HYDROLOGY STUDY

FOR

VISCAR TERRACE APARTMENTS
G-PC-RES-2024-00028

40475 Vista Murrieta,
Murrieta, CA 92562
&
40600 Myers Lane,
Murrieta, CA 92562

Prepared for:
Community Development Partners
3416 Via Oporto, Suite 301
Newport Beach, CA 92663
Tel: (949) 467-1344

Prepared: May 20, 2024
Revised: December 19, 2024, January 04, 2025
April 04, 2025

UNITED CIVIL, INC.
30141 Agoura Road, Suite 215
Agoura Hills, CA 91301
Tel: (818) 707-8648
Fax: (818) 707-8649

TABLE OF CONTENTS

APPENDIX

APPENDIX

INTRODUCTION

A. PROJECT LOCATION AND DESCRIPTION

The proposed 5.74-acre site of Viscar Terrace Apartments project is located at 40475 Vista Murrieta & 40600 Myers Lane in the City of Murrieta, County of Riverside, California (See Vicinity Map on Page 3). Currently, the site consists of three assessor parcels i.e. APN 949-180-025, APN 949-180-023, APN 949-180-022. The project site is bordered by a Religious Hindu Temple & Child Daycare Center to the north, Myers Lane & 2-residential lots on the west, 1-residential lot to the east, and Vista Murrieta on the south. The site has a zoning of O (office) per city of Murrieta Zoning Map.

Currently, the proposed site includes 2-single family houses, storage containers, concrete driveway, and landscape area. The site has steep slopes ranging from 61 feet of topographic relief on the west side of the project site to 33 feet of topographic relief on the east side of the project site. In the existing condition, the north side of the project site discharges runoff to Myers Lane & the south side discharges runoff to Vista Murrieta.

The proposed project involves constructing 4-prefabricated 3-story residential apartment buildings and 1-prefabricated 4-story residential apartment building, asphalt parking lot with 109 parking spaces & 122 carport parking spaces. The proposed project includes a total of 173 residential units, leasing office units, and community open space for recreational activities. (See Architectural Site Plan on page 4).

B. PURPOSE OF STUDY

The main purposes of this drainage study are:

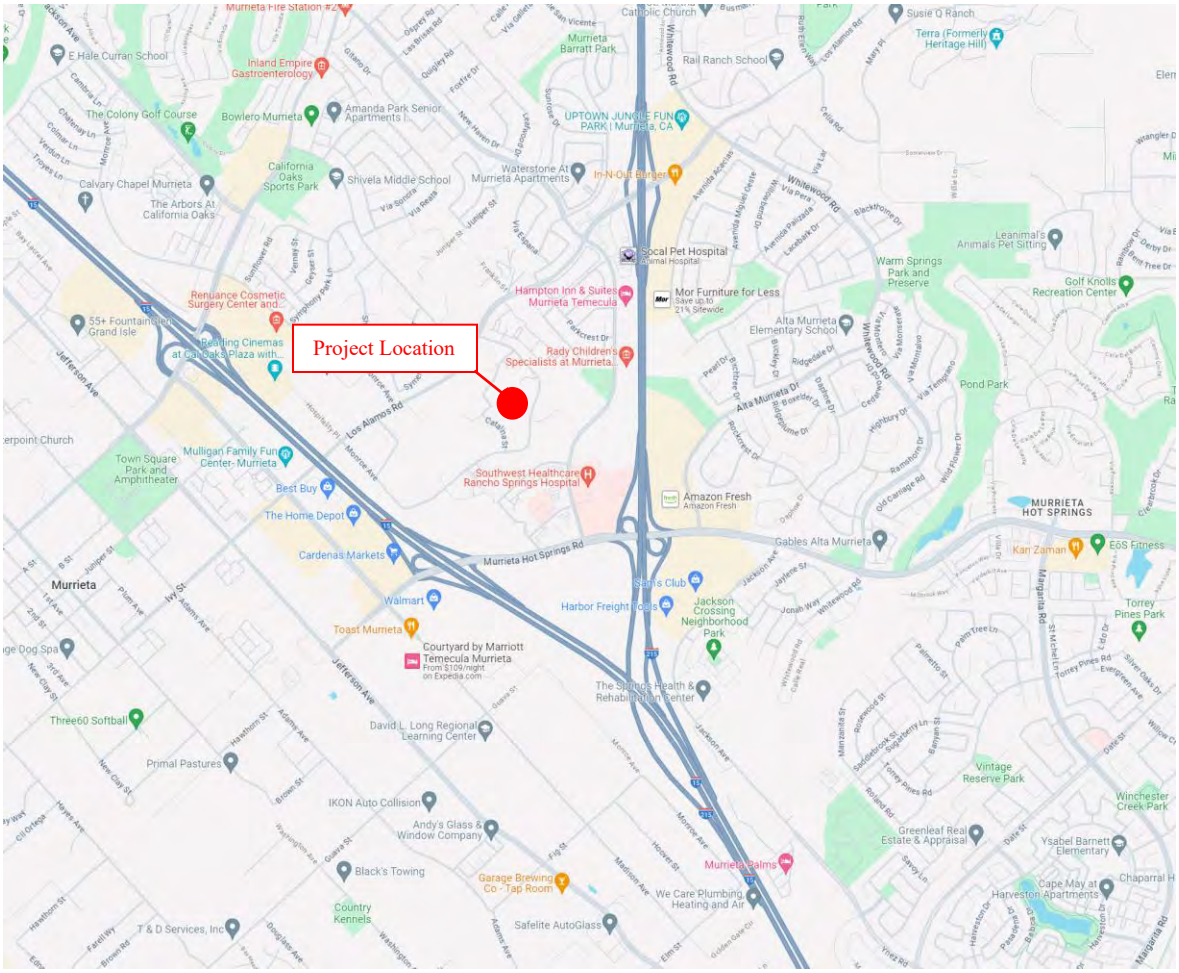
1) to calculate the design 100-year frequency storm runoff and the corresponding peak 10-year frequency storm runoff generated from project site in both the Existing Pre-Developed Condition and Proposed Post-Developed Condition using the standard County's Rational Method hydrology calculation;

2) to calculate the unit hydrographs of 1-hour, 3-hour, 6-hour, and 24-hour duration events for the design 10-year frequency storm runoffs generated from project site in the Proposed Post-Developed Condition using the standard County's Synthetic Unit Hydrograph calculation;

3) to perform unit hydrograph routing analysis through proposed underground detention system to determine the required onsite detention storage volume and the routed peak outflows for various storm events studied to mitigate the delta increase in peak runoff in the proposed post-development condition;

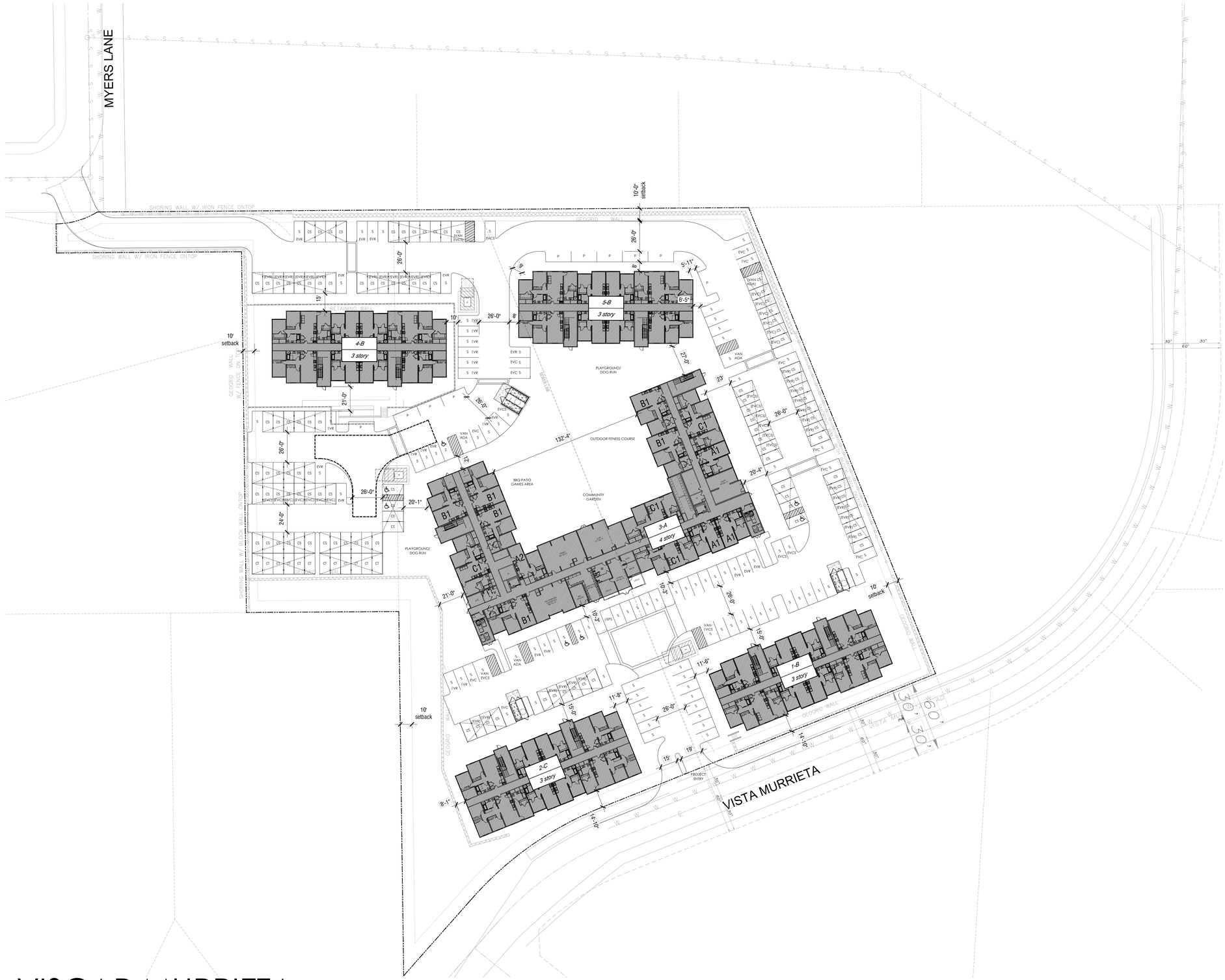
4) to determine the onsite BMP design flow rate and volume from proposed development and to propose appropriate treatment control Best Management Practices (BMPs) to complete the separate Project Water Quality Management Plan (WQMP) and to mitigate the onsite developed flow rate or volume in compliance with the stormwater management requirements of Countywide Drainage Area Management Plan (DAMP) and Local Implementation Plan (LIP); and

5) to determine the hydraulic capacities of proposed onsite drainage systems including various sizes of storm drain pipes, grated drop inlets, and parkway drains to convey onsite storm runoffs to outlet to corresponding tributary existing downstream drainage facilities and to curb and gutter of adjacent public streets. To determine the hydraulic capacities of the proposed street improvement for Vista Murrieta Road & Myers Lane.



Vicinity Map

NTS



PARKING PROVIDED

OPEN STALLS (7 HC)	100
OPEN PARALLEL	10
COVERED STALL	108
COVERED TANDEM	12
TOTAL	230 TOTAL

OPEN SURFACE PARKING EV COUNT

RES. VAN EVCS	2
RES. EVCS	4
RES. EV READY	27
RES. EV CAPABLE	11
RES. VAN ADA STALL	1
HANDICAP STALL	3
LEASING VAN ADA STALL	1

CARPORT PARKING EV COUNT

RES. VAN EVCS	1
RES. EVCS	6
RES. EV READY	31
RES. EV CAPABLE	13
RES. VAN ADA STALL	1
HANDICAP STALL	7

NORTH

1"=40'-0" 0 20' 40' 80' 120'

VISCAR MURRIETA

Etapes Corp.
13681 Newport Ave., Suite 8230
(657) 218-4856

DATE: 11-21-23
JOB NO.: 2023-581

AO ARCHITECTS
144 NORTH ORANGE ST., ORANGE, CA 92866
(714) 639-9860

Architecture. Design. Relationships.

METHODOLOGY

The drainage watershed studied (see enclosed Hydrology Maps in Appendix H), consists of no storm water run-on or tributary upstream offsite drainage area to its lot boundary and is located within the Santa Margarita River Watershed. The site is situated within the 0.77-inch of Design Capture Storm Depth of 85th Percentile, 24-hour Rainfall Zone (Appendix A) and located within the Soil Group C which has slow infiltration rates. (Appendix A). Overall, the project site is outside significant flood areas as it is within FEMA Zone X. (See Page A-28). The 2-year 1-hour precipitation for the watershed studied is 0.54 inches while the 100-year 1-hour precipitation is 1.25 inches. The relevant hydrologic data & maps, hydrologic descriptions and methods, curve numbers & imperviousness tables, and design charts are presented in Appendix A for references.

The RCFC & WCD's Rational Method Hydrology Program developed by Civilcadd/Civildesign Engineering Software was used to calculate the approximate time of concentration (TC) and the design peak 100-year storm runoff and the corresponding peak 10-year storm runoffs in the existing pre-developed and in the proposed post-developed conditions. The Standard Intensity-Duration Curve data generated from Plate D-4.1 of the Riverside County Flood Control and Water Conservation Rational Hydrology Manual for Murrieta/Temecula/Rancho California and a slope of 0.55 was used for this study. (See Appendix B & C for Rational Method Calculations for the existing and proposed conditions)

The RCFC & WCD's Synthetic Unit Hydrograph Hydrology Program Developed by Civilcadd/Civildesign Engineering Software was used to calculate the hydrograph flood volume for the onsite drainage subarea studied for the 1-hour, 3-hour, 6-hour & 24-hour duration events for the 100-year, 10-year, 5-year, and 2-year return frequency storm events both in the existing pre-developed condition and the proposed post-developed condition. For the simplicity of the Lag Time calculation as an input in the software program, 0.8*Time of concentration (T_C) from the Rational Method calculation was used for each drainage subarea studied. The difference of flood volume between the post-development and pre-development conditions is the required detention storage volume to be provided onsite to mitigate the increased developed runoff. (See Appendix D & E for Unit Hydrograph Method Calculations for the existing and proposed conditions)

Flood Hydrograph Routing Program Developed by Civilcadd/Civildesign Engineering Software was used to calculate the hydrograph routing analysis through the Detention Storage tank. The routing analysis was performed for the 1-hour, 3-hour, 6-hour & 24-hour duration events for the 10-year return frequency storm in the proposed developed condition. (See Appendix F for routing calculations)

In the present existing condition, a ridge line splits the drainage in the middle and half the project site discharges runoff north onto Myers Lane (Subarea A1) and half discharges runoff south onto Vista Murrieta (Subarea B1). The curb and gutter on Myers Lane discharges into a public catch basin just west of the project site which ultimately feeds stormwater runoff into a public channel which conveys runoff into the Murrieta Creek (tributary to Santa Margarita River). The runoff on Vista Murrieta Road discharges into a concrete circular inlet just east of the neighboring residential home. Larger flows not intercepted by the concrete circular inlet flow into an existing dirt channel and ultimately discharge into the Murrieta Creek. A portion of offsite area (westerly residential neighbor) flows onto the project site (Subarea B2). This area is also tributary to the existing concrete circular inlet & dirt channel. A portion of offsite area (easterly residential neighbor) does not flow onto the project site but is tributary to this concrete circular inlet & dirt channel. (Subarea B3)

In the proposed post-developed condition, most of the onsite runoff flowing north (Subarea A) will be collected by proposed grated inlet and conveyed to proposed diversion structure. The LID Q will be

conveyed to proposed Modular Wetland System (MWS-L-8-16-V) for Biofiltration treatment. Overflow will be diverted into proposed 7' diameter storage tank for detention purposes. This storage system will discharge the peak routed flow into the existing curb inlet catch basin on Catalina Street. Most of the onsite runoff flowing south (Subarea B) will be collected by proposed grated inlets and conveyed to proposed diversion structure. The LID Q will be conveyed to proposed Modular Wetland System (MWS-L-8-12-V) for Biofiltration treatment. Overflow will be diverted into proposed 6' diameter storage tank for detention purposes. This storage system will discharge peak routed flow into the curb and gutter of Vista Murrieta via 24" W x 3" H parkway drain. The existing drainage pattern and discharge points will remain in the proposed post-development condition.

The proportion imperviousness assigned for the watershed studied was based on the Table of Impervious Cover for land use for the existing and proposed condition (See Page A-13). The existing predevelopment consists of two existing residential buildings, paved driveway, and some landscaping area and was assigned an imperviousness of 20% with a land use of 1-acre single family residential lot (Subarea A1, B1, B2 & B3). The calculated imperviousness for Subarea A1 is 14.8% but the land use impervious cover for 1-acre lot (20%) will be used for this study. The calculated imperviousness for Subarea B1 is 20.1%, so the land use impervious cover for 1-acre lot (20%) will be used for this study. (see Appendix A for imperviousness calculations)

The proposed post development consisting of five-3/4-story apartment buildings, concrete paved walkways, asphalt driveway/parking lot, and planting & landscaping area was assigned with an imperviousness of 80% with a land use of Apartments. (Subarea A & B) The calculated imperviousness for Subarea A is 70.4% but the land use impervious cover for Apartments (80%) will be used for this study. The calculated imperviousness for Subarea B1 is 69.7%, but the land use impervious cover for Apartments (80%) will be used for this study. (see Appendix A for imperviousness calculations) No improvements will be proposed for the offsite Subareas B2 & B3; there will be no changes to the imperviousness values.

In accordance to the Riverside County DAMP and the Santa Margarita River Watershed Model Water Quality Management Plan (WQMP), the proposed project, which is a New Development project involving creation of 10,000 or more square feet of impervious surfaces, is categorized as Priority Development Project (PDP) per Santa Margarita Region WQMP-Exhibit D Checklist. PDPs are required to implement Low Impact Development (LID), treatment control, and hydromodification control BMPs to achieve performance criteria as described in the Riverside County Santa Margarita River Watershed Region Design Handbook for Low Impact Development Best Management Practices (revised June 2018). The first flush or BMP design flow rate (Qbmp) and design volume (Vbmp) calculations were performed based on the guidelines, criteria, and worksheets contained in said design handbook mentioned above. (see separate WQMP report for calculations)

FlowMaster by Bentley Systems was utilized to compute the full flow hydraulic capacity of the various sizes of proposed onsite privately maintained storm drain pipes, and public street capacities. (See appendix G for results & summary table)

Hydraulic Analysis Program Developed by Civilcadd/Civildesign Engineering Software was used to calculate the parkway drains & discharge pipe flow capacities for the detention storage tanks.

SUMMARY OF HYDROLOGIC CHARACTERISTICS & DESIGN CRITERIA

Runoff Calculations: RCFC&WCD Rational Method & Synthetic Unit Hydrograph Method

Design Storm: **100-Year Frequency Storm Event**

100-Year Storm Event 24-Hour Rainfall Intensity: 5.0 Inch

2-Year Storm Event 24-Hour Rainfall Intensity: 2.0 Inch

24-Hour, 85th Percentile Design Capture Storm Depth: 0.75 Inch

Soil Group: C (Slow Infiltration Rates)

Existing Onsite Land Use: 'Residential' – 2-existing 1-story buildings and paved driveway, and some landscaped area. Subarea A1 = 14.8% Imp, Subarea B1 = 20.1% Imp (See Actual Imperviousness Calculations in Appendix A)

Proposed Onsite Development: 'Apartments' – 5-proposed 3/4-story buildings, asphalt parking lot with 230 spaces, 173 residential units, open community area, and landscape area. Subarea A = 78.0% Imp, Subarea B = 80% Imp (See Actual Imperviousness Calculations in Appendix A)

Imperviousness: **20%** for 1-Acre Lot Residential Land Use (Exist. Pre-Developed Condition)
80% for Apartments Land Use (Prop. Post-Developed Condition)

Observed Infiltration rate: 0.19 TO 0.74 inch/hr (without reduction factors) (see Appendix A for test results)

Design Criteria

Peak Runoff from the 10-year storm event shall be contained within the private & public Streets's Top of Curbs.

Peak Runoff from the 100-year storm event shall be contained within the back of Walkway (onsite walkways adjacent to the onsite private streets) & within the Right-of-Way Limits on Myers Lane & Vista Murrieta.

Finished Pad Elevations of the proposed dwellings shall be at last 1 foot above the water surface elevation of a 100-year storm event.

DRAINAGE DISCUSSIONS

Appendix A presents the relevant maps of 24-hour 85th percentile rainfall Isoheytal map, Soil Group Map & Precipitation Maps showing the location of the project sit and the corresponding soils and hydrologic data all of which are from the Riverside County Hydrology Manual. The relevant flood protection criteria, standard intensity-duration curves data, runoff coefficient curves and curve data, table of runoff index numbers for pervious area, table of impervious cover for developed areas, Rational Method Instructions, Synthetic Unit Hydrograph Method instructions, lag time calculation instructions, FEMA FIRM Map from USGS National Map, and Preliminary Geotechnical Engineering Report "Vista Murrieta Apartments Project" by Terracon Inc. dated December 15, 2023; all of the above are included for references.

The project site is situated within 0.75-inch zone of 24-hour 85th percentile Design Capture Storm Depth and is located within Soil Group C. Groundwater was encountered at 15' below the location of boring B-1 which is on the north side of the project site.

Appendix A also presents the calculation for the actual imperviousness of each onsite subarea delineated on the Hydrology Map for both the proposed and existing condition.

Appendix B presents the Riverside County Flood Control & Water Conservation District's (RCFC&WCD) Rational Method hydrology analyses for 100-year storm event and the corresponding 10-year storm events in the Existing Pre-Developed Condition for the project site.

Currently, the project site consists of two existing single family homes on the high points of the project site, a concrete paved driveway, storage containers, and some landscape. A ridge line exists splitting the project site drainage to two outlet points, one on Vista Murrieta & one on Myers Lane. Currently, a part of the westerly neighbor discharges onto the project site. Therefore, three subareas: Subarea A1 (onsite) which discharges onto Myers Lane, Subarea B1 (onsite) which discharges onto Vista Murrieta, and Subarea B2 (offsite) which discharges onto Subarea B1 (tributary to Vista Murrieta), were assigned and delineated based on the assumed topographic ridge lines and & discharge points. The calculated imperviousness for the existing predeveloped condition for Subarea A1 and B1 is about **15% and 20%**, respectively, but an imperviousness of 20% was used for both subareas based on the land use impervious cover of 1-Acre residential lot (20%).

The tributary 3.42 acres of project area, designated as Subarea A1 with labeled hydrologic nodes 1 to 2 shown on the Existing Pre-Developed Condition Hydrology Map in Appendix H, generates a peak 100-year storm runoff (Q_{100}) of 10.84 cfs with a time of concentration (Tc) of 8.9 minutes. The corresponding 10-year storm runoff (Q_{10}) is 6.53 cfs. The tributary runoff mainly consists of sheet flow across the north side of the project site until it reaches the curb and gutter of Myers Lane which conveys runoff to an existing public catch basin. This catch basin ultimately discharges to a County maintained Channel north of the project site.

The remaining 2.33 acres of project site, designated as Subarea B1 with labeled hydrologic nodes 3 to 4 shown on the Existing Pre-Developed Condition Hydrology Map enclosed in Appendix H, generates a peak 100-year storm runoff (Q_{100}) of 6.92 cfs with a time of concentration (Tc) of 10 minutes. The corresponding 10-year storm runoff (Q_{10}) is 4.14 cfs. This tributary onsite runoff mainly consists of sheet flow to Vista Murrieta Road which conveys runoff into a circular inlet/dirt channel on the east side of the easterly residential neighboring lot.

The 0.38 acres of offsite area, designated as Subarea B2 with labeled hydrologic nodes 5 to 6 shown on the Existing Pre-Developed Condition Hydrology Map enclosed in Appendix H, generates a peak 100-year storm run-on (Q_{100}) of 1.64 cfs with a time of concentration (Tc) of 5.2 minutes. The corresponding 10-year storm runoff (Q_{10}) is 1.01 cfs. This tributary offsite run-on sheet flows onto Subarea B1.
The table of summary in Appendix B provides a summary of the findings and results.

Appendix C presents the Riverside County Flood Control & Water Conservation District's (RCFC&WCD) Rational Method hydrology analyses for design 100-year storm event and the corresponding 10-year storm events in the Proposed Post-Developed Condition for the project site.

The proposed project involves constructing 4-prefabricated 3-story residential apartment buildings and 1-prefabricated 4-story residential apartment building asphalt parking lot with 109 parking spaces & 122 carport parking spaces. The proposed project includes a total of 173 units, leasing office units, and community open space for recreational activities. The calculated imperviousness for the proposed post-developed condition for both Subarea A and B is about **78%**, but an imperviousness of 80% was used for Subarea A and B based on the land use impervious cover of Apartments land use.

The tributary 3.29-acre of project site, designed as Subarea A and E. Subarea A is approximately 3.08-acre with labeled hydrologic nodes 1 to 9 shown on the Proposed Post-Development Condition Hydrology Map consists of onsite runoff from landscaping areas, walkways, and roof downspouts to be intercepted by grated inlets and conveyed via underground storm drain system to the selected LID and treatment control BMP of Modular Wetland System by Bioclean (MWS-L-8-16-V) (See Separate WQMP). The Peak/Overflow is to be detained by 7' diameter storage tank. The routed peak runoff will be conveyed to a proposed 18" diameter public storm drain main that discharged to an existing curb inlet catch basin on Catalina Street located southwest of the project site. Subarea A generates a peak 100-year storm runoff (Q_{100}) of 13.60 cfs with a time of concentration (Tc) of 5 min. The corresponding 10-year storm runoff (Q_{10}) is 8.99 cfs. Area E represents a portion of the private driveway from to Myers Lane. Area E is approximately 0.21-acre with a calculated peak of 0.63 cfs and 0.95 cfs for Q_{10} and Q_{100} year, respectively. Total unmitigated Q_{10} discharging to the existing catch basin on Catalina Street is 9.62 cfs. Total Q_{100} to be discharged on Myers Lane is 14.55 cfs.

Total runoff discharging to Vista Murrieta Road consists of three tributary areas; A, B, and C, and an offsite runoff designated as tributary area G. The tributary 2.4-acre of project site, designated as Subarea B, C, and D. All three tributary areas are discharged onto Vista Murrieta Road. Subarea B is approximately 2.11-acre with labeled hydrologic nodes 1 to 7 shown on the Proposed Post-Development Condition Hydrology Map consist of onsite runoff from landscaping areas, walkways, and roof downspouts to be intercepted by proposed grated inlets and conveyed via underground storm drain system to the selected LID and treatment control BMP of Modular Wetland System by Bioclean (MWS-L-8-12-V) (See Separate WQMP). The Peak/Overflow is to be detained by 6' diameter storage tank. The routed peak runoff will be discharged via proposed parkway drain onto the curb and gutter of Vista Murrieta which conveys storm water to a concrete circular inlet/dirt channel. Subarea B generates a peak 100-year storm runoff (Q_{100}) of 7.33 cfs with a time of concentration (Tc) of 8 min. The corresponding 10-year storm runoff is 4.84 cfs. Subarea C is approximately 0.22-acre with a calculated peak flowrate of 0.24 and 0.42 cfs for 10 and 100 year, respectively. Subarea D is approximately 0.07-acre with a calculated peak flowrate of 0.10 and 0.17 cfs for 10 and 100 year, respectively. Flowrates from areas C and D are conveyed and pre-treated with a catch basin filter insert through a parkway drain that discharges onto Vista Murrieta Road. Total unmitigated Q_{10} discharging to Vista Murrieta Road is 5.18 cfs. Total Q_{100} to be discharged on Vista Murrieta Road is 7.92 cfs.

Tributary area G is an offsite runon from the neighboring south of the project site with labeled hydrologic nodes 1 to 2 shown on the Proposed Post-Development Condition Hydrology Map (Appendix H). See narrative for Subarea B2 in the Existing Condition section above for results. Tributary area G generates a run-on of 1.64 cfs Q_{100}. That run-on will be conveyed through an inlet that connects to an underground storm drain and discharged through a parkway drain to Vista Murrieta Rd. A small runoff of 0.09 cfs from Tributary Area C discharges into the same inlet making the total runoff of 1.73 cfs. Addition of Tributary areas B, C, D, and G totals to a Q_{10} of 9.56 cfs discharging to Vista Murrieta Rd.

Comparing the Existing Pre-Developed Condition to the Proposed Post-Developed Condition, there is an increase in total undetained developed Q_{10} of 4.13 cfs and Q_{100} of 4.71 cfs for the entire site. The difference between the Existing Q and Proposed Q in Tributary Areas A and B will be detained onsite through underground 6' and 7' diameter detention pipe (see unit hydrograph & routing analysis). Differences in Q for C, D, and E are considered negligible and can be conveyed through grate inlets with filters per agreement with the City of Murrieta. Refer to Summary Table 1A for Q comparison.

SUMMARY TABLE 1: COMPARISON OF RATIONAL METHOD HYDROLOGY BETWEEN EXISTING PRE-DEVELOPMENT CONDITION AND PROPOSED POST-DEVELOPMENT CONDITION

Developed Condition	Hydrology Subarea	Hydrology Subarea Nodes	Drainage Area (Acres)	Proportion Impervious	Calculated Tc (min.)	Calculated Peak 100-Year Flow Rate Q (cfs)	Calculated 10-Year Flow Rate Q (cfs)	Discharge Location
Existing Pre-Developed Condition	**A1**	**1 to 2**	**3.42**	**0.20**	**9**	10.84	6.53	Myers Lane
	B1	**3 to 4**	**2.33**	**0.20**	**10**	6.92	4.14	Vista Murrieta Rd.
	***B2**	**1 to 2**	**0.38**	**0.08**	**5**	1.64	1.01	
Total (to Myers Lane)			**3.42**			**10.84**	**6.53**	
Total (to Vista Murrieta Rd.)			**2.71**			**8.56**	**5.15**	
Total			**6.13**			**19.40**	**11.68**	
Proposed Post-Developed Condition	**A**	**1 to 8**	**3.08**	**0.80**	**5**	13.60	8.99	Myers Lane
	E	**1 to 2**	**0.21**	**0.80**	**5**	0.95	0.63	
	B	**1 to 7**	**2.11**	**0.80**	**8**	7.33	4.84	Vista Murrieta Rd.
	C	**1 to 2**	**0.22**	**0.80**	**5**	0.42	0.24	
	D	**1 to 2**	**0.07**	**0.80**	**5**	0.17	0.10	
	***G**	**5 to 6**	**0.38**	**0.08**	**5**	1.64	1.01	
Total (to Myers Lane)			**3.29**			**14.55**	**9.62**	
Total (to Vista Murrieta Rd.)			**2.78**			**9.56**	**6.19**	
Total			**6.07**			**24.11**	**15.81**	
Delta Increase in Peak Developed Runoff - Myers Lane						**3.71**	**3.09**	
Delta Increase in Peak Developed Runoff - Vista Murrieta Rd.						**1.00**	**1.04**	
Delta Increase in Peak Developed Runoff						**4.71**	**4.13**	

*Offsite Tributary Runon

Note: The 0.06 ac area reduction from Existing to Proposed condition contributes to an area that will be developed as part of Public Street (Vista Murrieta Road)

SUMMARY TABLE 1A: COMPARISON OF RATIONAL METHOD HYDROLOGY BETWEEN EXISTING PRE-DEVELOPMENT CONDITION AND PROPOSED POST-DEVELOPMENT CONDITION (FOR AREAS NOT STORED IN THE DETENTION BASINS)

Developed Condition	Hydrology Subarea	Hydrology Subarea Nodes	Drainage Area (Acres)	Proportion Impervious	Calculated Tc (min.)	Calculated Peak 100-Year Flow Rate Q (cfs)	Calculated 10-Year Flow Rate Q (cfs)	Discharge Location
Existing Pre-Developed Condition	*C	-	0.22	0.20	9	0.65	0.39	Vista Murrieta Rd.
	*D	-	0.07	0.20	10	0.21	0.12	
	**E	-	0.21	0.08	5	0.67	0.40	Myers Lane
Total (Vista Murrieta Rd.)			0.29			0.86	0.51	
Total (Myers Lane)			0.21			0.67	0.40	
Total			0.50			1.52	0.92	
Proposed Post Developed Condition	C	1 to 2	0.22	0.80	5	0.42	0.24	Myers Lane
	D	1 to 2	0.07	0.80	5	0.17	0.10	
	E	1 to 2	0.21	0.80	5	0.95	0.63	Vista Murrieta Rd.
Total (Vista Murrieta Rd.)			0.29			0.59	0.34	
Total (Myers Lane)			0.21			0.95	0.63	
Total			0.50			1.54	0.97	
Delta Increase in Peak Developed Runoff - Vista Murrieta Rd.						-0.27	-0.17	
Delta Increase in Peak Developed Runoff - Myers Lane						0.28	0.23	
Total Delta Increase in Peak Developed Runoff						0.02	0.05	

*Values are determined through area ratio interpolation from Tributary Area B1. Total area is 2.33 ac. Total Q for 100 and 10 year are 6.92 cfs and 4.14 cfs, respectively.

**Values are determined through area ratio interpolation from Tributary Area A1. Total area is 3.42 ac. Total Q for 100 and 10 year are 10.84 cfs and 6.53 cfs respectively

100-Year Storm Implementation

In the event of a 100-year storm, runoffs are conveyed through surface flow, private ribbon gutters, and grate inlets prior to discharge out to Myers Lane and Vista Murrieta Road.

Myers Lane: Subareas draining to Myers Lane are A and E.
During a 100-year storm, underground storm drain will be filled and overflow over the storm drain inlets and surface flow within parking areas and drive aisles. Runoff are conveyed through ribbon gutters and surface flows out to Myers Lane. Grate Inlets labeled as #6 through #11 on the hydrology map are sized to convey 100 year storm flowrate (Q_{100}), see below. Total Q from the proposed development discharging to Myers Lane is 9.62 cfs and 14.55 cfs for 10 and 100 year, respectively.

A new public 18 inch diameter RCP pipe on Myers Lane is proposed to convey the routed Q_{10} from the project site. That 18 inch pipe will connect to an existing curb inlet catch basin on Myers Lane at the intersection of Catalina Street. Based on approved offsite street improvement plans for the neighboring Tract 36863 drawing number 22-064, the curb inlet catch basin is a 7 ft long and 3' wide connected to another curb inlet catch basin on the other side of Myers Lane with an 18 inch diameter RCP pipe. That pipe is depicted to convey a Q_{100} of 6.81 cfs.

Myers Lane was analyzed to verify that its Q_{100} capacity (R/W to R/W) is greater than the new total Q_{100}. Approved hydrology report for the neighboring TM 36863 dated February 22, 2022 prepared by KHR Associates shows in existing condition the 6.81 cfs Q_{100} is from the southerly neighbor of the site. An additional 14.55 cfs Q_{100} from the proposed development brings a new total Q_{100} of 21.36 cfs to be conveyed on Myers Lane. The calculated capacity of Myers Lane is 22.87 cfs and 57.32 cfs for 10-yr and 100-yr, respectively.

The existing 7'L x 3'W curb inlet catch basin was also analyzed to verify its capacity can convey the additional flowrate from the proposed development. Using RCHDM's Curb Inlet Catch Basin in a Sump equation on Section 5.2.3.2 the existing curb inlet catch basin is calculated to be 24.70 cfs, which is greater than 21.36 cfs.

Vista Murrieta Road: Subareas draining to Vista Murrieta Road include B, C, D, and G.
During a 100-year storm, underground storm drain will be filled and overflow over the storm drain inlets and surface flow within parking areas and drive aisles. Runoffs are conveyed through ribbon gutters and surface flow out to Vista Murrieta Road. Grate Inlets labeled as #1 through #5 and #12 on the hydrology map are sized to convey Q_{100}, shown below. Total Q discharging to Vista Murrieta Road is 6.19 cfs and 9.56 cfs for Q_{10} and Q_{100} year, respectively.

Grate Inlet Summary:

Size	Clogging Factor	d (ft)	Q capacity (cfs)	Proposed Grate Inlet #
24" x 24"	0.50	0.25	1.50	1 to 7, 10 to 12
36" x 36"	0.50	0.25	2.25	8

48” x 48”	0.50	0.25	3.0	9

For calculations, See Grated Drop Inlet Interception Capacity Calculation in Appendix G.

Public Street Capacity:

Street	RW to RW width (ft)	Curb to Curb width (ft)	100-Yr Capacity (cfs)	10, 25-Yr Capacity (cfs)
Myers Lane	60	50	57.32	22.87
Vista Murrieta Rd.	66	44	62.60	25.84

For calculations, See FlowMaster printouts in Appendix G.

Appendix D presents the RCFC&WCD's Synthetic Unit Hydrograph Method hydrology analyses for 1-hour, 3-hour, 6-hour, and 24-hour duration events for the 10-year return frequencies in the Existing Pre-Developed Condition for the project site. The lag time used for these analyses is assumed to be 0.8 of the time of concentration computed from the Rational Method in Appendix B.

Subarea A1 (3.08 acres) has a Tc of 8.9 minutes which is equivalent to the lag time of 0.119 hours. The computed 1-hour, 3-hour, 6-hour, and 24-hour duration peak runoff rate and flood volume of design 10-year storm event are 4.74 cfs & 5,966 cu-ft, 2.48 cfs & 6,758 cu-ft, 2.18 cfs & 8,294 cu-ft, and 0.53 cfs & 9,795 cu-ft, respectively. Results can be found in the summary tables in this appendix.

Subarea B1 (2.11 acres) has a Tc of 10 minutes which is equivalent to the lag time of 0.133 hours. The computed 1-hour, 3-hour, 6-hour, and 24-hour duration peak runoff rate and flood volume of design 100-year storm event are 3.03 cfs & 4,068 cu-ft, 1.65 cfs & 4,608 cu-ft, 1.46 cfs & 6,274 cu-ft, and 0.36 cfs & 6,678 cu-ft, respectively. Results can be found in the summary tables in this appendix.

Appendix E presents the RCFC&WCD's Synthetic Unit Hydrograph Method hydrology analyses for 1-hour, 3-hour, 6-hour, and 24-hour duration events for the 10-year return frequencies in the Proposed Post-Developed Condition for the project site. The lag time used for these analyses is assumed to be 0.85 of time of concentration computed from the Rational Method in Appendix C.

Subarea A (3.08 acres) has a Tc of 5 minutes which is equivalent to the lag time of 0.07 hours. The computed 1-hour, 3-hour, 6-hour, and 24-hour duration peak runoff rate and flood volume are 5.85 cfs & 8,159 cu-ft, 3.27 cfs & 12,259 cu-ft, 3.0 cfs & 16,769 cu-ft, and 1.08 cfs & 26,946 cu-ft, respectively. Results can be found in the summary tables in this appendix.

Subarea B (2.11 acres) has a Tc of 6.7 minutes which is equivalent to the lag time of 0.093 hours. The computed 1-hour, 3-hour, 6-hour, and 24-hour duration peak runoff rate and flood volume are 3.96 cfs and 5,589 cu-ft, 2.21 cfs & 8,399 cu-ft, 1.96 cfs & 11,488 cu-ft, and 0.74 cfs & 18,460 cu-ft, respectively. Results can be found in the summary tables in this appendix.

Results were used in Routing Analyses to determine the Peak Flowrate mitigated through the proposed underground detention basins. The Underground detention basin was based on Hydromodification calculation template prepared by the City (per separate WQMP report) and Routing Analyses based on 10 year storm frequency.

Only Subarea A and B require underground detention. Flowrate difference between Existing and Post Development conditions in Subareas C, D, and E were concluded to be negligible therefore do not require a detention system.

SUMMARY TABLE 2A: COMPARISON OF UNIT HYDROGRAPHS BETWEEN EXISTING PRE-DEVELOPMENT CONDITION AND PROPOSED POST-DEVELOPMENT CONDITION (FOR DETENTION BASIN ROUTING ANALYSES)

Developed Condition	Hydrologic Watershed Designation	Hydrology Subarea Nodes	Drainage Area (Acres)	Land Use & Proportion Impervious	Lag Time (hrs)	Hydrologic Condition	10-Year 24-Hour Storm Event
Existing Pre-Developed Condition	A1	1 to 6	3.08	1-acre lot Residential Imp. = 0.2	0.119	Peak Runoff Flow Rate (cfs)	0.53
						Runoff Volume of Hydrograph (cu-ft)	9,795
	B1	3 to 4	2.11		0.133	Peak Runoff Flow Rate (cfs)	0.36
						Runoff Volume of Hydrograph (cu-ft)	6,678
						Total Area (ac) =	**5.19**
						Total Runoff Q (cfs) =	**0.89**
						Total Runoff Volume (cu-ft) =	**16,473**
Proposed Post-Developed Condition	A	1 to 9	3.08	Apartments Imp. = 0.8	0.07	Peak Runoff Flow Rate (cfs)	1.08
						Runoff Volume of Hydrograph (cu-ft)	26,946
	B	1 to 6	2.11		0.094	Peak Runoff Flow Rate (cfs)	0.74
						Runoff Volume of Hydrograph (cu-ft)	18,460
						***Total Area (ac) =**	**5.19**
						Total Runoff Q (cfs) =	**1.82**
						Total Runoff Volume (cu-ft) =	**45,406**
Delta Increase in Peak Runoff due to Increased Imperviousness (cfs) =							**0.93**
Delta Increase in Runoff Volume due to Increased Imperviousness (cu-ft) =							**28,933**

*Tributary areas C,D,and E (0.50 ac) do not get stored in the proposed underground detention basins.

SUMMARY TABLE 2B: COMPARISON OF UNIT HYDROGRAPHS BETWEEN EXISTING PRE-DEVELOPMENT CONDITION AND PROPOSED POST-DEVELOPMENT CONDITION (FOR DETENTION BASIN ROUTING ANALYSES)

Developed Condition	Hydrologic Watershed Designation	Hydrology Subarea Nodes	Drainage Area (Acres)	Land Use & Proportion Impervious	Lag Time (hrs)	Hydrologic Condition	10-Year 6-Hour Storm Event
Existing Pre-Developed Condition	A1	1 to 2	3.08	1-acre lot Residential Imp. = 0.2	0.119	Peak Runoff Flow Rate (cfs)	2.18
						Runoff Volume of Hydrograph (cu-ft)	8,294
	B1	3 to 4	2.11		0.133	Peak Runoff Flow Rate (cfs)	1.46
						Runoff Volume of Hydrograph (cu-ft)	6,274
						Total Area (ac) =	**5.19**
						Total Runoff Q (cfs) =	**3.64**
						Total Runoff Volume (cu-ft) =	**14,568**
Proposed Post-Developed Condition	A	1 to 9	3.08	Apartments Imp. = 0.8	0.07	Peak Runoff Flow Rate (cfs)	3.00
						Runoff Volume of Hydrograph (cu-ft)	16,769
	B	1 to 7	2.11		0.094	Peak Runoff Flow Rate (cfs)	1.96
						Runoff Volume of Hydrograph (cu-ft)	11,488
						***Total Area (ac) =**	**5.19**
						Total Runoff Q (cfs) =	**4.96**
						Total Runoff Volume (cu-ft) =	**28,257**
Delta Increase in Peak Runoff due to Increased Imperviousness (cfs) =							**1.32**
Delta Increase in Runoff Volume due to Increased Imperviousness (cu-ft) =							**13,689**

*Tributary areas C,D,and E (0.50 ac) do not get stored in the proposed underground detention basins.

SUMMARY TABLE 2C: COMPARISON OF UNIT HYDROGRAPHS BETWEEN EXISTING PRE-DEVELOPMENT CONDITION AND PROPOSED POST-DEVELOPMENT CONDITION (FOR DETENTION BASIN ANALYSES)

Developed Condition	Hydrologic Watershed Designation	Hydrology Subarea Nodes	Drainage Area (Acres)	Land Use & Proportion Impervious	Lag Time (hrs)	Hydrologic Condition	10-Year 3-Hour Storm Event
Existing Pre-Developed Condition	A1	1 to 2	3.08	1-acre lot Residential Imp. = 0.2	0.119	Peak Runoff Flow Rate (cfs)	2.48
						Runoff Volume of Hydrograph (cu-ft)	6,758
	B1	3 to 4	2.33		0.133	Peak Runoff Flow Rate (cfs)	1.65
						Runoff Volume of Hydrograph (cu-ft)	4,608
						Total Area (ac) =	5.41
						Total Runoff Q (cfs) =	4.13
						Total Runoff Volume (cu-ft) =	11,366
Proposed Post-Developed Condition	A	1 to 9	3.08	Apartments Imp. = 0.8	0.07	Peak Runoff Flow Rate (cfs)	3.27
						Runoff Volume of Hydrograph (cu-ft)	12,259
	B	1 to 7	2.11		0.094	Peak Runoff Flow Rate (cfs)	2.21
						Runoff Volume of Hydrograph (cu-ft)	8,399
						*Total Area (ac) =	5.19
						Total Runoff Q (cfs) =	5.48
						Total Runoff Volume (cu-ft) =	20,658
						Delta Increase in Peak Runoff due to Increased Imperviousness (cfs) =	1.35
						Delta Increase in Runoff Volume due to Increased Imperviousness (cu-ft) =	9,292

*Tributary areas C,D,and E (0.50 ac) do not get stored in the proposed underground detention basins.

SUMMARY TABLE 2D: COMPARISON OF UNIT HYDROGRAPHS BETWEEN EXISTING PRE-DEVELOPMENT CONDITION AND PROPOSED POST-DEVELOPMENT CONDITION (FOR DETENTION BASIN ROUTING ANALYSES)

Developed Condition	Hydrologic Watershed Designation	Hydrology Subarea Nodes	Drainage Area (Acres)	Land Use & Proportion Impervious	Lag Time (hrs)	Hydrologic Condition	10-Year 1-Hour Storm Event
Existing Pre-Developed Condition	A1	1 to 2	3.08	1-acre lot Residential Imp. = 0.2	0.119	Peak Runoff Flow Rate (cfs)	4.74
						Runoff Volume of Hydrograph (cu-ft)	5,966
	B1	3 to 4	2.11		0.133	Peak Runoff Flow Rate (cfs)	3.03
						Runoff Volume of Hydrograph (cu-ft)	4,068
						Total Area (ac) =	5.19
						Total Runoff Q (cfs) =	7.77
						Total Runoff Volume (cu-ft) =	10,034
Proposed Post-Developed Condition	A	1 to 9	3.08	Apartments Imp. = 0.8	0.07	Peak Runoff Flow Rate (cfs)	5.85
						Runoff Volume of Hydrograph (cu-ft)	8,159
	B	1 to 7	2.11		0.094	Peak Runoff Flow Rate (cfs)	3.96
						Runoff Volume of Hydrograph (cu-ft)	5,589
						*Total Area (ac) =	5.19
						Total Runoff Q (cfs) =	9.81
						Total Runoff Volume (cu-ft) =	13,748
						Delta Increase in Peak Runoff due to Increased Imperviousness (cfs) =	2.04
						Delta Increase in Runoff Volume due to Increased Imperviousness (cu-ft) =	3,714

*Tributary areas C,D,and E (0.50 ac) do not get stored in the proposed underground detention basins.

Appendix F presents the results of the Hydrograph Routing Analysis for the 1-hour, 3-hour, 6-hour, and 24-hour duration events for 10-year storm events for Drainage A and B.

Stormwater detention is required to mitigate the increased flows due to an increase in imperviousness. The outflow from the project site needs to be controlled to not exceed the existing condition flow (outflow calculations can be found in Appendix G, existing condition flow can be found in Appendix D). Separate routing analysis was done for each onsite Subareas (A & B). A diversion structure will precede both systems to convey LID Q to the respective Biofiltration Devices & Peak storm Events will be conveyed to each respective storage tanks.

For Subarea A, an 84" diameter storage tank will be installed at 1145.0 ft and 1152.0 ft bottom and top elevation, respectively. To restrict the flow two 2-inch orifices and an 8-inch overflow will be installed at the end of the pipe. One of the 2-inch orifices will be placed at 1145.0 ft elevation while the other will be installed at 1146.50 ft elevation for a secondary discharge. An 8-inch overflow pipe will be installed at 1151.0 ft elevation for a tertiary discharge. These outlets will be connected to a proposed 8-inchstorm drain that connects to a proposed 18" diam public storm in Myers Lane. The routing analysis satisfies mitigating the peak Q for each storm event & duration event (see summary table 3). Draining time of the basin begins when inflow is zero at 24.33 hr and ends when storage is at zero at 33.83 hr. Time difference indicates that it takes the trench to empty in 9.5 hrs which is less than the 72-hour maximum.

For Subarea B, a 72" diameter storage tank will be installed at at 1164.14 ft and 1170.14 ft bottom and top elevation, respectively. To restrict the flow two 2-inch orifices and a 6-inch overflow will be installed at the end of the pipe. One of the 2-inch orifices will be placed at 1164.14 ft elevation while the other will be installed at 1166.14 ft elevation for a secondary discharge. An 8-inch overflow pipe will be installed at 1169.14 ft elevation for a tertiary discharge. These outlets will be connected to a 6-inch storm drain that connects to a proposed parkway drain on Vista Murrieta Road. The routing analysis satisfies mitigating the peak Q for each storm event & duration event (see summary table 3). Draining time of the trench begins when inflow is zero at 24.33 hr and ends when storage is at zero at 28.75 hr. Time difference indicates that it takes the basin to empty in 4.42 hrs which is less than the 72-hour maximum.

SUMMARY TABLE 3a: Stage-Storage-Discharge for Drainage Area A				
Stage	**Storage**	**Storage**	**Q**	
(ft)	(ac-ft)	(cf)	(cfs)	
0	0	0	0	2" Orifice
0.25	0.003	131	0.04	
0.50	0.008	366	0.07	
0.75	0.015	665	0.09	
1.00	0.023	1012	0.10	
1.25	0.032	1397	0.12	
1.50	0.042	1814	0.13	2" Orifice
1.75	0.052	2257	0.18	
2.00	0.062	2722	0.22	
2.25	0.074	3205	0.25	
2.50	0.085	3702	0.27	
2.75	0.097	4210	0.29	
3.00	0.108	4726	0.31	
3.25	0.12	5248	0.33	
3.50	0.133	5773	0.35	
3.75	0.145	6297	0.37	
4.00	0.157	6819	0.38	
4.25	0.168	7336	0.40	
4.50	0.18	7844	0.41	
4.75	0.191	8341	0.43	
5.00	0.203	8823	0.44	
5.25	0.213	9288	0.45	
5.50	0.223	9731	0.47	
5.75	0.233	10148	0.48	
6.00	0.242	10534	0.49	8" Diam. Overflow
6.25	0.25	10881	0.50	
6.50	0.257	11179	1.22	
6.75	0.262	11414	1.65	
7.00	0.265	11545	1.96	

SUMMARY TABLE 3b: Stage-Storage-Discharge for Drainage Area B				
Stage	**Storage**	**Storage**	**Q**	
(ft)	(ac-ft)	(cf)	(cfs)	
0	0	0	0	2" Orifice
0.25	0.002	93	0.04	
0.50	0.006	259	0.07	
0.75	0.011	469	0.09	
1.00	0.016	712	0.10	
1.25	0.023	982	0.12	
1.50	0.029	1271	0.13	2" Orifice
1.75	0.036	1578	0.14	
2.00	0.044	1898	0.15	
2.25	0.051	2227	0.20	
2.50	0.059	2565	0.24	
2.75	0.067	2907	0.27	
3.00	0.075	3252	0.29	
3.25	0.083	3596	0.31	
3.50	0.09	3938	0.33	
3.75	0.098	4276	0.35	
4.00	0.106	4606	0.37	
4.25	0.113	4925	0.38	
4.50	0.12	5232	0.40	
4.75	0.127	5522	0.41	
5.00	0.133	5791	0.43	6" Diam. Overflow
5.25	0.139	6034	0.44	
5.50	0.143	6244	0.94	
5.75	0.147	6410	1.16	
6.00	0.149	6503	1.32	

SUMMARY TABLE 3c: UNIT HYDROGRAPH ROUTING THROUGH DETENTION STORAGE TANK AND TOTAL DISCHARGE FOR OUTLET POINT

Hydrology Subarea Designation	Drainage Outlet Point	Developed Condition	Hydrologic Condition	10-Year 24-Hour Storm Event	10-Year 6-Hour Storm Event	10-Year 3-Hour Storm Event	10-Year 1-Hour Storm Event
A1	**Myers Lane**	**Existing Condition**	**Peak Runoff Flow Rate (cfs)**	**0.53**	**2.18**	**2.48**	**4.74**
A	**Myers Lane**	**Proposed Condition**	**Peak Routed Outflow (cfs)**	**0.61**	**1.18**	**0.47**	**0.39**
			Runoff Volume of Hydrograph (cu-ft)	26,920	16,771	12,240	8,146
			***Peak Elevation inside Detention System (ft)**	4.82	5.77	4.66	3.24

Note:Top of 84" Diameter Detention System (Not Including Pipe Thickness) at 1152' / Bottom (INV) at 1145' / Street FS above at 1155.3' / Maximum Storage Volume Provided = 11,545 cu-ft
Top of 36" Diameter Detention System (Not including pipe thickness) at 1151' / Bottom (INV) at 1147' / Street FS above at 1155.3' / Maximum Storage Volume Provided = 891 cu-ft
Peak Elevation inside detention system is measured from 1145' (7 feet is the Maximum Storge Height) / Some storage will be provided via proposed storm drain system
2" Overflow Pipe at 1145 INV, 2" Overflow Pipe at 1146.5 INV, 8" Overflow Pipe at 1151 INV (See flow capacity calculations in Appendix G)

B1	**Vista Murrieta**	**Existing Condition**	**Peak Runoff Flow Rate (cfs)**	**0.36**	**1.46**	**1.65**	**3.03**
B	**Vista Murrieta**	**Proposed Condition**	**Peak Routed Outflow (cfs)**	**0.42**	**1.30**	**0.63**	**0.37**
			Runoff Volume of Hydrograph (cu-ft)	18,469	11,500	8,407	5,576
			***Peak Elevation inside Detention System (ft)**	4.07	5.32	4.37	2.94

Note:Top of 60" Diameter Detention System (Not Including Pipe Thickness) at 1170.14' / Bottom (INV) at 1164.14' / Street FS above at 1174' / Maximum Storage Volume Provided = 6,503 cu-ft

Peak Elevation inside detention system is measured from 1163' (7 feet is the Maximum Storge Height)

2" Overflow Pipe at 1164.14 INV, 2" Overflow Pipe at 1166.14 INV, 6" Overflow Pipe at 1169.14 INV (See flow capacity calculations in Appendix G)

SUMMARY TABLE 4: WQMP (LID) VOLUME CALCULATIONS

Hydrology Subarea Designation	Drainage Area (Acres)	Land Use & Proportion Impervious	Calculated DCV (cu-ft) Design Capture Volume per Separate WQMP report	Calculated LIDQ (cfs) per Separate WQMP report	Flow Capacity (cfs) provided by Proposed Treatment Control BMP Device	Proposed Treatment Control BMP Device
A	3.08	Apartments Imp. = 0.8	--	0.4 (DMA A)	0.462	Proprietary Biofiltration System
B	2.11	Apartments Imp. = 0.8	--	0.3 (DMA B)	0.346	Proprietary Biofiltration System
C	0.22	Apartments Imp. = 0.8	--	0	1.50	Proprietary Catch Basin Filter Insert
D	0.07	Apartments Imp. = 0.8	--	0	1.50	Proprietary Catch Basin Filter Insert
E	0.22	Apartments Imp. = 0.8	--	0	1.50	Proprietary Catch Basin Filter Insert

Appendix G presents hydraulic capacity calculations for various proposed onsite storm drain pipes, drain inlets, and parkway drains. The Hydraulic capacity calculations for the public streets Myers Lane & Vista Murrieta Road are also included.

The street gutter grade on Vista Murrieta Road along the project frontage is about 0.7% with an average cross fall slope of about 2%. The calculated street capacity at the top of 6-inch curb & gutter for 10-year flood level, and at the proposed right-of-way limit for 100-year flood level is 25.84 cfs and 62.60 cfs, respectively (see calculations in Appendix G by Flowmaster Program).

The street gutter grade on Myers Lane along the project frontage is about 0.5% with an average cross fall slope of about 2%. The calculated street capacity at the top of 6-inch curb & gutter for 10-year flood level, and at the proposed right-of-way limit for 100-year flood level is 22.87 cfs and 57.32 cfs, respectively (see calculations in Appendix G by Flowmaster Program).

The proposed onsite 6", 8", 10", 12" & 15" PVC storm drain pipes (to be privately maintained by owner) were sized to convey the full 10-year storm event flow for all the Subareas. The proposed minimum slope of the pipes is 1%. Calculation of the pipes were determined using Rational Method and Flowmaster by Bentley Systems. Below are tabulated summaries of the results.

Pipe Full Capacity Summary from FlowMaster Software:

Pipe Size (in)	Slope	Roughness Coefficient n	Full Flow Capacity cfs
Slope = 1%			
6	0.01	0.013	0.56
8	0.01	0.013	1.21
10	0.01	0.013	2.19
12	0.01	0.013	3.56
15	0.01	0.013	6.46
Slope=2%			
6	0.02	0.013	0.79
8	0.02	0.013	1.71
10	0.02	0.013	3.1
12	0.02	0.013	5.04

For calculation, See FlowMaster printout in Appendix G.

PIPE SIZE SUMMARY

	10-Year Flowrate	Slope	*Pipe Size
DRAINAGEAREA A			
SD-A1	2.95	0.01	12
SD-A2	2.3	0.059	10
SD-A3	5.25	0.058	12
SD-A4	0.51	0.046	6
SD-A5	5.74	0.035	**12
SD-A6	3.25	0.02	12
SD-A7	8.99	0.106	15
DRAINAGE AREA B			
SD-B1	2.46	0.01	12
SD-B2	0.37	0.046	6
SD-B3	0.7	0.01	8
SD-B4	1.07	0.01	8
SD-B5	3.53	0.01	12
SD-B6	3.99	0.01	15
SD-B7	0.85	0.03	8
SD-B8	4.84	0.02	12
DRAINAGE AREA C			
SD-C1	0.52	0.028	6
DRAINAGE AREA D			
SD-D1	0.58	0.0217	6
DRAINAGE AREA E			
SD-E1	0.63	0.025	6
DRAINAGE AREA E			
OFFSITE	1.01	0.01	8

*Pipe capacity is based on mimimum slope 1% and 2%. See tables above.

*Full capacity of a 12" diameter at 3.5% slope is 6.67 cfs

For the proposed detention storage tanks, the discharge pipes were analyzed using culvert analysis and were calculated using Hydraulic Analysis program by Civilcadd/Civildesign Engineering Software. (see results in Appendix G). These results were used in the stage storage discharge input for the routing analysis done in Appendix F. (see table in Appendix G)

Parkway Drain:

Size	n	Slope	Q capacity (cfs)	Velocity (fps)	Drainage Area
12”W x 3”H	0.013	0.02	1.22	4.90	C and G
24”W x 3”H	0.013	0.02	2.76	5.53	B

See FlowMaster printout in Appendix G.

Appendix H presents the Hydrology Maps for proposed Vista Terrace Apartments project in the Existing Pre-Developed Condition and in the Proposed Post-Developed Condition. The maps delineate and labels the watershed boundary studied, drainage surface flow paths, existing and proposed storm drain pipes and drainage devices, proposed LID treatment control BMPs, computed peak runoff rates and flood volumes, concentration points, design runoff at site's exit or discharge points, and table of summary of Rational Method & Synthetic Unit Hydrograph Method hydrology calculations.

CONCLUSIONS

From the calculations performed and summaries of this Drainage Study and the enclosed Hydrology Maps, proposed Viscar Terrace Apartments project will minimize negative impact to the downstream properties & storm water facilities. The Treatment control BMP devices are adequately designed to treat the 85th percentile storm event per WQMP requirement. The proposed underground detention basins will detain any increased runoff from the existing pre-developed condition to the proposed post-developed condition, which also satisfies the WQMP's hydromodification requirements. The two discharge points from the existing condition will remain the same in the proposed condition. The north side of the property will discharge onto Myers Lane and the south side of the property will discharge onto Vista Murrieta. The proposed designs are in accordance with the City of Murrieta and the County of Riverside's Drainage design criteria, guidelines and policies, and in compliance with the City's and County's Stormwater Programs' water quality management and related design criteria.

REFERENCES

1. Riverside County Flood Control and Water Conservation District. Hydrology Manual. April 1978.

2. Riverside County Flood Control and Water Conservation District. Riverside County, Water Quality Management Plan for Urban Runoff, Santa Margarita Region. July 2006.

3. Civilcadd/Civildesign Engineering Software, Orange County Rational Hydrology Program, Version 8.0.

4. California Stormwater Quality Association. New Development and Redevelopment BMP Handbook, September 2004.

5. California Stormwater Quality Association. Construction BMP Handbook, September 2004.

6. Riverside County Flood Control and Water Conservation District. Riverside County, Drainage Area Master Plan (DAMP), Santa Margarita Region. July 2006.

7. Riverside County Flood Control and Water Conservation District. Riverside County, Santa Margarita River Watershed Best Management Practices Design Handbook. June 2018.