DEWALT Corporation • ENGINEERING • PLANNING • SURVEYING • LAND DEVELOPMENT • CONSTRUCTION MANAGEMENT

DRAINAGE AND DETENTION ANALYSIS

-Revised per City Comments-

Rev. 1

SAGE RANCH

RESIDENTIAL DEVELOPMENT

APNs: 417-012-01, 417-012-27, 417-012-28, 417-012-25

T32S R33E SECTION 28

TRACT NO. 7366

TEHACHAPI, COUNTY OF KERN

STATE OF CALIFORNIA

Prepared by:
DEWALT
CORPORATION

Rev. 1: August 19, 2019

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Project # 18-146 Email: sbahr@dewaltcorp.com

PURPOSE OF STUDY:

This Drainage and Detention Study has been prepared for Tract 7366, a proposed Development for single-family and multi-unit housing located near Dennison Road, between Valley Ave. and Pinon Street, in Tehachapi, CA. The property encompasses approximately 132 acres, with clustered residential units of varying density planned for the Development. The existing property is undeveloped, with brush and grass cover. Existing topography trends approximately 2% north-northwest, which facilitates drainage across the site towards a series of drain inlets running along the south shoulder of Valley Blvd.

Post-Development, runoff will be collected by surface drainage structures along paved surfaces, with an estimated slope of 1%. Runoff for the entire development will be directed to a large detention basin. The design intent is to connect the detention basin to the City's existing storm drainage system, into which runoff will be discharged at an allowable rate. The Detention Basin will be designed in accordance with City of Tehachapi Standards. The planned location for the detention basin is the northwest corner of the site. Given anticipated discharge allowance, preliminary design capacity is about 10-acre-feet.

DESCRIPTION OF WATERSHED:

Property/APN Information:

417-012-01	32.97 Ac
417-012-25	19.16 Ac
417-012-27	20 Ac
417-012-28	60 Ac
Total	132.13 Ac

Current Land Use:

Vacant Undeveloped Land

Proposed Land Use:

Single and Multi-Family Development

Surrounding Land Use:

North:	Residential
East:	Tehachapi High School
South:	Residential
West:	Residential

Watershed Boundary:

Tract 7366

Watershed Location:

See attached drainage maps for drainage areas.

METHODOLOGY:

The Kern County Hydrology Manual was used to evaluate pre and post-development conditions for the property for 10, 25, and 100-year storms, as required by the City of Tehachapi's Subdivision and Development Standards. The Rational Method was used to evaluate the Pre-and Post-Development conditions for the property.

ASSUMPTIONS:

The project is located in a Type I storm area. Design Tables showing precipitation and runoff values have been prepared for the analysis.

The Kern County Hydrology Manual provides Runoff Coefficient Value by soil type, rainfall intensity and imperviousness. Kern County Rational Method equations were used to estimate runoff from the 100, 25, and 10-year design storms based on storm Yield fraction. KC Figure C-2 provides Curve Numbers for Pervious (Undeveloped) areas and Figure C-3 provides recommended imperviousness for Developed areas.

Per KC Hydrology Manual, Hydrologic Cover Density is defined as the percent of the ground surface covered by the crown canopy of live plants and litter. Three broad ranges of vegetative cover density have been established:

Poor: 0% - 20% Vegetative cover
Fair: 20% - 40% Vegetative cover
Good: Over 40% Vegetative cover

The Undeveloped property appears to have “Fair” to “Good” grass and brush cover. Runoff velocity and curve number are estimated based on this cover type and underlying soils. USGS Soil data for the property indicates that soil across the Site is well-drained “Type A” Sandy Loam soils. This type of soil is generally conducive to infiltration, with greater infiltration rates and lower runoff volumes as compared with other soils. Group A soils have high infiltration rates even when thoroughly wetted and consist chiefly of deep, well-drained sands or gravels. These soils have a high rate of water transmission.

Recommended SCS Curve Numbers for this type of cover ranges from about 45-60. An SCS Curve number of 55 is typical for Type A soils, and this value was therefore assumed for the analysis of the undeveloped property (C=0.4), given the sandy loam soils and fair to good cover. For the Developed property with 8-10 DU/Acre, the Kern-County recommended Range of Impervious Cover is 50-70. Dewalt used a value of 65 (C=0.70) for this analysis, which provides a more conservative design than the recommended average of 60.

In estimating Time of Concentration, the overall slope of 2% was assumed across the undeveloped site. For undeveloped land, the estimated surface flow velocity is 2.3 ft/s. For analysis of Developed property, a paved surface was assumed with an overall 1% typical slope, giving an estimated surface flow velocity of 2-ft/s. The Time of Concentration was determined using Figure D-1 from the Kern County Hydrology Manual. Time of Concentration Nomographs are provided in the Appendix.

EXISTING CITY DRAINAGE

Tehachapi’s existing storm drainage system includes drain inlets and storm piping trunk which runs along Tehachapi Blvd. The series of drain inlets along Tehachapi Blvd. capture significant runoff from developed and undeveloped areas south of Tehachapi Blvd.

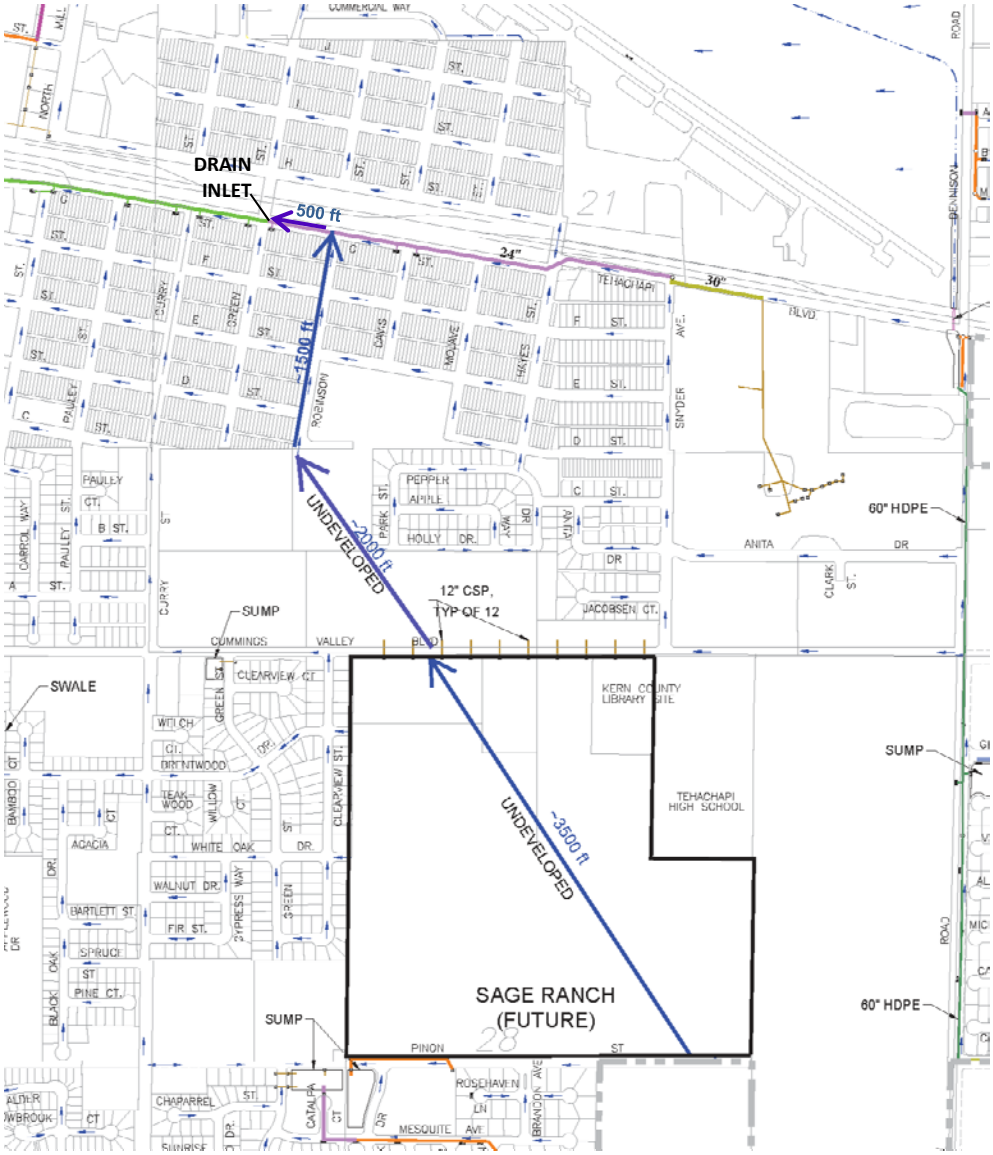
The City utilizes a stormwater trunk line running along Tehachapi Blvd, which includes a 24” segment and a 36” line segment. The 24” line extends from Green St. east, to Snyder Ave. The trunk line increases to a 36” line at Green St heading west, which allows the City to handle more runoff as the trunk continues west along Tehachapi Blvd. The 36” line ultimately conveys runoff into a drainage channel north of Tehachapi Blvd.

In June 2019, Dewalt surveyed portions of the City’s storm inlets and storm piping. The 24” line appears to be sloped between 0.6% and 1%. Based on this slope and assuming concrete pipe

(n=0.013), the maximum flow through the line is 20-24 cfs. For the 36" trunk, given a similar slope, the estimated maximum flow is 60-70 cfs. However, per City Standards, water depth in pipelines shall not exceed a Factor of 0.8 times the pipe diameter (0.8 x D) for flow calculations; applying this Factor yields 50-65 cfs capacity for the 36" line and 17-22 cfs for the 24" line.

Dewalt evaluated one drainage route from the undeveloped property to a downstream city storm drain inlet, approximately 4,000 feet from Valley Blvd, and 7,500 feet away from the furthest extent of the undeveloped property. This includes the following segments:

- 3500-feet from southeast to northwest location of property, furthest extent of the watershed.
- North of Valley Blvd, 2000-feet north/northwest through undeveloped land, to East C Street and developed city areas.
- 1500-feet north through city, along Robinson Street, to Tehachapi Blvd
- 500-feet west along Tehachapi Blvd. to drain Inlet at Green St, connected to 36" Trunkline



PATH FOR RUNOFF: FROM UNDEVELOPED PROPERTY TO CITY INLET

In order to determine the peak runoff from the project area that ultimately reaches city drain inlets, an analysis of estimated runoff was made along each segment of the overall path, with resulting flows and velocities based on surface type, slope, and time of concentration. Runoff from the project area that reaches the residential area blends with residential area runoff and combined runoff is conveyed by curb and gutter to the City drain inlets located along Tehachapi Blvd. Runoff originating from locations other than the undeveloped site were subtracted from combined flows along the path of analysis.

RUNOFF ANALYSIS for UNDEVELOPED PROPERTY:

Existing slope generally runs north-northwest through the property at 2%, although midway through the property a swale exists running predominantly west, which conveys runoff to the west side of the property and to an another swale running north. In conjunction with the overall slope of the property trending north/northwest, these swales convey significant runoff to the northwest corner of the property at Valley Blvd. Given the topography of the undeveloped site, it is estimated that runoff from approximately 100 acres of the 132-acre site will collect in this approximate area over a similar Time of Concentration. The runoff from the remaining 42-acres does not appear to reach this location at a similar time of concentration or at all. Runoff from these 42-acres was therefore disregarded as not immediately contributing for the selected path analysis.

The site is bounded on the north by Valley Blvd. A series of drain inlets installed along the south shoulder of Valley Blvd are designed to capture runoff from the undeveloped property and prevent ponding on the road. These inlets are spaced at about 200-feet, and connect to individual 12" corrugated steel pipelines running below the road to the adjacent undeveloped property on the north side of Valley Blvd. These lines are intended to convey runoff below and across the road to the north, discharging to the undeveloped land.

Site Investigation

In order to evaluate existing runoff conditions from the undeveloped property, Dewalt investigated site conditions and the functionality of the series of drain inlets and pipelines north of the property. North of Valley, no daylight locations of any of the 12" CSP lines were found. Further investigation revealed the discharge locations of the lines were covered with sediment. This was the case with all the lines, which are be buried and do not currently appear functional to convey drainage.

The CSP lines slope about 1%, and, if functional, would individually convey about 2 cfs to the undeveloped area directly north of Valley Blvd. Given the number and location of the inlets and CSP lines north of the undeveloped property, it appears that 10 inlets/pipelines discharge about 20 cfs runoff to the area north of Valley Blvd. Valley Blvd. appears relatively flat here, and runoff exceeding the flow capacity of the drain inlets/CSP lines would continue in the predominant flow direction, north to northwest, thereby also flowing to the undeveloped property north of Valley Blvd.

Runoff Path and Methodology

In total, runoff generated from the undeveloped property passes through an area of about 20-acres of undeveloped land between Valley Blvd. and East C Street, in route to the city drain inlets. Runoff reaching developed city areas becomes part of what the existing City system handles for the pre-developed site condition.

Runoff passing through the undeveloped areas north of Valley Blvd reach East C Street and residential areas. Along East C St., runoff runs west and combines with runoff along Robinson St. The east side of Robinson St has predominant runoff conveyance structures, with concrete swales conveying runoff past East E St. and East F St., to Tehachapi Blvd. Tehachapi Blvd slopes to the west at 0.5-1.0% at in this area, and it appears that runoff heads west from here to the city drain inlet at Green St., about 500-feet away.

In order to evaluate runoff volumes from the project site, the Rational Method was used. Runoff originating with the undeveloped area north of Valley Blvd was combined with the runoff generated

from the project site, and the combined flow and Time of Concentrations were entered into a spreadsheet. Runoff not originating from the project site was subtracted from the combined flow, providing an estimate of runoff attributable only the undeveloped project site. This procedure was followed through city-developed areas, with runoff not originating from the project site being fully subtracted from combined flow volumes.

Results

Using the Rational Method along the described path yielded runoff results that indicate a 24" trunk line would be inadequate to handle pre-development flows from the property. Fortunately, the City's 36" storm trunk line begins at Green St off of the inlet location analyzed, and, disregarding other major flows, appears to be sized sufficiently to convey peak pre-development runoff from the site.

Dewalt also estimated Total Runoff volume for the undeveloped property. The following results were obtained for the analyzed storm events:

UNDEVELOPED PROPERTY RUNOFF (CN=55)

Design Storm	24-hr Precipitation	24-hr Runoff Volume	Peak @ Inlet
100-YR	5.52"	13.5 Acre-ft	37 cfs
25-YR	4.16"	6.5 Acre-ft	27 cfs
10-YR	3.29"	3.0 Acre-ft	24 cfs

RUNOFF ANALYSIS for DEVELOPED PROPERTY:

As previously noted, the analysis of the developed property assumes typical slopes of 1% and typical imperviousness values for an 8-10 DU/Acre development. Runoff analysis for the Developed property was done in conjunction with analysis of a Detention Basin Requirement (see below). Using Rational Method equations, Runoff Volumes and Peak Flow rate were calculated for the 100, 25, and 10-year storm events for the developed property:

DEVELOPED PROPERTY RUNOFF (CN=77)

Design Storm	24-hr Precipitation	24-hr Runoff Volume	Q, Peak Flow
100-YR	5.52"	36 Acre-ft	115 cfs
25-YR	4.16"	17 Acre-ft	80 cfs
10-YR	3.29"	10.4 Acre-ft	60 cfs

DETENTION BASIN AND PIPEFLOW ROUTING

Section I of the KC Hydrology Manual describes combined use of a Detention Basin with Pipeflow Routing. Kern County methodology for Detention Basin design was reviewed, along with the Tehachapi Development Standards Section 2.7, which outlines Drainage Basin design requirements. These requirements will be referenced and used for the final basin and routing design for the property.

A proposed design for the project constitutes discharging runoff into the City's existing system at a rate not exceeding the peak flow reaching the city's storm system from the existing undeveloped land. The Detention Basin would discharge stormwater at a desired rate while being sized to detain 100-yr design inflows exceeding the design discharge flow rate.

Evaluating a flow path from the undeveloped property to the City, for the 100-year event, indicates nearly 40 cfs runoff reaches the City's inlet at S Green and Tehachapi Blvd. As previously indicated, the City's 36" trunk line (assuming 0.6% to 1% slope and roughness value n=0.013), has a Factor-applied capacity of 50-65 cfs, and connecting 24" a capacity of 17-22 cfs. Given these values, and accounting connection with the 24" line, the available capacity remaining where the 36" pipe begins is 28-48 cfs.

Dewalt proposes a 24"- 30" RCP pipe to convey runoff from an on-site detention basin to the City's storm system, along a similar flow path as was analyzed for the pre-development site. From the proposed detention basin, the line would cross below Valley Blvd, continue north along a desired path to East C St., down Robinson St, ultimately tying into the City's existing 36" trunk line on Tehachapi Blvd at Green St. A discharge of 37 cfs from the detention basin matches the estimated 100-yr peak flow from the undeveloped site reaching the City's drain inlet. This value falls in the middle of the estimated available capacity of 28-48 cfs, where the City's 36" trunk line begins. However, it is understood that the City's storm drainage system may not be designed or able to handle the 100-year storm event runoff, and the initial proposed discharge of 37 cfs could overwhelm the system. Dewalt also recognizes that the City's system has additional inflows west of the Green Street drain inlet, but it is beyond the scope of this preliminary study to perform a complete analysis of the City's system. Therefore, use of a reduced discharge rate based on the 10-year design storm is more appropriate, and more in-line with the City's storm system design.

The calculated undeveloped 10-year flow is 24 cfs to the city inlet. This value is below the calculated available 28-48 cfs capacity at the City's 36" trunk line. The primary outlet from the detention basin can be sized and sloped such that gravity-flow does not exceed this discharge rate. This could be accomplished simply by using a 24" outlet pipe (n=0.013) at 1% slope; hydraulic calculations indicate that gravity-flow through this outlet would not exceed 24 cfs. Alternatively, an overflow weir or outlet device within the basin could be used to limit discharge according to set water levels or controls.

Given the proposed discharge rate, a detention basin volume of 11-acre feet is sufficient for the 100-year storm. In addition, the discharge rate allows the basin to be emptied within a day, in conformance with the City's 5-day maximum detention time. The 11-acre ft basin volume is also sufficient to retain the 10-year design storm event runoff, without discharge.

The Developer has proposed an area of about 3.5-acres at the northwest corner of the Development for use as both a detention basin and as a park/play area for residents. With City allowance of the proposed discharge rate, the Developer can satisfy the City's drainage and detention requirements as well as use the location for the desired park area. The area would be graded about 3-feet below the rest of the development and designed in accordance with the City's Basin Design requirements.

Drainage Piping and Earthwork

Basin drainage piping shall be constructed of reinforced concrete piping with gasketed joints, as described in Tehachapi's Design Standards, Section 2.8 *Drainage Piping Material Standards and Workmanship.* Earthwork shall also conform to the City requirements. Pipeline Trenching shall conform to Section 3.6 of Tehachapi's Design Standards.

SUMMARY:

Dewalt analyzed both Pre and Post-Development runoff for the 132-acre Sage Ranch property, for the 100, 25, and 10-year storm events as required by Tehachapi Subdivision and Development Standards. Based on this analysis, a preliminary Detention Basin size is proposed. The basin is sized based on the 100-year event, and will discharge to the City's existing storm system at a rate of about 24 cfs, which matches the calculated 10-year pre-development peak runoff rate reaching Tehachapi's existing storm system. Runoff exceeding this peak flow will be detained in the on-site Detention Basin. Given the proposed 24-cfs design discharge rate, an 11-acre-ft Detention Basin is adequately sized for the 100-year design storm.

Attachments

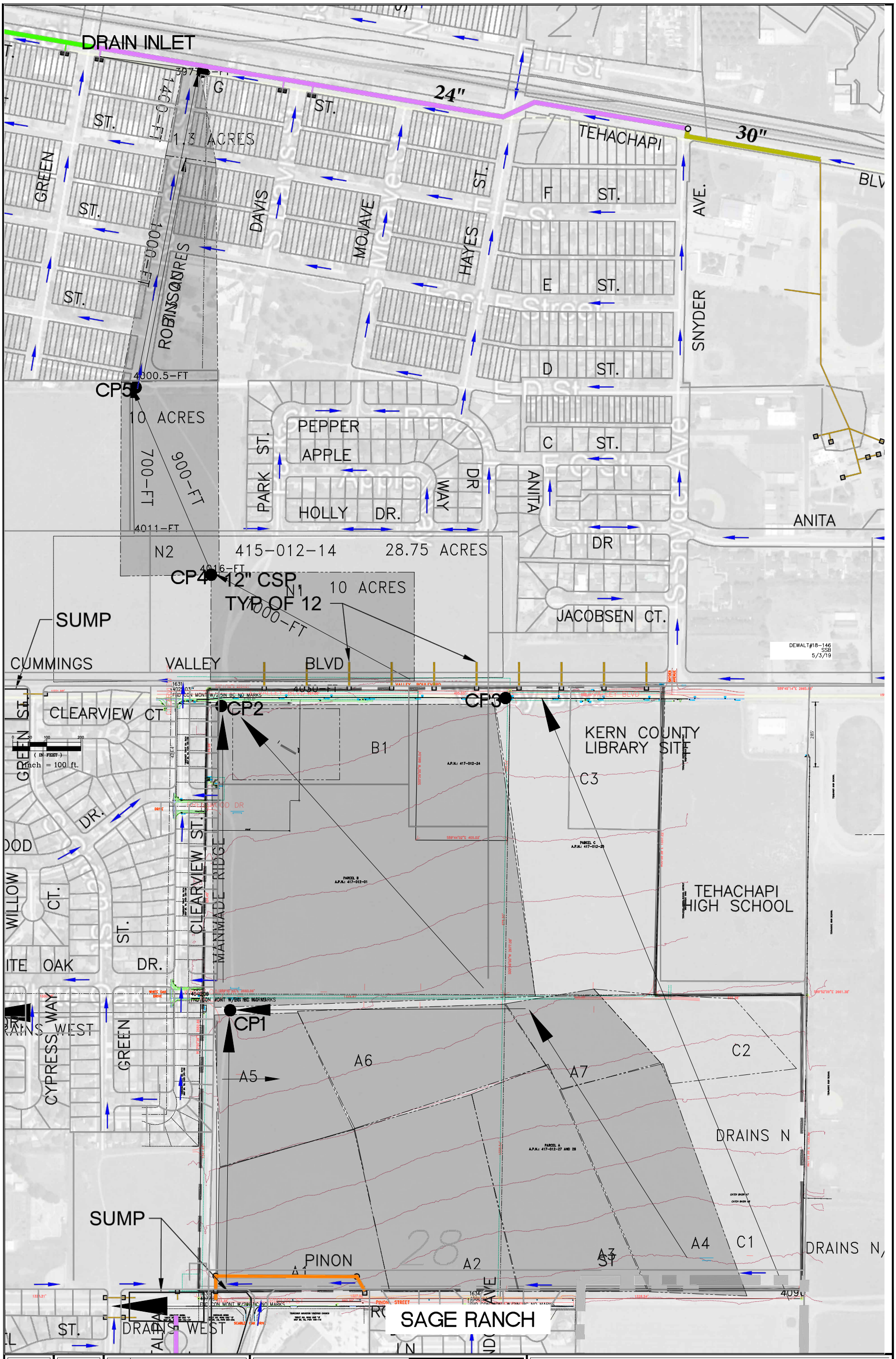
APPENDIX A: Pre-Development Runoff Path Analysis, 100, 25 and 10-year Events

APPENDIX B: USDA SoilSurvey, KC Hydrology Section C Worksheets: SCS Curve Number, 24-hr Storm Rainfall-Runoff

APPENDIX C: Detention Basin Sizing, 100-Yr Post-Development Storm

APPENDIX D: KC Hydrology Worksheets: IDF Chart, Time of Concentration Nomograph, 100, 25,10-Yr Area-Avg Mass Rainfall Plot, 100-Yr Hydrograph

APPENDIX A
PRE-DEVELOPMENT RUNOFF PATH ANALYSIS
RATIONAL METHOD 100, 25, 10-YR



DRAWN BY:	SB
CHECKED BY:	T.W.
APPROVED BY:	T.W.
DATE:	5/3/19
JOB NO:	18-146
ACAD FILE:	18-146 10ft_Basin

SHEET 1 OF: 1

DATE	REVISIONS

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SAGE RANCH
PRE-DEVELOPMENT DRAINAGE ANALYSIS
TEHACHAPI, CALIFORNIA

RATIONAL METHOD DRAINAGE STUDY

DATE: **7/22/2019** **JOB NO.** 18/-146 TR 7366

FREQ.: 100-YEAR SURFACE FLOWS, FROM UNDEVELOPED AREA TO CITY DRAIN INLET

PRE-DEVELOPMENT FLOW TO CITY INLET, 1-2% SLOPE

# CB PRE_DEVELOPMENT	SUBAREA	ACREAGE	RUN	FALL	AVG.	VELOCITY	TIME (MINUTES)	TOTAL TIME	I	C	C*A	FLOW CFS	COMMENTS
	A1	10.00	750	17	2.27%	2.43		28.0	1.94	0.4	4.000	**7.76**	
	A2	10.00	750	19	2.53%	2.57		28.0	1.94	0.4	4.000	**7.76**	
	A3	10.00	1000	23	2.30%	2.45		28.0	1.94	0.4	4.000	**7.76**	**UNDEVELOPED**
	A4	10.00	1000	23	2.30%	2.45		28.0	1.94	0.4	4.000	**7.76**	**Alternative Rational Method**
+ Travel Time to A5	**A5**	6.75	620	11.5	1.85%	2.20	4.7	32.7	1.77	0.4	2.700	**4.77**	**"Type A" Soils**
+ Travel Time to A6	**A6**	8.70	1000	11	1.10%	1.69	9.8	37.8	1.64	0.4	3.480	**5.69**	
+ Travel Time to A7	**A7**	3.90	750	7	0.93%		4.0	32.0	1.78	0.4	1.560	**2.78**	
TO CP1, ∑A		**59.35**						**37.8**	**1.64**	**0.4**	**23.740**	**38.84**	**A Areas, Pre-Development Flow**
	B1	40.00	1450	29	2.00%			36.0	1.69	0.4	16.000	**27.04**	**Area B1 to CP2**
CP1 '+ Travel Time to CP2, [∑A,B]	**∑A1-A7**	**59.35**	1343	24	1.79%	2.16	10.4	48.2	1.39	0.4	23.740	**33.00**	
TO CP2, ∑CP2		**99.35**						**48.2**	**1.39**	**0.4**	**39.740**	**55.24**	**Flow to CP2, to N. Area**
	C1	8.75	1000	20.5	2.05%	2.31		28.0	1.94	0.4	3.500	**6.79**	
+ Travel Time to C2	**C2**	4.80	750	9	1.20%	1.77	7.1	35.1	1.72	0.4	1.920	**3.30**	**C Areas - Limited Contribution**
+ Travel Time to C3	**C3**	19.00	1450	27	1.86%	2.20	11.0	46.1	1.43	0.4	7.600	**10.85**	
∑@CP3		**32.55**						**46.1**	**1.43**	**0.4**	**13.020**	**18.59**	**Runoff Not Included in Analysis**
From CP2 to CP4 (Across Valley)	**(2.3-ft/s)**	**99.35**	500				3.6	51.8	1.35	0.4	39.740	**53.65**	
N1 to CP4	**N1 (N. Area1)**	10.00	1000	14	1.40%	1.00		28.0	1.94	0.4	4.000	**7.76**	
∑CP4		**109.35**						**51.8**	**1.35**	**0.4**	**43.740**	**59.05**	**Flow to CP4**
												7.76	**Subtract Area N1 (not project)**
												51.29	**From Undevel. Project**
CP4 to CP5 (from Undevel Project)	**(2.3-ft/s)**	**99.35**	**900**				6.5	**58.3**	**1.28**	**0.4**	**39.740**	**50.87**	**UNDEVELOPED**
	N2 (N. Area2)	10.00	900	11	1.22%			**58.3**	**1.28**	**0.4**	**4.000**	**5.12**	
∑CP5, @CITY_RESIDENTIAL		**109.35**	**1900**					**58.3**	**1.28**	**0.4**	**43.740**	**50.87**	**To Res/Developed Area**
												5.12	**Subtract Area N2 (not project)**
												45.75	**From Undevel. Project**
Runoff through Developed Area	Travel to Tehachapi Blvd		**1400**		**2.00%**	2.90	8.5	**66.8**					
	Travel to Inlet @S. Green	**99.35**	**500**		**1.00%**	2.00	4.2	**71.0**	**1.14**	**0.4**	**39.740**	**45.30**	**From Undeveloped Project**
	S Robinson	7.30	1000	16.5	1.65%			71.0	1.14	0.85	6.205	7.07	**Disregard Contributions from**
		10.00	400	6.7	1.68%			71.0	1.14	0.85	8.500	9.69	**Developed Areas en Route**
∑@INLET		**116.65**	**1400**					**71.0**	**1.14**	**0.4**	**46.660**	**53.19**	**To Drain Inlet**
												16.76	**Subtract Developed Area Runoff**
												36.43	**Peak Q to City Inlet from Devel**

RATIONAL METHOD DRAINAGE STUDY

DATE: **7/22/2019** **JOB NO.** 18/-146 TR 7366

FREQ.: 25-YEAR SURFACE FLOWS, FROM UNDEVELOPED AREA TO CITY DRAIN INLET

PRE-DEVELOPMENT FLOW TO CITY INLET, 1-2% SLOPE

# CB PRE_DEVELOPMENT	SUBAREA	ACREAGE	RUN	FALL	AVG.	VELOCITY	TIME (MINUTES)	TOTAL TIME	I	C	C*A	FLOW CFS	COMMENTS
	A1	10.00	750	17	2.27%	2.43		28.0	1.48	0.4	4.000	**5.92**	
	A2	10.00	750	19	2.53%	2.57		28.0	1.48	0.4	4.000	**5.92**	
	A3	10.00	1000	23	2.30%	2.45		28.0	1.48	0.4	4.000	**5.92**	**UNDEVELOPED**
	A4	10.00	1000	23	2.30%	2.45		28.0	1.48	0.4	4.000	**5.92**	**Alternative Rational Method**
+ Travel Time to A5	**A5**	6.75	620	11.5	1.85%	2.20	4.7	32.7	1.36	0.4	2.700	**3.67**	**"Type A" Soils**
+ Travel Time to A6	**A6**	8.70	1000	11	1.10%	1.69	9.8	37.8	1.25	0.4	3.480	**4.35**	
+ Travel Time to A7	**A7**	3.90	750	7	0.93%		4.0	32.0	1.38	0.4	1.560	**2.15**	
TO CP1, ∑A	**Tc*1.07 per KC**	**59.35**						**40.0**	**1.22**	**0.4**	**23.740**	**28.96**	**A Areas, Pre-Development Flow**
	B1	40.00	1450	29	2.00%			36.0	1.27	0.4	16.000	**20.32**	**Area B1 to CP2**
CP1 '+ Travel Time to CP2, [∑A,B]	**∑A1-A7**	**59.35**	1343	24	1.79%	2.16	10.4	48.2	1.10	0.4	23.740	**26.11**	
TO CP2, ∑CP2	**Tc*1.07 per KC**	**99.35**						**52.0**	**1.00**	**0.4**	**39.740**	**39.74**	**Flow to CP2, to N. Area**
	C1	8.75	1000	20.5	2.05%	2.31		28.0	1.48	0.4	3.500	**5.18**	
+ Travel Time to C2	**C2**	4.80	750	9	1.20%	1.77	7.1	35.1	1.27	0.4	1.920	**2.44**	**C Areas - Limited Contribution**
+ Travel Time to C3	**C3**	19.00	1450	27	1.86%	2.20	11.0	46.1	1.13	0.4	7.600	**8.59**	
∑@CP3		**32.55**						**46.1**	**1.13**	**0.4**	**13.020**	**14.71**	**Runoff Not Included in Analysis**
From CP2 to CP4 (Across Valley)	**(2.3-ft/s)**	**99.35**	500				3.6	51.8	1.07	0.4	39.740	**42.52**	
N1 to CP4	**N1 (N. Area1)**	10.00	1000	14	1.40%	1.00		28.0	1.48	0.4	4.000	**5.92**	
∑CP4	**Tc*1.07 per KC**	**109.35**						**55.5**	**0.99**	**0.4**	**43.740**	**43.30**	**Flow to CP4**
												5.92	**Subtract Area N1 (not project)**
												37.38	**From Undevel. Project**
CP4 to CP5 (from Undevel Project)	**(2.3-ft/s)**	**99.35**	**900**				6.5	**62.0**	**0.97**	**0.4**	**39.740**	**37.38**	**UNDEVELOPED**
	N2 (N. Area2)	**10.00**	**900**	**11**	**1.22%**			**58.3**	**0.99**	**0.4**	**4.000**	**3.94**	
∑CP5, @CITY_RESIDENTIAL	**Tc*1.07 per KC**	**150.00**	**1900**					**62.0**	**0.97**	**0.4**	**60.000**	**37.38**	**To Res/Developed Area**
												3.94	**Subtract Area N2 (not project)**
												33.44	**From Undevel. Project**
Runoff through Developed Area	Travel to City Inlet		**1400**				8.0	**66.8**					
	Travel to Inlet @S. Green	**99.35**	**500**		**1.00%**	2.00	4.2	**71.0**	**0.89**	**0.4**	**39.740**	**35.17**	**From Undevel. Project**
	S Robinson	**7.30**	**1000**	**16.5**	**1.65%**			**71.0**	**0.89**	**0.85**	**6.205**	5.49	**Disregard Contributions from**
		10.00	**400**	**6.7**	**1.68%**			**71.0**	**0.89**	**0.85**	**8.500**	7.52	**Developed Areas en Route**
∑@INLET	**Tc*1.07 per KC**	**116.65**	**1900**					**76.0**	**0.86**	**0.4**	**46.660**	**40.13**	**To Drain Inlet**
												13.01	**Subtract Developed Area Runoff**
												27.11	**Peak Q to City Inlet from Devel**

RATIONAL METHOD DRAINAGE STUDY

DATE: **7/22/2019** **JOB NO.** 18/-146 TR 7366

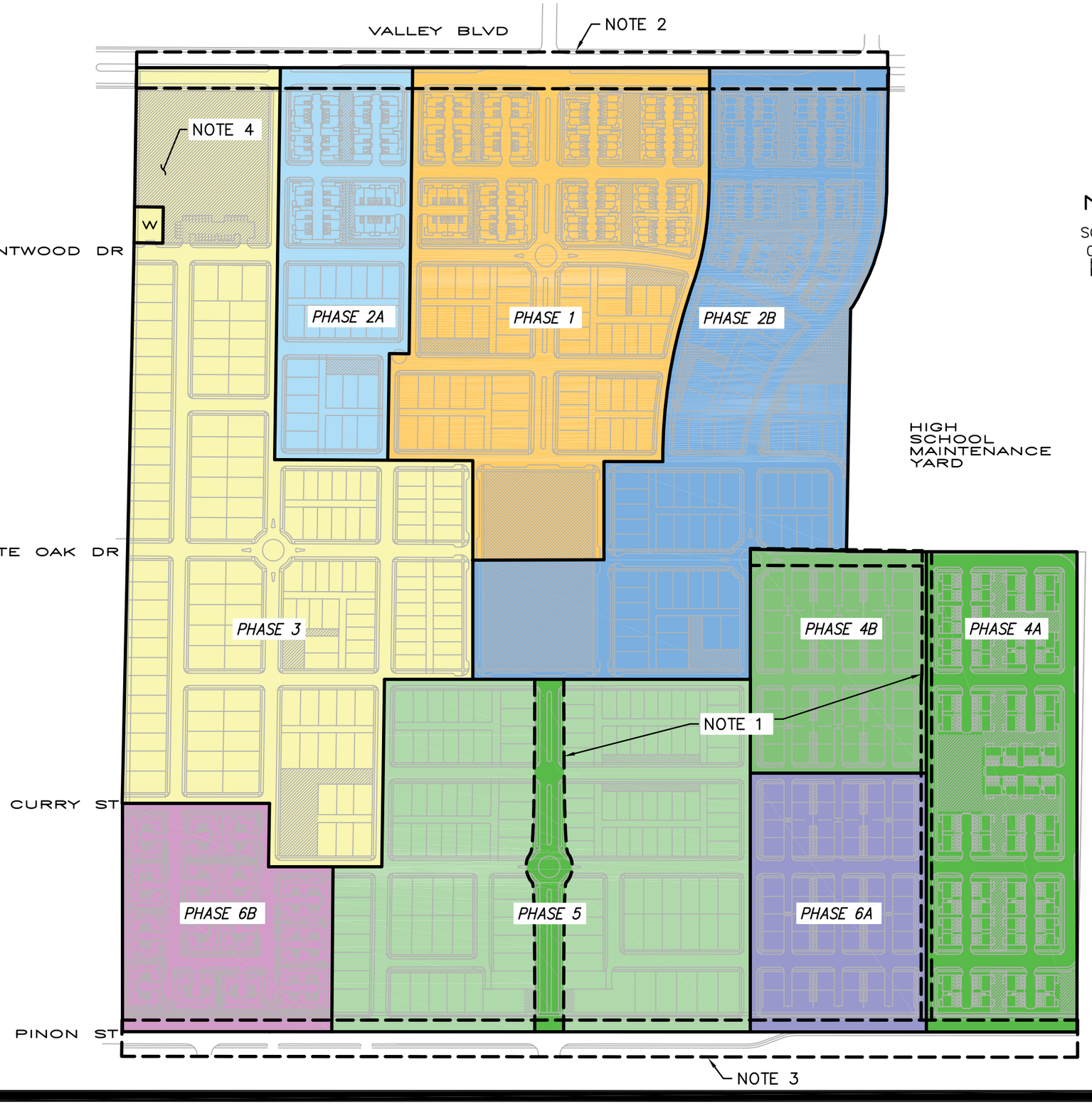
FREQ.: 10-YEAR SURFACE FLOWS, FROM UNDEVELOPED AREA TO CITY DRAIN INLET

PRE-DEVELOPMENT FLOW TO CITY INLET, 1-2% SLOPE

# CB PRE_DEVELOPMENT	SUBAREA	ACREAGE	RUN	FALL	AVG.	VELOCITY	TIME (MINUTES)	TOTAL TIME	I	C	C*A	FLOW CFS	COMMENTS
	A1	10.00	750	17	2.27%	2.43		28.0	1.27	0.4	4.000	**5.08**	
	A2	10.00	750	19	2.53%	2.57		28.0	1.27	0.4	4.000	**5.08**	
	A3	10.00	1000	23	2.30%	2.45		28.0	1.27	0.4	4.000	**5.08**	**UNDEVELOPED**
	A4	10.00	1000	23	2.30%	2.45		28.0	1.27	0.4	4.000	**5.08**	**Alternative Rational Method**
+ Travel Time to A5	**A5**	6.75	620	11.5	1.85%	2.20	4.7	32.7	0.00	0.4	2.700	**0.00**	**"Type A" Soils**
+ Travel Time to A6	**A6**	8.70	1000	11	1.10%	1.69	9.8	37.8	1.06	0.4	3.480	**3.69**	
+ Travel Time to A7	**A7**	3.90	750	7	0.93%		4.0	32.0	1.18	0.4	1.560	**1.84**	
TO CP1, ∑A	**Tc*1.14 per KC**	**59.35**						**43.0**	**1.02**	**0.4**	**23.740**	**24.21**	**A Areas, Pre-Development Flow**
	B1	40.00	1450	29	2.00%			36.0	1.08	0.4	16.000	**17.28**	**Area B1 to CP2**
CP1 '+ Travel Time to CP2, [∑A,B]	**∑A1-A7**	**59.35**	1343	24	1.79%	2.16	10.4	48.2	0.93	0.4	23.740	**22.08**	
TO CP2, ∑CP2	**Tc*1.14 per KC**	**99.35**						**55.0**	**0.89**	**0.4**	**39.740**	**35.41**	**Flow to CP2, to N. Area**
	C1	8.75	1000	20.5	2.05%	2.31		28.0	1.27	0.4	3.500	**4.45**	
+ Travel Time to C2	**C2**	4.80	750	9	1.20%	1.77	7.1	35.1	0.00	0.4	1.920	**0.00**	**C Areas - Limited Contribution**
+ Travel Time to C3	**C3**	19.00	1450	27	1.86%	2.20	11.0	46.1	0.95	0.4	7.600	**7.22**	
∑@CP3		**32.55**						**46.1**	**0.95**	**0.4**	**13.020**	**12.37**	**Runoff Not Included in Analysis**
From CP2 to CP4 (Across Valley)	**(2.3-ft/s)**	**99.35**	500				3.6	51.8	0.90	0.4	39.740	**35.77**	
N1 to CP4	**N1 (N. Area1)**	10.00	1000	14	1.40%	1.00		28.0	1.27	0.4	4.000	**5.08**	
∑CP4		**109.35**						**60.0**	**0.84**	**0.4**	**43.740**	**36.74**	**Flow to CP4**
												5.08	**Subtract Area N1 (not project)**
												31.66	**From Undevel. Project**
CP4 to CP5 (from Undevel Project)	**(2.3-ft/s)**	**99.35**	**900**				6.5	**62.0**	**0.81**	**0.4**	**39.740**	**32.19**	**UNDEVELOPED**
	N2 (N. Area2)	**10.00**	**900**	**11**	**1.22%**			**58.3**	**0.88**	**0.4**	**4.000**	**3.52**	
∑CP5, @CITY_RESIDENTIAL	**Tc*1.14 per KC**	**109.35**	**1900**					**66.5**	**0.79**	**0.4**	**43.740**	**34.55**	**To Res/Developed Area**
												3.52	**Subtract Area N2 (not project)**
												31.03	**From Undevel. Project**
Runoff through Developed Area	Travel to City Inlet		**1400**				8.0	**66.8**					
	Travel to Inlet @S. Green	**99.35**	**500**		**1.00%**	2.00	4.2	**71.0**	**0.76**	**0.4**	**39.740**	**30.20**	**From Undevel. Project**
	S Robinson	**7.30**	**1000**	**16.5**	**1.65%**			**71.0**	**0.76**	**0.85**	**6.205**	4.72	**Disregard Contributions from**
		10.00	**400**	**6.7**	**1.68%**			**71.0**	**0.76**	**0.85**	**8.500**	6.46	**Developed Areas en Route**
∑@INLET	**Tc*1.14 per KC**	**116.65**	**1400**					**81.0**	**0.76**	**0.4**	**46.660**	**35.46**	**To Drain Inlet**
												11.18	**Subtract Developed Area Runoff**
												24.29	**Peak Q to City Inlet from Devel**

APPENDIX B
PHASING PLAN
USDA WEBSOILSURVEY
KC HYDROLOGY SECTION C WORKSHEETS SCS CURVE NUMBER, 24-HR RAINFALL-RUNOFF

PHASING PLAN
TENTATIVE
TRACT NO. 7366



NORTH

SCALE: 1" = 300'

0 150 300

PHASE 1	–	144	DU
PHASE 2A	–	61	DU
PHASE 2B	–	137	DU
PHASE 3	–	142	DU
PHASE 4A	–	204	DU
PHASE 4B	–	60	DU
PHASE 5	–	126	DU
PHASE 6A	–	60	DU
PHASE 6B	–	66	DU

TOTAL – 1000 DU

132 ACRES = 7.6 DU/AC

NOTES

1. ROAD WILL BE CONSTRUCTED WITH PHASE 4A OR 4B, WHICHEVER IS CONSTRUCTED FIRST.
2. VALLEY WILL BE CONSTRUCTED WITH PHASE 1
3. PINION WILL BE CONSTRUCTED WITH PHASE 4.
4. CONSTRUCT RETENTION FACILITY WITH PHASE 1; CONSTRUCT PARK WITH PHASE 3.

PHASES

- PHASE 1
- PHASE 2A
- PHASE 2B
- PHASE 3
- PHASE 4A
- PHASE 4B
- PHASE 5
- PHASE 6A
- PHASE 6B

DEWALT Corporation
1930 22nD STREET BAKERSFIELD, CA 93301
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June 13, 2019

Tr7366 Phase Sales Map.dwg

Search

Map Unit Legend

Kern County, California, Southeastern Part (CA670)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Kern County, California, Southeastern Part (CA670)			
140	Havala sandy loam, 0 to 2 percent slopes	1.5	0.5%
174	Steuber sandy loam, 0 to 2 percent slopes	293.5	92.0%
175	Steuber sandy loam, 2 to 5 percent slopes	24.2	7.6%
Totals for Area of Interest		**319.2**	**100.0%**

Soil Map

Map Unit Description

Printable Version

Report — Map Unit Description

Kern County, California, Southeastern Part

174—Steuber sandy loam, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: hkpt
Elevation: 1,500 to 4,500 feet
Mean annual precipitation: 9 to 14 inches
Mean annual air temperature: 57 to 64 degrees F
Frost-free period: 150 to 225 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Steuber and similar soils: 85 percent
Minor components: 10 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Steuber

Setting

Landform: Flood plains, alluvial fans
Landform position (two-dimensional): Toeslope, backslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 12 inches: sandy loam
H2 - 12 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): 2s
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: A
Ecological site: COARSE LOAMY FAN (R018XE032CA)
Hydric soil rating: No

TABLE C.1. F_m (in/hr) VALUES FOR TYPICAL COVER TYPES

		SOIL GROUP			
	a_p (1)	A	B	C	D
NATURAL:					
Barren	1	0.41	0.27	0.18	0.14
Row Crops (good)	1	0.59	0.41	0.29	0.22
Grass (fair)	1	0.82	0.56	0.4	0.31
Orchards (fair)	1	0.88	0.62	0.43	0.34
Woodland (fair)	1	0.95	0.69	0.5	0.4
URBAN:					
Residential (1 DU/AC)	0.8	0.76	0.56	0.39	0.3
Residential (2 DU/AC)	0.7	0.65	0.49	0.34	0.27
Residential (4 DU/AC)	0.6	0.56	0.42	0.29	0.23
Residential (10 DU/AC)	0.4	0.37	0.28	0.19	0.15
Condominium	0.35	0.32	0.24	0.17	0.13
Mobilehome Park	0.25	0.23	0.17	0.12	0.1
Apartments	0.2	0.19	0.14	0.1	0.08
Commercial/Industrial	0.1	0.09	0.07	0.05	0.04

NOTES:

(1) Recommended a_p values from Figure C-3

(2) AMC II assumed for all F_m values

(3) CN values obtained from Figure C-2

(4) DU/AC = dwelling unit per acre

Residential Landscaping (Lawn, Shrubs, etc.) - The pervious portions of commercial establishments, single and multiple family dwellings, trailer parks and schools where the predominant land cover is lawn, shrubbery and trees.

Row Crops - Lettuce, tomatoes, beets, tulips or any field crop planted in rows far enough apart that most of the soil surface is exposed to rainfall impact throughout the growing season. At plowing, planting and harvest times it is equivalent to fallow.

Small Grain - Wheat, oats, barley, flax, etc. planted in rows close enough that the soil surface is not exposed except during planting and shortly thereafter.

Legumes - Alfalfa, sweetclover, timothy, etc. and combinations are either planted in close rows or broadcast.

Fallow - Fallow land is land plowed but not yet seeded or tilled.

Woodland - grass - Areas with an open cover of broadleaf or coniferous trees usually live oak and pines, with the intervening ground space occupied by annual grasses or weeds. The trees may occur singly or in small clumps. Canopy density, the amount of ground surface shaded at high noon, is from 20 to 50 percent.

Woodland - Areas on which coniferous or broadleaf trees predominate. The canopy density is at least 50 percent. Open areas may have a cover of annual or perennial grasses or of brush. Herbaceous plant cover under the trees is usually sparse because of leaf or needle litter accumulation.

Chaparral - Land on which the principal vegetation consists of evergreen shrubs with broad, hard, stiff leaves such as manzonita, ceanothus and scrub oak. The brush cover is usually dense or moderately dense. Diffusely branched evergreen shrubs with fine needle-like leaves, such as chamise and redchank, with dense high growth are also included in this soil cover.

Annual Grass - Land on which the principal vegetation consists of annual grasses and weeds such as annual bromes, wild barley, soft chess, ryegrass and filaree.

Irrigated Pasture - Irrigated land planted to perennial grasses and legumes for production of forage and which is cultivated only to establish or renew the stand of plants. Dry land pasture is considered as annual grass.

Meadow - Land areas with seasonally high water table, locally called cienegas. Principal vegetation consists of sod-forming grasses interspersed with other plants.

Orchard (Deciduous) - Land planted to such deciduous trees as apples, apricots, pears, walnuts, and almonds.

Orchard (Evergreen) - Land planted to evergreen trees which include citrus and avocados and coniferous plantings.

Turf - Golf courses, parks and similar lands where the predominant cover is irrigated mowed close-grown turf grass. Parks in which trees are dense may be classified as woodland.

KERN COUNTY

HYDROLOGY MANUAL

SCS
COVER TYPE
DESCRIPTIONS

FIGURE C-1

Curve[1] Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -					
Barren (Rockland, eroded and graded land)		77	86	91	94
Chaparral, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparral, Narrowleaf (Chamise and Redskank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadows or Cienagas (Areas with seasonally high water table, principal vegatation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	71	78
Open Brush (Soft wood shrubs-buckwheat,sage,etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (4) (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
URBAN COVERS -					
Residential or Commercial Landscaping (Lawns, shrubs, etc.)	Good	39	61	74	80
Turf (Irrigated and mowed grass)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80

KERN COUNTY
Hydrology Manual

CURVE NUMBERS FOR PERVIOUS AREAS

Curve[1] Numbers of Hydrologic Soil-Cover Complexes For Pervious Areas-AMC II

Cover Type (3)	Quality of Cover (2)	Soil Group A	B	C	D
AGRICULTURAL COVERS -					
Fallow (Bare Soil)		77	86	91	94
Close Seeded (alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Evergreen (Citrus, avacodos, etc.)	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Pasture (Grassland or range, continuos forage for grazing)	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Row Crops (Straight row, non-contoured)	Poor	72	81	88	91
	Good	67	78	85	89
Small Grain (Straight row, non-contoured)	Poor	65	76	84	88
	Good	63	75	83	87

Notes:

1. Average runoff condition, Ia = 0.2(S)

2. Poor: Heavily grazed, regularly burned areas, or areas of high burn potential. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.

   Fair: Moderate cover with 50 percent to 75 percent of the ground surface protected. In wooded areas the woods are grazed but not burned, and some forest litter covers the soil.

   Good: Heavy or dense cover with more than 75 percent of the ground surface protected. In wooded areas the woods are protected from grazing, litter and brush adequately cover soil.

3. See Figure C-1 for definition of cover types.

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Hydrology Manual

CURVE NUMBERS FOR PERVIOUS AREAS

ACTUAL IMPERVIOUS COVER

Land Use	Range-Percent	Recommended Value For Average Conditions-Percent (1)
Natural or Agriculture	0 - 0	0
Public Park	10 - 25	15
School	30 - 50	40
Single Family Residential: (2)		
2.5 acre lots	5 - 15	10
1 acre lots	10 - 25	20
2-3 DU/acre	20 - 40	30
3-5 DU/acre	30 - 50	40
5-8 DU/acre	35 - 55	50
8-10 DU/acre	50 - 70	60
More than 10 DU/acre	65 - 90	80
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Parks	60 - 85	75
Commercial, Downtown Business or Industrial	80 - 100	90

Notes:

1) Recommended values are based on average conditions which may not apply to a particular study. The percentage impervious may vary greatly even on comparable study sized lots due to differences in in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area shall always be made, and a review of aerial photos, where available, may assist in estimating the percentage of impervious cover in developed areas.

2) For typical equestrian subdivisions increase impervious area 5% over the values recommended in the table above.

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ACTUAL IMPERVIOUS COVER FOR DEVELOPED AREAS

FIGURE C-3

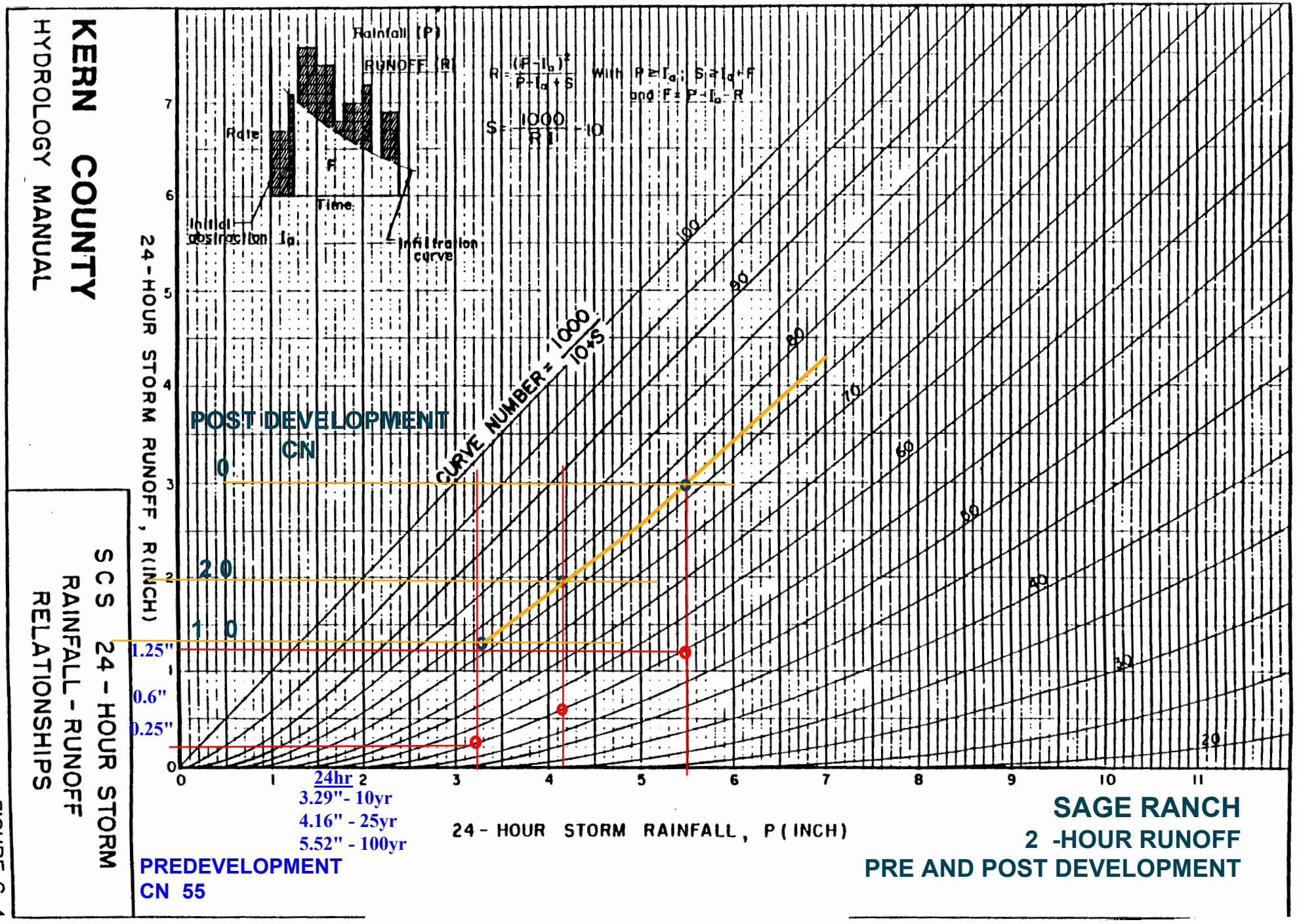
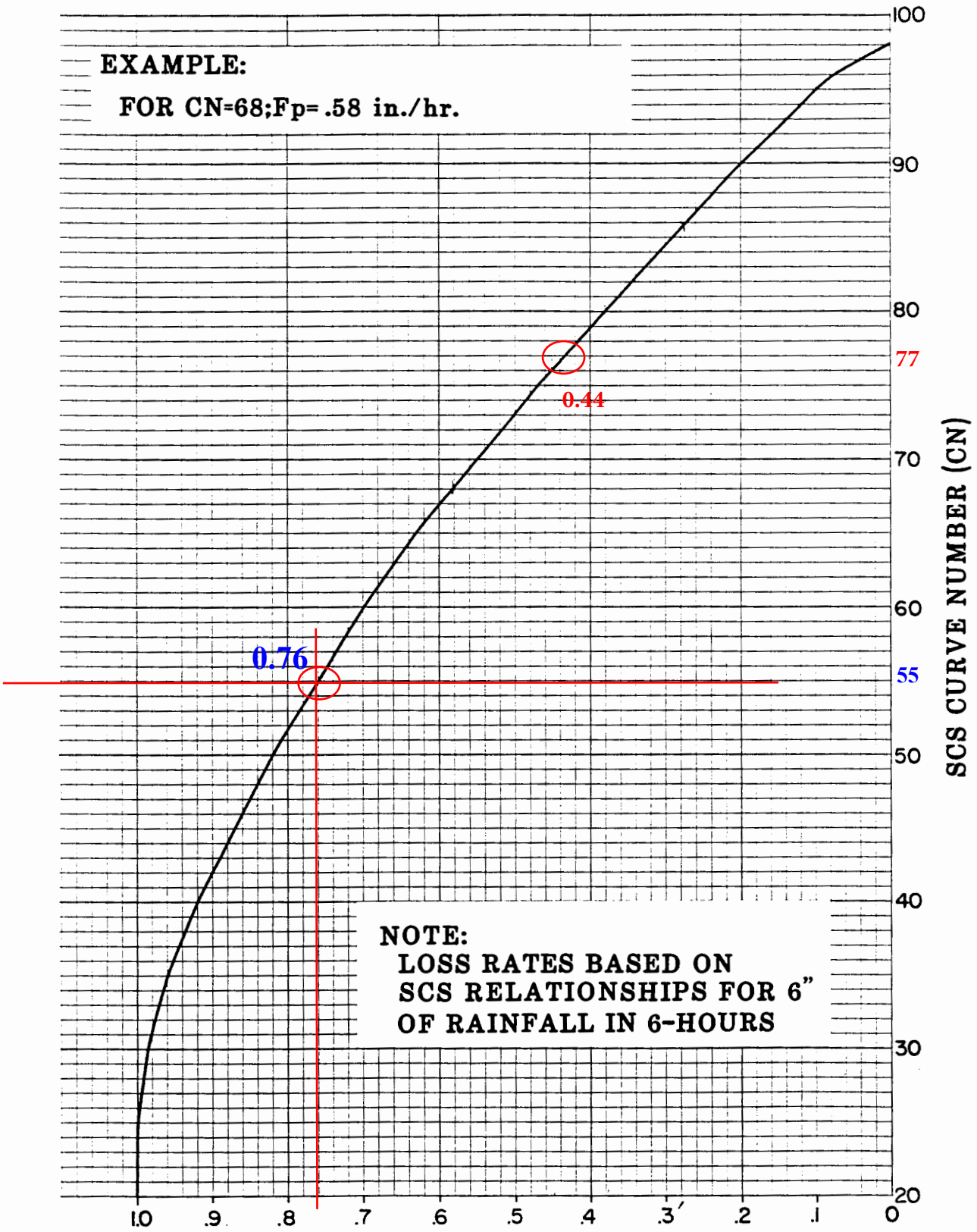

KERN COUNTY
HYDROLOGY MANUAL
SCS 24-HOUR STORM
RAINFALL-RUNOFF
RELATIONSHIPS
24-HOUR STORM RUNOFF, R(INCH)
24-HOUR STORM RAINFALL, P(INCH)
Rainfall (P)
RUNOFF (R)
Rate
F
Time
Initial abstraction Ia
Infiltration curve
$R = \frac{(P-I_a)^2}{P+I_a+S}$ With $P \geq I_a$; $S \geq I_a+F$
and $F = P-I_a-R$
$S = \frac{1000}{CN} - 10$
CURVE NUMBER = $\frac{1000}{10+S}$
POST DEVELOPMENT
CN
0
2 0
1 0
1.25"
0.6"
0.25"
24hr
3.29"- 10yr
4.16" - 25yr
5.52" - 100yr
PREDEVELOPMENT
CN 55
SAGE RANCH
2 -HOUR RUNOFF
PRE AND POST DEVELOPMENT

FIGURE C-4



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INFILTRATION RATE FOR PERVIOUS AREAS VERSUS SCS CURVE NUMBERS

FIGURE C-5

APPENDIX C
DETENTION BASIN SIZING
100-YR, 25-YR POST-DEVELOPMENT STORM EVENT

TABLE F.1

SAGE RANCH DEVELOPMENT
DETENTION BASIN SIZING

100-Year Storm Event - Storage w/ 10-yr (24 cfs) Outflow

Inflow_cfs	Avg Inflow	(I1+I2)*t/2 (AF)	S-O*t/2	S+O*t/2	Outflow (cfs)	Basin Storage (AF)
0					0.00	0.00
	3.02	0.021	0.00	0.02		
6.04					0.00	0.02
	6.65	0.046	0.02	0.07		
7.25					0.00	0.07
	7.88	0.054	0.07	0.12		
8.51					0.00	0.12
	9.12	0.063	0.12	0.18		
9.72					0.00	0.18
	10.30	0.071	0.18	0.25		
10.87					0.00	0.25
	11.48	0.079	0.25	0.33		
12.08					10.00	0.30
	12.56	0.086	0.26	0.35		
13.03					24.00	0.27
	13.60	0.094	0.19	0.28		
14.16					24.00	0.20
	14.88	0.102	0.11	0.22		
15.59					24.00	0.13
	16.36	0.113	0.05	0.16		
17.12					24.00	0.08
	18.03	0.124	0.00	0.12		
18.93					24.00	0.04
	20.04	0.138	6.25	0.10		
21.15					24.00	0.01
	22.37	0.154	6.85	0.08		
23.59					24.00	0.00
	25.18	0.173	7.45	0.09		
26.77					24.00	0.01
	29.08	0.200	8.05	0.13		
31.38					24.00	0.04
	34.53	0.238	8.65	0.20		
37.67					24.00	0.12
	43.49	0.300	0.00	0.33		
49.31					24.00	0.25
	56.88	0.392	0.00	0.56		
64.44					24.00	0.48
	72.60	0.500	0.00	0.90		
80.75					24.00	0.81
	92.07	0.634	0.00	1.36		
103.38					24.00	1.28
	113.86	0.784	0.00	1.98		
124.33					24.00	1.90
	131.69	0.907	0.00	2.72		
139.05					24.00	2.64
	143.97	0.992	0.00	3.55		
148.89					24.00	3.47
	154.92	1.067	0.00	4.45		
160.95					24.00	4.37
	165.22	1.138	0.00	5.42		
169.48					24.00	5.34
	166.98	1.150	0.00	6.41		
164.47					24.00	6.33
	160.33	1.104	0.00	7.35		
156.18					24.00	7.27
	149.69	1.031	0.00	8.21		
143.19					24.00	8.13
	130.64	0.900	0.00	8.95		
118.09					24.00	8.87
	59.05	0.407	0.00	0.41		
99.95					24.00	9.45
	49.98	0.344	0.00	0.34		
84.79					24.00	9.92
	42.40	0.292	0.00	0.29		
67.34					24.00	10.28
	33.67	0.232	0.00	0.23		
55.05					24.00	10.54
	27.53	0.190	0.00	0.19		
46.42					24.00	10.72
	23.21	0.160	0.00	0.16		
36.96					24.00	10.84
	18.48	0.127	0.00	0.13		
28.9					24.00	10.90
	14.45	0.100	0.00	0.10		
22.72					24.00	**10.92**
	11.36	0.078	0.00	0.08		
18.13					24.00	10.89
	9.07	0.062	0.00	0.06		
12.71					24.00	10.83
	6.36	0.044	0.00	0.04		
10.3					24.00	10.75
	5.15	0.035	0.00	0.04		
8.23					24.00	10.65
	4.12	0.028	0.00	0.03		
7.6					24.00	10.53
	3.80	0.026	0.00	0.03		

TABLE F.1

SAGE RANCH DEVELOPMENT
DETENTION BASIN SIZING

25-Year Storm Event - Storage w/ 10-year (24 cfs) Outflow

Inflow_cfs	Avg Inflow	(I1+I2)*t/2 (AF)	S-O*t/2	S+O*t/2	Outflow (cfs)	Basin Storage (AF)
0					0.00	0.00
	1.75	0.012	0.00	0.01		
3.5					0.00	0.01
	4.10	0.028	0.01	0.04		
4.7					10.00	0.01
	5.34	0.037	-0.03	0.01		
5.97					0.00	0.01
	6.77	0.047	0.01	0.05		
7.56					11.00	0.02
	8.40	0.058	-0.02	0.04		
9.24					11.00	0.00
	10.02	0.069	-0.04	0.03		
10.8					0.00	0.03
	11.50	0.079	0.03	0.11		
12.19					15.00	0.06
	12.70	0.087	0.01	0.09		
13.2					15.00	0.04
	13.60	0.094	-0.01	0.08		
14					15.00	0.03
	14.38	0.099	-0.02	0.08		
14.75					15.00	0.03
	15.09	0.104	-0.02	0.08		
15.43					0.00	0.08
	15.77	0.109	6.25	0.19		
16.11					0.00	0.19
	16.42	0.113	6.85	0.30		
16.72					24.00	0.22
	17.07	0.118	7.45	0.25		
17.41					24.00	0.17
	17.93	0.123	8.05	0.21		
18.44					24.00	0.13
	19.14	0.132	8.65	0.18		
19.84					24.00	0.10
	20.64	0.142	0.00	0.16		
21.43					24.00	0.07
	22.42	0.154	0.00	0.14		
23.4					24.00	0.06
	24.80	0.171	0.00	0.15		
26.19					24.00	0.07
	29.02	0.200	0.00	0.18		
31.85					24.00	0.10
	35.26	0.243	0.00	0.26		
38.67					24.00	0.18
	42.24	0.291	0.00	0.39		
45.8					24.00	0.31
	51.50	0.355	0.00	0.58		
57.19					24.00	0.49
	62.35	0.429	0.00	0.84		
67.51					24.00	0.76
	70.70	0.487	0.00	1.16		
73.88					24.00	1.08
	75.69	0.521	0.00	1.52		
77.5					24.00	1.44
	80.25	0.553	0.00	1.91		
83					24.00	1.82
	85.31	0.587	0.00	2.33		
87.61					24.00	2.25
	86.51	0.596	0.00	2.76		
85.4					24.00	2.68
	42.70	0.294	0.00	0.29		
81.6					24.00	3.09
	40.80	0.281	0.00	0.28		
75.23					24.00	3.46
	37.62	0.259	0.00	0.26		
61.9					24.00	3.77
	30.95	0.213	0.00	0.21		
53.22					24.00	4.00
	26.61	0.183	0.00	0.18		
45.86					24.00	4.17
	22.93	0.158	0.00	0.16		
36.9					24.00	4.29
	18.45	0.127	0.00	0.13		
31.02					24.00	4.36
	15.51	0.107	0.00	0.11		
26.7					24.00	4.40
	13.35	0.092	0.00	0.09		
21.53					24.00	**4.40**
	10.77	0.074	0.00	0.07		
17.52					24.00	4.37
	8.76	0.060	0.00	0.06		
17					24.00	4.32
	8.50	0.059	0.00	0.06		
17					24.00	4.27
	8.50	0.059	0.00	0.06		
17					24.00	4.22
	8.50	0.059	0.00	0.06		

TABLE F.1

SAGE RANCH DEVELOPMENT
DETENTION BASIN SIZING

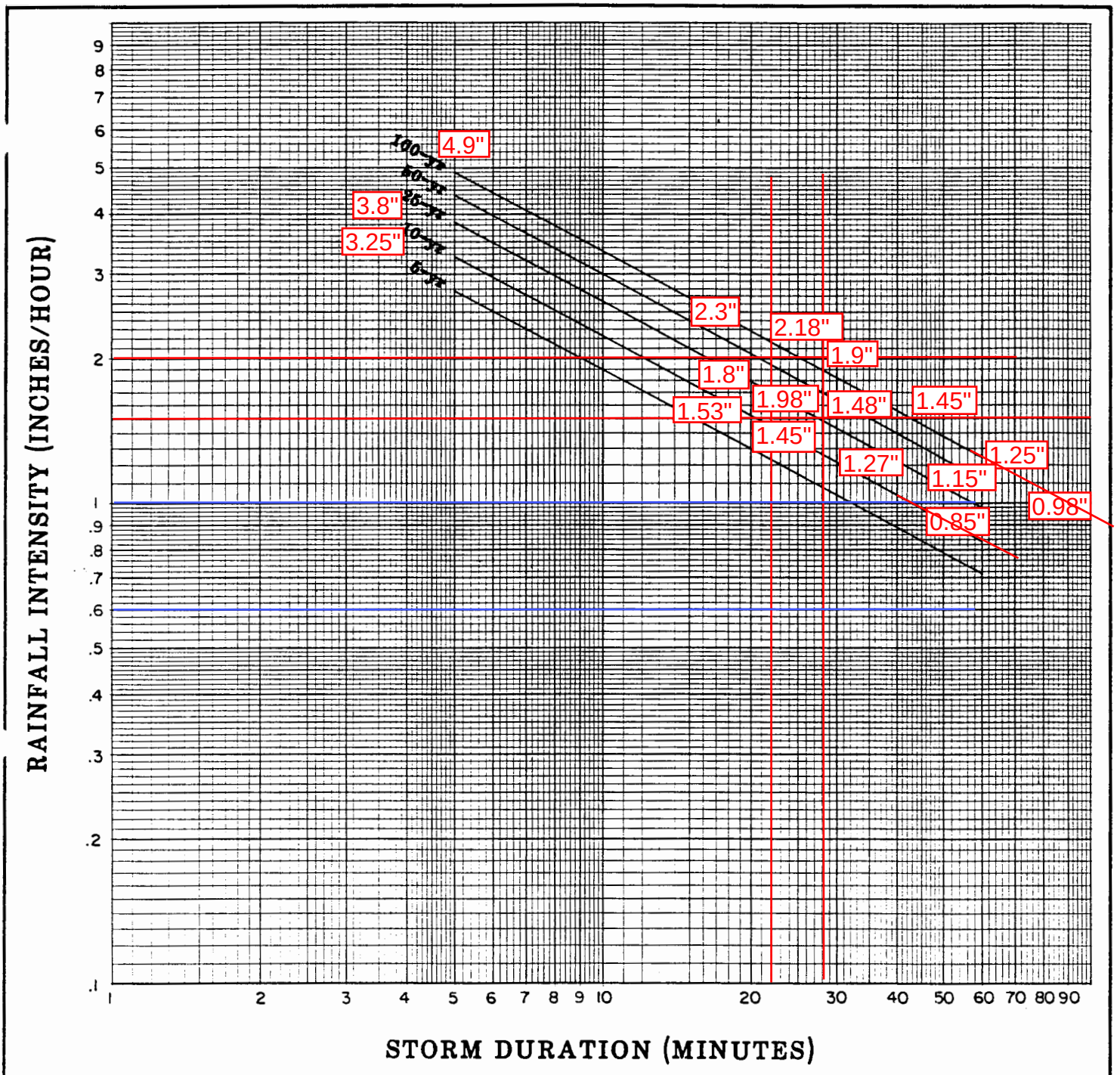
25-Year Storm Event - Storage, No Outflow

Inflow_cfs	Avg Inflow	(I1+I2)*t/2 (AF)	S-O*t/2	S+O*t/2	Outflow (cfs)	Basin Storage (AF)
0					0.00	0.00
	1.75	0.012	0.00	0.01		
3.5					0.00	0.01
	4.10	0.028	0.01	0.04		
4.7					0.00	0.04
	5.34	0.037	0.04	0.08		
5.97					0.00	0.08
	6.77	0.047	0.08	0.12		
7.56					0.00	0.12
	8.40	0.058	0.12	0.18		
9.24					0.00	0.18
	10.02	0.069	0.18	0.25		
10.8					0.00	0.25
	11.50	0.079	0.25	0.33		
12.19					0.00	0.33
	12.70	0.087	0.33	0.42		
13.2					0.00	0.42
	13.60	0.094	0.42	0.51		
14					0.00	0.51
	14.38	0.099	0.51	0.61		
14.75					0.00	0.61
	15.09	0.104	0.61	0.71		
15.43					0.00	0.71
	15.77	0.109	6.25	0.82		
16.11					0.00	0.82
	16.42	0.113	6.85	0.94		
16.72					0.00	0.94
	17.07	0.118	7.45	1.05		
17.41					0.00	1.05
	17.93	0.123	8.05	1.18		
18.44					0.00	1.18
	19.14	0.132	8.65	1.31		
19.84					0.00	1.31
	20.64	0.142	0.00	1.45		
21.43					0.00	1.45
	22.42	0.154	0.00	1.60		
23.4					0.00	1.60
	24.80	0.171	0.00	1.78		
26.19					0.00	1.78
	29.02	0.200	0.00	1.98		
31.85					0.00	1.98
	35.26	0.243	0.00	2.22		
38.67					0.00	2.22
	42.24	0.291	0.00	2.51		
45.8					0.00	2.51
	51.50	0.355	0.00	2.86		
57.19					0.00	2.86
	62.35	0.429	0.00	3.29		
67.51					0.00	3.29
	70.70	0.487	0.00	3.78		
73.88					0.00	3.78
	75.69	0.521	0.00	4.30		
77.5					0.00	4.30
	80.25	0.553	0.00	4.85		
83					0.00	4.85
	85.31	0.587	0.00	5.44		
87.61					0.00	5.44
	86.51	0.596	0.00	6.04		
85.4					0.00	6.04
	42.70	0.294	0.00	0.29		
81.6					0.00	6.61
	40.80	0.281	0.00	0.28		
75.23					0.00	7.15
	37.62	0.259	0.00	0.26		
61.9					0.00	7.62
	30.95	0.213	0.00	0.21		
53.22					0.00	8.02
	26.61	0.183	0.00	0.18		
45.86					0.00	8.36
	22.93	0.158	0.00	0.16		
36.9					0.00	8.65
	18.45	0.127	0.00	0.13		
31.02					0.00	8.88
	15.51	0.107	0.00	0.11		
26.7					0.00	9.08
	13.35	0.092	0.00	0.09		
21.53					0.00	9.25
	10.77	0.074	0.00	0.07		
17.52					0.00	9.38
	8.76	0.060	0.00	0.06		
17					0.00	9.50
	8.50	0.059	0.00	0.06		
17					0.00	9.62
	8.50	0.059	0.00	0.06		
17					0.00	**9.73***
	8.50	0.059	0.00	0.06		

***Peak 3hr Retention Volume, 25yr Storm; Calculated Retention Vol For 25yr/24hr Storm, is 17 acre-ft.**

APPENDIX D

KC HYDROLOGY MANUAL WORKSHEETS
IDF CHART
TIME OF CONCENTRATION NOMOGRAPHS
NOAA PRECIPITATION
100, 25, 10-YR AREA-AVG MASS RAINFALL
PLOT 100-YR HYDROGRAPH

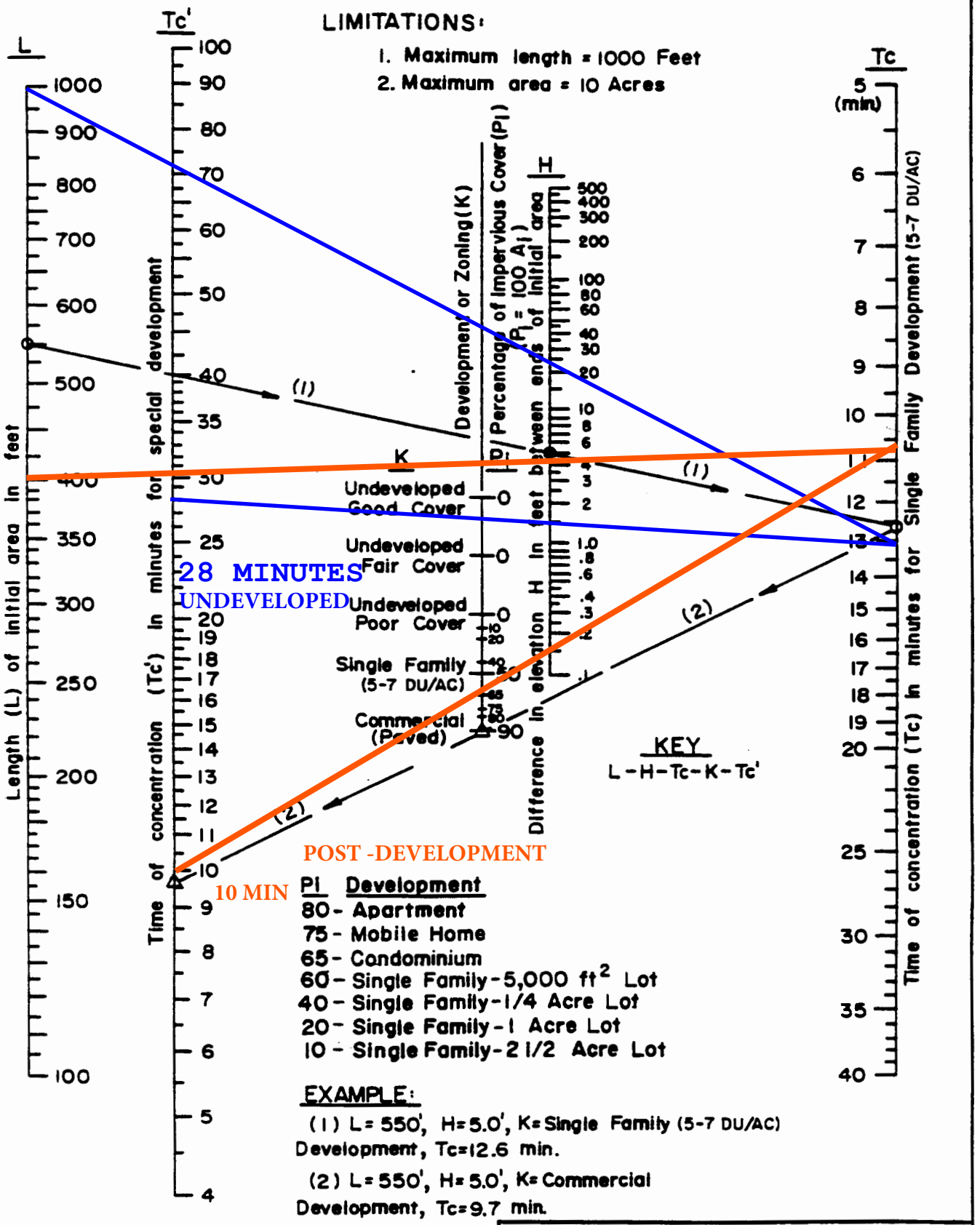


PROJECT LOCATION: Tehachapi

KERN COUNTY
Hydrology Manual

RAINFALL
INTENSITY-DURATION
FREQUENCY (IDF) CHART

SAGE RANCH



KERN COUNTY
HYDROLOGY MANUAL

TIME OF CONCENTRATION NOMOGRAPH FOR INITIAL SUBAREA

Figure D-1

NOAA Atlas 14, Volume 6, Version 2
Location name: Tehachapi, California, USA*
Latitude: 35.1322°, Longitude: -118.4491°
Elevation: 3969.57 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.102** (0.084-0.125)	**0.133** (0.109-0.164)	**0.182** (0.149-0.225)	**0.230** (0.187-0.286)	**0.308** (0.242-0.395)	**0.380** (0.293-0.499)	**0.481** (0.361-0.646)	**0.695** (0.508-0.960)	**1.17** (0.824-1.69)	**1.75** (1.19-2.61)
10-min	**0.146** (0.120-0.180)	**0.191** (0.157-0.235)	**0.261** (0.214-0.322)	**0.330** (0.268-0.409)	**0.441** (0.347-0.567)	**0.545** (0.420-0.715)	**0.689** (0.518-0.926)	**0.996** (0.728-1.38)	**1.68** (1.18-2.42)	**2.51** (1.70-3.74)
15-min	**0.177** (0.146-0.217)	**0.231** (0.190-0.284)	**0.316** (0.259-0.390)	**0.399** (0.324-0.495)	**0.534** (0.420-0.685)	**0.659** (0.508-0.864)	**0.833** (0.627-1.12)	**1.20** (0.881-1.66)	**2.04** (1.43-2.93)	**3.03** (2.06-4.52)
30-min	**0.233** (0.192-0.287)	**0.304** (0.250-0.374)	**0.417** (0.342-0.514)	**0.525** (0.427-0.653)	**0.704** (0.553-0.904)	**0.869** (0.670-1.14)	**1.10** (0.826-1.48)	**1.59** (1.16-2.19)	**2.68** (1.88-3.86)	**4.00** (2.71-5.95)
60-min	**0.313** (0.258-0.385)	**0.408** (0.336-0.502)	**0.559** (0.458-0.689)	**0.705** (0.573-0.876)	**0.944** (0.743-1.21)	**1.17** (0.899-1.53)	**1.48** (1.11-1.98)	**2.13** (1.56-2.94)	**3.60** (2.53-5.18)	**5.37** (3.64-7.99)
2-hr	**0.459** (0.378-0.564)	**0.578** (0.475-0.710)	**0.755** (0.618-0.930)	**0.916** (0.745-1.14)	**1.16** (0.916-1.50)	**1.38** (1.06-1.81)	**1.63** (1.22-2.18)	**2.15** (1.57-2.97)	**3.64** (2.55-5.24)	**5.42** (3.68-8.07)
3-hr	**0.563** (0.463-0.691)	**0.703** (0.578-0.864)	**0.906** (0.743-1.12)	**1.09** (0.884-1.35)	**1.36** (1.07-1.74)	**1.59** (1.22-2.08)	**1.84** (1.38-2.47)	**2.17** (1.59-3.00)	**3.67** (2.58-5.29)	**5.47** (3.71-8.15)
6-hr	**0.777** (0.640-0.954)	**0.979** (0.805-1.20)	**1.26** (1.03-1.55)	**1.50** (1.22-1.86)	**1.84** (1.45-2.36)	**2.11** (1.63-2.77)	**2.41** (1.81-3.23)	**2.72** (1.99-3.76)	**3.71** (2.60-5.34)	**5.53** (3.75-8.23)
12-hr	**0.984** (0.810-1.21)	**1.32** (1.09-1.62)	**1.77** (1.45-2.18)	**2.14** (1.74-2.66)	**2.66** (2.09-3.41)	**3.06** (2.36-4.01)	**3.47** (2.61-4.66)	**3.91** (2.86-5.39)	**4.50** (3.16-6.48)	**5.58** (3.79-8.32)
24-hr	**1.29** (1.15-1.49)	**1.88** (1.67-2.16)	**2.65** (2.35-3.06)	**3.29** (2.89-3.83)	**4.16** (3.53-5.00)	**4.83** (4.01-5.94)	**5.52** (4.47-6.95)	**6.23** (4.90-8.08)	**7.20** (5.43-9.74)	**7.95** (5.79-11.1)
2-day	**1.53** (1.36-1.76)	**2.26** (2.00-2.60)	**3.23** (2.86-3.73)	**4.04** (3.54-4.70)	**5.16** (4.38-6.21)	**6.04** (5.01-7.43)	**6.95** (5.63-8.77)	**7.91** (6.22-10.3)	**9.24** (6.97-12.5)	**10.3** (7.49-14.4)
3-day	**1.66** (1.48-1.91)	**2.45** (2.17-2.82)	**3.51** (3.10-4.05)	**4.40** (3.86-5.12)	**5.65** (4.79-6.80)	**6.64** (5.51-8.16)	**7.67** (6.21-9.67)	**8.76** (6.89-11.4)	**10.3** (7.75-13.9)	**11.5** (8.38-16.1)
4-day	**1.81** (1.61-2.08)	**2.66** (2.36-3.06)	**3.81** (3.37-4.40)	**4.78** (4.19-5.56)	**6.14** (5.20-7.39)	**7.22** (5.99-8.87)	**8.34** (6.75-10.5)	**9.53** (7.50-12.4)	**11.2** (8.44-15.2)	**12.5** (9.12-17.6)
7-day	**2.09** (1.85-2.40)	**3.04** (2.70-3.50)	**4.33** (3.83-4.99)	**5.40** (4.74-6.28)	**6.89** (5.84-8.29)	**8.06** (6.69-9.91)	**9.28** (7.51-11.7)	**10.6** (8.31-13.7)	**12.3** (9.30-16.7)	**13.7** (10.0-19.3)
10-day	**2.22** (1.97-2.55)	**3.22** (2.85-3.70)	**4.56** (4.03-5.26)	**5.67** (4.97-6.59)	**7.21** (6.11-8.68)	**8.42** (6.99-10.4)	**9.67** (7.82-12.2)	**11.0** (8.63-14.2)	**12.8** (9.63-17.3)	**14.2** (10.3-19.9)
20-day	**2.70** (2.40-3.10)	**3.92** (3.48-4.51)	**5.56** (4.92-6.42)	**6.93** (6.08-8.07)	**8.85** (7.50-10.6)	**10.4** (8.59-12.7)	**11.9** (9.64-15.0)	**13.6** (10.7-17.6)	**15.8** (11.9-21.4)	**17.6** (12.8-24.7)
30-day	**3.22** (2.86-3.69)	**4.66** (4.13-5.36)	**6.63** (5.86-7.65)	**8.29** (7.27-9.64)	**10.6** (9.01-12.8)	**12.5** (10.4-15.4)	**14.4** (11.7-18.2)	**16.5** (13.0-21.4)	**19.4** (14.6-26.3)	**21.8** (15.8-30.5)
45-day	**3.88** (3.45-4.46)	**5.59** (4.95-6.42)	**7.94** (7.03-9.16)	**9.96** (8.74-11.6)	**12.9** (10.9-15.5)	**15.2** (12.6-18.7)	**17.7** (14.3-22.3)	**20.4** (16.0-26.4)	**24.2** (18.3-32.8)	**27.3** (19.9-38.3)
60-day	**4.43** (3.94-5.09)	**6.30** (5.59-7.24)	**8.93** (7.89-10.3)	**11.2** (9.83-13.0)	**14.5** (12.3-17.5)	**17.3** (14.3-21.2)	**20.2** (16.4-25.5)	**23.4** (18.4-30.4)	**28.1** (21.2-38.0)	**32.0** (23.3-44.8)

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

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

Please refer to NOAA Atlas 14 document for more information.

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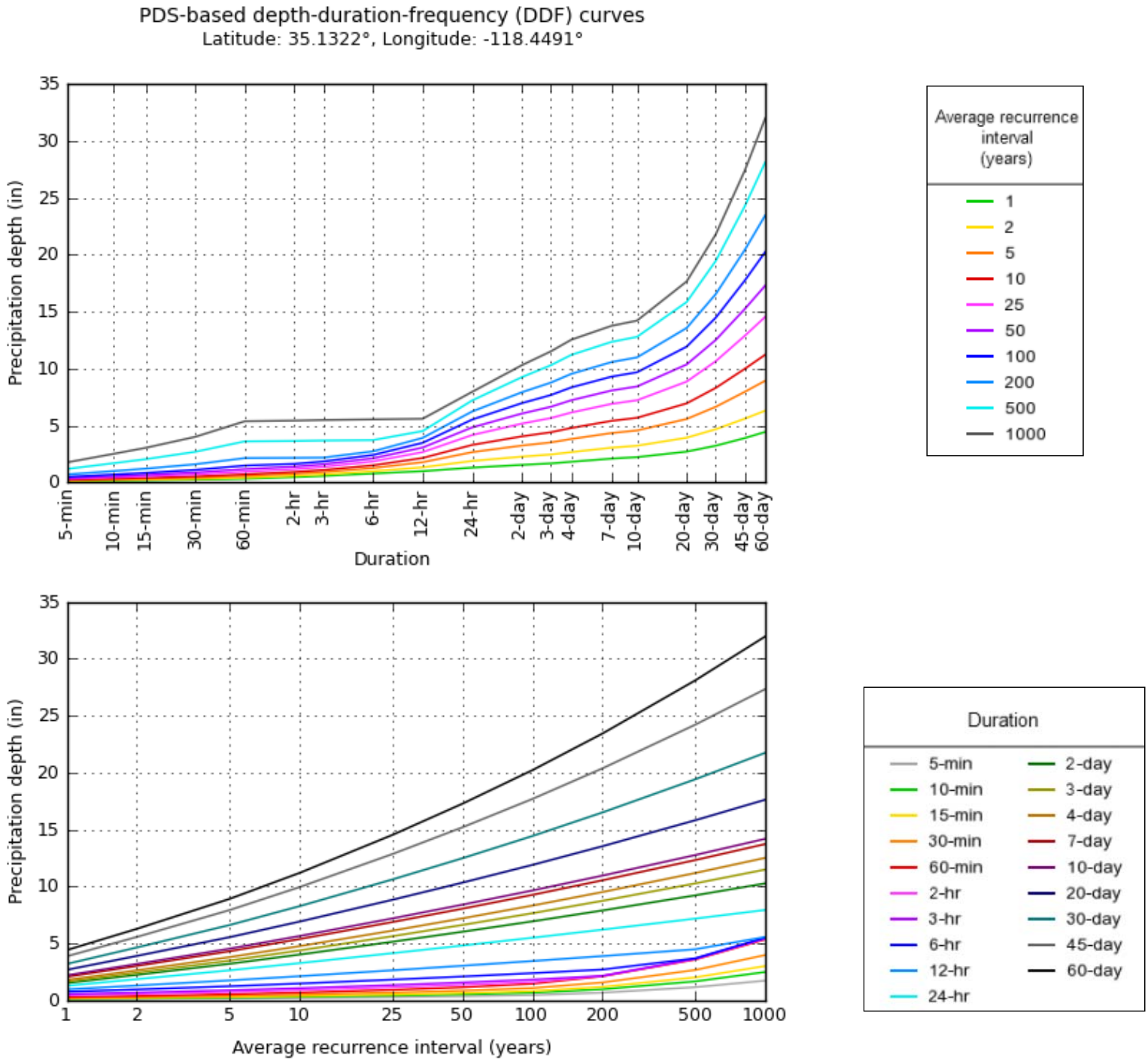
PF graphical



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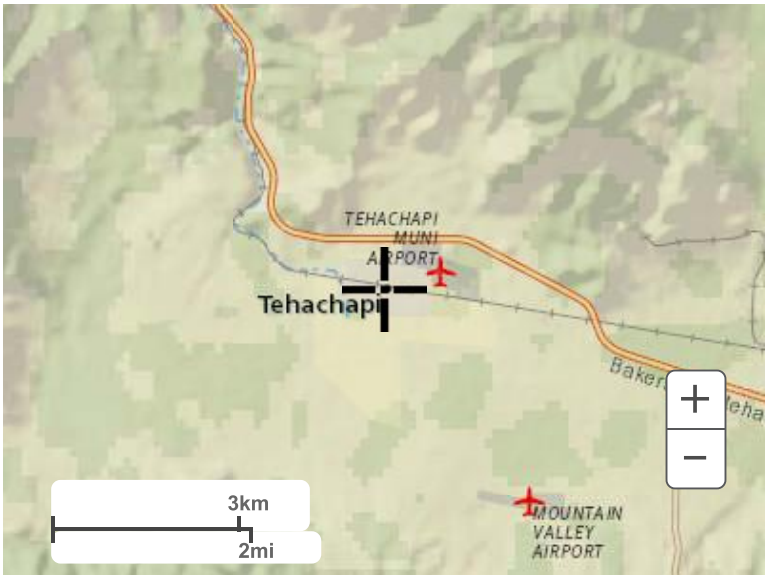
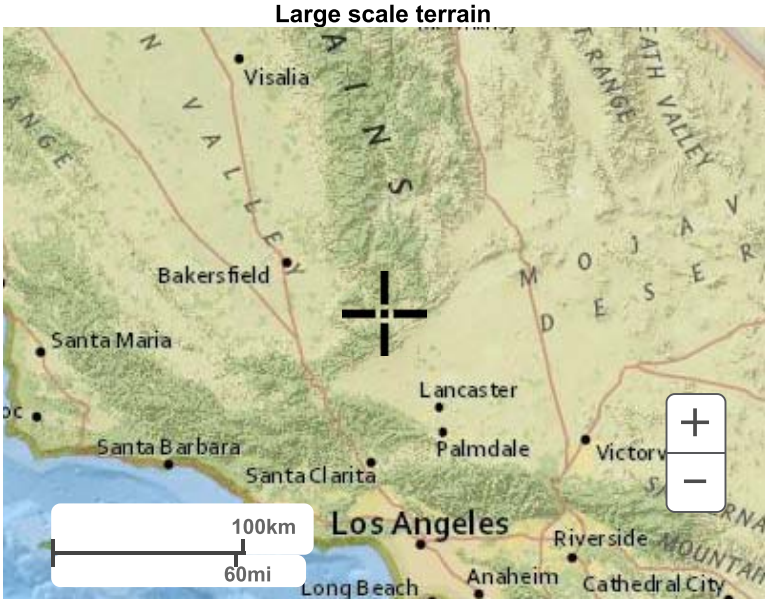
Maps & aerials

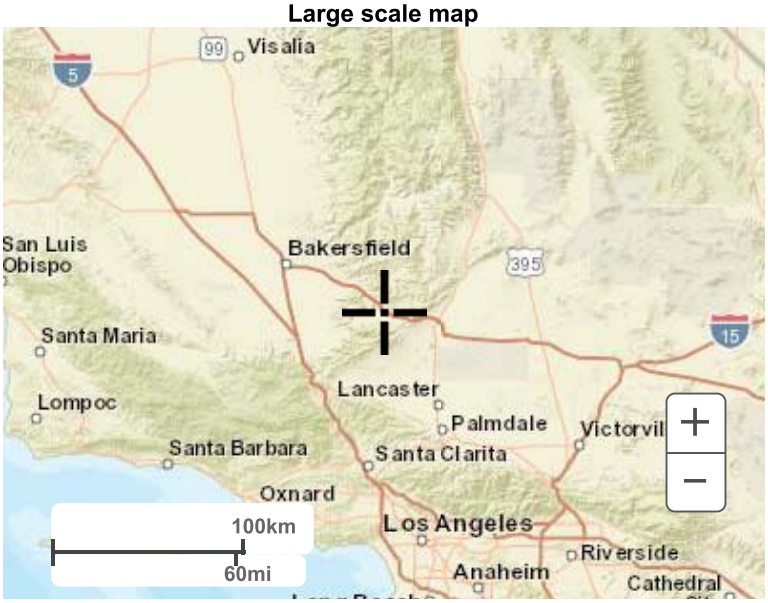
Small scale terrain



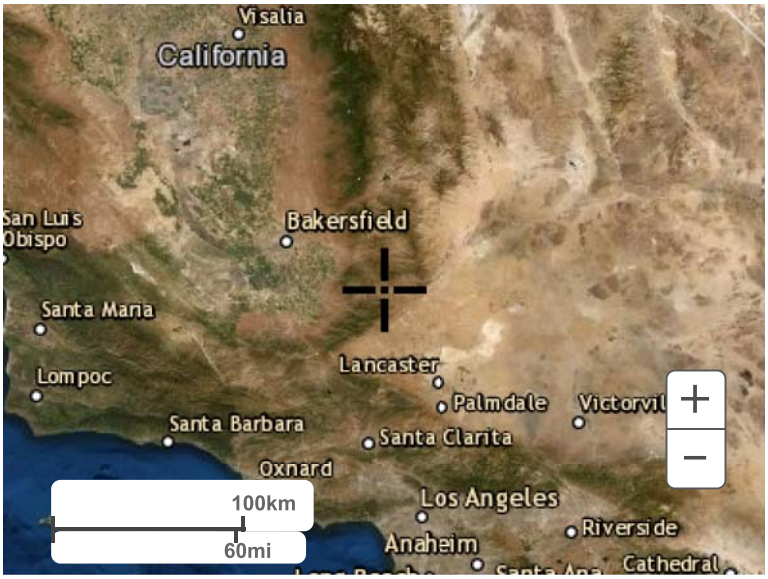
Large scale terrain



Large scale map



Large scale aerial



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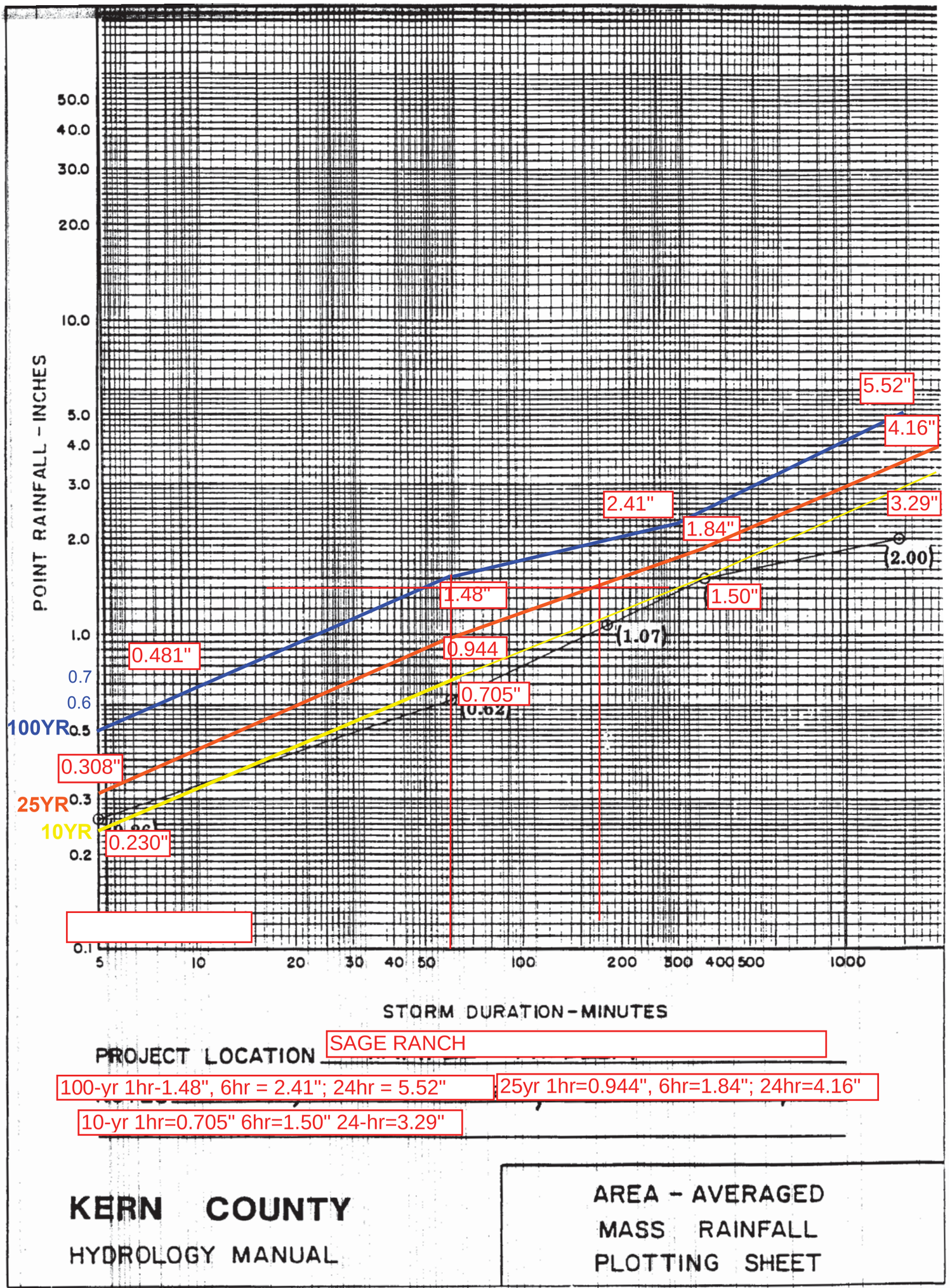
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer



PROJECT LOCATION SAGE RANCH

100-yr 1hr-1.48", 6hr = 2.41"; 24hr = 5.52"

25yr 1hr=0.944", 6hr=1.84"; 24hr=4.16"

10-yr 1hr=0.705" 6hr=1.50" 24-hr=3.29"

KERN COUNTY

HYDROLOGY MANUAL

AREA - AVERAGED
MASS RAINFALL
PLOTTING SHEET

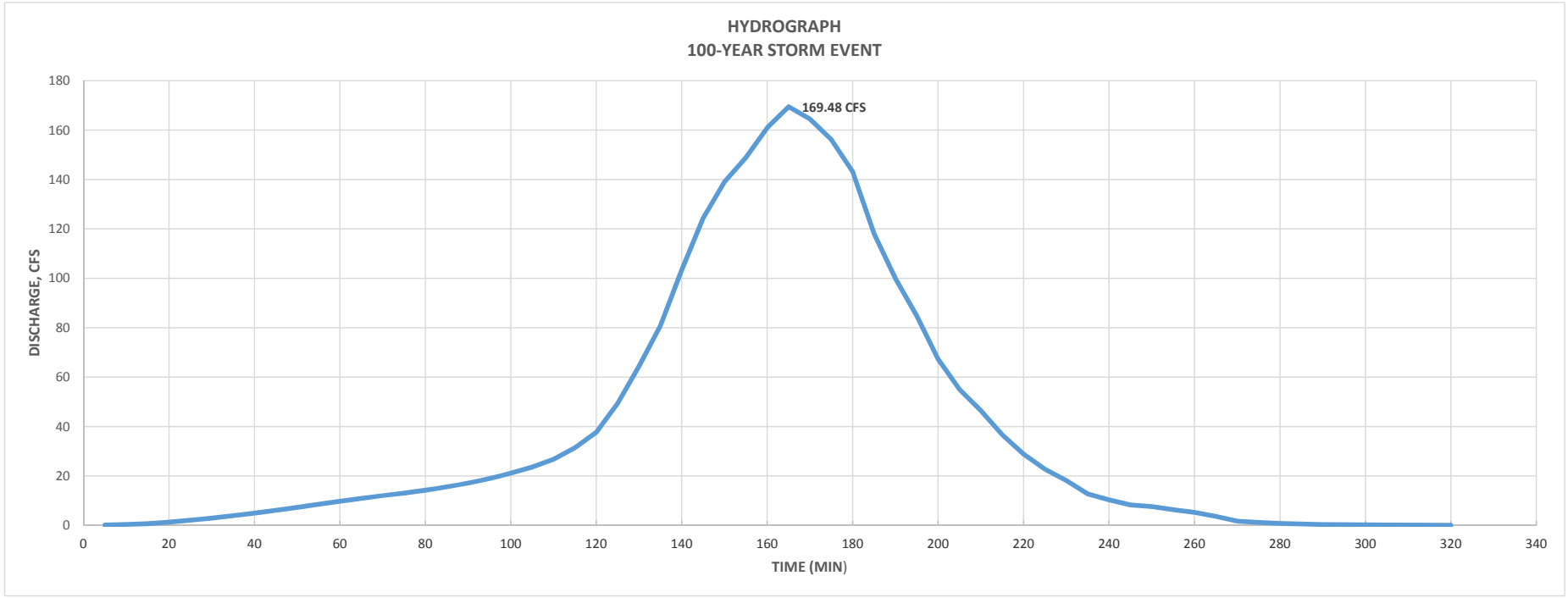
FIGURE E-13

SYNTHETIC UNIT HYDROGRAPH
SAGE RANCH DEVELOPMENT
100-YR STORM EVENT

Valley Developed	**0.011**	**0.006**	**0.011**	**0.006**	**0.006**	**0.006**	**0.006**	**0.006**	**0.011**	**0.017**	**0.011**	**0.011**	**0.017**	**0.011**	**0.011**	**0.022**	**0.017**	**0.032**	**0.039**	**0.032**	**0.032**	**0.087**	**0.111**	**0.175**	**0.448**	**0.064**
10.30	0.113																									
24.04	0.264	0.062																								
34.35	0.378	0.144	0.113																							
65.26	0.718	0.206	0.264	0.062																						
96.17	1.058	0.392	0.378	0.144	0.062																					
113.34	1.247	0.577	0.718	0.206	0.144	0.062																				
120.21	1.322	0.680	1.058	0.392	0.206	0.144	0.062																			
139.10	1.530	0.721	1.247	0.577	0.392	0.206	0.144	0.062																		
161.43	1.776	0.835	1.322	0.680	0.577	0.392	0.206	0.144	0.113																	
157.99	1.738	0.969	1.530	0.721	0.680	0.577	0.392	0.206	0.264	0.175																
152.84	1.681	0.948	1.776	0.835	0.721	0.680	0.577	0.392	0.378	0.409	0.113															
145.97	1.606	0.917	1.738	0.969	0.835	0.721	0.680	0.577	0.718	0.584	0.264	0.113														
106.47	1.171	0.876	1.681	0.948	0.969	0.835	0.721	0.680	1.058	1.109	0.378	0.264	0.175													
85.87	0.945	0.639	1.606	0.917	0.948	0.969	0.835	0.721	1.247	1.635	0.718	0.378	0.409	0.113												
73.84	0.812	0.515	1.171	0.876	0.917	0.948	0.969	0.835	1.322	1.927	1.058	0.718	0.584	0.264	0.113											
51.52	0.567	0.443	0.945	0.639	0.876	0.917	0.948	0.969	1.530	2.044	1.247	1.058	1.109	0.378	0.264	0.227										
39.50	0.434	0.309	0.812	0.515	0.639	0.876	0.917	0.948	1.776	2.365	1.322	1.247	1.635	0.718	0.378	0.529	0.175									
36.06	0.397	0.237	0.567	0.443	0.515	0.639	0.876	0.917	1.738	2.744	1.530	1.322	1.927	1.058	0.718	0.756	0.409	0.330								
25.76	0.283	0.216	0.434	0.309	0.443	0.515	0.639	0.876	1.681	2.686	1.776	1.530	2.044	1.247	1.058	1.436	0.584	0.769	0.402							
18.89	0.208	0.155	0.397	0.237	0.309	0.443	0.515	0.639	1.606	2.598	1.738	1.776	2.365	1.322	1.247	2.116	1.109	1.099	0.938	0.330						
13.74	0.151	0.113	0.283	0.216	0.237	0.309	0.443	0.515	1.171	2.482	1.681	1.738	2.744	1.530	1.322	2.494	1.635	2.088	1.340	0.769	0.330					
12.02	0.132	0.082	0.208	0.155	0.216	0.237	0.309	0.443	0.945	1.810	1.606	1.681	2.686	1.776	1.530	2.645	1.927	3.077	2.545	1.099	0.769	0.896				
5.15	0.057	0.072	0.151	0.113	0.155	0.216	0.237	0.309	0.812	1.460	1.171	1.606	2.598	1.738	1.776	3.060	2.044	3.627	3.751	2.088	1.099	2.092	1.144			
5.15	0.057	0.031	0.132	0.082	0.113	0.155	0.216	0.237	0.567	1.255	0.945	1.171	2.482	1.681	1.738	3.551	2.365	3.847	4.420	3.077	2.088	2.988	2.669	1.803		
3.43	0.038	0.031	0.057	0.072	0.082	0.113	0.155	0.216	0.434	0.876	0.812	0.945	1.810	1.606	1.681	3.476	2.744	4.451	4.688	3.627	3.077	5.677	3.812	4.207	4.616	
5.15	0.057	0.021	0.057	0.031	0.072	0.082	0.113	0.155	0.397	0.671	0.567	0.812	1.460	1.171	1.606	3.362	2.686	5.166	5.425	3.847	3.627	8.367	7.244	6.011	10.771	0.659
5.15	0.057	0.031	0.038	0.031	0.031	0.072	0.082	0.113	0.283	0.613	0.434	0.567	1.255	0.945	1.171	3.211	2.598	5.056	6.296	4.451	3.847	9.861	10.675	11.420	15.387	1.539
5.15	0.057	0.031	0.057	0.021	0.031	0.031	0.072	0.082	0.208	0.438	0.397	0.434	0.876	0.812	0.945	2.342	2.482	4.891	6.162	5.166	4.451	10.458	12.581	16.830	29.236	2.198
3.43	0.038	0.031	0.057	0.031	0.021	0.031	0.031	0.072	0.151	0.321	0.283	0.397	0.671	0.567	0.812	1.889	1.810	4.671	5.961	5.056	5.166	12.102	13.344	19.835	43.084	4.177
		0.021	0.057	0.031	0.031	0.021	0.031	0.031	0.132	0.234	0.208	0.283	0.613	0.434	0.567	1.625	1.460	3.407	5.693	4.891	5.056	14.044	15.440	21.037	50.777	6.155
		0.038	0.031	0.031	0.031	0.021	0.031	0.031	0.057	0.204	0.151	0.208	0.438	0.397	0.434	1.133	1.255	2.748	4.152	4.671	4.891	13.745	17.918	24.343	53.855	7.254
			0.021	0.031	0.031	0.031	0.021	0.031	0.057	0.088	0.132	0.151	0.321	0.283	0.397	0.869	0.876	2.363	3.349	3.407	4.671	13.297	17.537	28.250	62.318	7.694
				0.021	0.031	0.031	0.031	0.038	0.088	0.057	0.132	0.234	0.208	0.283	0.793	0.671	1.649	2.880	2.748	3.407	12.700	16.965	27.649	72.319	8.903
					0.021	0.031	0.031	0.057	0.058	0.057	0.057	0.204	0.151	0.208	0.567	0.613	1.264	2.009	2.363	2.748	9.263	16.203	26.747	70.781	10.331
						0.021	0.031	0.057	0.088	0.038	0.057	0.088	0.132	0.151	0.416	0.438	1.154	1.540	1.649	2.363	7.470	11.819	25.545	68.473	10.112
							0.021	0.057	0.088	0.057	0.038	0.088	0.057	0.132	0.302	0.321	0.824	1.406	1.264	1.649	6.424	9.531	18.633	65.395	9.782
								0.038	0.088	0.057	0.057	0.058	0.057	0.057	0.264	0.234	0.604	1.005	1.154	1.264	4.482	8.197	15.026	47.700	9.342
									0.058	0.057	0.057	0.088	0.038	0.057	0.113	0.204	0.440	0.737	0.824	1.154	3.436	5.719	12.923	38.468	6.814
										0.038	0.057	0.088	0.057	0.038	0.113	0.088	0.385	0.536	0.604	0.824	3.138	4.384	9.016	33.082	5.495
											0.038	0.088	0.057	0.057	0.076	0.088	0.165	0.469	0.440	0.604	2.241	4.003	6.912	23.081	4.726
												0.058	0.057	0.057	0.113	0.058	0.165	0.201	0.385	0.440	1.643	2.859	6.311	17.695	3.297
													0.038	0.057	0.113	0.088	0.110	0.201	0.165	0.385	1.195	2.097	4.508	16.156	2.528
														0.038	0.113	0.088	0.165	0.134	0.165	0.165	1.046	1.525	3.306	11.540	2.308
															0.076	0.088	0.165	0.201	0.110	0.165	0.448	1.334	2.404	8.463	1.649
																0.058	0.165	0.201	0.165	0.110	0.448	0.572	2.104	6.155	1.209
																	0.110	0.201	0.165	0.165	0.299	0.572	0.902	5.385	0.879
																		0.134	0.165	0.165	0.448	0.381	0.902	2.308	0.769
																			0.110	0.165	0.448	0.572	0.601	2.308	0.330
																				0.110	0.448	0.572	0.902	1.539	0.330
																					0.299	0.572	0.902	2.308	0.220
																						0.381	0.902	2.308	0.330
																							0.601	2.308	0.330
																								1.539	0.330
																									0.220

SYNTHETIC UNIT HYDROGRAPH
SAGE RANCH DEVELOPMENT
100-YR STORM EVENT

0.067	0.047	0.028	0.011	0.011	0.017	0.006	0.006	0.006	0.011	SUM
										0.11
										0.33
										0.64
										1.25
										2.03
										2.95
										3.86
										4.88
										6.04
										7.25
										8.51
										9.72
										10.87
										12.08
										13.03
										14.16
										15.59
										17.12
										18.93
										21.15
										23.59
										26.77
										31.38
										37.67
										49.31
										64.44
0.690										80.75
1.611	0.484									103.38
2.301	1.130	0.289								124.33
4.372	1.614	0.673	0.113							139.05
6.443	3.067	0.962	0.264	0.113						148.89
7.594	4.520	1.827	0.378	0.264	0.175					160.95
8.054	5.327	2.693	0.718	0.378	0.409	0.062				169.48
9.320	5.650	3.174	1.058	0.718	0.584	0.144	0.062			164.47
10.816	6.538	3.366	1.247	1.058	1.109	0.206	0.144	0.062		156.18
10.586	7.587	3.895	1.322	1.247	1.635	0.392	0.206	0.144	0.113	143.19
10.240	7.426	4.520	1.530	1.322	1.927	0.577	0.392	0.206	0.264	118.09
9.780	7.184	4.424	1.776	1.530	2.044	0.680	0.577	0.392	0.378	99.95
7.134	6.861	4.280	1.738	1.776	2.365	0.721	0.680	0.577	0.718	84.79
5.753	5.004	4.087	1.681	1.738	2.744	0.835	0.721	0.680	1.058	67.34
4.948	4.036	2.981	1.606	1.681	2.686	0.969	0.835	0.721	1.247	55.05
3.452	3.471	2.404	1.171	1.606	2.598	0.948	0.969	0.835	1.322	46.42
2.646	2.421	2.068	0.945	1.171	2.482	0.917	0.948	0.969	1.530	36.69
2.416	1.856	1.443	0.812	0.945	1.810	0.876	0.917	0.948	1.776	28.90
1.726	1.695	1.106	0.567	0.812	1.460	0.639	0.876	0.917	1.738	22.72
1.266	1.211	1.010	0.434	0.567	1.255	0.515	0.639	0.876	1.681	18.13
0.920	0.888	0.721	0.397	0.434	0.876	0.443	0.515	0.639	1.606	12.71
0.805	0.646	0.529	0.283	0.397	0.671	0.309	0.443	0.515	1.171	10.30
0.345	0.565	0.385	0.208	0.283	0.613	0.237	0.309	0.443	0.945	8.23
0.345	0.242	0.337	0.151	0.208	0.438	0.216	0.237	0.309	0.812	7.60
0.230	0.242	0.144	0.132	0.151	0.321	0.155	0.216	0.237	0.567	6.32
0.345	0.161	0.144	0.057	0.132	0.234	0.113	0.155	0.216	0.434	5.23
0.345	0.242	0.096	0.057	0.057	0.204	0.082	0.113	0.155	0.397	3.62
0.345	0.242	0.144	0.038	0.057	0.088	0.072	0.082	0.113	0.283	1.68
0.230	0.242	0.144	0.057	0.038	0.088	0.031	0.072	0.082	0.208	1.19
	0.161	0.144	0.057	0.057	0.058	0.031	0.031	0.072	0.151	0.76
		0.096	0.057	0.057	0.088	0.021	0.031	0.031	0.132	0.51
			0.038	0.057	0.088	0.031	0.021	0.031	0.057	0.32
				0.038	0.088	0.031	0.031	0.021	0.057	0.26
					0.058	0.031	0.031	0.031	0.038	0.19
						0.021	0.031	0.031	0.057	0.14
							0.021	0.031	0.057	0.11
								0.021	0.057	0.08
									0.038	0.04


HYDROGRAPH
100-YEAR STORM EVENT
169.48 CFS
DISCHARGE, CFS
TIME (MIN)
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340