APPENDIX A

HYDROLOGY REPORT

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A.1.0 BACKGROUND

A hydrologic analysis was performed for each of the six study regions to estimate peak storm flows that would occur for extreme storm events. The analysis consisted of the following steps:

- Watersheds boundaries were delineated;
- Curve Numbers were estimated for each watershed;
- Lag Times were estimated for each watershed;
- Routing parameters were estimated for each flowpath;
- Large detention structures were analyzed;
- The effect of small ponds was analyzed;
- Precipitation was estimated; and
- Hydrologic models were developed for each study area.

Detailed descriptions of the steps, assumptions, and results of the analysis are presented in this Appendix. Summaries of pertinent data, calculations, tables, and figures are located at the end of this Appendix. An overview of the project area is provided on Figure A-1.

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A.2.0 DATA SOURCES

Table A-1 lists the sources used in the hydrologic analysis, as well as the specific calculation(s) each source was used for.

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A.3.0 WATERSHED DELINEATION

A.3.1 Method Overview

Watershed boundaries were delineated for much of the Stormwater Master Plan (SMP) study area as part of the *Drainage On-Call Services, Work Order 1: Drainage System Evaluation and Audit* (URS Corporation [URS], 2007), and the *Drainage On-Call Services, Work Order 3: Dam Analysis Report* (URS, 2008). These watershed delineations were utilized where available and modified as appropriate to correspond to the scope of the SMP.

The purpose of the SMP is to develop projects to improve the performance of the El Paso Drainage Infrastructure in flood events up to the 100-year event. To accomplish this task, the Work Order 1 and Work Order 3 watersheds were modified to estimate the peak flows at the downstream end of each El Paso Water Utilities (EPWU) identified reach. For “Priority Reaches” identified in the SMP, Task 2: Regional Analysis Staging/Prioritization, additional watersheds were delineated at locations of significant changes in channel slope or channel bottom width or at confluence points. For the purposes of identifying significant changes in channel geometry, channel dimensions were obtained from a variety of sources including the Work Order 1 Study, the EPWU drainage shapefile, and site visits.

SMP watershed delineations and modifications were digitized utilizing ArcView, Version 9.2, based on 3-foot contours generated from 2004 Texas Department of Transportation (TxDOT) topography. In addition to the contours, the City of El Paso Engineering Department Flood Control System Base Maps (City of El Paso, 1987) were utilized to identify flowpaths along drainage infrastructure. Each watershed polygon was assigned a unique name based on the downstream element or primary flowpath. Successive watersheds for the same element were labeled with a number at the end of the name. For example, the watershed contributing to Range Dam was labeled as A_Range Dam, which denotes that it is the area tributary to Range Dam. If there were two watersheds contributing to Range Dam, then they would be named A_Range Dam_1 and A_Range Dam_2.

A.3.2 Watershed Delineation, Central Region

Many of the watersheds in the Central Region were previously delineated in Work Order 3. Five of the watersheds delineated in Work Order 3 were subdivided into smaller watersheds or modified to incorporate flows that result from the 10-, 25-, 50-, and 100-year storms, as opposed to the probable maximum flood (PMF), which is what was analyzed in Work Order 3. The remaining watersheds in the Central Region were delineated based on 3-foot contours generated from TxDOT topography, drainage inlet locations, storm sewers, channels, and site investigations.

South of Interstate Highway 10 (IH-10), the Central Region is very flat and the land use is primarily urban, making the storm sewers and drainage inlets the primary factors when determining watershed boundaries. All watersheds were checked using boundaries delineated in the S_HydroBasin_CoEP.shp file, which was generated during Work Order 1. Previous reports, such as the *Dallas St. Pump and Drainage System* Preliminary Engineering Report by Moreno Cardenas Inc. (MCi) (MCi, 2007), were also used to assist with the watershed delineations south of IH-10. Figure A-2 shows the final watershed delineations for the Central Region.

A.3.3 Watershed Delineation, East Side Region

The watershed delineation completed for Work Order 1 was analyzed further for the purposes of this master plan. Areas within the City limits were analyzed at the subdivision level, bringing their individual ponding areas into consideration and identifying areas built within a closed basin, in turn, breaking up the Work Order 1 watersheds. In areas where it was unclear where flows were concentrated because of existing structures and very flat terrain on the high Mesa, field visits were conducted and photos were taken. Site visits were useful in getting existing drainage condition information. Each basin system polygon was assigned a unique name based on the stream element at the south end of the system. Each watershed was then named based on the basin system it was within followed by a number. The numbers progress from smallest to largest from north to south. For example, the watershed at the farthest north within the Lomaland Basin System is labeled as A_Lomaland_0. Figure A-3 shows a map of the project watersheds within the East Region.

A.3.4 Watershed Delineation, Mission Valley Region

Only Work Order 1 watersheds were significantly modified for the Mission Valley study area, as the previous Work Order 3 scope did not include this region of El Paso. Also, watersheds delineated for the 2007 North Loop Study (MCi, 2007) were utilized in this analysis. The hydrologic approach for Mission Valley differed from the other five areas due to the flat terrain below the escarpment zone in the lower valley region and the resulting local flooding issues. The approach taken for Mission Valley was to focus on large-scale problems and appropriate solutions for handling the total volume of water generated by the various storms, but most importantly the 100-year event. The main problems addressed were increasing the capacity of the interceptor system and reversing the negative slope to the Basin G pump station to alleviate local flooding issues upstream. Therefore, the hydrologic analysis was performed using large-scale watersheds below the major dams to capture the flow into the three main drains (Mesa, Middle, and Franklin Drains), the interceptor channels, as well as Basin G. The advantage of using these larger watersheds is that the need for detailed delineation to capture, for instance, the presence of stormwater pipes crossing or emptying to the main drains is eliminated. This simplifying model approach was taken to reduce the complexity of the model while still obtaining valuable flow information to analyze Mesa, Middle, Franklin, and Playa Drains. Figure A-4 shows the watershed delineations for the Mission Valley study area. The TxDOT topography, City of El Paso *Engineering Department Flood Control System Base Map* (City of El Paso, 1987), and ArcView, Version 9.2 discussed above were utilized for delineating Mission Valley Watersheds. Additionally, the naming convention described above for watersheds was utilized.

A.3.5 Watershed Delineation, Northeast Region

Watershed delineations in the Northeast Region were originally taken from the Work Order 3 Study, but were modified in a number of areas due to the assumptions used in the Work Order 3 Hydrology. Work Order 3 involved modeling to analyze the dams to Texas Commission on Environmental Quality (TCEQ) standards, which include passing the PMF, a storm much larger than the 500-year frequency storm. This study is concerned with more frequent floods, and targets the 100-year storm. Assumptions made during the Work Order 3 modeling included assuming that all local drainage infrastructure in the Northeast Region would likely be overwhelmed due to the extremely high PMF flows, and flowpaths would travel over land based on topography and not be conveyed along the channels in the area. Watersheds were modified as part of the SMP analysis where deemed appropriate to more accurately model the flooding scenarios and flowpaths that would occur in more frequent floods. Additionally, watersheds were further subdivided to estimate flows at all of the priority channels and critical features identified in meetings with the EPWU. Figure A-5 shows the watershed delineations for the Northeast Region.

A.3.6 Watershed Delineation, Northwest Region

Where available, watershed delineations from Work Orders 1 and 3 were used for the Northwest Region. The existing delineations were modified as necessary to cover the differences in study areas and limits. The watershed modifications and new watershed delineations were delineated by hand using the 3-foot contour data from TxDOT topography and available orthophotography.

The watershed for the Nemexas Drain only includes the area that will have an effect on the politically defined areas of the City of El Paso in its route to the drain, i.e. the area east of the Rio Grande. The watershed crosses the state boundary of New Mexico and Texas. In order to delineate the watershed outside the City of El Paso, topography data of Doña Ana County, New Mexico was used. The whole Nemexas Drain Watershed is not included in this analysis. It was assumed that backwater pressure from flood waters east of the Rio Grande would effectively block excess flow from the siphon crossing of the Rio Grande. The excess flow would be discharged to the Rio Grande via the overflow weir structure on the west banks of the Rio Grande.

The watersheds that were used for the “Vinton” Channels were delineated as part of the Federal Emergency Management Agency (FEMA) update and analysis of the Flood Insurance Rate Maps (FIRMs) and Flood Insurance Study (FIS) for El Paso County.

These watersheds were not modified. Figure A-6 shows the watershed delineations for the Northwest Region.

A.3.7 Watershed Delineation, West Central Region

The West Central Region Watersheds were delineated primarily by hand. The watershed delineation was based on the 3-foot contour data from TxDOT topography and available orthophotography. Watersheds from Work Orders 1 and 3 covered only a portion of a few channels. Those watersheds were modified as needed to cover the entire channel. The watersheds were delineated assuming that the runoff remains within that watershed and is not diverted. Figure A-7 shows the watershed delineations for the West Central Region.

A.4.0 CURVE NUMBER ESTIMATION

A.4.1 Method Overview

Runoff losses were modeled in Hydrologic Engineering Center's Hydraulic Modeling System (HEC-HMS) by selecting the Soil Conservation Service (SCS) Curve Number Loss Method. This method requires the user to input the SCS Curve Number, Percent Impervious Cover, and Initial Abstraction. SCS Type II Curve Numbers were assigned based on the combination of hydrologic soil groups (HSGs) and land use cover description according to the El Paso Drainage Design Manual (DDM), Tables 4-9 and 4-10 (City of El Paso, 2008); which is summarized in Tables A-3 and A-4.

When entering the curve number parameters into the HEC-HMS Model, the percent impervious cover was left as 0 percent (%) because it is already accounted for in the Curve Number Calculation Method described below. The initial abstraction parameter defines the amount of rainfall that must fall before surface runoff occurs. This value was left blank, and by default, HEC-HMS calculates it as 0.2 times the potential retention.

HSGs were determined using the soil type shapefile for El Paso County available from the Soil Survey Geographic Database (SSURGO) (United States Department of Agriculture [USDA], 2004). The SSURGO soil shapefile delineates soil according to soil types, which were correlated to HSG based on a key code also available from SSURGO, summarized in Table A-2. Soils were classified as Soil Group A, B, C, D, Water, or Sink. Sinks are areas such as landfills or quarries that collect water and are thus not included in runoff calculations.

Land use types were estimated using 2006 Orthophotography (City of El Paso, 2006) and hand delineated in ArcMap. Polygons were digitized according to the land use cover categories provided in the DDM. Each polygon was assigned a Land Use Cover Type text attribute and a Land Use Identification (ID) numerical attribute corresponding to Tables A-5 and A-6 at the end of this Appendix.

A curve number shapefile was created by combining the land use and soils shapefiles using the ArcMap Union tool. The curve number shapefile contained both the HSG and Land Use ID for each polygon. Curve numbers were then assigned according to the DDM for each soil group-land use combination. Finally, a union was created between the curve number shapefile and the watershed boundary shapefile, and the area-weighted average curve number for each watershed was calculated using the following equation:

$$CN_{avg} = \frac{\sum AreaxCN}{\sum Area\ Sum}$$

A.4.2 Curve Number Estimation, Central Region

Results for the Central Region curve number estimation are given in Table A-7. A map of soil types is provided on Figure A-8, and a map showing Land Use categories delineated is provided on Figure A-9, found at the end of this Appendix.

A.4.3 Curve Number Estimation, East Side Region

Land use types were estimated using 2006 Orthophotography and delineated in ArcMap. With the delineated polygons in ArcMap and site visit analysis, land use cover types and hydrologic conditions were assigned to areas throughout the East Side Region study area. Using information gathered above, and Tables A-3 and A-4, curve numbers were assigned to each respective area. Table A-4 was used for undeveloped desert shrub areas surrounding the urbanized East Side Region. Table A-3 was used for curve numbers for developed areas, i.e. residential ¼-acre lot, commercial, industrial, and open space. Based on site visits, residential ¼-acre lot was used. The site visits were also referenced when assigning a curve number to open space and easements based on vegetation cover. A map of soil types is provided on Figure A-10, and a map showing Land Use categories delineated is provided on Figure A-11.

A.4.4 Curve Number Estimation, Mission Valley Region

Results for the Mission Valley Region curve number estimation are given in Table A-9. A map of soil types is provided on Figure A-12, and a map showing Land Use categories delineated is provided on Figure A-13, found at the end of this Appendix.

A.4.5 Curve Number Estimation, Northeast Region

Results for the Northeast Region curve number estimation are given in Table A-10. A map of soil types is provided on Figure A-14, and a map showing Land Use categories delineated is provided on Figure A-15, found at the end of this Appendix.

A.4.6 Curve Number Estimation, Northwest Region

The curve number estimation for the Northwest Region was found using the process described above, where the appropriate data were available. As mentioned in the watershed delineation section, the Nemexas Drain Watershed crosses the state boundary between New Mexico and Texas. The only data used to determine the curve number that was affected by this is the Soil Type shapefile. The Soil Type shapefile used for the area of Doña Ana County is from the National Resources Conservation Service (NRCS) in Geographic Information Systems (GIS) format. The “Vinton” channels were not included in this process because the hydrology was already completed by the FEMA update and analysis of the FIRMs and FIS for El Paso County.

Results for the Northwest Region curve number estimation are given in Table A-11. A map of soil types is provided on Figure A-16, and a map showing Land Use categories delineated is provided on Figure A-17, found at the end of this Appendix.

A.4.7 Curve Number Estimation, West Central Region

Results for the West Central Region curve number estimation are given in Table A-12. A map of soil types is provided on Figure A-18, and a map showing Land Use categories delineated is provided on Figure A-19, found at the end of this Appendix.

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A.5.0 LAG TIME ESTIMATION

A.5.1 Method Overview

The lag time was calculated for each modeled watershed using the modified Snyder Method developed for the FIS for Northeast and Central El Paso conducted by US Army Corp of Engineers (USACE) in 1978 (USACE, February 1978). The methodology for the Snyder calculation is shown below:

$$T_{lag} = C_T \left(L_L * L_{CA}\right)^{0.3}$$

where: T_{lag} = Lag Time (hrs);
C_T = Regional Coefficent (Plate A-3, USACE, February 1978);
L_L= Length of longest flow path (mi);
L_{CA} = Length from longest flow path centroid to outlet of watershed (mi).

The regional coefficient, C_T, was estimated according to equivalent slope based on the curves for undeveloped areas and urban areas found in Plate A3 of the USACE 1978 Report (USACE, February 1978). Equivalent slope was assumed to be the slope between the 10% and 85% marker elevations, traveling upstream along the longest flow path.

The Snyder peaking coefficient, c_p, was defined according to the following guidelines:

$$640c_p = 430 \; if \;\; slope\left(\frac{ft}{ft}\right) < 0.015$$

$$640c_p = 392 \; if \;\; slope\left(\frac{ft}{ft}\right) > 0.015$$

The longest flowpath was digitized by referencing 2004 TxDOT Contours (TxDOT, 2004). A polyline was created in ArcMap connecting the furthest upstream point in the watershed to the watershed outlet, while following a path of decreasing elevation. Physical barriers that were visible in the 2006 Orthophotography (City of El Paso, 2006) were taken into account while estimating the longest flow path for each watershed.

A.5.2 Lag Time Estimation, Central Region

Lag Times for the Central Region were estimated using the method above and are summarized in Table A-13. Longest flowpaths for the Central are shown on Figure A-20 located at the end of this Appendix.

A.5.3 Lag Time Estimation, East Side Region

Lag Times for the East Side Region were estimated using the method described above and are summarized in Table A-14. Longest flowpaths for the East Side Region are shown on Figure A-21 located at the end of this Appendix.

A.5.4 Lag Time Estimation, Mission Valley Region

Lag Times for the Mission Valley Region were estimated using the method described above and are summarized in Table A-15. Longest flowpaths for the Mission Valley Regions are shown on Figure A-22 located at the end of this Appendix.

A.5.5 Lag Time Estimation, Northeast Region

Lag Times for the Northeast Region were estimated using the method described above and are summarized in Table A-16. Longest flowpaths for the Northeast Region are shown on Figure A-23 located at the end of this Appendix.

A.5.6 Lag Time Estimation, Northwest Region

Lag Times for the Northwest Region were estimated using the method described above and are summarized in Table A-17. Longest flow paths for the Northwest Region are shown on Figure A-24 located at the end of this Appendix. The “Vinton” Channels were not included in this estimation because the hydrology used was taken from the FEMA update and analysis of the FIRMs and FIS for El Paso County.

A.5.7 Lag Time Estimation, West Central Region

Lag Times for the West Central Region were estimated using the method described above and are summarized in Table A-18. Longest flow paths for the West Central Region are shown on Figure A-25 located at the end of this Appendix.

A.6.0 HYDROLOGIC ROUTING

A.6.1 Method Overview

Once watershed delineations were completed, flowpaths were identified and the HEC-HMS model was constructed. A routing shapefile was digitized in ArcView containing the reaches corresponding to the HEC-HMS Model. When generating the routing schematic, the assumption was made that flow would be conveyed along the drainage infrastructure and would not be diverted due to insufficient capacity and overtopping. The HEC-HMS Muskingum-Cunge Method of routing was selected for all open channel reaches. In this method, the user first enters the channel shape. If “trapezoid” is selected, the user enters a channel slope, and Manning’s Roughness Coefficient and channel bottom width. If “eight point” is selected, then the X-Y coordinates for the channel cross-section are entered into the paired-data editor, along with the Manning’s Roughness Coefficient.

For routing through conduits, either the Muskingum-Cunge Method or the Lag Method of Routing was used. The Muskingum-Cunge Method is suitable for representing a free water surface inside a pipe, and should not be used for pressure flow or pipe networks. For pressure flow or other conduit scenarios, the Lag Method was used, where lag was calculated based on conduit length and estimated velocity.

Several data sources were available for the estimation of cross-section geometry. The first source utilized was the Bentley FlowMaster Reports included in the Work Order 1 Report (URS, 2008). In some cases, a corresponding Work Order 1 cross-section could not be located for the routing segment modeled in HEC-HMS, or the Work Order 1 geometry did not match other data sources. In these cases, the EPWU drainage feature shapefiles (EPWU, 2008) were examined to see if geometry could be found for the reach in question. If not, the TxDOT 2004 Topography (TxDOT, 2004) was used to approximate a simple eight-point cross-section or a field visit was performed. In several instances, water is routed through City streets. In such cases, the cross-section used for routing purposes is that of a street itself.

A.6.2 Hydrologic Routing, Central Region

The routing for open channels in the Central Region Watershed was estimated using the method described above. In addition to open channel routing, 29 conduits were modeled in HEC-HMS using the Lag Method. For 15 of these conduits, the conduit length was divided by an assumed velocity in order to estimate a routing lag time. The velocities were only assumed if they were not available in Work Order 1 or if the velocities provided in Work Order 1 seemed unreasonable. If Work Order 1 provided multiple velocities for different sections of the same conduit, then lag times were calculated based on the length of each section and added together to determine the total lag time for the conduit. Channel Routing Inputs for the Central Region are provided in Table A-19a and Conduit Routing Inputs for the Central Region are provided in Table A-19b. Figure A-26 shows the routing reaches for the Central Region.

A.6.3 Hydrologic Routing, East Side Region

The routing for open channels in the East Side Region Watershed was estimated using the Kinematic Wave Method. In addition to open channel routing, several conduit routing pathways under IH-10 were modeled in HEC-HMS using the Lag Method. For these conduits, an estimated velocity was multiplied by the conduit length in order to estimate a routing lag time. The lag times across IH-10 were rounded and entered into HEC-HMS as one minute. Figure A-27 shows the routing reaches for the East Side Region.

A.6.4 Hydrologic Routing, Mission Valley Region

Routing for the Mission Valley Region open channels was estimated using the method described above. In addition to open channel routing, two conduit routing pathways were modeled in HEC-HMS using the Lag Method. For these conduits, the conduit length was divided by an estimated velocity to estimate a routing lag time. Channel routing inputs for Mission Valley are provided in Table A-21a and Conduit routing inputs for Mission Valley are provided in Table A-21b. Figure A-28 shows the routing reaches for the Mission Valley Region.

A.6.5 Hydrologic Routing, Northeast Region

Routing for the Northeast Region open channels was estimated using the method described above. In addition to open channel routing, three conduit routing pathways were modeled in HEC-HMS using the Lag Method. For these conduits, the conduit length was divided by an estimated velocity to estimate a routing lag time. Velocity estimates were obtained from Work Order 1. Channel routing inputs for the Northeast are provided in Table A-22a and Conduit routing inputs for Northeast are provided in Table A-22b. Figure A-29 shows the routing reaches for the Northeast Region.

A.6.6 Hydrologic Routing, Northwest Region

Routing for the Northwest region open channels was estimated using the method described above. Channel routing inputs for the Northwest Region are provided in Table A-23. The “Vinton” Channels were not included in this process because the hydrology was completed with the FEMA update and analysis of the FIRMs and FIS for El Paso County. Figure A-30 shows the routing reaches for the Northwest Region.

A.6.7 Hydrologic Routing, West Central Region

Routing for the West Central Region open channels was estimated using the method described above. Channel routing inputs for the West Central Region are provided in Table A-24. Figure A-31 shows the routing reaches for the Northwest Region.

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A.7.0 MODELING OF SIGNIFICANT DETENTION STRUCTURES

A.7.1 Method Overview

Significant detention structures were modeled in HEC-HMS using one of two methods. Either a stage-storage-discharge relationship was entered into the HEC-HMS model, or the dam was modeled using the Outflow Structures method.

A stage-storage-discharge relationship was developed previously for each dam modeled in Work Order 3 (URS, 2008), and utilized in this study when available. This relationship dictated how upstream flow was attenuated by reservoirs and associated dam structures. The relationship consists of a stage elevation versus a storage volume versus a dam discharge, starting at the bottom elevation of the dam's storage reservoir and increasing to the top elevation of the dam embankment. This relationship is defined by the components of the dam, its storage basin, its embankment size and height, and its outflow structures.

For dams that did not have a stage-storage-discharge curve developed, the Outflow Structures method was used. When using the Outflow Structures method, information is entered into the HEC-HMS model to represent individual components of the outlet works. Both outlets and spillways can be modeled using this method. "Outlets" as defined in the HEC-HMS manual typically represent structures near the bottom of the dam that allow water to exit in a controlled manner. Inputs entered to model outlets include method (orifice or culvert), number of barrels, size, length, and invert elevations. "Spillways" typically represent structures at the top of the dam that allow water to go over the dam top in a controlled manner. When modeling a spillway structure in HEC-HMS, there are three different methods available: broad-crested, ogee, and use specified. Inputs entered to model spillways include elevation, length, and spillway coefficient. A map of the significant detention structures is provided on Figure A-32.

A.7.2 Significant Detention Structures, Central Region

Altura Avenue Dam

Previous reports and data gathered from multiple site visits were used to accurately model Altura Dam. The dam is located on the east side of the Franklin Mountains, south of Memphis Drive Dam (Lower) and northwest of the intersection of Scenic Drive and Kentucky Street. Altura Avenue Dam has a tributary area of 0.12 square miles. The drainage area is comprised of two landuse types. The first and most abundant is desert shrub. The second is residential which is scarce and is located upstream of the dam.

The area of the basin is 0.9 acres and it has a capacity of 2.1 acre-feet. The reservoir is 15 feet high from the outer toe to the top of the embankment. In this analysis, the top of the dam is considered to be the southeast side of the dam, which is approximately

95 feet long. The emergency spillway is on the south side of the dam and is 40 feet wide. The spillway overflows into a separate stilling basin that has a rock wall on the downstream side and a concrete channel that flows underneath the wall. The concrete channel is also the discharge location for the principal spillway, which is drop inlet connected to a 36-inch reinforced concrete pipe (RCP). The flow from the principal spillway is directed south, under Scenic Drive, and eventually discharges into Kentucky Dam (Upper). Altura Avenue Dam was entered into HEC-HMS as a reservoir using the stage-storage function and the assumption that the basin is empty at the beginning of the storm event.

Cemex Spillway

Previous reports and data gathered from multiple site visits were used to accurately model Cemex Spillway. The spillway is located at the foot of the Franklin Mountains, south of McKelligon Dam and west of Van Buren Dam. Cemex Spillway has a tributary area of 0.92 square miles. The upstream side of the drainage area is the Franklin Mountains, consisting of desert shrub, and the downstream end of the watershed is a large quarry, which was classified with newly graded or commercial and business land use types.

The area of the basin is 1.1 acres and it has a capacity of 6.1 acre-feet. The reservoir is 15 feet high from the outer toe to the top of the embankment. The top of the dam consists of a concrete crest control structure and is 125 feet long. The emergency spillway is also concrete and is 75 feet wide with energy dissipators on the downstream side. The spillway flows into the Van Buren Ditch, which conveys overflow to Van Buren Dam. Cemex Spillway does not have a principal spillway and was entered into HEC-HMS as a reservoir using the stage-storage function and the assumption that the basin is empty at the beginning of the storm event.

Campbell Reservoir

The reservoir is of sufficient size to hold enough water to let the peak of a large storm pass before beginning to pump into Dallas Reservoir. Therefore, the reservoir was not modeled in HEC-HMS for this analysis. The basin is located on the western side of the Central Region, just south of IH-10. Campbell Reservoir has a tributary area of 0.26 square miles. The drainage area is urban and consists of residential housing as well as commercial and business land use types. The basin also captures stormwater from the adjacent IH-10 Highway.

The footprint of the basin is 2 acres and it has a capacity of 25 acre-feet. The maximum capacity was determined to occur at the elevation just before the pump structure becomes inundated. The pump discharges flow through a 12-inch line towards Dallas Reservoir. The concrete reservoir is approximately 30 feet deep and has a perimeter of 1,357 feet.

Cebada Reservoir

Data were gathered from TxDOT plans and through multiple site visits to accurately model Cebada Reservoir. Cebada Reservoir is located at the intersection of Cebada Road and Gateway Boulevard The reservoir was originally intended to collect street flow through drop inlets on adjacent streets and along Gateway Boulevard The stormwater would then be discharged to the Rio Grande through two 6-foot by 6.5-foot box conduits. The two box conduits outfall into the Cebada Pump Station. The Pump station then releases the stormwater into the Rio Grande. The purpose of this structure is to pass all water north of IH-10 downstream without affecting the Highway.

Many watersheds contribute to the total flow entering the structure. A large portion of the water travels down the watershed as concentrated street flow until entering the surrounding drop inlets and discharging into Cebada Reservoir. A portion of the total volume enters Cebada Reservoir through a 48-inch conduit, which is the discharge structure for Copia Channel. Stormwater also enters through a 60-inch conduit, which conveys water from the drainage inlet at the intersection of Magnolia Street and Gateway Boulevard

The area of the reservoir is 1.6 acres and it has a capacity of 7.2 acre-feet. Cebada Reservoir is 7 feet deep and has a perimeter of 2,632 feet. The two 6-foot by 6.5-foot box outflow conduits are crossed at multiple locations by various utility lines, which reduce the overall discharge capacity. The two existing outlet conduits were modeled using CulvertMaster, which produced an elevation-discharge curve for the reservoir. The elevation-discharge curve produced in CulvertMaster and the elevation-storage curve produced by GIS were used as the input parameters to model the reservoir in HEC-HMS.

Dam No. 8

Dam No. 8 is a flood and debris control dam, maintained and operated by EPWU. The dam was constructed in 1948 by the City of El Paso. The dam is not used to retain water on a regular basis. Therefore, there is typically little to no water in the reservoir. The dam is located at the foot of the east side of the Franklin Mountains, northeast of the intersection of Tremont Avenue and Cotton Street. The dam has a tributary area of 0.05 square miles, most of which is undeveloped mountainous desert terrain with uncontrolled flow. The dam is an earth-filled structure and is classified has a downstream urban environment. Dam No. 8 is approximately 600 feet long and 12 feet high from the outer toe to the top of the embankment. The dam has a principal drop spillway, which is connected to a 112-foot-long, 36-inch diameter corrugated metal pipe (CMP).

The principal spillway tower was located by a survey crew and invert elevations were given for the 36-inch CMP. However, the discharge location was not located by the survey crew and no invert elevation was recorded to mark the outlet of the conduit. Furthermore, it was not obvious from the aerial photographs or 2003 retrofitting plans exactly where the outlet to the principal spillway is located. Therefore, it is assumed that the discharge location is 112 feet from the drop spillway, in the southeast direction. The discharge runs south, down Cotton Street, until it reaches the named Cotton Yandell storm drain where it is directed to the Dallas Reservoir. There is no auxiliary spillway for Dam No. 8. If the dam overtops, excess discharge will continue on the same route as the principal spillway discharge.

The total stage-area-discharge table produced for Dam No. 8 by MCi in the *Dallas St. Pump and Drainage System Preliminary Engineering Report* (MCi, 2007) was the input used to model the dam in HEC-HMS for this study. The elevations were adjusted to correlate with the datum used by URS for other dams in this analysis.

Dam No. 9

Dam No. 9 is a flood and debris control dam, maintained and operated by EPWU. The dam was constructed in 1948 by the City of El Paso. The dam is not used to retain water on a regular basis. The dam is located at the foot of the east side of the Franklin Mountains, north of the intersection of Denver Avenue and Idaho Street. Dam No. 9 has a tributary area of 0.03 square miles, most of which is undeveloped mountainous desert terrain with uncontrolled flow. However, there are also 4.9 acres of commercial development in the drainage area, which flows across Murchison Street and into the reservoir. There is potential for an even larger drainage area for the dam because 2003 retrofitting plans indicate that drainage inlets on the north and south sides of Detroit Street were proposed to be installed, as well as a ramp, which would direct flow from Detroit Street into the dam reservoir. These proposed structures were not marked by the survey crew and are not visible from the 2006 Orthophotography (City of El Paso, 2006) obtained; so it is assumed that currently they do not exist.

The dam is an earth-filled structure and has a downstream urban environment. Dam No. 9 is approximately 270 feet long and 21 feet high from the outer toe to the top of the embankment. The dam has a principal drop spillway, which is connected to a 104-foot-long, 36-inch CMP.

The principal outlet discharges into a 10-foot-wide earthen channel located southeast of the dam. The 50-foot-long channel leads directly to Denver Avenue. The discharge will continue to flow in the southeast direction until it reaches Cotton Street, where it will turn south and head towards the storm system. Once the flow has reached the storm drain system, it will eventually discharge into the Dallas Reservoir. There is no auxiliary spillway for Dam No. 9. If the dam overtops, excess discharge will continue on the same route as the principal spillway discharge.

The total stage-area-discharge table produced for Dam No. 9 by MCi in the *Dallas St. Pump and Drainage System Preliminary Engineering Report* (MCi, 2007) was the input used to model the dam in HEC-HMS for this study. The elevations were adjusted to correlate with the datum used by URS for other dams in this analysis.

Dam No. 10

Dam No. 10 is a City of El Paso dam for which original construction plans were unavailable, but it was included in the dam improvement project of 1948. The dam is located at the southern base of the Franklin Mountains, at the intersection of Wright Avenue and Grandview Avenue. The dam has a tributary area of 0.07 square miles, about 45% of which is residential; the rest is steep, undeveloped, mountainous desert terrain of the Franklin Mountains. The site consists of one detention basin with a 15-foot-high embankment structure, approximately 260 feet in length. The principal outlet is a 3-foot by 3-foot concrete drop structure that flows into a 3-foot by 3-foot concrete culvert conduit. Dam No. 10 has no auxiliary spillway, and overflow is expected to run over the entire breadth of the dam.

Dam No. 10 was modeled in the Water Resources Site Analysis Program (SITES) as part of the Work Order 3 analysis, which used information from survey data, the 1948 construction plan information, and the TxDOT contours. The total stage-storage-discharge table produced by SITES was the input used to model the dam in HEC-HMS for this study.

Dallas Reservoir

Data were gathered from TxDOT plans and through multiple site visits to accurately model Dallas Reservoir. The Dallas Reservoir is located at the intersection of IH-10 and Cotton Street. The Highway is elevated and the Reservoir is located beneath it. The Dallas Reservoir includes an east and a west reservoir, which are hydraulically connected and fill up simultaneously. These discharge conduits flow into different storm sewer systems. The two gravity box conduits (6-foot by 5-foot on the west and 7-foot by 5-foot on the east) discharge water into the Rio Grande. There is currently no pump to discharge water into the Rio Grande when the water surface elevation of the river is at flood levels. There are several drainage areas that contribute to the inflow of the reservoir. The landuse types of those drainage areas vary from desert shrub at the southern base of the Franklin Mountains to commercial and business immediately upstream of the reservoir.

The total area of the basin is 7.8 acres and it has a capacity of 39 acre-ft. The reservoir is 11 feet deep and has a perimeter of 2,363 feet. The two existing outlet conduits were modeled separately using CulvertMaster, which produced an elevation-discharge curve for each conduit. The outflows at each elevation were added together to produce a total elevation-discharge curve for the reservoir. The total elevation-discharge curve and the elevation-storage curve produced by GIS were used as the input parameters to model the reservoir.

Fort Boulevard Reservoir

Fort Boulevard Reservoir is a flood and debris control dam, maintained and operated by EPWU. The dam was constructed in 1948 by the City of El Paso. The dam is not used to retain water on a regular basis. The dam is located at the foot of the east side of the Franklin Mountains, west of the intersection of Nations Avenue and Morehead Avenue.

The dam has a tributary area of 0.22 square miles, all of which is undeveloped mountainous desert terrain with uncontrolled flow. The dam is an earth-filled structure and has a downstream urban environment. The crest of Fort Boulevard Reservoir is 226 feet long and 28 feet high from the outer toe to the top of the embankment. The dam has an emergency spillway, but no evidence of a principal spillway.

Retrofitting plans from 2003 indicate that an outlet tower was proposed to be built for Fort Boulevard Reservoir. An outlet tower and discharge location were not located by the survey crew, and it is not obvious from the aerial photographs exactly where these structures are relative to the dam. Therefore, it is assumed that the proposed drop spillway, which was supposed to connect to an existing 12-inch diameter steel pipe, has not been constructed yet. If the principal outlet is constructed, it will discharge into the same drainage path as the auxiliary spillway

The auxiliary spillway is 50 feet wide with concrete crest control. Flow leaving the spillway will travel east, into a 50-foot-wide earthen channel and then proceed east onto Fort Street. Eventually, the flow will drain southeast and then south, into Copia Ditch.

Kentucky Dam (Lower)

Kentucky Dam (Lower) is a City of El Paso dam that was also included in the storm and drainage control improvement project of 1948. The dam is located south of Kentucky Dam (Upper), between Kentucky Street and Alabama Avenue, at the southeastern base of the Franklin Mountains. Kentucky Dam (Lower) has a cumulative tributary area of 0.3 square mile and is directly downstream of Kentucky Dam (Upper), which discharges flow into the dam from its principal outlet, a 60-inch CMP.

Kentucky Dam (Lower) consists of a 9-foot-high masonry embankment structure, approximately 240 feet in length. The principal outlet of the downstream basin is a 4-foot by 4-foot masonry drop structure that flows into a 3.5-foot by 2-foot masonry box conduit which outlets into a stilling basin at the base of the auxiliary spillway drop structure. The auxiliary spillway of the downstream basin is a masonry drop structure approximately 40 feet wide. The stilling basin discharges directly into the Wheeling Street and Alabama Avenue intersection. The Kentucky Dam (Lower) modeled in SITES for Work Order 3 was the input used to model the dam in HEC-HMS.

Kentucky Dam (Upper)

Kentucky Dam (Upper) is a City of El Paso dam that was also included in the storm and drainage control improvement project of 1948. The dam is located south of Memphis Dam (Lower), between Kentucky Street and Alabama Avenue, at the southeastern base of the Franklin Mountains. Kentucky Dam (Upper) has a cumulative tributary area of 0.18 square mile and is directly upstream of Kentucky Dam (Lower).

The principal outlet of Kentucky Dam (Upper) is a 4-foot by 4-foot drop inlet structure that flows to a 60-inch conduit which outlets to the downstream Kentucky Dam (Lower) detention basin. The basin has no auxiliary spillway, although the south side embankment will act as an auxiliary spillway in a major flood event in which the dam is overtopped.

Kentucky Dam (Upper) is a rectangular basin-type pond, excavated into the existing terrain, rather than an embankment-type dam. There is currently no mechanism in place for releasing large flows. Floodwater overtops the dam crest on the south side. The south side embankment between Kentucky Dam (Upper) and Kentucky Dam (Lower) is approximately 48 feet wide and 265 feet long. The area on top of the embankment is currently being used as a storage area. The east side of the embankment is somewhat lower than the south side of the embankment; however, the 1948 construction plans indicate a wall running along the east side. The presence of the wall was confirmed by aerial photographs and should prevent flow over the east side of the embankment. The condition and exact extent of the wall is unknown. If the wall fails, floodwaters will drain into a residential area. The Kentucky Dam (Upper) was modeled in SITES for Work Order 3 and assumed overtopping on the south side of the embankment only. The total stage-storage-discharge table produced by SITES was the input used to model the dam in HEC-HMS for this study.

Louisiana Drive Dam (Lower)

Louisiana Drive Dam (Lower) is a flood and debris control dam, maintained and operated by EPWU. The dam was constructed in 1948 by the City of El Paso and is not used to retain water on a regular basis. Therefore, there is typically little to no water in the reservoir. The dam is located northeast of the intersection of Louisiana Street and Nashville Avenue and has a cumulative drainage area of 0.18 square mile. The land cover over which the runoff flows consists of undeveloped mountainous desert terrain with uncontrolled flow in the western section of the drainage area, and changes to runoff through residential neighborhoods in the eastern section of the drainage area. Louisiana Drive Dam (Upper) is directly upstream and drains into Louisiana Drive Dam (Lower) via two 48-inch culverts.

The earth-filled embankment is approximately 285 feet long and 18 feet high from the outer toe to the top of the embankment (Nashville Avenue). The dam has a drop spillway, which is connected to a 166-foot-long, 60-inch diameter CMP.

The principal outlet discharges into a 25-foot wide earthen channel located south of Nashville Avenue. The 250-foot long, loosely defined channel leads the flow southeast into residential neighborhoods. The discharge will continue to flow south, down Elm Street, eventually reaching Cebada Reservoir. Eucalyptus to Cebada drains northeast into the drainage area of the Cebada Drainage Outfall, a 6-foot by 5-foot concrete box culvert which flows south, into the Rio Grande River. There is no auxiliary spillway for Louisiana Drive Dam (Lower). If the dam overtops, excess discharge will flow over Nashville Avenue and continue on the same route as the principal spillway discharge.

Louisiana Drive Dam (Upper)

Louisiana Drive Dam (Upper) is a flood and debris control dam, maintained and operated by EPWU. The dam was constructed in 1948 by the City of El Paso and is not used to retain water on a regular basis. Therefore, there is typically little to no water in the reservoir. The dam is located northeast of the intersection of Louisiana Street and Mobile Avenue and has a drainage area of 0.14 square mile. The land cover over which the runoff flows consists of undeveloped mountainous desert terrain with uncontrolled flow in the western section of the drainage area. A small ponding area is directly upstream and drains into Louisiana Drive Dam (Upper) through two 48-inch culverts.

The earth-filled embankment is 140 feet long and 12 feet high from the outer toe to the top of the embankment (Mobile Avenue). The dam has two 48-inch concrete culverts, which act as a principal spillway into Louisiana Drive Dam (Lower). There is no auxiliary spillway for Louisiana Drive Dam (Upper). If the dam overtops, excess discharge will flow over Mobile Avenue and into Louisiana Drive Dam (Lower). The Louisiana Drive Dam (Upper) was entered into HEC-HMS as a reservoir using the stage-storage function and the assumption that the basin is empty at the beginning of the storm event.

Lower Durazno Basin

Lower Durazno Basin was modified in 2007 as part of the TxDOT *Plans of Proposed Highway Routine Maintenance Contract*. The basin is located at the intersection of US 54 (Patriot Freeway) and IH-10 and has a tributary area of 1 square mile. The landuse type of the drainage area is almost entirely urban, but the basin also receives inflow from the US 54 storm sewer as well as discharge from the Upper Durazno principal and emergency spillways.

The area of the basin is 22.8 acres and it has a capacity of 477 acre-feet. The reservoir is approximately 25.5 feet deep and has a perimeter of 6,147 feet. In this analysis, the top of the dam is considered to be the south side of the dam (excluding the spillway), which is approximately 2,270 feet long. The auxiliary spillway is located in the southeast corner of the dam and is lined with concrete. The spillway is 65 feet long and outfalls into a former residential area, which has now been bought by the City of El Paso. The principal spillway for the basin is a drop inlet connected to a 30-inch diameter RCP. The inlet tower has an 18-inch diameter inlet at the base of the tower and a 1.8-foot by 1.8-foot square inlet located on the side of the tower, 6.3 feet from the base. The outlet structure was modeled as an orifice with an inlet at an elevation equal to the elevation at the top of the square inlet. The 30-inch RCP connected to the intake tower directs outflow to the Lincoln Drain. Lower Durazno Basin was entered into HEC-HMS as a reservoir using the stage-storage function and the assumption that the basin is empty at the beginning of the storm event.

Magnolia Reservoir

Data were gathered from TxDOT plans and through multiple site visits to accurately model Magnolia Reservoir. The reservoir is located south of the intersection of Magnolia Street and Grant Avenue. Magnolia Reservoir has a direct urban tributary area of 0.09 square mile, but also receives discharges from San Diego Dam, Ohio Street Reservoir, and Tremont Reservoir.

The area of the reservoir is 1.4 acres and it has a capacity of 9 acre-feet. The reservoir is approximately 15 feet deep and has a perimeter of 1,139 feet. There is no emergency spillway for Magnolia Reservoir. A principal spillway, which consists of a drop inlet, is connected to a 48-inch conduit and discharges south of the dam onto Magnolia Street. The stormwater travels south as street flow until captured and directed into a 60-inch diameter storm drain known as Eucalyptus to Cebada. Magnolia Reservoir was entered into HEC-HMS using the stage-storage function and the assumption that the basin is empty at the beginning of the storm event.

McKelligon Dam

McKelligon Dam was built 4.5 miles north of downtown El Paso in 1982 by USACE. The dam is owned by the City of El Paso and located northwest of the intersection of McKelligon Canyon Road and Alabama Street. The dam is approximately 105 feet high with a top of embankment elevation of 4,447.8 feet. The drainage area encompasses approximately 2.2 square miles and consists of steeply sloping desert terrain runoff, captured from the east side of the Franklin Mountains. McKelligon Dam has a principal outlet and an auxiliary spillway that discharge into two different stilling basins.

The principal outlet consists of a hooded intake structure that flows into a 620-foot long, 3-foot diameter concrete conduit. The conduit discharges at the southeastern toe of the dam into a 10-foot wide, riprap-lined, earthen channel, which discharges into McKelligon Reservoir A. The auxiliary spillway is formed by McKelligon Canyon Road, which contours show to also release flow into McKelligon Reservoir B. McKelligon Dam was modeled in SITES for Work Order 3. The total stage-storage-discharge table produced by SITES was the input used to model the dam in HEC-HMS for this study.

McKelligon Reservoir A

McKelligon Reservoir A is one of the stilling basins in the McKelligon Dam System, which was built 4.5 miles north of downtown El Paso in 1982 by USACE. McKelligon Reservoir A receives flow from an immediate tributary area of 0.04 square mile as well as from the principal spillway of McKelligon Dam. The area of the basin is 1.8 acres and has a capacity of 7 acre-feet. The reservoir is 35 feet high from the outer toe to the top of the embankment (Davis-Seamon Road), which is approximately 130 feet long. The basin does not have an emergency spillway, but it does have a 2-foot by 2-foot principal drop spillway, which is connected to a 24-inch diameter RCP. The flow from the principal spillway is directed into McKelligon Reservoir B. The basin was entered into HEC-HMS as a reservoir using the stage-storage function and the assumption that the basin is empty at the beginning of the storm event. Outflow from the McKelligon system is modeled to eventually reach Pershing Dam.

McKelligon Reservoir B

McKelligon Reservoir B is one of the stilling basins in the McKelligon Dam System, which was built 4.5 miles north of downtown El Paso in 1982 by USACE. McKelligon Reservoir B receives flow from an immediate tributary area of 0.1 square mile as well as discharge from the principal spillway of McKelligon Reservoir A and the auxiliary spillway of McKelligon Dam. The McK_Srvy.shp file from Work Order 3 was used in GIS to determine the outlet structure's invert elevations.

The area of the basin is 12 acres and it has a capacity of 0.09 acre-feet. The upstream end of the basin is approximately 80 feet higher in elevation than the downstream end of the basin and the embankment is only roughly 12 feet high from the outer toe to the top of the embankment (McKelligon Canyon Road). Therefore, the storage area is relatively small compared to the area of the basin. McKelligon Reservoir B acts more as a localized drainage area to McKelligon Channel than as a reservoir. The basin does not have an emergency spillway, but it does have a 36-inch RCP outlet culvert, which acts as a principal spillway. The flow from the culvert is directed into McKelligon Reservoir C. The basin was entered into HEC-HMS as a reservoir using the stage-storage function and the assumption that the basin is empty at the beginning of the storm event. Outflow from the McKelligon system is modeled to eventually reach Pershing Dam.

McKelligon Reservoir C

McKelligon Reservoir C is one of the stilling basins in the McKelligon Dam System, which was built 4.5 miles north of downtown El Paso in 1982 by USACE. McKelligon Reservoir C receives flow from an immediate tributary area of only 0.01 square mile, but it receives the majority of its inflow from the principal spillway or overtopping of McKelligon Reservoir B.

The area of the basin is 3 acres and it has a capacity of 7.4 acre-feet. The basin does not have an emergency spillway, but it does have a principal drop spillway with a 2-foot by 2-foot opening on top. The drop spillway is connected to a 36-inch diameter RCP and conveys flow into McKelligon Reservoir D, the final stilling basin in the McKelligon system. McKelligon Reservoir C was entered into HEC-HMS as a reservoir using the stage-storage function and the assumption that the basin is empty at the beginning of the storm event. Outflow from the McKelligon system is modeled to eventually reach Pershing Dam.

McKelligon Reservoir D

McKelligon Reservoir D is one the final stilling basins in a series of stilling basins that are part of the McKelligon Dam System, which was built 4.5 miles north of downtown El Paso in 1982 by USACE. McKelligon Reservoir D receives flow from an immediate tributary area of only 0.01 square mile, but it receives the majority of its inflow from the principal spillway or overtopping of McKelligon Reservoir C.

The area of the basin is 1.1 acres and it has a capacity of 1.1 acre-feet. The basin does not have an emergency spillway, but it does have an 18-inch RCP culvert outlet that conveys flow under Alabama Street, and eventually onto Louisiana Street, where it flows south, and eventually discharges into Pershing Dam. The outlet of the 48-inch principal spillway flows through an alley located southwest of the intersection of McKelligon Canyon Road and Louisiana Street. In December 2007, the City of El Paso surveyed the top of the stilling basin profile, which confirmed that flow overtopping the furthest downstream stilling basin would flow out to Alabama Street. Project topography indicated flow would then follow Alabama Street south towards Van Buren Dam. McKelligon Reservoir D was entered into HEC-HMS as a reservoir using the stage-storage function and the assumption that the basin is empty at the beginning of the storm event.

Memphis Dam (Lower)

Memphis Dam (Lower) is a City of El Paso dam for which original construction plans were unavailable. Improvements to the dam were made by the City of El Paso in 1948 in a project called "Stormwater and Drainage Control Works" in which many of the City's dams were upgraded. Memphis Dam (Lower) is located at the west end of Memphis Avenue at the southeastern base of the Franklin Mountains. The dam has a cumulative tributary area of 0.26 square mile, most of which is the steep, undeveloped, mountainous desert terrain of the Franklin Mountains. A very small portion is residential, less than 5%.

The site consists of one detention basin with an 18-foot high masonry embankment structure, approximately 311 feet in length. The principal outlet, a 12-inch diameter steel standpipe and conduit, was not located during survey of the dam and was therefore not modeled. The auxiliary spillway is a masonry drop structure with a width of approximately 45 feet and a crest arc length of 53 feet. The embankment crest is 3 feet above the auxiliary spillway crest. The structure drops about 24 vertical feet in roughly 16 horizontal feet into a stilling basin that was assessed by URS in November 2006 (Ref 204) to be almost completely filled with sediment. The stilling basin discharges directly into the intersection of Memphis Avenue and Kentucky Street, a densely populated area.

The Memphis Dam (Lower) was modeled in SITES for Work Order 3. The total stage-storage-discharge table produced by SITES was the input used to model the dam in HEC-HMS for this study.

Memphis Dam (Upper)

Data were gathered from TxDOT plans and through multiple site visits to accurately model Memphis Dam. However, there is sufficient topographic data and information from previous reports to model the dam in HEC-HMS. The reservoir is located at the southeastern base of the Franklin Mountains, northeast and upstream of Memphis Dam (Lower). Memphis Dam (Upper) has a tributary area of 0.25 square mile, all of which is the steep, undeveloped, mountainous desert terrain of the Franklin Mountains.

The area of the reservoir is 0.4 acre and it has a capacity of 12.3 acre-feet. The dam is approximately 22 feet high from the outer toe to the top of the embankment. There is no principal spillway for Memphis Dam (Upper), but there is a 35-foot-wide auxiliary spillway which utilizes concrete crest control. The embankment is approximately 7 feet higher than the emergency spillway elevation and is bounded by a wall on the northeast side of the dam. A residential area exists directly on the other side of that wall. The emergency spillway discharges flow into a 500-foot-long channel, which leads to Memphis Dam (Lower). Memphis Dam Upper was entered into HEC-HMS as a reservoir using the stage-storage function and the assumption that the basin is empty at the beginning of the storm event.

Ohio Street Reservoir

Ohio Street Reservoir is a flood and debris control dam, maintained and operated by EPWU. URS could not obtain the original plans for the dam; therefore, it is not known when it was constructed or who constructed it. The dam is not used to retain water on a regular basis.

Ohio Street Reservoir is downstream of San Diego Dam and located north of the intersection of Portland Avenue and Ohio Street. The dam has a cumulative drainage area of 0.13 square miles, which is the sum of its relatively small drainage area of 0.01 square miles and San Diego Dam's larger drainage area of 0.12 square miles. Under controlled circumstances, Ohio Street Reservoir receives the majority of its flow from an inlet on the northwest side of the dam. This inlet captures the flow from a 200-foot long channel that conveys drainage from the principal spillway of San Diego Dam. Ohio Street Reservoir is an earth-filled structure. The embankment (Portland Avenue) is approximately 26 feet high from the outer toe to the top of the embankment and it is roughly 400 feet long. The dam has a drop spillway, which is connected to an arch shaped, 110-foot long, 48-inch-equivalent diameter RCP.

The principal outlet discharges on the south side of Portland Avenue, into an undeveloped lot, where it proceeds to drain south, toward a row of houses. There is a 48-inch diameter RCP just north of the houses, which under controlled circumstances should capture the flow coming out of the principal spillway, assuming that the pipe is not clogged with silt or other debris. This 48-inch diameter pipe then carries the water underneath Pittsburgh Street and into Tremont Reservoir. If there is a breach or overtopping of Ohio Street Reservoir and the volume of water is not able to be drained by the 48-inch diameter pipe located north of the houses, it will flow across the row of houses and across Pittsburgh Avenue, into Tremont Reservoir. The total elevation-area-discharge table produced for Ohio Street Reservoir by MCi in the *Dallas St. Pump and Drainage System Preliminary Engineering Report* (MCi, 2007) was the input used to model the dam in HEC-HMS for this study. The elevations were adjusted to correlate with the datum used by URS for other dams in this analysis.

Pershing Dam

Pershing Dam was designed by USACE in 1975 and completed in 1977. The dam is located at the outlet of the City of El Paso's Central Drainage Area. The upstream corner of the dam is located at the corner of US 54 and Pershing Avenue and it is bounded on the west side by US 54. The cumulative drainage area for Pershing Dam is approximately 4.7 square miles and includes the McKelligon and Van Buren drainage systems. Pershing Dam also receives discharge from the Fort Bliss Sump Outflow Conduit, which was modeled as a source in HEC-HMS. The drainage area immediately upstream of Pershing Dam encompasses approximately 1.1 square miles and consists mostly of developed, residential plots. Flow through this area is considered to be surface flow through streets and neighborhoods.

Pershing Dam is nearly 3,430 feet along the top of its embankment and 48 feet high. The dam was originally constructed with a 21.5-foot wide hood inlet draining to a 16-foot by 14.67-foot culvert serving as the principal and auxiliary spillways. The culvert flows into a concrete-lined stilling basin located across Pershing Avenue. In 1993, USACE completed a spillway modification project (Ref 74) that added a new concrete auxiliary spillway (crest elevation approximately 3,848.5 feet) to allow the dam to safely pass the full PMF. The existing hood inlet continues to function as the principal spillway. Plans and survey data show that both the auxiliary spillway crest and principal outlet inlet have approximately the same elevation. This means that except for outflow through the low-flow port in the intake structure, a significant discharge from Pershing Dam will not occur until the pool elevation is above the auxiliary spillway crest elevation. The concrete auxiliary spillway is approximately 170 feet wide and is located on the southern end of the dam. Starting at the crest of the auxiliary spillway and extending down the steep portion of the spillway channel, 8-foot-wide by 6.5-foot-tall concrete baffles spaced at 15.67 feet center to center were installed across the width of the spillway. Flow from the auxiliary spillway proceeds across Pershing Avenue and into the concrete stilling basin. The concrete stilling basin is drained by the Government Hill Ditch Outlet Conduit, which is 90 inches in diameter.

Pershing Dam was modeled in SITES for Work Order 3. The total stage-storage-discharge table produced by SITES was the input used to model the dam in HEC-HMS for this study.

San Diego Dam

San Diego Dam is a flood and debris control dam, maintained and operated by EPWU. The dam was constructed in 1948 by the City of El Paso. The dam is not used to retain water on a regular basis. Therefore, there is typically little to no water in the reservoir. The dam is located at the foot of the east side of the Franklin Mountains, north of the intersection of Cotton Street and San Jose Avenue. The dam has a tributary area of 0.12 square miles, most of which is undeveloped mountainous desert terrain with uncontrolled flow. However, within the drainage area, there is a commercial development with an area of approximately 3.9 acres. This development utilizes a culvert to discharge runoff from the property into the dam's reservoir. San Diego Dam is an earth-filled structure and has a downstream urban environment. The dam is approximately 500 feet long and 56 feet high from the outer toe to the top of the embankment. The principal outlet of the dam is a drop spillway, which is connected to an approximately 570-foot-long, 36-inch diameter RCP.

The principal outlet discharges into a 40-foot-wide earthen channel located to the southeast of the dam. The 200-foot-long channel leads directly to the Ohio Street Reservoir. There is no auxiliary spillway for San Diego Dam.

Scenic Drive Dam

There were no plans obtained by URS for Scenic Drive Dam, so it is unknown when it was built and who constructed the reservoir. However, there is sufficient topographic data and information from previous reports to model the dam in HEC-HMS. The reservoir is located at the eastern foot of the Franklin Mountains, south of Scenic Drive and west of the intersection of Indiana Street and Copper Avenue. Scenic Drive Dam has a tributary area of 0.13 square mile, all of which is the steep, undeveloped, mountainous desert terrain of the Franklin Mountains.

The area of the reservoir is 2 acres and it has a capacity of 18.4 acre-feet. The dam is approximately 36 feet high from the outer toe to the top of the embankment, which is about 363 feet long. There is no emergency spillway for Scenic Drive Dam, but there is a 24-inch metal culvert which acts as a principal spillway for the dam. The outlet discharges into a residential area and eventually drains into Cebada Reservoir. Scenic Drive Dam was entered into HEC-HMS as a reservoir using the stage-storage function and the assumption that the basin is empty at the beginning of the storm event.

Tremont Reservoir

Tremont Reservoir is a flood and debris control dam, maintained and operated by EPWU. The dam was constructed in 1948 by the City of El Paso. The dam is not used to retain water on a regular basis. Therefore, there is typically little to no water in the reservoir.

Tremont Reservoir is located northwest of the intersection of Tremont Avenue and Indiana Street. The dam has a cumulative drainage area of 0.14 square miles when its relatively small drainage area of 0.01 square miles is added to Ohio Street Reservoir's cumulative drainage area of 0.13 square miles. The dam receives the majority of its flow from an inlet channel on the northern side of the reservoir. The channel starts at Pittsburgh Street, where it can capture excess flow from the Ohio Street Reservoir. The channel is approximately 100 feet long and flows south into Tremont Reservoir. The dam is an earth-filled structure and has a downstream urban environment. The embankment (Tremont Avenue) is approximately 200 feet long and 20 feet high from the outer toe to the top of the embankment. The dam has a drop spillway, which is connected to a 90-foot long, 30-inch diameter RCP.

The principal outlet discharges on the south side of Tremont Avenue into a concrete energy dissipator, where it is directed into a drainage ditch flowing east and then south, around a commercial development. The drainage then continues to flow south, across Murchison Drive, onto the property of El Paso Technical High School. TxDOT topography and 2006 Orthophotography suggest that the majority of the high school campus drains east, into an approximately 26-foot-wide channel, which directs flow further east, towards Magnolia Reservoir.

There is no auxiliary spillway for Tremont Reservoir. If the dam is overtopped, water will flow over Tremont Avenue and into the same ditch which carries the discharge from the drop spillway. In the event that the ditch is full, flow will be carried across the commercial development and continue south on the same general route as the principal spillway discharge.

The total elevation-area-discharge table produced for Dam No. 9 by MCi in the *Dallas St. Pump and Drainage System Preliminary Engineering Report* (MCi, 2007) was the input used to model the dam in HEC-HMS for this study. The elevations were adjusted to correlate with the datum used by URS for other dams in this analysis.

Upper Durazno Basin

Upper Durazno Basin was modified in 2007 as part of the TxDOT *Plans of Proposed Highway Routine Maintenance Contract*. The basin is located northeast of the intersection of US 54 and IH-10 and has a tributary area of 1 square mile. The landuse type of the immediate drainage area is urban, but the basin also receives discharge from the Boone Street Basin diversion on the northwest and a flume on the western side, which drains runoff from Concordia Cemetery.

The area of the basin is 6.3 acres and it has a capacity of 73.4 acre-feet. The reservoir is approximately 22.5 feet deep and has a perimeter of 2,073 feet. In this analysis, the top of the dam is considered to be the south side of the dam (excluding the spillway), which is approximately 254 feet long. The auxiliary spillway is located in the center of the southern embankment, at an elevation that is one foot lower than the top of the embankment. The concrete emergency spillway is 46 feet long and outfalls into the Lower Durazno Basin.

A 72-inch RCP that conveys stormwater from US 54 to Lower Durazno runs through the Upper Durazno Basin. The 72-inch storm drain also acts as a principal spillway for Upper Durazno because it is connected to an intake tower that allows water to drain into the storm sewer system. The intake tower is located just north of the emergency spillway and acts as a junction where the 72-inch RCP and the inflow from Upper Durazno discharge through two 6-foot by 6-foot concrete box culverts, into Lower Durazno. Upper Durazno Basin was entered into HEC-HMS as a reservoir using the elevation-storage function and the assumption that the basin is empty at the beginning of the storm event.

Van Buren Dam

Van Buren Dam is an earthen structure built by the City of El Paso in 1948. The dam is located at the foot of the east side of the Franklin Mountain Range and has a cumulative tributary area of approximately 3.6 square miles. The drainage area consists mostly of undeveloped desert terrain, fair desert shrub, and bare land. A large quarry (Cemex Spillway) is within the cumulative drainage area and is located directly northwest of Van Buren Dam. In this analysis, the McKelligon Dam system also drains into Van Buren Dam. Overflow from McKelligon Dam's downstream stilling basin (McKelligon Reservoir D) flows down Alabama Street and into Van Buren Dam. Van Buren Dam's outflow ultimately flows into Pershing Dam through the Mountain Avenue Conduit.

The top of Van Buren Dam is roughly 25 feet above the embankment toe and the principal outlet consists of a rectangular open top riser. The riser is connected to two corrugated metal conduits, each 72 inches in diameter. The conduits discharge flow into a lightly vegetated channel that discharges into the Mountain Avenue conduit, which has a capacity of 386 cubic feet per second (cfs). All flow in excess of 386 cfs will travel as surface flow through residential neighborhoods until it reaches Pershing Dam.

Van Buren Dam was modeled in SITES for Work Order 3. The total stage-storage-discharge table produced by SITES was the input used to model the dam in HEC-HMS for this study. Although McKelligon-Fillmore Design Plans from 1978 indicate that Van Buren Dam has two auxiliary spillways approximately 6 feet below the top of dam, recent survey data and URS dam inspections found no evidence of a defined auxiliary spillway. The area designated as the auxiliary spillway on general plans is currently at the same elevation as the other top-of-dam sections. Flow in excess of the volume that the dam's principal outlet can discharge and the basin area can store will flow over the top of the embankment. Therefore, to analyze the dam using SITES in Work Order 3, the auxiliary spillway was defined as the top of dam (roughly 900 feet long at an elevation of 4,122.4 feet) with a very mild side slope. The drainage area used in previous studies was approximately 17% smaller than the drainage area delineated for Work Order 3. The discrepancies in drainage area are due in part to the assumption in previous studies that a new dam (Fillmore Dam) would be located below the active quarry currently located in the Van Buren drainage area. In the years after this study, the quarry site expanded to the point where construction of Fillmore Dam was no longer a feasible option.

A.7.3 Significant Detention Structures, East Side Region

Jesuit Basin

Jesuit Basin is located approximately one block north of the Lee Trevino Drive IH-10 intersection. It receives flow from a tributary area of 1.78 square miles of a mixture of commercial and residential land uses. Jesuit Basin has the capacity to hold 271 acre-feet and the maximum flow leaving the primary 18-inch spillway is 22 cfs. Outflow from Jesuit Basin is connected to the culvert system under IH-10 that empties into Burnham Channel and finally into Lomaland Basin System within Mission Valley Region.

Lafayette Draw Basin

The Lafayette Draw Basin is located just southwest of the intersection of Pellicano Drive and Vista De Oro Drive, within the Carolina Dam Basin System. It receives flow from 0.42 square miles of commercial and residential land use types. The storage capacity of Lafayette Draw Basin is 77 acre-feet and the capacity of the18-inch outlet pipe is 26 cfs. Outflow from Lafayette Draw Basin is connected to Lafayette Draw Channel under IH-10 into Mission Valley Region and finally into Carolina Dam.

Cielo Vista Basin A

Cielo Vista Basin A is a subterranean basin which lies directly under Cielo Vista Mall. The Cielo Vista Basin A receives flow from a tributary area 0.98 square miles. It has the storage capacity of 120 acre-feet. The 18-inch RCP primary outlet has a maximum capacity of 32 cfs. This flow is released downstream across IH-10 and into Mission Valley Region where it finally drains into the Phelps Dodge System.

Cielo Vista Basin B

Cielo Vista Basin B is located in the parking lot of the Cielo Vista Mall adjacent to the intersection of Montwood Drive and Viscount Boulevard. The tributary area to Cielo Vista B is only 0.06 square miles. Cielo Vista B has a storage capacity of 38 acre-feet and the maximum capacity of the 18-inch RCP primary outlet is 26 cfs. The flow exits the 18-inch RCP and is then routed under IH-10 into Mission Valley Region where it reaches Phelps Dodge System.

A.7.4 Significant Detention Structures, Mission Valley Region

Americas Ten Basin System

Though the construction date of Americas Ten Basin System is unknown, improvements were made to it in 1987 by Faught & Associates Inc. It is currently maintained and operated by EPWU. The basin is located in the Americas Ten Basin drainage system, approximately 4,500 feet south of the intersection of IH-10 and Loop 375. The basin has a tributary area of 2.60 square miles and receives flow from inlets on the north and northeast sides of the dam, which capture drainage from the Mercantile Channel and the RV Channel. The area of the basin is approximately 10 acres and it has a capacity of 198 acre-feet of storage. Americas Ten Basin System is approximately 18 feet deep from the outer toe to the top of the embankment and has a perimeter of approximately 2,600 feet. The dam has an emergency spillway and a principal drop spillway, which is connected to a 30-inch diameter RCP. The auxiliary spillway is 340 feet wide with concrete crest control. The outflow eventually discharges into the Mesa Drain Interceptor to City Limits. The basin was entered into HEC-HMS as a reservoir using the elevation-storage function with the assumption that the basin is empty at the beginning of the storm event.

Americas Basin System

Americas Basin System was constructed in 1991 by the USACE and is currently maintained and operated by EPWU. The basin is located approximately 2,500 feet west of the intersection of IH-10 and Loop 375 in the Americas Basin drainage system. The basin has a tributary area of 7.9 square miles and receives flow from concrete crest control inlets on the north and northeast sides of the dam. The inlet on the north side of the dam captures flow from Bluff Channel. The area of the basin is approximately 45 acres and it has a capacity of 960 acre-feet of storage. Americas Basin System is approximately 31 feet deep from the outer toe to the top of the embankment and has a perimeter of approximately 5,400 feet. The basin has an emergency spillway and a principal drop spillway, which is connected to a 36-inch diameter RCP. Outflow from Americas Basin System discharges into the Mesa Drain Interceptor, which flows along the south side of Bordeaux Drive and discharges beneath North Loop Drive into Feather Lake. The auxiliary spillway is a 290-foot-wide spillway with concrete crest control. The flow from the auxiliary spillway is directed south, towards Juan de Herrera Lateral Branch B. The basin was entered into HEC-HMS as a reservoir using the elevation-storage function with the assumption that the basin is empty at the beginning of the storm event.

Basin A

Though the construction date of Basin A is unknown, improvements were made to it in 1978. Basin A is part of the Basin A drainage system and is located west of the intersection of Springfield Drive and Ponce Drive, north of Border Highway. The basin receives flow from the Playa Drain, located on the north side of the basin. Flow from the Playa Drain bypasses Basin A through a 42-inch culvert connecting two portions of the Playa Drain just outside Basin A. Flow is also diverted to Basin A through two 10-foot by 10-foot concrete box culverts (CBCs). The area of the basin is approximately 9.6 acres with a perimeter of 2,800 feet. The basin is approximately 10 feet deep from the inside base to the top of the dam and has a capacity of 71 acre-feet of storage. According to a CH2MHILL report Basin A contains three pumps rated at 130 cfs each. The pumps convey stormwater from Basin A into an effluent chamber that is connected to a 78-inch RCP line. The RCP line conveys the stormwater from the effluent chamber, under Border Highway, to an outfall at the Rio Grande River. In addition to the pump station, Basin A has an outlet structure at the northeast end of the basin that releases flow back into the Playa Drain. The outlet structure consists of a rectangular shaped broad crested weir with a length of 170 feet that empties into a 10-foot wide by 7-foot-high concrete box. The structure acts a weir until the outlet area of the box is full and then acts as an orifice. The box structure also has a gate-controlled 2.5-foot by 6-foot opening near its outlet to allow some flow to re-enter the basin while it is filling. The basin was entered into HEC-HMS as a reservoir using the elevation-storage function with the assumption that the basin is empty at the beginning of the storm event.

Basin G

Though the construction date of Basin G is unknown, plans available for proposed enlargements of the basin are dated 1974. Basin G is part of the Basin G drainage system and is located in a rural area in the southwest valley of El Paso. Although it appears that the original intent of the basin was to receive flow from the Playa Drain, the Playa Interceptor Drain, and the interceptor system in Mission Valley, the basin currently receives flow only from the Playa Drain Interceptor under normal storm conditions. The area of the basin is approximately 16.5 acres with a perimeter of 3,500 feet. The basin is approximately 11 feet deep from the base to the top of the dam and has a capacity of 117 acre-feet of storage. The outlet structure for the basin is a pump station located on the west side of the basin that pumps water to the Rio Grande River. Basin G has no auxiliary spillway. The basin was entered into HEC-HMS as a reservoir using the elevation-storage function with the assumption that the basin is empty at the beginning of the storm event.

Carolina Dam

Carolina Dam is part of the Carolina Drive drainage system and is located north of the intersection of Carolina Drive and Lilac Drive. Carolina Dam receives flow from two inlets located on the north-northwest portion of the dam, one of which is the Lafayette Draw Channel. The area of the dam is approximately 12.5 acres with a perimeter of 2,950 feet. The dam is approximately 29 feet deep from the inside base to the top of the dam and has a capacity of 147 acre-feet of storage. Carolina Dam contains a concrete-lined auxiliary spillway 600 feet in length. The principal outlet of the dam is a 3.25-foot RCP conduit line that discharges into the Mesa Drain. The dam was entered into HEC-HMS as a reservoir using the elevation-storage function with the assumption that the dam is empty at the beginning of the storm event

Feather Lake

Feather Lake basin was constructed in 1969 and is located in the Basin G drainage system, southwest of the intersection of North Loop Drive and Bordeaux Drive. In addition to serving as a detention basin, Feather Lake is also a wildlife sanctuary managed by the El Paso Trans-Pecos Audubon. The basin receives flow from the Mesa Drain Interceptor inlet, located on the northeast side of the dam. The area of the basin is approximately 39 acres, with a perimeter of 5,300 feet. The basin is approximately 14.5 feet deep from the inside base to the top of the dam and has a capacity of 424 acre-feet of storage. The outlet structure consists of two 60-inch RCP culverts on the southwest side of the basin, which convey discharge from the basin to the Mesa Drain Interceptor. A concrete weir is located just before the culvert entrance in order to keep water in the basin for use as a wildlife sanctuary. The basin was entered into HEC-HMS as a reservoir using the elevation-storage function with the assumption that the water surface elevation of the basin is kept at 3,658 feet throughout most of the year (due to the concrete weir just before the culvert entrance).

Lomaland Basin System

Though the construction date of Lomaland Basin System is unknown, USACE basin plans available from an El Paso flood control project are dated 1987. Lomaland Basin System is a part of the Lomaland Basin drainage system, located in between Hillcrest Middle School and Loma Terrace Elementary School. The basin receives flow from the Burnham Channel located on the north-northeast side of the basin as well as from a small local drainage sump from Hillcrest Middle School. Lomaland Basin System has a capacity of 504 acre-feet of storage. The area of the basin is approximately 23 acres and it has a perimeter of approximately 4,600 feet. The basin is approximately 30 feet deep from the inside base to the top of the dam, and it has a 1,050-foot concrete-lined spillway. Outflow from the basin flows through a 36-inch RCP to the Mesa Drain. The basin was entered into HEC-HMS as a reservoir using the stage-storage-discharge function with the assumption that the basin is empty at the beginning of the storm event.

North Loop Detention Basin

The North Loop Detention basin is a part of the Phelps Dodge Drainage System and is located south of the intersection of North Loop Drive, Delta Drive, and Trowbridge Avenue. The basin receives flow from Fort Bliss Spur Drain, located on the north-northeast side of the basin. The North Loop Detention basin is approximately 9.5 feet deep from the inside base to the top of the dam and has a capacity of 42 acre-feet of storage. The area of the basin is approximately 10.3 acres and the perimeter is 2,700 feet. The outlet structure is a 24-inch pipe that eventually discharges into the Playa Drain. This detention basin has no auxiliary spillway. The basin was entered into HEC-HMS as a reservoir using the stage-storage-discharge function with the assumption that the basin is empty at the beginning of the storm event.

Phelps Dodge System

Phelps Dodge System was constructed in 1966 and is located in the Phelps Dodge drainage system. The basin is located south of IH-10, northeast of the intersection of Hawkins Boulevard and Phoenix Street, and northwest of El Paso Community College (EPCC). The basin receives flow from Phelps Dodge Channel, as well as flow from inlets located on the north and northeast sides of the dam. These inlets capture drainage from the ends of Arlington and Yuma Streets. Phelps Dodge System has a capacity of 420 acre-feet of storage and is approximately 24 feet deep from the inside base to the top of the dam. The area of the basin is approximately 27 acres and it has a perimeter of approximately 4,500 feet. The basin has a 560-foot-wide concrete spillway. The outflow from the basin discharges to Phoenix Street, then south, along the east side of EPCC Valle Verde campus to North Loop Road, where it eventually discharges into Mesa Drain. The basin was entered into HEC-HMS as a reservoir using the stage-storage-discharge function with the assumption that the basin is empty at the beginning of the storm event.

A.7.5 Significant Detention Structures, Northeast Region

Amber Basin

Amber Basin was constructed in 1977 as part of the Northeast Drainage Improvements project. The basin is located in the Fort Bliss Sump system in Northeast El Paso approximately 0.85 mile east of the foot of the Franklin Mountains. The basin has a tributary area of 0.25 square mile with approximately 40% undeveloped mountainous desert terrain and 60% developed area consisting of single-family housing. Amber Basin is approximately 30 feet deep from the inside embankment toe to the top of embankment. It encloses approximately one city block in area. The principal outlet of Amber Basin is a 20-inch diameter pipe that transitions to a 30-inch pipe before connecting to the local stormwater collection system. The rating curve for this outlet structure was estimated utilizing Bentley CulvertMaster. The auxiliary spillway is a 250-foot wide, concrete-paved spillway with a 16:1 side slope and flows onto Polaris Street. The basin was entered into the HEC-HMS as a reservoir using the stage-storage-discharge function and the assumption that the basin is empty at the beginning of the storm event. Outflow from Amber Basin is connected downstream to Sunrise Channel.

Fort Bliss Sump

Fort Bliss Sump is a depressed basin that, under non-extreme storm conditions, receives flow from the Range Dam and Mountain Park-Sunrise Dam detention systems and encompasses a total drainage area of over 52 square miles. The drainage area surrounding and draining directly to the sump is over 42 square miles and consists mostly of residential and commercial land. The sump is located in the center of its tributary drainage area and is northeast of the intersection of Fred Wilson Avenue and Railroad Drive, across the street from the George V. Underwood, Jr. golf course.

The primary outlet for Fort Bliss Sump is the Fort Bliss Outfall Conduit, which drains to Pershing Reservoir. The conduit is 78 inches in diameter and approximately 9,000 feet long. The intake structure for the conduit is a concrete headwall located in the southwest corner of the sump. If the storage in Fort Bliss Sump exceeds the elevation of the embankment (at approximately 3,874 feet), the inundation area increases to include a much larger outer region of low lying area surrounding the sump (outer sump).

The modeling approach for the HEC-HMS analysis was to divide the facility into a series of diversions, a sink, and a storage element. The first diversion was used to account for the Fort Bliss Sump Outlet Conduit flow. To represent conduit outflow over the range of stage-storage conditions, 200 cfs to Pershing Dam was assumed. The next diversion directed flow into a sink element representing the inner basin of Fort Bliss Sump and diverted flow up to the maximum storage volume of the inner basin. Flow in excess of the maximum storage volume was directed to the outer sump. The outer sump was represented by a storage element. Under the conditions modeled in the SMP, the Fort Bliss Sump embankment is not overtopped and thus, the maximum outflow is 200 cfs resulting from the Fort Bliss Sump Outlet Conduit.

Fusselman Dam

Fusselman Dam was built by USACE in 1961. The dam is located in the Northgate-Range system in northeast El Paso at the east side of the foot of the Franklin Mountains. The dam has a tributary area of 3.37 square miles consisting of mostly undeveloped mountainous desert terrain. Fusselman Dam is approximately 65 feet high from the upstream embankment toe to the top of embankment and is roughly 1,200 feet across, enclosing the small valley that is its tributary. The principal outlet of Fusselman Dam is a 4-foot by 6-foot drop inlet that flows into a 24-inch RCP which outlets just past the downstream toe. The auxiliary spillway is a 100-foot wide, 6-foot high ogee spillway that flows into a graded earthen channel sloped at about 10%. Both the principal and auxiliary spillways flow into a naturally graded arroyo that carries the flow to Northgate Dam, located roughly 7,500 feet downstream. The dam was modeled in HEC-HMS using the stage-storage-discharge function, and the assumption that the basin is empty at the beginning of the storm event.

Hondo Pass Basin

Hondo Pass Basin was constructed in 1977 as part of the Northeast Drainage Improvements project. The basin is located in the Fort Bliss Sump system approximately 0.77 mile east of the foot of the east side of the Franklin Mountains. The basin has a tributary area of 0.079 square mile, with approximately 5% undeveloped mountainous desert terrain and 95% developed area consisting of single-family housing and commercial/industrial areas. The mostly urbanized watershed shows no defined channels.

Hondo Pass Basin is approximately 24 feet deep from the inside embankment toe to the top of embankment and encloses approximately one city block in area. The principal outlet of Hondo Pass Basin is a 20-inch diameter pipe that connects to a 33-inch diameter pipe at Neptune Street, presumably part of the stormwater collection system. The dam was modeled in HEC-HMS using the stage-storage-discharge function, and the assumption that the basin is empty at the beginning of the storm event.

Keltner Dam

Keltner Dam is located at the foot of the east side of the Franklin Mountains, north of the intersection of Alabama Street and Fred Wilson Avenue. Keltner Dam is a City of El Paso structure that was constructed in 1959. The dam has a drainage area of approximately 0.5 square mile and consists of steeply sloping, undeveloped desert shrub. The top of dam is at roughly 4,082.3 feet, and the embankment spans 780 feet. The auxiliary spillway flows out of the northeast portion of the dam, across Alabama Street, and proceeds to flow east along Wickham Avenue. Both the principal and auxiliary spillways flow towards Fort Bliss Sump, located roughly 9,000 feet downstream.

The principal outlet for the dam is a rectangular drop inlet riser that releases into two 21-inch diameter concrete conduits. One of the conduits flows to the southeast, releasing into a residential street. The other conduit flows to the northeast, discharging into a more recently developed residential street. The dam was modeled in HEC-HMS using the stage-storage-discharge function, and the assumption that the basin is empty at the beginning of the storm event.

Mountain Park Dam

Mountain Park Dam was constructed in 1974 by USACE and is maintained and operated by the City of El Paso. The basin is located in the Fort Bliss Sump system at the foot of the east side of the Franklin Mountains. The dam has a tributary area of 0.81 square mile and is 99% undeveloped mountainous desert terrain with uncontrolled flow. The remaining 1% is a housing development that is adjacent to the watershed. The dam is an earth-filled structure, approximately 63 feet high from the streambed to the top of embankment and 633 feet long. The principal outlet of the dam is a 376-foot-long, 36-inch diameter RCP pipe that empties into a stilling basin. From the stilling basin, the principal outlet discharge travels underground for approximately 1,420 feet to the Fort Bliss Diversion Channel. The auxiliary spillway is 60 feet wide with concrete crest control and flows for approximately 750 feet on undeveloped area before reaching Zircon Street. The dam was modeled in HEC-HMS using the stage-storage-discharge function, and the assumption that the basin is empty at the beginning of the storm event.

Northeast Ponding Area

The Northeast Ponding Area consists of six separate ponds: a large pond in the middle with five smaller ponds bordering on the large inner pond's exterior. The Northeast Ponding Area is located in a sump with all nearby surrounding topography draining toward the ponds. The ponds themselves are mostly below grade, so there is little to no embankment rising above the surrounding ground surface. There is no outflow system for the ponds, and the ponds are not connected by any subsurface drains. The majority of the tributary area flows into the large pond from the north through the Greenbelt Levee Channel. The Greenbelt Levee Channel conveys drainage from approximately 24 square miles of mostly undeveloped area north of the City. The Greenbelt Levee Channel also receives flow from the Western Freeway Channel, which conveys outflow from the North Hills Dams. Northeast Channels 1 and 2 also connect to the Greenbelt Levee Channel. The outer ponds receive more localized drainage. With no outflow, the inner pond of the Northeast Ponding Area was modeled in HEC-HMS as a sink with an upstream diversion that stopped routing flow once its top of embankment storage volume was reached. The outer ponds were not identified during the prioritization phase of this analysis and were not modeled individually. The total storage they provide was analyzed to estimate the potential for the large sump area to be overwhelmed and contribute flow to the southern systems. The hydrologic analysis indicates that the Northeast Ponding area would not contribute flow during the 100-year storm, and is hydrologically separate from the rest of the Northeast Region. Any future projects involving the Northeast Ponds will require additional analysis.

Northgate Dam

Northgate Dam was built by USACE in 1971 as a part of the Northgate-Range System. The dam is located on the east side the Franklin Mountains in the alluvial fan, below the foot of the mountains. The dam's embankment is roughly 50 feet tall and spans 2,700 feet, detaining a directly tributary drainage area of 1.45 square miles. In addition to the directly tributary area, the Northgate Diversion Channel and the Northgate Interceptor Channel also discharge into the Northgate Storage Basin. The channels were also constructed as a part of the 1971 project. The Northgate Diversion Channel has a drainage area of 1.29 square miles and is located on the south side of the dam area, directly above a residential neighborhood. Flow is diverted into the Northgate Basin by a 9-foot tall earthen levee that forms the south side of the channel bank. The Northgate Interceptor Channel has a drainage area of 0.60 square mile. The channel is created by a roughly 8-foot tall earthen levee and diverts an area on the north side of Northgate Dam which, without the interceptor channel, would flow over the alluvial fan down to the Patriot Freeway instead of into the Northgate Basin. Northgate Dam also receives the outflow from Fusselman Dam, which flows approximately 9,000 feet from the auxiliary spillway of Fusselman through a naturally defined alluvial channel in the Northgate Dam tributary area and into the Northgate reservoir. All drainage areas tributary to Northgate Dam are undeveloped and are of arid mountain or alluvial fan type terrain. The dam was modeled in HEC-HMS using the stage-storage-discharge function, and the assumption that the basin is empty at the beginning of the storm event.

Northhills Dams

The Northhills Dams were built in 1987 at the foot of the east side of the Franklin Mountains on the northern edge of El Paso to provide flood protection for downstream residential development. The facility is comprised of two interconnected ponds. The tributary area to the north pond is 2.44 square miles, and the tributary area to the south pond is 3.09 square miles. The principal outlet of the north pond flows through a 30-inch RCP under its shared embankment with the south pond and drains into the south pond. The principal outlet of the south pond flows through a 30-inch RCP to a culvert crossing Martin Luther King, Jr. Boulevard (MLK Blvd.) and into the War Road Channel. The northern pond's 300-foot-wide auxiliary spillway is located on its north side and outflow flows east under (and during high flows over) MLK Blvd. across mostly undeveloped area and into the Western Freeway Channel. The southern pond has three separate auxiliary spillways - 70, 90, and 320 feet wide. The dam was modeled in HEC-HMS using the stage-storage-discharge function, and the assumption that the basin is empty at the beginning of the storm event.

Range Basin

The construction date of Range Basin is unknown due to lack of available information. The basin is located just downstream of the Northgate-Range system approximately 0.70 mile from the foot of the east side of the Franklin Mountains. The basin has a tributary area of 0.39 square mile, with approximately 15% undeveloped mountainous desert terrain and 85% developed area consisting of a major road (the Patriot Freeway), single-family housing, and commercial/ industrial areas.

Range Basin is approximately 15 feet deep from the inside embankment toe to the top of embankment. It encloses approximately one large city block in area. Through inspection of the survey data points and comparison with similar basins in the northeastern El Paso area (i.e., Amber, Sunrise, and Hondo Pass Basins), Range Basin was assumed to have a 20-inch diameter pipe principal outlet connected to a storm sewer at Rutherford Road. Since other spillways of similarly sized basins have auxiliary spillways 4 feet below the top-of-dam embankment, this value was used as a check of the survey data. The auxiliary spillway was measured as a 130-foot-wide, concrete-paved spillway with a 4:1 side slope that flows onto Rutherford Road. Flow exiting Range Basin was routed to Army Ditch. The dam was modeled in HEC-HMS using the stage-storage-discharge function, and the assumption that the basin is empty at the beginning of the storm event. The stage-storage-discharge relationship was applied from the Work Order 3.

<u>Range Dam</u>

Range Dam was built in 1971 by USACE as part of the Northgate-Range system. The dam is located on the east side of the Franklin Mountains, just east of the Patriot Freeway, bordering the north side of Diana Drive between Dyer Street and the Patriot Freeway. Range Dam has 3.95 square miles of directly tributary area and also receives flow from the Electric Ditch Diversion Channel (0.64 square mile) and the portion of the outflow from Northgate Dam conveyed by the Northgate Outlet Channel. Range Dam's auxiliary spillway is 150 feet wide and is located on the south side of the embankment. The dam was modeled in HEC-HMS using the stage-storage-discharge function, and the assumption that the basin is empty at the beginning of the storm event.

<u>Sunrise Basin</u>

Sunrise Basin was constructed in 1977 as part of the Northeast Drainage Improvements project. The basin is located in the Fort Bliss Sump system approximately 0.90 mile from the foot of the east side of the Franklin Mountains. The basin has a tributary area of 0.135 square mile, with 100% developed area consisting of single-family housing and some commercial/ industrial areas. The urbanized watershed contains no defined channels. Note that the watershed was delineated without considering the area contributing to the Sunrise Drain, which collects additional flow between the principal outlet of Amber Basin and Sunrise Basin before terminating at Sunrise Basin.

Sunrise Basin is approximately 20 feet deep from the inside embankment toe to the top of embankment. It encloses approximately one city block in area. The principal outlet of Sunrise Basin is a 20-inch corrugated steel culvert pipe (CSCP), which connects to a 24-inch RCP pipe at Gateway South Boulevard, presumably part of the stormwater collection system. The auxiliary spillway is a 112-foot wide, concrete-paved spillway that flows into Gateway South Boulevard. The basin was modeled in HEC-HMS using the stage-storage-discharge function, and the assumption that the basin is empty at the beginning of the storm event.

Sunrise Dam

Sunrise Dam was constructed in 1974 by USACE and is maintained and operated by the City of El Paso. The dam is located in the Fort Bliss Sump system at the foot of the east side of the Franklin Mountains. The dam has a tributary area of 0.50 square mile, all of which is undeveloped mountainous desert terrain with uncontrolled flow. The dam is an earth-filled structure and is classified as high-hazard due to the downstream urban environment. Sunrise Dam is approximately 60 feet high from the toe to the top of embankment and is 626 feet long. The principal outlet of the dam is a 368-foot long, 36-inch diameter RCP pipe that empties into a stilling basin. From the stilling basin, the principal outlet discharge travels underground for approximately 790 feet to the upper section of the Fort Bliss Diversion Channel. The auxiliary spillway is 60 feet wide with concrete crest control and flows directly onto Zircon Street. The dam was modeled in HEC-HMS using the stage-storage-discharge function, and the assumption that the basin is empty at the beginning of the storm event.

TxDOT Pond

This detention pond, located near the intersection of MLK Blvd. and War Road, was constructed in 2005. It is the only structure modeled in the Northeast Region that was not previously analyzed as part of Work Order 3. The MLK Blvd. TxDOT detention pond has a tributary area of approximately 0.6 square miles, and is approximately 17 feet deep. The pond was modeled in HEC-HMS using the stage-storage-discharge function, and the assumption that the detention basin is empty of the beginning of the storm event.

A.7.6 Significant Detention Structures, Northwest Region

Keystone Dam

Keystone Dam is a USACE dam that was constructed in 1983. The direct tributary drainage area is 3.12 square miles. Mulberry, Thorn, and Mesa Dams as well as the Borderland Channel drain to Keystone Dam. Total watershed draining to Keystone Dam is 12.8 square miles. The dam is located south of Mesa Dam, west of IH-10, and east of Doniphan Drive. The majority of the watershed is developed for residential and commercial purposes. The upper portion of the watershed is undeveloped as it is in the Franklin Mountains. Keystone Dam consists of a 66-foot high earth embankment structure at a length of 5,100 feet. The principal outlet structure is a 35-foot by 12-foot hood inlet structure that flows into a 96-inch RCP. The auxiliary spillway is an 80-foot-wide, 7-foot-deep, broad-crested weir that flows into a graded earthen channel sloped at about 1.5%. The dam was entered into HEC-HMS as a reservoir using the stage-storage-discharge function, and assuming that the dam is clean and empty at the beginning of the storm event.

Mesa Dam

Mesa Dam was constructed by the USACE in 1982. The dam is located northwest of the intersection of Mesa Street and Resler Drive. Mesa Dam’s 2.88-square-mile tributary drainage area borders the southern side of Thorn Dam’s tributary drainage area. Nearly 100% of the Mesa Dam Watershed is developed, primarily residential. The dam consists of a 45-foot-high earth embankment structure, about 4,230 feet long. The principal outlet of Mesa Dam is a 14-foot by 14-foot hood inlet structure that flows to a 36-inch RCP which outlets just past the downstream toe. The auxiliary spillway is a 200-foot-wide, 7-foot-deep, broad-crested weir located directly opposite the Thorn Dam Spillway. The dam was entered into HEC-HMS as a reservoir using the stage-storage-discharge function, assuming the dam is clean and empty at the beginning of the storm event. Outflow from Mesa Dam converges with the Borderland Channel before being routed to Keystone Dam.

Mulberry Dam

Mulberry Dam was originally built by the City of El Paso in 1957. The USACE constructed improvements to the dam in 1979 to contain the Standard Project Flood (SPF). Mulberry Dam is located northwest of the Resler Drive and E. Redd Road intersection. The tributary drainage area is 4.03 square miles, approximately 70% of which is steep, undeveloped mountainous desert terrain of the Franklin Mountains, and the other 30% is mainly residential. Mulberry Dam consists of four separate embankments between natural hills. The combined length of the four embankments is roughly 1,800 feet with the largest of the embankments having a maximum height of 60 feet. The principal outlet of Mulberry Dam is a 14-foot by 14-foot hood inlet structure that flows into a 36-inch RCP which outlets into Borderland Channel. The auxiliary spillway is a 250-foot-wide, 7-foot-deep, broad-crested weir that flows into an earthen bottom trapezoidal channel. The dam was entered into HEC-HMS as a reservoir using the stage-storage-discharge function, assuming the dam is clean and empty at the beginning of the storm event. The outflow of Mulberry Dam will flow into the Borderland Channel connecting it with the Keystone Dam.

Oxidation Dam

Oxidation Dam was not included in the Work Order 3 Dam Analysis Task conducted in October 2007. Oxidation Dam is located southeast of the IH-10 and Sunland Park Drive intersection. Approximately 70% of the watershed is developed as residential and commercial with the rest being the mountainous desert terrain of the Franklin Mountains. The dam consists of a 73-foot high earth embankment structure. The principal outlet is a 14-foot by 15-foot hooded intake structure that flows into a 36-inch RCP which eventually outlets into the Rio Grande. The auxiliary spillway is a 110-foot-wide, 9-foot-deep, broad-crested weir that flows into a natural channel on the south side of the dam. Oxidation Dam was analyzed by creating a stage-storage-discharge Curve using the dam as-builds, survey data, and TxDOT 2004 contours. Oxidation Dam was entered into HEC-HMS as a reservoir using the stage-storage-discharge function, assuming the dam is clean and empty at the beginning of the storm event.

Thorn Dam

Thorn Dam was built by the City of El Paso in 1957, around the same time as Mulberry Dam. It was also enlarged and improved in 1979 by USACE to contain the SPF. It is located just south of Mulberry Dam and east of IH-10. The tributary drainage area is 2.91 square miles and is adjacent to the south side of the Mulberry Dam tributary drainage area. Approximately 50% of the watershed is developed as residential; the rest is the mountainous desert terrain of the Franklin Mountains. Thorn Dam consists of a 39-foot-high earth embankment structure about 3,300 feet in length. The principal outlet is a 13.5-foot by 14.5-foot hooded inlet structure that flows into a 36-inch RCP which outlets just past the downstream toe into a natural channel. The auxiliary spillway is a 200-foot-wide, 7-foot-deep, broad-crested weir. Both the principal outlet and the auxiliary spillway flow into separate natural channels, which converge and flow to the Borderland Diversion Channel, where it flows to the Keystone Dam. Thorn Dam was entered into HEC-HMS as a reservoir using the stage-storage-discharge function, assuming the dam is clean and empty at the beginning of the storm event.

A.7.7 Significant Detention Structures, West Central Region

There are no major detention structures within the West Central Region.

A.8.0 MODELING OF SMALL PONDS

A.8.1 Method Overview

In addition to the significant detention structures described in Section A-7, there are a large number of ponds within each Region that would provide additional storage. For these small ponds, the storage provided was accounted for by a reduction in the SCS Curve Number as described below. The locations of these small ponds are shown on Figure A-33.

The location of each pond was determined in ArcMap, using 2006 Orthophotos for the City of El Paso (City of El Paso, 2006) and a shapefile containing points in the vicinities of ponds created as part of Work Order 1 (URS, 2007). TxDOT topography (TxDOT, 2004) data was used to estimate the volume of each pond.

Using the 100-year precipitation depth from the HEC-HMS model using the initial curve number as calculated in Section A.4.0 the watershed runoff was calculated using the following formulas:

$$Q = \frac{(P - 0.2 * S)^2}{(P + 0.8 * S)} \text{ and } S = \frac{1000}{CN} - 10$$

where:

Q = Calculated runoff (inches)
P = Precipitation (inches)
CN = Curve Number

The runoff depth obtained from the initial HEC-HMS run was then adjusted to account for the storage provided by the small ponds within each watershed. The total depth of storage over the watershed was divided by the watershed area to estimate depth of runoff that would potentially be captured. This number was then subtracted from the depth of runoff obtained from the initial run of the HEC-HMS Model with the unadjusted curve numbers to obtain the depth of runoff that might occur with the pond storage accounted for. The curve numbers were then back-calculated using this modified runoff value per the above equations.

A.8.2 Small Ponds, Central Region

The drainage area named A_Ohio_St_Reservoir_DS had a storage depth for the ponding area in the watershed that was greater than the model runoff depth for that particular drainage area. This condition resulted in a negative value for “Goal” cell (Runoff Minus Storage), causing the script not to function properly. Therefore, a Runoff Minus Storage value of 0 was entered into the spreadsheet and was used as the new “Goal” value to adjust the curve number.

Furthermore, drainage areas A_Fonseca and A_Glenwood Street 48-inch RCP have ponding areas within them which do not have storage-elevation curves. However, these drainage areas were located below IH-10 and were not modeled in the HEC-HMS model, so they did not need curve number adjustments. The adjusted curve numbers for the Central Region are provided in Table A-26 at the end of this Appendix.

A.8.3 Small Ponds, East Side Region

There are 131 small retention/detention basins in the East Side Region and all but 13 of them are within the high Mesa. The 117 retention/detention basins within the high Mesa are basins for individual subdivisions within closed watersheds and were analyzed as sumps that do not contribute any flows from the watersheds. The 13 retention/detention basins located within the escarpment zone were analyzed using as-builts for design capacity and discharge values. These small retention/detention basins did not occupy enough of the total area within their respective watersheds to have an effect on the runoff curve number.

A.8.4 Small Ponds, Mission Valley Region

Curve numbers were adjusted for 14 watersheds in the Mission Valley Region due to the capacity provided by the small ponds not modeled as reservoirs in HEC-HMS. Note that for two of the watersheds (A_Carolina Drive Basin and A_Mesa Drain), the method outlined above was altered slightly due to the total estimated pond storage capacity within the watershed being greater than the estimated model runoff storage required using the unadjusted curve numbers. For these sub-watersheds the curve number was adjusted based from a calculated runoff depth of zero, rather than a negative runoff depth. The adjusted curve numbers for Mission Valley are provided in Table A-27 at the end of this Appendix.

A.8.5 Small Ponds, Northeast Region

Curve numbers were adjusted for 12 watersheds in the Northeast Region due to the capacity provided by the small ponds not modeled as reservoirs in HEC-HMS. The adjusted curve numbers for the Northeast Region are provided in Table A-28 at the end of this Appendix.

A.8.6 Small Ponds, Northwest Region

Curve numbers were adjusted for 13 watersheds in the Northwest area due to the capacity provided by the small ponds not modeled as reservoirs in HEC-HMS. The adjusted curve numbers are provided in Table A-29 at the end of this Appendix. The “Vinton” Channels were not included in this process because the hydrology was completed with the FEMA update and analysis of the FIRMs and FIS for El Paso County.

A.8.7 Small Ponds, West Central Region

Curve numbers were adjusted for one watershed in the West Central Region, due to the capacity provided by the small ponds not modeled as reservoirs in HEC-HMS. The adjusted curve numbers are provided in Table A-30 at the end of this Appendix.

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A.9.0 ESTIMATION OF RAINFALL

Precipitation was initially estimated by assuming an SCS 24-Hour Type II-75 Rainfall Distribution as shown in Table 4-15 of the El Paso DDM (City of El Paso, 2008). Total rainfall depths found in Tables 4-1, 4-2 and 4-3 summarized in Table A-31 at the end of this Appendix of the El Paso DDM were applied to the SCS Type II-75 rainfall distribution in order to develop rain-gauge data to input directly into HEC-HMS. All preliminary hydrologic and hydraulic analysis, as well as associated quality control, was performed utilizing the above precipitation data. During the conceptual design phase and associated reviews, it became evident that the SCS Type II-75 rainfall distribution was not appropriate for the watersheds being analyzed and resulted in higher flows than would likely occur. Precipitation was then estimated utilizing the “Frequency Storm” function in HEC-HMS along with the depth-duration-frequency data located in Tables 4-1 through 4-3 of the El Paso Drainage Criteria Manual. Using this method, the user enters the depth of rainfall that occurs for various durations for a given storm. Additional inputs required include the intensity duration, the storm duration and intensity position. As a result of this modified precipitation model, flows decreased in the study areas and conceptual designs were adjusted as appropriate to accommodate the updated flows.

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A.10.0 ASSEMBLY OF HYDROLOGIC MODELS

A.10.1 Method Overview

Hydrologic models were developed for each of the six study areas. These models contained the following elements representing the major contributing drainage features of the project area:

- Watershed Area;
- Flow Diversion;
- Junction;
- Routing Reach; and
- Dam/Basin/Sump.

The Northeast, Northwest, West Central, and East Side Regions are independent and do not receive inflow from any other watersheds. The Central Region receives inflow from the Northeast Region as a source. Similarly, the Mission Valley Region receives input from the East Side Region. The specific approaches and assumptions used to model the various elements can be found in the individual study area descriptions.

A.10.2 Hydrologic Model, Central Region

The Central Region was modeled as three basins in HEC-HMS and is shown on Figures A-34 through A-41 at the end of this Appendix. The three systems are the Cebada, Government Hills, and Dallas Systems. The figures illustrate the HEC-HMS layout of the systems and show all drainage areas, reaches, junctions, diversions, sources, and reservoirs input into HEC-HMS. Additionally, tables are provided listing model elements and 100-year flow results.

Cebada System

The Cebada System consists of twenty-one different drainage areas, one diversion, eight junctions, twelve reaches, and twelve dams or reservoirs. The dams and reservoirs in this system include Altura Avenue Dam, Cebada Reservoir, Fort Blvd Reservoir, Lower Kentucky Dam, Upper Kentucky Dam, Lower Louisiana Drive Dam, Magnolia Reservoir, Lower Memphis Dam, Ohio Street Reservoir, San Diego Dam, Scenic Drive Dam, and Tremont Reservoir.

The diversion in this system is located just north of Houston Elementary School and is labeled D_Houston_Elementary. Street drainage inlets capture flow from north of the school and direct it towards Magnolia Reservoir. The maximum capacity of the storm sewer system is 250 cfs after that capacity is reached, the excess flow is diverted south, towards the Cebada Reservoir.

The outflow from Fort Blvd Reservoir is routed to Copia Ditch through the streets and eventually enters the Cebada Drainage Outfall, south of Memorial Park. The conduit conveys flow beneath the Cebada Reservoir and into the Cebada Reservoir Outfall Junction.

Dallas System

The Dallas System includes flow directed towards the reservoir located at the intersection of Cotton Street, Dallas Street, and IH-10 (S_Dallas_Reservoir). The HEC-HMS model for this system includes five drainage areas, two diversions, five junctions, three reaches, and four dams or reservoirs. The dams and reservoirs included in this basin model are Dallas Reservoir, Dam No. 8, Dam No. 9, and Dam No. 10.

The Campbell Reservoir, located on the western edge of the Central Region was not incorporated into the HEC-HMS model because it was assumed that Campbell Reservoir would be able to retain all inflow and not release into the Cebada System during the storm event.

The 3708 Diversion was used to divert street drainage which can no longer enter the drainage inlets at the curbs of the streets once the water elevation in the Dallas Reservoir reaches an elevation of 3,708 feet. At this elevation, the reservoir is discharging at a maximum capacity of 530 cfs. The excess street flow is diverted south of IH-10, via Cotton Street, and begins to pool next to the railroad tracks. The destination of this diverted flow is defined as the junction, J_Overflow_3708.

The Dallas Reservoir includes an east and a west reservoir, which are connected and fill up simultaneously, but direct flows into two different storm sewer systems. The east and west storm conduits receiving flow from the Dallas Reservoir are represented by the Diversion Junction and the Dallas West Junction, respectively, in the HEC-HMS model.

Another diversion (D_IH_10_Dallas) is used to distinguish how much outflow leaves the eastern side of the Dallas Reservoir and how much exits from the western side. Flows entering the reservoir are diverted to either the west or the east outlet conduits depending on the elevation of the overall reservoir. The conduit on the west begins to discharge once the water level in the entire Dallas Reservoir reaches an elevation of 3,700 feet. Once the water level reaches an elevation of 3,702 feet, the eastern reservoir begins to discharge.

Government Hills System

The Government Hills System consists of eighteen drainage areas, one diversion, eight junctions, thirteen reaches, ten dams or reservoirs, and one source. The source included is a discharge gauge from the Northeast Region, which conveys flow from Fort Bliss Sump into Pershing Dam. This discharge information was obtained from the output of the Northeast Region’s HEC-HMS model. The diversion used in this system is the Boon Street Basin, which conveys flow into the Government Hill Outlet Conduit until the capacity of the conduit (375 cfs) is reached. Then the excess flow is diverted into the Upper Durazno Basin through an arch-shaped culvert located at a higher elevation than the Government Hill Outlet Conduit. The Upper Durazno Basin drains into the Lower Durazno Basin through two 10-foot by 10-foot box culverts. The Lower Durazno Basin outflows south of IH-10 through a drop spillway and an auxiliary spillway, into a junction labeled J_Lower Durazno_Out on the HEC-HMS model.

The Government Hills System was the only basin model which includes drainage areas south of IH-10. However, only the drainage areas which contribute to flow from the Government Hill Outlet Conduit (A_Concordia_Cemetery and A_Hardesty_to_Shelter) were modeled below IH-10. The Government Hill Outlet Conduit eventually discharges into the Rio Grande, which is symbolized by the junction, J_Gov_Hills_Outfall in the HEC-HMS model.

A.10.3 Hydrologic Model, East Side Region

The East Side Region drainage systems are characterized by three different drainage patterns and land types. The drainage patterns for the East Side Region are very different from those of the rest of the City. They are characterized by the high mesa, the escarpment zone, and the IH-10 corridor. For a majority of the watersheds in the East Side Region, the Work Order 1 watersheds were modified for the drainage characteristics most abundant in the East Side Region, the high Mesa.

The high Mesa is a relatively flat area that consists of many closed drainage systems. These closed systems contain flows that fall within them and percolate into the groundwater system. Most of the flow in this area is routed through the streets into retention basins. The older developments in the area typically have one large retention basin to capture all the flow for a large area. When the area is too large and flow has a long distance to travel over flat terrain, it quickly becomes a problem within the streets. This is typical of the high Mesa west of George Dieter Drive to Central El Paso. East of George Dieter Drive, newer developments have been required to retain the developed flows. This has alleviated flooding of the streets.

The escarpment zone is the area where the terrain steepens and falls away from the high Mesa. The increase in slope causes an increase in velocity; the risk for erosion and flood damage caused by fast moving water also increases. This is the area most likely to see erosion and sediment transport problems.

At about midway down the escarpment zone IH-10 was constructed. IH-10 acts as a drainage barrier for the flows coming down the escarpment zone. This is where the amount of impervious area is in the highest concentration due to the large volume of commercial and industrial sites adjacent to IH-10. In interviews with TxDOT and the City of El Paso, it has been reported that there are many problem areas along the IH-10 Corridor as well as complaints from the public and commercial owners. These areas include the IH-10 corridor intersections from the McRae Boulevard to south of Loop 375.

The East Side Region was modeled as six basins in HEC-HMS and is shown on Figures A-42 through A-45 at the end of this Appendix. These systems include the Phelps Dodge System, Lomaland Basin System, Americas Basin System, Americas Ten Basin System, Carolina Dam Basin System, and the Mesa Drain Downstream System.

Phelps Dodge System

The Phelps Dodge System is characterized with all three of the different zones within the East Side Region: the high Mesa zone, escarpment zone, and IH-10 Corridor. HEC-HMS was used to calculate the peak flows for areas within the high Mesa that are closed basins. This flow was not routed to any structures or to any other watersheds. It was only used to get a peak intensity and volume for each basin. The basins with large localized flooding areas were broken down further to isolate the localized flooding problem areas and potential improvement projects, as requested by EPWU.

The escarpment zone and IH-10 Corridor within the Phelps Dodge System has previously been studied by TxDOT. The flows from the North Loop Drainage Study will be referenced and used with permission from TxDOT in conjunction with the EPWU for this master plan.

Lomaland Basin System

The Lomaland Basin System contains all three zones and is just east of the Phelps Dodge System. HEC-HMS was used to calculate the peak flows for areas within the high Mesa that are closed basins. This flow was not routed to any structures or to any other watersheds. It was only used to get a peak intensity and volume for each basin. The basins with large localized flooding areas were broken down further to isolate the localized flooding problem areas and potential improvement projects, as requested by EPWU, for this master plan.

The escarpment zone in the Lomaland Basin System was analyzed and peak flows are routed under IH-10. There are areas that have localized flooding issues because of the slopes and drainage structures that were not designed for the amount of flow they are receiving. Improvements have been constructed near Lee Trevino Drive and Jesuit Basin to improve the drainage there. Even with the newly implemented improvements, drainage impacts still exist at Lee Trevino Drive and James Watt Drive. There are more drainage impacts as flow travels down Lee Trevino Drive, between Rojas Drive and James Watt Drive, that will be analyzed with greater detail as requested by EPWU. IH-10 and the frontage roads experience localized flooding at Lee Trevino Drive because of flows routed to, and accumulating around crossings, flooding streets, and local businesses.

Americas Basin System and Americas Ten Basin System

The Americas Basin System and the Americas Ten Basin System include all three drainage zones but have a large number of retention ponds built into the urban infrastructure. In the high Mesa, the ponds are numerous and handle flows from the development without any major drainage problems reported. This however, is not the case within the escarpment zone.

The escarpment zone within the Americas Basin System and Americas Ten Basin System has several areas that have frequent flooding. The flows in this area were analyzed using HEC-HMS and routing basins into the large channels and through the IH-10 Corridor. There are three large channels in this area: the Bluff Channel, the RV Channel, and the Mercantile Channel. The Bluff Channel has a large area contributing flows with high velocities. Some of the flows upstream of the Bluff Channel are being impeded and thus cause flooding before entering the channel. These are potential areas for drainage improvements. These areas will be further analyzed as requested by EPWU.

The RV Channel and the Mercantile Channel are large channels that receive flows from large areas upstream beginning in the high Mesa and travel relatively long distances through the escarpment areas increasing in velocity and volume. This large amount of water, traveling at a high rate of speed, causes erosion problems downstream. These are potential areas for drainage improvements to reduce the energy within the flow paths.

Carolina Dam Basin

The IH-10 Corridor, for these two basin systems, was previously studied by TxDOT. The flows from the study *Drainage Study and Report (Existing Conditions) for Interstate Highway 10* (MCi, February 2008) will be referenced in our report with permission from TxDOT in conjunction with EPWU.

The Carolina Dam Basin System starts just north of the IH-10 Corridor within the escarpment area. HEC-HMS was used to analyze the amount of flow from this watershed that enters the Lafayette Draw Channel. This channel crosses under IH-10 into Mission Valley Region.

Mesa Drain Downstream System

The Mesa Drain Downstream System starts within the escarpment zone north of IH-10 and is mostly contained on the south side of IH-10 within Mission Valley Region. HEC-HMS was used to analyze approximately 750 acres contributing flows under IH-10 into Mission Valley Region.

A.10.4 Hydrologic Model, Mission Valley Region

The Mission Valley Region was modeled as one basin model in HEC-HMS and is shown on Figures A-46 and A-47 at the end of this Appendix. These figures illustrate the HEC-HMS layout of the system and show all drainage areas, reaches, junctions, diversions, sources, and reservoirs input into HEC-HMS. Additionally, tables are provided listing model elements and 100-year flow results. The Mission Valley system consists of thirty different drainage areas, nineteen junctions, twenty-seven reaches, nine dams or basins, four diversions, and nine source inputs. The basins included in the system are Americas Basin System, Americas Ten Basin System, Basin A, Basin G, Carolina Drive Basin, Feather Lake Basin, Lomaland Basin System, North Loop Detention Basin, and Phelps Dodge System.

Lincoln drain, residing in the northwestern region of Mission Valley, receives a source input flow from the Central Region. All eight other source inputs to Mission Valley are from the East Side Region above IH-10. Note that the source inputs from the East Side Region were not routed to the various downstream dams, but were rather input directly to the corresponding downstream dam. This was done for model simplification, as the purpose of the Mission Valley Model was to focus on the main drains (Mesa, Middle, Franklin, and Playa Drains), the Interceptor System, and Basin G. This simplification provides a more conservative estimate of flow into the dams since routing often attenuates the peak flow.

Other modeling points of interest include the configuration of Basin A. At the junction of Basin A with Playa Drain, there is a 42-inch culvert along Playa Drain in the direction of flow. Flow is diverted into the Playa Drain 42-inch culvert based on the water surface elevation of the upstream channel while the remaining flow gets directed into Basin A. Basin A was modeled as having two outlets and three pumps. The pumps' intake elevation is at 3,675 feet and the discharge elevation is at 3,675 feet. The first pumps turns on at an elevation of 3,681 feet and shuts off at 3,680 feet. Pump two starts pumping at an elevation of 3,681.5 feet and shuts off at 3,680.5 feet. The third pump turns on at 3,682 feet and shuts off at 3,681 feet.

Three other diversions exist at the junction of Mesa Drain and the Mesa Drain Interceptor: the Middle Drain and Middle Drain interceptor, and at the Playa Drain and Franklin Spur Drain. These first two diversions (Mesa and Middle) are currently place holders to indicate the presence of the 36-inch gated culvert that exists at each of those areas. Since the gates are not to be used as a stormwater control option for the City of El Paso, the gates were assumed closed, meaning all flow transitions to the corresponding interceptor drain (i.e. Mesa Drain to the Mesa Drain Interceptor and Middle Drain to the Middle Drain Interceptor). The "diverted flow," or flow through the gate, was set to zero. The diversion at the Playa Drain and Franklin Spur Drain is also used as a place holder. This diversion is a situation where the slope back to Basin G is negative. Therefore, the main flow continues down the Franklin Spur Drain from the Playa Drain, while no flow is diverted off towards Basin G.

A.10.5 Hydrologic Model, Northeast Region

The Northeast Region was modeled as one basin model in HEC-HMS and is shown on Figures A-48 and A-49 at the end of this Appendix. These figures illustrate the HEC-HMS layout of the system and show all drainage areas, reaches, junctions, diversions, sources, and reservoirs input into HEC-HMS. The Northeast Region consists of fifty-one different drainage areas, thirty-four junctions, twenty-six reaches, nineteen dams or sinks, and five diversions. A model for this region was generated previously as part of the *Drainage On-Call Services: Dam Analysis Report* and served as the basis for the model utilized in this analysis.

The dams included in the Northeast Region area are described in Section A.7.0. The Northeast Region is divided into three drainage systems including the Northeast Ponding System, the Range Dam System, and the Fort Bliss Sump System. A schematic illustrating the HEC-HMS model schematic and tables listing model elements and 100-year flows are provided on Figures A-48 and A-49.

The Northeast Ponding System is the most upstream system and includes the Northhills Dams, the TxDOT Pond, and Northeast Ponding Area. Outflow from the Northhills dams is routed through the Western Freeway Channel, to the Green Belt Levee System, and into the Northeast Ponding Inner Pond. Flows are also routed to the Northeast Inner Pond via Northeast Channels One and Two. The Northeast Ponding Area is modeled in HEC-HMS such that if the storage capacity of the sump is reached, flow would begin contributing to the Fort Bliss Sump System. In the conditions modeled, the Northeast Ponding system does not contribute flow to the southern systems.

The Range Dam System includes Range Dam, Fusselman Dam, and Northgate Dam. Outflow from Fusselman Dam is routed via a natural arroyo to Northgate Dam. Also contributing to Northgate Dam are the Northgate Interceptor Channel and the Northgate Diversion Channel. Outflow from Northgate Dam is routed downstream to Range Dam. Range Dam receives additional flow from its own tributary watershed, as well as the Electric Ditch Diversion Channel.

Outflow from Range Dam enters the Fort Bliss Sump System and is connected downstream to a diversion in order to model the separate flowpaths of the principal and auxiliary spillways. Flow is directed through the principal spillway until the elevation reaches the auxiliary spillway at which point flow is also conveyed through the auxiliary spillway according to the stage-storage-discharge curves generated as part of the *Dam Analysis Report.* Outflow from the auxiliary spillway is routed to Range Basin and outflow from the principal spillway is routed to Range Dam Outlet Channel, which is also called Army Ditch. All outflow from Range Dam is then routed to the Threadgill or Tobin Drain and eventually makes its way down to the Fort Bliss Sump. Fort Bliss Sump receives additional flow from Mountain Park and Sunrise Dam, Keltner Dam, and Hondo Pass Basin, Sunrise Basin and Amber Basin. Outflow from Mountain Park and Sunrise

Dam is conveyed via the Fort Bliss Diversion Channel to Diana Ditch and into Fort Bliss Sump. Outflow from Kelter Dam is routed overland directly to Fort Bliss Sump, and outflow from the small basins included in this system is routed via Sunrise Channel to Fort Bliss Sump. Other channels with hydrologic watersheds analyzed include Johnson Channel, Railroad Drive Channel, and Clearview (a.k.a. Bossworth) Channel. Once in Forth Bliss Sump, a diversion is used to convey flow into the sump until the maximum storage available is reached, and then direct flow into the outer sump area surrounding the sump itself. This diversion was necessary to model the PMF conditions, which was the goal of the *Dam Analysis Report*. However, in the conditions modeled for this study, the capacity of Fort Bliss Sump is sufficient and flow does not enter the outer sump. The only outflow from Fort Bliss Sump is through the Fort Bliss Outlet Conduit.

A.10.6 Hydrologic Model, Northwest Region

The Hydrologic Model for the Northwest Region was assembled in HEC-HMS Version 3.2, using the method described above. The schematics of the HEC-HMS model are provided on Figures A-50 through A-55 at the end of this Appendix. Specific assumptions that were made while assembling the HEC-HMS model are mentioned below with explanations.

Resler Channel is located south of Transmountain Road and north of Artcraft Road. It begins in the Franklin Mountains and terminates at its confluence with Flow Path 38. After the channel exits the foothills it splits into two separate channels; Resler Channel continues in a southwesterly direction and Flow Path 39A goes slightly northwest. As it is not really known which path the runoff will take, and it probably varies from year to year, it was decided to route 100% of the flow from the upstream watershed through both the downstream channels.

Flow Number 39A has a similar situation between Northwestern Drive and Resler Drive. The natural channel flows in a northwesterly direction until it reaches an earthen diversion berm east of the commercial development along Northwestern Drive, where it is redirected almost 90 degrees to the north. The berm has been blown out during previous major storm events. Therefore it was decided to model the flow going through both the diversion channel and the flow path taken if the barrier is blown out.

The “Vinton” Channels were not included in the hydrologic modeling, because the hydrology was completed with the FEMA update and analysis of the FIRMs and FIS for El Paso County.

A.10.7 Hydrologic Model, West Central Region

The Hydrologic Model for the West Central Region was assembled using the method described above. The schematics of the HEC-HMS model are provided on Figure A-56 at the end of this Appendix.

A.11.0 MODEL RESULTS

Model results for each of the six regions studied can be found in Tables A-32 through A-37 located at the end of this Appendix. Figure numbers for the corresponding HEC-HMS schematics and element tables are provided as well.

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TABLES

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Table A-1. Data Sources Utilized in Hydrologic Analysis

Source	Used For
Ashley G. Classen & Associates Consulting Engineers, 1948. Drainage Control Works.	Significant Detention Structures
Brock & Bustillos, Inc., 2007. Cebada & IH-10 Preliminary Master Study.	Watershed Delineation
City of El Paso, 2008. *El Paso Drainage Design Manual (DDM).*	Precipitation
City of El Paso, 2006. Orthophotography.	Watershed Delineation Curve Number Lag Time
City of El Paso, 1987. Engineering Department Flood Control System, Base Map Series.	Watershed Delineation
El Paso Water Utilities (EPWU), 2008. Drainage Shapefile (Incomplete)	Routing
ESRI ArcView, Version 9.2	All Parameters
Moreno Cardenas Inc. (MCi), February 2008. Drainage Study and Report (Existing Conditions) for Interstate Highway 10.	
MCi, 2007. Northloop Study.	Watershed Delineation
MCi, 2007. Dallas St. Pump and Drainage System, Preliminary Engineering Report.	Watershed Delineation
Texas Department of Transportation (TxDOT), 2007. Plans of Proposed Highway Routine Maintenance Contract.	Significant Detention Structures
TxDOT, 2005. FM 3255 (MLK JR BLVD), Plans for Proposed State Highway Improvement.	Significant Detention Structures
TxDOT, 2004. Topography. El Paso Office.	Watershed Delineation Lag Time
United States Army Corp of Engineers (USACE), HEC-HMS, V. 3.1.0.	HEC-HMS
USACE, March 2000. HEC-HMS Technical Reference Manual.	HEC-HMS
USACE, February 1978. Report on Hydrologic Investigations Flood Insurance Study-Northeast and Central El Paso, Texas. Albuquerque District.	Lag Times
United States Department of Agriculture (USDA), June 1986. Soil Conservation Service, Engineering Division, Technical Release 55 (TR-55). *Urban Hydrology for Small Watersheds.*	Curve Number
USDA National Resource Conservation Commission (NRCS), 2004. Soil Survey Geographic Database (SSURGO) Soil Data for El Paso County, Texas.	Curve Number
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Table A-2. Hydrologic Soil Groups in the El Paso Region

EL PASO HYDROLOGIC SOIL GROUPS		
Soil Type	**Soil Abbreviation**	**HSG**
Hueco-Wink association, hummocky	HW	C
Anapra silty clay loam	An	B
Brazito loamy fine sand	Br	A
Gila fine sandy loam	Ga	B
Gila loam	Gc	B
Glendale loam	Gd	B
Glendale silty clay loam	Ge	B
Glendale silty clay	Gs	B
Harkey loam	Ha	B
Harkey silty clay loam	Hk	B
Made land, gila soil material	Mg	B
Saneli silty clay loam	Sa	D
Saneli silty clay	Sc	D
Tigua silty clay	Tg	D
Vinton fine sandy loam	Vn	B
Turney-Berino association, undulating	TBB	B
Agustin association, undulating	AGB	B
Badlands	BA	D
Bluepoint association, rolling	BPC	A
Bluepoint gravelly association, rolling	BUC	A
Delnorte-Canutio association, undulating	DCB	D
Delnorte-Canutio association hilly	DCD	D
Dune land	DU	A
Igneous rock land	IG	D
Igneous rockland-Brewster association	IN	D
Rock outcrop-Lozier association	LM	D
Lozier association, hilly	LOD	D
Mimbres association, level	MBA	B
Pajarito association, level	PAA	B
Simona association, undulating	SMB	D
Wink association, level	WKA	B
Water	W	W
Urban land, sanitary landfill	SLF	SINK
Pits, gravel	GP	SINK

Table A-3. Runoff Curve Numbers for Urban Areas

Hydrologic Soil Group		A	B	C	D
Open Space	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Commercial and Business	NA	89	92	94	95
Industrial	NA	81	88	91	93
Residential (1/8 acre or less)	NA	77	85	90	92
Residential (1/4 acre)	NA	61	75	83	87
Residential (1/2 acre)	NA	54	70	80	85
Residential (1 acre)	NA	51	68	79	84
Newly graded areas	NA	77	86	91	94
Highway	NA	98	98	98	98

Table A-4. Runoff Curve Numbers for Arid and Semi Arid Rangelands

Hydrologic Soil Group		A	B	C	D
Herbaceous	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sage-grass	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert Shrub	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

Table A-5. Land Use Categories for Urban Areas

Land Use Description	Hydrologic Condition	Land Use ID
Open Space (lawns, parks, golf courses, cemeteries)	Poor (grass cover <50%)	1
	Fair (grass cover 50% to 75%)	2
	Good (grass cover >75%)	3
Commercial and Business	NA	10
Industrial	NA	20
Residential (1/8 acre or less, townhouses)	NA	30
Residential (1/4 acre)	NA	31
Residential (1 acre)	NA	33
Residential (2 acres)	NA	34
Newly graded areas (no vegetation, pervious area only)	NA	40
Highway	NA	99

Table A-6. Land Use Categories for Rural Areas

Land Use Cover Type	Hydrologic Condition	Land Use ID
Herbaceous: mixture of grass, weeds, and low-growing brush, with brush the minor element	Poor	50
	Fair	51
	Good	52
Oak-aspen: mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush	Poor	60
	Fair	61
	Good	62
Pinyon-juniper: pinyon, juniper, or both: grass understory	Poor	70
	Fair	71
	Good	72
Sagebrush with grass understory	Poor	80
	Fair	81
	Good	82
Desert shrub: major plants include saltbush, greasewood, creosote brush, black brush, bursage, palo verde, mesquite, and cactus	Poor	90
	Fair	91
	Good	92

Table A-7. Curve Number Summary for the Central Region

CENTRAL REGION - CURVE NUMBER SUMMARY		
Watershed Name and HEC-HMS ID	**Watershed Area (mi^2)**	**Weighted Curve Number**
A_Alameda Avenue	0.30	83
A_Altura_Ave_Dam	0.12	84
A_Blanco Avenue	0.09	90
A_Boone_St_Basin	0.40	83
A_Border_Hwy_Overpass	0.37	92
A_Cebada Drainage Outfall	0.27	84
A_Cebada_Reservoir	0.70	86
A_Cemex_Spillway	0.92	89
A_Channel 108 Discharge	0.03	86
A_Comanche Avenue	0.14	85
A_Concordia_Cemetery	0.31	84
A_Copia_Ditch_DS	0.16	92
A_Copia_Ditch_US	0.41	91
A_Cotton_Dallas_DS	0.37	92
A_Cotton_Dallas_US	1.05	91
A_Dallas, San Antonio and Lee	0.18	91
A_Dam_No_10	0.07	88
A_Dam_No_8	0.05	85
A_Dam_No_9	0.03	89
A_Delta Drive	0.08	82
A_El Paso Paisano to Ninth Outfall	0.16	92
A_Eucalyptus_to_Cebada	0.23	94
A_Fonseca	0.26	82
A_Fort_Blvd_Reservoir	0.22	84
A_Franklin_Campbell	0.26	94
A_Glenwood Street	0.06	75
A_Hardesty to Shelter	0.02	88
A_Hills Delta to Ninth	0.09	87
A_Houston_Elementary	0.50	91
A_Kentucky_Dam_Lower	0.12	85
A_Kentucky_Dam_Upper	0.06	87
A_Louisiana_Dr_Dam_Lower	0.05	89
A_Louisiana_Dr_Dam_Upper	0.14	85
A_Lower_Durazno	1.04	71
A_Magnolia_Reservoir	0.09	67
A_McKelligon_Dam	2.17	86
A_McKelligon_Reservoir_A	0.04	87
A_McKelligon_Reservoir_B	0.10	87
A_McKelligon_Reservoir_C	0.01	84
A_McKelligon_Reservoir_D	0.01	93
A_Memorial_Park	0.15	90

Table A-7. Curve Number Summary for the Central Region (Continued)

CENTRAL REGION - CURVE NUMBER SUMMARY		
Watershed Name and HEC-HMS ID	**Watershed Area (mi^2)**	**Weighted Curve Number**
A_Memphis_Dam_Lower	0.01	84
A_Memphis_Dam_Upper	0.25	84
A_Modesto Ditch	0.12	82
A_Mountain_Ave_Outlet_Conduit	0.88	91
A_Nixson Cypress to Central	0.05	87
A_Noble Myrtle to San Antonio	0.03	91
A_Octavia Texas to Magoffin	0.07	92
A_Ohio_St_Reservoir_DS	0.00	89
A_Ohio_St_Reservoir_US	0.01	88
A_Olive & Cebada takes flow ponds at IH-10	0.46	90
A_Overland Mesa to El Paso	0.01	92
A_Paisano and Delta Stanton to Tays	0.20	91
A_Paisano Ditch	0.22	83
A_Paisano San Francisco to El Paso	0.15	91
A_Pera to Cebada	0.23	91
A_Pershing_Dam	0.19	81
A_Pollard_Ditch	0.11	93
A_Pollard_Sacramento	0.02	92
A_Robert Alva Channel	0.44	78
A_Russel_Ditch_DS	0.12	91
A_Russel_Ditch_US	0.43	92
A_San Antonio Hills to Lee	0.15	89
A_San Antonio Mesa to El Paso	0.08	93
A_San_Diego_Dam	0.12	85
A_Scenic_Dr_Dam	0.13	84
A_Seventh and Hills Park to Ninth	0.34	89
A_Seventh Chihuahuita to St Vrain East	0.15	90
A_Seventh Chihuahuita to St Vrain West	0.07	89
A_Tremont_Reservoir	0.01	90
A_Upper_Durazno	0.02	79
A_Van_Buren_Dam	0.28	91
A_Van_Buren_Ditch	0.12	87

Table A-8. Curve Number Summary for the East Side Region

EAST SIDE REGION - CURVE NUMBER SUMMARY		
Watershed Name and HEC-HMS ID	Watershed Area (mi^2)	Weighted Curve Number
A_PHELPSDODGE-1	0.038	84
A_PHELPSDODGE-2	0.149	94
A_PHELPSDODGE-3	0.093	83
A_PHELPSDODGE-4	0.037	76
A_PHELPSDODGE-5	0.082	85
A_PHELPSDODGE-6	0.133	82
A_PHELPSDODGE-7	0.047	82
A_PHELPSDODGE-8	4.475	81
A_PHELPSDODGE-9	6.086	81
A_PHELPSDODGE-10	1.915	81
A_Lomaland-1	0.038	83
A_Lomaland-2	0.206	74
A_Lomaland-3	0.035	75
A_Lomaland-4	0.107	83
A_Lomaland-5	0.055	84
A_Lomaland-6	0.082	84
A_Lomaland-7	0.456	83
A_Lomaland-8	0.053	70
A_Lomaland-9	0.080	77
A_Lomaland-10	0.034	88
A_Americas-1	0.176	82
A_Americas-2	0.819	82
A_Americas-3	0.174	83
A_Americas-4	0.016	82
A_Americas-5	0.096	85
A_Americas-6	0.144	61
A_Americas-7	0.016	65
A_Americas-8	0.052	80
A_Americas-9	0.157	70
A_Americas-10	0.032	79
A_Americas-11	0.086	69
A_Americas-12	0.047	82
A_AmTen-1	0.075	84
A_AmTen-2	0.307	87
A_AmTen-3	0.095	83
A_AmTen-4	0.502	85
A_AmTen-5	0.064	84
A_AmTen-6	1.503	82
A_AmTen-7	2.317	82

Table A-8. Curve Number Summary for the East Side Region (Continued)

EAST SIDE REGION - CURVE NUMBER SUMMARY		
Watershed Name and HEC-HMS ID	Watershed Area (mi^2)	Weighted Curve Number
A_CarolinaDam-1	0.354	65
A_MesaDrain-1	0.097	68
A_MesaDrain-3	0.202	89
A_Sunmount	0.029	82
A_MesaDrain_UP	0.022	87
A_RLH_2	0.013	78
A_Lomaland_4a	0.010	83
A_CarolinaDam-2	0.102	89
A_LOMALAND_8A	0.036	77
A_MesaDrain_2	0.100	75
A_MesaDrain_4	0.072	76
A_PhelpsDodge_1a	0.016	88

Table A-9. Curve Number Summary for the Mission Valley Region

MISSION VALLEY REGION - CURVE NUMBER SUMMARY		
Watershed Name and HEC-HMS ID	**Watershed Area (mi^2)**	**Weighted Curve Number**
A_Americas Basin	0.50	71
A_Americas Ten Basin	0.26	56
A_Americas Ten NonContribute	0.09	50
A_Basin A	1.42	75
A_Basin G	0.36	87
A_Below Basin G to Cty Limit	1.88	80
A_Below Carolina Dam	1.02	76
A_Below Featherlake Basin	0.15	69
A_Below Phelps Dodge Basin	1.39	49
A_Carolina Drive Basin	0.29	38
A_Feather Lake Basin	0.70	44
A_Franklin Drain A	0.67	86
A_Franklin Drain B	0.91	81
A_Franklin Drn to City Limit	2.88	76
A_Franklin Spur Drain	0.11	80
A_Lincoln Drain	2.33	78
A_Lomaland Basin	0.66	62
A_Mesa Drain A	0.66	38
A_Mesa Drain B	0.74	63
A_Mesa Drain C	3.18	58
A_Mesa Drain to City Limit	0.80	72
A_Middle Drain A	4.31	69
A_Middle Drain B	0.12	88
A_Middle Drain Spur A	0.05	85
A_Middle Drain Spur B	0.07	87
A_Middle to City Limit	1.01	80
A_North Loop Detention Basin	1.13	44
A_Phelps Dodge Basin	1.08	72
A_Playa Drain A	0.57	79
A_Playa Drain B	5.84	70

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Table A-10. Curve Number Summary for the Northeast Region

NORTHEAST REGION - CURVE NUMBER SUMMARY		
Watershed Name and HEC-HMS ID	**Watershed Area (mi^2)**	**Weighted Curve Number**
A_Amber Basin	0.25	87
A_Army Ditch	0.42	82
A_Bossworth Ch D/S	0.12	87
A_Bossworth Ch U/S	0.42	86
A_Diana Ditch D/S	1.86	83
A_Diana Ditch U/S Sunrise Ch	0.96	83
A_E Fwy Ch	1.67	72
A_Electric Ditch	0.63	82
A_Fairbanks Drive	1.11	81
A_Fort Bliss Diversion Ch	0.17	88
A_Ft Bliss Diversion Channel D/S	24.62	83
A_Ft Bliss Diversion Channel U/S	0.15	86
A_Fusselman Dam	3.37	83
A_Green Belt Levee D/S	0.97	76
A_Green Belt Levee U/S	14.30	78
A_Hondo Pass Basin	0.08	87
A_Hondo Pass Ch	0.05	84
A_Johnson Ch	0.08	91
A_Keltner Dam	0.49	87
A_Mtn Park Dam	0.81	86
A_NE Pond Outer	3.20	81
A_NE Ponding	3.13	75
A_Northgate Dam	1.47	77
A_Northgate Div Ch	1.29	85
A_Northgate Int Ch	0.60	66
A_Northgate Out Ch	0.47	73
A_Northhills Dam N	2.45	84
A_Northhills Dam S	3.09	85
A_PSB Ch 1 D/S	0.46	83
A_PSB Ch 1 U/S Fannin Elem	1.80	81
A_PSB Ch 1 U/S Gateway	0.24	79
A_PSB Ch 1 U/S PSB 2 Jct	0.70	81
A_PSB Ch 2 D/S	0.99	76
A_PSB Ch 2 U/S Gateway	1.37	79
A_PSB Ch 2 U/S Rushing	0.80	75
A_Railroad Drain D/S	0.05	61
A_Railroad Drain U/S Statler Ditch	0.15	73
A_Railroad Drain U/S Tobin Drain	9.88	78
A_Range Basin	0.39	78
A_Range Dam	2.21	81
A_Statler Ditch	0.45	77

Table A-10. Curve Number Summary for the Northeast Region (Continued)

NORTHEAST REGION - CURVE NUMBER SUMMARY		
Watershed Name and HEC-HMS ID	**Watershed Area (mi^2)**	**Weighted Curve Number**
A_Sunrise Basin	0.14	87
A_Sunrise Ch	0.32	85
A_Sunrise Dam	0.50	86
A_Tobin Drain U/S Army Ditch	0.50	85
A_Tobin Drain U/S Irvin High	2.19	80
A_Tobin Drain U/S RR Drain	0.50	76
A_TXDOT Pond	0.61	80
A_W Fwy Ch D/S	1.34	72
A_W Fwy Ch U/S	1.03	76
A_War Road Ch	0.52	76

Table A-11. Curve Number Summary for the Northwest Region

NORTHWEST REGION - CURVE NUMBER SUMMARY		
Watershed Name and HEC-HMS ID	**Watershed Area (mi^2)**	**Weighted Curve Number**
Arroyo 1A (A1A)	1.04	84
Arroyo 4 (A4_1)	0.97	89
Arroyo 5 (A5_1)	0.79	87
Bandolero Channel_1 (BC_1)	0.38	86
Bandolero Channel_2 (BC_2)	0.86	87
Belvidere Channel (BDC_1)	0.99	88
Borderland Channel_1 (BLC_1)	0.21	92
Borderland Channel_2 (BLC_2)	0.23	82
Borderland Channel_3 (BLC_3)	0.30	71
Borderland Heights Ponds (BHP)	0.45	70
Buena Vista Channel_1 (BVC_1)	0.02	87
Buena Vista Channel_2 (BVC_2)	0.71	87
Coronado Channel (CC_1)	0.16	91
Doniphan Ditch_1 (DD_1)	1.53	81
Doniphan Ditch_3 (DD_3)	0.16	86
Easy Channel (EC_1)	0.13	60
Flow Path Number 38_1 (FPN38_1)	0.50	84
Flow Path Number 38_3 (FPN38_3)	0.27	87
Flow Path Number 38_4 (FPN38_4)	1.49	85
Flow Path Number 38A (FPN38A)	1.72	84
Flow Path Number 38B (FPN38B)	0.67	86
Flow Path Number 39A_1 (FPN39A_1)	0.06	91
Flow Path Number 39A_2 (FPN39A_2)	0.69	85
Flow Path Number 40_1 (FPN40_1)	0.14	93
Flow Path Number 40_2 (FPN40_2)	0.21	85
Flow Path Number 40_3 (FPN40_3)	2.63	84
Flow Path Number 41_1 (FPN41_1)	0.13	85
Flow Path Number 41_2 (FPN41_2)	1.83	84
Flow Path Number 41A (FPN41A)	1.87	84
Flow Path Number 42 (FPN42)	1.20	84
Flow Path Number 42 Trib 1_1 (FPN42T1_1)	0.11	84
Flow Path Number 42 Trib 1_2	0.44	84
Flow Path Number 42A (FPN42A)	0.11	84
Flow Path Number 43 (FPN43)	1.12	84
Granero Channel (GC_1)	0.34	87
High Ridge_1 (HR_1)	0.54	87
High Ridge_2 (HR_2)	0.39	86
High Ridge_3 (HR_3)	0.29	84
Highway Diversion Channel (HDC)	0.99	88
Keystone Dam (KD1)	0.14	77
Mace (Arroyo 1) (M1 (A1_2))	0.16	74

Table A-11. Curve Number Summary for the Northwest Region (Continued)

NORTHWEST REGION - CURVE NUMBER SUMMARY		
Watershed Name and HEC-HMS ID	**Watershed Area (mi^2)**	**Weighted Curve Number**
Mesa Dam (MeD1)	0.31	83
Mesa Dam Outlet (MDO_1)	0.04	83
Mesa Hills Channel (MHC_2)	1.07	88
Montoya Drain_1 (MD_1)	1.36	83
Montoya Drain_2 (MD_2)	1.43	74
Montoya Drain_3 (MD_3)	3.33	77
Mulberry Dam (MD1)	0.41	87
Mulberry Dam Outlet (MBDO_1)	0.25	85
Nemexas Drain (NeD1)	1.29	74
Ojo de Agua_1 (ODA_1)	1.29	88
Ojo de Agua_2 (ODA_2)	0.52	84
Oxidation Dam (OD)	0.24	87
Oxidation Outlet (OO_1)	0.19	82
Resler Channel_1 (RC_1)	1.47	85
Resler Channel_2 (RC_2)	1.75	84
Ridge View (RV_1)	1.30	85
Silver Springs Channel_1 (SSC_1)	0.64	85
Silver Springs Channel_2 (SSC_2)	0.74	84
Spring Crest Channel (SCC_1)	0.32	85
Thorn Dam (ThoD1)	0.46	84
Thorn Dam Outlet (TDO_1)	0.07	60
Thunderbird Valley (TBV_1)	0.89	86
Unknown 1(UN01)	0.24	84
Unknown 2_1 (UN02_1)	0.05	84
Unknown 2_2 (UN02_2)	0.03	84
Unknown 24 (UN024_1)	0.07	84
Unknown 3 (UN03)	0.16	84
Unnamed Stream 23_1 (UN23_1)	0.81	75
Unnamed Stream 23_2 (UN23_2)	0.05	85
Unnamed Stream 23_3 (UN23_3)	0.13	86
Unnamed Stream 23A (UN23A)	0.03	84
Unnamed Stream 24A Trib 1 (UN24AT1)	0.03	84
Unnamed Stream 24A_1 (UN24A1)	0.10	84
Unnamed Stream 24A_2 (UN24A2)	0.07	84
Unnamed Stream 24B (UN24B)	0.19	84
Unnamed Stream 24C (UN24C)	0.06	85
Unnamed Stream 24D (UN24D)	0.02	86
Via Serena (VS_1)	0.70	84
West of Rio Grande (WRG)	14.56	66
West_Montoya (WM)	1.46	78
White Spur Drain_1 (WSD_1)	0.08	78
White Spur Drain_2 (WSD_2)	0.21	90

Table A-12. Curve Number Summary for the West Central Region

WEST CENTRAL REGION - CURVE NUMBER SUMMARY		
Watershed Name and HEC-HMS ID	**Watershed Area (mi^2)**	**Weighted Curve Number**
Border Canal (Bcanal)	0.80	91
Canterbury Channel (CBC_1)	0.89	87
Flow Path Number 20_1 (FPN20_1)	0.21	89
Flow Path Number 20_2 (FPN20_2)	1.32	87
Flow Path Number 21_1 (FPN21_1)	0.24	90
Flow Path Number 21_2 (FPN21_2)	1.41	87
Flow Path Number 23 (FPN23_1)	1.85	88
Industrial 1 (Ind1)	1.38	86
Paragon Channel (PC_1)	1.55	88

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Table A-13. Summary of Lag Times for the Central Region

CENTRAL REGION - USACE SNYDER LAG TIME CALCULATION										
	L_L		L_{CA}		S_{ST}	C_T	N	T_{lag}	T_{lag}	C_P
Watershed Name and HEC-HMS ID	**(ft)**	**(mile)**	**(ft)**	**(mile)**	**(ft/ft)**	**(-)**	**(-)**	**(hr)**	**(min)**	**(-)**
A_Alameda Avenue	3901	0.74	1937	0.37	0.001	0.50	0.3	0.34	20.3	0.6719
A_Altura_Ave_Dam	4348	0.82	1938	0.37	0.164	0.31	0.3	0.22	13.0	0.6125
A_Blanco Avenue	2508	0.47	860	0.16	0.001	0.50	0.3	0.23	13.9	0.6719
A_Boone_St_Basin	8094	1.53	4028	0.76	0.012	0.29	0.3	0.30	18.2	0.6719
A_Border_Hwy_Overpass	2753	0.52	330	0.06	0.004	0.37	0.3	0.13	7.9	0.6719
A_Cebada Drainage Outfall	6852	1.30	2342	0.44	0.000	0.50	0.3	0.42	25.4	0.6719
A_Cebada_Reservoir	7584	1.44	2517	0.48	0.033	0.25	0.3	0.22	13.4	0.6125
A_Cemex_Spillway	7319	1.39	3885	0.74	0.163	0.31	0.3	0.31	18.7	0.6125
A_Channel 108 Discharge	1605	0.30	679	0.13	0.001	0.50	0.3	0.19	11.3	0.6719
A_Comanche Avenue	2952	0.56	1789	0.34	0.001	0.50	0.3	0.30	18.2	0.6719
A_Concordia_Cemetery	7919	1.50	1353	0.26	0.007	0.34	0.3	0.26	15.3	0.6719
A_Copia_Ditch_DS	4873	0.92	2065	0.39	0.039	0.24	0.3	0.18	10.6	0.6125
A_Copia_Ditch_US	7532	1.43	3960	0.75	0.051	0.23	0.3	0.23	14.1	0.6125
A_Cotton_Dallas_DS	6862	1.30	2672	0.51	0.084	0.21	0.3	0.19	11.1	0.6125
A_Cotton_Dallas_US	10938	2.07	4469	0.85	0.056	0.23	0.3	0.27	16.3	0.6125
A_Dallas, San Antonio and Lee	5878	1.11	3300	0.62	0.001	0.50	0.3	0.45	26.9	0.6719
A_Dam_No_10	2943	0.56	1235	0.23	0.194	0.21	0.3	0.11	6.8	0.6125
A_Dam_No_8	2047	0.39	1285	0.24	0.371	0.25	0.3	0.12	7.4	0.6125
A_Dam_No_9	2320	0.44	1057	0.20	0.286	0.27	0.3	0.13	7.8	0.6125
A_Delta Drive	2057	0.39	589	0.11	0.001	0.50	0.3	0.20	11.7	0.6719
A_El Paso Paisano to Ninth Outfall	5515	1.04	2697	0.51	0.001	0.50	0.3	0.41	24.8	0.6719
A_Eucalyptus_to_Cebada	4122	0.78	2484	0.47	0.018	0.27	0.3	0.20	12.0	0.6125
A_Fonseca	4197	0.79	1950	0.37	0.004	0.38	0.3	0.26	15.8	0.6719
A_Fort_Blvd_Reservoir	5043	0.96	2435	0.46	0.233	0.28	0.3	0.22	13.1	0.6125
A_Franklin_Campbell	3615	0.68	1299	0.25	0.045	0.23	0.3	0.13	8.1	0.6125
A_Glenwood Street	2565	0.49	1411	0.27	0.003	0.41	0.3	0.22	13.3	0.6719

Table A-13. Summary of Lag Times for the Central Region (Continued)

CENTRAL REGION - USACE SNYDER LAG TIME CALCULATION										
	L_L		L_{CA}		S_{ST}	C_T	N	T_{lag}	T_{lag}	C_P
Watershed Name and HEC-HMS ID	(ft)	(mile)	(ft)	(mile)	(ft/ft)	(-)	(-)	(hr)	(min)	(-)
A_Hardesty to Shelter	1418	0.27	817	0.15	0.002	0.48	0.3	0.18	11.1	0.6719
A_Hills Delta to Ninth	2855	0.54	828	0.16	0.001	0.50	0.3	0.24	14.3	0.6719
A_Houston_Elementary	6588	1.25	2530	0.48	0.044	0.50	0.23	0.44	26.7	0.6125
A_Kentucky_Dam_Lower	5902	1.12	3424	0.65	0.178	0.31	0.3	0.28	16.9	0.6125
A_Kentucky_Dam_Upper	2661	0.50	1271	0.24	0.188	0.21	0.3	0.11	6.7	0.6125
A_Louisiana_Dr_Dam_Lower	2024	0.38	1047	0.20	0.191	0.21	0.3	0.10	5.8	0.6125
A_Louisiana_Dr_Dam_Upper	4271	0.81	1934	0.37	0.138	0.21	0.3	0.15	8.7	0.6125
A_Lower_Durazno	10823	2.05	5784	1.10	0.010	0.31	0.3	0.40	23.7	0.6719
A_Magnolia_Reservoir	3088	0.58	1421	0.27	0.064	0.22	0.3	0.13	7.6	0.6125
A_McKelligon_Dam	14585	2.76	5872	1.11	0.084	0.36	0.3	0.50	30.2	0.6125
A_McKelligon_Reservoir_A	2334	0.44	784	0.15	0.380	0.25	0.3	0.11	6.6	0.6125
A_McKelligon_Reservoir_B	2810	0.53	891	0.17	0.265	0.27	0.3	0.13	7.9	0.6125
A_McKelligon_Reservoir_C	732	0.14	270	0.05	0.038	0.24	0.3	0.05	3.3	0.6125
A_McKelligon_Reservoir_D	915	0.17	413	0.08	0.059	0.22	0.3	0.06	3.6	0.6125
A_Memorial_Park	5940	1.12	2384	0.45	0.039	0.24	0.3	0.20	11.8	0.6125
A_Memphis_Dam_Lower	760	0.14	464	0.09	0.087	0.37	0.3	0.10	6.0	0.6125
A_Memphis_Dam_Upper	4999	0.95	2493	0.47	0.248	0.28	0.3	0.22	13.2	0.6125
A_Modesto Ditch	2413	0.46	723	0.14	0.005	0.36	0.3	0.16	9.4	0.6719
A_Mountain_Ave_Outlet_Conduit	8615	1.63	4681	0.89	0.037	0.24	0.3	0.27	16.1	0.6125
A_Nixson Cypress to Central	1838	0.35	1026	0.19	0.000	0.50	0.3	0.22	13.4	0.6719
A_Noble Myrtle to San Antonio	1816	0.34	915	0.17	0.002	0.50	0.3	0.21	12.9	0.6719
A_Octavia Texas to Magoffin	2638	0.50	1450	0.27	0.003	0.41	0.3	0.23	13.6	0.6719
A_Ohio_St_Reservoir_DS	214	0.04	19	0.00	0.166	0.21	0.3	0.01	0.9	0.6125
A_Ohio_St_Reservoir	937	0.18	392	0.07	0.120	0.34	0.3	0.09	5.6	0.6125
A_Olive & Cebada takes flow ponds at IH-10	6635	1.26	2122	0.40	0.001	0.50	0.3	0.41	24.4	0.6719
A_Overland Mesa to El Paso	1143	0.22	527	0.10	0.003	0.42	0.3	0.13	8.0	0.6719

Table A-13. Summary of Lag Times for the Central Region (Continued)

CENTRAL REGION - USACE SNYDER LAG TIME CALCULATION										
	L_L		L_{CA}		S_{ST}	C_T	N	T_{lag}	T_{lag}	C_P
Watershed Name and HEC-HMS ID	(ft)	(mile)	(ft)	(mile)	(ft/ft)	(-)	(-)	(hr)	(min)	(-)
A_Paisano and Delta Stanton to Tays	3850	0.73	1635	0.31	0.002	0.43	0.3	0.28	16.5	0.6719
A_Paisano Ditch	4309	0.82	1907	0.36	0.003	0.41	0.3	0.28	17.1	0.6719
A_Paisano San Francisco to El Paso	4667	0.88	1730	0.33	0.004	0.39	0.3	0.27	16.1	0.6719
A_Pera to Cebada	4177	0.79	2920	0.55	0.003	0.41	0.3	0.32	19.2	0.6719
A_Pershing_Dam	4887	0.93	2370	0.45	0.006	0.34	0.3	0.26	15.7	0.6719
A_Pollard_Ditch	4650	0.88	2554	0.48	0.028	0.26	0.3	0.20	12.1	0.6125
A_Pollard_Sacramento	1605	0.30	981	0.19	0.022	0.27	0.3	0.11	6.8	0.6125
A_Robert Alva Channel	5507	1.04	2557	0.48	0.003	0.42	0.3	0.34	20.5	0.6719
A_Russel_Ditch_DS	4290	0.81	1641	0.31	0.028	0.25	0.3	0.17	9.9	0.6125
A_Russel_Ditch_US	6058	1.15	2516	0.48	0.035	0.24	0.3	0.20	12.0	0.6125
A_San Antonio Hills to Lee	4215	0.80	2414	0.46	0.001	0.50	0.3	0.37	22.2	0.6719
A_San Antonio Mesa to El Paso	2817	0.53	729	0.14	0.001	0.50	0.3	0.23	13.7	0.6719
A_San_Diego_Dam	2868	0.54	1123	0.21	0.329	0.26	0.3	0.14	8.2	0.6125
A_Scenic_Dr_Dam	3606	0.68	2322	0.44	0.241	0.28	0.3	0.20	11.7	0.6125
A_Seventh and Hills Park to Ninth	5910	1.12	2953	0.56	0.003	0.41	0.3	0.36	21.4	0.6719
A_Seventh Chihuahuita to St Vrain East	5327	1.01	1257	0.24	0.001	0.50	0.3	0.33	19.6	0.6719
A_Seventh Chihuahuita to St Vrain West	2198	0.42	1113	0.21	0.000	0.50	0.3	0.24	14.5	0.6719
A_Tremont_Reservoir	470	0.09	225	0.04	0.073	0.22	0.3	0.04	2.5	0.6125
A_Upper_Durazno	1380	0.26	512	0.10	0.043	0.23	0.3	0.08	4.6	0.6125
A_Van_Buren_Dam	4412	0.84	2101	0.40	0.055	0.41	0.3	0.29	17.7	0.6125
A_Van_Buren_Ditch	6421	1.22	3404	0.64	0.192	0.30	0.3	0.28	16.7	0.6125

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Table A-14. Summary of Lag Times for the East Side Region

EAST SIDE REGION - USACE SNYDER LAG TIME CALCULATION										
	L_L		L_{CA}		S_{ST}	C_T	N	T_{lag}	T_{lag}	C_P
Watershed Name and HEC-HMS ID	(ft)	(mile)	(ft)	(mile)	(ft/ft)	(-)	(-)	(hr)	(min)	(-)
A_PHELPSDODGE-1	9500	1.80	4250	0.80	0.008	0.330	0.3	63.15	3788.8	0.6125
A_PHELPSDODGE-3	5000	0.95	3400	0.64	0.004	0.390	0.3	57.57	3454.2	0.6125
A_PHELPSDODGE-4	5800	1.10	1780	0.34	0.002	0.480	0.3	61.01	3660.6	0.6125
A_PHELPSDODGE-5	6690	1.27	2900	0.55	0.003	0.410	0.3	62.97	3778.2	0.6125
A_PHELPSDODGE-6	5800	1.10	3000	0.57	0.008	0.330	0.3	49.05	2943.3	0.6125
A_PHELPSDODGE-7	5490	1.04	200	0.04	0.006	0.350	0.3	22.71	1362.7	0.6125
A_PHELPSDODGE-8	12560	2.38	4050	0.77	0.005	0.880	0.3	180.47	10828.5	0.6125
A_PHELPSDODGE-9	17700	3.35	7500	1.42	0.002	1.300	0.3	355.51	21330.7	0.6125
A_PHELPSDODGE-10	10100	1.91	3000	0.57	0.004	0.950	0.3	166.78	10007.1	0.6125
A_Lomaland-1	2590	0.49	590	0.11	0.005	0.360	0.3	25.80	1547.7	0.6125
A_Lomaland-2	1600	0.30	580	0.11	0.008	0.330	0.3	20.36	1221.6	0.6125
A_Lomaland-3	2300	0.44	950	0.18	0.008	0.330	0.3	26.32	1579.4	0.6125
A_Lomaland-4	6220	1.18	7430	1.41	0.006	0.350	0.3	69.74	4184.6	0.6125
A_Lomaland-4a	6221	1.18	7431	1.41	0.006	0.350	0.3	69.75	4185.0	0.6125
A_Lomaland-5	4580	0.87	1700	0.32	0.008	0.330	0.3	38.54	2312.4	0.6125
A_Lomaland-6	4630	0.88	1500	0.28	0.006	0.350	0.3	39.50	2369.9	0.6125
A_Lomaland-7	4100	0.78	1750	0.33	0.008	0.330	0.3	37.61	2256.4	0.6125
A_Lomaland-8	7550	1.43	1700	0.32	0.020	0.270	0.3	36.63	2198.0	0.6125
A_Lomaland-8a	7460	1.41	3330	0.63	0.020	0.270	0.3	44.66	2679.6	0.6125
A_Lomaland-9	8200	1.55	2400	0.45	0.007	0.340	0.3	52.44	3146.6	0.6125
A_Lomaland-10	2690	0.51	980	0.19	0.020	0.270	0.3	22.79	1367.1	0.6125
A_Americas-1	4180	0.79	1960	0.37	0.010	0.310	0.3	36.76	2205.7	0.6125
A_Americas-2	5170	0.98	3000	0.57	0.005	0.360	0.3	51.70	3102.0	0.6125
A_Americas-3	3600	0.68	1230	0.23	0.014	0.290	0.3	28.59	1715.6	0.6125
A_Americas-4	2160	0.41	360	0.07	0.007	0.340	0.3	19.89	1193.6	0.6125

Table A-14. Summary of Lag Times for the East Side Region (Continued)

EAST SIDE REGION - USACE SNYDER LAG TIME CALCULATION										
	L_L		L_{CA}		S_{ST}	C_T	N	T_{lag}	T_{lag}	C_P
Watershed Name and HEC-HMS ID	(ft)	(mile)	(ft)	(mile)	(ft/ft)	(-)	(-)	(hr)	(min)	(-)
A_Americas-5	3670	0.70	1780	0.34	0.006	0.800	0.3	88.64	5318.2	0.6125
A_Americas-6	3230	0.61	1390	0.26	0.013	0.310	0.3	30.69	1841.5	0.6125
A_Americas-7	2430	0.46	740	0.14	0.017	0.270	0.3	20.31	1218.9	0.6125
A_Americas-8	3640	0.69	1670	0.32	0.005	0.880	0.3	95.42	5725.0	0.6125
A_Americas-9	5370	1.02	2590	0.49	0.018	0.270	0.3	37.53	2251.6	0.6125
A_Americas-10	2010	0.38	790	0.15	0.006	0.350	0.3	25.37	1522.2	0.6125
A_Americas-11	3900	0.74	1900	0.36	0.008	0.330	0.3	37.97	2278.3	0.6125
A_Americas-12	1500	0.28	450	0.09	0.004	0.950	0.3	53.27	3196.4	0.6125
A_AmTen-1	7520	1.42	2800	0.53	0.004	0.390	0.3	61.39	3683.2	0.6125
A_AmTen-2	1200	0.23	6300	1.19	0.001	0.490	0.3	56.72	3403.3	0.6125
A_AmTen-3	5000	0.95	1550	0.29	0.005	0.360	0.3	41.98	2519.1	0.6125
A_AmTen-4	4070	0.77	1930	0.37	0.005	0.360	0.3	42.15	2529.3	0.6125
A_AmTen-5	1680	0.32	1000	0.19	0.023	0.260	0.3	19.17	1150.1	0.6125
A_AmTen-6	12000	2.27	5800	1.10	0.002	1.300	0.3	292.90	17574.3	0.6125
A_AmTen-7	9410	1.78	4120	0.78	0.003	1.080	0.3	204.16	12249.6	0.6125
A_CarolinaDam-1	4420	0.84	1380	0.26	0.033	0.250	0.3	27.14	1628.1	0.6125
A_CarolinaDam-2	3020	0.57	900	0.17	0.015	0.280	0.3	23.85	1430.8	0.6125
A_MesaDrain-1	2750	0.52	1300	0.25	0.023	0.260	0.3	24.04	1442.5	0.6125
A_MesaDrain-2	4790	0.91	2040	0.39	0.023	0.260	0.3	32.51	1950.4	0.6125
A_Sunmount	4500	0.85	1490	0.28	0.008	0.330	0.3	36.85	2211.0	0.6125
A_RLH_2	1210	0.23	505	0.10	0.028	0.250	0.3	13.61	816.4	0.6125
A_MesaDrain-UP	2440	0.46	1190	0.23	0.026	0.250	0.3	21.72	1303.1	0.6125
A_MesaDrain-3	3140	0.59	1390	0.26	0.023	0.260	0.3	25.52	1531.5	0.6125
A_MesaDrain-4	4700	0.89	2180	0.41	0.020	0.270	0.3	34.24	2054.4	0.6125
A_PhelpsDodge_1a	3200	0.61	950	0.18	0.023	0.260	0.3	22.90	1374.0	0.6125

Table A-15. Summary of Lag Times for the Mission Valley Region

MISSION VALLEY REGION - USACE SNYDER LAG TIME CALCULATION										
	L_L		L_{CA}		S_{ST}	C_T	N	T_{lag}	T_{lag}	C_P
Watershed Name and HEC-HMS ID	(ft)	(mile)	(ft)	(mile)	(ft/ft)	(-)	(-)	(hr)	(min)	(-)
A_Americas Basin	10225	1.94	4260	0.81	0.007	0.780	0.3	0.89	53.5	0.6719
A_Americas Ten Basin	5043	0.96	1692	0.32	0.016	0.590	0.3	0.41	24.8	0.6125
A_Americas Ten NonContribute	2766	0.52	1563	0.30	0.018	0.590	0.3	0.34	20.2	0.6125
A_Basin A	10459	1.98	5464	1.03	0.002	0.480	0.3	0.60	35.7	0.6719
A_Basin G	19126	3.62	6752	1.28	0.000	0.500	0.3	0.79	47.5	0.6719
A_Below Basin G to Cty Limit	18490	3.50	9103	1.72	0.001	0.720	0.3	1.23	74.1	0.6719
A_Below Carolina Dam	11496	2.18	5810	1.10	0.014	0.290	0.3	0.38	22.6	0.6719
A_Below Featherlake Basin	2281	0.43	654	0.12	0.005	0.880	0.3	0.37	21.9	0.6719
A_Below Phelps Dodge Basin	14196	2.69	6774	1.28	0.005	0.370	0.3	0.54	32.2	0.6719
A_Carolina Drive Basin	4865	0.92	1950	0.37	0.025	0.260	0.3	0.19	11.3	0.6125
A_Feather Lake Basin	8765	1.66	3308	0.63	0.002	0.440	0.3	0.45	26.7	0.6719
A_Franklin Drain A	7507	1.42	3151	0.60	0.003	0.415	0.3	0.40	23.7	0.6719
A_Franklin Drain B	6217	1.18	2334	0.44	0.003	0.415	0.3	0.34	20.5	0.6719
A_Franklin Drn to City Limit	13601	2.58	6290	1.19	0.001	1.300	0.3	1.82	109.2	0.6719
A_Franklin Spur Drain	3831	0.73	2259	0.43	0.003	0.415	0.3	0.29	17.5	0.6719
A_Lincoln Drain	16605	3.14	9280	1.76	0.018	0.270	0.3	0.45	27.1	0.6125
A_Lomaland Basin	7144	1.35	1764	0.33	0.023	0.260	0.3	0.20	12.3	0.6125
A_Mesa Drain A	9197	1.74	4628	0.88	0.024	0.260	0.3	0.30	17.7	0.6125
A_Mesa Drain B	8686	1.65	4427	0.84	0.019	0.270	0.3	0.30	17.8	0.6125
A_Mesa Drain C	23070	4.37	9827	1.86	0.006	0.350	0.3	0.66	39.4	0.6719
A_Mesa Drain to City Limit	8574	1.62	4708	0.89	0.007	0.780	0.3	0.87	52.3	0.6719
A_Middle Drain A	37551	7.11	15118	2.86	0.001	0.500	0.3	1.23	74.1	0.6719
A_Middle Drain B	4049	0.77	2756	0.52	0.005	0.355	0.3	0.27	16.2	0.6719
A_Middle Drain Spur A	1527	0.29	689	0.13	0.008	0.325	0.3	0.12	7.3	0.6719
A_Middle Drain Spur B	2500	0.47	1374	0.26	0.006	0.345	0.3	0.18	11.0	0.6719
A_Middle to City Limit	8241	1.56	4125	0.78	0.002	0.330	0.3	0.35	21.0	0.6719

Table A-15. Summary of Lag Times for the Mission Valley Region (Continued)

MISSION VALLEY REGION - USACE SNYDER LAG TIME CALCULATION										
	L_L		L_{CA}		S_{ST}	C_T	N	T_{lag}	T_{lag}	C_P
Watershed Name and HEC-HMS ID	**(ft)**	**(mile)**	**(ft)**	**(mile)**	**(ft/ft)**	**(-)**	**(-)**	**(hr)**	**(min)**	**(-)**
A_North Loop Detention Basin	10314	1.95	5213	0.99	0.015	0.285	0.3	0.35	20.8	0.6719
A_Phelps Dodge Basin	9977	1.89	2988	0.57	0.010	0.320	0.3	0.33	19.6	0.6719
A_Playa Drain A	8716	1.65	3521	0.67	0.002	0.450	0.3	0.46	27.8	0.6719
A_Playa Drain B	46184	8.75	20436	3.87	0.001	0.500	0.3	1.44	86.3	0.6719

Table A-16. Summary of Lag Times for the Northeast Region

NORTHEAST REGION - USACE SNYDER LAG TIME CALCULATION										
	L_L		L_{CA}		S_{ST}	C_T	N	T_{lag}	T_{lag}	C_P
Watershed Name and HEC-HMS ID	(ft)	(mile)	(ft)	(mile)	(ft/ft)	(-)	(-)	(hr)	(min)	(-)
A_Amber Basin	5200	0.98	2163	0.41	0.083	0.210	0.3	0.16	9.6	0.6125
A_Army Ditch	6517	1.23	4495	0.85	0.009	0.310	0.3	0.31	18.9	0.6719
A_Bossworth Ch D/S	4318	0.82	2383	0.45	0.034	0.440	0.3	0.33	19.6	0.6125
A_Bossworth Ch U/S	7397	1.40	4218	0.80	0.071	0.380	0.3	0.39	23.6	0.6125
A_Diana Ditch D/S	20770	3.93	9008	1.71	0.035	0.250	0.3	0.44	26.6	0.6125
A_Diana Ditch U/S Sunrise Ch	9243	1.75	4780	0.91	0.013	0.280	0.3	0.32	19.3	0.6719
A_E Fwy Ch	15161	2.87	7719	1.46	0.006	0.830	0.3	1.28	76.6	0.6719
A_Electric Ditch	13557	2.57	6665	1.26	0.022	0.260	0.3	0.37	22.2	0.6125
A_Fairbanks Drive	20178	3.82	12453	2.36	0.066	0.390	0.3	0.75	45.3	0.6125
A_Fort Bliss Diversion Ch	3730	0.71	2035	0.39	0.048	0.230	0.3	0.16	9.3	0.6125
A_Ft Bliss Diversion Channel D/S	27026	5.12	2613	0.49	0.004	0.370	0.3	0.49	29.3	0.6719
A_Ft Bliss Diversion Channel U/S	4926	0.93	2418	0.46	0.065	0.220	0.3	0.17	10.2	0.6125
A_Fusselman Dam	15888	3.01	6160	1.17	0.093	0.360	0.3	0.52	31.5	0.6125
A_Green Belt Levee D/S	8912	1.69	4590	0.87	0.006	0.830	0.3	0.93	55.9	0.6719
A_Green Belt Levee U/S	38976	7.38	18966	3.59	0.026	0.510	0.3	1.36	81.8	0.6125
A_Hondo Pass Basin	5155	0.98	2241	0.42	0.066	0.215	0.3	0.17	9.9	0.6125
A_Hondo Pass Ch	1962	0.37	850	0.16	0.063	0.390	0.3	0.17	10.1	0.6125
A_Johnson Ch	4618	0.87	2261	0.43	0.035	0.240	0.3	0.18	10.7	0.6125
A_Keltner Dam	5661	1.07	4074	0.77	0.143	0.320	0.3	0.30	18.1	0.6125
A_Mtn Park Dam	11026	2.09	6414	1.21	0.145	0.315	0.3	0.42	25.0	0.6125
A_NE Pond Outer	11233	2.13	5385	1.02	0.008	0.320	0.3	0.40	24.2	0.6719
A_NE Ponding	17301	3.28	6884	1.30	0.007	0.770	0.3	1.19	71.4	0.6719
A_Northgate Dam	10857	2.06	3888	0.74	0.054	0.405	0.3	0.46	27.5	0.6125
A_Northgate Div Ch	13820	2.62	8409	1.59	0.082	0.365	0.3	0.56	33.6	0.6125
A_Northgate Int Ch	10387	1.97	7854	1.49	0.027	0.500	0.3	0.69	41.4	0.6125
A_Northgate Out Ch	6964	1.32	2452	0.46	0.016	0.595	0.3	0.51	30.8	0.6125

Table A-16. Summary of Lag Times for the Northeast Region (Continued)

NORTHEAST REGION - USACE SNYDER LAG TIME CALCULATION										
	L_L		L_{CA}		S_{ST}	C_T	N	T_{lag}	T_{lag}	C_P
Watershed Name and HEC-HMS ID	(ft)	(mile)	(ft)	(mile)	(ft/ft)	(-)	(-)	(hr)	(min)	(-)
A_Northills Dam N	16570	3.14	9652	1.83	0.089	0.365	0.3	0.62	37.0	0.6125
A_Northills Dam S	18475	3.50	9474	1.79	0.062	0.390	0.3	0.68	40.6	0.6125
A_PSB Ch 1 D/S	9994	1.89	6271	1.19	0.009	0.310	0.3	0.40	23.7	0.6719
A_PSB Ch 1 U/S Fannin Elem	26864	5.09	13672	2.59	0.056	0.405	0.3	0.88	52.7	0.6125
A_PSB Ch 1 U/S Gateway	6935	1.31	3511	0.66	0.054	0.410	0.3	0.39	23.6	0.6125
A_PSB Ch 1 U/S PSB 2 Jct	9171	1.74	5576	1.06	0.009	0.310	0.3	0.37	22.3	0.6719
A_PSB Ch 2 D/S	14012	2.65	7059	1.34	0.007	0.325	0.3	0.48	28.5	0.6719
A_PSB Ch 2 U/S Gateway	18893	3.58	9875	1.87	0.093	0.355	0.3	0.63	37.7	0.6125
A_PSB Ch 2 U/S Rushing	11672	2.21	4702	0.89	0.024	0.260	0.3	0.32	19.1	0.6125
A_Railroad Drain D/S	3909	0.74	2040	0.39	0.001	0.500	0.3	0.34	20.6	0.6719
A_Railroad Drain U/S Statler Ditch	6019	1.14	2486	0.47	0.005	0.850	0.3	0.71	42.3	0.6719
A_Railroad Drain U/S Tobin Drain	34210	6.48	15274	2.89	0.003	1.050	0.3	2.53	151.8	0.6719
A_Range Basin	5601	1.06	2473	0.47	0.022	0.260	0.3	0.21	12.6	0.6125
A_Range Dam	21002	3.98	10994	2.08	0.048	0.415	0.3	0.78	47.0	0.6125
A_Statler Ditch	5989	1.13	3252	0.62	0.001	0.500	0.3	0.45	26.9	0.6719
A_Sunrise Basin	5021	0.95	2828	0.54	0.051	0.230	0.3	0.19	11.3	0.6125
A_Sunrise Ch	12185	2.31	8084	1.53	0.025	0.260	0.3	0.38	22.8	0.6125
A_Sunrise Dam	9790	1.85	4128	0.78	0.133	0.320	0.3	0.36	21.5	0.6125
A_Tobin Drain U/S Army Ditch	6079	1.15	1324	0.25	0.007	0.330	0.3	0.23	13.6	0.6719
A_Tobin Drain U/S Irvin High	15912	3.01	7409	1.40	0.010	0.300	0.3	0.46	27.7	0.6719
A_Tobin Drain U/S RR Drain	6624	1.25	3660	0.69	0.005	0.350	0.3	0.34	20.1	0.6719
A_TXDOT Pond	14365	2.72	5556	1.05	0.041	0.355	0.3	0.49	29.2	0.6125
A_W Fwy Ch D/S	19427	3.68	10134	1.92	0.015	0.605	0.3	1.09	65.3	0.6125
A_W Fwy Ch U/S	7827	1.48	3853	0.73	0.017	0.270	0.3	0.28	16.6	0.6125
A_War Road Ch	7844	1.49	2560	0.48	0.014	0.285	0.3	0.26	15.5	0.6719

Table A-17. Summary of Lag Times for the Northwest Region

NORTHWEST REGION - USACE SNYDER LAG TIME CALCULATION										
Watershed Name and HEC-HMS ID	L_L		L_{CA}		S_{ST}	C_T	N	T_{lag}	T_{lag}	C_P
	(ft)	(mile)	(ft)	(mile)	(ft/ft)	(-)	(-)	(hr)	(min)	(-)
Arroyo 1A (A1A)	13072	2.48	8442	1.60	0.078	0.38	0.3	0.57	34.5	0.6125
Arroyo 4 (A4_1)	19185	3.63	9194	1.74	0.034	0.245	0.3	0.43	25.6	0.6125
Arroyo 5 (A5_1)	17006	3.22	7249	1.37	0.036	0.245	0.3	0.38	23.0	0.6125
Bandolero Channel_1 (BC_1)	12494	2.37	5166	0.98	0.029	0.295	0.3	0.38	22.8	0.6719
Bandolero Channel_2 (BC_2)	16448	3.12	9141	1.73	0.046	0.23	0.3	0.38	22.9	0.6125
Belvidere Channel (BDC_1)	17892	3.39	8978	1.70	0.036	0.245	0.3	0.41	24.9	0.6125
Borderland Channel_1 (BLC_1)	6064	1.15	2942	0.56	0.026	0.26	0.3	0.22	13.4	0.6125
Borderland Channel_2 (BLC_2)	6872	1.30	3229	0.61	0.023	0.268	0.3	0.25	15.0	0.6125
Borderland Channel_3 (BLC_3)	6072	1.15	3649	0.69	0.031	0.25	0.3	0.23	14.0	0.6125
Borderland Heights Ponds (BHP)	6454	1.22	3123	0.59	0.020	0.270	0.3	0.24	14.7	0.6125
Buena Vista Channel_1 (BVC_1)	1875	0.36	996	0.19	0.004	0.95	0.3	0.42	25.3	0.6719
Buena Vista Channel_2 (BVC_2)	17974	3.40	9057	1.72	0.052	0.23	0.3	0.39	23.4	0.6125
Coronado Channel (CC_1)	11499	2.18	5811	1.10	0.041	0.238	0.3	0.31	18.6	0.6125
Doniphan Ditch_1 (DD_1)	16518	3.13	8209	1.55	0.0007	0.70	0.3	1.13	67.5	0.6719
Doniphan Ditch_3 (DD_3)	5490	1.04	2924	0.55	0.020	0.27	0.3	0.23	13.7	0.6125
Easy Channel (EC_1)	3876	0.73	1659	0.31	0.019	0.27	0.3	0.17	10.4	0.6125
Flow Path Number 38_1 (FPN38_1)	12390	2.35	6418	1.22	0.023	0.26	0.3	0.36	21.4	0.6125
Flow Path Number 38_3 (FPN38_3)	5382	1.02	2760	0.52	0.025	0.26	0.3	0.22	12.9	0.6125
Flow Path Number 38_4 (FPN38_4)	15474	2.93	7595	1.44	0.049	0.23	0.3	0.35	21.2	0.6125
Flow Path Number 38A (FPN38A)	28155	5.33	14500	2.75	0.058	0.41	0.3	0.92	55.0	0.6125
Flow Path Number 38B (FPN38B)	13250	2.51	6804	1.29	0.035	0.47	0.3	0.67	40.1	0.6125
Flow Path Number 39A_1 (FPN39A_1)	5510	1.04	2695	0.51	0.030	0.25	0.3	0.21	12.4	0.6125
Flow Path Number 39A_2 (FPN39A_2)	16942	3.21	8605	1.63	0.040	0.46	0.3	0.76	45.3	0.6125
Flow Path Number 40_1 (FPN40_1)	5168	0.98	2336	0.44	0.027	0.52	0.3	0.40	24.3	0.6125
Flow Path Number 40_2 (FPN40_2)	6630	1.26	3493	0.66	0.036	0.47	0.3	0.44	26.7	0.6125
Flow Path Number 40_3 (FPN40_3)	33343	6.31	14135	2.68	0.040	0.46	0.3	1.07	64.5	0.6125
Flow Path Number 41_1 (FPN41_1)	7887	1.49	4013	0.76	0.033	0.48	0.3	0.50	29.9	0.6125
Flow Path Number 41_2 (FPN41_2)	23462	4.44	10691	2.02	0.033	0.48	0.3	0.93	55.7	0.6125
Flow Path Number 41A (FPN41A)	24856	4.71	12702	2.41	0.031	0.49	0.3	1.01	60.9	0.6125
Flow Path Number 42 (FPN42)	23035	4.36	11536	2.18	0.031	0.49	0.3	0.96	57.8	0.6125

Table A-17. Summary of Lag Times for the Northwest Region (Continued)

NORTHWEST REGION - USACE SNYDER LAG TIME CALCULATION										
Watershed Name and HEC-HMS ID	L_L		L_{CA}		S_{ST}	C_T	N	T_{lag}	T_{lag}	C_P
	(ft)	(mile)	(ft)	(mile)	(ft/ft)	(-)	(-)	(hr)	(min)	(-)
Flow Path Number 42 Trib 1_1 (FPN42T1_1)	683	0.13	440	0.08	0.016	0.6	0.3	0.15	9.2	0.6125
Flow Path Number 42 Trib 1_2	13249	2.51	6712	1.27	0.034	0.48	0.3	0.68	40.8	0.6125
Flow Path Number 42A (FPN42A)	3965	0.75	2115	0.40	0.028	0.5	0.3	0.35	20.9	0.6125
Flow Path Number 43 (FPN43)	15746	2.98	8094	1.53	0.034	0.48	0.3	0.76	45.4	0.6125
Granero Channel (GC_1)	7933	1.50	3714	0.70	0.048	0.225	0.3	0.23	13.7	0.6125
High Ridge_1 (HR_1)	6423	1.22	3085	0.58	0.036	0.243	0.3	0.22	13.2	0.6125
High Ridge_2 (HR_2)	9166	1.74	4327	0.82	0.037	0.24	0.3	0.27	16.0	0.6125
High Ridge_3 (HR_3)	8656	1.64	4420	0.84	0.051	0.413	0.3	0.45	27.2	0.6125
Highway Diversion Channel (HDC)	12722	2.41	5405	1.02	0.025	0.26	0.3	0.34	20.5	0.6125
Keystone Dam (KD1)	3875	0.73	1372	0.26	0.002	1.25	0.3	0.76	45.6	0.6719
Mace (Arroyo 1) (M1 (A1_2))	4286	0.81	2620	0.50	0.027	0.258	0.3	0.20	11.8	0.6125
Mesa Dam (MeD1)	7932	1.50	3400	0.64	0.023	0.263	0.3	0.26	15.6	0.6125
Mesa Dam Outlet (MDO_1)	7018	1.33	983	0.19	0.007	0.255	0.3	0.17	10.1	0.6125
Mesa Hills Channel (MHC_2)	11540	2.19	7267	1.38	0.040	0.24	0.3	0.33	20.0	0.6125
Montoya Drain_1 (MD_1)	15180	2.88	8578	1.62	0.0002	1.15	0.3	1.83	109.6	0.6719
Montoya Drain_2 (MD_2)	13486	2.55	7045	1.33	0.005	0.36	0.3	0.52	31.2	0.6719
Montoya Drain_3 (MD_3)	22111	4.19	13545	2.57	0.0004	0.86	0.3	1.75	105.2	0.6719
Mulberry Dam (MD1)	15180	2.88	3042	0.58	0.000	0.258	0.3	0.30	18.0	0.6125
Mulberry Dam Outlet (MBDO_1)	5632	1.07	3097	0.59	0.022	0.265	0.3	0.23	13.8	0.6125
Nemexas Drain (NeD1)	23356	4.42	8280	1.57	0.001	0.61	0.3	1.09	65.4	0.6719
Ojo de Agua_1 (ODA_1)	16046	3.04	7935	1.50	0.035	0.245	0.3	0.39	23.2	0.6125
Ojo de Agua_2 (ODA_2)	10148	1.92	5696	1.08	0.074	0.38	0.3	0.47	28.4	0.6125
Oxidation Dam (OD)	7520	1.42	2527	0.48	0.038	0.241	0.3	0.21	12.9	0.6125
Oxidation Outlet (OO_1)	4497	0.85	2588	0.49	0.022	0.65	0.3	0.50	30.0	0.6125
Resler Channel_1 (RC_1)	21276	4.03	11815	2.24	0.033	0.48	0.3	0.93	55.7	0.6125
Resler Channel_2 (RC_2)	22453	4.25	11048	2.09	0.075	0.38	0.3	0.73	43.9	0.6125
Ridge View (RV_1)	20294	3.84	11952	2.26	0.057	0.41	0.3	0.78	47.1	0.6125
Silver Springs Channel_1 (SSC_1)	11379	2.16	7982	1.51	0.076	0.38	0.3	0.54	32.5	0.6125
Silver Springs Channel_2 (SSC_2)	6840	1.30	4390	0.83	0.230	0.28	0.3	0.29	17.2	0.6125
Spring Crest Channel (SCC_1)	7790	1.48	4130	0.78	0.060	0.22	0.3	0.23	13.8	0.6125

Table A-17. Summary of Lag Times for the Northwest Region (Continued)

NORTHWEST REGION - USACE SNYDER LAG TIME CALCULATION										
Watershed Name and HEC-HMS ID	L_L		L_{CA}		S_{ST}	C_T	N	T_{lag}	T_{lag}	C_P
	(ft)	(mile)	(ft)	(mile)	(ft/ft)	(-)	(-)	(hr)	(min)	(-)
Thorn Dam (ThoD1)	7036	1.33	3131	0.59	0.025	0.258	0.3	0.24	14.4	0.6125
Thorn Dam Outlet (TDO_1)	3242	0.61	946	0.18	0.028	0.255	0.3	0.13	7.9	0.6125
Thunderbird Valley (TBV_1)	16810	3.18	10187	1.93	0.046	0.235	0.3	0.41	24.3	0.6125
Unknown 1(UN01)	7171	1.36	3829	0.73	0.028	0.5	0.3	0.50	29.9	0.6125
Unknown 2_1 (UN02_1)	3451	0.65	1775	0.34	0.022	0.54	0.3	0.34	20.6	0.6125
Unknown 2_2 (UN02_2)	2805	0.53	1410	0.27	0.033	0.48	0.3	0.27	16.0	0.6125
Unknown 24 (UN024_1)	4088	0.77	2068	0.39	0.027	0.51	0.3	0.36	21.4	0.6125
Unknown 3 (UN03)	6714	1.27	3123	0.59	0.027	0.5	0.3	0.46	27.5	0.6125
Unnamed Stream 23_1 (UN23_1)	15603	2.96	8228	1.56	0.027	0.51	0.3	0.81	48.4	0.6125
Unnamed Stream 23_2 (UN23_2)	2647	0.50	1462	0.28	0.031	0.49	0.3	0.27	16.3	0.6125
Unnamed Stream 23_3 (UN23_3)	5780	1.09	3289	0.62	0.024	0.53	0.3	0.47	28.3	0.6125
Unnamed Stream 23A (UN23A)	1956	0.37	1019	0.19	0.028	0.5	0.3	0.23	13.6	0.6125
Unnamed Stream 24A Trib 1 (UN24AT1)	2528	0.48	1309	0.25	0.035	0.47	0.3	0.25	14.9	0.6125
Unnamed Stream 24A_1 (UN24A1)	3346	0.63	1783	0.34	0.035	0.47	0.3	0.30	17.8	0.6125
Unnamed Stream 24A_2 (UN24A2)	4896	0.93	2532	0.48	0.031	0.49	0.3	0.38	23.1	0.6125
Unnamed Stream 24B (UN24B)	6535	1.24	3396	0.64	0.029	0.5	0.3	0.47	28.0	0.6125
Unnamed Stream 24C (UN24C)	3040	0.58	1489	0.28	0.041	0.45	0.3	0.26	15.6	0.6125
Unnamed Stream 24D (UN24D)	1354	0.26	733	0.14	0.030	0.49	0.3	0.18	10.8	0.6125
Via Serena (VS_1)	11544	2.19	6741	1.28	0.089	0.365	0.3	0.50	29.8	0.6125
West of Rio Grande (WRG)	28510	5.40	11973	2.27	0.009	0.72	0.3	1.53	91.6	0.6719
West_Montoya (WM)	16386	3.10	8118	1.54	0.001	0.62	0.3	0.99	59.4	0.6719
White Spur Drain_1 (WSD_1)	4186	0.79	2324	0.44	0.004	0.38	0.3	0.28	16.6	0.6719
White Spur Drain_2 (WSD_2)	6462	1.22	3698	0.70	0.025	0.258	0.3	0.25	14.8	0.6125

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Table A-18. Summary of Lag Times for the West Central Region

WEST CENTRAL REGION - USACE SNYDER LAG TIME CALCULATION										
	L_L		L_{CA}		S_{ST}	C_T	N	T_{lag}	T_{lag}	C_P
Watershed Name and HEC-HMS ID	**(ft)**	**(mile)**	**(ft)**	**(mile)**	**(ft/ft)**	**(-)**	**(-)**	**(hr)**	**(min)**	**(-)**
Border Canal (Bcanal)	11389	2.16	5845	1.11	0.001	0.610	0.3	0.79	47.5	0.6719
Canterbury Channel (CBC_1)	17367	3.29	9981	1.89	0.060	0.41	0.3	0.71	42.6	0.6125
Flow Path Number 20_1 (FPN20_1)	5537	1.05	3110	0.59	0.030	0.49	0.3	0.42	25.4	0.6125
Flow Path Number 20_2 (FPN20_2)	15662	2.97	8225	1.56	0.075	0.21	0.3	0.32	19.5	0.6125
Flow Path Number 21_1 (FPN21_1)	7059	1.34	3556	0.67	0.039	0.24	0.3	0.23	14.0	0.6125
Flow Path Number 21_2 (FPN21_2)	12086	2.29	6033	1.14	0.035	0.26	0.3	0.35	20.8	0.6125
Flow Path Number 23 (FPN23_1)	22242	4.21	9040	1.71	0.040	0.24	0.3	0.43	26.0	0.6125
Industrial 1 (Ind1)	10017	1.90	5119	0.97	0.047	0.44	0.3	0.53	31.7	0.6125
Paragon Channel (PC_1)	19477	3.69	10650	2.02	0.066	0.22	0.3	0.40	24.1	0.6125

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Table A-19a. Muskingum-Cunge Routing Inputs for the Central Region

CENTRAL REGION - MUSKINGUM CUNGE ROUTING											
							Trapezoid			Eight Point	
Reach Name	From Element	To Element	Length (ft)	Slope (ft/ft)	Channel Manning's n	Shape	Bottom Width (ft)	Side Slope (xH:1V)	Height (ft)	X	Y
R_McKelligon Channel	S_McKelligon Dam	S_McKelligon_ Reservoir_B	1129.0	0.0453	0.0400	Irregular	N/A	N/A	21.8	1122 1256 1276 1500 1534	4315.4 4294.2 4293.6 4305.2 4313
R_El Paso Rock Quarries	S_Mckelligon_ Reservoir_C	S_Mckelligon_ Reservoir_D	618.0	0.0138	0.0400	Trapezoid	50	2.0	10.0	N/A	N/A
R_McKelligon_ D_Out	S_Mckelligon_ Reservoir_D	S_Van_Buren_ Dam	2455.3	0.0300	0.0160	Trapezoid	35	0.1	0.5	N/A	N/A
R_Van_Buren_DS	J_Van_Buren_ Ditch_US	S_Van_Buren_ Dam	2077.0	0.0470	0.0350	Trapezoid	15	1.0	5.1	N/A	N/A
R_Pollard_ Sacramento	J_Pollard_Sacramento	J_Pershing_Dam	1087.8	0.0220	0.0160	Trapezoid	35	0.1	0.5	N/A	N/A
R_Pollard_Ditch	A_Pollard Ditch	J_Pershing_Dam	467.8	0.0176	0.0200	Trapezoid	8	1.0	5.0	N/A	N/A
R_Gov_Hills_ Conduit	J_Pershing_Dam	D_Boone_St_Basin	9325.2	0.0112	0.013	Trapezoid	14	1.3	4.4	0 3.6 19.2 22.8	3788.415 3783.759 3783.617 3787.716
R_Russel_Ditch	J_Russel_Ditch	D_Boone_St_ Basin	5975.0	0.0200	0.0160	Trapezoid	45	0.1	0.5	N/A	N/A
R_Fort_Blvd_to_ Copia_DitchUS	S_Fort_Blvd_ Reservoir	J_Copia_Ditch_ US	6108.0	0.0600	0.0160	Trapezoid	40	0.1	0.5	N/A	N/A
R_Copia_Ditch_DS	J_Copia_Ditch_US	J_Copia_Ditch_ DS	1998.1	0.0325	0.0130	Trapezoid	10	1.0	5.0	N/A	N/A
R_Copia_St	J_Copia_Ditch_DS	J_Cebada_US	885.0	0.0500	0.0160	Trapezoid	50	0.1	0.5	N/A	N/A
R_Cebada_to_ Cebada_Reservoir	J_Cebada_US	S_Cebada_ Reservoir	5340.0	0.0300	0.0160	Trapezoid	35	0.1	0.5	N/A	N/A
R_Cebada_ Reservoir_2	J_Cebada_North	S_Cebada_ Reservoir	9148.0	0.0400	0.0160	Trapezoid	35	0.1	0.5	N/A	N/A
R_Altura_to_ Kentucky_Upper	S_Altura_Ave_Dam	S_Kentucky_ Dam_Upper	890.8	0.0590	0.0160	Trapezoid	35	0.1	0.5	N/A	N/A

Table A-19a. Muskingum-Cunge Routing Inputs for the Central Region (Continued)

CENTRAL REGION - MUSKINGUM CUNGE ROUTING											
							Trapezoid			Eight Point	
Reach Name	From Element	To Element	Length (ft)	Slope (ft/ft)	Channel Manning's n	Shape	Bottom Width (ft)	Side Slope (xH:1V)	Height (ft)	X	Y
R_Cebada_ Reservoir_3	S_Kentucky_Dam_ Lower	S_Cebada_ Reservoir	6633.4	0.0340	0.0160	Trapezoid	30	0.1	0.5	N/A	N/A
R_Cebada_ Reservoir_4	S_Scenic_Dr_Dam	S_Cebada_ Reservoir	4800.0	0.0560	0.0160	Trapezoid	35	0.1	0.5	N/A	N/A
R_Tremont_to_ Magnolia	S_Tremont_Reservoir	S_Magnolia_ Reservoir	1585.5	0.0680	0.0160	Trapezoid	35	0.1	0.5	N/A	N/A
R_Magnolia_to_ Eucalyptus	S_Magnolia_Reservoir	J_Eucalyptus_ to_Cebada	2090.0	0.0230	0.0160	Trapezoid	55	0.1	0.5	N/A	N/A
R_Dam_9 and_ 8_to_Dallas_Res	J_Dam_9_and_8	S_Dallas_ Reservoir	2279.7	0.0400	0.0160	Trapezoid	50	0.1	0.5	N/A	N/A
R_CottonDallas_to_ Dallas_Res	J_Cotton_Dallas_US	S_Dallas_ Reservoir	4188.5	0.0330	0.0160	Trapezoid	35	0.1	0.5	N/A	N/A
R_Paisano_Ditch	J_Nixon_Cypress_ to_Central	J_Paisano_ Ditch	2038.3	0.0050	0.0350	Trapezoid	4	5.0	8.0	N/A	N/A

Table A-19b. Lag Routing Inputs for the Central Region

CENTRAL REGION - LAG ROUTING (CONDUITS)						
Reach Name	**From Element**	**To Element**	**Conduit Name**	**Length (ft)**	**Velocity (ft/s)**	**Lag (min)**
R_Mountain_Avenue_Conduit	S_Van_Buren_Dam	S_Pershing Dam	Mountain Avenue Outlet Conduit	8034.0	20.00	6.7
R_FortBliss_Sump	J_FortBliss_Sump_Inflow	S_Pershing Dam	Fort Bliss Outfall Conduit	9473.2	16.57	9.5
R_Boone_to_Concordia	D_Boone_St_Basin	J_Concordia Cemetery	Gov. Hill Outlet Conduit (90" CBC)	2530.0	15.00	2.8
R_Concordia_to_Hardesty	J_Concordia Cemetery	J_Hardesty_to_Shelter	Gov. Hill Outlet Conduit (90" CBC)	4296.0	15.00	4.8
R_Hardesty_to_Gov_Hills_Out	J_Hardesty_to_Shelter	Gov_Hills_Outfall	Gov. Hill Outlet Conduit (90" CBC)	2278.0	15.00	2.5
R_24hr-Emergency Drain	J_24hr-Emergency Drain	D_Voone_St_Basin	24hr-Emergency Drain (48in Conduit)	4434.0	15.00	4.9
R_Alameda_Avenue	J_Alameda Avenue	J_Blanco_Avenue	Ch 108 3X7 CBC Storm Drain	1760.0	15.00	2.0
R_Blanco_to_Comanche	J_Blanco_Avenue	J_Comanche_Avenue	Ch 108 3X7 CBC Storm Drain	1399.0	15.00	1.6
R_Comanche_to_Delta_Dr	J_Comanche_Avenue	J_Delta_Drive	Ch 108 3X7 CBC Storm Drain	1135.0	15.00	1.3
R_Delta_Dr_to_Channel108_Out	J_Delta_Drive	J_Channel 108	Ch 108 3X7 CBC Storm Drain	1366.0	15.00	1.5
R_Channel108_to_Robert_Alva	J_Channel 108	J_Robert_Alva_Channel	Ch 108 3X7 CBC Storm Drain	1490.0	15.00	1.7
R_Glenwood_to_Robert_Alva	J_Glenwood_Street_48in_RCP	J_Robert_Alva_Channel	Glenwood Street 48-inch rcp	1445.0	8.93	2.7
R_Paisaino_to_Hills_Delta	J_Paisano and Delta to Tays	J_Hills Delta to Ninth	Hills Delta to Ninth	1247.2	2.96	7.0
R_hills_Delta_to_Seventh_Out	J_Hills Delta to Ninth	J_Seventh and Hills to Ninth	Hills Delta to Ninth	1527.3	2.96	8.6
R_Paisano_to_Ninth	J_El Paso Paisano US	J El Paso Paisano to Ninth	El Paso Paisano to Ninth 54-inch RCP	2330.0	6.92	5.6
R_Sevnth_Vrain_West_to_Ninth	J_Seventh_Vrain_West	J El Paso Paisano to Ninth	Seventh Chihauhuita to St. Vrain (west) 42-inch RCP	573.9	4.09	2.3
R_Sevnth_Vrain_East_to_Ninth	J_Seventh_Vrain_East	J El Paso Paisano to Ninth	Seventh Chihauhuita to St. Vrain (east) 42-inch RCP	5401.9	5.49	16.4
R_Ninth_to_Outfall	J El Paso Paisano to Ninth	J_El Paso Paisano Outfall	El Paso Paisano to Ninth 54-inch RCP	1104.0	5.66	3.3
R_Eucalyptus to Cebada	J_Eucalyptus_to_Cebada	S_Cebada_Reservoir	Eucalyptus_to_Cebada	2734.0	15.00	3.0
R_Cebada_Reservoir_Outfall	S_Cebada_Reservoir	J_Pera	Cebada Drainage Outfall	3330.0	10.43	5.3

Table A-19b. Lag Routing Inputs for the Central Region (Continued)

CENTRAL REGION - LAG ROUTING (CONDUITS)						
Reach Name	**From Element**	**To Element**	**Conduit Name**	**Length (ft)**	**Velocity (ft/s)**	**Lag (min)**
R_Campbell_to_Dallas_Res	S_Campbell	S_Dallas_Reservoir	unknown	3937.00	15.00	4.4
R_Dallas_to_Cebada_Connector	D_IH_10_Dallas	J_Olive_to_Cebada	Olive and Cebada 2-5x5 CBC	6693.20	5.17	21.6
R_Pera_to_Cebada_Outfall	J_Pera	J_Cebada_Drainage_Outfall	Cebada Drainage Outfall	1909.4	6.67	4.8
R_Dallas_Res_to_San_Antonio	D_IH_10_Dallas	A_Dallas_San_Antonio	Dallas, San Antonio, and Lee	3070.7	8.08	6.3
R_San_Antonio_Hills	J_San_Antonio_Hills_to_Lee	A_Dallas_San_Antonio	San Antonio Hills to Lee 48-Inch RCP	1916.0	3.65	8.7
R_Dallas_System_Outfall	A_Dallas_San_Antonio	J_Dallas_System_Outfall	Dallas, San Antonio, and Lee	1770.9	8.08	3.7
R_Copia_St	L_Copia_Ditch_DS	J_Cebada_US	Copia Ditch	1287.0	15.00	1.4
R_Cebada_to_Cebada_Reservoir	J_Cebada_US	J_Cebada_Reservoir_Outfall	Cebada Drainage Outfall	10092.0	15.00	11.2
R_Houston Magnolia	S_Magnolia_Reservoir	D_Houston_Elementary	unknown	2197.0	15.00	2.4

Table A-20a. Kinematic Wave Routing Inputs for the East Side Region

EAST SIDE REGION - KINEMATIC WAVE ROUTING								
							Trapezoid	
Reach Name	From Element	To Element	Length (ft)	Slope (ft/ft)	Channel Manning's n	Shape	Bottom Width (ft)	Side Slope (xH:1V)
Sunmount Channel	A_Sunmount	A_EID_1	825	0.005	0.3	Trapezoid	10	5
Joe Battle Channel	A_Americas_5	A_Americas_4	200	0.005	0.013	Rectangle	20	
ARROYO-EAST	124C	124JE	3000	0.022	0.013	Trapezoid	60	1
ARROYO-EAST2	124JE	JB	3000	0.017	0.013	Trapezoid	50	1
ARROYO-WEST	124A	124JW	2600	0.019	0.03	Trapezoid	50	1
ARROYO-WEST2	124JW	JB	3000	0.023	0.013	Trapezoid	60	1
MV#14	9J	MISSION VALLEY	404	0.00248	0.013	Trapezoid	60	1
MV#20	JB	MISSION VALLEY	200	0.02	0.013	Trapezoid	100	1

Table A-20b. Kinematic Wave Routing Inputs (Conduits) for the East Side Region

EAST SIDE REGION - KINEMATIC WAVE ROUTING (CONDUITS)							
Reach Name	From Element	To Element	Conduit Name	Length (ft)	Slope (ft/ft)	Mannings (n)	Diameter (ft)
VCNT-1	CVP-1	CVB-A	VCNT-1	1422	0.0165	0.013	4.5
VCNT-2	CVP-2	CVB-A	VCNT-2	500	0.1025	0.013	6
VCNT-3	CVP-3	CVB-B	VCNT-3	546	0.0751	0.013	4.5
MV#11	LOMALAND @ IH-10	MISSION VALLEY	MV#11	260	0.005	0.013	3
9BR	9B_P	9J	9BR	2300	0.01	0.013	1.5
9CR	9C_P	9J	9CR	4500	0.01	0.013	1.5
MV#17	90	MISSION VALLEY	MV#17	260	0.00769	0.013	4
MV#17a	96J	MISSION VALLEY	MV#17a	694	0.018	0.013	4.5
MV#18	100	MISSION VALLEY	MV#18	355	0.01127	0.013	3
RCP375	96A	96J	RCP375	1475	0.03	0.013	4.5

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Table A-21a. Muskingum-Cunge Routing Inputs for the Mission Valley Region

MISSION VALLEY REGION - MUSKINGUM CUNGE ROUTING							Trapezoid		
Reach Name	From Element	To Element	Length (ft)	Slope (ft/ft)	Channel Manning's n	Shape	Bottom Width (ft)	Side Slope (xH:1V)	Height (ft)
R_Franklin Drain A	J_Middle Int w Franklin Drn	J_Franklin and Franklin Spur	4921.4	0.1900	0.045	Trapezoid	12	2	15.0
R_Franklin Drain Spur A	D_Playa and Playa Intercepto	R_Franklin Drain Spur B	2598.3	0.0050	0.085	Trapezoid	14	2	10.0
R_Franklin Drain Spur B	R_Franklin Drain Spur A	J_Franklin and Franklin Spur	1475.6	0.0050	0.085	Trapezoid	12	2	14.0
R_Franklin Drn to City Lmt A	J_Franklin and Franklin Spur	R_Franklin Drn to City Lmt B	907.6	0.1900	0.045	Trapezoid	8	2	10.0
R_Franklin Drn to City Lmt B	R_Franklin Drn to City Lmt A	J_Franklin Drain City Limit	8727.0	0.1900	0.045	Trapezoid	15	1	15.0
R_Lincoln Drain A	Source_CE Input	R_Lincoln Drain B	5704.7	0.0050	0.030	Trapezoid	7	1	4.5
R_Lincoln Drain B	R_Lincoln Drain A	J_Lincoln Drain Outlet	2413.0	0.0050	0.035	Trapezoid	8	2	1
R_Mesa Drain above Amer BsnA	J_Mesa Drain w Lomaland	R_Mesa Drain above Amer Bas B	17030.8	0.0050	0.035	Trapezoid	15	2	9.0
R_Mesa Drain above Amer BsnB	R_Mesa Drain above Amer Bas A	J_Mesa Drain w Americas Bsn	1125.0	0.0050	0.035	Trapezoid	70	2	6.0
R_Mesa Drain above Carolina	J_Mesa Drain w Phelps Dodge	J_Mesa Drain w Carolina Bsn	946.3	0.0050	0.030	Trapezoid	10	1	9.0
R_Mesa Drain below Carolina	J_Mesa Drain w Carolina Bsn	J_Mesa Drain w Lafayette Drw	7140.6	0.0050	0.035	Trapezoid	10	2	9.0
R_Mesa Drain above Lomaland	J_Mesa Drain w Lafayette Drw	J_Mesa Drain w Lomaland	1981.8	0.0050	0.030	Trapezoid	15	2	9.0
R_Mesa Drain to City Limit	D_Mesa to Mesa Interceptor	J_Mesa Drain w Americas Ten	6002.6	0.0050	0.035	Trapezoid	15	2	9.0
R_Mesa Interceptor above FL	D_Mesa to Mesa Interceptor	S_Featherlake Basin	1004.1	0.0050	0.035	Trapezoid	70	1	15.0

Table A-21a. Muskingum-Cunge Routing Inputs for the Mission Valley Region (Continued)

MISSION VALLEY REGION - MUSKINGUM CUNGE ROUTING									
							Trapezoid		
Reach Name	From Element	To Element	Length (ft)	Slope (ft/ft)	Channel Manning's n	Shape	Bottom Width (ft)	Side Slope (xH:1V)	Height (ft)
R_Mesa Interceptor blw FL A	S_Featherlake Basin	R_Mesa Interceptor blw FL B	652.8	0.0050	0.035	Trapezoid	18	1	15.0
R_Mesa Interceptor blw FL B	R_Mesa Interceptor blw FL A	J_Mesa Int w Middle Drain	907.0	0.0050	0.035	Trapezoid	10	2	12.0
R_Middle Drain to City Limit	D_Middle and Middle Int	J_Middle Drain City Limit	5070.0	0.0010	0.080	Trapezoid	10	0	15.0
R_Middle Drain to Intercept	J_Mesa Int w Middle Drain	J_Middle Drain w Middle Int	1844.1	0.0010	0.013	Trapezoid	18	2	12.0
R_Middle Interceptor A	D_Middle and Middle Int	J_Middle Int w Franklin Canl	1402.0	0.0050	0.030	Trapezoid	21	1	11.0
R_Middle Interceptor B	J_Middle Int w Franklin Canl	J_Middle Int w Franklin Drn	2767.9	0.0050	0.050	Trapezoid	20	1	12.0
R_Playa Drain Lower_A	J_Playa Drain Outlet Basin A	R_Playa Drain Conduit	7359.3	0.0500	0.030	Trapezoid	10	1	15.0
R_Playa Drain Lower_B	R_Playa Drain Conduit	R_Playa Drain Lower_C	26719.3	0.0500	0.030	Trapezoid	10	1	15.0
R_Playa Drain Lower_C	R_Playa Drain Lower_B	J_Playa Drain with Intercept	4394.3	0.0567	0.030	Trapezoid	24	1	15.0
R_Playa Drain Upper A	J_Playa Drain with Conduit	J_Playa Drn with North Loop	1910.0	0.0050	0.030	Trapezoid	10	1	12.0
R_Playa Drain Upper B	J_Playa Drn with North Loop	J_Playa Drain w Basin A	6875.9	0.0050	0.020	Trapezoid	10	1	12.0

Table A-21b. Lag Routing Inputs for the Mission Valley Region

MISSON VALLEY REGION - LAG ROUTING						
Reach Name	**From Element**	**To Element**	**Conduit Name**	**Length (ft)**	**Velocity (ft/s)**	**Lag (min)**
R_Lincoln to Playa Conduit	J_Lincoln Drain Outlet	J_Playa Drain with Conduit	Ch35 - Cor3	2204.0	15.0	2.45
R_Playa Drain Conduit	R_Playa Drain Lower_A	R_Playa Drain Lower_B	Ch89 - Cor1	4762.0	15.0	5.29

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Table A-22a. Muskingum-Cunge Routing Inputs for the Northeast Region

NORTHEAST REGION - MUSKINGUM CUNGE ROUTING											
							Trapezoid			Eight Point	
Reach Name	From Element	To Element	Length (ft)	Slope (ft/ft)	Channel Manning's n	Shape	Bottom Width (ft)	Side Slope (xH:1V)	Height (ft)	X	Y
R_Army Ditch	D_Range Dam	J_Army Ditch	4789.1	0.0015	0.030	Eight Point	N/A	N/A	N/A	0	3884.90
										5	3884.90
										17	3884.90
										23	3880.90
										41	3881.10
										47	3885.60
										50	3885.60
										55	3885.60
R_Bossworth U/S	A_Bossworth U/S	J_Bossworth Ch D/S	4588.7	0.0360	0.035	Trapezoid	25	2	5.0	N/A	N/A
R_Diana Ditch	J_Diana Ditch U/S	J_Diana Ditch D/S	5903.4	0.0014	0.016	Eight Point	N/A	N/A	4.5	1200	3883.80
										1201	3883.20
										1202	3883.20
										1209	3878.60
										1218	3878.60
										1226	3883.40
										1227	3883.40
										1228	3883.40
R_Electric Ditch	J_Fairbanks Drive	J_Electric Ditch	5609.5	0.0070	0.030	Trapezoid	20	7	2.0	N/A	N/A
R_Fusselman Out	S_Fusselman Dam	S_Northgate Dam	9263.3	0.0500	0.035	Eight Point	N/A	N/A	N/A	47.73	4272.89
										78.51	4270.39
										123.13	4268.32
										136.85	4267.15
										186.76	4270.38
										207.16	4271.84
										253.09	4273.42
										282.94	4274.29
R_Green Belt Levee	J_Green Belt Levee	D_NE Ponding	8925.2	0.0071	0.040	Trapezoid	1000	4	5.0	N/A	N/A
R_Hondo Pass Diversion	D_Hondo Pass	J_Diana Ditch U/S	7886.4	0.0230	0.016	Trapezoid	65	0.1	0.5	N/A	N/A

Table A-22a. Muskingum-Cunge Routing Inputs for the Northeast Region (Continued)

NORTHEAST REGION - MUSKINGUM CUNGE ROUTING											
							Trapezoid			Eight Point	
Reach Name	From Element	To Element	Length (ft)	Slope (ft/ft)	Channel Manning's n	Shape	Bottom Width (ft)	Side Slope (xH:1V)	Height (ft)	X	Y
R_Keltner Dam Out	S_Keltner Dam	J_Ft Bliss Sump	8939.9	0.0400	0.016	Trapezoid	36	0	0.5	N/A	N/A
R_NE Pond Overflow	S_NE Pond Outer	J_RR Drain U/S of Tobin	13842.1	0.0066	0.016	Trapezoid	36	0	0.5	N/A	N/A
R_Northgate Dam Out	S_Northgate Dam	J_Northgate Dam Out	5437.9	0.0077	0.035	Trapezoid	15	1	10.0	N/A	N/A
R_PSB Ch 1 a	J_PSB Ch 1 Jct 1	J_PSB Ch1 Jct2	7158.5	0.0050	0.016	Trapezoid	30	1	15.0	N/A	N/A
R_PSB Ch 1 b	J_PSB Ch1 Jct2	J_PSB Ch1 Jct3	6226.9	0.0050	0.016	Trapezoid	30	1	15.0	N/A	N/A
R_PSB Ch 1 c	J_PSB Ch1 Jct3	J_PSB Ch 1 D/S	2816.8	0.0050	0.016	Trapezoid	30	1	15.0	N/A	N/A
R_PSB Ch 2 a	J_PSB Ch 2 at Gateway	J_PSB Ch 2 at Rushing	7202.4	0.0033	0.030	Trapezoid	30	1	5.0	N/A	N/A
R_PSB Ch 2 b	J_PSB Ch 2 at Rushing	D_PSB Ch 2 D/S	8659.4	0.0033	0.030	Trapezoid	30	1	5.0	N/A	N/A
R_Range Dam Overflow	D_Range Dam	S_Range Basin	3553.6	0.0110	0.016	Trapezoid	36	0	0.5	N/A	N/A
R_RR Dr D/S	J_RR Ditch at Statler Ditch	J_RR Ditch Downstream	3745.9	0.0014	0.016	Trapezoid	7	2	3.4	N/A	N/A
R_RR Dr U/S Statler Ch	J_Tobin Drain and RR	J_RR Ditch at Statler Ditch	3844.5	0.0042	0.030	Trapezoid	6	3	4.0	N/A	N/A
R_Sunrise Channel	J_Sunrise Ch U/S	J_Sunrise Ch D/S	3515.7	0.0123	0.016	Trapezoid	10	1	4.0	N/A	N/A

Table A-22a. Muskingum-Cunge Routing Inputs for the Northeast Region (Continued)

NORTHEAST REGION - MUSKINGUM CUNGE ROUTING											
							Trapezoid			Eight Point	
Reach Name	From Element	To Element	Length (ft)	Slope (ft/ft)	Channel Manning's n	Shape	Bottom Width (ft)	Side Slope (xH:1V)	Height (ft)	X	Y
R_Tobin Drain U/S Army Ditch	J_Tobin Drain U/S Irwin H	J_Tobin Drain at Army Ditch	2187.7	0.0018	0.030	Eight Point	N/A	N/A	N/A	1189.8 1189.9 1190.00 1213.00 1239.00 1260.00 1260.1 1260.2	3885.10 3885.10 3885.10 3875.00 3875.70 3885.70 3885.70 3885.70
R_Tobin Drain U/S RR Ditch	J_Tobin Drain at Army Ditch	J_Tobin Drain D/S	5473.1	0.0018	0.016	Eight Point	N/A	N/A	N/A	1049.80 1049.90 1050.00 1054.00 1075.00 1080.00 1080.10 1080.20	3881.50 3881.50 3881.50 3877.40 3877.50 3881.70 3881.70 3881.70
R_W Fwy Ch_U/S	J_War Road Channel	J_W Fwy Ch U/S	8006.8	0.0045	0.035	Trapezoid	32	1	10.0	N/A	N/A
R_W Fwy Ch_D/S	J_W Fwy Ch U/S	J_W Fwy Ch D/S	6794.5	0.0045	0.035	Trapezoid	43	2	6.0	N/A	N/A

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Table A-22b. Lag Routing Inputs for Northeast Region

NORTHEAST REGION - LAG ROUTING (CONDUITS)						
Reach Name	**From Element**	**To Element**	**Conduit Name**	**Length (ft)**	**Velocity (ft/s)**	**Lag (min)**
R_Ft Bliss Div Ch D/S	J_Ft Bliss Div Ch Dyer St	J_Ft Bliss Sump	Core of Engineer-CH63	6399.2	13.6	7.9
R_Ft Bliss Div Ch U/S	J_Ft Bliss Div Ch U/S	J_Ft Bliss Div Ch Dyer St	Core of Engineer-CH63	8247.2	13.6	10.1
R_Hondo Channel	D_Hondo Pass	S_Hondo Pass Basin	Hondo Pass Channel	7006.9	16.7	7.0

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Table A-23. Routing Inputs for the Northwest Region

NORTHWEST REGION - MUSKINGUM CUNGE ROUTING											
							Trapezoid			Eight Point	
Reach Name	From Element	To Element	Length (ft)	Slope (ft/ft)	Channel Manning's n	Shape	Bottom Width (ft)	Side Slope (xH:1V)	Height (ft)	X	Y
A1	M1 (A1_2)	M1 DS	5637	0.0059	0.1	Eight Point	N/A	N/A	N/A	0.0	3753.0
										743.0	3750.0
										893.0	3749.0
										932.0	3750.0
										2313.0	3753.0
										2313.1	3753.1
										2313.2	3753.2
										2313.3	3753.3
BC_C1	GC1,BC2	BC_1,C1	4512	0.027	0.016	Eight Point	N/A	N/A	N/A	4861.2	4004.92
										4977.2	4004.31
										4985.0	4000.15
										4991.2	3994.15
										5009.1	3994.15
										5011.3	4000.15
										5017.6	4003.96
										5587.3	4008.32
BLC_C1	BLC2,MDO1	BLC2,BLC1	5661	0.007	0.013	Circle	N/A	N/A	11.0	N/A	N/A
BLC_C2	BLC3,TDO1	BLC_2,C2	2864	0.0021	0.027	Eight Point	N/A	N/A	N/A	4893.1	3830.55
										4976.2	3822.12
										4995.8	3817.96
										5003.5	3816.19
										5003.8	3814.84
										5010.5	3817.96
										5059.1	3831.75
										5074.5	3831.61

Table A-23. Routing Inputs for the Northwest Region (Continued)

NORTHWEST REGION - MUSKINGUM CUNGE ROUTING											
							Trapezoid			Eight Point	
Reach Name	From Element	To Element	Length (ft)	Slope (ft/ft)	Channel Manning's n	Shape	Bottom Width (ft)	Side Slope (xH:1V)	Height (ft)	X	Y
BLC_C3	MD1,MBDO_1	BLC_3,C3	2730	0.007	0.027	Eight Point	N/A	N/A	N/A	4892.4	3869.87
										4916.7	3865.62
										4996.5	3831.37
										5004.9	3827.25
										5005.0	3827.25
										5014.4	3831.22
										5098.5	3861.24
										5098.6	3861.25
BVC_C1	BVC2,TBV1	BVC_1,C1	2180	0.017	0.016	Eight Point	N/A	N/A	N/A	4920.0	3919.78
										4944.9	3911.37
										4972.5	3909.78
										4976.1	3899.43
										5013.3	3900.16
										5019.8	3910.29
										5035.4	3912.92
										5094.4	3915.87
BVC_C2	CC	BVC_2,C2	2538	0.007	0.016	Eight Point	N/A	N/A	N/A	4891.0	3924.68
										4916.0	3922.67
										4981.9	3921.16
										4985.3	3912.28
										5014.8	3912.28
										5020.2	3921.16
										5072.2	3923.12
										5075.2	3924.44

Table A-23. Routing Inputs for the Northwest Region (Continued)

NORTHWEST REGION - MUSKINGUM CUNGE ROUTING											
							Trapezoid			Eight Point	
Reach Name	From Element	To Element	Length (ft)	Slope (ft/ft)	Channel Manning's n	Shape	Bottom Width (ft)	Side Slope (xH:1V)	Height (ft)	X	Y
CC_C	SCC1,SSC1	CC	7398	0.037	0.017	Eight Point	N/A	N/A	N/A	4612.37	4056.00
										4867.80	4055.56
										4990.90	4051.95
										4994.30	4043.84
										5011.40	4043.80
										5015.40	4051.08
										5031.90	4054.31
										5203.14	4056.00
HR_C1	RV1,HR2	HR1,LDE1	4851	0.034	0.016	Eight Point	N/A	N/A	N/A	4956.3	4051.30
										4968.4	4048.45
										4970.0	4046.80
										4982.3	4034.17
										5010.8	4034.08
										5036.2	4044.89
										5048.3	4050.22
										5302.4	4049.42
HR_C2	A1A,HR3	HR_2,C2	5855	0.036	0.016	Eight Point	N/A	N/A	N/A	0.0	4227.0
										215.0	4221.0
										309.0	4212.0
										316.0	4209.0
										336.0	4209.0
										346.0	4215.0
										368.0	4218.0
										567.0	4293.0
KD_C	KD1 Dam	KD_Out	9751	0.004	0.013	Circle	N/A	N/A	8.0	N/A	N/A

Table A-23. Routing Inputs for the Northwest Region (Continued)

NORTHWEST REGION - MUSKINGUM CUNGE ROUTING											
							Trapezoid			Eight Point	
Reach Name	From Element	To Element	Length (ft)	Slope (ft/ft)	Channel Manning's n	Shape	Bottom Width (ft)	Side Slope (xH:1V)	Height (ft)	X	Y
MBDO_C1	MD1 Dam	MD1,MBDO_1	4812	0.024	0.016	Eight Point	N/A	N/A	N/A	0.0	3924.0
										225.0	3921.0
										280.0	3904.0
										284.0	3901.0
										289.0	3901.0
										293.0	3904.0
										299.0	3906.0
										315.0	3906.0
MD_C	MD2,WSD1	MD_Out	15180	0.00013	0.03	Eight Point	N/A	N/A	N/A	0.0	3739.0
										76.0	3738.0
										1478.0	3735.0
										1485.0	3732.0
										1507.0	3731.0
										1519.0	3732.0
										1532.0	3738.0
										1565.0	3739.0
MDO_C	Mesa Dam	MDO_1,C	1636	0.02400	0.013	Circle	N/A	N/A	5.0	N/A	N/A
MD2	M1 DS	MD_2,C2	6746	0.00104	0.03	Eight Point	N/A	N/A	N/A	0.0	3747.0
										2033.0	3744.0
										2039.0	3741.0
										2046.0	3738.0
										2075.0	3738.0
										2083.0	3741.0
										2093.0	3744.0
										3307.0	3747.0
OD_C	OD Dam	Ox_Out	3989	0.02100	0.013	Circle	N/A	N/A	3.0	N/A	N/A

Table A-23. Routing Inputs for the Northwest Region (Continued)

NORTHWEST REGION - MUSKINGUM CUNGE ROUTING											
							Trapezoid			Eight Point	
Reach Name	From Element	To Element	Length (ft)	Slope (ft/ft)	Channel Manning's n	Shape	Bottom Width (ft)	Side Slope (xH:1V)	Height (ft)	X	Y
ODA_C1	VS1,ODA2	ER1,ODA1	13033	0.032	0.016	Eight Point	N/A	N/A	N/A	0.0	4131.0
										1.0	4131.0
										190.0	4122.0
										219.0	4107.0
										232.0	4107.0
										268.0	4122.0
										586.0	4131.0
										586.1	4131.1
SSC_C1	SSC_2	SSC_C1,SSC_1	3468	0.044	0.03	Eight Point	N/A	N/A	N/A	0.0	4275.0
										30.0	4260.0
										35.0	4257.0
										50.0	4257.0
										55.0	4260.0
										229.0	4263.0
										244.0	4269.0
										246.0	4271.0
TDO_C	Thorn Dam	TDO_1,C	1468	0.033	0.033	Eight Point	N/A	N/A	N/A	0.0	3846.0
										104.0	3837.0
										405.0	3836.0
										780.0	3837.0
										854.0	3840.0
										884.0	3846.0
										885.0	3846.0
										886.0	3846.0

Table A-23. Routing Inputs for the Northwest Region (Continued)

NORTHWEST REGION - MUSKINGUM CUNGE ROUTING											
							Trapezoid			Eight Point	
Reach Name	From Element	To Element	Length (ft)	Slope (ft/ft)	Channel Manning's n	Shape	Bottom Width (ft)	Side Slope (xH:1V)	Height (ft)	X	Y
WSD_1_1	DD3,WSD2	WSD_1,WSD1_1	4182	0.003	0.035	Eight Point	N/A	N/A	N/A	0.0	3747.0
										15.0	3747.0
										16.0	3747.0
										26.0	3744.0
										33.0	3744.0
										40.0	3747.0
										66.0	3747.0
										66.1	3747.1

Table A-24. Routing Inputs for the West Central Region

WEST CENTRAL REGION - MUSKINGUM CUNGE ROUTING											
							Trapezoid			Eight Point	
Reach Name	From Element	To Element	Length (ft)	Slope (ft/ft)	Channel Manning's n	Shape	Bottom Width (ft)	Side Slope (xH:1V)	Height (ft)	X	Y
FPN21_C1	CBC1,FPN21	FPN21_OUT	1834	0.016	0.035	Eight Point	N/A	N/A	N/A	0.0	3795.0
										26.0	3786.0
										80.0	3747.0
										202.0	3747.0
										275.0	3774.0
										275.1	3774.1
										275.2	3774.2
										275.3	3774.3

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Table A-25. Adjusted Curve Numbers for the Central Region

CENTRAL REGION - ADJUSTED CURVE NUMBERS		
Watershed Name and HEC-HMS ID	**Initial CN**	**Storage Adjusted CN**
A_Louisiana_Dr_Dam_Upper	87	87
A_Magnolia_Reservoir	92	67
A_McKelligon_Reservoir_A	89	38

Table A-26. Adjusted Curve Numbers for the East Side Region

EAST SIDE REGION - ADJUSTED CURVE NUMBERS		
Watershed Name and HEC-HMS ID	**Initial CN**	**Storage Adjusted CN**
There were no adjustments made to watershed curve numbers. See Section A.8.3 for discussion.		

Table A-27. Adjusted Curve Numbers for the Mission Valley Region

MISSION VALLEY REGION - ADJUSTED CURVE NUMBERS		
Watershed Name and HEC-HMS ID	**Initial CN**	**Storage Adjusted CN**
A_Below Featherlake Basin	90	69
A_Below Phelps Dodge Basin	80	49
A_Carolina Drive Basin	78	38
A_Feather Lake Basin	78	44
A_Franklin Drain B	82	81
A_Franklin Drn to City Limit	76	76
A_Lincoln Drain	78	78
A_Lomaland Basin	64	62
A_Mesa Drain A	70	38
A_Mesa Drain B	73	63
A_Mesa Drain C	77	58
A_Middle Drain A	80	69
A_North Loop Detention Basin	78	44
A_Playa Drain B	83	70

Table A-28. Adjusted Curve Numbers for the Northeast Region

NORTHEAST REGION - ADJUSTED CURVE NUMBERS		
Watershed Name and HEC-HMS ID	**Initial CN**	**Storage Adjusted CN**
A_Army Ditch	82	79
A_Diana Ditch U/S Sunrise Ch	83	81
A_Ft Bliss Diversion Channel D/S	83	83
A_Green Belt Levee D/S	76	73
A_NE Pond Outer	81	81
A_PSB Ch 1 D/S	83	64
A_PSB Ch 1 U/S Fannin Elem	81	78
A_PSB Ch 2 D/S	76	75
A_Railroad Drain U/S Tobin Drain	78	78
A_Tobin Drain U/S Irvin High	80	74
A_W Fwy Ch U/S	76	71
A_War Road Ch	76	60

Table A-29. Adjusted Curve Numbers for the Northwest Region

NORTHWEST REGION - ADJUSTED CURVE NUMBERS		
Watershed Name and HEC-HMS ID	**Initial CN**	**Storage Adjusted CN**
Arroyo 4	89	78
Bandolero Channel_2	87	77
Belvidere Channel	88	82
Borderland Heights Ponds	70	33
Doniphan Ditch_1	81	80
Flow Path Number 38_4	85	33
High Ridge_1	87	84
Mace (Arroyo 1)	74	33
Montoya Drain_2	74	65
Montoya Drain_3	77	73
Mulberry Dam Outlet	85	42
Ojo De Agua_1	88	84
Thunderbird Valley	86	83
West of Rio Grande	66	65

Table A-30. Adjusted Curve Numbers for the West Central Region

WEST CENTRAL REGION - ADJUSTED CURVE NUMBERS		
Watershed Name and HEC-HMS ID	**Initial CN**	**Storage Adjusted CN**
Flow Path Number 21_2	87	81

Table A-31. Estimation of Rainfall Depth by Annual Exceedance Probability

Return Frequency	Total Rainfall Depth (inches) by Duration						
	1 hr	2 hr	3 hr	4 hr	6 hr	12 hr	24 hr
Central and Northeast El Paso							
1	0.41	0.52	0.57	0.61	0.66	0.72	0.8
2	0.7	0.88	0.95	0.99	1.07	1.18	1.35
5	0.97	1.22	1.3	1.36	1.46	1.61	1.83
10	1.15	1.45	1.55	1.62	1.73	1.91	2.16
25	1.41	1.79	1.89	1.99	2.11	2.33	2.6
50	1.61	20.6	2.18	2.3	2.43	2.68	2.96
100	1.84	2.36	2.49	2.64	2.78	3.06	3.34
250	2.18	2.82	2.96	3.16	3.3	3.63	3.89
500	2.47	3.21	3.37	3.62	3.74	4.12	4.35
West El Paso							
1	0.43	0.54	0.59	0.63	0.68	0.74	0.83
2	0.73	0.91	0.98	1.03	1.11	1.22	1.4
5	1.04	1.31	1.4	1.47	1.58	1.74	1.98
10	1.28	1.62	1.72	1.81	1.93	2.13	2.41
25	1.64	2.08	2.2	2.32	2.46	2.72	3.03
50	1.95	2.49	2.63	2.77	2.93	3.23	3.57
100	2.31	2.96	3.12	3.31	3.47	3.83	4.18
250	2.86	3.7	3.89	4.15	4.33	4.76	5.11
500	3.36	4.36	4.58	4.92	5.09	5.6	5.92
East El Paso							
1	0.35	0.45	0.49	0.52	0.56	0.61	0.69
2	0.64	0.8	0.87	0.91	0.98	1.08	1.23
5	0.97	1.22	1.3	1.36	1.46	1.61	1.83
10	1.22	1.54	1.64	1.72	1.84	2.02	2.29
25	1.61	2.05	2.17	2.28	2.42	2.67	2.98
50	1.96	2.5	2.64	2.79	2.95	3.25	3.59
100	2.38	3.05	3.21	3.41	3.58	3.94	4.3
250	3.04	3.92	4.12	4.4	4.59	5.05	5.42
500	3.65	4.73	4.97	5.34	5.52	6.08	6.42

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Table A-32. Central Region Complete HEC-HMS Results for 10 - 100-Year Storms

CENTRAL REGION - HEC-HMS RESULTS							
Schematic Figure Numbers(s)	Element Name	Area (mi^2)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
A-40, A-41	A_Alameda Avenue	0.299				11	
A-36, A-37	A_Altura_Ave_Dam	0.122	69	102	128	157	242
A-40, A-41	A_Blanco_Avenue	0.087				58	
A-34, A-35	A_Boone_St_Basin	0.398	176	264	337	419	658
A-40, A-41	A_Cebada_Drainage_Outfall	0.273				341	
A-38, A-39	A_Cebada_Reservoir	0.699	435	626	777	948	1431
A-34, A-35	A_Cemex_Spillway	0.923	575	793	963	1156	1694
A-40, A-41	A_Channel_108_Discharge	0.031				76	
A-40, A-41	A_Comanche_Avenue	0.136				233	
A-34, A-35	A_Concordia_Cemetery	0.305	171	251	315	388	597
A-36, A-37	A_Copia_Ditch_DS	0.160	174	230	272	320	451
A-36, A-37	A_Copia_Ditch_US	0.411	355	474	566	670	958
A-38, A-39	A_Cotton_Dallas_DS	0.375	428	567	670	670	670
A-38, A-39	A_Cotton_Dallas_US	1.047	828	1121	1342	1342	1342
A-38, A-39	A_Dam_No_10	0.073	88	123	150	150	150
A-38, A-39	A_Dam_No_8	0.052	49	71	88	88	88
A-38, A-39	A_Dam_No_9	0.033	39	54	65	65	65
A-40, A-41	A_Delta_Drive	0.076				146	
A-38, A-39	A_Eucalyptus_to_Cebada	0.226	244	319	374	437	609
A-36, A-37	A_Fort_Blvd_Reservoir	0.219	123	181	227	280	431
A-40, A-41	A_Glenwood_Street_48in_RCP	0.062				79	
A-34, A-35	A_Hardesty_to_Shelter	0.018	16	23	27	33	48
A-38, A-39	A_Houston_Elementary	0.498	279	377	453	538	774
A-36, A-37	A_Kentucky_Dam_Lower	0.124	62	91	114	140	214
A-36, A-37	A_Kentucky_Dam_Upper	0.057	56	79	98	118	176
A-36, A-37	A_Louisiana_Dr_Dam_Lower	0.049	60	82	99	118	171
A-36, A-37	A_Louisiana_Dr_Dam_Upper	0.137	105	151	188	231	351
A-34, A-35	A_Lower_Durazno	1.037	125	245	353	485	892
A-38, A-39	A_Magnolia_Reservoir	0.095	10	25	40	57	118
A-34, A-35	A_McKelligon_Dam	2.168	839	1200	1485	1809	2724
A-34, A-35	A_Mckelligon_Reservoir_A	0.038	38	54	66	80	119
A-34, A-35	A_Mckelligon_Reservoir_B	0.104	93	132	163	197	294
A-34, A-35	A_Mckelligon_Reservoir_C	0.009	8	11	14	18	27
A-38, A-39	A_Mckelligon_Reservoir_D	0.006	9	12	14	16	22
A-36, A-37	A_Memorial_Park	0.151	130	179	216	257	373
A-36, A-37	A_Memphis_Dam_Lower	0.015	13	19	24	30	45
A-36, A-37	A_Memphis_Dam_Upper	0.249	135	200	252	312	481
A-40, A-41	A_Modesto Ditch	0.117				218	
A-34, A-35	A_Mountain_Ave_Outlet_Condui	0.876	695	934	1116	1321	1890
A-40, A-41	A_Nixon_Cypress_to_Central	0.048				110	
A-38, A-39	A_Ohio_St_Reservoir	0.009	10	14	17	20	29
A-38, A-39	A_Ohio_St_Reservoir_DS	0.002	0	0	0	0	0
A-40, A-41	A_Paisano_Ditch	0.223				347	
A-34, A-35	A_Pershing Dam	0.193	82	127	164	207	331
A-34, A-35	A_Pollard Ditch	0.113	115	152	180	211	298
A-34, A-35	A_Pollard_Sacramento	0.021	28	37	44	52	73
A-40, A-41	A_Robert_Alva_Channel	0.442				486	
A-36, A-37	A_Russel_Ditch_DS	0.123	131	175	208	246	351
A-34, A-35	A_Russel_Ditch_US	0.434	424	564	671	791	1123
A-34, A-35	A_Saipan	0.152	141	205	258	316	484

Table A-32. Central Region Complete HEC-HMS Results for 10 - 100-Year Storms (Continued)

CENTRAL REGION - HEC-HMS RESULTS								
Schematic Figure Numbers(s)	Element Name	Area (mi^2)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
A-38, A-39	A_San_Diego_Dam	0.122	92	134	168	207	316
A-36, A-37	A_Scenic_Dr_Dam	0.126	75	111	139	172	264
A-38, A-39	A_Tremont_Reservoir	0.005	7	9	11	13	19
A-34, A-35	A_Upper_Durazno	0.018	11	17	22	28	46
A-34, A-35	A_Van_Buren_Dam	0.279	207	278	333	395	565
A-34, A-35	A_Van_Buren_Ditch	0.120	73	103	126	153	227
A-38, A-39	D_3708	1.580	530	530	530	530	530
A-34, A-35	D_Boone_St_Basin	5.682	375	375	375	375	375
A-36, A-37	D_Capacity of 60"Conduit	0.956	271	338	434	568	890
A-34, A-35	D_Government6_Hills	4.850	222	270	307	348	462
A-36, A-37	D_Houston_Elementary	0.498	250	250	250	250	250
A-38, A-39	D_IH_10_Dallas	1.580	216	216	216	216	216
A-38, A-39	D_Over_Cebada_Magnolia_Ridge	0.000	0	0	0	0	0
A-38, A-39	D_Overflow_Beneath_I-10	0.000	0	0	0	0	0
A-38, A-39	D_Overflow_Raynor_St	0.000	0	0	0	0	0
A-38, A-39	J_24hr-Emergency_Drain	0.000	100	100	100	100	100
A-40, A-41	J_Alameda Avenue	0.299				11	
A-40, A-41	J_Blanco_Avenue	0.386				59	
A-40, A-41	J_Cebada_Drainage_Outfall	0.544				780	
A-36, A-37	J_Cebada_Inflow	2.641	1186	1801	2480	3031	4682
A-36, A-37	J_Cebada_North	0.450	75	236	355	465	736
A-36, A-37	J_Cebada_Reservoir_Outfall	1.064	725	981	1171	1386	2134
A-38, A-39	J_Cebada_Total	0.878	239	451	589	732	1101
A-36, A-37	J_Cebada_US	1.064	738	988	1178	1393	2173
A-40, A-41	J_Channel 108	0.630				435	
A-40, A-41	J_Comanche_Avenue	0.522				249	
A-34, A-35	J_Concordia Cemetery	5.834	504	580	633	691	859
A-36, A-37	J_Copia_Ditch_DS	0.790	510	684	817	966	1635
A-36, A-37	J_Copia_Ditch_US	0.630	355	474	566	768	1294
A-38, A-39	J_Cotton_Dallas_US	0.073	0	0	0	0	0
A-38, A-39	J_Dallas_Reservoir	1.580	1248	1673	1988	1988	1988
A-38, A-39	J_Dallas_West	1.580	216	216	216	216	216
A-38, A-39	J_Dam_9_and_8	0.085	71	88	97	97	97
A-40, A-41	J_Delta_Drive	0.599				376	
A-38, A-39	J_Diversion	0.000	314	314	314	314	314
A-36, A-37	J_Eucalyptus_to_Cebada	0.956	371	438	534	668	990
A-34, A-35	J_Fort Bliss Channel Inflow	0.000	200	200	200	200	200
A-40, A-41	J_Glenwood_Street_48in_RCP	0.062				79	
A-34, A-35	J_Gov Hills Central Inflow	5.284	615	799	951	1098	1557
A-34, A-35	J_Gov Hills North Inflow	4.850	218	264	300	336	445
A-34, A-35	J_Gov Hills South Inflow	5.682	790	1063	1288	1517	2214
A-34, A-35	J_Gov_Hills_Outfall	5.852	496	574	629	687	852
A-34, A-35	J_Hardesty_to_Shelter	5.852	515	592	645	705	878
A-36, A-37	J_Houston_to_Cebada	0.699	435	673	880	1116	1775
A-36, A-37	J_I-10 Overtopping Flow	0.956	271	338	434	568	890
A-34, A-35	J_Inflow from Pershing Dam	4.850	322	370	407	448	562
A-36, A-37	J_Inflow to San Diego Dam	0.122	92	134	168	207	316
A-38, A-39	J_Inflow_Dam_No_10	0.073	88	123	150	150	150

Table A-32. Central Region Complete HEC-HMS Results for 10 - 100-Year Storms (Continued)

CENTRAL REGION - HEC-HMS RESULTS							
Schematic Figure Numbers(s)	Element Name	Area (mi^2)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
A-38, A-39	J_Inflow_Dam_No_8	0.052	49	71	88	88	88
A-38, A-39	J_Inflow_Dam_No_9	0.033	39	54	65	65	65
A-36, A-37	J_Inflow_Ft_Blvd_Res	0.219	123	181	227	280	431
A-36, A-37	J_Inflow_Kentucky_Dam_Lower	0.303	62	91	114	140	285
A-36, A-37	J_Inflow_Kentucky_Dam_Upper	0.179	61	117	165	211	348
A-38, A-39	J_Inflow_Louisiana_Dam_Lower	0.186	164	232	287	348	522
A-36, A-37	J_Inflow_Memphis_Dam	0.264	146	215	271	334	515
A-36, A-37	J_Inflow_Ohio_St_Res	0.130	69	91	105	118	148
A-36, A-37	J_Inflow_Tremont_Reservoir	0.138	47	54	58	99	152
A-34, A-35	J_Inflow_Van_Buren_Dam	3.647	833	1146	1386	1658	2421
A-34, A-35	J_Lower_Durazno_Out	1.360	0	0	0	0	42
A-34, A-35	J_Mckelligon Res A Inflow	2.206	38	54	66	113	209
A-34, A-35	J_McKelligon Res B Inflow	2.310	93	132	163	197	294
A-34, A-35	J_McKelligon Res C Inflow	2.318	79	134	165	199	297
A-34, A-35	J_McKelligon Res D Inflow	2.324	9	13	31	102	217
A-40, A-41	J_Modesto Ditch	0.117				218	
A-40, A-41	J_Nixon_Cypress_to_Central	0.048				110	
A-40, A-41	J_Outflow from Robert Alva	0.062				75	
A-38, A-39	J_Overflow_3708	0.000	47	120	160	160	160
A-40, A-41	J_Paisano_Ditch	0.271				453	
A-40, A-41	J_Pera	0.271				453	
A-34, A-35	J_Pershing_Dam	4.850	322	370	407	448	562
A-34, A-35	J_Pollard Ditch Inflow	0.113	113	150	178	209	295
A-34, A-35	J_Pollard_Sacramento	0.021	28	37	44	52	73
A-40, A-41	J_Robert_Alva_Channel	1.134				971	
A-34, A-35	J_Russel_Ditch	0.434	424	564	671	791	1123
A-34, A-35	J_Van Buren Ditch Inflow	1.044	626	870	1058	1272	1868
A-34, A-35	J_Van_Buren_Ditch_US	0.923	573	790	958	1148	1679
A-34, A-35	R_24hr-Emergency Drain	0.000	100	100	100	100	100
A-40, A-41	R_Alameda_Avenue	0.299				11	
A-36, A-37	R_Altura_to_Kentucky_Upper	0.122	46	89	115	150	234
A-40, A-41	R_Blanco_to_Comanche	0.386				59	
A-34, A-35	R_Boone_to_Concordia	5.682	375	375	375	375	375
A-36, A-37	R_Cebada_Reservoir_2	0.450	72	232	344	457	734
A-36, A-37	R_Cebada_Reservoir_3	0.303	65	92	111	137	283
A-36, A-37	R_Cebada_Reservoir_4	0.126	29	35	39	43	52
A-36, A-37	R_Cebada_to_Cebada_Reservoir	1.064	725	981	1171	1386	2134
A-40, A-41	R_Channel108_to_Robert_Alva	0.630				420	
A-40, A-41	R_Comanche_to_Delta_Dr	0.522				247	
A-34, A-35	R_Concordia_to_Hardesty	5.834	499	569	618	673	829
A-36, A-37	R_Copia_Ditch_DS	0.630	354	474	564	751	1257
A-38, A-39	R_CottonDallas_to_Dallas_Res	0.073	0	0	0	0	0
A-38, A-39	R_Dallas_to_Cebada_Connector	0.000	314	314	314	314	314
A-38, A-39	R_Dam_9 and_8_to_Dallas_Res	0.085	68	87	97	97	97
A-40, A-41	R_Delta_Dr_to_Channel108_Out	0.599				363	
A-34, A-35	R_El Paso Rock Quarries	2.318	0	13	31	102	217
A-36, A-37	R_Eucalyptus to Cebada	0.000	100	100	100	100	100
A-36, A-37	R_Fort_Blvd_to_Copia_DitchUS	0.219	43	110	169	241	403

Table A-32. Central Region Complete HEC-HMS Results for 10 - 100-Year Storms (Continued)

CENTRAL REGION - HEC-HMS RESULTS							
Schematic Figure Numbers(s)	Element Name	Area (mi^2)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
A-34, A-35	R_FortBliss Inflow	0.000	200	200	200	200	200
A-40, A-41	R_Glenwood_to_Robert_Alva	0.062				75	
A-34, A-35	R_Gov_Hills_Conduit	4.850	218	264	300	336	445
A-34, A-35	R_Hardesty_to_Gov_Hills_Out	5.852	496	574	629	687	852
A-36, A-37	R_Houston_Magnolia	0.498	250	250	250	250	250
A-36, A-37	R_Magnolia_to_Eucalyptus	0.731	288	301	309	327	406
A-34, A-35	R_Mckelligon_Channel	2.206	0	3	30	112	207
A-34, A-35	R_Mckelligon_D_Out	2.324	7	12	31	95	217
A-34, A-35	R_Mountain_Avenue_Conduit	3.647	820	1053	1133	1205	1359
A-40, A-41	R_Paisano_Ditch	0.048				106	
A-40, A-41	R_Pera_to_Cebada_Outfall	0.271				439	
A-34, A-35	R_Pollard_Ditch	0.113	113	150	178	209	295
A-34, A-35	R_Pollard_Sacramento	0.021	25	33	39	47	67
A-34, A-35	R_Russel_Ditch	0.434	410	545	659	767	1112
A-36, A-37	R_Tremont_to_Magnolia	0.138	40	46	49	54	133
A-38, A-39	R_Van_Buren_DS	0.923	557	772	939	1128	1655
A-36, A-37	S_Altura_Ave_Dam	0.122	49	90	121	154	236
A-36, A-37	S_Cebada_Reservoir	2.641	530	571	600	637	742
A-34, A-35	S_Cemex Spilway	0.923	573	790	958	1148	1679
A-38, A-39	S_Dallas_Reservoir	1.580	577	650	690	690	690
A-38, A-39	S_Dam_No_10	0.073	0	0	0	0	0
A-38, A-39	S_Dam_No_8	0.052	36	43	49	49	49
A-38, A-39	S_Dam_NO_9	0.033	36	45	49	49	49
A-36, A-37	S_Fort_Blvd_Reservoir	0.219	43	111	169	242	410
A-36, A-37	S_Kentucky_Dam_Lower	0.303	68	95	112	138	285
A-36, A-37	S_Kentucky_Dam_Upper	0.179	2	10	31	57	134
A-36, A-37	S_Louisiana_Dam_Lower	0.186	25	79	124	163	246
A-34, A-35	S_Lower_Durazno	1.360	0	0	0	0	42
A-36, A-37	S_Magnolia_Reservoir	0.731	291	301	309	330	411
A-34, A-35	S_McKelligon_Dam	2.168	0	4	30	111	205
A-34, A-35	S_Mckelligon_Reservoir_A	2.206	0	3	30	112	207
A-34, A-35	S_Mckelligon_Reservoir_B	2.310	73	126	154	186	277
A-34, A-35	S_Mckelligon_Reservoir_C	2.318	0	13	31	103	217
A-34, A-35	S_Mckelligon_Reservoir_D	2.324	7	12	31	95	218
A-36, A-37	S_Memorial_Park	0.941	631	847	1010	1196	1893
A-36, A-37	S_Memphis_Dam_Lower	0.264	72	157	232	308	494
A-36, A-37	S_Ohio_St_Reservoir	0.130	46	53	57	97	148
A-34, A-35	S_Pershing_Dam	4.716	225	240	252	263	298
A-36, A-37	S_San_Diego_Dam	0.122	64	85	97	110	138
A-36, A-37	S_Scenic_Dr_Dam	0.126	29	35	39	43	52
A-36, A-37	S_Tremont_Reservoir	0.138	40	46	49	54	142
A-34, A-35	S_Upper_Durazno	0.323	0	0	50	222	1531
A-34, A-35	S_Van_Buren_Dam	3.647	834	1058	1135	1206	1359
A-34, A-35	Source_NE_Input	Not Specified	200	200	200	200	200

Table A-33. East Side Region Complete HEC-HMS Results for 10 - 100-Year Storms

EAST SIDE REGION - HEC-HMS RESULTS							
Schematic Figure Numbers	**Element Name**	**Area (mi^2)**	**10-Year (cfs)**	**25-Year (cfs)**	**50-Year (cfs)**	**100-Year (cfs)**	**500-Year (cfs)**
A-42, A-45	A-PD-1	0.7542	341	492	618	763	1178
A-42, A-45	A-PD-1A	0.1608	161	220	269	324	478
A-42, A-45	A_Sunmount	0.2858	153	226	289	361	569
A-42, A-45	EID-1	0.3002	238	292	334	382	514
A-42, A-45	CVP-1	0.1859	130	164	190	220	302
A-42, A-45	CVP-2	0.5040	352	443	514	595	817
A-42, A-45	EID-2	0.1395	89	109	125	143	193
A-42, A-45	CVP-3	0.0630	45	57	66	77	105
A-42, A-45	RLH-1	0.1246	59	74	87	101	139
A-42, A-45	RLH_2	0.0319	17	27	36	47	77
A-42, A-45	ESTWD1	0.6150	499	618	710	815	1106
A-42, A-45	ESTWD2	0.6680	1195	1471	1688	1929	2604
A-42, A-45	SLTRHL	0.4390	253	320	372	431	594
A-42, A-45	A-CAR DAM-1	0.4161	29	74	124	190	409
A-42, A-45	A_CAR DAM-2	0.1015	105	142	172	206	300
A-42, A-45	A_MesaDrain_UP	0.0735	69	96	118	142	212
A-42, A-45	A-LL-8	1.0568	151	301	447	626	1191
A-42, A-45	A-LL-8a	0.7243	210	342	459	596	1005
A-42, A-45	A-LL-10	0.3416	341	467	571	687	1014
A-42, A-45	A-MESA-2	0.5021	143	244	335	443	768
A-42, A-45	A_MESA_3	0.2018	200	271	329	394	576
A-42, A-45	A_MESA_4	0.1603	49	82	111	145	248
A-42, A-45	CVB-A	0.9757	32	32	32	32	32
A-42, A-45	CVB-B	0.0630	22	26	26	26	26
A-42, A-45	ED	0.6150	214	306	381	466	692
A-42, A-45	LAF-B	0.4161	18	26	26	26	26
A-42, A-45	JESUIT BASIN	1.7811	22	22	22	22	22
A-42, A-45	PENDALE BASIN	0.5021	32	32	32	32	32
A-42, A-45	CLB_A_JN	1.2759	270	324	366	414	546
A-42, A-45	CLB_B_JN	0.1876	80	100	113	127	165
A-42, A-45	Node19	1.2830	1211	1488	1706	1949	2654
A-42, A-45	CARDAM@IH-10	0.5176	106	149	188	232	326
A-42, A-45	LOMALAND @IH-10	2.1227	355	489	593	709	1036
A-42, A-45	MESA -JN	0.7039	214	299	361	426	608
A-42, A-45	MV#1	0.7542	341	492	618	763	1178
A-42, A-45	MV#2	0.1608	161	220	269	324	478
A-42, A-45	Sunmount Channel	0.2858	151	224	286	357	566
A-42, A-45	VCNT-1	0.1859	130	164	190	220	302
A-42, A-45	VCNT-2	0.5040	352	443	514	595	817
A-42, A-45	MV#3	1.2759	270	324	366	414	546
A-42, A-45	MV#4	0.1395	89	109	125	143	193
A-42, A-45	VCNT-3	0.0630	45	57	66	77	105
A-42, A-45	MV#5	0.1876	80	100	113	127	165
A-42, A-45	MV#6	0.0319	17	27	36	47	77

Table A-33. East Side Region Complete HEC-HMS Results for 10 - 100-Year Storms (Continued)

EAST SIDE REGION - HEC-HMS RESULTS							
Schematic Figure Numbers	Element Name	Area (mi^2)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
A-42, A-45	MV#7	1.2830	1211	1488	1706	1949	2654
A-42, A-45	MV#8	0.4390	253	320	372	431	594
A-42, A-45	MV#9	0.5176	106	149	188	232	326
A-42, A-45	MV#10	0.0735	69	96	118	142	212
A-42, A-45	MV#11	2.1227	354	488	591	706	1032
A-42, A-45	MV#12	0.7039	214	299	361	426	608
A-42, A-45	MV#13	0.1603	49	82	111	145	248
A-43, A-45	9C	0.444	665	816	934	1066	1436
A-43, A-45	9A	0.934	1076	1321	1509	1725	2323
A-43, A-45	9B	0.262	433	531	608	694	934
A-43, A-45	29	0.0270	51	63	72	83	112
A-43, A-45	22	0.0440	84	103	119	135	182
A-43, A-45	34	0.0480	90	111	128	146	197
A-43, A-45	46	0.1180	226	278	319	364	490
A-43, A-45	52	0.0450	86	105	121	138	186
A-43, A-45	58	0.009	17	21	24	28	37
A-43, A-45	66	0.03	58	71	81	92	125
A-43, A-45	77	0.087	166	204	235	268	361
A-43, A-45	83	0.044	80	99	115	131	179
A-43, A-45	90	0.009	16	20	23	27	36
A-43, A-45	96A	0.05	95	117	134	154	207
A-43, A-45	96B	0.006	11	13	16	18	24
A-43, A-45	100	0.0490	88	110	127	145	198
A-43, A-45	106	0.0220	42	52	59	68	91
A-43, A-45	110	0.0150	29	35	40	46	62
A-43, A-45	124F	0.0160	31	38	43	49	66
A-43, A-45	124B	0.2380	377	463	530	606	816
A-43, A-45	124E	0.0690	8	11	13	15	21
A-43, A-45	124A	0.1990	367	454	523	599	811
A-43, A-45	124C	1.1480	621	842	1005	1181	1665
A-43, A-45	124D	0.0870	76	96	111	128	176
A-43, A-45	9C_P	0.444	6	9	112	226	745
A-43, A-45	9B_P	0.262	2	3	4	5	7
A-43, A-45	9J	1.64	1076	1321	1509	1726	2545
A-43, A-45	WS-22	0.282	537	660	758	866	1168
A-43, A-45	WS-77	0.17	321	395	454	519	701
A-43, A-45	96J	0.056	106	130	149	171	230
A-43, A-45	WS-110	0.037	71	87	100	114	153
A-43, A-45	124JW	0.5060	741	912	1048	1203	1630
A-43, A-45	124JE	1.2350	677	914	1089	1279	1801
A-43, A-45	JB	1.757	966	1257	1495	1754	2467
A-43, A-45	9CR	0.444	6	9	112	226	741
A-43, A-45	9BR	0.262	2	3	4	5	7
A-43, A-45	MV#14	1.64	1075	1320	1509	1725	2538

Table A-33. East Side Region Complete HEC-HMS Results for 10 - 100-Year Storms (Continued)

EAST SIDE REGION - HEC-HMS RESULTS							
Schematic Figure Numbers	Element Name	Area (mi^2)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
A-43, A-45	MV#15	0.282	537	660	758	866	1168
A-43, A-45	MV#16	0.17	321	395	454	519	701
A-43, A-45	MV#17	0.009	16	20	23	27	36
A-43, A-45	RCP375	0.05	95	117	134	153	206
A-43, A-45	MV#17a	0.056	105	129	148	169	229
A-43, A-45	MV#18	0.049	88	109	126	145	197
A-43, A-45	MV#19	0.037	71	87	100	114	153
A-43, A-45	ARROYO-WEST	0.199	366	450	517	592	805
A-43, A-45	ARROYO-WEST2	0.506	739	908	1046	1197	1618
A-43, A-45	ARROYO-EAST	1.148	621	842	1004	1180	1663
A-43, A-45	ARROYO-EAST2	1.235	676	913	1089	1278	1801
A-43, A-45	MV#20	1.757	966	1257	1493	1753	2466
A-43, A-45	A-PD-2	0.148594	202	259	304	354	493
A-43, A-45	A-PD-3	0.185453	82	121	153	190	296
A-43, A-45	A-PD-4	0.367969	85	142	192	251	430
A-43, A-45	A-PD-5	0.545313	265	378	471	578	882
A-43, A-45	A-PD-6	0.44422	201	299	382	477	752
A-43, A-45	A-PD-7	0.941047	661	977	1248	1557	2454
A-43, A-45	A-PD-8	4.475078	773	1163	1501	1890	3025
A-43, A-45	A-PD-9	6.086	623	928	1201	1509	2416
A-43, A-45	A-PD-10	1.915484	355	533	687	865	1384
A-43, A-45	A-LL-1	0.380719	270	393	497	617	962
A-43, A-45	A-LL-2	0.206188	73	127	176	234	412
A-43, A-45	A-LL-3	0.347156	121	206	283	373	644
A-43, A-45	A-LL-4	2.332031	971	1403	1765	2179	3361
A-43, A-45	A-LL-5	1.092469	659	949	1193	1471	2267
A-43, A-45	A-LL-6	1.632359	948	1366	1717	2119	3268
A-43, A-45	A-LL-7	0.455859	262	384	485	602	938
A-43, A-45	A-LL-9	1.600547	447	727	974	1264	2131
A-43, A-45	A-AM-1	3.529938	1892	2806	3585	4480	7069
A-44, A-45	A-AM-2	1.820891	801	1190	1519	1898	2998
A-44, A-45	A-AM-3	0.69725	463	676	855	1060	1652
A-44, A-45	A-AM-4	0.161688	119	177	225	281	441
A-44, A-45	A-AM-5	0.480344	218	312	389	478	729
A-44, A-45	A-AM-6	0.143594	4	14	26	44	108
A-44, A-45	A-AM-7	0.105219	8	22	37	56	122
A-44, A-45	A-AM-8	0.260047	65	100	130	165	267
A-44, A-45	A-AM-9	0.2859533	40	79	118	165	314
A-44, A-45	A-AM-10	0.107359	55	86	113	144	235
A-44, A-45	A-AM-11	1.724141	221	459	694	988	1916
A-44, A-45	A-AM-12	0.158297	69	103	131	164	258
A-44, A-45	A-AMTEN-1	1.504406	685	990	1244	1536	2369
A-44, A-45	A-AMTEN-2	1.535656	808	1122	1380	1673	2498
A-44, A-45	A-AMTEN-3	1.262859	673	983	1244	1545	2410

Table A-33. East Side Region Complete HEC-HMS Results for 10 - 100-Year Storms (Continued)

EAST SIDE REGION - HEC-HMS RESULTS							
Schematic Figure Numbers	Element Name	Area (mi^2)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
A-44, A-45	A-AMTEN-4	0.772672	477	679	846	1038	1582
A-44, A-45	A-AMTEN-5	0.921422	759	1090	1372	1690	2603
A-44, A-45	A-AMTEN-6	3.006453	393	580	743	929	1470
A-44, A-45	A-AMTEN-7	3.861875	662	980	1255	1570	2485

Table A-34. Mission Valley Region Complete HEC-HMS Results for 10 - 100-Year Storms

MISSION VALLEY REGION - HEC-HMS RESULTS							
Schematic Figure Numbers	Element Name	Area (mi^2)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
A-46, A-47	A_Americas Basin	0.498	38	71	101	138	253
A-46, A-47	A_Americas Ten Basin	0.261	2	7	14	25	73
A-46, A-47	A_Americas Ten NonContribute	0.085	0	0	1	3	12
A-46, A-47	A_Basin A	1.421	205	355	486	644	1119
A-46, A-47	A_Basin G	0.356	114	161	199	241	363
A-46, A-47	A_Below Basin G to Cty Limi	1.878	266	414	539	682	1104
A-46, A-47	A_Below Carolina Dam	1.024	229	387	522	684	1167
A-46, A-47	A_Below Featherlake Basin	0.153	15	31	47	66	127
A-46, A-47	A_Below Phelps Dodge Basin	1.386	0	3	17	44	166
A-46, A-47	A_Carolina Drive Basin	0.291	0	0	0	0	6
A-46, A-47	A_Feather Lake Basin	0.704	0	0	1	4	43
A-46, A-47	A_Franklin Drain A	0.668	318	455	565	691	1046
A-46, A-47	A_Franklin Drain B	0.908	333	519	671	847	1355
A-46, A-47	A_Franklin Drn to City Limit	2.884	181	298	402	523	888
A-46, A-47	A_Franklin Spur Drain	0.114	44	70	91	115	185
A-46, A-47	A_Lincoln Drain	2.330	481	790	1052	1364	2287
A-46, A-47	A_Lomaland Basin	0.663	22	66	122	204	499
A-46, A-47	A_Mesa Drain A	0.663	0	0	0	0	10
A-46, A-47	A_Mesa Drain B	0.740	26	70	123	196	443
A-46, A-47	A_Mesa Drain C	3.185	27	103	193	320	830
A-46, A-47	A_Mesa Drain to City Limit	0.803	67	124	175	238	430
A-46, A-47	A_Middle Drain A	4.306	200	394	580	807	1531
A-46, A-47	A_Middle Drain B	0.123	91	126	154	185	273
A-46, A-47	A_Middle Drain Spur A	0.055	59	85	106	129	195
A-46, A-47	A_Middle Drain Spur B	0.074	69	96	118	143	211
A-46, A-47	A_Middle to City Limit	1.013	346	544	707	896	1445
A-46, A-47	A_North Loop Detention Basin	1.129	0	0	1	7	73
A-46, A-47	A_Phelps Dodge Basin	1.081	162	318	458	627	1144
A-46, A-47	A_Playa Drain A	0.571	144	230	302	388	638
A-46, A-47	A_Playa Drain B	5.842	263	507	735	1014	1902
A-46, A-47	Basin_A_Sink	0.000	130	390	390	390	390
A-46, A-47	D_Basin A 42inch Culvert	NS	581	954	1275	1644	2785
A-46, A-47	D_Mesa to Mesa Interceptor	NS	1301	1783	2214	2728	4548
A-46, A-47	D_Middle and Middle Int	NS	416	663	903	1243	4359
A-46, A-47	D_Playa and Playa Intercepto	NS	342	882	1576	2552	5040
A-46, A-47	J_Franklin and Franklin Spur	NS	853	1576	2510	3733	8637
A-46, A-47	J_Franklin Drain City Limit	NS	995	1867	2878	4150	9344
A-46, A-47	J_Lincoln Drain Outlet	NS	481	790	1052	1364	2316
A-46, A-47	J_Mesa Drain w Americas Bsn	NS	1301	1783	2214	2728	4548
A-46, A-47	J_Mesa Drain w Americas Ten	NS	112	192	582	1155	2448
A-46, A-47	J_Mesa Drain w Carolina Bsn	NS	1160	1425	1632	1868	2559
A-46, A-47	J_Mesa Drain w Lafayette Drw	NS	1282	1660	1965	2318	3422
A-46, A-47	J_Mesa Drain w Lomaland	NS	1337	1787	2159	2596	3955
A-46, A-47	J_Mesa Drain w Phelps Dodge	NS	1256	1535	1753	1999	2728

Table A-34. Mission Valley Region Complete HEC-HMS Results for 10 - 100-Year Storms (Continued)

MISSION VALLEY REGION - HEC-HMS RESULTS								
Schematic Figure Numbers	Element Name	Area (mi^2)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
A-46, A-47	J_Mesa Int w Middle Drain	NS	416	664	905	1252	4439
A-46, A-47	J_Middle Drain City Limit	1.013	346	544	707	896	1445
A-46, A-47	J_Middle Drain w Middle Int	NS	416	663	903	1243	4359
A-46, A-47	J_Middle Int w Franklin Canl	NS	417	666	906	1240	4324
A-46, A-47	J_Middle Int w Franklin Drn	NS	505	732	994	1311	4381
A-46, A-47	J_Playa Drain Outlet Basin A	NS	104	411	905	1672	3649
A-46, A-47	J_Playa Drain w Basin A	NS	641	1036	1367	1747	2902
A-46, A-47	J_Playa Drain with Conduit	NS	621	1018	1352	1744	2924
A-46, A-47	J_Playa Drain with Intercept	NS	342	882	1576	2552	5040
A-46, A-47	J_Playa Drn with North Loop	NS	652	1043	1377	1773	2953
A-46, A-47	R_Franklin Drain A	NS	500	725	993	1309	4359
A-46, A-47	R_Franklin Drain Spur A	NS	342	857	1511	2390	4838
A-46, A-47	R_Franklin Drain Spur B	NS	341	843	1489	2341	4738
A-46, A-47	R_Franklin Drn to City Lmt A	NS	853	1575	2503	3720	8632
A-46, A-47	R_Franklin Drn to City Lmt B	NS	844	1570	2504	3711	8583
A-46, A-47	R_Lincoln Drain A	NS	0	0	0	0	30
A-46, A-47	R_Lincoln Drain B	NS	0	0	0	0	30
A-46, A-47	R_Lincoln to Playa Conduit	NS	477	788	1051	1359	2296
A-46, A-47	R_Mesa Drain above Amer BsnA	NS	1211	1599	1944	2359	3585
A-46, A-47	R_Mesa Drain above Amer BsnB	NS	1183	1585	1915	2287	3577
A-46, A-47	R_Mesa Drain above Carolina	NS	1160	1425	1632	1868	2559
A-46, A-47	R_Mesa Drain above Lomaland	NS	1231	1625	1939	2298	3398
A-46, A-47	R_Mesa Drain below Carolina	NS	1059	1298	1489	1713	2391
A-46, A-47	R_Mesa Drain to City Limit	0.000	0	0	0	0	0
A-46, A-47	R_Mesa Interceptor above FL	NS	1287	1744	2188	2725	4498
A-46, A-47	R_Mesa Interceptor blw FL A	NS	331	413	478	905	2981
A-46, A-47	R_Mesa Interceptor blw FL B	NS	331	413	478	904	2941
A-46, A-47	R_Middle Drain to City Limit	0.000	0	0	0	0	0
A-46, A-47	R_Middle Drain to Intercept	NS	416	663	903	1243	4359
A-46, A-47	R_Middle Interceptor A	NS	416	663	903	1237	4319
A-46, A-47	R_Middle Interceptor B	NS	417	665	905	1234	4248
A-46, A-47	R_Playa Drain Conduit	NS	104	408	884	1628	3546
A-46, A-47	R_Playa Drain Lower_A	NS	104	408	884	1628	3546
A-46, A-47	R_Playa Drain Lower_B	NS	104	406	876	1591	3538
A-46, A-47	R_Playa Drain Lower_C	NS	103	406	850	1581	3449
A-46, A-47	R_Playa Drain Upper_A	NS	612	997	1329	1720	2897
A-46, A-47	R_Playa Drain Upper_B	NS	641	1036	1367	1747	2902
A-46, A-47	S_Americas Basin	NS	104	115	124	135	159
A-46, A-47	S_Americas Ten Basin	NS	61	85	438	920	2074
A-46, A-47	S_Basin A	NS	77	353	828	1578	3532
A-46, A-47	S_Basin G	0.356	0	0	0	0	0
A-46, A-47	S_Carolina Drive Basin	NS	65	97	115	132	171
A-46, A-47	S_Featherlake Basin	NS	331	414	478	907	3004
A-46, A-47	S_Lomaland Basin	NS	89	97	104	110	128

Table A-34. Mission Valley Region Complete HEC-HMS Results for 10 - 100-Year Storms (Continued)

MISSION VALLEY REGION - HEC-HMS RESULTS							
Schematic Figure Numbers	Element Name	Area (mi^2)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
A-46, A-47	S_North Loop Detention Basin	NS	47	54	55	55	55
A-46, A-47	S_Phelps Dodge Basin	NS	112	122	130	138	158
A-46, A-47	Source_CE Input	NS	0	0	0	0	30
A-46, A-47	Source_MV# 1,2	NS	404	577	720	885	1352
A-46, A-47	Source_MV#11	NS	345	479	581	696	1016
A-46, A-47	Source_MV#12,13	NS	264	376	462	558	833
A-46, A-47	Source_MV#14,15,16,17a	NS	1623	1998	2285	2615	3534
A-46, A-47	Source_MV#17a,18,19,20	NS	1114	1434	1698	1992	2812
A-46, A-47	Source_MV# 3,4,5	NS	410	500	569	646	854
A-46, A-47	Source_MV#6,7	NS	1178	1454	1670	1913	2620
A-46, A-47	Source_MV#8,9,10	NS	304	391	466	552	786

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Table A-35. Northeast Region Complete HEC-HMS Results for 10 - 100-Year Storms

NORTHEAST REGION - HEC-HMS RESULTS							
Schematic Figure Numbers	Element Name	Area (mi^2)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
A-48, A-49	A_Amber Basin	0.248	203	287	353	404	717
A-48, A-49	A_Army Ditch	0.423	134	217	285	359	625
A-48, A-49	A_Bossworth D/S	0.120	68	95	117	139	217
A-48, A-49	A_Bossworth U/S	0.417	191	274	339	408	639
A-48, A-49	A_Diana Ditch DS Sunrise Ch	1.859	598	902	1150	1420	2295
A-48, A-49	A_Diana Ditch US Sunrise Ch	0.960	361	559	722	891	1508
A-48, A-49	A_E Fwy Channel	1.674	114	205	288	386	694
A-48, A-49	A_Electric Ditch	0.626	215	327	419	519	853
A-48, A-49	A_Fairbanks Drive	1.114	224	345	445	558	901
A-48, A-49	A_Fort Bliss Div Ch	0.166	146	204	249	282	496
A-48, A-49	A_Fort Bliss Div Ch D/S	24.625	7322	10969	13930	17154	27502
A-48, A-49	A_Fort Bliss Div Ch U/S	0.154	120	170	210	242	424
A-48, A-49	A_Fusselman Dam	3.371	958	1445	1843	2283	3667
A-48, A-49	A_Green Belt Levee D/S	0.968	86	154	215	288	516
A-48, A-49	A_Green Belt Levee U/S	14.301	1349	2183	2902	3735	6249
A-48, A-49	A_Hondo Pass Basin	0.079	66	93	114	130	226
A-48, A-49	A_Hondo Pass Ch	0.047	31	46	58	67	121
A-48, A-49	A_Johnson Channel	0.075	74	100	120	135	225
A-48, A-49	A_Keltner Dam	0.486	276	391	481	572	908
A-48, A-49	A_Mtn Park Dam	0.806	350	501	621	749	1169
A-48, A-49	A_NE. Pond Outer	3.201	1044	1612	2080	2584	4287
A-48, A-49	A_NE Ponding	3.133	286	489	668	878	1523
A-48, A-49	A_Northgate Dam	1.472	275	462	621	805	1393
A-48, A-49	A_Northgate Div Ch	1.293	422	615	770	940	1468
A-48, A-49	A_Northgate Int Ch	0.599	26	57	87	127	255
A-48, A-49	A_Northgate Outlet Channel	0.472	56	103	145	195	354
A-48, A-49	A_Northhills Dam N	2.446	674	999	1262	1555	2450
A-48, A-49	A_Northhills Dam S	3.087	853	1249	1568	1923	2995
A-48, A-49	A_PSB Ch 1 D/S	0.460	20	50	83	127	275
A-48, A-49	A_PSB Ch 1 U/S Fannin	1.798	136	249	352	478	867
A-48, A-49	A_PSB Ch 1 U/S Gateway	0.239	62	100	131	166	282
A-48, A-49	A_PSB Ch 1 U/S PSB2	0.701	240	372	481	597	998
A-48, A-49	A_PSB Ch 2 D/S	0.992	169	293	401	525	929
A-48, A-49	A_PSB Ch 2 U/S Gateway	1.371	267	424	555	705	1167
A-48, A-49	A_PSB Ch 2 U/S Rushing	0.803	162	283	389	509	919
A-48, A-49	A_Railroad Drain D/S	0.053	1	4	7	12	29
A-48, A-49	A_Railroad Drain U/S Statler	0.152	17	30	42	56	100
A-48, A-49	A_Railroad Drain U/S Tobin	9.876	635	1016	1350	1734	2886
A-48, A-49	A_Range Basin	0.391	136	224	297	373	680
A-48, A-49	A_Range Dam	2.210	428	658	849	1066	1720
A-48, A-49	A_Statler Ditch	0.448	100	165	221	283	487
A-48, A-49	A_Sunrise Basin	0.135	101	143	176	204	348
A-48, A-49	A_Sunrise Channel	0.318	135	197	247	299	476
A-48, A-49	A_Sunrise Dam	0.499	239	343	425	510	804

Table A-35. Northeast Region Complete HEC-HMS Results for 10 - 100-Year Storms (Continued)

NORTHEAST REGION - HEC-HMS RESULTS							
Schematic Figure Numbers	Element Name	Area (mi^2)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
A-48, A-49	A_Tobin Drain at U/S Army	0.501	317	460	574	677	1147
A-48, A-49	A_Tobin Drain U/S Irvin H	2.190	343	611	846	1120	2012
A-48, A-49	A_Tobin Drain U/S RR Drain	0.503	115	198	269	348	622
A-48, A-49	A_TXDOT Pond	0.614	145	229	300	379	632
A-48, A-49	A_W. Fwy Ch D/S	1.336	94	169	237	318	572
A-48, A-49	A_W. Fwy Ch U/S	1.031	65	158	254	378	803
A-48, A-49	A_War Road Channel	0.524	140	242	329	423	776
A-48, A-49	D_Ft Bliss Outflow	92.239	9104	14002	18049	22557	36838
A-48, A-49	D_Ft Bliss Sump	92.239	0	0	0	437	10013
A-48, A-49	D_Hondo Pass	0.047	31	46	58	67	121
A-48, A-49	D_NE Ponding	32.347	0	0	0	0	0
A-48, A-49	D_Range Dam	11.157	0	0	0	0	0
A-48, A-49	J_Army Ditch	11.972	134	217	285	359	625
A-48, A-49	J_Bossworth Ch D/S	0.538	248	356	440	531	824
A-48, A-49	J_Diana Ditch and FB Div	5.272	1255	1920	2448	3009	4873
A-48, A-49	J_Diana Ditch D/S	3.647	1039	1609	2066	2563	4173
A-48, A-49	J_Diana Ditch U/S	1.788	496	756	969	1193	1978
A-48, A-49	J_Electric Ditch	1.740	334	515	664	836	1345
A-48, A-49	J_Ft Bliss Div Ch Dyer St	1.624	222	312	382	447	723
A-48, A-49	J_Ft Bliss Div Ch U/S	1.459	120	170	220	357	448
A-48, A-49	J_Ft Bliss Sump	92.239	9304	14202	18249	22757	37038
A-48, A-49	J_Ft Bliss Sump Upper	66.515	1794	2915	3902	5065	8573
A-48, A-49	J_Green Belt Levee	25.014	1849	2990	3970	5109	8544
A-48, A-49	J_Green Belt Levee D/S	32.347	2292	3772	5065	6576	11191
A-48, A-49	J_Northgate Dam Out	7.207	56	103	145	195	354
A-48, A-49	J_PSB Ch 1 D/S	6.365	766	1295	1760	2317	4023
A-48, A-49	J_PSB Ch1 Jct1	0.239	62	100	131	166	282
A-48, A-49	J_PSB Ch1 Jct2	2.037	187	327	453	602	1064
A-48, A-49	J_PSB Ch1 Jct3	5.905	749	1257	1700	2227	3830
A-48, A-49	J_PSB Ch 2 at Gateway	1.371	267	424	555	705	1167
A-48, A-49	J_PSB Ch 2 at Rushing	2.175	350	567	752	966	1622
A-48, A-49	J_PSB Ch 2 D/S	3.167	460	763	1026	1337	2292
A-48, A-49	J_RR and Tobin Drain	60.590	756	1270	1718	2252	3869
A-48, A-49	J_RR Ditch at Statler Ditch	61.190	846	1427	1936	2542	4372
A-48, A-49	J_RR Ditch Downstream	61.243	840	1414	1917	2516	4331
A-48, A-49	J_RR Drain U/S of Tobin	45.424	635	1016	1350	1734	2886
A-48, A-49	J_RR Dr U/S Statler Ch	60.742	770	1295	1752	2296	3945
A-48, A-49	J_Sunrise Ch D/S	0.828	139	203	254	308	487
A-48, A-49	J_Sunrise Ch U/S	0.510	9	11	12	14	19
A-48, A-49	J_Tobin Drain at Army Ditch	14.663	572	970	1315	1720	2960
A-48, A-49	J_Tobin Drain D/S	15.166	652	1117	1522	2003	3452
A-48, A-49	J_Tobin Drain U/S Army Ditch	2.691	470	801	1088	1422	2474
A-48, A-49	J_War Road Channel	6.058	140	243	337	445	844
A-48, A-49	J_W Fwy Ch @ War Road	6.672	268	408	526	671	1091

Table A-35. Northeast Region Complete HEC-HMS Results for 10 - 100-Year Storms (Continued)

NORTHEAST REGION - HEC-HMS RESULTS							
Schematic Figure Numbers	Element Name	Area (mi^2)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
A-48, A-49	J_W Fwy Ch U/S	7.703	299	495	672	902	1624
A-48, A-49	J_W Fwy D/S	9.039	388	658	894	1175	2026
A-48, A-49	R_Army Ditch	0.000	0	0	0	14	159
A-48, A-49	R_Bossworth U/S	0.417	191	274	339	408	638
A-48, A-49	R_Diana Ditch	1.788	457	715	920	1145	1878
A-48, A-49	R_Electric Ditch	1.114	223	344	443	556	897
A-48, A-49	R_Ft Bliss Div Ch D/S	1.624	222	312	382	447	723
A-48, A-49	R_Ft Bliss Div Ch U/S	1.459	120	170	220	357	448
A-48, A-49	R_Fusselman Out	3.371	52	59	63	66	74
A-48, A-49	R_Green Belt Levee	25.014	1843	2983	3961	5099	8529
A-48, A-49	R_Hondo Pass Channel	0.047	31	46	58	67	121
A-48, A-49	R_Hondo Pass Diversion	0.000	0	0	0	0	0
A-48, A-49	R_Keltner Dam Out	0.486	86	91	94	97	372
A-48, A-49	R_NE Pond Overflow	35.548	0	0	0	0	0
A-48, A-49	R_Northgate Dam Out	6.735	4	31	45	81	161
A-48, A-49	R_PSB Ch1 a	0.239	62	99	131	166	280
A-48, A-49	R_PSB Ch 1 b	2.037	186	327	452	602	1063
A-48, A-49	R_PSB Ch 1 c	5.905	749	1256	1699	2226	3829
A-48, A-49	R_PSB Ch 2 a	1.371	263	417	546	695	1144
A-48, A-49	R_PSB Ch 2 b	2.175	350	567	752	966	1622
A-48, A-49	R_Range Dam Overflow	11.157	0	0	0	0	0
A-48, A-49	R_RR Dr D/S	61.190	838	1410	1911	2507	4310
A-48, A-49	R_RR Dr U/S Statler Ch	60.590	754	1265	1711	2242	3852
A-48, A-49	R_Sunrise Channel	0.510	9	11	12	14	19
A-48, A-49	R_Tobin Drain U/S Army Ditch	2.190	333	590	818	1085	1933
A-48, A-49	R_Tobin Drain U/S RR Drain	14.663	565	962	1305	1708	2941
A-48, A-49	R_W Fwy Ch D/S	7.703	296	490	668	891	1585
A-48, A-49	R_W Fwy Ch U/S	6.672	258	397	515	657	1066
A-48, A-49	S_Amber Basin	0.248	5	6	7	8	9
A-48, A-49	S_Ft Bliss Outer Sump	92.239	0	0	0	0	0
A-48, A-49	S_Ft Bliss Sump	0.000	9104	14002	18049	22557	36838
A-48, A-49	S_Fusselman Dam	3.371	52	59	63	66	74
A-48, A-49	S_Hondo Pass Basin	0.127	1	2	2	3	4
A-48, A-49	S_Keltner Dam	0.486	86	91	94	97	372
A-48, A-49	S_Mtn Park Dam	0.806	5	25	49	168	177
A-48, A-49	S_NE Ponding	3.133	2519	4189	5657	7376	12639
A-48, A-49	S_NE Pond Outer	35.548	0	0	0	0	0
A-48, A-49	S_Northgate Dam	6.735	5	32	45	81	161
A-48, A-49	S_Northhills Dam N	2.446	19	53	61	69	88
A-48, A-49	S_Northhills Dam S	5.533	70	72	73	74	76
A-48, A-49	S_Pershing Dam	0.000	200	200	200	200	200
A-48, A-49	S_Range Basin	11.549	0	0	1	1	3
A-48, A-49	S_Range Dam	11.157	0	0	0	15	159
A-48, A-49	S_Sunrise Basin	0.135	3	3	4	4	6

Table A-35. Northeast Region Complete HEC-HMS Results for 10 - 100-Year Storms (Continued)

NORTHEAST REGION - HEC-HMS RESULTS							
Schematic Figure Numbers	**Element Name**	**Area (mi^2)**	**10-Year (cfs)**	**25-Year (cfs)**	**50-Year (cfs)**	**100-Year (cfs)**	**500-Year (cfs)**
A-48, A-49	S_Sunrise Dam	0.499	32	130	168	173	185
A-48, A-49	Sink - Gov Hill Ch	92.239	0	0	0	0	0
A-48, A-49	TXDOT Pond	0.614	130	205	268	340	558

Table A-36. Northwest Region Complete HEC-HMS Results for 10 - 100-Year Storms

NORTHWEST REGION - HEC-HMS RESULTS							
Schematic Figure Numbers	Element Name	Area (mi^2)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
A-50	A1	0.16	0	0	0	0	5
A-53, A-54	A1A	1.04	503	763	1005	1291	2145
A-53, A-54	A1A,HR3	1.33	672	1017	1340	1719	2853
A-53, A-54	A4_1	0.97	370	613	850	1141	2052
A-53, A-54	A5_1	0.79	639	935	1205	1519	2438
A-53, A-54	BC_1	0.38	318	472	613	777	1262
A-53, A-54	BC_1,C1	1.58	1004	1552	2070	2687	4561
A-53, A-54	BC_2	0.86	342	575	805	1087	1978
A-53, A-54	BC_C1	1.20	686	1081	1458	1910	3299
A-53, A-54	BDC_1	0.99	530	828	1111	1449	2475
A-53, A-54	BeforeKD1	13.66	2559	3837	5036	6544	10855
A-53, A-54	Before MesaDam	2.57	1534	2380	3181	4136	7036
A-52	BHP	0.45	0	0	0	0	18
A-52	BHP_Outlet	0.45	0	0	0	0	18
A-53, A-54	BLC_1	0.21	335	458	566	689	1039
A-53, A-54	BLC_2	0.23	184	287	384	500	847
A-53, A-54	BLC_2,C2	7.78	332	465	663	956	1765
A-53, A-54	BLC_3	0.30	99	186	277	391	771
A-53, A-54	BLC_3,C3	4.52	192	203	305	482	953
A-53, A-54	BLC_C1	10.70	463	543	694	1012	1868
A-53, A-54	BLC_C2	7.56	325	342	358	521	918
A-53, A-54	BLC_C3	4.22	187	194	199	205	239
A-53, A-54	BLC2,BLC1	10.91	605	923	1235	1701	2906
A-53, A-54	BLC2,MDO1	10.70	464	544	770	1162	2086
A-53, A-54	BLC3,TDO1	7.56	325	342	359	595	1146
A-55	BVC_1	0.02	13	19	25	31	50
A-55	BVC_1,C1	3.46	2145	3276	4308	5555	9146
A-55	BVC_2	0.71	561	821	1058	1334	2141
A-55	BVC_2,C2	2.56	1713	2588	3374	4328	7035
A-55	BVC_C1	3.45	2132	3257	4284	5524	9096
A-55	BVC_C2	1.85	1152	1767	2316	2994	4893
A-55	BVC1,MHC2	4.53	3190	4785	6236	7966	12963
A-55	BVC2,TBV1	3.45	2224	3376	4424	5687	9327
A-55	CC	1.85	1242	1883	2451	3153	5126
A-55	CC_1	0.16	194	269	336	412	631
A-55	CC_C	1.70	1048	1614	2115	2741	4495
A-50	DD_1	1.53	341	542	735	968	1684
A-50	DD_3	0.16	169	249	323	408	659
A-50	DD_Out	1.53	341	542	735	968	1684
A-50	DD3,WSD2	0.36	454	650	826	1029	1616
A-52	EC_1	0.13	10	30	54	87	209
A-52	EC1US	8.00	1334	2005	2628	3360	5552
A-53, A-54	ER1,ODA1	2.51	1329	2016	2657	3412	5662
A-52	FPN38_1	0.50	347	528	697	896	1490

Table A-36. Northwest Region Complete HEC-HMS Results for 10 - 100-Year Storms (Continued)

NORTHWEST REGION - HEC-HMS RESULTS							
Schematic Figure Numbers	Element Name	Area (mi^2)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
A-52	FPN38_1US	4.65	348	528	697	896	1918
A-52	FPN38_3	0.27	316	461	592	743	1185
A-52	FPN38_4	1.49	0	0	0	0	51
A-52	FPN38_4US	1.49	0	0	0	0	51
A-52	FPN38A	1.72	544	823	1084	1392	2317
A-52	FPN38A,B,_3	4.15	864	1291	1687	2152	3582
A-52	FPN38B	0.67	315	466	605	768	1250
A-52	FPN39A_1	0.06	95	132	164	201	306
A-52	FPN39A1US	2.50	994	1495	1961	2509	4143
A-52	FPN39A2	0.69	281	420	548	698	1145
A-52	FPN39A2a	0.69	281	420	548	698	1145
A-52	FPN39A2aUS	2.44	988	1487	1951	2498	4126
A-52	FPN39A2US	2.44	988	1487	1951	2498	4126
A-52	FPN40_1	0.14	162	220	271	329	494
A-52	FPN40_2	0.21	128	193	253	324	534
A-52	FPN40_2 US	2.65	1061	1595	2092	2675	4413
A-52	FPN40_2US,FPN40_3	5.27	1718	2591	3403	4362	7230
A-51	FPN40_3	2.63	743	1122	1475	1891	3140
A-52	FPN41_1	0.13	76	113	148	188	309
A-52	FPN41_1 US	3.83	1158	1745	2291	2934	4884
A-52	FPN41_2	1.83	572	865	1140	1464	2437
A-52	FPN41A	1.87	564	851	1119	1434	2379
A-52	FPN41A, FP41_2	3.70	1125	1696	2227	2854	4727
A-51	FPN42	1.20	369	556	730	937	1561
A-51	FPN42A	0.11	76	116	153	197	327
A-51	FPN42T1_1	0.11	107	162	213	273	449
A-51	FPN42T1_1OUT	0.79	329	501	661	851	1421
A-51	FPN42T1_2	0.44	179	272	359	462	769
A-51	FPN43	1.12	427	646	850	1090	1808
A-53, A-54	GC_1	0.34	389	567	728	915	1459
A-53, A-54	GC1,BC2	1.20	731	1142	1534	2002	3437
A-53, A-54	HDC_1	0.99	946	1366	1746	2184	3460
A-53, A-54	HR_1	0.54	516	782	1030	1319	2178
A-53, A-54	HR_2	0.39	395	584	758	960	1551
A-53, A-54	HR_2,C2	1.72	844	1286	1699	2187	3651
A-53, A-54	HR_3	0.29	168	254	334	429	708
A-53, A-54	HR_C1	3.01	1254	1895	2491	3194	5294
A-53, A-55	HR_C2	1.33	643	980	1295	1667	2781
A-53, A-54	HR1,LDE1	3.56	1506	2308	3060	3950	6626
A-53, A-54	KD_C	13.81	251	387	473	534	1163
A-53, A-54	KD_Out	13.81	251	387	473	534	1163
A-53, A-54	KD1	0.14	37	61	85	114	205
A-53, A-54	KD1 Dam	13.81	251	387	473	534	1173
A-50	M1(A1_2)	0.16	0	0	0	0	7

Table A-36. Northwest Region Complete HEC-HMS Results for 10 - 100-Year Storms (Continued)

NORTHWEST REGION - HEC-HMS RESULTS							
Schematic Figure Numbers	Element Name	Area (mi^2)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
A-50	M1 DS	3.49	301	530	761	1049	1977
A-53, A-54	MBDO_1	0.25	0	0	2	11	92
A-53, A-54	MBDO_C1	3.97	187	194	199	204	216
A-50	MD_1	1.36	247	376	497	640	1073
A-50	MD_2	1.43	150	337	544	817	1772
A-50	MD_2,C2	4.92	304	551	791	1090	1957
A-50	MD_3	3.33	301	530	761	1049	1977
A-50	MD_C	6.66	161	298	442	618	1280
A-50	MD_Out	8.01	339	536	720	959	1810
A-53, A-54	MD1	0.41	411	600	772	972	1556
A-53, A-54	MD1,MBDO_1	4.22	187	194	199	205	239
A-53, A-54	MD1 Dam	3.97	187	194	199	204	216
A-50	MD2	3.49	288	514	738	1018	1774
A-50	MD2,WSD1	6.66	683	1137	1595	2155	4055
A-53, A-54	MDO_1	0.04	33	50	66	85	142
A-53, A-54	MDO_1,C	2.92	132	190	194	207	321
A-53, A-54	MDO_C	2.88	131	188	192	196	207
A-53, A-54	MeD1	0.31	270	416	553	714	1197
A-53, A-54	Mesa Dam	2.88	132	188	192	196	207
A-55	MHC_2	1.07	1045	1508	1927	2411	3818
A-50	NeD1	1.29	187	328	468	643	1205
A-55	OD	0.24	284	414	532	667	1063
A-55	OD_C	4.78	147	157	165	173	192
A-53, A-54	ODA_1	1.29	837	1273	1680	2161	3598
A-53, A-54	ODA_2	0.52	308	465	612	785	1299
A-53, A-54	ODA_C1	1.22	642	982	1300	1676	2803
A-55	OD Dam	4.78	147	157	165	173	192
A-55	OO_1	0.19	90	140	188	244	415
A-55	Ox_Out	4.96	225	282	335	398	583
A-52	Pond 4	4.15	1	12	27	46	1854
A-52	RC_1	1.47	491	735	960	1226	2017
A-52	RC_2	1.75	707	1067	1403	1799	2981
A-52	RC_2a	1.75	707	1067	1403	1799	2981
A-52	RC_2c	1.75	707	1067	1403	1799	2981
A-52	RC1US,FPN38_1	7.88	1332	2000	2621	3351	5534
A-52	RC2aUS	1.75	707	1067	1403	1799	2981
A-52	RC2cUS	3.23	1198	1802	2364	3025	4998
A-52	RC2US	1.75	707	1067	1403	1799	2981
A-53, A-54	RV_1	1.30	517	772	1008	1285	2108
A-53, A-54	RV1,HR2	3.02	1282	1929	2531	3240	5356
A-55	SCC_1	0.32	325	487	636	809	1321
A-55	SCC1,SSC1	1.70	1167	1769	2297	2957	4830
A-55	SSC_1	0.64	348	521	681	868	1424
A-55	SSC_2	0.74	619	941	1241	1594	2642

Table A-36. Northwest Region Complete HEC-HMS Results for 10 - 100-Year Storms (Continued)

NORTHWEST REGION - HEC-HMS RESULTS							
Schematic Figure Numbers	Element Name	Area (mi^2)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
A-55	SSC_C1	0.74	574	880	1133	1470	2386
A-55	SSC_C1,SSC_1	1.38	842	1283	1661	2148	3509
A-55	TBV_1	0.89	511	788	1049	1359	2293
A-53, A-54	TDO_1	0.07	6	16	29	47	112
A-53, A-54	TDO_1,C	3.04	134	142	149	155	193
A-53, A-54	TDO_C	2.97	134	141	148	154	170
A-53, A-54	ThoD1	0.46	433	657	865	1109	1833
A-53, A-54	Thorn Dam	2.97	134	141	148	154	170
A-51	UN01	0.24	131	198	261	335	556
A-51	UN01,FPN42T1_2	0.68	310	471	620	797	1325
A-51	UN02_1	0.05	36	55	73	94	156
A-51	UN01_1OUT	0.24	153	233	307	395	658
A-51	UN02_2	0.03	30	46	61	78	129
A-51	UN024_1	0.07	52	79	104	133	222
A-51	UN03	0.16	93	141	186	238	394
A-51	UN03,02,_2	0.19	117	177	234	302	503
A-52	UN23_1	0.81	150	258	365	498	924
A-52	UN23_1US	10.23	3148	4770	6287	8082	13481
A-52	UN23_2	0.05	44	66	86	110	180
A-52	UN23_2US	9.43	2999	4513	5922	7584	12558
A-52	UN23_3	0.13	88	130	169	213	345
A-52	UN23_3,FPN40_1	9.38	2993	4503	5910	7570	12536
A-51	UN23A	0.03	28	42	56	71	118
A-51	UN24A1	0.10	78	119	157	202	334
A-51	UN24A1OUT	0.19	149	227	299	385	638
A-51	UN24A2	0.07	44	67	88	113	189
A-51	UN24A2,T1	0.10	71	108	143	183	304
A-51	UN24AT1	0.03	27	41	54	70	115
A-51	UN24B	0.19	114	172	226	290	480
A-51	UN24C	0.06	55	83	109	138	226
A-51	UN24D	0.02	23	33	43	54	88
A-53, A-54	VS_1	0.70	382	578	761	977	1619
A-53, A-54	VS1,ODA2	1.22	690	1044	1374	1762	2918
A-50	WM	1.46	325	530	730	973	1730
A-50	WRG	14.56	656	1423	2262	3366	7182
A-50	WSD_1	0.08	51	84	116	155	278
A-50	WSD_1_1	0.36	394	555	691	832	1282
A-50	WSD_1,WSD1_1	0.45	420	597	749	907	1559
A-50	WSD_2	0.21	286	401	503	620	958

Table A-37. West Central Region Complete HEC-HMS Results for 10 - 100-Year Storms

WEST CENTRAL REGION - HEC-HMS RESULTS							
Schematic Figure Numbers	Element Name	Area (mi^2)	10-Year (cfs)	25-Year (cfs)	50-Year (cfs)	100-Year (cfs)	500-Year (cfs)
A-56	Bcanal	0.80	501	695	868	1066	1635
A-56	BCanalUS	0.80	501	695	868	1066	1635
A-56	CBC_1	0.89	429	624	802	1009	1614
A-56	CBC1,FPN21	2.30	1071	1666	2232	2908	4960
A-56	FPN20_1	0.21	175	249	317	394	619
A-56	FPN20_1US	3.08	2702	3925	5035	6318	10065
A-56	FPN20_2	1.32	1244	1819	2343	2949	4723
A-56	FPN21_1	0.24	339	475	596	735	1133
A-56	FPN21_2	1.41	817	1292	1747	2293	3957
A-56	FPN21_C1	2.30	1025	1563	2065	2700	4675
A-56	FPN21_OUT	2.54	1294	1991	2650	3434	5808
A-56	FPN23_1	1.85	1429	2068	2648	3319	5276
A-56	FPN23_US	1.85	1429	2068	2648	3319	5276
A-56	Ind_1	1.38	813	1201	1558	1974	3199
A-56	PC_1	1.55	1284	1857	2375	2975	4723
A-56	PC1,FPN20_2	2.87	2528	3676	4718	5924	9446

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FIGURES

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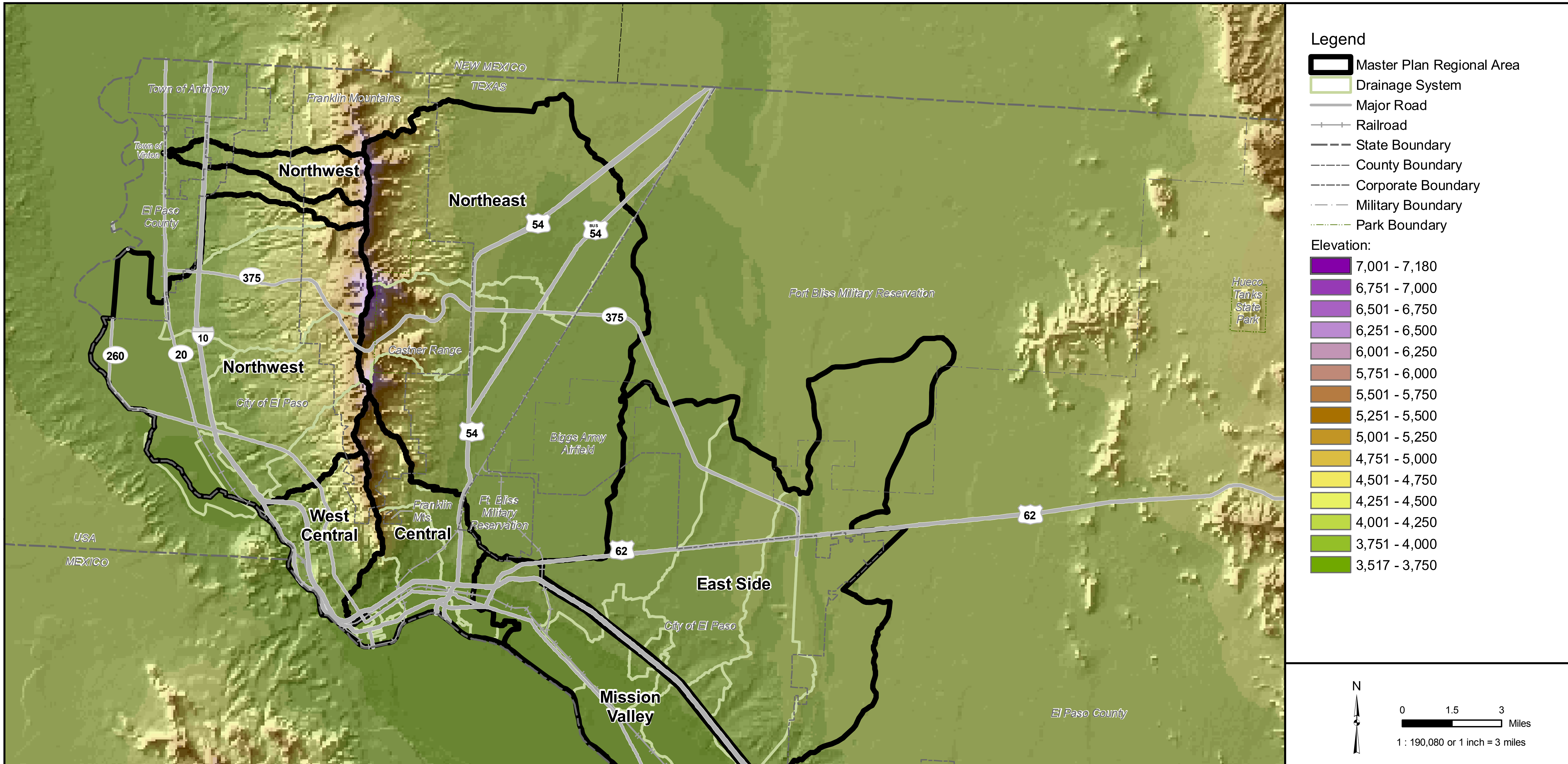

Project Area

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-1

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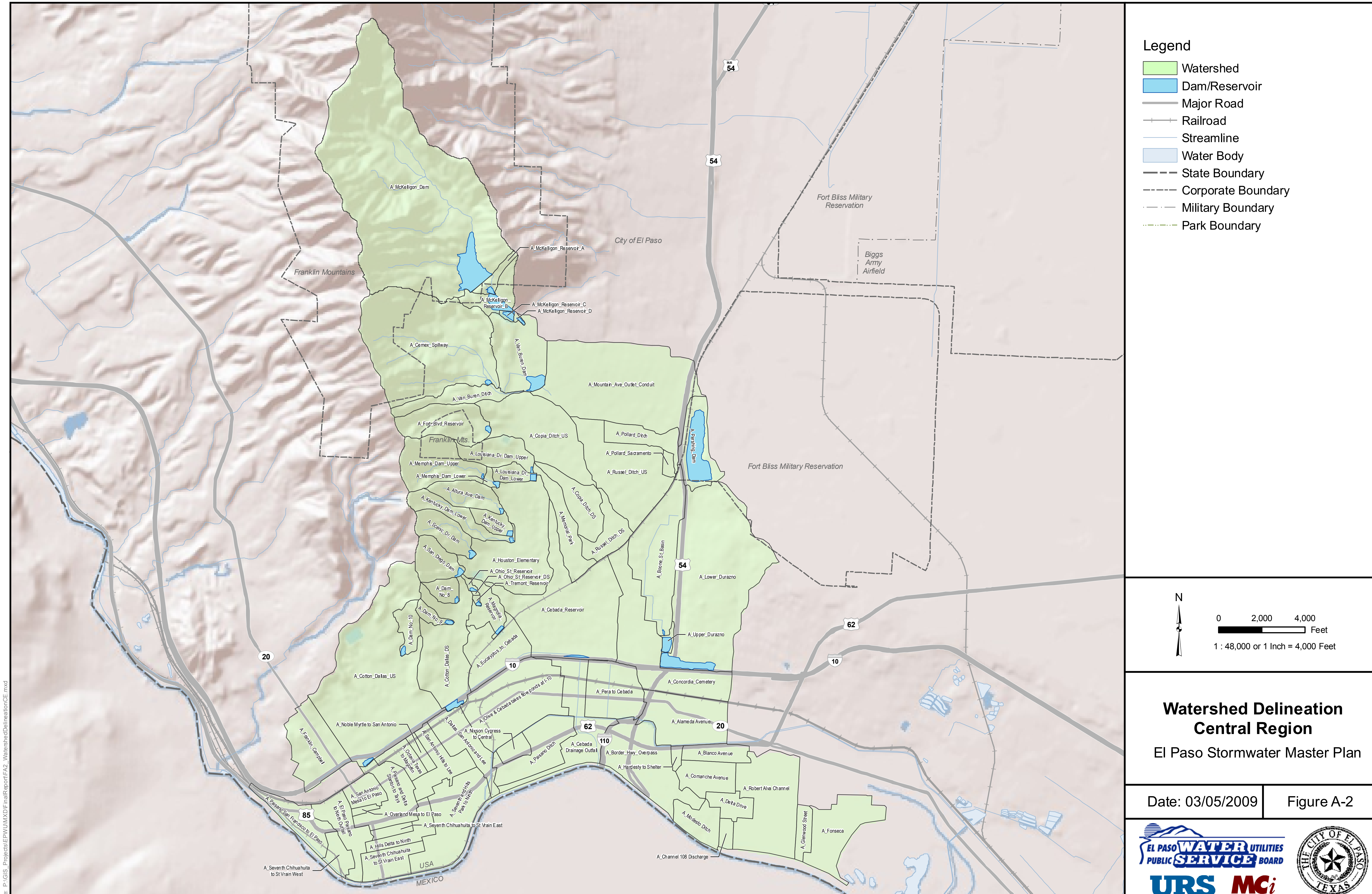

Watershed Delineation Central Region

El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-2

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

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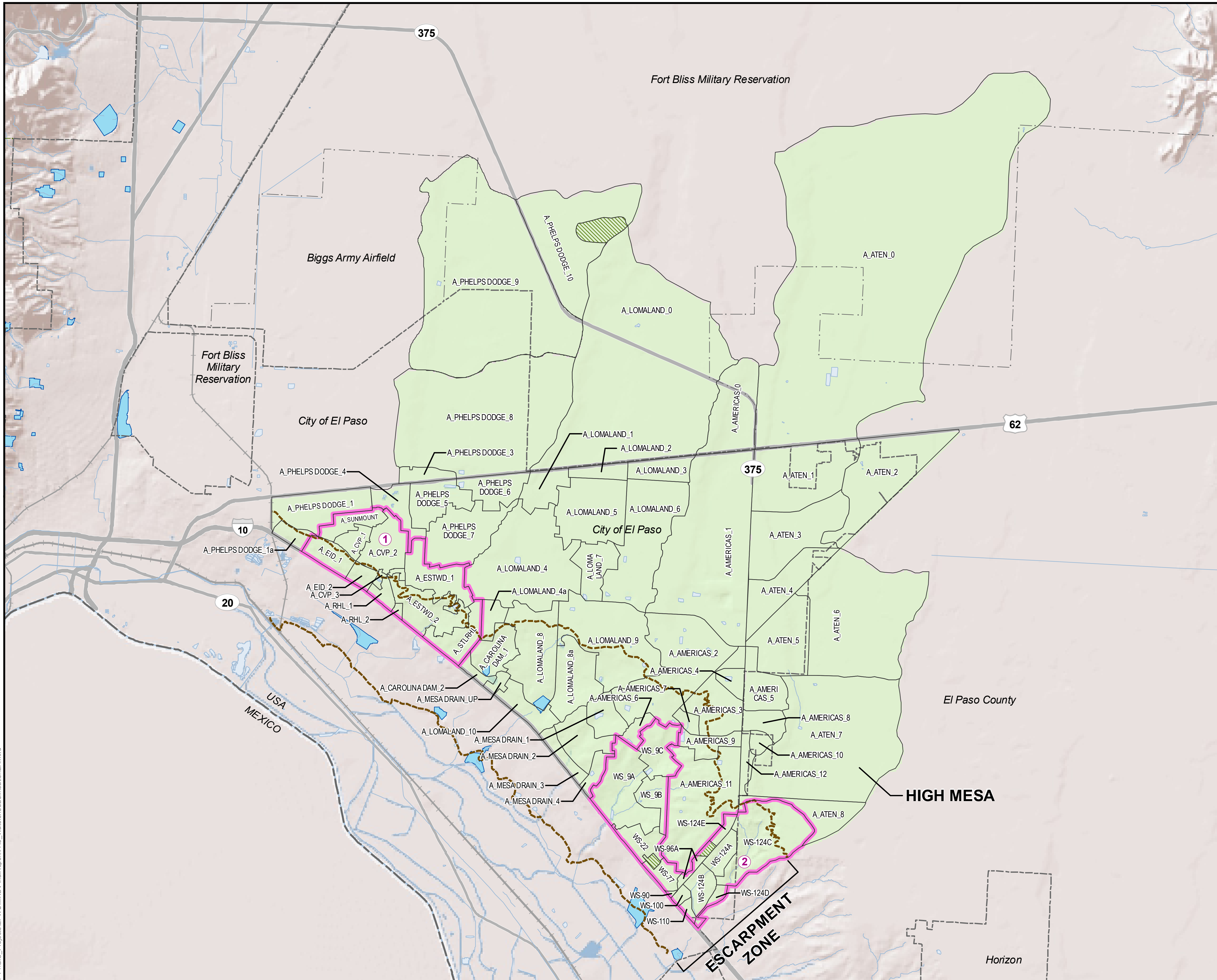

Legend

- Watershed
- Non-Contributing Watershed
- Watershed: Watershed parameters will be referenced from previous TxDOT drainage studies below.
- (1) Drainage Study and Report for (North Loop Road) Moreno Cardenas Inc. May 2007
- (2) Drainage Study and Report (Existing Conditions) for Interstate Highway 10, Moreno Cardenas Inc. Feb. 2008

Note: Rainfall Data from El Paso Drainage Design Manual June 2008. Applied for this Master Plan.

- Dam/Reservoir
- Major Road
- Railroad
- Streamline
- Water Body
- Escarpment Zone
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

Watershed Delineation East Side Region

El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-3

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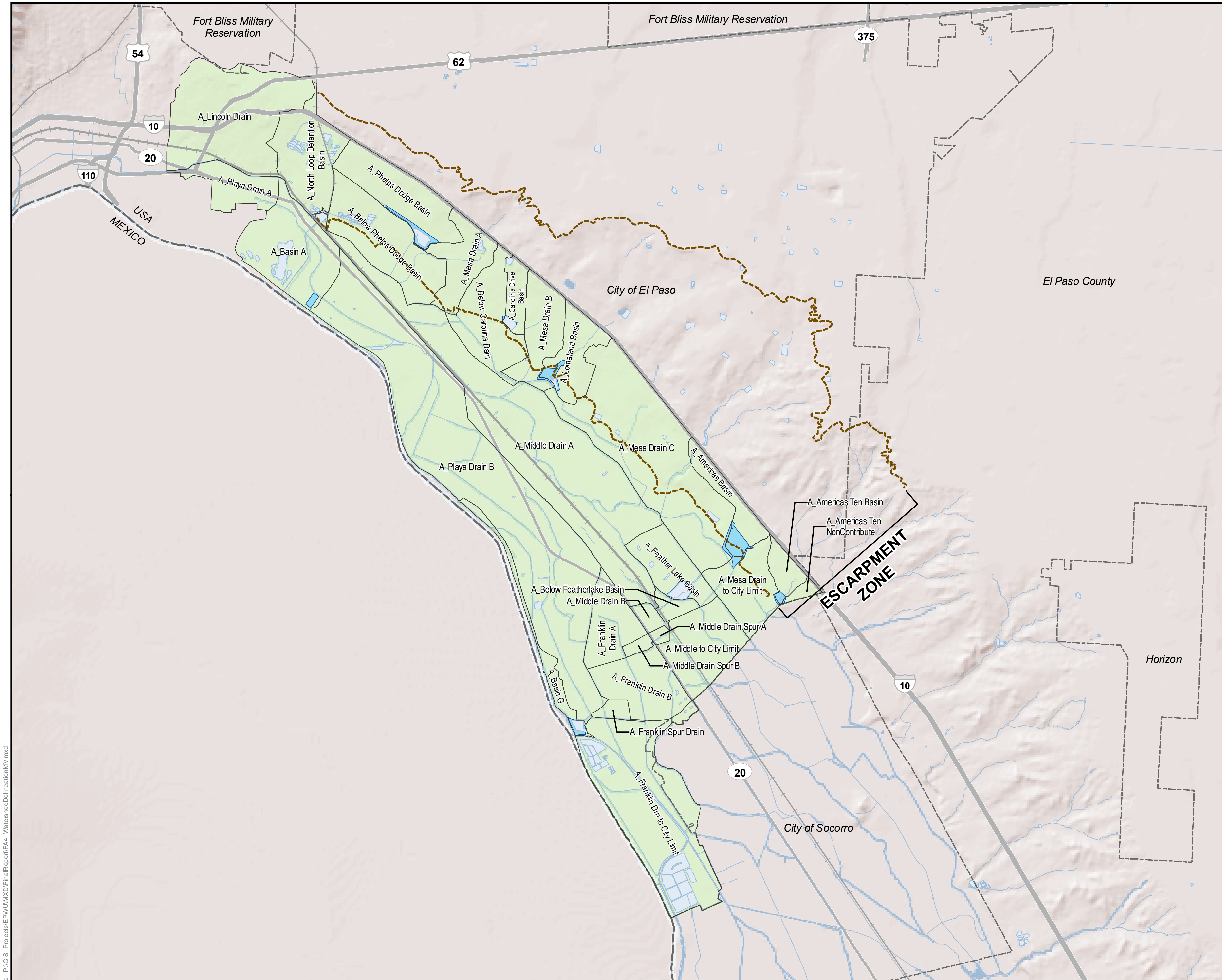

Legend

- Watershed
- Dam/Reservoir
- Major Road
- Railroad
- Streamline
- Water Body
- Escarpment Zone
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 3,500 7,000 Feet

1 : 84,000 or 1 Inch = 7,000 Feet

Watershed Delineation
Mission Valley Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-4

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

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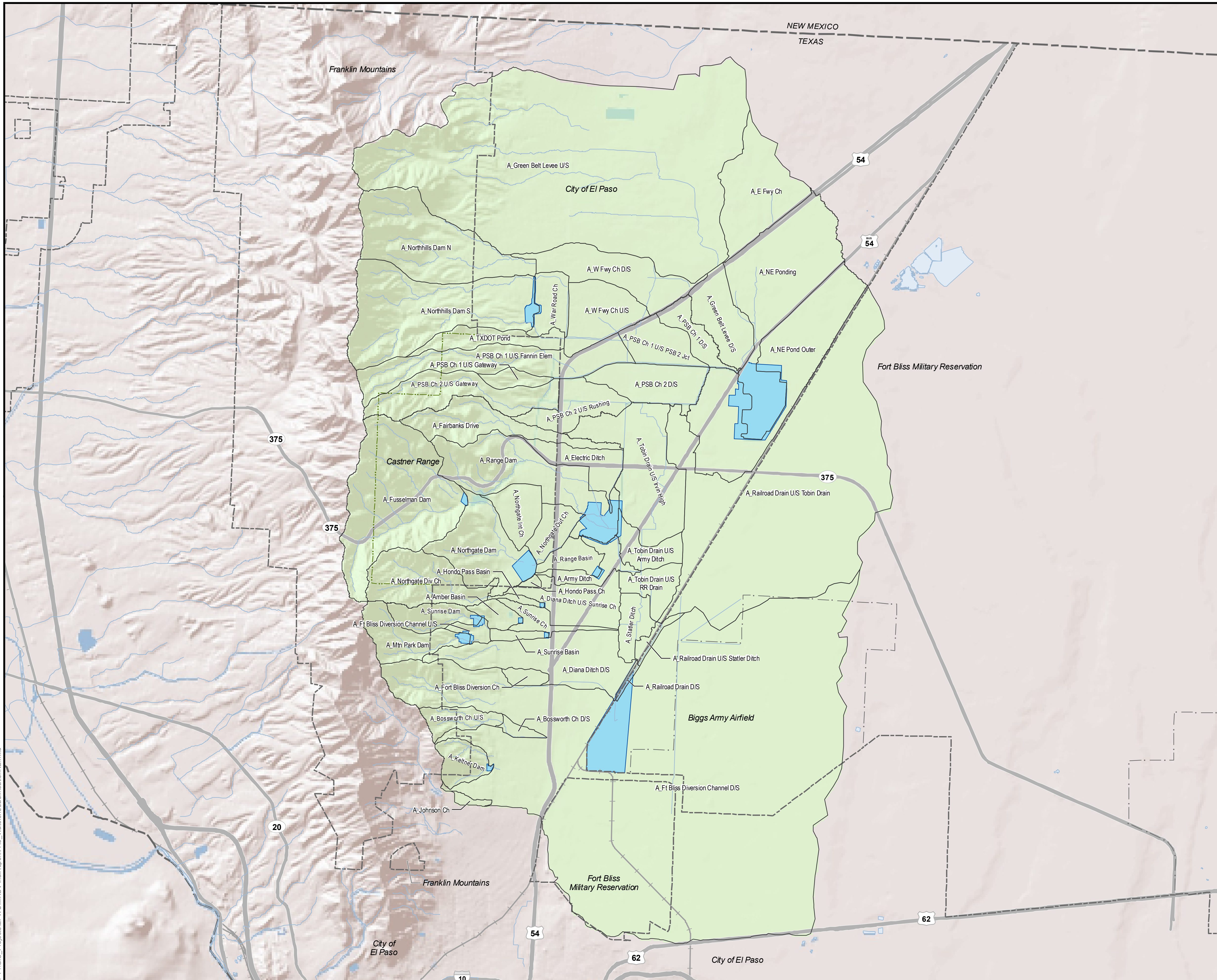

Legend

- Watershed
- Dam/Reservoir
- Major Road
- Railroad
- River, Stream, Canal
- Water Body
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 4,000 8,000 Feet

1 : 96,000 or 1 Inch = 8,000 Feet

Watershed Delineation Northeast Region

El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-5

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

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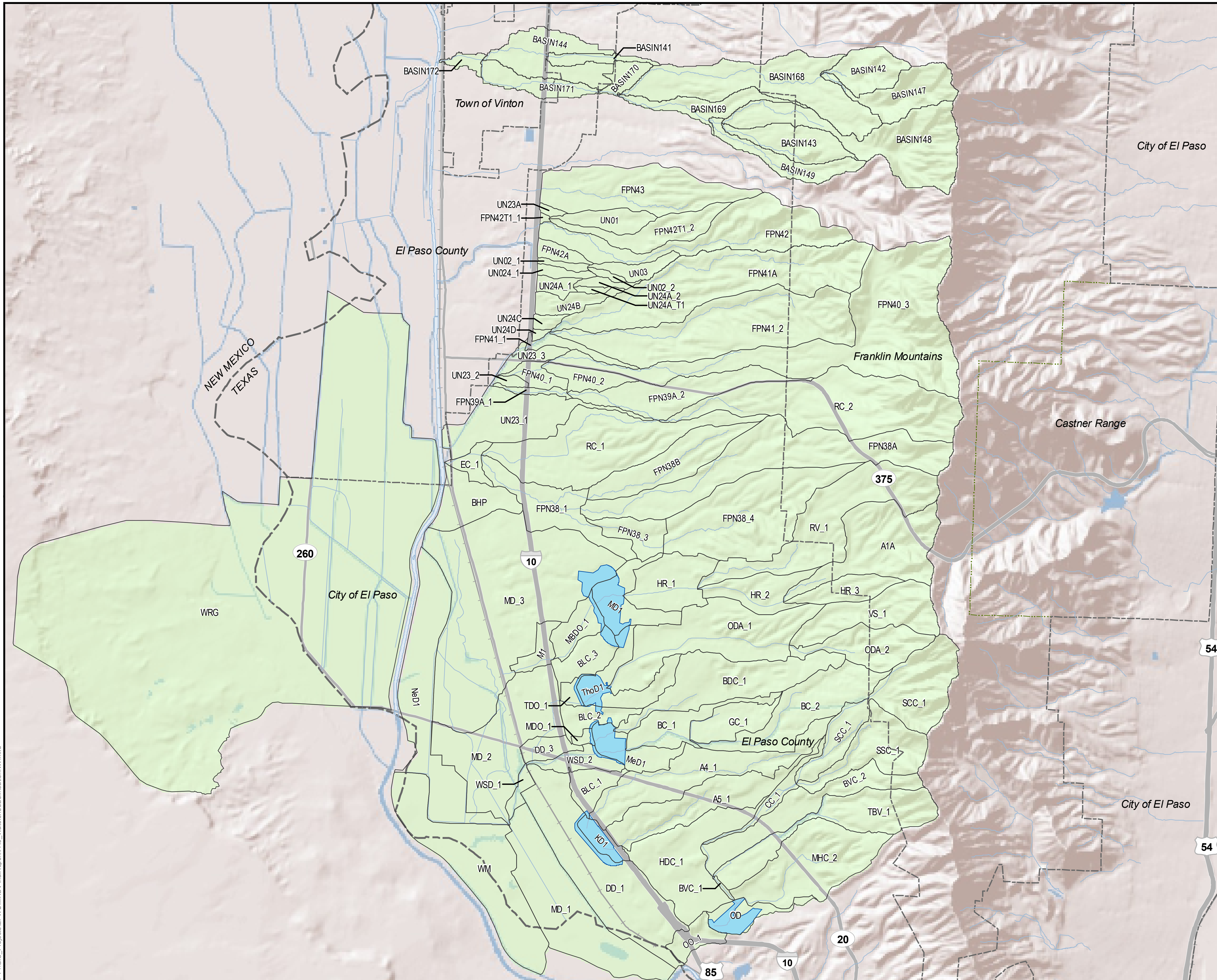

Legend

- Watershed
- Dam/Reservoir
- Major Road
- Railroad
- Streamline
- Water Body
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 3,000 6,000 Feet

1 : 72,000 or 1 Inch = 6,000 Feet

Watershed Delineation Northwest Region

El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-6

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

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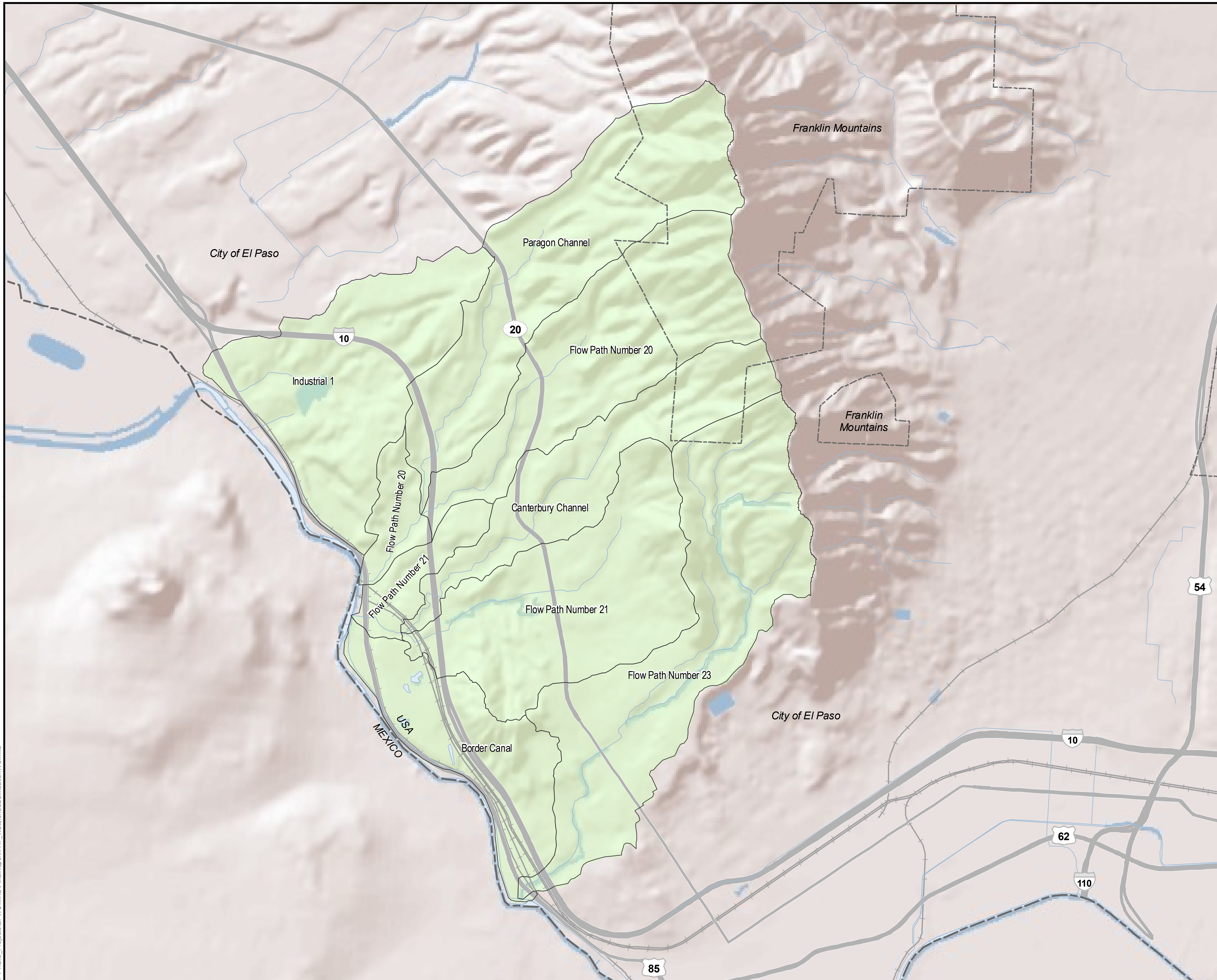

Legend

- Watershed
- Major Road
- Railroad
- Streamline
- Water Body
- State Boundary
- Corporate Boundary

N

0 1,500 3,000 Feet

1 : 36,000 or 1 Inch = 3,000 Feet

Watershed Delineation West Central Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-7

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

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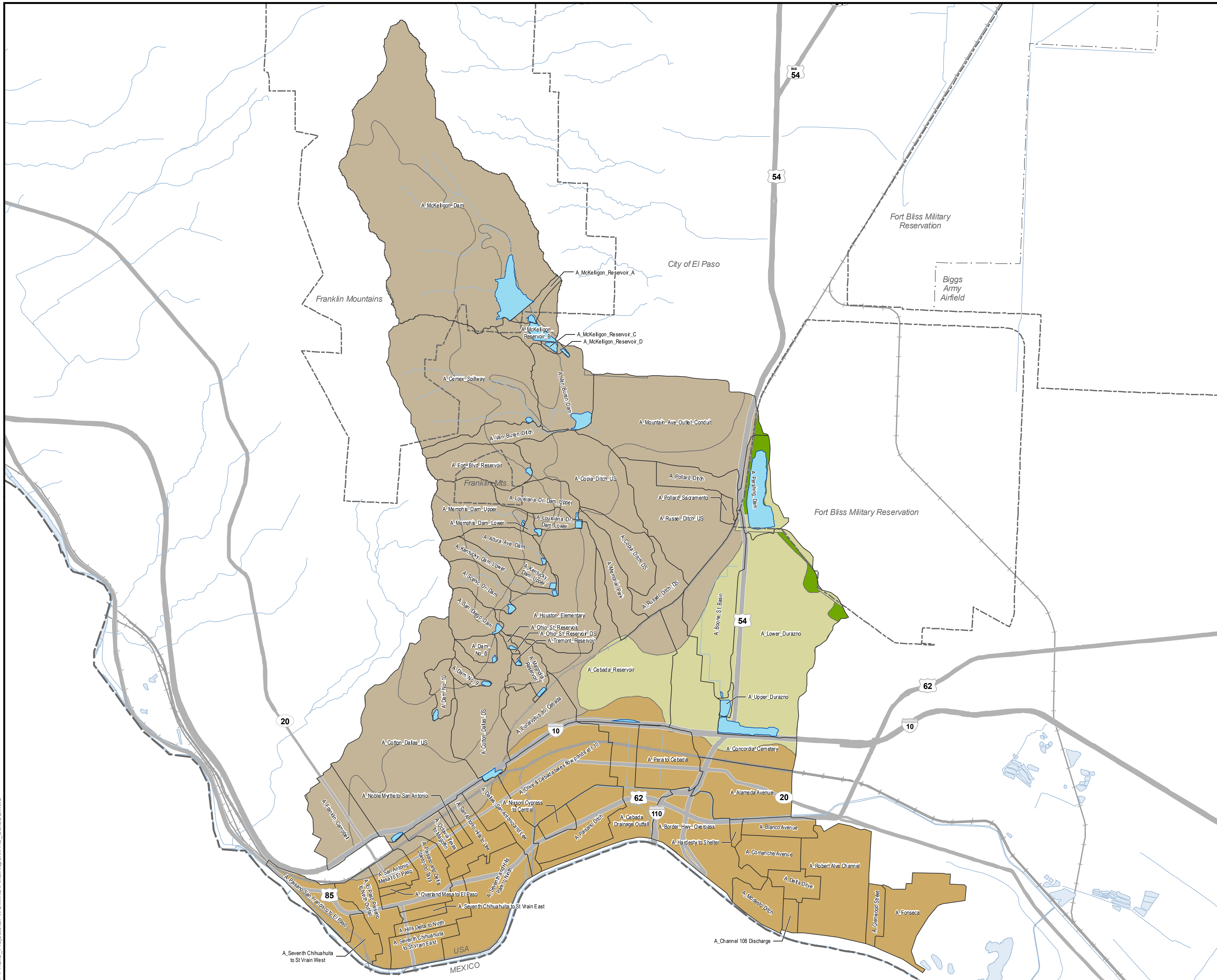

Legend

Hydrologic Soil Group

- A
- B
- C
- D
- W

- Watershed
- Dam/Reservoir
- Major Road
- Railroad
- Streamline
- Water Body
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 2,000 4,000 Feet

1 : 48,000 or 1 Inch = 4,000 Feet

Hydrologic Soil Groups Map Central Region

El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-8

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

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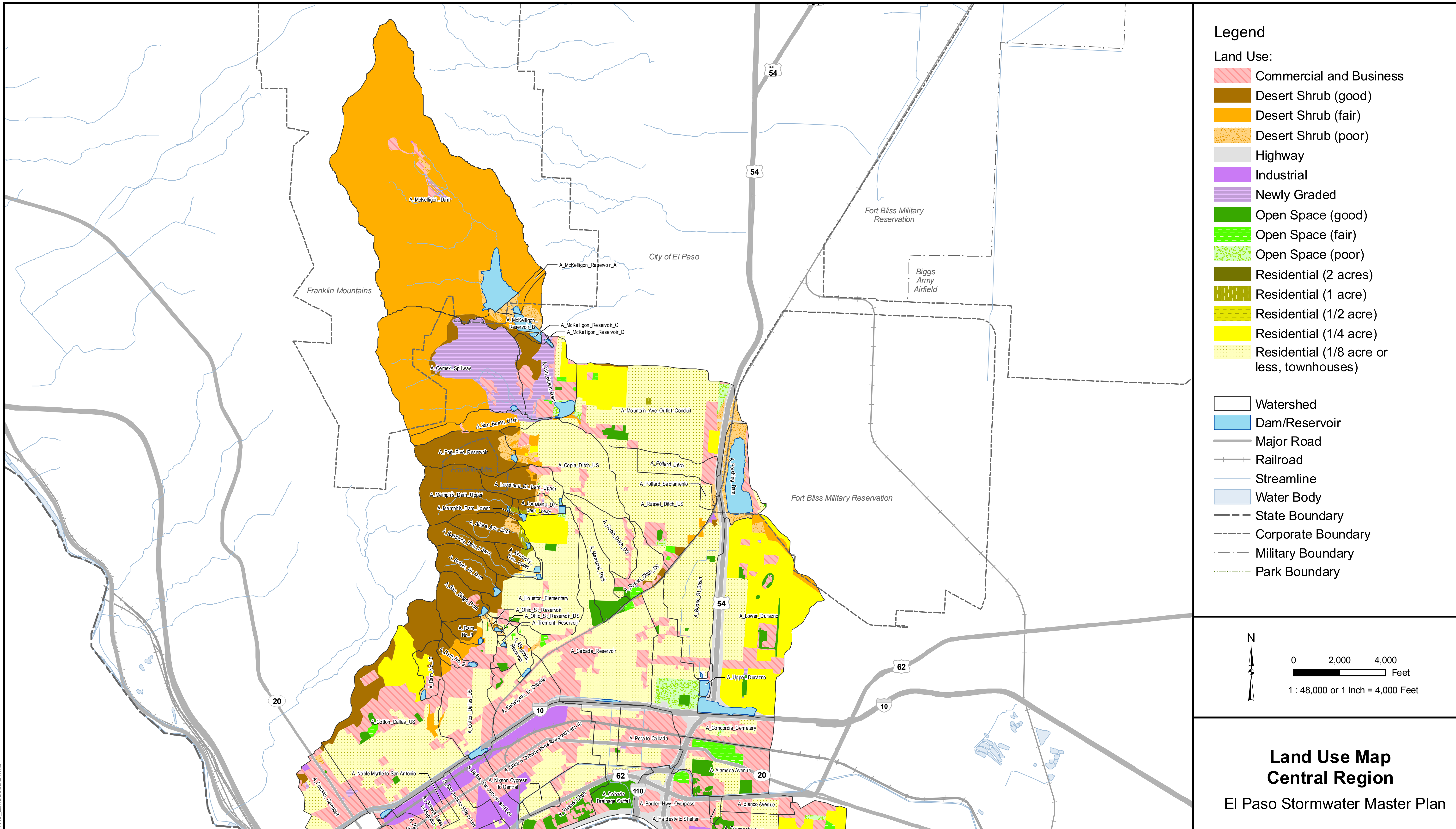

Land Use Map
Central Region

El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-9

El Paso Water Utilities Public Service Board

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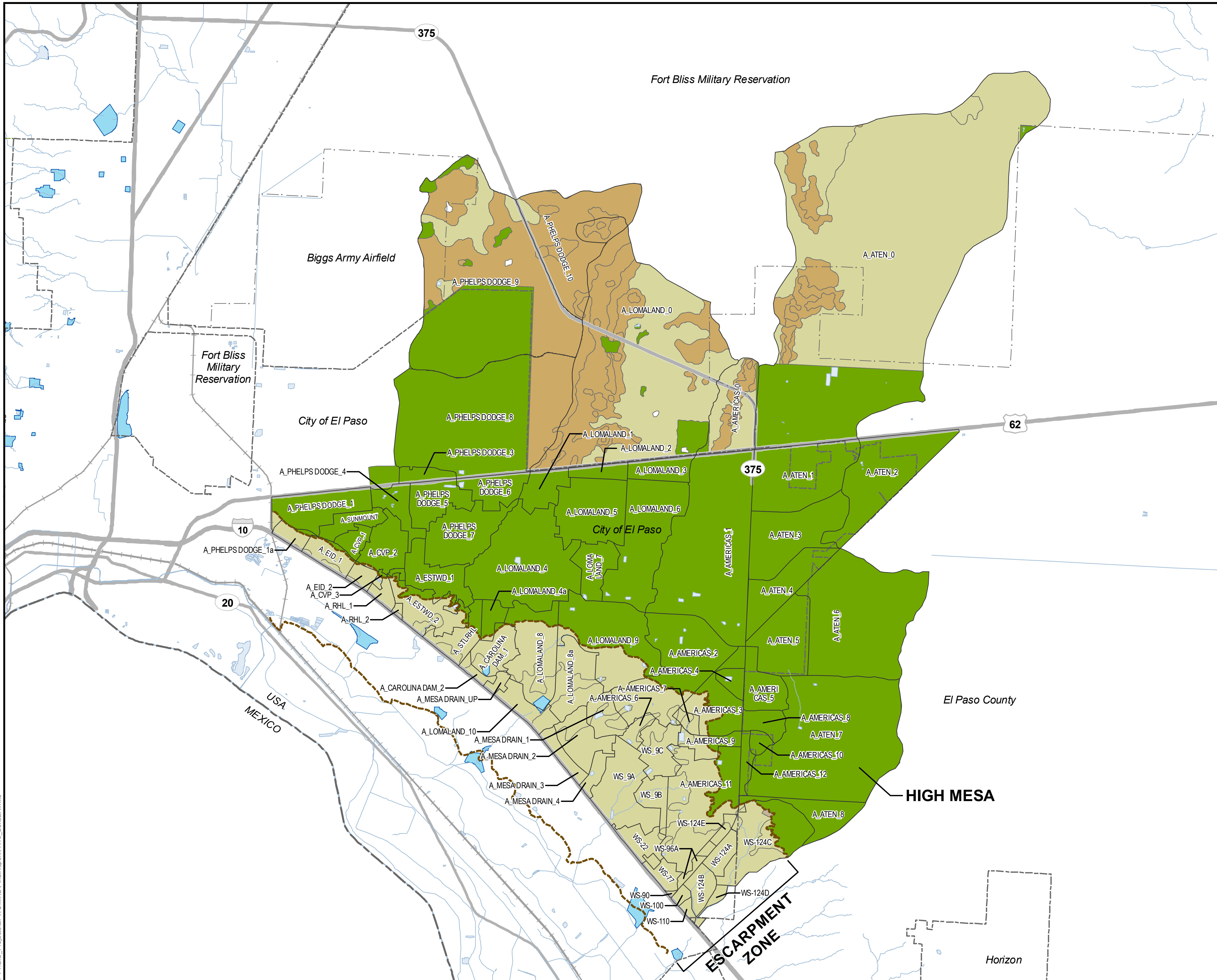
File: P:\GIS_Projects\EPWU\MXD\FinalReport\FA9_LandUseCE.mxd



Legend

Hydrologic Soil Group

- A
- B
- C
- D

- Watershed
- Dam/Reservoir
- Major Road
- Railroad
- Streamline
- Water Body
- Escarpment Zone
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 4,000 8,000 Feet

1 : 96,000 or 1 Inch = 8,000 Feet

Hydrologic Soil Groups Map
East Side Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-10

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

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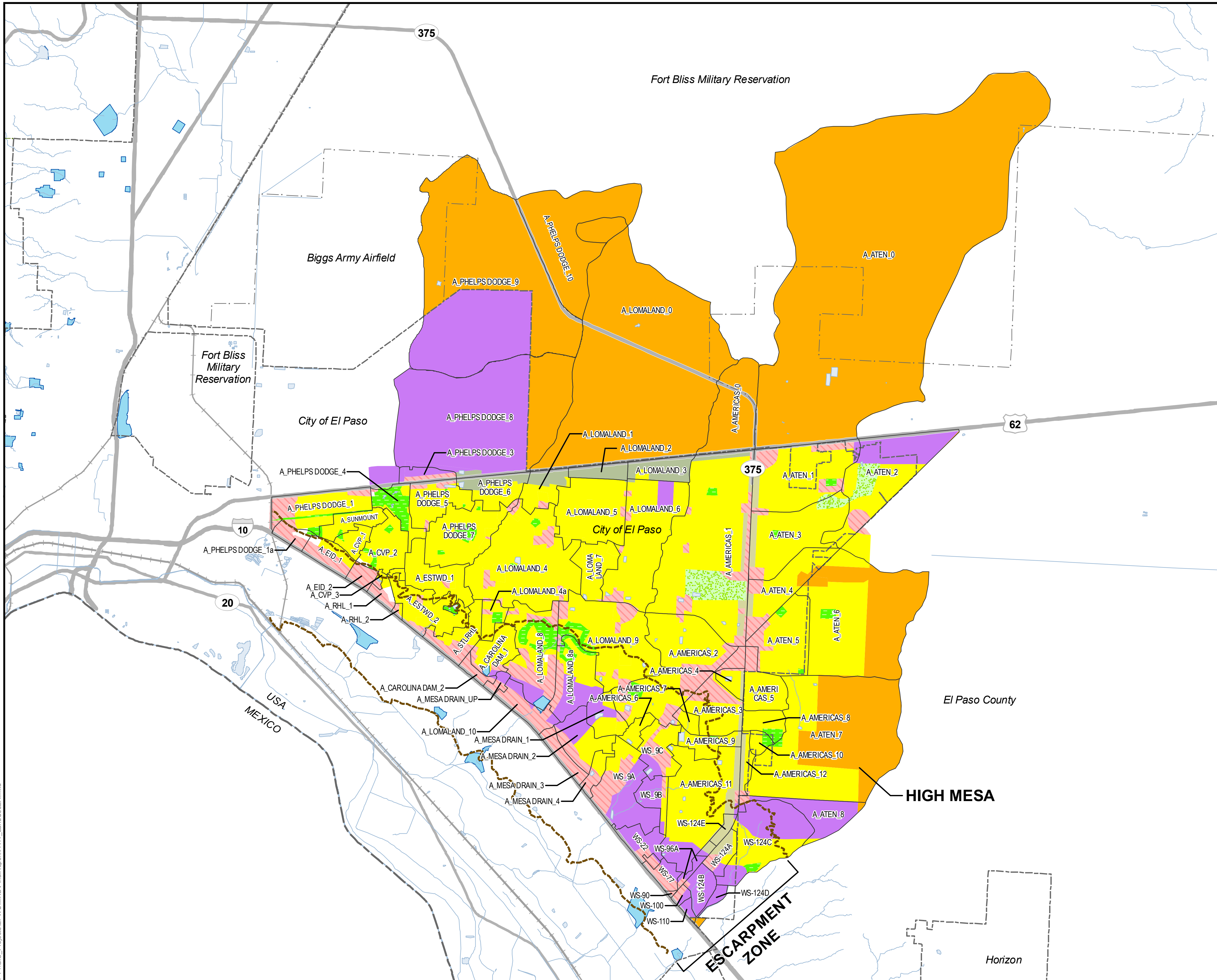
File: P:\GIS_Projects\EPWU\MXD\FinalReport\FA10_SoilsEA.mxd



Legend

Land Use:
- Commercial
- Desert Shrub
- Industrial
- Open Space (fair)
- Open Space (poor)
- Herbaceous Mixed Use - Good
- Herbaceous Mixed Use - Fair
- Residential (1/4 acre)

- Watershed
- Dam/Reservoir
- Major Road
- Railroad
- Streamline
- Water Body
- Escarpment Zone
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 4,000 8,000 Feet

1 : 96,000 or 1 Inch = 8,000 Feet

Land Use Map
East Side Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-11

El Paso Water Utilities Public Service Board — URS — MCi consulting engineers — The City of El Paso, Texas

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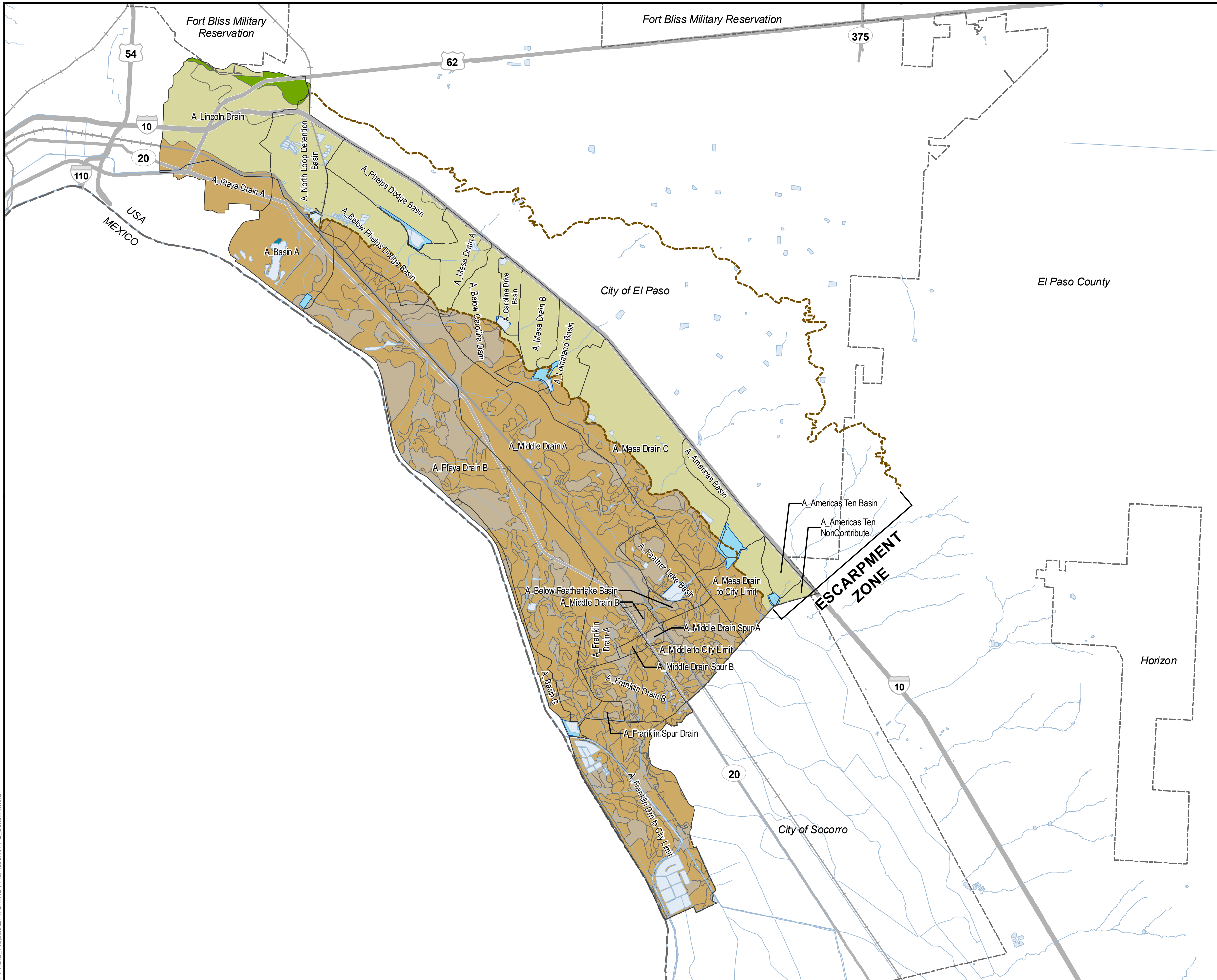

Legend

Hydrologic Soil Group

- A
- B
- C
- D
- W

- Watershed
- Dam/Reservoir
- Major Road
- Railroad
- Streamline
- Water Body
- Escarpment Zone
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 3,500 7,000 Feet

1 : 84,000 or 1 Inch = 7,000 Feet

Hydrologic Soil Groups Map
Mission Valley Region

El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-12

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

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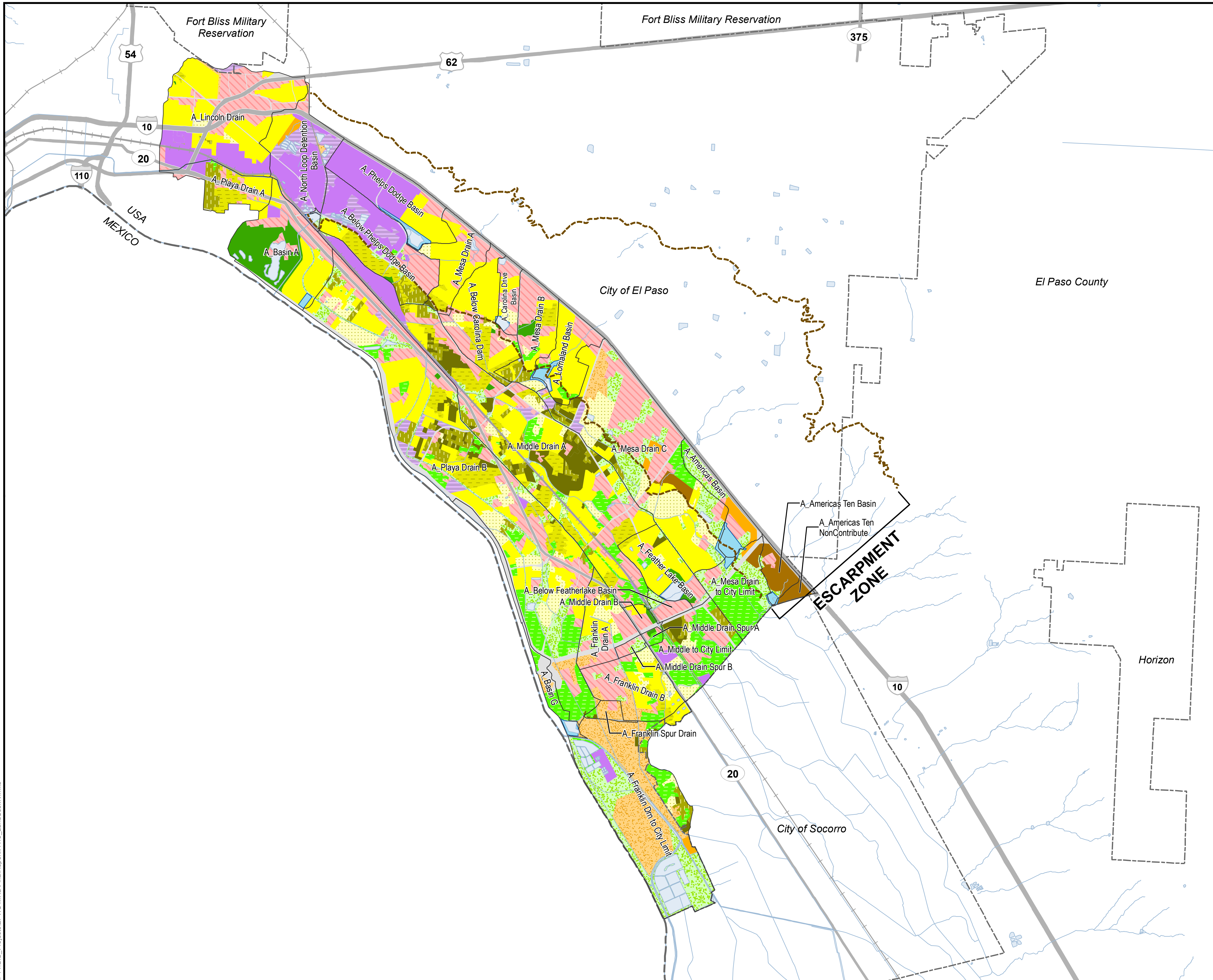
THE CITY OF EL PASO TEXAS



Legend

Land Use:

- Commercial and Business
- Desert Shrub (good)
- Desert Shrub (fair)
- Desert Shrub (poor)
- Highway
- Industrial
- Newly Graded
- Open Space (good)
- Open Space (fair)
- Open Space (poor)
- Water
- Residential (2 acres)
- Residential (1 acre)
- Residential (1/2 acre)
- Residential (1/4 acre)
- Residential (1/8 acre or less, townhouses)

- Watershed
- Dam/Reservoir
- Major Road
- Railroad
- Streamline
- Water Body
- Escarpment Zone
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 3,500 7,000 Feet

1 : 84,000 or 1 Inch = 7,000 Feet

Land Use Map
Mission Valley Region

El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-13

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

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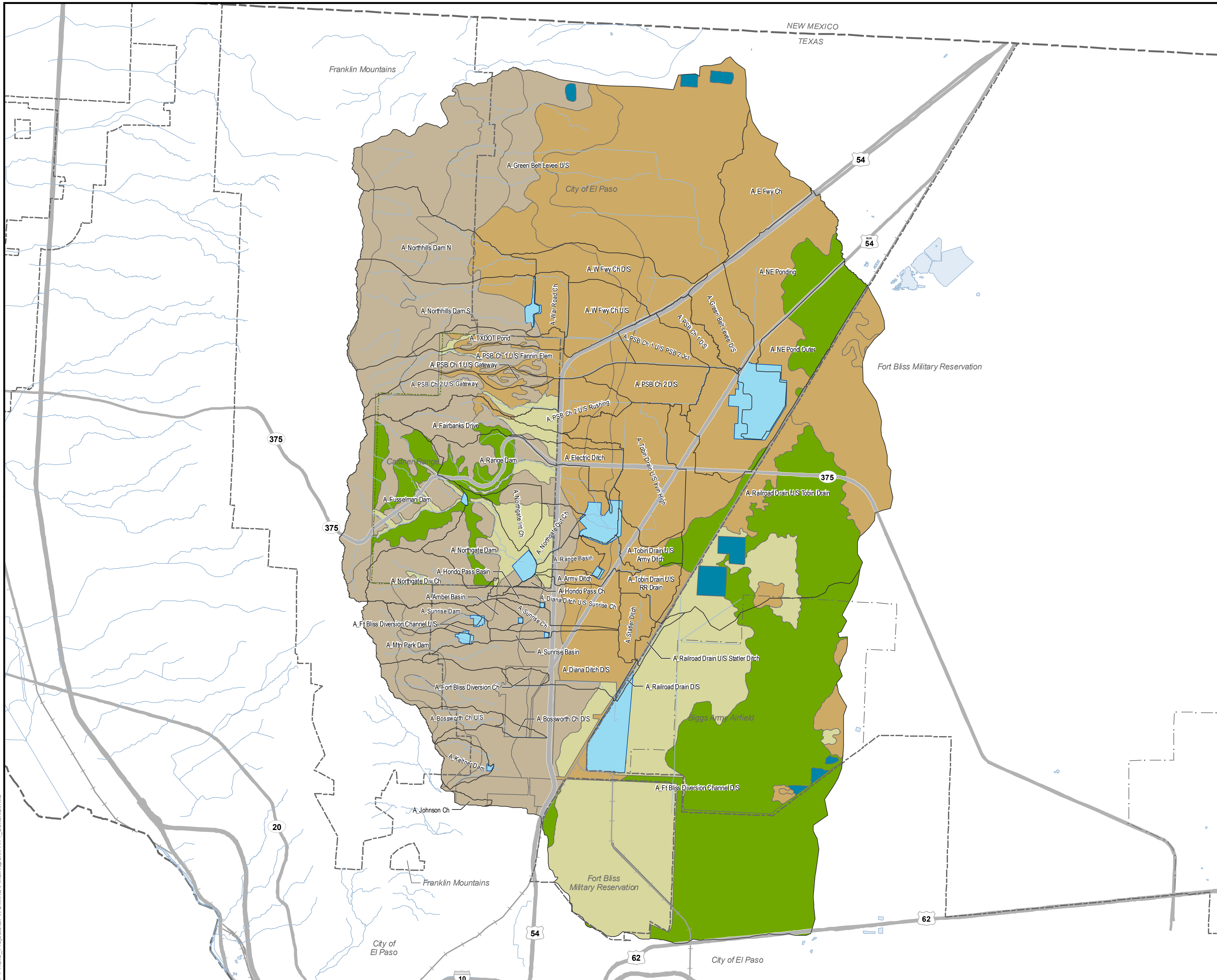
THE CITY OF EL PASO TEXAS



Legend

Hydrologic Soil Group
- A
- B
- C
- D
- W

- Watershed
- Dam/Reservoir
- Major Road
- Railroad
- River, Stream, Canal
- Water Body
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

Hydrologic Soil Groups Map
Northeast Region

El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-14

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

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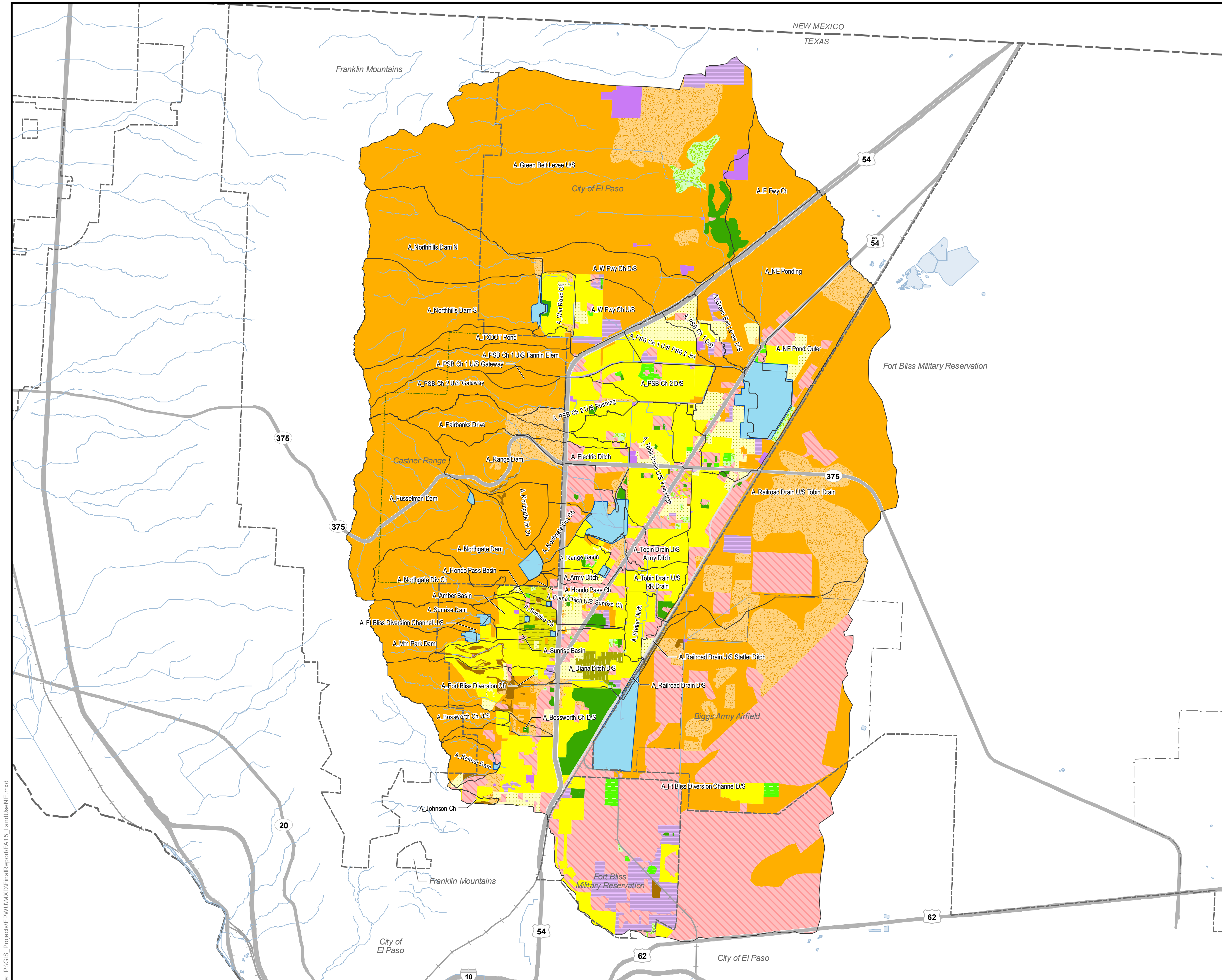
THE CITY OF EL PASO TEXAS



Legend

Land Use:

- Commercial and Business
- Desert Shrub (good)
- Desert Shrub (fair)
- Desert Shrub (poor)
- Highway
- Industrial
- Newly Graded
- Open Space (good)
- Open Space (fair)
- Open Space (poor)
- Residential (2 acres)
- Residential (1 acre)
- Residential (1/2 acre)
- Residential (1/4 acre)
- Residential (1/8 acre or less, townhouses)

- Watershed
- Dam/Reservoir
- Major Road
- Railroad
- River, Stream, Canal
- Water Body
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 4,000 8,000 Feet

1 : 96,000 or 1 Inch = 8,000 Feet

Land Use Map
Northeast Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-15

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

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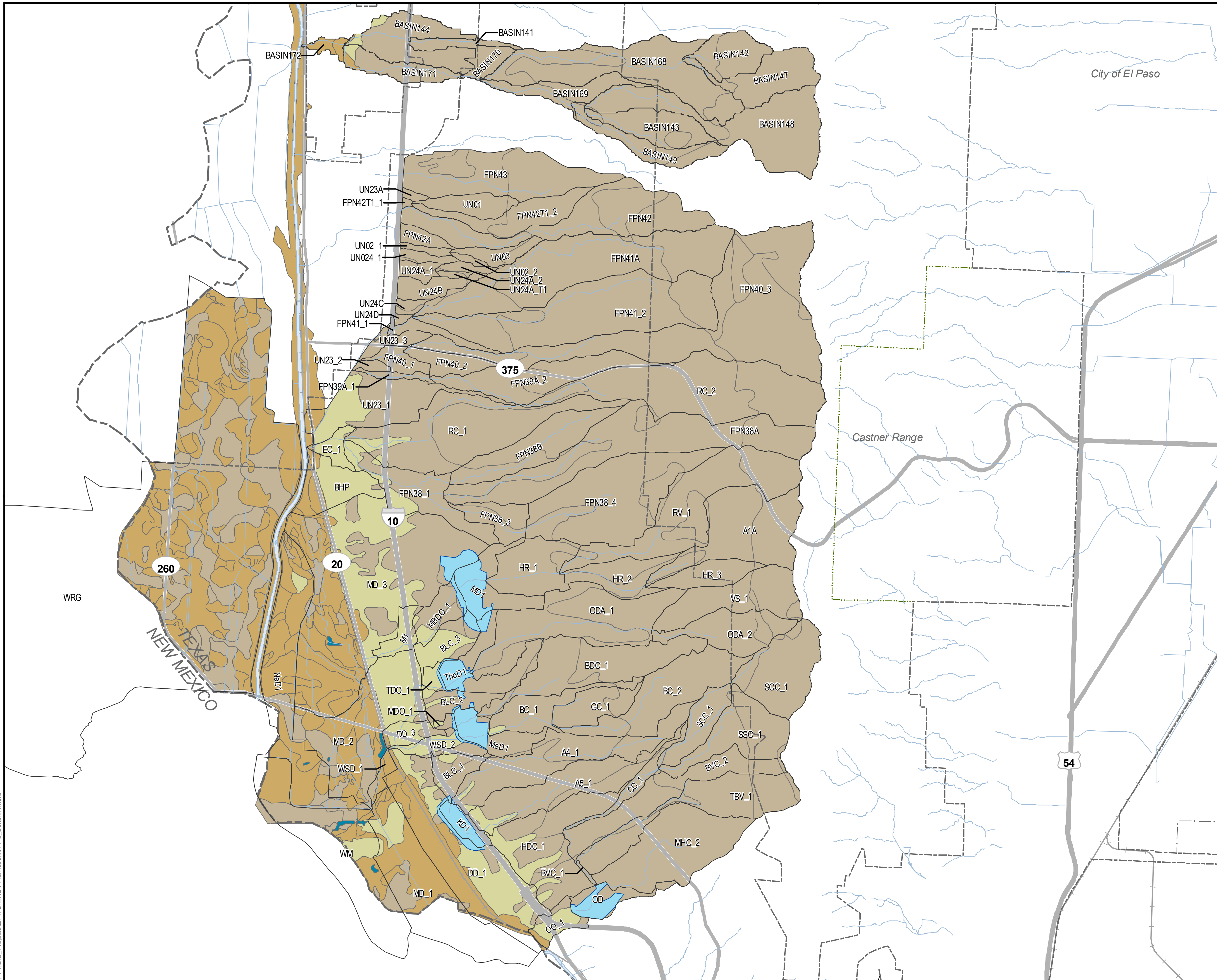
THE CITY OF EL PASO TEXAS



Legend

Hydrologic Soil Group

- A
- B
- D
- W

- Watershed
- Dam/Reservoir
- Major Road
- Railroad
- Streamline
- Water Body
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 3,000 6,000 Feet

1 : 72,000 or 1 Inch = 6,000 Feet

Hydrologic Soil Groups Map
Northwest Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-16

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

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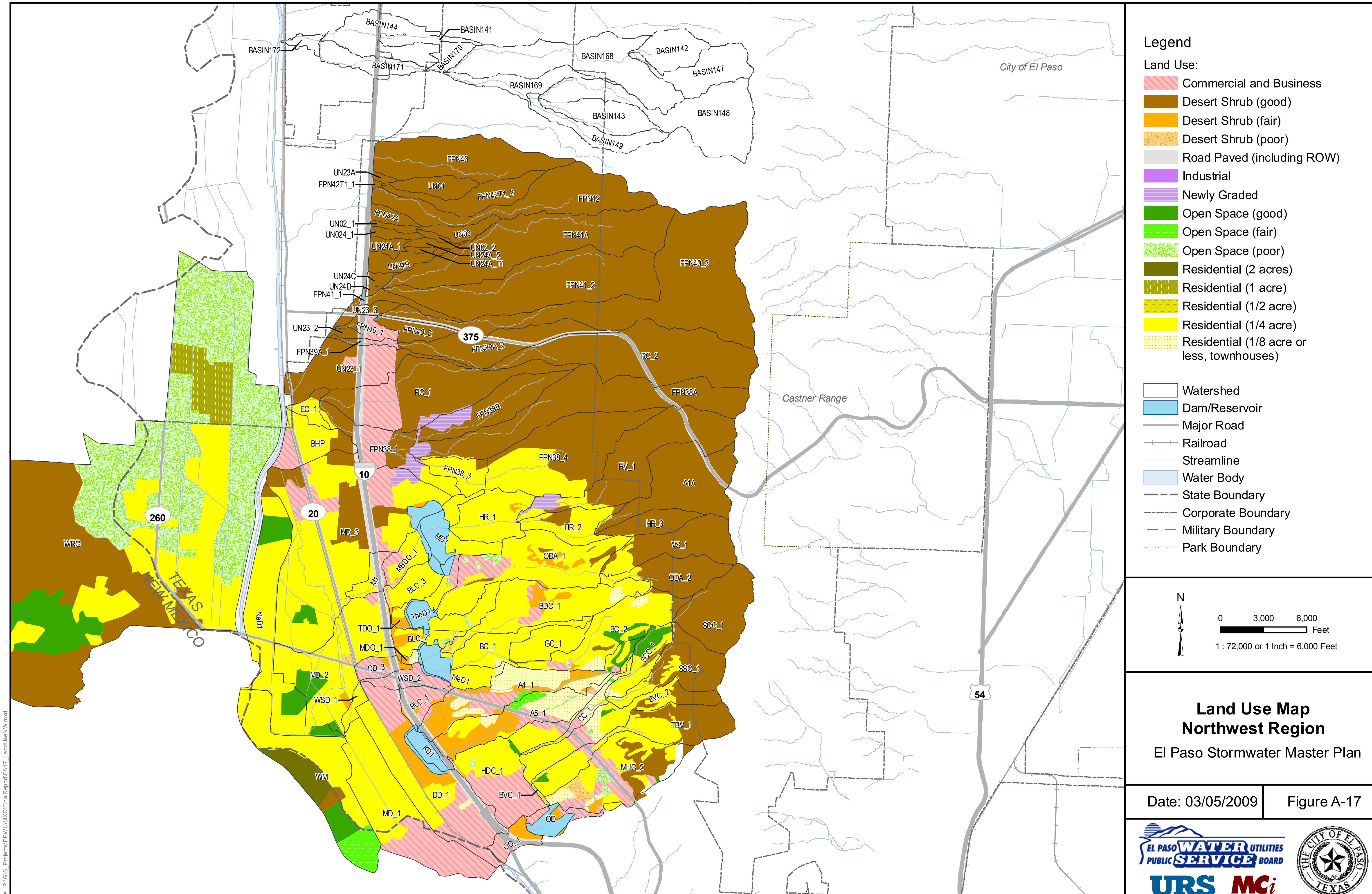

Land Use Map
Northwest Region

El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-17

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

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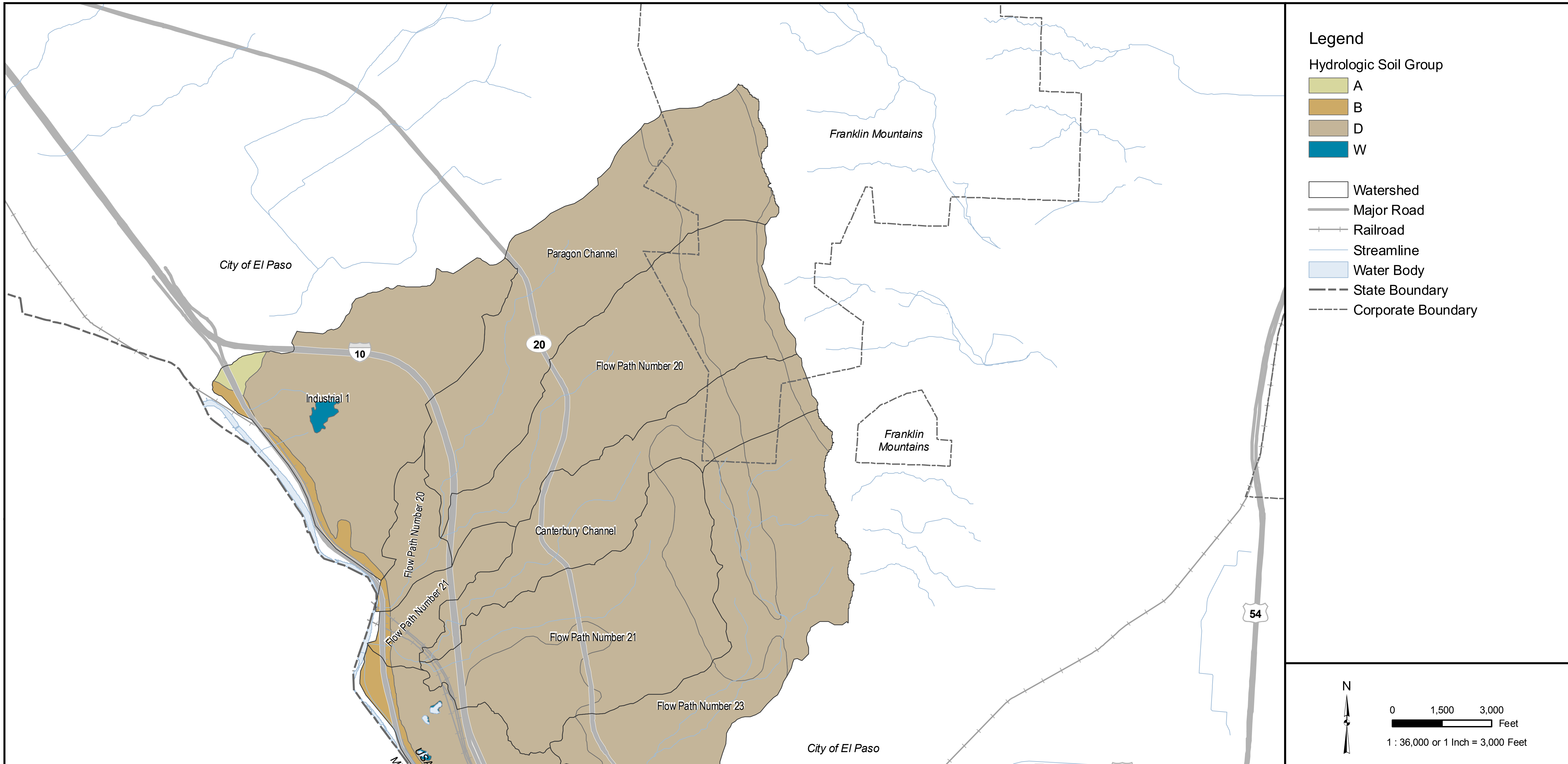
THE CITY OF EL PASO TEXAS



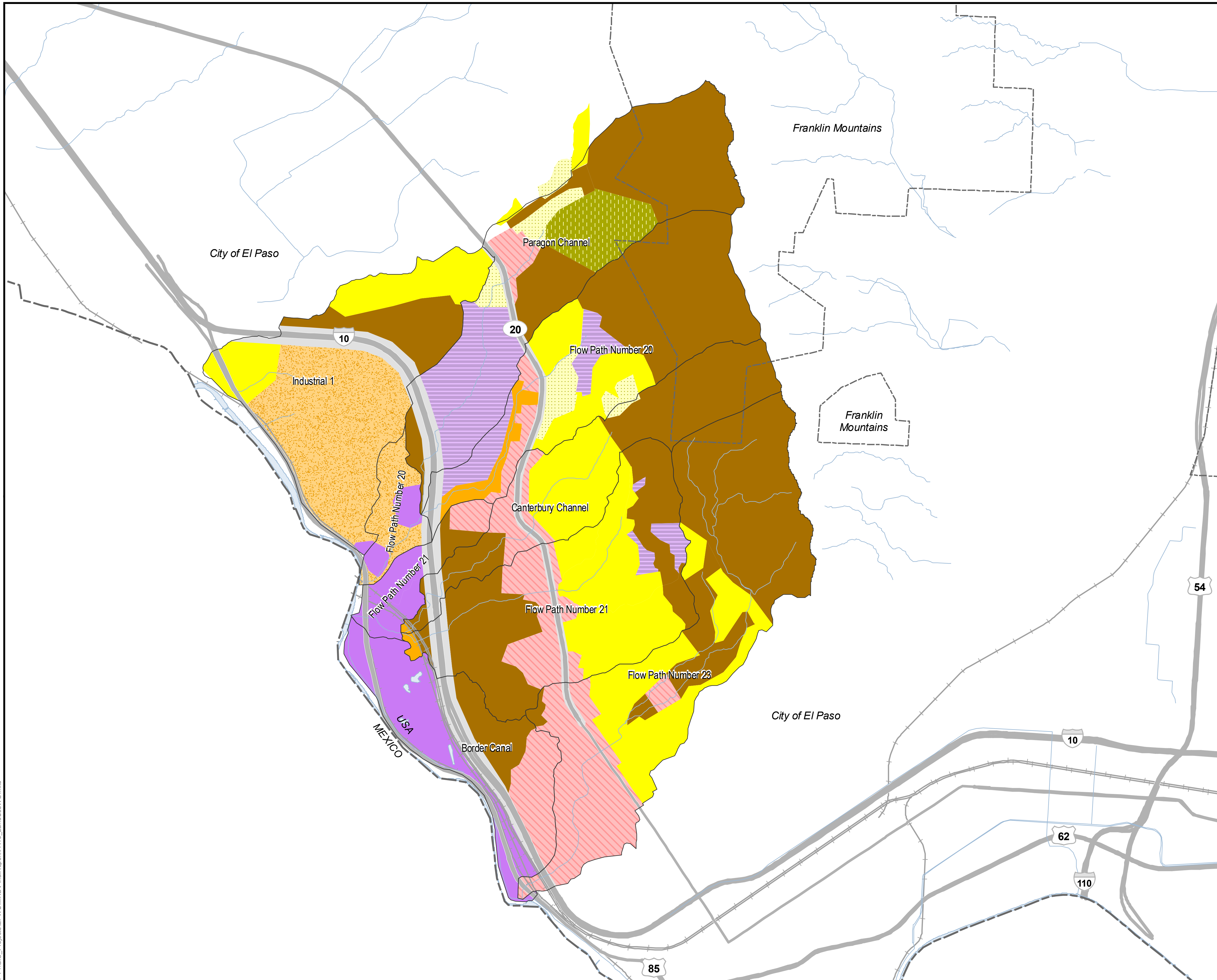
Hydrologic Soil Groups Map
West Central Region

El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-18

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD · URS · MCi consulting engineers · THE CITY OF EL PASO TEXAS



Legend

Land Use:

- Commercial and Business
- Desert Shrub (good)
- Desert Shrub (fair)
- Desert Shrub (poor)
- Road Paved (including ROW)
- Industrial
- Newly Graded
- Residential (1 acre)
- Residential (1/2 acre)
- Residential (1/4 acre)
- Residential (1/8 acre or less, townhouses)

- Watershed
- Major Road
- Railroad
- Streamline
- Water Body
- State Boundary
- Corporate Boundary

N

0 1,500 3,000 Feet

1 : 36,000 or 1 Inch = 3,000 Feet

Land Use Map
West Central Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-19

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

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THE CITY OF EL PASO TEXAS

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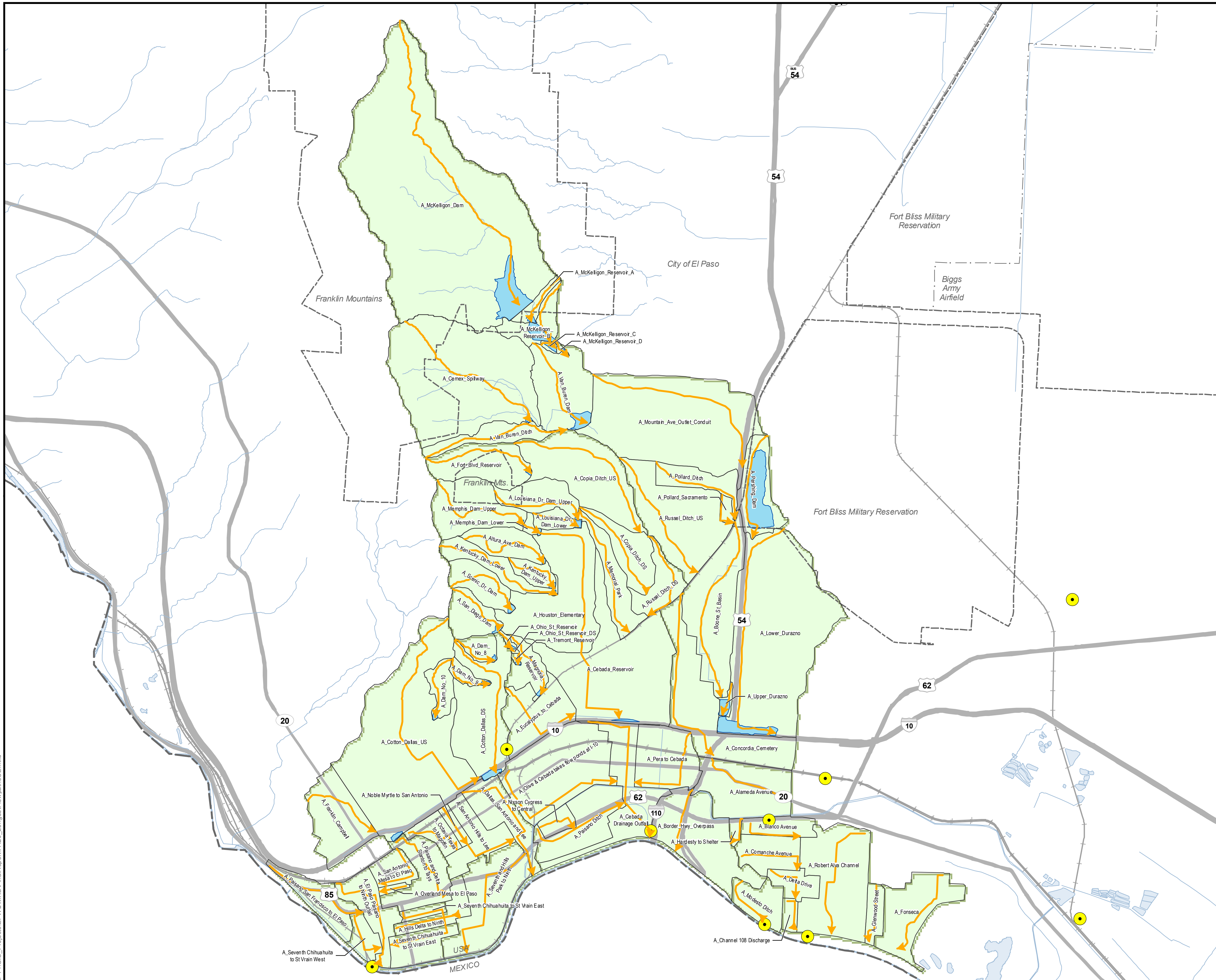

Legend

- Longest Flow Path
- Pump Station
- Watershed
- Drainage System
- Dam/Reservoir
- Major Road
- Railroad
- Streamline
- Water Body
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 2,000 4,000 Feet

1 : 48,000 or 1 Inch = 4,000 Feet

Longest Flowpaths Central Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-20

File: P:\GIS_Projects\EPWU\MXD\FinalReport\FA20_LongestFlowpathsCE.mxd

Legend

- Longest Flow Path
- Watershed
- Drainage System
- Dam/Reservoir
- Major Road
- Railroad
- Streamline
- Water Body
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 4,000 8,000 Feet

1 : 96,000 or 1 Inch = 8,000 Feet

Longest Flowpaths East Side Region

El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-21

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

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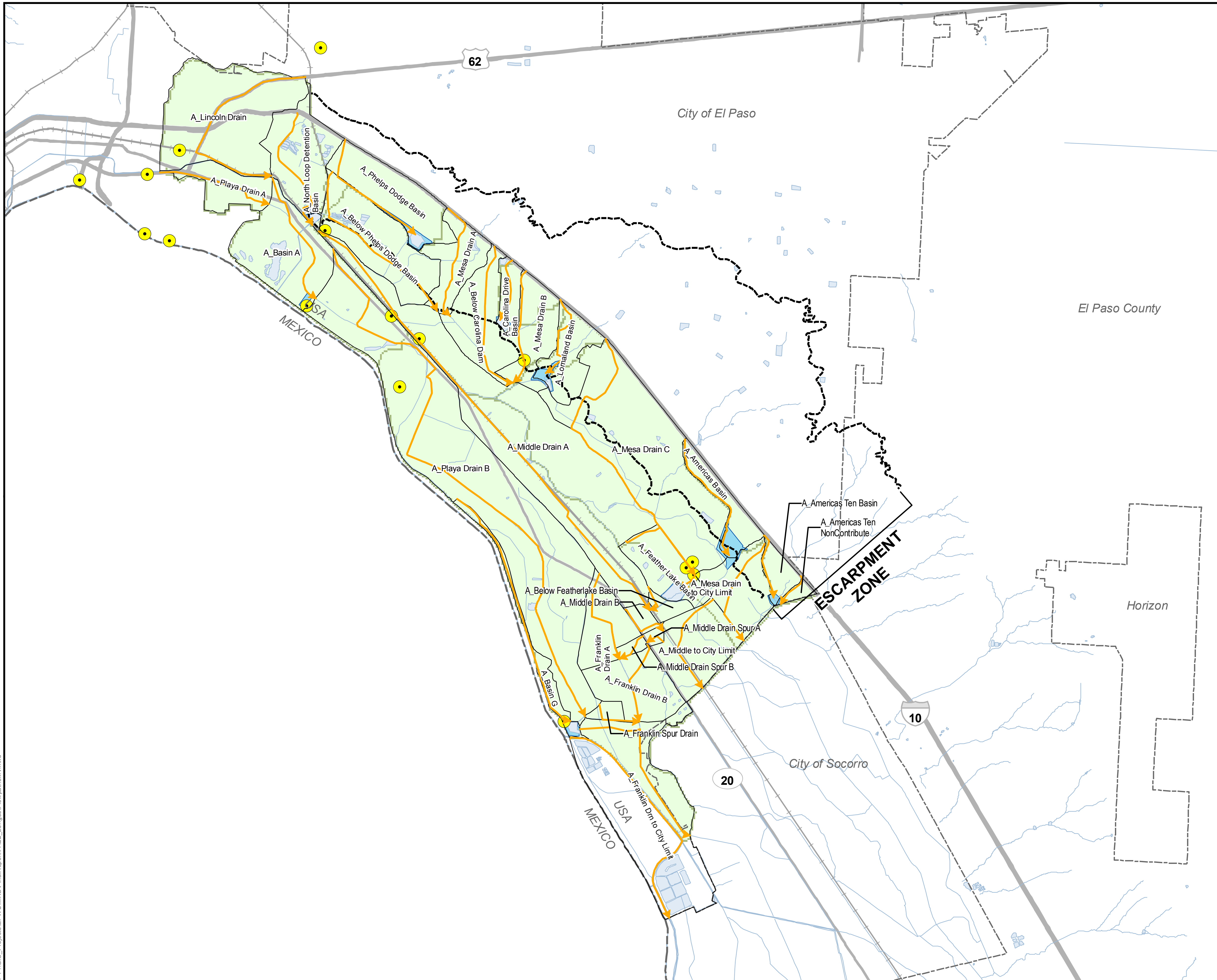

Legend

- Longest Flow Path
- Pump Station
- Watershed
- Drainage System
- Dam/Reservoir
- Major Road
- Railroad
- Streamline
- Water Body
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 3,500 7,000 Feet

1 : 84,000 or 1 Inch = 7,000 Feet

Longest Flowpaths
Mission Valley Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-22

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD
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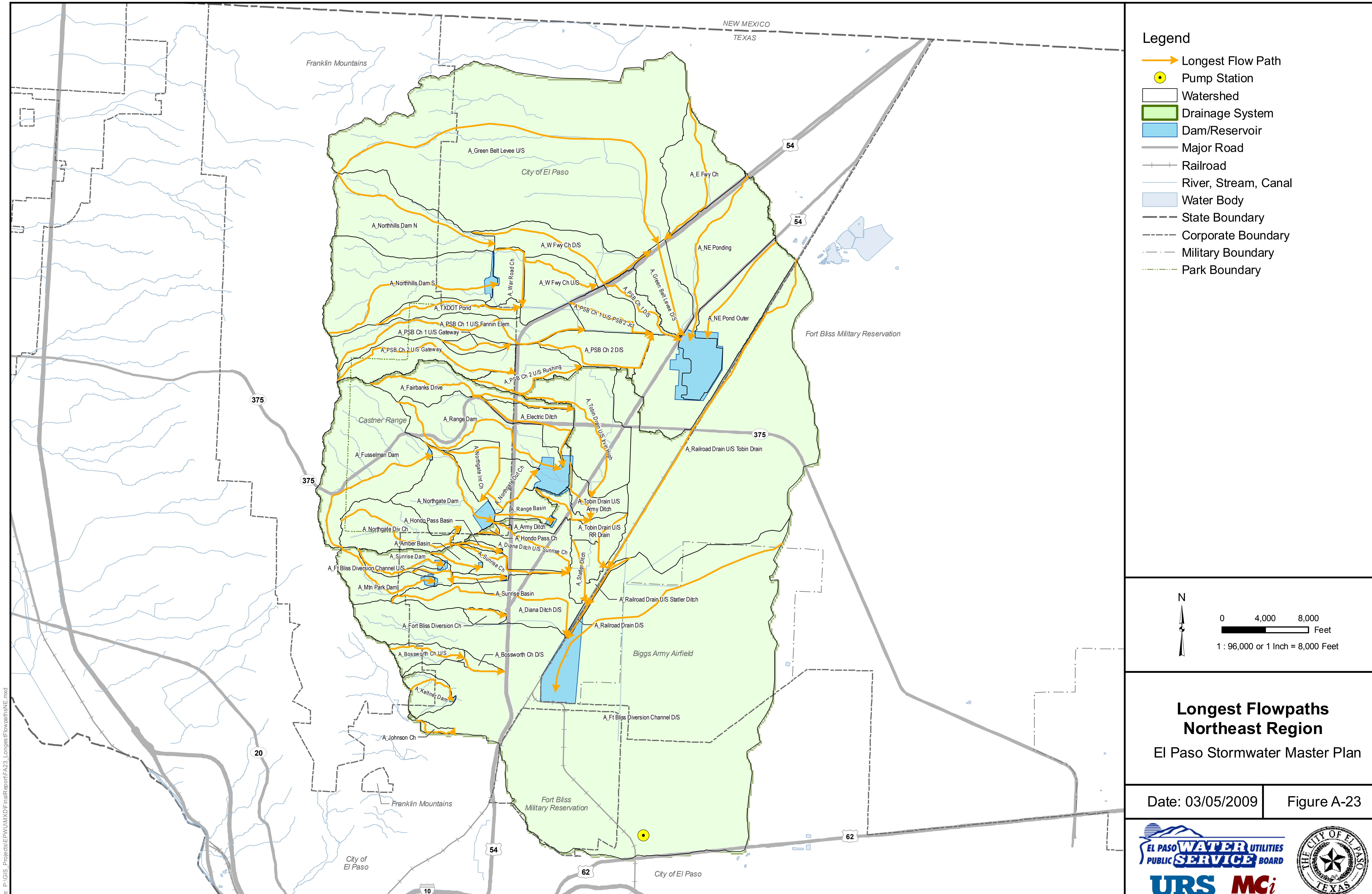
MCi consulting engineers
THE CITY OF EL PASO TEXAS

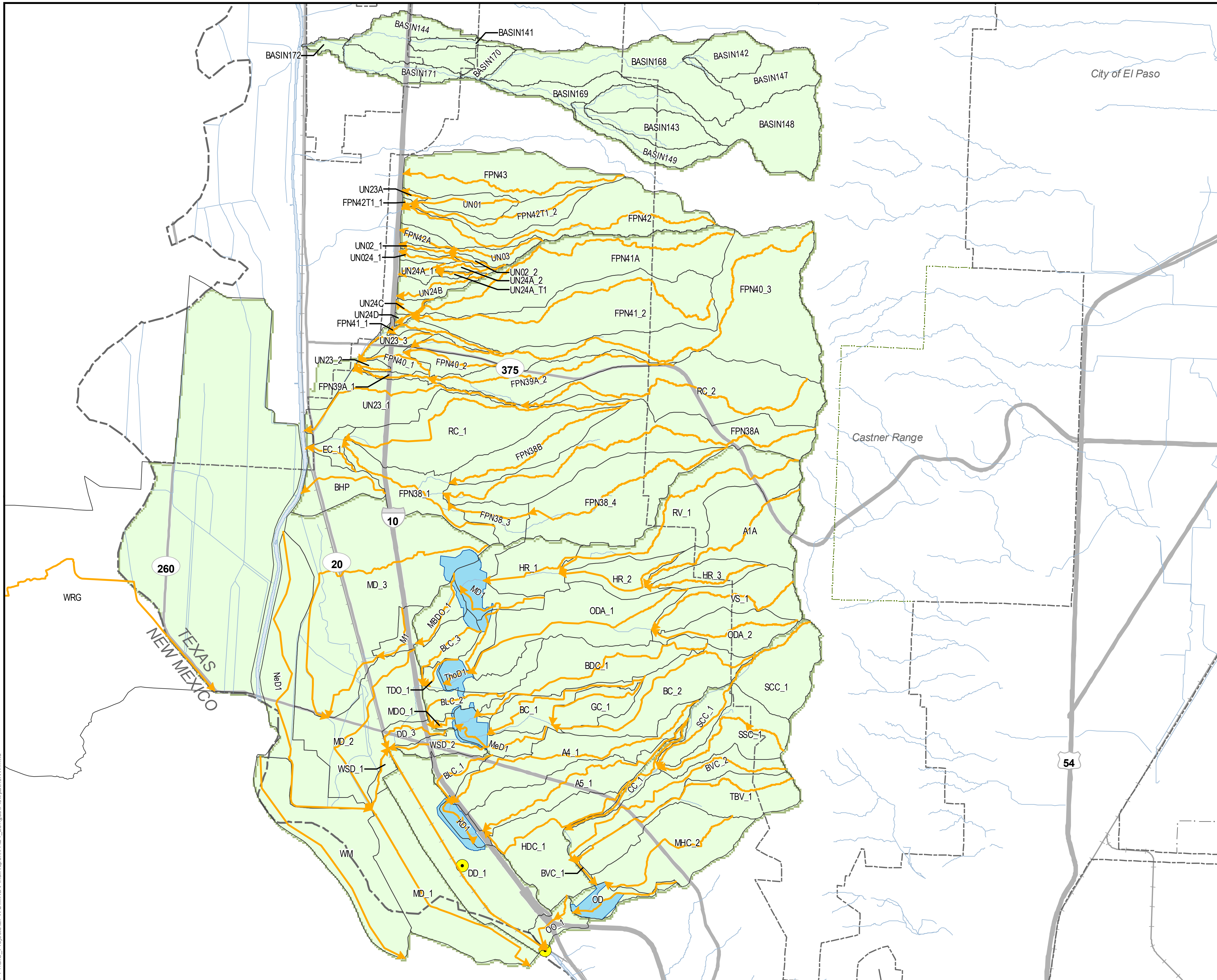


Longest Flowpaths
Northeast Region

El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-23



Legend

- Longest Flow Path
- Pump Station
- Watershed
- Drainage System
- Dam/Reservoir
- Major Road
- Railroad
- Streamline
- Water Body
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 3,000 6,000 Feet

1 : 72,000 or 1 Inch = 6,000 Feet

Longest Flowpaths Northwest Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-24

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

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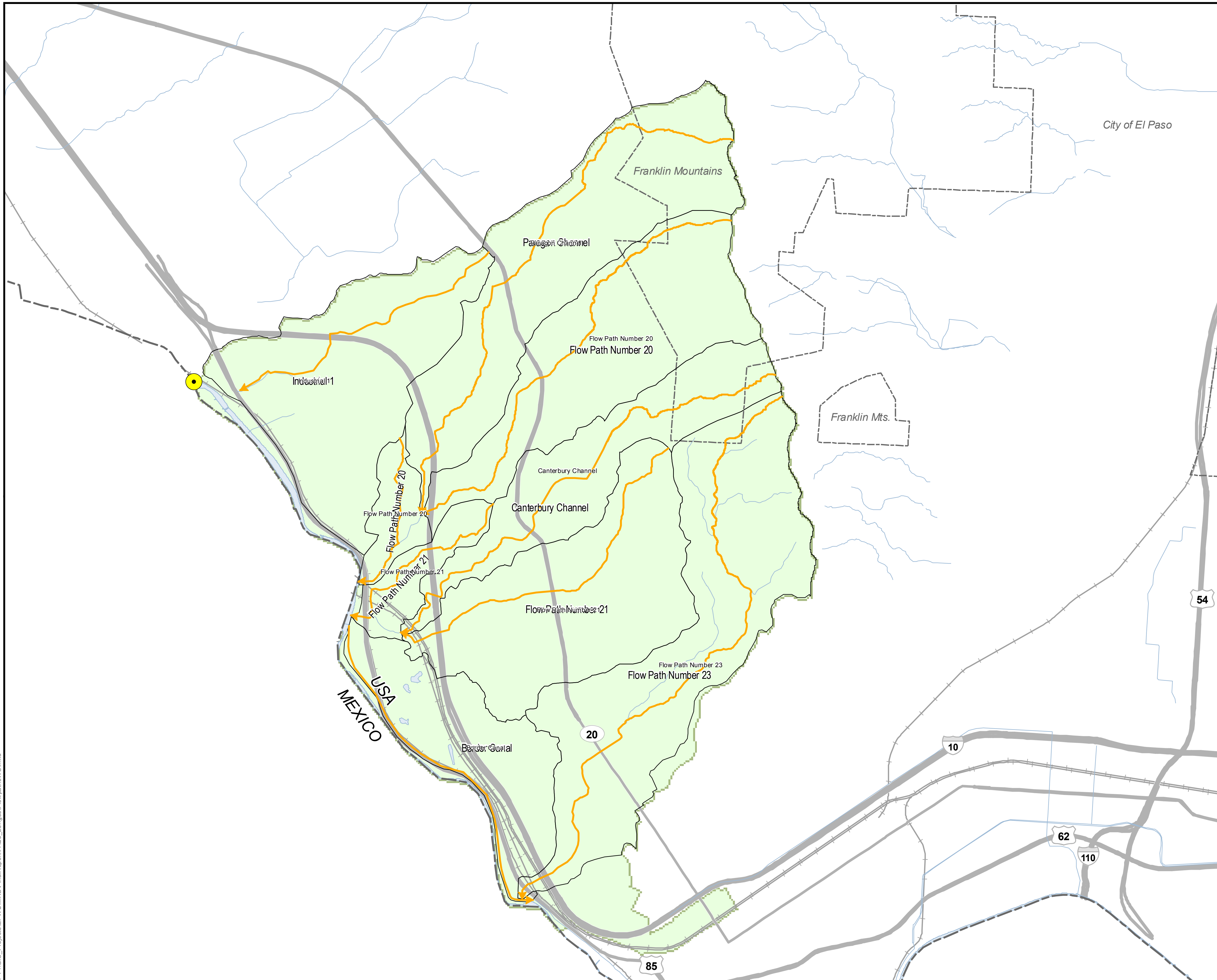

Legend
- Longest Flow Path
- Pump Station
- Watershed
- Drainage System
- Major Road
- Railroad
- Streamline
- Water Body
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 1,500 3,000 Feet

1 : 36,000 or 1 Inch = 3,000 Feet

Longest Flowpaths West Central Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-25

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD
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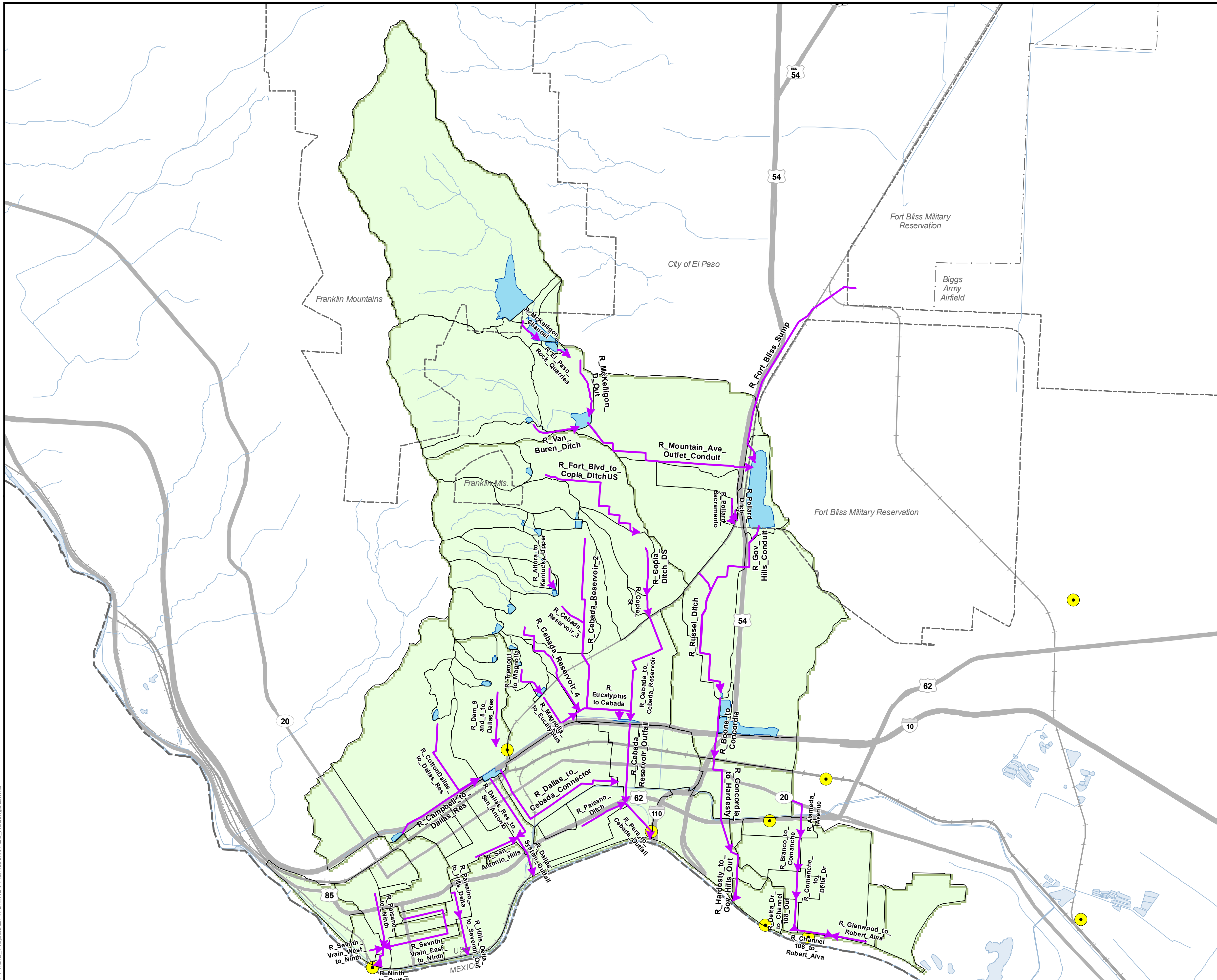
File: P:\GIS_Projects\EPWU\MXD\FinalReport\FA25_LongestFlowpathsWC.mxd



Legend

- Routing Reach
- Pump Station
- Watershed
- Drainage System
- Dam/Reservoir
- Major Road
- Railroad
- Streamline
- Water Body
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 2,000 4,000 Feet

1 : 48,000 or 1 Inch = 4,000 Feet

Routing Reaches Central Region

El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-26

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

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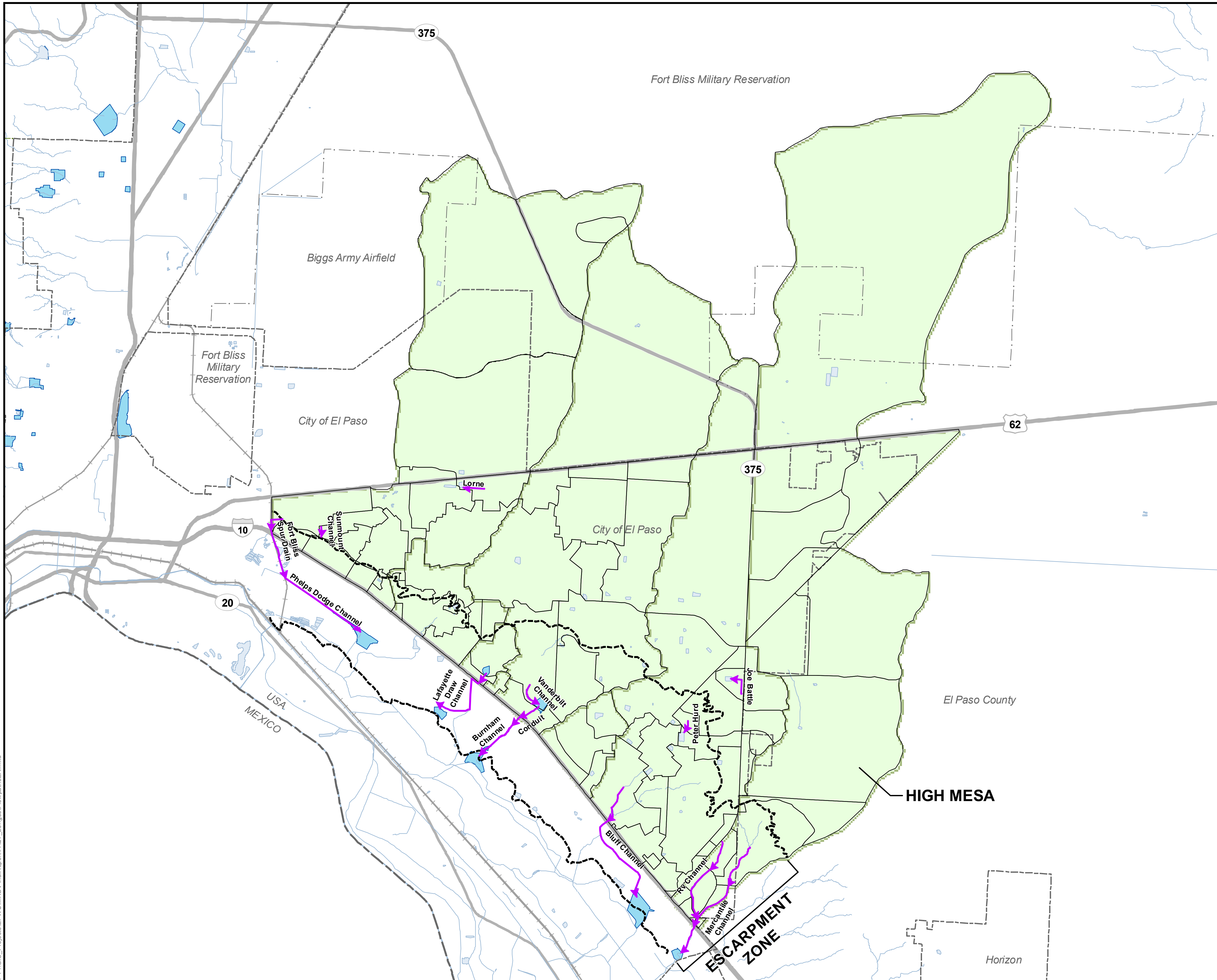
THE CITY OF EL PASO TEXAS

File: P:\GIS_Projects\EPWU\MXD\FinalReport\FA26_RoutingCE.mxd



Routing Reaches
East Side Region

El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-27

El Paso Water Utilities Public Service Board
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The City of El Paso Texas

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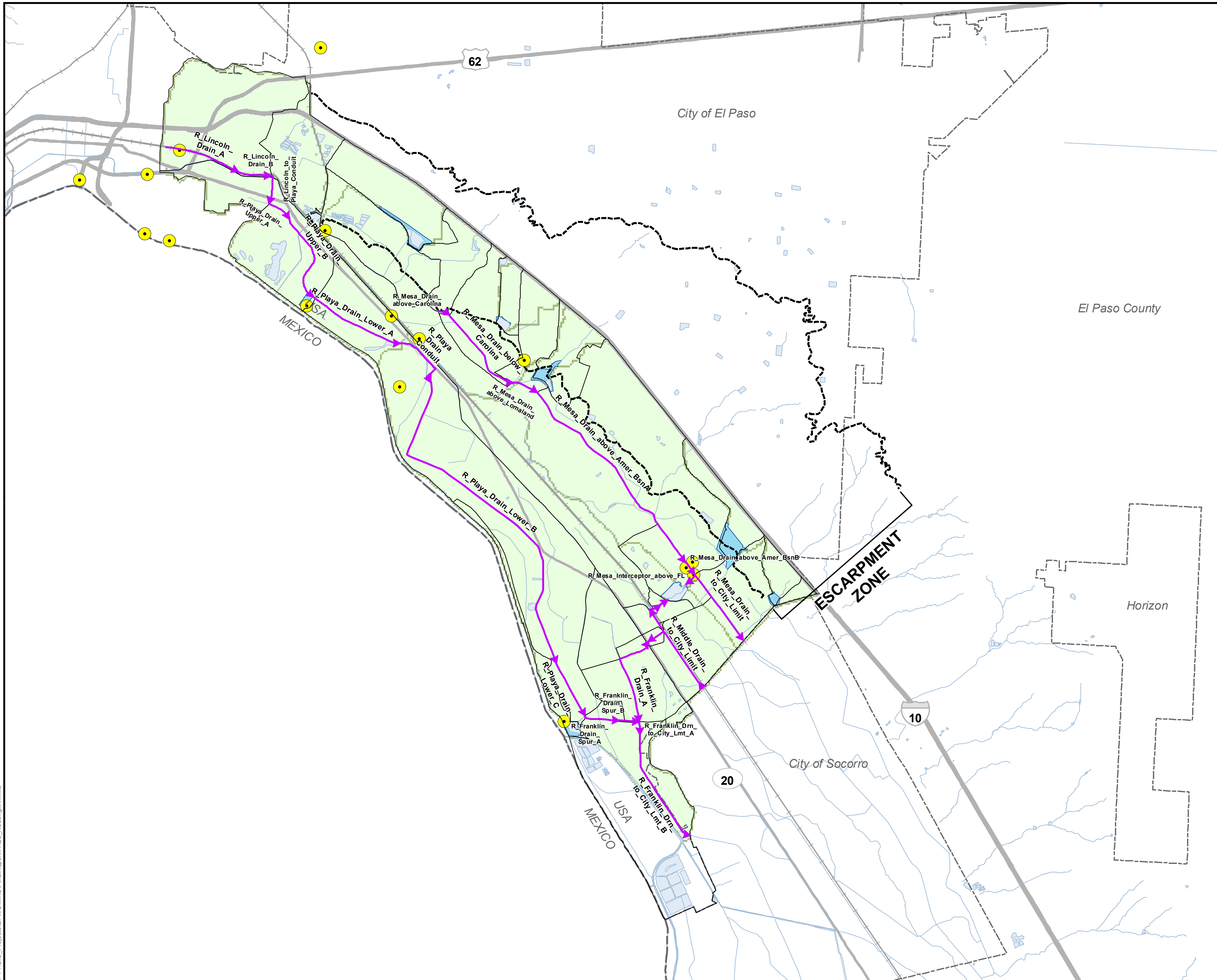

Legend

- Routing Reach
- Pump Station
- Watershed
- Drainage System
- Dam/Reservoir
- Major Road
- Railroad
- Streamline
- Water Body
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 3,500 7,000 Feet

1 : 84,000 or 1 Inch = 7,000 Feet

Routing Reaches
Mission Valley Region

El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-28

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD
URS
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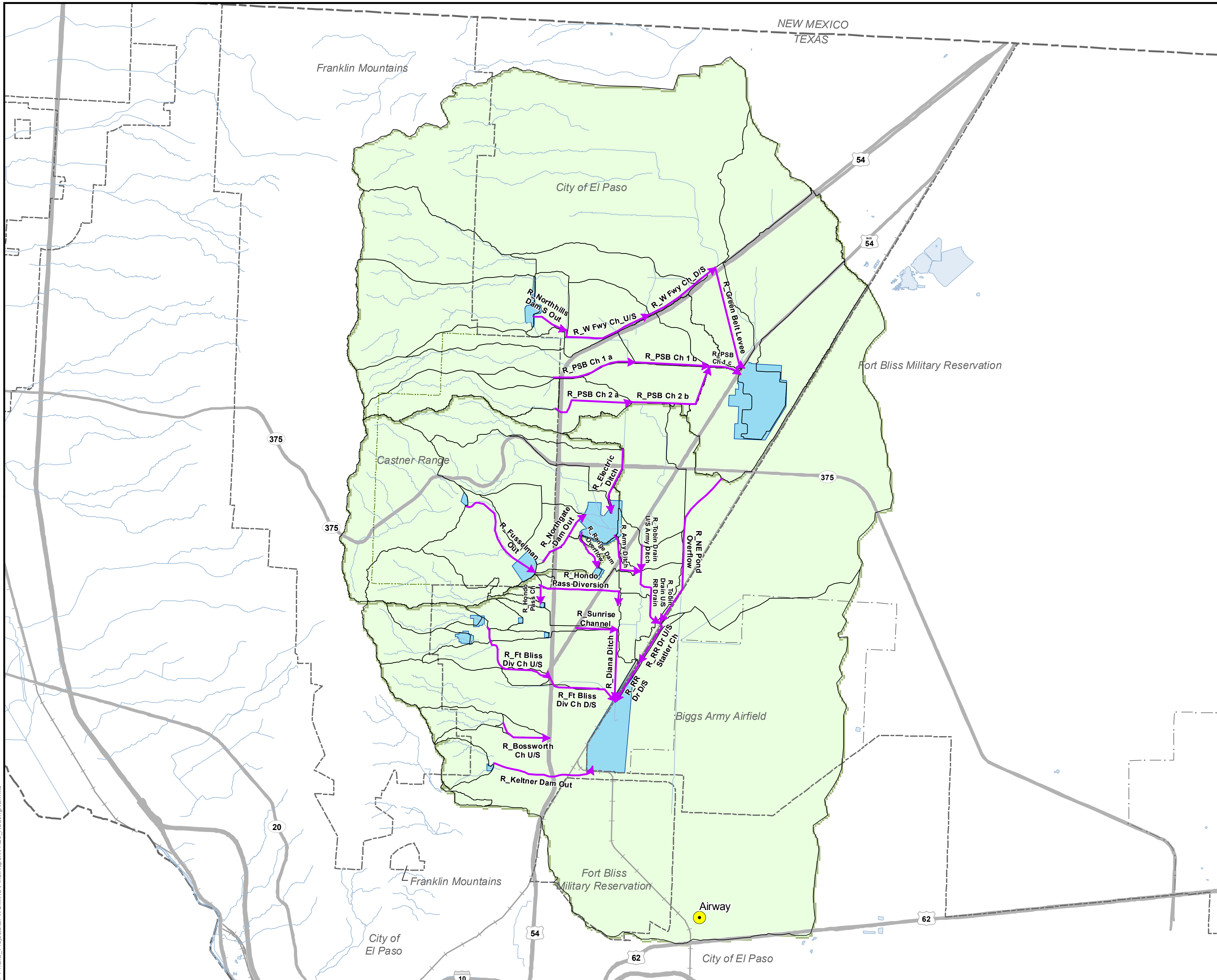
THE CITY OF EL PASO TEXAS



Legend

- Routing Reach
- Pump Station
- Watershed
- Drainage System
- Dam/Reservoir
- Major Road
- Railroad
- River, Stream, Canal
- Water Body
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 4,000 8,000 Feet

1 : 96,000 or 1 Inch = 8,000 Feet

Routing Reaches
Northeast Region

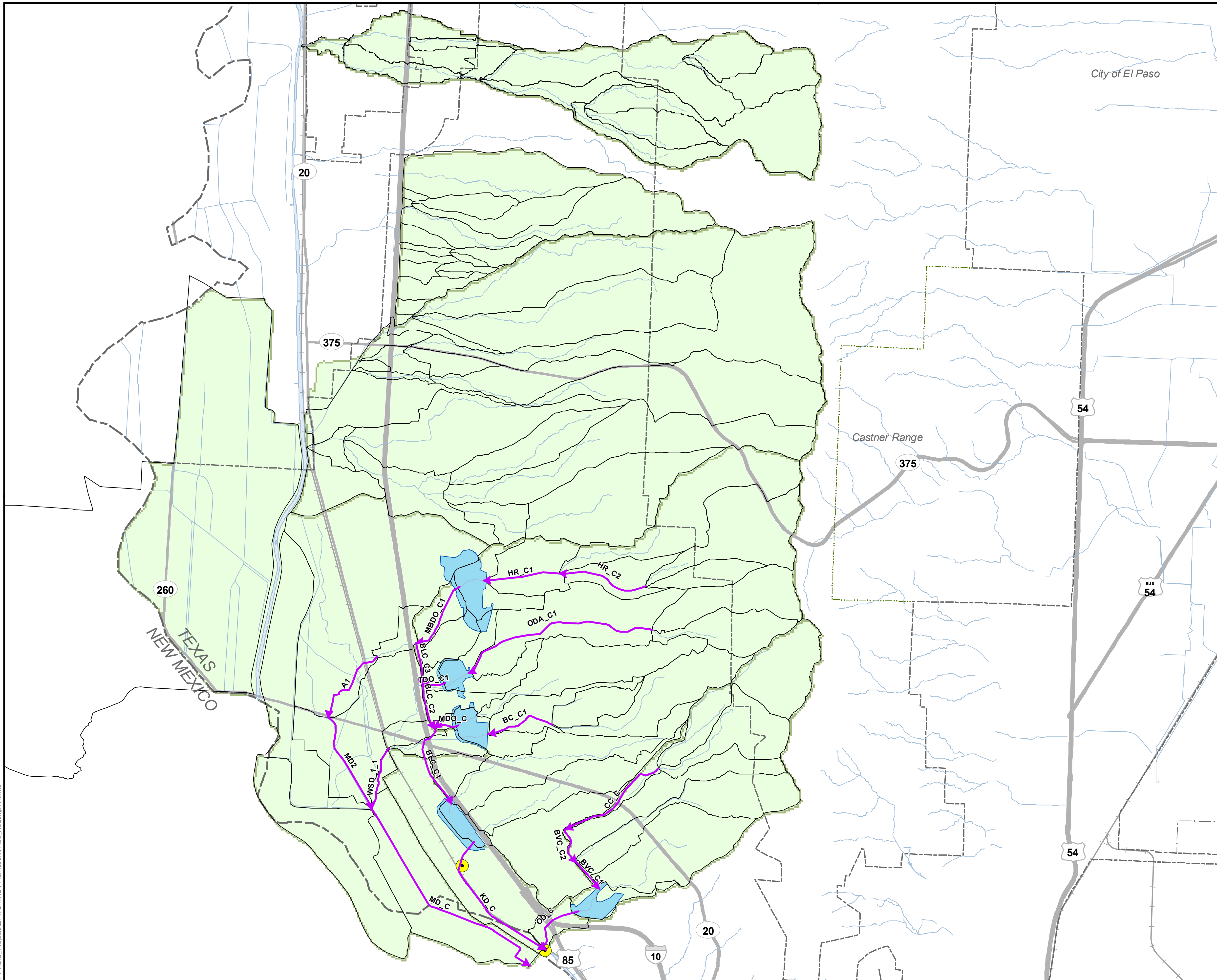
El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-29

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

URS MCi consulting engineers

THE CITY OF EL PASO TEXAS



Legend

- Routing Reach
- Pump Station
- Watershed
- Drainage System
- Dam/Reservoir
- Major Road
- Railroad
- Streamline
- Water Body
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 3,000 6,000 Feet

1 : 72,000 or 1 Inch = 6,000 Feet

Routing Reaches Northwest Region

El Paso Stormwater Master Plan

Date: 03/05/2009

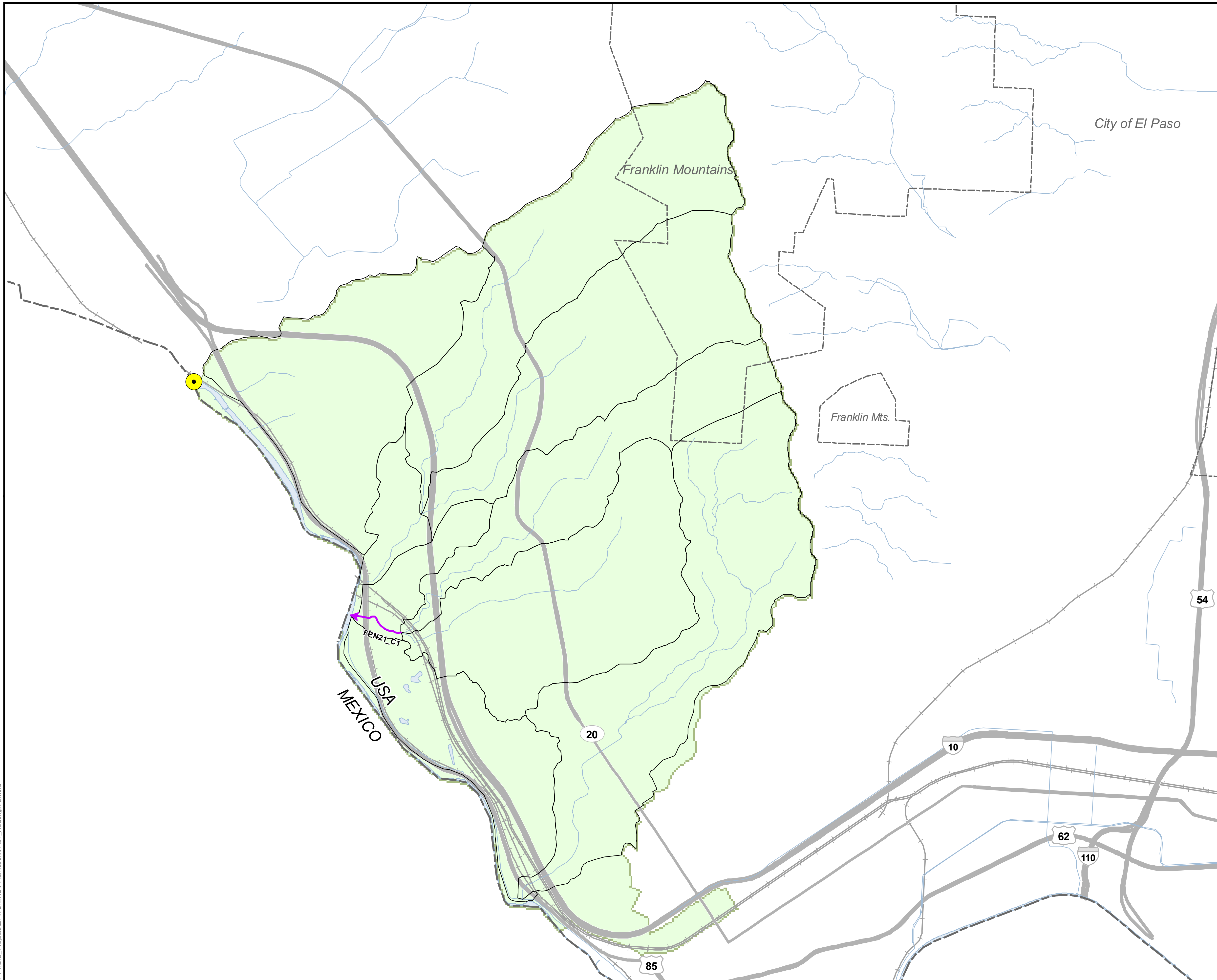
Figure A-30

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD

URS MCi consulting engineers

THE CITY OF EL PASO TEXAS

File: P:\GIS_Projects\EPWU\MXD\FinalReport\FA30_RoutingNW.mxd



Legend
- Routing Reach
- Pump Station
- Watershed
- Drainage System
- Major Road
- Railroad
- Streamline
- Water Body
- State Boundary
- Corporate Boundary
- Military Boundary
- Park Boundary

N

0 1,500 3,000 Feet

1 : 36,000 or 1 Inch = 3,000 Feet

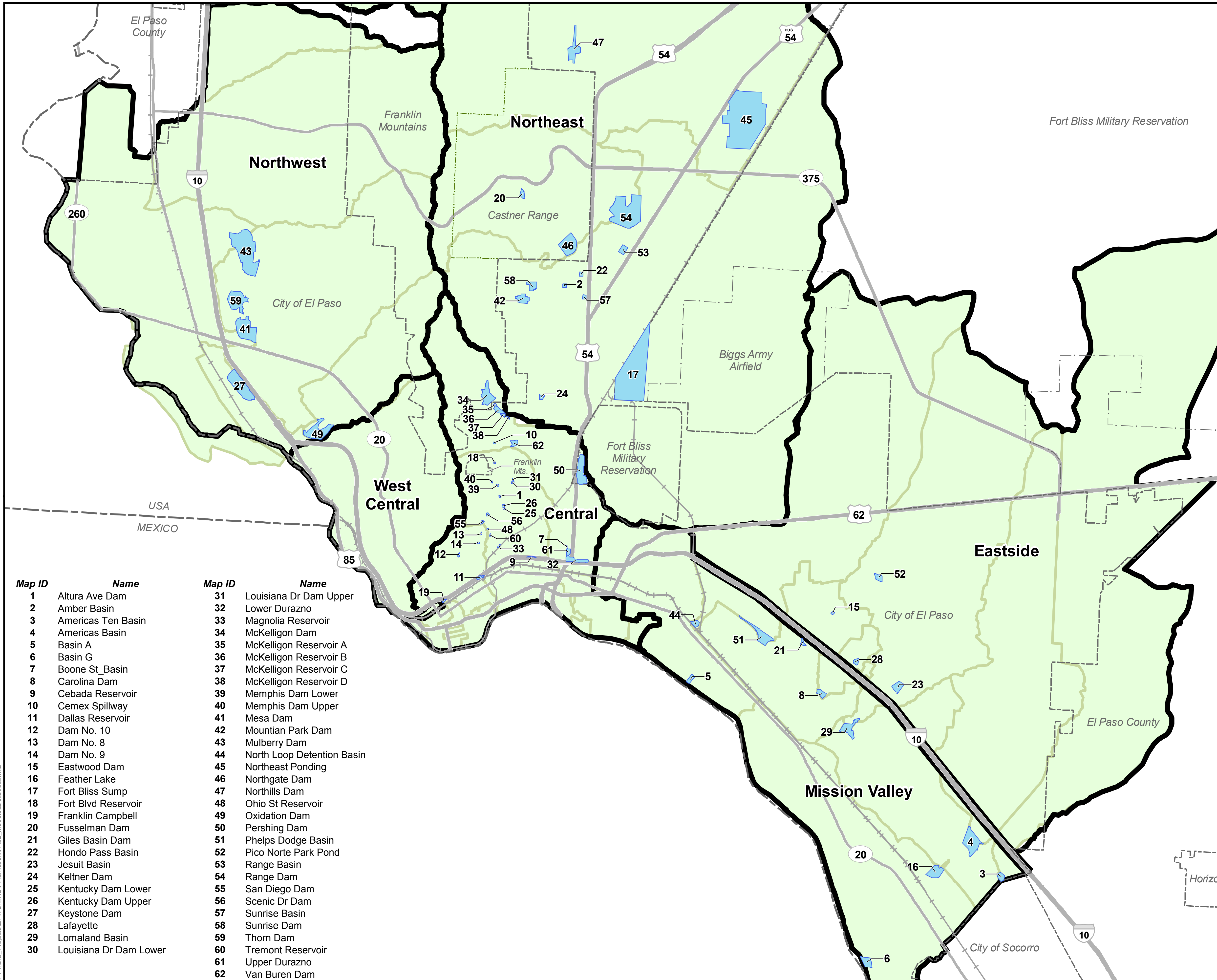
Routing Reaches
West Central Region

El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-31

File: P:\GIS_Projects\EPWU\MXD\FinalReport\FA31_RoutingWC.mxd



Map ID	Name	Map ID	Name
1	Altura Ave Dam	31	Louisiana Dr Dam Upper
2	Amber Basin	32	Lower Durazno
3	Americas Ten Basin	33	Magnolia Reservoir
4	Americas Basin	34	McKelligon Dam
5	Basin A	35	McKelligon Reservoir A
6	Basin G	36	McKelligon Reservoir B
7	Boone St_Basin	37	McKelligon Reservoir C
8	Carolina Dam	38	McKelligon Reservoir D
9	Cebada Reservoir	39	Memphis Dam Lower
10	Cemex Spillway	40	Memphis Dam Upper
11	Dallas Reservoir	41	Mesa Dam
12	Dam No. 10	42	Mountian Park Dam
13	Dam No. 8	43	Mulberry Dam
14	Dam No. 9	44	North Loop Detention Basin
15	Eastwood Dam	45	Northeast Ponding
16	Feather Lake	46	Northgate Dam
17	Fort Bliss Sump	47	Northills Dam
18	Fort Blvd Reservoir	48	Ohio St Reservoir
19	Franklin Campbell	49	Oxidation Dam
20	Fusselman Dam	50	Pershing Dam
21	Giles Basin Dam	51	Phelps Dodge Basin
22	Hondo Pass Basin	52	Pico Norte Park Pond
23	Jesuit Basin	53	Range Basin
24	Keltner Dam	54	Range Dam
25	Kentucky Dam Lower	55	San Diego Dam
26	Kentucky Dam Upper	56	Scenic Dr Dam
27	Keystone Dam	57	Sunrise Basin
28	Lafayette	58	Sunrise Dam
29	Lomaland Basin	59	Thorn Dam
30	Louisiana Dr Dam Lower	60	Tremont Reservoir
		61	Upper Durazno
		62	Van Buren Dam

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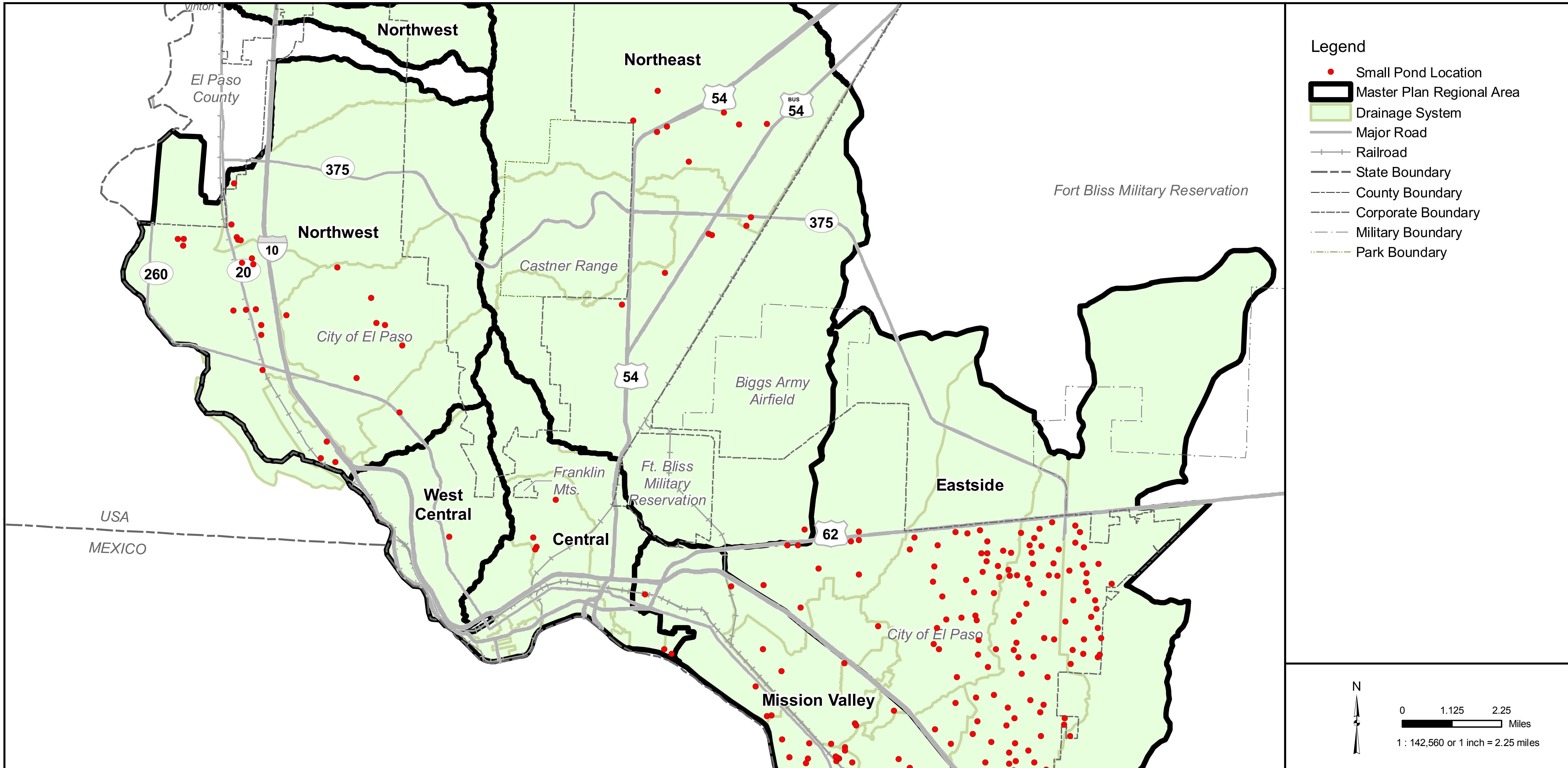
Location Map
Modeled Detention Structures
El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-32



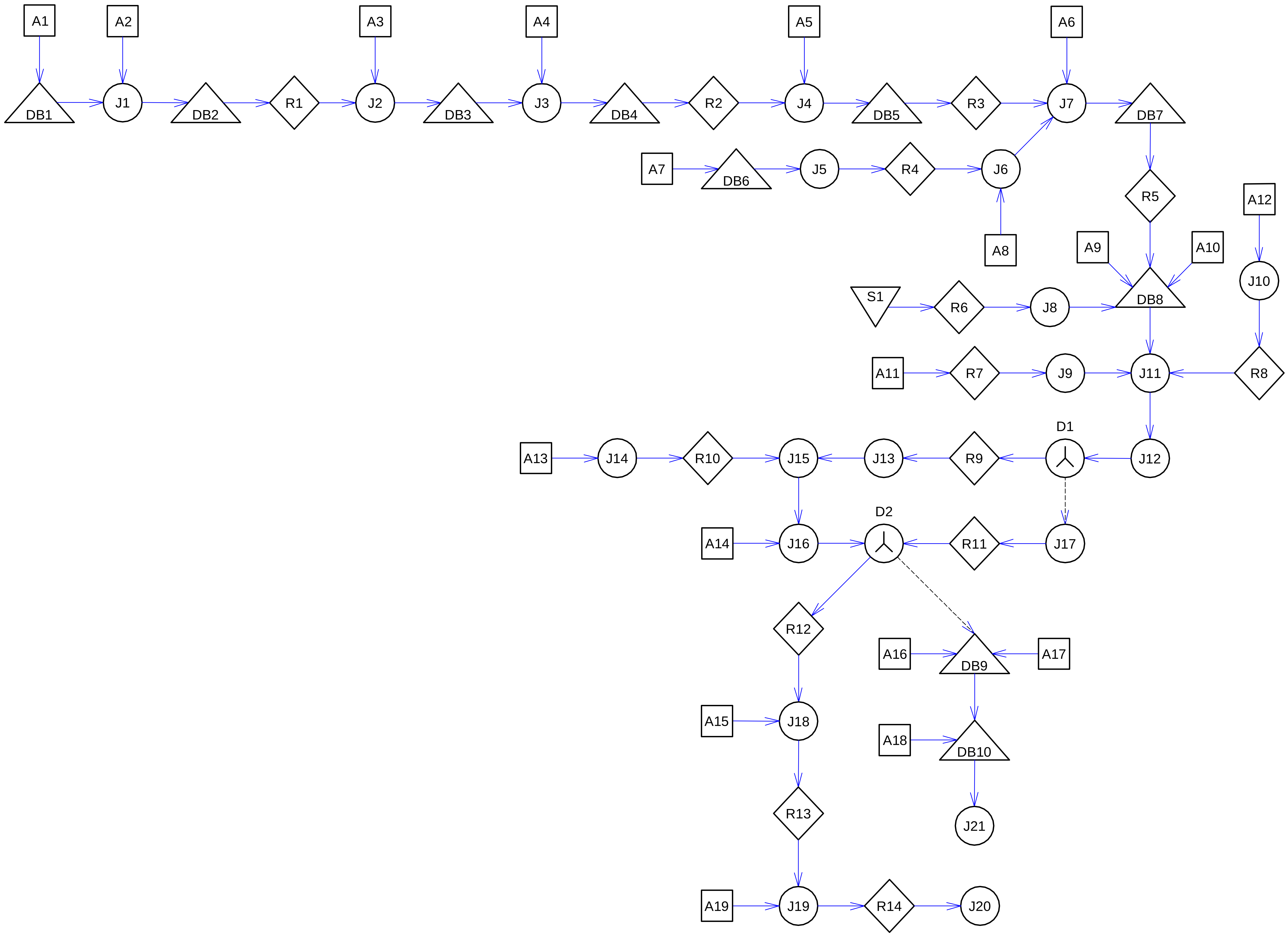
Location Map
Small Ponds

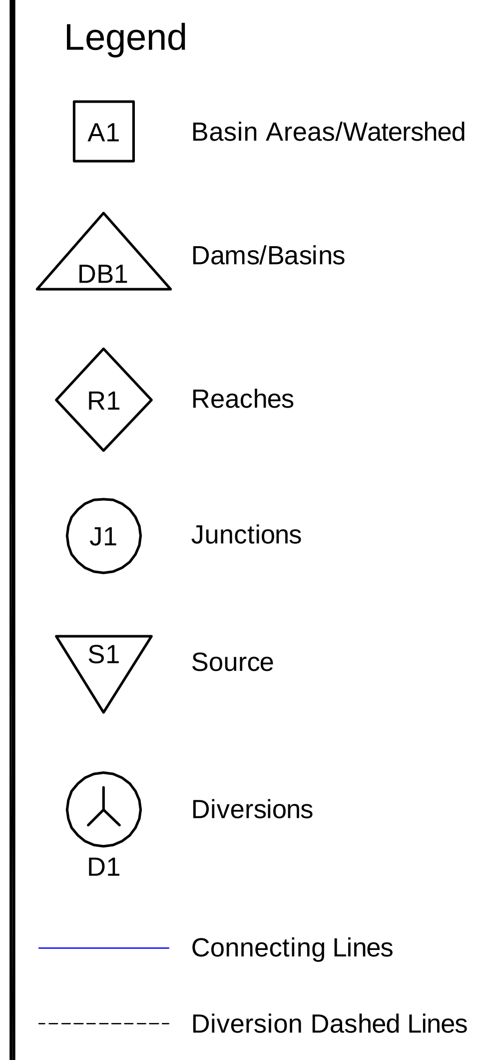
El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-33

File: P:\GIS_Projects\EPWU\MXD\FinalReport\FA33_SmallPonds.mxd





Government Hills System
HEC-HMS Model Layout
Central Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-34

File: Q:\El Paso Master Drainage Plan\Stormwater Master Plan Report\HMS Cad Diagrams\Schematics_App_A_013009.dwg Layout: Fig A-34 User: Scott_Coleman Plotted: Mar 02, 2009 - 10:48am

Basin				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
A1	A_McKelligon_Dam	2.168	1809	227.1
A2	A_Mckelligon_Reservoir_A	0.038	80	4.1
A3	A_Mckelligon_Reservoir_B	0.104	197	11.1
A4	A_Mckelligon_Reservoir_C	0.009	18	0.9
A5	A_Mckelligon_Reservoir_D	0.006	16	0.8
A6	A_Van_Buren_Dam	0.279	395	35.7
A7	A_Cemex_Spillway	0.923	1156	108.7
A8	A_Van_Buren_Ditch	0.120	153	13.2
A9	A_Mountain_Ave_Outlet_Condui	0.876	1321	112.0
A10	A_Pershing Dam	0.193	207	16.0
A11	A_Pollard Ditch	0.113	211	15.4
A12	A_Pollard_Sacramento	0.021	52	2.8
A13	A_Russel_Ditch_US	0.434	791	57.2
A14	A_Boone_St_Basin	0.398	419	36.1
A15	A_Saipan	0.152	316	14.5
A16	A_Concordia_Cemetery	0.305	388	29.2
A17	A_Upper_Durazno	0.018	28	1.4
A18	A_Lower_Durazno	1.037	485	53.7
A19	A_Hardesty_to_Shelter	0.018	33	2.1

Diversion				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
D1	D_Government6_Hills	4.850	348	330.2
D2	D_Boone_St_Basin	5.682	375	604.2

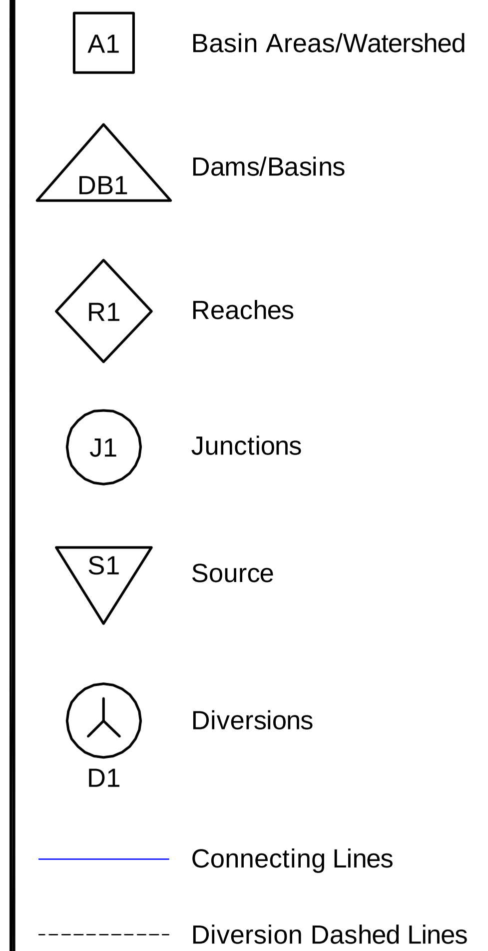
Dams and Basins				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
DB1	S_McKelligon_Dam	2.168	111	70.5
DB2	S_Mckelligon_Reservoir_A	2.206	112	68.6
DB3	S_Mckelligon_Reservoir_B	2.310	186	80.3
DB4	S_Mckelligon_Reservoir_C	2.318	103	73.1
DB5	S_Mckelligon_Reservoir_D	2.324	95	73.7
DB6	S_Cemex Spilway	0.923	1148	106.3
DB7	S_Van_Buren_Dam	3.647	1206	228.9
DB8	S_Pershing_Dam	4.716	263	554.5
DB9	S_Upper_Durazno	0.323	222	30.1
DB10	S_Lower_Durazno	1.360	0	0.0

Junction				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
J1	J_Mckelligon Res A Inflow	2.206	113	74.6
J2	J_McKelligon Res B Inflow	2.310	197	79.7
J3	J_McKelligon Res C Inflow	2.318	199	81.2
J4	J_McKelligon Res D Inflow	2.324	102	73.9
J5	J_Van_Buren_Ditch_US	0.923	1148	106.3
J6	J_Van Buren Ditch Inflow	1.044	1272	119.5
J7	J_Inflow_Van_Buren_Dam	3.647	1658	228.9
J8	J_Fort Bliss Channel Inflow	0.000	200	324.6
J9	J_Pollard Ditch Inflow	0.113	209	15.4
J10	J_Pollard_Sacramento	0.021	52	2.8
J11	J_Pershing_Dam	4.850	448	572.6
J12	J_Inflow from Pershing Dam	4.850	448	572.6
J13	J_Gov Hills North Inflow	4.850	336	328.7
J14	J_Russel_Ditch	0.434	791	57.2
J15	J_Gov Hills Central Inflow	5.284	1098	385.8
J16	J_Gov Hills South Inflow	5.682	1517	421.9
J17	J_24hr-Emergency_Drain	0.000	100	242.4
J18	J_Concordia Cemetery	5.834	691	618.2
J19	J_Hardesty_to_Shelter	5.852	705	619.1
J20	J_Gov_Hills_Outfall	5.852	687	618.5
J21	J_Lower_Durazno_Out	1.360	0	0.0

Reach				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
R1	R_Mckelligon_Channel	2.206	112	68.5
R2	R_El Paso Rock Quarries	2.318	102	73.1
R3	R_Mckelligon_D_Out	2.324	95	73.6
R4	R_Van_Buren_DS	0.923	1128	106.4
R5	R_Mountain_Avenue_Conduit	3.647	1205	228.8
R6	R_FortBliss Inflow	0.000	200	324.6
R7	R_Pollard_Ditch	0.113	209	15.4
R8	R_Pollard_Sacramento	0.021	47	2.8
R9	R_Gov_Hills_Conduit	4.850	336	328.7
R10	R_Russel_Ditch	0.434	767	57.1
R11	R_24hr-Emergency Drain	0.000	100	241.7
R12	R_Boone_to_Concordia	5.682	375	603.6
R13	R_Concordia_to_Hardesty	5.834	673	617.0
R14	R_Hardesty_to_Gov_Hills_Out	5.852	687	618.5

Source				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
S1	Source_NE_Input	Not Specified	200	324.6

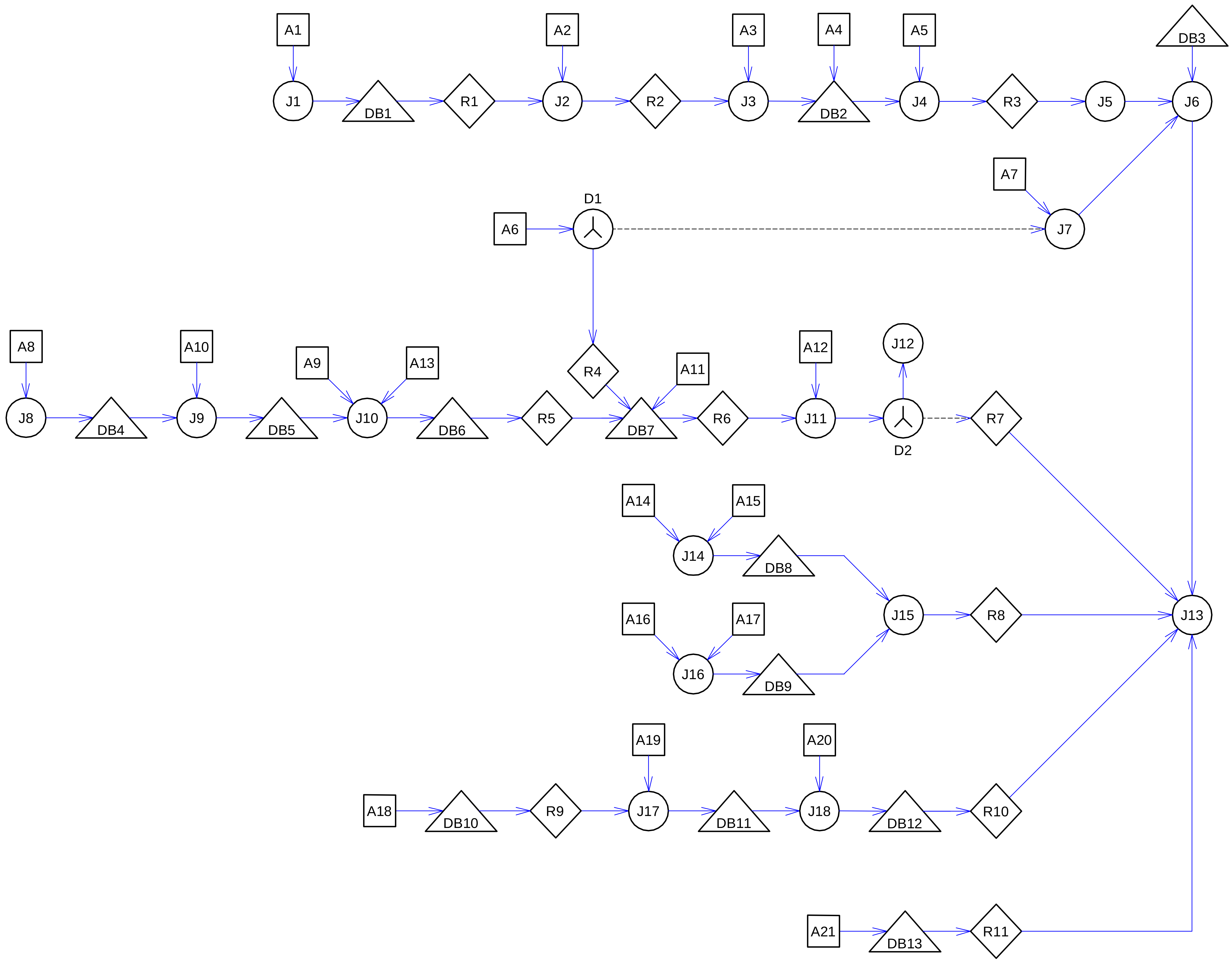
Legend

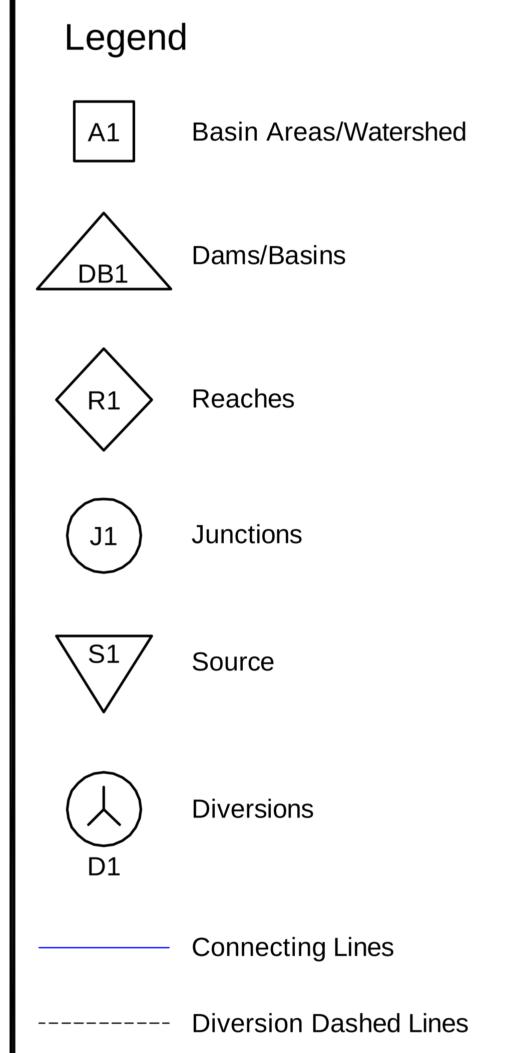


Government Hills System
HEC-HMS Model Table
Central Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-35





Cebada System
HEC-HMS Model Layout
Central Region

El Paso Stormwater Master Plan

Date: 03/05/2009	Figure A-36

Basin				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
A1	A_Fort_Blvd_Reservoir	0.219	280	21.4
A2	A_Copia_Ditch_US	0.411	670	53.2
A3	A_Copia_Ditch_DS	0.160	320	21.4
A4	A_Memorial_Park	0.151	257	18.2
A5	A_Russel_Ditch_DS	0.123	246	15.7
A6	A_Houston_Elementary	0.498	538	62.6
A7	A_Cebada_Reservoir	0.699	948	72.8
A8	A_San_Diego_Dam	0.122	207	12.0
A9	A_Tremont_Reservoir	0.005	13	0.7
A10	A_Ohio_St_Reservoir	0.009	20	1.0
A11	A_Magnolia_Reservoir	0.095	57	3.8
A12	A_Eucalyptus_to_Cebada	0.226	437	32.0
A13	A_Ohio_St_Reservoir_DS	0.002	0	0.0
A14	A_Louisiana_Dr_Dam_Lower	0.049	118	5.8
A15	A_Louisiana_Dr_Dam_Upper	0.137	231	13.8
A16	A_Memphis_Dam_Lower	0.015	30	1.4
A17	A_Memphis_Dam_Upper	0.249	312	23.9
A18	A_Altura_Ave_Dam	0.122	157	11.9
A19	A_Kentucky_Dam_Upper	0.057	118	6.1
A20	A_Kentucky_Dam_Lower	0.124	140	12.3
A21	A_Scenic_Dr_Dam	0.126	172	12.1

Reach				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
R1	R_Fort_Blvd_to_Copia_DitchUS	0.219	241	16.8
R2	R_Copia_Ditch_DS	0.630	751	70.0
R3	R_Cebada_to_Cebada_Reservoir	1.064	1386	126.1
R4	R_Houston_Magnolia	0.498	250	49.7
R5	R_Tremont_to_Magnolia	0.138	54	13.0
R6	R_Magnolia_to_Eucalyptus	0.731	327	61.0
R7	R_Eucalyptus to Cebada	0.000	100	45.6
R8	R_Cebada_Reservoir_2	0.450	457	34.3
R9	R_Altura_to_Kentucky_Upper	0.122	150	10.4
R10	R_Cebada_Reservoir_3	0.303	137	21.9
R11	R_Cebada_Reservoir_4	0.126	43	12.0

Diversion				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
D1	D_Houston_Elementary	0.498	250	49.7
D2	D_Capacity of 60"Conduit	0.956	568	47.4

Dams and Basins				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
DB1	S_Fort_Blvd_Reservoir	0.219	242	16.5
DB2	S_Memorial_Park	0.941	1196	110.5
DB3	S_Cebada_Reservoir	2.641	637	325.6
DB4	S_San_Diego_Dam	0.122	110	11.3
DB5	S_Ohio_St_Reservoir	0.130	97	12.3
DB6	S_Tremont_Reservoir	0.138	54	13.0
DB7	S_Magnolia_Reservoir	0.731	330	61.0
DB8	S_Louisiana_Dam_Lower	0.186	163	13.4
DB9	S_Memphis_Dam_Lower	0.264	308	21.0
DB10	S_Altura_Ave_Dam	0.122	154	10.4
DB11	S_Kentucky_Dam_Upper	0.179	57	10.6
DB12	S_Kentucky_Dam_Lower	0.303	138	21.9
DB13	S_Scenic_Dr_Dam	0.126	43	12.0

Junction				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
J1	J_Inflow_Ft_Blvd_Res	0.219	280	21.4
J2	J_Copia_Ditch_US	0.630	768	70.0
J3	J_Copia_Ditch_DS	0.790	966	91.5
J4	J_Cebada_US	1.064	1393	126.1
J5	J_Cebada_Reservoir_Outfall	1.064	1386	126.1
J6	J_Cebada_Inflow	2.641	3031	325.6
J7	J_Houston_to_Cebada	0.699	1116	85.7
J8	J_Inflow to San Diego Dam	0.122	207	12.0
J9	J_Inflow_Ohio_St_Res	0.130	118	12.3
J10	J_Inflow_Tremont_Reservoir	0.138	99	13.0
J11	J_Eucalyptus_to_Cebada	0.956	668	93.0
J12	J_I-10 Overtopping Flow	0.956	568	47.4
J13	J_Cebada_Total	0.878	732	113.8
J14	J_Inflow_Louisiana_Dam_Lower	0.186	348	19.7
J15	J_Cebada_North	0.450	465	34.4
J16	J_Inflow_Memphis_Dam	0.264	334	25.3
J17	J_Inflow_Kentucky_Dam_Upper	0.179	211	16.6
J18	J_Inflow_Kentucky_Dam_Lower	0.303	140	22.8

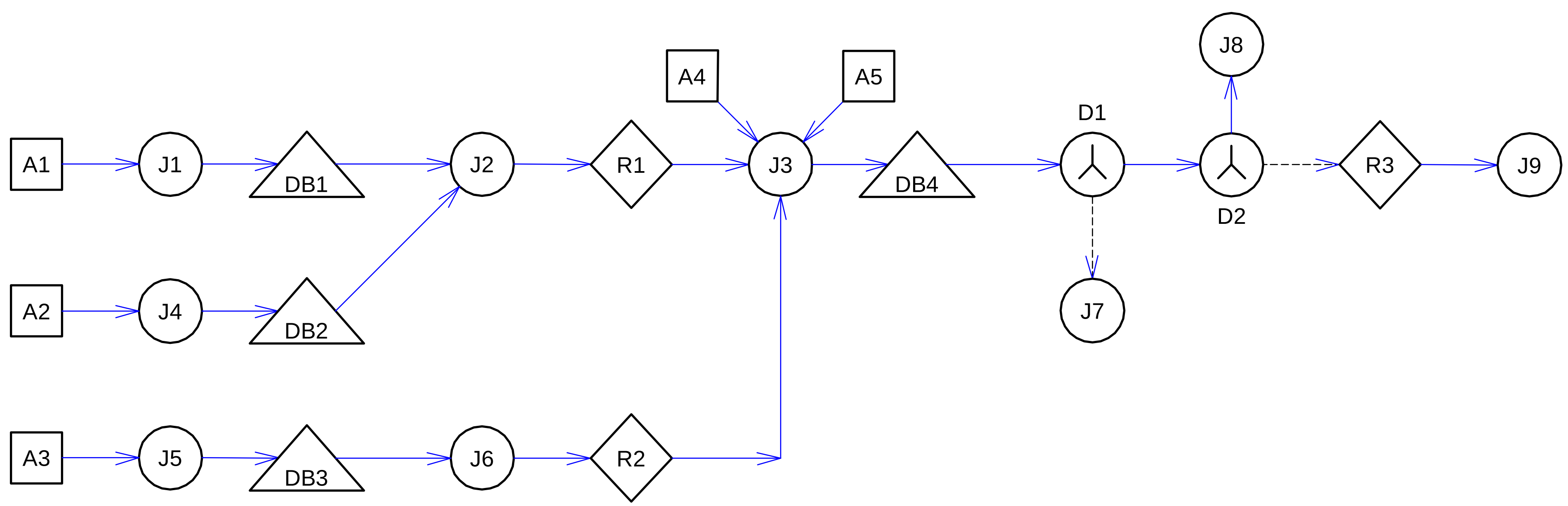
Legend

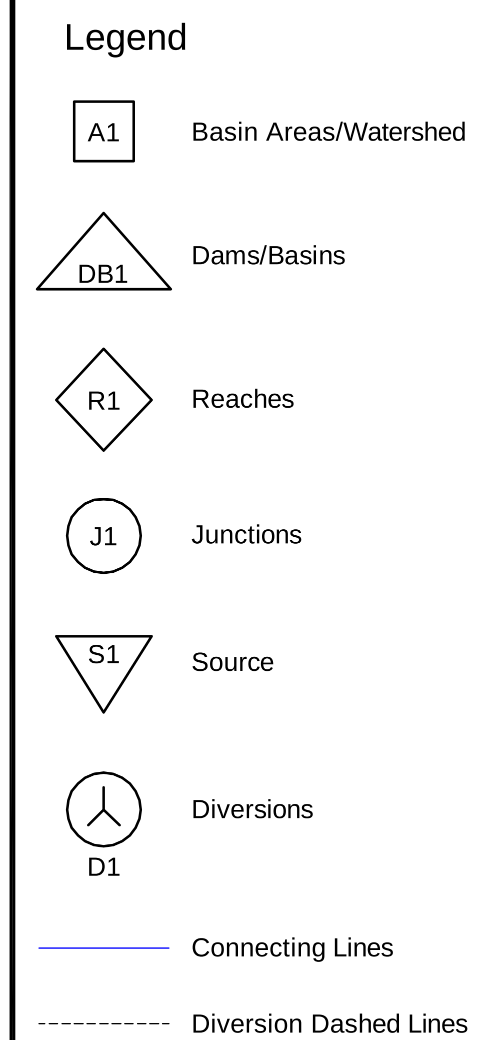
- A1 — Basin Areas/Watershed
- DB1 — Dams/Basins
- R1 — Reaches
- J1 — Junctions
- S1 — Source
- D1 — Diversions
- Connecting Lines
- Diversion Dashed Lines

Cebada System
HEC-HMS Model Table
Central Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-37





Dallas System
HEC-HMS Model Layout
Central Region

El Paso Stormwater Master Plan

Date: 03/05/2009	Figure A-38

El Paso Water Utilities Public Service Board

URS

MCi consulting engineers

The City of El Paso Texas

File: Q:\El Paso Master Drainage Plan\Stormwater Master Plan Report\HMS Cad Diagrams\Schematics_App_A_013009.dwg Layout: Fig A-38 User: Scott_Coleman Plotted: Mar 02, 2009 - 10:48am

Basin				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
A1	A_Dam_No_8	0.052	88	4.3
A2	A_Dam_No_9	0.033	65	3.3
A3	A_Dam_No_10	0.073	150	6.9
A4	A_Cotton_Dallas_DS	0.375	670	43.3
A5	A_Cotton_Dallas_US	1.047	1342	111.5

Diversion				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
D1	D_3708	1.580	530	145.4
D2	D_IH_10_Dallas	1.580	216	75.7

Dams and Basins				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
DB1	S_Dam_No_8	0.052	49	4.3
DB2	S_Dam_No_9	0.033	49	3.3
DB3	S_Dam_No_10	0.073	0	0.0
DB4	S_Dallas_Reservoir	1.580	690	162.4

Junction				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
J1	J_Inflow_Dam_No_8	0.052	88	4.3
J2	J_Dam_9_and_8	0.085	97	7.5
J3	J_Dallas_Reservoir	1.580	1988	162.4
J4	J_Inflow_Dam_No_9	0.033	65	3.3
J5	J_Inflow_Dam_No_10	0.073	150	6.9
J6	J_Cotton_Dallas_US	0.073	0	0.0
J7	J_Overflow_3708	0.000	160	16.9
J8	J_Dallas_West	1.580	216	75.7
J9	J_Diversion	0.000	314	69.8

Reach				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
R1	R_Dam_9 and_8_to_Dallas_Res	0.085	97	7.6
R2	R_CottonDallas_to_Dallas_Res	0.073	0	0.0
R3	R_Dallas_to_Cebada_Connector	0.000	314	69.8

Legend

A1 Basin Areas/Watershed

DB1 Dams/Basins

R1 Reaches

J1 Junctions

S1 Source

D1 Diversions

Connecting Lines

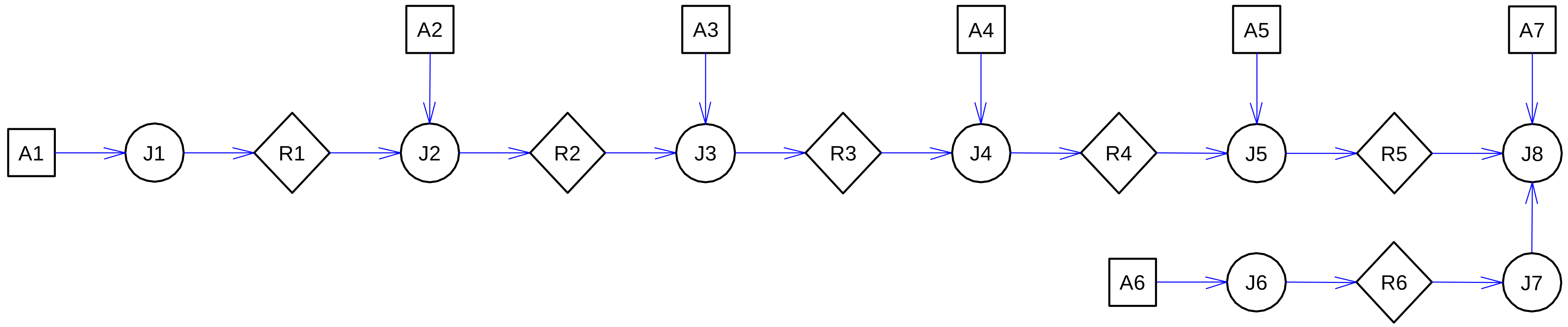
Diversion Dashed Lines

Dallas System
HEC-HMS Model Table
Central Region

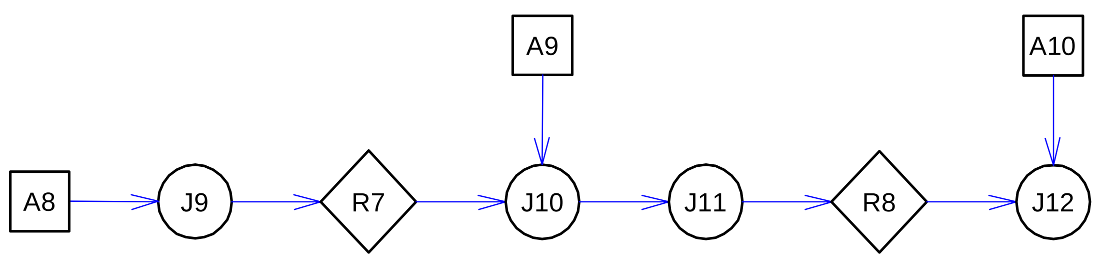
El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-39

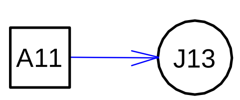
Channel 108 System



Paisano System



Modesto System



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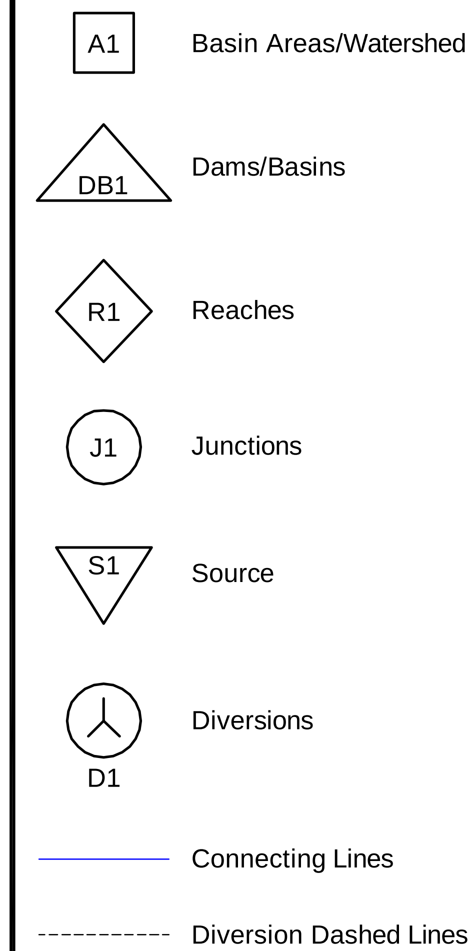

Modesto, Channel 108, and Paisano Systems
HEC-HMS Model Layout
Central Region
El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-40

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Basin

Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
A1	A_Alameda Avenue	0.299	11	17.0
A2	A_Blanco_Avenue	0.087	58	10.8
A3	A_Comanche_Avenue	0.136	233	13.7
A4	A_Delta_Drive	0.076	146	6.7
A5	A_Channel_108_Discharge	0.031	76	3.2
A6	A_Glenwood_Street_48in_RCP	0.062	79	3.9
A7	A_Robert_Alva_Channel	0.442	486	32.3
A8	A_Nixon_Cypress_to_Central	0.048	110	5.2
A9	A_Paisano_Ditch	0.223	347	20.2
A10	A_Cebada_Drainage_Outfall	0.273	341	25.7
A11	A_Modesto Ditch	0.117	218	10.1

Junction

Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
J1	J_Alameda Avenue	0.299	11	17.0
J2	J_Blanco_Avenue	0.386	59	27.8
J3	J_Comanche_Avenue	0.522	249	41.5
J4	J_Delta_Drive	0.599	376	48.2
J5	J_Channel 108	0.630	435	51.4
J6	J_Glenwood_Street_48in_RCP	0.062	79	3.9
J7	J_Outflow from Robert Alva	0.062	75	3.9
J8	J_Robert_Alva_Channel	1.134	971	87.5
J9	J_Nixon_Cypress_to_Central	0.048	110	5.2
J10	J_Paisano_Ditch	0.271	453	25.3
J11	J_Pera	0.271	453	25.3
J12	J_Cebada_Drainage_Outfall	0.544	780	51.0
J13	J_Modesto Ditch	0.117	218	10.1

Reach

Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
R1	R_Alameda_Avenue	0.299	11	16.9
R2	R_Blanco_to_Comanche	0.386	59	27.8
R3	R_Comanche_to_Delta_Dr	0.522	247	41.5
R4	R_Delta_Dr_to_Channel108_Out	0.599	363	48.2
R5	R_Channel108_to_Robert_Alva	0.630	420	51.4
R6	R_Glenwood_to_Robert_Alva	0.062	75	3.9
R7	R_Paisano_Ditch	0.048	106	5.2
R8	R_Pera_to_Cebada_Outfall	0.271	439	25.3

Legend

- A1 — Basin Areas/Watershed
- DB1 — Dams/Basins
- R1 — Reaches
- J1 — Junctions
- S1 — Source
- D1 — Diversions
- Connecting Lines
- Diversion Dashed Lines

Modesto, Channel 108, and Paisano Systems
HEC-HMS Model Table
Central Region
El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-41

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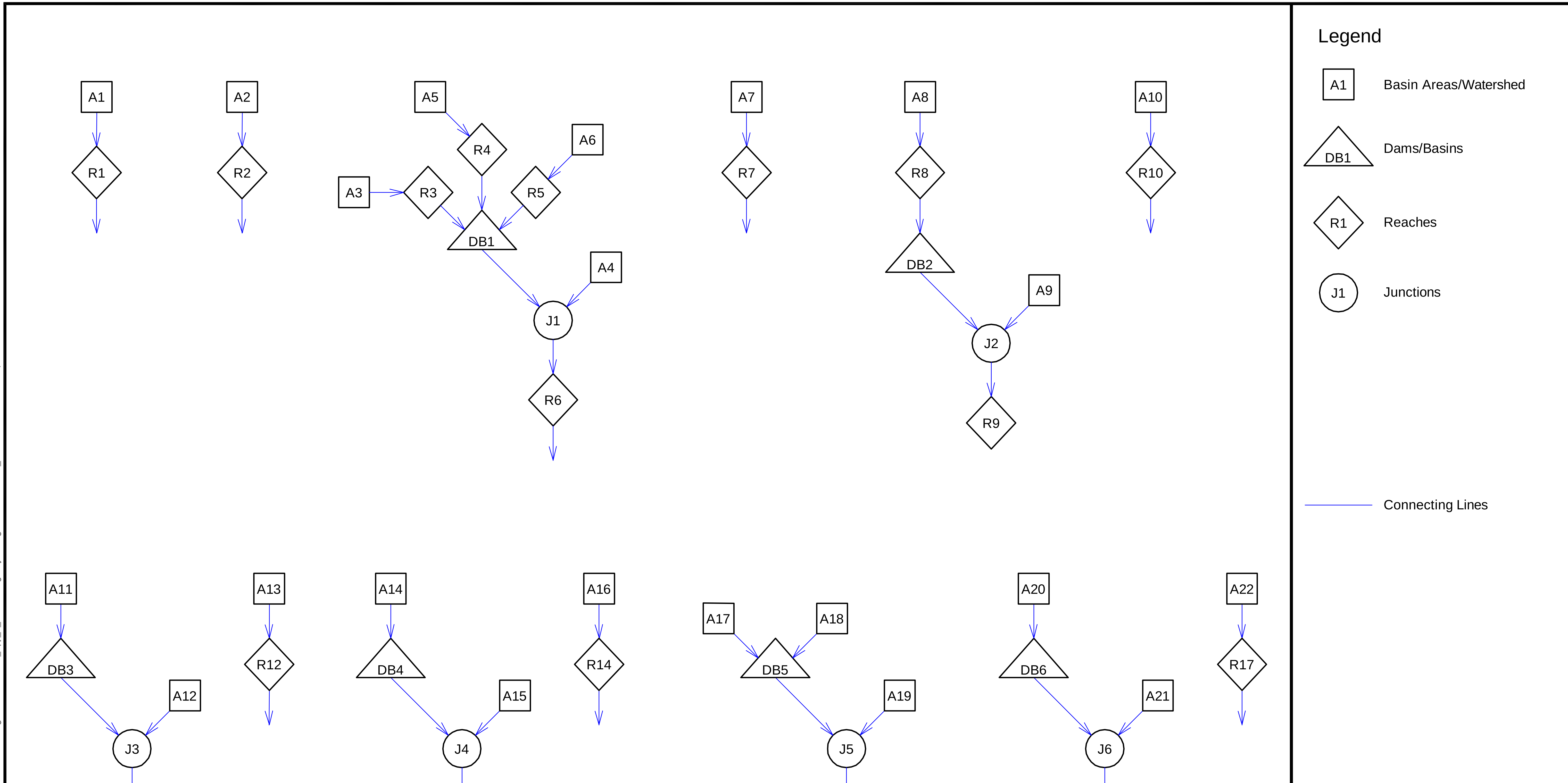
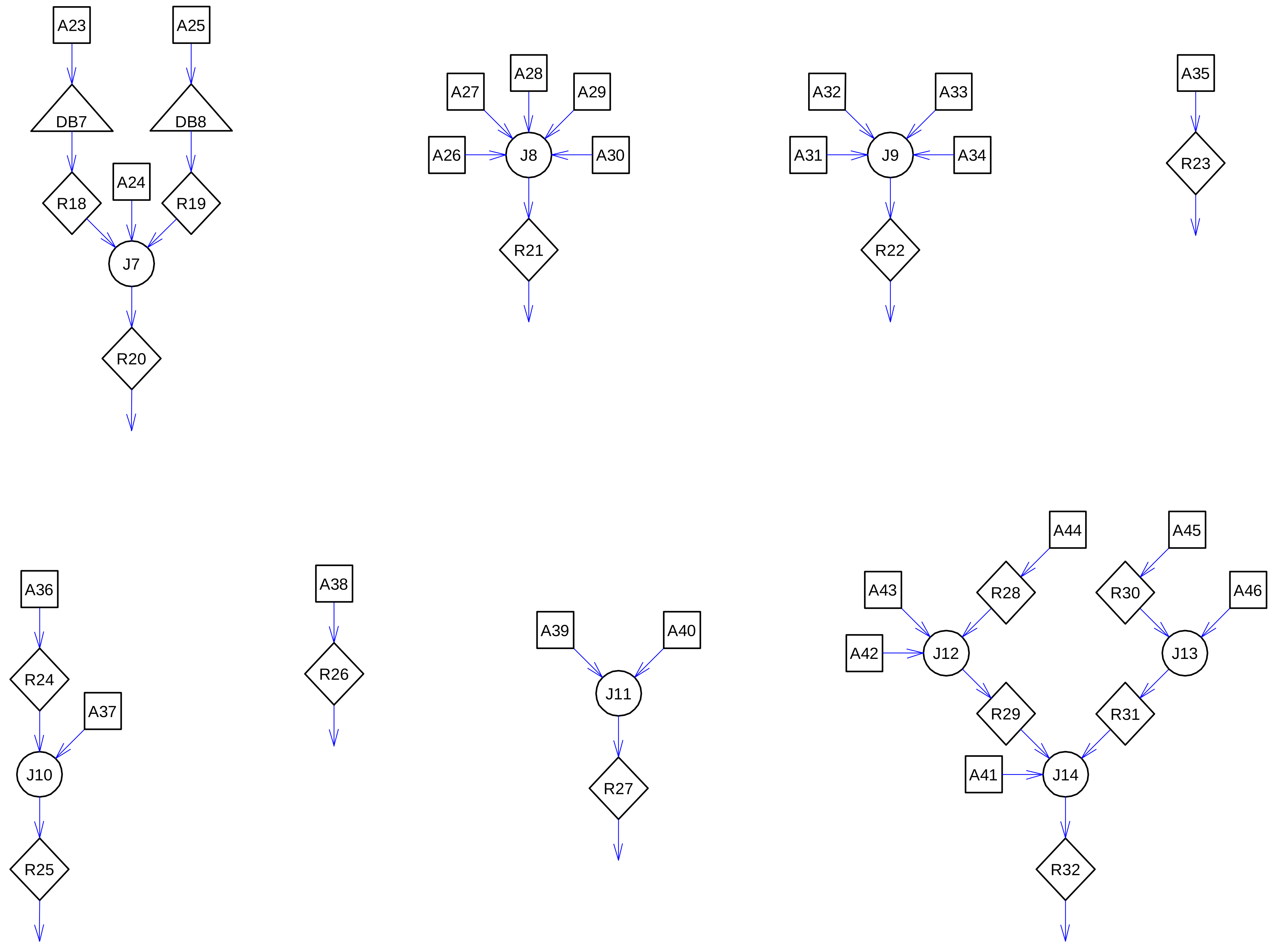
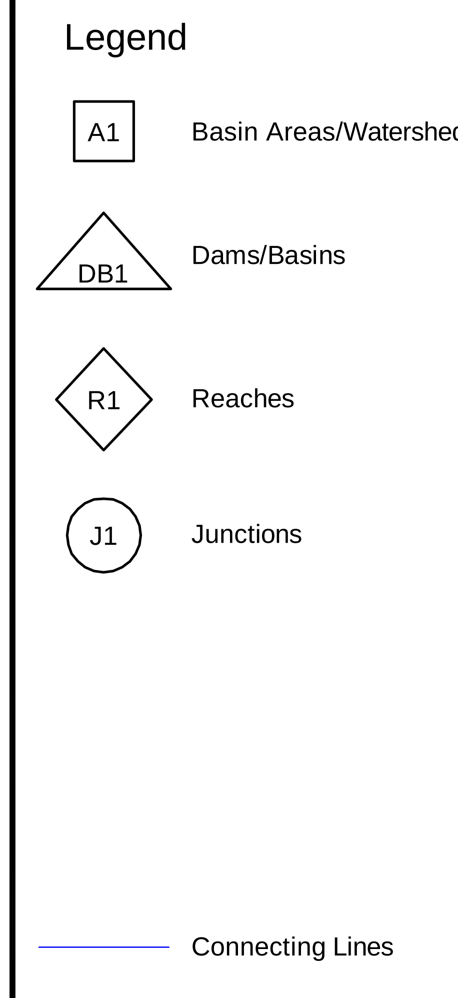


HEC-HMS Model Layout
East Side Region

El Paso Stormwater Master Plan

Date: 03/05/2009	Figure A-42



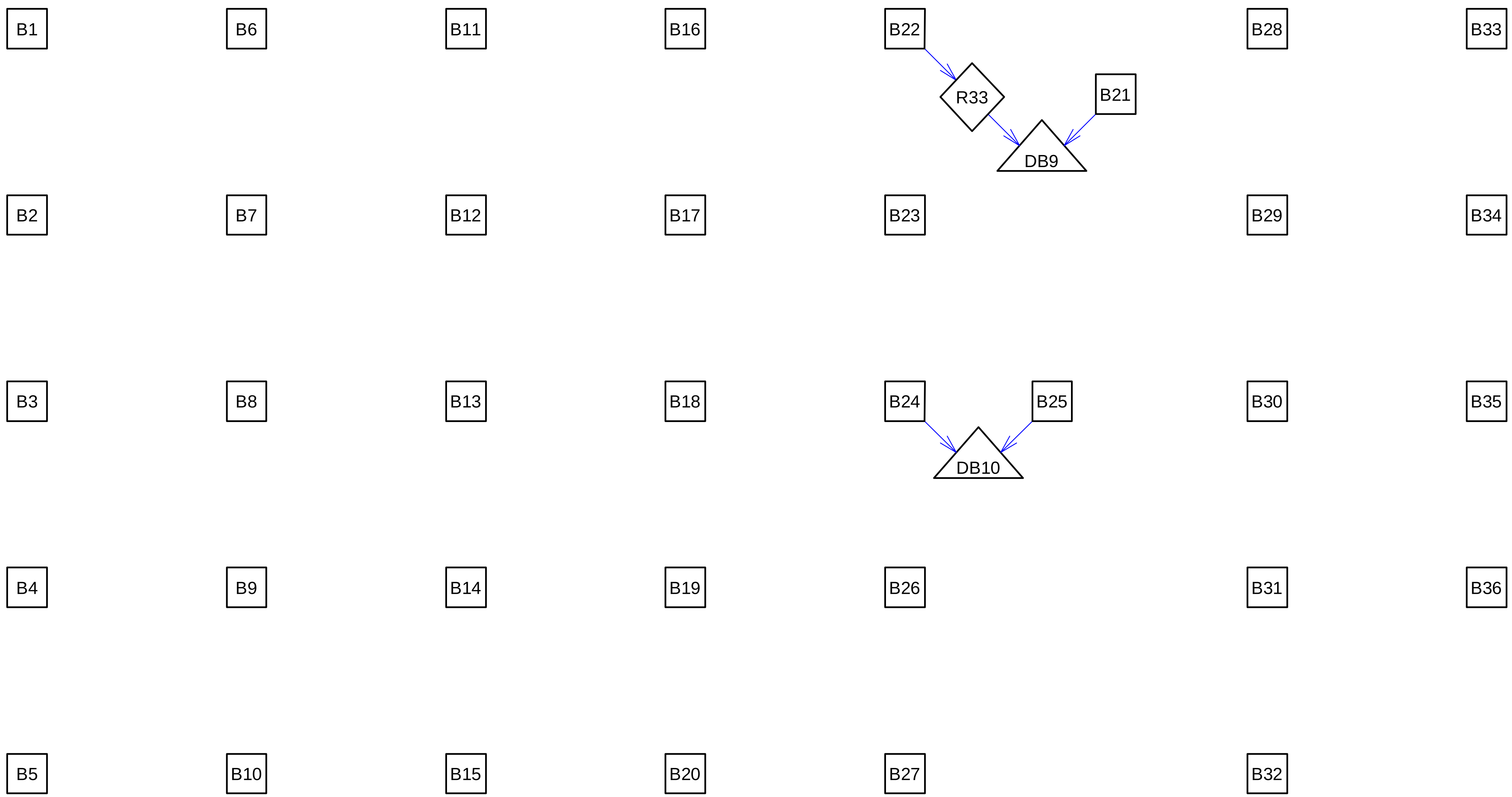


HEC-HMS Model Layout
for Referenced Study ⋆
East Side Region
El Paso Stormwater Master Plan

Date: 03/05/2009	Figure A-43

⋆ Model XX returned from: Drainage Study and report (existing conditions) for Interstate highway 10, Moreno Cardenas Inc. February 2008.

File: Q:\El Paso Master Drainage Plan\Stormwater Master Plan Report\HMS Cad Diagrams\Schematics_App_A_013009.dwg Layout: Fig A-43 User: Scott_Coleman Plotted: Mar 02, 2009 - 10:49am



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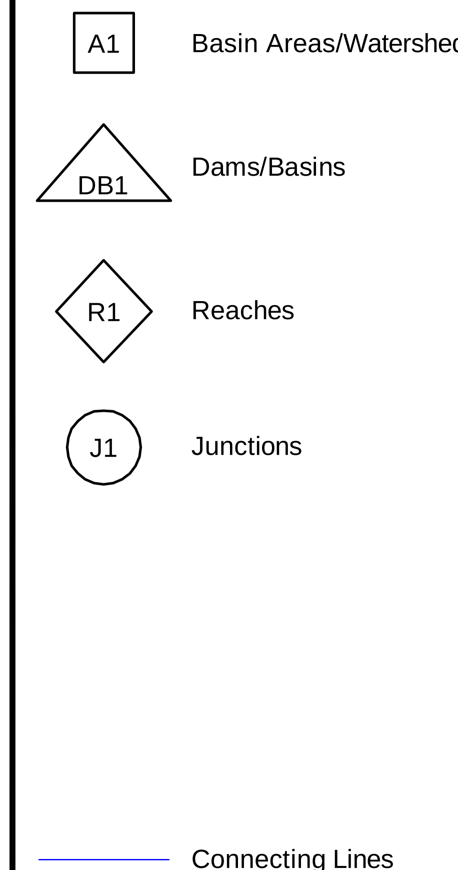

High Mesa (Closed Basins)
HEC-HMS Model Layout
East Side Region
El Paso Stormwater Master Plan

Date: 03/05/2009	Figure A-44

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD
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BASIN

Model XX NAME	HYDROLOGIC ELEMENT	DRAINAGE AREA (MI^2)	PEEK DISCHARGE (CFS)	VOLUME (ACRE-FEET)
A1	A-PD-1	0.7542	763.00	72.00
A2	A-PD-1A	0.1608	323.70	18.20
A3	A_SUNMOUNT	0.2858	360.60	25.10
A4	EID-1	0.3002	381.70	51.90
A5	CVP-1	0.1859	219.80	24.20
A6	CVP-2	0.5040	594.60	65.60
A7	EID-2	0.1395	143.00	24.10
A8	CVP-3	0.0630	76.70	8.20
A9	RLH-1	0.1246	100.70	16.20
A10	RLH_2	0.0319	46.70	2.30
A11	ESTWD1	0.6150	815.20	92.10
A12	ESTWD2	0.6680	1929.00	104.90
A13	SLTRHL	0.4390	431.10	57.10
A14	A-CAR DAM-1	0.4161	189.50	14.80
A15	A_CAR DAM-2	0.1015	205.50	11.90
A16	A_MESADRAIN_UP	0.0735	142.30	8.00
A17	A-LL-8	1.0568	626.00	51.00
A18	A-LL-8A	0.7243	596.10	50.40
A19	A-LL-10	0.3416	686.80	38.60
A20	A-MESA-2	0.5021	442.80	31.70
A21	A_MESA_3	0.2018	393.70	23.70
A22	A_MESA_4	0.1603	145.20	10.70
A23	9C	0.444	1066.4	77.9
A24	9A	0.934	1724.5	163.7
A25	9B	0.262	693.9	46
A26	29	0.0270	82.60	4.40
A27	22	0.0440	135.30	6.80
A28	34	0.0480	145.80	7.30
A29	46	0.1180	363.80	19.80
A30	52	0.045	138.2	7.5
A31	58	0.009	27.5	1.4
A32	66	0.03	92.4	4.8
A33	77	0.087	267.7	13.8
A34	83	0.044	131.4	5.5
A35	90	0.009	26.7	1
A36	96A	0.05	153.5	7.4
A37	96B	0.006	17.8	0.7
A38	100	0.0490	145.40	5.70
A39	106	0.0220	67.70	3.40
A40	110	0.0150	46.10	2.30
A41	124F	0.0160	49.20	2.40
A42	124B	0.2380	605.50	40.20
A43	124E	0.0690	14.70	8.40
A44	124A	0.1990	598.60	27.50
A45	124C	1.1480	1180.90	124.10
A46	124D	0.0870	127.80	10.70

DAMS AND BASINS

Model XX NAME	HYDROLOGIC ELEMENT	DRAINAGE AREA (MI^2)	PEEK DISCHARGE (CFS)	VOLUME (ACRE-FEET)
DB1	CVB-A	NOT SPECIFIED	32.00	38.70
DB2	CVB-B	NOT SPECIFIED	26.00	8.20
DB3	ED	NOT SPECIFIED	465.70	83.20
DB4	LAF-B	NOT SPECIFIED	26.00	14.70
DB5	JESUIT BASIN	NOT SPECIFIED	22.00	22.00
DB6	PENDALE BASIN	NOT SPECIFIED	32.00	30.90
DB7	9C_P	NOT SPECIFIED	226.2	24.3
DB8	9B_P	NOT SPECIFIED	5	4.7
DB9	PETER HURD POND	NOT SPECIFIED	185.2	24.5
DB10	QUAIL SUB POND	NOT SPECIFIED	602.3	62

JUNCTION

Model XX NAME	HYDROLOGIC ELEMENT	DRAINAGE AREA (MI^2)	PEEK DISCHARGE (CFS)	VOLUME (ACRE-FEET)
J1	CLB_A_JN	NOT SPECIFIED	413.70	90.60
J2	CLB_B_JN	NOT SPECIFIED	126.70	24.40
J3	NODE19	NOT SPECIFIED	1948.60	188.10
J4	CARDAM@IH-10	NOT SPECIFIED	231.50	26.60
J5	LOMALAND@IH-10	NOT SPECIFIED	708.80	60.60
J6	MESA-JN	NOT SPECIFIED	425.70	54.60
J7	9J	NOT SPECIFIED	1725.7	192.6
J8	WS-22	NOT SPECIFIED	865.6	45.7
J9	WS-77	NOT SPECIFIED	519	25.6
J10	96J	NOT SPECIFIED	170.6	8.1
J11	WS-110	NOT SPECIFIED	113.8	5.7
J12	124JW	NOT SPECIFIED	1230.30	76.00
J13	124JE	NOT SPECIFIED	1279.10	134.60
J14	JB	NOT SPECIFIED	1753.8	212.7

BASIN

Model XX NAME	HYDROLOGIC ELEMENT	DRAINAGE AREA (MI^2)	PEEK DISCHARGE (CFS)	VOLUME (ACRE-FEET)
B1	A-PD-2	0.148594	353.6	21.2
B2	A-PD-3	0.185453	189.7	17
B3	A-PD-4	0.367969	251.4	24.4
B4	A-PD-5	0.545313	577.8	54.3
B5	A-PD-6	0.44422	476.8	38.9
B6	A-PD-7	0.941047	1557	82.6
B7	A-PD-8	4.475078	1889.8	368.2
B8	A-PD-9	6.086	1509.3	490.5
B9	A-PD-10	1.915484	865.3	158.7
B10	A-LL-1	0.380719	616.9	34.9
B11	A-LL-2	0.206188	234.2	12.4
B12	A-LL-3	0.347156	372.7	22
B13	A-LL-4	2.332031	2178.5	221.8
B14	A-LL-5	1.092469	1471.1	104.4
B15	A-LL-6	1.632359	2118.5	155.8
B16	A-LL-7	0.455859	601.5	41.8
B17	A-LL-9	1.600547	1264.1	111.2
B18	A-AM-1	3.529938	4480.4	307.7
B19	A-AM-2	1.820891	1898.1	159.2
B20	A-AM-3	0.69725	1059.6	63.9
B21	A-AM-4	0.161688	280.8	14.2
B22	A-AM-5	0.480344	477.6	47.8
B23	A-AM-6	0.143594	43.5	3.8
B24	A-AM-7	0.105219	56.4	3.7
B25	A-AM-8	0.260047	165.2	20.8
B26	A-AM-9	0.2859533	165.1	13.8
B27	A-AM-10	0.107359	143.8	8.2
B28	A-AM-11	1.724141	987.8	78.3
B29	A-AM-12	0.158297	163.8	13.9
B30	A-AMTEN-1	1.504406	1535.9	143.4
B31	A-AMTEN-2	1.535656	1673.4	165.8
B32	A-AMTEN-3	1.262859	1544.7	115.5
B33	A-AMTEN-4	0.772672	1037.6	77
B34	A-AMTEN-5	0.821422	1690	88.2
B35	A-AMTEN-6	3.006453	928.9	257
B36	A-AMTEN-7	3.861875	1570.1	332.1

REACH

Model XX NAME	HYDROLOGIC ELEMENT	DRAINAGE AREA (MI^2)	PEEK DISCHARGE (CFS)	VOLUME (ACRE-FEET)
R1	MV#1	NOT SPECIFIED	763.00	72.00
R2	MV#2	NOT SPECIFIED	323.70	18.20
R3	SUNMOUNT CHANNEL	NOT SPECIFIED	356.60	24.80
R4	VCNT-1	NOT SPECIFIED	219.70	24.20
R5	VCNT-2	NOT SPECIFIED	594.60	65.60
R6	MV#3	NOT SPECIFIED	413.70	90.50
R7	MV#4	NOT SPECIFIED	143.00	24.10
R8	VCNT-3	NOT SPECIFIED	76.60	8.20
R9	MV#5	NOT SPECIFIED	126.70	24.40
R10	MV#6	NOT SPECIFIED	46.70	2.30
R11	MV#7	NOT SPECIFIED	1948.60	188.10
R12	MV#8	NOT SPECIFIED	431.10	57.10
R13	MV#9	NOT SPECIFIED	231.50	26.60
R14	MV#10	NOT SPECIFIED	142.30	8.00
R15	MV#11	NOT SPECIFIED	705.90	60.50
R16	MV#12	NOT SPECIFIED	425.70	54.60
R17	MV#13	NOT SPECIFIED	145.20	10.70
R18	9CR	NOT SPECIFIED	226	24.2
R19	9BR	NOT SPECIFIED	5	4.7
R20	MV#14	NOT SPECIFIED	1724.9	192.5
R21	MV#15	NOT SPECIFIED	865.6	45.7
R22	MV#16	NOT SPECIFIED	519	25.6
R23	MV#17	NOT SPECIFIED	26.5	1
R24	RCP375	NOT SPECIFIED	153	7.4
R25	MV#17A	NOT SPECIFIED	169.4	8.1
R26	MV#18	NOT SPECIFIED	144.5	5.7
R27	MV#19	NOT SPECIFIED	113.8	5.7
R28	ARROYO WEST	NOT SPECIFIED	591.9	27.4
R29	ARROYO WEST2	NOT SPECIFIED	1196.7	75.8
R30	ARROYO-EAST	NOT SPECIFIED	1180	124
R31	ARROYO-EAST2	NOT SPECIFIED	1278.2	134.5
R32	MV#20	NOT SPECIFIED	1753.2	212.7
R33	JOE BATTLE	NOT SPECIFIED	477.3	47.8

Legend

- A1 — Basin Areas/Watershed
- DB1 — Dams/Basins
- R1 — Reaches
- J1 — Junctions
- Connecting Lines

High Mesa (Closed Basins)
HEC-HMS Model Table
East Side Region
El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-45

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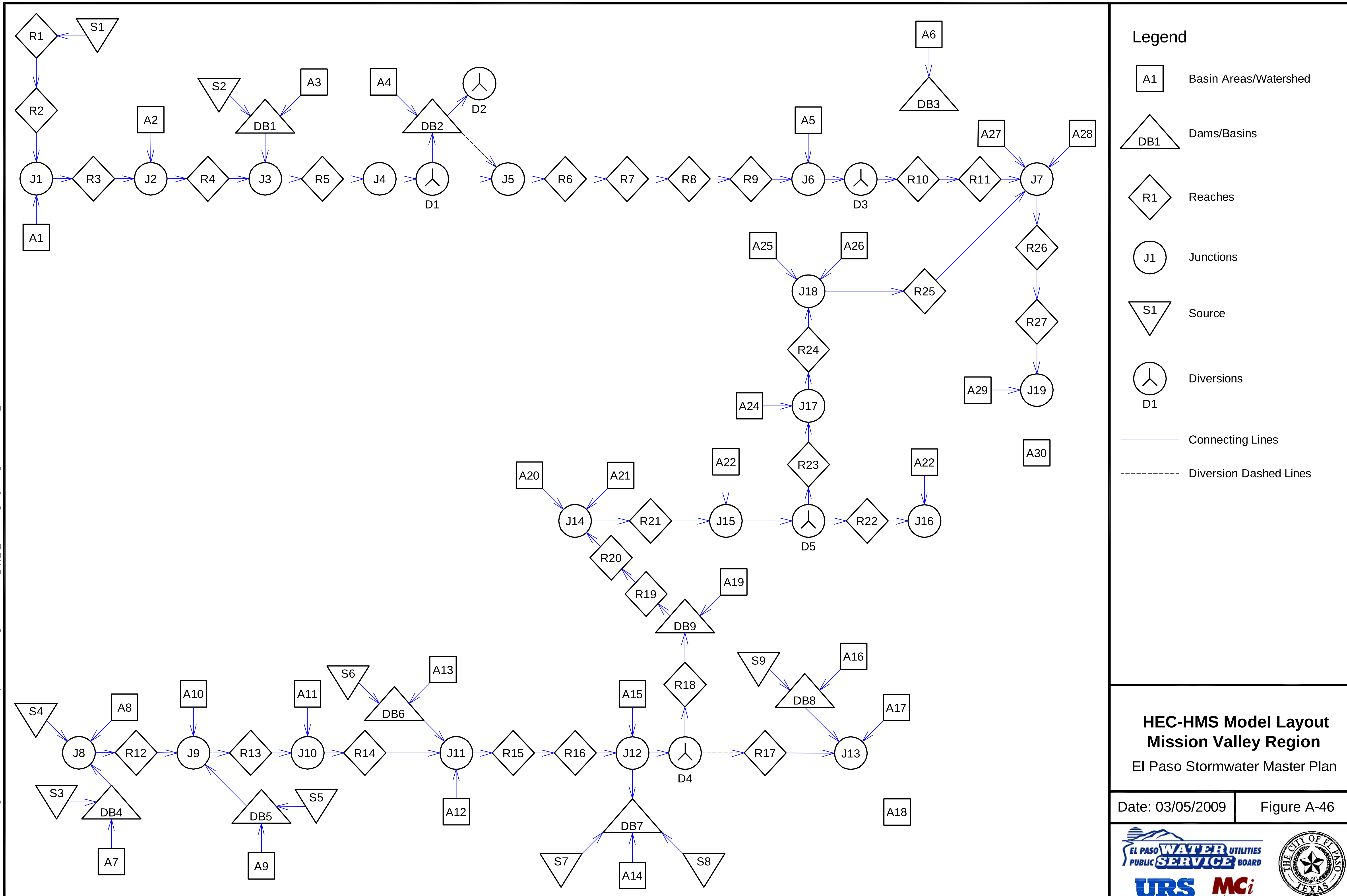

HEC-HMS Model Layout
Mission Valley Region
El Paso Stormwater Master Plan

Date: 03/05/2009	Figure A-46

El Paso Water Utilities Public Service Board — URS — MCi consulting engineers — The City of El Paso Texas

Basin

Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
A1	A_Lincoln Drain	2.330	1364	167.2
A2	A_Playa Drain A	0.571	388	43.3
A3	A_North Loop Detention Basin	1.129	7	2.6
A4	A_Basin A	1.421	644	89.3
A5	A_Playa Drain B	5.842	1014	275.9
A6	A_Basin G	0.356	241	38.1
A7	A_Phelps Dodge Basin	1.081	627	58.1
A8	A_Below Phelps Dodge Basin	1.386	44	10.4
A9	A_Carolina Drive Basin	0.291	0	0.0
A10	A_Mesa Drain A	0.663	0	0.0
A11	A_Below Carolina Dam	1.024	684	69.2
A12	A_Mesa Drain B	0.740	196	23.5
A13	A_Lomaland Basin	0.663	204	19.8
A14	A_Americas Basin	0.498	138	25.9
A15	A_Mesa Drain C	3.185	320	66.0
A16	A_Americas Ten Basin	0.261	25	4.6
A17	A_Mesa Drain to City Limit	0.803	238	43.4
A18	A_Americas Ten NonContribute	0.085	3	0.7
A19	A_Feather Lake Basin	0.704	4	1.7
A20	A_Below Featherlake Basin	0.153	66	7.1
A21	A_Middle Drain A	4.306	807	195.7
A22	A_Middle Drain B	0.123	185	13.9
A23	A_Middle to City Limit	1.013	896	81.8
A24	A_Middle Drain Spur A	0.055	129	5.6
A25	A_Middle Drain Spur B	0.074	143	8.1
A26	A_Franklin Drain A	0.668	691	68.8
A27	A_Franklin Spur Drain	0.114	115	9.3
A28	A_Franklin Drain B	0.908	847	74.8
A29	A_Franklin Drn to City Limit	2.884	523	190.5
A30	A_Below Basin G to Cty Limit	1.878	682	151.2

Diversion

Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
D1	D_Basin A 42inch Culvert	Not Specified	1644	277.1
D2	D_Basin A Pumps	0.000	0	0.0
D3	D_Playa and Playa Intercepto	Not Specified	2552	523.2
D4	D_Mesa to Mesa Interceptor	Not Specified	2728	1161.8
D5	D_Middle and Middle Int	Not Specified	1243	1336.1

Dams and Basins

Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
DB1	S_North Loop Detention Basin	Not Specified	55	91.9
DB2	S_Basin A	Not Specified	1578	222.5
DB3	S_Basin G	0.356	0	0.0
DB4	S_Phelps Dodge Basin	Not Specified	138	260.9
DB5	S_Carolina Drive Basin	Not Specified	132	65.0
DB6	S_Lomaland Basin	Not Specified	110	124.0
DB7	S_Americas Basin	Not Specified	135	348.1
DB8	S_Americas Ten Basin	Not Specified	885	159.1
DB9	S_Featherlake Basin	Not Specified	907	1120.5

Junction

Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
J1	J_Lincoln Drain Outlet	Not Specified	1364	167.2
J2	J_Playa Drain with Conduit	Not Specified	1744	210.5
J3	J_Playa Drn with North Loop	Not Specified	1773	302.4
J4	J_Playa Drain w Basin A	Not Specified	1747	302.3
J5	J_Playa Drain Outlet Basin A	Not Specified	1672	247.7
J6	J_Playa Drain with Intercept	Not Specified	2552	523.2
J7	J_Franklin and Franklin Spur	Not Specified	3733	2023.3
J8	J_Mesa Drain w Phelps Dodge	Not Specified	1999	471.1
J9	J_Mesa Drain w Carolina Bsn	Not Specified	1868	536.0
J10	J_Mesa Drain w Lafayette Drw	Not Specified	2318	604.2
J11	J_Mesa Drain w Lomaland	Not Specified	2596	751.4
J12	J_Mesa Drain w Americas Bsn	Not Specified	2728	1161.8
J13	J_Mesa Drain w Americas Ten	Not Specified	1112	202.5
J14	J_Mesa Int w Middle Drain	Not Specified	1252	1336.7
J15	J_Middle Drain w Middle Int	Not Specified	1243	1336.1
J16	J_Middle Drain City Limit	1.013	896	81.8
J17	J_Middle Int w Franklin Canl	Not Specified	1240	1341.3
J18	J_Middle Int w Franklin Drn	Not Specified	1311	1417.2
J19	J_Franklin Drain City Limit	Not Specified	4150	2213.3

Reach

Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
R1	R_Lincoln Drain A	Not Specified	0	0.0
R2	R_Lincoln Drain B	Not Specified	0	0.0
R3	R_Lincoln to Playa Conduit	Not Specified	1359	167.2
R4	R_Playa Drain Upper_A	Not Specified	1720	210.4
R5	R_Playa Drain Upper_B	Not Specified	1747	302.3
R6	R_Playa Drain Lower_A	Not Specified	1628	247.4
R7	R_Playa Drain Conduit	Not Specified	1628	247.3
R8	R_Playa Drain Lower_B	Not Specified	1591	247.4
R9	R_Playa Drain Lower_C	Not Specified	1581	247.3
R10	R_Franklin Drain Spur A	Not Specified	2390	522.4
R11	R_Franklin Drain Spur B	Not Specified	2341	522.4
R12	R_Mesa Drain above Carolina	Not Specified	1868	471.0
R13	R_Mesa Drain below Carolina	Not Specified	1713	535.0
R14	R_Mesa Drain above Lomaland	Not Specified	2298	603.9
R15	R_Mesa Drain above Amer BsnA	Not Specified	2359	747.9
R16	R_Mesa Drain above Amer BsnB	Not Specified	2287	747.7
R17	R_Mesa Drain to City Limit	0.000	0	0.0
R18	R_Mesa Interceptor above FL	Not Specified	2725	1161.5
R19	R_Mesa Interceptor blw FL A	Not Specified	905	1120.3
R20	R_Mesa Interceptor blw FL B	Not Specified	904	1120.0
R21	R_Middle Drain to Intercept	Not Specified	1243	1336.1
R22	R_Middle Drain to City Limit	0.000	0	0.0
R23	R_Middle Interceptor A	Not Specified	1237	1335.8
R24	R_Middle Interceptor B	Not Specified	1234	1340.3
R25	R_Franklin Drain A	Not Specified	1309	1416.8
R26	R_Franklin Drn to City Lmt A	Not Specified	3720	2023.3
R27	R_Franklin Drn to City Lmt B	Not Specified	3711	2022.8

Source

Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
S1	Source_CE Input	Not Specified	0	0.0
S2	Source_MV# 1,2	Not Specified	885	90.5
S3	Source_MV# 3,4,5	Not Specified	646	202.9
S4	Source_MV#6,7	Not Specified	1913	199.7
S5	Source_MV#8,9,10	Not Specified	552	92.0
S6	Source_MV#11	Not Specified	696	104.2
S7	Source_MV#12,13	Not Specified	558	66.3
S8	Source_MV#14,15,16,17a	Not Specified	2615	286.7
S9	Source_MV#17a,18,19,20	Not Specified	1992	233.9

Legend

A1 Basin Areas/Watershed

DB1 Dams/Basins

R1 Reaches

J1 Junctions

S1 Source

D1 Diversions

Connecting Lines

Diversion Dashed Lines

HEC-HMS Model Table
Mission Valley Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-47

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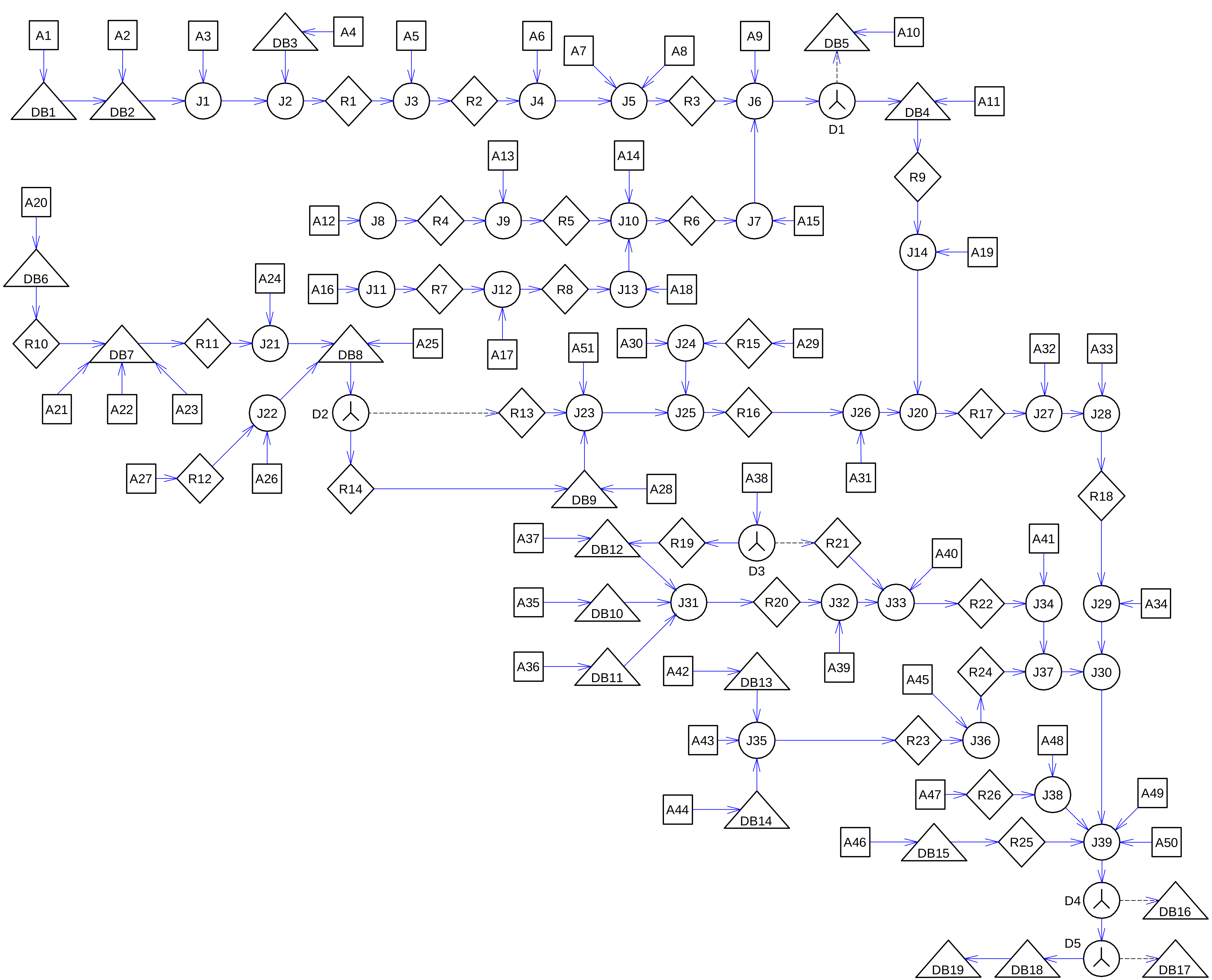

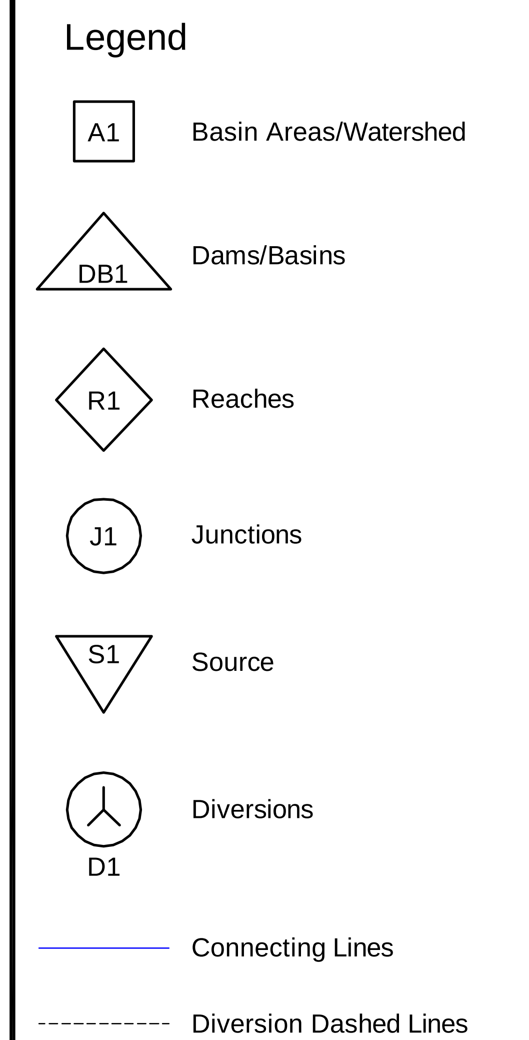

HEC-HMS Model Layout
Northeast Region

El Paso Stormwater Master Plan

Date: 03/05/2009	Figure A-48

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Basin				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
A1	A_Northhills Dam N	2.446	1555	230.2
A2	A_Northhills Dam S	3.087	1923	301.3
A3	A_War Road Channel	0.524	423	34.3
A4	A_TXDOT Pond	0.614	379	48.4
A5	A_W. Fwy Ch U/S	1.031	378	39.6
A6	A_W. Fwy Ch D/S	1.336	318	74.1
A7	A_E Fwy Channel	1.674	386	92.3
A8	A_Green Belt Levee U/S	14.301	3735	1015.4
A9	A_Green Belt Levee D/S	0.968	288	54.8
A10	A_NE Ponding	3.133	878	196.0
A11	A_NE. Pond Outer	3.201	2584	267.3
A12	A_PSB Ch 1 U/S Gateway	0.239	166	18.3
A13	A_PSB Ch 1 U/S Fannin	1.798	478	97.0
A14	A_PSB Ch 1 U/S PSB2	0.701	597	58.2
A15	A_PSB Ch 1 D/S	0.460	127	15.8
A16	A_PSB Ch 2 U/S Gateway	1.371	705	106.8
A17	A_PSB Ch 2 U/S Rushing	0.803	509	51.0
A18	A_PSB Ch 2 D/S	0.992	525	63.0
A19	A_Railroad Drain U/S Tobin	9.876	1734	698.2
A20	A_Fusselman Dam	3.371	2283	301.4
A21	A_Northgate Dam	1.472	805	101.1
A22	A_Northgate Int Ch	0.599	127	23.5
A23	A_Northgate Div Ch	1.293	940	128.0
A24	A_Northgate Outlet Channel	0.472	195	26.9
A25	A_Range Dam	2.210	1066	186.4
A26	A_Electric Ditch	0.626	519	54.6
A27	A_Fairbanks Drive	1.114	558	94.1
A28	A_Range Basin	0.391	373	28.5
A29	A_Tobin Drain U/S Irvin H	2.190	1120	132.4
A30	A_Tobin Drain at U/S Army	0.501	677	49.9
A31	A_Tobin Drain U/S RR Drain	0.503	348	33.2
A32	A_Railroad Drain U/S Statler	0.152	56	8.8
A33	A_Statler Ditch	0.448	283	31.8
A34	A_Railroad Drain D/S	0.053	12	1.5
A35	A_Amber Basin	0.248	404	26.7
A36	A_Sunrise Basin	0.135	204	14.5
A37	A_Hondo Pass Basin	0.079	130	8.8
A38	A_Hondo Pass Ch	0.047	67	4.5
A39	A_Sunrise Channel	0.318	299	31.5
A40	A_Diana Ditch US Sunrise Ch	0.960	891	79.8
A41	A_Diana Ditch DS Sunrise Ch	1.859	1420	166.8
A42	A_Mtn Park Dam	0.806	749	84.1
A43	A_Fort Bliss Div Ch U/S	0.154	242	16.3
A44	A_Sunrise Dam	0.499	510	52.0
A45	A_Fort Bliss Div Ch	0.166	282	18.7
A46	A_Keltner Dam	0.486	572	52.3
A47	A_Bossworth U/S	0.417	408	43.7
A48	A_Bossworth D/S	0.120	139	13.3
A49	A_Johnson Channel	0.075	135	9.5
A50	A_Fort Bliss Div Ch D/S	24.625	17154	2185.5
A51	A_Army Ditch	0.423	359	31.7

Diversion				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
D1	D_NE Ponding	32.347	0	0.0
D2	D_Range Dam	11.157	0	0.0
D3	D_Hondo Pass	0.047	67	4.5
D4	D_Ft Bliss Outflow	92.239	22557	3436.4
D5	D_Ft Bliss Sump	92.239	437	65.3

Dams and Basins				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
DB1	S_Northhills Dam N	2.446	69	118.1
DB2	S_Northhills Dam S	5.533	74	143.3
DB3	TXDOT Pond	0.614	340	48.4
DB4	S_NE Pond Outer	35.548	0	0.0
DB5	S_NE Ponding	3.133	7376	2096.6
DB6	S_Fusselman Dam	3.371	66	125.2
DB7	S_Northgate Dam	6.735	81	98.5
DB8	S_Range Dam	11.157	15	8.3
DB9	S_Range Basin	11.549	1	1.6
DB10	S_Amber Basin	0.248	8	14.0
DB11	S_Sunrise Basin	0.135	4	6.9
DB12	S_Hondo Pass Basin	0.127	3	4.4
DB13	S_Mtn Park Dam	0.806	168	47.9
DB14	S_Sunrise Dam	0.499	173	39.4
DB15	S_Keltner Dam	0.486	97	49.6
DB16	S_Pershing Dam	0.000	200	285.0
DB17	S_Ft Bliss Sump	0.000	22557	3371.0
DB18	S_Ft Bliss Outer Sump	92.239	0	0.0
DB19	Sink - Gov Hill Ch	92.239	0	0.0

Junction				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
J1	J_War Road Channel	6.058	445	177.7
J2	J_W Fwy Ch @ War Road	6.672	671	226.0
J3	J_W Fwy Ch U/S	7.703	902	262.0
J4	J_W Fwy D/S	9.039	1175	333.6
J5	J_Green Belt Levee	25.014	5109	1441.2
J6	J_Green Belt Levee D/S	32.347	6576	1900.7
J7	J_PSB Ch 1 D/S	6.365	2317	409.9
J8	J_PSB Ch1 Jct1	0.239	166	18.3
J9	J_PSB Ch1 Jct2	2.037	602	115.3
J10	J_PSB Ch1 Jct3	5.905	2227	394.1
J11	J_PSB Ch 2 at Gateway	1.371	705	106.8
J12	J_PSB Ch 2 at Rushing	2.175	966	157.6
J13	J_PSB Ch 2 D/S	3.167	1337	220.7
J14	J_RR Drain U/S of Tobin	45.424	1734	698.2
J20	J_RR and Tobin Drain	60.590	2252	953.5
J21	J_Northgate Dam Out	7.207	195	123.7
J22	J_Electric Ditch	1.740	836	148.7
J23	J_Army Ditch	11.972	359	40.6
J24	J_Tobin Drain U/S Army Ditch	2.691	1422	181.9
J25	J_Tobin Drain at Army Ditch	14.663	1720	222.5
J26	J_Tobin Drain D/S	15.166	2003	255.3
J27	J_RR Dr U/S Statler Ch	60.742	2296	962.0
J28	J_RR Ditch at Statler Ditch	61.190	2542	993.8
J29	J_RR Ditch Downstream	61.243	2516	994.6
J30	J_Ft Bliss Sump Upper	66.515	5065	1419.8
J31	J_Sunrise Ch U/S	0.510	14	25.4
J32	J_Sunrise Ch D/S	0.828	308	56.7
J33	J_Diana Ditch U/S	1.788	1193	136.4
J34	J_Diana Ditch D/S	3.647	2563	303.0
J35	J_Ft Bliss Div Ch U/S	1.459	357	103.7
J36	J_Ft Bliss Div Ch Dyer St	1.624	447	122.3
J37	J_Diana Ditch and FB Div	5.272	3009	425.2
J38	J_Bossworth Ch D/S	0.538	531	57.1
J39	J_Ft Bliss Sump	92.239	22757	3721.4

Reach				
Schematic Name	Hydrologic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Volume (acre-feet)
R1	R_W Fwy Ch U/S	6.672	657	222.4
R2	R_W Fwy Ch D/S	7.703	891	259.5
R3	R_Green Belt Levee	25.014	5099	1436.0
R4	R_PSB Ch1 a	0.239	166	18.3
R5	R_PSB Ch 1 b	2.037	602	115.3
R6	R_PSB Ch 1 c	5.905	2226	394.1
R7	R_PSB Ch 2 a	1.371	695	106.6
R8	R_PSB Ch 2 b	2.175	966	157.6
R9	R_NE Pond Overflow	35.548	0	0.0
R10	R_Fusselman Out	3.371	66	123.2
R11	R_Northgate Dam Out	6.735	81	96.7
R12	R_Electric Ditch	1.114	556	94.1
R13	R_Army Ditch	0.000	14	7.2
R14	R_Range Dam Overflow	11.157	0	0.0
R15	R_Tobin Drain U/S Army Ditch	2.190	1085	132.0
R16	R_Tobin Drain U/S RR Drain	14.663	1708	222.1
R17	R_RR Dr U/S Statler Ch	60.590	2242	953.1
R18	R_RR Dr D/S	61.190	2507	993.1
R19	R_Hondo Pass Channel	0.047	67	4.5
R20	R_Sunrise Channel	0.510	14	25.2
R21	R_Hondo Pass Diversion	0.000	0	0.0
R22	R_Diana Ditch	1.788	1145	136.2
R23	R_Ft Bliss Div Ch U/S	1.459	357	103.6
R24	R_Ft Bliss Div Ch D/S	1.624	447	122.2
R25	R_Keltner Dam Out	0.486	97	49.6
R26	R_Bossworth U/S	0.417	408	43.7

Legend

A1 Basin Areas/Watershed

DB1 Dams/Basins

R1 Reaches

J1 Junctions

S1 Source

D1 Diversions

Connecting Lines

Diversion Dashed Lines

HEC-HMS Model Table
Northeast Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-49

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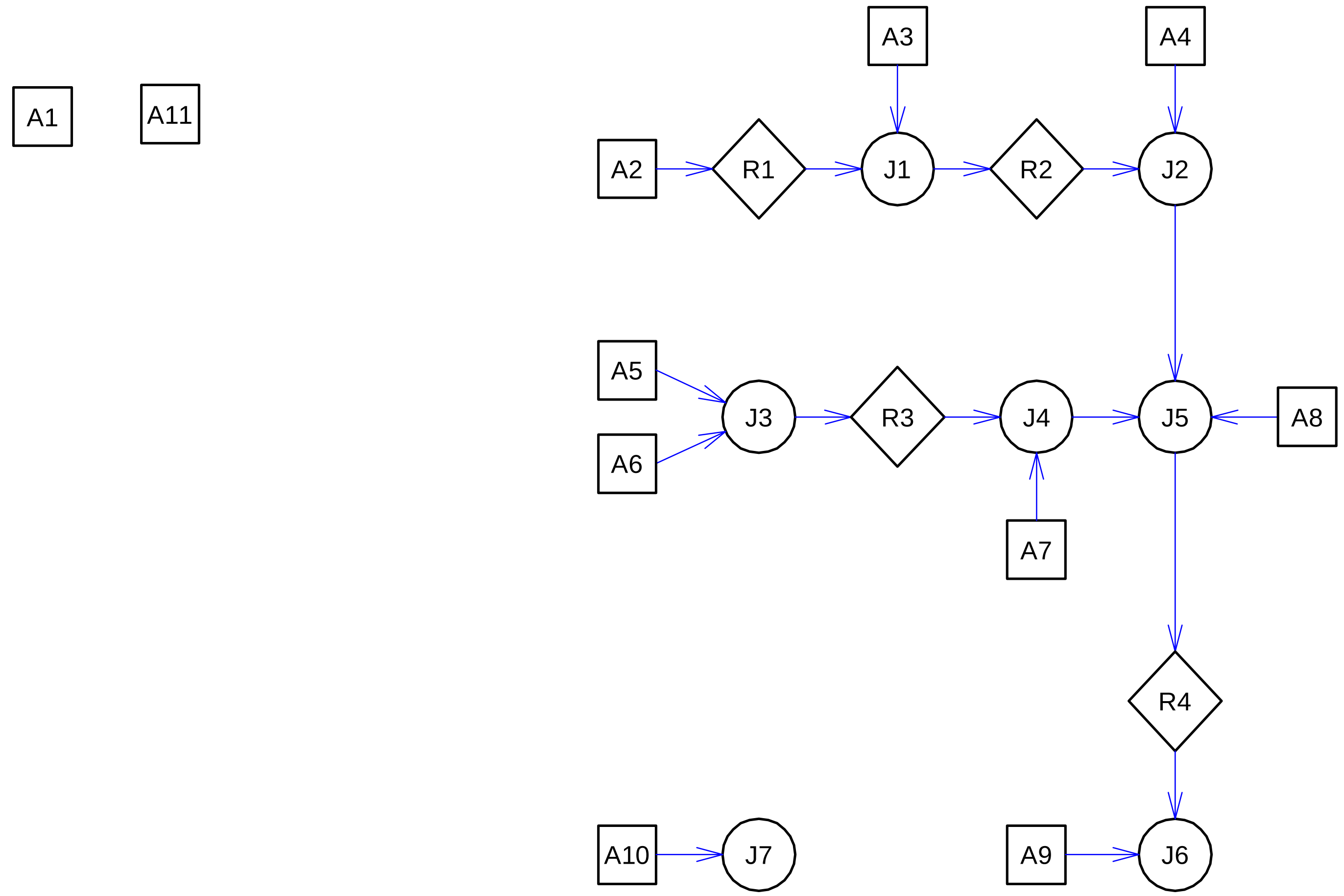

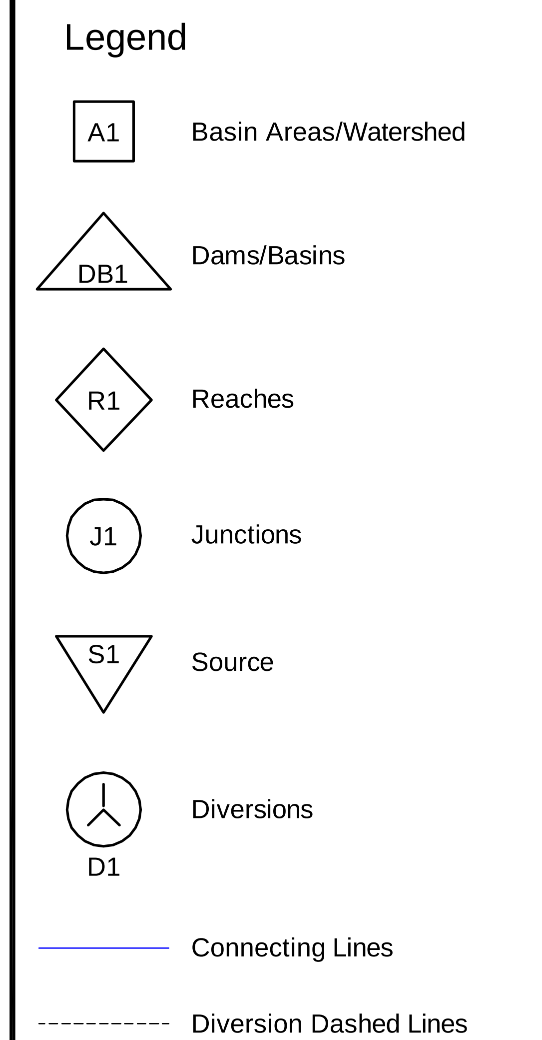

Symbol	Name	Description	Area (mi^2)	Peak Discharge (cfs)	Volume (ac-ft)
A1	WRG	West of Rio Grande Basin	14.5600	3366	880.96
A2	M1(A1_2)	Mace_1 (Arroyo 1_2) Basin	0.1580	0	0.01
A3	MD_3	Montoya Drain_3 Basin	3.3300	1049	294.44
A4	MD_2	Montoya Drain_2 Basin	1.4300	817	86.52
A5	DD_3	Doniphan Ditch_3 Basin	0.1560	408	22.55
A6	WSD_2	White Spur Drain_2 Basin	0.2070	620	34.12
A7	WSD_1	White Spur Drain_1 Basin	0.0840	155	9.10
A8	NeD1	Nemexas Drain Basin	1.2900	643	119.00
A9	MD_1	Montoya Drain_1Basin	1.3570	640	176.82
A10	DD_1	Doniphan Ditch_1 Basin	1.5300	968	178.81
A11	WM	West Montoya Basin	1.4609	973	158.27
J1	M1 DS	Junction of Montoya Drain_3 Basin and Mace_1 Reach	3.4880	1049	294.45
J2	MD_2,C2	Junction of Montoya Drain_2 Basin and Montoya Drain_2 Reach	4.9180	1090	380.20
J3	DD3,WSD2	Junction of Doniphan Ditch_3 Basin and White Spur Drain_2 Basin	0.3630	1029	56.66
J4	WSD_1,WSD1_1	Junction of White Spur Drain_1 Basin and White Spur Drain 1_1 Reach	0.4470	907	65.49
J5	MD2,WSD1	Junction of Montoya Drain_2 Basin and White Spur Drain_1 Basin	6.6550	2155	564.69
J6	MD_OUT	Montoya Drain Outlet	8.0120	959	751.52
J7	DD_OUT	Doniphan Ditch Outlet	1.5300	968	178.81
R1	A1	Mace_1 Reach	0.1580	0	0.01
R2	MD2	Montoya Drain_2 Reach	3.4880	1018	293.68
R3	WSD_1_1	White Spur Drain 1_1 Reach	0.3630	832	56.39
R4	MD_C	Montoya Drain_C Reach	6.6550	618	574.70

Doniphan & Montoya Drain Systems
HEC-HMS Model Layout and Table
Northwest Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-50

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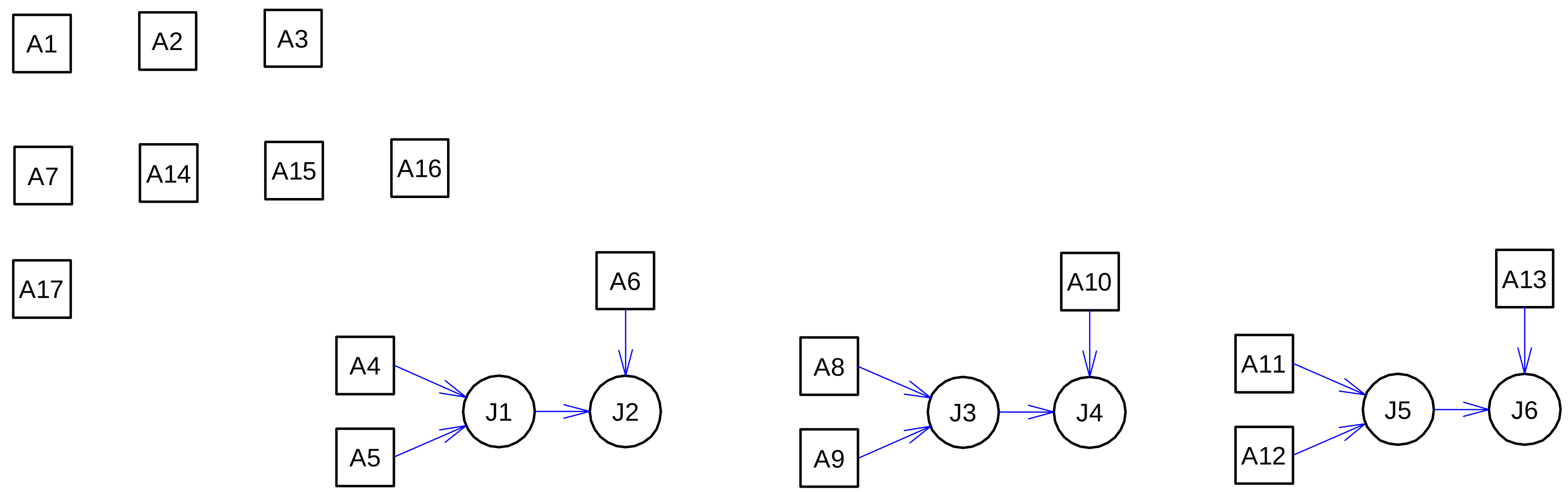
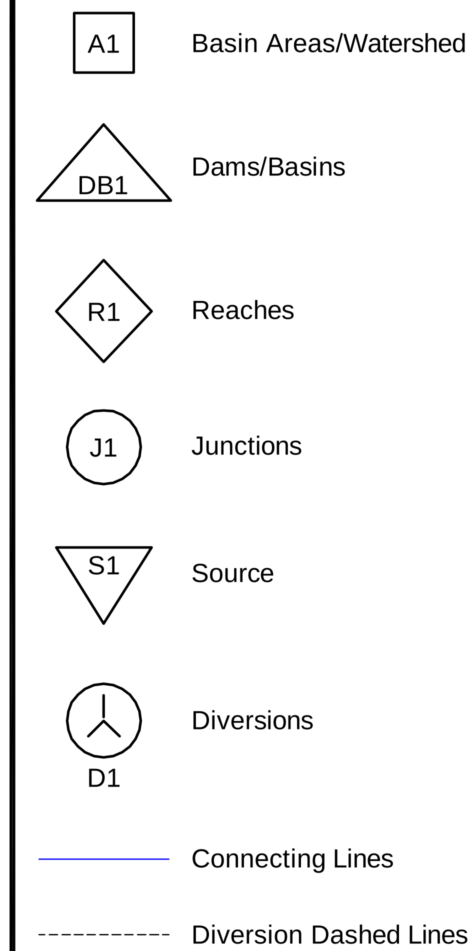


Symbol	Name	Description	Area (mi^2)	Peak Discharge (cfs)	Volume (ac-ft)
A1	FPN43	Flow Path Number 43 Basin	1.1163	1090	150.64
A2	UN23A	Unnamed Stream 23A Basin	0.0294	71	3.97
A3	UN024_1	Unknown 24_1 Basin	0.0742	133	10.01
A4	FPN42T1_2	Flow Path Number 42 Tributary 1_2 Basin	0.4390	462	59.25
A5	UN01	Unknown 1 Basin	0.2391	335	32.27
A6	FPN42T1_1	Flow Path Number 42 Tributary 1_1 Basin	0.1108	273	14.96
A7	FPN42A	Flow Path Number 42A Basin	0.1068	197	14.41
A8	UN03	Unknown 3 Basin	0.1561	238	21.07
A9	UN02_2	Unknown 2_2 Basin	0.0339	78	4.58
A10	UN02_1	Unknown 2_1 Basin	0.4972	94	6.71
A11	UN24A2	Unnamed Stream 24A_2 Basin	0.0661	113	8.92
A12	UN24AT1	Unnamed Stream 24A Tributary 1 Basin	0.0289	70	3.91
A13	UN24A1	Unnamed Stream 24A_1 Basin	0.0960	202	12.95
A14	UN24B	Unnamed Stream 24B Basin	0.1930	290	26.05
A15	UN24C	Unnamed Stream 24C Basin	0.0561	138	7.84
A16	UN24D	Unnamed Stream 24D Basin	0.0205	54	2.96
A17	FPN42	Flow Path Number 42 Basin	1.2002	937	161.97
J1	UN01,FPN42T1_2	Junction of Unknown 1 Basin and Flow Path Number 42 Tributary 1_2 Basin	0.6782	797	91.52
J2	FPN42T1_1OUT	Flow Path Number 42 Tributary 1_1 Outlet	0.7890	851	106.48
J3	UN03,02_2	Junction of Unknown 3 Basin and Unknown 2_2 Basin	0.1901	302	25.65
J4	UN02_1OUT	Unknown 2_1 Outlet	0.2398	395	32.36
J5	UN24A2,T1	Junction of Unnamed Stream 24A_2 Basin and Unknown 24A Tributary 1 Basin	0.0951	183	12.83
J6	UN24A1OUT	Unnamed Stream 24A_1 Outlet	0.1910	385	25.78

Legend



Enchanted Hills System
HEC-HMS Model Layout
and Table
Northwest Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-51

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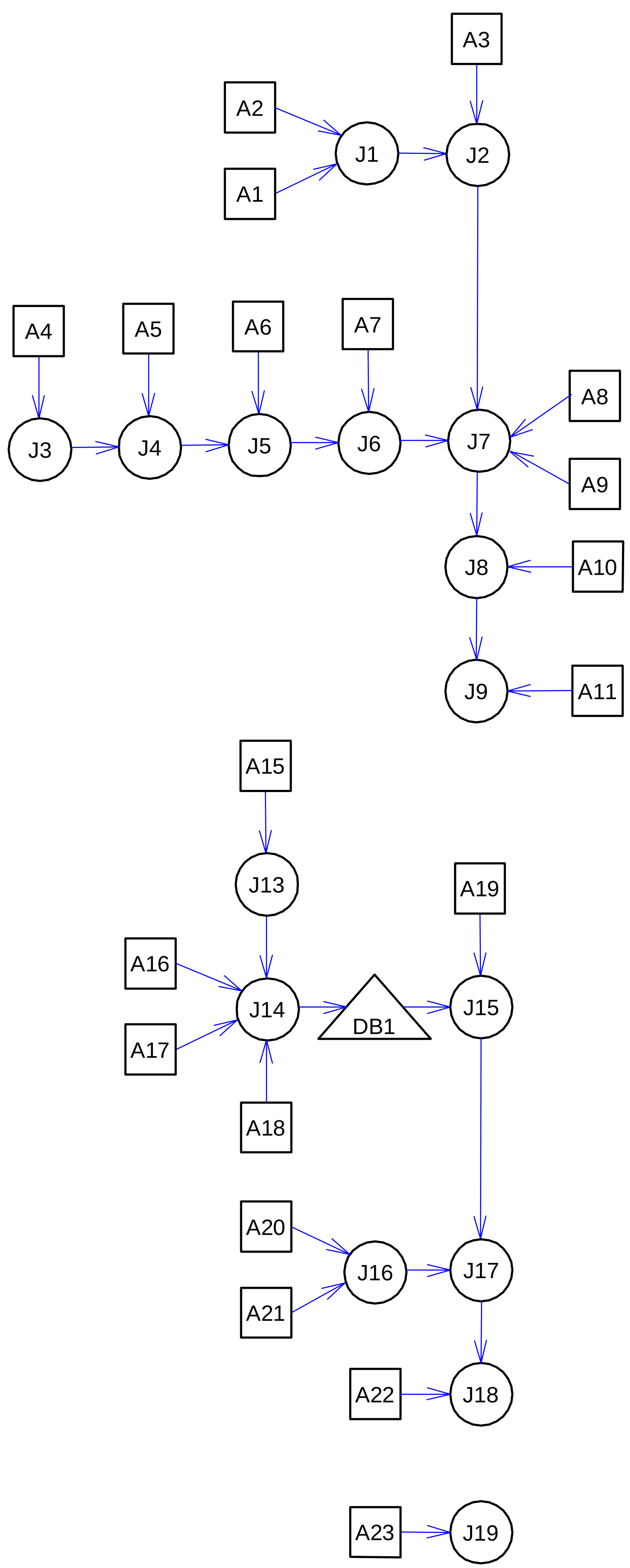
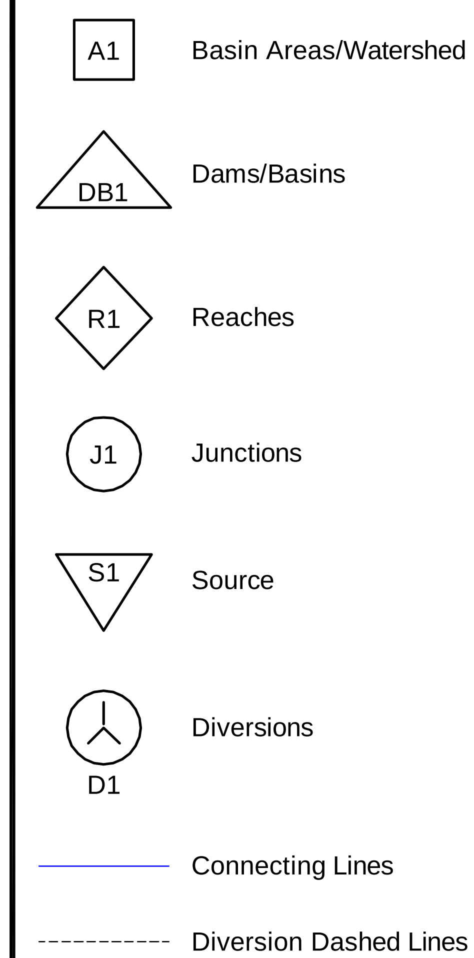


Symbol	Name	Description	Area (mi^2)	Peak Discharge (cfs)	Volume (ac-ft)
A1	FPN41A	Flow Path Number 41A Basin	1.8706	1434	252.44
A2	FPN41_2	Flow Path Number 41_2 Basin	1.8321	1464	247.24
A3	FPN41_1	Flow Path Number 41_1 Basin	0.1292	188	18.05
A4	RC_2	Resler Channel_2 Basin	1.7522	1799	236.47
A5	FPN39A2	Flow Path Number 39A_2 Basin	0.6875	698	96.04
A6	FPN40_2	Flow Path Number 40_2 Basin	0.2076	324	29.00
A7	FPN40_3	Flow Path Number 40_3 Basin	2.6276	1891	354.61
A8	FPN40_1	Flow Path Number 40_1 Basin	0.1441	329	26.10
A9	UN23_3	Unnamed Stream 23_3 Basin	0.1313	213	18.98
A10	UN23_2	Unnamed Stream 23_2 Basin	0.0461	110	6.44
A11	UN23_1	Unnamed Stream 23_1 Basin	0.8056	498	77.46
A12	RC_2a	Resler Channel_2 Basin	1.7522	1799	236.47
A13	FPN39A2a	Flow Path Number 39A_2 Basin	0.6875	698	96.04
A14	FPN39A_1	Flow Path Number 39A_1 Basin	0.0642	201	10.92
A15	FPN38_4	Flow Path Number 38_4 Basin	1.4938	0	0.06
A16	FPN38A	Flow Path Number 38A Basin	1.7193	1392	232.02
A17	FPN38B	Flow Path Number 38B Basin	0.6652	768	96.14
A18	FPN38_3	Flow Path Number 38_3 Basin	0.2729	743	40.78
A19	FPN38_1	Flow Path Number 38_1 Basin	0.4985	896	67.28
A20	RC_1	Resler Channel_1 Basin	1.4737	1226	205.86
A21	RC_2c	Resler Channel_2 Basin	1.7522	1799	236.47
A22	EC_1	Easy Channel_1 Basin	0.1288	87	5.85
A23	BHP	Borderland Heights Pond Basin	0.4469	0	0.02
J1	FPN41A,FPN41_2	Junction of Flow Path Number 41A and Flow Path Number 41_2	3.7027	2854	499.69
J2	FPN41_1 US	Flow Path Number 41_1 Outlet	3.8318	2934	517.73
J3	RC2US	Junction of Resler Channel_2 Basin	1.7522	1799	236.47
J4	FPN39A2US	Junction of Flow Path Number 39A_2 Basin and outflow of Junction RC2US	2.4397	2498	332.51
J5	FPN40_2 US	Junction of Flow Path Number 40_2 Basin and outflow of Junction FPN39A2US	2.6473	2675	361.51
J6	FPN40_2US,FPN40_3	Junction of Flow Path Number 40_3 Basin and outflow of Junction FPN40_2US	5.2749	4362	716.11
J7	UN23_3,FPN40_1	Junction of Unnamed Stream 23_3 Basin and Flow Path Number 40_1 Basin	9.3822	7570	1278.92
J8	UN23_2US	Junction of Unnamed Stream 23_2 Basin and outflow of Junction UN23_3, FPN40_1	9.4283	7584	1285.36
J9	UN23_1US	Unnamed Stream 23_1 Outlet	10.2339	8082	1362.83
J10	RC2aUS	Junction of Resler Channel_2 Basin	1.7522	1799	236.47
J11	FPN39A2aUS	Junction of Flow Path Number 39A_2a Basin and outflow of Junction RC2aUS	2.4397	2498	332.51
J12	FPN39A1US	Flow Path Number 39A_1 Outlet	2.5039	2509	343.43
J13	FPN38_4US	Junction of Flow Path Number 38_4 Basin	1.4938	0	0.06
J14	FPN38A,B,_3	Junction of Flow Path Number 38A Basin, Flow Path Number 38B Basin, and Flow Path Number 38_3 Basin	4.1511	2152	368.99
J15	FPN38_1US	Junction of Pond 4 Dam and FPN38_1 Basin	4.6496	896	163.19
J16	RC2cUS	Junction of Resler Channel_2 Basin and Resler Channel_1 Basin	3.2259	3025	442.33
J17	RC1US,FPN38_1	Junction of Flow Path Number 38_1 Basin and outflow of Junction RC1US	7.8755	3351	605.52
J18	EC1US	Junction of Easy Channel_1 Basin and outflow of Junction RC1US, FPN38_1	8.0044	3360	611.37
J19	BHP_Outlet	Borderland Heights Pond Outlet	0.4469	0	0.02
DB1	Pond 4	Pond 4 Dam	4.1511	46	95.91

Legend

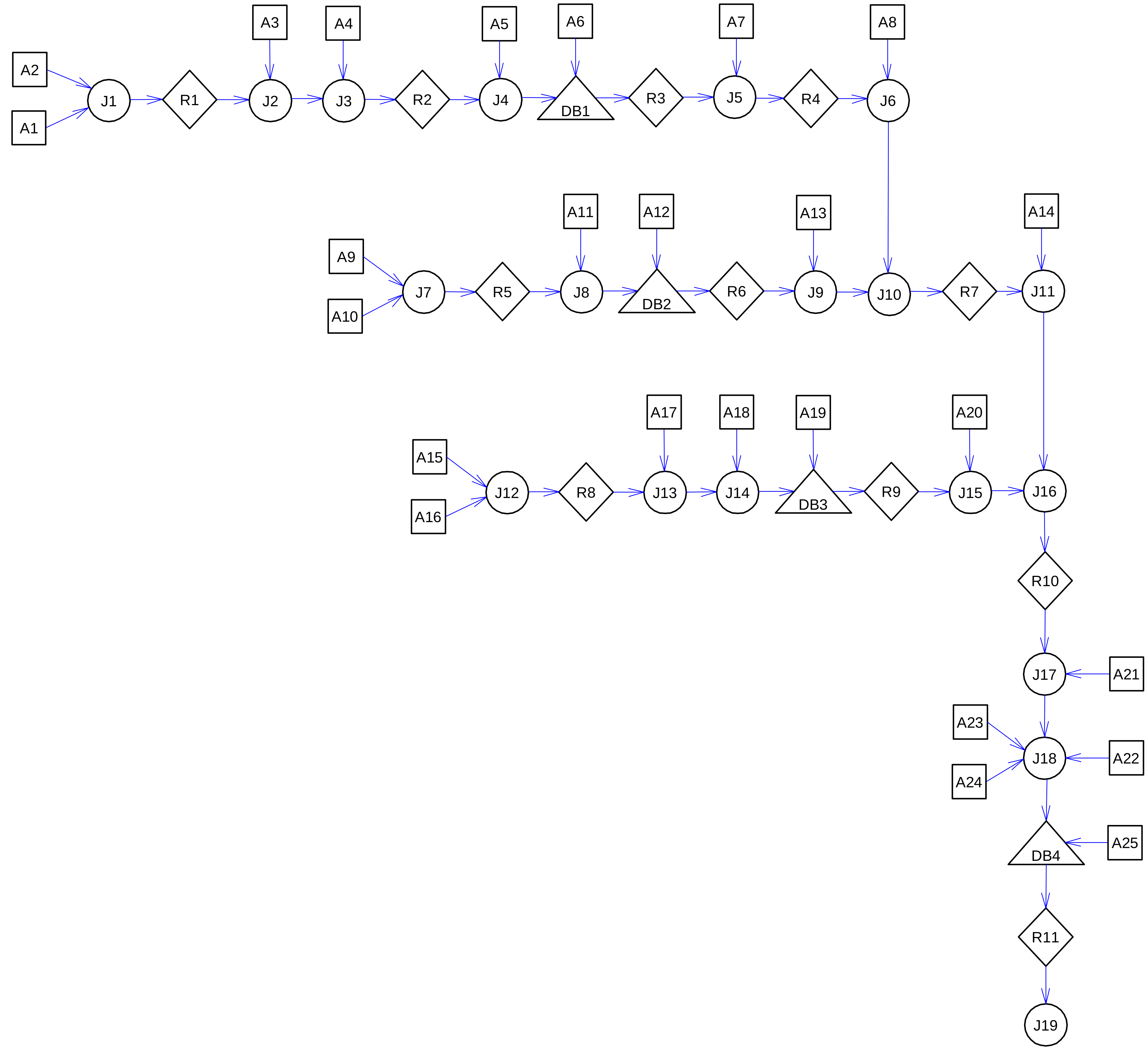


Flow Paths System HEC-HMS Model Layout and Table Northwest Region

El Paso Stormwater Master Plan

Date: 03/05/2009

Figure A-52



Legend

A1	Basin Areas/Watershed
DB1	Dams/Basins
R1	Reaches
J1	Junctions
S1	Source
D1	Diversions
(solid line)	Connecting Lines
(dashed line)	Diversion Dashed Lines

Keystone Dam System
HEC-HMS Model Layout
Northwest Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-53

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Symbol	Name	Description	Area (mi^2)	Peak Discharge (cfs)	Volume (ac-ft)
A1	A1A	Arroyo 1A Basin	1.0420	1291	140.62
A2	HR_3	High Ridge_3 Basin	0.2880	429	38.87
A3	HR_2	High Ridge_2 Basin	0.3870	960	55.93
A4	RV_1	Ridge View_1 Basin	1.3000	1285	181.60
A5	HR_1	High Ridge_1 Basin	0.5420	1319	73.14
A6	MD1	Mulberry Dam 1 Basin	0.4120	972	61.58
A7	MBDO_1	Mulberry Dam Outlet_1 Basin	0.2520	11	1.77
A8	BLC_3	Borderland Channel_3 Basin	0.2950	391	23.89
A9	VS_1	Via Serena_1 Basin	0.6970	977	94.06
A10	ODA_2	Ojo De Agua_2 Basin	0.5220	785	70.45
A11	ODA_1	Ojo De Agua_1 Basin	1.2920	2161	174.36
A12	ThoD1	Thorn Dam_1 Basin	0.4590	1109	61.94
A13	TDO_1	Thorn Dam Outlet_1 Basin	0.0690	47	3.13
A14	BLC_2	Borderland Channel_2 Basin	0.2250	500	28.29
A15	GC_1	Granero Channel_1 Basin	0.3370	915	50.37
A16	BC_2	Bandolero Channel_2 Basin	0.8640	1087	90.03
A17	BC_1	Bandolero Channel_1 Basin	0.3820	777	55.21
A18	BDC_1	Belvidere Channel_1 Basin	0.9855	1449	123.92
A19	MeD1	Mesa Dam_1 Basin	0.3140	714	40.91
A20	MDO_1	Mesa Dam Outlet_1 Basin	0.0360	85	4.69
A21	BLC_1	Borderland Channel_1 Basin	0.2140	689	37.57
A22	A4_1	Arroyo 4_1 Basin	0.9700	1141	105.09
A23	A5_1	Arroyo 5_1 Basin	0.7870	1519	117.62
A24	HDC_1	Highway Diversion Channel_1 Basin	0.9930	2184	153.39
A25	KD1	Keystone Dam_1 Basin	0.1430	114	14.90
J1	A1A,HR3	Junction of Arroyo_1A Basin and High Ridge_3 Basin	1.3300	1719	179.49
J2	HR_2,C2	Junction of High Ridge_2 Basin and High Ridge_C2 Reach	1.7170	2187	235.97
J3	RV1,HR2	Junction of Ridge View_1 Basin and High Ridge_2 Basin	3.0170	3240	417.57
J4	HR1,LDE1	Junction of High Ridge_1 Basin and High Ridge_C1 Reach	3.5590	3950	491.55
J5	MD1,MBDO_1	Junction of Mulberry Dam_1 Basin and Mulberry Dam Outlet_1 Basin	4.2230	205	472.98
J6	BLC_3,C3	Junction of Borderland Channel_3 Basin and Borderland Channel_C3 Reach	4.5180	482	496.06
J7	VS1,ODA2	Junction of Via Serena_1 Basin and Ojo de Agua_2 Basin	1.2190	1762	164.51
J8	ER1,ODA1	Junction of Ojo de Agua_1 Basin and Ojo de Agua_C1 Reach	2.5110	3412	339.29
J9	TDO_1,C	Junction of Thorn Dam Outlet_1 Basin and Thorn Dam Outlet_C Reach	3.0390	155	335.55
J10	BLC3,TDO1	Junction of Borderland Channel_3 Basin and Thorn Dam Outlet_1 Basin	7.5570	595	831.61
J11	BLC_2,C2	Junction of Borderland Channel_2 Basin and Borderland Channel_C2 Reach	7.7820	956	857.73
J12	GC1,BC2	Junction of Granero Channel_1 Basin and Bandolero Channel_2 Basin	1.2010	2002	140.39
J13	BC_1,C1	Junction of Bandolero Channel_1 Basin and Bandolero Channel_C1 Reach	1.5830	2687	196.24
J14	Before Mesa Dam	Junction of Belvidere Channel_1 Basin and outflow of Junction BC_1, C1	2.5685	4136	320.15
J15	MDO_1,C	Junction of Mesa Dam Outlet_1 Basin and Mesa Dam Outlet_C Reach	2.9185	207	311.19
J16	BLC2,MDO1	Junction of Borderland Channel_2 Basin and outflow of Junction MDO_1,C	10.7005	1162	1168.91
J17	BLC2,BLC1	Junction of Borderland Channel_1 Basin and Borderland Channel_C1 Reach	10.9145	1701	1205.54
J18	BeforeKD1	Junction of Arroyo4_1 Basin, Arroyo5_1 Basin, and Highway Diversion Channel_1 Basin	13.6645	6544	1581.64
J19	KD_Out	Keystone Dam outlet conduit with Rio Grande	13.8075	534	1168.61
R1	HR_C2	High Ridge C2 Reach	1.3300	1667	180.03
R2	HR_C1	High Ridge C1 Reach	3.0170	3194	418.41
R3	MBDO_C1	Mulberry Dam Outlet_C1 Reach	3.9710	204	471.21
R4	BLC_C3	Borderland Channel_C3 Reach	4.2230	205	472.16
R5	ODA_C1	Ojo De Agua_C1 Reach	1.2190	1676	164.93
R6	TDO_C	Thorn Dam Outlet_C Reach	2.9700	154	332.42
R7	BLC_C2	Borderland Channel_C2 Reach	7.5570	521	829.44
R8	BC_C1	Bandolero Channel_C1 Reach	1.2010	1910	196.24
R9	MDO_C	Mesa Dam Outlet_C Reach	2.8825	196	306.50
R10	BLC_C1	Borderland Channel_C1 Reach	10.7005	1012	1167.97
R11	KD_C	Keystone Dam_C Reach	13.8075	534	1168.61
DB1	MD1 Dam	Mulberry Dam	3.9710	204	471.67
DB2	Thorn Dam	Thorn Dam	2.9700	154	332.95
DB3	Mesa Dam	Mesa Dam	2.8825	196	306.53
DB4	KD1 Dam	Keystone Dam	13.8075	534	1174.91

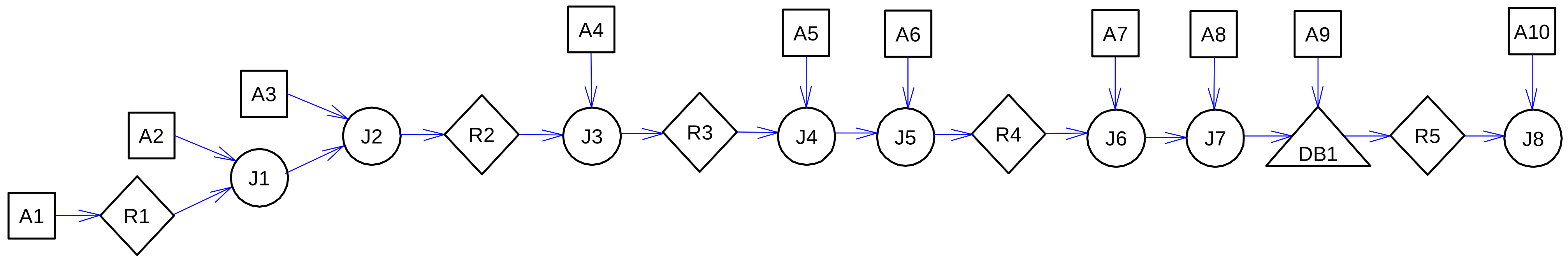
Legend

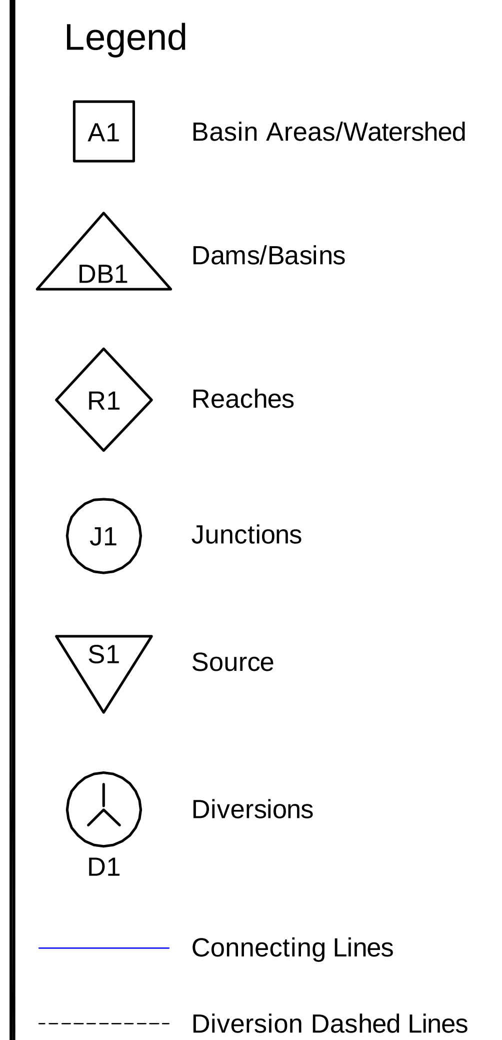
- A1 — Basin Areas/Watershed
- DB1 — Dams/Basins
- R1 — Reaches
- J1 — Junctions
- S1 — Source
- D1 — Diversions
- Connecting Lines
- Diversion Dashed Lines

Keystone Dam System
HEC-HMS Model Table
Northwest Region

El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-54



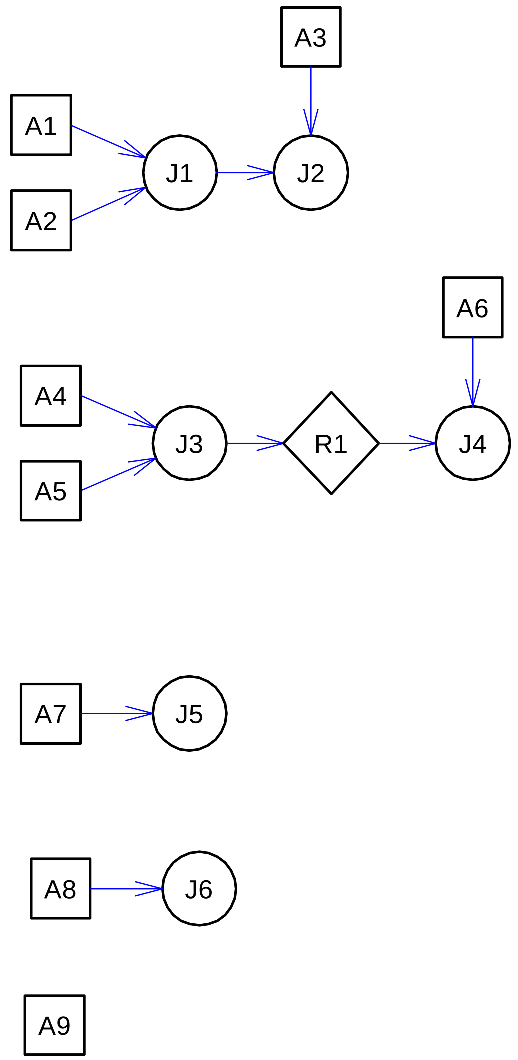


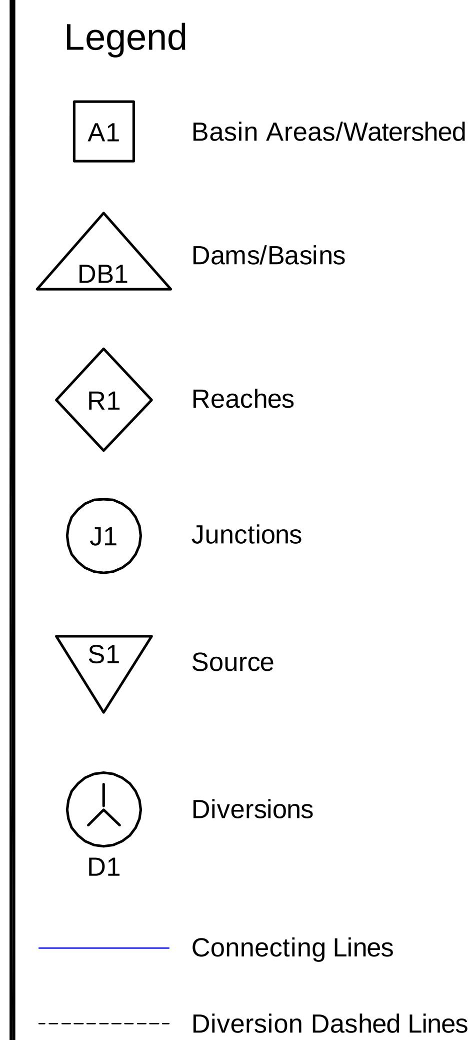
Symbol	Name	Description	Area (mi^2)	Peak Discharge (cfs)	Volume (ac-ft)
A1	SSC_2	Silver Springs Channel_2 Basin	0.7370	1594	99.46
A2	SSC_1	Silver Springs Channel_1 Basin	0.6400	868	89.40
A3	SCC_1	Spring Crest Channel_1 Basin	0.3210	809	44.84
A4	CC_1	Coronado Channel_1 Basin	0.1560	412	26.54
A5	BVC_2	Buena Vista Channel_2 Basin	0.7080	1334	105.81
A6	TBV_1	Thunderbird Valley_1 Basin	0.8860	1359	115.45
A7	BVC_1	Buena Vista Channel_1 Basin	0.0160	31	2.39
A8	MHC_2	Mesa Hills Channel_2 Basin	1.0670	2411	164.83
A9	OD	Oxidation Dam Basin	0.2440	667	36.47
A10	OO_1	Oxidation Outlet_1 Basin	0.1890	244	23.76
J1	SSC_C1,SSC_1	Junction of Silver Springs Channel_1 Reach and Silver Springs Channel_1 Basin	1.3770	2148	189.14
J2	SCC_1,SSC_1	Junction of Spring Crest Channel_1 Basin and Silver Springs Channel_1 Basin	1.6980	2957	233.98
J3	CC	Junction of Coronado Channel_1 Basin and Coronado Channel Reach	1.8540	3153	261.47
J4	BVC_2,C2	Junction of Buena Vista Channel_2 Basin and Buena Vista Channel_2 Reach	2.5620	4328	368.34
J5	BVC2,TBV1	Junction of Thunderbird Valley_1 Basin and outflow of Junction BVC_2,C2	3.4480	5687	483.79
J6	BVC_1,C1	Junction of Buena Vista Channel_1 Basin and Buena Vista Channel_1 Reach	3.4640	5555	487.20
J7	BVC1,MHC2	Junction of Mesa Hills Channel_2 Basin and outflow of Junction BVC_1,C1	4.5310	7966	652.03
J8	Ox_Out	Oxidation Dam Outlet	4.9640	398	430.38
R1	SSC_C1	Silver Springs Channel_1 Reach	0.7370	1470	99.73
R2	CC_C	Coronado Channel Reach	1.6980	2741	234.93
R3	BVC_C2	Buena Vista Channel_2 Reach	1.8540	2994	262.53
R4	BVC_C1	Buena Vista Channel_1 Reach	3.4480	5524	484.81
R5	OD_C	Oxidation Dam Reach	4.7750	173	406.61
DB1	OD Dam	Oxidation Dam	4.7750	173	407.29

Oxidation Dam System
HEC-HMS Model Layout
and Table
Northwest Region
El Paso Stormwater Master Plan

Date: 03/05/2009 | Figure A-55

File: Q:\El Paso Master Drainage Plan\Stormwater Master Plan Report\HMS Cad Diagrams\Schematics_App_A_013009.dwg Layout: Fig A-55 User: Scott_Coleman Plotted: Mar 02, 2009 - 10:50am





Symbol	Name	Description	Area (mi^2)	Peak Discharge (cfs)	Volume (ac-ft)
A1	PC_1	Paragon Channel_1 Basin	1.5489	2975	239.27
A2	FPN20_2	Flow Path Number 20_2 Basin	1.3208	2949	197.39
A3	FPN20_1	Flow Path Number 20_1 Basin	0.2074	394	33.10
A4	CBC_1	Canterbury Channel_1 Basin	0.8860	1009	132.42
A5	FPN21_2	Flow Path Number 21_2 Basin	1.4140	2293	171.46
A6	FPN21_1	Flow Path Number 21_1 Basin	0.2440	735	40.21
A7	FPN23_1	Flow Path Number 23_1 Basin	1.8498	3319	285.74
A8	Bcanal	Border Canal Basin	0.7974	1066	135.66
A9	Ind_1	Industrial_1 Basin	1.3751	1974	198.74
J1	PC1,FPN20_2	Junction of Paragon Channel_1 Basin and Flow Path Number 20_2 Basin	2.8696	5924	436.66
J2	FPN20_1US	Flow Path Number 20_1 Outlet	3.0770	6318	469.75
J3	CBC1,FPN21	Junction of Canterbury Channel_1 Basin and Flow Path Number 21_2 Basin	2.3000	2908	303.88
J4	FPN21_OUT	Flow Path Number 21 Outlet	2.5440	3434	345.14
J5	FPN23_US	Flow Path Number 23 Outlet	1.8498	3319	285.74
J6	BCanalUS	Border Canal Outlet	0.7974	1066	135.66
R1	FPN21_C1	Flow Path Number 21_C1 Reach	2.3000	2700	304.93

West Central System
HEC-HMS Model Layout
and Table
West Central Region

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Figure A-56