9.0 WILDLIFE

The site is mostly disturbed from the existing imported clay processing facility. The slope area to be reclaimed contains only a small area mostly previously disturbed coastal sage scrub. The areas currently impacted and to be impacted by slope reclamation are not likely to be habitat for any sensitive wildlife species due to existing and past activities.

The study area contains typical animal species associated with coastal sage scrub communities. Species observed were: House finch (*Haemorhous mexicanus*), song sparrow (*Melopiza melodia*), white crowned sparrow (*Zonotricia leucophrys*), common raven (*Corvus corax*), great horned owl (*Bubo virginianus*), white-throated swift (*Aeronautes saxatalis*), coyote (*Canis latrans*), red-tailed hawk (*Buteo jamaicensis*), mourning dove (*Zenaida macroua*), western fence lizard (*Scelopourus occidentalis*), and Belding's orange-throated whiptail lizard (*Aspidoscelis hyperythra beldingi*).

B. RECLAMATION PLAN

Corona Clay proposes to reclaim the previously mined slope on the site to minimize impacts to the surrounding area and environment. The continued use of the imported clay materials processing facility and storage yards are the subject of CUP 3265. The objectives of this Reclamation Plan are to:

- To reclaim the previously excavated slope areas though reduction in slopes and revegetation on the project site in accordance with the County's Ordinance No. 555 and SMARA;
- To construct drainage controls to manage the slope, on-site, and surrounding drainage that enters the site;
- To reclaim the site as commercial/industrial land use (not natural open space) consistent with County land use approval under a CUP for the continued end use as a clay processing facility for clay mix products; and
- To reclaim and maintain the site as necessary to eliminate future hazards to public health and safety.

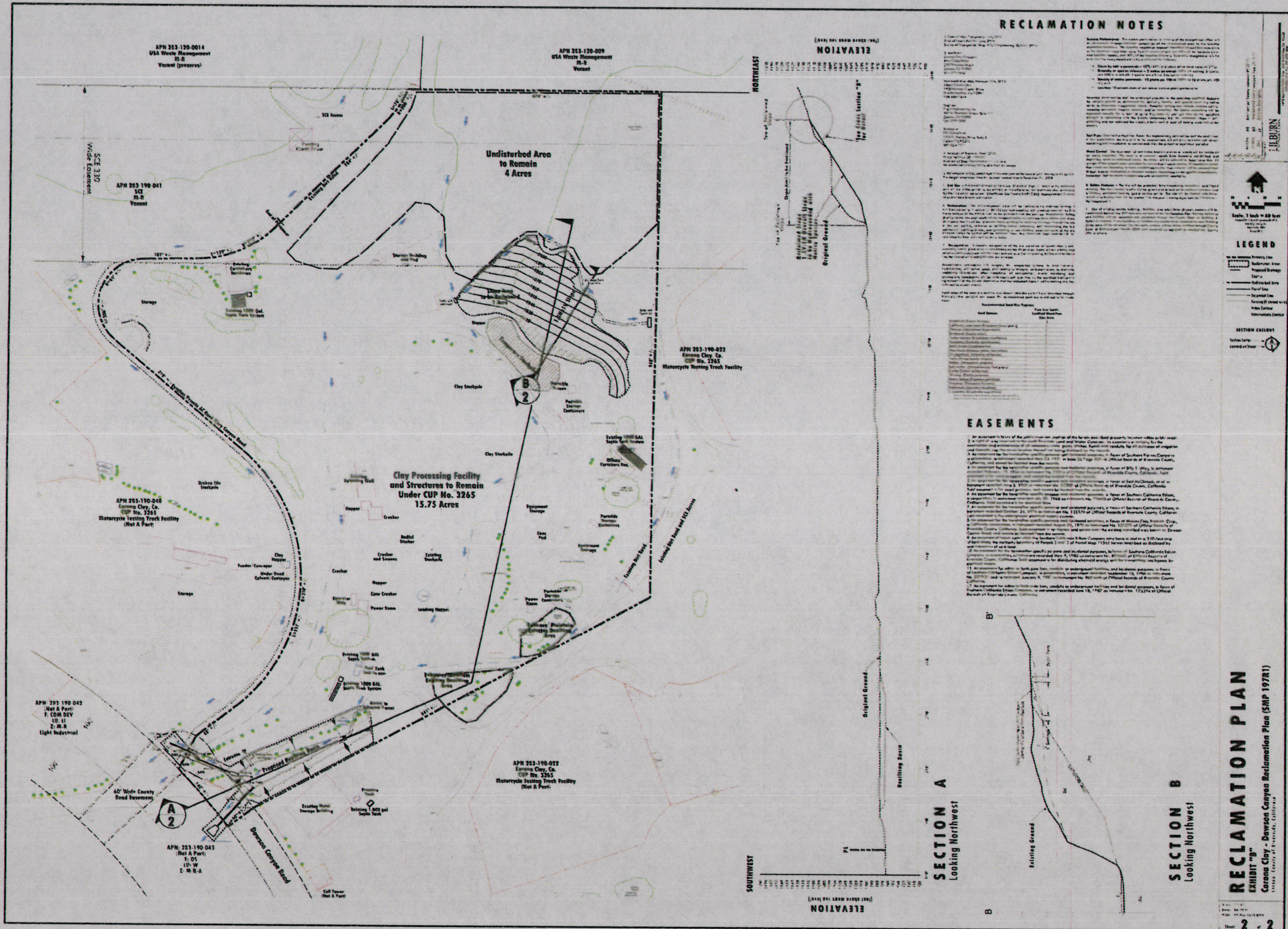
1.0 SUBSEQUENT USES

The proposed reclaimed land uses, or future land uses will be industrial/commercial land use. The owner/applicant is submitting a CUP to entitle the existing clay processing operations through the County. Final reclamation will be undertaken on approximately one acre of slopes with physical drainage controls, revegetation of the slope with a native seed mix for erosion control, and the development of an overall site drainage system including sediment and detention basins.

2.0 RECLAMATION AND SCHEDULE

Reclamation - Final physical reclamation for the slope and construction of drainage controls will be completed within one year of final approval of necessary permits followed by revegetation in the fall or early winter months after the initial winter rains. See Figure 7 for the Reclamation Plan Map and/or Sheet 2 of the Reclamation Plan. Note that the use of existing on-site buildings, facilities, and subsurface disposal systems will be conditioned through the CUP and are not part of the Reclamation Plan. Existing buildings and facilities will be inspected and permitted through the County Dept. of Building & Safety as needed. If any buildings or facilities are unable to be repaired to meet Building Code, they will be removed. On-site septic systems will be either certified through County Dept. of Environmental Health (DEH) and repaired or replaced as needed per County DEH, or closed.

The one-acre slope is near vertical at the toe and is approximately 40 to 70 feet high. The slope will be cut to 1.5H1V which has been determined to be stable per CHJ's *Slope Stability Evaluation* (see Section B.7 below). The cut will produce approximately 18,500 cubic yards of



RECLAMATION PLAN
Exhibit "B"

Dawson Canyon Reclamation Plan
Corona Clay Company
Corona, California

FIGURE 7

material that will be temporarily stockpiled at the base of the slope setback approximately 30 feet on approximately one acre and in other smaller stockpiles on-site as needed. Any available soils from the slope cut will not be salvaged due to the observed large number of non-native plant species identified by the project biologist and per County comment (see Section A.8 above). Cut material stockpiles will be clearly marked and seeded with an erosion control native seed mix or covered with larger material to limit wind and water erosion. The cut material will be used as needed to repair roads and flood control berms on the surrounding properties.

Revegetation - The disturbed reclaimed slope will be hydroseeded with an alluvial fan sage scrub seed mix of local native plant species. Commercially available certified weed-free seeds of local native plant species will be used for the revegetation and erosion control seed mix. Seeding will take place between November and February to take advantage of winter precipitation. Reclaimed areas will be clearly staked and flagged to eliminate additional disturbance. Refer to Section B.13 - Revegetation for detailed information.

Site Clean-up – The reclaimed slope and the detention basin will be constructed as shown on the Reclamation Plan. Other operations on-site related to the clay processing facility, stockpiles, equipment storage, and ancillary activities will be entitled to continue operations under the CUP.

3.0 FUTURE MINING

Reclamation, material quality, and the size of the site will limit any future mining. Corona Clay does not intend to conduct future mining operations on this site.

4.0 PUBLIC SAFETY

The excavated site will be protected from trespassing, vandalism, and illegal dumping. The top of the slope will have a perimeter down drain system with a 3-foot berm pushed up with warning signs. With completion of the reclaimed 1.5H:1V slopes, the hazardous steep slopes will be eliminated. The site's access roads will be gated and locked after hours at the southwestern entrance and a 24-hour caretaker/security guard will reside onsite. Access roads to the east will be blocked off and/or fenced. The upper slope will be fenced with three-strand wire and posted with trespass/warning signs such as ("Warning – No Trespassing").

5.0 POST-RECLAMATION

The northern and northeastern sections of the site will consist of a 1.5H:1V revegetated slope similar to the surrounding hills. The central portion of the site will be generally level with a slight gradient north to southwest. The existing clay processing plant and ancillary uses will be entitled under a CUP as approved by the County.

6.0 DRAINAGE AND EROSION CONTROLS

There are no onsite streams. The natural drainage from north to southwest will be maintained through the level area of the site. Precipitation falling directly on the site and runoff will be detained onsite by concrete down drains and draw ditch along the rim of the reclaimed slope; grading for positive drainage through the site to the two existing sediment or desilting basins; enhancing and maintaining the two sediment or desilting basins; constructing a new desilting basin just south of the site entrance areas to control off-site sediment flow; and draining "clean" water into a storm drain outlet under Park Canyon Road into the Temescal Wash floodplain as currently occurs. Down drains will be designed with appropriate energy dissipaters and splash walls/pads. Please see Figure 6 and Sheet 2 and refer to the *Drainage Study* in Appendix B.

A combination of temporary erosion control measures will be used on-site depending on actual circumstances and may include one or more of the following: blankets, mats, graded berms, sand and/or gravel bags, fiber rolls, filter cloth, and check dams.

7.0 SLOPES AND SLOPE TREATMENT

The final grades of the excavated reclaimed slopes will average about 1.5H:1V. Based on geologic field observations and evaluation and the results of slope stability calculations as assessed by CHJ Engineering (refer to Appendices A and A1), the reclaimed slopes inclined at 1.5H:1V meet or exceed County and Office of Mine Reclamation (OMR) criteria for slope stability, provided the recommendations contained in this report are implemented. Static and seismic factors of safety (fs) in excess of 1.5 and 1.1 are indicated for the modeled rock slope (static fs = 1.66 and seismic fs = 1.17; refer to Appendix A1 for calculations). A flatter slope such as a 1.5H:1V would be approximately 100 feet in height and is considered to be kinematically stable.

Benches are not considered necessary for the 1.5H:1V slope. Benches are not required under Building Code for the reclaimed mine slopes nor are they considered to be necessary for adequate stability of the slope. Given the fact that the finished slope face will not be planar due to fill removal, inclusion of benches and provision of drainage for them may not be practical for this slope.

The rock mass within the proposed slope area is generally hard, competent and capable of forming stable slopes at the proposed gradients for reclamation. The rock structure includes joint systems that have been characterized by mapping and analysis to yield suitably stable rock slopes. CHJ did not observe geologic structures that exhibit exceptional continuity or adverse geometry with regard to the planned slope aspect and that contain significant clay linings, water seepage or other potentially deleterious conditions during site mapping within the slope area.

Recommendations contained in the CHJ report to be implemented include:

- Scaling of loose or dislodged blocks from bench face cuts should be performed near the completion of final slope excavation at any construction level. This is necessary as portions of finished slopes may not be accessible to scaling equipment with progression of excavation.
- Fill associated with past benching/excavating/road building activities is present at the top of the existing steep slope and along existing bench surfaces. This material is susceptible

to shallow failure when exposed in slope faces. The proposed reclaimed slope design should provide for removal of this fill where present in reclaimed slopes. Fill material adjacent to the top of the slope shall be removed a minimum horizontal distance of 5 feet and shall be cut back to 3H:1V or flatter. The as-built slope face shall be moisture conditioned and track rolled with a D-6 or larger dozer or similar piece of equipment. This is illustrated in Figure 8, Cross Section B.

- Slopes shall be planted with appropriate drought-resistant vegetation that does not require an irrigation system (see Section 13 below).

The top of slope will also have an interceptor channel and down drain to limit slope erosion. The slopes will be final graded parallel to the slope (horizontal) in bedrock. The slopes will then be hydroseeded with an approved seed mix of native plant species. There will be no remaining fill on the reclaimed face of the slope that could erode. In addition, the designed on-site drainage takes into account the slope runoff. If needed, fiber rolls or straw bales will be used to address slope erosion.

8.0 PIT AREAS AND EXCAVATIONS

There are no existing, planned, or reclaimed pit areas. The one-acre over-steepened slope will be recontoured to a stable 1.5H:1V slope ratio.

9.0 PONDS, RESERVOIRS, TAILINGS, WASTES

There will be no ponds, reservoirs, tailings piles or other hazardous wastes on-site after reclamation. Hazardous materials related to the ongoing clay processing facility in the form of fuels and engine fluids will be entitled under the CUP.

10.0 CLEAN-UP

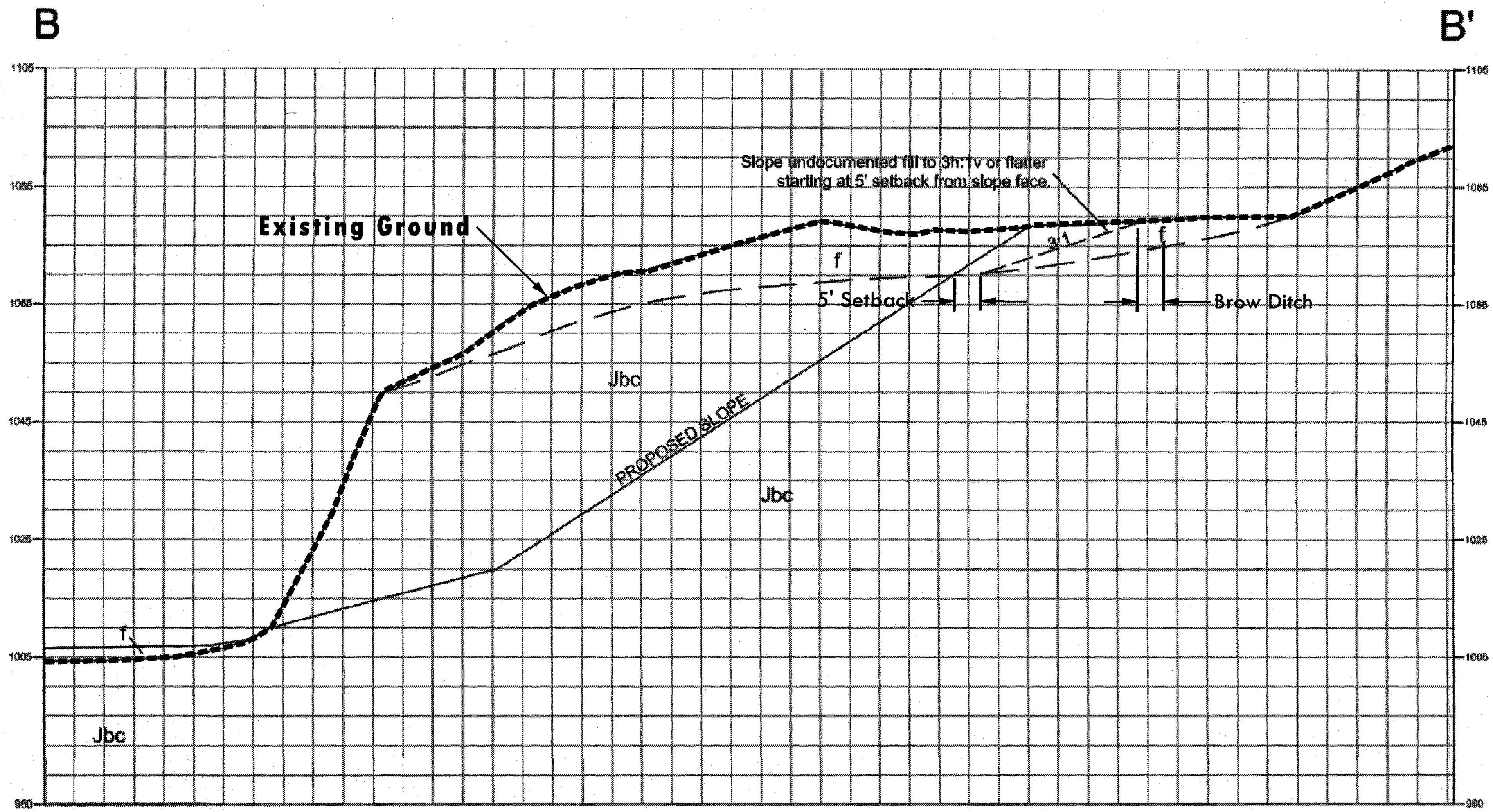
Corona Clay will comply with the requirements of the California Industrial Storm Water Permit by implementing a Stormwater Pollution Prevention Program (SWPPP) that incorporates Best Management Practices (BMPs) and a Spill Prevention, Control, and Counter-measure (SPCC) plan. Any fuel or oil spills, or other contaminants will be cleaned up immediately pursuant to the SPCC plan.

11.0 CONTAMINANTS

Corona Clay will comply with the requirements of the California Industrial Storm Water Permit by implementing a SWPPP that incorporates BMPs and a SPCC plant throughout the operation of the mining and processing activities.

12.0 SOILS AND FINE TEXTURED WASTE

There will no fine textured waste remaining on the reclaimed slope after reclamation.



CROSS SECTION "B"

Dawson Canyon Reclamation Plan
Corona Clay Company
Corona, California

FIGURE 8

Source: CHJ, 2016

LILBURN CORPORATION

13.0 REVEGETATION

Hernandez Environmental Services collected vegetation data and prepared a revegetation plan for the site. Please refer to Appendix D for detailed revegetation information summarized below.

Successful revegetation of the site would be achieved when a self-sustaining native plant cover is established on the slope area meets success criteria and controls erosion consistent with the site's end use as a clay processing facility. SMARA allows reclamation standards that "are consistent with the planned or actual subsequent use or uses of the mining site." [SMARA Section 3700(a)(2)] The reclaimed slope will be immediately adjacent to this industrial use and should resemble and blend into the natural surrounding hill side environment. Since the overall end use of the site is the continuation of an existing industrial use, the slope is not being reclaimed to natural open space but to a stable slope with erosion controls consistent with the end use.

Physical reclamation procedures will include cutting back the over-steepened slope to achieve planned 1.5H:1V slopes, roughening the compacted surface to hold moisture, hydroseeding with native seeds, and staking or flagging reclaimed areas to eliminate additional disturbance. After completion of revegetation, annual monitoring and appropriate remediation will be undertaken until such time as the qualified biologist in agreement with the County, determines that the reclaimed slope is self-sustaining and has achieved its success criteria and goal of limiting wind and water erosion consistent with the end use of an industrial site.

The slope will be recontoured as shown on the reclamation plot plan and the seed mix shall be applied to the slopes as a hydroseed spray. Application of the seed mix shall be completed within the period from November through February after an initial rain event of at least one inch. An approved commercial fertilizer at the appropriate rate shall be applied to the seeded area in the hydroseed mix if deemed appropriate by the qualified biologist. No irrigation will be undertaken as excess water tends to promote weed growth and the plant/seed mix consists of drought-tolerant native plant species adapted to the local climate. Natural revegetation from the surrounding hill sides will also aid in revegetating the slope area.

The recommended seed mix is outlined in Table 2 which may be amended due to seed availability and seed costs. Quick-growing, shallow-rooted species will be included in the seed mix to provide short-term erosion control. By providing short-term erosion control, more favorable growing conditions will be created for climax species that will provide long-term erosion control.

Success Performance – The success performance or criteria of the revegetation effort will be determined through statistical comparison of the revegetated area to the baseline vegetation inventory. The baseline vegetation transects identified alluvial fan sage scrub as the dominant vegetation type. Data from these transects measured the average absolute native shrub cover at 27%; the native shrub density at 26 shrubs per 100 square meters (m^2); and shrub diversity at an average of 2.8 per 100 m^2. (Note that half of the plant cover and 90% of the shrub density consisted of invasive non-native mustard plants.)

Table 2
Recommended Seed Mix (Typical)

Seed Species	Pure Live Seeds; Certified Weed-Free (Lbs/Acre)
Brittlebush (*Encelia farinose)*	2
California buckwheat *(Eriogonum fasciculatum)*	4
Chamise (*Adenostoma fasciculatum)*	2
Brittlebush *(Encelia astoni)*	2
Yerba sanctum *(Eriodictyon crassifolium)*	1
Penstemon (Keckiella antirrhinoides)	1
Scale broom (*Lepidospartum)*	1
Deerweed (*Acmispon glaber brevialatus)*	1
CA sagebrush *(Artemisia californica)*	1
Yucca *(Hesperoyucca whipplei)*	1
Mallow (*Malacothrix glabrata)*	1
Bush mallow *(Malocothamnus fasciculatus)*	1
Croton (*Croton californicus)*	1
Winecup (*Clarkia purpurea)*	1
Miners lettuce (*Claytonia perfoliata)*	1
Pincushion *(Chaenactis fremontii)*	1
Fiddleneck (*Amsinckia ttessellata)*	1
Cryptantha (*Cryptantha augustifolia)*	1

Source: Hernandez Environmental (Appendix D); May 2016.
Seed list typical. May vary due to seed availability and costs.

For alluvial fan sage scrub communities, typical success criteria are 45% of the baseline cover and baseline density; and 40% of the baseline diversity. Therefore, successful revegetation will be met when the revegetated areas have achieved the following:

- **Cover by native perennials – 12%** (45% of existing native shrub cover of 27%);
- **Diversity or species richness – 2 native perennials** (45% of existing 3 species per 100 m^2 is actually 1 species but will use 2 as success criteria);
- **Density of native perennials - 12 plants per 100 m^2** (40% of 26 plants per 100 m^2); and
- **Less than 10 percent cover of non-native invasive plant species cover**.

Perennial plant species shall be evaluated annually by the consulting qualified biologist for relative growth as determined by diversity, density, and ground cover by native plants and grasses to determine revegetation results. Remedial actions may include erosion control, removing non-native invasive species, and/or reseeding. The above procedure will be repeated annually for a total of up to five years or until such time as the qualified biologist in agreement with the County determines that the reclaimed slope is self-sustaining and has achieved the success criteria and its goal of limiting wind and water erosion.

Non-Native Invasive Species (Weed) Control - Non-native invasive species (weed) control is necessary to reduce or eliminate the occurrence of non-native plant species that may invade the site where active and natural revegetation is taking place. Non-native invasive species can compete with native plant species for available moisture and nutrients and affect revegetation efforts.

Many of these non-native invasive species are common and may be difficult to control. Weeds at the site may include some or all of the following: black mustard, mustard, common mustard, Russian thistle, ripgut brome, downy chess, tacolote, bull thistle, horehound, filaree, cheeseweed, tree tobacco and slim oats.

The occurrence of non-native invasive species will be monitored by visual inspection. The goal is to prevent non-native invasive species from becoming established and depositing seeds in the reclaimed areas. No areas will be allowed to have more than 10 percent of the ground cover provided by non-native invasive species. If inspections reveal that weeds are becoming or have established on site, then removal will be initiated. Inspections shall be made in conjunction with revegetation monitoring.

Non-native invasive species removal will be accomplished through manual, mechanical or chemical methods depending on the specific circumstances. Small numbers of non-native invasive shrub species will be manually removed (chopped) and the stumps sprayed with an approved weed killer such as Round-Up. Smaller plants (wild oats and bromes) that cover more area may be sprayed or chopped by hand. Reports of inspections and weed control implementation shall be part of the annual revegetation monitoring and kept on file by the operator.

Test Plots – Due to the short time frame for implementing reclamation, the small area to be revegetated, and the industrial end use (not open space), the one acre slope to be revegetated will act as a test plot with annual monitoring and remediation as recommended by the project revegetation specialist.

14.0 MONITORING AND MAINTENANCE

Revegetation Monitoring and Maintenance - The operator's qualified biologist will assess the revegetation and seeding results on the disturbed slope area until such time as the qualified biologist in agreement with the County determines that the reclaimed slope is self-sustaining and has achieved the performance goals above. The monitoring plan will annually monitor and assess vegetation growth and erosion control for up to five years or until the goals above are achieved. Appropriate remediation measures including weed control, reseeding, and erosion control will be implemented as needed. A monitoring report submitted by the operator to the County will be part of the overall compliance with conditions.

The revegetated areas will have perennial plant density, diversity, and cover data collected as well as grass, herb and non-native plant cover. Vegetative cover is defined as "the vertical projection of the crown or shoot area of a species to the ground surface expressed as a percentage of the reference area" (SMARA 1975). To evaluate vegetative conditions, 50-meter point-intercept transects will be established at random locations within slope reclamation area.

Raw data will be recorded on a standard form, and copies of these submitted in an annual report. Photo documentation stations will also be established for a number of plots and transects to visually document annual vegetation changes and community development. Representative photographs will be taken during each assessment.

Reclamation efforts will be monitored pursuant to SMARA requirements and according to the County approved Reclamation Plan. The operator will be required under SMARA (Public Resources Code Section 2207) to submit an annual mine report to the County and the State Department of Conservation. SMARA (Section 2774(b)) requires the lead agency (the County) to conduct an inspection of the mining operation within six months of receipt of the required Annual Report. In addition, the operator will submit an annual Status Report to the County to update the current and planned reclamation activities on-site.

15.0 RECLAMATION ASSURANCE

Corona Clay assures reclamation of the site in the form of a bond, letter of credit, or other appropriate amount guarantee payable to the County of Riverside and the California Department of Conservation. The financial assurance cost estimate (FACE) will be approved for the implementation of this proposed Reclamation Plan and will be reviewed and adjusted annually to account for, inflation, and reclamation of lands accomplished in accordance with the approved Reclamation Plan (SMARA, Section 2773.1 (a)(3). Upon approval of the project and FACE, Corona Clay will provide the County an assurance mechanism to guarantee reclamation of the site in the form of a bond, letter of credit, or other appropriate amount guarantee.

Statement of Responsibility

I, the undersigned, hereby agree to accept full responsibility for reclamation of all mined lands as described and submitted herein and in conformance with the applicable requirements of Articles 1 and 9 (commencing with Sections 3500 et. seq. and 3700 et. seq., respectively) of Chapter 8 of Division 2 of Title 14 of the California Code of Regulations, the Surface Mining and Reclamation Act commencing with Section 2710 et. seq., and with any modifications requested by the administering agency as conditions of approval.

Signed this______________ day of ___________, 2016 by

Signature ________________________Title ______________________

REFERENCES

Geologic Feasibility Investigation, Assessor's Parcel Numbers 283-290-019 and -022, Corona Area, Riverside County, CA. LOR Geotechnical Group, Inc., dated December 19, 2006.

Geologic Map of the Lake Mathews 7.5' Quadrangle, Riverside County, California. Douglas M. Morton and F. Harold Weber, USGS Open File Report 01-479, 2001.

Initial Drainage Study for Corona Clay Temescal Canyon. K & A Engineering, Inc. March 2015.

Soil Survey of Western Riverside Area California. U.S. Department of Agriculture, Soil Conservation Service, 1971.

Slope Stability Report. CHJ Geotechnical, March 2015.

Surface Mining and Reclamation Act (SMARA). California Department of Conservation, Office of Mine Reclamation, 2014.

Update of Mineral Land Classification For Portland Cement Concrete-Grade Aggregate in the Temescal Valley Production Area, Riverside County. Russell V. Miller and Lawrence L. Busch, Special Report 231, California Geological Survey, Department of Conservation, 2014.

Western Riverside County Multiple Species Habitat Conservation Plan. County of Riverside, Dudek & Associates, approved June 17, 2003.

ACRONYMS

BACT	Best available control technology (for control of air emissions)
BMP	Best Management Practices
CARB	California Air Resources Board
CEQA	California Environmental Quality Act
CY	Cubic yards
FESA	Federal Endangered Species Act
I-15	Interstate 15
mph	miles per hour
MSHCP	Multi-Species Habitat Conservation Plan
msl	mean sea level
NPDES	National Pollutant Discharge Elimination System
RWQCB	Regional Water Quality Control Board
SCAQMD	South Coast Air Quality Management Plan
SMARA	Surface Mining and Reclamation Act
SPCC	Spill Prevention, Control, and Counter-measure
SWPPP	Stormwater Pollution Prevention Program
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

APPENDIX A
SLOPE STABILITY REPORT
PREPARED BY CHJ CONSULTANTS
MARCH 2015

CHJ Consultants
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15345 Anacapa Road, Suite D, Victorville, CA 92392 ◆ Phone (760) 243-0506 ◆ Fax (760) 243-1225
77-564A Country Club Drive, Suite 122, Palm Desert, CA 92211 ◆ Phone (760) 772-8234 ◆ Fax (909) 503-1136

March 13, 2015

Corona Clay Company
22079 Knabe Road
Corona, California 92883
Attention: Mr. Craig Deleo

Job No. 15112-8

Dear Mr. Deleo:

This letter transmits four copies of our slope stability evaluation for the area of concern at Corona Clay, located at Park Canyon Road and Clay Canyon Road in Riverside County, California.

We are pleased to provide geotechnical services for this project. If you have questions or comments concerning this report, please contact this firm at your convenience.

Respectfully submitted,
CHJ CONSULTANTS

Jay J. Martin, E.G.
Vice President

JJM:lb

Distribution: Corona Clay (4)

SLOPE STABILITY EVALUATION
AREA OF CONCERN AT CORONA CLAY
PARK CANYON ROAD AND CLAY CANYON ROAD
RIVERSIDE COUNTY, CALIFORNIA
PREPARED FOR
CORONA CLAY COMPANY
JOB NO. 15122-8

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March 13, 2015

Corona Clay Company
22079 Knabe Road
Corona, CA 92883
Attention: Mr. Craig Deleo

Job No. 15112-8

Dear Mr. Deleo:

Attached herewith is the slope stability evaluation for the area of concern at Corona Clay, located at Park Canyon Road and Clay Canyon Road in Riverside County, California.

This report was based upon a scope of services generally outlined in our proposal, dated February 23, 2015, and other written and verbal communications.

We are pleased to provide geotechnical services for this project. If you have questions or comments concerning this report, please contact this firm at your convenience.

Respectfully submitted,
CHJ CONSULTANTS

Jay J. Martin, E.G.
Vice President

JJM:lb

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RIVERSIDE COUNTY, CALIFORNIA
PREPARED FOR
CORONA CLAY COMPANY
JOB NO. 15122-8

INTRODUCTION

We have prepared a slope stability evaluation for the area of concern at the Corona Clay Company facility in Riverside County, California. The area of concern includes an existing steep bedrock slope in the northern portion of the facility, which is proposed to be flattened to a more stable inclination. Our services included evaluation of kinematic and global slope stability for suitable rock slopes under Surface Mining and Reclamation Act (SMARA) criteria for reclaimed slopes. The purposes of our evaluation were to evaluate the site conditions and provide recommendations for configuration of suitable reclamation slopes with regard to kinematic and limit-equilibrium stability.

To orient our evaluation, we were provided with the following documents:

- Corona Clay Grading Exhibit – Current Conditions, prepared by K &A Engineering at 100 scale, dated January 26, 2015. This map shows the "area of concern" that includes the oversteepened slope.

- Corona Clay Grading Exhibit – 1.5:1 Slope Grading, prepared by K &A Engineering at 40 scale, dated February 23, 2015, 2015. This map shows one potential configuration for the finished slope. Steeper or flatter configurations may be utilized for the final slope.

- Black and white orthophoto aerial image of the facility dated October 3, 2014.

The approximate location of the "area of concern" (site) is shown on the attached Geologic Index Map (Enclosure A-1). The results of our evaluation, together with our conclusions and recommendations, are presented in this report.

SCOPE OF SERVICES

The scope of services provided during this slope stability evaluation included the following:

- Review of published geologic mapping
- Examination of Riverside County Flood Control and private source aerial imagery dated 1963, 1974, 1980, 1990, 1995 and 2014
- Examination of Google Earth aerial imagery flown between 1994 and 2015
- Site-specific geologic mapping and collection of geologic structural data
- Collection and laboratory testing of large rock samples
- Evaluation of site seismic setting and development of a suitable design acceleration coefficient
- Geologic (kinematic) evaluation of suitable rock slopes and global slope stability calculations of suitable rock slopes under static and seismic conditions
- Evaluation of geologic hazards including seismic shaking levels
- Evaluation of stability results and preparation of a report summarizing our findings and providing recommendations for final slope reclamation

SITE DESCRIPTION

Corona Clay is located along the east side of Temescal Valley and occupies a portion of the relatively planar valley floor and the adjacent steep hillside terrain. It includes an active clay processing area with screens and other equipment. A large collection of vintage mining equipment is present on the northern portion of the site. The site also includes several clay motorcycle tracks and portable offices. Significant grading has occurred associated with road building and flattening of the processing and track areas. The slope area addressed in this evaluation is located along the north side of the processing area. Review of old topographic mapping (USGS) indicates that the southern end of a bedrock ridge was removed, enlarging the processing area and resulting in the existing steep slope.

It is our understanding that the site was used as an aggregate mine beginning in the early part of 20th century, decades prior to the inception of SMARA in 1975. Current use of the facility includes processing of recycled clay and does not include mining.

PROJECT CONSIDERATIONS

It is our understanding that the County of Riverside has requested that the facility be entitled under the requirements of SMARA, given its history as a mine and current and future planned uses. Among other things, SMARA requires that reclaimed slopes be "stable." The scope of services included in this report provides calculated factors of safety for the steepest stable reclaimed slope configuration.

The 1.5:1 Slope Grading exhibit shows a reclaimed slope with no benches. It is desired to reduce the footprint of the final slope to the minimum size consistent with a stable SMARA slope. Final slope recommendations for a slope as steep as 1:1 are included in this report.

FIELD INVESTIGATION

A certified engineering geologist mapped existing quarry exposures and native bedrock outcrops on March 3, 2015. Rock exposures within the area include surface cuts. Adjacent undisturbed areas include scattered bedrock outcrops. Our evaluation included examination of existing cut exposures, and outcrops and surface mapping of the mine area. We mapped approximate geologic contacts using aerial imagery. Structural data, including joint, shear and foliation orientations, were measured using a Brunton compass and clinometer. Structural and geologic data were recorded. Our field program focused on rock strength and condition and identification of continuous features that could affect kinematic stability of quarry slope faces. The location and extent of available exposures, including mined cut slopes and road cuts, provided the data necessary to characterize the structural geology of the site. We used prior mapping by Weber (1977) for geologic unit nomenclature. A Geologic Map (Enclosure A-2), based on data collected during the field investigation and mapping review, is provided in Appendix A. Large samples of representative slope rock were collected and returned to our laboratory for analysis of unconfined compressive strength and unit weight. Geologic structural mapping areas referred to herein are numbered and indicated on the enclosed Geologic Map (Enclosure A-2).

GEOLOGIC SETTING

Corona Clay is located in Temescal Valley, part of the Peninsular Ranges geomorphic province. Temescal Valley is structurally dominated by branches of the Elsinore fault zone, which in this part of the valley consists of two subparallel strands: the Glen Ivy North and Glen Ivy South. This portion of the Peninsular Ranges is not dominated by the batholithic rocks common in much of the province. At the site, the bedrock consists of the Bedford Canyon Formation of Jurassic age. The Bedford Canyon Formation, as mapped by Weber (1977), consists of metasedimentary rocks (slate with lesser quartzite). The Bedford Canyon Formation is present as screens and roof pendants in the Southern California batholith.

Two geologic units were mapped on the site and are described below.

Jbc: Bedford Canyon Formation

Low-grade metamorphic rocks of mixed composition of the Jurassic age Bedford Canyon metasediments comprise all of the bedrock at the site. These rocks are poorly exposed on native slopes but are well exposed in steep cuts. They consist of slate with minor quartzite, with colors varying from gray to brown. Foliation is relatively uniform, inclined at a moderate angle (30 to 60 degrees) toward the northeast. Bedford Canyon rocks are moderately to intensely jointed, producing a blocky fabric. Dark brown to rust-colored staining is present along most of the joint surfaces. Very rare beds of quartzite were observed. In outcrop, relict interbeds of quartzite and slate exhibit distinctive boudinage deformation.

f: Fill

Fill is associated with historical-age grading/mining at the site. Fill was mapped in the processing pad area extending up to the toe of the steep and high, southwest-facing slope. Fill is also associated with two benches/roads oriented in a northeast direction. The fill is considered generally unsuitable for exposure in future cut slopes.

Stream channel deposits of late Holocene age underlie the fill in northeast-trending canyons located on the northwest and southeast sides of the site. Due to the burial by fill and/or surface disturbance, the stream channel deposits are not shown as a mapped unit.

GEOLOGIC STRUCTURE

Foliation in the Bedford Canyon Formation dips uniformly at a moderate angle to the northeast. A prominent joint set dips steeply (60 degrees) to the southwest, roughly normal to the foliation. This feature is prominently exposed in the steep cut. A third, less prominent joint set strikes northeast and dips moderately to the northwest. These three discontinuities form a roughly orthogonal set that dominates the appearance of the cut exposures at the site. All three discontinuities are spaced at approximately 12 inches or less, creating relatively small clasts when the material is mechanically excavated. All joint and foliation surface observed were rough.

Faults or fault-related features were not observed during field mapping. A few apparent shears (apparent gouge a few millimeters thick) were observed parallel to foliation, but no significant gouge or slickensides were observed.

FAULTING AND SEISMICITY

Regional seismic sources were assessed to determine ground motion conditions for evaluation of potential seismic effects on stability of potential finished slopes. We calculated deterministic peak ground accelerations for the regional seismic sources. These data are presented in the following sections.

REGIONAL FAULTS:

The tectonics of Southern California are dominated by the interaction of the North American and Pacific tectonic plates, which slide past each other in transform motion. Although some motion may be accommodated by rotation of crustal blocks such as the western Transverse Ranges (Dickinson, 1996), the San Andreas fault zone is the major surface expression of the tectonic boundary and accommodates most transform slip between the Pacific and North American Plates. Some slip is accommodated by other northwest-trending strike-slip faults related to the San Andreas system, such as the San Jacinto and the Elsinore faults. Local compressional or extensional strain resulting from the transform motion along this boundary is accommodated by left-lateral, normal and reverse faults such as the Cucamonga fault

Elsinore Fault Zone

The Glen Ivy segment of the Elsinore fault zone is the nearest major active fault, about 1-1/2 miles southwest of the site. The Elsinore fault zone is typified by multiple en echelon and diverging faults. To the north, it splays into the Whittier and Chino faults. The Elsinore is primarily a strike-slip fault zone; however, transtentional features such as the graben of the Elsinore and Temecula Valleys also occur. Most Elsinore fault traces are demonstrably active (Holocene) as documented by Saul (1978), Rockwell and others (1986) and Wills (1988).

The southern segment of the northwest-trending Chino-Central Avenue fault, a northern splay of the Elsinore fault zone, is approximately 7 miles northwest of the site and is assigned a 6.8 magnitude by Petersen and others (2008).

The west-to-northwest-trending Whittier fault is approximately 13-1/2 miles northwest of the site. The Whittier fault has almost pure right-lateral strike slip (Rockwell and others, 1986). Evidence for activity includes offset of Holocene sediments (Hannan and Lung, 1979) and historic microseismicity (Yerkes, 1985). The 2014 Working Group on California Earthquake Probabilities (Field and others, 2015) assigned a 5 percent probability of a magnitude ≥ 6.7 earthquake on the Elsinore-Whittier fault for the 30-year interval from 2014 to 2044.

San Jacinto Fault Zone

The San Jacinto fault zone is a system of northwest-trending, right-lateral, strike-slip faults approximately 20 miles northeast of the site. More large historic earthquakes have occurred on the San Jacinto fault than any other fault in Southern California. The 2014 Working Group on California Earthquake Probabilities (Field and others, 2015) assigned a 9 percent probability of a magnitude ≥ 6.7 earthquake on the San Jacinto fault for the 30-year interval from 2014 to 2044.

Based on the data of Matti and others (1992), a portion of the San Jacinto fault may accommodate most of the slip between the Pacific and the North American Plates. Matti and others (1992) suggest this motion is transferred to the San Andreas fault in the Cajon Pass region by "stepping over" to parallel fault strands that include the Glen Helen fault.

San Andreas Fault Zone

The San Andreas fault zone is located along the southwest margin of the San Bernardino Mountains, approximately 29 miles northeast of the site. The mountain front in the San Bernardino area approximately marks the active trace of the San Andreas fault, here characterized by youthful fault scarps, vegetation lineaments, springs and offset drainages. The 2014 Working Group on California Earthquake Probabilities (Field and others, 2015) assigned a 53 percent probability of a magnitude ≥ 6.7 earthquake on the Southern San Andreas fault for the 30-year interval from 2014 to 2044.

Blind Thrust Faults

The San Joaquin Hills fault is an inferred blind thrust beneath the San Joaquin Hills in coastal Orange County, southern California. The vertical surface projection of the San Joaquin Hills blind thrust (SJHT) is approximately 16 miles southwest of the site. The SJHT is southwest dipping and presumably gave rise to uplift of the San Joaquin Hills. Measurement of uplifted back-bay shorelines and fossil dating suggests an uplift rate of 0.24 meter per 1,000 years and an average earthquake recurrence of 2,500 years on the SJHT (Grant and others, 1999). The SJHT has a postulated potential to produce earthquakes with magnitudes up to Mw 7.3. A latest large event may have occurred in 1769 A.D. based on radiocarbon dating of uplifted marsh sediments (Grant and others, 2002).

The Puente Hills Blind-Thrust (PHBT) is a system of buried thrust fault ramps that extend from beneath Los Angeles to the Puente Hills of eastern Los Angeles County and Orange County. The PHBT is identified in the subsurface by seismic reflection profiles, petroleum well data and precisely located seismicity and at the surface by a series of contractional folds. Fault segments of the PHBT are the Los Angeles, Santa Fe Springs and Coyote Hills (Shaw and Shearer, 1999). This buried fault system is capable of producing estimated earthquakes of Mw 6.5 to 6.6 on individual segments or a Mw 7.1 earthquake as a group (Shaw and others, 2002). A study utilizing borehole data collected from sediments overlying the central segment of the PHBT indicates that subtle folding locally extends to the near surface and that four events occurred in the past 11,000 years (Dolan and others, 2003).

LOCAL FAULTS:

No active faults were identified within the site area during our review of published and unpublished literature and maps, stereoscopic aerial photographs or field mapping. Accordingly, ground fault rupture in the slope area is not anticipated.

As shown on Enclosures A-1 and A-2, a northwest-trending aerial photograph lineament was mapped by Weber (1977) through the bedrock ridge. No lineaments related to suspected faulting were observed on the aerial photographs reviewed. A joint surface striking N82W (the same strike as the

Weber lineament) was measured at map location 11, in a bulldozer cut less than 50 feet from the mapped lineament. Weber's lineament may be the expression of this relatively prominent joint set.

Several subparallel northeast-trending vegetational lineaments are visible in the east-facing portion of the native bedrock hillside north of the steep cut area on the site on the 1990 aerial photographs. These exist at a high angle to the foliation and may represent a joint set.

GROUND-SHAKING HAZARD

The ground-shaking hazard at the site was evaluated from a deterministic standpoint for use as a guide to formulate an appropriate seismic coefficient for use in slope stability analyses.

A deterministic evaluation of seismic hazard was performed for the Elsinore fault and other regional faults using the attenuation relations of Boore and Atkinson (2008), Campbell and Bozorgnia (2008) and Chiou and Youngs (2008). These data are summarized in the following table.

Table 1: Summary of Regional Seismic Sources

Fault (segments)	Magnitude	Distance (km)	Peak Ground Acceleration (g)
Elsinore (W+GI)	7.3	2.4	0.49
San Jacinto (SBV+SJV)	7.4	32	0.16
Cucamonga	6.7	43	0.09
San Andreas (SM+NSB+SSB)	7.6	47	0.13
San Joaquin Hills	7.1	28	0.16
Puente Hills	7.1	35	0.13

W=Whittier, GI=Glen Ivy, SBV=San Bernardino Valley, SJV=San Jacinto Valley, SM=South Mojave, NSB=North San Bernardino, SSB=South San Bernardino

We utilized Kh = 0.2 to model the psuedostatic condition for slope stability calculations, consistent with conservative application of methods described by Seed (1979). Seed (1979) considered the size of the sliding mass and earthquake magnitude in selection of Kh. For large slopes, Seed suggested Kh = 0.15 for sites near faults capable of generating magnitude 8.5 earthquakes. The closest fault to the site, the Elsinore fault, is assigned a characteristic magnitude of 7.3 for the Whittier and Glen Ivy segments. Based on the method of Seed (1979) and the seismic setting of the site, our selection of Kh = 0.20 is conservative and appropriate for evaluation of existing site slopes.

GROUNDWATER

We observed no seepage, springs, phreatophytes or other evidence for a groundwater table on or near the site during geologic mapping. The site is not located within an area of mapped liquefaction susceptibility. The area of Temescal Creek and Dawson Canyon are included within areas of "low" liquefaction susceptibility according to the Riverside County Integrated Project (2013). Bedrock underlies the proposed reclaimed slope and is not susceptible to liquefaction.

The site is located in subsection A of Section 35 of Township 4 South, Range 6 West. Groundwater data compiled by Western Municipal Water District (2014) indicate that groundwater occurs along the Temescal Wash channel at shallow depth. Measurements of water level for State Well Nos. 04S/06W-35G002 (located near the site and Temescal Wash) in March 2014, indicated a groundwater elevation at 992 feet above mean sea level (amsl). Since most of the valley bottom portions of Corona Clay are below 1,000 feet elevation, this data point suggests that shallow groundwater (less than 50 feet deep) may exist below the valley bottom at Corona Clay.

Based on the presence of non-liquefiable bedrock, the potential for liquefaction and other shallow groundwater-related hazards at the site is considered to be very low. Groundwater is not anticipated to significantly affect the stability of the proposed slopes; therefore, our evaluation considered dry conditions in the slope stability calculations.

SLOPE STABILITY

The term "landslide," as used in this report, refers to deep-seated slope failures that involve interbench-scale (whole slope) features with a potential to reduce the long-term stability of reclaimed slopes. Landslides are typically related to the structure of the parent material. In contrast surficial failures are shallow and potentially affect limited zones.

The susceptibility of a geologic unit to landsliding depends on various factors, primarily: 1) the presence and orientation of geologic structures, such as joints, fractures, faults or clay beds, 2) the height and steepness of the slope, 3) the presence and quantity of groundwater and 4) the occurrence of strong seismic shaking.

Our geologic mapping of the existing slope included observation of lithologic distribution and measurement of the orientation of bedrock structures that influence kinematic rock slope stability. Enclosure B-1 presents the measured orientation of joints, foliation and shears in tabular format. Data points are indicated by number. These kinematic data were evaluated using the Dips 6.0 software by Rocscience (2013). We performed kinematic analysis using this database (discussed in the section titled "Kinematic Analysis").

Jointing and foliation within the site is generally closely spaced (on the order of 12 inches or less) and moderately continuous (3 to 30 feet). Joint surfaces were generally rough. Our evaluation focused on the more continuous structures as these have a greater potential to define kinematic behavior in rock masses.

We evaluated the kinematic (potential/theoretical failure modes) and global (whole rock) slope stability of the proposed reclamation slope for representative material types.

Three of the largest available rock samples (boulders) with the fewest visible defects were taken from the slope and brought to our laboratory for measurement of unconfined compressive strength and specific gravity. Two attempts at coring the boulders resulted in fragmentation of the samples. They were not suitable for direct measurement of compressive strength. Therefore, rock strength properties for global stability calculations were modeled using Hoek-Brown criteria and results of back calculation of an existing rock face. A discussion and summary of these analyses are presented below. The slope stability data and calculations are presented in Appendices B and C.

KINEMATIC ANALYSIS:

Kinematic analysis is the evaluation of rock slope stability based on the orientation of structural discontinuities including joints, faults, shear zones, bedding and foliations. Kinematic analysis addresses the potential failure mode(s) and does not consider mass, force, shear strength or cohesion along surfaces as in a limit-equilibrium analysis. Limit-equilibrium of specific structures is addressed by global analyses that were also performed for the proposed slopes. Structurally controlled kinematic failure modes include planar, wedge and topple failures. Circular failure of highly fractured rock masses is also a potential failure mode and is considered in the analysis of global stability (presented in "Global Stability Calculations").

The kinematic evaluation considers the slope azimuth (facing direction), slope angle (slope plane) and frictional sliding angle of a planar surface versus the orientation of individual planar or linear features utilizing a stereonet diagram. Planar features include foliation planes, joints, bedding and/or sheared zones. Linear features include plane intersections that are modeled as dip vectors. The stereonet shows features as points (representing dip vectors or poles to planes) or lines (representing planes at the surface of a sphere). Construction of a critical zone representing a combination of slope azimuth, angle and failure mode for planar, wedge or topple failure types allows evaluation of the relation of a particular discontinuity or discontinuity set to established potential failure criteria. Each plot includes a table that summarizes the number of features within the "critical" zone. The term "critical" refers only to the potential for failure along a given discontinuity based on its orientation relative to a free face surface. Other factors, such as the presence/absence of a releasing surface, roughness/cohesion of a surface or limit-equilibrium-type analysis, are addressed in limit-equilibrium stability analysis.

We evaluated a 205 degree slope azimuth (southwest facing direction) with a 45-degree slope angle. A data set was compiled from the measured discontinuities (Enclosure B-1).

Stereonet analysis for planar sliding and wedge sliding potential for the representative slope was performed utilizing the data from mapped geologic structures (Table B-1) and Dips 6.0 software by Rocscience (2013). Topple was not evaluated due to the fractured character of the rock mass that precludes formation of topple features. We used intersection plots to evaluate the potential for wedge sliding and vector and pole plots to evaluate the potential for planar sliding. Stereonet diagrams are presented as Enclosures B-2.1 through B-2.3.

Planar Sliding

Planar sliding was evaluated using a slope angle of 45 degrees. The stereonet data are depicted with dip vectors (points) and as poles on the stereonet plots (Enclosures B-2.1 and B-2.2). Poles to planes and dip vectors were contoured to identify concentrations of points. The plots include a depiction of lateral limits, friction circle and critical zone.

The results of the planar sliding analysis indicate a low potential for planar sliding for the proposed southwest-facing slope aspect at the modeled 45-degree slope angle. It is expected that excavation of the slope at this or flatter angles will produce stable, finished slopes.

Wedge Sliding

Wedge sliding was evaluated using a slope face angle of 45 degrees. Since wedge geometry is formed by two or more planes, the data were contoured to identify concentrations of intersections. The results indicate a low potential for wedge formation in the southwest-facing aspect of the proposed slope. Field observations suggested clean, wedge-free faces in existing quarry cuts along the dominant joint system; therefore, we do not anticipate the occurrence of large wedge failures in the planned slope exacavation. Scaling of loose material appears to be an effective means to mitigate wedge-type failures in the slope area. Scaling of loose blocks or wedges should be performed during excavation of the slope. Kinematic plots of these data are presented in Enclosure B-2.3. The overall potential for wedge-type failures is low.

Kinematic Evaluation—Conclusions

A slope angle of 45 degrees or flatter, based on the geometry of dominant discontinuities in the slope area, would result in a kinematically stable configuration.

The results of the planar sliding and wedge sliding analyses indicate low potential for formation of unstable features in the proposed slope. The potential for rock fall or minor slope failure can be mitigated by scaling of the slope during excavation. Use of steel netting, rock bolts, anchors or other mechanical means is not anticipated to be required for the proposed slope construction. The overall slope angle appears to be suitable for the intended use. Scaling of loose or dislodged blocks from slope cuts should be performed near the completion of final slope excavation.

The slope configurations evaluated in this report are expected to produce a suitably configured slope geometry for the proposed slope under SMARA criteria.

GLOBAL STABILITY CALCULATIONS:

Global (rotational) stability was analyzed using Spencer's method under seismic conditions for rotational failures utilizing the SLIDE computer program, version 6.034 (Rocscience, 2015). The seismic stability calculations were performed using a lateral pseudostatic coefficient "Kh" of 0.20 as discussed previously. Slip surface search models were used for both circular and non-circular failure modes. Groundwater was not considered in the global stability evaluation based on the lack of evidence for seepage and regional groundwater table lower than the slope area.

Slope stability back calculation of a 78-degree existing slope face under static conditions was used to estimate minimum unconfined compressive strength (UCS) under Hoek-Brown strength criteria. The location of the back calculation slope is shown on Enclosure A-2. We started with the UCS obtained from the Jbc unit from a nearby site in March 2015 (2.71×10^6 pounds per square foot, similar to on-site slate) and used a sensitivity analysis to derive the UCS value of factor of safety = 1.0 in consideration of the increased jointing and foliation in the Jbc at Corona Clay. The geometry of the slope used for back calculation is depicted in Enclosure C-1.1. A graph of UCS versus factor of safety is provided as Enclosure C-1.2. It should be understood that the strength obtained from the back calculation is an absolute minimum, constrained by the geometry of the steepest existing slope. Actual UCS is expected to be much higher.

The strength parameters for the Bedford Canyon rock unit (Jbc) were modeled with the Generalized Hoek-Brown criteria (Hoek and Karzulovic, 2000; Hoek, Carranza-Torres and Corkum, 2002), using the results of the back calculation estimate, field strength criteria, such as how easily rock can be broken with a hammer, and the SLIDE program's integrated calculator application. The parameters were modeled using lower than anticipated values to produce a conservative model. Actual values are anticipated to be higher. The strength parameter values are presented in Table 2. Unit weight was obtained by measurement of specific gravity of the three samples returned to the laboratory, for an average of 162 pounds per square foot (psf).

Table 2: Bedford Canyon (Jbc) - Strength Parameters

	Value	Description
Unit Weight (pcf*)	162	Measured by laboratory testing
Intact UCS[1] (psf**)	3.96×10^5	Estimated by back-calculation
Geological Strength Index	40	Blocky/Disturbed/Seamy with fair surface conditions
Intact Rock Constant (mi***)	7	Phyllites
Disturbance Factor	1	Production blasting

[1] Uniaxial Compressive Strength test result
* pcf = pounds per cubic foot
** psf = pounds per square foot
*** mi = unitless constant

The results of our global slope stability analyses are summarized in Table 3. Details of stability calculations including material type boundaries, strength parameters, the minimum factor of safety and critical slip surface are presented in Enclosures C-1.1 through C-2.2.

Table 3: Summary of Global Stability Models and Results

Model	Material	Slope Configuration	Static Factor of Safety	Seismic Factor of Safety (k=0.2)	Enclosure Number
Existing Slope	Jbc	H = 38 Feet 78°	0.99	--	C-1.1
Proposed Slope		H = 56 45°	1.62	1.16	C-2.1 and C-2.2

As shown in Table 3, sufficient static and seismic factors of safety in excess of 1.5 and 1.1, respectively—in conformance with OMR criteria—are indicated for the modeled rock slope configurations for the proposed slope heights and angles. Flatter slopes are anticipated to exhibit equal or greater factor of safety values.

CONCLUSIONS

Based on geologic field observations and evaluation and the results of slope stability calculations, it is the opinion of this firm that reclaimed slopes inclined at 1(h) to 1(v) or flatter are stable with respect to SMARA criteria for slope stability, provided the recommendations contained in this report are implemented.

Based upon our analyses, a 45-degree slope up to approximately 60 feet in height is suitably stable against gross failure for the anticipated long-term conditions, including the effects of seismic shaking. A flatter slope such as a 1.5(h) to 1(v) would be approximately 100 feet in height and is also considered to be stable. Inclusion of benches in a 1(h):1(v) overall slope profile would help mitigate raveling and/or rockfall. Benches are not considered necessary for a 1.5(h):1(v) slope. Loose material should be scaled from slope faces during grading.

Fill associated with past benching/mining/road building activities is present at the top of the existing steep slope and along existing bench surfaces. This material is susceptible to shallow failure when exposed in slope faces. The proposed reclaimed slope design should provide for removal of this fill where present in reclaimed slopes.

Groundwater seepage, springs or indications of shallow groundwater were not observed and are not known to exist within the site. Neither groundwater nor seepage are expected to occur within the reclaimed slope during the reclamation lifetime.

Active faults with the potential to produce surface rupture are not mapped within the site.

RECOMMENDATIONS

SEISMIC SHAKING HAZARDS:

Moderate to severe seismic shaking of the site can be expected to occur during the lifetime of the proposed reclamation. This potential has been considered in our analyses and evaluation of slope stability.

PROPOSED RECLAIMED SLOPES:

An overall slope angle of 45 degrees or flatter will be suitable for the proposed reclamation plan. Should benches be selected, we recommend a preliminary minimum reclaimed bench width of 15 feet. The design width should be determined by the project engineer to be consistent with the design height and overall finished slope angles. Scaling of loose or dislodged blocks from bench face cuts should be performed near the completion of final slope excavation at any construction level. This is necessary as portions of finished slopes may not be accessible to scaling equipment with progression of excavation.

The rock mass within the proposed slope area is generally hard, competent and capable of forming stable slopes at the proposed gradients for reclamation. The rock structure includes joint systems that have been characterized by mapping and analysis to yield suitably stable rock slopes. We did not observe geologic structures that exhibit exceptional continuity or adverse geometry with regard to the planned slope aspect and that contain significant clay linings, water seepage or other potentially deleterious conditions during site mapping within the slope area.

Geologic mapping of the excavated slope may be performed during construction to identify conditions that may preclude reclamation of the slope in accordance with the approved reclamation plan.

LIMITATIONS

CHJ Consultants has striven to perform our services within the limits prescribed by our client, and in a manner consistent with the usual thoroughness and competence of reputable geotechnical engineers and engineering geologists practicing under similar circumstances. No other representation, expressed or implied, and no warranty or guarantee is included or intended by virtue of the services performed or reports, opinion, documents, or otherwise supplied.

This report reflects the testing and observations conducted on the site as the site existed during the evaluation, which is the subject of this report. However, changes in the conditions of a property can occur with the passage of time, due to natural processes or the works of man on this or adjacent properties. Changes in applicable or appropriate standards may also occur whether as a result of legislation, application or the broadening of knowledge. Therefore, this report is indicative of only those conditions tested and/or observed at the time of the subject evaluation, and the findings of this report may be invalidated fully or partially by changes outside of the control of CHJ Consultants. This report is therefore subject to review and should not be relied upon after a period of one year.

The conclusions and recommendations in this report are based upon observations performed and data collected at separate locations, and interpolation between these locations, carried out for the project and the scope of services described. It is assumed and expected that the conditions between locations observed and/or sampled are similar to those encountered at the individual locations where observation and sampling was performed. However, conditions between these locations may vary significantly. Should conditions that appear different than those described herein be encountered in the field by the client or any firm performing services for the client or the client's assign, this firm should be contacted immediately in order that we might evaluate their effect.

If this report or portions thereof are provided to contractors or included in specifications, it should be understood by all parties that they are provided for information only and should be used as such.

The report and its contents resulting from this evaluation are not intended or represented to be suitable for reuse on extensions or modifications of the project, or for use on any other project.

CLOSURE

We are pleased to be of service and trust this report provides the information desired at this time. Should questions arise, please do not hesitate to contact this firm at your convenience.

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LIST OF AERIAL PHOTOGRAPHS

Google Earth web-based software application, aerial imagery dated May 31, 1994, June 4, 2002, September 7, 2003, December 30, 2003, September 2, 2004, October 1, 2004, December 30, 2005, January 30, 2006, June 14, 2006, August 4, 2006, June 5, 2009, November 15, 2009, March 9, 2011, June 7, 2012, January 12, 2013, November 12, 2013, and March 11, 2015.

Riverside County Flood Control and Water Conservation District, June 24, 1963, black and white aerial photograph no. 166.

Riverside County Flood Control and Water Conservation District, June 24, 1974, black and white aerial photograph nos. 436 and 437.

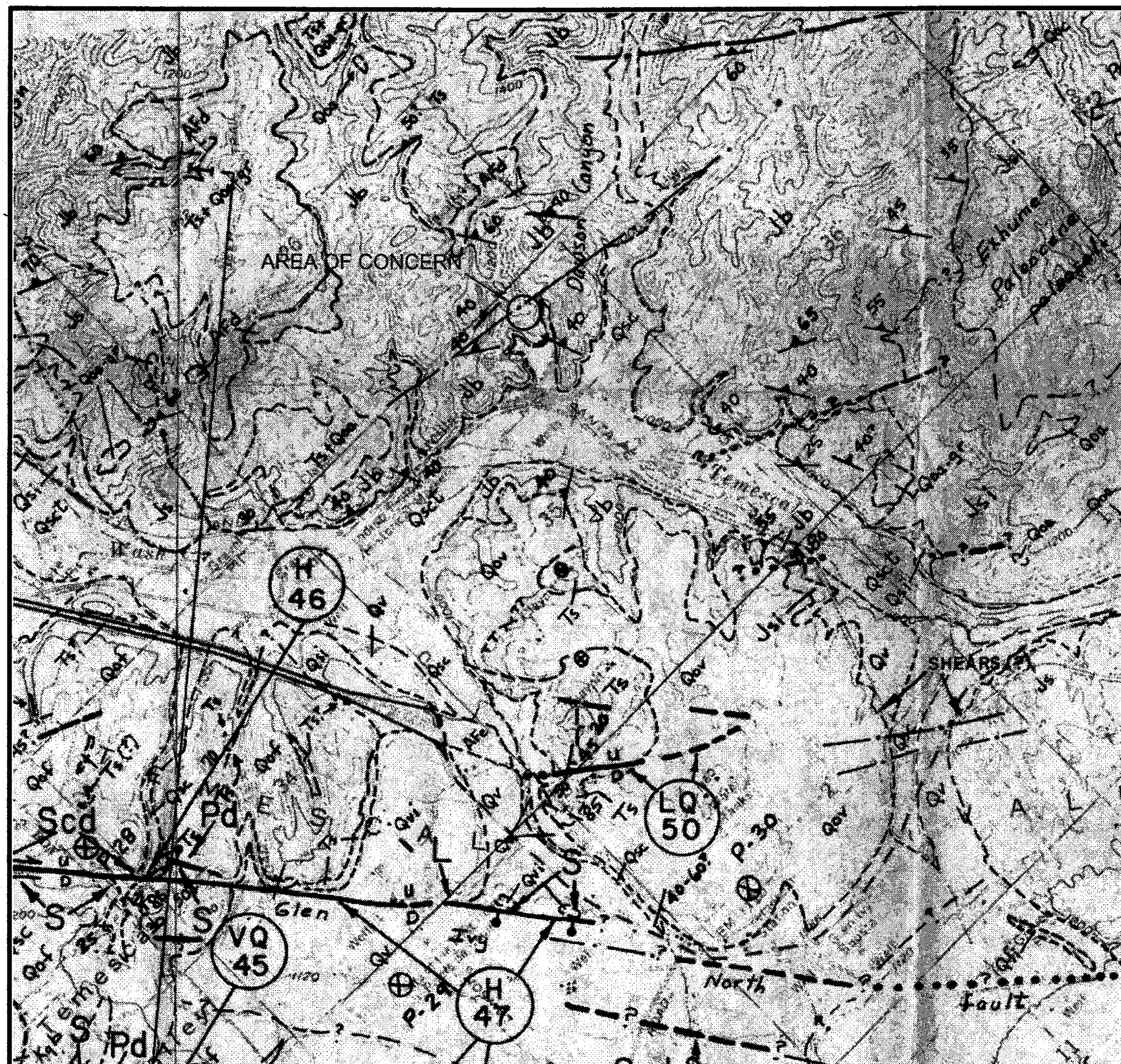
Riverside County Flood Control and Water Conservation District, April 10, 1980, black and white aerial photograph nos. 463 and 464.

Riverside County Flood Control and Water Conservation District, January 23, 1990, black and white aerial photograph no. 9-13.

Riverside County Flood Control and Water Conservation District, February 23, 1990, black and white aerial photograph no. 10-9.

Riverside County Flood Control and Water Conservation District, January 30, 1995, black and white aerial photograph nos. 9-9 and 9-10.

Western Aerial Surveys, March 5, 1990, black and white aerial photograph nos. 4 and 5.



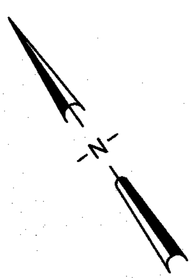
LEGEND:

Qsc - Quaternary stream channel deposits
Qoa - Pleistocene alluvium
Qov - Pleistocene flood plains and valley fill
Ts - Paleocene Silverado Formation
Jb - Jurassic Bedford Canyon Formation-slate with quartzite

geologic contact, relatively well-defined

Aerial photograph lineament suggestive of faults, but not verified

40 Strike and dip of layering/bedding in metasedimentary rocks



SCALE: 1" = 2000'

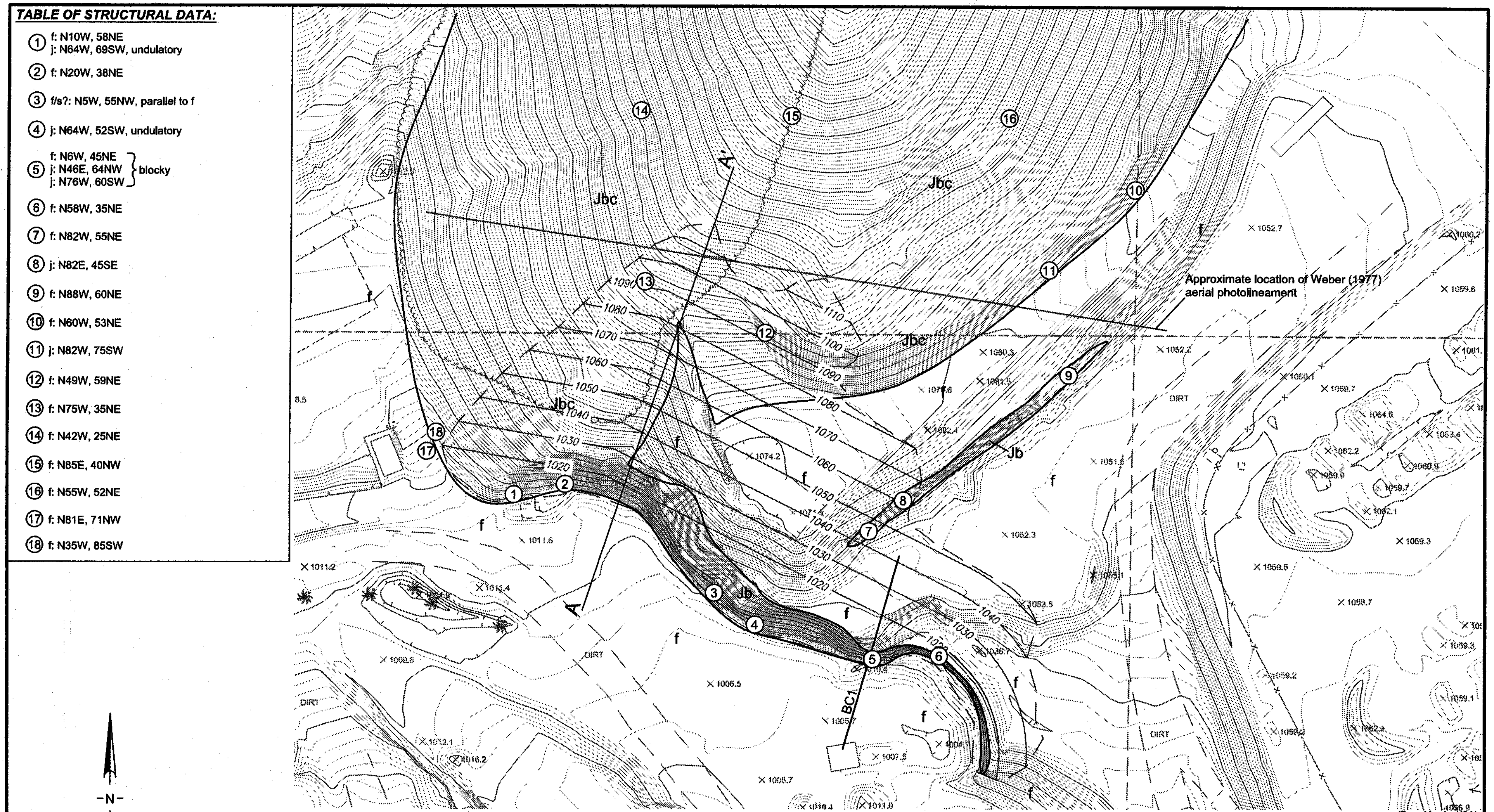
INDEX MAP

FOR: CORONA CLAY	SLOPE STABILITY INVESTIGATION AREA OF CONCERN, CORONA CLAY QUARRY CORONA, CALIFORNIA	ENCLOSURE "A-1"
DATE: MARCH 2015		JOB NUMBER 15112-8

CHJ Consultants

TABLE OF STRUCTURAL DATA:

(1)	f: N10W, 58NE j: N64W, 69SW, undulatory
(2)	f: N20W, 38NE
(3)	f/s?: N5W, 55NW, parallel to f
(4)	j: N64W, 52SW, undulatory
(5)	f: N6W, 45NE j: N46E, 64NW j: N76W, 60SW } blocky
(6)	f: N58W, 35NE
(7)	f: N82W, 55NE
(8)	j: N82E, 45SE
(9)	f: N88W, 60NE
(10)	f: N60W, 53NE
(11)	j: N82W, 75SW
(12)	f: N49W, 59NE
(13)	f: N75W, 35NE
(14)	f: N42W, 25NE
(15)	f: N85E, 40NW
(16)	f: N55W, 52NE
(17)	f: N81E, 71NW
(18)	f: N35W, 85SW



LEGEND:

f - fill

Jbc - Jurassic Bedford Canyon Formation-slate with minor quartzite

(18) structural data measurement location

f - foliation

j - joint

s - shear

A———A' Geologic Cross Section

GEOLOGIC MAP		
FOR: CORONA CLAY	SLOPE STABILITY INVESTIGATION AREA OF CONCERN, CORONA CLAY QUARRY CORONA, CALIFORNIA	ENCLOSURE "A-2"
DATE: MARCH 2015		JOB NUMBER 15112-8

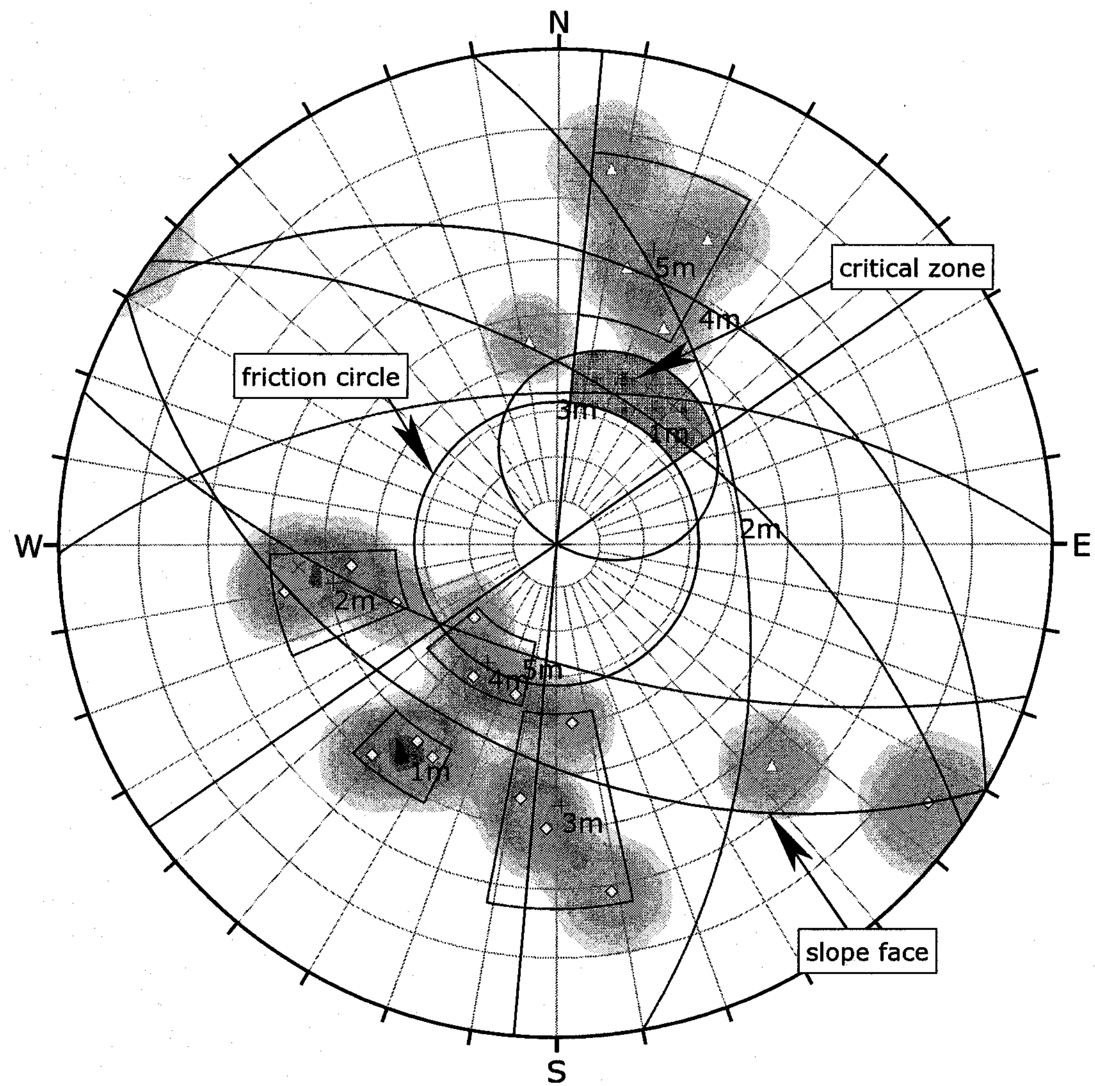
CHJ Consultants

APPENDIX B

KINEMATIC STABILITY EVALUATION

Table B-1: Corona Clay – Kinematic Data			
Discontinuity	**Dip**	**Dip Direction**	**Type**
1	58	080	f
2	69	206	j
3	38	070	f
4	55	085	fs
5	45	084	f
6	64	316	j
7	60	194	j
8	35	032	f
9	55	008	f
10	45	172	j
11	60	002	f
12	53	030	f
13	75	188	j
14	59	041	f
15	35	015	f
16	25	048	f
17	40	355	f
18	52	035	f
19	71	351	f
20	85	305	f
21	52	206	j

f = foliation j = joint fs = shear



Symbol	TYPE	Quantity
◇	f	14
×	fs	1
△	j	6

Color	Density Concentrations
	0.00 - 1.30
	1.30 - 2.60
	2.60 - 3.90
	3.90 - 5.20
	5.20 - 6.50
	6.50 - 7.80
	7.80 - 9.10
	9.10 - 10.40
	10.40 - 11.70
	11.70 - 13.00

Maximum Density	12.15%
Contour Data	Pole Vectors
Contour Distribution	Fisher
Counting Circle Size	1.0%

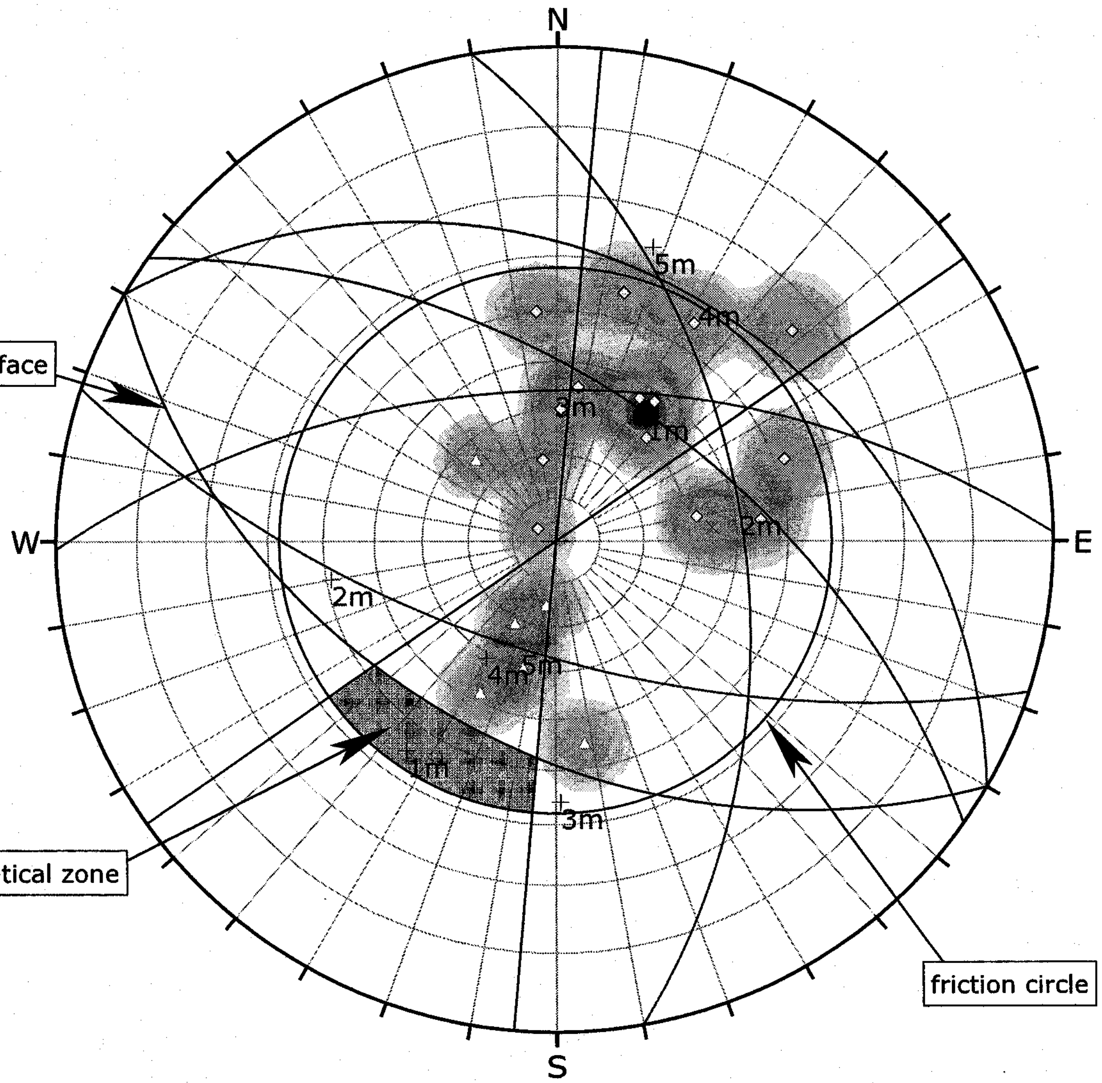
Kinematic Analysis	Planar Sliding
Slope Dip	45
Slope Dip Direction	210
Friction Angle	32°
Lateral Limits	25°

	Critical	Total	%
Planar Sliding (All)	0	21	0.00%

Plot Mode	Pole Vectors
Vector Count	21 (21 Entries)
Hemisphere	Lower
Projection	Equal Angle

Project	Corona clay		
Analysis Description	Planar Sliding - Pole Vectors		
Drawn By	CHJ	*Author*	JMc
File Name	A o Concern 205_45 plan pole.dips6	*Date*	3/12/2015
		Enclosure	B-2.1

DIPS 6.008



Symbol	TYPE	Quantity
◇	f	14
×	fs	1
△	j	6

Color	Density Concentrations
	0.00 - 1.30
	1.30 - 2.60
	2.60 - 3.90
	3.90 - 5.20
	5.20 - 6.50
	6.50 - 7.80
	7.80 - 9.10
	9.10 - 10.40
	10.40 - 11.70
	11.70 - 13.00

Maximum Density	12.65%
Contour Data	Dip Vectors
Contour Distribution	Fisher
Counting Circle Size	1.0%

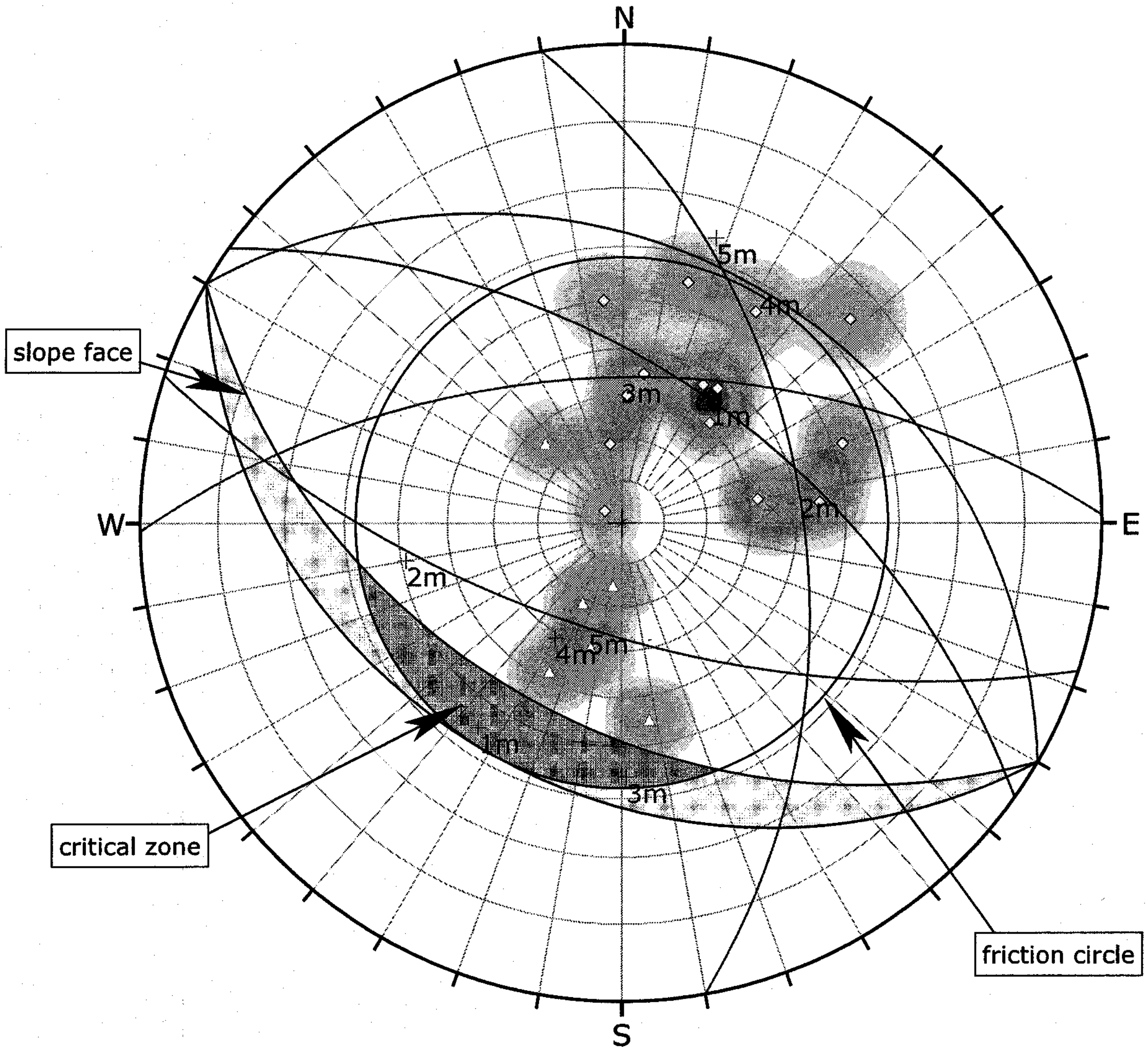
Kinematic Analysis	Planar Sliding
Slope Dip	45
Slope Dip Direction	210
Friction Angle	32°
Lateral Limits	25°

	Critical	Total	%
Planar Sliding (All)	0	21	0.00%

Plot Mode	Dip Vectors
Vector Count	21 (21 Entries)
Hemisphere	Lower
Projection	Equal Angle

Project	Corona clay		
Analysis Description	Planar Sliding - Dip Vectors		
Drawn By	CHJ	Author	JMc
File Name	A o Concern 205_45 plan dip vectors.dips6	Date	3/11/2015
		Enclosure	B-2.2

DIPS 6.008



Symbol	TYPE	Quantity
◇	f	14
×	fs	1
△	j	6
Symbol	**Feature**	
▩	Critical Intersection	

Color	Density Concentrations
	0.00 - 1.30
	1.30 - 2.60
	2.60 - 3.90
	3.90 - 5.20
	5.20 - 6.50
	6.50 - 7.80
	7.80 - 9.10
	9.10 - 10.40
	10.40 - 11.70
	11.70 - 13.00

Maximum Density	12.65%
Contour Data	Dip Vectors
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Wedge Sliding		
Slope Dip	45		
Slope Dip Direction	210		
Friction Angle	32°		
	Critical	**Total**	**%**
Wedge Sliding	1	210	0.48%

Plot Mode	Dip Vectors
Vector Count	21 (21 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	210
Hemisphere	Lower
Projection	Equal Angle

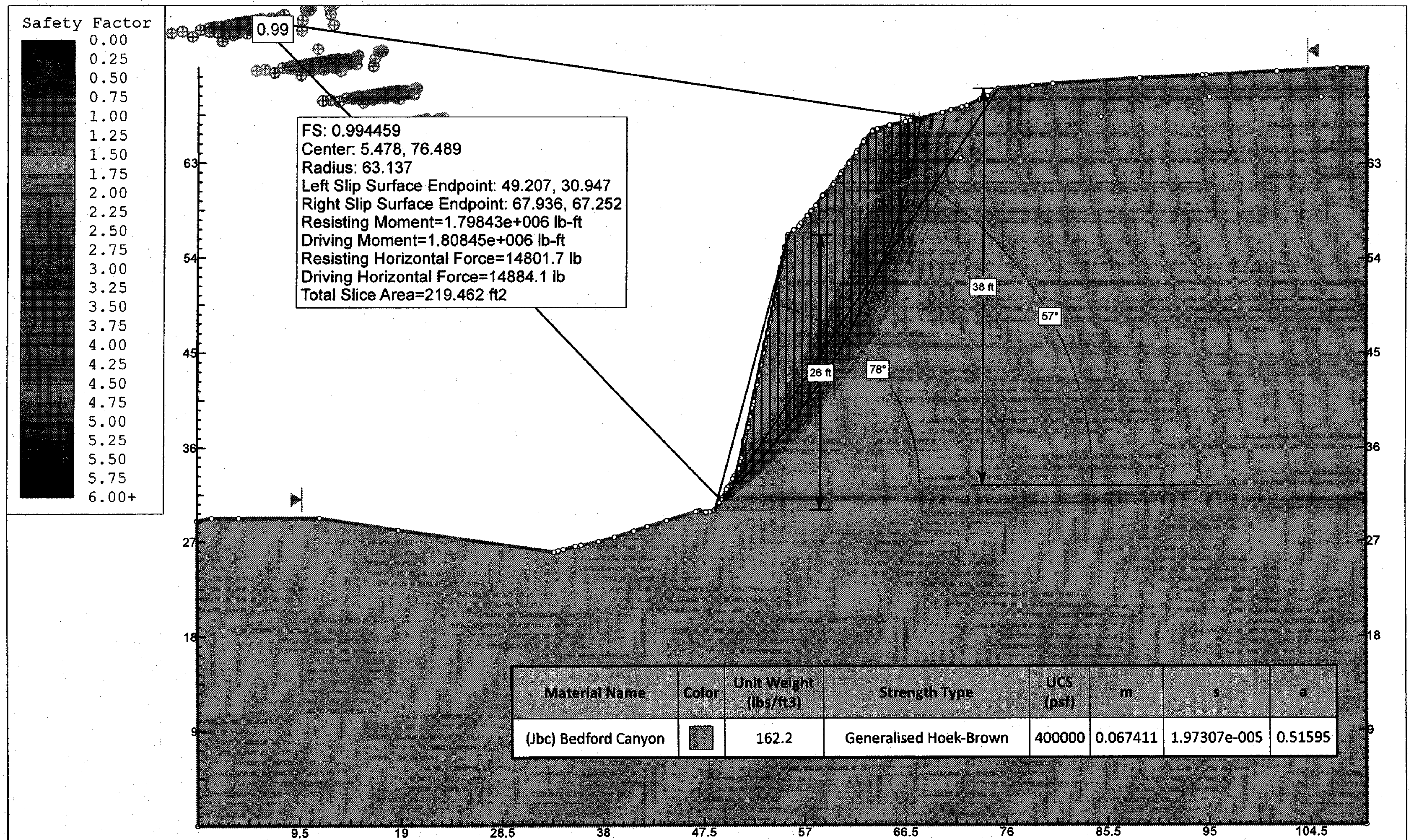
Project	Corona clay		
Analysis Description	Wedge Sliding - Dip Vectors		
Drawn By	CHJ	*Author*	JMc
File Name	A o Concern 205_45 wedge dip	*Date*	3/11/2015
		Enclosure	B-2.3

DIPS 6.008

vectors.dips6

APPENDIX C

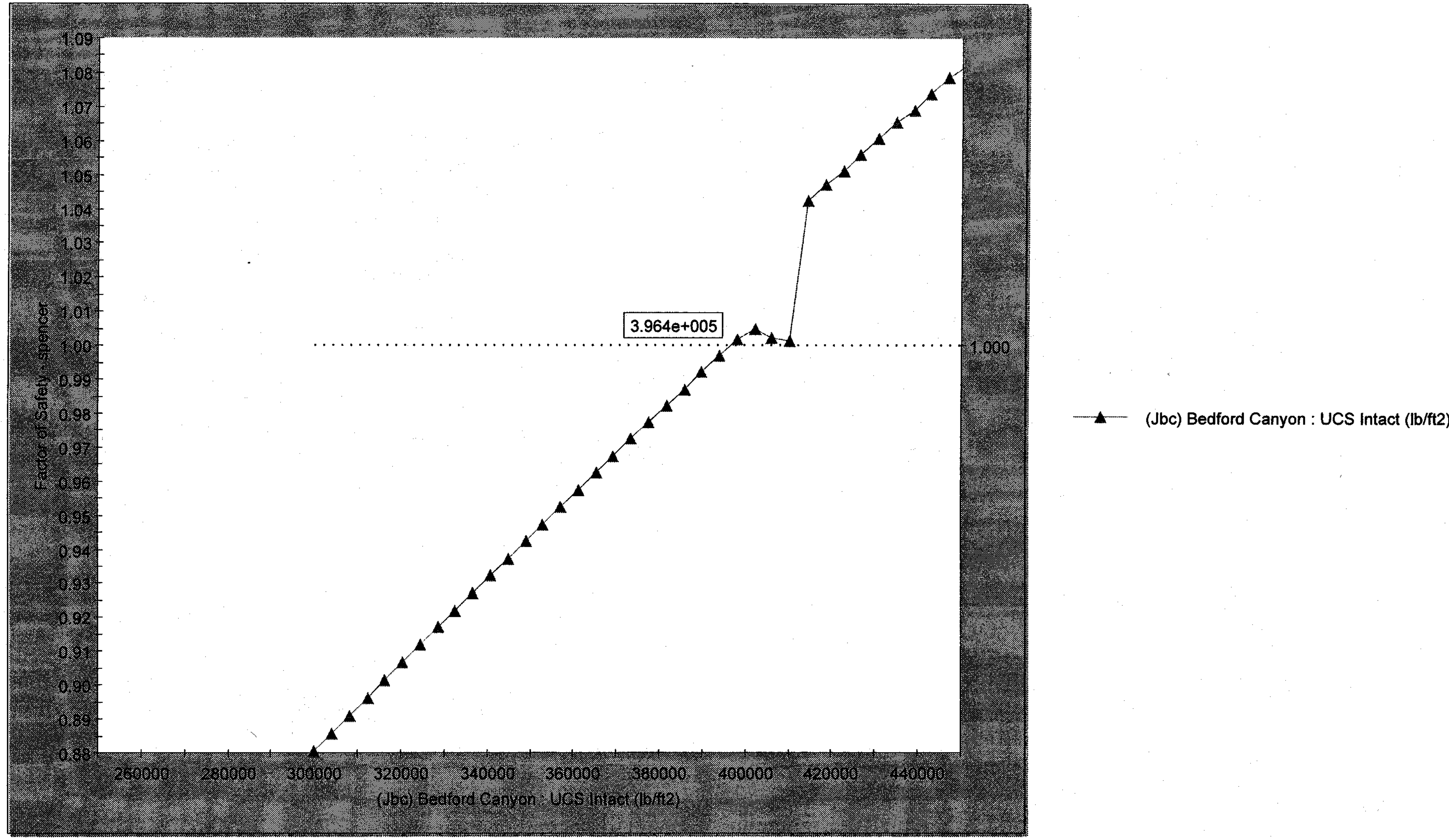
GLOBAL STABILITY CALCULATIONS



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)	m	s	a
(Jbc) Bedford Canyon		162.2	Generalised Hoek-Brown	400000	0.067411	1.97307e-005	0.51595

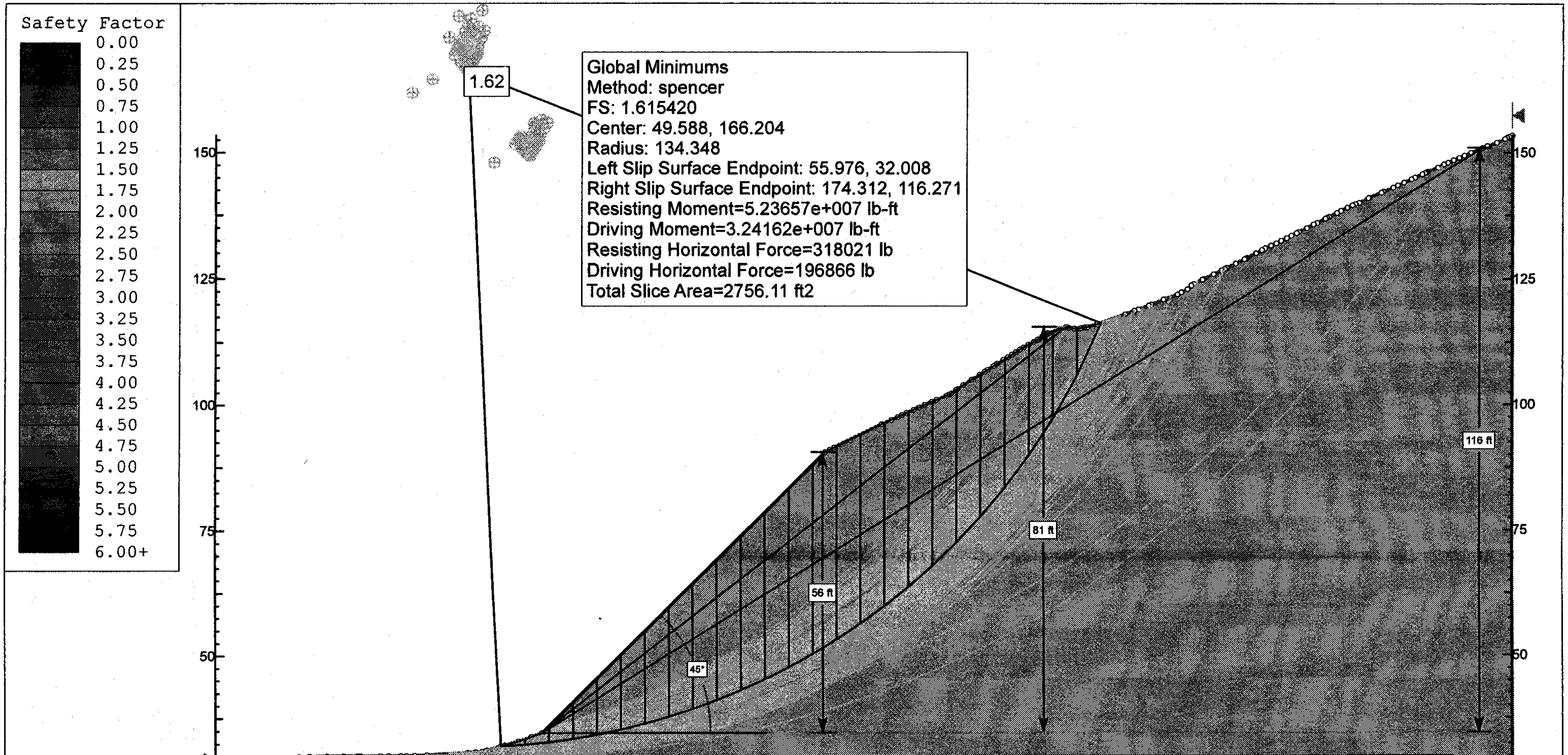
Project	Corona Clay				
Analysis Description	Section A				
Drawn By	CHJ	Author	JMc	Scale	1:150
File Name	BC1 Hoek model wi fill.slim	Date	March 2015	Enclosure	C-1.1

SLIDEINTERPRET 6.034



Project	Corona Clay			
Analysis Description	Back Calculation 1			
Drawn By	CHJ	Author	JMc	Scale
File Name	BC1 Hoek model.slim	Date	March 2015	Enclosure C-1.2

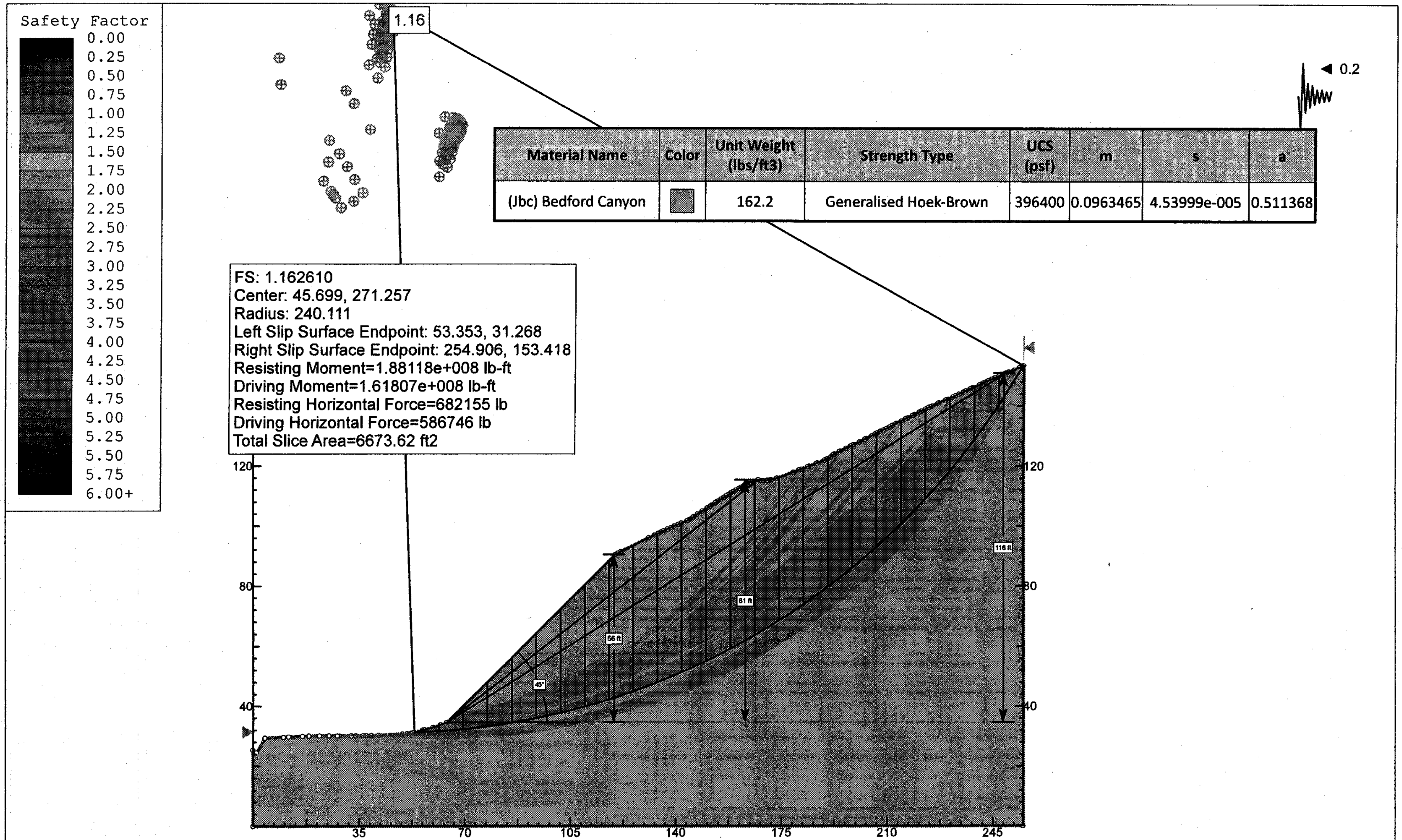
SLIDEINTERPRET 6.034



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)	m	s	a
(Jbc) Bedford Canyon		162.2	Generalised Hoek-Brown	396400	0.0963465	4.53999e-005	0.511368

Project	Corona Clay		
Analysis Description	Section A		
Drawn By	CHJ	Author	JMc
Scale	1:350		
File Name	Sect A 1_1slopestat.slim	Date	March 2015
Enclosure	C-2.1		

SLIDEINTERPRET 6.034



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)	m	s	a
(Jbc) Bedford Canyon		162.2	Generalised Hoek-Brown	396400	0.0963465	4.53999e-005	0.511368

Project	Corona Clay		
Analysis Description	Section A		
Drawn By	CHJ	Author: JMc	Scale: 1:525
File Name	Sect A 1_1slope seis.slim	Date: March 2015	Enclosure: C-2.2

SLIDEINTERPRET 6.034

APPENDIX A1
RESPONSE TO PLANNING DEPARTMENT COMMENTS LETTER

CHJ Consultants
1355 E. Cooley Drive, Suite C, Colton, CA 92324 ♦ Phone (909) 824-7311 ♦ Fax (909) 503-1136
15345 Anacapa Road, Suite D, Victorville, CA 92392 ♦ Phone (760) 243-0506 ♦ Fax (760) 243-1225
77-564A Country Club Drive, Suite 122, Palm Desert, CA 92211 ♦ Phone (760) 772-8234 ♦ Fax (909) 503-1136

April 11, 2016

Corona Clay Company
22079 Knabe Road
Corona, California 92883
Attention: Mr. Craig Deleo

Job No. 15112-8

Subject: Response to Comments
Riverside County Planning Department, Dated January 5, 2016
Corona Clay Quarry, SMP 197R1
Riverside County, California

Reference: Slope Stability Evaluation for the Area of Concern at Corona Clay
Park Canyon Road and Clay Canyon Road
Riverside County, California
Report by CHJ Consultants, Dated March 13, 2015
Job No. 15112-8

Dear Mr. Deleo:

This firm has prepared this letter to address comments by the Riverside County Planning Department regarding their review of our above-referenced slope stability evaluation at Corona Clay. The County's comments are presented in italics, followed by our response.

1. Please expand the list of significant faults (Table 1) to include faults within 100 km of the project site, indicate name, magnitude and distance of each individually.

A table with all seismic sources within 100 km of the site is attached as Table 1.

2. Please provide a listing of significant seismic events in the site vicinity (100 km).

A table with significant recorded seismic events within 100 km of the site is attached as Table 2.

3. Enclosure A-2 (Geologic Map) indicates an approximately 100-foot high 1.5:1 slope is proposed for the "Area of Concern" at the site. The geologic map also indicates that Geologic Cross-Section A-A' was prepared for this analysis. However, the consultant only evaluated a 56-foot high 1:1 slope in their slope stability analysis. Additionally, the consultant concludes that "A flatter slope such as a 1.5(h) to 1(v) .... .is also considered to be stable." The consultant should provide a slope stability analysis on the actual proposed slope depicted on the Reclamation Plan to justify their conclusion. The consultant should also provide all cross-sections and calculations utilized in their analysis.

The initial inclination of the proposed slope was 1:1 and we calculated the stability for that slope. The inclination was changed to 1.5:1 late in the report preparation process, and it was indicated by the project engineer that the inclination was not certain. Both configurations are statically stable by inspection. The static and seismic stability of the slope inclined at 1.5:1 is slightly lower than at 1:1. The associated calculations are attached for 1.5:1 (Enclosures 1 and 2, static fs = 1.66, seismic fs = 1.17 for Kh = 0.20). Slope stability results meet or exceed the standards of the County and the Office of Mine Reclamation.

Our report concluded that the (formerly) proposed 1:1 slope inclination was kinematically stable. Flattening the slope to 1.5:1 reduces the potential for adverse structural components, so the kinematic calculations performed at 1:1 do not require revision. The proposed 1.5:1 slope is considered kinematically stable based on the results for the 1:1 slope included in our report.

4. Enclosure A-2 indicates that a "fill over cut" condition exists on the proposed reclamation slope. This area coincides with an area mapped as underlain by undocumented, and unstable, artificial fill. The consultant should acknowledge and delineate this area on their map, and address this area in *their analysis. The locations and depths of the artificial fill should be depicted on the geologic cross sections.*

Geologic mapping of the slope and adjacent area, including fill areas, was included in our report. For this response, three geologic cross sections (Sections B, C and D) were prepared at critical locations along the strike of the slope. The locations of these sections are shown on the Geologic Map (Enclosure 3). The sections were prepared at 20 scale and reduced to 40 scale for presentation in Enclosures 4, 5 and 6. The sections show the conjectured bedrock/fill contact.

5. Remedial earthwork recommendations for any undocumented fill areas within the proposed reclamation slope should be provided, including removal bottom acceptance criteria.

The Bedford Canyon Formation bedrock on the site is weathered but has performed well in existing cuts, some of which are very steep (78 degrees and locally steeper). The Bedford Canyon Formation wherever it is exposed in removal bottoms is expected to perform well for the intended use of the site as a reclaimed mine.

Our report recommended that the slope design provide for removal of (undocumented) fill where present in finished slope faces. For specific remediation of the hazard of shallow failure in the undocumented fill, we recommend that the fill be removed a minimum horizontal distance of 5 feet from the finished slope face. In addition, the fill adjacent to the slope face should be cut back to 3:1 or flatter. The as-built slope face in the undocumented fill should then be moisture conditioned and track rolled with a D-6 or larger bulldozer, or similar tracked or rubber-tire equipment. The recommended reclaimed configuration of the undocumented fill is shown on geologic cross sections B, C and D (Enclosures 4 through 6).

This remedial work can be handled during grading and does not need to be depicted on the reclamation plan.

6. The consultant should provide recommendations for erosion control on and adjacent to the proposed slope.

Scaling of loose blocks and debris should be conducted during grading as the slope is cut.

All man-made slopes created as part of this project should be planted with appropriate drought-resistant vegetation that does not require an irrigation system. Modified slopes in the undocumented fill should be treated as recommended in Item No. 5 to mitigate erosion potential.

A brow ditch is now shown on the reclamation plan. The ditch traverses the undocumented fill at the top of the slope. The exact alignment of the brow ditch may need to be adjusted in the field based upon the removals of undocumented fill in Item No. 5 to provide positive drainage in the ditch.

Additional Item (unnumbered).

We received an additional comment related verbally by the County Geologist to the project mining consultant, Lilburn Corporation, regarding the need for benches on the completed slope. It is our understanding that this project is being processed as a reclaimed mine under Office of Mine Reclamation and Riverside County criteria for mine sites, and as such, terraces such as those required by the California Building Code are not required. Our report indicated "Inclusion of benches in a 1(h):1(v) overall slope profile would help mitigate raveling and/or rockfall. Benches are not considered necessary for a 1.5(h):1(v) slope." Benches are not required under code for reclaimed mine slopes, nor are they considered to be necessary for adequate stability of the slope. Given the fact that the finished slope face will not be planar due to fill removal during future grading, inclusion of benches and provision of drainage for them may not be practical for this slope.

LIMITATIONS

CHJ Consultants has striven to perform our services within the limits prescribed by our client, and in a manner consistent with the usual thoroughness and competence of reputable geotechnical engineers and engineering geologists practicing under similar circumstances. No other representation, expressed or implied, and no warranty or guarantee is included or intended by virtue of the services performed or reports, opinion, documents, or otherwise supplied.

This report reflects the testing and observations conducted on the site as the site existed during the investigation, which is the subject of this report. However, changes in the conditions of a property can occur with the passage of time, due to natural processes or the works of man on this or adjacent properties. Changes in applicable or appropriate standards may also occur whether as a result of legislation, application, or the broadening of knowledge. Therefore, this report is indicative of only those conditions tested and/or observed at the time of the subject investigation, and the findings of this report may be invalidated fully or partially by changes outside of the control of CHJ Consultants. This report is therefore subject to review and should not be relied upon after a period of one year.

The conclusions and recommendations in this report are based upon observations performed and data collected at separate locations, and interpolation between these locations, carried out for the project and the scope of services described. It is assumed and expected that the conditions between locations observed and/or sampled are similar to those encountered at the individual locations where observation and sampling was performed. However, conditions between these locations may vary significantly. Should conditions that appear different than those described herein be encountered in the field by the client or any firm performing services for the client or the client's assign, this firm should be contacted immediately in order that we might evaluate their effect.

If this report or portions thereof are provided to contractors or included in specifications, it should be understood by all parties that they are provided for information only and should be used as such.

The report and its contents resulting from this investigation are not intended or represented to be suitable for reuse on extensions or modifications of the project, or for use on any other project.

CLOSURE

We appreciate this opportunity to be of service and trust this letter provides the information requested by Riverside County Planning. Should questions arise, please do not hesitate to contact this firm at your convenience.

Respectfully submitted,
CHJ CONSULTANTS

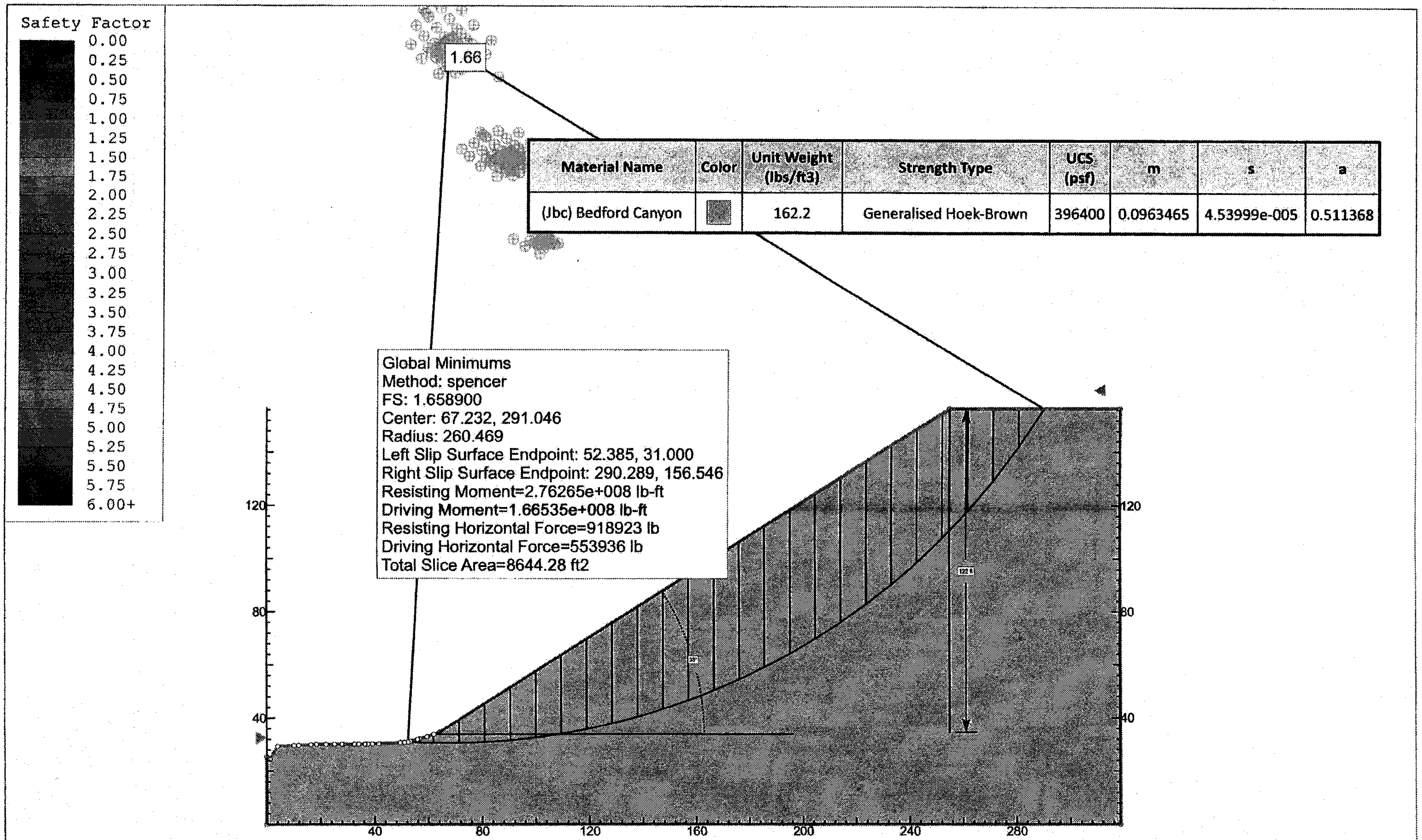
Jay J. Martin, E.G. 1529
Vice President

JJM:lb

Enclosures:	"Table 1"	- Summary of Regional Seismic Sources
	"Table 2"	- Summary of Historic Earthquakes
	"1"	- Static Global Stability (1.5h:1v, along A-A')
	"2"	- Pseudostatic Global Stability (1.5h:1v, Along A-A')
	"3"	- Geologic Map
	"4"	- Geologic Cross Section B-B'
	"5"	- Geologic Cross Section C-C'
	"6"	- Geologic Cross Section D-D'

Table 1: Summary of Regional Seismic Sources			
Fault	**Magnitude**	**Distance (km)**	**Direction**
Elsinore Fault Zone – Glen Ivy Section	6.9	3.4	SW
Elsinore Fault Zone – Chino Section	6.8	13	NW
Elsinore Fault Zone – Temecula Section	7.1	23	SE
Elsinore Fault Zone – Whittier Section	7.0	24	NW
San Jacinto Fault Zone – San Bernardino Segment	7.1	34	NE
San Jacinto Fault Zone – San Jacinto Valley Segment	7.0	35	NE
I-215 – SR-210 Faults	7.1	41	NE
Sierra Madre Fault Zone – Cucamonga Section	6.7	43	N
San Andreas Fault Zone – San Bernardino Section	6.9	45	NE
San Gorgonio Pass Fault Zone	6.9	46	NE
Crafton Hills Fault Zone	6.9	48	NE
Newport-Inglewood-Rose Canyon Fault Zone – South Los Angeles Basin Section	7.2	48	SW
Sierra Madre Fault Zone – Sierra Madre E Section	7.3	48	NW
Sierra Madre Fault Zone – Sierra Madre D Section	7.3	54	NW
San Andreas Fault Zone – Mojave Section	7.3	55	N
San Jacinto Fault Zone – Anza Section	7.3	60	SE
Sierra Madre Fault Zone – Sierra Madre C Section	7.3	64	NW
Sierra Madre Fault Zone – Sierra Madre Clamshell-Sawpit Section	6.7	64	
Palos Verde Fault Zone – San Pedro Shelf Section	7.3	66	SW
Raymond Fault	6.8	67	NW
Coronado Bank Fault Zone – Coronado Bank-Palos Verdes Section	7.4	69	SW
Newport-Inglewood-Rose Canyon Fault Zone – North Los Angeles Basin Section	7.2	73	NW
Pinto Mountains Fault Zone	7.3	75	NE
North Frontal Thrust System – Western Section	7.2	78	NE
Hollywood Fault	6.7	82	NW
Verdugo Fault	6.9	82	NW
Helendale-South Lockhart Fault Zone – Helendale Section	7.4	85	NE
Redondo Canyon Fault	7.3	86	W
San Gabriel Fault Zone – Newhall Section	7.3	88	NW
Sierra Madre Fault Zone – Sierra Madre B Section	6.7	88	NW
Silver Reef Fault	7.0	93	NE
Sierra Madre Fault Zone – San Fernando Section	6.7	94	NW
Long Canyon Fault	7.0	97	NE
Old Woman Springs Fault	7.5	97	NE
Lenwood-Lockhard Fault Zone – Lenwood Section	7.5	99	NE

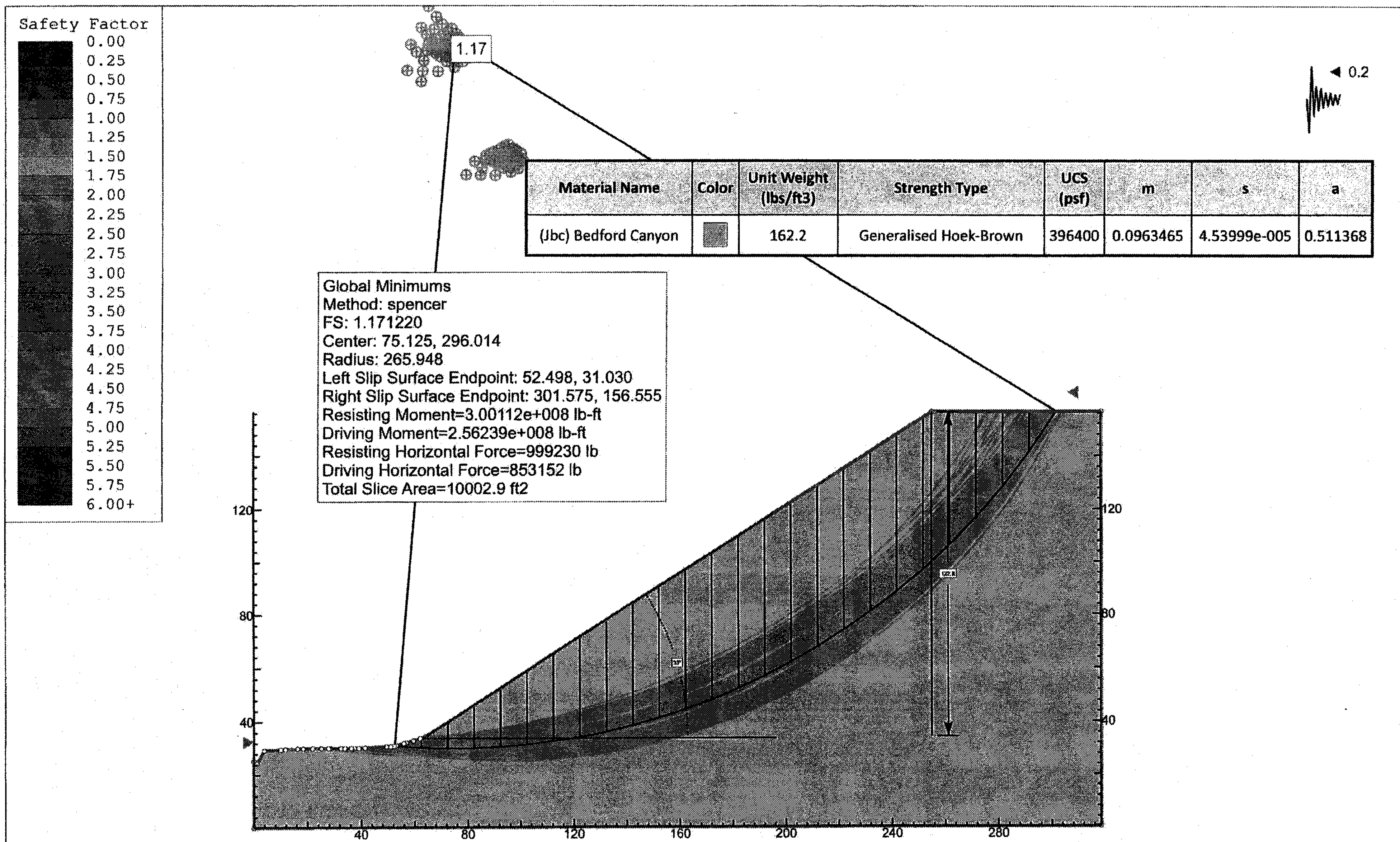
Table 2: Summary of Historic Earthquakes				
Event ID	**Date**	**Magnitude**	**Distance from Site (km)**	**Direction from Site**
Lake Matthews Area	4/21/1918	6.6	3.4	NE
Temescal Valley Area	9/2/2007	4.8	6.8	S
Yorba Linda	9/3/1992	4.8	31	NW
Yorba Linda	8/8/2012	4.5	32	NW
Chino Hills	7/29/2008	5.4	33	NW
Fontana Area	1/15/2014	4.4	40	N
San Timoteo Badlands	9/14/2011	4.2	42	NE
Upland	6/26/1988	4.7	44	NW
Upland	2/28/1990	5.4	45	NW
Yucaipa (14155260*)	6/16/2005	4.9	45	NE
Long Beach	3/10/1933	6.4	50	SW
Whittier Narrows	10/1/1987	5.9	64	NW
North of Cabazon	7/8/1986	5.9	67	NE
San Bernardino Mountains	7/5/2014	4.6	69	NE
Sierra Madre	6/28/1991	5.8	72	NW
Big Bear	6/28/1992	6.4	75	NE
Inglewood	5/17/2009	4.7	82	NW
Palm Springs Area	4/23/1992	6.2	86	E
West Hollywood	9/9/2001	4.2	91	NW
Coachella Area	7/7/2010	5.5	100	SE



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)	m	s	a
(Jbc) Bedford Canyon		162.2	Generalised Hoek-Brown	396400	0.0963465	4.53999e-005	0.511368

Project	Corona Clay		
Analysis Description	Section A 1.5 to 1		
Drawn By: CHJ	Author: JMc	Scale: 1:600	
File Name: Sect A 1_1slope stat_revised to 1.5to1.slim	Date: April 2016	Enclosure: 1	

SLIDEINTERPRET 6.038



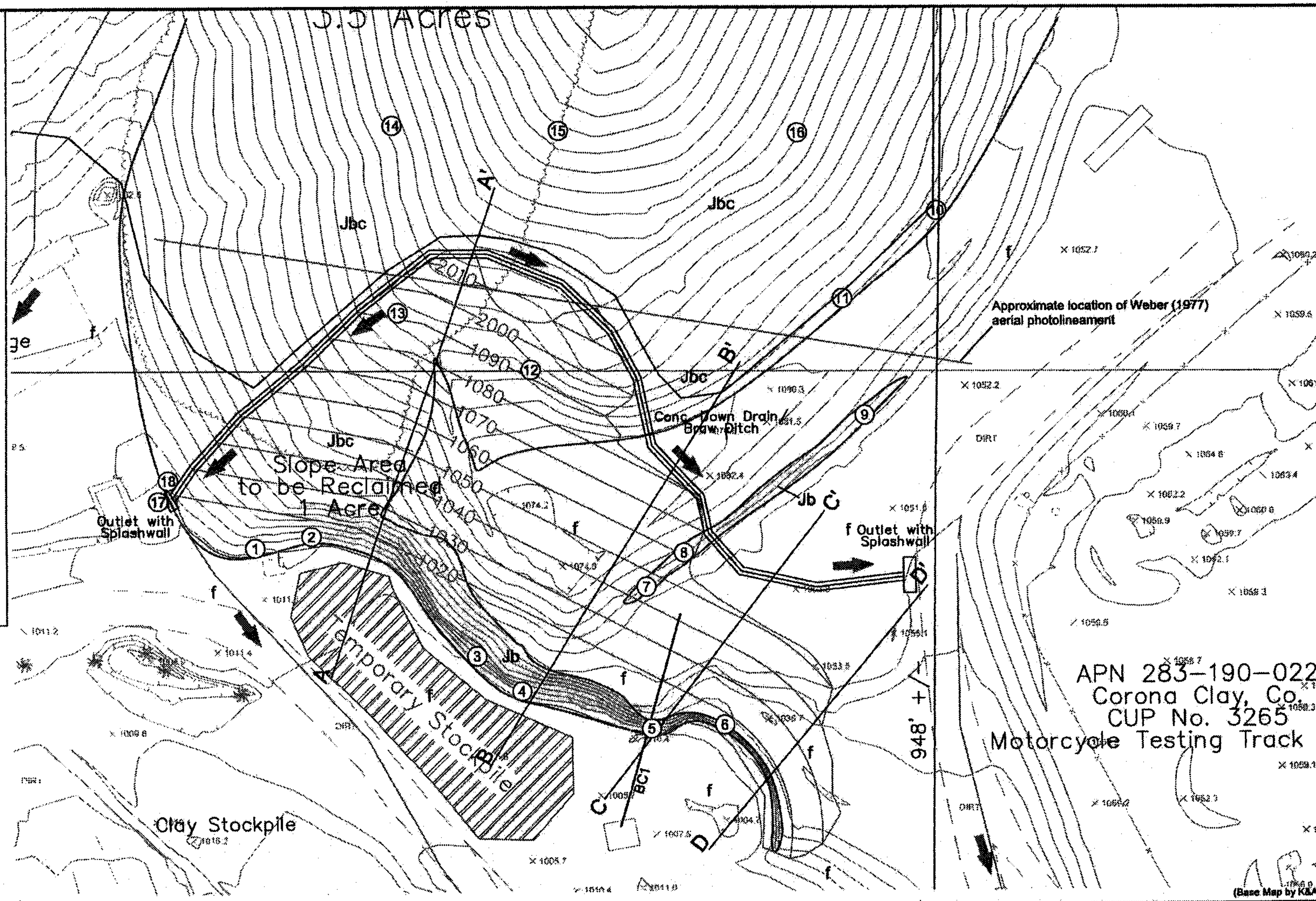
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	UCS (psf)	m	s	a
(Jbc) Bedford Canyon		162.2	Generalised Hoek-Brown	396400	0.0963465	4.53999e-005	0.511368

Project	Corona Clay		
Analysis Description	Section A 1.5 to 1		
Drawn By CHJ	*Author* JMc	*Scale* 1:600	
File Name Sect A 1_1slope seis_revised to 1.5to1.slim	*Date* April 2016	*Enclosure* 2	

SLIDEINTERPRET 6.038

TABLE OF STRUCTURAL DATA:

1	f: N10W, 58NE j: N64W, 69SW, undulatory
2	f: N20W, 38NE
3	f/s?: N5W, 55NW, parallel to f
4	j: N64W, 52SW, undulatory
5	f: N6W, 45NE j: N46E, 64NW j: N76W, 60SW } blocky
6	f: N58W, 35NE
7	f: N82W, 55NE
8	j: N82E, 45SE
9	f: N88W, 60NE
10	f: N60W, 53NE
11	j: N82W, 75SW
12	f: N49W, 59NE
13	f: N75W, 35NE
14	f: N42W, 25NE
15	f: N85E, 40NW
16	f: N55W, 52NE
17	f: N81E, 71NW
18	f: N35W, 85SW



-N-

SCALE: 1" = 50'

0 50 100

LEGEND:

f - fill

Jbc - Jurassic Bedford Canyon Formation- slate with minor quartzite

(18) structural data measurement location

f - foliation

j - joint

s - shear

D______D' Geologic Cross Section

GEOLOGIC MAP

FOR: CORONA CLAY

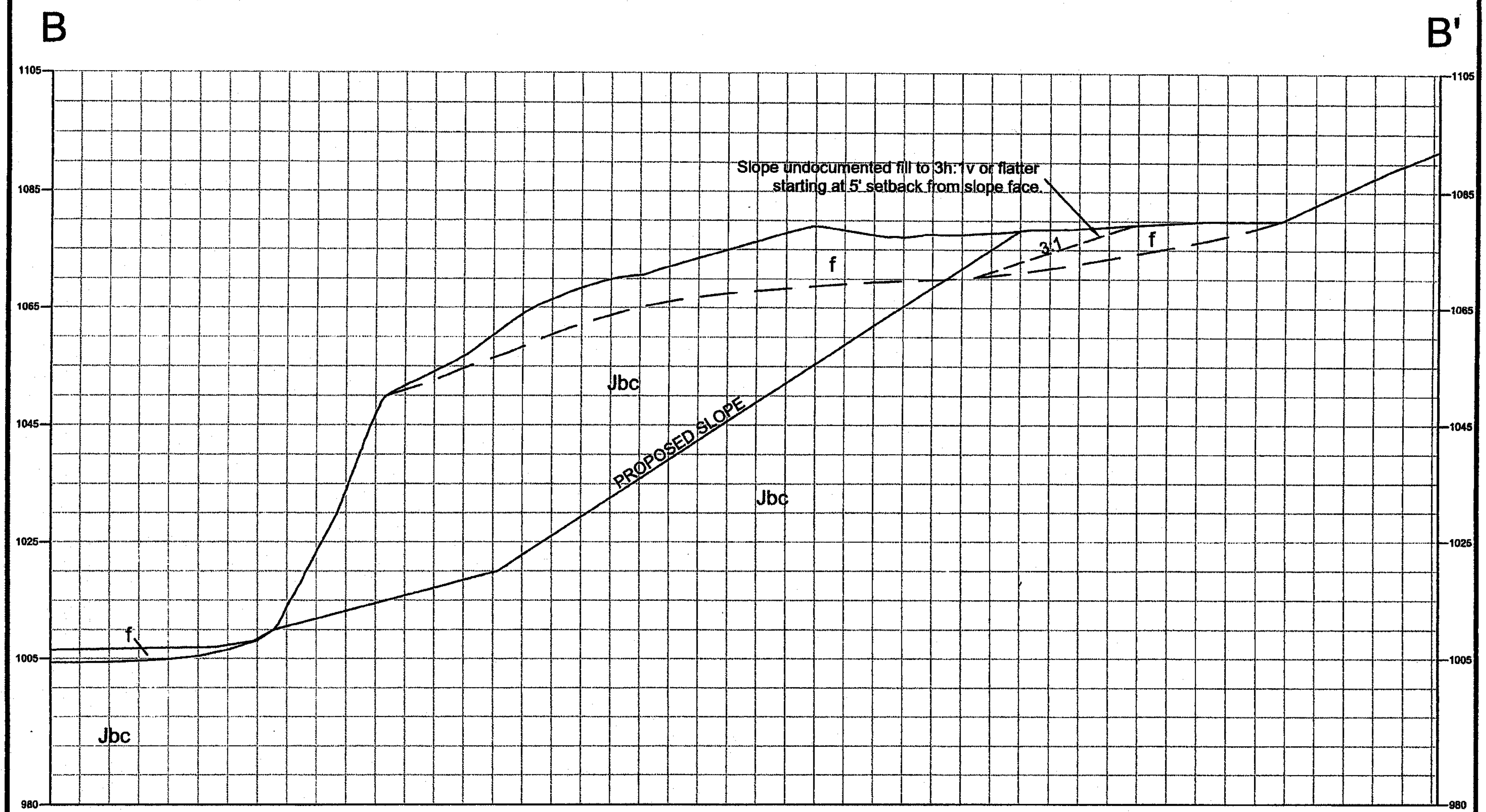
DATE: APRIL 2016

SLOPE STABILITY INVESTIGATION
AREA OF CONCERN, CORONA CLAY QUARRY
CORONA, CALIFORNIA

ENCLOSURE 3

JOB NUMBER 15112-8

CHJ Consultants

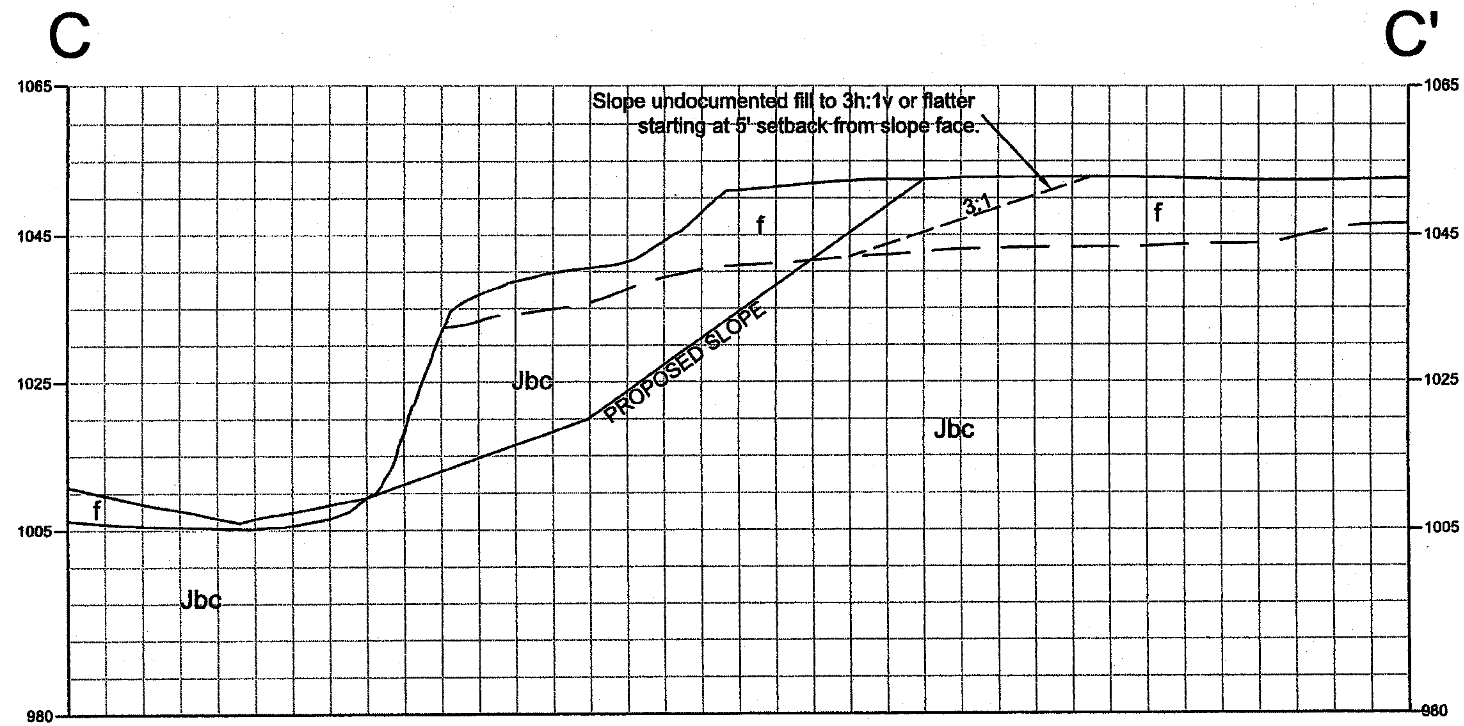


GEOLOGIC CROSS SECTION

FOR: CORONA CLAY	SLOPE STABILITY INVESTIGATION AREA OF CONCERN, CORONA CLAY QUARRY CORONA, CALIFORNIA	ENCLOSURE 4
DATE: APRIL 2016		JOB NUMBER 15112-8

SCALE: 1" = 25'

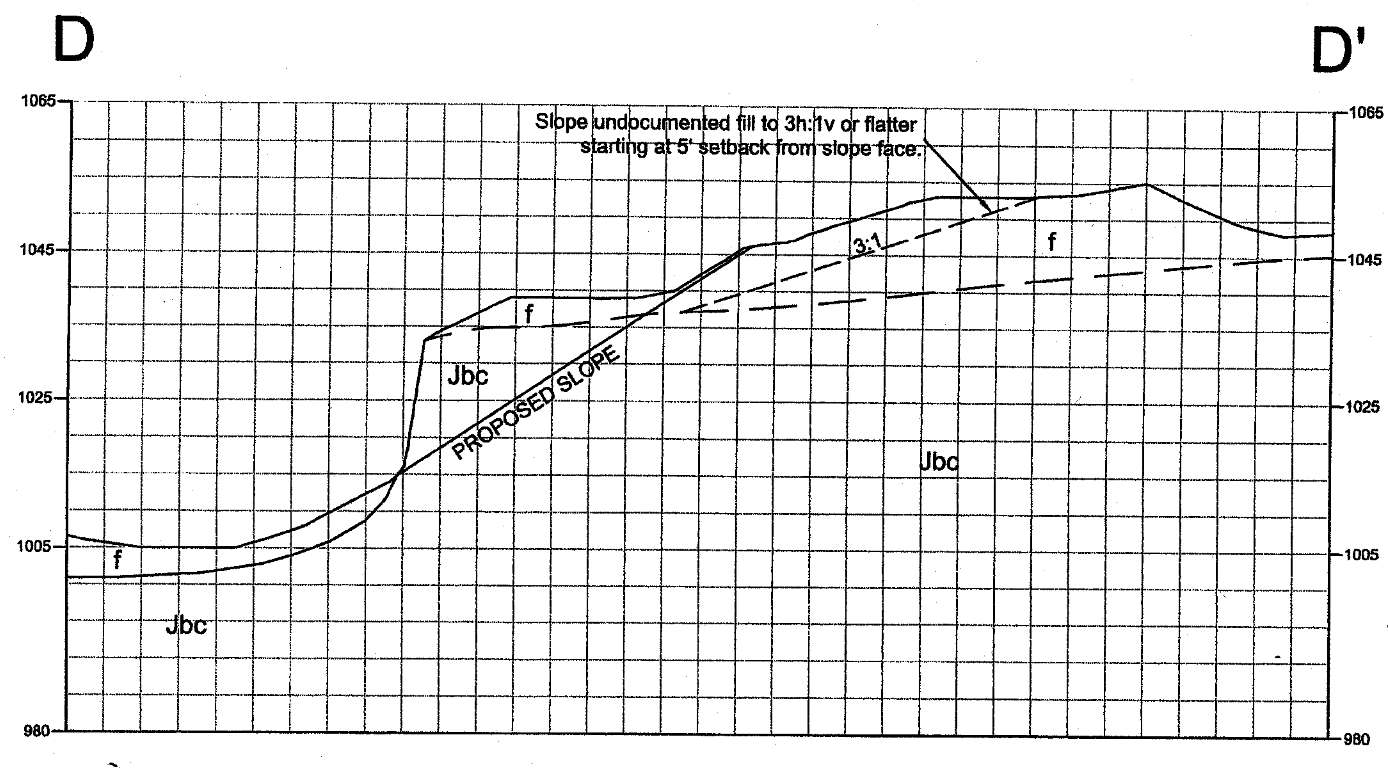
CHJ Consultants



SCALE: 1" = 25'

GEOLOGIC CROSS SECTION		
FOR: CORONA CLAY	SLOPE STABILITY INVESTIGATION AREA OF CONCERN, CORONA CLAY QUARRY CORONA, CALIFORNIA	ENCLOSURE 5
DATE: APRIL 2016		JOB NUMBER 15112-8

CHJ Consultants



SCALE: 1" = 25'

GEOLOGIC CROSS SECTION		
FOR: CORONA CLAY	SLOPE STABILITY INVESTIGATION AREA OF CONCERN, CORONA CLAY QUARRY CORONA, CALIFORNIA	ENCLOSURE 6
DATE: APRIL 2016		JOB NUMBER 15112-8

CHJ Consultants

Appendix B
Initial Drainage Study
prepared by K&A Engineering
March 2015

Initial Drainage Study
for
Corona Clay Temescal Canyon

Prepared for:

CORONA CLAY COMPANY
22079 Knabe Road
Corona, CA 92883

Prepared By:

K&A

K & A Engineering, Inc
357 N. Sheridan Street, Suite 117
Corona, CA 92880
(951) 279-1800

JN: 314.447

REGISTERED PROFESSIONAL ENGINEER
DONALD W. BERGH
No. 28949
CIVIL
STATE OF CALIFORNIA

MARCH 2015

TABLE OF CONTENTS

INTRODUCTION

This Initial Drainage Study has been prepared to provide supporting hydrology calculations for the reclamation plan being prepared by Lilburn Corporation for the Corona Clay Temescal Canyon project site located within unincorporated Riverside County, California.

This report identifies existing drainage patterns for the project site and evaluates potential runoff from the site under existing conditions. The in-closed hydrology calculations determine off-site flows tributary to the site, onsite storm water runoff, flow patterns, points of concentration and flows to existing storm drain systems. Calculations are also provided for determining potential sediment volumes along with initial flow volumes that could be used in determining BMP or sediment basin sizing.

Project Site Description

The existing subject property is located approximately five miles southeast of El Cerrito in the Gavilan Hills at 10600 Dawson Canyon Road, Corona CA 92883.

The Corona Clay is reached by driving south from Corona on I-15 and exiting at the Temescal Canyon exit. Going on old SH-71 and passing under the freeway after a distance of approximately one-half mile, a right turn is made onto the road which leads to El Sobrante Landfill. Just before crossing the bridge a right turn on the Dawson Canyon Road provides access to the subject property approximately ¾ of a mile east of the El Sobrante Landfill Road.

The subject site is currently designated as Assessor's Parcel Numbers 283-190-019, 283-190-021, 283-190-022, 283-190-040, and 283-190-041.

Project Area is shown on the Vicinity Map in Figure 1 and the Location Map in Figure 2.

Figure1: Vicinity Map

Figure 2: Location Map

Proposed Reclamation Plan

The total Corona Clay ownership includes approximately 122 acres with land use designations for Mineral Resources, Water, Rural and Recreation. The reclamation plan addresses a previous excavation on APN 283-19-021 being approximately 20.3 acres.

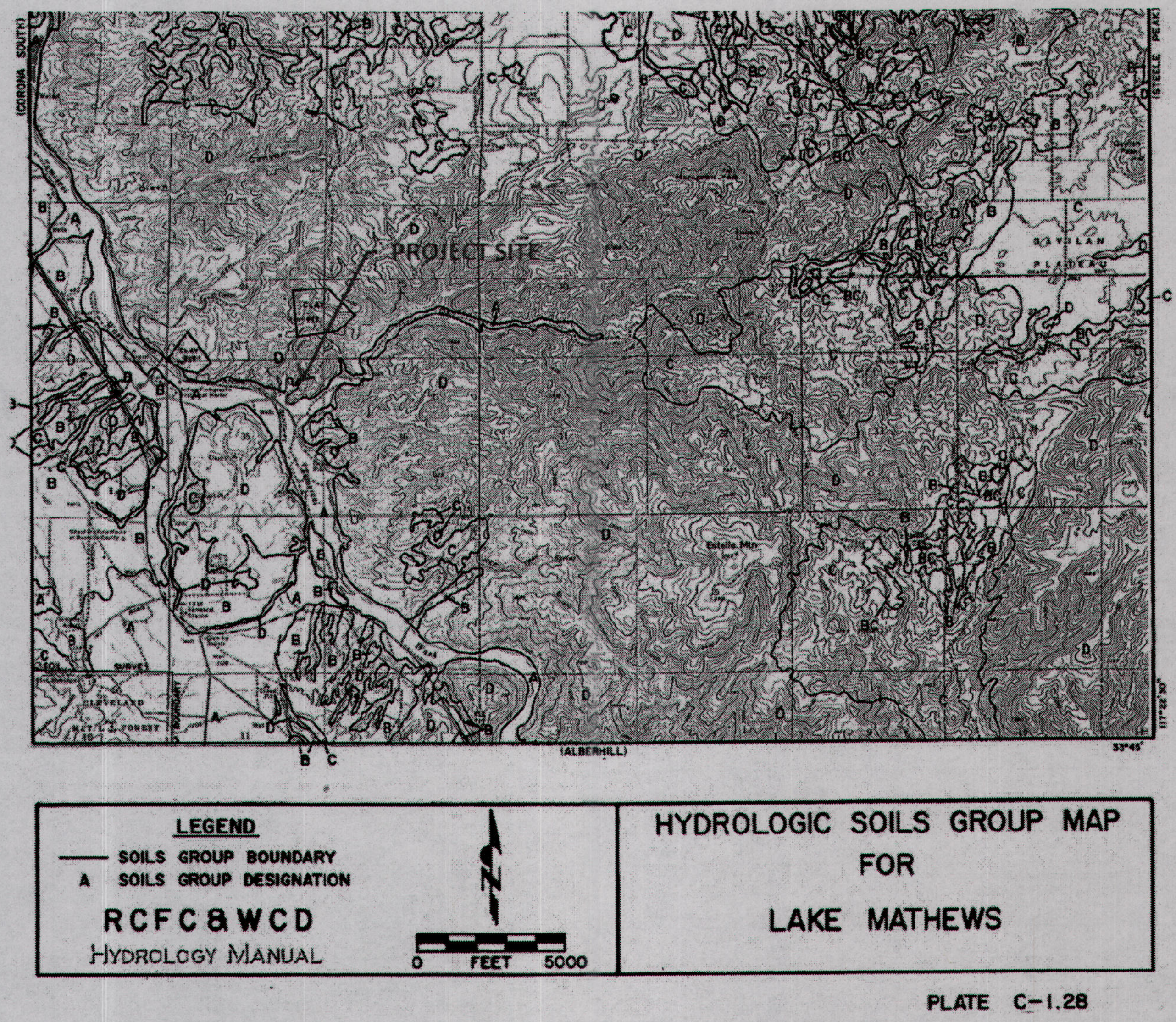
The reclamation plan is proposing to rework an existing excavated steep slope, provide temporary and permanent BMPs to mitigate storm flow erosion and to control storm runoff from the project site.

HYDROLOGY

The hydrology calculations for determining the on-site peak flows and time of concentration (Tc) have been conducted using the Rational Method as incorporated into the CivilCADD / CivilDesign Engineering Software Program.
The rational method relates rainfall intensity, the ratio of runoff to rainfall, and the drainage area size to the peak storm runoff and is expressed by the equation: Q = CIA. Where Q = runoff (in cubic feet per second), C = runoff coefficient relating the ratio of runoff to rainfall, I = rainfall intensity (in inches per hour), A = drainage area (in acres).
The soil type used in the analysis is majority Type D per Hydrologic Soils Group Map for Lake Mathew, Plate C-1.28 RCFC & WCD Hydrology Manual.

The rational method values were used for determining the pre-project (existing conditions) and post-project (proposed condition) peak discharges for the 2-year and 100-year storm events.

Hydrology Maps summarizes the results of the rational method hydrologic analysis, including drainage areas, subareas, node numbers, elevations and cumulative Q_2 and Q_{100} values at points of concentration or discharge.



Hydrologic Soils Group for the project site

The design discharge in the various sub-drainage areas considered in this study are listed in the table below:

Summary On-Site Hydrology – 2-year storm Existing Condition – Rational Method (see Attachment A-1 for calculation):

Drainage Area	Area in Acre	Q_2 sub-area in cfs	Q_2 conf. in cfs
E-1a	2.39	1.48	
E-1b	5.98	3.80	5.28
E-2a	2.68	1.49	
E-2b	1.90	1.15	2.65
E-3a	9.23	5.20	
E-3b	8.57	4.20	9.40
E-3c	4.62	2.26	11.66
E-3d	1.79	1.02	12.68
E-3e	5.48	3.13	15.81
E-3f	3.65	2.09	17.90
E-3g	9.47	5.24	23.14
E-3h	3.68	1.91	
E-3i	1.96	1.28	3.20
E-3j	8.28	4.92	8.12
			30.82
E-3k	5.48	2.93	33.74
E-4a	1.03	0.98	
E-4b	0.31	0.28	1.26

Summary On-Site Hydrology – 100-year storm Existing Condition – Rational Method (see Attachment A-1 for calculation):

Drainage Area	Area in Acre	Q_{100} sub-area in cfs	Q_{100} conf. in cfs
E-1a	2.39	5.52	
E-1b	5.98	12.88	18.40
E-2a	2.68	5.71	
E-2b	1.90	3.91	9.62
E-3a	9.23	19.83	
E-3b	8.57	17.12	36.95
E-3c	4.62	9.23	46.18
E-3d	1.79	3.61	49.79
E-3e	5.48	11.04	60.83
E-3f	3.65	7.35	68.18

E-3g	9.47	18.66	86.84
E-3h	3.68	7.42	
E-3i	1.96	4.20	11.62
E-3j	8.28	16.72	28.34
			114.55
E-3k	5.48	10.55	125.10
E-4a	1.03	3.01	
E-4b	0.31	0.89	3.90

HYDRAULICS

Storm Drain System Calculations

Open Channel, Pipe and Inlet program Flow Master by Haestad Methods, Reference 4 was used to determine the street capacity, ditch capacity and inlet sizing.

Main line system: the following assumptions and criteria were used to design the main line system:

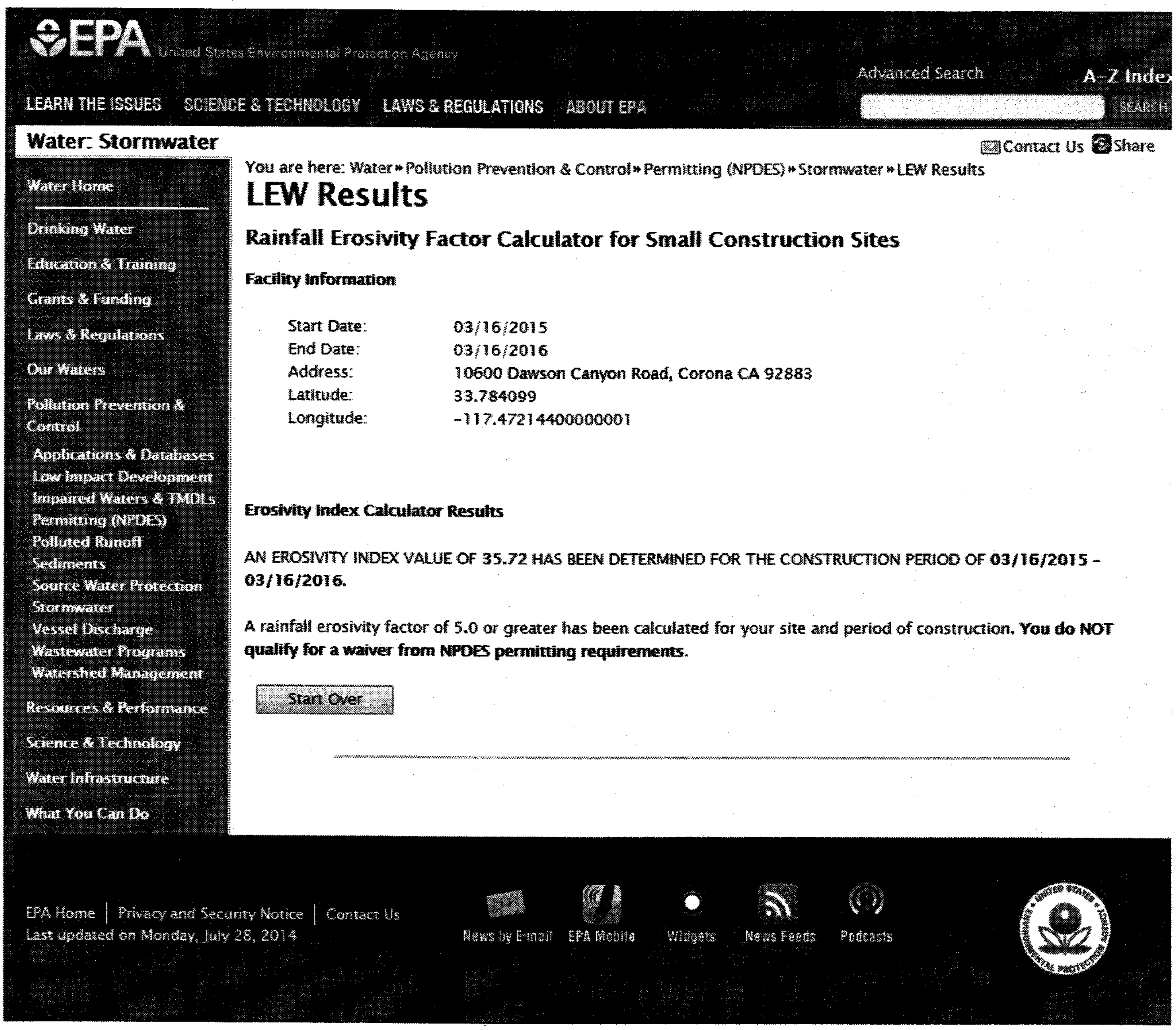
1. n = 0.013 for reinforced concrete pipe, n = 0.014 for reinforced concrete box, and n = 0.015 for concrete V-ditch.
2. The minor losses considered in this study are as follows: friction loss, junction loss, transition loss, and manhole loss. In order to minimize junction structure losses, all junctions are inleting the main line at an angle of approximately 45 degrees.

WSPG hydraulic calculations were used in the design for the principal off site and onsite storm drains to determine the hydraulic gradient elevation for proposed conduit sizes. Detailed Storm Drain Improvement Plans are provided to document final storm drain alignment, sizes and design flows.

SEDIMENT YIELD

Sediment Yield Calculations

Sediment Yield is calculated by using the Sediment Risk Factor Worksheet by EPA Rainfall Erosivity Calculator and individual data from project site.



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LEW Results

Rainfall Erosivity Factor Calculator for Small Construction Sites

Facility Information

Start Date:	03/16/2015
End Date:	03/16/2016
Address:	10600 Dawson Canyon Road, Corona CA 92883
Latitude:	33.784099
Longitude:	-117.47214400000001

Erosivity Index Calculator Results

AN EROSIVITY INDEX VALUE OF 35.72 HAS BEEN DETERMINED FOR THE CONSTRUCTION PERIOD OF **03/16/2015 - 03/16/2016.**

A rainfall erosivity factor of 5.0 or greater has been calculated for your site and period of construction. **You do NOT qualify for a waiver from NPDES permitting requirements.**

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Sediment Risk Factor Worksheet	**Entry**
A) R Factor	
Analyses of data indicated that when factors other than rainfall are held constant, soil loss is directly proportional to a rainfall factor composed of total storm kinetic energy (E) times the maximum 30-min intensity (I30) (Wischmeier and Smith, 1958). The numerical value of R is the average annual sum of EI30 for storm events during a rainfall record of at least 22 years. "Isoerodent" maps were developed based on R values calculated for more than 1000 locations in the Western U.S. Refer to the link below to determine the R factor for the project site. http://cfpub.epa.gov/npdes/stormwater/LEW/lewCalculator.cfm	
R Factor Value	35.72
B) K Factor (weighted average, by area, for all site soils)	
The soil-erodibility factor K represents: (1) susceptibility of soil or surface material to erosion, (2) transportability of the sediment, and (3) the amount and rate of runoff given a particular rainfall input, as measured under a standard condition. Fine-textured soils that are high in clay have low K values (about 0.05 to 0.15) because the particles are resistant to detachment. Coarse-textured soils, such as sandy soils, also have low K values (about 0.05 to 0.2) because of high infiltration resulting in low runoff even though these particles are easily detached. Medium-textured soils, such as a silt loam, have moderate K values (about 0.25 to 0.45) because they are moderately susceptible to particle detachment and they produce runoff at moderate rates. Soils having a high silt content are especially susceptible to erosion and have high K values, which can exceed 0.45 and can be as large as 0.65. Silt-size particles are easily detached and tend to crust, producing high rates and large volumes of runoff. Use Site-specific data must be submitted. Site-specific K factor guidance	
K Factor Value	0.4
C) LS Factor (weighted average, by area, for all slopes)	
The effect of topography on erosion is accounted for by the LS factor, which combines the effects of a hillslope-length factor, L, and a hillslope-gradient factor, S. Generally speaking, as hillslope length and/or hillslope gradient increase, soil loss increases. As hillslope length increases, total soil loss and soil loss per unit area increase due to the progressive accumulation of runoff in the downslope direction. As the hillslope gradient increases, the velocity and erosivity of runoff increases. Use the LS table located in separate tab of this spreadsheet to determine LS factors. Estimate the weighted LS for the site prior to construction. LS Table	
LS Factor Value	2.2
Watershed Erosion Estimate (=RxKxLS) in tons/acre	31.4336
Site Sediment Risk Factor Low Sediment Risk: < 15 tons/acre Medium Sediment Risk: >=15 and <75 tons/acre High Sediment Risk: >= 75 tons/acre	**Medium**

The project site sediment yield = 31.43 tons/acre = 740 cf/acre

Receiving Water (RW) Risk Factor Worksheet	Entry	Score
A. Watershed Characteristics	**yes/no**	
A.1. Does the disturbed area discharge (either directly or indirectly) to a **303(d)-listed waterbody impaired by sediment** (For help with impaired waterbodies please visit the link below) or has a **USEPA approved TMDL implementation plan for sediment**?: http://www.waterboards.ca.gov/water_issues/programs/tmdl/integrated2010.shtml **OR** A.2. Does the disturbed area discharge to a waterbody with designated beneficial uses of SPAWN & COLD & MIGRATORY? (For help please review the appropriate Regional Board Basin Plan) http://www.waterboards.ca.gov/waterboards_map.shtml	**no**	**Low**
Region 1 Basin Plan Region 2 Basin Plan Region 3 Basin Plan Region 4 Basin Plan Region 5 Basin Plan Region 6 Basin Plan Region 7 Basin Plan Region 8 Basin Plan Region 9 Basin Plan		

Combined Risk Level Matrix

<table>
<tr><th colspan="2" rowspan="2"></th><th colspan="3">Sediment Risk</th></tr>
<tr><th>Low</th><th>Medium</th><th>High</th></tr>
<tr><th rowspan="2">Receiving Water Risk</th><th>Low</th><td>Level 1</td><td colspan="2">Level 2</td></tr>
<tr><th>High</th><td colspan="2">Level 2</td><td>Level 3</td></tr>
</table>

Project Sediment Risk:	**Medium**
Project RW Risk:	**Low**
Project Combined Risk:	Level 2

SEDIMENT BASIN

A Sediment basin could be considered to capture sediment-laden runoff and that is temporarily detained under quiescent conditions, allowing sediment to settle out before the runoff is released.

A Sediment basin is one alternative presented here intended to provide options, methods, and techniques to optimize temporary sediment basin performance and basin sediment removal.

Therefore, optimally designed and maintained sediment basin should be used in conjuction with a comprehensive system of BMPs that includes:

- Diverting runoff from undisturbed areas away from the basin.
- Erosion control practices to minimize areas on-site and to provide temporary stabilization and interim sediment controls (e.g., silt fence, check dams, fiber rolls) to reduce the basin's influent sediment concentration.

The proposed sediment basin does not provide a stormwater detention basin for flood control in larger storm event, but it will provide some reduction in peak flow during more frequent rain event.

Locations best suited for a sediment basin are generally in lower elevation areas of the disturbed tributary area where site drainage would not require significant diversion or other means to direct water to the basin inlet. Emergency spillway will be provided to ensure where its failure would result in loss of life or interruption of the use or service.

Basin Design:
The total reclamation area is approximately 20 acres and approximately 15 acres will generate sediment yield. Based on sediment yield rate above (740 cuft/Ac), the proposed basin should provide at the minimum storage of 15 x 740 = 11,100 cuft.
The basin bottom area is 5,945 sqft at elevation 965 with 4:1 side slope. The basin storage sediment yield depth is approximately 1.5 feet or at elevation 966.5

Basin total depth is 3.0 feet, or top of basin is 968. The proposed top of riser outlet is at 966.5 and the proposed emergency spillway will be at elevation 967, which will provide about 1 foot freeboard.

In addition to a single sediment basin other on-site sediment traps can be designed to provide smaller sediment capture BMPs at the source disturbed area. Also temporary check dams, silt fence and fiber rolls can be added to reduce the basin's influent sediment concentration.

SUMMARY

The results as presented within this initial Drainage Study provide existing condition flow rates and volumes that can be used in determining erosion control methods or facilities to control on-site erosion and off-site run-off. Included within this study as attachment C, is a depiction of the size and location using a single sediment basin to control the calculated sediment volume and site runoff.

REFERENCES

1. Riverside County Flood Control and Water Conservation District Hydrology Manual.
2. Corona Clay Hydrology & Drainage Alternative by K & A Engineering, Inc.
3. CivilCADD / CivilDesign Engineering Software.
4. Hydraulic Calculations with Haestad Method, Inc., Flow Master V6.0
5. California Storm Water Best Management Practices Handbook.

ATTACHMENT A-1:

EXISTING CONDITION – RATIONAL METHOD 2- YEAR STORM

Corona Clay – Initial Drainage Study
ATTACHMENT A-1

```
             Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
       Rational Hydrology Study        Date: 03/16/15  File:clay2.out
------------------------------------------------------------------------
Corona Clay
Existing Condition
2-year storm

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

 English (in-lb) Units used in input data file

------------------------------------------------------------------------


Program License Serial Number 4029

------------------------------------------------------------------------
Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) =    2.00 Antecedent Moisture Condition = 1

Standard intensity-duration curves data (Plate D-4.1)
For the [ Corona ] area used.
10 year storm 10 minute intensity =  2.220(In/Hr)
10 year storm 60 minute intensity =  0.940(In/Hr)
100 year storm 10 minute intensity =  3.430(In/Hr)
100 year storm 60 minute intensity =  1.450(In/Hr)

Storm event year =   2.0
Calculated rainfall intensity data:
1 hour intensity =  0.584(In/Hr)
Slope of intensity duration curve = 0.4800



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      100.000 to Point/Station      101.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =    430.000(Ft.)
Top (of initial area) elevation =  1210.000(Ft.)
Bottom (of initial area) elevation =  1119.000(Ft.)
Difference in elevation =    91.000(Ft.)
Slope =    0.21163  s(percent)=      21.16
TC = k(0.940)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.501 min.
Rainfall intensity =      1.154(In/Hr) for a     2.0 year storm
UNDEVELOPED (good cover) subarea
Runoff Coefficient = 0.536
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 1)  =  63.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      1.478(CFS)
Total initial stream area =        2.390(Ac.)
Pervious area fraction = 1.000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      101.000 to Point/Station      102.000
```

```
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  1119.000(Ft.)
End of street segment elevation =   968.000(Ft.)
Length of street segment  =  1594.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  28.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =   2.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      3.328(CFS)
Depth of flow =   0.215(Ft.), Average velocity =   5.150(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   4.432(Ft.)
Flow velocity =   5.15(Ft/s)
Travel time =   5.16 min.     TC =   19.66  min.
 Adding area flow to street
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.637
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 1)   =  76.40
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      0.997(In/Hr) for a     2.0 year storm
Subarea runoff =      3.797(CFS) for      5.980(Ac.)
Total runoff =      5.275(CFS)       Total area =       8.370(Ac.)
Street flow at end of street =      5.275(CFS)
Half street flow at end of street =      2.638(CFS)
Depth of flow =   0.245(Ft.), Average velocity =   5.532(Ft/s)
Flow width (from curb towards crown)=   5.917(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     200.000 to Point/Station      201.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   635.000(Ft.)
Top (of initial area) elevation =  1146.000(Ft.)
Bottom (of initial area) elevation =  1010.000(Ft.)
Difference in elevation =   136.000(Ft.)
Slope =    0.21417  s(percent)=     21.42
TC = k(0.940)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.908 min.
Rainfall intensity =      1.072(In/Hr) for a     2.0 year storm
UNDEVELOPED (good cover) subarea
Runoff Coefficient = 0.520
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 1)   =  63.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      1.494(CFS)
Total initial stream area =       2.680(Ac.)
Pervious area fraction = 1.000


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     201.000 to Point/Station      202.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
```

```
Top of street segment elevation =  1010.000(Ft.)
End of street segment elevation =   966.000(Ft.)
Length of street segment  =   923.000(Ft.)
Height of curb above gutter flowline  =     6.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  28.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =   2.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      2.023(CFS)
Depth of flow =   0.205(Ft.), Average velocity =   3.599(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   3.930(Ft.)
Flow velocity =   3.60(Ft/s)
Travel time =    4.27 min.     TC =   21.18  min.
 Adding area flow to street
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.630
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 1)  =  76.40
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      0.962(In/Hr) for a     2.0 year storm
Subarea runoff =      1.152(CFS) for      1.900(Ac.)
Total runoff =      2.645(CFS)        Total area =       4.580(Ac.)
Street flow at end of street =        2.645(CFS)
Half street flow at end of street =        1.323(CFS)
Depth of flow =   0.223(Ft.), Average velocity =   3.708(Ft/s)
Flow width (from curb towards crown)=   4.797(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      300.000 to Point/Station      301.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance =    653.000(Ft.)
Top (of initial area) elevation =  1260.000(Ft.)
Bottom (of initial area) elevation =  1100.000(Ft.)
Difference in elevation =   160.000(Ft.)
Slope =     0.24502  s(percent)=       24.50
TC = k(0.940)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.644 min.
Rainfall intensity =      1.080(In/Hr) for a     2.0 year storm
UNDEVELOPED (good cover) subarea
Runoff Coefficient = 0.522
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 1)  =  63.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      5.200(CFS)
Total initial stream area =         9.230(Ac.)
Pervious area fraction = 1.000


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Process from Point/Station      301.000 to Point/Station      302.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
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```
Top of natural channel elevation =    1100.000(Ft.)
End of natural channel elevation =    1058.000(Ft.)
Length of natural channel  =   635.000(Ft.)
Estimated mean flow rate at midpoint of channel =      7.614(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
 Velocity = 5.48(q^.33)(slope^.492)
Velocity using mean channel flow =    2.81(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
       Normal channel slope =  0.0661
Corrected/adjusted channel slope =  0.0661
Travel time =     3.76 min.     TC =    20.40  min.


 Adding area flow to channel
UNDEVELOPED (good cover) subarea
Runoff Coefficient = 0.500
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 1)  =  63.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      0.979(In/Hr) for a     2.0 year storm
Subarea runoff =      4.197(CFS) for      8.570(Ac.)
Total runoff =      9.397(CFS)        Total area =      17.800(Ac.)


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Process from Point/Station      301.000 to Point/Station      302.000
**** SUBAREA FLOW ADDITION ****

UNDEVELOPED (good cover) subarea
Runoff Coefficient = 0.500
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 1)  =  63.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Time of concentration =   20.40 min.
Rainfall intensity =      0.979(In/Hr) for a     2.0 year storm
Subarea runoff =      2.263(CFS) for      4.620(Ac.)
Total runoff =     11.659(CFS)        Total area =      22.420(Ac.)


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Process from Point/Station      302.000 to Point/Station      303.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation =  1058.000(Ft.)
End of street segment elevation =  1010.000(Ft.)
Length of street segment  =   905.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  28.000(Ft.)
Slope from gutter to grade break (v/hz) =    0.020
Slope from grade break to crown (v/hz)  =    0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =  2.000(Ft.)
Slope from curb to property line (v/hz) =    0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     12.125(CFS)
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Depth of flow =   0.330(Ft.), Average velocity =   5.246(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  10.144(Ft.)
Flow velocity =   5.25(Ft/s)
Travel time =    2.88 min.     TC =   23.28  min.
 Adding area flow to street
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.622
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 1)  =  76.40
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =     0.919(In/Hr) for a     2.0 year storm
Subarea runoff =     1.023(CFS) for     1.790(Ac.)
Total runoff =     12.682(CFS)       Total area =      24.210(Ac.)
Street flow at end of street =     12.682(CFS)
Half street flow at end of street =      6.341(CFS)
Depth of flow =   0.334(Ft.), Average velocity =   5.300(Ft/s)
Flow width (from curb towards crown)=  10.343(Ft.)


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Process from Point/Station     302.000 to Point/Station     303.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.622
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 1)  =  76.40
Pervious area fraction =  1.000; Impervious fraction =  0.000
Time of concentration =    23.28 min.
Rainfall intensity =     0.919(In/Hr) for a     2.0 year storm
Subarea runoff =     3.131(CFS) for     5.480(Ac.)
Total runoff =     15.813(CFS)       Total area =      29.690(Ac.)


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Process from Point/Station     302.000 to Point/Station     303.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.622
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 1)  =  76.40
Pervious area fraction =  1.000; Impervious fraction =  0.000
Time of concentration =    23.28 min.
Rainfall intensity =     0.919(In/Hr) for a     2.0 year storm
Subarea runoff =     2.085(CFS) for     3.650(Ac.)
Total runoff =     17.898(CFS)       Total area =      33.340(Ac.)


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Process from Point/Station     303.000 to Point/Station     304.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  1010.000(Ft.)
End of street segment elevation =   977.000(Ft.)
Length of street segment  =   485.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  28.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
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Slope from grade break to crown (v/hz)  =    0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =   2.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     20.440(CFS)
Depth of flow =   0.367(Ft.), Average velocity =   6.517(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  12.006(Ft.)
Flow velocity =    6.52(Ft/s)
Travel time =    1.24 min.      TC =    24.52  min.
 Adding area flow to street
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.617
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 1)  =  76.40
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =       0.897(In/Hr) for a     2.0 year storm
Subarea runoff =      5.236(CFS) for      9.470(Ac.)
Total runoff =      23.135(CFS)        Total area =       42.810(Ac.)
Street flow at end of street =      23.135(CFS)
Half street flow at end of street =      11.567(CFS)
Depth of flow =   0.379(Ft.), Average velocity =   6.710(Ft/s)
Flow width (from curb towards crown)=  12.638(Ft.)


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Process from Point/Station      303.000 to Point/Station      304.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 1
Stream flow area =      42.810(Ac.)
Runoff from this stream =      23.135(CFS)
Time of concentration =   24.52 min.
Rainfall intensity =      0.897(In/Hr)


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Process from Point/Station      310.000 to Point/Station      311.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance =    900.000(Ft.)
Top (of initial area) elevation =  1239.500(Ft.)
Bottom (of initial area) elevation =  1007.000(Ft.)
Difference in elevation =    232.500(Ft.)
Slope =     0.25833  s(percent)=       25.83
TC = k(0.940)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   18.724 min.
Rainfall intensity =       1.021(In/Hr) for a     2.0 year storm
UNDEVELOPED (good cover) subarea
Runoff Coefficient = 0.509
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 1)  =  63.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =       1.913(CFS)
Total initial stream area =        3.680(Ac.)
Pervious area fraction = 1.000


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Process from Point/Station      310.000 to Point/Station      311.000
**** SUBAREA FLOW ADDITION ****

UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.641
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 1)  =  76.40
Pervious area fraction =  1.000; Impervious fraction =  0.000
Time of concentration =    18.72 min.
Rainfall intensity =      1.021(In/Hr) for a     2.0 year storm
Subarea runoff =      1.283(CFS) for      1.960(Ac.)
Total runoff =      3.195(CFS)        Total area =       5.640(Ac.)


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Process from Point/Station      311.000 to Point/Station      304.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****

Top of street segment elevation =   1007.000(Ft.)
End of street segment elevation =    977.000(Ft.)
Length of street segment  =   743.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  28.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =   2.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =       5.599(CFS)
Depth of flow =   0.279(Ft.), Average velocity =   3.976(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   7.598(Ft.)
Flow velocity =   3.98(Ft/s)
Travel time =    3.11 min.     TC =   21.84  min.
 Adding area flow to street
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.627
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 1)  =  76.40
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      0.948(In/Hr) for a     2.0 year storm
Subarea runoff =      4.924(CFS) for      8.280(Ac.)
Total runoff =      8.119(CFS)        Total area =      13.920(Ac.)
Street flow at end of street =      8.119(CFS)
Half street flow at end of street =      4.060(CFS)
Depth of flow =   0.307(Ft.), Average velocity =   4.311(Ft/s)
Flow width (from curb towards crown)=   9.028(Ft.)


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Process from Point/Station      311.000 to Point/Station      304.000
**** CONFLUENCE OF MINOR STREAMS ****

Along Main Stream number: 1 in normal stream number 2
Stream flow area =      13.920(Ac.)
Runoff from this stream =      8.119(CFS)
Time of concentration =   21.84 min.
Rainfall intensity =     0.948(In/Hr)
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Summary of stream data:

Stream    Flow rate      TC           Rainfall Intensity
 No.        (CFS)       (min)               (In/Hr)


1        23.135     24.52                  0.897
2         8.119     21.84                  0.948
Largest stream flow has longer time of concentration
Qp =      23.135 + sum of
          Qb          Ia/Ib
           8.119 *    0.946 =       7.680
Qp =      30.815

Total of 2 streams to confluence:
Flow rates before confluence point:
      23.135       8.119
Area of streams before confluence:
       42.810       13.920
Results of confluence:
Total flow rate =      30.815(CFS)
Time of concentration =     24.520 min.
Effective stream area after confluence =      56.730(Ac.)


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Process from Point/Station      304.000 to Point/Station      305.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =    977.000(Ft.)
End of street segment elevation =    965.000(Ft.)
Length of street segment  =    432.000(Ft.)
Height of curb above gutter flowline  =      6.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  28.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =    2.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      32.303(CFS)
Depth of flow =    0.473(Ft.), Average velocity =   5.175(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  17.304(Ft.)
Flow velocity =    5.17(Ft/s)
Travel time =    1.39 min.     TC =    25.91  min.
 Adding area flow to street
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.612
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 1)  =  76.40
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =       0.873(In/Hr) for a     2.0 year storm
Subarea runoff =       2.926(CFS) for      5.480(Ac.)
Total runoff =      33.741(CFS)        Total area =        62.210(Ac.)
Street flow at end of street =      33.741(CFS)
Half street flow at end of street =      16.870(CFS)
Depth of flow =    0.479(Ft.), Average velocity =   5.230(Ft/s)
Flow width (from curb towards crown)=  17.604(Ft.)


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Process from Point/Station      400.000 to Point/Station      401.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance =   507.000(Ft.)
Top (of initial area) elevation =  1035.000(Ft.)
Bottom (of initial area) elevation =   983.500(Ft.)
Difference in elevation =     51.500(Ft.)
Slope =    0.10158  s(percent)=      10.16
TC = k(0.530)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   10.114 min.
Rainfall intensity =      1.372(In/Hr) for a     2.0 year storm
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.692
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 1)  =  76.40
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      0.978(CFS)
Total initial stream area =        1.030(Ac.)
Pervious area fraction = 1.000


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Process from Point/Station      401.000 to Point/Station      402.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****

Upstream point/station elevation =    983.500(Ft.)
Downstream point/station elevation =    982.000(Ft.)
Pipe length  =    100.00(Ft.)   Manning's N = 0.015
No. of pipes = 1  Required pipe flow  =     0.978(CFS)
Nearest computed pipe diameter  =      9.00(In.)
Calculated individual pipe flow  =     0.978(CFS)
Normal flow depth in pipe =    4.80(In.)
Flow top width inside pipe =    8.98(In.)
Critical Depth =     5.44(In.)
Pipe flow velocity =      4.08(Ft/s)
Travel time through pipe =    0.41 min.
Time of concentration (TC) =    10.52 min.


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Process from Point/Station      402.000 to Point/Station      403.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****

Top of natural channel elevation =     982.000(Ft.)
End of natural channel elevation =     975.000(Ft.)
Length of natural channel  =    65.000(Ft.)
Estimated mean flow rate at midpoint of channel =      1.125(CFS)

Natural valley channel type used
L.A. County flood control district formula for channel velocity:
 Velocity(ft/s) = (7 + 8(q(English Units)^.352)(slope^0.5)
Velocity using mean channel flow =    5.03(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
       Normal channel slope =  0.1077
Corrected/adjusted channel slope =  0.1077
Travel time =    0.22 min.     TC =   10.74  min.


 Adding area flow to channel
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.688
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
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```
RI index for soil(AMC 1)  =  76.40
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      1.333(In/Hr) for a     2.0 year storm
Subarea runoff =      0.284(CFS) for      0.310(Ac.)
Total runoff =      1.262(CFS)        Total area =       1.340(Ac.)
End of computations, total study area =          76.50 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged RI index number =  85.3
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ATTACHMENT A-2:

EXISTING CONDITION – RATIONAL METHOD 100-YEAR STORM

Corona Clay – Initial Drainage Study
ATTACHMENT A-2

```
                Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2005 Version 7.1
       Rational Hydrology Study        Date: 03/16/15  File:clay100.out
------------------------------------------------------------------------
Corona Clay
Existing Condition
100-year storm

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

 English (in-lb) Units used in input data file

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Program License Serial Number 4029

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Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) =  100.00 Antecedent Moisture Condition = 2

Standard intensity-duration curves data (Plate D-4.1)
For the [ Corona ] area used.
10 year storm 10 minute intensity =  2.220(In/Hr)
10 year storm 60 minute intensity =  0.940(In/Hr)
100 year storm 10 minute intensity =  3.430(In/Hr)
100 year storm 60 minute intensity =  1.450(In/Hr)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity =  1.450(In/Hr)
Slope of intensity duration curve = 0.4800



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Process from Point/Station      100.000 to Point/Station      101.000
**** INITIAL AREA EVALUATION ****

Initial area flow distance =   430.000(Ft.)
Top (of initial area) elevation =  1210.000(Ft.)
Bottom (of initial area) elevation =  1119.000(Ft.)
Difference in elevation =    91.000(Ft.)
Slope =     0.21163  s(percent)=      21.16
TC = k(0.940)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   14.501 min.
Rainfall intensity =      2.867(In/Hr) for a   100.0 year storm
UNDEVELOPED (good cover) subarea
Runoff Coefficient = 0.806
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  80.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      5.524(CFS)
Total initial stream area =        2.390(Ac.)
Pervious area fraction = 1.000


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Process from Point/Station      101.000 to Point/Station      102.000
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**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  1119.000(Ft.)
End of street segment elevation =   968.000(Ft.)
Length of street segment  =  1594.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  28.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =   2.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      12.023(CFS)
Depth of flow =   0.304(Ft.), Average velocity =   6.554(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =   8.891(Ft.)
Flow velocity =   6.55(Ft/s)
Travel time =    4.05 min.     TC =   18.55  min.
 Adding area flow to street
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.845
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  89.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      2.547(In/Hr) for a   100.0 year storm
Subarea runoff =      12.875(CFS) for      5.980(Ac.)
Total runoff =     18.399(CFS)        Total area =       8.370(Ac.)
Street flow at end of street =      18.399(CFS)
Half street flow at end of street =       9.200(CFS)
Depth of flow =   0.341(Ft.), Average velocity =   7.219(Ft/s)
Flow width (from curb towards crown)=  10.713(Ft.)


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Process from Point/Station      200.000 to Point/Station      201.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =    635.000(Ft.)
Top (of initial area) elevation =  1146.000(Ft.)
Bottom (of initial area) elevation =  1010.000(Ft.)
Difference in elevation =   136.000(Ft.)
Slope =    0.21417  s(percent)=      21.42
TC = k(0.940)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =  16.908 min.
Rainfall intensity =      2.663(In/Hr) for a   100.0 year storm
UNDEVELOPED (good cover) subarea
Runoff Coefficient = 0.800
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  80.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =       5.709(CFS)
Total initial stream area =        2.680(Ac.)
Pervious area fraction = 1.000


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Process from Point/Station      201.000 to Point/Station      202.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
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Top of street segment elevation =  1010.000(Ft.)
End of street segment elevation =   966.000(Ft.)
Length of street segment  =   923.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  28.000(Ft.)
Slope from gutter to grade break (v/hz) =   0.020
Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =   2.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      7.733(CFS)
Depth of flow =   0.297(Ft.), Average velocity =   4.550(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =    8.504(Ft.)
Flow velocity =    4.55(Ft/s)
Travel time =    3.38 min.     TC =   20.29  min.
 Adding area flow to street
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.843
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  89.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      2.440(In/Hr) for a   100.0 year storm
Subarea runoff =      3.908(CFS) for      1.900(Ac.)
Total runoff =      9.618(CFS)        Total area =      4.580(Ac.)
Street flow at end of street =      9.618(CFS)
Half street flow at end of street =      4.809(CFS)
Depth of flow =   0.314(Ft.), Average velocity =   4.776(Ft/s)
Flow width (from curb towards crown)=   9.382(Ft.)


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Process from Point/Station      300.000 to Point/Station      301.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   653.000(Ft.)
Top (of initial area) elevation =  1260.000(Ft.)
Bottom (of initial area) elevation =  1100.000(Ft.)
Difference in elevation =   160.000(Ft.)
Slope =     0.24502   s(percent)=      24.50
TC = k(0.940)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   16.644 min.
Rainfall intensity =      2.683(In/Hr) for a   100.0 year storm
UNDEVELOPED (good cover) subarea
Runoff Coefficient = 0.801
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  80.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =     19.828(CFS)
Total initial stream area =        9.230(Ac.)
Pervious area fraction = 1.000


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Process from Point/Station      301.000 to Point/Station      302.000
**** NATURAL CHANNEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
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Top of natural channel elevation =   1100.000(Ft.)
End of natural channel elevation =   1058.000(Ft.)
Length of natural channel  =   635.000(Ft.)
Estimated mean flow rate at midpoint of channel =     29.033(CFS)

Natural mountain channel type used
L.A. County flood control district formula for channel velocity:
 Velocity = 5.48(q^.33)(slope^.492)
Velocity using mean channel flow =   4.38(Ft/s)

Correction to map slope used on extremely rugged channels with
drops and waterfalls (Plate D-6.2)
       Normal channel slope =  0.0661
Corrected/adjusted channel slope =  0.0661
Travel time =    2.42 min.     TC =   19.06  min.


 Adding area flow to channel
UNDEVELOPED (good cover) subarea
Runoff Coefficient = 0.795
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  80.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      2.514(In/Hr) for a    100.0 year storm
Subarea runoff =     17.122(CFS) for      8.570(Ac.)
Total runoff =     36.950(CFS)        Total area =      17.800(Ac.)


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Process from Point/Station      301.000 to Point/Station      302.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
UNDEVELOPED (good cover) subarea
Runoff Coefficient = 0.795
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  80.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Time of concentration =    19.06 min.
Rainfall intensity =      2.514(In/Hr) for a    100.0 year storm
Subarea runoff =      9.230(CFS) for      4.620(Ac.)
Total runoff =     46.180(CFS)        Total area =      22.420(Ac.)


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Process from Point/Station      302.000 to Point/Station      303.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  1058.000(Ft.)
End of street segment elevation =  1010.000(Ft.)
Length of street segment  =   905.000(Ft.)
Height of curb above gutter flowline  =    6.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  28.000(Ft.)
Slope from gutter to grade break (v/hz) =    0.020
Slope from grade break to crown (v/hz)  =    0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =   2.000(Ft.)
Slope from curb to property line (v/hz) =    0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     48.024(CFS)
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Depth of flow =    0.483(Ft.), Average velocity =    7.279(Ft/s)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  17.810(Ft.)
Flow velocity =    7.28(Ft/s)
Travel time =     2.07 min.      TC =    21.13  min.
 Adding area flow to street
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.842
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  89.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      2.393(In/Hr) for a    100.0 year storm
Subarea runoff =      3.606(CFS) for      1.790(Ac.)
Total runoff =     49.787(CFS)        Total area =      24.210(Ac.)
Street flow at end of street =     49.787(CFS)
Half street flow at end of street =     24.893(CFS)
Depth of flow =    0.488(Ft.), Average velocity =    7.344(Ft/s)
Flow width (from curb towards crown)=  18.064(Ft.)


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Process from Point/Station      302.000 to Point/Station      303.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.842
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  89.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Time of concentration =    21.13 min.
Rainfall intensity =      2.393(In/Hr) for a    100.0 year storm
Subarea runoff =     11.041(CFS) for      5.480(Ac.)
Total runoff =     60.827(CFS)        Total area =      29.690(Ac.)


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Process from Point/Station      302.000 to Point/Station      303.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.842
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  89.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Time of concentration =    21.13 min.
Rainfall intensity =      2.393(In/Hr) for a    100.0 year storm
Subarea runoff =      7.354(CFS) for      3.650(Ac.)
Total runoff =     68.181(CFS)        Total area =      33.340(Ac.)


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Process from Point/Station      303.000 to Point/Station      304.000
**** STREET FLOW TRAVEL TIME + SUBAREA FLOW ADDITION ****
______________________________________________________________________
Top of street segment elevation =  1010.000(Ft.)
End of street segment elevation =   977.000(Ft.)
Length of street segment  =   485.000(Ft.)
Height of curb above gutter flowline  =     6.0(In.)
Width of half street (curb to crown)  =  30.000(Ft.)
Distance from crown to crossfall grade break  =  28.000(Ft.)
Slope from gutter to grade break (v/hz) =    0.020
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Slope from grade break to crown (v/hz)  =   0.020
Street flow is on [2] side(s) of the street
Distance from curb to property line  =   2.000(Ft.)
Slope from curb to property line (v/hz) =   0.025
Gutter width =   2.000(Ft.)
Gutter hike from flowline =  2.000(In.)
 Manning's N in gutter =  0.0150
 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =      77.600(CFS)
Depth of flow =   0.542(Ft.), Average velocity =   8.685(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    1.67(Ft.)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  20.751(Ft.)
Flow velocity =    8.68(Ft/s)
Travel time =     0.93 min.      TC =    22.06  min.
 Adding area flow to street
UNDEVELOPED (poor cover) subarea
Runoff Coefficient = 0.841
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  89.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Rainfall intensity =      2.344(In/Hr) for a   100.0 year storm
Subarea runoff =     18.663(CFS) for      9.470(Ac.)
Total runoff =     86.844(CFS)        Total area =      42.810(Ac.)
Street flow at end of street =     86.844(CFS)
Half street flow at end of street =     43.422(CFS)
Depth of flow =   0.560(Ft.), Average velocity =   8.898(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    2.38(Ft.)
Flow width (from curb towards crown)=  21.644(Ft.)


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Process from Point/Station      303.000 to Point/Station      304.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     42.810(Ac.)
Runoff from this stream =     86.844(CFS)
Time of concentration =   22.06 min.
Rainfall intensity =      2.344(In/Hr)


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Process from Point/Station      310.000 to Point/Station      311.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =    900.000(Ft.)
Top (of initial area) elevation =  1239.500(Ft.)
Bottom (of initial area) elevation =  1007.000(Ft.)
Difference in elevation =   232.500(Ft.)
Slope =     0.25833  s(percent)=      25.83
TC = k(0.940)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   18.724 min.
Rainfall intensity =      2.536(In/Hr) for a   100.0 year storm
UNDEVELOPED (good cover) subarea
Runoff Coefficient = 0.795
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
RI index for soil(AMC 2)  =  80.00
Pervious area fraction =  1.000; Impervious fraction =  0.000
Initial subarea runoff =      7.423(CFS)
Total initial stream area =        3.680(Ac.)
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