easterly that are a maximum of approximately 1,300 feet in height and inclined as steep as approximately 45 to 50 degrees (0.84 horizontal to 1 vertical).

All proposed slopes, along with a partially reclaimed benched slope to the south of the east highwall, will be micro-benched to facilitate revegetation. Irregularities in slope aspect and configuration are proposed to mimic the original undisturbed topography of the canyon.

Regional Geologic Setting and Site Geology

The Project Site is located at the northern edge of the San Gabriel Valley in the foothills of the San Gabriel Mountains. The Sierra Madre fault separates the alluvium of the San Gabriel basin to the south from the San Gabriel Mountains on the north. The north-dipping Sierra Madre thrust fault is thought to be one of the major structures responsible for the uplift of the San Gabriel Mountains. Total vertical displacement is at least 1,900 feet (Crook and others, 1987).

The Project Site consists primarily of two basic rock types: igneous (qd) and metamorphic (gn). The contact between these two formations is very irregular and varies considerably between closely spaced borings. These rocks are covered locally by thin deposits of sediments consisting of modern stream alluvium (Qg), older Quaternary-age fan and terrace deposits (Qog), and by colluvium (slopewash/residual soil).

Igneous rock is predominant in the subsurface geology of the Project Site. Most of the western portion of the Project Site comprises igneous rock, and the exposed metamorphic rock in the eastern portion of the quarry is underlain by igneous rock. The igneous rock is early Cretaceous (approximately ~~one~~ 65 to 146 million years old), and representative of an intrusive event whereby magma moved through the preexisting surrounding basement rock, contributing to the metamorphism in the other major rock unit at the Project Site (see below). The igneous rock unit is laterally extensive across the mountain front in the San Gabriel Valley (Crook and others, 1987).

The igneous unit is generally of intermediate composition consisting largely of quartz diorite, though local mineralogic variations resulting in rocks of granodiorite, quartz monzonite, and granite composition are common. The geotechnical properties are generally unaffected by these minor mineralogic variations. Many of the igneous rocks exhibit weak to moderate metamorphic textures (foliation) that are generally characterized by alignment of dark minerals.

Precambrian metamorphic rocks (>540 Ma) are the oldest rocks at the Project Site. These ancient basement rocks were metamorphosed into gneiss, a banded or layered rock composed primarily of quartz, feldspar, and ferromagnesium minerals. Mineralogically, the composition of the gneiss found at the Project Site is similar to the igneous diorite found at the Project Site. Generally, the metamorphic rocks are highly fractured and weathered. At shallow depth within the weathered zone, these rocks can typically be broken apart by hand pressure or by soft blows from a hammer. In the east quarry, the upper approximately 100 to 300 feet are highly weathered and substantial weathering extends to an approximate depth of 400 feet.

Dikes are common throughout the Project Site in both igneous and metamorphic rocks. The most obvious dikes are basalt and andesite, but dikes of coarse-grained granitic/dioritic rock

GS-3: Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?

GS-4: Be located on expansive soil, as defined in Table 18 1 B of the Uniform Building Code (1994), creating substantial risks to life or property?

GS-5: Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

Project Design Features

The Proposed Project includes implementation and compliance with all applicable federal, State and County rules and regulations related to the geology and soils impacts as discussed in this section. The Proposed Project would result in recontouring and revegetating the existing "step-benching" reclamation plan in favor of a "micro-benching" design that results in reclaimed slopes and contouring in appearance and function compatibility to the natural slopes and vegetation of the setting. The end-result of micro-benching is a recontoured landform that would be more similar in appearance and to the immediate setting. Available data indicate that the slope stability for the proposed reclamation plan slopes is suitable to the proposed open space end use of the Project Site. The project design features related to geology and soils include:

PDF-2 Maintain the on-site slope and grade in a manner to direct drainage of surface flows to the on-site storm water detention basin.

PDF-3 Apply a micro-benching methodology to reduce the height and width of the step-benches and include native vegetation as measures to eliminate negative aesthetic elements associated with traditional benching method.

PDF-4 Final reclaimed slopes are to be contoured horizontally and vertically to mimic the pre-mining contours, incorporating vertical articulation thereby eliminating negative aesthetic elements.

4.5.4 Geology and Soils Issues Identified to Have No Impacts

Based upon the City's Initial Study, the following Geology and Soils issues were found to have no impacts.

GS-4: Be located on expansive soil, as defined in Table 18 1 B of the Uniform Building Code (1994), creating substantial risks to life or property?

The Project Site is not located on expansive soils as defined by California Building Code, and no permanent structures will be left on the Project Site when reclamation is complete. Accordingly, no substantial risk to life or property related to expansive soil would be created by the Proposed Project.

the West Side mine slope yields a lower bound FOS greatly exceeding the target FOS of 1.5 and clearly indicates that the mined slopes are much more stable than the natural slopes because the highly weathered rock and overburden material have been removed by mining. The stability of the final reclaimed slopes under the Proposed Project is expected to be as good or better than the surrounding natural slopes.

Mitigation measures are provided below to further reduce any potentially significant impacts to a level of less than significant.

Mitigation Measures

While nothing can be done to reduce earthquake potential at the Project Site, any measures that increase the static stability of the final slopes will also decrease the likelihood of seismically induced landslides. The following mitigation measures are recommended to assure stability in the final reclaimed slopes:

Mitigation Measure GS-1

Fill material selection and testing. The buttress fill constructed at the toe of the eastern slope to improve its stability ~~should~~ shall be constructed of material with a shear strength of equal or better than friction angle of 45° and cohesion of 500 psf. To ensure that these criteria are met, the fill material shall be laboratory tested prior to use. Due to the coarse gradation of the on-site fill available, specialized laboratory shear testing may be required. If laboratory test results indicate that the cohesion of the fill is insufficient, sufficiently strong material could potentially be obtained through the addition of geosynthetic fibers (Geofibers) or application of a geogrid; materials shall be approved by the City of Azusa.

Mitigation Measure GS-2

Geologic mapping of actual cut slopes. The existing natural and cut slopes are on the order of 1/4-mile from the planned final cut slopes. Considering the highly fractured, discontinuous nature of the rocks, it is possible that the planar discontinuity orientations within the final cut will be significantly different than the present exposures. The orientation of the cut slopes can be a major factor since slopes oriented such that discontinuities are daylighted (i.e. unsupported) will be more susceptible to slides than slopes with discontinuities dipping into slope or neutral to the slope face. The Applicant shall provide additional studies to determine the orientation and characteristics of the rock- mass discontinuities and of the cut slopes, to provide further mitigation of slope failure. By mapping and monitoring cut-slope discontinuities, slope cuts can be oriented to minimize adverse relationships thereby reducing the slide potential. In certain areas, adjusting the design of future phase bench widths and sequencing could mitigate the hazards.