



PRELIMINARY HYDROLOGY REPORT
RELATED BRISTOL SPECIFIC PLAN
SANTA ANA, CA

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SANTA ANA, CALIFORNIA

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1.0 INTRODUCTION

1.1 Geographic Setting

The Related Bristol project site is located in the city of Santa Ana (COSA), and encompasses an approximate total area of 41 acres. The project site is bounded by Bristol Street on the east, Plaza Drive and commercial development on the west, MacArthur Boulevard on the north, and Sunflower Avenue on the south. The project is entirely within Santa Ana, the city of Costa Mesa is directly south of the project site, with the jurisdictional boundary longitudinally along the Sunflower Avenue roadway, just northerly of the center median curb. The APN's are as follows: 412-131-12, -13, -14, -16, -17, -22, -24, -25, and -26.

1.2 Project Site Vicinity Map

A Vicinity Map is included, as Figure 1 below.



Figure 1 – Vicinity Map

1.3 Project Description

The existing 41-acre-site consists of a shopping center with various retail establishments, which comprise approximately 465,000 square feet of commercial/retail development. The site also includes various underground utility infrastructure to support the existing development.

The project proposes to demolish the existing shopping center and related infrastructure, and construct the proposed Related Bristol mixed-use development, with up to 3,750 multi-family residential units; 350,000 square feet of commercial uses; a 250-key hotel; a senior living/continuum of care with 200 units, and approximately 13 acres of open space. Underground and above-ground parking will be provided. A Site Plan is included as Appendix 1 of this report.

1.4 Purpose of this Report

The purpose of this report is to analyze and confirm the following objectives:

- Determine the existing & proposed 2-year storm (hydromodification) and 10- and 100-year (peak) storm flowrates, and 2-year hydromodification storm volume generated within the project site;
- Demonstrate that the proposed condition project flow rates for the various discharge locations, and overall will not exceed that of existing conditions;
- Prepare proposed drainage design to be consistent with existing drainage patterns.
- Provide an evaluation of COSA Master Plan of Drainage (MPD)

1.5 References

- Orange County Hydrology Manual (October 1986);
- Orange County Hydrology Manual Addendum No. 1 (1996);
- Orange County Local Drainage Manual (January 1996);
- Orange County Model Water Quality Management Plan (May 2011);
- Santa Ana Storm Drain Master Plan (SDMP) (December 2018).
- Web Soil Survey (United States Department of Agriculture (USDA, National Resources Conservation Service (NRCS))
- OC Stormwater Program Land Development Tool
- Orange County Flood Control District (OCFCD) as-built plans
- COSA storm drain as-built plans
- CBelow Utility Scanning

2.0 EXISTING TOPOGRAPHY & HYDROLOGIC CONDITIONS

2.1 Existing Topography and Drainage Pattern

The project site is within the COSA Gardens Watershed, and is tributary to the OCFCD Gardens Channel, as presented in the Santa Ana Storm Drain Master Plan (SDMP). Excerpts of the SDMP are included in this report as Appendix 2. The SDMP shows that the site is within subarea 40 of the Gardens Watershed. Subarea 40 is shown to drain toward Bristol Street, Plaza Drive, and Sunflower Avenue. Based on the drainage boundary of Subarea 40, it depicts that the site is not tributary to MacArthur Boulevard. However, based on our evaluation, the northerly portion of the site actually drains toward MacArthur Boulevard, which would place it in subarea 37 to the north. Additional SDMP discussion is included in a later section of this report.

The topography of the project site is relatively flat with storm water draining via surface flows to existing gutters and onsite area drain systems. Based on our evaluation of the existing drainage patterns and as-built plans, and confirmed with scanning results, we have concluded that in the existing condition, about ½ of the site drains northerly, and about ½ of the site drains southerly. However, as discussed above, this differs with what is presented in the SDMP, which shows the entire site draining southerly into the existing storm drain systems in Plaza Drive and Sunflower Avenue, as depicted by subarea 40 of the watershed (Appendix 2).

Based on our evaluation, Callen's Common, a private street that runs east-west through the middle of the site serves as a natural drainage boundary, basically splitting the drainage between the northerly portion of the site which drains to the north, and the southerly portion of the site which drains to the south.

The northerly drainage is conveyed to the city storm drain systems in Plaza Drive, Bristol Street, and MacArthur Boulevard, then to the OCFCD Gardens Channel to the north and northeast.

The southerly drainage, conversely, is conveyed to the city storm drain systems in Plaza Drive and Sunflower Avenue. The drainage is then conveyed easterly in a COSA storm drain in Sunflower Avenue, to the OCFCD Gardens Channel to the east of Bristol Street.

COSA and OCFCD storm drain and channel atlas maps and as-built plans are included in Appendix 3 of this report. The scanning results are included in Appendix 12.

2.2 Existing Storm Drain Facilities

As mentioned above, the drainage of the proposed project is tributary to the COSA owned storm drain facilities in the adjacent city streets, and the drainage is ultimately conveyed to the OCFCD Gardens Channel. The as-built storm drain plans are included in Appendix 3 of this report. Additionally, as discussed in the previous section, the onsite storm drain infrastructure was confirmed with the results of CBelow's utility scanning (Appendix 12).

Based on our investigation, there are three storm drain systems exiting the property at the northerly and northeasterly ends, and three at the southerly end. The northerly and northeasterly storm drain connections are as follows:

- 33-inch storm drain lateral at the corner of Plaza Drive and MacArthur Boulevard
- 30-inch storm drain lateral mid-block in MacArthur Boulevard (between Plaza Drive and Bristol Street)
- 24-inch storm drain lateral in Bristol Street (south of MacArthur Boulevard)

The southerly storm drain connections are as follows:

- 1 connection to the Plaza Drive storm drain (18-inch – 42-inch)
- 1 connection to the Sunflower storm drain (54-inch)

3.0 HYDROLOGY & HYDRAULICS

3.1 Storm Frequency

This study is intended to determine design flowrates and hydromodification volumes for the existing and proposed conditions. Modeling of the existing and proposed condition runoff hydrologic analyses were performed and the 2-year (hydromodification evaluation), 10-year, and 100-year frequency storm events. The city's storm drain infrastructure is designed to 10-year storm event. Additionally, the project will not include any "true sumps", those with no bypass. Therefore, the onsite storm drain will be prepared to comply with the 10-year storm event, while providing secondary overflow to allow runoff to drain to the adjacent roadways. The finished floor of the habitable buildings will be a minimum of 1 foot above the outflow elevations.

The 2-year design storm was analyzed to assess whether a HCOC exists at the project site which included analyzing the pre vs post development time of concentration and runoff volume. Discussions of HCOC are included in the PWQMP.

This study will meet the requirement of Orange County Hydrology Manual regarding 100-yr storm event. The combined capacity of Storm Drain and Street will carry the runoff within the theoretical right-of-way (R/W) through the private development, and to the public streets fronting the site. Any upsizing and modification to Storm Drain in R/W line will verify this requirement

3.2 Methodology

This study was prepared in accordance with the Orange County Hydrology Manual and the Orange County Local Drainage Manual and utilized storm event return periods of 2-year, 10-year, and 100-year to describe pre- vs post-development drainage characteristics.

Computer programs were used to perform hydrologic analyses. Advanced Engineering Software (AES) HydroWIN v.2016 Rational Method and Unit Hydrograph Analyses were utilized to compile the hydrologic data and calculate peak flow discharge rates and hydromodification (2-year) volumes.

A Soil Classification Report, which is included in Appendix 4 of this report, was obtained from the Natural Resources Conservation Service (NRCS) Web Soil Survey and utilized in determining the project site hydrologic soil group classification as type "C". Additionally, discussions and correspondence with the geotechnical engineer with Group Delta, along with the evaluation of the Orange County Stormwater Program Land Development Tool has confirmed that the project is within soil type "C". These references, as well as the email from the geotechnical engineer confirming the soil type "C", are provided in Appendix 4.

3.3 Hydrology

The existing and proposed conditions consist of generally similar drainage boundary characteristics with a high percentage of impervious area and an initial sub-area of sheet flow converging to either channelized or pipe flow prior to discharge from the site. In both the existing and proposed conditions, runoff is discharged to the existing storm drain and/or roadways fronting the project.

The existing and proposed condition Rational Method hydrologic modeling and calculation data are included in Appendix 5 and Appendix 7 respectively, and the existing and proposed hydrology maps are included in Appendix 6 and Appendix 8 respectively of this report. The existing and proposed condition unit hydrograph calculation data (2-year; hydromodification) are included in Appendix 9 and Appendix 10 respectively of this report.

3.4 Storm Drain Hydraulics

Flowmaster computer program was utilized to evaluate the hydraulic capacity of the offsite storm drain systems. The calculations are included in Appendix 11 of this report.

3.5 COSA Storm Drain Master Plan Review

As mentioned previously, the project site is within the Gardens Watershed, included in the SDMP. The SDMP provides recommended storm drain upgrades based on the hydrologic analysis. Additionally, the SDMP provided recommended upgrades to the city's storm drain infrastructure based on the results of the hydrologic analysis. It is our opinion that due to the subarea delineation discrepancy of subarea 40 adjacent to MacArthur Boulevard, there is a possibility that the recommended upgrades presented in the SDMP would not be as extensive as shown.

Fusco requested and received the backup AES Rational Method calculations (10-year storm event) and drainage map from the city's consultant, and had evaluated them to confirm the drainage patterns and recommendations included in the SDMP. The calculations and drainage map are included for reference as Appendix 13.

Based on our review of the SDMP calculations and drainage map, it is our opinion that the recommendations provided in the SDMP would not be required to be as extensive as shown in

the SDMP. Fuscoe has prepared and provided the city with a Technical Memorandum assessing our review of this portion of the Gardens Watershed, as a separate document.

4.0 RESULTS AND CONCLUSIONS

4.1 Drainage Comparison (Q10)

The results of the hydrologic analysis show that the proposed condition runoff at any of the discharge locations surrounding the site will not exceed the existing condition runoff. The existing storm drain infrastructure is designed for a 10-year storm event. Table 1 presents the comparison of existing and proposed conditions, including location, existing storm drain, acreage, and Q10 runoff.

Table 1

<i>Related Bristol Drainage Comparisons</i>							
			Existing		Proposed		
Line	Out-fall #	Existing SD	Acreage	Q10 (cfs)	Acreage	Q10 (cfs)	Difference (Proposed – Existing)
MacArthur Boulevard	#1	30" lateral to 63" SD (Dwg. No. HF-47-12 / Dwg. No. I-36-9)	14.11 ac	35 cfs	13.1 cfs	32.7 cfs	-2.3
	#2	30" lateral to 63" SD (Dwg. No. I-36-9)					
Bristol Street	#3	24" lateral (Dwg. No. I-13-8)	6.1 ac	17.1 cfs	5.78 ac	13.2 cfs	-3.9
Plaza Drive	#4	36" S D(Dwg. No. HF-47-12)	1.16 ac	4 cfs	1.1 ac	2.6 cfs	-1.4
Sunflower	#5	54" SD (Dwg. No. HF 18-58)	19.78 ac	50.7 cfs	21.1 cfs	49.6 cfs	-1.1
	#6						
	#7						
Total			41.15 ac	106.8 cfs	41.15 ac	98.2 cfs	For all lines, the proposed condition Q is less than the existing

4.2 Drainage Comparisons (Q2, Q10, Q100)

The following tables show the results of the hydrologic analysis prepared for this study for the other storm events.

Table 2 – Runoff Rates 2-year storm

Line	2-year Storm Event	
	Existing Condition	Proposed Condition
MacArthur Boulevard	18.3	17.8
Bristol Street	9.4	7.3
Plaza Drive	2.2	1.4
Sunflower Avenue	27.3	27.1
Totals	57.2	53.6

Table 3 – Runoff Rates 10-year storm

Line	10-year Storm Event	
	Existing Condition	Proposed Condition
MacArthur Boulevard	35.1	32.7
Bristol Street	17.1	13.2
Plaza Drive	4.0	2.6
Sunflower Avenue	50.7	49.6
Totals	106.9	98.1

Table 4 – Runoff Rates 100-year storm

Line	100-year Storm Event	
	Existing Condition	Proposed Condition
MacArthur Boulevard	55.2	50.6
Bristol Street	26.3	20.2
Plaza Drive	6.0	4.0
Sunflower Avenue	78.8	76.4
Totals	166.3	151.2

These hydrologic results demonstrate that the site-specific overall post development stormwater runoff will not increase as compared to the existing condition for any of the discharge locations. Therefore, the proposed development would not adversely impact existing drainage facilities. Additionally, water quality treatment is evaluated in the PWQMP for this project.