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TECHNICAL GUIDELINES FOR REVIEW OF GEOTECHNICAL AND GEOLOGIC REPORTS

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PREFACE

Consulting geotechnical engineers and geologists, are responsible for consistency, validity, accuracy, reliability and adequacy of information presented in technical reports. Performing adequate investigation, applying competent analysis, providing adequate grading design recommendations, ensuring implementation of proper earthwork procedures and assuring suitability of a project site for its intended use is the primary obligation of the consulting engineers and geologists and ultimately of the grading and building contractors and the applicant. Riverside County recognizes that site specific conditions and proposed developments vary greatly between projects and thus the consulting professionals need to apply discretion and judgements to reflect the appropriate assessment, analysis and recommendations in technical reports.

The following technical guidelines provide applicants and their consultants a basic model, fundamental format, a general theme and in some instances, where considered essential, the minimum standards of practice expected in technical reports. These guidelines are not "codes" to reflect definite parameters for design of project sites. Further they are not "static", but are, in most parts, rather flexible and are intended to evolve and to adapt to site's specific conditions, to changes of the industry and to the current scientific understanding of technical issue.

Depending upon site specifics, technical reports may be required to include and address all of the categories of technical reports identified herein in a single document. The consulting engineers and geologists of record are obligated, by the standards of professional practice, to evaluate all of the pertinent attributes within and around a project site regardless if they are referenced in these guidelines or not. These guidelines are not intended to limit the consultant's responsibility to study, consider and analyze other non-referenced technical issues, geotechnical, geological and environmental hazards nor limit their rights to practice in accordance with the State and national laws and with the applicable and evolving "Standard of Care".

These guidelines are inherently general and cover a wide range of issues and concerns. Therefore, the consulting engineers and geologists should use discretion and independent professional assessment to evaluate each project for applicability of these guidelines.

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SECTION 3: **Surface Mining Permits / Misc. (Plot Plan, CUP's, Energy Sites, WECS & CEQA reports**

PART II REPORTS FOR PLANNING AND BUILDING & SAFETY DEPARTMENTS REVIEW:

SECTION 1: **Fault Hazard Reports**:

These reports focus on projects located within or partially within the Alquist Priolo Special Studies Zones, County Fault Zones or within any active faults zones as currently defined by State, County or local government.

SECTION 2: **Liquefaction Reports:**

These reports are required for sites located in mapped liquefaction hazard zones and for other sites where potential liquefaction hazards have been identified .

PART III REPORTS FOR BUILDING & SAFETY DEPARTMENT REVIEW:

SECTION 1: Geotechnical & Geological Investigation Reports:

Geotechnical and geological investigations are intended to identify and evaluate issues that impact development of the site, and provide recommendations for mitigating or accommodating these issues.

SECTION 2: Grading & Inspection Reports:

These reports follow completion of earthwork activities and their intent is to document implementation of the recommendations outlined in previously approved geotechnical and geological investigation reports, to reflect any changes made in the original recommendations and present documentation of actual work performed on site during grading.

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DEFINITIONS

APPLICANT:

A person or entity applying for permit.

APPROVAL:

Shall mean that, in the opinion of the Building Official, the proposed work or completed work conforms to applicable national, State and local (Riverside County) governing regulations. However, approval shall not be construed to be a permit for or an approval of any violation of any of the provisions of the State, or County laws.

ENGINEERED GRADING:

According to UBC, Appendix Chapter 33, any grading exceeding 5000 cubic yard of earthwork is considered an "Engineered Grading". In addition, a site may be considered "Engineered Grading" according to the "Conditions of Approval" or as required by the Building Official. This type of grading requires a soils engineering report and / or engineering geology report as outlined in these guidelines.

REGULAR GRADING:

According to UBC, Appendix Chapter 33, any grading involving less than 5000 cubic yard of earthwork is considered "Regular Grading".

AS-GRADED OR AS-BUILT:

Is the extent of surface and subsurface conditions upon completion of grading activities.

BEDROCK:

Is in place solid rock as defined by a geologist.

SOIL:

Is naturally occurring surficial deposits overlying bedrock (UBC 3308).

FILL:

Is a deposit of earth material placed by artificial means (UBC 3308).

CIVIL ENGINEER (RCE):

Is a professional engineer registered in the State of California to practice in the field of civil works (UBC 3308).

GEOTECHNICAL ENGINEER, SOILS ENGINEER (GE):

Is an engineer experienced and knowledgeable in the practice of soil engineering (geotechnical engineering) and is registered in the State of California UBC 3308).

GEOLOGIST (RG):

Is a geologist experienced and knowledgeable in engineering geology and is registered in the State of California as a Geologist.

CERTIFIED ENGINEERING GEOLOGIST (CEG):

Is a geologist experienced and knowledgeable in engineering geology and is registered in the State of California as a Certified Engineering Geologist.

CONSULTING ENGINEER / GEOLOGIST:

The following guidelines refer to "consulting engineer / geologist" in general term. It refers to any registered professional such as either civil engineer (RCE), soils engineer (GE), geologist (RG) or engineering geologist (CEG), who is registered in the State of California. Grading activities and corresponding technical reports may involve various facets in geology and/or geotechnical engineering and accordingly appropriate professionals should provide opinion, recommendations, verification and certify their work by their signatures in a technical report.

PROFESSIONAL INSPECTION:

Is the inspection required to be performed by a civil engineer, soils engineer, geologist or certified engineering geologist. Such inspections are to be performed by professionals licensed in the State of California. Other non-registered professionals may perform these inspections provided that their work is supervised and approved by a licensed professional who signs the final technical reports.

GENERAL CRITERIA

All geotechnical and geological reports submitted for review should satisfy the following general criteria:

1- The report has been prepared and signed by an appropriate registered professional licensed to practice in the State of California.

2- The report includes a wet signature(s) and the appropriate professional stamps.

3- The licensed professionals signing a report are doing business under the auspices of a firm that is legally practicing civil engineering and /or geology under California state law. Such firms may consist of sole proprietorships, partnerships, or corporations.

4- The work described in the report was performed under responsible charge of the licensed professionals who sign the report as defined in the California Professional Engineers Act and the California Geologist and Geophysicist Act. Simply reviewing the work after it is completed is not being in responsible charge. In addition, simply having financial responsibility with no day-to-day involvement in the project is not being in responsible charge.

5- The report has been prepared for the project being submitted and for the applicant. If the report was prepared for a different project at the same site, or for a different applicant, then it should be accompanied by a letter from the project consulting engineer / geologist stating that it is applicable to the current project and applicant.

6- The project site is clearly identified with a site map, vicinity map, or other means, along with the tract number or other legal identification.

7- The construction work to be performed or the as-built conditions being reported are clearly identified and described.

8- The date of the report is no more than three years earlier than the date of the application (for Geotechnical and geological investigation reports) or no more than one year earlier than the date of the application (for compaction reports). If the report is older, then it should be accompanied by a letter from the project consulting engineer / geologist stating that it is still applicable.

9- The professional work described in the report is consistent with the current standards of practice in Southern California. Since the standards of practice change with time,

investigative criteria, techniques, and methods that have been approved in the past may not necessarily be applicable to the current or future project sites.

10- The investigative techniques, testing methods, and design recommendations are in conformance with the applicable codes, ordinances, these guidelines and standards of practice.

11- The report addresses issues as described in these guidelines, as well as all other relevant pertinent geotechnical and geological issues not referenced in these guidelines if they are pertinent to the development of the project site.

12- The reports should clearly present the subsurface exploration, testing, analysis, and other information to support and justify its conclusions, findings and recommendations.

13- The criteria, techniques, methods, and mitigation measures approved by the County of Riverside and applied as site specific on a project are not to be construed as standard of practice and to be applied on other projects.

PART I

REPORTS FOR PLANNING DEPARTMENT REVIEW

(THIS PART IS CURRENTLY UNDER DEVELOPMENT)

SECTION 1:
ENVIRONMENTAL IMPACT REPORTS,
SPECIFIC PLAN REPORTS

The scope of the geologic and soil engineering portion should be sufficient to identify existing and potential geologic hazards, soil hazards and present measures to mitigate their significance to the environment relative to the development project. CDMG Note 46 provides a checklist of environmental/geologic factors to consider. Requirements of the California Environmental Quality Act should be met.

SECTION 2:
TENTATIVE SUBDIVISION MAP REPORTS

All geologic and soil engineering reports which are submitted for the purpose of determining development feasibility of a tentative subdivision map should be based on the latest tentative plan submitted to the Planning Department. Sufficient geologic and geotechnical information should be presented to substantiate that the site is suitable for the proposed development as designed and that existing or potential geologic and geotechnical hazards have been identified and mitigation measures have been proposed.

SECTION 3:
SURFACE MINING PERMITS / MISC. (PLOT PLAN, CUP'S,
ENERGY SITES, WECS & CEQA REPORTS

All geologic and soil engineering reports submitted for Specific Use Sites should meet the criteria of Section 2 (Tentative Subdivision Map Reports) and any additional soil and geologic information required to provide recommendations to adequately address the proposed project.

PART II
REPORTS FOR PLANNING AND BUILDING & SAFETY DEPARTMENTS REVIEW

SECTION 1:

FAULT HAZARD REPORTS
(Source,CDMG Special Publication 42)

The fault hazards should be addressed in every soils report . Some of the investigative methods listed below should be carried out well beyond the site being investigated. However, it is not expected that all of the methods identified here would be used in a single investigation. Trenching for projects located within the Alquist Priolo Fault Zones should be sufficient to cover the entire limits of the project site. Trenching for projects located within County Fault Zones or within the designated set backs of other active or potentially active faults does not need to cover the entire zone and should be based on site-specific evidence suggestive of faulting.

Trenching of known or suspected faults should not be limited only to Alquist-Priolo Fault Zones. Aerial phographic lineament analysis may identify possible faults previously unrecognized, whether or not they are in an A-P Zone. Trenching or other types of subsurface exploration may be necessary in these cases.

The report should provide the general information as outlined in PART I and PART II (Section A) in addition to the followings:

II. 1.A- REPORT TEXT:

II. 1.A.a- Purpose: Scope of investigation, description of proposed development.

II.1.A.b- Geology: Geologic and tectonic setting, geologic province, seismicity, earthquake history.

II.1.A.c- Site description and conditions: Include information on geologic units, graded and filled areas, vegetation, existing structures, and other factors that may affect the choice of investigative methods and the interpretation of data.

II.1.A.d- Methods of Investigation:

II.1.A.d.1- Literature Research: Review of published and unpublished

literature and records concerning geologic units, faults, groundwater barriers, and other factors.

II.1.A.d.2- Stereoscopic Interpretation: use of aerial photographs and other remotely sensed images to detect fault-related topography, vegetation and soil contrasts, and other lineaments of possible fault origin. The aerial photographs should be identified (may require to include copies in the report) by source and date taken.

II.1.A.d.3- Surface Observations: including mapping of geologic and soil units and structures, geomorphic features, springs, deformation of manmade structures due to fault creep, both on and beyond the site.

II.1.A.d.4- Subsurface Investigations:

1- Trenching and other extensive excavations to permit detailed and direct observation of continuously exposed geologic units and features that should be carefully logged.

2- Borings and test pits to permit collection of data on geologic units and ground water at specific locations. Data points should be sufficient in number and spaced adequately to permit valid correlations and interpretations.

3- Cone penetrometer testing (CPT) in conjunction with continuously logged borings.

4- Geophysical investigations. These are indirect methods that require a knowledge of specific geologic conditions for reliable interpretations. they should seldom, if ever, be employed alone without knowledge of the geology. Geophysical methods alone never prove the absence of a fault nor do they identify the recency of activity. The types of equipment and techniques used should be described.

5- High resolution seismic refraction.

6- Magnetic intensity.

7- Other (e.g: electrical resistivity, seismic reflection, ground-penetrating radar, gravity).

8- Other methods should be included when special conditions permit, or requirements for critical structures demand, a more intensive investigation.

9- Aerial reconnaissance overflights.

10- Geodetic and strain measurements, microseismicity monitoring, or

other monitoring techniques.

11- Radiometric analysis (14C,K-Ar), stratigraphic correlation (fossils, mineralogy), soil profile development, paleomagnetism (magnetostratigraphy), or other age-dating techniques to identify the age of faulted or unfaulted units or surfaces.

II.1.B- CONCLUSIONS:

- Location (surveyed or otherwise accurately located) and existence (or absence) of hazardous faults on or adjacent to the site.
- Type of faults and nature of anticipated offset, including sense and magnitude of displacement, if possible.
- Nature and character of fault zone.
- Recurrence and slip rate information, if available.
- Probability of or relative potential for future surface displacement. The likelihood of future ground rupture seldom can be stated mathematically, but may be stated in semiquantitative terms such as low, moderate, or high, or in terms of slip rates determined for specific fault segments.
- Degree of confidence in and limitations of data and conclusions.

II.1.C- RECOMMENDATIONS:

- Set-back distances from hazardous faults, if appropriate. State and local law may dictate minimum standards. Setbacks should include consideration of adjustments that may be necessary for eventual grading (cutting and filling).
- Need for additional studies.
- Risk evaluation relative to the proposed development --- opinions are acceptable. But, remember that the ultimate decision as to whether the risk is acceptable lies with the governing body.

II.1.D- REFERENCES:

- Literature and records cited or reviewed.
- Aerial photographs or images interpreted --- list type, date, scale, source, and index numbers.
- Other sources of information, including well records, personal communications, and other data sources.

II.1.E- ILLUSTRATIONS:

These are essential to the understanding of the report and to reduce the length of text. Illustrations include:

- **Location Map** - identify site locality, significant faults, geographic features, regional geology, seismic epicenters, and other pertinent data; 1:24,000 scale is recommended.
- **Site Development Map** - show site boundaries, existing and proposed structures, graded areas, streets, exploratory trenches, boring, geophysical traverses, and other data, recommended scale is 1 inch equals 100 feet, or larger.
- **Geologic Map** - shows distribution of geologic units (if more than one), faults and other structures, geomorphic features, aerial photo lineaments, and springs; on topographic map 1:24,000 scale or larger; can be combined with III (B).
- **Geologic Cross-sections** - If needed to provide 3-dimensional picture.
- **Logs of Exploratory Trenches and Borings** - show details of observed features and conditions; should not be generalized or diagrammatic. Trench logs should show topographic profile and geologic structure at a 1:1 horizontal to vertical scale.
- **Geophysical Data and Geologic Interpretations.**

II.1.F- APPENDIX:

Supporting data not included above (e.g., water well data).

II.1.G- ADDITIONAL SUPPORTING DATA TO BE INCLUDED WITH REPORT:

Address the followings:

- Magnitude and distance of all relevant faults within 100-km radius.
- Probabilistic or deterministic earthquake and ground motion analysis for the site.
- Potential for ground lurching and amplification. Discuss and provide necessary recommendations.
- Potential for Liquefaction, discuss ground water, soil condition and provide necessary recommendations.
- Potential for seismic settlement and differential compaction, discuss and provide recommendations.

- Potential for landsliding, discuss and provide recommendations.
- Potential for earthquake-induced flooding, discuss and provide recommendations.
- Potential for seiches.
- Report prepared and signed by Engineering Geologist certified in California and/or Registered Geologist.
- The Riverside County Seismic Safety and Safety Element of the General Plan should be considered during the preparation of this report.
- The engineering geologist and/or geologist should indicate that he visited the site and verified the support data.

II.1. H- SIGNATURE:

This type of report should bear wet signature, registration number and expiration of license of a registered geologist or certified engineering geologist (State of California).

SECTION 2:

LIQUEFACTION REPORTS

(Reference CDMG Special Publication No. 117)

NOTE: THE LIQUEFACTION POTENTIAL AND ITS MITIGATION IS CURRENTLY UNDER FURTHER STUDY AND RESEARCH, THEREFORE THE FOLLOWING SECTION MAY BE REVISED.

Liquefaction potentials should be analyzed and addressed in every geotechnical or engineering geology report. However, for sites not requiring other reports and encompassing only this potential specifically should provide a more thorough and a detailed analysis of this phenomena. A report should provide the followings:

II.2.A- GENERAL INFORMATION: According to Part I, Section A).

II.2.B- SCOPE OF INVESTIGATION: According to Part I (including Sections 1, 2 & 3).

II.2.C- SITE HISTORY: According to Part I (Section C).

II.2.D- SITE PLAN(S) & EXHIBIT(S): According to Part I (section D).

II.2.E- BORING LOGS: According to Part I (Section E, except that minimum depth of exploration should be 50 (fifty) feet below proposed finished grades).

II.2.F- LABORATORY TESTING: According to Part I (only the pertinent tests).

II.2.G- GEOLOGY & GEOLOGIC MAP: According to Part I Geologic map:

1- Geologic Index Map: surface geology; a site surface geologic information to include all geologic units, symbol designations (USGS), contacts, attitudes and regional map (minimum scale map 1:24,000).

2- Site Specific Geologic Map: a site surface geologic map at a scale not to exceed 1"=100' to show all geologic units on site, contact lines between units, bearings and attitudes.

3- Subsurface Geology; to include all subsurface units and detailed cross-sections.

4- Geologic Description of site: a clear and concise description of geologic province, geologic history, identification and description of each geologic unit encountered on site should be included in the report.

II.2.H- INVESTIGATION:

Include detailed field investigation using SPT or CPT methods and appropriate sampling and testing of site soils (please refer to Part I, Section B-1, Field Investigation).

II.2.I- GROUNDWATER:

1- Provide accurate (within one foot) of existing ground water table, perched ground water and historic high ground water.

2- Historic high and fluctuations in the past and projected levels for the life of proposed structure.

3- Analysis for post-development rise of ground water table in relationship to the liquefaction.

II.2.J- FAULTING & SEISMICITY:

The report should include and provide the followings:

1- A complete list of all known active and potentially active faults within 100 km of the site, indicate name and distance of each individually.

2- Indicate moment magnitude and maximum moment magnitude of each fault.

3- Provide history of each fault and seismic activity of each fault.

4- Provide analysis of potential of faulting and seismic activity for the site.

5- Provide analysis of the effect of faulting and seismic activity with respect to site specific conditions including geology, ground water table and soil units having potential for liquefaction.

II.2.K- DISCUSSION & ANALYSIS:

Description of seismic setting, historical seismicity and methods and/or sources used to determine earthquake ground-motion parameters used in the liquefaction analysis. For high occupancy structures it is common practice t use a deterministic seismic hazard analysis with a median-plus-one-standard-deviation (84^{th} percentile) in developing ground motion estimates. The consulting engineering geologist should provide ground motion parameters using either the deterministic or probabilistic method as follows:

II.2.K.a- PROBABILISTIC METHOD:

Earthquake magnitudes and associated peak ground accelerations (PGA) based upon simple prescribed parameters values (SPPV) generated by the Department of Conservation may be used. These maps are included in the Seismic Hazard Evaluation Reports issued by DMG. PGA is dependent on site conditions and several maps have been prepared to accommodate these differences. Refer to CDMG Specific Report 117 for further details.

In lieu of utilizing SPPV, a site specific probabilistic seismic hazard analysis can be performed, and can supersede the SPPV values of PGA. If a site specific probabilistic hazard analysis is performed, earthquake magnitudes should be based upon the current California Division of Mines and Geology Fault Model (fault catalog), with associated PGA utilizing recently published attenuation equations, and a probabilistic seismic hazard analysis (PSHA) utilizing a hazard level of at least 10 percent probability of exceeding in 50 years. All input and output data files (Dat, Out, Raw) associated with the computer program (e.g. FRISKSP) should accompany the geotechnical report as hard copies.

Any modifications to the program, standard user-selected input parameters, or the current California of Division Mines and Geology Fault Model, should be justified. It is important that the difference in duration of various earthquake magnitudes be accounted for when performing liquefaction analysis. Therefore, magnitude weighting should be performed per Idriss (1985). Magnitude Weighting Factors used in FRISKSP should be equivalent to the inverse of the Magnitude Scaling Factors used in the engineering analysis for liquefaction. Attenuation equations and values should reflect the use of current literature and site conditions. Attenuation relations produced by Campbell (1997), and Sadigh, et al. (1997) are presently acceptable using the standard deviation on the attenuation functions. However, new information should be considered by the consultant of record, particularly as the standard of practice changes. The geotechncial consultants should conduct the analysis utilizing all three of the above attenuation relations and then submit a discussion and conclusions justifying the seismic parameters used in the liquefaction analysis. The geotechncial consultant should justify all input parameters and certify the integrity of the data and program utilized in generating magnitudes and peak ground accelerations.

II.2.K.b- DETERMINISTIC METHOD:

Earthquake magnitudes based upon the current California Division of Mines and Geology Fault Catalog, with associated PGA utilizing published attenuation equations and a deterministic seismic hazard analysis (DSHA). Attenuation equations and values should reflect the current literature and site conditions. Attenuation relations produced by Campbell (1997), Joyner & Boore (1997), and Sadigh, et al. (1997) are presently acceptable but are subject to change based on the availability of new informantion. The consultant engineer should utilize the average ground motion obtained from the three attenuation relations in the liquefaction analysis. Again for high occupancy structures it is presently common practice to use a seismic hazard analysis with a mean-plus-one-standard-deviation (84^{th} percentage) in developing ground motion estimates.

NOTE: The results of the submitted site specific hazard analysis will be reviewed by utilizing a probabilistic seismic hazard analysis (PSHA), a hazard level of 10 percent probability of accedence in 50 years, the current California Division of Mines and Geology Fault Catalog, the most updated version of FRISKSP by Thomas F. Blake, attenuation relation produced by Campbell (1997), Joyner & Boore (1997), and Sadigh , et al. (1997), and standard user-selected input parameters unless otherwise justified by the consulting engineer. Seismic parameters recommended by the consultant engineer are acceptable if they are greater than or equal to values obtained using these criteria. In addition the followings should be discussed and analyzed:

1- Provide geologic factors that may control or effect the severity of potential hazard (e.g., site specific response characteristics due to amplification of soft soils, deep sedimentary basins, topography, near source affects,

2- Conclusion should provide a minimum of Factor of Safety of 1.5 or greater based on appropriate method of analysis.

3- Magnitude and distance of all relevant faults within 100-km radius.

4- Potential for ground lurching, amplification and lateral spreads as related to liquefaction.

5- Consideration of the Riverside County Seismic Safety and Safety Element of the General Plans.

6- Potential for seismic settlement, differential compaction, differential settlement and flotation of underground storage structures.

II.2.L- RECOMMENDATIONS:

- Propose a mitigation method that will be suitable for the proposed use. A clear and well substantiated recommendation(s) should be presented to indicate what remedial actions, procedures and methods to be applied for mitigating the potential. If removals are considered as mitigation then specific depths and limits of removals should be indicated and be based on the obtained data from boring logs and engineering characteristics of materials determined in the laboratory testings. Depths and limits of over-excavations should concur with quantitative and qualitative data presented in the report. All laboratory testing performed on the samples should include all graphs and calculations.
- Indication that the consultant soil engineer / geologist has coordinated the mitigation design with structural engineer, foundation engineer, architect and project engineer.
- Indication that the consultant soil engineer / geologist has visited the site and verified the supporting data.

II.2.M-REFERENCES:

According to Part I, Section L, References).

II.2.N-SIGNATURES:

The report should bear wet signature of registered (State of California) engineering geologist, registration number and expiration of license.

PART III

REPORTS FOR BUILDING &

SAFETY DEPARTMENT REVIEW

SECTION 1:

GEOTECHNICAL & GEOLOGICAL INVESTIGATION REPORTS

Geotechnical and geological investigation reports are required for the following projects:

A- All tract subdivisions, Commercial, Special Use Case Projects.

B- Single Family sites categorized as Engineered Grading.

C- Single Family sites requiring geologic, soil and/or geotechnical investigation due to site specific conditions.

D- As required by the Building Official.

III.1.A- GENERAL INFORMATION:

The followings general information should be included (as appropriate/applicable):

- Subject of report (type or category of the report).
- Date the report was prepared.
- Project number (geotechnical firm's report identification number) & preferably the County's applicable permit application number.
- Name, address and phone number of consulting engineer / geotechnical firm preparing the report.
- Name, address, phone number of person or entity for whom the report was prepared.
- Site address.
- Legal description including Lot/Parcel No. & Tract/PM No, Assessor's Parcel Number.
- Site location description and/or location index map with reference to north.
- Description of site's existing conditions (topography, relief, vegetation, man-made & natural features, natural water courses, wells, watershed, existing improvements on site & immediate vicinity, previous / existing & proposed site use).
- Proposed grading (general scope, amount of earth work proposed,

feasibility of proposed grading, special equipment and/or methods to be applied in the investigation and earthwork proposed).

- Planned construction (type of structure and use, type of construction and foundation / floor system, number of stories).
- Signature, registration number and expiration date of license of consulting engineer/geologist of record.

III.1.B- SCOPE OF INVESTIGATION:

III.1.B.1- Site Investigation:

A brief description of the overall scope of work performed during the investigation of the site shall include geophysical methods applied, dates & duration of site investigation, sampling methods, measures taken for samples not to be disturbed, equipment used, type and number of borings drilled (or pits excavated), maximum depth of subsurface investigation, visual observation of site, natural and man-made features present during the investigation.

III.1.B.2- Pertinent Literature Research:

Review of published and unpublished reports, aerial photographs, maps and research of public information (with reference to dates of documents). These documents are to be cited completely so that they can readily be identified and be obtained by the reviewer.

III.1.C- SITE LAND USE HISTORY:

The site's history describes and includes previous, existing and proposed land use. All known land usage (as pertinent and applicable) including but not limited to wells, trash & debris, pits, septic tanks, underground storage tanks, basements, structures, surface and subsurface storage, previous earthwork, any known surface or subsurface investigation conducted previously, any agricultural, dairy, poultry, animal grazing, farming, chemicals, fertilizers, pesticides, toxic, hazardous substance disposal / manufacturing / industrial production, waste disposal / injection, usage in the past or present should be included. Demolition, mitigation, removal and disposal of existing features should be discussed.

III.1.D- SITE PLAN(S) & EXHIBIT(S):

A site plan, at a scale, preferably 1"=40' and not to exceed 1"=100', such as proposed

grading plans, delineating the entire area encompassed by the report, showing natural & proposed topography, natural & man-made features, geologic units, geologic features, type and boundaries of on-site soils, springs, seeps, ponds, boring/test pit locations, existing & proposed improvements including building areas, slopes, daylight lines, paving areas, retaining walls, subdrains, limits / depths and boundaries of previous grading and proposed earthwork / proposed keyways / over excavation / canyon clean outs / subdrains / uncertified fill areas, etc. should be included on a typical site plan. Boundaries of permit area to be delineated and adjacent property description as being either *"ungraded", "graded", "built out"* or *"under grading"* be identified.

III.1.E- BORING / TRENCH LOGS:

Each boring log should include the following data as applicable:

- boring log number,
- site address,
- geotechnical firm's name and project number,
- sample ID number (for referencing samples on test sheets),
- depths of samples taken,
- date of sampling,
- method of sampling,
- equipment used,
- ground elevation (concurring with the grading / exhibit plans), depths from surface ground (in feet) that concurs with the elevations on the grading plans,
- types of sample taken (ring, bulk, tube, other),
- soils classification (USCS 1986 Version or later as appropriate),
- geologic unit designation (USGS),
- blow counts per foot (indicate method & calculations used to determine the blow counts),
- moisture content,
- dry unit weight (pcf),
- saturation percentage,
- description of units to include a specified unit such as artificial fill/surficial soil / alluvium / colluvium / bedrock (to be specific such as sandstone / granitic / shale / limestone / claystone / siltstone to include name, age, degree of weathering/fracturing, physical characteristic; e.g. sorting/grain size/voids/color/ lithology, presence of rocks/boulders,

dampness, soil constitutes, presence of any organic materials, firmness; e.g. very loose/loose/firm/dense/very dense, etc.

- ground water table / perched water (identify saturation level/depth),
- total depth of boring, indication of caving.

NOTE: It should be pointed out that the consulting engineer / geologist should determine which of the above information needs to be provided for what type of samples, at what intervals such samples should be taken and what type of testing to be performed for each sample. Also the numbers and locations of borings, quantity and types of sampling are exclusively determined by the consulting engineer / geologist of record. Consultant engineer / geologist should consider and plan, well in advance, in deciding the number and the location of exploratory borings and type of samples to be taken to represent the actual field conditions. In all cases the presence or absence of ground water and regional ground water table elevation should be referenced. If site is located in a known liquefaction area or the report identifies liquefaction potential, then the presence or absence of ground water table should be determined to a minimum depth of 50 (fifty) feet (in at least one boring). The final recommendations pertaining to the amounts, limits and boundaries of over-excavations, removals, acceptance of bottoms and suitability of materials to be left-in-place are *primarily* based upon the qualitative & quantitative data obtained from the boring logs, the engineering characteristics of the materials and laboratory test results on samples provided in the report. It should be pointed out that extrapolation of data obtained from a boring log may be limited to a confined area and therefore adequate number of borings, sampling and testing are essential in substantiating the final conclusions and recommendations made.

III.1.F- LABORATORY AND RELATED TESTING:

A list of all laboratory testing performed for the project needs to be referenced in the report and where applicable and pertinent such tests to include necessary graphs and calculations. All testing methods, testing procedures (to include ASTM designation), soil classification (USCS 1986 Version or later), date test performed, sample ID number for reference to the boring log, depth the sample taken, sample description & condition (if disturbed or undisturbed) should be indicated. Such tests (with appropriate ASTM designation) may include:

- Maximum density & optimum moisture determination test (ASTM D1557),
- Consolidation Test (ASTM D 2435),

- Shear Test (ASTM D 3080),
- Bulk density, unit weight, and / or dry density determination,
- Specific gravity (ASTM C 127, coarse materials, & C 128, fine materials),
- Expansion Index (ASTM D 4829),
- Atterberg test (ASTM D 4318)),
- Sieve size analysis (ASTM D 422),
- Moisture content test (ASTM D 2216),
- Saturation determination,
- Collapse test (with description of procedures and criterial used to conduct the test),
- Soluble sulfate content of soils in contact with concrete (test by ASTM D 516 or equivalent),
- Geophysical survey & graphics and results,

NOTE: Indicate location of laboratory where testing was performed. If testing were not performed in a laboratory under direct supervision of the project soils engineer, then the test results should include either signature and stamp of other soils engineer in charge of such testing, or such independent testing should be included in the main report to be certified, signed and stamped by the project geotechnical engineer.

III.1.G- GEOLOGY:

III.1.G.a- GEOLOGIC SETTING:

Geologic province description, geomorphology of the project site, geology of vicinity (index map showing geology of vicinity area), complete references to published and unpublished reports, review of available reports, public records and interpretation of aerial photographs of the area. The date and scale of the aerial photographs should also be specified. County of Riverside may request copies of such photos if deemed necessary. In areas where geologic hazards exist or known to exit, all aerial photographs used in the investigation may be required to be copied and be included in the report.

III.1.G.b- SITE TOPOGRAPHY:

Topographic features, geomorphology of the site such as outcrop distribution, slope heights and angles and/or ratios, dip of slopes, cliffs, fault contacts, erosion pattern, presence of drainage courses, ponds, swamps, springs, seeps and

relationship to site geology should be discussed as appropriate.

III.1.G.c- GEOLOGIC MAPPING:

Geologic maps should include all geologic units and features before grading, contact lines with adequate attitudes, seeps or springs, faults (indicate if within the State's Alquist Priolo Fault Zone or within the County Fault Zone), surface ruptures, fault scarps, any reported ground fissures (past & present), ground ruptures, existing & proposed topography, present or past used pits, septic systems, wells, buried tanks, waste dumps, trash or soil stock piles, previous grading, proposed grading, location of proposed keyways, location of canyons to be cleaned out, proposed or existing subdrains to include elevation depth of installation, proposed buttresses, location of exploratory borings & trenches, scale of map, legend, date / source of base map, source of topography, rock or soil unit boundaries, geologic structure, downslope movement features (including soil/rock creep), proposed grading to indicate depths / limits / boundaries of earthwork, proposed thickness of engineered fill, depths of cuts, existing or proposed rock disposal area should be all included on the geologic map which depicted on the grading plans not to exceed 1"=40'. An overall geologic map of site on a scale not exceed 1"= 200 should also be included in the report.

III.1.G.d- GEOLOGIC HISTORY:

Presenting a brief geologic history of the site including known geologic hazards, landslides, seismic activity, subsidence, mass-wasting, groundwater fluctuations and other problems potentially impacting site development.

III.1.G.e- SEARCH & REVIEW OF REFERENCES:

Reference to previous geologic investigation conducted on the site and analysis of differences in investigative procedure, reviewing data, laboratory and / or field testing, findings, conclusions and recommendations.

III.1.G.f- MATERIAL TESTING:

Earth materials (bedrock and surficial units) testing to include any test applicable to the project site:

- Unit classification, general lithologic type, geologic age and classification.
- Unit description and characteristics (in sequence of relative age).
- Composition, texture, fabric, lithification, moisture content,

grain size.

- Pertinent engineering geologic attributes (clayey, weak, loose; alignments, fissility, planar boundaries, pervious or water-bearing parts, susceptibility to mass wasting, erosion, piping, hydro-collapse, compressibility, shrinkage or subsidence potential).
- Distribution, dimensions or occurrence (supplemental to data furnished on illustrations).
- Suitability of soil on site to be used as engineered fill.
- Effects and extent of weathering (existing and relationship to project design and future site stability, material strength, etc.).
- Rippability.
- Any other material testing characteristic pertinent to the project site.

III.1.G.g- STRUCTURAL GEOLOGY:

Geologic Structure should address the following where applicable and pertinent:

- Site structural geology.
- Distribution of structural features including position, attitudes, bearings, thickness, physical and chemical characteristics, pattern and frequency.
- Fissures, joints, shears, faults and other features of discontinuity.
- Bedding, folds, and other planar features.
- Character of structural features including: continuity, width of zones and activity. dominant vs. subordinate, planar nature, plunge, depth, open vs. closed (degree of cementation or infilling) gouge.
- Cross-sections (one or more appropriately positioned and referenced on map (especially through critical areas, slopes and slides) of suitable size and engineering scale; with labeled units, features and structures and include a legend. These sections should correlate with surface and subsurface data showing representative dip components, projections and stratigraphic/structural relationship.
- Adequate mapping, cross sections and description showing position, dimensions and type of existing downslope movement

features including soil/rock creep, debris flows, falls, slumps, landslides, shallow failure, possibility of erosion,

- Activity, cause or contribution factors of downslope movement features.
- Recent erosion, deposition, flooding, seismic activity, surface fissures.
- Subsidence/settlement, soil hydro-collapse, piping, solution or other void features or conditions.

III.1.G.h- STABILITY OF FILL & CUT SLOPES:

Generally the stability of all proposed cut and fill slopes higher than 10 (ten) feet in vertical height should be analyzed, however, *specifically* all cut and fill slopes higher than 30 feet or cut slopes steeper than 2:1 should be analyzed separately and be supported with slope stability analysis and drawings/cross sections. Fill slopes shall not be steeper than 2:1 per UBC Section 3313.5. The followings should also be addressed on overall stability of all cut or fill slopes higher than 10 feet:

- A slope stability analysis is required if failure is suspected owing to the presence of slide plane, fractures or any other adverse conditions.
- Susceptibility to mass-wasting (creep to rapid failure potential).
- Favorable or unfavorable inter-relationships of fractures (joints, shears, faults or zones) to planar structures (bedding, contacts, folds, plunges, weathered zones, etc.) and to each other forming potential failure planes, veneers, masses, or blocks.
- Favorable or unfavorable relationships of geologic structures, conditions and potential failure planes to natural and/or man-made topography forming actual or potential adverse dips and contacts, adverse fractures (jointing, shearing, faulting), adverse fold limbs or synclinal axes, adverse earth masses or blocks.
- Favorable or unfavorable relationships of height of existing or proposed slopes (weathering effects; rate, depth) to strength of earth materials.
- Slope stability effects onto or from developed, natural, or proposed slopes of adjacent properties.

III.1.G.h.1- Slope Stability Analysis:

Slope stability analysis is required by Ordinance 457 for all slopes higher than 30 feet and/or all cut slopes steeper than 2:1. All slope stability analysis should to include **seismic, static** and **surficial stability** analysis as follow:

III.1.G.h.1.a- Static and Seismic Stability Analysis:

1- Separate calculations for static and seismic conditions.

2- The pseudo static slope stability analysis shall be the minimum seismic analysis accepted for design.

3- Conventional static method of slope stability analysis based upon principles of mechanics may be used to analyze the stability of slopes under both static and pseudo static loads.

4- The minimum acceptable factor of safety for shear strength is 1.5 for static loads and 1.1 for pseudo-static loads. The factor of safety for strength is defined as the ratio of the shearing resistance force to the actual driving force acting along the potential failure surface.

5- The analysis shall include the effect of expected maximum moisture conditions, soil weight and seepage or pore pressure where applicable. Saturated conditions shall be utilized unless it can be shown that other moisture contents will represent the worst probable conditions for the project.

6- Pseudo-static analysis shall include the effect of static loads combined with a horizontal inertial force acting out of the potential sliding mass.

7- A minimum pseudo static horizontal inertial force equal to 0.15 times the total weight of the potential sliding mass shall be used. This minimum lateral design value should be increased where, in the opinion of the consultant engineer subsurface conditions or the proximity of active faults warrant the use of higher values.

8- The critical potential failure surface used in the analysis may be composed of circles, planes or other shapes considered to yield the minimum factor of safety against sliding and most appropriate to the soil and geologic site conditions. In cohesive soils, a vertical tension crack extending down from the top of the slope to the potential failure surface may be used to limit the

lateral extent of the potential sliding mass.

9- The critical potential failure surface having the lowest factor-of-safety on strength shall be sought for the static case. This same static surface and sliding mass may be assumed to be critical for pseudo-static case. The critical failure surface shall be depicted on geotechnical cross sections, used in slope stability analysis. Shear strength parameters shall be depicted on the appropriate segments of the failure plane.

10- Soil properties, including unit weight and shear strength parameters (cohesion and friction angle), may be used on conventional field and laboratory tests and/or field performance. Where appropriate, laboratory tests for long term residual strengths shall be performed. Shear resistance along bedding planes is normally arrived at by estimating bedding-strength values of the weakest unsupported plane. It is expected that the consultant engineer will use considerable judgement in the selection of shear tests and interpretation of the results to determine strength characteristics fitting the present and anticipated future slope conditions. Strength parameters used in static analysis shall not exceed residual (ultimate) values. Dynamic strengths used in a pseudo-static analysis shall not exceed peak point static strengths unless supported by dynamic test results or other convincing physical evidence.

11- In the design of slope support, bedding planes flatter than 12 degrees from horizontal normally need not be considered in a pseudo static analysis.

III.1.G.h.1.b- Surficial Stability Analysis:

1- Calculations shall be performed for surficial stability of slopes under saturated condition. Calculations shall be based on analysis of stability for infinite slope seepage parallel to the slope surface or other failure mode that would yield the minimum factor-of-safety against failure.

2- The minimum acceptable vertical depth of soil saturation should include a **4 (four) feet saturated** stability analysis.

3- The minimum factor-of-safety for surficial stability shall be 1.5.

4- Shear strength parameters (cohesion and friction angle) used in surficial slope stability should be representative of the surficial material and shall not exceed residual (ultimate) value.
5- Cross sections should be provided (on the grading plan or site plan) to exhibit the exact location where the analysis being performed. Cross sections, calculations and the identification of the method of analysis being used be indicated.

NOTE: Stability analysis should address requirements for slope protection and maintenance.

III.1.G.h.2- ALTERNATE SLOPE SETBACKS:

According to UBC Appendix Chapter 33, Section 3314.4, alternate slope setbacks may be approved based on "investigation and recommendation by a qualified engineer or engineering geologist". To comply with this section, a professional, proposing an alternate setback, should determine whether engineering characteristics or geological features of the slope are being investigated as a primary factor to determine alternate slope setback.

III.1.G.h.2.a- A civil engineer or geotechnical engineer (RCE, GE) may provide necessary engineering aspects, such as soil profile type, cohesion, friction angle, shear strength, shear velocity, soil strength, bearing capacity, slope stability and other engineering data substantiating adequacy of the set back proposed. Please note that if soil profile type "S_E" and "S_F" (UBC Table 16-J) are present, the alternate set back will not be applicable.

III.1.G.h.2.b- A geologist or engineering geologist may apply geological features, such as geologic unit description, intactness of the geologic unit, direction of bedding plans, geologic attitudes, identifying fissures/fractures directions, degree of weathering and other geological characteristics to justify the proposed set back.

NOTE: Specific quantitative and qualitative data are necessary to be included in the set back justification analysis. Engineering analysis should provide either field and/or laboratory testing data to confirm the study. In all cases of alternate slope set back analysis, the consultant engineer or

geologist shall indicate that potential hazards such as rock falls, rock slides, slope failure, mass wasting, land slides, adverse geologic features or any other features endangering the structure or life do not exist on the site or have been mitigated.

III.1.G.i- GROUNDWATER, AQUIFERS & SUBDRAINS:

Ground water, the effect of local aquifers and surface drainage should be addressed with following considerations where applicable and pertinent:

- Ground water level, past & present fluctuations, historic rise & fall and anticipated fluctuation based on specified change on site-specific land use.
- Perched water / perennial water,
- Surface expression (past and present),
- Permeability and porosity of near surface materials,
- Aquifers or conduits and their possible impact on the proposed development (such as subsidence due to water withdraw), perching, faults or other potential barriers, saturation zones or other controls of percolation and groundwater movement.
- Historic and future fluctuations of groundwater level at the site that may affect soil strength, cause hydrocollapse, consolidation, settlement or slope / foundation instability.
- Effects of ground water (potential rise) on-site drainage and sewage disposal.

NOTE: All existing and potential groundwater issues shall be addressed with appropriate control measures. These measures include subdrains along the bottom of canyons, behind stabilization fills, and at other key locations. The report shall identify the preliminary locations of all subdrains, including horizontal layouts, invert elevations, starting points, connection points, and discharge points. All subdrains shall be at a depth of at least 10 feet below finish grade, except as locally required to reach a discharge point. Subdrains shall be sized to accommodate the design flow and shall be protected with appropriate filters.

III.1.H- SETTLEMENT:

III.1.H.a- Objective:

All grading shall be performed in such a way that the post-construction total and differential settlements along the ground surface are within tolerable levels for the

proposed improvements. For typical residential and commercial buildings, a tolerable level is normally defined as one that produces post-construction angular distortions of no more than 1/480. If the 1/480 criterion cannot be reasonably satisfied by the grading procedures, then mitigation measures shall be evaluated on a case by-case-basis.

Therefore, geotechnical and geological investigations should include site-specific settlement evaluations and provide recommendations for grading procedures that will satisfy the settlement criteria. These evaluations and recommendations should consider the following concerns:

- Identification and assessment of unsuitable soils
- Criteria for establishing suitability of soil and rock to be left in place
- Variations in the subsurface profile
- Other relevant site specific issues

These site-specific settlement evaluations should include quantitative settlement analyses when any of the following conditions are present:

- The anticipated angular distortions are greater than 1/480
- Unsuitable soils are to be left in place
- The proposed fill depth is greater than 50 feet (i.e. a *deep fill*)
- As required by the Building Official

III.1.H.b- Identification and Assessment of Unsuitable Soils:

The existing soils are often unsuitable for support of compacted fills or proposed site improvements. This unsuitability may be due to excessive compressibility, hydrocollapse potential, high organic content, liquefaction potential, excessive expansive potential, or other reasons. Therefore, the geotechnical and geological investigation should include a detailed evaluation of unsuitable soils at the site. This evaluation shall include mapping the lateral and vertical extent of these soils and assessing their engineering characteristics. This data shall be shown on the maps and boring logs, and described in the text of the report.

In most cases, unsuitable soils are to be removed during grading in order to expose suitable soils on which to place the proposed fill. The investigation report shall describe the criteria to be used to control these

removals during grading, and these criteria shall be based on the evaluation described earlier. The depths of removals should concur and correlate with the data from the boring logs, laboratory testing, graphs and calculations presented in the report. The estimated boundaries and limits of removals should correspond with the physical and engineering characteristics of on-site materials determined through the investigation.

III.1.H.c- Criteria for Establishing Suitability of Soil and Rock to be Left-In-Place:

The suitability of all soil and rock to be left in place should be demonstrated using appropriate qualitative and/or quantitative assessments. These assessments should consider both the soil and rock exposed at the ground surface and that at depth. Simply using terms such as "competent", "dense", "hard", "unyielding", or "undisturbed" without supporting quantitative and qualitative data is not sufficient. Qualitative assessments could include criteria such as removing unsuitable soils to expose bedrock. Quantitative assessments could include criteria based on such physical properties as unit weight, degree of saturation, in-situ relative compaction, or hydrocollapse analysis results. These assessments should be tied to the site-specific data gathered from the subsurface investigation program, and will ultimately form the basis for determining removal depths during construction.

III.1.H.d- Variations in the Subsurface Profile:

Assessments of total and differential settlement also should consider variations in the subsurface profile across each lot. These variations are especially important in transition lots (i.e., those lots with a cut-fill daylight line). These assessments should consider at least the following issues:

9. Geometry of the bedrock contact, including both its inclination and variation. In general, bedrock contacts within 30 feet of finish grade should be no steeper than 3:1 unless justified by site-specific settlement analyses.

10. Location of cut-fill daylight line. In general this line should not pass through any building pad area, so over excavation is normally required. The depth and lateral

extent of such over-excavation should be clearly outlined and justified. For example, the grading specifications might be as shown in the figure 1 (see Appendix).

1II.1.H.e- Deep Fills:

If the proposed fill thickness is greater than 50 feet, the fill is considered a deep fill. Whenever deep fills are proposed, the following additional requirements shall be satisfied:

1. All portions of the fill to be located at a depth of more than 50 feet below finish grade shall be compacted to at least 95 percent relative compaction based on ASTM D1557.
2. A quantitative settlement analysis shall be provided, as described in Section III.1.H.f of these guidelines.
3. A settlement monitoring program shall be outlined.

III.1.H.f- Quantitative Settlement Analyses:

Quantitative settlement analyses, when required, are intended to predict the post-construction settlements at the finished ground surface. These analyses should consider both total and differential settlements. Quantitative settlement analyses should consider the compressibility of the proposed fill and the underlying soil and rock and their potential for settlement due to the weight of the fill and the weight of proposed structures. These evaluations should be based on laboratory tests of the various strata and should consider primary consolidation, secondary compression, hydro-compression, expansion, and any other pertinent characteristics.

Evaluations of differential settlement should consider both variations in the subsurface profile and uniformities in the various strata. The differential settlement values also should be expressed as an angular distortion, which is defined as the differential settlement between two points divided by the horizontal distance between these points.

III.1.I- ORGANIC SOILS, MANURE & METHANE GAS:

If the project site has organic soils or manure or land usage included dairy, poultry,

animal grazing, the following issues and criteria should be addressed as applicable and pertinent:

- Identify the amount (limits, boundaries, depths) of manure or organic materials on site.
- Determine the amount and location of disposal of unsuitable materials.
- If mixing of the organic or manure is proposed then the following shall be addressed:
- Determine the allowable percentage to be mixed (not to exceed 1%) with the engineered fill (and include guidelines for blending and quality control to assure such plan).
- Determine the interaction of such materials with the engineered fill, foundation system, hardscape or other future improvements and provide appropriate recommendations.
- Evaluate the potential for surface ground cracks and shrinkage resulting from soil dessication, the chemical interaction of organic mater, salinity of water used in the engineered fill.
- Determination if there are or have been pits on site used for disposing organic or waste materials.
- Analyze the number, location, depths and boundaries of these pits and how they should be mitigated or be treated during the grading.
- Determine presence or lack of methane gas and prepare plans to investigate, monitor and mitigate the potential.

III.1.J- GEOTECHNICAL & GEOLOGICAL REVIEW OF GRADING PLAN(S):

All grading plans should be reviewed (as applicable and pertinent) by the consulting engineer / geologist of record prior to approval by the Department of Building & Safety. This is to ensure that recommendations contained in the geotechnical and geological investigation have been properly implemented in the grading plans, and to confirm that the Department of Building & Safety and the consulting engineer / geologist of record are reviewing same grading plan(s). All grading plans submitted for grading permits, and exhibits included in the geotechnical reports, should coincide with one another. This review should be documented in a written report prepared and signed by the consulting engineer / geologist of record and include a statement that the plans are consistent with their

recommendations. Upon report approval, any changes in the following features should be re-evaluated by consulting engineer / geologist of record and all related exhibits in the report should be up-dated. Such changes may include:

- Reconfiguration of grades and finished elevations that may impact the design.
- Change/re-design of streets and lots (either in location, name or number).
- Re-configuration of lots or subdivision boundaries.
- Cut or fillslope steepness change (if steeper than previously approved).
- Cut or fillslope height change (if new slopes are higher than previously designed and are to be increased in height to more than 30 feet vertically, changes to any slopes that were analyzed previously for stability, any slope that needs to be re-evaluated at the request of the Building Official or geotechncial engineer / geologist of record).
- Proposed change in land use.
- Manmade or natural changes to the site: e.g., grading, dumping, ground fissures, subsidence, seismic activity, slope failures, flooding, wash out,
- Proposing structures for areas not previously so designated.
- Special request by Building Official or soil engineer / geologist of record.

III.1.K- EARTHWORK QUANTITIES:

Once the preliminary quantities of removals and over-excavations are estimated, the geotechnical consultant-of-record may be required to re-evaluate the quantities of cuts and fills identified on the grading plans. When a grading plan is prepared prior to geotechnical investigation, the actual earth quantities presented on the grading plans may not concur with the actual depths of removals determined by the geotechnical consultant. Therefore, a re-evaluation of such quantities needs to be carried out by the consulting engineer / geologist of record and, if necessary, new quantities be depicted on the proposed grading plans(s). The actual estimates of removals, over-excavations and re-compaction (to include cuts, fills, disposal, shrinkage, export, import) within the report should concur with the quantities shown on the grading plan(s).

III.1.L- SPECIAL GRADING ACTIVITY:

A preliminary report should also discuss other related issues in grading (if and when applicable) such as:

- **Proposed Rock Disposal** methods (for rocks larger than 12 inches). All disposal areas to be shown on grading plan(s) and include depths, boundaries and detailed discussion as to the method and procedures to be applied in placing the rock layers, thickness, length, height, filling void spaces, compaction method during grading and disposal. All rock disposals should take place a minimum of 10 (ten) feet below finished grades.
- Corrective or selective grading.
- Non structural fills including subgrade specifications and recommendations.
- Soil cement or lime stabilization.
- Rock disposal.
- Blasting (Regulated by the Sheriff's Department).
- Irrigation/drainage controls, dewatering, surface drain and subsurface subdrains.
- Special planting and irrigation measures, slope coverings and other erosion control measures, which may be apparent from the preparation of geotechncial report.
- Slough walls (including free board on retaining walls).
- Protection of existing structures and their foundations during grading.
- Foundation/wall excavation inspections and approval by Geotechnical engineer / geologist of record.
- Shoring requirements (to include details, parameters, specific recommendations).
- Actual or potential effects extending into site from adjacent areas or from the site into adjacent areas and recommendations pertaining to stability, erosion, sedimentation, groundwater.
- Dewatering.
- Stabilization measures:

  a- Fill blankets for pads or stabilization blankets for slopes.

  b-Stabilization fills; specifications (including subdrains and landscape) and parameters (including stability analysis and calculations if geologically surcharged).

c-Buttress fills: specifications (including landscape), subdrains, stability analysis with calculations and supporting test data and parameters.

- Fill over cut slope (provide specifications and recommendations).
- Subsidence, hydro consolidation, hydrocollapse, piping, surcharging, primary and secondary consolidations and specific mitigation (construction time delay or settlement monitoring program).
- Special provisions to be considered for observation, inspection and testing during and on completion of grading.
- Specific recommendations covering the adequacy (quality control / quality assurance) of the site to be developed by proposed grading.
- Special provisions to be considered for erosion control, mud flows and other construction related hazards.
- Safety measures to be considered during excavations, deep removals, blasting and other hazardous situations where safety of the public and workers need to be protected.
- **Debris Basins:** Consultant engineer / geologist shall provide slope stability analysis that will be based on possible rapid drawdown when slopes are steeper than 3:1 and designed with outlet structures. The factor-of-safety shall be a minimum of 1.5. Consultant soil engineer and civil engineer of record shall cooperate this in design task and provide recommended procedures for removing debris in a safe manner.
- **Detention Basins & Retention Basins:** Consultant soil engineers / geologists are responsible for analyzing the effect of erosion on the side of the basin and to determine the effect of the pounded water infiltration from the basin.

III.1.M- STRUCTURAL & NON-STRUCTURAL AREAS:

In proposing earth removals and certifying project sites, the report and the enclosed exhibit(s) should delineate " *proposed non-structural"* areas that are not and will not be suitable for construction of structures. Such areas may include septic tank and leach lines. Non structural areas may not include front, rear and side yards of graded lots on tract

subdivisions where future property owners may propose improvements such as room additions or other structures. All soil materials that have potential for settlement, hydro-collapse, consolidation or are unsuitable for structural support shall not be placed in side yards, front yards, slopes and areas where future improvements (by home owners) may take place or drainage facilities are proposed. Boundaries of certified fills should clearly be identified and be delineated on the exhibits. Adequate removals shall be performed to provide suitable materials to support streets, roads and right of ways. Such areas are not to be subject to settlements that may cause surface cracking or impairment of drainage flow.

III.1.N- OTHER PERTINENT ISSUES:

Geotechnical and geological investigation reports also should address all other pertinent issues not outlined elsewhere in these guidelines. These issues include, but are not limited to, the following:

- faulting, ground rupture and ground shaking,
- potential for seismically induced liquefaction,
- flooding, sheet flow, seiches, accelerated erosions and deposition,
- mud flows, debris flow, rock falls,
- ground subsidence,
- ground settlement,
- slope instability,
- slope failures,
- landslides (to include ancient, inactive, active and potential for proposed slopes),
- potential for ground fissure, ground cracks,
- high ground water table, ground water table fluctuations,
- expansive soils,
- organic soils,
- soil shrinkage,
- soil cracking,
- corrosive soils,
- any other hazard known to exist or having potential to exist.

NOTE 1: If the report concludes that the project site has potential for liquefaction then detailed analysis should be performed in accordance with the liquefaction report guidelines.

NOTE 2: If the project site is within Alquist Priolo Fault Zone or Riverside County Fault Zone, then a detailed analysis in accordance with the Fault Hazard Report guidelines should be provided.

Other facets in grading to be analyzed and discussed (if applicable) should include but be not limited to:

III.1.O- IMPROVEMENT RECOMMENDATIONS:

Geotechnical and geological investigation reports also should include geotechnical design and construction recommendations for proposed site improvements. These recommendations should reflect the subsurface conditions at the site and be supported by appropriate laboratory tests. These recommendations should encompass the following topics, as applicable and pertinent:

III.1.O.a- Foundation Design Criteria :

The followings (where pertinent & applicable) shall be addressed:

- Soil Profile Type determination (per UBC, Chapter 16).
- Seismic Source determination, per UBC, Chapter 16 (include fault name, classification, distance, maximum magnitude and slip rate).
- Near Source Acceleration & Velocity Factors (per UBC, Chapter 16).
- Seismic Zone (per UBC, Chapter 16).
- Seismic Coefficient for acceleration & velocity (per UBC, Chapter 16).
- Moment Magnitude & Maximum Moment Magnitude of nearby faults impacting the site (UBC, Chapter 16).
- Expansion Index and Plasticity Index (UBC, Chapter 18) and recommendations for accommodating expansive soils.
- Allowable bearing pressures for spread footing foundations.
- Minimum dimensions for spread footing foundations.
- Slab thickness, reinforcement, separation and expansion joints, construction joints, doweling, or ties.
- Grade beam specifications and recommendations, when applicable.
- Prestressed or post-tensioned slab design criteria.
- Exterior flatwork recommendations.
- Moisture barriers and/or selective grading (aggregate or sand base or other subbase).
- Soil moisture criteria prior to placement of concrete on foundations / slab.

- Necessary treatment prior to concrete pouring: "pre-pour moistening," "pre-soaking," or "pre-saturation."
- Drainage/irrigation controls to maintain moisture content in foundation materials (including increased positive drainage, paving, cut-off walls, sealed planters, gutters and down spouts, etc.).
- Soluble sulfate content (special recommendations to be provide if soluble sulfate concentrations are greater than 2000 ppm in soil and/or 1000 ppm in ground water).
- Chlorides (special recommendations to be provided if concentrations exceed 18000 ppm by cathodic protection, isolation of materials or wrapping).
- PH (special recommendations to be provided if PH is lower than 4.0).
- Organic Content (special recommendations to be provided if concentrations exceed 1.0%).
- Corrosiveness of soil.
- Footing setback from base of slopes and other setbacks (faults, fracture zones, contacts.
- Effects of adjacent loads when footings are at differing elevations.
- Deep foundation systems.

Additional loads or potential loads caused by geologic conditions (parameters and calculations).

III.1.O.b- Retaining Wall Design Criteria:

To be included on all proposed retaining walls (even when County standard wall designs are to be used (surcharged or greater than four feet in height above the bottom of footing), report should address:

- Design earth pressures (active and/or at-rest, as appropriate), typically expressed as equivalent fluid densities. Note that the equivalent fluid density values presented in Table 16-D on Page 14 of Riverside County Ordinance 457.90 (dated February 16, 1999) are valid only if the wall retains “drained earth.” This means the backfill should be a free-draining granular soil. Therefore, these design values may be used only if the backfill soils are adequately specified. Typically, such specifications call for a backfill soil with a sand equivalent of at least 30.
- Coefficient of sliding friction and allowable passive earth pressures

- Effect of surcharge loads.
- Drainage and backfill requirements including waterproofing and suitable drains.
- Horizontal footing setback from daylight of slopes.
- Minimum footing embedment.
- Recommendations on footing design in areas subject to potential of water saturation.
- Soil report shall include design criteria as per ICBO report based upon which non conventional walls are approved by the County.
- If retaining wall foundation is based on pile design then the report shall include design parameters for such proposal.

III.1.O.c- Asphaltic Concrete Pavement Design:

The report should reference areas, print on the grading plan and include:

- AC pavement design criteria (to include thickness and material classification).
- R-value testing: method (California 301-f or equivalent), results, sample location(s).
- Traffic indexes or projected loading conditions.
- AC structural sections: parking areas, access areas, service areas, heavy vehicle areas (to include thickness and type/ class of base materials).
- Untreated base compaction recommendations (min. 95% relative compaction).
- Subgrade recommendations: minimum depth, compaction (min. 90% relative compaction); special recommendations for bridging or founding, e.g., soil cement or lime treatment, over excavation, selective grading.
- AC sections shall be at minimum per Ordinance 348, section 18.12 if it is determined appropriate for the use.

III.1.O.d- Portland Cement Concrete Pavement:

- Minimum thickness and reinforcement.
- Size of placed or sawed sections; expansion joints.
- Untreated base specifications and recommendations.
- Subgrade recommendations.

III.1.P- REFERENCES:

A geotechnical investigation report should provide references to following:

- All previous reports prepared for the subject site.
- All published or unpublished sources reviewed throughout the investigation.
- All materials, maps, documents reviewed that are pertinent to the subject site.

III.1.Q- SIGNATURES:

All preliminary geologic and/or geotechnical investigation reports require wet signature, registration number and expiration date of license of a registered (State of California) geologist, certified engineering geologist, civil engineered or geotechnical engineer as appropriate. Engineered grading reports (involving more than 5000 cubic yards of cut or fill and implying or applying geologic interpretation) should be singed by a registered geologist or certified engineering geologist as well as a civil or geotechnical engineer. Regular grading projects (under 5000 cubic yards in earthwork either in cut or fill) involving no necessary geologic investigations, geologic mapping, geologic hazard analysis may be signed by a registered civil engineer or a registered Geotechnical engineer.

III.1.R- CHANGE OF CONSULTANT:

When there is a change in the consulting engineer / geologist of record for a project site, the applicant and the new consultant should notify the County of Riverside, in writing, and its appropriate departments of such change. The new consultant should also submit letter of understanding, confirming and accepting the content and recommendations of the previously approved report, assume all responsibilities and assure that the proposed grading shall conform and comply with the approved preliminary report and its recommendations. If the new consultant engineer / geologist of record intends to make changes, deviations or alterations in the recommendations, on file, then a revised report should be submitted to the County of Riverside for re-evaluation and be approved prior to commencing the earthwork.

SECTION 2:

GRADING AND INSPECTION REPORTS

Grading reports are required for the following kinds of projects:

A- Categorized as Engineered Grading.

B- Earthwork involving placing and compacting more than one foot (vertical) of fill to support structures, building pads and roads, backfilling behind retaining structures, utility trench backfilling.

C- As required by the Building Official.

III.2.A- GENERAL INFORMATION:

The followings are general information to be included in a report:

- Name, address, phone and fax number of geotechnical firm preparing the report.
- Date the report was prepared, date & duration of investigation, dates of inspections / observations.
- Project number.
- Subject of report.
- Name, address, phone number of property owner.
- Site address.
- Legal description including Lot/Parcel No. & Tract/PM No, Assessor's Parcel Number.
- Location description and/or location index map with reference to north.
- References to approved preliminary investigation report(s) that the grading report is based on and tends to substantiate compliance.
- Proposed development to include the type of development proposed: Commercial, Single Family, Tract, or Specific Use Case. Briefly describe the structures (multiple stories; wood frame masonry; concrete

tilt up).

- Signature, seal, number and expiration date of soils engineer or geologist's registration.

III.2.B- DATES OF OBSERVATION & TESTING:

Indicate dates and duration of the grading activity performed and dates and duration of the involvement, observation and testing conducted by the geotechnical firm.

III.2.C- SCOPE OF WORK PERFORMED:

The consulting engineer/geologist shall provide sufficient tests and observations during grading to verify that the grading was performed in accordance with the recommendations contained in the geotechnical and geological investigation reports (if applicable), the applicable codes and ordinances, and customary standards of practice. The grading and inspection report documents these activities by describing the scope of work conducted on the grading site, types of observations, testing, inspections, all surveying, equipment used on site. The following information should be included in a grading report, as applicable:

III.2.C.a- TESTS AND OBSERVATIONS:

The consultant engineer / geologist of record should provide a summary of the overall grading performed on the project site. This section briefly summaries the activities on the project site, facets of work that the geotechnical firm was involved with or was responsible for, the overall quality control and quality assurance exercised by the consultant to implement the firm's responsibilities, period of observations & testing, frequency of testing, testing equipments used, and earthwork equipment used on site. The report should identify which preliminary report's recommendations were implemented (if a preliminary report had been prepared for the project site).

Based on these tests and observations, the report shall include a clear statement that, in the opinion of the consulting engineer/geologist, the as-built grading conforms with the recommendations contained in the geotechnical investigation reports, the project drawings and specifications, the applicable codes and ordinances, and customary standards of practice.

III.2.C.b- OVER-EXCAVATION & REMOVALS:

Grading and inspection reports shall provide sufficient documentation to demonstrate that all unsuitable soils were removed and that all fills are underlain by suitable soil or rock. The criteria for determining suitability or unsuitability of soil and rock shall be as described in the in the applicable approved geotechnical investigation report (see Sections III.1.H.b & III.1.H.c of these guidelines). This documentation should include a description of the methods used in the field, the results of tests, as-built geologic and grading maps, and any other techniques used to implement the recommendations in the investigation report. It also shall document the as-built lateral extent and depth of removals required to meet the criteria. Simply stating that "all unsuitable soils have been removed to expose competent material" without supporting tests and observations is not sufficient.

If unforseen conditions encountered during grading make it impossible or impractical to remove all of the unsuitable soils, then appropriate alternative measures shall be implemented. The grading report shall clearly describe such deviations, and demonstrate how the alternative measures are sufficient to provide adequate support for the fill and the proposed structures.

If there no geotechnical investigation report was required for the project, or if the geotechnical investigation report does not include criteria that conforms to Part III, Section 1 of these guidelines, then the grading report shall include clear descriptions of the criteria used in the field to determine "suitable" and "unsuitable" soil and rock. Simply using terms such as "competent", "dense", "hard", "unyielding", or "undisturbed" without supporting qualitative and quantitative data is not sufficient. These descriptions shall be based on the engineering characteristics of the soil and rock, and should demonstrate that soil and rock left in place provides adequate support for the fill and the proposed structures.

III.2.C.c- KEYWAYS:

Sufficient observations and testing should be made to verify, substantiate and document that fills are adequately keyed into suitable material. The

report shall document the dimensions and locations of all keyways.

III.2.C.d- SUB-DRAIN INSTALLATIONS:

The grading report should include documentation of all subdrain installations (if applicable), including the horizontal alignment, invert elevations, starting points, connection points, discharge points, pipe sizes, and other pertinent geometric details. This information should be shown on the as-built grading plan, and include surveyed as-built invert elevations at key points.

The report also should include a description of the filter material, along with a statement that the flow capacities are adequate. This as-built design should be compared to the preliminary design presented in the geotechnical investigation report, and any differences noted and explained. Consulting engineer / geologist of record should keep on file all field notes made on depth elevations, location, method, observations and surveying of sub-drain installations and submit these to the Building Official upon requested.

III.2.C.e- CUT & FILL SLOPE STABILITY:

Examination, inspection and approval of all cut-and-fill slopes for stability should be conducted by the consulting engineer / geologist of record. This includes assessment of stability and identification of any adverse bedding, jointing or groundwater conditions. The adequacy and stability of all cut and fill slopes should be verified and documented in the final grading report along with supporting data. If height (more than 30 feet) or ratio of any cut or fill slopes has changed during grading, then a slope stability analysis shall be required.

The shear strength of soils used to construct stabilization fills or buttress fills (if applicable) should be measured during construction, and this strength should be compared to the design strength parameters to confirm that the as-built strength is at least equal to the design strength. The results of these tests should be included in the grading report.

III.2.C.f- OTHER INSPECTIONS:

Verification and documentation of other special grading observation as

determined in the approved preliminary report(s) should be included in the final grading report.

III.2.C.g- FILL PLACEMENT:

The final grading report should provide a summary of the engineered fill placement, the mixing and the compaction process and method. The thickness of fill lifts, moisture conditioning and equipment used for compaction should also be specified. Any import or export of fill materials should be noted and assessed for suitability.

III.2.D- DISCUSSION:

A short discussion should be presented to describe the overall earthwork performed and to include (as appropriate and pertinent) but not limited to:

- Indicate whether inspection/testing involved continuous or non-continuous observation,
- Indicate ASTM designation of all tests performed,
- All field density tests should be performed using either the ASTM D1556 sand cone method or the ASTM D2922 nuclear method. At least one sand cone test shall be performed for every ten nuclear tests. In addition, because of the soil conditions generally encountered in Riverside County, the drive cylinder test is not considered acceptable.
- Indicate if slopes steeper than 5:1 were keyed and benched prior to placing any fill,
- Discuss methods of treating transition lots including vertical and lateral extend of over-excavations,
- Indicate the kind of equipment used for compaction,
- Indicate compacting method used for surface of slopes,
- Specify the frequency of tests performed (elevation change and/or cubic yard moved),
- Indicate & identify tests taken at bottoms of keyways and / or over-excavations,
- Indicate the procedures followed on areas with failing density tests,
- Identify any import or export of earth materials from or to the project site, description and determination of suitability of materials imported,
- Indicate methods and procedures used to determine suitability of

imported soil,

- Specify procedures, means, methods, sources to determine elevations for testing, removals, over-excavations and keyways,
- Identify maps and grading plans used to plot information on the "As-Built" plans,
- Indicate any changes or deviations made during grading that was different from the original approved preliminary report,
- Discuss, analyze and justify any deviations or changes,
- Indicate if deep fills were placed (more than 50 feet thick) and discuss the primary and secondary consolidation potentials and anticipated total settlement and differential settlements, mitigation recommendations such as settlement monitoring, construction time delay and appropriate foundation design,
- Discuss any potential for primary or secondary consolidation, total settlement and differential settlement of soils left-in-place (indicate & delineate such area on the exhibits) and provide mitigation,
- Indicate the potential for hydro-collapse (indicate amount & delineate the area on the exhibits) and provide mitigation,

III.2.E- TESTING:

III.2.E.a- Test Data and Tables:

All tables showing test results should at least have the following information:

- Test number.
- Test location.
- Test elevation with respect to sea level (concurring with grading plan elevations).
- Date test taken.
- Method (with ASTM designation) of testing; sand cone / nuclear gauge.
- Moisture content.
- Dry density.
- Soil type.
- Maximum Dry Density & Optimum Moisture content.
- Relative compaction.
- Minimum acceptable relative compaction; 90%, 95%, etc.
- Retests.
- Remark.

III.2.E.b- Test Location Map(s), Exhibit(s), Plate(s):

A plan (preferably the "As-Built" grading plan) should be provided to show location of all density tests taken. This plot plan should include as a minimum:

- The property boundaries of the project site and delineating the specific area encompassed by the report being certified.
- Delineation of the ***"non-structural"***, ***"non-engineered",*** and ***"engineered"*** fills.
- The original topography contour lines.
- The graded contour lines.
- The depth elevations, limits and boundaries of all removals and over-excavations.
- The graded pad elevation (concurring with the approved grading plan).
- The transitions between cuts and fills (indicate depth of over-excavation).
- The test location with a designated symbol (preferably, those tests taken at the bottoms of removals / over-excavations to be marked differently).
- The location, depth elevation, limits and boundaries of all keyways (as appropriate).
- The location, depth elevation, starting point, end point, discharge point, direction of flow and flow line elevations of all subdrains (if installed).
- The location and depth of all settlement monitors (if installed).
- The "As-Built" geology (include all geologic units, boundary limits, depth encountered, contact lines and attitudes).
- The total thickness of engineered fill placed or depth of cut performed.

III.2.F- FOUNDATION RECOMMENDATIONS:

All grading reports should include foundation recommendations. If these recommendations have already been made in the approved preliminary report and the engineer / geologist of record believes that they remain unchanged, then the report should reference and cite such report. However, if the soil types have changed (because of import or mixing of different materials on site) or revisions have been made in the location of

building pad or building design then the engineer / geologist need to re-evaluate the existing conditions and provide up-dated recommendations. As a minimum the foundation recommendations should address the following:

III.2.F.a- Foundation Design Criteria :

The followings (where pertinent & applicable) shall be addressed:

- Soil Profile Type determination (per UBC, Chapter 16).
- Seismic Source determination, per UBC, Chapter 16 (include fault name, classification, distance, maximum magnitude and slip rate).
- Near Source Acceleration & Velocity Factors (per UBC, Chapter 16).
- Seismic Zone (per UBC, Chapter 16).
- Seismic Coefficient for acceleration & velocity (per UBC, Chapter 16).
- Moment Magnitude & Maximum Moment Magnitude of nearby faults impacting the site (UBC, Chapter 16).
- Expansion Index and Plasticity Index (UBC, Chapter 18) and recommendations for accommodating expansive soils.
- Allowable bearing pressures for spread footing foundations.
- Minimum dimensions for spread footing foundations.
- Slab thickness, reinforcement, separation and expansion joints, construction joints, doweling, or ties.
- Grade beam specifications and recommendations, when applicable.
- Prestressed or post-tensioned slab design criteria.
- Exterior flatwork recommendations.
- Moisture barriers and/or selective grading (aggregate or sand base or other subbase).
- Soil moisture criteria prior to placement of concrete on foundations / slab.
- Necessary treatment prior to concrete pouring: "pre-pour moistening," "pre-soaking," or "pre-saturation."
- Drainage/irrigation controls to maintain moisture content in foundation materials (including increased positive drainage, paving, cut-off walls, sealed planters, gutters and down spouts, etc.).
- Soluble sulfate content (special recommendations to be provide if soluble sulfate concentrations are greater than 2000 ppm in soil and/or 1000 ppm in ground water).
- Chlorides (special recommendations to be provided if concentrations exceed 18000 ppm by cathodic protection, isolation of materials or

wrapping).

- PH (special recommendations to be provided if PH is lower than 4.0).
- Organic Content (special recommendations to be provided if concentrations exceed 1.0%).
- Corrosiveness of soil.
- Footing setback from base of slopes and other setbacks (faults, fracture zones, contacts.
- Effects of adjacent loads when footings are at differing elevations.
- Deep foundation systems.
-

Additional loads or potential loads caused by geologic conditions (parameters and calculations).

III.2.F.b- Retaining Wall Design Criteria:

To be included on all proposed retaining walls (even when County standard wall designs are to be used (surcharged or greater than four feet in height above the bottom of footing), report should address:

- Design earth pressures (active and/or at-rest, as appropriate), typically expressed as equivalent fluid densities. Note that the equivalent fluid density values presented in Table 16-D on Page 14 of Riverside County Ordinance 457.90 (dated February 16, 1999) are valid only if the wall retains "drained earth." This means the backfill should be a free-draining granular soil. Therefore, these design values may be used only if the backfill soils are adequately specified. Typically, such specifications call for a backfill soil with a sand equivalent of at least 30.
- Coefficient of sliding friction and allowable passive earth pressures
- Effect of surcharge loads.
- Drainage and backfill requirements including waterproofing and suitable drains.
- Horizontal footing setback from daylight of slopes.
- Minimum footing embedment.
- Recommendations on footing design in areas subject to potential of water saturation.
- Soil report shall include design criteria as per ICBO report based upon which non conventional walls are approved by the County.

- If retaining wall foundation is based on pile design then the report shall include design parameters for such proposal.

III.2.F.c- Asphaltic Concrete Pavement Design:

The report should reference areas, print on the grading plan and include:

- AC pavement design criteria (to include thickness and material classification).
- R-value testing: method (California 301-f or equivalent), results, sample location(s).
- Traffic indexes or projected loading conditions.
- AC structural sections: parking areas, access areas, service areas, heavy vehicle areas (to include thickness and type/ class of base materials).
- Untreated base compaction recommendations (min. 95% relative compaction).
- Subgrade recommendations: minimum depth, compaction (min. 90% relative compaction); special recommendations for bridging or founding, e.g., soil cement or lime treatment, over excavation, selective grading.
- AC sections shall be at minimum per Ordinance 348, section 18.12 if it is determined appropriate for the use.

III.2.F.d- Portland Cement Concrete Pavement:

- Minimum thickness and reinforcement.
- Size of placed or sawed sections; expansion joints.
- Untreated base specifications and recommendations.
- Subgrade recommendations.

III.2.G- Potential Settlement:

Potential total and differential settlements should be evaluated based on the as-graded conditions and compared to the criteria described in III.1.H of these guidelines.

III.2.H- CERTIFICATION:

A grading report should include a clear statement that the geotechnical consultant certifies

and confirms that the grading performed was in accordance and conformance with the applicable requirement of UBC, Riverside County Grading Ordinance, the latest revision of the technical guidelines (to be referenced) and the approved preliminary report (to be referenced). Certification should include the entire permit boundary not just the building areas and structural fills.

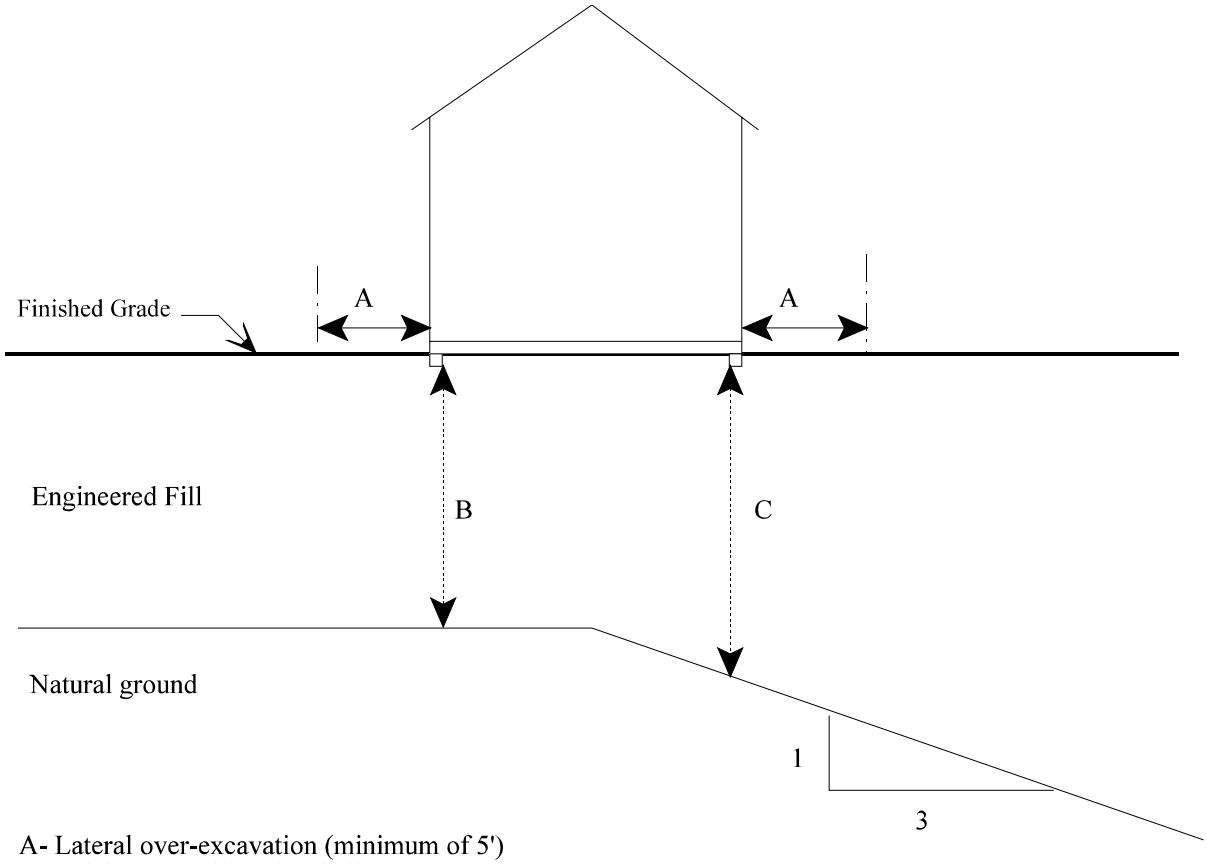
III.2.I- SIGNATURE:

All grading reports should be wet signed, with registration number, expiration of license of a registered geologist or certified engineering geologist, civil engineer or geotechnical engineer as appropriate. Project sites categorized as "Engineered Grading" or sites requiring geologic as-built mapping or observation of geologic features should be signed by a registered geologist or certified engineering geologist. Regular grading reports involving no geology may be signed by a registered civil engineer or geotechnical engineer.

III.2.J-CHANGE OF CONSULTANT:

If the consultant engineer / geologist is changed during the rough grading, the County of Riverside and its appropriate departments should be notified in writing by both the applicant and the new consultant. In addition, the new consultant should, by submitting a written letter, ***accept*** all analysis, findings, conclusions and recommendations presented by previous consultant and ***certify*** that all earth work and grading operations were completed in accordance and conformance with the approved preliminary report (to be cited). The new consultant should provide a grading report (upon completion of the earthwork) that certifies and documents the entire grading operation performed on the project site. If the consultant of record has been changed between independent phases of grading, then each consultant responsible for each phase may provide independent interim reports and certify only that phase. However, all consultants should certify implementation and compliance with the approved preliminary report (to be cited). Final approval of interim and separate reports by various consultants is given by of the Building Official on a case by case basis.

APPENDIX



A- Lateral over-excavation (minimum of 5')
B- Thickness of fill at the shallowest
C- Thickness of fill at the deepest

The minimum fill thickness (B) beneath any building pad should be at least half of the maximum fill thickness (C). B should be a minimum of 2 feet but need not exceed 15 feet.

FIGURE 1