

PRELIMINARY HYDROLOGY AND HYDRAULICS STUDY FOR THE COLONY COMMERCE CENTER EAST

**CITY OF ONTARIO
CALIFORNIA**

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CITY OF ONTARIO, CA**

This report has been prepared by or under the direction of the following registered civil engineer who attests to the technical information contained herein. The registered civil engineer has also judged the qualifications of any technical specialists providing engineering data upon which recommendations, conclusions, and decisions are based.



08/24/2016



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I. PURPOSE AND SCOPE

The purpose of this study is to determine the flow rates and runoff associated with the development of the Colony Commerce Center East in the City of Ontario. The project site is approximately 82 acres and proposes to construct 9 commercial buildings, parking and landscaped area, subsurface storm drain, and two infiltration basins. The scope of this study includes:

1. Determination of points of flow concentration
2. Determination of the 100-year and 10-year peak storm flows based upon the post-project condition utilizing the Rational Method as outlined in the San Bernardino County Flood Control Hydrology Manual.
3. Determination of the 2-year, 24-hour peak storm flows based upon the pre-project and post-project condition utilizing the Unit Hydrograph method as outlined in the San Bernardino County Hydrology Manual.
4. Determine the 100-year, 24-hour peak storm flows based upon the post-project condition utilizing the Unit Hydrograph method as outlined in the San Bernardino County Hydrology Manual.
5. Perform preliminary hydraulic sizing calculations for the proposed storm drain alignments to ensure the systems can adequately convey the tributary 100-year storm event.
6. Perform basin routing calculations to demonstrate that the project adequately mitigates the 2-year, 24-hour storm event (consistent with the hydrologic conditions of concern for the Water Quality Management Plan) and for the 100-year storm event to determine the peak flow rates discharging from the basins.
7. Preparation of a hydrology report, which consist of hydrological and analytical results and exhibits.

II. PROJECT SITE AND DRAINAGE AREA OVERVIEW

The Colony Commerce Center East is a proposed 82 acre commercial development that proposes to construct 9 commercial buildings, subsurface storm drain, and two infiltration basins. The project site is roughly bounded by Cucamonga Creek to the west, Merrill Avenue to the north, Archibald Avenue to the east, and the County Line Channel to the south, in the City of Ontario.

The project site is an existing dairy farm and graded area. Since the project site is discharging into the County Line Channel, which is a facility that has been designed for the peak 100-year storm event, pre-project rational method calculations were not performed. Only pre-project unit hydrograph calculations for the 2-year, 24-hour storm duration were performed in order to assess the hydrologic conditions of concern consistent with the Water Quality Management Plan. These calculations have been included within this report to support the design of the basins. Detailed information regarding the hydrologic conditions of concern has been included in the Preliminary Water Quality Management Plan.

The project site will collect the entire runoff emanating from the project site via subsurface storm drain and discharge the flows into one of two onsite infiltration basins. These basins will be used to treat the required water quality volume and to mitigate the 2-year, 24-hour storm duration for the hydrologic conditions of concern. Additional basin routing analyses were performed to determine the basin outflow for the peak 100-year storm event.

The project site ultimate discharges into the County Line Channel just south of the project site. This Channel is identified in the Ontario Master Plan of Drainage, and the project site is included in Drainage Area XI on the Drainage Area Map from the Ontario Master Plan of Drainage (see Excerpt A for excerpts of the MDP). Since the project site is not tributary to any identified basin within the watershed, the downstream system is intended to intercept the 100-year peak flow rate emanating from the project area. Therefore, the project site will only mitigate for the hydrologic conditions of concern.

III. HYDROLOGY

The San Bernardino County Hydrology Manual (Reference 1), was used to develop the hydrological parameters for the hydrology analyses. The rational method and unit hydrograph method were used for the analyses and the computations were performed using the computer program developed by Civil Cadd/Civil Design.

The rainfall depths for used in the hydrology calculations for the rational method and the unit hydrograph method are as follows:

Storm Event & Duration	Rainfall (inches)
2-Year, 6-Hour	1.45
2-Year, 24-Hour	2.54
10-Year, 1-Hour	0.88
100-Year, 1-Hour	1.37
100-Year, 6-Hour	3.40
100-Year, 24-Hour	6.22

The rainfall depths were obtained from NOAA Atlas 14, which has been included as Exhibit E.

The existing soil classification for the area consists of Hydrologic Soil Group “A” and Hydrologic Soil Group “C”, as shown in Exhibit D. Exhibit D is a Soils Map obtained from the National Resource Conservation Service Websoil Survey. For the 10-year and 100-year storm event rational method calculations, an AMC II was utilized. For the 100-year unit hydrograph method, an AMC III was utilized.

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The hydrology utilized the following land use covers:

Land Use Cover	Runoff Index Number	Pervious Ratio
Barren Soil "A"	78	1
Barren Soil "C"	91	1
Commercial Soil "A"	32	0.1
Commercial Soil "C"	69	0.1

The existing condition utilized barren, however, it did not account for the existing impervious areas within the project site, such as the existing buildings and homes.

The onsite area was divided into two sub-watershed areas designated as Areas A and B. Area A is tributary to Infiltration Basin A, and Area B is tributary to Infiltration Basin B.

The rational method hydrology calculations have been included in Appendix A, and the rational method hydrology map has been included as Exhibit A. The pre-project unit hydrograph calculations have been included in Appendix B, and the pre-project condition unit hydrograph map has been included as Exhibit B. The post-project condition unit hydrograph calculations have been included in Appendix C, and the post-project condition unit hydrograph hydrology map has been included as Exhibit C.

IV. PRELIMINARY STORM DRAIN SIZING

The project site will construct a series of subsurface storm drain systems designed to convey the peak flow rate emanating from the project site. The storm drain systems were sized using friction slope calculations, since the systems will be running under pressure when discharging into the basin (assuming the basin is full). The downstream water surface elevations for the storm drain systems discharging into the basins was determined by the 100-year basin routing calculations (discussed in Section V), and the Line 1 downstream water surface elevation was interpolated from the County Line Channel plans, included as Excerpt B.

The Line "1" Storm Drain system and associated laterals is the storm drain that collects flows discharging from the two infiltration basins and connects to the existing County Line Channel. A downstream water surface elevation of 635.09 was interpolated from the existing plans (and converted using the conversion factor of 2.411 feet, which was obtained from the VERTCON website, and has been included in Excerpt C). The channel improvement plans are based upon the North American Vertical Datum of 1988, and the base files and topographic mapping are based upon the National Geodetic Vertical Datum of 1929, therefore a conversion factor was utilized to adjust the channel plans invert elevations and water surface elevation by -2.411 feet (or just -2.41 feet).

The Line "A" systems and corresponding laterals collect flows from onsite Area A and discharge into Infiltration Basin A. The Line "B" systems and corresponding laterals collect flows from onsite Area B and discharge into Infiltration Basin B.

The soffit control sizing spreadsheets have been included in Appendix D, and a Drainage Facilities Map summarizing the storm drain systems has been included as Exhibit D.

V. BASIN ROUTING ANALYSES

The project site will mitigate the hydrologic conditions of concern using Infiltration Basins A and B. These basins will be used for water quality treatment, in addition to mitigation for the hydrologic conditions of concern.

The runoff volume is being mitigated through storage within the basins. The water quality volume within the basins ponds 4 feet above the infiltrating surface area (see the Preliminary Water Quality Management Plan for detailed information related to water quality sizing and treatment). The remaining volume available within the basins for HCOC mitigation was determined by subtracting the volume within the basin at 1 foot of freeboard, and subtracting the volume within the basin at 4 feet of depth (these values are shown on the basin storage volume tables included in Appendix E).

The flow rate for DMA's A and B are mitigated through the infiltration basins. The post-project condition flow rates exceed the pre-project levels, therefore the project site requires additional mitigation measures to effectively mitigate the flow rate associated with the hydrologic conditions of concern. Detailed basin routing calculations were performed for both basins to demonstrate that the basins and proposed outlet structures adequately mitigate the flows associated with the 2-year, 24-hour storm duration to below pre-project levels. An outlet structure was provided within both basins, however, flows do not enter the structure until the depth of water within the basin exceeds the water quality volume. This ensures that the water quality volume will be effectively treated via infiltration. The basin outflow calculations utilized the infiltration rate for the stages of the storage volume table that represent the water quality volume. The infiltration flow rate for each basin was calculated using the basin bottom surface area multiplied by the infiltration rate, and then converted appropriately. A series of orifice holes and weirs were utilized for flows entering the outlet structures. The basin routing calculations have been included in Appendix X. Based upon the calculations, the basins effectively mitigate the post-project flow rate.

The time of concentration (or lag time in the unit hydrograph calculations) is already mitigated for DMA A in the post-project condition due to the flows being conveyed through storm drain systems (and a longer flow path than in the pre-project condition). However, Basin B had an decrease in time of concentration. With the use of the basin outlet structures, the drawdown time for the 2-year, 24-hour storm event is significantly increased.

The following table summarizes the HCOC analysis results:

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Basin/ DMA	Pre-Project Condition			Post-Project Condition (Unmitigated)			Post-Project Basin Routed Condition		
	Flow Rate (ft³/s)	Volume (ft³)	TC (min)	Flow Rate (ft³/s)	Volume (ft³)	TC (min)	Flow Rate (ft³/s)	Volume (ft³)	TC (min)
A	29.71	65,540	7.26	43.90	259,578	9.06	2.12	259,578	15,505
B	28.21	91,067	10.14	53.43	321,133	9.24	3.40	321,133	15,720

After demonstrating that the basins effectively mitigate the hydrologic conditions of concern, basin routing calculations were performed for the 100-year storm event to determine the peak basin outflow and ponded depth within the basins. These values were utilized in the preliminary storm drain sizing as discussed in the previous section.

The basin analyses have been included in Appendix E.

VI. FINDINGS

The hydrology analyses evaluated the project site to determine the necessary drainage improvements to convey the peak flow rates associated 100-year storm event and to flood protect the project site. The following can be concluded:

1. The proposed infiltration basins effectively mitigate for the hydrologic conditions of concern
2. The proposed storm drain systems will adequately convey the peak 100-year storm event

VIII. REFERENCES

1. San Bernardino Flood Control Hydrology Manual, August 1986.