# T E C H N I C A L  M E M O R A N D U M

TO: Kevin Saxton, KASA Architects

FROM: Neil Pietrok, P.E.

DATE: October 23, 2017 Revised

RE: Storm Drainage Report for 314 Pleasant Avenue, Oregon City multi-family development –**Revised to include downstream analysis**

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This Technical Memorandum addresses the City of Oregon City and NOAA requirements for storm drainage (water quality and water quantity) to meet the requirements of the Oregon City Stormwater and Grading Design Standards Manual (February 2015) and the NOAA stormwater management plan for NOAA Oregon.

## Background

The 314 Pleasant Avenue site was formerly a single family residence situated on approximately 1-acre in Oregon City, Oregon. The site slopes down from southwest to northeast and is bordered by Pleasant Avenue and Caufield Street on two sides. The other two sides are residential properties and the end of Myrtle Street. The current site has some trees and groundcover and a gravel pad where the former house and outbuildings were located.

The site is to be developed into a single multi-family building and a 20-car parking lot. In addition the northeast corner of the site will be developed into a storm drainage feature discussed in this report. The remaining areas of the site will not be disturbed except for landscaping.

## Standards of Design

For projects within the jurisdiction of the City of Oregon City that “result in 5,000 square feet of new or replaced impervious surface” (1.2.1, A.) the Stormwater and Grading Standards Manual needs to be followed. Specifically the Stormwater Management Requirements of Chapter/Section 1.4 are required including a Stormwater Management Plan.

In addition, since this project is receiving federal monies through HUD, the NOAA stormwater requirements must also be met or exceeded.

The following report follows the City's Manual Management Plan format with notations where NOAA requirements are addressed.

Stormwater development requirements generally require that the stormwater flows on the site after development must not exceed those flows that existed prior to the development. The City's manual requires that the flows prior to development be calculated as the flows that existed 1851. In addition, Low Impact Development (LID) Standard goals are included in both the City's and NOAA's standards.

## Site Assessment

A site assessment document taken from the City's Manual (Appendix B) is included in this document as Attachment A. In addition, NOAA Stormwater Information Form OREGON ONLY is included in Attachment B.

In general, the current site does not contain landslide areas or any current drainage features such as streams or ponds. The topography slopes gently from southwest to northeast. A Geotechnical Investigation is contained in Attachment C that details soils and groundwater information. The attached plans show the downstream conveyance of City controlled catch basins and piping. There are heritage trees on the site that will be preserved.

Infiltration assessment is based on the findings of the Geotechnical Investigation. The soils found in the boring logs were poor soils for infiltration. Additional infiltration testing was not completed due to the findings in the boring logs.

The infiltration assessment, site topography, existing property utility easements, and LID goals resulted in site planning and facility selection of a detention pond to contain on-site stormwater and release the stormwater at pre-development flows.

## Site Planning and Design Objectives

1. *Preserve Existing Resources*: Heritage trees and other large trees that can be preserved will be protected during construction.
2. *Minimize Site Disturbance*: Impacts to the site are minimized to the building, parking, and detention pond areas. Drip line areas of trees to be preserved will be delineated.
3. *Minimize Soil Compaction*: Construction activities will be confined to the building and parking areas. Construction of the detention pond will be limited to excavation, grading, and landscaping.
4. *Minimize Imperviousness*: During the design process, alternatives to impervious pavement and roofs were examined. Due to the limited funding sources and the desire to reduce future maintenance needs, the decision was made to utilize existing site topography to offset the new impervious surfaces rather than go with a more expensive option (i.e. pavers or porous pavement versus asphalt pavement. Past experience with porous pavement option is more expensive to install and porous pavers have long term maintenance issues.)

## Stormwater Management Strategy

Following the City's hierarchy of Infiltration, Onsite, Offsite, Fees, we designed the site for a onsite stormwater management facility (detention pond). As previously mentioned, the site soils are not conducive for infiltration. Borings show up to 14-feet of clay soils cover the site. An infiltration facility would have caused more site disturbance than desired. The detention pond minimizes site disturbance (meeting both the City's Site Planning Objectives and NOAA's LID objectives) and can be incorporated with the existing site uses.

The conditions for a detention pond as required by Section 2.2.4.2 in the City's Manual have been met. In addition to the Geotechnical Investigation attached herein, a Environmental Site Assessment is included in Attachment D.

## Stormwater Management Facility Selection and Design (*Chapter 4, Oregon City Stormwater and Grading Design Standards*)

4.1 Facility Selection: As previously mentioned, a detention pond was selected as the LID facility that met the City's and NOAA's standards for design. The pond also serves as a landscaping feature and a feature of a future playground/natural area.

4.2 Design Criteria: The City's water quality requirement is to treat a water quality design storm of 1.0 inch over 24, hours. The design for the detention pond for this project will contain up to the 10-year peak flow rate before overflow into a controlled facility. The facility will also contain the 100-year flow on the property within the pond and surrounding area. This is critical because the slope of the property and the location of the pond could overflow to the adjacent property if not contained.

4.3 Design Methods: The BMP Sizing Tool provided by the City of Oregon City was used to size the pond. The results of the BMP Sizing Tool are included in Attachment E. As a check on the results of the BMP Sizing Tool, pre-development and post-development Santa Barbara Urban Hydrograph was prepared and used to calculate pond sizes. The Hydrograph results were used as a check only and are not included in this report.

4.7 Detention Pond Design Requirements:

4.7.1 Geotechnical Report: A Geotechnical Investigation is included in Attachment C.

4.7.2 Pond Depth: Active Storage Depth meets the 4 foot requirement for the 10-year storm.

4.7.3 Bottom Width: The pond designed for this project to match the surrounding contours is an hourglass shape. The bottom with exceeds 10' but not for the entire bottom due to shape.

4.7.4 Interior Side Slopes: Interior side slopes do not exceed 3h:1v.

4.7.5 Exterior Side Slopes: Exterior side slopes are the existing ground on the site. Most all undisturbed areas are flatter than 4h:1v.

4.7.6, 4.7.7, 4.7.8 Conveyance Outfalls, Outlet Structures, and Emergency Overflow: All items have been incorporated into the detention pond design per the BMP sizing tool. The 100-year storm will pass through the outfall and an emergency overflow will bypass the outfall and direct runoff to the conveyance system.

4.9.2 Detention Pond Interior Maintenance Access: The detention pond will be adjacent to Pleasant Avenue. Maintenance will be able to be done from Pleasant Avenue without disturbing the surrounding area.

***REVISION***

Sections 5.2.3 and 5.2.4 require Upstream and Downstream analysis.

5.2.3 Upstream Drainage Basins

The project is in the Newell Drainage Basin of the City. There are no upstream basins or sub-basins for this project.

5.2.4 Downstream Drainage Conveyance

The downstream analysis shows the property is in the Newell Basin of the City's Drainage basin maps (from OCWebMaps). The portion of the Newell Basin that is downstream of the property is bounded on the west by the westernmost edge of the Newell Basin boundary; on the south by Caulfield Street, Dewey Street, and Pearl Street; on the East by Euria Street; and, on the north by Roosevelt Street.

The stormwater runoff from the site will connect into the 10" OC line on Pleasant Avenue; then into a 12" OC line on Molalla Avenue which turns into an 18" OC line past Pearl Street; the 18" OC line continues on Roosevelt Street until just west of Warrant Street where the line changes down to a 6" line; at Euria Street the line changes back into an 18" OC line to the outfall to the east. The downstream analysis maps are included in Attachment F. Attachment G. Contains the Hydrographs for the basin flows and Attachment H is an excel spreadsheet of the pipe capacities. The 6" OC line on Roosevelt is undersized and does not meet the City's minimum size standard for storm water lines of 12" diameter.

The conveyance pipe lines were analyzed for capacity versus the expected flow from a 25-year storm. A Santa Barbara Urban Hydrograph (SBUH) was used to calculate the basin and sub-basin flows (Attachment H). The pipe analysis shows that downstream pipes all exceed the expected flows except for the 6" pipes mentioned above.

While these pipes cannot handle the flows through the system, the project at 314 Pleasant Avenue has been designed to retain the 25-year flows and release those flows at the pre-project level. Therefore, the project is not exacerbating the already undersized system downstream.

ATTACHMENTS

A. Site Assessment and Planning Checklist

B. NOAA Stormwater Information Form OREGON ONLY

C. Geotechnical Investigation

D. Phase 1 Environmental Site Assessment

E. BMP Sizing Tool Results

F. Downstream Analysis Maps

G. Santa Barbara Urban Hydrographs

H. Pipe Analysis

| SITE ASSESSMENT AND PLANNING CHECKLIST | | |
|---|---|---|
| ✓ | **Information needed** | **Attach supporting materials as needed** |
| **2.2.1 Site Information** | | |
| | Applicant contact information | Applicant name: _____<br>Business name: _____<br>Contact address, phone number, and e-mail: _____ |
| | Project location | Site address: 314 Pleasant Avenue, Oregon City Oregon<br>Site description: 1 acre residential lot<br>Major drainage basin: Singer Creek<br>Is the project site located with the WQRA as defined in OCMC 17.49? _____ (Y/N)<br>*Include a vicinity map of the site (including location of property in relation to adjacent properties, roads, and pedestrian/bike facilities).* |
| | Project type | Identify types of development planned for the site such as commercial, industrial, single-family residential, multi-family residential, or other (describe):<br>Multi-family residential. |
| | Size of site | Size of site: 1 (acres)<br>Number of existing/proposed tax lots: 1<br>Amount of new and replaced impervious area: 15,000 (SF) |
| **2.2.2 Site Assessment**<br>*Note: Site assessment information may be available from the OCMaps online tool available through the City's website.* | | |
| | **Site Assessment Map** | *Attach engineered scale Site Assessment Map, showing items below.* |
| | **Topography**<br>Evaluate site and map slopes:<br>*Flat: 0-10%*<br>*Moderate: 10-25%*<br>*Steep: 25% and greater* | *Surveyed or aerial-based mapping with 2-foot intervals for slopes 0-25% slope and 10-foot intervals for steeper. Indicate Geologic Hazard Areas as defined by OCMC 17.04.510 and Geologic Hazards Overlay Zone as defined by OCMC 17.04.515.* |
| | **Soils and Groundwater**<br>Research and map site soil hydrologic group, depth to groundwater | NRCS Hydrologic Soil Type (show on map if more than one type present):<br>*Attach seasonal groundwater depth evaluation if available or required (site has floodplain and/or wetland). Groundwater depth information is available from the City.* |
| | **Infiltration Assessment**<br>Determine soil capacity for onsite infiltration | If an infiltration test is performed, attach the documentation. Report the test type (Basic/Professional) performed and results. See **Appendix D** for the approved infiltration testing methods.<br>Test type: _____ _____ (inches/hour) |

| SITE ASSESSMENT AND PLANNING CHECKLIST | | |
|---|---|---|
| | **Hydrology – Conditions and Natural Features**<br>Map site floodplains, wetlands, streams, and location of outfalls | Clearly label on map all intermittent and perennial creeks/streams/rivers and wetlands, FEMA floodplains, and existing drainage systems (pipes, ditches, outfalls).<br>Check here if present on site: _____<br>Sensitive area(s) N/A<br>Floodplain N/A |
| | **Downstream Conveyance** | Indicate the proposed point of discharge on the site plan.<br>*Prepare and attach a Downstream Analysis as required by **Chapter 5**.*<br>Check here to verify that adequate downstream capacity is available: X |
| | **Existing Vegetation**<br>Map trees and vegetation | Using aerial photos or survey, map all trees and vegetation. Note all existing trees 6-inch caliper and greater (DBH) on map. Delineate and identify other areas and types of existing vegetation.<br>The local planning authority may require a formal tree survey. |
| | **Required Vegetated Buffers and Setbacks**<br>Assess and map buffers | Identify required vegetated buffer areas and other setback limits as defined by OCMC Title 17. |
| | **Land Use and Zoning** | Existing Land Use Zoning designation(s): _____ |
| | **Access and Parking** | Delineate proposed access points for all transportation modes on map. Indicate amount and area of required parking onsite if applicable, *attach documentation as needed.* |
| | **Utilities to Site and Surrounding Area** | Map existing utilities including stormwater facilities, storm conveyance, sewer, water, electricity, phone/cable, gas, and any public storm system/facility downstream. |
| **2.2.3 Site Planning Design Objectives** *(attach engineered scale Preliminary Site Plan)* | | |
| | **1. Preserve existing resources** | **Required:** Show sensitive areas and buffers on site plan. Denote buffer areas that require enhancement. Show any proposed areas of encroachment and associated buffer mitigation areas. |
| | **2. Minimize site disturbance** | **Required:** Delineate protection areas on site plan for areas to remain undisturbed during construction. |
| | **3. Minimize soil compaction** | **Required:** Delineate and note temporary fencing on site plan for proposed infiltration facilities, vegetated stormwater management facilities, and re-vegetation areas. |
| | **4. Minimize imperviousness** | **Required:** Delineate proposed impervious areas and proposed impervious area reduction methods on the site plan.<br>A. Total proposed new/replaced impervious area: 15,000 (SF)<br>B. Area of proposed Green Roofs: 0 (SF)<br>C. Area of proposed pervious pavements: 0 (SF)<br>D. Describe type of pavers or pavement proposed: _____<br>E. Impervious area requiring management [A-(B+C)]: 15,000 (SF) |

## SITE ASSESSMENT AND PLANNING CHECKLIST

**2.2.4 Proposed Stormwater Management Strategy**

| | | |
|---|---|---|
| | **Proposed Stormwater Management Strategy** | _____ Infiltration facilities<br>_____ Surface Infiltration facilities to the MEP<br>_____ Full onsite retention/infiltration up to the 10-year storm event<br>_____ Infiltration facilities are limited by the following conditions *(include documentation to demonstrate the limiting condition and choose an alternate strategy below):*<br>_____ Stormwater management facility to be located on fill<br>_____ Steep slopes<br>_____ High groundwater<br>_____ Contaminated soils<br>_____ Conflict with required Source Controls (**Chapter 6**)<br>__X__ Onsite Stormwater management facilities (indicate below)<br>_____ Offsite stormwater management facilities/regional facilities<br>_____ Fee in Lieu, as determined by the City |
| | **Preliminary Facility Selection/Sizing** | Check all that apply, *attach output from BMP Sizing Tool*, and show proposed Stormwater Management Facilities on Preliminary Site Plan.<br>LID facilities:<br>_____ Infiltration Stormwater Planter<br>_____ Filtration Stormwater Planter<br>_____ Infiltration Rain Garden<br>_____ Filtration Rain Garden<br>_____ Vegetated Swale<br>__X__ Detention Pond<br>_____ Infiltration Trench<br>_____ Manufactured Treatment Technology<br>_____ Other: _____ |
| | **Verify Minimum Facility Size** | A. Required surface area of onsite surface infiltration facilities:<br>As determined by BMP sizing tool or engineered method: _____ (SF)<br>B. Calculate MEP surface area of surface infiltration facilities for sites with limiting conditions:<br>Total new/replaced impervious area (SF) x 0.10 = _____ (SF)<br>C. Calculate required surface area of onsite LID facilities:<br>Smaller of [A] or [B]: _____ (SF)<br>D. Proposed surface infiltration facility size(s):<br>From site plan: _____ (SF) *must be larger than [C]* |

| SITE ASSESSMENT AND PLANNING CHECKLIST | | |
|---|---|---|
| **2.2.5 Other Project Requirements** | | |
| | **Grading Permit** | Review OCMC 15.48 to determine whether a grading permit will be required.<br>Grading permit required? _____ (Y/N)<br>Type of Grading Plan proposed (see **Chapter 3**): _____ |
| | **Erosion Prevention and Sediment Control** | Identify the required permits:<br>X ESC Permit from the City *(sites that include 1,000+ SF new or replaced impervious area)*<br>_____ 1200-C Permit from DEQ *(sites that disturb 1 acre or more land surface)* |
| | **Source Control for High Use Sites** | Identify whether the proposed development will include any of the following:<br>_____ Fuel Dispensing Facilities and Surrounding Traffic Areas<br>_____ Above-Ground Storage of Liquid Materials<br>_____ Solid Waste Storage Areas, Containers, and Trash Compactors<br>_____ Exterior Storage of Bulk Materials<br>_____ Material Transfer Areas/Loading Docks<br>_____ Equipment and/or Vehicle Washing Facilities<br>_____ Development on Land With Suspected or Known Contamination<br>_____ Covered Vehicle Parking Areas<br>_____ Industrial and Commercial High Traffic Areas<br>_____ Other land uses subject to the ODEQ 1200-Z Industrial Stormwater Permit |
| | **Other Permits** | Identify other natural resources related permits from local, state, or federal agencies that may be required as part of the proposed development activity. It is the responsibility of the applicant to identify and obtain required permits prior to project approval.<br>List other anticipated permits: |

# NOAA Stormwater Information Form
# OREGON ONLY

If you are submitting a project that includes a stormwater plan for review please fill out the following cover sheet **to be included with** stormwater management plan, and any other supporting materials.

Also include a drawing of the stormwater treatment area including drainage areas, direction of flow, BMP locations and types, contributing areas, other drainage features, receiving water/location, etc.

| | | | |
|---|---|---|---|
| | **Project Information** | | |
| | Name of Project: | Pleasant Avenue Housing | |
| | Type of project (i.e., new residential, residential rehabilitation, commercial) | Multi-family residential | |
| | Nearest receiving water occupied by ESA-listed species or designated critical habitat | Willamette River | |
| | Lat/Long (DDD.dddd) of Project Location: | | |
| | Street Address of Project: | 314 Pleasant Avenue, Oregon City, Oregon | |
| | Have you contacted anyone at NMFS regarding this project? Yes No | If Yes, who: | |
| | **Stormwater Designer and/or Engineer Contact Information** | | |
| | Name: | Neil Pietrok, P.E. | |
| | Phone: | 503-793-3469 | |
| | Email: | neil@per-eng.com | |
| | **Summary of Design Elements** | | |
| 1. | 2-year, 24-hour storm from NOAA Precipitation Atlas: http://www.nws.noaa.gov/ohd/hdsc/noaaatlas2.htm | 2.8 | Inches |
| 2. | 50% (Zones 1,2,3,6,8) or 67% (Zone 4) or 75% (Zone 5) of 2-yr, 24-hr storm fully treated: | (●) Yes ( ) No | |
| | For water quality design storm zones, see: http://www.oregon.gov/ODOT/HWY/GEOENVIRONMENTAL/pages/storm_management_program_wqsd.aspx | | |
| | 24-hour design storm: | 1 | Inches |
| 3. | **Total** contributing impervious area including all contiguous surface (e.g. roads, driveways, parking lots, sidewalks, roofs, and similar surfaces) | .34 | **Acres** |
| | Proposed new | .34 | Acres |
| | Existing | .13 | Acres |
| | Acres of total impervious area .21 x 1 design storm = 1250 | | $ft^3$ to be treated |
| 4. | Peak discharge of design storm: | 0.28 | cfs |
| 5. | Total stormwater to be treated: .28 | $ft^3$ .28 | cfs |
| 6. | Stormwater Design Manual Used and Year/Version: (example: City of Portland, Clean Water Services, King County, Western Washington) City of Oregon City Stormwater and Grading Design Standards, 2015 | | |
| | Describe which elements of your stormwater plan came from this manual: Design including sizing of the detention pond, outlet orifices, overflow, and emergency overflow. | | |

| | |
|---|---|
| 7. | Have you treated all stormwater to the design storm within the contributing impervious area?<br>◯ Yes ◯ No If no, why not and how will you offset the effects from remaining stormwater? |
| | Water Quality |
| 8. | Low Impact Development methods incorporated? ◯ Yes ◯ No<br>(e.g. site layout, vegetation and soil protection, reforestation, integrated management practices such as amended soils, bioretention, permeable pavement, rainwater collection, tree retention)<br>Please describe:<br>A detention pond was designed (bioretention) for water quality treatment and water quantity<br>How much of total stormwater is treated using LID: 100% |
| 9. | Treatment train, including pretreatment and bioretention methods used to treat water quality:<br>Bioretention (Detention Pond)<br>Why this treatment train was chosen for the project site:<br>Poor soils for infiltration, site topography.<br>Page in stormwater plan where more details can be found: C112 |
| | Water Quantity |
| 10. | Does the project discharge directly into a major water body*? ◯ Yes ◯ No<br>If yes, detention not required<br>*Willamette River below Eugene, Columbia River, large lakes, ocean (verify with NOAA) |
| 11. | Pre-development runoff rate (i.e., before human-induced changes to the unimproved property)<br>2-yr, 24-hour storm: .28<br>10-yr storm: .34<br>Post-development runoff rate (i.e., after proposed developments)<br>2-yr, 24-hour storm: .28<br>10-yr storm: .34 |
| | **Post-development runoff rate must be less than or equal to pre-development runoff rate** |
| 12. | Methods used to treat water quantity:<br>Bioretention<br>Page in stormwater plan where more details can be found: C112 |

| | Maintenance and Inspection Plan |
|---|---|
| 13. | Have you included a stormwater maintenance plan with a description of the onsite stormwater system, inspection schedule and process, maintenance activities, legal and financial responsibility, and inspection and maintenance logs? ◯ Yes ◯ No*<br>***NOAA review cannot be complete without a maintenance and inspection plan**<br><br>Page in stormwater plan where plan can be found: Separate from |
| 14. | Contact information for the party/parties that will be legally responsible for performing the inspections and maintenance or the stormwater facilities:<br>Name: _____<br>Phone number: _____<br>Email: _____<br><br>Name: _____<br>Phone number: _____<br>Email: _____<br><br>Name: _____<br>Phone number: _____<br>Email: _____<br><br>Page in stormwater plan where more details can be found: |

# WES BMP Sizing Report

## Project Information

| | |
|---|---|
| Project Name | New Project |
| Project Type | MultiFamily |
| Location | 314 Pleasant Avenue, Oregon City |
| Stormwater Management Area | 43000 |
| Project Applicant | KASA Architects |
| Jurisdiction | OutofDistrict |

## Drainage Management Area

| Name | Area (sq-ft) | Pre-Project Cover | Post-Project Cover | DMA Soil Type | BMP |
|---|---|---|---|---|---|
| DMA | 9,000 | Forested | Roofs | C | BMP |
| DMA(1) | 6,000 | Grass | ConventionalConcrete | C | BMP |
| DMA(2) | 24,300 | Forested | Forested | C | BMP |

## LID Facility Sizing Details

## Pond Sizing Details

| Pond ID | Design Criteria(1) | Facility Soil Type | Max Depth (ft)(2) | Top Area (sq-ft) | Side Slope (1:H) | Facility Vol. (cu-ft)(3) | Water Storage Vol. (cu-ft)(4) | Adequate Size? |
|---|---|---|---|---|---|---|---|---|
| BMP | FCWQT | C2 | 3.50 | 2,062.5 | 3 | 4,395.1 | 2,336.8 | Yes |

1. FCWQT = Flow control and water quality treatment, WQT = Water quality treatment only

2. Depth is measured from the bottom of the facility and includes the three feet of media (drain rock, separation layer and growing media).

3. Maximum volume of the facility. Includes the volume occupied by the media at the bottom of the facility.

4. Maximum water storage volume of the facility. Includes water storage in the three feet of soil media assuming a 40 percent porosity.

# Simple Pond Geometry Configuration

Pond ID: BMP
Design: FlowControlAndTreatment

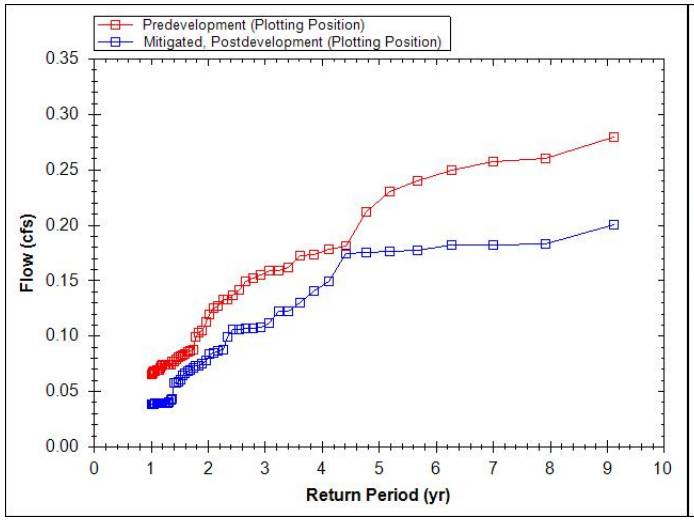
## Shape Curve

| Depth (ft) | Area (sq ft) |
|---|---|
| 3.5 | 2,062.5 |

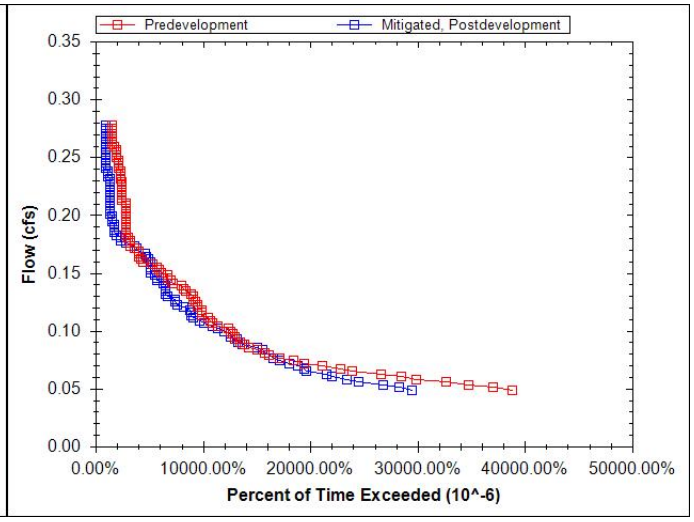
## Outlet Structure Details

| | |
|---|---|
| Lower Orifice Invert (ft) | 0.0 |
| Lower Orifice Dia (in) | 1.0 |
| Upper Orifice Invert(ft) | 2.3 |
| Upper Orifice Dia (in) | 2.9 |
| Overflow Weir Invert(ft) | 3.0 |
| Overflow Weir Length (ft) | 6.3 |

## Flow Frequency Chart




## Flow Duration Chart



646.01 ft
225.17 ft
210.00 ft
210.00 ft
362.05 ft
Area: 499,613.58 ft²
Perimeter: 3,499.08 ft
200.00 ft
225.48 ft
188.44 ft
232.59 ft
134.05 ft
157.60 ft
218.88 ft
187.67 ft
Pearl St
Caufield St
Molalla Ave
Pleasant Ave
Irving St
Warren
Singer Basin
Newell Basin
Roosevelt
Eluria St
Latourette St
Dimick St

Area: 90,972.20 ft²
Perimeter: 1,250.89 ft
Area: 33,053.28 ft²
Perimeter: 825.25 ft
Area: 88,250.63 ft²
Perimeter: 1,578.58 ft
Area: 499,613.58 ft²
Area: 86,138.16 ft²
Perimeter: 1,552.56 ft
Area: 48,778.54 ft²
Perimeter: 1,019.19 ft
312.68 ft
180.00 ft
210.00 ft
165.00 ft
210.00 ft
186.64 ft
225.48 ft
200.00 ft
188.44 ft
278.14 ft
324.05 ft
232.59 ft
117.87 ft
134.05 ft
157.60 ft
187.67 ft
147.45 ft
Caufield St
Irving St
Warren

Pietrok Engineering And Resources

Project No. 034
Date: 10/24/17
(SBUH)

HYDROLOGIC ANALYSIS USING SCS CURVE NUMBER (CN) AND SANTA BARBARA URBAN HYDROGRAPH (SBUH) METHOD

GIVEN:

| | | | | | |
|---|---|---|---|---|---|
| Project = | 314 Pleasant Avenue Development | | | | |
| Basin # = | sub-basin of Newell Basin | | | | |
| Area = | 11.46 | acres | | | |
| Event = | 25 | -year, 24-hour duration storm event | | | |
| Pt = | 4.00 | inches rainfall | | | |
| Tc = | 15.0 | min. | | | |
| dt = | 10 | min. | | | |
| PERVIOUS Parcel | | | IMPERVIOUS Parcel | | |
| Area = | 6.90 | acres | Area = | 4.56 | acres |
| CN = | 86.00 | | CN = | 98.00 | |
| S = | 1.63 | | S = | 0.20 | |
| 0.2S = | 0.33 | | 0.2S = | 0.04 | |

COMPUTE RUNOFF HYDROGRAPH

Column (3) = SCS Type IA Rainfall Distribution
Column (4) = Column (3) x Pt
Column (5) = Accumulated Sum of Col (4)
Column (6) = [If P <= 0.2S] = 0; Note, use pervious area "S" value
[If P > 0.2S] = (Col (5) - 0.2S)^2/(Col (5) + 0.8S)
Column (7) = Col (6) of present time step - Col (6) of previous time step
Column (8) = Same method as for Col (6), except use impervious "S"
Column (9) = Col (8) of present time step - Col (8) of previous time step
Column (10) = ((pervious area/total area) x Col (7)) + ((impervious area/total area) x Col (9))
Column (11) = (60.5 x Col (10) x total area)/10, where dt = 10 minutes
Routing Constant w = dt/(2Tc + dt) = 0.25
Column (12) = Col (12) of previous time step + (w x [Col (11) of previous time step
+ Col (11) of present time step - (2 x Col (12) of previous time step)])

| | | | | | Pervious Area | | Impervious Area | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Time Increment | (2) Time | (3) Rainfall distribution | (4) Incremental Rainfall | (5) Accumulated Rainfall | (6) Accumulated Runoff | (7) Incremental Runoff | (8) Accumulated Runoff | (9) Incremental Runoff | (10) Total Runoff | (11) Instant Hydrograph | (12) Design Hydrograph |
| | min. | % of Pt | in. | in. | in. | in. | in. | in. | in. | cfs | cfs |
| 1 | 10 | 0.0040 | 0.0160 | 0.0160 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.00 | 0.00 |
| 2 | 20 | 0.0040 | 0.0160 | 0.0320 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.00 | 0.00 |
| 3 | 30 | 0.0040 | 0.0160 | 0.0480 | 0.0000 | 0.0000 | 0.0002 | 0.0002 | 0.0001 | 0.01 | 0.00 |
| 4 | 40 | 0.0040 | 0.0160 | 0.0640 | 0.0000 | 0.0000 | 0.0024 | 0.0021 | 0.0008 | 0.06 | 0.02 |
| 5 | 50 | 0.0040 | 0.0160 | 0.0800 | 0.0000 | 0.0000 | 0.0063 | 0.0039 | 0.0016 | 0.11 | 0.05 |
| 6 | 60 | 0.0040 | 0.0160 | 0.0960 | 0.0000 | 0.0000 | 0.0117 | 0.0054 | 0.0022 | 0.15 | 0.09 |
| 7 | 70 | 0.0040 | 0.0160 | 0.1120 | 0.0000 | 0.0000 | 0.0184 | 0.0067 | 0.0027 | 0.18 | 0.13 |
| 8 | 80 | 0.0040 | 0.0160 | 0.1280 | 0.0000 | 0.0000 | 0.0261 | 0.0077 | 0.0031 | 0.21 | 0.16 |
| 9 | 90 | 0.0040 | 0.0160 | 0.1440 | 0.0000 | 0.0000 | 0.0347 | 0.0086 | 0.0034 | 0.24 | 0.19 |
| 10 | 100 | 0.0040 | 0.0160 | 0.1600 | 0.0000 | 0.0000 | 0.0439 | 0.0093 | 0.0037 | 0.26 | 0.22 |
| 11 | 110 | 0.0050 | 0.0200 | 0.1800 | 0.0000 | 0.0000 | 0.0564 | 0.0125 | 0.0050 | 0.34 | 0.26 |
| 12 | 120 | 0.0050 | 0.0200 | 0.2000 | 0.0000 | 0.0000 | 0.0698 | 0.0133 | 0.0053 | 0.37 | 0.31 |
| 13 | 130 | 0.0050 | 0.0200 | 0.2200 | 0.0000 | 0.0000 | 0.0838 | 0.0140 | 0.0056 | 0.39 | 0.34 |
| 14 | 140 | 0.0050 | 0.0200 | 0.2400 | 0.0000 | 0.0000 | 0.0984 | 0.0146 | 0.0058 | 0.40 | 0.37 |
| 15 | 150 | 0.0050 | 0.0200 | 0.2600 | 0.0000 | 0.0000 | 0.1135 | 0.0151 | 0.0060 | 0.42 | 0.39 |
| 16 | 160 | 0.0050 | 0.0200 | 0.2800 | 0.0000 | 0.0000 | 0.1291 | 0.0156 | 0.0062 | 0.43 | 0.41 |
| 17 | 170 | 0.0060 | 0.0240 | 0.3040 | 0.0000 | 0.0000 | 0.1482 | 0.0192 | 0.0076 | 0.53 | 0.44 |
| 18 | 180 | 0.0060 | 0.0240 | 0.3280 | 0.0000 | 0.0000 | 0.1679 | 0.0196 | 0.0078 | 0.54 | 0.49 |
| 19 | 190 | 0.0060 | 0.0240 | 0.3520 | 0.0004 | 0.0004 | 0.1879 | 0.0201 | 0.0082 | 0.57 | 0.52 |
| 20 | 200 | 0.0060 | 0.0240 | 0.3760 | 0.0015 | 0.0011 | 0.2083 | 0.0204 | 0.0088 | 0.61 | 0.56 |
| 21 | 210 | 0.0060 | 0.0240 | 0.4000 | 0.0033 | 0.0017 | 0.2290 | 0.0207 | 0.0093 | 0.64 | 0.59 |
| 22 | 220 | 0.0060 | 0.0240 | 0.4240 | 0.0056 | 0.0024 | 0.2500 | 0.0210 | 0.0098 | 0.68 | 0.63 |
| 23 | 230 | 0.0070 | 0.0280 | 0.4520 | 0.0091 | 0.0035 | 0.2748 | 0.0248 | 0.0120 | 0.83 | 0.69 |
| 24 | 240 | 0.0070 | 0.0280 | 0.4800 | 0.0134 | 0.0043 | 0.2998 | 0.0251 | 0.0125 | 0.87 | 0.77 |
| 25 | 250 | 0.0070 | 0.0280 | 0.5080 | 0.0184 | 0.0050 | 0.3251 | 0.0253 | 0.0131 | 0.91 | 0.83 |
| 26 | 260 | 0.0070 | 0.0280 | 0.5360 | 0.0241 | 0.0057 | 0.3507 | 0.0255 | 0.0136 | 0.94 | 0.88 |
| 27 | 270 | 0.0070 | 0.0280 | 0.5640 | 0.0305 | 0.0064 | 0.3764 | 0.0257 | 0.0141 | 0.98 | 0.92 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | 280 | 0.0070 | 0.0280 | 0.5920 | 0.0375 | 0.0070 | 0.4022 | 0.0259 | 0.0145 | 1.01 | 0.95 |
| 29 | 290 | 0.0082 | 0.0328 | 0.6248 | 0.0465 | 0.0090 | 0.4328 | 0.0305 | 0.0176 | 1.22 | 1.03 |
| 30 | 300 | 0.0082 | 0.0328 | 0.6576 | 0.0562 | 0.0098 | 0.4634 | 0.0307 | 0.0181 | 1.26 | 1.13 |
| 31 | 310 | 0.0082 | 0.0328 | 0.6904 | 0.0668 | 0.0105 | 0.4943 | 0.0309 | 0.0186 | 1.29 | 1.20 |
| 32 | 320 | 0.0082 | 0.0328 | 0.7232 | 0.0781 | 0.0113 | 0.5253 | 0.0310 | 0.0191 | 1.33 | 1.26 |
| 33 | 330 | 0.0082 | 0.0328 | 0.7560 | 0.0900 | 0.0120 | 0.5564 | 0.0311 | 0.0196 | 1.36 | 1.30 |
| 34 | 340 | 0.0082 | 0.0328 | 0.7888 | 0.1026 | 0.0126 | 0.5876 | 0.0312 | 0.0200 | 1.39 | 1.34 |
| 35 | 350 | 0.0095 | 0.0380 | 0.8268 | 0.1180 | 0.0154 | 0.6240 | 0.0363 | 0.0237 | 1.64 | 1.43 |
| 36 | 360 | 0.0095 | 0.0380 | 0.8648 | 0.1342 | 0.0162 | 0.6604 | 0.0364 | 0.0242 | 1.68 | 1.54 |
| 37 | 370 | 0.0095 | 0.0380 | 0.9028 | 0.1511 | 0.0169 | 0.6970 | 0.0366 | 0.0247 | 1.72 | 1.62 |
| 38 | 380 | 0.0095 | 0.0380 | 0.9408 | 0.1687 | 0.0176 | 0.7336 | 0.0367 | 0.0252 | 1.75 | 1.68 |
| 39 | 390 | 0.0095 | 0.0380 | 0.9788 | 0.1871 | 0.0183 | 0.7704 | 0.0367 | 0.0257 | 1.78 | 1.72 |
| 40 | 400 | 0.0095 | 0.0380 | 1.0168 | 0.2060 | 0.0190 | 0.8072 | 0.0368 | 0.0261 | 1.81 | 1.76 |
| 41 | 410 | 0.0134 | 0.0536 | 1.0704 | 0.2338 | 0.0278 | 0.8593 | 0.0521 | 0.0374 | 2.60 | 1.98 |
| 42 | 420 | 0.0134 | 0.0536 | 1.1240 | 0.2627 | 0.0289 | 0.9115 | 0.0522 | 0.0382 | 2.65 | 2.30 |
| 43 | 430 | 0.0134 | 0.0536 | 1.1776 | 0.2927 | 0.0300 | 0.9638 | 0.0523 | 0.0389 | 2.70 | 2.49 |
| 44 | 440 | 0.0180 | 0.0720 | 1.2496 | 0.3346 | 0.0419 | 1.0342 | 0.0704 | 0.0532 | 3.69 | 2.84 |
| 45 | 450 | 0.0180 | 0.0720 | 1.3216 | 0.3781 | 0.0435 | 1.1048 | 0.0706 | 0.0543 | 3.76 | 3.28 |
| 46 | 460 | 0.0340 | 0.1360 | 1.4576 | 0.4643 | 0.0862 | 1.2384 | 0.1336 | 0.1051 | 7.29 | 4.40 |
| 47 | 470 | 0.0540 | 0.2160 | 1.6736 | 0.6106 | 0.1463 | 1.4514 | 0.2130 | 0.1728 | 11.98 | 7.02 |
| 48 | 480 | 0.0270 | 0.1080 | 1.7816 | 0.6874 | 0.0768 | 1.5581 | 0.1067 | 0.0887 | 6.15 | 8.04 |
| 49 | 490 | 0.0180 | 0.0720 | 1.8536 | 0.7398 | 0.0524 | 1.6294 | 0.0712 | 0.0599 | 4.15 | 6.60 |
| 50 | 500 | 0.0134 | 0.0536 | 1.9072 | 0.7794 | 0.0396 | 1.6824 | 0.0531 | 0.0449 | 3.12 | 5.12 |
| 51 | 510 | 0.0134 | 0.0536 | 1.9608 | 0.8194 | 0.0400 | 1.7355 | 0.0531 | 0.0452 | 3.14 | 4.12 |
| 52 | 520 | 0.0134 | 0.0536 | 2.0144 | 0.8599 | 0.0405 | 1.7886 | 0.0531 | 0.0455 | 3.16 | 3.63 |
| 53 | 530 | 0.0088 | 0.0352 | 2.0496 | 0.8867 | 0.0268 | 1.8235 | 0.0349 | 0.0300 | 2.08 | 3.13 |
| 54 | 540 | 0.0088 | 0.0352 | 2.0848 | 0.9137 | 0.0270 | 1.8584 | 0.0349 | 0.0301 | 2.09 | 2.61 |
| 55 | 550 | 0.0088 | 0.0352 | 2.1200 | 0.9409 | 0.0272 | 1.8933 | 0.0349 | 0.0302 | 2.10 | 2.35 |
| 56 | 560 | 0.0088 | 0.0352 | 2.1552 | 0.9682 | 0.0273 | 1.9283 | 0.0349 | 0.0303 | 2.10 | 2.22 |
| 57 | 570 | 0.0088 | 0.0352 | 2.1904 | 0.9957 | 0.0275 | 1.9632 | 0.0349 | 0.0304 | 2.11 | 2.17 |
| 58 | 580 | 0.0088 | 0.0352 | 2.2256 | 1.0233 | 0.0276 | 1.9981 | 0.0349 | 0.0305 | 2.12 | 2.14 |
| 59 | 590 | 0.0088 | 0.0352 | 2.2608 | 1.0511 | 0.0278 | 2.0331 | 0.0349 | 0.0306 | 2.12 | 2.13 |
| 60 | 600 | 0.0088 | 0.0352 | 2.2960 | 1.0790 | 0.0279 | 2.0680 | 0.0350 | 0.0307 | 2.13 | 2.13 |
| 61 | 610 | 0.0088 | 0.0352 | 2.3312 | 1.1071 | 0.0281 | 2.1030 | 0.0350 | 0.0308 | 2.14 | 2.13 |
| 62 | 620 | 0.0088 | 0.0352 | 2.3664 | 1.1353 | 0.0282 | 2.1380 | 0.0350 | 0.0309 | 2.14 | 2.13 |
| 63 | 630 | 0.0088 | 0.0352 | 2.4016 | 1.1636 | 0.0283 | 2.1729 | 0.0350 | 0.0310 | 2.15 | 2.14 |
| 64 | 640 | 0.0088 | 0.0352 | 2.4368 | 1.1921 | 0.0285 | 2.2079 | 0.0350 | 0.0311 | 2.15 | 2.15 |
| 65 | 650 | 0.0072 | 0.0288 | 2.4656 | 1.2154 | 0.0234 | 2.2365 | 0.0286 | 0.0255 | 1.77 | 2.05 |
| 66 | 660 | 0.0072 | 0.0288 | 2.4944 | 1.2389 | 0.0235 | 2.2652 | 0.0286 | 0.0255 | 1.77 | 1.91 |
| 67 | 670 | 0.0072 | 0.0288 | 2.5232 | 1.2624 | 0.0235 | 2.2938 | 0.0286 | 0.0256 | 1.77 | 1.84 |
| 68 | 680 | 0.0072 | 0.0288 | 2.5520 | 1.2861 | 0.0236 | 2.3224 | 0.0286 | 0.0256 | 1.78 | 1.81 |
| 69 | 690 | 0.0072 | 0.0288 | 2.5808 | 1.3098 | 0.0237 | 2.3511 | 0.0286 | 0.0257 | 1.78 | 1.79 |
| 70 | 700 | 0.0072 | 0.0288 | 2.6096 | 1.3335 | 0.0238 | 2.3797 | 0.0286 | 0.0257 | 1.78 | 1.79 |
| 71 | 710 | 0.0072 | 0.0288 | 2.6384 | 1.3574 | 0.0238 | 2.4084 | 0.0286 | 0.0258 | 1.79 | 1.79 |
| 72 | 720 | 0.0072 | 0.0288 | 2.6672 | 1.3813 | 0.0239 | 2.4370 | 0.0286 | 0.0258 | 1.79 | 1.79 |
| 73 | 730 | 0.0072 | 0.0288 | 2.6960 | 1.4053 | 0.0240 | 2.4657 | 0.0287 | 0.0258 | 1.79 | 1.79 |
| 74 | 740 | 0.0072 | 0.0288 | 2.7248 | 1.4294 | 0.0241 | 2.4943 | 0.0287 | 0.0259 | 1.79 | 1.79 |
| 75 | 750 | 0.0072 | 0.0288 | 2.7536 | 1.4535 | 0.0241 | 2.5230 | 0.0287 | 0.0259 | 1.80 | 1.79 |
| 76 | 760 | 0.0072 | 0.0288 | 2.7824 | 1.4777 | 0.0242 | 2.5516 | 0.0287 | 0.0260 | 1.80 | 1.80 |
| 77 | 770 | 0.0057 | 0.0228 | 2.8052 | 1.4969 | 0.0192 | 2.5743 | 0.0227 | 0.0206 | 1.43 | 1.71 |
| 78 | 780 | 0.0057 | 0.0228 | 2.8280 | 1.5161 | 0.0192 | 2.5970 | 0.0227 | 0.0206 | 1.43 | 1.57 |
| 79 | 790 | 0.0057 | 0.0228 | 2.8508 | 1.5354 | 0.0193 | 2.6197 | 0.0227 | 0.0206 | 1.43 | 1.50 |
| 80 | 800 | 0.0057 | 0.0228 | 2.8736 | 1.5547 | 0.0193 | 2.6424 | 0.0227 | 0.0207 | 1.43 | 1.47 |
| 81 | 810 | 0.0057 | 0.0228 | 2.8964 | 1.5741 | 0.0194 | 2.6651 | 0.0227 | 0.0207 | 1.43 | 1.45 |
| 82 | 820 | 0.0057 | 0.0228 | 2.9192 | 1.5935 | 0.0194 | 2.6878 | 0.0227 | 0.0207 | 1.44 | 1.44 |
| 83 | 830 | 0.0057 | 0.0228 | 2.9420 | 1.6129 | 0.0194 | 2.7105 | 0.0227 | 0.0207 | 1.44 | 1.44 |
| 84 | 840 | 0.0057 | 0.0228 | 2.9648 | 1.6324 | 0.0195 | 2.7332 | 0.0227 | 0.0208 | 1.44 | 1.44 |
| 85 | 850 | 0.0057 | 0.0228 | 2.9876 | 1.6519 | 0.0195 | 2.7559 | 0.0227 | 0.0208 | 1.44 | 1.44 |
| 86 | 860 | 0.0057 | 0.0228 | 3.0104 | 1.6714 | 0.0195 | 2.7786 | 0.0227 | 0.0208 | 1.44 | 1.44 |
| 87 | 870 | 0.0057 | 0.0228 | 3.0332 | 1.6910 | 0.0196 | 2.8013 | 0.0227 | 0.0208 | 1.44 | 1.44 |
| 88 | 880 | 0.0057 | 0.0228 | 3.0560 | 1.7106 | 0.0196 | 2.8240 | 0.0227 | 0.0208 | 1.44 | 1.44 |
| 89 | 890 | 0.0050 | 0.0200 | 3.0760 | 1.7278 | 0.0172 | 2.8440 | 0.0199 | 0.0183 | 1.27 | 1.40 |
| 90 | 900 | 0.0050 | 0.0200 | 3.0960 | 1.7450 | 0.0172 | 2.8639 | 0.0199 | 0.0183 | 1.27 | 1.33 |
| 91 | 910 | 0.0050 | 0.0200 | 3.1160 | 1.7623 | 0.0173 | 2.8838 | 0.0199 | 0.0183 | 1.27 | 1.30 |
| 92 | 920 | 0.0050 | 0.0200 | 3.1360 | 1.7796 | 0.0173 | 2.9037 | 0.0199 | 0.0183 | 1.27 | 1.29 |
| 93 | 930 | 0.0050 | 0.0200 | 3.1560 | 1.7969 | 0.0173 | 2.9236 | 0.0199 | 0.0184 | 1.27 | 1.28 |
| 94 | 940 | 0.0050 | 0.0200 | 3.1760 | 1.8143 | 0.0173 | 2.9436 | 0.0199 | 0.0184 | 1.27 | 1.28 |
| 95 | 950 | 0.0050 | 0.0200 | 3.1960 | 1.8316 | 0.0174 | 2.9635 | 0.0199 | 0.0184 | 1.27 | 1.28 |
| 96 | 960 | 0.0050 | 0.0200 | 3.2160 | 1.8490 | 0.0174 | 2.9834 | 0.0199 | 0.0184 | 1.28 | 1.28 |
| 97 | 970 | 0.0050 | 0.0200 | 3.2360 | 1.8664 | 0.0174 | 3.0034 | 0.0199 | 0.0184 | 1.28 | 1.28 |
| 98 | 980 | 0.0050 | 0.0200 | 3.2560 | 1.8839 | 0.0174 | 3.0233 | 0.0199 | 0.0184 | 1.28 | 1.28 |
| 99 | 990 | 0.0050 | 0.0200 | 3.2760 | 1.9013 | 0.0175 | 3.0432 | 0.0199 | 0.0184 | 1.28 | 1.28 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 1000 | 0.0050 | 0.0200 | 3.2960 | 1.9188 | 0.0175 | 3.0631 | 0.0199 | 0.0185 | 1.28 | 1.28 |
| 101 | 1010 | 0.0040 | 0.0160 | 3.3120 | 1.9328 | 0.0140 | 3.0791 | 0.0159 | 0.0148 | 1.02 | 1.22 |
| 102 | 1020 | 0.0040 | 0.0160 | 3.3280 | 1.9468 | 0.0140 | 3.0950 | 0.0159 | 0.0148 | 1.02 | 1.12 |
| 103 | 1030 | 0.0040 | 0.0160 | 3.3440 | 1.9609 | 0.0140 | 3.1110 | 0.0159 | 0.0148 | 1.03 | 1.07 |
| 104 | 1040 | 0.0040 | 0.0160 | 3.3600 | 1.9749 | 0.0140 | 3.1269 | 0.0159 | 0.0148 | 1.03 | 1.05 |
| 105 | 1050 | 0.0040 | 0.0160 | 3.3760 | 1.9890 | 0.0141 | 3.1429 | 0.0159 | 0.0148 | 1.03 | 1.04 |
| 106 | 1060 | 0.0040 | 0.0160 | 3.3920 | 2.0030 | 0.0141 | 3.1588 | 0.0159 | 0.0148 | 1.03 | 1.03 |
| 107 | 1070 | 0.0040 | 0.0160 | 3.4080 | 2.0171 | 0.0141 | 3.1748 | 0.0159 | 0.0148 | 1.03 | 1.03 |
| 108 | 1080 | 0.0040 | 0.0160 | 3.4240 | 2.0312 | 0.0141 | 3.1907 | 0.0159 | 0.0148 | 1.03 | 1.03 |
| 109 | 1090 | 0.0040 | 0.0160 | 3.4400 | 2.0453 | 0.0141 | 3.2067 | 0.0159 | 0.0148 | 1.03 | 1.03 |
| 110 | 1100 | 0.0040 | 0.0160 | 3.4560 | 2.0594 | 0.0141 | 3.2226 | 0.0159 | 0.0148 | 1.03 | 1.03 |
| 111 | 1110 | 0.0040 | 0.0160 | 3.4720 | 2.0736 | 0.0141 | 3.2386 | 0.0159 | 0.0149 | 1.03 | 1.03 |
| 112 | 1120 | 0.0040 | 0.0160 | 3.4880 | 2.0877 | 0.0141 | 3.2545 | 0.0159 | 0.0149 | 1.03 | 1.03 |
| 113 | 1130 | 0.0040 | 0.0160 | 3.5040 | 2.1019 | 0.0142 | 3.2705 | 0.0160 | 0.0149 | 1.03 | 1.03 |
| 114 | 1140 | 0.0040 | 0.0160 | 3.5200 | 2.1161 | 0.0142 | 3.2864 | 0.0160 | 0.0149 | 1.03 | 1.03 |
| 115 | 1150 | 0.0040 | 0.0160 | 3.5360 | 2.1302 | 0.0142 | 3.3024 | 0.0160 | 0.0149 | 1.03 | 1.03 |
| 116 | 1160 | 0.0040 | 0.0160 | 3.5520 | 2.1444 | 0.0142 | 3.3183 | 0.0160 | 0.0149 | 1.03 | 1.03 |
| 117 | 1170 | 0.0040 | 0.0160 | 3.5680 | 2.1586 | 0.0142 | 3.3343 | 0.0160 | 0.0149 | 1.03 | 1.03 |
| 118 | 1180 | 0.0040 | 0.0160 | 3.5840 | 2.1729 | 0.0142 | 3.3502 | 0.0160 | 0.0149 | 1.03 | 1.03 |
| 119 | 1190 | 0.0040 | 0.0160 | 3.6000 | 2.1871 | 0.0142 | 3.3662 | 0.0160 | 0.0149 | 1.03 | 1.03 |
| 120 | 1200 | 0.0040 | 0.0160 | 3.6160 | 2.2013 | 0.0142 | 3.3821 | 0.0160 | 0.0149 | 1.03 | 1.03 |
| 121 | 1210 | 0.0040 | 0.0160 | 3.6320 | 2.2156 | 0.0143 | 3.3981 | 0.0160 | 0.0149 | 1.04 | 1.03 |
| 122 | 1220 | 0.0040 | 0.0160 | 3.6480 | 2.2298 | 0.0143 | 3.4140 | 0.0160 | 0.0149 | 1.04 | 1.03 |
| 123 | 1230 | 0.0040 | 0.0160 | 3.6640 | 2.2441 | 0.0143 | 3.4300 | 0.0160 | 0.0149 | 1.04 | 1.04 |
| 124 | 1240 | 0.0040 | 0.0160 | 3.6800 | 2.2584 | 0.0143 | 3.4459 | 0.0160 | 0.0150 | 1.04 | 1.04 |
| 125 | 1250 | 0.0040 | 0.0160 | 3.6960 | 2.2727 | 0.0143 | 3.4619 | 0.0160 | 0.0150 | 1.04 | 1.04 |
| 126 | 1260 | 0.0040 | 0.0160 | 3.7120 | 2.2870 | 0.0143 | 3.4778 | 0.0160 | 0.0150 | 1.04 | 1.04 |
| 127 | 1270 | 0.0040 | 0.0160 | 3.7280 | 2.3013 | 0.0143 | 3.4938 | 0.0160 | 0.0150 | 1.04 | 1.04 |
| 128 | 1280 | 0.0040 | 0.0160 | 3.7440 | 2.3157 | 0.0143 | 3.5098 | 0.0160 | 0.0150 | 1.04 | 1.04 |
| 129 | 1290 | 0.0040 | 0.0160 | 3.7600 | 2.3300 | 0.0143 | 3.5257 | 0.0160 | 0.0150 | 1.04 | 1.04 |
| 130 | 1300 | 0.0040 | 0.0160 | 3.7760 | 2.3444 | 0.0144 | 3.5417 | 0.0160 | 0.0150 | 1.04 | 1.04 |
| 131 | 1310 | 0.0040 | 0.0160 | 3.7920 | 2.3587 | 0.0144 | 3.5576 | 0.0160 | 0.0150 | 1.04 | 1.04 |
| 132 | 1320 | 0.0040 | 0.0160 | 3.8080 | 2.3731 | 0.0144 | 3.5736 | 0.0160 | 0.0150 | 1.04 | 1.04 |
| 133 | 1330 | 0.0040 | 0.0160 | 3.8240 | 2.3875 | 0.0144 | 3.5895 | 0.0160 | 0.0150 | 1.04 | 1.04 |
| 134 | 1340 | 0.0040 | 0.0160 | 3.8400 | 2.4019 | 0.0144 | 3.6055 | 0.0160 | 0.0150 | 1.04 | 1.04 |
| 135 | 1350 | 0.0040 | 0.0160 | 3.8560 | 2.4163 | 0.0144 | 3.6215 | 0.0160 | 0.0150 | 1.04 | 1.04 |
| 136 | 1360 | 0.0040 | 0.0160 | 3.8720 | 2.4307 | 0.0144 | 3.6374 | 0.0160 | 0.0150 | 1.04 | 1.04 |
| 137 | 1370 | 0.0040 | 0.0160 | 3.8880 | 2.4451 | 0.0144 | 3.6534 | 0.0160 | 0.0150 | 1.04 | 1.04 |
| 138 | 1380 | 0.0040 | 0.0160 | 3.9040 | 2.4595 | 0.0144 | 3.6693 | 0.0160 | 0.0150 | 1.04 | 1.04 |
| 139 | 1390 | 0.0040 | 0.0160 | 3.9200 | 2.4740 | 0.0144 | 3.6853 | 0.0160 | 0.0150 | 1.04 | 1.04 |
| 140 | 1400 | 0.0040 | 0.0160 | 3.9360 | 2.4884 | 0.0145 | 3.7013 | 0.0160 | 0.0151 | 1.04 | 1.04 |
| 141 | 1410 | 0.0040 | 0.0160 | 3.9520 | 2.5029 | 0.0145 | 3.7172 | 0.0160 | 0.0151 | 1.04 | 1.04 |
| 142 | 1420 | 0.0040 | 0.0160 | 3.9680 | 2.5173 | 0.0145 | 3.7332 | 0.0160 | 0.0151 | 1.04 | 1.04 |
| 143 | 1430 | 0.0040 | 0.0160 | 3.9840 | 2.5318 | 0.0145 | 3.7491 | 0.0160 | 0.0151 | 1.04 | 1.04 |
| 144 | 1440 | 0.0040 | 0.0160 | 4.0000 | 2.5463 | 0.0145 | 3.7651 | 0.0160 | 0.0151 | 1.05 | 1.04 |

Total Runoff Volume (cu. ft.) = 125160

Pietrok Engineering And Resources

Project No. 034
Date: 10/24/17
(SBUH)

HYDROLOGIC ANALYSIS USING SCS CURVE NUMBER (CN) AND SANTA BARBARA URBAN HYDROGRAPH (SBUH) METHOD

GIVEN:

| | | | | | |
|---|---|---|---|---|---|
| Project = | 314 Pleasant Avenue Development | | | | |
| Basin # = | sub-basin of Newell Basin | | | | |
| Area = | 8.08 | acres | | | |
| Event = | 25 | -year, 24-hour duration storm event | | | |
| Pt = | 4.00 | inches rainfall | | | |
| Tc = | 15.0 | min. | | | |
| dt = | 10 | min. | | | |
| PERVIOUS Parcel | | | IMPERVIOUS Parcel | | |
| Area = | 4.85 | acres | Area = | 3.23 | acres |
| CN = | 86.00 | | CN = | 98.00 | |
| S = | 1.63 | | S = | 0.20 | |
| 0.2S = | 0.33 | | 0.2S = | 0.04 | |

COMPUTE RUNOFF HYDROGRAPH

Column (3) = SCS Type IA Rainfall Distribution
Column (4) = Column (3) x Pt
Column (5) = Accumulated Sum of Col (4)
Column (6) = [If P <= 0.2S] = 0; Note, use pervious area "S" value
[If P > 0.2S] = (Col (5) - 0.2S)^2/(Col (5) + 0.8S)
Column (7) = Col (6) of present time step - Col (6) of previous time step
Column (8) = Same method as for Col (6), except use impervious "S"
Column (9) = Col (8) of present time step - Col (8) of previous time step
Column (10) = ((pervious area/total area) x Col (7)) + ((impervious area/total area) x Col (9))
Column (11) = (60.5 x Col (10) x total area)/10, where dt = 10 minutes
Routing Constant w = dt/(2Tc + dt) = 0.25
Column (12) = Col (12) of previous time step + (w x [Col (11) of previous time step
+ Col (11) of present time step - (2 x Col (12) of previous time step)])

| | | | | | Pervious Area | | Impervious Area | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Time Increment | (2) Time | (3) Rainfall distribution | (4) Incremental Rainfall | (5) Accumulated Rainfall | (6) Accumulated Runoff | (7) Incremental Runoff | (8) Accumulated Runoff | (9) Incremental Runoff | (10) Total Runoff | (11) Instant Hydrograph | (12) Design Hydrograph |
| | min. | % of Pt | in. | in. | in. | in. | in. | in. | in. | cfs | cfs |
| 1 | 10 | 0.0040 | 0.0160 | 0.0160 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.00 | 0.00 |
| 2 | 20 | 0.0040 | 0.0160 | 0.0320 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.00 | 0.00 |
| 3 | 30 | 0.0040 | 0.0160 | 0.0480 | 0.0000 | 0.0000 | 0.0002 | 0.0002 | 0.0001 | 0.00 | 0.00 |
| 4 | 40 | 0.0040 | 0.0160 | 0.0640 | 0.0000 | 0.0000 | 0.0024 | 0.0021 | 0.0008 | 0.04 | 0.01 |
| 5 | 50 | 0.0040 | 0.0160 | 0.0800 | 0.0000 | 0.0000 | 0.0063 | 0.0039 | 0.0016 | 0.08 | 0.04 |
| 6 | 60 | 0.0040 | 0.0160 | 0.0960 | 0.0000 | 0.0000 | 0.0117 | 0.0054 | 0.0022 | 0.11 | 0.06 |
| 7 | 70 | 0.0040 | 0.0160 | 0.1120 | 0.0000 | 0.0000 | 0.0184 | 0.0067 | 0.0027 | 0.13 | 0.09 |
| 8 | 80 | 0.0040 | 0.0160 | 0.1280 | 0.0000 | 0.0000 | 0.0261 | 0.0077 | 0.0031 | 0.15 | 0.12 |
| 9 | 90 | 0.0040 | 0.0160 | 0.1440 | 0.0000 | 0.0000 | 0.0347 | 0.0086 | 0.0034 | 0.17 | 0.14 |
| 10 | 100 | 0.0040 | 0.0160 | 0.1600 | 0.0000 | 0.0000 | 0.0439 | 0.0093 | 0.0037 | 0.18 | 0.16 |
| 11 | 110 | 0.0050 | 0.0200 | 0.1800 | 0.0000 | 0.0000 | 0.0564 | 0.0125 | 0.0050 | 0.24 | 0.18 |
| 12 | 120 | 0.0050 | 0.0200 | 0.2000 | 0.0000 | 0.0000 | 0.0698 | 0.0133 | 0.0053 | 0.26 | 0.22 |
| 13 | 130 | 0.0050 | 0.0200 | 0.2200 | 0.0000 | 0.0000 | 0.0838 | 0.0140 | 0.0056 | 0.27 | 0.24 |
| 14 | 140 | 0.0050 | 0.0200 | 0.2400 | 0.0000 | 0.0000 | 0.0984 | 0.0146 | 0.0058 | 0.29 | 0.26 |
| 15 | 150 | 0.0050 | 0.0200 | 0.2600 | 0.0000 | 0.0000 | 0.1135 | 0.0151 | 0.0060 | 0.30 | 0.28 |
| 16 | 160 | 0.0050 | 0.0200 | 0.2800 | 0.0000 | 0.0000 | 0.1291 | 0.0156 | 0.0062 | 0.30 | 0.29 |
| 17 | 170 | 0.0060 | 0.0240 | 0.3040 | 0.0000 | 0.0000 | 0.1482 | 0.0192 | 0.0077 | 0.37 | 0.31 |
| 18 | 180 | 0.0060 | 0.0240 | 0.3280 | 0.0000 | 0.0000 | 0.1679 | 0.0196 | 0.0079 | 0.38 | 0.35 |
| 19 | 190 | 0.0060 | 0.0240 | 0.3520 | 0.0004 | 0.0004 | 0.1879 | 0.0201 | 0.0083 | 0.40 | 0.37 |
| 20 | 200 | 0.0060 | 0.0240 | 0.3760 | 0.0015 | 0.0011 | 0.2083 | 0.0204 | 0.0088 | 0.43 | 0.39 |
| 21 | 210 | 0.0060 | 0.0240 | 0.4000 | 0.0033 | 0.0017 | 0.2290 | 0.0207 | 0.0093 | 0.46 | 0.42 |
| 22 | 220 | 0.0060 | 0.0240 | 0.4240 | 0.0056 | 0.0024 | 0.2500 | 0.0210 | 0.0098 | 0.48 | 0.44 |
| 23 | 230 | 0.0070 | 0.0280 | 0.4520 | 0.0091 | 0.0035 | 0.2748 | 0.0248 | 0.0120 | 0.59 | 0.49 |
| 24 | 240 | 0.0070 | 0.0280 | 0.4800 | 0.0134 | 0.0043 | 0.2998 | 0.0251 | 0.0126 | 0.61 | 0.54 |
| 25 | 250 | 0.0070 | 0.0280 | 0.5080 | 0.0184 | 0.0050 | 0.3251 | 0.0253 | 0.0131 | 0.64 | 0.59 |
| 26 | 260 | 0.0070 | 0.0280 | 0.5360 | 0.0241 | 0.0057 | 0.3507 | 0.0255 | 0.0136 | 0.67 | 0.62 |
| 27 | 270 | 0.0070 | 0.0280 | 0.5640 | 0.0305 | 0.0064 | 0.3764 | 0.0257 | 0.0141 | 0.69 | 0.65 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | 280 | 0.0070 | 0.0280 | 0.5920 | 0.0375 | 0.0070 | 0.4022 | 0.0259 | 0.0146 | 0.71 | 0.67 |
| 29 | 290 | 0.0082 | 0.0328 | 0.6248 | 0.0465 | 0.0090 | 0.4328 | 0.0305 | 0.0176 | 0.86 | 0.73 |
| 30 | 300 | 0.0082 | 0.0328 | 0.6576 | 0.0562 | 0.0098 | 0.4634 | 0.0307 | 0.0181 | 0.89 | 0.80 |
| 31 | 310 | 0.0082 | 0.0328 | 0.6904 | 0.0668 | 0.0105 | 0.4943 | 0.0309 | 0.0187 | 0.91 | 0.85 |
| 32 | 320 | 0.0082 | 0.0328 | 0.7232 | 0.0781 | 0.0113 | 0.5253 | 0.0310 | 0.0192 | 0.94 | 0.89 |
| 33 | 330 | 0.0082 | 0.0328 | 0.7560 | 0.0900 | 0.0120 | 0.5564 | 0.0311 | 0.0196 | 0.96 | 0.92 |
| 34 | 340 | 0.0082 | 0.0328 | 0.7888 | 0.1026 | 0.0126 | 0.5876 | 0.0312 | 0.0201 | 0.98 | 0.94 |
| 35 | 350 | 0.0095 | 0.0380 | 0.8268 | 0.1180 | 0.0154 | 0.6240 | 0.0363 | 0.0238 | 1.16 | 1.01 |
| 36 | 360 | 0.0095 | 0.0380 | 0.8648 | 0.1342 | 0.0162 | 0.6604 | 0.0364 | 0.0243 | 1.19 | 1.09 |
| 37 | 370 | 0.0095 | 0.0380 | 0.9028 | 0.1511 | 0.0169 | 0.6970 | 0.0366 | 0.0248 | 1.21 | 1.14 |
| 38 | 380 | 0.0095 | 0.0380 | 0.9408 | 0.1687 | 0.0176 | 0.7336 | 0.0367 | 0.0252 | 1.23 | 1.18 |
| 39 | 390 | 0.0095 | 0.0380 | 0.9788 | 0.1871 | 0.0183 | 0.7704 | 0.0367 | 0.0257 | 1.26 | 1.21 |
| 40 | 400 | 0.0095 | 0.0380 | 1.0168 | 0.2060 | 0.0190 | 0.8072 | 0.0368 | 0.0261 | 1.28 | 1.24 |
| 41 | 410 | 0.0134 | 0.0536 | 1.0704 | 0.2338 | 0.0278 | 0.8593 | 0.0521 | 0.0375 | 1.83 | 1.40 |
| 42 | 420 | 0.0134 | 0.0536 | 1.1240 | 0.2627 | 0.0289 | 0.9115 | 0.0522 | 0.0382 | 1.87 | 1.62 |
| 43 | 430 | 0.0134 | 0.0536 | 1.1776 | 0.2927 | 0.0300 | 0.9638 | 0.0523 | 0.0389 | 1.90 | 1.75 |
| 44 | 440 | 0.0180 | 0.0720 | 1.2496 | 0.3346 | 0.0419 | 1.0342 | 0.0704 | 0.0533 | 2.60 | 2.00 |
| 45 | 450 | 0.0180 | 0.0720 | 1.3216 | 0.3781 | 0.0435 | 1.1048 | 0.0706 | 0.0543 | 2.66 | 2.32 |
| 46 | 460 | 0.0340 | 0.1360 | 1.4576 | 0.4643 | 0.0862 | 1.2384 | 0.1336 | 0.1052 | 5.14 | 3.11 |
| 47 | 470 | 0.0540 | 0.2160 | 1.6736 | 0.6106 | 0.1463 | 1.4514 | 0.2130 | 0.1730 | 8.45 | 4.95 |
| 48 | 480 | 0.0270 | 0.1080 | 1.7816 | 0.6874 | 0.0768 | 1.5581 | 0.1067 | 0.0888 | 4.34 | 5.68 |
| 49 | 490 | 0.0180 | 0.0720 | 1.8536 | 0.7398 | 0.0524 | 1.6294 | 0.0712 | 0.0599 | 2.93 | 4.65 |
| 50 | 500 | 0.0134 | 0.0536 | 1.9072 | 0.7794 | 0.0396 | 1.6824 | 0.0531 | 0.0450 | 2.20 | 3.61 |
| 51 | 510 | 0.0134 | 0.0536 | 1.9608 | 0.8194 | 0.0400 | 1.7355 | 0.0531 | 0.0453 | 2.21 | 2.91 |
| 52 | 520 | 0.0134 | 0.0536 | 2.0144 | 0.8599 | 0.0405 | 1.7886 | 0.0531 | 0.0455 | 2.23 | 2.56 |
| 53 | 530 | 0.0088 | 0.0352 | 2.0496 | 0.8867 | 0.0268 | 1.8235 | 0.0349 | 0.0300 | 1.47 | 2.21 |
| 54 | 540 | 0.0088 | 0.0352 | 2.0848 | 0.9137 | 0.0270 | 1.8584 | 0.0349 | 0.0302 | 1.47 | 1.84 |
| 55 | 550 | 0.0088 | 0.0352 | 2.1200 | 0.9409 | 0.0272 | 1.8933 | 0.0349 | 0.0303 | 1.48 | 1.66 |
| 56 | 560 | 0.0088 | 0.0352 | 2.1552 | 0.9682 | 0.0273 | 1.9283 | 0.0349 | 0.0304 | 1.48 | 1.57 |
| 57 | 570 | 0.0088 | 0.0352 | 2.1904 | 0.9957 | 0.0275 | 1.9632 | 0.0349 | 0.0305 | 1.49 | 1.53 |
| 58 | 580 | 0.0088 | 0.0352 | 2.2256 | 1.0233 | 0.0276 | 1.9981 | 0.0349 | 0.0306 | 1.49 | 1.51 |
| 59 | 590 | 0.0088 | 0.0352 | 2.2608 | 1.0511 | 0.0278 | 2.0331 | 0.0349 | 0.0306 | 1.50 | 1.50 |
| 60 | 600 | 0.0088 | 0.0352 | 2.2960 | 1.0790 | 0.0279 | 2.0680 | 0.0350 | 0.0307 | 1.50 | 1.50 |
| 61 | 610 | 0.0088 | 0.0352 | 2.3312 | 1.1071 | 0.0281 | 2.1030 | 0.0350 | 0.0308 | 1.51 | 1.50 |
| 62 | 620 | 0.0088 | 0.0352 | 2.3664 | 1.1353 | 0.0282 | 2.1380 | 0.0350 | 0.0309 | 1.51 | 1.51 |
| 63 | 630 | 0.0088 | 0.0352 | 2.4016 | 1.1636 | 0.0283 | 2.1729 | 0.0350 | 0.0310 | 1.51 | 1.51 |
| 64 | 640 | 0.0088 | 0.0352 | 2.4368 | 1.1921 | 0.0285 | 2.2079 | 0.0350 | 0.0311 | 1.52 | 1.51 |
| 65 | 650 | 0.0072 | 0.0288 | 2.4656 | 1.2154 | 0.0234 | 2.2365 | 0.0286 | 0.0255 | 1.25 | 1.45 |
| 66 | 660 | 0.0072 | 0.0288 | 2.4944 | 1.2389 | 0.0235 | 2.2652 | 0.0286 | 0.0255 | 1.25 | 1.35 |
| 67 | 670 | 0.0072 | 0.0288 | 2.5232 | 1.2624 | 0.0235 | 2.2938 | 0.0286 | 0.0256 | 1.25 | 1.30 |
| 68 | 680 | 0.0072 | 0.0288 | 2.5520 | 1.2861 | 0.0236 | 2.3224 | 0.0286 | 0.0256 | 1.25 | 1.27 |
| 69 | 690 | 0.0072 | 0.0288 | 2.5808 | 1.3098 | 0.0237 | 2.3511 | 0.0286 | 0.0257 | 1.26 | 1.26 |
| 70 | 700 | 0.0072 | 0.0288 | 2.6096 | 1.3335 | 0.0238 | 2.3797 | 0.0286 | 0.0257 | 1.26 | 1.26 |
| 71 | 710 | 0.0072 | 0.0288 | 2.6384 | 1.3574 | 0.0238 | 2.4084 | 0.0286 | 0.0258 | 1.26 | 1.26 |
| 72 | 720 | 0.0072 | 0.0288 | 2.6672 | 1.3813 | 0.0239 | 2.4370 | 0.0286 | 0.0258 | 1.26 | 1.26 |
| 73 | 730 | 0.0072 | 0.0288 | 2.6960 | 1.4053 | 0.0240 | 2.4657 | 0.0287 | 0.0259 | 1.26 | 1.26 |
| 74 | 740 | 0.0072 | 0.0288 | 2.7248 | 1.4294 | 0.0241 | 2.4943 | 0.0287 | 0.0259 | 1.27 | 1.26 |
| 75 | 750 | 0.0072 | 0.0288 | 2.7536 | 1.4535 | 0.0241 | 2.5230 | 0.0287 | 0.0259 | 1.27 | 1.27 |
| 76 | 760 | 0.0072 | 0.0288 | 2.7824 | 1.4777 | 0.0242 | 2.5516 | 0.0287 | 0.0260 | 1.27 | 1.27 |
| 77 | 770 | 0.0057 | 0.0228 | 2.8052 | 1.4969 | 0.0192 | 2.5743 | 0.0227 | 0.0206 | 1.01 | 1.20 |
| 78 | 780 | 0.0057 | 0.0228 | 2.8280 | 1.5161 | 0.0192 | 2.5970 | 0.0227 | 0.0206 | 1.01 | 1.11 |
| 79 | 790 | 0.0057 | 0.0228 | 2.8508 | 1.5354 | 0.0193 | 2.6197 | 0.0227 | 0.0206 | 1.01 | 1.06 |
| 80 | 800 | 0.0057 | 0.0228 | 2.8736 | 1.5547 | 0.0193 | 2.6424 | 0.0227 | 0.0207 | 1.01 | 1.03 |
| 81 | 810 | 0.0057 | 0.0228 | 2.8964 | 1.5741 | 0.0194 | 2.6651 | 0.0227 | 0.0207 | 1.01 | 1.02 |
| 82 | 820 | 0.0057 | 0.0228 | 2.9192 | 1.5935 | 0.0194 | 2.6878 | 0.0227 | 0.0207 | 1.01 | 1.02 |
| 83 | 830 | 0.0057 | 0.0228 | 2.9420 | 1.6129 | 0.0194 | 2.7105 | 0.0227 | 0.0207 | 1.01 | 1.02 |
| 84 | 840 | 0.0057 | 0.0228 | 2.9648 | 1.6324 | 0.0195 | 2.7332 | 0.0227 | 0.0208 | 1.01 | 1.01 |
| 85 | 850 | 0.0057 | 0.0228 | 2.9876 | 1.6519 | 0.0195 | 2.7559 | 0.0227 | 0.0208 | 1.02 | 1.01 |
| 86 | 860 | 0.0057 | 0.0228 | 3.0104 | 1.6714 | 0.0195 | 2.7786 | 0.0227 | 0.0208 | 1.02 | 1.02 |
| 87 | 870 | 0.0057 | 0.0228 | 3.0332 | 1.6910 | 0.0196 | 2.8013 | 0.0227 | 0.0208 | 1.02 | 1.02 |
| 88 | 880 | 0.0057 | 0.0228 | 3.0560 | 1.7106 | 0.0196 | 2.8240 | 0.0227 | 0.0208 | 1.02 | 1.02 |
| 89 | 890 | 0.0050 | 0.0200 | 3.0760 | 1.7278 | 0.0172 | 2.8440 | 0.0199 | 0.0183 | 0.89 | 0.99 |
| 90 | 900 | 0.0050 | 0.0200 | 3.0960 | 1.7450 | 0.0172 | 2.8639 | 0.0199 | 0.0183 | 0.90 | 0.94 |
| 91 | 910 | 0.0050 | 0.0200 | 3.1160 | 1.7623 | 0.0173 | 2.8838 | 0.0199 | 0.0183 | 0.90 | 0.92 |
| 92 | 920 | 0.0050 | 0.0200 | 3.1360 | 1.7796 | 0.0173 | 2.9037 | 0.0199 | 0.0183 | 0.90 | 0.91 |
| 93 | 930 | 0.0050 | 0.0200 | 3.1560 | 1.7969 | 0.0173 | 2.9236 | 0.0199 | 0.0184 | 0.90 | 0.90 |
| 94 | 940 | 0.0050 | 0.0200 | 3.1760 | 1.8143 | 0.0173 | 2.9436 | 0.0199 | 0.0184 | 0.90 | 0.90 |
| 95 | 950 | 0.0050 | 0.0200 | 3.1960 | 1.8316 | 0.0174 | 2.9635 | 0.0199 | 0.0184 | 0.90 | 0.90 |
| 96 | 960 | 0.0050 | 0.0200 | 3.2160 | 1.8490 | 0.0174 | 2.9834 | 0.0199 | 0.0184 | 0.90 | 0.90 |
| 97 | 970 | 0.0050 | 0.0200 | 3.2360 | 1.8664 | 0.0174 | 3.0034 | 0.0199 | 0.0184 | 0.90 | 0.90 |
| 98 | 980 | 0.0050 | 0.0200 | 3.2560 | 1.8839 | 0.0174 | 3.0233 | 0.0199 | 0.0184 | 0.90 | 0.90 |
| 99 | 990 | 0.0050 | 0.0200 | 3.2760 | 1.9013 | 0.0175 | 3.0432 | 0.0199 | 0.0184 | 0.90 | 0.90 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 1000 | 0.0050 | 0.0200 | 3.2960 | 1.9188 | 0.0175 | 3.0631 | 0.0199 | 0.0185 | 0.90 | 0.90 |
| 101 | 1010 | 0.0040 | 0.0160 | 3.3120 | 1.9328 | 0.0140 | 3.0791 | 0.0159 | 0.0148 | 0.72 | 0.86 |
| 102 | 1020 | 0.0040 | 0.0160 | 3.3280 | 1.9468 | 0.0140 | 3.0950 | 0.0159 | 0.0148 | 0.72 | 0.79 |
| 103 | 1030 | 0.0040 | 0.0160 | 3.3440 | 1.9609 | 0.0140 | 3.1110 | 0.0159 | 0.0148 | 0.72 | 0.76 |
| 104 | 1040 | 0.0040 | 0.0160 | 3.3600 | 1.9749 | 0.0140 | 3.1269 | 0.0159 | 0.0148 | 0.72 | 0.74 |
| 105 | 1050 | 0.0040 | 0.0160 | 3.3760 | 1.9890 | 0.0141 | 3.1429 | 0.0159 | 0.0148 | 0.72 | 0.73 |
| 106 | 1060 | 0.0040 | 0.0160 | 3.3920 | 2.0030 | 0.0141 | 3.1588 | 0.0159 | 0.0148 | 0.72 | 0.73 |
| 107 | 1070 | 0.0040 | 0.0160 | 3.4080 | 2.0171 | 0.0141 | 3.1748 | 0.0159 | 0.0148 | 0.72 | 0.73 |
| 108 | 1080 | 0.0040 | 0.0160 | 3.4240 | 2.0312 | 0.0141 | 3.1907 | 0.0159 | 0.0148 | 0.73 | 0.73 |
| 109 | 1090 | 0.0040 | 0.0160 | 3.4400 | 2.0453 | 0.0141 | 3.2067 | 0.0159 | 0.0148 | 0.73 | 0.73 |
| 110 | 1100 | 0.0040 | 0.0160 | 3.4560 | 2.0594 | 0.0141 | 3.2226 | 0.0159 | 0.0149 | 0.73 | 0.73 |
| 111 | 1110 | 0.0040 | 0.0160 | 3.4720 | 2.0736 | 0.0141 | 3.2386 | 0.0159 | 0.0149 | 0.73 | 0.73 |
| 112 | 1120 | 0.0040 | 0.0160 | 3.4880 | 2.0877 | 0.0141 | 3.2545 | 0.0159 | 0.0149 | 0.73 | 0.73 |
| 113 | 1130 | 0.0040 | 0.0160 | 3.5040 | 2.1019 | 0.0142 | 3.2705 | 0.0160 | 0.0149 | 0.73 | 0.73 |
| 114 | 1140 | 0.0040 | 0.0160 | 3.5200 | 2.1161 | 0.0142 | 3.2864 | 0.0160 | 0.0149 | 0.73 | 0.73 |
| 115 | 1150 | 0.0040 | 0.0160 | 3.5360 | 2.1302 | 0.0142 | 3.3024 | 0.0160 | 0.0149 | 0.73 | 0.73 |
| 116 | 1160 | 0.0040 | 0.0160 | 3.5520 | 2.1444 | 0.0142 | 3.3183 | 0.0160 | 0.0149 | 0.73 | 0.73 |
| 117 | 1170 | 0.0040 | 0.0160 | 3.5680 | 2.1586 | 0.0142 | 3.3343 | 0.0160 | 0.0149 | 0.73 | 0.73 |
| 118 | 1180 | 0.0040 | 0.0160 | 3.5840 | 2.1729 | 0.0142 | 3.3502 | 0.0160 | 0.0149 | 0.73 | 0.73 |
| 119 | 1190 | 0.0040 | 0.0160 | 3.6000 | 2.1871 | 0.0142 | 3.3662 | 0.0160 | 0.0149 | 0.73 | 0.73 |
| 120 | 1200 | 0.0040 | 0.0160 | 3.6160 | 2.2013 | 0.0142 | 3.3821 | 0.0160 | 0.0149 | 0.73 | 0.73 |
| 121 | 1210 | 0.0040 | 0.0160 | 3.6320 | 2.2156 | 0.0143 | 3.3981 | 0.0160 | 0.0149 | 0.73 | 0.73 |
| 122 | 1220 | 0.0040 | 0.0160 | 3.6480 | 2.2298 | 0.0143 | 3.4140 | 0.0160 | 0.0149 | 0.73 | 0.73 |
| 123 | 1230 | 0.0040 | 0.0160 | 3.6640 | 2.2441 | 0.0143 | 3.4300 | 0.0160 | 0.0149 | 0.73 | 0.73 |
| 124 | 1240 | 0.0040 | 0.0160 | 3.6800 | 2.2584 | 0.0143 | 3.4459 | 0.0160 | 0.0150 | 0.73 | 0.73 |
| 125 | 1250 | 0.0040 | 0.0160 | 3.6960 | 2.2727 | 0.0143 | 3.4619 | 0.0160 | 0.0150 | 0.73 | 0.73 |
| 126 | 1260 | 0.0040 | 0.0160 | 3.7120 | 2.2870 | 0.0143 | 3.4778 | 0.0160 | 0.0150 | 0.73 | 0.73 |
| 127 | 1270 | 0.0040 | 0.0160 | 3.7280 | 2.3013 | 0.0143 | 3.4938 | 0.0160 | 0.0150 | 0.73 | 0.73 |
| 128 | 1280 | 0.0040 | 0.0160 | 3.7440 | 2.3157 | 0.0143 | 3.5098 | 0.0160 | 0.0150 | 0.73 | 0.73 |
| 129 | 1290 | 0.0040 | 0.0160 | 3.7600 | 2.3300 | 0.0143 | 3.5257 | 0.0160 | 0.0150 | 0.73 | 0.73 |
| 130 | 1300 | 0.0040 | 0.0160 | 3.7760 | 2.3444 | 0.0144 | 3.5417 | 0.0160 | 0.0150 | 0.73 | 0.73 |
| 131 | 1310 | 0.0040 | 0.0160 | 3.7920 | 2.3587 | 0.0144 | 3.5576 | 0.0160 | 0.0150 | 0.73 | 0.73 |
| 132 | 1320 | 0.0040 | 0.0160 | 3.8080 | 2.3731 | 0.0144 | 3.5736 | 0.0160 | 0.0150 | 0.73 | 0.73 |
| 133 | 1330 | 0.0040 | 0.0160 | 3.8240 | 2.3875 | 0.0144 | 3.5895 | 0.0160 | 0.0150 | 0.73 | 0.73 |
| 134 | 1340 | 0.0040 | 0.0160 | 3.8400 | 2.4019 | 0.0144 | 3.6055 | 0.0160 | 0.0150 | 0.73 | 0.73 |
| 135 | 1350 | 0.0040 | 0.0160 | 3.8560 | 2.4163 | 0.0144 | 3.6215 | 0.0160 | 0.0150 | 0.73 | 0.73 |
| 136 | 1360 | 0.0040 | 0.0160 | 3.8720 | 2.4307 | 0.0144 | 3.6374 | 0.0160 | 0.0150 | 0.73 | 0.73 |
| 137 | 1370 | 0.0040 | 0.0160 | 3.8880 | 2.4451 | 0.0144 | 3.6534 | 0.0160 | 0.0150 | 0.74 | 0.73 |
| 138 | 1380 | 0.0040 | 0.0160 | 3.9040 | 2.4595 | 0.0144 | 3.6693 | 0.0160 | 0.0150 | 0.74 | 0.73 |
| 139 | 1390 | 0.0040 | 0.0160 | 3.9200 | 2.4740 | 0.0144 | 3.6853 | 0.0160 | 0.0150 | 0.74 | 0.74 |
| 140 | 1400 | 0.0040 | 0.0160 | 3.9360 | 2.4884 | 0.0145 | 3.7013 | 0.0160 | 0.0151 | 0.74 | 0.74 |
| 141 | 1410 | 0.0040 | 0.0160 | 3.9520 | 2.5029 | 0.0145 | 3.7172 | 0.0160 | 0.0151 | 0.74 | 0.74 |
| 142 | 1420 | 0.0040 | 0.0160 | 3.9680 | 2.5173 | 0.0145 | 3.7332 | 0.0160 | 0.0151 | 0.74 | 0.74 |
| 143 | 1430 | 0.0040 | 0.0160 | 3.9840 | 2.5318 | 0.0145 | 3.7491 | 0.0160 | 0.0151 | 0.74 | 0.74 |
| 144 | 1440 | 0.0040 | 0.0160 | 4.0000 | 2.5463 | 0.0145 | 3.7651 | 0.0160 | 0.0151 | 0.74 | 0.74 |

Total Runoff Volume (cu. ft.)= 88311

Pietrok Engineering And Resources

Project No. 034
Date: 10/24/17
(SBUH)

HYDROLOGIC ANALYSIS USING SCS CURVE NUMBER (CN) AND SANTA BARBARA URBAN HYDROGRAPH (SBUH) METHOD

GIVEN:

| | | | | | |
|---|---|---|---|---|---|
| Project = | 314 Pleasant Avenue Development | | | | |
| Basin # = | sub-basin of Newell Basin | | | | |
| Area = | 1.11 | acres | | | |
| Event = | 25 | -year, 24-hour duration storm event | | | |
| Pt = | 4.00 | inches rainfall | | | |
| Tc = | 15.0 | min. | | | |
| dt = | 10 | min. | | | |
| PERVIOUS Parcel | | | IMPERVIOUS Parcel | | |
| Area = | 0.60 | acres | Area = | 0.51 | acres |
| CN = | 86.00 | | CN = | 98.00 | |
| S = | 1.63 | | S = | 0.20 | |
| 0.2S = | 0.33 | | 0.2S = | 0.04 | |

COMPUTE RUNOFF HYDROGRAPH

Column (3) = SCS Type IA Rainfall Distribution
Column (4) = Column (3) x Pt
Column (5) = Accumulated Sum of Col (4)
Column (6) = [If P <= 0.2S] = 0; Note, use pervious area "S" value
[If P > 0.2S] = (Col (5) - 0.2S)^2/(Col (5) + 0.8S)
Column (7) = Col (6) of present time step - Col (6) of previous time step
Column (8) = Same method as for Col (6), except use impervious "S"
Column (9) = Col (8) of present time step - Col (8) of previous time step
Column (10) = ((pervious area/total area) x Col (7)) + ((impervious area/total area) x Col (9))
Column (11) = (60.5 x Col (10) x total area)/10, where dt = 10 minutes
Routing Constant w = dt/(2Tc + dt) = 0.25
Column (12) = Col (12) of previous time step + (w x [Col (11) of previous time step
+ Col (11) of present time step - (2 x Col (12) of previous time step)])

| | | | | | Pervious Area | | Impervious Area | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Time Increment | (2) Time | (3) Rainfall distribution | (4) Incremental Rainfall | (5) Accumulated Rainfall | (6) Accumulated Runoff | (7) Incremental Runoff | (8) Accumulated Runoff | (9) Incremental Runoff | (10) Total Runoff | (11) Instant Hydrograph | (12) Design Hydrograph |
| | min. | % of Pt | in. | in. | in. | in. | in. | in. | in. | cfs | cfs |
| 1 | 10 | 0.0040 | 0.0160 | 0.0160 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.00 | 0.00 |
| 2 | 20 | 0.0040 | 0.0160 | 0.0320 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.00 | 0.00 |
| 3 | 30 | 0.0040 | 0.0160 | 0.0480 | 0.0000 | 0.0000 | 0.0002 | 0.0002 | 0.0001 | 0.00 | 0.00 |
| 4 | 40 | 0.0040 | 0.0160 | 0.0640 | 0.0000 | 0.0000 | 0.0024 | 0.0021 | 0.0010 | 0.01 | 0.00 |
| 5 | 50 | 0.0040 | 0.0160 | 0.0800 | 0.0000 | 0.0000 | 0.0063 | 0.0039 | 0.0018 | 0.01 | 0.01 |
| 6 | 60 | 0.0040 | 0.0160 | 0.0960 | 0.0000 | 0.0000 | 0.0117 | 0.0054 | 0.0025 | 0.02 | 0.01 |
| 7 | 70 | 0.0040 | 0.0160 | 0.1120 | 0.0000 | 0.0000 | 0.0184 | 0.0067 | 0.0031 | 0.02 | 0.01 |
| 8 | 80 | 0.0040 | 0.0160 | 0.1280 | 0.0000 | 0.0000 | 0.0261 | 0.0077 | 0.0035 | 0.02 | 0.02 |
| 9 | 90 | 0.0040 | 0.0160 | 0.1440 | 0.0000 | 0.0000 | 0.0347 | 0.0086 | 0.0039 | 0.03 | 0.02 |
| 10 | 100 | 0.0040 | 0.0160 | 0.1600 | 0.0000 | 0.0000 | 0.0439 | 0.0093 | 0.0043 | 0.03 | 0.02 |
| 11 | 110 | 0.0050 | 0.0200 | 0.1800 | 0.0000 | 0.0000 | 0.0564 | 0.0125 | 0.0057 | 0.04 | 0.03 |
| 12 | 120 | 0.0050 | 0.0200 | 0.2000 | 0.0000 | 0.0000 | 0.0698 | 0.0133 | 0.0061 | 0.04 | 0.03 |
| 13 | 130 | 0.0050 | 0.0200 | 0.2200 | 0.0000 | 0.0000 | 0.0838 | 0.0140 | 0.0064 | 0.04 | 0.04 |
| 14 | 140 | 0.0050 | 0.0200 | 0.2400 | 0.0000 | 0.0000 | 0.0984 | 0.0146 | 0.0067 | 0.05 | 0.04 |
| 15 | 150 | 0.0050 | 0.0200 | 0.2600 | 0.0000 | 0.0000 | 0.1135 | 0.0151 | 0.0069 | 0.05 | 0.04 |
| 16 | 160 | 0.0050 | 0.0200 | 0.2800 | 0.0000 | 0.0000 | 0.1291 | 0.0156 | 0.0071 | 0.05 | 0.05 |
| 17 | 170 | 0.0060 | 0.0240 | 0.3040 | 0.0000 | 0.0000 | 0.1482 | 0.0192 | 0.0088 | 0.06 | 0.05 |
| 18 | 180 | 0.0060 | 0.0240 | 0.3280 | 0.0000 | 0.0000 | 0.1679 | 0.0196 | 0.0090 | 0.06 | 0.05 |
| 19 | 190 | 0.0060 | 0.0240 | 0.3520 | 0.0004 | 0.0004 | 0.1879 | 0.0201 | 0.0094 | 0.06 | 0.06 |
| 20 | 200 | 0.0060 | 0.0240 | 0.3760 | 0.0015 | 0.0011 | 0.2083 | 0.0204 | 0.0100 | 0.07 | 0.06 |
| 21 | 210 | 0.0060 | 0.0240 | 0.4000 | 0.0033 | 0.0017 | 0.2290 | 0.0207 | 0.0105 | 0.07 | 0.07 |
| 22 | 220 | 0.0060 | 0.0240 | 0.4240 | 0.0056 | 0.0024 | 0.2500 | 0.0210 | 0.0109 | 0.07 | 0.07 |
| 23 | 230 | 0.0070 | 0.0280 | 0.4520 | 0.0091 | 0.0035 | 0.2748 | 0.0248 | 0.0133 | 0.09 | 0.07 |
| 24 | 240 | 0.0070 | 0.0280 | 0.4800 | 0.0134 | 0.0043 | 0.2998 | 0.0251 | 0.0138 | 0.09 | 0.08 |
| 25 | 250 | 0.0070 | 0.0280 | 0.5080 | 0.0184 | 0.0050 | 0.3251 | 0.0253 | 0.0143 | 0.10 | 0.09 |
| 26 | 260 | 0.0070 | 0.0280 | 0.5360 | 0.0241 | 0.0057 | 0.3507 | 0.0255 | 0.0148 | 0.10 | 0.09 |
| 27 | 270 | 0.0070 | 0.0280 | 0.5640 | 0.0305 | 0.0064 | 0.3764 | 0.0257 | 0.0153 | 0.10 | 0.10 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | 280 | 0.0070 | 0.0280 | 0.5920 | 0.0375 | 0.0070 | 0.4022 | 0.0259 | 0.0157 | 0.11 | 0.10 |
| 29 | 290 | 0.0082 | 0.0328 | 0.6248 | 0.0465 | 0.0090 | 0.4328 | 0.0305 | 0.0189 | 0.13 | 0.11 |
| 30 | 300 | 0.0082 | 0.0328 | 0.6576 | 0.0562 | 0.0098 | 0.4634 | 0.0307 | 0.0194 | 0.13 | 0.12 |
| 31 | 310 | 0.0082 | 0.0328 | 0.6904 | 0.0668 | 0.0105 | 0.4943 | 0.0309 | 0.0199 | 0.13 | 0.13 |
| 32 | 320 | 0.0082 | 0.0328 | 0.7232 | 0.0781 | 0.0113 | 0.5253 | 0.0310 | 0.0203 | 0.14 | 0.13 |
| 33 | 330 | 0.0082 | 0.0328 | 0.7560 | 0.0900 | 0.0120 | 0.5564 | 0.0311 | 0.0208 | 0.14 | 0.13 |
| 34 | 340 | 0.0082 | 0.0328 | 0.7888 | 0.1026 | 0.0126 | 0.5876 | 0.0312 | 0.0212 | 0.14 | 0.14 |
| 35 | 350 | 0.0095 | 0.0380 | 0.8268 | 0.1180 | 0.0154 | 0.6240 | 0.0363 | 0.0250 | 0.17 | 0.15 |
| 36 | 360 | 0.0095 | 0.0380 | 0.8648 | 0.1342 | 0.0162 | 0.6604 | 0.0364 | 0.0255 | 0.17 | 0.16 |
| 37 | 370 | 0.0095 | 0.0380 | 0.9028 | 0.1511 | 0.0169 | 0.6970 | 0.0366 | 0.0259 | 0.17 | 0.17 |
| 38 | 380 | 0.0095 | 0.0380 | 0.9408 | 0.1687 | 0.0176 | 0.7336 | 0.0367 | 0.0264 | 0.18 | 0.17 |
| 39 | 390 | 0.0095 | 0.0380 | 0.9788 | 0.1871 | 0.0183 | 0.7704 | 0.0367 | 0.0268 | 0.18 | 0.17 |
| 40 | 400 | 0.0095 | 0.0380 | 1.0168 | 0.2060 | 0.0190 | 0.8072 | 0.0368 | 0.0272 | 0.18 | 0.18 |
| 41 | 410 | 0.0134 | 0.0536 | 1.0704 | 0.2338 | 0.0278 | 0.8593 | 0.0521 | 0.0389 | 0.26 | 0.20 |
| 42 | 420 | 0.0134 | 0.0536 | 1.1240 | 0.2627 | 0.0289 | 0.9115 | 0.0522 | 0.0396 | 0.27 | 0.23 |
| 43 | 430 | 0.0134 | 0.0536 | 1.1776 | 0.2927 | 0.0300 | 0.9638 | 0.0523 | 0.0402 | 0.27 | 0.25 |
| 44 | 440 | 0.0180 | 0.0720 | 1.2496 | 0.3346 | 0.0419 | 1.0342 | 0.0704 | 0.0550 | 0.37 | 0.28 |
| 45 | 450 | 0.0180 | 0.0720 | 1.3216 | 0.3781 | 0.0435 | 1.1048 | 0.0706 | 0.0559 | 0.38 | 0.33 |
| 46 | 460 | 0.0340 | 0.1360 | 1.4576 | 0.4643 | 0.0862 | 1.2384 | 0.1336 | 0.1080 | 0.73 | 0.44 |
| 47 | 470 | 0.0540 | 0.2160 | 1.6736 | 0.6106 | 0.1463 | 1.4514 | 0.2130 | 0.1769 | 1.19 | 0.70 |
| 48 | 480 | 0.0270 | 0.1080 | 1.7816 | 0.6874 | 0.0768 | 1.5581 | 0.1067 | 0.0906 | 0.61 | 0.80 |
| 49 | 490 | 0.0180 | 0.0720 | 1.8536 | 0.7398 | 0.0524 | 1.6294 | 0.0712 | 0.0611 | 0.41 | 0.65 |
| 50 | 500 | 0.0134 | 0.0536 | 1.9072 | 0.7794 | 0.0396 | 1.6824 | 0.0531 | 0.0458 | 0.31 | 0.51 |
| 51 | 510 | 0.0134 | 0.0536 | 1.9608 | 0.8194 | 0.0400 | 1.7355 | 0.0531 | 0.0460 | 0.31 | 0.41 |
| 52 | 520 | 0.0134 | 0.0536 | 2.0144 | 0.8599 | 0.0405 | 1.7886 | 0.0531 | 0.0463 | 0.31 | 0.36 |
| 53 | 530 | 0.0088 | 0.0352 | 2.0496 | 0.8867 | 0.0268 | 1.8235 | 0.0349 | 0.0305 | 0.20 | 0.31 |
| 54 | 540 | 0.0088 | 0.0352 | 2.0848 | 0.9137 | 0.0270 | 1.8584 | 0.0349 | 0.0306 | 0.21 | 0.26 |
| 55 | 550 | 0.0088 | 0.0352 | 2.1200 | 0.9409 | 0.0272 | 1.8933 | 0.0349 | 0.0307 | 0.21 | 0.23 |
| 56 | 560 | 0.0088 | 0.0352 | 2.1552 | 0.9682 | 0.0273 | 1.9283 | 0.0349 | 0.0308 | 0.21 | 0.22 |
| 57 | 570 | 0.0088 | 0.0352 | 2.1904 | 0.9957 | 0.0275 | 1.9632 | 0.0349 | 0.0309 | 0.21 | 0.21 |
| 58 | 580 | 0.0088 | 0.0352 | 2.2256 | 1.0233 | 0.0276 | 1.9981 | 0.0349 | 0.0310 | 0.21 | 0.21 |
| 59 | 590 | 0.0088 | 0.0352 | 2.2608 | 1.0511 | 0.0278 | 2.0331 | 0.0349 | 0.0311 | 0.21 | 0.21 |
| 60 | 600 | 0.0088 | 0.0352 | 2.2960 | 1.0790 | 0.0279 | 2.0680 | 0.0350 | 0.0312 | 0.21 | 0.21 |
| 61 | 610 | 0.0088 | 0.0352 | 2.3312 | 1.1071 | 0.0281 | 2.1030 | 0.0350 | 0.0312 | 0.21 | 0.21 |
| 62 | 620 | 0.0088 | 0.0352 | 2.3664 | 1.1353 | 0.0282 | 2.1380 | 0.0350 | 0.0313 | 0.21 | 0.21 |
| 63 | 630 | 0.0088 | 0.0352 | 2.4016 | 1.1636 | 0.0283 | 2.1729 | 0.0350 | 0.0314 | 0.21 | 0.21 |
| 64 | 640 | 0.0088 | 0.0352 | 2.4368 | 1.1921 | 0.0285 | 2.2079 | 0.0350 | 0.0315 | 0.21 | 0.21 |
| 65 | 650 | 0.0072 | 0.0288 | 2.4656 | 1.2154 | 0.0234 | 2.2365 | 0.0286 | 0.0258 | 0.17 | 0.20 |
| 66 | 660 | 0.0072 | 0.0288 | 2.4944 | 1.2389 | 0.0235 | 2.2652 | 0.0286 | 0.0258 | 0.17 | 0.19 |
| 67 | 670 | 0.0072 | 0.0288 | 2.5232 | 1.2624 | 0.0235 | 2.2938 | 0.0286 | 0.0259 | 0.17 | 0.18 |
| 68 | 680 | 0.0072 | 0.0288 | 2.5520 | 1.2861 | 0.0236 | 2.3224 | 0.0286 | 0.0259 | 0.17 | 0.18 |
| 69 | 690 | 0.0072 | 0.0288 | 2.5808 | 1.3098 | 0.0237 | 2.3511 | 0.0286 | 0.0260 | 0.17 | 0.18 |
| 70 | 700 | 0.0072 | 0.0288 | 2.6096 | 1.3335 | 0.0238 | 2.3797 | 0.0286 | 0.0260 | 0.17 | 0.18 |
| 71 | 710 | 0.0072 | 0.0288 | 2.6384 | 1.3574 | 0.0238 | 2.4084 | 0.0286 | 0.0261 | 0.17 | 0.17 |
| 72 | 720 | 0.0072 | 0.0288 | 2.6672 | 1.3813 | 0.0239 | 2.4370 | 0.0286 | 0.0261 | 0.18 | 0.18 |
| 73 | 730 | 0.0072 | 0.0288 | 2.6960 | 1.4053 | 0.0240 | 2.4657 | 0.0287 | 0.0261 | 0.18 | 0.18 |
| 74 | 740 | 0.0072 | 0.0288 | 2.7248 | 1.4294 | 0.0241 | 2.4943 | 0.0287 | 0.0262 | 0.18 | 0.18 |
| 75 | 750 | 0.0072 | 0.0288 | 2.7536 | 1.4535 | 0.0241 | 2.5230 | 0.0287 | 0.0262 | 0.18 | 0.18 |
| 76 | 760 | 0.0072 | 0.0288 | 2.7824 | 1.4777 | 0.0242 | 2.5516 | 0.0287 | 0.0262 | 0.18 | 0.18 |
| 77 | 770 | 0.0057 | 0.0228 | 2.8052 | 1.4969 | 0.0192 | 2.5743 | 0.0227 | 0.0208 | 0.14 | 0.17 |
| 78 | 780 | 0.0057 | 0.0228 | 2.8280 | 1.5161 | 0.0192 | 2.5970 | 0.0227 | 0.0208 | 0.14 | 0.15 |
| 79 | 790 | 0.0057 | 0.0228 | 2.8508 | 1.5354 | 0.0193 | 2.6197 | 0.0227 | 0.0208 | 0.14 | 0.15 |
| 80 | 800 | 0.0057 | 0.0228 | 2.8736 | 1.5547 | 0.0193 | 2.6424 | 0.0227 | 0.0209 | 0.14 | 0.14 |
| 81 | 810 | 0.0057 | 0.0228 | 2.8964 | 1.5741 | 0.0194 | 2.6651 | 0.0227 | 0.0209 | 0.14 | 0.14 |
| 82 | 820 | 0.0057 | 0.0228 | 2.9192 | 1.5935 | 0.0194 | 2.6878 | 0.0227 | 0.0209 | 0.14 | 0.14 |
| 83 | 830 | 0.0057 | 0.0228 | 2.9420 | 1.6129 | 0.0194 | 2.7105 | 0.0227 | 0.0209 | 0.14 | 0.14 |
| 84 | 840 | 0.0057 | 0.0228 | 2.9648 | 1.6324 | 0.0195 | 2.7332 | 0.0227 | 0.0210 | 0.14 | 0.14 |
| 85 | 850 | 0.0057 | 0.0228 | 2.9876 | 1.6519 | 0.0195 | 2.7559 | 0.0227 | 0.0210 | 0.14 | 0.14 |
| 86 | 860 | 0.0057 | 0.0228 | 3.0104 | 1.6714 | 0.0195 | 2.7786 | 0.0227 | 0.0210 | 0.14 | 0.14 |
| 87 | 870 | 0.0057 | 0.0228 | 3.0332 | 1.6910 | 0.0196 | 2.8013 | 0.0227 | 0.0210 | 0.14 | 0.14 |
| 88 | 880 | 0.0057 | 0.0228 | 3.0560 | 1.7106 | 0.0196 | 2.8240 | 0.0227 | 0.0210 | 0.14 | 0.14 |
| 89 | 890 | 0.0050 | 0.0200 | 3.0760 | 1.7278 | 0.0172 | 2.8440 | 0.0199 | 0.0185 | 0.12 | 0.14 |
| 90 | 900 | 0.0050 | 0.0200 | 3.0960 | 1.7450 | 0.0172 | 2.8639 | 0.0199 | 0.0185 | 0.12 | 0.13 |
| 91 | 910 | 0.0050 | 0.0200 | 3.1160 | 1.7623 | 0.0173 | 2.8838 | 0.0199 | 0.0185 | 0.12 | 0.13 |
| 92 | 920 | 0.0050 | 0.0200 | 3.1360 | 1.7796 | 0.0173 | 2.9037 | 0.0199 | 0.0185 | 0.12 | 0.13 |
| 93 | 930 | 0.0050 | 0.0200 | 3.1560 | 1.7969 | 0.0173 | 2.9236 | 0.0199 | 0.0185 | 0.12 | 0.13 |
| 94 | 940 | 0.0050 | 0.0200 | 3.1760 | 1.8143 | 0.0173 | 2.9436 | 0.0199 | 0.0185 | 0.12 | 0.12 |
| 95 | 950 | 0.0050 | 0.0200 | 3.1960 | 1.8316 | 0.0174 | 2.9635 | 0.0199 | 0.0185 | 0.12 | 0.12 |
| 96 | 960 | 0.0050 | 0.0200 | 3.2160 | 1.8490 | 0.0174 | 2.9834 | 0.0199 | 0.0186 | 0.12 | 0.12 |
| 97 | 970 | 0.0050 | 0.0200 | 3.2360 | 1.8664 | 0.0174 | 3.0034 | 0.0199 | 0.0186 | 0.12 | 0.12 |
| 98 | 980 | 0.0050 | 0.0200 | 3.2560 | 1.8839 | 0.0174 | 3.0233 | 0.0199 | 0.0186 | 0.12 | 0.12 |
| 99 | 990 | 0.0050 | 0.0200 | 3.2760 | 1.9013 | 0.0175 | 3.0432 | 0.0199 | 0.0186 | 0.12 | 0.12 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 1000 | 0.0050 | 0.0200 | 3.2960 | 1.9188 | 0.0175 | 3.0631 | 0.0199 | 0.0186 | 0.12 | 0.12 |
| 101 | 1010 | 0.0040 | 0.0160 | 3.3120 | 1.9328 | 0.0140 | 3.0791 | 0.0159 | 0.0149 | 0.10 | 0.12 |
| 102 | 1020 | 0.0040 | 0.0160 | 3.3280 | 1.9468 | 0.0140 | 3.0950 | 0.0159 | 0.0149 | 0.10 | 0.11 |
| 103 | 1030 | 0.0040 | 0.0160 | 3.3440 | 1.9609 | 0.0140 | 3.1110 | 0.0159 | 0.0149 | 0.10 | 0.10 |
| 104 | 1040 | 0.0040 | 0.0160 | 3.3600 | 1.9749 | 0.0140 | 3.1269 | 0.0159 | 0.0149 | 0.10 | 0.10 |
| 105 | 1050 | 0.0040 | 0.0160 | 3.3760 | 1.9890 | 0.0141 | 3.1429 | 0.0159 | 0.0149 | 0.10 | 0.10 |
| 106 | 1060 | 0.0040 | 0.0160 | 3.3920 | 2.0030 | 0.0141 | 3.1588 | 0.0159 | 0.0149 | 0.10 | 0.10 |
| 107 | 1070 | 0.0040 | 0.0160 | 3.4080 | 2.0171 | 0.0141 | 3.1748 | 0.0159 | 0.0149 | 0.10 | 0.10 |
| 108 | 1080 | 0.0040 | 0.0160 | 3.4240 | 2.0312 | 0.0141 | 3.1907 | 0.0159 | 0.0149 | 0.10 | 0.10 |
| 109 | 1090 | 0.0040 | 0.0160 | 3.4400 | 2.0453 | 0.0141 | 3.2067 | 0.0159 | 0.0150 | 0.10 | 0.10 |
| 110 | 1100 | 0.0040 | 0.0160 | 3.4560 | 2.0594 | 0.0141 | 3.2226 | 0.0159 | 0.0150 | 0.10 | 0.10 |
| 111 | 1110 | 0.0040 | 0.0160 | 3.4720 | 2.0736 | 0.0141 | 3.2386 | 0.0159 | 0.0150 | 0.10 | 0.10 |
| 112 | 1120 | 0.0040 | 0.0160 | 3.4880 | 2.0877 | 0.0141 | 3.2545 | 0.0159 | 0.0150 | 0.10 | 0.10 |
| 113 | 1130 | 0.0040 | 0.0160 | 3.5040 | 2.1019 | 0.0142 | 3.2705 | 0.0160 | 0.0150 | 0.10 | 0.10 |
| 114 | 1140 | 0.0040 | 0.0160 | 3.5200 | 2.1161 | 0.0142 | 3.2864 | 0.0160 | 0.0150 | 0.10 | 0.10 |
| 115 | 1150 | 0.0040 | 0.0160 | 3.5360 | 2.1302 | 0.0142 | 3.3024 | 0.0160 | 0.0150 | 0.10 | 0.10 |
| 116 | 1160 | 0.0040 | 0.0160 | 3.5520 | 2.1444 | 0.0142 | 3.3183 | 0.0160 | 0.0150 | 0.10 | 0.10 |
| 117 | 1170 | 0.0040 | 0.0160 | 3.5680 | 2.1586 | 0.0142 | 3.3343 | 0.0160 | 0.0150 | 0.10 | 0.10 |
| 118 | 1180 | 0.0040 | 0.0160 | 3.5840 | 2.1729 | 0.0142 | 3.3502 | 0.0160 | 0.0150 | 0.10 | 0.10 |
| 119 | 1190 | 0.0040 | 0.0160 | 3.6000 | 2.1871 | 0.0142 | 3.3662 | 0.0160 | 0.0150 | 0.10 | 0.10 |
| 120 | 1200 | 0.0040 | 0.0160 | 3.6160 | 2.2013 | 0.0142 | 3.3821 | 0.0160 | 0.0150 | 0.10 | 0.10 |
| 121 | 1210 | 0.0040 | 0.0160 | 3.6320 | 2.2156 | 0.0143 | 3.3981 | 0.0160 | 0.0150 | 0.10 | 0.10 |
| 122 | 1220 | 0.0040 | 0.0160 | 3.6480 | 2.2298 | 0.0143 | 3.4140 | 0.0160 | 0.0150 | 0.10 | 0.10 |
| 123 | 1230 | 0.0040 | 0.0160 | 3.6640 | 2.2441 | 0.0143 | 3.4300 | 0.0160 | 0.0150 | 0.10 | 0.10 |
| 124 | 1240 | 0.0040 | 0.0160 | 3.6800 | 2.2584 | 0.0143 | 3.4459 | 0.0160 | 0.0151 | 0.10 | 0.10 |
| 125 | 1250 | 0.0040 | 0.0160 | 3.6960 | 2.2727 | 0.0143 | 3.4619 | 0.0160 | 0.0151 | 0.10 | 0.10 |
| 126 | 1260 | 0.0040 | 0.0160 | 3.7120 | 2.2870 | 0.0143 | 3.4778 | 0.0160 | 0.0151 | 0.10 | 0.10 |
| 127 | 1270 | 0.0040 | 0.0160 | 3.7280 | 2.3013 | 0.0143 | 3.4938 | 0.0160 | 0.0151 | 0.10 | 0.10 |
| 128 | 1280 | 0.0040 | 0.0160 | 3.7440 | 2.3157 | 0.0143 | 3.5098 | 0.0160 | 0.0151 | 0.10 | 0.10 |
| 129 | 1290 | 0.0040 | 0.0160 | 3.7600 | 2.3300 | 0.0143 | 3.5257 | 0.0160 | 0.0151 | 0.10 | 0.10 |
| 130 | 1300 | 0.0040 | 0.0160 | 3.7760 | 2.3444 | 0.0144 | 3.5417 | 0.0160 | 0.0151 | 0.10 | 0.10 |
| 131 | 1310 | 0.0040 | 0.0160 | 3.7920 | 2.3587 | 0.0144 | 3.5576 | 0.0160 | 0.0151 | 0.10 | 0.10 |
| 132 | 1320 | 0.0040 | 0.0160 | 3.8080 | 2.3731 | 0.0144 | 3.5736 | 0.0160 | 0.0151 | 0.10 | 0.10 |
| 133 | 1330 | 0.0040 | 0.0160 | 3.8240 | 2.3875 | 0.0144 | 3.5895 | 0.0160 | 0.0151 | 0.10 | 0.10 |
| 134 | 1340 | 0.0040 | 0.0160 | 3.8400 | 2.4019 | 0.0144 | 3.6055 | 0.0160 | 0.0151 | 0.10 | 0.10 |
| 135 | 1350 | 0.0040 | 0.0160 | 3.8560 | 2.4163 | 0.0144 | 3.6215 | 0.0160 | 0.0151 | 0.10 | 0.10 |
| 136 | 1360 | 0.0040 | 0.0160 | 3.8720 | 2.4307 | 0.0144 | 3.6374 | 0.0160 | 0.0151 | 0.10 | 0.10 |
| 137 | 1370 | 0.0040 | 0.0160 | 3.8880 | 2.4451 | 0.0144 | 3.6534 | 0.0160 | 0.0151 | 0.10 | 0.10 |
| 138 | 1380 | 0.0040 | 0.0160 | 3.9040 | 2.4595 | 0.0144 | 3.6693 | 0.0160 | 0.0151 | 0.10 | 0.10 |
| 139 | 1390 | 0.0040 | 0.0160 | 3.9200 | 2.4740 | 0.0144 | 3.6853 | 0.0160 | 0.0151 | 0.10 | 0.10 |
| 140 | 1400 | 0.0040 | 0.0160 | 3.9360 | 2.4884 | 0.0145 | 3.7013 | 0.0160 | 0.0151 | 0.10 | 0.10 |
| 141 | 1410 | 0.0040 | 0.0160 | 3.9520 | 2.5029 | 0.0145 | 3.7172 | 0.0160 | 0.0151 | 0.10 | 0.10 |
| 142 | 1420 | 0.0040 | 0.0160 | 3.9680 | 2.5173 | 0.0145 | 3.7332 | 0.0160 | 0.0152 | 0.10 | 0.10 |
| 143 | 1430 | 0.0040 | 0.0160 | 3.9840 | 2.5318 | 0.0145 | 3.7491 | 0.0160 | 0.0152 | 0.10 | 0.10 |
| 144 | 1440 | 0.0040 | 0.0160 | 4.0000 | 2.5463 | 0.0145 | 3.7651 | 0.0160 | 0.0152 | 0.10 | 0.10 |

Total Runoff Volume (cu. ft.)= 12425

Pietrok Engineering And Resources

Project No. 034
Date: 10/24/17
(SBUH)

HYDROLOGIC ANALYSIS USING SCS CURVE NUMBER (CN) AND SANTA BARBARA URBAN HYDROGRAPH (SBUH) METHOD

GIVEN:

| | | | | | |
|---|---|---|---|---|---|
| Project = | 314 Pleasant Avenue Development | | | | |
| Basin # = | sub-basin of Newell Basin | | | | |
| Area = | 3.09 | acres | | | |
| Event = | 25 | -year, 24-hour duration storm event | | | |
| Pt = | 4.00 | inches rainfall | | | |
| Tc = | 15.0 | min. | | | |
| dt = | 10 | min. | | | |
| PERVIOUS Parcel | | | IMPERVIOUS Parcel | | |
| Area = | 1.85 | acres | Area = | 1.24 | acres |
| CN = | 86.00 | | CN = | 98.00 | |
| S = | 1.63 | | S = | 0.20 | |
| 0.2S = | 0.33 | | 0.2S = | 0.04 | |

COMPUTE RUNOFF HYDROGRAPH

Column (3) = SCS Type IA Rainfall Distribution
Column (4) = Column (3) x Pt
Column (5) = Accumulated Sum of Col (4)
Column (6) = [If P <= 0.2S] = 0; Note, use pervious area "S" value
[If P > 0.2S] = (Col (5) - 0.2S)^2/(Col (5) + 0.8S)
Column (7) = Col (6) of present time step - Col (6) of previous time step
Column (8) = Same method as for Col (6), except use impervious "S"
Column (9) = Col (8) of present time step - Col (8) of previous time step
Column (10) = ((pervious area/total area) x Col (7)) + ((impervious area/total area) x Col (9))
Column (11) = (60.5 x Col (10) x total area)/10, where dt = 10 minutes
Routing Constant w = dt/(2Tc + dt) = 0.25
Column (12) = Col (12) of previous time step + (w x [Col (11) of previous time step
+ Col (11) of present time step - (2 x Col (12) of previous time step)])

| | | | | | Pervious Area | | Impervious Area | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Time Increment | (2) Time | (3) Rainfall distribution | (4) Incremental Rainfall | (5) Accumulated Rainfall | (6) Accumulated Runoff | (7) Incremental Runoff | (8) Accumulated Runoff | (9) Incremental Runoff | (10) Total Runoff | (11) Instant Hydrograph | (12) Design Hydrograph |
| | min. | % of Pt | in. | in. | in. | in. | in. | in. | in. | cfs | cfs |
| 1 | 10 | 0.0040 | 0.0160 | 0.0160 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.00 | 0.00 |
| 2 | 20 | 0.0040 | 0.0160 | 0.0320 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.00 | 0.00 |
| 3 | 30 | 0.0040 | 0.0160 | 0.0480 | 0.0000 | 0.0000 | 0.0002 | 0.0002 | 0.0001 | 0.00 | 0.00 |
| 4 | 40 | 0.0040 | 0.0160 | 0.0640 | 0.0000 | 0.0000 | 0.0024 | 0.0021 | 0.0009 | 0.02 | 0.00 |
| 5 | 50 | 0.0040 | 0.0160 | 0.0800 | 0.0000 | 0.0000 | 0.0063 | 0.0039 | 0.0016 | 0.03 | 0.01 |
| 6 | 60 | 0.0040 | 0.0160 | 0.0960 | 0.0000 | 0.0000 | 0.0117 | 0.0054 | 0.0022 | 0.04 | 0.02 |
| 7 | 70 | 0.0040 | 0.0160 | 0.1120 | 0.0000 | 0.0000 | 0.0184 | 0.0067 | 0.0027 | 0.05 | 0.03 |
| 8 | 80 | 0.0040 | 0.0160 | 0.1280 | 0.0000 | 0.0000 | 0.0261 | 0.0077 | 0.0031 | 0.06 | 0.04 |
| 9 | 90 | 0.0040 | 0.0160 | 0.1440 | 0.0000 | 0.0000 | 0.0347 | 0.0086 | 0.0034 | 0.06 | 0.05 |
| 10 | 100 | 0.0040 | 0.0160 | 0.1600 | 0.0000 | 0.0000 | 0.0439 | 0.0093 | 0.0037 | 0.07 | 0.06 |
| 11 | 110 | 0.0050 | 0.0200 | 0.1800 | 0.0000 | 0.0000 | 0.0564 | 0.0125 | 0.0050 | 0.09 | 0.07 |
| 12 | 120 | 0.0050 | 0.0200 | 0.2000 | 0.0000 | 0.0000 | 0.0698 | 0.0133 | 0.0053 | 0.10 | 0.08 |
| 13 | 130 | 0.0050 | 0.0200 | 0.2200 | 0.0000 | 0.0000 | 0.0838 | 0.0140 | 0.0056 | 0.11 | 0.09 |
| 14 | 140 | 0.0050 | 0.0200 | 0.2400 | 0.0000 | 0.0000 | 0.0984 | 0.0146 | 0.0059 | 0.11 | 0.10 |
| 15 | 150 | 0.0050 | 0.0200 | 0.2600 | 0.0000 | 0.0000 | 0.1135 | 0.0151 | 0.0061 | 0.11 | 0.11 |
| 16 | 160 | 0.0050 | 0.0200 | 0.2800 | 0.0000 | 0.0000 | 0.1291 | 0.0156 | 0.0062 | 0.12 | 0.11 |
| 17 | 170 | 0.0060 | 0.0240 | 0.3040 | 0.0000 | 0.0000 | 0.1482 | 0.0192 | 0.0077 | 0.14 | 0.12 |
| 18 | 180 | 0.0060 | 0.0240 | 0.3280 | 0.0000 | 0.0000 | 0.1679 | 0.0196 | 0.0079 | 0.15 | 0.13 |
| 19 | 190 | 0.0060 | 0.0240 | 0.3520 | 0.0004 | 0.0004 | 0.1879 | 0.0201 | 0.0083 | 0.16 | 0.14 |
| 20 | 200 | 0.0060 | 0.0240 | 0.3760 | 0.0015 | 0.0011 | 0.2083 | 0.0204 | 0.0088 | 0.17 | 0.15 |
| 21 | 210 | 0.0060 | 0.0240 | 0.4000 | 0.0033 | 0.0017 | 0.2290 | 0.0207 | 0.0094 | 0.17 | 0.16 |
| 22 | 220 | 0.0060 | 0.0240 | 0.4240 | 0.0056 | 0.0024 | 0.2500 | 0.0210 | 0.0098 | 0.18 | 0.17 |
| 23 | 230 | 0.0070 | 0.0280 | 0.4520 | 0.0091 | 0.0035 | 0.2748 | 0.0248 | 0.0120 | 0.23 | 0.19 |
| 24 | 240 | 0.0070 | 0.0280 | 0.4800 | 0.0134 | 0.0043 | 0.2998 | 0.0251 | 0.0126 | 0.24 | 0.21 |
| 25 | 250 | 0.0070 | 0.0280 | 0.5080 | 0.0184 | 0.0050 | 0.3251 | 0.0253 | 0.0131 | 0.25 | 0.22 |
| 26 | 260 | 0.0070 | 0.0280 | 0.5360 | 0.0241 | 0.0057 | 0.3507 | 0.0255 | 0.0137 | 0.26 | 0.24 |
| 27 | 270 | 0.0070 | 0.0280 | 0.5640 | 0.0305 | 0.0064 | 0.3764 | 0.0257 | 0.0141 | 0.26 | 0.25 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | 280 | 0.0070 | 0.0280 | 0.5920 | 0.0375 | 0.0070 | 0.4022 | 0.0259 | 0.0146 | 0.27 | 0.26 |
| 29 | 290 | 0.0082 | 0.0328 | 0.6248 | 0.0465 | 0.0090 | 0.4328 | 0.0305 | 0.0176 | 0.33 | 0.28 |
| 30 | 300 | 0.0082 | 0.0328 | 0.6576 | 0.0562 | 0.0098 | 0.4634 | 0.0307 | 0.0182 | 0.34 | 0.31 |
| 31 | 310 | 0.0082 | 0.0328 | 0.6904 | 0.0668 | 0.0105 | 0.4943 | 0.0309 | 0.0187 | 0.35 | 0.33 |
| 32 | 320 | 0.0082 | 0.0328 | 0.7232 | 0.0781 | 0.0113 | 0.5253 | 0.0310 | 0.0192 | 0.36 | 0.34 |
| 33 | 330 | 0.0082 | 0.0328 | 0.7560 | 0.0900 | 0.0120 | 0.5564 | 0.0311 | 0.0196 | 0.37 | 0.35 |
| 34 | 340 | 0.0082 | 0.0328 | 0.7888 | 0.1026 | 0.0126 | 0.5876 | 0.0312 | 0.0201 | 0.38 | 0.36 |
| 35 | 350 | 0.0095 | 0.0380 | 0.8268 | 0.1180 | 0.0154 | 0.6240 | 0.0363 | 0.0238 | 0.44 | 0.39 |
| 36 | 360 | 0.0095 | 0.0380 | 0.8648 | 0.1342 | 0.0162 | 0.6604 | 0.0364 | 0.0243 | 0.45 | 0.42 |
| 37 | 370 | 0.0095 | 0.0380 | 0.9028 | 0.1511 | 0.0169 | 0.6970 | 0.0366 | 0.0248 | 0.46 | 0.44 |
| 38 | 380 | 0.0095 | 0.0380 | 0.9408 | 0.1687 | 0.0176 | 0.7336 | 0.0367 | 0.0253 | 0.47 | 0.45 |
| 39 | 390 | 0.0095 | 0.0380 | 0.9788 | 0.1871 | 0.0183 | 0.7704 | 0.0367 | 0.0257 | 0.48 | 0.46 |
| 40 | 400 | 0.0095 | 0.0380 | 1.0168 | 0.2060 | 0.0190 | 0.8072 | 0.0368 | 0.0261 | 0.49 | 0.47 |
| 41 | 410 | 0.0134 | 0.0536 | 1.0704 | 0.2338 | 0.0278 | 0.8593 | 0.0521 | 0.0375 | 0.70 | 0.53 |
| 42 | 420 | 0.0134 | 0.0536 | 1.1240 | 0.2627 | 0.0289 | 0.9115 | 0.0522 | 0.0383 | 0.72 | 0.62 |
| 43 | 430 | 0.0134 | 0.0536 | 1.1776 | 0.2927 | 0.0300 | 0.9638 | 0.0523 | 0.0389 | 0.73 | 0.67 |
| 44 | 440 | 0.0180 | 0.0720 | 1.2496 | 0.3346 | 0.0419 | 1.0342 | 0.0704 | 0.0533 | 1.00 | 0.77 |
| 45 | 450 | 0.0180 | 0.0720 | 1.3216 | 0.3781 | 0.0435 | 1.1048 | 0.0706 | 0.0544 | 1.02 | 0.89 |
| 46 | 460 | 0.0340 | 0.1360 | 1.4576 | 0.4643 | 0.0862 | 1.2384 | 0.1336 | 0.1053 | 1.97 | 1.19 |
| 47 | 470 | 0.0540 | 0.2160 | 1.6736 | 0.6106 | 0.1463 | 1.4514 | 0.2130 | 0.1731 | 3.24 | 1.90 |
| 48 | 480 | 0.0270 | 0.1080 | 1.7816 | 0.6874 | 0.0768 | 1.5581 | 0.1067 | 0.0888 | 1.66 | 2.17 |
| 49 | 490 | 0.0180 | 0.0720 | 1.8536 | 0.7398 | 0.0524 | 1.6294 | 0.0712 | 0.0600 | 1.12 | 1.78 |
| 50 | 500 | 0.0134 | 0.0536 | 1.9072 | 0.7794 | 0.0396 | 1.6824 | 0.0531 | 0.0450 | 0.84 | 1.38 |
| 51 | 510 | 0.0134 | 0.0536 | 1.9608 | 0.8194 | 0.0400 | 1.7355 | 0.0531 | 0.0453 | 0.85 | 1.11 |
| 52 | 520 | 0.0134 | 0.0536 | 2.0144 | 0.8599 | 0.0405 | 1.7886 | 0.0531 | 0.0455 | 0.85 | 0.98 |
| 53 | 530 | 0.0088 | 0.0352 | 2.0496 | 0.8867 | 0.0268 | 1.8235 | 0.0349 | 0.0301 | 0.56 | 0.84 |
| 54 | 540 | 0.0088 | 0.0352 | 2.0848 | 0.9137 | 0.0270 | 1.8584 | 0.0349 | 0.0302 | 0.56 | 0.70 |
| 55 | 550 | 0.0088 | 0.0352 | 2.1200 | 0.9409 | 0.0272 | 1.8933 | 0.0349 | 0.0303 | 0.57 | 0.63 |
| 56 | 560 | 0.0088 | 0.0352 | 2.1552 | 0.9682 | 0.0273 | 1.9283 | 0.0349 | 0.0304 | 0.57 | 0.60 |
| 57 | 570 | 0.0088 | 0.0352 | 2.1904 | 0.9957 | 0.0275 | 1.9632 | 0.0349 | 0.0305 | 0.57 | 0.58 |
| 58 | 580 | 0.0088 | 0.0352 | 2.2256 | 1.0233 | 0.0276 | 1.9981 | 0.0349 | 0.0306 | 0.57 | 0.58 |
| 59 | 590 | 0.0088 | 0.0352 | 2.2608 | 1.0511 | 0.0278 | 2.0331 | 0.0349 | 0.0307 | 0.57 | 0.57 |
| 60 | 600 | 0.0088 | 0.0352 | 2.2960 | 1.0790 | 0.0279 | 2.0680 | 0.0350 | 0.0307 | 0.57 | 0.57 |
| 61 | 610 | 0.0088 | 0.0352 | 2.3312 | 1.1071 | 0.0281 | 2.1030 | 0.0350 | 0.0308 | 0.58 | 0.57 |
| 62 | 620 | 0.0088 | 0.0352 | 2.3664 | 1.1353 | 0.0282 | 2.1380 | 0.0350 | 0.0309 | 0.58 | 0.58 |
| 63 | 630 | 0.0088 | 0.0352 | 2.4016 | 1.1636 | 0.0283 | 2.1729 | 0.0350 | 0.0310 | 0.58 | 0.58 |
| 64 | 640 | 0.0088 | 0.0352 | 2.4368 | 1.1921 | 0.0285 | 2.2079 | 0.0350 | 0.0311 | 0.58 | 0.58 |
| 65 | 650 | 0.0072 | 0.0288 | 2.4656 | 1.2154 | 0.0234 | 2.2365 | 0.0286 | 0.0255 | 0.48 | 0.55 |
| 66 | 660 | 0.0072 | 0.0288 | 2.4944 | 1.2389 | 0.0235 | 2.2652 | 0.0286 | 0.0255 | 0.48 | 0.52 |
| 67 | 670 | 0.0072 | 0.0288 | 2.5232 | 1.2624 | 0.0235 | 2.2938 | 0.0286 | 0.0256 | 0.48 | 0.50 |
| 68 | 680 | 0.0072 | 0.0288 | 2.5520 | 1.2861 | 0.0236 | 2.3224 | 0.0286 | 0.0256 | 0.48 | 0.49 |
| 69 | 690 | 0.0072 | 0.0288 | 2.5808 | 1.3098 | 0.0237 | 2.3511 | 0.0286 | 0.0257 | 0.48 | 0.48 |
| 70 | 700 | 0.0072 | 0.0288 | 2.6096 | 1.3335 | 0.0238 | 2.3797 | 0.0286 | 0.0257 | 0.48 | 0.48 |
| 71 | 710 | 0.0072 | 0.0288 | 2.6384 | 1.3574 | 0.0238 | 2.4084 | 0.0286 | 0.0258 | 0.48 | 0.48 |
| 72 | 720 | 0.0072 | 0.0288 | 2.6672 | 1.3813 | 0.0239 | 2.4370 | 0.0286 | 0.0258 | 0.48 | 0.48 |
| 73 | 730 | 0.0072 | 0.0288 | 2.6960 | 1.4053 | 0.0240 | 2.4657 | 0.0287 | 0.0259 | 0.48 | 0.48 |
| 74 | 740 | 0.0072 | 0.0288 | 2.7248 | 1.4294 | 0.0241 | 2.4943 | 0.0287 | 0.0259 | 0.48 | 0.48 |
| 75 | 750 | 0.0072 | 0.0288 | 2.7536 | 1.4535 | 0.0241 | 2.5230 | 0.0287 | 0.0259 | 0.49 | 0.48 |
| 76 | 760 | 0.0072 | 0.0288 | 2.7824 | 1.4777 | 0.0242 | 2.5516 | 0.0287 | 0.0260 | 0.49 | 0.48 |
| 77 | 770 | 0.0057 | 0.0228 | 2.8052 | 1.4969 | 0.0192 | 2.5743 | 0.0227 | 0.0206 | 0.39 | 0.46 |
| 78 | 780 | 0.0057 | 0.0228 | 2.8280 | 1.5161 | 0.0192 | 2.5970 | 0.0227 | 0.0206 | 0.39 | 0.42 |
| 79 | 790 | 0.0057 | 0.0228 | 2.8508 | 1.5354 | 0.0193 | 2.6197 | 0.0227 | 0.0206 | 0.39 | 0.40 |
| 80 | 800 | 0.0057 | 0.0228 | 2.8736 | 1.5547 | 0.0193 | 2.6424 | 0.0227 | 0.0207 | 0.39 | 0.40 |
| 81 | 810 | 0.0057 | 0.0228 | 2.8964 | 1.5741 | 0.0194 | 2.6651 | 0.0227 | 0.0207 | 0.39 | 0.39 |
| 82 | 820 | 0.0057 | 0.0228 | 2.9192 | 1.5935 | 0.0194 | 2.6878 | 0.0227 | 0.0207 | 0.39 | 0.39 |
| 83 | 830 | 0.0057 | 0.0228 | 2.9420 | 1.6129 | 0.0194 | 2.7105 | 0.0227 | 0.0207 | 0.39 | 0.39 |
| 84 | 840 | 0.0057 | 0.0228 | 2.9648 | 1.6324 | 0.0195 | 2.7332 | 0.0227 | 0.0208 | 0.39 | 0.39 |
| 85 | 850 | 0.0057 | 0.0228 | 2.9876 | 1.6519 | 0.0195 | 2.7559 | 0.0227 | 0.0208 | 0.39 | 0.39 |
| 86 | 860 | 0.0057 | 0.0228 | 3.0104 | 1.6714 | 0.0195 | 2.7786 | 0.0227 | 0.0208 | 0.39 | 0.39 |
| 87 | 870 | 0.0057 | 0.0228 | 3.0332 | 1.6910 | 0.0196 | 2.8013 | 0.0227 | 0.0208 | 0.39 | 0.39 |
| 88 | 880 | 0.0057 | 0.0228 | 3.0560 | 1.7106 | 0.0196 | 2.8240 | 0.0227 | 0.0208 | 0.39 | 0.39 |
| 89 | 890 | 0.0050 | 0.0200 | 3.0760 | 1.7278 | 0.0172 | 2.8440 | 0.0199 | 0.0183 | 0.34 | 0.38 |
| 90 | 900 | 0.0050 | 0.0200 | 3.0960 | 1.7450 | 0.0172 | 2.8639 | 0.0199 | 0.0183 | 0.34 | 0.36 |
| 91 | 910 | 0.0050 | 0.0200 | 3.1160 | 1.7623 | 0.0173 | 2.8838 | 0.0199 | 0.0183 | 0.34 | 0.35 |
| 92 | 920 | 0.0050 | 0.0200 | 3.1360 | 1.7796 | 0.0173 | 2.9037 | 0.0199 | 0.0184 | 0.34 | 0.35 |
| 93 | 930 | 0.0050 | 0.0200 | 3.1560 | 1.7969 | 0.0173 | 2.9236 | 0.0199 | 0.0184 | 0.34 | 0.35 |
| 94 | 940 | 0.0050 | 0.0200 | 3.1760 | 1.8143 | 0.0173 | 2.9436 | 0.0199 | 0.0184 | 0.34 | 0.34 |
| 95 | 950 | 0.0050 | 0.0200 | 3.1960 | 1.8316 | 0.0174 | 2.9635 | 0.0199 | 0.0184 | 0.34 | 0.34 |
| 96 | 960 | 0.0050 | 0.0200 | 3.2160 | 1.8490 | 0.0174 | 2.9834 | 0.0199 | 0.0184 | 0.34 | 0.34 |
| 97 | 970 | 0.0050 | 0.0200 | 3.2360 | 1.8664 | 0.0174 | 3.0034 | 0.0199 | 0.0184 | 0.34 | 0.34 |
| 98 | 980 | 0.0050 | 0.0200 | 3.2560 | 1.8839 | 0.0174 | 3.0233 | 0.0199 | 0.0184 | 0.34 | 0.34 |
| 99 | 990 | 0.0050 | 0.0200 | 3.2760 | 1.9013 | 0.0175 | 3.0432 | 0.0199 | 0.0185 | 0.34 | 0.34 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 1000 | 0.0050 | 0.0200 | 3.2960 | 1.9188 | 0.0175 | 3.0631 | 0.0199 | 0.0185 | 0.35 | 0.34 |
| 101 | 1010 | 0.0040 | 0.0160 | 3.3120 | 1.9328 | 0.0140 | 3.0791 | 0.0159 | 0.0148 | 0.28 | 0.33 |
| 102 | 1020 | 0.0040 | 0.0160 | 3.3280 | 1.9468 | 0.0140 | 3.0950 | 0.0159 | 0.0148 | 0.28 | 0.30 |
| 103 | 1030 | 0.0040 | 0.0160 | 3.3440 | 1.9609 | 0.0140 | 3.1110 | 0.0159 | 0.0148 | 0.28 | 0.29 |
| 104 | 1040 | 0.0040 | 0.0160 | 3.3600 | 1.9749 | 0.0140 | 3.1269 | 0.0159 | 0.0148 | 0.28 | 0.28 |
| 105 | 1050 | 0.0040 | 0.0160 | 3.3760 | 1.9890 | 0.0141 | 3.1429 | 0.0159 | 0.0148 | 0.28 | 0.28 |
| 106 | 1060 | 0.0040 | 0.0160 | 3.3920 | 2.0030 | 0.0141 | 3.1588 | 0.0159 | 0.0148 | 0.28 | 0.28 |
| 107 | 1070 | 0.0040 | 0.0160 | 3.4080 | 2.0171 | 0.0141 | 3.1748 | 0.0159 | 0.0148 | 0.28 | 0.28 |
| 108 | 1080 | 0.0040 | 0.0160 | 3.4240 | 2.0312 | 0.0141 | 3.1907 | 0.0159 | 0.0148 | 0.28 | 0.28 |
| 109 | 1090 | 0.0040 | 0.0160 | 3.4400 | 2.0453 | 0.0141 | 3.2067 | 0.0159 | 0.0148 | 0.28 | 0.28 |
| 110 | 1100 | 0.0040 | 0.0160 | 3.4560 | 2.0594 | 0.0141 | 3.2226 | 0.0159 | 0.0149 | 0.28 | 0.28 |
| 111 | 1110 | 0.0040 | 0.0160 | 3.4720 | 2.0736 | 0.0141 | 3.2386 | 0.0159 | 0.0149 | 0.28 | 0.28 |
| 112 | 1120 | 0.0040 | 0.0160 | 3.4880 | 2.0877 | 0.0141 | 3.2545 | 0.0159 | 0.0149 | 0.28 | 0.28 |
| 113 | 1130 | 0.0040 | 0.0160 | 3.5040 | 2.1019 | 0.0142 | 3.2705 | 0.0160 | 0.0149 | 0.28 | 0.28 |
| 114 | 1140 | 0.0040 | 0.0160 | 3.5200 | 2.1161 | 0.0142 | 3.2864 | 0.0160 | 0.0149 | 0.28 | 0.28 |
| 115 | 1150 | 0.0040 | 0.0160 | 3.5360 | 2.1302 | 0.0142 | 3.3024 | 0.0160 | 0.0149 | 0.28 | 0.28 |
| 116 | 1160 | 0.0040 | 0.0160 | 3.5520 | 2.1444 | 0.0142 | 3.3183 | 0.0160 | 0.0149 | 0.28 | 0.28 |
| 117 | 1170 | 0.0040 | 0.0160 | 3.5680 | 2.1586 | 0.0142 | 3.3343 | 0.0160 | 0.0149 | 0.28 | 0.28 |
| 118 | 1180 | 0.0040 | 0.0160 | 3.5840 | 2.1729 | 0.0142 | 3.3502 | 0.0160 | 0.0149 | 0.28 | 0.28 |
| 119 | 1190 | 0.0040 | 0.0160 | 3.6000 | 2.1871 | 0.0142 | 3.3662 | 0.0160 | 0.0149 | 0.28 | 0.28 |
| 120 | 1200 | 0.0040 | 0.0160 | 3.6160 | 2.2013 | 0.0142 | 3.3821 | 0.0160 | 0.0149 | 0.28 | 0.28 |
| 121 | 1210 | 0.0040 | 0.0160 | 3.6320 | 2.2156 | 0.0143 | 3.3981 | 0.0160 | 0.0149 | 0.28 | 0.28 |
| 122 | 1220 | 0.0040 | 0.0160 | 3.6480 | 2.2298 | 0.0143 | 3.4140 | 0.0160 | 0.0149 | 0.28 | 0.28 |
| 123 | 1230 | 0.0040 | 0.0160 | 3.6640 | 2.2441 | 0.0143 | 3.4300 | 0.0160 | 0.0149 | 0.28 | 0.28 |
| 124 | 1240 | 0.0040 | 0.0160 | 3.6800 | 2.2584 | 0.0143 | 3.4459 | 0.0160 | 0.0150 | 0.28 | 0.28 |
| 125 | 1250 | 0.0040 | 0.0160 | 3.6960 | 2.2727 | 0.0143 | 3.4619 | 0.0160 | 0.0150 | 0.28 | 0.28 |
| 126 | 1260 | 0.0040 | 0.0160 | 3.7120 | 2.2870 | 0.0143 | 3.4778 | 0.0160 | 0.0150 | 0.28 | 0.28 |
| 127 | 1270 | 0.0040 | 0.0160 | 3.7280 | 2.3013 | 0.0143 | 3.4938 | 0.0160 | 0.0150 | 0.28 | 0.28 |
| 128 | 1280 | 0.0040 | 0.0160 | 3.7440 | 2.3157 | 0.0143 | 3.5098 | 0.0160 | 0.0150 | 0.28 | 0.28 |
| 129 | 1290 | 0.0040 | 0.0160 | 3.7600 | 2.3300 | 0.0143 | 3.5257 | 0.0160 | 0.0150 | 0.28 | 0.28 |
| 130 | 1300 | 0.0040 | 0.0160 | 3.7760 | 2.3444 | 0.0144 | 3.5417 | 0.0160 | 0.0150 | 0.28 | 0.28 |
| 131 | 1310 | 0.0040 | 0.0160 | 3.7920 | 2.3587 | 0.0144 | 3.5576 | 0.0160 | 0.0150 | 0.28 | 0.28 |
| 132 | 1320 | 0.0040 | 0.0160 | 3.8080 | 2.3731 | 0.0144 | 3.5736 | 0.0160 | 0.0150 | 0.28 | 0.28 |
| 133 | 1330 | 0.0040 | 0.0160 | 3.8240 | 2.3875 | 0.0144 | 3.5895 | 0.0160 | 0.0150 | 0.28 | 0.28 |
| 134 | 1340 | 0.0040 | 0.0160 | 3.8400 | 2.4019 | 0.0144 | 3.6055 | 0.0160 | 0.0150 | 0.28 | 0.28 |
| 135 | 1350 | 0.0040 | 0.0160 | 3.8560 | 2.4163 | 0.0144 | 3.6215 | 0.0160 | 0.0150 | 0.28 | 0.28 |
| 136 | 1360 | 0.0040 | 0.0160 | 3.8720 | 2.4307 | 0.0144 | 3.6374 | 0.0160 | 0.0150 | 0.28 | 0.28 |
| 137 | 1370 | 0.0040 | 0.0160 | 3.8880 | 2.4451 | 0.0144 | 3.6534 | 0.0160 | 0.0150 | 0.28 | 0.28 |
| 138 | 1380 | 0.0040 | 0.0160 | 3.9040 | 2.4595 | 0.0144 | 3.6693 | 0.0160 | 0.0150 | 0.28 | 0.28 |
| 139 | 1390 | 0.0040 | 0.0160 | 3.9200 | 2.4740 | 0.0144 | 3.6853 | 0.0160 | 0.0151 | 0.28 | 0.28 |
| 140 | 1400 | 0.0040 | 0.0160 | 3.9360 | 2.4884 | 0.0145 | 3.7013 | 0.0160 | 0.0151 | 0.28 | 0.28 |
| 141 | 1410 | 0.0040 | 0.0160 | 3.9520 | 2.5029 | 0.0145 | 3.7172 | 0.0160 | 0.0151 | 0.28 | 0.28 |
| 142 | 1420 | 0.0040 | 0.0160 | 3.9680 | 2.5173 | 0.0145 | 3.7332 | 0.0160 | 0.0151 | 0.28 | 0.28 |
| 143 | 1430 | 0.0040 | 0.0160 | 3.9840 | 2.5318 | 0.0145 | 3.7491 | 0.0160 | 0.0151 | 0.28 | 0.28 |
| 144 | 1440 | 0.0040 | 0.0160 | 4.0000 | 2.5463 | 0.0145 | 3.7651 | 0.0160 | 0.0151 | 0.28 | 0.28 |

Total Runoff Volume (cu. ft.)= 33794

Pietrok Engineering And Resources

Project No. 034
Date: 10/24/17
(SBUH)

HYDROLOGIC ANALYSIS USING SCS CURVE NUMBER (CN) AND SANTA BARBARA URBAN HYDROGRAPH (SBUH) METHOD

GIVEN:

| | | | | | |
|---|---|---|---|---|---|
| Project = | 314 Pleasant Avenue Development | | | | |
| Basin # = | sub-basin of Newell Basin | | | | |
| Area = | 5.12 | acres | | | |
| Event = | 25 | -year, 24-hour duration storm event | | | |
| Pt = | 4.00 | inches rainfall | | | |
| Tc = | 15.0 | min. | | | |
| dt = | 10 | min. | | | |
| PERVIOUS Parcel | | | IMPERVIOUS Parcel | | |
| Area = | 3.07 | acres | Area = | 2.05 | acres |
| CN = | 86.00 | | CN = | 98.00 | |
| S = | 1.63 | | S = | 0.20 | |
| 0.2S = | 0.33 | | 0.2S = | 0.04 | |

COMPUTE RUNOFF HYDROGRAPH

Column (3) = SCS Type IA Rainfall Distribution
Column (4) = Column (3) x Pt
Column (5) = Accumulated Sum of Col (4)
Column (6) = [If P <= 0.2S] = 0; Note, use pervious area "S" value
[If P > 0.2S] = (Col (5) - 0.2S)^2/(Col (5) + 0.8S)
Column (7) = Col (6) of present time step - Col (6) of previous time step
Column (8) = Same method as for Col (6), except use impervious "S"
Column (9) = Col (8) of present time step - Col (8) of previous time step
Column (10) = ((pervious area/total area) x Col (7)) + ((impervious area/total area) x Col (9))
Column (11) = (60.5 x Col (10) x total area)/10, where dt = 10 minutes
Routing Constant w = dt/(2Tc + dt) = 0.25
Column (12) = Col (12) of previous time step + (w x [Col (11) of previous time step
+ Col (11) of present time step - (2 x Col (12) of previous time step)])

| | | | | | Pervious Area | | Impervious Area | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Time Increment | (2) Time | (3) Rainfall distribution | (4) Incremental Rainfall | (5) Accumulated Rainfall | (6) Accumulated Runoff | (7) Incremental Runoff | (8) Accumulated Runoff | (9) Incremental Runoff | (10) Total Runoff | (11) Instant Hydrograph | (12) Design Hydrograph |
| | min. | % of Pt | in. | in. | in. | in. | in. | in. | in. | cfs | cfs |
| 1 | 10 | 0.0040 | 0.0160 | 0.0160 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.00 | 0.00 |
| 2 | 20 | 0.0040 | 0.0160 | 0.0320 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.00 | 0.00 |
| 3 | 30 | 0.0040 | 0.0160 | 0.0480 | 0.0000 | 0.0000 | 0.0002 | 0.0002 | 0.0001 | 0.00 | 0.00 |
| 4 | 40 | 0.0040 | 0.0160 | 0.0640 | 0.0000 | 0.0000 | 0.0024 | 0.0021 | 0.0008 | 0.03 | 0.01 |
| 5 | 50 | 0.0040 | 0.0160 | 0.0800 | 0.0000 | 0.0000 | 0.0063 | 0.0039 | 0.0016 | 0.05 | 0.02 |
| 6 | 60 | 0.0040 | 0.0160 | 0.0960 | 0.0000 | 0.0000 | 0.0117 | 0.0054 | 0.0022 | 0.07 | 0.04 |
| 7 | 70 | 0.0040 | 0.0160 | 0.1120 | 0.0000 | 0.0000 | 0.0184 | 0.0067 | 0.0027 | 0.08 | 0.06 |
| 8 | 80 | 0.0040 | 0.0160 | 0.1280 | 0.0000 | 0.0000 | 0.0261 | 0.0077 | 0.0031 | 0.10 | 0.07 |
| 9 | 90 | 0.0040 | 0.0160 | 0.1440 | 0.0000 | 0.0000 | 0.0347 | 0.0086 | 0.0034 | 0.11 | 0.09 |
| 10 | 100 | 0.0040 | 0.0160 | 0.1600 | 0.0000 | 0.0000 | 0.0439 | 0.0093 | 0.0037 | 0.12 | 0.10 |
| 11 | 110 | 0.0050 | 0.0200 | 0.1800 | 0.0000 | 0.0000 | 0.0564 | 0.0125 | 0.0050 | 0.15 | 0.12 |
| 12 | 120 | 0.0050 | 0.0200 | 0.2000 | 0.0000 | 0.0000 | 0.0698 | 0.0133 | 0.0053 | 0.17 | 0.14 |
| 13 | 130 | 0.0050 | 0.0200 | 0.2200 | 0.0000 | 0.0000 | 0.0838 | 0.0140 | 0.0056 | 0.17 | 0.15 |
| 14 | 140 | 0.0050 | 0.0200 | 0.2400 | 0.0000 | 0.0000 | 0.0984 | 0.0146 | 0.0058 | 0.18 | 0.17 |
| 15 | 150 | 0.0050 | 0.0200 | 0.2600 | 0.0000 | 0.0000 | 0.1135 | 0.0151 | 0.0061 | 0.19 | 0.18 |
| 16 | 160 | 0.0050 | 0.0200 | 0.2800 | 0.0000 | 0.0000 | 0.1291 | 0.0156 | 0.0062 | 0.19 | 0.18 |
| 17 | 170 | 0.0060 | 0.0240 | 0.3040 | 0.0000 | 0.0000 | 0.1482 | 0.0192 | 0.0077 | 0.24 | 0.20 |
| 18 | 180 | 0.0060 | 0.0240 | 0.3280 | 0.0000 | 0.0000 | 0.1679 | 0.0196 | 0.0079 | 0.24 | 0.22 |
| 19 | 190 | 0.0060 | 0.0240 | 0.3520 | 0.0004 | 0.0004 | 0.1879 | 0.0201 | 0.0083 | 0.26 | 0.23 |
| 20 | 200 | 0.0060 | 0.0240 | 0.3760 | 0.0015 | 0.0011 | 0.2083 | 0.0204 | 0.0088 | 0.27 | 0.25 |
| 21 | 210 | 0.0060 | 0.0240 | 0.4000 | 0.0033 | 0.0017 | 0.2290 | 0.0207 | 0.0093 | 0.29 | 0.27 |
| 22 | 220 | 0.0060 | 0.0240 | 0.4240 | 0.0056 | 0.0024 | 0.2500 | 0.0210 | 0.0098 | 0.30 | 0.28 |
| 23 | 230 | 0.0070 | 0.0280 | 0.4520 | 0.0091 | 0.0035 | 0.2748 | 0.0248 | 0.0120 | 0.37 | 0.31 |
| 24 | 240 | 0.0070 | 0.0280 | 0.4800 | 0.0134 | 0.0043 | 0.2998 | 0.0251 | 0.0126 | 0.39 | 0.35 |
| 25 | 250 | 0.0070 | 0.0280 | 0.5080 | 0.0184 | 0.0050 | 0.3251 | 0.0253 | 0.0131 | 0.41 | 0.37 |
| 26 | 260 | 0.0070 | 0.0280 | 0.5360 | 0.0241 | 0.0057 | 0.3507 | 0.0255 | 0.0136 | 0.42 | 0.39 |
| 27 | 270 | 0.0070 | 0.0280 | 0.5640 | 0.0305 | 0.0064 | 0.3764 | 0.0257 | 0.0141 | 0.44 | 0.41 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | 280 | 0.0070 | 0.0280 | 0.5920 | 0.0375 | 0.0070 | 0.4022 | 0.0259 | 0.0146 | 0.45 | 0.43 |
| 29 | 290 | 0.0082 | 0.0328 | 0.6248 | 0.0465 | 0.0090 | 0.4328 | 0.0305 | 0.0176 | 0.55 | 0.46 |
| 30 | 300 | 0.0082 | 0.0328 | 0.6576 | 0.0562 | 0.0098 | 0.4634 | 0.0307 | 0.0182 | 0.56 | 0.51 |
| 31 | 310 | 0.0082 | 0.0328 | 0.6904 | 0.0668 | 0.0105 | 0.4943 | 0.0309 | 0.0187 | 0.58 | 0.54 |
| 32 | 320 | 0.0082 | 0.0328 | 0.7232 | 0.0781 | 0.0113 | 0.5253 | 0.0310 | 0.0192 | 0.59 | 0.56 |
| 33 | 330 | 0.0082 | 0.0328 | 0.7560 | 0.0900 | 0.0120 | 0.5564 | 0.0311 | 0.0196 | 0.61 | 0.58 |
| 34 | 340 | 0.0082 | 0.0328 | 0.7888 | 0.1026 | 0.0126 | 0.5876 | 0.0312 | 0.0201 | 0.62 | 0.60 |
| 35 | 350 | 0.0095 | 0.0380 | 0.8268 | 0.1180 | 0.0154 | 0.6240 | 0.0363 | 0.0238 | 0.74 | 0.64 |
| 36 | 360 | 0.0095 | 0.0380 | 0.8648 | 0.1342 | 0.0162 | 0.6604 | 0.0364 | 0.0243 | 0.75 | 0.69 |
| 37 | 370 | 0.0095 | 0.0380 | 0.9028 | 0.1511 | 0.0169 | 0.6970 | 0.0366 | 0.0248 | 0.77 | 0.73 |
| 38 | 380 | 0.0095 | 0.0380 | 0.9408 | 0.1687 | 0.0176 | 0.7336 | 0.0367 | 0.0253 | 0.78 | 0.75 |
| 39 | 390 | 0.0095 | 0.0380 | 0.9788 | 0.1871 | 0.0183 | 0.7704 | 0.0367 | 0.0257 | 0.80 | 0.77 |
| 40 | 400 | 0.0095 | 0.0380 | 1.0168 | 0.2060 | 0.0190 | 0.8072 | 0.0368 | 0.0261 | 0.81 | 0.79 |
| 41 | 410 | 0.0134 | 0.0536 | 1.0704 | 0.2338 | 0.0278 | 0.8593 | 0.0521 | 0.0375 | 1.16 | 0.89 |
| 42 | 420 | 0.0134 | 0.0536 | 1.1240 | 0.2627 | 0.0289 | 0.9115 | 0.0522 | 0.0382 | 1.18 | 1.03 |
| 43 | 430 | 0.0134 | 0.0536 | 1.1776 | 0.2927 | 0.0300 | 0.9638 | 0.0523 | 0.0389 | 1.21 | 1.11 |
| 44 | 440 | 0.0180 | 0.0720 | 1.2496 | 0.3346 | 0.0419 | 1.0342 | 0.0704 | 0.0533 | 1.65 | 1.27 |
| 45 | 450 | 0.0180 | 0.0720 | 1.3216 | 0.3781 | 0.0435 | 1.1048 | 0.0706 | 0.0543 | 1.68 | 1.47 |
| 46 | 460 | 0.0340 | 0.1360 | 1.4576 | 0.4643 | 0.0862 | 1.2384 | 0.1336 | 0.1052 | 3.26 | 1.97 |
| 47 | 470 | 0.0540 | 0.2160 | 1.6736 | 0.6106 | 0.1463 | 1.4514 | 0.2130 | 0.1730 | 5.36 | 3.14 |
| 48 | 480 | 0.0270 | 0.1080 | 1.7816 | 0.6874 | 0.0768 | 1.5581 | 0.1067 | 0.0888 | 2.75 | 3.60 |
| 49 | 490 | 0.0180 | 0.0720 | 1.8536 | 0.7398 | 0.0524 | 1.6294 | 0.0712 | 0.0599 | 1.86 | 2.95 |
| 50 | 500 | 0.0134 | 0.0536 | 1.9072 | 0.7794 | 0.0396 | 1.6824 | 0.0531 | 0.0450 | 1.39 | 2.29 |
| 51 | 510 | 0.0134 | 0.0536 | 1.9608 | 0.8194 | 0.0400 | 1.7355 | 0.0531 | 0.0453 | 1.40 | 1.84 |
| 52 | 520 | 0.0134 | 0.0536 | 2.0144 | 0.8599 | 0.0405 | 1.7886 | 0.0531 | 0.0455 | 1.41 | 1.62 |
| 53 | 530 | 0.0088 | 0.0352 | 2.0496 | 0.8867 | 0.0268 | 1.8235 | 0.0349 | 0.0300 | 0.93 | 1.40 |
| 54 | 540 | 0.0088 | 0.0352 | 2.0848 | 0.9137 | 0.0270 | 1.8584 | 0.0349 | 0.0302 | 0.93 | 1.16 |
| 55 | 550 | 0.0088 | 0.0352 | 2.1200 | 0.9409 | 0.0272 | 1.8933 | 0.0349 | 0.0303 | 0.94 | 1.05 |
| 56 | 560 | 0.0088 | 0.0352 | 2.1552 | 0.9682 | 0.0273 | 1.9283 | 0.0349 | 0.0304 | 0.94 | 0.99 |
| 57 | 570 | 0.0088 | 0.0352 | 2.1904 | 0.9957 | 0.0275 | 1.9632 | 0.0349 | 0.0305 | 0.94 | 0.97 |
| 58 | 580 | 0.0088 | 0.0352 | 2.2256 | 1.0233 | 0.0276 | 1.9981 | 0.0349 | 0.0306 | 0.95 | 0.96 |
| 59 | 590 | 0.0088 | 0.0352 | 2.2608 | 1.0511 | 0.0278 | 2.0331 | 0.0349 | 0.0306 | 0.95 | 0.95 |
| 60 | 600 | 0.0088 | 0.0352 | 2.2960 | 1.0790 | 0.0279 | 2.0680 | 0.0350 | 0.0307 | 0.95 | 0.95 |
| 61 | 610 | 0.0088 | 0.0352 | 2.3312 | 1.1071 | 0.0281 | 2.1030 | 0.0350 | 0.0308 | 0.95 | 0.95 |
| 62 | 620 | 0.0088 | 0.0352 | 2.3664 | 1.1353 | 0.0282 | 2.1380 | 0.0350 | 0.0309 | 0.96 | 0.95 |
| 63 | 630 | 0.0088 | 0.0352 | 2.4016 | 1.1636 | 0.0283 | 2.1729 | 0.0350 | 0.0310 | 0.96 | 0.96 |
| 64 | 640 | 0.0088 | 0.0352 | 2.4368 | 1.1921 | 0.0285 | 2.2079 | 0.0350 | 0.0311 | 0.96 | 0.96 |
| 65 | 650 | 0.0072 | 0.0288 | 2.4656 | 1.2154 | 0.0234 | 2.2365 | 0.0286 | 0.0255 | 0.79 | 0.92 |
| 66 | 660 | 0.0072 | 0.0288 | 2.4944 | 1.2389 | 0.0235 | 2.2652 | 0.0286 | 0.0255 | 0.79 | 0.85 |
| 67 | 670 | 0.0072 | 0.0288 | 2.5232 | 1.2624 | 0.0235 | 2.2938 | 0.0286 | 0.0256 | 0.79 | 0.82 |
| 68 | 680 | 0.0072 | 0.0288 | 2.5520 | 1.2861 | 0.0236 | 2.3224 | 0.0286 | 0.0256 | 0.79 | 0.81 |
| 69 | 690 | 0.0072 | 0.0288 | 2.5808 | 1.3098 | 0.0237 | 2.3511 | 0.0286 | 0.0257 | 0.80 | 0.80 |
| 70 | 700 | 0.0072 | 0.0288 | 2.6096 | 1.3335 | 0.0238 | 2.3797 | 0.0286 | 0.0257 | 0.80 | 0.80 |
| 71 | 710 | 0.0072 | 0.0288 | 2.6384 | 1.3574 | 0.0238 | 2.4084 | 0.0286 | 0.0258 | 0.80 | 0.80 |
| 72 | 720 | 0.0072 | 0.0288 | 2.6672 | 1.3813 | 0.0239 | 2.4370 | 0.0286 | 0.0258 | 0.80 | 0.80 |
| 73 | 730 | 0.0072 | 0.0288 | 2.6960 | 1.4053 | 0.0240 | 2.4657 | 0.0287 | 0.0259 | 0.80 | 0.80 |
| 74 | 740 | 0.0072 | 0.0288 | 2.7248 | 1.4294 | 0.0241 | 2.4943 | 0.0287 | 0.0259 | 0.80 | 0.80 |
| 75 | 750 | 0.0072 | 0.0288 | 2.7536 | 1.4535 | 0.0241 | 2.5230 | 0.0287 | 0.0259 | 0.80 | 0.80 |
| 76 | 760 | 0.0072 | 0.0288 | 2.7824 | 1.4777 | 0.0242 | 2.5516 | 0.0287 | 0.0260 | 0.80 | 0.80 |
| 77 | 770 | 0.0057 | 0.0228 | 2.8052 | 1.4969 | 0.0192 | 2.5743 | 0.0227 | 0.0206 | 0.64 | 0.76 |
| 78 | 780 | 0.0057 | 0.0228 | 2.8280 | 1.5161 | 0.0192 | 2.5970 | 0.0227 | 0.0206 | 0.64 | 0.70 |
| 79 | 790 | 0.0057 | 0.0228 | 2.8508 | 1.5354 | 0.0193 | 2.6197 | 0.0227 | 0.0206 | 0.64 | 0.67 |
| 80 | 800 | 0.0057 | 0.0228 | 2.8736 | 1.5547 | 0.0193 | 2.6424 | 0.0227 | 0.0207 | 0.64 | 0.65 |
| 81 | 810 | 0.0057 | 0.0228 | 2.8964 | 1.5741 | 0.0194 | 2.6651 | 0.0227 | 0.0207 | 0.64 | 0.65 |
| 82 | 820 | 0.0057 | 0.0228 | 2.9192 | 1.5935 | 0.0194 | 2.6878 | 0.0227 | 0.0207 | 0.64 | 0.64 |
| 83 | 830 | 0.0057 | 0.0228 | 2.9420 | 1.6129 | 0.0194 | 2.7105 | 0.0227 | 0.0207 | 0.64 | 0.64 |
| 84 | 840 | 0.0057 | 0.0228 | 2.9648 | 1.6324 | 0.0195 | 2.7332 | 0.0227 | 0.0208 | 0.64 | 0.64 |
| 85 | 850 | 0.0057 | 0.0228 | 2.9876 | 1.6519 | 0.0195 | 2.7559 | 0.0227 | 0.0208 | 0.64 | 0.64 |
| 86 | 860 | 0.0057 | 0.0228 | 3.0104 | 1.6714 | 0.0195 | 2.7786 | 0.0227 | 0.0208 | 0.64 | 0.64 |
| 87 | 870 | 0.0057 | 0.0228 | 3.0332 | 1.6910 | 0.0196 | 2.8013 | 0.0227 | 0.0208 | 0.65 | 0.64 |
| 88 | 880 | 0.0057 | 0.0228 | 3.0560 | 1.7106 | 0.0196 | 2.8240 | 0.0227 | 0.0208 | 0.65 | 0.64 |
| 89 | 890 | 0.0050 | 0.0200 | 3.0760 | 1.7278 | 0.0172 | 2.8440 | 0.0199 | 0.0183 | 0.57 | 0.63 |
| 90 | 900 | 0.0050 | 0.0200 | 3.0960 | 1.7450 | 0.0172 | 2.8639 | 0.0199 | 0.0183 | 0.57 | 0.60 |
| 91 | 910 | 0.0050 | 0.0200 | 3.1160 | 1.7623 | 0.0173 | 2.8838 | 0.0199 | 0.0183 | 0.57 | 0.58 |
| 92 | 920 | 0.0050 | 0.0200 | 3.1360 | 1.7796 | 0.0173 | 2.9037 | 0.0199 | 0.0183 | 0.57 | 0.58 |
| 93 | 930 | 0.0050 | 0.0200 | 3.1560 | 1.7969 | 0.0173 | 2.9236 | 0.0199 | 0.0184 | 0.57 | 0.57 |
| 94 | 940 | 0.0050 | 0.0200 | 3.1760 | 1.8143 | 0.0173 | 2.9436 | 0.0199 | 0.0184 | 0.57 | 0.57 |
| 95 | 950 | 0.0050 | 0.0200 | 3.1960 | 1.8316 | 0.0174 | 2.9635 | 0.0199 | 0.0184 | 0.57 | 0.57 |
| 96 | 960 | 0.0050 | 0.0200 | 3.2160 | 1.8490 | 0.0174 | 2.9834 | 0.0199 | 0.0184 | 0.57 | 0.57 |
| 97 | 970 | 0.0050 | 0.0200 | 3.2360 | 1.8664 | 0.0174 | 3.0034 | 0.0199 | 0.0184 | 0.57 | 0.57 |
| 98 | 980 | 0.0050 | 0.0200 | 3.2560 | 1.8839 | 0.0174 | 3.0233 | 0.0199 | 0.0184 | 0.57 | 0.57 |
| 99 | 990 | 0.0050 | 0.0200 | 3.2760 | 1.9013 | 0.0175 | 3.0432 | 0.0199 | 0.0184 | 0.57 | 0.57 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 1000 | 0.0050 | 0.0200 | 3.2960 | 1.9188 | 0.0175 | 3.0631 | 0.0199 | 0.0185 | 0.57 | 0.57 |
| 101 | 1010 | 0.0040 | 0.0160 | 3.3120 | 1.9328 | 0.0140 | 3.0791 | 0.0159 | 0.0148 | 0.46 | 0.54 |
| 102 | 1020 | 0.0040 | 0.0160 | 3.3280 | 1.9468 | 0.0140 | 3.0950 | 0.0159 | 0.0148 | 0.46 | 0.50 |
| 103 | 1030 | 0.0040 | 0.0160 | 3.3440 | 1.9609 | 0.0140 | 3.1110 | 0.0159 | 0.0148 | 0.46 | 0.48 |
| 104 | 1040 | 0.0040 | 0.0160 | 3.3600 | 1.9749 | 0.0140 | 3.1269 | 0.0159 | 0.0148 | 0.46 | 0.47 |
| 105 | 1050 | 0.0040 | 0.0160 | 3.3760 | 1.9890 | 0.0141 | 3.1429 | 0.0159 | 0.0148 | 0.46 | 0.46 |
| 106 | 1060 | 0.0040 | 0.0160 | 3.3920 | 2.0030 | 0.0141 | 3.1588 | 0.0159 | 0.0148 | 0.46 | 0.46 |
| 107 | 1070 | 0.0040 | 0.0160 | 3.4080 | 2.0171 | 0.0141 | 3.1748 | 0.0159 | 0.0148 | 0.46 | 0.46 |
| 108 | 1080 | 0.0040 | 0.0160 | 3.4240 | 2.0312 | 0.0141 | 3.1907 | 0.0159 | 0.0148 | 0.46 | 0.46 |
| 109 | 1090 | 0.0040 | 0.0160 | 3.4400 | 2.0453 | 0.0141 | 3.2067 | 0.0159 | 0.0148 | 0.46 | 0.46 |
| 110 | 1100 | 0.0040 | 0.0160 | 3.4560 | 2.0594 | 0.0141 | 3.2226 | 0.0159 | 0.0149 | 0.46 | 0.46 |
| 111 | 1110 | 0.0040 | 0.0160 | 3.4720 | 2.0736 | 0.0141 | 3.2386 | 0.0159 | 0.0149 | 0.46 | 0.46 |
| 112 | 1120 | 0.0040 | 0.0160 | 3.4880 | 2.0877 | 0.0141 | 3.2545 | 0.0159 | 0.0149 | 0.46 | 0.46 |
| 113 | 1130 | 0.0040 | 0.0160 | 3.5040 | 2.1019 | 0.0142 | 3.2705 | 0.0160 | 0.0149 | 0.46 | 0.46 |
| 114 | 1140 | 0.0040 | 0.0160 | 3.5200 | 2.1161 | 0.0142 | 3.2864 | 0.0160 | 0.0149 | 0.46 | 0.46 |
| 115 | 1150 | 0.0040 | 0.0160 | 3.5360 | 2.1302 | 0.0142 | 3.3024 | 0.0160 | 0.0149 | 0.46 | 0.46 |
| 116 | 1160 | 0.0040 | 0.0160 | 3.5520 | 2.1444 | 0.0142 | 3.3183 | 0.0160 | 0.0149 | 0.46 | 0.46 |
| 117 | 1170 | 0.0040 | 0.0160 | 3.5680 | 2.1586 | 0.0142 | 3.3343 | 0.0160 | 0.0149 | 0.46 | 0.46 |
| 118 | 1180 | 0.0040 | 0.0160 | 3.5840 | 2.1729 | 0.0142 | 3.3502 | 0.0160 | 0.0149 | 0.46 | 0.46 |
| 119 | 1190 | 0.0040 | 0.0160 | 3.6000 | 2.1871 | 0.0142 | 3.3662 | 0.0160 | 0.0149 | 0.46 | 0.46 |
| 120 | 1200 | 0.0040 | 0.0160 | 3.6160 | 2.2013 | 0.0142 | 3.3821 | 0.0160 | 0.0149 | 0.46 | 0.46 |
| 121 | 1210 | 0.0040 | 0.0160 | 3.6320 | 2.2156 | 0.0143 | 3.3981 | 0.0160 | 0.0149 | 0.46 | 0.46 |
| 122 | 1220 | 0.0040 | 0.0160 | 3.6480 | 2.2298 | 0.0143 | 3.4140 | 0.0160 | 0.0149 | 0.46 | 0.46 |
| 123 | 1230 | 0.0040 | 0.0160 | 3.6640 | 2.2441 | 0.0143 | 3.4300 | 0.0160 | 0.0149 | 0.46 | 0.46 |
| 124 | 1240 | 0.0040 | 0.0160 | 3.6800 | 2.2584 | 0.0143 | 3.4459 | 0.0160 | 0.0150 | 0.46 | 0.46 |
| 125 | 1250 | 0.0040 | 0.0160 | 3.6960 | 2.2727 | 0.0143 | 3.4619 | 0.0160 | 0.0150 | 0.46 | 0.46 |
| 126 | 1260 | 0.0040 | 0.0160 | 3.7120 | 2.2870 | 0.0143 | 3.4778 | 0.0160 | 0.0150 | 0.46 | 0.46 |
| 127 | 1270 | 0.0040 | 0.0160 | 3.7280 | 2.3013 | 0.0143 | 3.4938 | 0.0160 | 0.0150 | 0.46 | 0.46 |
| 128 | 1280 | 0.0040 | 0.0160 | 3.7440 | 2.3157 | 0.0143 | 3.5098 | 0.0160 | 0.0150 | 0.46 | 0.46 |
| 129 | 1290 | 0.0040 | 0.0160 | 3.7600 | 2.3300 | 0.0143 | 3.5257 | 0.0160 | 0.0150 | 0.46 | 0.46 |
| 130 | 1300 | 0.0040 | 0.0160 | 3.7760 | 2.3444 | 0.0144 | 3.5417 | 0.0160 | 0.0150 | 0.46 | 0.46 |
| 131 | 1310 | 0.0040 | 0.0160 | 3.7920 | 2.3587 | 0.0144 | 3.5576 | 0.0160 | 0.0150 | 0.46 | 0.46 |
| 132 | 1320 | 0.0040 | 0.0160 | 3.8080 | 2.3731 | 0.0144 | 3.5736 | 0.0160 | 0.0150 | 0.46 | 0.46 |
| 133 | 1330 | 0.0040 | 0.0160 | 3.8240 | 2.3875 | 0.0144 | 3.5895 | 0.0160 | 0.0150 | 0.47 | 0.46 |
| 134 | 1340 | 0.0040 | 0.0160 | 3.8400 | 2.4019 | 0.0144 | 3.6055 | 0.0160 | 0.0150 | 0.47 | 0.46 |
| 135 | 1350 | 0.0040 | 0.0160 | 3.8560 | 2.4163 | 0.0144 | 3.6215 | 0.0160 | 0.0150 | 0.47 | 0.47 |
| 136 | 1360 | 0.0040 | 0.0160 | 3.8720 | 2.4307 | 0.0144 | 3.6374 | 0.0160 | 0.0150 | 0.47 | 0.47 |
| 137 | 1370 | 0.0040 | 0.0160 | 3.8880 | 2.4451 | 0.0144 | 3.6534 | 0.0160 | 0.0150 | 0.47 | 0.47 |
| 138 | 1380 | 0.0040 | 0.0160 | 3.9040 | 2.4595 | 0.0144 | 3.6693 | 0.0160 | 0.0150 | 0.47 | 0.47 |
| 139 | 1390 | 0.0040 | 0.0160 | 3.9200 | 2.4740 | 0.0144 | 3.6853 | 0.0160 | 0.0150 | 0.47 | 0.47 |
| 140 | 1400 | 0.0040 | 0.0160 | 3.9360 | 2.4884 | 0.0145 | 3.7013 | 0.0160 | 0.0151 | 0.47 | 0.47 |
| 141 | 1410 | 0.0040 | 0.0160 | 3.9520 | 2.5029 | 0.0145 | 3.7172 | 0.0160 | 0.0151 | 0.47 | 0.47 |
| 142 | 1420 | 0.0040 | 0.0160 | 3.9680 | 2.5173 | 0.0145 | 3.7332 | 0.0160 | 0.0151 | 0.47 | 0.47 |
| 143 | 1430 | 0.0040 | 0.0160 | 3.9840 | 2.5318 | 0.0145 | 3.7491 | 0.0160 | 0.0151 | 0.47 | 0.47 |
| 144 | 1440 | 0.0040 | 0.0160 | 4.0000 | 2.5463 | 0.0145 | 3.7651 | 0.0160 | 0.0151 | 0.47 | 0.47 |

Total Runoff Volume (cu. ft.)= 55974

Pietrok Engineering And Resources

Project No. 034
Date: 10/24/17
(SBUH)

HYDROLOGIC ANALYSIS USING SCS CURVE NUMBER (CN) AND SANTA BARBARA URBAN HYDROGRAPH (SBUH) METHOD

GIVEN:

| | | | | | |
|---|---|---|---|---|---|
| Project = | 314 Pleasant Avenue Development | | | | |
| Basin # = | sub-basin of Newell Basin | | | | |
| Area = | 7.21 | acres | | | |
| Event = | 25 | -year, 24-hour duration storm event | | | |
| Pt = | 4.00 | inches rainfall | | | |
| Tc = | 15.0 | min. | | | |
| dt = | 10 | min. | | | |
| PERVIOUS Parcel | | | IMPERVIOUS Parcel | | |
| Area = | 4.33 | acres | Area = | 2.88 | acres |
| CN = | 86.00 | | CN = | 98.00 | |
| S = | 1.63 | | S = | 0.20 | |
| 0.2S = | 0.33 | | 0.2S = | 0.04 | |

COMPUTE RUNOFF HYDROGRAPH

Column (3) = SCS Type IA Rainfall Distribution
Column (4) = Column (3) x Pt
Column (5) = Accumulated Sum of Col (4)
Column (6) = [If P <= 0.2S] = 0; Note, use pervious area "S" value
[If P > 0.2S] = (Col (5) - 0.2S)^2/(Col (5) + 0.8S)
Column (7) = Col (6) of present time step - Col (6) of previous time step
Column (8) = Same method as for Col (6), except use impervious "S"
Column (9) = Col (8) of present time step - Col (8) of previous time step
Column (10) = ((pervious area/total area) x Col (7)) + ((impervious area/total area) x Col (9))
Column (11) = (60.5 x Col (10) x total area)/10, where dt = 10 minutes
Routing Constant w = dt/(2Tc + dt) = 0.25
Column (12) = Col (12) of previous time step + (w x [Col (11) of previous time step
+ Col (11) of present time step - (2 x Col (12) of previous time step)])

| | | | | | Pervious Area | | Impervious Area | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) Time Increment | (2) Time | (3) Rainfall distribution | (4) Incremental Rainfall | (5) Accumulated Rainfall | (6) Accumulated Runoff | (7) Incremental Runoff | (8) Accumulated Runoff | (9) Incremental Runoff | (10) Total Runoff | (11) Instant Hydrograph | (12) Design Hydrograph |
| | min. | % of Pt | in. | in. | in. | in. | in. | in. | in. | cfs | cfs |
| 1 | 10 | 0.0040 | 0.0160 | 0.0160 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.00 | 0.00 |
| 2 | 20 | 0.0040 | 0.0160 | 0.0320 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.00 | 0.00 |
| 3 | 30 | 0.0040 | 0.0160 | 0.0480 | 0.0000 | 0.0000 | 0.0002 | 0.0002 | 0.0001 | 0.00 | 0.00 |
| 4 | 40 | 0.0040 | 0.0160 | 0.0640 | 0.0000 | 0.0000 | 0.0024 | 0.0021 | 0.0008 | 0.04 | 0.01 |
| 5 | 50 | 0.0040 | 0.0160 | 0.0800 | 0.0000 | 0.0000 | 0.0063 | 0.0039 | 0.0016 | 0.07 | 0.03 |
| 6 | 60 | 0.0040 | 0.0160 | 0.0960 | 0.0000 | 0.0000 | 0.0117 | 0.0054 | 0.0022 | 0.09 | 0.06 |
| 7 | 70 | 0.0040 | 0.0160 | 0.1120 | 0.0000 | 0.0000 | 0.0184 | 0.0067 | 0.0027 | 0.12 | 0.08 |
| 8 | 80 | 0.0040 | 0.0160 | 0.1280 | 0.0000 | 0.0000 | 0.0261 | 0.0077 | 0.0031 | 0.13 | 0.10 |
| 9 | 90 | 0.0040 | 0.0160 | 0.1440 | 0.0000 | 0.0000 | 0.0347 | 0.0086 | 0.0034 | 0.15 | 0.12 |
| 10 | 100 | 0.0040 | 0.0160 | 0.1600 | 0.0000 | 0.0000 | 0.0439 | 0.0093 | 0.0037 | 0.16 | 0.14 |
| 11 | 110 | 0.0050 | 0.0200 | 0.1800 | 0.0000 | 0.0000 | 0.0564 | 0.0125 | 0.0050 | 0.22 | 0.16 |
| 12 | 120 | 0.0050 | 0.0200 | 0.2000 | 0.0000 | 0.0000 | 0.0698 | 0.0133 | 0.0053 | 0.23 | 0.19 |
| 13 | 130 | 0.0050 | 0.0200 | 0.2200 | 0.0000 | 0.0000 | 0.0838 | 0.0140 | 0.0056 | 0.24 | 0.22 |
| 14 | 140 | 0.0050 | 0.0200 | 0.2400 | 0.0000 | 0.0000 | 0.0984 | 0.0146 | 0.0058 | 0.25 | 0.23 |
| 15 | 150 | 0.0050 | 0.0200 | 0.2600 | 0.0000 | 0.0000 | 0.1135 | 0.0151 | 0.0060 | 0.26 | 0.25 |
| 16 | 160 | 0.0050 | 0.0200 | 0.2800 | 0.0000 | 0.0000 | 0.1291 | 0.0156 | 0.0062 | 0.27 | 0.26 |
| 17 | 170 | 0.0060 | 0.0240 | 0.3040 | 0.0000 | 0.0000 | 0.1482 | 0.0192 | 0.0077 | 0.33 | 0.28 |
| 18 | 180 | 0.0060 | 0.0240 | 0.3280 | 0.0000 | 0.0000 | 0.1679 | 0.0196 | 0.0078 | 0.34 | 0.31 |
| 19 | 190 | 0.0060 | 0.0240 | 0.3520 | 0.0004 | 0.0004 | 0.1879 | 0.0201 | 0.0083 | 0.36 | 0.33 |
| 20 | 200 | 0.0060 | 0.0240 | 0.3760 | 0.0015 | 0.0011 | 0.2083 | 0.0204 | 0.0088 | 0.38 | 0.35 |
| 21 | 210 | 0.0060 | 0.0240 | 0.4000 | 0.0033 | 0.0017 | 0.2290 | 0.0207 | 0.0093 | 0.41 | 0.37 |
| 22 | 220 | 0.0060 | 0.0240 | 0.4240 | 0.0056 | 0.0024 | 0.2500 | 0.0210 | 0.0098 | 0.43 | 0.40 |
| 23 | 230 | 0.0070 | 0.0280 | 0.4520 | 0.0091 | 0.0035 | 0.2748 | 0.0248 | 0.0120 | 0.52 | 0.44 |
| 24 | 240 | 0.0070 | 0.0280 | 0.4800 | 0.0134 | 0.0043 | 0.2998 | 0.0251 | 0.0126 | 0.55 | 0.49 |
| 25 | 250 | 0.0070 | 0.0280 | 0.5080 | 0.0184 | 0.0050 | 0.3251 | 0.0253 | 0.0131 | 0.57 | 0.52 |
| 26 | 260 | 0.0070 | 0.0280 | 0.5360 | 0.0241 | 0.0057 | 0.3507 | 0.0255 | 0.0136 | 0.59 | 0.55 |
| 27 | 270 | 0.0070 | 0.0280 | 0.5640 | 0.0305 | 0.0064 | 0.3764 | 0.0257 | 0.0141 | 0.61 | 0.58 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 28 | 280 | 0.0070 | 0.0280 | 0.5920 | 0.0375 | 0.0070 | 0.4022 | 0.0259 | 0.0145 | 0.63 | 0.60 |
| 29 | 290 | 0.0082 | 0.0328 | 0.6248 | 0.0465 | 0.0090 | 0.4328 | 0.0305 | 0.0176 | 0.77 | 0.65 |
| 30 | 300 | 0.0082 | 0.0328 | 0.6576 | 0.0562 | 0.0098 | 0.4634 | 0.0307 | 0.0181 | 0.79 | 0.72 |
| 31 | 310 | 0.0082 | 0.0328 | 0.6904 | 0.0668 | 0.0105 | 0.4943 | 0.0309 | 0.0187 | 0.81 | 0.76 |
| 32 | 320 | 0.0082 | 0.0328 | 0.7232 | 0.0781 | 0.0113 | 0.5253 | 0.0310 | 0.0191 | 0.84 | 0.79 |
| 33 | 330 | 0.0082 | 0.0328 | 0.7560 | 0.0900 | 0.0120 | 0.5564 | 0.0311 | 0.0196 | 0.86 | 0.82 |
| 34 | 340 | 0.0082 | 0.0328 | 0.7888 | 0.1026 | 0.0126 | 0.5876 | 0.0312 | 0.0200 | 0.87 | 0.84 |
| 35 | 350 | 0.0095 | 0.0380 | 0.8268 | 0.1180 | 0.0154 | 0.6240 | 0.0363 | 0.0237 | 1.04 | 0.90 |
| 36 | 360 | 0.0095 | 0.0380 | 0.8648 | 0.1342 | 0.0162 | 0.6604 | 0.0364 | 0.0243 | 1.06 | 0.97 |
| 37 | 370 | 0.0095 | 0.0380 | 0.9028 | 0.1511 | 0.0169 | 0.6970 | 0.0366 | 0.0248 | 1.08 | 1.02 |
| 38 | 380 | 0.0095 | 0.0380 | 0.9408 | 0.1687 | 0.0176 | 0.7336 | 0.0367 | 0.0252 | 1.10 | 1.06 |
| 39 | 390 | 0.0095 | 0.0380 | 0.9788 | 0.1871 | 0.0183 | 0.7704 | 0.0367 | 0.0257 | 1.12 | 1.08 |
| 40 | 400 | 0.0095 | 0.0380 | 1.0168 | 0.2060 | 0.0190 | 0.8072 | 0.0368 | 0.0261 | 1.14 | 1.11 |
| 41 | 410 | 0.0134 | 0.0536 | 1.0704 | 0.2338 | 0.0278 | 0.8593 | 0.0521 | 0.0375 | 1.64 | 1.25 |
| 42 | 420 | 0.0134 | 0.0536 | 1.1240 | 0.2627 | 0.0289 | 0.9115 | 0.0522 | 0.0382 | 1.67 | 1.45 |
| 43 | 430 | 0.0134 | 0.0536 | 1.1776 | 0.2927 | 0.0300 | 0.9638 | 0.0523 | 0.0389 | 1.70 | 1.57 |
| 44 | 440 | 0.0180 | 0.0720 | 1.2496 | 0.3346 | 0.0419 | 1.0342 | 0.0704 | 0.0533 | 2.32 | 1.79 |
| 45 | 450 | 0.0180 | 0.0720 | 1.3216 | 0.3781 | 0.0435 | 1.1048 | 0.0706 | 0.0543 | 2.37 | 2.07 |
| 46 | 460 | 0.0340 | 0.1360 | 1.4576 | 0.4643 | 0.0862 | 1.2384 | 0.1336 | 0.1052 | 4.59 | 2.77 |
| 47 | 470 | 0.0540 | 0.2160 | 1.6736 | 0.6106 | 0.1463 | 1.4514 | 0.2130 | 0.1729 | 7.54 | 4.42 |
| 48 | 480 | 0.0270 | 0.1080 | 1.7816 | 0.6874 | 0.0768 | 1.5581 | 0.1067 | 0.0888 | 3.87 | 5.06 |
| 49 | 490 | 0.0180 | 0.0720 | 1.8536 | 0.7398 | 0.0524 | 1.6294 | 0.0712 | 0.0599 | 2.61 | 4.15 |
| 50 | 500 | 0.0134 | 0.0536 | 1.9072 | 0.7794 | 0.0396 | 1.6824 | 0.0531 | 0.0450 | 1.96 | 3.22 |
| 51 | 510 | 0.0134 | 0.0536 | 1.9608 | 0.8194 | 0.0400 | 1.7355 | 0.0531 | 0.0453 | 1.97 | 2.59 |
| 52 | 520 | 0.0134 | 0.0536 | 2.0144 | 0.8599 | 0.0405 | 1.7886 | 0.0531 | 0.0455 | 1.99 | 2.29 |
| 53 | 530 | 0.0088 | 0.0352 | 2.0496 | 0.8867 | 0.0268 | 1.8235 | 0.0349 | 0.0300 | 1.31 | 1.97 |
| 54 | 540 | 0.0088 | 0.0352 | 2.0848 | 0.9137 | 0.0270 | 1.8584 | 0.0349 | 0.0301 | 1.32 | 1.64 |
| 55 | 550 | 0.0088 | 0.0352 | 2.1200 | 0.9409 | 0.0272 | 1.8933 | 0.0349 | 0.0303 | 1.32 | 1.48 |
| 56 | 560 | 0.0088 | 0.0352 | 2.1552 | 0.9682 | 0.0273 | 1.9283 | 0.0349 | 0.0304 | 1.32 | 1.40 |
| 57 | 570 | 0.0088 | 0.0352 | 2.1904 | 0.9957 | 0.0275 | 1.9632 | 0.0349 | 0.0305 | 1.33 | 1.36 |
| 58 | 580 | 0.0088 | 0.0352 | 2.2256 | 1.0233 | 0.0276 | 1.9981 | 0.0349 | 0.0305 | 1.33 | 1.35 |
| 59 | 590 | 0.0088 | 0.0352 | 2.2608 | 1.0511 | 0.0278 | 2.0331 | 0.0349 | 0.0306 | 1.34 | 1.34 |
| 60 | 600 | 0.0088 | 0.0352 | 2.2960 | 1.0790 | 0.0279 | 2.0680 | 0.0350 | 0.0307 | 1.34 | 1.34 |
| 61 | 610 | 0.0088 | 0.0352 | 2.3312 | 1.1071 | 0.0281 | 2.1030 | 0.0350 | 0.0308 | 1.34 | 1.34 |
| 62 | 620 | 0.0088 | 0.0352 | 2.3664 | 1.1353 | 0.0282 | 2.1380 | 0.0350 | 0.0309 | 1.35 | 1.34 |
| 63 | 630 | 0.0088 | 0.0352 | 2.4016 | 1.1636 | 0.0283 | 2.1729 | 0.0350 | 0.0310 | 1.35 | 1.35 |
| 64 | 640 | 0.0088 | 0.0352 | 2.4368 | 1.1921 | 0.0285 | 2.2079 | 0.0350 | 0.0311 | 1.36 | 1.35 |
| 65 | 650 | 0.0072 | 0.0288 | 2.4656 | 1.2154 | 0.0234 | 2.2365 | 0.0286 | 0.0255 | 1.11 | 1.29 |
| 66 | 660 | 0.0072 | 0.0288 | 2.4944 | 1.2389 | 0.0235 | 2.2652 | 0.0286 | 0.0255 | 1.11 | 1.20 |
| 67 | 670 | 0.0072 | 0.0288 | 2.5232 | 1.2624 | 0.0235 | 2.2938 | 0.0286 | 0.0256 | 1.12 | 1.16 |
| 68 | 680 | 0.0072 | 0.0288 | 2.5520 | 1.2861 | 0.0236 | 2.3224 | 0.0286 | 0.0256 | 1.12 | 1.14 |
| 69 | 690 | 0.0072 | 0.0288 | 2.5808 | 1.3098 | 0.0237 | 2.3511 | 0.0286 | 0.0257 | 1.12 | 1.13 |
| 70 | 700 | 0.0072 | 0.0288 | 2.6096 | 1.3335 | 0.0238 | 2.3797 | 0.0286 | 0.0257 | 1.12 | 1.12 |
| 71 | 710 | 0.0072 | 0.0288 | 2.6384 | 1.3574 | 0.0238 | 2.4084 | 0.0286 | 0.0258 | 1.12 | 1.12 |
| 72 | 720 | 0.0072 | 0.0288 | 2.6672 | 1.3813 | 0.0239 | 2.4370 | 0.0286 | 0.0258 | 1.13 | 1.12 |
| 73 | 730 | 0.0072 | 0.0288 | 2.6960 | 1.4053 | 0.0240 | 2.4657 | 0.0287 | 0.0259 | 1.13 | 1.13 |
| 74 | 740 | 0.0072 | 0.0288 | 2.7248 | 1.4294 | 0.0241 | 2.4943 | 0.0287 | 0.0259 | 1.13 | 1.13 |
| 75 | 750 | 0.0072 | 0.0288 | 2.7536 | 1.4535 | 0.0241 | 2.5230 | 0.0287 | 0.0259 | 1.13 | 1.13 |
| 76 | 760 | 0.0072 | 0.0288 | 2.7824 | 1.4777 | 0.0242 | 2.5516 | 0.0287 | 0.0260 | 1.13 | 1.13 |
| 77 | 770 | 0.0057 | 0.0228 | 2.8052 | 1.4969 | 0.0192 | 2.5743 | 0.0227 | 0.0206 | 0.90 | 1.07 |
| 78 | 780 | 0.0057 | 0.0228 | 2.8280 | 1.5161 | 0.0192 | 2.5970 | 0.0227 | 0.0206 | 0.90 | 0.99 |
| 79 | 790 | 0.0057 | 0.0228 | 2.8508 | 1.5354 | 0.0193 | 2.6197 | 0.0227 | 0.0206 | 0.90 | 0.94 |
| 80 | 800 | 0.0057 | 0.0228 | 2.8736 | 1.5547 | 0.0193 | 2.6424 | 0.0227 | 0.0207 | 0.90 | 0.92 |
| 81 | 810 | 0.0057 | 0.0228 | 2.8964 | 1.5741 | 0.0194 | 2.6651 | 0.0227 | 0.0207 | 0.90 | 0.91 |
| 82 | 820 | 0.0057 | 0.0228 | 2.9192 | 1.5935 | 0.0194 | 2.6878 | 0.0227 | 0.0207 | 0.90 | 0.91 |
| 83 | 830 | 0.0057 | 0.0228 | 2.9420 | 1.6129 | 0.0194 | 2.7105 | 0.0227 | 0.0207 | 0.90 | 0.91 |
| 84 | 840 | 0.0057 | 0.0228 | 2.9648 | 1.6324 | 0.0195 | 2.7332 | 0.0227 | 0.0208 | 0.91 | 0.91 |
| 85 | 850 | 0.0057 | 0.0228 | 2.9876 | 1.6519 | 0.0195 | 2.7559 | 0.0227 | 0.0208 | 0.91 | 0.91 |
| 86 | 860 | 0.0057 | 0.0228 | 3.0104 | 1.6714 | 0.0195 | 2.7786 | 0.0227 | 0.0208 | 0.91 | 0.91 |
| 87 | 870 | 0.0057 | 0.0228 | 3.0332 | 1.6910 | 0.0196 | 2.8013 | 0.0227 | 0.0208 | 0.91 | 0.91 |
| 88 | 880 | 0.0057 | 0.0228 | 3.0560 | 1.7106 | 0.0196 | 2.8240 | 0.0227 | 0.0208 | 0.91 | 0.91 |
| 89 | 890 | 0.0050 | 0.0200 | 3.0760 | 1.7278 | 0.0172 | 2.8440 | 0.0199 | 0.0183 | 0.80 | 0.88 |
| 90 | 900 | 0.0050 | 0.0200 | 3.0960 | 1.7450 | 0.0172 | 2.8639 | 0.0199 | 0.0183 | 0.80 | 0.84 |
| 91 | 910 | 0.0050 | 0.0200 | 3.1160 | 1.7623 | 0.0173 | 2.8838 | 0.0199 | 0.0183 | 0.80 | 0.82 |
| 92 | 920 | 0.0050 | 0.0200 | 3.1360 | 1.7796 | 0.0173 | 2.9037 | 0.0199 | 0.0183 | 0.80 | 0.81 |
| 93 | 930 | 0.0050 | 0.0200 | 3.1560 | 1.7969 | 0.0173 | 2.9236 | 0.0199 | 0.0184 | 0.80 | 0.81 |
| 94 | 940 | 0.0050 | 0.0200 | 3.1760 | 1.8143 | 0.0173 | 2.9436 | 0.0199 | 0.0184 | 0.80 | 0.80 |
| 95 | 950 | 0.0050 | 0.0200 | 3.1960 | 1.8316 | 0.0174 | 2.9635 | 0.0199 | 0.0184 | 0.80 | 0.80 |
| 96 | 960 | 0.0050 | 0.0200 | 3.2160 | 1.8490 | 0.0174 | 2.9834 | 0.0199 | 0.0184 | 0.80 | 0.80 |
| 97 | 970 | 0.0050 | 0.0200 | 3.2360 | 1.8664 | 0.0174 | 3.0034 | 0.0199 | 0.0184 | 0.80 | 0.80 |
| 98 | 980 | 0.0050 | 0.0200 | 3.2560 | 1.8839 | 0.0174 | 3.0233 | 0.0199 | 0.0184 | 0.80 | 0.80 |
| 99 | 990 | 0.0050 | 0.0200 | 3.2760 | 1.9013 | 0.0175 | 3.0432 | 0.0199 | 0.0184 | 0.80 | 0.80 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 1000 | 0.0050 | 0.0200 | 3.2960 | 1.9188 | 0.0175 | 3.0631 | 0.0199 | 0.0185 | 0.81 | 0.80 |
| 101 | 1010 | 0.0040 | 0.0160 | 3.3120 | 1.9328 | 0.0140 | 3.0791 | 0.0159 | 0.0148 | 0.64 | 0.76 |
| 102 | 1020 | 0.0040 | 0.0160 | 3.3280 | 1.9468 | 0.0140 | 3.0950 | 0.0159 | 0.0148 | 0.64 | 0.70 |
| 103 | 1030 | 0.0040 | 0.0160 | 3.3440 | 1.9609 | 0.0140 | 3.1110 | 0.0159 | 0.0148 | 0.65 | 0.67 |
| 104 | 1040 | 0.0040 | 0.0160 | 3.3600 | 1.9749 | 0.0140 | 3.1269 | 0.0159 | 0.0148 | 0.65 | 0.66 |
| 105 | 1050 | 0.0040 | 0.0160 | 3.3760 | 1.9890 | 0.0141 | 3.1429 | 0.0159 | 0.0148 | 0.65 | 0.65 |
| 106 | 1060 | 0.0040 | 0.0160 | 3.3920 | 2.0030 | 0.0141 | 3.1588 | 0.0159 | 0.0148 | 0.65 | 0.65 |
| 107 | 1070 | 0.0040 | 0.0160 | 3.4080 | 2.0171 | 0.0141 | 3.1748 | 0.0159 | 0.0148 | 0.65 | 0.65 |
| 108 | 1080 | 0.0040 | 0.0160 | 3.4240 | 2.0312 | 0.0141 | 3.1907 | 0.0159 | 0.0148 | 0.65 | 0.65 |
| 109 | 1090 | 0.0040 | 0.0160 | 3.4400 | 2.0453 | 0.0141 | 3.2067 | 0.0159 | 0.0148 | 0.65 | 0.65 |
| 110 | 1100 | 0.0040 | 0.0160 | 3.4560 | 2.0594 | 0.0141 | 3.2226 | 0.0159 | 0.0149 | 0.65 | 0.65 |
| 111 | 1110 | 0.0040 | 0.0160 | 3.4720 | 2.0736 | 0.0141 | 3.2386 | 0.0159 | 0.0149 | 0.65 | 0.65 |
| 112 | 1120 | 0.0040 | 0.0160 | 3.4880 | 2.0877 | 0.0141 | 3.2545 | 0.0159 | 0.0149 | 0.65 | 0.65 |
| 113 | 1130 | 0.0040 | 0.0160 | 3.5040 | 2.1019 | 0.0142 | 3.2705 | 0.0160 | 0.0149 | 0.65 | 0.65 |
| 114 | 1140 | 0.0040 | 0.0160 | 3.5200 | 2.1161 | 0.0142 | 3.2864 | 0.0160 | 0.0149 | 0.65 | 0.65 |
| 115 | 1150 | 0.0040 | 0.0160 | 3.5360 | 2.1302 | 0.0142 | 3.3024 | 0.0160 | 0.0149 | 0.65 | 0.65 |
| 116 | 1160 | 0.0040 | 0.0160 | 3.5520 | 2.1444 | 0.0142 | 3.3183 | 0.0160 | 0.0149 | 0.65 | 0.65 |
| 117 | 1170 | 0.0040 | 0.0160 | 3.5680 | 2.1586 | 0.0142 | 3.3343 | 0.0160 | 0.0149 | 0.65 | 0.65 |
| 118 | 1180 | 0.0040 | 0.0160 | 3.5840 | 2.1729 | 0.0142 | 3.3502 | 0.0160 | 0.0149 | 0.65 | 0.65 |
| 119 | 1190 | 0.0040 | 0.0160 | 3.6000 | 2.1871 | 0.0142 | 3.3662 | 0.0160 | 0.0149 | 0.65 | 0.65 |
| 120 | 1200 | 0.0040 | 0.0160 | 3.6160 | 2.2013 | 0.0142 | 3.3821 | 0.0160 | 0.0149 | 0.65 | 0.65 |
| 121 | 1210 | 0.0040 | 0.0160 | 3.6320 | 2.2156 | 0.0143 | 3.3981 | 0.0160 | 0.0149 | 0.65 | 0.65 |
| 122 | 1220 | 0.0040 | 0.0160 | 3.6480 | 2.2298 | 0.0143 | 3.4140 | 0.0160 | 0.0149 | 0.65 | 0.65 |
| 123 | 1230 | 0.0040 | 0.0160 | 3.6640 | 2.2441 | 0.0143 | 3.4300 | 0.0160 | 0.0149 | 0.65 | 0.65 |
| 124 | 1240 | 0.0040 | 0.0160 | 3.6800 | 2.2584 | 0.0143 | 3.4459 | 0.0160 | 0.0150 | 0.65 | 0.65 |
| 125 | 1250 | 0.0040 | 0.0160 | 3.6960 | 2.2727 | 0.0143 | 3.4619 | 0.0160 | 0.0150 | 0.65 | 0.65 |
| 126 | 1260 | 0.0040 | 0.0160 | 3.7120 | 2.2870 | 0.0143 | 3.4778 | 0.0160 | 0.0150 | 0.65 | 0.65 |
| 127 | 1270 | 0.0040 | 0.0160 | 3.7280 | 2.3013 | 0.0143 | 3.4938 | 0.0160 | 0.0150 | 0.65 | 0.65 |
| 128 | 1280 | 0.0040 | 0.0160 | 3.7440 | 2.3157 | 0.0143 | 3.5098 | 0.0160 | 0.0150 | 0.65 | 0.65 |
| 129 | 1290 | 0.0040 | 0.0160 | 3.7600 | 2.3300 | 0.0143 | 3.5257 | 0.0160 | 0.0150 | 0.65 | 0.65 |
| 130 | 1300 | 0.0040 | 0.0160 | 3.7760 | 2.3444 | 0.0144 | 3.5417 | 0.0160 | 0.0150 | 0.65 | 0.65 |
| 131 | 1310 | 0.0040 | 0.0160 | 3.7920 | 2.3587 | 0.0144 | 3.5576 | 0.0160 | 0.0150 | 0.65 | 0.65 |
| 132 | 1320 | 0.0040 | 0.0160 | 3.8080 | 2.3731 | 0.0144 | 3.5736 | 0.0160 | 0.0150 | 0.65 | 0.65 |
| 133 | 1330 | 0.0040 | 0.0160 | 3.8240 | 2.3875 | 0.0144 | 3.5895 | 0.0160 | 0.0150 | 0.65 | 0.65 |
| 134 | 1340 | 0.0040 | 0.0160 | 3.8400 | 2.4019 | 0.0144 | 3.6055 | 0.0160 | 0.0150 | 0.66 | 0.65 |
| 135 | 1350 | 0.0040 | 0.0160 | 3.8560 | 2.4163 | 0.0144 | 3.6215 | 0.0160 | 0.0150 | 0.66 | 0.65 |
| 136 | 1360 | 0.0040 | 0.0160 | 3.8720 | 2.4307 | 0.0144 | 3.6374 | 0.0160 | 0.0150 | 0.66 | 0.66 |
| 137 | 1370 | 0.0040 | 0.0160 | 3.8880 | 2.4451 | 0.0144 | 3.6534 | 0.0160 | 0.0150 | 0.66 | 0.66 |
| 138 | 1380 | 0.0040 | 0.0160 | 3.9040 | 2.4595 | 0.0144 | 3.6693 | 0.0160 | 0.0150 | 0.66 | 0.66 |
| 139 | 1390 | 0.0040 | 0.0160 | 3.9200 | 2.4740 | 0.0144 | 3.6853 | 0.0160 | 0.0150 | 0.66 | 0.66 |
| 140 | 1400 | 0.0040 | 0.0160 | 3.9360 | 2.4884 | 0.0145 | 3.7013 | 0.0160 | 0.0151 | 0.66 | 0.66 |
| 141 | 1410 | 0.0040 | 0.0160 | 3.9520 | 2.5029 | 0.0145 | 3.7172 | 0.0160 | 0.0151 | 0.66 | 0.66 |
| 142 | 1420 | 0.0040 | 0.0160 | 3.9680 | 2.5173 | 0.0145 | 3.7332 | 0.0160 | 0.0151 | 0.66 | 0.66 |
| 143 | 1430 | 0.0040 | 0.0160 | 3.9840 | 2.5318 | 0.0145 | 3.7491 | 0.0160 | 0.0151 | 0.66 | 0.66 |
| 144 | 1440 | 0.0040 | 0.0160 | 4.0000 | 2.5463 | 0.0145 | 3.7651 | 0.0160 | 0.0151 | 0.66 | 0.66 |

Total Runoff Volume (cu. ft.)= 78793

Downstream Pipe Analysis
314 Pleasant Avenue

| | Beginning Location | Ending Location | Pipe Dia. | Length | Slope, % |
|---|---|---|---|---|---|
| 1 | Pleasanat Ave & Caufield St, Stru. ID 31443 | Dewey Street & Molalla Ave, Stru. ID 34721 | 10" | 208 | 6 |
| 2 | Dewey Street & Molalla Ave, Stru. ID 34721 | Molalla Ave & Pearl St, Stru. ID 34720 | 12" | 173 | 5 |
| 3 | Molalla Ave & Pearl St, Stru. ID 34720 | Molalla Ave & Roosevelt St, Stru. ID 34719 | 18" | 240 | 4 |
| 4 | Molalla Ave & Roosevelt St, Stru. ID 34719 | Roosevelt St & (W) Warren St, Stru. ID 36748 | 18" | 345 | 3 |
| 5 | Roosevelt St & (W) Warren St, Stru. ID 36748 | East of Warren on Roosevelt, Stru. ID 33570 | 6" | 198 | 2 |
| 6 | East of Warren on Roosevelt, Stru. ID 33570 | East to alley on Roosevelt St, Struc ID 36746 | 6" | 146 | 5.5 |
| 7 | East to alley on Roosevelt St, Struc ID 36746 | Roosevelt & Euria, Structure ID 36745 | 6" | 244 | 7.3 |
| 8 | Roosevelt & Euria, Structure ID 36745 | Outfall 39415 | 18" | 532 | 9 |

| Pipe Capacity, CFS | Basin Flow, CFS | Pipe Capacity Check |
|---|---|---|
| 5.4 | 0.8 | yes |
| 8 | 2.17 | yes |
| 21 | 3.6 | yes |
| 18 | 5.06 | yes |
| 0.8 | 5.06 | no |
| 1.3 | 5.68 | no |
| 1.5 | 8.04 | no |
| 31.5 | 8.04 | yes |