APPENDIX J

Sierra Gateway Apartments
Drainage Report

Prepared For

Rocklin Sierra Apartments II LLC

Prepared By

OMNI-MEANS, LTD.
ENGINEERS & PLANNERS
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Roseville, California 95678
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AUGUST 2015

25-7185-01
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PURPOSE

The purpose of this study is to provide an analysis of the existing hydraulic conditions and potential drainage related impacts within the Dry Creek Watershed due to the planned development of the Sierra Gateway Apartments project. This study is required by the City of Rocklin and utilizes the Placer County Flood Control and Water Conservation District Stormwater Management Manual for the approval of the project.

This study addresses drainage sheds and areas, flow rates for existing and proposed conditions at 10-year and 100-year storm events, including overland release points. Hydraulic grade line elevations and storm drain pipe sizing for the onsite and offsite storm drainage system are addressed in this report.

EXISTING CONDITIONS

GENERAL

The Sierra Gateway Apartments site is approximately 8.83 acres in size located in the city of Rocklin in Placer County, bounded on the north by Rocklin Road, on the west by Sierra College Boulevard, on the south by Aguilar Creek and a small residential development, and on the east by Rocklin Manor Apartments (**Figure 1**).

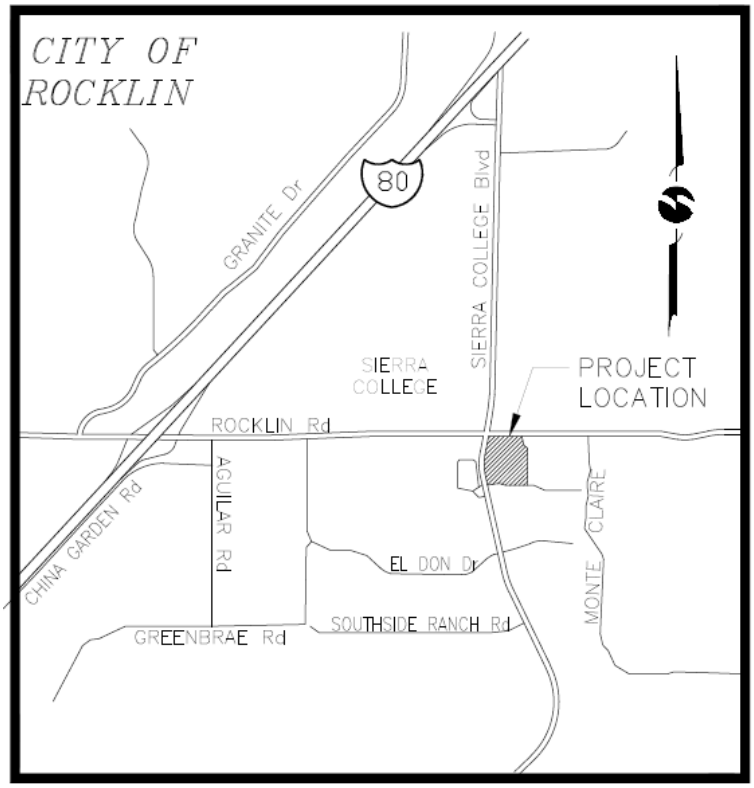


Figure 1 - Vicinity Map

Site topography is characterized by moderately sloped hills and a considerable depression located in the northwestern corner of the site as well as numerous existing swales located in the southern portion of the site near Aguilar Creek.

The majority of the slopes range from 2 to 10 percent. Site elevations vary from 305 ft. near the outfall of the subshed in the southern end of the site to 350 ft. in the northeastern corner of the site. Site vegetation consists mostly of native grasses and dense oak trees with some areas of dense brush and berry vines. The only existing structures on the site consist of two retaining walls along the eastern property boundary and along the northern side of Water Lily Lane.

REGIONAL HYDROLOGY

The Sierra Gateway Apartments site is located within the Secret Ravine Creek watershed. The Secret Ravine Creek watershed is part of a much larger watershed known as the Dry Creek watershed, which covers approximately 101 square miles in Placer and Sacramento Counties. In April 1992, the final report for the Dry Creek Watershed Flood Control Plan was completed by James M. Montgomery Consulting Engineers. The report was sponsored by the Placer County Flood Control and Water Conservation District (PCFCD) and the Sacramento County Water Agency. The report includes information and recommendations for policies necessary to manage the storm waters within the Dry Creek watershed.

As part of the Nonstructural Policy Recommendations contained in the final Dry Creek Watershed Flood Control Plan, it was recommended that all new development located in the upper reaches of the basin provide local, on-site detention of stormwater flows except where it is determined by the District Engineer that local detention is either not required or not practical. Pursuant to the Flood Control Plan, there are some locations in the watershed where model studies indicated that travel time and other timing considerations cause local detention to increase downstream flood flows over existing conditions. **Figure 2** and **Figure 3** on the following pages show the location of the Sierra Gateway Apartments site within the Dry Creek Watershed Flood Control Plan study area. The project site is located partially on the boundary of where detention is recommended and where it is not. The City of Rocklin condition of approval 3.a.iii for the project states that "detaining runoff is not recommended, however the developer shall assess the capacity of existing downstream drainage facilities to determine if mitigation measures are needed for controlling stormwater run-off. (Placer County Flood Control and Water Conservation District)"

LOCAL HYDROLOGY

EXISTING WATERSHEDS

The majority of the project site is located on a local high point, and as such, little offsite drainage enters the site. North of the site there are areas which historically drained through the site, but have since been directed around the site via storm drain piping in Rocklin Road and Sierra College Boulevard. East of the site a watershed of approximately 680 acres flows to a double 72-inch pipe culvert under Sierra College Boulevard south of Water Lily Lane. See "XS SHED 0" on **Figure 4** "Overall Watershed."

Runoff from the site drains through two sub-basins (North and South) referred to in this report with an "N" designation for the North shed and "S" for the South shed. The existing watersheds are labeled "XN" for the north subsheds and "XS" for the southern subsheds. For the proposed developed site, this report uses the prefixes "PN" for the north sheds and "PS" for the south. Each of these subbasins ultimately outfall into Aguilar Creek, with the North system discharging to the west (downstream) of Sierra College Boulevard and the South system to the east upstream of the double 72-inch pipe culvert. Aguilar Creek eventually drains into Secret Ravine Creek approximately 0.5 miles downstream to the west.

There are two points of outfall for the project site. The northern half of the site discharges into a 24-inch corrugated metal pipe underneath Sierra College Boulevard which also receives runoff from an 18-inch storm drain in Sierra College Boulevard which collects drainage from Rocklin Road and areas north of Rocklin Road . The outfall of this pipe is on the west side of Sierra College Boulevard near the outfall of a double 72-inch pipe culvert underneath Sierra College Boulevard as shown as point "XN-OUT" on **Figure 5** "Existing Watersheds."

Figure 5 also shows the location of the second outfall which receives runoff from the southern half of the project site and consists of an existing 24-inch storm drain along the southern property line. This storm drain collects drainage from the Rocklin Manor Apartment complex to the east of the project site. The outfall of this system is 27”concrete pipe which parallels Sierra College Boulevard and outfalls upstream of the double 72” pipe culvert underneath Sierra College Boulevard.

PROPOSED IMPROVEMENTS

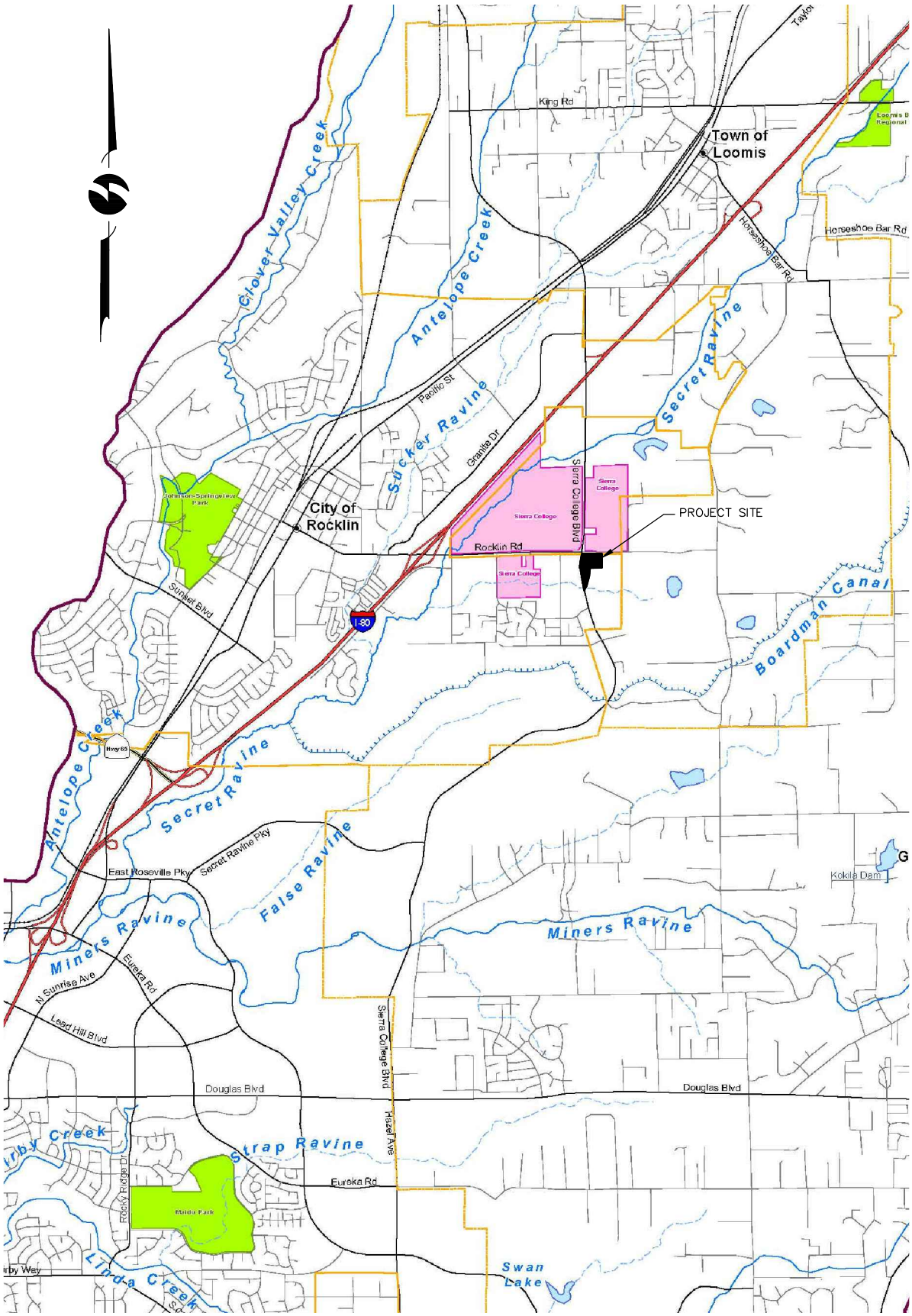
For analysis and comparison purposes, control points are established at the outfalls "XN-OUT" and "XS-OUT" for each system and "XS-0" located at the upstream end of the double 72-inch culvert under Sierra College Boulevard as shown on **Figures 4 through 6**.

The Sierra Gateway Apartments existing watershed analyzed in this report consists of the site itself of approximately 8.25 acres lying within an overall watershed encompassing approximately 719 acres (1.12 square miles). The watersheds are shown on **Figure 4** “Overall Watershed” and **Figure 5** "Existing Watersheds" on the following pages. The individual existing drainage sheds are labeled with letters XN SHED 1 through XN SHED 8 and XS SHED 0 through XS SHED 8.

Figure 6 “Proposed Watersheds” shows the proposed improvements which include 12 residential use buildings, 387 total parking stalls, one main entrance on Rocklin Road and one emergency access on Water Lily Lane. The shed boundaries were modified from existing to represent new drainage patterns as a result of the development. The site plan for the project identified the access roadways, building envelopes and access driveways for the site. These areas were measured and the quantity of impervious area was correspondingly increased to represent the proposed development.

The layout and design of the storm drainage system for the site determines the delineation of the proposed drainage sheds and the runoff response of the developed site. This project proposes to collect roadway and parking lot drainage through the use of surface drainage and drain inlets. Drainage will then be conveyed by storm drain to a suitable outfall.

Typically, drainage from a project is directed to outfall in the same location as existing and diversions of drainage from one shed to another are generally avoided. However minor changes in shed boundaries are expected as part of the development and for this project due to a known capacity problem with the northern system in Sierra College Boulevard and Rocklin Road, approximately one acre of shed area is diverted from the northern system to the southern system.



Sierra Gateway Apartments Drainage Study FIGURE 2

Project Location in Dry Creek Watershed

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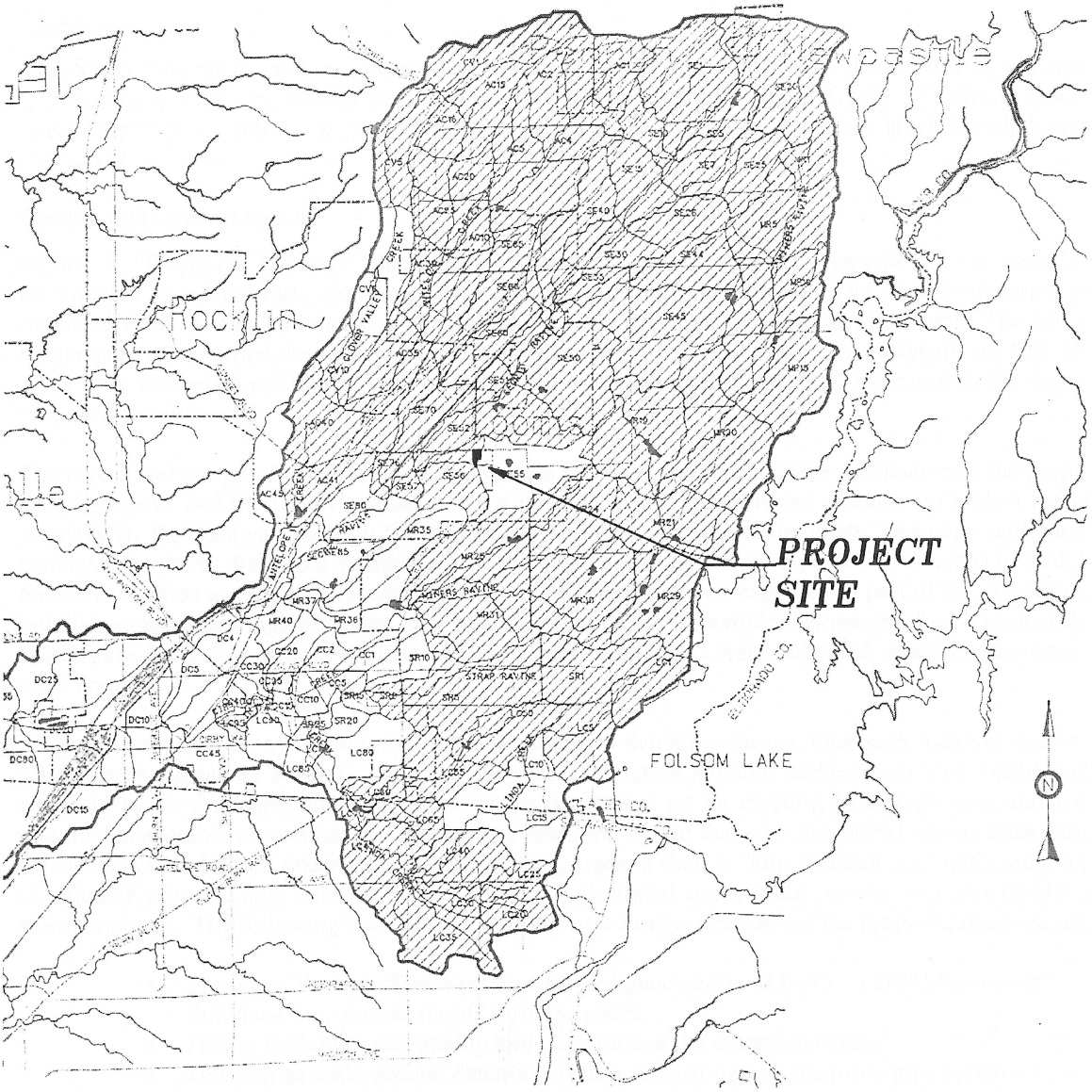

NOTES:

1. SOLID CROSS HATCHING INDICATES LOCATIONS WHERE LOCAL DETENTION IS RECOMMENDED.

2. THIS EXHIBIT IS A PORTION OF EXHIBIT 5-2 FROM THE DRY CREEK FLOOD CONTROL PLAN PREPARED BY JAMES MONTGOMERY CONSULTING ENGINEERS - APRIL 1992

Sierra Gateway Apartments Drainage Study FIGURE 3

Dry Creek Watershed Recommended Detention Areas

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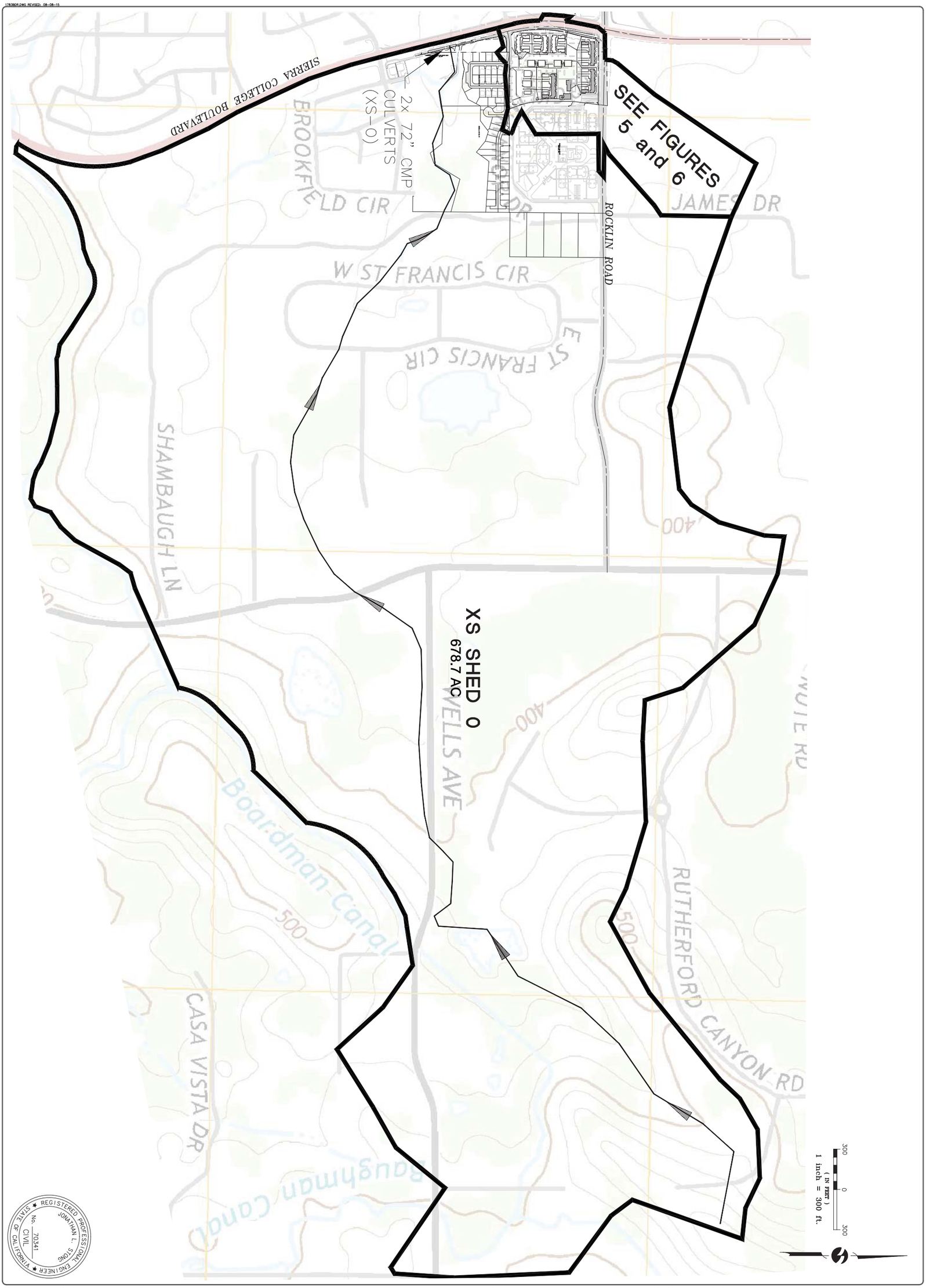

REGISTERED PROFESSIONAL ENGINEER ★ STATE OF CALIFORNIA ★ JONATHAN L. STONE No. 70341 CIVIL

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DRAWN	SMH
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CHECKED	JLS
DATE	8-7-15

FIGURE No. 4 - OF 3

OVERALL WATERSHED

SIERRA GATEWAY APARTMENTS
Rocklin Sierra Apartments II, LLC
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REVISIONS

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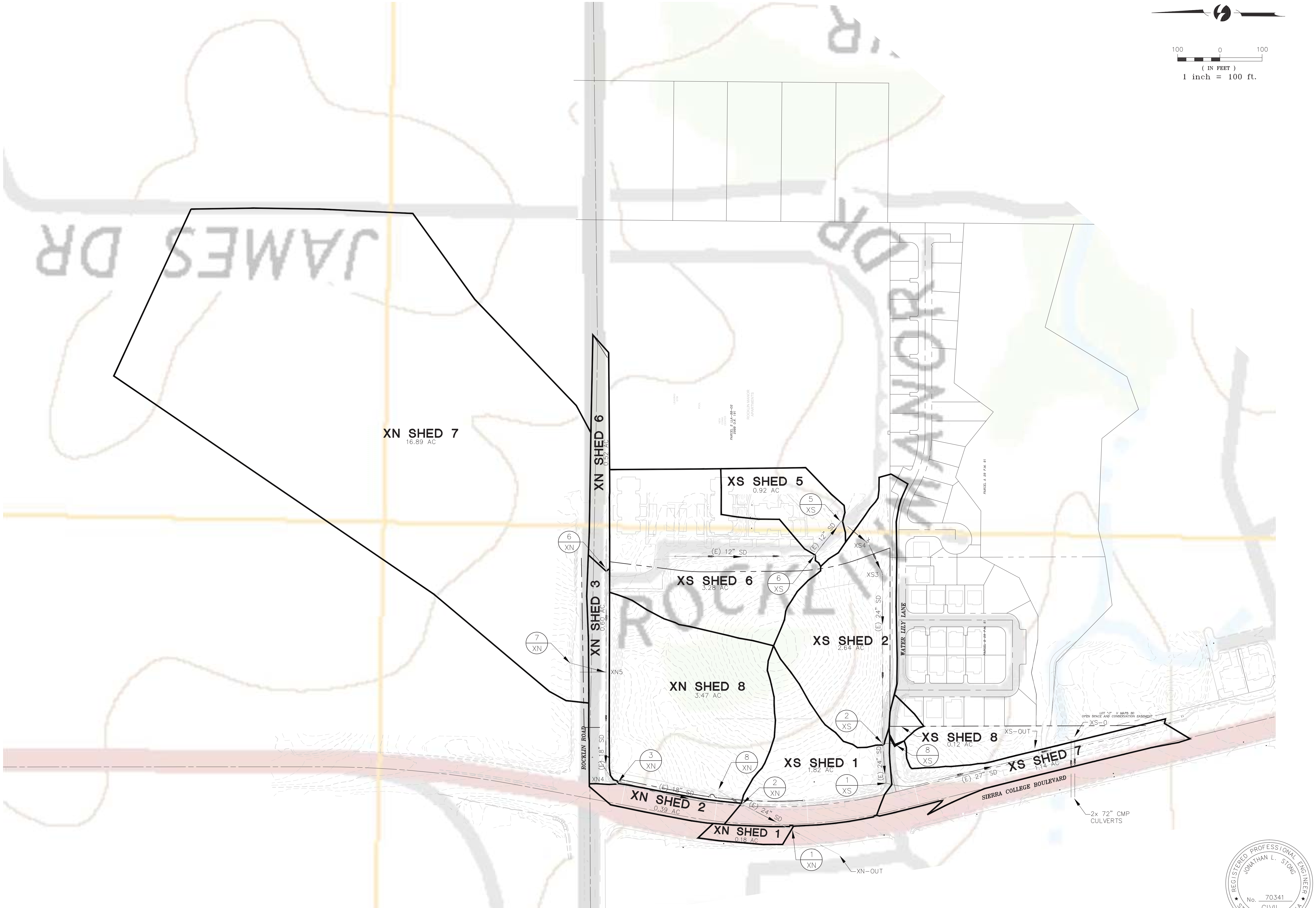

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EXISTING WATERSHEDS

SIERRA GATEWAY APARTMENTS
Rocklin Sierra Apartments II, LLC
City of Rocklin, California

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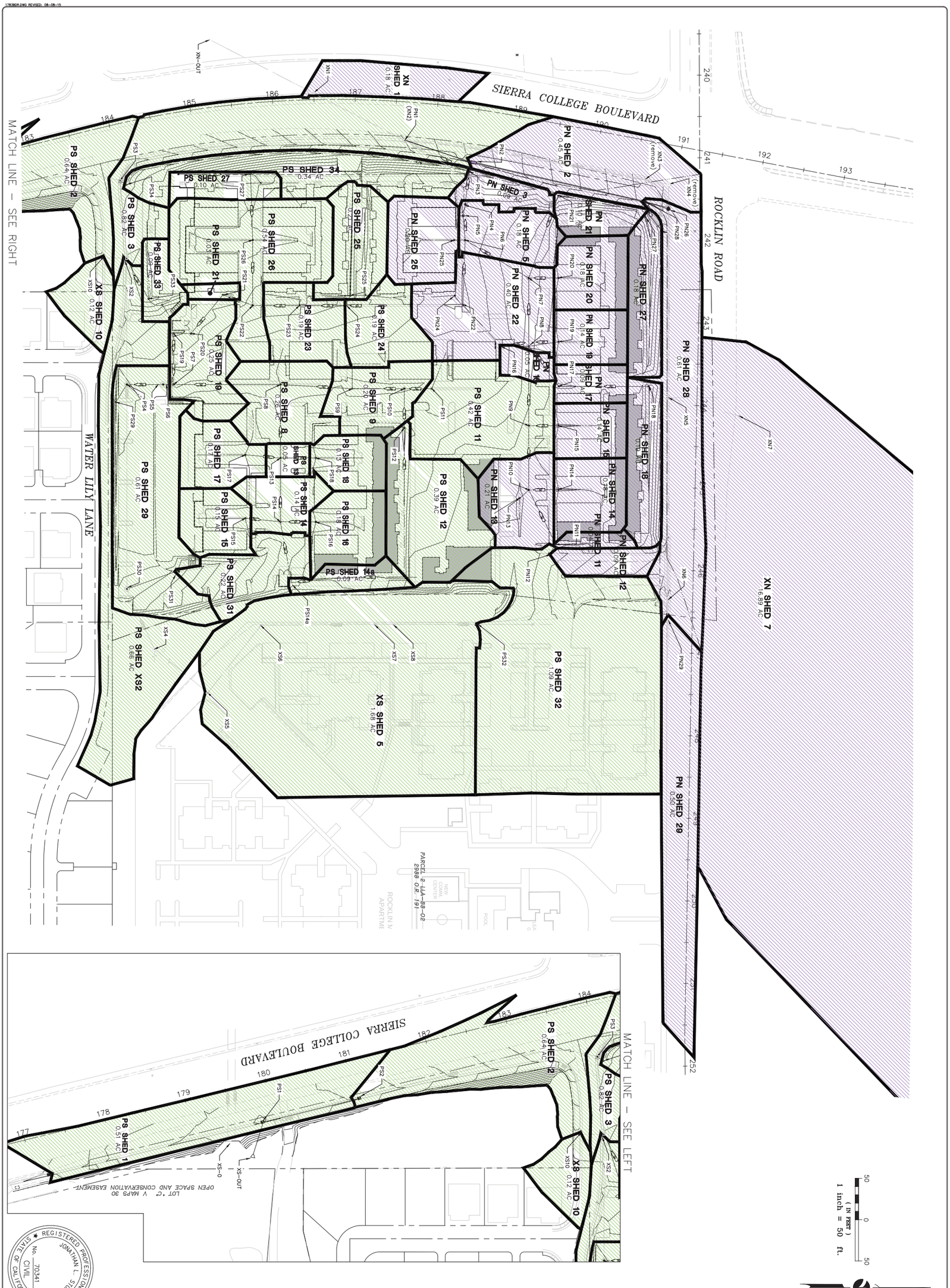
DATE	8-7-15

FIGURE No.
5
- OF 3



PROPOSED WATERSHEDS

SIERRA GATEWAY APARTMENTS

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REVISIONS

No.	DESCRIPTION	DATE	BY

REGISTERED PROFESSIONAL ENGINEER ★ STATE OF CALIFORNIA ★ JONATHAN L. SONS No. 70341 CIVIL

SCALE	1"=50'
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DRAWN	SMH
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CHECKED	JLS
DATE	8-7-15

FIGURE No. 6 - OF 3

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METHODOLOGY

GENERAL

Pre and post-development flows were determined for the 10 and 100-year (10% and 1% probability) storms using the Methods prescribed by the Placer County Flood Control and Water Conservation District (PCFCD) *Stormwater Management Manual, Sept 1, 1990 (with 1997 Addendum 1).* Existing site conditions were modeled based on aerial topographic mapping, existing surveys, and site reconnaissance. Proposed site conditions were modeled based on the proposed contours developed by the boundary and topographic survey conducted within Omni-Means, Ltd. and the building footprints developed by MVE architects.

PRECIPITATION

Rainfall depths for 10 and 100-year frequency storms were obtained directly from Appendix V-A of the PCFCD Stormwater Manual. Values of rainfall depth by duration were interpolated for the site's 345 ft average elevation.

LOSS RATE

The "Soil Survey of Placer County, California – Western Part" was referenced to determine the soil classification within the Sierra Gateway Apartments watershed. Per the survey, the project site is composed of Soil Type B hydrologic soil group as defined by the Soil Conservation Service. See **Appendix A**.

The Sierra Gateway Apartments ground cover type is best classified as "Woodland – Coniferous or broadleaf trees predominate (Canopy density of at least 50%)". The quality of the ground cover varies and is estimated as "fair". Pursuant to the criteria established by Table 5-3 of the PCFCD Stormwater Management Manual (Feb 1994), the constant rate infiltration capacities of this soil type is a constant rate loss of 0.22 inches per hour. This information is available for reference in **Appendix A**.

LAND USE

The proposed land use for the Sierra Gateway Apartments site is residential multi-family. Developed areas of the site averaged 84% impervious overall by assigning the building envelopes, driveways, and parking areas as impervious area and including dedicated open space and landscape areas as pervious area. For existing conditions, undeveloped areas were assumed to have an average imperviousness of 5%. The site plan, including the parking lots, is shown on **Figure 6**, "Proposed Watersheds."

RUNOFF RESPONSE

As specified in the PCFCD Stormwater Management Manual, the Kinematic Wave method shall be the basic approach to runoff response for developing watersheds. The representation of a watershed with the Kinematic Wave model requires great simplification and reduction. Parameters chosen for elements represent typical average parameters of the watershed and do not necessarily represent specific, physical elements.

The primary effect development will have on runoff will be due to an increase in the amount of impervious in addition to a reduced "roughness" (Manning's n value) of the storm drain pipes and collector channels. The derived "n" value for the developed and undeveloped collectors is contained in **Appendix B** and was represent the various developed and existing pipes, collectors and channel components. In order to select representative overland flow lengths and collector channels, the procedures

prescribed in the PCFCD Stormwater Management Manual were used and resulting table summaries can be found in **Appendix B**.

RESULTS

The results of the peak flow calculations for key points for comparative analysis of the existing site's 10-year and 100-year storm events are presented in Table 1 and 2 respectively. Full peak flow summaries for all subsheds are provided in **Appendix B**.

TABLE 1
EXISTING CONDITIONS
PEAK FLOW RATES FOR 10 YEAR (10% PROBABILITY) STORM

		Existing Conditions		
Shed No./ Control Point	**Accum Area (ac)**	**Peak Flow (cfs)**	**Unit Peak Runoff (cfs/ac)**	**Response Time Tr (min)**
XN 8	3.5	5.8	1.78	14.0
XN 7	16.9	5.8	0.62	39.0
XN OUT	**22.1**	**7.6**	**0.59**	**42.2**
XS 1	7.0	11.0	1.50	17.8
XS OUT	**9.9**	**11.7**	**1.30**	**19.9**
XS 0	**698**	**199**	**0.56**	**48.4**

TABLE 2
EXISTING CONDITIONS
PEAK FLOW RATES FOR 100 YEAR (1% PROBABILITY) STORM

		Existing Conditions		
Shed No./ Control Point	**Accum Area (ac)**	**Peak Flow (cfs)**	**Unit Peak Runoff (cfs/ac)**	**Response Time Tr (min)**
XN 8	3.5	10.3	3.24	14.0
XN 7	16.9	16.1	1.23	39.0
XN OUT	**22.1**	**20.2**	**1.16**	**42.2**
XS 1	7.0	18.4	2.78	17.8
XS OUT	**9.9**	**23.2**	**2.46**	**19.9**
XS 0	**698**	**534**	**1.04**	**48.4**

The results of the peak flow calculations for the key locations above for the developed site's 10-year and 100-year storm events are presented in Table 3 and 4 respectively. Where the label has changed from the existing to proposed condition, the existing condition label is presented in parentheses.

TABLE 3
DEVELOPED CONDITIONS PEAK FLOW RATES FOR 10 YEAR (10% PROBABILITY) STORM

		DEVELOPED CONDITION		
Shed No./ Control Point	**Accum Area (ac)**	**Peak Flow (cfs)**	**Unit Peak Runoff (cfs/ac)**	**Response Time Tr (min)**
PN 3 (XN 8)	2.32	4.5	1.94	12.1
XN 7	16.9	5.8	0.62	39.0
XN OUT	**21.1**	**8.2**	**0.59**	**42.1**

PS 3 (XS 1)	9.1	16.0	1.78	14.86
XS OUT	**10.3**	**16.2**	**1.60**	**16.6**
XS 0	**698**	**201**	**0.56**	**48.4**

TABLE 4
DEVELOPED CONDITIONS PEAK FLOW RATES FOR 100 YEAR (1% PROBABILITY) STORM

		DEVELOPED CONDITION		
Shed No./ Control Point	**Accum Area (ac)**	**Peak Flow (cfs)**	**Unit Peak Runoff (cfs/ac)**	**Response Time Tr (min)**
PN 3 (XN 8)	2.32	8.1	3.52	12.1
XN 7	16.9	16.1	1.23	39.0
XN OUT	**21.1**	**20.2**	**1.16**	**42.1**
PS 3 (XS 1)	9.1	29.3	3.24	14.9
XS OUT	**10.3**	**29.9**	**2.94**	**16.6**
XS 0	**698**	**536**	**1.04**	**48.4**

North System: Comparing the total runoff from the north system at point "XN OUT", there was a slight increase in total runoff during the 10-yr event of 0.6 cfs and no increase in peak flow for the 100-yr event. The fact that the 100-year peak flow is calculated to remain the same while the 10-year shows an increase seemed to indicate an error in calculations, however the results are determined to be due to the methodology itself. For the northern shed, the total response time is the same pre-development vs. post-development due to its dependency on sub-shed XN-7 with a response time of 39 minutes. The unit peak flow rate is therefore the same for each condition, and with the reduction of approximately 1 acre of contributory area the peak flows before infiltration factored in is actually reduced in the post-development condition. The infiltration factor is identical regardless of storm return frequency. When applying the infiltration reduction, the smaller difference in unadjusted Q_{10} (Pre vs. Post) and larger relative difference in infiltration adjustment results in an overall increase in peak flow. Unadjusted Q_{100} has a greater difference between pre- and post-development condition with the same infiltration adjustments resulting in this case a post-development Q_{100} which is equal to pre-development. These calculations are summarized in Table 5.

TABLE 5
COMPARISON OF 10-YEAR AND 100-YEAR PEAK FLOW AT XN-OUT

	Area (ac)	**Unit Peak Runoff (cfs/ac)**	**Unadjusted Peak Flow (cfs)**	**Difference (cfs)**	**Impervious Area**	**Infiltration Reduction (cfs)**	**Peak Flow (cfs)**
Q_{10} Existing Condition	22.1	0.59	13.0		12%	5.4	7.6
Q_{10} Proposed Condition	21.1	1.16	12.5	-0.5	21%	4.3	8.2
Q_{100} Existing Condition	22.1	0.59	25.6		12%	5.4	20.2
Q_{100} Proposed Condition	21.1	1.16	24.5	-1.1	21%	4.3	20.2

South System: At the southern outlet "XS OUT" the 10-year peak flow is calculated to increase by 4.5 cfs from 11.7 cfs to 16.2 cfs and the 100-year flow by 6.7 cfs from 23.2 cfs to 29.9 cfs. At the inlet to the double 72-inch pipe culvert (point "XS-0") the 10-year peak flow is calculated to increase by only 2 cfs from 199 cfs to 201 cfs. The smaller increase is due to the project site's location within the larger watershed. The 100-year peak flow at XS-0 is also calculated to increase by 2 cfs from 534 cfs to 536 cfs.

Therefore, although the site is located partially within the shaded area of the Dry Creek Watershed Map, the use of detention is not warranted. The outfall at XS-0 has runoff contributions from a much larger shed, with a comparatively larger peak in its hydrograph. This peak occurs after the peak from the hydrograph for this site. Consequently, onsite detention would not only fail to attenuate the larger peak, it would increase it slightly.

WATER QUALITY

Construction of the project is expected to take place over a period of 1 year. During this period, water quality will be addressed with the erosion control plan prepared as part of the improvement plans and City standards relating to construction related activities. All of the construction phase Best Management Practices (BMP's) are expected to be implemented to reduce construction related storm water pollution prior to the first rainy season.

Proposed post construction stormwater treatment will include a vortechnics® or similar system in order to provide treatment as per the City of Rocklin Standards. Sheets U1 through U5 in **Appendix C** depict the proposed locations of the two water quality manholes. **Appendix D** contains information on the types of systems proposed with this project.

DRAINAGE SYSTEMS

Drainage Shed Delineation and Nomenclature

Proposed drainage sheds were delineated for each drainage system and further for each drainage inlet. The basis for the delineation of these sub-sheds was the drainage system design and nomenclature. Sub-shed names, therefore, utilize the drainage system number and letter, for instance: PN-2 (Proposed Shed North, drain inlet 2). The proposed drainage shed map is presented on **Figure 6**.

Methodology

The determination of flows for specific drainage structures and drainage shed outfalls were completed using the Modified Rational Method (as outlined in the Placer County Flood Control and Water Conservation District Storm Water Management Manual). Individual drainage shed worksheets were developed for each drainage system sub-shed. Percent imperviousness was entered for each drainage shed. Additional data input into the worksheets consisted of empirical data derived directly from the drainage-shed maps. Data included estimates of overland flow distances, shallow collector flow distances and main channel distances and cross sections. The worksheets used a lookup table to emulate Figure 5-3A, 5-3B and 5-3C of the PCFCWCD manual.

Output from the worksheets included 10-year, 25-year and 100-year flows; these flows were then used along with physical characteristics of the existing and proposed drainage system to determine the 10-year and 100-yr hydraulic grade lines. A summary of the flows calculated for each watershed can be found in **Appendix B**.

Hydraulic Grade Line Calculations

The flows calculated in the individual drainage shed worksheets were tabulated and are located in **Appendix B**. These worksheets calculate the head loss that occurs in each of the drainage systems. All of the drainage systems were assumed to have an unobstructed outfall. Therefore, the hydraulic grade line was determined by adding the head loss to the elevation of a 70% full pipe (10-year condition) and 100% full pipe (100-year conditions) on the downstream end. Manning's equation was used to compute the friction losses by solving for a value of the energy gradient, then computing the total friction losses as a product of the energy gradient and the length of the applicable pipe segment.

In addition to friction loses, entrance loses were determined and are a part of the summation of head (energy) losses occurring within the system. The head loss at an entrance to a conduit segment was calculated as follows,

$h_k = KV^2/2g$

Where, h_k = Entrance Head Loss (ft)
V = Velocity in Conduit (ft/sec)
K = Entrance Loss Coefficient
$2g = 64.4$ ft/sec^2

Entrance Loss Coefficients (K) ranged from 0.2 to 0.9, for rounded entrances to square corners projecting respectively, but were generally input a 0.5 (square corners flush with head wall).

Freeboard was calculated by taking the top of grate or ground elevation minus the hydraulic grade line elevation.

CONCLUSIONS

Incremental Runoff

The project site is located on the boundary of areas identified where detention is recommended. Development of the project will result in a 2 cfs in peak runoff as measured at the two 72" diameter culverts underneath Sierra College Boulevard. However, the use of detention would further increase the peak due to the location of the project site in the lower portion of the drainage shed. Therefore, the use of detention is not recommended on this site provided there is capacity in the downstream drainage network.

Drainage Systems

Existing Conditions: Hydraulic grade line (HGL) calculation tables are contained in **Appendix B**. The existing northern drainage system is demonstrated to lack capacity to convey the 100-year storm event, and the pipe inlet from shed XN-7 is calculated to surcharge 1.65 feet over the top of pipe elevation during the 10-year event. During the 100-year event, the capacity of the existing 15-inch and 18-inch diameter storm drain system in Rocklin Road and Sierra College Boulevard is exceeded and runoff is calculated to be conveyed overland along Rocklin Road from the point XN-6 to point XN-2 (the drain inlet located at the on Sierra College Boulevard at the junction with a 24-inch storm drain pipe which crosses Sierra College Boulevard). As noted earlier, this system collects drainage from offsite shed XN-7 which totals nearly 17 acres.

The southern system shows deficiency in the Rocklin Manor Apartments complex during the 100-year event at inlet XS-6. The remainder of the system has capacity for both the 10-year and 100-year events, with a calculated 2.6 feet of freeboard (measured from the low point in the road to the headwater elevation) at the entrance to the double 72-inch pipe culverts under Sierra College Boulevard south of the project site.

Proposed Conditions: The proposed project includes widening of Sierra College Boulevard from north of El Don Drive to Rocklin Road and improvements to both the northern and southern drainage systems are proposed. See offsite improvement plans, **Appendix C**.

For the northern system it is proposed as part of the improvements to widen the road and relocate the pipes and drain inlets, to upsize a portion of the system to adequately convey the 10-year and 100-year runoff without objectionable head. It is proposed to replace the existing 18-inch pipe with a 24-inch pipe

beginning at the manhole near the southeast corner of Rocklin Road and Sierra College Boulevard and ending at the existing 24-inch pipe which crosses Sierra College Boulevard near the midpoint of west edge of the site (point XN-2 to XN-1). The proposed improvements are shown on Sheets L5 and L6. With the improvements, the restriction of the 18-inch line is removed and the backwater into the Rocklin Road system is eliminated. The 100-year HGL is contained within the system and the calculated head at the XN-7 inlet is reduced from 14.98 to 9.75 feet. These are theoretical values indicating head required to deliver the peak flow; where headwater depth is unavailable over the top of pipe inlet the flow will be overland.

The southern drainage system is also proposed to be expanded as part of the improvements to widen Sierra College Boulevard and construct curb, gutter and sidewalk. The drainage improvements include extending the existing 27-inch pipe from its existing outlet south of Water Lily Lane and north of the gravel driveway to connect to two new drain inlets and discharging north of and near the double 72-inch pipe culvert inlet. A new drain inlet will be constructed at the sag point of Sierra College Boulevard and discharge south of and near the double 72-inch pipe culvert inlet.

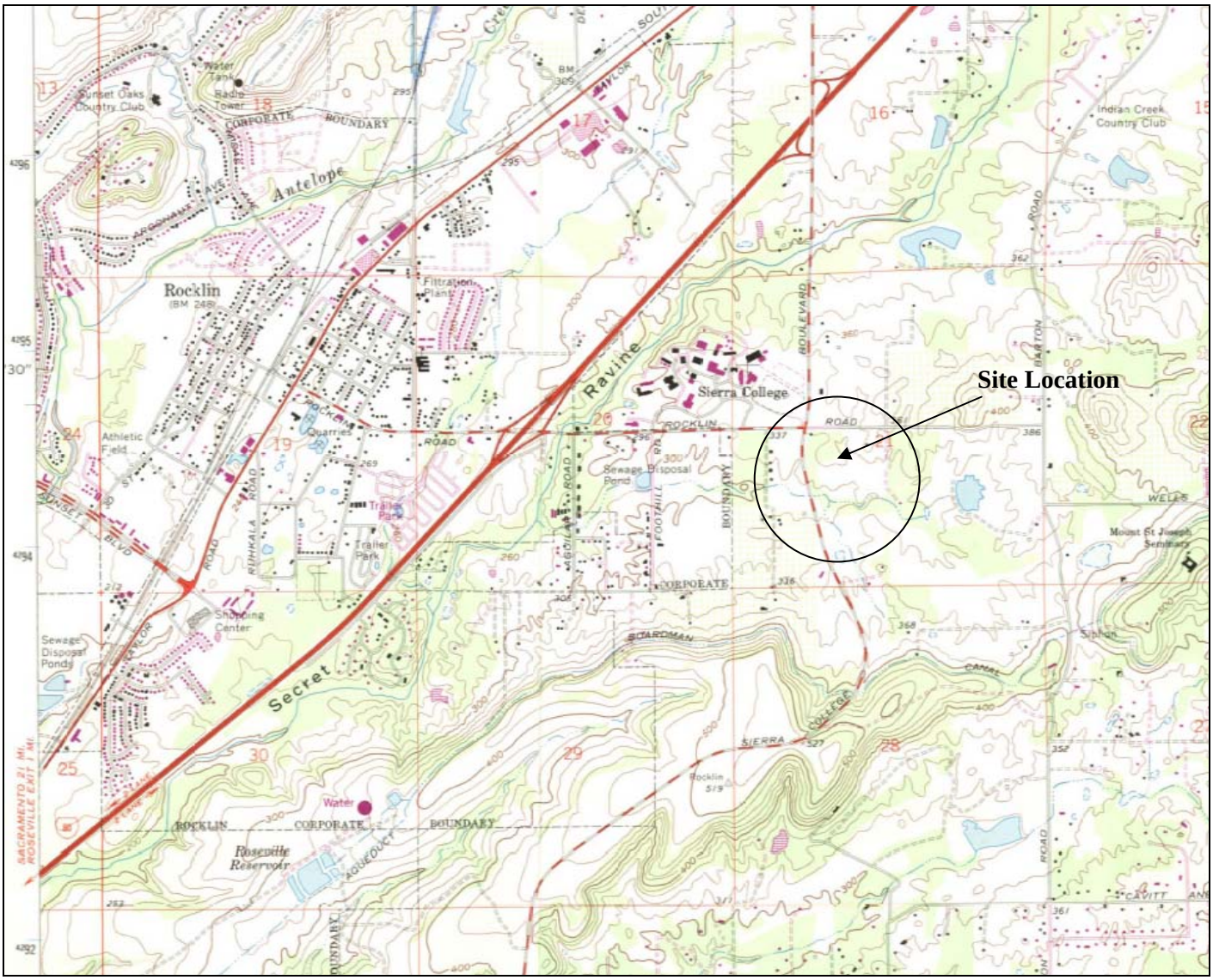
As shown on the tables in **Appendix B**, the southern system has capacity for both the 10- and 100-year events with the exception of at the drain inlet labeled PS-2 where the 100-year HGL is calculated to be 0.04 feet above the grate elevation, indicating a minor portion of the flow (estimated at 0.35 cfs) will overtop the grate and flow in the gutter to the next point in the system, PS-1, which is calculated to have sufficient freeboard (1.8 feet) to receive the additional flow through the grate.

Per the PCFDWCD Storm Water Manual, for arterials and expressways the roadway may be used to convey 100-yr runoff to the extent that bike lanes are inundated and provided the depth of flow over sidewalks does not exceed 6 inches. As described previously, overland flow along Rocklin Road is calculated to be eliminated for up to the 100-year event and on Sierra College Boulevard between point PS-2 to PS-1 to be approximately 0.35 cfs. The capacity of the gutter and bike lane was calculated at approximately 3cfs.

At the inlet to the double 72-inch pipe culvert (point XS-0), the freeboard for the proposed condition is calculated to be 6.32 feet in the 10-year and 2.54 feet in the 100-year. As previously discussed, the increase in peak flow at this location is calculated to be 2 cfs for both the 10-year and the 100-year events. Using the FHWA nomograph for corrugated metal pipe culverts with inlet control (Bureau of Public Roads, 1983), the headwater depth is estimated to increase by 0.06' over the existing condition with 10-yr and 100-yr freeboard calculated to be 6.38 feet 2.60 feet, respectively. The drainage system to Aguilar Creek including the existing double 72-inch pipe culvert under Sierra College Boulevard is calculated to have capacity for the project improvements.

APPENDIX A

1. Site Location on USGS Quad Sheet
2. Aerial Photo with Site Boundary
3. Table 8-1 PCFCD – Manning N for Stream Channels
4. Table 5-3 PCFCD – Constant Infiltration Rates
5. NRCS Soil Information


Site Location
Rocklin
(BM 248)
Sierra College
Antelope
Secret Ravine
Roseville Reservoir
Indian Creek Country Club
Sunset Oaks Country Club
Water Tank
Radio Tower
Filtration Plant
Athletic Field
Quarries
Trailer Park
Sewage Disposal Pond
Shopping Center
Sewage Disposal Ponds
Mount St. Joseph Seminary
Siphon
CORPORATE BOUNDARY
ROCKLIN
SIERRA COLLEGE
SCALE 1:24 000
1 MILE
7000 FEET
1 KILOMETER
CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U.S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST
ROAD CLASSIFICATION
Heavy-duty
Medium-duty
Light-duty
Unimproved dirt
Interstate Route
CALIF.
QUADRANGLE LOCATION
Revisions shown in purple and woodland compiled from aerial photographs taken 1978 and other source data
This information not field checked. Map edited 1981
Purple tint indicates extension of urban areas
ROCKLIN, CALIF.
SW/4 AUBURN 15' QUADRANGLE
N3845—W12107.5/7.5
1967
PHOTOREVISED 1981
DMA 1761 I SW-SERIES V895

Aerial Photo with Site Boundary

TABLE 8-1

MANNING N FOR STREAMS AND CHANNELS (24)

UNIFORM CHANNELS

Description	n
Concrete	0.012 - 0.016
Earth	0.017 - 0.022
Grass	0.020 - 0.025
Rock, Rubble	0.025 - 0.045

NATURAL STREAMS-CHANNELS

Channel n is a composite computed from the component n and k values in the table as follows:

$$n = k\,(n_1+n_2+n_3+n_4)$$

Component	Condition	n
Material involved (n_1)	Earth	0.020
	Rock Cut	0.025
	Fine Gravel	0.024
	Course Gravel	0.028
Degree of Irregularity (n_2)	Smooth	0.000
	Minor	0.005
	Moderate	0.010
	Severe	0.020
Relative effect of Obstructions (n_3)	Negligible	0.000
	Minor	0.010 - 0.015
	Appreciable	0.020 - 0.030
	Severe	0.040 - 0.060
Vegetation (n_4)	Low	0.005 - 0.010
	Medium	0.010 - 0.025
	High	0.025 - 0.050
	Very High	0.050 - 0.100
Degree of Meandering (k)	Minor	1.000
	Appreciable	1.150
	Severe	1.300

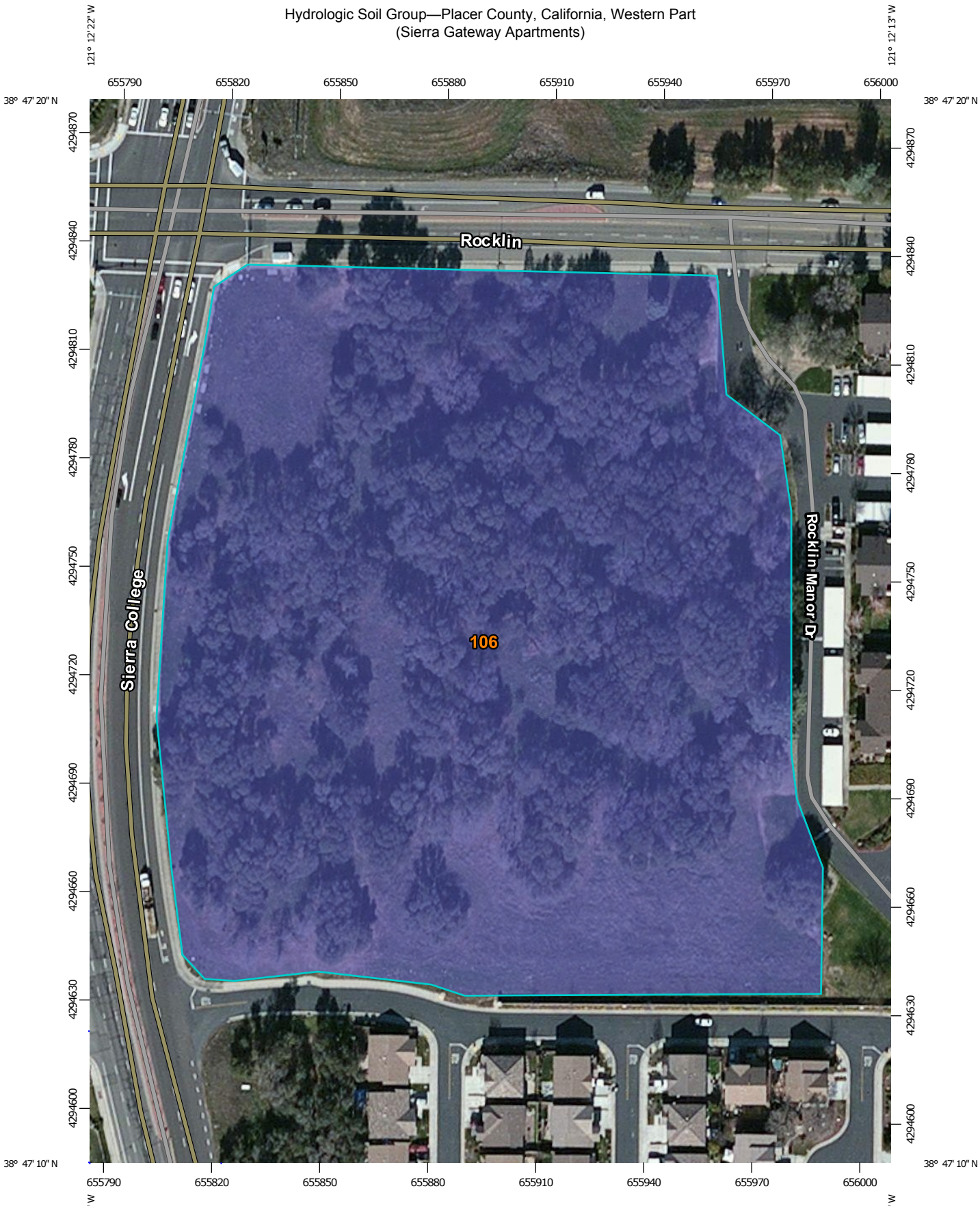
TABLE 5-3

CONSTANT INFILTRATION RATES' FOR HYDROLOGIC SOIL-COVER COMPLEXES

Cover Type			Quality of Cover (2)	Soil Group A	B	C	D
NATURAL COVERS -							
Bare - Rockland, eroded and newly-graded areas				.10	.02	.O1	.01
Grass,Annual or Perennial			Poor	.16	.09	.06	.04
			Fair	:31	.16	.09	.07
			Good	.41	.22	.12	.09
Meadows - Areas with seasonally high water table, principal vegetation is sod-forming grass			Poor	.20	.11	.06	.05
			Fair	.30	.15	.09	.07
			Good	.50	.24	.17	.14
Chaparral,Broadleaf (Manzanita and scrub oak)			Poor	.28	.15	.09	.06
			Fair	.40	.20	.12	.08
			Good	.49	.25	.14	.10
Open Brush - Softwood shrubs, buckwheat, sage, etc.			Poor	.21	.11	.07	.05
			Fair	.34	.18	.11	.07
			Good	.39	.20	.12	.08
Woodland - Coniferous or broadleaf trees predominate. Canopy density is at least 50%)			Poor	.35	.18	.11	.07
			Fair	.44	.22	.13	.09
			Good	.53	.26	.15	.11
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50%)			Poor	.25	.13	.08	.06
			Fair	.36	.18	.11	.08
			Good	.47	.24	.14	.09
URBAN COVERS -							
Residential or Commercial Landscaping (Lawn, shrubs, etc.)			Good	.48	.25	.16	.12
Open Space	Poor	(grass cover < 50%)		.26	.09	.06	.04
	Fair	(grass cover 50-75%)		.31	.16	.09	.07
	Good	(grass cover > 75%)		.41	.22	.12	.09

1. Loss rates in inches/hour
2. Use appropriate ground cover designation

Hydrologic Soil Group—Placer County, California, Western Part
(Sierra Gateway Apartments)



Map Scale: 1:1,430 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 20 40 80 120

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Placer County, California, Western Part
Survey Area Data: Version 7, Sep 17, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 15, 2011—Apr 29, 2012

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Placer County, California, Western Part (CA620)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
106	Andregg coarse sandy loam, 2 to 9 percent slopes	B	8.3	100.0%
Totals for Area of Interest			**8.3**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

APPENDIX B

1. Peak Flow and Hydraulic Grade Line Calculations
2. Q_{10} and Q_{100} Headwater Depth Calculations for Double 72-Inch Pipe Culverts
3. Sub-Shed Response Time Worksheets

SIERRA GATEWAY APARTMENTS
PEAK FLOW & HYDRAULIC GRADE LINE CALCULATIONS
(10-yr Summary PRE-DEVELOPMENT)

North System

Upstream Structure	Downstream Structure	Response Time				Unit Peak Discharge[1]	Shed Name	Shed Area	Shed Imp. Area	Tributary Area	Trib. Imp. Area	Infilt. Rate	Infilt. Factor	Peak Flow	Pipe Size	Length	Slope	n	A	V	K	H(e)[2]	H(K)[3]	H(L)	D/S Invert	U/S Invert	Top of Pipe	Rim or Grate	HGL	Free-board
		Shed	Pipe		Tr (min)																									
		Tr (min)	L (ft)	trp (min)		(cfs/acre)		(acre)	(acre)	(acre)	(%)	(in/hr)		(cfs)	(in)	(ft)	(ft/ft)		(sf)	(ft/sec)				(He+Hk)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
																													322.70	
XN-1	XN-OUT	41.43	180	0.75	42.18	0.59	XN SHED 1	0.18	100%	22.05	12%	0.17	0.28	7.6	24	150	0.012	0.015	3.14	2.43	0.2	0.228	0.018	0.246	319.50	321.30	323.30	329.21	322.95	6.26
XN-2	XN-1	40.20	295	1.23	41.43	0.60	XN SHED 2	0.39	100%	21.87	12%	0.17	0.28	7.6	24	180	0.0064	0.015	3.14	2.42	0.8	0.271	0.073	0.344	321.30	322.46	324.46	330.04	323.29	6.75
XN-3	XN-2	40.08	29	0.12	40.20	0.60	XN SHED 3	0.60	100%	18.01	11%	0.17	0.28	6.3	18	295	0.0201	0.015	1.77	3.57	0.5	1.415	0.099	1.514	322.46	328.39	329.89	338.78	329.89	8.89
XN-4	XN-3	39.00	260	1.08	40.08	0.60			100%	17.41	8%	0.17	0.29	5.8	18	29	0.0259	0.015	1.77	3.31	0.5	0.120	0.085	0.205	328.39	329.14	330.64	339.24	330.09	9.15
XN-5	XN-4	39.00	244	1.02	40.02	0.60			100%	17.41	8%	0.17	0.29	5.8	18	260	0.0181	0.015	1.77	3.31	0.8	1.072	0.136	1.208	329.14	333.85	335.35	342.57	335.35	7.22
XN-6	XN-5	10.00	0	0.00	10.00	2.10	XN SHED 6	0.52	100%	0.52	100%	0.06	0.10	1.1	15	244	0.017	0.015	1.23	0.89	0.5	0.093	0.006	0.099	333.85	338.01	339.26	345.81	339.26	6.55
XN-7	XN-5	39.00	0	0.00	39.00	0.62	XN SHED 7	16.89	5%	16.89	5%	0.17	0.29	5.8	18	89	0.0073	0.015	1.77	3.27	0.2	0.359	0.033	0.392	334.35	335.00	336.50	338.00	339.65	-1.65
XN-8	XN-2	14.00	0	0.00	14.00	1.78	XN SHED 8	3.47	5%	3.47	5%	0.17	0.29	5.2	24	62	0.0195	0.015	3.14	1.66	0.2	0.044	0.009	0.052	322.46	323.67	325.67	326.67	325.67	1.00

South System

Upstream Structure	Downstream Structure	Response Time				Unit Peak Discharge[1]	Shed Name	Shed Area	Shed Imp. Area	Tributary Area	Trib. Imp. Area	Infilt. Rate	Infilt. Factor	Peak Flow	Pipe Size	Length	Slope	n	A	V	K	H(e)[2]	H(K)[3]	H(L)	D/S Invert	U/S Invert	Top of Pipe	Rim or Grate	HGL[5]	Free-board
		Shed	Pipe		Tr (min)																									
		Tr (min)	L (ft)	trp (min)		(cfs/acre)		(acre)	(acre)	(acre)	(%)	(in/hr)		(cfs)	(in)	(ft)	(ft/ft)		(sf)	(ft/sec)				(He+Hk)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
n/a	XS-0	48.40	0	0	48.40	0.56	XS SHED 0	687.70	5%	697.61	6%	0.17	0.29	198.7	72	136	0.022	0.015	28.27	7.03	0.2	0.398	0.153	0.552	302	305	311.00	315.22	308.84	6.38
XS-7	XS-OUT	18.14	410	1.71	19.85	1.30	XS SHED 7	1.14	100%	9.91	44%	0.13	0.21	11.7	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
XS-1	XS-OUT	17.76	91	0.38	18.14	1.40	XS SHED 1	1.82	20%	8.77	36%	0.14	0.23	11.0	27	410	0.005	0.015	3.98	2.77	0.5	0.689	0.059	0.748	314.93	315.24	317.49	319.84	317.49	2.35
XS-2	XS-1	16.09	401	1.67	17.76	1.50	XS SHED 2	2.64	10%	6.96	41%	0.13	0.22	9.5	24	91	0.0112	0.015	3.14	3.03	0.5	0.215	0.071	0.286	315.24	316.29	318.29	322.49	317.78	4.71
XS-3	XS-2	15.77	76	0.32	16.09	1.60			75%	4.20	59%	0.11	0.18	6.4	24	401	0.0129	0.015	3.14	2.04	0.5	0.428	0.032	0.461	316.29	321.46	323.46	329.46	323.46	6.00
XS-4	XS-3	15.43	81	0.34	15.77	1.70			75%	4.20	59%	0.11	0.18	6.8	18	76	0.0158	0.015	1.77	3.86	0.5	0.428	0.116	0.544	322.16	323.42	324.92	334.42	324.00	10.42
XS-5	XS-4	15.00	103	0.43	15.43	1.70	XS SHED 5	0.92	75%	4.20	59%	0.11	0.18	6.8	18	81	0.015	0.015	1.77	3.86	0.5	0.456	0.116	0.572	326.82	328.07	329.57	334.39	329.57	4.82
XS-6	XS-5	15.00	0	0	15.00	1.70	XS SHED 6	3.28	55%	3.28	55%	0.11	0.19	5.3	12	103	0.015	0.015	0.79	6.74	0.5	3.029	0.353	3.382	328.07	329.63	330.63	335.52	332.95	2.57
XS-8	XS-2	10.00	0	0	10.00	2.10	XS SHED 8	0.12	50%	0.12	50%	0.12	0.20	0.2	12	26	0.015	0.015	0.79	0.31	0.5	0.002	0.001	0.002	316.29	317.00	318.00	322.66	317.78	4.88

Notes
1) Figure 5-3A Placer County Storm Water Management Manual
2) Energy Loss
3) Junction Loss
4) Initial HGL assumes 70% full pipe
5) Initial HGL based on inlet HW/D for 10-yr Q of 198.7 cfs = 0.64 (FHWA HEC-5 Hydraulic Charts for Selection of Highway Culverts)

SIERRA GATEWAY APARTMENTS
PEAK FLOW & HYDRAULIC GRADE LINE CALCULATIONS
(100-yr Summary PRE-DEVELOPMENT)

North System

Upstream Structure	Downstream Structure	Response Time				Unit Peak Discharge[1]	Shed Name	Shed Area	Shed Imp. Area	Tributary Area	Trib. Imp. Area	Infilt. Rate	Infilt. Factor	Peak Flow	Pipe Size	Length	Slope	n	A	V	K	H(e)[2]	H(K)[3]	H(L)	D/S Invert	U/S Invert	Top of Pipe	Rim or Grate	HGL[4]	Free-board
		Shed	Pipe		Tr (min)																									
		Tr (min)	L (ft)	trp (min)		(cfs/acre)		(acre)	(acre)	(acre)	(%)	(in/hr)		(cfs)	(in)	(ft)	(ft/ft)		(sf)	(ft/sec)				(He+Hk)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
																													323.30	
XN-1	XN-OUT	41.43	180	0.75	42.18	1.16	XN SHED 1	0.18	100%	22.05	12%	0.17	0.28	20.2	24	150	0.012	0.015	3.14	6.43	0.2	1.593	0.128	1.722	319.50	321.30	323.30	329.21	325.02	4.19
XN-2	XN-1	40.20	295	1.23	41.43	1.18	XN SHED 2	0.39	100%	21.87	12%	0.17	0.28	20.4	24	180	0.006	0.015	3.14	6.49	0.8	1.950	0.524	2.474	321.30	322.46	324.46	330.04	327.50	2.54
XN-3	XN-2	40.08	29	0.12	40.20	1.20	XN SHED 3	0.60	100%	18.01	11%	0.17	0.28	17.1	18	295	0.020	0.015	1.77	9.68	0.5	10.425	0.728	11.153	322.46	328.39	329.89	338.78	338.65	0.13
XN-4	XN-3	39.00	260	1.08	40.08	1.20			100%	17.41	8%	0.17	0.29	16.3	18	29	0.026	0.015	1.77	9.22	0.5	0.929	0.660	1.589	328.39	329.14	330.64	339.24	340.24	-1.00
XN-5	XN-4	39.00	244	1.02	40.02	1.20			100%	17.41	8%	0.17	0.29	16.3	18	260	0.018	0.015	1.77	9.22	0.8	8.329	1.056	9.385	329.14	333.85	335.35	342.57	349.62	-7.05
XN-6	XN-5	10.00	0	0.00	10.00	3.80	XN SHED 6	0.52	100%	0.52	100%	0.06	0.10	2.0	15	244	0.017	0.015	1.23	1.61	0.5	0.304	0.020	0.324	333.85	338.01	339.26	345.81	349.95	-4.14
XN-7	XN-5	39.00	0	0.00	39.00	1.23	XN SHED 7	16.89	5%	16.89	5%	0.17	0.29	16.1	18	89	0.007	0.015	1.77	9.10	0.2	2.778	0.257	3.036	334.35	335.00	336.50	338.00	352.98	-14.98
XN-8	XN-2	14.00	0	0.00	14.00	3.24	XN SHED 8	3.47	5%	3.47	5%	0.17	0.29	10.3	24	62	0.020	0.015	3.14	3.27	0.2	0.170	0.033	0.204	322.46	323.67	325.67	326.67	327.70	-1.03

South System

Upstream Structure	Downstream Structure	Response Time				Unit Peak Discharge[1]	Shed Name	Shed Area	Shed Imp. Area	Tributary Area	Trib. Imp. Area	Infilt. Rate	Infilt. Factor	Peak Flow	Pipe Size	Length	Slope	n	A	V	K	H(e)[2]	H(K)[3]	H(L)	D/S Invert	U/S Invert	Top of Pipe	Rim or Grate	HGL[5]	Free-board
		Shed	Pipe		Tr (min)																									
		Tr (min)	L (ft)	trp (min)		(cfs/acre)		(acre)	(acre)	(acre)	(%)	(in/hr)		(cfs)	(in)	(ft)	(ft/ft)		(sf)	(ft/sec)				(He+Hk)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
XS-0	XS-0	48.40	0	0	48.40	1.04	XS SHED 0	687.70	5%	697.61	6%	0.17	0.29	533.5	72 (x2)	136	0.022	0.015	56.55	9.43	0.2	2.872	0.276	3.149	302	305	311.00	315.22	312.62	2.60
XS-7	XS-OUT	18.14	410	1.71	19.85	2.46	XS SHED 7	1.14	100%	9.91	44%	0.13	0.21	23.2	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
XS-1	XS-OUT	17.76	91	0.38	18.14	2.62	XS SHED 1	1.82	20%	8.77	36%	0.14	0.23	21.7	27	410	0.001	0.015	3.98	5.46	0.5	2.681	0.231	2.912	314.93	315.24	317.49	319.84	315.53	4.31
XS-2	XS-1	16.09	401	1.67	17.76	2.78	XS SHED 2	2.64	10%	6.96	41%	0.13	0.22	18.4	24	91	0.012	0.015	3.14	5.87	0.5	0.804	0.267	1.071	315.24	316.29	318.29	322.49	316.60	5.89
XS-3	XS-2	15.77	76	0.32	16.09	2.94			75%	4.20	59%	0.11	0.18	12.0	24	401	0.013	0.015	3.14	3.83	0.5	1.512	0.114	1.626	316.29	321.46	323.46	329.46	323.46	6.00
XS-4	XS-3	15.43	81	0.34	15.77	3.10			75%	4.20	59%	0.11	0.18	12.7	18	76	0.017	0.015	1.77	7.19	0.5	1.482	0.402	1.883	322.16	323.42	324.92	334.42	325.34	9.08
XS-5	XS-4	15.00	103	0.43	15.43	3.10	XS SHED 5	0.92	75%	4.20	59%	0.11	0.18	12.7	18	81	0.015	0.015	1.77	7.19	0.5	1.579	0.402	1.981	326.82	328.07	329.57	334.39	329.57	4.82
XS-6	XS-5	15.00	0	0	15.00	3.10	XS SHED 6	3.28	55%	3.28	55%	0.11	0.19	9.9	12	103	0.015	0.015	0.79	12.59	0.5	10.564	1.230	11.794	328.07	329.63	330.63	335.52	341.36	-5.84
XS-8	XS-2	10.00	0	0	10.00	3.80	XS SHED 8	0.12	50%	0.12	50%	0.12	0.20	0.4	12	26	0.027	0.015	0.79	0.57	0.5	0.005	0.002	0.008	316.29	317.00	318.00	322.66	318.00	4.66

Notes
1) Figure 5-3A Placer County Storm Water Management Manual
2) Energy Loss
3) Junction Loss
4) Initial HGL assumes 100% full pipe
5) Initial HGL based on inlet HW/D for 100-yr Q of 533.5 cfs = 1.27 (FHWA HEC-5 Hydraulic Charts for Selection of Highway Culverts)

SIERRA GATEWAY APARTMENTS
PEAK FLOW & HYDRAULIC GRADE LINE CALCULATIONS
(10-yr Summary POST DEVELOPMENT)

North System

Upstream Structure	Downstream Structure	Response Time				Unit Peak Discharge[1]	Shed Name	Shed Area	Tributary Area	Imp. Area	Infilt. Rate	Infilt. Factor	Peak Flow	Pipe Size	Length	Slope	n	A	V	K	H(e)[2]	H(K)[3]	H(L)	D/S Invert	U/S Invert	Top of Pipe	Rim or Grate	HGL[4]	Free-board
		Shed	Pipe		Tr (min)																							
		Tr (min)	L (ft)	trp (min)		(cfs/acre)		(acre)	(acre)	(%)	(in/hr)		(cfs)	(in)	(ft)	(ft/ft)		(sf)	(ft/sec)				(He+Hk)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
																												322.70	
XN-1	XN-OUT	41.60	122.00	0.51	42.11	0.59	XN SHED 1	0.18	21.14	21%	0.15	0.26	8.2	24	150	0.012	0.015	3.14	2.60	0.5	0.260	0.052	0.312	319.50	321.30	323.30	329.21	323.30	5.91
PN1	XN1	41.25	83.00	0.35	41.60	0.60	JUNCTION	0.00	20.96	21%	0.16	0.26	8.1	24	122	0.010	0.015	3.14	2.59	0.5	0.210	0.052	0.262	321.30	322.46	324.46	330.04	324.46	5.58
PN2	PN1	40.37	211.00	0.88	41.25	0.60	PN SHED 2	0.45	2.78	83%	0.08	0.13	1.6	24	83	0.007	0.015	3.14	0.51	0.5	0.005	0.002	0.007	322.46	323.05	325.05	330.47	325.05	5.42
PN3	PN2	11.96	40.00	0.17	12.13	1.94	PN SHED 3	0.09	2.33	80%	0.08	0.14	4.5	18	10	0.311	0.015	1.77	2.52	0.9	0.024	0.089	0.113	323.05	326.16	327.66	332.16	327.66	4.50
PN4	PN3	11.90	14.00	0.06	11.96	2.02	WQMH	0.00	2.24	83%	0.08	0.14	4.5	18	40	0.000	0.015	1.77	2.53	0.5	0.097	0.050	0.146	327.75	327.77	329.27	335.99	329.27	6.72
PN5	PN4	11.77	30.00	0.13	11.90	2.02	PN SHED 5	0.18	2.24	83%	0.08	0.14	4.5	18	14	0.011	0.015	1.77	2.53	1.3	0.034	0.129	0.163	327.90	328.05	329.55	336.13	329.55	6.58
PN6	PN5	11.44	79.00	0.33	11.77	2.02	JUNCTION	0.00	2.06	82%	0.08	0.14	4.1	18	30	0.018	0.015	1.77	2.33	0.2	0.061	0.017	0.078	328.05	328.58	330.08	336.32	330.08	6.24
PN7	PN6	11.09	83.00	0.35	11.44	2.02	JUNCTION	0.00	1.46	77%	0.09	0.15	2.9	12	90	0.018	0.015	0.79	3.69	0.9	0.795	0.191	0.986	328.58	330.20	331.20	339.37	331.20	8.17
PN8	PN7	10.69	96.00	0.40	11.09	2.02	JUNCTION	0.00	1.18	80%	0.08	0.14	2.4	12	83	0.017	0.015	0.79	2.99	1.1	0.481	0.153	0.634	330.20	331.60	332.60	339.50	332.60	6.90
PN9	PN8	10.36	78.00	0.33	10.69	2.10	JUNCTION	0.00	0.71	79%	0.09	0.14	1.5	12	96	0.019	0.015	0.79	1.87	1.1	0.218	0.060	0.277	331.59	333.42	334.42	340.52	334.42	6.10
PN10	PN9	10.06	73.00	0.30	10.36	2.10	JUNCTION	0.00	0.57	77%	0.09	0.15	1.2	12	78	0.018	0.015	0.79	1.50	1.1	0.114	0.038	0.152	333.42	334.81	335.81	340.33	335.81	4.52
PN11	PN10	10.00	14.00	0.06	10.06	2.10	PN SHED 11	0.09	0.18	90%	0.07	0.12	0.4	12	73	0.018	0.015	0.79	0.48	0.9	0.011	0.003	0.014	334.81	336.14	337.14	341.78	337.14	4.64
PN12	PN11	10.00	0.00	0.00	10.00	2.10	PN SHED 12	0.09	0.09	100%	0.06	0.10	0.2	12	14	0.018	0.015	0.79	0.24	0.5	0.001	0.000	0.001	336.14	336.39	337.39	341.37	337.39	3.98
PN13	PN10	10.00	0.00	0.00	10.00	2.10	PN SHED 13	0.21	0.21	90%	0.07	0.12	0.4	12	15	0.020	0.015	0.79	0.56	0.9	0.003	0.004	0.007	336.25	336.55	337.55	339.77	337.55	2.22
PN14	PN10	10.00	0.00	0.00	10.00	2.10	PN SHED 14	0.18	0.18	85%	0.08	0.13	0.4	12	36	0.020	0.015	0.79	0.48	0.9	0.005	0.003	0.008	336.25	336.97	337.97	340.87	337.97	2.90
PN15	PN9	10.00	0.00	0.00	10.00	2.10	PN SHED 15	0.14	0.14	85%	0.08	0.13	0.3	12	36	0.020	0.015	0.79	0.37	0.9	0.003	0.002	0.005	333.42	334.13	335.13	340.87	335.13	5.74
PN16	PN8	10.00	0.00	0.00	10.00	2.10	PN SHED 16	0.05	0.05	95%	0.07	0.11	0.1	12	34	0.020	0.015	0.79	0.13	1.1	0.000	0.000	0.001	332.75	333.42	334.42	337.54	334.42	3.12
PN17	PN8	10.00	110.00	0.46	10.46	2.10	PN SHED 17	0.09	0.28	50%	0.12	0.20	0.6	12	61	0.021	0.015	0.79	0.71	1.1	0.020	0.009	0.029	332.75	334.04	335.04	340.71	335.04	5.67
PN18	PN17	10.57	0.00	0.00	10.57	2.10	PN SHED 18	0.19	0.19	40%	0.13	0.22	0.4	12	110	0.020	0.015	0.79	0.48	0.9	0.016	0.003	0.019	334.04	336.24	337.24	340.18	337.24	2.94
PN19	PN8	10.00	0.00	0.00	10.00	2.10	PN SHED 19	0.14	0.14	85%	0.08	0.13	0.3	12	36	0.020	0.015	0.79	0.37	1.1	0.003	0.002	0.006	332.75	333.47	334.47	340.19	334.47	5.72
PN20	PN7	10.00	0.00	0.00	10.00	2.10	PN SHED 20	0.18	0.18	85%	0.08	0.13	0.4	12	36	0.020	0.015	0.79	0.48	1.1	0.005	0.004	0.009	334.51	335.23	336.23	340.19	336.23	3.96
PN21	PN7	10.00	0.00	0.00	10.00	2.10	PN SHED 21	0.10	0.10	35%	0.14	0.23	0.2	12	106	0.020	0.015	0.79	0.25	1.1	0.004	0.001	0.005	330.20	332.33	333.33	335.60	333.33	2.27
PN22	PN6	10.00	0.00	0.00	10.00	2.10	PN SHED 22	0.40	0.40	95%	0.07	0.11	0.8	12	79	0.020	0.015	0.79	1.07	1.1	0.058	0.019	0.078	328.58	330.14	331.14	335.62	331.28	4.34
PN25	PN6	10.00	0.00	0.00	10.00	2.10	PN SHED 25	0.20	0.20	85%	0.08	0.13	0.4	12	79	0.020	0.015	0.79	0.53	1.1	0.014	0.005	0.019	328.58	330.14	331.14	335.62	332.62	3.00
PN28	PN2	40.26	27.00	0.11	40.37	0.60	PN SHED 28	0.61	18.18	11%	0.17	0.28	6.4	24	211	0.031	0.015	3.14	2.03	1.1	0.224	0.071	0.294	322.46	329.04	331.04	339.24	331.04	8.20
PN26	PN28	39.36	216.00	0.90	40.26	0.60	JUNCTION	0.00	17.39	8%	0.17	0.29	5.9	24	27	0.020	0.015	3.14	1.87	0.9	0.024	0.049	0.073	331.62	332.16	334.16	338.37	334.16	4.21
PN27	PN28	10.30	0.00	0.00	10.30	2.10	PN SHED 27	0.18	0.18	40%	0.13	0.22	0.4	12	17	0.039	0.015	0.79	0.45	0.5	0.002	0.002	0.004	332.16	332.83	333.83	337.99	333.83	4.16
XN5	PN26	39.00	87.00	0.36	39.36	0.62	JUNCTION	0.00	17.39	8%	0.17	0.29	6.2	18	216	0.022	0.015	1.77	3.50	1.1	0.995	0.209	1.204	329.14	333.85	335.35	342.35	335.36	6.99
XN7	XN5	39.00	0.00	0.00	39.00	0.62	XN SHED 7	16.89	16.89	5%	0.17	0.29	5.8	15	87	0.042	0.015	1.23	4.71	0.5	0.927	0.172	1.100	334.35	338.00	339.25	339.25	339.25	0.00
PN29	XN5	10.00	0.00	0.00	10.00	2.10	PN SHED 29	0.50	0.50	100%	0.06	0.10	1.1	12	267	0.015	0.015	0.79	1.34	0.2	0.309	0.006	0.315	334.35	338.30	339.30	346.11	339.30	6.81

Notes:
1) From Figure 5-3A Placer County Storm Water Management Manual
2) Energy Loss
3) Junction Loss
4) Initial HGL assumes 70% full pipe
5) Red shading indicates flow exceeds pipe system capacity; blue shading represents pipes upsized from existing condition

SIERRA GATEWAY APARTMENTS
PEAK FLOW & HYDRAULIC GRADE LINE CALCULATIONS
(10-yr Summary POST DEVELOPMENT)

South System

Upstream Structure	Downstream Structure	Response Time				Unit Peak Discharge[1]	Shed Name	Shed Area	Tributary Area	Imp. Area	Infilt. Rate	Infilt. Factor	Peak Flow	Pipe Size	Length	Slope	n	A	V	K	H(e)[2]	H(K)[3]	H(L)	D/S Invert	U/S Invert	Top of Pipe	Rim or Grate	HGL[4]	Free-board
		Shed	Pipe		Tr (min)																							
		Tr (min)	L (ft)	trp (min)		(cfs/acre)		(acre)	(acre)	(%)	(in/hr)		(cfs)	(in)	(ft)	(ft/ft)		(sf)	(ft/sec)				(He+Hk)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
n/a	XS-0	48.40	0.00	0.00	48.40	0.56	XS SHED 0	687.70	697.96	6%	0.17	0.29	200.8	72 (x2)	136	0.037	0.015	56.55	3.55	0.2	0.407	0.039	0.446	300.00	305.00	311.00	315.22	308.90	6.32
PS1	XS-OUT	16.08	121.00	0.50	16.58	1.60	PS SHED 1	0.51	10.26	83%	0.08	0.13	16.2	27	42	0.019	0.015	3.98	4.07	0.2	0.153	0.051	0.204	307.83	308.61	310.86	315.20	310.86	4.34
PS2	PS1	14.86	292.00	1.22	16.08	1.60	PS SHED 2	0.64	9.75	83%	0.08	0.13	15.4	27	121	0.015	0.015	3.98	3.87	0.5	0.397	0.116	0.513	308.61	310.39	312.64	315.09	312.64	2.45
PS3	PS2	14.47	94.00	0.39	14.86	1.78	PS SHED 3	0.82	9.11	83%	0.08	0.14	16.0	27	292	0.017	0.015	3.98	4.02	0.9	1.038	0.226	1.264	310.39	315.24	317.49	320.33	317.49	2.84
PS34	PS3	11.88	0.00	0.00	11.88	2.02	PS SHED 34	0.34	0.34	30%	0.14	0.24	0.6	12	15	0.023	0.015	0.79	0.80	0.9	0.006	0.009	0.015	315.24	315.59	316.59	320.31	317.51	2.80
XS2	PS3	13.83	153.00	0.64	14.47	1.78	PS SHED XS2	0.66	7.95	83%	0.08	0.14	14.0	24	94	0.011	0.015	3.14	4.45	0.9	0.477	0.276	0.754	315.24	316.29	318.29	323.07	318.29	4.78
PS4	XS2	14.75	44.00	0.18	14.93	1.78	JUNCTION	0.00	7.20	81%	0.08	0.14	12.6	24	153	0.013	0.015	3.14	4.02	0.9	0.635	0.226	0.861	316.29	318.27	320.27	326.91	320.27	6.64
PS29	PS4	10.00	0.00	0.00	10.00	2.10	PS SHED 29	0.61	0.61	90%	0.07	0.12	1.3	12	25	0.148	0.015	0.79	1.62	0.9	0.043	0.037	0.079	318.27	321.96	322.96	325.76	322.96	2.80
PS33	XS2	10.00	0.00	0.00	10.00	2.10	PS SHED 33	0.09	0.09	60%	0.11	0.18	0.2	12	56	0.031	0.015	0.79	0.23	0.9	0.002	0.001	0.003	316.29	318.00	319.00	322.26	319.00	3.26
XS10	XS2	10.00	0.00	0.00	10.00	2.10	XS SHED 10	0.12	0.12	75%	0.09	0.15	0.2	12	30	0.024	0.015	0.79	0.32	0.9	0.002	0.001	0.003	316.29	317.00	318.00	322.65	320.27	2.38
PS6	PS4	11.54	13.00	0.05	11.59	2.02	WQMH	0.00	3.60	84%	0.08	0.13	7.2	24	44	0.006	0.015	3.14	2.29	0.9	0.059	0.073	0.133	319.30	319.57	321.57	327.77	321.57	6.20
PS7	PS6	11.00	129.00	0.54	11.54	2.02	JUNCTION	0.00	3.60	84%	0.08	0.13	7.2	24	13	0.018	0.015	3.14	2.29	0.9	0.018	0.073	0.091	319.57	319.81	321.81	335.88	321.81	14.07
PS19	PS7	10.89	21.00	0.09	10.98	2.10	PS SHED 19	0.25	1.51	87%	0.08	0.13	3.1	12	62	0.021	0.015	0.79	4.00	0.9	0.644	0.224	0.868	322.99	324.32	325.32	332.83	325.32	7.51
PS20	PS19	10.64	60.00	0.25	10.89	2.10	JUNCTION	0.00	1.26	84%	0.08	0.13	2.6	12	21	0.026	0.015	0.79	3.33	0.9	0.151	0.155	0.307	324.22	324.77	325.77	333.49	325.77	7.72
PS21	PS20	10.48	39.00	0.16	10.64	2.10	PS SHED 21	0.03	1.26	84%	0.08	0.13	2.6	12	60	0.014	0.015	0.79	3.33	0.9	0.432	0.155	0.587	324.87	325.69	326.69	333.27	326.69	6.58
PS22	PS21	10.25	56.00	0.23	10.48	2.10	JUNCTION	0.00	1.23	84%	0.08	0.13	2.6	12	39	0.019	0.015	0.79	3.26	1.1	0.268	0.181	0.449	325.79	326.55	327.55	334.29	327.55	6.74
PS23	PS22	10.05	48.00	0.20	10.25	2.10	PS SHED 23	0.19	0.59	84%	0.08	0.13	1.2	12	56	0.021	0.015	0.79	1.56	0.5	0.088	0.019	0.107	326.65	327.85	328.85	334.39	328.85	5.54
PS24	PS23	10.00	13.00	0.05	10.05	2.10	PS SHED 24	0.19	0.40	84%	0.08	0.13	0.8	12	48	0.025	0.015	0.79	1.06	0.5	0.035	0.009	0.044	327.95	329.14	330.14	334.81	330.14	4.67
PS25	PS24	10.00	0.00	0.00	10.00	2.10	PS SHED 25	0.21	0.21	70%	0.10	0.16	0.4	12	13	0.008	0.015	0.79	0.55	0.5	0.003	0.002	0.005	329.24	329.35	330.35	332.85	330.35	2.50
PS26	PS22	10.00	80.00	0.33	10.33	2.10	PS SHED 26	0.54	0.64	84%	0.08	0.13	1.3	12	80	0.011	0.015	0.79	1.69	0.9	0.149	0.040	0.189	326.65	327.51	328.51	332.48	328.51	3.97
PS27	PS26	10.00	0.00	0.00	10.00	2.10	PS SHED 27	0.10	0.10	50%	0.12	0.20	0.2	12	80	0.011	0.015	0.79	0.25	0.9	0.003	0.001	0.004	327.61	328.47	329.47	332.26	329.47	2.79
PS8	PS7	10.64	87.00	0.36	11.00	2.02	PS SHED 8	0.26	2.09	83%	0.08	0.14	4.2	12	129	0.020	0.015	0.79	5.31	0.9	2.358	0.395	2.753	325.78	328.36	329.36	336.04	329.36	6.68
PS9	PS8	10.14	63.00	0.26	10.40	2.10	PS SHED 9	0.20	1.01	77%	0.09	0.15	2.1	12	87	0.020	0.015	0.79	2.66	0.5	0.397	0.055	0.452	328.36	330.10	331.10	336.50	331.10	5.40
PS10	PS9	10.00	33.00	0.14	10.14	2.10	JUNCTION	0.00	0.81	76%	0.09	0.15	1.7	12	63	0.020	0.015	0.79	2.13	0.9	0.185	0.063	0.248	330.10	331.36	332.36	337.65	332.36	5.29
PS11	PS10	10.00	0.00	0.00	10.00	2.10	PS SHED 11	0.42	0.42	100%	0.06	0.10	0.9	12	33	0.020	0.015	0.79	1.12	0.5	0.027	0.010	0.037	331.36	332.03	333.03	337.03	333.03	4.00
PS12	PS10	10.00	0.00	0.00	10.00	2.10	PS SHED 12	0.39	0.39	50%	0.12	0.20	0.8	12	48	0.020	0.015	0.79	0.99	0.9	0.031	0.014	0.044	331.36	332.31	333.31	337.65	333.31	4.34
PS13	PS8	10.32	77.00	0.32	10.64	2.10	PS SHED 13	0.05	0.82	91%	0.07	0.12	1.7	12	89	0.017	0.015	0.79	2.18	0.9	0.274	0.067	0.341	328.36	329.86	330.86	337.25	330.86	6.39
PS14	PS13	10.00	77.00	0.32	10.32	2.10	PS SHED 14	0.14	0.47	97%	0.06	0.11	1.0	12	77	0.017	0.015	0.79	1.26	0.9	0.079	0.022	0.101	329.86	331.17	332.17	337.12	332.17	4.95
PS14a	PS14	10.00	0.00	0.00	10.00	2.10	PS SHED 14a	0.09	0.09	60%	0.11	0.18	0.2	12	77	0.020	0.015	0.79	0.23	0.9	0.003	0.001	0.003	331.64	333.20	334.20	342.00	334.20	7.80
PS15	PS14	10.00	0.00	0.00	10.00	2.10	PS SHED 15	0.15	0.15	80%	0.08	0.14	0.3	12	43	0.020	0.015	0.79	0.40	0.9	0.004	0.002	0.007	331.64	332.49	333.49	337.50	333.49	4.01
PS16	PS14	10.00	0.00	0.00	10.00	2.10	PS SHED 16	0.18	0.18	80%	0.08	0.14	0.4	12	43	0.020	0.015	0.79	0.47	0.9	0.006	0.003	0.009	331.64	332.50	333.50	337.51	333.50	4.01
PS17	PS13	10.00	0.00	0.00	10.00	2.10	PS SHED 17	0.17	0.17	80%	0.08	0.14	0.4	12	43	0.020	0.015	0.79	0.45	0.9	0.006	0.003	0.008	331.64	332.49	333.49	337.50	333.49	4.01
PS18	PS13	10.00	0.00	0.00	10.00	2.10	PS SHED 18	0.13	0.13	80%	0.08	0.14	0.3	12	43	0.020	0.015	0.79	0.34	0.9	0.003	0.002	0.005	331.64	332.50	333.50	337.53	333.50	4.03
PS30	PS4	14.07	164.00	0.68	14.75	1.78	JUNCTION	0.00	2.99	76%	0.09	0.15	5.2	24	248	0.013	0.015	3.14	1.66	0.5	0.176	0.021	0.197	318.27	321.46	323.46	329.41	323.46	5.95
PS31	PS30	10.00	0.00	0.00	10.00	2.10	PS SHED 31	0.22	0.22	90%	0.07	0.12	0.5	12	66	0.040	0.015	0.79	0.58	0.9	0.015	0.005	0.019	322.08	324.70	325.70	330.45	325.70	4.75
XS5	PS30	12.55	365.00	1.52	14.07	1.78	XS SHED 5	1.68	2.77	75%	0.09	0.15	4.8	21	164	0.045	0.015	2.41	2.01	0.9	0.203	0.056	0.259	322.16	329.50	331.25	334.39	331.25	3.14
PS32	XS5	11.75	0.00	0.00	11.75	2.02	PS SHED 32	1.09	1.09	75%	0.09	0.15	2.2	12	365	0.015	0.015	0.79	2.75	0.9	1.788	0.106	1.894	329.50	335.00	336.00	339.63	336.00	3.63

Notes:
1) From Figure 5-3A Placer County Storm Water Management Manual
2) Energy Loss
3) Junction Loss
4) Initial HGL based on inlet HW/D for 10-yr Q of 200.8 cfs = 0.65 (FHWA HEC-5 Hydraulic Charts for Selection of Highway Culverts)
5) Red shading indicates flow exceeds pipe system capacity; blue shading represents pipes upsized from existing condition

SIERRA GATEWAY APARTMENTS
PEAK FLOW & HYDRAULIC GRADE LINE CALCULATIONS
(100-yr Summary POST DEVELOPMENT)

North System

Upstream Structure	Downstream Structure	Response Time				Unit Peak Discharge[1]	Shed Name	Shed Area	Tributary Area	Imp. Area	Infilt. Rate	Infilt. Factor	Peak Flow	Pipe Size	Length	Slope	n	A	V	K	H(e)[2]	H(K)[3]	H(L)	D/S Invert	U/S Invert	Top of Pipe	Rim or Grate	HGL[4]	Free-board
		Shed	Pipe		Tr (min)																							
		Tr (min)	L (ft)	trp (min)		(cfs/acre)		(acre)	(acre)	(%)	(in/hr)		(cfs)	(in)	(ft)	(ft/ft)		(sf)	(ft/sec)				(He+Hk)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
																												323.30	
XN-1	XN-OUT	41.60	122.00	0.51	42.11	1.16	XN SHED 1	0.18	21.14	21%	0.15	0.26	20.2	24	150	0.012	0.015	3.14	6.42	0.5	1.590	0.320	1.910	319.50	321.30	323.30	329.21	325.21	4.00
PN1	XN1	41.25	83.00	0.35	41.60	1.18	JUNCTION	0.00	20.96	20%	0.16	0.26	20.4	24	122	0.010	0.015	3.14	6.48	0.5	1.317	0.326	1.643	321.30	322.46	324.46	330.04	326.85	3.19
PN2	PN1	40.37	211.00	0.88	41.25	1.18	PN SHED 2	0.45	2.78	83%	0.08	0.13	3.2	24	83	0.007	0.015	3.14	1.02	0.5	0.022	0.008	0.031	322.46	323.05	325.05	330.47	325.24	5.23
PN3	PN2	11.96	40.00	0.17	12.13	3.52	PN SHED 3	0.09	2.33	80%	0.08	0.14	8.1	18	10	0.311	0.015	1.77	4.60	0.9	0.080	0.296	0.376	323.05	326.16	327.66	332.16	327.66	4.50
PN4	PN3	11.90	14.00	0.06	11.96	3.66	WQMH	0.00	2.24	83%	0.08	0.14	8.1	18	40	0.000	0.015	1.77	4.61	0.5	0.320	0.165	0.486	327.75	327.77	329.27	335.99	329.27	6.72
PN5	PN4	11.77	30.00	0.13	11.90	3.66	PN SHED 5	0.18	2.24	83%	0.08	0.14	8.1	18	14	0.011	0.015	1.77	4.61	1.3	0.112	0.429	0.541	327.90	328.05	329.55	336.13	329.81	6.32
PN6	PN5	11.44	79.00	0.33	11.77	3.66	JUNCTION	0.00	2.06	82%	0.08	0.14	7.5	18	30	0.018	0.015	1.77	4.24	0.2	0.203	0.056	0.259	328.05	328.58	330.08	336.32	330.08	6.24
PN7	PN6	11.09	83.00	0.35	11.44	3.66	JUNCTION	0.00	1.46	77%	0.09	0.15	5.3	12	90	0.018	0.015	0.79	6.74	0.9	2.649	0.635	3.284	328.58	330.20	331.20	339.37	333.36	6.01
PN8	PN7	10.69	96.00	0.40	11.09	3.66	JUNCTION	0.00	1.18	80%	0.08	0.14	4.3	12	83	0.017	0.015	0.79	5.46	1.1	1.600	0.508	2.108	330.20	331.60	332.60	339.50	335.47	4.03
PN9	PN8	10.36	78.00	0.33	10.69	3.80	JUNCTION	0.00	0.71	79%	0.09	0.14	2.7	12	96	0.019	0.015	0.79	3.41	1.1	0.722	0.198	0.920	331.59	333.42	334.42	340.52	336.39	4.13
PN10	PN9	10.06	73.00	0.30	10.36	3.80	JUNCTION	0.00	0.57	77%	0.09	0.15	2.1	12	78	0.018	0.015	0.79	2.73	1.1	0.377	0.128	0.505	333.42	334.81	335.81	340.33	336.90	3.43
PN11	PN10	10.00	14.00	0.06	10.06	3.80	PN SHED 11	0.09	0.18	90%	0.07	0.12	0.7	12	73	0.018	0.015	0.79	0.87	0.9	0.036	0.011	0.046	334.81	336.14	337.14	341.78	337.14	4.64
PN12	PN11	10.00	0.00	0.00	10.00	3.80	PN SHED 12	0.09	0.09	100%	0.06	0.10	0.3	12	14	0.018	0.015	0.79	0.44	0.5	0.002	0.001	0.003	336.14	336.39	337.39	341.37	337.39	3.98
PN13	PN10	10.00	0.00	0.00	10.00	3.80	PN SHED 13	0.21	0.21	90%	0.07	0.12	0.8	12	15	0.020	0.015	0.79	1.01	0.9	0.010	0.014	0.024	336.25	336.55	337.55	339.77	337.55	2.22
PN14	PN10	10.00	0.00	0.00	10.00	3.80	PN SHED 14	0.18	0.18	85%	0.08	0.13	0.7	12	36	0.020	0.015	0.79	0.87	0.9	0.017	0.010	0.028	336.25	336.97	337.97	340.87	337.97	2.90
PN15	PN9	10.00	0.00	0.00	10.00	3.80	PN SHED 15	0.14	0.14	85%	0.08	0.13	0.5	12	36	0.020	0.015	0.79	0.67	0.9	0.011	0.006	0.017	333.42	334.13	335.13	340.87	336.41	4.46
PN16	PN8	10.00	0.00	0.00	10.00	3.80	PN SHED 16	0.05	0.05	95%	0.07	0.11	0.2	12	34	0.020	0.015	0.79	0.24	1.1	0.001	0.001	0.002	332.75	333.42	334.42	337.54	335.47	2.07
PN17	PN8	10.00	110.00	0.46	10.46	3.80	PN SHED 17	0.09	0.28	50%	0.12	0.20	1.0	12	61	0.021	0.015	0.79	1.32	1.1	0.069	0.030	0.098	332.75	334.04	335.04	340.71	335.57	5.14
PN18	PN17	10.57	0.00	0.00	10.57	3.80	PN SHED 18	0.19	0.19	40%	0.13	0.22	0.7	12	110	0.020	0.015	0.79	0.89	0.9	0.056	0.011	0.067	334.04	336.24	337.24	340.18	337.24	2.94
PN19	PN8	10.00	0.00	0.00	10.00	3.80	PN SHED 19	0.14	0.14	85%	0.08	0.13	0.5	12	36	0.020	0.015	0.79	0.67	1.1	0.011	0.008	0.018	332.75	333.47	334.47	340.19	335.49	4.70
PN20	PN7	10.00	0.00	0.00	10.00	3.80	PN SHED 20	0.18	0.18	85%	0.08	0.13	0.7	12	36	0.020	0.015	0.79	0.87	1.1	0.017	0.013	0.030	334.51	335.23	336.23	340.19	336.23	3.96
PN21	PN7	10.00	0.00	0.00	10.00	3.80	PN SHED 21	0.10	0.10	35%	0.14	0.23	0.4	12	106	0.020	0.015	0.79	0.46	1.1	0.015	0.004	0.019	330.20	332.33	333.33	335.60	333.38	2.22
PN22	PN6	10.00	0.00	0.00	10.00	3.80	PN SHED 22	0.40	0.40	95%	0.07	0.11	1.5	12	79	0.020	0.015	0.79	1.93	1.1	0.191	0.064	0.255	328.58	330.14	331.14	335.62	331.14	4.48
PN25	PN6	10.00	0.00	0.00	10.00	3.80	PN SHED 25	0.20	0.20	85%	0.08	0.13	0.8	12	79	0.020	0.015	0.79	0.96	1.1	0.047	0.016	0.063	328.58	330.14	331.14	335.62	331.14	4.48
PN28	PN2	40.26	27.00	0.11	40.37	1.20	PN SHED 28	0.61	18.18	11%	0.17	0.28	17.3	24	211	0.031	0.015	3.14	5.49	0.9	1.635	0.422	2.057	322.46	329.04	331.04	339.24	331.04	8.20
PN26	PN28	39.36	216.00	0.90	40.26	1.20	JUNCTION	0.00	17.39	8%	0.17	0.29	16.3	24	27	0.028	0.015	3.14	5.18	0.9	0.186	0.375	0.560	328.39	329.14	331.14	339.24	331.60	7.64
PN27	PN28	10.30	0.00	0.00	10.30	3.80	PN SHED 27	0.18	0.18	40%	0.13	0.22	0.7	12	17	0.039	0.015	0.79	0.84	0.5	0.008	0.005	0.013	332.16	332.83	333.83	337.99	333.83	4.16
XN5	PN26	39.00	87.00	0.36	39.36	1.23	JUNCTION	0.00	17.39	8%	0.17	0.29	16.8	18	216	0.022	0.015	1.77	9.50	1.1	7.346	1.541	8.887	329.14	333.85	335.35	342.35	340.49	1.86
XN7	XN5	39.00	0.00	0.00	39.00	1.23	XN SHED 7	16.89	16.89	5%	0.17	0.29	16.1	15	87	0.042	0.015	1.23	13.10	0.5	7.183	1.333	8.516	334.35	338.00	339.25	339.25	349.00	-9.75
PN29	XN5	10.00	0.00	0.00	10.00	3.80	PN SHED 29	0.50	0.50	100%	0.06	0.10	1.9	12	267	0.015	0.015	0.79	2.42	0.2	1.012	0.018	1.030	334.35	338.30	339.30	346.11	341.52	4.59

Notes:
1) From Figure 5-3A Placer County Storm Water Management Manual
2) Energy Loss
3) Junction Loss
4) Initial HGL assumes 100% full pipe
5) Red shading indicates flow exceeds pipe system capacity; blue shading represents pipes upsized from existing condition

SIERRA GATEWAY APARTMENTS
PEAK FLOW & HYDRAULIC GRADE LINE CALCULATIONS
(100-yr Summary POST DEVELOPMENT)

South System

Upstream Structure	Downstream Structure	Response Time				Unit Peak Discharge[1]	Shed Name	Shed Area	Tributary Area	Imp. Area	Infilt. Rate	Infilt. Factor	Peak Flow	Pipe Size	Length	Slope	n	A	V	K	H(e)[2]	H(K)[3]	H(L)	D/S Invert	U/S Invert	Top of Pipe	Rim or Grate	HGL[4]	Free-board
		Shed	Pipe		Tr (min)																							
		Tr (min)	L (ft)	trp (min)		(cfs/acre)		(acre)	(acre)	(%)	(in/hr)		(cfs)	(in)	(ft)	(ft/ft)		(sf)	(ft/sec)				(He+Hk)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
n/a	XS-0	48.40	0.00	0.00	48.40	1.04	XS SHED 0	687.70	697.96	6%	0.17	0.29	535.8	72 (x2)	136	0.037	0.015	56.55	9.48	0.2	2.897	0.279	3.176	300.00	305.00	311.00	315.22	312.68	2.54
PS1	XS-OUT	16.08	121.00	0.50	16.58	2.94	PS SHED 1	0.51	10.26	83%	0.08	0.13	29.9	27	42	0.019	0.015	3.98	7.53	0.2	0.523	0.176	0.699	307.83	308.61	310.86	315.22	313.38	1.84
PS2	PS1	14.86	292.00	1.22	16.08	2.94	PS SHED 2	0.64	9.75	83%	0.08	0.13	28.4	27	121	0.015	0.015	3.98	7.15	0.5	1.359	0.397	1.756	308.61	310.39	312.64	315.09	315.13	-0.04
PS3	PS2	14.47	94.00	0.39	14.86	3.24	PS SHED 3	0.82	9.11	83%	0.08	0.14	29.3	27	292	0.017	0.015	3.98	7.37	0.9	3.480	0.759	4.239	310.39	315.24	317.49	320.33	317.62	2.71
PS34	PS3	11.88	0.00	0.00	11.88	3.66	PS SHED 34	0.34	0.34	30%	0.14	0.24	1.2	12	15	0.023	0.015	0.79	1.51	0.9	0.022	0.032	0.054	315.24	315.59	316.59	320.31	317.67	2.64
XS2	PS3	13.83	153.00	0.64	14.47	3.24	PS SHED XS2	0.66	7.95	83%	0.08	0.14	25.6	24	94	0.011	0.015	3.14	8.14	0.9	1.600	0.926	2.526	315.24	316.29	318.29	323.07	320.14	2.93
PS4	XS2	14.75	44.00	0.18	14.93	3.24	JUNCTION	0.00	7.20	81%	0.08	0.14	23.1	24	153	0.013	0.015	3.14	7.37	0.9	2.132	0.758	2.891	316.29	318.27	320.27	326.91	323.03	3.88
PS29	PS4	10.00	0.00	0.00	10.00	3.80	PS SHED 29	0.61	0.61	90%	0.07	0.12	2.3	12	25	0.148	0.015	0.79	2.94	0.9	0.140	0.121	0.261	318.27	321.96	322.96	325.76	323.30	2.46
PS33	XS2	10.00	0.00	0.00	10.00	3.80	PS SHED 33	0.09	0.09	60%	0.11	0.18	0.3	12	56	0.031	0.015	0.79	0.43	0.9	0.007	0.003	0.009	316.29	318.00	319.00	322.26	320.15	2.11
XS10	XS2	10.00	0.00	0.00	10.00	3.80	XS SHED 10	0.12	0.12	75%	0.09	0.15	0.5	12	30	0.024	0.015	0.79	0.57	0.9	0.006	0.005	0.011	316.29	317.00	318.00	322.65	320.16	2.49
PS6	PS4	11.54	9.00	0.04	11.58	3.66	WQMH	0.00	3.60	84%	0.08	0.13	13.1	24	44	0.006	0.015	3.14	4.17	0.9	0.197	0.243	0.440	319.30	319.57	321.57	327.77	321.57	6.20
PS7	PS6	11.00	129.00	0.54	11.54	3.66	JUNCTION	0.00	3.60	84%	0.08	0.13	13.1	24	9	0.027	0.015	3.14	4.17	0.9	0.040	0.243	0.283	319.57	319.81	321.81	335.88	321.85	14.03
PS19	PS7	10.89	21.00	0.09	10.98	3.80	PS SHED 19	0.25	1.51	87%	0.08	0.13	5.7	12	62	0.021	0.015	0.79	7.27	0.9	2.123	0.739	2.863	322.99	324.32	325.32	332.83	325.32	7.51
PS20	PS19	10.64	60.00	0.25	10.89	3.80	JUNCTION	0.00	1.26	84%	0.08	0.13	4.8	12	21	0.026	0.015	0.79	6.06	0.9	0.500	0.514	1.013	324.22	324.77	325.77	333.49	326.33	7.16
PS21	PS20	10.48	39.00	0.16	10.64	3.80	PS SHED 21	0.03	1.26	84%	0.08	0.13	4.8	12	60	0.014	0.015	0.79	6.06	0.9	1.428	0.514	1.941	324.87	325.69	326.69	333.27	328.27	5.00
PS22	PS21	10.25	56.00	0.23	10.48	3.80	JUNCTION	0.00	1.23	84%	0.08	0.13	4.6	12	39	0.019	0.015	0.79	5.92	1.1	0.884	0.598	1.483	325.79	326.55	327.55	334.29	329.76	4.53
PS23	PS22	10.05	48.00	0.20	10.25	3.80	PS SHED 23	0.19	0.59	84%	0.08	0.13	2.2	12	56	0.021	0.015	0.79	2.84	0.5	0.292	0.063	0.355	326.65	327.85	328.85	334.39	330.11	4.28
PS24	PS23	10.00	13.00	0.05	10.05	3.80	PS SHED 24	0.19	0.40	84%	0.08	0.13	1.5	12	48	0.025	0.015	0.79	1.92	0.5	0.115	0.029	0.144	327.95	329.14	330.14	334.81	330.26	4.55
PS25	PS24	10.00	0.00	0.00	10.00	3.80	PS SHED 25	0.21	0.21	70%	0.10	0.16	0.8	12	13	0.008	0.015	0.79	1.00	0.5	0.008	0.008	0.016	329.24	329.35	330.35	332.85	330.35	2.50
PS26	PS22	10.00	80.00	0.33	10.33	3.80	PS SHED 26	0.54	0.64	84%	0.08	0.13	2.4	12	80	0.011	0.015	0.79	3.08	0.9	0.491	0.132	0.623	326.65	327.51	328.51	332.48	330.38	2.10
PS27	PS26	10.00	0.00	0.00	10.00	3.80	PS SHED 27	0.10	0.10	50%	0.12	0.20	0.4	12	80	0.011	0.015	0.79	0.47	0.9	0.011	0.003	0.015	327.61	328.47	329.47	332.26	330.39	1.87
PS8	PS7	10.64	87.00	0.36	11.00	3.66	PS SHED 8	0.26	2.09	83%	0.08	0.14	7.6	12	129	0.020	0.015	0.79	9.68	0.9	7.822	1.309	9.131	325.78	328.36	329.36	336.04	330.98	5.06
PS9	PS8	10.14	63.00	0.26	10.40	3.80	PS SHED 9	0.20	1.01	77%	0.09	0.15	3.8	12	87	0.020	0.015	0.79	4.84	0.5	1.321	0.182	1.503	328.36	330.10	331.10	336.50	332.49	4.01
PS10	PS9	10.00	33.00	0.14	10.14	3.80	JUNCTION	0.00	0.81	76%	0.09	0.15	3.0	12	63	0.020	0.015	0.79	3.88	0.9	0.615	0.211	0.825	330.10	331.36	332.36	337.65	333.31	4.34
PS11	PS10	10.00	0.00	0.00	10.00	3.80	PS SHED 11	0.42	0.42	100%	0.06	0.10	1.6	12	33	0.020	0.015	0.79	2.03	0.5	0.088	0.032	0.120	331.36	332.03	333.03	337.03	333.43	3.60
PS12	PS10	10.00	0.00	0.00	10.00	3.80	PS SHED 12	0.39	0.39	50%	0.12	0.20	1.4	12	48	0.020	0.015	0.79	1.84	0.9	0.105	0.047	0.152	331.36	332.31	333.31	337.65	333.46	4.19
PS13	PS8	10.32	77.00	0.32	10.64	3.80	PS SHED 13	0.05	0.82	91%	0.07	0.12	3.1	12	89	0.017	0.015	0.79	3.96	0.9	0.902	0.219	1.121	328.36	329.86	330.86	337.25	332.11	5.14
PS14	PS13	10.00	77.00	0.32	10.32	3.80	PS SHED 14	0.14	0.47	97%	0.06	0.11	1.8	12	77	0.017	0.015	0.79	2.27	0.9	0.257	0.072	0.330	329.86	331.17	332.17	337.12	332.43	4.69
PS14a	PS14	10.00	0.00	0.00	10.00	3.80	PS SHED 14a	0.09	0.09	60%	0.11	0.18	0.3	12	77	0.020	0.015	0.79	0.43	0.9	0.009	0.003	0.012	331.64	333.20	334.20	342.00	334.20	7.80
PS15	PS14	10.00	0.00	0.00	10.00	3.80	PS SHED 15	0.15	0.15	80%	0.08	0.14	0.6	12	43	0.020	0.015	0.79	0.72	0.9	0.014	0.007	0.022	331.64	332.49	333.49	337.50	333.49	4.01
PS16	PS14	10.00	0.00	0.00	10.00	3.80	PS SHED 16	0.18	0.18	80%	0.08	0.14	0.7	12	43	0.020	0.015	0.79	0.86	0.9	0.021	0.010	0.031	331.64	332.50	333.50	337.51	333.50	4.01
PS17	PS13	10.00	0.00	0.00	10.00	3.80	PS SHED 17	0.17	0.17	80%	0.08	0.14	0.6	12	43	0.020	0.015	0.79	0.82	0.9	0.019	0.009	0.028	331.64	332.49	333.49	337.50	333.49	4.01
PS18	PS13	10.00	0.00	0.00	10.00	3.80	PS SHED 18	0.13	0.13	80%	0.08	0.14	0.5	12	43	0.020	0.015	0.79	0.62	0.9	0.011	0.005	0.016	331.64	332.50	333.50	337.53	333.50	4.03
PS30	PS4	14.07	164.00	0.68	14.75	3.24	JUNCTION	0.00	2.99	76%	0.09	0.15	9.6	24	248	0.013	0.015	3.14	3.05	0.5	0.592	0.072	0.665	318.27	321.46	323.46	329.41	323.70	5.71
PS31	PS30	10.00	0.00	0.00	10.00	3.80	PS SHED 31	0.22	0.22	90%	0.07	0.12	0.8	12	66	0.040	0.015	0.79	1.06	0.9	0.048	0.016	0.064	322.08	324.70	325.70	330.45	325.70	4.75
XS5	PS30	12.55	365.00	1.52	14.07	3.24	XS SHED 5	1.68	2.77	75%	0.09	0.15	8.9	21	164	0.045	0.015	2.41	3.69	0.9	0.684	0.190	0.875	322.16	329.50	331.25	334.39	331.25	3.14
PS32	XS5	11.75	0.00	0.00	11.75	3.66	PS SHED 32	1.09	1.09	75%	0.09	0.15	3.9	12	365	0.015	0.015	0.79	5.03	0.9	5.972	0.353	6.325	329.50	335.00	336.00	339.63	337.57	2.06

Notes:
1) From Figure 5-3A Placer County Storm Water Management Manual
2) Energy Loss
3) Junction Loss
4) Initial HGL based on inlet HW/D for 100-yr Q of 535.8 cfs = 1.28 (FHWA HEC-5 Hydraulic Charts for Selection of Highway Culverts)
5) Red shading indicates flow exceeds pipe system capacity; blue shading represents pipes upsized from existing condition

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**XN SHED 1**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**0.18**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**100%**
Infiltration Rate, Inches/Hour	**0.06**

Overland Flow:

Length, Feet:	**108.16**		
Slope, ft/ft:	**0.0294**		
N:	**0.11**		
		Tr, minutes:	4.5

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Gutter	1	0.18	165	0.0298	0.110	1	1.6

Total Tr, minutes: **6.1**

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.1
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.7
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.8

Fi, infiltration factor, cfs/acre: 0.10

Q , cfs 10-YEAR	**0.4**
Q , cfs 25-YEAR	**0.5**
Q , cfs 100-YEAR	**0.7**

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**XN SHED 2**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**0.39**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**100%**
Infiltration Rate, Inches/Hour	**0.06**

Overland Flow:

Length, Feet:	**108.16**		
Slope, ft/ft:	**0.0294**		
N:	**0.11**		
		Tr, minutes:	4.5

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Gutter	1	0.39	262.59	0.0298	0.110	1	2.1

Total Tr, minutes: **6.6**

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.1
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.7
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.8

Fi, infiltration factor, cfs/acre: 0.10

Q , cfs 10-YEAR	**0.8**
Q , cfs 25-YEAR	**1.1**
Q , cfs 100-YEAR	**1.5**

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**XN SHED 3**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**0.60**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**100%**
Infiltration Rate, Inches/Hour	**0.06**

Overland Flow:

Length, Feet:	**54.93**		
Slope, ft/ft:	**0.0283**		
N:	**0.11**		
		Tr, minutes:	3.0

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Gutter	1	0.6	228.66	0.0147	0.110	1	2.1

Total Tr, minutes: 5.2

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.1
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.7
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.8

Fi, infiltration factor, cfs/acre: 0.10

Q , cfs 10-YEAR	**1.3**
Q , cfs 25-YEAR	**1.6**
Q , cfs 100-YEAR	**2.3**

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**XN SHED 6**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**0.52**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**100%**
Infiltration Rate, Inches/Hour	**0.06**

Overland Flow:

Length, Feet:	**63.37**		
Slope, ft/ft:	**0.0300**		
N:	**0.11**	Tr, minutes:	3.3

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Gutter	1	0.52	500	0.015	0.110	1	4.7

Total Tr, minutes: 8.0

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.1
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.7
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.8

Fi, infiltration factor, cfs/acre: 0.10

Q , cfs 10-YEAR	**1.1**
Q , cfs 25-YEAR	**1.4**
Q , cfs 100-YEAR	**2.0**

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**XN SHED 7**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**16.89**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**5%**	
Infiltration Rate, Inches/Hour	**0.18**	

Overland Flow:

Length, Feet:	**199.78**		
Slope, ft/ft:	**0.0100**		
N:	**0.40**		
		Tr, minutes:	19.6

Channel Flow:

Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
1	16.9	1200	0.005	0.400	1	19.0

Total Tr, minutes: 38.6

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	0.6
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	0.9
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	1.3

Fi, infiltration factor, cfs/acre: 0.30

Q , cfs 10-YEAR	**6.0**
Q , cfs 25-YEAR	**9.7**
Q , cfs 100-YEAR	**16.4**

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**XN SHED 8**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**3.47**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**5%**
Infiltration Rate, Inches/Hour	**0.18**

Overland Flow:

Length, Feet:	**130**
Slope, ft/ft:	**0.0410**
N:	**0.40**
Tr, minutes:	9.9

Channel Flow:

Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
1	3.47	400	0.04	0.400	1	4.3

Total Tr, minutes: 14.2

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	1.8
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.2
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.2

Fi, infiltration factor, cfs/acre: 0.30

Q , cfs 10-YEAR 5.2

Q , cfs 25-YEAR 6.7

Q , cfs 100-YEAR 10.2

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**XS SHED 0**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**687.70**			
Elevation, Feet:	350			

Infiltration:

Impervious Area, % of Total	**5%**	
Infiltration Rate, Inches/Hour	**0.18**	

Overland Flow:

Length, Feet:	**200**	
Slope, ft/ft:	**0.0500**	
N:	**0.11**	
Tr, minutes:		5.6

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Shallow	1	5	500	0.08	0.400	3	4.3
Channel	2	687	10600	0.03	0.400	3	38.5

Total Tr, minutes: **48.4**

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	0.6
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	0.7
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	1.0

Fi, infiltration factor, cfs/acre: 0.30

Q , cfs 10-YEAR	**187.8**
Q , cfs 25-YEAR	**270.3**
Q , cfs 100-YEAR	**517.9**

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**XS SHED 1**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**1.82**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**20%**	
Infiltration Rate, Inches/Hour	**0.15**	

Overland Flow:

Length, Feet:	**110**	
Slope, ft/ft:	**0.0600**	
N:	**0.40**	
Tr, minutes:		8.0

Channel Flow:

Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
1	1.82	365	0.03	0.400	4	6.2

Total Tr, minutes: 14.2

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	1.8
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.2
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.2

Fi, infiltration factor, cfs/acre: 0.25

Q , cfs 10-YEAR	**2.9**
Q , cfs 25-YEAR	**3.7**
Q , cfs 100-YEAR	**5.5**

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**XS SHED 2**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:		**10**	**25**	**100**
Area, Acres:		**2.64**		
Elevation, Feet:		337		

Infiltration:

Impervious Area, % of Total	**10%**	
Infiltration Rate, Inches/Hour	**0.16**	

Overland Flow:

Length, Feet:	**100**	
Slope, ft/ft:	**0.0800**	
N:	**0.40**	
Tr, minutes:		6.9

Channel Flow:

Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
1	2.64	315	0.04	0.400	1	3.6

Total Tr, minutes: **10.6**

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.1
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.7
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.8

Fi, infiltration factor, cfs/acre: 0.27

Q , cfs 10-YEAR	**4.9**
Q , cfs 25-YEAR	**6.5**
Q , cfs 100-YEAR	**9.4**

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**XS SHED 5**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**2.64**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**75%**
Infiltration Rate, Inches/Hour	**0.12**

Overland Flow:

Length, Feet:	**50**
Slope, ft/ft:	**0.0200**
N:	**0.25**
Tr, minutes:	5.2

Channel Flow:

Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
1	2.64	150	0.04	0.400	1	1.7

Total Tr, minutes: 7.0

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.1
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.7
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.8

Fi, infiltration factor, cfs/acre: 0.20

Q , cfs 10-YEAR	**5.4**
Q , cfs 25-YEAR	**7.0**
Q , cfs 100-YEAR	**9.9**

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**XS SHED 6**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**2.64**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**55%**	
Infiltration Rate, Inches/Hour	**0.10**	

Overland Flow:

Length, Feet:	**100**	
Slope, ft/ft:	**0.0200**	
N:	**0.40**	
Tr, minutes:		10.5

Channel Flow:

Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
1	2.64	400	0.04	0.400	1	4.6

Total Tr, minutes: **15.1**

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	1.7
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.1
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.1

Fi, infiltration factor, cfs/acre: 0.17

Q , cfs 10-YEAR	**4.3**
Q , cfs 25-YEAR	**5.3**
Q , cfs 100-YEAR	**8.0**

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**PN SHED 2**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**0.53**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**100%**
Infiltration Rate, Inches/Hour	**0.06**

Overland Flow:

Length, Feet:	**131.93**		
Slope, ft/ft:	**0.0306**		
N:	**0.11**		
		Tr, minutes:	5.0

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Gutter	1	0.53	208.56	0.0282	0.110	1	1.6

Total Tr, minutes: 6.6

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.1
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.7
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.8

Fi, infiltration factor, cfs/acre: 0.10

Q , cfs 10-YEAR 1.1

Q , cfs 25-YEAR 1.4

Q , cfs 100-YEAR 2.0

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**PN SHED 13**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:		**10**	**25**	**100**
Area, Acres:		**0.21**		
Elevation, Feet:		337		

Infiltration:

Impervious Area, % of Total	**85%**
Infiltration Rate, Inches/Hour	**0.08**

Overland Flow:

Length, Feet:	**71.59**	
Slope, ft/ft:	**0.0540**	
N:	**0.11**	
Tr, minutes:		2.9

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Pave	1	0.21	23.98	0.0207	0.110	1	0.3
Gutter	2	0.21	25.31	0.005	0.110	2	0.5

Total Tr, minutes: **3.7**

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.1
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.7
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.8

Fi, infiltration factor, cfs/acre: 0.13

Q , cfs 10-YEAR	**0.4**
Q , cfs 25-YEAR	**0.6**
Q , cfs 100-YEAR	**0.8**

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**PN SHED 18**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:		**10**	**25**	**100**
Area, Acres:		**0.19**		
Elevation, Feet:		337		

Infiltration:

Impervious Area, % of Total		**40%**
Infiltration Rate, Inches/Hour		**0.13**

Overland Flow:

Length, Feet:	**54.15**	
Slope, ft/ft:	**0.0460**	
N:	**0.40**	
Tr, minutes:		5.7

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Gutter	1	0.19	177.06	0.008	0.240	1	4.9

Total Tr, minutes: 10.6

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.1
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.7
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.8

Fi, infiltration factor, cfs/acre: 0.22

Q , cfs 10-YEAR 0.4

Q , cfs 25-YEAR 0.5

Q , cfs 100-YEAR 0.7

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**PN SHED 21**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**0.10**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**30%**	
Infiltration Rate, Inches/Hour	**0.14**	

Overland Flow:

Length, Feet:	**32.53**	
Slope, ft/ft:	**0.1342**	
N:	**0.40**	
Tr, minutes:		3.0

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Gutter	1	0.1	95.93	0.0325	0.400	1	2.7

Total Tr, minutes: 5.7

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.1
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.7
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.8

Fi, infiltration factor, cfs/acre: 0.24

Q , cfs 10-YEAR 0.2

Q , cfs 25-YEAR 0.3

Q , cfs 100-YEAR 0.4

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**PN SHED 22**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**0.31**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**85%**
Infiltration Rate, Inches/Hour	**0.08**

Overland Flow:

Length, Feet:	**54.3**		
Slope, ft/ft:	**0.0529**		
N:	**0.11**		
		Tr, minutes:	2.5

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Pave	1	0.31	87.25	0.0333	0.110	1	0.7

Total Tr, minutes: 3.2

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.1
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.7
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.8

Fi, infiltration factor, cfs/acre: 0.13

Q , cfs 10-YEAR	**0.6**
Q , cfs 25-YEAR	**0.8**
Q , cfs 100-YEAR	**1.2**

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**PN SHED 25**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**0.21**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**85%**
Infiltration Rate, Inches/Hour	**0.08**

Overland Flow:

Length, Feet:	**33.69**		
Slope, ft/ft:	**0.0150**		
N:	**0.11**		
		Tr, minutes:	2.7

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Gutter	1	0.21	40.5	0.005	0.110	1	0.7

Total Tr, minutes: 3.5

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.1
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.7
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.8

Fi, infiltration factor, cfs/acre: 0.13

Q , cfs 10-YEAR 0.4

Q , cfs 25-YEAR 0.6

Q , cfs 100-YEAR 0.8

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**PN SHED 27**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**0.61**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**100%**
Infiltration Rate, Inches/Hour	**0.06**

Overland Flow:

Length, Feet:	**121.51**		
Slope, ft/ft:	**0.0232**		
N:	**0.11**		
		Tr, minutes:	5.2

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Gutter	1	0.61	443	0.0158	0.110	1	4.0

Total Tr, minutes: 9.2

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.1
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.7
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.8

Fi, infiltration factor, cfs/acre: 0.10

Q , cfs 10-YEAR 1.3

Q , cfs 25-YEAR 1.6

Q , cfs 100-YEAR 2.3

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**PN SHED 28**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**0.18**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**40%**
Infiltration Rate, Inches/Hour	**0.13**

Overland Flow:

Length, Feet:	**21.91**		
Slope, ft/ft:	**0.0315**		
N:	**0.40**		
		Tr, minutes:	3.7

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Gutter	1	0.18	174.37	0.01	0.400	1	6.6

Total Tr, minutes: 10.3

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.1
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.7
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.8

Fi, infiltration factor, cfs/acre: 0.22

Q , cfs 10-YEAR 0.4

Q , cfs 25-YEAR 0.5

Q , cfs 100-YEAR 0.7

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**PN SHED 29**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**0.50**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**100%**
Infiltration Rate, Inches/Hour	**0.06**

Overland Flow:

Length, Feet:	**50**		
Slope, ft/ft:	**0.0200**		
N:	**0.25**	Tr, minutes:	5.2

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Gutter	1	0.5	150	0.04	0.400	1	2.6

Total Tr, minutes: 7.8

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.1
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.7
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.8

Fi, infiltration factor, cfs/acre: 0.10

Q , cfs 10-YEAR 1.1

Q , cfs 25-YEAR 1.4

Q , cfs 100-YEAR 1.9

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**XN SHED 6**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:		**10**	**25**	**100**
Area, Acres:		**16.89**		
Elevation, Feet:		337		

Infiltration:

Impervious Area, % of Total	**5%**	
Infiltration Rate, Inches/Hour	**0.18**	

Overland Flow:

Length, Feet:	**199.78**		
Slope, ft/ft:	**0.0100**		
N:	**0.40**		
		Tr, minutes:	19.6

Channel Flow:

Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
1	16.9	1200	0.005	0.400	1	19.0

Total Tr, minutes: 38.6

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	0.6
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	0.9
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	1.3

Fi, infiltration factor, cfs/acre: 0.30

Q , cfs 10-YEAR	**6.0**
Q , cfs 25-YEAR	**9.7**
Q , cfs 100-YEAR	**16.4**

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**PS SHED 3**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**0.76**			
Elevation, Feet:	325			

Infiltration:

Impervious Area, % of Total	**100%**
Infiltration Rate, Inches/Hour	**0.06**

Overland Flow:

Length, Feet:	**85**		
Slope, ft/ft:	**0.0200**		
N:	**0.11**		
		Tr, minutes:	4.4

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Gutter	1	0.76	400	0.0282	0.110	1	2.7

Total Tr, minutes: 7.1

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.1
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.7
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.8

Fi, infiltration factor, cfs/acre: 0.10

Q , cfs 10-YEAR	**1.6**
Q , cfs 25-YEAR	**2.1**
Q , cfs 100-YEAR	**2.9**

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**PS SHED XS2**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**0.66**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**80%**
Infiltration Rate, Inches/Hour	**0.08**

Overland Flow:

Length, Feet:	**149.34**		
Slope, ft/ft:	**0.0523**		
N:	**0.40**		
		Tr, minutes:	10.0

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Gutter	1	0.66	442.29	0.0165	0.110	1	3.8

Total Tr, minutes: 13.8

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	1.9
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.3
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.4

Fi, infiltration factor, cfs/acre: 0.14

Q , cfs 10-YEAR 1.2

Q , cfs 25-YEAR 1.5

Q , cfs 100-YEAR 2.2

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**PS SHED 29**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**0.83**			
Elevation, Feet:	330			

Infiltration:

Impervious Area, % of Total	**100%**	
Infiltration Rate, Inches/Hour	**0.06**	

Overland Flow:

Length, Feet:	**50**	
Slope, ft/ft:	**0.0200**	
N:	**0.11**	
Tr, minutes:		3.2

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Gutter	1	0.83	210	0.0282	0.110	1	1.4
Ditch	2	0.83	170	0.01	0.250	1	3.1

Total Tr, minutes: **7.7**

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.1
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.7
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.8

Fi, infiltration factor, cfs/acre: 0.10

Q , cfs 10-YEAR **1.7**

Q , cfs 25-YEAR **2.2**

Q , cfs 100-YEAR **3.2**

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**PS SHED 32**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**1.09**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**75%**	
Infiltration Rate, Inches/Hour	**0.09**	

Overland Flow:

Length, Feet:	**90**	
Slope, ft/ft:	**0.0200**	
N:	**0.40**	
Tr, minutes:		9.9

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Gutter	1	1.09	221	0.0121	0.110	1	1.9

Total Tr, minutes: 11.7

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.0
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.6
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.7

Fi, infiltration factor, cfs/acre: 0.15

Q , cfs 10-YEAR	**2.2**
Q , cfs 25-YEAR	**2.8**
Q , cfs 100-YEAR	**3.9**

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**PS SHED 34**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**0.34**			
Elevation, Feet:	325			

Infiltration:

Impervious Area, % of Total	**20%**	
Infiltration Rate, Inches/Hour	**0.16**	

Overland Flow:

Length, Feet:	**50**	
Slope, ft/ft:	**0.0500**	
N:	**0.35**	
Tr, minutes:		4.9

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Ditch	1	0.34	400	0.02	0.250	1	7.0

Total Tr, minutes: 11.9

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	2.0
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.6
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.7

Fi, infiltration factor, cfs/acre: 0.27

Q , cfs 10-YEAR 0.6

Q , cfs 25-YEAR 0.8

Q , cfs 100-YEAR 1.2

Q=q*A-(A*(1-Impervious Area)*Fi)

Small Watershed Time of Concentration / Flow Worksheet

Runoff calculations based on the Placer County Storm Water Management Manual

Basic Information

Project:	**Sierra Gateway Apartments**			
Job No.:	25-7185-01			
Watershed No.:	**XS SHED 5**			
Prepared By:	Omni-Means, Ltd.			
Date:	08/09/15			
Return Period(s), Years:	**10**	**25**	**100**	
Area, Acres:	**1.68**			
Elevation, Feet:	337			

Infiltration:

Impervious Area, % of Total	**75%**
Infiltration Rate, Inches/Hour	**0.09**

Overland Flow:

Length, Feet:	**120**
Slope, ft/ft:	**0.0350**
N:	**0.40**
Tr, minutes:	9.9

Channel Flow:

	Channel no.	Area Ac.	Length ft.	Slope ft/ft	n	Sideslope ft/l	Tr minutes
Gutter	1	1.68	150	0.02	0.200	1	1.5
Pipe	2	1.68	276	0.02	0.015		1.2

Total Tr, minutes: 12.5

Flow Calculations:

q10, cfs/acre	Figure 5-3A, Stormwater Management Manual	1.9
q25, cfs/acre	Figure 5-3B, Stormwater Management Manual	2.5
q100, cfs/acre	Figure 5-3C, Stormwater Management Manual	3.5

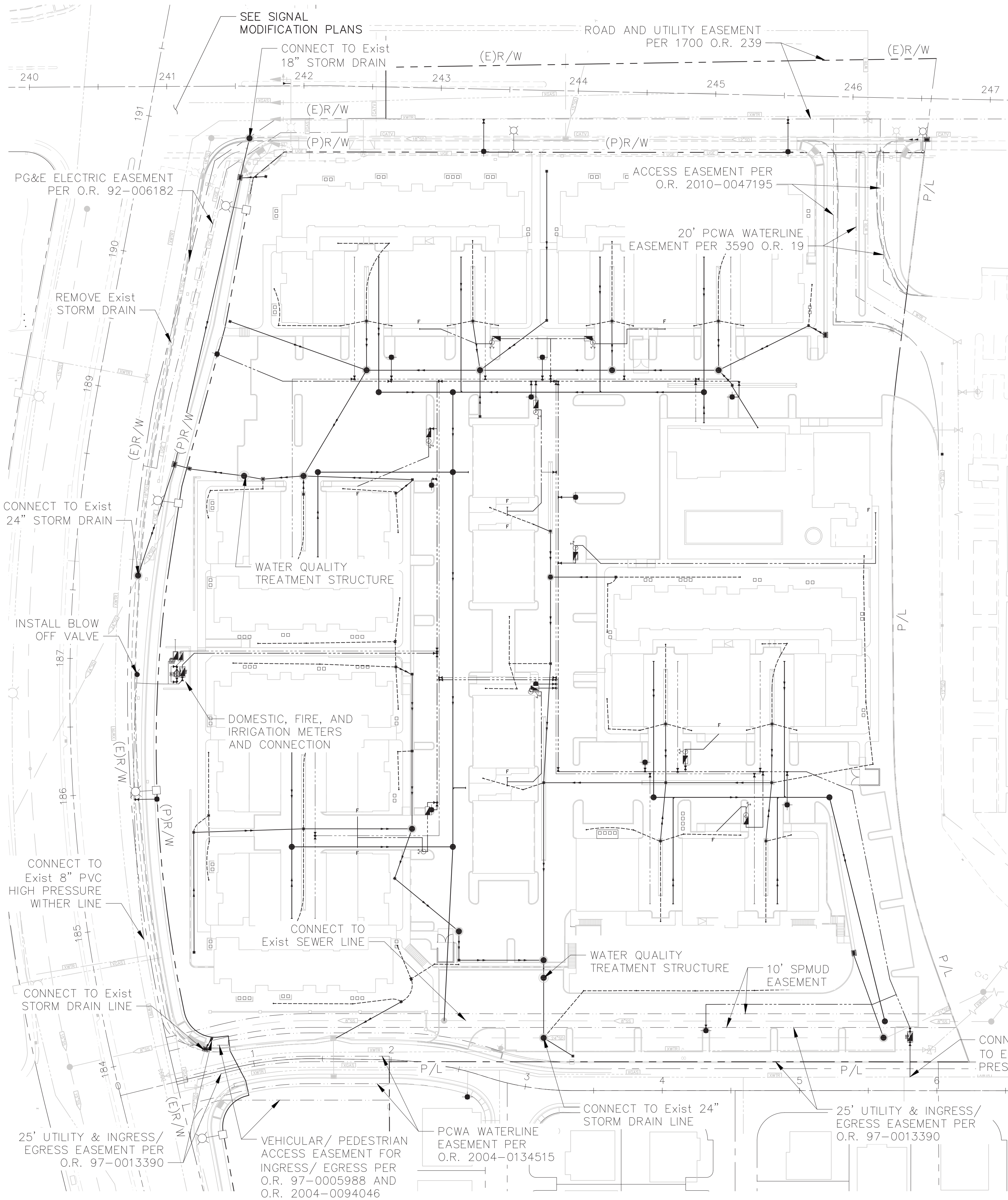
Fi, infiltration factor, cfs/acre: 0.15

Q , cfs 10-YEAR	**3.2**
Q , cfs 25-YEAR	**4.1**
Q , cfs 100-YEAR	**5.9**

Q=q*A-(A*(1-Impervious Area)*Fi)

APPENDIX C

1. Sierra Gateway Apartments Utility Plan Sheets (U1 through U5)
2. Sierra Gateway Apartments Offsite Improvements to Sierra College Blvd (L5 and L6)



UTILITY NOTES:

1. ALL ONSITE SEWER, WATER, AND STORM DRAIN UTILITIES SHALL BE PRIVATELY OWNED AND MAINTAINED.
2. ALL ON-SITE SEWER PIPE TO BE PVC SDR 35.
3. ALL LANDSCAPE AREA STORM DRAIN PIPE SHALL BE PVC SDR 35. ALL OTHER STORM DRAIN PIPE SHALL BE SMOOTH INNER WALL CORRUGATED HDPE.
4. ALL WATER PIPE SHALL BE PVC C900.
5. ROOF LEADERS NOT SHOWN SHALL BE CONNECTED TO ON-SITE INLETS.
6. PROVIDE APPROPRIATE FITTINGS TO CONNECT 3" BUILDING SEWER SERVICE WITH 6" SERVICE LATERAL.
7. SEE SHEETS U6-U12 FOR ON-SITE UTILITY PROFILES.
8. PROVIDE CONCRETE THRUST BLOCKS AT ALL ANGLES IN ACCORDANCE WITH THE PCWA STANDARD DETAIL S111.
9. WATER PIPE TRENCH AND BACKFILL SHALL BE INSTALLED PER PCWA STANDARD DETAIL S101 SEE SHEET C3.
10. SEE PLUMBING PLANS FOR EXACT LOCATION OF BUILDING SEWER AND CLEANOUT LOCATIONS.
11. METER AND BACKFLOW TO BE INSTALLED AT TIME OF FEE PAYMENT.
12. ALL STORM DRAIN INLETS SHALL BE STAMPED PER CITY STANDARD DWG #4-24; SEE DETAIL ON SHEET C3.
13. ALL LARGE UTILITY FEATURES, SUCH AS DOUBLE DETECTOR CHECK VALVES, SHALL BE SCREENED FROM THE STREET USING UTILITY BLANKETS.
14. WATER QUALITY TREATMENT STRUCTURES PER DETAIL 1 ON SHEET C4.

20 0 20
(IN FEET)
1 inch = 20 ft.

LEGEND:

- PROPOSED STORM DRAIN PIPE, FLOW DIRECTION
- PROPOSED LANDSCAPE AREA STORM DRAIN PIPE (6" MIN, 0.5% MIN SLOPE)
- SD — EXISTING STORM DRAIN PIPE, SIZE, FLOW DIRECTION
- PROPOSED SEWER PIPE, FLOW DIRECTION
- SS — EXISTING SEWER PIPE, SIZE, FLOW DIRECTION
- WTR — PROPOSED DOMESTIC WATER PIPE, SIZE
- FW — PROPOSED FIRE WATER PIPE, SIZE
- FW — EXISTING WATER PIPE, SIZE
- EXISTING EASEMENT

KEYED NOTES (SHEETS U1-U5):

1. PROPOSED AIR CONDITIONING UNITS (SEE BUILDING PLANS)
2. ATRIUM DRAIN PER DETAIL 3 ON SHEET C4.
3. 12" x 12" CONCRETE AREA DRAIN PER DETAIL 2 ON SHEET C4.

RECORD DRAWING

ALL INFORMATION SHOWN ON THESE PLANS HAVE BEEN PREPARED BY, OR UNDER THE DIRECTION OF, THE UNDERSIGNED ENGINEER. ADJUSTMENTS MADE IN THE FIELD DURING CONSTRUCTION ARE INCLUDED HEREIN WHEN THE PROJECT ENGINEER IS ADVISED IN WRITING OF SUCH CHANGE BY THE OWNER, DEVELOPER, CONTRACTOR, OR THE CITY OF ROCKLIN.

PROJECT ENGINEER ____ DATE ____

RCE # ____

REGISTERED PROFESSIONAL ENGINEER — JONATHAN L. STONG — No. 70341 — CIVIL — STATE OF CALIFORNIA

REVISIONS

No.	DESCRIPTION	DATE	BY

■ PRELIMINARY
☐ APPROVED
☐ BID
☐ CONSTRUCTION
☐ RECORD

omni•means ENGINEERING SOLUTIONS — SACRAMENTO REGION

OVERALL UTILITY PLAN

SIERRA GATEWAY APARTMENTS

Rocklin Sierra Apartments II, LLC
City of Rocklin, California

SCALE	1"=40'
JOB NO.	25-7185-01
DESIGNED	SMH
DRAWN	SMH
FILE	1783U001
CHECKED	JLS
DATE	8-7-15

SHEET No. U1

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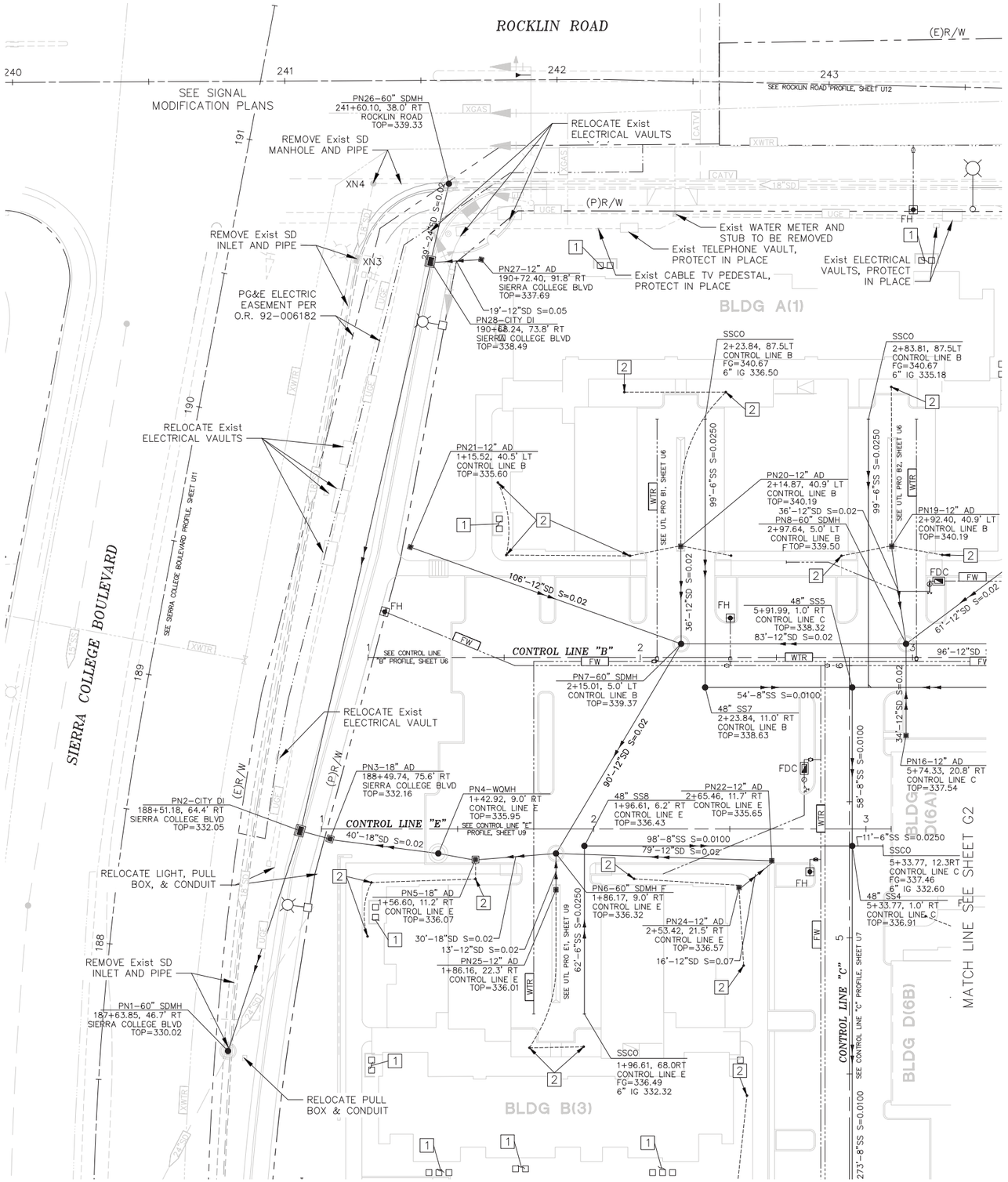

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(IN FEET)
1 inch = 20 ft.

No.	DESCRIPTION	DATE	BY
	REVISIONS		

■ PRELIMINARY ☐ APPROVED ☐ BID ☐ CONSTRUCTION ☐ RECORD

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PLEASANT HILL, CA 94523
(925) 937-9010 Fax (925) 937-9026
www.omnimeans.com
SACRAMENTO REGION
SAN LUIS OBISPO & NAPA

UTILITY PLAN

SIERRA GATEWAY APARTMENTS
Rocklin Sierra Apartments II, LLC
City of Rocklin, California

RECORD DRAWING

ALL INFORMATION SHOWN ON THESE PLANS HAVE BEEN PREPARED BY, OR UNDER THE DIRECTION OF, THE UNDERSIGNED ENGINEER. ADJUSTMENTS MADE IN THE FIELD DURING CONSTRUCTION ARE INCLUDED HEREIN WHEN THE PROJECT ENGINEER IS ADVISED IN WRITING OF SUCH CHANGE BY THE OWNER, DEVELOPER, CONTRACTOR, OR THE CITY OF ROCKLIN.

PROJECT ENGINEER _____ DATE _____

RCE # _____

REGISTERED PROFESSIONAL ENGINEER
JONATHAN L. STONG
No. 70341
CIVIL
STATE OF CALIFORNIA

SCALE	1"=20'
JOB NO.	25-7185-01
DESIGNED	SMH
DRAWN	SMH
FILE	1783U001
CHECKED	JLS
DATE	8-7-15

SHEET No. U2

27 OF 51

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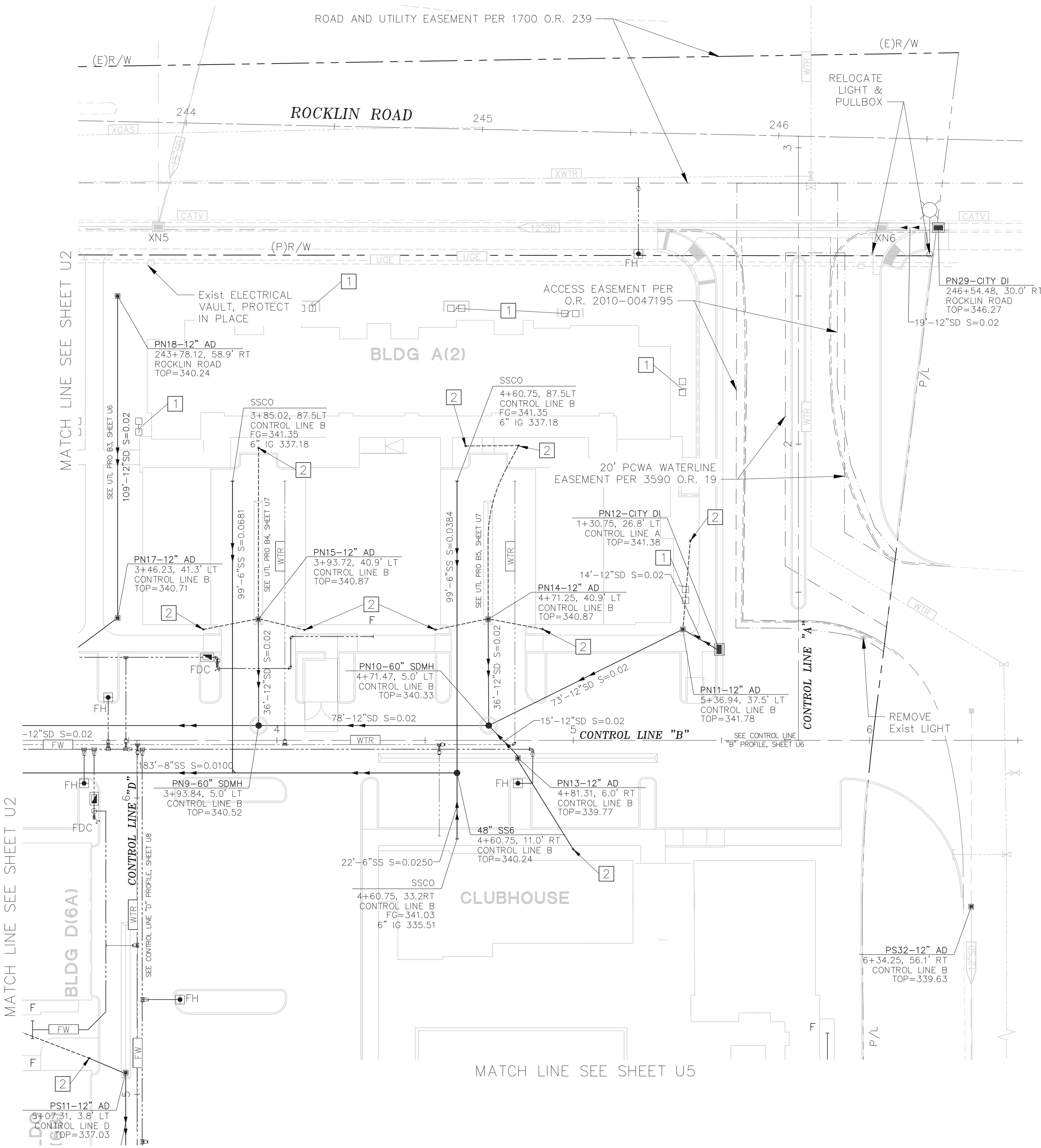

20 0 20
(IN FEET)
1 inch = 20 ft.

REVISIONS

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□ CONSTRUCTION
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UTILITY PLAN

SIERRA GATEWAY APARTMENTS

Rocklin Sierra Apartments II, LLC
City of Rocklin, California

SCALE	1"=20'
JOB NO.	25-7185-01
DESIGNED	SMH
DRAWN	SMH
FILE	1783U001
CHECKED	JLS
DATE	8-7-15

SHEET No.
U3
28 of 51

RECORD DRAWING

ALL INFORMATION SHOWN ON THESE PLANS HAVE BEEN PREPARED BY, OR UNDER THE DIRECTION OF, THE UNDERSIGNED ENGINEER. ADJUSTMENTS MADE IN THE FIELD DURING CONSTRUCTION ARE INCLUDED HEREIN WHEN THE PROJECT ENGINEER IS ADVISED IN WRITING OF SUCH CHANGE BY THE OWNER, DEVELOPER, CONTRACTOR, OR THE CITY OF ROCKLIN.

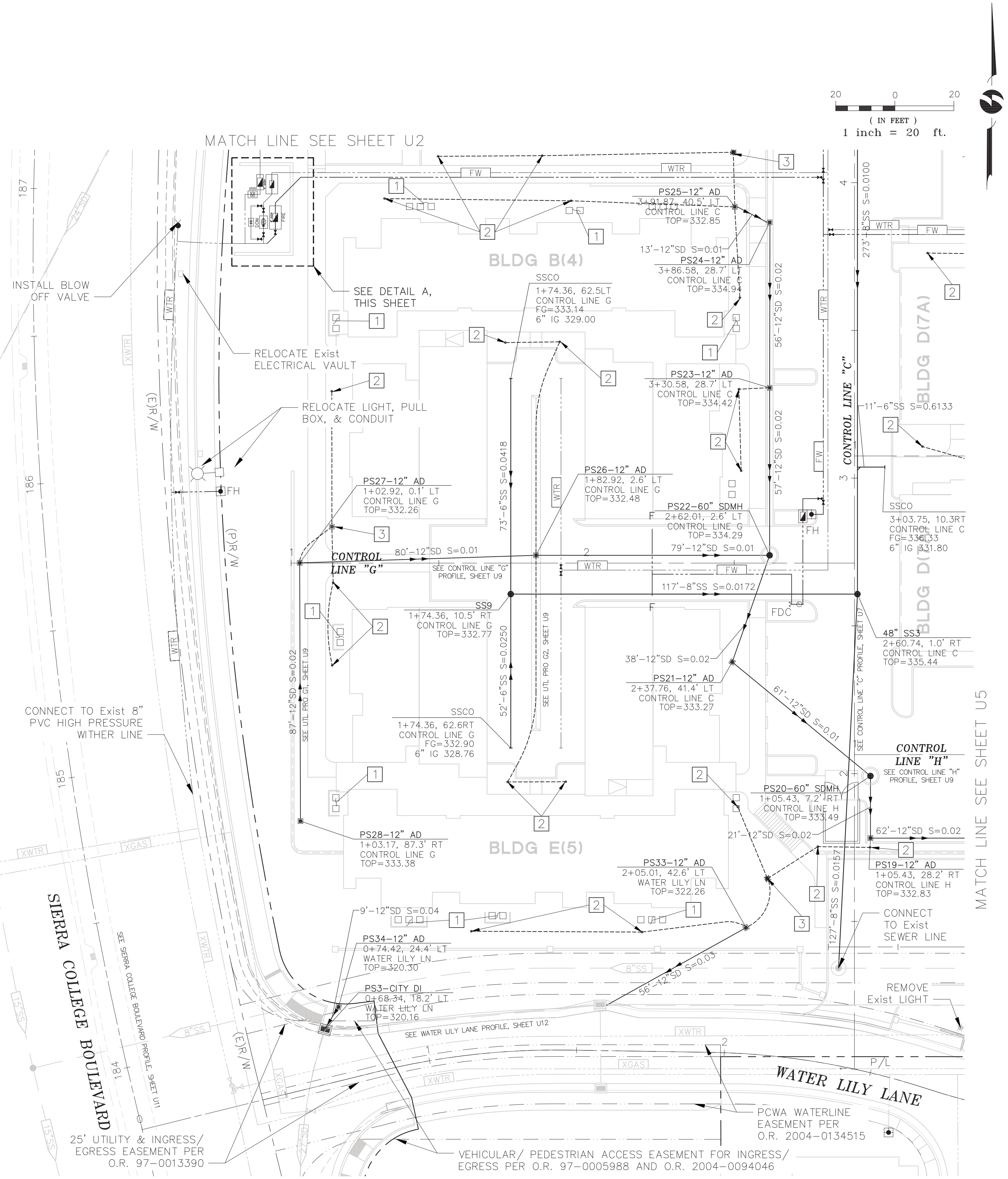
PROJECT ENGINEER ____________ DATE ____________

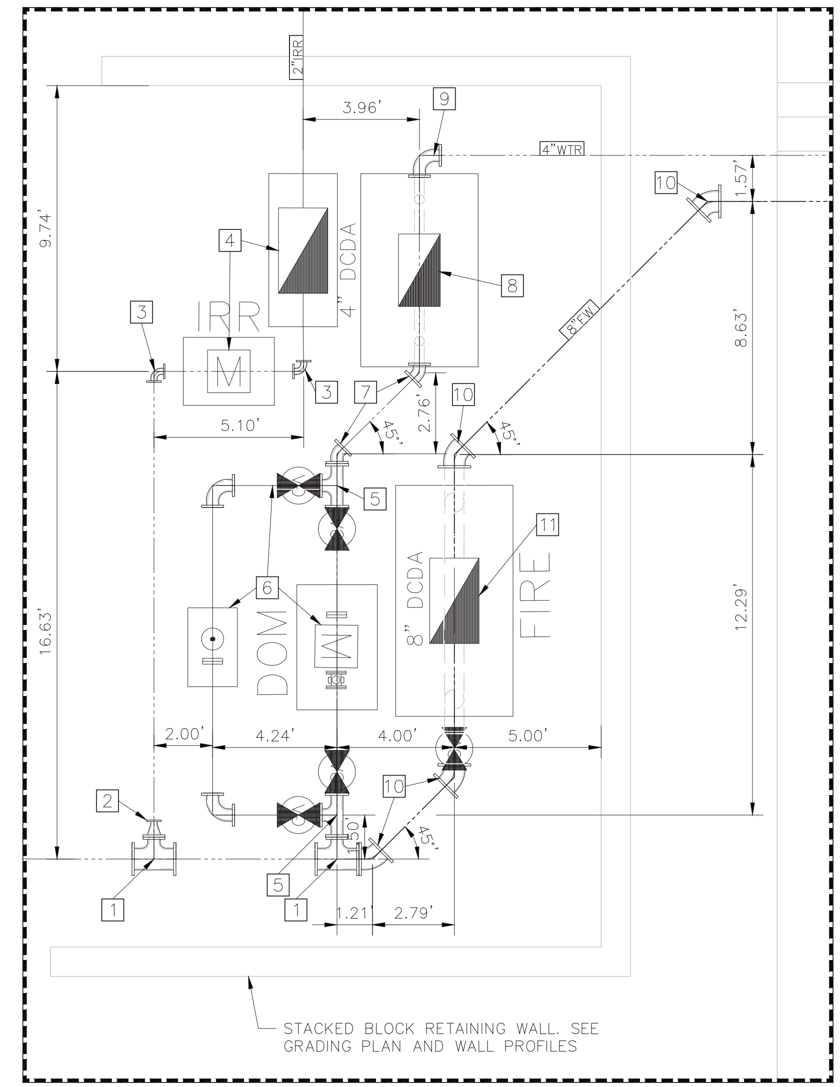
RCE # ____________

REGISTERED PROFESSIONAL ENGINEER
JONATHAN L. STONG
No. 70341
CIVIL
STATE OF CALIFORNIA

WATER NOTES:

1. INSTALL 8"x8"X4" TEE
2. INSTALL 4"x2" REDUCER
3. INSTALL 2"x2" ELBOW
4. INSTALL 2" METERED ONSITE IRRIGATION SERVICE PER PCWA STANDARD DETAIL S202 AND 2" R.P. BACKFLOW PREVENTOR PER PCWA STANDARD DETAIL S206.
5. INSTALL 4"x4"x4" TEE
6. INSTALL 3" COMPOUND METER WITH STRAINER IN CHRISTY B-48 WATER METER BOX PER PCWA STANDARD DETAIL S204.
7. INSTALL 4" 45° ANGLE FITTING
8. INSTALL 4" BACKFLOW PREVENTOR PER PCWA STANDARD DETAIL S207.
9. INSTALL 4" ELBOW.
10. INSTALL 8" 45° ANGLE FITTING
11. INSTALL 8" D.C.D.A. BACKFLOW PREVENTION DEVICE PER PCWA STANDARD DETAIL S207.





DETAIL A

SCALE 1"=3'

RECORD DRAWING

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PROJECT ENGINEER ____________ DATE ____________

RCE # ____________

REGISTERED PROFESSIONAL ENGINEER — JONATHAN L. STONG — No. 70341 — CIVIL — STATE OF CALIFORNIA

REVISIONS — No. | DESCRIPTION | DATE | BY

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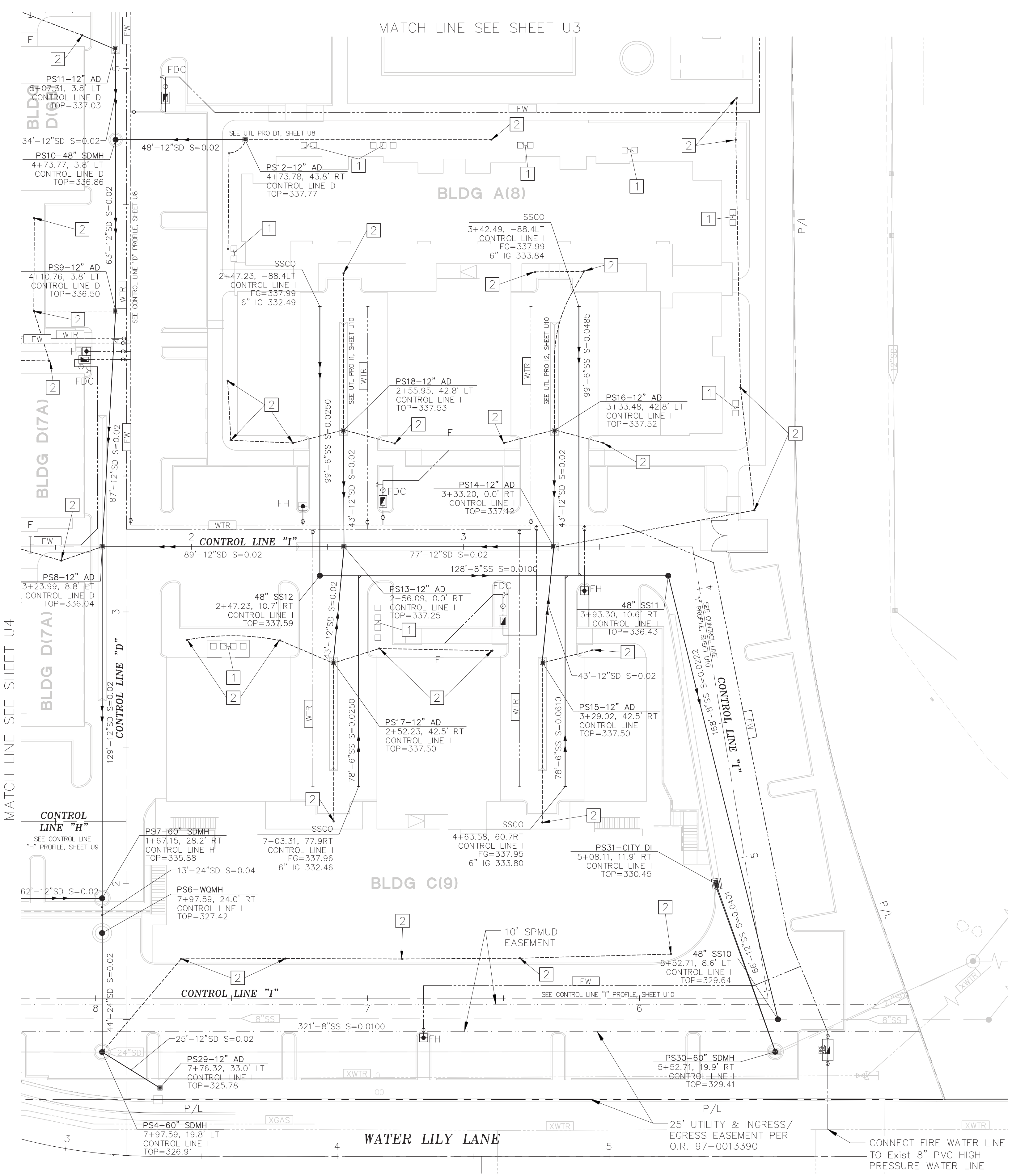
UTILITY PLAN

SIERRA GATEWAY APARTMENTS

Rocklin Sierra Apartments II, LLC
City of Rocklin, California

SCALE	1"=20'
JOB NO.	25-7185-01
DESIGNED	SMH
DRAWN	SMH
FILE	1783U001
CHECKED	JLS
DATE	8-7-15

SHEET No. U4



RECORD DRAWING

ALL INFORMATION SHOWN ON THESE PLANS HAVE BEEN PREPARED BY, OR UNDER THE DIRECTION OF, THE UNDERSIGNED ENGINEER. ADJUSTMENTS MADE IN THE FIELD DURING CONSTRUCTION ARE INCLUDED HEREIN WHEN THE PROJECT ENGINEER IS ADVISED IN WRITING OF SUCH CHANGE BY THE OWNER, DEVELOPER, CONTRACTOR, OR THE CITY OF ROCKLIN.

PROJECT ENGINEER ____ DATE ____

RCE # ____

REGISTERED PROFESSIONAL ENGINEER — JONATHAN L. STONG — No. 70341 — CIVIL — STATE OF CALIFORNIA

REVISIONS

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■ PRELIMINARY □ APPROVED □ BID □ CONSTRUCTION □ RECORD

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UTILITY PLAN

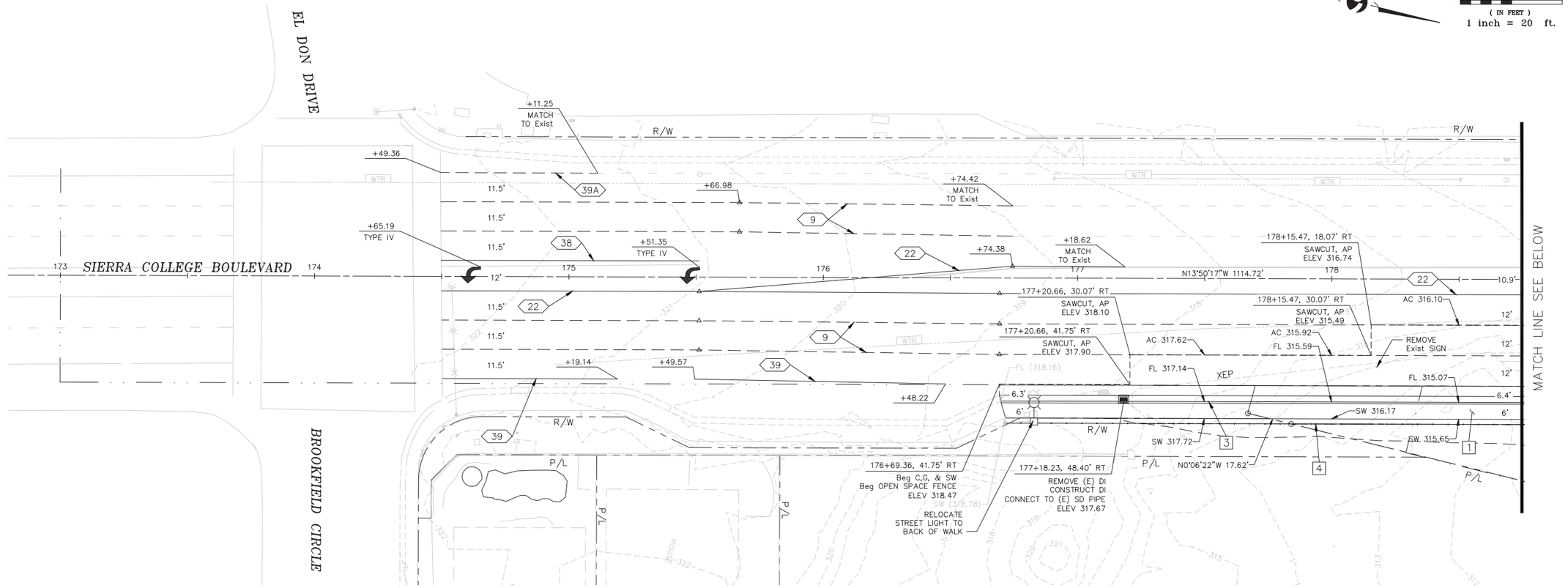
SIERRA GATEWAY APARTMENTS

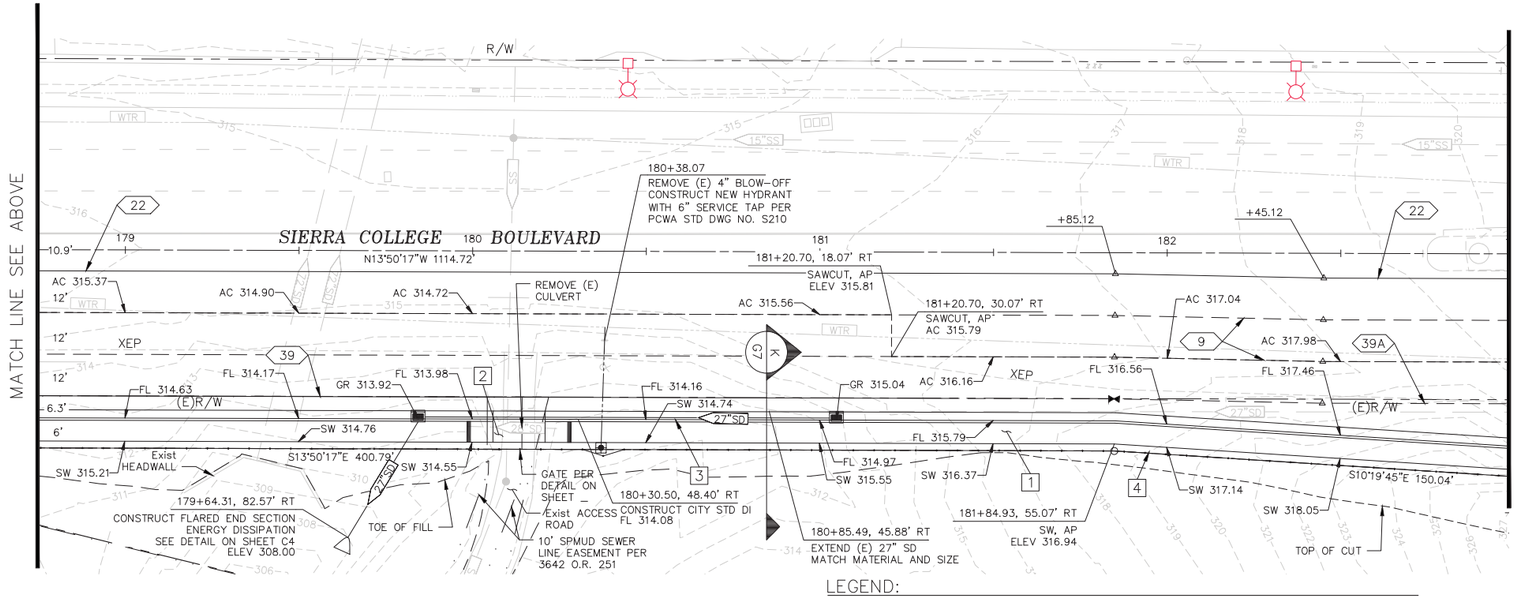
Rocklin Sierra Apartments II, LLC
City of Rocklin, California

SCALE	1"=20'
JOB NO.	25-7185-01
DESIGNED	SMH
DRAWN	SMH
FILE	1783U001
CHECKED	JLS
DATE	8-7-15

SHEET No. U5

30 of 51





NOTES:

1. ALL DIMENSIONS REFERENCE TOP FACE OF CURB UNLESS OTHERWISE NOTED.
2. ALL CONSTRUCTION SHALL COMPLY WITH CALIFORNIA TITLE 24 REGULATIONS AND ADA REGULATIONS. MOST CURRENT AND MOST RESTRICTIVE SHALL APPLY.
3. REFERENCE TO "CITY STD" AS SHOWN ON THESE PLANS SHALL MEAN CITY OF ROCKLIN DESIGN STANDARDS.

KEY NOTES:

[1] PCC SIDEWALK, TYP.

[2] CONSTRUCT CITY STANDARD DRIVEWAY PER CITY STD DWG NO. 3-19.

[3] CONSTRUCT TYPE 2 CURB AND GUTTER PER CITY STD DWG NO. 3-15, SEE DETAIL ON SHEET C5.

[4] POST AND CABLE FENCE PER DETAIL 2 ON SHEET C5.

LEGEND:

STREET WIDENING (7" HMA/ 9.5" AB)

<# > CALTRANS STANDARD TRAFFIC STRIPE DETAIL NO.

ANGLE POINT

CHANGE IN STRIPING

RECORD DRAWING

ALL INFORMATION SHOWN ON THESE PLANS HAVE BEEN PREPARED BY, OR UNDER THE DIRECTION OF, THE UNDERSIGNED ENGINEER. ADJUSTMENTS MADE IN THE FIELD DURING CONSTRUCTION ARE INCLUDED HEREIN WHEN THE PROJECT ENGINEER IS ADVISED IN WRITING OF SUCH CHANGE BY THE OWNER, DEVELOPER, CONTRACTOR, OR THE CITY OF ROCKLIN.

PROJECT ENGINEER _____ DATE _____

RCE # _____

REGISTERED PROFESSIONAL ENGINEER
JONATHAN L. STONG
No. 70341
CIVIL
STATE OF CALIFORNIA

REVISIONS

No.	DESCRIPTION	DATE	BY

■ PRELIMINARY ☐ APPROVED ☐ BID ☐ CONSTRUCTION ☐ RECORD

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(925) 935-9020 FAX (925) 935-9021
www.omnimeans.com

SIERRA COLLEGE BOULEVARD FRONTAGE IMPROVEMENTS
SIERRA GATEWAY APARTMENTS
Rocklin Sierra Apartments II, LLC
City of Rocklin, California

SCALE	1"=20'
JOB NO.	25-7185-01
DESIGNED	SMH
DRAWN	SMH
FILE	1783L002
CHECKED	JLS
DATE	8-7-15

SHEET No. L5
15 OF 51

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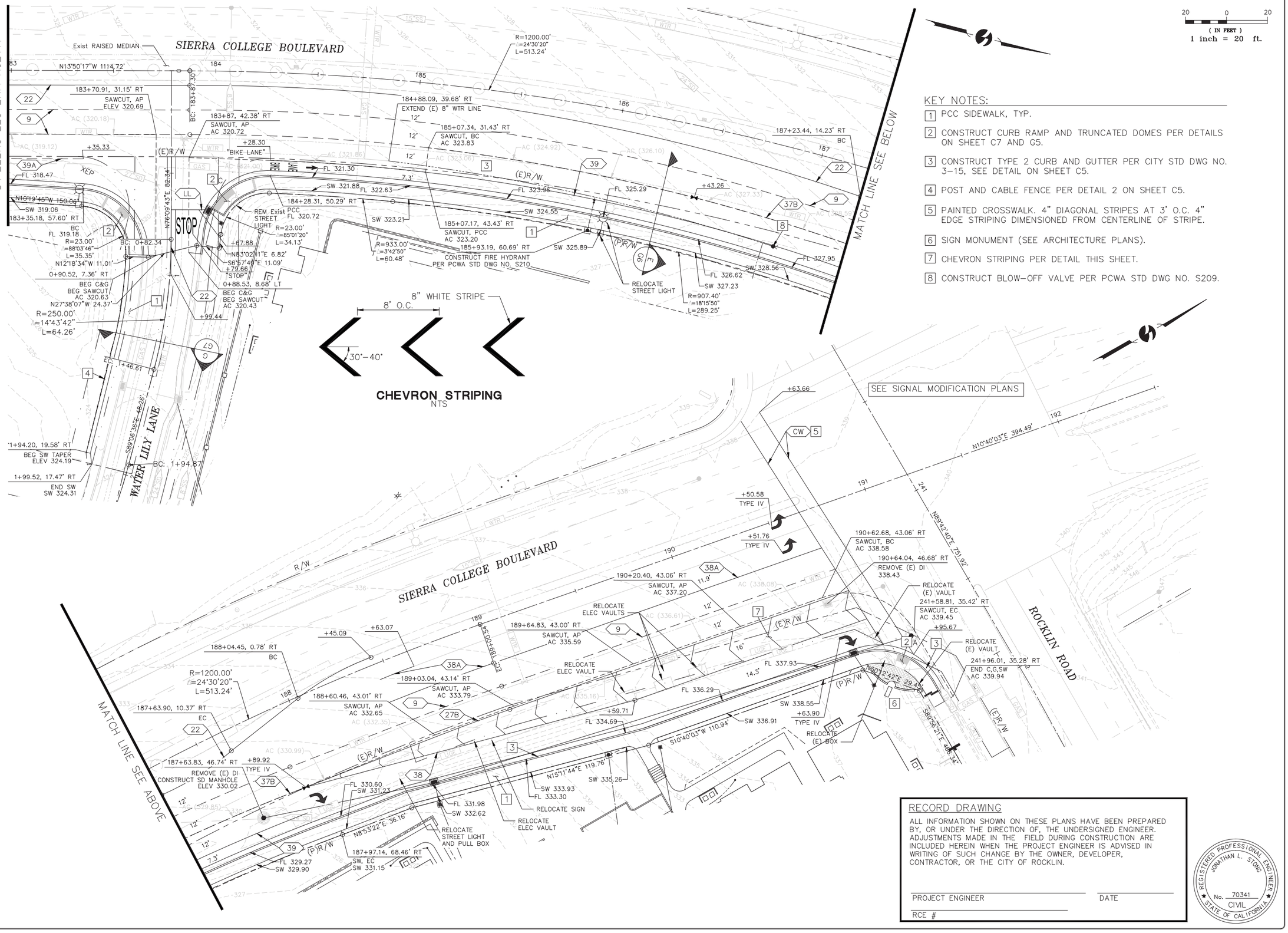

KEY NOTES:

1. PCC SIDEWALK, TYP.
2. CONSTRUCT CURB RAMP AND TRUNCATED DOMES PER DETAILS ON SHEET C7 AND G5.
3. CONSTRUCT TYPE 2 CURB AND GUTTER PER CITY STD DWG NO. 3-15, SEE DETAIL ON SHEET C5.
4. POST AND CABLE FENCE PER DETAIL 2 ON SHEET C5.
5. PAINTED CROSSWALK. 4" DIAGONAL STRIPES AT 3' O.C. 4" EDGE STRIPING DIMENSIONED FROM CENTERLINE OF STRIPE.
6. SIGN MONUMENT (SEE ARCHITECTURE PLANS).
7. CHEVRON STRIPING PER DETAIL THIS SHEET.
8. CONSTRUCT BLOW-OFF VALVE PER PCWA STD DWG NO. S209.

RECORD DRAWING

ALL INFORMATION SHOWN ON THESE PLANS HAVE BEEN PREPARED BY, OR UNDER THE DIRECTION OF, THE UNDERSIGNED ENGINEER. ADJUSTMENTS MADE IN THE FIELD DURING CONSTRUCTION ARE INCLUDED HEREIN WHEN THE PROJECT ENGINEER IS ADVISED IN WRITING OF SUCH CHANGE BY THE OWNER, DEVELOPER, CONTRACTOR, OR THE CITY OF ROCKLIN.

PROJECT ENGINEER _____ DATE _____

RCE # _____

REGISTERED PROFESSIONAL ENGINEER
JONATHAN L. STONG
No. 70341
CIVIL
STATE OF CALIFORNIA

REVISIONS

No.	DESCRIPTION	DATE	BY

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PLEASANT HILL, CA 94523
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SIERRA COLLEGE BOULEVARD
FRONTAGE IMPROVEMENTS
SIERRA GATEWAY APARTMENTS
Rocklin Sierra Apartments II, LLC
City of Rocklin, California

SCALE	1"=20'
JOB NO.	25-7185-01
DESIGNED	SMH
DRAWN	SMH
FILE	1783L002
CHECKED	JLS
DATE	8-7-15

SHEET No. L6

16 OF 51

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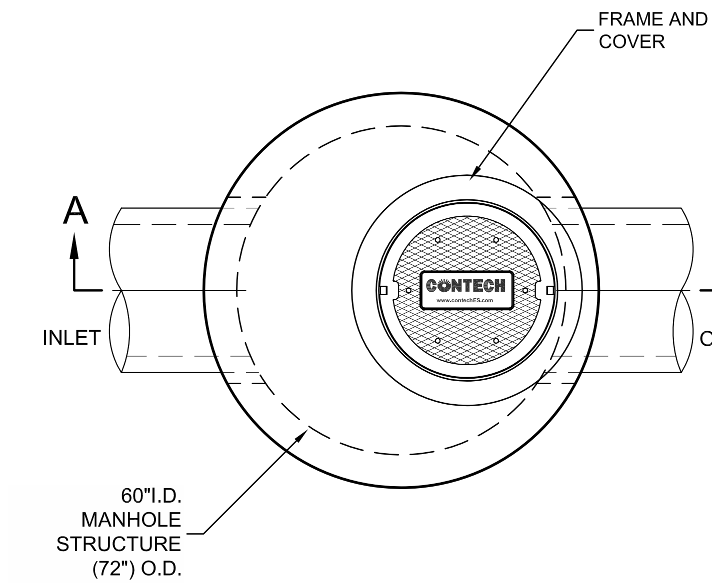
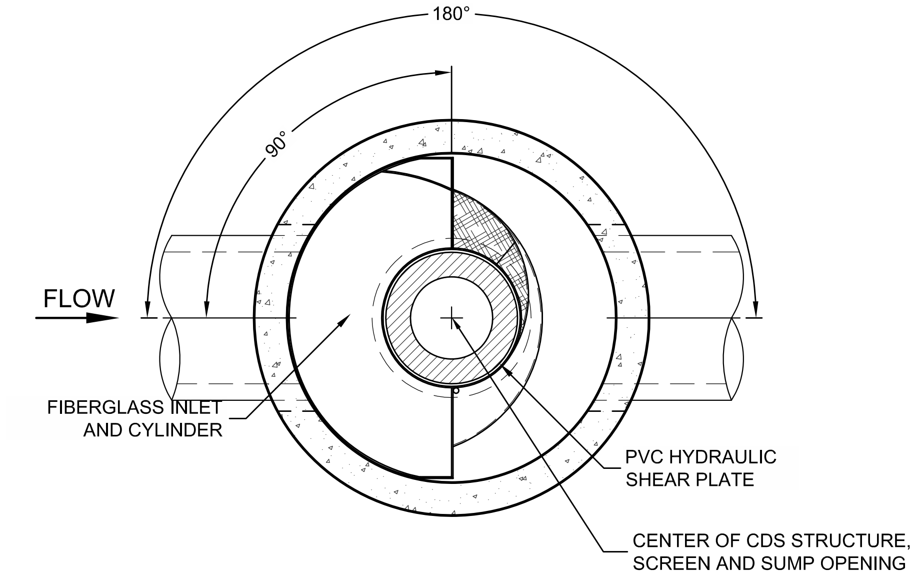
APPENDIX D

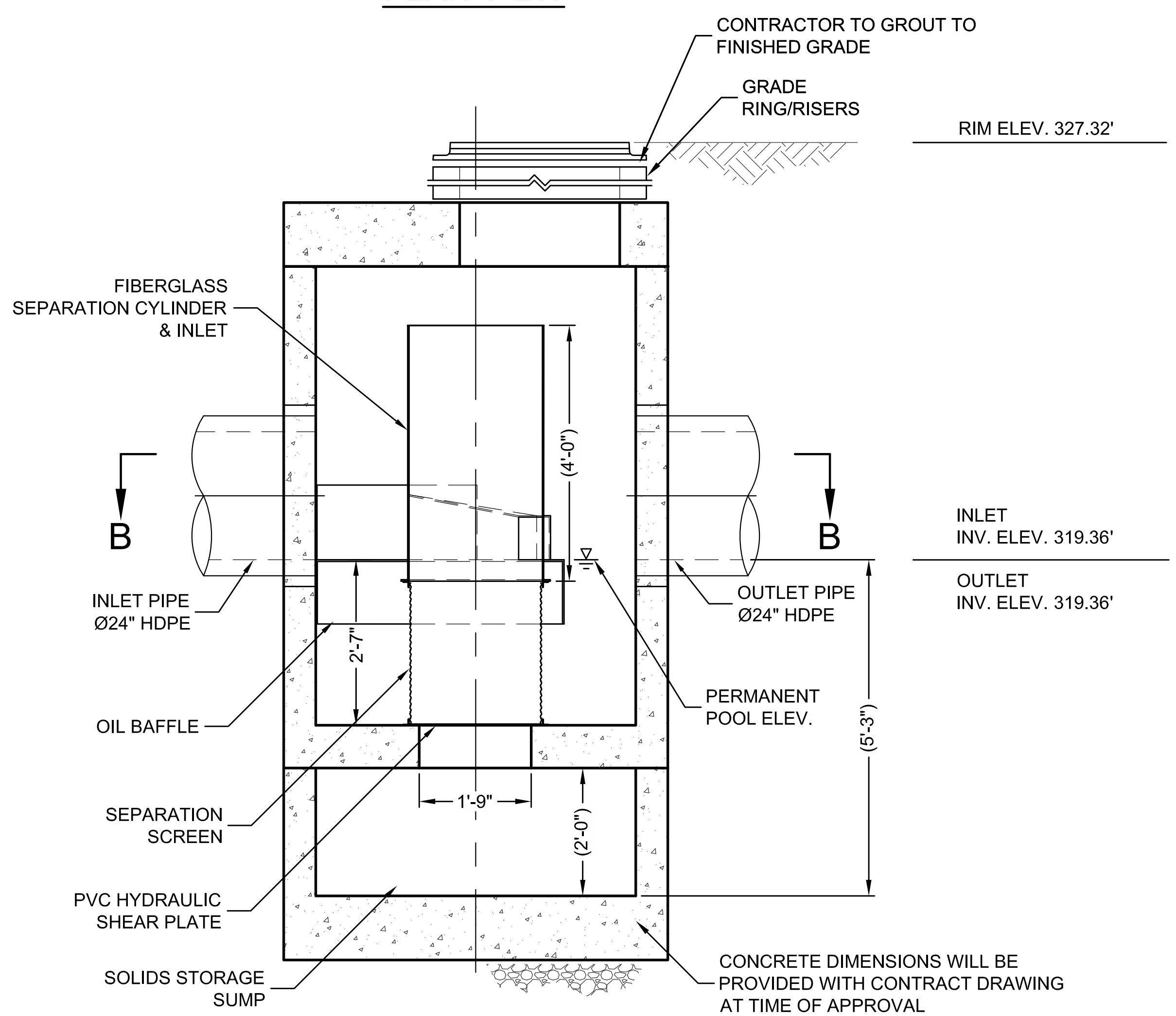
1. Water Quality Structural BMPs



PLAN VIEW



SECTION B-B



SECTION A-A

MATERIALS LIST - PROVIDED BY CONTECH

COUNT	DESCRIPTION	INSTALLED BY
1	FIBERGLASS INLET & CYLINDER	CONTECH
1	2400 MICRON SEP. SCREEN	CONTECH
1	SEALANT FOR JOINTS	CONTRACTOR
1	GRADE RINGS/ RISERS	CONTRACTOR
1	Ø30"x4" FRAME AND COVER	CONTRACTOR

SITE DESIGN DATA

WATER QUALITY FLOW RATE	0.605 CFS
PEAK FLOW RATE	7.2 CFS
RETURN PERIOD OF PEAK FLOW	10 YRS

GENERAL NOTES
1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR SITE SPECIFIC DRAWINGS WITH DETAILED DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE SHALL MEET AASHTO HS20 AND CASTINGS SHALL MEET AASHTO M306 LOAD RATING, ASSUMING GROUNDWATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. ENGINEER OF RECORD TO CONFIRM ACTUAL GROUNDWATER ELEVATION
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES
A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

STRUCTURE WEIGHT
APPROXIMATE HEAVIEST PICK = XXX LBS.

CONTECH
PROPOSAL
DRAWING

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MARK	DATE	REVISION DESCRIPTION	BY

CDS2020-5-C - 527114-10
SIERRA GATEWAY APARTMENTS
ROCKLIN, CA
SITE DESIGNATION: PS6

CONTECH ENGINEERED SOLUTIONS LLC
www.contechES.com
9025 Centre Pointe Dr., Suite 400, West Chester, OH 45069
800-338-1122 513-645-7000 513-645-7993 FAX

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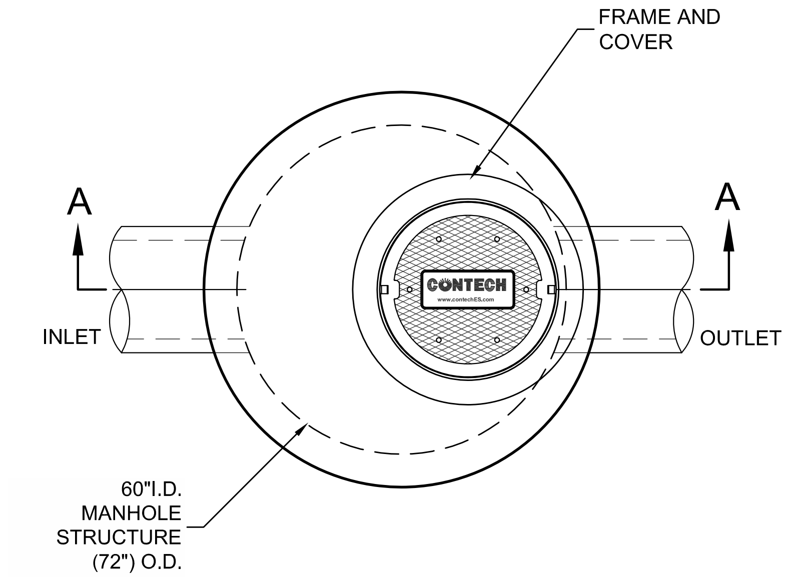
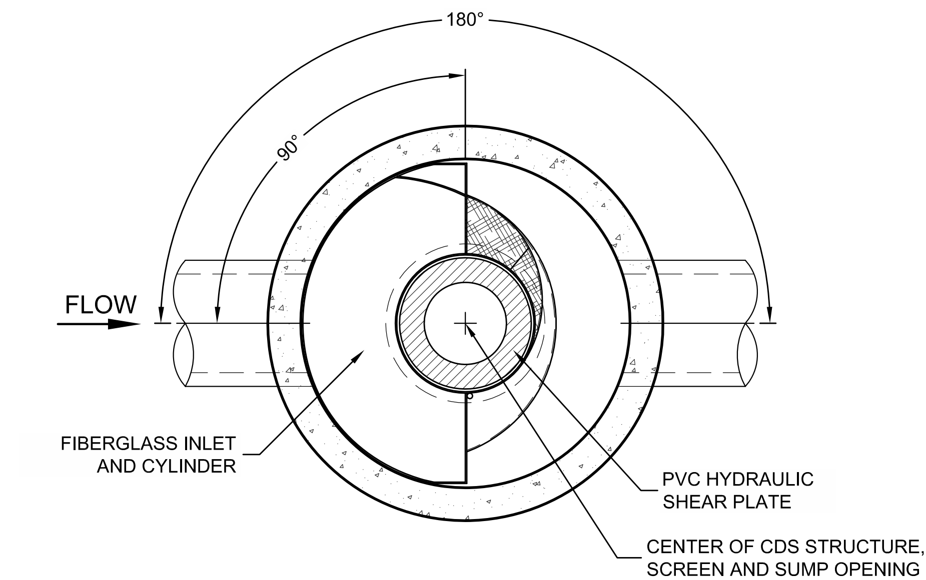
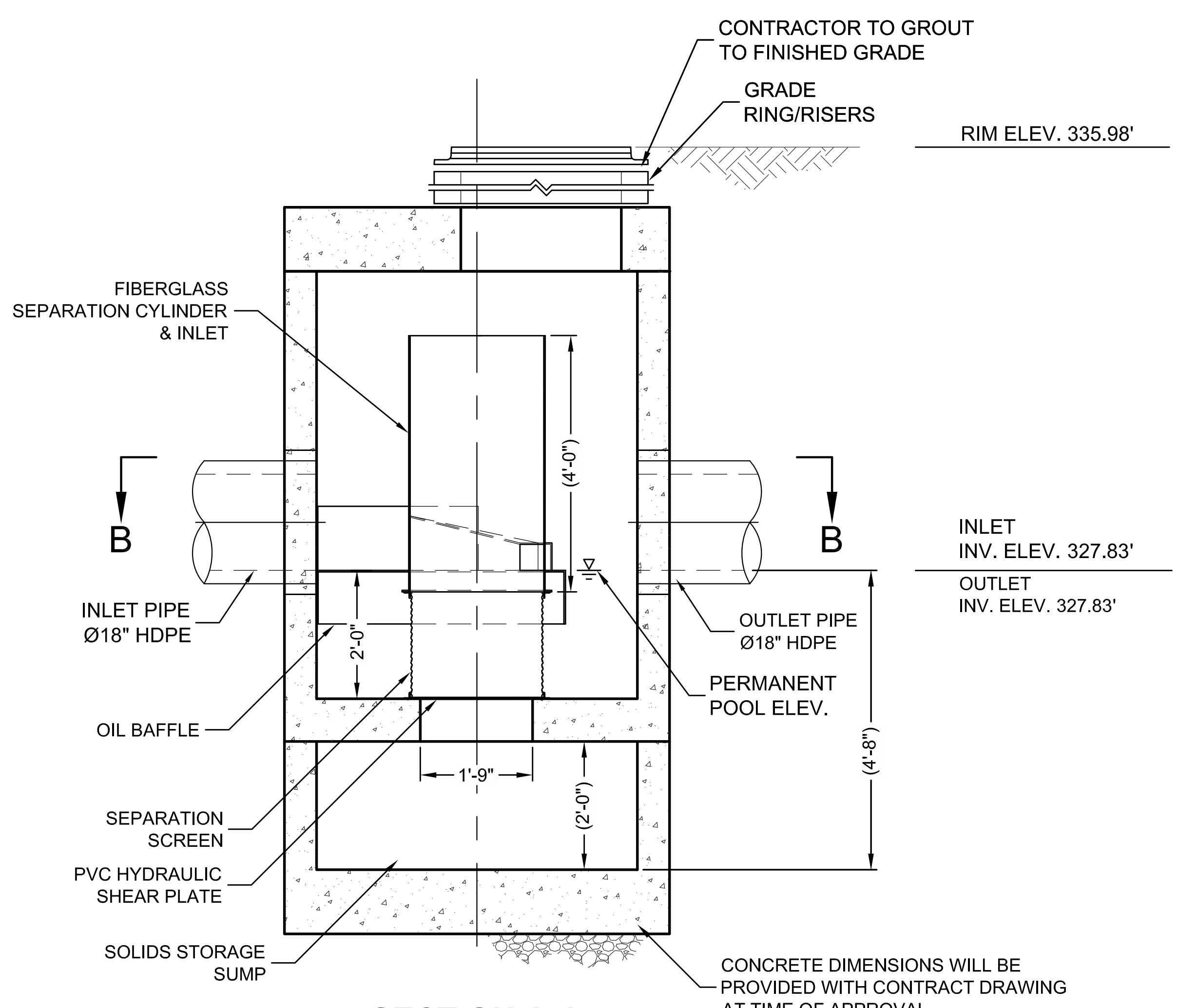
DATE: 8/7/15	
DESIGNED: JML	DRAWN: JML
CHECKED:	APPROVED:
PROJECT No.: 527114	SEQUENCE No.: 10
SHEET: 1 OF #	



PLAN VIEW



SECTION B-B



SECTION A-A

MATERIALS LIST - PROVIDED BY CONTECH

COUNT	DESCRIPTION	INSTALLED BY
1	FIBERGLASS INLET & CYLINDER	CONTECH
1	2400 MICRON SEP. SCREEN	CONTECH
1	SEALANT FOR JOINTS	CONTRACTOR
1	GRADE RINGS/ RISERS	CONTRACTOR
1	Ø30"x4" FRAME AND COVER	CONTRACTOR

SITE DESIGN DATA

WATER QUALITY FLOW RATE	0.378 CFS
PEAK FLOW RATE	4.5 CFS
RETURN PERIOD OF PEAK FLOW	10 YRS

GENERAL NOTES

1. CONTECH TO PROVIDE ALL MATERIALS UNLESS NOTED OTHERWISE.
2. DIMENSIONS MARKED WITH ( ) ARE REFERENCE DIMENSIONS. ACTUAL DIMENSIONS MAY VARY.
3. FOR FABRICATION DRAWINGS WITH DETAILED STRUCTURE DIMENSIONS AND WEIGHTS, PLEASE CONTACT YOUR CONTECH ENGINEERED SOLUTIONS LLC. REPRESENTATIVE. www.contechES.com
4. CDS WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING.
5. STRUCTURE AND CASTINGS SHALL MEET AASHTO HS20 LOAD RATING.
6. PVC HYDRAULIC SHEAR PLATE IS PLACED ON SHELF AT BOTTOM OF SCREEN CYLINDER. REMOVE AND REPLACE AS NECESSARY DURING MAINTENANCE CLEANING.

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE-SPECIFIC DESIGN CONSIDERATIONS AND SHALL BE SPECIFIED BY ENGINEER OF RECORD.
B. CONTRACTOR TO PROVIDE EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE CDS MANHOLE STRUCTURE (LIFTING CLUTCHES PROVIDED).
C. CONTRACTOR TO ADD JOINT SEALANT BETWEEN ALL STRUCTURE SECTIONS, AND ASSEMBLE STRUCTURE.
D. CONTRACTOR TO PROVIDE, INSTALL, AND GROUT PIPES. MATCH PIPE INVERTS WITH ELEVATIONS SHOWN.
E. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO ASSURE UNIT IS WATER TIGHT, HOLDING WATER TO FLOWLINE INVERT MINIMUM. IT IS SUGGESTED THAT ALL JOINTS BELOW PIPE INVERTS ARE GROUTED.

STRUCTURE WEIGHT

APPROXIMATE HEAVIEST PICK = XXX LBS.

CONTECH
PROPOSAL
DRAWING

MARK	DATE	REVISION DESCRIPTION	BY

CDS2015-5-C - 527114-20
SIERRA GATEWAY APARTMENTS
ROCKLIN, CA
SITE DESIGNATION: PN4

CONTECH ENGINEERED SOLUTIONS LLC
www.contechES.com

DATE: 8/7/15
DESIGNED: JML | DRAWN: JML
CHECKED: | APPROVED:
PROJECT No.: 527114 | SEQUENCE No.: 20
SHEET: 1 OF #

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Sizing Estimate

Provided by Jeremiah Lehman on August 7, 2015

Sierra Gateway Apartments

Rocklin, Placer Co., CA

Site information:

Structure ID	Area, A (acres)	Runoff Coefficient, C	Intensity, I (in/hr)	Water Quality Flow, Q=CIA (cfs)	Peak Flow (cfs)
PS6	3.6 ac	0.84	0.20	0.605	7.2
PN4	2.25 ac	0.84	0.20	0.378	4.5

.

CDS System Sizing:

The CDS Stormwater Treatment System is a high-performance hydrodynamic separator. Using patented continuous deflective separation technology, the CDS system screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls physically separate captured solids, preventing re-suspension and release of previously trapped pollutants

Extensive laboratory testing has been conducted with full scale CDS systems using silica based solids introduced at a range of flow rates and concentrations typical of field conditions. Removal rates have been determined for a wide range of particle sizes and this information is used to inform sizing decisions. For example, the listed capacity of the CDS system is the flow rate at which 80% removal of 125 micron particles will be removed. If a coarser or finer particle size is targeted, a design capacity multiplier can be determined from the equation shown in the enclosed “CDS Sediment Removal Rates” document can be used to determine the 80% removal rate.

The CDS model was selected based on the Water Quality Flow calculated above and its ability to remove 80% of the Total Suspended Solids associated with the 75-micron particle size at the required flow rate, per the requirements of the City of Rocklin.

Recommended CDS Model	Target Particle Size (µm)	Water Quality Flow (cfs)	Design Capacity Multiplier	CDS Treatment Flow Capacity, 125 µm (cfs)	Adjusted CDS Treatment Flow Capacity, 75 µm, (cfs)
CDS2020-5-C	75	0.605	0.68	1.1	0.748
CDS2015-5-C	75	0.378	0.68	0.7	0.476

Maintenance:

Like any stormwater best management practice, the CDS system requires regular inspection and maintenance to ensure optimal performance. Maintenance frequency will be driven by site conditions. Quarterly visual inspections are recommended, at which time the accumulation of pollutants can be determined. On average, the CDS system requires annual removal of accumulated pollutants.

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contechstormwater.com
11835 NE Glenn Widing Drive Portland, OR
Toll-free: 800.548.4667 Fax: 800.561.1271

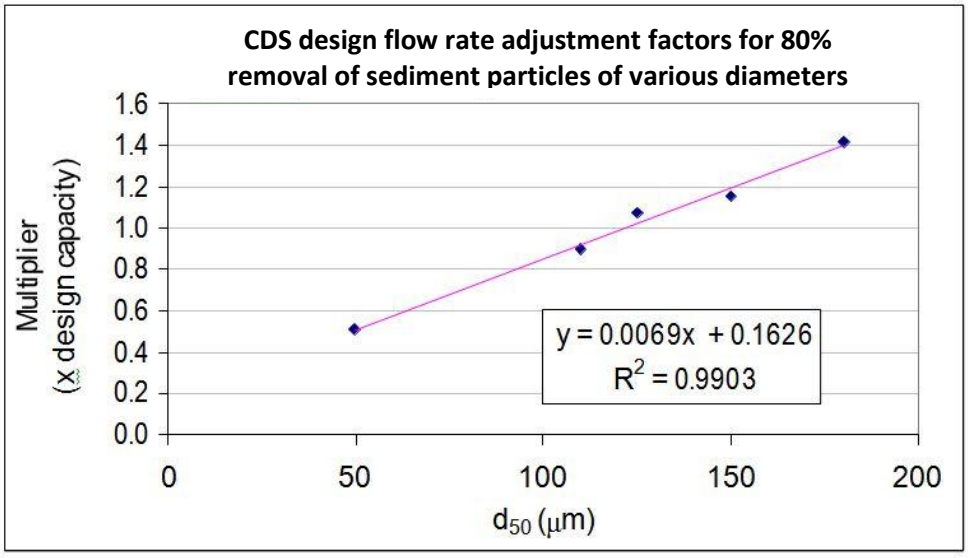
CONTECH ENGINEERED SOLUTIONS

9025 Centre Pointe Drive, Suite 400
West Chester, OH 45069
Phone: (513) 645-7000
Toll Free: (800) 338-1122
www.ContechES.com

CDS Sediment Removal Rates
August 12, 2008

The CDS® system is a hydrodynamic separator (HDS) best known for its ability to remove 100% of neutrally buoyant materials greater than 2.4mm - 4.7mm in diameter (depending on the screen size), including most trash and debris, from treated flows. It is also designed to remove floating pollutants like oil and grease, and sinking pollutants, including sediment, from stormwater flows. A common metric used to compare the sediment removal ability of Stormwater Control Measures is Total Suspended Solids (TSS). This analytical method has been borrowed from wastewater analysis and is best suited to the measurement of particles smaller than 75 to 100 microns which have not been removed by a primary gross solids removal treatment step. In stormwater flows, the size range of particles varies dramatically in response to flow rates and available materials, and is likely to contain larger particles including coarse silt and sand which the TSS measurement method tends to exclude. So, to be precise about system capabilities, we discuss sediment removal rates for the CDS system in terms of specific particles sizes.

Extensive laboratory testing has been conducted with full scale CDS systems using silica based solids introduced at a range of flow rates and concentrations typical of field conditions. Removal rates have been determined for a wide range of particle sizes and this information is used to inform sizing decisions. For example, the listed capacity of the CDS system is the flow rate at which 80% removal of 125 micron particles will be removed. If a coarser or finer particle size is targeted, the equation from the following figure can be used to determine the 80% removal rate.



Ultimately the question of TSS removal rate depends on the size and density of the solids measured by the TSS analytical procedure. The 125 micron default particle size was selected because it is a reasonable approximation of the average particle size of all sediment in stormwater runoff. If solids targeted for removal are expected to be significantly coarser or finer, another particle size may be more appropriate. In order to compare different sediment removal strategies, it is important to specify a target particle size or particle size distribution. Each system should then be evaluated relative to that standard. Please note that media filtration may be necessary to remove particles substantially finer than 50 microns, including dissolved pollutants.

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CONTECH®
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CDS® Inspection and Maintenance Guide

CDS TECHNOLOGIES

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	yd3	m3
CDS2015-4	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

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CDS Inspection & Maintenance Log

CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.