3.3 HYDROLOGY / DRAINAGE

Introduction

Background

In January 2009, the Moraga Town Council decided that a Focused Environmental Impact Report should be prepared for the proposed Hetfield Estates subdivision. The Town Council identified, in part, the need for additional evaluation of potential hydrologic impacts based upon comments received at the public hearing for the Initial Study/Proposed Mitigated Negative Declaration (IS/MND) for the proposed project. These comments are summarized as follows:

- Surface water flow from the natural hillside above the proposed home sites needs further evaluation to determine if the proposed debris benches and storm drain system are adequate to accommodate storm runoff. Containment basins may be required in lieu of debris benches. The possibility of artesian groundwater flows at the buttress fills should be investigated.
- Technical data on the location and significance of a bedrock fault trending southeast to northwest through the project site is inadequate. Conceivably, the fault may effect the distribution of groundwater either by acting as groundwater barrier and allowing transverse groundwater flow along the fault.
- The influence of groundwater has not been sufficiently analyzed. There is an assumption in the Engeo report that subsurface drainage facilities will control groundwater levels. Subdrains and culvert pipes require a commitment to long-term maintenance, and these costs may ultimately be an unmanageable burden on the future property owners.
- There is concern that the subsurface drains and the surface storm drain system may adversely affect the hydrology of Larch Creek that borders the northern side of the project site. Base stream flows may be reduced causing the creek to dry up sooner in dry weather. The proposed underground storm water detention basin would prolong the discharge of water to Larch Creek which may cause increased creek bed and bank erosion.

Supplemental Geotechnical Exploration by Engeo, Inc.

Engeo, Inc. performed a supplemental subsurface exploration in September 2009. The scope of work, which was agreed to by all geologists interested in the proposed project, was intended to address the various questions raised at the Moraga Town Council's public hearing on the Initial Study/Proposed Mitigated Negative Declaration. The following discussion regarding the bedrock fault trending southeast to northwest through the project site summarizes key findings of Engeo's supplemental exploration.

The proposed grading is expected to intersect the fault at the upslope limit of the debris bench for Landslides L4 and L6. Based on the lack of groundwater encountered in Engeo's supplemental exploration, it appears unlikely that large quantities of groundwater will be encountered where the corrective grading excavations intersect the fault zones. In general, Engeo anticipates that localized, low volumes of seepage will be encountered in the excavations. The volume of water can be accommodated by the proposed subdrain system.

Based on previous grading experience in Moraga, localized zones of perched groundwater exposed during grading may produce initial flows of a few gallons per minute. Usually, within a few hours, these flows decrease to a fraction of a gallon per minute. Over the long term, Engeo anticipates that entire subdrain system will produce less than a gallon per minute. The upper portions of the subdrain system will discharge to the proposed wetland mitigation areas, and only the lower portions of the subdrain system will discharge to the creek. Therefore, in Engeo's professional opinion, discharge from the subdrain system will be insignificant relative to the storm water flow regime of Larch Creek.

The reader is referred to Section 3.2 Geology/Soils of this document for further discussion of Engeo's supplemental geotechnical exploration.

Setting

The proposed project site is a relatively steep, undeveloped parcel of land that slopes down to the north to Larch Creek, an ephemeral (i.e., seasonal) stream that flows behind the existing houses on the south side of Sanders Drive. The headwaters of Larch Creek are in the hills approximately 1,400 feet northeast of the cul-de-sac at the east end of Sanders Drive. A good portion of that hillside drains to the storm drain system that is installed along Sanders Drive. Larch Creek drains into Moraga Creek, which drains into Upper San Leandro Reservoir, located southwest of the Town of Moraga. The average undeveloped slope on the project site that will be graded is 18.4 percent (The Wyro Company, 2006), with the upper portion of the site considerably steeper. The average rainfall is 29 inches per year with most of the rainfall occurring between November and April.

An ephemeral spring exists in the slope above Lot 1 (Engeo, 2009). During most years, this spring dries up through the summer but continues to support grassy vegetation (Skinner, 2008). A stock pond exists in the northwest corner of the project site. Wetlands exist on the landslides at the east of Lot 6.

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map Panel 0606370007A, dated May 19, 1981, shows the water surface of Larch Creek opposite Carr Drive at elevation 516 feet during the 100-year storm event. This elevation is well below the street elevation of approximately 560 feet. FEMA did not study flood flows upstream from this location.

At the public hearing for the Initial Study/Proposed Mitigated Negative Declaration for the Hetfield Estates project, testimony was received that flooding had occurred in 2002 and 2006 in the backyard of the house at 1112 Sanders Drive. However, the Contra Costa County

Flood Control and Water Conservation District has no records of flooding complaints for Larch Creek (Boucher, 2010). Over the past two decades or so, the Town of Moraga has not received any complaints about flooding in the vicinity of the proposed project site (Blatner, 2010). Landscaping and backyard improvements at the existing houses on the south side of Sanders Drive have substantially altered the natural conditions along the northern bank of Larch Creek.

Larch Creek Drainage Study

In 1998, KCA Engineers, Inc. prepared a drainage study for the Larch Creek watershed that included the project site. This study was undertaken because of flooding problems in the gently sloping area between Larch Avenue and Camino Pablo. This study recommended improvements to increase the hydraulic capacity of Larch Creek to 300 cubic feet per second. As recommended in the KCA Engineers study, a second 72-inch-diameter culvert has been installed under Camino Pablo. However, the stretch of Larch Creek between Camino Pablo and Larch Avenue has not been lined as recommended in the study. Larch Creek is overgrown with vegetative growth as shown in the photographs below. Therefore, the capacity of the creek appears insufficient to convey flows from the 100-year storm that may result in flooding upstream.

Photo 5 – Larch Creek looking upstream at Larch Avenue near Roberts Court.

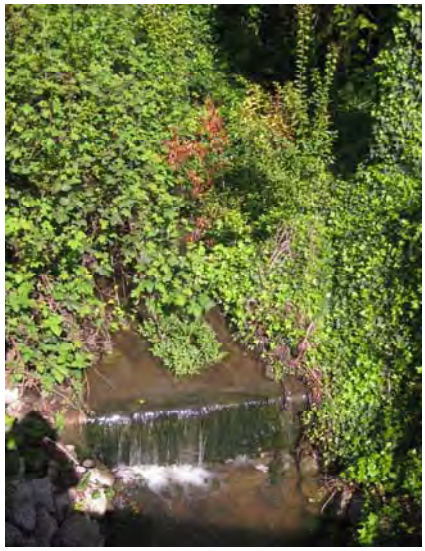


Photo 6- Larch Creek looking upstream at Wadell Avenue near Sanders Drive.

The Hetfield Estates applicant is not responsible for maintaining Larch Creek free of weeds and silt that reduces hydraulic capacity downstream of proposed project site. Either the Town of Moraga or the property owners abutting the creeks are responsible for maintaining hydraulic capacity.

Regulatory Setting

The following regulations are applicable to the proposed project:

- Contra Costa County's National Pollutant Discharge Elimination System (NPDES) C.3 permit requirements for a long-term Storm Water Management Plan to reduce the discharge of pollutants from the storm drain system to the maximum extent practicable and protect water quality in the receiving waters.
- Phase I National Pollutant Discharge Elimination System (NPDES) permit program under which developers of projects that disturb five acres or more of land are required to prepare a Storm Water Pollution Prevention Plan to implement Best Management Practices to reduce the off-site impacts of sediment-laden runoff during construction of the proposed project.
- United States Corps of Engineers (USCOE) permit under Section 404 of the federal Clean Water Act for construction of the detention basin outlet structure in Larch Creek.
- California Department of Fish and Game (CDFG) Stream Alteration Agreement for construction of the detention basin outlet structure in Larch Creek.
- Town of Moraga General Plan Policies:

  OS2.2: Preservation of Riparian Environments. Preserve creeks, streams and other waterways in the natural state whenever possible.

  OS2.3: Natural Carrying Capacity. Require that land development be consistent with the natural carrying capacity of creeks, streams and other waterways to preserve their natural environment.

  OS3.2: Polluting Materials. Prohibit the accumulation and dumping of trash, garbage, vehicle lubricant wastes and other materials that might cause pollution.

  OS3.3: Street and Gutter Maintenance. Maintain streets and gutters to prevent accumulation of debris and litter.

  OS3.4: Watercourse Capacity. Ensure that the design capacity of watercourses is not exceeded when approving new development.

  OS3.5: Watercourse Preservation. Whenever possible, preserve and protect natural watercourse areas that will reflect a replica of flora and fauna of early historical conditions.

  OS3.6: Run-off from New Developments. Engineer future major developments to reduce peak storm runoff and non-point source pollution to local creeks and streams, taking into consideration economically viable Best Management Practices (BMPs) in the design of the project as well as factors such as the physical constraints of the site, the potential impact on public health and safety and the practicability of possible mitigation measures.

  PS5.5 Streambank Erosion and Flooding Potential. Reduce the potential for future streambank erosion and flooding by requiring appropriate mitigation measures.

  PS5.6: On-site Storm Water Retention. Require on-site storm water retention for new developments.

- Town of Moraga Municipal Code Chapter 13.04, Storm Water Management and Discharge Control.

Impacts and Mitigation Measures

CEQA Significance Criteria

Appendix G of the CEQA Guidelines identifies environmental issues to be considered when determining whether a project could have significant effects on the environment. As identified in Appendix G, the following issues relevant to the proposed project are considered when evaluating the hydrological water quality impacts of the proposed subdivision:

- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site?
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?
- Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

Project Details

Grading Plan

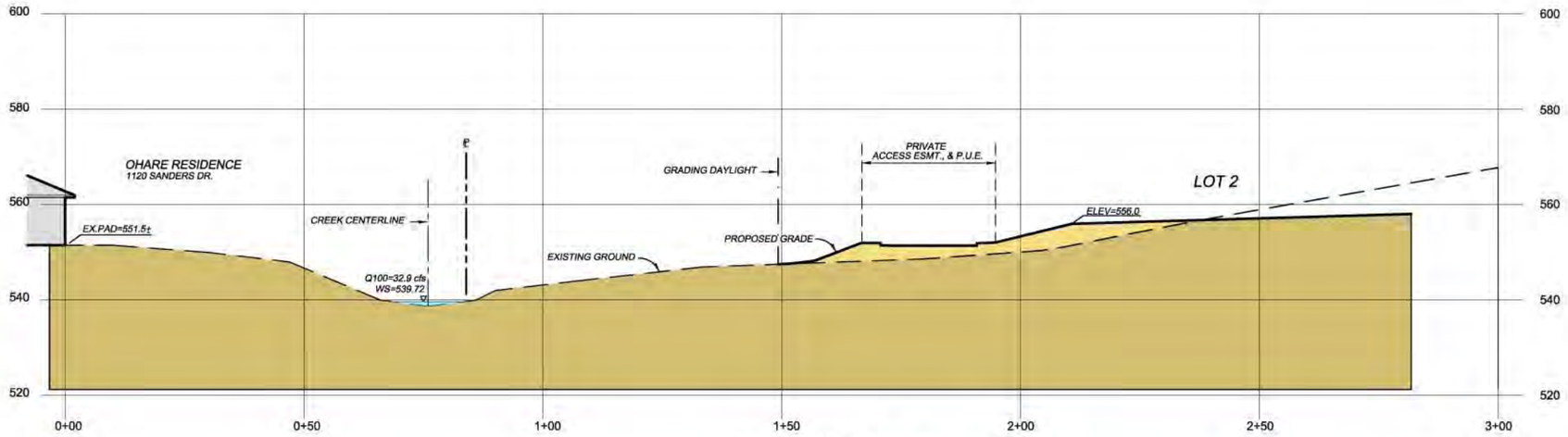
A grading plan for the project is presented on Figure 3.2-3. Figure 3.3-1 illustrates the location of the cross sections and debris bench locations shown in Figures 3.3-2 and 3.3-3. The grading concept involves removal of slide debris within the portion of the site planned for development and retaining the steep upper portion of the ridge in an ungraded scenic easement. Basal keyways would be cut into bedrock in the area of the building sites, subdrains would be installed, and then a compacted-engineered fill would be placed on top of the keyway. The existing Larch Creek channel on the north side of the property would be retained.

Slopes of the engineered fills above the building sites would be 3:1 (horizontal to vertical). At the top of the fill slopes, debris benches would be constructed at ten percent cross-slopes. The benches are intended to intercept and retain uphill soil that may slide down slope. The benches, as well as the proposed sub-drain and storm drain systems, will require maintenance over the life of the project (e.g., removal of slide debris and routine cleaning and repair of V-ditches, catch basins, storm drain pipelines, and the downstream detention basin).

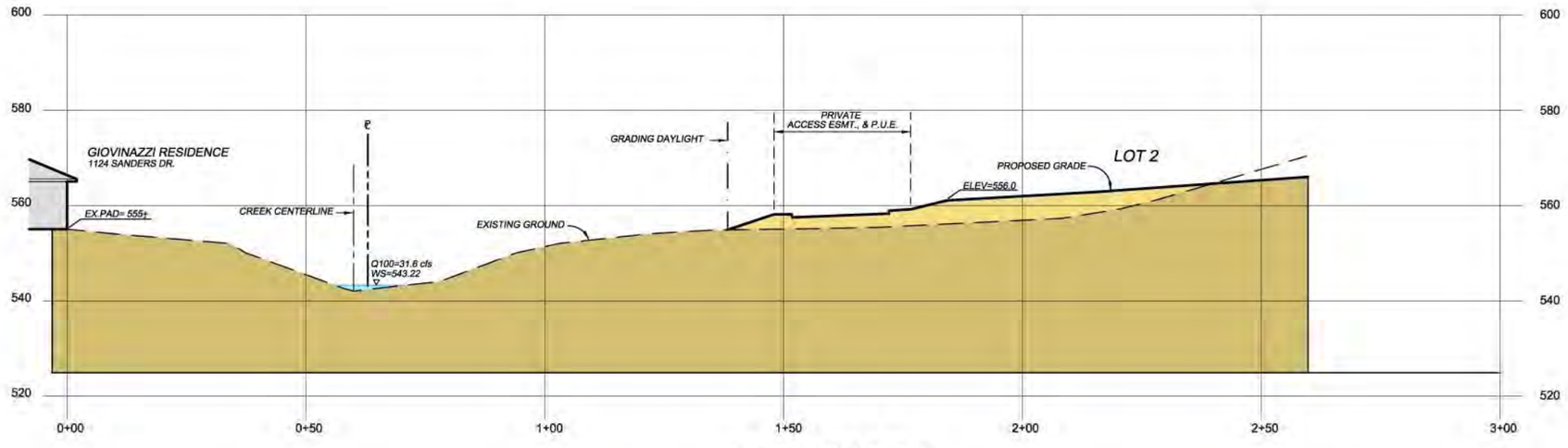
The Moraga General Plan gives consideration to slopes gradients in evaluation of the relative development potential of properties, recognizing the cost and engineering difficulties of grading areas with steep slopes. The applicant has identified a “cell” on each proposed parcel in which a portion of the parcel is proposed for grading and development. Calculations

Source: RMR Design Group

Figure 3.3-1 Cross Section and Debris Bench Locations



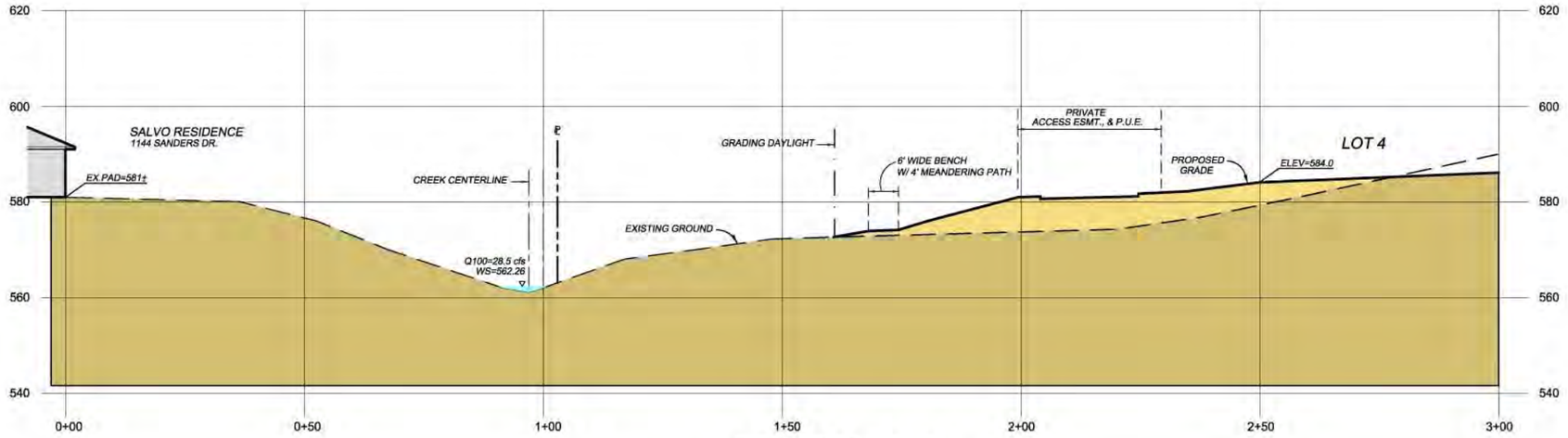
SECTION A-A



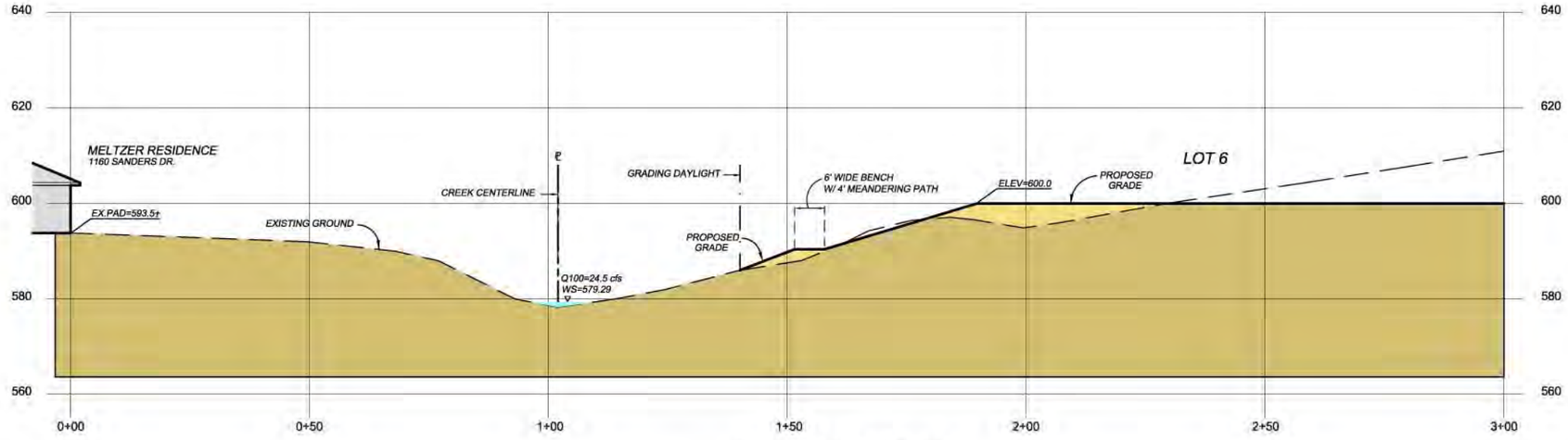
SECTION B-B

Source: RMR Design Group

Figure 3.3-2 Creek Cross Sections A-A and B-B



SECTION C-C



SECTION D-D

Source: RMR Design Group

Figure 3.3-3 Creek Cross Sections C-C and D-D

submitted with the Vesting Tentative Subdivision Map indicate the average slope within each "cell" is less than 20 percent. Lots 1 and 6 have designated building pads. The remaining lots have gently sloping surfaces with ten percent gradients toward the northwest property line. Runoff from all the lots would be intercepted and conveyed to drainage facilities within the private road easement.

Subdrain System

Subdrains, consisting of 6-inch-diameter perforated plastic pipe enclosed in Caltrans Class II permeable filter media, would be installed at the bottoms of two or three of the keyways cut into bedrock under the engineered fills (refer to Figure 3.3-4). Subdrains would be installed at the bottom of the uppermost (i.e., southern) keyway, and geo-composite blanket drains, consisting of dimpled plastic incased within filter fabric, would be installed on the sloping face of the fill to convey surface water down from the grading daylight line to the subdrains. Standard practice includes the construction of cleanouts for the purpose of flushing out the subdrains.

Subdrains located above the building pads for Lots 1 and 2 would drain to the proposed mitigated stock pond to the west of Lot 1 to assist in keeping it wet during the winter and spring seasons. Any overflow from the pond would flow overland toward Larch Creek. Subdrains located below the building pads for Lots 1 and 2 would drain through a separate outfall pipe to Larch Creek (not the outlet pipeline from the project's underground storm drain detention basin). Subdrains for Lots 3, 4, and 5 would drain to the project's storm drain system and underground detention basin that will be located under the access road. Subdrains from Lot 6 would discharge to the existing wetland east of the Lot 6 building pad to assist in keeping it wet during the winter and spring seasons. Any overflow from this wetland would be conveyed by pipeline to Larch Creek (Engeo, 2009).

Proposed Storm Drain Improvements

A privately maintained storm drain system would be installed to serve the six-unit subdivision. This system would extend uphill to the top of the area to be graded at 3:1 (horizontal to vertical) where catch basins would collect water from east-west concrete drainage ditches. These ditches would have one-foot deep by two-foot wide V-shaped cross-sections. These ditches would intercept runoff from the hillside above and prevent the water from running down the graded slopes. These ditches would discharge into catch basins (a.k.a. drop inlets) and storm drain pipelines that are part of the project's storm drain system. This storm drain system would eventually discharge to Larch Creek.

It is standard practice for the Contra Costa County Flood Control and Water Conservation District and local municipalities to require that storm drain systems for residential developments be designed to limit runoff. Specifically, runoff from a certain significant storm event following new development can be no greater than the runoff from the project site prior to development. For the Town of Moraga, this design storm is the 100-year, 12-hour storm, which is a storm event lasting 12 hours that has a one-percent statistical probability of occurring each year. Curbs, gutters, and small pipelines are designed for a 10-year storm, which is a storm event that has a ten-percent probability of occurring each year.

A 245-foot-long, 7-foot-diameter reinforced concrete pipe detention basin would be constructed under the access road on the project site as part of the storm drain system. A 24-inch outlet pipe would be installed from the bottom of the detention basin to an outlet structure on the bank of Larch Creek. An energy dissipater would be incorporated in the outlet structure to prevent erosion of the creek bed and opposing bank. The 9,430 cubic foot detention basin is sized to ensure that runoff from the subdivision during a storm with a 100-year recurrence interval and a 12-hour duration will not exceed the runoff from the existing undeveloped site (RMR Design Group, 2007).

Several of these concrete pipe detention basins have been installed in Moraga, and they perform well. At least one was inspected very soon after a significant storm and was found to be completely clean of suspended soil materials (Rourke, 2010).

Permanent Integrated Management Practices (IMPs), consisting of eleven vegetated swales and one bioretention area designed in conformance with the Contra Costa Clean Water Program Stormwater C.3 Guidebook, would be installed at the project site (RMR, 2008a). The primary purpose of these facilities is to remove pollutants from the storm runoff. Runoff from impervious surfaces (roofs and pavements) would be conveyed to these IMP facilities.

The access bridge crossing Larch Creek would completely span the creek (i.e., no intermediate supports) so that it would not interfere with the flow channel of the creek. The bridge would slope down to the north and drain to the existing storm drain system in Sanders Drive.

Project Impacts

Alteration of Existing Drainage Pattern

IMPACT 3.3-1: The project could substantially alter the existing drainage pattern of the site which could result in substantial erosion or siltation on- or off-site. This is considered a *less-than-significant* impact.

The proposed storm drain system includes a detention basin that would discharge through a pipe to Larch Creek. The drainage pattern would be slightly altered because much of the flow from the project site would be discharged at one point along the creek rather than spread along the northern frontage of the project site. The course of the creek would not be altered. However, the concentrated flow from the storm drain system could erode the bed and northern bank of the creek unless this portion of the creek channel is lined, or the outlet structure on the detention basin outlet pipe is designed to dissipate the energy of the discharge. Project plans call for an energy dissipation structure at the discharge point to Larch Creek (RMR Design Group, 2007), thereby mitigating the impact to a less-than-significant level.

The first flush from the initial large storm of the rainy season will convey the most silt and other solids to Larch Creek. The amount of silt would be less than under existing conditions because the hard surfaces, such as roofs and pavement, replace bare ground. The amount of litter, oil and urban solids would increase, but would be subsequently reduced by the Integrated Management Practices (IMPs) designed to reduce water pollution. The amount of these solids can also be reduced through a thorough cleaning of the storm drain system. (Refer to Mitigation Measure 3.3-5.)

☐ **MITIGATION MEASURE 3.3-1:** No mitigation measures are required.

Surface Runoff

IMPACT 3.3-2: The project could substantially increase the rate or amount of surface runoff, which could result in flooding on- or off-site. This is considered a *less-than-significant* impact.

RMR Design Group, the applicants' civil engineer, prepared drainage calculations to determine the water surface elevations along Larch Creek during the 100-year, 12-hour storm event under existing, undeveloped conditions at the project site assuming no restrictions to down-stream flow (RMR, 2008b). The drainage area is 51.75 acres, which is relatively small. The resulting water surface elevations in Larch Creek are shown on the cross-sections on Figures 3.3-2 and 3.3-3. The water surface elevations are well below the banks of the creek and the properties along Sanders Drive. Thus, any current flooding along this portion of Larch Creek is due to the clogged and restricted conditions downstream that prohibits the creek from accommodating flood flows.

Construction of the proposed project would result in new impervious surfaces (e.g., roofs and paving). The decrease in pervious surfaces would result in less percolation of rainfall into the ground, causing peak flows as well as total runoff volumes to increase. A detention basin would be installed under the access road. The basin would be sized to ensure that the rate of runoff from the subdivision during a 100-year, 12-hour storm would not exceed the rate of runoff from the existing undeveloped site. The RMR Design Group, with assistance from the Contra Costa County Flood Control and Water Conservation District, prepared a Preliminary Drainage Study (RNR Design Group, 2007). Two hydrographs were developed for the 100-year, 12-hour storm. One hydrograph was for the existing, undeveloped project site, and the other was for the built-out, developed project site. The difference in the area under the two hydrographs (approximately 6,290 cubic feet) determined the theoretical volume of the detention basin. The volume of the proposed 245-foot-long, 7-foot-diameter detention basin would be 150 percent of the theoretical volume, so that it would perform well hydraulically.

A comment on the IS/MND stated that two consecutive smaller storms (i.e., back-to-back storms) might have more impact on the geomorphology of Larch Creek than a single 100-year storm. The commenter did not state which recurrence-interval storms were of concern. A 100-year storm has a one-percent chance of occurring each year. A 10-year storm has a

10-percent chance of occurring each year. Therefore, the chance of two, 10-year storms occurring in a year is one-percent, the same as a single 100-year storm. However, the chance that two, 10-year storms would occur back-to-back is in the order of magnitude of less than one percent.

Nevertheless, a brief analysis was made regarding the impact of two, back-to-back 10-year storms at the developed project site. A review of the Precipitation Duration-Frequency-Depth Curves B-159 and B-162 prepared by the Contra Costa County Flood Control and Water Conservation District, reveals that the precipitation depth for the 10-year storm is two thirds (67 percent) of the precipitation depth for the 100-year storm for storm durations of three, six, and twelve hours.

The time of concentration is defined as the time it takes for a drop of runoff to flow from the farthest location of the drainage basin to the basin outlet. Assuming that the ground at the project site is completely saturated from antecedent storms, the time of concentration would be approximately the same regardless of the frequency of the storm. Several formulae for estimating times of concentration (e.g., Kirpich and the California Culverts Practice) do not include rainfall intensity as a factor; times of concentration are based on length of watercourse, slope of the watershed, and runoff or roughness coefficients. Under this assumption the peak discharge rate from the proposed developed project, using the rational formula, would be proportional to the precipitation depth.

The pre-development peak runoff rate for the 100-year storm from that portion of the project site that will be developed is 40 cubic feet per second (cfs). The post-development 100-year peak discharge rate for the same area of the proposed project is 50 cfs (RMR, 2007). Therefore, a detention basin has been proposed to temporarily hold storm runoff and discharge at a flow rate of less than 40 cfs.

Using the two-thirds relationship described above, the anticipated discharge for a 10-year, 12 hour storm would be 33 cfs, which is less than the 40 cfs flow to Larch Creek from the existing, undeveloped site during the 100-year, 12-hour storm. The discharge from the detention basin through its 24-inch diameter outlet pipeline to Larch Creek would discharge 39.6 cfs when the basin is full under the 100-year storm scenario. Therefore, during the 10-year storm, the detention basin would partially fill until the head on the orifice of the outlet pipe would allow 33 cfs to flow through the outlet pipe to Larch Creek.

The time to drain the detention basin following two back-to-back 10-year, 12-hour storms could be longer than 24 hours. A concern was also raised that cleaner water discharged to Larch Creek during back-to-back storms might do more work (i.e., expend more energy) through shear forces on the creek channel, which could cause both erosion and subsequent sedimentation.

Creek turbulence, the primary cause of erosion, is strongest near the creek bed and banks. Erosion is typically caused by sediment particles that are carried in these turbulent zones that collide with, lift, and transport soil particles from the creek bed and banks. Cleaner water in

the creek would tend to pick up solids to replace the base load of the creek flow as turbulence in the creek decreases following a storm. This would return the creek to the sediment-carrying capacity that existed before the water in the creek cleared up.

The major hydrologic impact created by the project's proposed storm drain system is that the discharge for the western two-thirds portion of the site would be at a single location (i.e., the detention basin outlet) rather than all along the northern frontage of Larch Creek by means of surface runoff and creek bank seepage. Runoff from the eastern one third portion of the site that is not proposed for development would continue as it does under existing conditions. While this concentration of flow may cause some geomorphological impacts over a short distance upstream and downstream of the discharge location, the impacts would not be significant over the full length of Larch Creek. Therefore, erosion and subsequent deposition of solids caused by clean water shear forces do not appear to be a serious concern especially when velocities to the creek decline as discharge from the detention basin decreases at the ends of each of the two storms. Project plans have designed to comply with the Town of Moraga General Plan Policy PS5.6 that requires on-site storm water retention for new developments.

The total volume discharged to Larch Creek would increase by 6,300 cubic feet (cf) above existing conditions (RMR, 2007). However, since the Larch Creek watershed upstream of the project site is relatively small, this additional amount would be discharged to the creek following subsidence of the peak storm flows in the creek at the detention basin discharge location. The impact of the proposed project on the rate or amount of off-site surface runoff would be less than significant.

□ **MITIGATION MEASURE 3.3-2:** No mitigation measures are required.

Adequacy of Storm Drain System

IMPACT 3.3-3: The debris benches and storm drain system may not be adequate to accommodate storm runoff from uphill areas. This is considered a *potentially significant* impact.

The proposed debris benches at the tops of the graded slopes are designed to intercept mud and slide debris descending from the open space above. The debris benches would have 10 percent cross slopes. Surface water that percolates into the soil on the benches would find its way to the subdrain system below. The concrete V–ditches proposed for the downhill sides of the benches would intercept any surface water that does not percolate into soil and flows across the benches. Water intercepted in these ditches would be conveyed to catch basins and subsequently through storm drain pipes to the detention basin.

□ **MITIGATION MEASURE 3.3-3:** The V–ditches shall be designed to convey the surface runoff from the natural areas above the debris benches resulting from a 100-year, 12-hour storm with saturated soil conditions.

Groundwater Flow

IMPACT 3.3-4: The southeast to northwest trending fault that extends through the middle of the project site may affect the distribution of groundwater either by acting as a groundwater barrier or allowing transverse groundwater flow along the fault. This is considered a *less-than-significant* impact.

The supplemental geotechnical exploration by Engeo determined that there was no seepage or other indication of impounded groundwater where the fault was exposed in test pits and trenches. The sandstone and conglomerate encountered on the upslope side of the fault were red-brown in color suggesting that these units are in an oxidizing state, which means they are not saturated with water and are not below the groundwater table. Therefore, it appears unlikely that large quantities of groundwater will be encountered where the grading excavations intersect the fault zone (Engeo, 2009).

As stated previously, localized, low volumes of seepage likely will be encountered in the excavations, but the volume of water can be accommodated by the proposed subdrain system. Localized zones of perched groundwater exposed during grading may produce initial flows of a few gallons per minute. Usually within a few hours these flows will decrease to a fraction of a gallon per minute. Over the long term, the entire subdrain system should produce less than a gallon per minute (Engeo, 2009). The upper portions of the subdrain system will discharge to proposed wetland mitigation areas, and only the lower portions of the subdrain system will discharge directly to the creek. The discharge from the subdrain system will be negligible relative to the storm water flow regime of the creek, therefore the impact is considered insignificant.

□ **MITIGATION MEASURE 3.3-4:** No mitigation measures are required.

Drainage System Maintenance

IMPACT 3.3-5: The subdrain and storm drain systems may not function properly without periodic, long-term maintenance. This is considered a *potentially significant* impact.

The capacities of subdrains and storm drain pipelines can be reduced by sediments and litter that are deposited within them when flow velocities decrease after storms. Leaves and litter often flow down gutters plugging the grates of drop inlets (i.e., catch basins). Plugged drop

inlets often cause local gutter and street flooding. Therefore, an active and well-financed maintenance program is necessary to keep the subdrain and storm drain systems fully operational during the rainy season.

□ **MITIGATION MEASURES:**

3.3-5A: Prior to submitting the final map, the applicant shall submit a Stormwater Facilities Operation and Maintenance Plan, including detailed maintenance requirements and a maintenance schedule.

3.3-5B: A Joint Maintenance Agreement (JMA) shall be established for maintaining and cleaning the Hetfield Estates storm drain system, including subdrains, V–ditches, catch basins and gratings, storm drain pipelines, the detention basin, and the IMPs that are proposed in the Stormwater Control Plan for the proposed project (RMR, 2008a, Table 1). All facilities shall be cleaned prior to the rainy season (mid-October each year) and following every major storm. All Hetfield Estates property owners shall be required to contribute annually to fund the JMA. Potential buyers of Hetfield Estates properties shall be informed of their commitments to the JMA so that they can assess their ability to pay their annual contributions.

Larch Creek Hydrology

IMPACT 3.3-6: The storm drain system may adversely affect the hydrology of Larch Creek. This is considered a *less-than-significant* impact.

Concern was expressed during the public review process for the IS/MND that the proposed storm drain system could adversely affect flows in the creek. Base stream flows could be reduced causing the creek to dry up sooner in dry weather. The proposed underground storm water detention basin could also prolong the discharge of water to Larch Creek, which could cause increased creek bed and bank erosion.

During a storm, rainfall initially percolates into the soil and flows downward through the voids between the soil particles under the force of gravity. Some of the water reaches the groundwater table, and some of the runoff flows downslope toward Larch Creek where it seeps out of the banks into the creek. When the soils become saturated, rainfall runs off over the surface of the ground toward the creek. Some of the runoff evaporates and some is taken up by plants and later transpired back to the atmosphere.

The subdrains proposed for the project would intercept some of the percolated water and convey it either to the project's storm drain system that discharges to Larch Creek or to the stock pond or wetland, each of which overflows to the creek if there is more runoff than can be held in the pond/wetland. With either the undeveloped or developed project site,

essentially the same amount of runoff would reach Larch Creek, therefore the creek would not dry up faster if it were developed. Larch Creek is a seasonal stream that typically dries up during the summer months with the exception of runoff that is generated by adjacent residents irrigating their yards.

When a storm begins, runoff from impervious surfaces (roofs and pavements) will quickly flow to the IMP systems located throughout the developed portion of the project site. The vegetative growth in these facilities will slow down the flow. When the ground becomes saturated and percolation stops, runoff will flow through the IMP subdrains to the nearest storm drain catch basin. Clay soils at the project site allow very little percolation when saturated, so replacing these soils with impervious surfaces would have a smaller effect on the post-development runoff hydrograph for smaller recurrence-interval storms than for a development on sandier soils.

In accordance with the Contra Costa Clean Water C.3 Program requirements, the IMPs would maintain the pre-project flow rates and volumes to Larch Creek for smaller storm events up to the 10-year storm (a storm that has a ten percent change of occurring each year). These smaller storm events are events that can impact the receiving stream channel characteristics and geomorphology. The intent of the C.3 requirements is to mimic the pre-development hydrograph discharges to the creek for more frequent rainfall runoff events. Therefore, the amount of total energy generated by post-development discharges on the creek bed and banks would be less than under existing conditions. The range of flows for which the IMPs are applicable is widely accepted by the regulatory agencies and engineering profession as the range of flow that may affect downstream channel geomorphology (Buck, 2010).

Runoff from the hillsides above the developed portion of the project site will saturate the ground (if not already saturated) and then flow overland to the concrete V–ditches at the tops of the 3:1 graded slopes and hence to the catch basins at the ends of the ditches. Although the flow routes through the proposed storm drain system would be more circuitous than direct overland flow to the creek, the reduced friction in the hard-surface storm drain facilities would increase flow velocities so that the runoff would probably reach the creek sooner than under existing undeveloped conditions.

Storm runoff will flow through storm drain pipelines to the 7-foot-diameter detention basin under the main road on the project site. Initially, water will flow through the basin and out the 24-inch outlet pipe to Larch Creek. Storm runoff will reach the creek sooner than it does from the undeveloped site because much of the flow route is along paved gutters and storm drain pipelines. The runoff to the creek would occur at one location (the detention basin outlet) rather than along the entire frontage of the project site.

If the storm is large enough, the detention basin would begin to fill above the crown of the outlet pipe, and the outlet pipe would begin to act as an orifice. If the detention basin completely fills, the hydraulic head (i.e., pressure) would increase the outlet flow rate to a maximum of 39.6 cfs, which is less than the maximum allowed flow rate of 40 cfs from the

undeveloped site. As the storm subsides, flow from the detention basin would continue after the peak flow in the creek has passed. Therefore, discharge to Larch Creek would continue through the entire storm event. As the storm subsides, the flow velocity through the length of the detention basin would increase as the basin empties, re-suspending some of the deposited solids and carrying them to the creek. Discharge would continue until the detention basin is empty.

During lighter storms in the spring months, runoff would flow unimpeded through the storm drain system, including the detention basin, to the creek, and Larch Creek would not dry up any earlier in the year.

Thus, the proposed storm drain system, with its IMPs and detention basin, would not adversely impact flows in Larch Creek or the hydrology of the creek.

□ **MITIGATION MEASURE 3.3-6:** No mitigation measures are required.

Groundwater

IMPACT 3.3-7: The presence of groundwater in an engineered fill is capable of adversely affecting the stability of engineered slopes. This is considered a *potentially significant* impact.

The grading plans for the project identify surface drainage facilities along with drainage easements on the private lots that allow runoff to be collected and conveyed to the project's storm drain system. The Engeo geotechnical report provides recommendations for the construction of subsurface drainage systems in order to control perched near-surface groundwater. The locations of the subdrains are to be selected in the field during construction based upon the recommendations of the geotechnical engineer. No mid-slope terrace drains are required on the proposed 3:1 (horizontal to vertical) fill slopes.

□ **MITIGATION MEASURES:**

3.3-7A: Lined ditches capable of collecting surface runoff shall be provided at the toe of the engineered slope to collect and transport runoff from the fills to the selected discharge points.

3.3-7B: During grading, the location and approximate depth of subdrains shall be established by field survey. At the conclusion of site grading, the project applicant shall submit an as-built drainage plan showing the location and elevation of the subdrains and cleanouts, as well as the surface drainage facilities.

The following impact and mitigation measure was included in the IS/MND and continues to apply to the proposed project.

Creek Vegetation

IMPACT 3.3-8: Construction of a storm drain discharge structure and access bridge could impact Larch Creek and the vegetation within the creek corridor. This is considered a *potentially significant* impact.

Development plans call for the roadway bridge to span the creek with its anchors located on both creek banks, staying out of the riparian corridor. As discussed in Section IV. Biological Resources in the Initial Study/Proposed Mitigated Negative Declaration, several small oaks would be removed. Additionally, the potential exists that a 30-inch-diameter coast live oak located in very close proximity to the southwest side of the proposed bridge crossing could also be impacted. The storm drain outlet into Larch Creek would require removal of vegetation in the immediate vicinity of the outlet.

☐ **MITIGATION MEASURE 3.3-8:** The applicant shall contact the United States Corps of Engineers and the California Department of Fish and Game to obtain required permits and a Streambed Alteration Agreement for construction and operation of a storm drain discharge structure and access bridge over Larch Creek.

Sources of Information

Blatner, Dana, Public Works Department, Town of Moraga. 2010. Personal communication with Robert Mills, Mills Associates, April 20.

Boucher, Mark, Contra Costa County Flood Control and Water Conversation District. 2010. Personal communication with Robert Mills, Mills Associates, April 26.

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Kennedy, Frank, Town Engineer, Town of Moraga. 2010. Personal communication with Robert Mills, Mills Associates, April 19.

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RMR Design Group. 2008b. Hetfield Estates, Subdivision 9051,Creek Flow Calculations, July 1.

RMR Design Group. 2008. Hetfield Estates, Subdivision 9051, Conceptual Development Plan, August 27.

Rourke, Robert, RMR Design Group. 2010. Personal communications with Robert Mills, Mills Associates, March 31 and April 20.

Skinner, Ray, Engeo, Inc. 2008. Memorandum to John Wyro, The Wyro Company, re: seepage area on Lot 1, May 30.

Skinner, Ray, Engeo, Inc. 2010. Personal communication with Robert Mills, Mills Associates, April 20.

3.4 PLANNING AND LAND USE

This section provides an overview of the plans and policies of the Town of Moraga. It describes the project's consistency with policies relating to land use, open space and the Moraga Open Space Ordinance (MOSO). Policies in the Community Design, Housing, Safety and Open Space Elements pertaining to neighborhood compatibility, slope stability, watercourse preservation, storm water retention, and riparian corridors have been identified in the preceding sections.

Setting

General Plan and Zoning Designations

The Town of Moraga General Plan is the Town's chief planning document for the area (General Plan, 2002). Adopted in June 2002, the plan sets out goals and policies for development throughout the town limits and its sphere of influence. The land use policies described in the General Plan are implemented by means of the Town's Zoning Code, which further defines permitted land uses and development requirements.

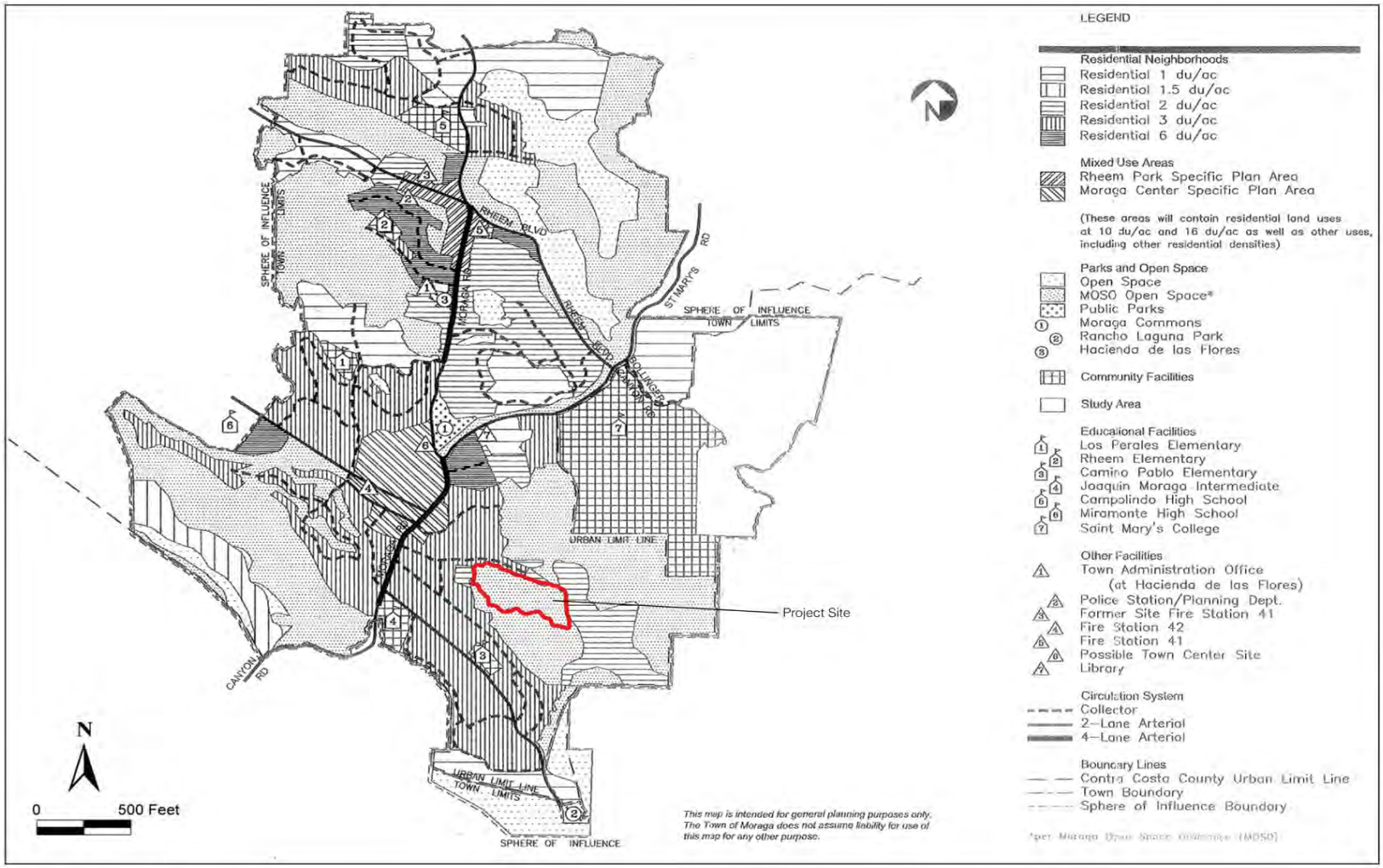
The General Plan Land Use map is a part of the General Plan Land Use Element and shows the land use designation for all areas within the town limits and its sphere of influence. Figure 3.4-1 shows the General Plan designations for the project site and the entire community. The project area is designated MOSO Open Space (Moraga Open Space Ordinance). As stated in the Land Use Element, the density for MOSO designated land is as follows:

> LU1.5 Development Densities in Open Space Lands. Notwithstanding any other provision of the General Plan, any development on lands depicted on the General Plan Diagram or by the Moraga Open Space Ordinance as "Public Open Space–Study" or "Private Open Space" (now designated as MOSO Open Space in the General Plan Diagram) shall be limited to a maximum density of one (1) dwelling unit per twenty (20), ten (10), or five (5) acres, but in no case shall density on such lands exceed one (1) dwelling unit per five (5) acres. Areas identified as "high risk" areas, as defined by the Moraga Open Space Ordinance, shall be limited to a maximum density of one (1) dwelling per twenty (20) acres.

Because the project site is located on land designated as MOSO, other elements and their policies also apply when considering the proposed residential development. Relevant policies pertaining to the proposed project are as follows:

LAND USE

> LU1.6: Minimum Lot Sizes and Percentage Mix for Single Family Developments. For MOSO Open Space designated land the minimum lot size is 40,000 square feet.



Source: Town of Moraga

Figure 3.4-1 General Plan Land Use Map

e) *Lot sizes in Open Space Areas*. Lot sizes in areas designated…"MOSO Open Space on the General Plan Diagram may be less than 40,000 square feet, but not less than 15,000 square feet when part of the overall project will provide outdoor recreational facilities with guaranteed permanent access to the general public. This policy may not be used to alter the density on lands designated MOSO Open Space.

Under the terms of the Moraga Open Space Ordinance, development is prohibited on slopes greater than 20 percent in areas designated MOSO Open Space.

LU1.8: Slope Restrictions. ….development shall be avoided on slopes of 20 percent or steeper, but may be permitted if supported by site-specific analysis. No new residential structures may be placed on after-graded average slopes of 25 percent or steeper within the development area….

LU1.9: Cluster Housing to Protect Open Space. Provide for the permanent preservation of open space by allowing clustered housing designs in areas designated MOSO Open space…However, do not place cluster housing in locations that are visually prominent from the scenic corridor or where it would adversely impact existing residential areas.

LU1.10: Planned District Zoning. Apply Planned District zoning for all new residential development on parcels in excess of ten (10) acres (with the exception of MOSO Open Space areas) and on parcels designated as Residential – 6 DUA. The Planning Commission may, at its option, require any residential development to be processed by Planned District when issues relating to access, visual impact, geologic hazards, environmental sensitivity, community design and other related factors are deemed to be significant.

LU1.12: Residual Parcels as Open Space. Residual parcels within designated MOSO Open Space shall remain designated MOSO Open Space as required by the Moraga Open Space Ordinance.

OPEN SPACE AND CONSERVATION

Open Space Preservation

OS1.1: Open Space Preservation. Preserve open space to the maximum extent possible, using tools such as acquisition, lease, dedication, easements, donations, regulation or tax incentive programs.

OS1.2: Major Ridgeliines. Moraga's major ridgelines are highly visible throughout the Town and are included within areas designated as MOSO Open Space on the General Plan Diagram.

OS1.3: Development Densities in Open Space Areas. Any use of or development on lands designated on the General Plan Diagram or by the Moraga Open Space Ordinance as 'Public Open Space-Study' or 'Private Open Space' (now designated as MOSO Open Space in the General Plan Diagram) shall be limited to a maximum density of one (1) dwelling unit per twenty (20), ten (10), or five (5) acres, but in no case shall density on such lands exceed one (1) dwelling unit per five (5) acres. Areas identified as 'High Risk' areas, as defined by the Moraga Open Space Ordinance, shall be limited to a maximum density of one (1) dwelling unit per twenty (20) acres. Transfers of Development Rights (referred to as 'Density Transfer' as in MOSO) from any open space designation to other lands shall be encouraged; provided that in no event shall dwelling units be transferred to another open space designation or to 'High Risk' areas. The Town Council shall identify 'High risk' areas after taking into account soil stability, history of soil slippage, slope grade, accessibility, and drainage conditions.

OS1.4: Private Ownership and Use of Open Space Areas. Areas designated on the General Plan Diagram as MOSO Open Space or Non-MOSO Open Space may be retained in private ownership, may be used for such purposes as are found to be compatible with the corresponding open space designation and may or may not be accessible to the general public.

OS1.5: Development on Slopes and Ridgelines in Open Space Lands. In MOSO Open Space, development shall be prohibited on slopes with grades of twenty percent (20%) or greater and on the crests of minor ridgelines. The Town council shall reduce the allowable densities on slopes of less than twenty percent (20%) through appropriate means such as requiring proportionally larger lot sizes or other appropriate siting limitations. For the purposes of this paragraph the term 'minor ridgeline' means any ridgeline including lateral ridges, with an elevation grater than 800 feet above mean sea level, other than a major ridgeline.

OS1.8: Open Space Access and Recreational Use. Where appropriate and consistent with the General Plan goals and policies, areas with a MOSO Open Space or Non-MOSO Open Space designation on the General Plan Diagram should be made available to the public for recreational use.

Environmental Quality

OS2.1: Protection of Wildlife Areas. Prohibit development in locations where it will have a significantly adverse effect on wildlife areas. When development is permitted in the vicinity of wildlife areas, require implementation of appropriate mitigation measures to reduce any adverse impact upon wildlife.

OS2.2: Preservation of Riparian Environments. Preserve creeks, streams and other waterways in their natural state whenever possible.

OS2.3: Natural Carrying Capacity. Require that land development be consistent with the natural carrying capacity of creeks, streams and other waterways to preserve their natural environment.

OS2.5: Wildlife Corridors. To the extent possible connect open space areas so that wildlife can have free movement through the area, bypass urban areas and have proper access to adjacent regional parks and related open space systems.

OS2.8: Tree Preservation. Preserve and protect trees wherever they are located in the community as they contribute to the beauty and environmental quality of the Town.

OS2.9: Tree-covered Areas. Preserve or substantially maintain in their present form certain tree-covered areas, especially with respect to their value as wildlife habitats, even if development in those areas is permitted. Give preference to the retention of original growth over replanting. These areas include, but are not limited to:

d) – l).....

m) Wooded area on the ridge south of Sanders Drive.

Water Quality and Conservation

OS3.1 Sewer Connections. Require all development to be connected to a sewage system….

The proposed project is consistent with Land Use policies regarding lot size, slope restriction, clustering of housing to protect open space, establishing a Planned District and leaving the residual parcel (number 7) as permanent open space. Lot sizes range from a low of 41,826 square feet to a high of 59,930 square feet. Slope gradient is less than 20 percent for all six lots. The houses are clustered along the toe of the slope in order to protect the upper slope and ridge that will remain as permanent open space.

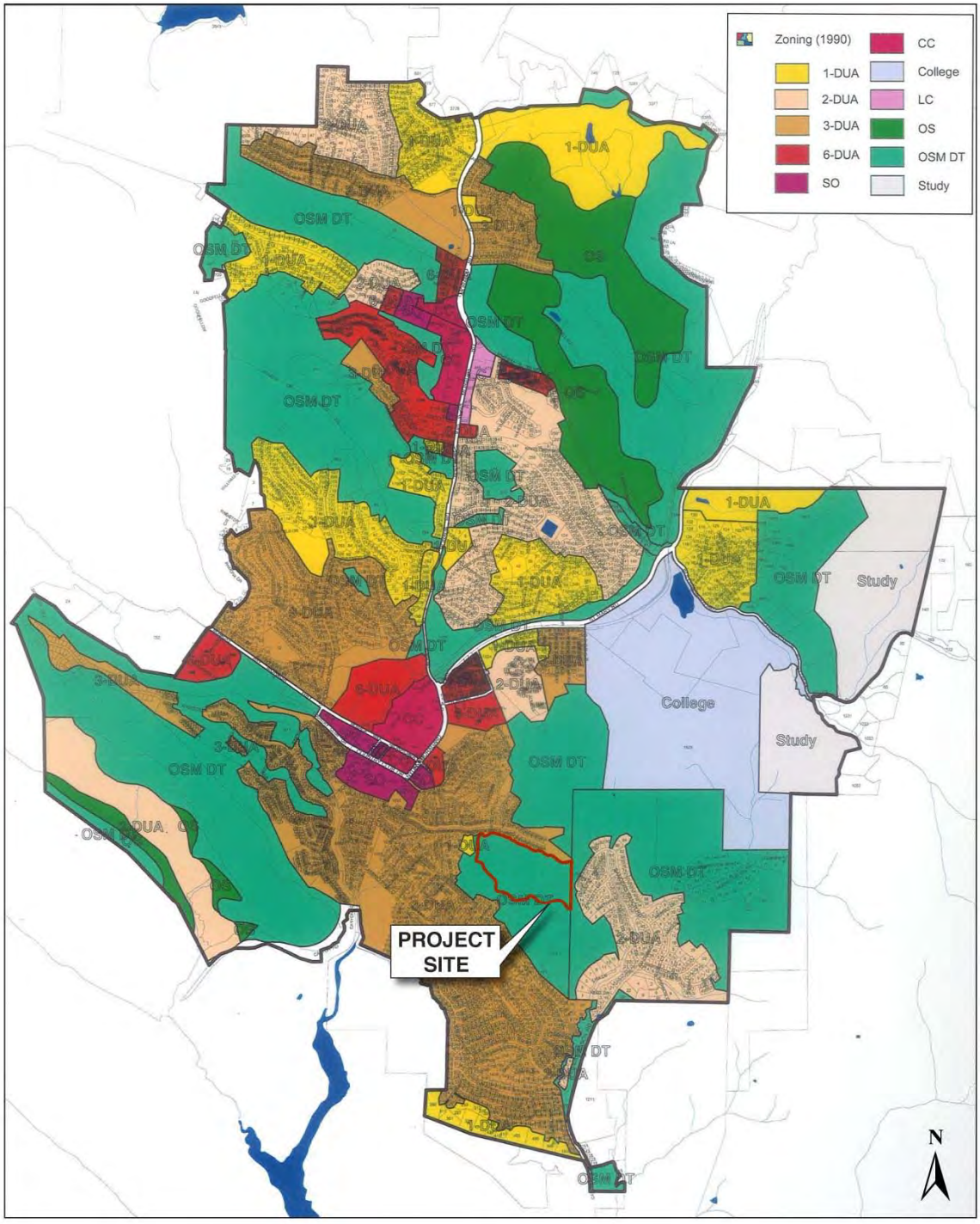
Open Space and Conservation policies lay out a framework by which development can occur within MOSO designated land, providing the proposed development is consistent with these policies. The proposed project provides a permanent open space easement on 51.45 of the total 58.2 acres. Trails would be available to the public, which will extend through the property and connect to other public trails located southeast of the project site. The northeast/southwest trending ridgeline is not identified as a major ridgeline in the Town's General Plan; however, it is considered a minor ridgeline and would be protected through the open space easement. The open space would be privately owned with a public easement overlaying the identified area. Development would be contained to slopes that have a less than 20 percent gradient and the density of the proposed project is lower than what could be allowed. Therefore, the proposed project is consistent with the policies of the Open Space Preservation segment of the Open Space and Conservation Element.

The Environmental Quality segment of the element is directed to the protection of wildlife areas, riparian environments, wildlife corridors, tree preservation and tree covered areas, as well as the carrying capacity of the land. The Biological Resources section of the Initial Study/Mitigated Negative Declaration discusses the potential impacts of the development and identifies numerous mitigation measures to reduce the impacts. There will be a temporary disturbance to wildlife once grading and site improvement activities begin, but the open space area would continue to provide habitat for the various species that currently utilize the site. Wildlife corridors would not be eliminated and the riparian corridor along the creek would not be disturbed except where the bridge crossing and storm drain outfall would be located. There will be some trees eliminated and mitigation measures requiring the replacement of these trees has been included. The proposed storm drain system and underground detention basin would reduce flows during peak storm events. The amount of projected runoff does not exceed current conditions.

The proposed project is consistent with OS3.1 regarding sewer connections. The proposed houses would be connected to the Central Contra Costa Sanitary District sewer.

Zoning

The project site is currently zoned OSM-DT (Open Space Moraga – Density Transfer) as shown in Figure 3.4-2. This designation implies that any development on MOSO designated lands comply with the requirements of the Moraga Open Space Ordinance (MOSO) that was adopted in April 1986. The purpose of the Ordinance is to revise and augment policies of the General Plan relating to the preservation of open space and protection of ridgelines. The ordinance is the instrument by which the policies of the General Plan are carried out.



Source: Town of Moraga

Figure 3.4-2 Zoning Map

The MOSO designation allows the following conditional uses: single-family residential dwelling; public or private park or nonprofit recreational facility, playground, trail and related facility; public or private school; and accessory uses and structures incidental to conditional uses (Ord. 173 § 1 (part), 1998). Densities on MOSO designated land is determined by the Planning Commission based upon site constraints of the property and in compliance with applicable goals and policies of the General Plan (Ord. 173 § 1 (part) 1998). As stated above, the General Plan Diagram limits the maximum density of one dwelling unit per 20, 10 or 5 acres and in no case shall density exceed one unit per 5 acres. In areas of high risk, the density is restricted to one unit per 20 acres.

The MOSO ordinance also allows for increased density in areas classified as high risk. This can be done providing the Town is satisfied that the characteristics making the site high risk can be abated by appropriate remedial efforts which are consistent with CEQA and the Goals and Policies of the General Plan. The following risk factors must be considered prior to making the density determination:

a. whether the area has the potential to be adversely impacted by a landslide, unstable soil, soil with a history of slippage or a slope subject to severe surface erosion or deterioration;

b. whether the site serves as a natural drainage way or swale, with a drainage basin of 50 acres or more or crossed by a perennial or ephemeral (intermittent) drainage channel;

c. whether the project is within 50 feet of a known active or dormant fault trace;

d. whether the site contains a regular or intermittent spring or adverse ground water conditions;

e. whether the site is located within 1900 yards upstream or 500 yards downstream of a reservoir, detention basin or pond of one acre or more in surface area;

f. whether the site is located within an area subject to enhanced seismically induced ground shaking or a seismically induced ground failure such as a landslide, lateral spread, rockfall, ground lurching, liquefaction, soil settlement, differential compaction and compression; and

g. whether the site is located within an area subject to the effect of seismically induced flooding and/or dam or stock pond failure.

The Ordinance also states that precise site standards for the development of property within the district requires a conditional use permit, which is prescribed at the time the reviewing authority approves the issuance of the conditional use permit. The standards fix the lot area, frontage, front, side and rear setbacks, building height and site coverage requirements.

Impacts and Mitigation Measures

CEQA Significance Criteria

Appendix G of the CEQA Guidelines identifies environmental issues to be considered when determining whether a project could have significant effects on the environment. As identified in Appendix G, the following issue relevant to the proposed project is considered when evaluating the project's consistency with planning policy:

- Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect.

Project Details

The proposed project consists of subdividing the property into seven lots with the lots ranging in size from .96 acres to 51.45 acres. Lot 7, the largest lot, would remain in permanent open space available to the public with a trail connecting to an existing public trail at the southeast corner of the property. The six residential lots are clustered at the base of the slope, fronting along the northern edge of the project site. An open space easement separates the six houses and roadway from the creek. A trail will extend east through this open space easement eventually following the northwest/southeast trending ridge.

The project applicant is requesting approval of six residential lots on the 58.2-acre site, which results in a density of one dwelling unit (du) per 9.7 acres. To be eligible for an increase in density, the site must not be considered high risk. An assessment of the proposed project is utilized to make this determination, based upon the criteria identified in the MOSO ordinance.

The proposed project is being processed as a Planned Development because it exceeds 10 acres in area. In addition, the proposed project will require a Conditional Use Permit, a Hillside Development Permit, as well as undergo Design Review of future house plans. The minimum required lot areas, dimensions, and setbacks will be established through approval of a Conditional Use Permit.

Project Impacts

General Plan Consistency

IMPACT 3.4-1: The applicant is requesting an increase in density of one unit per 20 acres to one unit per 9.7 acres. This is considered a *less-than-significant* impact.

LU1.5 and OS1.3 identify the development density for MOSO Open Space designated land. Density is limited to one dwelling unit per 20, 10 or 5 acres. The applicant is proposing a density of one dwelling unit per 9.7 acres. In order for the Planning Commission to consider whether density can be increased on the project site, it must be determined that the site is not considered "high risk." This status determination is established in the MOSO Ordinance. An area is classified as high risk depending upon both (1) its own site characteristics and (2) its location in relation to other geological and topographical conditions. MOSO provides criteria to determine whether the density can be increased. The following points summarize the risk factors to make density determination followed by a summarized response:

a. whether the area has the potential to be adversely impacted by a landslide, unstable soil, soil with a history of slippage or a slope subject to severe surface erosion or deterioration;

   Response: Previous reconnaissance mapping supplemented by limited subsurface exploration confirmed six landslides within the area proposed for residential development. The landslides are primarily slumps and earthflows. Slides range up to 20 feet in thickness and are considered slow moving. Slide debris within the development area would be removed and replaced with engineered fill. The grading plan for the project indicates that the reconstructed fill slope would have a gradient of 3:1 (horizontal to vertical). A large slump block exists upslope of the development area in the open space. This would not be disturbed. Debris benches would be installed, creating a flatter slope gradient to trap a slump block. Anticipated slope instability is located outside the proposed development area. (Refer to discussion in Section 3.2 Geology/Soils.)

b. whether the site serves as a natural drainage way or swale, with a drainage basin of 50 acres or more or crossed by a perennial or ephemeral (intermittent) drainage channel;

   Response: The project site's drainage basin is less than 50 acres. Presently runoff from the site (easterly-facing slope) flows downslope to Larch Creek, an ephemeral stream. Project plans call for an underground and above ground storm drain system with an underground detention basin to monitor flows into Larch Creek during peak storm periods. Natural drainage ways that would not be altered by the proposed development are located outside the areas proposed for grading and development. (Refer to discussion in Section 3.3 Hydrology/ Drainage.)

c. whether the project is within 50 feet of a known active or dormant fault trace;

   Response: The property is crossed by a northwest-trending fault, although it is not considered active by the state and federal geological surveys. In the event of a major earthquake on the Hayward fault however, it could be reactivated. As

required by the Alquist-Priolo Act, the fault zone would be mapped on the final map. The proposed houses are set back sufficiently from the fault zone. (Refer to discussion in Section 3.2 Geology/Soils.)

d. whether the site contains a regular or intermittent spring or adverse ground water conditions;

Response: The project site does contain springs, however the springs are located within the open space area, outside the area proposed for development. (Refer to Conceptual Development Plan, Figure 2-1.)

e. whether the site is located within 1900 yards upstream or 500 yards downstream of a reservoir, detention basin or pond of one acre or more in surface area;

Response: No ponds of one acre or more in surface area are proposed within 500 yards of the proposed development. The nearest reservoir is located approximately three miles southwest of the project site.

f. whether the site is located within an area subject to enhanced seismically induced ground shaking or a seismically induced ground failure such as a landslide, lateral spread, rockfall, ground lurching, liquefaction, soil settlement, differential compaction and compression; and

Response: The site does contain an inactive fault trace and a major earthquake on the Hayward fault could result in slope movement. Houses would be set back from identified fault zone at a sufficient distance. The risk of structural damage from ground shaking is low provided the requirements of the Uniform Building Code are followed. The site has low liquefaction potential. Houses will be subject to the shrink/swell characteristics of expansive soils. This can be reduced through the use of pier and grade-beam foundation, placing slabs on select, granular fill, and/or use of rigid mat or post-tension slabs. (Refer to discussion in Section 3.2 Geology/Soils.)

g. whether the site is located within an area subject to the effect of seismically induced flooding and/or dam or stock pond failure.

Response: There are no dams or stock ponds on the project site that could cause flooding as a result of seismic event.

The proposed project complies with the MOSO requirements. It meets the above criteria to no longer be considered high risk and thus, allow the increase in density. The development plan proposes five fewer housing sites than what could be allowed should the Planning Commission approve a maximum increase in density. Therefore, the proposed project complies with LU1.5 and OS1.3.

☐ **MITIGATION MEASURE 3.4-1:** No mitigation measures are required.

Consistency with MOSO Ordinance

IMPACT 3.4-2: A small portion of Lot 1 is located outside the MOSO cell. This is considered a *potentially significant* impact.

Figure 3.4-3 illustrates the pre-development MOSO cell analysis. A review of this map indicates that a small portion in the northern boundary of Lot 1 is outside the MOSO cell and was not included in the cell analysis. As required in the MOSO ordinance, the entirety of an individual lot must be calculated to determine that the average slope is less than 20 percent within a defined cell. Development must occur within the cell. The calculations show that under pre-development conditions the average slope is 18.39 percent which is far below the 20 percent maximum permitted. The small portion that has not been included in the calculations would increase the percentage of slope gradient, but not enough to exceed the maximum percentage.

Figure 3.4-4 illustrates the post-development cell calculations within each lot. Average slope ranges from a high of 18.4 percent on Lot 4 to a low of 16.41 percent on Lot 6. The overall development complies with the maximum 20 percent average slope.

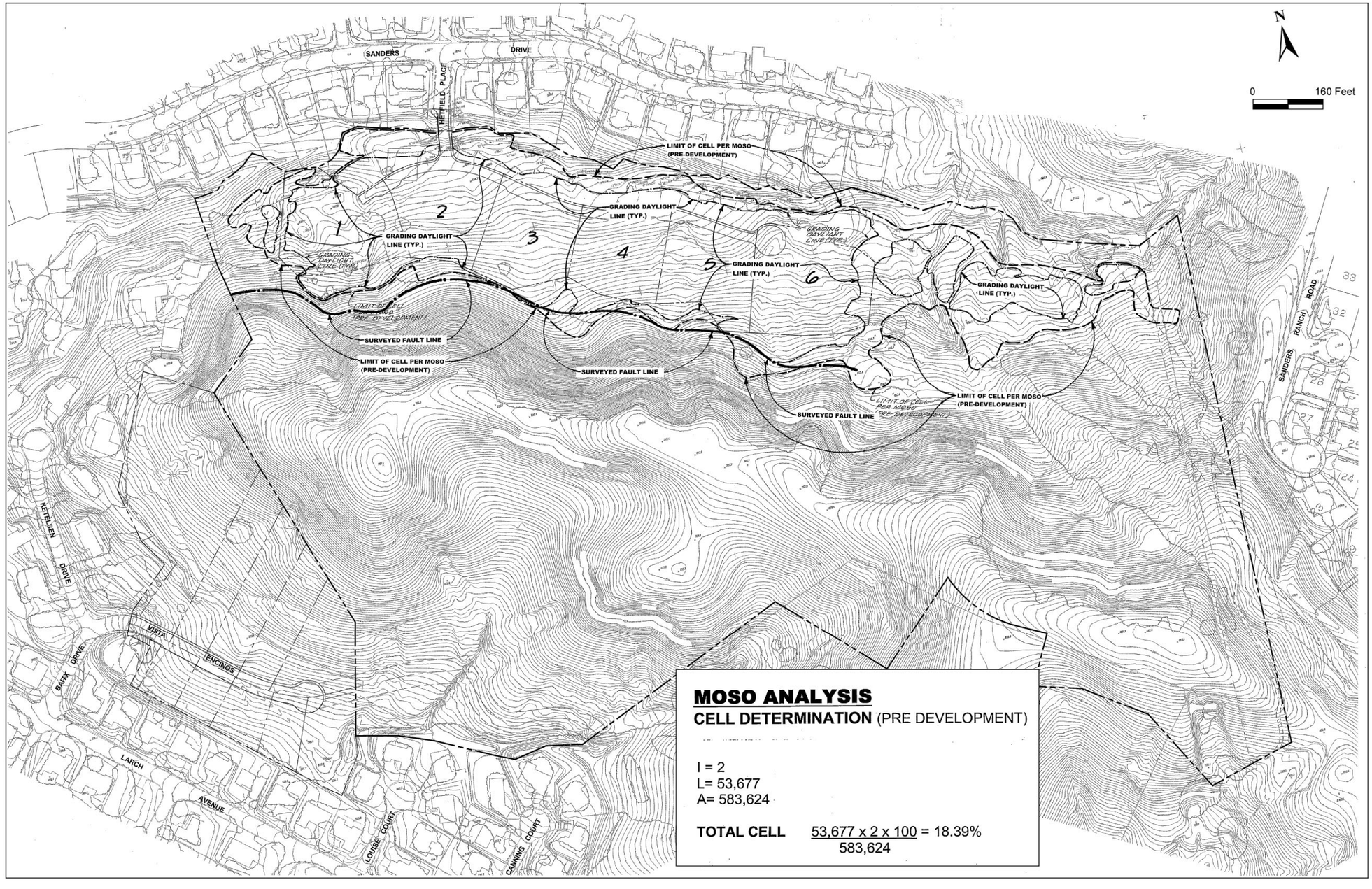
☐ **MITIGATION MEASURE 3.4-2:** The applicant shall revise the Conceptual Development Plan to include all of the area within Lot 1 in the MOSO Cell Analysis for both pre- and post-development conditions, prior to approval of a general development plan.

Sources of Information

RMR Design Group, 2008, Conceptual Development Plan, August 27.

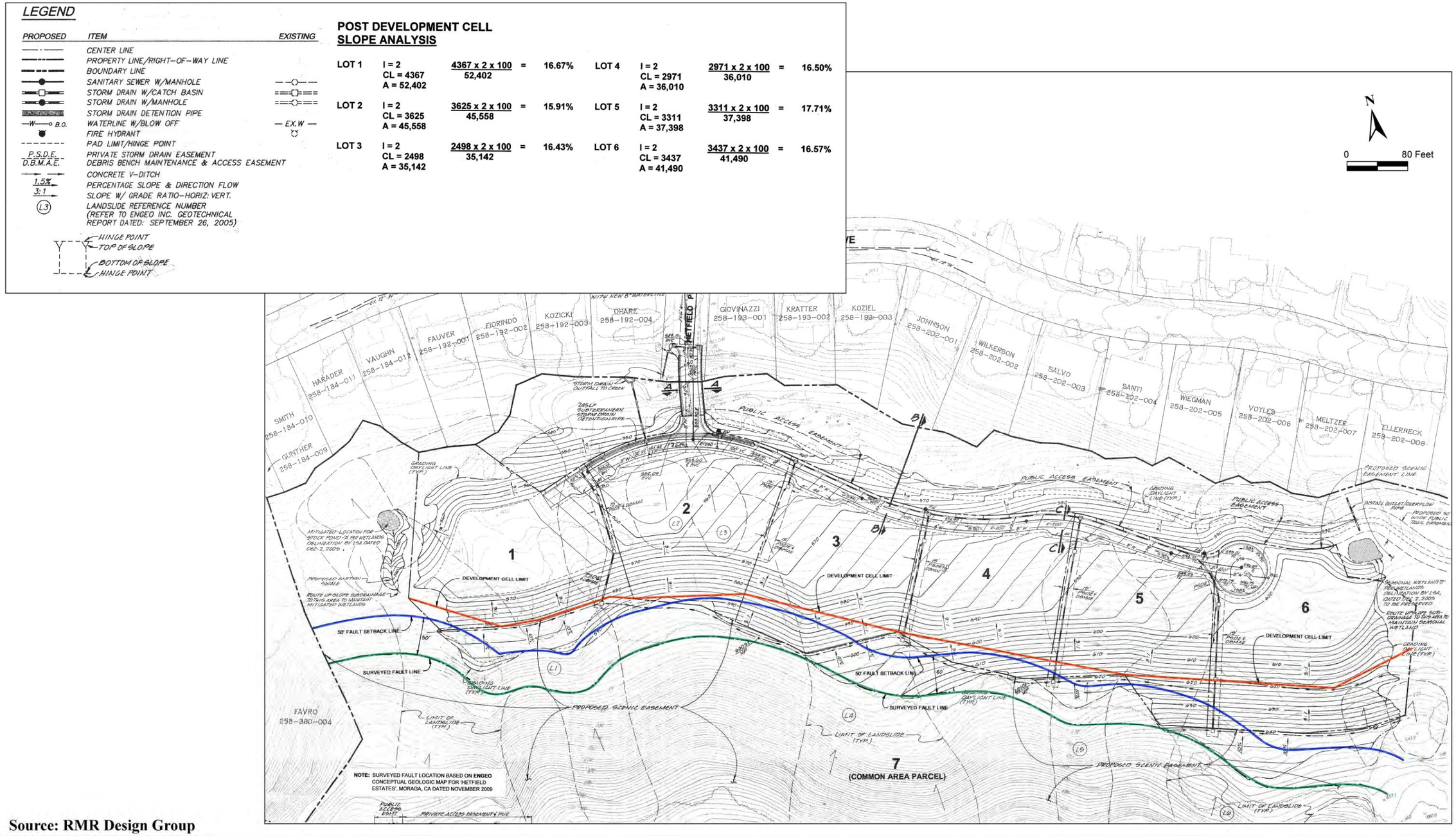
Town of Moraga, 2002, *General Plan*, June.

Town of Moraga, 1986, *MOSO Guidelines,* April 26.



Source: RMR Design Group

Figure 3.4-3 MOSO Cell Analysis - Pre-development Conditions



Source: RMR Design Group

Figure 3.4-4 MOSO Cell Analysis - Post-development Conditions

4
IMPACT OVERVIEW

4.1 SIGNIFICANT AND UNAVOIDABLE ADVERSE IMPACTS

The phrase "significant effect on the environment" is defined as follows in Section 15382 of the CEQA Guidelines (2010).

> "Significant effect on the environment" means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project, including land, air, water, mineral, flora, fauna, ambient noise, and objects of historic or aesthetic significance. An economic or social change by itself shall not be considered a significant effect on the environment. A social or economic change related to a physical change may be considered in determining whether the physical change is significant.

Section 15126 of the State CEQA Guidelines (2010) requires that the EIR describe any significant impacts, including those that can be mitigated, but not reduced to a level of insignificance. Where there are impacts that cannot be alleviated without imposing an alternative design, their implications and the reasons why the project is being proposed, notwithstanding their effect, should be described.

The environmental effects of adopting and implementing the proposed project on selected aspects of the environment are discussed in detail in Chapter 3 of this EIR, as well as identified in Appendix B. All potentially significant impacts identified throughout Chapter 3 can be mitigated to a less-than-significant level providing all of the mitigation measures are implemented as recommended.

4.2 BENEFICIAL IMPACTS

The beneficial impact of the project, if implemented, would provide permanent open space, a creek crossing and new trail available for public use that would connect to the existing public trail system. The trail system would not be available to the public if the site is left undeveloped or used for other agricultural purposes. Landslides currently occurring on the project site would be stabilized and measures to control underground drainage that contribute to the ground movement would be implemented.

4.3 IMPACTS FOUND NOT TO BE SIGNIFICANT

Section 15128 of the State CEQA Guidelines requires that an EIR contain a statement briefly indicating the reasons that various possible new significant effects of a project were determined not to be significant, and were therefore not discussed in detail in the EIR. Some of those effects are discussed in the individual topics in Chapter 3. The effects listed here were determined to be less than significant based on the discussion contained in the Initial Study contained in Appendix B. The Initial Study Checklist found that implementation of the proposed project would not create impacts in the following environmental categories: loss of agricultural land, health hazards, mineral resources, noise, population/housing, recreation, and utilities/service systems.

4.4 CUMULATIVE IMPACTS

Section 15130 of the State CEQA Guidelines requires consideration and discussion of cumulative impacts of the proposed project. The cumulative discussion is required when the project's incremental effect is cumulatively considerable and the cumulative impact is significant. Incremental effects that are less than significant should also be discussed.

A cumulative impact is an impact that is created as a result of the combination of the project evaluated in the EIR together with other projects causing related impacts.

Cumulative impacts of the proposed project would relate to the loss of biological resources; increase in drainage; increase in traffic volumes, loss of open space and the increased demand for public services and utilities in combination with other potential development within the Town of Moraga.

Development of the project site would incrementally add to the cumulative loss of biological resources and open space within the Town of Moraga. The entire development envelope consists of 6.75 acres, which would be permanently lost This represents a 0.3 percent loss of open space (Moraga 2000 General Plan Update, 1999) within the Town and is considered a less-than-significant impact. The increased drainage from the development area would contribute to the Larch Creek watershed. However, because flows would be monitored through the use of a detention basin to prevent potential flooding, this is considered a less-than-significant cumulative impact.

Cumulative traffic conditions (Nickelson, 2010) were based upon the recent analysis identified in the *Moraga Center Specific Plan* (2008). The Plan identified year 2030 cumulative conditions at the Moraga Road/Moraga Way intersection. Intersection operation is expected to operate at an acceptable LOS "D" during both peak periods. The proposed project would add about 0.2 percent to the cumulative volumes at the Moraga Road/Moraga Way intersection. This is considered a less-than-significant impact.

The proposed project would also place an incremental demand on public services and utilities. Discussions with the water and wastewater providers indicated that they either have the water supply or treatment capabilities to serve both the project and future users. (Refer to Section XVI in Appendix B. The incremental demand on local services such as the schools, fire service in combination with the cumulative growth within the Town is considered less-than significant. However, the demand for police services in conjunction with other development (not yet constructed) could adversely affect police services. This impact is identified in Section XIII of Appendix B.

4.5 GROWTH-INDUCING IMPACTS

Implementation of the residential project would not create a growth-inducing impact within the Town or in the project vicinity. The project site is considered infill since it is surrounded by development. The proposed project does not set a precedent for development on MOSO lands since this has occurred previously within the Town. Future projects that may be proposed on MOSO land would have to be considered on their own merits.

Sources of Information

Nickelson, George, P.E., 2010, Letter to John Wyro, applicant, April 28.

Town of Moraga, 1999, Moraga 2000 General Plan Update, pages 2-3, November.

5
ALTERNATIVES

5.1 INTRODUCTION

CEQA Guidelines, Section 15126(d), require that an EIR describe a range of reasonable alternatives to the proposed project, or to the location of the project, that could feasibly attain most of the basic objectives of the project. In addition, the alternatives should also avoid or substantially decrease the significant adverse environmental impacts identified for the proposed project even if these alternatives impede to some degree the attainment of project objectives or are more costly.

The applicant's objectives for implementing the proposed project include the following:

- Construct and market single-family custom lots that would accommodate homes on estate-sized lots;
- Avoid development on the ridge top and steep slopes;
- Cluster the development on a smaller portion of the property, significantly reducing all project impacts;
- Provide a significant portion of the property as permanent open space;
- Preserve existing wildlife corridors and avoid sensitive plants and wildlife; and
- Construct debris benches and perform slide repair in connection with grading and creation of project lots to ensure future protection of both project homeowners and adjacent homeowners.

The alternatives required by CEQA must include a "No Project" analysis that discusses existing conditions and what could reasonably be expected to occur on the site in the foreseeable future given current community plans and available public infrastructure and services. In addition, CEQA guidelines require that an environmentally superior alternative be designated. If the alternative with the least adverse environmental impact is the "No Project" alternative, then one of the remaining alternatives is to be designated as the environmentally superior alternative. This analysis considers four alternatives, which are: (1) No Project – the project site remains vacant; (2) 3-lot subdivision on reduced project acreage; (3) 8-lot subdivision on reduced project acreage; and 11-lot subdivision on proposed project acreage.

5.2 NO PROJECT ALTERNATIVE

Under this alternative, conditions would remain the same. There would be no slide repair of the hillside or measures taken to control underground seeps. Access to the on-site trails would not be allowed, as the property is considered private open space that is not accessible to the public. If left undeveloped, it is likely that the site would once again be used for cattle grazing or possibly for other agricultural uses, such as a vineyard. Cultivating the site would reduce and/or eliminate habitat and would not result in corrective grading/stabilization of the site. Depending upon the type of agricultural use that could occupy the site, such as a horse facility, potential problems associated with odors and pests could arise. Such a facility would require a bridge crossing, resulting in increased traffic. The project site could also be used for a community garden that would attract traffic. Any agricultural use would not require a conditional use permit.

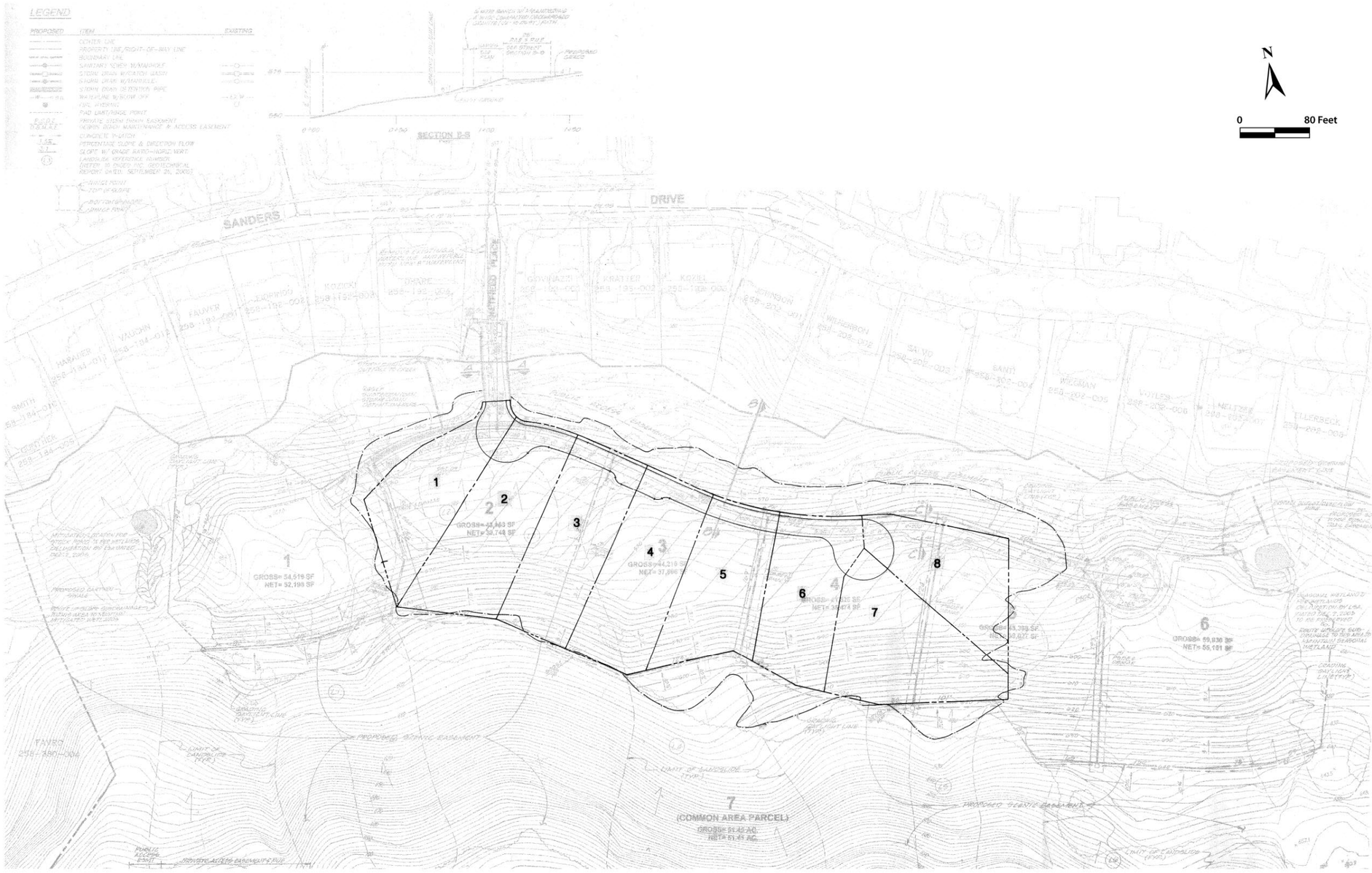
This alternative does not meet the proposed project objectives pertaining to development of the project. If left in its present state, the site does however meet the project objectives to preserve wildlife corridors, retain the ridge top and steep slopes as well as leave the property in open space.

5.3 THREE–LOT SUBDIVISION ON REDUCED PROJECT ACREAGE

This alternative consists of three lots contained within a reduced development area. Under this alternative the amount of grading would be reduced, as well as the number of debris benches and soils repair that would be required for the proposed project. The major slide that occurs in the area of proposed lot 6 would not be repaired, nor would the slide that occurs in the area of proposed lot 1 be repaired. The alternative plan would site the lots within the two existing slides. The three-lot alternative on the reduced project acreage would result in only three lot owners maintaining the entire remaining project site as permanent open space. The cost to improve the development area under this alternative, as well as to construct the private road would make this alternative economically infeasible. In addition, it is unlikely that three individual homeowners would want to take on the financial burden of maintaining the open space area. This alternative does not meet the project applicant's objective, as it is not considered an economically viable alternative to the proposed project.

5.4 EIGHT–LOT SUBDIVISION – REDUCED PROJECT ACREAGE

Figure 5-1 illustrates an alternative that consists of eight lots contained within a reduced development area. The development area essentially covers the same area for proposed project lots 2-5. The total development area would consist of approximately 3.6 acres, thereby leaving 54.6 acres in open space—an increase of 3.2 acres over the proposed project. The lot sizes would range in size from 16,529 square feet to 22,840 square feet. The average slope would range from 8.53 percent on Lot 8 to 19.19 percent on Lot 7. The size of the lots would be similar in size to the adjoining neighborhood.



Source: RMR Design Group

Figure 5.1 Eight-lot Subdivision (smaller lots on reduced acreage) Overlain on Proposed Project Plan

This alternative would generally accomplish the proposed project objectives regarding clustering, retention of permanent open space, soils repair and debris benches. The eight smaller lot alternative on reduced project acreage would reduce the estate lot and custom home design/approach as stated in the proposed project alternatives.

Visual/Aesthetics

Fewer residents on Sanders Drive would view this alternative due to the size of the development area. This alternative would also reduce the amount of grading required to stabilize the hillside, which would leave more of the site in its natural condition. The eight lots would result in a denser development due to the restricted development area. The smaller lots would not have the siting opportunities that are available with the larger lots that are proposed. The ability for Sanders Drive residents to view the hillside between the houses may be limited due to the smaller setbacks. The ridge top and upper slope would still be visible above the eight houses. Insofar as neighborhood compatibility, this alternative lends itself to a subdivision that could be more compatible with the neighborhood. The building pads are smaller thereby resulting in smaller size houses than what is proposed.

Geology/Soils/Slope Stability

The developer would reduce the amount of grading, the number of debris benches and soils repair that would be required for the proposed project. Specifically, the debris benches and soils repair in the areas of proposed project Lot 1 and Lot 6 would not be performed under this alternative. The residential project would serve as a buffer, separating the existing landslide deposits from the creek. Any reduction in the amount of corrective grading would reduce the creek protection that is provided. This alternative results in a very small building area on Lot 7. The developer would likely need to construct a portion of the residence on the lower portion of the 3:1 fill slope. Maintenance access to the debris benches through the sideyard area would be difficult. Given the smaller footprint of the graded and developed area, it might be appropriate to grant a maintenance easement to the debris benches. The most appropriate location would be along the north property line of Lot 8, and then within the open space adjacent to the east and south boundary of Lot 8. Extend the maintenance easement along the edge of the open space from Lot 8 to Lot 1. A 25-foot-wide easement would appear adequate for this purpose. No grading would be needed within the maintenance easement. Other slope stabilization measures as identified for the proposed project would also be required with the 8-lot subdivision alternative.

Hydrology/Drainage

The development area of this alternative is much smaller than the proposed project, although there are two additional lots. The total area of all eight lots would be 3.6 acres, approximately 53-percent of the proposed project development area. The houses in the 8-lot alternative could have floor areas between 3,200 and 4,500 square feet (sf), while the floor areas for the houses in the proposed project would be between 5,100 and 6,500 sf. Therefore, the total impervious area of the house roofs would be approximately 11.49 percent less than the house roofs of the proposed project (8 × 3,850 avg..sf. vs. 6 × 5,800 avg. sf).

The impervious area of the driveways for the 8-lot alternative would be approximately 33-percent greater than the driveway area in the proposed project, therefore the total amount of impervious surface area from this alternative could be greater than the proposed project. A similar size detention basin would be required for the 8-lot alternative. Assuming the detention basin is sized using the same methodology as for the proposed project, it would be adequate to accommodate storm runoff from the 8-lot alternative. Impacts and mitigation measures recommended for the proposed project are applicable to this alternative.

Planning and Land Use

This alternative would comply with the MOSO ordinance and would be more consistent with General Plan policies regarding neighborhood character. This alternative would also meet the criteria to no longer be considered high risk, thus allowing an increase in density. The eight-lot alternative proposes three fewer housing sites than what could be allowed should the Planning Commission approve a maximum density increase.

Other Issues

The impacts on biological resources would be less with this alternative, due to the reduction in grading. The wetland areas located on proposed project Lot 1 and east of proposed project Lot 6 would not be disturbed, as well as other biological features that are identified on Figure 3-4 in Appendix C. The proposed mitigated wetland area as shown on Figure 3-5 in Appendix C may not be required, as the development under this alternative would not disturb existing wetlands. The stand of creeping ryegrass that is located on alternative lots 3 and 4 would be eliminated and would require mitigation.

Noise generated from an eight-lot subdivision would be greater than from a six-lot subdivision. However, the noise associated with site grading would be reduced as the amount of grading would be substantially less. Noise generated by the residential neighborhood would be similar to that of the existing neighborhood on Sanders Drive. The increase in noise levels from the subdivision would be imperceptible to adjoining residents.

The increase of two additional lots would result in an insignificant change to the demand for public services and utilities. Approximately 7 to 11 students would reside in the development. The proposed project is estimated to have 5 to 9 students attending local schools. This is not considered a substantial increase to the student population at the elementary, middle and high schools.

The eight-lot subdivision would generate 77 daily trips, 6 AM peak hour trips and 8 PM peak hour trips. The overall daily traffic volume represents an increase of 17 trips over what was projected for the proposed project. These trip totals when added to the when added to base levels would not significantly affect traffic conditions. The local streets would continue to carry volumes for a local street and a local collector street (Nickelson, 2010).

5.5 ELEVEN–LOT SUBDIVISION – SAME ACREAGE

Figure 5-2 illustrates the 11-lot alternative, which would be contained within the proposed development area. The lots would be considerably smaller, similar to the adjoining neighborhood. The acreage of the open space would be the same as the proposed project – 51.45 acres. Lot sizes would range in size from 21,700 square feet to 34,782 square feet. The average slope within the cell ranges from 14.45 percent on Lot 11 to 19.37 percent on Lot 10.

This alternative would generally accomplish the proposed project objectives regarding clustering, retention of permanent open space, soils repair and debris benches. The 11 smaller lot alternative would reduce the estate lot and custom home design/approach as stated in the proposed project objectives.

The 11-lot subdivision alternative, while it provides a similar development pattern to the adjoining neighborhood, would create greater visual impacts. The lots are smaller, thus the houses would be set closer together creating a more dense development than what is proposed. Residents abutting the project site would see more houses in their viewshed as compared to the proposed project. The ability for adjoining residents to view the slopes between the houses would be limited as the setbacks would be smaller than the proposed project. Houses would still be clustered at the base of the slope, keeping the upper slope and ridgeline visible to the residents of Sanders Drive. Since the lots would be smaller, the houses would be smaller which would be consistent with the adjoining neighborhood.

Geology/Soils/Slope Stability

This alternative would have the same approach to grading as the proposed project. (i.e., removal of slide debris within the footprint of grading and buttressing the hillside with engineered fill using a 3:1 (horizontal to vertical) slope gradient). Building pads are indicated on Lots 1, 10 and 11. The other eight lots would have cross-slopes that are less than 10 percent. The areas available for development are smaller, especially for Lots 2 and 10, resulting in these building sites pushed to the toe of the graded slope. This would likely result in two-story houses that are separated by 10 foot sideyards. Maintenance of the debris benches is likely to be more difficult in this alternative because the dwellings would be located closer together. The Engeo report indicates that along with sediment accumulation in the drainage ditches, there is potential for sizable slump blocks to come to rest on the debris benches. That implies the need for earthmoving equipment to access the rear yards and climb up the engineered slope to reach the debris bench and perform corrective work. Narrow sideyards would complicate the process of gaining access to the slope. The impacts and mitigation measures identified for the proposed project would be no different for this alternative.

Hydrology/Drainage

The 11-lot alternative would develop within the same acreage of the project site as the 6-lot proposed project. The houses in the 11-lot alternative would have floor areas of between 2,500 and 3,500 sf. Therefore, the total impervious area of the house roofs would be approximately the same as the house roofs of the proposed project (11 × 3,000 sf / 6 × 5,500 sf). The impervious area of driveways for the 11-lot alternative would be approximately 83 percent greater than the driveway area in the proposed project. Therefore, the rate and amount of runoff from the 11-lot alternative would be greater than from the proposed project.

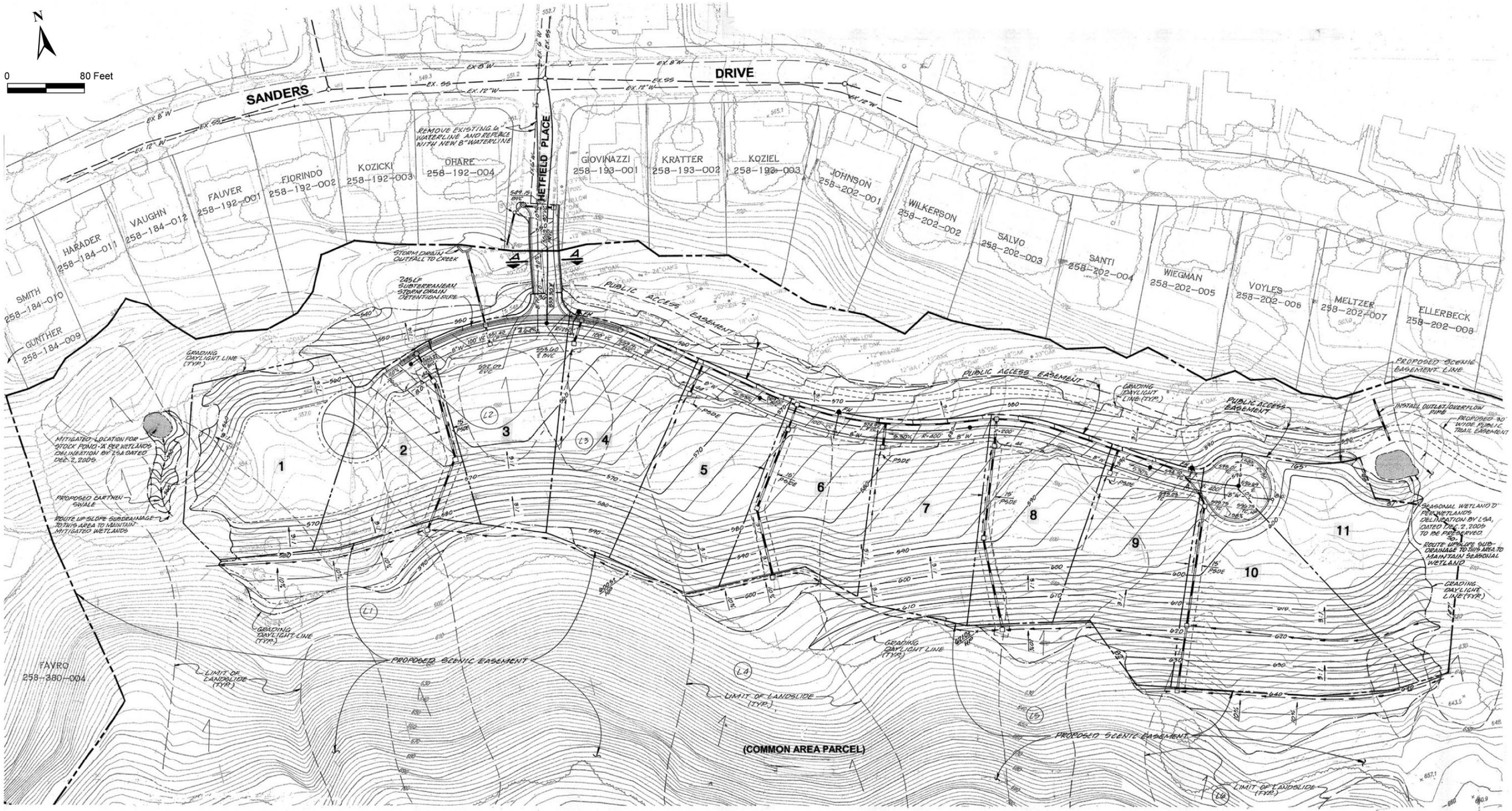
The detention basin for the 11-lot alternative would be the same as for the proposed project. Considering there is a substantial factor-of-safety in the design of the detention basin for the proposed project, it would adequately serve the 11-lot alternative. Impacts and mitigation measures for the 6-lot proposed project that are applicable to the 11-lot alternative should be applied to this alternative.

Planning/Land Use

This alternative presents the maximum number of units allowed under MOSO providing the criteria to eliminate the high-risk designation can be met. Since the 11-lot subdivision is proposed within the same development envelope, it is likely that the alternative would meet the criteria to eliminate the high-risk designation. Therefore, it is a decision of the planning commission as to increasing the density to the maximum number of units. This does present a much more dense development than the proposed project, however the lot size is similar to the adjoining neighborhood which would be compatible. Since this alternative is similar to the proposed project, the impacts and mitigation measures applied to the proposed project would also apply to this alternative.

Other Issues

The impacts to biological resources and the mitigation measures identified in the Initial Study/Proposed Negative Declaration would apply to this alternative. Noise levels would increase with an 11-unit subdivision, five more than proposed, but would not be significant. Noise levels must increase by at least 3 decibels to be perceived by the nearest receptor. Residential noise from five additional houses would not typically raise noise levels three decibels. Construction noise levels would be no different than with the proposed project, except it would last longer due to more houses being built. The demand for services would increase under this alternative, but would not be considered a significant change over that projected for the proposed project. The number of children attending the local schools would be 10 to 14 students versus the proposed project of 5 to 9 students. This is not considered a significant increase from that estimated for the proposed project. The 11-lot alternative would generate 105 daily trips – 8 AM peak and 11 PM peak. The overall daily traffic volume represents an increase of 45 daily trips over what was projected for the proposed project. As with the 8-lot subdivision alternative, these trip totals when added to the base levels would not significantly affect traffic conditions. The local streets would continue to carry volumes for a local street and a local collector street (Nickelson, 2010).



Source: RMR Design Group

Figure 5.2 Eleven-lot Subdivision - Smaller Lots on Proposed Project Acreage

5.6 ENVIRONMENTALLY SUPERIOR ALTERNATIVE

In accordance with the state CEQA guidelines, project alternatives have been evaluated for their comparative environmental superiority. Table 5-1 provides a summary comparison of alternatives discussed above to the proposed project. In those cases in which the alternative is clearly environmentally superior to the proposed project, the text is prefaced with a plus sign (+). Where the alternative either would produce additional impacts or would forego substantial beneficial environmental effect, the text is prefaced with a minus sign (-); otherwise the impact is similar to the proposed project and there is no change.

Typically a No-Project Alternative is considered by many as the environmentally superior alternative. In this case, if the project site is left undeveloped, soil conditions would continue to erode and the slopes would continue to slide as the soil becomes saturated. Depending upon rainfall conditions, the creek could flood due to debris buildup in the creek channel. Agricultural uses do not require a conditional use permit and thus, the Town would not require site improvements. Therefore, the No Project alternative is not considered the environmentally superior alternative to the proposed project.

As shown in the following table, the 8-Lot Subdivision contained within a smaller development area would be environmentally superior to the proposed project. It requires less grading, retains more land in open space, and provides for a development that is compatible to the existing neighborhood. However, it does create its own set of potential impacts and in many instances, the mitigation measures identified for the proposed project would apply to this alternative as well. Without further information, it is unknown how the debris benches would be maintained. The narrow sideyard setbacks,could make it difficult for equipment to get between the houses to clean out the debris benches located upslope of the dwelling units. There could be a greater area of impervious surface (again depending upon the size of the structures), however a similar size detention basin as proposed would be sufficient to control the runoff. This alternative also reduces the biological impacts to habitat and wetlands by avoiding most of the wetland areas. The 8-Lot Subdivision Alternative does meet all of the project applicant's objectives with the exception of providing estate size lots for custom homes.

Source of Information

Nickelson, George, P.E., 2010, Letter to John Wyro, April 28.

Table 5-1
ALTERNATIVES COMPARISON TABLE

Environmental Topic	No Project	3-Lot Subdivision, Reduced Development Area	8–Lot Subdivision, Reduced Development Area	11–Lot Subdivision, Same Development Area
Aesthetics/Visual	+ Existing views of open space maintained.	+ More open space retained; fewer lots; most views retained; Development of large estate homes; more outside amenities.	+ More open space; denser project; lot size similar to neighborhood; less site disturbance.	– More houses create less view corridors between houses; same amount of site disturbance; denser development.
Geology/Soils/Slope Stability	– Slopes would continue to slump without engineered slope stability measures.	– Major slides not repaired; no debris benches placed in slide areas.	+ Less grading and fewer slide repairs; maintenance of debris benches may be difficult due to narrow sideyards.	– Same amount of grading and slide repair as project; narrow lots push houses to toe of slopes; maintenance of debris benches a problem due to narrow sideyards.
Hydrology/Drainage	– Runoff would continue to flow into Larch Creek once the soils become saturated.	+ Reduced runoff – runoff conveyed directly to creek; no detention basin.	Smaller development area, but impervious surface area would be greater, but not significant. Project detention basin would be adequate.	– Amount of runoff greater; detention basin for project adequate for this alternative.
Planning/Land Use	+ No change in the land use or planning designations; however depending upon agricultural use, impacts could occur..	Would require PC to make 'high' risk determination.	Would require PC to make 'high' risk determination; complies with planning policies regarding slope, lot size, protection of open space and ridgelines and neighborhood compatibility.	Would require PC to make 'high' risk determination; complies with planning policies regarding slope, lot size, protection of open space and ridgelines and neighborhood compatibility.
Other Issues	+ Existing conditions would remain – no effect on biological resources, public services/utilities or traffic conditions.	+ Less disturbance to biological resources; habitat and wetlands. Less daily traffic trips; less demand for public services and utilities.	+ Less disturbance to biological resources and wetlands; minimal increase in daily traffic trips; minimal increase in demand for public services and utilities.	– Disturbance to biological resources same as project; increased daily traffic volumes; greater demand for public services and utilities.
Meets Project Objectives	No.	No – not economically feasible for both applicant and future homeowners.	Yes – but does not allow for estate lots.	Yes – but does not allow for estate lot.

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REPORT PREPARATION

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