4	86.9	84.2	
Diameter	1.86	1.86	1.86	
Height	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture %	20.9%	20.1%	20.6%	
Dry Dens., pcf	107.8	109.4	108.5	
Void Ratio	0.564	0.542	0.555	
Saturation %	100.0	100.0	100.0	
Diameter	1.86	1.86	1.86	
Height	0.993	0.998	0.984	
Normal Stress, psf	1000	2000	4000	
Shear Stress, psf	1484	1908	2385	
Strengths picked at Ult. Stress, psf	5.0%	5.0%	5.0%	
Strain Rate, %/min.	1.0	1.0	1.0	

CTL #	287-044
Client:	Golder Associates
Project	Hanson - 063-7109-400 Phase 9
Tested By:	MD
Reduced By:	RU
Date:	8/31/2009

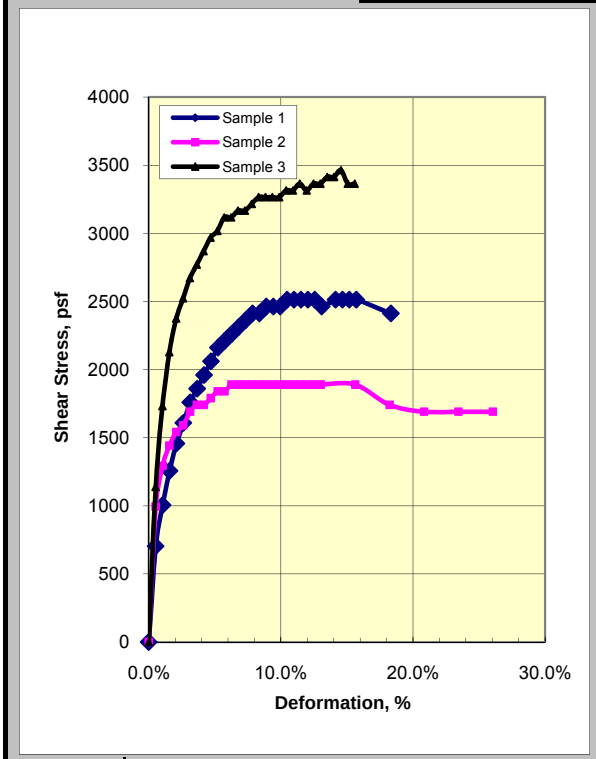
Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	TSS-2		10	Pale Brown Silty SAND w/ Gravel
2	TSS-2		15	Olive Sandy Lean CLAY
3	TSS-2		15	Olive Sandy Lean CLAY
Remarks:				
	DS-CU A fully undrained condition may not be attained in this test.			

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)		Ult. Phi (degrees)	
P. Cohesion (psf)		Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	16.3%	19.5%	18.5%	
Dry Dens., pcf	112.9	110.5	112.0	
Void Ratio	0.493	0.526	0.505	
Saturation %	89.0	100.0	98.9	
Diameter	1.91	1.92	1.93	
Height	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture %	17.3%	20.1%	18.6%	
Dry Dens., pcf	114.9	109.4	112.3	
Void Ratio	0.468	0.542	0.503	
Saturation %	100.0	100.0	100.0	
Diameter	1.91	1.92	1.93	
Height	0.982	1.010	0.998	
Normal Stress, psf	1000	2000	4000	
Shear Stress, psf	2061	1790	2969	
Strengths picked at Ult. Stress, psf	5.0%	5.0%	5.0%	
Strain Rate, %/min.	1.0	1.0	1.0	

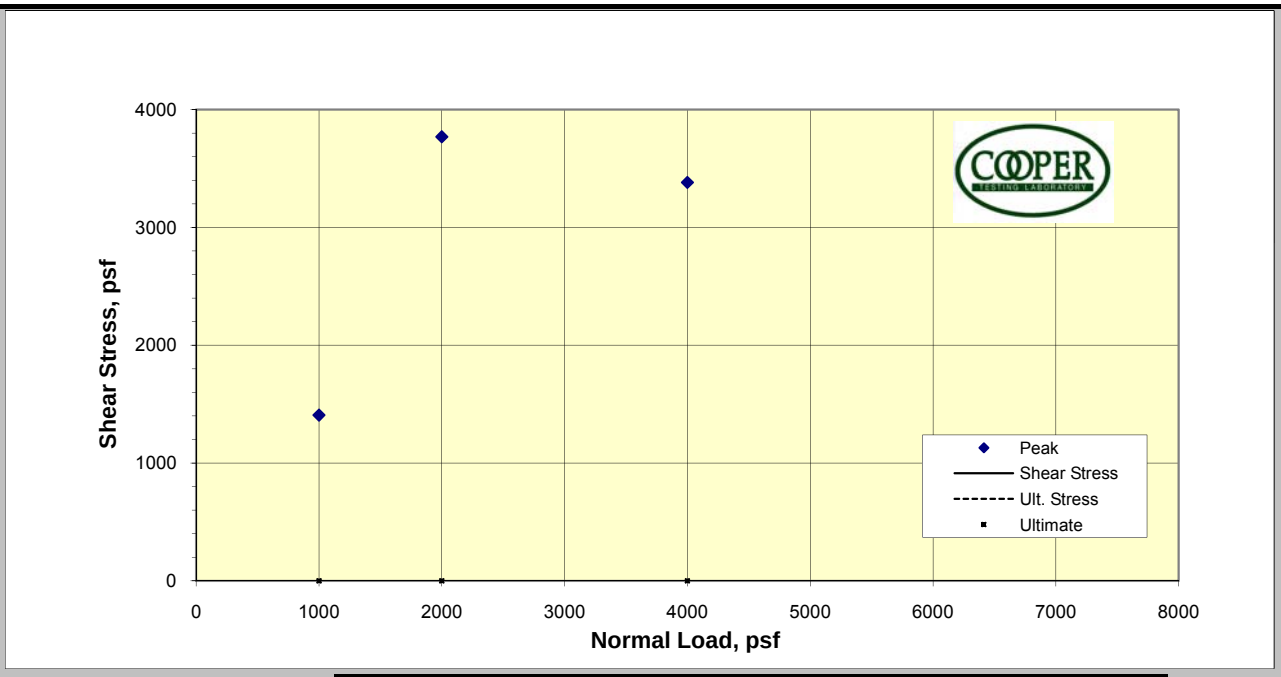
CTL #	287-044
Client:	Golder Associates
Project	Hanson - 063-7109-400 Phase 9
Tested By:	MD
Reduced By:	RU
Date:	8/31/2009

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	TSS-3		20	Brown Lean Clayey SAND w/ Gravel
2	TSS-3		25	Brown Lean Clayey GRAVEL w/ Sand
3	TSS-3		25	Brown Lean Clayey GRAVEL w/ Sand

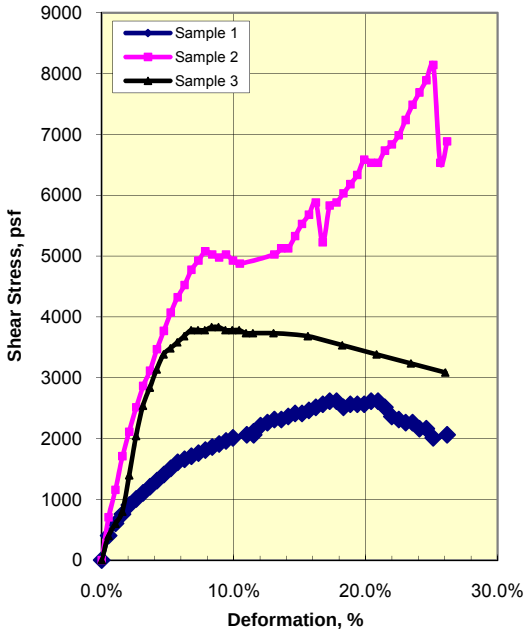
Remarks: *DS-CU* A fully undrained condition may not be attained in this test. Major patching on all three points due to gravel.

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)		Ult. Phi (degrees)	
P. Cohesion (psf)		Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	8.6%	9.8%	16.6%	
Dry Dens., pcf	128.3	128.0	115.9	
Void Ratio	0.314	0.317	0.455	
Saturation %	74.1	83.4	98.7	
Diameter	1.91	1.91	1.92	
Height	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture %	11.5%	10.9%	17.6%	
Dry Dens., pcf	128.7	130.3	114.3	
Void Ratio	0.311	0.295	0.476	
Saturation %	100.0	100.0	100.0	
Diameter	1.91	1.91	1.92	
Height	0.997	0.983	1.014	
Normal Stress, psf	1000	2000	4000	
Shear Stress, psf	1407	3769	3382	
Strengths picked at Ult. Stress, psf	5.0%	5.0%	5.0%	
Strain Rate, in/min	0.020	0.020	0.020	

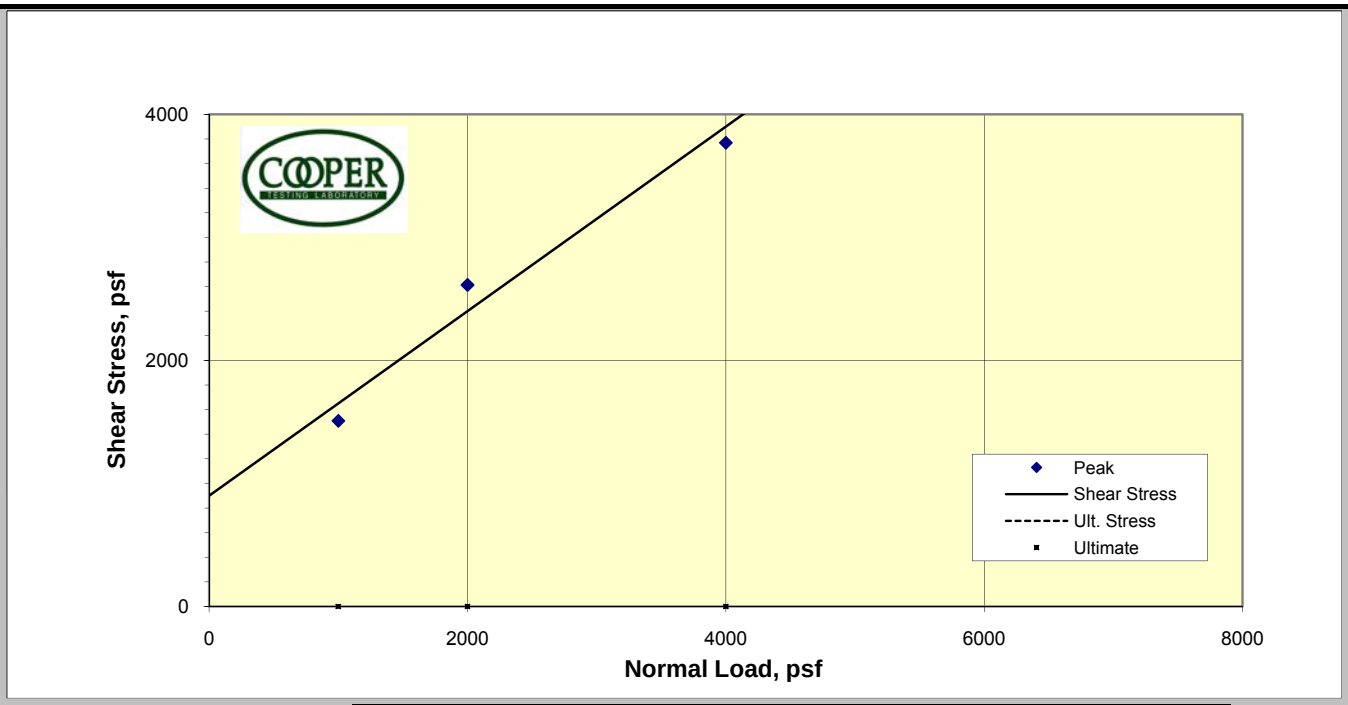
CTL #	287-044
Client:	Golder Associates
Project	Hanson - 063-7109-400 Phase 9
Tested By:	MD
Reduced By:	RU
Date:	8/31/2009

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	TSS-3		30	Gray Silty SAND w/ Gravel
2	TSS-3		30	Gray Silty SAND w/ Gravel
3	TSS-3		35	Greenish Gray Sandy Lean CLAY

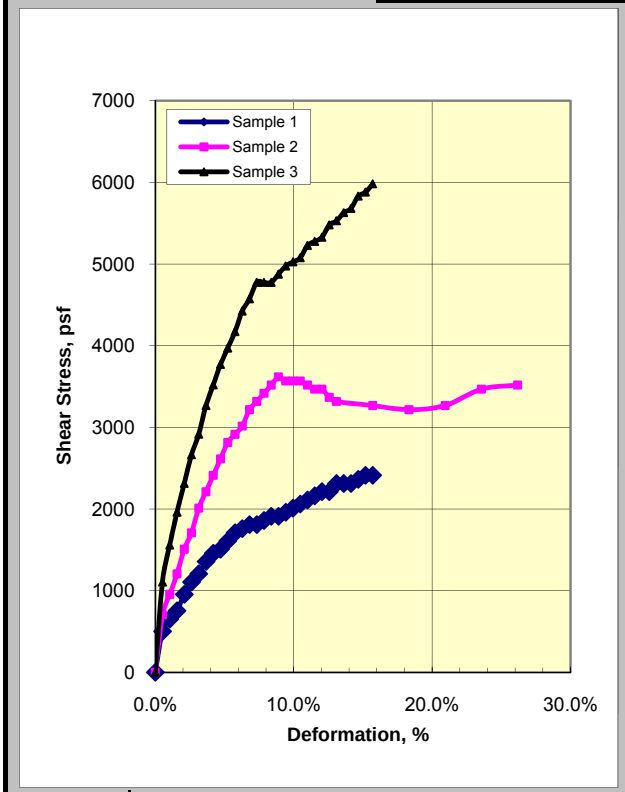
Remarks: *DS-CU* A fully undrained condition may not be attained in this test. Major patching on all three points due to gravel.

Direct Shear

(Consolidated-Undrained)



P. Phi (degrees)	36.9	Ult. Phi (degrees)	
P. Cohesion (psf)	900	Ult. Cohesion (psf)	



	Sample Data: Initial			
	1	2	3	4
Moisture %	7.8%	7.4%	8.1%	
Dry Dens., pcf	123.5	126.0	125.6	
Void Ratio	0.365	0.338	0.342	
Saturation %	57.7	59.3	63.7	
Diameter	1.91	1.91	1.91	
Height	1.00	1.00	1.00	
	Sample Data: At Test			
Moisture %	12.9%	12.5%	12.7%	
Dry Dens., pcf	125.2	126.2	125.5	
Void Ratio	0.347	0.337	0.344	
Saturation %	100.0	100.0	100.0	
Diameter	1.91	1.91	1.91	
Height	0.986	0.999	1.001	
Normal Stress, psf	1000	2000	4000	
Shear Stress, psf	1508	2613	3769	
Strengths picked at Ult. Stress, psf	5.0%	5.0%	5.0%	
Strain Rate, %/min.	1.0	1.0	1.0	

CTL #	287-044
Client:	Golder Associates
Project	Hanson - 063-7109-400 Phase 9
Tested By:	MD
Reduced By:	RU
Date:	8/31/2009

Specimen #	Boring:	Sample:	Depth, ft:	Visual Soil Classification
1	TSS-3		40	Brown Lean Clayey SAND w/ Gravel
2	TSS-3		40	Brown Lean Clayey SAND w/ Gravel
3	TSS-3		40	Brown Lean Clayey SAND w/ Gravel

Remarks: *DS-CU* A fully undrained condition may not be attained in this test. Major patching on all three points due to gravel.

APPENDIX 12.A

South Quarry Core Logs and Photos

			Run Data																											
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge					
																							Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	11	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt	1	26.0	27.3	1.3	N	1.3	0			R4	W0																
	Fault gouge	1	27.3	30.0	5.3	N	0.0	55	0	0	S3	W5											27.3	30.0	Sc			Soft clayey fault gouge
	Metabasalt fault gouge	2	30.0	35.0	4.7	N	0.0	50	0	0	S4	W5											30.0	35.0	Sc			
	Metabasalt fault gouge/breccia	3	35.0	39.0	3.9	N	0.0	40	0	0	S4/R3	W5	35.5	F	1	51	P		Sc	15	0.0		35.0	39.0	Sc/G	35.0	39.0	Mostly fault gouge; some areas of highly broken R3 rock (angular)
	Metabasalt/breccia	4	39.0	42.0	3.0	N	0.0	30	16	0	R4	W2	39.1	S	1	44	P	K	Sc	3	1.0	4				39.0	42.0	Entire run broken up, angular gravel and sand; mostly 1/4" to 3"
													41.6	J	1	55	C	R	Sc	0.5	8.0	12						
	Metabasalt/breccia	5	42.0	47.0	3.8	N	0.0	25	15	0	R4	W3	42.5	J	1	35	P	R	Sc	C	8.0	15						
													46.5	F	1				Sc	60		0	46.5	46.8	Sc			Entire run broken 1/4" to 3" angular gravel
	Metabasalt	6	47.0	50.0	3.0	N	0.5	15	14	8	R4	W2	48.5	J	1	50	P	R	Sc	1	8.0	12						
													49.2	J	2	80	P	R	Sc	C	10.0	15						
													49.1	J	1	60	C	R			15.0	20						
													48.8	J	1	38	P	R	Sc	3	12.0	10						
	Metabasalt	7	50.0	55.0	5.0	N	0.9	20	15	8	R4	W2	51	J	2	50	P	R	Sc	C	10.0	15						
													51.1	J	1	40	ST	R	Sc	1	12.0	13						
													52	J	1	40	P	R	Sc	C	10.0	16						
													53	J	1	30	P	S	CH	C	3.0	10						
													54.2	J	1	20	P	R		1	12.0	20						
	Metabasalt	8	55.0	59.0	4.0	N	0.0	40	5	0	R4/S4	W3	55	F	1				CH	60		0	55.0	55.4	CH			Could be cave in
													56	J	1	25	V	VR	CH	3	15.0	8						
													56.2	J	1	45	P	VR	Fe	C	15.0	20						
													57.5	F	1	55	IR		Sp	1 ft		0						angular sand
	Fault gouge	9	59.0	60.0	0.8	N	0.0	11	0	0	S4	W4	59	F	1	50			Sc	1 ft		0	59.0	60.0	Sc			Coarse sand/high plasticity clay
	Metabasalt breccia	10	60.0	65.0	3.7	N	0.3	22	10	2	R3	W3	60.8	J	1	50	P	R	Sc	2	10.0	10				60.0	65.0	>10 fractures/foot entire run
													64.2	J	1	48	C	R	Sc	0.5	12.0	12						
	Metabasalt breccia	11	65.0	70.0	2.3	N	0.0	55	8	2	R3/S4	W4	66.8	J	1	40	C	R	Sc	1	10.0	10				65.0	70.0	>10 fractures/foot entire run
	Metabasalt breccia	12	70.0	73.0	25.0	N	0.4	33	10	8	R3	W3	72	J	3	50	P	R	Sc	C	8.0	12				70.0	71.0	>10 fractures/foot entire run
	Metabasalt breccia	13	73.0	76.0	0.8	N	0.0	33	10	3	R3	W3	73.5	J	2	40	P	R	Sc	2	12.0	10						>10 fractures/foot entire run
	Metabasalt breccia/gouge	14	76.0	80.0	3.4	N	0.0	44	10	0	R3/S4	W4	78	F	1				Sc	1 ft		0	78.0	78.0	Sc	76.0	80.0	Rubble
	Metabasalt breccia	15	80.0	81.0	0.8	N	0.0	11	10	2	R3/S4	W	80.5	F	1				Sc	40		0				80.0	81.0	
	Metabasalt	16	81.0	83.0	1.4	N	0.0	33	12	8	R4	W2	81.5	J	5	58	P	R	Sc	0.5	8.0	12				81.0	83.0	
	Metabasalt	17	83.0	87.0	2.0	N	0.0	44	12	12	R3	W2	84	5	3	50	C	R	Sc	1	8.0	12				83.0	87.0	
	Metabasalt breccia	18	87.0	90.0	2.5	N	0.0	33	12	2	R3	W2														87.0	90.0	Entire run angular gravel 0.2" to 2" in diameter
	Metabasalt breccia	19	90.0	94.0	1.5	N	0.0	44	12	12	R3	W2														90.0	94.0	Entire run angular gravel 0.2" to 2" in diameter
	Metabasalt breccia	20	94.0	96.0	1.4	N	0.0	22	12	12	R3	W2																Entire run angular gravel 0.2" to 2" in diameter

Core Dia: Depth	ROCK TYPE	RUN	Run Data: Recovery & Other Basic Information: From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	JCR: Average	Minimum	Strength Index	Weathering Index	Detailed Discontinuity Data: Depth (ft.)	Type	Count	α	11	Roughness	Infill	Thickness (mm)	JRC	JCR	Rubble/Gouge: Gouge: From	To	Type	Broken Core: From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt breccia	21	96.0	100.0	1.0	N	0.0	44			R3																		Entire run rubble; low recovery
	Metabasalt	22	100.0	102.0	0.5	N	0.0	22	0	0	R4																100.0	102.0	Entire run rubble
	Metabasalt	23	102.0	104.0	0.4	N	0.0	22	0	0	R4																102.0	104.0	Entire run rubble
	Fault gouge	24	104.0	107.0	1.6	N	0.0	33	0	0	S3	W5	104	F	1				CH	1.5 ft		0	104.0	105.5	CH	105.5	107.0	First 1.5 feet is rubble
	Greenstone with Ca veins	25	107.0	111.0	1.2	N	0.0	50	12		R3	W2																	>10 fractures/foot entire run
	Greenstone	26	111.0	113.0	0.7	N	0.0	20	12		R2	W2																	>10 fractures/foot entire run
	Greenstone	27	113.0	114.0	1.0	N	0.0	20	19	18	R2	W2	113.2	J	2	60	P	R	<1	Chl	8.0	18							>10 fractures/foot entire run
													133.6	J	1	49	P	VR	<1	Chl	14.0	20							
	No recovery	28	114.0	116.0																									
	Greenstone	29	116.0	120.0	1.4	N	0.4	40	16	16	R3	W3	119.1	J	1	74	C	R			12.0	16							>10 fractures/foot entire run
													119.5	J	1	53	P	R			12.0	16							
	Gouge; Silty Clay to Clayey Silt (CL/ML)	30	120.0	125.0	0.5	N					S3	W5											124.0	125.0	ML/CL			
	Silty Sand (SM)	31	125.0	127.0	2.0	N					S3	W5											125.0	127.0	SM			
	Metabasalt with Ca veins	32	127.0	130.0	0.5	N	0.0	10	14		R3	W2																	>10 fractures/foot entire run
	Metabasalt	33	130.0	132.0	0.3	N	0.0	10	12		R3	W2																	>10 fractures/foot entire run
	Metabasalt	34	132.0	134.0	0.3	N	0.0	5	12		R3	W2																	>10 fractures/foot entire run
	Metabasalt	35	134.0	136.0	2.0	N	0.0	30	16	12	R3	W2	135.8	J	1	54	U	SR			6.0	16							>10 fractures/foot entire run
													135.3	J	2	60	P	R			8.0	16							
													134.8	J	1	43	ST	R			8.0	18							
													134.4	J	1	52	P	S			2.0	12							
	Metabasalt	36	136.0	137.0	1.0	N	0.5	25	13	12	R3	W2	136.2	J	1	11	P	S			2.0	12							>10 fractures/foot 136.4' to 137'
													136.6	J	1	57	P	R			10.0	16							
													136.8	J	1	38	P	S			4.0	12							
	Metabasalt	37	137.0	139.0	0.7	N	0.0	20	12		R3	W2																	>10 fractures/foot entire run
	Metabasalt	38	139.0	140.0	0.7	N	0.0	20	12		R3	W2																	>10 fractures/foot entire run
	Metabasalt	39	140.0	141.0	0.8	N	0.0	20	14		R3	W2																	>10 fractures/foot entire run
	No recovery	40	141.0	143.0																									
	Metabasalt	41	143.0	144.0	0.5	N	0.0	15	12		R3	W2																	>10 fractures/foot entire run
	No recovery	42	141.0	146.0																									
	Metabasalt	43	146.0	150.0	1.7	N	0.0	75	12		R3	W2																	>10 fractures/foot entire run
	Gouge/Clayey Sand (SC)	44	150.0	152.0	2.0	N			0	0	S4	W4											150.0	152.0	Sc			
	Metabasalt	45	152.0	154.0	1.4	N	0.0	40	16	16	R3	W3	152.8	J	1	47	U	R			10.0	16							>10 fractures/foot entire run
	Gouge/clayey sand	46	154.0	156.0	1.3	N					S3	W4											154.0	156.0	Sc			

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge					
																							Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	11	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Gouge/clayey sand	47	156.0	158.0	2.0	N					S3	W4											156.0	158.0	Sc			
	Metabasalt	48	158.0	160.0	0.3	N	0.0	10	14		R3	W2																>10 fractures/foot entire run
	No recovery	49	160.0	164.0																								
	No recovery	50	164.0	168.0																								
	Metabasalt	51	168.0	170.0	0.6	N	0.0	15	14		R3	W2																>10 fractures/foot entire run
	Metabasalt	52	170.0	174.0	1.2	N	0.0	15	12		R3	W2																>10 fractures/foot entire run
	Sandy silt (ML)	53	174.0	176.5	0.0	N					S1	W5																No recovery; material so fine it will not stay in tube to bring up to surface
	Metabasalt gouge	54	176.5	178.0	0.4	N					S5	W4											177.6	178.0	Gc			Metabasalt fragments in silty clay matrix
	Metabasalt	55	178.0	180.0	1.1	N	0.0	20	12		R3	W2																>10 fractures/foot entire run
	Metabasalt	56	180.0	182.0	0.7	N	0.0	15	12		R3	W2																>10 fractures/foot entire run
	Metabasalt	57	182.0	185.0	0.7	N	0.0	15	14		R3	W2																>10 fractures/foot entire run
	Metabasalt	58	185.0	190.0	2.6	N	0.0	40	14		R3	W3											189.2	190.0	Sc			>10 fractures/foot entire run
	Metabasalt	59	190.0	192.0	1.2	N	0.0	30	14		R3/S2	W2																>10 fractures/foot entire run
	Metabasalt gouge	60	192.0	196.0	3.9	N					S2	W5											192.0	192.7	Sc			Clayey sand; very fine
																							192.7	196.0	Cl			
	Metabasalt	61	196.0	200.0	0.9	N	0.0	30	12		R3	W2																>10 fractures/foot entire run
	Metabasalt with Ca veins	62	200.0	202.0	1.5	N	0.0	40	12		R3/S5	W3											200.0	200.5	Gc			>10 fractures/foot entire run; gouge is matrix supported gravelly/sandy clay
	Metabasalt	63	202.0	203.0	0.6	N	0.0	10	12		R3	W2																Calcite veins; >10 fractures/foot entire run
	Gouge/clayey sand (Sc)	64	203.0	206.0	1.0	N	0.0				S2/R3	W4																Some metabasalt clasts; can see some vesicles filled with chlorite
	Metabasalt	65	206.0	208.0	1.0	N	0.4	10	18	18	R3	W2	207.6	J	1	41	ST	R			10.0	18						>10 fractures/foot entire run
	Brecciated metabasalt	66	208.0	210.0	1.6	N	0.0				R3/S3	W4											208.8	209.4	Sc/Bx			Matrix supported breccia
	Metabasalt	67	210.0	212.0	0.6	N	0.0	7	14		R3	W2																>10 fractures/foot entire run
	Metabasalt	68	212.0	215.0	3.0	N	0.0	53	12	10	R3	W2	214	V	1	20	P	SR	Ca	<1	7.0	14						Ca veins and chlorite
													214.3	J	2	40	P	SR	Cl	<1	5.0	10						>10 fractures/foot 213' to 214'
													214.8	J	1	37	P	SR	Cl	<1	7.0	12						
	Metabasalt	69	215.0	217.0	1.0	N	0.0																215.0	215.5	Sc/Bx			Matrix supported breccia; >10 fractures/foot 215.5 to 216
	Metabasalt	70	217.0	220.0	3.0	N	2.9	0			R3	W2														217.0	217.3	
	Metabasalt	71	220.0	223.0	1.6	N	0.0	50			R3	W2																Rubble recovered
	Metabasalt	72	223.0	224.0	1.3	N	1.3	1			R3	W2	223.7	J	1	50	P	R			8.0	20						
	Metabasalt	73	224.0	226.0	1.9	N	0.0	50			R2	W2											224.0	224.8	Sc			Rubble recovered
	Metabasalt	74	226.0	230.0	3.2	N	0.0	50			R2	W2														226.0	230.0	Rubble recovered
	Metabasalt	75	230.0	232.0	2.0	N	0.8		10		R3	W3														231.1	230.0	>10 fractures/foot 231.1' to 232'

			Run Data																											
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	11	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt	76	232.0	235.0	3.0	N	0.0		9		R3	W3																>10 fractures/foot entire run; Sc mixed in with metabasalt
	Metabasalt	77	235.0	237.0	1.8	N	0.0		10		R3	W3																same as above
	Metabasalt	78	237.0	240.0	3.0	N	0.0		11		R3	W2																>10 fractures/foot entire run; rubble near end
	Metabasalt	79	240.0	242.0	2.0	N	0.4	2	12	12	R3	W2	240.4	J	2	27	P	VR			6.0	12				240.9	242.0	>10 fractures/foot 240.9' to 242'
	Metabasalt	80	242.0	247.0	5.0	N	1.3	4	13	13	R4	W2	242.7	J	1	45	P	R			8.0	13						Calcite veins
													243.5	J	2	34	P	R			8.0	13						
													243.7	J	1	29	P	VR	Cl	1	10.0	14				244.4	247.0	>10 fractures/foot 244.4' to 247
	Metabasalt	81	247.0	250.0	3.0	N	0.0		14		R4	W2																>10 fractures/foot entire run
	Metabasalt	82	250.0	255.0	5.0	N	1.5	3	14	12	R4	W2	251.4	J	1	28	P	R	Chl	1	6.0	12				252.7	255.0	Some foliation of vitreous black minerals
													252	J	1	34	U	R			12.0	16						>10 fractures/foot 252.7' to 255'
													252.5	J	1	26	P	R			8.0	14						Ca veins
	Metabasalt	83	255.0	259.0	4.0	N	0.0	2	10	8	R3	W3	255.3	J	2	59	P	R			5.0	8				255.5	258.5	Ca veins
													258.7	J	1	56	P	R			7.0	12				258.7	259.0	
	Metabasalt	84	259.0	261.0	1.5	N	0.0		6		R3	W3											260.3	260.5	CL	259.0	260.3	Rubble; gouge at end of run
	Metabasalt	85	261.0	265.0	3.5	N	1.3	3	14	14	R4	W2	261.8	J	2	34	P	VR	CL	1	12.0	14	261.0	261.4	CL			Ca veins; some mechanical fractures
													263.7	J	1	34	P	R			8.0	14						
	Metabasalt	86	265.0	270.0	5.0	N	1.6	4	16	14	R4	W2	266.3	J	1	53	P	VR			10.0	16						> 10 fractures/foot 265' to 266.3'; mechanical fractures
													268	J	1	36	P	R			8.0	14						Ca veins; some chlorite
													268.5	J	1	38	U	R			14.0	18						
													268.9	J	1	75	U	R			12.0	16						
	Metabasalt	89	270.0	273.0	2.9	N	1.1	4	10	6	R4	W2	270.5	J	2	51	P	R	Chl/CL	1	6.0	12						Ca veins; some fault breccia at the end of run
													271.2	J	1	66	P	R			6.0	12						
													271.5	J	1	52	P	S	CL	1	4.0	6						
	Metabasalt	90	273.0	278.0	3.3	N	0.0	55	0	0	S4/R4	W4											273.0	278.0	Sc/G	273.0	278.0	Gouge and rubble recovered; rounded clasts up to 2.5" diameter
	Metabasalt	91	278.0	281.0	1.2	N	0.4	7	12	12	R4	W2	280.8	5	1	55	C	R	Sc	0.5	8.0	12				278.0	278.8	
																										280.8	281.0	
	Metabasalt	92	281.0	284.0	3.0	N	1.2	9	12	10	R4	W2	281.4	J	1	55	P	R	Cl	1	4.0	8				281.0	281.5	
													282.7	J	1	30	IR	R	SC	C	7.0	17						
													283.1	J	1	25	C	R	SC	C	7.0	16						
													283.5	J	1	25	C	R	SC	1	7.0	12						
	Metabasalt	93	284.0	287.0	4.0	N	0.5	30	15	13	R4	W1	284	J	1	50	P	R	CL	C	7.0	18				284.0	285.4	Rubble
													285.4	J	1	55	IR	R			8.0	20						
													286.5	J	3	50	P	S			3.0	13						
	Metabasalt	94	287.0	289.0	1.8	N	0.4	7	12	12	R4	W1	287.2	J	1	50	C	R	SC	0.5	8.0	14				287.2	288.0	Many joints along veins
													288.6	V	1	25	P	S	Ca	C	4.0	12						
													288.8	V	1	45	P	R	SC	C	4.0	12						
	Metabasalt	95	289.0	293.0	3.0	N	1.0	15	18	18	R4	W1	289.3	J	1	60	P	R			9.0	18				291.0	293.0	
													289.8	J	1	45	P	R			8.0	18						
													290.1	V	1	20	C	R	Ca	0.5	8.0	18						
													290.5	J	1	45	P	R			8.0	18						
	Metabasalt	96	293.0	296.0	2.8	N	1.2	0.8	19	18	R5	W1	293.2	J	1	5	P	R			12.0	20				293.5	295.0	Weakness planes along Ca veins
													294	J	1	40	P	R	SC	C	8.0	18						
													295	J	1	45	IR	R			8.0	20						
	Metabasalt	97	269.0	300.0	4.0	N	2.6	11	15	12	R4	W1	296.4	J	1	10	C	R			7.0	20						

			Run Data																											
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	11	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													298	J	1	45	P	SR	CL	1	4.0	12				298.0	300.0	
													299.7	J	1	60	P	SR	CL	0.5	4.0	15						
	Metabasalt	98	300.0	302.0	2.0	N	0.0	10	12	0	R4	W1	301	J	3	45	P	S		2	2.0	6				300.0	302.0	Gouge in broken core
													300.5	F	1				SC	10		0						
	Metabasalt	99	302.0	304.0	2.0	N	1.3	10	8	0	R4	W2	302	J	1	45	C	S		C	4.0	12						
													303	J	2	50	P	SR		2	4.0	10						
													303.8	F	1				SC	25		0						
	Metabasalt	100	304.0	306.0	1.5	N	0.0	55	12	12	R4	W2	305	J	1	30	C	R		C	8.0	13				304.0	306.0	
													305.1	J	1	54	P	R		2	8.0	12						
	Metabasalt	101	306.0	307.0	0.7	N	0.0	11	12	12	R4	W2	306.8	J	1	55	C	R	CL	C	10.0	12				306.0	308.0	
	Metabasalt	102	307.0	310.0	0.1	N	0.0	33			R4																	One 2"-diameter clast recovered
	Metabasalt breccia	103	310.0	312.0	1.6	N	0.5	15	12	0	R3	W2	310.4	J	1	50	P	R	CL	2	10.0	10				310.4	312.0	
													311.3	F	1				SC	60		0	311.3	311.8				
	Metabasalt breccia	104	312.0	316.0	2.0	N	0.0	44	10	0	R3	W2	315.8	J	1	25	P	SR	SC	4	4.0	2				312.0	316.0	Clasts 1/4"- to 1.5"-diameter
	Metabasalt	105	316.0	317.0	0.7	N	0.0	11	12	12	R2	W2																Weak rock; recovered soft rubble up to 1"-diameter
	Metabasalt	106	317.0	320.0	1.7	N	0.6	20	12	12	R3	W2	318	J	2	30	U	R		1	8.0	12				317.0	317.5	
																										318.5	320.0	
	Metabasalt	107	320.0	324.0	3.7	N	0.6	25	12	12	R3	W2	321	J	4	40	P	R		0.5	6.0	11				322.0	324.0	
	Metabasalt	108	324.0	326.0	2.0	N	0.5	10	12	12	R3	W2	325	J	2	25	C	R			13.0	15				324.0	324.5	
																										325.0	326.0	
	Metabasalt breccia	109	326.0	328.0	1.4	N	0.0	15	15	15	R3	W2														326.0	328.0	Clasts 0.25"- to 2"-diameter
	Metabasalt	110	328.0	329.0	1.0	N	0.0	10	12	12	R3	W2	328.5	J	2	35	C	R			10.0	15				328.0	329.0	Clasts 0.25"- to 2"-diameter
	Metabasalt	111	329.0	331.0	2.0	N	0.0	15	12	12	R3	W2														329.0	329.8	Clasts 0.25"- to 2"-diameter
																										330.2	331.0	Clasts 0.25"- to 2"-diameter
	Metabasalt	112	331.0	333.0	2.0	N	1.5	4	12	12	R3	W2	331	F	1	45	P	E	SP	40	10.0	2						
	Metabasalt	113	333.0	335.0	2.8	N	0.4	15	6	0	R3	W3	334	F	1				SP/G	1.5 ft			333.5	335.0	SP/G			Clasts 1/8"- to 2"-diameter
	Metabasalt	114	335.0	340.0	5.0	N	0.0	15	8	8	R2	W2/W3											335.0	337.3	G/CL	337.3	340.0	>10 fractures/foot; Ca veins
	Metabasalt breccia/gouge	115	340.0	342.0	2.0	N	0.0	25	7	7	R2	W3											341.3	342.0	G/CL	340.0	341.3	Mostly gouge with some breccia
	Greenstone/gouge	116	342.0	344.0	2.0	N	0.9	2	9	2	R3/R2	W2/W3	343	J	1	53	U	R	CL	1	14.0	15	343.5	344.0	Gc	342.0	342.3	
													343.5	F					CL	6"		2						
	Metabasalt breccia/gouge	117	344.0	346.0	2.0	N	0.0	10	10	2	R2/R3	W2/W3	344.7	J	1	48	U	VR			17.0	18	344.0	344.3	CL			Brecciated 344.3' to 344.8'
													344.8	F	1				CL/Ox	1.2'		2	344.8	346.0	CL/Bx			
	Metabasalt breccia	118	346.0	349.0	3.0	N	0.0	7	10	10	R3	W2	346.2	J	7	55	P	VR	CL	1	10.0	10						All brecciated; Ca veins
	Metabasalt breccia	119	349.0	353.0	4.0	N	0.5	30			R3	W2	351	J	2	34	P	VR	CL	1	6.0	8				349.0	351.0	All brecciated
																										351.4	352.7	

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	11	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt breccia	120	353.0	355.0	2.0	N	0.6	10	8	8	R3	W2	353.2	J	1	40	P	VR	CL	1	6.0	8				358.0	353.2	
																										353.8	355.0	>10 fractures/foot; some gouge
	Metabasalt gouge with FeOx	121	355.0	359.0	3.5	N	0.0	20	2	2	R2	W3											355.0	357.4	CL/Ox	357.4	359.0	FeOx specs on gouge
	Metabasalt gouge with FeOx	122	359.0	361.0	1.8	N	0.0	1	2	2	R2	W3														359.0	361.0	All gouge; brecciated at very end of run
	Metabasalt gouge with FeOx	123	361.0	362.0	1.0	N	0.0		2	2	R2	W3														361.0	362.0	
	Metabasalt breccia	124	362.0	363.0	1.0	N	0.8	2	6	2	R3	W3	362.3	J	1	28	P	VR	CL	1	12.0	10						
													362.5	F	1	58	U	R	CL/G	3"	14.0	2						
	Metabasalt gouge with FeOx	125	363.0	364.0	1.0	N	0.0		2	2	R2	W4											363.0	364.0	CL/Ox			
	Metabasalt breccia	126	364.0	366.0	2.0	N	0.0	40	4	4	R3	W2																>10 fractures/foot entire run
	Metabasalt breccia	127	366.0	367.0	1.0	N	0.0	40	4	4	R3	W2																>10 fractures/foot entire run
	Metabasalt breccia	128	367.0	370.0	3.0	N	0.6	2	8	8	R2	W2	368.4	J	2	45	P	VR	CL	1	6.0	8						Clasts slightly imbricated
	Metabasalt breccia	129	370.0	373.0	2.9	N	0.4	30	8	8	R2	W3	370.5	J	1	50	P	R			5.0	8				370.0	370.7	
																										371.5	372.5	
																							372.5	373.0	CL			
	Metabasalt	130	373.0	374.0	0.8	N	0.0	20	6	6	R2	W3														373.0	373.8	Broken core entire run
	Metabasalt gouge with FeOx	131	374.0	376.0	1.5	N	0.0		2	2	R2	W4											374.0	375.5	CL/Ox			
	Metabasalt breccia	132	376.0	379.0	3.0	N	0.0	20	8	8	R3	W2																>10 fractures/foot entire run
	Greenstone	133	379.0	381.0	2.0	N	0.6	20	6	6	R3	W2	380.2	J	1	23	ST	R	CL/Chl	2	14.0	6				379.0	380.2	Some Ca veins
													380.6	J	1	42	U	R	CL/Chl	1	12.0	6						
	Greenstone	134	381.0	385.0	4.0	N	1.4	20	10	8	R3	W2	381.6	J	1	51	P	VR	CL/Chl	1	10.0	8	384.6	385.0	CL/Chl	382.5	384.6	Some Ca veins
													382.5	J	1	63	P	VR	Chl	1	14.0	12						
	Metabasalt gouge	135	385.0	389.0	4.0	N	1.1	2	8	8	R3	W2	387.3	J	1	65	P	VR	Chl	1	12.0	8	385.0	387.3	Chl			
													388.1	J	1	34	P	R			10.0	8						
	Metabasalt	136	389.0	392.0	2.8	N	2.5	1	22	22	R3	W1	391	J	1	69	P	VR			18.0	22						
	Metabasalt	137	392.0	394.0	1.8	N	1.8	1	20	20	R3	W1	393	J	1	67	P	VR			17.0	20						
	Metabasalt	138	394.0	396.0	2.0	N	0.0	20	10	6	R2	W4	395.4	J	1	55	P	K			4.0	6	395.5	396.0	Gc			Breaks mostly mechanical; >10 fractures/foot 394' to 394.8'
	Metabasalt gouge	139	396.0	398.0	2.0	N	0.0		0	0	S4	W4											396.0	398.0	Gc			
	Metabasalt	140	398.0	400.0	1.7	N	0.4	25	6	0	R2	W3											398.8	399.6	Gc			>10 fractures/foot 399.6' to 400'
	Metabasalt	141	400.0	402.0	2.0	N	0.0	40	16	16	R3	W2	401	J	2	40	P	R			10.0	16						>10 fractures/foot entire run
														J	2	24	P	R			10.0	16						
	Metabasalt	142	402.0	404.0	1.3	N	0.0	35	18	16	R3	W2	403.5	J	1	40	ST	S			14.0	20						>10 fractures/foot 402' to 402.5'
													403.7	J	1	35	P	SR			8.0	16						

			Run Data										Rubble/Gouge											
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	11	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt	143	404.0	408.0	3.4	N	0.5	50	16	16	R4	W2	405.2	J	2	55	P	R			10.0	16						>10 fractures/foot entire run
	Metabasalt	144	408.0	410.0	2.0	N	0.0	15	20	20	R4	W2	409	J	2	65	U	R			16.0	20						Breaks mostly mechanical
	Metabasalt	145	410.0	415.0	5.0	N	0.4	40	14	14	R4	W2																Breaks mechanical
	Metabasalt	146	415.0	416.0	1.0	N	0.0	20	14	14	R3	W2																>10 fractures/foot entire run
	Metabasalt	147	416.0	417.0	0.3	N	0.0	5	12	12	R3	W2																>10 fractures/foot entire run
	Metabasalt	148	417.0	418.0	1.0	N	0.0	20	12	12	R3	W3																>10 fractures/foot entire run
	Metabasalt	149	418.0	425.0	1.2	N	0.0	50	12	12	R3	W3																>10 fractures/foot entire run
	Metabasalt	150	425.0	427.0	1.7	N	0.0	20	14	14	R3	W2																>10 fractures/foot entire run
	Metabasalt	151	427.0	428.0	0.6	N	0.0	10	14	14	R3	W2																>10 fractures/foot entire run
	Metabasalt	152	428.0	430.0	0.7	N	0.0	10	14	14	R3	W2																>10 fractures/foot entire run
	Metabasalt	153	430.0	432.0	1.0	N	0.6	5	22	22	R4	W1	430.5	J	1	45	IR	VR			18.0	22						
	Metabasalt/Limestone	154	432.0	436.0	4.0	N	0.8	25	22	22	R4	W2	434.5	J	1	50	P	R			16.0	22						Breaks mostly mechanical; contact at 433'; >10 fractures/foot 435' to 436
	Limestone	155	436.0	438.0	2.0	N	1.8	1	20	20	R2	W1	437.8	V	1	33	P	R	Ca	1	16.0	20						
	Limestone	156	438.0	440.0	2.0	N	2.3	15	19	18	R2	W1	439	J	1	68	P	R			16.0	20						
													439.5	J	1	11	ST	R			14.0	18						
	Limestone/Metabasalt	157	440.0	445.0	3.5	N	1.1	35	18	18	R2/R3	W2	440.4	V	1	50	P	R	Ca	3	14.0	18						>10 fractures/foot 442' to 445'
	Metabasalt	158	445.0	447.0	2.0	N	0.0	25	14	14	R3	W2																Breaks mechanical; >10 fractures/foot entire run
	Metabasalt	159	447.0	449.0	0.5	N	0.0	10	12	12	R3	W2																>10 fractures/foot entire run
	Metabasalt gouge	160	449.0	450.0	0.8	N	0.0		0	0	S4	W4											449.2	450.0	Gc			
	Metabasalt	161	450.0	453.0	2.7	N	0.0	20	6	0	R1/S4	W4											450.4	451.4	Gc			>10 fractures/foot 450' to 450.4' and 451.4' to 453'

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Sandstone	1 to 35	0.0	117.0					12		R2	W3																Almost all >10 fractures/foot intermixed with clays, silts, and gravels
	Metabasalt	36	117.0	119.0	0.5	N	0.0		14		R2	W2														118.5	119.0	Rubble/redrill
	Metabasalt	37	119.0	121.0	0.4	N	0.0		15		R2	W2														120.6	121.0	Rubble/redrill
	Metabasalt	38	121.0	124.0	1.5	N	0.0	20	15		R2	W2	122.8	J	1	19	U	R	CL	<1	12.0	20						>10 fractures/foot entire run
	Metabasalt gouge	39	124.0	134.0	0.9	N	0.0		0		S5	W4											133.1	134.0	CL/Bx			
	Metabasalt/metabasalt gouge	40	134.0	136.0	1.5	N	0.0	1	12	0	S5/R2	W3	130.2	J	1	26	P	VR	CL	4	14.0	20	134.4	135.1	CL/Bx			
	Metabasalt	41	136.0	139.0	1.8	N	0.0	30	15		R2	W2																>10 fractures/foot entire run
	Metabasalt	42	139.0	142.0	1.7	N	0.0	25	15		R2	W2																>10 fractures/foot entire run
	Metabasalt/metabasalt gouge	43	142.0	147.0	2.0	N	0.0	20	0		R2/S4	W3											146.2	147.0	CL/Bx			
	Metabasalt gouge	44	147.0	149.0	1.2	N	0.0		0		S5	W4											147.8	149.0	Cl/Bx			
	Metabasalt gouge	45	149.0	151.0	1.7	N	0.0	1	0		S5/R2	W3	150	F	1	65	C	VR	G	0.8'	16.0	0	149.2	150.0	CL/Bx			
	Metabasalt gouge	46	151.0	154.0	1.6	N	0.0		0		S5	W4											152.4	154.0	CL/Bx			
	Metabasalt gouge	47	154.0	157.0	3.0	N	0.0		9	0	R2/S5	W4	154.3	J	1	82	P	R	CL	<1	12.0	18						
													154.5	F	1	45	P	SM	G	2.3'	4.0	0	154.5	157.0	CL/Bx			
	Metabasalt gouge	48	157.0	159.0	0.7	N	0.0		0		S5/R2	W4											157.3	158.3	CL/Bx			
	No recovery	49	159.0	164.0																								
	Metabasalt gouge	50	164.0	169.0	1.6	N	0.0		0		S5	W4											167.4	169.0	CL/Bx			
	Metabasalt	51	169.0	176.0	0.7	N	0.0		15		R2	W2														175.3	176.0	Rubble/redrill
	Metabasalt gouge	52	176.0	179.0	1.7	N	0.0		0		S5	W4											177.3	179.0	CL/Bx			
	Metabasalt gouge	53	179.0	184.0	5.0	N	0.0		0		S5	W4											179.0	184.0	CL/Bx			Hematite, greenstone, and greywacke clasts
	Metabasalt gouge	54	184.0	189.0	5.0	N	0.0		0		S5	W4											184.0	189.0	CL/Bx			Hematite
	Metabasalt gouge	55	189.0	194.0	4.5	N	0.0		0		S5	W4											189.5	194.0	CL/Bx			Hematite
	Metabasalt gouge	56	194.0	199.0	3.4	N	0.0		0		S5	W4											195.6	199.0	CL/Bx			
	Metabasalt	57	199.0	204.0	3.4	N	0.4	50	17		R2	W2	202.7	F	1	70	ST	K			8.0	0						>10 fractures/foot entire run
	Metabasalt gouge	58	204.0	206.0	2.0	N	0.0		0		S5	W4											204.0	206.0	CL/Bx			
	Metabasalt breccia	59	206.0	209.0	3.0	N	0.0	40	6		R2	W3																>10 fractures/foot entire run
	Metabasalt breccia	60	209.0	210.0	1.0	N	0.0	20	8		R2	W3																>10 fractures/foot entire run
	Metabasalt breccia	61	210.0	212.0	2.0	N	0.0	35	12		R2	W2																>10 fractures/foot entire run

			Run Data										Detailed Discontinuity Data									Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt breccia	62	212.0	215.0	2.4	N	0.0	45	12		R1	W3																>10 fractures/foot entire run
	Metabasalt breccia	63	215.0	218.0	3.0	N	0.0	50	14		R1/R2	W3																>10 fractures/foot entire run
	Metabasalt breccia	64	218.0	223.0	4.3	N	0.0	65	12		R1	W3	221.4	F	1	75	C	K	G	1.1'	2.0	0						>10 fractures/foot entire run
	Metabasalt breccia	65	223.0	226.0	2.4	N	0.0		0		R2/S5	W4											223.6	226.0	CL/Bx			Slickensides
	Metabasalt breccia	66	226.0	229.0	3.0	N	0.0		0		R2/S5	W4											226.0	227.0	CL/Bx			
																							227.7	228.3	CL/Bx			
	Metabasalt breccia	67	229.0	231.0	2.5	N	0.0	50	14		R1	W2																>10 fractures/foot entire run
	Metabasalt breccia	68	231.0	236.0	5.0	N	0.0	75	12		R2	W2																>10 fractures/foot entire run
	Greywacke	69	236.0	239.0	3.0	N	0.0	50	12		R2	W2																>10 fractures/foot entire run
	Greywacke	70	239.0	241.0	2.0	N	0.0	40	12		R2	W2																>10 fractures/foot entire run
	Greywacke	71	241.0	244.0	3.0	N	0.0	45	14		R2	W2																>10 fractures/foot entire run
	Greywacke	72	244.0	245.0	1.0	N	0.0	20	14		R2	W2																>10 fractures/foot entire run
	Greywacke	73	245.0	247.0	2.0	N	0.0	45	16		R2	W2																>10 fractures/foot entire run
	Greywacke	74	247.0	248.0	1.0	N	0.0	25	16		R2	W2																>10 fractures/foot entire run
	Gerywacke	75	248.0	250.0	1.6	N	0.0	25	8	0	S5/R2	W4											248.4	250.0	CL/Bx			
	Metabasalt	76	250.0	252.0	0.7	N	0.0		4		R2	W2														251.3	252.0	
	Metabasalt	77	252.0	253.0	0.7	N	0.0	15	14		R2	W2																>10 fractures/foot entire run
	Metabasalt	78	253.0	255.0	2.0	N	0.0	25	12		R1/R2	W3																>10 fractures/foot entire run
	Metabasalt	79	255.0	259.0	1.5	N	0.0	20	12		R1/R2	W2																>10 fractures/foot entire run
	Metabasalt	80	259.0	263.0	1.4	N	0.5	20	14		R2	W2																>10 fractures/foot entire run
	Metabasalt	81	263.0	267.0	2.2	N	0.0	30	12		R2	W2																>10 fractures/foot entire run
	Metabasalt	82	267.0	269.0	0.2	N	0.0		12		R2	W2														268.8	269.0	
	Metabasalt	83	269.0	271.0	1.9	N	0.0	15	6		S5/R2	W3											270.3	271.0	CL/Bx			>10 fractures/foot 269.1' to 270.3'
	Metabasalt	84	271.0	273.0	1.3	N	0.0	20	14		R2	W2																>10 fractures/foot entire run
	Metabasalt	85	273.0	276.0	2.0	N	0.0	15	3		S5/R2	W3											275.6	276.0	CL/Bx			Slikensides; >10 fractures/foot 274' to 275.6'
	Metabasalt	86	276.0	276.0	0.7	N	0.0	10	10		R2	W3																>10 fractures/foot entire run
	Metabasalt	87	278.0	281.0	2.6	N	0.5	17	14		R2	W2																>10 fractures/foot 279.5' to 281'
	Metabasalt	88	281.0	284.0	3.2	N	0.0	45	12		R2	W3	282.4	F	1	63	P	P	G	0.3'	2.0	0	282.3	282.6	CL/Bx			>10 fractures/foot entire run
	Metabasalt/greenstone	89	284.0	287.0	3.2	N	0.7	35	6	0	R1/R2	W3																>10 fractures/foot entire run

			Run Data																											
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge							
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greenstone	90	287.0	289.0	2.0	N	0.0	25	9	6	R1/R2	W3																>10 fractures/foot entire run
	Greenstone	91	289.0	292.0	3.3	N	0.0	45	6	6	R1	W3																>10 fractures/foot entire run
	Greenstone/greenstone gouge	92	292.0	296.0	3.3	N	0.0		6	0	S5/R1	W3											293.7	296.0	CL/Bx			>10 fractures/foot 292.7' to 293.7'
	Greenstone gouge	93	296.0	299.0	2.1	N	0.0		4	0	S6/R2	W3											296.9	299.0	CL/Bx			
	Greenstone	94	299.0	301.0	2.0	N	0.0	50	12		R2	W3																>10 fractures/foot entire run
	Greenstone/greenstone gouge	95	301.0	304.0	3.0	N	0.0	40	6	0	S5/R2	W2/W4											302.0	304.0	CL/Bx			>10 fractures/foot 301' to 302'
	Greenstone/greenstone gouge	96	304.0	306.0	1.2	N	0.0	30	6	0	R2/S5	W3																>10 fractures/foot entire run
	Greenstone/greenstone gouge	97	306.0	308.0	2.0	N	0.0	50	12	0	R2/S5	W3											307.4	308.0	CL/Bx			>10 fractures/foot 306' to 307.4'
	Greenstone/Limestone	98	308.0	313.0	5.0	N	0.4	75	18	0	R1/R3	W2	308.8	F	1	20	P	K	Cl/B	0.2'								>10 fractures/foot entire run; fault is contact
	Limestone	99	313.0	317.0	5.0	N	0.9	60	18		R3	W2	314.7	J	1	60	P	VR			16.0	20						Low grade
	Limestone	100	317.0	322.0	5.0	N	1.2	70	18		R3	W2	318.7	J	1	75	IR	R			10.0	20						>10 fractures/foot 317' to 317.5' and 319' to 322'
													319.2	J	1	33	P	K			6.0	12						
	Limestone	101	322.0	326.0	4.0	N	0.0	80	18		R3	W2																>10 fractures/foot entire run
	Limestone	102	326.0	329.0	3.0	N	1.6	3	21	20	R3	W1	326.4	J	1	74	ST	VR			20.0	22						
													327.3	J	1	30	P	VR			18.0	22						
													328.6	J	1	76	IR	R			14.0	20						
	Limestone	103	329.0	330.0	1.0	N	0.0	1	0	0	R3	W1	329	F	1	65	P	R	CL	0.2'	12.0	0						Pyrite in fault gouge
	Limestone	104	330.0	332.0	2.0	N	0.0	35	18		R3	W1																>10 fractures/foot entire run
	Limestone	105	332.0	334.0	2.0	N	0.0	15	18		R3	W1	333.2	J	1	70	U	R			10.0	18						>10 fractures/foo 332.5' to 333.2' and 333.5' to 334'
	Limestone	106	334.0	337.0	3.0	N	1.2	15	20		R3	W1	334.6	J	1	65	ST	R			14.0	22				334.0	334.2	>10 fractures/foot 336.7' to 337'
													336.4	J	1	65	IR	R			14.0	22						
	Limestone	107	337.0	339.0	2.0	N	0.4	17	17		R3	W1	337.4	J	1	59	P	VR			16.0	20						
	Limestone	108	339.0	340.0	1.0	N	0.0	15	18		R3	W1	339.7	J	1	60	P	VR			16.0	20				339.0	339.3	
	Limestone	109	340.0	341.0	0.8	N	0.0	0	18		R3	W1																
	Limestone	110	341.0	343.0	1.9	N	0.0	2	17	14	R3	W1	341.9	J	1	23	P	SM			6.0	14						
													342.4	J	1	73	C	R			12.0	20						
	Limestone	111	343.0	347.0	3.6	N	0.4	55	18		R3	W1																>10 fractures/foot entire run
	Limestone	112	347.0	349.0	2.0	N	0.0	50	18		R3	W1																>10 fractures/foot entire run
	Limestone	113	349.0	350.0	1.0	N	0.0	20	18		R3	W1																>10 fractures/foot entire run

			Run Data																												
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data											Rubble/Gouge							
																								Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	114	350.0	352.0	1.2	N	0.0	2	17	17	R3	W1	350.8	J	2	40	P	SM			6.0	17				350.8	351.0	
	Limestone	115	352.0	354.0	2.0	N	0.0	50	18		R3	W1																>10 fractures/foot entire run
	Limestone	116	354.0	356.0	1.5	N	0.0	25	18		R3	W1																>10 fractures/foot entire run
	Limestone	117	356.0	358.0	2.0	N	0.0	50	18		R3	W1																>10 fractures/foot entire run
	Limestone	118	358.0	362.0	3.5	N	0.0	60	18		R3	W1																>10 fractures/foot entire run
	Limestone	119	362.0	364.0	2.0	N	0.0	45	18		R3	W1																>10 fractures/foot entire run
	Limestone	120	364.0	365.0	0.9	N	0.0	25	18		R3	W1																>10 fractures/foot entire run
	Limestone	121	365.0	367.0	2.0	N	0.0	50	18		R3	W1																>10 fractures/foot entire run
	Limestone	122	367.0	369.0	2.0	N	0.0	65	18		R3	W1																>10 fractures/foot entire run
	Limestone	123	369.0	370.0	0.6	N	0.0	20	18		R3	W1																>10 fractures/foot entire run
	Limestone	124	370.0	371.0	1.0	N	0.4	15	20	20	R3	W1	37037	J	1	25	P	VR			16.0	20						
	Limestone	125	371.0	374.0	3.0	N	0.0	50	18		R3	W1																>10 fractures/foot entire run
	Limestone	126	374.0	376.0	2.0	N	0.0	15	18		R3	W1																>10 fractures/foot entire run
	Limestone	127	376.0	379.0	2.6	N	0.0	40	18		R3	W1																>10 fractures/foot entire run
	Limestone	128	379.0	380.0	1.0	N	0.4	15	18		R3	W1																>10 fractures/foot entire run
	Limestone	129	380.0	382.0	1.8	N	0.4	3	19	18	R3	W1	380.6	J	2	53	P	R			12.0	18						
													381.5	J	1	27	P	VR			16.0	20						
	Limestone	130	382.0	384.0	2.0	N	0.4	30	18		R3	W1																>10 fractures/foot entire run
	Limestone	131	384.0	385.0	0.7	N	0.0	5	18		R3	W1																Mechanical fractures
	Limestone	132	385.0	386.0	1.0	N	0.0	25	18		R3	W1																>10 fractures/foot entire run
	Limestone	133	386.0	387.0	0.9	N	0.0	25	18		R3	W1																>10 fractures/foot entire run
	Limestone	134	387.0	389.0	2.0	N	0.0	70	18		R3	W1																>10 fractures/foot entire run
	Limestone	135	389.0	391.0	1.5	N	0.0	35	18		R3	W1																>10 fractures/foot entire run
	Limestone	136	391.0	392.0	1.0	N	0.0	80	18		R3	W1																>10 fractures/foot entire run
	Limestone	137	392.0	393.0	1.0	N	0.0	50	18		R3	W2																>10 fractures/foot entire run
	Limestone	138	393.0	396.0	2.7	N	0.0	60	18		R3	W1																>10 fractures/foot entire run
	Limestone	139	396.0	398.0	2.3	Y	0.4	40	20	20	R3	W1	396.2	J	5	65	P	R/VR			16.0	20						Bedded with chert
	Limestone	140	398.0	399.0	0.9	N	0.0	1	20	20	R4	W1	398.7	J	1	45	U	R			8.0	20						Mechanical fracture
	Limestone	141	399.0	401.0	2.0	N	0.4	2	20	20	R4	W1	400.1	J	2	48	U	R	CL	<1	14.0	20						Mechanical fracture

			Run Data											Detailed Discontinuity Data									Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	142	401.0	402.0	1.0	N	0.0	2	18	18	R4	W1	401.5	J	2	68	U	R			14.0	18						
	Limestone	143	402.0	404.0	2.0	N	0.0	50	18	18	R4	W1														402.0	404.0	
	Limestone	144	404.0	406.0	1.4	N	0.0	1	22	22	R4	W1	405	J	1	46	U	VR	CL	<1	16.0	22				404.0	404.7	
	Limestone	145	406.0	408.0	2.0	N	0.0	1	24	24	R4	W2	406.4	J	1	46	U	VR			18.0	24				406.7	407.3	
																										407.6	408.0	
	Limestone	146	408.0	409.0	1.0	N	0.0	1	22	22	R4	W1	408.5	J	1	61	U	R	CL	1	16.0	22						Mechanical fracture, low to medium grade
	Limestone	147	409.0	412.0	3.0	N	0.0		22	22	R4	W1														409.0	412.0	
	Limestone	148	412.0	416.0	4.0	N	0.0	1	20	20	R4	W1	414.8	J	1	46	P	R			12.0	20				412.0	414.8	
																										415.0	416.0	
	Limestone	149	416.0	419.0	3.0	N	0.7	2	24	24	R4	W1	418.4	J	1	54	V	R			18.0	24						
													418.8	J	1	68	U	R			20.0	24						
	Limestone	150	419.0	420.0	0.8	N	0.0		20	20	R4	W1														419.0	420.0	
	Limestone	151	420.0	423.0	3.0	N	0.0		20	20	R4	W1														420.0	423.0	
	Limestone	152	423.0	424.0	0.7	N	0.0		18	18	R4	W1														423.0	424.0	Low to medium grade
	Limestone	153	424.0	425.0	1.0	N	0.0		18	18	R4	W1														424.0	425.0	
	Limestone	154	425.0	427.0	1.8	N	0.0	1	24	24	R4	W1	426.4	J	1	28	U	VR			22.0	24				425.0	426.4	
	Limestone	155	427.0	429.0	2.0	N	0.0	1	24	24	R4	W1	428.8	J	1	53	U	R			18.0	22				427.0	429.0	Medium to high grade
	Limestone	156	429.0	431.0	2.0	N	0.0		18	18	R4	W1														429.0	431.0	Low to medium grade
	Limestone	157	431.0	433.0	2.0	N	0.0		18	18	R4	W1														431.0	433.0	Medium grade
	Limestone	158	433.0	436.0	3.0	N	0.0		18	18	R4	W1														433.0	436.0	Mechanical fractures; low to medium grade
	Limestone	159	436.0	437.5	1.5	N	0.0		20	20	R4	W1														436.0	437.5	Medium to high grade
	Limestone	160	437.5	439.0	1.5	N	0.0		20	20	R4	W1														437.5	439.0	Medium to high grade; mechanical fractures
	Limestone	161	439.0	440.0	0.5	N	0.0		18	18	R4	W1														439.0	440.0	Medium to high grade; mechanical fractures
	Limestone	162	440.0	441.0	1.0	N	0.0	1	14	14	R4	W1	440.8	J	1	57	U	R	CL	3	12.0	14				440.0	440.8	
	Limestone	163	441.0	445.0	4.0	N	0.0	2	25	25	R4	W1	444.5	J	1	29	ST	R			24.0	25				441.0	444.5	High grade; Ca viens
													444.8	J	1	61	ST	R			24.0	25						
	Limestone	164	445.0	448.5	3.5	N	0.4	4	18	16	R4	W1	446.2	J	1	52	U	R	CL	<1	16.0	20						High grade; Ca veins
													446.7	J	1	41	U	R			15.0	20						
													446.9	J	1	44	V	R	CL	2	14.0	18						
													447.1	J	1	46	U	R	CL	4	14.0	16						
	Limestone	165	448.5	450.0	1.5	N	0.0		18	18	R4	W1														448.5	450.0	
	Limestone	166	450.0	452.0	2.0	N	0.0	1	18	18	R4	W1	451.5	J	1	64	P	R			12.0	18				450.0	451.5	Mechanical fractures; high grade

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	167	452.0	454.0	0.8	N	0.0		18	18	R4	W1														452.0	454.0	Mechanical fractures; high grade
	Limestone	168	454.0	455.0	0.7	N	0.0		18	18	R4	W1														454.0	455.0	Mechanical fractures; high grade
	Limestone	169	455.0	459.0	3.2	N	0.0		18	18	R4	W1														455.0	459.0	Mechanical fractures; high grade
	Limestone	170	459.0	460.0	1.0	N	0.0		18	18	R4	W1														459.0	460.0	Mechanical fractures; high grade
	Limestone	171	460.0	462.0	2.0	N	0.0		20	20	R4	W1														460.0	462.0	Mechanical fractures; high grade
	Limestone	172	462.0	464.0	2.0	N	0.0		20	20	R4	W1														462.0	464.0	Mechanical fractures; high grade
	Limestone	173	464.0	467.0	3.0	N	0.0		20	20	R4	W1														464.0	467.0	Mechanical fractures; high grade
	Limestone	174	467.0	468.0	0.8	N	0.0		20	20	R4	W1														467.0	468.0	Mechanical fractures; high grade
	Limestone	175	468.0	469.0	1.0	N	0.0		20	20	R4	W1														468.0	469.0	Mechanical fractures; high grade
	Limestone	176	469.0	471.0	0.4	N	0.0		20	20	R4	W1														469.0	471.0	
	Limestone breccia/gouge	177	471.0	474.0	3.0	N	0.5		6	6	R2	W2											472.7	474.0	G/Bx	471.0	472.7	Large calcite clasts
	Limestone breccia with calcite cement	178	474.0	479.0	5.0	N	1.3	3	8	8	R3	W1	477	J	1	54	U	VR	Ca	5	16.0	8						Mechanical fractures
													477.4	J	2	45	U	VR	Ca	5	16.0	8						
	Limestone breccia with calcite cement	179	479.0	484.0	5.0	N	1.4	1	10	10	R3	W1	482.3	J	1	46	U	VR	Ca	3	18.0	10				480.8	481.6	Mechanical fracture
																										482.2	484.0	
	Limestone	180	484.0	487.0	1.4	N	0.0		20	20	R4	W1														484.0	487.0	Medium to high grade
	Limestone	181	487.0	488.0	1.0	N	0.0		20	20	R4	W1														487.0	488.0	Medium to high grade
	Limestone	182	488.0	489.0	0.6	N	0.0		20	20	R4	W1														488.0	489.0	Medium to high grade
	Limestone	183	489.0	491.0	2.0	N	0.0		18	18	R3	W1														489.0	491.0	Medium to high grade
	Limestone	184	491.0	494.0	2.8	N	0.0		18	18	R3	W1														491.0	494.0	Some FeOx; medium grade
	Limestone breccia with calcite cement	185	494.0	496.0	2.0	N	1.2	2	16	16	R4	W1	494.1	J	1	59	U	R	Ca	3	14.0	16				495.3	495.6	Low grade
													495.8	J	1	73	U	R	Ca	2	14.0	16						
	Limestone breccia with calcite cement	186	496.0	499.0	3.0	N	1.4	0	18	18	R4	W1																Medium to high grade; mechanical fractures (veritcal); fractures along Ca veins
	Limestone breccia with calcite cement	187	499.0	503.0	4.0	N	0.0		18	18	R3	W1														499.0	503.0	Mechanical fractures; vertical along Ca veins
	Limestone breccia with calcite cement	188	503.0	506.5	3.5	N	0.0		18	18	R3	W1														503.0	506.5	Medium to high grade
	Limestone breccia with calcite cement	189	506.5	509.5	3.0	N	2.1		20	20	R4	W1														508.5	509.5	Mechanical fractures; low to medium grade

			Run Data																											
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge							
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone breccia with calcite cement	190	509.5	513.5	4.0	N	0.0	1	15	15	R3	W1	510.2	J	1	51	P	VR	Ca	3	12.0	15				510.2	513.5	High grade
	Limestone breccia with calcite cement	191	513.5	515.5	2.0	N	0.0		18	18	R3	W1														513.5	515.5	High grade
	Limestone breccia with calcite cement	192	515.5	516.0	0.5	n	0.0		18	18	R3	W1														515.5	516.0	Medium to high grade
	Limestone breccia with calcite cement	193	516.0	517.0	1.0	N	0.0		20	20	R4	W1														516.0	517.0	Medium to high grade
	Limestone breccia with calcite cement	194	517.0	519.0	2.0	N	0.4	2	18	18	R4	W1	517.5	J	1	47	U	VR	Ca	2	20.0	18				517.0	517.5	Low to medium grade; mechanical fractures
													518.9	J	1	54	P	R			14.0	18						
	Limestone	195	519.0	523.0	4.0	N	0.0	4	17	14	R4	W1	519	J	2	56	P	VR			16.0	18				519.8	522.0	Low to high grade; mechanical fractures
													522	J	1	46	ST	R	Ca	2	22.0	20						
													522.4	J	1	48	P	R	CL/C	5	12.0	14						
	Limestone	196	523.0	524.0	1.0	N	0.0	2	19	18	R4	W1	523.3	J	1	49	P	R			14.0	18						Low to medium grade
													523.4	J	1	49	U	R			18.0	20						
	Limestone	197	524.0	528.0	4.0	N	0.0	1	16	16	R4	W1	526.8	J	1	47	P	SM			8.0	16				524.0	528.0	Medium to high grade
	Limestone	198	528.0	529.0	1.0	N	0.5		18	18	R4	W1														528.5	529.0	Mechanical fractures; low to medium grade
	Limestone	199	529.0	531.0	2.0	N	0.0		18	18	R4	W1														529.0	531.0	
	Limestone	200	531.0	533.0	2.0	N	0.0		18	18	R4	W1														531.0	533.0	Mechanical fractures; low grade
	Limestone	201	533.0	536.0	3.0	N	0.4	1	16	16	R4	W1	533.6	J	1	68	P	R			8.0	16				533.0	536.0	
	Limestone	202	536.0	537.0	1.0	N	0.0	1	16	16	R4	W1	536.5	J	1	36	P	R			8.0	16				536.0	537.0	
	Limestone	203	537.0	539.0	2.0	N	0.0		20	20	R4	W1														537.0	539.0	Mechanical fractures; low to medium grade
	Limestone to metabasalt to limestone gouge	204	539.0	543.0	4.0	N	0.9	3	7	0	R2/R3	W2	540.1	J	1	28	U	R			14.0	18						May be bedding (541.1 to 542'); pyrite at contact; Limestone gouge 542' to 543'
													541.2	F	1	35	P	K	CL	1	2.0	4						
													542	F	1	35	P	K	CL	1'	4.0	0	542.0	543.0	G/CL			
	Limestone breccia/gouge	205	543.0	546.0	3.0	N	0.6		6	6	R3	W2											544.0	544.9	G/CL	544.9	546.0	
	Limestone	206	546.0	547.0	1.0	N	0.0		16	16	R3	W1														546.0	547.0	
	Limestone	207	547.0	549.0	2.0	N	0.0		18	18	R4	W2														547.0	549.0	Medium grade
	Limestone	208	549.0	551.0	2.0	N	0.4		18	18	R4	W2														549.0	551.0	
	Limestone	209	551.0	553.0	2.0	N	0.0	20	20	20	R4	W1														552.2	553.0	>10 fractures/foot 551' to 552.2'
	Limestone	210	553.0	554.0	0.8	N	0.0		18	18	R4	W1														553.0	554.0	
	Limestone	211	554.0	557.0	3.0	N	0.0		20	20	R4	W1														554.0	557.0	Mechanical fractures
	Limestone	212	557.0	559.0	2.0	N	0.0		22	22	R4	W1														557.0	559.0	Medium to high grade

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	213	559.0	561.0	2.0	N	0.0		22	22	R4	W1														559.0	561.0	Medium to high grade
	Limestone	214	561.0	565.0	4.0	N	0.5	1	17	17	R4	W1	563	J	1	51	P	SM			4.0	17				561.0	561.9	Medium to high grade; mechanical fractures
																										563.5	565.0	
	Limestone	215	565.0	567.0	2.0	N	0.0		22	22	R4	W1														565.0	567.0	High grade
	Limestone	216	567.0	569.0	1.8	N	0.0		22	22	R4	W1														567.0	569.0	
	Limestone	217	569.0	573.0	4.0	N	0.0	2	14	14	R4	W2	571.6	J	2	53	P	R	CL	2	10.0	14				571.8	573.0	Medium to high grade
	Limestone with breccia	218	573.0	575.0	2.0	N	0.0	2	14	14	R4	W2	574.6	J	2	61	P	SM	CL	2	8.0	14				573.0	574.6	
	Limestone	219	575.0	578.0	3.0	N	0.0		18	18	R4	W2														575.0	578.0	High grade
	Limestone	220	578.0	579.0	1.0	N	0.8	0	22	22	R4	W1																High grade; mechanical fractures
	Limestone	221	579.0	582.0	3.0	N	0.0	2	18	18	R4	W1	579.5	J	2	43	U	R	Ca	2	16.0	18				579.7	582.0	
	Limestone breccia	222	582.0	585.0	3.0	N	0.0	30	20	20	R4	W1																>10 fractures/foot entire run
	Limestone breccia	223	585.0	587.0	1.9	N	0.0		18	18	R4	W1														585.0	587.0	Medium to high grade
	Limestone breccia	224	587.0	589.0	2.0	N	0.4	3	17	16	R4	W1	587.1	J	1	48	U	R			14.0	18				588.3	589.0	
													588	J	1	39	P	R			14.0	18						
													588.3	J	1	64	P	R			12.0	16						
	Limestone breccia	225	589.0	590.0	1.0	N	0.0		18	18	R4	W1														589.0	590.0	Medium to high grade
	Limestone breccia	226	590.0	594.0	4.0	N	2.7	4	15	14	R4	W1	590.8	J	1	29	P	SM			6.0	14						
													591	J	1	38	P	R			10.0	18						
													593	J	1	41	P	R			12.0	18						
													593.2	J	1	56	P	R			12.0	20						
	Limestone breccia	227	594.0	598.0	4.0	N	0.9	3	17	14	R4	W1	594.4	J	1	54	P	SM	Ca	2	6.0	14				597.2	598.0	
													596.6	J	2	61	ST	R	Ca	1	18.0	20						
	Limestone breccia	228	598.0	599.0	0.9	N	0.7		18	18	R4	W1																
	Limestone breccia	229	599.0	604.0	5.0	N	0.8	8	18	16	R4	W1	599.3	J	2	55	U	R			16.0	20						Medium to high grade
													599.9	J	3	60	U	R	Ca	2	14.0	16						
													601.2	J	1	61	U	R			16.0	20						
													602.9	J	2	54	P	R	Ca	2	14.0	16						
	Limestone	230	604.0	609.0	5.0	N	1.0	7	18	18	R4	W1	604.1	J	3	46	P	R			10.0	18						High grade
													606.6	J	2	54	P	R	Ca	1	10.0	18						
													606.8	J	1	46	ST	R	Ca	2	20.0	20						
													607.9	J	1	57	P	R			10.0	18						
	Limestone breccia	231	609.0	611.0	2.0	N	0.0		20	20	R4	W1														609.0	611.0	
	Limestone breccia	232	611.0	615.0	3.6	N	0.0		20	20	R4	W1														611.0	615.0	
	Limestone breccia	233	615.0	618.0	3.0	N	0.0	3	18	18	R4	W1	616.2	J	3	52	P	R			12.0	18				615.0	615.8	Medium to high grade
																										617.5	618.0	

			Run Data																											
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge							
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone breccia	234	618.0	623.0	5.0	N	0.0		20	20	R4	W1														618.0	623.0	
	Limestone breccia	235	623.0	625.0	2.0	N	1.1	0	18	18	R4	W1														623.0	623.3	
	Limestone breccia	236	625.0	629.0	4.0	N	0.0	6	18	16	R4	W1	625.3	J	2	56	P	R			14.0	18						
													625.9	J	1	48	P	R			14.0	18						
													627.7	J	2	70	P	R			14.0	18						
													628.6	J	1	51	P	R	Ca	2	12.0	16						
	Limestone breccia with chert	237	629.0	634.0	5.0	N	0.4	8	17	16	R4	W1	629	J	1	68	P	R			12.0	18						
													629.5	J	3	49	P	R	Ca	2	12.0	16						
													631.4	J	2	42	P	R	Ca	2	12.0	16						
													632.4	J	2	35	ST	R	Ca	2	18.0	18						
	Limestone breccia	238	634.0	636.0	1.8	N	0.4	2	19	18	R4	W1	634.2	J	1	71	U	R			16.0	20						
													635.6	J	1	64	P	R	Ca	1	13.0	18						
	Limestone breccia	239	636.0	639.0	3.0	N	1.5	5	18	15	R4	W1	636.4	J	3	60	U	R			16.0	20						
													638.5	J	1	31	P	R			14.0	19						
													638.8	V	1	49	P	R	Ca	3	12.0	15						
	Limestone breccia	240	639.0	644.0	5.0	N	1.3	5	16	16	R4	W1	639.3	J	3	49	U	R			14.0	18				642.2	643.4	Medium to high grade
													641.6	V	1	54	P	R	Ca	3	12.0	16						
													643.4	J	1	41	U	R			18.0	20						
	Limestone breccia with some calcite cement	241	644.0	649.0	5.0	N	2.3	5	18	18	R4	W1	644.9	J	3	60	ST	R			18.0	22						Medium grade
													646.3	J	1	51	P	R			14.0	18						
													646.8	J	1	64	U	R			16.0	20						
	Limestone breccia with some calcite cement	242	649.0	654.0	5.0	N	0.8	6	20	20	R3	W2	649.2	J	3	44	ST	R			18.0	22						
													652.4	J	2	44	ST	R	Ca	2	18.0	20						
													652.6	J	1	65	U	R			16.0	20						
	Limestone breccia with some calcite cement	243	654.0	658.0	4.0	N	0.0	40	16	16	R3	W2																>10 fractures/foot entire run
	Limestone breccia and gouge	244	658.0	661.0	3.0	N	0.6	3	11	0	R3/S3	W3	658.3	J	1	7	U	R	Ca	2	14.0	16						
													659.4	J	1	53	P	R			12.0	16						
													659.6	F	1	41	P	K	G	1.4'	6.0	0	659.6	661.0	Bx/Ca			
	Limestone	245	661.0	662.0	0.6	N	0.0		16	16	R3	W2														661.0	662.0	
	Limestone	246	662.0	663.0	1.0	N	0.0		16	16	R3	W2														662.0	663.0	
	Limestone	247	663.0	664.0	0.4	N	0.0		16	16	R3	W2														663.0	664.0	
	Limestone	248	664.0	665.0	0.7	N	0.0		16	16	R3	W2														664.0	665.0	
	Limestone	249	665.0	666.0	1.0	N	0.0		16	16	R3	W2														665.0	666.0	

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	250	666.0	668.0	2.0	N	0.0		18	18	R3	W2														666.0	668.0	Medium to high grade
	Limestone	251	668.0	671.0	3.0	N	0.0	1	18	18	R3	W2	669.3	J	1	44	U	R			14.0	18				668.0	671.0	Medium to high grade
	Limestone	252	671.0	673.0	2.0	N	0.0		18	18	R3	W2														671.0	673.0	Medium to high grade
	Limestone	253	673.0	674.5	1.5	N	0.0		18	18	R3	W2														673.0	674.5	Medium grade
	Limestone	254	674.5	679.5	5.0	N	0.0		18	18	R3	W2														674.5	679.5	
	Limestone	255	679.5	683.0	3.5	N	0.0		20	20	R4	W2														679.5	683.0	
	Limestone	256	688.0	5.0	5.0	N	0.0		20	20	R4	W2														683.0	685.0	
	Limestone	257	688.0	691.0	3.0	N	0.0		20	20	R4	W2														688.0	691.0	
	Limestone	258	691.0	695.0	4.0	N	0.0	5	18	18	R4	W1	691.9	J	4	46	P	R			14.0	18						Medium to high grade
													694.3	J	1	35	P	R			16.0	18						
	Limestone	259	695.0	698.0	3.0	N	0.0		20	20	R4	W1														695.0	698.0	
	Limestone	260	698.0	700.0	2.0	N	0.0		20	20	R4	W1														698.0	700.0	
	Limestone	261	700.0	702.0	2.0	N	0.0		18	18	R3	W2														700.0	702.0	
	Limestone	262	702.0	707.0	5.0	N	0.4	4	18	16	R4	W2	702.5	J	1	53	P	R			12.0	18				704.0	707.0	
													702.8	J	1	57	P	R			14.0	18						
													703.1	J	1	48	U	R			16.0	20						
													703.7	J	1	44	P	R	Ca	2	14.0	16						
	Limestone	263	707.0	709.0	2.0	N	0.0	1	16	16	R4	W1	708.6	J	1	36	U	R	Ca	1	16.0	16						
	Limestone	264	709.0	714.0	5.0	N	0.0	7	19	18	R4	W2	709.4	J	2	41	U	R			16.0	18						Healed fractures
													709.8	J	4	50	U	R			18.0	20						
													712.5	J	1	62	P	R			14.0	18						
	Limestone	265	714.0	719.0	5.0	N	0.0		18	18	R4	W2														714.0	719.0	
	Limestone breccia	266	719.0	721.0	2.0	N	0.0		18	18	R4	W2														719.0	721.0	Medium to high grade
	Limestone breccia	267	721.0	722.0	1.0	N	0.0		18	18	R4	W2														721.0	722.0	Medium to high grade
	Limestone breccia	268	722.0	726.0	3.4	N	0.4	1	18	18	R4	W2	724.4	J	1	55	U	R			14.0	18				722.0	726.0	
	Limestone breccia	269	726.0	729.0	3.0	N	0.0		18	18	R4	W1														726.0	729.0	
	Limestone breccia	270	729.0	734.0	5.0	N	0.0		20	20	R4	W1														729.0	734.0	
	Limestone breccia	271	734.0	739.0	5.0	N	0.0		20	20	R4	W1														734.0	739.0	
	Limestone breccia	272	739.0	744.0	5.0	N	0.0		20	20	R4	W1														739.0	744.0	
	Limestone breccia	273	744.0	748.0	4.0	N	0.0		20	20	R4	W1														744.0	748.0	
	Limestone breccia	274	748.0	753.0	5.0	N	0.0		20	20	R4	W1														748.0	753.0	Medium to high grade
	Limestone breccia	275	753.0	756.0	3.0	N	0.0	2	14	14	R4	W1	755.8	J	2	65	P	SM			2.0	14				753.0	756.0	

			Run Data																					Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone breccia	276	756.0	759.0	3.0	N	0.0	5	20	18	R4	W1	756.4	J	2	68	ST	R			20.0	22						
													756.7	J	2	63	P	SM			4.0	18						
													758.4	J	1	50	P	SM			4.0	18						
	Limestone breccia	277	759.0	764.0	5.0	N	0.0		20	20	R4	W1														759.0	764.0	
	Limestone breccia	278	764.0	769.0	5.0	N	0.0		20	20	R4	W1														764.0	769.0	High grade
	Limestone breccia	279	769.0	774.0	5.0	N	1.3	5	18	18	R4	W1	769.2	J	2	64	P	R			10.0	18				770.4	771.2	
													769.5	J	2	69	P	R			10.0	18				772.0	774.0	
													77.2	J	1	49	P	VR			14.0	20						
	Limestone breccia	280	774.0	779.0	5.0	N	0.0	3	20	18	R4	W1	774.4	J	1	50	P	R			10.0	18				775.6	779.0	
													775.2	J	1	35	U	R			17.0	20						
													775.6	J	1	62	U	VR			20.0	22						
	Limestone breccia	281	779.0	784.0	5.0	Y	0.5	6	20	18	R4	W2	779.5	J	4	54	P	R			10.0	18				782.5	784.0	Some foliation with breccia clasts
													781.8	J	1	56	U	R			16.0	20						Chert bedding ~10 degrees
													782.5	J	1	33	ST	R			20.0	22						
	Limestone breccia	282	784.0	789.0	5.0	Y	0.0	2	18	18	R4	W1	785.2	J	1	67	P	R			14.0	18				784.0	789.0	Bedded chert ~2 degrees
													788.7	J	1	36	P	R			12.0	18						
	Limestone breccia	283	789.0	793.0	4.0	Y	0.0	4	19	18	R4	W1	291.8	J	3	58	P	R			14.0	18				789.0	793.0	Bedded chert ~32 degrees
													292.1	J	1	46	U	R			18.0	20						
	Limestone breccia	284	793.0	798.0	5.0	N	0.0	0	18	18	R4	W1														793.0	798.0	Some chert
	Limestone breccia	285	798.0	799.0	1.0	N	0.0	0	18	18	R4	W1														798.0	799.0	Some chert

3			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt	1	36.0	37.0	0.7	n	0.0				R3	W3														3.0	37.0	rubble recovered
	Metabasalt	2	37.0	40.0	0.7	n	0.0				R3	W3														37.0	40.0	
	Metabasalt	3	40.0	41.0	0.8	n	0.7	0			R3	W3																few mechanical fractures
	Metabasalt	4	41.0	42.0	0.4	n	0.4	0			R3	W3																
	Metabasalt	5	42.0	43.0	0.9	n	0.9	0			R3	W3																2 mechanical fractures
	Metabasalt	6	43.0	44.0	0.8	n	0.4	0			R3	W3																some rubble
	Metabasalt	7	44.0	45.0	0.4	n	0.0				R3	W3																rubble recovered
	Metabasalt	8	45.0	46.5	1.2	n	0.0				R3	W3																extensively mchanically fractured rubbl ein places
	Metabasalt	9	46.5	48.0	1.4	n	0.7				R3	W3														46.5	47.2	
	Metabasalt	10	48.0	50.0	1.2	n	0.6				R3	W3														49.2	50.0	
	Metabasalt	11	50.0	51.5	1.4	n	0.5				R3	W3														50.0	50.7	
	Metabasalt	12	51.5	53.0	0.3	n	0.0				R2	W3																bad recovery, mostly redrilled gravel
	Metabasalt	13	53.0	57.0	0.4	n	0.0				R2	W3																gravel recovered
	norecovery	14	57.0	58.5	0.0																							
	Metabasalt	15	58.5	63.0	0.5	n	0.0																					gravel recovered, noted by drillers to be extremely soft
	no recovery	16	63.0	68.0	0.0																							soft clayey mud brought up, cohesion s1
	Metabasalt	17	68.0	70.0	0.3	n	0.0				S4	W3																gravely clay recovered
	Metabasalt	18	70.0	72.0	0.6	n	0.0	50			S5	W3											70.0	71.8	Gc			
	Metabasalt	19	72.0	73.0	1.0	n	0.0	50			S5	W3																rubble/clay recovered
	Metabasalt	20	73.0	74.0	1.3	n	0.4	50			S5	W3																sol.id core at bottom of run, clay above
	Metabasalt	21	74.0	75.0	0.7	n	0.0				R1	W3														74.0	75.0	rubble recovered
	Metabasalt	22	75.0	75.5	0.4	n	0.0				R1	W3																
	Metabasalt	23	75.5	77.0	1.6	n	0.0																					
	Metabasalt	24	77.0	80.0	1.0	n	0.0																					
	Metabasalt	25	80.0	82.0	0.4	n	0.0																					
	Metabasalt	26	82.0	85.5	0.7	n	0.0																					
	no recovery	27	85.5	90.0	0.0	n																						
	Metabasalt	28	90.0	92.0	0.3	n	0.0																					
	Metabasalt	29	92.0	93.5	0.0	n	0.0				R2	W3																redrilled rubble
	no recovery	30	93.5	94.5	0.0						R2	W3																
	Metabasalt	31	94.5	96.0	0.1	n	0.0				R2	W3																rubble
	no recovery	32	96.0	97.0	0.0						R2	W3																
	Metabasalt	33	97.0	100.0	0.9	n	0.0				R2	W3																rubble
	Metabasalt	34	100.0	104.0	0.6	n	0.0				R2	W3																rubble

3			Run Data																					Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	no recovery	35	104.0	105.0	0.0						R2	W3																
	Metabasalt	36	105.0	109.0	0.0						R2	W3																
	Metabasalt	37	109.0	110.0	0.0						R2	W3																
	Metabasalt	38	110.0	111.0	0.0						R2	W3																
	Metabasalt	39	111.0	112.0	1.0	n	0.0				R2	W3																redrilled rubble
	Metabasalt	40	112.0	116.0	0.6	n	0.0				R2	W3																rubble
	Metabasalt	41	116.0	120.0	0.7	n	0.0				R2	W3																rubble, one 0.3 ft solid piece
	greenstone gouge	42	120.0	124.0	1.1	n	0.0	50			S5	W3																gouge recovered
	greenstone gouge	43	124.0	127.0	0.9	n	0.0	20			S5	W3											124.0	127.0	Gc			
	greenstone gouge	44	127.0	130.0	1.0	n	0.0	10			S5	W3											127.0	130.0	Gc			
	greenstone gouge	45	130.0	134.0	3.6	n	0.0	50			S5	W3											130.0	134.0	Gc			
	greenstone gouge	46	134.0	140.0	4.4	n	0.0	50			S5	W3											134.0	140.0	Gc			Increasing greenstone on gouge material
	greenstone gouge	47	140.0	142.0	1.3	n	0.0	50			S3	W3											140.0	142.0	Gc			
	greenstone gouge	48	142.0	147.0	1.7	n	0.0	50			S4	W3											142.0	147.0	Gc			
	greenstone gouge	49	147.0	150.0	1.2	n	0.0	50			S4	W3											147.0	150.0	Gc			
	greenstone gouge	50	150.0	154.0	0.5	n	0.0	50			S4	W3											150.0	154.0	Gc			
	greenstone gouge	51	154.0	158.0	1.2	n	0.4	50			S4	W3											154.0	158.0	Gc			
	greenstone gouge	52	158.0	162.0	2.3	n	0.0	50			S4	W3											158.0	162.0	Gc			
	greenstone gouge	53	162.0	165.0	2.2	n	0.0	50			S4	W3											162.0	165.0	Gc			
	greenstone gouge	54	165.0	170.0	0.7	n	0.0	50			S4	W3											165.0	170.0	Gc			mostly washed rubble recovered, small amount of gouge at bottom of run
	greenstone gouge	55	170.0	172.5	0.6	n	0.0	50			S4	W3											170.0	172.0	Gc			mostly washed rubble, 0.1ft gouge
	greenstone gouge	56	172.5	174.6	2.1	n	0.0	25			S4	W3											172.5	174.6	Gc			
	greenstone	56	174.6	176.5	2.0	n	2.0	2	6	6	R2	W3	175.2	J1	1	60	P	R	Ca	2	10.0	6						
													176.1	J1	1	40	P	R	Ca	2	12.0	6						
	greenstone	57	176.5	180.0	3.7	n	3.3	5	12	12	R2	W3	177	J2	2	50	C	R	Cl	1	10.0	12						
													177.5	J1	1	70	P	R	Cl	1	8.0	12						
													179.2	J2	1	60	P	R	Cl	C	8.0	12						
	greenstone	58	180.0	184.0	3.4	n	2.2	10			R1	W3											182.8	184.0	Gc			
	greenstone gouge	59	184.0	188.0	1.6	n	0.0	20			S5	W3																
	greenstone gouge	60	188.0	190.0	0.2	n	0.0																					
	greenstone gouge	61	190.0	193.0	1.3	n	0.0																					
	greenstone gouge	62	193.0	197.0	2.1	n	0.0	50			S5	W3											193.0	197.0	Gc			
	greenstone gouge	63	197.0	199.0	2.0	n	0.0	10			R0	W3											197.0	199.0	Gc			flowbanded graywacke within greenstone gouge
	greenstone gouge	64	199.0	203.0	2.1	n	0.0	25			S5	W3											199.0	203.0	Gc			
	greenstone gouge	65	203.0	205.0	0.8	n	0.0																					rubble recovered
	greenstone	66	205.0	208.0	2.0	n	0.0																					rubble recovered

3			Run Data																									
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge					
																							Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	greenstone	67	208.0	209.5	0.7	n	0.7	10	6	6	R1	W3	208.1	J1	1	15	P	R	Cl	3	8.0	6						0.3ft of gouge at bottom of recovery
	greenstone	68	209.5	211.5	1.4	n	0.0	20			S4	W3											209.5	211.5	Gc			
	greenstone	69	211.5	213.5	0.6	n	0.0				R2	W3																Washed rubble recovered
	greenstone	70	213.5	215.5	1.5	n	0.0	20			R1	W3											213.5	215.5	Gc			Coarse greenstone fragments in clay gouge
	greenstone	71	215.5	220.0	0.6	n	0.0				R2	W3																Washed fragments recovered
	greenstone	72	220.0	222.0	1.6	n	0.7	10	6	0	R1	W3	220.5	J2	2	50	P	R	Cl	C	10.0	12						
													221.1	J1	1	50	P	R	Cl	5	12.0	0						
	greenstone	73	222.0	224.0	1.6	n	0.0	10	6	6	R1.5	W3														222.0	222.3	entire run highly fractured
													222.5	J1	1	40	P	R	Ca	8	10.0	6						
	greenstone	74	224.0	226.0	1.8	n	1.8	0			R2	W3																
	greenstone	75	226.0	227.0	1.2	n	0.7	0			R2	W3																
	greenstone	76	227.0	229.0	1.6	n	1.6	0			R2	W3																moderately fractured
	greenstone	77	229.0	232.0	3.0	n	3.0	0			R2	W3																
	greenstone	78	232.0	236.0	4.1	n	4.1	1			R2	W3	235.3	J2	1	30	P	R	Cl	1	8.0	6						
	greenstone	79	236.0	238.0	2.0	n	1.4	2	9	6	R2	W3	237.1	J1	1	70	P	R	Ca	2	8.0	6				236.0	236.8	moderately fractured in zone of extensive ca veining
													237.8	J1	1	40	P	R	Cl	C	10.0	12						
	greenstone	80	238.0	241.0	2.2	n	1.2	5	3	0	R2	W3	238.3	J1	1	60	P	R	Cl	20	10.0	0						metabasalt clasts appearing in greenstone gouge
													240.2	J1	1	30	P	R	Cl	3	10.0	6						
	greenstone	81	241.0	242.5	1.2	n	0.0				R1	W3														241.0	242.5	angular clay cemented frags falling apart
	greenstone	82	242.5	244.0	1.8	n	1.3	5			R1.5	W3											242.5	242.7	Gc			
	metabasalt	83	244.0	248.0	4.1	n	4.1	1	12	12	R2	W3	244.6	J2	1	50	P	R	Cl	1	12.0	12						infrequent mechanical fractures throughout
	metabasalt	84	248.0	250.0	1.4	n	1.2	2	12	12	R3	W3	249.7	J2	2	55	P	R	Ca	1	10.0	12						
	metabasalt	85	250.0	254.0	4.0	n	2.8	2	12	12	R3	W3	251.4	J1	1	30	P	R	Cl	1	12.0	12						
													253.2	J1	1	40	P	R	Cl	C	10.0	12						
	metabasalt	86	254.0	259.0	5.0	n	3.8	10	10	0	R3	W3	254.3	J1	1	60	P	R	Cl	C	10.0	12						
													255.1	J1	1	60	P	R	Gc	30	8.0	0	254.8	255.1	Gc			
													257	J2	1	20	P	R	Cl	C	10.0	12						
													257.6	J2	1	60	P	R	Cl	C	14.0	12						
													258.2	J1	1	40	P	R	Cl	1	10.0	12						
	metabasalt	87	259.0	260.0	1.0	n	0.0	1	12	12	R2	W3	259.4	J2	1	40	P	R	Cl	C	10.0	12						run highly fractured
	metabasalt	88	260.0	263.0	2.2	n	2.2	0			R3	W3																
	metabasalt	89	263.0	267.0	2.6	n	1.2	10			R2.5	W3	265	J2	1	50	P	R	Cl	C	8.0	12	264.2	264.4	Gc			Increasing greenstone gouge through out
																							265.3	267.0	Gc			
	greenstone gouge	90	267.0	270.0	1.4	n	0.0	50			S4	W3											267.0	270.0	Gc			
	greenstone gouge	91	270.0	274.0	2.3	n	0.0	30			R0	W3																entire run highly fractured metabasalt with weak greenstone gouge
	greenstone gouge	92	274.0	280.0	1.1	n	0.0	50			S4	W3											274.0	280.0	Gc			
	greenstone gouge	93	280.0	284.0	1.8	n	0.0	20			R0	W3											280.0	284.0	Gc			highly fractured greenstone, clayey in places
	greenstone	94	284.0	289.0	4.9	n	4.8	2	12	12	R2	W3	284.9	J1	2	30	P	R	Cl	1	10.0	12	284.0	284.1	Gc			
													286	J1	1	35	P	R	Cl	1	8.0	12						
	greenstone	95	289.0	294.0	5.0	n	3.8	10			R2	W3	290.4	J2	1	30	P	R	Ca	1	10.0	12						
													291.8	J1	1	50	P	R	Cl	6	8.0	0						
																							292.8	294.0	Gc			

3			Run Data																				Rubble/Gouge					ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	
	greenstone	96	294.0	299.0	2.2	n	0.0	20			R1	W3														294.0	295.7	
																							296.3	299.0	Gc			
	greenstone	97	299.0	301.0	2.4	n	1.9	0			R1.5	W3																
	greenstone	98	301.0	305.0	2.1	n	0.0	10			R1	W3											301.0	305.0	Gc			
	grrenstone	99	305.0	307.0	1.5	n	0.0	15			R1	W3											305.0	307.0	Gc			
	greenstone	100	307.0	310.0	3.8	n	0.0	50			S4	W3	307.5	J1	1	30	P	R	Cl	180	10.0	0	307.5	310.0	gc			
	greenstone	101	310.0	315.0	2.1	n	0.0	50			S4	W3																
	grrenstone	102	315.0	319.0	3.7	n	0.0	50			S5	W3																
	greenstone	103	319.0	322.0	3.0	n	3.0	0			R1.5	W3																
	greenstone	104	322.0	322.5	2.7	n	2.5	2	9	6	R1.5	W3	323	J2	1	30	P	R	Cl	C	8.0	12						
													323.6	J1	1	45	P	R	Cl	3	10.0	6						
	greenstone	105	322.5	330.0	4.7	n	4.7	1	6	6	R1	W3	327.4	J1	1	40	P	R	Cl	3	10.0	6						very soft, clayey greenstone
	greenstone	106	330.0	334.0	4.0	n	0.0	50			S4	W3											330.0	334.0	Gc			entire run soft, gougy
	greenstone	107	334.0	338.0	4.2	n	0.0	50			S4	W3											334.0	338.0	Gc			
	greenstone	108	338.0	341.0	2.4	n	2.0	10			R1	W3											338.0	338.7	Gc			
	greenstone	109	341.0	345.0	4.7	n	4.6	3	8	0	R1.5	W3	341.3	J2	1	50	P	R	Cl	C	8.0	12						
													342.8	J1	1	75	P	S	Cl	15	6.0	0						
													344.1	J1	1	60	P	R	Cl	C	8.0	12						
	greenstone	110	345.5	350.0	4.7	n	2.3	50			R0	W3											347.8	350.0	Gc			

			Run Data																					Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	rehealed fault gouge of gray wacke and greenstone	1.0	398.6	403.0	4.8	N	3.4	6	20	12	R2-R3	W1-W2	399	J		20	P	SM	CA	0.5	8.0	20						
													400.1	J		40	P	SM	CA	0.1	8.0	20						
													401.5	J		55	P	R	CA	0.1	10.0	20						
													401.7	J		30	P	SM	CA	0.1	6.0	12						
													402.3	J		35	P	SM	CA	0.01	6.0	12						
													402.5	J		25	IR	R	NA	NA	12.0	25						
	rehealed fault gouge of gray wacke and greenstone	2.0	43.0	408.0	5.0	N	3.0	6	12	6	R2-R3	W1-W2	403.5	J		35	P	R	CA	0.1	10.0	20						
													404.3	SH		40	C	K	CL	2	6.0	6						
													405.5	SH		40	P	K	CL	2	6.0	6						
													406.1	SH		55	P	K	CL	3	6.0	6						
													406.2	SH		30	P	K	CL	2	4.0	6						
													407.5	SH		15	U	K	CL	1	10.0	6						
	rehealed fault gouge of gray wacke and greenstone	3.0	408.0	413.1	5.1	N	2.2	3	6-12	6	R2	W2-W3	408.8	SH		20	IR	K	CA	1	10.0	6				411.7	413.1	Broken zone
													409.7	J		35	IR	R	CL	1	8.0	12						
													411.2	SH		10	IR	K	CL	5	4.0	6						
	Partially rehealed fault breccia of graywacke and greenstone	4.0	413.1	418.2	5.1	N	2.9	3/>20			R2	W3-W4	415.3	SH		20	IR	K	CL	2	4.0	6						
													416.8	SH		15	C	K	CL	3	6.0	6						
													417.5.	SH		10	C	K	CL	2	6.0	6						
	Partially rehealed graywacke gouge	5.0	418.2	421.5	3.2	N	0.9	>20	6	0	R1-R2	W3-W4	419.5	SH		20	P	K	CL	5	6.0	6						Discontinuous fractures throughout core
	Rehealed graywacke gouge	6.0	421.5	424.0	2.6	N	2.6	0			R2	W2-W3																No fractures
	Graywacke w/zones of partially healed gouge	7.0	424.0	429.0	4.6	N	0.5	>20	0	0	R2	W3-W4											424.0	424.8				R1-R2 Partially rehealed gouge
																							425.8	429.0				R1-R2 Partially rehealed gouge
	Partially rehealed graywacke gouge	8.0	429.0	432.5	3.4	N	1.4	3/>20	6	0	R2	W3-W4	429.5	SH		50	C	K	CA	0.1	10.0	6				431.6	432.5	Broken zone rubble
													429.5	SH		25	P	K	CL	1	8.0	6						
													430.3	SH		65	P	K	CL	2	4.0	6						
	Rehealed graywacke gouge	9.0	432.5	434.0	0.9	N	0.9	0			R2	W2-W3																No fractures
	Graywacke gouge	10.0	434.0	436.5	2.3	N	0.0	>20	0	0	R1-R2	W4-W5											434.0	436.5	G			gouge
	Graywacke & gyaywacke gouge	11.0	436.5	440.0	3.5	N	1.2	>20	6	6	R2	W3-W4											436.5	437.3	G			gouge
	Graywacke	12.0	440.0	442.5	2.5	N	2.0	0			R2-R3	W2-W3																
	Graywacke	13.0	442.5	444.0	0.9	N	0.4	2	20	12	R2-R3	W2-W3	443.5	J		45	P	SM	NA		6.0	20						
													443.7	J		60	P	SM	NA		8.0	20						
	No recovery	14.0	444.0	444.5	0.0																							
	Graywacke	15.0	444.5	445.0	0.5	N	0.0	1	0	0	R1-R2	W3-W4	444.6	SH		65	P	K	FB	80	6.0	0	444.6	444.8	FB			Fault breccia
	Graywacke	16.0	445.0	446.0	1.3	N	1.3	0			R2-R3	W2-W3																
	Graywacke	17.0	446.0	447.5	0.8	N	0.6	1	6	6	R2-R3	W3-W4	446.7	SH		65	C	K	CL	2	8.0	6						
	Graywacke gouge and rubble	18.0	447.5	450.0	2.5	N	0.0	>20																				

			Run Data																							Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data													Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Graywacke	19.0	450.0	452.0	2.0	N	1.4	2	12	6	R2-R3	W3-W4	451.2	J		35	C	SM	CA	0.1	6.0	12						
													451.9	SH		45	P	K	CL	10	6.0	6						
	Graywacke gouge	20.0	452.0	452.5	0.5	N	0.0	>20	0	0	R0-R1	W4-W5											452.0	452.5	G			rubble/gouge
	Graywacke	21.0	452.5	454.0	4.0	N	0.4	>20	0	6	R1-R3	W3-W4	452.9	SH		40	C	K	CL	3	6.0	6	452.5	452.9	g			
													453.3	SH		30	P	K	CL	2	6.0	6						
													453.7	SH		50	U	K	CL	3	6.0	6						
	Graywacke	22.0	454.0	457.0	2.5	N	0.0	>20			R2	W2-W3																rubble- noncontinuous fractures throughout core
	Graywacke	23.0	457.0	461.5	4.0	N	3.0	2	12	12	R2-R3	W2	458	J		35	P	SM		8	12.0							
													458.1	J		35	P	SM		8	12.0							
	Graywacke gouge	24.0	461.5	462.5	0.4	N	0.0	>20	0	0	R0-R1	W3-W4											461.5	462.5	G			rubble
	Graywacke gouge	25.0	462.5	463.0	1.2	N	0.4	0			R1-R2	W3-W4																
	Graywacke gouge	26.0	463.0	464.0	0.2	N	0.0	0			R1-R2	W3-W4																Very low recovery
	rehealed graywacke gouge	27.0	464.0	465.5	1.5	N	0.7	1	6	6	R1-R2	W3-W4	464.7	SH		60	P	K	CL	1	6.0	6						
	Graywacke gouge	28.0	465.5	467.5	2.0	N	0.0	>20	0	0	R0-R1	W4-W5											465.5	467.5	FG			gouge
	Graywacke	29.0	467.5	468.7	0.6	N	0.4	0			R2-R3	W3-W4																
	Graywacke	30.0	468.7	473.4	4.6	N	0.8	>20	6	6	R2-R3	W3-W4																Noncontinuous fractures throughout core, slickensides present
	Graywacke breccia	31.0	473.4	475.5	1.6	N	0.0	>20	6	0	R1-R2	W3-W4	473.8	SH		60	P	K	CL	1	8.0	6						
													474	SH		75	P	K	CL	2	6.0	6						
	Graywacke breccia	32.0	475.5	478.8	3.0	N	0.0	>20	12	12	R1-R2	W3-W4														475.5	478.8	Noncontinuous fractures through out core
	Graywacke breccia	33.0	478.8	481.1	2.0	N	0.0	>20	12	6	R1-R2	W3-W4														478.8	481.1	Noncontinuous fractures through out core
	Graywacke breccia	34.0	481.1	481.8	0.3	N	0.0	>20	12	6	R1-R2	W3-W4														481.1	481.8	Noncontinuous fractures through out core
	Graywacke breccia	35.0	481.8	484.0	2.3	N	0.0	>20	12	6	R1-R2	W3-W4														481.8	484.0	Noncontinuous fractures through out core
	Graywacke breccia	36.0	484.0	488.3	4.2	N	0.0	>20	12	6	R1-R2	W3-W4														484.0	488.3	Noncontinuous fractures through out core
	Partially rehehealed graywacke breccia	37.0	488.3	493.4	4.7	N	0.0	>20	12	0	R0-R2	W3-W5											493.0	493.4	FG	488.3	493.4	Noncontinuous fractures through out core
	Graywacke & breccia	38.0	493.4	498.4	4.6	N	0.0	>20	0	0	R0-R2	W3-W5	496.2	SH		25	P	K	CL	2	4.0	6	493.4	496.1	FG			Gouge
													496.5	SH		35	P	K	CL	1	8.0	6						
													496.7	SH		40	C	K	CL	0.1	6.0	6						
	Graywacke	39.0	498.4	501.5	3.0	N	0.8	>20	12	12	R1-R2	W3-W4														498.4	498.6	rubble
																										499.5	501.5	rubble
		40.0	501.5	504.0	2.5	N	0.4	>20	12	6	R1-R2	W3-W4	501.9	SH		35	P	K	CL	1	6.0	6						
													502.3	J		40	P	SM	CA	1	8.0	12						
													503.3	SH		45	P	K	CL	3	4.0	6						
	Graywacke BRECCIA	41.0	504.0	506.7	2.8	N	0.0	>20	12	6	R1-R2	W3-W4	505.8	SH		80	P	K	CA	2								
	Graywacke	42.0	506.7	511.0	2.5	N	2.0	5	12	6	R1-R2	W2-W3	506.8	SH		40	P	K	CL	4	4.0	6						
													507.7	J		70	ST	SM	CA	1	10.0	12						
													508.2	SH		65	P	K	CA	2	4.0	6						
													509.3	SH		35	C	K	CA	1	8.0	6						
													509.7	SH		45	P	K	CL	0.1	6.0	6						
	Graywacke	43.0	511.0	514.0	3.1	N	0.8	3	6	6	R2-R3	W2-W3	511.6	SH		15	P	K	CL	5	6.0	6						
													511.7	SH		25	P	K	CA	2	6.0	6						

			Run Data																				Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													513	SH		65	P	K	CA	0.1	6.0	6						
	Graywacke	44.0	514.0	519.0	5.0	N	2.6	4	12	6	R2-R3	W2-W3	514.4	SH		40	P	SM	CA	0.1	8.0	12				517.2	518.0	Broken zone
													514.8	J		35	P	K	CA	1	10.0	6						
													515.4	SH		15	P	SM	CA	0.1	6.0	12						
													516.5	J		45	P	K	CA	1	6.0	6						
	Graywacke	45.0	519.0	524.0	4.7	N	2.5	4	6	6	R2-R3	W2-W3	519.7	J		25	P	SM	CA	0.1	6.0	12						
													520.4	SH		30	P	K	CL	1	4.0	6						
													521.9	SH		70	C	K	CA	0.1	8.0	6						
													522.6	SH		45	P	K	CA	0.2	4.0	6						
	Graywacke	46.0	524.0	529.0	3.0	N	2.8	6	12	6	R2-R3	W2-W3	524	J		40	P	R	CA	1	8.0	12						
													524.3	J		35	P	SM	CA	C	4.0	12						
													526.7	SH		65	C	K	CL	2	6.0	6						
													527.2	SH		55	P	K	CA	2	10.0	6						
													527.9	SH		65	P	K	CA	2	10.0	6						
													528.5	SH		40	P	K	CA	0.1	8.0	6						
	Graywacke	47.0	529.0	531.0	2.1	N	0.0	2/>20	6	6	R2-R3	W2-W3	529	SH		70	P	K	CA	0.5	6.0	6						
													530.2	SH		45	P	K	CL	1	4.0	6						
													530.4	SH		35	P	K	CL	1	4.0	6						
	Graywacke	48.0	531.0	534.0	2.9	N	1.9	4	12	6	R2-R3	W2-W3	531.7	SH		65	C	K	CL	1	8.0	6						
													532.1	SH		30	P	K	CA	2	6.0	6						
													532.8	SH		75	IR	K	CL	1	10.0	6						
													533.1	SH		45	P	K	CL	0.5	6.0	6						
	Graywacke	49.0	534.0	537.3	3.3	N	0.0	>20	12	6	R0-R3	W2-W3	534.4	SH		40	P	K	CL	1	4.0	6						
													536	SH		45	P	K	CL	2	4.0	6						
	Graywacke	50.0	537.3	539.5	2.3	N	0.0	7	12	6	R2-R3	W1-W2	537.7	J		55	P	SM	CA	0.01	8.0	12						
													538	J		80	P	R	CA	1	10.0	12						
													538.4	J		45	P	SM	CL	1	6.0	12						
													538.6	SH		30	ST	K	CA	1	4.0	6						
													538.7	ST		70	C	K	CL	2	4.0	6						
													538.9	SH		50	P	K	CL	2	6.0	6						
													539.1	ST		65	ST	K	CL	3	6.0	6						
	Graywacke	51.0	539.5	543.0	3.2	N	0.0	>20	12	6	R2-R3	W1-W2	539.7	SH		55	P	K	CA	0.5	8.0	6						
													539.9	J		65	P	R	CA	1	10.0	12						
													540.4	J		85	P	R	CA	1	8.0	12						
													540.6	SH		45	U	K	CL	1	10.0	6						
													541.1	SH		30	P	K	CL	2	6.0	6						
													541.9	J		65	P	SM	CA	0.5	6.0	12						
	Graywacke	52	543.0	545.5	2.1	N	0.0	>20	12	6	R2-R3	W1-W2	543.2	SH		40	U	K	CL	1	10.0	6				543.0	545.5	Noncontinuous fractures throughout core
	Graywacke	53	545.5	548.0	2.5	N	0.7	>20	12	6	R2-R3	W1-W2	545.7	SH		35	IR	K	CL	1	8.0	6				546.7	548.0	Noncontinuous fractures throughout core
													546.5	SH		55	C	K	CL	4	4.0	6						
	Graywacke	54	548.0	550.0	1.7	N	0.5	>20	12	6	R2-R3	W1-W2														548.0	550.0	Noncontinuous fractures throughout core
	Graywacke	55	550.0	552.5	2.4	N	0.8	5	12	6	R2-R3	W1-W2	550.2	J		65	P	SM	CA	1	6.0	12						
													550.6	J		60	P	SM	CA	1	8.0	12						
													550.8	J		55	P	SM	CA	0.5	8.0	12						
													551.3	SH		30	P	K	CL	2	4.0	6						
													552	SH		40	P	K	CL	1	6.0	6						
	Graywacke	56	552.5	555.0	2.1	N	1.4	3	20	0	R1-R3	W1-W3	552.5	J		45	IR	R	CL	2	16.0	20	554.3	555.0	G			
													553.3	J		65	P	R	CA	1	10.0	20						
													553.9	SH		35	ST	K	CL	0.5	8.0	6						
	Partially rehealed graywacke gouge-calcite	57	555.0	558.0	2.7	N	1.0	>20	0	0	R0-R2	W3-W4											556.0	558.0	G			

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge					
																							Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Graywacke gouge and calcite vein	58	558.0	560.0	1.6	N	0.0	>20	0	0	R0-R1	W3-W4											558.0	560.0	G			
	Graywacke gouge and calcite vein	59	560.0	562.0	1.7	N	0.0	>20	0	0	R0-R1	W3-W4											560.0	562.0	G			
	Partially rehealed graywacke gouge w/calcite veining	60	562.0	564.0	2.0	N	0.4	>20	0	0	R0-R2	W3-W4	552.7	SH		40	P	K	CL	1	4.0	6	562.0	564.0	G			
	Gouge w/ graywacke clasts	61	564.0	566.0	1.5	N	0.6	>20	0	0	R0-R2	W3-W4											564.0	566.0	G			
	Partially rehealed graywacke gouge	62	566.0	568.0	2.2	N	0.7	>20	0	0	R0-R2	W3-W4											566.0	568.0	G			
	Gouge w/ graywacke clasts	63	568.0	570.5	2.2	N	0.0	>20	0	0	R0-R1	W3-W4											568.0	570.5	G			
	Gouge w/ graywacke clasts	64	570.5	574.0	3.4	N	1.3	>20	0	0	R0-R2	W3-W4	571.6	SH		30	U	K	CL	2	8.0	6	570.5	574.0	G			
													572.4	SH		15	IR	K	CL	1	8.0	6						
	Gouge & graywacke clasts/breccia	65	574.0	576.0	2.0	N	0.0	>20	0	0	R0-R2	W3-W4											574.0	576.0	FB/FG			Gouge & breccia-rubble
	Gouge & graywacke clasts	66	576.0	577.0	0.7	N	0.0	>20	0	0	R0-R2	W3-W4											576.0	577.0	FB/FG			gouge & breccia
	Rehealed gouge w/graywacke clasts-calcite	67	577.0	581.5	4.5	N	1.3	>20	6	0	R1-R2	W3-W4	578.6	SH		65	C	K	CL	5	4.0	6	580.5	581.5	FB			Breccia
													578.7	SH		30	P	K	CL	3	4.0	6						
													579	SH		65	U	K	CL	2	6.0	6						
													580.1	SH		40	P	K	CL	1	4.0	6						
													580.3	SH		40	P	K	CL	2	4.0	6						
	Graywacke clasts in gouge	68	581.5	584.0	2.0	N	0.0	>20	6	0	R1-R2	W3-W4	581.5	SH		70	P	K	CL	2	6.0	6						
													582	SH		50	P	K	CL	1	6.0	6						
													582.6	SH		45	P	K	CL	1	6.0	6						
																										582.7	584.0	rubble/breccia
	Graywacke clast	69	584.0	585.5	1.4	N	0.4	0			R1-R3	W2-W4																
	Partially rehealed graywacke gouge	70	585.5	587.5	1.7	N	0.0	>20	6	0	R0-R2	W3-W4	585.9	SH		80	U	K	CL	0.5	8.0	6				586.2	587.5	GOUGE/BRECCIA
													586.5	SH		40	P	K	CL	1	4.0	6						
	Partially rehealed graywacke gouge	71	587.5	592.7	5.0	N	2.5	>20	0	0	R0-R2	W3-W4	588.3	SH		55	C	K	CL	2	8.0	6						
													589.5	SH		75	ST	K	CL	1	12.0	6						
													590.2	SH		65	IR	K	CL	3	12.0	6						
													591.3	SH		30	P	K	CL	15	4.0	6						
													592.1	SH		80	P	K	CL	3	6.0	6						
	Partially rehealed graywacke gouge	72	592.7	594.0	1.3	N	0.5	>20	6	0	R1-R2	W3-W4	593.4	SH		35	C	K	CL	2	10.0	6						
	Gouge w/ graywacke clasts	73	594.0	599.0	4.8	N	0.4	>20	6	0	R0-R2	W3-W4	594.6	SH		50	ST	K	CL	2	12.0	6	597.4	599.0	FG			
													595.5	SH		80	C	K	CL	1	8.0	6						
													595.7	SH		75	ST	K	CL	2	10.0	6						
													595.7	SH		85	P	K	CL	1	4.0	6						
													596.4	SH		45	C	K	CL	10	4.0	6						
													597.6	SH		45	IR	K	CL	5	12.0	6						
													598.1	SH		55	C	K	CL	3	6.0	6						
	Partially rehealed gouge & graywacke clasts	74	599.0	604.0	4.8	N	0.5	>20	0	0	R0-R2	W3-W4	602.4	SH		45	U	K	CL	1	8.0	6	599.0	602.9	FG			
													602.9	SH		45	ST	K	CL	2	10.0	6						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge					
																							Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													603.1	SH		65	U	K	CL	1	6.0	6						
	Gouge & graywacke clasts	75	604.0	609.0	5.0	N	0.5	>20	0	0	R0-R3	W3-W4	605.2	SH		25	P	K	CL	2	8.0	6	607.5	609.0	FG/FB			Breccia/gouge
													606.6	SH		30	P	K	CL	1	6.0	6						
													607.4	SH		45	P	K	CL	1	6.0	6						
	Partially rehealed graywacke, limestone & greenstone gouge	76	609.0	614.0	4.7	N	2.2	>20	0	0	R0-R2	W3-W4	610.1	SH		65	P	K	CL	2	6.0	6						
													611.3	SH		65	C	K	CL	6	6.0	6						
													612	SH		70	ST	K	CL	0.1	8.0	6						
													612.7	SH		65	P	K	CL	1	6.0	6						
													613.2	SH		60	IR	K	CL	2	10.0	6						
	Limestone, graywacke gouge-partially rehealed	77	614.0	619.0	4.9	N	2.0	>20	0	0	R0-R2	W3-W4											614.0	619.0	G			
	Limestone	78	619.0	624.0	4.5	N	1.9	>20	6	6	R2-R3	W2-W3	619.3	SH		70	P	K	CL	1	8.0	6				619.9	621.4	Breccia
	Limestone	79	624.0	629.0	5.1	N	4.9	1	20	20	R2-R3	W1-W2	625.6	J		35	U	R	CA	2	12.0	20						Stick core
	Limestone	80	629.0	630.0	1.0	N	0.0	>20			R2-R3	W2														629.0	630.0	Rubble
	Limestone	81	630.0	634.0	2.2	N	1.0	>20	12	6	R2	W2-W3	630.9	J		45	P	SM	NA		6.0	12						
	Limestone	82	634.0	635.0	0.5	N	0.0	>20	12	6	R2	W2-W3														634.0	635.0	Rubble
	Limestone	83	635.0	640.0	4.5	N	0.9	>20	12	6	R2	W2-W3	635.7	J		15	IR	VR	CA	2	14.0	20				637.3	640.0	Rubble
	Limestone	84	640.0	643.0	2.5	N	0.0	>20	20	12	R2	W2-W3														640.0	643.0	Rubble
	Limestone	85	643.0	648.2	4.5	N	2.1	3	20	12	R2-R3	W1-W2	643.5	J		10	IR	VR	CA	2	16.0	25						
													645.5	J		10	IR	VR	CA	>.01	16.0	25						
													646.7	J		20	IR	VR	NA		12.0	25						
	Limestone	86	648.2	653.4	5.0	N	0.9	4/>20	20	12	R2-R3	W1-W2	548.2	J		15	P	R	CA	2	12.0	20						
													549.2	J		15	IR	VR	CA	0.5	14.0	25						
													550.3	J		10	IR	VR	NA		16.0	25						
													552.5	J		20	P	R	CA	0.5	12.0	20						
	Limestone	87	553.4	558.4	4.6	N	2.1	>20	20	12	R1-R2	W3-W4	655.1	J		15	U	R	CA	0.5	10.0	20				553.4	553.9	Rubble zone
													656.5	J		40	P	R	CL	2	8.0	12						possible shear
																										656.9	657.2	Rubble zone
	Limestone	88	558.4	662.5	3.9	N	0.5	>20	6	0	R1-R2	W3-W4	661.2	SH		65	P	K	CL	2	4.0	6				658.4	660.8	Rubble zone
													661.5	SH		35	P	K	CL	5	10.0	6				661.7	662.1	Rubble zone
	Limestone	89	662.5	664.5	1.9	N	0.4	>20	6	6	R1-R2	W3-W4	662.9	J		55	IR	VR	CL	0.5	16.0	25				662.5	664.5	Rubble
	Limestone	90	664.5	668.0	3.0	N	0.0	>12	12	6	R1-R2	W3-W4														664.5	668.0	rubble
	Limestone	91	668.0	669.0	0.6	N	0.0	>20	12	6	R1-R2	W3-W4														668.0	669.0	rubble
	Limestone	92	669.0	671.0	2.0	N	0.0	>20	12	6	R1-R2	W3-W4														669.0	671.0	rubble
	Limestone	93	671.0	672.5	1.5	N	0.0	>20	12	6	R1-R2	W3-W4														671.0	672.5	rubble
	Limestone	94	672.5	675.0	2.0	N	0.0	>20	12	6	R1-R2	W3-W4														672.5	675.0	rubble
	Limestone	95	675.0	680.0	4.7	N	0.0	>20	12	6	R1-R2	W3-W4														675.0	680.0	Rubble, non continuous fractures throughout core
	Limestone	96	680.0	684.0	3.8	N	1.1	>20	12	6	R1-R2	W3-W4														680.0	684.0	rubble/breccia
	Limestone gouge/breccia	97	684.0	689.0	4.5	N	0.0	>20	6	0	R0-R2	W3-W4	685.9	SH		45	P	K	CL	2	4.0	6				684.0	689.0	Rubble/breccia
													686.2	SH		25	IR	K	CL	4	10.0	6						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge					
																							Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone gouge/breccia	98	689.0	691.2	2.0	N	0.0	>20	6	0	R0-R2	W3-W4														689.0	691.2	rubble/breccia
	Limestone gouge/breccia	99	691.2	692.2	0.4	N	0.0	>20	6	0	R0-R2	W3-W4														691.2	692.2	rubble/breccia
	Limestone gouge/breccia	100	692.2	694.0	1.5	N	0.0	>20	6	0	R0-R2	W3-W4														692.2	694.0	rubble/breccia
	Partially rehealed limestone breccia	101	694.0	699.0	4.8	N	1.5	>20	6	6	R0-R2	W3-W4														694.0	696.4	rubble/breccia
																												696.4-698.5 rehealed
																									698.5	699.0	rubble/gouge breccia

fds			Run Data																				Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	1	15.0	16.0	1.0	N	0.5	0			R2	W3																RUBBLE SOME REDRILLED AT TOP OF RUN
	Limestone	2	16.0	20.0	2.8	N	2.7	3	15	12	R2	W3	16.7	J1	1	50	P	R	CL	1	8.0	12						LG CHERT NODULES THROUGHOUT
													17.5	J1	1	30	P	R	CL	1	10.0	12						
													18.2	J2	1	30	P	R	CL	C	10.0	20						
	LIMESTONE	3	20.0	23.0	3.2	N	0.0	10	11	6	R2	W3	20.2	J1	1	20	P	R	CL	1	10.0	12						
													20.5	J1	1	60	P	R	CL	C	8.0	12						BREAK ALONG BOTTOM OF CHERT NODULE
													20.8	J2	1	20	U	R	CL	1	10.0	12						
													21.1	J1	1	60	P	R	CL	C	12.0	12						
																							22.0	22.5	BX			
													22.4	J1	1	45	P	R	CL	4	12.0	6						
	LIMESTONE	4	23.0	27.0	3.8	N	2.0	3	12	12	R2	W3	24	J2	1	50	P	R	CL	C	10.0	12						
													25	J2	2	60	P	R	CL	1	1.0	12						
													26.2	J1	1	25	P	R	CL	3	12.0	6						
	LIMESTONE	5	27.0	30.0	2.7	N	2.0	3	12	12	R2	W3	27.8	J2	1	60	P	R	CL	C	8.0	12						
													28.1	J2	1	60	P	R	CL	C	10.0	12						
													28.6	J2	1	20	P	R	CL	C	12.0	12						
	LIMESTONE	6	30.0	31.5	1.8	N	0.0	3	9	6	R2	W3	30.4	J1	1	45	P	R	CL	4	10.0	6						
													30.9	J1	2	30	P	R	CL	C	8.0	12						
	LIMESTONE	7	31.5	35.0	2.3	N	1.6	8	11	0	R2	W3	32.9	J2	3	20	IR	R	CL	C	14.0	20						
													33.9	J1	1	60	P	VR	CL	10	18.0	0						
													34.2	J2	1	50	P	R	CL	C	8.0	12						
													34.4	J2	2	75	P	R	CL	C	10.0	12						
	LIMESTONE	8	35.0	37.0	2.0	N	0.0	10			R2	W3																RUN HIGHLY FRACTURED
	LIMESTONE	9	37.0	42.0	4.9	N	3.0	3			R2	W3	38.3	J1	1	60	P	R	CL	1	12.0	12						
													38.7	J1	1	20	P	R	CL	C	8.0	12						
													39.6	J2	1	60	P	R	CL	C	12.0	12						
																										40.9	42.0	
	LIMESTONE	10	42.0	43.0	1.5	N	0.0	1			R2	W3	42.8	J1	1	55	P	R	CL	1	10.0	12						
	LIMESTONE	11	43.0	47.0	3.3	N	0.0	4	12	12	R2	W3	43.7	B2	1	50	P	R	CL	1	10.0	12						BREAK ALONG BOTTOM OF CHERT NODULE
													45.1	J2	1	30	P	R	CL	C	8.0	12						
	LIMESTONE	12	47.0	49.0	2.2	N	1.9	1	12	12	R2	W3	48.6	J1	1	60	P	R	CL	C	8.0	12						
	LIMESTONE	13	49.0	49.5	0.7	N	0.7	0			R2	W3																
	LIMESTONE	14	49.5	52.5	2.4	N	1.7	5	20	20	R2	W3	51.9	J2	3	20	P	R	CL	C	10.0	20						
	LIMESTONE	15	52.5	53.5	1.3	N	1.3	0			R2	W3																
	LIMESTONE	16	53.5	54.5	0.8	N	0.8	0			R2	W3																
	LIMESTONE	17	54.5	55.0	0.4	N	0.4	0			R2	W3																
	LIMESTONE	18	55.0	59.0	3.7	N	0.4	20			R2	W3																ENTIR RUN HIGHLY FRACTURED
	LIMESTONE	19	59.0	59.5	0.8	N	0.0	0			R2	W3																HIGHLY FRACTURED
	LIMESTONE	20	59.5	60.5	1.6	N	1.2	0			R2	W3																
	LIMESTONE	21	60.5	63.0	1.9	N	0.0	10			R2	W3														60.5	63.0	
	LIMESTONE	22	63.0	63.5	0.2	N	0.0				R2	W3																RUBBLE RECOVERED
	LIMESTONE	23	63.5	68.5	4.1	N	0.8	15			R2	W3																

fds			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	LIMESTONE	24	68.5	73.0	3.4	N	0.0	10			R2	W3																
	LIMESTONE	25	73.0	76.5	3.5	N	2.8	2	12	12	R2	W3	73.7	J2	1	15	P	VR	CL	1	18.0	12						
													74.9	J2	1	40	P	R	CL	C	12.0	12						
	LIMESTONE	26	76.5	81.0	4.5	N	0.0	15			R2	W3														76.5	81.0	
	LIMESTONE	27	81.0	86.0	5.1	N	0.0	10			R2	W3														81.0	86.0	
	LIMESTONE	28	86.0	91.0	5.0	N	5.0	0			R1.5	W3														86.0	91.0	INTACT BUT HIGHLY FRACTURED
	LIMESTONE	29	91.0	94.5	3.3	N	0.0	0			R1.5	W3														91.0	91.8	ENTIRE RUN HIGHLY FRACTURED
	LIMESTONE	30	94.5	97.5	2.7	N	2.4	0			R1.5	W3																RUN HIGHLY FRACTURED
	LIMESTONE	31	97.5	102.0	4.3	Y	4.3	0	16	12	R1.5	W3	99.7	B2	3	35	P	R	CL	C	10.0	12						
													100.8	B2	2	50	P	R	CL	C	12.0	20						
	LIMESTONE	32	102.0	104.0	1.9	N	0.7	10			R1.5	W3														102.7	104.0	
	LIMESTONE	33	104.0	107.5	3.8	Y	0.0	30	12	12	R1.5	W3	104.7	B1	30	50	P	R	CL	1	10.0	12						HIGHLY FRACTURED
	LIMESTONE	34	107.5	108.0	0.5	N	0.0				R1.5	W3														107.5	108.0	
	BANDED SHALE	35	108.0	111.0	2.7	Y	0.0	30	12	12	R1.5	W3	109.1	B1	30	50	P	R	CL	1	10.0	12						HIGHLY FRACTURED, WEAK EASILY BROKEN UP
	LIMESTONE	36	111.0	113.0	1.7	Y	0.0	5	12	12	R1.5	W3	111.6	B1	5	50	P	R	CL	1	10.0	12						
	LIMESTONE	37	113.0	116.0	3.4	Y	0.0	15	12	12	R1.5	W3														113.0	114.1	
													115.1	B1	8	40	P	R	CL	1	12.0	12						
	LIMESTONE	38	116.0	119.0	3.0	Y	0.0	20	12	12	R1.5	W3	117.2	B1	18	50	P	R	CL	1	10.0	12						RUN HIGHLY FRACTURED
	LIMESTONE	39	119.0	121.0	2.0	N	2.0	2	12	12	R2	W3	119.5	J1	1	20	P	R	CL	C	12.0	12						
													120.7	J1	1	30	P	R	CL	C	10.0	12						
	LIMESTONE	40	121.0	126.0	4.2	Y	2.8	10	6	6	R2	W3	121.4	B1	6	30	P	R	CL	1	8.0	6						
																										124.4	126.0	
	LIMESTONE	41	126.0	131.0	5.0	N	4.6	1	12	12	R2	W3														126.4	126.8	
													128.8	J1	1	55	P	R	CL	8	12.0							RUN MODERATELY FRACTURED
	LIMESTONE	42	131.0	133.0	1.7	N	1.7	2	12	12	R2	W3	131.6	J1	1	50	P	R	CL	C	10.0	12						
													132.1	J2	1	30	P	R	CL	C	14.0	12						
	LIMESTONE	43	133.0	136.5	4.1	N	2.8	4	12	12	R2	W3	133.4	J1	1	30	P	R	CA	2	12.0	12						
													134.5	J1	1	40	P	R	CA	1	10.0	12						
													135.2	J1	1	40	P	R	CL	1	8.0	12						
													136.2	J2	1	40	P	R	CL	1	12.0	12						
	LIMESTONE	44	136.5	141.0	4.4	N	1.9	5	12	12	R2	W3	137	J1	1	40	P	R	CL	C	12.0	12						RUN HIGHLY FRACTURED
													138.8	J2	1	45	P	R	CL	1	10.0	12						
	LIMESTONE	45	141.0	146.0	4.8	N	4.4	6	11	6	R3	W3	141.5	J1	1	60	P	R	CL	1	12.0	12						
													142.4	J1	1	45	P	R	GC	10	14.0	6						
													143.7	J1	1	30	P	R	CL	2	10.0	12						
													144	J1	1	50	P	R	CL	1	10.0	12						
													144.5	J2	1	40	P	R	CL	1	10.0	12						
	LIMESTONE	46	146.0	151.0	5.0	N	5.0	0			R3	W3																RUN MODERATELY FRACTURED, NONE NATURAL
	LIMESTONE	47	151.0	153.0	2.0	N	0.9	3	10	6	R3	W3	151.3	J2	1	30	P	R	CL	C	12.0	12						
													151.8	J1	1	60	P	R	CL	3	10.0	6						
													152.7	J2	1	60	P	R	CL	1	10.0	12						

fds			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	LIMESTONE	48	153.0	155.0	2.3	N	0.0				R2.5	W3														153.0	155.0	RUN HIGHLY FRACTURED
	LIMESTONE	49	155.0	157.5	2.2	N	0.4				R2.5	W3														155.0	155.6	RUN HIGHLY FRACTURED
																										156.1	157.5	
	LIMESTONE, CHERTY	50	157.5	160.0	2.9	N	0.0	5	6	6	R2	W3	159.2	J1	3	50	P	R	CL	2	10.0	6						HIGHLY FRACTURED
	LIMESTONE	51	160.0	163.0	2.7	N	2.1	5	12	12	R2	W3																
													161.5	V1	1	15	P	VR	CA	8	20.0	12						
	LIMESTONE	52	163.0	164.0	1.0	N	0.4	1	12	12	R2	W3	163.4	J1	1	20	P	R	CL	1	14.0	12						
	LIMESTONE	53	164.0	165.5	0.9	N	0.0	10			R1.5	W3																RUN HIGHLY FRACTURED
	LIMESTONE	54	165.5	167.0	1.1	Y	0.0	5	12	12	R1.5	W3	165.6	B2	5	60	P	R	CL	C	8.0	12						
	LIMESTONE	55	167.0	169.0	1.8	Y	0.0	7	12	12	R1.5	W3	168	B2	7	50	P	R	CL	1	8.0	12						HIGHLY FRACTURED
	LIMESTONE	56	169.0	173.0	4.1	Y	3.1	7			R2	W3	170.7	B1	7	50	P	R	CL	1	8.0	6						CHERT BAND IN THIS RUN HAVE SAME ORIENTATION AS BROKEN BEDDING FRACTURES
	LIMESTONE	57	173.0	176.0	3.3	Y	2.2	10	9	6	R2	W3	173.4	J1	1	50	P	R	CL	1	10	12						BOTTOM OF CHERT BED
													175.6	B1	5	60	P	R	CL	1	10	6						
																										176.1	176.3	
	LIMESTONE	58	176.0	181.0	0.2	N	0.0	10																				A TINY BIT OF GC MUD RECOVERED
	LIMESTONE	59	181.0	183.0	0.1	n	0.0																					SMALL PIECES OF RUBBLE RECOVERED
	NO RECOVERY	60	183.0	185.5	0.0																							
	LIMESTONE	61	185.5	189.0	3.1	N	1.9	50			R1	W3																ENTIRE RUN VERY WEAK, FRACTURED, SOLID BUT GOUGY
	LIMESTONE	62	189.0	193.0	3.7	N	2.3	10			R1																	RUN INTACT BUT VERY WEAK, FALLS APART
	LIMESTONE	63	193.0	193.5	0.6	N	0.0	1	12	12	R1.5	W3	193.4	J1	1	70	P	R	CL	C	12.0	12						
	LIMESTONE	64	193.5	194.0	0.2	N	0.0	0			R1.5	W3																
	LIMESTONE	65	194.0	194.5	0.3	N	0.0	0			R1.5	W3																
	LIMESTONE	66	194.5	198.0	3.8	N	3.8	0			R1.5	W3																NO NATURAL FRACTURES-IRREGULAR SUBVERTICAL FRACTURES THROUGHOUT
	LIMESTONE	67	198.0	203.0	5.0	N	5.0	1	12	12			200.7	J1	1	55	P	R	CL	10	12.0							
	LIMESTONE	68	203.0	207.0	4.0	N	1.0	10	6	6	R1.5	W3	204.2	B1	1	85	P	R	CL	3	10.0	6				203.0	204.1	
													205.4	J1	1	35	P	R	CL	4	10.0	6						
													206.5	B1	3	75	P	R	CL	2	10.0	6						
	LIMESTONE	69	207.0	210.0	3.2	Y	0.0	15	6	6	R1.5	W3	207.2	B1	15	80	P	R	CL	2	12.0	6						PARALLEL BREAKS THROUGHOUT RUN, NO OTHER NATURAL BREAKS
	LIMESTONE	70	210.0	213.0	2.1	Y	1.2	5	6	6	R1.5	W3	210.4	B1	5	80	P	R	CL	1	10.0	6						
	LIMESTONE	71	213.0	217.0	3.9	N	2.6	2	12	12	R2	W3	214.6	J1	1	70	P	R	CL	2	14.0	12						
													214.8	J2\	1	30	P	R	CL	1	14.0	12						
	LIMESTONE	72	217.0	222.0	5.0	N	2.8	1	12	12	R2	W3	217.2	B1	1	70	P	R	CL	2	12.0	12						FRACTURES THROUGHOUT RUN
																										212.9	214.0	
													214	J2	1	20	P	R	CL	C	10.0	12						
	LIMESTONE	73	222.0	227.0	5.0	N	1.9	8	12	12	R2	W3	222.3	J2	1	40	P	R	CL	C	8.0	12						
													223.4	J1	1	20	P	R	CL	C	8.0	12						
													223.9	B1	2	60	P	R	CL	1	10.0	12						
	LIMESTONE	74	227.0	232.0	5.0	N	3.1	5	12	12	R2	W3	227.6	B1	1	80	P	R	CL	1	12.0	12						RUN HIGHLY FRACTURED

fds			Run Data																				Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
																										228.4	228.8	
													229.4	J1	1	60	P	R	CL	C	10.0	12						
													230.1	J1	1	50	P	R	CL	2	12.0	12						
													231.2	J1	1	75	P	R	CL	1	12.0	12						
	LIMESTONE	75	232.0	235.5	3.8	N	3.4	2	12	12	R2	W3														232.0	232.6	
													233.5	J1	1	75	P	R	CL	2	10.0	12						
	LIMESTONE	76	235.5	240.5	4.7	N	0.0	5			R2	W3	236.4	J1	1	75	P	R	CA	1	8.0	12						RUN HIGHLY FRACTURED
													236.9	J1	2	30	P	R	CL	1	12.0	12						
													237.1	J1	3	50	P	R	CL	1	10.0	12						
													238.4	J1	1	60	P	R	CL	10	14.0	0						
	LIMESTONE	77	240.5	242.0	0.9	N	0.0	10			R1	W3														240.5	242.0	ENTIRE RUN CLAY CEMENTED FRAGS
	LIMESTONE	78	242.0	247.0	4.7	N	4.4	2	9	6	R2	W3	243.4	J1	1	25	C	S	CA	1	6.0	6				242.0	242.5	
													245.7	J1	1	30	P	R	CL	1	8.0	12						
	LIMESTONE	79	247.0	252.0	5.0	N	5.0	0			R2	W3																
	LIMESTONE	80	252.0	256.5	4.0	N	1.9	20			R1.5	W3														252.5	253.0	
																							254.4	255.5	GC			
	LIMESTONE	81	256.5	261.5	5.0	N	5.0	0			R1.5	W3																EXTENSIVE CA VEINING, RUN WEAK,BRKN
	LIMESTONE	82	261.5	266.5	5.2	N	4.1	5	9	6	R1.5	W3	261.7	J2	1	30	P	R	CA	2	12.0	12						ENTIRE RUN HIGHLY FRACTURED
													263.2	J2	1	60	P	R	CL	1	12.0	12						
													264.5	J1	1	60	P	R	CL	1	8.0	6						
													266.1	B1	3	50	P	R	CL	1	8.0	6						
	LIMESTONE	83	266.5	271.5	4.8	N	3.9	15	6	6	R1.5	W3	266.6	J1	1	65	P	R	CL	2	10.0	6						
													268.8	J1	1	30	P	R	CL	2	10.0	6						
																							269.4	271.5	GC			MILLED GOUGE MATERIAL, VERY WEAK
	LIMESTONE	84	271.5	275.0	1.8	N	0.0	20			R1	W3														271.5	275.0	MILLED GRAVEL & CLAY
	LIMESTONE	85	275.0	279.0	4.0	N	1.3	50			R1	W3											275.0	276.5	GC			
																							277.7	278.3	GC			
	LIMESTONE	86	279.0	283.0	3.2	N	0.0	50			R0	W3											279.0	283.0	GC			RUN HIGHLY FRACTURED, GOUGY, FALLS APART
	LIMESTONE	87	283.0	287.0	3.4	N	0.0	25			R1	W3														283.0	284.9	
																							284.9	587.0	GC			
	LIMESTONE	88	287.0	291.0	3.9	N	2.4	20	12	12	R1.5	W3	289.1	J1	3	35	P	R	CL	1	8.0	12						
																							289.9	291.0	GC			
	CHERT GOUGE	89	291.0	295.0	1.7	N	0.0	20			S4	W3											291.0	295.0	GC			
	CHERT	90	295.0	298.0	2.8	N	1.1	20			R1	W3											295.0	296.2	GC			
																							297.6	298.0	GC			
	CHERT	91	298.0	303.0	4.9	N	3.1	10	3	0	R1.5	W3											298.0	298.4	GC			
													299.9	J1	1	60	P	R	CL	10	8.0	0	299.4	299.9	GC			
													301.2	J2	1	50	P	R	CL	1	12.0	6						
	CHERT	92	303.0	307.5	4.3	N	3.5	6			R2	W3	303.3	B1	3	30	P	R	CL	1	8.0	6						
	CHERT	93	307.5	312.5	4.9	N	4.9	5	8	6	R2	W3	309.1	J1	2	30	P	R	CL	2	10.0	6						
													310.2	J1	1	55	P	R	CL	1	10.0	6						
													311.8	J1	1	30	P	R	CL	1	14.0	12						
	CHERT	94	312.5	315.0	2.0	Y	0.0	15	6	6	R1.5	W3	313	J1	15	40	P	S	CL	1	4.0	6						CA VEINS OFFSET ALONG FRACTURES-REACTIVATED JOINTS
	CHERT	95	315.0	320.0	4.8	N	1.1	15	6	6	R1.5	W3	3153.8	J1	2	40	P	S	CL	1	6.0	6						
																										316.3	317.9	
													318.3	J1	1	50	P	R	CL	2	8.0	6						
																							318.6	320.0	GC			

fds			Run Data																				Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	CHERT	96	320.0	323.0	2.9	N	0.0	25	6	6	R1.5	W3	320.2	J1	20	55	P	S	CL	1	6.0	6						PARALLEL FRACTURES THROUGHOUT
	CHERT W/LIMESTONE	97	323.0	327.0	4.0	N	0.0	10	6	6	R1.5	W3	323.4	J1	6	50	P	R	CL	1	8.0	6						
													326.7	J2	1	30	P	R	CL	1	10.0	6						
																										325.1	327.0	
	LIMESTONE W/CHERT	98	327.0	331.5	3.9	Y	0.0	15	10	6	R1.5	W3	328.5	J2	1	40	P	R	CL	C	14.0	12						
													228.2	J2	1	38	P	R	CL	C	12.0	12						
													330	J1	12	50	P	S	CL	1	6.0	6						
	LIMESTONE	99	331.5	333.0	1.2	N	1.3	1	6	6	R2	W3	332.8	J1	1	70	P	R	CL	2	10.0	6						
	LIMESTONE	100	333.0	338.0	5.0	N	2.6	10			R1.5	W3																RUN VERY GOUGY, NO DISTINCT NATURAL FRACS
	LIMESTONE	101	338.0	343.0	4.8	N	4.8	3	6	6	R1.5	W3	342.4	J2	4	50	P	R	CL	C	8.0	6						RUN HIGHLY FRACTURED
	LIMESTONE	102	343.0	348.0	4.2	N	3.0	10	6	6	R1.5	W3	344.1	J1	1	35	P	R	CL	2	12.0	6						
																							344.7	345.0	GC			
													345.5	J1	1	40	P	R	CL	2	10.0	6						
													346.2	J1	2	50	P	R	CL	3	10.0	6						
													347.2	J1	1	40	P	R	CL	2	12.0	6						
	LIMESTONE	103	348.0	353.0	5.0	N	4.0	10	6	6	R1.5	W3														348.2	348.7	
													348.9	J1	2	40	P	R	CA	2	10.0	6						
													350.6	J1	1	40	P	R	CL	3	8.0	6						
													352.4	J1	1	30	P	R	CL	2	10.0	6						
	LIMESTONE	104	353.0	358.0	5.1	N	5.1	0			R2.5	W3																EXTENSIVE FINE CA VEINING THROUGH HIGH GRADE LIMESTONE
	LIMESTONE	105	358.0	363.0	5.0	N	3.7				R2.5	W3														361.8	363.0	
	LIMESTONE	106	363.0	368.0	5.0	N	1.8	30	6	6	R1.5	W3											363.0	365.2	GC			
													365.7	J1	2	40	P	S	CL	1	6.0	6						
																							367.0	368.0	GC			
	LIMESTONE	107	368.0	373.0	4.2	N	0.0	50			R1	W3											368.0	373.0	GC			COARSE LIMESTONE CLASTS IN CLAY
	LIMESTONE	108	373.0	378.0	5.0	N	2.9	20			R1.5	W3											373.0	373.2	GC			
																							375.2	377.0	GC			
	LIMESTONE	109	378.0	383.0	5.2	N	5.2	0			R1.5	W3																
	LIMESTONE	110	383.0	388.0	4.8	N	4.8	0			R1.5	W3																VERTICAL FRACRUES THROUGHOUT RUN TOP TP BOTTOM, NOT IN PREVIOUS
	LIMESTONE	111	388.0	393.0	4.8	N	4.8	0			R1.5	W3																
	LIMESTONE	112	393.0	398.0	5.0	N	5.0	0			R1.5	W3																
	LIMESTONE	113	398.0	403.0	4.7	N	4.7	0			R1.5	W3																
	LIMESTONE	114	403.0	408.0	3.6	N	1.3	0			R1	W3																CLAYEY GOUGE THROUGHOUT
	LIMESTONE	115	408.0	413.0	4.8	N	2.6	0			R1	W3											408.3	409.8	GC			
													411.4	J2	1	50	P	R	CL	1	8.0	6						
	LIMESTONE	116	413.0	417.0	3.7	N	1.4	25			R1.5	W3											413.3	414.2	GC			
																							415.7	417.0	GC			
	LIMESTONE	117	417.0	422.0	5.0	N	4.7	10	6	6	R1.5	W3											417.0	417.2	GC			OUT OF HIGH GRADE LIMESTONE
													421.2	J1	1	60	P	R	CL	3	10.0	6						
																							421.7	422.0	GC			

fds			Run Data																				Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	LIMESTONE	118	422.0	426.0	3.9	N	0.0	25	12	12	R1	W3	422.3	J1	2	30	P	R	CL	1	8.0	12						
																							422.3	426.0	GC			HIGHLY FRACTURED CLAY CEMENTED LIMESTONE
	LIMESTONE	119	426.0	430.5	2.3	N	0.0	25			R1	W3											426.0	430.5				
	LIMESTONE	120	430.5	433.0	2.3	Y	0.0	25	6	6	R1	W3											430.5	431.0	GC			
																										431.3	431.5	
													432.1	B1	6	50	P	R	CL	1	8.0	6						LIGHT BROWN LIMESTONE
	LIMESTONE	121	433.0	438.0	4.7	Y	3.4	10	12	12	R1.5	W3	433.7	B1	3	30	P	R	CL	1	10.0	12						
													435.6	J1	1	60	P	R	CL	1	10.0	12						
													435.9	J1	1	60	P	R	CL	1	12.0	12						
													436.9	B1	4	60	P	R	CL	1	8.0	12						
	LIMESTONE	122	438.0	441.5	3.4	N	1.9	10			R2	W3	438.8	J1	2	70	P	R	CL	C	10.0	12						
													440	J1	1	60	P	R	CL	10	8.0	0						
																							440.5	441.5	GC			
	LIMESTONE	123	441.5	445.6	3.2	N	0.0	25			R1	W3											441.5	445.5	GC			
	LIMESTONE	124	445.5	450.5	4.4	N	4.0	10	12	12	R1.5	W3														445.5	445.9	VERY WEAK, EASILY BROKEN BY HAND
													450.3	J2	1	40	P	R	CL	C	12.0	12						
	LIMESTONE	125	450.5	453.0	2.2	N	0.8				R1	W3														450.9	453.0	
	LIMESTONE	126	453.0	454.0	0.5	N	0.0				R1	W3														453.0	454.0	
	LIMESTONE	127	454.0	457.0	3.4	N	1.4				R1.5	W3														454.0	457.0	RUN FALLS APART AT HAND PRESSURE
	LIMESTONE	128	457.0	461.0	3.8	N	2.7	3	10	6	R2	W3	458.1	J2	1	40	P	S	CL	C	6.0	12						CHANGE TO MUCH HARDER SMOOTHER ROCK458.1
													469.1	J1	1	50	P	R	CL	2	10.0	6						
													460.2	J2	1	35	P	R	CA	1	12.0	12						
	LIMESTONE	129	461.0	463.0	2.0	N	2.0	0			R2	W3																
	LIMESTONE	130	463.0	465.0	2.1	N	2.1	2	9	6	R2	W3	463.7	J1	1	20	P	R	CL	1	12.0	6						
													464.5	J2	1	45	P	R	CL	C	10.0	12						
	LIMESTONE	131	465.0	470.0	4.4	N	2.5	2	12	12	R2	W3	466	J1	1	40	P	R	CL	C	12.0	12						
													466.7	J2	1	60	P	R	CL	1	14.0	12						
																										467.4	470.0	
																										470.0	470.9	

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	1	55.0	57.0	1.1	N	0.0		14	18	R4	W2														55.0	57.0	low grade
	Limestone	2	57.0	58.0	0.8	N	0.0		18	18	R4	W2														57.0	58.0	low grade
	Limestone	3	58.0	58.5	0.5	N	0.0		18	18	R4	W2														58.0	58.5	low grade
	Limestone	4	58.5	59.0	0.5	N	0.0		18	18	R4	W2														58.5	59.0	
	Limestone	5	59.0	61.0	1.8	N	0.0		19	19	R4	W2														59.0	61.0	
	Limestone	6	61.0	63.0	2.0	N	0.0		19	19	R4	W2														61.0	63.0	
	Limestone	7	63.0	64.0	0.0																							
	Limestone	8	64.0	66.0	1.7	N	0.0		18	18	R4	W2														64.0	66.0	
	Limestone	9	66.0	71.0	3.7	N	0.0	40	18	18	R4	W2																>10 fract/ft entire run
	Limestone	10	71.0	73.0	2.0	N	0.0	25	18	18	R4	W2																>10 fract/ft entire run
	Limestone	11	73.0	74.0	0.4	N	0.0		18	18	R4	W2														73.0	74.0	
	Limestone	12	74.0	76.0	2.0	N	0.0	20	18	18	R4	W2																>10 fract/ft entire run
	Limestone	13	76.0	78.0	2.0	N	0.0	20	20	20	R4	W2																>10 fract/ft entire run
	Limestone	14	78.0	83.0	4.7	N	0.0	50	20	20	R4	W2																>10 fract/ft entire run; low-med grade some sand in matrix
	Limestone	15	83.0	86.0	0.4	N	0.0	25	18	18	R4	W2																>10 fract/ft entire run; low-med grade some sand in matrix
	Limestone	16	86.0	88.0	1.7	N	0.0	20	18	18	R4	W2																>10 fract/ft entire run; low-med grade some sand in matrix
	Limestone	17	88.0	90.0	2.0	N	0.0	30	20	20	R4	W2																low-med grade, some high
	Limestone	18	90.0	92.5	1.90	N	0.0		18	18	R4	W2														90.0	92.5	
	Limestone	19	92.5	95.5	3.0	N	0.0	40	18	18	R4	W2																>10 fract/ft entire run
	Limestone	20	95.5	99.0	3.5	N	0.0	1	18	18	R4	W2	96.6	J	1	52	P	SM			6.0	18						healed fractures, mech. fract.
	Limestone	21	99.0	103.0	3.8	N	0.0	40	18	18	R4	W2																>10 fract/ft entire run, sandy matrix, low + high grade
	Limestone	22	103.0	108.0	5.0	N	0.0	60	20	20	R4	W2																
	Limestone	23	108.0	109.5	1.5	N	0.0		18	18	R4	W2														108.0	109.5	Sandy matrix
	Limestone	24	109.5	113.0	2.5	N	0.0	1	0	0	R3/S4	W3	111.4	F	1	40	P	K	G	0.6	4.0	0	111.4	112.0	CL	109.5	110.7	
	Fault Breccia	26	117.0	120.0	3.0	N	0.0	3	0	0	S4	W3	117.9	F	3	37	V	R	CL	0.6	12.0	0	117.0	120.0	CL/BX			Santa Clara Fm
	Fault Breccia	27	120.0	123.0	3.0	N	0.0	2	0	0	S4	W3	121.1	F	2	35	P	R	CL	0.7	4.0	0	120.0	123.0	CL/BX			
	Greywacke	28	123.0	126.0	3.0	N	0.0		4	4	R2/S4	W3											123.0	123.5	CL/BX	123.5	126.0	Fissile
	Greywacke	29	126.0	129.0	2.5	N	0.0		0	0	S4	W3											126.0	129.0	CL/BX			
	Greywacke	30	129.0	133.0	4.0	N	0.0		0	0	S4	W3											129.0	133.0	CL/BX			
	Greywacke	31	133.0	145.0	0.0																							
	Greywacke	32	145.0	145.5	0.5	N	0.0		15	15	R3	W3																Nech. Fract.
	Fault Breccia	33	145.5	148.0	1.6	N	0.0		0	0	S4	W3											145.5	148.0	CL			
	Fault Breccia	34	148.0	152.0	3.4	N	0.0		0	0	S4/R2	W3											148.0	152.0	CL/BX			
	Fault Breccia	35	152.0	155.0	3.0	N	0.0		0	0	S4/R2	W3											152.0	155.0	CL/BX			
	Fault Breccia	36	155.0	158.0	2.8	N	0.0		0	0	S4/R2	W3											155.0	158.0	CL/BX			
	Fault Breccia	37	158.0	162.5	3.8	N	0.8	2	0	0	R2/S4	W3	158.8	F	2	33	P	SM	G	0.6	4.0	0	158.0	162.5	CL/BX			Sample: 159-158.8
	Fault Breccia	38	162.5	165.0	2.5	N	0.0	0	0	0	S4	W3											162.5	165.0	CL/BX			
	Fault Breccia	39	165.0	168.0	2.6	N	0.0		0	0	S3	W3											165.0	168.0	CL/BX			
	Fault Breccia	40	168.0	171.5	3.0	N	0.0		0	0	S3/S4	W3											168.0	171.5	CL/BX			
	Fault Breccia	41	171.5	173.0	1.5	N	0.0		0	0	R2/S4	W4																Gouge Matrix
	Fault Breccia	42	173.0	175.0	2.0	N	0.0		0	0	R2/S4	W4																Gouge Matrix
	Fault Breccia	43	175.0	179.0	3.8	N	0.0	1	4	4	R2	W4	175.5	J	1	25	P	SM	CL	3	6.0	4				176.6	179.0	
	Fault Breccia	44	179.0	183.0	3.0	N	0.0	40	4	4	R2/S4	W4																>10 fract/ft. entire run
	Fault Breccia	45	483.0	186.5	3.2	N	0.0	40	0	0	R2/S4	W4	183.8	F	2	28	P	SM	G	0.9	4.0	0	183.8	184.7	CL/BX			>10 fract/ft. entire run
	Fault Breccia	46	186.5	189.5	2.7	N	0.0	30	0	0	R2/S4	W4																>10 fract/ft. entire run
	Fault Breccia	47	189.5	193.0	2.7	N	0.0		0	0	S4	W4											189.5	193.0	CL/BX			
	Fault Breccia	48	193.0	198.0	5.0	N	0.0	3	15	16	R2	W3	196.4	J	2	51	U	R			14.0	17				193.0	194.3	
	Fault Breccia												194.1	J	1	40	P	R	Ca	3	10.0	15						
	Fault Breccia	49	198.0	201.0	3.0	N	0.0		0	0	S4	W4											198.0	201.0	CL/BX			
	Fault Breccia	50	201.0	203.0	1.9	N	0.0		0	0	S4	W4											201.0	203.0	CL/BX			
	Fault Breccia	51	203.0	207.0	3.8	N	0.0		0	0	S4	W4											203.0	207.0	CL/BX			
	Greenstone	52	207.0	209.0	2.3	N	2.2	0			R1	W3																
	Fault Breccia	53	209.0	213.0	4.2	N	4.2	2	9	6	R1	W3	209.7	J1	1	30	P	R	CL	C	8.0	12						
	Fault Breccia												210.6	J1	1	40	P	R	CL	1	10.0	6						
	Fault Breccia	54	213.0	218.0	4.8	N	0.0	100			S6	W3											213.0	218.0	GC			hard gouge
	Fault Breccia	55	218.0	221.0	2.9	N	0.0	100			S5	W3											218.0	221.0	GC			clayey gouge with solid gragments
	Fault Breccia	56	221.0	223.0	1.8	N	0.7	50			S6	W3											221.9	223.0	GC			
	Metabasalt	57	223.0	228.0	4.9	N	3.3	15	6	0	R2	W3											223.0	223.6	GC			
													224.6	J1	1	30	P	R	CL	1	8.0	12						

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													227.2	J1	1	30.0	P	SM	CL	10	6.0	0						
	Metabasalt	58	228.0	233.0	4.9	N	4.9	0			R0	W3																
	Fault Breccia	59	233.0	238.0	4.6	N	0.0	100			S5	W3											233.0	238.0	GC			
	Fault Breccia	60	238.0	243.0	4.9	N	2.6	30	6	6	R1	W3											238.0	239.3	GC			
													240.3	J1	1	20.0	P	S	CL	2	6.0	6	241.9	243.0	GC			
	Fault Breccia	61	243.0	248.0	4.7	N	0.0	100			S6	W3											243.0	248.0	GC			firm clayey gouge
	Fault Breccia	62	248.0	253.0	5.0	N	0.6	100			S5	W3											248.0	252.4	GC			
	Fault Breccia	63	253.0	258.0	5.1	N	0.0	100			S5	W3											253.0	258.0	GC			
	Fault Breccia	64	258.0	263.0	4.9	N	0.0	100			S5	W3											258.0	263.0	GC			
	Fault Breccia	65	263.0	268.0	4.9	N	0.0	100			S6	W3											263.0	268.0	GC			
	Limestone	66	268.0	273.0	5.3	N	4.6	10			R2	W3											268.0	268.4	GC			
	Fault Breccia	67	273.0	278.0	4.9	N	0.0	100			S6	W3											273.2	278.0	GC			return to clay gouge 273.2
	Fault Breccia	68	278.0	283.0	5.0	N	0.0	75			S6	W3											278.0	283.0	GC			gravel coarser, large clasts in places
	Fault Breccia	69	283.0	288.0	5.0	N	1.8	50			R0	W3											283.0	286.3	GC			solid unbroken metabasalt 268.3-287.8
	Fault Breccia	70	288.0	292.5	4.5	N	0.0	100			S4.5	W3											288.0	292.5	GC			
	Fault Breccia	71	292.5	297.5	5.0	N	0.0	100			S5	W3											292.5	297.5	GC			
	Fault Breccia	72	297.5	298.0	0.2	N	0.0	10			S5	W3											297.5	298.0	GC			
	Fault Breccia	73	298.0	303.0	4.7	N	0.0	100			S5	W3											298.0	303.0	GC			
	Fault Breccia	74	303.0	308.0	4.9	N	0.0	100			S5	W3											303.0	308.0	GC			
	Fault Breccia	75	308.0	313.0	4.9	N	0.0	100			S5.5	W3											308.0	313.0	GC			
	Fault Breccia	76	313.0	137.0	4.2	N	0.0	100			S5	W3											313.0	317.0	GC			
	Fault Breccia	77	317.0	322.0	4.7	N	0.0	100			S6	W3											317.0	322.0	GC			
	Fault Breccia	78	322.0	323.0	1.1	N	0.0	25			S5	W3											322.0	323.0	GC			
	Fault Breccia	79	323.0	328.0	4.6	N	0.0	100			S5	W3											323.0	328.0	GC			
	Fault Breccia	80	328.0	330.5	2.2	N	0.7	25	6	6	R0	W3	329.1	J2	1	20	P	R	CL	1	8.0	6	329.6	330.5	GC			very weak, easily broken up
	Fault Breccia	81	330.5	333.0	2.6	N	0.9	25	6	6	R0	W3	330.9	J1	1	35	P	R	CL	2	8.0	6						
																							331.1	332.0	GC			
	Fault Breccia	82	333.0	335.0	2.2	N	0.0	100			S5	W3											333.0	335.0	GC			
	Fault Breccia	83	335.0	340.0	4.7	N	0.0	100			S5	W3											335.0	340.0	GC			
	Fault Breccia	84	340.0	343.0	2.7	N	0.0	100			S5	W3											340.0	343.0	GC			
	Fault Breccia	85	343.0	347.5	2.1	N	0.0	100			S4	W3											343.0	347.5	GC			
	Fault Breccia	86	347.5	348.5	1.3	N	0.0	100			S4	W3											347.5	348.5	GC			

			Run Data																												
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge								
																							Gouge			Broken Core				
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greywacke	1	15.0	16.0	0.7	N	0.0	2	18	16	R4	W2	15.2	J	1	65	C	R	Ox	-	8.0	16				15.0	16.0	5 rubble pieces recovered with rounded edges, worked in core barrel
													15.4	J	1	65	P	SR	-	-	4.0	20						Possible shear zone
	Greywacke	2	16.0	17.5	1.2	N	0.0	5	12	0	R3	W2	16.2	J	1	65	P	R	Ox	-	8.0	16				16.0	17.5	
													16.4	J	2	75	P	SR	Sc	4	8.0	0						Rubble; clay on surface, much washed away
													16.6	J	1	65	P	SR	Ox	-	4.0	16						Most of core Is re-drill
													16.8	J	1	75	P	S	Ox	-	3.0	14						
	Greywacke	3	17.5	18.5	0.6	N	0.0	1	15	15	R3	W2	18.5	J	1	63	C	SR	Chl/ Ox	-	4.0	15				17.5	18.5	Mostly rubble and re-drill
	Limestone	4	18.5	19.5	0.5	N	0.0	3	17	13	R3	W2	18.8	J	1	50	C	R	Chl/ Ox	0.5	8.0	12						Chert does not react to HCL, harness ~7-8, dark grey and veined
													19	J	1	60	C	R	-	-	12.0	16				19.2	19.5	
													19.2	J	1	80	P	VR	-	-	14.0	22						
	Limestone	5	19.5	20.0	0.4	N	0.0	2	13	3	R3	W2	19.5	J	1	40	P	VR	-	-	15.0	22						Brecciated and veined
													19.9	J	1	40	C	SR	Cl/Bx	3	7.0	3				19.7	20.0	Probably was a fault (19.9)
	Limestone	6	20.0	25.0	0.75	N	0.5	4	20	14	R3	W2	24.3	V	1	40	P	VR	Ca	0.1	15.0	23						Brecciated and veined; very low recovery
													24.2	J	1	62	P	SR	-	-	4.0	14						
													24.5	J	1	10	P	R	Ox/Cl	0.1	10.0	20						
													25	J	1	45	p	VR	Ca	0.1	14.0	22						
	Limestone	7	25.0	27.0	0.5	N	0.0	1	18	18	R3	W2	26.8	V	1	40	P	R	Ca	0.5	8.0	18						Low recovery; induced fractures show weakness planes with clay infill
	Limestone	8	27.0	28.5	1.0	N	0.7	2	20	20	R4	W1	27.7	J	1	50	P	SR	-	-	5.0	20						Brecciate and veined (calcite); parallel joints along vein orientation
													28.1	J	1	64	P	SR	-	-	5.0	20						Intact core recovery
	Limestone	9	28.5	30.5	1.0	N	0.7	1	20	20	R4	W1	30.2	J	1	55	P	SR	Ca	0.1	6.0	20						Brecciated; intact core recovery
	Limestone	10	30.5	32.5	1.0	N	0.5	7	15	10	R3	W2	31.2	V	1	60	P	R	Ca	1	10.0	20						Brecciated; 30.5' to 31.8' str: R4;
													31.8	S	6	40	P	R	Cl	1	8.0	10						31.8' to 32.5' Fracture set (shear zone); fissile shale; str: R2
	Limestone	11	32.5	34.5	0.3	N	0.0				R4	W1																Low recovery - rubble
	Limestone	12	34.5	36.5	1.3	N	0.0	7	10	10	R1/R2	W3	35.8	5	7	40	P	R	Ox	-	8.0	10						Heavily oxide stained; very fissile shale (shear zone)
	No recovery	13	36.5	38.5	0.0																							No recovery; expected mud and clay
	Fault Breccia	14	38.5	40.5	1.3	N	0.0	4	3	0	R4	W3	39.3	J	2	38	C	R	Ox	0.1	9.0	10						Fault zone separated by chert
													39.8	F	1	35	P	SR	G	20	8.0	0	39.8	39.9	Bx/Cl			Strong rock; weak faults
													40.1	F	1	55	P	R	G	18	6.0	0	40.1	40.2	Bx/Cl			
	No recovery	15	40.5	45.5	0.0																							No recovery; expected mud and clay
	Limestone	16	45.5	47.0	1.1	N	0.0	2	6	0	R1	W3	45.5	Bc												45.5	46.2	Weathered and faulted
													46.3	J	1	35	P	R	Cl/Bx	0.2	8.0	12						
													46.6	F	1	65	IR		G	130		0	46.6	47.0	Cl/Bx			Fault extends to end of run; infill is a coarse to fine sand with silt and clay (breccia)
	Limestone	17	47.0	50.0	0.6	N					R3		47	Bc												47.0	50.0	Weathered; only rubble recovered; continuation of previous fault
	Limestone	18	50.0	52.0	0.6	Y	0.0	2	12	12	R1/R2	W3	50	J	2	40	P	SR	Ox	0.1	6.0	12				50.1	52.0	Bedded; mostly rubble and re-drill
	Limestone	19	52.0	55.0	1.2	Y	0.0	7	12	12	R2	W3	54.1	J	2	36	P	SR	Ox/Cl	0.1	6.0	12						Fissile
													54.7	J	5	36	P	SR	Ox/Cl	0.1	6.0	12						
	Limestone	20	55.0	57.0	2.0	N	0.8	3	10	0	R2	W2	55.8	J	1	28	P	VR	Cl	0.3	14.0	4						Brecciated
													56.2	F	1	70	C	S	Bx	70	4.0	0	56.1	56.3	Bx			Fault infill - sandy gravel with clay
													56.7	J	1	55	P	S	Ox	0.1	3.0	16						

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	21	57.0	62.0	5.0	N	1.4	30	12	8	R2	W2	57.5	J	1	37.0	IR	VR	Ox	0.1	16.0	14						Brecciated
													57.7	J	1	60.0	P	SR	Cl/Ox	0.1	6.0	12						
													58	J	1	10.0	C	SR	Ox/Sc	0.1	8.0	12						
													58.5	J	10	75.0	C	R	Ox/Sc	0.1	10.0	12						>10 fractures/foot 57.2' to 57.7'
													59	J	1	65.0	P	SR	Cl	0.1	4.0	10						
													59.5	J	1	65.0	U	VR	Cl/Ox	0.1	16.0	14						
													59.6	J	1	65.0	P	VR	Cl/Ox	0.1	14.0	12						
													60	F	1	23.0	P	VR	Cl/Ox	45	10.0	8	60.2	60.3	Bx			
													60.5	J	1	83.0	C	SR	Cl/Ox	0.1	5.0	12						
													60.8	J	1	45.0	U	VR	Cl/Ox	0.1	10.0	14						
													61	J	1	51.0	U	R	Cl/Ox	0.1	8.0	12						
													61.6	J	10	60.0	P	R	Cl/Ox	0.1	12.0	10						>10 fractures/foot 61.2' to 61.8'
	Greywacke	22	62.0	66.0	1.8	N	0.0	3	12	0	R1	W3	64.2	J	2	55	P	SR	Cl	0.5	4.0	18						Fault zone
													64.2	J	1	65	C	R	Ox/Cl	0.4	8.0	18						
													64.6	F	1	70	P	SR	G	300	4.0	0	64.6	65.7	Sc			Fault 64.6' to 65.7; soft clay when wet
													65.7	BC													65.7	66.0	
	Greywacke	23	66.0	69.0	2.5	N	0.0	27	14	8	R3	W2	66.2	J	1	80	P	SR	Cl	0.2	4.0	15						Highly fractured
													66.4	J	9		IR	SR	Ox	0.1	6.0	15						>10 fractures/foot 66.4' to 67.1'
													67.2	J	1	80	P	SR	Ox	-	6.0	15						
													67.3	J	1	75	ST	SR	Cl	-	8.0	18						
													67.4	J	12	70	P	SR	Ox	0.1	8.0	10						Highly fractured 67.4' to 69'; fell apart when boxed
													67.9	J	1	50	P	R	Ox	-	8.0	20						
													68.4	J	1	30	P	R	Sp	2	8.0	8						
													68.6	J	1	20	P	R	Sp	2	8.0	8						
	Greywacke	24	69.0	72.0	0.7	N	0.0				R2	W2	71	BC													71.0	72.0	All rubble and re-drill
	Greywacke	25	72.0	76.0	1.0	N	0.0	2	14	12	R3	W2	75	BC													75.0	75.5	
													75.5	J	1	67	P	SR	Cl	0.1	4.0	12						
													75.8	J	1	65	C	R	Ox	-	9.0	15						
	Greywacke	26	76.0	78.5	1.3	N	0.0	5	14	14	R3	W2	77.4	J	3	70	P	R	Ox	-	10.0	14						
													78	J	1	75	P	R	Ca/Ox	0.1	6.0	14						
													78.4	J	1	57	ST	SR	Ox	-	6.0	15						
	Greywacke	27	78.5	83.5	3.5	Y	1.4	15	12	8	R3	W2	80.8	J	2	40	P	R	Ox	0.1	8.0	14						
													81.3	V	2	45	IR	VR	Ox/Ca	0.3	14.0	15						
													81.5	J	1	75	P	SR	Cl	0.1	4.0	10						
													81.9	J	1	79	S	SR	Cl	0.1	4.0	10						
													82.6	J	3	66	ST	SR	Cl	0.2	6.0	14						Sample 81.9' to 82.5' (UCS)
													83	J	1	32	P	R	Cl	0.3	6.0	12						
													83.1	J	1	75	P	R	Sc	0.2	8.0	12						
													83.4	J	2	68	P	SR	Sc	0.2	3.0	8						
	Greywacke	28	83.5	88.5	4.1	N	1.6	10	17	0	R3	W2	84.8	F	1	46	P	R	Bx/Cl	70	10.0	0	84.7	85.0	W/Cl/Bx			
													85.3	J	1	50	P	SR	Bx/Cl	3	8.0	6						
													86.3	J	1	65	P	VR	Cl	0.2	12.0	22						Sample 85.4' to 86.3' (UCS)
													86.8	J	1	40	P	VR	Cl	0.1	14.0	22						
													87.1	J	1	50	P	VR	Cl	0.2	14.0	22						
													87.7	J	1	30	C	VR	Cl	0.9	14.0	22						
													88	J	1	35	P	VR	Cl	1.5	14.0	20						
													88.2	J	3	70	P	VR	Cl	0.2	13.0	22						
	Greywacke	29	88.5	93.5	4.6	N	2.2	15	14	10	R3	W2	88.8	J	1	46	P	R	Cl	0.2	10.0	16						
													89.4	J	2	29	U	R	Ca/Cl	0.3	12.0	17						
													89.7	J	3	52	P	R	Cl	0.1	14.0	16						
													90.2	J	2	52	P	R	Sc/Cl	0.2	10.0	14						
													90.7	J	1	72	P	SR	Cl	0.2	2.0	10						
													91.4	J	1	38	U	R	Ox	-	8.0	17						

			Run Data																												
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge								
																							Gouge			Broken Core				
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													91.6	J	2	59	P	R	Cl	0.2	8.0	14						
													91.8	J	1	33	C	R	Cl	0.3	8.0	14						
													92.6	J	1	84	C	R	Cl	0.1	10.0	16						
													93.2	F	1	70	P	R	G	-	8.0	6	93.2	93.3	Sc			
	Greywacke	30	93.5	96.5	1.9	N	1.0	6	20	15	R3	W2	94.7	J	1	8	IR	VR	Ca	0.2	16.0	23						
													94.8	J	2	65	P	R	Ox	-	10.0	18						Matrix supported; cores well
													95.3	J	1	75	P	VR	Cl	0.1	12.0	23						
													95.8	J	1	65	P	R	Cl	0.5	10.0	15						
													96.1	J	1	55	P	VR	Ox	-	14.0	23						
	Greywacke	31	96.5	101.0	4.0	N	1.7	15	17	12	R3	W2	96.7	J	1	81	P	VR	Cl	0.1	14.0	20						
													97	J	2	58	P	VR	Cl	0.1	12.0	17						
													97.5	J	2	61	P	R	Cl	0.1	12.0	17						
													98	J	1	43	P	VR	Ox	-	16.0	18						
													98.4	J	2	81	P	VR	Ox	-	14.0	15						
													98.7	J	1	36	P	VR	Ox	-	16.0	18						
													99.2	J	1	75	P	VR	Chl/Cl	0.1	14.0	17						
													99.5	J	1	55	P	VR	Ox	-	14.0	17						
													100	J	1	76	P	VR	Chl	0.1	18.0	20						
													100.5	J	1	66	ST	R	Ox	-	10.0	14						
													100.6	J	1	82	P	R	Ox	-	10.0	14						
													100.7	J	1	10	P	VR	Ca	0.5	8.0	12						
	Greywacke	32	101.0	106.0	4.2	N	1.5	12	15	12	R3	W2	101.7	J	2	70	P	VR	Chl	0.1	10.0	16						
													103.1	J	1	73	P	VR	Ca/Ox	0.01	12.0	17						
													103.6	J	1	55	P	VR	Ox	-	12.0	17						
													103.9	J	1	10	U	VR	Cl/Ox	0.1	10.0	16						
													104.3	J	1	60	P	VR	Cl/Ox	0.1	14.0	17						
													104.6	J	1	64	C	VR	Ox	-	10.0	16						
													104.8	J	1	64	P	R	Cl/Ox	0.5	10.0	12						
													105	J	1	65	P	R	Ox	-	12.0	16						
													105.3	J	2	40	P	VR	Sc/Ox	0.2	10.0	14						
													105.7	J	1	30	P	VR	Cl	0.5	10.0	12						
	Greywacke	33	106.0	109.0	2.0	N	0.0	15	13	12	R3	W2	106.5	BC												106.5	107.8	
													108	J	13	10	P	VR	Ox	-	14.0	14						>10 fractures/foot 108' to 109'
													108.1	J	1	75	P	VR	Cl	0.2	14.0	12						
													108.8	J	1	42	P	VR	Cl	0.2	14.0	12						
	Greywacke	34	109.0	112.5	2.3	N	0.0	16	16	12	R3	W2	110.1	J	1	49	ST	R	Ox	-	8.0	20						
													110.6	J	1	38	P	VR	Ox	-	18.0	20						
													111	J	2	50	P	VR	Ox	-	12.0	15						
													111.2	J	10	20	P	VR	Ca	1	18.0	14						>10 fractures/foot 111.2' to 112'
													112.5	J	2	35	U	VR	Ca	1	12.0	12						
	Greywacke	35	112.5	116.5	1.9	N	1.0	2	10	0	R5	W2	114.8	F	1	65	P	R	G	120	10.0	0	114.8	115.4	Bx/Sc			Chlorite alteration; point load test 114'
													116	J	1	75	P	R	Chl	-	8.0	20						Point load test 116'
	Greywacke	36	116.5	122.5	3.2	N	0.7	11	18	14	R3-R5	W2	119.4	J	1	77	P	VR	Chl	0.1	10.0	20						Point load test 119.5'
													119.6	J	1	26	P	VR	Chl	0.1	10.0	20						
													120	J	2	54	P	R	Sc	0.2	8.0	14				120.1	120.5	Sample 121.8' to 122.5' (UCS)
													120.5	J	3	45	P	VR	Ox	-	10.0	20						Point load 121.3'
													120.9	J	1	62	IR	R	Ox	-	8.0	16						
													121.1	J	1	23	P	VR	Ox	-	14.0	20						
													121.4	J	1	49	P	VR	Ox	-	10.0	16						
													121.8	J	1	64	P	VR	Cl	0.1	10.0	16						
	Greywacke	37	122.5	126.0	3.5	N	1.6	12	18	10	R3	W2	122.6	J	1	48	IR	VR	Ox	-	15.0	22						
													122.5	J	3	40	C	VR	Ox	-	15.0	22						
													123.6	J	1	20	P	VR	Cl/Ox	1	14.0	18						Point load 123.7'

			Run Data											Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index													Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													123.7	J	1	55	C	R	Cl/Ox	0.5	10.0	20						
													123.9	J	1	75	ST	SR	Ox	-	8.0	20						
													124.3	J	1	25	P	VR	Cl	0.8	12.0	18						
													124.6	J	1	8	C	R	Cl	0.3	10.0	18						
													124.7	J	1	75	P	S	Cl	0.8	6.0	10						
													125.2	J	1	70	P	SR	Cl	0.1	8.0	18						
													125.6	J	1	80	P	SR	Cl	0.3	8.0	18						
	Greywacke	38	126.0	130.0	3.7	N	1.6	8	17	12	R4	W2	126.4	J	2	20	P	R	Cl	0.3	8.0	16						
													127	J	1	66	P	R	Cl	0.1	8.0	16						Point load 127'
													129	J	1	81	P	R	Ox	-	8.0	18						Point load 128'
													129.3	J	1	66	P	VR	Ox	-	8.0	20						
													129.5	J	1	68	P	R	Cl	0.5	6.0	12						
													129.6	J	1	68	IR	R	Cl	0.2	12.0	20						
													129.8	J	1	48	P	VR	Ox	-	12.0	18						
	Greywacke	39	130.0	134.5	4.1	N	2.2	13	13	0	R3	W2	131.1	F	1	60	P	R	G	30	10.0	0	131.1	131.2	Bx/Cl			
													130.5	J	1	30	P	SR	Cl	0.2	10.0	15						
													130.9	J	1	65	P	SR	Cl	0.1	8.0	15						
													131.5	J	3	60	IR	SR	Cl	0.1	6.0	15						
													131.6	V	1	25	P	SR	Cl	1.1	8.0	8						
													131.7	J	2	75	P	S	Cl	1	4.0	8						
													131.9	J	1	55	P	R	Cl	0.1	4.0	9						
													132	J	1	15	C	VR	Cl	0.1	12.0	20						
													132.6	J	1	58	P	SR	Cl	0.3	6.0	18						
													132.8	J	1	40	ST	SR	Ox/Sc	0.2	6.0	20						1.8 foot section of stick rock; no fractures
	Greywacke	40	134.5	137.0	2.5	N	0.0	1	15	15	R3	W2	134.3	J	1.0	69	P	VR	Cl	0.2	10.0	15						Point load 134.5'
														BC												134.5	137.0	All rubble and re-drill
	Greywacke	41	137.0	141.0	2.4	N	1.3	6		12	R3	W2	138.6	J	1	46	P	VR	Ox	-									Point load 138'
													139.4	J	1	42	P	VR	Cl	0.2									
													139.9	J	1	66	P	R	Cl	0.2									
													140.4	J	3	53	U	R	Cl	0.2									
	Greywacke	42	141.0	143.5	0.6						R3	W2	141	BC												141.0	143.5	All rubble and re-drill
	Greywacke	43	143.5	147.5	3.0	N	2.4	2	23	22	R4	W2	144.1	BC												144.1	144.5	Rubble
													145.6	V	1	36	P	R	Ox	-	10.0	23						Point load 145', 147'
													146.1	V	1	33	C	R	Ox	-	8.0	22						Sample 146' to 147' (UCS)
	Greywacke	44	147.5	150.0	3.3	N	1.4	7	22.0	21	R3/R4	W2	147	J	1	58	C	VR	Chl	<0.5	10.0	22						Point load 149.7'
													148	J	2	30	U	R	Ox	<0.5	8.0	21						Greywacke contact at 149'
													148.3	J	1	35	P	VR	Ox	<0.5	10.0	21						
													149	J	1	20	C	VR	Ox	<0.5	12.0	23						
													149.9	J	1	44	P	VR	Ox	<0.5	15.0	23						
													148.8	J	1	25	P	R	Cl/Ox	<0.5	14.0	22						
	Greywacke	45	150.0	154.5	3.3	N	0.4	17	10	0	R3	W2	151.4	J	4	55	P	SR	Ox/Cl	0.2	6.0	18						
													151.9	J	1	45	P	R	Cl	0.5	8.0	15						
													152.3	J	2	50	P	R	Ox	-	10.0	20						Point load 152.7'
													152.4	J	2	50	P	SR	Cl	0.3	6.0	15						
													152.9	J	2	52	P	K	Cl	0.2	4.0	6						
													153.1	F	1	52	P	K	G	50	4.0	0	153.1	153.3	Bx/Cl			Dipping opposite direction as fault at 153.6'
													153.6	F	1	5	P	R	G	30	4.0	0	153.6	153.7	Bx/Cl			Dipping opposite direction as fault at 153.1'
													154.1	V	2	40	P	SR	Cl	0.3	6.0	13						
													154.3	J	1	65	P	S	Cl	0.2	4.0	8						
													154.4	F	1	30	IR	R	G	>30	8.0	0	154.4	154.5	Bx/Cl			Fault extends to end of run
	Greywacke	46	154.5	156.5	1.8	N	0.0	5	14	13	R3	W2	155	J	1	52	P	R	Ox	<0.5	10.0	14						
													155.4	J	1	49	P	VR	Ox	<0.5	14.0	14						

			Run Data										Detailed Discontinuity Data									Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													155.7	J	1	49	IR	R	Ox	<0.5	8.0	17						
													156	J	1	10	P	VR	Ox	<0.5	14.0	14						
													156.1	J	1	66	P	R	Ox	<0.5	8.0	13						
	Greywacke	47	156.5	158.5	1.9	N	0.9	3	20	12	R3	W2	157.2	J	1	15	C	R	Ox/Cl	0.1	12.0	22						
													157.4	J	1	45	IR	R	-	-	16.0	25						
													158.5	J	1	55	P	SR	Cl	0.5	8.0	12						
	Greywacke	48	158.5	161.5	2.9	N	1.3	6	12	4	R3/R4	W2	159.4	J	1	55	U	R	Ox	-	6.0	20						
													159.7	J	1	50	P	S	Ox	-	2.0	10						
													160.5	J	2	20	U	R	Ox	-	10.0	20						
													161	J	1	45	U	SR	Sc	4	6.0	8						
													161.5	J	1	40	P	SR	Sc	5	6.0	4						
	Greywacke	49	161.5	165.5	2.6	N	0.0	5	17	2	R3	W2	163.2	J	1	70	ST	VR	Ox	-	12.0	22						
													163.6	J	2	20	U	VR	Ox	0.2	14.0	23						
													164.3	J	1	40	P	R	Ox	-	10.0	19						
													164.7	J	1	45	P	R	Ox	0.2	10.0	19						
													164.8	F	1	50	P	R	G	200	8.0	2	164.8	165.5	Bx/Cl			
	Greywacke	50	165.5	168.0	1.5	N	0.0				R3															165.5	168.0	Likely continuation of previous fault
	Greywacke	51	168.0	169.5	1.1	N					R3/R4															168.0	169.5	Rubble
	Greywacke	52	169.5	174.5	3.0	N	0.3	6	16	10	R3	W1	169.5	BC												169.5	172.2	Rubble
													172.3	V	1	55	P	SR	Ca	0.2	6.0	15						
													172.5	J	1	45	P	SR	Ox	-	4.0	15						
													172.6	BC												172.6	173.2	Rubble
													173.2	J	1	52	U	R	Ox	-	8.0	18						
													173.4	J	1	10	P	S	Ox	-	2.0	10						
													174	J	2	2	U	VR	Ox	-	14.0	24						
	Greywacke	53	174.5	178.5	3.8	Y	0.4	13	14	0	R3	W2	174.5	BC														
													175.5	J	1	70	P	R	Ox/Cl	0.1	8.0	20				174.5	175.5	
													175.8	J	2	80	U	R	Ox	-	8.0	20						
													176.1	V	2	55	P	S	Ca	1	4.0	12						Bedding
													176.8	F	1	40	IR	R	G	140	10.0	0	176.8	177.3	Bx/Cl			
													177.4	J	2	0	P	VR	Cl	0.5	14.0	22						
													177.6	V	1	45	P	R	Cl/Ca	1	7.0	12						
													178	J	4	55	P	R	Ox/Cl	0.5	8.0	12						Bedding; fissile area
	Greywacke	84	175.5	180.5	1.9	N	0.7	3	20	19	R3	W2	178.7	V	1	30	P	VR	Cl/Ca	0.6	14.0	22						
													179.1	J	1	30	U	R	Ox	-	11.0	20						
													179.6	V	1	23	P	R	Ca/Ox	0.8	8.0	19						
	Greywacke	85	180.5	185.5	4.3	Y	0.4	17	12	0	R3	W2	181.5	J	2	60	P	SR	Ox	1	6.0	12						
													181.8	F	1	55	P	SR	G	100	6.0	0	181.8	182.0	Bx/Cl			Bedding controlled
													182.5	J	3	60	P	S	Cl/Ox	0.1	2.0	10						Bedding
													182.6	J	1	10	U	VR	Cl/Sp	2	15.0	12						
													183.1	J	2	45	P	S	G	0.5	3.0	10	183.2	183.6	Bx/Cl			
													183.3	F	1	45	P	SR	Cl/Bx	100	8.0	0						
													184.2	J	3	55	P	SR	Cl/Ox	0.1	4.0	20						
													184.8	J	1	50	P	SR	Cl/Ox	0.1	4.0	20						
													184.9	J	1	15	P	R	Cl/Ox	0.1	8.0	22						
													185.3	J	1	60	IR	VR	Ox	-	14.0	24						
													185.5	J	1	40	P	R	Cl	2	8.0	6						
	Greywacke	86	185.5	188.5	2.7	N	0.4	7	8	0	R3	W2	186	F	1	50	P	SR	G	80	6.0	0	186.0	186.3	Bx/Cl			
													186.4	J	1	70	IR	VR	Ox/Cl	0.1	16.0	22						
													187	F	1	20	P	SR	Bx/Cl	6	10.0	0						
													187.7	J	3	80	P	SR	Ox/Cl	0.3	8.0	18						

			Run Data											Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index													Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													188	F	1	50	P	SR	G	8	6.0	2	179.9	188.0	Bx/Cl			Point load 188.3'
	Greywacke	87	188.5	192.5	3.3	N	0.4	8	15	0	R3	W2	189.3	J	1	35	P	SR	Cl/Ox	0.1	8.0	20						Calcite veins
													190	J	3	42	P	SR	Cl/Ox	0.1	8.0	20						Point load 190.2'
													190.5	V	1	38	P	SR	Ox	-	6.0	19						
													190.9	J	1	45	P	SR	Ox	-	6.0	19						
													191.1	J	1	45	P	R	Cl	3	8.0	10						
													191.2	F	1				G	200		0	191.2	192.5	Bx/Cl			Mixed broken core, Bx, and clay interpreted as fault
	Fault Breccia	88	192.5	195.5	2.6	N	0.0	27	7	0	R3	W2	193.1	J	1	65	P	SR	Ox	-	6.0	12						
													193.2	J	1	25	P	SR	Cl	1.1	6.0	8						
													193.5	F	1	55	IR	SR	G	20	6.0	0	193.5	193.6	Cl/Bx			
													193.9	F	1	50	P	SR	G	60	6.0	0	193.8	194.0	Cl/Bx			
													194	J	20			SR	Ox	-	6.0	12						>10 fractures/foot 194' to 194.9'
													195	J	1	20	P	SR	Cl	1.2	7.0	8						
													195.2	J	2	50	P	SR	Cl	0.2	8.0	10						
	Fault Breccia	89	195.5	199.5	3.9	N	0.0	30	16	15	R3	W2	195.6	BC												195.6	196.3	Highly fractured; >10 fractures/foot almost entire run
													196.3	J	22	65	P	SR	Ox/Cl	0.2	6.0	16						Joint set ~ every 1-2" entire run
													196.6	J	2	10	C	SR	Ox/Cl	0.1	7.0	16						
													197.8	J	2	0	IR	SR	Ox/Cl	-	4.0	15						
													198.5	J	2	0	P	SR	Ox/Cl	0.2	4.0	15						
	Fault Breccia	90	199.5	202.5	2.0	N	0.0	7	10	0	R3	W2	199.5	BC															
													191.2	J	1	60	P	R	Cl	0.3	8.0	20						
													191.4	J	1	45	P	VR	Ox/Cl	0.3	10.0	12						
													191.5	J	1	15	P	SR	Cl	1.2	6.0	6						
													191.9	J	3	55	P	SR	Ox/Cl	0.5	8.0	12						
													202	F	1				G	70		0	202.0	202.5	Bx/Cl			Clay and broken core at end of run interpreted as fault
	Fault Breccia	91	202.5	203.5	1.2	N	0.0	3	8	0	R3	W2	202.5	V	1	20	P	R	Ca/Cl	1.2	8.0	11						
													202.6	J	2	45	C	SR	Cl	0.5	5.0	13						
													202.7	F	1	35	U	SR	G	200		0	202.7	203.5	Bx/Cl			Fault extends to end of run
	Greywacke	92	203.5	206.0	2.5	N	0.9	7	13	9	R2	W2	203.6	J	1	85	IR	VR	Cl	0.2	15.0	20						Highly fractured; clay filled joints that hold together as core
													204.2	S	1	68	P	SR	Cl	0.5	4.0	12						Point load 203.8'
													204.6	J	2	58	ST	R	Cl	0.2	8.0	15						
													205.3	S	1	30	P	SR	Cl	0.3	6.0	10						
													205.35	J	1	40	P	SR	Cl	0.2	6.0	10						Point load 205.5'
													205.8	S	1	68	P	SR	Cl	0.1	4.0	9						
	Greywacke	93	206.0	208.5	2.4	Some	1.2	6	12	11	R2	W2	206.2	J	1	25	P	R	Cl	0.8	6.0	11						
													206.3	J	2	55	P	SR	Cl	0.5	4.0	9						Point load 206'
													207.2	J	1	38	P	R	Cl	0.1	6.0	16						
													207.5	J	2	20	P	SR	Cl	0.1	4.0	11						Point load 207'
													208.2	BC												208.2	208.5	
	Greywacke	94	208.5	210.5	2.0		8.0	9	10	7	R3	W2	208.6	J	3	48	P	SR	Cl	0.3	6.0	13						
													209.3	S	2	48	P	SR	Cl	0.3	4.0	10						
													209.7	S	2	46	P	SR	Cl	0.3	4.0	10						
													210.3	J	1	45	C	SR	Cl	1.1	5.0	7						
													210.5	J	1	44	C	R	Cl	0.5	8.0	11						
	Greywacke	95	210.5	213.5	2.9	N	1.5	9	10	0	R3	W2	210.7	J	2	80	P	VR	Cl	1.1	14.0	20						
													211.4	J	1	75	C	SR	Cl	0.3	6.0	13						
													212	J	2	40	P	SR	Cl	0.4	4.0	11						Point load 211'
													212.3	S	2	40	P	SR	Cl	0.8	4.0	10						
													212.8	F	1	42	P	SR	G	25	8.0	0	212.7	212.8	Cl/Bx			
													213.1	S	1	35	P	R	Bx/Cl	4	8.0	3						
	Greywacke	96	213.5	214.5	1.0	N	0.0	10	15	3	R3	W2	213.6	J	6	35	P	R	Cl/Ox	0.5	7.0	12				213.6	214.2	Core has been disturbed

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													214.1	J	1	80	P	R	Ox	0.2	8.0	20						
													214.5	J	1	65	P	SR	Cl/Ox	0.3	4.0	13						
	Greywacke	97	214.5	215.5	1.2	N	0.0	3	19	15	R3	W2	214.5	J	1	60	P	R	Cl/Ox	0.1	8.0	15						
													214.7	J	1	45	P	VR	Cl/Ox	0.1	14.0	19						
													215	J	1	38	IR	R	Cl/Ox	0.1	10.0	22						
													215.2	BC												215.2	215.5	
	Greywacke	98	215.5	218.5	2.0	N	0.5	8	8	0	R2	W3	216.2	J	2	50	ST	VR	Cl	0.5	8.0	10						
													216.8	J	2	50	P	R	Cl	0.2	6.0	8						Many healed fractures
													217.4	J	3	42	P	R	Cl	0.3	8.0	12						
													217.7	F	1	40	P	SR	G	80	10.0	0	217.7	218.5	Bx/Cl			Point load 216.2
	Greywacke	99	218.5	221.5	3.0	N	0.9	11	11	0	R3	W2	219	J	1	25	P	SR	Cl/Ox	0.5	5.0	12						
													219.5	F	1	45	P	SR	G	80	6.0	0	219.5	219.9	Bx			
													220.4	J	4	48	P	SR	Cl/Ox	0.5	4.0	12						
													220.5	J	3	20	P/C	SR	Cl/Ox	0.5	4.0	12						
													221.3	J	2	40	P	R	Ox	-	10.0	17						Point load 220.5'
	Fault Breccia	100	221.5	222.5	1.0	N	0.0	4	7	0	R3	W2	221.4	J	2	55	P	SR	Cl/Bx	0.5	6.0	13						
													221.6	F	2	35	P	SR	G	150	10.0	0	221.6	222.5	Bx/Cl			
	Fault Breccia	101	222.5	224.5	1.6	N	0.0	25	3	3	R1/R2	W3	222.5	J	25	~30	P	S	G	1.1	2.0	1	222.5	224.5	Bx/Cl			>10 fractures/foot entire run
	Fault Breccia	102	224.5	228.0	2.5	N	0.0	100	0	0	R0/R1	W3	224.5	F		0-30	P/C					0	224.5	228.0	Bx			>10 fractures/foot entire run
	Fault Breccia	103	228.0	232.5	4.0	N	0.4	100	4	0	R3	W3	228	F					G			0	224.5	228.0	Bx			>10 fractures/foot entire run
													230	J	15	50	P	SR	Cl	0.5	8.0	8						Joint set; point load 230' and 232'
	Fault Breccia	104	232.5	233.5	1.0	N	0.0	100	4	0	R3	W3	332	F					G			0	232.5	233.5	Bx			>10 fractures/foot; fault zone
													233	V	1	55	P	SR	Ca/Cl	0.2	8.0	8						
	Fault Breccia	105	233.5	237.5	4.0	N	0.0	107	11	0	R0	W3	233.5	F	100				G	2.5		0	233.5	236.0	Cl/Bx			Fault zone; >10 fractures/foot 233.5' to 236'
													236.2	J	2	40	P	R	Ox	1	8.0	22						
													236.6	J	3	35	P	SR	Cl/Ox	1.1	6.0	8						
													237.1	V	2	65	P	SR	Ox	0.1	4.0	12						
													237.2	BC												237.2	237.5	
	Fault Breccia	106	237.5	238.5	0.5	N	0.0				R3		237.5	BC												237.5	238.5	
	Fault Breccia	107	238.5	241.0	2.5	N	0.0	15	13	0	R3	W2	238.5	F	1	40	P	SR	G	60		0	238.5	239.1	Cl/Bx			
													239.2	J	3	42	P	S	Cl	0.5	1.0	6						
													239.8	J	1	40	P	R	Ox.Cl	0.2	8.0	15						
													240.1	J	2	30	P	SR	Ox.Cl	0.5	6.0	10						
													240.3	J	2	44	P	SR	Ox.Cl	0.2	8.0	15						
													240.4	J	3	20	P	SR	Ox.Cl	0.2	8.0	15						
													240.6	J	1	70	P	S	Ox.Cl	0.2	3.0	10						
													240.7	J	1	40	C	R	Ox.Cl	0.1	8.0	21						
													240.7	J	1	50	P	R	Ox.Cl	0.2	8.0	22						
	Fault Breccia	108	241.0	242.5	1.5	N	0.5	7	12	4	R3	W2	241.2	J	1	46	C	SR	Ox/Cl	0.1	6.0	18						
													241.3	J	3	40	P	SR	Ox/Cl	0.5	6.0	12						Point load
													241.5	J	1	55	P	SR	Cl	1.1	6.0	9						
													242	J	2	30	C	SR	Ox/Cl	0.5	4.0	8						
	Fault Breccia	109	242.5	246.0	3.0	N	0.6		12	7			243	V	1	20	P	R	Ox/Cl	0.5	8.0	20						
													243.6	BC												243.6	244.4	
													244.5	J	1	75	P	S	Cl	0.2	1.0	7						
													244.6	J	1	30	P	S	Ox/Cl	0.3	2.0	7						
													244.7	BC												244.7	245.8	Likely fault in here; some clay and gouge present
													245.9	J	1	26	P	SR	Cl	0.5	8.0	12						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greywacke	110	246.0	251.0	5.0	N	3.6	10	16	10	R3	W2	247.2	J	1	75	C	SR	Ox/Cl	0.1	6.0	18						Calcite veins
													247.8	V	1	47	P	SR	Ca/Cl	0.8	8.0	13						
													248.2	V	1	30	P	SR	Ca/Cl	0.2	8.0	17						
													249.5	J	3	54	C	VR	Cl	0.2	14.0	23						Sample 246.5' to 247.5
													250.2	J	1	68	P	SR	Cl	0.5	6.0	16						Point load
													250.5	J	2	55	P	SR	Ca/Cl	0.3	3.0	10						
													250.6	V	1	24	ST	R	Ca/Cl	1	7.0	13						
	Greywacke	111	251.0	253.0	2.1	N	1.0	4	19	14	R3	W2	251	J	1	30	C	R	Cl/Ox	0.1	7.0	21						Calcite veins
													251.3	J	1	20	ST	R	Ox	-	8.0	24						Point load
													252.2	J	1	54	C	R	Cl/Ox	0.2	8.0	18						
													252.7	J	1	80	P	R	Cl	0.5	9.0	14						
	Greywacke	112	253.0	258.0	5.0	N	4.2	7	17	8	R3	W2	253.8	V	1	32	P	R	Ox/Ca	0.5	12.0	22						Point load
													254.8	V	1	62	P	R	Ca/Cl	0.5	10.0	18						Sample 254' to 254.5'
													256.5	V	1	18	P	R	Cl	0.2	6.0	18						
													256.6	J	1	70	P	R	Cl	0.3	8.0	19						
													257.3	J	1	32	C	S	Cl	0.4	3.0	8						
													257.7	J	1	65	IR	SR	Ox/Cl	0.2	6.0	19						Point load
													257.8	J	1	25	C	SR	Cl	0.5	6.0	18						
	Greywacke	113	258.0	259.5	1.5	N	0.0	4	6	0	R3	W2	258	F	1.0	5	C	VR	Bx/Cl	5	12.0	0						
													258.3	J	1.0	60	P	R	Cl	3	10.0	6						
													258.6	V	1.0	32	P	SR	Cl	1.1	6.0	6						
													258.8	J	1.0	0	C	R	Cl	0.9	10.0	12						
	Greywacke	114	259.5	263.5	4.0	N	4.0	0			R3	W1	261	B	40													Bedding? Fabric/ dipping 40 degrees; no fractures
	Greywacke	115	263.5	268.5	4.8	N	4.4	6	18	13	R3	W2	264.3	J	1	70	P	VR	Ox		12.0	25						
													264.6	J	1	15	P	SR	Ox		6.0	15						
													264.8	V	1	50	P	R	Ca		12.0	24						Fabric 34 degrees
													266.1	J	1	55	P	SR	Cl	0.2	34.0	13						Point load
													267.4	V	1	20	P	SR	Cl/Ox	0.2	6.0	18						
													268.2	J	1	45	P	SR	Cl	0.2	4.0	14						
	Greywacke	116	268.5	270.0	2.1	N	1.8	2	9	0	R3	W2	261.6	F	1	38	P	SR	G	9	6.0	0	261.6	261.7	G			
													261.8	V	1	25	P	SR	Cl/Ca	0.2	5.0	18						
	Greywacke	117	270.0	273.0	3.0	N	0.5	13	20	0	R3	W2	270.2	J	1	8	C	R	Ox		6.0	20						
													270.4	J	1	55	P	R	Ox		8.0	20						
													271.2	J	2	40	P	R			10.0	22						
													271.3	J	1	30	P	R	Ca	2	10.0	22						
													271.6	J	3	42	C	SR	Ox/Ca	0.5	8.0	20						
													272	J	2	18	P	VR			10.0	20						
													272.4	J	2	55	C	SR	Cl	0.5	6.0	18						
													272.5	BC												272.5	273.0	
													272.8	F	1	40	P	SR	G	15	10.0	0	272.8	272.9	G			
	Fault Breccia	118	273.0	278.0	5.0	Y	0.0	24	12	0	R2/R3	W2	273	F	52	40	P	SR	G	8	6.0	0	273.0	273.5	Bx			
													274	J	4	40	P	SR			8.0	12						
													274.5	J	2	60	IR	R			12.0	18						
													274.6	J	1	0	C	SR			8.0	19						
													275.2	J	5	25	P	SR	Ox/Cl	0.3	5.0	13						
													276	J	2	80	P	R	Ox	0.2	8.0	18						
													276	J	1	10	C	SR	Ox		6.0	17						
													276.5	S	2	25	P	S	Cl	1.1	3.0	6						
													277	J	2	75	P	S	Cl	0.8	3.0	7						
													277.5	J	1	10	C	SR	Cl	0.5	5.0	12						
													277.8	J	2	60	P	SR	Cl	0.1	4.0	10						

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greywacke	119	278.0	283.0	3.3		0.4	62	14	0	R2/R3	W2	278	BC	50	30			Ox							378.0	380.5	>10 fractures/foot; disturbed core
													280.9	F	1	38	P	SR	G	60	10.0	0	280.9	281.3	Bx			
													282	J	3	35	P	SR			6.0	20						
													282	J	2	60	P	R			10.0	20						
													282.5	J	2	60	C	R			8.0	24						
													282.8	J	2	50	C	SR	Cl	1.1	5.0	6						
	Greywacke	120	283.0	288.0	4.4	N	1.7	20	14	0	R3	W2	283.8	J	2	40	C	SR	Cl	0.5	6.0	15						
													284.5	J	5	60	IR	R	Ox		8.0	20						
													284.6	J	1	5	U	R	Ox/Cl	1.1	8.0	10						
													285.2	J	4	80	C	R			9.0	20						
													285.5	F	1	80	P	SR	G	35	8.0	0	285.5	285.6	Cl/Bx			
													286	J	1	78	C	R	Cl	0.8	10.0	18						
													286.2	J	1	50	P	SR			6.0	20						
													286.6	J	2	70	P	S	Cl	0.2	3.0	10						
													286.8	J	1	30	P	SR	Cl	0.5	4.0	10						
													287.3	V	1	85	P	SR	Ca	0.5	8.0	18						
													288	V	1	42	P	SR	Ca	0.2	6.0	17						
	Greenstone	121	288.0	291.5	3.5	Some	1.1	22	13	0	R3	W2	288.1	J	1	50	U	VR			15.0	24						
													288.8	J	3	38	P	SR	Cl	0.5	10.0	15						
													289.2	J	10	30-70					8.0	12						>10 fractures/foot 289.1' to 289.7'
													289.6	F	1	70	P	SR	G	20	10.0	0	289.6	289.7	Bx			
													290.2	J	7	55	P	SR	Cl	0.1	5.0	12						Joint set
	Greenstone	122	291.5	294.5	2.9	Y	1.7	8	17	15	R3	W2	292.3	J	1	35	P	SR	Cl	0.2	6.0	15						
													292.8	J	1	40	P	R	Cl	0.2	12.0	17						
													293.8	J	3	50	P	SR			10.0	18						
													294	J	1	45	P	SR			7.0	18						
													294.3	J	2	50	P	SR	Cl	0.2	7.0	17						
	Greenstone	123	294.5	298.5	3.7	Y	1.9	11	14	0	R3	W2	295.4	J	2	34	P	R	Cl	0.8	6.0	18						
													295.7	J	1	0	C	R	Cl	0.5	6.0	18						
													296.2	J	3	25	U	VR	Cl	0.3	13.0	24						
													296.4	J	1	25	P	R	Cl	1.1	10.0	13						
													296.7	F	1	45	P	SR	G	11	8.0	0	296.7	296.8	Bx			
													296.8	J	1	45	P	SR			4.0	18						
													297.2	F	1	45	P	SR	G	22	8.0	0	297.2	297.3	Bx			
													298.4	V	1	65	C	SR	Ca	0.8	8.0	18						Point load
	Greenstone	124	298.5	303.3	4.7	N	1.6	7	13	0	R3	W2/W3	299.2	J	2	35	P	SR	Cl/G	1.2	6.0	7						
													300.2	V	2	48	P	SR	Ca	1	4.0	19						
													300.5	J	1	10	C	R	Cl	0.1	8.0	20						
													301.3	J	1	45	ST	R	Cl	0.1	6.0	19						
													300.6	F	1	50			G			0	300.6	303.5	Cl/Bx			Fault breccia
	Fault Breccia	125	303.5	305.5	2.2		0.0	NA	0	0	R0/R1	W3	303.5	F		30	P		G			0	303.5	305.2	Bx			
													305.2	F		45	P		G	100		0	305.2	305.5	G			Breccia and gouge entire run
	Fault Breccia	126	305.5	309.0	1.7		0.0		0	0			305.5	F					G			0	305.5	309.0	Bx			
	Fault Breccia	127	309.0	312.0	2.8		0.6	2	0	0	R0/R1	W3	309.2	F	1	30	P		G	200		0	309.2	310.6	Bx			R3 clasts
													310.8	F	1	35	P		G			0	310.8	312.0	Bx			
	Fault Breccia	128	312.0	314.5	1.4		0.0	NA	0	0	R0	W3	312	F					G			0	312.0	314.5	Bx			R3 clasts; Sample 309' to 310'
	Fault Breccia	129	314.5	317.0	2.2		0.0	8	5	0	R0	W2	314.5	F	1	55	P		G	180		0	314.5	315.3	Bx			
													315.2	J	4	5	P	S	Cl	0.3		10						
													315.5	F	1	50	P	S	G	150		0	314.5	316.0	Bx			
													316.3	J	1	30	P	SR	Cl	0.2	6.0	13						
													316.5	F	1	48	P	R	G	140		0	316.5	317.0	G	S		

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Fault Breccia	130	317.0	318.0	0.9	N	0.0	NA	0	0			317	F	1							0	317.0	318.0	Bx			
	Fault Breccia	131	318.0	319.0	1.0	N	0.0	NA	0	0	R0/R1	HW	318	F	1	57	P	R	Chl/Cl		8.0	0	318.0	319.0	Bx			>10 fractures/foot
	Fault Breccia	132	319.0	321.5	2.0	N	0.9	11	20	0	R3	W2	319.6	J	2	80	IR	VR			14.0	23						
													319.7	J	2	0	C	VR			14.0	23						
													320.2	J	2	30	P	SR	Cl	0.5	6.0	13						
													320.3	J	3	30	IR	SR			8.0	20						
													321	J	1	8	U	R	Cl	0.1	10.0	20						
													321.3	F	1	30						0	321.3	321.5	G			Fault goes to end of run
	Fault Breccia	133	321.5	324.5	3.0	N	0.5	>10	7	6	R1/R2	HW	321.5	J	1	41	U	R	Chl/Cl	<1	10.0	8						
													322	F	1	61	U	R	Chl/Cl		9.0	6	322.0	324.5	Bx			
	Fault Breccia	134	324.5	325.5	0.9	N	0.0	15	4	0	R1	HW	324.5	F	1	56	I	R	Chl/Cl	0.4"	12.0	0	324.5	324.9	Bx			
													324.9	J	1	28	P	R	Chl/Cl	2	8.0	8						
	Fault Breccia	135	325.5	327.5	2.0	N	0.0	11	22	18	R3	W2	325.7	J	1	58	P	SR	Cl	0.5	6.0	18				325.5	326.5	Lots of chlorite
													326	J	2	25	P	R			8.0	22						
													326.6	J	2	48	P	R			8.0	22						
													326.8	J	3	38	C	R			10.0	23						
													327	J	2	15	C	R			10.0	23						
													327.2	J	1	30	P	SR			8.0	22				327.0	327.5	
	Graywacke	136	327.5	331.5	4.0	N	2.2	12	9	0	R3	MW	372.5	J	1	59	U	R		0.5	6.0	0				327.5	328.0	
													328	J	1	46	U	R	Chl	<1	7.0	12						
													329	J	3	57	U	R	Cl/Chl	<1	10.0	12						
													329.9	J	1	59	U	R			7.0	11						
													330.7	J	1	71	U	R	Cl/Chl	<1	8.0	10						
													331	J	1	41	P	R	Chl	<1	8.0	10						
	Greywacke	137	331.5	332.5	1.0	N	0.5	3	14	13	R3	W2	331.5	J	2	50	C	VR			10.0	15						
													331.6	BC												331.6	332.0	
													332.2	V	1	50	P	SR	Ca/Cl	0.3	7.0	13						
	Greywacke	138	332.5	335.5	3.0	N	0.9	12	11	7	R3	MW	332.7	J	1	36	C	VR	Cl/Chl	<1	14.0	15						
													332.9	J	1	31	P	R	Cl/Chl	<1	10.0	12						Oxidized infill
													333.1	J	1	64	P	R	Bx/Chl	3	10.0	7				333.1	333.6	
													333.6	J	1	57	U	V	Ox/Chl	<1	11.0	14						
													333.8	J	1	50	P	R	Ox/Chl	<1	9.0	12						
													334.4	J	1	40	U	R	Ox/Chl	<1	10.0	12						
													334.5	J	1	44	U	R	Ox/Chl	<1	10.0	10						
													335.1	J	1	55	U	R	Ox/Chl	<1	11.0	8						
	Greywacke	139	339.5	338.5	3.6	N	0.4	14	15	10	R3	W2	335.3	J	2	70	P	R			8.0	18						
													335.4	J	1	0	C	R			8.0	18						
													335.9	J	3	56	P	R			7.0	18						
													336.4	J	1	25	P	R			14.0	22						
													336.8	V	1	50	P	R	Ca/Cl	1.1	8.0	10						
													337.3	J	2	0	C	SR			4.0	13						Point load
													337.9	S	2	60	P	SR	Cl/Bx	1.5	4.0	7						
													338	S	2	25	P	SR	Cl	1.1	5.0	10						
	Greywacke	140	338.5	341.5	3.0	N	0.5	12	11	0	R2	MW	338.6	J	2	43	P	R	Ox/Chl	<1	10.0	12						
													338.9	J	3	36	P	R	Chl	<1	8.0	9						
													339.7	J	1	51	U	R	Ox/Chl	<1	12.0	15						
													340	J	1	37	U	R	Chl/Cl	<1	13.0	15						
													341.3	J	1	65	P	S	Ca/Cl	0.25	4.0	0				340.3	340.9	
													340.9	J	1	45	P	R	Chl	<1	9.0	10						
													341	J	1	25	P	R	Chl	<1	10.0	13						

			Run Data										Detailed Discontinuity Data									Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Fault Breccia	141	341.5	343.5	2.2	N	0.5	9	18	12			341.5	BC													
													341.6	J	2	25	P	SR			6.0	20						
													342	J	2	28	P	SR	Ox		8.0	20						
													342.5	J	3	44	P	S	Cl	0.5	4.0	12						Joint set
													342.8	J	2	50	P	SR			8.0	19						Point load
	Fault Breccia	142	343.5	348.5	4.0	N	0.0	15	8	0	R2	HW	343.5	F	1	46	G/Bx	R	Chl/Cl	1 ft.	10.0	0						
													346	J	2	49	U	R	Chl	<1	12.0	14						
													346.5	F	1	70	P	S	Chl/Cl	3 cm	8.0	0						
													347	J	2	64	P	R	Ox/Chl	<1	10.0	12						
													347.7	J	2	25	P	S	Ox/Chl	<1	6.0	9						
													348.2	J	1	73	U	R	Chl	<1	13.0	14						
	Greywacke	143	348.5	351.5	3.8	N	0.5	14	19	18	R3	W2	348.5	J	2	20	P	R	Ox	0.2	8.0	20				348.5	348.8	
													348.6	J	2	70	C	R	Ox	0.2	8.0	20						
													349	J	4	45	P	R	Chl	0.1	8.0	20						
													349.8	J	2	45	P	R	Chl		6.0	19						
													350.4	J	1	10	P	SR	Cl	0.2	7.0	19						
													350.5	J	3	50	P	SR			4.0	18						
													350.8	BC												350.8	351.5	
	Greywacke	144	354.5	355.5	4.8	N	1.8	11	11	0	R3	W2	352.2	S	1	60	P	S	Chl/Cl	1.5	2.0	7						
													352.8	V	1	40	P	R	Ca	1	8.0	13						
													353	S	1	50	P	S	Chl/Cl	0.8	3.0	8						
													353.4	J	2	40	P	SR	Chl/Ca	0.5	6.0	12						Point load
													353.8	F	1	45	P	SR	G	20	8.0	0	353.8	353.9	G			
													354.2	J	2	65	P	SR	Chl/Cl	0.5	4.0	12						
													354.4	J	1	25	P	SR	Ox		6.0	15						
													355.4	J	2	48	C	R	Ox	0.1	12.0	19						
	Greywacke	145	355.5	356.5	0.0																							
	Greywacke	146	356.5	361.5	4.7	N	3.0	9	20	18	R3	W2	357.8	J	3	61	P	R	Chl	0.5	8.0	20						
													358.5	J	1	45	P	S	Cl/Chl	0.1	3.0	18						
													359.7	J	2	40	C	VR	Cl/Chl	0.2	14.0	22						
													360.5	J	1	45	P	R	Ca/Chl	0.1	10.0	20						
													361.2	J	2	58	P	R			8.0	18						
	Greywacke	147	361.5	366.5	4.5	N	4.0	4	18	16	R3	W2	363.5	J	2	5	C	R	Cl/Ox	0.5	8.0	16						
													363.4	J	1	80	IR	R	Ox		8.0	17						
													364.6	J	1	70	IR	VR	Cl/Chl	0.1	12.0	20						
	Greywacke	148	366.5	368.5	2.1	N			20	12			366	J	2	45	IR	R	Cl	0.1	10.0	22						
													366.8	J	1	15	C	R	Ox/Cl	0.1	12.0	23						
													366.9	J	1	30	C	R	Cl	0.1	12.0	23						
													368.5	J	1	25	P	S	Ox/Cl		4.0	12						
	Greywacke	149	368.5	373.5	5.0	N	1.2	15	19	10	R3	W2	369	V	1	31	P	VR	Cl	0.5	12.0	18						
													369.3	J	1	30	C	VR	Cl	0.5	14.0	20						
													370	J	1	80	P	R			14.0	23						
													370.8	J	1	75	ST	R	Ox		12.0	23						
													371.2	J	3	35	P	SR	Cl	1.1	8.0	10						
													371.4	J	3	45	C	SR	Ox		7.0	15						
													371.8	J	1	45	P	R	Ox	0.2	10.0	20						
													372.3	J	1	25	P	VR	Ox		12.0	22						
													372.7	J	2	75	C	R	Chl/Cl	0.1	8.0	20						
													373.2	J	1	24	C	SR			8.0	20						
	Greywacke	150	373.5	378.5	2.8	N	1.8	1	0	0	R3	W3	376	F	1	P		S	G	1.5 ft	1	0.0	0	375.5	376.6	Bx			
													377	V	5	P												Vein set parallel to fault 40 degrees

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	151	378.5	382.5	3.4	N	0.0	2	0	0	R0/R1	W4	380	F	1	30	P	SR	G		4.0	0	380.0	381.0	Bx			>10 fractures/foot entire run
													381.1	F	1	5	U		G			0	381.0	382.5	Bx			Near vertical contact at 378 feet
	Limestone	152	382.5	383.5	1.2	N	0.0	1	0	0	R0/R1	W4	382.5	BC												382.5	383.5	
													383.3	F	1	30	P	SR	G			0	383.0	383.5				
	Limestone	153	383.5	386.0	2.5	N	0.7	2	9	0	R3	W2	384.5	J	1	50	P	SR	Cl	0.5	4.0	18						
													384	F	1		C		G			0	384.0	384.2	G			
													384.3	BC												384.3	386.0	Rubble/redrill
	Limestone	154	386.0	386.5	0.4	N	0.0	1	20	20	R4	W2	386	J	1	20	P	SR	1	1	4.0	20				386.0	386.5	Rubble/redrill; very difficult drilling
	Limestone	155	386.5	387.5	0.8	N	0.0				R4	W2														386.5	387.5	Rubble/redrill
	Limestone	156	387.5	388.0	0.5	N	0.0				R4	W2														387.5	388.0	Rubble/redrill
	Limestone	157	388.0	393.0	1.0	N	0.0				R0/R4	W2											388.0	388.1	Cl	388.0	393.0	Rubble/redrill
	Limestone	158	393.0	395.0	1.0	N	0.4		18	18			393	J	1	35	P	SR			4.0	18						
													393.4	J	2	32	P	S			3.0	18						
													393.5	BC												393.5	395.0	Rubble/redrill
	Limestone	159	395.0	397.0	0.7	N	0.0				R4	W2														395.0	397.0	Gravel size rubble/redrill
	Limestone	160	397.0	401.5	2.0	N	0.0	4	19	18	R4	W2	400.7	J	1	60	C	SR			8.0	20				397.0	401.0	Rubble/redrill; gravel size to coarse sand
													401	J	2	70	P	SR			5.0	18						
													401.2	J	1	8	C	SR	Cl	0.1	5.0	18						
	Limestone	161	401.5	404.5	1.5	N	0.0				R4	W2	403	BC									403.0	403.1	G	401.5	404.5	Rubble/redrill; some gouge present indicating fault
	Limestone	162	404.5	407.0	2.3	N	0.4	20	12	12	R4	W2	406.4	J	1	50	P	S	Cl	1	6.0	12						Shattered rock
	Limestone	163	407.0	409.0	1.1	N	0.0	10			R4	W2																Shattered rock; some clayey gouge
	Limestone	164	409.0	412.5	2.2	N	0.0	15			R4	W2																Shattered rock; milled material; some Sc gouge; no structures preserved
	Limestone	165	412.5	415.5	2.7	N	0.0	25			S4	W3											412.5	413.7	Sc			Sc gouge with few larger pebble clasts; below 413.7 milled Gc with shattered fragments of limestone
	Limestone	166	415.5	417.5	2.0	N	1.3	15	6	6	R4	W3	416.6	J	1	30	P	R	Gc	2	8.0	6						Continuous break in shattered core; extensive milled, gravelly clay infilling
	Limestone	167	417.5	422.5	2.9	N	1.3	15	12	12	R4	W3	418.7	J	1	30	P	R	Cl	C	10.0	12						Top of run Sc, strength S4; below 419.3 milled fragments
	Limestone	168	422.5	424.0	1.9	N	0.9	20			S4	W3																Entire run highly fractured Gc held together with clay infill
	Limestone	169	424.0	429.0	2.5	N	0.0	25			R4	W3																Entire run milled Gc with 0.9-foot zone of shattered limestone; no structural fractures observable
	Limestone	170	429.0	432.0	1.3	N	0.0	20			S4/R4	W3																Reworked fragments at top of run; below few clasts supported in Sc gouge; no solid recovery
	Limestone	171	432.0	434.0	1.4	N	0.0	20			S4/R4	W3																Top half of recovery milled Gc gouge with small clasts; bottom half of reworked limestone fragments; no clay
	Limestone	172	434.0	438.0	2.2	N	0.5	5	12	12	R3	W3	437.2	J	1	35	P	R	Cl	C	8.0	12						Sample 437.2' to 437.7' limestone with chert nodule; majority of run milled pieces of Sc gouge, bottom 0.2 feet
	Limestone	173	438.0	442.5	3.4	N	1.3	20	0	0	R3	W2	440.7	F	1	50	P	R	Sc	13	4.0	0	441.4	442.5	Gc			
	Limestone	174	442.5	444.0	1.7	N	0.0	20			R3	W2											442.5	443.4	Gc			Below 443.4 recovery small solid pieces, framented

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	175	444.0	447.0	2.6	N	0.4	10	6	6	R3	W2	445.1	J	5	40	P	R	Sc	3	10.0	6						Series of parallel fractures over 1-foot interval through limestone with small chert nodules
																							446.3	447.0	Sc			Milled gouge
	Limestone	176	447.0	450.0	2.7	N	0.0	20	12	12	R3	W2											447.7	448.3	Gc			Milled sandy clay with small (<10mm) gravel chips
													449	J	1	70	P	S	Ca	1	4.0	12						
	Limestone	177	450.0	452.0	1.7	N	1.5	2	6	6	R3	W2	450.9	J	1	30	P	R	Ca	2	10.0	12						
													451.8	J	1	20	P	R	Cl	10	8.0	0						Limestone/Sc gouge contact
	Limestone	178	452.0	454.0	1.5	N	0.6	1	12	12	R3	W2	453.8	J	1	45	P	R	Cl	C	10.0	12						Run to 453.4' fragmented
	Limestone	179	454.0	457.0	1.2	N	0.0	5			R3	W2																Poor recovery; run broken into loose fragments
	Limestone	180	457.0	461.0	3.3	N	0.6	25			R3	W2											457.6	459.8	Gc			Most of run milled gouge with variably sized chips in Sc matrix; hard rock core highly broken
	Limestone	181	461.0	464.0	2.9	N	0.5	30	8	0	S4/R3	W2											461.0	462.0	Gc			Milled gravely clay
													462	J	1	50	P	R	Ca	2	12.0	0						Gouge/limestone contact
													462.9	J	1	50	P	R	Cl	C	14.0	12						
													463.6	J	1	60	P	R	Cl	1	14.0	12						
	Limestone	182	464.0	467.0	2.7	N	0.0																			464.0	467.0	Entire run rubble recovery, coarse gravel
	Limestone	183	467.0	468.0	0.6	N	0.0	5			R3	W2														467.0	468.0	Rubble recovery
	Limestone	184	468.0	471.0	1.5	N	0.0	10	20	20	R3	W2	470	J	1	70	P	R			8.0	20						Entire run rubble; measured break possible mechanical fracture
	Limestone	185	471.0	474.0	0.5	N	0.0	10			R3	W2																Entire run redrilled fragments
	Limestone	186	474.0	477.0	2.0	N	1.4	10	16	12	R3	W2	475.9	J	1	65	P	R			10.0	20						Possibly mechanical
													476.2	J	1	65	P	R	Ca	2	8.0	12						Break along Ca vein
																							476.6	477.0				Milled gouge; gravel to coarse sand with clay

			Run Data											Detailed Discontinuity Data									Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greenstone	1	15.0	20.0	0.0		NA				R4																	
	Graywacke	2	20.0	30.0	0.5		0.0																					Rubble (road gravel)
	Graywacke	3	30.0	35.0	0.0		NA																					
	Graywacke	4	35.0	37.0	0.0		NA																					Rubble (road gravel), likely still in soil (not bedrock)
	Graywacke	5	37.0	42.0	0.0		NA																					
	Graywacke	6	42.0	45.0	0.0		NA																					
	Graywacke	7	45.0	48.5	0.0		NA																					
	Graywacke	8	48.5	49.5	0.3		0.0				R4																	Rubble (road gravel)
	Graywacke	9	49.5	52.0	0.0		NA																					
	Graywacke	10	52.0	56.0	0.2		0.0				R4																	Rubble (road gravel)
	Graywacke	11	56.0	59.5	0.7		0.0				R4																	Rubble (road gravel)
	Graywacke	12	59.5	63.0	1.0		0.0				R4																	Rubble (road gravel)
	Graywacke	13	63.0	67.5	0.0		NA																					
	Graywacke	14	67.5	71.0	0.0		NA																					
	Graywacke	15	71.0	75.0	0.8		0.0				R4																	Rubble (road gravel)
	Graywacke	16	75.0	77.0	0.0		NA																					
	Graywacke	17	77.0	82.0	0.0		NA																					
	Graywacke	18	82.0	83.5	0.5		0.0																					Rubble
	Graywacke	19	83.5	85.5	1.5	N	0.0	1	6	6	R2	W3	84.2	S	1	20	P	PK	CL/SC	C	0.0	6						
	Graywacke	20	85.3	86.5	0.3		0.0																					Rubble
	Graywacke	21	86.5	89.0	0.0																							
	Graywacke	22	89.0	90.0	0.0																							
	Graywacke	23	90.0	92.0	0.0																							
	Graywacke	24	92.0	97.0	0.0																							Rubble
	Graywacke	25	97.0	98.5	0.5		0.0																					
	Graywacke	26	98.5	99.5	0.7	N	0.0	3	15	15	R3	W2	98.8	J	1	45	IR	SR	Fe	C	4.0	15				99.0	99.5	
	Graywacke	27	99.5	100.0	0.5	N	0.0	5	13	13	R3	W2	99.8	S	1	45	ST	VR	CL	1	12.0	13				99.5	99.8	
	Metabasalt/green stone	28	100.0	102.0	2.0	N	1.2	2	15	12	R3	W2	100.7	J	1	30	P	SR	SC	1	4.0	12						Many healed fractures
													100.8	J	1	55	P	SR	/	/	4.0	17						Point load
	Metabasalt/green stone	29	102.0	104.0	1.4	N	0.4	5	14	14	R2	W2										14				102.0	103.6	
	Metabasalt/green stone	30	104.0	106.5	2.3	N	0.7	7	10	0	R2	W2	104.4	J	2	25	P	R	Fe	C	5.0	13						
													104.7	J	2	40	P	SR	CL	C	7.0	12						
													105.5	J	1	80	P	R	SC	1	8.0	15						
													105.7	J	2	42	C	R	SC	0.5	9.0	17				106.2	106.5	
													106.4	J	1	8?			G	5	7.0	0	106.4	106.5	G			

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt/greenstone	31	106.5	108.0	1.5	N	0.8	8	15	14	R2	W2	106.7	J	1	35	IR	R	SC	1	8.0	14						
													107.4	J	1	68	P	SM	Fe	C	5.0	17				106.7	107.4	Broken run
	Metabasalt/greenstone	32	108.0	112.0	3.5	N	0.0	11	13	1	R2	W2	108.4	J	1	80	IR	VR	Fe	C	12.0	21						
													109.3	J	1	40	U	VR	Fe/SC	C	12.0	18						
													109.6	J	1	38	C	VR	Fe/CL	C	8.0	15						
													110.3	J	2	60	IR	R	SC	2	10.0	12						
													111.2	J	2	32	P	SR	Fe	C	8.0	17						Soft joint
													111.4	J	1	40	P	R	SC	1	10.0	12						
													111.9	J	1	?			SC/G	5	7.0	1	111.9	112.0	SC/G			Fault gouge at end of run? Maybe cuttings
	Brecciated/healed greenstone	33	112.0	114.0	1.0	N	0.0	6	12	12	R1	W3	113	J	5	60	IR	VR	/	/	10.0	12				112.0	113.0	Weak rock; Point load
	Greenstone	34	114.0	119.0	3.0	N	1.3	6	12	12	R2	W3	116.4	J	1	30	P	R	Fe	C	8.0	13						
													117.3	J	1	55	P	R	SC	0.5	6.0	12						
													117.6	J	1	44	P	R	SC	0.5	7.0	12						
													118.2	J	1	45	P	R	SC	1	6.0	12				118.5	119.0	Many healed fractures
	Greenstone	35	119.0	124.0	1.0		0.0																					Rubble
	Greenstone	36	124.0	125.0	0.0		NA				R3																	R3 clasts
	Greenstone	37	125.0	127.0	1.0		0.0																					Rubble
	Greenstone	38	127.0	130.0	0.3	0.0																						Rubble
	Greenstone	39	130.0	135.0	0.0		NA				R3																	R3 clasts
	Greenstone	40	135.0	137.5	0.4		0.0																					Rubble
	Greenstone	41	137.5	139.5	1.9	N	0.4	20	12	10	R2	W2	137.9	J	1	60	C	SM	CL	C	3.0	10				137.5	137.9	
													138.2	J	3	40	P	SR	SC	C	7.0	12						
													138.7	J	1	50	P	SR	Fe	C	6.0	12				139.2	139.5	
	Greenstone	42	139.5	144.0	4.3	N	1.0	40	10	7	R2	W2	142.2	J	1	30	C	R	SC	0.5	6.0	12						
													142.4	J	1	85	C	SR	Fe	C	7.0	12						>10 fractures per foot: 142.2' - 142.4'
													141.2	J	1	55	C	S	CL	0.5	4.0	11						
													141.6	J	1	65	IR	SR	Fe	C	5.0	12						RQD: 1 ft of R2-3 rock
													142.5	J	2	22	U	S	CL	0.5	3.0	8						
													143	J	3	52	P	S	CL	0.5	3.0	8						
													143.4	J	1	30	P	SR	SC	3	5.0	7						
													143.6	J	2	70	P	SR	SC	0.5	6.0	9				143.4	144.0	
	Greenstone	43	144.0	145.0	0.4		0.0				R3																	R3 clasts, rubble
	Greenstone	44	145.0	149.0	4.0	N	0.6	25	8	2	R2	W3	146	F	1	?			SC	40		2	145.6	146.0	SC			
													146.3	F	1	45	P		SC	10	6.0	2				144.0	146.0	>10 fractures per foot: 146' - 147.2'
													146.7	J	5	55	P	SR	SC	2	4.0	8						Joint set
													147.2	J	2	58	P	SR	/	/	7.0	15						RQD: 0.6' of R2-3 rock
													147	J	1	28	P	SR	SC	1	7.0	10				148.0	149.0	
	Greenstone	45	149.0	153.0	3.7	N	0.7	4	4	0	R2	W2	149.5	F	1	20	U	R	SC	180		0	149.5	150.6	SC			Green gouge, clayey sand
													152	J	2	25	C	K	SC	1	4.0	7						
													152.7	J	1	32	U	SM	SC	1	4.0	8				152.7	153.0	Could be another fault at the end of the run
	Greenstone	46	153.0	157.0	3.4	N	1.6	20	11	10	R2	W2	154.6	J	1	85	U	SR	/	/	6.0	13						RQD is in R2-3
											R1		154.6	J	3	45	P	SR	SC	0.5	5.0	11						>10 fractures per foot: 154.6' - 155.2'. Crumbles when handled
													155.2	J	3	30	P	SR	SC	0.5	5.0	10						
											R1		156.2	J	1	65	C	SR	Fe	C	5.0	10				156.2	157.0	R1: 154.6' - 155.2' and 156.2' - 157'
	Greenstone	47	157.0	160.0	3.0	N	0.6	10	12	10	R2	W2	157.4	J	2	50	C	RS	Fe	C	6.0	13						RQD is R2-3 rock
													158	J	1	35	U	R	SC	0.5	4.0	15				157.8	157.0	Rock is R2 but R1 around joints
													159	J	2	25	U	S	Fe	0.5	4.0	10						
													159.2	J	1	23	P	SR	SC	0.5	6.0	12				159.0	160.0	R1 area

			Run Data																											
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data									Rubble/Gouge								
																						Gouge			Broken Core					
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greenstone fault breccia	48	160.0	164.0	1.7	N	0.0	1	0	0	R0	W3	162.3	F	1?	1		SC/Bx	1.7ft		0.0	162	164.0	SC/BX				Fault breccia and sandy gouge (entire run)
	Greenstone	49	164.0	168.5	3.4	N	0.6	4	6	0	R2	W4	165.5	F	1	45	P	R	SC/BX	120	12.0	1	165.2	165.9	SC/BX			Fault breccia and sandy gouge
													167.2	J	1	40	P	SR	SC	1.5	6.0	12						RQD is R2-3 rock
													167.7	F	1	30	C	SR	SC/BX	140	7.0	0	167.7	168.5	SC/BX			Fault breccia and sandy gouge
													166.5	J	1	85	IR	SR	/	/	8.0	12						
	Greenstone fault breccia	50	168.5	173.0	2.3	N	0.0						168.5	F	1	?	IR		SC/BX	4.5FT		0	168.5	173.0	SC/BX			Fault breccia and sandy gouge (green)
	Greenstone	51	173.0	176.0	2.8	N	0.0	10	5	1	R2	W3	173.8	J	1	35	P	R	SC	1	10.0	10				173.2	173.6	
													174.6	F	1	50	P	R	SC	50	10.0	1	174.6	174.8	SC	173.8	174.4	Green clayey sand, sandy gouge
													175.6	F		?							175.5	175.6	SC	175.2	175.7	Broken core with fault gouge
	Greenstone with calcite veins (~10%)	52	176.0	177.5	1.5	N	0.5	10	7	6	R2	W2	176	S	1	85	P	K	CL	0.5	2.0	6						1.2" thick calcite vein
													176.4	J	5	50	P	SR	Fe	C	7.0	10						>10 fractures per foot: 176.4' - 176.7'
													177.2	J	1	60	P	K	CL	0.5	2.0	6				177.3	177.5	
	Greenstone	53	177.5	179.0	1.5	N	0.5	20?	12	12	R2	W2	178	J	1	75	P	SR	/	/	8.0	12				177.5	178.0	Rubble, 1.6" undisturbed piece
													178.5	J	1	60	P	SR	/	/	7.0	12				178.5	179.0	Rubble
	Greenstone	54	179.0	181.0	1.0		0.0	20?			R2	W2														179.0	181.0	Rubble entire run
	Greenstone	55	181.0	184.0	3.6	N		4	15	10	R3		180.5	J	1	48	C	R	/	/	10.0	18						Lower end R3
													181.1	J	1	47	ST	SR	/	/	6.0	18						
													182.5	J	1	70	P	SR	CL	0.5	5.0	12						
													182.8	J	1	55	P	PK	Chl.	C	4.0	10				183.4	184.0	Point load
	Greenstone with calcite veins	56	184.0	188.0	3.8	N	2.8	3	8	4	R2	W2	185.7	J	1	54	ST	SR	/	/	6.0	12						Sample: 184' - 185.5' , point load: 186'
													187	F	1	?			SC	10	SC	4	186.9	187.0	SC	186.8	188.0	Gouge in broken core
	Greenstone	57	188.0	191.0	0.6	N	0.4	?			R3	W2														190.5	191.0	Rubble, one 3" intact piece, what is left is R3
	Greenstone	58	191.0	193.0	2.0	N	0.7	0	-	-	R2	W2														192.0	193.0	RQD is upper end R2 rock
	Greenstone	59	193.0	194.0	1.0	N	0.4	0	-	-	R3	W2														193.5	194.0	Lower end R3
	Greenstone	60	194.0	195.0	0.2	N	0.0	0			R2	W2																One 2" piece
	Greenstone	61	195.0	198.0	1.6	N	0.0	0	-	-	R2	W2														195.0	197.0	Rubble
																										197.4	198.0	
	Greenstone	62	198.0	200.5	0.5	N	0.0	0			R2	W2														199.5	200.0	
	Greenstone	63	200.5	205.5	5.0	N	9.7	1	12	10	R3	W2	204	J	1	40	ST	R	/	/	10.0	14				205.0	205.5	Lower end R3, sample 200.5' - 2.1.5', VCS greenstone
													205.2	S	1	60	P	K	CL	C	6.0	10						
	Greenstone	64	205.5	207.0	1.5	N	0.6	1	10	10	R2	W2																RQD is R2-33 rock
													206													206.4	207.0	R1 area: partially drilled a fault?
													206.3	J	1	30	P	R	SC	1.5	8.0	10						Broken core
	Greenstone fault breccia, and gouge	65	207.0	210.5	3.3	N	0.0	∞	5	5	R1	W4	209.4	S	1	45	C	PK	Chl./CH	0.5	2.0	5	207.0	209.8	SC/Bx			Many areas of R0, ~10% of run, breaks down to SC and gravel
																							209.8	210.3	G			R0, soft green gouge with sand (sampled)
	Greenstone fault breccia, and gouge	66	210.5	213.5	2.6	N	0.0	∞	1	0	S4/R0	W4	211.6	FO		53	P					0						Foliation within fault gouge
													212	FO		65	P					0	210.5	212.7	G/SC			Foliation within fault gouge
																							212.7		Bx			R1 area: coarse grained chlorite present
	Greenstone	67	213.5	218.5	4.8	N	1.7	8	12	10	R2	W2	214.3	V	1	25	C	SR	Ca	1	7.0	12				213.5	214.7	
													214.7	J	1	28	P	SR	SC	0.5	8.0	10						
													215.2	J	2	34	C	SR	SC	0.5	8.0	10						

			Run Data																											
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													215.5	J	1	47	IR	R	SC	C	12.0	18						
													216	J	1	22	C	R	SC/Chl	1	9.0	11						
													217.6	J	1	50	C	R	SC	1	10.0	12						
													217.2	J	1	15	C	SR	Chl	0.5	8.0	12				218.0	218.5	
	Greenstone, brecciated	68	218.5	221.0	2.4	N	0.0	28	10	8	R2	W2	219	J	1	20	C	SR	SC	2	7.0	8						
													219.8	V	2	25	P	SR	Chl.	0.5	4.0	11				220.0	220.0	>10 fractures per foot: 218.8' - 222'
													219.3	J	2	38	P	SR	Chl.	C	4.0	12						Some R1 rock, ~10% near joints
	Greenstone	69	221.0	226.0	4.8	N	0.8	12	11	8	R2	W2	221.5	J	2	30	P	SR	Chl	0.5	8.0	12						RQD is in R2-3 rock
													222	J	1	44	P	SR	SC	0.5	8.0	10						
													222.6	J	2	45	P	SR	Chl	C	6.0	12						
													223	S	1	35	P	SR	Chl/SC	2	5.0	8						
													223.6	J	2	35	C	SR	CL/Chl	C	5.0	12						
													224.8	J	2	35	C	SR	CL	C	5.0	12				225.0	225.7	
	Greenstone	70	226.0	229.5	3.6	N	0.8	10	13	2	R2	W2	226.2	J	1	35	C	SR	CL	C	6.0	13				226.4	226.9	RQD is in R2-3
													227.4	J	2	25	P	R	/	/	9.0	16						
													227.5	S	1	28	P	SR/K	Chl	C	8.0	12						
													228.3	J	2	55	ST	SR	Chl	C	5.0	12				228.8	229.2	
	Greenstone	71	229.5	234.5	5.0	N	3.2	12	12	10	R3	W2	230	J	1	60	P	SR	SC	0.5	8.0	10						
													230.5	J	1	35	P	SR	Chl	0.5	5.0	10						
													230.6	J	1	63	P	SR	SC/Chl	C	4.0	11						R2 rock near joints on this run
													231.2	J	1	65	C	SR	Chl	C	8.0	12				232.6	233.2	
													232.3	J	2	68	P	SR	CL	C	5.0	12						
													232.9	J	2	65	P	SR	SC/Chl	0.5	7.0	10						
													233.3	J	1	35	P	R	CL	0.5	8.0	12						
													233.6	J	1	55	U	R	/	/	10.0	14						
	Greenstone fault breccia	72	234.5	238.0	3.0	N	0.0	∞	4	0	R1	W3	236.7	S	6	30	P	SR	SC	2	6.0	7	234.5	237.5	Bx/SC			R2 clasts, R0 matrix
													237.5	J	5	35	P	SR	SC	1	6.0	8	237.5	238.0	SC/G			Fabric with breccia, major planes within breccia
	Greenstone fault breccia	73	238.0	241.0	3.0	N	0.0	∞	4	3	R0-1		239.7	F		50						3	238.0	241.0	Bx/SC			Planes in fault: Bx, JCR = 3, R2 clasts, R0 matrix, sample 239.2'-240'
	Greenstone fault breccia and gouge	74	241.0	243.5	2.0	N	0.0	∞	2	0	R0-1		240.8			55							241.0	242.0	SC/Bx/G			0.8 ft of R2 rock: 242' - 243'. Fault breccia is R2 clasts, R0 matrix
													241.3			30												Breaks down to a sandy clay w/ gravel.
													241.4			40												Orientation of features in fault breccia
	Healed brecciated greenstone	75	243.5	245.5	4.9	N	3.1/NA	5			R2		244.6	S	1	50	P	PK	Chl	C	3.0	6						Polished chlorite slickensides
													245	J	1	70	ST	SM	Chl	0.5	3.0	7						RQD is weaker side of R2, so NA or 0 may be better suited
													245.6	J	1	25	P	SR	Chl	C	5.0	12						
													246	B	1	55	U	K	Chl	C	3.0	7						Could be bedding, other rock breaks along a similar orientation
													246.8	J	1	25	P	R	Chl	C	8.0	12						
	Greenstone with calcite veins	76	248.5	253.5	4.4	N	4.0	5	15	8	R3	W2	250	J	1	40	P	SR	Chl	C	6.0	18						
													250.8	J	1	40	C	R	Chl	C	10.0	19				251.3	251.5	
													252	J	1	80	IR	R	Chl	C	15.0	20						Lower end R3
													252.7	J	1	35	C	R	SC	C	15.0	13						
													253.2	J	1	55	C	S	Chl	C	6.0	8						
	Greenstone	77	253.5	256.5	3.5	N	0.7	6	18	18	R3	W2	253.4	J	1	65	P	SR	/	/	5.0	18						
													254.4	J	1	72	U	SR	/	/	8.0	18						Point load
													255	J	2	70	P	SR	Chl.	C	7.0	17				755.7	756.5	
	Greenstone	78	256.5	259.5	3.0	N	1.3	5	18	18	R3	W2	257	J	1	45	C	SR	SC	C	6.0	18				256.8	258.7	Pieces 1-4" long
													258.4	J	1	45	U	SR	CL	C	6.0	18						
	Greenstone	79	259.5	263.0	3.5	N	2.0	6	15	12	R3	W2	260.3	J	1	45	IR	SR	CL	0.5	7.0	12						Sample: 260.3 -261.3 UCS
													261.3	J	1	56	P	SR	CL	C	6.0	16						
													261.6	J	1	85	P	VR	CL	C	14.0	19						

			Run Data																												
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge								
																							Gouge			Broken Core				
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													262.3	J	1	50	P	R	CL	0.5	10.0	15						
	Greenstone	80	263.0	267.5	4.5	N	3.4	8	16	8	R3	W2	263.5	J	1	15	P	R	CL	C	13.0	20				264.6	264.8	Lower end R3
													264.6	J	1	32	P	R	SC	2	9.0	8						
													266	J	2	45	P	SR	SC	0.5	7.0	15						
													267.2	J	1	38	P	SR	CL	C	7.0	18						
	Greenstone	81	267.5	270.5	2.1	N	1.9	3	15	10	R3	W2	269	J	1	60	IR	SR	CL	C	8.0	22						
													269.6	J	1	38	P	R	CL	C	12.0	18						R2 around joints
													270	J	1	60	P	S	SC	1	3.0	10						
	Greenstone	82	270.5	273.5	2.8	N	0.5	4	12	8	R3	W2	271.7	J	1	30	C	S	Chl/SC	3	4.0	8				270.8	271.0	Lower end R3, R2 around joints
																										271.7	272.5	
																										272.8	273.0	
	Greenstone	83	273.5	275.5	2.4	N	1.5	5	16	12	Re	W2	273.7	J	1	40	P	SR	CL	C	7.0	19						
													274.5	J	1	20	P	SR	SC	1.5	8.0	12						
													275	J	2	45	P	R	Chl	C	12.0	18						
													275.3	V	1	50	P	SR	Ca	1	8.0	15				275.0	275.5	Point load
	Greenstone	84	275.5	277.5	1.8	N	0.8	3	15?		R3	W2														275.5	275.7	Only broken core (assume 3 total joints). No data on conditions.
																										276.6	277.5	Est. JCR 15 based on broken core. Most core is R2-3
	Greenstone	85	277.5	281.0	3.5	N	2.8	5	17	6	R3	W2	278	J	1	45	C	SR	CL	C	8.0	19						
													278.7	J	2	50	C	R	CL	C	10.0	19						Most joints dip a similar direction
													279.6	J	1	70	U	SR	CL	C	6.0	17						Pseudo joint set
													279.9	J	1	75	C	SR	CL	3	8.0	6				280.5	281.0	
	Greenstone with Ca veins	86	281.0	285.0	3.5	N	1.5	7	11	0	R3	W2	281.8	J	2	55	P	SR	/	/	6.0	17				281.0	281.5	Lower end R3
													282.2	J	1	60	C	R	SC	C	8.0	15						
													282.4	J	1	50	P	SR	/	/	5.0	16						
													282.7	S	1	45	P	SR	CL	0.5	4.0	12						
													283.9	S	1	48	C	S	CL	1	3.0	6						
													284.3	F	1	22	P		SC/G	130		0	284.3	285.0				Soft sandy fault gouge to end of run (sampled)
	Greenstone (fault breccia?), rubble	87	285.0	288.0	0.5		0.0				R2 clasts																	Rubble: assumed continuation of last fault--drill blocked off
	Greenstone (fault breccia?)	88	288.0	290.0	0.0		NA				R3 clasts																	Zero recovery. Fault continued?
	Greenstone (fault breccia?)	89	290.0	291.5	0.6		0.0				R3 clasts																	Rubble
	Brecciated greenstone (fault breccia)	90	291.5	295.0	2.4	N	0.0	30	5	0	R2	W3	293	S	2	55	P	S	Chl	2	2.0	4						>10 fractures per foot entire run. R3 clasts, R1 around joints, R0 infill
													293.5	J	2	35	P	SR	Chl	1	5.0	8						
													294	J	2	44	P	SR	SC	0.5	6.0	8						Two dominant joint sets at 35 and 50 degrees
													294.2	S	2	55	P	S	Chl	2	2.0	6						
													294.5	F	1	?			SC/G	90		0	294.5	295.0	SC/G			Sandy, green fault gouge. Core breaks down to coarse gravel w/SC
	Greenstone fault breccia	91	295.0	300.0	2.6	N	0.0	40.0	6	6	R2	W3	298.7	S	2	30	P	S	Chl	1	3	6.0						>10 fractures per foot: 298.2 - 300
	healed: 297.3 - 298.2												299.1	S	2	30	P	S	Chl	1	2	6.0				299.5	300.0	297.3 - 298.2 is R2. 298.2 - 300 is R2-3 clasts with R0 matrix
	Greenstone (almost entirely chlorite)	92	300.0	305.0	2.6	N	0.4	20	3	1	R2	W3	303.5	F	1	48	P	SR	SC	75	/	1	303.5	303.7	SC	302.4	302.6	>10 fractures per foot: 303.4 - 303.7 and 302.5 - 302.7
													304.1	S	1	38	P	SR	CL	3	4.0	5				304.7	305.0	R1 rock near joint. Breaks along smooth large crystal chlorite plates
	Greenstone fault breccia	93	305.0	310.0	2.2	N	0.0	60	3	0	R2 clasts	W3											307.8	309.1	Bx/SC			Assumed entire run is Bx and gouge/SC. >10 fractures /ft. R2 clasts,
																			SC/G	60		0	309.1	310.0	SC/G			R0 matrix. Rock breaks along planes and shiny green chlorite.
	Greenstone	94	310.0	315.0	2.3	N	0.0	3	9	3	R1-2	W3	313	F	1	51	P	SR	SC/Bx	60		3	312.7	313.0	Bx/SC			Lower end R2
													313.4	J	1	49	P	VR	Chl	C	12.0	12						RQD is actually ~0.8 but is R2 rock

			Run Data																											
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													314.2	J	1	33	P	R	Chl	C	12.0	12						Sample: 313.4' - 314.2 UCS
	Greenstone	95	315.0	320.0	2.8	N	0.0	1	12	12	R2	W3	317.9	J	1	65	P	SR	Chl	C	6.0	12						Lower end R2. RQD is 2.4 but is R2 rock.
	Greenstone fault gouge, rubble	96	320.0	323.0	1.0	N	0.0	50	?	0	R0	W5	320	F		?			SC/G	>2'		0	322.0	323.0	SC/G			All recovery is fault gouge/rubble. All recovery is R0, 1, 2" R2 clast.
	Greenstone fault breccia	97	323.0	327.0	3.8	N	0.0	30	5	0	R1	W4	232.2	F	1	25	P?		SC	55		0	323.2	323.6	SC			80% R1-0, 20% R@ and R3
													324.4	F	1	48	P	R	SC	6	10.0	2						
													324.9	J	1	44	P	S	Chl	C	1.0	6						
													325.5	J	4	36	P	SR	Chl/SC	1.5	6.0	8	325.2	326.6	Bx/SC			>10 fractures/ft: 325.2 - 327 fault breccia
													326.5	S	5	30	P	S	Chl	1	3.0	6						R2 clasts, R0 matrix
													326.7	F	1	?	?		SC/G	30		0	326.6	327.0	G/SC			Possible broken core, sandy clay gouge. RQD: 0.6' of R2
	Greenstone	98	327.0	330.0	3.0	N	0.0	1	10	10	R1	W3	329	J	1	45	P	SR	SC	0.5	8.0	10				327.0	327.4	Upper end R1
																										329.5	330.0	RQD would be 2.1' but is R1
	Greenstone	99	330.0	332.0	2.0	N	0.0	0			R1	W3																RQD would be 1.7 but is R1, good core, many healed fractures
																												Sample: 330.7 - 331.6 UCS, point load
	Greenstone fault breccia	100	332.0	336.0	1.8	N	0.0	70	2	0	R0	W4	314.4	F					Bx/SC			0	334.4	336.0	Bx/SC	333.9	334.3	Fault breccia, breaks down to well graded sand w/ silt and clay
																												angular clasts, >10 fractures/ft entire run, 50% R0, 50% R1 and R2
	Greenstone fault gouge and breccia	101	336.0	339.5	1.2	N	0.0	50	1	0	R0?	W5	339.6	F	1	40	P	VR	SC/G	90			338.2	338.7	Bx			Sandy gouge, 60% R2 clasts, 40% R0 gouge, orientations w/same
													339.1	F	1	75	P	S		90			338.7	339.2	G/SC			fault gouge/breccia
	Greenstone (continuation of fault	102	339.5	342.0	1.1	N	0.0	>100																				Rubble and broken core entire run. R3 clasts
	breccia?)																											
	Greenstone rubble (continuation of	103	342.0	345.0	0.8	N	0.0	>100			R0?	W5														342.0	345.0	Rubble - well graded, angular sand, coarse - fine, R2 clasts
	fault breccia?)																											
	Greenstone fault breccia	104	345.0	350.0	1.5	N	0.0	>100	5	0	R2 clasts	W4	349	J	2	42	P	S	/	/	0.0	6						Breaks down to gravel w/ sand. Breaks along shiny, smooth,
																												lustrous green surfaces
	Weak greenstone	105	350.0	355.0	1.6	N	0.0	1	3	3	R1	W3	354.4	F	1	70?	IR		Fine sand	20	8.0	3	354.8	355.0	Fine sand			RQD is 1.4' of R1 rock
	Greenstone - greywacke, healed fault	106	355.0	360.0	1.4	N	0.0	0			R1	W3														358.6	359.0	RQD is 0.4' of R1 rock, point load
	breccia																											
	Brecciated greenstone	107	360.0	365.0	2.0	N					R2	W3	363.4	J	1	60	P	R	/	/	13.0	12						Many healed fractures
													363.7	J	1	60	C	SR	/	/	10.0	12						Very weak - crumbles if squeezed by hand
													363.9	S	1	38	C	PK	Chl	C	8.0	6				362.8	363.0	
													364.2	S	1	24	P	PK	Chl	C	6.0	6				364.5	365.0	
		108	365.0	370.0	0.0																							Zero recovery? Drill is low feed, high rotation, low water pressure
	Greenstone	109	370.0	372.0	2.0	N	0.4	6	12	12	R2	W2	270.2	J	1	42	SR	SC	C	8	12.0							
													270.5	S	1	20	SR/K	/	/	4	10.0							
													270.8	J	1	42	R	/	/	10	13.0							
													271.2	J	1	39	R	/	/	9	13.0					271.5	272.0	
		110	372.0	375.0	0.0																							
	Greenstone	111	375.0	375.5	0.5	N	0.0	?			R2	W2														375.0	375.5	Broken core entire run. Breaks down to well graded, angular SC
	Greenstone	112	375.5	378.5	2.7	N	0.4	11	12	12	R2		375.9	J	2	40	P	SR	/	/	8.0	12				375.5	375.8	

			Run Data																					Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													376.2	J	1	45	C	R	/	/	10.0	12						Lower end R3
													376.6	J	1	30	C	R	/	/	10.0	12				376.2	377.2	
													377.3	J	2	75	ST	SR	/	/	8.0	12						
													377.7	J	1	30	C	SR	/	/	8.0	12				377.7	378.5	
		113	378.5	380.0	0.0																							
	Greenstone	114	380.0	382.0	0.1						R3																	Recovered 1-2" diameter pebble
	Greenstone	115	382.0	383.0	0.7	N	0.0	1	12	12	R1	W3	382.7	J	1	78	C	SR	/	/	8.0	12				382.7	383.0	Healed brecciated greenstone
		116	383.0	385.0	0.0																							
	Greenstone	117	385.0	390.0	1.2	N	0.0	15			R1	W3																Some very weak rock amid green clay
	Greenstone	118	390.0	395.0	1.3	N	0.6	20			R1	W3																Weak, highly friable rock amid clay/rock chips
		119	395.0	400.0	0.0																							
		120	400.0	405.0	0.0																							
	Metabasalt	121	405.0	409.5	2.2	N	0.5	10			R2	W3																1.2' of solid core, but rock full of fractures
	Metabasalt	122	409.5	413.5	1.6	N	0.0	10			R2	W3																Very weak rock, highly fractured
	Metabasalt	123	413.5	415.5	1.0	N	0.0	20			R0	W3																Milled gravely clay
	Metabasalt	124	415.5	418.5	0.6	N	0.0	20			R1	W3																Gravel recovered
	Metabasalt	125	418.5	421.5	2.4	N	0.4	30			R1	W3	420	J	1	40	P	S	CL	C	6.0	6						Entire run very weak, friable
	Metabasalt	126	421.5	425.0	1.2	N	0.7	20			R1	W3																Entire run friable
	Metabasalt	127	425.0	429.5	1.1	N	0.0	30			R1	W3																Entire fun gravel
	Metabasalt	128	429.5	435.0	0.0																							
	Metabasalt	129	435.0	439.5	1.3	N	0.4	30			R2	W3																0.4' piece of solid core at top of run. 1' of milled Gc below
	Metabasalt	130	439.5	444.5	3.1	N	2.9/0	50																				Run highly damaged - milled gouge in places, solid core very weak
	Metabasalt	131	444.5	449.0	1.2	N	0.0	10			R2	W3																Run highly fractured
	Metabasalt	132	449.0	451.5	1.7	N	0.0	25			S4	W2											449.0	451.5	SC			Entire run milled clay
	Metabasalt	133	451.5	454.5	2.7	N	2.6	1	12	12	R2	W3	452.2	F	1	40	C	P	CL	1	2.0	12						
	Metabasalt	134	454.5	459.5	3.2	N	0.0	50			R2	W3											454.5	456.4	Gc			Entire run highly milled, clay-rich gouge. Some solid fragments of
																										456.4	457.5	weak rock.
	Greenstone	135	459.5	461.0	0.9	N	0.7	0			R3	W2																Sample 459.7 - 460.2
		136	461.0	465.0	0.0																							
	Greenstone	137	465.0	466.0	0.2	N	0.0				R2	W2																Solid fragments, no clay
	Greenstone	138	466.0	468.0	0.6	N	10.0	10			R2	W2																Highly milled gravel, no intact core
	Greenstone	139	468.0	470.0	0.8	N	0.0	10			R2	W2																Highly milled Gc, no intact core
	Greenstone	140	470.0	472.0	0.6	N	0.0				R2	W2																Redrilled fragments
	Greenstone (soft with angular metabasalt breccia suspended)	141	472.0	477.0	4.5	N	3.3	20	12	12	R2	W2	474.1	J	1	65	C	R	CL	1	10.0	12	472.0	473.1	Gc			

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													475.7	J	1	35	P	P	CL	1	2.0	12						
																							476.5	477.0	Gc			
	Greenstone (with metabasalt breccia)	142	477.0	482.0	4.8	N	3.2	20	12	12	R2	W2											477.0	477.6	Gc			Thick clayey gouge (drill mud?)
													478.7	J	1	30	IR	S	CL	1	4.0	12						Run mechanically fractured - very weak
	Greenstone	143	482.0	487.0	2.2	N	0.0	30			R2	W2																Entire run in form of intact core but full of (mechanical?) fractures
																												reducing run to rubble
	Greenstone	144	487.0	489.0	2.0	N	0.8	10			R1	W2														487.0	487.5	Very weak friable rock
													488.5	J	1	70	P	S	CL	1	6.0	12						
													488.8	J	1	65	P	P	CL	1	2.0	12						
	Greenstone	145	489.0	489.5	0.5	N	0.0	10			R2	W2																Highly fractured
	Greenstone	146	489.5	492.0	1.4	N	1.0	10			R2	W2														489.5	489.9	Sample 491.1' to 491.6'
	Greenstone	147	492.0	497.0	3.2	N	1.7	25			R2	W2											492.0	493.3	Gc			
													496.6	V	1	15	IR	S	Ca	35	6.0	25						Unbroken Ca vein -strength R1 but solid
	Greenstone	148	497.0	502.0	0.2	N	0.0				R2	W2																Milled clay with some small rock fragments
	Greenstone clayey gouge	149	502.0	503.3	1.2	N	1.2				R1	W2																Healed gouge - Gc greenstone
	Greenstone - solid breccia	149	503.3	506.5	1.4	N	0.0				R3	W2																Lower half of run solid unmilled rock filled with small fractures; some Gc infilling
	Greenstone	150	506.5	508.0	0.2	N	0.0				R3	W2																
		151	508.0	510.5	0.0																							
		152	510.5	512.0	0.0																							
		153	512.0	514.0	0.0																							

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	1	0.0	3.0	1.9	N	0.0		18	18	R3	W2														0.0	3.0	low grade
	Limestone	2	3.0	5.5	2.5	N	0.0		18	18	R3	W2														3.0	5.5	
	Limestone	3	5.5	8.5	2.7	N	0.0		20	20	R3	W2														5.5	8.5	low grade
	Limestone	4	8.5	9.5	1.0	N	0.0		20	20	R3	W2														8.5	9.5	low-med grade
	Limestone	5	9.5	10.5	0.8	N	0.0		18	18	R3	W2														9.5	10.5	
	Limestone	6	10.5	13.0	1.3	N	0.0		20	20	R3	W3														10.5	13.0	med grade
	Limestone	7	13.0	14.0	1.0	N	0.0		18	18	R3	W2														13.0	14.0	low-med grade
	Limestone	8	14.0	18.0	2.3	N	0.0	2	21	20	R3	W2	15.8	J	1	41	ST	R			17.0	22				14.0	15.8	high grade
													16.1	J	1	56	P	R			15.0	20						
	Limestone	9	18.0	22.0	3.0	N	0.0	25	18	18	R3	W2																>10 fract/ft entire run
	Limestone	10	22.0	23.0	0.7	N	0.0		18	18	R3	W2														22.0	23.0	
	Limestone	11	23.0	24.0	0.7	N	0.0		18	18	R3	W2														23.0	24.0	low-med grade
	Limestone	12	24.0	25.0	0.8	N	0.0		18	18	R3	W2														24.0	25.0	low-med grade
	Limestone	13	25.0	25.5	0.5	N	0.0		18	18	R3	W2														25.0	25.5	
	Limestone	14	25.5	29.0	3.3	N	0.0	40	18	18	R3	W2																med-high grade, >0 fract/ft entire run
	Limestone	15	29.0	32.2	3.0	N	0.0	35	18	18	R3	W2																> 10 fract/ft entire run
	Limestone	16	32.0	32.7	0.3	N	0.0		18	18	R3	W2																
	Limestone	17	32.7	36.8	3.40	N	0.0	40	18	18	R3	W2																> 10 fract/ft entire run
	Limestone	18	36.8	40.0	2.2	N	0.0	25	18	18	R3	W2																>10 fract/ft entire run, med-high grade
	Limestone	19	36.8	37.8	0.5	N	0.0		18	18	R3	W2														36.8	37.8	
	Limestone	20	40.0	42.0	2.0	N	0.0	20	18	18	R3	W2																>10 fract/ft entire run
	Limestone	21	42.0	44.0	2.0	N	0.0	20	18	18	R3	W2																> 10 fract/ft entire run
	Limestone	22	44.0	49.0	2.7	N	0.0	30	20	20	R3	W2																> 10 fract/ft entire run
	Limestone	23	49.0	50.5	1.5	N	0.0		18	18	R3	W2														49.0	50.5	
	Limestone	24	50.5	51.5	1.0	N	0.0		18	18	R3	W2														50.5	51.5	
	Limestone	25	51.5	52.5	1.0	N	0.0		18	18	R3	W2														51.5	52.5	
	Limestone	26	52.5	54.0	1.5	N	0.0		18	18	R3	W3														52.5	54.0	
	(tri-cone from 25-51.1)	27	54.0	55.0	0.0																							
	Limestone	28	55.0	56.0	1.0	N	0.0		18	18	R3	W3														55.0	56.0	
	Limestone	29	56.0	56.5	0.5	N	0.0		18	18	R3	W3														56.0	56.5	
	Limestone	30	56.5	59.5	2.5	N	0.0		20	20	R3	W3														56.5	59.5	
	Limestone	31	59.5	61.5	2.0	N	0.0	2	20	20	R3	W3	60.4	J	2	48	U	R			18.0	20						
	Limestone	32	61.5	64.0	2.5	N	0.0		20	20	R3	W3														61.5	64.0	mech. Fract.
	Limestone	33	64.0	67.0	3.0	N	0.0	30	18	18	R3	W3																> 10 fract/ft entire run
	Limestone	34	67.0	69.0	2.0	N	0.0		20	20	R3	W3														67.0	69.0	mech. Fract.
	Limestone	35	69.0	73.2	1.3	N	0.0		18	18	R3	W3														69.0	73.2	
	Limestone	36	73.2	74.7	1.3	N	0.0		18	18	R3	W3														73.2	74.7	
	Limestone	37	74.7	76.5	1.1	N	0.0		18	18	R3	W3														74.7	76.5	
	Limestone	38	76.5	79.7	3.2	N	0.0		20	20	R3	W3														76.5	77.5	healed fractures
	Limestone	39	79.7	80.2	0.5	N	0.0		18	18	R3	W3														79.7	80.2	
	Limestone	40	80.2	84.0	3.0	N	0.0	30	20	20	R3	W3																> 10 fract/ft entire run
	Limestone	41	84.0	89.0	0.1	N	0.0				R2	W3																low grade
	Limestone	42	89.0	94.0	2.6	N	0.0		16	16	R2	W3														89.0	94.0	
	Limestone	43	94.0	95.5	1.5	N	0.0		16	16	R2	W3														94.0	95.5	high grade
	Limestone	44	95.5	96.0	0.4	N	0.0		16	16	R2	W3														95.5	96.0	
	Limestone	45	96.0	97.0	0.7	N	0.0		16	16	R2	W3														96.0	97.0	
	Limestone	46	97.0	97.5	0.5	N	0.0		18	18	R3	W3														97.0	97.5	
	Limestone	47	97.5	97.8	0.3	N	0.0		18	18	R3	W3														97.5	97.8	
	Limestone	48	97.8	100.0	2.0	N	0.0	1	18	18	R3	W3	99.6	J	1	51	U	R			16.0	18						high grade
	Limestone	49	100.0	104.0	4.0	N	0.0	40	18	18	R3	W3																> 10 fract/ft entire run
	Limestone	50	104.0	1077.6	3.5	N	0.0	40	18	18	R3	W3																>10 fract/ft entire run
	Limestone	51	107.5	111.5	4.0	N	0.0	40	18	18	R3	W3																>10 fract/ft entire run, healed fract
	Limestone	52	111.5	1144.0	2.5	N	0.0	3	18	18	R3	W3	113	J	3	68	U	R			16.0	18				111.5	113.0	
	Limestone	53	114.0	118.0	4.0	N	0.0	40	18	18	R3	W3																> 10 fract/ft entire run
	Limestone	54	118.0	123.0	5.0	N	0.0	1	22	22	R4	W2	121.8	J	1	48	U	R			16.0	22						healed fractures, low-high grade, mech fract.
	Limestone	55	123.0	124.5	1.3	N	0.0		18	18	R3	W3														123.0	124.5	
	Limestone	56	124.5	126.5	2.0	N	0.0		18	18	R3	W3														124.5	126.5	
	Limestone	57	126.5	127.0	0.4	N	0.0		18	18	R3	W3														126.5	127.0	> 10 fract/ft entire run
	Limestone	58	107.0	129.0	2.0	N	0.0	20	20	20	R3	W3																
	Limestone	59	129.0	129.5	0.3	N	0.0		18	18	R3	W3														129.0	129.5	
	Limestone	60	129.5	130.2	0.7	N	0.0		18	18	R3	W3														129.5	130.2	
	Limestone	61	130.2	131.2	0.8	N	0.0		18	18	R3	W3														130.2	131.2	
	Limestone	62	131.2	132.7	1.0	N	0.0		18	18	R3	W3														131.2	130.7	
	Limestone	63	132.7	134.0	0.7	N	0.0		18	18	R3	W3														132.7	134.0	
	Limestone	64	134.0	135.0	1.0	N	0.0		20	20	R3	W3														134.0	135.0	
	Limestone	65	135.0	139.0	0.6	N	0.0		18	18	R3	W3														135.0	139.0	
	Limestone	66	139.0	141.0	1.4	N	0.0		20	20	R3	W3														139.0	141.0	med grade

			Run Data																											
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	67	141.0	144.0	3.0	N	0.0	30	20	20	R3	W3																>10 fract/ft entire run
	No Recovery	68	144.0	145.0	0.0																							
	No Recovery	69	145.0	146.5	0.0																							
	No Recovery	70	146.5	148.0	0.0																							
	Limestone	71	148.0	148.5	0.5	N	0.0		18	18	R3	W3														148.0	148.5	
		72	148.5	149.5	0.4	N	0.0		18	18	R3	W3														148.5	149.5	
		73	149.5	152.0	2.5	N	0.0	12	16	12	R3	W3	149.9	J	1	20	P	R	Cl	1	14.0	12						some chert, numerous fractures
													150.5	J	2	55	U	R	Cl	C	12.0	20						
	Limestone	74	152.0	153.7	2.1	N	0.0	10			R3	W3														152.2	152.9	chert throughout
	No Recovery	75	153.7	154.2	0.0																							
	Limestone	76	154.2	154.7	0.4	N	0.0				R3	W3																rubble recovered
	Limestone	77	154.7	155.2	0.3	N	0.0				R3	W3																rubble recovered
	Limestone	78	152.0	155.7	0.4	N	0.0				R2.5	W3																rubble recovered
	Limestone	79	155.7	158.3	1.5	N	0.0				R2.5	W3																rubble recovered
	Limestone, chert throughout	80	158.3	162.0	3.4	N	0.0	15	6	0	R2.5	W3	158.7	J2	2	50	P	R	Cl	1	12.0	12						healed bedding?
													160.4	J1	1	50	P	R	Cl	2	12.0	6						
													160.9	J1	1	20	P	R	Cl	10	10.0	0						
	Limestone	81	162.0	164.0	2.1	N	0.0	4	6	6	R2.5	W3	163	J1	1	40	P	R	Cl	2	14.0	6						
													163.2	J1	2	50	P	R	Cl	2	12.0	6						
													163.7	J1	1	45	P	R	Cl	4	12.0	6						
	Limestone	82	164.0	168.0	3.3	N	0.6	7	9	6	R2.5	W3	165	J2	2	50	P	R	Cl	1	10.0	12						run highly broken, weak
													167.1	J2	1	50	P	R	Cl	2	8.0	6						
													167.1	J2	1	50	P	R	Cl	2	8.0	6						
	Limestone (cherty)	83	168.0	170.0	2.2	N	1.3	10	9	6	R2.5	W3	168.9	J2	1	60	P	R	Cl	C	14.0	12						
																										169.1	169.3	clay filled fragments
													169.6	J1	1	45	P	R	Cl	3	12.0	C						
																										169.7	169.9	shattered chert
	Limestone	84	170.0	171.0	0.8	N	0.0				R2.5	W3																rubble recovered
	Limestone	85	171.0	171.5	0.4	N	0.0	1	12	12	R25	W3	171.3	J2	1	60	P	R	Cl	C	14.0	12						
	Limestone	86	171.5	173.5	1.6	N	0.0	1	0	0	R2	W3	173.1	J1	1	40	P	R	Cl	30	10.0	0						highly fractured
	Limestone	87	173.5	176.5	2.8	N	0.0	30			R1.5	W3																highly fractured, milled? Very weak
	Limestone	88	176.5	178.0	1.4	N	0.0	20			R1.5	W3																highly fractured, mostly gravel recovered
	Limestone	89	178.0	180.5	2.1	N	0.4	10	6	6	R3	W3	179.6	J1	1	20	P	R	Cl	3	12.0	6						run fractured
	Limestone	90	180.5	184.0	2.9	N	0.6	15	12	2	R2	W3	181	J2	1	45	P	R	Cl	C	14.0	12						run highly fractured, weak
																										183.3	183.7	rubble
	Limestone	91	184.0	188.0	2.9	N	1.7	10	6	6	R2	W3	185.4	J1	1	50	P	R	Cl	4	12.0	6						
	Limestone	92	188.0	190.0	1.8	N	0.9	1	20	20	R2	W3	189.7	J2	1	40	P	E	Ca	1	8.0	20						broken vein
	Limestone	93	190.0	192.0	2.2	N	0.0	10	9	6	R2	W3	190.4	J1	1	30	P	R	Cl	1	10.0	12						
													191	J1	1	60	P	R	Ca	2	8.0	12						
													191.3	J2	1	50	P	R	Cl	C	12.0	12						
													191.5	J1	1	50	P	R	Ca	1	10.0	6						
													191.8	J1	1	60	P	R	Ca	1	12.0	6						bottom .4 ft gravely
	No Recovery	94	192.0	192.7	0.0																							
	Limestone	95	192.7	193.2	0.4	N	0.0				R2	W3																rubble recovered
	Limestone	96	193.2	194.0	0.2	N	0.0				R2	W3																rubble recovered
	Limestone	97	194.0	194.5	0.8	N	0.0				R2	W3																rubble recovered, some soft clayey material
	Gouge	98	194.5	195.0	0.2	N	0.0				S5	W3																fine gravely clay
	Gouge	99	195.0	196.0	0.3	N	0.0				S4	W3																limestone gravely gouge
	Limestone	100	196.0	200.9	1.7	N	0.0				R2	W3																gravel recovered
	No Recovery	101	200.8	201.2	0.0																							
	Limestone	103	301.2	203.4	0.9	N	0.0				R2	W3																rubble recovered, NQ sized core ???
	Limestone	103	203.4	205.0	1.4	N	0.9	2	9	6	R2.5	W3	204	J1	1	35	P	R	Cl	3	12.0	6						
													204.7	J1	1	45	P	R	Cl	1	8.0	12						
	No Recovery	104	205.0	205.7	0.0																							
	Limestone	105	205.7	206.7	0.2	N	0.0				R2	W3																gravel recovered
	Limestone	1066	206.7	208.0	1.2	N	0.0				R2	W3																highly broken core
	Limestone	107	208.0	208.9	0.8	N	0.8				R2	W3																run fractured with vertical break throughout
	Limestone	108	208.9	211.3	2.4	N	0.0	7	12	12	R2	W3	210.3	J2	1	30	P	R	Cl	1	10.0	12						
	Limestone	109	211.3	212.1	0.2	N	0.0				R2	W3																gravel recovered
	Limestone	110	212.1	214.0	1.7	N	0.0	2	12	12	R2	W3	213.2	J1	1	45	P	R	Cl	C	10.0	12						very weak, broken rock
													213.8	J1	1	30	P	R	Cl	C	8.0	12						
	Gouge	111	214.0	217.0	2.8	N	0.4	50			S6	W3																run very soft, milled, increasing clay
	Gouge	112	217.0	219.5	2.4	N	0.0	50			S6	W3																coarse clay filled limestone breccia
	Limestone (gouge?)	113	219.5	222.0	0.2	N	0.0																					gravel recovered, no fines
	Gouge	114	222.0	223.0	0.8	N	0.0	50			S4	W3																soft clay
	No Recovery	115	223.0	224.0	0.0																							

Core Dia: Depth	ROCK TYPE	RUN	Run Data: Recovery & Other Basic Information: From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	JCR: Average	Minimum	Strength Index: Strength Index	Weathering Index	Detailed Discontinuity Data: Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	Rubble/Gouge: Gouge: From	To	Type	Broken Core: From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Gouge	116	224.0	230.0	3.0	N	0.0	100			S3	W3																	
	Limestone gouge	117	230.0	232.0	2.4	N	2.1	0			R1	W3																	weak, gougy limestone sample 231-231.6
	Gouge	118	232.0	234.0	1.8	N	0.0	50			S6	W3																	
	Gouge	119	234.0	237.0	2.7	N	0.0	50			S6	W3																	firm, weak gouge with limestone fragments throughout
	Limestone gouge	120	237.0	238.0	0.8	N	0.8	0			R1	W3																	solid, but weak material
	Gouge	121	238.0	243.0	4.3	N	0.0	100			S6	W3																	milled material, clay, solid fragments throughout
	Limestone gouge	122	243.0	247.0	4.0	N	1.3	25			R1	W3																	material highly fractured, weak
	Gouge	123	247.0	248.5	1.2	N	0.0	30			S6	W3																	rubble recovered, fragments of milled material
	Gouge	124	248.5	250.0	0.9	N	0.0	30			S5	W3																	
	Limestone gouge	125	250.0	254.0	4.0	N	0.0	50			S5	W3																	milled limestone, soft clay toward bottom of run
	Limestone	126	254.0	257.5	1.2	N	0.7	10			R1.5	W3																	weak, mechanically fractured limestone
	Lime	127	257.5	261.5	3.5	N	1.8	10			R2	W3												257.5	259.1	Gc			milled material with coarse limestone fragments
																								261.2	261.5	Gc			weak but solid limestone between milled zones
	Limestone	128	261.5	264.0	1.4	N	0.0	10			R1.5	W3																	solid but very weak core
	Limestone	129	264.0	269.0	4.5	N	1.6	10	6	6	R1.5	W3	267.7	J2	1	50	P	R	Cl	1	12.0	6							run very weak, easily fractured
	Limestone	130	269.0	271.5	1.4	N	0.0	5			R2	W3																	weak, highly fractured
	Limestone	131	271.5	273.0	1.5	N	0.0	10			R2	W3																	rubble recovered
	No Recovery	132	273.0	274.0	0.0																								
	No Recovery	133	274.0	276.3	0.0																								
	No Recovery	134	276.3	277.5	0.0																								
	Limestone	135	277.5	279.5	1.4	N	0.0	5	0	0	R2	W3	278.4	J1	1	35	P	R	Cl	8	10.0	0							
	Limestone	136	279.6	281.8	2.2	N	0.0	10			R2	W3																	run highly fractured, weak, chert again
	Limestone	137	281.8	284.0	2.2	N	1.4	5			R2	W3																	run weak, falling apart
	Limestone	138	284.0	288.5	4.2	N	1.2	10	6	6	R2	W3	286.6	J1	1	30	P	R	Cl	3	10.0	6							run highly fractured, gougy clay throughout
													287.9	J1	2	30	P	R	Cl	1	12.0	6							
	Limestone	139	288.5	291.5	2.7	N	0.0	10			R2	W3																	run highly fractured
	Limestone	140	291.5	294.0	2.5	N	1.4	3	9	6	R2	W3	292.6	J2	2	30	P	R	Cl	1	10.0	12							
													293.8	V1	1	40	P	R	Ca	8	12.0	6							
	Limestone	141	294.0	297.5	3.3	N	2.1	2	12	12	R2.5	W3	295.2	J2	1	55	P	R	Cl	C	10.0	12							large brittle chert nodules throughout
	Limestone	142	297.5	300.0	2.3	N	0.9	10			R2	W3															298.8	299.1	Chert throughout, highly fractured
	Limestone	143	300.0	304.0	3.6	N	2.6	1	20	20	R2	W3	303.5	J2	1	50	P	R	Cl	C	10.0	20							fractured chert at top of run
	Limestone	144	304.0	309.0	4.7	N	3.2	20			R2	W3												307.5	309.0	Gc			massively Ca cemented fine limestone breccia at top of run
	Gouge	145	309.0	309.5	0.4	N	0.4	0			R1.5	W3												309.0	309.5	Gc			Ca cemented milled gouge
	Limestone gouge	146	309.5	314.0	3.5	N	0.0	50			R1	W3												309.5	311.2	Gc			Entire run highly fractured, weak milled gouge throughout
																								312.0	312.8	Gc			
																								313.0	313.7	Gc			
	Limestone	147	314.0	316.0	1.3	N	0.0	25			R2	W3															214.0	215.7	
																								315.0	316.0	Gc			
	Limestone	148	316.0	317.5	1.1	N	0.0	25			R1.5	W3												316.0	316.7	Gc			
																											316.7	317.1	
	Limestone	149	317.5	318.0	0.7	N	0.0	5			R2	W3															317.7	318.5	
	Limestone	150	318.5	321.5	3.1	N	1.1	10	6	6	R1.5	W3	319.7	J1	1	20	P	R	Cl	2	8.0	6							entire run highly fractured, brittle, weak
	Limestone	151	321.5	324.0	2.1	N	0.0	20			R1	W3												322.9	324.0	Gc			
	Limestone	152	324.0	327.0	3.2	N	0.0	10	6	6	R1.5	W3	325	J1	1	15	P	R	Cl	4	10.0	6							subvertical fracture 324.4-326.4 run fractured around it
	Limestone	153	327.0	331.0	3.4	N	1.6	10	6	6	R2	W3	328.9	J1	1	20	P	R	Cl	3	12.0	6							run weak, fractured
													330.5	J1	1	20	P	R	Gc	15	14.0	6							
	Limestone	154	331.0	334.0	3.4	N	2.4	0			R2	W3																	run highly fractured, no obvious natural breaks
	Limestone	155	334.0	339.0	5.0	N	2.7	10	6	6	R2	W3	335.2	J2	1	45	P	R	Cl	1	10.0	6							clay infilled, subvertical fractures 335.6-336.7 extensive caving throughout, weak, fractured
	Limestone	156	339.0	344.0	5.0	N	0.0	25			R2	W3												342.6	344.0	Gc			entire run highly fractured
	Limestone	157	344.0	348.0	3.9	N	0.0	50			R1	W3																	gravely clay throughout, substantial fractured limestone
	Limestone	158	348.0	350.0	1.9	N	1.3	0			R2	W3															348.0	348.3	entire run highly fractured
	Limestone	159	350.0	353.5	3.4	N	1.0	30			R1	W3												351.0	353.0	Gc			highly fractured rock with clay below 351
	Limestone gouge	160	353.5	355.5	1.8	N	0.0	25			R0	W3												353.6	355.5	Gc			
	Limestone	161	355.5	359.5	3.8	N	1.5	25			R1.5	W3																	gougy limestone throughout
	Limestone gouge	162	359.5	360.5	1.2	N	0.0	20			R1.5	W3												359.5	360.5	Gc			Weak milled material
	Limestone gouge	163	360.5	363.3	2.8	N	0.6	30			R1.5	W3																	entire run well consolidated clayey gouge with gravel
	Limestone gouge	164	363.3	368.5	4.9	N	1.6	50			R0	W3	365.5	not J3	1	60	P	R	Cl	1	8.0	25							soft milled gouge material throughout
	Limestone gouge	165	368.5	373.9	4.4	N	0.0	100			S5	W3												368.5	373.8				
	Limestone	166	373.8	376.0	2.4	N	0.5	50			R1.5	W3												373.8	375.0	Gc			
	Basalt	167	376.0	381.0	5.2	N	5.2	0			R2	W3																	solid, unbroken run
	Basalt	168	381.0	384.0	3.0	N	2.2	10			R2	W3												381.0	381.8	Gc			
	Basalt	169	384.0	389.0	5.0	N	4.3	2	16	12	R2	W3	384.8	J2	1	40	U	R	Cl	1	10.0	20							
													386.3	J2	1	20	P	R	Cl	2	12.0	12							
																											387.8	388.0	
	Basalt	170	389.0	394.0	5.0	N	5.0	0			R2	W3																	run unbroken
	Basalt	171	394.0	399.0	4.1	N	4.1	2	12	12	R2	W3	397.5	J1	1	40	U	R	Cl	1	8.0	12							
													379.9	J2	1	50	P	R	Cl	1	12.0	12							

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Basalt	172	399.0	403.0	3.6	N	0.9	20			R1.5	W3											399.7	400.7	Gc			
	Basalt	173	403.0	408.0	5.2	N	4.4	10	12	12	R2	W3											403.0	403.8	Gc			
													406.2	J2	1	55	P	R	Cl	1	14.0	12						
	Basalt	174	408.0	413.1	5.0	N	5.0	0			R2	W3																solid core, no natural fractures
	No Recovery	175	413.1	413.4	0.0																							core not recovered, picked up in next run
	Basalt	176	413.4	416.5	3.4	N	1.5	10			R2	W3														414.8	415.2	weak fractured in places sample 413.7-414.4
	Basalt	177	416.5	418.0	1.4	N	1.4	1	20	20	R2	W3	417.6	J2	1	50	P	R	Cl	C	14.0	20						
	Basalt	178	418.0	423.0	5.0	N	3.7	8	10	5	R2	W3	420.2	J1	1	20	P	R	Cl	3	10.0	6	420.2	420.6	solid but crumbled Gc			
													421.3	J1	1.0	40	P	R	Cl	1	14.0	12						
													422.6	J2	1	75	P	R	Cl	C	8.0	12						
	Basalt	179	423.0	428.0	5.0	N	2.9	25	8	6	R2	W3											423.3	428.0	Gc			
													424.3	J1	1	50	P	R	Cl	1	10.0	6						
													425.1	J2	1	25	P	R	Cl	C	8.0	12						
													425.7	J1	1	40	P	R	Cl	2	8.0	6						
																							426.6	428.0	Gc			
	No Recovery	180	428.0	428.5	0.0																							
	Bassa;t	181	428.5	429.0	0.5	N	0.0	5			R2	W3																rubble recovered
	No Recovery	182	429.0	429.3	0.0																							
	Basalt	183	429.3	430.0	0.5	N	0.5	0			R2	W3																extensive Ca veining
	Basalt	184	430.0	434.0	4.0	N	2.9	10			R2	W3																Ca veining throughout
	Basalt	185	434.0	436.0	1.9	N	1.8	5			R2	W3														434.4	434.5	
	Basalt	186	436.0	437.5	1.4	N	1.0	1	6	6	R2	W3	437.1	J1	1	40	P	R	Cl	1	14.0	6						
	Basalt	187	437.0	439.5	2.4	N	2.4	0			R2	W3																
	Basalt	188	439.5	442.0	2.5	N	2.5	0			R2	W3																easily fractured along thin Ca cemented fractures throughout
	Basalt	189	442.0	444.0	1.9	N	1.9	0			R1	W2																
	Basalt	190	444.0	445.5	2.7	N	2.7	0			R0	W3																can be broken by hand sample 445.5-446.1
	Basalt	191	446.0	451.5	5.2	N	2.3	15			R1.5	W3											446.5	446.9	Gc			
																							449.4	449.8	Gc			
	Gouge	192	451.5	454.0	1.9	N	0.0	25			S5	W3											451.0	454.0	Gc			
	Basalt	193	454.0	456.0	1.2	N	0.0	20			R1	W3																entire run Ca with bits of basalt in it, weak, highly fractured
	Basalt	194	456.0	456.5	0.4	N	0.4	0			R2	W3																weak
	Basalt	195	456.5	461.8	5.0	N	5.0	2	12	12	R1.5	W3	458.1	J1	1	50	P	R	Cl	1	14.0	12						
													458.7	J1	1	50	P	R	Cl	1	12.0	12						
	No Recovery	196	461.8	462.3	0.0																							
	No Recovery	197	462.3	463.0	0.0																							new bit-old one shot
	Metabasalt	198	463.0	467.0	3.4	N	1.1	25			R1.5	W3														464.8	467.0	highly fractured into coarse gravel
	Metabasalt	199	467.0	472.0	4.4	N	0.0	50			R1.5	W3														467.0	472.0	entire run highly fractured, extensive Ca cementing, some clay
	Metabasalt	200	472.0	474.0	2.0	N	0.0	20			R1.5	W3														427.0	474.0	highly fractured, weak
	Metabasalt	201	474.0	479.0	3.8	N	0.0	30			R1.5	W3														474.0	476.0	more solid below 4766 but still weak, fractured, falls apart at hand pressure
	Metabasalt	202	479.0	481.0	1.4	N	1.1	10			R2	W3																core recovered intact but still cemented gravel
	Metabasalt	203	481.0	484.0	3.0	N	0.0	20			R2	W3																intact but highly fractured
	Metabasalt	204	484.0	488.0	3.5	N	0.4	30			R1.5	W3											485.0	486.4	Gc			solid core above highly fractured
																							486.9	488.0	Gc			core broken gouges solid, unbroken
	Metabasalt	205	488.0	493.0	5.1	N	5.1	1	6	6	R2	W3	491.1	J1	1	25	P	VR	Cl	1	16.0	6						run overall very weak but solid, broken up in places
	Metabasalt	206	493.0	498.3	5.2	N	4.4	10	0	0	R2	W3														493.2	493.9	
													494.4	F1	1	80	P	VR	Cl	14	18.0	0						
													494.8	F1	1	70	P	VR	Cl	30	16.0	0						
	Metabasalt	207	498.3	502.0	3.5	N	0.0	15			R1	W3	501.8	J1	1	30	P	R	Cl	1	8.0	6						change to plastically deformed material at 499.6
	Metabasalt	208	502.0	504.0	1.7	N	1.0	10	12	12	R2	W3	502.7	J1	1	60	P	R	Cl	1	8.0	12						material highly deformed
													503.2	J1	1	50	P	R	Cl	1	8.0	12						
	Metabasalt	209	504.0	509.0	4.7	N	4.0	10	12	12	R2	W3	505.5	J1	1	60	P	R	Cl	1	8.0	12				503.7	504.0	
													506.9	J1	1	60	C	R	Cl	1	8.0	12						
													508	J1	1	75	P	R	Cl	1	10.0	12						
	Metabasalt	210	509.0	514.0	5.0	N	0.7	50	6	6	R1.5	W3	509.7	J1	1	55	P	R	Cl	2	8.0	6						
																							509.7	514.0	Gc			strong gouge, penetrated with great dificulty
	Metabasalt	211	514.0	519.0	5.0	N	5.0	0			R1.5	W3																very solid rocklike gouge
	Metabasalt	212	5199.0	524.0	5.0	N	5.0	0			R1.5	W3																
	Metabasalt	213	524.0	528.0	3.9	N	3.4	8	12	12	R2	W3	524.3	J1	1	60	P	R	Cl	1	10.0	12						
													525.6	J2	1	60	P	S	Cl	1	6.0	12						
													527	J1	1	35	P	R	Cl	1	8.0	12						
																							527.0	528.0	Gc			
	Metabasalt	214	528.0	532.0	3.8	N	1.6	20			R1.5	W3											529.0	532.0	Gc			
	Metabasalt	215	532.0	534.0	2.0	N	0.0	20			R1	W3											532.0	534.0	Gc			
	Metabasalt	216	534.0	539.0	4.9	N	4.9	0			R2	W3																solid
	Metabasalt	217	539.0	544.0	5.0	N	5.0	1	20	20	R3	W3	540.1	J2	1	35	P	R	Ca	2	10.0	20						
	Metabasalt	218	544.0	549.0	5.0	N	5.0	0			R3	W3																

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	limestone, lots of chert	1	20.0	21.5	1.5	N	0.0				R3	W3																run broken into pieces, no natural fractures apparent
	limestone	2	21.5	22.0	0.4	N	0.0				R3	W3																fragments recovered
	limestone	3	22.0	22.5	0.5	N	0.0				R3	W3																rubble recovered
	limestone	4	22.5	23.5	1.3	N	1.3	0			R3	W3																
	limestone, very cherty	5	23.5	25.0	1.5	N	0.0				R3	W3																redrilled, broken
	limeston, >50%chert	6	25.0	26.4	0.8	N	0.8	0			R3	W3																solid but for 2 breaks, not natural
	limestone, cherty	7	26.4	27.0	0.6	N	0.6	0			R3	W3																
	limestone	8	27.0	29.5	1.7	N	0.6	.			R3	W3														22.7	29.5	rubble below 27.7, redrilled 27.7 - 28.1
	limestone	9	29.5	30.5	1.0	N	0.0				R2	W3														29.5	30.5	
	limestone	10	30.5	34.0	3.2	N	2.2	1	12	12	R3	W3														32.0	32.5	
													32.5	J1	1	50	P	R	Cl	1	8.0	12						
	limestone	11	34.0	37.0	3.4	N	2.9	2	18	12	R3	W3	35.3	V3	2	30	P	VR	Ca	2	12.0	25						large ~ 10 mm voids but not totally separated
													36.8	J1	1	30	P	R	Cl	1	10.0	12						
	limestone	12	37.0	41.0	4.0	N	3.6	2	16	12	R2	W3	39	J1	1	50	P	R	Cl	C	10.0	12						
													40.3	J2	1	30	P	R	Cl	C	8.0	20						
	limestone	13	41.0	44.0	2.8	N	2.8	0			R3	W3																moderately fractured, rubble in places, not natural
	limestone	14	44.0	49.0	4.7	N	2.9	10	12	12	R3	W3	44.7	J2	1	60	P	R	Cl	1	12.0	12						
																										45.5	47.2	cherty section, highly fractured, breaks 35-45°
													47.9	J2	1	45	P	R	Cl	1	10.0	12						
	limestone	15	49.0	54.0	4.8	N	3.0	10			R3	W3											51.1	52.9	Gc			
	limestone	16	54.0	59.0	5.0	N	4.8	5			R3	W3											55.4	55.7	Gc			
	limestone	17	59.0	64.0	4.7	N	4.4	5	12	12	R3	W3											60.7	60.9	Gc			
													62.7	J2	1	50	P	R	Cl	1	12.0	12						
	limestone	18	64.0	68.5	2.9	N	1.6	10			R3	W3														65.2	68.0	1.2 ft of redrilled gravel over this interval
	limestone	19	68.5	71.5	2.8	N	0.0	20			R2	W3														68.5	71.5	entire run highly fractured, many void spaces
	limestone	20	71.5	74.0	2.3	N	0.7	10			R2	W3														71.5	72.3	cherty, highly fractured
	limestone	21	74.0	77.5	3.2	N	0.0	10			R2	W3														74.0	77.5	entire run highly fractured
	limestone	22	77.5	81.5	2.2	N	1.0	10	6	6	R2	W3	80.5	J1	1	55	P	R	Cl	3	14.0	6						
	limestone	23	81.5	84.0	2.5	N	2.4	1			R2	W3	83.1	J2	1	50	P	R	Cl	C	8.0	12						run cherty, fractured
	limestone	24	84.0	86.0	0.7	N	0.5	0			R2	W3																
	limestone	25	86.0	88.0	1.5	N	0.8				R2	W3																very cherty, weak
	limestone	26	88.0	91.0	1.7	N	2.0				R2	W3	90.5	J2	2	60	P	R	Cl	C	10.0	12						
	no recovery	27	91.0	94.0	0.0																							
	chert	28	94.0	97.0	0.2	N	0.0				R0	W3																chert recovered
	no recovery	29	97.0	98.0	0.0																							
	limestone	30	98.0	99.8	1.2	N	0.0	5			R1	W3																very weak gougy material recovered
	limestone	31	99.8	100.8	0.3	N	0.0																					rubble recovered
	limestone	32	100.8	103.0	2.2	N	0.7	25			R0	W3														100.8	101.5	
																							102.2	103.0	Gc			
	no recovery	33	103.0	104.5	0.0																							
	limestone	34	104.4	105.5	0.4	N	0.0				R1.5	W3																
	limestone	35	105.5	108.5	2.7	N	2.1				R2	W3																very cherty, weak
	limestone	36	108.5	109.5	0.3	N	0.0				R0	W3																rubble recovered
	limestone	37	109.5	110.3	0.9	N	0.5				R1.5	W3											109.5	109.8	Gc			
	limestone	38	110.3	112.5	2.2	N	1.6	20			R1.5	W3																weak, highly fractured
	no recovery	39	112.5	113.0	0.0																							stop here to change bit
	no recovery	40	113.0	114.0	0.0																							
	limestone	41	114.0	115.0	1.0	N	1.0	0			R2	W3																
	limestone	42	115.0	117.8	1.9	N	1.9	0			R2	W3																
	limestone	43	117.8	120.6	1.4	N	0.7				R2	W3																rubble recovered
	limestone	44	120.6	123.1	2.5	N	1.7	10			R2	W3														120.6	121.4	
	limestone	45	123.1	124.0	0.9	N	0.9	0			R2	W3																few small void spaces
	limestone	46	124.0	126.5	2.4	N	2.4	0			R2	W3																increasing small voids throughout, not fractured
	limestone	47	126.5	131.5	4.4	N	4.1	0			R2	W3																some drilling fractures througout
	limestone	48	131.5	133.0	1.3	N	1.3	0			R2	W3																
	limestone	49	133.0	136.5	3.5	N	3.5	2	12	12	R2	W3	135	J1	1	70	P	R	Cl	C	8.0	12						
													135.7	J1	1	60	P	R	Ca	1	12.0	12						
	limestone	50	136.5	138.5	2.3	N	1.4	1			R2	W3	136.9	J1	1	65	P	R	Cl	C	8.0	12						run moderately fractured
	limestone	51	138.5	141.5	2.9	N	2.9	1	12	12	R2	W3	141	J2	1	60	P	R	Cl	C	8.0	12						
	limestone	52	141.5	144.0	2.6	N	2.6	2	16	12	R3	W3	141.5	J1	1	35.0	P	R	Cl	2	8.0	20						not separated

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													141.9	J2	1	60.0	P	R	Cl	C	8.0	12						
													142.8	J2	1	65.0	P	R	Cl	C	8.0	12						
	limestone	53	144.0	149.0	4.9	N	4.9	0			R3	W3																numerous small voids throughout, moderately broken due to drilling
	limestone	54	149.0	154.0	5.1	N	5.1	0			R3	W3																many voids, no n atural fractures
	limestone	55	154.0	154.5	0.5	N	0.5	0			R3	W3																shale rich
	limestone	56	154.5	159.0	4.7	N	3.8	2	16	12	R3	W3	155.8	V2	1	20.0	P	R	Ca	3	10.0	20						run highly fractured
													157.3	J2	1	30.0	P	R	Cl	2	8.0	12						
	limestone	57	159.0	159.5	0.6	N	0.6	0			R3	W3																
	limestone	58	159.5	159.8	0.3	N	0.3	0			R3	W3																
	limestone	59	159.8	161.2	1.5	N	1.0	0			R3	W3														159.8	160.2	
	limestone	60	161.2	162.4	1.0	N	1.0	0			R3	W3																
	limestone	61	162.4	164.0	1.5	N	1.5	0			R3	W3																cherty
	limestone	62	164.0	164.8	0.8	N	0.8	1	12	12	R3	W3	164.2	J1	1	50	P	S	Ca	2	6.0	12						
	limestone	63	164.8	169.8	5.0	N	5.0	3	6	6	R3	W3	166.1	J1	1	30	P	R	Cl	4	10.0	6						
													165.5	J1	1	40	P	R	Cl	1	12.0	6						
													167.3	J1	1	30	P	R	Cl	3	10.0	6						
	limestone	64	169.8	174.0	3.8	N	3.8	0			R3	W3																break through chert at 173
	gouge	65	174.0	177.7	1.5	N	0.0	100			S4	W3											176.9	177.4	Gc			
	limestone	66	177.7	182.7	4.5	N	1.7	50			R2	W3											177.7	178.2	Gc			
													178.7	J1	1	55	P	R	Cl	3	8.0	6						
													180.1	J2	1	40	P	R	Ca	2	12.0	6						
																										180.8	182.7	intact but highly fractured clay infilled
	limestone	67	182.7	187.7	4.3	N	0.7	100	6	6	R1	W3	183.2	J1	1	40	P	R	Cl	2	10.0	6						
																							183.2	187.2	Gc			falls to powder on being boxed
	limestone	68	187.7	190.0	2.3	N	0.0	25			R2	W3											187.7	188.5	Gc			
													189	J1	1	50	P	R	Cl	1	10.0	6						
													189.2	J1	1	30	P	R	Cl	2	8.0	6						
													189.5	J2	1	50	P	R	Cl	C	14.0	12						
	limestone	69	190.0	192.5	2.5	N	0.0	10	12	12	R2	W3	190.7	J2	1	55	U	R	Cl	C	8.0	12						run highly fractured
	limestone	70	192.5	195.5	2.7	N	0.0	10	6	6	R2	W3	194.9	J1	1	20	P	R	Cl	3	10.0	6						run highly fractured
	limestone	71	195.5	200.5	4.9	N	4.9	3			R2	W3	196.3	J1	1	50	P	R	Cl	1	12.0	12						
													197.4	J1	1	50	P	R	Cl	1	10.0	12						
	limestone	72	200.5	204.0	3.7	N	3.7	2	6	6	R2	W3	202.4	J1	1	35	P	R	Cl	3	8.0	6						
													204	J1	1	35	P	R	Cl	1	12.0	6						
	limestone	73	204.0	209.0	4.9	N	3.0	10	12	12	R2	W3	204.3	J1	1	40	P	S	Cl	C	6.0	12						
													206.3	J2	6	50	P	R	Cl	C	8.0	12						a lot of parallel fractures throughout run
	limestone	74	209.0	214.0	4.9	N	4.9	5	11	6	R2	W3	209.6	J1	1	30	P	R	Cl	3	12.0	6						
													209.9	J2	2	50	P	S	Cl	C	6.0	20						
													210.8	J2	1	40	P	R	Cl	C	8.0	12						
													211.2	J2	1	50	P	S	Cl	C	6.0	12						
													213.6	J1	1	25	P	R	Cl	3	14.0	6						
	limestone	75	214.0	218.0	3.6	N	3.6	3	12	12	R2	W3	215	J1	1	55	P	R	Cl	C	8.0	12						
													215.8	J1	1	20	P	VR	Cl	2	16.0	12						
													216.5	J1	1	40	P	R	Cl	1	10.0	12						
	limestone	76	218.0	221.0	2.8	N	2.2	2	6	6	R2	W3	218.7	J1	1	20	P	R	Cl	3	10.0	6						moderately to highly fractured
													219.3	J1	1	30	P	R	Cl	2	12.0	6						
																										220.1	221.0	
	limestone	77	221.0	224.0	3.3	N	3.3	1	12	12	R1.5	W3	223.7	J2	1	60	P	S	Cl	C	6.0	12						very weak, falls apart
	limestone	78	224.0	229.0	5.0	N	5.0	3	10	6	R2	W3	226.5	J1	1	50	P	R	Cl	1	10.0	6						
													227.2	J1	1	60	P	R	Cl	1	12.0	12						
													227.9	K1	1	55	P	R	Cl	1	10.0	12						
	limestone	79	229.0	234.0	4.5	N	3.7	4	12	12	R2	W3	229.7	J2	1	40	P	S	Cl	C	6.0	12						
													230.7	J1	1	65	P	R	Cl	C	14.0	12						
													232.4	J1	1	30	P	R	Cl	1	10.0	12						
	limestone	80	234.0	239.0	4.8	N	4.3	3	6	6	R2	W3	235.5	J1	1	30	P	R	Cl	4	10.0	6						
													236.7	J1	1	40	P	R	Cl	2	14.0	6						
													239.5	J1	1	40	P	R	Cl	2	8.0	6						
	limestone	81	239.0	242.0	3.3	N	3.2	0			R2	W3														238.4	239.0	
	limestone	82	242.0	245.5	3.2	N	1.7	25			R2	W3														242.0	242.7	highly fractured
																							243.3	243.6	Gc			
	limestone	83	245.5	250.5	5.0	N	5.0	4	10	6	R2	W3	246.2	J2	1	45	P	R	Cl	1	10.0	12						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													246.9	J2	1	50	P	R	Cl	1	10.0	12						
													248.6	J1	3	50	P	R	Cl	1	8.0	6						
													250.3	J1	1	35	P	R	Cl	1	10.0	12						
	limestone	84	250.5	254.0	4.1	N	2.2	8	11	6	R2	W3	251.3	J2	1	40	P	R	Cl	C	10.0	12						
													252	J2	1	50	P	R	Cl	C	12.0	12						
													252.5	J2	1	60	P	R	Cl	C	10.0	12						
													253.4	J1	3	10	P	R	Cl	3	14.0	6						
	limestone	85	254.0	257.0	2.8	N	0.0	10			R1.5	W3																
	limestone	86	257.0	260.5	3.2	N	0.7	10	6	6	R1.5	W3	257.8	J1	1	25	P	R	Cl	2	10.0	6						
													258.7	J1	2	65	P	R	Cl	2	12.0	6						
																										259.0	260.5	
	limestone	87	260.5	264.0	3.7	N	1.3	8	12	12	R1.5	W3	260.9	J1	1	50	P	R	Cl	C	10.0	12						highly fractured
													261.9	J1	1	50	P	R	Cl	1	10.0	12						
													263.4	J1	1	40	P	R	Cl	1	8.0	12						
	Limestone	88	264.0	266.0	2.0	N	0.0	10	12	12	R1.5	W3	264.7	J1	1	15	P	R	Cl	C	10.0	12						
													265.1	J1	2	50	P	R	Cl	1	10.0	12						
																										265.2	266.0	
	limestone	89	266.0	269.7	3.5	N	2.2	20			R1.5	W3	266.5	J1	1	40	P	R	Cl	1	10.0	12						
																							266.9	269.2	Gc			
	limestone	90	269.7	274.0	4..3	N	0.0	8	6	0	R1.5	W3	270.9	J1	1	30	P	R	Cl	10	8.0	0						weak, highly fractured
													271.9	J2	6	35	P	R	Cl	C	10.0	12						
	limestone	91	274.0	277.7	3.7	N	3.7	1	12	12	R1.5	W3	274.7	J1	1	30	P	R	Ca	2	12.0	12						
	limestone	92	277.7	282.7	5.0	N	2.6	25	12	12	R1.5	W3											278.2	280.3	Gc			
													281.2	J2	1	70	P	R	Cl	1	8.0	12						
	limestone	93	282.7	287.7	5.0	N	5.0	0			R1.5	W3																entire run moderately fractured, no obvious natural
	limestone	94	287.7	291.0	3.3	N	1.6	3	12	12	R1.5	W3														287.7	288.6	
													288.9	J2	3	70	P	R	Cl	C	1.0	12						
	limestone	95	291.0	293.0	2.0	N	0.8	20	10	0	R1	W3	291.3	J2	1	20	P	R	Cl	2	12.0	20						
																							292.1	293.0	Gc			
	limestone	96	293.0	298.3	4.1	N	4.0	2	6	6	R1.5	W3											293.0	293.9	Gc			
													296.8	J1	1	40	P	R	Cl	2	14.0	6						
	limestone	97	298.3	303.1	4.6	N	3.2	0	25	25	R2	W3														300.1	301.1	
													302.6	V2	1	80	P	R	Ca	2	10.0	25						
	limestone	98	303.1	308.3	5.0	N	5.0	2	9	6	R2	W3	303.7	J1	1	50	P	R	Cl	2	14.0	6						
													307.4	J2	1	60	P	R	Cl	1	14.0	12						
	limestone	99	308.3	313.6	5.2	N	2.7	20	6	6	R1.5	W3											308.3	309.2	Gc			entire run very weak
													310.7	J1	1	40	ST	R	C;	3	12.0	6						
	limestone	100	313.6	318.8	4.8	N	4.5	2	6	6	R1.5	W3	307.8	V1	1	70	P	R	Cl	4	10.0	6						very weak, easily broken
	limestone	101	318.8	323.0	4.2	N	4.2	0			R1.5	W3																weak
	lime	102	323.0	328.0	5.0	N	5.0	0			R1.5	W3																moderately mechanically fractured
	limestone	103	328.0	333.0	5.1	N	4.4	10			R1.5	W3											332.7	333.0	Gc			
	limestone	104	333.0	338.0	4.7	N	0.6	100			S4	W3											333.6	338.0	Gc			soft gouge sample 335.9 - 336.8
	limestone	105	338.0	343.0	4.9	N	4.3	10			R1	W3											338.0	338.7	Gc			change to black limestone below 338.7
	limestone	106	343.0	346.0	2.6	N	0.0	30			R1	W3														343.0	346.0	
	limestone	107	346.0	348.0	1.7	N	0.0	20			R1	W3														246.0	248.0	highly fractured
	limestone	108	348.0	353.0	5.0	Y	4.5	10	6	6	R1.5	W3														348.0	348.5	
													348.5	J1	1	50	P	R	Cl	3	10.0	6						
													349.5	B2	10	65	P	R	Cl	1	8.0	6						
													351.7	J1	1	30	P	R	Cl	3	10.0	6						
	limestone	109	353.0	358.0	5.0	Y	5.0	15	6	6	R1.5	W3	355.5	B1	15	70	P	R	Cl	1	8.0	6						black limestone with large chert bonds
	limestone	110	358.0	363.0	5.1	Y	4.3	15	6	0	R2	W3	358.6	B1	10	70	P	R	Cl	1	8.0	6						
													361	F1	1	50	P	R	Cl	15	8.0	0						
	limestone	111	363.0	368.0	4.9	Y	4.1	15	6	6	R2	W3	364.4	J1	1	40	P	R	Cl	1	12.0	6						
													367.2	B1	10	70	P	R	Cl	1	8.0	6						
	limestone	112	368.0	373.0	4.9	Y	4.0	15	6	6	R2	W3	368	B1	15	70	P	R	Cl	1	8.0	6						
	limestone	113	373.0	378.2	5.2	Y	4.4	10	3	0	R2	W3	374.7	F1	1	50	P	R	Cl	30	8.0	0						
													376.4	B1	70	70	P	R	Cl	1	8.0	6						
	limestone	114	378.2	383.4	5.1	Y	3.9				R2	W3	380.1	J1	1	50	P	R	Cl	7	12.0	0						
																							378.6	379.5	Gc			
	limestone	115	383.4	388.5	5.1	Y	4.7	4	6	6	R2	W3	385.7	J1	1	60	P	R	Cl	C	8.0	6						
													386.6	J1	1	50	P	R	Cl	1	8.0	6						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													388.2	J1	2	70	P	R	Cl	1	8.0	6						
	limestone	116	388.5	391.0	1.9	N	0.7	10			R2	W3											388.9	389.3	Gc	388.5	388.9	
	limestone	117	391.0	394.0	3.4	N	3.4	1	6	6	R2	W3	391.8	J1	1	60	C	R	Cl	1	10.0	6						
	limestone	118	394.0	399.0	5.1	N	3.1	2	6	6	R2	W3											394.0	395.8	Gc			
													398.5	J1	2	50	P	R	Cl	1	10.0	6						
	limestone	119	399.0	404.0	4.8	N	4.1	5	6	6	R2	W3	401.1	J1	1	70	P	R	Cl	1	10.0	6						
													402.4	J1	1	55	P	R	Cl	1	10.0	6						
													403.1	J1	3	70	P	R	Cl	1	12.0	6						
	limestone	120	404.0	409.0	5.1	N	3.7	8	8	6	R2	W3	405.5	J1	1	40	P	R	Cl	1	10.0	6						
													405.9	J2	1	30	P	R	Cl	2	10.0	12						
													408	J1	1	45	P	R	Cl	2	12.0	6						
	limestone	121	409.0	414.0	5.1	N	5.1	0			R2	W3																
	limestone	122	414.0	419.0	4.9	N	3.9	10			R2	W3	415.3	J1	2	60	P	R	Cl	2	14.0	6						
																							418.1	418.3	Gc			
	limestone	123	419.0	424.0	4.9	N	4.9	4	8	6	R2	W3	421	J1	1	50	P	R	Cl	4	10.0	6						
													421.6	J2	1	20	P	R	Cl	C	12.0	12						
													423.3	J1	1	40	P	R	Cl	1	10.0	6						
													423.7	J1	1	20	P	R	Cl	1	10.0	6						
	limestone	124	424.0	429.0	5.1	N	1.4	10	0	0	R1.5	W3														424.8	425.1	run weak, moderately fractured
													426.2	J1	1	60	P	R	Cl	15	16.0	0						
																										426.4	427.8	
	limestone	125	429.0	434.0	4.9	N	4.6	10	10	6	R1.5	W3	429.4	J1	1	35	P	R	Cl	2	12.0	6						
													430.8	J2	2	30	P	R	Cl	1	10.0	12						
													432	J2	3	50	P	R	Cl	1	10.0	12						
	limestone	126	434.0	439.0	4.9	N	4.1	5	12	12	R15	W3	435.4	J2	5	50	P	R	Cl	C	8.0	12						parallel breaks, not bedding
																										438.8	439.6	
	limestone	127	439.0	444.0	4.8	N	3.9	10	12	12	R1.5	W3											439.6	440.2	Gc			
													440.7	J1	1	40	P	R	Cl	C	10.0	12						
	Limestone	128	444.0	449.0	4.9	N	4.9	5	8	6	R1.5	W3	445.5	J1	1	70	P	R	Cl	3	12.0	6						
													446	J2	1	20	P	R	Cl	1	8.0	12						
													446.6	J2	1	30	P	S	Cl	1	6.0	6						
													447.9	J1	1	40	P	R	Cl	4	8.0	6						
	limestone	129	449.0	451.0	2.1	N	2.1	2	12	12	R2	W3	449.5	J2	1	50	P	R	Cl	C	10.0	12						
													450.1	J2	1	30	P	R	Cl	C	10.0	12						

			Run Data										Detailed Discontinuity Data									Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Clayey sand	1	35.0	40.0	5.0	N	2.0	1	2	2	R1	W4	38.5	F	1	50	U	SR	SC	5 ft	6.0	2	35.0	40.0	SC			Clayey sand (faults)
	Clayey sand	2	40.0	41.5	1.5	N	0.0	0			R1	W4											40.0	41.5	SC			Clayey sand fault gouge
	Limestone	3	41.5	46.5	4.5	N	0.0				R3	W3														41.5	46.5	>10 fractures per foot; FeOx and Sc; low grade limestone
	Limestone	4	46.5	51.5	3.5	N	0.0	1	16	16	R2	W3	49.9	J	1	38	U	VR	Sc	2	14.0	16				46.5	49.9	low grade
	No recovery	5	51.5	53.0																								
	Limestone/gouge	6	53.0	58.0	3.5	N	0.0	0			R2	W3											53.5	58.0	Sc	53.0	53.5	Rubble and gouge; limestone rubble cemented with Sc
	Metabasalt gouge	7	58.0	63.0	3.0	N	0.0	0			R1	W4											58.0	63.0	Sc/Cl			Fault
	Greywacke gouge	8	63.0	65.5	1.5	N	0.0	1	2	2	R2	W3	64	J	1	36	U	K	Sc	1	11.0	2	64.0	64.5	Sc			Calcite veins
	Fault breccia and gouge	9	65.5	70.5	5.0	N	0.0	0			R2	W3											65.5	70.5	Bx/Chl			Greywacke clasts; some slickensides
	Greywacke gouge	10	70.5	73.0	2.5	N	0.0	0			R1/R2	W3/W4											70.5	73.0	Bx/Cl			Fault; FeOx, Santa Clara Formation?
	Fault breccia and gouge	11	73.0	76.0	3.0	N	0.0	0			R1/R2	W3											73.0	76.0	Bx/Cl			Fault; greywacke clasts
	Fault breccia and gouge/Limestone	12	76.0	81.0	5.0	N	2.0	4	9	4	R2	W3											76.0	78.8	Bx/Cl			At 78.8 feet: Contact between fault and limestone (med to low grade)
											R4	W3	78.8	F	1	2	U	SR	G	3	6.0	4						
													79.5	J	3	65	U	R	Ca	1	12.0	14						
	Dolomitic limestone	13	81.0	83.0	2.0	N	0.0	2	17	16	R2	W2	82	J	1	22	ST	R	Ca	<1	16.0	18						Medium to high grade; dolomitic
													82.6	J	1	57	U	R	Ca	<1	14.0	16						
	Dolomitic limestone	14	83.0	88.0	5.0	N	0.0	30			R3	W3														84.5	86.8	>10 fractures per foot; medium to high grade; dolomitic
	Limestone	15	88.0	88.5	0.4	N	0.0																					Rubble
	Limestone	16	88.5	93.0	4.5	N	0.0	5	17	16	R3	W3	88.7	J	1	25	U	VR	Ca	<1	16.0	18						Medium to high grade
													89	J	4	53	U	R	Ca	<1	14.0	16						
	Limestone	17	93.0	93.5	0.3	N	0.0																			93.0	93.5	
	Limestone	18	93.5	98.0	4.5	N	0.0	4	14	14	R3	W3	93.8	J	4	45	P	SR	Ca/Cl	<1	6.0	14						Healed fracture (infill: 5mm); same as other joints; low to medium grade
	Limestone	19	98.0	103.0	5.0	N	0.0	5	18	18	R3	W3	98.3	J	5	22	U	VR	Ca	<1	17.0	18						Mostly low grade, some high grade
	Limestone	20	103.0	108.0	5.0	N	0.0	3	15	14	R2/R3	W3	104.6	J	1	54	U	R	Ca	<1	13.0	16						Some mechanical fractures; crumbles when picked up; low to medium grade
													105	J	2	18	U	R	Ca	<1	12.0	14						
	Limestone	21	108.0	113.0	5.0	N	0.5	1	17	17	R3	W3	111.2	J	1	25	U	VR	Ca	1	14.0	17				108.0	109.0	>10 fractures/foot but intact until handled; some healed fractures; low to medium grade
	Limestone	22	113.0	118.0	5.0	N	1.5	2	13	13	R3	W3	113.6	J	2	30	U	R	Ca	<1	10.0	13						>10 fractures/foot; low to medium grade; some high grade
	Limestone (some dolomite)	23	118.0	123.0	5.0	N	0.7	7	16	15	R3	W3	119.7	J	5	35	U	R	Ca	<1	12.0	15						Many healed fractures; dolomitic limestone 119.4' to 120.6'
													122.3	J	2	57	U	R	Ca	<1	14.0	17						Sample 120.6' to 121.1'
	Limestone	24	123.0	127.5	4.5	N	1.6	4	14	12	R3	W3	123.4	J	1	53	U	R	Ca/Ox	<1	8.0	12						Medium grade
													124	J	2	60	U	R	Ca	<1	10.0	14						Point load 125'
													125.8	J	1	49	U	VR	Ca	<1	14.0	17				126.3	127.5	
	Limestone	25	127.5	128.0	0.5	N	0.5	0			R3	W2																Run - one piece; low grade

			Run Data																											
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data											Rubble/Gouge						
																								Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	26	128.0	129.0	1.0	N	0.4	0			R3	W2																Medium to high grade
	Limestone	27	129.0	133.0	4.0	N	0.0	9	14	12	R3	W2	129.3	J	3	44	U	R	Ca	<1	9.0	12						Low and high grade
													129.8	J	4	47	U	R	Ca	<1	14.0	16						
													132	J	2	36	U	R	Ca	<1	12.0	15						
	Limestone (some dolomitic)	28	133.0	138.0	5.0	N	0.8	7	16	12	R3	W2	133.7	J	2	44	U	VR	Ca/Ox	<1	14.0	18						Dolomitic limestone 135.6' to 136.4'
													134.4	J	4	53	U	R	Ca	<1	14.0	18						High grade
													136.1	J	1	65	P	R			6.0	12						Everything else low grade
	Limestone (some dolomitic)	29	138.0	143.0	5.0	N	0.0	2	9	2	R3	W2/W3	139.7	J	1	35	U	R			12.0	16						
													140	J	1	49	U	R	Cl/Ox	40	6.0	2				140.8	143.0	Broken core dolomitic
	Limestone (some dolomitic)	30	143.0	148.0	5.0	N	0.0	6			R3	W2	144.1	J	2	51	U	VR	Ca	<1	16.0	18						Dolomitic: 144.5' to 145.1' and 146.5' to 147.3'
													144.7	J	3	40	U	R			14.0	17						
													146.9	J	1	54	U	R	Cl/Ca	25	10.0	2						
	Limestone	31	148.0	153.0	5.0	N	0.0	4	16	16	R3	W3	150.1	J	1	20	U	R			12.0	16						Medium to high grade; many healed fractures; some chert
													150.4	J	1	57	U	R	Ca	<1	13.0	16						
													151.3	J	1	48	U	R			15.0	18						
													151.7	J	1	26	U	R	Ca/Ox	<1	10.0	16						
	Limestone (dolomitic:153' to 155.5')	32	153.0	158.0	5.0	N	0.0	4	7	0	R3	W3	154.3	J	1	55	U	R	Sp	750	6.0	0						Healed fractures; falls apart when handled; Point load 156'
													154.9	J	3	61	P	R			10.0	14						>10 fractures/foot 156.7' to 158'
	Limestone	33	158.0	163.0	5.0	N	1.0	5	17	16	R3	W3	159.2	J	3	58	U	R	Ca	2	12.0	16						>10 fractures/foot 159.2' t0 160.3' and 162' to 163'
													161.2	J	2	61	U	VR			15.0	18						Many healed fractures; medium to high grade
	Limestone (some dolomitic)	34	163.0	168.0	5.0	N	0.0	8	16	15	R3	W3	163.4	J	7	63	U	R	Ca	2	10.0	15						>10 fractures/foot 167' to 168'; some chert
													165.6	J	1	24	P	VR	Ca	1	13.0	17						Dolomitic 165.7' to 166.4'
	Limestone	35	168.0	173.0	5.0	N	36.0	2	16	15	R3	W3	168.8	J	1	45	P	R			12.0	15						>10 fractures/foot 170.4' to 172.2'
													170	J	1	30	P	VR			14.0	17						Healed fractures; medium to high grade
	Limestone	36	173.0	177.0	4.0	N	0.0	1	18	18	R3	W3	175	J	1	47	ST	R	Ca/Ox	1	16.0	18				173.0	173.5	>10 fractures/foot 173.5' to 175' and 175.2' to 176.4'
																										176.4	177.0	Same as above
	Limestone	37	177.0	179.0	2.0	N	0.0	1	15	15	R3	W4	178.5	J	1	30	P	VR	Ca/Ox	1	12.0	15						>10 fractures/foot 177' to 178.5'; some chert
	Limestone	38	179.0	183.0	4.0	N	2.3	6	17	16	R3	W3	180.1	J	5	54	U	VR			14.0	18						Low grade
													181.3	J	1	68	U	R			12.0	16						
	Limestone	39	183.0	188.0	5.0	N	0.8	100			R2	W4																Many healed fractures; >10 fractures/foot entire run
	Limestone	40	188.0	193.0	5.0	N	0.0	500			R2	W4																Same as above
	Limestone (dolomitic 194.2' to 195.1')	41	193.0	197.5	4.5	N	1.3	3			R3	W3	194.2	J	3	52	U	R	Ca	2	10.0	12						Some chert, calcite veins; some sand in fractures; Point load 193.5'
	Limestone	42	197.5	202.5	5.0	N	0.5	10	12	10	R3	W4	198	J	4	50	U	R	Sp/Ca	2	12.0	14						>10 fractures/foot entire run; log is general characterization
													199	J	6	59	U	VR	Sp/Ca	4	14.0	10						
	Limestone	43	202.5	207.5	5.0	N	0.0	200			R3	W4																Dolomitic: 202.5' to 203.1''; some chert; >10 fractures/foot entire run; many healed fractures with 2 to 3 mm of Ca

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	44	207.5	212.5	5.0	N	0.0	200			R3	W5																>10 fractures/foot entire run; some chert; Rubble: 210' to 211.7' - limestone gravel with Ca ;many healed fractures
	Limestone (dolomitic 212.5' to 213.5')	45	212.5	217.5	5.0	N	0.0	50	12	12	R3	W4	214	3	10	63	P	R	Ca/Ox	###	10.0	12						>10 fractures/foot entire run; general characterization; many healed fractures
	Limestone	46	217.5	221.0	3.8	N	0.0	1	14	14	R3	W3	219.3	1	J	31	P	R			8.0	14						>10 fractures/foot (general characterization)
	Limestone	47	221.0	223.0	2.0	N	0.4	3	17	16	R3	W3	221.2	1	J	48	U	R			13.0	16						Medium to high grade
													221.5	2	J	41	U	R			14.0	18						
	Limestone	48	223.0	228.0	5.0	N	0.8	3	18	16	R3	W3	223.9	1	J	60	U	VR			16.0	18				224.9	226.6	Low to medium grade
													224.3	1	J	55	P	R			14.0	16						
													227.5	1	J	68	P	VR			16.0	18						
	Limestone	49	228.0	233.0	5.0	N	0.6	3	17	16	R3	W3	232	2	J	65	P	R			14.0	16				228.0	231.7	Medium grade
													232.8	1	J	48	U	R			16.0	18						
	Limestone	50	233.0	238.0	5.0	N	0.6	4	18	13	R3	W3	234.6	1	J	34	U	VR			18.0	20						>10 fractures/foot:233' to 234.3'
													234.9	1	J	52	U	VR			19.0	21						Gravelly sand: 237.7' to 238'
													235.1	1	J	59	P	R	Ca	2	6.0	13						Low to medium grade
													236.8	1	J	38	U	VR			20.0	22						
	Limestone	51	238.0	241.0	3.0	N	0.5	2	15	14	R3	W3	239.6	1	J	44	U	R	Ca/Cl	1	14.0	16				238.7	239.6	Medium to high grade
													239.8	1	J	34	P	R			12.0	14				240.1	241.0	
	Limestone	52	241.0	243.0	2.0	N	0.0	1	14	14	R3	W3	241.9	1	J	64	P	R			10.0	14				241.0	241.9	Gravelly sand: 242.1' to 242.6'
																										242.6	243.0	Medium to high grade
	Limestone	53	243.0	248.0	5.0	N	0.0	5	15	15	R3	W3	244.9	J	5	10	U	R			12.0	15						Core already boxed
	Limestone (dolomitic)	54	248.0	249.0	1.0	N	0.5	0			R3	W2																Core already boxed; healed fractures
	Limestone (dolomitic)	55	249.0	252.0	3.0	N	0.0	3	17	16	R3	W2	249.8	J	2	59	U	R	Ca	1	13.0	16						
													250.3	J	1	65	U	R	Ox/Ca	1	14.0	18						
	Limestone	56	252.0	254.5	2.5		0.0	3	17	15	R3	W3	252.3	J	1	59	U	VR			16.0	18				252.3	252.9	
													254.1	J	2	61	P	R			8.0	15						
	Limestone (some dolomitic layers)	57	254.5	259.0	4.5	N	0.8	8	14	14	R3	W3	255	J	1	26	P	R			6.0	14						Low to medium grade
													255.4	J	2	46	P	R			6.0	14						Point load 258.8'; some chert
													253.9	J	5	51	P	R	Ca/Ox	2	10.0	16						
	Limestone	58	259.0	259.5	0.1	N	0.0				R3	W3														259.0	259.5	
	Limestone	59	259.5	260.0	0.5	N	0.0				R3	W3														259.5	260.0	
	Limestone	60	260.0	263.0	3.0	N	0.0	2	14	14	R3	W3	260.7	J	1	55	P	R			12.0	14				260.0	260.4	>10 fractures/foot entire run
													260.9	J	1	28	P	R			12.0	14						
	Limestone	61	263.0	266.0	2.6	N	0.0	2	13	13	R3	W3	264.3	J	2	59	P	R			11.0	13						>10 fractures/foot: 263.5' to 264.3'; mechanical fractures
	Limestone	62	266.0	267.0	2.8	N	0.0				R3	W2																Mechanical fractures
	Limestone	63	267.0	268.0	1.0	N	0.0				R3	W3														267.0	267.6	Mechanical fractures
	Limestone (small dolomitic layer)	64	268.0	270.0	2.0	N	0.0	2	19	18	R3	W3	269.1	J	1	34	U	VR	Ca	1	16.0	18				268.0	269.1	Low grade
													269.5	J	1	68	C	VR			18.0	20						

			Run Data																					Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	65	270.0	273.0	3.0	N	0.0	3	17	16	R3	W2	271.3	J	1	64	P	R			12.0	16				270.0	271.3	
													272	J	2	41	P	VR			14.0	18						
	Limestone	66	273.0	278.0	5.0	N	0.6	3	15	14	R3	W2	274.8	J	1	26	P	VR	Ca	1	13.0	16						>10 fractures/foot: 273' to 274.8'
													276.1	J	1	50	P	R			11.0	14						Mechanical fractures
													277.5	J	1	39	U	R	Ca	1	13.0	16						Low grade
	Limestone	67	278.0	281.5	3.5	N	0.8	4	16	15	R3	W2	279	J	2	64	P	VR			16.0	16				278.0	279.0	Low grade
													279.2	J	1	49	P	VR	Ca/O›	1	16.0	15				281.0	281.5	Sample 279.6' to 280.4'
													279.6	J	1	55	P	VR			18.0	18						
	Limestone	68	281.5	283.0	2.3	N	0.0	1	16	16	R3	W2	282.5	J	1	30	P	VR			14.0	16						Mechanical fractures
	Limestone	69	283.0	288.0	5.0	N	0.9	13	17	16	R3	W2	283.4	J	5	57	U	R			14.0	17						
													283.6	J	6	55	U	R			13.0	17						
													284.5	J	1	34	U	R			13.0	16						
													286	J	1	21	U	VR			16.0	18						
	Limestone (some dolomitic)	70	288.0	293.0	5.0	N	2.7	7	17	16	R3	W2	289.2	J	3	51	V	R			14.0	18						Medium to high grade
													290.4	J	4	40	P	VR	Ca	1	15.0	16						More competent rock
	Limestone (some dolomitic)	71	293.0	298.0	5.0	N	1.0	6	15	14	R3	W2	293.7	J	5	56	P	R	Ca/O›	1	12.0	14						Medium to high grade
													293.9	J	1	46	P	VR			14.0	16						
	Limestone	72	298.0	303.0	5.0	N	2.0	2	15	14	R4	W2	300	J	1	49	U	R			14.0	16						>10 fractures/foot: 300.3' to 301.6'; 1-inch Ca bands
													301.9	J	1	54	P	R	Ca	1	12.0	14						Medium to high grade
	Limestone	73	303.0	308.0	5.0	N	1.4	2	18	17	R4	W2	304	J	1	57	U	R			15.0	17						Mostly mechanical fractures
													301.9	J	1	33	C	VR			16.0	19						Point load 305.6'; medium to high grade
	Limestone	74	308.0	313.0	5.0	N	0.6	7	10	6	R3	W3	308.7	J	4	70	U	R	Ca	2	11.0	14				308.0	308.7	Thick calcite veins
													308.9	V	3	41	U	R	Ca	7	10.0	6				311.7	313.0	
	Limestone (some dolomitic)	75	313.0	318.0	5.0	N	0.9	4	12	12	R3	W3	315.5	J	3	31	U	R	Ca/Cl	2	10.0	12				313.0	315.1	Low to high grade
													317	J	1	26	U	R	Ca/Cl	2	10.0	12						
	Limestone	76	318.0	323.0	5.0	N	1.7	3	14	13	R3	W2	320.5	J	1	45	P	R			8.0	14						
													320.9	J	1	27	P	R	Ca	1	10.0	14						Some mechanical fractures; medium to high grade
													322.3	J	1	70	P	R			6.0	13						
	Dolomitic Limestone	77	323.0	328.0	5.0	N	1.6	7	15	14	R3	W2	323.9	J	1	48	P	R			9.0	14				324.3	325.5	Dolomite: 327.4' to 328'
													325.5	J	3	43	U	R	Ca	1	13.0	16						
													325.7	J	2	36	U	R	Ca	1	13.0	16						
													327.4	J	1	43	P	R			9.0	14						
	Limestone	78	328.0	333.0	5.0	N	3.8	1	17	17	R4	W2	328.4	J	1	45	P	R			10.0	17						Mostly mechanical fractures; medium to high grade; Point load 328.6'
	Limestone	79	333.0	338.0	5.0	N	0.0	3	16	15	R3	W3	333.3	J	1	50	P	R	Ca	1	8.0	15						>10 fractures/foot: 333.3' to 335.1'; medium to high grade
													335.5	J	2	26	P	VR	Ca	1	12.0	17						Some limestone breccia veins
	Limestone	80	338.0	343.0	5.0	N	0.5	3	16	15	R3	W3	338.7	J	1	54	U	R	Ca/Cl	1	12.0	15						>10 fractures/foot: 340.7' to 343' ; rubble with Ca/Cl matrix
													339	J	2	39	U	R	Ca	1	14.0	17						Medium to high grade
	Limestone (some dolomitic)	81	343.0	348.0	5.0	N	0.5	2	12	12	R3	W4	346.7	J	2	61	U	R	Ca	3	13.0	12						Ca veins; many healed fractures (Ca matrix with LS clasts); medium to high grade
	Limestone (some dolomitic)	82	348.0	353.0	5.0	N	0.0				R3	W4																Many Ca/Cl healed fractures; >10 fractures/foot entire run

			Run Data										Detailed Discontinuity Data									Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone (dolomitic)	83	353.0	358.0	5.0	N	0.8	2	15	15	R3	W3	355.9	J	1	57	U	R	Ca	2	14.0	15						Many healed fractures and mechanical fractures
													356.7	J	1	51	P	VR	Ca	1	12.0	15						>10 fractures/foot: 354.1' to 355.8'; medium to high grade
	Limestone	84	358.0	363.0	5.0	N	1.8	4	15	13	R4	W2	358.5	J	3	56	P	VR			14.0	18						Point load: 359.1'
													361.8	J	1	31	P	VR	Ca/Cl	3	14.0	13						
	Limestone (some dolomitic)	85	363.0	368.0	5.0	N	0.0	5	15	10	R4	W3	363.3	J	2	41	U	VR			16.0	18						>10 fractures/foot: 366.4' to 368'; many healed fractures
													363.8	J	1	71	P	R			13.0	16						Medium to high grade
													365.5	V	2	54	P	R	Ca	4	10.0	10						
	Limestone	86	368.0	373.0	5.0	N	0.0	5	14	10	R3	W3	368.3	J	1	31	U	R	Ca	1	14.0	16						Many Ca/Cl healed fractures; high grade
													369.5	V	1	53	P	R	Cl/Ca	3	13.0	14						
													370.4	J	1	65	P	R	Cl/Ca	2	13.0	14						
													372.5	J	2	54	P	R	Cl/Ca	5	10.0	10						
	Limestone	87	373.0	378.0	5.0	N	0.0	2	14	13	R3	W4	374.5	J	1	70	P	VR	Ca/Cl	1	14.0	15						>10 fractures/foot: 374.8' to 378'; medium to high grade
													374.8	J	1	68	P	VR	Ca/Cl	3	14.0	13						Many healed fractures (Ca/Cl)
	Limestone; Metabasalt (382.7' to 383')	88	378.0	383.0	5.0	N	23.0	5	12	13	R4	W3	379.9	J	4	37	P	R	Ca/Cl	1	13.0	15				378.0	378.3	Medium to high grade; healed fractures
													382.2	J	1	30	P	R	Ca	2	12.0	13						
	Greywacke (383' to 384.8'); Limestone (384.8' to 388')	89	383.0	388.0	5.0	N	0.0	3	13	12	R3	W3	383.5	J	1	31	P	R			12.0	14				385.8	388.0	
													384.8	F	1	25	V	R	Ca	1	14.0	12						
													385.8	J	1	43	P	VR	Ca	1	12.0	13						
	Limestone/greywacke	90	388.0	393.0	5.0	N	0.0	7	13	12	R3	W3	388.6	J	2	50	U	R	Ca	1	12.0	14						Charcoal color; hard to see if there are grains; fizzes with HCl; calcite veins
													389	J	5	50	P	R	Ca	2	12.0	12						
	Limestone/greywacke	91	393.0	398.0	5.0	N	1.1	5	12	12	R3	W3	394.3	J	5	43	P	Sm	Ca	2	10.0	12						Fizzes but can see grains; point load 396.2'
	Limestone with greywacke contact and metabasalt	92	398.0	402.5	4.5	N	1.0	4	6	2	R3	W3	398.5	J	1	37	P	VR	Ca	2	12.0	12				401.7	402.5	Contact at 398.7 feet
													398.7	F	1	21	P	R	Cl	250	8.0	2						
													340	J	1	20	P	R	Ca	5	8.0	4						
													341.2	F	1	20	P	R	Cl	2	8.0	4						Contact with metabasalt
	Metabasalt with greywacke contact	93	402.5	407.5	5.0	N	2.4	5	11	6	R3	W2	403.6	J	1	55	U	R	Cl	2	12.0	12						Sample: 402.5' to 403.2'
													404.1	F	2	43	P	R	Cl	5	8.0	6						
													405.3	J	2	64	U	R	Cl	1	15.0	14						
	Greywacke	94	407.5	412.5	5.0	N	0.0				R3	W2																>10 fractures/foot entire run; calcite veins
	Limestone	95	412.5	417.0	4.5	N	0.0				R3	W3																>10 fractures/foot entire run; many calcite veins
	Limestone	96	417.0	422.0	5.0	N	1.4	5	10	6	R3	W2	418.1	J	4	63	P	R	Ca	1	12.0	14				418.7	419.7	
													420	J	1	45	P	R	Ca	5	10.0	6						
	Limestone/fault breccia	97	422.0	426.5	4.0	N	2.1	0			R3	W3											425.5	426.0	Metabasalt			Limestone clasts cemented with Ca and Cl; metabasalt gouge
	Limestone/fault breccia	98	426.5	431.5	5.0	N	0.0	0			R3	W4											429.0	431.5	Cl/Bx	426.5	427.9	
	Limestone/fault gouge and breccia	99	431.5	436.5	4.5	N																	431.5	436.0	Bx/Cl			

			Run Data										Detailed Discontinuity Data									Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Fault gouge (limestone clasts)	100	436.5	441.0	2.7	N																	436.5	439.2	Bx/Cl			
	Limestone	101	441.0	443.0	2.0	N	0.8	3	11	10	R3	W3	441.7	J	1	35	U	R	Ca	5	14.0	10						
													442.4	J	2	43	U	R	Ca	2	12.0	12						
	Limestone	102	443.0	445.0	2.0	N	2.0	2																				Healed fractures
	Limestone	103	445.0	450.0	5.0	N	2.2	3	16	16	R4	W2	448.4	J	3	46	U	R			13.0	16				445.4	445.9	
	Limestone	104	450.0	453.0	3.0	N	1.2	1	16	16	R3	W2	452.7	J	1	61	P	VR	Ca	1	12.0	16						Some chert; point load: 452.7; some breccia
	Limestone (some dolomitic)	105	453.0	458.0	5.0	N	1.4	1	14	14	R2	W2	455.4	J	1	38	P	R	Ca	2	12.0	14				456.7	458.0	Some brecciated core; many Ca fractures; >10 fractures/foot: 453' to 454.6'; high grade
	Limestone	106	458.0	463.0	5.0	N	3.1	4	17	16	R3	W2	458.7	J	2	66	U	R			16.0	18						Mostly high grade (Dolomitic)
													458.9	J	2	39	P	R			12.0	16						
	Limestone	107	463.0	468.0	5.0	N	1.5	3	17	15	R3	W2	464	J	2	35	ST	R			17.0	20				464.5	465.5	
													467	J	1	65	U	R	Ca	2	13.0	15				467.0	468.0	
	Limestone	108	468.0	473.0	5.0	N	1.4	3	3	0	R3	W3	468.6	F	1	28	P	Sm	Ca/Cl	500	4.0	0						>10 fractures/foot: 471.5' to 473'
													469.3	J	1	35	U	Sm	Ca/Cl	10	6.0	4						Some brecciated core
													469.9	J	1	35	U	Sm	Ca/Cl	10	6.0	4						
	Limestone breccia and fault (metabasalt)	109	473.0	478.0	5.0	N	2.0	2			R2/R3	W3	474.4	J	1	41	U	R	Cl/Ca	3	10.0	10	476.0	478.0	Bx/Cl			
													476	F	1	54	P	Sm	Cl	500	6.0	0						
	Fault (metabasalt) back to limestone	110	478.0	483.0	5.0	N	3.6	2	5	4	R3	W3	480	F	1	45	U	R	Ca	2	13.0	6						Metabasalt/Limestone contact: 480 feet
													481.8	J	1	45	U	R	Sc/Ca	10	8.0	4						Some chert; Sample: 478' to 478.8'
	Limestone	111	483.0	488.0	5.0	N	4.1	1	8	8	R2/R3	W3	483.6	J	1	35	U	VR	Ca/Cl	5	14.0	8						Some Sc layer healed fractures
	Limestone	112	488.0	493.0	5.0	N	2.8	4	18	16	R3	W2	490	J	1	48	U	VR	Ca/Ox	3	15.0	16						Some chert
													491.1	J	1	73	P	VR			13.0	17						
													491.7	J	1	54	U	VR			17.0	20						
													492.5	J	1	54	U	VR			17.0	20						
	Limestone	113	493.0	498.0	5.0	N	2.8	1	16	16	R3	W3	495.3	J	1	40	U	R	Ca	2	12.0	16						Some chert; medium to high grade
	Limestone	114	498.0	503.0	5.0	N	1.9	2			R3	W3	500.5	J	1	26	U	R	Ca	2	12.0	16				498.0	498.7	Medium grade
													501.5	J	1	55	P	PK	Ca	1	4.0	0				501.9	502.0	Slickensides
	Limestone	115	503.0	508.0	5.0	N	0.5	4	14	6	R3	W3	504.2	J	1	37	P	R	Ca/Cl	4	8.0	6				504.6	506.7	Low to high grade
													504.6	J	1	57	U	R			13.0	14						Point load: 504.5'
													506.7	J	1	36	ST	R			16.0	18						
													507.6	J	1	65	U	R			16.0	18						
	Limestone	116	508.0	513.0	5.0	N	0.4	3	11	4	R3	W2	511	V	1	61	U	R	Ca	25	12.0	4						
													511.4	J	2	44	P	VR			15.0	18				509.4	511.0	Some mechanical fractures

			Run Data										Detailed Discontinuity Data									Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt	1	35.0	39.0	4.0	N	0.0	100	0	0	S5	W3	37.3	J	1	50	P	S			6.0	0	35.0	39.0	Gc			Soft, weathered to soil
	Metabasalt	2	39.0	42.0	3.0	N	0.0	25	0	0	R1	W3																Very friable, weak rock
	Metabasalt	3	42.0	47.0	3.2	N	0.0	20	0	0	R2	W3	46.5	J	1	20	C	S	Cl	8	6.0	0						Run very weak; easily broken
	Metabasalt	4	47.0	48.0	0.6	N	0.0	10	0	0	R2	W3																Recovery highly fractured
	No Recovery	5	48.0	49.5	0.0																							No recovery
	No Recovery	6	49.5	51.0	0.0																							Borehole caved; no solid recovery
	Metabasalt	7	51.0	52.0	1.7	N	0.0	20	0	0	R2	W3																Fractured lithic fragments in soil matrix
	Metabasalt	8	52.0	57.0	4.5	N	0.0	100	0	0	S5	W3	53.1	J	1	50	P	R	Cl	8	10.0	0						Entire run clay with some solid metabasalt pieces
	Metabasalt	9	57.0	62.0	1.4	N	0.0	20	0	0	S4	W3																Entire run clay; small metabasalt fragments
	Metabasalt	10	62.0	64.5	0.3	N	0.0	10	0	0	S2	W3																Recovery mud; some rounded metabasalt pebbles
	No Recovery	11	64.5	67.0	0.0																							
	No Recovery	12	67.0	69.0	0.0																							
	Metabasalt	13	69.0	71.0	0.7	N	0.0	20	0	0																		Clay supported metabasalt sub-rounded pebbles
	Sandy clay	14	71.0	73.0	0.6	N	0.0	20	0	0	S4	W3																Clay
	Metabasalt	15	73.0	75.0	0.4	N	0.0	20	0	0	R0	W3																Loose angular fragments; no clay (washed out?)
	Metabasalt	16	75.0	77.0	1.4	N	1.2	1	6	6	R2	W3	76.3	J	1	30	P	S	Cl	3	6.0	6						Very weak but solid core
	Metabasalt	17	77.0	78.5	0.3	N	0.0	5			R2	W3																Shattered rock; some cave-in material also recovered
	Metabasalt	18	78.5	79.8	1.2	N	0.6	3	10	6	R2	W3	78.8	J	1	60	P	R	Cl/Fe	1	14.0	12						
													79.3	J	1	50	P	VR	Gc	3	16.0	6						
													79.8	J	1	25	IR	R	Cl	1	8.0	12						
	Clayey gouge	18	79.8	82.0	1.9	N	0.0	30	0	0	S5	W3											79.8	82.0	Gc			
	Metabasalt	19	82.0	87.0	4.3	N	1.4	15	8	0	R2	W3	83	J	1	50	C	R	Cl	2	10.0	12						
													83.4	J	1	20	P	S	Cl	3	6.0	12						
													83.8	J	1	65	C	R	Gc	4	12.0	6						
													84	J	1	70	IR	R	Cl	1	14.0	12						
													84.3	J	1	50	IR	VR	Cl	3	16.0	6						
													84.6	J	1	40	P	R	Cl	6	12.0	0						
	Metabasalt	20	87.0	92.0	4.8	N	2.2	5	4	0	R2	W3	87.7	J	1	40	P	R	Gc	3	10.0	6						
													88.4	J	1	50	P	R	Cl	8	12.0	0						
													89.5	J	1	40	P	VR	Gc	8	16.0	0						
													90.4	J	1	40	P	R	Gc	6	10.0	0						
													91.5	J	1	20	P	S	Cl/Fe	1	6.0	12						
	Metabasalt	21	92.0	97.0	3.4	N	0.4	20	4	0	R2	W3	94.2	J	1	75	P	R	Cl	3	8.0	6						Entire run highly fractured; clay filled
													94.7	J	1	60	P	R	Cl	4	10.0	6						
													95.1	J	1	35	IR	R	Cl	6	14.0	0						
	Metabasalt	22	97.0	102.0	3.9	N	0.5	20	8	0	R2	W3	97.5	J	1	60	P	R	Gc	8	14.0	0						Run full of clay filled fractures
													98.1	J	2	40	P	S	Cl	1	6.0	12						
													98.4	J	1	30	P	S	Cl	2	6.0	12						
													99.2	J	1	55	P	R	Gc	4	8.0	6						
													99.6	J	1	50	P	S	Cl	2	4.0	12						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt	23	102.0	105.2	3.2	N	0.5	5	6	0	R2	W3	103.2	J	1	40	P	R	Gc	10	8.0	0						
													103.6	J	1	15	C	R	Gc	3	12.0	6						
													104.3	J	1	65	P	R	Cl	2	8.0	12						
													104.8	J	2	55	P	S	Cl	1	6.0	12						
													105.2	F	1	60	P	S	Cl	400	6.0	0						Contact with limestone clay gouge
	Limestone gouge	23	105.2	107.0	1.8	N	0.0	25	0	0	S4	W3											105.2	107.0	Gc			Clay gouge with limestone clasts
	Limestone gouge	24	107.0	109.3	2.3	N	0.0	25	0	0	S4	W3											107.0	109.3	Gc			Clay gouge with limestone clasts
	Limestone	24	109.3	112.0	2.1	N	1.7	0	25	25	R2	W3											111.7	112.0	Gc			Back into gouge at bottom of 0.3 ft of run; Sample 111.1' to 111.8'
	Greenstone	25	112.0	117.0	4.7	N	1.2	40	0	0	S4/R2	W3											112.0	113.8	Gc			Solid metabasalt between gravelly clay bands
																							114.4	115.2	Gc			Sample 115.3' to 115.9'
																							115.9	117.0	Gc			
	Greenstone	26	117.0	122.0	4.3	N	0.4	45	0	0	S4	W3	112.4	J	1	35	P	S	Cl	200	6.0	0						Upper edge of 0.4 feet of solid greenstone among Gc
	Greenstone	27	12.0	127.0	4.3	N	1.6	15	11	0	R2	W3	123.6	J	1	60	P	S	Cl	10	6.0	0						
																										124.4	124.9	Gc rubble
													125.4	J	1	35	P	R	Ca	1	10.0	16						
													125.6	J	2	50	P	R	Cl	2	14.0	12						
													126.1	J	1	40	P	R	Cl	3	10.0	6						
	Greenstone	28	127.0	132.0	3.7	N	3.3	10	6	0	R2	W3	127.5	J	1	30	P	R	Cl	6	12.0	0						Run highly fractured and very weak; RQD0? Most likely mechnical but rock still very weak
													128.5	J	1	55	P	R	Cl	1	10.0	12						
	Greenstone	29	132.0	136.0	2.6	N	1.2	10	0	0	R2	W3			1											132.0	132.4	Solid core friable but solid, unbroken
																							133.2	133.6	Gc			
	Greenstone	30	136.0	139.0	2.1	N	1.2	10	0	0	R2	W3											136.0	136.6	Gc			Intact core below 136.6'
	Greenstone	31	139.0	142.0	2.2	N	0.4	1	0	0	R2	W3	139.4	F	1	30	P	S	Cl	14	6.0	0						Run highly fractured below 139.4'
	Greenstone	32	142.0	143.0	0.9	N	0.4	5	12	12	R2	W3	142.3	J	2	50	P	R	Cl	1	8.0	12						
	Greenstone	33	143.0	148.0	5.0	N	3.1	15	4	0	R2	W3											143.0	143.4	Gc			
													143.4	F	1	60	P	R	Gc	15	14.0	0						
													145.2	J	1	50	IR	VR	Cl	1	16.0	12						Core highly fractured below 146.2'
													147.3	J	1	80	P	VR	Gc	7	18.0	0						
	Greenstone	34	148.0	150.0	1.2	N	0.0	10			R2	W3	149.3	J	2	50	IR	VR	Gc	4	18.0	6						rock very weak
																										149.6	150.0	
	Greenstone	35	150.0	152.0	1.3	N	1.3	0	25	25	R2	W3																Intact recovery but weak and friable
	Greenstone	36	152.0	157.0	2.9	N	0.0	50	0	0	R1	W3																Entire run highly fractured Gc with small angular greenstone pebbles
	Greenstone	37	157.0	162.0	4.0	N	2.4	20	20	0	R2	W3											157.0	157.9	Gc			
													160.1	J	1	55	P	R	Cl	1	12.0	20						
																							160.6	162.0	Gc			
	Greenstone	38	162.0	165.0	0.4	N	0.0	10			R2	W3																Rubble recovered
	Greenstone	39	165.0	168.0	0.6	N	0.0				R2	W3																Rubble recovered - loose rounded pieces of greenstone
	No Recovery	40	168.0	170.0	0.0																							
	No Recovery	41	170.0	172.0	0.0																							
	Greenstone	42	172.0	173.0	0.8	N	0.0	10			R0	W3																Intact recovery but rock soft, pitted by water washing away clayey rock

			Run Data																				Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greenstone gouge	43	173.0	177.0	1.1	N	0.0	20			S6	W3											173.0	177.0	Gc			Milled greenstone
	Greenstone gouge	44	177.0	179.5	2.3	N	0.0	30			S6	W3											177.0	179.5	Gc			Milled greenstone with angular clasts suspended
	Gouge	45	179.5	181.1	1.6	N	0.0	20			S6	W3											179.5	181.1	Gc			Greenstone gouge; some angular limestone clasts among greenstone
	Greenstone/Limeston e	45	181.1	182.0	0.9	N	0.9	0	25	25	R3	W2	181.4	V	1	35	P	R	Ca	2	6.0	25						Unbroken Ca vein; solid core; strange mixture of limestone and greenstone together in solid rock; Sample 181.1' to 181.9'
	Greenstone/Limeston e gouge	46	182.0	184.5	2.5	N	0.0	40			R1	W3																Highly fractured greenstone/limestone with clay infill; some Ca veining
	Greenstone	47	184.5	185.5	0.0																							Few rounded pebbles recovered
	Greenstone	48	185.5	187.0	0.7	N	0.0	15			R1	W3											185.5	187.0	Gc			Angular fragments in clay matrix; no solid core
	No Recovery	49	187.0	191.0	0.0																							
	No Recovery	50	191.0	192.0	0.0																							
	Greenstone	51	192.0	193.5	0.2																							Rubble recovered; tripped out , problem with bit - replaced
	Greenstone gouge	52	193.5	197.0	3.0	N	0.8	10			R1	W3																Entire run soft greenstone matrix with sub-rounded, fractured but intact greywacke clasts
	Greenstone gouge	53	197.0	201.0	4.0	N	3.1	3	12	12	R2	W3	198.2	J	1	50	P	VR	Cl	2	16.0	12						Greenstone gouge with greywacke clasts
													199	J	1	70	P	VR	Cl	1	18.0	12						
	Greenstone gouge	54	201.0	202.0	0.6	N	0.4	0			R1	W3																
	Greenstone gouge	55	202.0	203.5	0.8	N	0.0	10			R0	W3																Milled greenstone with greywacke clasts
	No Recovery	56	203.5	204.5	0.0																							

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Graywacke	1	50.0	51.5	1.3	N	0.0	20			R1.5	W3																
	Graywacke	2	51.5	55.0	3.7	N	3.5	5			R2	W3																
	Graywacke	3	55.0	60.0	4.7	N	4.1	10	9	6	R2	W3																
	Graywacke	4	60.0	63.5	3.5	N	3.5	0			R2	W3																
	Graywacke	5	63.5	67.5	2.6	N	1.2	10	3	0	R1.5	W3																
	Graywacke	6	67.5	70.0	2.4	N	1.3	25	12	12	R1.5	W3																
	Graywacke	7	70.0	72.0	1.3	N	0.7				R1.5	W3																
	Graywacke	8	72.0	74.0	0.9	N	0.0				R1.5	W3																
	Graywacke	9	74.0	75.5	1.2	N	1.2	1			R2	W3																
	Graywacke	10	75.5	78.0	2.0	N	0.0				R1.5	W3																
	Graywacke	11	78.0	80.0	1.6	N	0.5				R1.5	W3																
	Dolomite	12	80.0	83.0	2.0	N	0.0	10	12	12	R1.5	W3	80.4	J1	1	40	P	R	Cl	1	8.0	12						
																										81.6	83.0	
	Dolomite	13	83.0	85.0	1.7	N	0.0	5	6	6	R1.5	W3	84.6	J1	1	40	P	R	Cl	1	8.0	6						
	Dolomite	14	85.0	90.0	0.8	N	0.0	1	12	12	R1.5	W3	87	J1	1	30	P	R	Cl	2	10.0	12						
	Dolomite	15	90.0	94.0	3.4	N	0.0	1	6	6	R2	W3	92.8	J1	1	10	P	R	Cl	2	10.0	6						
	Dolomite	16	94.0	98.5	4.8	N	4.7	4	12	12	R2	W3	94.4	J2	1	30	P	R	Cl	C	8.0	12						
													95.5	J2	2	20	P	R	Cl	1	14.0	12						
													96.7	J1	1	40	P	R	Cl	1	12.0	12						
	Dolomite	17	98.5	104.0	3.5	N	2.9	1	12	12	R2	W3	103.1	J1	1	50	P	R	Cl	2	10.0	12						
	Dolomite	18	104.0	107.0	2.4	N	0.0	10	9	6	R2	W3	105.1	J1	1	40	P	R	Cl	1	10.0	12						
													105.6	J1	1	30	P	R	Cl	2	8.0	6						
	Dolomite	19	107.0	110.0	2.3	N	1.7	5			R3	W3														105.9	107.0	
	Dolomite	20	110.0	113.0	1.6	N	0.9	10			R2	W3														107.0	110.0	
	Dolomite gouge	21	113.0	115.5	1.5	N	0.0	25			S5	W3											112.6	113.0	Gc			
	Dolomite	22	115.5	120.0	1.1	N	0.7	5			R1.5	W3											113.0	115.5	Gc			
	Dolomite	23	120.0	124.0	1.2	N	0.0				R2	W3														120.0	124.0	
	Dolomite	24	124.0	126.0	0.7	N	0.0				R1.5	W3														124.0	126.0	
	Dolomite	25	126.0	130.0	0.8	N	0.0	10			R1	W3																
	Dolomite	26	130.0	134.0	1.2	N	0.0	20			R1	W3																
	No recovery	27	134.0	138.0	0.0																							
	No recovery	28	138.0	140.0	0.0																							
	dolomite	29	140.0	144.0	0.6	N	0.0																					

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	No recovery	30	144.0	153.0	0.0																							
	No recovery	31	153.0	163.0	0.0																							
	Greywacke w/calcite veining	32	168.0	170.0	0.5		0.5	10	6														168.0	189.0				
	Greywacke	33	170.0	174.0	0.6		0.0	10			R1	W3														170.0	174.0	
	Greywacke	34	174.0	177.0	0.7		0.0	10			R1	W3														174.0	177.0	
	Greywacke	35	177.0	180.0	1.7	N	0.0	10			R1	W3														177.0	179.0	
																							179.0	180.0				
	Greywacke	36	180.0	184.0	0.3	N	0.0	10			R1	W3														180.0	184.0	
	Greywacke	37	184.0	188.0	0.2	N	0.0	10			R1	W3														184.0	188.0	
	Greywacke	38	188.0	189.0	0.4	N	0.0	10			R1	W3														188.0	189.0	
	Greywacke	39	189.0	192.0	2.6	N	1.7	10			R2	W3														189.0	190.0	
	Greywacke	40	192.0	194.0	2.0	N	0.3	10			R2	W2	193.3	J	1	70	PL	SM	CA	C	12.0	30				192.0	193.0	
	Greywacke	41	194.0	194.5	0.5	N	0.0	10			R2	W2														194.0	194.5	
	Greywacke	42	194.5	197.0	1.0	N	0.0	10			R1	W2														194.5	197.0	
	Greenstone	43	197.0	200.0	2.3	N	6.0	10			R2	W2	197.7	J	1	60	UN	SM			1.5	20						
													198.2	C	1	30	UN	S			1.5	6						
													198.5	F	1	40				G	0.5	0						
																							198.5	199.0				
	Graywacke	44	200.0	203.0	2.5	N	0.0	10																		200.0	203.0	
	Greywacke	45	203.0	205.0	1.5	N	0.0	10			R1.5	W3	203.6	F	1	65	PL	SM	C	0.5		6						
													203.9	F	1		IR	R	G	0.3								
																							203.8	204.1				
	Greywacke	46	205.0	208.0	2.5	N	0.0	10	6	0	R2	W3	205.3	SH	1	50	PL	R	CL	1		6						
														SH	1	40	PL	R	CL	1		6						
														SH	1	50	PL	R	CL	1		6						
	Greywacke	47	208.0	213.0	3.7	N	1.8	5	6	6	R1.5	W3	208.5	SH	1	75	ST	R	BR			6						
													209	F	1	70	PL	SM	BR	1			209.0	209.1				
													209.1	SH	1	75	ST	R				6						
													209.8	J	1	25	IR	R	CA	0.5		20						
													210.5	F	1	75	PL	SM	G	0.5		0	210.5	211.0				
	Greywacke	48	213.0	217.0	2.5	N	0.0	2	6	6	R1.5	W3	213.3	SH	1	50	PL	R		0		6				213.4	215.5	
													213.4	SH	1	45	PL	R		0		6						
	Greywacke	49	217.0	220.0	1.6	N	0.4	2	6	0	R2.5	W3														217.0	219.1	
													219.4	SH	1	50	PL	SL	CL	1	8.0	6						
													219.5	SH	1	55	C	SL	CL	1	8.0	6						
	Greywacke	50	220.0	222.0	2.0	N	0.0	10	6	0	R1.5	W3	120.7	F	1	25	PL	SM	G	10	0.0	0	120.7	120.8		121.0	122.0	
													120.6	F	1	30	PL	SM	G	10	0.0	0						
													120.9	SH	1	40	PL	R	CL	1	6.0	6						

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													121.2	SH	1	50	PL	R	CL	1	12.0	6						
	Greywacke	51	222.0	227.0	5.0	N	3.8	8	6	6	R2.5	W2	222.3	SH	1	35	PL	R	CL	1	8.0	6						
													222.4	SH	1	55	PL	R	CL	1	8.0	6						
													222.8	SH	1	40	PL	R	CL	0.5	6.0	6						
													224.4	J	1	20	ST	R	CL	0.5	6.0	20						
													225.2	J	1	45	ST	SM			4.0	25						
													225.4	SH	1	45	PL	SM	CL	0.5	4.0	6						
													225.5	SH	1	60	PL	R	CL	0.5	8.0	6						
													225.8	J	1	45	UN	R			10.0	25						
	Greywacke	52	227.0	230.0	3.0	N	3.0	3	20	20	R3	W2	227.8	J	1	30	PL	R	CA	0.5	4.0	20						
													229.1	J	1	35	CU	R	NA		6.0	25						
													229.7	J	1	35	PL	SM	CA	0.5	4.0	20						
	Greywacke	53	230.0	233.0	2.4	N	0.4	10	6	0	R2	W3	230.9	F	1	75	PL	SM	G	1	2.0	0	230.9	231.5		232.0	233.0	
	Greywacke	54	233.0	235.0	1.5	N	0.0	10	0	0	R1	W4	233	F	1	60	PL	SM	G		2.0	0	233.0	235.0				
	Greywacke	55	235.0	239.0	3.3	N	0.6	10			R2	W3	235.7	SH	1	40	PL	ST	CL	1	8.0	6						
													237.1	SH	1	55	PL	T	G	5	6.0	0						
													237.8	J	1	45	PL	SM	CA	1	4.0	12						
	Greywacke	56	239.0	240.0	0.8	N	0.4	1	20	6	R2.5	W3	239.4	J	1	45	IR	SM	CL	1	12.0	6				239.6	239.8	
	Greywacke	57	240.0	243.0	2.5	N	0.7	10	6	0	R2.5	W2	241.2	SH	1	35	ST	SM	CL	1	10.0	6				240.0	241.2	
													241.3	SH	1	10	PL	R	CA	C	8.0	6						
													242.2	SH	1	50	PL	SM	H	2	4.0	0						
													242.5	J	1	65	ST	R			18.0	25						
													242.8	J	1	35	ST	R			18.0	25						
	Greywacke	58	243.0	245.0	1.6	N	0.0	6	6	0	R1.5	W3	243.4	SH	65	PL	1.0	R	G	10	8	0						
													243.6	SH	65	IR	1.0	P	CL	1	12	6						
													243.6	SH	30	PL	1.0	P	CL	1	6	6						
													244	SH	45	IR	1.0	P	CL	1	8	6						
													244.1	F	45	PL	1.0	SM	G	10	4	0						
													244.6	J	30	PL	1.0	R	CA	1	8	20						
	Greywacke	59	245.0	249.0	1.6	N	0.5	3	6	0	R2	W3														245.0	247.7	
													247.7	F	1	40	PL	SM	G	10	4.0	0						
													248	F	1	75	PL	SM	G	3	2.0	0	248.0	248.3				
													248.8	J	1	60	ST	R			10.0	20						
	Greywacke	60	249.0	252.0	2.5	N	0.4	2	6	6	R1.5	W3	250.1	J	1	45	PL	SM			4.0	12						
													250.8	SH	1	65	CU	PO	CL	1	6.0	6						
	Greywacke	61	252.0	255.0	2.2	N	0.0	20	0	0													252.0	255.0				
	Greywacke	62	255.0	258.0	2.7	N	1.0	5	6	0	R1.5	W3											255.0	255.3				
													255.3	SH	1	60	UN	R	G	30	6.0	0						
													255.7	SH	1	50	UN	R	CL	1	6.0	6						
													256.2	SH	1	65	PL	SM	CL	1	2.0	6						
													256.5	SH	1	70	IR	PO	CL	1	2.0	6						
													256.7	SH	1	75	UN	PO	CL	1	4.0	6						
	Greywacke	63	258.0	260.0	2.0	N	0.4	6	6	0	R1.5	W3	258.4	F	1	45	PL	SM	G				258.4	258.8				
													259.1	F	1	65	UND	R	G	5								
													259.4	F	1	60	PL	SM	G	3								
													259.5	SH	1	45	PL	SM	CL	1								
													259.6	SH	1	60	IR	R	CL	2								
													259.7	F	1	60	IR	SM	G	15								

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greywacke	64	260.0	264.0	4.4	N	3.7	3	20	0	R2.5	W2	263.3	F	1	55	PL	P	G	100	2.0	0						
													261.2	J	1	60	PL	VR			14.0	20						
													262.6	J	1	35	PL	VR	CA	1	14.0	20						
	Greywacke	65	264.0	267.0	3.5	N	1.2	20	0	0			269.9	F	1	30	PL	PO	G	10	2.0	0	267.0	270.0				
			267.0	270.0	1.8	N	0.0	20	0	0																		
	Greywacke	66	270.0	273.0	1.9	N	0.5	20	0	0																		
	Greywacke	67	273.0	277.0	2.5	N	0.4	7	6	0	R2	W2	273.5	F	1	60	PL	SM	G	20	2.0	0	273.5	273.6				
													274.1	J	1	50	IR	R			12.0	20						
													274.3	SH	1	60	IR	SM	CA	1	8.0	6						
													274.7	SH	1	75	C	SM	CL	1	10.0	6						
													274.8	F	1	75	PL	SM	CL	2	4.0	0						
													274.9	SH	1	70	C	SM	CL	1	10.0	6						
													275.1	SH	1	65	C	SM	CL	1	6.0	6						
	Greywacke	68	277.0	280.0	1.8	N	0.0	20	0	0	R1.5	W4																
	Greywacke	69	280.0	284.0	3.4	N	0.0	5	0	0	R1	W4	280.6	F	1	70	C	SM	G	50	4.0	0	280.6	281.3				
													281.3	F	1	60	PL	SM	G	50	4.0	0						
													281.6	SH	1	70	PL	R	CL	1	6.0	6						
													282.9	SH	1	45	PL	R	CL	1	6.0	6						
													283.1	F	1	30	IR	SM	G	50	4.0	0	282.1	284.0				
	Greywacke	70	284.0	286.0	2.4	N	0.0	20	6	6	R2.5	W3	284.7	SH	1	30	PL	SM	CL	1	4.0	6						
	Greywacke	71	286.0	289.0	2.5	N	0.8	8	12	6	R2.5	W2.5	286.3	J	1	55	ST	SM	CA	1	6.0	12						
													286.5	J	1	35	ST	R			12.0	20						
													286.7	SH	1.0	65.0	C	P	CL	1	2.0	6						
													287.1	J	1.0	65.0	C	SM			4.0	20						
													287.2	J	1.0	55.0	PL	SM			4.0	20						
													287.7	SH	1.0	55.0	C	P	CL	1	4.0	6						
													287.9	SH	1.0	55.0	PL	SM	CL	1	2.0	6						
													288.2	SH	1.0	35.0	IR	SR	CA	1	10.0	6						
	Greywacke	72	289.0	295.0	3.1	N	1.2	3	6	0	R2	E2.5	290.8	F	1.0	70.0	PL	SM	G	10	2.0	0						
													291.3	SH	1.0	50.0	C	SM	CL	1	2.0	6						
													291.7	F	1.0	45.0	IR	SM								291.7	295.0	
	Greywacke	73	295.0	297.0	1.1	N	0	20	6	6	R2	W2	296.5	SH	1.0	45.0	IR	P	CL	2								
	Greywacke	76	297.0	300.0	1.8	N	0.9	1	20	20	R2.5	W2	299	J	1.0	30.0	IR	R			10.0	20						
	Greywacke	77	300.0	303.0	1.2	N	0	20	0	0	R1	W3.5														300.0	303.0	
	Greywacke	78	303.0	307.0	0																							
	Greywacke	79	307.0	309.0	1.5	N	0	20																		307.0	309.0	
	Greywacke	80	309.0	310.0	1	N	0	20																		309.0	310.0	
	Greywacke	81	310.0	313.0	2.2	N	0	20	20				310.3	J	1.0	55.0	PL	R			6.0	20						
	Greywacke	82	313.0	315.0	1.4	N	0	20																				
	Greywacke	83	315.0	317.0	0.4	N	0	20																				
	Greywacke	84	317.0	318.0	0.5	N	0	20																				

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greywacke	85	318.0	319.0	0.3	N	0	20																				
	Greywacke	86	319.0	321.0	1.8	N	0	20	12	6	R2	W3	319.4	SH	1.0	30.0	PL	SM	CL	1	2.0	6						
													319.7	SH	1.0	45.0	PL	SM	CL	1	2.0	6						
													320.4	SH	1.0	40.0	IR	R			14.0	20						
													320.6	SH	1.0	15.0	IR	P	CL	1	6.0	6						
	Greywacke	87	321.0	323.0	1.2	N	0.4	20	6	6	R2	W3	322.5	F	1.0	55.0	IR	P	G	20	14.0	0				321.0	322.0	
	Greywacke	88	323.0	327.0	2.8	N	0.4	20	0	0	R1	W3.5											323.9	324.6	G			
													324.9	J	1.0	65.0	IR	R	CL	1								
	Greywacke	89	327.0	330.0	0.4	N	0	20																		327.0	330.0	
	Greywacke	90	330.0	333.0	2.6	N	0.7	20	0	0	R1	W3.5	331.2	F	1.0	40.0	PL	SM	G		2.0	0	330.2	330.3				
													331.5	J	1.0	40.0	C	SM	CL	1	2.0	12						
													331.7	F	1.0	35.0	PL	SM	G		2.0	0	331.7	333.0				
	Greywacke	91	333.0	336.0	2.6	N	0	20	6	6	R2	W3														334.6	336.0	
													333.4	SH	1.0	50.0	C	VR	CL	1	12.0	6						
													333.7	SH	1.0	55.0	IR	SM	CL	1	4.0	6						
													334	SH	1.0	45.0	C	SM	CL	1	6.0	6						
													334.3	SH	1.0	55.0	ST	SM	CL	15	4.0	6						
	Greywacke	92	336.0	338.0	1.3	N	0.5	20	6	6																336.8	338.0	
													336.2	SH	1.0	50.0	IR	VR	CA	1	14.0	6						
	No recovery	93	338.0	339.0	0																							
		94	339.0	343.5	1.4	N	0	20															339.0	343.5				
	No recovery	95	343.5	345.5	0																							
	Greywacke	96	345.5	350.0	1.2	N	0	20	6		R1.5	W3														345.5	350.0	
	Greywacke	97	350.0	354.0	1.5	N	0	20	0	0	R2	W3	353	SH	1.0	35.0	UN	R	CA	0.5	10.0	12						
													353.3	F	1.0	30.0	PL	SM	G			0						
													353.7	F	1.0	55.0	C	SM	G			0						
	Greywacke	98	354.0	358.0	1	N	0.5	20	6	0	R1.5	W4	354.6	SH	1.0	35.0	IR	SM	CL	1	6.0	6						
	No recovery	99	358.0	360.0	0																							
	Greywacke	100	360.0	364.0	2	N	0	20	0	0	R1.5	W4											360.8	364.0				
													360.6	SH	1.0	40.0	ST	SM	CL	1	14.0	6						
	Greywacke	101	364.0	368.0	2	N	0	20																		364.0	368.0	
	Greywacke	102	368.0	370.0	2	N	0	30	6	0	R2	W3.5											369.7	370.0				
													368.8	SH	1.0	45.0	ST	P	CL	1	10.0	6						
													369	J	1.0	70.0	PL	SM	CL	1	4.0	12						
													369.3	SH	1.0	70.0	ST	SL	CL	1								
													369.5	SH	1.0	30.0	UN	SL	CL	1								
													369.7	F	1.0	40.0	C	SL	G									
	Greywacke	103	370.0	374.0	0.9	N	0	20																		370.0	374.0	
	Greywacke	104	374.0	378.0	2.4	N	0.4	20	6	0	R2	W3											374.9	378.0				
													347.4	J	1.0	35.0	PL	SM			6.0	20						
													374.6	J	1.0	40.0	PL	SM			6.0	20						
													375.5	SH	1.0	65.0	C	SL	CL	1	4.0	6						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength		Detailed Discontinuity Data											Rubble/Gouge					
																								Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													376	SM	1.0	75.0	IR	SL	CL	1	12.0	6						
	Greywacke	105	378.0	380.0	1.9	N	0.5	4	6	0	R2	W3											379.4	379.6				
													378.7	J	1.0	30.0	PL	SM			4.0	20						
													379	SH	1.0	35.0	C	SL	CL	1	4.0	6						
													379.1	SH	1.0	40.0	C	SL	CL	1	6.0	6						
													379.3	SH	1.0	70.0	PL	SL	CL	1	4.0	6						
	Greywacke	106	380.0	384.0	1.3	N	0	20	0	0	R1	W4											380.0	384.0				
													383.5	SH	1.0	60.0	PL	SL	G		2.0	0						
	Greywacke	107	384.0	386.0	1.2	N	0	20																		384.0	386.0	
	Greywacke	108	386.0	387.0	1	N	0	20																		386.0	387.0	
	Greywacke	109	387.0	390.0	1.2	N	0.5	20																				
	Greywacke	110	390.0	395.0	0.6	N	0	20																		390.0	395.0	
	Greywacke	111	395.0	400.0	0.2	N	0	20																				
	Greywacke	112	400.0	401.0	0.2	N	0	20																				
	Greywacke	113	401.0	403.5	0.6	N	0	20																				
	No recovery	114	403.5	413.0	0																							
	No recovery	115	413.0	415.0	0																							
	Greywacke	116	415.0	419.0	1.2	N	0	20																		415.0	419.0	
	Greywacke	117	419.0	422.5	0.5	N	0	0																		419.0	422.5	
	Greywacke	118	422.5	425.0	0.7	N	0	20																		422.5	425.0	
	Greywacke	119	425.0	428.0	0.6	N	0	20																		425.0	428.0	
	Greywacke	120	425.0	430.0	2	N	0	20	0	0	R1	W4											428.0	430.0				
													429.3	SH	1.0	50.0	PL	SL	G	10	2.0	6						
													429.8	SH	1.0	25.0	PL	SL	G	2	4.0	6						
	Greywacke	121	430.0	433.0	2.7	N	0	20	0	0	R1	W4											430.0	433.0				
	No recovery	122	433.0	436.0	0																							
	Greenstone	123	436.0	440.0	1.6	N	0	20																		436.0	440.0	
	Greenstone	124	440.0	442.0	0.3	N	0	20																		440.0	442.0	
	Greenstone	125	442.0	446.0	3.7	N	2	7	6	6	R2.5	W3	442.7	SH	1.0	60.0	PL	SM	CL	3.5	10.0	12						
													443	J	1.0	50.0	PL	R	CL	0.5	8.0	20						
													443.2	J	1.0	60.0	ST	R	CL	1	10.0	20						
													443.6	J	1.0	70.0	PL	R			8.0	20						
													443.9	SH	1.0	50.0	PL	SL	CL	2	4.0	6						
													444	SH	1.0	45.0	PL	SL	CL	1	8.0	6						
													444.9	SH	1.0	30.0	PL	SL	CL	1	6.0	6						
	Greenstone	126	446.0	450.0	4.4	N	0	20	0	0	R1	W4											446.9	450.0				
	Greenstone	127	450.0	453.5	3.2	N	0	20	0	0	R1	W4											450.0	453.5				

			Run Data										Rubble/Gouge																				
			Recovery & Other Basic Information						JCR		Strength		Detailed Discontinuity Data										Gouge			Broken Core		ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	
	Greenstone	128	453.5	457.5	3.5	N	0	20	0	0	R1	W4											457.5	460.0				
	Greenstone	129	460.0	465.0	5.2	N	0	20	0	0	R1.5	W4											460.0	465.0				
	Greenstone	130	465.0	470.0	4.8	N	1.9	20	0	0	R2.5	W2.5											465.0	467.4				
													468.8	SH	1.0	55.0	IR	R	CA	1	12.0	12						
	Greenstone	131	470.0	475.0	5.2	N	5	1	20	20	R3	W1.5	472.6	J	1.0	30.0	PL	R			10.0	20						
	Greenstone	132	475.0	480.0	5	N	2.6	3	20	20	R3	W1.5	475.3	J	1.0	85.0	C	VR			12.0	20						
													476.5	J	1.0	20.0	PL	VR			12.0	25						
													477.4	J	1.0	65.0	PL	R			8.0	20						
	Limestone	133	480.0	484.0	4	N	3.4	5	20	20	R2.5	W1.5	480.7	J	1.0	50.0	PL	R			8.0	20						
													480.9	J	1.0	65.0	PL	VR			12.0	25						
													481.5	J	1.0	65.0	ST	VR			12.0	25						
													482.7	J	1.0	25.0	PL	SM			6.0	20						
													483.5	J	1.0	25.0	ST	SM	CA	1	12.0	20						
	Limestone	134	484.0	487.0	2.8	N	2.7	2	20	20	R2.5	W1.5	484.7	J	1.0	75.0	PL	SM			6.0	20						
													486.2	J	1.0	80.0	PL	VR			12.0	25						
	Limestone	135	487.0	490.0	3	N	1.9	4	20	20	R2	W2.5	488.1	SH	1.0	70.0	PL	SL	CL	1	6.0	6						
													488.4	SH	1.0	70.0	PL	SM	CL	1	6.0	12						
													488.6	SH	1.0	65.0	ST	SL	CL	1	8.0	6						
													489.6	SH	1.0	75.0	PL	SM	CL	5	4.0	6						
	Limestone	136	490.0	493.5	3.5	N	2.6	4	12	6	R2.5	W1.5	492	SH	1.0	15.0	IK	SL	CA	1	10.0	6						
													492.1	J	1.0	70.0	PL	SM	OX	C	4.0	12						
													493.1	J	1.0	20.0	PL	SM	OX	C	6.0	12						
													493.3	J	1.0	65.0	ST	R			10.0	20						
	Limestone	137	493.5	498.0	4.3	N	2.8	4	12	6	R2.5	W1.5	494.3	J	1.0	65.0	PL	R	CA	1	8.0	20						
													495.1	SH	1.0	20.0	IR	SL	CL	1	10.0	6						
													497.4	J	1.0	25.0	IR	R			10.0	12						
													497.8	SH	1.0	85.0	IR	P	CL	3	8.0	12						
	Limestone	138	498.0	500.0	2.3	N	2.2	2			R2.5	W1.5	498.7	J	1.0	55.0	PL	SM			6.0	20						
													499.5	SH	1.0	50.0	ST	SL	CA	1	8.0	6						
	Limestone	139	500.0	504.0	3.9	N	2.9	5			R2.5	W1.5	500.6	J	1.0	60.0	C	VR	OX	C	8.0	20						
													500.9	J	1.0	80.0	PL	VR	OX	1	10.0	20						
													501.2	J	1.0	60.0	PL	VR	CA	1	8.0	20						
													501.8	J	1.0	55.0	ST	R	OX	1	10.0	20						
													502.1	J	1.0	70.0	ST	R	OX	C	8.0	20						
	Limestone	140	504.0	508.0	4.5	N	2.3	8	12	6	R2.5	W1.5	504	J	1.0	65.0	ST	VR			12	25.0						
													504.4	SH	1.0	70.0	C	SL	CL	2.0	6.0	6.0						
													504.6	SH	1.0	70.0	PL	SL	CL	1.0	4.0	6.0						
													505.3	SH	1.0	20.0	PL	SL	CA	1.0	8.0	6.0						
													506.1	SH	1.0	15.0	IR	SL	CA	1.0	8.0	6.0						
													506.6	J	1.0	60.0	PL	SM			6.0	12.0						
													506.9	J	1.0	60.0	PL	SM			6.0	12.0						
													507.6	SH	1.0	65.0	PL	PO	CL	1.0	4.0	6.0						
	Limestone	141	508.0	511.0	2.8	N	0	20			R2	W1.5														508.8	511.0	
	Limestone	142	511.0	514.0	2.9	N	1.6	20			R2.5	W1.5														511.0	512.3	
	Limestone	143	514.0	518.0	3.8	N	2.1	3	20	12	R2	W1.5	514.6	J	1.0	10.0	PL	SM	CA	1	4.0	20						
													516	J	1.0	65.0	PL	SM	OX	C	4.0	12						

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													517.6	J	1.0	15.0	PL	R			8.0	12						
	Limestone	144	518.0	520.0	1.8	N	1.7	0			R2.5	W1.5																
	Limestone	145	520.0	521.0	1	N	0	20																		520.0	521.0	
	Limestone	146	521.0	523.0	2	N	1.1	20	25	25	R2.5	W1.5														521.0	521.6	
													522	J	1.0	70.0	ST	VR			14.0	25						
													522.7	J	1.0	85.0	ST	VR			16.0	25						
	Limestone	147	523.0	528.0	5.2	N	2.4	6	12	6	R2.5	W1.5	524.2	SH	1.0	45.0	PL	CL	1.0	4.0	6.0							
													524.6	J	1.0	65.0	SM			8	12.0							
													525.4	SH	1.0	60.0	SL	CL	1.0	8.0	6.0							
													525.9	J	1.0	65.0	SM	CA	1.0	6.0	12.0							
													526.8	J	1.0	70.0	SM			10	12.0							
													527.7	J	1.0	45.0	SM			12	20.0							
	Limestone	148	528.0	533.0	5	N	4.1	4	20	12	R2.5	W1.5	528.5	J	1.0	60.0	UN	SM			8.0	20						
													529.6	J	1.0	40.0	PL	SM	CL	1	4.0	12						
													530.2	J	1.0	20.0	PL	R			6.0	12						
													531.3	J	1.0	75.0	UN	VR			16.0	25						
	Limestone	149	533.0	535.5	2.5	N	1.6	2	20	20	R2.5	W1.5	533.3	J	1.0	45.0	UN	R	OX	C	10.0	20						
													534.9	J	1.0	60.0	PL	SM			6.0	20						
	Limestone	150	535.5	540.0	4.4	N	3.1	8			R2.5	W1.5	536.3	J	1.0	70.0	UN	VR			14	25						
													536.4	SH	1.0	70.0	PL	SL	CL	1.0	4.0	6						
													536.7	SH	1.0	20.0	IR	SL	CA	1.0	6.0	6						
													537.3	J	1.0	80.0	PL	VR			12	12						
													537.6	SH	1.0	60.0	C	SL	OX	C	6	6						
													537.8	SH	1.0	55.0	ST	SL	OX	C	6	6						
													539	SH	1.0	70.0	PL	SL			6	6						
													540	SH	1.0	60.0	PL	SL	CA	1.0	6.0	6						
	Limestone	151	540.0	544.0	4.2	N	2	9	25	6	R2.5	W1.5	510	SH	1.0	70.0	PL	SL	CA	1	6.0	6						
													540.1	SH	1.0	75.0	PL	SL	CA	1	6.0	6						
													542.5	J	1.0	50.0	ST	VR			12.0	25						
													542.8	J	1.0	70.0	PL	VR	OX	C	14.0	25						
													543	J	1.0	30.0	ST	R	OX	C	14.0	25						
													543.2	J	1.0	75.0	PL	VR			12.0	25						
													543.4	J	1.0	70.0	ST	R			10.0	20						
													543.6	J	1.0	65.0	PL	R	OX	C	8.0	20						
													543.8	J	1.0	75.0	PL	VR	OX	C	12.0	25						
	Limestone	152	544.0	545.0	1	N	0.4	4	20		R2.5	W1.5	544.2	J	1.0	70.0	PL	R	CA	1	8.0	20						
													544.4	J	1.0	80.0	PL	R	CA	1	8.0	20						
													544.5	J	1.0	75.0	C	SL	CA	1	6.0	6						
													544.8	J	1.0	60.0	PL	R	CA	1	8.0	20						
	Limestone	153	545.0	547.0	1.9	N	0	20	20	6	R2.5	W1.5	545.4	SH	1.0	60.0	ST	SL	CA	1	6.0	6						
													545.6	J	1.0	70.0	ST	R	CA	1	8.0	20						
	Limestone	154	547.0	550.0	2.8	N	0.5	7	20	20	R2.5	W1.5	547.4	J	1.0	20.0	PL	SM	CA	2	4.0	20						
													547.5	J	1.0	75.0	PL	VR	OX	C	10.0	20						
													547.7	J	1.0	80.0	PL	R	OX	C	8.0	20						
													548.2	J	1.0	35.0	PL	R	OX	C	6.0	20						
													548.7	J	1.0	80.0	ST	SM	OX	C	6.0	20						
													549	J	1.0	20.0	PL	R	OX	C	10.0	20						
													549.2	J	1.0	65.0	UN	SM	OX	C	6.0	20						
	Limestone	155	550.0	554.0	3.8	N	1.2	6	12	6	R2.5	W1.5	551.4	J	1.0	45.0	PL	SM			6.0	20						

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													551.7	J	1.0	30.0	PL	SM			6.0	20						
													552	SH	1.0	55.0	PL	SL	CL	1	8.0	6						
													553.4	J	1.0	70.0	PL	SM	OX	1	8.0	12						
													553.6	J	1.0	10.0	PL	PO	CA	1	6.0	12						
													553.7	J	1.0	50.0	C	SM	OX	1	6.0	12						
	Limestone	156	554.0	559.0	4.9	N	0	20	20	12	R2.5	W2	554.6	J	1.0	30.0	IR	SM	CA	1	8.0	20						
													555	J	1.0	50.0	IR	R			10.0	25						
													555.5	J	1.0	80.0	PL	R			8.0	20						
													556.6	J	1.0	20.0	PL	SM			6.0	12						
													557.2	J	1.0	40.0	PL	SM			4.0	12						
													557.8	J	1.0	5.0	IR	R	OX	1	12.0	20						
													558.1	J	1.0	65.0	PL	SM	CL	1	6.0	12						
	Limestone	157	559.0	564.0	4.6	N	3.4	3	20	12	R2.5	W2.5	559.3	J	1.0	55.0	PL	SM	CL	1	4.0	12						
													560.9	J	1.0	70.0	IR	R			23.0	36						
													561.4	J	1.0	80.0	IR	VR	CA	1	16.0	25						
	Limestone	158	564.0	568.0	4.4	N	3.7	1	20	20	R2.5	W2.5	567	J	1.0	50.0	IR	VR	CL	1	14.0	20						
	Limestone	159	568.0	570.0	1.7	N	0	20	12	12	R2.5	W2.5	568.7	J	1.0	65.0	UN	SM	CL	1	4.0	12						
													569.2	J	1.0	20.0	IR	SM	OX	C	8.0	20						
	Limestone	160	570.0	573.0	2.8	N	0	20	12	12	R2.5	W2.5														570.0	573.0	
	Limestone	161	573.0	576.0	2.2	N	0	20			R2	W2.5														573.0	576.0	
	Limestone	162	576.0	579.0	3.3	N	0	20	12	12	R2.5	W1.5														576.0	579.0	
													576.7	J	1.0	20.0	PL	SM	CA	1	6.0	12						
	Limestone	163	579.0	583.0	4.1	N	3.6	0			R2.5	W1.5																
	Limestone	164	583.0	587.0	4	N	3.3	2	16	12	R2.5	W2.5	585.1	J	1.0	65.0	PL	R			6.0	12						
													585.5	J	1.0	80.0	PL	R	OX	1	8.0	20						
	Limestone	165	587.0	590.0	3.1	N	1	20			R2	W2.5														587.0	589.1	
	Limestone	166	590.0	593.0	2.6	N	1.6	20			R1.5	W2.5														590.0	591.0	
													592	J	1.0	60.0	IR	R	CL	1	18.0	20						
	Limestone	167	593.0	597.0	3.6	N	2.2	20																		593.0	593.8	
																										595.1	595.3	
																										595.6	595.8	
	Limestone	168	597.0	600.0	3	N	2.3	20			R2.5	W2														597.4	597.7	
	Limestone	169	600.0	604.0	4.3	N	2.2	7	12	6	R2	W2.5														600.4	600.9	
													600.4	J	1.0	75.0	IR	R	CL	1	10.0	12						
													601.1	J	1.0	80.0	IR	R	CL	1	8.0	20						
													601.4	J	1.0	60.0	IR	R	CL	1	8.0	12						
													601.9	SH	1.0	20.0	PL	SL	CA	1	4.0	6						
													602.4	SH	1.0	80.0	PL	SM	G	15	6.0	6						
													603	SH	1.0	70.0	PL	SL	G	20	4.0	6						
													603.2	SH	1.0	80.0	PL	SL	CL	1	6.0	6						
	Limestone	170	604.0	608.0	3.9	N	2	6	6	6	R2.5	W2.5	605.2	SH	1.0	60.0	ST	SL	CA	1	12.0	6						
													605.5	J	1.0	80.0	PL	VR	OX	1	16.0	20						
													606.4	SH	1.0	85.0	PL	SL	CL	1	6.0	6						
													606.7	SH	1.0	35.0	PL	SL	CA	1	10.0	6						
													607.1	SH	1.0	80.0	PL	SL	CA	1	4.0	6						
													607.7	SH	1.0	75.0	PL	SL	CL	1	8.0	6						

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	171	608.0	611.0	2.6	N	1.2	3	12	6	R2.5	W2.5	608.6	J	1.0	75.0	PL	VR	CL	1	10.0	20						
													609.2	SH	1.0	30.0	UN	SL	CA	1	8.0	6						
													610.1	J	1.0	70.0	PL	PO	CL	1	4.0	12						
	Limestone	172	611.0	615.0	4.3	N	2.8	7	6	0	R2	W2.5	611.8	SH	1.0	75.0	PL	SL	CL	2	2.0	6						
													611.9	J	1.0	70.0	C	PO	CL	1	2.0	12						
													612.3	J	1.0	80.0	IR	PO	CL	1	8.0	12						
													613.6	J	1.0	50.0	IR	PO	CL	1	6.0	12						
													613.7	SH	1.0	75.0	PL	SL	CL	1	2.0	6						
													613.9	F	1.0	30.0	PL	SL	G	0.5	2.0	0						
													614.8	SH	1.0	40.0	IR	SL	CA	1	8.0	6						
	Limestone	173	615.0	617.0	1.6	N	0	20			R1.5	W2														615.0	617.0	
	Limestone	174	617.0	620.0	2.8	N	0	20			R1.5	W2														617.0	620.0	
	Limestone	175	620.0	623.0	2	Y	0	20	6	6	R1.5	W2	620.4	SH	20.0	40.0	PL	SL	C	1	4.0	6				621.7	623.0	
	Limestone	176	623.0	627.0	3.9	Y	0.4	20	12	6	R1.5	W2	624.6	J	1.0	40.0	PL	R			8.0	12						
													624.8	B	1.0	40.0	PL	SM			2.0	12						
													625	B	1.0	40.0	PL	SM			2.0	12						
													625.1	B	1.0	40.0	PL	SM			2.0	12						
													625.3	SH	1.0	60.0	PL	SL			2.0	6						
													626	B	1.0	45.0	PL	SM			2.0	12						
													626.3	B	1.0	45.0	PL	SL			2.0	6						
													626.5	B	1.0	45.0	PL	SM			2.0	12						
	Limestone	177	627.0	629.0	2.2	Y	0.4	3	6	6	R1.5	W2	627.9	SH	1.0	40.0	PL	SL	CL	1	2.0	6						
													628.4	SH	1.0	40.0	PL	SL	CL	1	2.0	6						
													628.9	SH	1.0	40.0	PL	SL	CL	1	4.0	6						
	Limestone	178	629.0	633.0	3.1	Y	0.8	4	8	0	R1.5	W2											632.1	633.0				
													629.6	B	1.0	40.0	PL	SL	CL	1	2.0	6						
													629.7	B	1.0	40.0	PL	PO	CL	1	2.0	12						
													629.8	B	1.0	40.0	PL	PO	CL	1	2.0	12						
													632.1	F	1.0	40.0	PL	SL	G		2.0	0						
	Limestone	179	633.0	637.0	3.5	N	0	20			R1.5	W1.5														633.0	637.0	
	Limestone	180	637.0	640.0	3.1	N	0	20	0	0	R1	W2.5											637.0	640.0				
	Limestone	181	640.0	644.0	3.5	Y	0.8	20	6	0	R1.5	W2.5											640.0	642.3				
													642.3	B	1.0	40.0	PL	SL	CL	1	4.0	6						
													643.3	B	1.0	35.0	PL	SL	CL	1	2.0	6						
													645.7	B	1.0	35.0	PL	SL	CL	1	2.0	6						
	Limestone	182	644.0	649.0	5	N	3.7	2	6	1	R1.5	W2.5														644.0	644.9	
													646.4	SH	1.0	50.0	ST	SL	CL	1	12.0	6						
													648.1	SH	1.0	50.0	ST		CL	1	14.0	6						
	Limestone	183	649.0	652.0	3.3	Y	1.3	4	9	6	R1.5	W2.5	649.5	SH	1.0	60.0	IR	SL	CL	2	10.0	6						
													650.3	J	1.0	30.0	PL	PO	CL	1	2.0	12						
													651	B	1.0	25.0	PL	SL	CL	1	2.0	6						
													651.7	J	1.0	20.0	C	PO	CL	1	2.0	12						
	Limestone	184	652.0	656.0	3.2	Y	1	4	6	0	R1.5	W2.5	653.6	B	1.0	40.0	ST	SL	CL	2	2.0	6						
													653.9	B	1.0	20.0	PL	SL	CL	1	4.0	6						
													654	B	1.0	40.0	PL	SL	CL	1	2.0	6						
													654.7	F	1.0	40.0	PL	SL	G		4.0	0	654.7	655.4				
	Limestone	184	656.0	660.0	4	N	4	0	25	25	R2.5	W1.5																

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	185	660.0	664.0	4	N	2.6	1	6	6	R2.5	W2	660.4	SH	1.0	35.0	PL	SL	CA		6.0	6						
	Limestone	186	664.0	668.0	3.8	N	1.6	4	6	6	R2.5	W2	664.3	SH	1.0	5.0	IR	SL	CA	1	10.0	6						
													666.3	SH	1.0	25.0	UN	SL	CL	1	8.0	6						
													667.1	SH	1.0	35.0	UN	SL	CL	10	8.0	6						
													667.3	SH	1.0	15.0	UN	SL	CL	1	10.0	6						
	Limestone	187	668.0	672.0	3.2	N	0	20	0	0	R1	W3											668.0	672.0				
	Limestone	188	672.0	676.0	4.1	N	0	20	0	0	R1	W3											672.0	676.0				
	Limestone	189	676.0	680.0	4	N	0	20	0	0	R1	W3											676.0	680.0				
	Limestone	190	680.0	684.0	4.3	N	0	20	0	0	R1	W3											680.0	684.0				
	Limestone	191	684.0	688.0	4.1	N	0	20	0	0	R1	W3											684.0	688.0				
	Limestone	192	688.0	692.0	3.9	N	0	20	0	0	R1	W3											688.0	692.0				
	Limestone	193	692.0	696.0	3.1	N	0	20	0	0	R1	W3											692.0	696.0				
	Limestone	194	696.0	700.0	3.7	Y	0	20	0	0	R1.5	W3	698.3	F	1.0	40.0	PL	SL	G	100	2.0	0	696.0	698.3				
													698.5	SH	1.0	35.0	PL	SL	CL	1	4.0	6						
													699	SH	1.0	35.0	UN	SL	CL	1	8.0	6						
													699.4	J	1.0	35.0	PL	PO	CL	1	8.0	12						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	No recovery	1	60.0	61.0	0.0																							Casing originally set at 60 ft, but had some problems at 70 ft, so reset casing at 70 ft
	No recovery	2	61.0	63.0	0.0																							
	Greenstone	3	63.0	65.0	0.2		0.0	>20																		63.0	65.0	rubble
	Greenstone	4	65.0	66.0	0.6		0.0	>20																		65.0	66.0	rubble
	Greenstone	5	66.0	69.0	0.2		0.0	>20																		66.0	69.0	one chunk of greenstone
	No recovery	6	69.0	70.0	0.0																							rock bit
	Greenstone	7	70.0	70.5	0.5			>20																		70.0	70.5	rubble
	Greenstone	8	70.5	72.0	1.0		0.5	>20																		70.5	71.5	rubble w/ 0.5 ft clast of greenstone
	Greenstone	9	72.0	74.5	0.7		0.0	>20																		72.0	74.5	rubble
	No recovery	10	74.5	76.0	0.0																							no recovery
	Greenstone w/calcite vein	11	76.0	76.5	0.4		0.0	>20																		76.0	76.5	rubble
	Greenstone w/ Iron ox staining	12	76.5	78.5	1.0		0.0	>20																		76.5	78.5	rubble
	No recovery	13	81.0	82.5	0.0																							no recovery
	No recovery	14	82.5	85.5	0.0																							no recovery
	No recovery	15	83.5	86.0	0.0																							
	Greenstone	16	86.0	88.0	0.2	n	0.0	>20				W4														86.0	88.0	rubble
	no recovery	17	88.0	91.0	0.0																							No recovery
	Greenstone	18	91.0	93.0	0.3	n	0.0	>20				W4														91.0	93.0	rubble
	Greenstone	19	93.0	94.0	0.2	n	0.0	>20				W4																
	Greenstone	20	94.0	95.0	0.3	n	0.0	>20				W4																
	Greenstone	21	95.0	100.0	0.4	n	0.0	>20				W4																
	Greenstone	22	100.0	104.0	0.6	n	0.0	>20				W4																
	Greenstone	23	104.0	104.5	0.2	n	0.0	>20				W4																
	Greenstone	24	104.5	106.0	0.7	n	0.0	>20				W4																
	Greenstone	25	106.0	108.0	0.4	n	0.0	>20				W4																
	Greenstone	26	108.0	109.0	0.7	n	0.0	>20				W4														108.0	109.0	rubble
	Greenstone	27	109.0	110.0	0.6	n	0.4	1			R2	W3-W2																
													109.4	J	1	15	ST	R	FeOx	1	8.0	12						
	Greenstone	28	110.0	111.5	1.4	n	0.0	3	12	12	R2-R3	W3																
													110.4	J		5	Pl	R	FeOx	1	8.0	12						
													110.8	J		70	Pl	SM	Ca	>1	6.0	12						
													111.1	J		70	C	SM	Cl	0.5	6.0	12						
	Greenstone	29	111.5	115.0	3.5	n	2.0	4	12	6	R2-R3	W2-W3														111.5	112.7	rubble
													112.4	J		60	P	R	FeOx	C	10.0	12						
													112.7	J		65	P	SM	Ca	C	6.0	12						
													113.5	J		60	C	R	Ca	C	8.0	20						
													114.4	SH		25	P	SM	Cl	1	4.0	6						Slickensides

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength		Detailed Discontinuity Data										Rubble/Gouge					
																							Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greenstone	30	115.0	120.0	3.3	n	2.2	4	12	6	R2-R3	W2-W3	115.6	J		40	P	R	Ca	0.5	10.0	20						
													116.4	SH		65	P	R	Ca	1	6.0	6						Slickensides
													117	J		45	P	R	Ca	0.5	12.0	20						
													117.7	SH		25	P	R	Ca	1	6.0	6						Slickensides
	Greenstone	31	120.0	125.0	2.3	n	0.6	>20	12	12	R1-R2	W3-W4											123.0	123.9	G/B			Small fault
													124.5	J		70	ST	R	Ca	0.5	12.0	12						
													124.7	J		75	C	SM	Ca	0.5	8.0	12						
	Greenstone	32	125.0	126.5	0.7	n	0.0	>20			R2	W3-W4														125.0	126.5	rubble
	no recovery	33	126.5	127.5	0.0																							no recovery
	Greenstone	34	127.5	128.5	0.2	n	0.0	>20			R2	W3-W4														127.5	128.5	rubble
	Greenstone	35	128.5	130.0	1.1	n	0.0	>20			R2	W3-W4														128.5	130.0	rubble
	Greenstone	36	130.0	130.5	0.2	n	0.0	>20			R2	W3-W4														130.0	130.5	rubble
	Greenstone	37	130.5	133.0	0.4	n	0.0	>20			R2	W3-W4														130.5	133.0	rubble
	Greenstone	38	133.0	133.5	0.3	n	0.0	>20			R2	W3-W4														133.0	133.5	rubble
	Greenstone	39	133.5	134.0	0.2	n	0.0	>20			R2	W3-W4														133.5	134.0	rubble
	no recovery	40	134.0	135.0	0.0																							no recovery
	no recovery	41	135.0	135.5	0.0																							no recovery
	Greenstone	42	135.5	138.0	2.7	n	0.8	7	6	6	R2	W3-W4	135.9	J		65	P	SM	Cl	0.5	6.0	12						
													136.4	SH		60	P	K	Cl	1	8.0	6						
													136.5	SH		50	P	K	Cl	>1	8.0	6						
													136.9	SH		40	U	K	Cl	1	10.0	6						
													137.1	SH		35	C	K	Cl	1	10.0	6						
													137.5	SH		35	ST	K	Cl	>1	10.0	6						
													137.9	J		45	IR	VR	Ca	C	12.0	20						
	Greenstone	43	138.0	140.0	1.7	n	0.8	0																				Noncontinuous fractures common
	Greenstone	44	140.0	143.0	3.2	n	0.6	>20	6	0	R1-R2	W3-W4	140.8	SH		50	P	K	Cl	>1	6.0	6						
													141.1	SH		40	P	K	Cl	2								
													141.6	F		55	P	K	G				141.6	141.8				Fault w/ gouge
	Greenstone	45	143.0	147.0	4.0	n	2.2	4	12	0	R1-R3	W3-W4	143.7	J		60	P	VR	Ca	0.5	10.0	20						
													143.8	J		10	IR	VR	Ca	0.5	12.0	20						
													144.1	J		20	IR	VR	NA		10.0	20						
													145.3	F		25	P	K	G				145.3	146.0				
	Greenstone	46	147.0	149.0	1.5	n	0.4	2	6	6	R1-R2	W3-W4	147.2	SH		30	P	K	Br	3	6.0	6				148.3	149.0	
													147.9	SH		40	C	K	Cl	1	6.0	6						
	Greenstone	47	149.0	151.5	2.4	n	0.0	>20	6	0	R1-R2	W3-W4	149.9	SH		50	U	K	G	4	8.0	6						
	no recovery, fault?	48	151.5	152.0	0.0																							
	no recovery, fault?	49	152.0	154.0	0.0																							
	no recovery, fault?	50	154.0	156.0	0.0																							
	fault zone, no recovery	51	156.0	160.0	0.0																							
	no recovery	52	160.0	161.0	0.0																							

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength		Detailed Discontinuity Data										Rubble/Gouge					
																							Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greenstone	53	161.0	162.0	0.9	n	0.4	>20	6	6	R1-R2	W3-W4	161.5	SH	1	70	P	K	Cl	1	8.0	6				161.5	162.0	
	Greenstone	54	162.0	166.0	0.8	n	0.0	>20			R1-R2	W3-W4														162.0	166.0	rubble
	no recovery	55	166.0	168.0	0.0																							
	no recovery	56	168.0	169.0	0.0																							
	no recovery	57	169.0	170.0	0.0																							
	no recovery	58	170.0	174.0	0.0																							
	no recovery	59	174.0	175.0	0.0																							
	no recovery	60	175.0	179.0	0.0																							
	no recovery	61	179.0	182.0	0.0																							
	Greenstone	62	182.0	186.0	0.5	n	0.0	>20			R1-R2	W3-W4																rubble
	no recovery	63	186.0	190.0	0.0																							
	no recovery	64	190.0	194.0	0.0																							
	Greenstone	65	194.0	198.0	0.1	n	0.0	>20			R1-R2	W3-W4																rubble
	Greenstone	66	198.0	200.0	0.4	n	0.0	>20			R1-R2	W3-W4																rubble
	Greenstone grading to fault gouge	67	200.0	204.0	1.8	n	0.4	2/>20	6	6	R1-R2	W3-W4	200.5	SH		45	IR	K	Cl	>1	8.0	6	201.6	204.0				
													201.2	SH		50	P	K	Cl	1	6.0	6						
	Greenstone gouge	68	204.0	206.0	2.1	n	0.0	2/>20	6	0	R0-R1	W4-W5	204.7	SH		40	U	K	G	1	4.0	6	204.0	206.0				
													205.5	SH		55	C	K	G	1	6.0	6						
	Gouge w/ greenstone clasts	69	206.0	209.0	2.3	n	0.0	>20	0	0	R0-R1	W4-W5											206.0	209.0				fault gouge
	Gouge w/ greenstone clasts	70	209.0	211.0	2.7	n	0.0	>20	0	0	R0-R1	W4-W5											209.0	211.0				fault gouge
	Gouge w/ greenstone clasts	71	211.0	214.0	1.3	n	0.0	>20	0	0	R0-R1	W4-W5											211.0	214.0				fault gouge
	Gouge w/ greenstone clasts	72	214.0	218.0	1.6	n	0.0	>20	0	0	R0-R2	W4-W5											214.0	218.0				fault gouge
	Greenstone/gouge	73	218.0	220.0	2.0	n	1.2	2/>20	6	0	R0-R3	W2-W4	218.1	SH		60	P	K	Cl	2	2.0	6						
													219.2	SH		55	IR	K	G		4.0	0	219.2	220.0	G			begin fault gouge
	Gouge w/ greenstone clast	74	220.0	223.0	2.4	n	0.0	1/>20	0	0	R0-R1	W4-W5	221.9	SH/F		40	P	K	G		4.0	0	220.0	223.0				
	no recovery	75	223.0	224.0	0.0																							
	no recovery	76	224.0	225.0	0.0																							
	no recovery	77	225.0	226.0	0.0																							
	no recovery	78	226.0	227.5	0.0																							
	no recovery	79	227.5	229.0	1.0	n	0.0	>20	6	6	R1-R2	W3-W4																rubble

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength		Detailed Discontinuity Data										Rubble/Gouge					
																							Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greenstone	80	229.0	231.0	0.7	n	0.5	1	6	6	R2-R3	W2-W3	229	SH		45	P	K	Ca	1	4.0	6						
	Greenstone	81	231.0	235.0	1.1	n	0.0	>20	6	6	R2-R3	W3-W4	231.6	SH		45	C	K	Cl	1	6.0	6				231.0	235.0	rubble w/ slickensides
	Greenstone	82	235.0	239.5	0.7	n	0.0	>20	6	0	R1-R2	W2														235.0	239.5	rubble
	fault gouge greenstone clasts	83	239.5	241.0	1.8	n	0.0	>20	0	0	R1-R2	W3-W4											239.5	241.0	G			
	fault gouge w/greenstone clasts	84	241.0	245.0	1.5	n	0.0	>20	0	0	R1-R2	W3-W4											241.0	245.0	G			
	Greenstone(fault ?)	85	245.0	249.0	0.7	n	0.0	>20	6	0	R1-R2	W3-W4														245.0	249.0	gouge w/ matrix washed out
	no recovery	86	249.0	254.0	0.0																							
	no recovery	87	254.0	258.0	0.0																							
	fault gouge w/greenstone clasts	88	258.0	260.0	1.2	n	0.0	>20	0	0	R1-R2	W3-W4											258.0	260.0	G			fault gouge w/ greenstone clasts
	fault gouge w/ greenstone clasts	89	260.0	264.0	2.2	n	0.0	3/>20	6	6	R1-R2	W3-W4	260.6	SH		50	IR	K	Cl	1	6.0	6	260.0	260.5				
													261.1	SH		40	IR	K	Cl	>1	12.0	6	261.7	264.0				
													261.5	SH		65	ST	K	Ca	2	10.0	6						
	fault gouge w/greenstone clasts	90	264.0	267.5	1.8	n	0.0	>20	0	0	R1-R2	W3-W4											264.0	267.5	G			gouge supported breccia
	fault gouge	91	267.5	270.0	1.6	n	0.5	1/>20	6	0	R1-R2	W3-W4	268.3	SH	1	40	P	K	Cl	1	4.0	6	268.6	270.0	G			w/ lg 1ft clast of greenstone
	fault gouge	92	270.0	272.0	2.2	n	0.0	>20	0	0	R1-R2	W3-W4											270.0	272.0	G			w/ greenstone breccia clasts
	fault breccia	93	272.0	274.0	1.2	n	0.0	>20	0	0	R2	W3											272.0	274.0	FB			Slickensides on corestones, less in matrix
	fault breccia	94	274.0	277.0	1.2	n	0.0	5/>20	6	0	R1-R2	W3-W4	274.5	SH		60	IR	K	Cl	1	8.0	6	274.0	277.0	FB			fault breccia w/ obvious shear
													274.6	SH		65	IR	K	Cl	1	10.0	6						
													274.7	SH		75	IR	K	Cl	1	12.0	6						
													274.7	SH		45	IR	K	Cl	1	10.0	6						
													274.8	SH		80	IR	K	Cl	1	10.0	6						
	fault gouge	95	277.0	280.0	1.3	n	0.0	>20	0	0	R1-R2	W3-W4											277.0	280.0	G			fault gouge w/ greenstone breccia
	fault gouge	96	280.0	284.0	3.1	n	0.0	>20	0	0	R1-R2	W3-W4	280.6	SH		50	P	K	Cl	2	2.0	6	280.0	284.0	G			gouge w/ greenstone clasts sample 280.3-281
	fault gouge	97	284.0	288.0	2.9	n	0.0	>20	0	0	R1-R2	W3-W4											284.0	288.0	G			gouge w/ greenstone clasts
	fault gouge	98	288.0	290.0	1.6	n	0.0	>20	0	0	R1-R2	W3-W4	289.5	SH		60	P	K	Cl	2	2.0	6	288.0	290.0	G			gouge w/ greenstone clasts
	fault gouge	99	290.0	292.0	1.4	n	0.0	>20	0	0	R1-R2	W3-W4	291.4	SH		45	P	K	Cl	3	2.0	6	290.0	292.0	G			gouge with greenstone clasts and limestone vein
	fault gouge	100	292.0	296.0	3.5	n	0.0	>20	0	0	R1-R2	W3-W4											292.0	296.0	G			gouge w/ greenstone clasts
	fault gouge & fault breccia	101	296.0	300.0	3.5	n	1.3	5/>20	6	0	R1-R3	W2-W4	296.9	SH		25	P	K	Cl	1	2.0	6	296.0	296.6	G			0.6 gouge then partially rehealed fault breccia w/ 5 obvious shears, common noncontinuous fractures in core
													297.8	SH		60	IR	K	Cl	2	12.0	6						
													298.4	SH		45	P	K	Cl	1	4.0	6						
													298.5	SH		45	P	K	Cl	1	4.0	6	298.4	300.0	FB			Brecciated core
													299.3	SH		45	P	K	Cl	2	2.0	6						
	Fault gouge	102	300.0	301.0	0.7	n	0.0	>20	0	0													300.0	301.0	FG			gouge w/ greenstone clasts

			Run Data																				Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Partially rehealed fault gouge	103	301.0	305.0	3.8	n	2.1	>20	0	0	R1-R2	W3-W4	301.9	SH		70	IR	R	Cl	1	12.0	6						
													303.7	F		50	IR	K	G	30	2.0	0						
								>20															303.7	305.0	FB			fault breccia(greenstone)
	Brecciated greenstone	104	305.0	306.5	1.3	n	0.0	2/>20	6	0	R1-R2	W3-W4	305.5	SH		60	C	K	Cl	>1	6.0	6						
													306	SH		50	P	K	Cl	1	4.0	6						
	Greenstone rubble	105	306.5	309.0	0.2	n	0.0	>20			R1-R2	W3-W4														306.5	309.0	rubble w/slickensides visible
	no recovery	106	309.0	311.0	0.0																							
	Greenstone rubble	107	311.0	314.0	0.4	n	0.0	>20			R1-R2	W3-W4														311.0	314.0	rubble
	rehealed greenstone breccia	108	314.0	318.0	2.2	n	0.6	3/.20	6	0	R1-R3	W2-W4	314.2	SH		70	P	K	G	7	4.0	6	314.0	318.0	FB			
													314.9	SH		70	IR	K	Cl	2	10.0	6						
													315.5	SH		50	P	K	Cl	1	8.0	6						
	no recovery	109	318.0	322.0	0.0																							
	Greenstone clasts	110	322.0	323.0	1.0	n	0.7	0/>20	20	20	R1-R3	W2-W3														322.0	322.3	
	No recovery	111	323.0	325.0	0.0																							
	No recovery	112	325.0	327.0	0.0																							
	Greenstone clasts	113	327.0	329.0	0.4	n	0.0	>20			R1-R2	W3-W4														327.0	329.0	rubble
	Fault gouge	114	329.0	332.0	1.8	n	0.0	>20			R0-R1	W4-W5											329.0	332.0				gouge w/ greenstone clasts
	Greenstone clasts	115	332.0	334.0	0.2	n	0.0	>20			R1-R2	W3-W4														332.0	334.0	rubble
	Cataclasite	116	334.0	335.0	0.8	n	0.0	>20			R0	W4-W5														334.0	335.0	silty fine to coarse sand, some fine to medium angular gravel-greenstone
	no recovery	117	335.0	338.0	0.0																							
	Greenstone clasts	118	338.0	340.0	0.2	n	0.0	>20			R1-R2	W3-W4														338.0	340.0	rubble
	Greenstone clasts	119	340.0	344.0	0.5	n	0.0	>20			R1-R2	W3-W4														340.0	344.0	rubble-slickensides visible on some surfaces
	no recovery	120	344.0	349.0	0.0																							
	Greenstone clasts	121	349.0	351.0	0.4	n	0.0	>20			R1-R3	W3-W4														349.0	351.0	a 0.3 clast and rubble
	no recovery	122	351.0	354.0	0.0																							
	no recovery	123	354.0	357.5	0.0																							
	no recovery	124	357.5	362.0	0.0																							
	Greenstone	125	362.0	364.0	1.2	n	0.7	1	6	6	R2-R3	W2-W3	363	SH		35	P	K	Cl	1	10.0	6						rehealed breccia
	Greenstone	126	364.0	365.0	1.0	n	0.0	3	6	6	R2-R3	W2-W3	364.3	SH		85	P	K	Cl	>1	6.0	6						rehealed breccia w/ shears
													364.6	SH		75	P	K	Cl	>1	8.0	6						
													364.8	SH		40	P	K	Cl	1	6.0	6						
	Greenstone clasts	127	365.0	368.5	0.5	n	0.0	1	6	6	R2-R3	W2-W3	365.3	SH		50	P	K	Cl	>1	4.0	6						
	Gouge	128	368.5	372.0	0.5	n	0.0	>20	6	0	R1-R2	W3-W4											368.5	372.0	G			gouge w/ greenstone clasts, slickensides visible

			Run Data																				Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Gouge	129	372.0	375.0	1.5	n	0.0	>20	0	0	R1-R2	W3-W4											372.0	375.0	G			gouge w/ greenstone clasts
	Gouge	130	375.0	377.5	1.8	n	0.0	1/>20	0	0	R1-R2	W3-W4	375.7	SH		25	P	K	G	2	4.0	0	375.0	377.5	G			gouge with greenstone clasts, slickensides and 1 obvious shear
	Gouge	131	377.5	380.0	2.5	n	0.0	3/>20	0	0	R1-R2	W3-W4	378.5	SH		65	C	K	Cl	2	4.0	6	377.5	380.0	FG			Gouge w/ greenstone clasts & obvious shear
													379	SH		85	ST	K	Cl	>1	14.0	6						
													379.6	SH		65	C	K	Cl	1	6.0	6						
	Gouge	132	380.0	383.0	2.2	n	0.0	1/>20	0	0	R1-R2	W3-W4	381.2	SH		55	P	K	Cl	2	4.0	6	380.0	383.0	FG			Brecciated greenstone w/ gouge matrix
	Gouge	133	383.0	385.0	1.1	n	0.0	1/>20	0	0	R1-R2	W3-W4	383.1	SH		45	P	K	Cl	2	6.0	6	383.0	385.0	FG			gouge w/ greenstone breccia
	Gouge	134	385.0	386.0	0.4	n	0.0	>20	0	0	R1-R2	W3-W4											385.0	386.0	FG			gougw w/ greenstone breccia
	Gouge	135	386.0	388.0	1.0	n	0.0	>20	0	0	R0-R2	W3-W5											386.0	388.0	FG			gouge w/ greenstone breccia
	Gouge	136	388.0	390.0	0.1	n	0.0	>20	0	0	R0-R2	W4-W5											388.0	390.0	FG			gouge w/greenstone breccia
	Gouge	137	390.0	393.0	2.2	n	0.0	>20	0	0	R0-R2	W4-W5											390.0	393.0	FG			gouge with greenstone breccia
	Gouge	138	393.0	395.5	2.1	n	0.0	>20	0	0	R0-R2	W4-W5	393.8	SH		40	C	K	Cl	2	4.0	6	393.0	395.5	FG			gouge w/greenstone breccia
	Gouge	139	395.5	397.0	0.8	n	0.0	>20	0	0	R0-R2	W3-W5											395.5	397.0	FG			gouge w/ greenstone breccia
	Gouge	140	397.0	398.0	1.0	n	0.0	>20	0	0	R0-R1	W4-W5											397.0	398.0	FG			gouge greenstone
	Gouge	141	398.0	400.0	2.0	n	0.0	>20	0	0	R0-R1	W4-W5											398.0	400.0	FG			gouge w/greenstone breccia
	Gouge	142	400.0	403.0	1.8	n	0.0	>20	0	0	R0-R1	w4-W5											400.0	403.0	FG			gouge w/greenstone breccia
	Gouge	143	403.0	405.0	2.0	n	0.0	>20	0	0	R0-R1	W4-W5											403.0	405.0	FG			gouge w/greenstone breccia
	Gouge	144	405.0	407.0	1.0	n	0.0	>20	0	0	R0-R1	W4-W5											405.0	407.0	FG			gouge w/greenstone breccia
	Gouge	145	407.0	408.0	1.0	n	0.0	>20	0	0	R0-R1	W4-W5											407.0	408.0	FG			gouge w/greenstone breccia
	Gouge	146	408.0	410.0	0.8	n	0.0	>20	0	0	R0-R1	W4-W5											408.0	410.0	FG			gouge w/greenstone breccia
	no recovery	147	410.0	413.0	0.0																							
	no recovery	148	413.0	415.0	0.0																							
	no recovery	149	415.0	420.0	0.0																							
	no recovery	150	420.0	424.0	0.0																							
	no recovery	151	424.0	426.0	0.0																							
	Greenston	152	426.0	427.5	0.4	n	0.0	>20			R1-R3	W2-W3														426.0	427.5	rubble
	Rehealed greenstone gouge	153	427.5	429.0	1.5	n	0.8	2	6	6	R1-R3	W2-W3	427.7	SH		80	IR	K	Cl	>1	12.0	6						
													428.7	SH		35	P	K	Cl	2	6.0	6						
	rehealed greenstone gouge	154	429.0	430.0	0.8	n	0.8	0			R1-R3	W2-W3																
	rehealed greenstone gouge	155	430.0	432.0	2.0	n	1.2	2	6	0	R1-R3	W2-W3	430.3	SH		15	C	K	Cl	>1	4.0	6						
													431.5	SH		40	C	K	Cl	1	6.0	6						
								>20																		431.7	432.0	rubble with slickensides
	rehealed greenstone gouge	156	432.0	435.0	0.9	n	0.0	1/>20	6	6	R1-R3	W2-W3	432.6	SH		40	U	K	Cl	1	6.0	6						Non continuous fractures throughout core

			Run Data																				Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	partially rehealed greenstone breccia	157	435.0	438.0	2.1	n	0.0	2/>20	6	6	R1-R3	W2-W3	435.6	SH		65	P	K	Cl	2	2.0	6				436.4	438.0	
													435.9	SH		60	P	K	G	10	2.0	6						
	rehealed greenstone breccia	158	438.0	440.0	2.0	n	1.8	1	20	20	R2-R3	W2-W3	439.5	J		70	IR	R	NA	NA	10.0	20						
	rehealed greenstone breccia	159	440.0	443.0	2.9	n	2.1	2	12	6	R2-R3	W2-W3	440.3	SH		50	U	K	Cl	1	6.0	6						
													442.3	J		35	IR	R	Cl	1	8.0	12						
	rehealed greenstone breccia	160	443.0	445.0	1.3	n	0.7	1	6	6	R2-R3	W2-W3	443.8	SH		60	IR	K	Cl	>1	10.0	6				444.1	445.0	rubble
	rehealed greenstone breccia	161	445.0	446.0	0.2	n	0.0	>20			R2-R3	W2-W4														445.0	446.0	
	rehealed greenstone breccia	162	446.0	449.0	2.3	n	1.6	2	6	6	R2	W2-W3	446.8	SH		50	IR	K	Cl	>1	10.0	6						
													447.5	SH		25	IR	K	Cl	1	14.0	6						
	rehealed greenstone breccia	163	449.0	452.0	3.0	n	1.5	3	6	6	R2	W2-W3	150.7	SH		35	ST	K	NA	NA	8.0	6						
													151.1	SH		30	P	K	NA	NA	8.0	6						
													151.4	SH		40	P	K	Cl	>1mm	6.0	6						
	rehealed greenstone breccia	164	452.0	455.0	2.7	n	2.1	1	12	12	R2	W2-W3	452.9	J		40	P	R	NA	NA	12.0	12						
	partially rehealed greenstone breccia	165	455.0	456.5	2.6	n	0.8	2	6	6	R1-R2	W3-W4	455.2	SH		20	P	K	Cl	0.5	10.0	6						
													457	SH		50	C	K	Cl	1	8.0	6						
	partially rehealed greenstone breccia	166	456.5	460.0	2.2	n	1.0	>20	12	6	R2	W2-W3											456.9	457.4				rubble zone
	partially rehealed greenstone breccia	167	460.0	465.0	4.7	n	2.0	>20	6	0	R1-R2	W2-W3	460.8	SH		40	IR	K	Cl	10	6.0							
													461.4	SH		30	P	K	Cl	6	6.0							
														F									462.2	463.0	G			gougy
													463.5	SH		80	IR	K	Cl	12	6.0							
													464.2	SH		50	U	K	Cl	12	6.0							
													464.6	SH		35	U	K	Cl	4	6.0							
	rehealed greenstone breccia	168	465.0	468.5	2.7	n	1.9	0			R2	W2-W3														266.7	267.2	rubble zone
	partially rehealed greenstone breccia	169	468.5	472.5	3.9	n	2.3	8	6	0	R1-R2	W3-W4	469.2	SH		50	IR	K	Cl	0.5	6.0	6						
													469.3	SH		80	P	K	Cl	0.5	4.0	6						
													469.6	SH		65	P	K	Cl	1	6.0	6						
													470	SH		80	C	K	Cl	0.5	6.0	6						
													470.7	SH		25	IR	K	Cl	1	10.0	6						
													470.9	SH		60	P	K	Cl	2	2.0	6						
													471.1	SH		80	ST	K	NA	NA	6.0	6						

			Run Data																				Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													472	SH		70	C	K	Cl	1	2.0	6				472.0	472.5	rubble zone
	partially rehealed greenstone breccia	170	472.5	477.0	1.2	N	0.4	>20			R1-R2	W3-W4														472.5	473.2	rubble zone
	rehealed breccia	171	477.0	480.0	2.9	n	2.5	1	6	6	R2	W3-W4	478.4	SH		40	IR	K	Cl	2	12.0	6						
	partially rehealed greenstone breccia	172	480.0	482.0	1.7	n	0.4	2/>20	6	0	R1-R2	W3-W4	480.7	SH		65	P	K	G	120	2.0	6						gouge
													481	SH		65	IR	K	G	open	2.0	0						fault
	partially rehealed breccia	173	482.0	486.0	4.1	n	2.0	5/>20	6	0	R1-R2	W3-W4	483.5	SH		50	P	K	G	100	8.0	6						
													484	SH		55	C	K	Cl	1	2.0	6						
													484.9	SH		65	P	K	Cl	2	4.0	6						
													485.6	SH		55	C	K	Cl	2	4.0	6						
													485.7	SH		70	P	K	Cl	2	2.0	6						
													486	SH		35	P	K	Cl	1	4.0	6						
artially healed greenstone		174	486.0	488.5	2.5	n	0.7	2/>20	6	0	R1-R2	W3-W4	486.8	SH		70	U	K	Cl	2	2.0	6						
													487.3	SH		40	ST	K	Cl	2	4.0	6	487.3	488.5	GB			breccia in gouge matrix
	partially rehealed greenstone breccia	175	488.5	490.0	1.5	n	1.0	1					489.8	SH		75	P	K	Cl	1	4.0	6						
	partially rehealed greenstone breccia	176	490.0	494.0	3.3	n	1.1	>20	6	0	R1-R2	W3-W4	490.3	SH		35	ST	K	Cl	2	4.0	6						
													491	SH		45	P	K	Cl	10	2.0	6	491.0	492.4	FB/FG			
													491.3	SH		55	P	K	Cl	>1	4.0	6						
													491.6	SH		40	IR	K	Cl	5	8.0	6						
													491.7	SH		20	IR	K	Cl	>1	10.0	6						
													492.3	SH		55	C	K	Cl	1	8.0	6						
													493	SH		40	IR	K	Cl	10	10.0	6						
eenstone fault breccia/fa		177	494.0	497.0	2.6	n	0.0	>20	0	0	R1-R2	W3-W4	495	SH		45	U	K	Cl	4	4.0	6						shear within gouge
	gouge with greenstone breccia - partially healed	178	497.0	500.0	3.0	n	1..2	>20	6	0	R1-R2	W3-W4	497.4	SH		45	U	K	Cl	1	4.0	6						
													497.8	SH		60	P	K	G	50	4.0	6						
																							497.8	498.9	FB/FG			Gouge and breccia

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone with some chert	1	31.0	33.0	2.0	N	0.0	40			R2	W3																Bands of chert; low to medium grade; >10 fractures per foot entire run
	Limestone with some chert	2	33.0	36.6		N	0.5	3	17	14	R2	W3														33.0	34.0	Low grade
													34.5	J	1	21	ST	S			4.0	14						
													34.9	J	1	45	C	VR			14.0	18						
													35.2	J	1	63	P	VR			16.0	18				35.8	36.6	
	Limestone	3	36.6	37.5	0.7	N	0.0				R2	W3														36.6	37.5	Low grade; rubble/redrill
	Limestone	4	37.5	39.1	1.7	N	0.0	20	12	12	R2	W3	38.1	J	3	50	P	SR			8.0	12						>10 fractures/foot 37.5'-37.9-
													39	J	2	36	P	SR			6.0	12						Low to medium grade
	Limestone	5	39.1	41.7	1.4	N	0.0	20			R2	W3																>10 fractures/foot entire run
	Limestone	6	41.7	42.8	0.7	N	0.0				R2	W3														41.7	42.8	Rubble/redrill; low to medium grade
	Limestone	7	42.8	43.8	1.0	N	0.0				R2	W3														42.8	43.8	Rubble/redrill; low to medium grade
	Limestone	8	43.8	45.0	0.9	N	0.0	1	16	16	R2	W3	44	J	1	33	P	VR			16.0	16				44.1	44.8	Low to medium grade
	Limestone	9	45.0	47.0	2.0	N	0.0	2	12	12	R2	W3	45.9	J	2	62	P	R	Cl	<1	6.0	12				46.2	47.0	Low to medium grade
	Limestone	10	47.0	49.0	1.3	N	0.0	25	10	10	R2	W3	48	J	1	28	P	R	Cl	<1	4.0	10						>10 fractures/foot entire run; low to medium grade
	Limestone	11	49.0	54.0	1.6	N	0.0				R2	W3																>10 fractures/foot entire run; low to medium grade
	No recovery	12	54.0	58.5	0.0																							
	Limestone with some chert	13	58.5	59.0	0.5	N	0.0	25			R2	W3																>10 fractures/foot entire run; low grade
	Limestone with some chert	14	59.0	59.6	0.6	N	0.0	30			R2	W3																>10 fractures/foot entire run; low grade
	Limestone with chert	15	59.6	61.0	1.4	N	0.0	40	18	16	R2	W3	59.8	J	1	30	P	R	Cl	<1	12.0	18						>10 fractures/foot entire run
													60	J	2	60	P	R	Ca/Cl	<1	10.0	16						Chert from 60.3 to 61'
													60.2	J	1	42	P	VR	Cl	<1	16.0	20						Healed fractures (Ca and Cl); low grade
	Limestone with chert	16	61.0	61.7	0.7	N	0.0	25			R2	W3																>10 fractures/foot entire run; low grade
	Limestone with chert	17	61.7	62.5	0.8	N	0.0	15	15	6	R2	W3	62.1	J	1	33	C	R	Cl	<1	8.0	14						>10 fractures/foot entire run; low to medium grade
													62.4	J	1	70	C	P			1.0	6						
	Limestone with some chert	18	62.5	63.0	0.5	N	0.0	10			R2	W2																>10 fractures/foot entire run
	Limestone	19	63.0	64.0	1.0	N	0.0	0			R3	W2														63.0	64.0	Rubble recovered
																												***All runs up to this point boxed backwards
	Limestone	20	100.0	100.7	0.7	N	0.0	0			R3	W2																Set casing from 100' but did not recover core from 64' to 100'; four fragments recovered
	Limestone with chert nodules and Ca veins	21	100.7	101.7	1.0	N	0.0	3	20	20	R3	W2	100.9	J	2	45	P	R			8.0	20						Breaks along chert

			Run Data																				Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	22	101.7	103.0	1.2	N	1.1	1	12	12	R3	W2	102.5	J	1	70	IR	R	Cl	1	12.0	12						Break possibly mechanical
	Limestone	23	103.0	104.5	1.5	N	0.0	5	12	12	R2	W2	103.2	J	1	55	P	S	Ca	1	6.0	12						Entire run highly fractured
													104.1	J	2	30	P	S	Ca	1	6.0	12						
	Limestone	24	104.5	106.2	1.7	N	0.0	15	12	12	R2	W2														104.5	105.3	
													105.4	J	1	20	P	R	Ca	1	12.0	12						
																							105.6	####	Fine gravel			
																										106.0	106.2	
	Limestone	25	106.2	107.7	1.2	N	0.0	8	12	12	R2	W2														106.2	107.7	
													107.2	J	1	25	IR	VR	Ca	1	16.0	12						
	Limestone	26	107.7	109.0	0.8	N	0.0	5	12	12	R2	W2	108.5	J	1	50	P	R	Ca	1	10.0	12						
	Limestone	27	109.0	110.5	1.3	N	0.5	5			R2	W2																Run highly fractured; none measureable
	Limestone	28	110.5	114.1	2.9	N	0.9	6	14	12	R3	W2	111.9	J	1	35	C	R	Ca	1	10.0	12						
													112.2	J	1	50	P	R			8.0	20						
													113	V	1	60	P	R	Ca	1	10.0	12						Break along edge of 6mm Ca vein
	Limestone	29	114.1	116.3	1.1	N	0.0	3	10	6	R3	W2	114.9	V	1	25	P	R	Ca	7	12.0	6						Run highly fractured
													115.3	J	1	70	P	S	Ca	1	6.0	12				115.3	115.5	
													115.6	J	1	35	P	R	Ca	1	10.0	12				115.9	116.3	
	Limestone	30	116.3	116.7	0.4	N	0.0	1	12	12	R3	W2	116.6	J	1	30	P	R	Ca	1	8.0	12				116.3	116.5	
	Limestone	31	116.7	117.0	0.2	N	0.0																					Rubble recovered
	Limestone	32	117.0	121.6	3.6	N	2.2	10	14	12	R3	W2														117.2	117.5	Entire run mechanically fractured
													117.9	J	1	45	P	R	Ca	3	10.0	12						
													118.4	J	1	40	C	R			12.0	20						Possibly mechanical
													118.9	J	1	70	P	R	Cl	1	8.0	12						
	Limestone	33	121.6	123.0	1.4	N	0.0	15			R3	W2														121.6	123.0	Entire run rubbly
	Limestone	34	123.0	124.5	1.5	N	0.0	5	13	6	R3	W2	123.7	V	2	10	IR	R	Ca	2	8.0	6						Entire run rubbly
													124	J	1	30	P	VR			16.0	20						
	Limestone	35	124.5	129.0	4.5	N	2.1	7	10	6			125.3	J	1	60	P	R	Ca	1	10.0	12						
													125.5	J	1	20	IR	R	Cl	2	14.0	6						
													127.4	J	1	60	P	R	Cl	1	10.0	12						
													127.8	J	1	40	P	R	Cl	1	10.0	12						
	Limestone	36	129.0	129.6	0.6	N	0.0	1	12	12	R3	W2	129.4	J	1	SS	P	R	I	1	8.0	12						
	Limestone	37	129.6	134.7	5.0	N	3.7	5	13	12	R3	W2	130.8	J	1	60	P	S	Cl	1	6.0	12						
													131.8	J	1	30	P	R	Cl	1	10.0	12						
													132.1	J	1	40	P	R	Cl	1	12.0	12						
													132.3	J	1	35	IR	R	Ca	1	14.0	12						
													133.4	J	1	50	P	S	Cl	1	6.0	20						
	Limestone	38	134.7	139.8	5.0	N	3.4	6	13	6	R3	W2	135	J	1	35	ST	R	Cl	1	8.0	20						
													137.7	J	2	15	P	VR	Cl	3	18.0	6						Breaks in Ca veined area, some offset
																										139.2	139.8	Mechanically broken
	Limestone	39	139.8	144.7	4.9	N	2.1	5	15	6	R3	W2	140.8	J	1	25	P	R	Cl	1	14.0	20						
													141.5	J	1	20	ST	R	Cl	1	14.0	20						

			Run Data																							Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data													Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													142.6	J	1	30	P	VR	Ca	1	16.0	20						
													143	V	1	50	P	VR	Ca	1	18.0	6						Break along 5mm Ca vein
													144	J	1	40	P	R	Ca	1	14.0	12						
	Limestone	40	144.7	150.0	5.2	N	4.5	5	12	6	R3	W2	145.5	J	1	30	IR	R	Ca	1	14.0	12						
													146.4	J	1	80	P	R			10.0	20						
													147.5	J	1	70	P	R	Ca	1	12.0	12						
													147.8	J	1	30	P	R	Ca	1	10.0	12						
													148.3	V	1	40	P	R	Ca	18	8.0	6						
	Limestone	41	150.0	155.0	4.8	N	4.8	3	20	20	R3	W2	150.4	J	1	40	P	R			10.0	20						
													151.7	J	1	30	C	S	Ca	0.5	6.0	20						
													153.1	J	1	30	P	R			12.0	20						
	Limestone	42	155.0	160.0	4.8	N	2.8	8			R3	W2	155.6	J	1	10	P	R	Cl	0.5	10.0	20						
													155.9	J	1	75	P	R	Cl	2	8.0	12						
													157.5	J	2	60	P	R	Ca	1	8.0	12						
													158	J	1	55	P	R	Ca	1	8.0	12						
													159.1	J	3	35	P	R	Cl	1	12.0	12						
	Limestone	43	160.0	162.0	2.0	N	0.0	14	12	12	R3	W2	161.2	J	1	30	P	R	Cl	2	8.0	12						Significant Ca veining; entire run highly fractured
	Limestone	44	162.0	164.5	2.1	N	0.0	9	15	12	R3	W2	163	J	1	75	P	VR	Cl	0.5	16.0	20						
													163.5	J	1	15	W	VR	Cl	1	16.0	12						
																										163.7	163.9	Gravel
													164.1	J	1	40	P	S	Cl	1	6.0	12						
	Limestone	45	164.5	168.0	3.1	N	0.8	5	16	12	R3	W2	165.9	V	1	50	P	R	Ca	1	10.0	12						
													166.1	J	1	60	P	R	Ca	C	8.0	20						
													166.4	J	1	30	P	R			8.0	20						
													167.2	J	1	60	P	R	Cl	1	10.0	12						
	Limestone	46	168.0	169.4	1.4	N	0.0	10	12	12	R3	W2	168.8	J	2	25	P	R	Ca	1	10.0	12						Entire run highly fractured
	Limestone	47	169.4	171.5	2.1	N	1.2	4	15	12	R3	W2	169.8	J	1	20	P	VR	Cl	1	18.0	20						
													170.6	J	1	15	P	VR	G	3	16.0	12						
													171.1	J	1	30	P	R	Ca	1	14.0	12						
	Limestone	48	171.5	174.0	2.3	N	0.0	15	16	12	R3	W2	172.3	J	2	20	P	R			8.0	20						
													173.2	J	1	20	P	S	Ca	3	6.0	12						
	Limestone	49	174.0	176.4	2.2	N	1.1	7	16	12	R3	W2														174.0	174.2	
													174.4	V	1	50	P	S	Ca	1	4.0	12						
																										174.4	174.7	
													175.3	J	2	70	P	S			6.0	20						
	Limestone	50	176.4	178.0	1.6	N	1.2	3	12	12	R3	W2	176.8	J	1	85	P	R	Ca	1	8.0	12						
													177	J	1	70	P	R	Ca	2	8.0	12						
	Limestone - increasing occurrences of chert	51	178.0	181.2	3.1	N	0.7	10	8	6	R3	W2	178.8	V	1	5	P	R	Ca	3	8.0	6						Run extensively fractured; vertical Ca vein through entire run
													179.2	J	2	30	P	S	Ca	0.5	6.0	12						
													180	J	3	40	P	R	Ca	0.5	10.0	6						
	Limestone	52	181.2	185.0	3.3	N	2.4	5	0	0	R3	W2	184.4	F	1	30	P	R	Cl	30	10.0	0	184.4	####	Sc			Sample 183.7' to 184.1'
	Dolomite	53	185.0	190.0	5.0	N	3.3	12	7	6	R3	W2	186	J	1	30	P	R	Cl	1	8.0	6						
													187.3	J	2	25	P	S	Cl	0.5	8.0	6						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													187.7	J	1	30	P	R	Cl	1	8.0	6						
																							188.3	####	Gc			Faulted dolomite/limestone contact
													189.2	V	1	50	P	S	Ca	1	6.0	12						Limestone below 188.7' all fractured
	Limestone	54	190.0	195.0	5.2	N	4.9	7	3	0	R3	W2	190.3	V	1	40	P	R	Ca	1	10.0	6						
													192.1	V	1	65	P	R	Ca	10	8.0	0						
													193.2	V	1	60	P	R	Ca	8	10.0	0						
													193.6	J	1	20	C	R	Cl	1	12.0	6						
													193.7	V	1	55	P	R	Ca	4	10.0	6						
													194.4	V	1	80	P	R	Ca	10	12.0	0						
	Limestone	55	195.0	199.5	4.2	N	0.9	8	9	6	R2	W2	195.5	J	1	60	C	R	Cl	1	8.0	12						
													195.8	J	1	70	P	R	Cl	1	14.0	12						
																							195.9	####	Gravel			
													197.6	V	1	25	P	S	Ca	1	6.0	6						
													198.2	J	1	40	P	R	Cl	2	10.0	6						
	Limestone	56	199.5	201.0	1.5	N	0.6	5			R2	W2														199.7	200.1	
	Metabasalt	56	201.0	204.6	1.2	N	0.5	20			R3	W2											200.7	####	Gc			
	Limestone	57	204.6	209.7	4.9	N	2.9	20	12	12	R3	W2											206.5	####	Cl			Greenstone gouge
													209	J	1	20	P	R	Cl	1	8.0	12						Weak, brecciated limestone below 208.3'
	Limestone breccia	58	209.7	215.0	4.4	N	0.0	40	6	6	R1	W2											209.7	####	Gc			Run highly brecciated; milled greenstone gouge
													212.2	J	3	30	P	R	Cl	1	8.0	6						
	Limestone (fault zone)	59	215.0	220.0	1.5	N	0.5	20	12	12	R2	W2											Top of recovery	####	Gc			
																							219.0	####	Gc			
													219.4	F	1	60	P	R	Cl	1	8.0	12						
	Limestone	60	220.0	223.3	3.3	N	2.2	4	12	12	R2	W2														220.0	220.4	Redrill
													221.5	J	1	20	P	R	Cl	1	14.0	12						Run highly fractured
													222.6	J	1	40	C	R	Cl	1	8.0	12						
	Dolomitic limestone	61	223.3	225.0	1.7	N	0.0	4	4	0	R2	W2														223.3	223.6	
													224.2	V	1	70	P	R	Ca	40	8.0	0						Thick vein (Qtz?)
													224.5	V	1	60	IR	R	Ca	17	10.0	0						
													224.7	J	1	50	C	R	Cl	1	14.0	12						
	Limestone	62	225.0	229.0	3.7	N	2.9	4	12	12	R2	W2	227.1	J	1	25	P	R			8.0	12						Entire run highly fractured
													227.8	J	2	25	P	R	Cl	1	8.0	12						
																										228.2	229.0		
	Limestone with chert and extensive Ca veins	63	229.0	233.2	4.1	N	0.9	10	9	6	R2	W2	231.3	J	1	70	P	R	Cl	1	10.0	12						Highly fractured
													232	V	1	45	IR	R	Grstn	6	12.0	6						
	Limestone	64	233.2	238.4	5.0	N	1.0	3	6	6	R2	W2	232.8	V	1	70	P	R	Ca	14	12.0	6						Run extensively fractured
													234.9	V	1	50	C	R	Ca	28	10.0	6						Break along edge of Ca vein
													236.4	V	1	65	P	R	Ca	8	14.0	6						
	Limestone	65	238.4	243.0	4.4	N	3.5	4	6	6	R2	W2	239.4	V	1	75	P	R	Ca	3	12.0	6						
													239.9	V	1	40	P	R	Ca	20	10.0	6						
													240.6	J	1	80	P	R	Ca	2	12.0	6						

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													242.7	J	1	45	P	R	Ca	40	8.0	6						
	Chert/Limestone 245.5' to 246.6'	66	243.0	248.3	4.6	N	3.0	10	8	0	R2	W2	243.6	J	2	45	ST	R	Cl	1	8.0	12						
													244.6	J	1	30	P	VR			16.0	12						
													246.7	F	1	35	P	R	Gc	0.9'	8.0	0						
	Limestone	67	248.3	253.7	4.1	N	2.9	4	15	12	R2	W2	251.4	J	2	30	P	R			10.0	20						Intact bedding 50 degrees at 249.1'
													252.1	J	1	70	P	R	Ca	1	12.0	12						Redrilled fragments at top of run
													252.9	J	1	70	P	R	Ca	1	10.0	12						
	Dolomitic limestone	68	253.7	258.7	4.9	N	2.7	5	10	6	R2	W2	254.9	J	1	70	C	VR	Ca	1	16.0	12						
													256.4	V	1	60	IR	R	Ca	1	8.0	12						
													257.4	B	1	70	P	S	Ca	3	6.0	6						Edge of chert nodule
																										257.5	258.7	
	Dolomitic limestone	69	258.7	263.9	5.0	N	3.2	10	12	12	R2	W2														259.1	259.8	
													250.7	J	1	75	C	R	Ca	2	8.0	12				260.9	261.3	
	Dolomitic limestone	70	263.9	266.9	2.0	N	0.0	15	12	12	R2	W2	265.5	B	2	50	P	R	Ca	0.5	12.0	12						Entire run highly fractured; large intact Ca vein 265.9'
	Dolomitic limestone	71	266.9	272.0	5.0	N	3.3	5	18	12	R2	W2	268.9	J	1	40	P	R	Ca	0.5	8.0	12						
													270.4	V	1	50	P	R	Ca	5	12.0	25						Intact Ca vein
	Dolomitic limestone	72	272.0	275.0	2.8	N	0.0	4	9	6	R2	W2	272.8	J	1	50	P	S			2.0	6						
													273.1	J	1	60	P	R	Ca	1	10.0	12						
													273.8	J	1	60	P	R	Cl	0.5	8.0	12						
													274.4	V	1	50	P	R	Ca	30	8.0	6						Break along edge of breccia filled Ca vein
	No recovery	73	275.0	276.4	0.0																							
	Dolomitic limestone	74	276.4	281.5	5.0	N	3.2	5	20	20	R2	W2	277.4	J	1	30	P	R			14.0	20						
													280.2	J	1	45	P	R			12.0	20						
													280.9	J	1	50	P	R	Gr	2	14.0	20						
	Dolomitic limestone	75	281.5	285.0	3.5	N	3.2	0			R2	W2														281.5	281.7	Run highly fractured; all mechanical
	Dolomitic limestone	76	285.0	290.0	5.0	N	3.9	10	15	12	R2	W2	286.5	J	2	35	P	R	Cl	1	8.0	20						
													286.8	J	1	40	IR	R	Cl	3	12.0	12						
													288.4	J	1	40	P	R	Cl	1	14.0	12						
	Dolomite	77	290.0	292.4	1.7	N	0.4	15			R2	W2											291.5	####	Gc			milled gouge
	Dolomitic limestone - Ca healed breccia	78	292.4	295.0	2.4	N	1.8	10	10	0	R2	W2	292.9	F	1	60	P	R	Gc	30	10.0	0	292.4	####	Gc			
													294.4	J	1	50	IR	VR	Gc	3	16.0	20						
	Greywacke	79	295.0	300.0	5.0	N	0.0	50	0	0	S6	W2	296.4	J	1	SS	P	R	Gc	100	10.0	0						Entire run solid Gc gouge with some clasts of metabasalt
	Greywacke	80	300.0	305.0	4.8	N	2.3	10	12	12	R3	W2											300.0	####	Sc			
													302.1	J	1	40	C	R	Cl	2	8.0	12						
													303.1	J	1	30	IR	R	Cl	1	8.0	12						

			Run Data										Rubble/Gouge																
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greywacke	81	305.0	305.8	0.8	N	0.0	0			R3	W2																Rubble recovered
	Greywacke	82	305.8	306.1	0.3	N	0.0	10			R2	W2																Poor, broken recovery; some redrill
	Greywacke	83	306.1	311.1	2.1	N	1.5	14	20	20	R2	W2	309.4	J	1	30	P	R			10.0	20						
													309.8	J	2	50	P	R			12.0	20						
																							310.6	####	Gc			
	Gouge	84	311.1	315.0	1.7	N	0.0	20			S4	W2											311.1	####	Gc			
	Gouge	85	315.0	318.3	2.6	N	0.0	50			S4	W2											315.0	####	Gc			
	Greywacke	86	318.3	321.6	1.9	N	1.2	10	12	12	R3	W2	320.4	J	1	20	P	R	Cl	2	8.0	12						
													320.8	J	1	80	P	S	Ca	1	6.0	12						
													321.2	J	1	70	P	S	Ca	0.5	6.0	12						
	Gouge	87	321.6	325.0	1.4	N	0.0	100			S4	W2											321.5	####	Gc			
	Gouge	88	325.0	327.5	1.8	N	0.0	100			S4	W2											325.0	####	Gc			
	Greywacke	89	327.5	331.0	2.2	N	1.2	6	8	0	R3	W2	329.7	J	1	45	P	R	Gc	14	8.0	0						
													330	J	1	40	C	R	Cl	1	10.0	12						Greenstone within breaks
													330.6	J	1	40	P	R	Cl	3	8.0	12						Greenstone within breaks
	Greywacke	90	331.0	333.1	1.9	N	0.4	3	6	6	R3	W2	332.4	J	1	70	IR	R	Cl	8	8.0	6						Entire run broken
	Greywacke	91	333.1	336.2	2.1	N	1.1	2	0	0	R3	W2	334.6	F	1	40	P	R	Cl	15	8.0	0						
	Greywacke	92	336.2	338.5	2.2	N	1.0	4			R3	W2	338.1	J	4	35	IR	R	Gc	20	12.0	6						
	Greywacke	93	338.5	341.0	1.2	N	0.0	20			R3	W2																Entire run fragmented
	Greywacke	94	341.0	345.0	1.7	N	0.0	1	12	12	R2	W2	344.3	V	1	10	P	S	Ca	1	6.0	12						Subvertical Ca vein throughout run
	No recovery	95	345.0	346.2	0.0																							
	Greywacke	96	346.2	347.2	0.6	N	0.0	4	20	20	R3	W2	345.8	J	1	30	P	R	Cl	0.5	8.0	20						
													346.1	J	1	75	P	R	Cl	1	8.0	20						
													346.2	J	1	65	P	R	Cl	0.5	8.0	20						
	Greywacke	97	347.2	350.1	2.9	N	2.6	3	13	0	R3	W2	347.9	J	1	65	P	R	Cl	0.5	8.0	20						
													348.7	J	1	25	P	R	Cl	1	12.0	20						
													349.8	F	1	40	P	R	Cl	10	14.0	0						
	Greywacke	98	350.1	355.0	2.3	N	0.0																					Milled rubble to sand recovered; no visible structures
	Greywacke	99	355.0	355.5	0.3	N	0.0																					Small rock fragments recovered
	Greywacke	100	355.5	360.5	5.0	N	4.7	15	6	6	R3	W2	356.9	V	1	50	P	R	Ca	3	12.0	6						
													358.2	J	1	30	P	R	Cl	2	10.0	6						
																							360.2	####	Gc			
	Greywacke	101	360.5	364.4	3.7	N	1.9	15	12	12	R3	W2											360.2	####	Gc			
													362.7	J	1	60	C	R	Cl	1	8.0	12						
													363	J	1	60	P	R	Cl	1	8.0	12						
	Greywacke	102	364.4	368.2	3.8	N	3.1	4	10	6	R3	W2	365.1	J	1	60	P	S	Cl	4	6.0	6						
													365.7	J	1	60	P	R	Cl	1	10.0	12						
													366.4	J	1	50	P	R	Cl	0.5	8.0	12						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge					ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
																							Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	
													367.1	J	1	35	C	R	Cl	2	8.0	12						
	Greywacke	103	368.2	372.5	4.1	N	2.2	16			R3	W2	368.9	J	1	40	P	R	Cl	1	14.0	12						
													369.2	J	1	60	P	R	Cl	1	10.0	12						
													369.5	J	1	55	P	R	Cl	0.5	8.0	20						
													371.4	J	1	40	P	R	Cl	3	8.0	6						
													371.6	J	1	40	P	R	Cl	3	10.0	6						
																							361.8	####	Gc			
	Greywacke	104	372.5	375.6	2.3	N	0.0	10	6	6	R3	W2	375.1	J	1	40	P	R	Cl	4	10.0	6						Entire run highly fractured
	Greywacke	105	375.6	380.6	1.2	N	0.0	1	20	20	R3	W2	380.3	J	1	30	P	R			8.0	20						Rubble recovered
	Greywacke	106	380.6	384.2	0.6	N	0.0	10			R3	W2																Rubble/gravel recovered
	Greywacke	107	384.2	388.0	0.9	N	0.0	10			R3	W2	387.3	J	1	60	P	R			12.0	20						Rubble/broken core
	Greywacke	108	388.0	392.2	0.6	N	0.0	6			R3	W2																Rubble recovered

			Run Data										Detailed Discontinuity Data									Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt	1	23.0	28.0	4.3	N	0.0	50	12	12	R0	W3	24.6	J	1	60	P	VR	Cl	1	16.0	12						Soft, gougy material; two small 0.3-ft more solid R2 sections
													27.5	J	2	50	P	R	Ca	1	12.0	12						
	Metabasalt	2	28.0	32.0	2.9	N	1.7	6	3	0	R1	W3	29.3	V	1	30	C	R	Ca	4	8.0	6						Very weak, clay altered rock
													29.5	J	1	50	P	VR	Gc	12	20.0	0						
	Metabasalt	3	32.0	36.4	4.2	N	3.3	6	6	6	R2	W3	32.5	V	1	25	ST	R	Ca	3	14.0	6						Milled gougy material above
													33.5	B	1	35	P	R	Cl	2	10.0	6						
	Metabasalt	4	36.4	38.6	2.2	N	2.2	3	12	12	R2	W3	37.2	J	1	30	P	R	Cl	1	10.0	12						
													37.6	J	1	30	P	R	Cl	1	10.0	12						
													38.2	J	1	45	P	R	Cl	1	8.0	12						
	Limestone	4	38.6	41.5	2.9	N	2.6	5	10	6	R3	W2	38.6	C	1	70	IR	R	Cl	2	14.0	6						Metabasalt/limestone contact
													39.6	J	1	30	P	VR	Cl	1	16.0	12						
													40.5	J	1	35	P	R	Cl	1	12.0	12						
	Limestone	5	41.5	45.0	2.3	N	0.7	10	8	6	R3	W2	42.1	J	1	55	P	R	Cl	1	10.0	12						Break through chert nodule
													42.4	J	1	50	P	R	Chert	8	8.0	6						Break in weak, friable rock
													43.3	J	1	20	P	R	Cl	2	10.0	6						
	Limestone	6	45.0	48.0	3.0	N	1.2	8	12	12	R3	W2	45.2	J	1	30	P	R	Ca	1	8.0	12						
													46.3	J	1	40	P	R	Cl	1	10.0	12						
													47.2	J	1	40	P	R	Cl	1	14.0	12						
																										47.5	48.0	
	Limestone	7	48.0	52.0	3.5	N	2.1	1	12	12	R3	W2	50	J	1	15	P	VR	Cl	1	18.0	12						
	Limestone	8	52.0	54.2	1.2	N	0.0	5	6	6	R3	W2	53.5	F	1	25	P	R	Gc	17	12.0	6						Core highly broken
	Limestone	9	54.2	56.0	1.2	N	0.6	20			R2	W2														54.2	56.0	Run highly fractures; extensive Ca veins
	Limestone	10	56.0	58.0	1.7	N	0.0	20			R2	W2														56.0	58.0	
	Limestone	11	58.0	60.2	2.2	N	0.0	10	9	6	R2	W2	58.5	J	1	40	P	R	Cl	1	10.0	12						Run highly fractured
													59.2	J	1	25	P	R	Ca	3	8.0	6						
	Limestone	12	60.2	61.2	0.8	N	0.0	10			R2	W2														60.2	61.2	
	Limestone with much chert	13	61.2	62.0	0.5	N	0.0	10			R2	W2														61.2	62.0	
	Limestone with much chert	14	62.0	65.4	3.2	N	0.0	7	8	6	R2	W2	62.5	J	1	50	P	R	Cl	1	8.0	12						
													63.6	J	1	65	IR	R	Cl	2	10.0	12						
													63.7	J	1	45	P	R	Gc	4	14.0	6						
													64.3	J	3	20	P	R	Gc	25	14.0	6						
													64.7	J	1	25	P	R	Cl	2	8.0	6						
	Limestone	15	65.4	68.0	2.2	N	1.0	3	12	12	R3	W2	66.7	J	3	40	P	R	Cl	0.5	10.0	12				65.4	66.2	
	Limestone	16	68.0	70.0	1.1	N	0.0	2	9	6	R3	W2	69.2	J	1	30	P	R	Cl	3	8.0	6						Run fractured
													69.8	J	1	20	P	R	Cl	1	12.0	12						
	Limestone	17	70.0	72.0	2.0	N	1.1	3	16	12	R3	W2	70.7	J	1	55	IR	VR	Gc	0.5	16.0	20				70.0	70.7	Gravel above 70.7
													71.1	J	1	60	P	VR	Cl	1	18.0	12						
																										71.3	72.0	
	Limestone	18	72.0	73.4	1.1	N	0.0	10	12	12	R2	W2	73.2	V	1	65	P	R	Ca	2	8.0	12				72.0	73.4	Gravel recovered

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	19	73.4	75.0	1.4	N	0.0	10	20	20	R2	W2	74.3	J	1	60	P	R	Cl	0.5	8.0	20						Run highly fractured
	Limestone	20	75.0	77.0	0.9	N	0.4	10			R2	W2																Run highly fractured; redrilled
	Limestone	21	77.0	79.0	1.6	N	0.5	2	12	12	R2	W2	78.1	J	1	15	P	R	Cl	0.5	8.0	12						Highly broken
													78.7	J	1	45	P	R	Cl	1	10.0	12						
	Limestone	22	79.0	80.7	1.7	N	1.3	0			R2	W2																Run highly fractured; no natural breaks through core, all mechanical
	Limestone	23	80.7	85.0	4.2	N	2.7	6	14	6	R2	W2														80.7	81.5	
													81.7	V	1	40	IR	R	Ca	3	12.0	6						
													82	J	1	50	P	R	Cl	1	14.0	20						
													82.7	J	1	65	P	R	Cl	1	8.0	12						
													83.3	J	1	40	P	R	Cl	0.5	10.0	20						
													83.8	J	2	50	P	R	Cl	1	12.0	12						
	Limestone	24	85.0	87.2	2.2	N	1.4	2	20	20	R3	W2	86.2	J	1	70	P	R	Cl	1	8.0	20						
													86.6	J	1	65	C	R	Cl	1	12.0	20						
	Sandy clay gouge	24	87.2	90.3	0.2	N	0.0	10			S3	W2																Contact at ~87.2 feet
	Greywacke	25	90.3	95.0	2.1	N	0.0	15	7	0	R2	W2	93.3	C	1	80	P	R	Cl	20	10.0	0						Clay/greywacke contact
													93.9	F	1	70	P	R	Cl	20	14.0	0						
													94.3	B	1	60	C	R	Cl	1	8.0	20						Flow banding
																							94.4	94.7	Sc			
	Greywacke with extensive Gc gouge	26	95.0	98.9	3.4	N	0.0	20	6	0	R1	W2	95.5	J	1	30	P	R	Cl	1	10.0	6						
																							95.7	97.0	Gc			
													98.1	J	1	20	P	R	Cl	1	8.0	12						
													98.4	J	1	40	P	R	Cl	15	10.0	0						
																							98.6	98.9	Gc			
	Greywacke	27	98.9	102.0	3.1	N	0.5	30	0	0	R1	W2	90.3	C	2	65	P	R	Cl	10	12.0	0						Gouge zones throughout; limestone contact at 101.5 feet
	Limestone	28	102.0	104.1	2.1	N	2.3	0	25	25	R3	W2																Solid recovery
	Limestone	29	104.1	109.3	5.2	N	4.6	8	9	6	R3	W2														104.6	104.8	
																										105.3	105.5	
													105.5	J	1	85	P	R	Gc	10	14.0	6						
													107	J	1	60	P	R	Cl	1	10.0	12						
	Limestone	30	109.3	112.0	2.7	N	2.7	1	20	20	R3	W2	111	J	1	20	P	R	Cl	0.5	8.0	20						
	Limestone	31	112.0	116.6	4.6	N	0.6	15	12	12	R2	W2	115.9	J	1	30	P	S	Cl	1	6.0	12						Irregular clay filled breaks throughout run
	Limestone	32	116.6	120.8	3.9	N	3.3	0			R2	W2																Extensive clay filled breaks, not natural?; none planar, continuous
	Limestone	33	120.8	125.9	5.0	N	3.6	3	16	12	R2	W2	122	J	1	35	IR	R	Cl	2	12.0	20						
													123.6	J	1	40	IR	R	Cl	2	14.0	12						
	Limestone	34	125.9	130.2	4.3	N	4.0	1	12	12	R2	W2	127.8	J	1	20	P	R	Ca	2	10.0	12						Healed breccia
																										129.9	130.2	
	Limestone	35	130.2	132.0	1.8	N	0.4	5	8	6	R2	W2	130.4	J	1	15	P	R	Cl	1	10.0	12						
													131	J	1	30	IR	R	Cl	3	14.0	6						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													131.3	J	1	25	P	R	Cl	5	10.0	6						
	Limestone	36	132.0	135.0	2.5	N	1.0	3	15	12	R2	W2	132.6	J	1	30	P	R	Cl	0.5	14.0	20						Very long, irregular break
													134.3	J	1	25	P	R	Cl	0.5	14.0	12						
													134.6	J	1	30	P	R	Cl	1	12.0	12						
	Limestone	37	135.0	140.0	5.0	N	2.5	4	16	12	R2	W2	135.5	J	1	20	IR	VR	Cl	1	18.0	20						Run highly fractured 135.0' to 137.2'
													136.5	J	1	25	IR	VR	Cl	2	20.0	20						
													137.6	V	1	60	P	R	Ca	2	14.0	12						
													138.2	J	1	40	P	R	Cl	1	10.0	12						
	Limestone	38	140.0	142.0	2.0	N	2.0	1	12	12	R2	W2	141.2	V	1	65	P	R	Ca	2	8.0	12						Run mechanically fractured; no obvious natural breaks
	Limestone	39	142.0	147.0	4.3	N	2.9	4	15	12	R3	W2	143.4	J	1	35	P	R	Ca	1	10.0	12						
													144.1	J	1	50	P	R	Cl	1	10.0	12						
													145.9	J	1	30	P	R	Cl	0.5	8.0	20						
	Limestone	40	147.0	149.2	2.2	N	0.9	5	12	12	R3	W2	148.3	J	3	30	P	R	Cl	1	8.0	12				147.4	147.6	
																										148.5	149.0	
	Limestone	41	149.2	153.4	4.2	N	2.6	3	15	12	R3	W2	149.9	J	1	20	P	R	Ca	1	14.0	20						
													150.7	V	1	30	P	R	Ca	2	8.0	12						
													152.2	J	1	30	P	R	Ca	1	10.0	12						
	Limestone	42	153.4	157.4	3.8	N	2.3	4	13	6	R3	W2	154.1	J	1	25	P	S	Cl	0.5	6.0	20						
													155.6	J	1	25	P	R	Ca	4	10.0	6						
													156.9	J	1	35	P	R	Cl	1	12.0	12						
	Limestone	43	157.4	162.0	4.2	N	2.9	1	6	6	R3	W2														158.0	158.4	
																										160.1	160.3	Chert nodule
													160.8	J	1	25	P	R	Ca	3	10.0	6						
	Limestone with large amounts of chert throughout and Ca veins	44	162.0	167.0	4.1	N	2.7	4	14	12	R2	W2	162.8	J	2	30	P	R	Ca	1	12.0	12						
													165.1	J	1	25	P	R	Cl	1	10.0	12						
													165.6	J	1	50	P	R	Cl	0.5	8.0	20						
													166.2	J	1	50	P	R	Ca	2	12.0	12						
	Limestone	45	167.0	170.0	3.0	N	1.9	3	12	12	R2	W2	167.6	J	1	40	P	R	Cl	1	12.0	12						
													168	J	1	50	P	R	Cl	1	8.0	12						
													168.8	J	1	40	P	R	Cl	1	8.0	12						
	Limestone	46	170.0	173.2	3.2	N	3.0	1	20	20	R2	W2	170.8	J	1	35	P	S	Ca	0.5	6.0	20						Run extensively fractured - mechanical
	Limestone	47	173.2	176.8	3.5	N	2.2	4	11	0	R2	W2	173.5	J	1	30	P	R	Ca	0.5	12.0	20						
													175	J	1	40	P	R	Ca	1	10.0	12						
													175.4	J	1	40	P	R	Cl	1	12.0	12						
													176.2	F	1	15	P	R	Cl	8	8.0	0	176.2	176.8	Gc			Milled black gouge
	No recovery	48	176.8	177.2	0.0																							
	Limestone	49	177.2	179.6	0.6	N	0.6	0			R2	W2																Recovery highly fractured especially throughout large chert nodule in center of recovery
	Limestone	50	179.6	182.0	2.4	N	1.1	5	15	12	R3	W2	180.1	J	2	60	IR	R	Cl	2	14.0	20						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													180.4	J	1	40	IR	R	Ca	2	8.0	12						
													180.7	J	1	20	P	R	Ca	1	10.0	12						
	Limestone with extensive chert	51	182.0	186.0	3.7	N	2.5	3	17	12	R3	W2	182.6	J	1	40	P	VR	Cl	1	16.0	20						
													183.1	J	2	50	P	R	Cl	1	12.0	12						
													183.4	J	1	40	P	R	Cl	1	10.0	20						
																										184.6	186.0	Run becoming increasingly fractured over this interval
	Limestone	52	186.0	191.2	5.0	N	3.7	4	14	12	R3	W2	186.8	J	1	40	P	R	Cl	1	10.0	12						
													187.6	J	1	45	P	R	Cl	2	12.0	12						
													188.5	J	1	40	P	R	Cl	1	8.0	12						
													190.2	J	1	35	IR	VR	Cl	1	16.0	20						
	Limestone	53	191.2	196.2	4.9	N	4.9	1	6	6	R3	W2	193.4	J	1	35	P	R	Cl	3	8.0	6						
																										194.4	196.2	Run highly fractured over this interval
	Limestone	54	196.2	200.2	3.8	N	3.2	6	11	0	R3	W2	196.6	J	1	35	P	R	Cl	1	14.0	12						
													197.6	J	1	70	P	R	Cl	0.5	12.0	20						Break through chert nodules
													198.3	J	1	40	P	R	Cl	1	14.0	20						
													198.8	J	1	50	P	R	Gc	7	10.0	0						
													199	J	1	60	P	R	Cl	1	12.0	12						
													199.7	V	1	80	P	R	Ca	20	10.0	6						Thick Ca band
	Limestone	55	200.2	202.0	0.4	N	0.0																					Redrilled, broken pieces recovered
	Limestone	56	202.0	205.4	3.4	N	2.2	4	12	12	R3	W2	203.3	J	1	50	P	R	Ca	1	10.0	12						
													203.6	J	1	50	P	R	Ca	0.5	8.0	12						
													204	J	1	50	P	R	Ca	2	8.0	12						
													205	J	1	30	P	R	Ca	1	10.0	12						
	Limestone	57	205.4	210.1	4.6	N	2.2	8	12	6	R3	W2																
													206.4	J	1	50	P	R	Cl	2	12.0	12						
													207.1	V	2	70	P	R	Ca	28	12.0	6						
													208.3	J	1	75	C	R	Ca	1	8.0	20						
													209	J	3	65	P	R	Cl	1	10.0	12						
	Limestone	58	210.1	215.0	4.6	N	4.6	4	10	6	R3	W2	211	J	1	60	P	R	Cl	2	12.0	12						Run extensively fractured
													212.1	J	1	50	P	R	Cl	1	10.0	12						
													213	J	1	70	P	VR	Cl	1	18.0	12						
													214.1	J	1	50	P	VR	Gc	4	16.0	6						
	Limestone	59	215.0	217.4	2.4	N	2.4	1	12	12	R3	W2	215.7	J	1	40	P	R	Cl	1	14.0	12						
	Limestone	60	217.4	222.0	4.4	N	3.2	1	20	20	R3	W2	219.4	J	1	60	C	R	Cl	0.5	8.0	20						
																										220.3	220.6	
													221	J	1	30	P	R	Cl	0.5	8.0	20						
	Limestone	61	222.0	223.0	1.0	N	0.6	1	20	20	R3	W2	222.6	J	1	60	P	R	Cl	0.5	8.0	20						
																										222.7	223.0	Large chunks recovered
	Limestone	62	223.0	228.0	5.0	N	4.1	6	15	6	R3	W2	223.9	J	1	50	P	R			14.0	20						
													224.2	J	1	40	IR	R	Cl	1	12.0	20						
													224.8	J	1	70	P	R	Cl	0.5	10.0	16						
													225.1	V	1	60	P	R	Cl	1	12.0	12						Linear break along edge of irregular Ca vein
													226.3	V	1	65	P	R	Cl	1	14.0	16						Break at edge of vein
													227	J	1	80	P	R	Cl	4	10.0	6						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													227.4	J	1	60	W	VR	Cl	0.5	18.0	20						
	Limestone	63	228.0	232.0	3.9	N	2.9	5	20	20	R3	W2	228.7	J	1	60	P	R	Cl	0.5	8.0	20						
													229.9	J	1	70	IR	R	Cl	0.5	14.0	20						
													230.6	J	1	40	P	R	Cl	0.5	8.0	20						
													231	J	1	45	C	R	Cl	0.5	8.0	20						
													231.3	J	1	80	P	VR	Cl	0.5	16.0	20						
	Limestone	64	232.0	237.0	5.0	N	4.2	7	15	6	R3	W2	233	J	1	20	P	R	Cl	2	10.0	6						
													233.5	J	1	70	P	R	Cl	1	12.0	12						
													234.1	J	1	80	P	R	Cl	0.5	12.0	20						
													235.3	J	1	70	P	R	Ca	2	8.0	12						
													235.6	J	1	55	P	R	Cl	0.5	10.0	20						
													235.9	J	1	50	P	R	G	3	12.0	12						
													236.4	J	1	45	P	R	Cl	0.5	12.0	20						
	Limestone	65	237.0	242.0	4.9	N	4.6	5	15	12	R3	W2	237.7	J	1	50	P	R	Cl	0.5	8.0	20						
													239.2	J	1	20	C	R	Cl	0.5	8.0	16						
													239.7	J	1	70	P	R	Gc	2	12.0	12						
													241.3	J	1	40	P	R	Cl	1	10.0	12						
													241.8	J	1	50	P	R	Cl	1	8.0	12						
	Limestone	66	242.0	247.0	5.0	N	5.0	4	17	12	R3	W2	242.4	J	1	50	P	R	Cl	0.5	10.0	20						
													242.9	J	1	60	P	R	Cl	0.5	14.0	20						
													245.6	J	1	60	P	R	Cl	1	8.0	16						
													246.3	J	1	30	P	R	Ca	4	8.0	12						Break through Ca vein
	Limestone	67	247.0	252.0	4.4	N	3.2	7	11	6	R3	W2	247.5	J	1	70	P	R	Cl	1	10.0	12						
													247.9	J	1	70	P	R	Cl	2	14.0	12						
													248.3	J	1	70	P	R	Ca	1	10.0	12						
													249.3	J	1	70	P	R	Cl	1	14.0	12						
													249.7	V	3	30	P	R	Ca	20	10.0	6						
	Limestone	68	252.0	255.2	3.2	N	1.3	10	9	6	R3	W2	252.4	J	1	40	P	R	Cl	2	8.0	6						
													253.7	J	1	40	P	R	Cl	1	10.0	12						
													254.1	V	1	70	P	R	Ca	2	10.0	12						
													254.3	J	1	65	P	R	Cl	2	12.0	6						
																										254.4	254.8	
													254.8	J	1	50	P	R	Cl	2	12.0	6						
	Limestone	69	255.2	258.6	3.0	N	1.9	10	12	12	R3	W2	256	J	1	20	P	VR	Cl	1	18.0	12						
													256.7	J	1	50	P	R	Cl	1	14.0	12						
																										256.8	257.4	Gravel recovery
	Limestone	70	258.6	262.0	3.4	N	1.8	8	15	12	R3	W2														258.7	259.0	
													259	J	1	40	P	R	Cl	0.5	14.0	12						
													261	J	1	50	P	R	Cl	0.5	10.0	20						
													261.4	J	1	40	P	R	Ca	1	12.0	12						
	Limestone	71	262.0	265.6	4.1	N	3.1	6	18	12	R3	W2	263.1	J	1	70	P	R	Cl	0.5	8.0	20						
													263.4	J	1	75	P	R	Cl	0.5	8.0	20						
													263.6	J	1	75	P	R	Cl	0.5	8.0	20						
													263.9	J	1	80	P	R	Cl	0.5	10.0	20						
													264.4	J	1	30	P	R	Cl	1	10.0	16						
													265.4	J	1	30	P	R	Cl	1	8.0	12						
	Limestone	72	265.6	270.7	5.1	N	4.7	4	14	12	R3	W2	267.5	J	1	30	P	R	Ca	1	10.0	12						
													268.9	J	1	50	P	R	Cl	1	10.0	12						
													269.2	J	1	30	P	R	Ca	1	8.0	12						Bottom of 0.15- foot chert unit

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													270.1	B	1	80	P	R	Cl	1	12.0	20						
	Limestone	73	270.7	276.0	4.0	N	2.0	15	15	12	R3	W2	271.1	J	1	50	P	R	Cl	0.5	10.0	20						
													271.7	J	1	70	P	R	Ca	1	12.0	12						
													272.4	J	1	45	C	R	Cl	1	12.0	12						
																										273.1	276.0	Gravel recovered
	Limestone	74	276.0	277.7	1.7	N	0.0	10			R3	W2														276.0	277.7	Rubble recovered
	Limestone	75	277.7	279.0	1.3	N	9.0	1	12	12	R3	W2	278.3	J	1	35	P	S	Cl	1	6.0	12						Rubble/redrill on top of recovery
	Limestone	76	279.0	280.0	1.0	N	0.0				R2	W2																Rubble recovered; redrill on top of recovery
	Limestone	77	280.0	282.0	2.3	N	2.2	2	16	12	R3	W2	280.5	J	1	60	P	R	Cl	0.5	10.0	20						
													281.4	J	1	40	C	R	Cl	1	8.0	12						
																							282.2	282.3	Sc			
	Limestone	78	282.0	284.0	1.4	N	0.0	10			R3	W2											283.7	284.0	Gc			Rubble recovered
	Metabasalt	79	284.0	285.5	3.6	N	0.7	6	6	6	R3	W2											284.0	284.4	Gc			Highly fractured, clay filled but intact core
													284.8	J	1	70	P	R	Cl	2	8.0	6						
	Limestone	79	285.5	287.6	2.1	N	2.1	0	6	6			285.5	F	1	25	ST	R	Cl	2	8.0	6						Metabasalt/limestone contact
	Limestone	80	287.6	292.0	4.3	N	3.7	8	12	12	R3	W2	288	J	1	60	P	R	Cl	1	12.0	12						
													288.8	J	1	40	P	R	Cl	1	10.0	12						
													289.3	J	1	35	P	R	Cl	1	14.0	12						
																							291.0	291.3	Gc			
	Limestone	81	292.0	297.0	5.0	N	5.0	2	20	20	R3	W2	292.7	V	1	80	P	S	Ca	1	6.0	20						Only partly broken along vein
													294.7	J	1	50	P	S			6.0	20						
	Limestone	82	297.0	300.0	2.7	N	2.1	10	12	12	R3	W2	299.1	J	1	60	U	R	Cl	0..5	14.0	12						
																							299.3	300.0	Gc			Angular coarse fault gouge
	Clayey gouge with metabasalt clasts	83	300.0	302.0	1.1	N	0.0	25			S3	W2											300.0	302.0	Gc			No limestone visible among clast fragments
	Limestone/metabasalt gouge	84	302.0	306.5	3.2	N	0.0	20	4	0	R1	W2	302.5	F	1	70	P	S	Cl	4	6.0	6						Solid chert band in gouge zone
													303.3	F	1	45	P	R	Cl	20	8.0	0						
													304.1	J	2	40	P	R	Cl	3	8.0	6						
	Metabasalt	85	306.5	309.0	2.5	N	2.1	5	6	6	R2	W2	307.2	J	1	40	P	R	Cl	1	10.0	6						Metabasalt with extensive Ca veins
													307.7	J	1	60	P	R	Cl	1	14.0	6						
																							308.2	308.6	Gc			
	Metabasalt	86	309.0	312.0	2.9	N	1.9	6	4	0	R2	W2	310	J	1	35	P	S	Cl	2	6.0	6						
													310.4	J	1	40	P	R	Cl	2	8.0	6						
													311.5	J	1	50	P	R	Cl	10	8.0	0						
	Metabasalt	87	312.0	317.0	4.8	N	3.5	4	8	6	R2	W2	313.2	J	1	35	P	R	Cl	2	8.0	6						
													314.7	J	1	60	C	R	Cl	3	10.0	6						
													316.1	J	1	30	P	R	Cl	1	8.0	12						
	Metabasalt	88	317.0	319.5	2.5	N	0.9	5	10	6	R2	W2	317.6	J	1	35	W	R	Cl	1	8.0	12						Possibly all mechanical breaks
													317.9	J	1	20	P	R	Cl	1	8.0	12						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													318.5	J	2	30	P	R	Cl	3	10.0	6						Limestone below
													319.1	J	1	30	P	R	Cl	1	8.0	12						
	Limestone	89	319.5	322.0	2.5	N	0.7	12	12	12	R2	W2	319.7	J	1	30	P	R	Cl	1	14.0	12						
													320.4	J	1	20	P	R	Ca	1	10.0	12						
																							320.6	321.4	Gc			
	Limestone	90	322.0	325.5	3.5	N	2.3	4	0	0	R2	W2	322.7	F	1	15	P	R	Cl	8	10.0	0						
	Limestone (weakly reactive)	91	325.5	328.5	2.7	N	0.6	6	9	6	R2	W2	325.9	J	3	20	P	S	Ca	1	6.0	12						Entire run highly broken
													327	J	1	40	P	R	Cl	2	10.0	6						
	Limestone	92	328.5	332.0	3.1	N	2.6	10	10	0	R2	W2	329.7	J	1	30	P	R	Cl	0.5	8.0	20						
													330.8	F	1	40	P	R	Cl	27	10.0	0						
	Metabasalt	93	332.0	335.0	2.8	N	0.0	25	0	0	R1	W2	332.8	J	1	45	P	R	Cl	5	8.0	0						Entire run milled material; top 0.6 feet and bottom 0.7 feet red weathered material
													333.2	J	1	50	P	R	Cl	5	8.0	0						
	Limestone	94	335.0	336.5	1.4	N	0.6	10			R2	W2														335.0	335.6	Solid limestone between broken up chert units
																										336.2	336.5	
	Metabasalt	95	336.5	340.8	3.6	N	1.2	35	0	0	R2	W2	336.9	F	1	50	P	R	Cl	S	8.0	0	337.0	339.1	Gc			Limestone 340.4' to 340.8'
	Limestone	96	340.8	346.1	4.9	N	1.2	35	0	0	R3	W2	343.3	J	1	40	IR	R	Ca	1	10.0	6						
													343.7	B	1	15	ST	S			6.0	25						Red chert contact with healed fault breccia
													344.1	F	1	40	P	R	Cl	10	8.0	0	344.1	345.1	Gc			
	Greenstone	97	346.1	349.2	3.1	N	2.2	4	9	6	R3	W2	347	J	1	50	P	R	Cl	1	12.0	12						
													347.4	J	1	30	P	R	Cl	1	10.0	12						
													348.2	J	2	25	P	R	Cl	1	8.0	6						
													349.1	J	1	30	P	R	Cl	2	8.0	6						
	Metabasalt	98	349.2	352.0	2.7	N	1.5	20	6	0	R1	W2	349.3	J	1	40	P	R	Cl	1	8.0	12						
													350.2	F	1	50	ST	R	Cl	30	8.0	0	350.2	350.5	Gc			Below 350.2' milled gougy greenstone

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Clayey Sandy Gravel	1	20.0	23.0	2.7	N	0.0	0	0	0	S4	W3											20.0	22.7	CL/FeOx			Landslide deposit, FeOx, rubble
	Clayey Sandy Gravel	2	23.0	28.0	0.4	N	0.0	0	0	0	S4	W3											23.0	23.4	CL/FeOx			Landslide deposit, FeOx, rubble
	Clayey Sandy Gravel	3	28.0	30.2	0.4	N	0.0	0	0	0	S4	W3											28.0	28.4	CL/FeOx			Landslide deposit, FeOx, rubble
	Clayey Sandy Gravel	4	30.2	32.9	0.6	N	0.0	0	0	0	S4	W3											30.2	30.8	CL/FeOx			Landslide deposit, FeOx, rubble
	Clayey Sandy Gravel	5	32.9	37.3	4.2	N	0.0	0	0	0	S4	W3											32.9	37.3	CL/FeOx			Landslide deposit, FeOx, rubble
	Clayey Sandy Gravel	6	37.3	42.5	3.0	N	0.0	0	0	0	S4	W3											37.3	40.3	CL/FeOx			Landslide deposit, FeOx, rubble, wet
	Clayey Sandy Gravel	7	42.5	48.0	0.3	N	0.0	0	0	0	S4	W3											42.5	42.8	CL/FeOx			Landslide deposit, FeOx, rubble, wet
	No Recovery	8	48.0	51.5	0.0																							
	No Recovery	9	51.5	57.0	0.0																							
	No Recovery	10	57.0	62.5	0.0																							
	No Recovery	11	62.5	64.8	0.0																							
	No Recovery	12	64.8	68.0	0.0																							
	No Recovery	13	68.0	69.3	0.0																							
	No Recovery	14	69.3	71.3	0.0																							
	Gravel	15	71.5	73.0	0.8	N	0.0	0	0	0	R3	W2											71.5	72.3	Bx			Gravel to 2" diameter
	Clayey Gravel	16	73.0	78.0	2.4	N	0.0	0	0	0	S4	W3											73.0	75.4	CL			Gravel to 1" diameter, some coarse sand, wet
	No Recovery	17	78.0	83.0	0.0																							
	No Recovery	18	83.0	98.0	0.0																							
	Fault breccia/gouge	19	98.0	103.0	2.1	N	0.0	30	6	6	R3	W3											98.0	100.1	Bx/G			>10 fractures/ft.: entire run
	Greenstone gouge and breccia	20	103.0	108.0	5.0	N	2.6	5	9	2	R2	W3	104.9	F	2	54	P	R	CL	0.5"	8.0	2						Some mechanical fractures; slickensides
													106.2	J	2	51	P	VR	OX	2	14.0	12						Sample 104.1" to 104.9"
													106.8	J	1	63	P	VR	OX	2	14.0	12						
	Greenstone breccia	21	108.0	113.0	5.0	N	2.5	4	8	4	R4	W2	108.6	J	1	61	P	R	Ox	1	8.0	12						
													110.2	J	1	64	P	R	CL/Ch	5	6.0	4						
													111.6	J	2	44	P	R	CL/Ch	2	6.0	8						
	Greenstone breccia	22	113.0	118.0	4.8	N	2.7	3	2	2	R4	W2	113.3	J	1	46	P	R	Chl	3	8.0	2						Some gouge; slickensides
													116.2	J	2	34	P	Sm	Chl	3	6.0	2						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greenstone breccia	23	118.0	120.0	5.0	N	2.7	2.2	4	4	R4	W2	118.9	J	1	60	P	Sm			4.0	4						
	Greenstone breccia	24	120.0	123.0	3.0	N	1.8	4	6	6	R4	W2	120.6	J	2	51	P	R	Chl	2	6.0	6						
													121.4	J	2	48	P	R	Chl/Cl	2	6.0	6						
	Greenstone breccia	25	123.0	128.0	5.0	N	2.2	3	13	12	R4	W2	123.5	J	1	35	U	R	Chl	1	12.0	12						Sample 125.2' to 126.0'
													123.9	J	1	54	U	R	Chl	2	13.0	14						
													125.2	J	1	66	P	R	Chl	1	8.0	12						
	Greenstone breccia/gouge	26	128.0	130.3	2.3	N	0.0	0	4	4	R3	W3											128.0	130.3	G/Bx/Chl			
	Greenstone breccia/gouge	27	130.3	132.0	1.3	N	0.0	0	4	4	R3	W3											130.3	131.6	G/Bx/Chl			
	Greenstone breccia	28	132.0	134.3	1.9	N	0.0	100	4	4	R4	W3														132.0	133.9	Entire run broken core
	Greenstone breccia	29	134.3	139.5	5.0	N	0.7	1	2	2	R4	W3	134.5	J	1	61	P	Sm	Chl	3	2.0	2	136.8	139.5	CL/Bx	135.2	135.7	Mechanical fractures; slickensides
	Greenstone breccia	30	139.5	143.0	3.5	N	0.0	2	12	12	R4	W3	139.8	J	1	70	U	R	Chl	1	8.0	12				140.0	140.6	
	Greenstone gouge	31	143.0	144.0	1.0	N	0.0																143.0	144.0	Chl/Bx			
	Greenstone breccia	32	144.0	149.3	5.0	N	0.0	5	6	2	R4	W2	145	J	4	53	P	Sm	Chl	1	4.0	2						Ca veins; slickensides
													146.4	J	1	30	P	R	Chl	3	8.0	10						
	Greenstone	33	149.3	150.5	0.8	N	0.0		6	6	R4	W2														149.3	150.1	Entire run broken core
	Greestone gouge/breccia	34	150.5	154.0	2.7	N	0.0	0	4	4	R3	W3											150.5	154.0	Bx/G			
	Greenstone gouge/breccia	35	154.0	155.0	1.0	N	0.0	0	4	4	R3	W3											154.0	155.0	Bx/G			
	Greenstone gouge/breccia	36	155.0	158.0	2.9	N	0.0	1	2	2	R3	W3	155.7	J	1	33	P	Sm	Chl	5	4.0	2	156.1	157.9	G/Bx/Chl			Slickensides
	Greenstone breccia	37	158.0	161.0	3.0	N	0.0	4	3	2	R3	W3	158.5	J	2	68	P	Sm	Chl	3	4.0	4						Slickensides
													159.9	J	2	41	P	R	Chl	8	6.0	2						
	No recovery	38	161.0	162.0																								
	No recovery	39	162.0	163.0																								
	No recovery	40	163.0	164.0																								
	Greenstone breccia/gouge	41	164.0	169.0	3.5	N	0.4	3	12	4	R4	W3	166.2	J	1	48	P	R	Chl	3	6.0	4	164.0	166.2	Chl/Bx			
													166.6	J	1	42	U	R			10.0	12						
													167.2	J	1	44	U	VR			16.0	18						
	Greenstone breccia	42	169.0	171.0	2.0	N	0.0	1	6	6	R4	W2	169.6	J	1	42	P	R	Chl	5	8.0	6				169.6	171.0	

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greenstone breccia	43	171.0	173.0	2.0	N	0.0	30	12	12	R4	W2	171.3	J	1	44	P	VR	Chl	1	6.0	12						>10 fractures/foot 171.3' to 173'
	Greenstone breccia	44	173.0	174.2	1.2	N	0.0				R4	W2														173.0	174.2	Entire run broken core
	Greenstone breccia	45	174.2	177.2	2.3	N	0.0	30	9	8	R4	W2	174.6	J	1	29	P	R			4.0	10						>10 fractures/foot 174.9' to 176.5'
													174.9	J	1	56	P	R	Chl	2	6.0	8						
	Greenstone breccia	46	177.2	182.0	4.8	N	0.0	20	8	6	R4	W2	178.3	J	1	62	P	VR	Chl	1	6.0	8				177.2	177.8	Ca veins; mechanical fractures
													179.1	J	1	55	U	R	Chl	1	8.0	10						>10 fractures/foot 180' to 182'
													179.6	J	1	55	U	R	Chl	5	10.0	6						
													180	J	1	40	P	VR	Chl	1	8.0	10						
	No recoverey	47	182.0	183.0																								
	Greenstone breccia	48	183.0	187.0	3.5	N	0.0	30	18	18	R4	W2	185.6	J	1	59	U	R			8.0	18				183.0	183.5	>10 fractures/foot 183.5' to 185.6'
																										185.6	186.5	
	Greenstone	49	187.0	192.2	4.8	N	0.0	6	9	2	R4	W1	187.3	J	3	57	U	R	Chl	2	12.0	10						Breccia from 190.7' to 191.8'; Ca veins
													188.8	J	1	38	P	VR	Chl	1	14.0	14						
													189.5	J	1	25	P	Sm	Chl	5	4.0	4						
													190.7	J	1	30	P	R	Cl/Chl	20	4.0	2						
	Greenstone gouge/breccia	50	192.2	197.2	5.0	N	0.0	50	14	13	R4	W2	195.1	J	1	40	P	R	Chl	1	6.0	15	192.2	192.8	G/Bx			Some mechanical fractures
													195.6	J	1	47	P	SM	Chl	1	4.0	13						>10 fractures/foot 195.6' to 197.2'
	Greenstone	51	197.2	201.0	2.8	N	0.0	50	14	14	R4	W2																>10 fractures/foot entire run; some broken core
	Greenstone	52	201.0	206.3	4.8	N	0.0	50	15	14	R4	W2	202.2	J	1	24	P	SM	Chl	1	4.0	14						Ca/Chl veins; mechanical fractures; many healed fractures
													203.3	J	1	46	P	VR	Chl	3	8.0	16						>10 fractures/foot 204.5' to 205.8'
	Greenstone	53	206.3	210.5	4.2	N	0.0	3	14	12	R4	W1	208.8	J	1	36	P	R	Chl	1	6.0	16						Many healed fractures; mechanical fractures
													209.3	J	1	35	P	SM	Chl	2	4.0	12						
													209.9	J	1	49	P	SM	Chl	1	4.0	14						
	Greenstone	54	210.5	213.0	2.5	N	0.0	6	13	0	R4	W2	210.7	J	2	48	U	R	Chl	1	14.0	20	212.2	213.0	Chl/Bx/G			
													210.8	J	3	53	P	R			12.0	18						
													212.1	F	1	44	P	R	Chl/Bx	0.8'	6.0	0						
	Greenstone	55	213.0	218.0	1.9	N	0.0	1	0	0	R4	W2	214.2	F	1	35	U	R	Chl	0.7'	12.0	0	214.2	214.9	G/Bx/Chl	213.0	213.2	
	Greenstone	56	218.0	222.5	0.9	N	0.0		2	2	R4	W2											218.4	218.9	G/Bx/Chl	218.0	218.4	
	No recovery	57	222.5	225.0																								
	Greenstone gouge	58	225.0	230.0	2.6	N	0.0		0	0	R3	W3											225.0	227.6	Bx/Chl			Some clay, hematite
	Greenstone gouge/breccia	59	230.0	23.5	2.3	N	0.0																230.5	232.3	Bx/Chl	230.0	230.5	Ca veins
	Greenstone gouge/breccia	60	235.5	238.5	2.4	N	0.0	1	0	0	R3/R4	W2	235.9	F	1	28	P	SM	G	2	2.0	0	235.9	237.9	Bx/Chl			
	No recovery	61	238.5	239.0																								

			Run Data																									
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge					
																							Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greenstone gouge/breccia	62	239.0	240.0	1.0	N	0.0		0	0	R3	W3											239.0	240.0	Bx/Chl			
	Greenstone gouge/breccia	63	240.0	242.0	1.4	N	0.0		0	0	R3	W3											240.0	241.4	Bx/Chl			
	Greenstone gouge/breccia	64	242.0	243.0	0.7	N	0.0		2	2	R3/R4	W3											242.0	242.7	Bx/Chl			
	Greenstone gouge/breccia	65	243.0	245.0	0.6	N	0.0		0	0	R3	W3											243.0	243.6	Bx/Chl			
	Greenstone gouge/breccia	66	245.0	247.5	1.7	N	0.0		0	0	R3	W3																
	Greenstone breccia	67	247.5	249.5	2.0	N	0.0	30	4	4	R4	W3																>10 fractures/foot entire run
	Greenstone breccia	68	249.5	252.7	3.2	N	0.0	70	4	4	R3	W3																Intermixed gouge; >10 fractures/foot entire run
	Greenstone breccia	69	252.7	256.0	3.3	N	0.0	100	2	2	R3	W3																Healed fractures, some with hematite; >10 fractures/foot entire run
	Greenstone breccia	70	256.0	257.1	0.6	N	0.0		16	16	R3	W2																Hematite
	Greenstone breccia	71	257.1	258.9	1.8	N	0.0	3	18	18	R3	W2	257.4	J	3	48	U	R	Chl	2	12.0	18				258.3	258.9	
	Greenstone breccia	72	258.9	261.9	3.0	N	0.4	30	10	10	R3	W3																Mechanical fractures; intermixed with gouge; >10 fractures/foot entire run
	Greenstone breccia	73	261.9	263.0	0.8	N	0.0	1	20	20	R3	W2	262.2	J	1	53	U	R			16.0	20						
	Greenstone breccia	74	263.0	265.2	2.2	N	0.0	20	14	14	R2	W2											263.0	263.5	Chl			Some hematite; >10 fractures/foot 263.5'-265.2'
	Greenstone	75	265.2	270.2	4.0	N	0.0	30	14	14	R3	W2	267.1	J	2	37	U	R	Chl	3	16.0	14	268.5	270.2	Chl			>10 fractures/foot 265.2' to 266.4' and 267.8' to 268.5'
	Greenstone	76	270.2	273.0	2.4	N	0.0	20	14	14	R3	W2											271.8	273.0	Chl			>10 fractures/foot 270.2' to 271.8'
	Greenstone breccia	77	273.0	277.3	4.3	N	0.0	30	4	4	R3	W2	275.6	J	2	40	P	R	Chl	2	4.0	4	276.7	277.3	Chl			Some hematite; >10 fractures/foot 273' to 275.6'
	Greenstone breccia	78	277.3	280.0	2.7	N	0.0	25	4	4	R3	W3											277.3	277.9	Chl			>10 fractures/foot 277.9' to 278.9'
																							278.9	280.0	Chl			
	Greenstone	79	280.0	283.0	2.4	N	0.4	1	16	16	R3	W3	280.5	J	1	57	U	R	Chl	1	16.0	16	281.2	283.0	Chl			
	Greenstone gouge	80	283.0	284.5	1.5	N	0.0		0	0	R3	W3											283.0	284.5	Chl			
	No recovery	81	284.5	286.0	0.0																							
	Greenstone gouge to limestone	82	286.0	288.5	2.5	N	0.0	1	0	0	R3	W3	288.1	F	1	46	U	R	Chl	2.1	8.0	0	286.0	288.1	Chl			Limestone contact at 288.1'
	Greenstone/metabasalt gouge	83	288.5	293.0	3.0	N	0.0		0	0	R3	W3											288.5	293.0	Chl			

			Run Data										Detailed Discontinuity Data									Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index											Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt	84	293.0	295.0	2.0	N	1.1	1	20	20	R4	W1	293.6	J	1	35	U	R			14.0	20						
	Metabasalt/greenstone gouge	85	295.0	300.0	3.1	N	0.0		0	0	R3	W3											295.0	300.0	Chl			
	Metabasalt	86	300.0	305.0	4.5	N	0.8	4	17	15	R3	W2	300.7	J	1	56	U	VR			16.0	22						Sample: 303.5' to 304.1'
													301.4	V	1	30	P	R	Ca	5	10.0	15						
													302.1	J	1	56	P	R			12.0	18						
													303.5	J	1	50	P	R	Chl	2	10.0	16						
	Metabasalt	87	305.0	310.0	5.0	N	1.8	5	15	14	R4	W2	305.4	J	1	49	U	R	Chl	1	10.0	16						Large Ca vein; some chert
													306.5	J	1	65	P	R	Chl	3	8.0	14						
	Metabasalt	88	310.0	315.0	5.0	N	3.5	3	15	12	R4	W1	313.1	J	1	70	U	R			14.0	18						Mechanical fractures
													313.5	V	2	52	P	R	Ca	3	6.0	12						
	Metabasalt	89	315.0	319.0	4.0	N	2.4	5	18	16	R4	W1	315.8	J	3	30	U	R	Ca	2	16.0	18						
													316.2	J	1	52	U	R			16.0	20						
													317.4	J	1	32	P	R			12.0	16						
	Metabasalt/greenstone	90	319.0	322.5	3.5	N	1.6	5	13	0	R4	W2	319.2	J	1	36	U	R	Chl	2	15.0	16	321.5	321.8	Chl/Bx			
													320.5	J	1	25	U	R	Chl	3	15.0	16						
													321	J	1	48	U	R			14.0	18						
													321.5	F	1	68	P	K	G	0.3'	6.0	0						
	Metabasalt/greensonte	91	322.5	327.5	5.0	N	4.2	3	12	4	R4	W1	324.3	J	1	61	ST	R			18.0	18						
													325	J	1	67	P	R	Chl	3	10.0	14						
													325.2	J	1	30	U	K	CL/Ch	3	4.0	4						
	Metabasalt/greenstone	92	327.5	332.5	5.0	N	2.2	6	18	16	R4	W1	327.9	J	3	45	U	R			18.0	20						
													329	J	2	38	P	R			14.0	18						
													330.2	J	1	62	P	R	Chl	1	14.0	16						
	Metabasalt/greenstone	93	332.5	337.5	5.0	N	1.5	3	11	0	R3	W1	333.7	J	1	35	P	VR	Chl	2	16.0	16	337.0	338.5	Chl	332.5	333.5	
													335.3	J	1	64	P	R	Chl	1	14.0	16						
													337	F	1	68	P	G	Chl	0.5'	6.0	0						
	Greenstone	94	337.5	342.6	5.1	N	4.1	6	11	0	R3/R4	W1	338	F	1	56	U	R	G	0.5'	10.0	0	337.5	338.0				
													338.4	J	3	68	P	R	Chl	4	12.0	14						
													342.2	J	2	57	P	R			14.0	18						
	Greenstone	95	342.6	347.8	5.2	N	2.2	4	13	6	R4	W1	342.9	J	2	63	P	R	Chl	2	14.0	16						
													344.6	J	1	57	P	R			16.0	18						
													345	F	1	58	P	R	G	3"	14.0	6						
	Greenstone/metabasalt	96	347.8	353.0	5.2	N	3.4	4	16	10	R4	W1	348	J	1	48	P	R			12.0	18						
													348.4	J	1	42	P	R	Ca	5	14.0	10						
													349.8	J	2	45	P	R			16.0	18						
	Greenstone/metabasalt	97	353.0	358.0	4.3	N	1.2	2	8	0	R3	W1	354.3	J	1	51	U	R	Chl	2	16.0	16	356.1	358.0	Chl/Bx			
													356.1	F	1	67	U	R	G	1.9	4.0	0						
	Greenstone/metabasalt	98	358.0	363.0	5.0	N	3.1	3	6	0	R3	W1	359.2	V	1	68	U	R	Ca	4	14.0	14						

			Run Data																											
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge							
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													357.2	F	1	59	U	R	G	2.3'	12.0	0						
													361.5	F	1	61	P	R	Chl	8	4.0							
	Greenstone/metabasalt	99	363.0	368.0	5.0	N	3.0	1	0	0	R3	W1	365.5	F	1	54	P	R	G	2.5'	10.0	0	365.5	368.0	Chl/Bx			
	Greenstone/metabasalt	100	368.0	373.0	5.0	N	3.1	1	0	0	R3	W1	371.1	F	1	61	P	R	G	1.9'	12.0	0	371.1	373.0				
	Limestone	101	373.0	378.0	5.0	Y	0.8	15	4	0	R3	W1	373.7	F	1	70	P	SM	G	0.4	4.0	0	373.7	374.1	CL/Chl			Rock reacts with HCl but looks like metabasalt
													376.5	J	2	54	P	K	Ca	3	4.0	8						>10 fractures/foot 374.1' to 376.5'
	Greenstone/metabasalt	102	378.0	383.0	4.7	N	2.2	2	12	10	R3	W1	379.9	J	1	73	U	R	Chl	8	14.0	10						Some breccia
													382.4	J	1	75	U	R	Chl	2	12.0	14						
	Greenstone/metabasalt	103	383.0	388.0	5.0	N	1.3	30	16	16	R4	W1	387.7	J	3	49	U	R			16.0	16						>10 fractures/foot 383.6' to 387.7'
	Greenstone/metabasalt	104	388.0	393.0	5.0	N	1.6	2	10	8	R4	W1	390.2	J	1	60	P	K	Chl	3	4.0	8				391.6	393.0	Mechanical fractures
													391.1	J	1	65	P	K			6.0	12						
	Greenstone/metabasalt	105	393.0	398.0	5.0	N	2.6	5	19	18	R4	W1	393.2	J	1	38	P	R			12.0	18						
													393.4	J	2	42	U	R			16.0	18						
													397	J	1	51	ST	R			22.0	22						
													397.8	J	1	68	P	R			18.0	20						
	Greenstone/metabasalt	106	398.0	403.0	5.0	N	1.4	2	11	4	R3	W1	401.2	J	1	65	P	R			12.0	18				398.0	401.2	
													402.8	J	1	68	P	K	Chl	2	6.0	4						
	Metabasalt	107	403.0	407.5	4.5	N	2.4	5	13	12	R3	W1	401.2	J	1	65	P	R			12.0	18						Some chert; some gouge
													402.8	J	1	68	P	K	Chl	2	6.0	4						
	Metabasalt/chert	108	407.5	408.0	0.5	N	0.4	0	20	20	R4	W1																Mechanical fractures
	Metabasalt/chert	109	408.0	413.0	5.0	N	4.1	3	14	12	R4	W1	409.6	J	3	60	U	R	Chl	3	12.0	12						Some bedded chert
													410.3	J	2	57	P	R			12.0	16						
	Metabasalt breccia	110	413.0	418.0	5.0	N	3.2	0	22	22	R4	W1																Mechanical fractures
	Metabasalt breccia	111	418.0	423.0	5.0	N	1.8	3	19	18	R3	W2	419.6	J	2	57	P	R			14.0	18						
													421.2	J	1	48	U	R			18.0	20						
	Metabasalt breccia	112	423.0	428.0	5.0	N	0.8	4	2	0			426.1	J	3	52	P	K	Chl	2	6.0	2	423.0	425.0	Bx/Chl			
													426.5	F	1	53	P	K	G	0.3'	4.0	0						
	Metabasalt gouge	113	428.0	432.0	3.5	N	0.0	20	0	0	R3	W3											429.5	432.0	Bx/Chl			>10 fractures/foot 428' to 429.5'
	Metabasalt	114	432.0	437.0	5.0	N	4.1	1	18	18	R4	W1	432.4	J	1	42	U	R	Chl	2	16.0	18						Mechanical fractures
	Metabasalt	115	437.0	442.0	5.0	N	4.7	2	22	20	R4	W1	438.9	J	1	68	P	R			12.0	20						
													439.5	J	1	52	ST	R			20.0	24						

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	
	Metabasalt gouge	116	42.0	447.0	5.0	N	0.0	0	0	0	S3/R3	W3											442.0	447.0	Bx/Chl			
	Metabasalt breccia	117	447.0	452.3	5.0	N	0.6	3	0	0	R3	W3	447.5	F	2	50	P	K	Chl	0.3'	6.0	0						Some chert
													457.4	F	1	52	P	K	Chl	0.6'	6.0	0	451.4	452.3	Chl			
	Metabasalt gouge	118	452.3	457.5	4.8	N	0.0	0	0	0	S3	W3											452.2	457.5	Chl/Bx			
	Metabasalt breccia	119	457.5	463.0	3.2	N	0.7	2	18	18	R4	W2	459	J	2	47	U	R			14.0	18				457.5	458.0	
	Metabasalt breccia	120	463.0	468.0	5.0	N	4.6	1	18	18	R4	W1	464.3	J	1	68	U	R			14.0	18						
	Metabasalt breccia	121	468.0	473.0	5.0	N	3.7	4	8	0	R4	W2	468.2	F	1	48	P	K	Chl	0.2'	6.0	0						
													468.6	J	1	45	P	R			8.0	14						
													470.5	J	1	51	U	R	Chl	2	6.0	12						
													471.5	J	1	53	P	K	Chl	2	4.0	4						
	Metabasalt breccia	122	473.0	478.0	5.0	N	2.5	3	9	2	R3	W2	473.2	J	1	34	U	R	Chl	2	16.0	18				476.3	478.0	Healed fractures
													474.8	J	1	61	U	K	Chl	8	4.0	2						
													475	J	1	61	U	K	Ca/Ch	2	4.0	6						
	Metabasalt with some limestone	123	478.0	483.0	4.1	N	2.1	2	9	0	R3	W2	478.9	F	1	49	P	K	G	1.4'	4.0	0	478.9	480.3	Chl/Bx			
													481.6	J	1	49	U	R	Chl	2	10.0	18						
	Metabasalt breccia and gouge	124	483.0	488.0	5.0	N	1.7	5	11	0	R3	W2	483.5	V	1	52	U	R	Ca	0.1'	16.0	20	484.7	486.1	Chl/Bx			
													483.9	J	1	68	P	K	Chl	2	4.0	12						
													484.7	F	2	71	P	K	Chl	2	4.0	0						
													487.5	J	1	48	P	IK	Chl	3	6.0	6						
	Metabasalt	125	488.0	493.0	5.0	N	0.4	3	12	8	R3	W2	488.7	J	1	53	P	K	Chl	<1	4.0	8						
													488.9	J	1	54	U	R			16.0	18						
													492.3	J	1	48	P	K	Chl	<1	6.0	8						
	Metabasalt	126	493.0	498.0	5.0	N	2.5	5	20	20	R3	W1	493.4	J	1	67	U	R			16.0	20				493.0	493.4	
													494.6	J	2	28	U	R			16.0	20				495.9	496.3	
													496.3	J	1	45	U	R			16.0	20				496.7	498.0	
													496.9	J	1	52	P	VR			17.0	20						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data											Rubble/Gouge					
																								Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt	1	95.0	96.0	3.0	N	0.0	19	7	6	R1	W4	94.6	J	1	28	P	K	CL	1	6.0	6						>10 Fractures/ft: 93 - 94'
													94.8	J	1	38	U	S	CL	1	6.0	8						Fault zone
													95.2	J	2	54	P	S	CL	1	6.0	8						>10 Fractures/ft: 95.4 - 96'
	Metabasalt breccia and gouge	2	96.0	100.5	1.1	N	0.4	10			R1	W4											99.6	100.0	CL/Bx			>10 Fractures/ft 100 - 100.5'
	Metabasalt breccia	3	100.5	105.5	3.0	N	0.0	20	13	10	R1	W3	101.8	J	2	48	P	R	CL	1	8.0	10						>10 Fractures/ft entire run
													101.5	J	1	50	U	VR	CL	<1	14.0	16						
	Metabasalt breccia	4	105.5	108.0	3.2	N	1.2	6	15	6	R1	W3	104.1	J	2	36	P	VR	CL	<1	16.0	20						
													104.8	J	2	38	U	R	CL	<1	10.0	20						
													105.9	J	1	65	P	S	CL	1	5.0	14						
													106.0	J	1	46	P	K	CL	1	4.0	6						
	Metabasalt breccia and gouge	5	108.0	111.5	2.0	N	0.0		0	0	R1/S5	W4										0	109.5	111.5	Bx/CL			Entire run brecciated and gougy
	Metabasalt breccia and gouge	6	111.5	116.0	1.7	N	0.0		0	0	R1/S5	W4										0	114.3	116.0	Bx/CL			Entire run brecciated and gougy
	Metabasalt breccia	7	116.0	118.0	1.7	N	0.0	20	6	6	R1	W3	116.6	J	1	64	P	K	CL	1	4.0	6						>10 Fractures/ft entire run
													117.1	J	1	64	P	S	CL	1	4.0	8						
													117.2	J	1	41	P	K	CL	1	4.0	6						
													117.3	J	1	48	P	K	CL	1	4.0	6						
	Metabasalt/greenstone breccia	8	118.0	120.5	1.8	N	0.0	17	6	6	R1	W3	119.0	J	1	55	U	K	Cl/Chl	1	4.0	6						Some chlorite alteration, >10 fractures/ft: 119.2 - 120.5'
	Metabasalt gouge/breccia	9	120.5	123.0	2.2	N	0.0	15	6	6	R1/S5	W3	122.3	J	1	73	C	K	CL	1	3.0	6	121.0	121.8	CL/Bx			>10 Fractures/ft: 121.8 - 123'
	Metabasalt gouge/breccia	10	123.0	125.0	1.6	N	0.0	30	0	0	R1/S5	W3										0	123.4	125.0	Bx			>10 Fractures/ft entire run
	Metabasalt gouge	11	125.0	127.0	1.4	N	1.1		0	0	S6	W4										0	125.6	127.0	CL/Bx			
	Metabasalt gouge/breccia	12	127.0	129.5	2.0	N	0.5	8	0	0	S3/R1	W3	128.3	F	1	47	P	K	G	0.7'	2.0	0	127.0	128.3	CL/Bx			>10 Fractures/ft: 128.3 - 129.5'
	Metabasalt gouge/breccia	13	129.5	132.5	3.2	N	0.7	40	0	0	S6/R1	W3										0	129.5	130.0	CL/Bx			>10 Fractures/ft entire run, entire run brecciated and gougy
																						0	130.5	131.3	Bx			
	Metabasalt	14	132.5	135.0	2.3	N	0.0	20	2	2	R1	W3	133.4	J	3	50	P	K	CL	10	14.0	2						>10 Fractures/ft: 134 - 135'

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt gouge	15	135.0	139.0	2.9	N	0.6	1.5	0	0	S5/R1	W3										0	136.0	137.3	CL/Bx			>10 Fractures/ft: 137.3 - 138.1'
																						0	138.1	139.0	CL/Bx			
	Metabasalt gouge	16	139.0	141.0	2.3	N	0.5	3	0	0	S5/R1	W3	139.5	F	1	18	P	K	G	7	2.0	0	139.3	139.5	CL/Bx			
													140.5	F	2	29	P	K	G	0.5'	4.0	0	140.5	141.0	CL/Bx			
	Metabasalt	17	141.0	143.0	1.5	N	0.6		14	14	R1	W3										14				141.0	141.6	Rubble/re-drill - mechanical fractures
	Metabasalt breccia	18	143.0	147.5	4.2	N	1.6		0	0	R1/S5	W3	145.4	F	1	52	U	K	G	1.8'	4.0	0	145.4	147.5	CL/Bx			Mechanical fractures
	Metabasalt gouge	19	147.5	150.5	2.8	N	0.5	20	6	6	R1/S5	W4										6	147.5	149.4	CL/Bx			>10 Fractures/ft: 149.4 - 150.5'
	Metabasalt breccia	20	150.5	153.0	2.5	N	0.0	35	12	12	R1/S5	W3																>10 Fractures/ft entire run
	Metabasalt	21	153.0	155.0	2.5	N	0.0	24	18	18	R1	W3	153.0	J	3	29	P	R	CL	<1	12.0	18						>10 Fractures/ft: 154 - 155'
	Metabasalt gouge	22	155.0	158.0	2.2	N	0.0	12	12	12	R1/S5	W3										12	153.7	157.0	CL/Bx			>10 Fractures/ft: 157 - 158'
	Metabasalt	23	158.0	163.0	5.0	N	0.0	70	0	0	R1/S5	W3	160.7	F	1	51	U	S	G	0.5'	4.0	0	160.7	161.2	CL/Bx			>10 Fractures/ft entire run
	Greenstone breccia w/greywacke clasts	24	163.0	168.0	5.0	N	1.8	5	13	6	R1	W3	163.4	J	1	64	C	R	CL	<1	12.0	17						
													163.8	J	1	53	P	R	SC	2	10.0	14						
													164.1	J	1	48	P	VR	SC	2	14.0	16						
													164.2	J	1	25	P	R	SC	1	8.0	12						
													166.6	J	1	52	P	S	CL	10	4.0	6						
	Greenstone breccia w/greywacke clasts	25	168.0	173.0	5.0	N	1.3	2.6	15	6	R2	W2	168.4	J	1	50	P	R	CL	<1	10.0	16						>10 Fractures/ft: 170.6 - 173'
													169.1	J	1	55	P	R	CL	<1	12.0	17						
													196.6	J	1	50	ST	VR	CL	1	18.0	20						
													170.0	J	1	63	P	R	CL	<1	10.0	16						
													170.2	J	1	33	P	VR	CL	<1	14.0	17						
													170.5	J	2	33	P	VR	CL	30	14.0	6						
	Greenstone breccia w/greywacke clasts	26	173.0	177.0	3.4	N	0.4	15	9	0	R2	W3	174.4	J	2	65	P	S	CL	2	6.0	9						
													175.0	J	1	70	C	VR	FeOx	<1	16.0	20						
													175.3	J	1	33	C	VR	CL	1	16.0	12						
													175.6	J	2	44	P	S	CL	1	4.0	6						
													176.2	F	1	38	P	S	G	0.2'	2.0	0	176.0	176.2	CL/Bx			>10 Fractures/ft: 176.4 - 177'
	Greenstone breccia w/greywacke clasts	27	177.0	180.0	3.0	N	0.0	8	5	0	R2	W3	177.5	J	1	55	P	R	CL/Bx	25	14.0	0						Brecciated and gougy
													178.2	F	1	56	U	R	G	0.6'	12.0	0	177.9	178.5	CL/Bx			

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													178.9	J	1	20	R	VR	CL	<1	16.0	18						
													179.4	J	1	10	P	R	G	0.2'	14.0	0	179.2	179.4	CL/Bx			
	Greenstone breccia w/greywacke clasts	28	180.0	182.5	2.3	N	0.0	25	12	12	R2	W3	180.6	J	5	50	U	R	G	>5	12.0	0	180.6	182.5	CL/Bx			Brecciated and gougy, >10 fractures/ft entire run
	Greenstone breccia w/greywacke clasts	29	182.5	185.0	2.0	N	0.0		0	0	R2/S3	W4											183.7	184.8	SC	183.0	183.7	Rubble/redrill and mechanical fractures
	Greenstone breccia	30	185.0	186.5	1.5	N	0.0		12	12	R2	W3														185.0	186.5	Rubble/redrill and mechanical fractures
	Greenstone breccia	31	186.5	188.0	1.2	N	0.0	3	17	14	R2	W2	186.8	J	1	47	P	R	CL/FeOx	<1	8.0	14						
													187.1	J	1	30	U	R	CL/FeOx	<1	10.0	18						
													187.4	J	1	28	U	R	CL/FeOx	<1	10.0	18						
	Greenstone breccia	32	188.0	188.5	0.5	N	0.0				R2	W2														188.0	188.5	Rubble/re-drill
	Greenstone breccia	33	188.5	192.0	3.4	N	1.6	4	12	0	R2	W3	189.4	J	1	50	P	VR	CL/FeOx	<1	16.0	20				188.5	188.9	
													189.8	J	1	28	U	VR	CL/FeOx	<1	15.0	20						
													191.0	F	1	46	K	S	G	0.5'	2.0	0	190.5	191.0	Bx/CL			
													191.6	J	1	47	P	R	CL	6	6.0	6						
	Greenstone breccia	34	192.0	194.0	2.0	N	0.8	16	16	10	R2	W3	193.0	J	1	34	U	VR	CL	<1	16.0	20						>10 Fractures/ft 192.5 - 192.9', brecciated and gougy
													193.4	J	3	45	P	R	CL	<1	10.0	16						
													193.4	J	1	58	P	S	CL	2	6.0	10						
													193.8	J	1	27	P	R	CL/FeOx	<1	10.0	16						
	Greenstone breccia/Limestone	35	194.0	199.0	5.0	N	1.5	8	19	18	R2	W2	195.0	J	1	20	P	VR	CL/FeOx	<1	14.0	20						Contact @ 194.3'
													195.1	J	1	54	P	VR	CL/FeOx	1	14.0	18						
													196.3	J	2	43	P	VR	CL/FeOx	1	14.0	18						
													197.4	J	2	15	P	R	CL/FeOx	<1	10.0	18						
													198.4	J	1	30	P	R	CL/FeOx	<1	10.0	18						
													198.8	J	1	65	U	VR	FeOx	<1	20.0	22						
	Limestone/Greenstone breccia	36	199.0	203.0	3.6	N	1.5	7	15	0	R2	W2/W3	200.0	F	1	50	P	VR	G	0.3'	18.0	0	199.8	200.1	SC			Contact @ 200'
													200.4	J	1	80	IR	R	CL/FeOx	<1	12.0	20						
													200.7	J	1	26	P	R	CL/FeOx	<1	10.0	17						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													201.1	J	1	26	P	R	CL/Fe Ox	1	10.0	14						
													201.3	J	1	63	P	R	CL/Fe Ox	1	10.0	14						
													202.4	J	1	84	IR	VR			16.0	22						
													202.9	J	1	88	P	R	CL/Fe Ox	<1	8.0	17						
	Breccia	37	203.0	208.0	5.0	N	0.0	30	0	0	R2	W3	203.7	F	1	40	P	VR	G	0.4'	16.0	0	203.6	207.0	CL/Bx			>10 Fractures/ft: 205.7 - 208'
													204.3	F	1	38	P	R	G	1.4'	10.0	0	204.3	205.7	Bx			
	Breccia	38	208.0	213.0	5.0	N	1.8	5	9	0	R1	W3	209.6	J	1	35	U	VR	CL	2	16.0	13						
													210.2	J	1	35	P	S	CL	1	6.0	12						
													211.0	F	1	41	C	R	G	35	12.0	0	210.8	211.2	CL/Bx			
													211.5	J	2	36	P	S	CL	3	10.0	10						
	Breccia	39	213.0	218.0	4.0	N	1.2		0	0	R2	W2	215.6	F	1	33	U	R	G	0.9'	12.0	0	215.6	216.5	CL/Bx			
	Greenstone breccia	40	218.0	223.0	5.0	N	5.0	3	20	20	R3	W2	219.8	J	1	27	P	VR	CL	1	16.0	20						
													221.4	J	1	46	ST	R			10.0	20						
													222.7	J	1	27	P	VR	CL	<1	14.0	20						
	Greenstone breccia	41	223.0	228.0	5.0	n	5.0	3	17	15	R3	W2	223.5	J	1	27	P	R	CL	<1	8.0	15						
													224.1	J	1	46	ST	R	CL	<1	10.0	20						
													227.3	J	1	27	P	R	CL	<1	8.0	15						
	Greenstone breccia	42	228.0	231.0	3.0	N	0.4	1	0	0	R2	W3	228.4	F	1	6	U	R	G	2.2'	6.0	0	228.4	230.6	CL/Bx			Near vertical fault/joint
	Greenstone breccia	43	231.0	233.0	1.8	N	0.0	3	13	6	R2	W3	231.8	J	1	35	U	R	CL/Fe Ox	<1	10.0	20						
													232.5	J	1	12	P	R	CL/Bx	25	8.0	6						
													231.7	J	1	31	P	S	CL/Bx	1	6.0	14						
	Greenstone breccia	44	233.0	238.0	5.0	N	3.2	2	0	0	R2	W2	236.9	F	1	34	P	S	G	50	6.0	0	236.9	237.2	CL/Bx			
													237.5	F	1	15	U	S	G	100	6.0	0	237.5	238.0	CL/Bx			
	Greenstone breccia	45	238.0	243.0	5.0	N	2.5	22	12	12	R2	W3	239.5	J	2	22	P	S	CL	<1	6.0	12						>10 Fractures/ft: 238 - 239'; 242 - 243'
	Greenstone breccia	46	243.0	428.0	5.0	N	3.4	18	19	14	R2	W2	243.8	J	1	38	P	VR	CL/Fe Ox	<1	18.0	22						>10 Fractures/ft: 247.2 - 248'
													244.4	J	1	64	P	VR			14.0	20						
													244.9	J	1	53	P	S	CL	1	6.0	14						
	Greenstone breccia	47	428.0	250.5	2.5	N	0.0	35	15	15	R1	W3																>10 Fractures/ft entire run
	Greenstone breccia	48	250.5	253.0	2.5	N	1.9				R2	W2																Solid recovery with few mechanical fractures
	Greenstone breccia	49	253.0	258.0	5.0	N	4.5	2	15	12	R2	W2	256.5	V	2	25	P	R	Ca	2	12.0	17						
													257.2	J	1	45	P	S	CL	2	6.0	12						
	Greenstone breccia	50	258.0	263.0	5.0	N	3.7	2	19	18	R2	W2	259.2	J	1	31	U	R			12.0	20						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data											Rubble/Gouge					
																								Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													260.0	J	1	49	P	R			12.0	18						
	Greenstone breccia	51	263.0	268.0	5.0	N	4.0	2	8	0	R3	W2	263.3	J	1	45	P	R	CL	<1	14.0	16						
													265.0	J	1	38	P	S	CL	2	6.0	0						
	Greenstone breccia	52	268.0	273.0	5.0	N	3.6	5	11	10	R4	W2	269.5	J	4	54	P	R	Chl	1	10.0	12						
													271.8	J	1	51	P	R	Chl	1	6.0	10						
	Greenstone breccia	53	273.0	278.0	5.0	N	3.8	2	9	6	R4	W2	274.2	J	1	63	P	R	Chl	1	10.0	12						Calcite veins, mechanical fractures
													275.9	V	1	44	P	SM	Ca	5	4.0	6						
	Greenstone breccia and gouge	54	278.0	282.0	3.8	N	1.5	15	11	10	R4	W2	279.0	J	1	59	P	R			8.0	12						Cacite veins, >10 fractures/ft: 280.8 - 281.8'
													279.4	J	1	43	P	SM			4.0	10						
	Greenstone breccia and gouge	55	282.0	285.0	3.0	N	1.4	2	18	18	R4	W2	282.2	J	2	68	P	VR			14.0	18	284.7	285.0	CL/Chl			Ca veins, mechanical fractures
	Greenstone breccia and gouge	56	285.0	286.0	1.0	N	0.0		6	6	R3	W2														285.0	286.0	
	No Recovery	57	286.0	287.0	0.0																							
	Greenstone gouge	58	287.0	289.0	0.8	N	0.0		4	4	R3	W3											287.0	287.8	CL/Chl			
	Greenstone gouge and breccia	59	289.0	291.5	2.2	N	0.0	1	6	6	R3	W2	289.0	J	1	45	P	R	CL/Ch	3	8.0	6						Gouge and breccia mix
	Greenstone breccia	60	291.5	293.0	1.8	N	1.0	1	12	12	R4	W2	291.8	J	1	51	P	VR	Chl	1	10.0	12						
	Greenstone breccia/gouge	61	293.0	297.0	2.8	N	0.4	1	0	0	S2/R2	W4	294.5	F	1	35	P	S	G	1.7'	2.0	0	294.5	296.2	SC			
	Greenstone gouge	62	297.0	299.0	1.5	N	0.0		0	0	S4	W4											297.5	299.0	CL/Bx			
	No Recovery	63	299.0	299.5																								
	No Recovery	64	299.5	300.0																								
	Greenstone gouge/breccia	65	300.0	300.5	0.5	N	0.0		0	0	S3	W4											300.0	300.5	CL/Bx			Slickensides
	Greenstone gouge/breccia	66	300.5	301.5	1.0	N	0.0		0	0	S3	W4											300.5	301.5	Cl/Bx			
	Greenstone	67	301.5	303.0	0.7	N	0.0		16	16	R2	W2														302.3	303.0	Rubble/re-drill
	Greenstone gouge/breccia	68	303.0	306.0	1.8	N	0.0		0	0	S3	W4											304.2	306.0	CL/Bx			
	Greenstone gouge/breccia	69	306.0	309.0	2.0	N	0.0		0	0	S3	W4											307.0	309.0	CL/Bx			

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data											Rubble/Gouge					
																								Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greenstone breccia	70	309.0	312.0	3.0	N	0.0	20	18	18	R2/S3	W4	309.7	V	1	74	P	VR	Ca	1	14.0	18	310.7	312.0	CL/Bx			>10 Fractures/ft: 309 - 310.7'
	Greenstone breccia/gouge	71	312.0	313.5	1.5	N	0.0		0	0	S3	W4											312.0	313.5	CL/Bx			
	Greenstone breccia	72	313.5	318.5	5.0	N	1.2	30	12		R2/S2	W4	313.7	J	1	80	P	K	CL	1	4.0	6	316.3	317.3	CL/Bx			>10 Fractures/ft: 314.3 - 315.5'; 317.5 - 318.5
	Greenstone breccia/gouge	73	318.5	320.5	1.2	N	0.0		0	0	S2	W4											319.8	320.5	CL/Bx			
	Greenstone breccia	74	320.5	323.0	2.4	N	0.4	20	6	0	R2/S2	W3	321.3	F	1	23	U	K	G	0.8'	2.0	0	320.5	321.3	CL/Bx			
													322.2	J	1	50	U	VR	CL	2	14.0	12						
	Greenstone breccia	75	323.0	325.5	2.3	N	0.0	12	7	0	R2/S2	W3	323.9	J	1	40	P	R	CL	<1	10.0	14						>10 Fractures/ft: 323.2 - 323.5'
													324.3	F	1	63	P	K	G	0.9'	2.0	0	324.3	325.2	CL/Bx			
	Greenstone breccia	76	325.5	330.5	4.0	N	0.4	4			R2/S2	W3	326.9	F	1	49	P	K	G	0.8'	4.0	0	326.9	327.7	CL/Bx			
													328.0	V	1	35	P	R	Ca/CL	0.4'	10.0	16						
													328.6	J	1	37	P	R	CL	4	12.0	12						
													329.4	F	1	36	P	R	G	0.2'	12.0	0	329.4	329.6	CL/Bx			
	Greenstone breccia	77	330.5	333.0	1.7	N	0.0		0	0	R2/S2	W4											332.3	333.0	CL/Bx			
	Greenstone breccia	78	333.0	337.0	2.7	N	0.0		0	0	S3	W4											334.3	337.0	CL/Bx			
	Greenstone breccia	79	337.0	341.0	4.0	N	0.0		0	0	S6	W4											337.0	341.0	CL/Bx			Slickensides
	Greenstone breccia	80	341.0	343.0	1.6	N	0.0		0	0	S6	W4											341.4	343.0	CL/Bx			
	Greenstone breccia	81	343.0	345.5	2.1	N	0.0		0	0	S5	W4											343.4	345.5	CL/Bx			
	Greenstone breccia	82	345.5	346.5	1.0	N	0.0		0	0	S5	W4											345.5	346.5	CL/Bx			
	Greenstone breccia	83	346.5	349.0	2.5	N	0.0		0	0	S5/R2	W4	348.5	F	1	38	U	S	G	2'	6.0	0	346.5	348.5	CL/Bx			
	Greenstone/Greenstone gouge and Limestone gouge	84	349.0	352.0	1.5	N	0.0		0	0	R2/S5	W4	350.7	F	1	63	P	K	G	1.3'	6.0	0	350.7	352.0	CL/Bx			Limestone gouge @ 351.7'
	Limestone gouge	85	352.0	353.0	0.8	N	0.0		0	0	S4	W4											352.2	353.0	Gc			
	Limestone gouge	86	353.0	355.0	1.8	N	0.0		0	0	S4	W4	353.9	F	1	65	P	S	G	0.3'	6.0	0	353.6	353.9	Gc	353.2	353.6	Rubble/re-drill
	Metabasalt gouge	87	355.0	359.0	4.0	N	0.0		0	0	S6	W4	356	F	1	11	U	K	G	3'	2.0	0	355.0	355.7	CL/Bx			
																							356.0	359.0	CL/Bx			

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge					
																							Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt gouge	88	359.0	360.0	1.0	N	0.0		0	0	S4	W4											359.0	360.0	CL/Bx			
	Metabasalt gouge	89	360.0	361.5	1.2	N	0.0		0	0	S6	W4											360.6	361.5	CL/Bx			
	Metabasalt gouge	90	361.5	363.0	1.2	N	0.0		1	0	R2/S6	W3	362.1	F	1	55	P	K	G	0.2'	2.0	0	361.9	362.1	CL/Bx			
													362.5	F	1	50	P	K	G	0.2'	2.0	0	362.3	362.5	CL/Bx			
													362.7	J	1	65	P	S	CL	4	4.0	4						
	Metabasalt	91	363.0	365.0	2.6	N	0.0	30	18	18	R3	W2	363.3	J	1	44	U	R	CL	<1	10.0	18				363.0	363.3	>10 Fractures/ft; healed fractures, calcite veins
	Metabasalt	92	365.0	369.0	3.7	N	0.4	100	15	15	R3	W3																>10 Fractures/ft; healed fractures, calcite veins
	Metabasalt	93	369.0	373.0	4.0	N	0.5	25	20	20	R3	W3	372.9	V	1	22	C	R	Ca	<1	6.0	20						>10 Fractuers/ft: 369 - 371.1'
	Metabasalt	94	373.0	377.0	4.0	N	0.0	30	20	20	R3	W2	373.4	J	2	47	C	SM			10.0	20						>10 Fractures/ft: 374.5 - 377'
	Metabasalt	95	377.0	379.0	2.0	N	0.0	30			R2	W3											378.4	379.0	CL/Bx	377.0	377.2	>10 Fractures/ft enitre run
	Metabasalt	96	379.0	381.0	1.5	N	0.0	20			R2	W3											379.6	380.3	CL/Bx			>10 Fractures/ft: 380.3 - 381'
	Metabasalt	97	381.0	383.0	2.0	N	0.0	20	15	0	R2	W3											381.3	381.8	CL/Bx	381.0	381.3	
	Metabasalt	98	383.0	388.0	5.0	N	0.0		0	0	S6/R2	W4	384.6	F	1	58	C	K	G	3.4	2.0	0	383.0	383.5	CL/Bx			
																							384.6	388.0	CL/Bx			
	Greenstone gouge	99	388.0	391.5	3.0	N	0.0		0	0	S5	W4											388.5	391.5	CL/Bx			
	Greenstone gouge	100	391.5	394.0	2.5	N	0.0		0	0	S5	W4											391.5	394.0	CL/Bx			
	Greenstone gouge	101	394.0	398.0	4.0	N	0.0		0	0	S5/R1	W4											394.0	398.0	CL/Bx			Large clasts, calcite veins, greenstone
	Greenstone gouge	102	398.0	399.0	1.0	N	0.0		0	0	S6/R2	W4											398.0	399.0	CL/Bx			
	Greenstone gouge	103	399.0	403.0	2.7	N	0.0		0	0	S5	W4											400.3	403.0	CL/Bx			
	Greenstone gouge	104	403.0	407.0	0.3	N	0.0		0	0	S5	W4											406.7	407.0	CL/Bx			
	No Recovery	105	407.0	409.5	0.0																							
	No Recovery	106	409.5	410.5	0.0																							
	Limestone/gouge	107	410.8	413.0	1.4	N	0.0	3	11	0	R3/S5	W2/W3	411.7	J	2	31	ST	VR			16.0	22						Medium grade
													412.5	F	1	54	P	S	G	0.3'	4.0	0	412.5	412.8	CL/Bx			
	Limestone/gouge	108	413.0	415.5	2.5	N	0.0	35	0	0	R2/S5	W2/W4	413.9	F	1	40	P	S	G	0.6'	4.0	0	413.9	414.5	CL/Bx			Medium to low grade, stylolites, dolomitic
																												>10 Fractures/ft: 413 - 413.9'; 414.5 - 415.1'
	Limestone/gouge	109	415.5	419.0	2.8	N	0.0	2	0	0	R2/S5	W2/W4	416.2	F	1	48	U	R	G	0.2'	8.0	0	416.0	416.2	CL/Bx			Dolomitic, low grade
													416.8	F	1	66	P	S	G	2.2'	2.0	0	416.8	419.0	CL/Bx			

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data											Rubble/Gouge					
																								Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone/gouge	110	419.0	422.5	3.4	N	0.0	1	0	0	S4	W4	420.6	F	1	43	P	K	G	3.4'	0.0	0	419.1	422.5	SC/Bx			
	Limestone/gouge	111	422.5	427.0	4.4	N	0.0	16	0	0	S6/R2	W4	425.8	F	1	45	P	S	G	3.2	0.0	0	422.6	425.8	SC/Bx			>10 Fractures/ft: 425.8 - 427'
	Limestone/gouge	112	427.0	432.0	4.7	N	0.0		0	0	R1	W4											425.3	427.0	CL/Bx			
	Limestone/gouge	113	432.0	432.5	0.5	N	0.0		0	0	R0	W4											432.0	432.5	CL/Bx			
	Limestone/gouge	114	432.5	435.5	3.0	N	0.0	30	6	0	S5/R1	W3/W4											432.5	433.2	CL/Bx			
	Limestone/gouge	115	435.5	436.0	0.2	N	0.0		0	0	S5	W4											435.8	436.0	CL/Bx			
	Brecciated Limestone	116	436.0	441.0	4.8	N	0.0	15	6	0	S5/R2	W4											436.2	441.0	SC/Bx			
	Brecciated Limestone	117	441.0	443.0	2.0	N	0.0	100	6	0	R1	W3																>10 Fractures/ft. entire run
	Brecciated Limestone	118	443.0	446.5	3.3	N	0.0	1	0	0	S5/R2	W4	444.0	F	1	57	U	K	G	3.5'	12.0	0	444.0	446.5	SC/Bx			>10 Fractures/ft: 443.3 - 444'
	Brecciated Limestone	119	446.5	450.0	3.0	N	0.0		0	0	S5	W4											447.0	450.0	SC/Bx			
	Brecciated Limestone	120	450.0	453.0	2.9	N	0.0	1	0	0	R2/R1	W4	452.6	F	1	23	P	K	G	2.2'	6.0	0	450.1	452.6	CL/Bx			
	Limestone breccia	121	453.0	458.0	5.0	N	0.0	65	12	12	R1	W3	453.8	J	3	64	P	VR	Ca/Bx	10	14.0	12						>10 Fractures/ft: 454.4 - 458', slicksides on some surfaces
	Limestone breccia	122	458.0	460.5	2.6	N	0.0	45	6	6	R1	W4																>10 Fractures/ft entire run
	Limestone breccia	123	460.5	465.5	5.0	N	0.0	3	12	6	R1	W4	462.0	J	1	54	P	VR			16.0	18	460.6	461.8	Bx			
													463.1	J	1	50	P	VR	Bx	20	16.0	6						
													464.2	J	1	44	U	R	CL	<1	20.0	12						
	Limestone breccia	124	465.5	469.0	3.5	N	2.0	4	12	6	R2	W3	465.6	J	1	70	P	VR			14.0	18						
													466.0	J	1	49	IR	R	Bx	0.9'	10.0	6						
													466.9	J	1	65	IR	VR	Bx	10	14.0	6						
													467.9	J	1	75	ST	R	Ca	<1	10.0	18						
	Limestone	125	469.0	473.0	4.0	N	0.0	7	12	6	R2	W2	469.5	J	1	51	P	S			6.0	12						>10 Fractures/ft: 471.9 - 473'
													469.8	J	1	30	P	R	CL	<1	10.0	12						
													470.0	J	1	45	IR	R	CL	2	10.0	6						
													470.9	J	2	40	P	R	CL	<1	12.0	12						
													471.5	J	1	70	P	S			6.0	12						
													471.6	J	1	46	ST	VR			16.0	18						
	Limestone	126	473.0	478.0	5.0	N	1.9	5	15	6	R2	W2	474.1	J	1	75	IR	R			12.0	18						
													474.6	J	1	27	P	R	CL	2	8.0	6						
													475.2	J	1	42	P	R			8.0	17						
													475.8	J	1	33	P	R	Ca	<1	8.0	16						
													476.4	V	1	25	P	VR	Ca	<1	14.0	18						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	127	478.0	479.0	1.0	N	0.0	1	0	0	R2	W2	478.6	F	1	43	P	K	CL	3	2.0	0				478.0	478.5	
	Limestone	128	479.0	485.0	4.0	N	0.6	3	12	0	R2	W2	479.2	J	1	60	P	R	Bx	1	12.0	17						
													479.7	J	1	59	C	R	CL	<1	12.0	19						
													482.0	F	1	58	P	VR	Bx	0.5'	16.0	0						
	Limestone	129	485.0	489.0	5.0	N	0.0	17	18	12	R2	W2	485.6	J	2	54	P	VR	Bx	50	16.0	12						
													486.1	V	1	50	P	R	Ca	<1	12.0	18						
													486.8	J	1	25	U	VR			16.0	20						
													487.7	J	1	65	P	R			122.0	18						
													488.1	J	1	28	U	R			14.0	20						
	Limestone	130	489.0	493.0	4.0	N	1.5	8	18	16	R2	W2	489.9	J	2	38	P	VR	Bx	1	16.0	16						
													490.5	J	1	13	P	R			12.0	18						
													491.2	J	1	45	P	VR	Ca	1	16.0	20						
													491.5	J	1	62	P	R			12.0	18						
													492.7	J	1	46	IR	VR			16.0	20						
	Limestone	131	493.0	495.0	1.6	N	0.5	5	22	22	R2	W2	494.3	J	5	65	P	VR			18.0	22						
	Limestone	132	495.0	498.0	3.6	N	0.4	22	20	20	R2	W2	495.7	J	1	47	P	VR	CL	<1	19.0	20						>10 Fractures/ft: 496.6 - 498'
													495.8	J	1	38	P	VR	CL	<1	19.0	20						
	Limestone	133	498.0	500.5	2.2	N	0.6	22	20	20	R2	W2	498.8	J	2	48	P	VR			18.0	20						>10 Fractures/ft: 499.1 -500.5', sample: 499.2 - 499.8'
	Limestone	134	500.5	501.0	0.5	N	0.0				R2	W2																
	Limestone	135	501.0	503.0	2.4	N	0.7	13	15	12	R2	W2	501.3	J	1	50	P	R			10.0	17						>10 Fractures/ft: 502.5 - 503'
													501.8	J	1	65	P	VR	CL/Bx	3	16.0	12						
													502.5	J	1	53	P	R			10.0	17						
	Limestone	136	503.0	505.5	2.5	N	0.0	23	10	0	R2	W2	504.5	J	1	35	P	R			10.0	17	501.5	505.5	CL/Bx			>10 Fractures/ft: 503 - 505.1'
													504.8	J	1	53	P	S	CL	1	6.0	12						
													505.1	F	1	20	P	S	CL/Bx	0.4'	2.0	0						
	Chert/gouge	137	505.5	507.5	1.9	N	0.0		0	0	R4/S4	W4											505.6	507.5	SC/Bx			
	Limestone	138	507.5	511.0	3.0	N	0.0	2	6	0	S4/R4	W3	508.5	F	1	27	P	S	G	2'	2.0	0	508.0	809.5	CL/Bx			
													510.3	J	1	64	P	R	CL	3	14.0	12						
	Limestone/chert	139	511.0	512.0	1.0	N	1.0	1	16	16	R4	W1	511.9	J	1	60	P	R	CL	<1	12.0	18						Sample: 512 - 512.5'
	Chert	140	512.0	517.0	5.0	N	1.1	31	0	0	S4/R4	W4/W1	515.9	F	1	37	P	S	G	1.1'	4.0	0	515.9	517.0	CL/Bx			>10 Fractures/ft: 512.7 - 514.5'
	Greenstone/Metabasalt to Limestone	141	517.0	520.0	2.6	N	0.0	21	0	0	S4/R3	W4	519.4	F	1	3	C	S	G	2.6	2.0	0	517.4	520.0	SC/Bx			Near vertical fault, greenstone/limestone contact
	Limestone/chert gouge	142	520.0	522.0	2.0	N	0.0		0	0	S4/R4	W4											520.0	522.0	SC/Bx			
	Limestone/chert gouge	143	522.0	526.0	3.6	N	0.0		0	0	S4/R4	W4											522.0	526.0	SC/Bx			
	Limestone/chert	144	526.0	530.0	4.0	N	0.0	3	13	0	R4	W3	526.5	F	1	44	U	R	G	0.5'	6.0	0	526.0	526.5	Bx			Mechanical fractures
													527.9	J	1	38	ST	R			16.0	20						
													529.2	J	1	65	P	R			14.0	18						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge						
																							Gouge			Broken Core			
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone	145	530.0	533.0	3.0	N	0.0	20	21	20	R4	W2	530.4	J	1	58	U	R	Ca	2	14.0	20						>10 Fractures/ft: 536.1 - 533', low grade
													530.9	J	2	59	P	VR	Ca	2	16.0	22						
	Limestone/chert breccia	146	533.0	535.5	2.5	N	0.0	20	6	6	R3	W2																>10 Fractures/ft entire run
	Limestone/chert breccia	147	535.5	538.0	2.5	N	0.0	25	4	4	R3	W3																>10 Fractures/ft entire run
	Limestone/chert breccia	148	538.0	541.5	3.5	N	0.0	40	4	4	R3	W3																>10 Fractures/ft entire run
	Limestone	149	541.5	543.0	1.5	N	0.0	2	17	16	R3	W3	542.3	J	1	57	U	R			16.0	18	541.5	541.9	CL/Bx			Low grade
													540.7	J	1	49	P	R			14.0	16						
	Limestone/chert	150	543.0	548.0	5.0	N	0.0	50	8	8	R3	W2																>10 Fractures/ft entire run, some mechanical fractures
	Limestone/chert	151	548.0	553.0	4.8	N	0.0	50	4	4	R3	W3																Low grade, >10 fractures/ft entire run
	Limestone	152	553.0	556.0	3.0	N	0.0	40	4	4	R3	W4																>10 Fractures/ft entire run, gouge intermixed
	Limestone/chert	153	556.0	561.0	5.0	N	0.0	50	4	4	R3	W3																> 10 Fractures/ft entire run
	Limestone/chert gouge	154	561.0	563.5	2.5	N	0.0		0	0	S4	W3											561.0	563.5	Bx/Ca			
	Limestone/chert gouge and breccia	155	563.5	571.5	3.5	N	0.0	15	0	0	S4/R3	W3	564.9	F	1	51	P	K	G	1.4'	2.0	0	563.5	564.9	Bx/Ca			> 10 Fractures/ft: 565.5 - 566.3'
																							566.3	571.5	Bx/Ca			
	Limestone/chert gouge and breccia	156	571.5	575.5	4.0	N	0.0	40	4	4	R3	W3																> 10 Fractures/ft entire run
	Limestone/chert gouge and breccia	157	575.5	579.5	4.0	N	0.5	40	16	16	R3	W3	576.4	J	2	64	U	R			14.0	16						>10 Fractures/ft: 577.1 - 579.5'
	Limestone/chert gouge and breccia	158	579.5	583.0	3.5	N	1.8	1	0	0	R3	W3	580.2	F	1	58	ST	R	Bx/Ca	2.3	18.0	0	580.7	583.0	Bx/Ca			Mechanical fractures
	Limestone/chert gouge and breccia	159	583.0	586.5	2.5	N	0.0	20	2	2	R3	W3																> 10 Fractures/ft entire run, low grade
	Limestone/chert gouge and breccia	160	586.5	590.0	3.5	N	0.0	40	0	0	R3	W3																
	Limestone/chert gouge and breccia	161	590.0	593.0	3.0	N	0.0	30	2	2	R3	W3																Large calcite vein
	Metabasalt gouge	162	593.0	598.0	5.0	N	0.0		0	0	S4	W3											593.0	598.0	Chl/Bx			
	Limestone	163	598.0	602.5	4.5	N	0.6	40	4	4	R3	W2																Metabasalt to ~598.4', >10 fractures/ft: 599.6 - 602.5'

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Rubble/Gouge					
																							Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone breccia	164	602.5	607.5	5.0	N	1.6	3	8	0	R3	W3	603.2	F	1	68	P	K	G	0.7'	6.0	0	602.5	603.2	Ca/Bx			
													605.1	J	1	54	P	R	Ca	4	8.0	10						
													607.2	J	1	64	U	R	Ca	1	12.0	16						
	Limestone breccia w/some chert	165	607.5	612.5	5.0	N	0.9	15	23	22	R3	W3	608.7	J	1	23	ST	R	Ca	1	20.0	24						Some mechanical fractures, > 10 fractures/ft: 609.2 - 612.1'
													612.1	J	1	53	P	R	Ca	1	9.0	22						
	Limestone breccia w/some chert	166	612.5	613.5	0.6	N	0.0	0	4	4	R3	W3														612.5	613.5	
	Limestone/chert breccia	167	613.5	615.0	0.8	N	0.0	0	4	4	R3	W3														613.5	615.0	
	Limestone gouge	168	615.0	618.0	3.0	N	0.0	0	0	0	R2	W3											615.0	618.0	CL/Bx			
	Limestone breccia w/ gouge	169	618.0	622.0	3.7	N	0.0	0	4	4	R2/R3	W3											618.9	621.0	CL/Bx			Little metabasalt, mechanical fractures
	Metabasalt gouge	170	622.0	627.0	4.5	N	0.0	0	0	0	R2	W3											622.0	627.0	CL/Chl			
	Metabasalt gouge	171	627.0	631.5	4.5	N	0.0	0	0	0	R2	W3											627.0	631.5	CL/Chl			
	Metabasalt gouge	172	631.5	635.0	3.3	N	0.0	0	0	0	R2	W3											631.5	635.0	CL/Chl			
	Metabasalt gouge w/trace limestone	173	635.0	640.0	5.0	N	1.0	3	0	0	R2/R3	W3	636.0	F	3	44	P	K	CL/Ch	0.3'	4.0	0	636.0	640.0	CL/Chl			
	Metabasalt	174	640.0	643.0	3.0	N	0.0	3	8	4	R3	W2	641.1	J	1	69	P	R	Chl	2	6.0	15						
													642.0	J	1	26	P	R	Chl	5	6.0	6						
													642.3	J	1	39	P	K	CL/Ch	3	4.0	4						
	Metabasalt	175	643.0	647.5	4.5	N	0.0	50	8	8	R3	W2																>10 Fractures/ft entire run
	Metabasalt gouge	176	647.5	649.5	2.0	N	0.0		0	0	S4	W3											647.5	649.5	Chl/Bx			
	Metabasalt gouge	177	649.5	652.0	1.8	N	0.0		0	0	S4	W3											649.5	652.0	Chl/Bx			
	Metabasalt/greenstone gouge	178	652.0	656.0	4.0	N	0.0		0	0	S4	W3											652.0	656.0	Chl			
	Metabasalt	178	656.0	661.0	5.0	N	0.0	1	0	0	S4/R3	W3	657.4	F	1	61	P	K	Chl	1.4'	6.0	0	656.0	657.4	Chl			Mechanical fractures
	Metabasalt	179	661.0	665.0	4.0	N	0.0		0	0	S4	W3											661.0	665.0	Chl			Mechanical fractures
	Metabasalt gouge	180	665.0	668.0	3.0	N	0.0		0	0	S4	W3											665.0	668.0	Chl			
	Metabasalt gouge	181	668.0	673.0	5.0	N	0.0	1	0	0	S4	W3	670.5	J	1	48	P	K	Chl	2.5'	4.0	0	668.0	673.0	Chl			

			Run Data																				Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Metabasalt gouge	182	673.0	678.0	4.8	N	0.0		0	0	S4	W3											673.0	678.0	Chl			
	Metabasalt gouge	183	678.0	681.0	3.0	N	0.0		0	0	S4	W3											678.0	681.0	Chl			
	Metabasalt gouge	184	681.0	686.0	4.3	N	0.0		0	0	S4	W3											681.0	686.0	Chl			
	Metabasalt gouge	185	686.0	691.0	5.0	N	0.0		0	0	S4	W3											686.0	691.0	Chl			
	Metabasalt gouge	186	691.0	694.0	3.0	N	0.0		0	0	S4	W3											691.0	694.0	Chl			
	Metabasalt gouge	187	694.0	697.5	3.5	N	0.0		0	0	S4	W3											694.0	697.5	Chl			
	Metabasalt/greenstone breccia and gouge	188	697.5	701.5	4.0	N	0.0		0	0	S4	W3											697.5	701.5	Chl/Bx			
	Metabasalt/greenstone breccia and gouge	189	701.5	705.0	3.3	N	0.0		0	0	S4	W3											701.5	705.0	Chl/Bx			
	Metabasalt/greenstone breccia and gouge	190	705.0	710.0	5.0	N	0.0		0	0	S4	W3											705.0	710.0	Chl/Bx			
	Metabasalt/greenstone breccia and gouge	191	710.0	713.0	3.0	N	0.0		0	0	S4	W3											710.0	713.0	Chl/Bx			

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Sandstone/ Greywacke	1	30.0	33.0	2.7	N	2.3	1	22	22	R2	W3	30.5	J	1	82	P	VR	FeOx	<1	16.0	22						
	Brecciated greywacke	2	33.0	38.0	5.0	N	2.5	3	19	18	R1	W4	35.2	J	1	68	P	R	FeOx	<1	8.0	18						
													36.5	J	1	33	IR	R	FeOx	<1	8.0	20						
													37.5	J	1	49	U	R	FeOx	<1	10.0	20						
	Brecciated greywacke	3	38.0	43.0	4.6	N	3.3	4	18	16	R1	W4	39.3	J	1	50	P	VR	FeOx	<1	14.0	20						
													41.2	J	1	56	P	R	FeOx	<1	12.0	20						
													42.5	J	2	60	P	VR	FeOx/CL	2	14.0	16						
	Brecciated greywacke	4	43.0	48.0	3.6	N	1.0	13	8	0	R1	W4	44.9	J	1	60	P	VR	FeOx/CL	2	14.0	16						>10 fractures/ft.: 47-48'
													45.7	J	2	32	ST	SM	FeOx/CL	5	21.0	0						
	Brecciated greywacke	5	48.0	51.0	3.0	N	0.5	4	13	0	R1	W3	48.4	J	1	60	IR	R	FeOx	<1	10.0	18						
													48.9	J	1	63	P	R	FeOx	<1	10.0	18						
													49.5	J	1	75	P	R	FeOx	<1	10.0	18						
													49.9	F	1	35	P	R	G	1.1'	6.0	0	49.5	51.0	Bx			
	Brecciated greywacke	6	51.0	53.0	2.0	N	0.0	100	12	12	R1	W4																>10 fractures/ft entire run
	Greywacke	7	53.0	56.5	3.5	N	0.7	5	0	15	R2	W3	53.9	J	1	38	C	R	FeOx	<1	10.0	18						
													54.3	J	1	55	IR	R	CL/Bx	5	12.0	20						
													54.9	J	1	23	U	R	FeOx/Bx	2	8.0	18						
													55.3	J	1	35	P	R	FeOx	<1	10.0	18						
													55.5	F	1	25	P	SM	G	1'	6.0	0	55.5	56.5	Bx/CL			
	Greywacke breccia	8	56.5	58.5	2.0	N	0.0	100	12	12	R1	W4																>10 fractures/ft entire run
	Greywacke	9	58.5	60.5	1.3	N	0.4	3	3	0	R2	W3	59.2	F	1	46	P	SM	G	30			59.1	59.2	Sc			>10 fractures/ft entire run
													59.5	J	1	35	P	SM	CL/FeOx	1								
													59.9	J	1	65	P	SM	Bx	20								
	Greywacke breccia	10	60.5	63.0	2.5	N	0.0	70	12	12	R2	W3																>10 fractures/ft entire run
	Greywacke breccia	11	63.0	64.5	1.5	N	0.0	50	12	12	R2	W4																>10 fractures/ft entire run
	Greywacke breccia/gouge	12	64.5	66.0	1.5	N	0.0	70	1	1	R1	W4											64.5	66.0	Bx/CL			
	Greywacke	13	66.0	68.0	0.5	N	0.0	1	8	0	R2	W3	67.3	F	1	62	P	P			0.0	0						
													67.7	J	1	36	P	VR	FeOx	<1	14.0	16						
	Greywacke breccia	14	68.0	69.0	1.0	N	0.0	50	0	0	R1	W4	68.5	F	1	51	U	P	G	0.5	0.0	0	68.5	69.0	Bx/CL	68.0	68.5	

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data											Rubble/Gouge					
																								Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greywacke gouge	15	69.0	70.0	0.6	N	0.0		6	6	S6	W4											69.4	70.0	Bx/CL			
	Greywacke gouge	16	70.0	72.0	2.0	N	0.0	1	0	0	R2/S4	W4	70.7	F	1	43	P	SM	G	1.8'	2.0	0	70.0	70.6	Bx/CL			Slickensides on some clasts
																							70.8	72.0	Bx			
	Greywacke breccia	17	72.0	73.0	0.4	N	0.4	0			R1	W3																
	Greenstone/ greenstone gouge	18	73.0	74.5	1.5	N	1.2	1	0	0	R2	W3	73.7	F	1	50	P	K	G	0.7'	1.0	0	73.0	73.7	SC			Slickensides
	Greenstone	19	74.5	75.0	0.5	N	0.0	1	2	2	R1	W4	74.4	J	1	67	U	P	Chl/Bx	<1	1.0	2						
	Greenstone	20	75.0	77.5	2.0	N	0.0	3	0	0	R1	W4	75.6	J	1	51	IR	P	Chl/Bx	10	2.0	0						
													76.1	J	1	68	P	P	Chl/Bx	50	2.0	0						
													76.5	F	1	63	P	K	Chl/Bx	1'	0.0	0	76.5	77.5	Bx/Chl			
	Greenstone	21	77.5	78.5	0.3	N	0.0	0			R1	W2																
	Greenstone	22	78.5	80.0	1.5	N	0.0	50	6	0	R1	W4											78.5	79.0	Chl/Bx			>10 fractures/ft: 79-80'; slickensides
	Greenstone	23	80.0	82.0	1.5	N	0.5	1	0	0	R1	W4	81	F	1	60	P	K	G	1'	4.0	0	81.0	82.0	Chl/Bx			
	Greenstone	24	82.0	84.0	2.0	N	0.0	3	0	0	R1/S5	W4	82.5	J	1	52	P	P	G	0.5'	0.0	0	82.0	82.5	Chl/Bx			
													82.8	F	1	52	P	P	G	0.9'	0.0	0	82.8	83.7	Chl/Bx			
													83.8	J	1	78	P	P	Chl/Bx	<1	0.0	0						
	Greenstone breccia	25	84.0	88.0	2.5	N	0.6	4	8	0	R2	W3	85.7	J	1	77	P	SM	Chl/Bx	<1	4.0	6						
													86	J	1	79	P	SM	Chl/Bx	1	4.0	6						
													87	F	1	67	P	SM	G	0.7'	2.0	0	86.3	87.0	Chl/Bx			
													87.3	J	1	64	P	VR	Chl/Bx	<1	16.0	18						
	Greenstone breccia	26	88.0	89.5	2.0	N	0.0	35	3	3	R1	W4	88	J	4	53	P	P	Chl/Bx/SC	3	4.0	3						Slickensides/ >10 fractures/ft: 88.7-89.5'
	Greenstone breccia/gouge	27	89.5	91.0	1.5	N	0.0		6	6	R2	W4											90.5	91.0	G/Bx			
	Greenstone breccia	28	91.0	93.0	2.0	N	0.0	1	10	10	R2	W4	91.9	J	1	52	U	R	Chl/Bx	2	8.0	10	92.3	93.0	G/Bx			
	Greenstone gouge and breccia	29	93.0	95.0	2.0	N	0.0	2	8	8	R2	W4	93.3	J	1	57	U	R	Chl/Bx	3	14.0	8	94.5	95.0	G/Bx			
													94.1	J	1	62	U	R	Chl/Bx	3	14.0	8						
	Greenstone gouge	30	95.0	97.0	1.7	N	0.0	2	0	0	S4	W4	95.7	F	2	48	P	K	Chl/Bx	10	6.0	0	95.0	97.0	G/Bx			
	Greenstone breccia/gouge	31	97.0	99.0	1.4	N	0.0		0	0	S4	W4											97.0	99.0	G/Bx			

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greenstone gouge	32	99.0	101.0	2.0	N	0.0		0	0	S4	W4											99.0	101.0	G/Bx			
	Greenstone gouge	33	101.0	103.0	2.0	N	0.0		0	0	S4	W4											101.0	103.0	G/Bx			
	Greenstone gouge	34	103.0	106.0	3.0	N	0.0		0	0	S4	W4											103.0	106.0	G/Bx			Slickesides
	Greenstone gouge/breccia	35	106.0	109.0	3.0	N	0.0	2	2	2	S4/R2	W4	106.9	J	2	35	P	K	Chl/Bx	5	6.0	2	107.7	109.0	G/Bx			
	Greenstone gouge/breccia	36	109.0	111.5	2.5	N	0.0	2	1	0	S4/R2	W4	110.2	F	1	66	P	K	Chl/Bx/Bx	1.3'	4.0	0	109.0	110.2	G/Bx			
													111.1	F	1	71	P	K	Chl/Bx/Bx	0.4'	10.0	2	111.1	111.5	G/Bx			
	Greenstone/ Metabasalt	37	111.5	116.0	4.5	N	1.4	5	7	2	R2	W3	112.1	J	1	33	P	K	Chl/Bx/CL	4	6.0	2						
													113.1	J	3	61	P	K			6.0	8						
													115.2	F	1	70	P	K	Chl/Bx/Bx	0.7'	14.0	10						
	Greenstone breccia/gouge	38	116.0	119.5	3.5	N	0.0	2	6	0	R2	W3	119.9	F	1	65	P	K	Chl/Bx	0.4'	4.0	0	118.0	119.5	G/Bx			
													120.9	J	1	53	U	R	Chl/Bx	2	10.0	12						
	Greenstone gouge	39	119.5	121.5	2.0	N	0.0	0	0	0	S4	W4	120	F	1	72	P	K	Chl/Bx	1.5'	6.0	0	120.0	121.5	G/Chl			
	Greenstone gouge	40	121.5	123.0	1.5	N	0.0	0	0	0	S4	W4											121.5	123.0	G/Bx			
	No Recovery	41	123.0	123.5	0.0																							
	Greenstone gouge	42	123.5	126.0	2.1	N	0.0	0	0	0	S4	W4											123.5	126.0	G/Bx			
	Greenstone gouge	43	126.0	128.0	1.5	N	0.0	0	0	0	S4	W4											126.0	128.0	G/Bx			
	Greenstone	44	128.0	129.5	1.5	N	0.7	2	10	0	R2	W3	128.8	J	1	51	U	R			16.0	20						
													129.3	F	1	58	P	K	G	0.3'	4.0	0						
	Greenstone gouge/breccia	45	129.5	132.0	2.5	N	0.0	0	0.0	0.0	S4	W4											129.5	132.0	Bx/Chl			Mechanical fractures
	Greenstone gouge/breccia	46	132.0	134.0	1.7	N	0.0	0	0.0	0.0	S4	W4											132.0	134.0	Bx/Chl			
	Greenstone gouge/breccia	47	134.0	136.5	2.5	N	0.0	1	22	22	S4/R2	W4	136	J	1	60	U	R			18.0	22	134.0	135.3	Bx/Chl			
	Greenstone gouge/breccia	48	136.5	138.5	2.0	N	0.0	0	0.0	0.0	S4	W4											138.2	138.5	Bx/Chl			

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data											Rubble/Gouge					
																								Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greenstone gouge/breccia	49	138.5	140.0	1.5	N	0.0	0	0.0	0.0	S4	W4											138.5	140.0	Bx/Chl			
	Greenstone gouge/breccia	50	140.0	142.0	1.8	N	0.0	0	0.0	0.0	S4	W4											140.0	142.0	Bx/Chl			
	Greenstone breccia	51	142.0	149.5	2.2	N	0.0	15	0.0	0.0	R2	W3	142.4	F	1	65	U	R	G	10	14.0	0	142.0	142.4				
	Greenstone breccia	52	144.5	146.5	2.0	N	0.0	3	0.0	0.0	R2	W3	145.4	F	2	70	P	R	G	20	8.0	0				144.5	144.9	
													146.2	J	1	58	P	R	Chl/Bx	5	10.0	0						
	Greenstone breccia	53	146.5	149.0	2.3	N	0.0	2	5.0	0.0	R2	W3	147.1	J	1	69	U	R	Chl/Bx	2	14.0	10	147.5	148.1	Bx/Chl	146.5	146.8	
													148.1	J	1	71	P	VR	G	20	6.0	0						
	Greenstone breccia	54	149.0	150.5	1.5	N	0.0	1	0.0	0.0	R2	W4	149.8	J	1	65	P	R	G	15	4.0	0	149.4	149.8	Bx/Chl			
																							149.9	150.5	Bx/Chl			
	Greenstone breccia	55	150.5	153.0	2.5	N	0.0	3	13.0	4.0	R2	W3	151.1	J	1	68	P	VR			14.0	18				150.5	150.9	
													152.2	J	1	31	U	R	G	5	16.0	4						
													152.8	J	1	57	U	R	Chl/Bx	3	14.0	16						
	Greenstone breccia	56	153.0	155.0	1.6	N	0.0	1	12.0	12.0	R0	W3	153.2	J	1	73	U	R	Chl/Bx	2	12.0	12	153.4	155.0	Bx/Chl			
	Greenstone breccia	57	155.0	157.5	2.3	N	0.0	0	0.0	0.0	S4	W4											155.0	157.5	Bx/Chl			
	Greenstone breccia	58	157.5	160.0	2.1	N	0.0	0	0.0	0.0	S4	W4											157.5	158.0	Bx/Chl			
																							158.4	160.0	Bx/Chl			
	Greenstone breccia	59	160.0	162.0	2.0	N	0.0	0	0.0	0.0	S4	W4											160.0	162.0	Bx/Chl			
	Greenstone breccia	60	162.0	166.0	4.0	N	0.4	6	16.0	16.0	R2	W3	162.2	J	4	64	P	R	Chl/Bx	2	8.0	16						
													163.4	J	2	64	P	R	Chl/Bx	2	8.0	16						
	Greenstone breccia	61	166.0	169.5	2.4	N	0.9	3	4.0	4.0	R2	W3	166.4	J	2	57	P	R	G	5	6.0	4						
													167.5	J	1	49	P	R	G	5	6.0	4						
	Greenstone breccia	62	169.5	173.0	3.5	N	3.1	3	20.0	18.0	R3	W2	170.5	J	1	64	P	R	Chl/Bx	1	8.0	18						
													171.2	J	1	48	P	R			8.0	20						
													1971.9	J	1	50	P	VR			16.0	22						
	Greenstone breccia	63	173.0	178.0	2.7	N	2.3	1	18.0	18.0	R3	W2	2.3	J	1	56	P	R	Chl/Bx	1	10.0	18						
	Greenstone breccia	64	178.0	181.5	3.1	N	0.0	0	0.0	0.0	S4	W4											178.0	181.5	Bx/Chl			

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greenstone breccia	65	181.5	184.5	2.8	N	0.0	0	0.0	0.0	S4	W4											181.5	184.5	Bx/Chl			
	Greenstone breccia	66	184.5	188.5	4.0	N	0.0	4	5.0	0.0	R0	W4	185.4	F	1	53	U	R	G	20	14.0	0	184.5	185.4	Bx/Chl			
													185.9	J	2	34	P	R			12.0	16	187.1	188.5				
													187.1	F	1	34	P	R	G	40	6.0	0						
	Greenstone breccia	67	188.5	193.0	3.9	N	0.0	0	0.0	0.0	S4	W4											188.5	193.0	Bx/Chl			
	Greenstone breccia	68	193.0	196.5	2.8	N	0.0	2.5	0.0	0.0	R0	W3											195.2	195.7	Bx/Chl			
	Greenstone breccia	69	196.5	198.5	1.2	N	0.0		0.0	0.0	R2	W3														196.5	198.5	
	Greenstone breccia	70	198.5	199.5	1.0	N	0.0		10.0	10.0	R2	W3														198.5	199.5	
	Greenstone breccia	71	199.5	200.5	1.0	N	0.0	10	10.0	10.0	R2	W3																
	Greenstone breccia	72	200.5	202.0	1.5	N	0.0		4.0	4.0	R2	W3														200.5	202.0	
	Metabasalt breccia	73	202.0	206.5	2.7	N	0.0	20	0.0	0.0	R0	W4											204.0	206.5	Bx/Chl			
	Metabasalt gouge	74	2006.5	208.0	0.5	N	0.0		0.0	0.0	S4	W4											206.5	208.0	Bx/Chl			
	Metabasalt gouge	75	208.0	209.0	0.5	N	0.0		0.0	0.0	S4	W4											208.0	209.0	Bx/Chl			
	No Recovery	76	209.0	209.5	0.0																							
	Greenstone Gouge	77	209.5	211.0	1.5	N	0.0		0.0	0.0	S4	W4											209.5	211.0	Bx/Chl			
	Greenstone Gouge	78	211.0	213.0	1.5	N	0.0		0.0	0.0	S4	W4											211.0	213.0	Bx/Chl			
	Greenstone Breccia	79	213.0	214.0	1.0	N	0.0		0.0	0.0	S4	W4											213.0	214.0	Bx/Chl			
	Greenstone Breccia	80	214.0	215.0	1.0	n	0.0		0.0	0.0	S4	W4											214.0	215.0	Bx/Chl			
	No Recovery	81	215.0	217.0	0.0																							
	No Recovery	82	217.0	218.5	0.0																							
	No Recovery	83	218.5	220.0	0.0																							

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	No Recovery	84	220.0	223.0	0.0																							
	Greenstone Gouge	85	223.0	224.0	0.5	N	0.0		0.0	0.0	S4	W4											223.0	224.0	Bx/Chl			
	No Recovery	86	224.0	225.0	0.0																							
	Greenstone Gouge	87	225.0	226.5	0.8	N	0.0		0.0	0.0	S4	W4											226.5	229.0	Bx/Chl			
	Greenstone Gouge	88	226.5	229.0	2.5	N	0.0		0.0	0.0	S4	W4											226.5	229.0	Bx/Chl			
	Greenstone Gouge	89	229.0	231.0	2.0	N	0.0		0.0	0.0	S4	W4											229.0	231.0	Bx/Chl			
	Greenstone Gouge	90	231.0	232.5	1.3	N	0.0		0.0	0.0	S3	W4											231.0	232.5	Bx/Chl			
	Greenstone Gouge	91	232.5	233.0	0.5	N	0.0																			232.5	233.0	
	Greenstone Gouge	92	233.0	235.0	1.7	N	0.0	1	18.0	18.0	R0	W3	233.9	J	1	61	U	R			16.0	18	233.0	233.9	Bx/Chl			
																							234.4	235.0	Bx/Chl			
	No Recovery	93	235.0	235.5	0.0																							
	Greenstone Breccia	94	235.5	236.0	0.5	N	0.0	0	6.0	6.0	R2	W3																
	Greenstone Breccia	95	236.0	237.0	1.0	N	0.0	0	6.0	6.0	R2	W3														236.8	237.0	
	Metabasalt/ Greenstone	96	237.0	239.0	2.0	N	0.0	0	0.0	0.0	R1	W4											238.6	239.0	Bx/Chl	237.0	237.3	
	Greenstone Gouge	97	239.0	241.0	2.0	N	0.0	0	0.0	0.0	S4	W4											239.0	241.0	Bx/Chl			
	Greenstone Breccia w/ Metabasalt	98	241.0	243.0	2.0	N	0.0	20	2.0	2.0	R2	W3																
	Greenstone Breccia w/ Metabasalt	99	243.0	245.0	1.7	N	0.0	20	0.0	0.0	R2	W4																
	Greenstone Breccia w/ Metabasalt	100	245.0	246.0	1.0	N	0.0	15	0.0	0.0	R0	W4																
	Greenstone Gouge	101	246.0	249.0	3.0	N	0.0	0	0.0	0.0	S4	W4											246.0	249.0	Bx/Chl			
	Greenstone Breccia	102	249.0	251.5	2.5	N	0.0	3	7.0	0.0	R2	W3	249.6	J	2	44	P	R			12.0	14	250.7	251.5	Bx/Chl			

			Run Data																				Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data										Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
													250.7	F	1	31	P	R	Chl/Bx	30	6.0	0						
	Greenstone/ Metabasalt gouge	103	251.5	253.5	2.0	N	0.0		0.0	0.0	S4	W4											251.5	253.5	Bx/Chl			
	Greenstone	104	253.5	254.5	0.8	N	0.0		0.0	0.0	R2	W3														253.5	254.5	
	Greenstone/ Metabasalt	105	254.5	256.5	2.0	N	0.8	1	0.0	0.0	R2	W3	255.5	F	1	61	P	K	G	20	12.0	0	255.5	256.5	Bx/Chl	254.5	254.7	
	Greenstone/ Metabasalt	106	256.5	257.5	1.0	N	0.4	0	0.0	0.0	R0	W4											257.2	257.5	Bx/Chl	256.5	257.6	
	Greenstone/ Metabasalt	107	257.5	259.5	2.0	N	0.0	20	0.0	0.0	R2	W3																
	Greenstone/ Metabasalt	108	259.5	262.0	2.5	N	0.0	30	0.0	0.0	R2	W3																
	Greenstone/ Metabasalt	109	262.0	267.0	5.0	N	1.5	35	4.0	4.0	R3	W3	265.5	J	1	53	U	R	Chl/Bx	5	18.0	4						
	Greenstone breccia/gouge	110	267.0	271.0	4.0	N	0.0	1	0.0	0.0	R0	W4	268.8	F	1	65	P	K	G	40	4.0	0	268.8	270.0	Bx/Chl			
	Greenstone gouge	111	271.0	273.0	2.0	N	0.0		0.0	0.0	S4	W4											271.0	273.0	Bx/Chl			
	Metabasalt to greenstone gouge	112	273.0	277.0	2.8	N	0.0		0	0	S4	W4											273.0	277.0	Bx/Chl			
	Greenstone g	113	277.0	282.0	5	N	0	6	0	0	S4	W4	279.2	F	3.0	57.0	P	K	G	40	2.0	0	277.0	280.2	Bx/Chl			
													280.7	F	1.0	40.0	P	K	G	20	2.0	0	280.7	282.0	Bx/Chl			
													281.3	F	2.0	33.0	P	K	G	10	2.0	0						
	Greenstone g	114	282.0	284.0	1.7	N	0		0	0	S4	W4											282.0	284.0	Bx/Chl			
	Greenstone g	115	284.0	288.0	3	N	0		0	0	S4	W4											284.0	288.0	Bx/Chl			
	Greenstone g	116	288.0	290.5	1.2	N	0		0	0	S4	W4											288.0	290.5	Bx/Chl			
	Greenstone g	117	290.5	293.0	2.5	N	0		0	0	S4	W4											290.5	293.0	Bx/Chl			
	Greenstone g	118	293.0	295.0	2	N	0		0	0	S4	W4											293.0	295.0	Bx/Chl			
	Greenstone g	119	295.0	296.5	1.5	N	0		0	0	S4	W4											295.0	296.5	Bx/Chl			
	Greenstone g	120	296.5	299.0	2.2	N	0	30	4	4	R2	W4																
	Greenstone g	121	299.0	300.5	1.5	N	0		0	0	S4	W4											299.0	300.5	Bx/Chl			
	Greenstone g	122	300.5	301.5	1	N	0		0	0	S4	W4											300.5	301.5	Bx/Chl			
	Greenstone g	123	301.5	302.5	1	N	0		0	0	S4	W4											301.5	302.5	Bx/Chl			

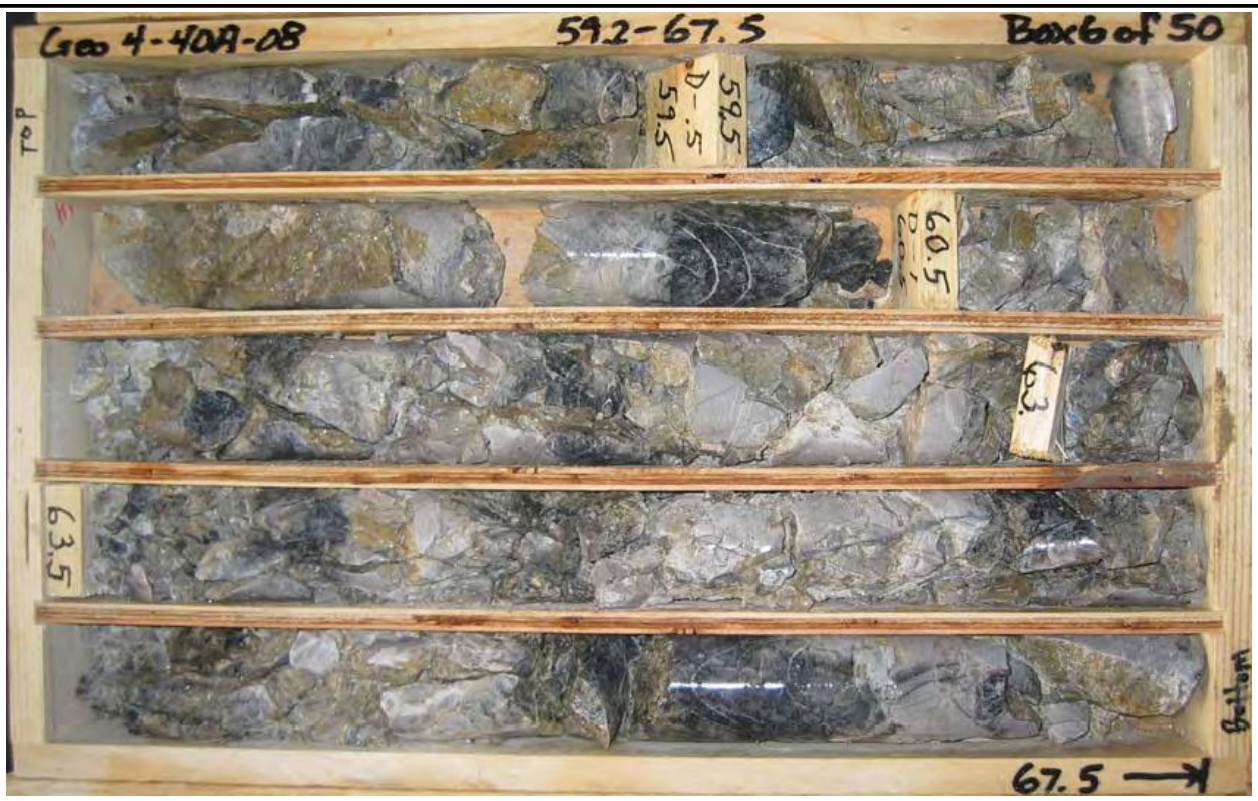
			Run Data																							Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data													Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greenstone g	124	302.5	307.0	3.5	N	1	1	0	0	R0	W4	304.1	F	1.0	49.0	P	K	G	35	6.0	0	304.1	307.0	Bx/Chl			
	Greenstone g	125	307.0	312.0	5	N	5	0	20	20	R3	W2																
	Greenstone g	126	312.0	317.0	5	N	1.7	2	8	0	R0	W3	312.8	J	1.0	51.0	U	R	Chl/Bx	2	14.0	16	313.4	315.0	Bx/Chl			
													313.4	F	1.0	38.0	P	K	G	45	4.0	0						
	Greenstone g	127	317.0	321.5	3.6	N	0	30	0	0	R0	W4																
	Greenstone g	128	321.5	325.0	3.5	N	0		0	0	S4	W4											321.5	325.0	Bx/Chl			
	Greenstone g	129	325.0	327.5	2.5	N	0	30	4	4	R2	W3											327.0	327.5	Bx/Chl			
	Greenstone g	130	327.5	332.5	4.8	N	0		0	0	S4	W4											327.5	332.5	Bx/Chl			
	Greenstone g	131	332.5	337.5	5	N	0	2	0	0	S4	W4	334.5	F	1.0	46.0	P	K	G	20	6.0	0	332.5	334.5	Bx/Chl			
													335.6	F	1.0	58.0	P	K	G	16	6.0	0	335.6	337.5	Bx/Chl			
	Greenstone g	132	337.5	340.5	3	N	0		0	0	S4	W4											337.5	340.5	Bx/Chl			
	Greenstone g	133	340.5	342.0	1.5	N	0	1	0	0	R0	W4	340.7	F	1.0	34.0	P	K	G	10	8.0	0	340.5	340.7	Bx/Chl			
																							341.2	342.0	Bx/Chl			
	Greenstone g	134	342.0	344.0	2	N	0	15	6	6	R2	W3														342.0	342.5	
																										343.3	344.0	
	Greenstone g	135	344.0	348.5	3.7	N	0	2	0	0	R0	W3	345.6	F	2.0	30.0	P	K	G	15	8.0	0	345.6	348.5	Bx/Chl			
	Greenstone g	136	348.5	351.0	2.5	N	0		0	0	S4	W4											348.5	351.0	Bx/Chl			
	Greenstone g	137	351.0	353.0	2	N	0		0	0	S4	W4											351.0	353.0	Bx/Chl			
	Greenstone g	138	353.0	357.0	4	N	0	2	3	0	S4	W4	354.4	J	1.0	57.0	U	R	Chl/Bx	4	10.0	6	354.9	357.0	Bx/Chl			
													354.9	F	1.0	34.0	P	K	G	40	4.0	0						
	Greenstone/I	139	357.0	360.5	3.3	N	0	3	6	0	R0	W3	358.3	F	1.0	35.0	P	K	G	40	6.0	0	357.0	358.3	Bx/Chl			
													358.8	J	1.0	54.0	U	R			10.0	18	359.5	360.5	Bx/Chl			
													359.5	F	1.0	61.0	P	K	G	12	4.0	0						
	Greenstone g	140	360.5	363.0	2	N	0		0	0	S4	W4											360.5	363.0	Bx/Chl			
	Greenstone g	141	363.0	364.0	1	N	0		0	0	R0	W4														363.0	364.0	
	Greenstone g	142	364.0	368.0	3	N	0	15	0	0	R2	W3	365.5	F	1.0	63.0	P	K	G	12	6.0	0	365.5	368.0	Bx/Chl			
	Greenstone g	143	368.0	369.5	1.5	N	0		0	0	R2	W4														368.0	369.5	
	Greenstone g	144	369.5	371.0	0.5	N	0		0	0	S4	W4											369.5	371.0	Bx/Chl			
	Greenstone g	145	371.0	373.0	1.6	N	0		0	0	S4	W4											371.0	373.0	Bx/Chl			
	Greenstone g	146	373.0	375.0	1	N	0		0	0	S4	W4											373.0	375.0	Bx/Chl			
	Greenstone g	147	375.0	378.0	2.6	N	0		0	0	R0	W4											376.4	378.0	Bx/Chl			
	Greenstone g	148	378.0	380.0	2	N	0		0	0	S4	W4											378.0	380.0	Bx/Chl			

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data											Rubble/Gouge					
																								Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greenstone g	149	380.0	381.0	1	N	0	1	0	0	R0	W4	380.4	F	1.0	60.0	P	SM	G	8	8.0	0	340.4	381.0	Bx/Chl			
	Greenstone g	150	381.0	383.0	1.7	N	0	20	0	0	R2	W4																
	Greenstone g	151	383.0	385.0	2	N	0	1	0	0	R0	W4																
	No recovery	152	358.0	385.5	0																							
	Greenstone b	153	358.5	387.5	1	N	0		0	0	R0	W4											385.5	386.0	Bx/Chl			
	No recovery	154	387.5	388.0	0																							
	Greenstone g	155	388.0	390.0	2	N	0		0	0	S4	W4											388.0	390.0	Bx/Chl			
	Greenstone g	156	390.0	392.5	2.5	N	0		0	0	S4	W4											390.0	392.5	Bx/Chl			
	greenstone b	157	392.5	395.5	3	N	0	2	7	0	R2	W3	393.4	J	1.0	46.0	U	R	Chl/Bx	3	16.0	14	394.6	395.5	Bx/Chl			
													394.6	F	1.0	32.0	P	K	G	10	4.0	0						
	greenstone b	158	395.5	399.5	4	N	0	40	6	6	R2	W3																
	greenstone b	159	399.5	401.0	1.5	N	0	15	0	0	R2	W4																
	greenstone b	160	401.0	403.0	2	N	0	20	0	0	R2	W4																
	Greenstone/t	161	403.0	408.0	5	n	0	15	18	18	R2	W3	405.1	J	1.0	46.0	ST	R	Chl/Bx	3	18.0	18						
													406.1	J	2.0	65.0	P	R			14.0	18						
	Greenstone C	162	408.0	409.5	1.5	N	0		0	0	S4	W4											408.0	409.5	Bx/Chl			
	Greenstone B	163	409.5	411.5	2	N	0	20	6	6	R2	W3																
	Greenstone/t	164	411.5	416.5	5	N	3.2	5	18	16	R2	W3	411.8	J	1.0	61.0	U	R	Chl/Bx	2	18.0	20						
													412.2	J	1.0	46.0	P	R			16.0	20						
													413.4	J	1.0	48.0	P	R	Chl/Bx	2	16.0	18						
													415.2	J	1.0	30.0	P	R			16.0	20						
													416.2	J	1.0	68.0	P	R	CL	4	14.0	16						
	Greenstone/t	165	416.5	419.5	3	N	0.8	20	4	4	R2	W4											419.0	419.5	Bx/Chl			
	Greenstone/t	166	419.5	423.0	3.5	N	0	40	10	10	R2	W3																
	Greenstone/t	167	423.0	428.0	5	N	0	45	15	14	R2	W3	423.7	J	1.0	63.0	U	R			14.0	18						
													424.2	V	1.0	73.0	P	SM	Chl/Bx	3	4.0	14						
													424.8	V	1.0	44.0	ST	R	Chl/Bx	4	18.0	14						
	Greenstone/t	168	428.0	433.0	5	N	0	3	13	0	R0	W4	428.2	J	1.0	68.0	P	R			14.0	18	430.0	433.0	Bx/Chl			
													429	J	1.0	32.0	ST	R			20.0	22						
													5															
													0	F	1.0	35.0	P	SM	G	35	4.0	0						
	Greenstone	169	433.0	438.0	5	n	0	8	16	14	R2	W4	434.2	J	1.0	30.0	P	R	Chl/Bx	4	6.0	14						
													436.2	J	1.0	36.0	U	R	Chl/Bx	3	16.0	16						
													436.4	J	6.0	58.0	U	VR	Chl/Bx	3	20.0	18						

			Run Data										Detailed Discontinuity Data										Rubble/Gouge					
			Recovery & Other Basic Information						JCR		Strength Index												Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Greenstone	170	438.0	443.0	5	N	4.8	1	22	22	R3	W2	439	J	1.0	45.0	U	R			18.0	22						
	Greenstone	171	443.0	448.0	5	N	4.7	0	22	22	R3	W2																
	Greenstone C	172	448.0	450.0	1.5	N	0		0	0	S4	W4											448.0	450.0	Bx/Chl			
	No Recovery	173	450.0	450.5	0																							
	Greenstone	174	450.5	453.0	2.5	N	0	3	5	0	R2	W4	450.8	J	1.0	46.0	P	R	G	10	10.0	0	450.5	450.8	Bx/Chl	452.3	453.0	
													451.4	J	1.0	53.0	P	R	Chl/Bx	4	12.0	4						
													451.8	J	1.0	66.0	P	R	Chl/Bx	1	12.0	10						
	Greenstone B	175	453.0	458.0	5	N	1.3	25	10	10	R2	W3																
	Greenstone	176	458.0	463.0	5	N	1.2	5	8	0	R2	W3	458.3	J	1.0	49.0	P	K	Chl/Bx	2	8.0	6						
													459.6	J	1.0	75.0	P	SM			4.0	10						
													460.1	J	1.0	48.0	U	R	Chl/Bx	10	8.0	0						
													461	J	1.0	35.0	P	R			6.0	12						
													461.3	J	1.0	43.0	P	R			12.0	16						
	Greenstone	177	463.0	468.0	5	N	1	30	15	15	R2	W3																
	Greenstone	178	468.0	472.5	4.5	N	1.9	3	14	14	R2	W3	468.6	J	1.0	50.0	ST	R	CW	3	20.0	16	471.4	471.8	Bx/Chl			
													469.9	J	1.0	53.0	P	R			10.0	14						
													471.2	J	1.0	57.0	P	R	Bx	1	10.0	14						
	Greenstone	179	472.5	477.5	5	N	2	30	6	6	R2	W3																
	Greenstone	180	477.5	482.5	5	N	2.4	3	18	14	R2	W3	478.9	J	1.0	26.0	U	R			14.0	20						
													481.1	J	1.0	73.0	P	R			12.0	20						
													482.3	J	1.0	41.0	P	SM	Chl/Bx	3	4.0	14						
	Greenstone	181	482.5	486.5	3.5	N	0	1	16	16	R2	W4	483.9	J	1.0	55.0	U	R	Chl/Bx	3	12.0	16						
	Greenstone b	182	486.5	489.0	2.5	N	0	1	0	0	R0	W4	487.8	F	1.0	S4	P	K	G	25	4.0	0	487.8	489.0	Bx/Chl			
	Greenstone b	183	489.0	493.0	2	N	0	1	14	14	R2	W4	489.3	J	1.0	44.0	P	R	CW	2	10.0	14						
	Greenstone b	184	493.0	494.5	3.5	N	1.2	2	12	12	R2	W4	493.8	J	2.0	34.0	U	R	Chl/Bx	4	14.0	12						
	Greenstone b	185	494.5	499.5	5	N	0	4	0	0	R0	W4	495.2	F	1.0	31.0	P	K	G	25	2.0	0	495.2	498.2	Bx/Chl			
													497	F	3.0	40.0	P	K	G	20	0.0	0						
	Greenstone b	186	499.5	501.0	1	N	0	1			R0	W4	499.7	J	1.0	46.0	U	R			16.0	16	500.0	501.0	Bx/Chl			
	Greenstone/I	187	501.0	506.0	5	N	0		0	0	S4	W4											501.0	506.0	Chl/Bx			
	Greenstone g	188	506.0	511.0	4.3	N	0		0	0	S4	W4											506.0	511.0	Chl/Bx			
	Greenstone/I	189	511.0	515.5	4.5	N	0		0	0	S4	W4											511.0	515.5	Chl/Bx			
	Greenstone/I	190	515.5	520.7	5.2	N	0	20	2	0	R0	W4	516.8	F	2.0	33.0	P	K	CL	5	2.0	0	515.5	516.8	Cl/Bx			
													518.2	J	1.0	41.0	P	K	CL	2	2.0	4	519.2	520.7	Cl/Bx			
	Limestone	191	520.7	526.0	5.3	N	5	1	16	16	R3	W3	524.4	J	1.0	65.0	U	R	CL	2	16.0	16						

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data											Rubble/Gouge					
																								Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone go	192	526.0	531.0	5	N	2.5	1	0	0	R0	W4	528.7	F	1.0	40.0	P	K	G	35	2.0	0	528.7	531.0	Cl/Bx			
	Limestone go	193	531.0	536.0	5	N	2.1	3	0	0	R0	W4	531.4	F	3.0	43.0	P	K	G	8	4.0	0						
	Limestone go	194	536.0	541.0	5	N	1.1	1	0	0	S4	W4	537.3	F	1.0	48.0	U	K	G	45	10.0	0	538.3	541.0	Cl/Bx			
	Limestone go	195	541.0	546.3	5.3	N	1.2	15	18	18	R0	W4	543.8	J	1.0	45.0	P	VR			16.0	18	541.0	541.9	Cl/Bx			
	Limestone	196	546.3	551.5	5	N	0.7	3	2	0	R3	W3	547.1	J	1.0	64.0	P	K	CL	5	10.0	4						
													547.7	F	2.0	45.0	P	K	Chl	10	12.0	0						
	Limestone	197	551.5	556.5	5	N	0	25	8	0	R3	W3	552.1	J	1.0	49.0	P	K	CL	1	8.0	16	552.9	556.5	Chl/Bx			
													552.9	F	1.0	66.0	P	G	Chl	45	2.0	0						
	Limestone/M	198	556.5	561.5	5	N	0.9	3	8	0	R0	W4	556.1	J	2.0	41.0	U	K	CL	1	6.0	16	558.6	561.5	Bx/Chl			
													558.6	F	1.0	33.0	P	K	G	35	4.0	0						
	Limestone/G	199	561.5	566.5	5	N	0	4	0	0	S4	W4	563.2	F	3.0	42.0	P	K	G	10.0	8	0.0	561.5	566.5	Cl/Bx			
													564.9	F	1.0	28.0	U	VR	G	8								
	Limestone/G	200	566.5	571.0	4	N	0		0	0	S4	W4											566.5	571.0	CL/Bx			
	Greenstone g	201	571.0	572.0	0.4	N	0		0	0	S4	W4											571.0	572.0	Chl/Bx			
	Limestone/G	202	572.0	577.0	5	N	0	3	0	0	R0	W4	573.7	F	1.0	39.0	U	K	G	10	12.0	0	573.7	575.7	Cl/Bx			
													574.8	F	1.0	46.0	U	K	G	10	14.0	0	575.9	577.0	Cl/Bx			
													575.7	F	1.0	36.0	P	K	CL	2	14.0	0						
	Limestone/G	203	577.0	582.0	5	N	1.9	3	13	12	R3	W4	578.5	F	1.0	35.0	P	K	CL	2	6.0	12	581.0	582.0	Cl/Bx			
													579.1	J	1.0	31.0	U	K	CL	1	8.0	12						
													580.4	J	1.0	43.0	U	K	CL	1	14.0	14						
	Limestone/G	204	582.0	587.0	5	N	0.8	40	10	10	R0	W4	582.1	F	1.0	28.0	P	K	CL	2	4.0	10	583.7	587.0	Cl/Bx			
													583.7	F	1.0	37.0	P	K	CL	2	4.0	10						
	Limestone	205	587.0	592.2	5	N	1.1	4	10	10	R3	W4	588.1	J	4.0	33.0	P	K	CL	3	8.0	10						
	Limestone br	206	592.2	597.3	5.1	N	0	25	17	16	R3	W3	592.6	J	1.0	61.0	U	R			14.0	18						
													593.5	J	1.0	54.0	P	SM			4.0	16						
													594.3	J	1.0	39.0	U	R			14.0	18						
	Limestone	207	597.3	602.3	5	N	1.9	1	16	16	R3	W3	598.9	J	1.0	39.0	U	K	CL	2	12.0	16						
	Limestone go	208	602.3	607.4	3.7	N	0		0	0	S4	W3											602.3	607.4	Cl/Bx			
	Limestone/G	209	607.4	611.0	3.6	N	0	1	2	2	R0	W3	610.1	F	1.0	30.0	U	K	CL	5	8.0	2	607.4	608.3	Cl/Bx			
																							609.0	610.1	Cl/Bx			
	Limestone	210	611.0	613.0	2	N	1	1	18	18	R3	W3	612	J	1.0	56.0	U	R			16.0	18						
	Limestone/G	211	613.0	618.0	5	N	1.2	2	5	0	R2	W3	614.3	F	1.0	33.0	P	K	CL	10	2.0	0						
													616.9	J	1.0	60.0	P	K	CL	2	4.0	10						
	Limestone/G	212	618.0	623.0	5	N	1.2	35	18	18	R2	W3	619.8	J	1.0	51.0	V	VR	CL	2	18.0	18						
	Greenstone g	213	623.0	625.5	2.5	N	0		0	0	S4	W4											623.0	625.5	Cl/Bx			

			Run Data																										
			Recovery & Other Basic Information						JCR		Strength Index		Detailed Discontinuity Data											Rubble/Gouge					
																								Gouge			Broken Core		
Core Dia: Depth	ROCK TYPE	RUN	From (ft.)	To (ft.)	Recovery (ft.)	Bedding Dominant (Y/N)	RQD (ft.)	Natural Fracture Count	Average	Minimum	Strength Index	Weathering Index	Depth (ft.)	Type	Count	α	Shape	Roughness	Infill	Thickness (mm)	JRC	JCR	From	To	Type	From	To	ADDITIONAL TESTING OR COMMENTS, SAMPLES COLLECTED
	Limestone/G	214	625.5	628.5	3	N	0		0	0	R2	W4																
	Limestone	215	628.5	633.0	4.5	n	0	35	2	2	R2	W4	629.7	J	1.0	36.0	P	K	CL	5	8.0	2						
	Limestone/G	216	633.0	638.0	5	N	1	2	7	0	R2	W4	634	J	1.0	35.0	U	R	CL	2	16.0	14	634.9	638.0	CI/Bx			
													634.9	F	1.0	28.0	P	K	G	35	10.0	0						
	Limestone/G	217	638.0	643.0	5	N	0	2	2	0	R0	W4	641.8	F	1.0	41.0	U	K	CL	2	10.0	4	638.0	641.8	CI/Bx			
													642.3	F	1.0	46.0	P	K	G	15	4.0	0	642.3	642.7	CI/Bx			
	Limestone/G	218	643.0	648.0	5	N	0.7	30	8	0	R0	W4	643.7	J	1.0	45.0	U	R			16.0	18	644.2	646.0	CI/Bx			
													644.2	F	1.0	48.0	U	R	G	22	14.0	0						
													646	F	1.0	51.0	P	K	CL	5	6.0	6						
	Limestone/G	219	648.0	651.5	2	N	0	0	0	0	S4	W4											648.0	651.5	CI/Bx			
	Greenstone g	220	651.5	653.0	1.5	N	0	0	0	0	S4	W4											651.5	653.0	CI/Bx			
	Greenstone/	221	653.0	658.0	4.6	N	1.6	5	16	12	R3	W3	654.3	J	1.0	54.0	P	R			8.0	18						
													654.7	J	3.0	55.0	P	K	CL	2	6.0	12						
													656.9	J	1.0	39.0	P	VR			14.0	18						
	Metabasalt t	222	658.0	662.5	4.5	N	2.2	6	19	18	R3	W3	658.6	J	1.0	54.0	U	VR			18.0	20						
													659.4	J	1.0	56.0	U	R			18.0	20						
													660.5	J	3.0	35.0	U	R			16.0	18						
													662.2	J	1.0	43.0	C	VR			18.0	20						
	Metabasalt	223	662.5	667.5	5	N	2.1	5	19	18	R3	W3	664.1	5	1.0	28.0	P	VR	FeOx	1	18.0	20						
													665	J	3.0	28.0	P	R	FeOx	1	14.0	18						
													666.7	J	1.0	30.0	P	VR	FeOx	1	18.0	20						
	Metabasalt	224	667.5	672.5	5	N	4	2	20	20	R3	W2	667.9	J	1.0	42.0	U	R	FeOx	1	14.0	20						
													668.1	J	1.0	26.0	U	R	FeOx	1	16.0	20						
	Metabasalt	225	672.5	677.5	4.7	N	2.9	3	1	0	R3	W2	674.4	F	1.0	65.0	P	K	G	17	6.0	0	674..4	675.6	CI/Bx			
													675.6	F	1.0	60.0	U	R	CL	5	12.0	2						
													676.1	J	1.0	38.0	P	SM	CL	8	6.0	0						
	Metabasalt b	226	677.5	682.5	5	N	0.4	50	0	0	R0	W4											677.9	681.6	Bx			
	Metabasalt b	227	682.5	687.5	5	N	2	0	0	0	R0	W4											684.5	687.5	CI/Bx			
	Metabasalt b	228	687.5	692.5	5	N	1.2	1	0	0	R0	W4	688.8	F	1.0	28.0	P	K	G	44	4.0	0	688.8	692.5	CI/Bx			
	Metabasalt b	229	692.5	695.0	0.4	N	0		0	0	S4	W4											692.5	695.0	CI/Bx			
	Metabasalt b	230	695.0	700.0	4.6	N	3.3	4	20	20	R3	W3	695.2	J	1.0	43.0	U	R			16.0	20						
													695.9	J	3.0	45.0	P	R			14.0	20						



Golder Associates

TITLE

Typical Limestone Core

CLIENT/PROJECT					
Lehigh Hanson **Pit 4 Slope Design Study**	DRAWN	IT	DATE	04/14/09	JOB NO. 063-7109400
	CHECKED	GM	SCALE	NA	DWG. NO. / REV. NO.
	REVIEWED	GM	FILE NO.		Photo 1,2

Golder Associates	TITLE: Typical Greenstone Core			
CLIENT/PROJECT: **Lehigh Hanson** **Pit 4 Slope Design Study**	DRAWN: IT	DATE: 04/14/09	JOB NO.: 063-7109400	
	CHECKED: GM	SCALE: NA	DWG. NO. / REV. NO.	
	REVIEWED: GM	FILE NO.	Photo 3,4	

Golder Associates

TITLE

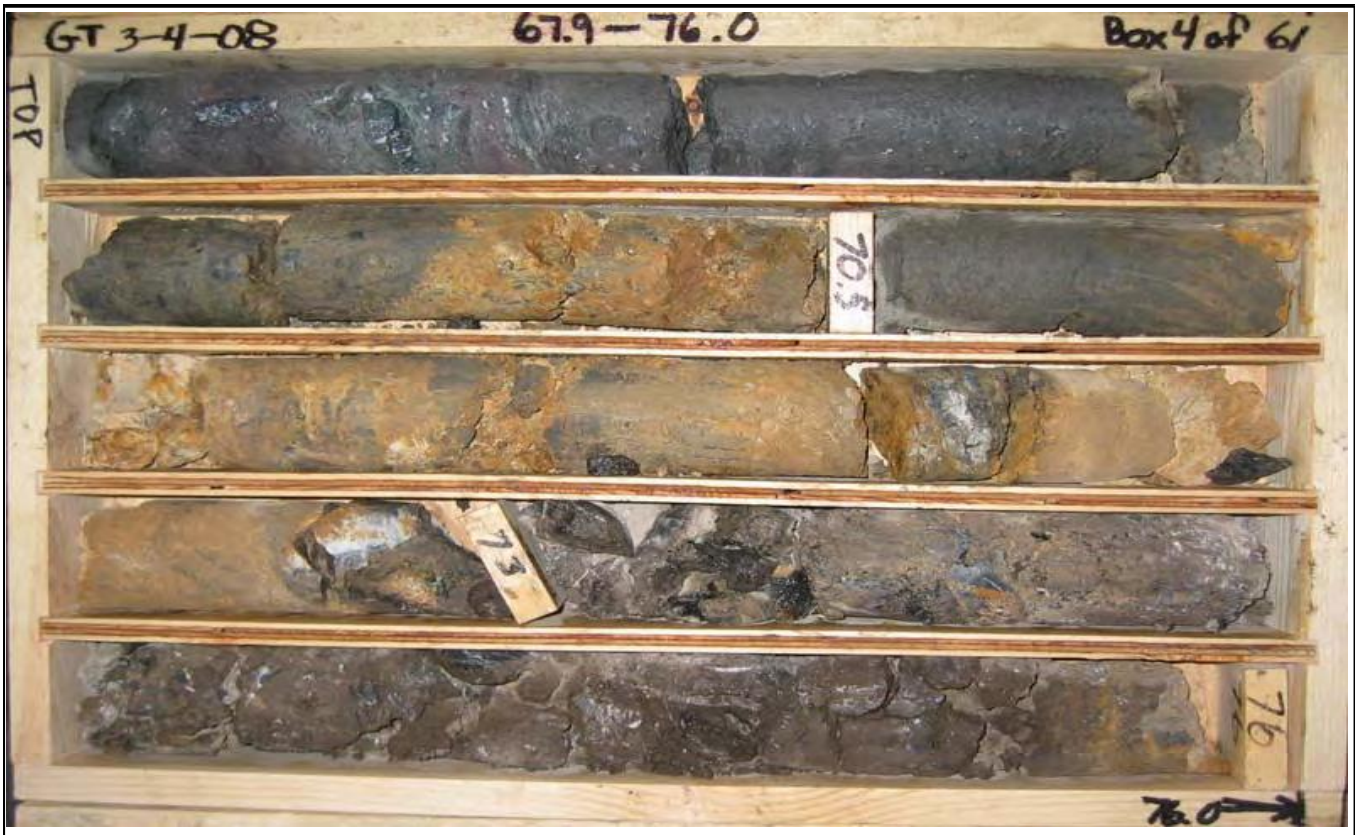
Typical Greywacke Core

CLIENT/PROJECT

Lehigh Hanson
Pit 4 Slope Design Study

DRAWN	IT	DATE	04/14/09	JOB NO.	063-7109400
CHECKED	GM	SCALE	NA	DWG. NO. / REV. NO.	
REVIEWED	GM	FILE NO.		Photo 5,6	

Golder Associates	TITLE: Typical Metabasalt Core			
CLIENT/PROJECT: **Lehigh Hanson** **Pit 4 Slope Design Study**	DRAWN: IT	DATE: 04/14/09	JOB NO.: 063-7109400	
	CHECKED: GM	SCALE: NA	DWG. NO. / REV. NO.	
	REVIEWED: GM	FILE NO.	Photo 7,8	



Golder Associates

TITLE

Typical Fault Breccia Core

CLIENT/PROJECT

Lehigh Hanson

Pit 4 Slope Design Study

DRAWN	IT	DATE	04/14/09	JOB NO.	063-7109400
CHECKED	GM	SCALE	NA	DWG. NO. / REV. NO.	
REVIEWED	GM	FILE NO.		Photo 9,10	

APPENDIX 12.B

Laboratory Test Results

UNCONFINED COMPRESSIVE STRENGTH
ASTM D 7012; Method C (Previously ASTM D 2938)

CLIENT: Golder Associates

JOB NO.: 2003-123

LOCATION:

DATE TESTED: 3/1/09 HN

PROJECT: 063-7109.100

Specimen ID Boring, Depth(ft.), Rock type	Diameter (in.)	Length (in.)	Mass (gms)	Wet Density (pcf)	Failure Load (lb)	Failure Types **	Compressive Strength (psi)
GT2-7-07, 246.5-247.5, Graywacke	2.383	5.317	1071.80	172.2	26,846	F/S	6,020
GT2-7-07, 262.5-263.0, Graywacke	2.388	5.225	1076.60	175.3	56,250	F	12,560
GT4-33A-08, 254.7-255.5, Greenstone	2.385	5.278	1132.50	183.0	39,784	C	8,910
GT4-30A-08, 499.2-499.8, Limestone	2.394	5.093	1013.80	168.5	17,534	F/S	3,900
GT3-2A-08, 330.7-331.6, Metabasalt	2.395	5.077	980.00	163.2	628	F/S	140
GT3-2A-08, 459.7-460.2, Metabasalt	2.389	3.913	840.80	182.6	2,184	F	*470
GT4-33A-08, 658.6-659.4, Metabasalt	2.389	4.575	923.70	171.6	22,246	F/S	*4940

Notes and Comments:

* Indicates regardless of ASTM D 7012 method C, sample with L/D < 2.0. was tested and correction factor for short sample was applied to the calculation.
C=Ca/[0.88+0.24b/h]
Ca = Failure Load / Surface Area
b = Sample Diameter
h = Sample Length

** Failure types S: Shear Failure, M: Matrix Failure, F: Failure due to Fracture/Bedding, V: Void Failure, C: Combination

Data Entered By: HN Date: 03/01/2009
Data Checked By: Date: __/__/__
Filename: GOUCS123

PRELIMINARY

ADVANCED TERRA TESTING, INC. ATT

UNCONFINED COMPRESSIVE STRENGTH
With Stress / Strain Measurements
ASTM D 7012; Method D (Previously ASTM D 3148)

CLIENT: Golder Associates

JOB NO.: 2003-123

LOCATION: 063-7109.100

DATE TESTED: 3/2-3/09 HN

Specimen ID			Diameter (in.)	Length (in.)	Mass (gms)	Wet Density (pcf)	Failure Load (lb)	Failure Type **	Compressive Strength (psi)	Young's Modulus (X10^6 psi)	Poisson's Ratio
Boring	Depth (ft.)	Rock type									
GT3-5A-08	230.0-230.5	Graywack	2.390	4.473	874.10	165.9	41,250	F	*9120	5.84	0.082
GT3-5A-08	261.2-261.7	Graywack	2.386	4.831	940.10	165.8	5,375	F	1,200	1.73	0.234
***GT3-2A-08	184.0-185.0	Greenstone	2.385	4.216	890.10	180.0	6,000	F	*1320	N/A	N/A
GT2-7-07	437.2-437.7	Limestone	2.393	4.451	873.10	166.2	19,000	F	*4190	4.84	0.111
GT3-3A-08	120.6	Limestone	2.385	4.682	897.10	163.4	6,250	F	*1400	1.51	0.188
GT3-4-08	306.5-307.8	Limestone	2.389	5.287	1053.40	169.3	33,000	F	7,360	4.90	0.125
GT3-2A-08	313.4-314.2	Metabasalt	2.393	4.961	998.20	170.4	1,400	F	310	0.31	0.194
GT3-3B-08	413.7-414.4	Metabasalt	2.395	4.974	1007.10	171.2	10,750	F	2,390	1.15	0.233
GT3-2A-08	284.3-285.0	Metabasalt	2.401	5.000	1004.90	169.1	260	F	60	0.06	0.206
GT3-4A-08	115.3-115.9	Greenstone	2.380	5.330	1044.10	167.7	3,000	F/S	670	1.04	0.176

Notes and Comments:

* Indicates regardless of ASTM D 7012 method D, sample with L/D < 2.0.
was tested and correction factor for short sample was applied to the calculation.
C=Ca/[0.88+0.24b/h]
Ca = Failure Load / Surface Area
b = Sample Diameter
h = Sample Length

** Failure Type:
S: Shear Failure, M: Matrix Failure, F/V Fracture, Bedding/Void Collapse, C: Combination

*** Sudden failure without measurable axial strain.

Data Entered By: HN Date: 03/04/2009
Data Checked By: _____ Date: __/__/__
Filename: GOUGSS12

PRELIMINARY

ADVANCED TERRA TESTING, INC. ATT

TRIAXIAL COMPRESSIVE STRENGTH
ASTM D 7012; Method A (Previously ASTM D 2664)

CLIENT: Golder Associates JOB NO.: 2003-123

PROJECT No. 063-7109.100 DATE TESTED: 3/23-27/09 BKL/HN

Specimen ID Boring, Depth (ft.), Rock type	Diameter (in.)	Length (in.)	Mass (gms)	Wet Density (pcf)	Failure Load (lb)	Failure Types *	Confining Pressure (psi)	Compressive Strength (psi)
GT2-7-07, 81.9-82.5, Graywacke	2.381	5.026	996.20	169.6	84,260	S/F	4,600	18,920
GT2-7-07, 85.4-86.3, Graywacke	2.387	4.948	966.20	166.2	49,485	S/M	1,850	11,060
GT3--3A-08, 279.6, Limestone	2.384	4.993	981.40	167.7	88,460	F/S	850	19,820
GT3-4-08, 113.5-114.3, Limestone	2.404	5.084	991.20	163.6	90,585	F/S	2,100	19,960
GT4-30A-08, 353.9-355.0, Limestone	2.396	5.010	994.50	167.7	58,035	F/S	1,500	12,870
GT3-2A-08, 200.5-201.5, Metabasalt	2.377	4.871	1035.60	182.5	22,435	S/F	250	5,060
GT3-3B-08, 445.5-446.1, Metabasalt	2.400	5.181	980.70	159.4	14,485	F	450	3,200
GT3-6A-08, 116.3-116.9, Metabasalt	2.392	4.689	1020.70	184.5	42,935	S/F	700	9,550

Notes and Comments:

* Failure Types:
S: Shear Failure, M: Matrix Failure, F/V: Fracture/Void Failure, C: Combination

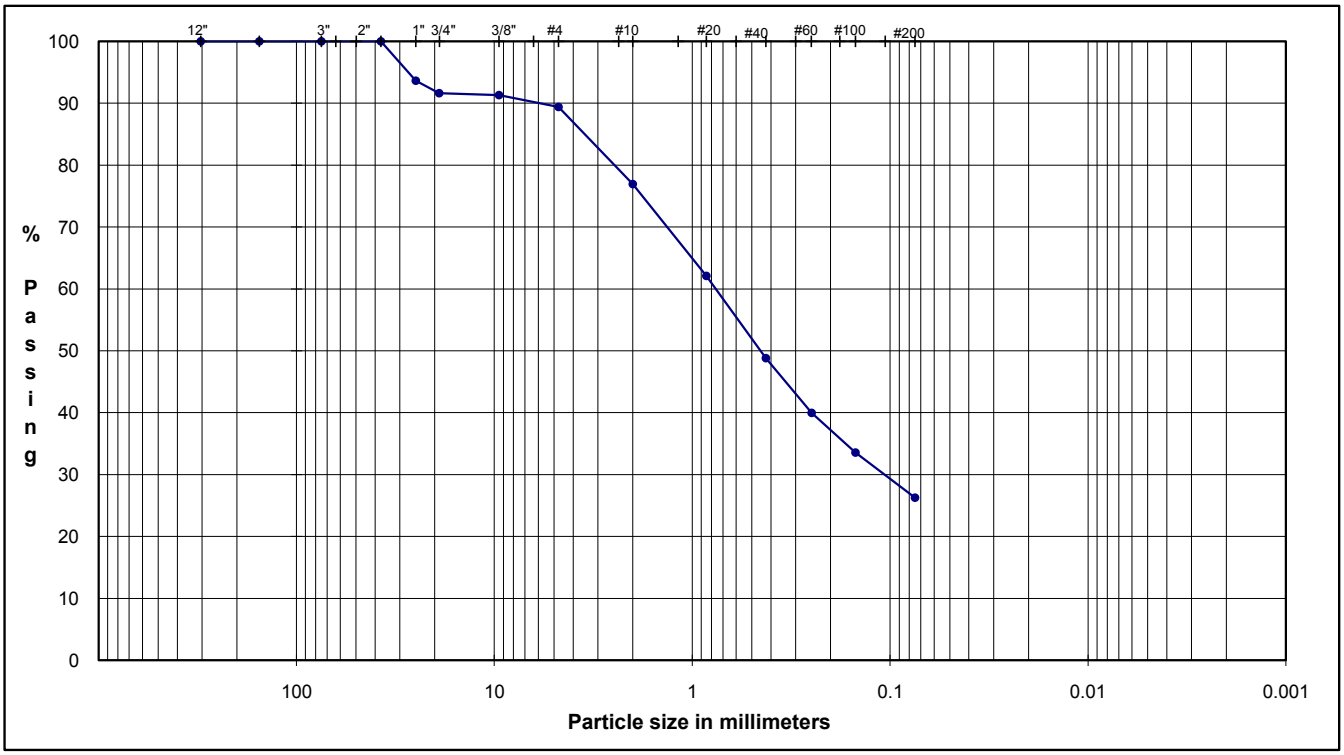
Data Entered By: HN Date: 03/27/2009
Data Checked By: CJ Date: 03/27/09
Filename: GOTRIRCK

ADVANCED TERRA TESTING, INC. ATT

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

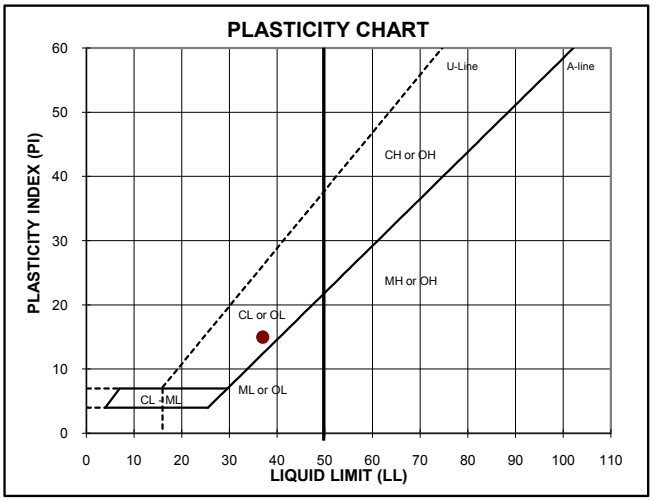
PROJECT NAME: **Hanson/Permanente Cement Quarry/CA**
SAMPLE ID: **GT2-1-08** Depth (ft) **158-158.8**
TYPE: **Core**



COBBLES	Coarse GRAVEL	Fine GRAVEL	Coarse SAND	Medium SAND	Fine SAND	Silt or Clay FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Cobbles	**0.00**
3.0"	75.0	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**93.6**		
0.75"	19.0	**91.6**	Coarse Gravel	**8.40**
0.375"	9.5	**91.3**		
#4	4.8	**89.4**	Fine Gravel	**2.21**
#10	2.0	**77.0**	Coarse Sand	**12.41**
#20	0.9	**62.1**		
#40	0.4	**48.8**	Medium Sand	**28.13**
#60	0.3	**40.0**		
#100	0.2	**33.6**		
#200	0.1	**26.3**	Fine Sand	**22.55**
			Fines	**26.30**



ATTERBERG LIMITS

M_c	LL	PL	PI
--	**37**	**22**	**15**

DESCRIPTION: Light yellowish brown clayey sand

USCS: SC

TECH	MS
DATE	3/2/09
REVIEW	MB

ATTERBERG LIMITS

ASTM D 4318

PROJECT NAME: Hanson/Permanente Cement Quarry/CA
PROJECT NUMBER: 063-7109100
SAMPLE ID: GT2-1-08 **SAMPLE DEPTH (ft):** 158-158.8
SAMPLE TYPE: Core

SAMPLE PREPARATION

Wet or Dry: Dry

Minus #40 Sieve: Yes

PLASTIC LIMIT DETERMINATION

Number of Blows		
Weight of Wet Soil & Tare (gm)	20.12	21.17
Weight of Dry Soil & Tare (gm)	18.98	19.83
Weight of Tare (gm)	13.90	13.84
Weight of Water (gm)	1.14	1.34
Weight of Dry Soil (gm)	5.08	5.99
Water Content %	22.44	22.37

LIQUID LIMIT DETERMINATION

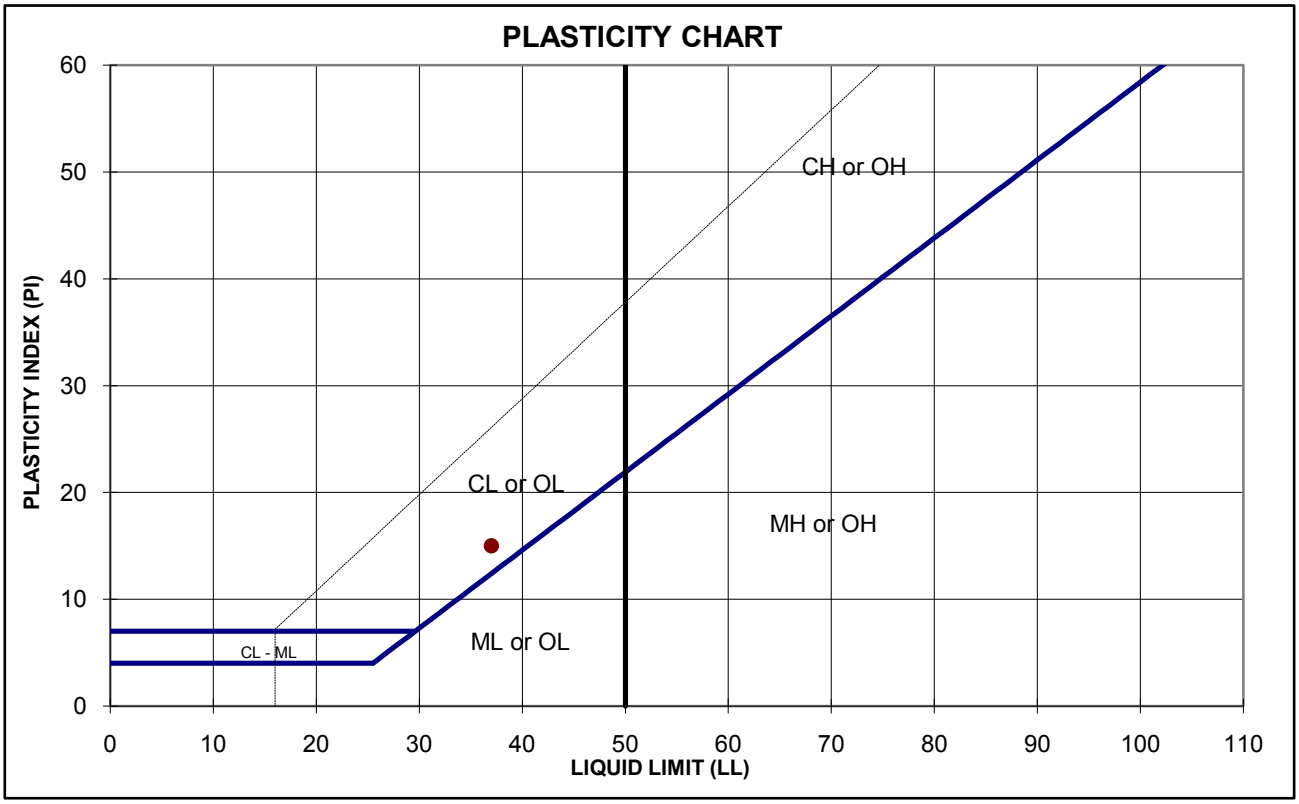
34	26	15
35.22	33.61	35.93
30.17	28.37	29.83
15.88	14.00	13.93
5.05	5.24	6.10
14.29	14.37	15.90
35.34	36.46	38.36

PLASTIC LIMIT (PL): 22

LIQUID LIMIT (LL): 37

PLASTICITY INDEX (PI): 15

NOTE:



TECH: TS
DATE: 2/3/09
REVIEW: MB

ATTERBERG LIMITS

ASTM D 4318

PROJECT NAME: Hanson/Permanente Cement Quarry/CA
PROJECT NUMBER: 063-7109100
SAMPLE ID: GT2-7-07 **SAMPLE DEPTH (ft):** 305-305.5
SAMPLE TYPE: Core

SAMPLE PREPARATION

Wet or Dry: Dry

Minus #40 Sieve: Yes

PLASTIC LIMIT DETERMINATION

Number of Blows		
Weight of Wet Soil & Tare (gm)	23.91	25.28
Weight of Dry Soil & Tare (gm)	22.61	23.82
Weight of Tare (gm)	13.71	13.90
Weight of Water (gm)	1.30	1.46
Weight of Dry Soil (gm)	8.90	9.92
Water Content %	14.61	14.72

LIQUID LIMIT DETERMINATION

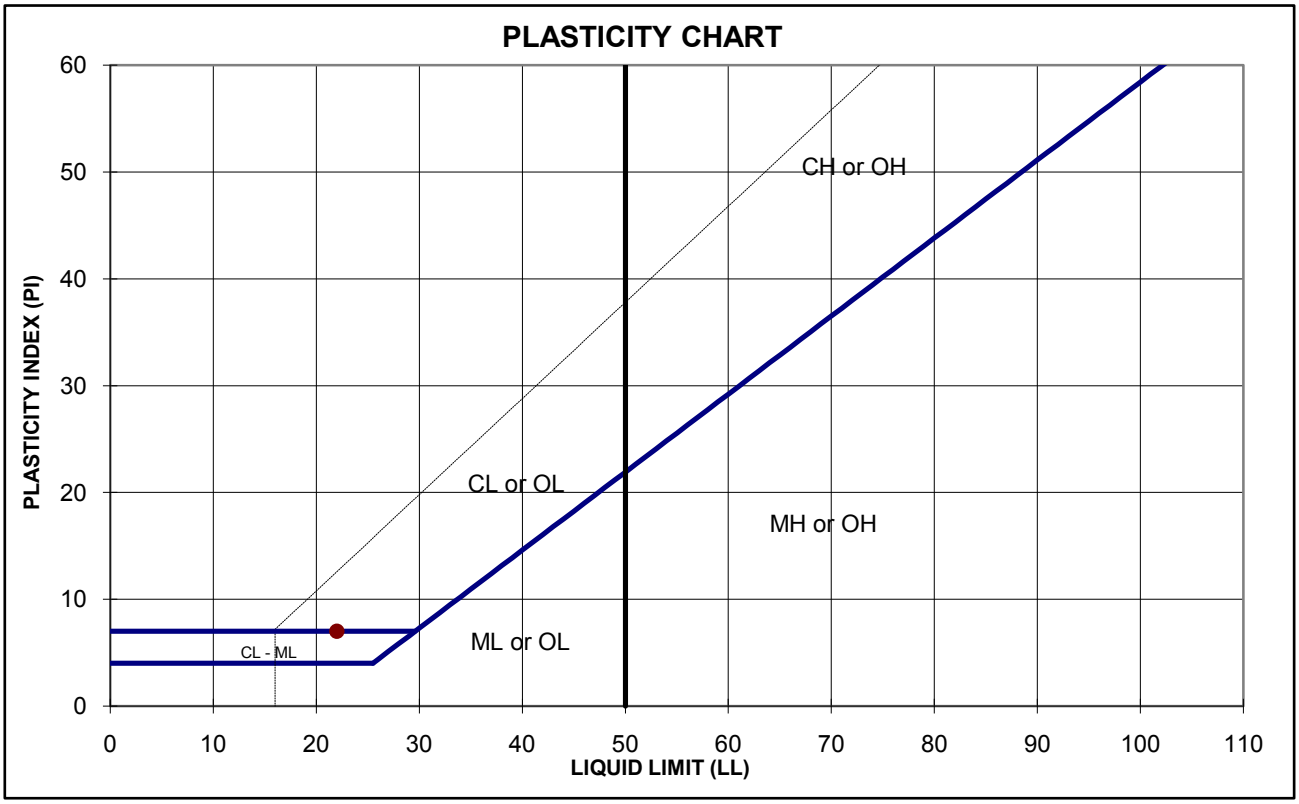
Number of Blows	16	25	32
Weight of Wet Soil & Tare (gm)	30.64	28.02	29.56
Weight of Dry Soil & Tare (gm)	27.87	25.49	27.17
Weight of Tare (gm)	15.69	14.01	15.64
Weight of Water (gm)	2.77	2.53	2.39
Weight of Dry Soil (gm)	12.18	11.48	11.53
Water Content %	22.74	22.04	20.73

PLASTIC LIMIT (PL): 15

LIQUID LIMIT (LL): 22

PLASTICITY INDEX (PI): 7

NOTE:



TECH: TS
DATE: 2/3/09
REVIEW: MB

ATTERBERG LIMITS

ASTM D 4318

PROJECT NAME: Hanson/Permanente Cement Quarry/CA
PROJECT NUMBER: 063-7109100
SAMPLE ID: GT3-2A-08 **SAMPLE DEPTH (ft):** 239.2 - 240
SAMPLE TYPE: Core

SAMPLE PREPARATION

Wet or Dry	Dry	Minus #40 Sieve	Yes

PLASTIC LIMIT DETERMINATION

Number of Blows		
Weight of Wet Soil & Tare (gm)	28.98	25.04
Weight of Dry Soil & Tare (gm)	27.42	23.83
Weight of Tare (gm)	14.23	14.16
Weight of Water (gm)	1.56	1.21
Weight of Dry Soil (gm)	13.19	9.67
Water Content %	11.83	12.51

LIQUID LIMIT DETERMINATION

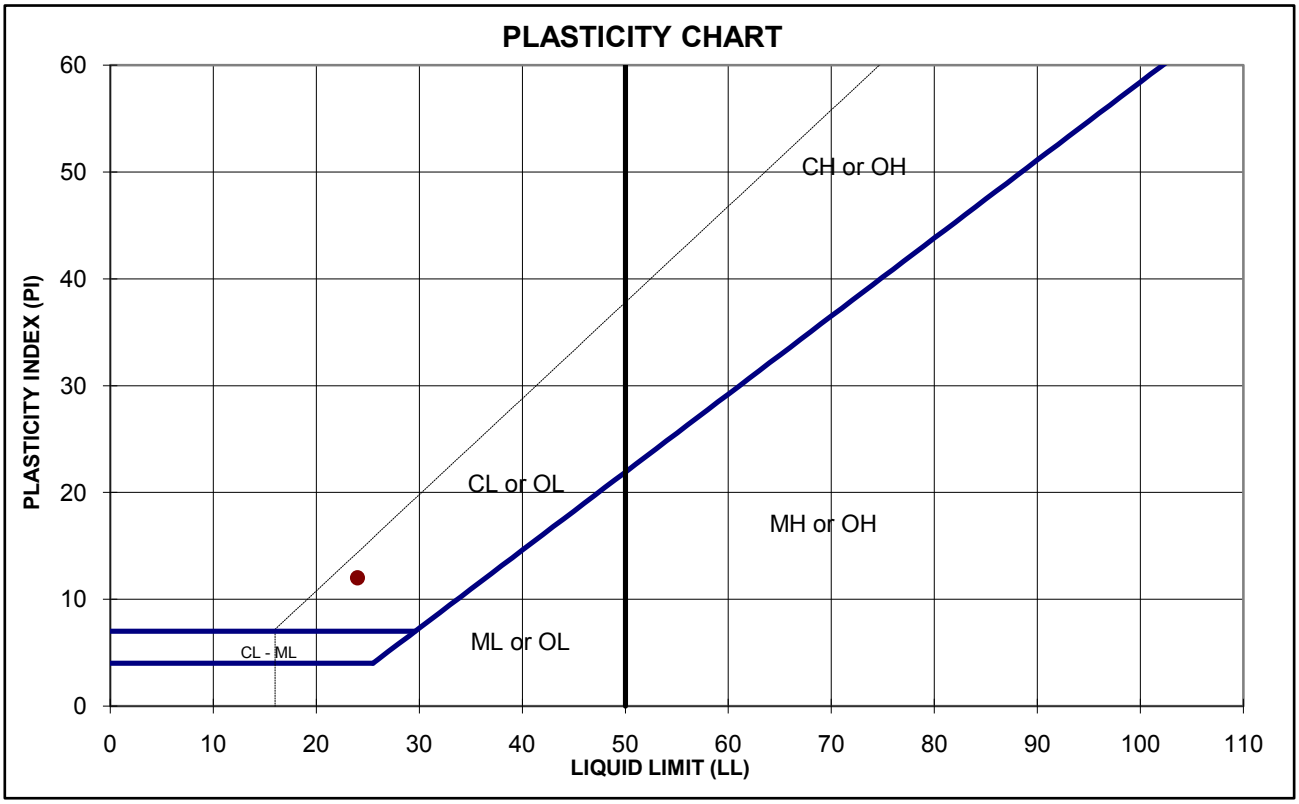
Number of Blows	18	24	30
Weight of Wet Soil & Tare (gm)	24.03	28.10	25.37
Weight of Dry Soil & Tare (gm)	21.97	25.72	23.17
Weight of Tare (gm)	13.78	15.84	13.73
Weight of Water (gm)	2.06	2.38	2.20
Weight of Dry Soil (gm)	8.19	9.88	9.44
Water Content %	25.15	24.09	23.31

PLASTIC LIMIT (PL): 12

LIQUID LIMIT (LL): 24

PLASTICITY INDEX (PI): 12

NOTE:



TECH	TS
DATE	2/3/09
REVIEW	MB

ATTERBERG LIMITS

ASTM D 4318

PROJECT NAME: Hanson/Permanente Cement Quarry/CA
PROJECT NUMBER: 063-7109100
SAMPLE ID: GT3-3-08 **SAMPLE DEPTH (ft):** 368.5-369.4
SAMPLE TYPE: Core

SAMPLE PREPARATION

Wet or Dry: Dry

Minus #40 Sieve: Yes

PLASTIC LIMIT DETERMINATION

Number of Blows		
Weight of Wet Soil & Tare (gm)	--	--
Weight of Dry Soil & Tare (gm)	--	--
Weight of Tare (gm)	--	--
Weight of Water (gm)		
Weight of Dry Soil (gm)		
Water Content %		

LIQUID LIMIT DETERMINATION

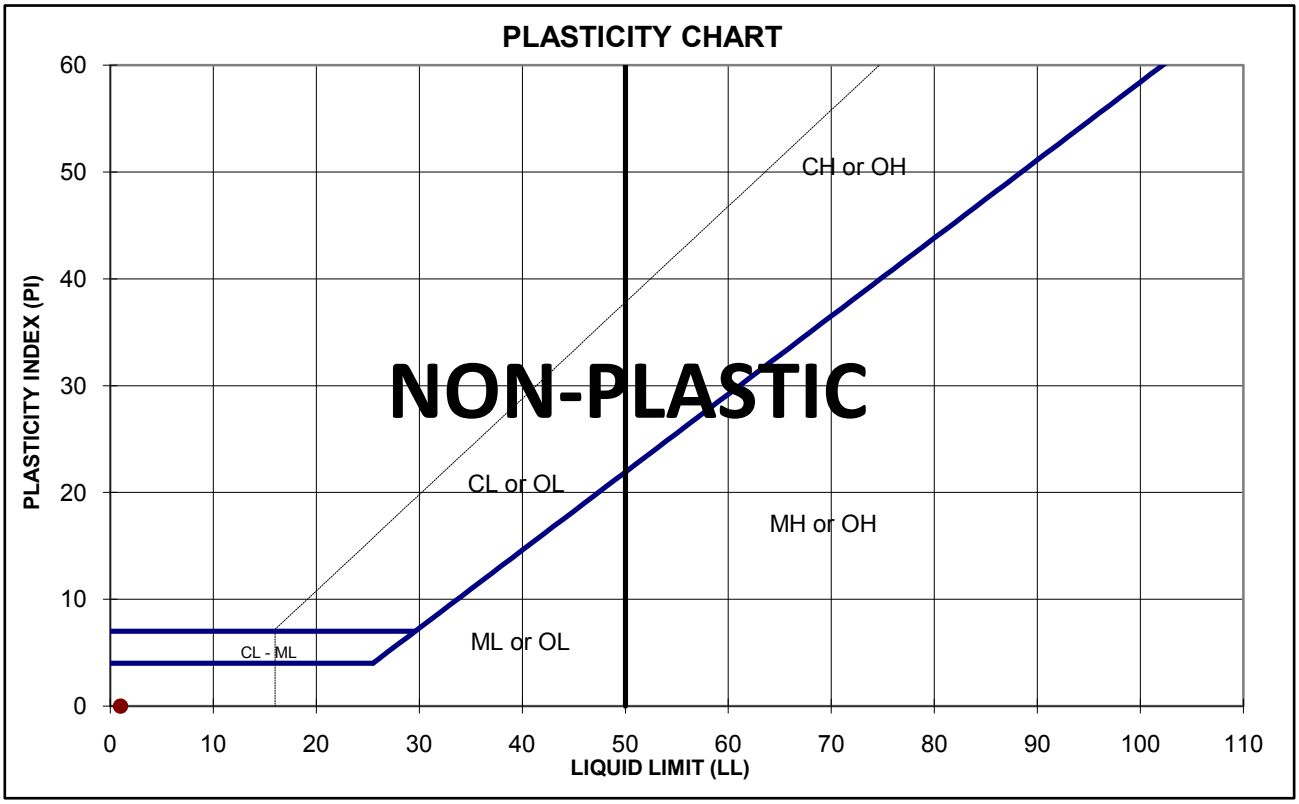
Number of Blows	--	--	--
Weight of Wet Soil & Tare (gm)	--	--	--
Weight of Dry Soil & Tare (gm)	--	--	--
Weight of Tare (gm)	--	--	--
Weight of Water (gm)			
Weight of Dry Soil (gm)			
Water Content %			

PLASTIC LIMIT (PL): --

LIQUID LIMIT (LL): --

PLASTICITY INDEX (PI): --

NOTE:

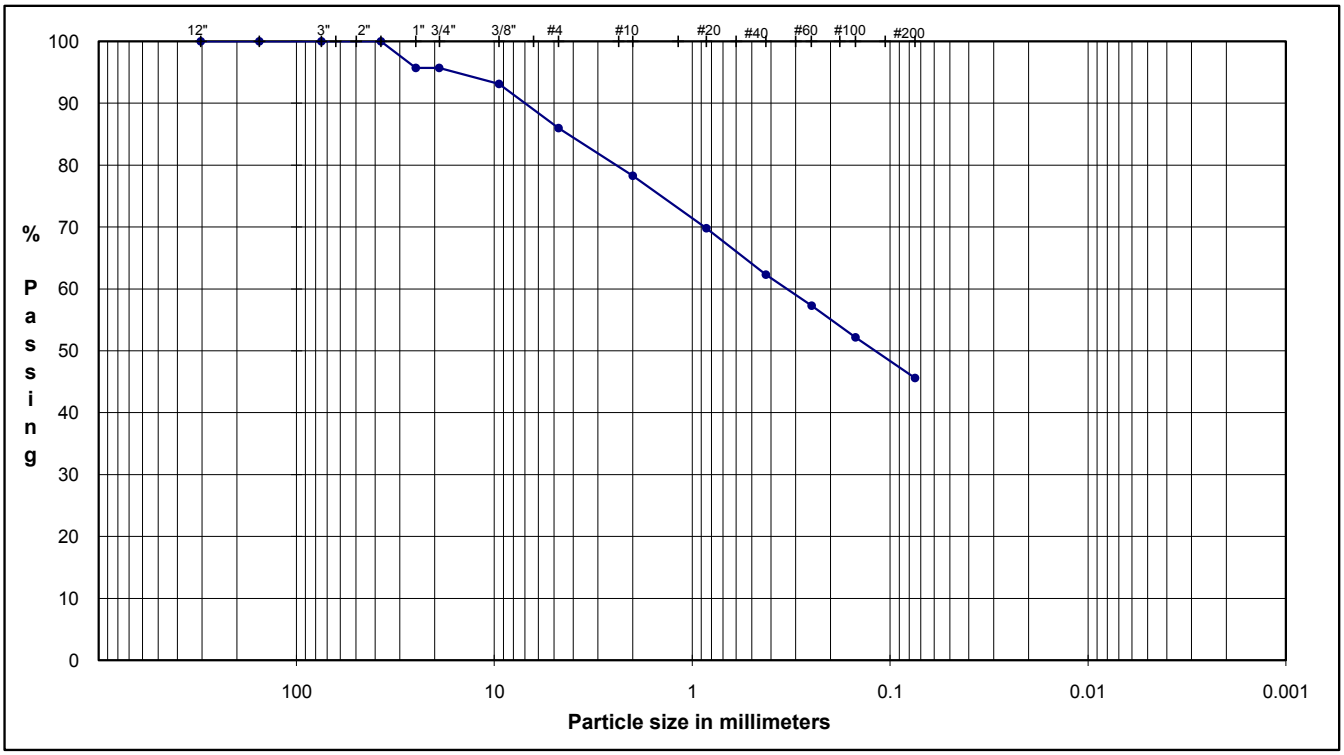


TECH	TS
DATE	2/6/09
REVIEW	MB

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

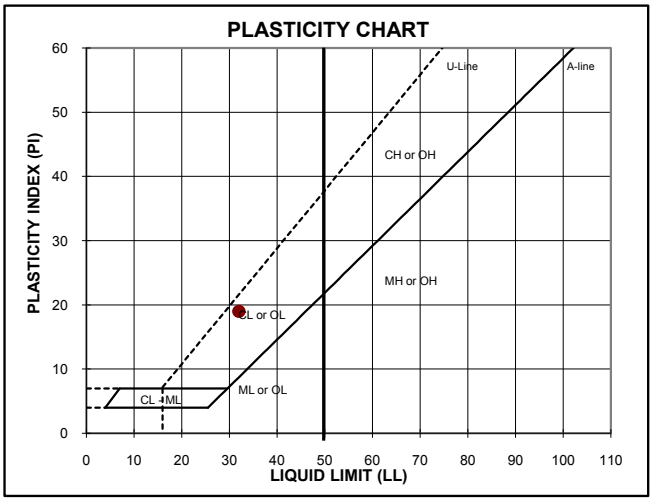
PROJECT NAME: **Hanson/Permanente Cement Quarry/CA**
SAMPLE ID: **GT3-4-08** Depth (ft) **478**
TYPE: **Core**



COBBLES	Coarse GRAVEL	Fine GRAVEL	Coarse SAND	Medium SAND	Fine SAND	Silt or Clay FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	**100.0**		
6.0"	154.2	**100.0**	Cobbles	**0.00**
3.0"	75.0	**100.0**		
3.0"	75.0	**100.0**		
1.5"	37.5	**100.0**		
1.0"	25.0	**95.7**		
0.75"	19.0	**95.7**	Coarse Gravel	**4.31**
0.375"	9.5	**93.1**		
#4	4.8	**86.0**	Fine Gravel	**9.71**
#10	2.0	**78.3**	Coarse Sand	**7.71**
#20	0.9	**69.8**		
#40	0.4	**62.3**	Medium Sand	**15.97**
#60	0.3	**57.3**		
#100	0.2	**52.2**		
#200	0.1	**45.6**	Fine Sand	**16.70**
			Fines	**45.60**



ATTERBERG LIMITS

M_c	LL	PL	PI
--	**32**	**13**	**19**

DESCRIPTION: Gray clayey sand

USCS: SC

TECH	MS
DATE	3/2/09
REVIEW	MB

ATTERBERG LIMITS

ASTM D 4318

PROJECT NAME: Hanson/Permanente Cement Quarry/CA
PROJECT NUMBER: 063-7109100
SAMPLE ID: GT3-4-08 **SAMPLE DEPTH (ft):** 478.0
SAMPLE TYPE: Core

SAMPLE PREPARATION

Wet or Dry: Dry

Minus #40 Sieve: Yes

PLASTIC LIMIT DETERMINATION

Number of Blows		
Weight of Wet Soil & Tare (gm)	26.03	25.17
Weight of Dry Soil & Tare (gm)	24.88	23.93
Weight of Tare (gm)	16.02	14.57
Weight of Water (gm)	1.15	1.24
Weight of Dry Soil (gm)	8.86	9.36
Water Content %	12.98	13.25

LIQUID LIMIT DETERMINATION

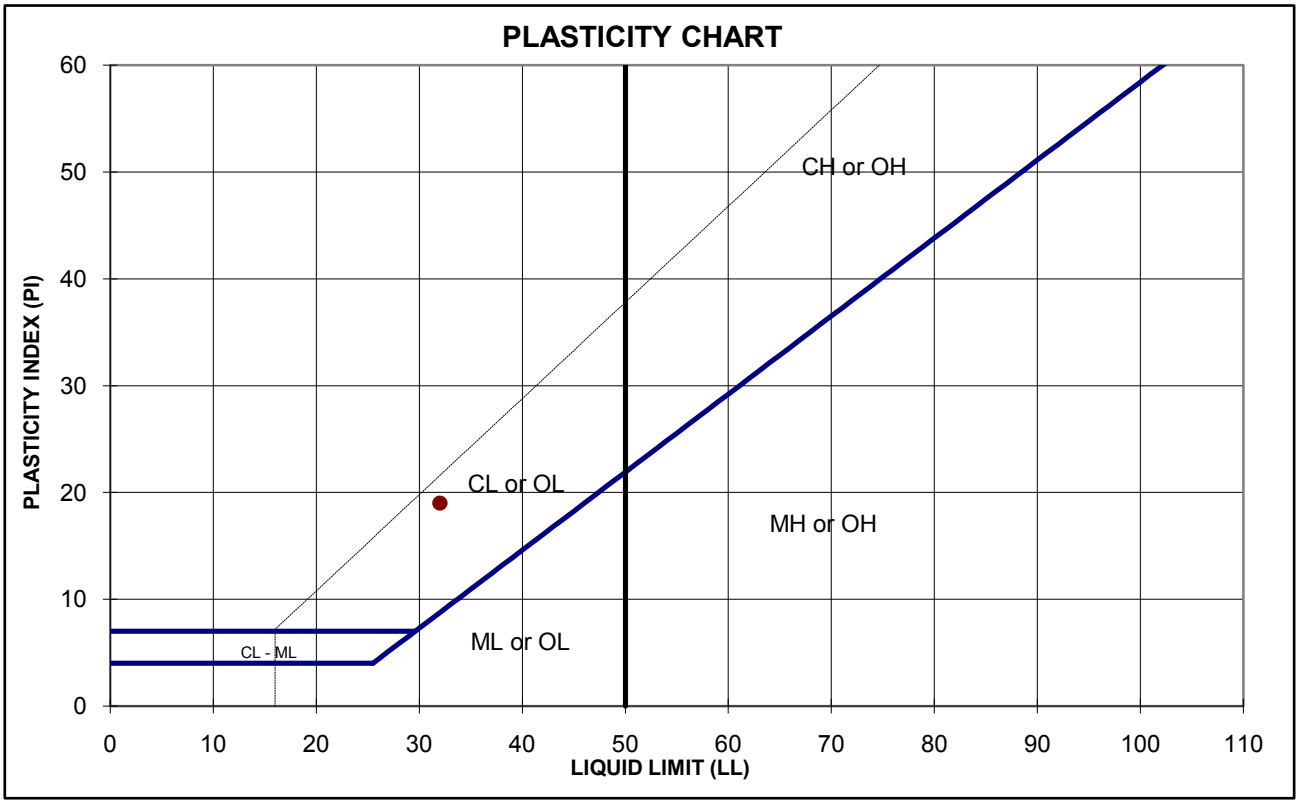
Number of Blows	16	25	35
Weight of Wet Soil & Tare (gm)	26.13	27.09	26.41
Weight of Dry Soil & Tare (gm)	23.05	24.43	23.54
Weight of Tare (gm)	14.12	15.94	13.97
Weight of Water (gm)	3.08	2.66	2.87
Weight of Dry Soil (gm)	8.93	8.49	9.57
Water Content %	34.49	31.33	29.99

PLASTIC LIMIT (PL): 13

LIQUID LIMIT (LL): 32

PLASTICITY INDEX (PI): 19

NOTE:



TECH: TS
DATE: 2/3/09
REVIEW: MB

ATTERBERG LIMITS

ASTM D 4318

PROJECT NAME: Hanson/Permanente Cement Quarry/CA
PROJECT NUMBER: 063-7109100
SAMPLE ID: GT3-5A-08 **SAMPLE DEPTH (ft):** 177.3-178
SAMPLE TYPE: Core

SAMPLE PREPARATION

Wet or Dry: Dry Minus #40 Sieve: Yes

PLASTIC LIMIT DETERMINATION

Number of Blows		
Weight of Wet Soil & Tare (gm)	25.83	25.97
Weight of Dry Soil & Tare (gm)	24.49	24.63
Weight of Tare (gm)	13.83	13.77
Weight of Water (gm)	1.34	1.34
Weight of Dry Soil (gm)	10.66	10.86
Water Content %	12.57	12.34

LIQUID LIMIT DETERMINATION

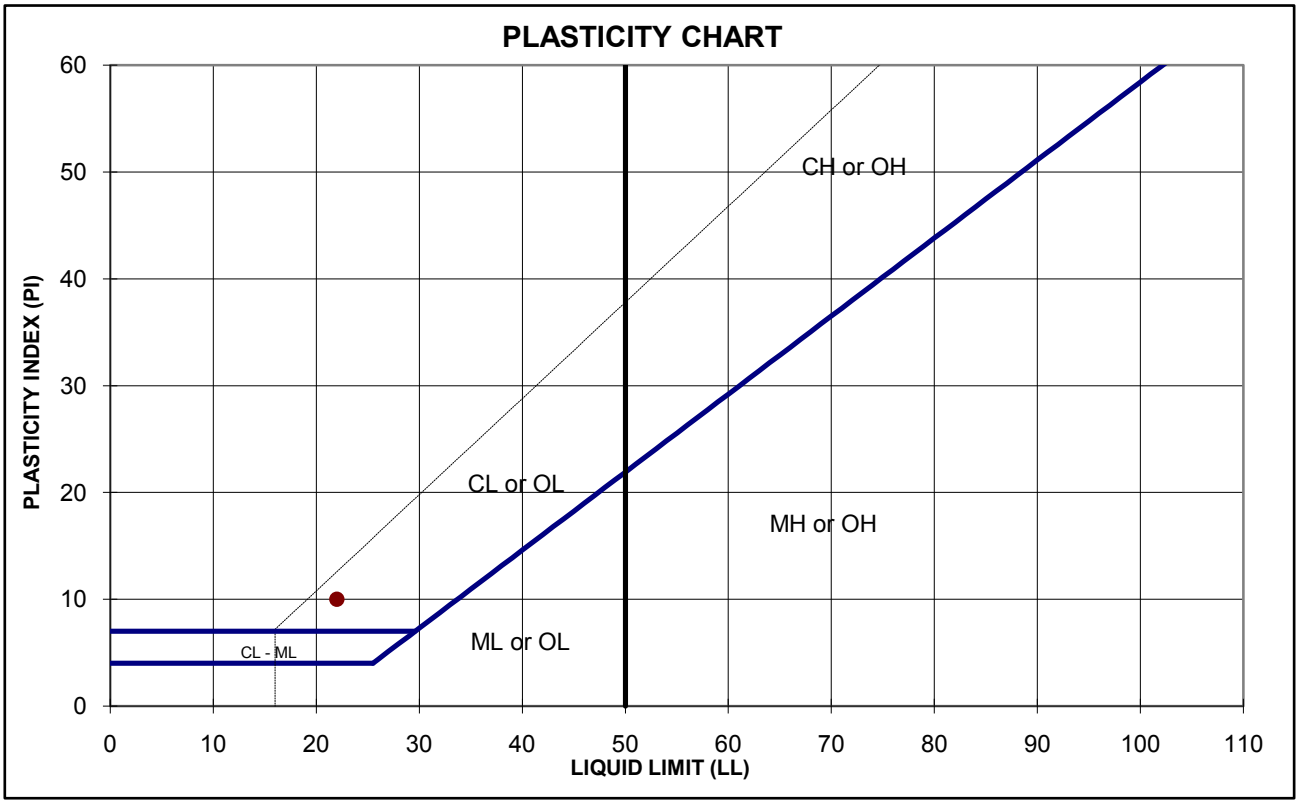
Number of Blows	18	25	32
Weight of Wet Soil & Tare (gm)	27.14	28.50	26.76
Weight of Dry Soil & Tare (gm)	24.64	26.18	24.61
Weight of Tare (gm)	13.81	15.61	13.83
Weight of Water (gm)	2.50	2.32	2.15
Weight of Dry Soil (gm)	10.83	10.57	10.78
Water Content %	23.08	21.95	19.94

PLASTIC LIMIT (PL): 12

LIQUID LIMIT (LL): 22

PLASTICITY INDEX (PI): 10

NOTE:



TECH: TS
DATE: 2/6/09
REVIEW: MB

ATTERBERG LIMITS

ASTM D 4318

PROJECT NAME: Hanson/Permanente Cement Quarry/CA
PROJECT NUMBER: 063-7109100
SAMPLE ID: GT3-6A-08 **SAMPLE DEPTH (ft):** 220.6 - 221.1
SAMPLE TYPE: Core

SAMPLE PREPARATION

Wet or Dry: Dry

Minus #40 Sieve: Yes

PLASTIC LIMIT DETERMINATION

Number of Blows		
Weight of Wet Soil & Tare (gm)	33.15	32.04
Weight of Dry Soil & Tare (gm)	31.46	30.42
Weight of Tare (gm)	21.50	20.82
Weight of Water (gm)	1.69	1.62
Weight of Dry Soil (gm)	9.96	9.60
Water Content %	16.97	16.88

LIQUID LIMIT DETERMINATION

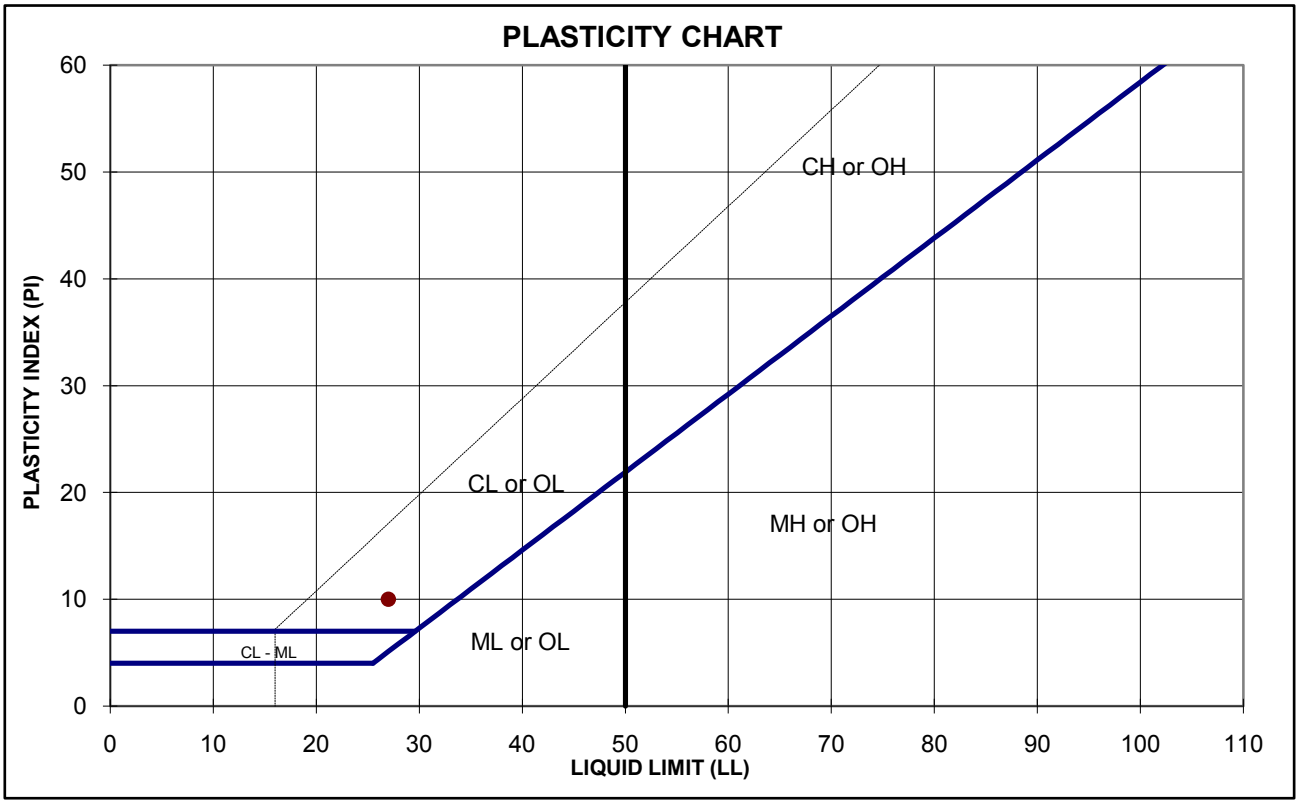
Number of Blows	19	25	31
Weight of Wet Soil & Tare (gm)	32.69	32.21	34.69
Weight of Dry Soil & Tare (gm)	30.03	29.88	31.91
Weight of Tare (gm)	20.72	21.34	21.38
Weight of Water (gm)	2.66	2.33	2.78
Weight of Dry Soil (gm)	9.31	8.54	10.53
Water Content %	28.57	27.28	26.40

PLASTIC LIMIT (PL): 17

LIQUID LIMIT (LL): 27

PLASTICITY INDEX (PI): 10

NOTE:



TECH: TS
DATE: 2/3/09
REVIEW: MB

ATTERBERG LIMITS

ASTM D 4318

PROJECT NAME: Hanson/Permanente Cement Quarry/CA
PROJECT NUMBER: 063-7109100
SAMPLE ID: GT3-6A-08 **SAMPLE DEPTH (ft):** 379.1-379.7
SAMPLE TYPE: Core

SAMPLE PREPARATION

Wet or Dry	Dry	Minus #40 Sieve	Yes

PLASTIC LIMIT DETERMINATION

Number of Blows		
Weight of Wet Soil & Tare (gm)	24.50	24.97
Weight of Dry Soil & Tare (gm)	23.03	23.53
Weight of Tare (gm)	13.61	14.04
Weight of Water (gm)	1.47	1.44
Weight of Dry Soil (gm)	9.42	9.49
Water Content %	15.61	15.17

LIQUID LIMIT DETERMINATION

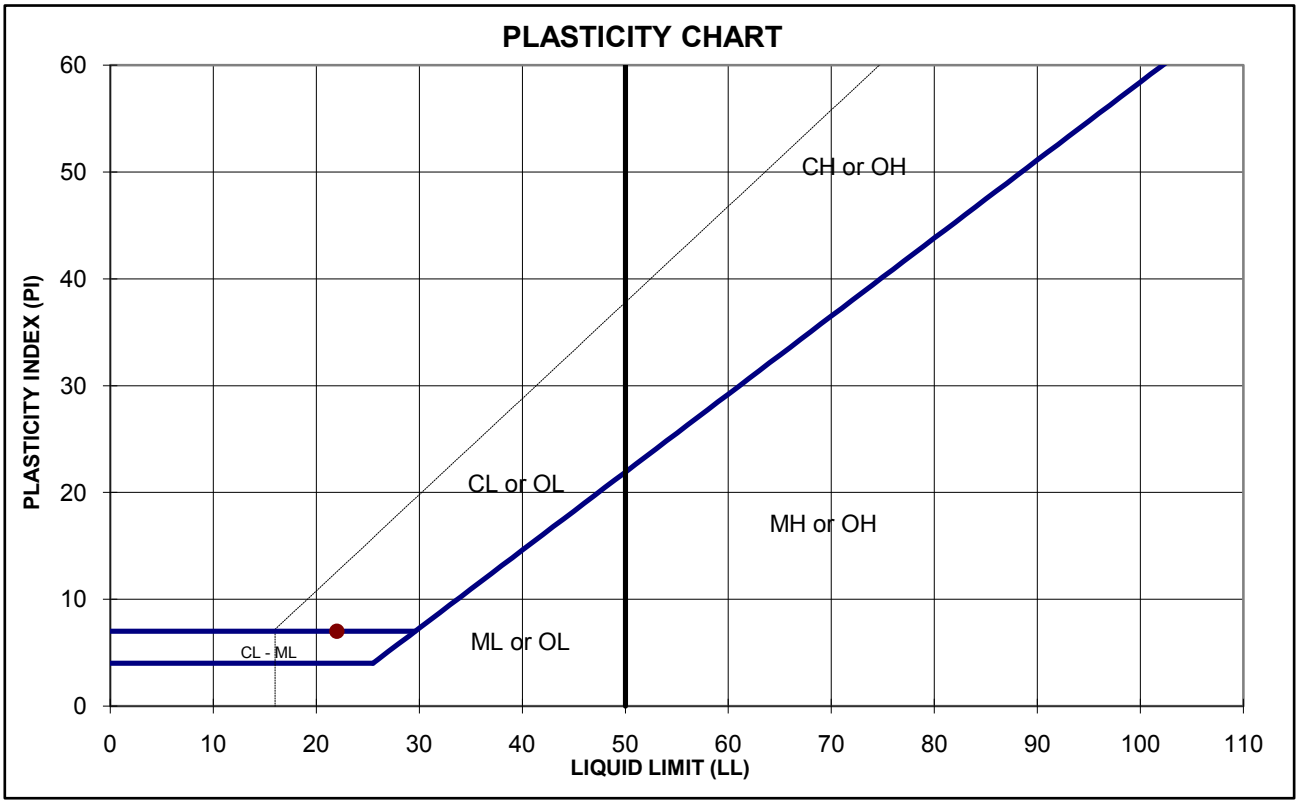
20	26	32
27.72	28.80	29.33
25.49	26.46	26.82
15.87	15.63	14.20
2.23	2.34	2.51
9.62	10.83	12.62
23.18	21.61	19.89

PLASTIC LIMIT (PL): 15

LIQUID LIMIT (LL): 22

PLASTICITY INDEX (PI): 7

NOTE:



TECH	TS
DATE	2/3/09
REVIEW	MB

ATTERBERG LIMITS

ASTM D 4318

PROJECT NAME: Hanson/Permanente Cement Quarry/CA
PROJECT NUMBER: 063-7109100
SAMPLE ID: GT4-32A-08 **SAMPLE DEPTH (ft):** 87.3 - 88
SAMPLE TYPE: Core

SAMPLE PREPARATION

Wet or Dry: Dry

Minus #40 Sieve: Yes

	PLASTIC LIMIT DETERMINATION		LIQUID LIMIT DETERMINATION	
Number of Blows			25	
Weight of Wet Soil & Tare (gm)	20.97	18.97	29.03	
Weight of Dry Soil & Tare (gm)	20.20	18.25	27.26	
Weight of Tare (gm)	15.37	13.83	21.59	
Weight of Water (gm)	0.77	0.72	1.77	
Weight of Dry Soil (gm)	4.83	4.42	5.67	
Water Content %	15.94	16.29	31.22	

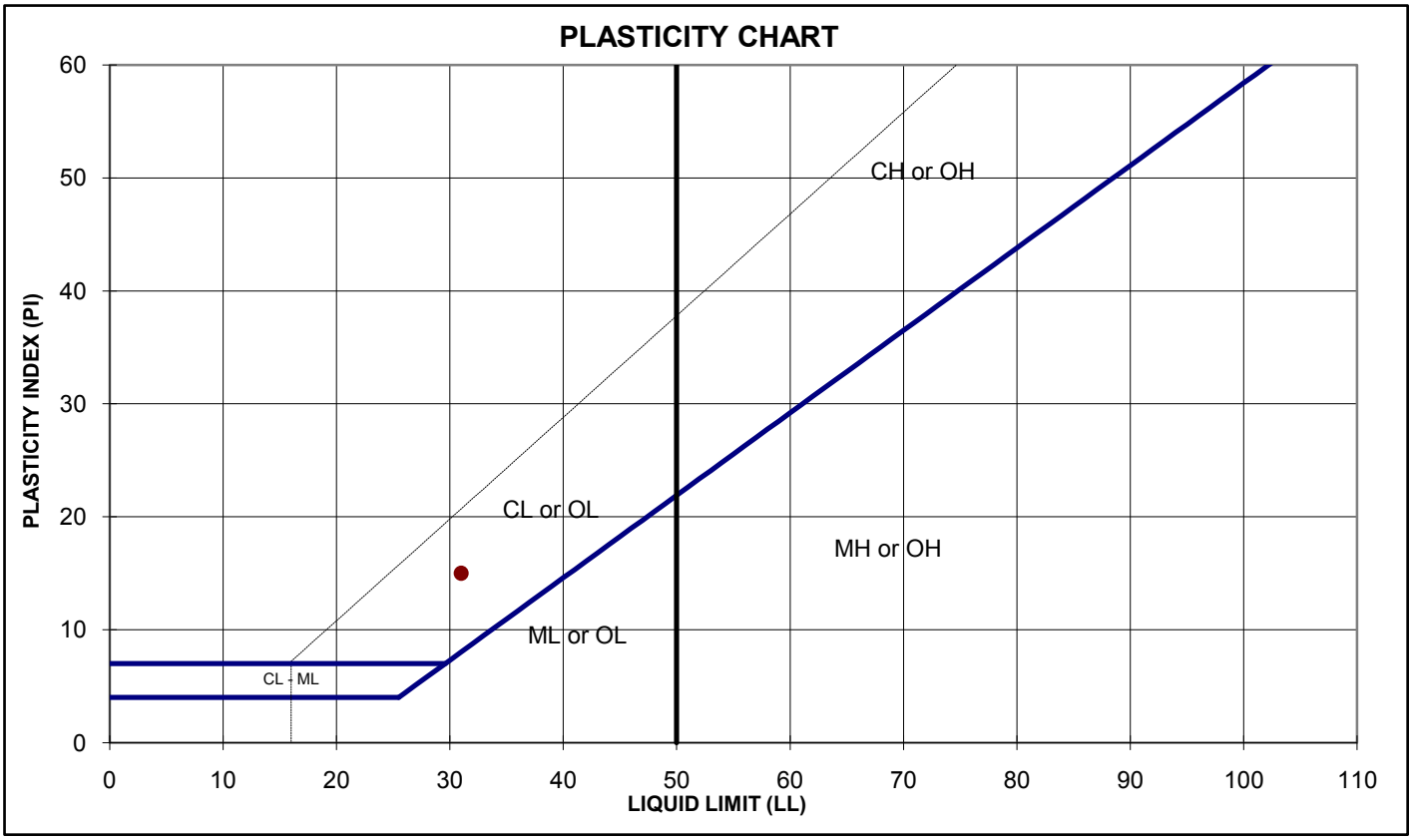
	TRIAL 1
BLOWS:	25
K VALUE:	1

PLASTIC LIMIT (PL): 16

LIQUID LIMIT (LL): 31

PLASTICITY INDEX (PI): 15

NOTE: **Insufficient material for ASTM D4318**

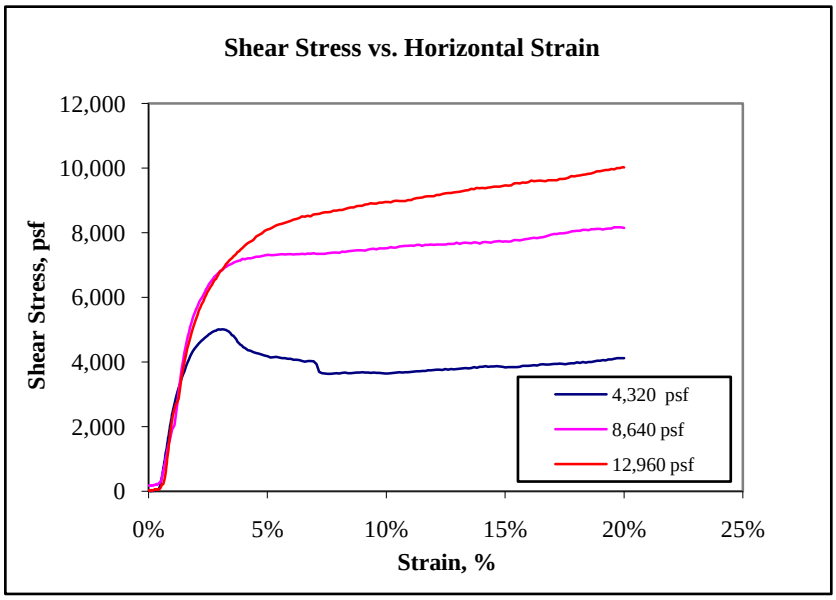


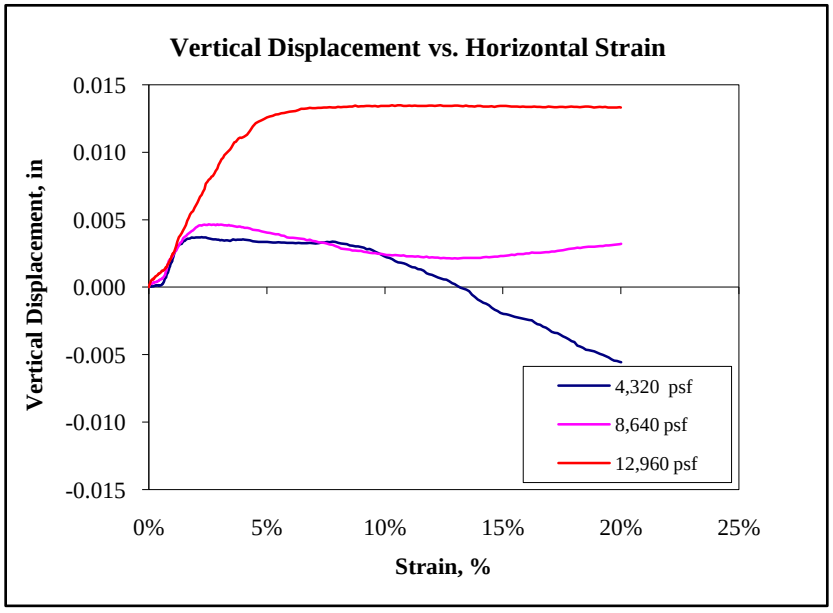
TECH: TS
DATE: 2/3/2009
REVIEW: MB

Sample #:	GT3-4-08		Sample # =	GT3-4-08		Sample # =	GT3-4-08	
Point #	1		Point #	2		Point #	3	
Load =	30	psi	Load =	60	psi	Load =	90	psi
	Initial			**Initial**			**Initial**	
Height =	2.982	cm	Height =	2.982	cm	Height =	2.982	cm
Diameter =	6.350	cm	Diameter =	6.350	cm	Diameter =	6.350	cm
Wet Weight =	214.90	g	Wet Weight =	214.90	g	Wet Weight =	214.90	g
Area =	31.7	cm^2	Area =	31.7	cm^2	Area =	31.7	cm^2
Sample Area =	4.91	in^2	Sample Area =	4.91	in^2	Sample Area =	4.91	in^2
Sample Area =	0.03	ft^2	Sample Area =	0.03	ft^2	Sample Area =	0.03	ft^2
Volume =	94.4	cm^3	Volume =	94.4	cm^3	Volume =	94.4	cm^3
Moisture Content =	9.6%		Moisture Content =	9.6%		Moisture Content =	9.6%	
Specific Gravity =	-		Specific Gravity =	-		Specific Gravity =	-	
Dry Weight of Solids =	196.08	g	Dry Weight of Solids =	196.08	g	Dry Weight of Solids =	196.08	g
Wet Density =	2.28	g/cm^3	Wet Density =	2.28	g/cm^3	Wet Density =	2.28	g/cm^3
Dry Density =	2.08	g/cm^3	Dry Density =	2.08	g/cm^3	Dry Density =	2.08	g/cm^3
Wet Density =	142.0	pcf	Wet Density =	142.0	pcf	Wet Density =	142.0	pcf
Dry Density =	129.6	pcf	Dry Density =	129.6	pcf	Dry Density =	129.6	pcf
Initial Normal Stress =	4,320	psf	Initial Normal Stress =	8,640	psf	Initial Normal Stress =	12,960	psf
Failure Normal Stress =	4,496	psf	Failure Normal Stress =	10,629	psf	Failure Normal Stress =	15,980	psf
Failure Shear Stress =	5,010	psf	Failure Shear Stress =	7,745	psf	Failure Shear Stress =	9,454	psf
Failure Strain =	3.0%		Failure Strain =	14.8%		Failure Strain =	14.9%	
Normal Stress at Large Disp. =	5,784	psf	Normal Stress at Large Disp. =	11,569	psf	Normal Stress at Large Disp. =	17,345	psf
Large-Disp. Shear Stress =	4,117	psf	Large-Disp. Shear Stress =	8,154	psf	Large-Disp. Shear Stress =	10,025	psf
Strain at Large Disp.=	20.0%		Strain at Large Disp.=	20.0%		Strain at Large Disp.=	20.0%	

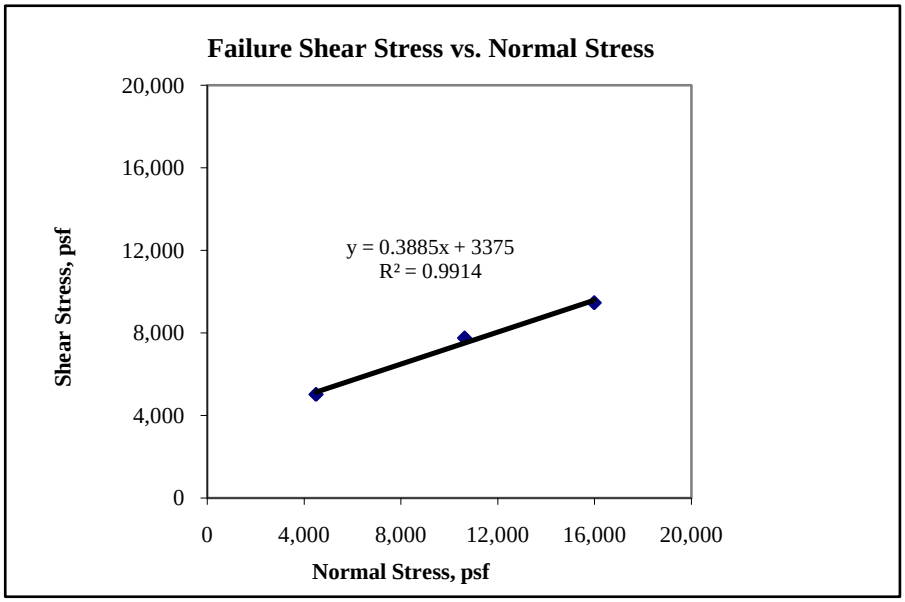
Note: -Samples were remolded to a "dense" condition at "appropriate moisture" per Rhonda Knupp's instruction.
-Samples were inundated post-consolidation and pre-shear.

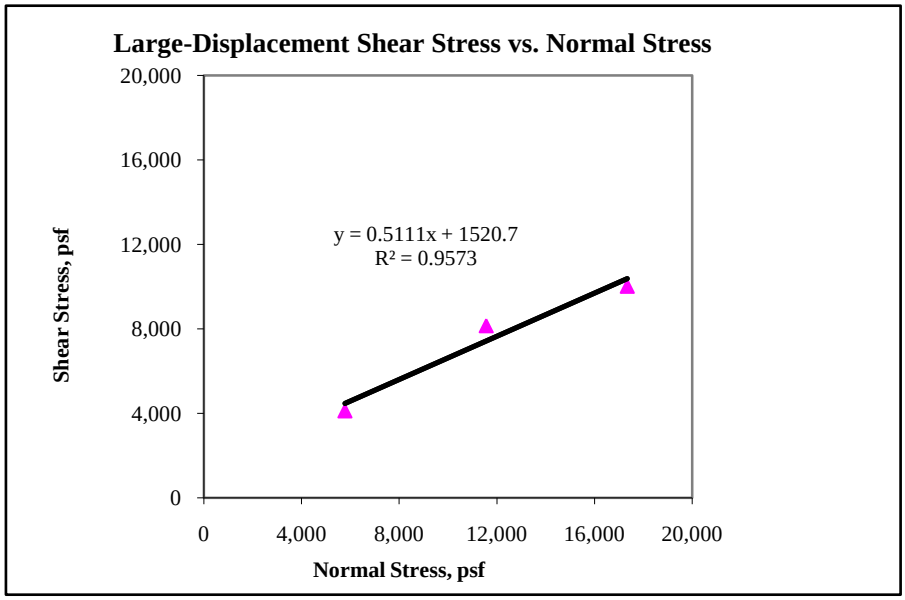
Golder Associates, Inc. **Denver, Colorado**	**Title:** **DIRECT SHEAR TEST REPORT** **SAMPLE DATA AND CALCULATIONS**			
Job Short Title: **Permanente**				
Sample Number: **GT3-4-08 @ 478'**	**Reviewed:** **JEO**	**Date:** **3/19/2009**	**Job Number:** **063-7109**	**Figure:** **1**





Golder Associates, Inc. **Denver, Colorado**				**Title:** **STRESS AND VERTICAL DISPLACEMENT VS. STRAIN**
Job Short Title: **Permanente**				
Sample #: **GT3-4-08**	**Reviewed:** **JEO**	**Date:** **03/19/09**	**Job Number:** **063-7109**	**Figure:** **2**





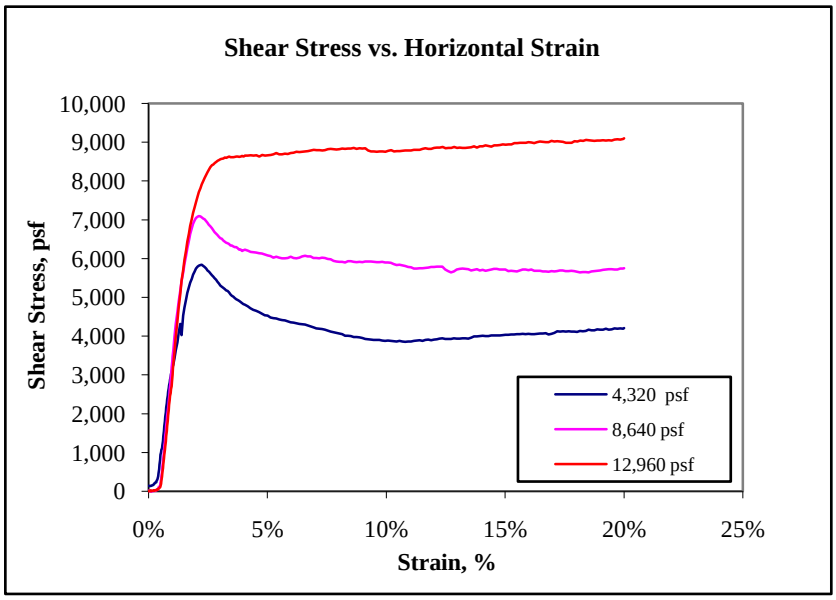
	Failure		Large-Displacement
ϕ =	21.2	degrees	ϕ = 27.1 degrees
c =	3,375	psf	c = 1,521 psf

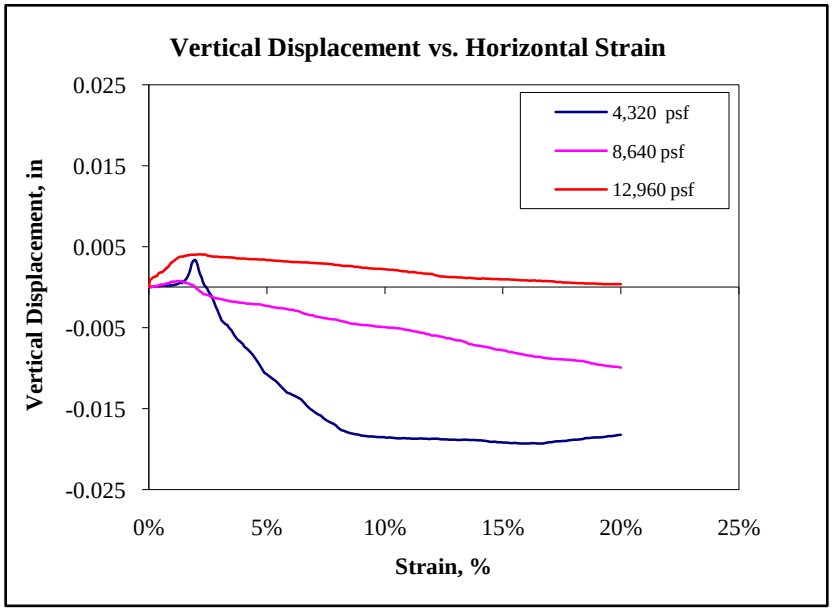
Golder Associates, Inc. **Denver, Colorado**			**Title:** **DIRECT SHEAR TESTING** **FAILURE ENVELOPES**	
Job Short Title: **Permanente**				
Sample Number: **GT3-4-08**	**Reviewed:** **JEO**	**Date:** **03/19/09**	**Job Number:** **063-7109**	**Figure:** **3**

Sample # :	GT2-1-08		Sample # =	GT2-1-08		Sample # =	GT2-1-08	
Point #	1		Point #	2		Point #	3	
Load =	30	psi	Load =	60	psi	Load =	90	psi
	Initial			**Initial**			**Initial**	
Height =	2.540	cm	Height =	2.540	cm	Height =	2.540	cm
Diameter =	6.350	cm	Diameter =	6.350	cm	Diameter =	6.350	cm
Wet Weight =	214.90	g	Wet Weight =	214.90	g	Wet Weight =	214.90	g
Area =	31.7	cm^2	Area =	31.7	cm^2	Area =	31.7	cm^2
Sample Area =	4.91	in^2	Sample Area =	4.91	in^2	Sample Area =	4.91	in^2
Sample Area =	0.03	ft^2	Sample Area =	0.03	ft^2	Sample Area =	0.03	ft^2
Volume =	80.4	cm^3	Volume =	80.4	cm^3	Volume =	80.4	cm^3
Moisture Content =	15.3%		Moisture Content =	15.3%		Moisture Content =	15.3%	
Specific Gravity =	-		Specific Gravity =	-		Specific Gravity =	-	
Dry Weight of Solids =	186.38	g	Dry Weight of Solids =	186.38	g	Dry Weight of Solids =	186.38	g
Wet Density =	2.67	g/cm^3	Wet Density =	2.67	g/cm^3	Wet Density =	2.67	g/cm^3
Dry Density =	2.32	g/cm^3	Dry Density =	2.32	g/cm^3	Dry Density =	2.32	g/cm^3
Wet Density =	166.7	pcf	Wet Density =	166.7	pcf	Wet Density =	166.7	pcf
Dry Density =	144.6	pcf	Dry Density =	144.6	pcf	Dry Density =	144.6	pcf
Initial Normal Stress =	4,320	psf	Initial Normal Stress =	8,640	psf	Initial Normal Stress =	12,960	psf
Failure Normal Stress =	4,490	psf	Failure Normal Stress =	8,883	psf	Failure Normal Stress =	13,792	psf
Failure Shear Stress =	5,844	psf	Failure Shear Stress =	7,096	psf	Failure Shear Stress =	8,671	psf
Failure Strain =	2.2%		Failure Strain =	2.1%		Failure Strain =	4.8%	
Normal Stress at Large Disp. =	5,781	psf	Normal Stress at Large Disp. =	11,557	psf	Normal Stress at Large Disp. =	17,337	psf
Large-Disp. Shear Stress =	4,211	psf	Large-Disp. Shear Stress =	5,751	psf	Large-Disp. Shear Stress =	9,102	psf
Strain at Large Disp.=	20.0%		Strain at Large Disp.=	20.0%		Strain at Large Disp.=	20.0%	

Note: -Samples were remolded to a "dense" condition at "appropriate moisture" per Rhonda Knupp's instruction.
-Samples were inundated post-consolidation and pre-shear.

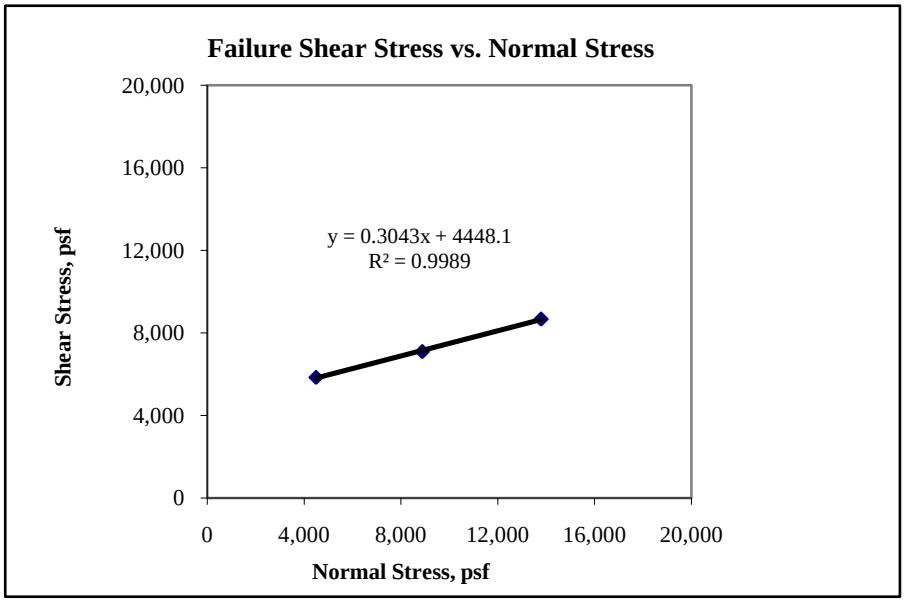
Golder Associates, Inc. Denver, Colorado	**Title:** **DIRECT SHEAR TEST REPORT SAMPLE DATA AND CALCULATIONS**			
Job Short Title: Permanente				
Sample Number: GT2-1-08 @ 158-158.8	**Reviewed: JEO**	**Date: 3/17/2009**	**Job Number: 063-7109**	**Figure: 1**

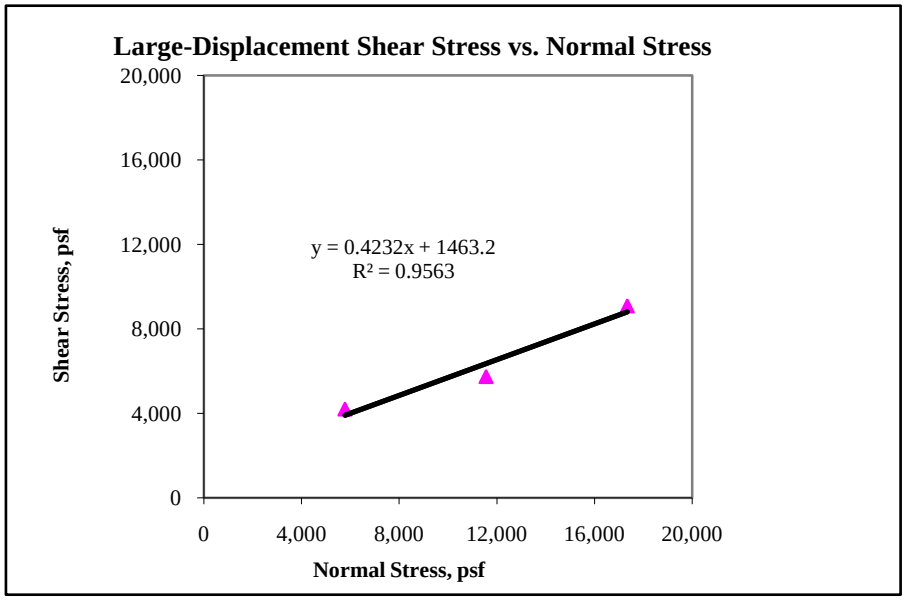




Golder Associates, Inc. **Denver, Colorado**	**Title:** **STRESS AND VERTICAL DISPLACEMENT VS. STRAIN**
Job Short Title: **Permanente**	

Sample # :	Reviewed:	Date:	Job Number:	Figure:
GT2-1-08 @ 158-158.8	**JEO**	**03/17/09**	**063-7109**	**2**





Failure		Large-Displacement	
ϕ =	16.9 degrees	ϕ =	22.9 degrees
c =	4,448 psf	c =	1,463 psf

Golder Associates, Inc. **Denver, Colorado**		**Title:** **DIRECT SHEAR TESTING** **FAILURE ENVELOPES**		
Job Short Title: **Permanente**				
Sample Number: **GT2-1-08 @ 158-158.8**	**Reviewed:** **JEO**	**Date:** **03/17/09**	**Job Number:** **063-7109**	**Figure:** **3**

APPENDIX 12.C

Seismic Displacement Calculations

Summary of Dynamic Deformation Analysis

Selected Notations			
M_w =	Moment magnitude	k_y =	Yield acceleration
a_{brk} =	Peak Horizontal Acceleration at the bedrock	U =	Dynamic deformation along critical slide surface
a_{max} =	Peak Horizontal Acceleration at the crest of slope		

Earthquake Characterization		
M_w	a_{brk}	a_{max} (Reference 1)
	g	g
7.1	0.60	0.60

Deformation Calculation (Reference 2)							
Slope Description	Comment	Failure Description	k_y	k_y/a_{max}	Slope Deformation, U (in) (Bray and Travasarou)		
			g		84% Exc.	16% Exc.	50% Exc.
South Wall (Fault Breccia)		circular	0.16	0.27	3	13	6

References:

1. Seed, H. B. and Idriss, I. M. (1982), Ground Motions and Soil Liquefaction During Earthquakes Monograph No. 5, Earthquake Engineering Research Institute, Berkeley, California.
2. Bray, J. D. and Travasarou, T. (2007), Simplified Procedure for Estimating Earthquake-Induced Deviatoric Slope Displacements Journal of the Geotechnical and Geoenvironmental Engineering, ASCE, Vol. 133, No. 4, pp. 381-392.

Note: This spreadsheet is only intended to estimate seismic deformation under the above shown earthquake events and sections.