SUMMIT ENGINEERING

- House and Vacant Lot Inspection
- Soils Reports
- Surveying, Parcel Maps, Subdivisions
- Storm Drain Design
- Hazardous Waste Studies

5855 Castle Drive
Oakland, CA 94611
Tel: (510) 531-6655
Fax:(510) 482-5848

Dan Tealdi
TEALDI DEVELOPMENT GROUP, LLC
320 Washington Street, Suite 104
Daly City, California 94015

June 2, 2014

RE: **Geotechnical Report for the Proposed Two Single Family Homes, De Anza Boulevard, San Mateo, California.**

Dear Mr. Tealdi :

The vacant land substantially remains unchanged with respect to the condition when the original Soils Report (Ref. 1) was prepared. Therefore, all recommendations in the original report remain valid to this day. The requirement for 2013 California Building Code are also complied with.

Please feel free to contact us at anytime in the future if there are questions about this report, or we may be of further service.

Sincerely,

AGM
Al G. Masso
GE-2089

PROFESSIONAL ENGINEER
ALBERTO G. MASSO
No. GE-2089
Exp. 3/31/16
GEOTECHNICAL
STATE OF CALIFORNIA

References

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SUMMIT ENGINE RING

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Dan Tealdi
TEALDI DEVELOPMENT GROUP, LLC
320 Washington Street, Suite 104
Daly City, California 94015

November 25th, 2010

RE: **Geotechnical Report for the Proposed Two Single Family Homes, De Anza Boulevard, San Mateo, California.**

Dear Mr. Tealdi :

The attached geotechnical report is based on a detailed engineering study by the undersigned of the above property, where two single family homes are planned in the future.

We conclude that from a geotechnical standpoint, the land is suitable for the proposed constructions, provided that our recommendations are implemented and good building practices are followed.

Special concerns for this site include the potential hazards of seepage, seismic shock and differential foundation movement. Therefore, we ask that this report be carefully studied and taken into account for the engineering design which is to follow.

Upon request, we will review foundation plans, and inspect earthwork construction and foundation installation on a regular basis while the work is performed. We will also discuss construction procedures, and field changes if needed in a Final Report.

Please feel free to contact us at anytime in the future if there are questions about this report, or we may be of further service.

Sincerely,

Al G. Masso
GE-2089

REGISTERED PROFESSIONAL ENGINEER
ALBERTO G. MASSO
No. GE-2089
Exp. 3/2012
GEOTECHNICAL
STATE OF CALIFORNIA

GEOTECHNICAL INVESTIGATION

FOR

THE PROPOSED TWO SINGLE FAMILY HOMES

DE ANZA BOULEVARD

SAN MATEO, CA 94402

FOR

DAN TEALDI

TEALDI DEVELOPMENT GROUP, LLC

320 WASHINGTON STREET, SUITE 104

DALY CITY, CALIFORNIA 94015

SUMMIT ENGINEERING

5855 CASTLE DRIVE

OAKLAND, CALIFORNIA 94611

NOVEMBER 22, 2010

REPORT SUMMARY

The present geotechnical study can be summarized as follows :

- The soil profile consists of a foot of sandy/gravelly clay soils underlain by sheared and fractured rocks consisting of weathered to hard grayish to greenish sandstone and shale.

- Ground water was not found during drilling. The local soils found do not show characteristics of liquefiable materials under seismic effects.

- The proposed structures should be built allowing positive drainage, i.e. allowing the storm runoff to travel toward the public street.

- Nearby M7.1 earthquake on the San Andreas Fault may produce soil deformations which may lead to differential settlements. Adequate seismic foundation design and reinforcement is, therefore, recommended.

- The new foundations will consist of either drilled piers, or shallow footing/drilled pier combinations that will be embedded in underlying bedrock.

INTRODUCTION

This report presents the results of an investigation of the soil and geologic conditions of a vacant lot described as "Parcel F, Timber-lane Meadows, City of San Mateo, County of San Mateo, California, Filed 6/3/1988 in Map Book 118, Pages 34 and 35, Official Records". The parcel address is on the 2100 block of De Anza Boulevard, San Mateo, California. The lot's APN and surface area are 041-200-500 and 26,450 square feet (0.60 acres) respectively (Figures 1 and 3).

PROPOSED CONSTRUCTION

The current owner plans to build two, two-story residences. The proposed buildings will rest on either drilled piers, or a shallow footing/ drilled pier combinations that will be embedded in underlying bedrock. Grading will include excavation and retaining walls for driveways and garages, the house foundations, and to provide drainage and runoff disposal.

SCOPE

The scope of this investigation included:

1. A geologic reconnaissance of the surrounding area;
2. A review of pertinent geologic maps and reports relevant to the site;
3. The drilling of four soil borings, and collecting representative soil samples; and
4. The testing of subsurface materials for moisture content, plasticity, and the correlation between penetration resistance and shear strength.

SITE TOPOGRAPHY AND VEGETATION

The subject lot is located adjacent and east of 2151/2153 De Anza Boulevard, on a gently sloping area with slope grades of 27%. Site vegetation consists of wild grasses and a few mature trees along the periphery. The SE area by a mature pine tree shows signs of incipient, shallow sliding. The lower areas show mound-shaped soil accumulations which may be the result of small soil slides.

GEOLOGY

Geologic maps covering the area (Ref. 1, Figure 2A) indicate that the lot lies within Cretaceous and Jurassic Franciscan sheared rocks consisting of predominantly soft, light to dark-gray, sheared shale, siltstone, and sandstone (graywacke) containing various-size tectoni inclusions of Franciscan rock types that weather to grayish-yellow clayey and silty sand and in places is eroded to form badlands topography. Out-crop areas may be larger than shown and it may include areas labeled as sandstone (fs). Slopes underlain by sheared rock unit are unstable, especially when wet. Thickness unknown but more than several hundred feet.

The official San Mateo County map of geotechnical hazards (Figure 2B, Ref. 2) show the subject site in Zone 9 (Uplands/Bedrock including firm to soft with hard masses). Gouge soils are expansive, other bedrock is not. Permeability is low at depth and in clayey surface mantle. Excavation is easy to moderate. Fills maybe weak and locally expansive commonly with expansive oversized blocks. This zone shows indications of 'poor' slope stability; 'poor to good' earthquake stability; and 'poor' foundation conditions. Landslide maps (Ref. 3)show some small slides near and south of the site.

Seismicity maps (Figure 2C) show the site located 1 mile (1.6 Km) NE of the well-known, active San Andreas Fault. The active, NW-trending San Gregorio/Seal Cove Fault is 8 miles (13 Km) SW from the site. Although considered inactive, a number of geologic faults are mapped in the San Francisco peninsula. Such are the Pilarcitos and San Mateo Faults, etc.

There is also a number of active faults on the East Bay. The Hayward and Calaveras Faults are located 17 miles (27 Km) NE, and 26 miles (42 Km) ENE of the site, respectively (Figure 2C).

FIELD INVESTIGATION

Field investigation consisted of a detailed site inspection and subsurface exploration. During the detailed site inspection on November 19, 2010, the site topography and features were examined. Except for observed area by a mature pine tree showing stepped, 1-foot scarps indicating incipient, shallow sliding, the proposed building site and nearby existing buildings appeared in sound condition.

Subsurface exploration, also performed on November 19, 2010, consisted of drilling four soil borings at the locations shown in Figure 3. These borings were drilled to refusal using a portable, power drilling rig (Minuteman) equipped with a 3-inch solid auger.

LABORATORY TESTING

Samples of materials from soil cuttings were collected for standard laboratory analyses to determine representative soil properties. Plasticity tests were performed as they are useful for soil classification and property correlation. Boring logs and details regarding field and laboratory investigations are included in the attached Appendix.

SOILS

The B-1 through B-4 exploratory borings encountered mostly a foot of sandy/gravelly clay soils underlain by fractured rocks consisting of weathered to hard grayish to greenish sandstone and shale. Drilling refusal was reached at depths between 2 feet and 4 feet (Figure 3).

For engineering purposes, the following layers will be considered: 0-1 feet, topsoil, shallow colluvium will be disregarded; 1-4 feet, soft, weathered bedrock; below 4 feet, there is Hard bedrock.

Groundwater was not encountered during drilling. Detailed descriptions of the materials encountered in the borings are shown on the boring logs in the Appendix. The attached boring logs, and related information show subsurface conditions at the approximate locations shown on the Site Plan in Figure 3.

It should be noted that at the prospective building sites, soils are predominantly sandy-clay in nature

SEISMICITY

The lot is located in the San Francisco Bay Area which is considered to be one of the most seismically-active region of the United States. The nearest active fault and also the likely producer of the controlling seismic event is the San Andreas Fault which is mapped 1 mile (1.6 Km) NE of the site. The seismically-active San Grgorio/Seal Cove Fault is mapped 8 miles (13 Km) SW of the site.

Although considered inactive, a number of geologic faults are mapped nearby in the peninsula. Such are the Pilarcitos and San Mateo Faults, etc. There is also a number of active faults on the East Bay. The Hayward and Calaveras Faults are located 17 miles (27 Km) NE and 26 miles (42 Km) ENE of the site, respectively (Figure 2C).

All of these faults are currently exhibiting creep movements and micro-seismic activity, and are capable of generating major earthquakes with the capacity for widespread damage to both man-made and natural structures. Major Bay Area earthquakes last occurred on the Hayward, San Andreas and Calaveras Faults in the year 1868, 1989 and 1861, respectively. Other small faults are mapped in the immediate area, although none are associated with any seismic activity or considered active.

Although it is not yet possible to accurately predict when and where an earthquake will occur on the basis of current technology, it is reasonable to assume that the proposed structures will be subjected during their useful life to at least one moderate to severe earthquake. During such an earthquake, the danger from fault offset thru the site is remote, but strong local shaking is likely to occur.

However, foundations built on competent strata, although may suffer some damage, should perform satisfactorily during a strong event. In addition, wood-framed buildings are generally flexible enough to sustain some seismic deformations with minor or moderate structural damage. An effective surface drainage will contribute to maintaining higher shear strength, and hence stable ground.

Additional 2007 California Building Code Seismic Parameters.
The existing soil profile may be assimilated to a Sc site class, i.e. 'Very Dense Soil and Soft Rock' (CBC, Ref. 15). Other CBC seismic coefficients are calculated as follows :

Site coordinates 37.519828 deg N, 122.337028 deg W (NAD27)
Ss = 2.198, Fa = 1.0, Sms = 2.198, Sds = 1.465
S1 = 1.247, Fv = 1.3, Sm1 = 1.622, Sd1 = 1.081

The subject building will have a II occupancy category. Therefore, the buildings will have a D seismic design category.

CONCLUSIONS

Based on our field and office studies, it is our opinion that from a geotechnical engineering standpoint, the site is suitable for the proposed new constructions, provided that the recommendations presented in this report are incorporated into the design and construction of the proposed structures.

The new foundations will consist of either a pier and grade beam system, or pier/shallow footing combinations supported/embedded in Hard shale bedrock. The pier foundation must be designed and built to provide adequate vertical and horizontal restraint. The vertical restraint will be provided by a skin-friction and end-bearing of piers penetrating the Hard bedrock. The horizontal restraint will also be provided by passive resistance of competent bedrock.

Ground shaking will be the major cause of earthquake damage. Ground shaking will be strongly influenced by local soil conditions such as topography, soil thickness, soil type, density, water content, and bedrock firmness. The proposed dwellings will consist of wood-framed, two-story buildings supported by a relatively rigid system embedded in competent bedrock.

Seismic effects may be considered based on the premise that the maximum credible San Andreas Fault event would have a 7.8 magnitude on the Richter Scale. The building period for a two-storey structure may fall within range of maximum spectral values, and therefore, the structure will be subject to high base shear and high shear stresses. Seismic CBC (2007) spectral values for design are shown in the previous SEISMICITY Section.

RECOMMENDATIONS

The following are recommendations for the successful completion and maintenance of the project. Because the recommendations are partly general and partly specific to certain items of concern identified above, recommendation implementation should be discussed with an experienced Soils Engineer. A Soils Engineer must be retained to:

- Review the drainage plans and later, foundation repair if needed prior to construction.
- Update this report if necessary because of observed changes or delays.
- Inspect the excavation operations, particularly for footings or drilling of pier boreholes; and the installation of surface drains and sub-drains.
- Prepare a Final Soils Engineer's Report that indicates whether construction was done according to expected soils characteristics, or new features were encountered which required special engineering considerations.

We request to be allowed to provide these additional engineering services so that there will be no question about interpreting our recommendations which are based on our findings and conclusions.

A. <u>Site Preparation and Grading</u>

The area of the proposed improvements should be cleared and stripped so sufficient depth to remove any obstructions, debris, and all surface vegetation. These materials should be removed from the site. If any obstructions (such as tree root systems) are removed below the planned finished grades, the resulting holes should be backfilled with approved materials that are compacted to the requirements given below.

Due to low soil plasticity, rock fragments below shallow clays may be used for fill or backfill materials. Any imported fill used at the site should be a non-expansive soil with a plasticity index of 12 or less. All fill and backfill materials placed at the site should not contain rocks or lumps greater than 6 inches in their greatest dimension, with not more than 15 % larger than 2.5 inches.

All sub-grade surfaces that will receive fill, should be scarified to a depth of 6 inches, moisture-conditioned wet of optimum, and compacted to the requirements given below. All structural fill and backfill materials placed at the site should be compacted to at least 90% relative compaction by mechanical means only, as determined by ASTM Test Designation D1557-70.

In addition, structural fills (including wall backfills) equal or greater than 4 feet in thickness should be compacted to at least 95% relative compaction over their full depth. All new fills should be keyed into compact materials and compacted in lifts not exceeding 8 inches in un-compacted thickness.

We recommend that all finished ground disturbed by the construction operations be either landscaped or planted to minimize sloughing and erosion (Ref. 16). All finished grades should slope at least 2% in such a manner that surface water will not run over exposed slopes or collect against obstructions. For other grading details, the reader is referred to the CBC (Ref. 15).

B. <u>Drainage</u>

Particular attention must be given to both surface and subsurface drainage at this site. Plastic soils may be affected by drying-and-wetting cycles, and must be protected by a carefully planned drainage system to avoid water percolation near the foundations.

No storm water should be allowed to concentrate anywhere in the building area except where collected for disposal. Rough and finish grading should be planned to prevent ponding of water on the surface, except where a safe sediment pond is prepared if grading is done during the winter.

Drainage must not be allowed to collect and pond anywhere near or under the structure. Crawl spaces beneath floors can collect seepag if the rough interior grade is lower than the finish grade around the outside. Finished ground surfaces must be sloped at least 2% away from foundation walls for positive drainage (See Figure 4).

Roof runoff should also be directed away from foundations. Do not allow downspouts to deposit runoff where it can saturate foundation soil. All downspouts should be connected by solid pipe and allow to discharge, ideally, onto paved surfaces or into city storm drains.

Installation and operation of automatic sprinkler systems must be carried out carefully so as not produce excessive amounts of water. Further, irrigation either manual or automatic should be kept to a minimum. Landscaping should consist of drought and fire resistant species of trees and bushes.

Proper house maintenance should include annual flushing with a garden hose of all sub-drains, catch basins and downspout piping. If any pipes become clogged, they should be cleared so that hydrostatic water pressures do not lessen the shear strength of the soils. Likewise, ground surfaces should be maintained to promote good drainage and to prevent erosion and foundation soil saturation.

C. Drilled Pier Foundations

Drilled, reinforced-concrete, friction piers should be used for the new foundations. Piers must be designed according to the parameters given below. Minimum pier diameter should be 16 inches. Piers should penetrate into dense bedrock with a minimum pier length (measured from the original ground elevation) of 8 feet, or at least 4 feet into hard bedrock, whatever is deeper. Final pier depths to be decided in the field by Soils Engineer. The following summary table may be used for pier design :

Table 1A - Soil Parameters for Foundation Design

Depth (ft)	Soil Charact.	Skin Frct (psf)	Pullout Res. (psf)	Pass Res (pcf) (*)	Bearing Pres. (ksf)
0					
	Shallow Soils Disregard (Creep Depth)	0	0	0	
1					
	Very Stiff to Hard Weath. Shale	400	200	350	
≥ 4					4+

≥ 4			4+
Hard Wheathrd Shale	600	300	500

where (*) means applied to 1.5 pier diameters. The allowable bearing pressure, qa, inside the weathered bedrock is given by :

$$qa = 4 (1 + 0.1 (L - 4)) \quad \text{ksf}$$

and L = pile length (ft) below finished ground ≥ 4 feet

When embedded in Hard bedrock, and provided that the pier boreholes will be clean from all debris, piers may be designed to account for the end-bearing effect, with an allowable bearing pressure of 4 kips per square foot, plus 10% per foot of penetration starting from the depth of 4 feet below the ground surface, to a maximum of 12 ksf for dead plus live load, with a one-third increase for all loads including wind or seismic. If the end-bearing effects are added, the total pile capacity will be calculated as follows :

Pier capacity = Shaft resistance + Tip resistance / 3
(for lengths ≥ 4 ft only)

The following pier capacities have been calculated for foundation design. For given pier spacings, and hence pier loads, pier lengths may be obtained from Table 2 in order to minimize foundation costs :

Table 2 - Vertical Pier Capacities in kips (1 kip = 1,000 lbs)

D	L(ft)					
(in)	8	10	12	14	16	18
16	17	23	28	33	39	44
18	20	26	32	38	43	49

where :

D = Pier Diameter in inches

L = Pier length (ft) below original ground

Creep Pressures on Piers
Pier design will account for creep earth pressures thru the soil depth with creep potential (Creep Depth), which in this case is estimated to be an average of 1 feet from the original ground. Creep pressures on perimeter piers will be accounted for by using a rectangular lateral pressure diagram of stress equal to the creep depth times 100 pcf-efw, i.e., creep stress = 1 x 200 = 200 psf in this case. Creep pressures will be applied to one pier diameter.

Passive Soil Resistance, only below the so-called Passive Depth of 1 feet on average, will be applied to 1.5 diameters and is given on Table 1 above and in Section H below.

Pier Construction
Piers might not be installed deeply enough to gain fixity at their bottoms in order to act as vertical cantilever beams. However, if a minimum embedment of 8 feet is provided, fixed-end effects at pier bottoms may be assumed for structural design. All piers must be tied together with tie beams or grade beams. The spacing of piers should be determined by the Structural Engineer, but pier center-to-center spacing should not be closer than five pier diameters. Pier foundations become more efficient when using fewer, widely spaced, larger piers.

All pier holes should be dry and reasonably free of loose cuttings and falling debris prior to installing reinforcing steel and placing concrete. Some of the pier holes may encounter different soil conditions that assumed thru their design depths; such piers will be evaluated on an individual basis at the time of construction.

In addition, care must be taken during the pier hole drilling operation to verify that pier holes reach the underlying dense bedrock materials, and that boulders or locally unconfined rock outcrops are avoided. Pier boreholes should not be left un-poured over 24 hours and by no means over 48 hours. If water is encountered in any of the pier excavations, pumping may be required to remove the mud from the holes. If open boreholes are caving-in, a drill-and-pour technique may have to be implemented.

D. Shallow Foundations
Shallow footings only may be used for secondary structures outside the house perimeter. These footings build on excavated cuts of at least 2 feet, supported on weathered shale may be designed for an allowable bearing pressure of 2,000 psf for dead plus live loads, with a one-third increase for all loads including wind and seismic. Footing allowable bearing pressures are net values; there-fore, the weight of the footings can be neglected for design purposes.

Minimum footing depth below finished grade is 24 inches; minimum footing thickness and width should be 8 and 15 inches respectively. At least, four No. 4 re-bars, two above and two below, are suggested as minimum reinforcement. Footing stems should be reinforced and designed as grade beams. We suggest to use 8-in x 15-in stems with four No. 4 re-bars. Because of the proximity to the San Andreas Fault, we recommend to design for at least 2.5-inch differential settlement across the building.

Foundations for primary retaining walls may be designed using piers for vertical and horizontal (passive) loads supplemented by short footings of, say, 2 to 4 feet to provide a rigid bending joint at the base of the wall. The footing trench bottoms should be thoroughly compacted. The footings may be designed for maximum allowable bearing pressures as follows :

Footing Depth (ft)	Allowable Pressure (psf)
2.0	2,000
4.0	3,000
6.0	4,000

All foundation bearings must be reasonably dry and free of cuttings or falling debris prior to installing steel bars and placing concrete. In addition, any visible cracks in the bottom of the footing excavations should be closed by soaking prior to the placement of concrete. In any areas where utility conduits will extend through perimeter footings, the holes in the footings should be thoroughly sealed and waterproofed. This will prevent any water from seeping along the utility trench and saturating soils under the structure.

E. Concrete Slabs on Grade

Framed wood flooring is preferable for the living areas of buildings. However, where slabs are to be used, the following is recommended :

A minimum of 4 inches of crushed rock should be used between compacted sub-grade or bedrock and concrete slabs. Any over-excavated subgrade should be filled with densely compacted crushed rock or other non-expansive fill material. Use of a vapor barrier under slabs is optional depending on the nature of the use of the floor. An efficient vapor barrier may be achieved by installing a 10-mil plastic membrane over the layer of gravel or crushed rock. A two-inch layer of sand must be placed over the plastic membrane before pouring in order to avoid puncturing damage and help the concrete during the curing process.

Post-tensioned slabs may not need vapor barriers if the concrete is permanently in compression. The top 6 inches of soil should be removed and replaced by a non-plastic, sub-base, import fill material.

Concrete slabs should be at least 4 inches thick and reinforced preferably with No. 4 steel re-bar. Exterior slabs, garage or carport slabs, and driveways may be free-floating and separate from foundations. Weakened-plane contraction joints should be provided in exposed, non-structural slabs at 10- to 12-foot intervals. Reinforcing should be continuous through contraction joints. An average value for the modulus of sub-grade reaction at this site may be taken as 250 Tons/ft3. This value may be used for stress analysis.

Concrete walks should be reinforced concrete over sand or gravel. If truck traffic passes over concrete walks, they should be 6-inch reinforced slabs over 6 inches of rock. Similar concrete pads should be placed wherever a debris box or a trailer storage is anticipated.

F. Pavement

The customary driveway section consists of a 4-inch, reinforced-concrete slab as described above, or a 2-inch cover of plant-mixed asphalt. (A thicker "engineered" R-Value design can be prepared upon request). Either pavement should be placed over at least 4 inches of CalTrans Class II Aggregate Base rock.

Install pavement according to CalTrans Standard Specifications, Sections 16, 19, 26, and 39. Compact the sub-grade to 95% relative compaction (ASTM D1557) at a moisture content of 2% over optimum moisture, and then rock tack, and pave immediately to keep the soil from drying and subject to swell heave the following winter. Base rock should be CalTrans Class II aggregate, asphalt should be plant-mixed Type B. Base rock should also be compacted to 95% and tacked. Asphalt should be sealed after paving.

G. Lateral Pressures

Back-drained, retaining walls must be designed to resist active lateral soil pressures which may be taken as follows:

Wall Type	Active Pressure(pcf-efw)*
Unrestrained, Slope ≤ 4:1	35
Unrestrained, Slope = 2:1	45
Restrained	Add an additional uniform lateral pressure of 8 x H (psf), where H = height of backfill above retaining wall foundation in feet.

(*) Pounds per cubic foot-equivalent fluid weight

- A 50% pressure increase should be used for shoring design.

- For unrestrained walls, add an additional uniform pressure equal to one-third the maximum surcharge load applied to the wall backfill.

- For restrained walls this additional uniform design pressure should be one-half the maximum surcharge.

- Seismic pressures will be accounted by adding a uniform pressure = 10 x H psf, where H = height in feet of retaining wall.

The above pressures assume that sufficient drainage will be provided behind the walls to prevent the build-up of hydrostatic pressures from surface and subsurface water infiltration. Adequate drainage may be provided by a sub-drain system consisting of 4-inch diameter perforated pipes bedded in free-draining material. The free-draining material should consist preferably of clean, uniform, 1- to 2-inch gravel or crushed rock.

The free-draining material should be wrapped with a synthetic filter fabric and placed behind the wall with at least 1 foot of thickness and should extend to within 2 feet of finished grade (See Section A for backfill placement and compaction). Compaction of wall backfill should be conducted in such a way that will not damage the wall. The upper 1 foot of backfill should consist of compacted on-site or imported clayey materials (See Figure 5).

<u>Construction equipment and transport vehicle surcharges</u> should also be anticipated in design, and the construction specifications should provide for adequate concrete curing time before allowing the backfill to be compacted. Sliding friction and passive resistance should be taken as discussed in Section H below. On hillsides we recommend using concrete piers supplemented by shallow, well reinforced footings designed to take bending and passive stresses.

Retaining walls behind non-living spaces should have a wall drainage system including conventional drain material (such as Miradrain), and a sub-drain installed as a "drainage burrito" (i.e., perforated pipe, gravel, and filter fabric) as said earlier. The perforated sub-drain pipes should be connected to a system of closed pipes that discharges in the paved street gutter or appropriately in the backyard area.

Besides being provided with proper sub-drains, all retaining walls behind living spaces must be thoroughly water-proofed, preferably by hot-mopping, or better yet, with sealing synthetic membranes such as PermaSeal, Bituthene, Miradri, HLM 5000, or equivalent.

Lined surface ditches must be provided behind any wall having an exposed sloping surface draining towards it. These ditches will collect runoff water from the slopes and should be sloped to drain to suitable discharge facilities. The top of the walls should extend at least 6 inches of free board above the ditch in order to retain minor erosion or sloughing materials.

The walls can be supported on either pier or pier/ footing foundations, that are designed in accordance with the recommendations presented previously under Section C, "Drilled Piers" or Section D, "Shallow Foundations". Lateral load resistance can be developed in accordance with the recommendations presented below.

H. Lateral Load Resistance

Lateral loads on piers may be resisted by passive pressures acting against the sides of the piers. Equivalent passive pressures as shown on Table 1 :

Between 0 and 1 feet, use 0 pcf-efw;
between 1 and 4 feet, use 350 pcf-efw;
below 4 feet, use 500 pcf-efw to a max. value of 8,000 psf.

Passive resistance of drilled piers will be calculated by applying passive stresses on 1.5 pier diameters.

Lateral loads on footing foundations may be resisted by friction, with a friction coefficient of 0.35 times the dead load when footings are on weathered bedrock.

We recommend that the factor of safety against sliding and overturning for all retaining walls be at least 1.5. We wish to note that when calculating the weight of soil on the portion of the protruding wall footing where backfill will be placed (i.e., the weight of soil that will resist over-turning forces), an imaginary line at an inclination of 10 degrees from vertical can be used starting at the top of the wall footing. In addition, the backfill materials can be assumed to have a unit weight of at least 110 pounds per cubic foot.

LIMITATIONS

The recommendations presented herein are based on the soil conditions revealed by our test borings and laboratory procedures according to generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied.

It must be understood that for this report to be valid, the owner should ensure that necessary steps are taken to carry out the recommendations of the report in the field. Any added risk incurred by the choice of alternative construction methods which depart from our recommendations will be borne by the owner. Further, this report must not be construed as any guarantee or insurance against any type of soil failure.

The recommendations in this report are general in nature and are subject to adoption or revision as the construction circumstances warrant. We should be notified for supplemental recommendations should unusual situations be encountered during construction. We may be consulted for supplemental advice, or to provide assistance in interpreting our findings and recommendations, or to inspect various aspects of construction.

Our recommendations are valid as of the present time. However, future conditions may change conditions due to legislation, improvement of engineering knowledge, natural process, or man's works. Therefore, this report is subject to review and its validity may decrease with the passage of time.

Finally, careful design and construction cannot guarantee that damage will not occur if disaster strikes. Disaster may strike, for instance, in the form of a large, destructive, nearby earthquake or a massive landslide. The owner alone undertakes such risk, and therefore, the owner should obtain home insurance if available against earthquake and landslide damage.

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13. American Society for Testing Materials, Annual Standards.

14. Architectural Drawings by Bexton Associates, Architects, 9/9/10. Boundary and Topographic Survey by Advanced Development, 6/12/10.

15. California Building Code, 2007 Edition.

16. ABAG, 1998, Manual of Standards for Erosion and Sediment Control Measures.

APPENDIX

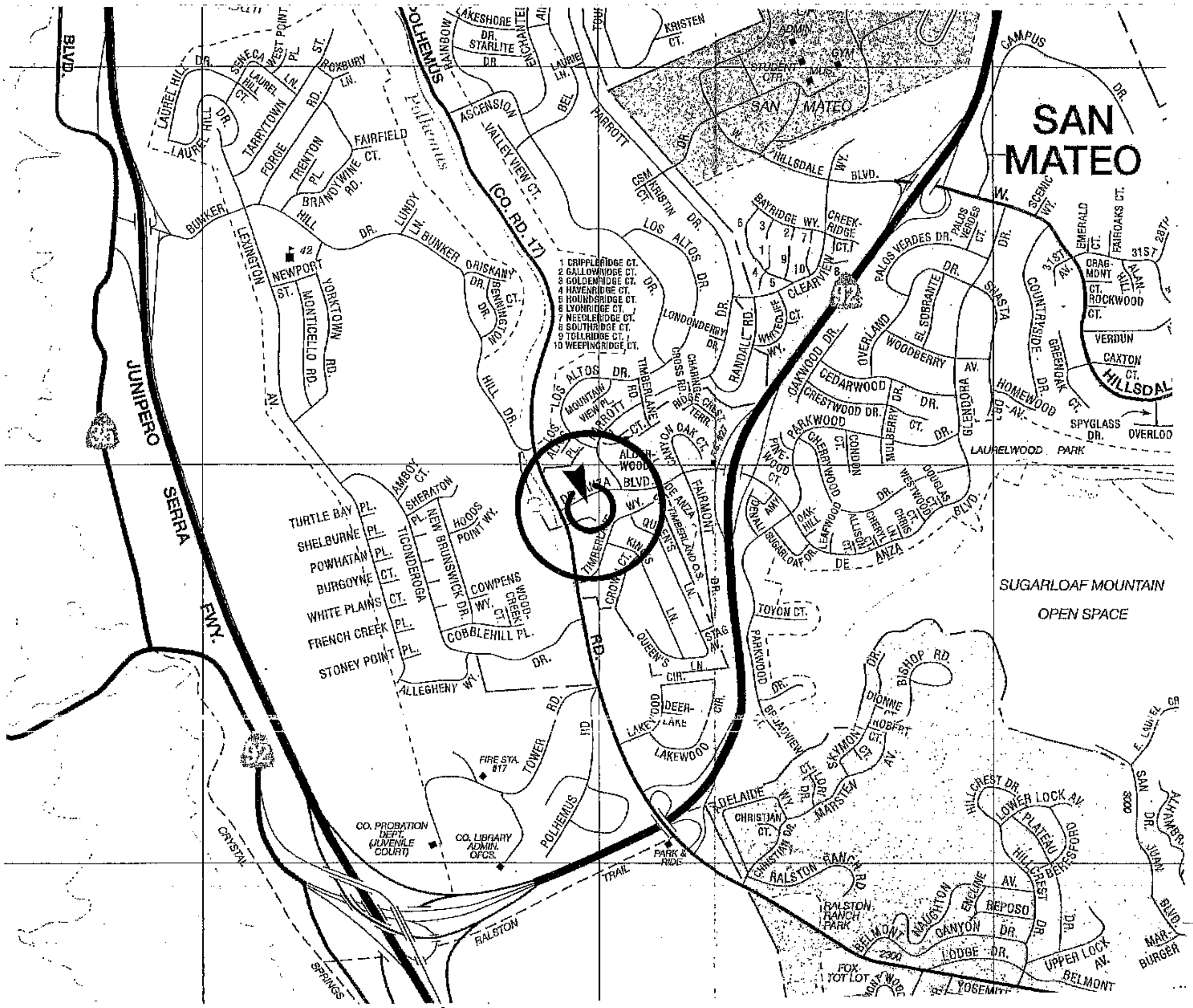
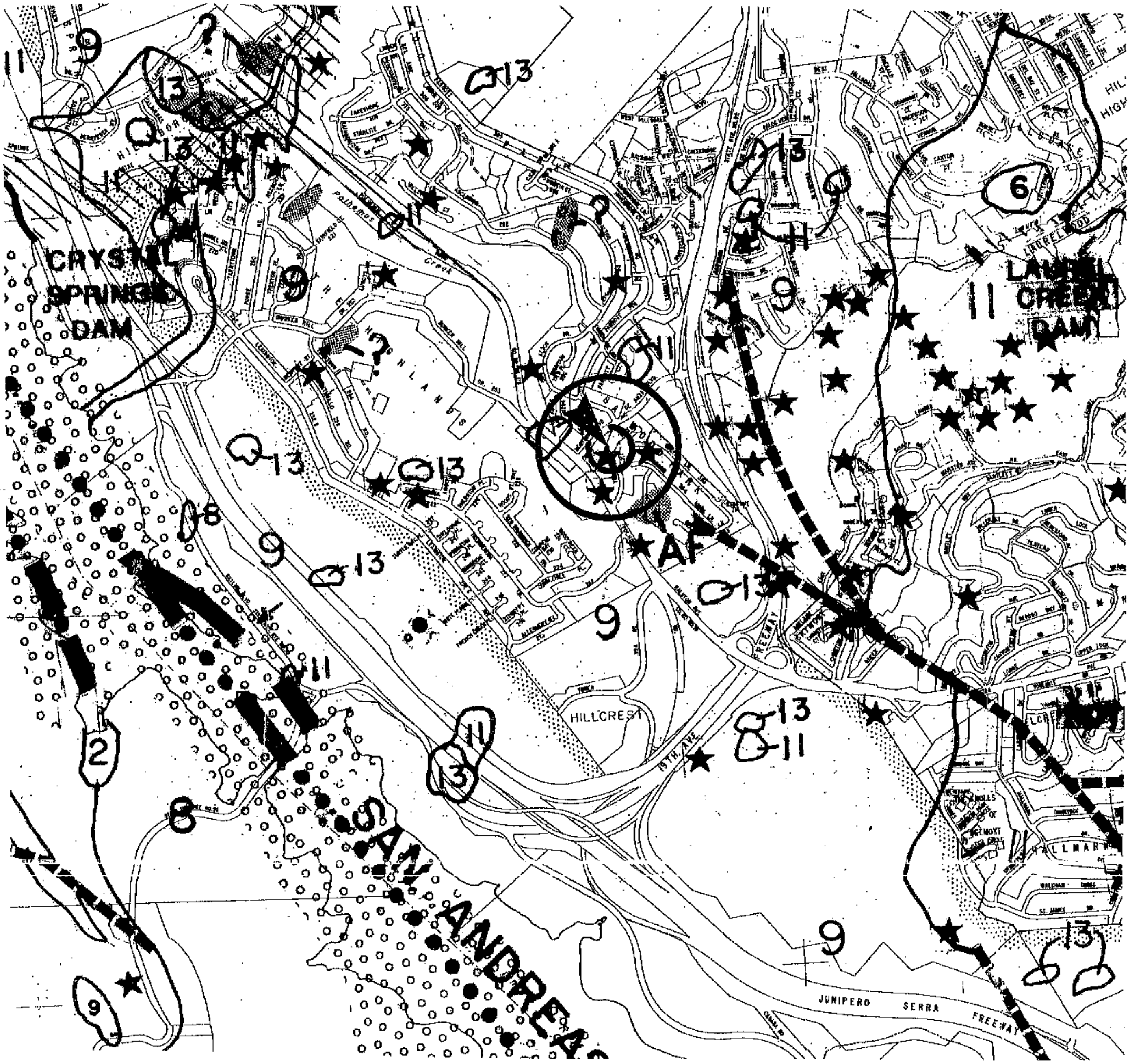


FIGURE 1 - SITE LOCATION

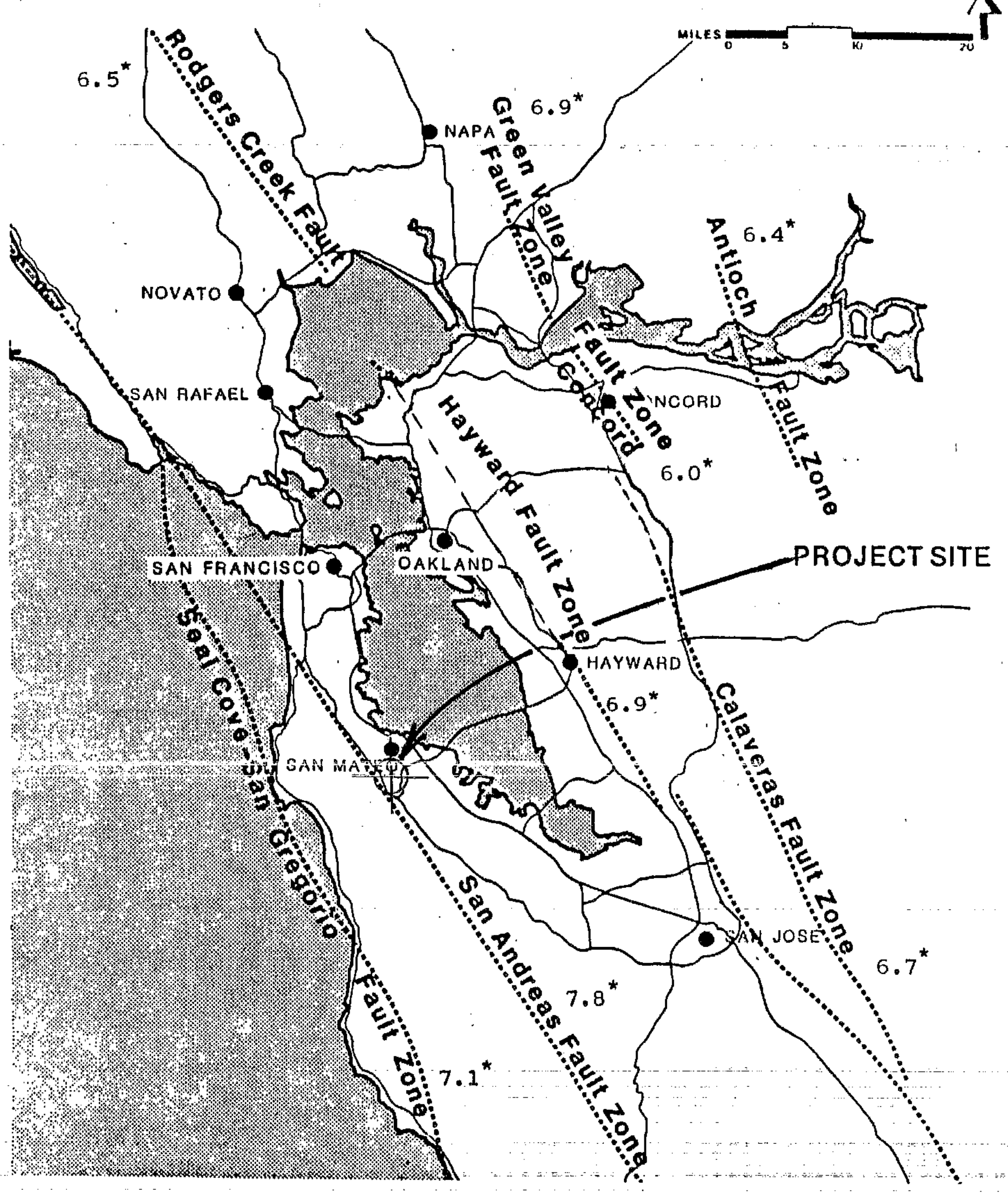
SUMMIT ENGINEERING



Ref. San Mateo County Official Map
of Geologic Hazards (1976)
Scale : 1" = 2,000'

FIGURE 2B - REGIONAL LAND STABILITY

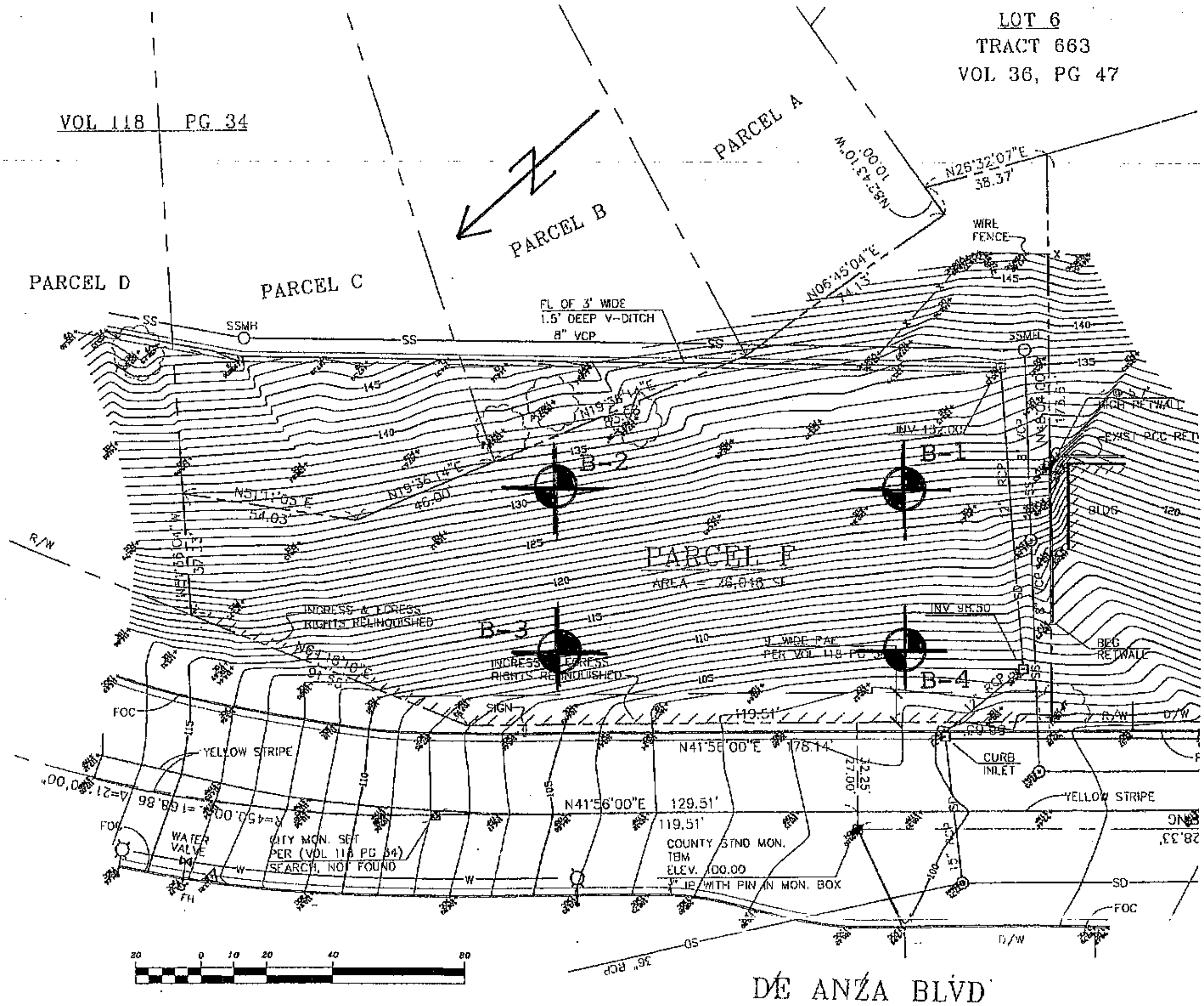
SUMMIT ENGINEERING



Ref. : Calif. Div. of Mines and Geology (1976)
(*) = Most Probable Magnitude or
Maximum Credible Earthquake

FIGURE 2C - ACTIVE FAULT ZONES

SUMMIT ENGINEERING

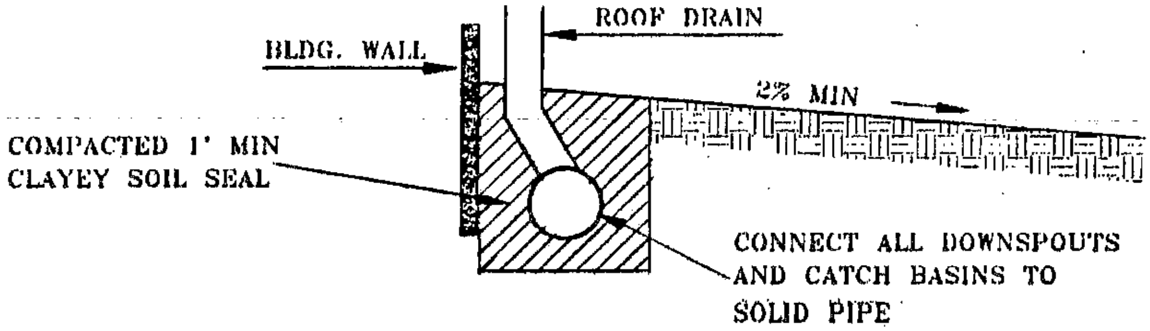


LEGEND

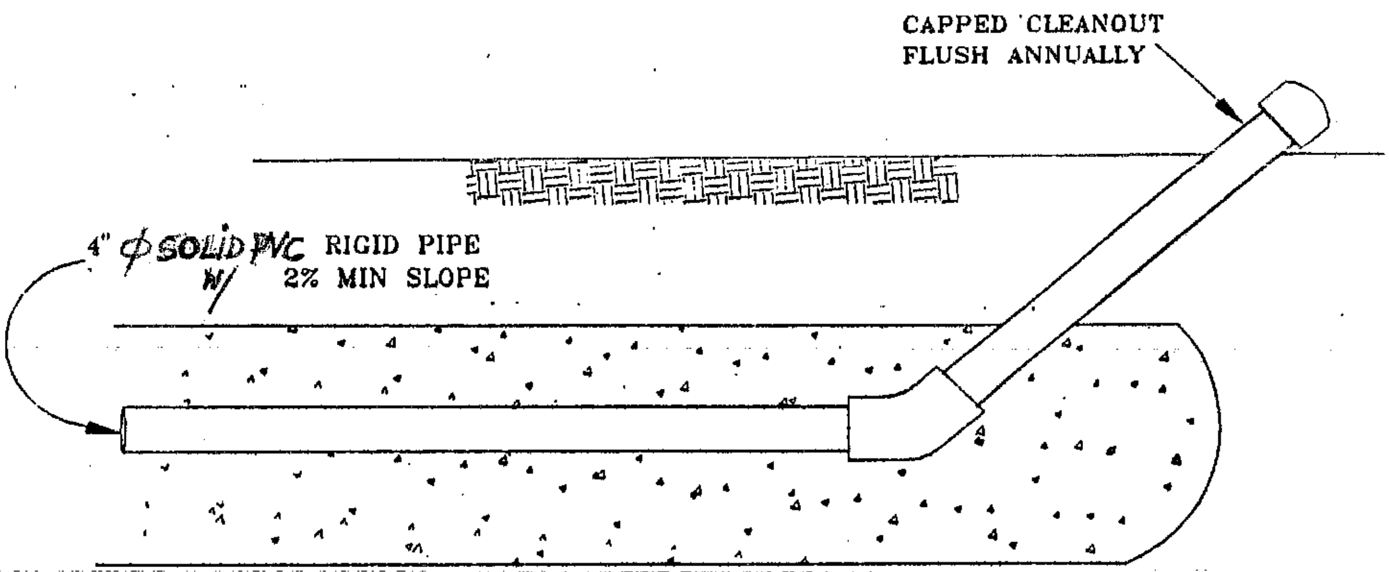
B-1 Soil Boring Location

FIGURE 3 - SITE PLAN AND SOIL BORING LOCATIONS

SUMMIT ENGINEERING



BUILDING SUBDRAIN (NTS)



CLEANOUT DETAIL (NTS)

FIGURE 4 – SUBDRAIN DETAILS

SUMMIT ENGINEERING

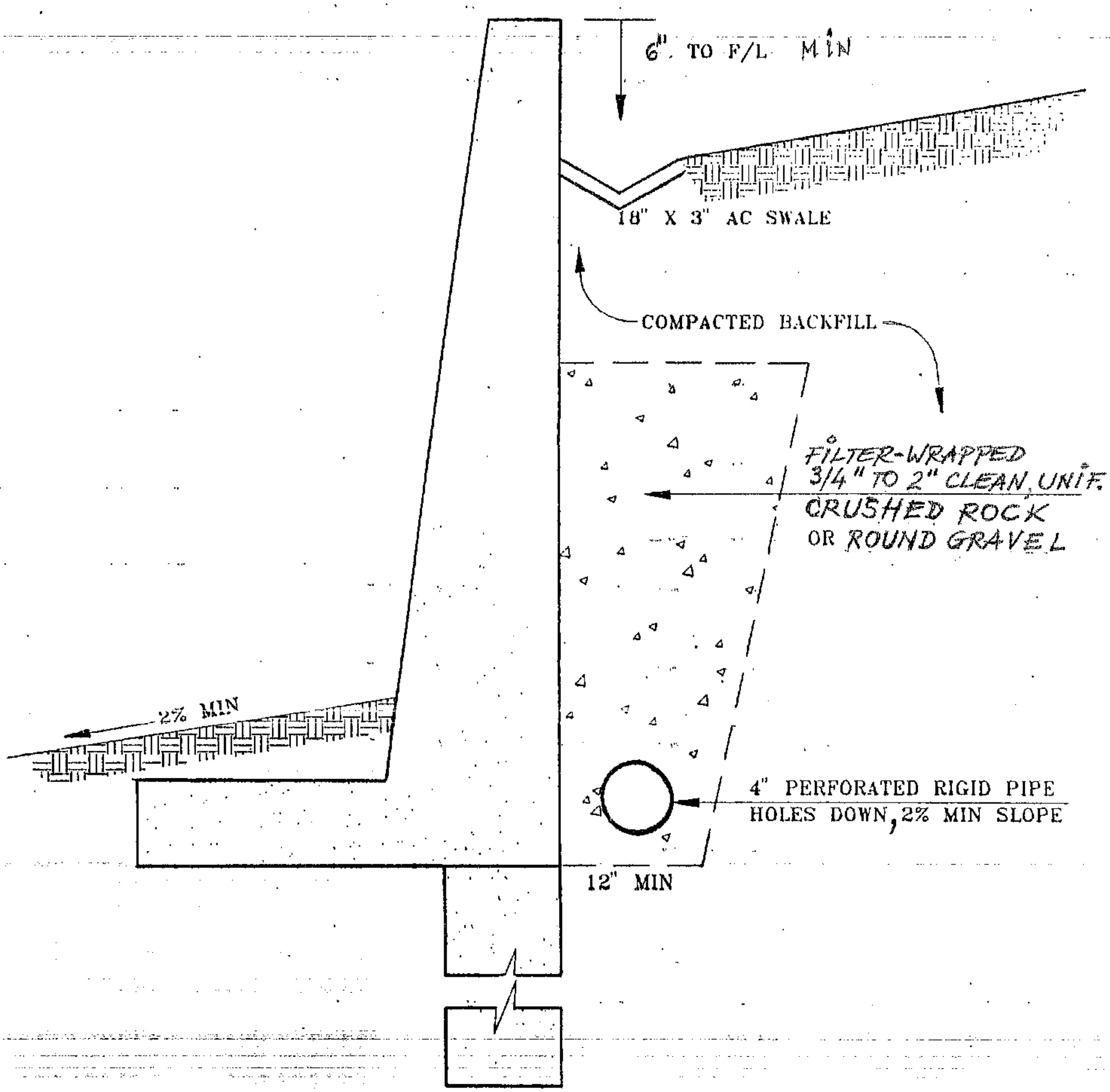


FIGURE 5 – RETAINING WALL DETAILS

SUMMIT ENGINEERING

PROJECT No. 101105	BORING No. B-1	DATE: 11/19/2010
PROJECT NAME: Two New Residences		PAGE 1 OF 1
LOCATION: De Anza Boulevard, San Mateo CA		GWL DEPTH: N.E.
DRILLING METHOD: Minuteman w/ 3-in Auger, 140-lb Hammer		HOLE DIAM: 3.5 in
DRILLING CONTRACTOR Access Drilling Co.		DRILLER: Jose

DEPTH (FT)	SAMPLE TYPE & NUMBER	BLOW/FT	SPT	MATERIAL DESCRIPTION	USCS SYMBOL	MOISTURE CONTENT %	DRY DENSITY (PCF)	SHEAR STRENGTH (PSF)
0				Dark-brn, gravelly clay, damp				
2				Light-brn, creamy, weathered shale and/or sandstone, dry, pwdery, very hard drilling, slow grind. Refusal at 3 ft				
4								
6				BOH = 3 feet				
8								
10								
12								
14								
16								
18								
20								
22								
24								

NOTES: N.E. = Not Encountered

- ▯ 3-in sample
- SPT sample
- 2.5-in sample
- Grab sample

SUMMIT ENGINEERING

6045 Shirley Drive
Oakland, CA 94611

PROJECT No. 101105	BORING No. B-2	DATE: 11/19/2010
PROJECT NAME: Two New Residences		PAGE 1 OF 1
LOCATION: De Anza Boulevard, San Mateo CA		GWL DEPTH: N.E.
DRILLING METHOD: Minuteman w/ 3-in Auger, 140-lb Hammer		HOLE DIAM: 3.5 in
DRILLING CONTRACTOR Access Drilling Co.		DRILLER: Jose

DEPTH (FT)	SAMPLE TYPE & NUMBER	BLOW/FT	SPT	MATERIAL DESCRIPTION	USCS SYMBOL	MOISTURE CONTENT %	DRY DENSITY (PCF)	SHEAR STRENGTH (PSF)
0				Dark-brown, gravelly clay, damp				
2				hardr drilling into lite-brn shale dry, powdery. Slow grind Refusal at 4 ft				
4								
6				BOH = 4 feet				
8								
10								
12								
14								
16								
18								
20								
22								
24								

NOTES: N.E. = Not Encountered
- 3-in sample
- SPT sample
- 2.5-in sample
- Grab sample

SUMMIT ENGINEERING
6045 Shirley Drive
Oakland, CA 94611

PROJECT No. 101105	BORING No. B-3	DATE: 11/19/2010
PROJECT NAME: Two New Residences		PAGE 1 OF 1
LOCATION: De Anza Boulevard, San Mateo CA		GWL DEPTH: N.E.
DRILLING METHOD: Minuteman w/ 3-in Auger, 140-lb Hammer		HOLE DIAM: 3.5 in
DRILLING CONTRACTOR Access Drilling Co.		DRILLER: Jose

DEPTH (FT)	SAMPLE TYPE & NUMBER	BLOW/FT	SPT	MATERIAL DESCRIPTION	USCS SYMBOL	MOISTURE CONTENT %	DRY DENSITY (PCF)	SHEAR STRENGTH (PSF)
0				Gravel and rock fragments near out crop. Gray to greenish shale, very hard drilling. Refusal at 2 ft				
2								
4								
6				BOH = 2 feet				
8								
10								
12								
14								
16								
18								
20								
22								
24								

NOTES: N.E. = Not Encountered

- 3-in sample
- SPT sample
- 2.5-in sample
- Grab sample

SUMMIT ENGINEERING
6045 Shirley Drive
Oakland, CA 94611

PROJECT No. 101105	BORING No. B-4	DATE: 11/19/2010
PROJECT NAME: Two New Residences		PAGE 1 OF 1
LOCATION: De Anza Boulevard, San Mateo CA		GWL DEPTH: N.E.
DRILLING METHOD: Minuteman w/ 3-in Auger, 140-lb Hammer		HOLE DIAM: 3.5 in
DRILLING CONTRACTOR Access Drilling Co.		DRILLER: Jose

DEPTH (FT)	SAMPLE TYPE & NUMBER	BLOW/FT	SPT	MATERIAL DESCRIPTION	USCS SYMBOL	MOISTURE CONTENT %	DRY DENSITY (PCF)	SHEAR STRENGTH (PSF)
0				Dark-brn, gravelly clay, damp.				
2				Hard drilling in fragmented shale, brown to gray, dry, powdery. Slow grind. Refusal at 3 ft				
4								
6								
8				BOH = 3 feet				
10								
12								
14								
16								
18								
20								
22								
24								

NOTES: N.E. = Not Encountered

- 3-in sample
- SPT sample
- 2.5-in sample
- Grab sample

SUMMIT ENGINEERING

6045 Shirley Drive
Oakland, CA 94611

HYDROLOGY REPORT

For

DE ANZA RESIDENCES

NEW SINGLE FAMILY HOMES

DE ANZA BOULEVARD VICINITY POLHEMUS ROAD
SAN MATEO, CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
STEVE DEVICH
No: C042024
Exp 3/31/1
CIVIL
STATE OF CALIFORNIA

July 2014

TABLE OF CONTENTS

1.0 INTRODUCTON

This report presents a preliminary hydrology study for the design of the stormwarter management plan required for the proposed De Anza Residences project in San Mateo, California. Analysis is provided for pre and post construction hydrologic conditions and includes a proposal to meet the requirements of Provision C.3 in the Municipal Regional Stormwater Permit applicable to the City of San Mateo.

1.1 Project Location

The site is located on De Anza Boulevard approximately 200 feet southeast of the intersection of De Anza Boulevard and Polhemus Road. The frontage of the site at De Anza Boulevard is at the northerly boundary of the site. The site is bounded by existing residential structures along the Westerly, Easterly and Southerly boundaries. The site coordinates are: 37 31' 14.13" N, 122 20' 11.61" W.

1.2 Site Description

The area of the De Anza Residences (DAR) parcel is 46,047+/- sq. ft. (0.61 Ac.). The terrain is sloping downward to the northwest (toe of slope along De Anza Boulevard frontage). The shape of the property is approximately trapezoidal. The slope of the terrain is generally uniform although the slope does flatten out somewhat immediately adjacent to the existing concrete curb and gutter at the southwesterly side of De Anza Boulevard. The average slope of the site is approximately 33%.

An existing concrete "v" ditch traverses northwesterly across the site at an elevation of approximately 138'. Approximately 2,500 +/- sq. ft. of the site extend beyond and upslope of this ditch. The "v" ditch collects runoff from the upslope adjacent properties as well as the portion of the site about the ditch. The "v" ditch discharges into a catch basin at the the westerly boundary of the property and is conveyed via a 12" conduit to a storm drain in De Anza Blvd. (described further below).

An existing below grade sanitary sewer traverses the site, paralleling the path of the "v"ditch and storm drain, discharging into a sewer main in De Anza Blvd. The sanitary sewer located on the parcel is a 8" dia. Vitreous clay pipe (VCP). The sewer main ties to two (2) sanitary sewer manholes located along the westerly side of the property and discharges to the sewer main in De Anaz Blvd.

The existing parcel is vacant undeveloped land with minimal vegetation cover. Trees on the site consists of a single double trunk 36" diameter oak located at the approximate mid-point of the southeasterly side of the property. The parcel is zoned for residential occupancies in the City of San Mateo Land Use Plan.

1.3 Proposed Site Development

Two (2) single family homes are proposed to be constructed on the existing site. The areas for the are proposed to be 12,555 and 13,432 with a common area of 60 sq. ft. Each lot will have the primary dwelling unit, detached garages. parking areas an lower level patios at the rear of each house. The driveways are proposed to be approximately 12' wide leading the to garages set at approximately the minimum required setbacks from De Anza Boulevard. The houses are to be setback approximately a minimum of 15 feet from the front property line and 10' from side property lines.

The homes are to be partially cut into grade at the lower levels with the southernly wall of each house being retaining walls approximately 4' in height. Two additional retaining walls terraced to southeasterly of the house retaining walls are to be constructed so as to retain the excavated slopes required to create the level building pads for the homes. These terraced retaining walls will have maximum retained heights of approximately 7 feet.

2.0 SITE HYDROLOGY

2.1 Existing Regional Hydrologic Designation

The City of San Mateo has designated seven major watershed areas as listed below:

North Shoreview Pump Stations
East 3rd Ave.
San Mateo Creek
16th Avenue Drain
19th Avenue Drain
Laurel Creek
Drainage to Marina Lagoon

Each watershed area have existing infrastructure drainage control measures consisting of streams, culverts and channels and storm drain piping. The DAR lot is located in San Mateo Creek Watershed.

2.2 Soil Conditions

A geotechnical report has been prepared for this project. The site was found a buildable site in terms of geotechnical considerations. Sandstone strata was encountered at shallow depths at all test locations. Consequently, it is anticipated that a "mat slab" foundation with perimeter concrete retaining walls will be utilized for the home and garage structures. The southerly terraced retaining walls are anticipated to utilize drilled piers with wide-flange steel posts and wood lagging. The wood lagging will facilitate drainage via spacing between the individual lagging members.

2.3 Groundwater

No ground water was encountered project sited during the site investigation phase in the preparation of the project geotechnical report. Consequently, ground water is not anticipated as contributing to site drainage to collected and dissipated on site. Should ground water be encountered, additional measures may be required to be designed and installed as required.

2.4 Flooding

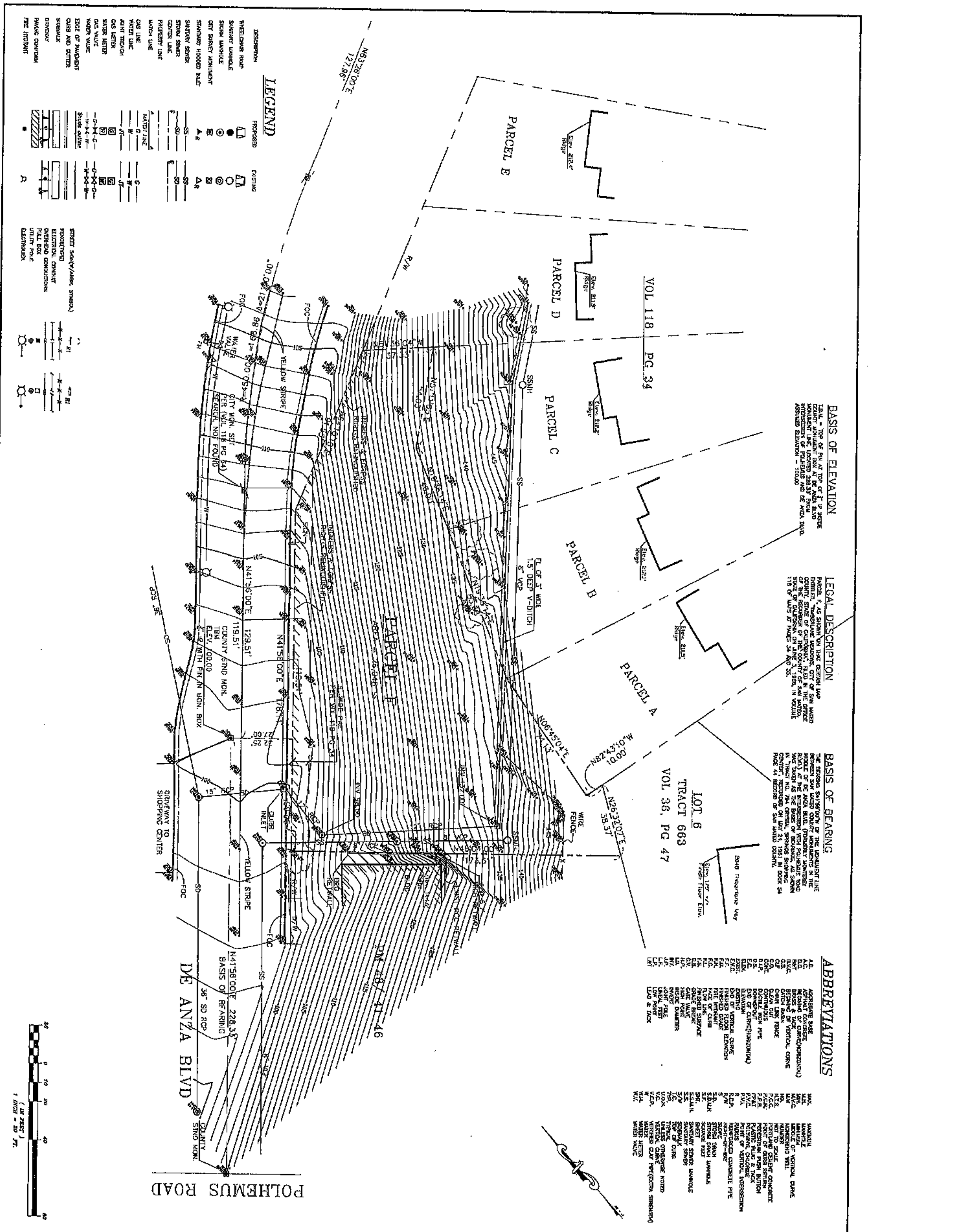
Flooding of the DAR site is not anticipated as likely to occur. Per previous hydrology studies may by the City of San Mateo, the areas of high hazard to flooding, in vicinity of this site, are those of lower elevation east of State Highway 92 and below Crystal Springs Reservoir.

2.5 Existing Site Drainage

The existing site is essentially entirely undeveloped and previous. off site drainage has been historically been limited due to percolation into the underlying soils. Additionally, the uppermost portion of the DAR parcel drains to the existing concrete "v" ditch transversing the property. For the site drainage not percolating into the underlying soils, runoff sheet flows into the existing concrete gutter pan at the southeasterly side of De Anza Boulevard, flowing in to an existing storm drain curb inlet located at the northwesterly corner for the DAR parcel.

2.6 Post Construction Site Drainage

See attached hydrologic analysis for design of the bioretention areas / volumes required to prevent off site discharge of site runoff.



Checked: JS	APPROVED BY: YADOLLAH SAIDIAN	TOPOGRAPHICAL & RECORD BOUNDARY SURVEY FOR APN 041-200-500 JPN 041-020-200-04 CITY OF SAN MATEO, CALIFORNIA	ADVANCED DEVELOPMENT
Drawn: RA			2953 BENJAMIN COURT SAN JOSE, CALIFORNIA 95124
Designed: JS			(408) 378-0590
Surveyed: JS	R.C.E. NO. 33509		JACOB SAIDIAN - CIVIL ENGINEER
Scale: 1"=20'	EXPIRES 06/30/10		
Date: 06-11-10			

Revision	Date	App'd	Description

C1.0

06-12-10

LANDSCAPE DESIGNS FOR STORMWATER MANAGEMENT

Stormwater Control for Small Projects

Bay Area Stormwater Management Agencies Association

Dry creek infiltrates and conveys runoff.

Designing landscaped areas to soak up rainfall runoff from building roofs and paved areas helps protect water quality in local creeks and waterways. These landscape designs reduce polluted runoff and help prevent creek erosion.

As the runoff flows over vegetation and soil in the landscaped area, the water percolates into the ground and pollutants are filtered out or broken down by the soil and plants.

This fact sheet shows how you can design your landscape to absorb runoff from impervious surfaces, such as roofs, patios, driveways, and sidewalks, with landscape designs that can be very attractive.

If you are interested in capturing and storing water for irrigation use, see the Rain Barrel fact sheet in this series.

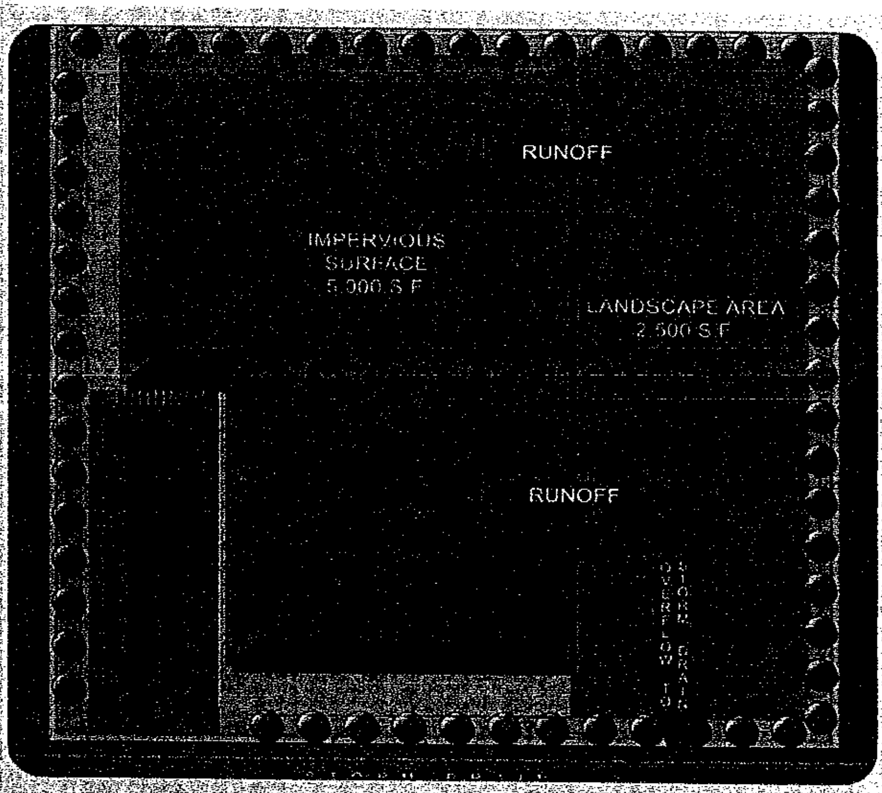
Can My Project Manage Stormwater in the Landscape?

Directing stormwater runoff to the landscape is suitable for sites with the following conditions:

- Roofs, driveways, parking areas, patios, and walkways that can drain to an existing landscape, or an area that may be converted to landscape.
- Areas of landscape with a slope of 5% or less are preferred; check with the municipality regarding requirements for steeper sites.
- Works best in well-drained soil; soil amendments may be used in areas with poor drainage.
- Landscaped areas that total at least 1/2 the size of the impervious area draining to it.
- Direct runoff away from building foundations.
- Runoff should not create ponding around trees and plants that won't tolerate wet conditions.

How Do I Size My Landscape?

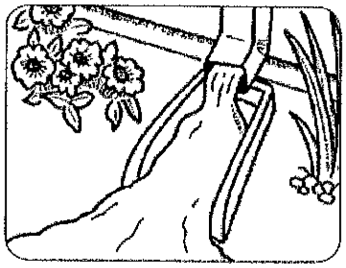
The landscaped area should be 50% of the size of the contributing impervious surface. For example (see below), to manage runoff from a 5,000 square foot roof or paved surface, you should have 2,500 square feet of landscaping.



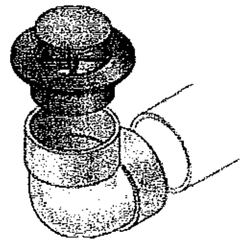
Techniques to Manage Stormwater in Landscaping

Direct Roof Runoff to Landscape

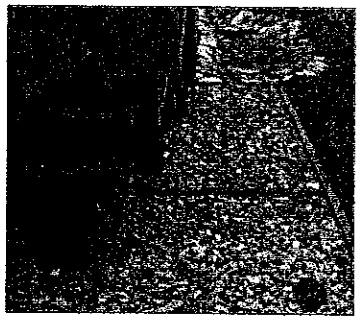
- Use additional piping to connect the downspout to the landscape if needed.
- Direct runoff away from building foundation.
- Prevent erosion by installing:
  - Splash blocks,
  - Rain chains,
  - Gravel area under a gutterless roof,
  - Pop-up drainage emitter connected to a pipe that carries runoff away from the foundation, or
  - Other energy dissipation technique.



Splash block



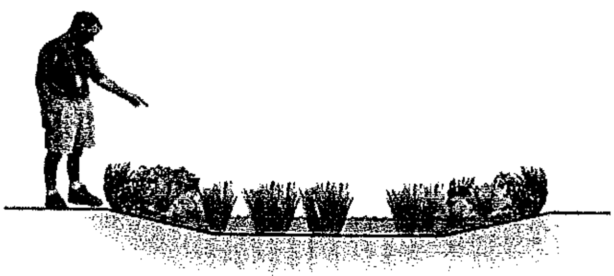
Pop-up emitter



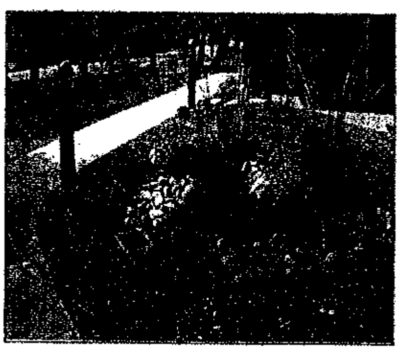
Gravel area under a gutterless roof

Rain chain

Swales or Dry Creeks



Cross section

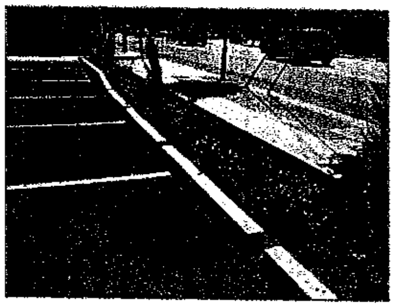


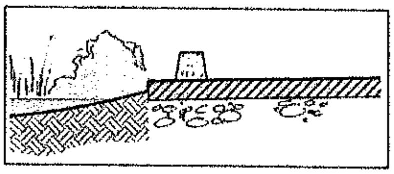
Swales and dry creeks are narrow, linear depressions designed to capture and convey water. Swales imitate a natural creek's ability to slow, infiltrate, and filter stormwater. To install a swale follow these steps:

- Excavate a narrow linear depression that slopes down to provide a flow path for runoff. The path length (10 to 15 feet or more) should meander to slow water and prevent erosion.
- Use plants from creek and river ecosystems to help reduce erosion and increase evaporation of runoff.
- The end of the swale requires an outlet for high flows (another landscaped area or a yard drain). Talk to municipal staff to identify an appropriate discharge location.
- Contact municipal staff for a local list of plants suitable for swales.

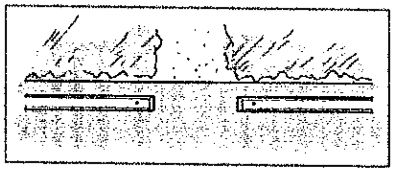
Techniques to Manage Stormwater in Landscaping

Direct Parking Lot Runoff to Landscape





Cross section



View from above

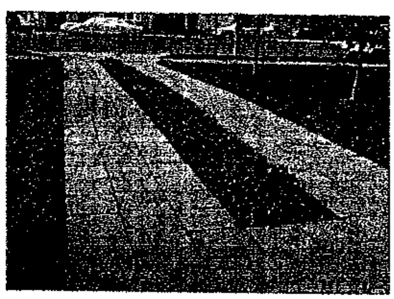
During storms, parking lots generate large amounts of runoff, which picks up oils, grease, and metals from vehicles. Landscaped areas can be designed to absorb and filter this runoff.

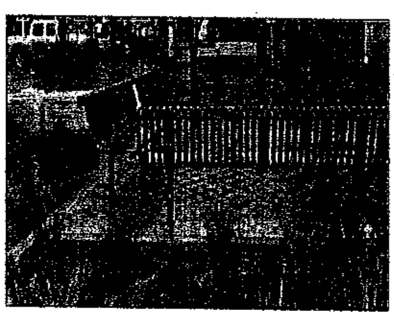
- Landscaped areas must be below the paved elevation. Allow an elevation change of 4 to 6 inches between the pavement and the soil, so that vegetation or mulch build-up does not block the flow.
- Grade the paved area to direct runoff towards the landscaping.
- If possible, provide a long path for runoff to infiltrate (while meeting the landscaped area sizing on page 1).
- Provide multiple access points for runoff to enter the landscape. Install curb cuts or separate wheel stops for the water to flow through. Provide cobbles or other permanent erosion control at points of concentrated flow.

Manage Runoff from Driveways/Small Paved Areas

Driveways, sidewalks, patios, walkways, and other small paved areas can offer creative opportunities to drain runoff to landscaping.

- Install landscape adjacent to the paved surface, and grade the paved area so runoff flows toward the landscaping.
- Landscaped areas must be below the paved elevation. Allow an elevation change of 4 to 6 inches between the pavement and the soil, so that vegetation or mulch build-up does not block the flow.
- Install cobbles or rocks where runoff enters the landscape to avoid erosion.
- Use sizing ratio described on page 1.
- Use drought-tolerant native or climate-adapted plants to reduce irrigation.





Design Checklist

- ☐ Maximize the use of landscaping and natural areas that already exist. Try to design new landscapes immediately adjacent to impervious surfaces.
- ☐ Water should flow evenly (without concentrating runoff into small streams) from the impervious surface to the landscape; this will maximize the filtration and settling of sediment and pollutants and prevent erosion. The design should avoid allowing straight channels and streams to form.
- ☐ Amend soils to improve drainage, when necessary.
- ☐ If the project is located next to standard asphalt or concrete pavement, and there is concern about water undermining the pavement, include a water barrier in the design.
- ☐ Use curb cuts to create places where water can flow through to the landscape.
- ☐ Disconnect roof downspouts and redirect flow to adjacent landscapes. Disconnected downspout systems should incorporate a splash block to slow the runoff flow rate; a landscape flow path length of 10 to 15 feet is recommended.
- ☐ Use drought-tolerant native or climate-adapted plant species whenever possible. Avoid invasive or pest species. A list of invasive species may be found at the California Invasive Plant Council website (www.cal-ipc.org). Contact municipal staff for a list of plants suitable for stormwater management areas.
- ☐ Design the landscape area so that overflow from large storms discharges to another landscaped area or the storm drain system to prevent flooding.

Maintain Your Landscape

The following practices will help maintain your landscape to keep it attractive and managing stormwater runoff effectively.

- ☐ During dry months, irrigate during the first year to encourage root growth and establish the plants. In subsequent years, irrigate as needed by the plant species to maintain plant health.
- ☐ Repair signs of erosion immediately and prevent further erosion by reinforcing the surrounding area with ground cover or using rocks for energy dissipation.
- ☐ If standing water remains in the landscaped area for more than 4 days, use soil amendments to improve infiltration.
- ☐ Inspect the locations where water flows into a landscaped area from adjacent pavement to ensure that there is positive flow into the landscape, and vegetation or debris does not block the entrance point.

The City of Los Angeles and Geosyntec Consultants are acknowledged for providing text, formatting and various images used in this fact sheet. The Sonoma Valley Groundwater Management Program, San Mateo Countywide Water Pollution Prevention Program, City of San Jose, Sacramento Stormwater Quality Partnership, and the Purissima Hills Water District are acknowledged for images used in the fact sheet.

RAIN GARDENS

Stormwater Control for Small Projects

Bay Area Stormwater Management Agencies Association

Large Residential Rain Garden

Rain gardens are landscaped areas designed to capture and treat rainwater that runs off roof and paved surfaces. Runoff is directed toward a depression in the ground, which is planted with flood and drought-resistant plants. As the water nourishes the plants, the garden stores, evaporates, and infiltrates rainwater into the soil. The soil absorbs runoff pollutants, which are broken down over time by microorganisms and plant roots.

Rain gardens are a relatively low-cost, effective, and aesthetically pleasing way to reduce the amount of stormwater that runs off your property and washes pollutants into storm drains, local streams, and the San Francisco Bay. While protecting water quality, rain gardens also provide attractive landscaping and habitat for birds, butterflies, and other animals, especially when planted with native plants.

Is a Rain Garden Feasible for My Project?

Rain gardens are appropriate where the following site characteristics are present:

- Rain gardens should be installed at least 10 feet from building foundations. The ground adjacent to the building should slope away at a 2% minimum slope. A downspout extension or "swale" (landscaped channel) can be used to convey rain from a roof directly into a rain garden. Rain gardens can also be located downstream from a rain barrel overflow path.
- Rain gardens should be at least 3 feet from public sidewalks (or have an appropriate impermeable barrier installed), 5 feet from property lines, and in an area where potential overflow will not run onto neighboring properties.
- The site should have well-drained soil and be relatively flat. Soil amendments can improve infiltration in areas with poor drainage. Add about 3 inches of compost to any soil type and till it in to a depth of about 12 inches.
- A front or backyard can work well for a rain garden, especially in areas where the slope naturally takes the stormwater.

How Large Does My Rain Garden Need to Be?

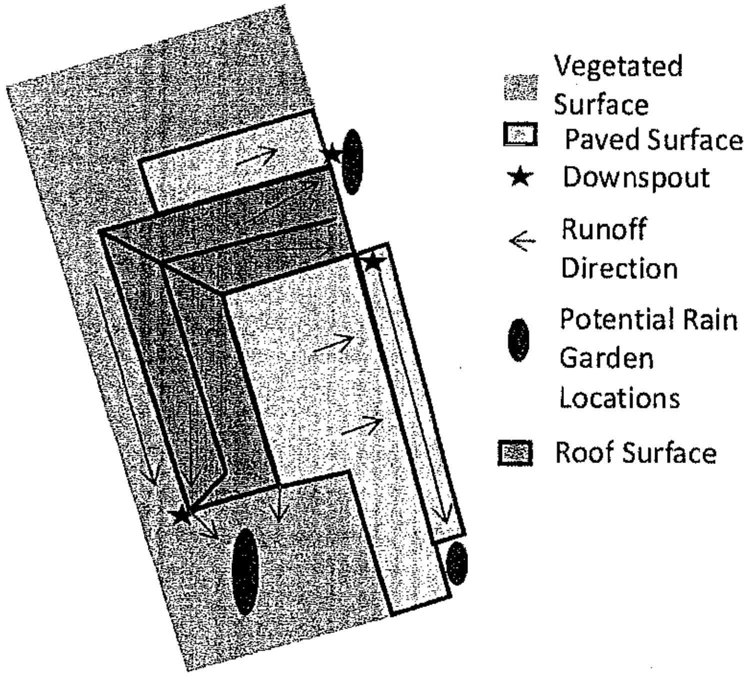
A general recommendation for a garden with a 6-inch ponding depth is to size the rain garden to approximately 4% of the contributing impervious area. Your soil type will affect how the rain garden should be sized because the water infiltration rate depends on the soil type; rain gardens should be larger in areas with slower infiltration. The following table can be used as general guidance.

Contributing Area (sq. ft.)	Rain Garden Area (sq. ft.)
500 – 700	24
701 – 900	32
901 – 1,100	40
1,101 – 1,300	48
1,301 – 1,500	56
1,501 – 2000*	70

*Projects adding roof or other impervious areas in excess of 2,000 sq. ft. should add 20 sq. ft. of rain garden surface area per every 500 sq. ft. of additional area.

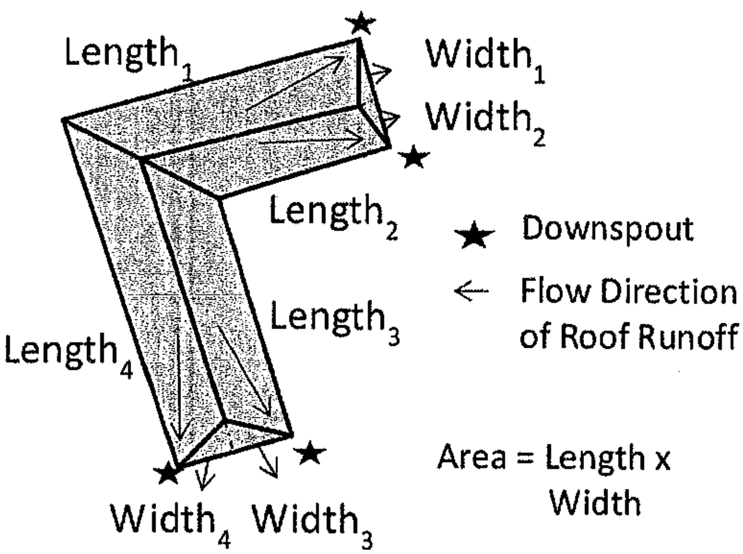
How to Plan and Install a Rain Garden

Select a Location and Plan for Overflow



- Before choosing the location of your rain garden, observe how rainwater is distributed across your home and yard. The ideal rain garden location is a flat or gently sloped area and is down slope from a runoff source.
- Site your garden at least 10 feet away from any structures (unless an impermeable barrier is used) and 5 feet from property lines.
- Avoid siting your garden over underground utilities and septic systems, near large trees, or next to a creek, stream or other water body.
- Your rain garden will overflow in large storms. Therefore, all garden designs should include an overflow system. One option is to build the perimeter of the garden so that it is perfectly level and to allow water to gently spill over the top during large storms. Another option is to build in a spillway that connects to another landscaped area, or the storm drain system.

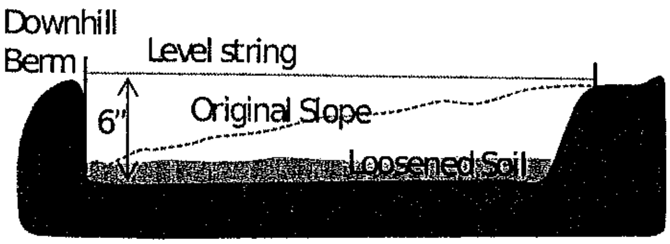
Plan the Size of Your Rain Garden



- Once you have determined where your garden will be sited, look at the surrounding area and identify which surfaces will contribute runoff to the garden. Is it all or just a part of the roof, patio, or driveway?
- Estimate the roof area by measuring the length and width of the building foundation and adding a few inches for the overhang. Multiply the length times the width to determine the contributing area. Once you have calculated the area of each contributing surface, add them up to obtain the total contributing area.
- Refer to the chart on page 1 to identify the size of the rain garden you will need to manage runoff from the contributing area.

If you do not have the space, budget, or interest in building a garden of this size, you may consider capturing some of your roof runoff in rain barrels to reduce the amount of runoff, or discharge the overflow to another landscaped area.

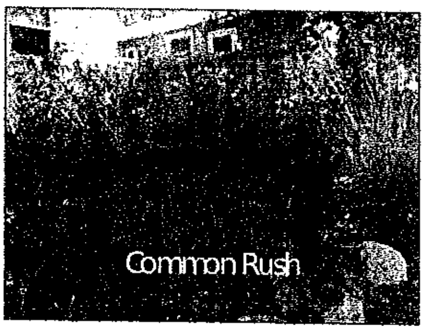
Install your Rain Garden



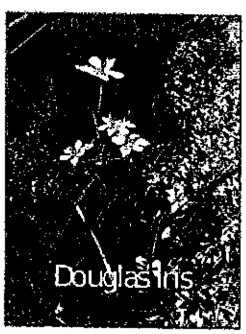
- Once you have selected a site and planned the size of your rain garden, lay out the shape using a string or tape to define the outline of where you will dig.
- If the yard is level, dig to a depth of 6-inches and slope the sides. If the site is sloped, you may need to dig out soil on the uphill side of the area and use the soil to construct a small berm (a compacted wall of soil) along the down slope side of the garden.
- Use a string level to help level the top of the garden and maintain an even 6-inch depth.
- Once the garden is excavated, loosen the soil on the bottom of the area so you have about 12 inches of soft soil for plants to root in. Mix in about 3 inches of compost to help the plants get established and improve the water-holding capacity of the soil.
- If water enters the garden quickly, include a layer of gravel or river rock at the entry points to prevent erosion.

Select Appropriate Plants


California Fuchsia


Common Rush


White Sage


Douglas Iris

You can design your rain garden to be as beautiful as any other type of garden. Select plants that are appropriate for your location and the extremes of living in a rain garden

Site Considerations:

- How much light will your garden receive?
- Is your property near the coast or located in an inland area (this affects sun and temperature)?
- Are there high winds near your home?

Recommended plant characteristics:

- Native plants adapted to local soil and climate,
- Drought tolerant,
- Flood tolerant,
- Not invasive weedy plants,
- Non-aggressive root systems to avoid damaging water pipes,
- Attracts birds and beneficial insects.

*Contact municipal staff to obtain a full list of recommended plants, provided in the countywide stormwater guidance.

Design Checklist

When installing a rain garden, the following design considerations are recommended.

- [ ] Locate the rain garden at least 10 feet from home foundation, 3 feet from public sidewalks, and 5 feet from private property lines. If rain gardens need to be located closer to buildings and infrastructure, use an impermeable barrier.
- [ ] Locate the rain garden to intercept and collect runoff from a roof downspout or adjacent impervious area.
- [ ] Size the rain garden appropriately based on the soil type and drainage area (see Page 1).
- [ ] Do not locate the rain garden over septic systems or shallow utilities. Locate utilities before digging by calling Underground Service Alert at 811 or (800) 227-2600.
- [ ] Locate the rain garden on a relatively flat area, away from steep slopes. If you plan on moving a large quantity of soil, you may need a grading permit. Contact your local municipality for further assistance.
- [ ] Consider installing an underdrain to enhance infiltration in very clayey soils. Contact municipal staff for guidance on how to properly install an underdrain.
- [ ] An overflow should been incorporated in the rain garden to move water that does not infiltrate to another pervious area and away from the home's foundation or neighboring property.
- [ ] Drought and flood resistant native plants are highly recommended and a variety of species should be planted. Avoid invasive plants. Contact municipal staff for a list of plants appropriate for rain gardens from the applicable countywide stormwater guidance. A list of invasive species may be found at the California Invasive Plant Council website (www.cal-ipc.org).

Maintenance Considerations

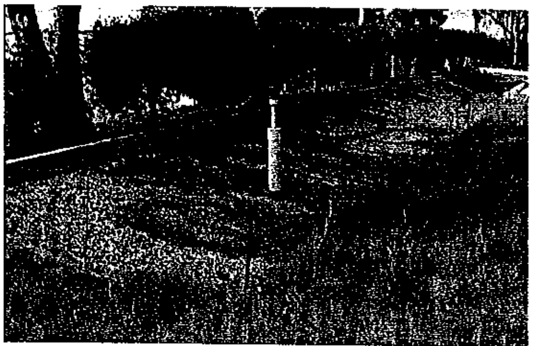
Once a rain garden is installed, the following steps will help the garden function effectively.♦

- [ ] Rain gardens should be irrigated periodically (as needed) during dry months, especially while plants are being established. Plants should be inspected for health and weeds should be removed as often as necessary.
- [ ] Apply about 2 inches of mulch and replace as needed. Mulch with a material that will not float away such as compost or a larger sized hardwood mulch (avoid microbark, for example).
- [ ] Areas of erosion should be repaired. Further erosion can be prevented by stabilizing the eroding soil with ground cover or using energy dispersion techniques (e.g., splashblock or cobbles) below downspouts.
- [ ] Avoid using synthetic fertilizers or herbicides in your rain garden because these chemicals are water pollutants.
- [ ] Standing water should not remain in a rain garden for more than 3 days. Extended periods of flooding will not only kill vegetation, but may result in the breeding of mosquitos or other vectors.

The City of Los Angeles and Geosyntec Consultants are acknowledged for providing text, formatting and various images used in this fact sheet. Contra Costa County is acknowledged for an image used in the fact sheet.

Infiltration Trench Maintenance Plan for De Anza Residences – APN 041-200-500

July 2014



An infiltration trench is a long, narrow, excavated trench backfilled with a stone aggregate, and lined with a filter fabric. Runoff is stored in the void space between the stones and infiltrates through the bottom and into the soil matrix.

Project Address and Cross Streets

De Anza Boulevard at Polhemus Road

Assessor's Parcel No.: 041-200-500

The property contains 3 infiltration trench(es), located as described below and as shown in the attached site plan.

- **Infiltration Trench No. 1** -3 are located at the front of the property fronting De Anza Boulevard

I. Routine Maintenance Activities

The principal maintenance objective is to prevent sediment buildup and clogging, which reduces pollutant removal efficiency and may lead to trench failure. Routine maintenance activities, and the frequency at which they will be conducted, are shown in Table 1.

Table 1
Routine Maintenance Activities for Infiltration Trenches

No.	Maintenance Task	Frequency of Task
1	Remove obstructions, debris and trash from infiltration trench and dispose of properly.	Monthly, or as needed after storm events
2	Inspect trench to ensure that it drains between storms, and within 5 days after rainfall. Check observation well 2-3 days after storm to confirm drainage.	Monthly during wet season, or as needed after storm events
3	Inspect filter fabric for sediment deposits by removing a small section of the top layer.	Annually
4	Monitor observation well to confirm that trench has drained during dry season.	Annually, during dry season
5	Mow and trim vegetation around the trench to maintain a neat and orderly appearance.	As needed
6	Remove any trash, grass clippings and other debris from the trench perimeter and dispose of properly.	As needed
7	Check for erosion at inflow or overflow structures.	As needed
8	Confirm that cap of observation well is sealed.	At every inspection
9	Inspect infiltration trench using the attached inspection checklist.	Monthly, or after large storm events, and after removal of accumulated debris or material

II. Prohibitions

Trees and other large vegetation shall be prevented from growing adjacent to the trench to prevent damage.

Standing water shall not remain in the treatment measures for more than five days, to prevent mosquito generation. Should any mosquito issues arise, contact the San Mateo County Mosquito Abatement District (SMCMAD), as needed for assistance. Mosquito larvicides shall be applied only when absolutely necessary, as indicated by the SMCMAD, and then only by a licensed professional or contractor. Contact information for SMCMAD is provided below.

III. Mosquito Abatement Contact Information

San Mateo County Mosquito Abatement District
1351 Rollins Road
Burlingame,CA 94010
PH:(650) 344-8592
FAX: (650) 344-3843
Email: info@smcmad.org

IV. Inspections

The attached Infiltration Trench Inspection and Maintenance Checklist shall be used to conduct inspections monthly (or as needed), identify needed maintenance, and record maintenance that is conducted.

Infiltration Trench
Inspection and Maintenance Checklist

Property Address: ______________________ Property Owner: ______________________

Treatment Measure No.: ________ Date of Inspection: ________ Type of Inspection: ☐ Monthly ☐ Pre-Wet Season ☐ After heavy runoff ☐ End of Wet Season ☐ Other:__________

Inspector(s): ______________________

Defect	Conditions When Maintenance Is Needed	Maintenance Needed? (Y/N)	Comments (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)	Results Expected When Maintenance Is Performed
1. Standing Water	When water stands in the infiltration trench between storms and does not drain within 5 days after rainfall.			There should be no areas of standing water once inflow has ceased. Any of the following may apply: sediment or trash blockages removed, improved grade from head to foot of infiltration trench, removed clogging at check dams, or added underdrains.
2. Trash and Debris Accumulation	Trash and debris accumulated in the infiltration trench.			Trash and debris removed from infiltration trench and disposed of properly.
3. Sediment	Evidence of sedimentation in trench. Less than 50% storage volume remaining in sediment traps, forebays or pretreatment swales.			Material removed and disposed of properly so that there is no clogging or blockage.
4. Inlet/Outlet	Inlet/outlet areas clogged with sediment or debris, and/or eroded.			Material removed and disposed of properly so that there is no clogging or blockage in the inlet and outlet areas.
5. Overflow Spillway	Clogged with sediment or debris, and/or eroded.			Material removed and disposed of properly so that there is no clogging or blockage, and trench is restored to design condition.
6. Filter Fabric	Annual inspection, by removing a small section of the top layer, shows sediment accumulation that may lead to trench failure.			Replace filter fabric, as needed, to restore infiltration trench to design condition.
7. Observation Well	Routine monitoring of observation well indicates that trench is not draining within specified time or observation well cap is missing.			Restore trench to design conditions. Observation well cap is sealed.
8. Miscellaneous	Any condition not covered above that needs attention in order for the infiltration trench to function as designed.			Meet the design specifications.

Stormwater Treatment Measure Operation and Maintenance Inspection Report to the City of San Mateo, California

This report and attached Inspection and Maintenance Checklists document the inspection and maintenance conducted for the identified stormwater treatment measure(s) subject to the Maintenance Agreement between the City and the property owner during the annual reporting period indicated below.

I. Property Information:

Property Address or APN: 041-200-500

Property Owner: Dan Tealdi

II. Contact Information:

Name of person to contact regarding this report:__________

Phone number of contact person:__________ Email:__________

Address to which correspondence regarding this report should be directed:

____

____

III. Reporting Period:

This report, with the attached completed inspection checklists, documents the inspections and maintenance of the identified treatment measures during the time period from __________ to __________.

IV. Stormwater Treatment Measure Information:

The following stormwater treatment measures (identified treatment measures) are located on the property identified above and are subject to the Maintenance Agreement:

Identifying Number of Treatment Measure	Type of Treatment Measure	Location of Treatment Measure on the Property

V. Summary of Inspections and Maintenance:

Summarize the following information using the attached Inspection and Maintenance Checklists:

Identifying Number of Treatment Measure	Date of Inspection	Operation and Maintenance Activities Performed and Date(s) Conducted	Additional Comments

VI. Sediment Removal:

Total amount of accumulated sediment removed from the stormwater treatment measure(s) during the reporting period: _________ cubic yards.

How was sediment disposed?

- ☐ landfill
- ☐ other location on-site as described in and allowed by the maintenance plan
- ☐ other, explain ____________________

VII. Inspector Information:

The inspections documented in the attached Inspection and Maintenance Checklists were conducted by the following inspector(s):

Inspector Name and Title	Inspector's Employer and Address

VIII. Certification:

I hereby certify, under penalty of perjury, that the information presented in this report and attachments is true and complete:

____________________________________ ________________

Signature of Property Owner or Other Responsible Party Date

____

Type or Print Name

____

Company Name

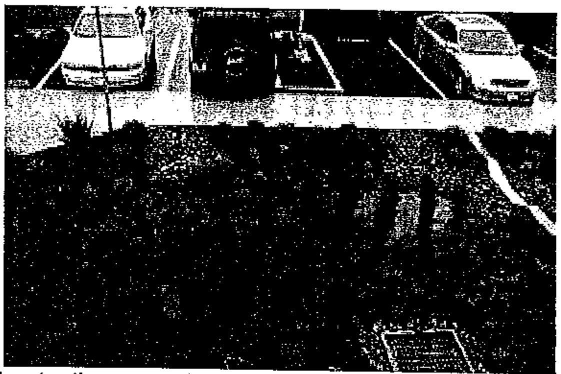
____

Address

Phone number:________________ Email:__________________________

Bioretention Area[1] Maintenance Plan for De Anza Residences

July 2014



Bioretention areas function as soil and plant-based filtration devices that remove pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants.

Project Address and Cross Streets

De Anza Boulevard at Polhemus Road

Assessor's Parcel No.: 041-200-500

Property Owner: Dan Tealdi

The property contains 3 bioretention area(s), located as described below and as shown in the attached site plan[2].

- **Bioretention Area No. 1-3 are loacated at the front of the propety (@ De Anaza Blvd.)**

I. Routine Maintenance Activities

The principal maintenance objective is to prevent sediment buildup and clogging, which reduces pollutant removal efficiency and may lead to bioretention area failure. Routine maintenance activities, and the frequency at which they will be conducted, are shown in Table 1.

Table 1
Routine Maintenance Activities for Bioretention Areas

No.	Maintenance Task	Frequency of Task
1	Remove obstructions, debris and trash from bioretention area and dispose of properly.	Monthly, or as needed after storm events
2	Inspect bioretention area to ensure that it drains between storms and within five days after rainfall.	Monthly, or as needed after storm events
3	Inspect inlets for channels, soil exposure or other evidence of erosion. Clear obstructions and remove sediment.	Monthly, or as needed after storm events
4	Remove and replace all dead and diseased vegetation.	Twice a year
5	Maintain vegetation and the irrigation system. Prune and weed to keep bioretention area neat and orderly in appearance.	Before wet season begins, or as needed
6	Check that mulch is at appropriate depth (3 inches per soil specifications) and replenish as necessary before wet season begins.	Monthly

[1] Bioretention areas include linear treatment measures designed to filter water through biotreatment soils. A bioretention area that has no waterproof liner beneath it and has a raised underdrain in the underlying rock layer to promote infiltration, as shown in Section 6.1 of the C.3 Technical Guidance, may also be called a "bioinfiltration area".
[2] Attached site plan must match the site plan exhibit to Maintenance Agreement.

Table 1 Routine Maintenance Activities for Bioretention Areas		
7	Inspect bioretention area using the attached inspection checklist.	Monthly, or after large storm events, and after removal of accumulated debris or material

II. Prohibitions

The use of pesticides and quick release fertilizers shall be minimized, and the principles of integrated pest management (IPM) followed:

1. Employ non-chemical controls (biological, physical and cultural controls) before using chemicals to treat a pest problem.
2. Prune plants properly and at the appropriate time of year.
3. Provide adequate irrigation for landscape plants. Do not over water.
4. Limit fertilizer use unless soil testing indicates a deficiency. Slow-release or organic fertilizer is preferable. Check with municipality for specific requirements.
5. Pest control should avoid harming non-target organisms, or negatively affecting air and water quality and public health. Apply chemical controls only when monitoring indicates that preventative and non-chemical methods are not keeping pests below acceptable levels. When pesticides are required, apply the least toxic and the least persistent pesticide that will provide adequate pest control. Do not apply pesticides on a prescheduled basis.
6. Sweep up spilled fertilizer and pesticides. Do not wash away or bury such spills.
7. Do not over apply pesticide. Spray only where the infestation exists. Follow the manufacturer's instructions for mixing and applying materials.
8. Only licensed, trained pesticide applicators shall apply pesticides.
9. Apply pesticides at the appropriate time to maximize their effectiveness and minimize the likelihood of discharging pesticides into runoff. With the exception of pre-emergent pesticides, avoid application if rain is expected.
10. Unwanted/unused pesticides shall be disposed as hazardous waste.

Standing water shall not remain in the treatment measures for more than five days, to prevent mosquito generation. Should any mosquito issues arise, contact the San Mateo County Mosquito Abatement District (SMCMAD), as needed for assistance. Mosquito larvicides shall be applied only when absolutely necessary, as indicated by the SMCMAD, and then only by a licensed professional or contractor. Contact information for SMCMAD is provided below.

III. Mosquito Abatement Contact Information

San Mateo County Mosquito Abatement District
1351 Rollins Road
Burlingame,CA 94010
PH:(650) 344-8592
FAX: (650) 344-3843
Email: info@smcmad.org

IV. Inspections

The attached Bioretention Area Inspection and Maintenance Checklist shall be used to conduct inspections monthly (or as needed), identify needed maintenance, and record maintenance that is conducted.

Bioretention Area
Inspection and Maintenance Checklist

Property Address: ______________________ Property Owner: ______________________

Treatment Measure No.: __________ Date of Inspection: __________ Type of Inspection: ☐ Monthly ☐ Pre-Wet Season ☐ After heavy runoff ☐ End of Wet Season ☐ Other:__________

Inspector(s): ______________________

Defect	**Conditions When Maintenance Is Needed**	**Maintenance Needed? (Y/N)**	**Comments** (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)	**Results Expected When Maintenance Is Performed**
1. Standing Water	When water stands in the bioretention area between storms and does not drain within five days after rainfall.			There should be no areas of standing water once inflow has ceased. Any of the following may apply: sediment or trash blockages removed, improved grade from head to foot of bioretention area, or added underdrains.
2. Trash and Debris Accumulation	Trash and debris accumulated in the bioretention area.			Trash and debris removed from bioretention area and disposed of properly.
3. Sediment	Evidence of sedimentation in bioretention area.			Material removed so that there is no clogging or blockage. Material is disposed of properly.
4. Erosion	Channels have formed around inlets, there are areas of bare soil, and/or other evidence of erosion.			Obstructions and sediment removed so that water flows freely and disperses over a wide area. Obstructions and sediment are disposed of properly.
5. Vegetation	Vegetation is dead, diseased and/or overgrown.			Vegetation is healthy and attractive in appearance.
6. Mulch	Mulch is missing or patchy in appearance. Areas of bare earth are exposed, or mulch layer is less than 3 inches in depth.			All bare earth is covered, except mulch is kept 6 inches away from trunks of trees and shrubs. Mulch is even in appearance, at a depth of 3 inches.
7. Miscellaneous	Any condition not covered above that needs attention in order for the bioretention area to function as designed.			Meet the design specifications.

Alcon Engineering
1125 Byron St.
Palo Alto, CA
364-3832

Site Hydrologic Analysis :

Purpose:

Determine the post-construction site runoff to be treated via bioretention areas and / or infiltration trenches located downslope from new proposed houses.

Calculations:

Design of stormwater treatment measures is based upon runoff flow analysis.

Hydrologic Parameters:

A = site area, acres

I = Rainfall Intensity (k/T_c^n) (actual factor taken from data provided by San Mateo DPW)

C = Runoff coefficient (weighted average of site, coefficients taken from San Mateo County DPW data)

k = Regional Constant (function of event return period and mean annual precipitation)

t_c = Time for runoff concentration (small site, use t_c = 10 min w/ 1.75 factor).

n = dependent upon mean annual precipitation

F = Intensity Factor (from San Mateo County DPW map)

Q = CIAF site runoff rate

Determine Site Post Construction Characteristics and Runoff Coefficients:

Total Site Watershed Area:

$Wshed_{total} := 21000$ sq.ft. total watershed area to new treatment features

Post Construction Areas:

$PC_{impervious} := 8590$ sqft. post construction impervious area

$PC_{pervious} := 12410$ sqft., post construction impervious area

Determine Average Runoff Coefficient:

$$c_{com} := \frac{PC_{impervious} \cdot 0.8 + PC_{pervious} \cdot 0.1}{Wshed_{total}}$$

$c_{com} = 0.386$ composite post construction site coefficient to be used for design of treatment systems

REGISTERED PROFESSIONAL ENGINEER STEVE DIVICH No: C042024 Exp 3/31/16 CIVIL STATE OF CALIFORNIA

Size Bioretention Areas:

Determine Effective Impervious Area:

$A_{eff} := \frac{Wshed_{total} \cdot c_{com}}{0.8}$ $\quad$ $A_{eff} = 10141.25$ $\quad$ sqft., total effective impervious design area

Then:

$i_{wq} := 0.2$ $\quad$ in/hr $\quad$ rain intensity

$Q_{wq} := 0.8 \cdot A_{eff} \cdot i_{wq} \cdot \frac{1}{12}$ $\quad$ $Q_{wq} = 135.217$

Determine Bioretention Area:

$V_{bf} := 5$ $\quad$ in./hr. infiltration rate $\quad$ $C_{impervious} := 0.8$

Then

$A_{bf} := \frac{Q_{wq}}{V_{bf}} \cdot 12 \cdot \frac{1}{C_{impervious}}$ $\quad$ $A_{bf} = 405.65$ $\quad$ < 4% watershed area (21,000 x 0.04= 840 sq. ft, controls)

Assume 40% Effective Area for Bioretention / Infiltration

$A_{bfReqd} := \frac{A_{bf}}{0.4}$ $\quad$ $A_{bfReqd} = 1014.125$ $\quad$ sqft., required area for Bioretention

Area Provided per Plans:

$A_{provided} := 1400$ $\quad$ sqft. > 1,014 sq.ft -adequate.