RGH CONSULTANTS
Experience is the difference

Santa Rosa Office
3501 Industrial Drive, Suite A
Santa Rosa, CA 95403
707-544-1072

Napa Office
1041 Jefferson St, Suite 4
Napa, CA 94559
707-252-8105

July 5, 2023

Matt Quirie
mquirie@gmail.com

Geotechnical Review
Grading Plans
Quirie Residence
12 Barker Avenue
Fairfax, California

Project Number: 4999.01.04.1

This letter documents our geotechnical review of the grading plans for the residence to be constructed at the subject property. The results of our geotechnical study for the project were presented in a report dated May 31, 2023 (revised June 2, 2023). The grading plans we reviewed are Sheets C-1, C-2, C-3, and C-4 of five sheets of a plan set titled "Quirie House," prepared by BKF, dated June 2023.

Based on our review, we conclude that the geotechnical aspects of the grading plans are in general conformance with the intent of the recommendations presented in the geotechnical study report. Review of hydrological calculations addressing surface drainage systems and verifying survey lines and grades is not within our area of expertise and was not included in our scope of services for this plan review.

During construction, we should observe site excavations, compaction of fills and backfills, subdrain installations, and perform field and laboratory testing. These observations and testing will allow us to check the contractor's methods and materials, verify that the soil and rock conditions are as anticipated, and modify our recommendations, if necessary. Our geotechnical consultation and grading observation and testing services provided during the construction phase of the project will be documented in a written report, as required.

We trust this provides the information you require at this time. Please call if you have questions.

Very truly yours,
RGH Consultants

Sarah C. Lockwood
Project Manager

CERTIFIED ENGINEERING GEOLOGIST
SARAH C. LOCKWOOD
No. 2664
STATE OF CALIFORNIA

Travis A. Whitted
Principal Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
TRAVIS A. WHITTED
No. 2782
GEOTECHNICAL
STATE OF CALIFORNIA

SCL:TAW:scl:brw
Electronically submitted

cc: millargary07@gmail.com

https://rghgeo.sharepoint.com/sites/shared/shared documents/project files/4751-4999/4999/4999.01.prv/4999.01.04.1 plan review-grading.docx

ATTACHMENT D

RGH CONSULTANTS

Experience is the difference

GEOTECHNICAL STUDY REPORT

QUIRIE RESIDENCE
12 BARKER AVENUE
FAIRFAX, CALIFORNIA

Project Number:

4999.01.04.1

Prepared For:
Matt Quirie

Prepared By:

RGH Consultants

Santa Rosa Office
1305 North Dutton Avenue
Santa Rosa, CA 95401
707-544-1072

Napa Office
1041 Jefferson Street, Suite 4
Napa, CA 94559
707-252-8105

Sarah C. Lockwood
Engineering Geologist
Project Manager

Travis A. Whitted
Principal Geotechnical Engineer

CERTIFIED ENGINEERING GEOLOGIST
SARAH C. LOCKWOOD
No. 2664
STATE OF CALIFORNIA

May 31, 2023

Revised June 2, 2023

REGISTERED PROFESSIONAL ENGINEER
TRAVIS A. WHITTED
No. 2782
GEOTECHNICAL
STATE OF CALIFORNIA

TABLE OF CONTENTS

TABLE OF CONTENTS (cont'd)

INTRODUCTION

This report presents the results of our geotechnical study for the residence and other improvements to be constructed at 12 Barker Avenue in Fairfax, California. The undeveloped property extends over gently to steeply sloping terrain and contains a dirt access road. The site location is shown on Plate 1, Appendix A.

We understand it is planned to construct a new residence with attached junior ADU, a separate split-level ADU, and a detached garage, partially below grade and with a living roof. We understand that the structures will have a combination of concrete slab-on-grade floors and raised wood floors supported on spread footings or drilled piers. According to preliminary grading plans by BKF, auto access will be provided by a new, asphalt-paved driveway approximately 450 feet long. An asphalt-paved extension of Barker Avenue on the order of 200 feet long is also proposed. Retaining walls are planned on either side of the driveway and road extension. Based on the referenced plans, we anticipate that grading could include cuts and fills on the order of 5 to 15 feet.

Actual foundation loads are not known at this time. We anticipate the loads will be typical for the light to moderately heavy type of construction planned. Utility plans are not available, but we have assumed for this study that the project utilities will extend no deeper than 5 feet below the existing ground surface.

SCOPE

The purpose of our study, as outlined in our Professional Service Agreement dated February 23, 2023, was to generate geotechnical information for the design and construction of the project. Our scope of services included reviewing selected published geologic data pertinent to the site; evaluating the subsurface conditions with test pits and laboratory tests; analyzing the field and laboratory data; and presenting this report with the following geotechnical information:

1. A brief description of the soil, bedrock, and groundwater conditions observed during our study;

2. A discussion of seismic hazards that may affect the proposed improvements; and

3. Conclusions and recommendations regarding:

    a. Primary geotechnical engineering concerns and mitigating measures, as applicable;

    b. Site preparation and grading including remedial grading of weak, porous, compressible and/or expansive, creep-prone surface soil and the construction of hillside fills;

    c. Foundation types, design criteria, and estimated settlement behavior;

    d. Lateral loads for retaining wall design;

    e. Support of concrete slabs-on-grade;

    f. Preliminary pavement thickness based on our experience with similar soil and projects and the results of an R-value test on the anticipated subgrade soil;

    g. Utility trench backfill;

    h. Geotechnical engineering drainage improvements; and

    i. Supplemental geotechnical engineering services.

STUDY

Site Exploration

We reviewed our previous geotechnical studies in the vicinity and selected geologic references pertinent to the site. The geologic literature reviewed is listed in Appendix B. On March 23 and April 6, 2023, we performed a geotechnical reconnaissance of the site and explored the subsurface conditions by excavating 16 test pits to depths ranging from about 1½ to 8 feet in depth and three hand-auger holes excavated to depths ranging from about 1¼ to 4¼ feet. The test pits were excavated with a track-mounted mini-excavator at the approximate locations shown on the Exploration Plan, Plate 2. A 4-inch diameter hand-auger was used at three locations that were too steep for the excavator. The test pit and hand auger locations were determined approximately by pacing their distance from features shown on the Exploration Plan and should be considered accurate only to the degree implied by the method used. Our geologist located and logged the test pits and hand auger holes and obtained samples of the materials encountered for visual examination, classification, and laboratory testing.

The logs of the test pits and hand auger holes showing the materials encountered, groundwater conditions, and sample depths are presented on Plates 3 through 13. The soil is described in accordance with the Unified Soil Classification System, outlined on Plate 14. Bedrock is described in accordance with Engineering Geology Rock Terms, shown on Plate 15.

The test pit and hand auger logs show our interpretation of the subsurface soil, bedrock, and groundwater conditions on the date and at the locations indicated. Subsurface conditions may vary at other locations and times. Our interpretation is based on visual inspection of soil and bedrock samples, laboratory test results, and interpretation of excavation and sampling resistance. The location of the soil and bedrock boundaries should be considered approximate. The transition between soil and bedrock types may be gradual.

Laboratory Testing

The samples obtained from the test pits and hand auger holes were transported to our office and re-examined to verify soil classifications, evaluate characteristics, and assign tests pertinent to our analysis. Selected samples were laboratory tested to determine their classification (Atterberg Limits, percent of silt and clay), expansion potential (Expansion Index - EI) and R-value. The test results are presented on the test pit/hand auger logs. Results of the classification and R-value tests are presented on Plates 16 and 17, respectively.

SITE CONDITIONS

General

Marin County is located within the California Coast Range geomorphic province. This province is a geologically complex and seismically active region characterized by sub-parallel northwest-trending faults, mountain ranges and valleys. The oldest bedrock units are the Jurassic-Cretaceous Franciscan Complex and Great Valley sequence sediments originally deposited in a marine environment. Subsequently, younger rocks such as the Tertiary-age Sonoma Volcanics group, the Plio-Pleistocene-age Clear Lake Volcanics and sedimentary rocks such as the Guinda, Domengine, Petaluma, Wilson Grove, Cache, Huichica and Glen Ellen formations were deposited throughout the province. Extensive folding and thrust faulting during late Cretaceous through early Tertiary geologic time created complex geologic conditions that underlie the highly varied topography of today. In valleys, the bedrock is covered by thick alluvial soil.

Geology

Published geologic maps (Blake et al., 2000) indicate the property is underlain by Cretaceous to Jurassic aged Franciscan Complex Mélange. The mélange generally consists of a chaotic assemblage of sedimentary and metamorphic rock types including meter- to kilometer-scale masses of intact rock within a pervasively sheared matrix.

Landslides

Published landslide maps (Smith, et al., 1976) do not indicate large-scale slope instability at the site, and we did not observe active landslides at the site during our study. We did observe a repaired/retained landslide outside of the northern property line on adjacent slopes. We judge that the location of this feature is not pertinent to the stability of the planned improvements at the subject property.

Surface

The property extends primarily over a northeast-trending ridgeline with steeply sloping sides. The vegetation consists of mature trees and light undergrowth. Thicker scotch broom is present on the northern property slopes beyond the areas that have been cleared for the project. The building sites are located near the top of the ridge. In general, the main residence/junior ADU area is gently to moderately sloping and the garage and separate ADU areas are steeply sloping. In general, the ground surface is soft and spongy. This is a condition generally associated with weak, porous surface soil. On sloping terrain 5:1 or steeper, the weak surface materials (topsoil, residual soil, colluvium) undergo a gradual downhill movement known as creep. Soil creep is inherent to hillsides in the area and its force is directly proportional to slope inclination, the soil's plasticity, water content and expansion potential.

Natural drainage consists of sheet flow over the slopes that concentrates in man-made surface drainage elements and natural drainage elements such as swales and ravines.

Subsurface

Our test pits, hand auger holes, and laboratory tests indicate that the portion of the site we studied is blanketed by ½ to 2 feet of weak, porous, compressible, clayey soil. Porous soil appears hard and strong when dry but becomes weak and compressible as its moisture content increases towards saturation. In general, sandstone and shale bedrock extends from beneath the surface materials to the maximum depths explored (8 feet). The bedrock is generally soft to moderately hard, plastic to moderately strong, and highly to moderately weathered. Locally, especially in the north-facing sloping areas (TP-4, 5, 6, 7, 8, and 13 and HA-3), portions of the shale bedrock are completely weathered to, and mantled by, clayey to silty residual soil ranging from about 1 to 2 feet thick. This soil exhibits low to high plasticity (LL = 24.2, 45.7, 61.5, 54.2; PI = 3.8, 23.4, 35.3, 28.1) and low to high expansion potential (EI = 22, 93, 85, 89). Generally, we encountered this material within about 3 feet of the surface, however, locally, it occurs deeper (5 to 6½ feet at test pit TP-7) where the shale is highly weathered. Locally, such as at the edges of the existing dirt access road, the surface soil may covered by a thin layer of heterogeneous fill. Heterogeneous fill is a material with varying density, strength, compressibility and shrink-swell characteristics that often has an unknown origin and placement history. As previously discussed, on hillsides 5:1 or steeper, the weak or expansive surface materials typically creep.

A detailed description of the subsurface conditions found in our test pits and borings is given on Plates 3 through 13, Appendix A. Based on Table 20.3-1 of American Society of Civil Engineers (ASCE) Standard 7-16, titled "Minimum Design Loads and Associated Criteria for Buildings and Other Structures" (2017), we have determined a Site Class of C should be used for the site.

Corrosion Potential

Mapping by the Natural Resources Conservation Service (2023) indicates that the corrosion potential of the near surface soil is low for uncoated steel and low for concrete. Performing corrosivity tests to verify these values was not part of our requested and/or proposed scope of work. Should the need arise, we would be pleased to provide a proposal to evaluate these characteristics.

Groundwater

Locally, perched groundwater seeped into the test pit TP-8 at about 3 feet below the ground surface (about the interface of the surface materials and the bedrock), at the time of excavation. On hillsides, rainwater typically percolates through the porous surface materials and migrates downslope in the form of seepage at the interface of the surface materials and bedrock, and through fractures in the bedrock. Fluctuations in the seepage rates typically occur due to variations in rainfall intensity, duration and other factors such as periodic irrigation.

DISCUSSION AND CONCLUSIONS

Seismic Hazards

General

We did not observe subsurface conditions within the portion of the property we studied that would suggest the presence of materials that may be susceptible to seismically induced densification, liquefaction, or lurching. Therefore, we judge the potential for the occurrence of these phenomena at the site to be low.

Faulting and Seismicity

We did not observe landforms within the area that would indicate the presence of active faults and the site is not within a current Alquist-Priolo Earthquake Fault Zone (Bryant and Hart, 2007). Therefore, we believe the risk of fault rupture at the site is low. However, the site is within an area affected by strong seismic activity and future seismic shaking should be anticipated at the site. It will be necessary to design and construct the proposed improvements in strict adherence with current standards for earthquake-resistant construction.

Geotechnical Issues

General

Based on our study, we judge the proposed improvements can be built as planned, provided the recommendations presented in this report are incorporated into their design and construction. The primary geotechnical concerns during design and construction of the project are:

1. The presence of ½ to 2 feet of weak, porous, compressible, creep-prone clayey surface soil and the likely presence of local heterogeneous fill along the existing dirt road;
2. The presence of locally expansive residual soil and weathered bedrock;
3. The detrimental effects of uncontrolled surface runoff and groundwater seepage on the long-term satisfactory performance of residences, especially those constructed on hillsides, given the erosion potential and porous nature of the surface soil; and
4. The strong ground shaking predicted to impact the site during the life of the project.

Weak, Porous Surface Soil

Weak, porous surface soil, such as that found at the site, appears hard and strong when dry but will lose strength rapidly and settle under the load of fills, foundations, slabs, and pavements as its moisture content increases and approaches saturation. The moisture content of this soil can increase as the result of rainfall, periodic irrigation or when the natural upward migration of water vapor through the soil is impeded by, and condenses under fills, foundations, slabs, and pavements. The detrimental effects of such movements can be reduced by strengthening the soil during grading. This can be achieved by excavating the weak soil and replacing it as properly compacted (engineered) fill. Alternatively, satisfactory foundation support could be obtained below the weak surface soil.

Heterogeneous Fill

Heterogeneous fills of unknown quality and unknown method of placement, such as those likely to be found along the existing dirt roads at the site, can settle and/or heave erratically under the load of new fills, structures, slabs, and pavements. Footings, slabs, and pavements supported on heterogeneous fill could also crack as a result of such erratic movements. Thus, where not removed by planned grading, the heterogeneous fill must be excavated and replaced as an engineered fill if it is to be used for structural support.

Expansive Soil

In addition, the clayey residual soil weathering from the shale bedrock is expansive and was observed generally in the northernmost sloping areas of the site at depths ranging from 2 to 6½ feet below the surface. This material is not suitable for support of fills, slabs, pavements, or foundations. Expansive surface soil shrinks and swells as it loses and gains moisture throughout the yearly weather cycle. Near the surface, the resulting movement can heave and crack lightly loaded shallow foundations (spread footings) and slabs and pavements. The zone of significant moisture variation (active layer) is dependent on the expansion potential of the soil and the extent of the dry season. In the project area, the active layer is generally considered to range in thickness from about 2 to 3 feet. Where planned grading does not remove it, stable foundation support needs to be obtained below this layer.

Exterior Slabs and Pavements

Exterior slabs and pavements constructed directly on expansive soils or weathered bedrock will heave and crack as the expansive material shrinks and swells through the yearly weather cycle. Slab and pavement cracking and distress are typically concentrated along edges where moisture content variation is more prevalent within the subgrade soil. Slab and pavement performance can be improved and the incidence of repair can be reduced, but not eliminated, by covering the pre-swelled expansive soil with at least 12 inches of select fill (see "On-Site Soil Quality" section) prior to constructing the slab or pavement required to carry the anticipated traffic.

Downslope Creep

Weak, creep-prone surface soil, such as that found at the site, tends to naturally consolidate and settle on sloping terrain that is 5:1 (horizontal to vertical) or steeper. Fills and foundations deriving support from these materials will be susceptible and contribute to the downslope creep and settlement unless properly embedded in bedrock or buttressed (keyed, benched, drained and compacted). The settlement causes cracks in the slabs and structural distress in the form of cracked plaster and sticky doors and windows. Therefore, it will be necessary to obtain fill and/or foundation support below the creeping soil and, outside buttressed or retained areas, design the foundations to resist stresses imposed by the creeping soil.

Fill Support - Hillside fills need to be constructed on level keyways and benches excavated entirely on bedrock. However, regardless of the care used during grading, buttressed fills of uneven thickness such as those typically built on hillsides, will settle differentially. Satisfactory performance of structural elements constructed on hillside fills including structures and driveways will require the use of specialized grading techniques discussed in the following sections of this report. These include excavating all weak soil and replacing these materials as a buttressed fill of even thickness or constructing the improvements

entirely on cut. For the purpose of this discussion, fills with a differential thickness of less than 5 feet can be assumed to have equal thickness. Where fills have a differential thickness of more than 5 feet, the fill should be placed at 95 percent relative compaction. In order to provide the equal thickness where bedrock is exposed in a cut/fill transition, it may be necessary to perform additional excavation of bedrock in cut areas to replace it as compacted fill. Where the total fill thickness is less than 5 feet, the fill can be placed at 95 percent relative compaction in lieu of overexcavation of bedrock in cut areas. Where structures include slab floor areas and/or footings supported on engineered fill as well as bedrock, all of the fill will need to be placed at 95 percent relative compaction.

Foundation Support - Satisfactory foundation support for the proposed structures can be obtained from spread footings that bottom at minimum depth on firm bedrock exposed by planned excavations, in bedrock reached by footings excavated through the creeping soil, or from spread footings supported on buttressed or retained fills of equal thickness. Where the creeping soil is not buttressed or removed by grading, the footings must be designed to resist creep forces. Spread footings can also be used for foundation support where the building pad transitions from bedrock to fill and the fill (or differential fill thickness) is less than 5 feet thick, provided the fills are compacted to at least 95 percent relative compaction.

As an alternative, drilled piers gaining support in bedrock and designed to resist creeping forces, as needed, can be used for foundation support either under all parts of the structure or within areas of deep soil (including expansive clay soils) or buttressed fill of uneven thickness.

Floor Systems - Wood floors supported on joists above-grade can be used in living areas, as planned. Structurally-supported slabs over void forms supported on a drilled pier and grade beam system may be used in lieu of slab-on-grade floors where expansive soils are not removed in living areas. Conventional slab-on-grade floors can be used in the living areas and garages provided that:

1. The planned grading completely removes clayey soils;
2. The planned grading removes the weak surface soil or increases its supporting capacity by mechanical compaction;
3. The subgrade materials are pre-swelled by soaking prior to installation of the slabs;
4. Garage slabs are cast separate from foundations and framing to allow differential settlement or heave to occur without distressing the slabs or framing;
5. The slabs are reinforced to reduce cracks;
6. The slabs are grooved to induce cracking in a non-obtrusive manner; and
7. The slab area is underlain by firm rock, bedrock and fill placed at 95 percent relative compaction or buttressed fills of even thickness, entirely.

Excavation Difficulty

Site excavation will encounter hard, resistant bedrock a few feet below the surface. Site excavations, including utility trenches will require heavy ripping and jack hammering. The contractors and subcontractors bidding this job should read this report and become familiar with site conditions as they pertain to their operation and the appropriate equipment needed to perform their tasks. If more detailed information regarding excavatability of the bedrock is required, a seismic refraction study should be performed or additional test pits should be excavated using the type and size of equipment planned for construction.

On-Site Soil Quality

All fill materials used in the building areas where conventional slabs-on-grade are used, and the upper 12 inches of garage and/or exterior slab subgrade must be select, as subsequently described in "Recommendations." We anticipate that, with the exception of organic matter and of rocks or lumps larger than 6 inches in diameter, the excavated material will be suitable for re-use as general fill, but may not be suitable for use as select fill.

Select Fill

The select fill can consist of approved on-site soil or import materials with a low expansion potential. The geotechnical engineer must approve the use of on-site soil as select fill during grading.

Settlement

Since all foundations will bear on firm, undisturbed bedrock or buttressed/retained fill of even thickness, we estimate that post-construction differential settlement across the building could be about ½ inch.

Surface Drainage

Because of topography and location, the site will be impacted by surface runoff from the upgradient slopes. Surface runoff typically sheet flows over the slopes but can be concentrated by the planned site grading, landscaping, and drainage. The ensuing erosion can create sloughing and promote slope instability or the surface runoff can pond against structures and cause deeper than normal soil heave and/or seep into the crawl space or slab rock. Therefore, strict control of surface runoff is necessary to provide long-term satisfactory performance of projects constructed on or near hillsides. It will be necessary to divert surface runoff around slopes and improvements, provide positive drainage away from structures, and install energy dissipaters at discharge points of concentrated runoff. This can be achieved by constructing the building pad several inches above the surrounding area and conveying the runoff into man made drainage elements or natural swales that lead downgradient of the site.

Groundwater

We anticipate that rainwater will percolate through the porous surface soil and migrate downslope at the interface of the surface soil and bedrock and through fractures in the bedrock and seep into the crawl space and/or slab rock. Groundwater will also seep into excavations exposing the water migration zone or into hillside fills. Therefore, it will be necessary to intercept, collect and divert groundwater outside of the proposed improvements. This can be accomplished by installing perimeter foundation drains and slab underdrains as recommended herein.

RECOMMENDATIONS

Seismic Design

Seismic design parameters presented below are based on Section 1613 titled "Earthquake Loads" of the 2022 California Building Code (CBC). Based on Table 20.3-1 of American Society of Civil Engineers (ASCE) Standard 7-16, titled "Minimum Design Loads and Associated Criteria for Buildings and Other Structures" (2017), we have determined a Site Class of C should be used for the site. Using a site latitude and longitude of 37.9778°N and 122.5925°W, respectively, and the OSHPD Seismic Design Maps website (https://seismicmaps.org), we recommend that the following seismic design criteria be used for applicable structures at the site.

2022 CBC Seismic Criteria	
Spectral Response Parameter	**Acceleration (g)**
S_S (0.2 second period)	1.5
S_1 (1 second period)	0.6
S_{MS} (0.2 second period)	1.8
S_{M1} (1 second period)	0.84
S_{DS} (0.2 second period)	1.2
S_{D1} (1 second period)	0.56

Grading

Site Preparation

Areas to be developed should be cleared of vegetation and debris, including that left by the removal of obsolete structures. Trees and shrubs that will not be part of the proposed development should be removed and their primary root systems grubbed. Cleared and grubbed material should be removed from the site and disposed of in accordance with County Health Department guidelines. We did not observe septic tanks, leach lines or underground fuel tanks during our study. Any such appurtenances found during grading should be capped and sealed and/or excavated and removed from the site, respectively, in accordance with established guidelines and requirements of the County Health Department. Voids created during clearing should be backfilled with engineered fill as recommended herein.

Stripping

Areas to be graded should be stripped of the upper few inches of soil containing organic matter. Soil containing more than two percent by weight of organic matter should be considered organic. Actual stripping depth should be determined by a representative of the geotechnical engineer in the field at the time of stripping. The strippings should be removed from the site, or if suitable, stockpiled for re-use as topsoil in landscaping.

Excavations

Following initial site preparation, excavation should be performed as recommended herein. Excavations extending below the proposed finished grade should be backfilled with suitable materials compacted to the requirements given below.

Within fill and interior conventional slab-on-grade areas, the weak, porous, compressible, expansive, creep-prone surface soil and heterogeneous fill (if encountered) should be excavated completely (generally about ½ to 3 feet in our pits, locally may be 5 to 6½ feet deep near the ADU). The excavation of weak, compressible, expansive soil and heterogeneous fill should also extend at least 12 inches below exterior slab and pavement subgrade to allow space for the installation of 12 inches of select fill.

On sloping terrain 5:1 or steeper, fills should be constructed by excavating level keyways that expose undisturbed bedrock. The keyways should be at least 10 feet wide, extend at least 2 feet below the bedrock surface on the downhill side and should be sloped to drain to the rear. Keyway excavations should extend laterally to at least a 1:1 imaginary line extending down from the toe of the fill. Keyway subdrains are discussed hereinafter in "Subsurface Drainage."

The excavation of weak, porous, compressible, expansive, creep-prone surface materials should extend at least 5 feet beyond the outside edge of planned fill areas and 3 feet beyond the edge of exterior slabs and pavements. The excavated materials should be stockpiled for later use as compacted fill, or removed from the site, as applicable. Excavation of hard resistant bedrock at the site may require heavy ripping and/or jack hammering. The grading contractor should review this report, become familiar with site conditions as they pertain to their operation and draw their own conclusions regarding excavation difficulty and suitable grading equipment.

At all times, temporary construction excavations should conform to the regulations of the State of California, Department of Industrial Relations, Division of Industrial Safety or other stricter governing regulations. The stability of temporary cut slopes, such as those constructed during the installation of underground utilities, should be the responsibility of the contractor. Depending on the time of year when grading is performed, and the surface conditions exposed, temporary cut slopes may need to be excavated to 1½:1, or flatter. The tops of the temporary cut slopes should be rounded back to 2:1 in weak soil zones.

Subsurface Drainage

A subdrain should be installed at the rear of the keyways and/or where evidence of seepage is observed. The subdrain should consist of a 4-inch diameter (minimum) perforated plastic pipe with SDR 35 or better embedded in Class 2 permeable material. The permeable material should be at least 12 inches thick and extend at least 48 inches above the bottom of the keyway (see Plate 18) and/or 12 inches above and below the seepage zone.

In addition, subdrains should be installed at a minimum slope of 1 percent and should have cleanouts located at their ends and at turning points. "Sweep" type elbows and wyes should be used at all turning points and cleanouts, respectively. Subdrain outlets and riser cleanouts should be fabricated of the same material as the subdrain pipe as specified herein. Outlet and riser pipe fittings should not be perforated. A licensed land surveyor or civil engineer should provide "record drawings" depicting the locations of subdrains and cleanouts.

Fill Quality

All fill materials should be free of perishable matter and rocks or lumps over 6 inches in diameter, and must be approved by the geotechnical engineer prior to use. The upper 30 inches of fill beneath and within 5 feet of the living area conventional slabs-on-grade and the upper 12 inches of fill beneath and within 3 feet of exterior slabs and/or pavement edges should be select fill. We judge the on-site soil is generally suitable for use as general fill but may not be suitable for use as select fill The suitability of the on-site soil for use as select fill should be verified during grading.

Select Fill

Select fill should be free of organic matter, have a low expansion potential, and conform in general to the following requirements:

SIEVE SIZE	PERCENT PASSING (by dry weight)
6 inch	100
4 inch	90 – 100
No. 200	10 – 60

Liquid Limit – 40 Percent Maximum
Plasticity Index – 15 Percent Maximum
R-value – 20 Minimum (pavement areas only)

In general, imported fill, if needed, should be select. Material not conforming to these requirements may be suitable for use as import fill; however, it shall be the contractor's responsibility to demonstrate that the proposed material will perform in an equivalent manner. The geotechnical engineer should approve imported materials prior to use as compacted fill. The grading contractor is responsible for submitting, at least 72 hours (3 days) in advance of its intended use, samples of the proposed import materials for laboratory testing and approval by the soils engineer.

Fill Placement

The surface exposed by stripping and removal of weak, compressible, expansive, creep-prone surface soil should be scarified to a depth of at least 6 inches, uniformly moisture-conditioned to near optimum and compacted to at least 90 percent of the maximum dry density of the materials as determined by ASTM Test Method D-1557. Approved fill material should then be spread in thin lifts, uniformly moisture-conditioned to near optimum and properly compacted. All structural fills, including those placed to establish site surface drainage, should be compacted to at least 90 percent relative compaction. All structural fills in areas where buildings will span cut and fill areas should be compacted to 95 percent relative compaction. Only approved select materials should be used for fill within the upper 30 inches of interior slab subgrades and within the upper 12 inches of exterior slabs. Fills placed on terrain sloping at 5:1 or steeper should be continually keyed and benched into firm, undisturbed bedrock. The benches should allow space for the placement of select fill of even thickness under settlement sensitive structural elements supported directly on the fill. An illustration of this grading technique is shown on Plate 18.

SUMMARY OF COMPACTION RECOMMENDATIONS

Area	Compaction Recommendation (ASTM D-1557)
Preparation for areas to receive fill	After preparation in accordance with this report, compact upper 6 inches to a minimum of 90 percent relative compaction.
General fill (native or import)	Compact to a minimum of 90 percent relative compaction.
Structural fill beneath buildings, extending outward to 5' beyond building perimeter	Compact to a minimum of 90 percent relative compaction. Compact to a minimum of 95 percent where building pad transitions between bedrock and fill.
Structural fill beneath building pads that transition between bedrock and fills less than 3 feet thick	Compact to a minimum of 95 percent relative compaction.
Trenches	Compact to a minimum of 90 percent relative compaction. Compact the top 6 inches below vehicle pavement subgrade to a minimum of 95 percent relative compaction.
Retaining wall backfill	Compact to a minimum of 90 percent relative compaction, but not more than 95 percent.

SUMMARY OF COMPACTION RECOMMENDATIONS	
Area	**Compaction Recommendation (ASTM D-1557)**
Pavements, extending outward to 3' beyond edge of pavement	Compact upper 6 inches of subgrade to a minimum of 95 percent relative compaction.
Concrete flatwork and exterior slabs, extending outward to 3' beyond edge of slab	Compact subgrade to a minimum of 90 percent relative compaction. Where subject to vehicle traffic, compact upper 6 inches of subgrade to at least 95 percent relative compaction, unless the area is to be finished with pervious asphalt.
Aggregate Base	Compact aggregate base to at least 95 percent relative compaction.

Permanent Cut and Fill Slopes

In general, cut and fill slopes should be designed and constructed at slope gradients of 2:1 (horizontal to vertical) or flatter, unless otherwise approved by the geotechnical engineer in specified areas. Where steeper slopes are required, retaining walls should be used. Fill slopes steeper than 2:1 will require the use of geogrid to increase stability. Providing recommendations for grid type and spacing was not part of our requested and/or proposed scope of work. Should the need to use geogrid arise, additional laboratory testing and stability analyses will be required. Fill slopes should be constructed by overfilling and cutting the slope to final grade. "Track walking" of a slope to achieve slope compaction is not an acceptable procedure for slope construction. Permanent cut slopes should be observed in the field by the geotechnical engineer to verify that the exposed bedrock conditions are as anticipated. In test pit TP-12, we observed unfavorable "dip-slope" bedding orientation in the bedrock. The planned cut slopes should be retained in this general area, as planned, as well as anywhere dip-slope bedding is exposed in cut slopes, to avoid long-term stability problems of exposed dip slope bedding.

The geotechnical engineer is not responsible for measuring the angles of finished slopes. Denuded slopes should be planted with fast-growing, deep-rooted groundcover to reduce sloughing or erosion. The cut and fill slope inclinations recommended herein address only the stability of the slopes. It should not be inferred that they address the feasibility of landscaping and weed control. Where these are concerns, the slopes should be flattened accordingly.

Wet Weather Grading

Generally, grading is performed more economically during the summer months when the on-site soil is usually dry of optimum moisture content. Delays should be anticipated in site grading performed during the rainy season or early spring due to excessive moisture in on-site soil. Special and relatively expensive construction procedures, including dewatering of excavations and importing granular soil, should be anticipated if grading must be completed during the winter and early spring or if localized areas of soft saturated soil are found during grading in the summer and fall.

Open excavations also tend to be more unstable during wet weather as groundwater seeps towards the exposed cut slope. Severe sloughing and occasional slope failures should be anticipated. The occurrence of these events will require extensive clean up and the installation of slope protection measures, thus delaying projects. The general contractor is responsible for the performance, maintenance and repair of temporary cut slopes.

Foundation Support

In general, spread footings should only be used in level areas excavated into undisturbed bedrock, areas where footing excavations expose bedrock in their entirety, or areas underlain by select engineered fill of even thickness. In general, supporting bedrock was found in our test pits at depths ranging from 1½ to 3 feet in the main residence area, 1½ to 2½ feet near the garage, 3 to 6½ feet at the detached ADU, and ½ to 4 feet along the planned driveway. Spread footings can also be used where the building pad straddles level areas excavated into firm, undisturbed bedrock and areas underlain by buttressed (or retained) fills provided the differential fill thickness does not exceed 5 feet and the fills are compacted to at least 95 percent relative compaction.

Alternatively, because of the presence of expansive soil, the structures and retaining walls may be supported on a system of grade beams supported on drilled, cast-in-place, concrete piers that gain support below the zone of significant moisture variation and are designed to resist the uplift and creep forces induced by the expansive soil. Drilled pier foundations may be paired with raised wood floors or structural slabs over void forms.

Spread Footings

Spread footings should be at least 12 inches wide and should bottom on select engineered fill placed at 95 percent compaction or on undisturbed bedrock, as applicable, at least 12 inches below pad subgrade (lowest adjacent grade). Additional embedment or width may be needed to satisfy code and/or structural requirements. On ungraded sloping terrain, the footings should be stepped as necessary to produce level tops and bottoms. Footings should be deepened as necessary to provide at least 7 feet of horizontal confinement between the footing bottoms and the face of the nearest slope.

Where grading is not performed to create a level pad that exposes bedrock, all continuous and isolated footings should be connected in the upslope-downslope and cross-slope direction with tie beams to form a "grid-type" foundation system. Perimeter and interior strip footings can be considered part of the grid. The maximum plan dimensions of this grid should be on the order of 15 feet in each direction.

The bottoms of all footing excavations should be thoroughly cleaned out or wetted and compacted using hand-operated tamping equipment prior to placing steel and concrete. This will remove the soil disturbed during footing excavations, or restore their adequate bearing capacity, and reduce post-construction settlement. Footing excavations should not be allowed to dry before placing concrete. If shrinkage cracks appear in soil exposed in the footing excavations, the soil should be thoroughly moistened to close all cracks prior to concrete placement. The moisture condition of the foundation excavations should be checked by the geotechnical engineer no more than 24 hours prior to placing concrete.

Bearing Pressures - Footings installed in accordance with these recommendations may be designed using allowable bearing pressures of 2,000, 3,000, and 4,000 pounds per square foot (psf), for dead loads, dead plus code live loads, and total loads (including wind and seismic), respectively.

Lateral Pressures - The portion of spread footing foundations extending into undisturbed bedrock or select engineered fill may impose a passive equivalent fluid pressure and a friction factor of 350 pounds per cubic foot (pcf) and 0.35, respectively, to resist sliding. Passive pressure on ungraded weak surface soil should be reduced to 150 pcf. Passive pressure should be neglected within the upper 6 inches, unless the soil is confined by concrete slabs or pavements.

For structures on the northern slope, footings (except retaining walls) installed on terrain 5:1 or steeper, where grading is not performed to create a level building pad excavated entirely on bedrock, or not underlain by buttressed (or retained) fills of even thickness, should be designed to resist lateral forces exerted by the creeping soil. The lateral forces should be assumed to act on a 2-foot-thick zone and exert an equivalent fluid pressure of 65 pcf.

Drilled Piers

Drilled, cast-in-place, reinforced concrete piers should be used for foundation support where grading is not used to remove weak, expansive clay subsoils, to control expansive soil heave and/or strengthen the weak, compressible surface soil. Drilled piers should be at least 12 inches in diameter and at least 10 feet deep and should develop support in undisturbed bedrock. Where fill is placed to create a pad and the weak, compressible active layer is not strengthened by grading, the piers should be deepened in direct proportion to the thickness of fill. Bedrock was found in our test pits at depths ranging from less than one foot to about 6½ feet. Larger piers and deeper embedment may be needed to resist the lateral forces imposed by earthquakes per the California Building Code. Piers should be spaced no closer than 3 pier diameters, center to center.

Skin Friction - The portion of the piers extending below the bedrock surface may be designed using an allowable skin friction of 450 psf for dead load plus long term live loads. This value can be increased by ⅓ for total loads, including downward vertical wind or seismic forces. A skin friction value of 300 psf should be used to resist uplift forces. End bearing should be neglected because of the difficulty of cleaning out small diameter pier holes, and the uncertainty of mobilizing end bearing and skin friction simultaneously.

Lateral Forces - Lateral loads on piers will be resisted by passive pressure on the bedrock. An equivalent fluid pressure of 350 pcf acting on two pier diameters should be used. Confinement for passive pressure may be assumed from a point where there is at least 7 feet of horizontal confinement between the outside of the pier and the face of the nearest slope.

For structures and retaining walls along the north-facing slope, the piers should be designed and reinforced, by the project structural engineer, to resist creep forces equivalent to a 6-foot thick zone exerting an equivalent fluid pressure of 65 pcf acting on two pier diameters.

The piers should be interconnected with grade beams and tie beams, as necessary,to support building loads and to redistribute stresses imposed by wind or earthquakes and the creeping soil. The grade beams should be designed to span between the piers in accordance with structural requirements. The steel from the piers should extend sufficient distance into the grade beams to develop its full bond strength.

Uplift Forces - The piers and grade beams should be designed to resist uplift pressures imposed by expansive soil. The uplift pressure should be assumed to be 2,000 psf of grade beam surface contact.

Pier Drilling - Locally, we encountered minor seepage of perched groundwater within the planned pier depth during our study. If groundwater is encountered during drilling, it may be necessary to de-water the holes and/or place the concrete by the tremie method. If caving soil is encountered, it may be necessary to case the holes. Difficult drilling may be required to achieve the required penetration. The drilling subcontractor should review this report, become familiar with site conditions as they pertain to their operation and draw their own conclusions regarding drilling difficulty, suitable drill rigs and the need for casing and dewatering prior to bidding.

Concrete - Concrete mix design and placement should be done in accordance with the current ADSC and/or ACI specifications. Concrete should not be allowed to mushroom at the top of the piers or below the bottom of grade beams.

Retaining Walls

Retaining walls constructed at the site must be designed to resist lateral earth pressures plus additional lateral pressures that may be caused by surcharge loads applied at the ground surface behind the walls. Retaining walls free to rotate (yielding greater than 0.1 percent of the wall height at the top of the backfill) should be designed for active lateral earth pressures. If walls are restrained by rigid elements to prevent rotation, they should be designed for "at rest" lateral earth pressures.

Retaining walls should be designed to resist the following earth equivalent fluid pressures (triangular distribution):

EARTH EQUIVALENT FLUID PRESSURES		
Loading Condition	**Pressure (pcf)**	**Additional Seismic Pressure (pcf)***
Active - Level Backfill	42	13
Active - Sloping Backfill 3:1 or Flatter	53	31
At Rest - Level Backfill	63	32

* If required

These pressures do not consider additional loads resulting from adjacent foundations or other loads. If these additional surcharge loadings are anticipated, we can assist in evaluating their effects. Where retaining wall backfill is subject to vehicular traffic, the walls should be designed to resist an additional surcharge pressure equivalent to two feet of additional backfill.

Retaining walls will yield slightly during backfilling. Therefore, walls should be backfilled prior to building on, or adjacent to, the walls. Backfill against retaining walls should be compacted to at least 90 and not more than 95 percent relative compaction. Over-compaction or the use of large compaction equipment should be avoided because increased compactive effort can result in lateral pressures higher than those recommended above.

Foundation Support

Retaining walls should be supported on spread footings or drilled piers bearing on/in undisturbed bedrock and designed in accordance with the recommendations presented in this report. Retaining wall foundations should be designed by the project civil or structural engineer to resist the lateral forces set forth in this section.

Wall Drainage and Backfill

Retaining walls should be backdrained as shown on Plate 19, Appendix A. The backdrains should consist of 4-inch diameter, rigid perforated pipe embedded in Class 2 permeable material. The pipe should be PVC Schedule 40 or ABS with SDR 35 or better, and the pipe should be sloped to drain to outlets by gravity. The top of the pipe should be at least 8 inches below lowest adjacent grade. The Class 2 permeable material should extend to within 1½ feet of the surface. The upper 1½ feet should be backfilled with compacted soil to exclude surface water. Expansive soil should not be used for wall backfill. Where expansive soil is present in the excavation made to install the retaining wall, the excavation should be sloped back 1:1 from the back of the footing or grade beam. The ground surface behind retaining walls should be sloped to drain. Where migration of moisture through retaining walls would be detrimental, retaining walls should be waterproofed.

Slab-On-Grade

Provided grading is performed in accordance with the recommendations presented herein, living area, garage, and exterior slabs should be underlain by undisturbed bedrock and/or select engineered fill compacted to 95 percent maximum density.

These recommendations are based on expansive clay and weathered berock materials being completely removed where encountered (likely garage and ADU on northern slope). As an alternative to the removal of expansive surface soil and localized deeper zones of weak, expansive clays, structural slabs may be used, provided that they are designed with a void form under the slabs to mitigate expansive soil heave. Structural slas should be supported on a system of grade beams connected to drilled piers designed in accordance with the recommendations provided in this report. Void forms should be a minimum of 4 inches thick and the slab should be designed to span between the grade beams and over the void forms.

Slab subgrade should be rolled to produce a dense, uniform surface. The future expansion potential of the subgrade soil should be reduced by thoroughly presoaking the slab subgrade prior to concrete placement. The moisture condition of the subgrade soil should be checked by the geotechnical engineer no more than 24 hours prior to placing the capillary moisture break. The slabs should be underlain with a capillary moisture break consisting of at least 4 inches of clean, free-draining crushed rock or gravel (excluding pea gravel) at least ¼-inch and no larger than ¾-inch in size. Interior slabs subject to vehicular traffic may be underlain by Class 2 aggregate base. The use of Class 2 aggregate base should be reviewed on a case by case basis. Class 2 aggregate base can be used for slab rock under exterior slabs. Interior area slabs should be provided with an underdrain system. The installation of this subdrain system is discussed in the "Geotechnical Drainage" section.

Slabs should be designed by the project civil or structural engineer to support the anticipated loads, reduce cracking and provide protection against the infiltration of moisture vapor. Garage slabs should be separated from foundations and framing elements with low friction material.

A vapor barrier should be incorporated into the floor slab design in all areas where moisture-sensitive floor coverings, coatings, underlayments, adhesives, moisture sensitive goods, humidity-controlled environments, or climate-cooled environments are anticipated initially, or in the future. Vapor barrier should consist of a minimum 15 mil extruded polyolefin plastic (no recycled content or woven materials permitted); permeance as tested before and after mandatory conditioning (ASTM E1745 Section 7.1 and Sub-paragraphs 7.1.1 – 7.1.5): less than 0.01 perms [grains/(ft2 per hour in Hg)] and comply with the ASTM E1745 class a requirements. The vapor barrier should also meet paragraph's 8.1 and 9.3 of ASTM E1745; subsequent documentation should be provided by the vapor barrier manufacturer. Install vapor barrier in accordance with ASTM E1643, including proper perimeter seal.

Due to the presence of void form, standard vapor barriers may not perform satisfactorily. We understand that Stego Crete Claw tape is designed to work with slabs over void form. It should be understood that RGH does not practice in the field of moisture vapor transmission evaluation or mitigation. Therefore, we recommend that a qualified person be consulted to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. This person should provide recommendations for mitigation of the potential adverse impact of moisture vapor transmission on various components of the structure as deemed appropriate.

Utility Trenches

The shoring and safety of trench excavations is solely the responsibility of the contractor. Attention is drawn to the State of California Safety Orders dealing with "Excavations and Trenches."

Unless otherwise specified, on-site, inorganic soil may be used as general utility trench backfill. Where utility trenches support (traditional/impervious) pavements, slabs and foundations, trench backfill should consist of aggregate baserock. The baserock should comply with the minimum requirements in Caltrans Standard Specifications, Section 26 for Class 2 Aggregate Base. Trench backfill should be moisture-conditioned as necessary, and placed in horizontal layers not exceeding 8 inches in thickness, before compaction. Each layer should be compacted to at least 90 percent relative compaction as determined by ASTM Test Method D-1557. The top 6 inches of trench backfill below vehicle pavement subgrades should be moisture-conditioned as necessary and compacted to at least 95 percent relative compaction. Jetting

or ponding of trench backfill to aid in achieving the recommended degree of compaction should not be attempted.

Pavements

Provided the site grading is performed to remediate expansive soil heave, as recommended herein, the uppermost 12-inches of pavement subgrade soil will be imported select fill with a minimum R-value of 20. Based on this R-value we recommend the pavement sections listed in the table below be used.

PAVEMENT SECTIONS WITH IMPORTED SELECT FILL SUBGRADE

TI	ASPHALT CONCRETE (feet)	CLASS 2 AGGREGATE BASE (feet)	IMPORTED SELECT FILL* (feet)
7.0	0.30	1.15	1.0
6.0	0.25	1.05	1.0
5.0	0.20	0.90	1.0

* R-value ≥ 20

Pavement thicknesses were computed using the Caltrans Highway Design Manual and are based on a pavement life of 20 years. These recommendations are intended to provide support for traffic represented by the indicated Traffic Indices. They are not intended to provide pavement sections for heavy concentrated construction storage or wheel loads such as forklifts, parked truck-trailers and concrete trucks. In areas where heavy construction storage and wheel loads are anticipated, the pavements should be designed to support these loads. Support could be provided by increasing pavement sections or by providing reinforced concrete slabs. Alternatively, paving can be deferred until heavy construction storage and wheel loads are no longer present.

Prior to placement of aggregate base, the upper 6 inches of the pavement subgrade soil should be scarified, uniformly moisture-conditioned to near optimum, and compacted to at least 95 percent relative compaction to form a firm, non-yielding surface. Aggregate base materials should be spread in thin layers, uniformly moisture-conditioned, and compacted to at least 95 percent relative compaction to form a firm, non-yielding surface. The materials and methods used should conform to the requirements of the Town of Fairfax and the current edition of the Caltrans Standard Specifications, except that compaction requirements should be based on ASTM Test Method D-1557. Aggregate used for the base course should comply with the minimum requirements specified in Caltrans Standard Specifications, Section 26 for Class 2 Aggregate Base.

Wet Weather Paving

In general, the pavements should be constructed during the dry season to avoid the saturation of the subgrade and base materials, which often occurs during the wet winter months. If pavements are constructed during the winter, a cost increase relative to drier weather construction should be anticipated. Unstable areas may have to be overexcavated to remove soft soil. The excavations will probably require backfilling with imported crushed (ballast) rock. The geotechnical engineer should be consulted for recommendations at the time of construction.

Geotechnical Drainage

This section presents recommendations for surface and subsurface drainage. For the discussion of subsurface drainage related to grading, especially on hillsides, refer to the "Subsurface Drainage" section.

Surface

Surface water should be diverted away from slopes, foundations and edges of pavements. Surface drainage gradients should slope away from building foundations in accordance with the requirements of the CBC or local governing agency. Roofs should be provided with gutters and the downspouts should be connected to closed (glued Schedule 40 PVC or ABS with SDR of 35 or better) conduits discharging well away from foundations, onto erosion resistant natural drainages or into the site's surface drainage system. Roof downspouts and surface drains must be maintained entirely separate from the slab underdrains recommended hereinafter.

Water seepage or the spread of extensive root systems into the soil subgrade of footings, slabs or pavements could cause differential movements and consequent distress in these structural elements. Landscaping should be planned with consideration for these potential problems.

Perimeter Foundation Drains

Where interior crawl spaces are lower than adjacent exterior grade, subdrains should be installed adjacent to perimeter foundations, except on the downhill side, to prevent surface runoff from entering the crawl space. Foundation drains should consist of trenches that are at least 10 inches below the crawl space surface and are sloped to drain by gravity. Four-inch diameter perforated pipe sloped to drain to outlets by gravity should be placed in the bottom of the trenches. The top of subdrain pipes should be at least 6 inches lower than the adjacent crawl space. The perimeter subdrain trenches should be backfilled to within 12 inches of the surface with Class 2 permeable material. The upper 12 inches should be backfilled with compacted soil to exclude surface water. An illustration of this system is shown on Plate 20. Where perimeter foundation drains are not used, water ponding in the crawl space should be anticipated. Where retaining walls are used for perimeter foundations, retaining wall backdrains may be used in lieu of foundation drains.

Crawl Space Drains

Crawl spaces are inherently damp and humid. In addition, groundwater seepage is unpredictable and difficult to control and, regardless of the care used in installing perimeter foundation drains, can find its way into crawl spaces. The ground surface within the crawl space should be sloped to drain away from foundations and toward a 12 inch square drain trench that is excavated through the longitudinal axis of the crawl space. A 4-inch diameter perforated drain pipe (SDR 35 or better) should be embedded in Class 2 permeable materials near the bottom of the trench. The drain rock should extend to the surface of the crawl space (see Plate 20). Piped outlets should be provided to allow drainage of the collected water through foundations and discharge into the storm drain system. Additional protection against water seepage into crawl spaces can be obtained by compacting fill placed adjacent to perimeter walls to at least 90 percent relative compaction.

Slab Underdrains

Where living area slab subgrades are less than 6 inches above adjacent exterior grade and where migration of moisture through the slab would be detrimental, slab underdrains should be installed to dispose of surface and/or groundwater that may seep and collect in the slab rock. Slab underdrains should consist of 6-inch wide trenches that extend at least 6 inches below the bottom of the slab rock and slope to drain by gravity. The slab underdrain trenches should be spaced no further than 15 feet, both ways. Additional drain trenches should be installed, as necessary, to drain all isolated under slab areas. Four-inch diameter perforated pipe (SDR 35 or better) sloped to drain to outlets by gravity should be placed in the bottom of the trenches. Slab underdrain trenches should be backfilled to subgrade level with clean, free draining slab rock. An illustration of this system is shown on Plate 20. If slab underdrains are not used, it should be anticipated that water will enter the slab rock, permeate through the concrete slab and ruin floor coverings.

Maintenance

Periodic land maintenance, especially on hillsides, will be required. Surface and subsurface drainage facilities should be checked frequently, and cleaned and maintained as necessary or at least annually. A dense growth of deep-rooted ground cover must be maintained on all slopes to reduce sloughing and erosion. Sloughing and erosion that occurs must be repaired promptly before it can enlarge.

Supplemental Services

Pre-Bid Meeting

It has been our experience that contractors bidding on the project often contact us to discuss the geotechnical aspects. Informal contacts between RGH Consultants (RGH) and an individual contractor could result in incomplete or misinterpreted information being provided to the contractor. Therefore, we recommend a pre-bid meeting be held to answer any questions about the report prior to submittal of bids. If this is not possible, questions or clarifications regarding this report should be directed to the project owner or their designated representative. After consultation with RGH, the project owner or their representative should provide clarifications or additional information to all contractors bidding the job.

Plan and Specifications Review

Coordination between the design team and the geotechnical engineer is recommended to assure that the design is compatible with the soil, geologic and groundwater conditions encountered during our study. RGH recommends that we be retained to review the project plans and specifications to determine if they are consistent with our recommendations. In the event we are not retained to perform this recommended review, we will assume no responsibility for misinterpretation of our recommendations.

Construction Observation and Testing

Prior to construction, a meeting should be held at the site that includes, but is not limited to, the owner or owner's representative, the general contractor, the grading contractor, the foundation contractor, the underground contractor, any specialty contractors, the project civil engineer, other members of the project design team and RGH. This meeting should serve as a time to discuss and answer questions regarding the recommendations presented herein and to establish the coordination procedure between the contractors and RGH.

In addition, we should be retained to monitor all soil related work during construction, including, but not limited to:

- Site stripping, over-excavation, grading, and compaction of near surface soil;
- Placement of all engineered fill and trench backfill with verification field and laboratory testing;
- Observation of all foundation excavations; and
- Observation of foundation and subdrain installations.

If, during construction, we observe subsurface conditions different from those encountered during the explorations, we should be allowed to amend our recommendations accordingly. If different conditions are observed by others, or appear to be present beneath excavations, RGH should be advised at once so that these conditions may be evaluated and our recommendations reviewed and updated, if warranted. The validity of recommendations made in this report is contingent upon our being notified and retained to review the changed conditions.

If more than 18 months have elapsed between the submission of this report and the start of work at the site, or if conditions have changed because of natural causes or construction operations at, or adjacent to, the site, the recommendations made in this report may no longer be valid or appropriate. In such case, we recommend that we be retained to review this report and verify the applicability of the conclusions and recommendations or modify the same considering the time lapsed or changed conditions. The validity of recommendations made in this report is contingent upon such review.

These supplemental services are performed on an as-requested basis and are in addition to this geotechnical study. We cannot accept responsibility for items that we are not notified to observe or for changed conditions we are not allowed to review.

LIMITATIONS

This report has been prepared by RGH for the exclusive use of the property owner and their consultants as an aid in the design and construction of the proposed improvements described in this report.

The validity of the recommendations contained in this report depends upon an adequate testing and monitoring program during the construction phase. Unless the construction monitoring and testing program is provided by our firm, we will not be held responsible for compliance with design recommendations presented in this report and other addendum submitted as part of this report.

Our services consist of professional opinions and conclusions developed in accordance with generally accepted geotechnical engineering principles and practices. We provide no warranty, either expressed or implied. Our conclusions and recommendations are based on the information provided to us regarding the proposed construction, the results of our field exploration, laboratory testing program, and professional judgment. Verification of our conclusions and recommendations is subject to our review of the project plans and specifications, and our observation of construction.

The test pits and hand auger holes represent the subsurface conditions at the locations and on the date indicated. It is not warranted that they are representative of such conditions elsewhere or at other times. Site conditions and cultural features described in the text of this report are those existing at the time of our field exploration and may not necessarily be the same or comparable at other times.

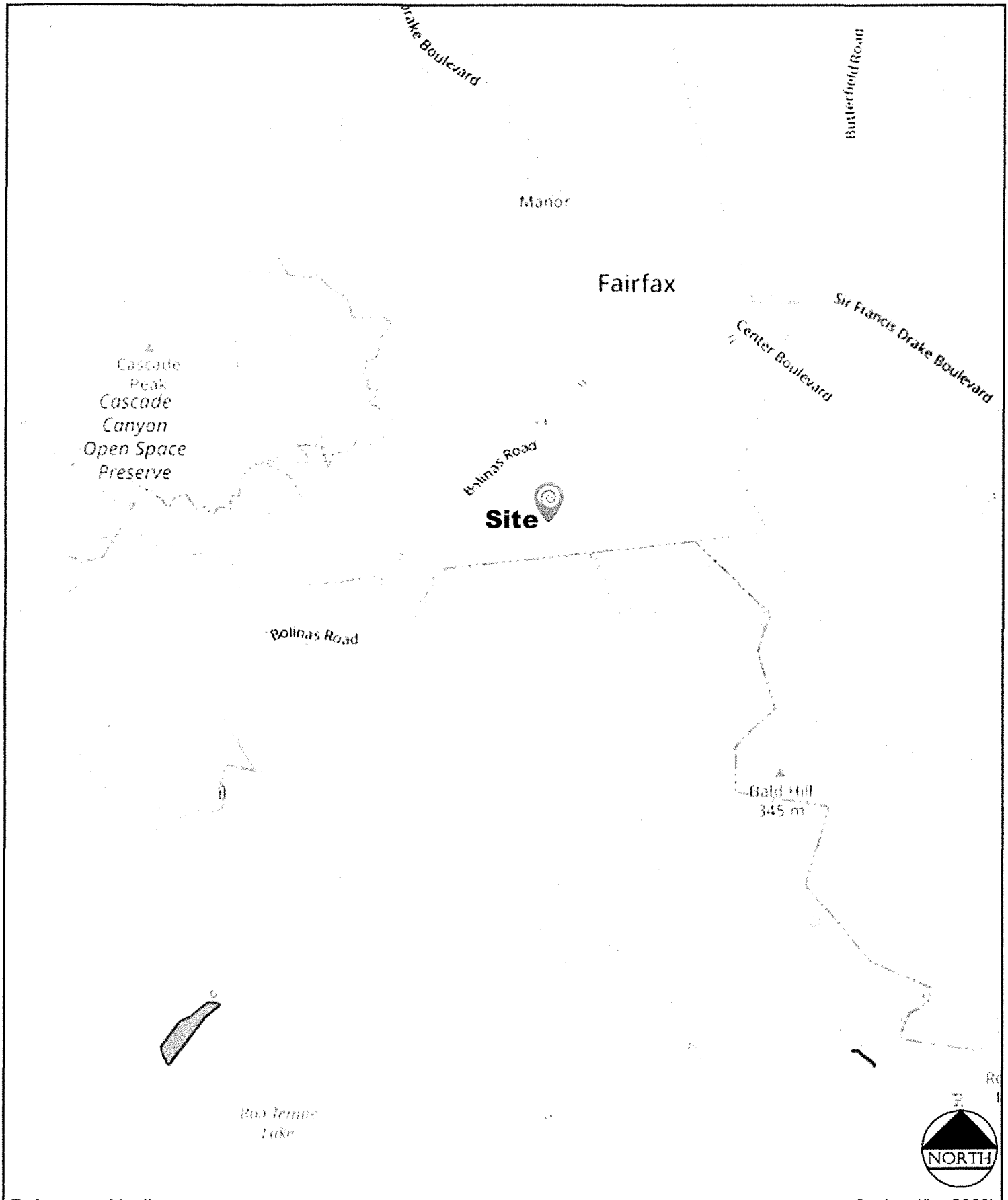
It should be understood that slope failures including landslides, debris flows and erosion are on-going natural processes which gradually wear away the landscape. Residual soil and weathered bedrock can be susceptible to downslope movement, even on apparently stable sites. Such inherent hillside and slope risks are generally more prevalent during periods of intense and prolonged rainfall, which occasionally occur, in northern California and/or during earthquakes. Therefore, it must be accepted that occasional, unpredictable slope failure and erosion and deposition of the residual soil and weathered bedrock materials are irreducible risks and hazards of building upon or near the base of any hillside or any steeper slope area throughout northern California. By accepting this report, the client and other recipients acknowledge their understanding and acceptance of these risks and hazards, and the terms and conditions herein.

The scope of our services did not include an environmental assessment or a study of the presence or absence of toxic mold and/or hazardous, toxic or corrosive materials in the soil, surface water, groundwater or air (on, below or around this site), nor did it include an evaluation or study for the presence or absence of wetlands. These studies should be conducted under separate cover, scope and fee and should be provided by a qualified expert in those fields.

APPENDIX A - PLATES

LIST OF PLATES

Plate 1	Site Location Map
Plate 2	Exploration Plan
Plates 3 through 10	Logs of Test Pits TP-1 through TP-16
Plates 11 through 13	Logs of Hand Augers HA-1 through HA-3
Plate 14	Soil Classification Chart and Key to Test Data
Plate 15	Engineering Geology Rock Terms
Plate 16	Classification Test Data
Plate 17	Resistance (R) Value Data
Plate 18	Hillside Grading Illustration
Plate 19	Retaining Wall Backdrain Illustration
Plate 20	Typical Subdrain Details Illustration



Reference: Mapline

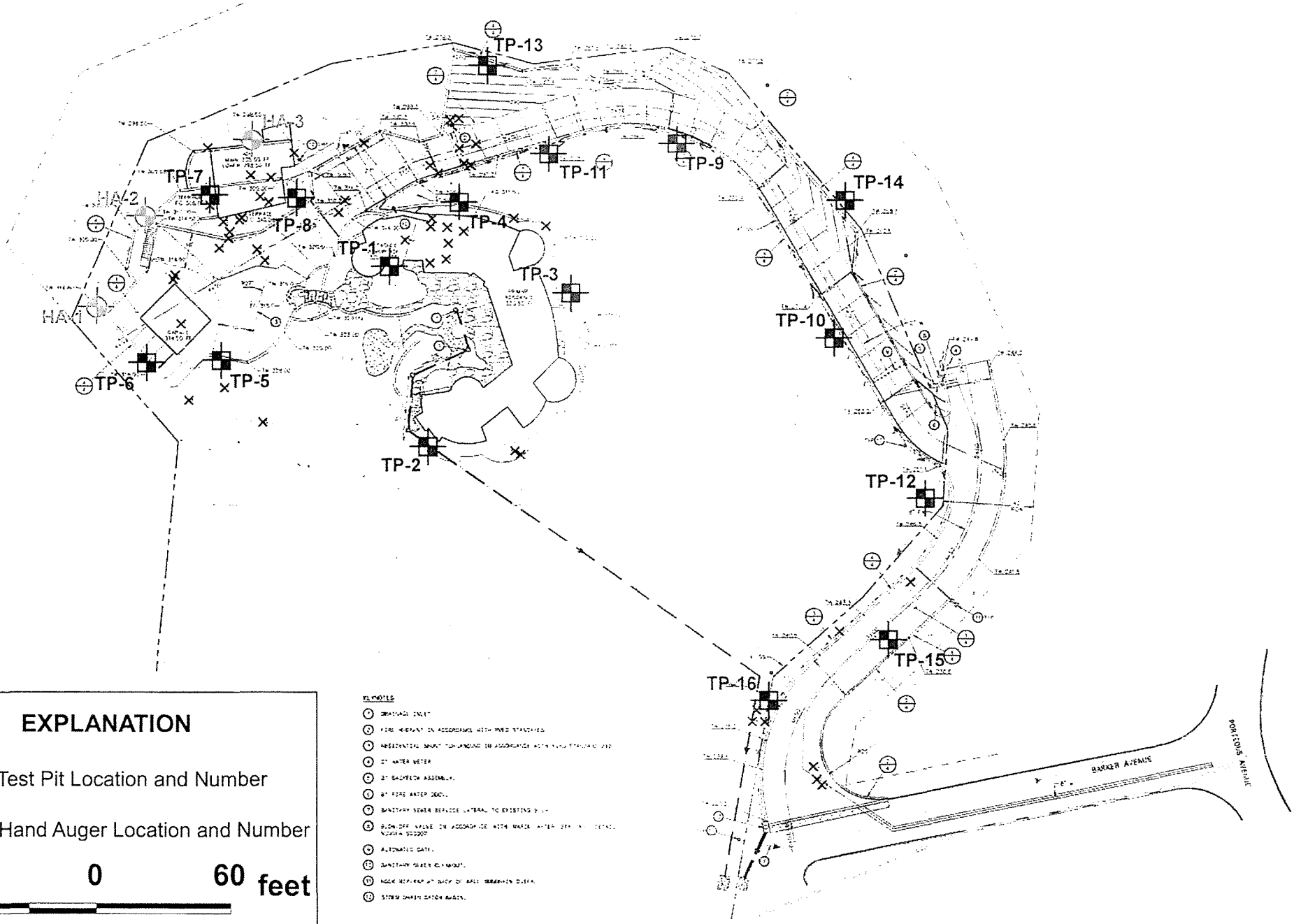
Scale: 1" = 2000'

RGH CONSULTANTS

Job No: 4999.01.04.1 | Date: MAY 2023

SITE LOCATION MAP
Quirie Residence
12 Barker Avenue
Fairfax, California

PLATE
1



EXPLANATION

TP-2 Test Pit Location and Number

HA-3 Hand Auger Location and Number

60 0 60 feet

Reference: Preliminary Plans Titled Quirie House by BKF, dated 12/13/2022, Drawing Number C-2, Sheet 2 Scale: 1" = 60'

RGH CONSULTANTS

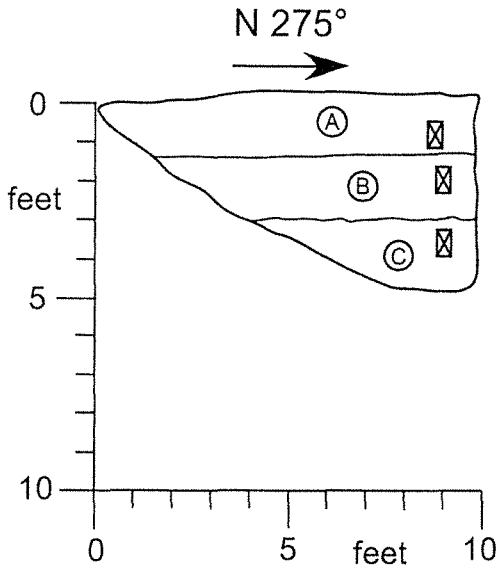
Job No: 4999.01.04.1 | Date: MAY 2023

EXPLORATION PLAN

Quirie Residence
12 Barker Avenue
Fairfax, California

PLATE 2

TP-1
Main House/Jr ADU



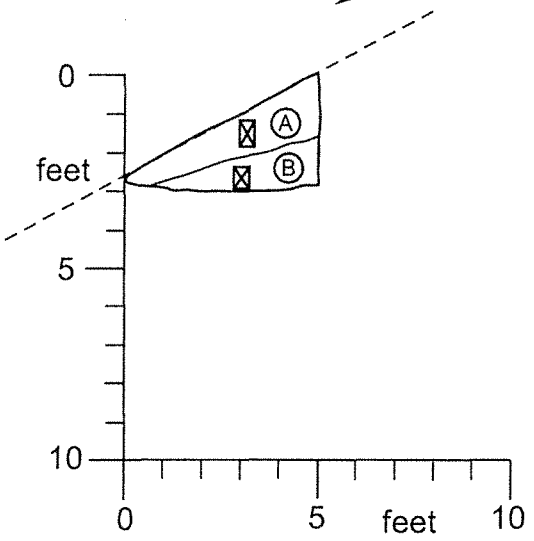
(A) BROWN CLAY WITH SAND (CL), very stiff, wet; porous, with roots, abundant organics in upper 6 inches

(B) GRAY SHALE, very closely spaced fracturing, moderately strong, moderately to highly weathered; wet

(C) BROWN SHALE MELANGE, closely spaced fracturing, moderately hard, moderately strong, moderately to highly weathered

No Groundwater encountered, no caving

TP-2
Main House



(A) BROWN CLAY (CL), medium stiff, wet; porous, abundant roots

(B) BROWN SHALE MELANGE, closely spaced fracturing, moderately hard, moderately strong, moderately to highly weathered; digging refusal at 3'; locally with green serpentinite mélange from 1' to 1½'

No Groundwater encountered, no caving

Scale: 1" = 5'

RGH CONSULTANTS

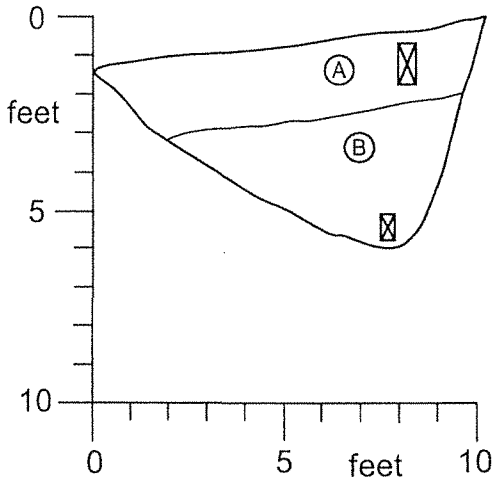
Job No: 4999.01.04.1 | Date: MAY 2023

LOGS OF TEST PITS TP-1 AND TP-2
Quirie Residence
12 Barker Avenue
Fairfax, California

PLATE
3

TP-3
Main House

N 247°



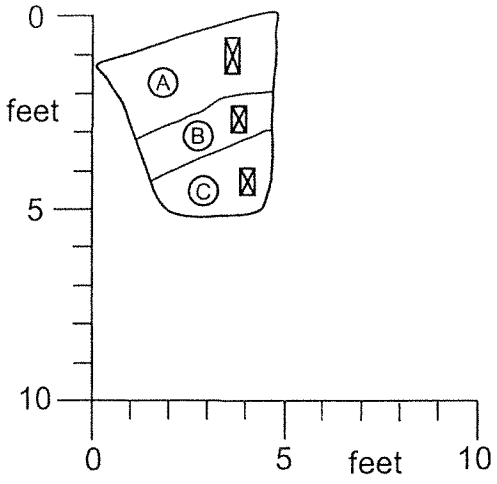
(A) BROWN/YELLOW-BROWN CLAY (CL), stiff, wet; porous, abundant large roots

(B) YELLOW-BROWN SANDSTONE, closely to very closely spaced fracturing, moderately hard to firm, moderately strong, highly weathered to 3', moderately weathered from 3' to 6'

No Groundwater encountered, no caving

TP-4
Main House

N 160°



(A) YELLOW-BROWN CLAY WITH GRAVEL (CL), stiff, wet; porous, abundant large roots

(B) YELLOW-ORANGE WITH GREEN SANDY CLAY (CH), stiff, wet

LL = 54.2; PI = 28.1; EI = 89

(C) GRAY SHALE, very closely spaced fracturing, moderately hard, moderately strong, moderately to highly weathered to red-brown

No Groundwater encountered, no caving

Scale: 1" = 5'

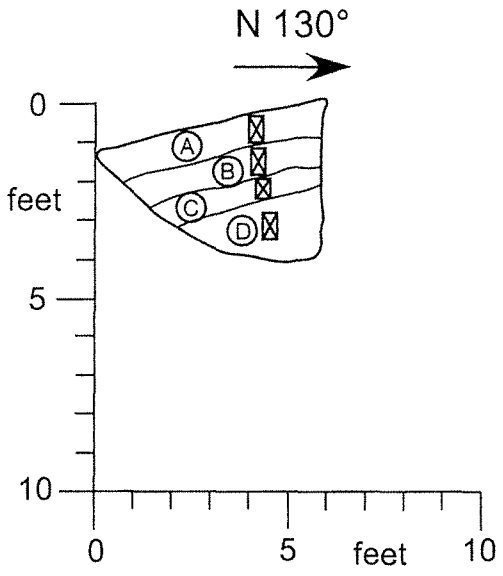
RGH CONSULTANTS

Job No: 4999.01.04.1 | Date: MAY 2023

LOGS OF TEST PITS TP-3 AND TP-4
Quirie Residence
12 Barker Avenue
Fairfax, California

PLATE
4

TP-5
Garage Retaining Wall



Ⓐ BROWN CLAY WITH GRAVEL (CL), soft, wet; porous, with roots

Ⓑ YELLOW-BROWN WITH GREEN CLAYEY GRAVEL (GC), dense, wet (completely weathered mélange)

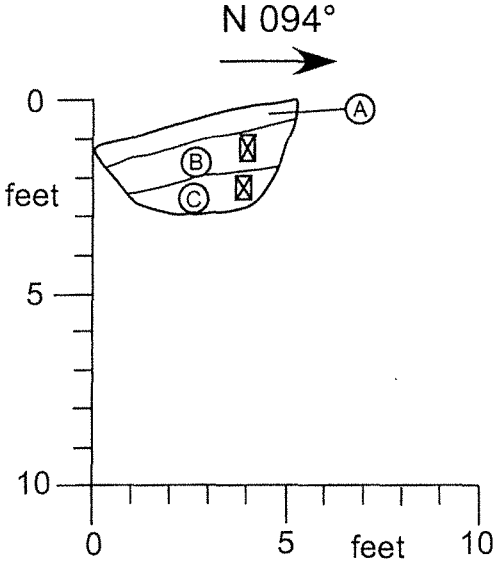
Ⓒ YELLOW-BROWN CLAY (CH), very stiff, wet (completely weathered shale)

LL = 61.5; PI = 35.3; EI = 85

Ⓓ BROWN SHALE, sheared, extremely closely spaced fractures, firm to moderately hard, moderately strong, moderately weathered.

No groundwater encountered, no caving

TP-6
Garage/Wall



Ⓐ BROWN CLAY (CL), soft, wet; porous, abundant roots, rootlets

Ⓑ BROWN TO YELLOW-BROWN CLAY (CH), stiff, wet with roots

Ⓒ BROWN SHALE, sheared, very closely spaced fracturing, moderately hard, moderately strong, moderately weathered

No groundwater encountered, no caving

Scale: 1" = 5'

RGH CONSULTANTS

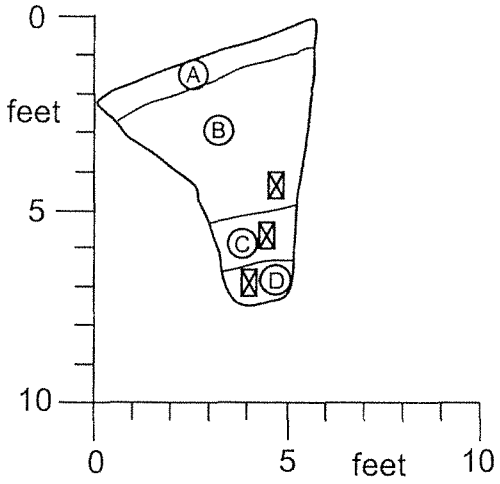
Job No: 4999.01.04.1 | Date: MAY 2023

LOGS OF TEST PITS TP-5 AND TP-6
Quirie Residence
12 Barker Avenue
Fairfax, California

PLATE
5

TP-7
ADU

N 141°



Ⓐ BROWN CLAY WITH GRAVEL (CL), soft, wet; porous, abundant roots to 1.5'

Ⓑ YELLOW-BROWN SANDSTONE, very closely spaced fracturing, moderately hard to hard, moderately strong, highly weathered 0.5' to 2.5'

Ⓒ ORANGE-BROWN SHALE, soft, plastic, completely weathered to clay (CH)

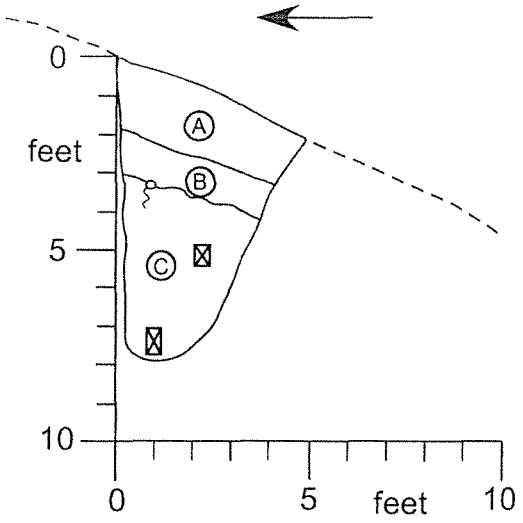
LL = 45.7; PI = 23.4; EI = 93

Ⓓ YELLOW SANDSTONE, closely to very closely spaced fractures, moderately hard, moderately strong, moderately weathered, hard digging

No groundwater encountered, no caving

TP-8
ADU, Driveway, Wall

N 144°



Ⓐ BROWN CLAY (CL), soft, wet; porous, abundant large roots

Ⓑ ORANGE-BROWN SHALE, soft, plastic, completely weathered to clay (CH)

Ⓒ DARK BROWN SHALE, pervasively sheared, soft, plastic to friable, highly weathered

Minor seepage at 3', no caving

Scale: 1" = 5'

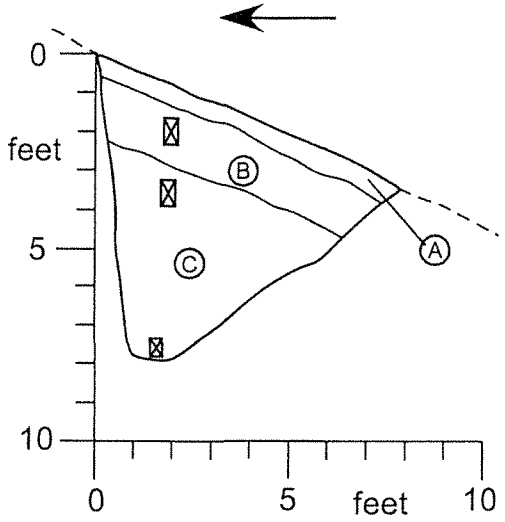
RGH CONSULTANTS

Job No: 4999.01.04.1 | Date: MAY 2023

LOGS OF TEST PITS TP-7 AND TP-8
Quirie Residence
12 Barker Avenue
Fairfax, California

PLATE
6

TP-9
Driveway
N 225°



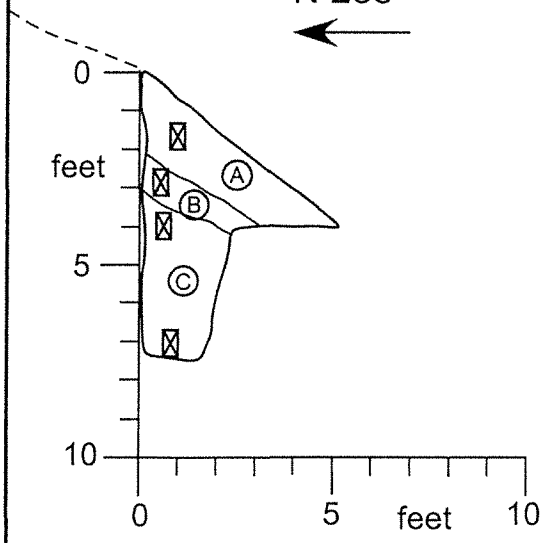
(A) BROWN CLAY (CL), soft, wet; porous, abundant roots, wood chips at surface

(B) YELLOW-BROWN SANDSTONE/SHALE, very closely spaced fracturing, moderately hard, moderately strong, highly weathered

(C) YELLOW-RED SANDSTONE, closely spaced fractures, moderately hard, moderately strong, moderately weathered

No groundwater encountered, no caving

TP-10
Driveway
N 235°



(A) LIGHT BROWN CLAY (CL), soft, wet; porous, abundant roots

(B) ORANGE CLAYEY SAND WITH GRAVEL (SC), medium dense, wet (completely weathered sandstone)

LL = 35.9; PI = 12.2; EI = 48; 52.3% passing #200

(C) BROWN-GRAY SHALE AND YELLOW-BROWN-ORANGE SANDSTONE, closely to very spaced fracturing, moderately hard, moderate strong, moderate weathering

No groundwater encountered, some sloughing/caving of loose rock

Scale: 1" = 5'

RGH CONSULTANTS

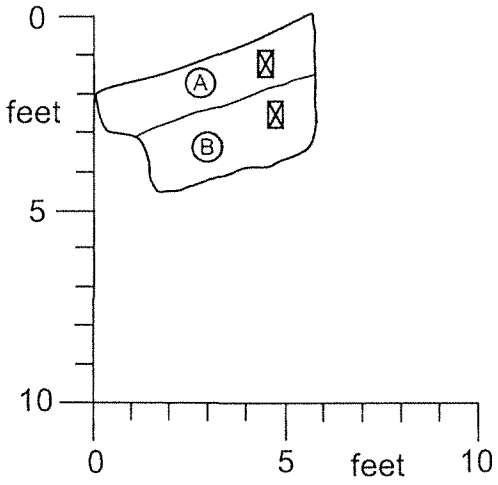
Job No: 4999.01.04.1 | Date: MAY 2023

LOGS OF TEST PITS TP-9 AND TP-10
Quirie Residence
12 Barker Avenue
Fairfax, California

PLATE
7

TP-11
Driveway

N 175°



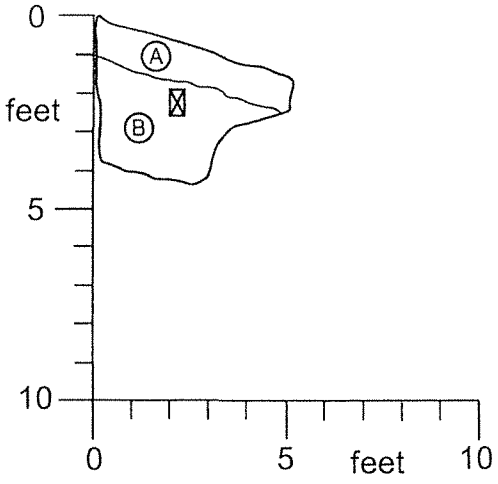
(A) BROWN SANDY CLAY (CL), medium stiff to stiff, moist to wet; porous to 2', roots to 2'

(B) YELLOW SANDSTONE, closely spaced fracturing, firm, weak, highly to moderately weathered

No groundwater encountered, no caving

TP-12
Driveway/Barker Ave. Ext.

N 252°



(A) BROWN SANDY CLAY (CL), soft to medium stiff, moist; porous, with abundant roots to 2'

(B) BROWN SHALE & YELLOW SANDSTONE, closely spaced fracturing, firm to moderately hard, weak to moderately strong, highly to moderately weathered; dip-slope bedding orientation 346/045°E

No groundwater encountered, no caving

Scale: 1" = 5'

RGH CONSULTANTS

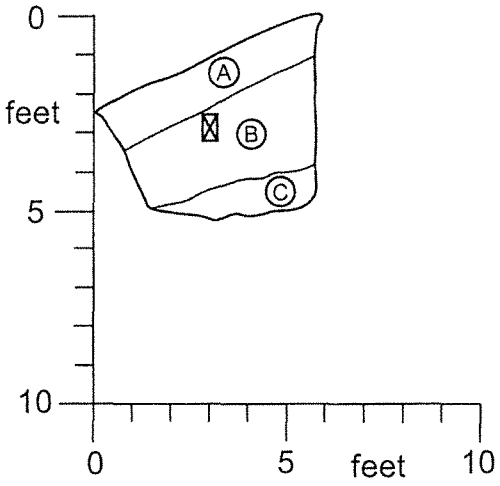
Job No: 4999.01.04.1 | Date: MAY 2023

LOGS OF TEST PITS TP-11 AND TP-12
Quirie Residence
12 Barker Avenue
Fairfax, California

PLATE
8

TP-13
Driveway/Fill Slope

N 165°



Ⓐ BROWN SANDY CLAY (CL), soft, moist to wet; porous

Ⓑ ORANGE SANDY SILT (ML), soft to medium stiff, wet; roots throughout

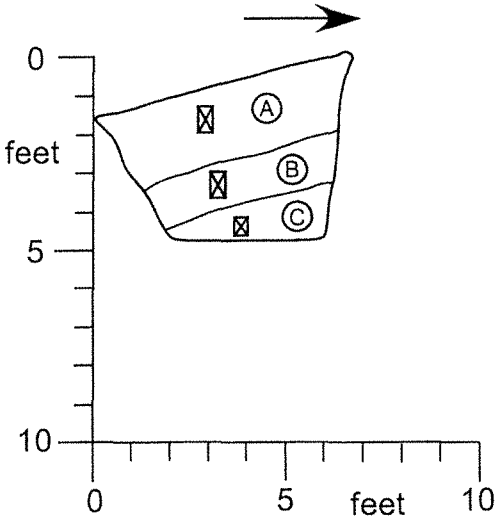
LL = 24.2; PI = 3.8; EI = 2; 58.6% passing #200; R-Value = 50

Ⓒ YELLOW-BROWN SANDSTONE/SHALE, closely spaced fracturing, firm to moderately hard, highly weathered.

No groundwater encountered, no caving

TP-14
Driveway/Fill Slope

N 230°



Ⓐ BROWN CLAY / SANDY CLAY (CL), medium stiff, moist to wet; porous, with abundant roots throughout

Ⓑ ORANGE YELLOW CLAYEY GRAVEL (GC), dense, moist (completely weathered sandstone)

Ⓒ YELLOW-ORANGE SANDSTONE, closely spaced fracturing, firm to moderately hard, weak, highly weathered.

No groundwater encountered, no caving

Scale: 1" = 5'

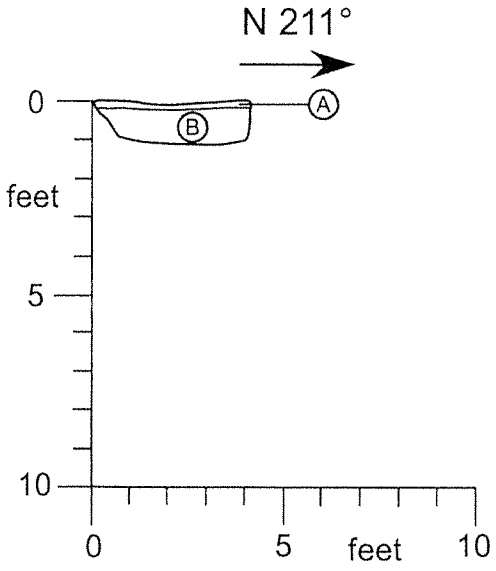
RGH CONSULTANTS

Job No: 4999.01.04.1 | Date: MAY 2023

LOGS OF TEST PITS TP-13 AND TP-14
Quirie Residence
12 Barker Avenue
Fairfax, California

PLATE
9

TP-15
Barker Ave. Ext.

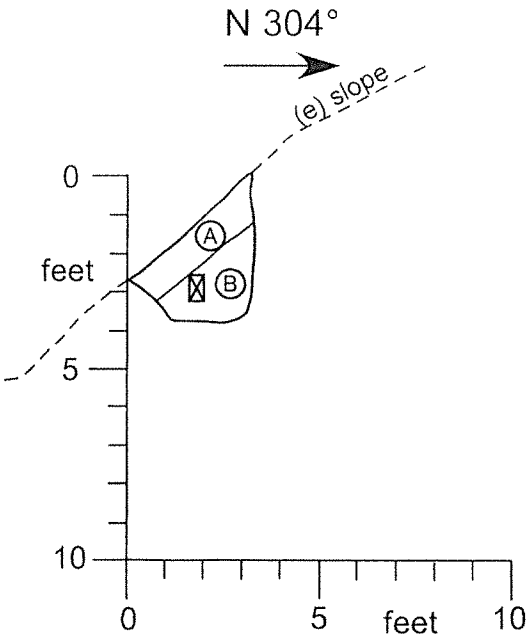


(A) BROWN CLAYEY SAND (SC), loose, moist

(B) YELLOW-BROWN SANDSTONE, closely spaced fracturing, firm to moderately hard, weak to moderately strong, moderately weathered

No groundwater encountered, no caving

TP-16
Barker Ave. Ext.



(A) BROWN SANDY CLAY (CL), medium stiff, moist to wet; porous, with roots to 1.5'

(B) DARK GRAY SHALE, moderately spaced fracturing to sheared, moderately hard, moderately strong, moderately weathered, hard digging

No groundwater encountered, no caving

Scale: 1" = 5'

RGH CONSULTANTS

Job No: 4999.01.04.1 | Date: MAY 2023

LOGS OF TEST PITS TP-15 AND TP-16
Quirie Residence
12 Barker Avenue
Fairfax, California

PLATE
10

Date Drilled: 4/6/2023	Logged By: SCL	Project Manager: SCL
Drilling Method:	Drill Bit Size/Type: 4 inch	Total Depth of Borehole: 1 1/4 feet
Drill Rig Type: Hand Auger	Drilling Contractor: Pearson Excacation	Approximate Surface Elevation: Existing Ground Surface
Groundwater Level: No Groundwater Encountered	Sampling Method(s):	Hammer Data: N/A

Depth (feet)	Sample Type	Sampling Resistance, blows/ft	Graphic Log	MATERIAL DESCRIPTION	Dry Density (pcf)	Water Content (%)	% <#200 Sieve	PI, %	LL, %	Expansion Index (EI)	UC, ksf	REMARKS AND OTHER TESTS
0				BROWN SANDY CLAY (CL), medium stiff, moist to wet, with roots								
1				BROWN SHALE, closely to very closely spaced fracturing, firm to moderately hard, moderately strong, moderately weathered								
				Hand auger refusal at 1 1/4 feet. No groundwater encountered, no caving.								
2												
3												
4												

RGH CONSULTANTS

Job No: 4999.01.04.1 | Date: MAY 2023

LOG OF HAND AUGER HA-1

Quirie Residence
12 Barker Avenue
Fairfax, California

PLATE 11

Date Drilled: 4/6/2023	Logged By: SCL	Project Manager: SCL
Drilling Method:	Drill Bit Size/Type: 4 inch	Total Depth of Borehole: 1 1/5 feet
Drill Rig Type: Hand Auger	Drilling Contractor: Pearson Excacation	Approximate Surface Elevation: Existing Ground Surface
Groundwater Level: No Groundwater Encountered	Sampling Method(s): Bulk	Hammer Data: N/A

Depth (feet)	Sample Type	Sampling Resistance, blows/ft	Graphic Log	MATERIAL DESCRIPTION	Dry Density (pcf)	Water Content (%)	% <#200 Sieve	PI, %	LL, %	Expansion Index (EI)	UC, ksf	REMARKS AND OTHER TESTS
0				BROWN SANDY CLAY (CL), medium stiff, moist, porous, with roots								
1				BROWN SHALE/SANDSTONE, closely spaced fracturing, hard, strong, moderately weathered								
				Hand auger refusal at 1 1/2 feet. No groundwater encountered, no caving.								
2												
3												
4												

RGH CONSULTANTS

Job No: 4999.01.04.1 | Date: MAY 2023

LOG OF HAND AUGER HA-2

Quirie Residence
12 Barker Avenue
Fairfax, California

PLATE 12

Date Drilled: 4/6/2023	Logged By: SCL	Project Manager: SCL
Drilling Method:	Drill Bit Size/Type: 4 inch	Total Depth of Borehole: 4 1/4 feet
Drill Rig Type: Hand Auger	Drilling Contractor: Pearson Excacation	Approximate Surface Elevation: Existing Ground Surface
Groundwater Level: No Groundwater Encountered	Sampling Method(s): Bulk	Hammer Data: N/A

Depth (feet)	Sample Type	Sampling Resistance, blows/ft	Graphic Log	MATERIAL DESCRIPTION	Dry Density (pcf)	Water Content (%)	% <#200 Sieve	PI, %	LL, %	Expansion Index (EI)	UC, ksf	REMARKS AND OTHER TESTS
0				BROWN CLAYEY SAND (SC), loose to medium dense, moist, porous, with roots								
1												
2				ORANGE-BROWN CLAY (CH), stiff, moist								
3												
4				GRAY SHALE, closely spaced fracturing, moderately hard, strong, highly weathered, soil matrix								
				Hand auger refusal at 4 1/4 feet. No groundwater encountered, no caving								

RGH CONSULTANTS

Job No: 4999.01.04.1 | Date: MAY 2023

LOG OF HAND AUGER HA-3

Quirie Residence
12 Barker Avenue
Fairfax, California

PLATE 13

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS — MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL (LITTLE OR FINES)		GW	WELL-GRADED GRAVEL, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVEL, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVEL WITH FINES (OVER 12% OF FINES)		GM	WELL-GRADED GRAVEL, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GC	CLAYEY GRAVEL, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SAND, GRAVELLY SAND, LITTLE OR NO FINES
				SP	POORLY-GRADED SAND, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (OVER 12% OF FINES)		SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES
				SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS — LIQUID LIMIT LESS THAN 50			ML	INORGANICS SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS — LIQUID LIMIT GREATER THAN 50			MH	ORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS AND OTHER SOILS WITH HIGH ORGANIC-CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

KEY TO TEST DATA

Consol - Consolidation
Gs - Specific Gravity
SA - Sieve Analysis
■ - "Undisturbed" Sample
⊠ - Bulk or Disturbed Sample
◥ - Standard Penetration Test
⊘ - Sample Attempt With No Recovery
◫ - Sample Recovered But Not Retained

Shear Strength, psf		Confining Pressure, psf	
Tx	320	(2600)	- Unconsolidated Undrained Traixial
TxCU	320	(2600)	- Consolidated Undrained Triaxial
DS	2750	(2600)	- Consolidated Drained Direct Shear
UC	2000		- Unconfined Compression
FVS	470		- Field Vane Shear
LVS	700		- Laboratory Vane Shear
SS			- Shrink Swell
EXP			- Expansion
P			- Permeability

Note: All strength tests on 2.8-in. or 2.4-in. diameter sample, unless otherwise indicated.

RGH CONSULTANTS

Job No: 4999.01.04.1 | Date: MAY 2023

SOIL CLASSIFICATION AND KEY TO TEST DATA
Quirie Residence
12 Barker Avenue
Fairfax, California

PLATE
14

LAYERING		JOINT, FRACTURE, OR SHEAR SPACING	
MASSIVE	Greater than 6 feet	VERY WIDELY SPACED	Greater than 6 feet
THICKLY BEDDED	2 to 6 feet	WIDELY SPACED	2 to 6 feet
MEDIUM BEDDED	8 to 24 inches	MODERATELY SPACED	8 to 24 inches
THINLY BEDDED	2½ to 8 inches	CLOSELY SPACED	2½ to 8 inches
VERY THINLY BEDDED	¾ to 2½ inches	VERY CLOSELY SPACED	¾ to 2½ inches
CLOSELY LAMINATED	¼ to ¾ inches	EXTREMELY CLOSELY SPACED	Less than ¼ inch
VERY CLOSELY LAMINATED	Less than ¼ inch		

HARDNESS

Soft - pliable; can be dug by hand

Firm - can be gouged deeply or carved with a pocket knife

Moderately Hard - can be readily scratched by a knife blade; scratch leaves heavy trace of dust and is readily visible after the powder has been blown away

Hard - can be scratched with difficulty; scratch produces little powder and is often faintly visible

Very Hard - cannot be scratched with pocket knife, leaves a metallic streak

STRENGTH

Plastic - capable of being molded by hand

Friable - crumbles by rubbing with fingers

Weak - an unfractured specimen of such material will crumble under light hammer blows

Moderately Strong - specimen will withstand a few heavy hammer blows before breaking

Strong - specimen will withstand a few heavy ringing hammer blows and usually yields large fragments

Very Strong - rock will resist heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments

DEGREE OF WEATHERING

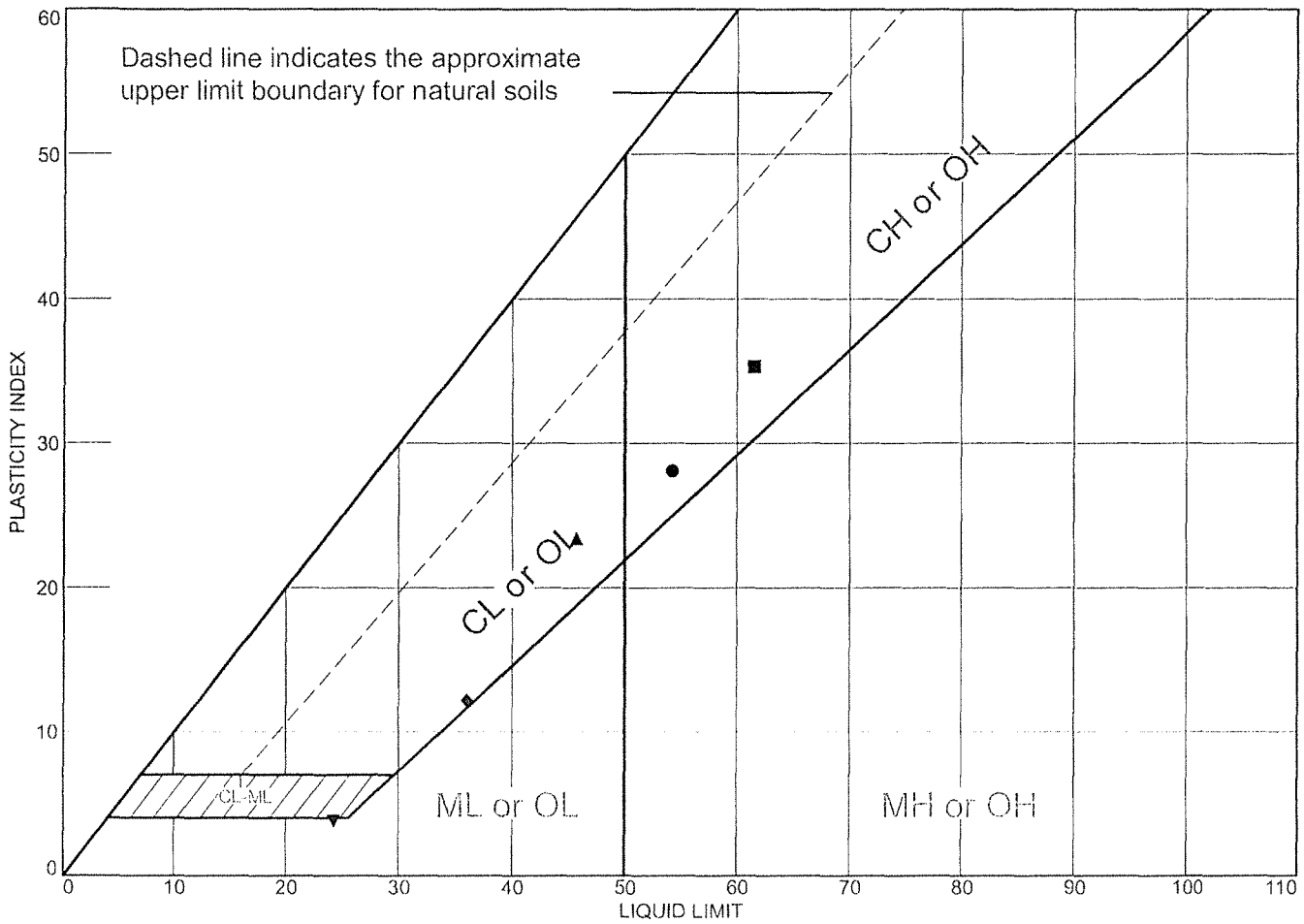
Highly Weathered - abundant fractures coated with oxides, carbonates, sulphates, mud, etc., thorough discoloration, rock disintegration, mineral decomposition

Moderately Weathered - some fracture coating, moderate or localized discoloration, little to no effect on cementation, slight mineral decomposition

Slightly Weathered - a few stained fractures, slight discoloration, little or no effect on cementation, no mineral composition

Fresh - unaffected by weathering agents; no appreciable change with depth

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Brown Sandy Clay (CH)	54.2	26.1	28.1			CH
■	Brown Sandy Clay (CH)	61.5	26.2	35.3			CH
▲	Brown Sandy Clay (CL)	45.7	22.3	23.4			CL
◆	Brown Clayey Sand W/ Gravel (SC) -#200 Analysis Performed on -#4 Portion of Sample	35.9	23.7	12.2		52.3	SC
▼	Brown Sandy Silt (ML)	24.2	20.4	3.8		58.6	ML

Project No. 4999.01.04.1

Project: Quirie Residence

● Source of Sample: TP-4 Depth: 2.0'-3.0'
■ Source of Sample: TP-5 Depth: 1.75'-2.5'
▲ Source of Sample: TP-7 Depth: 5.0'-6.5'
◆ Source of Sample: TP-10 Depth: 2.0'-3.0'
▼ Source of Sample: TP-13 Depth: 1.0'-2.0'

RGH CONSULTANTS

Remarks:
● Expansion Index= 89 (Medium)
■ Expansion Index= 85 (Medium)
▲ Expansion Index= 93 (High)
◆ Expansion Index= 48 (Low)
▼ Expansion Index= 22 (Low)

Figure

Tested By: SCW Checked By: SEF

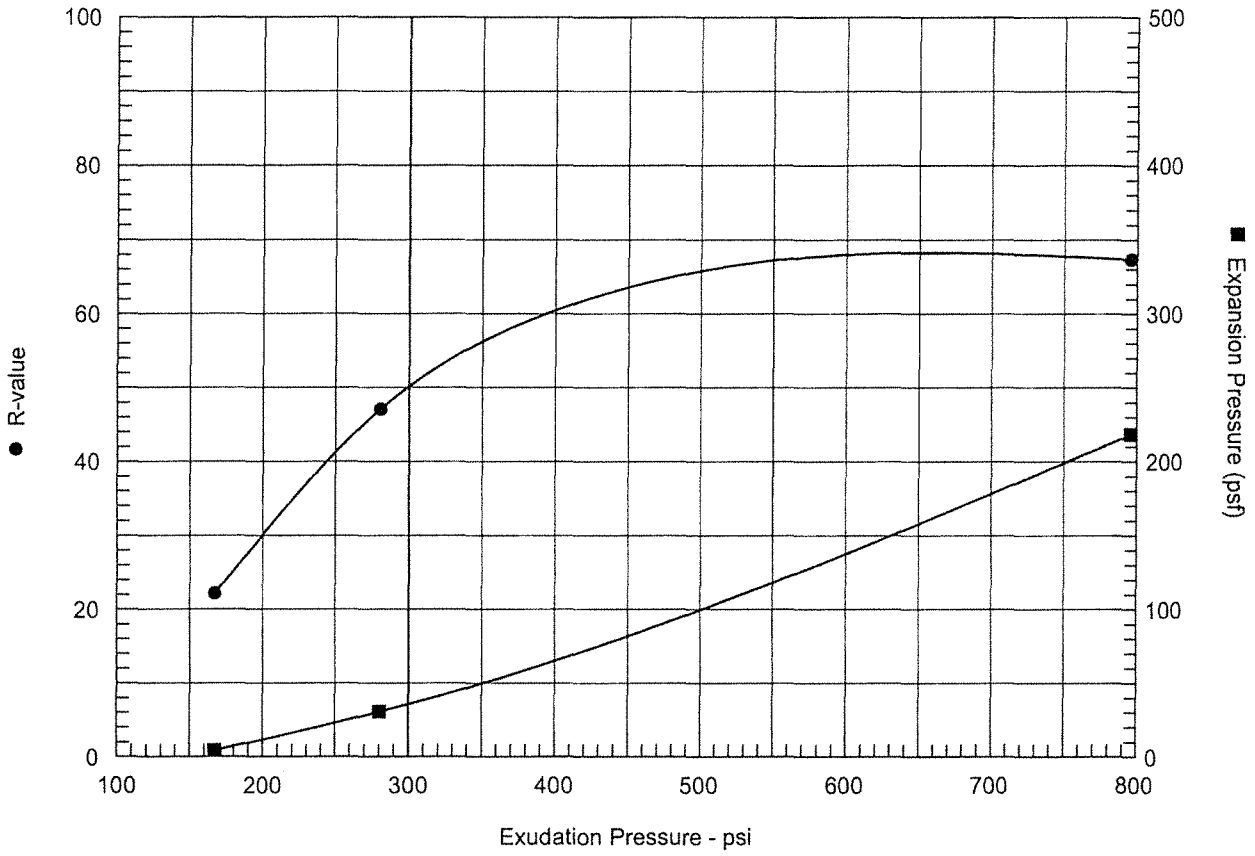
RGH CONSULTANTS

Job No: 4999.01.04.1 | Date: MAY 2023

CLASSIFICATION TEST DATA
Quirie Residence
12 Barker Avenue
Fairfax, California

PLATE
16

R-VALUE TEST REPORT



Resistance R-Value and Expansion Pressure - ASTM D2844

No.	Compact. Pressure psi	Density pcf	Moist. %	Expansion Pressure psf	Horizontal Press. psi @ 160 psi	Sample Height in.	Exud. Pressure psi	R Value	R Value Corr.
1	50	112.5	16.5	4	106	2.59	167	21	22
2	100	115.8	15.3	31	64	2.47	281	47	47
3	350	114.6	13.9	218	37	2.50	796	67	67

Test Results	Material Description
R-value at 300 psi exudation pressure = 50 Exp. pressure at 300 psi exudation pressure = 36 psf	Brown Sandy Silt (ML)

Project No.: 4999.01.04.1
Project: Quirie Residence
Source of Sample: TP-13 Depth: 1.0'-3.0'

Date: 4/25/2023

Tested by: SAM
Checked by: SEF
Remarks:

RGH CONSULTANTS

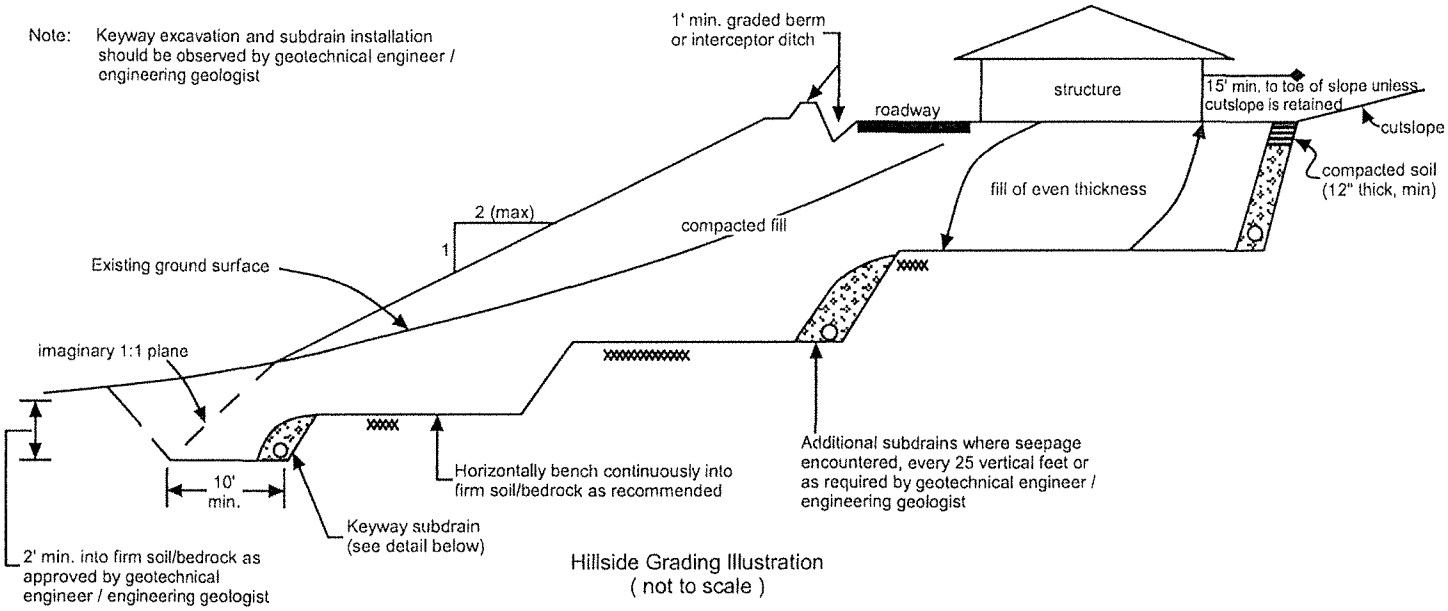
Figure ____

RGH CONSULTANTS

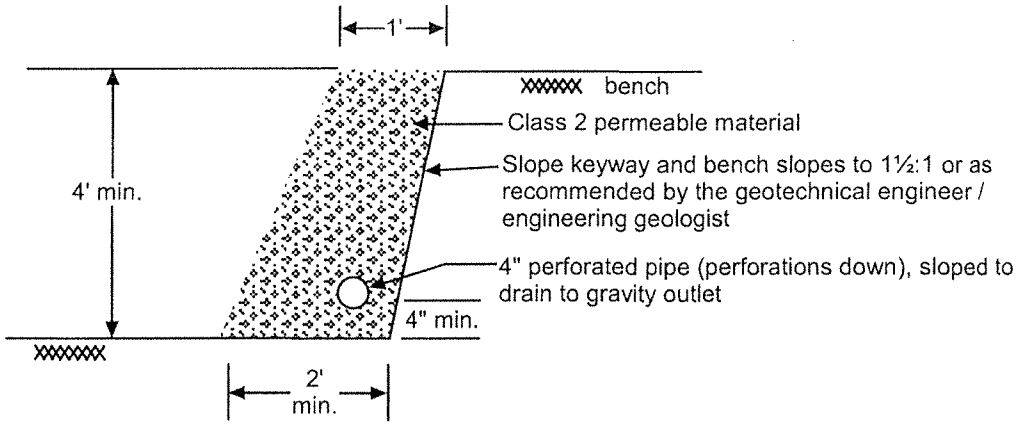
Job No: 4999.01.04.1 | Date: MAY 2023

RESISTANCE (R) VALUE DATA
Quirie Residence
12 Barker Avenue
Fairfax, California

PLATE
17



Hillside Grading Illustration
(not to scale)



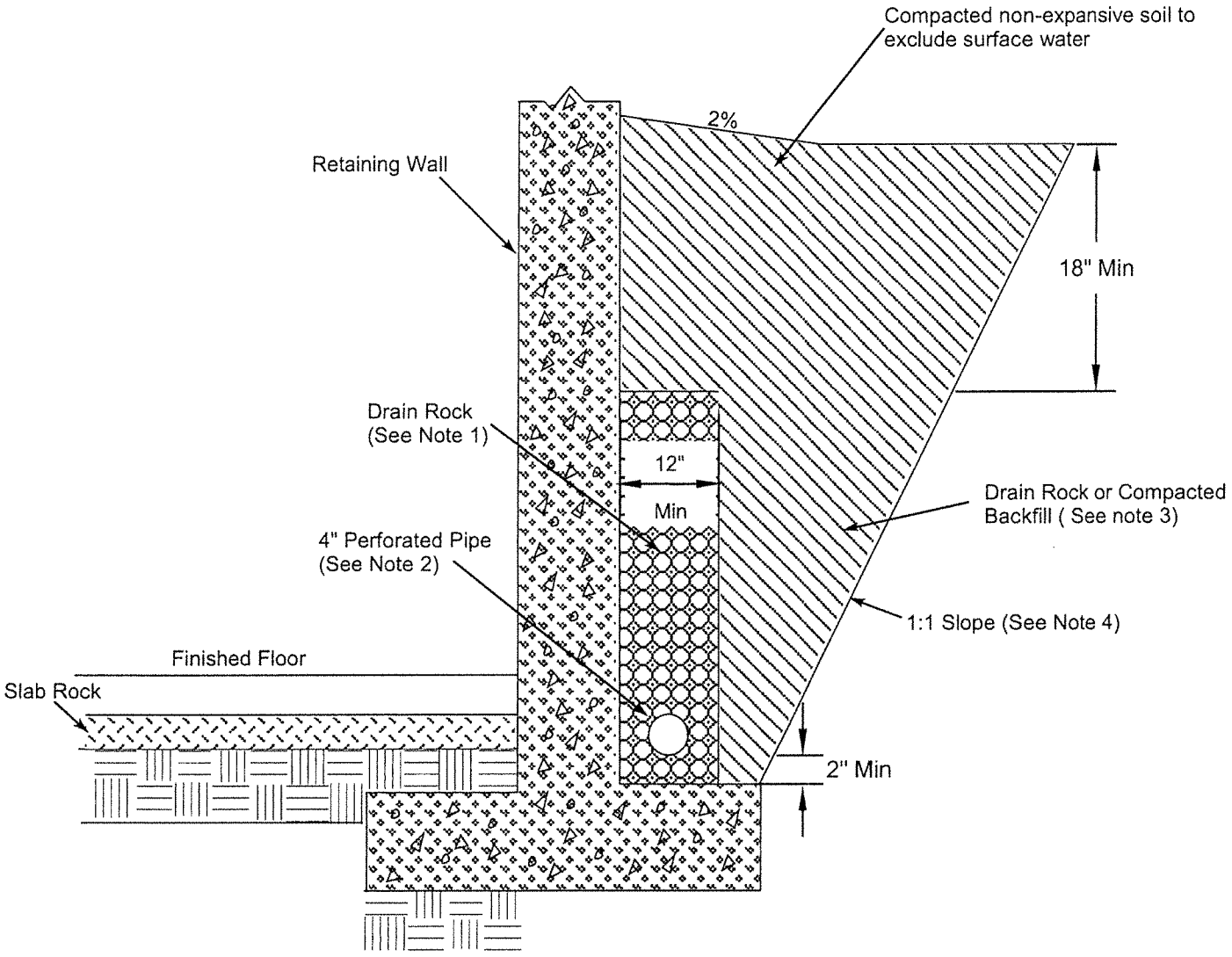
Keyway Subdrain
(not to scale)

RGH CONSULTANTS

Job No: 4999.01.04.1 | Date: MAY 2023

HILLSIDE GRADING ILLUSTRATION
Quirie Residence
12 Barker Avenue
Fairfax, California

PLATE
18



Notes:

1. Drain rock should meet the requirements for Class 2 Permeable Material, Section 68, State of California "Caltrans" Standard Specification, latest edition. Drain rock should be placed to approximately three-quarters the height of the retaining wall.

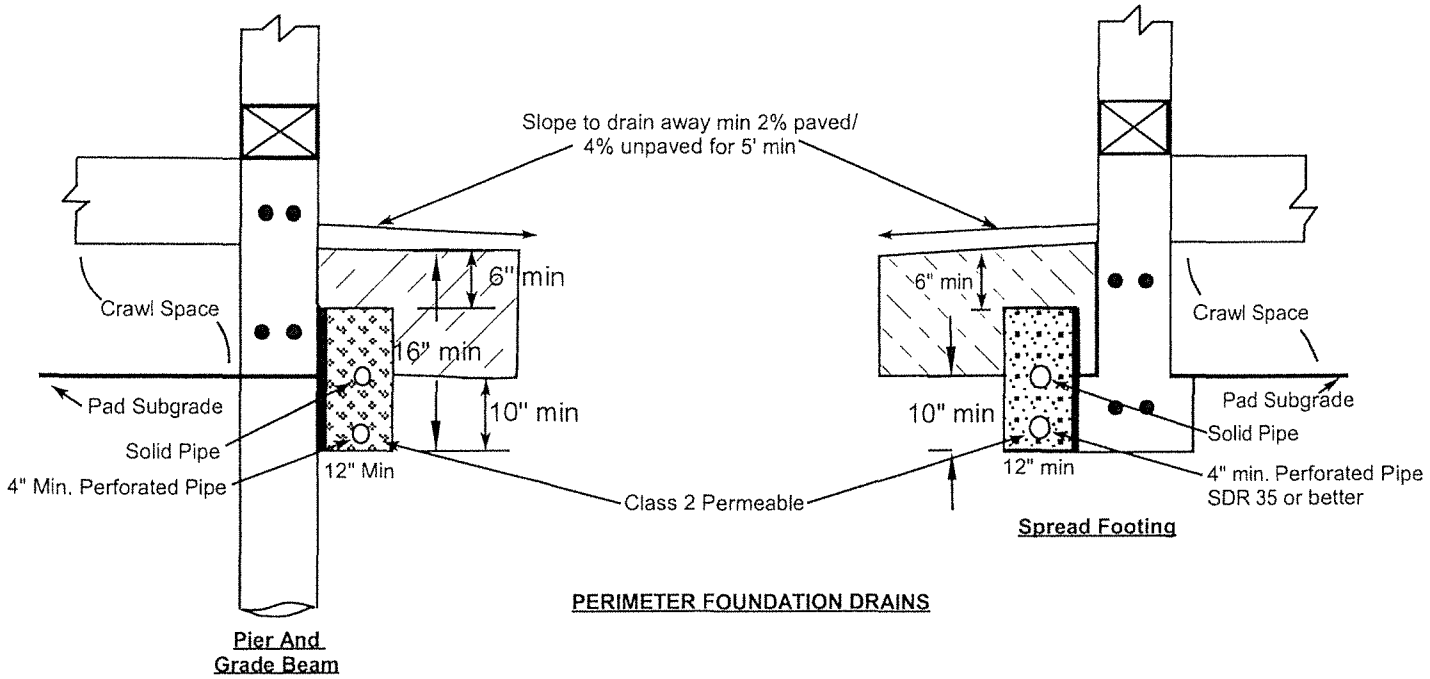
2. Pipe should conform to the requirements of Section 68 of State of California "Caltrans" Standards, perforations placed down, sloped at 1% for gravity flow to outlet or sump with automatic pump. The pipe invert should be located at least 8 inches below the lowest adjacent finished surface.

3. During construction the contractor should use appropriate methods such as temporary bracing and/or light compaction equipment to avoid overstressing the walls. Non-expansive soils to be used as backfill.

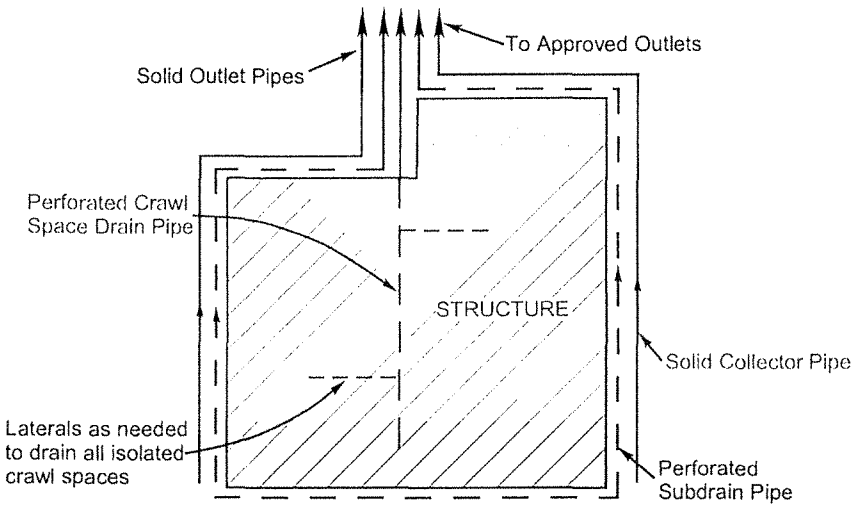
4. Slope excavation back at a 1:1 gradient from the back of footing where expansive materials are exposed.

Not to Scale

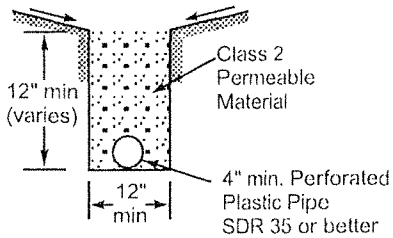
RGH CONSULTANTS Job No: 4999.01.04.1 | Date: MAY 2023	**RETAINING WALL BACKDRAIN ILLUSTRATION** Quirie Residence 12 Barker Avenue Fairfax, California	PLATE **19**



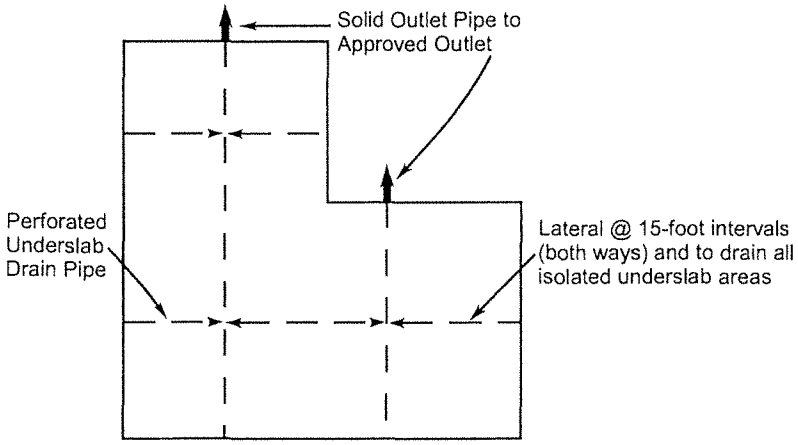
PERIMETER FOUNDATION DRAINS



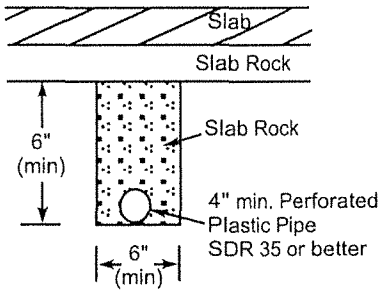
TYPICAL FOUNDATION DRAIN PLAN



CRAWL SPACE DRAIN



TYPICAL UNDERSLAB DRAIN PLAN



SLAB UNDERDRAIN

RGH CONSULTANTS

Job No: 4999.01.04.1 | Date: MAY 2023

TYPICAL SUBDRAIN DETAILS

Quirie Residence
12 Barker Avenue
Fairfax, California

PLATE
20

APPENDIX B - REFERENCES

American Society of Civil Engineers, 2017, Minimum Design Loads and Associated Criteria for Buildings and Other Structures, ASCE Standard ASCE/SEI 7-16.

Blake Jr., M.C., Graymer, R.W., and Jones, D.L., 2000, Geologic Map and Map Database of parts of Marin, San Francisco, Alameda, Contrac Costa, and Sonoma Counties, California; USGS MF-2337.

Bryant, W.A., and Hart, E.W., Interim Revision 2007, Fault-Rupture Zones in California; California Geological Survey, Special Publication 42, p. 21 with Appendices A through F.

California Building Code, 2022, California Building Standard Commission.

California Department of Transportation, 2020, Highway Design Manual, Chapter 630 - Flexible Pavement.

Dwyer, M.J., Noguchi, N., and O'Rourke, J., 1976, Reconnaissance Photo-Interpretation Map of Landslides in 24 Selected 7.5-Minute Quadrangles in Lake, Napa, Solano, and Sonoma Counties, California: U.S. Geological Survey OFR 76-74, 25 Plates, Scale 1:24,000.

Natural Resources Conservation Service, United States Department of Agriculture, accessed May 2023. Web Soil Survey, available online at http://websoilsurvey.nrcs.usda.gov/.

Smith, T.C., Rice, S.J., and Strand, R.G., 1976, Geology of the Upper Ross Valley and the Western part of the San Rafael Area, Marin County, California, California Division of Mines and Geology, Geology for Planning in Central and Southeastern Marin County, California, OFR 76-2 S.F. Plate 1B, Scale 1:12,000.

APPENDIX C - DISTRIBUTION

Matt Quirie (e)
mquirie@gmail.com

Gary Millar (e)
Millargary07@gmail.com

SCL:TAW:scl:brw

https://rghgeo.sharepoint.com/sites/shared/shared documents/project files/4751-4999/4999/4999.01.04.1 quirie residence/.01 - gs/4999.01.04.1 gs report-revised.docx

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from alight industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes - even minor ones - and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ-sometimes significantly from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the express purpose of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in-this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechnical Engineer For Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone:' 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

JOB NO. 21028

PRELIMINARY
STORM WATER CONTROL PLAN

FOR

QUIRIE HOUSE

BARKER AVENUE

FAIRFAX, CA

APN 002-071-01

JUNE 2023

200 4TH Street, Suite 300, Santa Rosa, CA 95401 | 707-58:

ATTACHMENT E

APPLICANT/OWNER:

Matt Quirie
156 Cascade Drive
Fa

As the Applicant/Owner, I declare that permanent storm water Best Management Practices will be installed and maintained in accordance with this document and municipal regulations.

BY: _____

Matt Quirie

CIVIL ENGINEER

This document was prepared by BKF Engineers to summarize storm water treatment facilities proposed with this development. Storm water elements reflected in this document have been designed using sound engineering principals in general conformance with the municipality's guidelines.

For Review
06/09/2023 3:29:24 PM

BILL BORIOLO, PE
JUNE 9, 2022
NO. C-75905

Table of Contents

Tables

Attachments

Vicinity Map

Storm water Control Plan Exhibit

Appendices

Bioretention Facility Sizing Calculations

Storm water Facility Operation and Maintenance Fact Sheet (Bioretention Areas)

Storm water IMP Inspection and Maintenance Log (Sample)

This Storm water Control Plan was prepared using the template dated July 11, 2014.

I. Project Data

Table 1. Project Data

Project Name/Number	Quirie House
Application Submittal Date	June 12, 2023
Project Location	Barker Avenue, Fairfax, CA 94930
Project Phase No.	N/A
Project Type and Description	Residential development
Total Project Site Area (acres)	±9.7
Total New and Replaced Impervious Surface Area	±22,200 (0.50 acres)
Total Pre-Project Impervious Surface Area	±0 (0 acres)
Total Post-Project Impervious Surface Area	±22,200 (0.50 acres)

II. Setting

II.A. Project Location and Description

The proposed *Quirie House project* will include one main residence, attached Junior ADU, detached garage, and detached ADU with an asphalt driveway. A public extension of Barker Avenue is also proposed and will consist of asphalt paving. The project site is a 9.7-acre lot located on Barker Avenue in southern Fairfax, CA.

II.B. Existing Site Features and Conditions

The site in its existing condition slopes to the north and east and drains to the San Francisco Bay. The site is undeveloped.

The Geotechnical Engineer reports that ground water was not encountered at the time of their subsurface exploration, though groundwater elevations fluctuate seasonally and higher groundwater levels may be present during periods of intense rainfall. The site is underlain by weak porous clayey soil over sandstone and shale bedrock.

II.C. Opportunities and Constraints for Storm water Control

An opportunity with this project site is the knoll which has flatter areas of the site where the residence will be built. A constraint with this site is the large area of sloping hillside. As a result, the bioretention facility for the driveway will be located at the lower portion of the driveway, with a short retaining wall on at least one side of the bioretention facility in order to create a level treatment area.

Low Impact Development Design Strategies

III.A. Optimization of Site Layout

III.A.1. Limitation of development envelope

The development envelope has been limited to the maximum extent practicable.

III.A.2. Preservation of natural drainage features

Significant natural drainage features have been avoided to the maximum extent practicable.

III.A.3. Setbacks from creeks, wetlands, and riparian habitats

A small creek near Barker Avenue has been avoided to the maximum extent practicable.

III.A.4 Minimization of imperviousness

Impervious surfaces have been limited to the maximum extent practicable.

III.A.5 Use of drainage as a design element

Water efficient landscaping is proposed around the residence. Drought tolerant plantings best suited on the surface of storm water treatment facilities will be utilized. The Storm Water Control Plan Exhibit reflects the proposed geometry and location of each storm water treatment facility.

III.B. Use of Permeable Pavements

The use of permeable pavements is anticipated with this development adjacent to the residence and ADUs, and will be incorporated as pathways among landscaping.

III.C. Dispersal of Runoff to Pervious Areas

Dispersal of runoff to pervious areas is utilized to the maximum extent practicable.

III.D. Storm water Control Measures

The development proposes to integrate a bioretention facility to treat runoff from the asphalt driveway portion of the site. Runoff from the driveway and Barker Avenue will be captured in a catch basin and piped to a cistern with an orifice outlet designed to limit runoff to the pre-construction condition for the 100-year storm. The cistern then outlets to the bioretention treatment area.

The residence, garage, and ADUs utilize rain barrels to collect runoff from roof-leaders. The rain barrels have been sized to capture the first inch of rainfall. Overflow from the rain barrels is piped to cisterns, which have been designed with an orifice outlet to limit runoff to the pre-construction condition for the 100-year storm. The cisterns then outlet to stormwater dissipaters located within existing vegetation.

III. Documentation of Drainage Design

IV.A. Descriptions of each Drainage Management Area

See Appendix for descriptions of drainage management areas.

IV.B. Tabulation and Sizing Calculations

IV.B.1. Table 2. Information Summary for Bioretention Facility Design

Total Project Area:	±9.7 acres
Average Annual Precipitation:	47 inches
IMPs Designed For:	Treatment and Infiltration

IV.B.2. Areas Draining to Bioretention Facilities

See Appendix for treatment calculations.

IV. Source Control Measures

V.A. Site activities and potential sources of pollutants

BKF Engineers does not anticipate significant potential for pollutants on the project site. The sources listed in the table below are taken from the BASMAA *Post-Construction Manual: Design Guidance for Storm water Treatment and Control for Projects in Marin, Sonoma, Napa, and Solano Counties (January 2019).*

V.B. Sources and Source Control Measures

Table 3. Sources and Source Control Measures

Potential source of runoff pollutants	Permanent source control BMPs	Operational source control BMPs
Landscape/Outdoor Pesticide Use/ Building and Grounds Maintenance	Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to storm water pollution.	Maintain landscaping using minimum or no pesticides.
Refuse Areas	See where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas.	Implement refuse disposal in accordance with Fact Sheet SC-34, "Waste Handling and Disposal" in the CESQA Storm water Quality Handbook at www.casqa.org/resources/bmp-handbooks.

Vehicle/Equipment Repair and Maintenance	State that no vehicle repair or maintenance will be done outdoors	All of the following will apply to the site: - No person shall dispose of, nor permit the disposal, directly or indirectly, of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains. - No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contain or drained from the vehicle immediately. - No person shall leave unattended parts or other open contains containing vehicle fluid, unless such contains are in use or in an area of secondary containment.

V.C. Features, Materials, and Methods of Construction of Source Control BMPs

To be determined at time of construction.

V. Storm water Facility Maintenance

VI.A. Ownership and Responsibility for Maintenance in Perpetuity

The applicant commits to execute any necessary agreements and/or annex into a fee mechanism in accordance with local requirements. The applicant will accept responsibility for operation and maintenance of facilities until that responsibility is formally transferred.

All storm water treatment facilities described in this report will be owned and maintained in perpetuity by the private owner of the subject property. The applicant will accept responsibility for interim operation and maintenance of the facilities until such time as this responsibility is formally transferred to subsequent owners.

VI.B. Summary of Maintenance Requirements for Each Storm water Facility

See the attached sample Operation and Maintenance Fact Sheet for Bioretention Areas.

VI. Construction Plan Checklist

Table 4. Construction Plan C.3 Checklist

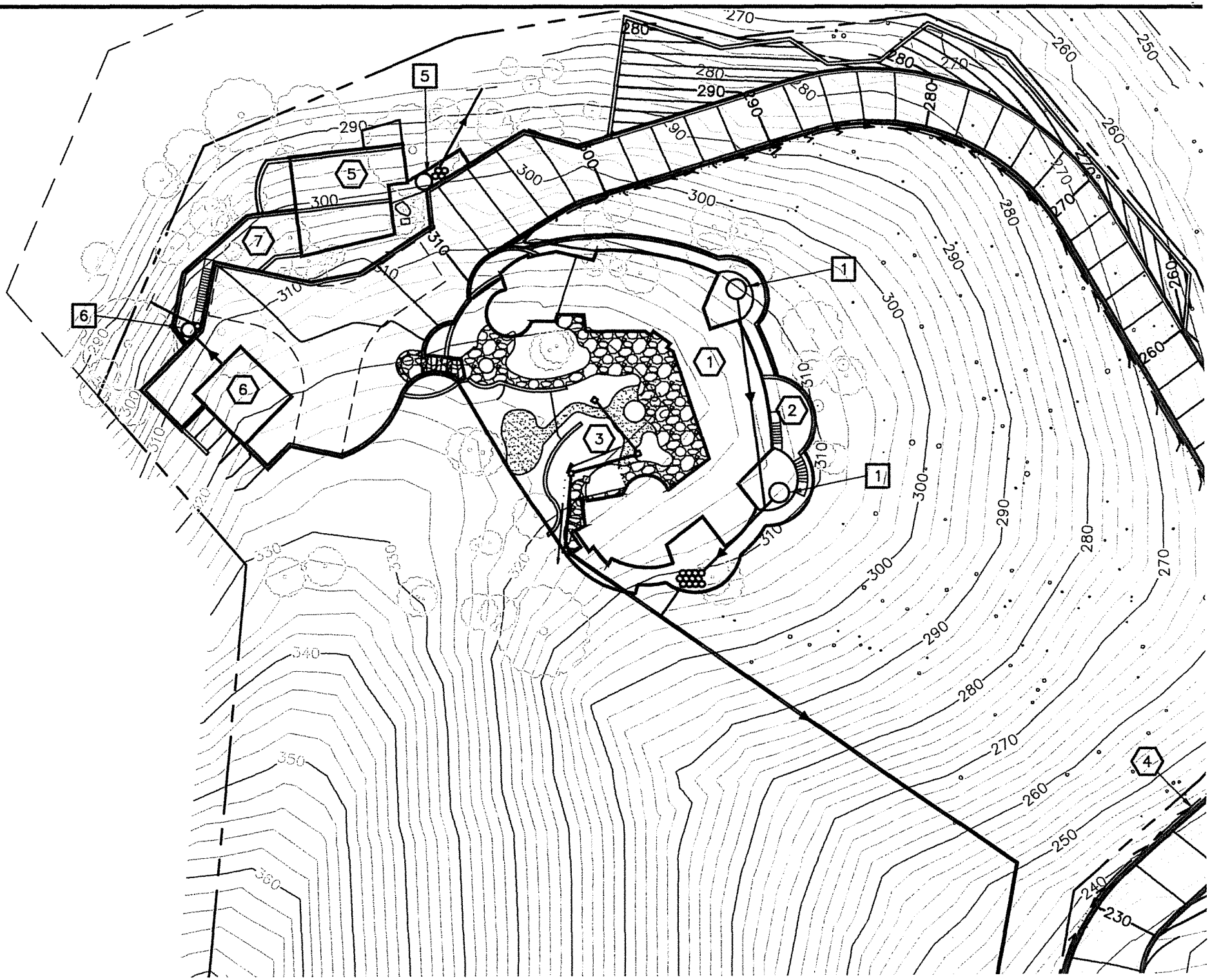
Storm water Control Plan Page #	Source Control or Treatment Control Measure	See Plan Sheet #s
Attachments	Integrated Management Practices (IMP) sizes as specified and designed to capture and route drainage from areas delineated on Exhibit.	Storm Water Control Plan Exhibit
	Plant selection to minimize irrigation, minimize use of fertilizers and pesticides, and for pest resistance.	Refer to the Landscape Drawings

VII. Certifications

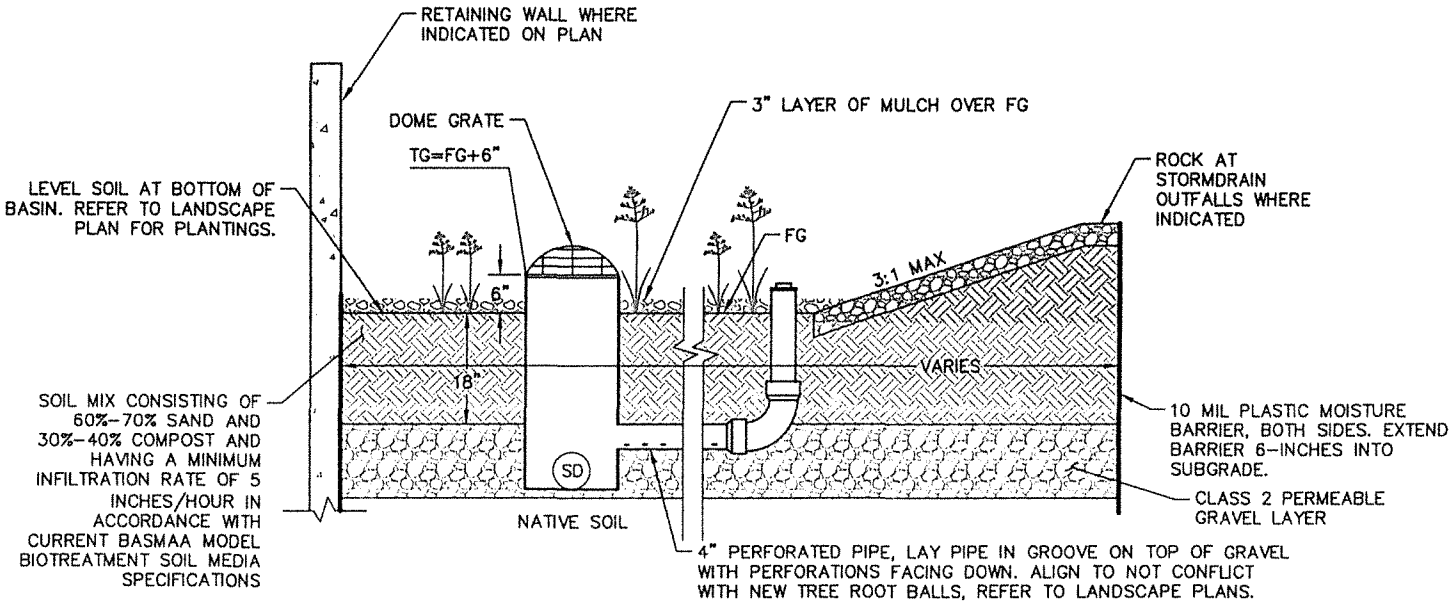
The preliminary design of storm water treatment facilities and other storm water pollution control measures in this plan are in accordance with the current edition of the BASMAA *Post-Construction Manual: Design Guidance for Storm water Treatment and Control for Projects in Marin, Sonoma, Napa, and Solano Counties (January 2019).*

Quirie Residence
BKF Engineers
June 2023

DMA Name	DMA Area (sf)	Post-Project Surface Type	Runoff Reduction Measure	Sizing Factor	Minimum Facility Size	Proposed Facility Size
1	3840	Hardscape	Rain Barrel	0.083	320 cu ft, or 2394 gal	2400 gal
2	2290	Pervious	Self-Treating	-	-	-
3	3900	Pervious	Self-Treating	-	-	-
4	16860	Hardscape	Bioretention	0.04	674 sf	675 sf
5	1000	Hardscape	Rain Barrel	0.083	83 cu ft, or 621 gal	625 gal
6	500	Hardscape	Rain Barrel	0.083	42 cu ft, or 315 gal	325 gal
7	1200	Pervious	Self-Treating	-	-	-


1
2
3
4
5
6
7
270
280
290
300
310
320
330
340
350
360
250
240
230

Bioretention Facility Detail



1 — BIORETENTION FACILITY

NO SCALE

Stormwater IMP Inspection and Maintenance Log

Facility Name	
Address	
Begin Date	End Date

Date	IMP ID#	IMP Description	Inspected by:	Cause for Inspection	Exceptions Noted	Comments and Actions Taken

Instructions: Record all inspections and maintenance for all treatment IMPs on this form. Use additional log sheets and/or attach extended comments or documentation as necessary. Submit a copy of the completed log with the annual independent inspectors' report to the municipality, and start a new log at that time.

- IMP ID# — Always use ID# from the Operation and Maintenance Manual.
- Inspected by — Note all inspections and maintenance on this form, including the required independent annual inspection.
- Cause for inspection — Note if the inspection is routine, pre-rainy-season, post-storm, annual, or in response to a noted problem or complaint.
- Exceptions noted — Note any condition that requires correction or indicates a need for maintenance.
- Comments and actions taken — Describe any maintenance done and need for follow-up.

► BIORETENTION AREAS

These facilities remove pollutants primarily by filtering runoff slowly through an active layer of soil. Routine maintenance is needed to ensure that flow is unobstructed, that erosion is prevented, and that soils are held together by plant roots and are biologically active. Typical maintenance consists of the following:

- Inspect **inlets** for channels, exposure of soils, or other evidence of erosion. Clear any obstructions and remove any accumulation of sediment. Examine rock or other material used as a splash pad and replenish if necessary.

- Inspect **outlets** for erosion or plugging.

- Inspect **side slopes** for evidence of instability or erosion and correct as necessary.

- Observe soil at the bottom of the swale or filter for uniform **percolation** throughout. If portions of the swale or filter do not drain within 48 hours after the end of a storm, the soil should be tilled and replanted. Remove any debris or accumulations of sediment.

- Confirm that **check dams** and **flow spreaders** are in place and level and that channelization within the swale or filter is effectively prevented.

- Examine the **vegetation** to ensure that it is healthy and dense enough to provide filtering and to protect soils from erosion. Replenish mulch as necessary, remove fallen leaves and debris, prune large shrubs or trees, and mow turf areas. When mowing, remove no more than 1/3 height of grasses. Confirm that irrigation is adequate and not excessive. Replace dead plants and remove noxious and invasive vegetation.

- Abate any potential **vectors** by filling holes in the ground in and around the swale and by insuring that there are no areas where water stands longer than 48 hours following a storm. If mosquito larvae are present and persistent, contact the Marin/Sonoma Mosquito and Vector Control District for information and advice. Mosquito larvicides should be applied only when absolutely necessary and then only by a licensed individual or contractor.

RAIN BARRELS AND CISTERNS

Stormwater Control for Small Projects

Bay Area Stormwater Management Agencies Association

Daisy chained system of 205-gallon rain barrels
Courtesy of The City of Oakland

Rain barrels and cisterns can be installed to capture stormwater runoff from rooftops and store it for later use. They are low-cost systems that will allow you to supplement your water supply with a sustainable source and help preserve local watersheds by detaining rainfall.

Collected rainwater may be used for landscape irrigation. Subject to permitting requirements, harvested rainwater may be allowed for toilet flushing; contact municipal staff for more information. Capturing even a small amount of your roof runoff will have environmental benefits because it will reduce the quantity and speed of stormwater runoff flowing to local creeks.

Rain barrels typically store between 50 and 200 gallons. They require very little space and can be connected or "daisy chained" to increase total storage capacity.

Cisterns are larger storage containers that can store 200 to over 10,000 gallons. These come in many shapes, sizes, and materials, and can be installed underground to save space.

How Much Storage is Recommended?

The number of rain barrels recommended to capture runoff from a given roof (or other impervious area) is shown in the following table.

Are Rain Barrels or Cisterns Feasible for My Project?

Rain barrels and cisterns are appropriate for sites with the following characteristics:

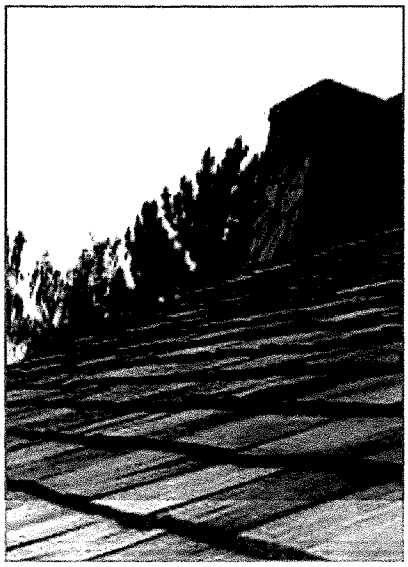
- Roof areas that drain to downspouts.
- A level, firm surface is needed to support a rain barrel(s) or cistern to prevent shifting or falling over. A full 55-gallon rain barrel will weigh over 400 lbs.
- A landscaped area where the captured water can be used (and where it can be drained by gravity flow) should be located within a reasonable distance from the rain barrel(s).
- A landscaped area or safe path to the storm drain system that can handle overflow.

Roof or Impervious Area (sq. ft.)	Suggested Minimum Number of 55 Gallon Rain Barrels*
Up to 750	1-2
750 – 1,250	2-3
1,250 – 1,750	3-4
1,750 – 2,250**	4-5

* Or equivalent capture using larger rain barrels or a cistern.
** To harvest rainwater from an area greater than 2,250 sq. ft. install 1 additional rain barrel per each additional 500 sq. ft.

Components of a Rainwater Harvesting System

Roofing Materials



Wood shingle roof
Courtesy of Gutter Glove

Technically, any impervious surface can be used for harvesting rainwater; however, the surface materials will affect the quality of captured rainwater, which has implications for the recommended uses.

Although it is technically possible to harvest runoff from parking lots, patios, and walkways, it is more difficult since a subterranean cistern or a pump is usually needed to move the water into an above-ground rain barrel or cistern. Also, there are typically greater levels of debris and contaminants that must be filtered out of the runoff before it enters the storage system. Due to these complexities, it is more common to harvest rainwater from rooftops, which is the focus of this fact sheet.

When designing your system, consider the roofing material on the building.

- If you have asphalt or wooden shingles, use the harvested rainwater only for non-edible landscapes, unless the water is treated first. Petroleum or other chemicals from these roofing materials can leach into the rain water.
- Roofs with cement, clay, or metal surfaces are ideal for harvesting water for a wide variety of uses.

Gutters and Downspouts

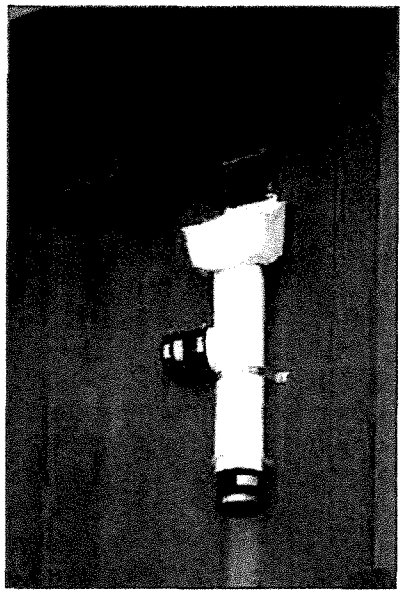
Properly sized and maintained gutters and downspouts are essential to a rainwater harvesting system.

- Strategically locate any new downspouts in an area where the rain barrel or cistern will be most useful.
- Consider the height of the rain barrel and the first flush device. Existing downspouts may have to be shortened to make room for the rain barrel and first flush device.
- Install a fine mesh gutter guard on gutters to keep leaves and other debris from entering and clogging the gutters. This will reduce the need for cleaning gutters and the rain barrel or cistern.
- As needed, consult a professional roofer to aid in gutter and downspout installation.

This gutter is covered by a fine mesh gutter guard to keep debris out.
Courtesy of Gutter Glove

Components of a Rainwater Harvesting System

Rain Barrel and Cistern Accessories to Keep Water Clean



First flush and downspout diverter installation
Courtesy of The City of Oakland

Various accessories to rain barrels and cisterns help protect the quality of harvested water and reduce maintenance. These accessories include "first flush" diverters, filters, and screens.

Leaves, twigs, sediment, and animal waste are common in runoff, especially at the beginning of a storm ("first flush"). This debris can result in clogging and encourage bacterial growth. A first flush diverter helps remove debris and contaminants by directing the first few gallons of runoff from the roof to landscaping, away from the rain barrel or cistern.

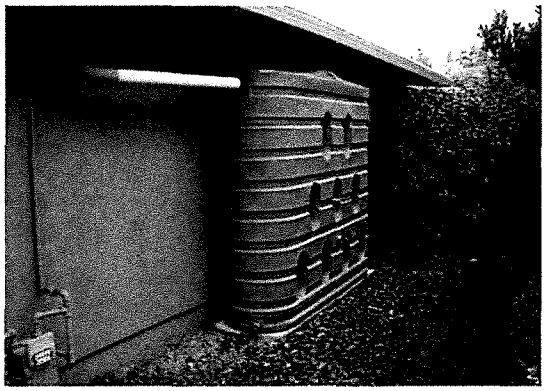
The following tips will help you keep the water in your system clean.

- Install a first flush diverter directly under your downspout. You may have to cut the downspout to connect the first flush diverter above the rain barrel.
- Use the same diameter pipe for the first flush diverter, the downspout, and the connector to the rain barrel. Avoid changing diameters of pipes in order to keep the system from backing up.
- **Design the first flush diverter to discharge the first flush to non-edible landscaping.**
- Install mosquito-proof screens under the lid of the rain barrel and inside the overflow outlet.

Foundation and Overflow

Before installing a rain barrel or cistern, prepare the site so that the system will function safely.

- Find or create a level location near the downspout on which to place the rain barrel or cistern.
- A concrete or stone paver foundation may be appropriate for smaller rain barrels. A more substantial foundation will likely be required for large cisterns.
- **Secure rain barrels and cisterns to your structure with metal strapping, or anchor to the foundation,** to prevent tipping in an earthquake.
- Maintain clear access to the rain barrel outlets and cleaning access points.
- Design an overflow path, so that overflow from the rain barrel(s) will discharge safely to a landscaped area, or storm drain system.
- Where possible, direct overflow to a rain garden, swale, or other landscaped area to maximize retention of rainwater onsite.
- Direct the overflow away from the rain barrel, building foundation, and neighboring properties.
- Consult with the municipality to identify overflow locations.



Large unit installed at a single family residence.
Courtesy of Stephanie Morris

Design Checklist

When installing rain barrels and cisterns, consider the following criteria unless otherwise instructed by the municipality.

- ❑ Do not use flexible piping, to prevent mosquito breeding in water that may pool in flexible pipes. If irrigating edible landscapes, consider pipes that meet FDA food grade standards.
- ❑ When designing the overflow path, remember that in heavy storms rain barrels and cisterns *will* overflow. A 1,000-sq.-ft. roof will produce about 600 gallons of runoff during a storm that has produces a depth of 1 inch of rain.
- ❑ There shall be no direct connection of any rain barrel or cistern and/or rainwater collection piping to any potable water pipe system. Rainwater systems shall be completely separate from potable water piping systems.
- ❑ Place the bottom of the barrel at a higher elevation than the landscape, to use gravity flow.
- ❑ All rain barrels and cisterns should have a screen to ensure mosquitoes cannot enter.
- ❑ Allow overflow to drain to your landscape or a rain garden. Ensure that areas receiving overflow do not have standing water for more than 48-hours.
- ❑ The low water pressure from a small rain barrel will not operate in-ground sprinkler or low-volume devices. Consider using a soaker hose.
- ❑ If using a soaker hose, remove the pressure-reducing washer to increase the water flow.
- ❑ If the water is not needed for irrigation during the rainy season, consider releasing the water to a vegetated area between storms, so the barrels will be empty to catch rain from the next storm. This will help protect your watershed by reducing the quantity and speed of water entering local creeks during storms. Install a spigot and drip tape to allow the rain barrel or cistern to slowly drain between storms. You can store the water captured towards the end of the rainy season to irrigate your garden in the dry season.
- ❑ For more information, ask municipal staff to refer you to countywide stormwater guidance.

Operation and Maintenance

After installing your rain barrel or cistern, follow these tips for long-term safety and functionality.

- ❑ Regularly check the gutters and gutter guards to make sure debris is not entering the rainwater harvesting system.
- ❑ Inspect the screens on the rain barrel or cistern prior to the wet season to make sure debris is not collecting on the surface and that there are not holes allowing mosquitoes to enter the rain barrel. Inspect screens more frequently if there are trees that drop debris on the roof.
- ❑ Clean the inside of the rain barrel once a year (preferably at the end of the dry season when the rain barrel has been fully drained) to prevent buildup of debris. If debris cannot be removed by rinsing, use vinegar or another non-toxic cleaner. Use a large scrub brush on a long stick, and avoid actually entering the rain barrel. Drain washwater to landscaping.
- ❑ Clean out debris from cisterns once a year, preferably at the end of the dry season.

Daisy-chained system
Courtesy of Acterra

The City of Los Angeles and Geosyntec Consultants are acknowledged for providing text and formatting used in this fact sheet. The City of Oakland, Acterra, Gutter Glove, and Stephanie Morris are acknowledged for images used in the fact sheet.

TECHNICAL MEMORANDUM

Date: June 9, 2023
Deliver To: Town of Fairfax
From: BKF Engineers
Subject: Quirie House Fairfax Drainage Memorandum

BKF Job Number: C20210284-11

A single-family residence with a detached ADU is being proposed with roadway site improvements. After construction of the site, the stormwater runoff will exceed the pre-developed runoff. To meet the pre-developed stormwater runoff, the site will implement three detention cistern facilities with orifices to accommodate the 100-year storm event

The Simplified Instructions from the County of Marin Department of Public Works' Hydrology Manual were used to calculate the pre-developed and developed flows for the site. The first step to finding the flows was determining the time of concentration (T_c). After deducing T_c, design Rainfall Intensities Map I and Map V were used to identify I_{60} and the zone. When I_{60} is found and interpreted, then intensity (I_{100}) can be determined from zone C2 chart K. I_{100} was determined to be 3.2 in/hr which was then used for calculating the existing and proposed site's flows. The main residential area with an impervious area of 0.152 acres had an existing flow of 0.340 cfs and a proposed flow of 0.438 cfs. The driveway with an impervious area of 0.387 acres had an existing flow of 0.867 cfs and 1.115 cfs for the proposed development. The detached ADU with an impervious area of 0.042 acres had an existing flow of 0.094 cfs and a proposed flow of 0.120 cfs. The garage with an impervious area of 0.011 acres had an existing flow of 0.026 cfs and a proposed flow of 0.033 cfs.

With the calculated proposed flows for the 100-year storm, the site will need to implement stormwater detention cisterns with orifices to meet existing flow conditions. The volume of the detention cisterns was assessed by using the triangular hydrograph where the initial time of concentration is used. The orifice of the detention cistern's diameter is determined by using the pre-developed flow and the cross-sectional area of the orifice perpendicular to the flow. The main residence's detention cistern was calculated to be 88 ft^3 with an orifice diameter of 2.43 inches in diameter. The detached ADU's detention cistern was calculated to be 23 ft^3 with an orifice of 1.28 inches in diameter. For the driveway, the detention cistern was calculated to be 230 ft^3 with an orifice of 3.59 inches in diameter. The garage's detention cistern was calculated to be 6 ft^3 with an orifice of 0.67 inches in diameter.

With these findings factored into the development's proposed stormwater system, the developed site's runoff will be limited to the pre-development flow for the 100-year storm event.

WJB

BKF Engineers
Bill Boriolo, P.E. C-75905

For Review
06/09/2023 1:38:18 PM

Appendices
Appendix "A" – Hydrology Manual Simplified Instructions
Appendix "B" – Q100 Detention Calculations
Appendix "C" – 100 Year Detention Calculation Pages

APPENDIX "A"

Hydrology Manual Simplified Instructions

COUNTY OF MARIN
DEPARTMENT OF PUBLIC WORKS

HYDROLOGY MANUAL
SIMPLIFIED INSTRUCTIONS
(Revision: 8/2/00)

The instructions:

1. Determine the Time of Concentration (t_c)

$$t_c = \frac{1.8(1.1-C)\sqrt{L}}{\sqrt[3]{S(100)}} + 5Min$$

C = Runoff Coefficient *

L = Longest run in feet

S = Average Slope in ft/ft $= \frac{\Delta H}{L}$

2. Determine Zone from Map V
3. Determine I_{60} from Map I
4. From appropriate Zone Chart (Chart K), find correct curve using the I_{60} and 1 hour intersect.
5. Follow this curve to the t_c intersect.
6. Read i on Y-axis.
7. Utilize this value into $Q=CiA$

   C = Runoff Coefficient *

   i = Intensity (I_{60})

   A = Drainage Area in Acres

   Q = Discharge/Capacity in Cubic Feet per Second (cfs)

* There is often much discussion as to what value to use for "C" for a specific site. What we are concerned with here, however, is the major event. These often occur in the mid to late season and after one or more days of light rainfall. Thus the ground is close to saturation and "C" is approaching 1.0. To cut to the chase, we recommend a "C" value of at least 0.7.

State of California
Department of Transportation (CALTRANS)
District 4 - Hydraulics Section

GUIDELINES FOR THE USE OF STANDARDS DEVELOPED BY THE 1941-71 RAINFALL INTENSITY-DURATION-FREQUENCY ANALYSIS

October 1974

I. ABSTRACT

These guidelines are user-oriented, and are limited to a listing of the standards developed, a summary of the changes involved and a brief explanation of their use.

Those interested in the methods, criteria and techniques used in the development of these standards are referred to the "Abridged Report - 1941-71 Rainfall Intensity-Duration-Frequency Analysis", October 1974.

II. STANDARDS DEVELOPED

Map "I" - Design Rainfall Intensities ($I_{1, 100}$), 9/74 *
Map "V" - Design Rainfall Variations (Zones & Subzones), 9/74 *
Charts "K"(6) - 1-in-100 Years Design Rainfall Intensity-Duration Curves, and 10-vs-100-years Design Intensity Ratios *
Chart "R" - Frequency Distribution Ratios, 9/74 *
Computer Program - Tenet 210 "111;DHYD;IDF" **

III. FORMER STANDARDS (for reference)

Chart "Intensity vs. Duration for various P_{60} values" derived from Chart "A", California Culvert Practice.

IV. ESSENTIAL CHANGES/IMPROVEMENTS INVOLVED BY THE NEW STANDARDS DEVELOPED

A. Map "I"

This map is an update - with increased reliability and detail - of the 1968 P_{60} Isopleths map. As far as the users' calculations are concerned, the changes are quantitative only: in some areas the 1-hour, 1-in-100 years intensities are now expected to be somewhat higher, in other areas somewhat lower, than they were in the previous standards.

*=Appendixes B thru E of "Abridged Report"
**=See Attachments (a) to (e) to these "Guidelines"

B. Map "V"

This map shows the division of the region into 6 zones and 14 sub-zones of similar patterns of rainfall variation.

The use of one of the 6 zonal intensity-duration functions generally yields more representative 1-in-100-years intensities than the statewide standard from Chart "A" (see Item III, above).

The use of one of the 14 sets of intensity-frequency ratios yields ratios variable as a function of duration. This is more representative than the uniform ratio (regardless of duration) used previously.

C. Charts "K"

Each one of these 6 charts represents the tool to be used to convert the 1-hour, 1-in-100 years intensity from Map "I" ($I_{1,100}$) to 1-in-100 and 1-in-10-years intensities for any duration 5 minutes to 72 hours (24-hrs. for Zone F).

These charts are not needed if computer program "111;DHYD;IDF" is used.

D. Chart "R"

This is a format update of the previously used chart "I_T/I_{100} vs. I_{10}/I_{100} for various T".

Its $R_{D,10}$ scale has been doubled, and the upper limit of the $R_{D,T}$ scale extended from 100 to 2500 + years.

It is the tool used to convert 1-in-100-year intensities to intensities of any return period of the $R_{D,T}$ range of the chart. It is not needed if computer program "111;DHYD;IDF" is used.

E. Computer Program - Tenet 210 "111;DHYD;IDF"

This program may be used in lieu - or as a check - of Charts "K" and "R". It can be particularly valuable where many subzones/durations/return periods are involved.

Its features are explained from Item V. D.

V. GUIDE FOR CALCULATING INTENSITIES AT SITE

A. Scope of the Design Rainfall Intensity Standards Developed by this Analysis

One of the main objectives of the CALTRANS drainage design standards is economically balanced design. Therefore, the standards are based on the mean (theoretical) probability of exceedance. In other words, the standards are based on the mean (theoretical) return period at which the given intensity can be expected to be equalled or exceeded.

The developed standards are not intended for high risk situations, such as dam design. In those cases, confidence limits must be taken into consideration. The 68% confidence bands were calculated in the course of the station-depth-frequency analysis, and their upper limits (for the 100-year return period) are generally 20-40% higher than the mean values used for the analysis.

B. Chart Solution - New District 4 "Zonal" Method

(For return period 100 years, use steps 1-5; For return period 10 years, use steps 1-7; for all other return periods (T), use steps 1-6, 8 and 9).

(1) From Map "I", determine the 1-hour, 100-year intensity ($I_{1,100}$);

(2) From Map "V", determine the zone (letter) and subzone (letter & number);

(3) From the six Charts "K", selects the one for the zone determined by (2);

(4) On this Chart "K", select the curve for the $I_{1,100}$ determined by (1)

(5) From this curve, read the 100-year intensity for the given duration;

(6) From Chart "K" selected by (3), determine the 10-vs-100-year ratio ($R_{D,10}$) for the subzone determined by (2), for the given duration. Interpolate if necessary.

(7) Multiply the 100-year intensity, from (5), with the ratio from (6). This is the 10-year intensity.

(8) Enter Chart "R" with the 10-vs-100-year ratio, from (6), and with the given return period; and read the ratio ($R_{D,T}$) for this return period;

(9) Multiply the 100-year intensity, from (5), with the ratio from (8). This is the T-year intensity.

NOTE: Where a watershed is located on or near a subzone boundary, determine intensities for all subzones involved, and take a weighted average.

Note that any apparently abrupt change of values at a subzone boundary is not intended to represent a discrete discontinuity, but serves to indicate the general location of transition. As a rule of thumb, the width of the transition at the boundary of each subzone may be taken as 10% (of wider) to 20% of (narrower) subzone widths. Weighting factors should be chosen accordingly.

C. Chart Solution - Chart "A" Method

(For return period 100 years, use steps 1-3; for return period 10 years, use steps 1-6; for all other return periods, use steps 1-5, 7 and 8).

(1) From Map "I", determine the 1-hour, 100-year intensity ($I_{1,100}$ = P60)

(2) On Chart "Intensity vs Duration for various P60 values" (derived from Chart "A", California Culvert Practice), select the curve for the P60 determined by (1);

(3) From this curve, read the 100-year intensity for the given duration

(4) From Map "V", determine the subzone (letter & number)

(5) From Map "V", determine the 10-vs-100-year ratio for the subzone determined by (4) and the 1-hour duration.

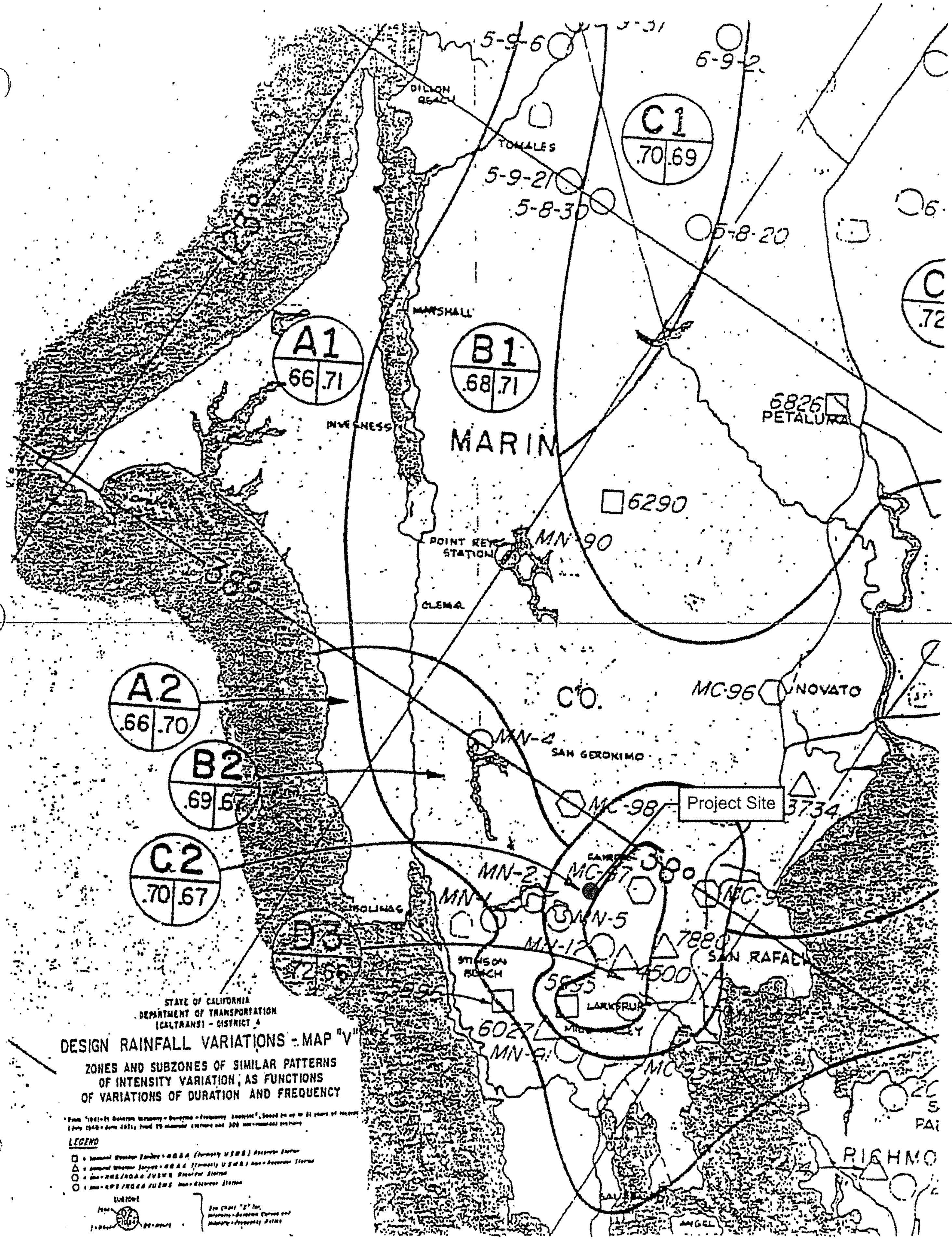
(6) Multiply the 100-year intensity, from (3), with the ratio from (5). This is the 10-year intensity.

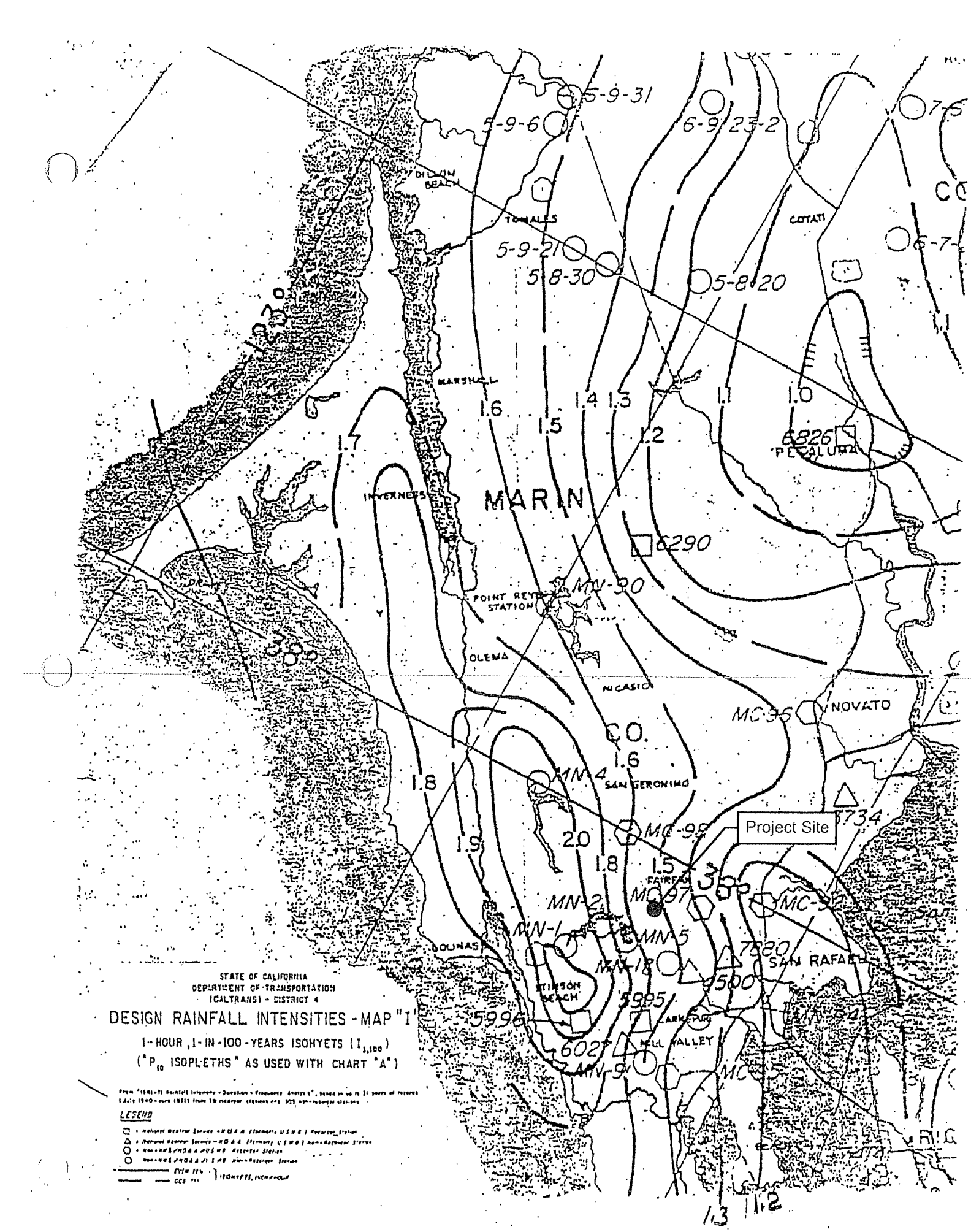
(7) Enter Chart "R" with the 10-vs-100-year ratio, from (5), and with the given return period; and read the ratio ($R_{D,T}$) for this return period;

(8) Multiply the 100-year intensity, from (3), with the ratio from (7). This is the T-year intensity.

D. Solution by Computer

Tenet 210 Computer Program "111;DHYD;IDF" offers quick and reliable solutions. Program features are explained in Attachments (a) to (c); Attachments (d) and (e) show a typical problem input and printout respectively.


STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
(CALTRANS) - DISTRICT 4
DESIGN RAINFALL VARIATIONS - MAP "V"
ZONES AND SUBZONES OF SIMILAR PATTERNS
OF INTENSITY VARIATION, AS FUNCTIONS
OF VARIATIONS OF DURATION AND FREQUENCY
LEGEND
Project Site
MARIN
CO.
A1 .66 .71
B1 .68 .71
C1 .70 .69
A2 .66 .70
B2 .69 .67
C2 .70 .67
D3 .72 .66
DILLON BEACH
TOMALES
MARSHALL
INVERNESS
POINT REYES STATION
OLEMA
PETALUMA
NOVATO
SAN GERONIMO
BOLINAS
STINSON BEACH
LARKSPUR
MILL VALLEY
SAN RAFAEL
RICHMO
5-9-6
6-9-2
5-9-21
5-8-30
5-8-20
6826
6290
MN-90
MC-96
MN-4
MC-98
3734
MN-2
MC-57
MN-1
MN-5
MN-12
7880
4500
5835
6027
MN-9
MC-5


MARIN
Project Site
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
(CALTRANS) - DISTRICT 4
DESIGN RAINFALL INTENSITIES - MAP "I"
1-HOUR, 1-IN-100-YEARS ISOHYETS ($I_{1,100}$)
("P_{60} ISOPLETHS" AS USED WITH CHART "A")
LEGEND

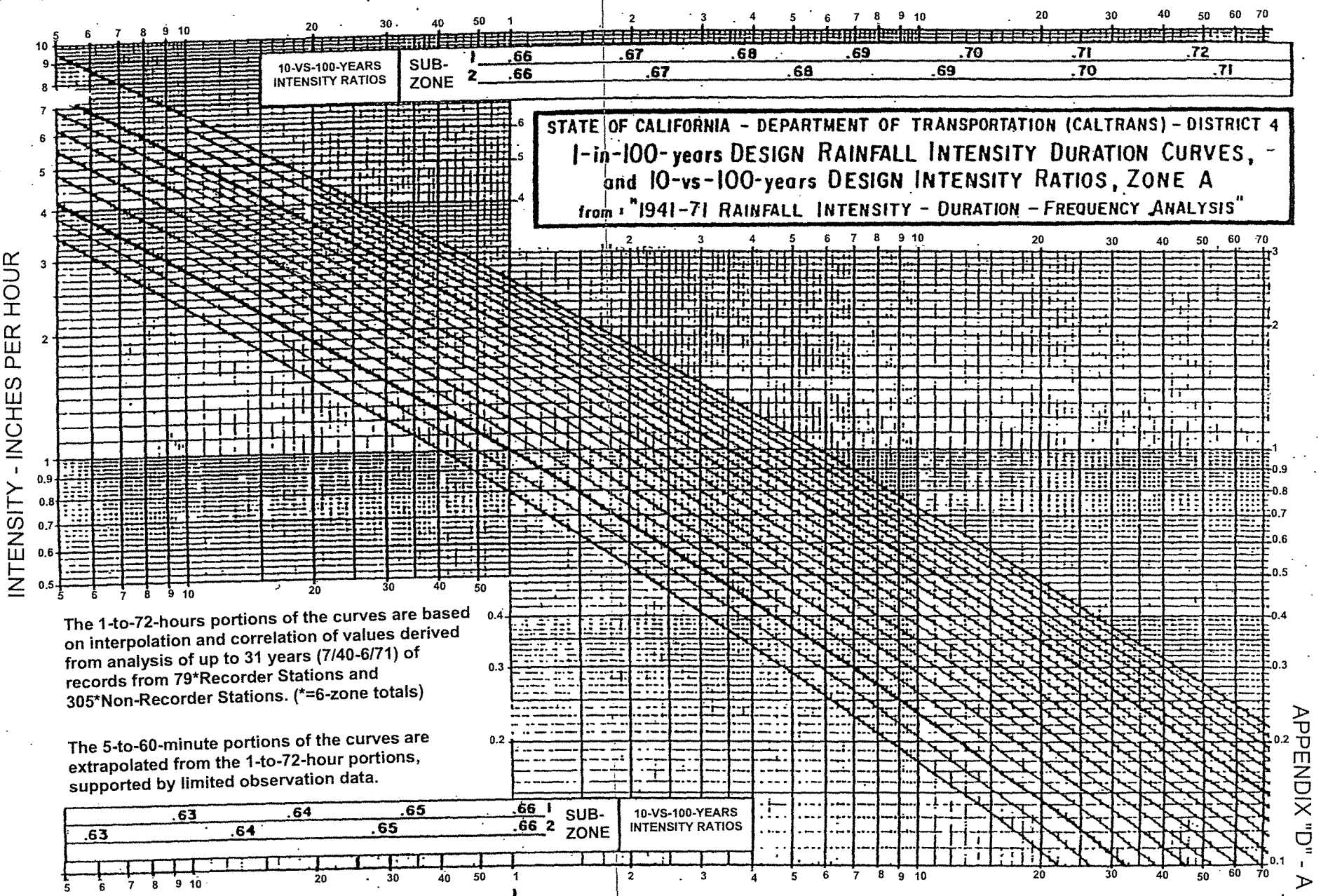


CHART "K" , ZONE A

EK/ERR
9/74

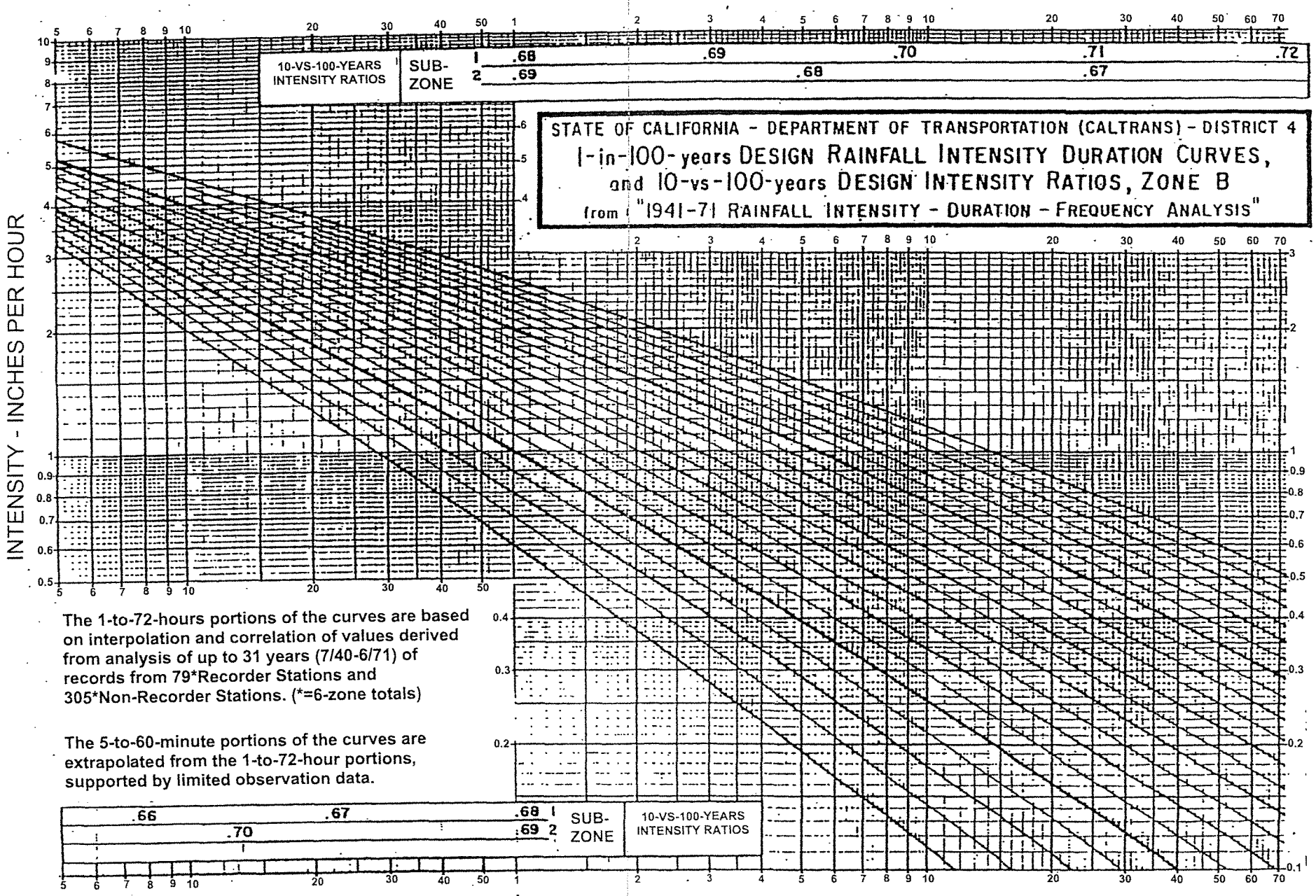
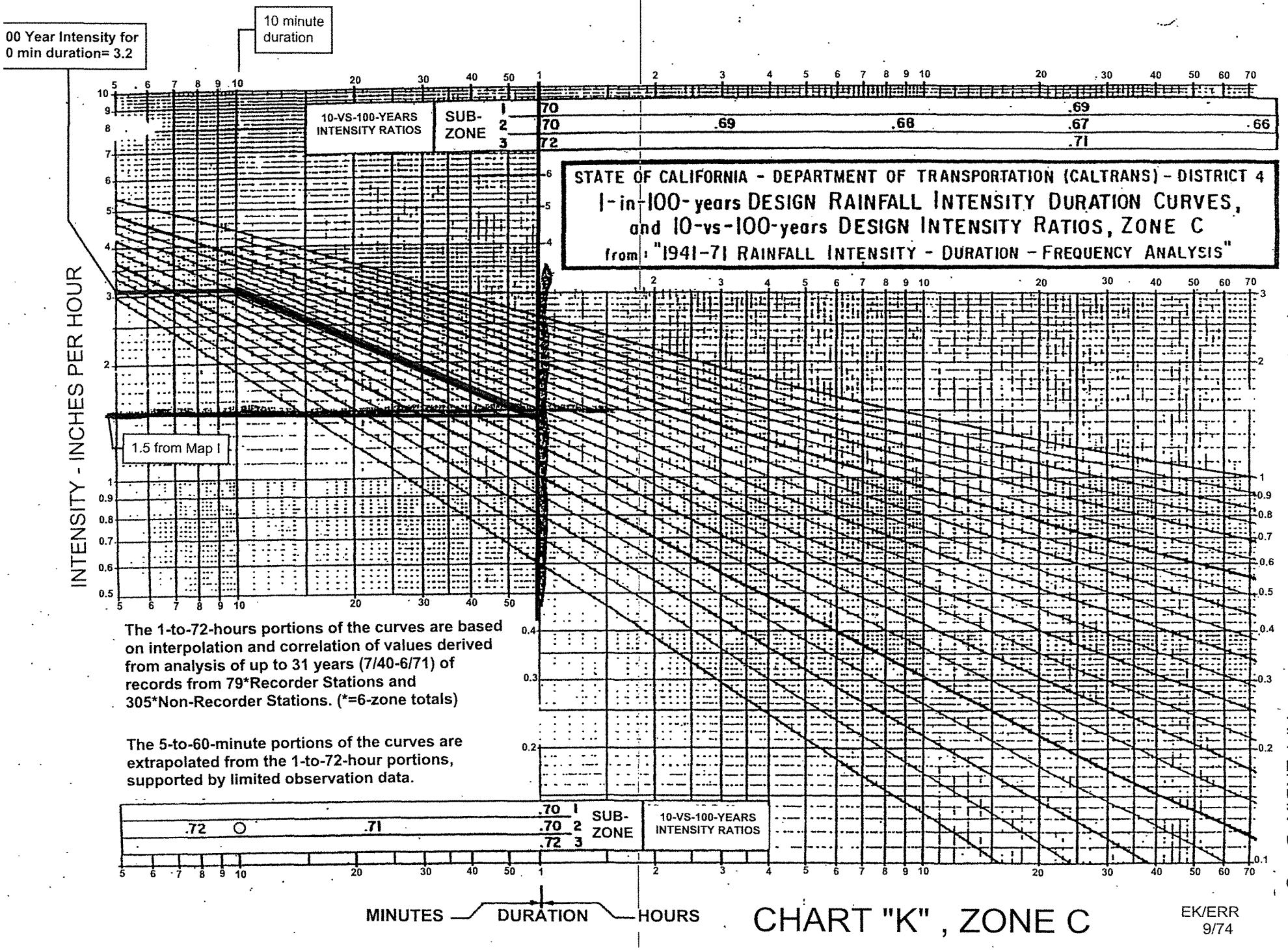
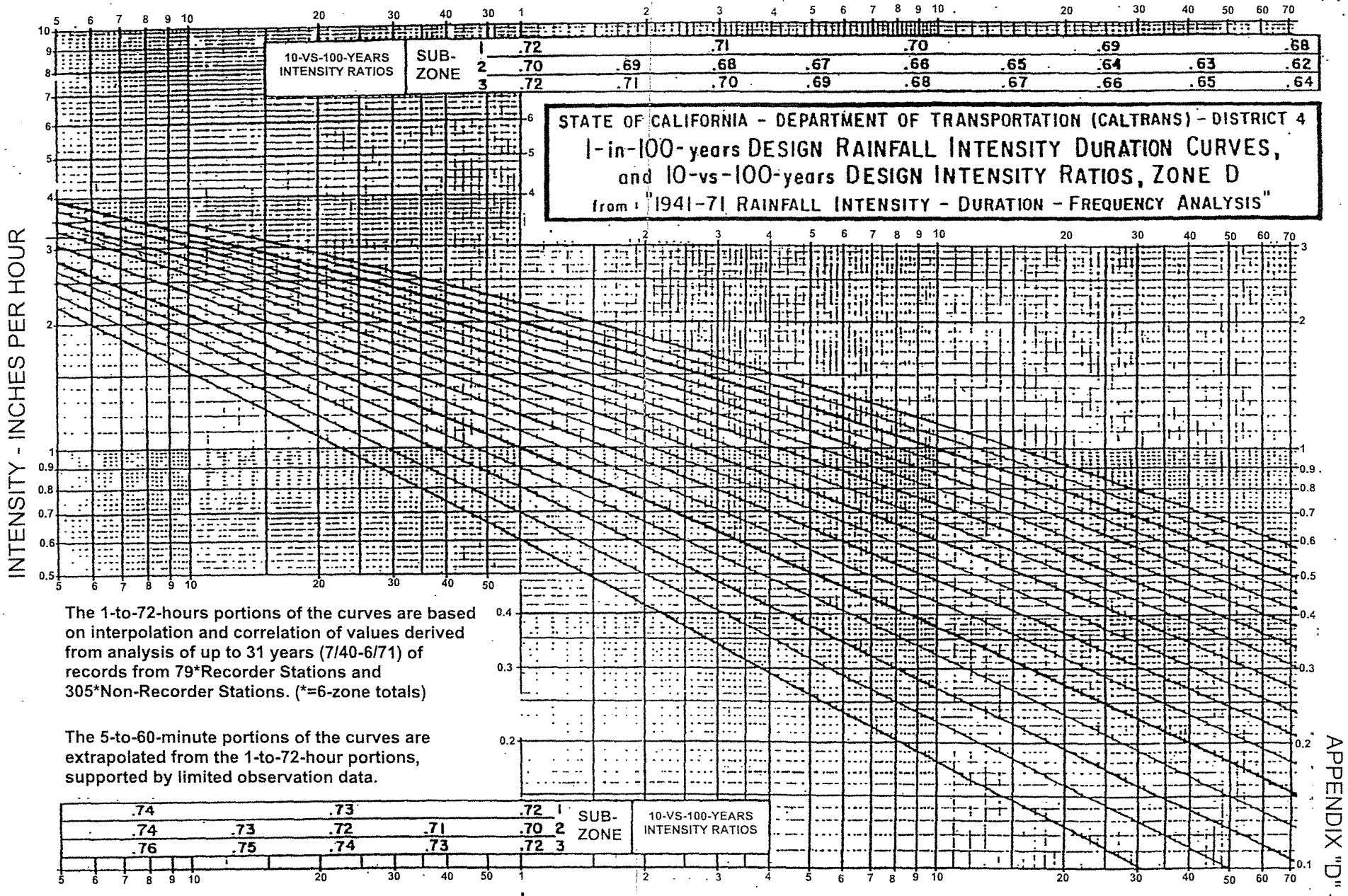


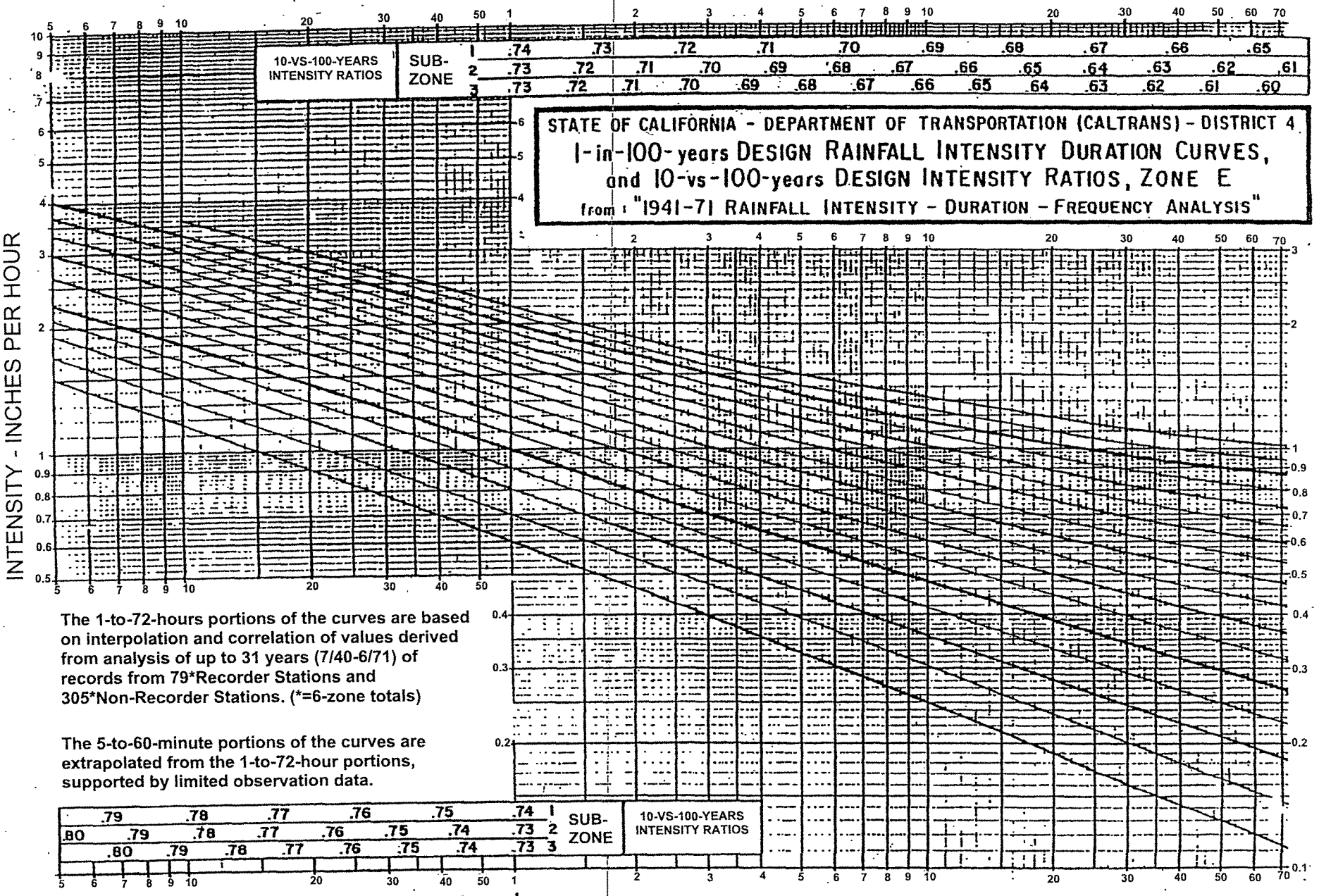
CHART "K" , ZONE B

EK/ERR
9/74

APPENDIX "D" - B


00 Year Intensity for
0 min duration= 3.2
10 minute
duration
10-VS-100-YEARS
INTENSITY RATIOS
SUB-
ZONE
1
2
3
.70
.70
.72
.69
.68
.67
.66
.71
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION (CALTRANS) - DISTRICT 4
1-in-100-years DESIGN RAINFALL INTENSITY DURATION CURVES,
and 10-vs-100-years DESIGN INTENSITY RATIOS, ZONE C
from: "1941-71 RAINFALL INTENSITY - DURATION - FREQUENCY ANALYSIS"
INTENSITY - INCHES PER HOUR
1.5 from Map I
The 1-to-72-hours portions of the curves are based on interpolation and correlation of values derived from analysis of up to 31 years (7/40-6/71) of records from 79*Recorder Stations and 305*Non-Recorder Stations. (*=6-zone totals)
The 5-to-60-minute portions of the curves are extrapolated from the 1-to-72-hour portions, supported by limited observation data.
.72
.71
.70
.70
.72
SUB-
ZONE
10-VS-100-YEARS
INTENSITY RATIOS
MINUTES
DURATION
HOURS
CHART "K" , ZONE C
EK/ERR
9/74
APPENDIX "D" - C


10-VS-100-YEARS INTENSITY RATIOS
SUB-ZONE
1 .72 .71 .70 .69 .68
2 .70 .69 .68 .67 .66 .65 .64 .63 .62
3 .72 .71 .70 .69 .68 .67 .66 .65 .64
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION (CALTRANS) - DISTRICT 4
1-in-100-years DESIGN RAINFALL INTENSITY DURATION CURVES,
and 10-vs-100-years DESIGN INTENSITY RATIOS, ZONE D
from "1941-71 RAINFALL INTENSITY - DURATION - FREQUENCY ANALYSIS"
INTENSITY - INCHES PER HOUR
The 1-to-72-hours portions of the curves are based on interpolation and correlation of values derived from analysis of up to 31 years (7/40-6/71) of records from 79*Recorder Stations and 305*Non-Recorder Stations. (*=6-zone totals)
The 5-to-60-minute portions of the curves are extrapolated from the 1-to-72-hour portions, supported by limited observation data.
.74 .73 .72 1
.74 .73 .72 .71 .70 2
.76 .75 .74 .73 .72 3
SUB-ZONE
10-VS-100-YEARS INTENSITY RATIOS
MINUTES
DURATION
HOURS
CHART "K" , ZONE D
EK/ERR 9/74
APPENDIX "D" - D


10-VS-100-YEARS INTENSITY RATIOS
SUB-ZONE
1 .74 .73 .72 .71 .70 .69 .68 .67 .66 .65
2 .73 .72 .71 .70 .69 .68 .67 .66 .65 .64 .63 .62 .61
3 .73 .72 .71 .70 .69 .68 .67 .66 .65 .64 .63 .62 .61 .60
STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION (CALTRANS) - DISTRICT 4
1-in-100-years DESIGN RAINFALL INTENSITY DURATION CURVES,
and 10-vs-100-years DESIGN INTENSITY RATIOS, ZONE E
from : "1941-71 RAINFALL INTENSITY - DURATION - FREQUENCY ANALYSIS"
INTENSITY - INCHES PER HOUR
The 1-to-72-hours portions of the curves are based on interpolation and correlation of values derived from analysis of up to 31 years (7/40-6/71) of records from 79*Recorder Stations and 305*Non-Recorder Stations. (*=6-zone totals)
The 5-to-60-minute portions of the curves are extrapolated from the 1-to-72-hour portions, supported by limited observation data.
.79 .78 .77 .76 .75 .74 1
.80 .79 .78 .77 .76 .75 .74 .73 2
.80 .79 .78 .77 .76 .75 .74 .73 3
SUB-ZONE
10-VS-100-YEARS INTENSITY RATIOS
MINUTES
DURATION
HOURS
CHART "K" , ZONE E
EK/ERR
9/74
APPENDIX "D" - E

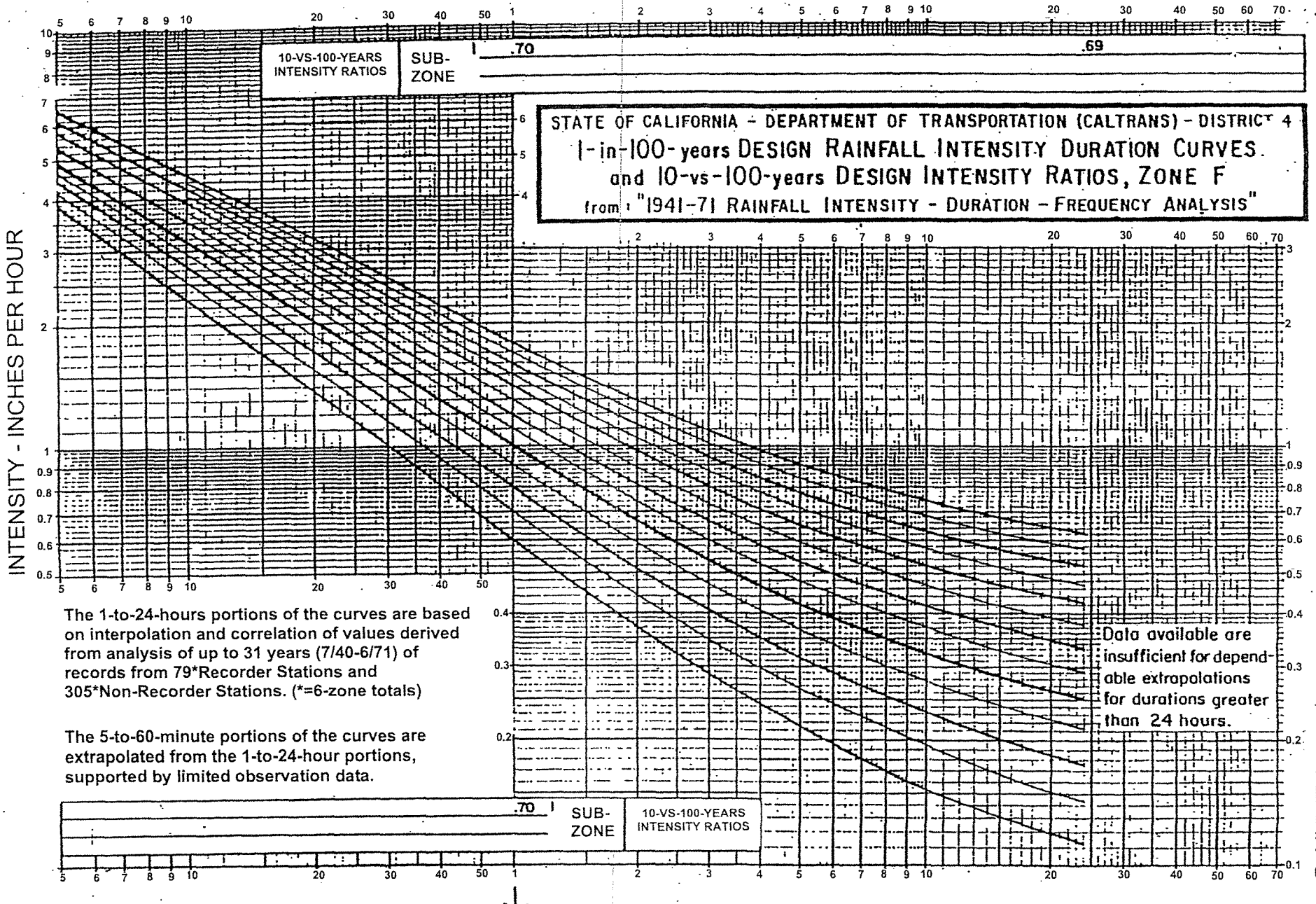
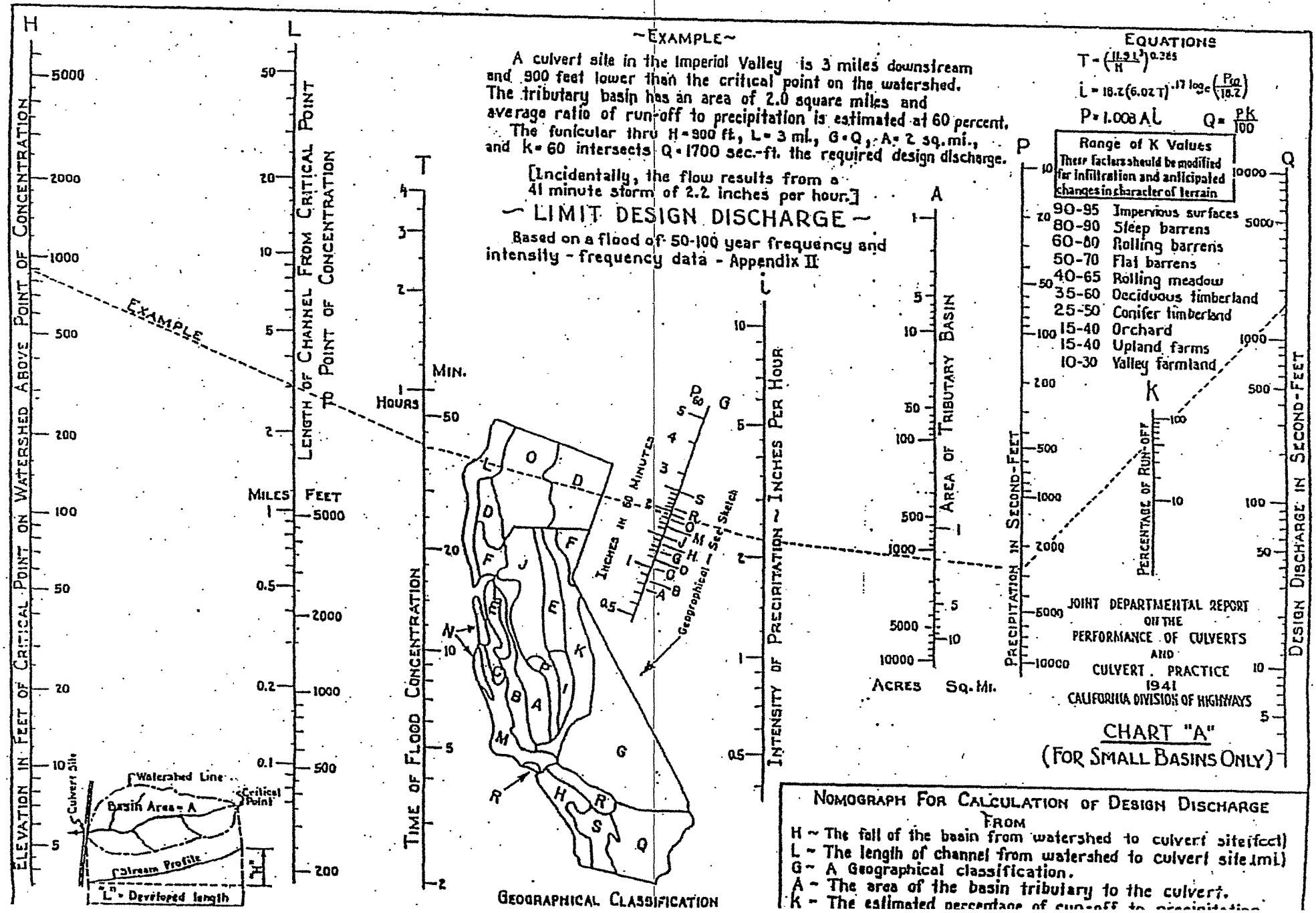


CHART "K", ZONE F

EK/ERR
9/74

APPENDIX "D" - F



~EXAMPLE~

A culvert site in the Imperial Valley is 3 miles downstream and 900 feet lower than the critical point on the watershed. The tributary basin has an area of 2.0 square miles and average ratio of run-off to precipitation is estimated at 60 percent. The funicular thru H = 900 ft., L = 3 mi., G = Q, A = 2 sq. mi., and k = 60 intersects Q = 1700 sec.-ft. the required design discharge.

[Incidentally, the flow results from a 41 minute storm of 2.2 inches per hour.]

~ LIMIT DESIGN DISCHARGE ~

Based on a flood of 50-100 year frequency and intensity - frequency data - Appendix II

EQUATIONS

$$T = \left(\frac{11.9\,L^3}{H}\right)^{0.385}$$

$$i = 18.2\,(6.02\,T)^{-.17\log_e\left(\frac{P_{50}}{18.2}\right)}$$

$$P = 1.008\,Ai \qquad Q = \frac{Pk}{100}$$

Range of K Values (These factors should be modified for infiltration and anticipated changes in character of terrain)	
90-95	Impervious surfaces
80-90	Steep barrens
60-80	Rolling barrens
50-70	Flat barrens
40-65	Rolling meadow
35-60	Deciduous timberland
25-50	Conifer timberland
15-40	Orchard
15-40	Upland farms
10-30	Valley farmland

JOINT DEPARTMENTAL REPORT ON THE PERFORMANCE OF CULVERTS AND CULVERT PRACTICE 1941 CALIFORNIA DIVISION OF HIGHWAYS

CHART "A"

(FOR SMALL BASINS ONLY)

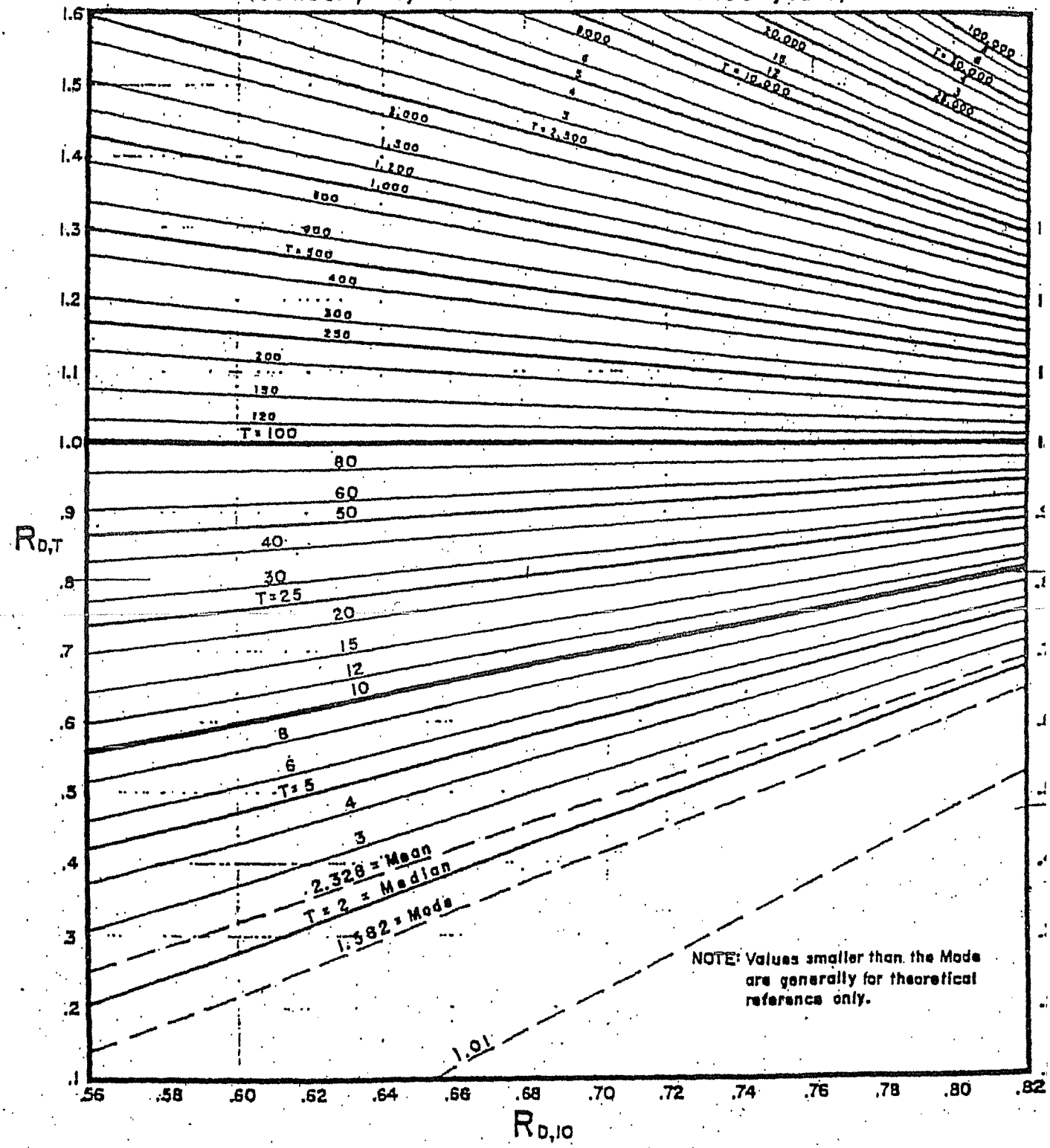
NOMOGRAPH FOR CALCULATION OF DESIGN DISCHARGE FROM

H ~ The fall of the basin from watershed to culvert site (feet)
L ~ The length of channel from watershed to culvert site (mi.)
G ~ A Geographical classification.
A ~ The area of the basin tributary to the culvert.
k ~ The estimated percentage of run-off to precipitation

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION (CALTRANS) – DISTRICT 4

FREQUENCY DISTRIBUTION RATIOS CHART "R"

(Gumbel ; Key Return Periods = 10 and 100 years)



EQUATIONS SEE "1941-71 RAINFALL INTENSITY-DURATION-FREQUENCY ANALYSIS"

(29) $R_{D,T} = I_{D,T} / I_{D,100}$, where

(31) $I_{D,T} = I_{D,100}\left\{1 + \left[\left(\frac{1-R_{D,10}}{y_{100}-y_{10}}\right)(y_T - y_{100})\right]\right\}$ and

( ) $y_T = -\ln\left[-\ln(1-1/T)\right]$

T = Return Period, Years
R = Ratio
I_D = Intensity (For a given duration D), Inches/Hr.

Other parameters, such as discharge rate (Q) may be substituted for T_R.

APPENDIX "B"

Q100 Detention Calculations

Quirie Residence - Barker Avenue, Fairfax, CA
Detention Calculations for 100 Year Storm

References: County of Marin Hydrology Manual

10 Minute Time of Concentration:
i_100 = 3.2 in/hr
i_10 = in/hr
Zone= C2
10 yr vs 100 yr ratio = 0.718
R_D1T= 0.82

Total Watershed Analysis Area
425675 sf
acres

Total Pre-Project Impervious Surface: 0 acres
Total Post-Project Impervious Surface: 0.59 acres

	Watershed 1 Main Res Area	**Watershed 2 Driveways**	**Watershed 3 Detached ADU**	**Watershed 3 Garage**	
Impervious Area (sf)	6619	16860	1820	500	
Existing:	Q_100 = CiA				
c=	0.700	0.700	0.7	0.7	
i=	3.20	3.20	3.20	3.20	in/hr
A=	0.152	0.387	0.042	0.011	acres
Q=	**0.340**	**0.867**	**0.094**	**0.026**	**cfs runoff**
Proposed:	Q_100 = CiA				
c=	0.9	0.9	0.9	0.9	
i=	3.20	3.20	3.20	3.20	in/hr
A=	0.152	0.387	0.042	0.011	acres
Q=	**0.438**	**1.115**	**0.120**	**0.033**	**cfs runoff**
Δ=	**0.097**	**0.248**	**0.027**	**0.007**	**Δ cfs**

Existing: Q_100 = CiA
c= 0.700
i= 3.20 in/hr
A= 9.77 acres
Q= 21.890 cfs total site runoff

Proposed: Q_100 = CiA
c= 0.712
i= 3.20 in/hr
A= 9.77 acres
Q= 22.269 cfs total site runoff

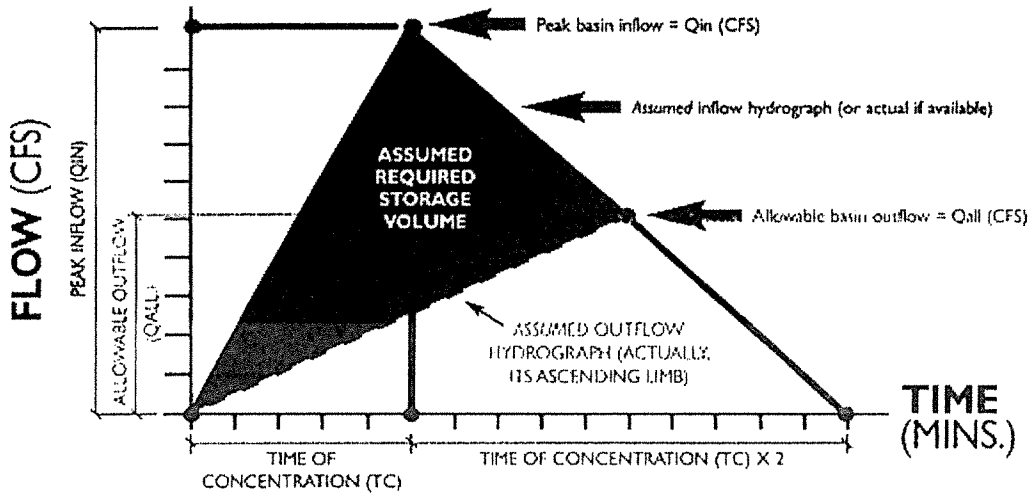
Δ= 0.379 Δ cfs total runoff

APPENDIX "C"

100 Year Detention Calculation Pages

Quirie Residence
JOB # 210284
DATE: 4/25/2023

Detention Computation to Limit Discharge to the Predevelopment Flow Rate for the 100-Year Storm



The approximate size of a detention basin may be assessed using a triangular hydrograph where the storm duration is taken as a function of the initial time of concentration (generally either 2 or 3 times the initial time of concentration).

Detention Volume Computation

$V = (Q_{DEV} - Q_{EXST})\ (3Tc)(.5)(60sec/min)$

V = Required Detention Volume (ft^3)
Q_{DEV} = 100 Year flow rate for the developed condition (cfs)
Q_{EXST} = 100 Year flow rate for the existing condition (cfs)
Tc= Developed time of concentration (min)

100 year storm	Q_{DEV} =	0.438 cfs
	Q_{EXST} =	0.340 cfs
	Tc=	10.0 min
Storm Duration as a function of Tc=		3 Tc
Storm Duration (Min) =		30.0 min

V = (0.438-0.34)(3)(10)(.5)(60)

V = 88 Ft^3 **Main Residence Area**

Main Residence Area

Calculation of orifice diameter to limit the 100-year developed flow to the pre-development condition

$$Q_{max} = (n)(A_0)(C)(2gZ)^{1/2}$$

$$A_0 = \frac{Q_{max}}{(n)(C)(2gZ)^{1/2}}$$

A_0 = Cross sectional area of Orifice perpendicular to flow (ft^2)
Q_{max} = Maximum flow rate (cfs)
n = number of orifices
C = Orifice coefficient (0.60 typical for drilled orifice)
g = Acceleration due to gravity (ft/s^2)
Z = Water depth above the orifice with a full detention basin (ft)

Q_{max} = 0.34 cfs
n = 1 ea
C = 0.77
g = 32.2 (ft/s^2)
Z = 2.90 ft

A_0 = 0.34 / [(1)(0.77) ((2)(32.2)(2.9))^1/2]

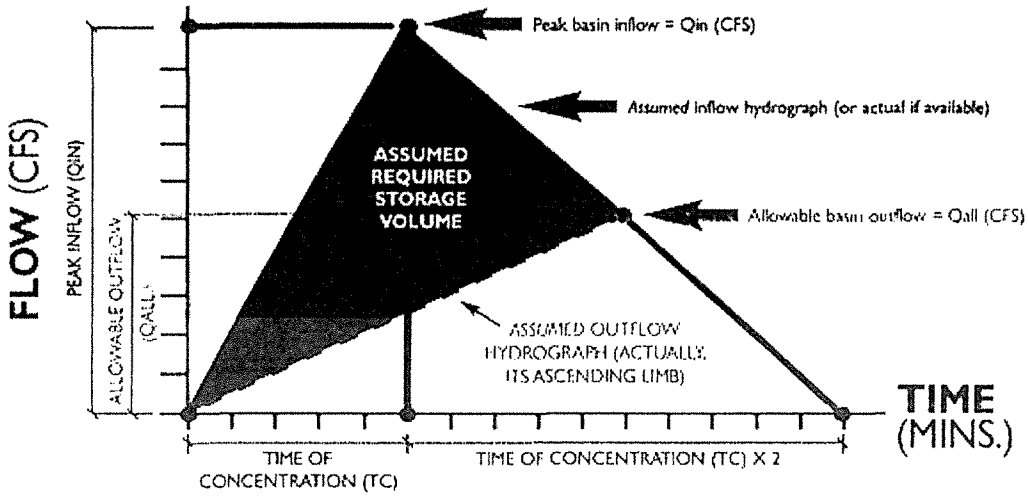
A_0 = **0.03** sf

Orifice Diameter, D = **2.43** in

The detention volume required to limit the 100-year post development storm water runoff to the pre-development flow rate is a function of the inflow and outflow hydrographs. Although the existing condition was used to model the outflow hydrograph to assess storage, the actual shape of the outflow hydrograph will depend on the orifice size, the outlet geometry and depth of water above the orifice. The orifice will be oversized.

Quirie Residence
JOB # 210284
DATE: 4/25/2023

Detention Computation to Limit Discharge to the Predevelopment Flow Rate for the 100-Year Storm



The approximate size of a detention basin may be assessed using a triangular hydrograph where the storm duration is taken as a function of the initial time of concentration (generally either 2 or 3 times the initial time of concentration).

Detention Volume Computation

$V = (Q_{DEV} - Q_{EXST})\ (3Tc)(.5)(60sec/min)$

V = Required Detention Volume (ft^3)
Q_{DEV} = 100 Year flow rate for the developed condition (cfs)
Q_{EXST} = 100 Year flow rate for the existing condition (cfs)
Tc= Developed time of concentration (min)

100 year storm	Q_{DEV} =	1.148 cfs
	Q_{EXST} =	0.893 cfs
	Tc=	10.0 min
Storm Duration as a function of Tc=		3 Tc
Storm Duration (Min) =		30.0 min

V = (1.148-0.893)(3)(10)(.5)(60)

V = 230 Ft^3 **Public Road Extension and Private Driveway**

Public Road Extension and Private Driveway

Calculation of orifice diameter to limit the 100-year developed flow to the pre-development condition

$$Q_{max} = (n)(A_0)(C)(2gZ)^{1/2}$$

$$A_0 = \frac{Q_{max}}{(n)(C)(2gZ)^{1/2}}$$

A_0 = Cross sectional area of Orifice perpendicular to flow (ft^2)
Q_{max} = Maximum flow rate (cfs)
n = number of orifices
C = Orifice coefficient (0.60 typical for drilled orifice)
g = Acceleration due to gravity (ft/s^2)
Z = Water depth above the orifice with a full detention basin (ft)

Q_{max} = 0.89 cfs
n = 1 ea
C = 0.77
g = 32.2 (ft/s^2)
Z = 4.25 ft

A_0 = 0.893 / [(1)(0.77) ((2)(32.2)(4.25))^1/2]

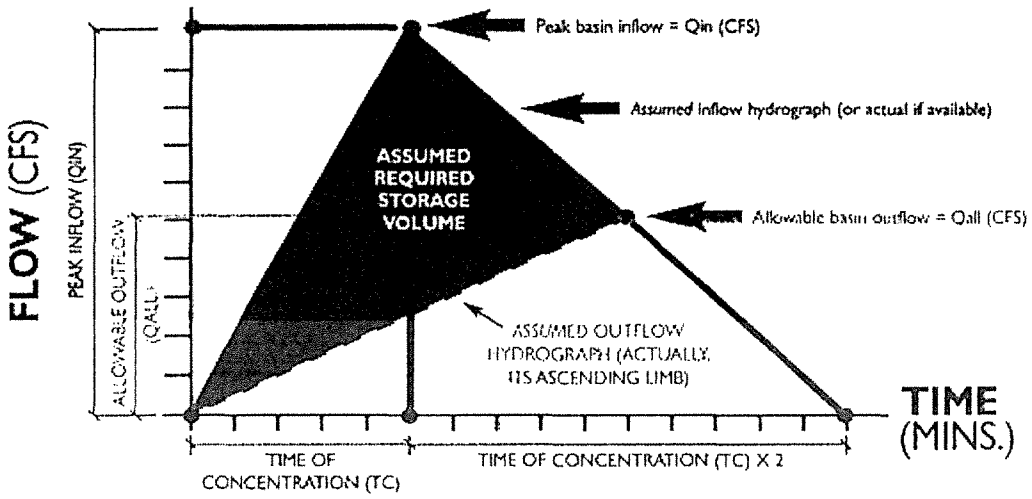
A_0 = **0.07** sf

Orifice Diameter, D = **3.59** in

The detention volume required to limit the 100-year post development storm water runoff to the pre-development flow rate is a function of the inflow and outflow hydrographs. Although the existing condition was used to model the outflow hydrograph to assess storage, the actual shape of the outflow hydrograph will depend on the orifice size, the outlet geometry and depth of water above the orifice. The orifice will be oversized.

Quirie Residence
JOB # 210284
DATE: 4/25/2023

Detention Computation to Limit Discharge to the Predevelopment Flow Rate for the 100-Year Storm



The approximate size of a detention basin may be assessed using a triangular hydrograph where the storm duration is taken as a function of the initial time of concentration (generally either 2 or 3 times the initial time of concentration).

Detention Volume Computation

$V = (Q_{DEV} - Q_{EXST})\ (3Tc)(.5)(60sec/min)$

V = Required Detention Volume (ft^3)
Q_{DEV} = 100 Year flow rate for the developed condition (cfs)
Q_{EXST} = 100 Year flow rate for the existing condition (cfs)
Tc= Developed time of concentration (min)

100 year storm	Q_{DEV} =	0.120 cfs
	Q_{EXST} =	0.094 cfs
	Tc=	10.0 min
Storm Duration as a function of Tc=		3 Tc
Storm Duration (Min) =		30.0 min

$V = (0.12-0.094)(3)(10)(.5)(60)$

$V =$ 23 Ft^3 **Detached ADU**

Detached ADU

Calculation of orifice diameter to limit the 25-year developed flow to the pre-development condition

$$Q_{max} = (n)(A_0)(C)(2gZ)^{1/2}$$

$$A_0 = \frac{Q_{max}}{(n)(C)(2gZ)^{1/2}}$$

A_0 = Cross sectional area of Orifice perpendicular to flow (ft^2)
Q_{max} = Maximum flow rate (cfs)
n = number of orifices
C = Orifice coefficient (0.60 typical for drilled orifice)
g = Acceleration due to gravity (ft/s^2)
Z = Water depth above the orifice with a full detention basin (ft)

Q_{max} = 0.09 cfs
n = 1 ea
C = 0.77
g = 32.2 (ft/s^2)
Z = 2.90 ft

A_0 = 0.094 / [(1)(0.77) ((2)(32.2)(2.9))^1/2]

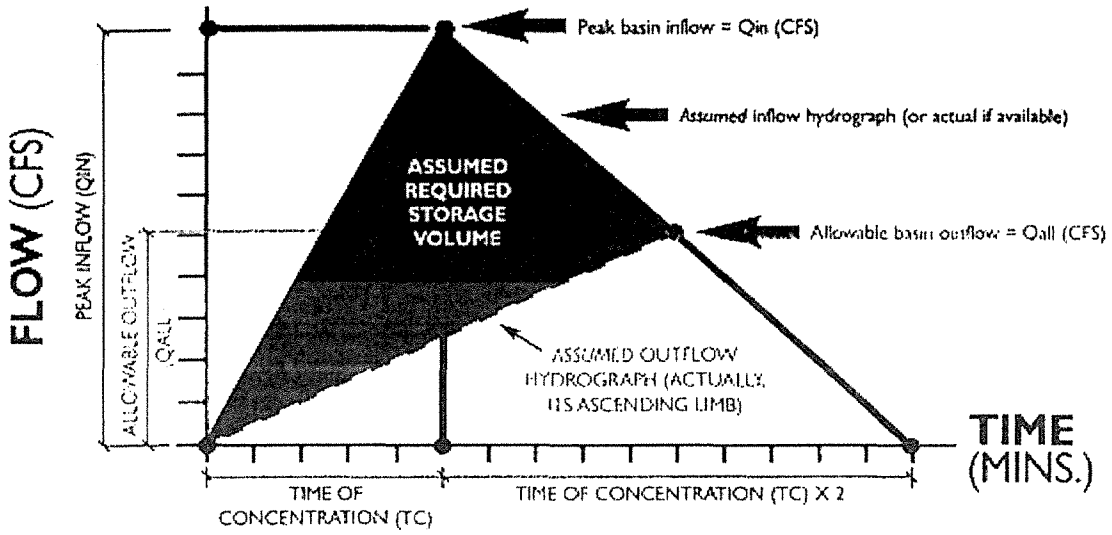
A_0 = **0.01** sf

Orifice Diameter, D = **1.28** in

The detention volume required to limit the 100-year post development storm water runoff to the pre-development flow rate is a function of the inflow and outflow hydrographs. Although the existing condition was used to model the outflow hydrograph to assess storage, the actual shape of the outflow hydrograph will depend on the orifice size, the outlet geometry and depth of water above the orifice. The orifice will be oversized.

Quirie Residence
JOB # 210284
DATE: 6/9/2023

Detention Computation to Limit Discharge to the Predevelopment Flow Rate for the 100-Year Storm



The approximate size of a detention basin may be assessed using a triangular hydrograph where the storm duration is taken as a function of the initial time of concentration (generally either 2 or 3 times the initial time of concentration).

Detention Volume Computation

$V = (Q_{DEV} - Q_{EXST})\ (3Tc)(.5)(60sec/min)$

V = Required Detention Volume (ft^3)
Q_{DEV} = 100 Year flow rate for the developed condition (cfs)
Q_{EXST} = 100 Year flow rate for the existing condition (cfs)
Tc= Developed time of concentration (min)

100 year storm	Q_{DEV} =	0.033 cfs
	Q_{EXST} =	0.026 cfs
	Tc=	10.0 min
Storm Duration as a function of Tc=		3 Tc
Storm Duration (Min) =		30.0 min

$V = (0.033-0.026)(3)(10)(.5)(60)$

V = 6 Ft^3 **Garage**

Garage

Calculation of orifice diameter to limit the 25-year developed flow to the pre-development condition

$$Q_{max} = (n)(A_0)(C)(2gZ)^{1/2}$$

$$A_0 = \frac{Q_{max}}{(n)(C)(2gZ)^{1/2}}$$

A_0 = Cross sectional area of Orifice perpendicular to flow (ft^2)
Q_{max} = Maximum flow rate (cfs)
n = number of orifices
C = Orifice coefficient (0.60 typical for drilled orifice)
g = Acceleration due to gravity (ft/s^2)
Z = Water depth above the orifice with a full detention basin (ft)

Q_{max} = 0.03 cfs
n = 1 ea
C = 0.77
g = 32.2 (ft/s^2)
Z = 2.90 ft

A_0 = 0.026 / [(1)(0.77) ((2)(32.2)(2.9))^1/2]

A_0 = **0.00** sf

Orifice Diameter, D = **0.67** in

The detention volume required to limit the 100-year post development storm water runoff to the pre-development flow rate is a function of the inflow and outflow hydrographs. Although the existing condition was used to model the outflow hydrograph to assess storage, the actual shape of the outflow hydrograph will depend on the orifice size, the outlet geometry and depth of water above the orifice. The orifice will be oversized.

August 15, 2023
BKF No C20210284-11

Town of Fairfax
c/o Nate Klemin, Senior Engineer
Miller Pacific Engineering Group
1360 Redwood Way, Suite B
Petaluma, CA 94954
Transmitted Via Email

Subject: **2nd Planning-Level Geologic, Geotechnical, & Civil Engineering Review Response Letter for 12 Barker Avenue, Fairfax**
Marin County APN 002-071-02
File: 201.218cltr.doc

Nate:

The project team received comments from the Town of Fairfax (Town) through Miller Pacific Engineering Group in a letter dated 08/01/23. The majority of these comments have been addressed during the planning review, while the remaining comments will be resolved with the construction drawings.

This project is subject to the requirements outlined in the BASMMA Post-Construction Manual. The project proponents have opted to retain the stormwater runoff from the design event (first inch of rainfall) and utilize it for irrigation. This was achieved by employing cisterns to store the rainwater runoff. In addition to retaining this design storm event, the Town requested the post-construction flows not exceed the preconstruction flows for the 100-year design storm event. For this purpose, the project utilizes cisterns with orifices to detain the stormwater from this event.

A site-specific geotechnical investigation was conducted for this project site. This investigation encompassed both above and below-grade observations. In addition, and unique to this project, the geotechnical engineer reviewed the planning grading and drainage drawings submitted to the Town to help ensure compliance with the geotechnical investigation's recommendations. The project drawings were aligned with these recommendations and submitted to the Town. The geotechnical engineer of record has confirmed the project site can support the proposed development.

At present, the drawings intended for planning review detail the locations of a level spreaders (dissipater). These devices are proposed for the garage and ADU. Stormwater runoff from the roofs of these buildings flows to the retention system for the BASMAA storm event and then overflows into the 100-year design storm event cisterns. Subsequently, the stormwater is directed to the level spreader. These level spreaders will comprise of a rock trench and a concrete curb set to a consistent elevation. It is expected that rainwater hitting the native ground will continue to exit the site as it currently does.

Given that this project has already implemented improvements related to 100-year post-construction flows, undergone a geotechnical investigation, and had the geotechnical engineer of record review the existing set of drawings, it has effectively addressed the planning-related comments. We anticipate comments typically encountered in construction-level drawings will be provided alongside the construction drawings.

Sincerely,

BKF Engineers

WJB

Bill Boriolo
Project Manager

TECHNICAL MEMORANDUM

Date: April 12, 2021 **BKF Job Number: C20210284-10**

Deliver To: **Matt Quirie**

From: **Andrew DeZurik, PE**

Subject: **Quirie Residence**

The high-level earthwork analysis performed by BKF used the design package provided to us on February 16, 2021. BKF performed the analysis using the volume between the existing and proposed surfaces provided for the proposed condition of the house as currently shown on the drawings. The second analysis assumed a graded pad in half way down the hill to assess the volume for comparison purposes. Our findings are what we expected and show that keeping the house in its current design location reduces the earthwork volume substantially. We have found that the proposed location of the house, as shown in the submitted drawings, had a rough earthwork volume of nearly 1,200 cubic yards of net cut. The revised location closer to the bottom of the hill would have a rough earthwork volume of nearly 5,000 cubic yards of net cut. This option to relocate the improvements further down the hill would place the house on a severe slope that is close to 2:1 (50%) which could have major erosion implications and retaining wall costs. While we understand the Town's concerns regarding the long road, the approximate earthwork volume, including the longer road, is less than the Town's suggested alternative by nearly 75%. The analysis does not include other earthwork measures that may be required by the Geotechnical Engineer to properly support the improvements such as mitigating poor soils, over excavation, re-compaction or the installation of keyways to support slopes.

August 15, 2023
BKF No C20210284-11

Town of Fairfax
c/o Nate Klemin, Senior Engineer
Miller Pacific Engineering Group
1360 Redwood Way, Suite B
Petaluma, CA 94954
Transmitted Via Email

Subject: **2nd Planning-Level Geologic, Geotechnical, & Civil Engineering Review Response Letter for 12 Barker Avenue, Fairfax**
Marin County APN 002-071-02
File: 201.218cltr.doc

Nate:

The project team received comments from the Town of Fairfax (Town) through Miller Pacific Engineering Group in a letter dated 08/01/23. The majority of these comments have been addressed during the planning review, while the remaining comments will be resolved with the construction drawings.

This project is subject to the requirements outlined in the BASMMA Post-Construction Manual. The project proponents have opted to retain the stormwater runoff from the design event (first inch of rainfall) and utilize it for irrigation. This was achieved by employing cisterns to store the rainwater runoff. In addition to retaining this design storm event, the Town requested the post-construction flows not exceed the preconstruction flows for the 100-year design storm event. For this purpose, the project utilizes cisterns with orifices to detain the stormwater from this event.

A site-specific geotechnical investigation was conducted for this project site. This investigation encompassed both above and below-grade observations. In addition, and unique to this project, the geotechnical engineer reviewed the planning grading and drainage drawings submitted to the Town to help ensure compliance with the geotechnical investigation's recommendations. The project drawings were aligned with these recommendations and submitted to the Town. The geotechnical engineer of record has confirmed the project site can support the proposed development.

At present, the drawings intended for planning review detail the locations of a level spreaders (dissipater). These devices are proposed for the garage and ADU. Stormwater runoff from the roofs of these buildings flows to the retention system for the BASMAA storm event and then overflows into the 100-year design storm event cisterns. Subsequently, the stormwater is directed to the level spreader. These level spreaders will comprise of a rock trench and a concrete curb set to a consistent elevation. It is expected that rainwater hitting the native ground will continue to exit the site as it currently does.

Given that this project has already implemented improvements related to 100-year post-construction flows, undergone a geotechnical investigation, and had the geotechnical engineer of record review the existing set of drawings, it has effectively addressed the planning-related comments. We anticipate comments typically encountered in construction-level drawings will be provided alongside the construction drawings.

Sincerely,

BKF Engineers

WJB

Bill Boriolo
Project Manager

Linda Neal

From: Nathan G. Klemin <NKlemin@millerpac.com>
Sent: Friday, August 18, 2023 8:05 AM
To: Linda Neal; Scott A. Stephens
Subject: RE: Quirie House Fairfax (BKF Job# 210284) - Response Letter
Attachments: 2023-08-15_PlanCheckResponseLetter.pdf

Hi Linda,

Looping in Scott Stephens. Based on discussions with Scott, with this letter, I think we can move them forward. We would recommend having the Geotechnical Engineer provide a supplemental plan review letter once final plans are prepared that specifically addresses the location and details of the dissipators along with other typical review items.

Thanks,

Nathan Klemin, P.E., G.E.

Senior Engineer

Miller Pacific Engineering Group

707-765-6140 Ext. 225 Office

From: Linda Neal <lneal@townoffairfax.org>
Sent: Friday, August 18, 2023 7:55 AM
To: Nathan G. Klemin <NKlemin@millerpac.com>
Subject: FW: Quirie House Fairfax (BKF Job# 210284) - Response Letter

Hi Nate,

I am just wondering if the letter the applicants engineer has submitted for 12 Barker provides all the remaining information needed for Miller Pacific to be able to recommend the project move forward to the Planning Commission. Basically, that there is adequate information to determine that the house, road and driveway, ADU and garage can be built using accepted engineering standards in a manner that will protect future occupants of the house and neighboring homes from death/damage due to geologic, hydrologic or seismic hazards.

Linda Neal
Principal Planner
(415) 453-1584

From: Gary Millar <millargary07@gmail.com>
Sent: Tuesday, August 15, 2023 2:45 PM
To: Linda Neal <lneal@townoffairfax.org>
Cc: Bill Boriolo <BBoriolo@bkf.com>; Matt Quirie <mquirie@gmail.com>; Stefan Ritter <stefan@holzbau-construction.com>
Subject: Fwd: Quirie House Fairfax (BKF Job# 210284) - Response Letter

ATTACHMENT F

Hi Linda,
Bill Boriolo, our civil engineer, has been in contact with Nathan Klemin of Miller Pacific to resolve the remaining concerns about the drainage design for the Quirie Project, as illustrated by this email string. The letter is attached, and represents what we trust is the last piece required to be deemed complete.
It would be great if we could squeeze into this month's hearing.
Take care,
Gary

Millar Architecture
46 Santa Barbara Ave
San Anselmo, CA 94960
cell- 415-250-9091

---------- Forwarded message ---------
From: **Nathan G. Klemin** <NKlemin@millerpac.com>
Date: Tue, Aug 15, 2023 at 11:45 AM
Subject: RE: Quirie House Fairfax (BKF Job# 210284) - Response Letter
To: Bill Boriolo <bboriolo@bkf.com>
Cc: Gary Millar <millargary07@gmail.com>, Matt Quirie <matt@nofrickingway.com>

Hi Bill,

I think this should be sufficient to get the project through to building level. We will likely include a comment that requests an updated geotechnical plan review letter that specifically addresses the grading/drainage plans and details along with other typical review items.

Thanks,

Nathan Klemin, P.E., G.E.

Senior Engineer

Miller Pacific Engineering Group

707-765-6140 Ext. 225 Office

From: Bill Boriolo <bboriolo@bkf.com>
Sent: Tuesday, August 15, 2023 9:49 AM
To: Nathan G. Klemin <NKlemin@millerpac.com>

MILLER PACIFIC ENGINEERING GROUP

August 1, 2023
File: 201.218cltr.doc

Town of Fairfax
Planning and Building Services Department
142 Bolinas Avenue
Fairfax, California 94930

Attn: Ms. Linda Neal, Principal Planner

Re: Second Planning-Level Geologic, Geotechnical, and Civil Engineering Review
New Residential Development and Roadway Extension
12 Barker Avenue (APN 002-071-01)
Fairfax, California

Introduction

In response to your request and in accordance with our agreement dated March 20, 2018, this letter summarizes our second planning-level review of project plans and supporting documentation for the planned new residential development and roadway extension to the property located at 12 Barker Avenue (APN 002-071-02) in Fairfax, California. The purpose of our services is to review the submitted documents, comment on the completeness and adequacy of the submittal in consideration of Town requirements, and to provide a recommendation to Town Planning staff regarding project approval. Our first planning-level review comments were included in our letter dated February 8, 2023.

The scope of our services to date has included:

- A site reconnaissance to observe existing conditions and review proposed development features;
- Development of opinions regarding project compliance with applicable Town Hill Area Residential Development Overlay Zone requirements; and
- Development of recommendations to Town staff as to whether the project may be safely constructed in consideration of any geologic, hydrologic, or geotechnical hazards.

The purpose of our current review is to determine whether all planning-level geotechnical comments and conditions of approval are appropriately reflected by the building plans. It should be noted that the scope of our review is limited solely to geologic, geotechnical, and civil portions of the project, and does not include review of structural, architectural, mechanical, or other items beyond the scope of our qualifications. We recommend that non-geotechnical aspects of the plans be reviewed by suitably qualified professionals.

Project Description

The project generally includes construction of a new 3,347 square-foot, 3-bedroom, 3-bathroom single-family residence, a 994 square-foot, 2-bedroom, 1.5-bathroom, 2-story accessory dwelling unit (ADU), a 492 square-foot, 1-bedroom, 1-bathroom junior ADU, and a 500 square-foot garage with a rooftop deck. Ancillary improvements will include an approximately 250 foot-long extension

of Barker Avenue as well as an approximately 430 foot-long, 18-foot wide private driveway with fire shunt turnaround, both consisting of pervious asphalt, and other "typical" residential items. New retaining walls up to about 13-feet high will be required to accommodate the new development, and we expect moderate grading, including excavations up to 13 feet and fills up to about 7-feet deep, will be required for construction.

Project Review

We performed a brief site reconnaissance to observe existing conditions at the site. Additionally, we reviewed the following documents provided by the Town as part of our first review:

- Millar Architecture (2022), "New residence, Quirie Family, 1 Barker Avenue, Fairfax, California A.P. 002-071-01" (Architectural, Civil, and Landscape Plans), Plan Set dated December 30, 2022.
- William W. Moore, P.E, G.E. (2019), "Preliminary Geotechnical Report, Quirie Fairfax Property, Northwest of Barker Road, Fairfax, CA", dated July 8, 2019.
- William W. Moore, P.E, G.E. (2020), "Geotechnical Report, Quirie Fairfax Property, Northwest of Barker Road, Fairfax, CA," dated February 6, 2020.

Subsequently, we reviewed the following additional documents provided by the Town as part of our second review:

- Millar Architecture (2023), "Re: Responses to Miller Pacific Review, Dated February 8, 2023, AP# 002-071-01, 12 Barker Ave." letter dated June 7, 2023.
- Millar Architecture (2023), "New Residence, Quirie Family, 1 Barker Avenue, Fairfax, California A.P. 002-071-01" (Architectural, Civil, and Landscape Plans), "Planning Dept. Completeness" Plan Set dated June 7, 2023.
- Cinquini & Passarino (2018), "Record of Survey Being the lands of Sierra Enterprises, Inc. as described by deed recorded in Book 2460, Page 388, Official Records of Marin County, Town of Fairfax.
- Fidelity National Title Company (2018), "Preliminary Report, Property Address(es): APN: 002-071-01, Fairfax, CA."
- BKF Engineers (2023), "Quirie House Fairfax Drainage Memorandum," BKF Job No. C20210284-11, dated June 9, 2023.
- BKF Engineers (2023), "Preliminary Storm Water Control Plan For Quirie House, Barker Avenue, Fairfax, CA, APN 002-071-01," BKF Job No. 21028, dated June 2023.
- RGH Consultants, "Geotechnical Study Report, Quirie Residence, 12 Barker Avenue, Fairfax, California," Project No. 4999.01.04.1, Revised Report dated June 2, 2023.

Most recently, we reviewed the following document for this third review:

- RGH Consultants (2023), "Geotechnical Review, Grading Plans, Quirie Residence, 12 Barker Avenue, Fairfax, California", Project Number 4999.01.01.1, dated July 5, 2023.

- Millar Architecture (2023), "Re: Site Context Photos, AP# 002-071-01, 12 Barker Ave." letter dated May 16, 2023.

Conclusions

Based on our site reconnaissance and document review, the following submittal items required by the Town of Fairfax Hill Area Residential Development Ordinance remain outstanding:

Hill Area Residential Development Ordinance

- Section 17.072.080(B) – Topographical and Boundary Survey

A topographic and boundary survey was provided for our review and prepared Grand Line Land Surveying, dated January 5, 2023 and shows site topography, property lines, existing utility connections and Barker Avenue, and the Barker Avenue Right of Way. A Title Report and recorded Record of Survey were provided for review.

- Section 17.072.080(C) – Site Plan

The Site Plan does shows existing utility connections, fences, site elevations, or other features, along with proposed new structures, driveways, retaining walls, and hardscape improvements. The Site Plan indicates portions of the new driveway, drainage improvements/modifications, and driveway retaining walls will be constructed in the Barker Avenue right-of-way.

Comment 2: A Town encroachment permit should be required for all improvements proposed in the right-of-way. This item can be handled during Building Permit submittal.

- Section 17.072.080(E) – Geotechnical Report

The project original geotechnical report was prepared by William W. Moore, P.E., G.E. of San Rafael, California on the basis of 7 probes within the driveway, 4 probes within the "house area, "and 3 test pits in the "house area." Probes extended between 1- and 6-feet below the ground surface and test pits extended between 8- to 24-inches below the ground surface. Laboratory testing was not included in the report.

The report provides brief discussion of local geologic mapping and regional seismicity, a brief discussion on geologic hazards (seismic shaking and erosion) and site investigation, and provides recommendations for seismic design, shallow footing, retaining walls, grading, fill compaction, and site drainage.

We note that a new Geotechnical Report, provided by RGH (2023), was submitted and addresses the majority of our First Review comments and included additional subsurface exploration with borings and test pits extending to about 8-feet below the ground surface, laboratory testing, a discussion of geologic hazards at the site, detailed discussion on site

grading, foundation and retaining wall recommendations, site drainage, and pavement design discussions.

- Section 17.072.080(F) – Grading and Erosion-Control Plan

A Grading and Erosion-Control Plan was prepared by BKF for our review and uses the topographic and boundary survey as a base, and shows all proposed site grading, provides earthwork quantity calculations, and shows all proposed erosion-control measures.

Grading and drainage plans indicate installation of catch basins within the new development around the main residence. This drainage is conveyed downslope in a new storm drainpipe to discharge on the upslope side of the existing Barker Avenue. A concrete v-ditch is planned to collect surface water on the upslope side of the driveway retaining wall to also be discharged on the upslope side of the existing Barker Street.

Comment 4: Future drainage plan submissions should include retaining wall and foundation drain alignments, clean-outs, and outlet locations. No dissipators or outlets are currently shown for retaining walls on the north side and downslope walls on the east side of the development.

Comment 4a: Drainage plans include dissipators, cisterns, rain barrels, and bioretention basins. Future drainage plans should include location retaining wall and foundation drains clean-out and outlet locations. Details for the dissipators and cisterns should be provided. Geotechnical Engineer should review the drainage plans and comment on or provide recommendations for dissipator size and location. Geotechnical Engineer should confirm the dissipators do not create a substantial risk for new erosion or slope stability. This should be addressed at the planning level.

Comment 4b: Drainage plans include dissipators, cisterns, rain barrels, and bioretention basins. Future drainage plan submissions should include retaining wall and foundation drain alignments, clean-outs, and outlet locations. The Geotechnical Engineer's June 2023 review letter indicates they have reviewed the Grading Plans and that their content generally reflects the intent of the Engineer's recommendations. The slopes below the project area have a history of landslides along with flooding on the streets below Barker Avenue. We understand that storm drain dissipators will be constructed at two locations on the slopes below the driveway in the northern portion of the site. We did not see details for these dissipators in the plans The Civil Engineer should evaluate the drainage calculations and consult with the project Geotechnical Engineer to locate and size the dissipators to avoid excess or concentrated discharge onto the slopes that would increase the risk of erosion or slope instability to the downslope neighbors. This should be addressed at the planning level.

- Section 17.072.110(C) – Geotechnical Report Adequacy

We judge that the geotechnical report, RGH (2023), is generally adequate to facilitate code-compliant design of the proposed improvements.

Exploration and Laboratory Testing – Subsurface conditions are expected to vary from shallow bedrock on the crest of the ridge to thicker soils on the downslope edge of the existing access road and lower flanks of the site.

Comment 6: Soil borings should be performed that extend to the planned excavation depths (up to 13-feet for the upslope driveway retaining wall) and on the lower portion of the steep slope in the vicinity of the planned ADU and retaining structures.

Comment 6a: Test pits were provided to a maximum depth of 8-feet below the ground surface in areas with taller retaining walls. Planned excavations are on the order 13-feet for driveway retaining walls. A discussion on potential hard rock excavation is included in the report indicating that hard rock may be encountered at the site in deeper excavations. We recommend the Geotechnical Engineer be on site during grading and excavation to observe conditions during construction to confirm soil and rock exposed are consistent with the recommendations. This item can be handled during Building Permit submittal.

Recommendations

We recommend that the dissipator locations and details be developed and reviewed at the planning level. We judge that other outstanding items, including review of design-level grading, drainage, structural, erosion control plans, and other materials can be handled at the Building Permit submittal level.

We trust that this letter contains the information you require at this time. If you have any questions, please call. We will directly discuss our comments with the applicant's consultants if they wish to do so.

Yours very truly,
MILLER PACIFIC ENGINEERING GROUP

Nate Klemin
Geotechnical Engineer No. 3168
(Expires 3/31/25)

REVIEWED BY:

Scott Stephens
Town of Fairfax Contract Engineer
Geotechnical Engineer No. 2398
(Expires 6/30/25)

MILLER PACIFIC ENGINEERING GROUP

June 20, 2023
File: 201.218bltr.doc

Town of Fairfax
Planning and Building Services Department
142 Bolinas Avenue
Fairfax, California 94930

Attn: Ms. Linda Neal, Principal Planner

Re: Second Planning-Level Geologic, Geotechnical, and Civil Engineering Review
New Residential Development and Roadway Extension
12 Barker Avenue (APN 002-071-01)
Fairfax, California

Introduction

In response to your request and in accordance with our agreement dated March 20, 2018, this letter summarizes our second planning-level review of project plans and supporting documentation for the planned new residential development and roadway extension to the property located at 12 Barker Avenue (APN 002-071-02) in Fairfax, California. The purpose of our services is to review the submitted documents, comment on the completeness and adequacy of the submittal in consideration of Town requirements, and to provide a recommendation to Town Planning staff regarding project approval. Our first planning-level review comments were included in our letter dated February 8, 2023.

The scope of our services to date has included:

- A site reconnaissance to observe existing conditions and review proposed development features;
- Development of opinions regarding project compliance with applicable Town Hill Area Residential Development Overlay Zone requirements; and
- Development of recommendations to Town staff as to whether the project may be safely constructed in consideration of any geologic, hydrologic, or geotechnical hazards.

The purpose of our current review is to determine whether all planning-level geotechnical comments and conditions of approval are appropriately reflected by the building plans. It should be noted that the scope of our review is limited solely to geologic, geotechnical, and civil portions of the project, and does not include review of structural, architectural, mechanical, or other items beyond the scope of our qualifications. We recommend that non-geotechnical aspects of the plans be reviewed by suitably qualified professionals.

Project Description

The project generally includes construction of a new 3,347 square-foot, 3-bedroom, 3-bathroom single-family residence, a 994 square-foot, 2-bedroom, 1.5-bathroom, 2-story accessory dwelling unit (ADU), a 492 square-foot, 1-bedroom, 1-bathroom junior ADU, and a 500 square-foot garage with a rooftop deck. Ancillary improvements will include an approximately 250 foot-long extension

of Barker Avenue as well as an approximately 430 foot-long, 18-foot wide private driveway with fire shunt turnaround, both consisting of pervious asphalt, and other "typical" residential items. New retaining walls up to about 13-feet high will be required to accommodate the new development, and we expect moderate grading, including excavations up to 13 feet and fills up to about 7-feet deep, will be required for construction.

Project Review

We performed a brief site reconnaissance to observe existing conditions at the site. Additionally, we reviewed the following documents provided by the Town as part of our first review:

- Millar Architecture (2022), "New residence, Quirie Family, 1 Barker Avenue, Fairfax, California A.P. 002-071-01" (Architectural, Civil, and Landscape Plans), Plan Set dated December 30, 2022.

- William W. Moore, P.E, G.E. (2019), "Preliminary Geotechnical Report, Quirie Fairfax Property, Northwest of Barker Road, Fairfax, CA", dated July 8, 2019.

- William W. Moore, P.E, G.E. (2020), "Geotechnical Report, Quirie Fairfax Property, Northwest of Barker Road, Fairfax, CA," dated February 6, 2020.

Most recently, we reviewed the following additional documents provided by the Town as part of our second review:

- Millar Architecture (2023), "Re: Responses to Miller Pacific Review, Dated February 8, 2023, AP# 002-071-01, 12 Barker Ave." letter dated June 7, 2023.

- Millar Architecture (2023), "New Residence, Quirie Family, 1 Barker Avenue, Fairfax, California A.P. 002-071-01" (Architectural, Civil, and Landscape Plans), "Planning Dept. Completeness" Plan Set dated June 7, 2023.

- Cinquini & Passarino (2018), "Record of Survey Being the lands of Sierra Enterprises, Inc. as described by deed recorded in Book 2460, Page 388, Official Records of Marin County, Town of Fairfax.

- Fidelity National Title Company (2018), "Preliminary Report, Property Address(es): APN: 002-071-01, Fairfax, CA."

- BKF Engineers (2023), "Quirie House Fairfax Drainage Memorandum," BKF Job No. C20210284-11, dated June 9, 2023.

- BKF Engineers (2023), "Preliminary Storm Water Control Plan For Quirie House, Barker Avenue, Fairfax, CA, APN 002-071-01," BKF Job No. 21028, dated June 2023.

- RGH Consultants, "Geotechnical Study Report, Quirie Residence, 12 Barker Avenue, Fairfax, California," Project No. 4999.01.04.1, Revised Report dated June 2, 2023.

Conclusions

Based on our site reconnaissance and document review, the following submittal items required by the Town of Fairfax Hill Area Residential Development Ordinance remain outstanding:

Hill Area Residential Development Ordinance

- Section 17.072.080(B) – Topographical and Boundary Survey

A topographic and boundary survey was provided for our review and prepared Grand Line Land Surveying, dated January 5, 2023 and shows site topography, property lines, existing utility connections and Barker Avenue, and the Barker Avenue Right of Way. A Title Report and recorded Record of Survey were provided for review.

- Section 17.072.080(C) – Site Plan

The Site Plan does shows existing utility connections, fences, site elevations, or other features, along with proposed new structures, driveways, retaining walls, and hardscape improvements. The Site Plan indicates portions of the new driveway, drainage improvements/modifications, and driveway retaining walls will be constructed in the Barker Avenue right-of-way.

Comment 2: A Town encroachment permit should be required for all improvements proposed in the right-of-way. This item can be handled during Building Permit submittal.

- Section 17.072.080(E) – Geotechnical Report

The project original geotechnical report was prepared by William W. Moore, P.E., G.E. of San Rafael, California on the basis of 7 probes within the driveway, 4 probes within the "house area, "and 3 test pits in the "house area." Probes extended between 1- and 6-feet below the ground surface and test pits extended between 8- to 24-inches below the ground surface. Laboratory testing was not included in the report.

The report provides brief discussion of local geologic mapping and regional seismicity, a brief discussion on geologic hazards (seismic shaking and erosion) and site investigation, and provides recommendations for seismic design, shallow footing, retaining walls, grading, fill compaction, and site drainage.

We note that a new Geotechnical Report, provided by RGH (2023), was submitted and addresses the majority of our First Review comments and included additional subsurface exploration with borings and test pits extending to about 8-feet below the ground surface, laboratory testing, a discussion of geologic hazards at the site, detailed discussion on site grading, foundation and retaining wall recommendations, site drainage, and pavement design discussions.

- Section 17.072.080(F) – Grading and Erosion-Control Plan

A Grading and Erosion-Control Plan was prepared by BKF for our review and uses the topographic and boundary survey as a base, and shows all proposed site grading, provides earthwork quantity calculations, and shows all proposed erosion-control measures.

Grading and drainage plans indicate installation of catch basins within the new development around the main residence. This drainage is conveyed downslope in a new storm drainpipe to discharge on the upslope side of the existing Barker Avenue. A concrete v-ditch is planned to collect surface water on the upslope side of the driveway retaining wall to also be discharged on the upslope side of the existing Barker Street.

Comment 4: Future drainage plan submissions should include the retaining wall and foundation drains clean-out and outlet locations. No dissipators or outlets are currently shown for retaining walls on the north side and downslope walls on the east side of the development.

Comment 4a: Drainage plans include dissipators, cisterns, rain barrels, and bioretention basins. Future drainage plans should include location retaining wall and foundation drains clean-out and outlet locations. Details for the dissipators and cisterns should be provided. Geotechnical Engineer should review the drainage plans and comment on or provide recommendations for dissipator size and location. Geotechnical Engineer should confirm the dissipators do not create a substantial risk for new erosion or slope stability. This should be addressed at the planning level.

- Section 17.072.110(C) – Geotechnical Report Adequacy

We judge that the geotechnical report, RGH (2023), is generally adequate to facilitate code-compliant design of the proposed improvements.

Exploration and Laboratory Testing – Subsurface conditions are expected to vary from shallow bedrock on the crest of the ridge to thicker soils on the downslope edge of the existing access road and lower flanks of the site.

Comment 6: Soil borings should be performed that extend to the planned excavation depths (up to 13-feet for the upslope driveway retaining wall) and on the lower portion of the steep slope in the vicinity of the planned ADU and retaining structures.

Comment 6a: Test pits were provided to a maximum depth of 8-feet below the ground surface in areas with taller retaining walls. Planned excavations are on the order 13-feet for driveway retaining walls. A discussion on potential hard rock excavation is included in the report indicating that hard rock may be encountered at the site in deeper excavations. We recommend the Geotechnical Engineer be on site during grading and excavation to observe conditions during construction to confirm soil and rock exposed are consistent with the recommendations. This item can be handled during Building Permit submittal.

Recommendations

We recommend that project processing be continued at planning level to address Comment 4a. Comments 2 and 6, as well as other outstanding items including review of design-level grading, drainage, structural, erosion control plans, and other materials can be handled at the Building Permit submittal level.

We trust that this letter contains the information you require at this time. If you have any questions, please call. We will directly discuss our comments with the applicant's consultants if they wish to do so.

Yours very truly,
MILLER PACIFIC ENGINEERING GROUP

Nate Klemin
Geotechnical Engineer No. 3168
(Expires 3/31/25)

REVIEWED BY:

Scott Stephens
Town of Fairfax Contract Engineer
Geotechnical Engineer No. 2398
(Expires 6/30/25)

1031Survey, Inc.
High Definition Surveying
1357RainierCircle-Petaluma-California-94954
415-827-6370

August 9, 2023

Town of Fairfax
142 Bolinas Road
Fairfax, California 94930

Attention: Linda Neal, Principal Planner

Subject: 12 Barker Avenue -Mapping Review

Dear Linda,

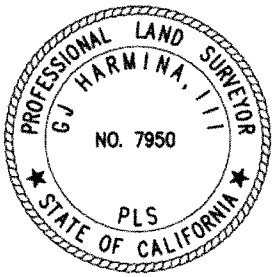
This is to address the plans submitted by Miller Architecture for the Quirie Family new residence.

I have reviewed the plans and Record of Survey and performed a site visit to visually verify the topographic features. I find that the features under my review meet the level of adequacy for the project submittal.

Let me know if you have any questions.

Sincerely,

GJ Harmina, PLS



emailed to: 156 CASCADE DR. on 3-20-23

TOWN OF FAIRFAX

142 BOLINAS ROAD, FAIRFAX, CALIFORNIA 94930
(415) 453-1584/FAX (415) 453-1618

Date: March 2, 2023 Permit #23-T-10

NOTICE OF TREE COMMITTEE ACTION

This action may be appealed to the Fairfax Town Council within 10 days of the Tree Committee decision. This permit is not in effect until the 10 day appeal period is over.

Request for a tree permit to remove: (127 ct) Multiple trees – Madrone, Bay, Oak Cedar

Address of Tree(s) to be removed: 12 Barker Avenue

Applicant's Phone: Matt & Mireya Quirie (415) 250-4259

February 27, 2023, the Fairfax Tree Committee took the following action on the above referenced tree permit application:

_____X_____ APPROVED - **'For Recommendation to Planning Commission Only'**

Motion to approve by Childers with condition that no trees be altered or removed until issuance of a building permit. Seconded by Pugh. Richardson-Mack abstained.

Vote : Aye – unanimous with abstention by Richardson-Mack

REMINDER: PLEASE KEEP PERMIT NOTICE UP DURING THE 10 DAY WAITING PERIOD

_____ CONTINUED

_____ DENIED

CONDITIONS OF APPROVAL:
THIS APPROVED APPLICATION IS YOUR PERMIT-KEEP IT ON THE JOB SITE. FAILURE TO HAVE THE PERMIT ON THE SITE WHILE THE TREE WORK IS IN PROGRESS MAY RESULT IN THE WORK BEING HALTED UNTIL YOU SHOW PROOF OF APPROVAL.
Please verify that the tree company performing the work has a current Fairfax Business license and worker's compensation coverage.
THIS TREE PERMIT EXPIRES IN SIX MONTHS. If necessary, you may apply for an extension in writing prior to the expiration date.

ATTACHMENT G

FOR RECOMMENDATION TO PLANNING COMMISSION 8/2/23

TOWN OF FAIRFAX

142 BOLINAS ROAD, FAIRFAX, CA 94930
(415) 453-1584 / FAX (415) 453-1618

APPLICATION FOR TREE REMOVAL OR ALTERATION

A permit is required to remove or alter one or more trees on any parcel in the Town of Fairfax. All trees for which a permit is requested shall be tagged with an orange ribbon, a minimum of 10 days prior to the Tree Advisory Committee meeting date. Applicants must also post a notice of intent to alter or remove the marked Tree(s) in a prominent location visible along the frontage of the affected property.

APPLICANT INFORMATION

OWNER (APPLICATIONS MUST BE FILED BY PROPERTY OWNER): Matt + Mireya Quirie	DATE OF APPLICATION: 2/14/23
JOB ADDRESS/ASSESSOR'S PARCEL NO. IF SITE IS VACANT 12 Barker Ave	PHONE NUMBER: 415 250 4259
EMAIL ADDRESS: mquirie@gmail.com	FAX NUMBER:
PROPERTY OWNER'S ADDRESS IF DIFFERENT FROM ABOVE	ALTERNATE PHONE NUMBER: 415 948 6592

TREE INFORMATION

SPECIES AND DESIGNATION OF HERITAGE/SPECIMEN/UNDESIRABLE TREE: Please see list attached	CIRCUMFERENCE BREAST HEIGHT: Please see list REASON FOR REMOVAL/ALTERATION New road + building site
SPECIES AND DESIGNATION OF HERITAGE/SPECIMEN/UNDESIRABLE TREE: MADRONE, BAY, OAK, CEDAR - MULTIPLE - 127 CT	CIRCUMFERENCE BREAST HEIGHT: MULTIPLE REASON FOR REMOVAL/ALTERATION See Arborist report
SPECIES AND DESIGNATION OF HERITAGE/SPECIMEN/UNDESIRABLE TREE:	CIRCUMFERENCE BREAST HEIGHT: REASON FOR REMOVAL/ALTERATION
SPECIES AND DESIGNATION OF HERITAGE/SPECIMEN/UNDESIRABLE TREE:	CIRCUMFERENCE BREAST HEIGHT: REASON FOR REMOVAL/ALTERATION

Please attached a site plan to this application showing the location and species of all trees with a diameter of 4 inches (circumference of 12 inches or more), measured 4.5feet above grade at tree base, property boundaries and easements, location of structures, foundation lines of neighboring structures and paved areas including driveways, .

AGENDA ITEM #3

Any tree company used for the removal or alteration must have a current and valid Fairfax Business license. Please include the name, address, and phone number of the person or company doing the above listed work:

NAME: The Tree Man	PHONE NUMBER: 800 753 TREE
ADDRESS:	CONTRACTOR BUSINESS LICENSE NUMBER #727576

Please note the Tree Advisory Committee may require applicants to submit their application to a Qualified Arborist for a report or recommendation at the expense of the applicant. A Qualified Arborist is defined as a Certified Arborist, A Certified Urban Forester, a Registered Consulting Arborist, or a Registered Professional Forester.

OWNER'S STATEMENT

I understand that in order to properly process and evaluate this application, it may be necessary for Town personnel to inspect the property, which is the subject of the application. I also understand that due to time constraints it may not always be possible for Town personnel to provide advanced notice of such inspections. Therefore, this application will be deemed to constitute my authorization to enter upon the property for the purpose of inspecting the same, provided that Town personnel shall not enter any building on the property except in my presence or the presence of any other rightful occupant of such building. I understand that my refusal to permit reasonable inspection of any portion of the property by town personnel may result in a denial of this application due to the lack of adequate information regarding the property.

Signature of Property Owner

2/14/23

Date

[AREA BELOW FOR STAFF USE ONLY]

Permit Number: 23-T-10	
Date Received: 2-15-23	Received by: S. Walker
Conditions of Approval:	
Tree Committee Action:	Date:

Tree Committee Actions can be appealed to the Town Council within 10 days of the Tree Committee Action. Contact Town Hall for more information.

Client: Matt Quirie
Project Location: Barker Road, Fairfax, CA
Inspection Date: 2020-2022
Arborist: Ben Anderson

URBAN FORESTRY ASSOCIATES, INC.

Assignment

Matt Quirie asked me to perform an inventory of the trees with the potential to be significantly impacted by the proposed development of an unimproved lot and to produce a report documenting the removals and any recommendations to protect the remaining trees during construction. This report is to be viewed only as a supplement to the two plan sheets I produced, which contain the inventory spreadsheet and map of tree locations. I also produced a vegetation management plan for the project.

Observations

The only improvement currently on the site is a dirt road leading to an open area at the top of the hill where the home will be. Mr. Quirie has done a large amount of work in the understory during the time I have been visiting the site to remove invasive species and reduce the wildfire fuel load. The property is covered by a forest of native trees including coast live oak (*Quercus agrifolia*), California black oak (*Quercus kelloggii*), valley oak (*Quercus lobata*), Pacific madrone (*Arbutus menziesii*), and California bay (*Umbellularia californica*). Many of these trees are in poor health due to drought and sudden oak death (*Phytophthora ramorum*). An inventory of the subject trees can be found on Sheet T-1.1. The map showing tree locations can be found on Sheet T-1.0. The latter also shows recommended tree protection fencing locations and specifications.

Approximately 190 trees were included in the inventory. I included all trees greater than four inches in trunk diameter that would need to be removed or suffer significant root damage for excavation. The numbering is erratic. This was due to multiple project redesigns, which necessitated adding trees beyond the initial scope. Many trees also died and were removed in the time since my initial survey.

The home is proposed in an area that will have the least amount of tree impact. The project's greatest impacts are the road and driveway, which must meet fire department standards for width, load capacity, turnout, and turnaround requirements.

Discussion & Conclusions

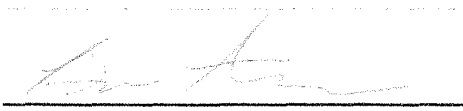
127 tree removals will be required for the project. Of these, 20 have "poor to fair" or worse structure or health (107 healthy, stable removals). 53 are "heritage" as defined in the Fairfax Municipal Code. 13 of the heritage trees have "poor to fair" or worse structure or health (40 healthy stable removals). Given the size and tree density of the property, this is a small percentage of the overall tree population, and these removals will not change the look or feel of the parcel.

I have seen an overall improvement in the health of the trees on the site in the years since Mr. Quirie began his clearing work, despite the ongoing drought and no supplemental water added to the landscape. This is likely the result of decreased competition for resources from the removal of small trees and invasive species in the understory.

SCOPE OF WORK AND LIMITATIONS

Urban Forestry Associates has no personal or monetary interest in the outcome of this investigation. All observations regarding trees in this report were made by UFA, independently, based on our education and experience. All determinations of health condition, structural condition, or hazard potential of a tree or trees at issue are based on our best professional judgment. The health and hazard assessments in this report are limited by the visual nature of the assessment. Arborists cannot detect every condition that could possibly lead

to the structural failure of a tree. Since trees are living organisms, conditions are often hidden within the tree and below ground. Arborists cannot guarantee that a tree will be healthy or safe under all circumstances, or for a specific period of time. Likewise, remedial treatments cannot be guaranteed. Trees can be managed but they cannot be controlled. To live near trees is to accept some degree of risk and the only way to eliminate all risk associated with trees is to eliminate all trees.



Benjamin Anderson, Urban Forester
ISA Board Certified Master Arborist & TRAQ
RCA #686, WE #10160B
(415) 454-4212 ex. 1

Tree Number	Species	Trunk Diameter (inches)			Health	Structure	Form	Comments	Removal	Heritage
1	Valley oak	17.8			Good	Fair	Poor to fair	South canopy distribution		Heritage
2	Coast live oak	11.2	10.2		Good	Good	Fair to good			Heritage
3	Valley oak	14.9			Good	Good	Fair	Southwest canopy distribution		Heritage
4	Valley oak	12.8			Good	Good	Fair			Heritage
5	Black oak	14.3			Good	Good	Good		X	Heritage
6	Black oak	9.5			Good	Good	Fair		X	Heritage
7	Black oak	7			Good	Fair	Poor to fair	Decay cavity in base	X	
8	Black oak	12.5			Poor to fair	Fair	Fair		X	Heritage
9	Black oak	6.7	5.7		Good	Good	Fair to good		X	
10	Black oak	15.2			Good	Good	Good		X	Heritage
11	Black oak	16			Poor	Poor	Poor to fair	Nearly dead		Heritage
12	Pacific madrone	17.2			Fair	Poor to fair	Fair to good			Heritage
13	California bay	6.7	5		Good	Good	Good			
14	Black oak	14.6	14.2		Fair	Poor	Good	Large necrotic area on base		Heritage
15	Coast live oak	13	7		Poor	Poor	Fair	Large necrotic area on base with hypoxylon and strong lean.	X	Heritage
16	Pacific madrone	15.2			Good	Good	Good			Heritage
17	Pacific madrone	10.1			Poor	Fair	Fair	Top dead	X	Heritage
18	California bay	10.2	8.8	6.5	Good	Good	Good		X	
19	California bay	10.1	9.1	8	Good	Fair to good	Good			
20	Valley oak	13.3			Good	Good	Good		X	Heritage
23	Valley oak	17.4			Good	Fair	Good	Large decay cavity in trunk		Heritage

24	Valley oak	10			Good	Good	Good			Heritage
25	Coast live oak	6.9			Good	Good	Poor	Strong bow in trunk		
26	California bay	11.5			Good	Good	Good			
27	California bay	11.7	7.5		Good	Good	Good			
28	California bay	15	13.9	13	Good	Fair to good	Good			
29	Valley oak	13.3			Good	Good	Fair to good	Not on survey		Heritage
100	California Bay	17	17		Good	Poor to Fair	Fair to Good	Decayed stump between two spars. Targets power lines and road	X	Heritage
101	California Bay	18.5			Good	Good	Fair to Good		X	Heritage
102	California Bay	36			Good	Fair to Good	Fair to Good	One stem was previously topped. Partially failed branch high in canopy.	X	Heritage
103	Valley oak	27			Fair	Fair	Fair to Good	Large diameter deadwood in canopy but base is sound.	X	Heritage
104	California Bay	12	12	10	Good	Good	Fair to Good	Six stems. Leans away from adjacent Valley Oak	X	
105	California Bay	13	12	9	Good	Good	Fair to Good	Six stems. Leans away from adjacent Valley Oak.	X	
106	California Bay	8	7.5		Fair to Good	Fair to Good	Fair to Good	Leans towards road.	X	
107	Deodar Cedar	12			Good	Good	Excellent			
108	Valley oak	20			Good	Good	Fair to Good	On neighboring property. Not tagged.		Heritage
109	California Bay	11.5	6	5	Good	Good	Good			
110	Coast live oak	14			Good	Good	Fair to Good	Canopy balance over road	X	Heritage

111	Coast live oak	24			Poor to Fair	Fair	Fair to Good	Appears to have an early phytophthora infection. Large old decaying wound on base. Leans over adjacent home		Heritage
112	California Bay	7			Good	Good	Good		X	
113	California Bay	7			Poor	Poor to Fair	Fair	Nearly girdled by rope that has been tied around the base for many years. Nearly dead.	X	
114	California Bay	10			Good	Fair to Good	Fair to Good	Top previously broke out of tree.		
115	Black Oak	13			Fair	Fair	Fair	Top previously broke out of tree. Two necrotic areas on base.	X	Heritage
116	California Bay	16			Good	Good	Good			Heritage
117	California Bay	7			Good	Fair to Good	Fair to Good	Top previously broke out at 15 feet above grade. Canopy now consists of sprouts.	X	
118	California Bay	9	8		Good	Fair to Good	Fair to Good	Top previously broke out of both stems.	X	
119	California Bay	7			Good	Good	Fair to Good	Leans over adjacent property		
120	Black Oak	26			Fair to Good	Fair	Fair	Advanced decay in trunk at 6 feet associated with two large old wounds. Top previously broke out of tree at 30 feet.	X	Heritage
121	California Bay	8	7	6	Good	Good	Fair to Good		X	

Tree Number	Species	Trunk Diameter (inches)			Health	Structure	Form	Comments	Removal	Heritage
122	California Bay	4.5			Good	Fair	Good	Several codominant sprouts arise from old topping cut at 6 feet.		
123	California Bay	27			Good	Poor to Fair	Fair	Large tree leaning over driveway. Last remaining stem from cluster of sprout growth from a decaying stump. Failure within the next few years is probable.	X	Heritage
124	California Bay	9			Good	Fair to Good	Fair	Strong bow and stem away from adjacent large bay. Trunk is rubbing against another adjacent bay		
125	California Bay	6.5			Good	Good	Fair	Suppressed and leaning away from road.		
126	California Bay	8.5			Good	Good	Fair	Leaning over road		
127	California Bay	8.5	8	7.5	Good	Good	Fair to Good	Three stems lean over road		
128	California Bay	5.5			Fair	Fair to Good	Poor to Fair	Sparse. Leaning over road		
129	California Bay	9.5			Good	Good	Fair to Good	Adjacent tree is rubbing on trunk.		
130	California Bay	12			Good	Fair	Fair	Top previously broke out of tree. Extensive decay associated with long wound on top side of stem. Leans over road.		
131	California Bay	10.5			Good	Fair to Good	Fair to Good			
132	California Bay	8.5			Fair	Poor to Fair	Fair to Good	Armillaria in base. Leaning over road.	X	
133	California Bay	15.5			Good	Good	Fair	Wound on road side of base.		
134	California Bay	7			Good	Good	Good			
135	Blackwood Acacia	14	12	12	Good	Fair to Good	Good	On opposite side of wire fence		
136	Coast live oak	8			Fair to Good	Good	Fair	Scraggly. Top broke out at 20 feet	X	Heritage

138	California Bay	15			Good	Fair to Good	Fair to Good	Tree engulfed wire fencing		
139	California Bay	11	11		Good	Good	Good			
140	California Bay	10.5			Fair to Good	Good	Fair to Good		X	
141	California Bay	7.5			Fair	Good	Fair to Good	Sparse. Nearly girdled at base.		
146	California Bay	7.5			Good	Good	Fair			
147	California Bay	7.5			Good	Good	Good			
148	California Bay	8.5			Fair to Good	Good	Fair	Canopy is in conflict with adjacent black oak	X	
149	Pacific Madrone	22			Poor to Fair	Poor to Fair	Poor to Fair	Nearly dead with extensive decay in base	X	Heritage
151	Pacific Madrone	6.5			Fair	Good	Poor to Fair		X	
152	Black Oak	11			Good	Fair	Fair	Decay cavities in trunk. Broken top. Suppressed.	X	Heritage
153	Pacific Madrone	7			Poor to Fair	Poor to Fair	Fair	Extensive decay in main trunk. Appears to be nearly dead.	X	
154	Pacific Madrone	6.5			Good	Good	Fair		X	
155	Black Oak	10			Good	Fair	Fair	Decay in trunk at two old failure points	X	Heritage
156	Black Oak	14			Good	Good	Fair to Good		X	Heritage
157	Black Oak	14.5			Fair to Good	Poor to Fair	Good	Nearly half girdled at base from old wound likely from original road cut. Wound is partially buried and decaying.	X	Heritage
158	Black Oak	11.5			Good	Fair	Fair	Twist in trunk creates structural weak point. Leans over road.	X	Heritage
159	Black Oak	12	4.5		Good	Good	Fair to Good		X	Heritage
160	Black Oak	22			Good	Good	Good		X	Heritage
161	California Bay	8			Good	Good	Good		X	
162	California Bay	5.5			Good	Good	Good		X	

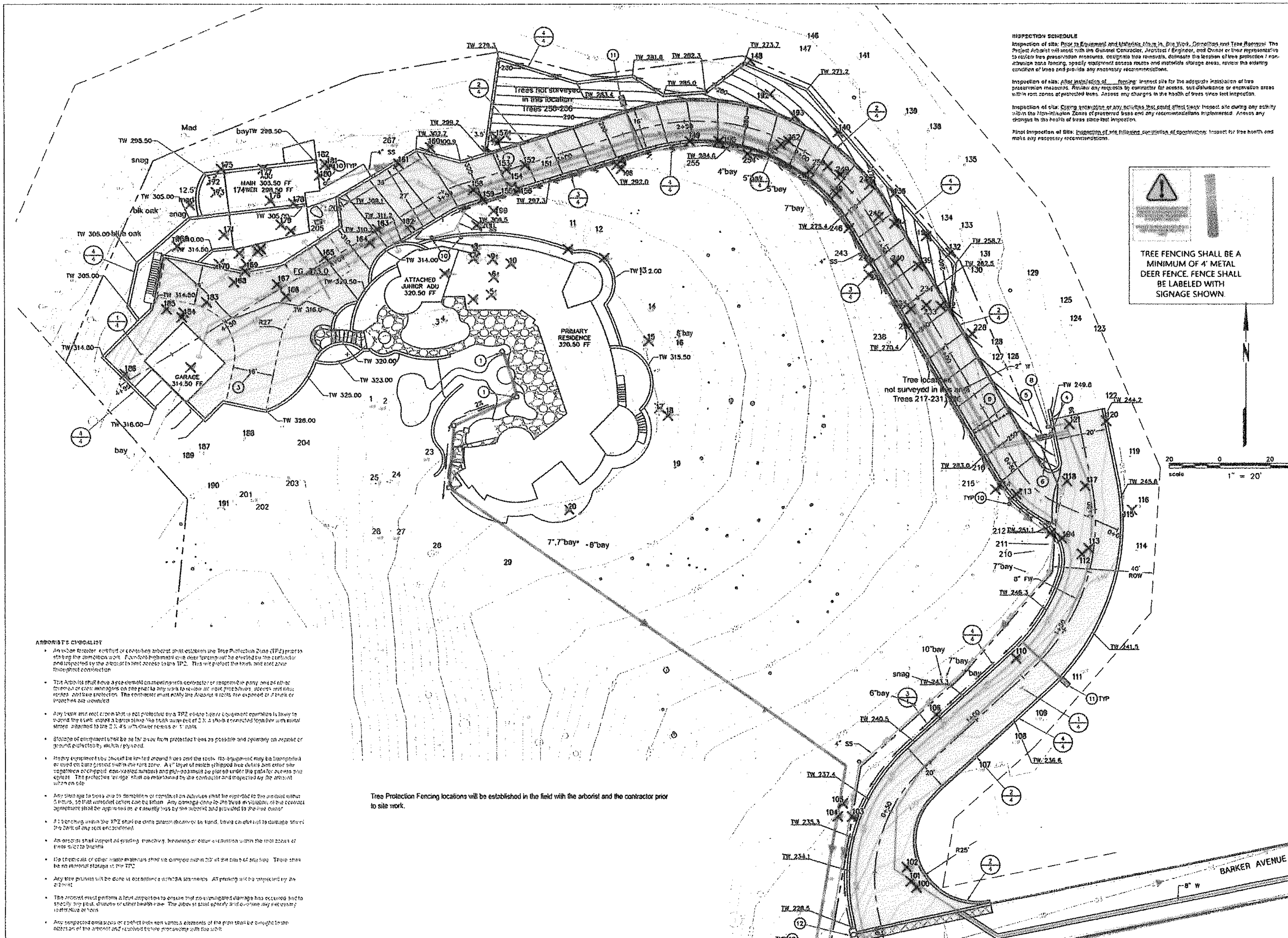
163	Pacific Madrone	16.5	10		Good	Poor to Fair	Fair to Good	Extensive decay in base. Leaning over road.	X	Heritage
164	California Bay	8.5			Good	Good	Good		X	
165	Valley oak	13			Good	Good	Fair to Good		X	Heritage
166	Pacific Madrone	7			Fair	Good	Good		X	
167	Black Oak	15.5			Good	Good	Fair to Good		X	Heritage
168	Pacific Madrone	9			Good	Good	Good		X	Heritage
169	Pacific Madrone	7.5			Good	Good	Good		X	
170	Pacific Madrone	7			Fair to Good	Good	Fair to Good		X	
171	Pacific Madrone	12.5			Good	Good	Good	Large old canker on trunk from grade to 6 feet	X	Heritage
172	Pacific Madrone	4.5			Fair to Good	Good	Fair	Leaning downhill and suppressed	X	

Tree Number	Species	Trunk Diameter (inches)			Health	Structure	Form	Comments	Removal	Heritage
173	California Bay	5.5			Good	Good	Good		X	
174	Pacific Madrone	6			Good	Good	Good		X	
175	Pacific Madrone	7.5			Fair	Good	Fair	Snaking downhill through the canopy. Suppressed.	X	
176	Black Oak	8			Good	Good	Fair	Strong lean downhill	X	Heritage
177	California Bay	4.5			Good	Good	Good		X	
178	California Bay	6.5			Good	Good	Fair to Good	Downhill lean	X	
179	Pacific Madrone	7			Fair to Good	Good	Fair to Good		X	
180	California Bay	7			Good	Good	Fair		X	
181	Pacific Madrone	17	14		Poor to Fair	Poor to Fair	Fair	One of three codominant stems is dead. Extensive decay in base.	X	Heritage
182	Black Oak	10.5			Fair to Good	Fair to Good	Poor to Fair	Strong lean downhill.	X	Heritage
183	California Bay	18.5			Good	Fair to Good	Good	Decay cavity in trunk at 6 feet	X	Heritage
184	California Bay	10			Good	Good	Excellent		X	
185	Pacific Madrone	8			Fair to Good	Fair to Good	Fair	Second stem previously died and was removed. Long necrotic strip on trunk of remaining stem	X	Heritage
186	Coast live oak	12			Good	Good	Fair to Good	Leans uphill	X	Heritage
187	Valley oak	19.5			Good	Good	Good			Heritage
188	Valley oak	13			Good	Good	Good			Heritage
189	Toyon	5			Good	Good	Fair		X	
190	Valley oak	7			Good	Good	Good			
191	Valley oak	11			Good	Good	Good			Heritage
192	California Bay	7.5			Good	Good	Fair to Good		X	
193	Pacific Madrone	5.5			Good	Good	Fair		X	
194	California Bay	7.2			Good	Good	Fair to Good	Downhill lean	X	
195	California Bay	5.7			Good	Good	Fair to Good		X	

196	Black oak	12.1			Good	Fair to Good	Fair	Strong lean over road	X	Heritage
197	California Bay	6.6			Good	Good	Fair		X	
198	Black oak	18.2			Good	Good	Fair to Good		X	Heritage
199	Black oak	10.4			Good	Good	Fair to Good	Canopy full of poison oak	X	Heritage
200	Black oak	12.5			Poor	Good	Good	Infested with bark beetles	X	Heritage
201	Valley oak	11.3			Fair	Good	Good			Heritage
202	California Bay	8.2,	7.1,	5.5	Good	Fair to Good	Fair to Good			
203	Valley oak	12.3			Fair to Good	Good	Good			Heritage
204	Valley oak	13			Good	Good	Good			Heritage
205	California Bay	12,	9.7		Good	Good	Good			
206	California Bay	9.1,	7.2		Good	Good	Good			
210	California Bay	6.5			Good	Good	Fair			
211	California Bay	6.8			Fair	Fair	Fair			
212	California Bay	5.5			Good	Good	Fair to Good		X	
213	Black Oak	12			Fair	Poor to Fair	Fair to Good	One of two codominant stems died, and was removed, leaving a large rotting wound	X	Heritage
214	California Bay	9			Good	Fair to Good	Poor to Fair	Second stem previously removed.	X	
215	California Bay	10.5			Fair to Good	Good	Fair			
216	California Bay	13	12	5.5	Good	Good	Fair to Good			
217	Pacific Madrone	8.5	7		Fair	Fair to Good	Fair		X	Heritage
218	California Bay	7.5	6.5	6	Good	Fair	Fair to Good	6 stems.	X	
219	California Bay	8			Fair	Fair to Good	Fair		X	

220	Pacific Madrone	12			Fair	Fair	Fair	Strong downhill lean. Decay in base.	X	Heritage
221	Pacific Madrone	12.5			Poor to Fair	Good	Fair	Leans uphill.	X	Heritage
222	California Bay	8	7		Poor to Fair	Fair to Good	Poor to Fair		X	
223	California Bay	9	5		Fair	Good	Fair to Good	Smaller stem is nearly dead.	X	
224	California Bay	5.5			Good	Good	Fair to Good		X	
225	California Bay	4.5			Poor to Fair	Fair to Good	Poor to Fair	Heavily suppressed	X	
226	California Bay	9			Good	Good	Fair to Good		X	
227	Pacific Madrone	7			Fair to Good	Fair to Good	Fair		X	
228	California Bay	8			Good	Good	Fair to Good		X	
229	California Bay	8			Good	Good	Fair		X	
230	California Bay	6			Fair	Good	Fair		X	
231	California Bay	5			Fair to Good	Good	Poor to Fair		X	
232	California Bay	7			Fair to Good	Good	Fair		X	

254	Black Oak	15			Fair	Fair	Fair to Good	Large necrotic area on lower trunk with decay moving into structural wood	X	Heritage
255	Black Oak	14	8.5		Good	Good	Good	Large poison oak vine climbing into tree		Heritage
256	Pacific Madrone	8.5			Good	Good	Fair to Good		X	Heritage
257	California Bay	5			Fair to Good	Good	Fair		X	
258	California Bay	8.5	7.5		Fair	Good	Fair	Large chunk of the canopy is entirely dead	X	
259	Black Oak	8	7.5		Fair	Fair to Good	Fair	Necrotic area on base. 9" dbh bay within 1' of tree.	X	Heritage
260	California Bay	7.5			Fair to Good	Good	Fair to Good		X	
261	California Bay	11.5	8.5		Good	Good	Fair to Good	Smaller stem, broke off at 15 feet	X	
262	Black Oak	7.5			Good	Good	Fair		X	
263	California Bay	12	6.5	6	Fair	Good	Fair to Good		X	
264	Pacific Madrone	15			Fair	Good	Fair to Good	Second stem previously died, and was removed	X	Heritage
265	Black Oak	12			Good	Good	Good	Maybe outside development impact, but is not shown on survey	X	Heritage
266	California Bay	8			Good	Good	Good		X	
267	California Bay	13.5			Good	Good	Fair to Good			
268	Pacific Madrone	7.5			Fair to Good	Fair to Good	Fair		X	



INSPECTION SCHEDULE

Inspection of site: Prior to Equipment and Materials Move in, Site Work, Demolition and Tree Removal: The Project Arborist will meet with the General Contractor, Architect / Engineer, and Owner or their representative to review tree preservation measures, designate tree removals, delineate the location of tree protection / non-intrusion zone fencing, specify equipment access routes and materials storage areas, review the existing condition of trees and provide any necessary recommendations.

Inspection of site: After installation of ___ fencing: Inspect site for the adequate installation of tree preservation measures. Review any requests by contractor for access, soil disturbance or excavation areas within root zones of protected trees. Assess any changes in the health of trees since last inspection.

Inspection of site: During excavation or any activities that could affect trees: Inspect site during any activity within the Non-intrusion Zones of preserved trees and any recommendations implemented. Assess any changes in the health of trees since last inspection.

Final Inspection of Site: Inspection of site following completion of construction: Inspect for tree health and make any necessary recommendations.

ARBORIST'S CHECKLIST

- [illegible] Tree Protection Zone (TPZ) [illegible]
- The Arborist shall have a pre-demolition meeting with contractor or responsible party [illegible]
- Any trunk and root crown that is not protected by a TPZ where heavy equipment operation is likely to [illegible]
- Storage of equipment shall be as far away from protected trees as possible [illegible] ground protection by mulch / plywood.
- Heavy equipment use should be limited around trees and the roots. [illegible]
- Any damage to trees due to demolition or construction activities shall be reported to the arborist [illegible]
- All trenching within the TPZ shall be done [illegible] by hand, being careful not to damage [illegible]
- An arborist shall inspect all grading, trenching, [illegible] within the root zones of trees [illegible]
- No chemicals or other waste materials shall be dumped within [illegible] of the base of any tree. There shall be no material storage in the TPZ.
- Any tree pruning will be done in accordance with ISA standards. All pruning will be [illegible] arborist.
- The arborist must perform a final inspection to ensure that no unmitigated damage has occurred and to specify any pest, disease or other health care. [illegible]
- Any suspected omissions or conflict between various elements of the plan shall be brought to the attention of the arborist and resolved before proceeding with the work.

REVISIONS	BY

URBAN FORESTRY ASSOCIATES, INC.
209 SAN ANSELMO AVE
SAN ANSELMO, CA
415 454 4212

TREE PROTECTION MANAGEMENT PLAN

NEW RESIDENCE
QUIRIE FAMILY
1 BARKER AVENUE
FAIRFAX, CALIFORNIA
A.P. #002-071-01

DATE DEC 22, 2022
SCALE AS NOTED
JOB QUIRIE

T - 1.0

Tree Number	Species	Trunk Diameter (inches)			Health	Structure	Form	Comments	Removal	Heritage
1	Valley oak	17.8			Good	Fair	Poor to fair	South canopy distribution		Heritage
2	Coast live oak	11.2	10.2		Good	Good	Fair to good			Heritage
3	Valley oak	14.9			Good	Good	Fair	Southwest canopy distribution		Heritage
4	Valley oak	12.8			Good	Good	Fair			Heritage
5	Black oak	14.3			Good	Good	Good		X	Heritage
6	Black oak	9.5			Good	Good	Fair		X	Heritage
7	Black oak	7			Good	Fair	Poor to fair	Decay cavity in base	X	
8	Black oak	12.5			Poor to fair	Fair	Fair		X	Heritage
9	Black oak	6.7	5.7		Good	Good	Fair to good		X	
10	Black oak	15.3			Good	Good	Good		X	Heritage
11	Black oak	16			Poor	Poor	Poor to fair	Nearly dead		Heritage
12	Pacific madrone	17.2			Fair	Poor to fair	Fair to good			Heritage
13	California bay	6.7	5		Good	Good	Good			
14	Black oak	14.6	14.2		Fair	Poor	Good	Large necrotic area on base		Heritage
15	Coast live oak	13	7		Poor	Poor	Fair	Large necrotic area on base with hypoxylon and strong lean.	X	Heritage
16	Pacific madrone	15.2			Good	Good	Good			Heritage
17	Pacific madrone	10.1			Poor	Fair	Fair	Top dead	X	Heritage
18	California bay	10.2	8.8	6.5	Good	Good	Good		X	
19	California bay	10.1	9.1	8	Good	Fair to good	Good			
20	Valley oak	13.3			Good	Good	Good		X	Heritage
21	Valley oak	17.4			Good	Fair	Good	Large decay cavity in trunk		Heritage
22	Valley oak	10			Good	Good	Good			Heritage
23	Coast live oak	6.9			Good	Good	Poor	Strong bow in trunk		
24	California bay	11.5			Good	Good	Good			
25	California bay	11.7	7.5		Good	Good	Good			
26	California bay	15	11.9	13	Good	Fair to good	Good			
27	Valley oak	13.3			Good	Good	Fair to good	Not on survey		Heritage
100	California Bay	17	17		Good	Poor to Fair	Fair to Good	Decayed stump between two spars. Targets power lines and road	X	Heritage
101	California Bay	16.5			Good	Good	Fair to Good		X	Heritage
102	California Bay	36			Good	Fair to Good	Fair to Good	One stem was previously topped. Partially failed branch high in canopy.	X	Heritage
103	Valley oak	27			Fair	Fair	Fair to Good	Large diameter deadwood in canopy but base is sound.	X	Heritage
104	California Bay	12	12	10	Good	Good	Fair to Good	Six stems. Leans away from adjacent Valley Oak	X	
105	California Bay	13	12	9	Good	Good	Fair to Good	Six stems. Leans away from adjacent Valley Oak.	X	
106	California Bay	8	7.5		Fair to Good	Fair to Good	Fair to Good	Leans towards road.	X	
107	Deodar Cedar	12			Good	Good	Excellent			
108	Valley oak	20			Good	Good	Fair to Good	On neighboring property. Not tagged.		Heritage
109	California Bay	11.5	6	5	Good	Good	Good			
110	Coast live oak	14			Good	Good	Fair to Good	Canopy balance over road	X	Heritage
111	Coast live oak	24			Poor to Fair	Fair	Fair to Good	Appears to have an early phytophthora infection. Large old decaying wound on base. Leans over adjacent home		Heritage
112	California Bay	7			Good	Good	Good		X	
113	California Bay	7			Poor	Poor to Fair	Fair	Nearly girdled by rope that has been tied around the base for many years. Nearly dead.	X	
114	California Bay	10			Good	Fair to Good	Fair to Good	Top previously broke out of tree.		
115	Black Oak	13			Fair	Fair	Fair	Top previously broke out of tree. Two necrotic areas on base.	X	Heritage
116	California Bay	16			Good	Good	Good			Heritage
117	California Bay	7			Good	Fair to Good	Fair to Good	Top previously broke out at 15 feet above grade. Canopy now consists of sprouts	X	
118	California Bay	9	8		Good	Fair to Good	Fair to Good	Top previously broke out of both stems.	X	
119	California Bay	7			Good	Good	Fair to Good	Leans over adjacent property		
120	Black Oak	26			Fair to Good	Fair	Fair	Advanced decay in trunk at 6 feet associated with two large old wounds. Top previously broke out of tree at 30 feet.	X	Heritage
121	California Bay	8	7	6	Good	Good	Fair to Good		X	
122	California Bay	4.5			Good	Fair	Good	Several codominant sprouts arise from old topping cut at 6 feet.		
123	California Bay	27			Good	Poor to Fair	Fair	Large tree leaning over driveway. Last remaining stem from cluster of sprout growth from a decaying stump. Failure within the next few years is probable	X	Heritage
124	California Bay	9			Good	Fair to Good	Fair	Strong bow and stem away from adjacent large bay. Trunk is rubbing against another adjacent bay		
125	California Bay	6.5			Good	Good	Fair	Suppressed and leaning away from road.		
126	California Bay	8.5			Good	Good	Fair	Leaning over road		
127	California Bay	8.5	8	7.5	Good	Good	Fair to Good	Three stems lean over road		
128	California Bay	5.5			Fair	Fair to Good	Poor to Fair	Sparse. Leaning over road		
129	California Bay	9.5			Good	Good	Fair to Good	Adjacent tree is rubbing on trunk.		
130	California Bay	12			Good	Fair	Fair	Top previously broke out of tree. Extensive decay associated with long wound on top side of stem. Leans over road.		
131	California Bay	10.5			Good	Fair to Good	Fair to Good			
132	California Bay	8.5			Fair	Poor to Fair	Fair to Good	Aerollaria in base. Leaniey over road.	X	
133	California Bay	15.5			Good	Good	Fair	Wound on road side of base.		
134	California Bay	7			Good	Good	Good			
135	Blackwood Acacia	14	12	12	Good	Fair to Good	Fair	On opposite side of wire fence		
136	Coast live oak	8			Fair to Good	Good	Fair	Scraggly. Top broke out at 20 feet	X	Heritage
138	California Bay	15			Good	Fair to Good	Fair to Good	Tree engulfed wire fencing		
139	California Bay	11	11		Good	Good	Good			
140	California Bay	10.5			Fair to Good	Good	Fair to Good		X	
141	California Bay	7.5			Fair	Good	Fair to Good	Sparse. Nearly girdled at base.		
146	California Bay	7.5			Good	Good	Fair			
147	California Bay	7.5			Good	Good	Good			
148	California Bay	8.5			Fair to Good	Good	Fair	Canopy is in conflict with adjacent black oak	X	
149	Pacific Madrone	22			Poor to Fair	Poor to Fair	Poor to Fair	Nearly dead with extensive decay in base	X	Heritage
151	Pacific Madrone	6.5			Fair	Good	Poor to Fair		X	
152	Black Oak	11			Good	Fair	Fair	Decay cavities in trunk. Broken top. Suppressed.	X	Heritage
153	Pacific Madrone	7			Poor to Fair	Poor to Fair	Fair	Extensive decay in main trunk. Appears to be nearly dead.	X	
154	Pacific Madrone	6.5			Good	Good	Fair		X	
155	Black Oak	16			Good	Fair	Fair	Decay in trunk at two old failure points	X	Heritage
156	Black Oak	14			Good	Good	Fair to Good		X	Heritage
157	Black Oak	14.5			Fair to Good	Poor to Fair	Good	Nearly half girdled at base from old wound likely from original road cut. Wound is partially buried and decaying.	X	Heritage
158	Black Oak	11.5			Good	Fair	Fair	Twist in trunk creates structural weak point. Leans over road.	X	Heritage
159	Black Oak	12	4.5		Good	Good	Fair to Good		X	Heritage
160	Black Oak	22			Good	Good	Good		X	Heritage
161	California Bay	8			Good	Good	Good		X	
162	California Bay	5.5			Good	Good	Good		X	
163	Pacific Madrone	16.5	10		Good	Poor to Fair	Fair to Good	Extensive decay in base. Leaning over road	X	Heritage
164	California Bay	8.5			Good	Good	Good		X	
165	Valley oak	13			Good	Good	Fair to Good		X	Heritage
166	Pacific Madrone	7			Fair	Good	Good		X	
167	Black Oak	15.5			Good	Good	Fair to Good		X	Heritage
168	Pacific Madrone	9			Good	Good	Good		X	Heritage
169	Pacific Madrone	7.5			Good	Good	Good		X	
170	Pacific Madrone	7			Fair to Good	Good	Fair to Good		X	
171	Pacific Madrone	12.5			Good	Good	Good	Large old canker on trunk from grade to 6 feet	X	Heritage
172	Pacific Madrone	4.5			Fair to Good	Good	Fair	Leaning downhill and suppressed	X	
173	California Bay	5.5			Good	Good	Good		X	
174	Pacific Madrone	6			Good	Good	Good		X	
175	Pacific Madrone	7.5			Fair	Good	Fair	Snaking downhill through the canopy. Suppressed.	X	
176	Black Oak	9			Good	Good	Fair	Strong lean downhill	X	Heritage
177	California Bay	4.5			Good	Good	Good		X	
178	California Bay	6.5			Good	Good	Fair to Good	Downhill lean	X	
179	Pacific Madrone	7			Fair to Good	Good	Fair to Good		X	
180	California Bay	7			Good	Good	Fair		X	
181	Pacific Madrone	17	14		Poor to Fair	Poor to Fair	Fair	One of three codominant stems is dead. Extensive decay in base.	X	Heritage
182	Black Oak	10.5			Fair to Good	Fair to Good	Poor to Fair	Strong lean downhill.	X	Heritage
183	California Bay	18.5			Good	Fair to Good	Good	Decay cavity in trunk at 5 feet	X	Heritage
184	California Bay	10			Good	Good	Excellent		X	
185	Pacific Madrone	8			Fair to Good	Fair to Good	Fair	Second stem previously died and was removed. Long necrotic strip on trunk of remaining stem	X	Heritage
186	Coast live oak	12			Good	Good	Fair to Good	Leans uphill	X	Heritage
187	Valley oak	19.5			Good	Good	Good			Heritage
188	Valley oak	13			Good	Good	Good			Heritage
189	Toyon	5			Good	Good	Fair		X	
190	Valley oak	7			Good	Good	Good			
191	Valley oak	11			Good	Good	Good			Heritage
192	California Bay	7.5			Good	Good	Fair to Good		X	
193	Pacific Madrone	5.5			Good	Good	Fair		X	
194	California Bay	7.2			Good	Good	Fair to Good	Downhill lean	X	
195	California Bay	5.7			Good	Good	Fair to Good		X	
196	Black oak	12.1			Good	Fair to Good	Fair	Strong lean over road	X	Heritage
197	California Bay	6.6			Good	Good	Fair		X	
198	Black oak	18.2			Good	Good	Fair to Good		X	Heritage
199	Black oak	10.4			Good	Good	Fair to Good	Canopy full of poison oak	X	Heritage
200	Black oak	12.9			Poor	Good	Good	Infested with bark beetles	X	Heritage
201	Valley oak	11.3			Fair	Good	Good			Heritage
202	California Bay	8.7,	7.1,	5.5	Good	Fair to Good	Fair to Good			
203	Valley oak	12.3			Fair to Good	Good	Good			Heritage
204	Valley oak	13			Good	Good	Good			Heritage
205	California Bay	12,	9.7		Good	Good	Good			
206	California Bay	9.1,	7.2		Good	Good	Good			
210	California Bay	6.8			Good	Good	Fair			
211	California Bay	6.8			Fair	Fair	Fair			
212	California Bay	5.5			Good	Good	Fair to Good		X	
213	Black Oak	12			Fair	Poor to Fair	Fair to Good	One of two codominant stems died, and was removed, leaving a large rotting wound	X	Heritage
214	California Bay	9			Good	Fair to Good	Poor to Fair	Second stem previously removed.	X	
215	California Bay	10.5			Fair to Good	Good	Fair			
216	California Bay	18	12	5.5	Good	Good	Fair to Good			
217	Pacific Madrone	8.5	7		Fair	Fair to Good	Fair		X	Heritage
218	California Bay	7.5	6.5	6	Good	Fair	Fair to Good	6 stems.	X	
219	California Bay	6			Fair	Fair to Good	Fair		X	
220	Pacific Madrone	12			Fair	Fair	Fair	Strong downhill lean. Decay in base.	X	Heritage
221	Pacific Madrone	12.5			Poor to Fair	Good	Fair	Leans uphill.	X	Heritage
222	California Bay	8	7		Poor to Fair	Fair to Good	Poor to Fair		X	
223	California Bay	9	5		Fair	Good	Fair to Good	Smaller stem is nearly dead.	X	
224	California Bay	5.5			Good	Good	Fair to Good		X	
225	California Bay	4.5			Poor to Fair	Fair to Good	Poor to Fair	Heavily suppressed	X	
226	California Bay	9			Good	Good	Fair to Good		X	
227	Pacific Madrone	7			Fair to Good	Fair to Good	Fair		X	
228	California Bay	8			Good	Good	Fair to Good		X	
229	California Bay	8			Good	Good	Fair		X	
230	California Bay	6			Fair	Good	Fair		X	
231	California Bay	5			Fair to Good	Good	Poor to Fair		X	
232	California Bay	7			Fair to Good	Good	Fair		X	
233	California Bay	6.5			Fair	Good	Fair		X	
234	Pacific Madrone	4			Fair to Good	Good	Fair		X	
235	Pacific Madrone	14			Poor to Fair	Fair to Good	Fair to Good	Downhill lean. Old wound on base.	X	Heritage
236	California Bay	4.5			Fair to Good	Fair to Good	Poor to Fair		X	
237	California Bay	6.5	5.5		Fair to Good	Good	Fair			
238	Black Oak	23			Good	Good	Fair to Good	Slight downhill lean		Heritage
239	California Bay	7.5			Good	Good	Good		X	
240	California Bay	8.5			Good	Good	Fair to Good		X	
241	California Bay	9			Fair to Good	Good	Fair		X	
242	Pacific Madrone	12			Fair to Good	Fair to Good	Fair	Downhill lean and bow	X	Heritage
243	California Bay	8.5	7		Good	Fair to Good	Fair to Good			
244	Pacific Madrone	9.5			Fair	Fair to Good	Fair		X	Heritage
245	California Bay	8			Good	Good	Good		X	
246	California Bay	4			Fair to Good	Fair	Poor to Fair		X	
247	California Bay	6.5			Good	Fair to Good	Fair		X	
248	California Bay	5			Good	Fair	Fair		X	
249	California Bay	6			Fair to Good	Fair	Fair	Main leader previously broke out of tree	X	
250	California Bay	5.5			Fair to Good	Poor to Fair	Fair to Good	Top previously broke out of tree	X	
251	California Bay	5			Good	Good	Good		X	
252	Pacific Madrone	5.5			Poor to Fair	Fair	Poor to Fair		X	
253	Pacific Madrone	9.5			Fair to Good	Fair to Good	Fair	Downhill lean	X	Heritage
254	Black Oak	15			Fair	Fair	Fair to Good	Large necrotic area on lower trunk with decay moving into structural wood	X	Heritage
255	Black Oak	14	8.5		Good	Good	Good	Large poison oak vine climbing into tree		Heritage
256	Pacific Madrone	8.5			Good	Good	Fair to Good		X	Heritage
257	California Bay	5			Fair to Good	Good	Fair		X	
258	California Bay	8.5	7.5		Fair	Good	Fair	Large chunk of the canopy is entirely dead	X	
259	Black Oak	8	7.5		Fair	Fair to Good	Fair	Necrotic area on base. 9" dbh bay within 1' of tree.	X	Heritage
260	California Bay	7.5			Fair to Good	Good	Fair to Good		X	
261	California Bay	11.5	8.5		Good	Good	Fair to Good	Smaller stem, broke off at 15 feet	X	
262	Black Oak	7.5			Good	Good	Fair		X	
263	California Bay	12	6.5	6	Fair	Good	Fair to Good		X	
264	Pacific Madrone	15			Fair	Good	Fair to Good	Second stem previously died, and was removed	X	Heritage
265	Black Oak	12			Good	Good	Good	Maybe outside development impact, but is not shown on survey	X	Heritage
266	California Bay	8			Good	Good	Good		X	
267	California Bay	13.5			Good	Good	Fair to Good		X	
268	Pacific Madrone	7.5			Fair to Good	Fair to Good	Fair		X	

Summary Table

	Healthy and suitable	Poor to Fair Health or Structure	Total
Tree Removals Over 4" dbh, Non-Heritage	68	7	75
Heritage Removals	39	13	52
Total	107	20	127

REVISIONS	BY

209 SAN ANSELMO AVE
SAN ANSELMO, CA
415 454 4212

TREE PROTECTION MANAGEMENT PLAN

NEW RESIDENCE
QUIRIE FAMILY
1 BARKER AVENUE
FAIRFAX, CALIFORNIA
A.P. #002-071-01

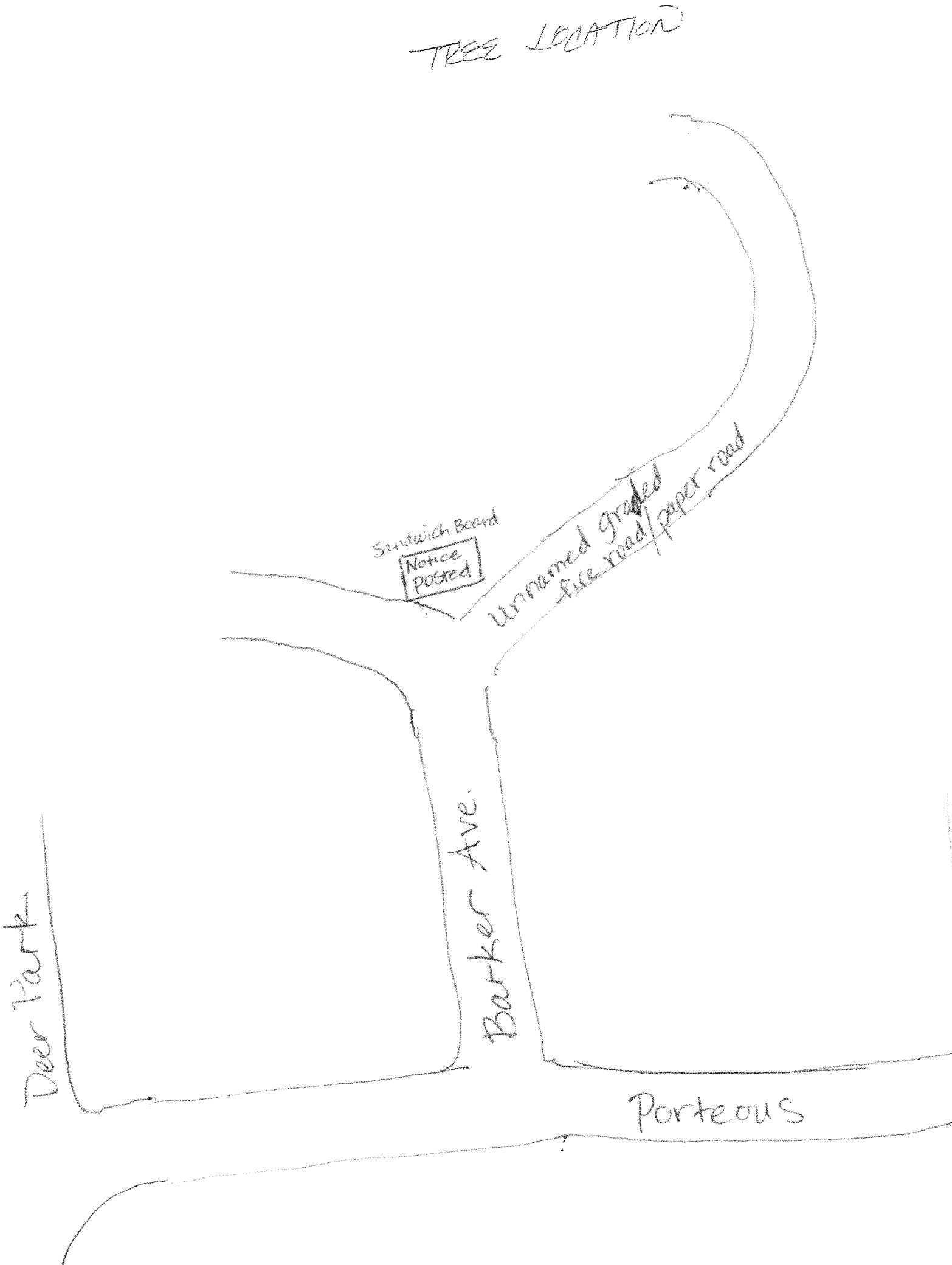
DATE December 22, 20
SCALE N/A
BY QUIRIE

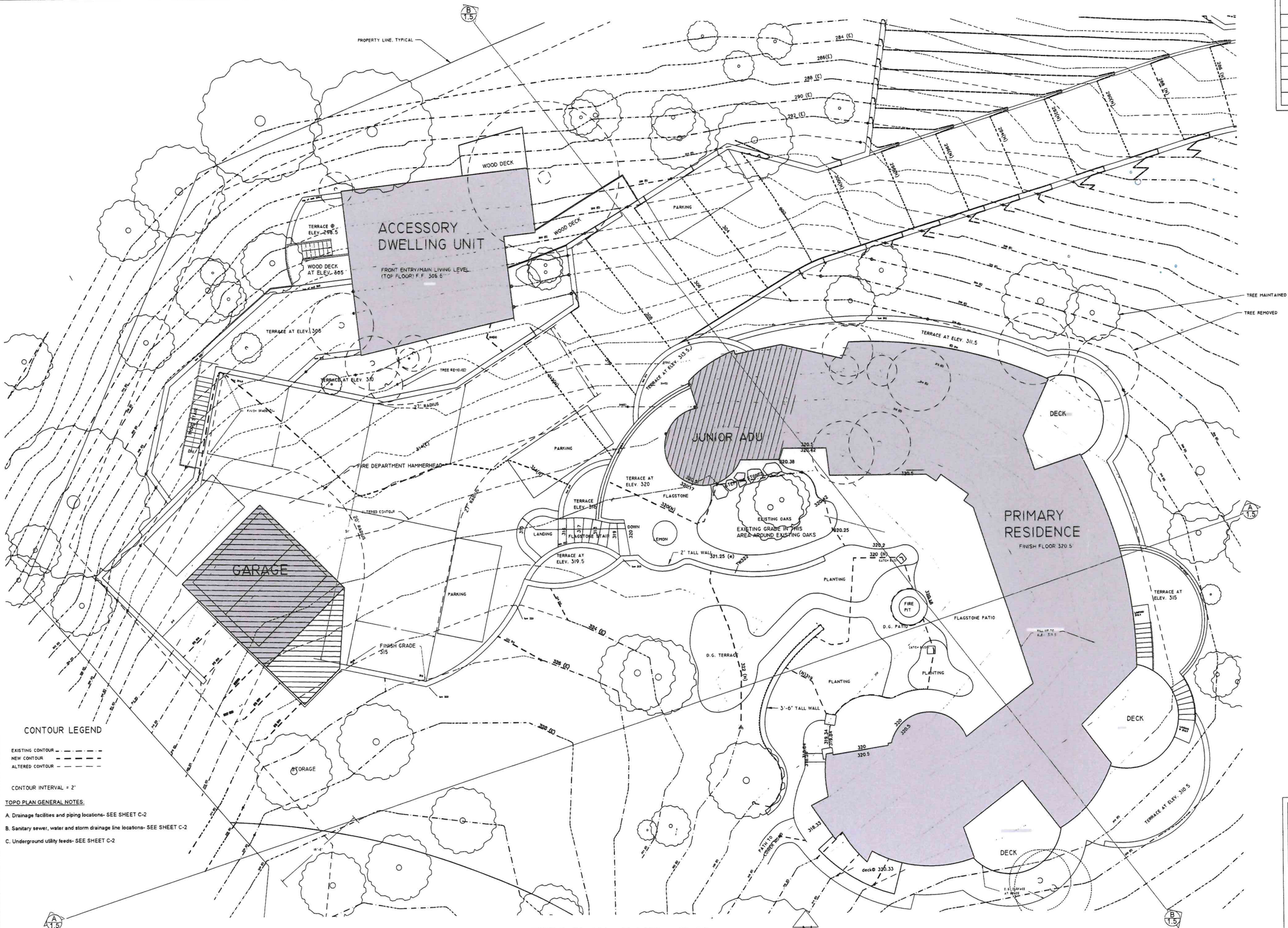
T - 1.1

Summary Table

	Healthy and stable	Poor to Fair health or structure	Total
Tree Removals Over 4" dbh, Non-Heritage	68	7	75
Heritage Removals	39	13	52
Total	107	20	127

X= 109 CT


TREE LOCATION
Sandwich Board
Notice Posted
Unnamed graded fire road/paper road
Barker Ave.
Deer Park
Porteous



CONTOUR LEGEND

EXISTING CONTOUR
NEW CONTOUR
ALTERED CONTOUR

CONTOUR INTERVAL = 2'

TOPO PLAN GENERAL NOTES:

A. Drainage facilities and piping locations- SEE SHEET C-2

B. Sanitary sewer, water and storm drainage line locations- SEE SHEET C-2

C. Underground utility feeds- SEE SHEET C-2

TOPO PLAN @ 1/8" = 1'-0"

REVISIONS	BY

MILLAR ARCHITECTURE
46 SANTA BARBARA AVE.
SAN ANSELMO, CA. 94960
TEL 415-250-9091
millargary07@gmail.com

BUILDING SITE TOPOGRAPHY

NEW RESIDENCE
QUIRIE FAMILY
1 BARKER AVENUE
FAIRFAX, CALIFORNIA
A.P. #002-071-01

DATE 12/30/2022
SCALE AS NOTED
DRAWN GRM
JOB QUIRIE

1.4
OF SHEETS

REVISIONS	BY

INSPECTION SCHEDULE

Inspection of site: Prior to Equipment and Materials Move In, Site Work, Demolition and Tree Removal. The Project Arborist will meet with the General Contractor, Architect / Engineer, and Owner or their representative to review tree preservation measures, designate tree removals, delineate the location of tree protection / non-intrusion zone fencing, specify equipment access routes and materials storage areas, review the existing condition of trees and provide any necessary recommendations.

Inspection of site: After installation of fencing: Inspect site for the adequate installation of tree preservation measures. Review any requests by contractor for access, soil disturbance or excavation areas within root zones of protected trees. Assess any changes in the health of trees since last inspection.

Inspection of site: During excavation or any activities that could affect trees: Inspect site during any activity within the Non-Intrusion Zones of preserved trees and any recommendations implemented. Assess any changes in the health of trees since last inspection.

Final Inspection of Site: Inspection of site following completion of construction. Inspect for tree health and make any necessary recommendations.

Trees not surveyed in this location Trees 256-266

Tree locations not surveyed in this area Trees 217-231, 236

Tree Protection Fencing locations will be established in the field with the arborist and the contractor prior to site work.

ARBORIST'S CHECKLIST

- An urban forester, certified or consulting arborist shall establish the Tree Protection Zone (TPZ) prior to starting the demolition work. Four-foot-high metal wire deer fencing will be erected by the contractor and inspected by the arborist to limit access to the TPZ. This will protect the trunk and root zone throughout construction.
- The Arborist shall have a pre-demolition meeting with contractor or responsible party and all other foremen or crew managers on site prior to any work to review all work procedures, access and haul routes, and tree protection. The contractor must notify the Arborist if roots are exposed or if trunk or branches are wounded.
- Any trunk and root crown that is not protected by a TPZ where heavy equipment operation is likely to wound the trunk. Install a barrel stave-like trunk wrap out of 2 X 4 studs connected together with metal straps, attached to the 2 X 4's with driver screws or ½" nails.
- Storage of equipment shall be as far away from protected trees as possible and optimally on asphalt or ground protected by mulch / plywood.
- Heavy equipment use should be limited around trees and the roots. No equipment may be transported or used on bare ground within the root zone. A 6" layer of mulch (chipped tree debris and other site vegetation or chipped, non-treated lumber) and plywood must be placed under the path for access and egress. The protective "bridge" shall be maintained by the contractor and inspected by the arborist when on site.
- Any damage to trees due to demolition or construction activities shall be reported to the arborist within 6 hours, so that remedial action can be taken. Any damage done to the trees in violation of the contract agreement shall be appraised as a casualty loss by the arborist and provided to the tree owner.
- All trenching within the TPZ shall be done pneumatically or by hand, being careful not to damage any of the bark of any root encountered.
- An arborist shall inspect all grading, trenching, tunneling or other excavation within the root zones of trees prior to backfill.
- No chemicals or other waste materials shall be dumped within 20' of the base of any tree. There shall be no material storage in the TPZ.
- Any tree pruning will be done in accordance with ISA standards. All pruning will be inspected by the arborist.
- The arborist must perform a final inspection to ensure that no unmitigated damage has occurred and to specify any pest, disease or other health care. The arborist shall specify and oversee any necessary restorative actions.
- Any suspected omissions or conflict between various elements of the plan shall be brought to the attention of the arborist and resolved before proceeding with the work.

209 SAN ANSELMO AVE
SAN ANSELMO, CA
415-454-4212
URBAN FORESTRY ASSOCIATES, INC.

TREE PROTECTION MANAGEMENT PLAN

NEW RESIDENCE
QUIRIE FAMILY
1 BARKER AVENUE
FAIRFAX, CALIFORNIA
A.P. #002-071-01

ISSUE: DEC 22, 2022
SCALE: AS NOTED
JOB: QUIRIE

scale 1" = 20' (20 0 20 40 feet)

T - 1.0
SHEETS

Tree Number	Species	Trunk Diameter (inches)			Health	Structure	Form	Comments	Removal	Heritage
1	Valley oak	17.8			Good	Fair	Poor to fair	South canopy distribution		Heritage
2	Coast live oak	11.2	10.2		Good	Good	Fair to good			Heritage
3	Valley oak	14.9			Good	Good	Fair	Southwest canopy distribution		Heritage
4	Valley oak	12.8			Good	Good	Fair			Heritage
5	Black oak	14.3			Good	Good	Good		X	Heritage
6	Black oak	9.5			Good	Good	Fair		X	Heritage
7	Black oak	7			Good	Fair	Poor to fair	Decay cavity in base	X	
8	Black oak	12.5			Poor to fair	Fair	Fair		X	Heritage
9	Black oak	6.7	5.7		Good	Good	Fair to good		X	
10	Black oak	15.2			Good	Good	Good		X	Heritage
11	Black oak	16			Poor	Poor	Poor to fair	Nearly dead		Heritage
12	Pacific madrone	17.2			Fair	Poor to fair	Fair to good			Heritage
13	California bay	6.7	5		Good	Good	Good			
14	Black oak	14.6	14.2		Fair	Poor	Good	Large necrotic area on base		Heritage
15	Coast live oak	13	7		Poor	Poor	Fair	Large necrotic area on base with hypoxylon and strong lean.	X	Heritage
16	Pacific madrone	15.2			Good	Good	Good			Heritage
17	Pacific madrone	10.1			Poor	Fair	Fair	Top dead	X	Heritage
18	California bay	10.2	8.8	6.5	Good	Good	Good		X	
19	California bay	10.1	9.1	8	Good	Fair to good	Good			
20	Valley oak	13.3			Good	Good	Good		X	Heritage
23	Valley oak	17.4			Good	Fair	Good	Large decay cavity in trunk		Heritage
24	Valley oak	10			Good	Good	Good			Heritage
25	Coast live oak	6.9			Good	Good	Poor	Strong bow in trunk		
26	California bay	11.5			Good	Good	Good			
27	California bay	11.7	7.5		Good	Good	Good			
28	California bay	15	13.9	13	Good	Fair to good	Good			
29	Valley oak	13.3			Good	Good	Fair to good	Not on survey		Heritage
100	California Bay	17	17		Good	Poor to Fair	Fair to Good	Decayed stump between two spars. Targets power lines and road	X	Heritage
101	California Bay	18.5			Good	Good	Fair to Good		X	Heritage
102	California Bay	36			Good	Fair to Good	Fair to Good	One stem was previously topped. Partially failed branch high in canopy.	X	Heritage
103	Valley oak	27			Fair	Fair	Fair to Good	Large diameter deadwood in canopy but base is sound.	X	Heritage
104	California Bay	12	12	10	Good	Good	Fair to Good	Six stems. Leans away from adjacent Valley Oak	X	
105	California Bay	13	12	9	Good	Good	Fair to Good	Six stems. Leans away from adjacent Valley Oak.	X	
106	California Bay	8	7.5		Fair to Good	Fair to Good	Fair to Good	Leans towards road.	X	
107	Deodar Cedar	12			Good	Good	Excellent			
108	Valley oak	20			Good	Good	Fair to Good	On neighboring property. Not tagged.		Heritage
109	California Bay	11.5	6	5	Good	Good	Good			
110	Coast live oak	14			Good	Good	Fair to Good	Canopy balance over road	X	Heritage
111	Coast live oak	24			Poor to Fair	Fair	Fair to Good	Appears to have an early phytophthora infection. Large old decaying wound on base. Leans over adjacent home		Heritage
112	California Bay	7			Good	Good	Good		X	
113	California Bay	7			Poor	Poor to Fair	Fair	Nearly girdled by rope that has been tied around the base for many years. Nearly dead.	X	
114	California Bay	10			Good	Fair to Good	Fair to Good	Top previously broke out of tree.		
115	Black Oak	13			Fair	Fair	Fair	Top previously broke out of tree. Two necrotic areas on base.	X	Heritage
116	California Bay	16			Good	Good	Good			Heritage
117	California Bay	7			Good	Fair to Good	Fair to Good	Top previously broke out at 15 feet above grade. Canopy now consists of sprouts.	X	
118	California Bay	9	8		Good	Fair to Good	Fair to Good	Top previously broke out of both stems.	X	
119	California Bay	7			Good	Good	Fair to Good	Leans over adjacent property		
120	Black Oak	26			Fair to Good	Fair	Fair	Advanced decay in trunk at 6 feet associated with two large old wounds. Top previously broke out of tree at 30 feet.	X	Heritage
121	California Bay	8	7	6	Good	Good	Fair to Good		X	

Tree Number	Species	Trunk Diameter (inches)			Health	Structure	Form	Comments	Removal	Heritage
122	California Bay	4.5			Good	Fair	Good	Several codominant sprouts arise from old topping cut at 6 feet.		
123	California Bay	27			Good	Poor to Fair	Fair	Large tree leaning over driveway. Last remaining stem from cluster of sprout growth from a decaying stump. Failure within the next few years is probable.	X	Heritage
124	California Bay	9			Good	Fair to Good	Fair	Strong bow and stem away from adjacent large bay. Trunk is rubbing against another adjacent bay		
125	California Bay	6.5			Good	Good	Fair	Suppressed and leaning away from road.		
126	California Bay	8.5			Good	Good	Fair	Leaning over road		
127	California Bay	8.5	8	7.5	Good	Good	Fair to Good	Three stems lean over road		
128	California Bay	5.5			Fair	Fair to Good	Poor to Fair	Sparse. Leaning over road		
129	California Bay	9.5			Good	Good	Fair to Good	Adjacent tree is rubbing on trunk.		
130	California Bay	12			Good	Fair	Fair	Top previously broke out of tree. Extensive decay associated with long wound on top side of stem. Leans over road.		
131	California Bay	10.5			Good	Fair to Good	Fair to Good			
132	California Bay	8.5			Fair	Poor to Fair	Fair to Good	Armillaria in base. Leaning over road	X	
133	California Bay	15.5			Good	Good	Fair	Wound on road side of base.		
134	California Bay	7			Good	Good	Good			
135	Blackwood Acacia	14	12	12	Good	Fair to Good	Good	On opposite side of wire fence		
136	Coast live oak	8			Fair to Good	Good	Fair	Scraggly. Top broke out at 20 feet	X	Heritage
138	California Bay	15			Good	Fair to Good	Fair to Good	Tree engulfed wire fencing		
139	California Bay	11	11		Good	Good	Good			
140	California Bay	10.5			Fair to Good	Good	Fair to Good		X	
141	California Bay	7.5			Fair	Good	Fair to Good	Sparse. Nearly girdled at base.		
146	California Bay	7.5			Good	Good	Fair			
147	California Bay	7.5			Good	Good	Good			
148	California Bay	8.5			Fair to Good	Good	Fair	Canopy is in conflict with adjacent black oak	X	
149	Pacific Madrone	22			Poor to Fair	Poor to Fair	Poor to Fair	Nearly dead with extensive decay in base	X	Heritage
151	Pacific Madrone	6.5			Fair	Good	Poor to Fair		X	
152	Black Oak	11			Good	Fair	Fair	Decay cavities in trunk. Broken top. Suppressed.	X	Heritage
153	Pacific Madrone	7			Poor to Fair	Poor to Fair	Fair	Extensive decay in main trunk. Appears to be nearly dead.	X	
154	Pacific Madrone	6.5			Good	Good	Fair		X	
155	Black Oak	10			Good	Fair	Fair	Decay in trunk at two old failure points	X	Heritage
156	Black Oak	14			Good	Good	Fair to Good		X	Heritage
157	Black Oak	14.5			Fair to Good	Poor to Fair	Good	Nearly half girdled at base from old wound likely from original road cut. Wound is partially buried and decaying.	X	Heritage
158	Black Oak	11.5			Good	Fair	Fair	Twist in trunk creates structural weak point. Leans over road.	X	Heritage
159	Black Oak	12	4.5		Good	Good	Fair to Good		X	Heritage
160	Black Oak	22			Good	Good	Good		X	Heritage
161	California Bay	8			Good	Good	Good		X	
162	California Bay	5.5			Good	Good	Good		X	
163	Pacific Madrone	16.5	10		Good	Poor to Fair	Fair to Good	Extensive decay in base. Leaning over road	X	Heritage
164	California Bay	8.5			Good	Good	Good		X	
165	Valley oak	13			Good	Good	Fair to Good		X	Heritage
166	Pacific Madrone	7			Fair	Good	Good		X	
167	Black Oak	15.5			Good	Good	Fair to Good		X	Heritage
168	Pacific Madrone	9			Good	Good	Good		X	Heritage
169	Pacific Madrone	7.5			Good	Good	Good		X	
170	Pacific Madrone	7			Fair to Good	Good	Fair to Good		X	
171	Pacific Madrone	12.5			Good	Good	Good	Large old canker on trunk from grade to 6 feet	X	Heritage
172	Pacific Madrone	4.5			Fair to Good	Good	Fair	Leaning downhill and suppressed	X	

Tree Number	Species	Trunk Diameter (inches)			Health	Structure	Form	Comments	Removal	Heritage
173	California Bay	5.5			Good	Good	Good		X	
174	Pacific Madrone	6			Good	Good	Good		X	
175	Pacific Madrone	7.5			Fair	Good	Fair	Snaking downhill through the canopy. Suppressed.	X	
176	Black Oak	8			Good	Good	Fair	Strong lean downhill	X	Heritage
177	California Bay	4.5			Good	Good	Good		X	
178	California Bay	6.5			Good	Good	Fair to Good	Downhill lean	X	
179	Pacific Madrone	7			Fair to Good	Good	Fair to Good		X	
180	California Bay	7			Good	Good	Fair		X	
181	Pacific Madrone	17	14		Poor to Fair	Poor to Fair	Fair	One of three codominant stems is dead. Extensive decay in base.	X	Heritage
182	Black Oak	10.5			Fair to Good	Fair to Good	Poor to Fair	Strong lean downhill.	X	Heritage
183	California Bay	18.5			Good	Fair to Good	Good	Decay cavity in trunk at 6 feet	X	Heritage
184	California Bay	10			Good	Good	Excellent		X	
185	Pacific Madrone	8			Fair to Good	Fair to Good	Fair	Second stem previously died and was removed. Long necrotic strip on trunk of remaining stem	X	Heritage
186	Coast live oak	12			Good	Good	Fair to Good	Leans uphill	X	Heritage
187	Valley oak	15.5			Good	Good	Good			Heritage
188	Valley oak	13			Good	Good	Good			Heritage
189	Toyon	5			Good	Good	Fair		X	
190	Valley oak	7			Good	Good	Good			
191	Valley oak	11			Good	Good	Good			Heritage
192	California Bay	7.5			Good	Good	Fair to Good		X	
193	Pacific Madrone	5.5			Good	Good	Fair		X	
194	California Bay	7.2			Good	Good	Fair to Good	Downhill lean	X	
195	California Bay	5.7			Good	Good	Fair to Good		X	
196	Black oak	12.1			Good	Fair to Good	Fair	Strong lean over road	X	Heritage
197	California Bay	6.6			Good	Good	Fair		X	
198	Black oak	18.2			Good	Good	Fair to Good		X	Heritage
199	Black oak	10.4			Good	Good	Fair to Good	Canopy full of poison oak	X	Heritage
200	Black oak	12.5			Poor	Good	Good	Infested with bark beetles	X	Heritage
201	Valley oak	11.3			Fair	Good	Good			Heritage
202	California Bay	8.2,	7.1,	5.5	Good	Fair to Good	Fair to Good			
203	Valley oak	12.3			Fair to Good	Good	Good			Heritage
204	Valley oak	13			Good	Good	Good			Heritage
205	California Bay	12,	9.7		Good	Good	Good			
206	California Bay	9.1,	7.2		Good	Good	Good			
210	California Bay	6.5			Good	Good	Fair			
211	California Bay	6.8			Fair	Fair	Fair			
212	California Bay	5.5			Good	Good	Fair to Good		X	
213	Black Oak	12			Fair	Poor to Fair	Fair to Good	One of two codominant stems died, and was removed, leaving a large rotting wound	X	Heritage
214	California Bay	9			Good	Fair to Good	Poor to Fair	Second stem previously removed.	X	
215	California Bay	10.5			Fair to Good	Good	Fair			
216	California Bay	13	12	5.5	Good	Good	Fair to Good			
217	Pacific Madrone	8.5	7		Fair	Fair to Good	Fair		X	Heritage
218	California Bay	7.5	6.5	6	Good	Fair	Fair to Good	6 stems.	X	
219	California Bay	8			Fair	Fair to Good	Fair		X	
220	Pacific Madrone	12			Fair	Fair	Fair	Strong downhill lean. Decay in base.	X	Heritage
221	Pacific Madrone	12.5			Poor to Fair	Good	Fair	Leans uphill.	X	Heritage
222	California Bay	8	7		Poor to Fair	Fair to Good	Poor to Fair		X	
223	California Bay	9	5		Fair	Good	Fair to Good	Smaller stem is nearly dead.	X	
224	California Bay	5.5			Good	Good	Fair to Good		X	
225	California Bay	4.5			Poor to Fair	Fair to Good	Poor to Fair	Heavily suppressed	X	
226	California Bay	9			Good	Good	Fair to Good		X	
227	Pacific Madrone	7			Fair to Good	Fair to Good	Fair		X	
228	California Bay	8			Good	Good	Fair to Good		X	
229	California Bay	8			Good	Good	Fair		X	
230	California Bay	6			Fair	Good	Fair		X	
231	California Bay	5			Fair to Good	Good	Poor to Fair		X	
232	California Bay	7			Fair to Good	Good	Fair		X	

Tree Number	Species	Trunk Diameter (inches)			Health	Structure	Form	Comments	Removal	Heritage
233	California Bay	6.5			Fair	Good	Fair		X	
234	Pacific Madrone	4			Fair to Good	Good	Fair		X	
235	Pacific Madrone	14			Poor to Fair	Fair to Good	Fair to Good	Downhill lean. Old wound on base.	X	Heritage
236	California Bay	4.5			Fair to Good	Fair to Good	Poor to Fair		X	
237	California Bay	6.5	5.5		Fair to Good	Good	Fair			
238	Black Oak	23			Good	Good	Fair to Good	Slight downhill lean		Heritage
239	California Bay	7.5			Good	Good	Good		X	
240	California Bay	8.5			Good	Good	Fair to Good		X	
241	California Bay	9			Fair to Good	Good	Fair		X	
242	Pacific Madrone	12			Fair to Good	Fair to Good	Fair	Downhill lean and bow	X	Heritage
243	California Bay	8.5	7		Good	Fair to Good	Fair to Good			
244	Pacific Madrone	9.5			Fair	Fair to Good	Fair		X	Heritage
245	California Bay	8			Good	Good	Good		X	
246	California Bay	4			Fair to Good	Fair	Poor to Fair		X	
247	California Bay	6.5			Good	Fair to Good	Fair		X	
248	California Bay	5			Good	Fair	Fair		X	
249	California Bay	6			Fair to Good	Fair	Fair	Main leader previously broke out of tree	X	
250	California Bay	5.5			Fair to Good	Poor to Fair	Fair to Good	Top previously broke out of tree	X	
251	California Bay	5			Good	Good	Good		X	
252	Pacific Madrone	5.5			Poor to Fair	Fair	Poor to Fair		X	
253	Pacific Madrone	9.5			Fair to Good	Fair to Good	Fair	Downhill lean	X	Heritage
254	Black Oak	15			Fair	Fair	Fair to Good	Large necrotic area on lower trunk with decay moving into structural wood	X	Heritage
255	Black Oak	14	8.5		Good	Good	Good	Large poison oak vine climbing into tree		Heritage
256	Pacific Madrone	8.5			Good	Good	Fair to Good		X	Heritage
257	California Bay	5			Fair to Good	Good	Fair		X	
258	California Bay	8.5	7.5		Fair	Good	Fair	Large chunk of the canopy is entirely dead	X	
259	Black Oak	8	7.5		Fair	Fair to Good	Fair	Necrotic area on base. 9" dbh bay within 1' of tree.	X	Heritage
260	California Bay	7.5			Fair to Good	Good	Fair to Good		X	
261	California Bay	11.5	8.5		Good	Good	Fair to Good	Smaller stem, broke off at 15 feet	X	
262	Black Oak	7.5			Good	Good	Fair		X	
263	California Bay	12	6.5	6	Fair	Good	Fair to Good		X	
264	Pacific Madrone	15			Fair	Good	Fair to Good	Second stem previously died, and was removed	X	Heritage
265	Black Oak	12			Good	Good	Good	Maybe outside development impact, but is not shown on survey	X	Heritage
266	California Bay	8			Good	Good	Good		X	
267	California Bay	13.5			Good	Good	Fair to Good			
268	Pacific Madrone	7.5			Fair to Good	Fair to Good	Fair		X	

Summary Table

	Healthy and stable	Poor to Fair health or structure	Total
Tree Removals Over 4" dbh, Non-Heritage	68	7	75
Heritage Removals	39	13	52
Total	107	20	127

REVISIONS	BY

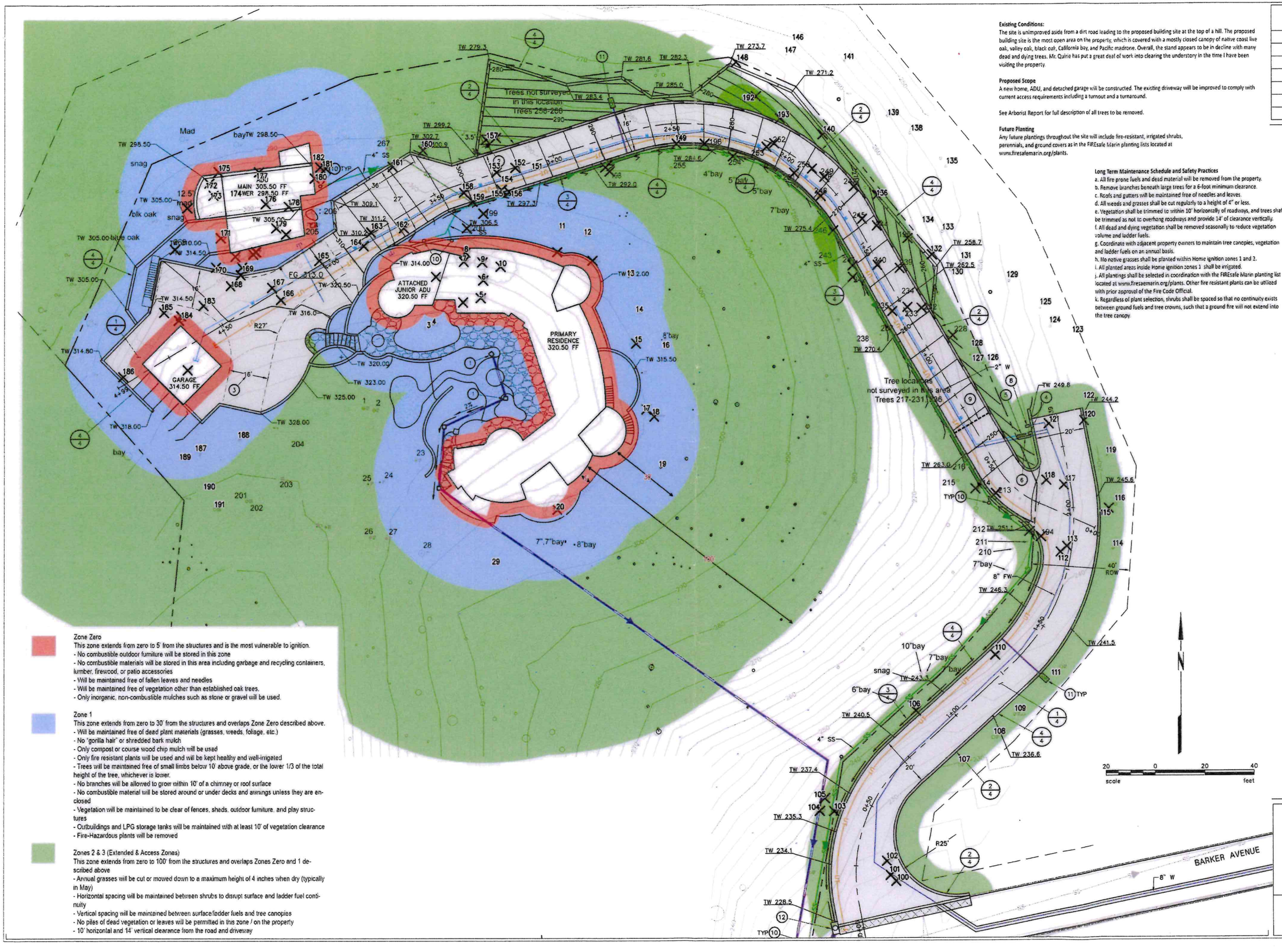
209 SAN ANSELMO AVE
SAN ANSELMO, CA
415-454-4212

TREE PROTECTION MANAGEMENT PLAN

NEW RESIDENCE
QUIRIE FAMILY
1 BARKER AVENUE
FAIRFAX, CALIFORNIA
A.P. #002-071-01

DATE December 22, 2022
SCALE N/A
JOB QUIRIE

T - 1.1



Existing Conditions:
The site is unimproved aside from a dirt road leading to the proposed building site at the top of a hill. The proposed building site is the most open area on the property, which is covered with a mostly closed canopy of native coast live oak, valley oak, black oak, California bay, and Pacific madrone. Overall, the stand appears to be in decline with many dead and dying trees. Mr. Quirie has put a great deal of work into clearing the understory in the time I have been visiting the property.

Proposed Scope
A new home, ADU, and detached garage will be constructed. The existing driveway will be improved to comply with current access requirements including a turnout and a turnaround.

See Arborist Report for full description of all trees to be removed.

Future Planting
Any future plantings throughout the site will include fire-resistant, irrigated shrubs, perennials, and ground covers as in the FIREsafe Marin planting lists located at www.firesafemarin.org/plants.

Long Term Maintenance Schedule and Safety Practices
a. All fire prone fuels and dead material will be removed from the property.
b. Remove branches beneath large trees for a 6-foot minimum clearance.
c. Roofs and gutters will be maintained free of needles and leaves.
d. All weeds and grasses shall be cut regularly to a height of 4" or less.
e. Vegetation shall be trimmed to within 10' horizontally of roadways, and trees shall be trimmed as not to overhang roadways and provide 14' of clearance vertically.
f. All dead and dying vegetation shall be removed seasonally to reduce vegetation volume and ladder fuels.
g. Coordinate with adjacent property owners to maintain tree canopies, vegetation and ladder fuels on an annual basis.
h. No native grasses shall be planted within Home ignition zones 1 and 2.
i. All planted areas inside Home ignition zones 1 shall be irrigated.
j. All plantings shall be selected in coordination with the FIREsafe Marin planting list located at www.firesafemarin.org/plants. Other fire resistant plants can be utilized with prior approval of the Fire Code Official.
k. Regardless of plant selection, shrubs shall be spaced so that no continuity exists between ground fuels and tree crowns, such that a ground fire will not extend into the tree canopy.

Zone Zero
This zone extends from zero to 5' from the structures and is the most vulnerable to ignition.
- No combustible outdoor furniture will be stored in this zone
- No combustible materials will be stored in this area including garbage and recycling containers, lumber, firewood, or patio accessories
- Will be maintained free of fallen leaves and needles
- Will be maintained free of vegetation other than established oak trees.
- Only inorganic, non-combustible mulches such as stone or gravel will be used.

Zone 1
This zone extends from zero to 30' from the structures and overlaps Zone Zero described above.
- Will be maintained free of dead plant materials (grasses, weeds, foliage, etc.)
- No "gorilla hair" or shredded bark mulch
- Only compost or course wood chip mulch will be used
- Only fire resistant plants will be used and will be kept healthy and well-irrigated
- Trees will be maintained free of small limbs below 10' above grade, or the lower 1/3 of the total height of the tree, whichever is lower.
- No branches will be allowed to grow within 10' of a chimney or roof surface
- No combustible material will be stored around or under decks and awnings unless they are enclosed
- Vegetation will be maintained to be clear of fences, sheds, outdoor furniture, and play structures
- Outbuildings and LPG storage tanks will be maintained with at least 10' of vegetation clearance
- Fire-Hazardous plants will be removed

Zones 2 & 3 (Extended & Access Zones)
This zone extends from zero to 100' from the structures and overlaps Zones Zero and 1 described above
- Annual grasses will be cut or mowed down to a maximum height of 4 inches when dry (typically in May)
- Horizontal spacing will be maintained between shrubs to disrupt surface and ladder fuel continuity
- Vertical spacing will be maintained between surface/ladder fuels and tree canopies
- No piles of dead vegetation or leaves will be permitted in this zone / on the property
- 10' horizontal and 14' vertical clearance from the road and driveway

REVISIONS	BY

209 SAN ANSELMO AVE
SAN ANSELMO, CA
415 454 4212
URBAN FORESTRY ASSOCIATES, INC.

VEGETATION MANAGEMENT PLAN

NEW RESIDENCE
QUIRIE FAMILY
1 BARKER AVENUE
FAIRFAX, CALIFORNIA
A.P. #002-071-01

DATE DEC 27, 2022
SCALE AS NOTED
JOB QUIRIE

V - 1.0

Linda Neal

From: David Gartin <vikingsandblastingllc@gmail.com>
Sent: Tuesday, September 12, 2023 3:25 PM
To: Linda Neal
Subject: Planning Commission Meeting 12 Barker Ave

Dear Linda Neal,

I have resided at 15 Barker for 61 years my wife and I am very much in favor of Matt Quirie and his family building their forever home on the hill above us.
Before Mr. Quirie purchased the property we were very concerned with the state of the land it was an extreme fire hazard with downed rotted trees and scotch broom it was really overgrown.
Mr Quirie has improved the property so much he has really cleaned up the hill and most likely saved us and many of our neighbors on Barker and Wood Lane from possible fire.
He has always been very considerate and respectful and has a lovely family.
Our neighborhood wood only improve with the Quirie's building here.

Thank you,
David Gartin
15 Barker Ave
Fairfax, Ca 94930
415-302-8325

ATTACHMENT H

Linda Neal

From: Camp Liz <campliz@comcast.net>
Sent: Tuesday, September 12, 2023 2:38 PM
To: Linda Neal
Subject: Quirie's on Barker

Hello
My name is Liz Campana and I have been a longtime resident on Porteous Avenue. I am aware Matt and Mireya are interested in building a property on the hill on Barker.
I am writing to say I encourage you to allow them to go forward with their project. They are two of the most generous, conscientious and friendly people I have ever met. I know they respect the land, flora and fauna and will make good decisions and improve the neighborhood by moving in. Please allow us to welcome them to our neighborhood. Many thanks.
Liz Campana
83 Porteous Avenue

Sent from my iPhone

Linda Neal

From: Scott Hurd <hurdscott@comcast.net>
Sent: Tuesday, September 12, 2023 1:40 PM
To: Linda Neal
Subject: 12 Barker Ave.

Follow Up Flag: Follow up
Flag Status: Flagged

Hello Linda, I just wanted share my experience with Matt and Mireya and their property on the hill above my house. They have been an amazing part of the Fairfax community for as long as I have known them. What i have seen, first hand, up there has been nothing short of incredible. They have taken the care and time and money to reduce the fuels on the property to make this neighborhood much more safe in case of a fire. They have already proven to be great stewards of this property as neighbors and in this unique situation of bordering residents and open space. What they have done in three years of hand pulling scotch broom, clearing dead fuels and processing most everything on site has been mind boggling to be honest. Their openness to getting to know, and work with, as many neighbors as possible has been great and has made this a win win all of the way around. I, and my neighbors, all look forward to being neighbors with them and the kids as soon as possible.

sincerely,
Scott Hurd,
77 Porteous

Linda Neal

From: jeremy mondot <jeremymondot@gmail.com>
Sent: Wednesday, September 13, 2023 2:22 PM
To: Linda Neal
Subject: 12 Barker project

Follow Up Flag: Flag for follow up
Flag Status: Flagged

Linda,

I am writing you on behalf of Matt Quirie and his project planned for 12 Barker (I believe it is 12 but not sure). I simply want to share that my wife and I at 104 PORTEOUS, a lot just below the proposed project, are in favor of it moving forward. When we first purchased our property, we were unaware that there was an undeveloped lot at out back fence. When it went up for sale we were upset that we would be losing out "back fence to the watershed," but it was our error in assuming it was public land. We were quite disappointed.
Shortly after Matt purchased the property we met him walking down the street and we have become friends since then. What started as an apparent loss to the neighborhood has turned into quite the addition. Matt hit the ground running and began doing simple property maintenance on the property cleared dead and down vegetation and addressing drainage issue from years of being wild. As he has been developing his plan for his future family home, he has been taking into account the concerns of his neighbors as well. We truly appreciate the local Fairfax atmosphere that Matt has brought to this project and we can't think of any better way that he could have gone about adding another home to the valley.
Please pass along our support to for his project to whom ever it will concern.

Thank you.

Jeremy and Lauren Mondot
104 PORTEOUS Ave