Final Geotechnical Report
White Point Landslide
W.O. E1907483
Task Order Solicitation 11-087
San Pedro District
Los Angeles, California

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EXECUTIVE SUMMARY

This report presents geotechnical and geological data and recommendations for the White Point Landslide in the San Pedro District of Los Angeles. The report presents our field explorations, laboratory testing, geotechnical analyses, conclusions, and recommendations. The purpose of our geotechnical engineering services was to evaluate the landslide geometry and movement to assess the risk of future landsliding, and to develop repair options to restore Paseo del Mar.

Paseo del Mar is an east-west roadway at the top of a steep, approximately 120-foot-high, south-facing bluff overlooking the Pacific Ocean. On November 20, 2011, a large block of the coastal bluff moved rapidly towards the ocean, destroying an approximately 600-foot-long section of Paseo del Mar and associated utilities (2011 Landslide). The block moved approximately 60 feet to the south.

Indications of movement consistent with a landslide were first noted by City of Los Angeles (City) representatives in January 2010 following a smaller landslide to the southeast of the White Point landslide (2009 Landslide). Based on these observations, the movements of the 2009 and 2011 landslides appear to have started simultaneously, but the causal relationship is unclear. Movement of the 2011 Landslide accelerated beginning in June 2011 and continued toward the beach over a period of five months leading up to the November 20, 2011 failure.

Results of our literature review indicate that the White Point landslide may be similar to other major landslides on the Palos Verdes Peninsula in terms of geologic conditions that are conducive to slope instability. Nearby landslides are known to occur along beds of bentonite clay within the Altamira Shale member of the Monterey Formation, which occurs at the White Point Landslide. Aerial photographs of the area dating back to 1928 indicate that local slope instability along the coastal bluffs may have been present in the area of the current day White Point Landslide.

Nine borings were completed near the landslide between November 25 and December 20, 2011, using bucket auger, rotary core, and rotosonic drilling techniques. Geotechnical laboratory tests were performed on selected samples retrieved from the borings. Bentonite clay beds were observed in several borings near the depth of the landslide failure surface. Of particular note, the bentonite beds encountered between 88 and 97 feet in two of the borings were highly polished, soft, wet, and discordant with adjacent bedding.

Instrumentation consisting of observation wells, inclinometers, and vibrating wire piezometers was installed in several of the borings. Groundwater levels encountered during drilling and from continued monitoring indicate that a complex groundwater regime exists at the site consisting of both unconfined and confined (artesian) zones. Previous reports by other consultants for the nearby Nike Missile Base confirmed our assessment of the groundwater conditions.

We used the computer program SLOPE/W version 7.17 (Geo-Slope International, 2007) to perform slope stability analyses of the current landslide and potential future landslides. For the analyses, we assumed that bedding dips out of the slope and that a continuous bentonite clay layer formed the failure surface. We assumed that geologic discontinuities acted as release surfaces to define the geometry of the landslide. We performed back analyses of the pre-landslide conditions to help determine material strengths and groundwater conditions for forward analyses of the current and future conditions.

Combined with the weak strength of the bentonite clay, we found that the presence of water in rock discontinuities and artesian groundwater pressure acting on the failure surface had the strongest influence on the stability of the slope. Although measured groundwater levels have not reached the level that our analyses indicate would cause further instability, we believe it is feasible that these elevated levels could be reached in the future. Based on our analyses, we recommend that long-term infrastructure improvements take place outside of a 170-foot buffer zone extending from the headscarp of the 2011 Landslide unless additional measures are taken to stabilize the remaining slope.

The results of our observations and engineering analyses suggests that precipitation, irrigation, and to a lesser extent, coastal bluff erosion may have contributed to the development of the White Point Landslide. Residential development in the area may have also contributed to the landslide because of its influence on groundwater infiltration. With the information provided to us by the City, we were unable to conclude as to whether the underground utilities in the area contributed groundwater to the subsurface prior to the landslide activation. Based on our review of the historical precipitation data, it is our opinion that changes in the area development between about 2005 and 2010 should be further evaluated to determine potential influence on the groundwater from surface and near-surface sources. We determined that it is unlikely that the Nike Missile Base silos contributed groundwater to the subsurface prior to the landslide occurrence.

We recommend that dewatering improvements along with installation of a slope anchor system be implemented along the eastern margin of the landslide, which our analyses indicate is marginally stable. We also recommend that the steep headscarp of the landslide be graded to avoid shallow sliding and toppling failures that could be hazardous. This work should be completed prior to the 2012-2013 rain season.

We prepared five alternative long-term mitigation options: 1) re-routing the road around a landslide buffer zone: 2) partially re-grading the landslide debris and adjacent area to restore the road to its previous alignment across the existing landslide, 3) supporting the road at its previous alignment with a soil buttress; 4) supporting the road with a retaining wall; or 5) or spanning the landslide with a bridge.