3.5 Geology, Soils, and Seismicity

This section supplements the Geology, Soils, and Seismicity analysis in the Master Plan EIR (ESA, 2000; ESA, 2001), based on new information on soils characteristics at the Project site and changes in the Project description. The design of the pond in the Master Plan EIR included terracing of slopes to reduce the potential for slope failure and erosion while the pond is active; this design feature is not included in the Project design. Therefore, the analysis of impacts related to slope failure is supplemented in this Draft SEIR. Analysis in the Master Plan EIR that does not require updating is not addressed further in this section.

3.5.1 Setting

Information below is obtained from the Geomatrix Feasibility-Level Geotechnical Evaluation (Geomatrix, 2007), which is included as Appendix F to this Draft SEIR.

In and around the Project site, geologic conditions generally consist of friable, locally fossiliferous marine sand and clayey sand of the Wilson Grove Formation. The Formation sediments are overlain by thin (2-5 feet) colluvial soils and local terrace deposits. Bedrock generally inclines to the north-northeast.

Field mapping of the Project site revealed areas of active landsliding and severe erosion, including pervasive bank erosion and slumping along the upper reaches of the drainage flowing through the site. A large and relatively narrow deeply-incised gully/debris flow chute occurs on the south-facing slopes near the middle of the site.

The Project is not located in the general vicinity of a mapped Alquist-Priolo Special Studies Fault Zone. The Rodgers-Creek fault, located approximately five miles to the east-northeast, is the closest active fault to the Project site. Several potentially-active faults are located about three miles from the site; the closest is the Trenton fault, located approximately 1.1 miles to the south. There are no known fault-rupture hazards onsite (ESA, 2000).

3.5.2 Standards of Significance

The Standards of Significance are based on Appendix G of the CEQA Guidelines, and are focused on the impact categories that require update in this SEIR. Significant impacts could occur if implementation of the Project would:

- Expose people or structures to potential adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault; or
- Expose people or structures to loss, injury, or death due to strong ground shaking, liquefaction, or landslides.

3.5.3 Impacts and Mitigation Measures

Impact 3.5-1: The Project could expose structures to potential adverse effects, involving landslides.

Analysis: Potentially Significant

Shallow landslides/slumps and erosion gullies occur at numerous locations on-site. Field observations indicate the landslides/slumps are typically shallow (less than 5 feet), with some approximately 10-15 feet thick. In addition to its highly erodible nature, the shallow, north-tipping beds of the Wilson Grove Formation make structural cuts on the north slope of the Project site difficult.

Slope failures are common in the Wilson Grove Formation and occur typically in the surficial mantle (colluvium) overlying the more competent bedrock. Some historic slope failures, including shallow landslides and debris flows, were observed on the slopes surrounding the proposed dam site. Reservoir slopes overlain by unstable colluvial materials would be most susceptible to failure and erosion, especially under conditions of fluctuating water levels and strong ground shaking from an occurrence of earthquake on nearby seismic sources.

When full, an unlined pond would be expected to cause saturation of near surface soils or weathered bedrock; during subsequent pond drawdown, water would tend to drain from these soils and weathered bedrock, increasing the risk of slope failures on the exposed pond slope. In addition, seepage from an unlined pond might also travel through a more pervious bedrock layer through one of the perimeter ridges around the pond, or through the dam abutment, daylighting on an exposed slope and increasing risk of failure of natural slopes. Slope failure could affect operation and capacity of the pond.

Mitigation Measure 3.5-1: Design the dam and pond according to site-specific geotechnical design recommendations and California Division of Safety of Dams (DSOD) standards and requirements.

This mitigation measure replaces Master Plan EIR Mitigation Measure 4.1.2a for the Project. Due to the size of the dam and the volume of the impounded water, the Project is subject to DSOD jurisdiction. DSOD standards require that pond slopes and dams be designed to provide slope stability for site-specific geologic conditions, expected operational scenarios and potential seismic loading conditions for the Project area. DSOD standards have been established to provide protection to life and safety.

The general approach for assuring slope stability on the Project is based on geologic mapping and subsurface exploration of the site during preliminary analysis (Geomatrix, 2007) as well as supplemental ongoing investigations analysis to support preliminary design (Geomatrix, 2008). During Project construction, loose surficial soils and slide debris shall be overexcavated from the pond footprint. Underdrains shall be installed on a localized basis to drain perched groundwater that might be encountered. Based on preliminary engineering analysis (CH2M HILL, 2007), it was determined that a geomembrane liner would be preferred rather than a compacted clay liner covered with riprap erosion protection and shall be installed during Project construction.

Preliminary geotechnical engineering analysis (Geomatrix, 2007) indicates that the following slopes will be required to assure stability and shall be included in final design plans:

- Pond slopes— 3 horizontal to 1 vertical (3H:1V)
- Dam slopes— 3H:1V upstream and 2.5H:1V downstream

- Access Road cut/fill slopes— 2H:1V minimum, plus benching or further flattening in select areas or to facilitate maintenance

Final design of dam embankment and pond slopes shall be based on design-level site investigations subject to detailed review and approval of DSOD. In addition, DSOD oversight of construction is required to assure that the construction complies with the approved designs.

With the incorporation of these design requirements, the risk of catastrophic failure from landslides would be low. Compliance with design recommendations and DSOD requirements would reduce potential impacts related to landslides to a less than significant level.

After Mitigation: Less than Significant

3.5.4 References

CH2M HILL. 2007. *Technical Memorandum 3.7: Preliminary Analysis Summary Report, Windsor Eastside Road Storage Project*. Prepared for the Town of Windsor. August.

Environmental Science Associates (ESA). 2000. *Town of Windsor Water Reclamation Master Plan for Treatment, Storage and Disposal Draft Environmental Impact Report*. Prepared for the Town of Windsor. October.

_____. 2001. *Town of Windsor Water Reclamation Master Plan for Treatment, Storage and Disposal Final Environmental Impact Report*. Certified by the Town of Windsor on February 7, 2001 and compiled in May 2001.

Geomatrix Consultants, Inc. 2007. *Technical Memorandum 3.2: Feasibility-Level Geotechnical Evaluation, Windsor Eastside Road Storage Project*. Prepared for CH2M HILL. May.

_____. 2008. Draft Geotechnical Investigation Report. Work in progress.