

## SECTION 7

### HYDRAULIC ANALYSIS

#### 7-1 HYDRAULIC MODEL

The capacity of the City's existing and ultimate drainage systems was analyzed with either the Water Surface and Pressure Gradient (WSPG) computer program, or Manning's Equation. The City storm drains were analyzed with the use of the WSPG program to determine the water surface elevations or hydraulic grade lines in each system, whenever possible. A mathematical model of the existing storm drain system was prepared using information from record drawings which includes pipe size, length, material, slope and downstream water surface control elevation or hydraulic grade line. The design discharges of 25-year storms for each reach were developed through the hydrologic studies described in Section 6 - HYDROLOGY. In general, the storm drain systems carrying less than 20 cfs during a 25-year storm event were evaluated using Manning's Equation.

#### 7-2 HYDRAULIC ANALYSIS RESULTS

The existing drainage system is currently not capable of conveying the 25-year storm peak discharge. The recommended improvements and new storm drain facilities were determined based on the results of the WSPG analysis. The WSPG program calculates either the water surface elevations in free water surface, or the hydraulic grade (HGL) line elevations where closed storm drain facilities flow full.

Detailed hydraulic analyses including the laterals to each drainage inlet should be conducted during the design stage to refine these recommendations.

#### 7-3 FUTURE STORM DRAIN FACILITIES

Future storm drain facilities will include the replacement or relief drains that will mitigate the deficiencies in the existing storm drain systems. Future storm drains also include the new facilities where the existing storm drain systems need to be extended to provide 25-year flood protection. In general, future facilities are sized to maintain the HGL one (1) foot minimum below the street gutter grade, unless there are restrictions which make this not possible. The following restrictions may prohibit the ultimate system from meeting the design criteria.

- Limited storm drain easement
- Shallow ground cover over the pipe
- Very flat slopes in the system
- Fixed high invert elevations and/or control water surface elevations at existing downstream facilities
- Existing utility crossings
- Existing facilities are underneath buildings

Although flooding during the design storm may not be prevented in these restricted areas, improvements will still be recommended to shorten the duration of flooding and also reduce the flooding areas.

The detailed hydraulic analyses of the existing and future drainage facilities are included in Appendix D. The recommendations for the improvements are described in Section 9 – RECOMMENDATIONS.