APPENDIX E

PROJECT ALTERNATIVES EVALUATION AND SELECTION

Table of Contents

Section **Page**

LIST OF TABLES

LIST OF FIGURES

E.1.0 GENERAL

Each developed alternative for drainage improvement was evaluated through the following general process:

- A set of general concept design level cost estimation procedures were developed for each generic type of improvement, specifically:
  - Road crossings (bridges, culverts, new or expanded)
  - Debris/sediment retention basins (new or expanded)
  - Stormwater detention/retention dams/basins (new or expanded)
  - Pump stations (new or expanded)
  - Storm drains (new or expanded, gravity or force main)

  These procedures generally involved sizing the improvement, assessing easement/property purchase needs, and making engineering judgments as to site construction complexity (utility relocations, other issues).
- The individual improvements (new/expanded culverts; new/expanded pump stations; new/expanded detention, etc.) associated with each project were sized using refined hydrologic and hydraulic analyses.
- The improvement sizes and other site information were input into the developed cost estimation procedures to obtain an estimated construction cost for each improvement. Costs of individual improvements associated with each project were summed to develop estimated project total costs.
- Qualitative factors were then evaluated among alternatives for each project with multiple alternatives.
- Finally, the most favorable alternative was selected for each project.

This appendix will present the basic methodologies associated with this evaluation process.

This page was intentionally left blank.

E.2.0 COST ESTIMATION PROCEDURES

The basic sources used for unit costs for all cost analyses were cost data available from the Texas Department of Transportation (TxDOT), the New Mexico Department of Transportation (NMDOT), and bid tabs and other cost data provided by the City of El Paso and/or the El Paso Water Utilities (EPWU). Specific sources are detailed in Table E-1.

E.2.1 Land and Utility Relocation Costs

E.2.1.1 General

In many instances, a component of a drainage improvement alternative included the acquisition of land and/or the relocation of utilities. Land purchases were required for some of the new basins and some of the basin expansions. Utility relocations were accounted for in most cases when a conduit, channel, or culvert was newly installed or expanded.

E.2.1.2 Cost Basis

In the case of land acquisition, the property value was determined by accessing the county property records site (www.elpasocad.org) for the property of interest. An adjustment factor was applied to the assessed property value as stated on the records to calculate the estimated price of acquisition. If the property was in a developed area, the assessed value was multiplied by three. If the property was in an undeveloped area or an area with little development, the assessed value was multiplied by two.

The cost of utility relocation was included by different methods depending on the improvement in question. Each channel installation or widening was evaluated against historical data and estimated to require major, moderate, or no utility relocation. Primary evaluation factors included extent of widening and urbanization along the route. For projects expected to have minor effect on existing utilities, estimated construction costs were increased by 10 percent (%); for projects expected to have major effect on existing utilities, estimated construction costs were increased by 50%.

For conduit placement a markup factor was used which was a large multiple of the cost of conduit construction alone. This factor included a number of significant project elements that could not be estimated in detail: relocation of major utilities (water/sewer/electrical line), installation of curb and gutter, road repair, traffic control, etc.). The best sources for estimation of this factor were recent City of El Paso bid tabulations at http://www.elpasotexas.gov/financial_services/bid_tabs.asp. The factor estimation process included the following (see Table E-2):

- The over 500 bid tabs available on the website were reviewed for applicability to this project. Specifically, to be relevant, projects had to be

focused on installation of new large diameter conduits (36 inches or greater) through an existing urban area. Four projects were identified: Upper Valley Drainage Improvements Phase III, Carnegie Avenue Street and Drainage Improvements, Davis Drive Street and Drainage Improvements, and 3rd Avenue Street and Drainage Improvements;

- The total cost of each project was divided by a length of right-of-way disturbed associated with the project; and
- This unit cost (cost per length) was divided by the TxDOT unit cost for the conduit configuration per the website listed in Table E-1. The results showed a factor of roughly 11.1 for concrete box culverts (CBC), and 3.7 for reinforced concrete pipe (RCP).

In project cost estimation, these factors were only applied to the construction of a single barrel in a multiple barrel conduit.

E.2.2 Road Crossings

E.2.2.1 General

In many instances, a component of a drainage improvement alternative included the expansion/replacement of existing drainage structures under roads or railroads to meet project flood protection criteria (e.g. protection of road/railroad overtopping for the 100-year or 1% annual exceedance probability flood). The basic sources reviewed for cost per linear foot for each relevant crossing size (diameter, width/height) or configuration (CBC, RCP) are listed in Table E-1 and include the City of El Paso, TxDOT, and NMDOT.

During review of costs estimated for project alternatives, it became apparent that use of the TxDOT data led to some significant inconsistencies in conduit costs, i.e. small conduits could have costs per unit length higher than significantly larger conduits. To address this issue a scattergram of current costs was developed versus conduit area (see Figure E-1). From this figure, a conservative cost estimate of $25 per square foot of conduit area per foot of length was used for road crossing structure cost.

In general, the estimation of construction cost for this improvement involved the following tasks:

- A hydraulic analysis was performed to estimate needed drainage structure size, shape, and material type to meet the desired flood protection criteria, given the height and width limitations associated with the particular crossing site. The methods used for this analysis were identical to those documented in Appendix B;
- This structure flow area was multiplied by $25 per linear foot times the length of the conduit; and

- This structure cost was adjusted to reflect relative complexity of construction at the specific site, using the following subjective adjustment factors discussed in Section E.2.1 above.

E.2.2.2 Cost Basis

Table E-1 summarizes the sources of cost data used in developing road crossing cost estimates.

E.2.3 Basins

E.2.3.1 General

In many instances, a component of a drainage improvement alternative included the construction of a new or expanded basin for the retention of debris, sediment, or floodwater. The estimated cost of construction generally consisted of the following significant components:

- Cost of excavation;
- Cost of excess spoil disposal. For cases where an embankment was constructed to provide above ground detention, the estimated embankment volume was subtracted from the volume of excavation to obtain volume of excavation spoil;
- Cost of riprap for upstream and downstream slopes of embankments;
- Cost of principal outlet (for basins including aboveground storage); and
- An additional $100,000 was added to costs to account for trash racks, and principal spillway inlet towers.

E.2.3.2 Cost Basis

Excavation unit cost was estimated at $10 per cubic yard, derived from recent TxDOT bid tabs. The unit cost applied for disposal of excess excavation spoil was $5 per cubic yard, derived from recent EPWU experience. The cost for principal outlet construction was based upon conduit cost and estimated length per cost basis described in Section E.2.2.

E.2.4 Pump Stations

E.2.4.1 General

Many of the drainage improvement alternatives required the addition or expansion of pump stations. In several instances, the elevation change across the area of interest was so small that the only way to achieve the required flow rate was to install a pump station.

E.2.4.2 Cost Basis

Cost estimates were put together for four "example" pump stations. The costs were based on past experience and history with pump station construction. They included the pumps, piping, major valves, power, controls, and the building. A curve was generated from these sample costs (dollars [$] per gallons per minute [gpm] vs. gpm) so that a dollar value could be assigned based on the capacity required for the modeled pump station. As the capacity of the pump station increased, the cost per gpm decreased due to economies of scale. For example the cost to build a building, install the controls, supply the power, supply the other infrastructure would be required for any pump station construction. The increase of capacity by adding another pump or using larger pumps would have decreasing influence on the costs as the size increased.

E.2.5 Storm Drains

E.2.5.1 General

Most of the models of the alternatives required that new conduits be installed or that existing conduits be replaced with larger conduits. The storm drain conduits included both gravity and pressure lines. The conduits were typically RCP or CBC depending on the requirements for the design. Costs of the storm drains were not significantly sensitive to the specific material type, and within reason, differences in the sizes of the conduits. There was typically a significant price jump from RCP to CBC. The major costs were typically tied up in items such as excavation, bedding and backfill, utility relocation, street repair, curb and gutter repair, and traffic control.

E.2.5.2 Cost Basis

Storm drain conduits were priced based on TxDOT bid tabulations and then multiplied by a factor to determine the installation price per linear foot of conduit. The basis for this factor is described in Section E.2.1 above.

E.2.6 Other Improvement Costing

Severing Connections Between Lines. For some of the alternatives redirecting flow was required. The redirection generally required severing existing ties to connecting storm drain conduits. Costs considered for severing ties included excavation, severing the connection, plugging the affected lines, backfilling, and restoration. The costs were estimated using experience from other projects.

Curb Inlet. In at least one instance, a significant street flooding problem could be alleviated by installing curb inlets. The inlets provided the water a more efficient path to the channel. The costs were estimated using similar items from TxDOT along with engineering experience and judgment.

Flow Control Gates. For one solution, there was a requirement to keep the backwater from the Rio Grande from flooding the storm sewer system. Automatic gates were selected for this control. In other solutions, flow was only to be released back into channels from basins after the peak of a storm had passed. Automatic gates were also selected for these controls. The prices came from vendor information.

E.2.7 Markups to Construction Cost

Construction costs were estimated based on the best available data as described above. The subtotal for each component was increased by 35% because of the lack of detail at this stage of alternative evaluation. Property acquisition was the exception to this procedure. The estimated cost for property (per Section E.2.1) was not increased based on the 35% contingency.

This page was intentionally left blank.

E.3.0 IMPROVEMENT CONCEPT DESIGN

Tables E-3 through E-7 list the principal improvement components of each alternative. This section will describe the concept design of these improvements.

E.3.1 Road Crossings

E.3.1.1 Methodology

Road crossings for each watershed were analyzed using CulvertMaster. Characteristics such as existing invert elevations, length, dimensions, and material were used to develop a maximum capacity. The sources for this information included an earlier post-2006 flood study by URS Corporation (URS) (URS, December 2006) and an existing crossing structure database maintained by the City of El Paso. Each culvert was analyzed, and the maximum capacity was compared to the peak flow (cubic feet per second [cfs]) from the contributing watershed. This was used to develop an approximate return interval capacity for each culvert. A conceptual design was completed on all crossings that did not have a maximum capacity equal to or greater than the 100-year return period (1% annual exceedance probability) flood.

CulvertMaster was used to estimate the culvert size needed to pass the peak flow without overtopping of the structure (road) to be protected. Channel geometry downstream of each culvert was entered into CulvertMaster to account for tailwater effects. Design parameters entered into CulvertMaster include culvert size, material, and elevations at the inlet, outlet, and top of road. Design culvert sizes were proposed based on the geometry of the channel and the top of road elevation, to ensure that the road is returned to its original geometry after construction and the required culverts would fit properly. In some instances, the channel must be expanded at the culvert entrance to adjust for the proposed culvert widths.

E.3.1.2 Results

The material and dimensions of each existing and proposed crossing for selected alternatives are summarized in Table E-3. Other key parameters affecting cost, as well as estimated cost, are also provided in the table.

E.3.2 Basins

E.3.2.1 Methodology

Basins were sized to provide retention for debris flow or sediment, or detention/retention of stormwater to reduce downstream peak flows. Basin locations were determined by selecting sites that were vacant (no structure) or sites that were identified by the EPWU as potential basin sites. Sediment and debris volumes were estimated by an assumption that the top one foot of the full upstream delineated area of sediment/debris

(per the maps presented in Appendix C) would be retained. This volume is a rough estimate, chosen to provide a rational comparison between required basin sizes for varying watersheds. This estimate should be revised through field study by a qualified geologist for each of the selected debris/sediment basin sites during later design.

The storage volumes needed for stormwater detention/retention were estimated through use of the hydrologic models developed per Section 3.2 of this Plan. The existing or modified hydrologic models were run to produce hydrographs for the areas where new basins were proposed. In the more straightforward concept designs, basin characteristics (storage volume, spillway discharge rating) were input into Hydrologic Engineering Center-Hydraulic Modeling System (HEC-HMS) and altered in iterative manner until the design downstream peak flow was achieved. In the more complex basins (such as those located within the Central Region), concept designs included multiple alternative inflows (from conduits, channels, and local watersheds) and outflows (via gravity flow conduit, channel, or force main). In this case, inflow hydrographs produced by HEC-HMS for each proposed basin were then copied into Excel, and the basin size and outlet configuration(s) were developed using a water balance performed at the same time step as the HEC-HMS model. Elevation-outflow curves for each outlet structure were derived using standard hydraulic measures. When the water balance analysis was complete, the peak volume stored per the analysis was considered the proposed basin's storage capacity. Alternative combinations of outlet size and basin size were considered and engineering judgment and concept level cost analyses were applied to choose the most favorable combination.

The pond area previously estimated was then used as the maximum surface area of the reservoir and an excavation volume total could be calculated. Most ponds were designed to a depth between 10 feet and 20 feet with 1 horizontal to 1 vertical side slopes. These characteristics varied depending on the location of the pond. For cases where embankments were sized to allow for storage volume above ground, the embankment length and volume were estimated consistent with the terrain slope of the site, and the needed embankment height. Embankments were designed with 3 horizontal to 1 vertical side slopes.

E.3.2.2 Results

The dimensions of each proposed basin for selected alternatives are summarized in Table E-4. Other key parameters affecting cost, as well as estimated cost, are also provided in the table.

E.3.3 Pump Stations

E.3.3.1 Methodology

Pump stations were designed by analyzing the inflow hydrograph, checking the available storage (if any), and then determining the required capacity of the pump.

Pump stations, depending on available area, were designed either with a basin or a wet-well.

Basin Pump Station Design

Pump stations that were designed with a basin and force main were designed in conjunction with the basin using a spreadsheet-based water balance as described above. For each pump station, the inflow volume per time step was determined using HEC-HMS or a discharge hydrograph from an upstream reservoir. The available storage within the proposed pond was also approximated using available area and a proposed depth. A series of functions in Excel was then used to incrementally adjust the volume of stormwater in the basin over time based on the capacity chosen for the discharge pump. The outflow hydrograph would adjust to show the decrease in storage once the peak had passed. Finally, an iterative procedure was used to determine the discharge pump capacity required to keep the pond from exceeding its maximum volume. The required pump capacity, available head, and head losses were used to determine the required pressure for the pump and the minimum size of the force main needed to discharge flow from the pump.

Conduit Pump Station Design

Conduit pump stations must be designed to the maximum capacity of the conduit, unless the conduit is pressurized. A large pressurized conduit may have enough storage within the pipe to reduce the pump size. These unique systems have been looked at individually and adjustments to the pump capacities have been made. Head requirements were also estimated during analysis to select a pump and force main size.

E.3.3.2 Results

The capacity of each existing (if applicable) and proposed pump station for selected alternatives are summarized in Table E-5. Other key parameters affecting cost, as well as estimated cost, are also provided in the table.

E.3.4 Storm Drains and Force Mains

E.3.4.1 Methodology

Storm drains were either designed for gravity flow or as force mains.

Gravity Flow

Gravity flow storm drains were designed using FlowMaster. FlowMaster inputs include type of conduit, size, material, length, and slope. Multiple conduit types and sizes were selected to maintain a velocity between 6 and 8 feet per second (ft/s). Once a size was selected, the cover depth required along the route of the conduit was determined to ensure proper cover over the length of the conduit. The capacity of the conduit was checked using Manning's equations and hand calculations. Hydraulic gradients were also checked to ensure positive flow.

Force Mains

Force mains were analyzed using Excel spreadsheets, based upon the Hazen Williams Equation. Inputs for the Hazen Williams Equation are length of conduit, inlet and outlet invert elevations, discharge (cfs), and the C coefficient for the pipe material. The spreadsheet was then used to estimate the head required for each type of conduit and its velocity. A design velocity of 6 ft/s was used in all analyses. The pressure required for each conduit was also calculated to help size the force main and estimate needed standard of material.

E.3.4.2 Results

The dimensions of each existing (if applicable) and proposed storm drain for selected alternatives are summarized in Table E-6. Other key parameters affecting cost, as well as estimated cost, are also provided in the table.

E.3.5 Channels

E.3.5.1 Methodology

Where existing channels were estimated to lack 100-year return period (1% annual exceedance probability) capacity, a concept design was developed to provide additional capacity. This capacity was added either by channel widening or by lining an existing unlined channel. Where an existing backwater model Hydrologic Engineering Center-River Analysis System (HEC-RAS) was available, the model was used in concept design. Where no model was currently available, flow capacity was estimated using a normal depth assumption and FlowMaster (or equivalent) software was used for design. In general, because of citizen-expressed preference for natural channels, channels were designed to be unlined except in cases of urban channels with severe right-of-way restrictions.

E.3.5.2 Results

The dimensions of each existing (if applicable) and proposed channel for selected alternatives are summarized in Table E-7. Other key parameters affecting cost, as well as estimated cost, are also provided in the table.

E.4.0 ALTERNATIVE COST ESTIMATION

The improvements per the types and dimensions developed in concept design (Section E.3.0) were cost estimated per the procedures presented in Section E.2.0. The resulting costs are presented in Tables E-2 through E-7.

This page was intentionally left blank.

E.5.0 ALTERNATIVE QUALITATIVE EVALUATION

Qualitative factors were evaluated among alternatives for each project with multiple alternatives. Factors evaluated were both technical values (constructability, ease of maintenance, reliability, right-of-way, and safety) and community values (safety, aesthetics, opportunity for dual use, and compatibility with natural systems). This evaluation was performed in conjunction with representatives from the City and EPWU.

These qualitative factors significantly affected alternative selection. The technical values were applied as follows.

Constructability was considered to be the ease with which the defined alternative could be constructed. General knowledge concerning conditions at the site (density of urban area, ease of excavation, complexity of construction/design, and other site-specific issues) was applied.

Ease of maintenance was considered to be the relative likelihood of significant maintenance being required to retain the favorable functions (conveyance, environmental, etc.) associated with the project over time, i.e. the susceptibility of the alternative to flood (or other) damage, erosion, excessive sediment/debris deposition, etc. In general, alternatives with upstream sediment/debris basins in locations with significant sediment/debris risk were estimated to be easier to maintain than those lacking debris/sediment controls. Channels with non-erosive liners (rock, concrete) were estimated to be easier to maintain than vegetated channels, where steep slopes led to heightened erosion risk.

Reliability was considered to be the relative likelihood of the alternative successfully addressing the targeted issue (excessive flooding, erosion, deposition). In some cases, causes of the targeted issue were uncertain or difficult to fully address. A judgment was made to rate an alternative higher in reliability if that alternative successfully addressed more of the project uncertainty than another. In the easiest example to present, an alternative designed to prevent flooding from a 50-year flood (2% annual exceedance probability) was deemed less reliable than alternative designed to prevent flooding from a 100-year flood (1% annual exceedance probability).

Right-of-way (ROW) was considered to be the relative complexity of obtaining the needed ROW (property or easement purchase) for an alternative. Alternatives involving significant ROW acquisition in dense urban areas or in highly regulated areas were rated lower than those where ROW acquisition was confined to open land, or urban land not in active use.

Safety was considered to be the relative risk to public health and welfare associated with each project. Steep-sided, deep channels or basins in urban environments were rated less safe than more moderately sloped improvements. In urban areas, stormwater detention basins (which drain quickly following a flood) were generally rated

safer than stormwater retention basins (which can impound water for longer periods). In areas identified as susceptible to high risk of debris flow, alternatives that included debris control basins were rated safer than those that lacked debris control.

The community values qualitative factors considered were developed in public meetings with local stakeholder groups and include safety, aesthetics, dual use, and natural systems. **Safety** was considered as a technical qualitative factor. **Aesthetics** were considered to be improved relative to another project, if the project provided more of a visual asset to the community than a competing alternative. An alternative rated higher than another for **dual use** if the project provided more recreational (park) benefits in addition to flood reduction.

An alternative that minimized disturbance to an existing **natural system** was also rated favorably. This provided a relative favorable rating to projects that did not disturb natural arroyos.

Table E-8 provides a listing of each alternative, its associated estimated construction cost, and where needed for comparison among competing alternatives, its associated qualitative evaluation factors.

E.6.0 ALTERNATIVE SELECTION

Alternatives were selected during a series of meetings with the City, EPWU, and URS staff in which the information in Table E-8 was discussed. In general, alternatives were selected which:

- Addressed fully the identified root flooding issue: i.e. 100-year return period protection was generally selected over alternatives with lesser protection;
- Addressed fully existing community safety issues;
- Addressed other identified community concerns: i.e. alternatives that minimized disturbance to a natural system, had opportunities for improving community aesthetics, had opportunities for improving community dual use; and
- Were cost effective relative to comparably functional alternatives.

In the case of larger projects (in excess of $5 to $10 million in estimated cost), projects were divided into phases. Early phases were chosen which provided substantive improvement in safety and flood protection at relatively low cost; later phases allowed for full achievement of the desired flood protection. Selected projects and associated phases are shown in Table E-9.

This page was intentionally left blank.

TABLES

This page was intentionally left blank.

Table E-1. Sources for Unit Costs

Item	Source				
	Web Link	TxDOT Bid Tabs			
		Statewide 12 month moving average bid	Statewide	El Paso	Abilene
Excavation, Embankments, Etc.					
Embankment and Berm Fill	"Draft Unit Cost Summary" Spreadsheet for Active El Paso Drainage Projects				
Excavation (Special)	http://www.dot.state.tx.us/insdtdot/geodist/ELP/cserve/bidprice/s_0101.htm			x	
Backfill (Type A)					
CL C CONC FOR EXT STR (ABUT)					
REMOV STR (PIPE)					
EXCAVATION (CHANNEL)					
REMOVING CONC (MISC)					
REMOVING CONC (RIPRAP)					
Rework base material (6-inch) (ord comp)	Based on average cost of rework base material for different soil types at 6-inch ordinary compaction from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
(ASPH)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CUT AND RESTORING PAV (CONC)					
CUT AND RESTORING PAV (FLEX BASE)					
Channel Lining					
RIPRAP (CONC) (4 IN)	http://www.dot.state.tx.us/insdtdot/geodist/ELP/cserve/bidprice/s_0101.htm			x	
RIPRAP (STONE PROTECTION)(24 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/distinfo/bidprice/avgd08.txt				x
Riprap (Stone Common) (Dry) (24in)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
(Dry) (24 IN)					
CL A CONC (Misc)					
CL A CONC (Misc) (6-inch)					
Gabions (3' x 3') (Galv)					
Riprap (Stone Common) (Grout) (12in)					
Gabion Mattress (Galv) (6 in)					
Pipe and Box Culverts					
RC PIPE (CL III) (12 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
RC PIPE (CL III) (18 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
RC PIPE (CL III) (24 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
RC PIPE (CL III) (30 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		

Table E-1. Sources for Unit Costs (Continued)

Item	Source				
	Web Link	TxDOT Bid Tabs			
		Statewide 12 month moving average bid	Statewide	El Paso	Abilene
Pipe and Box Culverts (Continued)					
RC PIPE (CL III) (36 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
RC PIPE (CL III) (42 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
RC PIPE (CL III) (48 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
RC PIPE (CL III) (54 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
RC PIPE (CL III) (60 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
RC PIPE (CL III) (66 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
RC PIPE (CL III) (72 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
RC PIPE (CL III) (78 IN)	Interpolated cost from 72-inch RCP and 84-inch RCP from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
RC PIPE (CL III) (96 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CMP (GAL STL 8 IN)	estimate based on cost of 12in, 15in, 18in from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CMP (GAL STL 12 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CMP (GAL STL 18 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CMP (GAL STL 24 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CMP (GAL STL 30 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CMP (GAL STL 36 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CMP (GAL STL 42 IN)	Interpolated cost from 36-inch CMP and 48-inch CMP from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CMP (GAL STL 48 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
60-inch CMP	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CMP (GAL STL 66 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CMP (GAL STL 72 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CMP (GAL STL 96 IN)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CMP (GAL STL 168 IN)	Jow Menicucci (505-228-5198), Contech Sales Engineer, Albuquerque 10/28/08. Quote for 10 gage steel pipe. Cost includes freight to El Paso from plant.		x		
35-inch X 24-inch CMPA	NMDOT average unit bid prices 2007				
112-inch X 75-inch CMPA	Contech regional sales office quote 10/27/08 for 12 gage galvanized corrugated metal, Portland Oregon (Karen 866-400-3180 ext. 193)				
141.8-inch X 91.3-inch CMPA	Contech regional sales office quote 10/27/08 for 10 gage galvanized corrugated metal, Portland Oregon (Karen 866-400-3180 ext. 193)				
63-inch X 98-inch Ellipse	Avg price between a 91-inch x 58-inch RCP Ellipse and a 106-inch x 68-inch RCP Ellipse from http://www.dot.state.co.us/App_EEMA_CDB/CostData2006.txt	CDOT cost data 2006			

Table E-1. Sources for Unit Costs (Continued)

Item	Source				
	Web Link	TxDOT Bid Tabs			
		Statewide 12 month moving average bid	Statewide	El Paso	Abilene
Pipe and Box Culverts (Continued)					
CONC BOX CULV (2 FT X 2 FT)	actual cost of 3'x2' CBC from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (3 FT X 2 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CONC BOX CULV (3 FT X 3 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CONC BOX CULV (3 FT X 6 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CONC BOX CULV (4 FT X 2 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CONC BOX CULV (4 FT X 3 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CONC BOX CULV (4 FT X 4 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CONC BOX CULV (5 FT X 2 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CONC BOX CULV (5 FT X 3 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CONC BOX CULV (5 FT X 5 FT)	http://www.dot.state.tx.us/insdtdot/geodist/ELP/cserve/bidprice/s_0101.htm		x		
CONC BOX CULV (6 FT X 2 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CONC BOX CULV (6 FT X 4 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CONC BOX CULV (6 FT X 5 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CONC BOX CULV (6 FT X 6 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CONC BOX CULV (6 FT X 10 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CONC BOX CULV (7 FT X 3 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CONC BOX CULV (7 FT X 4 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (7 FT X 5 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CONC BOX CULV (7 FT X 6 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CONC BOX CULV (7 FT X 6.5 FT)	actual cost of 7'x7' CBC from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (7 FT X 7 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CONC BOX CULV (8 FT X 3 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CONC BOX CULV (8 FT X 4 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CONC BOX CULV (8 FT X 5 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CONC BOX CULV (8 FT X 6 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CONC BOX CULV (8 FT X 7 FT)	Interpolated cost from 8' x 6' CBC and 8' x 8' CBC from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CONC BOX CULV (8 FT X 8 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		

Table E-1. Sources for Unit Costs (Continued)

Item	Source				
	Web Link	TxDOT Bid Tabs			
		Statewide 12 month moving average bid	Statewide	El Paso	Abilene
Pipe and Box Culverts (Continued)					
CONC BOX CULV (9 FT X 4 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CONC BOX CULV (9 FT X 5 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CONC BOX CULV (9 FT X 6 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CONC BOX CULV (9 FT X 7 FT)					
CONC BOX CULV (9 FT X 8 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CONC BOX CULV (9 FT X 9 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CONC BOX CULV (10 FT X 2 FT)	actual bid price of a 10'x4' CBC from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (10 FT X 3 FT)	actual bid price of a 10'x4' CBC from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (10 FT X 4 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CONC BOX CULV (10 FT X 5 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CONC BOX CULV (10 FT X 7 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt	x			
CONC BOX CULV (10 FT X 8 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CONC BOX CULV (10 FT X 10 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CONC BOX CULV (10.5 FT X 3.5 FT)	Actual cost of 10' x 4' CBC from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CONC BOX CULV (11 FT X 1.5 FT)	Cost of one 6'x2' CBC and one 5'x2' CBC from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (12 FT X 2 FT)	Cost of 2 6'x2' CBCs from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (12 FT X 3 FT)	Cost of 2 3'x6' CBCs from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (12 FT X 4 FT)	Cost of 2 6'x4' CBCs from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (12 FT X 6 FT)	ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CONC BOX CULV (12.5 FT X 5.5 FT)	Actual cost of 12' x 6' CBC from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt		x		
CONC BOX CULV (12.5 FT X 6 FT)	Actual cost of 12' x 6' CBC from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (13 FT X 6 FT)	Actual cost of 12' x 6' CBC from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (14 FT X 2 FT)	cost of two 6'x2' CBCs and one 3'x2' CBC from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (15.5 FT X 10 FT)	cost of three 10'x5' CBCs from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (16 FT X 6 FT)	cost of two 8'x6' CBCs from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (18 FT X 6 FT)	cost of two 9'x6' CBCs from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (19 FT X 4 FT)	cost of one 10'x4' CBC and one 9'x4' CBC from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				

Table E-1. Sources for Unit Costs (Continued)

Item	Source				
	Web Link	TxDOT Bid Tabs			
		Statewide 12 month moving average bid	Statewide	El Paso	Abilene
Pipe and Box Culverts (Continued)					
CONC BOX CULV (20 FT X 4 FT)	cost of two 10'x4' CBCs from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (20 FT X 5 FT)	cost of two 10'x5' CBCs from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (20 FT X 6 FT)	Actual cost of 20'x8' precast CBC from http://www.dot.state.co.us/App_EEMA_CDB/CostData2007.txt	CDOT cost data 2007			
CONC BOX CULV (22 FT X 4 FT)	cost of two 10'x4' CBCs and one 4'x2' CBC from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (22 FT X 6 FT)	cost of two 10'x6' CBCs and one 6'x2' CBC from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (24 FT X 4 FT)	cost of two 10'x4' CBCs and one 4'x4' CBC from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
CONC BOX CULV (24 FT X 6 FT)	cost of two 10'x6' CBCs and one 6'x4' CBC from ftp://ftp.dot.state.tx.us/pub/txdot-info/cmd/cserve/bidprice/as1458.txt				
Bridges					
	Based on various bridge projects around NM.				
Bridge with concrete abutment	Based on various bridge projects around NM.				
Railroad Bridge	Based on various bridge projects around NM.				
Dam-Related					
ROLLER COMPACTED CONCRETE	Data from recent URS bids and TX NRCS Bidtabs				
Cementitious Material for RCC					
Concrete Pressure Pipe (18-inch)	TX NRCS Bid Tabs	EFAL 1A Bid Tab			
Concrete Pressure Pipe (30-inch)	TX NRCS Bid Tabs	Dam No. 13A			
Concrete Pressure Pipe (54-inch)	TX NRCS Bid Tabs	Double Creek 3 - Rehab Bid Summary			
Concrete Pipe Cradle	TX NRCS Bid Tabs	EFAL 1A Bid Tab			
Conduit Abandonment	TX NRCS Bid Tabs	EFAL 1A Bid Tab			

This page was intentionally left blank.

Table E-2. Summary of Basis, Factor Adjusting For Construction of Storm Drain Conduit in Urban Areas

El Paso Project	Total Cost	Length of Significant Conduit	Conduit Sizes Considered	Project Cost per LF	TxDOT Cost per LF	Factor (Project/ TxDOT)	Factor, Based Upon Engineering Judgment after Evaluating Each of the Example Projects
Reinforced Concrete Pipe							
Upper Valley Drainage Improvements Phase III - Bid Phase I	$3,600,947	3406	54-inch, 60-inch	$1,057.24	$223.00	4.7	3.7
Upper Valley Drainage Improvements Phase III - Bid Phase II	$2,705,521	2450	42-inch, 48-inch	$1,104.29	$190.00	5.8	
Carnegie Avenue Street and Drainage Improvements - Base Bid I	$2,997,275	2694	66-inch	$1,112.57	$338.00	3.3	
Carnegie Avenue Street and Drainage Improvements - Base Bid II	$1,060,622	1124	54-inch, 60-inch	$943.61	$223.00	4.2	
Davis Drive Street and Drainage Improvements	$807,539	986	24-inch, 30-inch, 36-inch	$819.01	$92.00	8.9	
3RD Avenue Street and Drainage Improvements	$998,333	1176	24-inch	$848.92	$80.00	10.6	
Concrete Box Culvert							
Upper Valley Drainage Improvements Phase III - Box R&R Line 66	$79,200	36	4 x 5	$2,200.00	$207.00	10.6	11.1

This page was intentionally left blank.

Table E-3. Summary of Road Crossing Concept Designs

Project and Alternative	Location	Material and Dimensions of Existing Crossing	Dimensions of Proposed Crossing	Type	Length (ft)	Road Surface	ROW/ Easement Issues	Utility Relocation	Total Cost	Preferred Alternative	Comments
CE2_1	Cambridge	2 - 8' x 3' CBC	2 - 8' x 4'	CBC	70	CONC	none	MINOR	$205,000	X	
	Cumberland	2 - 8' x 3' CBC	2 - 8' x 4'	CBC	75	CONC	none	MINOR	$220,000	X	
	Trowbridge	5 - 5' x 2.5' CBC	3- 8' x 4'	CBC	70	CONC	none	MINOR	$316,000	X	
	Chester	2 - 8' x 3' CBC	72' wide	BRIDGE	28	CONC	none	none	$1,318,000	X	
CE6_5 Ph III	Cebada	n/a	3 - 5' x 4'	CBC	190	CONC	MAJOR	MAJOR	$1,214,000	X	
MV1	Bucher Rd	1 - 48-inch RCP	3 - 10' x 7'	CBC	52	ASPH	none	none	$407,000	X	
MV3	Conduits for Feather Lake II	none	2 - 6' x 4'	CBC	200	none	none	MAJOR	$547,000	X	
MV4	Conduits for Middle Interceptor Basin	none	4 - 6' x 4'	CBC	1570	none	none	MINOR	$6,323,000	X	
MV5	Carl Longuemare	2- 60-inch RCP	3 - 10' x 9'	CBC	40	ASPH	none	none	$401,000	X	
	Southside	2- 60-inch RCP	3 - 10' x 9'	CBC	40	none	none	none	$384,000		
MV8	Mimosa	1 - 108-inch CMP	2 - 10' x 10'	CBC	62	ASPH	none	none	$456,000	X	
MV9	DS of Yarbrough	1 - 36-inch RCP	2 - 5' x 5'	CBC	47	ASPH	none	none	$95,000	X	
MV10	Independence	3 - 5' x 5' CBC	2 - 6' x 4'	CBC	225	ASPH	none	none	$433,000	X	Current crossing slopes to Playa Drain.
NE7_1	Falcon Ave	1 - 18-inch RCP	5 - 4' x 2'	CBC	100	ASPH	none	none	$177,000	X	
	Waycross Ave	1 - 12-inch RCP	5 - 4' x 2'	CBC	109	ASPH	none	none	$191,000		
	Wren	1 - 18-inch RCP	5 - 4' x 2'	CBC	127	ASPH	none	none	$225,000		
	Lexington	1 - 18-inch RCP	7 - 4' x 2'	CBC	114	ASPH	none	none	$283,000		
	Crossing South of Falcon Ave	1 - 12-inch RCP	7 - 4' x 2'	CBC	23	none	none	none	$47,000		
NE8_1	East of Diana	5 - 8' x 4' CBC	6 - 7' x 6'	CBC	45	none	none	none	$402,000	X	
NE10/NE9_2 Ph I	Alps	5 - 6' x 3' CBC	8 - 10' x 4'	CBC	63	ASPH	none	MAJOR	$1,180,000	X	
	Hollings	5 - 6' x 3' CBC	8 - 10' x 4'	CBC	50	ASPH	none	MAJOR	$937,000		
	Hondo Pass	4 - 6' x 3' CBC	8 - 10' x 3'	CBC	80	ASPH	none	MAJOR	$1,161,000		
NE10/NE9_2 Ph II	Wren	1 - 18-inch CMP	8 - 10' x 4'	CBC	47	ASPH	none	MAJOR	$880,000		
	Raymond Telles	5 - 6' x 3' CBC	8 - 10' x 4'	CBC	52	ASPH	none	MAJOR	$974,000		
NE10/NE9_2Ph III	Sanders	1 - 8' x 5' CBC	4 - 10' x 5'	CBC	75	ASPH	none	MAJOR	$905,000		
NE11_2	Raymond Telles	1 - 2' x 2' CBC	2 - 6' x 3'	CBC	49	CONC	none	none	$80,000		
NE14_1	Morningside Circle	3 - 36-inch CMP	2 - 6' x 4'	CBC	61	ASPH	none	none	$117,000		
	Byron Drive	3 - 36-inch CMP	2 - 5' x 3'	CBC	67	ASPH	none	none	$89,000		
NW1_1	Corona Del Sol	1 - 36-inch RCP	2 - 6' x 3'	CBC	162	ASPH	none	MINOR	$258,000	X	
	Villa Del Sol	2 - 6' x 4' CBC	3 - 6' x 4'	CBC	81	ASPH	none	MINOR	$83,000		Add 1 barrel to existing.
	Playa Del Sol	1 - 24-inch RCP	1 - 5' x 5'	CBC	112	ASPH	none	MINOR	$118,000		
NW5_1	Transmountain	4 - 6' x 6' CBC	6 - 6' x 6'	CBC	145	ASPH	none	MINOR	$433,000	X	TxDOT Responsibility, Add 2 barrels to existing.
NW6_1	Desert Canyon Drive	2 - 6' x 4' CBC	2 - 7' x 6'	CBC	110	ASPH	none	MINOR	$402,000	X	
	Shelby Dr	2 - 8' x 6' CBC	3 - 8' x 6'	CBC	82	ASPH	none	MINOR	$162,000		Add 1 barrel to existing
NW7_1	Franklin Hills	2 - 8' x 4' CBC	4 - 8' x 7'	CBC	79	ASPH	none	MINOR	$730,000	X	
	Franklin Crest	2 - 8' x 4' CBC	3 - 9' x 8'	CBC	77	ASPH	none	MINOR	$679,000		
NW8_1	Bird Rd.	2 - 35' x 24' ARCH	2 - 4' X 3'	CBC	54	ASPH	none	MINOR	$262,000		
	Frontera	2 - 35' X 24' ARCH	3 - 5' X 4'	CBC	64	ASPH	none	MINOR	$370,000		
	Sunland Park	2 - 6' x 4' CBC	5 - 6' x 4'	CBC	121	ASPH	none	MINOR	$581,000		Add 3 barrels to existing.
NW8_2	Bird Rd.	2 - 35' x 24' ARCH	2 - 4' x 2'	CBC	54	ASPH	none	MINOR	$245,000	X	
	Frontera	2 - 35' X 24' ARCH	3 - 4' x 4'	CBC	64	ASPH	none	MINOR	$336,000		
	Sunland Park	2 - 6' x 4' CBC	5 - 6' x 4'	CBC	121	ASPH	none	MINOR	$579,000		Add 3 barrels to existing.
NW12_1	Railroad 1	44' wide	44' wide	BRIDGE	10	RAILROAD	none	none	$377,000		
	Pedestrian	44' wide	44' wide	BRIDGE	8	CONC	none	none	$308,000		
	Power Station	2 - 36-inch RCP	44' wide	BRIDGE	48	ASPH	none	none	$845,000		
	Dona Ana County Rd.	2 - 36-inch RCP	44' wide	BRIDGE	111	ASPH	none	none	$1,688,000		
	Railroad 2	No existing information	44' wide	BRIDGE	60	RAILROAD	none	none	$1,005,000		Bridge is buried.

Table E-3. Summary of Road Crossing Concept Designs (Continued)

Project and Alternative	Location	Material and Dimensions of Existing Crossing	Dimensions of Proposed Crossing	Type	Length (ft)	Road Surface	ROW/ Easement Issues	Utility Relocation	Total Cost	Preferred Alternative	Comments
NW12_2	Railroad 1	44' wide	48' wide	BRIDGE	10	RAILROAD	none	none	$393,000	X	
	Pedestrian	44' wide	48' wide	BRIDGE	8	CONC	none	none	$318,000		
	Power Station	2 - 36-inch RCP	4 - 6' x 5'	CBC	48	ASPH	none	none	$427,000		
	Dona Ana County Rd.	2 - 36-inch RCP	4 - 7' x 7'	CBC	111	ASPH	none	none	$1,017,000		
	Railroad 2	No existing information	48' wide	BRIDGE	60	RAILROAD	none	none	$1,078,000		Bridge is buried.
NW15_1	River Bend Dr.	3 - 48-inch RCP	2 - 8' x 6'	CBC	66	ASPH	none	none	$242,000	X	
	Railroad Tracks	18.3' wide	44' wide	BRIDGE	8.5	RAILROAD	none	none	$149,000		
NW17_1	Train Tracks	1 - 24-inch CMP	2 - 10' x 5'	CBC	178	CONC	none	MAJOR	$1,098,000	X	
	Mulberry	1 - 36-inch CMP	2 - 10' x 5'	CBC	75	ASPH	none	MINOR	$321,000		
	Lindbergh	1 - 36-inch CMP	2 - 10' x 5'	CBC	59	ASPH	none	MINOR	$253,000		
	Country Club 2	No existing information	2 - 10' x 5'	CBC	90	ASPH	none	MINOR	$385,000		Existing culvert collapsed.
	Country Club 1	No existing information	2 - 10' x 5'	CBC	70	ASPH	none	MINOR	$300,000		Existing culvert collapsed.
	Lombardy	1 - 48-inch RCP	2 - 12' x 6'	CBC	88	ASPH	none	MINOR	$524,000		
	Sunset	1 - 48-inch RCP	2 - 12' x 6'	CBC	73	ASPH	none	MINOR	$434,000		
	Montoya Dr.	1 - 18-inch CMP	2 - 10' x 7'	CBC	64	ASPH	none	MAJOR	$499,000		
NW19_1	Turnstone	64' wide	64' wide	BRIDGE	50	ASPH	none	MAJOR	$1,310,000		
	Pedestrian	59' wide	60' wide	BRIDGE	5	ASPH	none	none	$95,000		
	Frontera	45' wide	45' wide	BRIDGE	32	ASPH	none	MAJOR	$582,000		
NW19_2	Turnstone	64' wide	73' wide	BRIDGE	50	ASPH	none	MAJOR	$1,490,000		
	Pedestrian	59' wide	73' wide	BRIDGE	5	ASPH	none	none	$110,000		
	Frontera	45' wide	73' wide	BRIDGE	32	ASPH	none	MAJOR	$940,000		
NW21_1	840 ft US of Dona Ana County Rd.	1 - 96-inch CMP	4 - 12' x 6'	CBC	74	none	none	none	$768,000		
	Sunland Park	1 - 72-inch CMP	3 - 16' x 6'	CBC	140	ASPH	none	MINOR	$1,666,000		
	Unknown (before outlet)	3 - 5' x 5' CBC	4 - 12' x 6'	CBC	45	ASPH	none	none	$488,000		
NW21_2	840 ft US of Dona Ana County Rd.	1 - 96-inch CMP	4 - 12' x 6'	CBC	74	none	none	none	$768,000	X	
	Sunland Park	1 - 72-inch CMP	3 - 16' x 6'	CBC	140	ASPH	none	MINOR	$1,666,000		
	Unknown (before outlet)	3 - 5' x 5' CBC	4 - 12' x 6'	CBC	45	ASPH	none	none	$488,000		
NW22_1	Northwestern	1 - 23' x 9' ARCH	2 - 12' x 10'	CBC	126	ASPH	none	none	$1,121,000		
NW24_1	Westwind Dr.	1 - 9' x 8' CBC	3 - 9' x 8'	CBC	161	ASPH	none	MINOR	$970,000	X	Add 2 barrels to existing.
	Loma De Cristo Dr.	1 - 9' x 9' CBC	2 - 9' x 9'	CBC	88	ASPH	none	MINOR	$295,000		Add 1 barrel to existing.
	Via Descanso	2 - 6' x 4' CBC	3 - 6' x 4'	CBC	98	ASPH	none	MINOR	$102,000		Add 1 barrel to existing.
NW24_2	Via Descanso	2 - 6' x 4' CBC	3 - 6' x 4'	CBC	98	ASPH	none	MINOR	$102,000		Add 1 barrel to existing.
NW25_1	Mesa	2 - 4' x 4' CBC	3 - 6' x 6'	CBC	484	ASPH	none	MINOR	$2,216,000		
	Resler	2 - 48-inch RCP	4 - 48-inch	RCP	1677	ASPH	MINOR	MAJOR	$1,675,000		Add 2 barrels to existing.
	Westwind Dr.	1 - 30-inch RCP & 1 - 36-inch RCP	1 - 6' x 5'	CBC	95	ASPH	none	MINOR	$123,000		
	El Puente	2 - 42-inch RCP	2 - 6' x 4'	CBC	164	ASPH	none	none	$399,000		
	Northwind	1 - 54-inch RCP	2 - 5' x 5'	CBC	172	ASPH	none	none	$344,000		
NW25_2	Mesa	2 - 4' x 4' CBC	5 - 4' x 4'	CBC	484	ASPH	none	MINOR	$1,056,000		Add 3 barrels to existing.
	Resler Dr.	2 - 48-inch RCP	3 - 48-inch	RCP	1677	ASPH	MINOR	MAJOR	$1,362,000		Add 1 barrel to existing.
	Westwind Dr.	1 - 30-inch RCP & 1 - 36-inch RCP	1 - 5' x 5'	CBC	95	ASPH	none	MINOR	$100,000		
NW25_3	Westwind Dr.	1 - 30-inch RCP & 1 - 36-inch RCP	1 - 6' x 5'	CBC	95	ASPH	none	MINOR	$123,000	X	
	Northwind	1 - 54-inch RCP	2 - 5' x 5'	CBC	172	ASPH	none	none	$344,000		
	Resler Dr.	2 - 48-inch RCP	3 - 48-inch	RCP	1677	ASPH	MINOR	MAJOR	$1,362,000		Add 1 barrel to existing.
	Mesa	2 - 4' x 4' CBC	5 - 4' x 4'	CBC	484	ASPH	none	MINOR	$1,056,000		Add 3 barrels to existing.
NW26_1	Mesa	1 - 6' x 4' CBC	2 - 8' x 6'	CBC	478	ASPH	none	MINOR	$1,900,000	X	
NW32_1	Kiely Road	2 - 30-inch RCP	6 - 30-inch RCP	RCP	47	ASPH	none	none	$35,000		Add 4 barrels to existing culvert.
	Iron Drive	3 - 30-inch RCP	6 - 30-inch RCP	RCP	38	ASPH	none	none	$20,000		Add 3 barrels to existing culvert.

Table E-3. Summary of Road Crossing Concept Designs (Continued)

Project and Alternative	Location	Material and Dimensions of Existing Crossing	Dimensions of Proposed Crossing	Type	Length (ft)	Road Surface	ROW/ Easement Issues	Utility Relocation	Total Cost	Preferred Alternative	Comments
NW32_2	Kiely Road	2 - 30-inch RCP	5 - 7' x 4'	CBC	47	ASPH	none	none	$256,000		
	Iron Drive	3 - 30-inch RCP	6 - 6' x 6'	CBC	38	ASPH	none	none	$311,000		
	Railroad 1	1 - 48-inch CMP	33' wide	BRIDGE	76	RAILROAD	none	none	$758,000		
	Railroad 2	1 - 24-inch CMP	33' wide	BRIDGE	72	RAILROAD	none	none	$719,000		
	Railroad 3	1 - 48-inch x 30-inch Ellipse	4 - 6' x 5'	CBC	128	RAILROAD	none	none	$628,000		
	Railroad 4	2 - 30-inch CMP	5 - 5' x 5'	CBC	61	RAILROAD	none	none	$314,000		
NW32_3	Kiely Road	2 - 30-inch RCP	5 - 7' x 4'	CBC	47	ASPH	none	none	$256,000	X	
	Iron Drive	3 - 30-inch RCP	6 - 6' x 6'	CBC	38	ASPH	none	none	$311,000		
NW33_1	Railroad	42' wide	84' wide	BRIDGE	18.5	RAILROAD	none	none	$620,000	X	
	A P Ramirez Street	4 - 36-inch RCP	110' wide	BRIDGE	40	ASPH	none	none	$1,410,000		
	Doniphan Drive	2 - 6' x 6' CBC	56' wide	BRIDGE	70	ASPH	none	none	$1,259,000		
NW35_2	IH-10 Off-Ramp	13 - 9' x 5' CBC	16 - 9' x 5'	CBC	38.5	ASPH	none	none	$199,000	X	Add 3 barrels to existing culvert.
	Kiely Road	2 - 8' x 3' CBC	58' wide	BRIDGE	42	ASPH	none	none	$731,000		
	Vinton Road	Low-water crossing	58' wide	BRIDGE	42	ASPH	none	none	$731,000		
	Quejette Road	Low-water crossing	58' wide	BRIDGE	40	ASPH	none	none	$696,000		
WC1_1	Zenith Drive	1 - 72-inch CMP	2 - 12' x 7'	CBC	82	ASPH	none	none	$514,000		
WC2_1	Paisano Drive	44' wide	50' wide	BRIDGE	186	ASPH	none	none	$2,782,000	X	Coordinate with TxDOT to be constructed as part of the Border Hwy project.
WC6_1	Mesa Street	2 - 4' x 4' CBC	8 - 4' x 4'	CBC	770	ASPH	MAJOR	MINOR	$7,246,000		Add 6 barrels to existing culvert.
	Wallington	1 - 63-inch x 98-inch Ellipse	3 - 10' x 8'	CBC	60	ASPH	none	MINOR	$588,000		
WC6_2	Mesa Street	2 - 4' x 4' CBC	8 - 4' x 4'	CBC	770	ASPH	MAJOR	MINOR	$7,246,000	X	Add 6 barrels to existing culvert.
WC7_1	Paisano Drive	13' wide	40' wide	BRIDGE	150	ASPH	none	none	$1,871,000	X	Coordinate with TxDOT to be constructed as part of the Border Hwy project.
WC8_1	University Avenue	1 - 141.8-inch x 91.3-inch	3 - 7' x 7'	CBC	86	ASPH	none	none	$509,000	X	
	Oregon Street	2 - 84-inch CMP	4 - 9' x 9'	CBC	71	ASPH	none	none	$873,000		
WC8_2	Campbell Street	2 - 72-inch CMP	2 - 10' x 9'	CBC	71	ASPH	none	none	$472,000		
	Kansas Street	2 - 10' x 5' CBC	2 - 9' x 9'	CBC	52	ASPH	none	none	$109,000		
	Mesa/Stanton Streets	2 - 12.5' x 5.5' CBC	3 - 8' x 7'	CBC	400	ASPH	none	none	$1,035,000		
	Oregon Street	2 - 84-inch CMP	2 - 7' x 7'	CBC	71	ASPH	none	none	$114,000		
WC9_1	US Paisano Drive	6 - 8' x 3' CBC	10 - 12' x 4'	CBC	42	ASPH	none	none	$786,000	X	Coordinate with TxDOT to be constructed as part of the Border Hwy project.
	Paisano Drive	4 - 7' x 7' CBC	5 - 7' x 7'	CBC	182	ASPH	none	none	$340,000		Coordinate with TxDOT to be constructed as part of the Border Hwy project. Add 1 barrel to existing culvert.
	DS Paisano Drive	4 - 6' x 4' CBC	6 - 12' x 6'	CBC	43	ASPH	none	none	$700,000		Coordinate with TxDOT to be constructed as part of the Border Hwy project.
EA1 Ph I	Edgemere Boulevard at Airway Boulevard	1 - 7' x 4' CBC	2 - 8' x 4'	CBC	120	CONC	none	MAJOR	$488,000	X	
	Edgemere Boulevard at Robert E. Lee Road	1 - 8' x 4' CBC	2 - 8' x 4'	CBC	165	CONC	none	MAJOR	$669,000	X	
	Robert E. Lee Road at Railroad Crossing	1 - 92.4-inch x 65-inch ARCH	NA	NA	60	CONC	none	MAJOR	$26,000	X	Current crossing is a french drain that will be removed and the channel connected.
EA3 Ph I	Lorne Channel at Lorne Road	1 - 8' x 2' CBC	1 - 10' x 3'	CBC	80	CONC	none	MAJOR	$154,000	X	
EA8 Ph I	Bluff Channel at Esther Lama Drive	1 - 10' x 5' CBC	3 - 10' x 5'	CBC	115	CONC	none	MAJOR	$1,081,000	X	

Table E-4. Summary of Basin Concept Designs

Project and Alternative	Location	Footprint Area (Acres)	Depth of Excavation (ft)	Total Capacity of Basin (Ac-ft)	Volume of Excavation Required (Ac-Ft)	Embankment Height (ft)	Outlet Structure	Property Cost	Total Cost	Preferred Alternative	Comments
CE1_1	Austin High Pond	2.5	5	9	9	0	none	$348,345	$635,000	X	
CE3_1	Saipan Reservoir	6.4	10	60	65	0	Cost included in Pump Stations	$0	$2,130,000		
CE3_2	Saipan Reservoir	6.4	10	60	65	0	Cost included in Pump Stations	$0	$2,130,000	X	
CE6_1	Copia Reservoir	2.3	15	23	23.6	0	Cost included in Storm Drains	$36,000	$807,000		
CE6_1	Magnolia Reservoir	1.4	Sediment Removal	4 to 6	4	0	Existing Storm Drains will be utilized	$0	$131,000		
CE6_2	Copia Reservoir	2.3	15	23	23.6	0	Cost included in Storm Drains	$36,000	$807,000		
CE6_2	Magnolia Reservoir	1.4	Sediment Removal	4 to 6	4	0	Existing Storm Drains will be utilized	$0	$131,000		
CE6_2	Piedras St. RR Pond	5.7	20	83.8	84	0	Cost included in Storm Drains	$1,820,000	$4,558,000		
CE6_3	Copia Reservoir	2.3	15	23	23.6	0	Cost included in Storm Drains	$36,000	$807,000		
CE6_3	Magnolia Reservoir	1.4	Sediment Removal	4 to 6	4	0	Existing Storm Drains will be utilized	$0	$131,000		
CE6_3	Piedras St. RR Pond	5.7	20	83.8	84	0	Cost included in Storm Drains	$1,820,000	$4,558,000		
CE6_4	Copia Reservoir	2.3	15	23	23.6	0	Cost included in Storm Drains	$36,000	$807,000		
CE6_4	Magnolia Reservoir	1.4	Sediment Removal	4 to 6	4	0	Existing Storm Drains will be utilized	$0	$131,000		
CE6_4	Piedras St. RR Pond	5.7	20	83.8	84	0	Cost included in Storm Drains	$1,820,000	$4,558,000		
CE6_5 Ph I	Copia Reservoir	2.3	15	23	23.6	0	Cost included in Storm Drains	$36,000	$807,000	X	
CE6_5 Ph I	Magnolia Reservoir	1.4	Sediment Removal	4 to 6	4	0	Existing Storm Drains will be utilized	$0	$131,000	X	
CE6_5 Ph III	Piedras St. RR Pond	5.7	20	83.8	84	0	Cost included in Storm Drains	$1,820,000	$4,558,000	X	
CE11_1	Citrus Place Pond	6.4	20	45		0	Cost included in Storm Drains	$0	$4,912,000		
CE11_2	Citrus Place Pond and Mills Ave. RR Pond	N/A	20	45	N/A	0	Cost included in Storm Drains	$0	$7,335,000		
MV8 Ph I	Basin B	24.8	2	50	50	0	Cost included in Pump Stations	$0	$1,634,000	X	
MV3	Feather Lake II property	19.8	15	195	237	0	Automated Gates (Cost included elsewhere)	$0	$7,755,000	X	
MV4	Middle Drain Interceptor	9.4	20	115	173	0	Automated Gates (Cost included elsewhere)	$1,806,000	$7,458,000	X	
MV5 Ph I	Basin G	15.4	N/A	55	154	0	Cost included in Pump Stations	$0	$5,044,000	X	
MV10	Basin C	18.4	5	30	60	0	Cost included in Pump Stations	$0	$1,960,000	X	
NE5_1	West of US 54	8.1	20	225	262	3	50 ft - 30-inch Concrete Pressure Pipe	$0	$9,270,000		
NE5_2	West of US 54	4.2	9	50	69	3	50 ft - 30-inch Concrete Pressure Pipe	$0	$2,836,000	X	
NE5_2b	East of US 54	2.5	20	50	50	0	none	$948,000	$2,582,000		
NE5_4b	Museum Area	3.6	9	40	49	3	50 ft - 30-inch Concrete Pressure Pipe	$72,000	$2,137,000		
NE10/NE9_1 Ph I	Basin 3	7.2	4	26	26	0	Cost included in Storm Drains	$2,341,000	$3,194,000		
NE10/NE9_1 Ph II	Basin 2	1.5	10	10.4	10.4	0	Cost included in Storm Drains	$765,000	$5,705,000		
NE10/NE9_1 Ph III	Basin 1	10.6	20	215	205	0	Cost included in Storm Drains	$1,967,000	$8,664,000		
NE10/NE9_1 Ph IV	Basin 4	5.2	10	50	50	0	Cost included in Storm Drains	$273,000	$23,795,000		
NE14_1	Clearview Debris	2.8	8	20	45	0	none	$11,000	$1,481,000	X	
NE14_2	Clearview Debris and Detention	6	14	84	128	0	none	$23,000	$4,189,000		
NE16_1	Johnson Channel	1	16	13.5	13	0	none	$82,000	$521,000	X	
NW5_1	East of Westside Masterplan	6.0	N/A	38.8	93.1	6.5	none	$0	$3,092,000	X	Developer's responsibility
NW5_2	East of Westside Masterplan	15.9	N/A	318.5	353.6	20	90 ft - 30-inch Concrete Pressure Pipe	$0	$12,635,000		Developer's responsibility
NW6_2	East of Franklin Hills St.	4.4	N/A	69.8	37.3	16	none	$1,657,000	$3,988,000		
NW7_2	East of Franklin Hills St.	8.5	6.7	110.0	206.1	5	none	$126,000	$7,266,000		
NW12_1	400 ft NE of Dona Ana County Rd.	0.9	N/A	1.8	0.9	2	none	$78,000	$129,000		
NW12_2	400 ft NE of Dona Ana County Rd.	0.9	N/A	1.8	0.9	2	none	$78,000	$129,000	X	
NW22_2	South of Loop 375	20.7	N/A	248.0	264.9	12	60 ft - 18-inch Concrete Pressure Pipe	$577,000	$9,995,000	X	Developer's responsibility
NW24_1	Northeast of Via Descanso	1.2	N/A	9.6	4.5	8	none	$60,000	$581,000	X	Developer's responsibility
NW24_2	Northeast of Via Descanso	5.2	N/A	101.8	82.1	19.5	88 ft - 30-inch Concrete Pressure Pipe	$60,000	$3,399,000		
NW25_2	North of Satellite Dr.	1.3	N/A	11.9	10.2	9	none	$929,000	$1,509,000		
	Intersection of Cloudview Dr. & El Puente St.	1.2	N/A	24.1	4.0	21	none	$10,000	$142,000		
NW25_3	Intersection of Cloudview Dr. & El Puente St.	1.2	N/A	24.1	4.0	21	none	$10,000	$142,000	X	

Table E-4. Summary of Basin Concept Designs (Continued)

Project and Alternative	Location	Footprint Area (Acres)	Depth of Excavation (ft)	Total Capacity of Basin (Ac-ft)	Volume of Excavation Required (Ac-Ft)	Embankment Height (ft)	Outlet Structure	Property Cost	Total Cost	Preferred Alternative	Comments
NW28_1	Existing basin E of Thunderbird Dr and Torrey Pines Dr	1.2	9.8	23.9	20.17	10.0	none	$0	$659,000	X	
NW29_1	US of Silver springs and Castlerock	4.0	N/A	60.3	28.52	15.0	75 ft - 30-inch Concrete Pressure Pipe	$489,414	$4,905,000	X	
NW30_1	Intersection of Mesa Hills and Double Tree	2.2	4.7	16.1	14.9	7.5	none	$34,000	$521,000	X	Cost to be provided by EPWU.
NW31_1	E of Remington Dr	1.7	N/A	10.3	7.43	6.0	none	$114,000	$417,000		
NW31_2	Confluence of Flow Path No. 45 and Flow Path No. 45B	22.0	N/A	528.9	380.2	24.0	106 ft - 54-inch Concrete Pressure Pipe	$0	$13,868,000	X	Basins may also be constructed as part of NW34_2.
	S of Westway Blvd	16.5	N/A	378.8	200.2	23.0	102 ft - 54-inch Concrete Pressure Pipe	$0	$7,765,000		
NW32_1	E of Lovena Way	14.2	N/A	212.6	159.6	15.0	70 ft - 18-inch Concrete Pressure Pipe	$270,000	$6,515,000		
NW34_1	Confluence of Flow Path No. 45 and Flow Path No. 45B	23.0	N/A	573.9	441.2	25.0	110 ft - 54-inch Concrete Pressure Pipe	$0	$15,991,000		
	S of Westway Blvd	25.8	N/A	619.8	484.3	24.0	106 ft - 54-inch Concrete Pressure Pipe	$0	$17,379,000		
NW34_3	Confluence of Flow Path No. 45 and Flow Path No. 45B	10.3	N/A	134.3	142.9	13.0	none	$0	$5,248,000		
	S of Westway Blvd	9.6	N/A	135.0	101.2	14.0	none	$0	$3,947,000		
NW35_1	DS of De Alva	37.3	N/A	895.3	662.52	24.0	106 ft - 54-inch Concrete Pressure Pipe	$1,865,000	$25,934,000		
WC1_1	N of Zentith Dr	1.6	N/A	9.4	5.1	6.0	36 ft - 36-inch Concrete Pressure Pipe	$78,000	$297,000		Developer Responsibility
	NW of Stanton Dr	0.9	N/A	6.1	2.93	7.0	38 ft - 18-inch Concrete Pressure Pipe	$44,000	$176,000		Developer Responsibility
WC1_2	N of Zentith Dr	5.4	N/A	108.3	53.23	20.0	none	$271,000	$2,476,000	X	Developer Responsibility
	NW of Stanton Dr	3.7	N/A	56.0	42.8	15.0	75 ft - 18-inch Concrete Pressure Pipe	$187,000	$1,903,000		Developer Responsibility
WC3_1	E of Crimson Cloud Ln and Stanton St	1.7	N/A	8.7	17.1	5.0	35 ft - 54-inch Concrete Pressure Pipe	$87,000	$687,000	X	Developer Responsibility
WC4_1	E of Stanton St and Buckingham Dr	0.8	N/A	3.2	4.5	4.0	none	$222,000	$375,000	X	Developer Responsibility
WC8_1	DS of Robinson Ave and Kingery Dr	2.6	N/A	31.0	14.37	12.0	none	$0	$569,000	X	
WC8_2	DS of Robinson Ave and Kingery Dr	7.7	7.5	173.6	174.43	22.5	100 ft - 18-inch Concrete Pressure Pipe	$0	$6,504,000		
EA2	Sunmount Channel at Upstream Viscount Boulevard	2	10	20	20	0	none	$0	$653,000	X	
EA5	Eastwood/Album Park Pond	4.25	20	85	85	0	none	$0	$2,777,000	X	
EA9 Ph I	RV Channel at Upstream Paseo Del Este Boulevard	5.5	15	80	80	0	none	$3,155,850	$5,769,000	X	
EA10 Ph I	Mercantile Channel at Upstream Paseo Del Este Boulevard	9.5	15	140	140	0	none	$67,766	$4,642,000	X	

Table E-5. Summary of Pump Station Concept Designs

Project and Alternative	Location	New Pump Station or Expansion of Existing Pump Station	Existing Pump Station Capacity (cfs)	Proposed Pump Station Capacity Increase		Unit Cost ($/gpm)	Total Cost	Preferred Alternative	Comments
				cfs	gpm				
CE3_1	Saipan	New	0	20	9000	151	$1,831,000		
CE3_2	Saipan	New	0	20	9000	151	$1,831,000	X	
CE6_1	Magnolia Pond	New	0	293	131500	65	$11,544,000		
CE6_2	Cebada System	New	0	293	131500	68	$12,077,000		
CE6_2	RR Pond	New	0	355	159300	65	$13,987,000		
CE6_3	Cebada System	New	0	293	131500	68	$12,077,000		
CE6_3	RR Pond	New	0	255	114400	75	$11,593,000		
CE6_4	Cebada System	New	0	646	289900	55	$21,537,000		
CE6_4	RR Pond	New	0	425	190700	60	$15,457,000		
CE6_5 Ph II	RR Pond	New	0	425	190700	60	$15,457,000	X	
CE11_3	Dallas Pump Station	New	0	380	170500	60	$13,820,000		
CE11_4	Dallas Pump Station	New	0	115	51600	80	$5,573,000		
CE11_5 Ph I	Dallas Pump Station	New	0	115	51600	80	$5,573,000	X	
CE11_5 Ph II	Dallas Pump Station	Expansion	115	255	114500	50	$7,728,000	X	
MV3	Feather Lake II	New	0	25	11200	151	$2,287,000	X	
MV4	Middle Drain Interceptor	New	0	25	11200	151	$2,287,000	X	
MV5 Ph II	Basin G	New	N/A	820	368000	60	$29,809,000	X	Assumed new pump station would be constructed.
MV7	Basin A	New	390	525	235600	60	$19,076,000	X	CH2MHill design and URS cost.
MV8 Ph I	Basin B	New	0	165	74100	75	$7,498,000	X	
MV8 Ph II	Basin B	Expansion	165	165	74100	52	$5,198,000	X	
MV10	Basin C	New	0	160	71800	75	$7,271,000	X	
NE9/NE10_1 Ph IV	Threadgill	New	0	10	4500	200	$1,212,000		

This page was intentionally left blank.

Table E-6. Summary of Storm Drain/Force Main Concept Designs

Project and Alternative	Location	Existing Structure Dimensions	Proposed Dimensions	Type	Length (ft)	Total Cost	Preferred Alternative	Comments
CE3_1	Saipan Entering	none	1-48-inch	RCP	1654	$826,000		
	Saipan Entering	none	1-54-inch	RCP	514	$719,000		
	Saipan Entering	none	1-60-inch	RCP	89	$128,000		
	Saipan Entering	none	1-48-inch	RCP	983	$341,000		
CE3_2	Saipan Entering	none	1-48-inch	RCP	1654	$826,000	X	
	Saipan Entering	none	1-54-inch	RCP	514	$719,000	X	
	Saipan Entering	none	1-60-inch	RCP	89	$128,000	X	
	Saipan Entering	none	1-48-inch	RCP	983	$341,000	X	
CE6_1	Copia Entering	none	2 - 5' x 5'	CBC	580	$2,842,000		
	Copia Discharge	none	1 - 36-inch	RCP	520	$260,000		
	Magnolia System	none	1 - 4.5' x 3.5'	CBC	2341	$4,210,000		
	RR Pond Discharge	none	1 - 42-inch	RCP	5941	$2,968,000		
CE6_2	Copia Entering	none	2 - 5' x 5'	CBC	580	$2,842,000		
	Copia Discharge	none	1 - 36-inch	RCP	520	$260,000		
	Cebada System	none	1 - 42-inch	RCP	2305	$1,151,000		
	Magnolia System	none	1 - 5' x 3.5'	CBC	2341	$5,262,000		
	RR Pond Discharge	none	1 - 48-inch	RCP	5941	$2,968,000		
CE6_3	Copia Entering	none	2 - 5' x 5'	CBC	580	$2,842,000		
	Copia Discharge	none	1 - 36-inch	RCP	520	$260,000		
	Cebada System	none	1 - 42-inch	RCP	2305	$1,151,000		
	Magnolia System	none	1 - 5' x 4.5'	CBC	2341	$8,068,000		
	RR Pond Discharge	none	1 - 42-inch	RCP	5941	$2,968,000		
CE6_4	Copia Entering	none	2 - 5' x 5'	CBC	580	$2,842,000		
	Copia Discharge	none	1 - 36-inch	RCP	520	$260,000		
	Cebada System	none	1 - 54-inch	RCP	2304	$3,224,000		
	Magnolia System	none	1- 5' x 4'	CBC	2341	$6,314,000		
	RR Pond Discharge	none	1 - 48-inch	RCP	5941	$2,968,000		
CE6_5 Ph I	Copia Entering	none	2 - 5' x 5'	CBC	580	$2,842,000	X	
	Copia Discharge	none	1 - 36-inch	RCP	520	$260,000	X	
CE6_5 Ph II	Magnolia System	none	1- 5' x 4'	CBC	2341	$6,314,000	X	
	RR Pond Discharge	none	1 - 48-inch	RCP	5941	$2,968,000	X	
CE11_3	North Segment 1	1 - 7' x 5' CBC	1 - 42-inch	RCP	4800	$2,479,000		

Table E-6. Summary of Storm Drain/Force Main Concept Designs (Continued)

Project and Alternative	Location	Existing Structure Dimensions	Proposed Dimensions	Type	Length (ft)	Total Cost	Preferred Alternative	Comments
CE11_4	North Segment 1	none	1 - 36-inch	RCP	4800	$2,398,000		
	North Segment 2	none	1 - 7' x 5'	CBC	2500	$11,239,000		
CE11_5 Ph I	North Segment 1	none	1 - 36-inch	RCP	4800	$2,398,000	X	
	North Segment 2	none	1- 7' x 5'	CBC	2500	$11,239,000	X	
MV5	Basin G Pump Conduit	none	6 - 72-inch	RCP	668	$2,197,000	X	
MV6	Alameda Storm Drain	none	2 - 6' x 5'	CBC	8750	$42,879,000	X	
MV8 Ph I	Basin B Pump Conduit	none	1 - 72-inch	RCP	590	$825,000	X	
MV8 Ph II	Basin B Pump Conduit	none	1 - 72-inch	RCP	590	$825,000	X	
MV10	Basin C Pump Conduit	none	1 - 72-inch	RCP	770	$1,077,000	X	
NE10/NE9_1 Ph I	Into Basin 3	none	1 - 5' x 5'	CBC	1275	$5,732,000		
	Basin 3 to Threadgill	none	1 - 3' x 2'	CBC	300	$495,000		
NE10/NE9_1 Ph II	Into Basin 2	none	1 - 5' x 5'	CBC	386	$1,735,000		
	Basin 2 to Threadgill	none	1 - 3' x 2'	CBC	2010	$3,313,000		
NE10/NE9_1 Ph III	Basin 1 to Threadgill	none	1 - 3' x 2'	CBC	3341	$5,507,000		
NE10/NE9_1 Ph II	Into Basin 4	none	1 - 5' x 5'	CBC	386	$1,735,000		
	Basin 4 to Threadgill	none	1 - 3' x 2'	CBC	2010	$3,313,000		
NW27_1	Pump Station 14 to Pump Station 13	Unknown	1 - 72-inch	RCP	7775	$10,874,000		
	Pump Station 13 to Outlet Rio Grande	Unknown	1 - 48-inch	RCP	140	$70,000		
NW27_2	Pump Station 14 to Doniphan Ditch	Unknown	1 - 36-inch	RCP	334	$167,000	X	
	Pump Station 13 to Doniphan Ditch	Unknown	1 - 42-inch	RCP	131	$65,000		
NW31_3	Remington to IH-10	none	1 - 60-inch	RCP	4530	$6,539,000		
WC1_1	Castellano Drive	none	2 - 33' x 5'	CBC	2040	$22,721,000		
WC8_1	Campbell to Mesa	none	2 - 29' x 7'	CBC	1375	$18,841,000	X	
EA1 Ph II	Cielo Vista Drive	none	1 - 48-inch	RCP	1370	$1,026,000	X	
	Cielo Vista Drive	none	1 - 60-inch	RCP	2275	$2,159,000	X	
	Catalina Way	none	1 - 8' x 4'	CBC	1470	$3,304,000	X	
EA3 Ph II	Wexford Drive & Dungarvan Drive	none	1 - 30-inch	RCP	550	$275,000	X	
	Cardigan Drive & Darin Road	none	1 - 36-inch	RCP	1240	$681,000	X	
	Kinross Avenue, Darin Road, Shannon Place & Limerick Road	none	1 - 48-inch	RCP	2080	$1,558,000	X	
	Shannon Place & Limerick Road	none	1 - 8' x 3'	CBC	680	$1,528,000	X	

Table E-6. Summary of Storm Drain/Force Main Concept Designs (Continued)

Project and Alternative	Location	Existing Structure Dimensions	Proposed Dimensions	Type	Length (ft)	Total Cost	Preferred Alternative	Comments
EA4 Ph I	McRae Boulevard & Wedgewood Drive	1 - 18-inch RCP, 1 - 24-inch RCP, 1 - 30-inch RCP	1 - 48-inch	RCP	2085	$1,562,000	X	
	McRae Boulevard	1 - 36-inch RCP	1 - 60-inch	RCP	2420	$2,297,000	X	
	Wedgewood Drive	1 - 36-inch RCP, 1 - 42-inch RCP	1 - 8' x 5'	CBC	900	$2,158,000	X	
	McRae Boulevard	3 - 36-inch RCP	1 - 9' x 5'	CBC	1200	$3,057,000	X	
EA4 Ph II	Everwood Street & Gum Lane	none	1 - 30-inch	RCP	335	$167,000	X	
	Garwood Court, Sugarberry Drive, Hemlock Street & Bois D Arc Drive	none	1 - 36-inch	RCP	1370	$753,000	X	
	Springwood Dive	none	1 - 48-inch	RCP	920	$689,000	X	
	Sugarberry Drive	none	1 - 54-inch	RCP	750	$599,000	X	
	Springwood Drive	none	1 - 60-inch	RCP	1000	$949,000	X	
EA5	Wedgewood Drive	none	1 - 54-inch	RCP	2700	$2,158,000	X	
	Ballymote Drive & Zanzibar Road	none	1 - 66-inch	RCP	3875	$4,065,000	X	
EA6 Ph I	Sam Snead Drive & Bert Yancey Drive	none	1 - 48-inch	RCP	1300	$974,000	X	
	Lee Trevino Drive & Sam Snead Drive	none	1 - 60-inch	RCP	3300	$3,132,000	X	
	Octubre Drive & Frank Beard Drive	none	1 - 66-inch	RCP	4000	$4,196,000	X	
	Sam Snead Drive	none	1 - 7' x 4'	CBC	330	$643,000	X	
	Sam Snead Drive	none	1 - 9' x 5'	CBC	800	$2,398,000	X	
	Sam Snead Drive	none	1 - 10' x 5'	CBC	1350	$4,248,000	X	
EA6 Ph II	Yarbrough Drive	none	1 - 66-inch	RCP	1870	$1,962,000	X	
	Ashwood Drive to Gran Cima Lane to Pico Norte Park	1 - 60-inch RCP	1 - 9' x 5'	CBC	2800	$8,392,000	X	
EA6 Ph III	Pebble Hills Boulevard	none	1 - 60-inch	RCP	1350	$1,281,000	X	
	Eads Place	none	1 - 7' x 4'	CBC	2000	$3,896,000	X	

Table E-6. Summary of Storm Drain/Force Main Concept Designs (Continued)

Project and Alternative	Location	Existing Structure Dimensions	Proposed Dimensions	Type	Length (ft)	Total Cost	Preferred Alternative	Comments
EA6 Ph IV	Ivanhoe Drive	none	1 - 54-inch	RCP	2000	$1,598,000	X	
	Pebble Hills Boulevard	none	1 - 66-inch	RCP	670	$703,000	X	
	Gaston Drive	none	1 - 7' x 4'	CBC	2000	$3,896,000	X	
EA6 Ph V	Bywood Drive	none	1 - 48-inch	RCP	1600	$1,199,000	X	
	Bywood Drive	none	1 - 60-inch	RCP	1600	$1,518,000	X	
EA7 Ph I	Lee Trevino Drive & Pellicano Drive	none	1 - 36-inch	RCP	2350	$1,291,000	X	
	Cedar Oak Drive, Wilkinson Drive, Allen Bradley Drive, James Watt Drive & Bessemer Drive	2 - 42-inch RCP	1 - 48-inch, 2 - 48-inch	RCP	6650	$4,983,000	X	
	Bessemer Drive	none	1 - 60-inch	RCP	500	$475,000	X	
	Lee Trevino Drive	2 - 48-inch RCP	1 - 10' x 4'	CBC	1500	$4,496,000	X	
EA7 Ph II	Lee Trevino Drive, Rojas Drive & Gateway Boulevard West	none	1 - 54-inch	RCP	5050	$4,036,000	X	
	Kaiser Drive	1 - 18-inch RCP	1 - 8' x 5'	CBC	1000	$2,398,000	X	
EA7 Ph III	Vista del Sol Drive & Dale Douglas Drive	none	1 - 36-inch	RCP	3700	$2,033,000	X	
	Common Drive	none	1 - 42-inch	RCP	2000	$1,299,000	X	
	Bessemer Drive	none	1 - 48-inch	RCP	1350	$1,011,000	X	
EA8 Ph I	Zaragoza Road & Tie-in to Bluff Channel	2 - 36-inch RCP, 2 - 42-inch RCP, 3 - 48-inch RCP	1 - 48-inch, 4 - 48-inch	RCP	3700	$2,772,000	X	
	Rojas Drive	2 - 36-inch RCP	1 - 60-inch	RCP	1350	$1,281,000	X	

Table E-6. Summary of Storm Drain/Force Main Concept Designs (Continued)

Project and Alternative	Location	Existing Structure Dimensions	Proposed Dimensions	Type	Length (ft)	Total Cost	Preferred Alternative	Comments
EA8 Ph II	Rojas Drive & Henry Brennan Drive	none	1 - 36-inch	RCP	3100	$1,703,000	X	
	George Dieter Drive & Rojas Drive	none	1 - 48-inch	RCP	2950	$2,210,000	X	
	Peter Cooper Drive & Henry Brennan Drive	1 - 18-inch RCP, 1 - 54-inch RCP, 2 - 42-inch RCP, 2 - 36-inch RCP, 1 - 42-inch RCP	1 - 60-inch	RCP	4750	$4,508,000	X	

This page was intentionally left blank.

Table E-7. Summary of Channel Concept Designs

Project and Alternative	Location	Existing Channel Material and Dimensions (ft) [11]	Proposed Channel Material	Proposed Bottom Width (ft)	Proposed Depth (ft)	Side Slopes	Length of Improvements (ft)	Property Cost	Total Cost	Preferred Alternative	Comments
CE6_5 Ph III	Cebada System	none	CONC	11	4	1	2305	$0	$1,649,000	X	
MV5 Ph I	Carl Longuemare to Basin G	EARTH b=14 d=13 z=1.5	EARTH	14	15	1.5	4692	$0	$407,000	X	Re-grading
MV11	North Loop to Center	EARTH b=15 d=10 z=2	EARTH	35	10	2	2949	$0	$401,000	X	
	Lining for Crossings (North Loop to Center)	EARTH b=15 d=10 z=2	CONC	35	10	2	80	$0	$24,000		
	Center to Eastland	EARTH b=15 d=10 z=2	EARTH	35	10	2	8816	$0	$1,198,000		
	Lining for Crossings (Center to Eastland)	EARTH b=15 d=10 z=2	CONC	35	10	2	160	$0	$193,000		
	Eastland to Pendale	EARTH b=15 d=10 z=2	CONC	15	10	2	3416	$0	$2,836,000		
	Pendale to Burgandy	EARTH b=15 d=10 z=2	EARTH	35	10	2	10604	$0	$1,441,000		
	Lining for Crossings (Pendale to Burgandy)	EARTH b=15 d=10 z=2	CONC	35	10	2	140	$0	$169,000		
NE10/NE9_2 Ph I	Alps to Hollings	CONC b=25 d= 4.5 z=2	EARTH	75	4.5	2	2000	$3,423,000	$4,048,000	X	
	Hollings to Hondo Pass	none	EARTH	75	4	2	75	$236,000	$269,000		
NE10/NE9_2 Ph II	Sanders to Wren	CONC b=25 d= 4.5 z=2	CONC	30	4.5	1	1105	$0	$1,074,000		
	Wren to Alps	CONC b=25 d= 4.5 z=2	EARTH	75	4.5	2	2140	$6,613,000	$7,282,000		
NE10/NE9_2 Ph III	Threadgill to Sanders	CONC b=25 d= 4.5 z=2	EARTH	75	4.5	2	1401	$5,069,000	$5,507,000		
NW_8_1	Sunset to 100 ft US of Bird	EARTH b=30 d=3 z=3.3	EARTH	38	3	2	3340	$0	$107,000		Flow Master
	100 ft US of Bird to Bird	EARTH b=30 d=3 z=3.3	CONC	38	3	2	100	$0	$73,000		Flow Master
	50 ft DS of Bird and 100 ft US of Frontera	EARTH b=20 d=3.5 z=3.5	CONC	20	6	2	150	$0	$107,000		Flow Master
	50 ft DS of Bird to 100 ft US of Frontera	EARTH b=20 d=3.5 z=3.5	EARTH	20	6	2	3900	$0	$314,000		Flow Master
	50 ft DS of Frontera and 100 ft US of Sunland Park	EARTH b=19 d=4.5 z=3	CONC	20	6	2	150	$0	$104,000		Flow Master
	50 ft DS of Frontera to 100 ft US of Sunland Park	EARTH b=19 d=4.5 z=3	EARTH	20	6	2	3930	$0	$218,000		Flow Master
	US of Sunset	EARTH b=9 d=1 z=6.5	EARTH	9	2.5	2	1200	$0	$28,000		Flow Master
NW8_2	Sunset to 100 US of Bird	EARTH b=30 d=3 z=3.3	EARTH	38	3	2	3340	$0	$108,000	X	Flow Master
	100 ft US of Bird to Bird	EARTH b=30 d=3 z=3.3	CONC	38	3	2	100	$0	$114,000		Flow Master
	50 ft DS of Bird and 100 ft US of Frontera	EARTH b=20 d=3.5 z=3.5	CONC	25	5.5	2	150	$0	$336,000		Flow Master
	50 ft DS of Bird to 100 ft US of Frontera	EARTH b=20 d=3.5 z=3.5	EARTH	25	5.5	2	3900	$0	$107,000		Flow Master
	50 ft DS of Frontera and 100 ft US of Sunland Park	EARTH b=19 d=4.5 z=3	CONC	24	5.5	2	150	$0	$73,000		Flow Master
	50 ft DS of Frontera to 100 ft US of Sunland Park	EARTH b=19 d=4.5 z=3	EARTH	24	5.5	2	3930	$0	$222,000		Flow Master
	US of Sunset	EARTH b=9 d=1 z=6.5	EARTH	9	2.5	2	1200	$0	$28,000		Flow Master
NW12_1	DS of Dona Ana County Rd.	EARTH b=10 d=3 z=1.7	EARTH	12	8	2	3820	$0	$802,000		Flow Master
	100 ft US and 50 ft DS of each of the 5 crossings.	EARTH b=10 d=3 z=1.7	CONC	12	8	2	750	$0	$814,000		Flow Master
NW12_2	DS of Dona Ana County Rd.	EARTH b=10 d=3 z=1.7	EARTH	16	8	2	3820	$0	$935,000	X	Flow Master
	100 ft US and 50 ft DS of each of the 5 crossings.	EARTH b=10 d=3 z=1.7	CONC	16	8	2	750	$0	$895,000		Flow Master
NW13_1	US of White Spur Drain	EARTH b=9 d=1 z=6.5	EARTH	20	4	2	1050	$0	$107,000		Flow Master
NW13_2	US of White Spur Drain	EARTH b=9 d=1 z=6.5	EARTH	30	4	2	1050	$0	$151,000	X	Flow Master
NW14_1	US of Doniphan Dr.	CONC b=6 d=3 z=1.25	CONC	6	3.5	1.25	1290	$0	$758,000	X	Flow Master
NW19_1	White Spur Drain to Frontera Rd.	EARTH b=36 d=6.5 z=1.55	EARTH	45	7	2	6345	$0	$970,000		Flow Master
NW19_2	White Spur Drain to Frontera Rd.	EARTH b=36 d=6.5 z=1.55	EARTH	45	7	2	6345	$0	$1,055,000	X	Flow Master
NW21_1	Frontera Rd. to outlet	EARTH b=35 d=6.5 z=0.4	EARTH	35	7	2	9075	$0	$1,007,000		Flow Master
NW21_2	Frontera Rd. to outlet	EARTH b=35 d=6.5 z=0.4	EARTH	45	7	2	9075	$0	$1,464,000	X	Flow Master
NW22_1	385 ft DS of Rancho Norte Dr.	EARTH b=25 d=10 z=3	CONC	12.5	10	1.5	40	$0	$90,000		Flow Master
NW22_2	385 ft DS of Rancho Norte Dr.	EARTH b=25 d=10 z=3	CONC	12.5	10	1.5	40	$0	$90,000	X	Flow Master
NW31_2	US of Remington	none	EARTH	10	3	2	2240	$55,000	$180,000	X	FlowMaster
NW32_2	Residential Area	EARTH b=0 d=2 z=7	EARTH	15	5	2	950	$165,000	$242,000		FlowMaster
	Lovena to Iron	EARTH b=0 d=2 z=23	EARTH	15	4.5	2	1700	$0	$124,000		FlowMaster
NW32_3	Residential Area	EARTH b=0 d=2 z=7	EARTH	15	5	2	950	$165,000	$242,000	X	FlowMaster
NW34_2	Tom Mays to De Alva	EARTH b=0 d=1.5 z=41	EARTH	30	3	2	1600	$0	$120,000	X	FlowMaster

[1] b=bottom width, d=depth, z=side slopes (H:1)

Table E-7. Summary of Channel Concept Designs (Continued)

Project and Alternative	Location	Existing Channel Material and Dimensions (ft) [11]	Proposed Channel Material	Proposed Bottom Width (ft)	Proposed Depth (ft)	Side Slopes	Length of Improvements (ft)	Property Cost	Total Cost	Preferred Alternative	Comments
NW34_3	Diversion US of Tom Mays to FP44 Trib	none	EARTH	20	12	2	1700	$0	$730,000		FlowMaster
NW35_2	IH-10 to Quejette	EARTH b=2 d=6.7 z=2.85	EARTH	20	9.5	2	2250	$0	$404,000	X	FlowMaster
	Quejette to confluence with FP45A	EARTH b=2 d=4 z=3.7	EARTH	20	9.5	2	1800	$0	$456,000		FlowMaster
WC2_1	650 ft US of IH-10 to Rio Grande	EARTH b =17 d=6 z=3	EARTH	24	9	1.5	900	$0	$141,000	X	FlowMaster. Coordinate with TxDOT to be constructed as part of the Border Hwy project.
WC7_1	US of Paisano to Rio Grande	CONC b=13 d=10 z=0	CONC	20	5	2	800	$33,000	$1,036,000	X	FlowMaster. Coordinate with TxDOT to be constructed as part of the Border Hwy project.
WC8_1	Robinson Road	Asphalt Road	CONC	77.5	NA	NA	130	$0	$133,000	X	Concrete lining of Robinson Road. Calculated using unit cost of concrete per unit length.
WC8_2	Campbell to Mesa	EARTH b=16 d=4 z=0	EARTH	16	6.5	0	1265	$0	$95,000		FlowMaster
EA1 Ph I	Robert E. Lee at Railroad Crossing	none	CONC	4	4	1.5	80	$0	$22,000	X	Remove Existing French Drain
EA3 Ph I	Lorne Channel from Limerick Road to Lorne Road	CONC b=8 d=2 z=1	CONC	10	3	0	1050	$0	$383,000	X	
	Lorne Channel from Lorne Road to Pond	CONC b=3 d=3 z=1	CONC	10	3	0	700	$0	$254,000	X	
EA8 Ph I	Bluff Channel from Rojas Drive to Esther Lama Drive	CONC b=10 d=4 z=1.5	CONC	20	4	1.5	1000	$0	$791,000	X	
EA9 Ph II	RV Channel from Paseo Del Este Boulevard to Pine Springs Drive	EARTH b=50 d=5.17 z=0	CONC	20	4	1	1350	$0	$881,000	X	
	RV Channel from Rojas Drive to RV Drive	EARTH b=50 d=2.83 z=0	CONC	30	4	1	500	$0	$431,000	X	
	RV Channel from RV/Mercantile Channel Junction to IH-10 Bridge Crossing	EARTH b=40 d=2 z=1	CONC	40	2	1	750	$0	$714,000	X	
EA10 Ph II	Mercantile Channel from Paseo Del Este Boulevard to Mercantile Avenue	EARTH b =45.67 d=5 z=0	CONC	20	5	1	2000	$0	$1,424,000	X	

[1] b=bottom width, d=depth, z=side slopes (H:1)

Table E-8. Alternative Costing Table

Project No & Alternative	Issue to be Addressed	Description of Alternative	Component Description	Total Cost (Rounded to $10,000)	Constructability	Maintenance	Reliability	Safety	Aesthetics	Dual Use	Natural Systems	ROW
Government Hills System												
Government Hills Channel (Inlets)												
CE1_1	Multiple street intersections along Government Hills Channel do not have sufficiently sized drainage inlets. Undersized inlets restrict water from entering the channel and contribute to localized flooding at the crossings.	Expand the street inlets at Altura, Hastings, Cambridge and Cumberland to allow street flow to enter the channel without flooding surrounding properties. Also, add Austin High Pond upstream from the channel to decrease the flow entering the street inlets.	Austin High Pond Intersection drain modifications (4) Property acquisition (2 acres) Site #1 (x2)	$ 850,000								
Government Hills Channel (Crossings)												
CE2_1	Multiple culverts along Government Hills Channel are undersized and contribute to channel flooding in localized areas.	Enlarge culverts at Cambridge, Cumberland, Chester and Trowbridge to increase the overall capacity of the Government Hills Channel to convey the 100-year storm.	Culverts Bridges	$ 2,060,000								
Government Hills Outfall												
CE3_1	The Government Hills System consists of a 90in pressurized conduit that outfalls into the Rio Grande. The design capacity is 375 cfs but has been reduced to 50cfs. The reduction in flow is a direct result of multiple tie-ins along the system which cause a drop in pressure and reduce the total capacity of the conduit. Also the water surface elevation of the Rio Grande causes the system to back up and cause flooding at drainage inlets.	The Government Hills System will be modified to reflect as builts conditions. This will enable the system to remain Pressurized from Boone St. Basin to The Rio Grande River. The flow through the 90" conduit will increase from a current capacity of 50 cfs to a design capacity of 375 cfs. All tie-ins must be removed of redesigned to maintain the required pressure. Approximately 12 tie-ins were identified. Eight of which will have manual gates installed. The other four will be severed and re-directed. An automatic gate and sensor will also be installed at the outfall of the conduit which will keep water from the Rio Grande out of the system when water surface elevations are high.	Saipan Reservoir Saipan Pump Station Storm sewer conduit Sever tie-ins and install manual gates (8) Automatic gate at outlet (90")	$ 6,410,000	○	◑	◑	◑	○	○	○	◑
CE3_2		The Government Hills System will be modified to reflect as builts conditions. This will enable the system to remain Pressurized from Boone St. Basin to The Rio Grande River. The flow through the 90" conduit will increase from a current capacity of 50 cfs to a design capacity of 375 cfs. All tie-ins must be removed of redesigned to maintain the required pressure. Approximately 12 tie-ins were identified. Eight of which will have Automatic gates installed. The other four will be severed and re-directed. An automatic gate, and sensor will also be installed at the outfall of the conduit which will keep water from the Rio Grande out of the system when water surface elevations are high.	Saipan Reservoir Saipan Pump Station Storm sewer conduit Sever tie-ins and install automatic gates (8) Automatic gate at outlet (90")	$ 6,670,000	○	◑	●	●	○	○	○	◑

Table E-8. Alternative Costing Table (Continued)

Project No & Alternative	Issue to be Addressed	Description of Alternative	Component	Total Cost (Rounded to $10,000)	Constructability	Maintenance	Reliability	Safety	Aesthetics	Dual Use	Natural Systems	ROW
			Description									
Cebada System												
Cebada and Magnolia Systems												
CE6_1	The Cebada system is a complex network of reservoirs and conduits that receive flow from multiple dams located on the side of the Franklin Mountains. The network is divided by I-10. The northern areas is primarily street flow and the south area is primarily conduit flow. The southern area has very little slope and does not convey water through the system properly. This back up is carried through the TXDOT reservoir structures and ultimately cause massive flooding at I-10 and at Cebada Reservoir. I-10 has been identified as a critical route and should not be compromised during any storm event.	The Magnolia Reservoir system is separated from the Cebada Reservoir System by severing the connecting 60" line. The existing outfall to Cebada Reservoir will be cleared of crossing conduits which will allow for an increase in flow. A 4.5 x 3 box conduit will also be added at Magnolia Rd and I-10 to convey water to a proposed 295 cfs pump station. The proposed pump station will discharge the water into the Rio Grande. A proposed increase in storage at Magnolia Reservoir and a Weir will further separate the systems and will greatly reduce flooding. Protection Level - 25-year	Storm drains	$ 22,760,000	○	○	○	○	○	○	○	◑
			Copia Reservoir									
			Magnolia Reservoir expansion									
			Magnolia PS (25-yr)									
			Copia property acquisition (X3)									
CE6_2		The Magnolia Reservoir system is separated from the Cebada Reservoir System by severing the connecting 60" line. The existing outfall to Cebada Reservoir will be cleared of crossing conduits which will allow for an increase in flow. A 293 cfs pump station with a 42" discharge conduit will convey water from Cebada to a proposed 84 acre-ft capacity pond, which will be located south of I-10 in an existing rail yard. A 5 x 3.5 box conduit with a 0.6 % slope will also be added at Magnolia Rd and I-10 to convey water to the proposed railroad pond. A 355 cfs pump with a 48 inch force main will discharge water from the railroad pond into the Rio Grande. An increase in storage for Magnolia Reservoir and a Weir will further separate the systems and greatly reduce flooding. Protection Level - 50-year	Storm drains 50 yr	$ 44,040,000	○	○	◑	◑	○	○	○	◑
			Piedras St. RR Pond (50-yr)									
			Copia Reservoir									
			Magnolia Reservoir expansion									
			Piedras St. RR Pond PS									
			Cebada System PS									
			Copia property acquisition (X3)									
			RR property acquisition (x2)									
CE6_3		The Magnolia Reservoir system is separated from the Cebada Reservoir System by severing the connecting 60" line. The existing outfall to Cebada Reservoir will be cleared of crossing conduits which will allow for an increase in flow. A 293 cfs pump station with a 42" discharge conduit will convey water from Cebada to a proposed two chamber 84 acre-ft capacity pond, which will be located south of I-10 in an existing rail yard. A 5 x 4.5 box conduit with a 0.2 % slope will also be added at Magnolia Rd and I-10 to convey water to the proposed railroad pond. A 255 cfs pump with a 42 inch force main will discharge water from the railroad pond into the Rio Grande. An increase in storage for Magnolia Reservoir and a weir will further separate the systems and greatly reduce flooding. Protection Level - 50-year	Storm drains (50-yr)	$ 44,460,000	○	◑	◑	◑	◑	◑	○	◑
			Piedras St. RR Pond (50-yr)									
			Copia Reservoir									
			Magnolia Reservoir expansion									
			Piedras St. RR Pond PS									
			Cebada System PS									
			Copia property acquisition (X3)									
			RR property acquisition (x2)									
CE6_4		The Magnolia Reservoir system is separated from the Cebada Reservoir System by severing the connecting 60" line. The existing outfall to Cebada Reservoir will be cleared of crossing conduits which will allow for an increase in flow. A 645 cfs pump station with a 54" discharge conduit will convey water from Cebada to a proposed 84 acre-ft capacity pond, which will be located south of I-10 in an existing rail yard. A 5 x 4 box conduit with a 0.6 % slope will also be added at Magnolia Rd and I-10 to convey water to the proposed railroad pond. A 425 cfs pump will discharge water from the railroad pond into the Rio Grande. An increase in storage for Magnolia Reservoir and a weir will further separate the systems and greatly reduce flooding. Protection Level - 100-year	Storm drains (100-yr)	$ 58,100,000	○	◑	◑	◑	◑	◑	○	◑
			Piedras St. RR Pond (100-yr)									
			Copia Reservoir									
			Magnolia Reservoir expansion									
			Cebada System PS									
			Piedras St. RR Pond PS									
			Copia property acquisition (X3)									
			RR property acquisition (x2)									
CE6_5 Phase I		The Magnolia Reservoir system is separated from the Cebada Reservoir System by severing the connecting 60" line. The existing outfall to Cebada Reservoir will be cleared of crossing conduits which will allow for an increase in flow. A Trapezoidal Concrete lined channel with an 11ft base and 1 to 1 side slope will discharge water from Cebada to a proposed 84 acre-ft capacity pond, which will be located south of I-10 in an existing rail yard. A 5 x 4 box conduit with a 0.6 % slope will also be added at Magnolia Rd and I-10 to convey water to the proposed railroad pond. A 425 cfs pump will discharge water from the railroad pond into the Rio Grande. An increase in storage for Magnolia Reservoir and a weir will further separate the systems and greatly reduce flooding. Protection Level - 100-year	Debris removal from existing utilities	$ 36,890,000	○	◑	●	●	◑	◑	○	◑
			Copia Reservoir									
			Copia storm drains									
			Magnolia Reservoir expansion									
			Copia property acquisition (X3)									
CE6_5 Phase II			Storm drains (100-yr)									
			Piedras St. RR Pond PS									
CE6_5 Phase III			Culverts									
			Channels									
			Piedras St. RR Pond (100-yr)									
			RR property acquisition (x2)									

Table E-8. Alternative Costing Table (Continued)

Project No & Alternative	Issue to be Addressed	Description of Alternative	Component Description	Total Cost (Rounded to $10,000)	Constructability	Maintenance	Reliability	Safety	Aesthetics	Dual Use	Natural Systems	ROW
Dallas System												
Dallas Reservoir and Outlet												
CE11_1	The Dallas Reservoir does not properly discharge flow into the Rio Grande when river levels are high. This causes a back up and flooding occurs along the system at multiple locations.	Dams 8, 9, and 10 will have a storage increase creating more storage upstream. The existing lines will be increase and , the inlets will be modified. Both improvements will increase conveyance through the system. A new pond will also be created near the Rio Grande which will serve as a sump for a 350 cfs pump station. 100-yr protection.	Site research, storm water management, safety/traffic control plans, and debris removal Removal of selected portions of Lines A and D Pavement removal and replacement Excavation of unclassified material for Citrus Place Pond and reservoir expansions Line A improvements Line D improvements Storm water pollution prevention plan with best management practices included Water utility relocations Sanitary sewer utility relocations Preliminary opinions of probable construction cost of 350 cfs pump station	$ 44,850,000	○	◑	●	●	◑	◑	○	○
CE11_2		Dams 8, 9, and 10 will have a storage increase creating more storage upstream. All the existing conduits will remain in place but will have inlet upgrades. A new pond will also be created in the Rail yard. The pond will drain to a new pond near the Rio Grande which will serve as the sump for a 350 cfs pump station. 100-yr protection	Storm drain Removal of selected portions of Lines A and D Pavement removal and replacement Excavation of unclassified material for Citrus Place Pond and Mills Ave. RR Pond Line A improvements Line D improvements Storm water pollution prevention plan with best management practices included Water utility relocations Sanitary sewer utility relocations Preliminary opinions of probable construction cost of 350 cfs pump station	$ 40,930,000	○	◑	●	●	◑	◑	○	○
CE11_3		Remove existing eastern discharge conduit in Dallas reservoir and add a 380 cfs pump station. Discharge flow from the pump station into a new 42 in. force main which runs along the same path as the existing eastern conduit. Instead of tying in to Line D or the Cebada system, the new force main will discharge into the Rio Grande separately. 50-yr protection.	Storm drains Sever lines (2) Dallas Pump Station	$ 16,380,000	●	◑	◑	●	○	○	○	○
CE11_4		Add a 115 cfs pump station which discharges into a new 42 in. force main running parallel to the existing eastern discharge conduit at Dallas Reservoir. Sever tie-ins of eastern discharge conduit to Line D and Cebada System and construct an extension of the line from the point where the tie-in to the Cebada system was severed. 50-yr protection.	Storm drains Sever lines (2) Dallas Pump Station	$ 19,290,000	●	◑	◑	●	○	○	○	○
CE11_5 Phase I		Phase 1 of Alternative 5 includes adding a 115 cfs pump station which discharges into a new 42 in. force main running parallel to the existing eastern discharge conduit at Dallas Reservoir. Sever tie-ins of eastern discharge conduit to Line D and Cebada System and construct an extension of the line from the point where the tie-in to the Cebada system was severed. 100-yr protection.	Storm drains Sever lines (2) Dallas Pump Station	$ 27,020,000	●	◑	◑	●	○	○	○	○
CE11_5 Phase II		Phase 2 of Alternative 5 includes upgrading the proposed 115 cfs pump station from Phase 1 to a 370 cfs pump station.	Dallas Pump Station improvements									

Table E-8. Alternative Costing Table (Continued)

Project No & Alternative	Issue to be Addressed	Description of Alternative	Component Description	Total Cost (Rounded to $10,000)	Constructability	Maintenance	Reliability	Safety	Aesthetics	Dual Use	Natural Systems	ROW
McKelligon Dam Outfall												
CE13_1	The McKelligon Dam discharges through a series of smaller reservoirs before finally discharging through a 48" Conduit onto Louisiana St. The discharge flows directly towards houses and causes erosion along the road.	An energy dissipater is proposed to reduced the velocity of the water and force it to enter the road correctly. This would keep the water away from surrounding houses.	Energy dissipaters and diversion	$ 10,000								
Mesa Drain Downstream												
Mesa Drain Storage												
MV2	There is a need for additional detention storage along the upper portion of Mesa Drain Interceptor.	This project involves constructing a parapet wall along the banks of Mesa Drain from Le Barron Rd to Feather Lake. The wall would bring the elevation of the channel banks to 3668 feet and would then allow Feather Lake to also fill to 3668 feet (thereby using most of the Feather Lake capacity).	Construct 7173 feet of 2 foot high parapet wall and 855 feet of 5 foot high parapet wall	$ 4,780,000								
Mesa Drain Upstream and Downstream												
Mesa Drain Concrete Lining												
MV11	Mesa Drain is significantly undersized (< 10 year)	This project involes three capacity remedies for Mesa Drain. They are a) expand Mesa Drain 20 feet in width on the south side of the channel where feasible; b) line portions of the channel with concrete that cannot be expanded; and c) line 20 feet upstream of all crossings with concrete.	Expand Mesa Drain from North Loop Drive to Center Way (2,949 feet), from Center Way to Eastland Street (8,816 feet), and from Pendale Road to Burgundy Drive (10,604 feet). Line 20 ft upstream of all crossings Add concrete lining to Mesa Drain from Eastland Street to Pendale Road (3,416 feet).	$ 6,260,000								
Basin G												
Feather Lake II Improvements												
MV3	The Middle Drain is contributing flow to the Mesa Drain Interceptor causing capacity and tailwater issues. There is need for additional storage along the Interceptor System in Mission Valley.	This project involves excavating the City owned Feather Lake II property so that it can be utilized as detention storage for the Middle Drain. All flow would be diverted to the basin via conduit and would exit to the Mesa Drain Interceptor controlled by automatic gates. In addition, a small pump station would be installed to drain the portion of the basin that is below the elevation of the Mesa Drain Interceptor channel. The basin will be sized to capture the 100 year flow from Middle Drain.	Excavation of Featherlake II 18.26 acre footprint 18 feet deep 5 feet already excavated	$ 10,720,000								
			Install 2 - 6 ft x 4 ft CBC									
			Install 25 cfs pump station									
			Install 2 - 36 inch automated flow gates									
Middle Drain Interceptor Storage												
MV4	The Franklin Drain is contributing flow to the Middle Drain Interceptor causing capacity and tailwater issues. There is a need for additional storage along the Interceptor System in Mission Valley.	This project involves creating a detention basin along the Middle Drain Interceptor to be used as detention storage for the Franklin Drain. All flow would be diverted to the basin via conduit and would exit to the Middle Drain Interceptor controlled by automatic gates. In addition, a small pump station would be installed to drain the portion of the basin that is below the elevation of the Middle Drain Interceptor channel. The basin will be sized to capture the 100 year flow from Franklin Drain.	New detention basin 8.65 acre footprint 20 feet deep	$ 16,200,000								
			Property for basin									
			Install 4 - 6 ft x 4f t CBC									
			Install 25 cfs pump station									
			Install 2 - 36 inch automated flow gates									
Basin G Improvements												
MV5 Phase I	The current configuration and capacity of Basin G is causing tailwater to significantly restrict the capacity of the major drains and Interceptor System in Mission Valley. There is a need for additional storage in Basin G.	Excavate existing Basin G area to a depth of 20 ft, replace the undersized crossings at Carl Longuemare and Southside, and re-grade the Franklin Drain Intereceptor so that water will flow to the basin from both the Playa Drain and the Interceptor System.	Excavate Basin G to depth of 20 feet. Base elevation: 3645 feet	$ 33,270,000								
			Re-grade Franklin Interceptor so that water will flow to Basin G									
			Replace 2 undersized crossing Carl Longuemare (3 - 10ft x 9 ft CBC) Southside (3 - 10ft x 9 ft CBC)									
MV5 Phase II		Upgrade the existing pump station at Basin G by installing new pumps (820 cfs capacity total) and installing new conduits to the Rio Grande River.	Upgrade pump station with new pumps (820 cfs total capacity)									
			Install conduits from pump station to Rio Grande River									
Basin A												
Alameda Drive Storm Drain												
MV6	There are flooding issues on Alameda Dr. (SH20) between Paisano Dr. and El Paso Dr.	This project involves installing a storm drain system along the affected area of Alameda Drive that empties into Playa Drain just north of the intersection with Delta Drive.	Install 8750 feet of 2- 6 ft x 5 ft CBC storm sewer along Alameda Drive.	$ 42,880,000								
Basin A Improvements												
MV7	The pump station at Basin A does not have capacity for the 100 year storm based on the CH2MHILL peak inflow of 985.09 cfs. Additional flow is contributed back into the Playa Drain.	(CH2MHILL-01/2007) Replace 3 undersized pumps (130 cfs each) with pumps sized for the 100 year storm.	(CH2MHILL-01/2007) Upgrade pump station with 3 new pumps (175 cfs each)	$ 19,080,000								

Table E-8. Alternative Costing Table (Continued)

Project No & Alternative	Issue to be Addressed	Description of Alternative	Component Description	Total Cost (Rounded to $10,000)	Constructability	Maintenance	Reliability	Safety	Aesthetics	Dual Use	Natural Systems	ROW
Basin B Pump Station												
MV8 Phase I	Basin B currently acts as detention storage for the upper portion of the Playa Drain and the neigborhoods surrounding the basin. After leaving the basin, water flows through a conduit and enters the lower portion of the Playa Drain where it contributes to the capacity problems of the drain.	Phase I of this project involves installing a pump station and conduits in the portion of Basin B west of Mimosa Ave to pump water from Basin B to the Rio Grande River. Basin B would be excavated and re-graded so that the water will flow to the western portion of the basin, where the pump station will be located. In addition, the culvert under Mimosa Ave would be replaced by larger culverts that are sloping in the correct direction.	Install new pump station (165 cfs total capacity) Install conduit for pump station Excavate Basin B an additional 2 ft and grade slope so that water flows to the pump station Install culverts under Mimosa Ave 2 - 10 ft x 10 ft CBC	$ 16,440,000								
MV8 Phase II		Phase II of this project involves upgrading the pump station at Basin B by adding a new pump and conduit for added capacity	Upgrade pump station (165 cfs total capacity added) Install conduit for pump station									
Basin G												
Playa Drain Crossing												
MV9	The following crossing on Playa Drain has significantly less capacity than the upstream cross section (14% of Channel Capacity): Crossing just downstream of Yarbrough Dr. (1 - 36" RCP)	This project involves removing the undersized culvert and replacing it with culverts having the same capacity as the upstream cross section. The proposed culverts are sized so that they will not interfere with the channel width or road surface elevation.	Replace one crossing structure (2 - 5 ft x 5 ft CBC)	$ 100,000								
Basin C Pump Station												
MV10	Basin C is currently serving as a detention area for water from surrounding neigborhoods. After leaving the basin, water enters the Playa Drain where it contributes to the capacity problems of the drain.	This project involves excavating Basin C so that it is 3 feet below the elevation of the Playa Drain and installing a pump station to pump water from the basin to the Rio Grande River. In addition, new culverts would be installed under Independence Dr. allow water to enter the basin from Playa Drain.	Excavate Basin C to a depth 3 feet below the channel elevation in Playa Drain Install culverts from Playa Drain to Basin C (2 - 6 ft x 4 ft CBC) Install new pump station (160 cfs total capacity) Install conduit for pump station	$ 10,740,000								
Northeast Ponding System												
Northeast Channel Number 2												
NE3/ NE2_1	Northeast Channel No. 2 is significantly undersized (<10 year) with undersized crossings and serious erosion problems.	This alternative involves expanding and adding concrete lining to the entire length of Northeast Channel No. 2. In addition, all undersized crossings will be removed and replaced.	NE Channel No. 2 expansion and crossing improvements (Moreno Cardenas Inc.) Expand channel to rectangular shape 23 - 33 ft Bottom width Remove and replace 6 undersized crossings	$ 16,530,000	●	○	◑	◑	◑	◑	●	●
NE3/ NE2_2		This alternative involves constructing a Detention basin and expanding and adding concrete lining to the entire length of Northeast Channel No. 2. In addition, all undersized crossings will be removed and replaced.	Detention basin (Moreno Cardenas Inc.) 269 Ac-ft capacity 19 ft High embankment NE Channel No. 2 expansion and crossing improvements (Moreno Cardenas Inc.) Expand channel to rectangular shape 23 - 33 ft Bottom width Remove and replace 6 undersized crossings	$ 31,950,000	○	◑	●	●	○	◑	○	○
NE3/ NE2_3		This alternative involves constructing a diversion channel from Northeast Channel No. 2 to Northeast Channel No.1 and making improvements to Northeast Channel No. 1.	Diversion channel from NE Channel No 2. to NE Channel No. 1 (Moreno Cardenas Inc.) NE Channel No. 2 expansion and crossing improvements (Moreno Cardenas) Expand channel to rectangular shape 23 - 33 ft bottom width Remove and replace 6 undersized crossings Improve NE Channel No. 1 (Moreno Cardenas Inc.)	$ 40,980,000	○	◑	●	●	○	◑	○	○
NE3/ NE2_4 Phase I		Phase 1 of alternative 4 is already in progress and involves the expansion and lining of a portion of Northeast Channel No. 2.	NE Channel No. 2 expansion and improvements	$ 39,880,000	○	◑	●	●	○	◑	○	○
NE3/ NE2_4 Phase II		Phase 2 of alternative 4 involves the expansion and lining of the portion of Northeast Channel No. 2 not improved in Phase 1.	NE Channel No. 2 expansion and improvements									
NE3/ NE2_4 Phase III		Phase 3 of alternative 4 involves the construction of a debris basin west of US 54 and further monitoring of storm events.	Debris basin and monitoring of storm events									
NE3/ NE2_4 Phase IV		Phase 4 of alternative 4 involves adding detention storage to the debris basin constructed in Phase 3	Adding detention storage to debris basin									

Table E-8. Alternative Costing Table (Continued)

Project No & Alternative	Issue to be Addressed	Description of Alternative	Component / Description	Total Cost (Rounded to $10,000)	Constructability	Maintenance	Reliability	Safety	Aesthetics	Dual Use	Natural Systems	ROW
Range Dam System												
Electric Ditch Diversion Channel and Fairbanks Drive												
NE5_1	1. Flooding on Fairbanks Drive 2. High sediment load from Castner Range. 3. Flow in Fairbanks Drive bypasses the entrance to Electric Ditch Channel resulting in downstream flooding.	This alternative involves constructing a debris basin with detention storage west of US 54 (vacant land) to address issues 1 and 2. Additionally, cross sectional inlets would be installed on Electric Ditch Channel and the outlet of the culvert under US 54 would be improved to address issue 3.	New debris basin with detention storage (West of US 54) 225 Ac-ft capacity 20 ft deep 3 ft high embankment Add cross sectional inlets to Electric Ditch Channel/ Improve outlet of US 54 Culvert	$ 10,620,000	○	◑	●	●	○	○	○	○
NE5_2		This alternative involves constructing a debris basin west of US 54 (vacant land) to address issue 2. Additionally, cross sectional inlets would be installed on Electric Ditch Channel and the outlet of the culvert under US 54 would be improved to address issue 3.	New debris basin (West of US 54) 50 Ac-ft capacity 9 ft deep 3 ft high embankment Improve outlet of US 54 Culvert Add cross sectional inlets to Electric Ditch Channel	$ 4,190,000	○	◑	●	◑	○	○	○	○
NE5_2b		This alternative involves constructing a debris basin east of US 54 (residential area) to address issue 2. Additionally, cross sectional inlets would be installed on Electric Ditch Channel and the outlet of the culvert under US 54 would be improved to address issue 3.	New debris basin (East of US 54) 50 Ac-ft capacity 20 ft deep Property for debris basin Add cross sectional inlets to Electric Ditch Channel/ Improve outlet of US 54 Culvert	$ 3,930,000	○	◑	●	◑	○	○	●	○
NE5_4b		This alternative involves constructing a debris basin near the Border Patrol Museum (city property) to address issue 2. Additionally, cross sectional inlets would be installed on Electric Ditch Channel and the outlet of the culvert under US 54 would be improved to address issue 3.	New debris basin (Museum Area) 40 Ac-ft capacity 9 ft deep 3 ft high embankment Property for debris basin Add cross sectional inlets to Electric Ditch Channel/ Improve outlet of US 54 Culvert	$ 3,490,000	◑	◑	◑	◑	○	●	◑	○
NE5_5		This alternative involves adding cross sectional inlets to Electric Ditch Channel and improving the outlet of the culvert under US 54 to address issue 3.	Add cross sectional inlets to Electric Ditch Channel/ Improve outlet of US 54 Culvert	$ 1,350,000	●	○	○	○	●	○	●	●
Fort Bliss Sump System												
Railroad Drive Ditch Upstream of Junction with Tobin Drain												
NE7_1	The following crossings on Railroad Channel are undersized: Falcon Ave (1-18" RCP) Waycross Ave (1-12" RCP) Wren Dr (1-18" RCP) Lexington Dr (1-18" RCP) Crossing S. of Falcon Ave (1-12" RCP).	This alternative involves removing and replacing all five undersized crossings. The proposed culverts would not interfere with the elevation of the road surface and would not extend beyond the outer channel banks.	Replace five crossing structures 1. Falcon Ave (5 - 4' x 2' CBC) 2. Waycross Ave (5 - 4' x 2' CBC) 3. Wren Dr (5 - 4' x 2' CBC) 4. Lexington Dr (7 - 4' x 2' CBC) 5. Crossing S. of Falcon Ave (7 - 4' x 2' CBC)	$ 920,000								
Railroad Drive Ditch from Junction with Tobin Drain to Fort Bliss Sump												
NE8_1	1. The following crossing on Railroad Channel Downstream is undersized East of Julian Dr. (5 - 8' x 4' CBC).	This alternative involves removing and replacing the undersized crossing. The proposed culvert would not interfere with the elevation of the road surface and would not extend beyond the outer channel banks.	Replace one crossing structure East of Julian Dr. (6 - 7' x 6' CBC)	$ 400,000	◑	◑	●	●	◑	○	○	○
NE8_2		This alternative involves removing the undersized crossing completely and would require the abondonment of the dirt road that currently utilizes the crossing.	Remove crossing structure	$ 70,000	●	●	◑	●	◑	○	○	○

Table E-8. Alternative Costing Table (Continued)

Project No & Alternative	Issue to be Addressed	Description of Alternative	Component Description	Total Cost (Rounded to $10,000)	Constructability	Maintenance	Reliability	Safety	Aesthetics	Dual Use	Natural Systems	ROW
Threadgill/Tobin Drain												
NE10/ NE9_1 Phase I	1. Tobin Drain is significantly undersized with the exception of the far downstream end. 2. Crossings capacities are well below the 10-year flow.	Phase 1 of project 1 involves construction of basin 3	New detention Basin 3 26 Ac-ft capacity 4 ft deep	$ 64,790,000	○	○	○	○	◑	◑	○	◑
			Property for Basin 3									
			Inlet/Outlet conduits for Basin 3 1 - 5' x 5' CBC inlet conduit 1 - 3' x 2' CBC outlet conduit									
NE10/ NE9_1 Phase II		Phase 2 of project 1 involves construction of an underground detention basin and conversion of the area into a parking lot.	New underground CMP detention Basin 2 10.4 Ac-ft capacity 10 ft deep									
			Property for Basin 2									
			Inlet/Outlet conduits for Basin 2 1 - 5' x 5' CBC inlet conduit 1 - 3' x 2' CBC outlet conduit									
			Paving for Basin 2									
NE10/ NE9_1 Phase III		Phase 3 of project 1 involves construction of detention basin 1.	New detention Basin 1 215 Ac-ft capacity									
			Property for Basin 1									
			Outlet conduits for Basin 1 1 - 3' x 2' CBC outlet conduit									
NE10/ NE9_1 Phase IV		Phase 4 of project 1 involves construction of a covered detention basin (Basin 4) under the Irvin High School baseball field. The basin would require a pump station to move the water to Tobin Drain.	New underground detention Basin 4 50 Ac-ft capacity 10 ft deep									
			10 cfs pump station									
			Property for Basin 4									
			Inlet/Outlet conduits for Basin 4 1 - 5' x 5' CBC inlet conduit 1 - 2' x 2' CBC outlet conduit									
NE10/ NE9_2 Phase I	1. Tobin Drain is significantly undersized with the exception of the far downstream end. 2. Crossings capacities are well below the 10-year flow.	Phase 1 of project 2 involves expanding the portion of Tobin Drain from Alps to Hollings and constructing a new portion of Tobin Drain parallel to Hollings from Hollings to Hondo Pass. In addition, the three undersized crossings will be removed and replaced with the largest culverts that can be installed without interfering with the width of the channel or the elevation of the road surface.	Expand Tobin Drain from Alps to Hollings b = 75 ft d = 4.5 ft z = 2 ft and Construct new portion of Tobin Drain parallel to Hollings from Hollings to Hondo Pass b = 75 ft d = 4 ft z = 2 ft	$ 24,220,000	◑	●	●	●	○	○	○	○
			Property for phase 1									
			Replace three crossing structures Alps (8 - 10 ft x 4 ft CBC) Hollings (8 - 10 ft x 4 ft CBC) Hondo Pass (8 - 10 ft x 3 ft CBC)									
NE10/ NE9_2 Phase II		Phase 2 of project 2 involves expanding the portion of Tobin Drain from Wren to Alps and expanding and lining the portion of Tobin Drain from Sanders to Wren. In addition, the two undersized crossings will be removed and replaced with the largest culverts that can be installed without interfering with the width of the channel or the elevation of the road surface.	Expand Tobin Drain from Wren to Alps b = 75 ft d = 4.5 ft z = 2 ft and Expand and line Tobin Drain from Sanders to Wren b = 30 ft d = 4.5 ft z = 1 ft									
			Property for phase 2									
			Replace two crossing structures Wren (7 - 10 ft x 4 ft CBC) Raymond Telles (7 - 10 ft x 3 ft CBC)									
NE10/ NE9_2 Phase III		Phase 3 of project 2 involves expanding the portion of Tobin Drain from Threadgill to Sanders. In addition, the undersized crossing will be removed and replaced with the largest culverts that can be installed without interfering with the width of the channel or the elevation of the road surface.	Expand Tobin Drain from Threadgill to Sanders b = 75 ft d = 4.5 ft z = 2 ft									
			Property for phase 3									
			Replace one crossing structure Sanders (4 - 10 ft x 4 ft CBC)									

Table E-8. Alternative Costing Table (Continued)

Project No & Alternative	Issue to be Addressed	Description of Alternative	Component Description	Total Cost (Rounded to $10,000)	Constructability	Maintenance	Reliability	Safety	Aesthetics	Dual Use	Natural Systems	ROW
Range Dam Outlet Channel												
NE11_2	1. The following crossing on Range Dam Outlet Channel is undersized (< 10 - year): Raymond Telles Dr. (1 - 2' x 2' CBC) 2. Downstream junction of Range Dam Outlet Channel and Tobin Drain Channel identified by EPWU as issue and thus included in cost table.	This alternative involves removing and replacing the undersized crossing. The proposed culvert would not interfer with the elevation of the road surface and would not extend beyond the outer channel banks. In addition, the downstream junction would be modified. This alternative addresses issues 1 and 2.	Replace one crossing structure Raymond Telles Dr. (2 - 6' x 3' CBC) Modify downstream junction	$ 1,430,000								
Northgate Diversion Channel												
NE6_1	1. Flooding and erosion issues at the intersection of Hondo Pass Avenue and Hondo Pass Drive.	This alternative involves construction of a detention basin to reduce the peak flow in the Northgate Diversion Channel.	Northgate Diversion Dam (Dorado Engineering Inc.) 200 Ac-ft capacity 35 ft High embankment	$ 3,160,000	○	●	●	●	○	○	○	○
NE6_2		This alternative involves expanding and defining the existing channel to convey flow to the Northgate Dam Impounding Area.	Northgate Diversion Channel (Dorado Engineering Inc.) Rectangular concrete lined channel 10 ft Bottom width 5 ft Deep	$ 810,000	◑	◑	●	◑	○	○	○	○
NE6_3		This alternative involves the installation of pipes to convey flow to the Northgate Dam Impounding Area.	Northgate Diversion Pipe (Dorado Engineering Inc.) 2 - Reinforced concrete pipes 66 in Diameter	$ 740,000	◑	○	◑	◑	◑	◑	◑	○
Clearview Channel												
NE14_1	1. The following crossings on Clearview Channel are undersized (< 10 - year): Morningside Circle (3 - 36" CMP) Byron Drive (3 - 36" CMP) 2. There is a sediment problem in the upstream portion of Clearview Channel.	This alternative involves removing and replacing both of the undersized crossings and construction of a debris basin. The proposed culvert would not interfere with the elevation of the road surface and would not extend beyond the outer channel banks. This alternative would address issues 1 and 2.	Replace two crossing structures Morningside Circle (2 - 6' x 4' CBC) Byron Drive (2 - 5' x 3' CBC) Property for debris basin New debris basin 20 Ac-ft capacity 8 ft deep	$ 1,690,000	◑	●	●	●	○	○	○	○
NE14_2		This alternative involves constructing a debris basin with detention storage to capture all of the sediment and runoff from the upstream portion of the watershed. This alternative would address issues 1 and 2.	New debris basin with storage 84 Ac-ft capacity 14 ft deep Property for debris basin with storage	$ 4,190,000	◑	●	●	●	○	○	○	○
Johnson Channel												
NE16_1	1. Erosion along Lincoln Ave due to flows in the downstream portion of Johnson Channel. 2. One undersized crossing was identified on Johnson Channel beneath a dead-end road in a vacant lot, but is not causing any serious problems.	This alternative involves the construction of a retention basin on vacant lots at the lower end of Johnson Channel and removal of the undersized crossing.	New retention basin 13.5 Ac-ft capacity 16 ft deep Property for retention basin	$ 520,000								
Doniphan System												
Doniphan Ditch												
NW8_1	3 undersized crossings and undersized channel.	Increase culvert size,increase channel capacity. Divert flow north to White Spur Drain.	Increase 3 culvert crossings Increase channel capacity Grade section north of Sunset Dr. to drain to White Spur Drain	$ 2,160,000	◑	●	●	◑	●	○	○	○
NW8_2		Increase channel to detain some volume while upsizing some crossings, making a linear "Heritage Park/ Loop Trail."	Increase 3 culvert crossings Increase channel capacity Grade section north of Sunset Dr. to drain to White Spur Drain	$ 2,150,000	◑	◑	●	◑	●	●	●	●

Table E-8. Alternative Costing Table (Continued)

Project No & Alternative	Issue to be Addressed	Description of Alternative	Component	Total Cost (Rounded to $10,000)	Constructability	Maintenance	Reliability	Safety	Aesthetics	Dual Use	Natural Systems	ROW
			Description									
Doniphan Ditch												
NW12_1	5 undersized crossings and undersized channel.	Increase crossing sizes, increase channel capacity, and create sediment basin.	Increase 5 bridge crossings Increase channel capacity Add sedimentation basin	$ 5,970,000	◑	●	●	○	●	○	○	○
NW12_2		Increase channel to detain some volume while upsizing some crossings, making a linear "Heritage Park/ Loop Trail." Create sedimentation basin.	Increase 2 culvert crossings Increase 3 bridge crossings Increase channel capacity Add sedimentation basin	$ 5,190,000	◑	◑	●	○	●	●	●	●
Keystone Dam Outlet												
NW27_1	Outlet pipe discharges to Keystone Dam outlet conduit.	Add conduit separate from, but parallel to keystone outlet conduit, to take residential flow to Rio Grande.	Add 1 conduit	$ 10,940,000	○	○	◑	○	●	○	○	○
NW27_2		Add conduits that discharge to Doniphan Ditch.	Add 2 conduits	$ 230,000	●	◑	●	●	●	○	○	○
Flow Paths System												
Flow Path Number 38												
NW1_1	3 crossing undersized.	Increase culvert size	Increase 3 culvert crossings	$ 460,000								
Flow Path Number 40												
NW5_1	1 crossing undersized and part of channel undersized. Upstream sediment and debris flow.	Increase culvert size and construct debris/sediment basin (option to add some detention)	Increase 1 culvert crossing Create debris/sediment basin (NW_DEB1)	$ 3,530,000	◑	◑	●	●	◑	◑	○	◑
NW5_2		Create sediment/detention upstream to reduce peak flow	Create sediment/detention upstream to reduce peak flow (NW_DEB1)	$ 12,640,000	◑	◑	●	●	●	○	○	○
Flow Path Number 39A Redirect												
NW22_1	1 undersized crossing and historical blow-out of berm redirecting flow.	Increase culvert size and add concrete lining to berm where flow is redirected.	Increase 1 arch crossing Add concrete lining to berm where flow is redirected	$ 1,210,000	◑	◑	●	●	◑	●	○	●
NW22_2		Create sediment/detention upstream to reduce peak flow at divergence point.	Create sediment/detention upstream to reduce peak flow (NW_SED7) Add concrete lining to berm where flow is redirected	$ 10,090,000	◑	●	●	●	●	○	○	○
Keystone System												
Ridge View												
NW6_1	2 undersized crossings.	Increase culvert size	Increase 2 box culvert crossings	$ 560,000	◑	◑	●	●	◑	●	○	●
NW6_2		Create sediment/detention basin upstream.	Create sediment/detention basin upstream (NW_SED6)	$ 3,990,000	◑	●	●	○	●	○	○	○
High Ridge												
NW7_1	2 undersized crossings.	Increase culvert sizes.	Increase 2 box culvert crossings	$ 1,410,000	◑	◑	●	●	◑	●	○	●
NW7_2		Create sediment/detention basin upstream.	Create sediment/detention basin upstream (NW_SED5)	$ 7,270,000	◑	●	●	○	●	○	○	○
Ojo De Agua												
NW24_1	3 undersized crossings.	Increase culvert sizes and create a sediment basin.	Increase 3 box culvert crossings Create sediment basin (NW_SED1)	$ 1,950,000	◑	◑	●	◑	◑	◑	○	◑
NW24_2		Create sediment/detention basin and up-size crossing upstream of confluence.	Create sediment/detention basin upstream (NW_SED1) Increase 1 box culvert crossing	$ 3,500,000	●	●	●	○	●	○	○	○
Arroyo 4												
NW25_1	5 undersized crossings.	Increase culvert sizes.	Increase 5 culvert crossings	$ 4,760,000	○	◑	●	●	●	◑	○	◑
NW25_2		Create 2 detention basins along channel and upsize crossings accordingly.	Create 2 detention basin along channel Increase 3 culvert crossings based on detention outflow	$ 4,170,000	●	◑	●	○	●	○	○	○
NW25_3		Create 1 detention basin and upsize crossing accordingly.	Create 1 detention basin at El Puente (NW_DET2) Increase 4 culvert crossings.	$ 3,030,000	●	◑	●	◑	●	◑	○	◑
Arroyo 5												
NW26_1	1 undersized crossing.	Increase crossing capacity.	Increase 1 long culvert.	$ 1,900,000								

Table E-8. Alternative Costing Table (Continued)

Project No & Alternative	Issue to be Addressed	Description of Alternative	Component / Description	Total Cost (Rounded to $10,000)	Constructability	Maintenance	Reliability	Safety	Aesthetics	Dual Use	Natural Systems	ROW
Montoya System												
Montoya Drain												
NW17_1	8 undersized crossings.	Increase crossing sizes.	Increase 8 culvert crossings	$ 3,810,000								
Doniphan Ditch												
NW13_1	Undersized channel (no crossings).	Increase channel capacity to convey 100-yr flow.	Increase channel capacity to convey flow	$ 110,000	◑	●	●	○	●	○	○	○
NW13_2		Increase channel capacity to detain some volume.	Increase channel to detain some volume, making it part of the "Heritage Park/Loop Trail"	$ 150,000	◑	◑	●	○	●	●	●	●
White Spur Drain												
NW14_1	Undersized channel.	Increase channel capacity to convey flow.	Increase channel capacity to convey flow	$ 760,000								
White Spur Drain												
NW15_1	2 undersized crossings.	Increase culvert and bridge sizes.	Increase 1 bridge crossing Increase 1 culvert crossing	$ 390,000								
Montoya Drain												
NW19_1	3 undersized crossings and undersized channel.	Increase crossing sizes and increase channel capacity	Increase 3 bridge crossings Increase 6,300 ft of channel capacity	$ 2,960,000	●	◑	●	●	●	○	○	○
NW19_2		Increase channel to detain some volume while upsizing some crossings, making it part of the "Heritage Park/ Loop Trail"	Increase 3 bridge crossings Increase 6,300 ft of channel capacity	$ 3,600,000	●	◑	●	●	●	●	●	●
Montoya Drain												
NW21_1	3 undersized crossings and undersized channel.	Increase culvert size, increase channel capacity, and incorporate an automatic gate at confluence with river.	Increase 3 culvert crossings Increase 9000 ft of channel capacity Add an automatic gate	$ 4,130,000	●	◑	●	●	●	○	○	○
NW21_2		Increase channel to detain some volume while upsizing some crossings, making a linear "Heritage Park/Loop Trail", and incorporate an automatic gate at confluence with river.	Increase 3 culvert crossings Increase 9000 ft of channel capacity Add an automatic gate	$ 4,590,000	◑	○	●	●	●	●	●	●
Oxidation System												
Spring Crest Channel												
NW28_1	Upstream debris and sediment flow.	Create debris/sediment basin.	Create debris/sediment basin (NW_SED2)	$ 660,000								
Silver Springs Channel												
NW29_1	Upstream sediment flow.	Create sediment/detention basin.	Create sediment/detention upstream (NW_SED3)	$ 4,910,000								
Mesa Hills Channel												
NW30_1	Known sediment/debris issues.	Purchase and enhance existing debris/sediment basin.	Improve existing debris/sed basin	$ 520,000								
Vinton System												
Flow Path 45A												
NW31_1	The flowpath is the roadway, and does not contain the flow.	Construct retention basin upstream.	Construct 1 retention basin (NW_DET5)	$ 420,000	◑	◑	●	○	◑	○	○	○
NW31_2		Construct a diversion channel to FP45 and a sediment/detention basin on FP45.	Construct a channel upstream of Remington Drive to drain south to FP45. Construct 2 sediment/detention basins (NW_SED10 and NW_SED11)	$ 21,810,000	●	◑	●	◑	◑	○	○	○
NW31_3		Construct a storm drain system in Southwood Street from Remington Drive to IH-10.	Construct a storm drain system.	$ 6,540,000	○	○	◑	○	●	●	○	◑
Flow Path 45A												
NW32_1	The channel is undersized and there are 6 undersized crossings.	Construct detention basin upstream and increase 2 culvert sizes	Increase 2 culvert crossings in residential area (Iron and Kiely Streets). Construct 1 detention basin (NW_DET4)	$ 6,570,000	◑	◑	●	○	◑	○	○	○
NW32_2		Increase culvert and channel sizes	Increase 2 bridge crossings Increase 4 culvert crossings Increase 2650 ft of channel capacity	$ 3,350,000	◑	○	●	○	●	●	○	○
NW32_3		Increase 2 culverts and channel sizes	Increase 2 culvert crossings in residential area (Iron and Kiely Streets). Increase 950ft of channel capacity in residential area.	$ 810,000	●	●	●	◑	●	●	○	○

Table E-8. Alternative Costing Table (Continued)

Project No & Alternative	Issue to be Addressed	Description of Alternative	Component Description	Total Cost (Rounded to $10,000)	Constructability	Maintenance	Reliability	Safety	Aesthetics	Dual Use	Natural Systems	ROW
Vinton Arroyo (Flow Path 45)												
NW33_1	There are 3 undersized crossings.	Increase culvert and bridge sizes	Increase 3 bridge crossings.	$ 3,290,000								
Vinton Arroyo (Flow Path 45)												
NW34_1	The channel is undersized, and upstream sediment flow.	Construct 2 sediment/detention basins upstream.	Construct 2 sediment/detention basins (NW_SED10 and NW_SED11)	$ 33,370,000	●	◑	●	●	◑	○	○	○
NW34_2		Increase channel size.	Increase 1600 ft of channel capacity	$ 120,000	◑	◑	●	◑	◑	○	○	○
NW34_3		Construct 2 sediment basins and divert flow south to Flow Path 44 Trib.	Construct a 1700ft channel upstream of Tom Mays Drive to drain south to FP44 Trib. Construct 2 sediment basins	$ 9,930,000	○	●	●	◑	◑	◑	○	○
Vinton Arroyo (Flow Path 45)												
NW35_1	The channel is undersized and there are 4 undersized crossings.	Construct detention basin upstream.	Construct 1 detention basin (NW_DET3)	$ 25,934,000	◑	◑	●	◑	◑	○	○	○
NW35_2		Increase crossing and channel sizes.	Increase 4500 ft of channel capacity. Add 3 bridges. Increase 1 culvert crossing.	$ 3,220,000	●	●	●	●	●	◑	○	○
West Central System												
Paragon Channel												
WC3_1	Upstream debris flow.	Create debris basin upstream.	Construct 1 debris basin (WC_DEB1)	$ 690,000								
Flow Path Number 20												
WC1_1	Upstream debris flow and crossing undersized.	Increase culvert size and construct 2 debris basins along debris paths.	Increase 1 culvert crossing Increase 1 storm drain system Construct 2 debris basins (WC_DEB2 and WC_DEB3)	$ 23,710,000	○	◑	◑	○	◑	◑	○	○
WC1_2		Create two debris/detention basins upstream.	Construct 2 debris/detention basins (WC_DEB2 and WC_DEB3)	$ 4,380,000	◑	●	●	○	●	○	○	○
Canterbury Channel												
WC4_1	Upstream debris flow.	Construct debris basin.	Construct 1 debris basin (WC_DEB4)	$ 380,000								
Flow Path Number 21												
WC6_1	2 undersized crossings.	Increase the capacity of 2 culverts.	Increase 2 culvert crossings	$ 7,830,000	○	◑	◑	◑	◑	◑	○	○
WC6_2		Increase the capacity of 1 culvert.	Increase Mesa St. crossing	$ 7,250,000	◑	●	●	◑	●	○	○	○
Flow Path Number 20												
WC2_1	Channel and crossing are undersized.	Increase crossing and channel capacity.	Increase 1 box culvert crossing (bridge) Increase 900 ft of DS channel capacity	$ 2,920,000								
Flow Path Number 21												
WC7_1	Channel and crossing are undersized.	Increase culvert size, increase channel capacity.	Increase 1 box culvert crossing Increase 800 ft of DS channel capacity	$ 2,910,000								
Flow Path Number 23												
WC8_1	A portion of the channel is undersized, 2 culverts are undersized, and upstream sediment flow.	Increase culvert size, install storm drain, construct sediment basin.	Increase 2 culvert crossings Construct 1 low water crossing Construct a storm drain system Create 1 Sediment basin upstream (WC_SED1)	$ 20,930,000	○	◑	●	○	◑	○	○	○
WC8_2		Create sediment/detention basin upstream, upsize necessary culverts and channel.	Create 1 Sediment/Detention upstream (WC_SED1) Upsize 1265 ft of channel Increase 4 culvert crossings	$ 8,330,000	○	◑	●	○	●	○	○	○

Table E-8. Alternative Costing Table (Continued)

Project No & Alternative	Issue to be Addressed	Description of Alternative	Component Description	Total Cost (Rounded to $10,000)	Constructability	Maintenance	Reliability	Safety	Aesthetics	Dual Use	Natural Systems	ROW
Flow Path Number 23												
WC9_1	3 undersized crossings.	Increase culvert size.	Increase 3 box culvert crossings	$ 1,830,000								
Phelps Dodge Basin												
Fort Bliss Spur Drain Channel												
EA1_1	Undersized culvert crossings.	Increase culvert size at Edgemere Blvd./Airway Ave. and Egemere Blvd./Robert E. Lee crossings.	Culverts: 2-8'x4' CBC at Edgemere Blvd./Airway Ave. and 2-8'x4' CBC at Edgemere Blvd./Robert E. Lee Crossing; Remove French Drain at Railroad Crossing and connect concrete channel Add Storm Drain System including 48" RCP, 60" RCP, and 8'X4' CBC	$ 7,710,000								
Phelps Dodge Basin												
Sunmount Channel												
EA2_1	Undersized culvert crossing.	Create Retention Basin at Sunmount Channel Downstream before Sunmount/Viscount Culvert Crossing.	20 Ac-ft detention basin	$ 650,000								
Phelps Dodge Basin												
Lorne Channel												
EA3_1	Undersized channel and flooding problems upstream of channel.	Increase channel capacity and add storm drain system.	Increase channel capacity down to retention basin Add storm drain system within streets to reduce street flooding issues.	$ 4,840,000								
Phelps Dodge Basin												
McRae												
EA4_1	Street flows flooding at Interstate crossing.	Add drop inlets and storm drain, and increase capacity of existing storm drain.	Add to existing storm drain system to increase capacity and reduce street and commercial flooding by getting flows to Giles Basin Dam for effectively. Add new storm drain system to reduce street by getting flows to Giles Basin Dam for effectively.	$ 12,230,000								
Phelps Dodge Basin												
Zanzibar												
EA5_1	Street flows travel too far over flat slopes causing flooding, street closures and damage.	Add storm drain system to surrounding areas of Eastwood Park.	Storm drain system consisting of 54" RCP and 66"RCP Excavation of pond of 85 Ac-ft storage capacity, within Easwood to handle flows from surrounding residential areas	$ 9,000,000								
Lomaland Basin												
Pico Norte												
EA6_1	Street flows travel too far over flat slopes causing flooding, street closures and damage.	Add storm drain system to surrounding areas of Pico Norte Park.	Storm drain system consisting of 48" RCP to 66"RCP, 7'X4' CBC, 9'X5' CBC, and 10'X5' CBC to handle flows from surrounding residential areas Storm drain system consisting of 66"RCP and 9'X5' CBC to handle flows from surrounding residential areas Storm drain system consisting of 60"RCP and 7'X4' CBC to handle flows from surrounding residential areas Storm drain system consisting of 54" RCP, 66"RCP and 7'X4' CBC to handle flows from surrounding residential areas Storm drain system consisting of 48" RCP and 60"RCP to handle flows from surrounding residential areas	$ 40,030,000								
Lomaland Basin												
Jesuit Basin												
EA7_1	Runoff flooding streets because it does not enter Jesuit Basin effectively.	Add storm drain system and increase capacity of existing storm drain system.	Addition of 36" RCP, 48" RCP, 60" RCP and 10'X4' CBC storm drain system to capture flows from residential and commercial areas before flooding at Lee Trevino and James Watt Addition of 54" RCP and 8'X5' CBC storm drain system to capture flows from residential and commercial areas before flooding at Kaiser Dr and Gateway West addition of 36" RCP, 42" RCP and 48" RCP storm drain system to capture flows from residential and commercial areas before flooding at Bessemer Dr and Lee Trevino	$ 22,020,000								

Table E-8. Alternative Costing Table (Continued)

Project No & Alternative	Issue to be Addressed	Description of Alternative	Component / Description	Total Cost (Rounded to $10,000)	Constructability	Maintenance	Reliability	Safety	Aesthetics	Dual Use	Natural Systems	ROW
Americas Basin												
Bluff Channel												
EA8_1	Runoff from surrounding commercial areas flooding streets because of ineffective routing to Bluff Channel.	Add storm drain sysem, and increase capacity of existing storm drain.	Increase size of Bluff channel to a 20' bottwom width from Rojas Dr to Esther Lama Dr and upgrade crossing at Esther Lama Dr to 3-10'X5' CBC Addition of 24" RCP to 60" RCP storm drain system added to surrounding commercial lots and streets to prevent flooding in Zaragosa Rd. and George Dieter DR. and also IH-10 George Dieter intersection.	$ 14,350,000								
Americas 10 Basin												
RV Channel												
EA9_1	Undersized crossings, unfinished earthen channels, and sediment transfer clogging culverts.	Add detention/debris basins, and concrete line channels to IH-10.	Concrete line channels below proposed basins and concrete line earthen channels between concrete sections. Add detention/debris basin (75 Ac-ft) capacity above Paseo Del Este Blvd. to eliminate sediment and crossing capacity issues downstream.	$ 7,800,000								
Americas 10 Basin												
Mercantile Channel												
EA10_1	Undersized crossings, unfinished earthen channels, and sediment transfer clogging culverts.	Add drop inlets and storm drain, and increase capacity of existing storm drain.	Concrete line channels below proposed basins and concrete line earthen channels between concrete sections. Add detention/debris basin (140 Ac-ft) capacity above Paseo Del Este Blvd. to eliminate sediment and crossing capacity issues downstream.	$ 6,070,000								

This page was intentionally left blank.

Table E-9. Selected Alternatives Summary

Region	System	Project Number	New Project Number	Issue to be addressed	Description of Improvements	Total Cost
Central	Government Hills	CE_1	CE1	Multiple street intersections along Government Hills Channel do not have sufficiently sized drainage inlets. Undersized inlets restrict water from entering the channel and contribute to localized flooding at the crossings.	Expand the street inlets at Altura, Hastings, Cambridge and Cumberland to allow street flow to enter the channel without flooding surrounding properties. Also, add Austin High Pond upstream from the channel to decrease the flow entering the street inlets.	$850,000
Central	Government Hills	CE2_1	CE2	Multiple culverts along Government Hills Channel are undersized and contribute to channel flooding in localized areas.	Enlarge culverts at Cambridge, Cumberland, Chester and Trowbridge to increase the overall capacity of the Government Hills Channel to convey the 100-year storm.	$2,060,000
Central	Government Hills	CE3_2	CE3	The Government Hills System consists of a 90-inch pressurized conduit that outfalls into the Rio Grande. The design capacity is 375 cfs but has been reduced to 50 cfs.	The Government Hills System will be modified to reflect as built conditions. This will enable the system to remain pressurized from Boone Street Basin to the Rio Grande River. The flow through the 90-inch conduit will increase from a current capacity of 50 cfs.	$6,672,000
Central	Cebada	CE6_5 Phase I	CE4 Phase 1	Conveyance problems through Cebada Reservoir and Magnolia systems cause major flooding on IH-10 and on Cebada Road.	Clearing and relocating of existing utilities in Cebada Outfall Conduit (In Progress). Expansion of Magnolia Reservoir (In Progress). Construct Copia Street Pond	$4,740,000
Central	Cebada	CE6_5 Phase II	CE4 Phase 2	Conveyance problems through Cebada Reservoir and Magnolia systems cause major flooding on IH-10 and on Cebada Road.	Magnolia storm drains, Pump Station and Force Main to Rio Grande.	$24,739,000

Table E-9. Selected Alternatives Summary (Continued)

Region	System	Project Number	New Project Number	Issue to be addressed	Description of Improvements	Total Cost
Central	Cebada	CE6_5 Phase III	CE4 Phase 3	Conveyance problems through Cebada Reservoir and Magnolia systems cause major flooding on IH-10 and on Cebada Road.	Railroad Pond and Concrete lined channel from Cebada to RR Pond.	$7,407,000
Central	Dallas	CE11_5 Phase I	CE5 Phase 1	The Dallas Reservoir does not properly discharge flow into the Rio Grande when river levels are high. This causes a back up and flooding occurs along the system at multiple locations.	Add a 115 cfs pump station which discharges into a new 42-inch force main running parallel to the existing eastern discharge conduit at Dallas Reservoir. Sever tie-ins of eastern discharge conduit to Line D and Cebada System and construct an extension of the line from the point where the tie-in to the Cebada System was severed. 50-year protection.	$19,290,000
Central	Dallas	CE11_5 Phase II	CE5 Phase 2	The Dallas Reservoir does not properly discharge flow into the Rio Grande when river levels are high. This causes a back up and flooding occurs along the system at multiple locations.	Increase capacity of pump station from 115 cfs to 370 cfs.	$7,728,000
Mission Valley	Basin A	MV7	MV1	The pump station at Basin A does not have capacity for the 100-year storm event. Additional flow is contributed back into the Playa Drain.	Upgrade the existing pump station at Basin A by installing new pumps (525 cfs total capacity).	$19,076,000

Table E-9. Selected Alternatives Summary (Continued)

Region	System	Project Number	New Project Number	Issue to be addressed	Description of Improvements	Total Cost
Mission Valley	Mesa Drain Upstream and Downstream	MV11	MV10	Mesa Drain is significantly undersized.	Expand Mesa Drain 20 feet in width on the south side of the channel where feasible. Also, line portions of channel with concrete that cannot be expanded and line 20 feet upstream of all crossings with concrete.	$6,262,000
Mission Valley	Basin A	MV8 Phase I	MV2 Phase 1	Basin B currently serves as detention storage for the upper portion of the Playa Drain and the neighborhoods surrounding the basin.	Install a new pump station (165 cfs total capacity) and conduit in the portion of Basin B west of Mimosa Avenue to pump water to the Rio Grande River. Excavate and regrade the slope in Basin B so that water flows to the pump station. Install new culverts.	$10,413,000
Mission Valley	Basin A	MV8 Phase II	MV2 Phase 2	Basin B currently serves as detention storage for the upper portion of the Playa Drain and the neighborhoods surrounding the basin.	Expand pump station by installing an additional 165 cfs pump and conduit.	$6,023,000
Mission Valley	Basin G	MV_3	MV3	The Middle Drain is contributing flow to the Mesa Drain Interceptor causing capacity and tailwater issues. There is need for additional storage along the Interceptor System in Mission Valley.	Excavate the City-owned Feather Lake II property and divert all flow from the Middle Drain to it via conduit. Install a small pump station at basin. Flow back into the Mesa Drain Interceptor from the basin will be controlled by automatic gates.	$10,724,000
Mission Valley	Basin G	MV4	MV4	The Franklin Drain is contributing flow to the Middle Drain Interceptor causing capacity and tailwater issues. There is a need for additional storage along the Interceptor System in Mission Valley.	Create a detention basin along the Middle Drain Interceptor and divert flow from the Franklin Drain to it via conduit. Install a small pump station at basin. Flow back into the Middle Drain Interceptor from the basin will be controlled by automatic gate.	$16,203,000

Table E-9. Selected Alternatives Summary (Continued)

Region	System	Project Number	New Project Number	Issue to be addressed	Description of Improvements	Total Cost
Mission Valley	Basin G	MV5 Phase I	MV5 Phase I	The current configuration and capacity of Basin G is causing tailwater to significantly restrict the capacity of the major drains and Interceptor System in Mission Valley. There is a need for additional storage in Basin G.	Excavate existing Basin G area to a depth of 20 feet, replace the undersized crossings at Carl Longuemare and Southside, and re-grade the Franklin Drain Interceptor so that water will flow to the basin from both the Playa Drain and the Interceptor System.	$6,236,000
Mission Valley	Basin G	MV5 Phase II	MV5 Phase 2	The current configuration and capacity of Basin G is causing tailwater to significantly restrict the capacity of the major drains and Interceptor System in Mission Valley. There is a need for additional storage in Basin G.	Upgrade the existing pump station at Basin G by installing new pumps (820 cfs capacity total) and installing new conduits to the Rio Grande River.	$27,038,000
Mission Valley	Basin A	MV6	MV6	There are flooding issues on Alameda Drive (SH 20) between Paisano Drive and El Paso Drive.	Install a storm drain system along the affected area of Alameda Drive that empties into Playa Drain just north of the intersection with Delta Drive.	$42,879,000
Mission Valley	Basin G	MV9	MV7	The following crossing on Playa Drain is undersized: Just downstream of Yarbrough Drive (one 36-inch RCP).	Remove the undersized culvert and replace it with a culvert having the same capacity as the upstream cross section. The replaced culvert will not interfere with the channel width or road surface elevation.	$95,000

Table E-9. Selected Alternatives Summary (Continued)

Region	System	Project Number	New Project Number	Issue to be addressed	Description of Improvements	Total Cost
Mission Valley	Basin G	MV10	MV8	Basin C is currently serving as a detention area for water from surrounding neighborhoods. After leaving the basin, water enters the Playa Drain where it contributes to the capacity problems of the drain.	Install a new pump station (160 cfs total capacity) and conduits at Basin C to pump water from the basin to the Rio Grande River. Excavate the basin so it is three feet below the channel elevation of Playa Drain. Install new culverts under Independence Drive.	$10,741,000
Mission Valley	Mesa Drain Downstream	MV2	MV9	The elevation of the channel banks along the lower portion of Mesa Drain is preventing the top portion of the Feather Lake capacity from being utilized.	Construct a parapet wall along both sides of Mesa Drain from Le Barron Rd to Feather Lake to raise the channel bank elevation.	$4,777,000
Northeast	Fort Bliss Sump	NE7_1	NE1	The following crossings on Railroad Channel are undersized: Falcon Avenue (one 18-inch RCP), Waycross Avenue (one 12-inch RCP), Wren Dr (one 18-inch RCP), Lexington Dr (one 18-inch RCP), Crossing S. of Falcon Avenue (one 12-inch RCP).	Replacement of five crossing structures.	$922,000
Northeast	Fort Bliss Sump	NE8_1	NE2	The following crossing on Railroad Channel Downstream is undersized: east of Julian Drive (five 8-foot by 4-foot CBCs).	Replacement of one crossing structure.	$402,000

Table E-9. Selected Alternatives Summary (Continued)

Region	System	Project Number	New Project Number	Issue to be addressed	Description of Improvements	Total Cost
Northeast	Fort Bliss Sump	NE10/NE9_2 Phase I	NE3 Phase 1	1. Tobin Drain is significantly undersized with the exception of the far downstream end. 2. Crossing capacities are well below the 10-year flow.	Expansion of channel from Alps to Hollings. Construction of new portion of Tobin Drain parallel to Hollings from Hollings to Hondo Pass. Replacement of three crossing structures.	$7,595,000
Northeast	Fort Bliss Sump	NE10/NE9_2 Phase II	NE3 Phase 2	1. Tobin Drain is significantly undersized with the exception of the far downstream end. 2. Crossing capacities are well below the 10-year flow.	Expansion of the portion of Tobin Drain from Wren to Alps. Expansion and lining of Tobin Drain from Sanders to Wren. Replacement of two crossing structures.	$10,210,000
Northeast	Fort Bliss Sump	NE10/NE9_2 Phase III	NE3 Phase 3	1. Tobin Drain is significantly undersized with the exception of the far downstream end. 2. Crossing capacities are well below the 10-year flow.	Expansion of Tobin Drain from Threadgill to Sanders. Replacement of one crossing structure.	$6,412,000
Northeast	Fort Bliss Sump	NE11_2	NE4	1. The following crossing on Range Dam Outlet Channel is undersized (<10-year): Raymond Telles Drive (one 2-foot by 2-foot CBC). 2. Downstream junction of Range Dam Outlet Channel and Tobin Drain Channel identified by EPWU as issue and thus included in cost table.	Remove and replace undersized crossing and modify downstream junction.	$1,430,000

Table E-9. Selected Alternatives Summary (Continued)

Region	System	Project Number	New Project Number	Issue to be addressed	Description of Improvements	Total Cost
Northeast	Fort Bliss Sump	NE14_1	NE5	1. The following crossings on Clearview Channel are undersized (<10-year): Morningside Circle (three 36-inch CMPs), Byron Drive (three 36-inch CMPs). 2. There is a sediment problem in the upstream portion of Clearview Channel.	Replace two crossing structures and construct new sediment basin.	$1,686,000
Northeast	Fort Bliss Sump	NE_16_1	NE6	1. Erosion along Lincoln Avenue due to flows in the downstream portion of Johnson Channel. 2. One undersized crossing was identified on Johnson Channel.	Construct new retention basin.	$521,000
Northeast	Northeast Ponding	NE3/NE2_4 Phase I	NE7 Phase 1	Northeast Channel No. 2 is significantly undersized (< 10-year) with undersized crossings and serious erosion problems.	Expansion and lining of portion NE Channel 2 in progress.	$7,020,000
Northeast	Northeast Ponding	NE3/NE2_4 Phase II	NE7 Phase 2	Northeast Channel No. 2 is significantly undersized (<10-year) with undersized crossings and serious erosion problems.	Expansion and lining of remaining channel.	$9,513,000
Northeast	Northeast Ponding	NE3/NE2_4 Phase III	NE7 Phase 3	Northeast Channel No. 2 has high sediment loads due to large upstream deposits.	Construction of sediment basin.	$7,933,000

Table E-9. Selected Alternatives Summary (Continued)

Region	System	Project Number	New Project Number	Issue to be addressed	Description of Improvements	Total Cost
Northeast	Northeast Ponding	NE3/NE2_4 Phase IV	NE7 Phase 4	Northeast Channel No. 2 is significantly undersized.	Construction of detention with Phase 2 sediment basin.	$15,416,000
Northeast	Range Dam	NE5_2	NE8 Phase 1	1. Flooding on Fairbanks Drive. 2. High sediment load from Castner Range.	Construction of sediment. Improve US 54 culvert outlet.	$2,836,000
Northeast	Range Dam	NE5_2	NE8 Phase 2	Flow in Fairbanks Drive bypasses the entrance to Electric Ditch Channel resulting in downstream flooding.	Construction of cross sectional inlets.	$1,350,000
Northeast	Range Dam	NE6_3	NE9	Flooding and erosion issues at the intersection of Hondo Pass Avenue and Hondo Pass Drive due to flow from Northgate Diversion Channel.	Installation of pipes to convey flow to Northgate Dam.	$736,000
Northwest	Doniphan Ditch	NW8_2	NW1	This section of Doniphan Ditch is severely undersized with undersized crossings.	Increase the capacity of three culvert crossings. Increase the capacity of the channel to detain some volume. Grade the section north of Sunset Drive to drain to White Spur Drain.	$2,150,000
Northwest	Keystone Dam	NW6_1	NW10	Ridge View Channel has two undersized crossings.	Increase capacity of two box culverts.	$564,000
Northwest	Keystone Dam	NW24_1	NW11	Ojo De Agua Arroyo has three undersized crossings. Identified upstream sediment source.	Increase capacity of three box culverts. Construct sediment basin.	$1,947,000
Northwest	Montoya Drain	NW13_2	NW12	Northern section of Doniphan Ditch is undersized.	Increase the capacity of the channel.	$151,000

Table E-9. Selected Alternatives Summary (Continued)

Region	System	Project Number	New Project Number	Issue to be addressed	Description of Improvements	Total Cost
Northwest	Montoya Drain	NW17_1	NW13	North section of Montoya Drain has eight undersized crossings.	Increase capacity of eight culverts.	$3,814,000
Northwest	Montoya Drain	NW19_2	NW14	Mid section of Montoya Drain has three undersized culverts and the channel is undersized.	Increase the capacity of three culvert crossings. Increase the capacity of the channel to detain some volume.	$3,595,000
Northwest	Montoya Drain	NW21_2	NW15	Lower section of Montoya Drain has three undersized culverts and the channel is undersized. This section of the drain is in New Mexico.	Increase the capacity of three culvert crossings. Increase the capacity of the channel to detain some volume.	$4,590,000
Northwest	Montoya Drain	NW14_1	NW16	East extent of White Spur Drain is undersized.	Increase channel capacity. May need a storm drain system due to limited ROW.	$758,000
Northwest	Montoya Drain	NW15_1	NW17	White Spur Drain has two undersized crossings.	Increase capacity of crossings.	$391,000
Northwest	Oxidation Dam	NW30_1	NW18	Mesa Hills Channel has known sediment/debris issues.	Purchase and enhance existing debris/sediment basin.	$521,000
Northwest	Oxidation Dam	NW29_1	NW19	Silver Springs Channel has identified upstream sediment source.	Construct detention basin or dam.	$4,905,000
Northwest	Doniphan Ditch	NW12_2	NW2	This section of Doniphan Ditch has five undersized crossings and the channel is undersized. There is a known sediment issue.	Increase the capacity of three culvert crossings and two bridge. Increase the capacity of the channel to detain some volume. Construct a sediment basin.	$5,192,000
Northwest	Vinton	NW31_2	NW21	For the upper portion of Flow Path No. 45A, the roadway serves as the channel and does not contain the flow.	Construct a diversion channel to FP 45 and a sediment/detention basin on FP 45.	$21,812,000

Table E-9. Selected Alternatives Summary (Continued)

Region	System	Project Number	New Project Number	Issue to be addressed	Description of Improvements	Total Cost
Northwest	Vinton	NW32_3	NW22	The lower portion of Flow Path No. 45A has six undersized culverts and the channel is undersized.	Increase the capacity of the two culvert crossings and the channel in the residential area only.	$809,000
Northwest	Vinton	NW33_1	NW23	The lower portion of Flow Path No. 45 has three undersized crossings.	Increase the capacity of three crossings.	$3,288,000
Northwest	Vinton	NW35_2	NW24	The mid portion of Flow Path No. 45 has four undersized crossings and the channel is undersized.	Increase the capacity of the four crossings and the channel.	$3,217,000
Northwest	Vinton	NW34_2	NW25	For the upper portion of Flow Path No. 45 the channel is undersized and there is identified upstream sediment source.	The detention/sediment basin is to be constructed as part of PRJ_NW31. Increase the capacity of the channel based on the outflow from the detention basin.	$120,000
Northwest	Oxidation Dam	NW28_1	NW20	Spring Crest Channel has identified upstream debris and sediment sources.	There is an existing debris/sediment basin. Would need maintenance permit or easement.	$659,000
Northwest	Doniphan Ditch	NW27_2	NW3	Pump station outlet pipes discharges to Keystone Dam outlet conduit.	Install conduits that discharge to Doniphan Ditch.	$232,000
Northwest	Flow Paths	NW1_1	NW4	Flow Path No. 38 has three undersized crossings.	Increase the capacity of three culvert crossings.	$458,000
Northwest	Flow Paths	NW22_2	NW5	Flow Path No. 39A has one undersized crossing and historical blow out of berm redirecting flow.	Create sediment/detention upstream to reduce peak flow at divergence point. Concrete line 90-degree bend in channel.	$10,850,000

Table E-9. Selected Alternatives Summary (Continued)

Region	System	Project Number	New Project Number	Issue to be addressed	Description of Improvements	Total Cost
Northwest	Flow Paths	NW5_1	NW6	Flow Path No. 40 has one undersized crossing and part of channel undersized. Identified upstream sediment and debris source.	Increase culvert Size and construct a debris basin.	$3,525,000
Northwest	Keystone Dam	NW25_3	NW7	Arroyo 4 has four undersized crossings.	Construct detention basin, increase capacity of four culvert crossings.	$3,027,000
Northwest	Keystone Dam	NW26_1	NW8	Arroyo 5 has one undersized crossing.	Increase capacity of one long culvert.	$1,900,000
Northwest	Keystone Dam	NW7_1	NW9	High Ridge Channel has two undersized crossings.	Increase capacity of two box culverts.	$1,409,000
West Central	West Central	WC4_1	WC1	Canterbury Channel has an identified upstream debris source.	Construct a debris basin.	$375,000
West Central	West Central	WC1_2	WC2	Flow Path No. 20 has identified upstream debris sources. There are two undersized culverts.	Construct two debris/detention basins.	$4,379,000
West Central	West Central	WC2_1	WC3	The lower portion of Flow Path No. 20 has an undersized culvert and channel.	Increase capacity of channel and crossing.	$2,923,000
West Central	West Central	WC6_2	WC4	Flow Path No. 21 has one undersized crossing.	Increase the capacity of the Mesa Street crossing. The other crossing is a low water crossing.	$7,246,000
West Central	West Central	WC7_1	WC5	The lower portion of Flow Path No. 21 has an undersized culvert and channel.	Increase crossing and channel capacity.	$2,907,000

Table E-9. Selected Alternatives Summary (Continued)

Region	System	Project Number	New Project Number	Issue to be addressed	Description of Improvements	Total Cost
West Central	West Central	WC8_1	WC6	For the upper portion of Flow Path No. 23, the channel and six culverts are undersized. There is an identified upstream sediment source.	Increase the capacity of two CBC culverts. Construct one low water crossing. Construct a storm drain system to bypass the undersized portion of the channel and three culverts.	$20,925,000
West Central	West Central	WC9_1	WC7	The lower portion of Flow Path No. 23 has three undersized culverts and discharges to Americas Canal.	Increase capacity of three crossings.	$1,825,000
West Central	West Central	WC3_1	WC8	Paragon Channel has an identified upstream debris source.	Construct a debris basin.	$687,000
East	Phelps Dodge	EA1_1	EA1 Phase 1	Undersized culvert crossings, street flows travel too far over flat slopes causing flooding.	Culverts: Two 8-foot by 4-foot CBC at Edgemere Boulevard/Airway Avenue and two 8-foot by 4-foot CBC at Edgemere Boulevard/Robert E. Lee Crossing; Remove french drain at Railroad Crossing and connect concrete channel.	$1,215,000
East	Phelps Dodge	EA1_1	EA1 Phase 2	Undersized culvert crossings, street flows travel too far over flat slopes causing flooding.	Add storm drain system including 48-inch RCP, 60-inch RCP, and 8-foot by 4-foot CBC.	$6,490,000
East	Americas Ten Basin	EA10_1	EA10 Phase 1	Undersized crossings, unfinished earthen channels, and sediment transfer clogging culverts.	Build sediment/detention basin upstream of Paseo del Este Drive.	$4,642,000

Table E-9. Selected Alternatives Summary (Continued)

Region	System	Project Number	New Project Number	Issue to be addressed	Description of Improvements	Total Cost
East	Americas Ten Basin	EA10_1	EA10 Phase 2	Undersized crossings, unfinished earthen channels, and sediment transfer clogging culverts.	Concrete line channels below proposed sediment/detention basin and concrete line earthen channels between concrete sections.	$1,424,000
East	Phelps Dodge	EA2_1	EA2	Undersized culvert crossing.	Construction of sediment basin.	$653,000
East	Phelps Dodge	EA3_1	EA3 Phase 1	Undersized channel and flooding problems upstream of channel.	Increase channel capacity down to retention basin.	$792,000
East	Phelps Dodge	EA3_1	EA3 Phase 2	Undersized channel and flooding problems upstream of channel.	Add storm drain system within streets to reduce street flooding issues.	$4,043,000
East	Phelps Dodge	EA5_1	EA4	Street flows travel too far over flat slopes causing flooding, street closures and damage.	Storm drain system consisting of 54-inch RCP and 66-inch RCP.	$8,999,000
East	Phelps Dodge	EA4_1	EA5 Phase 1	Street flows flooding at Interstate crossing.	Add to existing storm drain system to increase capacity and reduce street and commercial flooding by getting flows to Giles Basin Dam more effectively.	$9,074,000
East	Phelps Dodge	EA4_1	EA5 Phase 2	Street flows flooding at Interstate crossing.	Add new storm drain system to reduce street by getting flows to Giles Basin Dam more effectively.	$3,158,000
East	Lomaland Basin	EA6_1	EA6 Phase 1	Street flows travel too far over flat slopes causing flooding, street closures and damage.	Storm drain system consisting of 48-inch RCP to 66-inch RCP, 7-foot by 4-foot CBC, 9-foot by 5-foot CBC, and 10-foot by 5-foot CBC to handle flows from surrounding residential areas.	$15,590,000
East	Lomaland Basin	EA6_1	EA6 Phase 2	Street flows travel too far over flat slopes causing flooding, street closures and damage.	Storm drain system consisting of 66-inch RCP and 9 foot by 5-foot CBC to handle flows from surrounding residential areas.	$10,353,000

Table E-9. Selected Alternatives Summary (Continued)

Region	System	Project Number	New Project Number	Issue to be addressed	Description of Improvements	Total Cost
East	Lomaland Basin	EA6_1	EA6 Phase 3	Street flows travel too far over flat slopes causing flooding, street closures and damage.	Storm drain system consisting of 60-inch RCP and 7-foot by 4-foot CBC to handle flows from surrounding residential areas.	$5,177,000
East	Lomaland Basin	EA6_1	EA6 Phase 4	Street flows travel too far over flat slopes causing flooding, street closures and damage.	Storm drain system consisting of 54-inch RCP, 66 inch RCP and 7-foot by 4-foot CBC to handle flows from surrounding residential areas.	$6,197,000
East	Lomaland Basin	EA6_1	EA6 Phase 5	Street flows travel too far over flat slopes causing flooding, street closures and damage.	Storm drain system consisting of 48-inch RCP and 60-inch RCP to handle flows from surrounding residential areas.	$2,717,000
East	Lomaland Basin	EA7_1	EA7 Phase 1	Runoff flooding streets because it does not enter Jesuit Basin effectively.	Addition of 36-inch RCP, 48-inch RCP, 60-inch RCP and 10-foot by 4-foot CBC storm drain system to capture flows from residential and commercial areas before flooding at Lee Trevino and James Watt.	$11,244,000
East	Lomaland Basin	EA7_1	EA7 Phase 2	Runoff flooding streets because it does not enter Jesuit Basin effectively.	Addition of 54-inch RCP and 8-foot by 5-foot CBC storm drain system to capture flows from residential and commercial areas before flooding at Kaiser Dr and Gateway West.	$6,434,000
East	Lomaland Basin	EA7_1	EA7 Phase 3	Runoff flooding streets because it does not enter Jesuit Basin effectively.	Addition of 36-inch RCP, 42-inch RCP and 48-inch RCP storm drain system to capture flows from residential and commercial areas before flooding at Bessemer Dr and Lee Trevino.	$4,343,000

Table E-9. Selected Alternatives Summary (Continued)

Region	System	Project Number	New Project Number	Issue to be addressed	Description of Improvements	Total Cost
East	Americas Basin	EA8_1	EA8 Phase 1	Runoff from surrounding commercial areas flooding streets because of ineffective routing to Bluff Channel.	Increase size of Bluff Channel to a 20-foot bottom width from Rojas Dr to Esther Lama Dr and upgrade crossing at Esther Lama Dr to three 10-foot by 5-foot CBCs.	$5,926,000
East	Americas Basin	EA8_1	EA8 Phase 2	Runoff from surrounding commercial areas flooding streets because of ineffective routing to Bluff Channel.	Addition of 24-inch RCP to 60-inch RCP storm drain system added to surrounding commercial lots and streets to prevent flooding in Zaragosa Road and George Dieter Drive and also IH-10 George Dieter intersection.	$8,422,000
East	Americas Ten Basin	EA9_1	EA9 Phase 1	Undersized crossings, unfinished earthen channels, and sediment transfer clogging culverts.	Build sediment/detention basin upstream of Paseo del Este Drive.	$5,769,000
East	Americas Ten Basin	EA9_1	EA9 Phase 2	Undersized crossings, unfinished earthen channels, and sediment transfer clogging culverts.	Concrete line channels below proposed sediment/detention basin and concrete line earthen channels between concrete sections.	$2,026,000

This page was intentionally left blank.

FIGURES

This page was intentionally left blank.

Figure E-1. Cost per Square Foot of Flow Area vs. Flow Area of Culverts