EXHIBIT G

LYONS HILLSIDE VINEYARDS

New Vineyard Development Hydrologic Analysis

Property Information:

Owner: Lyons Hillside Vineyards, Cap Lyons
Address: 8280 Wild Horse Valley Road, Napa, CA.
Parcel No.: 033-190-004

Report Preparer Information:

Civil Engineer: Omar Reveles, PE R.C.E. 74723
Acme Engineering Inc.
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Napa, CA 94559
(707) 253-2263
Date: December 17, 2019

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Project Narrative

Introduction and Scope of Project

This project proposes the development of approximately 19.0 acres of vineyard (comprised of 15.9 acres of vineyard and 3.1 acres of vineyard avenues) at 8280 Wild Horse Valley Road in Napa, CA. The property is owned by Cap Lyons, and corresponds to APN: 033-190-004. The mentioned parcel measures approximately 79.3 acres. Vineyard development activities shall consist of: land clearing and tree removal, ripping, incorporation of soil amendments, disking, installation of deer fence, vineyard planting, trellising, installation of a drip irrigation system and cover cropping. The proposed development activities shall begin upon approval from the Napa County Department of Planning, Building & Environmental Services and shall be completed by October 15, 2020.

Existing Conditions

The project site is located within the Suisun Creek watershed. The project site lies immediately north and south of Wild Horse Valley Road. The project site currently consists mostly of oak woodland, chaparral and non-native grassland. Portions of the property in the immediate vicinity consist mostly of trees, grasses and existing vineyard. The project site consists of moderate to very strong sloping terrain (13-38%). Slopes surrounding the development areas are similar to those inside. It is important to note that an approved erosion control plan exists for vineyard development of an additional 3.8 acres (including vineyard avenues). These previously approved development areas are adjacent to 3 of the newly proposed development areas. As a result the owner would like to develop the pre-approved areas and the newly proposed development area concurrently in 2020.

The project site is part of an overall watershed (watersheds A-F) that measures approximately 243.9 acres and consists of approximately 19.0 acres of proposed development area, 3.8 acres of previously approved development area and approximately 3.0 acres of existing vineyard. The remaining overall watershed area consists of approximately 125.2 acres of tree canopy and approximately 114.0 acres of grass/shrub/scrub. The overall watershed can be described as the tributary area that drains into the junction of two blue line streams, at a location downslope from the proposed development area. The westernmost blue line stream runs along the subject parcel's western boundary, while the easternmost blue line stream runs through the middle of the subject parcel. All portions of the project site drain into one of these two blue line streams. Which in turn combine at the mentioned stream junction. Eventually runoff from this junction makes its way to Wooden Valley Creek, then to Suisun Creek and finally drains into Suisun Marsh.

At watershed A, the critical path consists of surface sheet flow, shallow concentrated flow and channel flow; however, this critical path never intersects the proposed development boundaries. Only surface sheet flow and shallow concentrated flow occurs at the development area in watersheds A and F. Surface sheet flow, shallow concentrated flow and channel flow occurs at the development areas in watersheds B, C, D and E. The shallow concentrated flow occurs at the existing drainage swales and culverts along the existing access roads and driveways, which is also at the edge of the proposed development. Watershed F contains a culvert outlet; however, it appears that discharge is dispersed back into sheet flow and shallow concentrated flow, it does not become channel flow until after it exits the proposed development area in watershed F.

Methodologies

In order to evaluate the hydrologic impact of the proposed development, two watershed runoff models were developed using the NRCS United States Department of Agriculture (USDA) Technical Release 55 (TR-55) methodology (USDA-NRCS 2003). WinTR-55 is single-event rainfall-runoff, small watershed hydrologic model. The model generates hydrographs from both urban and agricultural areas and at selected points along the stream system. Hydrographs are routed downstream through channels and/or reservoirs. Multiple sub-areas can be modeled within the watershed. The WinTR-55 methodology was used to generate peak flow estimates for the project site.

This methodology was applied to the entire effective watersheds. It was used to determine the pre-development and post-development peak flow rates for the 2, 5, 10, 25, 50 and 100 year return period 24 hour storm events.

Assumptions

As previously mentioned there are several existing drainage swales and culverts along the existing access roads and driveways. The intent of this project is to maintain the existing flow regimes to the maximum extent as practicable. As a result all existing drainage swales and culverts shall be maintained.

The effective watershed extends past Napa County and into Solano County. As a result a small portion of the watershed lies outside the extents of the aerial image. The cover characteristics in this portion of the watershed were assumed from aerial imagery from Google Earth. These assumptions are justified because they only apply to areas that will remain unchanged by the proposed development, and as a result will not contribute to a net change in peak flow rates between pre-development and post-development.

Based on soil loss calculations (part of the Erosion Control Plan Application) the inclusion of cross slope diversions at certain locations (watersheds A, C and F) is required to maintain soil loss values at an acceptable level.

Hydrologic soil groups are based on estimates of runoff potential. This parameter is based on the type of soil encountered. Based on the interactive web soil survey found at: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm there is only one soil type within the project site. The soil type present is Sobrante Loam (178 & 179). Sobrante Loam is classified as a soil in hydrologic group “C”. Additionally, within the overall watershed boundaries there are three other types of soils present. These soil types are: Toomes Stony Loam (ToG2so), Hambright Loam (HaFso), and Gilroy Loam (GIEso). Gilroy Loam is classified as a soil in hydrologic group “C”. Toomes Stony Loam and Hambright Loam are classified as soils in hydrologic group “D”.

The determination of the hydrologic soil conditions was based on the historical and current use of these lands. Historically, the region was open rangeland of larger ranches and vineyards. A “fair” hydrologic soil condition was selected for “pasture, grasslands or range” and “woods grass combination” within the areas that are currently not developed. A “good” hydrologic soil condition was selected for “pasture, grasslands or range” within the areas of existing and proposed vineyard. A good hydrologic soil condition for the proposed and existing vineyard is justified by all the land preparation, cover cropping and straw mulching associated with the proposed development and the existing vineyards.

Finally, based on the hydrologic soil-cover complex definitions: "pasture, grasslands or range" land use was selected for the existing and proposed vineyard areas. The selected land use is the one that most closely resembles the proposed cover crop seed mix and anticipated farming practices.

Impacts

The proposed development project shall not have any negative impacts on the project site. This is due to the fact that the proposed development shall not adversely affect any of the hydrologic characteristics. Currently, runoff flows across the project site as sheet flow, shallow concentrated flow and channel flow.

The proposed development shall incorporate cross slope diversions at specific locations within the development boundaries. These cross slope diversions will achieve two goals: they will divert runoff away from the steeper slopes and they will reduce the run lengths on the steeper slopes of the project site. This in turn will reduce the overall soil loss.

Finally, with all the land preparation, cover cropping and straw mulching associated with the proposed vineyard development, the hydrologic condition at the project site will actually improve. The reduction in run lengths at steep slopes and enhancement of hydrologic soil condition within the proposed development boundaries will result in no net increase in peak flow rates.

While the proposed vineyard development could potentially lead to pollutants entering the nearby waterways, the project would incorporate several measures to minimize the potential for erosion and transport of pollutants during and after the proposed vineyard development. These measures include:

1. Inclusion of cross slope diversions shall divert runoff away from the steeper slopes towards more stabilized outfall locations, and reduce the overall run length on the steeper slopes of the proposed development. This in turn will reduce the overall soil loss at the project site.
2. Establishment of a 75% minimum ground cover, by means of a tilled cover crop in combination with cross slope diversions, straw roll installation and straw mulch, will minimize the amount of sediment leaving the project site during the soil building period. This will also maintain the volume and probability of rainfall generated runoff at or below pre-development conditions.
3. A no-till cover crop on all vineyard blocks will minimize the amount of sediment leaving the project site throughout the life of the proposed vineyard. This will also maintain the volume and probability of rainfall generated runoff at or below pre-development conditions.
4. Incorporation of setbacks to the nearby streams, and the use of grassy turnaround avenues shall help filter sediment from surface runoff before it enters the streams. These setbacks and grassy turnaround avenues shall also trap and hold dust and fertilizers (from vineyard operations), before they can enter the streams.
5. Inclusion of drop inlets and drainage mainlines shall divert channel flow away from proposed vineyard areas and towards more stabilized outfall locations.
6. All outfall locations shall have rock aprons installed to minimize erosion and ensure that runoff exits the project site as surface sheet flow.

Conclusions and statement addressing adequacy of design

Based on the results from TR-55, the proposed development will not have any adverse effects on the existing hydrology of the watersheds. The proposed drainage improvements shall reduce the overall run length on the steepest slopes of the proposed development. This will generate channel flow; however, the proposed drainage improvements shall also divert potential runoff away from the proposed vineyard

areas and direct it to more stabilized outfall locations. All outfall locations shall have rock outlet protection installed to minimize erosion and ensure that runoff exits the project site as surface sheet flow. The proposed cover crop, farming practices and drainage improvements shall maintain peak runoff flow rates at or below pre-development conditions.

References

See the attached TR-55 report print outs for watersheds A-F pre-development and post-development.

See the attached sheets labeled “TR-55 Pre-Development Site Plan and Curve Numbers” and “TR-55 Post-Development Site Plan and Curve Numbers” for references to watershed areas and features mentioned in this report.

Land use selection was based on “Hydrologic Soil-Cover Complexes” National Engineering Handbook (NEH), Part 650, (EFH), Amend. IA50, Nov. 2007.

Hydrologic soil conditions are based on a field visits conducted by Omar Reveles of Acme Engineering, Inc. on March 20, 2019, August 21, 2019, November 7 and 12, 2019 and December 10, 2019.

Manning’s roughness coefficients were obtained from Civil Engineering Reference Manual Appendix 19A and ADS product literature.

WinTR-55 Current Data Description

--- Identification Data ---

User: Acme Eng.
Project: Lyons
SubTitle: Pre-development
State: California
County: Napa
Filename: Z:\Jobs 2018\180802 Lyons\0122 New Vineyard Development ECP\Calc\01\TR55\OR\12 13 19\Lyons Prede

Date: 12/18/2019
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
A		Outlet	185.7	78	.318
B		Reach 1	4.4	79	.146
C		Reach 2	5.5	77	.168
D		Reach 2	14.8	78	.238
E		Reach 3	11.2	78	.11
F		Reach 4	22.3	78	.265

Total area: 243.90 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	0-Yr (in)
4.18	5.5	6.55	7.94	8.98	10.0	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type IA
Dimensionless Unit Hydrograph: <standard>

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Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	0-Yr (in)
4.18	5.5	6.55	7.94	8.98	10.0	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type IA
Dimensionless Unit Hydrograph: <standard>

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Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS						
A	82.44	135.57	180.30	241.26	287.62	333.37
B	2.19	3.52	4.64	6.16	7.31	8.45
C	2.44	4.05	5.41	7.27	8.69	10.10
D	6.81	11.16	14.82	19.80	23.58	27.32
E	5.30	8.68	11.51	15.36	18.28	21.17
F	10.14	16.65	22.12	29.56	35.22	40.81
REACHES						
Reach 1	2.19	3.52	4.64	6.16	7.31	8.45
Down	2.19	3.52	4.64	6.16	7.31	8.45
Reach 2	9.24	15.20	20.21	27.03	32.22	37.35
Down	9.24	15.19	20.20	27.03	32.22	37.35
Reach 3	14.48	23.73	31.49	42.06	50.13	58.11
Down	14.47	23.73	31.48	42.06	50.13	58.11
Reach 4	26.78	43.88	58.20	77.73	92.57	107.23
Down	26.78	43.87	58.20	77.72	92.56	107.23
OUTLET	109.16	179.42	238.43	318.97	380.10	440.53

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Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 2-Yr (cfs)	(hr)	5-Yr (cfs)	(hr)	10-Yr (cfs)	(hr)	25-Yr (cfs)	(hr)	50-Yr (cfs)	(hr)	100-Yr (cfs)	(hr)
SUBAREAS												
A	82.44	8.07	135.57	8.07	180.30	8.05	241.26	8.06	287.62	8.05	333.37	8.05
B	2.19	8.00	3.52	7.96	4.64	7.95	6.16	7.94	7.31	7.94	8.45	7.94
C	2.44	8.01	4.05	8.00	5.41	7.98	7.27	7.97	8.69	7.96	10.10	7.95
D	6.81	8.03	11.16	8.02	14.82	8.02	19.80	8.01	23.58	8.01	27.32	8.00
E	5.30	7.94	8.68	7.94	11.51	7.93	15.36	7.93	18.28	7.92	21.17	7.92
F	10.14	8.05	16.65	8.03	22.12	8.04	29.56	8.03	35.22	8.03	40.81	8.01
REACHES												
Reach 1	2.19	8.00	3.52	7.96	4.64	7.95	6.16	7.94	7.31	7.94	8.45	7.94
Down	2.19	8.02	3.52	7.99	4.64	7.97	6.16	7.97	7.31	7.96	8.45	7.97
Reach 2	9.24	8.03	15.20	8.01	20.21	8.01	27.03	8.01	32.22	8.00	37.35	7.99
Down	9.24	8.04	15.19	8.03	20.20	8.02	27.03	8.02	32.22	8.01	37.35	8.00
Reach 3	14.48	8.01	23.73	8.01	31.49	8.00	42.06	7.99	50.13	7.97	58.11	7.96
Down	14.47	8.05	23.73	8.04	31.48	8.03	42.06	8.01	50.13	7.99	58.11	7.98
Reach 4	26.78	8.05	43.88	8.04	58.20	8.03	77.73	8.01	92.57	8.01	107.23	8.00
Down	26.78	8.09	43.87	8.07	58.20	8.06	77.72	8.05	92.56	8.04	107.23	8.03
OUTLET	109.16		179.42		238.43		318.97		380.10		440.53	

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Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
A	185.70	0.318	78	Outlet	
B	4.40	0.146	79	Reach 1	
C	5.50	0.168	77	Reach 2	
D	14.80	0.238	78	Reach 2	
E	11.20	0.110	78	Reach 3	
F	22.30	0.265	78	Reach 4	

Total Area: 243.90 (ac)

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Reach Summary Table

Reach Identifier	Receiving Reach Identifier	Reach Length (ft)	Routing Method
Reach 1	Reach 4	763	CHANNEL
Reach 2	Reach 3	357	CHANNEL
Reach 3	Reach 4	741	CHANNEL
Reach 4	Outlet	1334	CHANNEL

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Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
A							
SHEET	100	0.0500	0.150				0.099
SHALLOW	1713	0.1600	0.050				0.074
CHANNEL	3699	0.0700	0.035	10.00	20.10	7.086	0.145
					Time of Concentration		.318
B							
SHEET	100	0.0400	0.150				0.108
SHALLOW	41	0.0200	0.050				0.005
CHANNEL	1071	0.1300	0.035	2.00	4.47	9.015	0.033
CHANNEL	14	0.1400	0.024	0.79	3.14		0.000
					Time of Concentration		.146
C							
SHEET	100	0.0400	0.150				0.108
SHALLOW	752	0.2100	0.050				0.028
CHANNEL	490	0.0300	0.035	2.00	4.47	4.253	0.032
CHANNEL	15	0.1300	0.024	9.62	11.00		0.000
					Time of Concentration		.168
D							
SHEET	100	0.0100	0.150				0.189
SHALLOW	747	0.2600	0.050				0.025
CHANNEL	646	0.0900	0.035	2.00	4.47	7.477	0.024
CHANNEL	15	0.1300	0.024	9.62	11.00		0.000
					Time of Concentration		.238
E							
SHEET	100	0.0800	0.150				0.082
SHALLOW	651	0.1800	0.050				0.026
CHANNEL	81	0.1900	0.035	10.00	20.10	11.250	0.002
					Time of Concentration		.11
F							
SHEET	100	0.0100	0.150				0.189
SHALLOW	1526	0.1200	0.050				0.076
					Time of Concentration		.265

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
A	Paved parking lots, roofs, driveways		C	.4	98
	Pasture, grassland or range	(fair)	C	84.5	79
	Pasture, grassland or range	(fair)	D	.1	84
	Woods - grass combination	(fair)	C	96.2	76
	Woods - grass combination	(fair)	D	4.5	82
	Total Area / Weighted Curve Number			185.7	78
B	Pasture, grassland or range	(fair)	C	4.4	79
	Total Area / Weighted Curve Number			4.4	79
C	Pasture, grassland or range	(fair)	C	2.4	79
	Woods - grass combination	(fair)	C	3.1	76
	Total Area / Weighted Curve Number			5.5	77
D	Pasture, grassland or range	(fair)	C	8.8	79
	Woods - grass combination	(fair)	C	6	76
	Total Area / Weighted Curve Number			14.8	78
E	Paved parking lots, roofs, driveways		C	1.1	98
	Pasture, grassland or range	(fair)	C	1.8	79
	Pasture, grassland or range	(good)	C	2.8	74
	Woods - grass combination	(fair)	C	5.5	76
	Total Area / Weighted Curve Number			11.2	78
F	Paved parking lots, roofs, driveways		C	.2	98
	Pasture, grassland or range	(fair)	C	12	79
	Pasture, grassland or range	(good)	C	.2	74
	Woods - grass combination	(fair)	C	9.9	76
	Total Area / Weighted Curve Number			22.3	78

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Reach Channel Rating Details

Reach Identifier	Reach Length (ft)	Reach Manning's n	Friction Slope (ft/ft)	Bottom Width (ft)	Side Slope
Reach 1	763	0.035	0.15	0.1	10 :1
Reach 2	357	0.035	0.1	0.1	10 :1
Reach 3	741	0.035	0.07	0.1	10 :1
Reach 4	1334	0.035	0.09	0.1	10 :1

Reach Identifier	Stage (ft)	Flow (cfs)	End Area (sq ft)	Top Width (ft)	Friction Slope (ft/ft)
Reach 1	0.0	0.000	0	0.1	0.15
	0.5	16.695	2.6	10.1	
	1.0	104.625	10.1	20.1	
	2.0	659.943	40.2	40.1	
	5.0	7567.415	250.5	100.1	
	10.0	47986.093	1001	200.1	
	20.0	304489.557	4002	400.1	
Reach 2	0.0	0.000	0	0.1	0.1
	0.5	13.632	2.6	10.1	
	1.0	85.426	10.1	20.1	
	2.0	538.842	40.2	40.1	
	5.0	6178.768	250.5	100.1	
	10.0	39180.481	1001	200.1	
	20.0	248614.682	4002	400.1	
Reach 3	0.0	0.000	0	0.1	0.07
	0.5	11.405	2.6	10.1	
	1.0	71.472	10.1	20.1	
	2.0	450.827	40.2	40.1	
	5.0	5169.528	250.5	100.1	
	10.0	32780.742	1001	200.1	
	20.0	208005.966	4002	400.1	
Reach 4	0.0	0.000	0	0.1	0.09
	0.5	12.932	2.6	10.1	
	1.0	81.042	10.1	20.1	
	2.0	511.190	40.2	40.1	
	5.0	5861.694	250.5	100.1	
	10.0	37169.868	1001	200.1	
	20.0	235856.597	4002	400.1	

WinTR-55 Current Data Description

--- Identification Data ---

User: Acme Eng.
Project: Lyons
SubTitle: Postdevelopment
State: California
County: Napa
Filename: Z:\Jobs 2018\180802 Lyons\0122 New Vineyard Development ECP\Calc\01\TR55\OR\12 13 19\Lyons Postd

Date: 12/18/2019
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
A		Outlet	185.7	77	.318
B		Reach 1	4.4	77	.146
C		Reach 2	5.6	76	.18
D		Reach 2	14.8	77	.238
E		Reach 3	11.2	78	.11
F		Reach 4	22.2	77	.265

Total area: 243.90 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	0-Yr (in)
4.18	5.5	6.55	7.94	8.98	10.0	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type IA
Dimensionless Unit Hydrograph: <standard>

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Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	0-Yr (in)
4.18	5.5	6.55	7.94	8.98	10.0	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type IA
Dimensionless Unit Hydrograph: <standard>

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Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS						
A	77.91	130.15	174.28	234.79	280.87	326.49
B	1.97	3.26	4.35	5.85	6.99	8.12
C	2.35	3.95	5.31	7.19	8.62	10.04
D	6.44	10.72	14.33	19.27	23.04	26.77
E	5.30	8.68	11.51	15.36	18.28	21.17
F	9.55	15.92	21.29	28.66	34.27	39.82
REACHES						
Reach 1	1.97	3.26	4.35	5.85	6.99	8.12
Down	1.97	3.26	4.35	5.85	6.99	8.12
Reach 2	8.78	14.66	19.64	26.44	31.63	36.77
Down	8.78	14.66	19.63	26.44	31.63	36.77
Reach 3	14.01	23.18	30.91	41.45	49.50	57.48
Down	14.01	23.18	30.90	41.45	49.50	57.48
Reach 4	25.51	42.33	56.52	75.89	90.66	105.27
Down	25.50	42.33	56.51	75.89	90.65	105.27
OUTLET	103.41	172.45	230.74	310.60	371.50	431.55

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Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 2-Yr (cfs)	(hr)	5-Yr (cfs)	(hr)	10-Yr (cfs)	(hr)	25-Yr (cfs)	(hr)	50-Yr (cfs)	(hr)	100-Yr (cfs)	(hr)
SUBAREAS												
A	77.91	8.07	130.15	8.06	174.28	8.05	234.79	8.05	280.87	8.04	326.49	8.05
B	1.97	8.01	3.26	7.97	4.35	7.96	5.85	7.94	6.99	7.95	8.12	7.94
C	2.35	8.01	3.95	8.00	5.31	8.00	7.19	7.98	8.62	7.97	10.04	7.96
D	6.44	8.03	10.72	8.02	14.33	8.03	19.27	8.02	23.04	8.00	26.77	8.00
E	5.30	7.94	8.68	7.94	11.51	7.93	15.36	7.93	18.28	7.92	21.17	7.92
F	9.55	8.04	15.92	8.03	21.29	8.03	28.66	8.03	34.27	8.02	39.82	8.01
REACHES												
Reach 1	1.97	8.01	3.26	7.97	4.35	7.96	5.85	7.94	6.99	7.95	8.12	7.94
Down	1.97	8.02	3.26	7.99	4.35	7.98	5.85	7.97	6.99	7.97	8.12	7.97
Reach 2	8.78	8.03	14.66	8.02	19.64	8.01	26.44	8.00	31.63	8.00	36.77	8.01
Down	8.78	8.04	14.66	8.03	19.63	8.02	26.44	8.02	31.63	8.01	36.77	8.01
Reach 3	14.01	8.01	23.18	8.01	30.91	8.01	41.45	8.00	49.50	7.98	57.48	7.97
Down	14.01	8.04	23.18	8.03	30.90	8.02	41.45	8.01	49.50	7.99	57.48	7.98
Reach 4	25.51	8.04	42.33	8.04	56.52	8.03	75.89	8.02	90.66	8.01	105.27	8.01
Down	25.50	8.07	42.33	8.06	56.51	8.05	75.89	8.04	90.65	8.03	105.27	8.02
OUTLET	103.41		172.45		230.74		310.60		371.50		431.55	

Lyons
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Napa County, California

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
A	185.70	0.318	77	Outlet	
B	4.40	0.146	77	Reach 1	
C	5.60	0.180	76	Reach 2	
D	14.80	0.238	77	Reach 2	
E	11.20	0.110	78	Reach 3	
F	22.20	0.265	77	Reach 4	

Total Area: 243.90 (ac)

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Reach Summary Table

Reach Identifier	Receiving Reach Identifier	Reach Length (ft)	Routing Method
Reach 1	Reach 4	763	CHANNEL
Reach 2	Reach 3	357	CHANNEL
Reach 3	Reach 4	741	CHANNEL
Reach 4	Outlet	1334	CHANNEL

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Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
A							
SHEET	100	0.0500	0.150				0.099
SHALLOW	1713	0.1600	0.050				0.074
CHANNEL	3699	0.0700	0.035	10.00	20.10	7.086	0.145
					Time of Concentration		.318
B							
SHEET	100	0.0400	0.150				0.108
SHALLOW	41	0.0200	0.050				0.005
CHANNEL	1071	0.1300	0.035	2.00	4.47	9.015	0.033
CHANNEL	14	0.1400	0.024	0.79	3.14		0.000
					Time of Concentration		.146
C							
SHEET	100	0.0400	0.150				0.108
SHALLOW	289	0.0900	0.050				0.017
SHALLOW	385	0.3200	0.050				0.012
CHANNEL	53	0.0400	0.035	0.89	2.98	3.681	0.004
CHANNEL	606	0.0300	0.035	2.00	4.47	4.316	0.039
					Time of Concentration		.18
D							
SHEET	100	0.0100	0.150				0.189
SHALLOW	747	0.2600	0.050				0.025
CHANNEL	646	0.0900	0.035	2.00	4.47	7.477	0.024
CHANNEL	15	0.1300	0.024	9.62	11.00		0.000
					Time of Concentration		.238
E							
SHEET	100	0.0800	0.150				0.082
SHALLOW	651	0.1800	0.050				0.026
CHANNEL	81	0.1900	0.035	10.00	20.10	11.250	0.002
					Time of Concentration		.11
F							
SHEET	100	0.0100	0.150				0.189
SHALLOW	1526	0.1200	0.050				0.076
					Time of Concentration		.265

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Napa County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
A	Paved parking lots, roofs, driveways		C	.4	98
	Pasture, grassland or range	(fair)	C	79.5	79
	Pasture, grassland or range	(fair)	D	.1	84
	Pasture, grassland or range	(good)	C	6.3	74
	Woods - grass combination	(fair)	C	94.9	76
	Woods - grass combination	(fair)	D	4.5	82
	Total Area / Weighted Curve Number			185.7	77
				=====	==
B	Pasture, grassland or range	(fair)	C	2.6	79
	Pasture, grassland or range	(good)	C	1.8	74
	Total Area / Weighted Curve Number			4.4	77
				===	==
C	Pasture, grassland or range	(fair)	C	1.6	79
	Pasture, grassland or range	(good)	C	1.6	74
	Woods - grass combination	(fair)	C	2.4	76
	Total Area / Weighted Curve Number			5.6	76
				===	==
D	Pasture, grassland or range	(fair)	C	5.8	79
	Pasture, grassland or range	(good)	C	4.4	74
	Woods - grass combination	(fair)	C	4.6	76
	Total Area / Weighted Curve Number			14.8	77
				====	==
E	Paved parking lots, roofs, driveways		C	1.1	98
	Pasture, grassland or range	(fair)	C	1.4	79
	Pasture, grassland or range	(good)	C	5.2	74
	Woods - grass combination	(fair)	C	3.5	76
	Total Area / Weighted Curve Number			11.2	78
				====	==
F	Paved parking lots, roofs, driveways		C	.2	98
	Pasture, grassland or range	(fair)	C	7.7	79
	Pasture, grassland or range	(good)	C	6.5	74
	Woods - grass combination	(fair)	C	7.8	76
	Total Area / Weighted Curve Number			22.2	77
				====	==

Lyons
Postdevelopment
Napa County, California

Reach Channel Rating Details

Reach Identifier	Reach Length (ft)	Reach Manning's n	Friction Slope (ft/ft)	Bottom Width (ft)	Side Slope
Reach 1	763	0.035	0.15	0.1	10 :1
Reach 2	357	0.035	0.1	5	10 :1
Reach 3	741	0.035	0.07	7	.5 :1
Reach 4	1334	0.035	0.09	10	.5 :1

Reach Identifier	Stage (ft)	Flow (cfs)	End Area (sq ft)	Top Width (ft)	Friction Slope (ft/ft)
Reach 1	0.0	0.000	0	0.1	0.15
	0.5	16.695	2.6	10.1	
	1.0	104.625	10.1	20.1	
	2.0	659.943	40.2	40.1	
	5.0	7567.415	250.5	100.1	
	10.0	47986.093	1001	200.1	
	20.0	304489.557	4002	400.1	
Reach 2	0.0	0.000	0	5	0.1
	0.5	32.202	5	15	
	1.0	142.886	15	25	
	2.0	718.034	50	45	
	5.0	6993.164	275	105	
	10.0	41753.378	1050	205	
	20.0	256762.222	4100	405	
Reach 3	0.0	0.000	0	7	0.07
	0.5	23.789	3.6	7.5	
	1.0	73.329	7.5	8	
	2.0	224.356	16	9	
	5.0	1012.172	47.5	12	
	10.0	3445.808	120	17	
	20.0	13402.465	340	27	
Reach 4	0.0	0.000	0	10	0.09
	0.5	38.953	5.1	10.5	
	1.0	120.770	10.5	11	
	2.0	370.471	22	12	
	5.0	1637.759	62.5	15	
	10.0	5311.441	150	20	
	20.0	19189.666	400	30	

Draiange Design Flow Rates Summary Table

Area Label	Area (acres)	Flow/Acre (cfs/acre)	Flow (cfs)	Drop Inlet Label	Drop Inlet Flow (cfs)	Mainline Section	Drop Inlets Spanned	Flow (cfs)
a	0.477	1.95	0.93	1	1.19	A	1-4	1.19
b	0.133	1.95	0.26			B	4-Out	2.72
c	0.262	1.95	0.51	2	0.78			
d	0.136	1.95	0.27			C	2-6	0.78
e	0.039	1.95	0.08	3	1.03	D	6-9	1.40
f	0.49	1.95	0.96			E	9-Out	2.51
g	0.607	1.95	1.18	4	1.53			
h	0.176	1.95	0.34			F	3-7	1.03
i	0.03	1.95	0.06	5	0.23	G	7-10	2.23
j	0.086	1.95	0.17			H	10-Out	3.25
k	0.195	1.95	0.38	6	0.63			
l	0.126	1.95	0.25			I	5-8	0.23
m	0.093	1.95	0.18	7	1.20	J	8-Out	0.77
n	0.522	1.95	1.02					
o	0.28	1.95	0.55	8	0.55	K	11-Out	0.17
p	0.387	1.95	0.75	9	1.11			
q	0.182	1.95	0.35			L	12-Out	0.18
r	0.101	1.95	0.20	10	1.02			
s	0.422	1.95	0.82			M	13-Out	1.38
t	0.086	1.95	0.17	11	0.17			
u	0.094	1.95	0.18	12	0.18	N	14-Out	0.57
v	0.707	1.95	1.38	13	1.38			
w	0.294	1.95	0.57	14	0.57	O	15-Out	0.08
x	0.042	1.95	0.08	15	0.08			

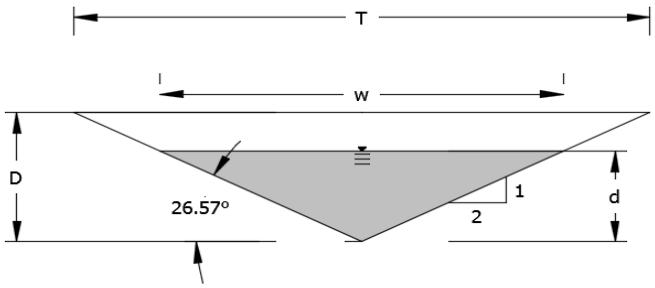
Max tributary area occurs at area v, 0.707 acres. The corresponding flow rate is 1.38 cfs.
Max flow rate into any drop inlet occurs at drop inlet 4. The corresponding flow rate is 1.53 cfs.
Max flow rate along any mainline section occurs at section H. The corresponding flow rate is 3.25 cfs.

Subject: Lyons Hillside Vineyard - New Vineyard Development
Project #: 180802-0122
By: Omar Reveles
Date: 12/6/2019

Cross Slope Diversion

Using Mannings Equation Q=(((1.49/n) x A x R^(2/3)) x s^(1/2))

where: Q= flow, in cfs
n = Mannings Roughness Coefficient
A =area in flow, in square feet
R = hydraulic radius, in feet
s = slope, in ft/ft



TRIANGLE

w = 4 x d

Flow Area (A) in square feet = (w x d)/2

Wetted Perimeter (P) in feet = (((d^2) + ((w/2)^2))^(1/2)) x 2

Hydraulic Radius (R) in feet = A/P

Cross Slope Diversion Sizing Table

Watershed	Channel Slope (ft/ft)	Side Slopes		Channel Depth (inches)	Mannings "n" value	% Full (d/D)	Flow Capacity (cfs)	Peak Anticipated Flow (cfs)	Notes
		Horizontal	Vertical						
a	0.04	2	to 1	6	0.035	100%	1.57	0.93	OK
b	0.04	2	to 1	6	0.035	100%	1.57	0.26	OK
c	0.04	2	to 1	6	0.035	100%	1.57	0.51	OK
d	0.04	2	to 1	6	0.035	100%	1.57	0.27	OK
e	0.04	2	to 1	6	0.035	100%	1.57	0.08	OK
f	0.04	2	to 1	6	0.035	100%	1.57	0.96	OK
g	0.04	2	to 1	6	0.035	100%	1.57	1.18	OK
h	0.04	2	to 1	6	0.035	100%	1.57	0.34	OK
i	0.04	2	to 1	6	0.035	100%	1.57	0.06	OK
j	0.04	2	to 1	6	0.035	100%	1.57	0.17	OK
k	0.04	2	to 1	6	0.035	100%	1.57	0.38	OK
l	0.04	2	to 1	6	0.035	100%	1.57	0.25	OK
m	0.04	2	to 1	6	0.035	100%	1.57	0.18	OK
n	0.04	2	to 1	6	0.035	100%	1.57	1.02	OK
o	0.04	2	to 1	6	0.035	100%	1.57	0.55	OK
p	0.04	2	to 1	6	0.035	100%	1.57	0.75	OK
q	0.04	2	to 1	6	0.035	100%	1.57	0.35	OK
r	0.04	2	to 1	6	0.035	100%	1.57	0.20	OK
s	0.04	2	to 1	6	0.035	100%	1.57	0.82	OK
t	0.04	2	to 1	6	0.035	100%	1.57	0.17	OK
u	0.04	2	to 1	6	0.035	100%	1.57	0.18	OK
v	0.04	2	to 1	6	0.035	100%	1.57	1.38	OK
w	0.04	2	to 2	6	0.035	100%	1.57	0.57	OK
x	0.04	2	to 3	6	0.035	100%	1.57	0.08	OK

Notes:
1.) Mannings roughness coefficients (n values) for channels were acquired from "Civil Engineering Reference Manual Appendix 19.A"
2.) Mannings roughness coefficients (n values) for smooth wall pipe were acquired from ADS product literature
3.) Peak anticipated flows were obtained from TR-55 hydrologic modeling for post-development conditions.

Subject: Lyons Hillside Vineyard - New Vineyard Development
Project #: 180802-0122
By: Omar Reveles
Date: 12/6/2019

Drop Inlet Riser and Sump Design										
Point of Concentration	Qw Peak Flow (cfs)	Drop Inlet Riser Diameter (inches)	Inlet Riser Diameter (ft)	Inlet Weir Head Required (ft)	Inlet Sump Diameter (inches)	Inlet Sump Diameter (ft)	Head Required for Sump Inlet (ft)	Design		Remarks
1	1.19	6	0.50	0.39	12	1.0	0.39	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
2	0.78	6	0.50	0.30	12	1.0	0.29	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
3	1.03	6	0.50	0.36	12	1.0	0.35	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
4	1.53	6	0.50	0.46	12	1.0	0.46	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
5	0.23	6	0.50	0.13	12	1.0	0.13	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
6	0.63	6	0.50	0.26	12	1.0	0.26	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
7	1.20	6	0.50	0.39	12	1.0	0.39	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
8	0.55	6	0.50	0.23	12	1.0	0.23	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
9	1.11	6	0.50	0.37	12	1.0	0.37	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
10	1.02	6	0.50	0.35	12	1.0	0.35	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
11	0.17	6	0.50	0.11	12	1.0	0.11	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
12	0.18	6	0.50	0.11	12	1.0	0.11	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
13	1.38	6	0.50	0.43	12	1.0	0.43	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
14	0.57	6	0.50	0.24	12	1.0	0.24	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
15	0.08	6	0.50	0.06	12	1.0	0.06	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.

Equations Used:

Circular Riser Weir Flow Equation: $Qw = 9.73 \times d \times h^{(3/2)}$

where Qw = weir flow, in cfs
d = pipe diameter, in feet
h = height of water above riser, in feet

rearranging terms, and solving for h, yields:

$h = (Qw/(9.73 \times d))^{(2/3)}$

when only half of the circumference of the circular riser behaves as a weir

$h = (Qw/(4.87 \times d))^{(2/3)}$

Setting the Circular Riser Weir Flow Equation equal to the Standard Weir Equation yields: $9.73 \times d \times h^{(3/2)} = C \times b \times h^{(3/2)}$

substituting circumference ($\pi \times d$) for "b" yields:

$9.73 \times d \times h^{(3/2)} = C \times (\pi \times d) \times h^{(3/2)}$

simplifying the equation yields: $9.73 = c \times \pi$

Solving for C yields: C = 3.10

Weir coefficient is on the conservative side of the acceptable range (3.0 - 3.9)

Standard Weir Equation: $Qw = C \times b \times h^{(3/2)}$

where C = weir coefficient (3.0 - 3.9)
b = effective weir length, in feet
h = height of water above weir, in feet

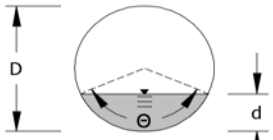
This equation calculates the flow in terms of the effective length of the weir and the height of the water above the weir. If a circular pipe riser is used, the effective weir length is equal to the circumference of that circular pipe

Subject: Lyons Hillside Vineyard - New Vineyard Development
Project #: 180802-0122
By: Omar Reveles
Date: 12/6/2019

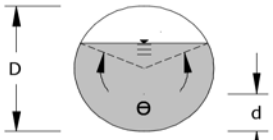
Drainage Mainline

Using Mannings Equation Q=(((1.49/n) x A x R^(2/3)) x s^(1/2))

where: Q= flow, in cfs
n = Mannings Roughness Coefficient
A =area in flow, in square feet
R = hydraulic radius, in feet
s = slope, in ft/ft



CIRCLE



CIRCLE

From the previous illustration:

θ (RAD) = 2 x arccos((D/2-d)/(D/2))

Area = 1/8(θ-sinθ)D^2 (θ in radians)

Wetted Perimeter = θD/2 (θ in radians)

Hydraulic Radius = (1-(sin(θ)/θ)) x (D/4) (θ in radians)

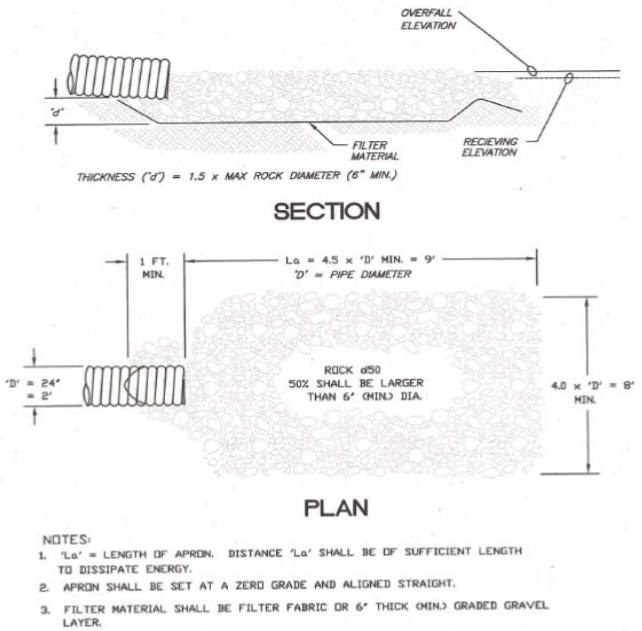
Drainage Mainline Sizing Table

Section	Spanned DI's	Pipe Slope (ft/ft)	HDPE Pipe Size (inches)	HDPE Pipe S/W or D/W	Mannings "n" value	% Full (d/D)	Flow Capacity (cfs)	Peak Anticipated Flow (cfs)	Notes
A	1-4	0.33	8	Single Wall	0.016	70%	4.73	1.19	OK
B	4-Outlet	0.41	8	Single Wall	0.016	70%	5.28	2.72	OK
C	2-6	0.28	8	Single Wall	0.016	70%	4.36	0.78	OK
D	6-9	0.27	8	Single Wall	0.016	70%	4.28	1.40	OK
E	9-Outlet	0.26	8	Single Wall	0.016	70%	4.20	2.51	OK
F	3-7	0.29	8	Single Wall	0.016	70%	4.44	1.03	OK
G	7-10	0.31	8	Single Wall	0.016	70%	4.59	2.23	OK
H	10-Outlet	0.32	8	Single Wall	0.016	70%	4.66	3.25	OK
I	5-8	0.31	8	Single Wall	0.016	70%	4.59	0.23	OK
J	8-Outlet	0.32	8	Single Wall	0.016	70%	4.66	0.77	OK
K	11-Out	0.16	8	Single Wall	0.016	70%	3.30	0.17	OK
L	12-Out	0.28	8	Single Wall	0.016	70%	4.36	0.18	OK
M	13-Out	0.04	8	Single Wall	0.016	70%	1.65	1.38	OK
N	14-Out	0.13	8	Single Wall	0.016	70%	2.97	0.57	OK
O	15-Out	0.20	8	Single Wall	0.016	70%	3.69	0.08	OK

Notes:
1.) Mannings roughness coefficients (n values) for channels were acquired from "Civil Engineering Reference Manual Appendix 19.A"
2.) Mannings roughness coefficients (n values) for smooth wall pipe were acquired from ADS product literature
3.) Peak anticipated flows were obtained from TR-55 hydrologic modeling for post-development conditions.

Subject: Lyons Hillside Vineyard - New Vineyard Development
Project #: 180802-0122
By: Omar Reveles
Date: 12/6/2019

Energy Dissipater Sizing

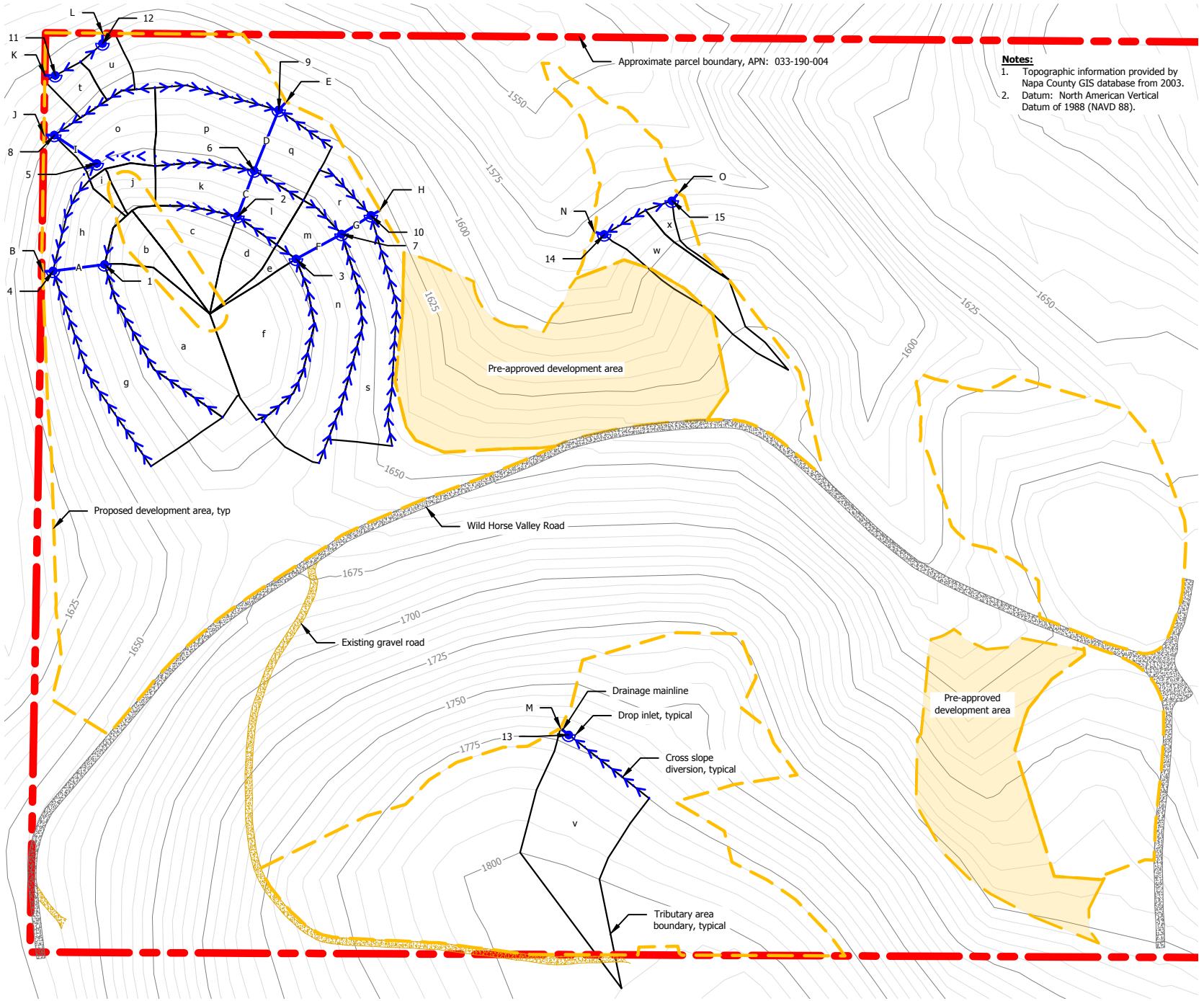


Pipe Geometry		
Diameter (in)	**Diameter (ft)**	**Area (sq. ft.)**
3	0.25	0.05
4	0.33	0.09
6	0.50	0.20
8	0.67	0.35
10	0.83	0.55
12	1.00	0.79
15	1.25	1.23
18	1.50	1.77
24	2.00	3.14

Channel Geometry (assuming 2:1 side slopes)				
Depth (in)	**Depth (ft)**	**Width (ft)**	**Area (sq. ft.)**	**Equivalent Pipe Size (in)**
4	0.33	1.33	0.22	8
6	0.50	2.00	0.50	10
8	0.67	2.67	0.89	15
10	0.83	3.33	1.39	18
12	1.00	4.00	2.00	24

Energy Dissipater Geometry								
Areas	**Outfall Type**	**Channel Depth (in)**	**Equivalent Pipe Size (in)**	**Min Apron Width "Wa" (ft)**	**Min Apron Length "La" (ft)**	**d50 Rock Size (in)**	**Largest Stone Size (in)**	**Rock Layer Depth "d" (in)**
abgh	Pipe	-	8	2.7	3.0	6	9	14
cdklpq	Pipe	-	8	2.7	3.0	6	9	14
efmnrs	Pipe	-	8	2.7	3.0	6	9	14
o	Pipe	-	8	2.7	3.0	6	9	14
t	Pipe	-	8	2.7	3.0	6	9	14
u	Pipe	-	8	2.7	3.0	6	9	14
v	Pipe	-	8	2.7	3.0	6	9	14
w	Pipe	-	8	2.7	3.0	6	9	14
x	Pipe	-	8	2.7	3.0	6	9	14
	Waterbar	4	8	2.7	3.0	6	9	14

CSD = Cross Slope Diversion



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707-253-ACME

LAND OF LYONS
NEW VINEYARD DEVELOPMENT
PROPOSED DRAINAGE

PROJECT NO. 180802-0122
DRAWING NO. 01 01
SCALE 1" = 200'
DATE 12/17/2019

SHEET 1 OF 1

HYDROLOGIC SOIL-COVER COMPLEXES

A combination of the effects of hydrologic soil group (soil) and the land use and treatment class (cover) is used to determine the runoff curve number (CN). The CN indicates the runoff potential of a soil-cover complex during periods when the soil is not frozen. The higher the CN, the higher the potential for runoff.

Land Use

Fallow is the land use with the highest potential for runoff because the land is kept as bare as possible to conserve moisture for use by a succeeding crop.

A row crop is any field crop planted in rows far enough apart that most of the soil surface is exposed to rainfall impact during the early growing season (i.e.: corn, soybeans, sorghum).

Small grain is planted in rows close enough together that the soil surface is not exposed except during planting and shortly thereafter.

Close-seeded legumes or rotation meadow are either planted in close rows or broadcast. This cover may be allowed to remain for more than a year so that year-round protection is given to the soil.

Pasture is a long term stand of forage plants which gives year-round protection to the soil.

Meadow is a field in which grass is continually grown, protected from grazing, and generally mowed for hay.

Woods are forested areas that have at least 30 percent canopy coverage as viewed by aerial photography.

Farmsteads include the area surrounding the farm headquarters including buildings, lots, driveways, etc.

Roads are improved travelways (not farm lanes). Hard surface roads include any type of asphalt or concrete paving. Road right-of-way is included in the total road area used to determine CN.

Treatment or Practice

Straight row fields are those farmed in straight rows either up and down hill or across the slope.

Contoured fields are those farmed as nearly as possible on the contour. The hydrologic effect of contouring is due to the surface storage provided by the furrows because the storage prolongs the time during which infiltration can take place. The magnitude of the storage depends not only on the dimensions of the furrows but also on the land slope, crop, and manner of planting and cultivation. See Contour Farming (330) in the Field Office Technical Guide for additional guidance.

The contoured and terraced condition is to be used for systems containing open-end level or graded terraces with grassed waterway outlets where all tillage is done on the contour between the terraces. The area above closed-end level terraces and terraces with tile outlets is to be included with the contoured area for runoff curve number computations.

Hydrologic Condition

Ratings as to “poor” or “good” are based largely on the proportion of dense vegetation in the rotation.

Pasture is considered poor if it is heavily grazed and has no mulch or has plant cover on less than half of the area. Fair pasture has plant cover on 50 to 75 percent of the area. Heavily grazed pasture in Iowa is generally considered to be fair pasture. Good pasture is lightly grazed and has plant cover on more than 75 percent of the area.

Poor woods are heavily grazed or are regularly burned and have no litter or new young growth. Fair woods are grazed but not burned. There may be some litter but these woods are not protected. Good woods are protected from grazing and have litter and shrubs covering the soil.

Table IA2-1 gives CN’s for agricultural land uses and for selected suburban and urban land uses.

Effects of Conservation Tillage

Cropland with conservation tillage and residue management practices will be considered to be in good hydrologic condition.

RUNOFF CURVE NUMBERS[1/]

TABLE IA2-1

COVER TYPE	LAND USE AND TREATMENT[2/]	HYDROLOGIC CONDITION[3/]	A	CN	B	CN	C	CN	D	CN
1	**FULLY DEVELOPED URBAN AREAS (Veg Est)**									
2	Open space (Lawns, parks, etc.)									
3	Poor condition; grass cover < 50%			68		79		86		89
4	Fair condition; grass cover 50% to 75%			49		69		79		84
5	Good condition; grass cover > 75%			39		61		74		80
6										
7	***Impervious Areas:***									
8	Paved parking lots, roofs, driveways			98		98		98		98
9										
10	Streets and roads:									
11	Paved; curbs and storm sewers			98		98		98		98
12	Paved; open ditches (w/ right-of-way)			83		89		92		93
13	Gravel (w/ right-of-way)			76		85		89		91
14	Dirt (w/ right-of-way)			72		82		87		89
15										
16	***Urban Districts***	Avg % Imperv								
17	Commercial & business	85		89		92		94		95
18	Industrial	72		81		88		91		93
19										
20	***Residential districts (by average lot size)***	Avg % Imperv								
21	1/8 acre (town houses)	65		77		85		90		92
22	1/4 acre	38		61		75		83		87
23	1/3 acre	30		57		72		81		86
24	1/2 acre	25		54		70		80		85
25	1 acre	20		51		68		79		84
26	2 acre	12		46		65		77		82
27										
28	***Western Desert Urban Areas***									
29	Natural desert (pervious areas only)			63		77		85		88
30	Artificial desert landscaping			96		96		96		96
31										
32	***User defined urban (Click button to define)***	Custom CN								
33	% Impervious Area:									
34	% Unconnected Impervious Area:									
35	Pervious Curve Number:									
36										
37	**DEVELOPING URBAN AREA (NO VEGETATION)**									
38	Newly graded area (pervious only)			77		86		91		94
39										
40	**CULTIVATED AGRICULTURAL LANDS**									
41	Fallow Bare soil	——		77		86		91		94
42	Fallow Crop residue (CR)	poor		76		85		90		93
43	Fallow Crop residue (CR)	good		74		83		88		90
44										
45	Row crop Straight row (SR)	poor		72		81		88		91
46	Straight row (SR)	good		67		78		85		89
47	SR + Crop residue	poor		71		80		87		90
48	SR + Crop residue	good		64		75		82		85
49	Contoured (C)	poor		70		79		84		88
50	Contoured (C)	good		65		75		82		86
51	C + Crop residue	poor		69		78		83		87
52	C + Crop residue	good		64		74		81		85
53	Cont & terraced (C&T)	poor		66		74		80		82
54	Cont & terraced (C&T)	good		62		71		78		81
55	C&T + Crop residue	poor		65		73		79		81
56	C&T + Crop residue	good		61		70		77		80
57										
58	Small grain Straight row (SR)	poor		65		76		84		88
59	Straight row (SR)	good		63		75		83		87
60										

RUNOFF CURVE NUMBERS[1/]
TABLE IA2-1

COVER TYPE	LAND USE AND TREATMENT[2/]	HYDROLOGIC CONDITION[3/]	A	CN	B	CN	C	CN	D	CN
61	SR + Crop residue	poor		64		75		83		86
62	SR + Crop residue	good		60		72		80		84
63	Contoured (C)	poor		63		74		82		85
64	Contoured (C)	good		61		73		81		84
65	C + Crop residue	poor		62		73		81		84
66	C + Crop residue	good		60		72		80		83
67	Cont & terraced (C&T)	poor		61		72		79		82
68	Cont & terraced (C&T)	good		59		70		78		81
69	C&T + Crop residue	poor		60		71		78		81
70	C&T + Crop residue	good		58		69		77		80
71										
72	Close-seeded Straight Row	poor		66		77		85		89
73	legumes or Straight Row	good		58		72		81		85
74	rotation Contoured	poor		64		75		83		85
75	meadow Contoured	good		55		69		78		83
76	Cont & terraced	poor		63		73		80		83
77	Cont & terraced	good		51		67		76		80
78										
79	**OTHER AGRICULTURAL LANDS**									
80	Pasture, grassland or range[4/]	poor		68		79		86		89
81	Pasture, grassland or range	fair		49		69		79		84
82	Pasture, grassland or range	good		39		61		74		80
83										
84	Meadow - cont. grass (non grazed)			30		58		71		78
85										
86	Brush - brush, weed, grass mix[5/]	poor		48		67		77		83
87	Brush - brush, weed, grass mix	fair		35		56		70		77
88	Brush - brush, weed, grass mix	good		30[6/]		48		65		73
89										
90	Woods - grass combination[7/]	poor		57		73		82		86
91	Woods - grass combination	fair		43		65		76		82
92	Woods - grass combination	good		32		58		72		79
93										
94	Woods[8/]	poor		45		66		77		83
95	Woods	fair		36		60		73		79
96	Woods	good		30		55		70		77
97										
98	Farmsteads	——		59		74		82		86
99	Feedlots									
100	Earthen	——		90		90		90		90
101	Paved			98		98		98		98

1/ Average runoff condition, and I_a=0.2s.

2/ Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

3/ Hydrologic condition is based on combinations of factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥20%), and (e) degree of surface toughness.
Poor: factors impair infiltration and tend to increase runoff.
Good: Factors encourage average and better than average infiltration and tend to decrease runoff.
For conservation tillage poor hydrologic condition, 5 to 20% of the surface is covered with residue (less than 750 pounds per acre for row crops or 300 pounds per acre for small grain).
For conservation tillage good hydrologic condition, more than 20% of the surface is covered with residue (greater than 750 pounds per acre for row crops or 300 pounds per acre for small grain).

4/ Poor: <50% ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: >75% ground cover and lightly or only occasionally grazed.

5/ Poor: <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

6/ If actual curve number is less than 30, use CN = 30 for runoff computation.

7/ CNs shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CNs for woods and pasture.

8/ Poor: Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed, but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and letter and brush adequately cover the soil.

APPENDIX 19.A

Manning's Roughness Coefficient[a,b]
(design use)

channel material	n
plastic (PVC and ABS)	0.009
clean, uncoated cast iron	0.013–0.015
clean, coated cast iron	0.012–0.014
dirty, tuberculated cast iron	0.015–0.035
riveted steel	0.015–0.017
lock-bar and welded steel pipe	0.012–0.013
galvanized iron	0.015–0.017
brass and glass	0.009–0.013
wood stave	
small diameter	0.011–0.012
large diameter	0.012–0.013
concrete	
average value used	0.013
typical commercial, ball and spigot rubber gasketed end connections	
– full (pressurized and wet)	0.010
– partially full	0.0085
with rough joints	0.016–0.017
dry mix, rough forms	0.015–0.016
wet mix, steel forms	0.012–0.014
very smooth, finished	0.011–0.012
vitrified sewer	0.013–0.015
common-clay drainage tile	0.012–0.014
asbestos	0.011
planed timber (flume)	0.012 (0.010–0.014)
canvas	0.012
unplaned timber (flume)	0.013 (0.011–0.015)
brick	0.016
rubble masonry	0.017
smooth earth	0.018
firm gravel	0.023
corrugated metal pipe (CMP)	0.024 (see App. 17.F)
natural channels, good condition	0.025
rip rap	0.035
natural channels with stones and weeds	0.035
very poor natural channels	0.060

[a] Compiled from various sources.
[b] Values outside these ranges have been observed, but these values are typical.

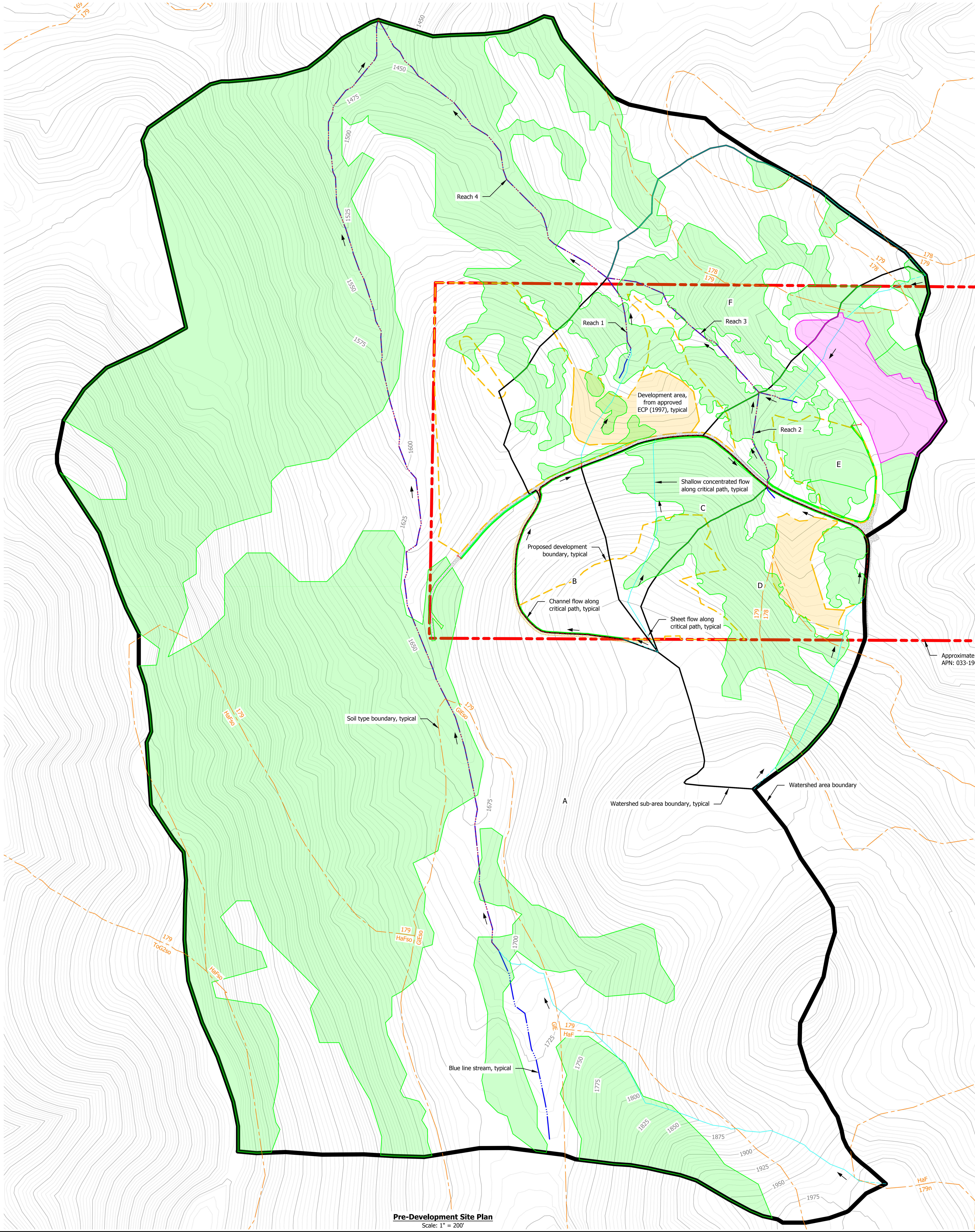
Support Material

Table 3-1
Conveyance Factors (Standard Units)

Design Manning's Values for ADS Thermoplastic Pipe *		
Product	**Diameter**	**Design Manning's "n"**
N-12, MEGA GREEN, N-12 STIB, N-12 WTIB, HP STORM, SaniTite, SaniTite HP, N-12 Low Head	4" - 60"	"n" = 0.012
Single Wall Highway and Heavy Duty *	18" - 24" 12" - 15" 10" 8" 3" - 6"	"n" = 0.020 "n" = 0.018 "n" = 0.017 "n" = 0.016 "n" = 0.015
TripleWall and Smoothwall Sewer & Drain	3" - 6"	"n" = 0.009 **
Conveyance Equations: k = Q/(s^0.5) Q = k s^0.5		

Conveyance Factors for Circular Pipe Flowing Full																		
Manning's "n" Values																		
Dia. (in.)	**Area (sq. ft.)**	**0.009**	**0.010**	**0.011**	**0.012**	**0.013**	**0.014**	**0.015**	**0.016**	**0.017**	**0.018**	**0.019**	**0.020**	**0.021**	**0.022**	**0.023**	**0.024**	**0.025**
3	0.05	1.3	1.1	1.0	1.0	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5
4	0.09	2.7	2.5	2.2	2.1	1.9	1.8	1.6	1.5	1.5	1.4	1.3	1.2	1.2	1.1	1.1	1.0	1.0
6	0.20	8.1	7.3	6.6	6.1	5.6	5.2	4.9	4.6	4.3	4.1	3.8	3.6	3.5	3.3	3.2	3.0	2.9
8	0.35	17.5	15.7	14.3	13.1	12.1	11.2	10.5	9.8	9.2	8.7	8.3	7.9	7.5	7.1	6.8	6.5	6.3
10	0.55	31.6	28.5	25.9	23.7	21.9	20.3	19.0	17.8	16.8	15.8	15.0	14.2	13.6	12.9	12.4	11.9	11.4
12	0.79	51.5	46.3	42.1	38.6	35.6	33.1	30.9	28.9	27.2	25.7	24.4	23.2	22.1	21.1	20.1	19.3	18.5
15	1.23	93.3	84.0	76.3	70.0	64.6	60.0	56.0	52.5	49.4	46.7	44.2	42.0	40.0	38.2	36.5	35.0	33.6
18	1.77	151.7	136.6	124.1	113.8	105.0	97.5	91.0	85.3	80.3	75.9	71.9	68.3	65.0	62.1	59.4	56.9	54.6
21	2.41	228.9	206.0	187.3	171.6	158.4	147.1	137.3	128.7	121.2	114.4	108.4	103.0	98.1	93.6	89.6	85.8	82.4
24	3.14	326.8	294.1	267.3	245.1	226.2	210.1	196.1	183.8	173.0	163.4	154.8	147.0	140.0	133.7	127.9	122.5	117.6
27	3.98	447.3	402.6	366.0	335.5	309.7	287.6	268.4	251.6	236.8	223.7	211.9	201.3	191.7	183.0	175.0	167.8	161.0
30	4.91	592.5	533.2	484.7	444.3	410.2	380.9	355.5	333.3	313.7	296.2	280.6	266.6	253.9	242.4	231.8	222.2	213.3
33	5.94	763.9	687.5	625.0	572.9	528.9	491.1	458.3	429.7	404.4	382.0	361.9	343.8	327.4	312.5	298.9	286.5	275.0
36	7.07	963.4	867.1	788.2	722.6	667.0	619.3	578.0	541.9	510.0	481.7	456.4	433.5	412.9	394.1	377.0	361.3	346.8
42	9.62	1453.2	1307.9	1189.0	1089.9	1006.1	934.2	871.9	817.5	769.4	726.6	688.4	654.0	622.8	594.5	568.7	545.0	523.2
45	11.04	1746.8	1572.1	1429.2	1310.1	1209.3	1122.9	1048.1	982.6	924.8	873.4	827.4	786.1	748.6	714.6	683.5	655.0	628.8
48	12.57	2074.8	1867.4	1697.6	1556.1	1436.4	1333.8	1244.9	1167.1	1098.4	1037.4	982.8	933.7	889.2	848.8	811.9	778.1	746.9
54	15.90	2840.5	2556.4	2324.0	2130.4	1966.5	1826.0	1704.3	1597.8	1503.8	1420.2	1345.5	1278.2	1217.4	1162.0	1111.5	1065.2	1022.6
60	19.63	3762.0	3385.8	3078.0	2821.5	2604.4	2418.4	2257.2	2116.1	1991.6	1881.0	1782.0	1692.9	1612.3	1539.0	1472.1	1410.7	1354.3
72	28.27	6117.3	5505.6	5005.1	4588.0	4235.1	3932.6	3670.4	3441.0	3238.6	3058.7	2897.7	2752.8	2621.7	2502.5	2393.7	2294.0	2202.2

* Corrugated Polyethylene Pipe Association (2000) "Hydraulic Considerations for Corrugated Polyethylene Pipe"
** "Lingedburg, Michael, "Civil Engineer Reference Manual"[4]

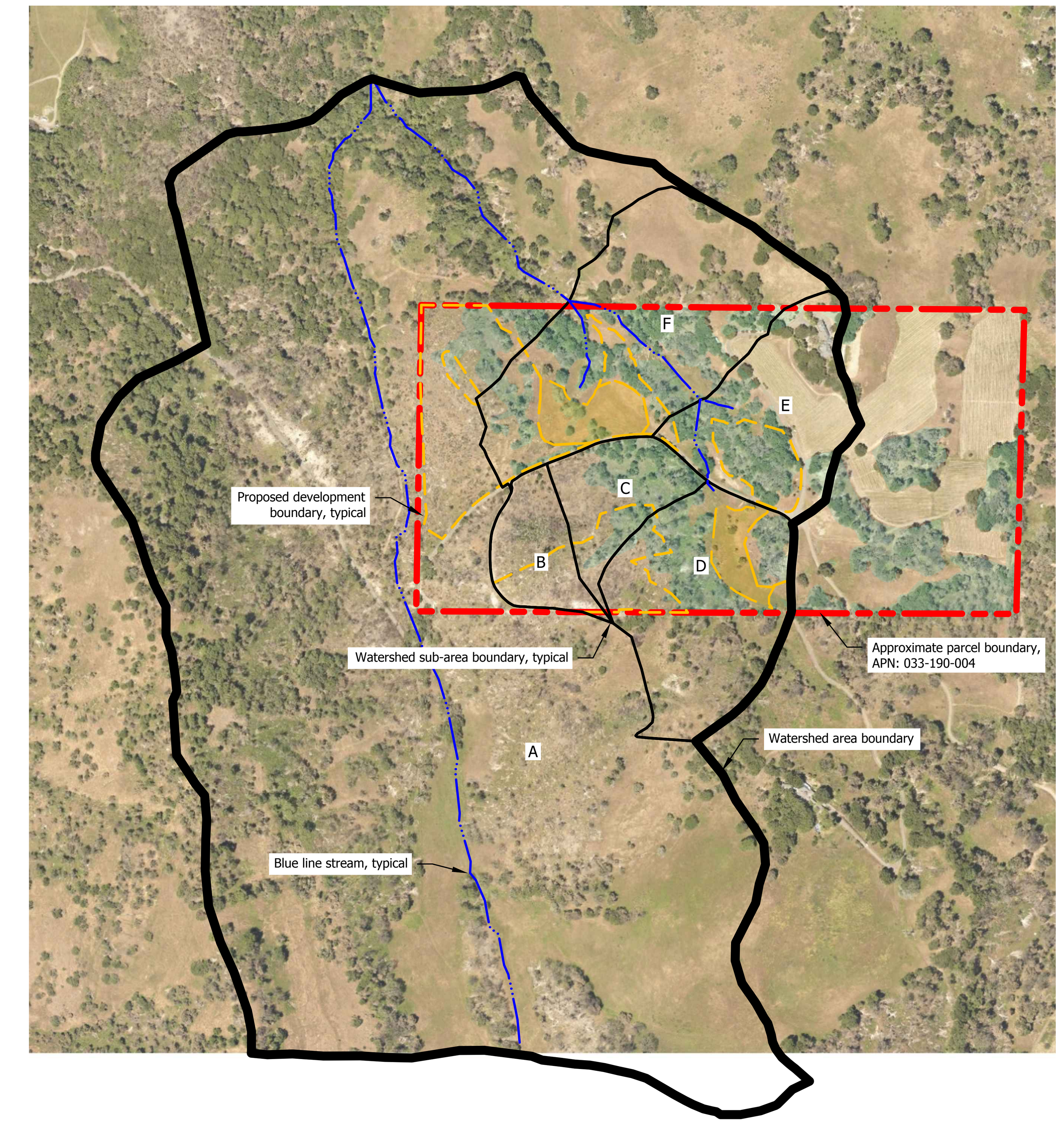


Pre-Development Site Plan
Scale: 1" = 200'

0' 200' 400'

Notes:
1. Topographic information provided by Napa County GIS database from 2003.
2. Datum: North American Vertical Datum of 1988 (NAVD 88).
3. Aerial image is from 2018 and was provided by Napa County.
4. The effective watershed extends past Napa County and into Solano County. As a result a small portion of the watershed lies outside the extents of the aerial image. The cover characteristics in this portion of the watershed were assumed from aerial imagery from Google Earth.

Soil Types on Site:
178, 179 - Sobrante loam, Hydrologic Soil Group C
GlEso, GlE - Gilroy loam, Hydrologic Soil Group C
HaFso, HaF - Hambright loam, Hydrologic Soil Group D
ToG2so - Toomes stony loam, Hydrologic Soil Group D



Watershed Aerial Map
Scale: 1" = 500'

Summary Table of Pre-Development Hydrologic Characteristics For Lands of Lyons

Watershed	Land Use	Hydrologic Condition	Hydrologic Soil Group	Acres	Curve Number
A	Paved parking lots, roofs, driveways	-	C	0.4	98
	Pasture, grassland or range	Fair	C	84.5	79
	Pasture, grassland or range	Fair	D	0.1	84
	Woods - grass combination	Fair	C	96.2	76
	Woods - grass combination	Fair	D	4.5	82
	Total	**-**	**-**	**185.7**	**78**
B	Pasture, grassland or range	Fair	C	4.4	79
	Total	**-**	**-**	**4.4**	**79**
C	Pasture, grassland or range	Fair	C	2.4	79
	Woods - grass combination	Fair	C	3.1	76
	Total	**-**	**-**	**5.5**	**77**
D	Pasture, grassland or range	Fair	C	8.8	79
	Woods - grass combination	Fair	C	6.0	76
	Total	**-**	**-**	**14.8**	**78**
E	Paved parking lots, roofs, driveways	-	C	1.1	98
	Pasture, grassland or range	Fair	C	1.8	79
	Pasture, grassland or range	Good	C	2.8	74
	Woods - grass combination	Fair	C	5.5	76
	Total	**-**	**-**	**11.2**	**78**
F	Paved parking lots, roofs, driveways	-	C	0.2	98
	Pasture, grassland or range	Fair	C	12.0	79
	Pasture, grassland or range	Good	C	0.2	74
	Woods - grass combination	Fair	C	9.9	76
	Total	**-**	**-**	**22.3**	**78**

Legend

- Major contour (25' interval) (1000)
- Minor contour (5' interval)
- Approximate parcel boundary
- Watershed area boundary
- Watershed sub-area boundary
- Development boundary
- Development area, from approved ECP (1997)
- Soil type boundary (179 / 178)
- Gravel roadway
- Paved roadway
- Blue line stream
- Existing vineyard boundary
- Woodland boundary
- Sheet flow along critical path
- Shallow concentrated flow along critical path
- Channel flow along critical path
- Runoff flow direction arrow
- Culvert
- Existing swale

QR
CHECKED BY

QR/LB
DRAWN BY

QR
DESIGNED BY

NOTES/ REMARKS:

REGISTERED PROFESSIONAL ENGINEER
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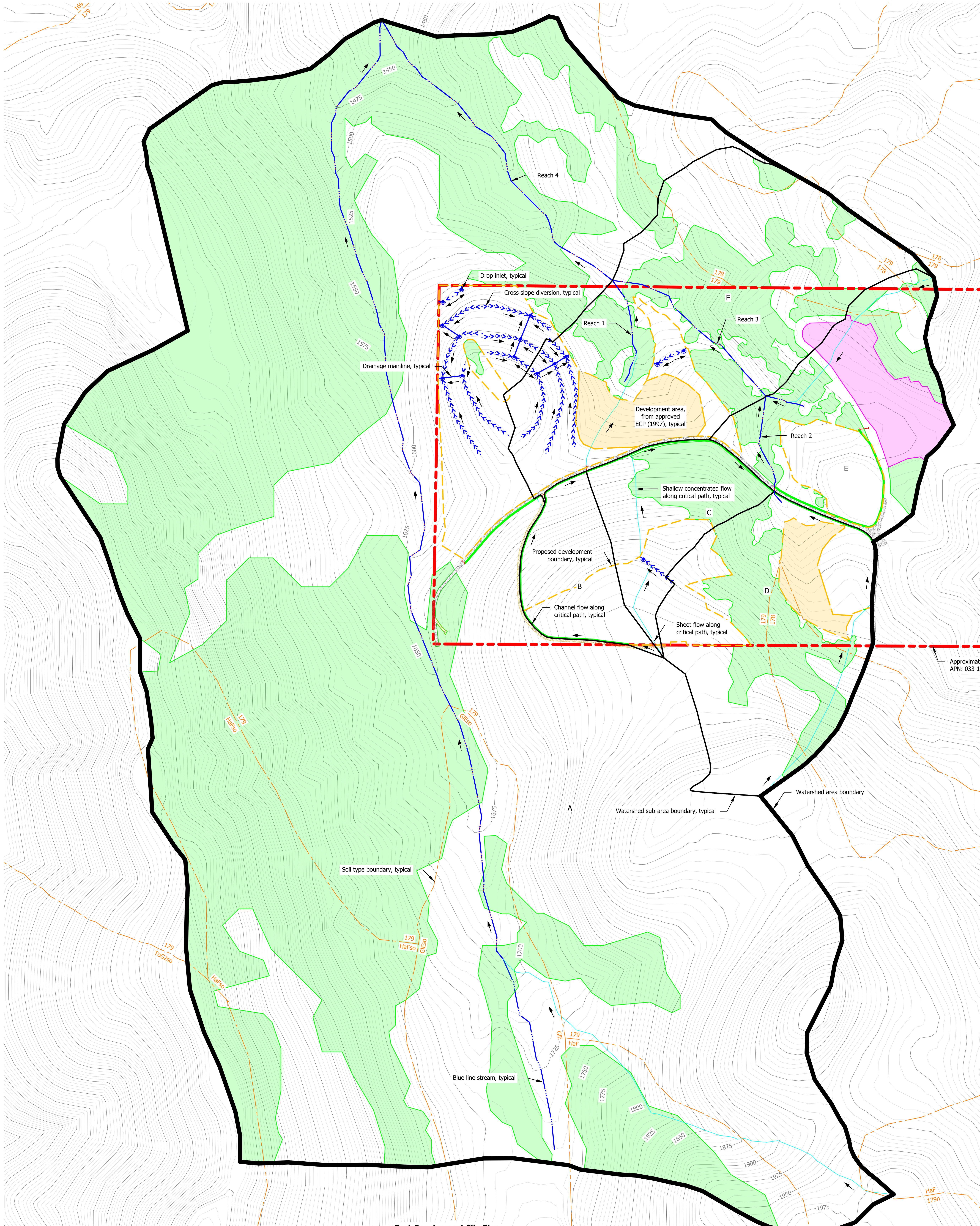
LANDS OF LYONS

NEW VINEYARD DEVELOPMENT
PRE-DEVELOPMENT SITE PLAN AND CURVE NUMBERS

PROJECT NO. 180802-0122
DRAWING NO. 01 01
SCALE AS SHOWN
DATE 12/17/2019

SHEET 1 OF 2



Post-Development Site Plan
Scale: 1" = 200'

N
True
0' 200' 400'

Notes:
1. Topographic information provided by Napa County GIS database from 2003.
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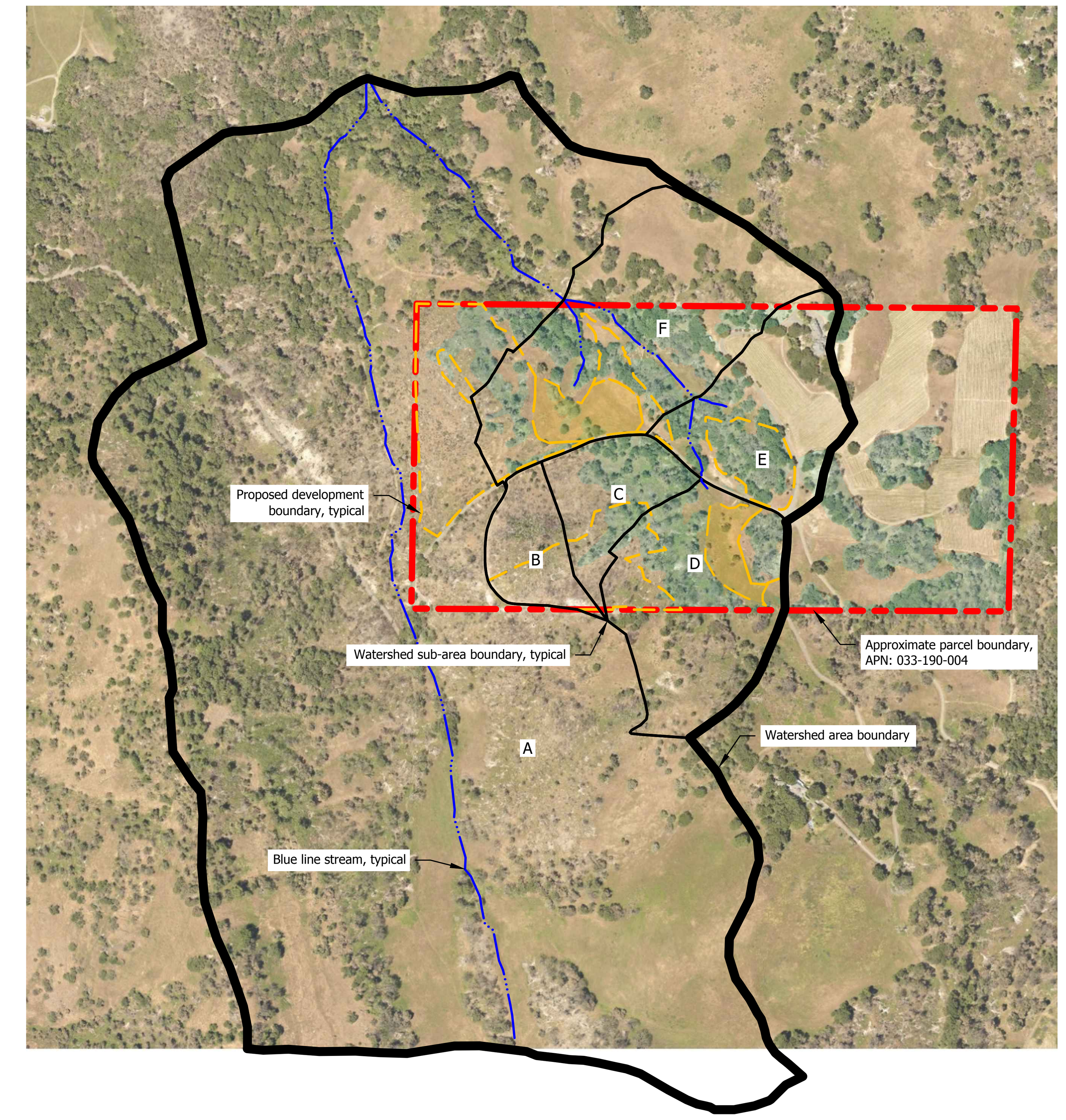
GlEso, GlE - Gilroy loam, Hydrologic Soil Group C
HaFso, HaF - Hambright loam, Hydrologic Soil Group D
ToG2so - Toomes stony loam, Hydrologic Soil Group D



Watershed Aerial Map
Scale: 1" = 500'

Summary Table of Post-Development Hydrologic Characteristics For Lands of Lyons

Watershed	Land Use	Hydrologic Condition	Hydrologic Soil Group	Acres	Curve Number
A	Paved parking lots, roofs, driveways	-	C	0.4	98
	Pasture, grassland or range	Fair	C	79.5	79
	Pasture, grassland or range	Fair	D	0.1	84
	Pasture, grassland or range	Good	C	6.3	74
	Woods - grass combination	Fair	C	94.9	76
	Woods - grass combination	Fair	D	4.5	82
	Total	**-**	**-**	**185.7**	**77**
B	Pasture, grassland or range	Fair	C	2.6	79
	Pasture, grassland or range	Good	C	1.8	74
	Total			**4.4**	**77**
C	Pasture, grassland or range	Fair	C	1.6	79
	Pasture, grassland or range	Good	C	1.6	74
	Woods - grass combination	Fair	C	2.4	76
	Total			**5.6**	**76**
D	Pasture, grassland or range	Fair	C	5.8	79
	Pasture, grassland or range	Good	C	4.4	74
	Woods - grass combination	Fair	C	4.6	76
	Total			**14.8**	**77**
E	Paved parking lots, roofs, driveways	-	C	1.1	98
	Pasture, grassland or range	Fair	C	1.4	79
	Pasture, grassland or range	Good	C	5.2	74
	Woods - grass combination	Fair	C	3.5	76
	Total			**11.2**	**78**
F	Paved parking lots, roofs, driveways	-	C	0.2	98
	Pasture, grassland or range	Fair	C	7.7	79
	Pasture, grassland or range	Good	C	6.5	74
	Woods - grass combination	Fair	C	7.8	76
	Total			**22.2**	**77**

Legend

- 1000 — Major contour (25' interval)
- Minor contour (5' interval)
- Approximate parcel boundary
- Watershed area boundary
- Watershed sub-area boundary
- Development boundary
- Development area, from approved ECP (1997)
- 179/178 — Soil type boundary
- Gravel roadway
- Paved roadway
- Blue line stream
- Existing vineyard boundary
- Woodland boundary
- Sheet flow along critical path
- Shallow concentrated flow along critical path
- Channel flow along critical path
- Cross slope diversion
- Culvert
- Drainage mainline
- Drop inlet
- Existing swale
- Runoff flow direction arrow

OR — CHECKED BY
OR/LB — DRAWN BY
OR — DESIGNED BY

NOTES/ REMARKS:

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LANDS OF LYONS
NEW VINEYARD DEVELOPMENT
POST-DEVELOPMENT SITE PLAN AND CURVE NUMBERS

PROJECT NO. 180802-0122
DRAWING NO. 01 02
SCALE AS SHOWN
DATE 12/17/2019

SHEET 2 OF 2

WinTR-55 Current Data Description

--- Identification Data ---

User: Acme Eng.
Project: Lyons
SubTitle: Pre-development
State: California
County: Napa
Filename: Z:\Jobs 2018\180802 Lyons\0122 New Vineyard Development ECP\Calc\03\TR55\Lyons Pre X Comparison

Date: 5/1/2020
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
X		Outlet	6.7	78	0.1

Total area: 6.70 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	0-Yr (in)
4.18	5.5	6.55	7.94	8.98	10.0	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type IA
Dimensionless Unit Hydrograph: <standard>

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	0-Yr (in)
4.18	5.5	6.55	7.94	8.98	10.0	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type IA
Dimensionless Unit Hydrograph: <standard>

Lyons
Pre-development
Napa County, California

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS						
X	3.18	5.20	6.90	9.20	10.95	12.68
REACHES						
OUTLET	3.18	5.20	6.90	9.20	10.95	12.68

Acme Eng. Lyons
Pre-development
Napa County, California

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period 2-Yr (cfs)	(hr)	5-Yr (cfs)	(hr)	10-Yr (cfs)	(hr)	25-Yr (cfs)	(hr)	50-Yr (cfs)	(hr)	100-Yr (cfs)	(hr)
SUBAREAS												
X	3.18	7.94	5.20	7.93	6.90	7.92	9.20	7.93	10.95	7.92	12.68	7.92
REACHES												
OUTLET	3.18		5.20		6.90		9.20		10.95		12.68	

Acme Eng. Lyons

Pre-development

Napa County, California

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
X	6.70	0.100	78	Outlet	

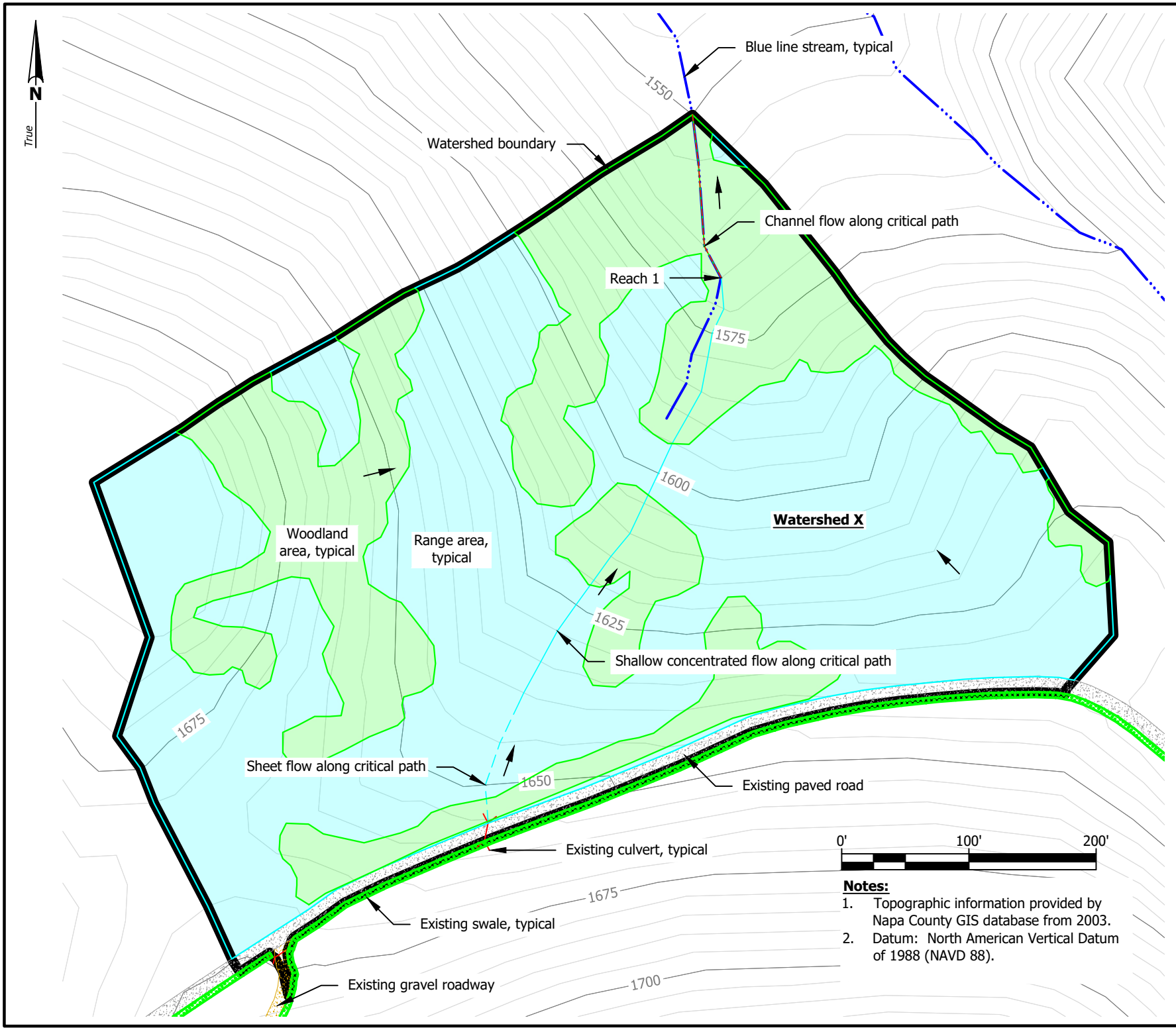
Total Area: 6.70 (ac)

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
X							
CHANNEL	609	0.1700	0.035	10.00	20.10	11.278	0.015
					Time of Concentration		0.1

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
X	Paved parking lots, roofs, driveways		C	.2	98
	Pasture, grassland or range	(fair)	C	4.1	79
	Woods - grass combination	(fair)	C	2.4	76
	Total Area / Weighted Curve Number			6.7	78



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707-253-ACME

LAND OF LYONS
NEW VINEYARD DEVELOPMENT
WATERSHED X
PRE-DEVELOPMENT SITE PLAN

PROJECT NO. 180802-0122
DRAWING NO. 01 01
SCALE 1" = 100'
DATE 5/1/2020

SHEET 1 OF 2

WinTR-55 Current Data Description

--- Identification Data ---

User: Acme Eng.
Project: Lyons
SubTitle: Post-development
State: California
County: Napa
Filename: Z:\Jobs 2018\180802 Lyons\0122 New Vineyard Development ECP\Calc\03\TR55\Lyons Post X Comparisc

Date: 5/1/2020
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
X		Outlet	7	75	0.1

Total area: 7 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	0-Yr (in)
4.18	5.5	6.55	7.94	8.98	10.0	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type IA
Dimensionless Unit Hydrograph: <standard>

Lyons
Post-development
Napa County, California

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	0-Yr (in)
4.18	5.5	6.55	7.94	8.98	10.0	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type IA
Dimensionless Unit Hydrograph: <standard>

Lyons
Post-development
Napa County, California

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS						
X	2.81	4.80	6.50	8.86	10.66	12.44
REACHES						
OUTLET	2.81	4.80	6.50	8.86	10.66	12.44

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period					
	2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
	(hr)	(hr)	(hr)	(hr)	(hr)	(hr)
SUBAREAS						
X	2.81	4.80	6.50	8.86	10.66	12.44
	8.01	7.94	7.93	7.93	7.92	7.92
REACHES						
OUTLET	2.81	4.80	6.50	8.86	10.66	12.44

Acme Eng. Lyons

Post-development

Napa County, California

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
X	7.00	0.100	75	Outlet	

Total Area: 7 (ac)

Lyons
Post-development
Napa County, California

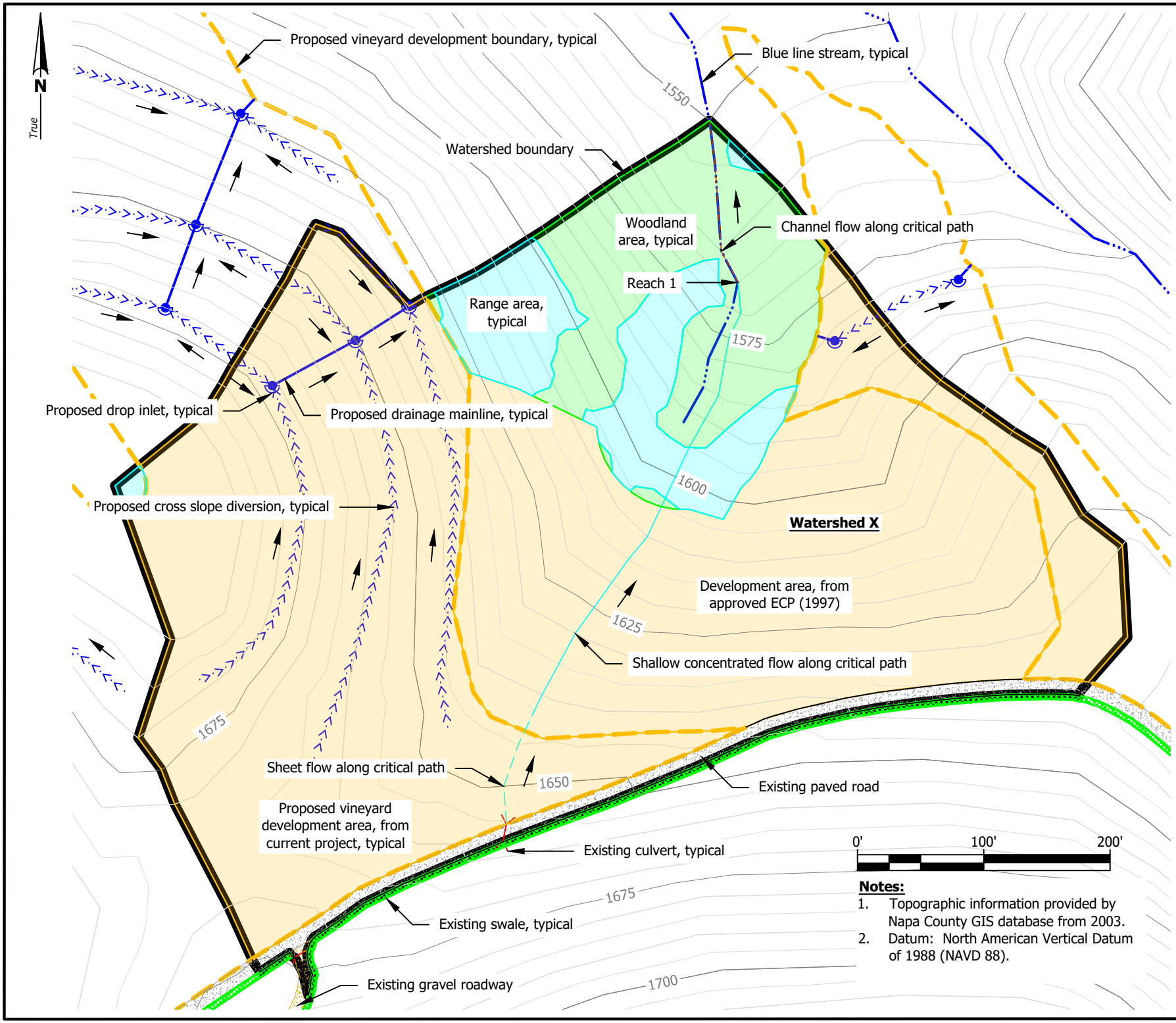
Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
X							
CHANNEL	609	0.1700	0.035	10.00	20.10	11.278	0.015
					Time of Concentration		0.1

Lyons
Post-development
Napa County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
X	Paved parking lots, roofs, driveways		C	.2	98
	Pasture, grassland or range	(fair)	C	.5	79
	Pasture, grassland or range	(good)	C	5.5	74
	Woods - grass combination	(fair)	C	.8	76
	Total Area / Weighted Curve Number			7	75
				=	==



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LAND OF LYONS

NEW VINEYARD DEVELOPMENT
WATERSHED X
POST-DEVELOPMENT

PROJECT NO.	DRAWING NO.	SCALE	DATE
180802-0122	01 02	1" = 100'	5/1/2020

SHEET 2 OF 2

Assumptions used for WinTR55 Analyses of Watershed X for Pre and Post Development

The determination of the hydrologic soil conditions was based on the historical and current use of these lands. Historically, the region was open rangeland of larger ranches and vineyards. A "fair" hydrologic soil condition was selected for "pasture, grasslands or range" and "woods grass combination" within the areas that are currently not developed. A "good" hydrologic soil condition was selected for "pasture, grasslands or range" within the areas of existing and proposed vineyard. A good hydrologic soil condition for the proposed and existing vineyard is justified by all the land preparation, cover cropping and straw mulching associated with the proposed development and the existing vineyards.

Finally, based on the hydrologic soil-cover complex definitions: "pasture, grasslands or range" land use was selected for the existing and proposed vineyard areas. The selected land use is the one that most closely resembles the proposed cover crop seed mix and anticipated farming practices.

Lyons New Vineyard Development

Pre/Post Development Peak Flow Rate Analysis at Blocks 2 and 4

Prepared by: Omar Reveles

July 20,2020

Purpose:

The purpose of this supplemental analysis is to demonstrate that the proposed drainage infrastructure at blocks 2 and 4 shall not cause an increase in peak flow rates to the adjacent ephemeral drainage(s).

Background:

From previous submittals it was demonstrated that the peak flow rates after vineyard development would not exceed pre-development flow rates. However, Napa County Planning Building and Environmental Services – Engineering Division requested that a greater percent ground cover be used at certain development areas for pre-development conditions. Because post-development soil loss may not exceed pre-development soil loss levels, this adjustment reduced the allowable soil loss at certain areas. As a result, additional cross slope diversions were required at blocks 2 and 4 in order to maintain soil loss at or below acceptable level(s).

Methodologies:

Two additional runoff models (pre/post development) were developed using the NRCS United States Department of Agriculture (USDA) Technical Release 55 (TR-55) methodology (USDA-NRCS 2003). The TR-55 methodology was used to generate peak flow estimates for watersheds D and E, which contain blocks 4 and 2, respectively.

Assumptions:

Land use details (for pre/post development conditions) from the overall watershed analysis previously submitted were used for this supplemental analysis.

Pre-development and post-development time of concentration for each watershed (D and E) were determined individually.

Conclusion:

The attached TR55 reports and site plans demonstrate that the proposed drainage infrastructure at blocks 2 and 4 shall not cause an increase in peak flow rates to the adjacent ephemeral drainage(s).

WinTR-55 Current Data Description

--- Identification Data ---

User: Acme Eng. Date: 7/17/2020
Project: Lyons Units: English
SubTitle: Watershed D and E Predevelopment (Individually)
Areal Units: Acres
State: California
County: Napa
Filename: Z:\Jobs 2018\180802 Lyons\0122 New Vineyard Development ECP\Calc\05\TR55\Pre development D and

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
D		Outlet	14.8	78	.1
E		Outlet	11.2	78	.187

Total area: 26 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	0-Yr (in)
4.18	5.5	6.55	7.94	8.98	10.0	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type IA
Dimensionless Unit Hydrograph: <standard>

Watershed D and E Predevelopment (Individually)
Napa County, California

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	0-Yr (in)
4.18	5.5	6.55	7.94	8.98	10.0	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type IA
Dimensionless Unit Hydrograph: <standard>

Watershed D and E Predevelopment (Individually)
Napa County, California

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS						
D	7.02	11.49	15.23	20.33	24.19	28.01
E	5.24	8.56	11.35	15.16	18.05	20.91
REACHES						
OUTLET	12.22	19.95	26.48	35.37	42.13	48.81

Watershed D and E Predevelopment (Individually)
Napa County, California

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period					
	2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
	(hr)	(hr)	(hr)	(hr)	(hr)	(hr)
SUBAREAS						
D	7.02	11.49	15.23	20.33	24.19	28.01
	7.94	7.93	7.92	7.93	7.92	7.92
E	5.24	8.56	11.35	15.16	18.05	20.91
	8.02	8.00	8.00	7.97	7.98	7.97
REACHES						
OUTLET	12.22	19.95	26.48	35.37	42.13	48.81

Watershed D and E Predevelopment (Individually)
Napa County, California

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
D	14.80	0.100	78	Outlet	
E	11.20	0.187	78	Outlet	

Total Area: 26 (ac)

Watershed D and E Predevelopment (Individually)
Napa County, California

Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
D							
SHEET	100	0.0700	0.130				0.077
SHALLOW	430	0.1400	0.050				0.020
CHANNEL	51	0.0400	0.035	10.00	20.10	4.722	0.003
					Time of Concentration		.1
E							
SHEET	100	0.0200	0.130				0.127
SHALLOW	1680	0.2300	0.050				0.060
					Time of Concentration		.187

Watershed D and E Predevelopment (Individually)
Napa County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
D	Pasture, grassland or range	(fair)	C	8.8	79
	Woods - grass combination	(fair)	C	6	76
	Total Area / Weighted Curve Number			14.8	78
E	Paved parking lots, roofs, driveways		C	1.1	98
	Pasture, grassland or range	(fair)	C	1.8	79
	Pasture, grassland or range	(good)	C	2.8	74
	Woods - grass combination	(fair)	C	5.5	76
	Total Area / Weighted Curve Number			11.2	78

WinTR-55 Current Data Description

--- Identification Data ---

User: Acme Eng. Date: 7/17/2020
Project: Lyons Units: English
SubTitle: Watershed D and E Post-Development (Individually)
Areal Units: Acres
State: California
County: Napa
Filename: Z:\Jobs 2018\180802 Lyons\0122 New Vineyard Development ECP\Calc\05\TR55\Post development D and

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
D		Outlet	14.8	77	.136
E		Outlet	11.2	78	.191

Total area: 26 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	0-Yr (in)
4.18	5.5	6.55	7.94	8.98	10.0	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type IA
Dimensionless Unit Hydrograph: <standard>

Watershed D and E Post-Development (Individually)
Napa County, California

Storm Data

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	0-Yr (in)
4.18	5.5	6.55	7.94	8.98	10.0	.0

Storm Data Source: User-provided custom storm data
Rainfall Distribution Type: Type IA
Dimensionless Unit Hydrograph: <standard>

Watershed D and E Post-Development (Individually)
Napa County, California

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS						
D	6.62	10.96	14.65	19.69	23.53	27.33
E	5.23	8.55	11.34	15.14	18.04	20.89
REACHES						
OUTLET	11.84	19.48	25.95	34.79	41.51	48.17

Acme Eng. Lyons

Watershed D and E Post-Development (Individually)

Napa County, California

Hydrograph Peak/Peak Time Table

Sub-Area or Reach Identifier	Peak Flow and Peak Time (hr) by Rainfall Return Period					
	2-Yr (cfs)	5-Yr (cfs)	10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
	(hr)	(hr)	(hr)	(hr)	(hr)	(hr)
SUBAREAS						
D	6.62	10.96	14.65	19.69	23.53	27.33
	8.00	7.96	7.95	7.94	7.94	7.93
E	5.23	8.55	11.34	15.14	18.04	20.89
	8.02	8.01	7.99	7.98	7.97	7.97
REACHES						
OUTLET	11.84	19.48	25.95	34.79	41.51	48.17

Acme Eng. Lyons

Watershed D and E Post-Development (Individually)

Napa County, California

Sub-Area Summary Table

Sub-Area Identifier	Drainage Area (ac)	Time of Concentration (hr)	Curve Number	Receiving Reach	Sub-Area Description
D	14.80	0.136	77	Outlet	
E	11.20	0.191	78	Outlet	

Total Area: 26 (ac)

Watershed D and E Post-Development (Individually)
Napa County, California

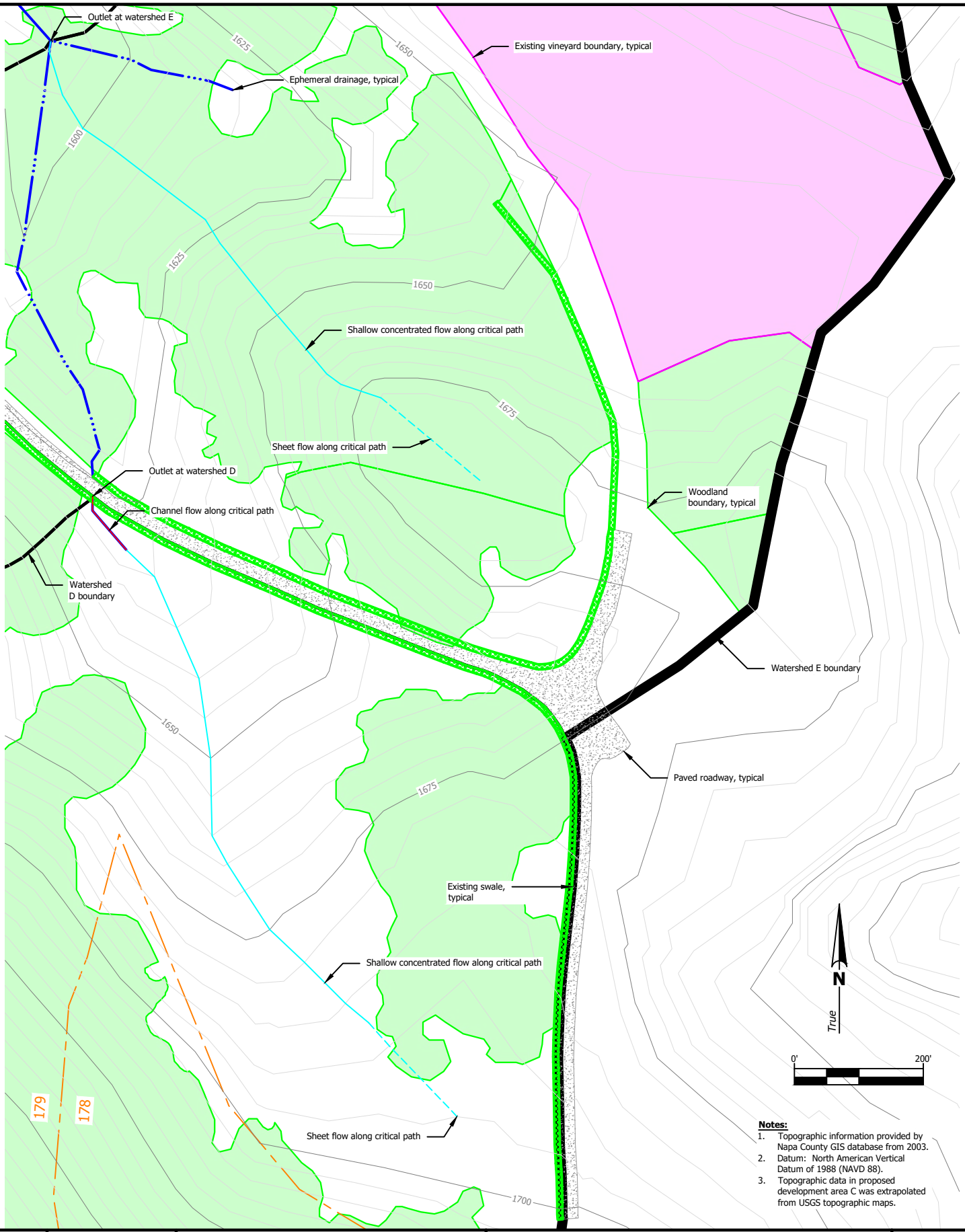
Sub-Area Time of Concentration Details

Sub-Area Identifier/	Flow Length (ft)	Slope (ft/ft)	Mannings's n	End Area (sq ft)	Wetted Perimeter (ft)	Velocity (ft/sec)	Travel Time (hr)
D							
SHEET	100	0.0700	0.170				0.096
SHALLOW	27	0.1100	0.050				0.001
CHANNEL	286	0.0400	0.035	0.50	2.24	3.178	0.025
CHANNEL	408	0.1100	0.035	2.00	4.47	8.095	0.014
					Time of Concentration		.136
E							
SHEET	100	0.0200	0.170				0.158
SHALLOW	126	0.2700	0.050				0.004
SHALLOW	280	0.1400	0.050				0.013
CHANNEL	157	0.0400	0.035	0.50	2.24	3.115	0.014
CHANNEL	63	0.1600	0.035	10.00	20.10	8.750	0.002
					Time of Concentration		.191

Watershed D and E Post-Development (Individually)
Napa County, California

Sub-Area Land Use and Curve Number Details

Sub-Area Identifier	Land Use		Hydrologic Soil Group	Sub-Area Area (ac)	Curve Number
D	Pasture, grassland or range	(fair)	C	5.8	79
	Pasture, grassland or range	(good)	C	4.4	74
	Woods - grass combination	(fair)	C	4.6	76
	Total Area / Weighted Curve Number			14.8	77
E	Paved parking lots, roofs, driveways		C	1.1	98
	Pasture, grassland or range	(fair)	C	1.4	79
	Pasture, grassland or range	(good)	C	5.2	74
	Woods - grass combination	(fair)	C	3.5	76
	Total Area / Weighted Curve Number			11.2	78



Notes:

1. Topographic information provided by Napa County GIS database from 2003.
2. Datum: North American Vertical Datum of 1988 (NAVD 88).
3. Topographic data in proposed development area C was extrapolated from USGS topographic maps.

SHEET 1 OF 1

PROJECT NO. 180802-0122

DRAWING NO. 05 01

SCALE 1" = 200'

DATE 07/20/2020

LAND OF LYONS

NEW VINEYARD DEVELOPMENT
BLOCKS 2 & 4 PRE-DEVELOPMENT
TIME OF CONCENTRATION DETERMINATION

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1700 Soscol Avenue
Ste. 9, Napa, CA 94559
707-253-ACME

ACME Engineering Incorporated

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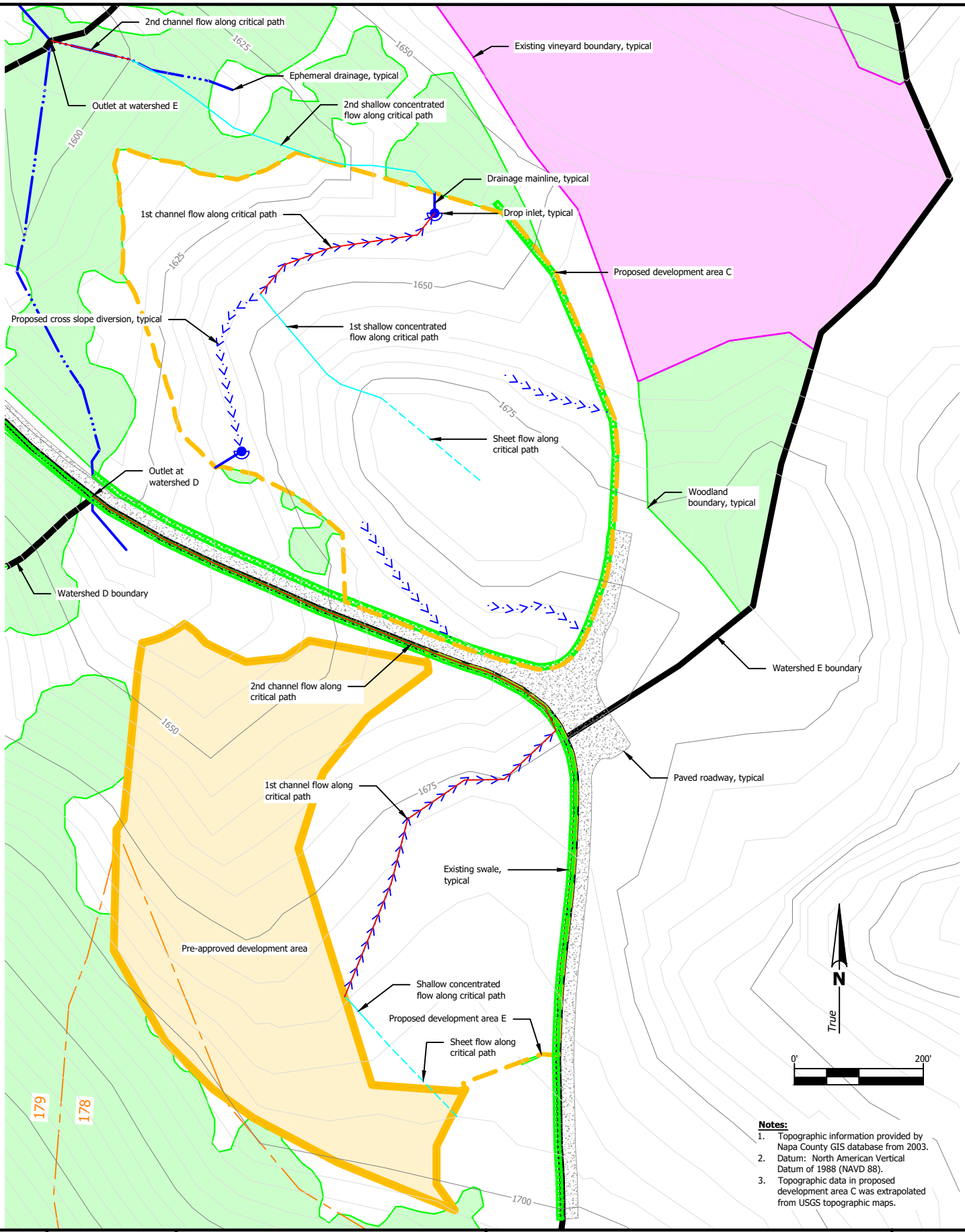


Notes:

1. Topographic information provided by Napa County GIS database from 2003.
2. Datum: North American Vertical Datum of 1988 (NAVD 88).
3. Topographic data in proposed development area C was extrapolated from USGS topographic maps.

SHEET 1 OF 1	PROJECT NO. 180802-0122 DRAWING NO. 05 02 SCALE 1" = 200' DATE 07/20/2020	# LAND OF LYONS NEW VINEYARD DEVELOPMENT BLOCKS 2 & 4 POST-DEVELOPMENT TIME OF CONCENTRATION DETERMINATION	www.acmeng.com 1700 Soscol Avenue Ste. 9, Napa, CA 94559 707-253-ACME ACME Engineering Incorporated	DESIGNED BY OR DRAWN BY OR CHECKED BY OR

Draiange Design Flow Rates Summary Table

Area Label	Area (acres)	Flow/Acre (cfs/acre)	Flow (cfs)	Drop Inlet Label	Drop Inlet Flow (cfs)	Mainline Section	Drop Inlets Spanned	Flow (cfs)
a	0.477	1.95	0.93	1	1.19	A	1-4	1.19
b	0.133	1.95	0.26			B	4-Out	2.72
c	0.262	1.95	0.51	2	0.78			
d	0.136	1.95	0.27			C	2-6	0.78
e	0.039	1.95	0.08	3	1.03	D	6-9	1.40
f	0.49	1.95	0.96			E	9-Out	2.51
g	0.607	1.95	1.18	4	1.53			
h	0.176	1.95	0.34			F	3-7	1.03
i	0.03	1.95	0.06	5	0.23	G	7-10	2.23
j	0.086	1.95	0.17			H	10-Out	3.25
k	0.195	1.95	0.38	6	0.63			
l	0.126	1.95	0.25			I	5-8	0.23
m	0.093	1.95	0.18	7	1.20	J	8-Out	0.77
n	0.522	1.95	1.02					
o	0.28	1.95	0.55	8	0.55			
p	0.387	1.95	0.75	9	1.11			
q	0.182	1.95	0.35					
r	0.101	1.95	0.20	10	1.02			
s	0.422	1.95	0.82					
t	0.086	1.95	0.17	11	0.17	K	11-Out	0.17
u	0.094	1.95	0.18	12	0.18	L	12-Out	0.18
v	0.707	1.95	1.38	13	1.38	M	13-Out	1.38
w	0.195	1.95	0.38	14	0.38	N	14-Out	0.38
x	0.167	1.95	0.33		0.33			
y	0.219	1.95	0.43	15	0.43	O	15-Out	0.43
z	0.35	1.95	0.68	16	0.68	P	16-Out	0.68
a2	0.117	1.95	0.23					
b2	0.132	1.95	0.26					
c2	0.414	1.95	0.81					

Date: December 6, 2019

Revised: July 16, 2020

Max tributary area occurs at area v, 0.707 acres. The corresponding flow rate is 1.38 cfs.

Max flow rate into any drop inlet occurs at drop inlet 4. The corresponding flow rate is 1.53 cfs.

Max flow rate along any mainline section occurs at section H. The corresponding flow rate is 3.25 cfs.

From previous calculations it was shown that the largest anticipated flow rates at cross slope diversions, drop inlets and drainage mainlines were 1.38 cfs, 1.53 cfs and 3.25 cfs, respectively.

Previous calculations also demonstrated that the maximum anticipated flow could be carried by the cross slope diversion, drop inlet and drainage mainline specified in the plan set.

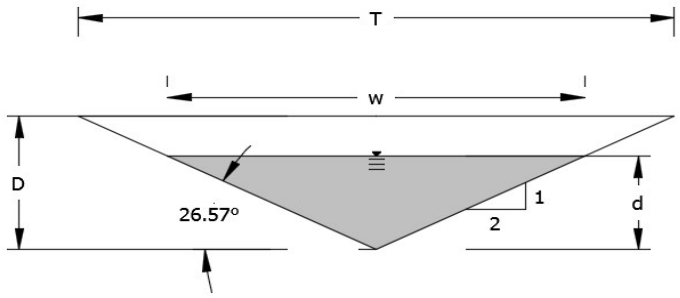
Because the anticipated flow rates at the new drainage structures are less than the maximum anticipated flow rates previously calculated. The cross slope diversion, drop inlet and drainage mainline specified in the plans will be adequate for the new drainage structures.

Subject: Lyons Hillside Vineyard - New Vineyard Development
Project #: 180802-0122
By: Omar Reveles
Date: 12/6/2019
Revised: 7/16/2020

Cross Slope Diversion

Using Mannings Equation Q=(((1.49/n) x A x R^(2/3)) x s^(1/2))

where: Q= flow, in cfs
n = Mannings Roughness Coefficient
A =area in flow, in square feet
R = hydraulic radius, in feet
s = slope, in ft/ft



TRIANGLE

w = 4 x d

Flow Area (A) in square feet = (w x d)/2

Wetted Perimeter (P) in feet = (((d^2) + ((w/2)^2))^(1/2)) x 2

Hydraulic Radius (R) in feet = A/P

Cross Slope Diversion Sizing Table

Watershed	Channel Slope (ft/ft)	Side Slopes (Horizontal	Vertical)	Channel Depth (inches)	Mannings "n" value	% Full (d/D)	Flow Capacity (cfs)	Peak Anticipated Flow (cfs)	Notes
		Horizontal							
a	0.04	2	to 1	6	0.035	100%	9.96	0.93	OK
b	0.04	2	to 1	6	0.035	100%	1.57	0.26	OK
c	0.04	2	to 1	6	0.035	100%	1.57	0.51	OK
d	0.04	2	to 1	6	0.035	100%	1.57	0.27	OK
e	0.04	2	to 1	6	0.035	100%	1.57	0.08	OK
f	0.04	2	to 1	6	0.035	100%	1.57	0.96	OK
g	0.04	2	to 1	6	0.035	100%	1.57	1.18	OK
h	0.04	2	to 1	6	0.035	100%	1.57	0.34	OK
i	0.04	2	to 1	6	0.035	100%	1.57	0.06	OK
j	0.04	2	to 1	6	0.035	100%	1.57	0.17	OK
k	0.04	2	to 1	6	0.035	100%	1.57	0.38	OK
l	0.04	2	to 1	6	0.035	100%	1.57	0.25	OK
m	0.04	2	to 1	6	0.035	100%	9.96	0.18	OK
n	0.04	2	to 1	6	0.035	100%	1.57	1.02	OK
o	0.04	2	to 1	6	0.035	100%	1.57	0.55	OK
p	0.04	2	to 1	6	0.035	100%	1.57	0.75	OK
q	0.04	2	to 1	6	0.035	100%	1.57	0.35	OK
r	0.04	2	to 1	6	0.035	100%	1.57	0.20	OK
s	0.04	2	to 1	6	0.035	100%	1.57	0.82	OK
t	0.04	2	to 1	6	0.035	100%	1.57	0.17	OK
u	0.04	2	to 1	6	0.035	100%	1.57	0.18	OK
v	0.04	2	to 1	6	0.035	100%	1.57	1.38	OK
w	0.04	2	to 1	6	0.035	100%	1.57	0.38	OK
x	0.04	2	to 1	6	0.035	100%	1.57	0.33	OK
y	0.04	2	to 1	6	0.035	100%	1.57	0.43	OK
z	0.04	2	to 1	6	0.035	100%	1.57	0.68	OK
a2	0.04	2	to 1	6	0.035	100%	1.57	0.23	OK
b2	0.04	2	to 1	6	0.035	100%	1.57	0.26	OK
c2	0.04	2	to 1	6	0.035	100%	1.57	0.81	OK

Notes:
1.) Mannings roughness coefficients (n values) for channels were acquired from "Civil Engineering Reference Manual Appendix 19.A"
2.) Mannings roughness coefficients (n values) for smooth wall pipe were acquired from ADS product literature
3.) Peak anticipated flows were obtained from TR-55 hydrologic modeling for post-development conditions.

Subject: Lyons Hillside Vineyard - New Vineyard Development
Project #: 180802-0122
By: Omar Reveles
Date: 12/6/2019
Revised: 7/16/2020

Drop Inlet Riser and Sump Design

Point of Concentration	Qw Peak Flow (cfs)	Drop Inlet Riser Diameter (inches)	Inlet Riser Diameter (ft)	Inlet Weir Head Required (ft)	Inlet Sump Diameter (inches)	Inlet Sump Diameter (ft)	Head Required for Sump Inlet (ft)	Design		Remarks
1	1.19	6	0.50	0.39	12	1.0	0.39	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
2	0.78	6	0.50	0.30	12	1.0	0.29	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
3	1.03	6	0.50	0.36	12	1.0	0.35	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
4	1.53	6	0.50	0.46	12	1.0	0.46	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
5	0.23	6	0.50	0.13	12	1.0	0.13	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
6	0.63	6	0.50	0.26	12	1.0	0.26	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
7	1.20	6	0.50	0.39	12	1.0	0.39	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
8	0.55	6	0.50	0.23	12	1.0	0.23	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
9	1.11	6	0.50	0.37	12	1.0	0.37	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
10	1.02	6	0.50	0.35	12	1.0	0.35	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
11	0.17	6	0.50	0.11	12	1.0	0.11	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
12	0.18	6	0.50	0.11	12	1.0	0.11	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
13	1.38	6	0.50	0.43	12	1.0	0.43	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
14	0.38	6	0.50	0.18	12	1.0	0.18	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
15	0.43	6	0.50	0.20	12	1.0	0.20	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.
16	0.68	6	0.50	0.27	12	1.0	0.27	6" riser	12" sump	Set riser invert to 1' below sump invert. Use an earthen berm to create required head at sump.

Equations Used:

Circular Riser Weir Flow Equation: $Qw = 9.73 \times d \times h^{(3/2)}$

where Qw = weir flow, in cfs
d = pipe diameter, in feet
h = height of water above riser, in feet

rearranging terms, and solving for h, yields:

$h = (Qw/(9.73 \times d))^{(2/3)}$

when only half of the circumference of the circular riser behaves as a weir

$h = (Qw/(4.87 \times d))^{(2/3)}$

Setting the Circular Riser Weir Flow Equation equal to the Standard Weir Equation yields: $9.73 \times d \times h^{(3/2)} = C \times b \times h^{(3/2)}$

substituting circumference ($\pi \times d$) for "b" yields:

$9.73 \times d \times h^{(3/2)} = C \times (\pi \times d) \times h^{(3/2)}$

simplifying the equation yields: $9.73 = c \times \pi$

Solving for C yields: $C = 3.10$

Weir coefficient is on the conservative side of the acceptable range (3.0 - 3.9)

Standard Weir Equation: $Qw = C \times b \times h^{(3/2)}$

where C = weir coefficient (3.0 - 3.9)
b = effective weir length, in feet
h = height of water above weir, in feet

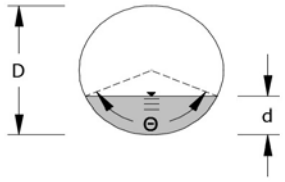
This equation calculates the flow in terms of the effective length of the weir and the height of the water above the weir. If a circular pipe riser is used, the effective weir length is equal to the circumference of that circular pipe

Subject: Lyons Hillside Vineyard - New Vineyard Development
Project #: 180802-0122
By: Omar Reveles
Date: 12/6/2019
Revised: 7/16/2020

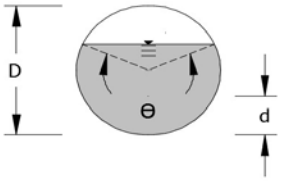
Drainage Mainline

Using Mannings Equation Q=(((1.49/n) x A x R^(2/3)) x s^(1/2))

where: Q= flow, in cfs
n = Mannings Roughness Coefficient
A =area in flow, in square feet
R = hydraulic radius, in feet
s = slope, in ft/ft



CIRCLE



CIRCLE

From the previous illustration:

θ (RAD) = 2 x arccos((D/2-d)/(D/2))

Area = 1/8(θ-sinθ)D^2 (θ in radians)

Wetted Perimeter = θD/2 (θ in radians)

Hydraulic Radius = (1-(sin(θ)/θ)) x (D/4) (θ in radians)

Drainage Mainline Sizing Table

Section	Spanned DI's	Pipe Slope (ft/ft)	HDPE Pipe Size (inches)	HDPE Pipe S/W or D/W	Mannings "n" value	% Full (d/D)	Flow Capacity (cfs)	Peak Anticipated Flow (cfs)	Notes
A	1-4	0.33	8	Single Wall	0.016	70%	4.73	1.19	OK
B	4-Outlet	0.41	8	Single Wall	0.016	70%	5.28	2.72	OK
C	2-6	0.28	8	Single Wall	0.016	70%	4.36	0.78	OK
D	6-9	0.27	8	Single Wall	0.016	70%	4.28	1.40	OK
E	9-Outlet	0.26	8	Single Wall	0.016	70%	4.20	2.51	OK
F	3-7	0.29	8	Single Wall	0.016	70%	4.44	1.03	OK
G	7-10	0.31	8	Single Wall	0.016	70%	4.59	2.23	OK
H	10-Outlet	0.32	8	Single Wall	0.016	70%	4.66	3.25	OK
I	5-8	0.31	8	Single Wall	0.016	70%	4.59	0.23	OK
J	8-Outlet	0.32	8	Single Wall	0.016	70%	4.66	0.77	OK
K	11-Out	0.16	8	Single Wall	0.016	70%	3.30	0.17	OK
L	12-Out	0.28	8	Single Wall	0.016	70%	4.36	0.18	OK
M	13-Out	0.04	8	Single Wall	0.016	70%	1.65	1.38	OK
N	14-Out	0.31	8	Single Wall	0.016	70%	4.59	0.38	OK
O	15-Out	0.20	8	Single Wall	0.016	70%	3.69	0.43	OK
P	16-Out	0.1	8	Single Wall	0.016	70%	2.61	0.68	OK

Notes:
1.) Mannings roughness coefficients (n values) for channels were acquired from "Civil Engineering Reference Manual Appendix 19.A"
2.) Mannings roughness coefficients (n values) for smooth wall pipe were acquired from ADS product literature
3.) Peak anticipated flows were obtained from TR-55 hydrologic modeling for post-development conditions.

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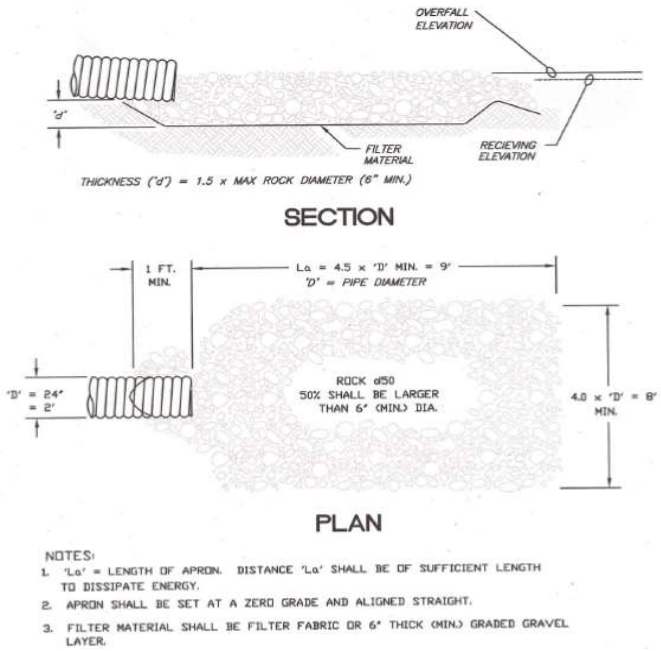
Project #: 180802-0122
By: Omar Reveles
Date: 12/6/2019
Revised: 7/16/2020

Energy Dissipater Sizing

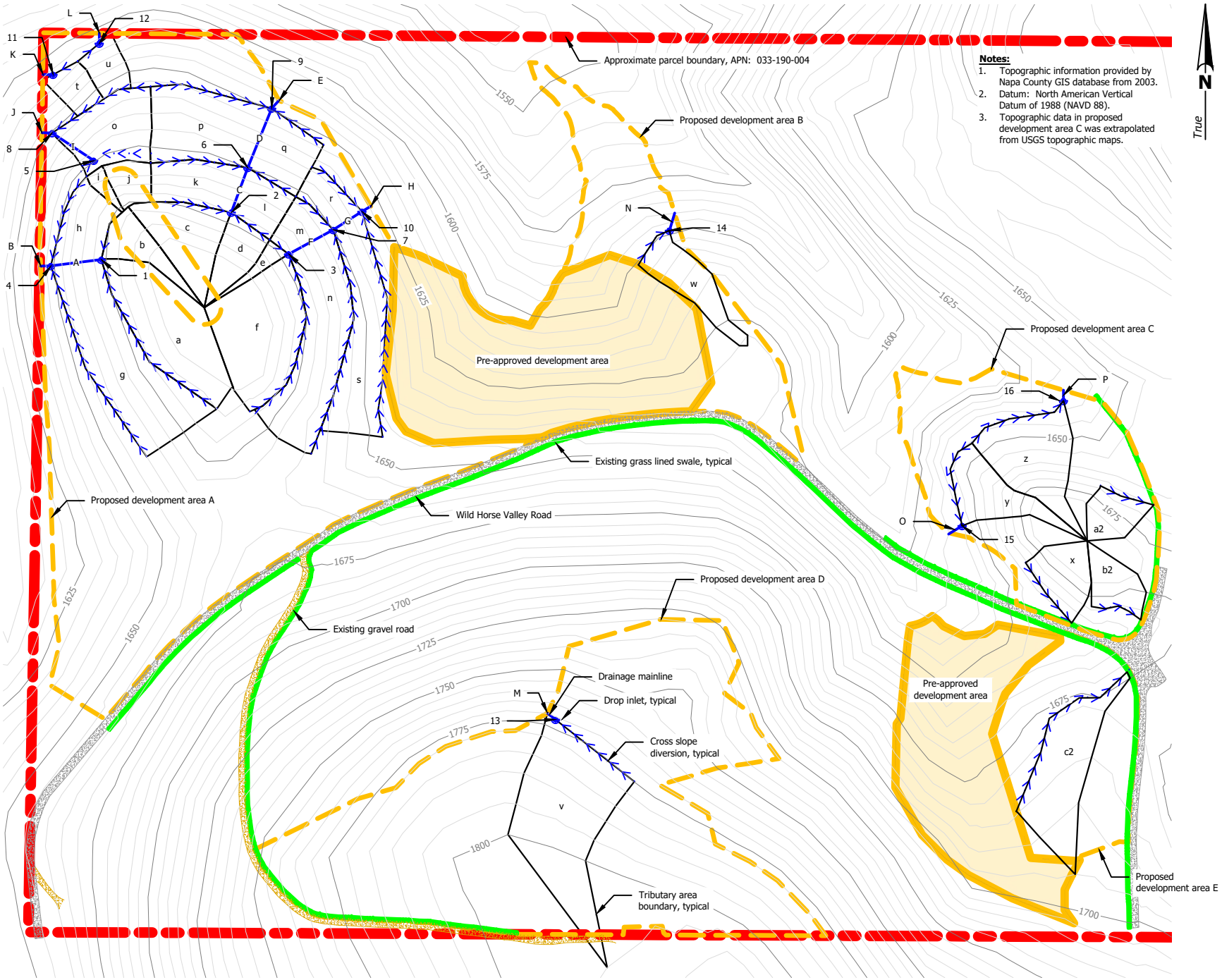


Pipe Geometry		
Diameter (in)	**Diameter (ft)**	**Area (sq. ft.)**
3	0.25	0.05
4	0.33	0.09
6	0.50	0.20
8	0.67	0.35
10	0.83	0.55
12	1.00	0.79
15	1.25	1.23
18	1.50	1.77
24	2.00	3.14

Channel Geometry (assuming 2:1 side slopes)				
Depth (in)	**Depth (ft)**	**Width (ft)**	**Area (sq. ft.)**	**Equivalent Pipe Size (in)**
4	0.33	1.33	0.22	8
6	0.50	2.00	0.50	10
8	0.67	2.67	0.89	15
10	0.83	3.33	1.39	18
12	1.00	4.00	2.00	24

Energy Dissipater Geometry								
Areas	**Outfall Type**	**Channel Depth (in)**	**Equivalent Pipe Size (in)**	**Min Apron Width "Wa" (ft)**	**Min Apron Length "La" (ft)**	**d50 Rock Size (in)**	**Largest Stone Size (in)**	**Rock Layer Depth "d" (in)**
abgh	Pipe	-	8	2.7	3.0	6	9	14
cdklpq	Pipe	-	8	2.7	3.0	6	9	14
efmnrs	Pipe	-	8	2.7	3.0	6	9	14
ijo	Pipe	-	8	2.7	3.0	6	9	14
t	Pipe	-	8	2.7	3.0	6	9	14
u	Pipe	-	8	2.7	3.0	6	9	14
v	Pipe	-	8	2.7	3.0	6	9	14
w	Pipe	-	8	2.7	3.0	6	9	14
x	N/A							
y	Pipe	-	8	2.7	3.0	6	9	14
z	Pipe	-	8	2.7	3.0	6	9	14
a2	N/A							
b2	N/A							
c2	N/A							
	Waterbar	4	8	2.7	3.0	6	9	14

N/A = Not applicable because ties into existing swale



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LAND OF LYONS
NEW VINEYARD DEVELOPMENT
PROPOSED DRAINAGE

PROJECT NO.	180802-0122
DRAWING NO.	05 01
SCALE	1" = 200'
DATE	07/18/2020

SHEET 1 OF 1