

## **MEMORANDUM**

To: Shauna Stringham, Impact Sciences

From: Willard Hopkins, CEG, Questa Engineering Corporation

Date: September 5, 2007

Re: Geology and Soils Issues, Ticonderoga EIR

This memorandum presents a summary of the comments provided by Cotton Shires and Associates on the Geotechnical work performed by TRC Lowney on the subject project, a summary of the TRC Lowney responses, and additional review performed by Questa Engineering staff on the geotechnical issues.

### **Cotton, Shires and Associates concerns**

- 1) Planned house sites along Bunker Hill drive are within stable bedrock, but are on steep slopes in close proximity to landslide deposits. Data exists from one borehole; there is a need to address stabilization piers (where? how deep?).
- 2) Ticonderoga lots are within highly sheared *mélange*, and existing landslide deposits extend beneath all planned house sites. Cotton Shires does not agree that the potential for landsliding in the Franciscan is low due to unmapped, active landslide from failure of sheared bedrock in lot 8.
- 3) Characterization of the dimensions of the landslides is incomplete, boring logs, cross-sections, and maps are inconsistent.
- 4) Some landslide debris is proposed to be left in place and supported by retaining walls, but walls cannot be designed without a better characterization of the landslide mass.
- 5) In general slope stability conditions are not sufficiently defined to allow design of stable buttress grading repair within Ticonderoga lots.
- 6) Proposed fill prism construction for driveway access on lots 7 and 8 may overload underlying *mélange* materials and potentially induce new slope instability.

### **Cotton Shires Proposed Measures**

- 1) Additional subsurface exploration via large diameter borings, test pits or shafts should be done to allow direct and conclusive identification of landslide basal rupture surfaces.
- 2) Samples should be taken from identified shear surfaces for strength testing and slope stability analysis.
- 3) Minimum of two borings should be obtained for each lot for accurate geologic cross sections.
- 4) Excavations should extend into underlying *mélange* to obtain an understanding of bedrock materials.

- 5) Engineering design (earthen buttress, retaining wall) should be completed after site geologic evaluation has been completed.

### **TRC Response**

In a letter dated August 16, 2007, TRC Lowney responded to the concerns raised by Cotton Shires. TRC feels that their geologic characterization was sufficient to address geotechnical concerns during the CEQA/EIR process. They did not specifically address inconsistent maps and cross-sections. They recommend removal of landslide deposits during site grading and founding residences and retaining walls on drilled pier foundations into bedrock. They recommend designing retaining walls and basement walls for sufficient lateral pressures from landslide or fill material. This material load would be quantified prior to detailed design and building permit approval. TRC Lowney proposes that if conditions are different from those expected they will change the design appropriately.

### **Questa Analysis**

The proposed project is planned for steeply sloping areas that have experienced landsliding and slope instabilities in the past. In our preliminary review of the TRC Lowney report we indicated that the report appeared to be adequate for Lots 5 through 8 and that appropriate mitigation measures were proposed to control the identified geotechnical impacts. However, upon closer scrutiny, the report appears to have missing or inaccurate data to support their conclusions and recommendations. The proposed design recommendations of the TRC Lowney report appear to be sound, but some of the supporting data appears to be missing or inadequate.

TRC Lowney's geologic documentation of the project site appears to be incomplete. There are inconsistencies in the figures presented by TRC Lowney in the report. Figure 2, in plan view, shows landslide deposits extending to Ticonderoga Drive, while cross section figures 4A through 4C show the landslide deposits ending well above the street, near the edge of the proposed home locations. As proper characterization of landslide dimensions is necessary for the design of slope instability mitigation measures (e.g. retaining walls, stabilization piers), further investigation of the extent of landsliding would be prudent prior to detailed site design. Given the limited geotechnical characterization of the site by TRC Lowney and the mistakes present in their geotechnical report, further testing and revisions to the report would be appropriate for further defining of the geotechnical design recommendations. This testing should include strength testing of samples taken from the potentially unstable soils at the landslide mass base for detailed slope stability analysis, additional boreholes or test pits to allow accurate identification of the landslide base, and further evaluation of the underlying bedrock conditions. At least two boreholes should be completed in each lot in order to generate accurate geological cross sections for determination of the extent of landslide deposits, prior to the development of the final grading plan and permit approval.

TRC Lowney's site plan suggests that landslide deposits may extend down slope from the proposed subdivision, while the cross sections presented in Figures 4A, 4B and 4C show landslide deposits as terminating adjacent to the proposed residences, but locations are queried or shown as uncertain on the cross sections. Should these landslide features extend off site, they could affect Ticonderoga Road. Off site boreholes within Ticonderoga Drive would be appropriate to fully evaluate the potential for slope instabilities beneath and adjacent to the road. This will allow for more accurate design of earthen buttresses and retaining walls prior to the construction period, thereby reducing the need for any significant design changes during the construction process. Minor changes during construction can be expected when excavating landslide deposits and replacing with buttress fill deposits. The total depth of the landslide will not be known in all areas prior to excavation, but a more complete picture can be generated prior to construction by completion of a supplemental geotechnical investigation.

Based on review of the Ticonderoga EIR information available including Geology, Soils and Geotechnical studies, a current Geotechnical Study needs to be performed for the four lots studied in 1993 and 1994 by Soil Foundation Systems, Inc., shown on the proposed site plan as lots 1, 2, 3, and 4. The Limitations section in the 1993 report indicates, "this report is subject to review and should not be relied upon after a period of three years." Soil Foundation Systems, Inc. does not appear to be an active company at the present time. A new Geotechnical Engineer-of-record is required for these lots and should prepare an updated Geotechnical Study for these four lots. Conditions, regulations, and standards of practice have changed since the original report was prepared. The Applicant should retain a Geotechnical Engineering Firm to act as the Geotechnical Engineer of Record and to provide a current Geotechnical Investigation supporting the previous conclusions and design recommendations, or providing updated geotechnical design recommendations.