CORNERSTONE EARTH GROUP

Date:	November 26, 2008
Project No.:	229-1-3
Prepared For:	Mr. John Ward **Laurel Way Joint Venture, LLC** 792 Willborough Place Burlingame, California 94010
Re:	Supplemental Geologic and Geotechnical Feasibility Evaluation Laurel Way Development Redwood City California, California

Dear Mr. Ward,

This letter presents the results of our supplemental geologic and geotechnical feasibility evaluation for the proposed Laurel Way Development (hereinafter referred to as "the project") in Redwood City, California. The purpose of this supplemental letter is to update the geotechnical consultant of record, respond to comments provided in a peer review letter from the geologic/geotechnical firm (Treadwell & Rollo, Inc.) retained as subconsultant's for the environmental impact report for the project, as well as to provide our professional opinions on the feasibility of the project as shown in the most recent development plan (*October 2008).* In performing our evaluation, we reviewed the following documents:

- A report titled, "Geologic and Geotechnical Feasibility Evaluation, Laurel Way Development, Redwood City, California" by TRC/Lowney dated July 6, 2007.
- A set of plans titled, "Conceptual Development Plan, Laurel Way Joint Venture, Redwood City California" by BKF Engineers dated October 28, 2008.

In addition to reviewing the above documents, we visited the project site to perform a current field reconnaissance on October 31, 2008 and attended a meeting on November 4, 2008 to discuss the project with Roland Haga, P.E., project engineer from BKF Engineers; Dean Iwasa, G.E. and Chris Hundemer, C.E.G., of Treadwell & Rollo, Inc., geologic and geotechnical consultant to RMT/MHA, Mr. Jeff Smith of RMT/MHA, the project EIR consultant; Dr. Robert Wright, C.E.G., geologic peer reviewer retained by the Laurel Way Joint Venture, and yourself as project manager for Joint Venture.

Update of Geotechnical Consultant of Record

We have reviewed the project documents prepared by TRC/Lowney and in our opinion the geologic and geotechnical conclusions and recommendations are appropriate for the planned development. During our site review, we observed a new small landslide, which in our opinion, will need to be addressed during the design and construction of the project. We also understand new storm water retention and treatment facilities will be included in the proposed project. To address these issues, we have provided our opinions and recommendations below. We are in the process of providing consultation on the geologic and geotechnical aspects of this

issue to the project team. In summary, we acknowledge and accept the role as geotechnical consultant of record for the project.

Project Description

Currently, the planned development area consists of 19 lots on either side of the planned approximately 750-foot long expansion of Laurel way. Two houses are present above the existing culvert crossing of Laurel Way, but these houses and the lots that have been developed are not within the current development area. Minor grading has been done on several of the lots and the Laurel Way alignment, but the general terrain remains in its natural state. Based on our discussions with the applicant and after reviewing the conceptual site plan prepared by BKF Engineers, we understand single-family, two-to-three story, wood frame homes are proposed to be built on 18 of the existing 19 vacant parcels of land. Grading for each home is not known, but will likely consist of cuts and fills up to 10 feet for each lot. The homes will likely be supported on drilled pier foundations. Based on the conceptual site plan provided, the building footprints may extend 60 to 80 feet from Laurel Way. No building is shown on Lot 6, an open space area. A discussion of the Laurel Way project and storm retention/drainage improvements is presented in the following paragraphs.

The Laurel Way Joint Venture project proposes a private street extension from the end of the existing Laurel Way to a new cul-de-sac turnaround. This new private street will provide public ingress and egress along with emergency vehicle access. The proposed private street will also provide the area needed for public utilities, including storm drainage improvements to convey, store and treat storm water runoff (in accordance with current C-3 requirements) from the proposed project area, new sanitary sewer extensions, water main extension to create a looped water system, underground electric, telephone, CATV and gas lines to serve the proposed and existing residences along the Laurel Way extension. Therefore, the proposed Laurel Way extension will provide a public benefit of access and utilities to serve the existing and proposed homes in the project area.

At the center of the project is an existing drainage swale that passes through the project site and drains a 25-acre watershed area, an area approximately five times greater than the Laurel Way Joint Venture project site area. Within the project site, the existing drainage swale discharges through an 18-inch diameter, approximately 45-feet long corrugated metal culvert, conveying storm water flows under the existing 10foot wide gravel roadway. The existing 18-inch diameter corrugated metal pipe (CMP) culvert has a flow capacity of about 19 cubic feet per second (cfs) with no surcharge and about 20 cfs when rainfall runoff ponds to the edge of the road. Under existing conditions the roadway will be overtopped with water briefly during a 10-year storm event. Downstream erosion and landsliding has occurred due to overtopping and uncontrolled discharge from the culvert outlet and the existing 10-foot wide gravel access roadway. Additionally, the peak 100-year inflow to the culvert is about 30 cfs. Therefore, the existing culvert is undersized and needs to be replaced with a new 24-inch pipe in the future. The attached Figure 1 shows the proposed Private Street improvements in the vicinity of the existing drainage swale that passes through the project site. The figure also shows the extent of the storm drainage facilities to convey and treat storm water from the private street area as well as drainage from the lots on the upper side of the street. Three Filterra units are proposed in the street area adjacent to the swale to treat the storm water runoff prior to discharge into the drainage swale. A retaining wall is proposed along the lower side of the street to support these facilities and to deal with the grade differential due to the widening of improvements in this area. This retaining wall varies in height from approximately 5 feet to 11 feet in the area of the existing

swale. The retaining wall will also stabilize the stream bank erosion and landsliding that has occurred at the outlet of the culvert The new culvert extension will extend approximately 30 feet further than the existing 18-inch CMP culvert to the face of the new retaining wall, and from there the new storm drain culvert will discharge into the existing drainage swale. Outfall protection will be needed and is shown at the downstream side of the retaining wall location. The outfall protection/erosion protection will most likely be comprised of rock rip-rap for the bottom and banks of the swale and extend approximately 25 additional feet down the swale from the new culvert outfall. Therefore, the new storm drainage and private street improvements will affect approximately 55 to 60 feet of the existing swale below the current outlet of the existing 18-inch CMP culvert (refer to Figure 2). The project would fill in approximately 55 to 60 feet of the existing swale and gravel road for street and public utilities needed to support the existing and proposed future homes. In summary, improvements are needed to the current culvert. These improvements will benefit the downstream neighbors, existing homeowners and the proposed homes and street improvements.

There are other storm drainage improvements proposed in the area of the swale just before the point where the swale leaves the project site (refer to Conceptual Utility Plan). In this area, storm flow from Lots 1 through 5 and Lots 7 through 10 are conveyed through pipes, with detention and storm water treatment and discharge through storm water lateral spreader outfalls along the top of the banks of the existing drainage swale (refer to Sheet C-3 Conceptual Utility Plan). There are no impacts to the swale in this area since the current development plan does not include any work in the swale.

In addition to the information provided above, the proposed drainage improvements include storm water storage, treatment, conveyance and energy dissipation facilities. The project area is divided into six drainage areas that will store, treat, convey and discharge runoff in separate facilities. The following describes proposed facilities for each of the lot areas:

- Lots 1 through 4 - Storm water detention pipes are needed on each lot. Each detention system would include a 36-inch diameter pipe approximately 20 feet long. The individual detention pipes will release water into a vegetated swale that is 118 feet long, with a 1.5 foot width at bottom. The swale area will be constructed on the existing slope with retaining walls to create the graded bench and will carry runoff to the existing drainage swale.
- Lot 5 - A bio-retention basin is provided for this lot with 9-inches of ponding depth. Bio-retention media consists of 21-inches of sand/compost mix and 12inches of drain rock. The bio-retention basin is sized based on the 100-year storage volume requirements for lot conditions. The bio-retention basin will release to a storm drain line and from there will discharge into the storm water lateral spreader outfalls along the top of the banks of the existing drainage swale.
- Lots 7 through 10 - Bio-retention basins are provided for these lots with 9 inches of ponding depth. Bio-retention media consist of 21-inches of sand/compost mix and 12-inches of rock. The bio-retention basins are sized based on the 100-year storage volume requirements for each of the lot conditions. The bio-retention basin will release to a storm drain line and from there will discharge into the storm water lateral spreader outfalls along the top of the banks of the existing drainage swale
- Lots 11 through 13 and part of the Street Area - Storm water detention pipes are needed on each lot. Each detention system would include a 36-inch diameter pipe of approximately 20 feet length with a restrictor orifice for controlled release of storm water flows. The pipes will release through curb drains to the street gutter. The

detained flow will be conveyed to a Filterra storm water treatment unit previously mentioned. The Filterra will release to the drainage swale at the culvert crossing.

- Lots 14 through 19 and part of the Street Area - Storm water detention pipes are needed on each lot. Each detention system would include 36-inch diameter pipe of approximately 20 feet length with a restrictor orifice for controlled release of storm water flows. The pipes will release through curb drains to the street gutter. The detained flow will be conveyed to dual Filterra storm water treatment units previously mentioned. The Filterra will release to the drainage swale at the culvert crossing. In addition, a cut-off swale across the upper area of lots 14 through 19, upslope of the proposed homes will convey off-site storm water runoff to the drainage swale with no treatment or detention.
- Lot 6 and the Sanitary Sewer Easement - No development is proposed within this area. No treatment or storage facilities are required. As previously mentioned, the existing corrugated metal pipe culvert crossing under the roadway is undersized for a 100-year storm event. The existing pipe shall be removed and replaced with a 24-inch diameter reinforced concrete pipe as a part of the overall development plan proposed by Laurel Way Joint Venture.

Additional details and information can be found in the Conceptual Development Plans, which further delineate these systems, including additional information on the water system and sanitary sewer tie-in points to existing facilities. Please refer to the Conceptual Plans, e.g. Development Plan, Grading Plan, Utility Plan and Retaining Wall Plan and the Storm Drainage Report for Laurel Way Joint Venture dated May 30, 2008.

Summary of Site Reconnaisance

We conducted a site reconnaissance to observe the current site conditions on October 31, 2008. In general, the site conditions were similar to the conditions that we observed during the field work that was done to prepare the Geologic and Geotechnical Feasibility Evaluation (TRC/Lowney 2007), with one exception. During our site reconnaissance, we observed that a small landslide has occurred on the downhill side of Laurel Way at the right hand side of the unimproved road near the existing culvert discharge point within Lot 6. The small landslide appears to have been caused by creek erosion of the undocumented fill along Laurel Way. As discussed in the TRC/Lowney report, stream bank erosion in this area was anticipated, therefore, the presence of this new feature is not unexpected from a geologic and geotechnical view point. Our recommendations to mitigate this feature are discussed below.

Supplemental Geologic and Geotechnical Feasiblilty Evaluation

During our November 4, 2008 meeting, we discussed the October 28, 2008 conceptual development plans by BKF Engineers and discussed the geologic and geotechnical issues that have been disclosed in the previous report by TRC/Lowney (2007) relative the current development plans. Treadwell & Rollo, Inc. also provided comments regarding the previous report and the current development plans. In general, the findings and conclusions in the TRC/Lowney (2007) report are still valid for the proposed project with the following supplemental comments:

1) **Expansive Soils and Soil Creep.** As discussed in the 2007 report, the site is locally blanketed with expansive soils which will expand or shrink during wetting and drying cycles. On steep slopes, these soils will be subject to soil creep. To mitigate these

conditions, we recommend that the residences and site retaining walls, including the walls for the bio-retention basins be supported on drilled piers designed to resist soil creep and vertical expansion of the soils. Concrete driveways, sidewalks, walkways, and pavers should be supported on a layer of non-expansive fill designed to limit the expansion potential of the underlying soils. Proper detailing of construction and control joints for concrete slabs should be considered in the final design of sidewalks and patio's. For example, a construction joint with rebar dowels should be provided where concrete slabs on grade meet the proposed perimeter foundation for the residence to minimize vertical offset from soil expansion or shrinkage. Underground utilities that enter and exit the building envelope should be designed with flexible connections that allow movement due to the expansive soils.

2) **Vegetated Swale at the Base of Lots 3 and 4.** The previous investigation (TRC/Lowney, 2007) mapped a questionable landslide in this area based on aerial photo interpretation. The conceptual development plan shows minor grading to form an earthen swale near the bottom of Lots 3 and 4. Construction of this swale in this area appears feasible from a geologic and geotechnical viewpoint. We recommend that the area of the questionable landslide and proposed swale be further evaluated during the design level geotechnical investigation(s) for Lots 1 through 4 to provide detailed recommendations for keyways, benching and subdrains.

3) **Retaining wall on Downhill Side of Laurel Way.** A long retaining wall is proposed on the downhill side of Laurel Way. Other shorter retaining walls are proposed at other locations on the site. As discussed above, these retaining walls should be founded on drilled pier foundations deriving their support from the underlying bedrock materials. The existing undocumented fill along the Laurel Way should be removed and replaced as compacted engineered fill. As discussed above, the retaining wall at the lower side of Laurel Way will cross the swale and become the downstream head wall for the new culvert that will be constructed. Construction of this retaining will mitigate the observed landslide in this area because the failed material will be removed and replaced with engineered fill and the toe area will be stabilized. Erosion control protection at the culvert outlet should be installed as described above. We recommend that the area of the proposed retaining wall be further evaluated during the design level geotechnical investigation to provide detailed recommendations for final design of the retaining wall. The retaining wall backfill will support a network of utility pipes including the culvert and storm drainage pipes and filtration systems. A discussion of construction of trenches in sloped areas is presented below.

4) **Limit Infiltration from Bio-Retention Basins.** Bio-Retention basins are proposed on the downhill sides of Lots 5, 7, 8, 9 and 10. As discussed above, the down slope retaining walls should be supported on drilled pier foundations designed to resist soil creep. The bottom of the basins should be lined with HDPE liner to limit water infiltration into the native soils below the permeable filter soils (i.e. sandy loam). A subdrain should be installed above the HDPE liner to intercept the access water and direct it to a suitable discharge point. Specific recommendations for the HDPE liner system and subdrains will be presented in the design-level geotechnical report. The outfall for the Bio-Retention basins should be discharged near the base of the creek and not allowed to flow over the top of the creek banks.

5) **Construction of Trenches on Slopes.** Numerous utility trenches are planned at the project. Many of these trenches will be used to retain and convey storm drain water for the homes. A 24-inch diameter culvert will replace the existing culvert that crosses Laurel Way. Eight inch water and 6 inch sanitary sewer lines are proposed. These utilities are typically bedded and shaded with imported granular backfill such as sand or quarry fines which may intercept natural ground water. From a geotechnical viewpoint, the intercepted groundwater may wash out the backfill around the pipes causing trench settlement and possible settlement of the utility pipes. To mitigate this condition, we recommend cut-off plugs consisting of controlled density fill about 2 feet wide and keyed into native soils be installed at 25 to 50 feet intervals along the pipe line trenches and at the beginning, midpoints and ends of the culvert and 36 inch diameter detention pipes. The purpose of the utility cut-off plugs will be to limit ground water flow in the permeable trench backfill materials. Specific recommendations for the cut-off plugs will be presented in the design-level geotechnical report.

Closure

This letter has been prepared specifically for Laurel Way Joint Venture, LLC for the Laurel Way Development project in Redwood City, California. Our professional services were performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices at this time and location. No warranties are either expressed or implied.

If you have any questions or need any additional information, please call and we will be glad to discuss them with you.

Sincerely,

Cornerstone Earth Group, Inc.

Scott E. Fitinghoff, P.E., G.E.
Principal Engineer

Copies: Addressee (10)