Hydrologic Analysis of Montclair Subbasin in Unincorporated San Bernardino

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Background:

Certain areas of San Bernardino are considered unincorporated areas. This means that they are not governed by its own local municipal corporation but instead is governed by its respective county instead. Certain parts of Montclair fall under this category under San Bernardino County. In these cases, these areas do not have any storm drainage. Because of this, these areas can encounter large amount of flooding in the streets during heavy rains. This can cause multiple problems including pedestrian and automobile obstruction. The area of study is a specific subbasin in Montclair enclosed by Mission Blvd, Ramona Ave, Grand Ave, and Kadota Ave. The intersection in particular that has the largest amount of flooding is Kadota Ave and 9th St.

Figure 1: 9th Street and Kodata Ave Intersection after a large rainstorm.

Objective:

This project aims to analyze the hydrologic profile of the subbasins based on a 10-year 25-hour storm period. A hydrologic map is developed which is then used to analyze the peak flow and volume at the specific intersection. Following this, an infiltration gallery is designed to mitigate the flooding at the intersection.

Methods:

For the hydrologic analysis, the rational method was used:

$Q = CiA$ Where *Q* is the flow, *C* is the runoff coefficient, *i* is the intensity, and *A* is the area.

Volume was found by:

$V = PAC$ Where *V* is the volume, *P* is the precipitation depth, *A* is the area, and *C* is the runoff coefficient

To size the pipe that connects the two infiltration basins, an orifice flow calculation was used:

$Q = CA\sqrt{2gh}$ Where *Q* is the flow, *C* is the discharge coefficient, *A* is the area, *g* is gravity , and *h* is the hydraulic depth

Analysis:

The hydrologic map was created using the rational method from the San Bernardino County Hydrology Manual. The peak flow at the intersection was found to be 12 cfs. The volume based on a 10-year 24-hour storm is found to be 106,662 ft^3. A maximum height of 15 ft was set to account for trenching which then the area of the infiltration gallery was adjusted accordingly to accommodate the volume of water.

Design:

An infiltration gallery is a structure that captures water and then allows it to percolate through the ground. This design will use Brett Martin's StormCrate which are units that can be stacked to create a structural underground holding tank and allow the infiltration of stormwater into ground around it. There will be the maximum 10 layers, 23 crates long and 9 crates wide for the north side and 40 crates long and 54 crates wide. Six 12" reinforced concrete pipes will run across the street to connect the north and south galleries.

Conclusion:

Based on the findings of this project, it is feasible to implement infiltration galleries at the intersection of the highest flow and to accommodate for all the volume of water. This design will use StormCrate to capture the high volume of water and will still continue to use of the surface for driving and aboveground use.

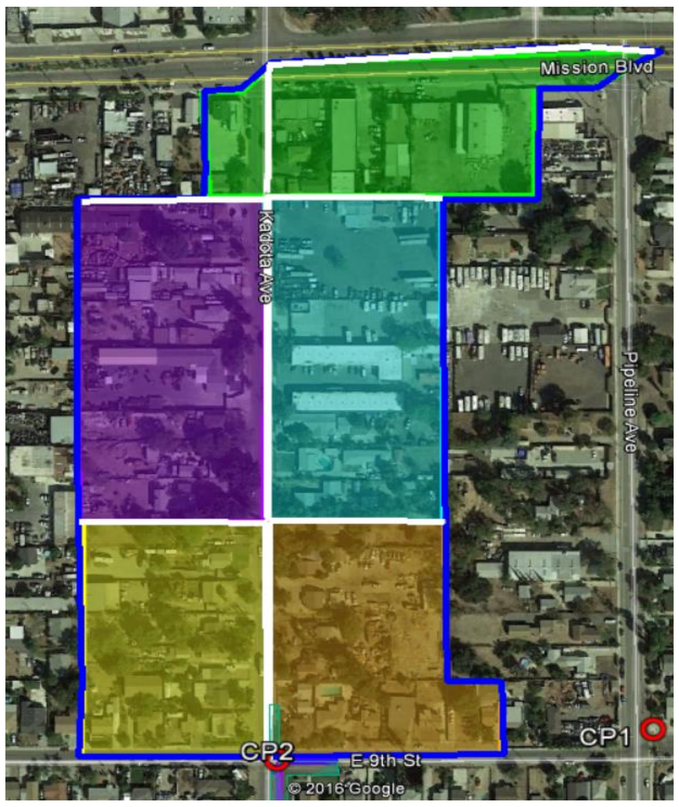

Figure 2: Hydrologic map of the area of interest broken down into subbasins.

Figure 3: Plan view of the infiltration galleries shaded in green.

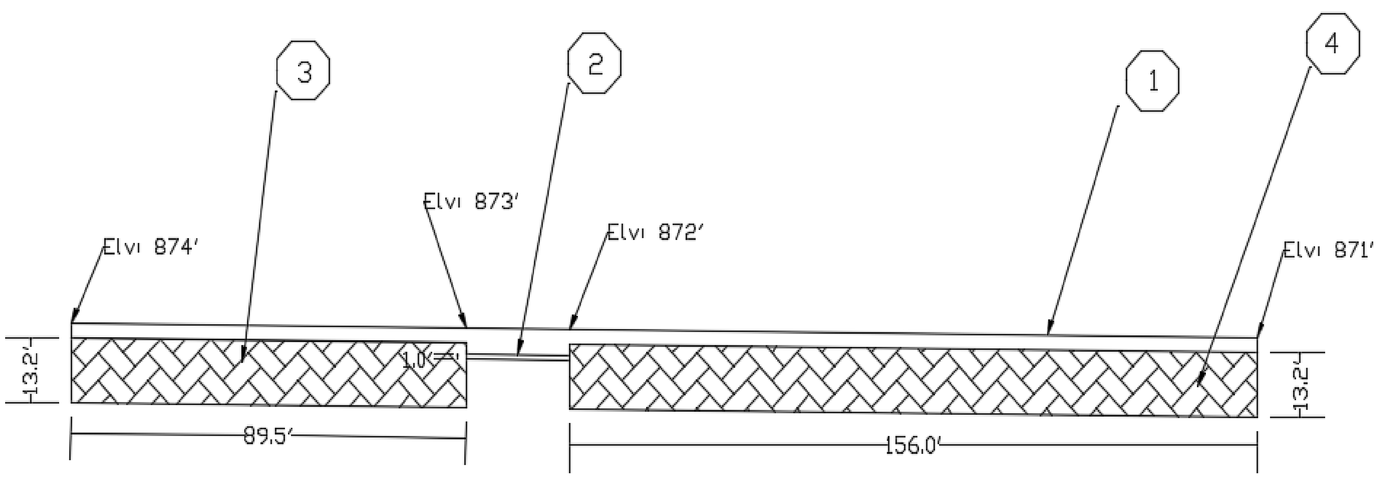

Figure 4: Section view of the infiltration galleries with the hatched areas representing the galleries.

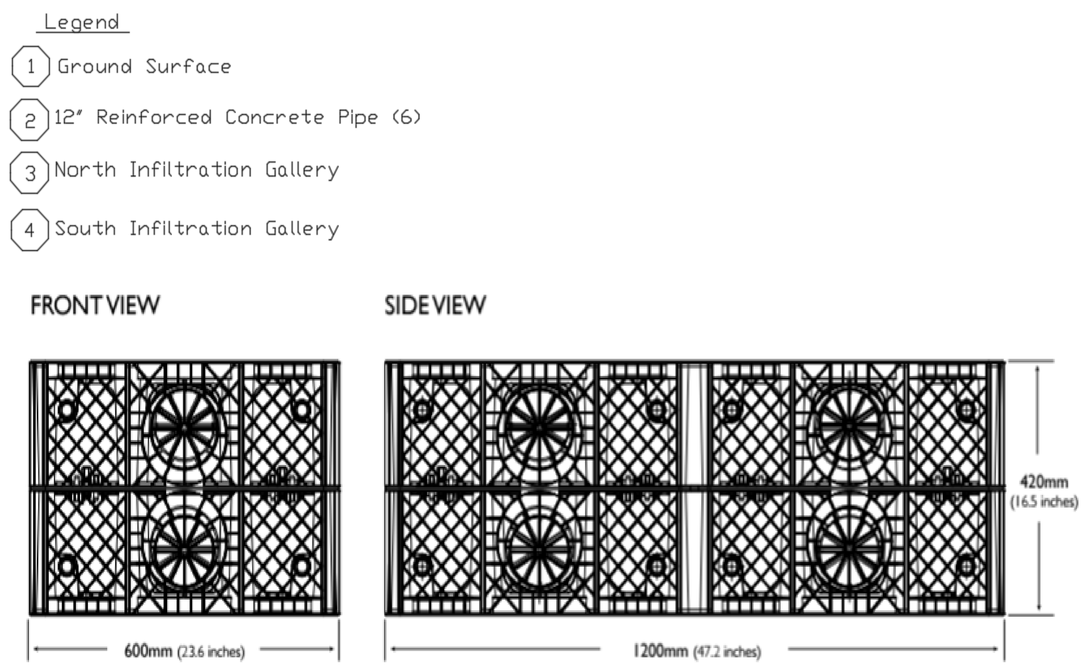

Figure 5: Section views of the StormCrate with dimensions.

References:

Hromadka, T. V. (1986). San Bernardino county hydrology manual. *San Bernardino Flood Control District, San Bernardino, California*.
Brett Martin. StormCrate: Stormwater Attenuation & Infiltration Crates Brochure