



TRINITY VALLEY CONSULTING ENGINEERS, INC

Engineering – Surveying – Land Planning – Construction Management

DRAINAGE REPORT

Proposed Subdivision
1820 Pickett Road
McKinleyville 95519
County of Humboldt
California
APN: 510-381-021

Report Provided For:

Dane Valadao
3848 E Street
Eureka, CA 95503

Report Provided By:

Trinity Valley Consulting Engineers, Inc.
Post Office Box 1567
Willow Creek, California 95573
(530) 629-3000

Date: February 2021
Revised: December 2023

Project Number: 873.01



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Introduction:

Trinity Valley Consulting Engineers, Inc. (TVCE) was secured by Mr. Dane Valadao to perform a drainage report for the proposed project. The following is an outline of our findings and recommendations.

Project Site Location:

The project site is in a portion of Section 32, of Township 6 North, Range 1 East of Humboldt Meridian, in the town of McKinleyville, in the County of Humboldt, and State of California (see Attachment 1, Location Map). The Assessor Parcel Number (APN) for the property is 509-114-016.

Project Site Conditions:

The existing site is mainly manicured lawn with a single residence, single garage, and storage shed located in the center of the parcel. Paved access is from G Lane to the east. The parcel is bordered by Pickett Road to the north and Gwin Road to the south. Existing stormwater drainage inlets have not been identified in the immediate area.

Relief of the project area slopes to the north. Slopes onsite are nearly flat (less than 1%), and stormwater flows as overland flow and eventually onto Pickett Road (see Attachment 2, Drainage Map). Pickett road drainage consists a roadside swale along the south border and a curb and gutter along the north.

Proposed Project:

The proposed project is to subdivide the existing parcel into approximately twenty (20) lots. The center lot will consist of the existing home and garage. The existing garage may need to be moved in order to accommodate the development. The remaining lots will be developed with single and multi-family residences. New access for this development will consist of a paved two-lane road from Gwin Road to Pickett Road. Grading for each site will consist of construction of access roadways and building pads. Building pads will generally be constructed of standard cut/fill bench construction. All utilities will be trenched underground.

Runoff Calculations:

Calculations were performed for the entire site in order to determine the amount of increase in runoff from the property after the development of the

property is complete (see attached calculations, Attachment 3).

For these calculations the following constraints and assumptions were utilized:

Pre-development constraints

Design Storm Event (year): 100
Design Storm Duration (hr): 1
Pervious Surface (Acres): 2.65
Impervious Surface (Acres): 0.09

Post Development constraints

Design Storm Event (year): 100
Design Storm Duration (hr): 1
Pervious Surface (Acres): 1.01
Impervious Surface (Acres): 1.73

Runoff coefficient: The runoff coefficient was determined to be 0.23 pre-development and 0.64 post-development. These numbers were calculated based on the existing conditions, area of roadway surfaces, and assumed area of roof cover at total buildout. Proposed roof areas were calculated by utilizing the preliminary plans for each unit including overhangs and parking areas. Allowance was made for sidewalks and any other hardscapes. The proposed development also incorporates permeable asphalt in the parking stalls.

Calculations showed an increase of 3.38 cubic feet per second (cfs) runoff as a result of the proposed development during a 100-year event. Per this method and the McKinleyville Drainage Plan, the minimum retention volume shall be 4,873 cubic feet (36,452 gallons).

Design Measures:

Primary design measures for treating and handling stormwater include and are not limited to: self-retaining areas, landscaping, tree planting, rain barrels, natural buffers, preservation of existing vegetation, permeable paving and reduction to impervious surfaces. In addition to these basic design measures, there are two other major design measures that a project must consider: bioretention, and subsurface infiltration. Both are explained in greater detail below:



Option 1:

Bioretention uses vegetation and soil, or engineered media, to promote stormwater treatment through filtration and storage. Bioretention utilizes bermed or excavated areas to create a basin to capture runoff. They can be adjacent to impervious areas within parking lot landscaping, along roadsides, and in open spaces to allow stormwater runoff to flow into the retention area either as sheet flow or as an end of pipe system that receives concentrated flows (e.g., from a culvert system or rock lined ditch). Bioretention is used for treating stormwater runoff from project pavement areas (e.g., roadways, parking lots, maintenance facilities, etc.) that contain pollutants of concern. Infiltration (in facilities without a liner), filtration (in facilities with a liner), sedimentation, adsorption to soil particles, biochemical processes, and plant uptake are the primary means for pollutant removal and treatment.

During a storm, runoff enters the Bioretention causing the water level in the basin to rise. During the rainfall, and for some time after it ends, the runoff infiltrates into the soil or engineered media through the invert area which is sized based upon the water treatment volume, the permeability of the soil below the invert, and the time period selected for infiltration. It is preferred that events greater than the design storm event be bypassed around the facility to preserve infiltration capacity and to prevent erosion or scour. Flows greater than the design storm event can be passed through the facility, typically over a spillway through the confining berm or through an overflow riser, when necessary.

Option 2:

Subsurface stormwater infiltration is a stormwater management technique that involves collecting rainwater then allowing it to percolate into the ground rather than runoff into surface waters. Like bioretention, this option can improve water quality by filtering contaminants from stormwater as it passes through the soil.

By reducing surface runoff and potential flooding, subsurface infiltration can contribute to the creation of aesthetically pleasing landscapes and recreational spaces. This can enhance the overall quality of life for residents in a development.

Lastly, subsurface infiltration helps mimic natural hydrological processes by allowing water to gradually percolate into the ground. This preserves the natural flow patterns and reduces the disruption caused by conventional stormwater management practices.

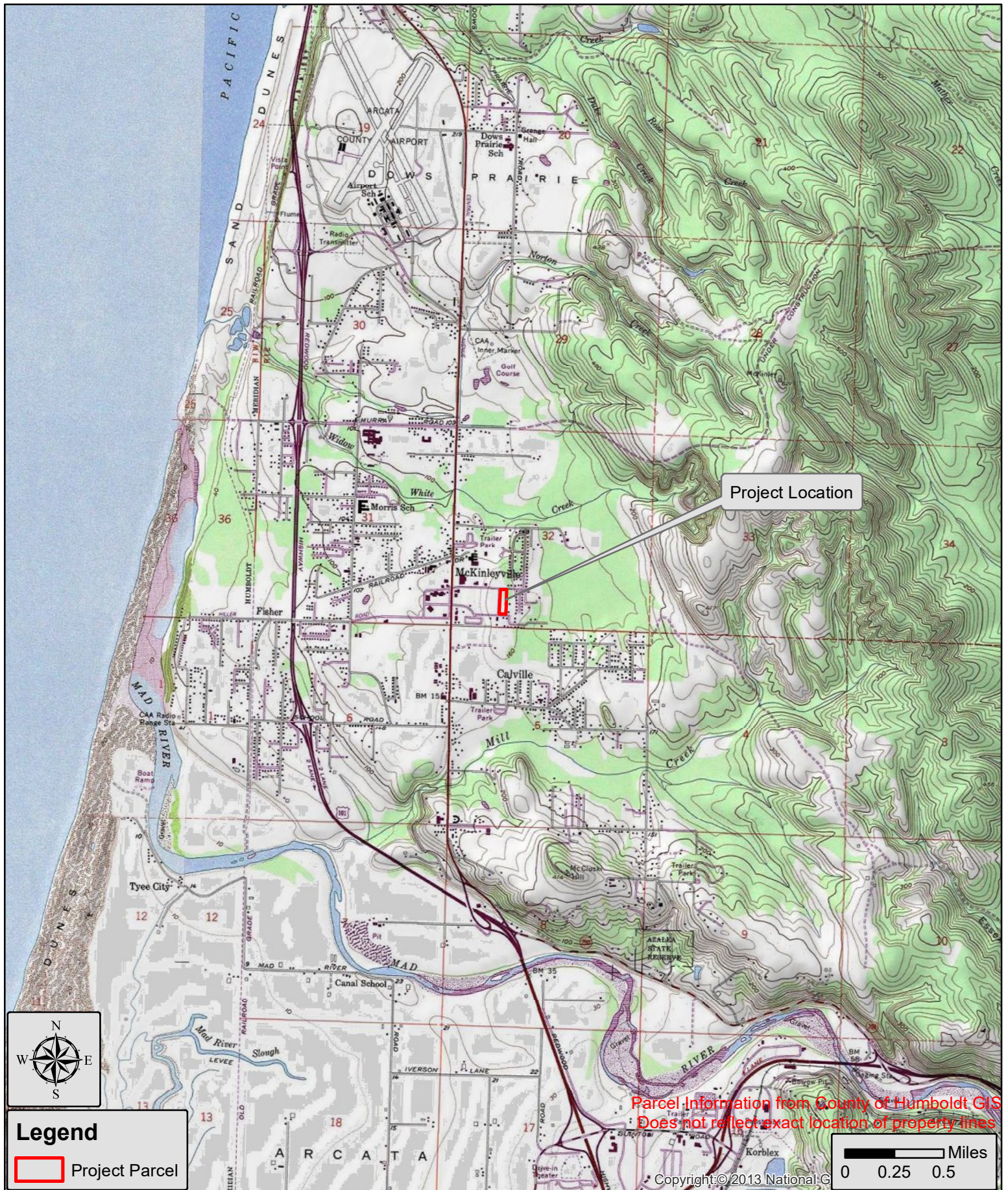
Conclusion:

Based upon the review of the site plan, preliminary drainage plan, and runoff calculations, stormwater flows from the proposed development can be accommodated within the property boundary through the use of self-retaining areas, landscaping, subsurface infiltration and bioretention strategically placed on the property.



Attachment 1:

Location Map



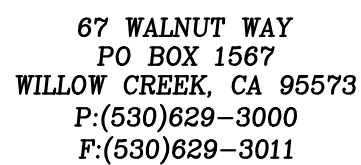
Valadao Proposed Subdivision
 APN: 510-381-021
 1820 Pickett Road
 McKinleyville, CA 95519

Location Map



Attachment 2:

Drainage Map



REV	DATE	DESCRIPTION	DOWN BY	DESS BY	CHK BY	APP BY
A	12/12/23	REVISED LOT LID VALUES PER AGENCY REVIEW	NRC	EEL	EEL	JTM

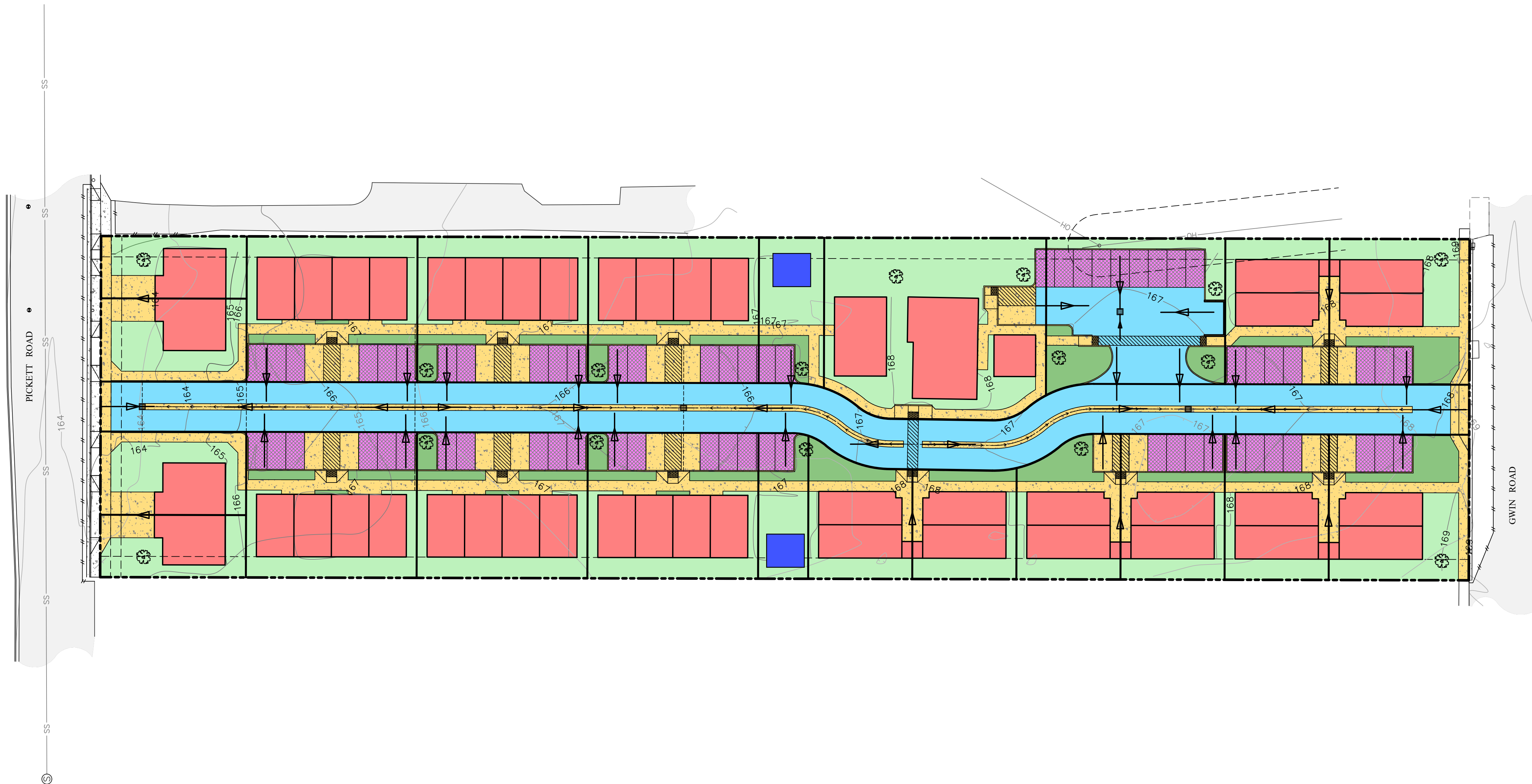
LID PLAN

HUMBOLDT, CALIFORNIA

DRAWING NO:



SCALE: 1" = 30'



1. **STREAM SETBACK AND BUFFERS:**
A STREAM SETBACK OR BUFFER IS AN AREA ALONG A SHORELINE, WETLAND, OR STREAM WHERE DEVELOPMENT IS RESTRICTED OR PROHIBITED. THE PRIMARY FUNCTION OF SETBACKS AND BUFFERS IS TO PHYSICALLY PROTECT AND SEPARATE A STREAM, LAKE OR WETLAND FROM FUTURE DISTURBANCE OR ENVOICHMENT. IF PROPERLY DESIGNED, SETBACKS AND BUFFERS CAN PROVIDE STORM WATER MANAGEMENT AND ACT AS A RIGHT-OF-WAY DURING FLOODS, SUSTAINING THE INTEGRITY OF STREAM ECOSYSTEMS AND HABITATS.
2. **SOIL QUALITY IMPROVEMENT**
IN AREAS SUBJECT TO GRADING/CLEARING NOT COVERED BY IMPERVIOUS SURFACE, CREATE/AMEND PERVIOUS AREAS WITH A 12" LAYER OF TOPSOIL. SOIL QUALITY IMPROVEMENT OPTIONS INCLUDE THE FOLLOWING:

OPTION 1: LEAVE NATIVE VEGETATION AND SOIL UNDISTURBED AND PROTECT FROM COMPACTION DURING CONSTRUCTION IDENTIFY AREAS OF THE SITE THAT WILL NOT BE STRIPPED, LOGGED, GRADED, OR DRIVEN ON, AND FENCE OFF THOSE AREAS TO PREVENT IMPACTS DURING CONSTRUCTION. IF NEITHER SOILS NOR VEGETATION ARE DISTURBED, THESE AREAS DO NOT REQUIRE AMENDMENT.






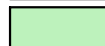



OPTION 2: AMEND EXISTING SITE TOPSOIL OR SUBSOIL.
SCARIFY OR TILL SUBGRADE TO 8 INCH DEPTH (OR TO DEPTH NEEDED TO ACHIEVE A TOTAL DEPTH OF 12 INCHES OF UN-COMPACTED SOIL AFTER CALCULATED AMOUNT OF AMENDMENT IS ADDED). ENTIRE SURFACE SHOULD BE DISTURBED BY SCARIFICATION. AMEND SOIL TO MEET DESIRED ORGANIC CONTENT.

OPTION 3: STOCKPILE EXISTING TOPSOIL DURING GRADING. REPLACE TOPSOIL BEFORE PLANTING. STOCKPILE AND COVER SOIL WITH WEED BARRIER MATERIAL THAT SHEDS MOISTURE YET ALLOWS AIR TRANSMISSION. STOCKPILE TOPSOIL PRIOR TO PLANTING AND ENSURE THAT REPLACED SOIL PLUS ADDITIONAL COMPOST AS NEEDED WILL AMOUNT TO AT LEAST 12 INCHES OF DEPTH.

3. TREE PLANTING AND PRESERVATION
TREES INTERCEPT RAIN WATER ON THEIR LEAVES AND BRANCHES, ALLOWING WATER TO EVAPORATE OR RUN DOWN THE BRANCHES AND TRUNK WHERE IT READILY INFILTRATES INTO THE SOIL. TREE ROOTS ALSO INCREASE INFILTRATION OF THE SOIL.
4. ROOFTOP AND IMPERVIOUS AREA DISCONNECTION
DISCONNECTION OF ROOFTOP AND IMPERVIOUS AREAS FROM THE STORM DRAIN SYSTEM HELPS REDUCE RUNOFF AND PROVIDE POLLUTANT REMOVAL AS THE RE-DIRECTED WATER TRAVELS OVER AND THROUGH VEGETATION AND SOIL INSTEAD OF BEING DIRECTLY PIPED AND DISCHARGED INTO THE STORM DRAIN. ROOF RUNOFF IS DIRECTED TO SPREAD OVER A PERVIOUS AREAS SUCH AS A STREAM SETBACK AND BUFFERS, AREAS OF SOIL QUALITY IMPROVEMENT, OR OTHER APPROPRIATE INFILTRATION AREAS.
5. PERVIOUS PAVEMENT
THIS OPTION CAN BE EASY TO INSTALL AND MAINTAIN, COST EFFECTIVE, AND CAN ADD AESTHETIC VALUE TO YOUR PROJECT. PERMEABLE PAVEMENTS MAY INCLUDE PERVIOUS CONCRETE, PERVIOUS ASPHALT, POROUS PAVERS, CRUSHED AGGREGATE, OPEN PAVERS WITH GRASS OR PLANTINGS, OPEN PAVERS WITH GRAVEL, OR SOLID PAVERS.
6. GREEN ROOFS
A GREEN ROOF IS A MULTI-LAYERED, VEGETATED ROOFTOP SYSTEM DESIGN FOR FILTERING, ABSORBING, AND RETAINING STORM WATER. A GREEN ROOF CAPTURES STORM WATER WITHIN THE PORE SPACE OF THE GROWTH MEDIUM AND THEN RELEASES THE WATER SLOWLY VIA EVAPORATION, TRANSPIRATION, AND DISCHARGE TO THE ROOF DRAINS.
7. VEGETATED SWALES
A VEGETATED SWALE IS A BROAD, SHALLOW CHANNEL WITH DENSE VEGETATION COVERING THE BOTTOM AND SIDE SLOPES. VEGETATION IN THE CHANNEL PROVIDES FILTRATION AND SOLIDS REMOVAL AND REDUCES FLOW VELOCITIES AS STORM WATER IS CONVEYED THROUGH THE SYSTEM. DEPENDING ON SOIL TYPE, SOME INFILTRATION MAY ALSO OCCUR, DECREASING RUNOFF VOLUME AND PROVIDING ADDITIONAL FILTRATION.

DOWNSPOUTS:

1. DIRECT DOWNSPOUT RAINWATER AWAY FROM BUILDING TO PREVENT SATURATION OF FOUNDATION.
2. PROVIDE SPLASH BLOCKS OR OTHER MEANS TO PREVENT SOIL EROSION.
3. DOWNSPOUT RAINWATER SHALL NOT DISCHARGE ONTO A SIDEWALK. CONTRACTOR TO PROVIDE UNDER-WALK DRAINS IN THESE AREAS.

ON-SITE LID LEGEND		
	IMPERVIOUS ASPHALT	16,733 SF
	IMPERVIOUS CONCRETE	19,139 SF
	IMPERVIOUS ROOF SURFACING	29,484 SF
	PERMEABLE ASPHALT	10,236 SF
	PERVIOUS LANDSCAPING	25,163 SF
	SELF RETAINING AREA	6,985 SF
	ROOF DRAIN	
	TREE	17 EA
	BIORETENTION	
	IMPERVIOUS SURFACE TOTALS:	65,356 SF
	PERVIOUS SURFACE TOTALS:	42,384 SF





Attachment 3:

Stormwater Runoff Calculations



Project: Proposed Subdivision
Date: 12/18/2023
Client: Dane Valadao
Address: 1820 Pickett Road
McKinleyville, CA

Project No: 873
APN: 510-381-021
By: E. Keyes
Check By: J. McKnight
Sheet: 1 of 3

HYDRAULIC CALCULATIONS - PRE-DEVELOPMENT

Summary

Drainage Area #1

Q ₁₀₀	5.25 cfs	Post Development	See Page 3
Q ₂	1.87 cfs	Pre development	See Page 2
Difference	3.38 cfs	increase	

Conversions

60 sec/min
60 min/hour
24 hours/day
7.48 gal/cf

Total	4873 cf	Minimum Detention Volume
Total	36452 gallons	for 24 Hour Storm Event



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HYDRAULIC CALCULATIONS - PRE-DEVELOPMENT

Determination of Runoff Coefficients, C

Area Number	Total Area (acres)	Area _{ground}	Area _{impervious}	C _{ground}	C _{impervious}	C _{adjusted}
1	2.74	2.65	0.09	0.2	0.98	0.23

100-Year Runoff Flow Rates

Area Number	L	H	S	T _c	C	i ₁₀₀	Q ₂
1	0.131	6	0.01	0.167	0.23	2.9	1.87

A = area of runoff in acres

C = Runoff Coefficient per McKinleyville Drainage report

L = Overland Travel Distance in miles

S = Slope in ft/ft

T_c = Time of Concentration in Minutes (California Culvert Method)

$$T_c = \frac{((11.9L^3)/H)^{0.385}}{(0.167 \text{ hours minimum})}$$

i₁₀₀ = rainfall intensity for a 100-year storm event (in/hour)

Q = Water flow rate in cubic feet per second

$$Q_2 = 1.04 * C_{i_{100}} A \quad \text{Rational Method with 1.04 adjustment factor}$$



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HYDRAULIC CALCULATIONS - POST-DEVELOPMENT

Determination of Runoff Coefficients, C

Area Number	Total Area (acres)	Area _{ground}	Area _{impervious}	C _{ground}	C _{impervious}	C _{adjusted}
1	2.74	1.01	1.73	0.2	0.89	0.64

100-Year Runoff Flow Rates

Area Number	L	H	S	T _c	C	i ₁₀₀	Q
1	0.131	6	0.01	0.167	0.64	2.9	5.25
Flow Difference (cfs) :							3.38

A = area of runoff in acres

C = Runoff Coefficient per McKinleyville Drainage Report

L = Overland Travel Distance in miles

S = Slope in ft/ft

T_c = Time of Concentration in Minutes (California Culvert Method)

$$T_c = \frac{((11.9L^3)/H)^{0.385}}{(0.167 \text{ hours minimum})}$$

i₁₀₀ = rainfall intensity for a 100-year storm event (in/hour)

Q = Water flow rate in cubic feet per second

$$Q_{100} = 1.04 \cdot C i_{100} A \quad \text{Reational Method with 1.04 adjustment factor}$$



Attachment 4:

IDF Intensity Chart



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aeriels](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.135 (0.118-0.155)	0.169 (0.148-0.195)	0.216 (0.189-0.251)	0.258 (0.223-0.301)	0.318 (0.265-0.387)	0.369 (0.299-0.459)	0.423 (0.334-0.541)	0.483 (0.369-0.638)	0.570 (0.415-0.790)	0.643 (0.451-0.927)
10-min	0.193 (0.169-0.223)	0.242 (0.212-0.279)	0.310 (0.270-0.359)	0.370 (0.319-0.432)	0.456 (0.379-0.555)	0.528 (0.429-0.658)	0.606 (0.478-0.776)	0.692 (0.528-0.914)	0.817 (0.595-1.13)	0.922 (0.646-1.33)
15-min	0.234 (0.205-0.269)	0.292 (0.256-0.337)	0.375 (0.327-0.434)	0.447 (0.386-0.522)	0.552 (0.459-0.671)	0.639 (0.518-0.795)	0.733 (0.578-0.939)	0.836 (0.639-1.11)	0.988 (0.720-1.37)	1.11 (0.781-1.61)
30-min	0.313 (0.274-0.361)	0.392 (0.343-0.452)	0.503 (0.438-0.582)	0.599 (0.518-0.700)	0.740 (0.615-0.899)	0.856 (0.695-1.07)	0.983 (0.775-1.26)	1.12 (0.857-1.48)	1.32 (0.965-1.84)	1.49 (1.05-2.15)
60-min	0.439 (0.385-0.506)	0.550 (0.481-0.634)	0.705 (0.615-0.816)	0.840 (0.726-0.982)	1.04 (0.862-1.26)	1.20 (0.974-1.50)	1.38 (1.09-1.76)	1.57 (1.20-2.08)	1.86 (1.35-2.57)	2.10 (1.47-3.02)
2-hr	0.677 (0.593-0.780)	0.831 (0.727-0.959)	1.05 (0.913-1.21)	1.23 (1.07-1.44)	1.50 (1.25-1.83)	1.73 (1.40-2.15)	1.97 (1.55-2.52)	2.23 (1.70-2.94)	2.61 (1.90-3.61)	2.92 (2.04-4.20)
3-hr	0.877 (0.768-1.01)	1.07 (0.934-1.23)	1.33 (1.16-1.54)	1.56 (1.35-1.83)	1.89 (1.57-2.30)	2.16 (1.75-2.69)	2.45 (1.93-3.14)	2.76 (2.11-3.65)	3.21 (2.34-4.45)	3.58 (2.51-5.16)
6-hr	1.35 (1.18-1.56)	1.63 (1.43-1.88)	2.01 (1.76-2.33)	2.34 (2.02-2.73)	2.80 (2.33-3.41)	3.18 (2.58-3.95)	3.57 (2.82-4.57)	4.00 (3.05-5.28)	4.60 (3.35-6.38)	5.09 (3.57-7.34)
12-hr	2.01 (1.76-2.32)	2.43 (2.13-2.80)	2.99 (2.61-3.46)	3.46 (2.99-4.05)	4.12 (3.42-5.01)	4.64 (3.77-5.78)	5.18 (4.09-6.64)	5.76 (4.40-7.61)	6.56 (4.78-9.10)	7.21 (5.05-10.4)
24-hr	2.92 (2.61-3.33)	3.55 (3.17-4.05)	4.38 (3.91-5.01)	5.07 (4.48-5.84)	6.00 (5.16-7.13)	6.74 (5.68-8.16)	7.49 (6.17-9.27)	8.28 (6.65-10.5)	9.36 (7.24-12.3)	10.2 (7.66-13.9)
2-day	3.94 (3.52-4.49)	4.81 (4.30-5.49)	5.95 (5.30-6.81)	6.87 (6.08-7.92)	8.12 (6.97-9.64)	9.07 (7.65-11.0)	10.0 (8.28-12.4)	11.0 (8.88-14.0)	12.4 (9.60-16.4)	13.5 (10.1-18.3)
3-day	4.62 (4.13-5.26)	5.67 (5.06-6.47)	7.01 (6.25-8.03)	8.10 (7.17-9.34)	9.57 (8.22-11.4)	10.7 (9.00-12.9)	11.8 (9.73-14.6)	13.0 (10.4-16.4)	14.5 (11.2-19.1)	15.7 (11.8-21.4)
4-day	5.19 (4.65-5.92)	6.39 (5.71-7.30)	7.92 (7.06-9.06)	9.15 (8.10-10.5)	10.8 (9.27-12.8)	12.0 (10.1-14.6)	13.3 (11.0-16.4)	14.6 (11.7-18.5)	16.3 (12.6-21.4)	17.6 (13.2-23.9)
7-day	6.57 (5.88-7.49)	8.13 (7.26-9.28)	10.1 (9.00-11.6)	11.7 (10.3-13.4)	13.7 (11.8-16.3)	15.3 (12.9-18.5)	16.8 (13.9-20.8)	18.4 (14.8-23.3)	20.5 (15.8-27.0)	22.0 (16.5-30.0)
10-day	7.63 (6.83-8.70)	9.47 (8.46-10.8)	11.8 (10.5-13.5)	13.6 (12.0-15.7)	16.0 (13.7-19.0)	17.7 (14.9-21.5)	19.5 (16.1-24.1)	21.2 (17.1-27.0)	23.5 (18.2-31.0)	25.3 (19.0-34.4)
20-day	10.4 (9.32-11.9)	12.9 (11.6-14.8)	16.0 (14.3-18.3)	18.4 (16.3-21.2)	21.5 (18.5-25.6)	23.7 (20.0-28.8)	25.9 (21.4-32.1)	28.1 (22.6-35.7)	30.9 (23.9-40.7)	32.9 (24.7-44.8)
30-day	13.0 (11.6-14.8)	16.1 (14.4-18.3)	19.8 (17.7-22.7)	22.7 (20.1-26.2)	26.4 (22.7-31.3)	29.0 (24.4-35.1)	31.5 (26.0-39.0)	34.0 (27.3-43.2)	37.2 (28.8-49.0)	39.5 (29.6-53.8)
45-day	16.7 (15.0-19.1)	20.6 (18.5-23.6)	25.3 (22.6-29.0)	28.9 (25.6-33.3)	33.3 (28.6-39.6)	36.5 (30.7-44.1)	39.4 (32.5-48.8)	42.3 (34.0-53.7)	46.0 (35.6-60.6)	48.6 (36.5-66.2)
60-day	19.9 (17.8-22.7)	24.4 (21.8-27.9)	29.8 (26.6-34.1)	33.8 (29.9-39.0)	38.8 (33.3-46.1)	42.3 (35.6-51.2)	45.6 (37.6-56.4)	48.7 (39.1-61.8)	52.7 (40.7-69.4)	55.5 (41.6-75.5)

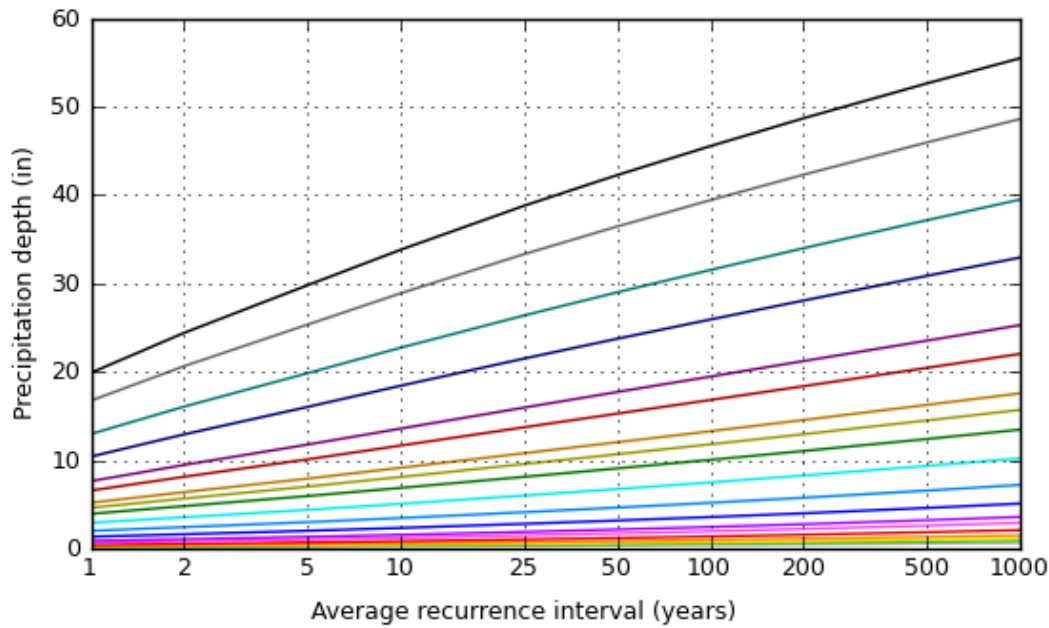
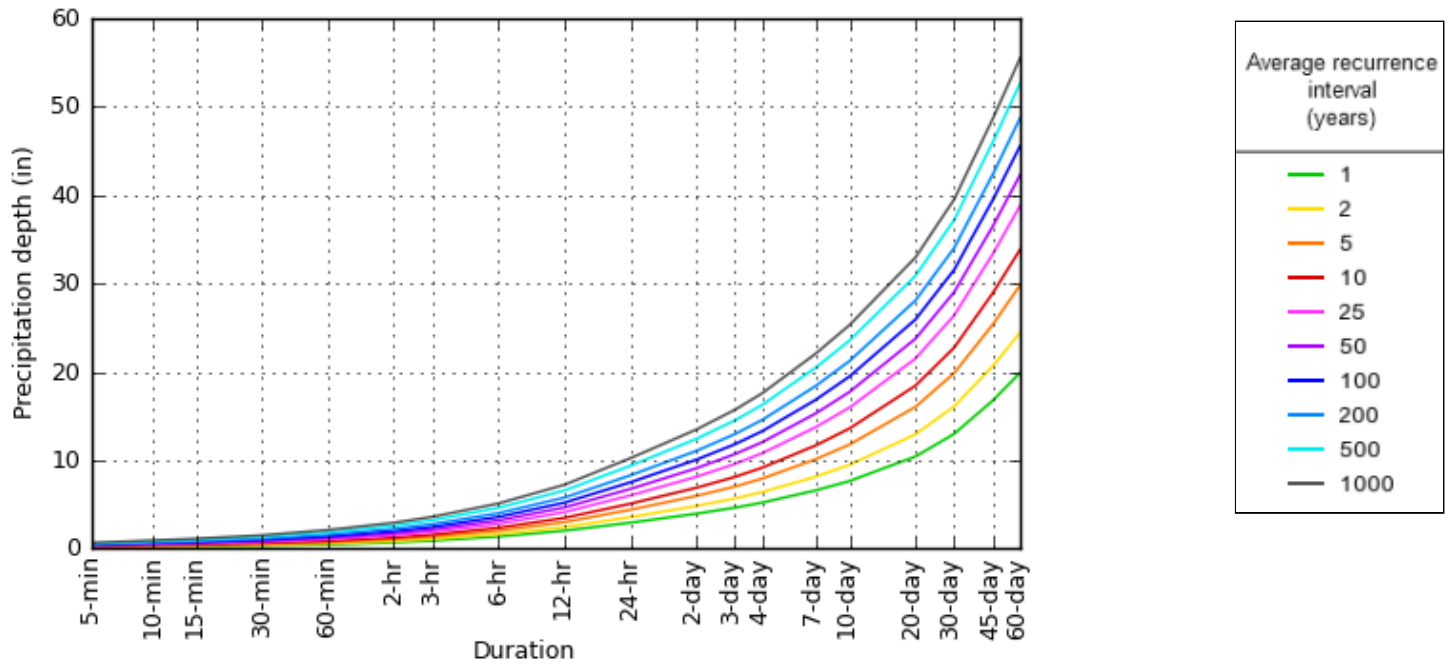
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

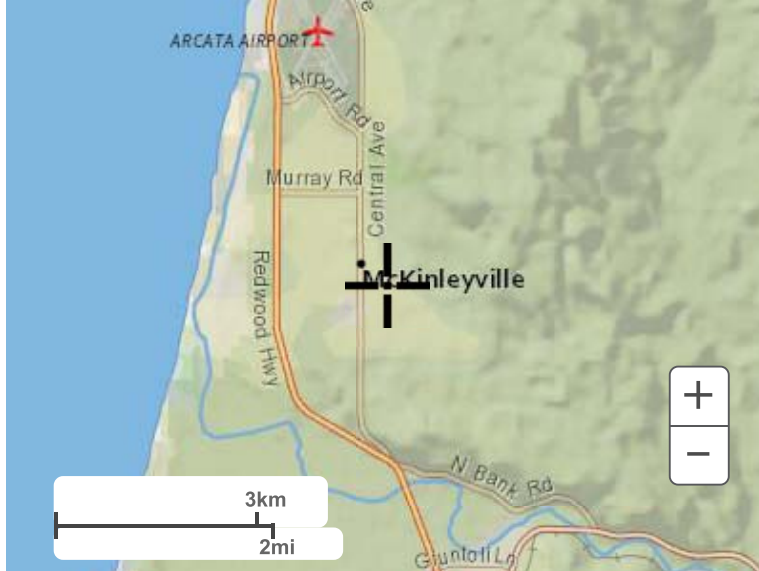
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 40.9435°, Longitude: -124.0958°

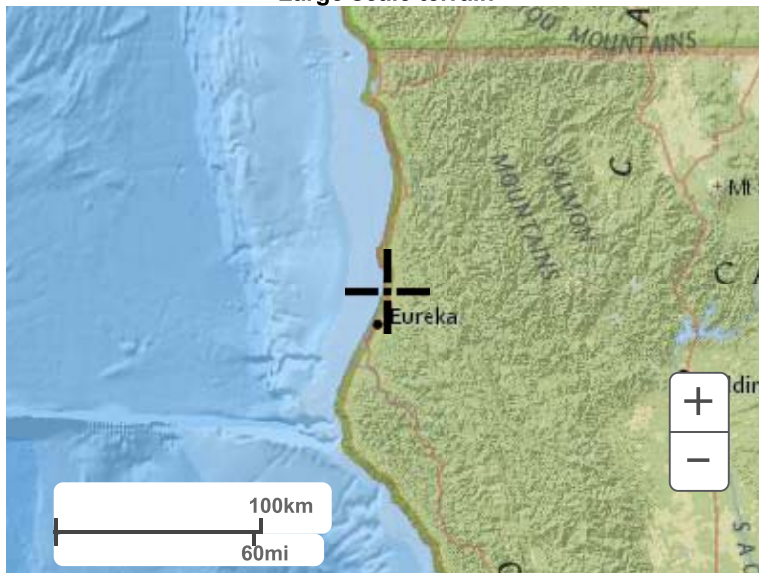


Maps & aerals

Small scale terrain



Large scale terrain



Large scale map



Large scale aerial



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[National Weather Service](#)
[National Water Center](#)
1325 East West Highway
Silver Spring, MD 20910
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[Disclaimer](#)



Attachment 5:

Runoff Coefficients

July 1, 2020

Table 819.2B**Run off Coefficients for Developed Areas⁽¹⁾**

Type of Drainage Area	Runoff Coefficient
Business:	
Downtown areas	0.70 - 0.95
Neighborhood areas	0.50 - 0.70
Residential:	
Single-family areas	0.30 - 0.50
Multi-units, detached	0.40 - 0.60
Multi-units, attached	0.60 - 0.75
Suburban	0.25 - 0.40
Apartment dwelling areas	0.50 - 0.70
Industrial:	
Light areas	0.50 - 0.80
Heavy areas	0.60 - 0.90
Parks, cemeteries:	0.10 - 0.25
Playgrounds:	0.20 - 0.40
Railroad yard areas:	0.20 - 0.40
Unimproved areas:	0.10 - 0.30
Lawns:	
Sandy soil, flat, 2%	0.05 - 0.10
Sandy soil, average, 2-7%	0.10 - 0.15
Sandy soil, steep, 7%	0.15 - 0.20
Heavy soil, flat, 2%	0.13 - 0.17
Heavy soil, average, 2-7%	0.18 - 0.22
Heavy soil, steep, 7%	0.25 - 0.35
Streets:	
Asphaltic	0.70 - 0.95
Concrete	0.80 - 0.95
Brick	0.70 - 0.85
Drives and walks	0.75 - 0.85
Roofs:	0.75 - 0.95

NOTES:

(1) From HDS No. 2.



Attachment 6:

Bioretention



Project: Proposed Subdivision
Date: 12/18/2023
Client: Dane Valadao
Address: 1820 Pickett Road
McKinleyville, CA

Project No: 873
APN: 510-381-021
By: E. Keyes
Check By: J. McKnight
Sheet: 1 of 3

BIORETENTION

Equations:

$$A_f = WQV(df/[k(hf+df)tf])$$

$$A_{br} = L \times W$$

$$WQV = Q_t - Q_g$$

Definitions:

A_f = Minimum surface area of the bioretention ponding area

WQV = Water quality volume

d_f = Media layer depth

k = Coefficient of permeability for bioretention soil media (infiltration rate)

h_f = Average water depth above the soil media layer (ponding depth)

t_f = Design drain time for WQV

Q_t = Total volume

Q_g = Volume of Gravel

L = Length of Bioretention

W = Width of Bioretention

D = Depth of Bioretention

A_{br} = Design area of bioretention facility

Calculations:

$$Q_t = 4873 \text{ ft}^3$$

$$L = 20 \text{ ft}$$

$$W = 20 \text{ ft}$$

$$D = 1 \text{ ft}$$

$$A_{br} = 400 \text{ ft}^2$$

$$V_s = 20 \%$$

$$Q_g = 80 \text{ ft}^3$$

$$WQV = 4793 \text{ ft}^3$$

$$d_f = 2 \text{ ft}$$

$$k = 10 \text{ ft/day}$$

$$h_f = 0.5 \text{ ft}$$

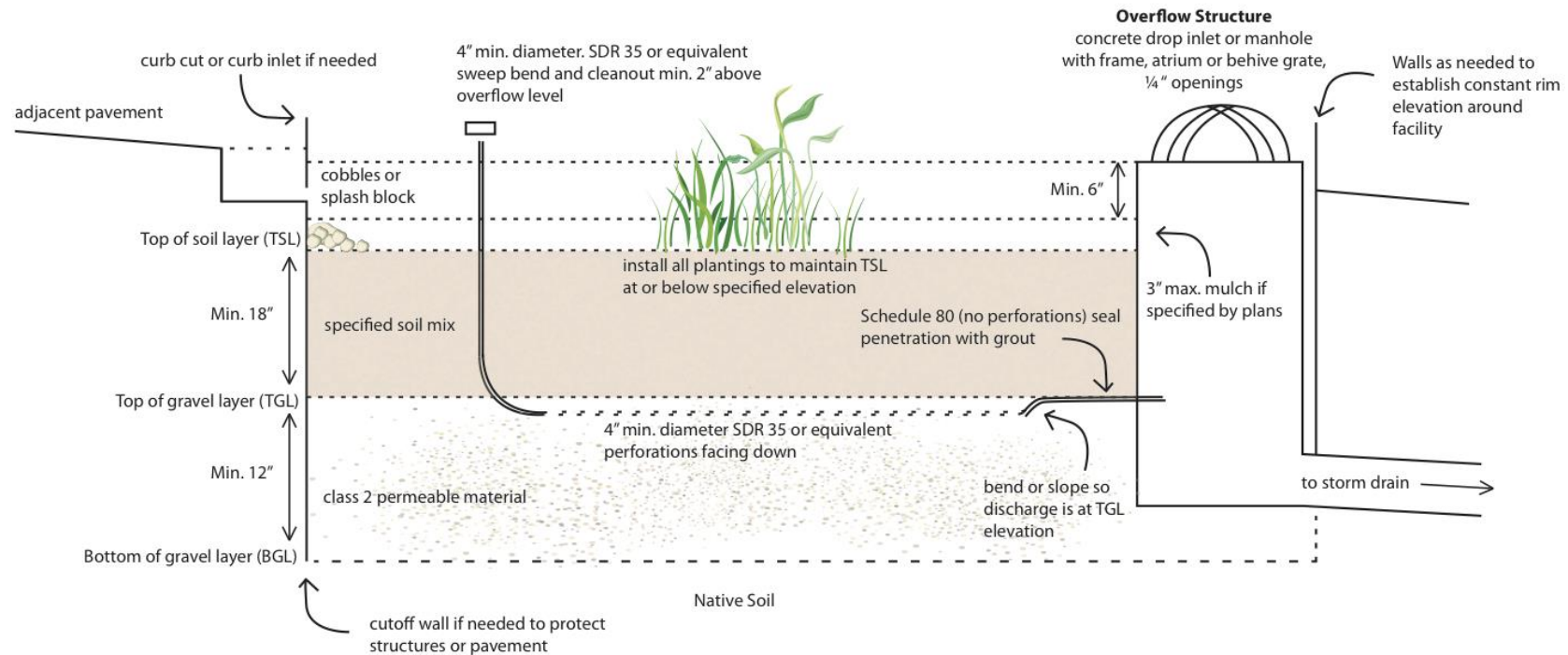
$$t_f = 1 \text{ days}$$

$$A_f = 383.4 \text{ ft}^2$$

Use a 400 square foot bioretention facility to mitigate excess stormwater

Bioretention Facility

not to scale



Allowed variations for special site conditions:

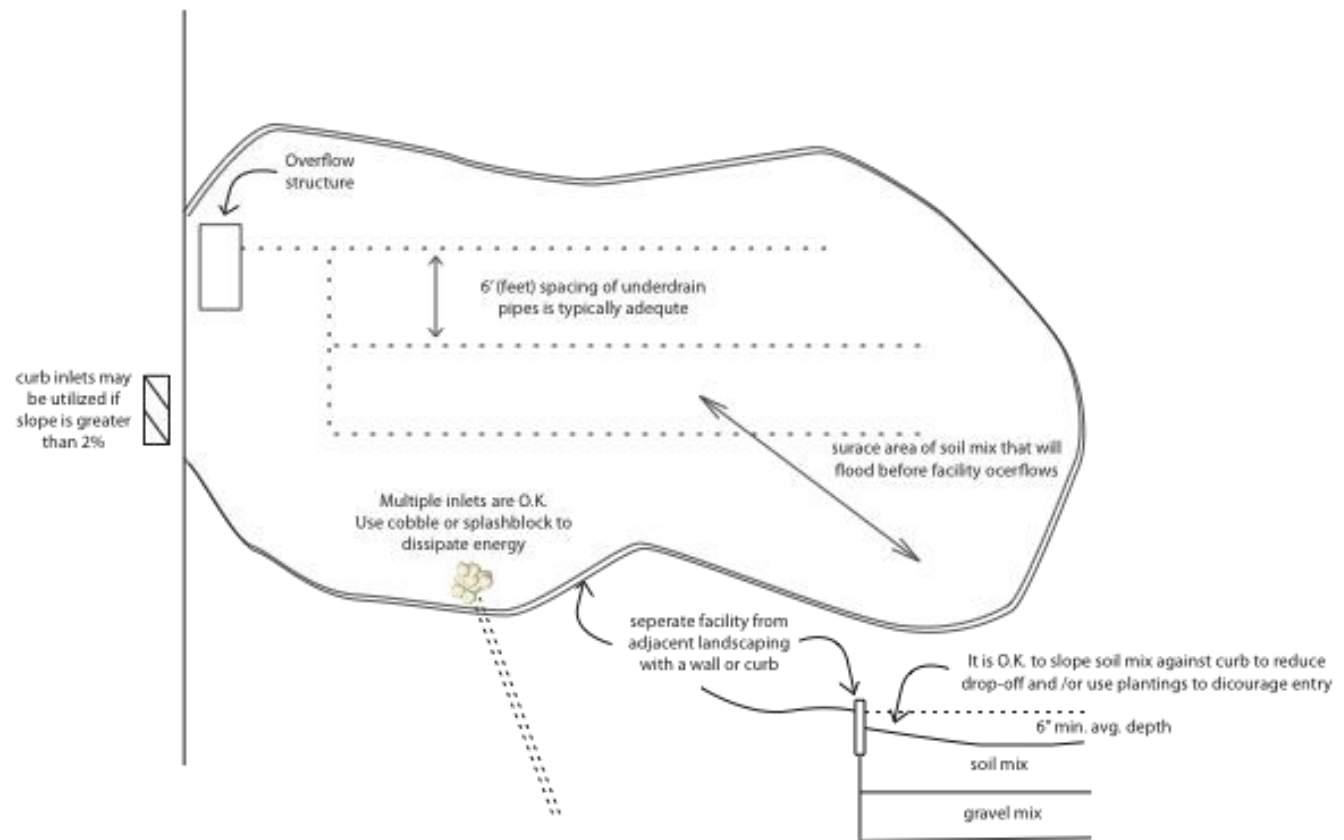
- Facilities located within 10 feet of structures or other potential geotechnical hazards may incorporate an impervious cutoff wall
- Facilities with documented high concentrations of pollutants in underlying soil or groundwater, facilities where infiltration could contribute to a geotechnical hazard, and facilities located on elevated plazas or other structures may incorporate an impervious liner between the native soil and the BGL and locate the underdrain discharge at the BGL (flow-through planter configuration)
- Facilities located in areas of high groundwater, highly infiltrative soils, or where connection of the underdrain to a surface drain or subsurface storm drain are infeasible may omit the underdrain

Notes:

- No liner, no filter fabric, no landscape cloth.
- Maintain BGL, TGL, TSL throughout facility area at elevations to be specified in plan.
- Class 7 permeable layer may extend below and underneath drop inlet.
- Elevation or underdrain discharge is at top of gravel layer.
- See Section 6.3 for instructions on facility sizing and additional specifications

Bioretention Facility - Overview

not to scale



Note:

Show all elevations of curb, pavement, inlet, top of soil layer (TSL), top of gravel layer (TGL), and bottom of gravel layer (BGL) at all inlets and outlets and at key points along edge of facility.

Soil/Compost and Gravel Specifications for Bioretention Facility

Compost shall be a well-decomposed, stable, weed-free organic matter source derived from waste materials including yard debris, wood wastes or other organic materials not including manure or biosolids, and shall meet the standards developed by the US Composting Council (USCC). The product shall be certified through the USCC Seal of Testing Assurance (STA) Program (a compost testing and information disclosure program).

Compost Quality Analysis:

Before delivery of the soil, the supplier shall submit a copy of the lab analysis performed by a laboratory that is enrolled in the USCC's Compost Analysis Proficiency (CAP) program and using approved Test Methods for the Evaluation of Composting and Compost (TMECC). The lab report shall verify that the compost parameters are within the limits specified below.

Parameter	Range	Reported as (units)
Organic Matter Content	35-75	%, dry weight basis
Carbon to Nitrogen Ratio	15:1 to 25:1	ratio
Maturity (Seed Emergence and Seedling Vigor)	>80	average % of control
Stability (CO ₂ Evolution Rate)	<8	mg CO ₂ -C/g unit OM/day
Soluble Salts (Salinity)	<6.0	mmhos/cm
pH	6.5 - 8.0 May vary with plant species	units
Heavy Metals Content	PASS	PASS/FAIL: US EPA Class A standard, 40 CFR § 503.13, tables 1 and 3.
Pathogens		
Fecal coliform	PASS	PASS/FAIL: US EPA Class A standard, 40 CFR § 503.32(a) levels
Salmonella	PASS	PASS/FAIL: US EPA Class A standard, 40 CFR § 503.32(a) levels
Nutrient Content (provide analysis, including):		
Total Nitrogen (N)	≥0.9	%
Boron (Total B)	<80	ppm
Calcium (Ca)	For information only	%
Sodium (Na)	For information only	%
Magnesium (Mg)	For information only	%
Sulfur (S)	For information only	%

Soil/Compost and Gravel Specifications for Bioretention Facility

Gravel Layer

The gravel layer used in the bioretention facility must consist of *Class 2 Permeable Material* as specified in the State of California's Business, Transportation and Housing Agency, Department of Transportation; Standard Specifications 2010, manual (http://www.dot.ca.gov/hq/esc/oe/construction_contract_standards/std_specs/2010_StdSpecs/2010_StdSpecs.pdf).

The specific section, Subsurface Drains, Sec. 68, of the manual is used because it offers specific specifications for subsurface drains. In addition to the standardized permeable layer, a membrane layer of pea gravel or other intermediate-sized material is recommended at the top of the gravel layer to prevent fines from the soil/compost layer from moving downward into the gravel layer.

68-2.02F (1) General

Permeable material for use in backfilling trenches under, around, and over underdrains must consist of hard, durable, clean sand, gravel, or crushed stone and must be free from organic material, clay balls, or other deleterious substances.

Permeable material must have a durability index of not less than 40.

68-2.02F (3) Class 2 Permeable Material

The percentage composition by weight of Class 2 permeable material in place must comply with the grading requirements shown in the following table:

Class 2 Permeable Material* Grading Requirements

Sieve sizes	Percentage passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

*Class 2 permeable material must have a sand equivalent value of not less than 75.

Layout (to be confirmed prior to beginning excavation permit approval stage)

- | |
|---|
| Excavation (to be confirmed prior to backfilling or pipe installation) |
|---|

- Overflow or Surface Connection to Storm Drainage** (to be confirmed prior to backfilling with any materials)

-

Bioretention Facility Construction Checklist

Underground connection to storm drain/outlet orifice

- | | |
|--------------------------|--|
| <input type="checkbox"/> | Perforated pipe underdrain (PVC SDR 35 or approved equivalent) is installed with holes facing down |
| <input type="checkbox"/> | Perforated pipe is connected to storm drain at specified elevation (typ. bottom of soil elevation) |
| <input type="checkbox"/> | Cleanouts are in accessible locations and connected via sweep |

Drain Rock/Subdrain (to be confirmed prior to installation of soil mix)

- | | |
|--------------------------|--|
| <input type="checkbox"/> | Rock is installed as specified, 12" min. depth. Class 2 permeable, Caltrans specification 68- 2.02F(3) recommended |
| <input type="checkbox"/> | Rock is smoothed to a consistent top elevation. Depth and top elevation are as shown in plans |
| <input type="checkbox"/> | Slopes or side walls protect from sloughing of native soils into the facility |
| <input type="checkbox"/> | No filter fabric is placed between the subdrain and soil mix layers |

Soil Mix

- | | |
|--------------------------|--|
| <input type="checkbox"/> | Soil mix is as specified. |
| <input type="checkbox"/> | Mix installed in lifts not exceeding 12" |
| <input type="checkbox"/> | Mix is not compacted during installation but may be thoroughly wetted to encourage consolidation |
| <input type="checkbox"/> | Mix is smoothed to a consistent top elevation. Depth of mix (18" min.) and top elevation are as shown in plans, accounting for depth of mulch to follow and required reservoir depth |

Irrigation

- | | |
|--------------------------|--|
| <input type="checkbox"/> | Irrigation system is installed so it can be controlled separately from other landscaped areas |
| <input type="checkbox"/> | Smart irrigation controllers and drip emitters are recommended and may be required by local code or ordinance. |
| <input type="checkbox"/> | Spray heads, if any, are positioned to avoid direct spray into outlet structures |

Bioretention Facility Construction Checklist

Planting	
<input type="checkbox"/>	Plants are installed consistent with approved planting plan, consistent with site water allowance
<input type="checkbox"/>	Any trees and large shrubs are staked securely
<input type="checkbox"/>	No fertilizer is added; compost tea may be used
<input type="checkbox"/>	No native soil or clayey material are imported into the facility with plantings
<input type="checkbox"/>	1"-2" mulch may be applied following planting; mulch selected to avoid floating
<input type="checkbox"/>	Final elevation of soil mix maintained following planting
<input type="checkbox"/>	Curb openings are free of obstructions

Final Engineering Inspection	
<input type="checkbox"/>	Drainage Management Area(s) are free of construction sediment and landscaped areas are stabilized
<input type="checkbox"/>	Inlets are installed to provide smooth entry of runoff from adjoining pavement, have sufficient reveal (drop from the adjoining pavement to the top of the mulch or soil mix, and are not blocked
<input type="checkbox"/>	Inflows from roof leaders and pipes are connected and operable
<input type="checkbox"/>	Temporary flow diversions are removed
<input type="checkbox"/>	Rock or other energy dissipation at piped or surface inlets is adequate
<input type="checkbox"/>	Overflow outlets are configured to allow the facility to flood and fill to near rim before overflow
<input type="checkbox"/>	Plantings are healthy and becoming established
<input type="checkbox"/>	Irrigation is operable
<input type="checkbox"/>	Facility drains rapidly; no surface ponding is evident
<input type="checkbox"/>	Any accumulated construction debris, trash, or sediment is removed from facility
<input type="checkbox"/>	Permanent signage is installed and is visible to site users and maintenance personnel