The City of SAN DIEGO

Guidelines for Geotechnical Reports

2018

Development and Permit Information: (619) 446-5000
Appointments: (619) 446-5300
www.sandiego.gov/development-services

This information, document, or portions thereof, will be made available in alternative formats upon request.

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1. INTRODUCTION

1.1 Purpose

These guidelines are intended to facilitate the preparation and review of preliminary geotechnical reports and as-graded (as-built) reports submitted to the City of San Diego ("City"). The following sections provide information for preparing well-documented reports. Not all the informational items will be applicable to every site or every project, but the investigative scope should be consistent with the intended use and the physical constraints of the site. It is not the intent of these guidelines to specify methods or scope of studies for individual projects or to supplant the judgment of the licensed geotechnical[1] consultant. No provision in these guidelines is mandatory or should be construed to constitute a statute, ordinance, or regulation, unless stipulated elsewhere.

Geologic conditions exist within the City of San Diego that can pose serious problems when land is developed. No permits shall be issued where the geotechnical investigation establishes that land development or construction of structures would be unsafe due to geologic hazards. Issuance of a permit does not constitute a representation that a site or construction is safe.

San Diego's unique physiography features a wide variety of environmental conditions © UT

1.2 The Permit Process

The various permits required for land development and construction are issued by the Development Services Department (see https://www.sandiego.gov/development-services for details). These permits fall into two general categories: development permits and construction permits[2]. Development permits or entitlements are discretionary in nature, granted by a decision maker. Depending on the type of project, the decision maker could be City staff, a Hearing Officer, the Planning Commission, or the City Council. Examples of development permits include Coastal Development Permits, Site Development Permits, Neighborhood Development Permits, Conditional Use Permits, and Tentative Maps. Construction permits are ministerial, which means that projects found to comply with City standards and existing property entitlements may be permitted without a public hearing. Grading permits, improvement permits, and building permits are examples of ministerial permits.

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[1] For the purposes of this document, "geotechnical" encompasses both the fields of geotechnical (soils) engineering and engineering geology.

2 (for additional information see the Development Services' Development Process: Step by Step.

1.2.1 Submittal

Plans and documents submitted for permitting proposed projects are referred to as a "submittal package." Geotechnical reports provided in the original "submittal package" or as part of a subsequent resubmittal will be assigned to a reviewer. Due dates are set by department standards based upon project size and complexity. As is often the case, more than one review cycle is required to complete the geologic review.

Submittals are made at the Development Services Center located in downtown San Diego (see https://www.sandiego.gov/development-services for details). Appointments are recommended and can be made by phoning (619) 446-5300. Refer to the Project Submittal Manual for specific submittal requirements.

1.2.2 Geotechnical Review

Geotechnical reports submitted to the City are reviewed by the Geology Section of Development Services for conformity with City and State standards. These guidelines are the basis for interpreting minimum City standards. When appropriate, reviewers include a field reconnaissance of the project site.

In some cases, such as when geologic conditions could restrict the intended use of the site, it may be beneficial to have City staff review preliminary plans and reports prior to completing final design or making a formal submittal. This process is called "Preliminary Review" (see Information Bulletin 513) and should be used whenever geologic hazards are encountered during the investigative stage that could negatively impact the planned project. Preliminary Review may also be used whenever there are questions of Development Services' staff needing to be answered prior to your submittal.

1.3 Definitions

- **Applicant:** Project applicants include developers, landowners, and others directly involved with development or construction activities. Applicants are responsible for submittal of complete documents and payment of fees.
- **Chief Building Official:** Manager of Building and Safety, which is the division that issues construction permits based, in part, upon adequate project plans and technical documents. The Building Official is responsible for enforcement of building codes, and resolves issues or conflicts regarding construction practices or code interpretations.
- **City Engineer:** A registered civil engineer responsible for oversight and approval of City works. The City Engineer, or designees (Deputy City Engineer), is responsible for approving grading permits, right-of-way permits (e.g. improvement plans), and maps.
- **Development Services:** The City Department that regulates development and construction.
- **Development Project Manager (DPM):** Point of contact for the applicant during the discretionary or ministerial permitting process.
- **Public Works:** The City Department responsible for planning, design and inspection of public improvement projects that encompass building fire stations, bridges, libraries, police stations, bikeways, drainage, street lights, traffic signals, street improvements, underground facilities, and water and sewer facilities.
- **Engineer of Work:** The civil engineer who designs and is responsible for the proposed project plans.
- **Environmental Analyst:** The City staff member who conducts environmental review and writes the environmental document during the discretionary permitting process in accordance with the California Environmental Quality Act (CEQA) of 1970.

- **Geotechnical Consultants:** Appropriately registered and licensed professionals that provide geologic and geotechnical engineering services for project applicants. These consultants provide design recommendations, approve project plans and specifications, and provide construction observation services. Geotechnical consultants include:
  - **Soil Engineer:** A State of California licensed Professional Engineer (PE) who practices soil engineering.
  - **Professional Civil Engineer:** A State of California licensed Professional Engineer (PE).
  - **Geotechnical Engineer:** A Professional Engineer who is additionally a State of California Registered Geotechnical Engineer (GE)
  - **Professional Geologist**: A State of California licensed Professional Geologist (PG).
  - **Engineering Geologist:** A Professional Geologist who is also a State of California Certified Engineering Geologist (CEG).
- **Geotechnical Reports:** This is an inclusive term covering many types of geologic and geotechnical engineering documents. Documents referred to as preliminary soil reports, geologic reconnaissance reports, geologic investigation reports, fault hazard studies, geotechnical investigation reports, preliminary geotechnical reports, and as-graded geotechnical reports, are examples of geotechnical reports.
- **Reviewer:** Appropriately licensed professional City staff member (or employees working directly under the supervision of appropriately licensed and registered professionals) who reviews geotechnical reports. Appropriately licensed and registered professionals providing services under contract with the City may also review geotechnical reports. Geotechnical reports are evaluated for conformity with City and State codes, ordinances, and standards. These guidelines are the basis for interpreting minimum City standards.

1.4 Applicable Codes, Ordinances, and Guidelines

Geotechnical consultants providing services in the City of San Diego should be familiar with the current codes, ordinances, guidelines, information bulletins, and technical bulletins applicable to development and construction including the following:

- City of San Diego Municipal Code
- City of San Diego General Plan, Seismic Safety Element
- City of San Diego Drainage Manual
- City of San Diego Storm Water Standards
- California Building Code (CBC), and City Amendments
- Subdivision Map Act of 1907, and Amendments
- California Environmental Quality Act of 1970, and Amendments
- Alquist-Priolo Earthquake Fault Zone Act of 1972, and Amendments
- Seismic Hazards Mapping Act of 1990
- The "Greenbook" – Standard Specifications for Public Works Construction
- City Supplement to the "Greenbook"
- Information Bulletin 141 – Residential Foundation Requirements
- Information Bulletin 208 – Gray Water Systems
- Information Bulletin 515 – Geotechnical Study Requirements for Development and Grading permits

In addition to applicable codes and ordinances, applicants and consultants should be familiar with the selected references listed in Appendix A.

1.5 City Records Research and Publications

Records and maps of projects previously permitted by the City may be researched in the Records Section of Development Services Department. An appointment is recommended and can be made in advance by calling 619-446-5200 or 619-446-5300.

1.6 Consumer Information Regarding Geotechnical Reports

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes. The following information should be considered by the customer:

- Geotechnical services are performed for specific purposes, persons, and projects.
- A geotechnical report is based on a unique set of project-specific factors.
- Subsurface conditions can change.
- Most geotechnical findings are professional opinions.
- A report's recommendations are not final.
- A geotechnical report is subject to misinterpretation.
- The consumer must not edit the contents of the geotechnical report.
- A complete, original quality report is required by regulating agencies, design professionals, and contractors.
- Read and understand responsibility provisions.
- Geo-environmental issues are typically not addressed in geotechnical reports.
- Rely on your geotechnical consultant for additional assistance or contact ASFE at www.asfe.org.

2. GEOTECHNICAL REPORTS

The appropriate scope of a geotechnical investigation is a function of the type of proposed land use or project, the soil or geologic conditions of the project site, and type of permit or approval sought. The geotechnical consultant is responsible for targeting the scope of their investigation, testing, analyses, and documentation to balance these factors. Unnecessary delays in obtaining permits or approvals can be avoided by submitting appropriately focused geotechnical investigation reports that address the plans submitted for permitting or approval.

The City recognizes two basic types of geotechnical studies: preliminary geotechnical reports and as-graded (or as-built) geotechnical reports. Geotechnical reports that address a proposed project are considered preliminary reports whether they address development or construction plans. Types of preliminary geotechnical reports include soils reports, geologic reconnaissance reports, geologic hazard investigations reports, geotechnical investigation reports, or many other types of focused geotechnical reports addressing a proposed project. See Sections 5 and 6 for additional information on preliminary geotechnical reports.

Comprehensive geotechnical reports may sufficiently address all the requirements of the various permits that might be required by a project. However, it is often the case that project plans change during the permitting process. The applicant must decide if a comprehensive geotechnical report should be submitted and updated as plans evolve or if permit specific geotechnical reports are appropriate for their project.

As-graded (or as-built) geotechnical reports address geologic conditions encountered during construction or grading and document various aspects of construction observation and testing. As-graded or as-built geotechnical reports include compaction test reports and foundation inspection reports, as well as many other types of geotechnical reports documenting construction inspection or testing (see Section 7.0).

2.1. Geologic Hazard Category

The San Diego Seismic Safety Study, *Geologic Hazard and Fault Maps*, delineate and characterize areas within the City based on known or suspected geologic hazards and their relative risk. The maps are planning tools and should not be considered a source for site-specific geologic information. However, the maps may be used to help determine geotechnical

investigation report submittal requirements for specific projects. In addition, the geotechnical consultant must consider the geologic hazard category of a site when formulating the scope of their investigation. Detailed requirements for geotechnical reports are addressed in Section 6.

2.2 Types of Land Uses and Projects

Geotechnical investigation reports should focus on the specific type of land use or project that is proposed. Proposed projects can be broadly divided into Development (entitlement) and Construction projects. Development projects typically require discretionary approval and often involve public hearings. Construction projects require ministerial permits.

2.2.1 Discretionary Projects

Geotechnical reports for discretionary projects should provide geologic input needed for environmental documents, address the geologic issues for certain sites as required by the San Diego Municipal Code (Section 143.01, Environmentally Sensitive Lands Regulations), and address the suitability of sites proposed for Tentative Subdivision Maps.

For environmental documents, the scope of the geotechnical investigation must be sufficient to identify existing and potential geologic hazards, determine potential impacts, recommend mitigation measures, and identify significant unmitigated geologic impacts. The geotechnical consultant should refer to California Geological Survey Note 46 and Note 52 for a checklist of items that should be addressed. In addition, the consultant should consider the City's Geologic Conditions Initial Study Checklist Questions.

Every development proposed on a sensitive coastal bluff (within 100 feet of the bluff edge) or on the beach will be subject to the Environmentally Sensitive Lands regulations.

A geotechnical investigation report submitted for determining the development feasibility of a Tentative Subdivision Map must provide sufficient geologic information to substantiate that the geologic hazards of the site have been adequately identified and the impacts related to the development have been established. The geotechnical investigation must conclude that the site is suitable for the proposed development as designed or the consultant must provide recommendations to mitigate the geologic hazards to an acceptable level. Hazard zones such as structural setbacks from faults or slopes must be identified and shown on the Tentative Map.

For discretionary projects, the geotechnical consultant should be prepared to defend their findings, conclusions, or recommendations in a public hearing, if necessary.

2.2.2 Ministerial Projects

Geotechnical investigation reports for these projects must specifically address the relevant topics listed in Chapter 6 of these guidelines and specifically address construction plans submitted for approval. The report must provide detailed supporting data as well as construction recommendations and specifications for the submitted construction plans.

2.3 Exceptions

Geotechnical investigation reports may not be required for certain minor projects. For information on exceptions, see Information Bulletin 141, Information Bulletin 515, and San Diego Municipal Code §145.1803.

City review of project plans or field conditions may determine that a geotechnical investigation is required for any project.

2.4 Expiration Date

Geotechnical reports submitted for support of permits should reflect the current site conditions and proposed project. An addendum geotechnical report or updated geotechnical report may be required if site conditions differ or proposed project elements have changed relative to those addressed in the geotechnical report. Geotechnical reports are considered valid for three years unless the geotechnical consultant identifies a shorter expiration date.

3. CHANGE OF GEOTECHNICAL CONSULTANT OF RECORD

The geotechnical consultant that has prepared documents in support of an approved permit is considered the geotechnical consultant of record. A change of geotechnical consultant of record must be processed if the project's geotechnical consultant is changed after a permit has been issued and before the project is as-built and closed. The new geotechnical consultant must prepare a Transfer of Geotechnical Responsibility letter. If the new geotechnical consultant utilized the geotechnical investigation and test data prepared by the previous geotechnical consultants of record, the new geotechnical consultant must reference the geotechnical reports approved for the project and must state that they agree with the data, recommendations and conclusions contained in those reports. The new consultant must also state that the data, recommendations and conclusions are valid for the proposed construction. For grading permits, the specific drawing number must be included in the statement. Alternatively, the new geotechnical consultant has the option of conducting an independent geotechnical investigation. A change of geotechnical consultant of record after a grading permit has been issued will require a formal construction change to the grading plans.

4. SUBSURFACE EXPLORATION PERMITS

Permits for exploratory excavations and monitoring wells must be obtained in compliance with OSHA and County of San Diego requirements. Contact the County regarding well or boring permits and backfill requirements. Information is available on line.

Information on how to obtain a grading permit for exploration on a site that contains environmentally sensitive lands can be found in Information Bulletin 511 for public projects and Information Bulletin 560 for private projects (see Appendix B).

Pursuant to State Assembly Bill (AB) 73, every person planning to conduct any subsurface excavation is required to contact a regional notification center at least 2 days prior to excavation and, if practical, delineate the areas to be excavated.

The City of San Diego Trench-Cut Excavation Ordinance (Municipal Code 62.1200), describes the requirements for excavations in the Public Right-of-Way. Work in the Right-of-Way requires permits from Development Services. For information on construction plans for excavations in the Right-of-Way see https://www.sandiego.gov/development-services/industry/information/standtemp. For traffic control requirements see Information Bulletin 177.

5. PRELIMINARY GEOTECHNICAL REPORT CONTENT

Outlined herein are the major elements of a preliminary geotechnical report. These elements will be present in most preliminary geotechnical reports; however, not all of these elements may not be applicable to every project. The geotechnical consultant will determine the organization and format of the preliminary geotechnical report.

5.1 Introductory Information

5.1.1 Purpose

The report shall clearly identify the purpose of the geotechnical investigation. Indicate if the investigation is intended to be comprehensive or if it addresses a specific permit (i.e., grading plan).

5.1.2 Site Description

Describe the site location and access. Provide a description of the physiography (geomorphology), vegetation, and significant cultural (man-made) features of the site. Describe natural and manufactured slope height and gradient (or ratio). Reference to an index map that uses a topographic base may reduce the need for lengthy descriptions.

5.1.3 Proposed Development

Provide a general description of the proposed project. Reference should be made to the plans addressed by the investigation.

5.1.4 Previous Studies

List and describe the relevant published and unpublished literature pertinent to the geologic or geotechnical aspects of the site. Typically, this will include regional geologic reports and maps as well as reports by other geotechnical consultants. All geotechnical data utilized from previous investigations that are used to support geologic and geotechnical engineering interpretations should be referenced in the report.

If a geotechnical consultant utilizes the geotechnical report and test data prepared by another geotechnical consultant, they must reference the geotechnical reports and state that they agree with the data, findings, and conclusions contained in those reports. Copies of referenced reports must accompany the submitted report.

5.1.5 Scope of Investigation

Describe the research, field exploration, laboratory testing, and analyses conducted. Details of the methods and procedures used in the investigation may be described in the introduction, in the body, or in an appendix of the report.

5.2 Geologic and Geotechnical Site Conditions

Describe the geologic or geotechnical conditions of the site. The emphasis of this section should reflect the Geologic Hazard Category of the site as depicted on the San Diego Seismic Safety maps.

5.3 Geologic and Geotechnical Analysis

Describe and discuss site or project specific geologic or geotechnical analyses. For example, a geotechnical report that focuses on slope stability should describe the stability analyses that were conducted and discuss the results.

5.4 Conclusions

A conclusion regarding the suitability of the site for the intended use should be provided. Summarize all hazardous or damaging geologic or geotechnical conditions potentially impacting the proposed development. Conclusions and opinions should be substantiated by factual information and experience. Where a conclusion is based on experience or judgment, the rationale used should be clearly discussed.

5.5 Recommendations

Provide project specific recommendations targeting the type of permit that is sought. For environmental review, provide recommendations to mitigate or avoid geologic hazards. For grading permits, provide grading recommendations. A preliminary geotechnical report addressing building plans should provide foundation and design recommendations. A report may provide comprehensive recommendations for all phases of the permit process. However, updated recommendations may be required as plans evolve.

The geotechnical consultant should indicate if additional exploration, testing, or analyses are recommended to address the proposed project.

5.6 Illustrations

Maps, cross sections, plans, and details are important tools for conveying location, geological, and geotechnical information and recommendations. Illustrations should be clear and all symbols must be defined for the illustrations to be understood. A graphic scale and north arrow should be provided on all maps. Typical illustrations of preliminary geotechnical investigation reports include an index map (site location map), regional geologic map, and site-specific geological or geotechnical maps and cross sections.

5.7 Logs of Exploratory Excavations (including Cone Penetration Test Data)

Present logs for all exploratory excavations and a legend for all symbols used in the logs. See Appendix B for additional details.

5.8 Geophysical Data

Attach geophysical data and graphical output from geophysical studies used to support the findings, conclusions, and recommendations.

5.9 Geotechnical Test Data

The geotechnical consultant should conduct sufficient in situ and laboratory testing to characterize the physical geotechnical parameters of the earth materials affecting the proposed development. The test procedures and sample preparation should be described and the applicable ASTM or other recognized standard referenced. The resulting test data should be presented in tabular format or plots as deemed appropriate. The presented data should be representative of site conditions and must substantiate the geotechnical parameters used for analyses. See Appendix C for additional discussion.

5.10 Computer Aided Analysis - Output

Attach the relevant output of computer-aided analyses. The user defined geologic or geotechnical input parameters should be clearly documented.

5.11 References

Provide a bibliography that includes cited publications, unpublished reports, aerial photographs, etc.

5.12 Authentication

All geotechnical reports submitted to the City of San Diego must be signed and sealed (stamped) by an appropriately licensed professional as prescribed by State law (http://www.bpelsg.ca.gov/laws/index.shtml).

6. GUIDELINES FOR PRELIMINARY GEOTECHNICAL REPORTS

6.1 Geology

6.1.1 Regional Geological Setting

Geotechnical reports should provide a discussion with respect to the regional geologic setting of the project site. The level of detail should be consistent with the focus of the investigation and the type of proposed project and type of permit. At a minimum, the Geologic Hazard Category or Categories of the site must be identified, based on the San Diego Seismic Safety Study maps.

6.1.2 Site Geology

The earth materials at the subject site must be described in all geotechnical reports. The descriptions should be based on independent observation by the licensed professional geotechnical consultant or qualified individuals under their supervision.

Professional Geologists could refer to Guidelines for Engineering Geologic Reports prepared by the State of California Board for Geologist and Geophysicists (1998). A comprehensive geotechnical report focusing on site geology would address the following where applicable:

6.1.2.1 Bedrock Units

Identify geologic units on or beneath the site and discuss their relative age and correlation to known formations. Describe the physical characteristics and distribution of the units and relationship to other geologic units on site. Also describe the bedrock unit's response to geologic processes and engineering characteristics.

6.1.2.2 Geologic Structure

Describe the bedding, folds, fractures, joint, faults, etc. of the bedrock units. The description should include the attitude and other quantitative attributes of the structures. Discuss the relationship of the geologic structure to potential impact on the proposed project. Indicate if the geologic structure is favorable or adverse with respect to slope stability, proposed excavations, grading, or retaining structures.

6.1.2.3 Surficial Deposits

Surficial deposits include artificial fill, topsoil, alluvium, colluvium, beach sand and gravel, landslide debris, and other types of earth materials mantling bedrock or occurring on or near the surface. The general type, distribution, occurrence, and relative age of the deposits or soils should be described. In addition, physical characteristics and response to surface processes and engineering characteristics should be described.

6.1.2.4 Surface Water and Groundwater

The occurrence of streams, ponds, springs, and seeps on the site must be identified and described in relationships to site topography and geology. The sources, variation, and permanence of the surface water and groundwater conditions must be discussed. Any surface water hazards and possible effects on the proposed development shall be addressed.

"Seasonal high groundwater level" may need to be determined for evaluation of suitability of structural BMPs that involve storm water infiltration or percolation, or gray water systems.

6.2 Geologic and Geotechnical Hazards

Geotechnical reports for discretionary permits should address all potential geologic hazards of a site proposed for development with focus on the geologic hazards implied by the geologic hazard category of the site as shown on the San Diego Seismic Safety Study Geologic Hazards and Faults Maps. When hazards are identified, potential impacts must be described, feasible mitigation measures discussed, and remaining unmitigated significant affects recognized. Reports for ministerial permits should focus on design-level analyses and remedial recommendations.

Faulted San Diego Formation within the La Nacion fault zone.

Off-set krotovina on the San Diego fault.

6.2.1 Earthquake Fault-Rupture Hazard

All geotechnical reports should address if the proposed project site is located in an Alquist-Priolo Fault-Rupture Hazard Zone.

Most proposed projects located in Alquist-Priolo Earthquake Fault Hazards Zones (Geologic Hazard Category 11), potentially active fault zones (Geologic Hazard Category 12), and the Downtown Special Fault Zone (Geologic Hazard Category 13) will require a fault-rupture hazard evaluation as part of the geotechnical report. For additional details refer to Appendix D – Guidelines for Fault-Rupture Hazard Investigation Reports.

Note that it is responsibility of a project's professional geologist to identify if an active fault crosses a project site whether located inside or outside an identified fault zone.

6.2.2 Earthquake Induced Ground Failure

Geotechnical reports for discretionary permits should address the likelihood of earthquake induced ground failure at the proposed project site. For sites located in Geologic Hazard Category 31 and 32, the report should specifically address liquefaction, dry sand settlement, lateral spread, and flow slides.

Screening-level investigations may be appropriate for proposed projects seeking discretionary approval. However, if ground improvement is recommended, a design-level investigation to determine the proposed limits of ground disturbance may be required to determine the collateral impacts to environmentally sensitive lands or historic or prehistoric resources.

Geotechnical reports for ministerial projects located in Geologic Hazard Category 31 should evaluate liquefaction hazards in accordance with section 6.4.2 of these guidelines. Liquefaction hazard assessment shall take into account any increase in groundwater elevation, or groundwater mounding that could occur due to irrigation, gray water systems, or storm water infiltration.

Liquefaction and lateral spread at Redondo Beach Marina parking lot, Northridge Earthquake 1994

6.2.3 Landslides and Slope Stability

The movement of a mass of rock, soil, or earth down a slope is considered a landslide. Preliminary Geotechnical Reports for proposed projects in hillside areas (slopes greater than 4 horizontal to 1 vertical) must address the presence of landslides within or adjacent to the site. For projects located in geologic hazard category 21-27 and 41-46 the potential for gross and surficial slope instability must also be addressed. For proposed hillside or bluff top developments, the geotechnical consultant should investigate and report if the geologic conditions are favorable or unfavorable for future slope stability.

Soledad Mountain Road Landslide December 14, 1961

Soledad Mountain Road Landslide October 2007

Deep-seated landslides, if present, may require a detailed investigation involving aerial photograph interpretation, geologic field mapping, subsurface exploration, and geologic analysis to determine the limits, geometry, and mode of failure of the landslide. For bedrock sites, subsurface exploration of landslides typically involves detailed direct observation in drilled shafts (borings) conducted by an engineering geologist to describe the geologic profile, and collect geologic structural information and samples. Surface exploration should extend well below the lowest slip surface of the landslide. The number of exploratory excavations should be sufficient in number and adequately spaced to define the three-dimension geometry of the landslide and groundwater conditions.

The potential for deep-seated failures of existing and proposed slopes may require a detailed investigation involving aerial photograph interpretation, geologic field mapping, subsurface exploration, and geologic analysis to adequately model the geologic conditions affecting slope stability. For bedrock sites, subsurface exploration typically involves large diameter drilled shafts (borings) that allow detailed direct observation, detailed logging, measurement of geologic structural elements, in situ testing, and sampling by an engineering geologist. Surface exploration should extend below the lowest potential failure path with an inadequate factor of safety (see Section 6.4). The number of exploratory excavations should be sufficient in number and adequately spaced to provide a well constrained three-dimensional geologic and groundwater model for representative slope stability analysis.

For proposed hillside or bluff top developments, the potential for surficial instability, debris and mudflow, rock fall, and soil creep impacting the proposed development or potentially caused by the proposed project must be investigated and reported.

Surficial slope failure after heavy rainfall December 2010

6.2.4 Tsunami, Seiche, and Flooding (Earthquake Induced Dam Failure)

Seismic sea waves (tsunamis) may be a hazard for sites located in low-lying coastal areas of San Diego. Geotechnical consultants should refer to the Multi-Jurisdictional Hazard Mitigation Plan, San Diego County, CA (2004) or Tsunami Inundation Maps for Emergency Planning (2009) for the location of sites at risk. The consultant must address the tsunami hazard for sites located in these areas.

The consultant should also address the potential for flooding due to seiche adjacent enclosed or semi-enclosed bodies of water or the potential for flooding due to earthquake induced dam failure.

6.2.5 Subsidence

For projects that require dewatering or groundwater extraction address the potential for subsidence. If the potential for adverse subsidence is indicated, provide recommendations to monitor and mitigate the potential adverse effects.

6.3 Coastal Geology

Proposed projects located within 100-feet of the coast that are applying for a discretionary permit (e.g., Coastal Development Permit) are subject to the requirements of San Diego Municipal Code (§143.0143 and §143.0144) and the Coastal Bluffs and Beaches Guidelines. Geotechnical reports for proposed projects in Geologic Hazard Category 41-47 require a bluff edge determination in accordance with the Coastal Bluffs and Beaches Guidelines.

Faulted coastal bluff near the La Jolla Caves

A geologic map and three cross sections must be presented for each proposed project within 100-feet of the coastal bluff edge. The geologic map and cross section must clearly identify the coastal bluff edge. The cross sections should be aligned orthogonal to the bluff edge and located on each side of the property and one located intermediate between the other two. The geologic map and cross sections should show the distribution of geologic units, depict geologic structure, and represent groundwater conditions.

Bluff stability at the site must be addressed. All areas of the site with static a factor-of-safety less than 1.5 for gross and surficial stability should be identified.

Coastal bluff recession rates must be addressed. The recession rate must support an appropriate bluff setback for the anticipated life span (75 years) of proposed structures within 100 feet of the coastal bluff edge. Minimum setbacks from the bluff edge are discussed in the San Diego Municipal Code (§143.0143 (f)). Copies of aerial photographs or historic maps used to determine coastal bluff recession rates must be provided. Show on the aerial photographs or historic map the location of the fixed features and distance to the coastal bluff edge used to determine recession rate.

The geotechnical report must include an analysis of the potential effects on bluff stability of rising sea levels[3], using the latest scientific data (SDMC 143.0143 (B)) and an analysis of the potential effects of past and projected El Niño events on bluff stability (SDMC 143.0143 (C)). The report must also provide an analysis of whether this section of coastline is under a process of retreat (SDMC 143.0143(D)).

Coastal erosion protection in Ocean Beach. Note recession between seawall and bluff face.

6.4 Geotechnical Evaluation

6.4.1 Slope Stability Analyses

When appropriate, analysis of slope stability should be conducted in accordance with the American Society of Civil Engineering (ASCE) and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California. A factor of safety of 1.5 for static long-term slope stability and 1.25 for static short-term (during construction) stability are typically considered minimum standards.

[3] California Coastal Commission Sea Level Rise Policy Guidance, August 12, 2015

Slope stability analyses shall take into account all foreseeable temporary and permanent site conditions that could influence slope stability on or in the vicinity of the subject property during and following project development. Such site conditions may include, but are not limited to, seismic forces, structural loading, site grading, excavation, roadway, haul road, cut, fill, stockpile, groundwater, or water infiltration (rainfall, storm water, irrigation, etc.).

6.4.1.1 Surficial Slope Stability

Surficial instability typically occurs on steep slopes during periods of prolonged or intense rain or due to excessive irrigation or waterline breaks. Debris and mudflows are examples of surficial instability. Where natural or proposed slopes are steeper that 2:1 (horizontal to vertical), a surficial stability analysis is typically required.

The assessment of surficial slope stability shall be modeled as an infinite slope with seepage parallel to the slope surface. If the depth of saturation used in the analysis is less than 5-feet, the shallower depth must be justified. Shear strengths should be based on saturated samples tested at representative effective overburden pressures.

Surficial stability analyses should be performed under rapid drawdown conditions where applicable (e.g., for debris and detention basins).

6.4.1.2 Static Gross Stability

Geotechnical reports are typically required to evaluate gross slope stability for proposed projects located in Geologic Hazard Categories 21-27 and 41-46. An evaluation of gross slope stability may be required in other Geologic Hazard Categories if non-conforming slopes or adverse geologic conditions are indicated.

Gross stability analyses should be based on accurately modeled geologic conditions and appropriate geotechnical test data. The analysis will typically evaluate either rotational or translational stability as appropriate to reflect geologic conditions. The use of isotropic or anisotropic strength parameters in the analysis along with the soil or geologic conditions should be discussed.

Subsurface exploration should be sufficiently deep to assess the conditions at or below the level of the deepest potential failure path with an inadequate factor of safety. Subsurface exploration typically relies on detailed direct observation and sampling in drilled shafts (borings) conducted by an engineering geologist. Where direct observation is not possible, the geotechnical consultant should apply appropriately conservative shear strength parameters and assume worst-case geologic conditions.

A geologic cross section should be presented for each natural slope or cut slope analyzed for slope stability. The analyzed cross section should extend beyond the top and toe of the slope being evaluated. Each geologic cross section must be representative of the subsurface geologic and groundwater conditions of the site and adjacent areas.

Modeling of the moisture content and groundwater conditions used in each slope stability analysis should be described. Modeling should consider all potential sources of water (including rainfall, irrigation, proposed gray water or storm water management facilities, or other sources) on-site and on nearby properties in the evaluation of slope stability.

Each stability analysis presented in a preliminary geotechnical report should be described and the results discussed. The description should include the method of analysis, specified material profile, pore pressures, and specified search areas for critical failure paths. Where multiple slope stability analyses are conducted, a tabulated summary of the analyses and results should be provided.

6.4.1.3 Seismic Slope Stability Analysis

Slopes prone to earthquake-induced instability should be analyzed in accordance with the American Society of Civil Engineering (ASCE) and Southern California Earthquake Center (2002) Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Landslide Hazards in California or an equivalent method.

6.4.2 Seismic Induced Ground Failure

The geotechnical consultant must quantify expected total and differential seismic induced settlement. Investigation of soil liquefaction, dry sand settlement, lateral spread and flow slide should be conducted per California Geological Survey (2008), Special Publication 117a; Southern California Earthquake Center (1999) Recommended Procedures for implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction Hazards in

California; Lew, M. (2001) Liquefaction Evaluation Guidelines for Practicing Engineering and Geologic Professionals and Regulators, Environmental & Engineering Geoscience, Vol. VII, No. 4 or other recognized method.

The minimum statewide safety standard defined in Special Publication 117a indicates "the minimum level of mitigation for a project should reduce the risk of ground failure during an earthquake to a level that does not cause the collapse of buildings for human occupancy, but in most cases, not to a level of no ground failure at all." The project's geotechnical consultant should address if their recommendations are in accordance with this standard.

6.4.3 Hydroconsolidation

Some soils under constant load may undergo a decrease in volume when wetted, which is referred to as hydroconsolidation or hydrocollapse. Materials prone to hydroconsolidation include artificial fill, and rapidly deposited alluvium and mudflow debris. The composition of materials most susceptible to hydroconsolidation potential include silty to clayey sands that exhibit a degree of cementation.

Based on ASTM D5333, the potential severity of hydroconsolidation at a pressure of four ksf, ranges from none (0%), slight (0.1 to 2.0%), moderate (2.1 to 6.0%), moderately severe (6.1 to 10.0%), to severe (>10%).

When appropriate, the geotechnical consultant shall identify and evaluate the potential effects of hydroconsolidation. The evaluation shall consider the potential impacts of all aspects of the proposed development and sources of water (including irrigation, proposed storm water management facilities or other sources) on on-site and nearby properties. When appropriate, the Geotechnical Consultant shall provide recommendations for remediation of hydroconsolidation prone soils based on site-specific considerations and accepted engineering practices.

6.4.4 Expansive Soils

Soils with an expansion index of more than 20 are considered expansive and are subject to changes in volume with changes in the moisture content. An increase in moisture can cause swelling resulting in foundation and slab uplift, while decreasing moisture can result in settlement. Recommendations must be provided to mitigate expansive soil conditions.

Geotechnical site evaluations shall identify potentially expansive soils and the extent of such soils when appropriate. The geotechnical consultant shall identify any potential impact the expansive soils may have on proposed structures and improvements at the site.

At a minimum, expansive soil subgrade for public improvements shall be remediated in accordance with the Section 301-1.2 of the City Supplement to the "Greenbook."

6.4.5 Corrosivity and Chemically Reactive Soils

Geotechnical site evaluations should identify if deleterious chemicals are present in liquids, soil, or rock that could cause construction materials to corrode or deteriorate (see Appendix C).

Where applicable, the geotechnical site evaluation should also identify soil or rock material subject to sulfate-induced heave.

6.4.5 Settlement

The geotechnical consultant shall analyze and estimate future total and differential movements of all footings, slabs, pipelines, and engineered fills supporting structures. The settlement analysis calculations must be submitted. If professional judgment is used in addition to or to modify the calculated movement, justification or rationale used should be discussed. Where significant settlement is indicated, the geotechnical consultant should estimate the time for settlement to be substantially complete.

The geotechnical consultant shall indicate if a settlement-monitoring program is or is not recommended. If the consultant recommends a settlement-monitoring program, they should also recommend the location of surface monuments and subsurface settlement plates and a monitoring schedule.

6.5 Infiltration and Percolation

6.5.1 Storm Water Infiltration and Percolation Systems

Refer to the City of San Diego *Storm Water Standards* for requirements.

6.5.2 Gray Water Infiltration and Percolation Systems

Residential gray water irrigation systems are regulated by the City as described in Information Bulletin 208. Soil classification or infiltration or percolation testing may be required for system design. In addition, evidence of groundwater level may be required.

6.6 Recommendations

6.6.1 Grading

Information regarding grading regulations can be found in the San Diego Municipal Code Chapter 12, Article 09, Division 06 and Chapter 14, Article 02, Division 01.

6.6.1.1 Site Preparation

Grading recommendations shall include comments on clearing and grubbing, removal of old fill, debris, and abandoned tanks, wells, and septic systems.

Provide recommendations regarding proposed excavations with conventional grading equipment or blasting. See San Diego Municipal Code Section 53.01 and Section 129.0602(e)(8) for blasting regulations.

6.6.1.2 Unsuitable Soil Removal

Provide recommended limits and depth of removal of unsuitable soils. Indicate if the soil may be reused on site or if the unsuitable soil must be exported from the site.

6.6.1.3 Transition Areas

Recommend measures to mitigate potential differential soil movement across cut-fill transitions or a construction area with a significant differential fill thickness.

6.6.1.4 Compaction Requirements

Provide soil placement, moisture, and compaction recommendations. Note that if non-engineered or undocumented fill soil is recommended to remain on-site, indicate if the fill is suitable for the intended use, will not result in adverse impacts to improvements due to settlement or heave, and will not endanger public health, safety, and welfare. An uncontrolled embankment agreement may be required pursuant to San Diego Municipal Code Section 142.0132.

6.6.1.5 Slopes

Provide recommendations for stable slope height and slope ratio (horizontal to vertical). Provide recommendations for toe and top of slope setback from property lines or existing structures and improvements. The need for slope terraces and terrace drains must be discussed.

The consultant must also provide recommendations for the construction of fill slopes and fill over cut slopes. Describe recommended keyways, benching, and surface and subsurface drainage. Typical details may be helpful to convey the consultant's recommendations.

6.6.1.6 Slope Stabilization

Describe all recommended stability fills or slope buttresses. For prescriptive stability fills, provide a typical detail illustrating the specifications of the grading and construction. Provide a map depicting the slope(s) recommended for stabilization. For non-uniform design, provide cross sections depicting the details of the recommended grading and construction. Address temporary slopes and subsurface drainage.

Detailed design recommendations must be provided for slope buttresses. The location of proposed buttresses must be depicted on a map (s) and cross section(s). Details of the construction (keyways, slot cuts, temporary slopes, etc) and subsurface drainage must be provided.

6.6.1.7 Subdrains

Preliminary geotechnical investigation reports must include recommendations for subdrains. If subdrains are not recommended, this must be clearly stated.

Canyon subdrains shall consist of a minimum 6-inch diameter perforated pipe surrounded in drain material. The geotechnical consultant must provide recommendations for the type of pipe; drain material, and filter fabric; gradient; cut-off walls; outlet; and headwall design. Graphical construction details of the canyon subdrain and headwall design must be provided. The recommended locations of canyon subdrains and outlets must be clearly shown on the grading plans.

When retaining walls are proposed, retaining wall subdrains (aka backdrain) recommendations must be provided in a preliminary geotechnical investigation report. Retaining wall discharge points must be protected and clearly shown on grading plans and retaining wall plans.

Subdrain systems recommended for stabilization or buttresses fills must be clearly described and shown on details, map(s), and cross-section(s).

Surface drainage systems must not connect to a subdrain. Subdrains must connect to a storm drain (preferably a catch basin) or outlet through a headwall. Connection of a subdrain to a pressurized storm drain is not permitted. Subdrains must not outlet onto a sidewalk or other area where seepage may cause a nuisance or hazard.

6.6.2 Foundations

6.6.2.1 Shallow Foundations (continuous and spread footings)

A preliminary geotechnical investigation report addressing shallow foundations is expected to recommend allowable bearing pressure, lateral pressures, coefficient of friction, minimum footing embedment, estimated total and differential settlement, and minimum slope setback.

6.6.2.2 Deep Foundations (cast in hole caissons, driven piles, auger cast piles)

Recommendations for the design of deep foundations are expected to include allowable vertical capacity (specify end bearing or skin friction) and lateral resistance from earth pressures. The geotechnical consultant should address recommended pile or pier type, minimum embedment, diameter, spacing, as well as construction recommendations. Pile or pier embedment recommendations should specify the material of embedment (i.e., embedment in fill, native surficial soils, or bedrock).

Petco Park under construction 2003

Where applicable, the geotechnical consultant must address potential downdrag (negative friction) or reduction in lateral capacity or additional lateral demands due to ground or slope conditions under both static and earthquake induced loading.

6.6.2.3 Slab on Grade

All slab-on-grade construction, as a minimum, shall conform to the currently adopted California Building Code (CBC) or California Residential Code (CRC) as applicable.

6.6.2.4 Retaining Walls

When retaining walls are proposed, the geotechnical consultant should provide recommendations for allowable bearing pressures, coefficient of friction against sliding, passive resistance, and lateral pressures. The lateral pressures must account for potential surcharge loads, hydrostatic pressure, seismic pressure, expansive soil, adverse geology, slopes, etc.

6.6.2.5 Temporary Excavations and Shoring

Recommendations for adequately stable temporary slopes must be provided. If temporary shoring is necessary, the geotechnical consultant must recommend the active and passive pressures, and lateral pressure distribution for design. If tieback anchors are necessary, the consultant must recommend the geometry of the active wedge to be used in the design.

Temporary slopes or shoring adjacent to existing improvements or the City's right-of-way, will require stability analysis and an explicit statement from the geotechnical consultant that the proposed temporary excavation or shoring system will be adequately stable. In addition, the geotechnical consultant must address potential soil movement associated with the excavation. The geotechnical consultant must provide recommendations for monitoring points and a monitoring schedule to evaluate soil movement adjacent to the temporary excavation.

The geotechnical consultant should review the structural calculations for temporary shoring systems to confirm that the geotechnical parameters used in the calculations are appropriate for the site conditions.

Temporary shoring system tieback anchors or soil nails within the upper 20-feet of the City's right-of-way must be removed and the removal confirmed by the geotechnical consultant. See Appendix E for the City's procedure regarding temporary shoring in the right-of-way.

Temporary shoring consisting of internal bracing, tie-back anchors, and soil nail anchors, Downtown San Diego

6.6.3 Seismic Design Factors

Seismic design criteria shall be in accordance with the currently adopted CBC and amendments. Site Class shall be based on specified physical parameters of the earth materials in the upper 100 feet of the site profile. Where soil properties are not known in sufficient detail to determine the site class, Site Class D shall be used. However, soils vulnerable to potential failure or collapse under seismic loading, such as liquefiable soils, require site-specific evaluation.

If site-specific ground motion procedures for seismic design are used, the consultant must provide a discussion of the procedures used including the computer program utilized; selection of attenuation function(s); time histories, fault model; and other user specified input parameters. Provide documentation for all analysis.

6.6.4 Drainage

Preliminary geotechnical investigation reports must address surface and subsurface drainage where necessary to mitigate differential movement due to expansive soils or hydroconsolidation, erodible soils, or slope instability. Consultants should be familiar with the City's "Drainage Design Manual."

6.6.5 Infiltration and Percolation

Refer to the City of San Diego *Storm Water Standards* or Information Bulletin 208 for requirements.

6.7. Illustrations

6.7.1 Index Map (Site Location Map)

Every preliminary geotechnical investigation report must include an index map (location map). The location of the site should be clearly identified on a USGS 7.5 minute topographic base, City of San Diego topographic map, or a street map base. A street map base should only be used for relatively level sites adjacent to existing streets. The map should include a north arrow and scale.

6.7.2 Regional Geologic Map or Geologic Hazard Map

Show the location of the site on a regional geologic map or the San Diego Seismic Safety Study map. The map should include a north arrow and scale.

6.7.3 Geologic and Geotechnical Maps

A combined site-specific geological and geotechnical map or separate site-specific geological and geotechnical maps should accompany every preliminary geotechnical investigation report. The maps should be on a topographic base that shows the proposed development. The map scale should be appropriate for the project and typically range from 1:120 to 1:2,400. All maps should include a legend of symbols, map scale, and north arrow.

Site-specific geologic maps are the product of independent observation of the licensed professional geotechnical consultant or qualified individuals under their supervision. These maps depict the distribution of geologic units and geologic structures within and adjacent to the project site. The geologic units should be divided into bedrock and surficial units. Contacts between units must be clearly delineated and observed versus interpreted contacts must be clearly defined. Geologic structures such as faults and folds must be shown on the map. Measured attitude of bedding, fractures, joints, faults, etc. based on surface geologic mapping and subsurface exploration must be depicted on the map. The geologic map should show significant features such as seeps or springs, scarps, cracks or fissures, creeping soil, marker beds, etc. The location of subsurface exploratory excavations, seismic survey lines, cross sections, etc. must be shown.

Geotechnical maps should show the locations of subsurface exploratory excavations, tests, and cross sections. In addition, these maps must illustrate the location of recommended remedial measures. Examples include; buttresses, stabilization fills, canyon subdrains, buttress subdrains, retaining wall subdrains, settlement monuments, soil removal bottom elevations, over-

size rock disposal zones, limits of remedial grading, building restricted use area, hazard zones, etc. For large projects, the consultant should consider numbering features such as proposed cut slopes, proposed buttresses, landslides, etc.

6.7.4 Geological and Geotechnical Cross Sections

Cross sections are particularly useful for illustrating geologic conditions in relationship to proposed projects. The cross sections should depict existing and proposed grades and subsurface geologic and groundwater conditions. The location of exploratory excavations must be clearly depicted. Indicate the distance and direction that information is projected to a section. Clearly indicate true versus apparent dip of bedding or planar structures. Horizontal and vertical scale should be equal, but if an exaggerated section is necessary it must be clearly identified. Bearing and location identifying attributes of the cross section should be indicated per convention.

Geological cross sections should be positioned to take maximum advantage of available information or aligned to clarify the relationship of geologic structures and the proposed development. The geotechnical consultant should consider aligning sections to cross data points and minimize projecting information into the section. Intersecting cross sections can help constrain geologic interpretations and should be used to demonstrate the veracity of complex geologic models.

Geotechnical cross sections are typically presented for highest natural slope, cut slopes, and fill slope associated with a proposed project. Geotechnical cross sections should also be presented to show buttress fills and keyways, shear keys, false slopes for soil removals, or other non-prescriptive geotechnical remedial design that can be depicted on a typical detail.

6.7.5 Typical Details

Fully dimensioned typical details are important for conveying recommended design specifications. Typical details should be provided for the following: canyon subdrains, retaining wall subdrains and backfill, stabilization fills, fill over cut, transition building pad over-excavation, and false slopes for removals.

6.7.6 Photographs

Photographs are optional, but can be useful in illustrating site conditions or specific features. Photographs can help reduce lengthy descriptions; however, each photograph must be described and the locations of photograph indicated.

7. AS-GRADED OR AS-BUILT GEOTECHNICAL REPORTS

An as-graded (or as-built) geotechnical report documents the results of geologic and geotechnical observations, tests, and analyses conducted during grading or construction of a permitted project. The report describes and documents the as-graded or as-built conditions of the permitted project site. As-graded geotechnical reports typically provide updated geotechnical construction recommendations based on the as-graded condition. In addition, the report documents that the permitted grading or construction was conducted in accordance with the geotechnical consultant's recommendations and permitted plans.

An as-graded geotechnical report is required for all grading permits as part of the bond release and close out process. The as-graded geotechnical report must be submitted with a red-line copy of the "as-built" grading plans.

In some cases, an interim as-graded or as-built geotechnical report will be required to document specific geologic or geotechnical conditions. Interim as-graded or as-built geotechnical report are typically required to verify location and activity of faulting, or to verify that ground improvement has been adequately completed prior to foundation inspection.

If, in the course of inspecting the construction, the geotechnical consultant encounters work not being done in conformance with the permitted plans, discrepancies must be reported immediately in writing to the owner, the contactor, and the City's permitting authority.

Outlined here are the major elements of an as-graded geotechnical report.

7.1 Introductory As-Graded Information

7.1.1 Project Description and Identification

The report shall contain a description of the recently constructed project, project location, and identify the project permit and approved plans. For grading plans, the project number and Drawing Number must be identified. For building plans, indicate the project number.

7.1.2 Construction Summary

Describe the construction that was performed. If the construction was conducted in phases, describe each phase. Provide a summary of the equipment used and the start and end dates of construction. Identify the contractor and subcontractors involved in the construction that was observed by the geotechnical consultant.

7.1.3 Scope of Services

Provide a general description of the scope of geologic or geotechnical services that were provided.

7.2 As-Graded Conditions

7.2.1 Geologic Conditions

Describe the geologic conditions encountered during the grading or construction. Describe differences between the anticipated and observed conditions. Report any exploratory excavations conducted during construction to illuminate geologic conditions and provide logs of the excavations.

Provide a geologic (or geotechnical) map that illustrates the as-graded distribution of geologic units at the completion of the construction, based on the independent observation by the licensed professional geotechnical consultant or individuals under their supervision. The map should use the approved and permitted (redline as-built) plans as a base and must include a north arrow and scale. For sites with complex geology or complicated geotechnical remediation, separate as-graded geologic and geotechnical maps should be considered. On the map, show the geologic conditions exposed during construction, the distribution of geologic units, marker beds, and geologic structures. Indicate the attitude of bedding or other planar discontinuities such as faults, joints, and fractures. Depict the locations of springs or seeps on the as-graded geologic map. The geologic conditions of temporary slopes, removal bottoms, and areas to receive fill should be field mapped by the project geologist. The geologic mapping should be sufficiently detailed to support professional opinions and conclusions.

Landslide in the Lomas del Rubi neighborhood of Tijuana, 2018. Note recent grading.

The geologic maps should show the location of recommended structural setbacks or building restricted easements related to geologic hazards. Show the location of any exploratory excavations conducted during construction to illuminate geologic conditions on the geologic or geotechnical map.

Where changed geologic conditions are indicated, update the geologic cross sections to illustrate the as-graded conditions.

7.2.2 Geotechnical Conditions

Soils encountered during grading should be described, with emphasis on any differences between the anticipated and observed conditions. Report any exploratory excavations or testing conducted during construction to illuminate or verify geotechnical conditions and provide logs of the excavations and test results.

The distribution of soils on the project site should be shown on the as-graded geotechnical map. For example, show the distribution of undisturbed native soil, alluvium, engineered compacted fill, or undocumented fill. Clearly show the limits of structural (engineered compacted) fill on the as-graded geotechnical map placed to construct the permitted project.

Consider identifying over-excavated and structural fill capped building pads necessary due to expansive or reactive soil, cut-fill transition pads, or building pads with differential fill thickness. Indicate thickness of the structural fill cap.

Identify the distribution of undocumented fill soil placed without adequate preparation of the subgrade, or fill soil that has not been properly compacted as an uncontrolled embankment on the as-graded geotechnical map.

Show the location and elevations of stabilization fill or buttress fill keyways on the geotechnical map. Depict the accurate and precise location of canyon subdrains, keyway subdrains, and other subsurface drainage. Indicate location of subdrain discharge points and, if not connected to a storm drain, the location of headwalls. Show the location of oversize rock windrows or disposal fields. Indicate the bottom elevation of over-excavations, removals, and cleanouts.

Show the areas of ground improvement on a geotechnical map and on representative geotechnical cross sections.

Indicate the location of any instrumentation such as settlement monuments, piezometers, inclinometers, extensometer, etc. on the geotechnical map.

Soledad Mountain Road repair

7.3 Fill Placement, Compaction Testing, and Uncontrolled Embankment

Describe the areas of fill placed within the limits of grading or construction boundaries and the purpose for which the fill was placed. Discuss the preparation of subgrade to receive engineered fill. Characterize the material used as engineered fill within the construction area. Indicate maximum fill depth.

Discuss the field soil compaction operation and describe the procedure used for observing and testing fill soil compaction. Specifically address the operation used to compact soil near the face of fill slopes.

Provide a soil compaction test summary table that indicates test number, elevation, test date, maximum dry density, optimum moisture, field dry density, field moisture content, and relative compaction. Indicate if the test is a re-test.

Soil compaction test locations must be plotted on a map that shows the permitted construction, such as the grading plan for a grading permit or building plan for a building permit. The map must be of sufficient scale to easily review. The test numbers indicated on the map must correspond to the test numbers indicated in the soil compaction test summary.

An uncontrolled embankment agreement will be required pursuant to San Diego Municipal Code Section 142.0132, where undocumented fill soil, fill soil placed without adequate preparation of the subgrade, or fill soil that has not been properly compacted will remain within the permit area. The project's geotechnical consultant must state if the fill is suitable for the intended use, will not result in adverse impacts to improvements due to settlement or heave, and will not endanger public health, safety, and welfare. A construction change to the grading plans will be required if an uncontrolled embankment is proposed after issuance of the grading permit.

7.4 Material Testing and Monitoring

Report the soil expansion test results. For subdivisions, the soil expansion index must be provided for each lot. Report the results of soil corrosion tests, or other chemical tests as required.

If monitoring of settlement or lateral movement was recommended, provide the results of the monitoring program.

7.5 Shoring, Shear Pins, Reinforced Embankments

Where shoring has been constructed to support City property or the right-of-way, the project's geotechnical consultant must address the results of monitoring movement of the shoring system. In addition and as indicated in Appendix E, the geotechnical consultant must confirm that soil nails or tieback anchors have been removed from the upper 20-feet of the right-of-way and all other anchors have been de-tensioned (i.e., disengaged).

Where shear pins have been used for slope stabilization, the project's geotechnical consultant should provide detailed logs of the drilled staffs (borings) constructed for the shear pins.

The precise and accurate area of the geotextile placed for reinforced embankments should be clearly indicated on the as-graded geotechnical map and "as-built" grading plans.

7.6 Infiltration or Percolation BMPs

Refer to the City of San Diego *Storm Water Standards* for requirements.

7.6 Conclusions

7.6.1 Site Suitability

The geotechnical consultant must provide a professional opinion as to the suitability of the site for the intended use.

An opinion must be provided regarding the suitability of natural soil to support the fill or structure.

An opinion must be provided regarding the gross and surficial stability of all slopes within the project area.

7.6.2 Changed Conditions

If the observed geologic or geotechnical conditions differ from the anticipated conditions, the geotechnical consultant must clearly explain the differences. If there is a substantial change, the geotechnical consultant must present their re-evaluation. If the project involves cut slopes or excavations, the consultant must provide a professional opinion that the excavations or slopes are adequately stable with respect to gross and surficial stability.

Any revised cross sections or stability analyses must be included in the as-graded geotechnical report to substantiate professional opinions.

Changed conditions that require revision of recommendations and result in revisions to the approved grading plans will require a construction change.

The as-graded geotechnical report must reflect all approved construction changes.

7.6.3 Opinion of Compliance

The project's geotechnical consultant must certify that the soil engineering and engineering geologic aspects of the grading are in compliance with the approved geotechnical report and the grading plan (Drawing no. -----).

7.7 Recommendations

7.7.1 Grading

Describe if there is any remaining grading to be conducted prior to completion of the construction. If necessary, provide recommendations for the remaining or corrective earthwork.

7.7.2 Foundations

If necessary, provide updated recommendations for foundations, retaining walls, and improvements based on the encountered conditions and soil test results.

8. ABATEMENT OF UNSAFE, DANGEROUS OR SUBSTANDARD STRUCTURES

The Chief Building Official or designee may determine that a structure is unsafe, dangerous or substandard. A structure may be considered dangerous if any portion of the structure is likely to partially or completely collapse due to many conditions including earthquake damage, surcharge loading, or the removal, movement, or instability of any portion of the ground necessary to support the building. If the Chief Building Official or designee determines that a structure is unsafe, dangerous or substandard due to geologic or other conditions to the extent that an imminent hazard to the life, health, and safety of its occupants is indicated, the occupants may be ordered to vacate all or a portion of the structure or premises. The Chief Building Official or designee shall post a sign or placard at or near each entrance of the structure (in accordance with SDMC 121.0421). A "Red" Tag shall indicate that it is unlawful for any person to enter or remain in that structure or premises, except that entry may be made by a licensed professional to inspect the structure, or to repair or demolish the structure with the proper permits. A "Yellow" Tag shall indicate that use of portions of a structure or premises is restricted as specified on the yellow tag.

Once a yellow tag or red tag (placard) has been placed on a structure or premises, the restrictions shall remain in effect until the hazard is abated and the tag (placard) removed by the Chief Building Official or designee. New construction proposed to abate a hazard shall be in accordance with the prevailing adopted Building Code, San Diego Municipal Code, and these guidelines.

Posted red tag placard

Geotechnical investigation reports prepared in support of hazard abatement shall also be in accordance with these guidelines. The geotechnical investigation report shall specifically describe the site conditions and provide recommendations to abate the hazards. In addition, the geotechnical consultant shall provide a conclusion regarding whether the threatened structure or premises will be safe to re-occupy and suitable for habitation following completion of the measures recommended to abate the hazard(s).

APPENDIX A REFERENCES

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APPENDIX B FIELD EXPLORATION AND LOGS

Subsurface excavations for geologic and geotechnical exploration are an integral part of an invasive investigations for direct observation, testing and sampling. Logs should be provided for all subsurface exploratory excavations that are part of an investigation. The types of logs are as varied as the types of exploratory excavations. Here are some common elements of all logs.

- Excavation ID
- Date or period of excavation and logging
- Project name
- Name of logger
- Method of exploration (e.g., hand excavated, bucket auger, rotary wash, etc)
- Total depth
- Groundwater observation
- Ground conditions, such as caving or flowing ground
- Shoring or casing
- Backfill material and backfill specification (i.e., concrete grout, compacted fill, etc.)

A legend should be provided that defines any symbols used on the log.

All logs should include a graphic depiction of the encountered conditions. Geologic conditions should be clearly depicted including contacts between units, bedding, fractures, joints, faults, etc. The geologic units should be described and classified. Geologic attitudes or other geologic data should be provided. Colors are often described, but without the use of a standardize color palate (e.,g., Munsell Soil Color Charts or Rock Color Charts) they are at best imprecise. Typically soils for engineering purposes are described using the Unified Soil Classification System (USCS) or the Revised ASTM Standard on the Description and Identification of Soils (Visual-Manual Procedure). The soil classification system used should be clearly indicated on the log.

Type and depth range of samples should be clearly indicated on the log. Some sampling procedures must be described in detail to support the usefulness of the data. Some common sampling information may include:

- Type of sampler
- Field (unmodified) blow counts.
- Detail of Kelly bar weight and drop height.
- Hammer type (e.g., safety hammer).
- Method of hammer drop (e.g., automatic, cathead and rope with number of wraps)
- Percent recovery for rock cores.

In situ tests, such as pocket penetrometer, infiltration or percolation tests, or vane shear results should be indicated on the log. Laboratory test data, such as dry density, moisture content, and degree of saturation are often presented on logs, and is recommended to facilitate correlation with other engineering properties.

Cone penetrometer test (CPT) data, should include profiles of cone tip resistance, either sleeve resistance or friction ratio, pore pressure, and, when available, shear wave velocity. Interpreted results, such as soil type and equivalent sample blow counts should be provided. The methodology for interpreting the CPT data should be cited. The type and size of cone and penetration rate shall be documented. CPT data is typically corroborated by at least one adjacent soil boring. Grouting or filling of the resulting CPT void should be described.

APPENDIX C MATERIALS TESTING

Preliminary geotechnical investigation reports should contain sufficient in-situ and laboratory test data to characterize the physical parameters of the earth materials affecting the proposed development and to substantiate calculations from which the conclusions and recommendations are derived. Sample preparation and testing procedures must be described in the report. Laboratory procedures are typically selected that will be representative of the site conditions during and after development of the site.

Test results should be presented in tabular form or as plots or illustrations of laboratory data. Numerical and graphical presentations of laboratory data that are commonly included in the report are:

- Dry density and moisture content of all samples.
- Soil classification (ASTM D422, ASTM 4318).
- Compaction curves plot showing maximum dry density and optimum moisture content for major soil types. (ASTM D1557)
- Grain-size analyses (sieve and hydrometer) for representative samples.
- Permeability (ASTM D2434)
- Consolidation tests plots for representative undisturbed samples as well as remolded samples to represent fill materials (ASTM D 2435). Show the impact of water inundation at proposed overburden pressures.
- Shear strength by direct shear, triaxial compression, and or unconfined compression tests (ASTM D3080, D2166, D2850). Provide plots and stress deformation curves. Indicate moisture content and degree of saturation of the tested sample. Residual shear strength under saturated conditions should be determined for use in slope stability analyses.
- Expansion index tests (ASTM 4829).
- Soil corrosivity testing including pH (ASTM G51), soluble chloride ion (ASTM D 512), soluble sulfate ion (ASTM D 516), resistivity (ASTM 57, dry and wet); and oxidation-reduction potential (ASTM D 1498).
- Tests to determine the R-value of potential subgrade materials when providing pavement sections.

APPENDIX D TECHNICAL GUIDELINES FOR FAULT-RUPTURE HAZARD REPORTS

A. GENERAL INFORMATION

1. Statement of Intent – These guidelines are intended to facilitate the investigation of surface fault-rupture hazard in the city of San Diego. The following outline provides a checklist for preparing well-documented reports. Not all checklist items will be applicable to every site or every project, but the investigative scope needs to be commensurate with the attributes of the intended use and the physical constraints of the site. No provision in these guidelines is mandatory or should be construed to constitute a statue, ordinance, or regulation, unless stipulated elsewhere. For other aspects of seismic hazard evaluation, refer to the *Guidelines for evaluating and mitigating seismic hazards in California*.

2. Required Studies - Surface fault rupture investigations may be required for certain projects or subdivision maps in geologic hazard categories 11, 12, and 13 as delineated on the San Diego Seismic Safety Study Geologic Hazards and Fault Maps. Refer to City of San Diego Municipal Code §145.1803 and City of San Diego Development Services' Information Bulletin 515 for the applications requiring a fault-rupture hazard investigation.

   Geologic Hazard Category 11 corresponds to the Earthquake Fault Zones delineated in compliance with the Alquist-Priolo Earthquake Fault Zoning Act (AP Act). The investigation of a site within geologic hazard category 11 should be conducted per Special Publication 42 as well as City guidelines.

   Note that the Building Official may require a geotechnical investigation report for any site if the Building Official has reason to believe that a geologic hazard may exist at the site, even if the hazard is not shown on the City of San Diego Seismic Safety Study maps (San Diego Municipal Code 145.1803(e)).

   A fault rupture hazard investigation may be conducted as a stand-alone document or as part of a comprehensive geotechnical investigation.

3. Authentication – All fault hazard investigations conducted as part of the City of San Diego permit or approval process must be conducted by or under the supervision of a California Professional Geologist. All fault-rupture hazard reports submitted to the City of San Diego require the signature and seal (stamp) of the Professional Geologist.

4. Review – Fault hazard investigation reports submitted to the City may be evaluated for conformity with City and State standards. These guidelines are the basis for interpreting minimum City standards.

   To facilitate reviews, consultants are encouraged to invite reviewers to observe field excavations for fault-rupture investigation. The reviewer(s) should be given sufficient advanced notification to allow for scheduling.

B. FAULT RUPTURE HAZARD INVESTIGATION

1. Research
   a. Review published literature and maps regarding regional geology, faults, and other pertinent information.
   b. Search City records for fault investigation reports on properties in the site vicinity. Review pertinent reports on file for local geologic conditions, structural trends, ground water, and other pertinent factors.
   c. Analyze maps, aerial photographs, or other information to evaluate geomorphic features, soil or vegetation contrasts, or lineaments suggestive of faulting.
   d. Evaluate site-specific maps and plans to determine appropriate scope of field investigation.

2. Field Investigation
   a. **Surface mapping** – Natural or artificial exposures on or adjacent the site should be mapped in detail, particularly where used to demonstrate structural continuity or activity of faulting.
   b. **Invasive subsurface exploration**
      i. *Trenching* - This is the preferred method of subsurface fault investigation as it allows direct and detailed observation of continuously exposed geologic units and structures. Trench depth must be sufficient to expose geologic features used to support conclusions. Trench walls must be properly prepared to allow accurate and detailed logging. Trenches are typically logged at a scale of 1:60. All geologic features should be logged and described in detail. Emphasis should be placed on defining and describing contacts between recognized units. Special attention should also be directed to evaluating and describing late Quaternary deformation of those units. Munsell color charts and notation should be used for describing color.

Trench excavated for fault investigation in downtown San Diego.

ii. *Borings* – In-hole logged or continuously cored borings can provide an alternative to trenching at some sites where trenching is not feasible. The borings should be sufficient in number and adequately spaced to allow valid correlations and interpretations as well as provide optimal coverage. Boring depth must be sufficient to expose geologic features used to support conclusions. The boring should be logged in detail, similar to a fault trench. Borings should be spaced on 10- to 15-foot centers and be sufficient in number to provide optimum coverage. Tighter spacing may be necessary to accurately locate faults. Standard, intermittently sampled, geotechnical borings are typically not adequate for fault investigations, but they may provide valuable supplemental information.

iii. *Cone Penetrometer Testing (CPT)* – This technique may also provide an alternative to trenching at some sites where trenching is not feasible. The CPTs must be spaced on 10- to 15-foot centers and be sufficient in number to provide optimum coverage. Tighter spacing may be necessary to accurately locate faults. CPTs are typically advanced to a depth of ~50-feet or refusal. CPTs must be validated with a sufficient number of continuously logged borings. Discuss effect of deflection on results.

iv. *Optimum Coverage* – Subsurface exploration should be located to intercept faults within 30-degrees of the expected trend.

v. *Underground Service Alert (Dig Alert)* – Pursuant to State Assembly Bill (AB) 73, every person planning to conduct any subsurface excavation is required to contact a regional notification center at least 2 days prior to excavation and, if practical, delineate the areas to be excavated.

vi. *County of San Diego Department of Environmental Health* – Contact the County regarding well/ boring permits and backfill requirements. Information is available on line.

vii. *City Right-of-Way* – See Information Bulletin 165 and San Diego Municipal Code Article 2 Division 12 regarding the requirements for excavations in the Public Right-of-Way.

viii. *Environmentally Sensitive Lands* – Information on how to obtain a grading permit for exploration on a site that contains environmentally sensitive lands can be found in Information Bulletin 511 and Information Bulletin 560.

c. **Geophysical Methods** – High resolution seismic reflection, ground penetrating radar, residual gravity, electrical resistivity, and other geophysical surveys are indirect methods that may be used to target subsurface exploration or supplement subsurface exploration. Geophysical investigation should not be considered as an alternative to the invasive subsurface exploration methods described above.

3. Age-Dating Techniques – Chronologic control is crucial for determining the recency and activity of faulting. The most common techniques are:

a. **Radiocarbon (^{14}C) dating** – This isotopic method produces a numerical-age and has optimum resolution in the age range of interest for evaluating active faulting. This method depends on availability and preservation of carbon. It is subject to errors due to contamination. Laboratory documentation should be included in a report containing radiocarbon dates.

b. **Thermoluminescence (TL) and Optical Stimulated Luminescence (OSL) dating** – TL/OSL dating is an emerging approach for direct numerical dating of late Quaternary sediments based on radiogenic methods. Laboratory documentation should be included in a report containing TL or OSL dates.
c. **Soil-profile development** – Relative age determined from soil properties that systematically develop with time. The rate of soil development is dependent on other variables in addition to time and should be discussed. If soil-profile development is used for age dating, a detailed soil profile using standard procedures and terms should be provided (e.g., National Soil Survey Center Field Book for Describing and Sampling Soils).
d. **Stratigraphy** – Relative age determined from geologic sequences, age correlated to Quaternary climatic cycles. Depends on recognition of chronostratigraphic units. Basis for correlations and supporting data should be discussed in detail.
e. **Others** – Many other, less common, age-dating techniques are available that can be used to provide chronologic control. These other dating techniques, if used in the fault-rupture hazard evaluation, should be described in detail or key references provided.

C. TYPICAL FAULT-RUPTURE HAZARD REPORT

1. Introduction
   a. Purpose of investigation
   b. Description of site location, size, and configuration; and existing site conditions
   c. Description of proposed project

2. Scope of Investigation – Outline the methods and procedures used to evaluate fault-rupture hazards potentially impacting the proposed project or subdivision map.

3. Geologic Setting – Describe the major geomorphic and geologic features in the area of the site based on published or unpublished literature, maps, and records. The discussion should include:
   a. Geomorphology and physiographic features
   b. Geologic or stratigraphic units and geochronology
   c. Geologic structure
   d. Other pertinent information (e.g., ground water)

4. Site Geology – Describe the geomorphology and geology of the site based on the results of the site-specific fault-rupture hazard investigation.
   a. Stratigraphy and geochronology
      i. Characterize pedogenic and stratigraphic units
      ii. Describe contacts, unconformities, relationship of geologic units
      iii. Discuss geochronology
   b. Geologic structure
      i. Attitude of bedding, fractures, joints, faults, etc.
      ii. Describe fault features (e.g., gouge, breccia, slickensides, etc.)
      iii. Describe folding or warping

c. Faulting and zones of deformation
    i. Relative displacement and fault movement
    ii. Displacement history, timing of last event
    iii. Slip rate
    iv. Describe zones of deformation

5. Conclusions
    a. An explicit professional opinion is necessary regarding the existence or absence of active faults or potentially active faults[4] on the site.
    b. Probability of or relative potential for future surface displacement or deformation. The likelihood of future ground rupture or deformation can seldom be stated mathematically, but may be stated in semi-quantitative terms such as low, moderate, or high.

6. Recommendations
    a. If hazardous faults have been identified on or adjacent to the site, recommend an appropriate structural setback zone. Provide the rationale for the recommended structural setback distance. The consultant could consider the following factors:
        i. Precision and accuracy of fault location at foundation elevation
        ii. Activity and risk of surface fault rupture
        iii. Kinematics and complexity of faulting
        iv. Extent of tectonic deformation
        v. Standard of practice
        vi. Attributes of the proposed structure and use
        vii. Foundation design
    b. Provide recommendations to mitigate potential impacts of tectonic ground deformation for structures located outside the structural setback zone.
    c. Address need for additional studies.

7. References – Cite all pertinent published and unpublished literature, reports, documents, maps, aerial photographs, or other information used in support of the investigation, conclusions, and professional opinions.

8. Illustrations – The following illustrations should be included in a typical fault-rupture hazard investigation report:
    a. *Index map* – Identify the location of the site on a USGS 7.5 minute topographic map (1:24,000) or similar base map.
    b. *Local fault map* – Illustrate the location of documented Quaternary faults within the vicinity of the site (1:2,400). Due to the rapidly evolving understanding of faulting in the downtown area, this map should be up-to-date.
    c. *Geologic map* – Provide a geologic map on a topographic base that includes the property lines, and shows the proposed development. The map should depict the geologic units, geologic structure, and location of exploratory excavations,

[4] A three-tier fault classification is used in the city of San Diego as follows: ***Active Faults*** – this class of fault has had demonstrable surface displacement during Holocene time; ***Potentially Active Faults*** - faults with Quaternary displacement, but Holocene surface displacement is indeterminate; ***Inactive Faults*** – pre-Quaternary faults.

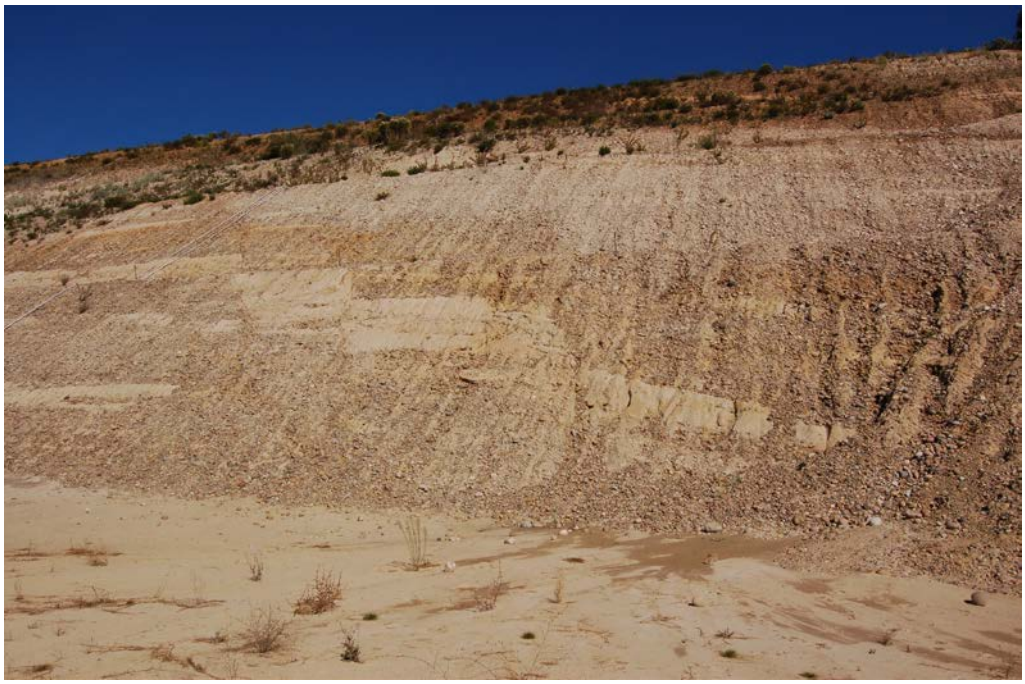
geophysical traverses, and other pertinent information. Identified faults and any recommended setback zone should be clearly delineated on the plan. The plan should be 1:240 to 1:480 for most projects.

d. *Geologic cross sections* – Appropriately placed geologic cross sections should be provided to illustrate interpreted subsurface conditions and correlation of units. This is particularly necessary for illustrating the correlations between borings and CPT soundings.

CPTs shown on cross sections should show tip resistance (cone bearing) profile and when appropriate sleeve friction profile. The borings shown on cross sections should indicate Unified Soil Classification System and lithologic units.

e. *Graphic logs of exploratory excavations*
   i. Trench Logs – Illustrate details of observed geologic features in a graphic log, which is typically depicted at a scale of 1:60 (vertical=horizontal scale). The logs should not be generalized or diagrammatic and should include vertical and horizontal scale control. The bearing of each linear trench or linear trench segment should be indicated. A legend of symbols and a detailed description of the recognized units should be presented on each log sheet. Benches, slopes, and shoring should be indicated, but should not obscure geologic details represented on the log. Emphasis should be placed on defining and describing contacts and intervening units.
   ii. Boring Logs – A graphic log illustrating details of the observed geologic features should be provided for each boring log.
   iii. CPT Logs – High quality color prints of the CPT logs should be included in reports where CPTs are used to support conclusions regarding faulting.

f. *Photographic Logs* – Trenches and core(s) used in fault investigations should be photographically documented. Photographs should be presented in the report, which are representative of the geologic features used to support conclusions.



Faulting north side of Mission Valley

APPENDIX E TEMPORARY SHORING IN THE CITY RIGHT OF WAY

NOTICE

LAND DEVELOPMENT REVIEW/SHORING IN CITY RIGHT-OF-WAY

CITY OF SAN DIEGO ◆ 1222 FIRST AVENUE, M.S. 501, SAN DIEGO, CALIFORNIA 92101

DATE: July 1, 2003

TO: All Private Engineers and Geotechnical Consultants

FROM: Robert N. Hawk, Deputy City Engineer - Land Development Review

SUBJECT: Temporary Shoring in the City Right-of-Way or Easements in Downtown San Diego

Effective immediately, the City has a revised policy regarding the use shoring systems including tieback anchors or soil nails extending into the City's Right-of-Way (ROW) or easements in downtown San Diego, in the area identified on the City's Seismic Safety Study Geologic Hazard Maps as Zone 13 (definition attached). In order to reduce permanent construction debris impeding the use of the ROW, cantilever systems using soldier piles and lagging are encouraged. Tieback anchors or soil nails may be used for temporary shoring abutting or extending into the (ROW) only under the following conditions:

1. The tieback anchors or soil nails must be necessary to limit lateral deflections to acceptable levels as determined by the project's shoring engineer and soil engineer.

2. The retaining/shoring system submitted (soil nails or tiebacks) must have the minimum number of tendons possible for safe construction and to avoid damage to public improvements as documented by the project's shoring engineer.

3. No drilling is allowed within a 10-foot radius from the outside edge of any sewer. No high-pressure grouting which will compress adjacent soil is allowed within 15 feet of the outside edge of any sewer. Any deviation will have to be specifically approved by the Wastewater Section of Development Services. For any such construction within 20 feet of the outside edge of a sewer, the sewer line(s) shall be televised by the contractor before and after the shoring work. Any damages caused by the shoring work shall be repaired entirely at the permittee's expense. For certain, large diameter, high risk facilities, continuous special inspection may be required during the shoring operations.

4. High strength metal tieback anchors or soil nails extending more than 5 feet horizontally from the shoring system into the ROW must be removed from the uppermost 20 feet of the ROW (measured vertically from the centerline of the ROW, and extending horizontally to the edge) or anywhere they are directly above a sewer main without specific approval of the wastewater plan check . engineer . Alternatively, pre-approved low-shear strength tieback anchors or nails, such as fiberglass, need not be removed or de-tensioned in the upper 20 foot restricted zone of the ROW or above existing sewer mains.

5. The plans must indicate that all of the tie-backs shall be disengaged following completion of the work, and all metal tendons removed from the 20 foot restricted zone (See Attached Sketch). All metal tendons which are not removed are subject to the provisions of the Notice of Geotechnical Conditions which encumbers the property owners for any costs the City incurs for future construction costs in the downtown area as a result of the tendon. Projects proposing non-metal anchors will not require the Notice.

6. A "Notice of Geotechnical Conditions" shall be recorded against the property where metal tendons are installed, constraining the property owner(s) to hold the City harmless and defend the City from future costs, damage or litigation resulting from permitted work occurring in City ROW or easements. This Notice shall be rescinded following removal of all of the tendons from the upper 20 feet ROW and all tendons (including those outside the zone) are detensioned.

All shoring systems must be independent of the building's basement walls and the basement walls must be designed to support lateral loads assuming that the shoring system is absent. Permanent tieback anchors or soil nails extending into the ROW shall not be used. Soldier beams must be removed to 3 feet below curb inlet.

All shoring systems which support the ROW will be subject to review by City Development Services Department engineering and geology staff. A geotechnical engineer must evaluate the stability of the proposed shoring system and verify that the geotechnical site conditions have been appropriately implemented in the shoring system design, and provide recommendations outlining an inspection program during installation. Removal of tieback anchors or soil nails must be verified by the project geotechnical engineer.

It is emphasized that permanent installation of tieback tendons or soil nails is not permitted in the City ROW. It is also encouraged to design temporary metal anchors so that corrosion will occur as rapidly as possible.

Downtown Geologic Hazard Zone 13 (Graphic Attached):

"Beginning at the intersection of the centerline of Laurel Street and the centerline of Highway 163, thence in a general westerly and southwesterly direction along the centerline of Laurel Street to the intersection of the centerline of Harbor Drive, thence westerly to the intersection of the US Bulkhead line of San Diego Bay, thence in a general southerly and southeasterly direction along said Bulkhead line to an intersection of the southwesterly prolongation of the centerline of 28th Street, thence northerly along the centerline of 28th to the intersection of the centerline of Ocean View Boulevard, thence northwesterly along the centerline of Ocean View Boulevard to the intersection of the centerline of 25th Street, thence northerly along the centerline of 25th Street to the intersection of the centerline of Russ Boulevard, thence westerly along the prolongation of the Centerline of Russ Boulevard, to the intersection of the centerline of Highway I-5, thence in a general northerly and westerly direction along the centerline of Highway I-5 to the intersection of the centerline of Highway 163, thence generally northerly along the centerline of Highway 163 tot he point or place of beginning."

POINT OF CONTACT: If you have any questions regarding this Notice, please contact Rob Hawk at 619-446-5288 or Mo Sammak at 619-446-5292.

Robert N. Hawk, PE
Deputy City Engineer