

### **3.0 MASTER PLAN METHODOLOGY**

Several areas of El Paso experience flooding problems on a yearly basis. Other areas of town experience flooding only during significant rainfall events. Based on relevant data, a prioritization matrix was developed and discussed with EPWU. This matrix helped identify the focus of the SMP and led to the identification of critical stormwater infrastructure features. Key components of the matrix included:

- Historical flooding that has occurred;
- Critical area identifications as a result of Storm 2006;
- Structures at risk of flooding;
- Critical features and routes; and
- Land use.

Watershed delineations were generated for these critical features based on available topographic information. The watershed boundaries were used in the hydrologic analysis, which led to the analysis of the 100-year storm. The peak discharge rates were developed for the existing development conditions found within the City at the time of this analysis.

Based on the hydrologic analysis, the existing drainage system was evaluated for conveyance capacities. These capacities were based on data gathered from a variety of sources. All hydrologic and hydraulic evaluations were performed in accordance with the City of El Paso DDM.

In general, the approach to evaluating the City of El Paso's existing drainage system included the following steps:

- Review the existing data available to be used in this study, including existing studies and plans;
- Divide the major watersheds developed from earlier studies into sub-watersheds at critical locations;
- Determine the watershed hydrologic properties;
- Supplement available data with field reconnaissance;
- Determine the geometric properties of the drainage features from available data (in general, storm sewers were not included in the analysis unless integral to the analysis of a critical system component);
- Develop the hydrologic modeling in order to estimate peak discharge rates and volumes;
- Evaluate the existing system conveyance capacities;
- Identify system inadequacies;

- Develop conceptual alternatives to improve system performance and minimize potential flooding and flood damages;
- Evaluate the conceptual alternatives; and
- Select the preferred alternative.

FEMA floodplain maps, which are discontinuous across the study area, were one of several indicators used to identify and evaluate flood-prone areas in El Paso. This study did not include validation of existing floodplains or formal delineation of new floodplains in currently unmapped areas of the city. This study is a planning document and does not guarantee that identified solutions without further detailed definition will lead to removal of flood prone areas from designated floodplains or flood zones.

### 3.1 Historical Flooding

Several data sources were utilized to determine where the historical flooding problems occurred. Previous studies developed for the City of El Paso before and after Storm 2006 were utilized to determine areas of concern. Interviews were conducted with field personnel, City staff, and Stormwater Utility staff. This information was compiled at the onset of the project and was continually evaluated throughout the process to include the major flooding problem areas in the SMP. A list of the primary data sources used is shown below.

Report	Date	Author	Description
Basin A Draft Technical Memorandum	Jan-07a	CH2M HILL	This report provides an assessment of the current pump station configuration of Basin A and a recommendation for new, higher capacity pumps to adequately handle the 100-year storm flows.
Cebada & IH-10, Preliminary Master Study and Report	Oct-07	Brock & Bustillos Inc.	This report is a hydrologic analysis of the Cebada Drainage System from the Franklin Mountains to IH-10. This report also provides preliminary designs for drainage infrastructure that would alleviate flooding at Cebada Reservoir.
Dallas Street Pump & Drainage System, Preliminary Engineering Report	Oct-07	MCI	This report is a Preliminary Engineering Report that recommends various solutions to adequately discharge water from the Dallas Reservoir when the Rio Grande is at flood levels.
Dam Analysis Report (Work Order 3)	Feb-08	URS Corporation (URS)	An analysis of select, existing dams within the City of El Paso for the Probable Maximum Flood.

<b>Report</b>	<b>Date</b>	<b>Author</b>	<b>Description</b>
Drainage Study & Report (Existing Conditions) for IH-10	Feb-08	MCI	This report summarizes the study consisting of the delineation of drainage areas contributing to the IH-10 corridor, estimation of off-site runoff impacting the corridor, identification of locations for potential drainage problems, and evaluation of existing structure capacities. The study area is along IH-10 from the Zaragoza Road at the northwest end to Darrington Road in the southeast.
Drainage Study & Report for FM 76 (North Loop Road)	May-07	MCI	This report summarizes the impacts of urbanization and drainage improvements on the North Loop Road (FM 76) corridor. The study area is bounded by Montana Avenue to the north, Southern Pacific Railroad Company railroad tracks to the south, Yarbrough Drive to the east and Fort Bliss Railroad Spur to the west.
Drainage System Evaluation and Audit Report (WO1)	Mar-07	URS	A general assessment of the overall stormwater system, including dams, ponds, conveyance systems and pumping stations.
FEMA Flood Recovery Tools	Jul-07	Mapping Alliance Partnership 6 (MAP 6)	This study is an evaluation and assessment of the flooding risk in El Paso. The study consisted of collecting and analyzing data where appropriate. The data collected was used to produce Advisory Flood Recovery tools for rebuilding, such as Flood Recovery Maps, Floodplain Elevation Data Tables, and Advisory Flood Recovery Profiles.
Government Hill Outfall Durazno Neighborhood, Storm 2006 Drainage Repairs Project	Jan-07a	PSC	This report is an analysis of the 90-inch discharge conduit that extends from Boone Street Basin to the Rio Grande. Factors contributing to the diminished performance of the system are discussed along with possible solutions.
Interviews with EPWU, City of El Paso, and Texas Department of Transportation (TxDOT) Personnel	2007	URS	Interviews were conducted with engineering and maintenance personnel to help in identifying problem areas, the causes of the problems, and possible solutions.
Northeast Channel 2 Improvements, Preliminary Engineering Report	Jan-07	MCI	This report details the hydrologic and hydraulic analysis performed for Northeast Channel 2 and makes recommendations for project alternatives to alleviate flooding associated with the channel.

Report	Date	Author	Description
Northgate Diversion Channel Study	2007	Dorado Engineering, Inc.	This report details the hydrologic analysis methods used to analyze the Northgate Diversion Channel, and provides alternatives to address the erosion and flooding issues.
Proposed Hydrology Conditions Flow Path No. 38 Letter Of Map Revision (LOMR)	Feb-06	MCI	An update of the Hydrology and Hydraulics of the area containing Flow Path Nos. 38, 38A and 38B. The update consists of as-built information of drainage ponds, the drainage of new development in the area, and a LOMR.
Saipan - Ledo Pond Design, Preliminary Report	Dec-07	Quantum Engineering Consultants Inc.	This report is an analysis of the Saipan Neighborhood storm sewer system. The report also provides preliminary designs for proposed ponds.
Stormwater Pump Station Assessment	Jan-07b	PSC	An evaluation and assessment of the existing pump stations in El Paso. The report includes the facilities components, a brief description of the workings, the facilities condition, and recommended improvements along with costs.

### 3.2 Hydrology

The purpose of the hydrologic analysis was to determine peak discharge rates that were used to evaluate capacities of the existing facilities. Hydrologic analysis consisted of the Unit Hydrograph Method as outlined in the DDM and was performed on over 290 square miles of watershed area within the six regional delineations. Detailed information regarding the hydrologic analysis and the results tables can be found in Appendix A.

### 3.3 Hydraulics

The purpose of the hydraulic analysis was to evaluate capacities of existing facilities. The level of detail available for characterizing hydraulic capacity of existing structures varied across the City, from areas where a FEMA detailed study had been previously performed (with associated surveyed cross-sections and structures) to areas where structural dimensions and elevations were estimated by field measurements. Where system inadequacies were identified, flow diversion was approximated and flood risks evaluated. The hydraulic designs performed to size facilities to address inadequacies were dependent upon the level of detail of site information collected, and are consistent with the planning level of this SMP. In no case were new site-specific surveys performed as part of hydraulic design. Detailed information regarding the hydraulic analyses inputs, methods, and results can be found in Appendix B.

### **3.4 El Paso Water Utilities Working Meetings**

Throughout the master planning process, technical input was received from EPWU and key stakeholders during a series of six working meetings. The first two working meetings included a wide cross section of technical stakeholders including:

- EPWU Stormwater Engineering;
- EPWU Environmental;
- EPWU Stormwater Operations;
- EPWU Water Resources;
- EPWU Administration;
- City Engineering;
- City Streets Department;
- Texas Department of Transportation (TxDOT);
- EPCWID No. 1; and
- United States Geological Survey (USGS).

The initial working meeting included a discussion of the technical approach for the stormwater master planning process and specific problem areas to be addressed in the SMP. The second working meeting was held after the initial modeling results were completed and focused on discussions of the results of the modeling, problems identified, and the path forward. The intent of these first two working meetings was to engage the technical stakeholders in the process in order to identify the major stormwater problem areas and to develop consensus on the technical approach.

The following four working meetings were conducted with a smaller group and focused on detailed discussions of the results. The third working meeting focused on detailed discussion, evaluation, and selection of the recommended alternative for each project in the Northwest, West Central, Central, and Northeast Regions. The fourth working meeting focused on detailed discussion, evaluation, and selection of the recommended alternative for each project in the East Side and Mission Valley Watersheds. The final two working meetings focused on the development and ranking of stormwater projects for the Draft CIP.

### **3.5 Project Area Definitions**

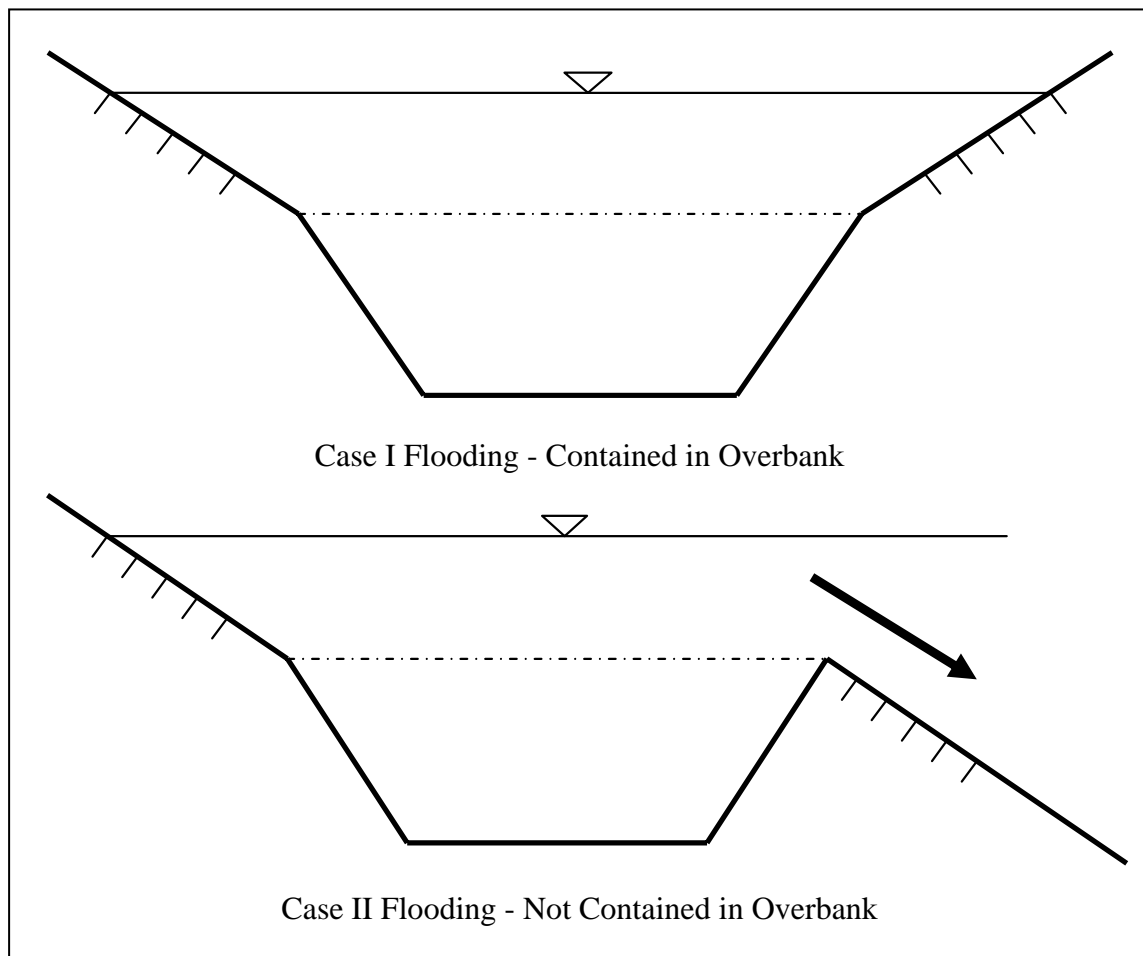
Projects were defined within each system based on the area characteristics and magnitude of flows combined with engineering judgment in order to aggregate reaches with fairly uniform flooding issues, and combine potential improvements into a single project. Some of the issues considered in the organization of projects for later prioritization included:

- type of potential flooding;

- population density;
- return period capacity (i.e. capacity to convey a flood of a specified return period) of structures; and
- location within the watershed.

Project reaches where potential flooding would be contained within the overbanks (denoted as Case I flooding) were separated from reaches where flooding would not be contained within the overbanks and had the potential to enter adjacent watersheds (denoted as Case II flooding). A graphical representation of the flooding types is provided in Figure 3-1. Additionally, reaches were grouped such that reaches included in a single project should have a relatively uniform population density adjacent to the project. This served to separate projects that benefit a small number of people from those that would benefit a large number of people.

**Figure 3-1 Typical Flooding Types**



### 3.6 Development of Project Alternatives

For each project defined, alternatives were identified to address the issues associated with that project. Typically, multiple alternatives were developed for each project in line with community values identified by the CAC. However, for simpler projects with a clear solution only one alternative was developed. These alternatives were developed with extensive input from the EPWU. Each project alternative consisted of proposed improvements designed to meet the 100-year storm criteria whenever possible. Improvements considered include:

- adding or improving detention/retention;
- adding sediment and or debris control;
- improving channel and crossing capacity;
- building new channels and storm drains; and
- building new or improve existing pump stations.

Additionally, some projects were studied recently by the City as part of the Storm 2006 initiative. Alternatives from these projects were incorporated whenever appropriate.

Each developed alternative consisted of a series of individual improvements. Sizing of the improvements was based on the hydrologic and hydraulic analyses performed as part of this SMP. Cost estimates for each alternative were developed. Cost estimates included the costs associated with the structure improvements as well as excavation and grading, demolition, possible utility relocations, right-of-way (ROW) acquisitions, and repaving as applicable. The costs developed for each improvement were then summed to develop a total project cost. The total project cost was then used for evaluation of each alternative. The methodologies used for concept design and cost estimation of alternatives are described in Appendix E.

### 3.7 Alternative Evaluation

During the third working meeting, the alternatives developed for each identified project were evaluated not only through total project cost, but also through a series of qualitative factors. These qualitative factors significantly affected alternative selection. The qualitative factors evaluated are as follows.

- **Constructability** considered the ease with which the defined alternative could be constructed. General knowledge concerning conditions at the site was used to determine constructability (density of urban area, ease of excavation, complexity of construction/design, and other site-specific issues).
- **Ease of maintenance** considered the relative likelihood of significant maintenance being required to retain the system performance associated with the project over time. Alternatives were evaluated for the susceptibility of the alternative to flood, experience erosion, experience

excessive sediment/debris deposition, etc. In general, alternatives with upstream sediment/debris basins in locations with significant sediment/debris risk were estimated to be easier to maintain than those lacking debris/sediment controls. Channels with non-erosive liners (rock, concrete) were estimated to be easier to maintain than vegetated channels, where steep slopes led to heightened erosion risk.

- **Reliability** considered the relative likelihood of the alternative successfully addressing the flood risk. In some cases, causes of the flood risk were uncertain or difficult to fully address. A judgment was made to rate an alternative higher in reliability if that alternative successfully addressed more of the project uncertainty than another did. An example of the reliability factor is an alternative anticipated to alleviate flooding from a 50-year storm that was deemed less reliable than an alternative anticipated to alleviate flooding from a 100-year storm.
- **Right-of-Way** considered the relative complexity of obtaining the needed ROW (property or easement purchase) for an alternative. Alternatives involving significant ROW acquisition in dense urban areas or in highly regulated areas were rated lower than those where ROW acquisition was confined to open land or urban land not in active use.
- **Safety** considered the relative risk to public health and welfare associated with each project. In urban areas, stormwater detention ponds (which drain quickly following a flood) were generally rated safer than stormwater retention ponds (which can impound water for longer periods). In areas identified as susceptible to high risk of debris flow, alternatives that included debris control basins were rated safer than those that lacked debris control.

During a series of public meetings with the SMP CAC defined the El Paso community values as they pertain to stormwater infrastructure. (Section 7.0 discusses the CAC in more detail.) In the SMP, these community values were added as additional qualitative factors to the evaluation of each alternative.

- **Safety** was listed as a key community value by the CAC and as a technical evaluation factor.
- **Aesthetics** were considered to be improved relative to another alternative if the alternative provided more of a visual asset to the community than a competing alternative.
- **Dual use** considered the ability of a project to provide recreational opportunities in addition to flood control. An alternative was rated higher than another if the project provided more recreational potential.
- **Natural systems** considered whether a project minimized the impact to natural systems. An alternative that minimizes disturbance to (or blends in with) an existing natural system was rated higher than one that uses more

concrete or hard structures. This provided a relative favorable rating to projects that did not disturb natural arroyos.

Table E-8 in Appendix E provides a listing of each alternative, its associated estimated construction cost, comparison among competing alternatives, and its associated qualitative evaluation factors. Tables E-3 through E-7 list the principal improvement components of each alternative.

### **3.8 Alternative Selection**

A single alternative was selected for each project during Working Meetings Three and Four with technical and operational representatives from EPWU, the City of El Paso, URS Corporation (URS), and MCI. The attendees at these meetings:

- Discussed the basic issue to be addressed by each project,
- Described each alternative for a project: specifically, type, cost, location, and level of flood protection provided by the alternative;
- Presented and discussed the technical and community values qualitative factors for each alternative; and
- Selected the most favorable alternative for each project.

During the alternative evaluation and discussion process, new alternatives were sometimes identified. When this happened, URS and MCI further developed the new alternatives. The new alternatives were then evaluated and discussed at the next working meeting. This process helped ensure that the most appropriate alternatives for each project were thoroughly considered.

### **3.9 Existing Master Plans**

The intent of the SMP is to address stormwater improvements for the existing El Paso infrastructure. Guidance for new development should adhere to the requirements detailed in the City of El Paso DDM (City of El Paso, 2008). In addition to the analysis of the existing infrastructure, two existing Master Plans of Development were reviewed to identify any potential issues that would affect the SMP. The Northeast Master Plan (KHA, 2005) and the Westside Land Study (PSC & MCI, 2005) are discussed briefly in the following sections.

#### **3.9.1 Northeast Master Plan**

The Northeast Master Plan proposes a plan for the development of approximately 16,000 acres of land located in the Northeast Region, east of the Franklin Mountains and North of US 54 (Patriot Freeway). The development would include residential, commercial, and industrial areas, roads, drainage, parks, and other development areas integrated with designated open spaces. The total build-out for the project is approximately 60 years with a maximum population of approximately 207,000 people

(KHA, 2005). A review of the Northeast Master Plan revealed that 100% of the discharge from the new development would ultimately be conveyed to the Northeast Ponds. The levees used to convey this runoff to the ponds have over a 100-year capacity. The Northeast Master Plan Report demonstrated that the proposed development does not increase the runoff volume or the peak timing versus existing conditions, and thus should not adversely affect development downstream if constructed as designed as such it is consistent with the goals of the DDM and of this SMP.

### **3.9.2 Westside Land Study**

The Westside Land Study proposes a development plan for approximately 1,850 acres of PSB owned property located in the Northwest Region, west of the Franklin Mountains and bisected by Trans-Mountain Road. The land study site lies with approximately one-third of the area falling north of Trans-Mountain Road and two-thirds falling south of this major thoroughfare. The land study site is bounded on the east by Franklin Mountain State Park. The development will include residential and commercial areas, and designated open space. Full build-out for the area is approximately 16 to 20 years with an approximate population of 14,000 people (PSC & MCI, 2005). A review of the Westside Land Study revealed that increased runoff due to development would be detained onsite in accordance with the DDM. The historic runoff would continue to be conveyed offsite where Flow Paths 38A, 38B, 39, and 40 exit the study site on the west via a series of engineered channels.

The Westside Land Study is consistent with the goals of the DDM and this SMP.