

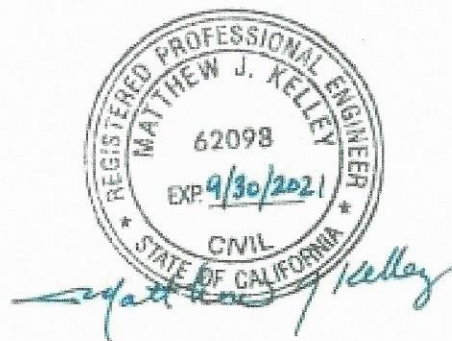
Hydrologic and Hydraulic Calculations (2021)



HYDROLOGIC AND HYDRAULIC CALCULATIONS

JOB No. 19019
San Benito Traveler's Station
PLN 200017
San Benito County, CA

June 2021



6/22/2021

KELLEY
ENGINEERING & SURVEYING
400 PARK CENTER DR, STE #4, HOLLISTER, CA 95023
OFFICE: (831) 636-1104 FAX (831) 636-1837

Introduction

Site Location:

The site is located east of Searl Road at its north end, south of Highway 129, and west of the 101 on-ramp.

Site Description:

Existing topography can be described as a pear-shaped basin that falls north to south with an average slope of 0.8 percent. Embankment slopes from Searl Road vary from 6:1 to 3.5:1. The ground slopes away from the 101 on-ramp into the site at a range of 2% to 6%.

There are no existing drainage facilities on-site, but there are culverts that terminate just outside the property to the south.

Proposed Project Description:

The project is a fuel station and fast food restaurant serving motorists and diesel trucks traveling along the 101 and 129 corridors.

Existing Drainage System

Characteristics:

The existing drainage system consists of overland sheet flow and shallow concentrated flow from north to south leading to a number of ditches and culverts within Caltrans' jurisdiction that carry runoff in a counter-clockwise route back to the north where it confluent with tributaries to the Pajaro River.

Proposed Drainage System

On-site drainage is conveyed to a detention pond via sheet flow, curb & gutter, valley gutter, catch basins and storm pipes.

Hydrologic Method:

The SCS unit-hydrograph method is used to calculate peak flows for use in sizing the drainage facilities, and to develop the 10-year pre-development peak flow. In accordance with the County Subdivision Ordinance, post development runoff is limited to this 10-year pre-development rate during a 100-year storm event. Storm events are simulated by the SCS unit hydrograph procedure provided in HydroCAD 10 storm water modeling software. Pond routing is accomplished by the Storage-Indication method also provided in HydroCAD 10. Rainfall depths used in the calculations are from the San Benito County Subdivision Ordinance.

Storm Frequencies Analyzed:

In accordance with Section 1.1, Chapter 3 of the County Subdivision Ordinance all on-site closed conduit systems and minor channel sections are designed with a capacity sufficient to handle the 10-year storm event. Detentions ponds are designed to accommodate the 100-year storm event. Allowable discharge for developed areas is limited to the 10-year pre-development rate.

Proposed Flow Patterns:

As the existing ground slopes north to south so does the finish grade. Storm waters are conveyed to a detention pond located at the south end of the site via sheet flow, curb & gutter, valley gutter, catch basins and storm pipes.

Hydraulic Controls for Drainage Outfall:

The outlet of the pond is a sharp crested weir. The weir releases storm flows into an earthen ditch that leads to an existing culvert located south of the property line.

Conclusions

All on-site runoff is directed to the on-site detention pond located at the south end of the site. The shape of the basin is trapezoidal and measures roughly 40 feet wide at the south end, 60 feet wide at the north end and spans roughly 164 feet. Pond capacity is just over 26,000 cubic feet. The impact of the development is a net increase in rainfall runoff. This net increase is mitigated by attenuating the 100-year post-development storm to the level of a 10-year pre-development storm. This is accomplished by routing the storm through a detention pond. The calculations in exhibit C-1 show that the 10-year pre-developed runoff is 4.21 CFS. The 100-year post developed runoff is calculated to be 10.81 CFS and is shown on exhibit D-1. When this 100-year post-developed storm is routed through the detention pond the result is a peak runoff release at the rate of 4.17 CFS as shown on exhibit E-1.

Attachments

- A Drainage Area Map
- B Rainfall Volume Calculations
- C-1 Pre-developed Runoff Summary – 10-year event
- C-2 Pre-developed Runoff Hydrograph – 10-year event
- D-1 Post-developed Runoff Summary – 100-year event
- D-2 Post-developed Runoff Hydrograph – 100-year event
- E-1 Post-developed Results Summary – 100-year event
- E-2 Post-developed Results Hydrograph – 100-year event.
- E-3 Post-developed Results Tabulated Hydrograph – 100-year event



**KELLEY
ENGINEERING & SURVEYING**

400 PARK CENTER DRIVE, SUITE #4
HOLLISTER, CA 95023
OFFICE (831) 636-1104 FAX (831) 636-1837

**SAN BENITO TRAVELER'S STATION
HWY 129 & 101, SAN BENITO COUNTY
DRAINAGE AREA MAP
EXHIBIT A**

Job No.:	19019
Designed:	TJK
Scale:	1" = 100'
Date:	May 2021
Sheet:	1
of	1



KELLEY
ENGINEERING & SURVEYING
400 Park Center Drive, Suite #4
Hollister, CA 95023
831-636-1104/Fax 831-636-1837

JOB TRAVELERS STATION
SHEET NO. 1 OF 1
CALCULATED BY WJK DATE 5/21/2021
CHECKED BY _____ DATE _____
SCALE _____

SBC VOLUME CALCULATIONS

TC = ~19 MW.

MAP = 18"

10 YEAR INTENSITY

$$0.6 \times 1.8 = 1.08''/\text{HR}$$

SHALLOW CONC. FLOW
 $L = 700 \text{ FT}$ $S = 0.0078$

FIGURE 3-1

FIGURE 3-2

100 YEAR INTENSITY

$$0.9 \times 1.8 = 1.62''/\text{HR}$$

FIGURE 3-2

VOLUME

10 YEAR

$$1.09 \times 1.48 \times 1.8 = 2.90 \text{ IN}$$

FIGURE 3-5

100 YEAR

$$1.09 \times 2.22 \times 1.8 = 4.36 \text{ IN}$$

FIGURE 3-5

19019 preliminary pond design

Type I 24-hr SBC 10-year Rainfall=2.90"

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Printed 5/21/2021

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Summary for Subcatchment 3S: Predeveloped

Runoff = 4.21 cfs @ 10.12 hrs, Volume= 0.644 af, Depth= 1.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs

Type I 24-hr SBC 10-year Rainfall=2.90"

Area (ac)	CN	Description
* 1.020	98	Searl Road, Portion 129
4.920	79	50-75% Grass cover, Fair, HSG C
5.940	82	Weighted Average
4.920		82.83% Pervious Area
1.020		17.17% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
18.9	700	0.0078	0.62		Shallow Concentrated Flow, Shallow Concentrated Flow Short Grass Pasture Kv= 7.0 fps

19019 preliminary pond design

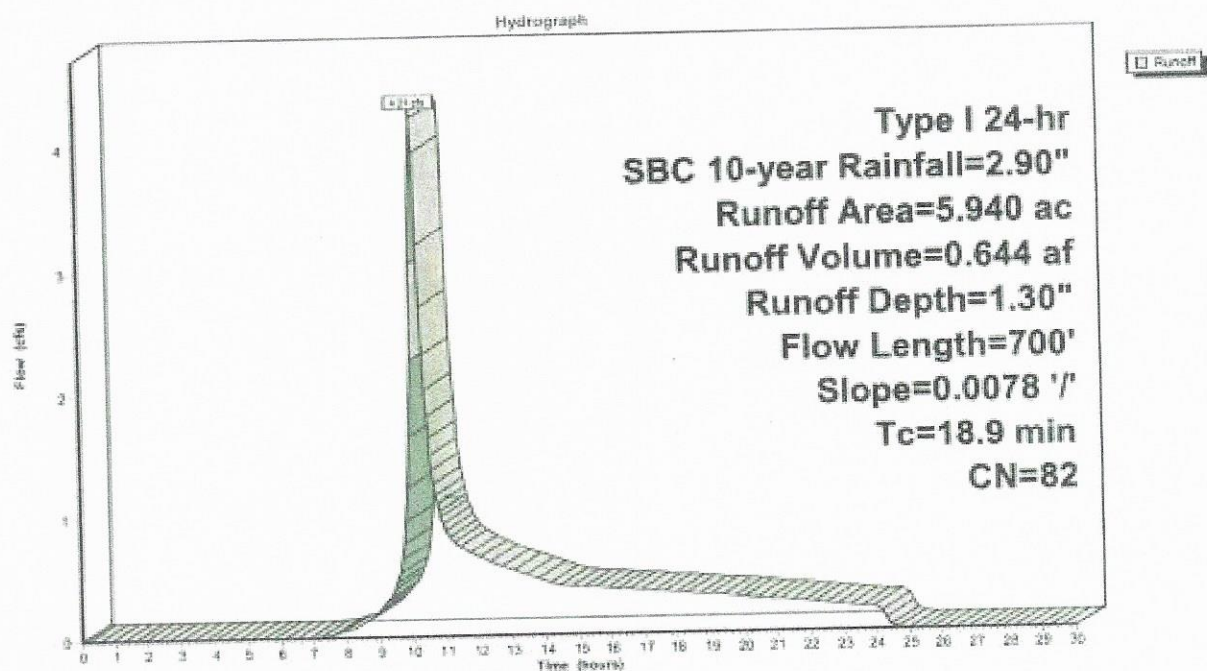
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Type I 24-hr SBC 10-year Rainfall=2.90"

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Subcatchment 3S: Predeveloped



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Type I 24-hr SBC 100-year Rainfall=4.36"

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Summary for Subcatchment 1S: Proposed Developemnt

Runoff = 10.81 cfs @ 10.08 hrs, Volume= 1.423 af, Depth= 2.87"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
Type I 24-hr SBC 100-year Rainfall=4.36"

Area (ac)	CN	Description
2.987	74	>75% Grass cover, Good, HSG C
2.952	98	Paved parking, HSG C
5.939	86	Weighted Average
2.987		50.29% Pervious Area
2.952		49.71% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.0					Direct Entry, Direct Entry - Minimum TC

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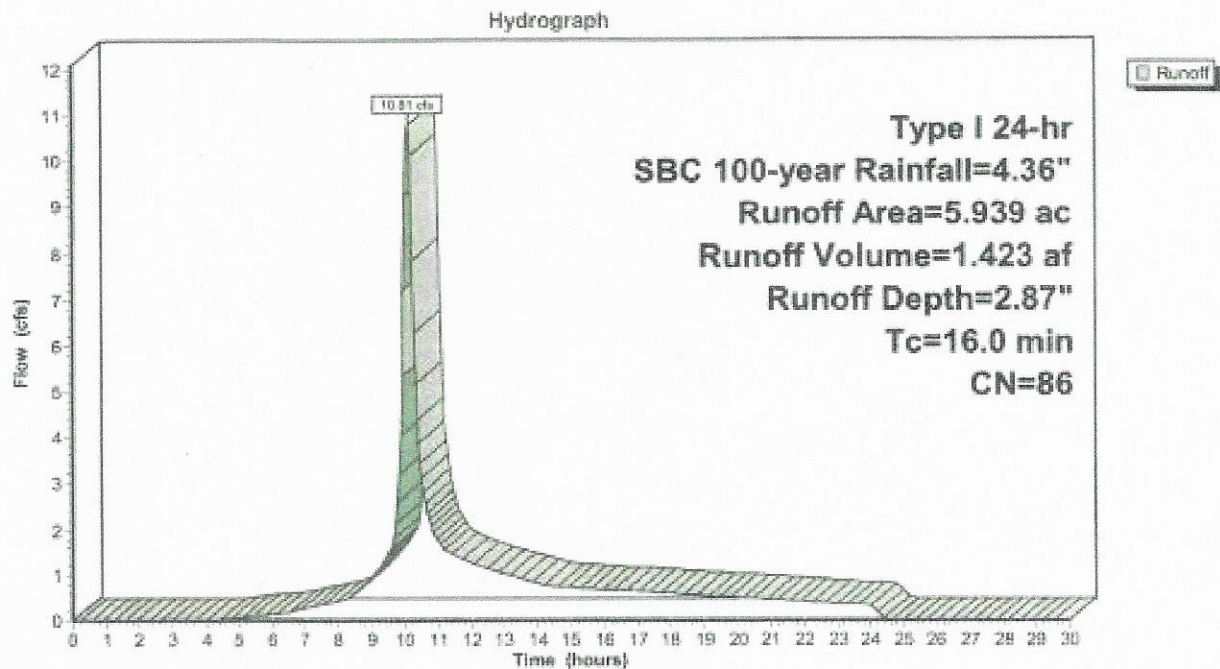
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Type I 24-hr SBC 100-year Rainfall=4.36"

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Subcatchment 1S: Proposed Developemnt



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Type I 24-hr SBC 100-year Rainfall=4.36"

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Summary for Pond 2P: Proposed Pond

Inflow Area = 5.939 ac, 49.71% Impervious, Inflow Depth = 2.87" for SBC 100-year event
 Inflow = 10.81 cfs @ 10.08 hrs, Volume= 1.423 af
 Outflow = 4.20 cfs @ 10.37 hrs, Volume= 1.076 af, Atten= 61%, Lag= 17.6 min
 Primary = 4.20 cfs @ 10.37 hrs, Volume= 1.076 af

Routing by Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.05 hrs
 Peak Elev= 92.43' @ 10.37 hrs Surf.Area= 8,616 sf Storage= 20,643 cf

Plug-Flow detention time= 242.1 min calculated for 1.074 af (76% of inflow)
 Center-of-Mass det. time= 117.9 min (902.7 - 784.8)

Volume	Invert	Avail.Storage	Storage Description		
#1	88.00'	26,014 cf	Custom Stage Data (Irregular) Listed below (Recalc)		
Elevation (feet)	Surf.Area (sq-ft)	Perim. (feet)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)	Wet.Area (sq-ft)
88.00	51	30.0	0	0	51
89.00	2,275	272.0	889	889	5,869
90.00	5,350	439.0	3,705	4,593	15,324
91.00	6,189	494.0	5,764	10,358	19,434
92.00	7,492	813.0	6,830	17,188	52,619
93.00	10,232	921.0	8,826	26,014	67,547

Device	Routing	Invert	Outlet Devices
#1	Primary	91.70'	127.0 deg x 1.0' long x 1.25' rise Sharp-Crested Vee/Trap Weir Cv= 2.48 (C= 3.10)

Primary OutFlow Max=4.17 cfs @ 10.37 hrs HW=92.43' (Free Discharge)
 1=Sharp-Crested Vee/Trap Weir (Weir Controls 4.17 cfs @ 2.33 fps)

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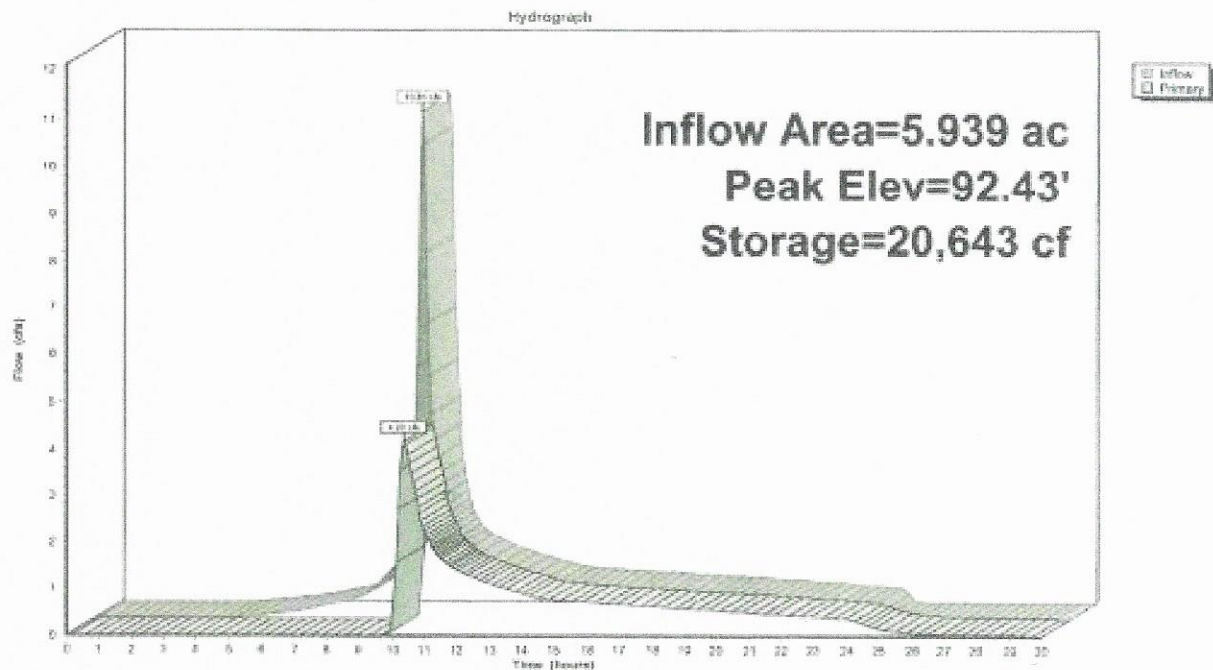
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Type I 24-hr SBC 100-year Rainfall=4.36"

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Pond 2P: Proposed Pond



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Type I 24-hr SBC 100-year Rainfall=4.36"

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Hydrograph for Pond 2P: Proposed Pond

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	0	88.00	0.00
1.00	0.00	0	88.00	0.00
2.00	0.00	0	88.00	0.00
3.00	0.00	0	88.00	0.00
4.00	0.00	0	88.00	0.00
5.00	0.06	91	88.38	0.00
6.00	0.13	438	88.75	0.00
7.00	0.26	1,117	89.10	0.00
8.00	0.41	2,342	89.50	0.00
9.00	0.94	4,570	90.00	0.00
10.00	9.23	12,976	91.41	0.00
11.00	1.74	19,028	92.24	2.27
12.00	1.27	18,085	92.12	1.40
13.00	1.03	17,714	92.07	1.11
14.00	0.81	17,411	92.03	0.90
15.00	0.73	17,191	92.00	0.76
16.00	0.69	17,103	91.99	0.71
17.00	0.64	17,027	91.98	0.66
18.00	0.60	16,951	91.97	0.62
19.00	0.55	16,874	91.96	0.58
20.00	0.51	16,794	91.95	0.53
21.00	0.46	16,703	91.93	0.49
22.00	0.42	16,608	91.92	0.44
23.00	0.37	16,511	91.91	0.40
24.00	0.32	16,411	91.90	0.35
25.00	0.00	15,799	91.81	0.14
26.00	0.00	15,468	91.77	0.06
27.00	0.00	15,311	91.74	0.03
28.00	0.00	15,214	91.73	0.02
29.00	0.00	15,147	91.72	0.02
30.00	0.00	15,101	91.71	0.01