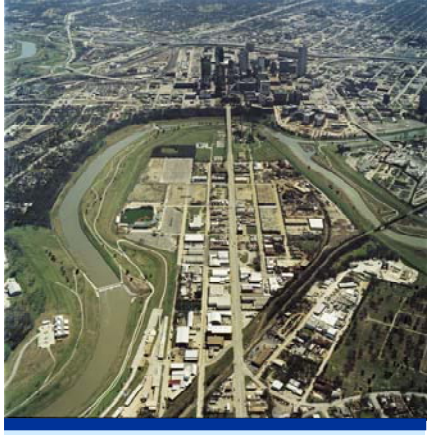
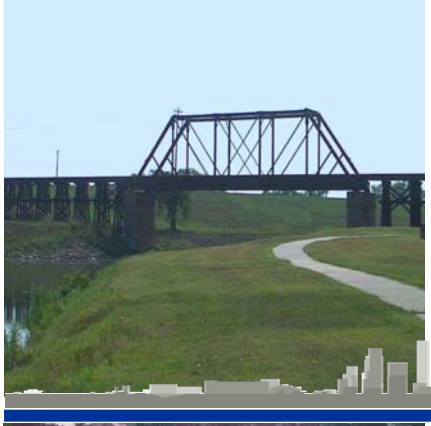
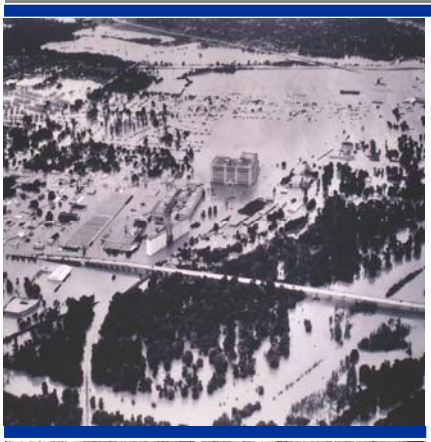
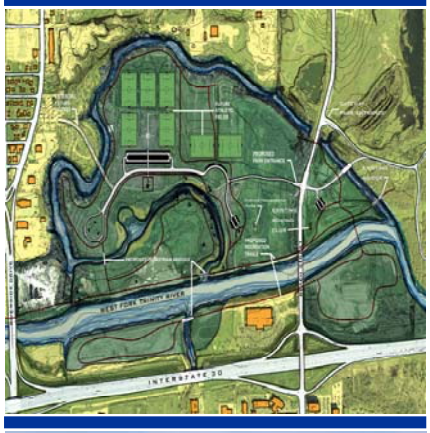
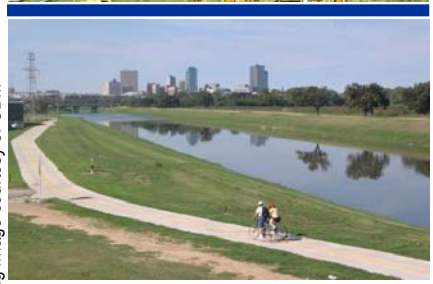










Rendering Image courtesy of CDM

Upper Trinity River Central City Fort Worth, Texas

Cost and Schedule Risk Analysis Report

Prepared by:

Risk Strategics, LLC

On behalf of:

Camp Dresser & McKee Inc.

April 2008

Table of Contents

Section 1 Purpose and Scope 1

Section 2 FWCC Project Background 1

Section 3 Risk Analysis Process 2

- Section 3.1 Identify and Assess Risk Factors 3
- Section 3.2 Quantify Risk Factor Impacts 3
- Section 3.3 Analyze Contingency 4

Section 4 Risk Analysis Results 5

- Section 4.1 Risk Register 6
- Section 4.2 Cost Contingency 6
- Section 4.3 Schedule Contingency 32

Section 5 Risk Management Recommendations 32

List of Tables

Table 1 Risk Register 7
Table 2 WBS/Risk Factor Crosswalk 16
Table 3 Total Project Cost Contingency 25
Table 4 Cost Contingency by Feature 27
Table 5 Contingency Allocation Table 29
Table 6 Cost Risk Factor Sensitivity Analysis 31
Table 7 Total Project Schedule Contingency 33
Table 8 Schedule Sensitivity Analysis 34

List of Figures

Figure 1 Total Project Cost with Confidence Levels 26
Figure 2 Project Risk Management Process Map 35
Figure 3 Project Performance Measurement, Assessment and Planning Process Map 36

List of Appendices

Appendix A Cost Estimate
Appendix B Schedule
Appendix C Cost Risk Factor Probability Distributions
Appendix D Cost Contingency Simulation Report
Appendix E Schedule Critical Path Stress Tests
Appendix F Schedule Risk Factor Probability Distributions
Appendix G Schedule Contingency Simulation Report

1. Purpose and Scope

The primary purpose of the Cost and Schedule Risk Analysis (CSRA) described in this report is to quantify contingencies for the Upper Trinity River Central City Project located in Fort Worth, Texas (FWCC Project). The scope of the report includes both cost estimate and schedule contingencies and is based on probabilistic risk analysis methods. The results are intended to provide project leadership with contingency information for scheduling, budgeting, and project control purposes, as well as to provide tools to support decision making and risk management as the project progresses through planning and implementation. To fully recognize its benefits, CSRA should be considered as an ongoing process conducted concurrent to, and iteratively with, other important project processes such as scope and execution plan development, resource planning, procurement planning, cost estimating, budgeting and scheduling.

The CSRA is a requirement only for the portion of the project that is currently federally-authorized (as described further in Section 2); however, federal risks are probably better understood within the context, objectives and constraints of the project in its entirety. Therefore, the scope of the CSRA includes the complete FWCC Project and results are provided for both federal and non-federal project scopes.

In addition to broadly defined risk analysis standards and recommended practices, the CSRA was performed to meet the requirements and recommendations of the following documents and sources:

- *Cost and Schedule Risk Analysis Process* guidance prepared by the U.S. Army Corps of Engineers (USACE), dated August 2007.
- *Application of Cost Risk Analysis Methods to Develop Contingencies for Civil Works Total Project Costs* memorandum from Major General Don T. Riley (US Army Director of Civil Works), dated July 3, 2007.
- *Application of Cost Risk Analysis Methods to Develop Contingencies for Civil Works Total Project Costs* engineering and construction bulletin issued by James C. Dalton, P.E. (Chief, Engineering and Construction, Directorate of Civil Works), dated September 10, 2007.
- Project-specific, independent technical review comments, suggestions and recommendations provided by Walla Walla District personnel.

2. FWCC Project Background

The FWCC Project is a multi-agency endeavor involving several federal agencies (primarily the USACE) and at least three non-Federal partners (Tarrant Regional Water District, City of Fort Worth and Tarrant County). The primary focus of the FWCC Project is to enhance existing levels of flood protection while restoring components of the natural riverine system that were sacrificed in construction of the existing flood control system and facilitating urban revitalization. The project is located within the vicinity of the downtown area of Fort Worth, Texas, along the West Fork and Clear

Fork of the Trinity River and consists of a bypass channel, levee system, and associated improvements to divert flood flows around a segment of the existing floodway system.

Section 116 of Public Law 108-447, dated December 8, 2004, authorized USACE's participation in construction of the FWCC Project. Within that specific authorization, a subset which can be constructed by the USACE and the local sponsor, identified as the USACE's project, was defined at $110,000,000 federal cost and a $220,000,000 total project cost.

The FWCC Project is currently in the preliminary design phase. The project cost estimate and schedule that serve as key inputs to the CSRA process are provided as Appendices A and B, respectively. In consideration of the Authorization language, results presented on the allocation tables are shown in Federal 220 Project and non-Federal Project groupings.

3. Risk Analysis Process

The risk analysis process used for the FWCC Project is intended to determine the probability of various cost outcomes and quantify the required contingency needed in the cost estimate to achieve any desired level of confidence. A parallel process is also used to determined the probability of various project schedule duration outcomes and quantify the required schedule contingency (float) needed in the schedule to achieve any desired level of confidence.

In simple terms, contingency is an amount added to an estimate (cost or schedule) to allow for items, conditions or events for which the occurrence or impact is uncertain and that experience suggests will likely result in additional costs being incurred or additional time being required. The amount of contingency included in project control plans depends, at least in part, on the project leadership's willingness to accept risk. The less risk that project leadership is willing to accept that the project will overrun its budget or schedule, the more contingency that it should include in the control plans. The risk of overrun is expressed, in a probabilistic context, using confidence levels.

USACE guidance focuses on the eighty-percent level of confidence (P80) and, accordingly, the risk analysis for the FWCC Project generally highlights that particular level in reporting results. It should be noted that use of P80 as a decision criteria is a risk adverse approach (whereas the use of P50 would be a risk neutral approach, and use of levels less than fifty-percent would be risk-seeking).

The risk analysis process uses *Monte Carlo* techniques to determine probabilities and contingency. The *Monte Carlo* techniques are facilitated computationally by a commercially available risk analysis software package (Crystal Ball) that is an add-in to Microsoft Excel. The specific use of the Crystal Ball software is identified as a USACE requirement in the September 10, 2007 engineering and construction bulletin listed in Section 1. Because Crystal Ball is an Excel add-in, both the cost estimate and schedule were recreated in Excel format from their native MII (MCACES 2nd Generation) and Microsoft Project formats, respectively. The level of detail recreated in the Excel-format cost estimate and schedule is sufficient for CSRA purposes, but generally less than that of the native formats. It is important to note that no contingency was included in the cost estimate or schedule so that the estimate costs and

schedule durations represent the most likely outcomes without subjective adjustments for perceived risks.

The primary steps, in functional terms, of the risk analysis process are described in the following subsections. Risk analysis results are provided in Section 4.

3.1 Identify and Assess Risk Factors

Risk factors are events and conditions that may influence or drive uncertainty in project performance. They may be inherent characteristics or conditions of the project, or external influences, events, or conditions such as weather or economic conditions. Risk factors may have either favorable or unfavorable impacts on project cost and schedule.

Checklists or historical databases of common risk factors are sometimes used to facilitate risk factor identification. However, key risk factors are often unique to a project and not readily derivable from historical information. Therefore, input from the entire project team about its risk perceptions is generally obtained using creative processes such as brainstorming or other facilitated risk assessment meetings. In practice, a combination of professional judgment from the project team and empirical data from similar projects is desirable.

Two project team meetings were held for the formal purposes of identifying and assessing FWCC Project risk factors. The initial meeting (held February 7, 2008) and subsequent meeting (held February 20, 2008) included capable and qualified representatives from multiple project team disciplines and functions, including project management, technical management, finance, design engineering, cost engineering and estimating, scheduling and risk analysis. The initial meeting focused primarily on risk factor identification using brainstorming techniques, but also included some facilitated discussions based on risk factors common to projects of similar scope. The second meeting focused primarily on risk factor assessment and quantification. It was facilitated using a consensus-building approach.

A third formal meeting (held March 6, 2008), included project team members as well as USACE Walla Walla District independent reviewers and resulted in additional risk factor identification and assessment. Additionally, numerous conference calls and informal meetings were conducted on as as-needed basis to further facilitate risk factor identification and assessment.

3.2 Quantify Risk Factor Impacts

An effective CSRA process requires a clear understanding of each key risk factor and its potential impact to project cost and schedule. Moreover, risk factors should be carefully and thoughtfully defined in mathematical terms to avoid interactions and dependencies that may prove difficult for the project team to understand or estimate. For these cognitive reasons, as well as computational efficiency, risk factors used in probabilistic risk analysis should be modeled as independent random variables to the extent possible.

The quantitative impacts of FWCC Project risk factors on project plans were analyzed using a combination of professional judgment, empirical data and analytical techniques. Risk factor impacts were quantified using probability distributions (density functions), both as a tool to help project team members visualize the uncertainty of risk factor impacts, and because risk factors are entered into the Crystal Ball software in the form of probability density functions.

Similar to the identification and assessment process, risk factor quantification involved multiple project team disciplines and functions, including project management, technical management, finance, design engineering, cost engineering and estimating, scheduling and risk analysis. However, the quantification process relied more extensively on collaboration between technical management, cost engineering, scheduling and risk analysis team members with lesser inputs from other functions and disciplines.

The project team used an iterative, consensus-building approach to estimate the following elements of each risk factor:

- Maximum possible value for the risk factor
- Minimum possible value for the risk factor
- Most likely value (the statistical mode), if applicable
- Nature of the probability density function used to approximate risk factor uncertainty

For this CSRA, risk factors are defined in mathematical terms to literally function as factors (*i.e.*, a number multiplied by an estimated cost or schedule duration to form a product) in the *Monte Carlo* simulations used to quantify contingency. Accordingly, the risk factors are generally expressed in the form of a percentage with a statistical mode equal to 100%. This approach is favorable conceptually because it results in the most likely value of an estimated cost or schedule duration being preserved in probabilistic terms when it is multiplied by the risk factor (*e.g.*, a deterministic most likely cost in the MII estimate multiplied by a risk factor with a mode of 100% yields a probability distribution of costs with a mode equal to the most likely cost).

Perhaps more importantly, defining risk factors in percentage terms allows the impact of multiple risk factors on a single estimated cost or schedule duration to be quantified simply by multiplying each risk factor probability density function by the most likely value (*i.e.*, value from the MII cost estimate or Microsoft Project schedule) to form a product. For example, if four independent risk factors (R_1, R_2, R_3 and R_4) impact a single most likely estimated cost (C_{ML}), and the risk factor probability density functions are defined in percentage terms as described above, the probability distribution of the estimated cost can be quantified as a simple product (*i.e.*, equal to $C_{ML} \times R_1 \times R_2 \times R_3 \times R_4$).

Additionally, all most likely estimated costs or schedule durations which are multiplied by the same risk factor become intrinsically correlated. This characteristic is important because it greatly simplifies the establishment of correlations between cost estimate elements as compared to the alternative of defining correlation matrices to establish the desired correlations.

3.3 Analyze Contingency

Contingency was analyzed using the Crystal Ball software as an add-in to the Microsoft Excel format of the cost estimate and schedule. *Monte Carlo* simulations were performed by applying the risk factors (quantified as probability density functions) to the appropriate estimated cost and schedule elements identified by the project team.

For the cost estimate, the total project contingency was calculated as the difference between the P80 cost forecast and the most likely cost. The total project contingency was then allocated on a feature-specific level based on the dollar-weighed relative risk of each feature as quantified by *Monte Carlo* simulation. Standard deviation was used as the feature-specific measure of risk for contingency allocation purposes. This approach results in a relatively larger portion of total project contingency being allocated to features with relatively higher estimated cost uncertainty.

For schedule contingency analysis, the total project contingency was calculated as the difference between the P80 project duration forecast and the most likely project duration. Schedule contingency was analyzed only on the basis of the total project and not allocated to specific tasks.

Based on USACE guidance, only critical path and near critical path tasks were considered uncertain for the purposes of contingency analysis. Crystal Ball sensitivity analysis and schedule stress tests were used to identify probabilistic critical path and near critical path tasks, as well as the relative importance of each to the overall project duration.

To identify the probabilistic critical path and near critical path tasks, a series of three stress tests were performed. For the first stress test, the duration of every task was assumed to be uncertain based on a 3-point distribution (low, most likely, high) where the low value is -10 percent and the high value is +10 percent (relative to the most likely duration). The most likely value is the duration used in the Microsoft Project schedule. The resulting sensitivity analysis identified the deterministic critical path tasks, as well as the contribution to variance of each.

The second stress test doubled the assumed uncertainty with 3-point distributions based on +/- 20 percent. Because of the impact of schedule constraints and predecessor/successor relationships, tasks that are not part of the deterministic (Microsoft Project) critical path become important in sensitivity analysis terms (in some cases having a contribution to variance that exceeds a few deterministic critical path tasks). These tasks are near the critical path in a risk analysis context and important to consider for risk management purposes.

The third stress test doubled the assumed uncertainty again to 3-point distributions based on +/- 40 percent. Additional near critical path tasks were identified.

4. Risk Analysis Results

The results of the FWCC Project CSRA are provided in the following sections.

4.1 Risk Register

A risk register is a tool commonly used in project planning and risk analysis. The FWCC Project risk register (Table 1) reflects the results of risk factor identification and assessment, risk factor quantification, and contingency analysis.

It is important to note that the risk register can be an effective tool for managing identified risks throughout the project lifecycle. As such, it is recommended that the risk register be updated as the FWCC Project progresses through planning and implementation.

Recommended uses of the risk register going forward include:

- Documenting risk mitigation strategies being pursued in response to the identified risks and their assessment in terms of probability and impact.
- Providing project sponsors, stakeholders and leadership/management with a documented framework from which risk status can be reported in the context of project controls.
- Communicating risk management issues to stakeholders.
- Providing a mechanism for eliciting risk analysis feedback and project control input from stakeholders.
- Identifying risk transfer, elimination or mitigation actions required for implementation of risk management plans.

Table 2 provides a crosswalk of each risk factor and the work breakdown structure (WBS) elements impacted by the factor.

4.2 Cost Contingency

Overall project cost contingency was quantified as 17.6% of total estimated costs based on P80. Feature-specific cost contingencies range from under 5% (for construction management) to over 50% (for electric transmission line relocation). Table 3 provides the implied, overall project cost contingencies calculated for various levels of confidence. Figure 1 presents the Table 3 data in a graphical format.

Cost contingencies on a feature-specific basis are provided in Table 4. Table 5 summarizes the allocation of overall project contingency on a feature-specific level based on the dollar-weighed relative risk (standard deviation) of each feature as quantified by *Monte Carlo* simulation. A sensitivity analysis of the cost risk factors is provided as Table 6. In functional terms, the sensitivity analysis ranks the relative impact of each risk factor as a percentage of total cost uncertainty.

The probability density functions used to quantify cost risk factors are presented in Appendix C. The *Monte Carlo* simulation report generated by Crystal Ball for cost contingency analysis is provided as Appendix D.

TABLE 1 – RISK REGISTER					
Risk No.	**Risk Description**	**Likelihood**	**Impact**	**Risk Level**	**Notes**
1	Bidding Climate and Economic Factors				
1.1	Craft Labor Cost	Likely	Marginal	Moderate	Craft labor is subject to competition by several large, contemporaneous local projects. It is impacted by federal and state prevailing wage laws; therefore, labor costs can not drop below prevailing levels but can exceed prevailing wages under competitive market conditions. *Monte Carlo* simulation results indicate that this risk factor is associated with 5.6% of total project cost uncertainty.
1.2	General Materials Cost	Likely	Negligible	Low	The general materials risk factor is primarily intended to capture uncertainty of future costs for all materials except steel (*e.g.*, rebar) and concrete. General materials cost uncertainty is skewed towards higher costs (costs can not drop below zero, but can increase to the full extent the market will bear). *Monte Carlo* simulation results indicate that this risk factor is associated with less than 0.5% of total project cost uncertainty.
1.3	Equipment Cost (ex fuel)	Likely	Marginal	Moderate	Equipment costs are subject to competition by several large, contemporaneous local projects. Equipment cost (excluding fuel) uncertainty is skewed towards higher costs (costs can not drop below zero, but can increase to the full extent the market will bear). *Monte Carlo* simulation results indicate that this risk factor is associated with 5.2% of total project cost uncertainty.
1.4	Fuel Costs	Very Likely	Significant	High	There is significant, short-term uncertainty in future fuel costs. This risk factor is intended to capture the uncertainty of gasoline, off-road diesel and on-road diesel costs. The historical costs of each of these fuel product types are strongly

TABLE 1 – RISK REGISTER					
Risk No.	**Risk Description**	**Likelihood**	**Impact**	**Risk Level**	**Notes**
					correlated. Fuel cost uncertainty is skewed towards higher costs (costs can not drop below zero, but can increase to the full extent the market will bear). *Monte Carlo* simulation results indicate that this risk factor is associated with 8.5% of total project cost uncertainty.
1.5	Material Cost (High Historic Volatility)	Very Likely	Significant	High	The material cost (high historic volatility) risk factor is primarily intended to capture uncertainty of future costs for steel and concrete. The cost uncertainty for this risk factor is skewed towards higher costs (costs can not drop below zero, but can increase to the full extent the market will bear). *Monte Carlo* simulation results indicate that this risk factor is associated with 13.2% of total project cost uncertainty.
2	Land Acquisition Cost	Likely	Marginal	Moderate	Most land will be acquired within 3 years; 5 years for remainder. Prices may be at a near-term peak and are likely to be supported by the potential value of mineral rights. The cost uncertainty for this risk factor is skewed towards higher costs (costs can not drop below zero, but can increase to the full extent the market will bear). The quantity of land that will be actually acquired is probably less than the amount reflected in the cost estimate. *Monte Carlo* simulation results indicate that this risk factor is associated with 3.7% of total project cost uncertainty.
3	138 kV Transmission Line Relocation	Very Likely	Significant	High	Relocation of the 138 kV transmission line is highly dependent on TXU cooperation and assistance. This risk factor significantly impacts the schedule critical path. *Monte Carlo* simulation results indicate that this risk factor is associated with 2.1% of total project cost uncertainty.

TABLE 1 – RISK REGISTER					
Risk No.	**Risk Description**	**Likelihood**	**Impact**	**Risk Level**	**Notes**
4	Contract Packaging/Size	Likely	Marginal	Moderate	The number and size of contracts significantly impacts economies of scale, project management costs, etc. *Monte Carlo* simulation results indicate that this risk factor is associated with 6.4% of total project cost uncertainty. This risk factor may be partially mitigated through procurement planning.
5	Number of Contract Owners; Contract Capacity	Likely	Marginal	Moderate	The number of contract owners impacts economies of scale, project management costs, etc. Contract capacity may have schedule impacts on near critical path procurement tasks. *Monte Carlo* simulation results indicate that this risk factor is associated with 7.0% of total project cost uncertainty. This risk factor may be partially mitigated through procurement planning.
6	Design Guidance/Standard Changes				
6.1	Channels	Very Likely	Significant	High	Standards or guidance for channel design may be revised at any time. Hydrology and hydraulics, geotechnical, and structural design *buy-in* is still outstanding. Changes may affect other design elements. This risk factor impacts the schedule critical path. *Monte Carlo* simulation results indicate that this risk factor is associated with 9.3% of total project cost uncertainty.
6.2	Roadway Bridges	Likely	Marginal	Moderate	Standards or guidance for design may be revised at any time. May be impacted by changes in other design elements. This risk factor impacts the schedule critical path. *Monte Carlo* simulation results indicate that this risk factor is associated with 5.1% of total project cost uncertainty.
6.3	Samuels Avenue Dam	Likely	Negligible	Low	Standards or guidance for design may be revised at any time. May be impacted by changes in other design elements. *Monte Carlo* simulation results

TABLE 1 – RISK REGISTER					
Risk No.	**Risk Description**	**Likelihood**	**Impact**	**Risk Level**	**Notes**
					indicate that this risk factor is associated with 1.9% of total project cost uncertainty.
6.4	Marine Creek Low Water Dam/Locks	Likely	Negligible	Low	Standards or guidance for design may be revised at any time. May be impacted by changes in other design elements. *Monte Carlo* simulation results indicate that this risk factor is associated with less than 0.5% of total project cost uncertainty.
6.5	Flood Control and Diversion Structures	Likely	Significant	Moderate	Standards or guidance for design may be revised at any time. May be impacted by changes in other design elements. This risk factor impacts the schedule critical path. *Monte Carlo* simulation results indicate that this risk factor is associated with 3.3% of total project cost uncertainty.
6.6	Valley Storage	Likely	Negligible	Low	Standards or guidance for design may be revised at any time. May be impacted by changes in other design elements. *Monte Carlo* simulation results indicate that this risk factor is associated with 1.7% of total project cost uncertainty.
6.7	Pedestrian and Other Bridges	Unlikely	Negligible	Low	Changes in standards not anticipated. May be impacted by changes in other design elements. *Monte Carlo* simulation results indicate that this risk factor is associated with less than 0.5% of total project cost uncertainty.
6.8	Planning, Engineering and Design	Likely	Negligible	Low	May be impacted by changes in design standards/guidance. *Monte Carlo* simulation results indicate that this risk factor is associated with 1.5% of total project cost uncertainty.
6.9	Utilities	Likely	Negligible	Low	Standards or guidance for design may be revised at any time. May be impacted by changes in other design elements. *Monte Carlo* simulation results indicate that this risk factor is associated with 1.4% of total project cost uncertainty.

TABLE 1 – RISK REGISTER					
Risk No.	**Risk Description**	**Likelihood**	**Impact**	**Risk Level**	**Notes**
6.10	Stormwater Pumping Facility	Likely	Negligible	Low	Standards or guidance for design may be revised at any time. May be impacted by changes in other design elements. *Monte Carlo* simulation results indicate that this risk factor is associated with less than 0.5% of total project cost uncertainty.
6.11	Recreation Facilities	Likely	Negligible	Low	Standards or guidance for design may be revised at any time. May be impacted by changes in other design elements. *Monte Carlo* simulation results indicate that this risk factor is associated with less than 0.5% of total project cost uncertainty.
6.12	Fish and Wildlife Facilities	Likely	Negligible	Low	Standards or guidance for design may be revised at any time. May be impacted by changes in other design elements. *Monte Carlo* simulation results indicate that this risk factor is associated with less than 0.5% of total project cost uncertainty.
6.13	Feasibility Studies	Likely	Negligible	Low	May be impacted by changes in design standards/guidance. *Monte Carlo* simulation results indicate that this risk factor is associated with less than 0.5% of total project cost uncertainty.
6.14	Cultural Resource Preservation	Unlikely	Negligible	Low	Changes in guidance or standards not anticipated. *Monte Carlo* simulation results indicate that this risk factor is associated with less than 0.5% of total project cost uncertainty.
7	Wastewater Plant Site Availability	Likely	Negligible	Low	Site needed for disposal of material from Valley Storage construction. This risk factor may be partially mitigated through effective project planning. *Monte Carlo* simulation results indicate that this risk factor is associated with less than 0.5% of total project cost uncertainty.
8	HTRW	Likely	Marginal	Moderate	Phase I environmental site assessments are underway and results are generally favorable to date. However, only limited environmental characterization data is available. The nature of

TABLE 1 – RISK REGISTER					
Risk No.	**Risk Description**	**Likelihood**	**Impact**	**Risk Level**	**Notes**
					future cleanup needs is uncertain at this time. Partial mitigation of this risk factor is possible, but only at high costs (*e.g.*, using environmental insurance products). *Monte Carlo* simulation results indicate that this risk factor is associated with 7.0% of total project cost uncertainty.
9	Marine Creek Low Water Dam/Lock Project Definition	Likely	Marginal	Moderate	Number of bridges across Marine Creek not yet clearly defined. This risk factor impacts critical path and near critical path tasks. *Monte Carlo* simulation results indicate that this risk factor is associated with less than 0.5% of total project cost uncertainty.
10	Relocation	Likely	Marginal	Moderate	Several relocations involve permitting and other factors largely controlled by third parties. This risk factor impacts the schedule critical path. *Monte Carlo* simulation results indicate that this risk factor is associated with 2.6% of total project cost uncertainty.
11	Property Acquisition Assistance	Likely	Negligible	Low	Most land will be acquired within 3 years; 5 years for remainder. Quantity of land actually necessary probably less than estimated. *Monte Carlo* simulation results indicate that this risk factor is associated with less than 0.5% of total project cost uncertainty.
12	Utilities				
12.1	Utilities - City	Likely	Marginal	Moderate	City of Fort Worth plans expansion that includes upgrades. Utility work is highly dependent on City cooperation and assistance. Several relocations involve permitting and other factors largely controlled by third parties. *Monte Carlo* simulation results indicate that this risk factor is associated with 0.5% of total project cost

TABLE 1 – RISK REGISTER					
Risk No.	**Risk Description**	**Likelihood**	**Impact**	**Risk Level**	**Notes**
					uncertainty.
12.2	Utilities - Franchise	Likely	Marginal	Moderate	Potential right-of-way issues may impact schedule critical path and near critical path tasks. Utility work is highly dependent on the cooperation and assistance franchise owner/operators. *Monte Carlo* simulation results indicate that this risk factor is associated with less than 0.5% of total project cost uncertainty.
13	Electrical Design	Likely	Negligible	Low	No electrical designs have been prepared. However, large changes in estimated electrical design costs do not have a significant impact on overall project costs. *Monte Carlo* simulation results indicate that this risk factor is associated with less than 0.5% of total project cost uncertainty.
14	Technical Complexity				
14.1	Flood Control and Diversion Structures	Likely	Marginal	Moderate	Technically complex project features are more likely to experience schedule delays and cost overruns (change orders) than relatively simple features. This risk factor is intended to capture the uncertainty in estimated costs and schedule associated with technical uncertainty. It may significantly impact critical path and near critical path tasks. *Monte Carlo* simulation results indicate that this risk factor is associated with 3.3% of total project cost uncertainty.
14.2	Roadway Bridges	Likely	Marginal	Moderate	Technically complex project features are more likely to experience schedule delays and cost overruns (change orders) than relatively simple features. This risk factor is intended to capture the uncertainty in estimated costs and schedule associated with technical uncertainty. It may

TABLE 1 – RISK REGISTER					
Risk No.	**Risk Description**	**Likelihood**	**Impact**	**Risk Level**	**Notes**
					significantly impact critical path and near critical path tasks. *Monte Carlo* simulation results indicate that this risk factor is associated with 5.2% of total project cost uncertainty.
14.3	Dams	Likely	Marginal	Moderate	Technically complex project features are more likely to experience schedule delays and cost overruns (change orders) than relatively simple features. This risk factor is intended to capture the uncertainty in estimated costs and schedule associated with technical uncertainty. It may significantly impact critical path and near critical path tasks. *Monte Carlo* simulation results indicate that this risk factor is associated with 1.3% of total project cost uncertainty.
14.4	Levees and Floodwalls	Likely	Marginal	Moderate	Technically complex project features are more likely to experience schedule delays and cost overruns (change orders) than relatively simple features. This risk factor is intended to capture the uncertainty in estimated costs and schedule associated with technical uncertainty. It may significantly impact critical path and near critical path tasks. *Monte Carlo* simulation results indicate that this risk factor is associated with 0.5% of total project cost uncertainty.
14.5	Valley Storage	Likely	Negligible	Low	Technically complex project features are more likely to experience schedule delays and cost overruns (change orders) than relatively simple features. This risk factor is intended to capture the uncertainty in estimated costs and schedule associated with technical uncertainty. *Monte Carlo* simulation results indicate that this risk factor is associated with less than 0.5% of total project cost uncertainty.

TABLE 1 – RISK REGISTER					
Risk No.	**Risk Description**	**Likelihood**	**Impact**	**Risk Level**	**Notes**
15	Contract Acquisition Strategy - Federal	Likely	Marginal	Moderate	The types of contracts available and special requirements (*e.g.*, small business set asides) may significantly affect project costs for the federal project. *Monte Carlo* simulation results indicate that this risk factor is associated with 1.6% of total project cost uncertainty. Only minor levels of mitigation are anticipated.
16	Equipment Productivity	Likely	Marginal	Moderate	The estimated productivity of equipment and equipment operators is based on historical data and may not be reflective of conditions actually experienced. This risk factor is primarily intended to capture equipment productivity uncertainty for high cost areas, such as earthen haul/placement and concrete wall construction. This risk factor impacts critical path and near critical path tasks. *Monte Carlo* simulation results indicate that this risk factor is associated with less than 0.5% of total project cost uncertainty.

TABLE 2 – WBS/RISK FACTOR CROSSWALK					
Risk No.	**Risk Description**	**WBS Labor Costs Impacted**	**WBS Equip Cost Impacted**	**WBS Materials Costs Impacted**	**WBS Sub Bid Costs Impacted**
1	Bidding Climate and Economic Factors				
1.1	Craft Labor Cost	All Construction Features[1]	-	-	-
1.2	General Materials Cost	-	-	1.2 03 Reservoirs[2]; 1.3 06 Fish and Wildlife Facilities[2]; 1.4 11 Levees and Floodwalls (except for 1.4.1.5 Retaining Walls and 1.4.2.5 Retaining Walls)[2]; 2.2 02 Relocations[2]; 2.4 06 Fish and Wildlife Facilities[2]; 2.5.5 25 Other Street Modifications; 2.5.6 30 Riverside Oxbow Park; 2.5.7 35 Riverside Gateway Park; 2.5.8 40 Bypass Channel Pedestrian Bridges; 2.6 13 Pumping Plants; 2.7 14 Recreation Facilities[2]	-
1.3	Equipment Cost (ex fuel)	-	All Construction Features[1]	-	-
1.4	Fuel Cost	-	All Construction Features[1]	-	-

TABLE 2 – WBS/RISK FACTOR CROSSWALK					
Risk No.	**Risk Description**	**WBS Labor Costs Impacted**	**WBS Equip Cost Impacted**	**WBS Materials Costs Impacted**	**WBS Sub Bid Costs Impacted**
1.5	Material Cost (High Historic Volatility)	-	-	1.4.1.5 Retaining Walls; 1.4.2.5 Retaining Walls; 1.5.1 05 Clear Fork; 1.5.2 15 TRWD; 2.3.1 05 Samuels Avenue Dam; 2.3.2 10 Marine Creek Low Water Dam/Lock; 2.5.1 05 Henderson Bridge and Roadway; 2.5.2 10 White Settlement Bridge and Roadway; 2.5.3 15 Main Street Bridge and Roadway; 2.5.4 20 White Settlement Extension Bridge and Roadway; 2.8.1 10 Trinity Point	-
2	Land Acquisition Cost	-	-	-	1.1.1 10 Property Acquisition 2.1.2 10 Property Acquisition
3	138 kV Transmission Line Relocation	2.2.4 20 Utility Relocation - Transmission Lines	2.2.4 20 Utility Relocation - Transmission Lines	2.2.4 20 Utility Relocation - Transmission Lines	2.2.4 20 Utility Relocation - Transmission Lines
4	Contract Packaging/Size	All Construction Features[1] 1.8 31 Construction Management 2.10 31 Construction Management	All Construction Features[1] 1.8 31 Construction Management 2.10 31 Construction Management	All Construction Features[1] 1.8 31 Construction Management 2.10 31 Construction Management	All Construction Features[1] 1.8 31 Construction Management 2.10 31 Construction Management

TABLE 2 – WBS/RISK FACTOR CROSSWALK

Risk No.	Risk Description	WBS Labor Costs Impacted	WBS Equip Cost Impacted	WBS Materials Costs Impacted	WBS Sub Bid Costs Impacted
5	Number of Contract Owners; Contract Capacity	All Construction Features[1] 1.8 31 Construction Management 2.10 31 Construction Management	All Construction Features[1] 1.8 31 Construction Management 2.10 31 Construction Management	All Construction Features[1] 1.8 31 Construction Management 2.10 31 Construction Management	All Construction Features[1] 1.8 31 Construction Management 2.10 31 Construction Management
6	Design Guidance/Standard Changes				
6.1	Channels	1.4 11 Levees and Floodwalls[2]	1.4 11 Levees and Floodwalls[2]	1.4 11 Levees and Floodwalls[2]	1.4 11 Levees and Floodwalls[2]
6.2	Roadway Bridges	2.5.1 05 Henderson Bridge and Roadway; 2.5.2 10 White Settlement Bridge and Roadway; 2.5.3 15 Main Street Bridge and Roadway; 2.5.4 20 White Settlement Extension Bridge and Roadway	2.5.1 05 Henderson Bridge and Roadway; 2.5.2 10 White Settlement Bridge and Roadway; 2.5.3 15 Main Street Bridge and Roadway; 2.5.4 20 White Settlement Extension Bridge and Roadway	2.5.1 05 Henderson Bridge and Roadway; 2.5.2 10 White Settlement Bridge and Roadway; 2.5.3 15 Main Street Bridge and Roadway; 2.5.4 20 White Settlement Extension Bridge and Roadway	2.5.1 05 Henderson Bridge and Roadway; 2.5.2 10 White Settlement Bridge and Roadway; 2.5.3 15 Main Street Bridge and Roadway; 2.5.4 20 White Settlement Extension Bridge and Roadway
6.3	Samuels Avenue Dam	2.3.1 05 Samuels Avenue Dam	2.3.1 05 Samuels Avenue Dam	2.3.1 05 Samuels Avenue Dam	2.3.1 05 Samuels Avenue Dam
6.4	Marine Creek Low Water Dam/Locks	2.3.2 10 Marine Creek Low Water Dam/Lock	2.3.2 10 Marine Creek Low Water Dam/Lock	2.3.2 10 Marine Creek Low Water Dam/Lock	2.3.2 10 Marine Creek Low Water Dam/Lock
6.5	Flood Control and Diversion Structures	1.5.1 05 Clear Fork; 1.5.2 15 TRWD; 2.8.1 10 Trinity Point	1.5.1 05 Clear Fork; 1.5.2 15 TRWD; 2.8.1 10 Trinity Point	1.5.1 05 Clear Fork; 1.5.2 15 TRWD; 2.8.1 10 Trinity Point	1.5.1 05 Clear Fork; 1.5.2 15 TRWD; 2.8.1 10 Trinity Point
6.6	Valley Storage	1.2 03 Reservoirs[2]	1.2 03 Reservoirs[2]	1.2 03 Reservoirs[2]	1.2 03 Reservoirs[2]

TABLE 2 – WBS/RISK FACTOR CROSSWALK					
Risk No.	**Risk Description**	**WBS Labor Costs Impacted**	**WBS Equip Cost Impacted**	**WBS Materials Costs Impacted**	**WBS Sub Bid Costs Impacted**
6.7	Pedestrian and Other Bridges	2.5.5 25 Other Street Modifications; 2.5.6 30 Riverside Oxbow Park; 2.5.7 35 Riverside Gateway Park; 2.5.8 40 Bypass Channel Pedestrian Bridges	2.5.5 25 Other Street Modifications; 2.5.6 30 Riverside Oxbow Park; 2.5.7 35 Riverside Gateway Park; 2.5.8 40 Bypass Channel Pedestrian Bridges	2.5.5 25 Other Street Modifications; 2.5.6 30 Riverside Oxbow Park; 2.5.7 35 Riverside Gateway Park; 2.5.8 40 Bypass Channel Pedestrian Bridges	2.5.5 25 Other Street Modifications; 2.5.6 30 Riverside Oxbow Park; 2.5.7 35 Riverside Gateway Park; 2.5.8 40 Bypass Channel Pedestrian Bridges
6.8	Planning, Engineering and Design	1.7.1 A/E Design Services; 1.7.2 Permitting; 2.9.1 A/E Design Services; 2.9.2 Permitting	1.7.1 A/E Design Services; 1.7.2 Permitting; 2.9.1 A/E Design Services; 2.9.2 Permitting	1.7.1 A/E Design Services; 1.7.2 Permitting; 2.9.1 A/E Design Services; 2.9.2 Permitting	1.7.1 A/E Design Services; 1.7.2 Permitting; 2.9.1 A/E Design Services; 2.9.2 Permitting
6.9	Utilities	2.2.3 15 Utility Relocation - Sanitary Sewer, Potable Water, Storm Sewer and Natural Gas; 2.2.4 20 Utility Relocation - Electrical and Communication; 2.2.5 25 Utility Relocation - Transmission Lines	2.2.3 15 Utility Relocation - Sanitary Sewer, Potable Water, Storm Sewer and Natural Gas; 2.2.4 20 Utility Relocation - Electrical and Communication; 2.2.5 25 Utility Relocation - Transmission Lines	2.2.3 15 Utility Relocation - Sanitary Sewer, Potable Water, Storm Sewer and Natural Gas; 2.2.4 20 Utility Relocation - Electrical and Communication; 2.2.5 25 Utility Relocation - Transmission Lines	2.2.3 15 Utility Relocation - Sanitary Sewer, Potable Water, Storm Sewer and Natural Gas; 2.2.4 20 Utility Relocation - Electrical and Communication; 2.2.5 25 Utility Relocation - Transmission Lines
6.10	Stormwater Pumping Facility	2.6.1 05 Stormwater Pumping Facility	2.6.1 05 Stormwater Pumping Facility	2.6.1 05 Stormwater Pumping Facility	2.6.1 05 Stormwater Pumping Facility
6.11	Recreation Facilities	2.7 14 Recreation Facilities[2]	2.7 14 Recreation Facilities[2]	2.7 14 Recreation Facilities[2]	2.7 14 Recreation Facilities[2]

TABLE 2 – WBS/RISK FACTOR CROSSWALK

Risk No.	Risk Description	WBS Labor Costs Impacted	WBS Equip Cost Impacted	WBS Materials Costs Impacted	WBS Sub Bid Costs Impacted
6.12	Fish and Wildlife Facilities	1.3.1 15 Ham Branch 2.4 06 Fish and Wildlife Facilities[2]	1.3.1 15 Ham Branch 2.4 06 Fish and Wildlife Facilities[2]	1.3.1 15 Ham Branch 2.4 06 Fish and Wildlife Facilities[2]	1.3.1 15 Ham Branch 2.4 06 Fish and Wildlife Facilities[2]
6.13	Feasibility Studies	1.7.3 Survey and Testing; 1.7.4 Legal costs; 2.9.3 Survey and Testing; 2.9.4 Legal costs	1.7.3 Survey and Testing; 1.7.4 Legal costs; 2.9.3 Survey and Testing; 2.9.4 Legal costs	1.7.3 Survey and Testing; 1.7.4 Legal costs; 2.9.3 Survey and Testing; 2.9.4 Legal costs	1.7.3 Survey and Testing; 1.7.4 Legal costs; 2.9.3 Survey and Testing; 2.9.4 Legal costs
6.14	Cultural Resource Preservation	1.6 18 Cultural Resource Preservation	1.6 18 Cultural Resource Preservation	1.6 18 Cultural Resource Preservation	1.6 18 Cultural Resource Preservation
7	Wastewater Plant Site Availability (Excavated Material Disposal Costs)	1.2.1.6 30 Riverside Oxbow/Gateway (impacts $1,474,951.63 of total labor cost)	1.2.1.6 30 Riverside Oxbow/Gateway (impacts $3,953,227.34 of total equipment cost)	-	-
8	HTRW	2.11 33 HTRW[2]	2.11 33 HTRW[2]	2.11 33 HTRW[2]	2.11 33 HTRW[2]
9	Marine Creek Low Water Dam/Lock Project Definition	2.3.2 10 Marine Creek Low Water Dam/Lock	2.3.2 10 Marine Creek Low Water Dam/Lock	2.3.2 10 Marine Creek Low Water Dam/Lock	2.3.2 10 Marine Creek Low Water Dam/Lock
10	Relocation	1.1.2 15 Relocations; 2.1.3 15 Relocations	1.1.2 15 Relocations; 2.1.3 15 Relocations	1.1.2 15 Relocations; 2.1.3 15 Relocations	1.1.2 15 Relocations; 2.1.3 15 Relocations
11	Property Acquisition Assistance	2.1.1 05 Property Acquisition Assistance	2.1.1 05 Property Acquisition Assistance	2.1.1 05 Property Acquisition Assistance	2.1.1 05 Property Acquisition Assistance
12	Utilities				

TABLE 2 – WBS/RISK FACTOR CROSSWALK					
Risk No.	**Risk Description**	**WBS Labor Costs Impacted**	**WBS Equip Cost Impacted**	**WBS Materials Costs Impacted**	**WBS Sub Bid Costs Impacted**
12.1	Utilities - City	2.2.2 10 Utility Relocation	2.2.2 10 Utility Relocation	2.2.2 10 Utility Relocation	2.2.2 10 Utility Relocation
12.2	Utilities - Franchise	2.2.3 15 Utility Relocation	2.2.3 15 Utility Relocation	2.2.3 15 Utility Relocation	2.2.3 15 Utility Relocation
13	Electrical Design	-	-	-	1.5.1 05 Clear Fork (impacts $355,000 of total sub bid cost); 1.5.2 15 TRWD (impacts $195,000 of total sub bid cost); 2.8.1 10 Trinity Point (impacts $355,000 of total sub bid cost); 2.7.1 05 Water Feature (impacts $500,000 of total sub bid cost); 2.7.3 15 Marine Creek (impacts $100,000 of total sub bid cost); 2.7.7 35 Riverside Oxbow/Gateway Park (impacts $188,300 of total sub bid cost)
14	Technical Complexity				
14.1	Flood Control and Diversion Structures	1.5.1 05 Clear Fork; 1.5.2 15 TRWD; 2.8.1 10 Trinity Point	1.5.1 05 Clear Fork; 1.5.2 15 TRWD; 2.8.1 10 Trinity Point	1.5.1 05 Clear Fork; 1.5.2 15 TRWD; 2.8.1 10 Trinity Point	1.5.1 05 Clear Fork; 1.5.2 15 TRWD; 2.8.1 10 Trinity Point

TABLE 2 – WBS/RISK FACTOR CROSSWALK					
Risk No.	**Risk Description**	**WBS Labor Costs Impacted**	**WBS Equip Cost Impacted**	**WBS Materials Costs Impacted**	**WBS Sub Bid Costs Impacted**
14.2	Roadway Bridges	2.5.1 05 Henderson Bridge and Roadway; 2.5.2 10 White Settlement Bridge and Roadway; 2.5.3 15 Main Street Bridge and Roadway; 2.5.4 20 White Settlement Extension Bridge and Roadway	2.5.1 05 Henderson Bridge and Roadway; 2.5.2 10 White Settlement Bridge and Roadway; 2.5.3 15 Main Street Bridge and Roadway; 2.5.4 20 White Settlement Extension Bridge and Roadway	2.5.1 05 Henderson Bridge and Roadway; 2.5.2 10 White Settlement Bridge and Roadway; 2.5.3 15 Main Street Bridge and Roadway; 2.5.4 20 White Settlement Extension Bridge and Roadway	2.5.1 05 Henderson Bridge and Roadway; 2.5.2 10 White Settlement Bridge and Roadway; 2.5.3 15 Main Street Bridge and Roadway; 2.5.4 20 White Settlement Extension Bridge and Roadway
14.3	Dams	2.3.1 05 Samuels Avenue Dam 2.3.2 10 Marine Creek Low Water Dam/Lock	2.3.1 05 Samuels Avenue Dam 2.3.2 10 Marine Creek Low Water Dam/Lock	2.3.1 05 Samuels Avenue Dam 2.3.2 10 Marine Creek Low Water Dam/Lock	2.3.1 05 Samuels Avenue Dam 2.3.2 10 Marine Creek Low Water Dam/Lock
14.4	Levees and Floodwalls	1.4 11 Levees and Floodwalls[2]	1.4 11 Levees and Floodwalls[2]	1.4 11 Levees and Floodwalls[2]	1.4 11 Levees and Floodwalls[2]
14.5	Valley Storage	1.2 03 Reservoirs[2]	1.2 03 Reservoirs[2]	1.2 03 Reservoirs[2]	1.2 03 Reservoirs[2]

TABLE 2 – WBS/RISK FACTOR CROSSWALK					
Risk No.	**Risk Description**	**WBS Labor Costs Impacted**	**WBS Equip Cost Impacted**	**WBS Materials Costs Impacted**	**WBS Sub Bid Costs Impacted**
15	Contract Acquisition Strategy - Federal	1.2 03 Reservoirs[2]; 1.3 06 Fish and Wildlife Facilities[2]; 1.4 11 Levees and Floodwalls[2]; 1.5 15 Flood Control and Diversion Structures[2]; 1.6 18 Cultural Resource Preservation[2]; 1.7 30 Planning, Engineering, and Design[2]; 1.8 31 Construction Management[2]	1.2 03 Reservoirs[2]; 1.3 06 Fish and Wildlife Facilities[2]; 1.4 11 Levees and Floodwalls[2]; 1.5 15 Flood Control and Diversion Structures[2]; 1.6 18 Cultural Resource Preservation[2]; 1.7 30 Planning, Engineering, and Design[2]; 1.8 31 Construction Management[2]	1.2 03 Reservoirs[2]; 1.3 06 Fish and Wildlife Facilities[2]; 1.4 11 Levees and Floodwalls[2]; 1.5 15 Flood Control and Diversion Structures[2]; 1.6 18 Cultural Resource Preservation[2]; 1.7 30 Planning, Engineering, and Design[2]; 1.8 31 Construction Management[2]	1.2 03 Reservoirs[2]; 1.3 06 Fish and Wildlife Facilities[2]; 1.4 11 Levees and Floodwalls[2]; 1.5 15 Flood Control and Diversion Structures[2]; 1.6 18 Cultural Resource Preservation[2]; 1.7 30 Planning, Engineering, and Design[2]; 1.8 31 Construction Management[2]
16	Equipment Productivity	1.2.1.1 05 Samuels Avenue Sites (impacts $228,138.98 of total labor cost); 1.2.1.4 20 Riverside Park (impacts $265,789.54 of total labor cost); 1.2.1.5 25 Rockwood Park – West (impacts $192,255.35 of total labor cost); 1.2.1.6 30 Riverside Oxbow/Gateway (impacts $3,057,711.33 of total labor cost); 1.4.1.3 Excavation, Hauling, and	1.2.1.1 05 Samuels Avenue Sites (impacts $1,351,042.49 of total equip cost); 1.2.1.4 20 Riverside Park (impacts $453,951.35 of total equip cost); 1.2.1.5 25 Rockwood Park – West (impacts $313,397.22 of total equip cost); 1.2.1.6 30 Riverside Oxbow/Gateway (impacts $5,560,247.47 of total equip cost); 1.4.1.3 Excavation, Hauling, and Placement; 1.4.2.3	-	-

TABLE 2 – WBS/RISK FACTOR CROSSWALK

Risk No.	Risk Description	WBS Labor Costs Impacted	WBS Equip Cost Impacted	WBS Materials Costs Impacted	WBS Sub Bid Costs Impacted
		Placement; 1.4.2.3 Excavation, Hauling, and Placement	Excavation, Hauling, and Placement		

Notes

1 Construction features include the following WBS features and all associated subfeatures under the following headings:

1.2 03 Reservoirs
1.3 06 Fish and Wildlife Facilities
1.4 11 Levees and Floodwalls
1.5 15 Flood Control and Diversion Structures
2.2 02 Relocations
2.3 04 Dams
2.4 06 Fish and Wildlife Facilities
2.5 08 Roads, Railroads and Bridges
2.6 13 Pumping Plants
2.7 14 Recreation Facilities
2.8 15 Flood Control and Diversion Structures

2 Impacts all features and associated subfeatures under the WBS heading indicated (unless exceptions are noted).

TABLE 3 – TOTAL PROJECT COST CONTINGENCY		
MII Cost Estimate without Contingency (2007 baseline)		**$506,743,627**
Confidence Level	**Value**	**Percent Contingency**
0%	$467,794,905	-7.7%
10%	$538,169,117	6.2%
20%	$549,395,027	8.4%
30%	$557,717,760	10.1%
40%	$564,976,142	11.5%
50%	$571,831,681	12.8%
60%	$578,897,983	14.2%
70%	$586,827,731	15.8%
80%	$596,111,405	17.6%
90%	$609,352,259	20.2%
100%	$716,281,926	41.3%

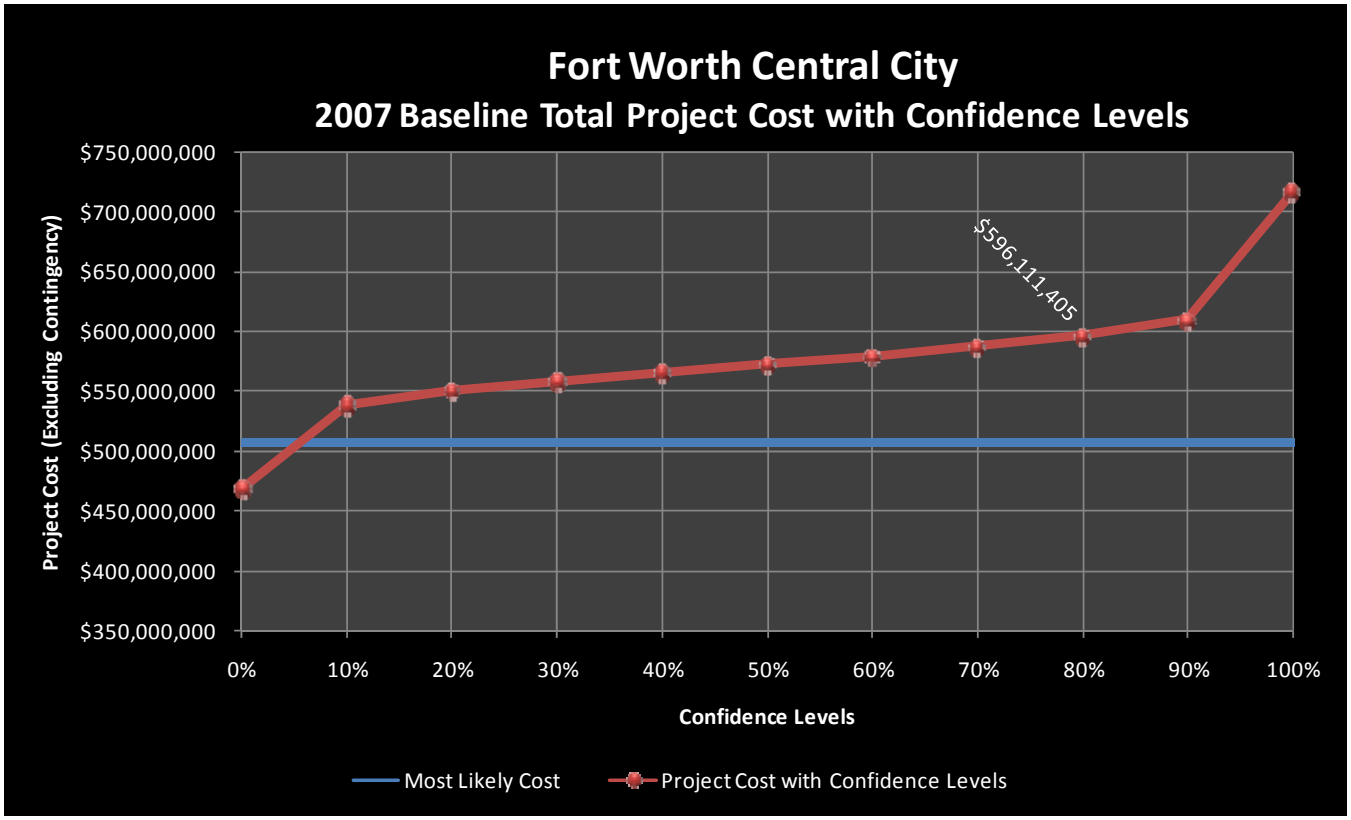


FIGURE 1 – TOTAL PROJECT COST WITH CONFIDENCE LEVELS

TABLE 4 – COST CONTINGENCY BY FEATURE			
Description	Project Cost 2007 $	Contingency	
		%	$
Total Project Cost	506,743,627		
1 01 Federal 220 Project	159,108,916		
1.1 01 Lands and Damages	31,183,334		
1.1.1 10 Property Acquisition	26,568,716	12%	3,176,504
1.1.2 15 Property Relocations	4,614,618	24%	1,085,656
1.2 03 Reservoirs	43,268,796		
1.2.1.1 05 Samuels Avenue Sites	5,323,585	19%	1,008,375
1.2.1.2 10 University Drive	3,952,653	12%	468,697
1.2.1.3 15 Ham Branch	822,375	12%	96,205
1.2.1.4 20 Riverside Park	2,375,242	18%	437,363
1.2.1.5 25 Rockwood Park - West	1,579,999	19%	308,083
1.2.1.6 30 Riverside Oxbow/Gateway	29,214,941	20%	5,799,745
1.3 06 Fish and Wildlife Facilities	304,109		
1.3.1 15 Ham Branch	304,109	10%	30,436
1.4 11 Levees and Floodwalls	41,125,153		
1.4.1 Bypass Channel - North	18,580,541	28%	5,191,780
1.4.2 Bypass Channel - South	22,544,611	28%	6,347,971
1.5 15 Flood Control and Diversion Structures	24,695,906		
1.5.1 05 Clear Fork	11,774,910	24%	2,768,234
1.5.2 15 TRWD	12,920,996	24%	3,074,963
1.6 18 Cultural Resource Preservation	1,108,740	12%	132,648
1.7 30 Planning, Engineering, and Design	11,345,131	11%	1,205,257
1.8 31 Construction Management	6,077,749	4%	261,167
2 02 Non-Federal Project	347,634,710		
2.1 01 Lands and Damages	53,111,628		
2.1.1 05 Property Acquisition Assistance	7,239,991	10%	687,890
2.1.2 10 Property Acquisition	28,406,743	12%	3,396,255
2.1.3 15 Property Relocations	17,464,894	24%	4,108,869
2.2 02 Relocations	32,887,990		
2.2.1 05 Mobilization and Demobilization	10,230	15%	1,576
2.2.2 10 General Demolition and Site Preparation	10,293,929	16%	1,608,755
2.2.3 15 Utility Relocation - Sanitary Sewer, Potable Water, Storm Sewer and Natural Gas	10,444,027	27%	2,792,557
2.2.4 20 Utility Relocation - Electrical and Communication	2,873,548	27%	766,493
2.2.5 25 Utility Relocation - Transmission Lines	9,266,254	53%	4,949,016
2.3 04 Dams	42,239,100		
2.3.1 05 Samuels Avenue Dam	30,949,414	18%	5,665,737
2.3.2 10 Marine Creek Low Water Dam/Lock	11,289,686	27%	3,065,588

TABLE 4 – COST CONTINGENCY BY FEATURE			
Description	Project Cost 2007 $	Contingency	
		%	$
2.4 06 Fish and Wildlife Facilities	10,835,246		
2.4.1 10 Riverside Oxbow/Gateway	10,166,517	9%	944,962
2.4.2 05 Rockwood Park	668,729	15%	100,732
2.5 08 Roads, Railroads and Bridges	70,579,566		
2.5.1 05 Henderson Bridge and Roadway	19,398,453	18%	3,585,619
2.5.2 10 White Settlement Bridge and Roadway	14,813,840	18%	2,693,425
2.5.3 15 Main Street Bridge and Roadway	19,594,591	18%	3,516,537
2.5.4 20 White Settlement Extension Bridge and Roadway	4,705,205	19%	899,765
2.5.5 25 Other Street Modifications	2,841,232	9%	267,510
2.5.6 30 Riverside Oxbow Park	5,934,883	11%	659,990
2.5.7 35 Riverside Gateway Park	1,196,511	11%	130,596
2.5.8 40 Bypass Channel Pedestrian Bridges	2,094,852	9%	195,454
2.6 13 Pumping Plants	5,622,722		
2.6.1 05 Stormwater Pumping Facility	5,622,722	14%	766,547
2.7 14 Recreation Facilities	22,269,848		
2.7.1 05 Water Feature	12,264,109	9%	1,161,066
2.7.2 10 Samuels Avenue	308,904	8%	24,866
2.7.3 15 Marine Creek	3,180,897	8%	256,051
2.7.4 20 Ham Branch	39,958	9%	3,502
2.7.5 25 Riverside Park	594,394	6%	37,191
2.7.6 30 Rockwood Park - West	156,711	8%	12,735
2.7.7 35 Riverside Oxbow/Gateway Park	5,724,877	6%	365,617
2.8 15 Flood Control and Diversion Structures	12,116,580		
2.8.1 10 Trinity Point	12,116,580	22%	2,682,091
2.9 30 Planning, Engineering, and Design	32,717,096	9%	3,037,301
2.10 31 Construction Management	40,432,378	3%	1,245,016
2.11 33 HTRW	24,822,555		
2.11.1 Environmental Assessments	2,628,880	34%	883,834
2.11.2 Site Remediation	19,832,531	34%	6,667,731
2.11.3 Remediation Program Management	2,361,144	34%	793,821

TABLE 5 – CONTINGENCY ALLOCATION TABLE					
Description	**Project Cost 2007 $**	**Forecast Standard Deviation $**	**Forecast Standard Deviation %**	**Contingency Allocation (% of total)**	**Contingency Allocation $**
Total Project Cost	506,743,627				
1 01 Federal 220 Project	159,108,916				
1.1 01 Lands and Damages	31,183,334				
1.1.1 10 Property Acquisition	26,568,716	$2,727,400.56	10%	4%	$3,176,504.43
1.1.2 15 Property Relocations	4,614,618	$932,162.33	20%	1%	$1,085,655.63
1.2 03 Reservoirs	43,268,796				
1.2.1.1 05 Samuels Avenue Sites	5,323,585	$865,807.91	16%	1%	$1,008,375.04
1.2.1.2 10 University Drive	3,952,653	$402,430.98	10%	1%	$ 468,696.75
1.2.1.3 15 Ham Branch	822,375	$82,603.17	10%	0%	$ 96,204.91
1.2.1.4 20 Riverside Park	2,375,242	$375,527.30	16%	0%	$ 437,363.01
1.2.1.5 25 Rockwood Park - West	1,579,999	$264,525.67	17%	0%	$ 308,083.45
1.2.1.6 30 Riverside Oxbow/Gateway	29,214,941	$4,979,759.22	17%	6%	$5,799,744.80
1.3 06 Fish and Wildlife Facilities	304,109				
1.3.1 15 Ham Branch	304,109	$26,132.62	9%	0%	$ 30,435.71
1.4 11 Levees and Floodwalls	41,125,153				
1.4.1 Bypass Channel - North	18,580,541	$4,457,750.04	24%	6%	$5,191,779.65
1.4.2 Bypass Channel - South	22,544,611	$5,450,475.11	24%	7%	$6,347,970.51
1.5 15 Flood Control and Diversion Structures	24,695,906				
1.5.1 05 Clear Fork	11,774,910	$2,376,853.03	20%	3%	$2,768,234.44
1.5.2 15 TRWD	12,920,996	$2,640,215.13	20%	3%	$3,074,962.72
1.6 18 Cultural Resource Preservation	1,108,740	$113,894.18	10%	0%	$ 132,648.42
1.7 30 Planning, Engineering, and Design	11,345,131	$1,034,853.67	9%	1%	$1,205,256.50
1.8 31 Construction Management	6,077,749	$224,241.99	4%	0%	$ 261,166.51
2 02 Non-Federal Project	347,634,710				
2.1 01 Lands and Damages	53,111,628				
2.1.1 05 Property Acquisition Assistance	7,239,991	$590,634.35	8%	1%	$ 687,890.39
2.1.2 10 Property Acquisition	28,406,743	$2,916,082.46	10%	4%	$3,396,255.39
2.1.3 15 Property Relocations	17,464,894	$3,527,944.51	20%	5%	$4,108,868.90
2.2 02 Relocations	32,887,990				
2.2.1 05 Mobilization and Demobilization	10,230	$1,353.48	13%	0%	$ 1,576.35
2.2.2 10 General Demolition and Site Preparation	10,293,929	$1,381,304.38	13%	2%	$1,608,755.07
2.2.3 15 Utility Relocation - Sanitary Sewer, Potable Water, Storm Sewer and Natural Gas	10,444,027	$2,397,737.17	23%	3%	$2,792,557.44
2.2.4 20 Utility Relocation - Electrical and Communication	2,873,548	$658,124.22	23%	1%	$ 766,493.39

TABLE 5 – CONTINGENCY ALLOCATION TABLE					
Description	**Project Cost 2007 $**	**Forecast Standard Deviation $**	**Forecast Standard Deviation %**	**Contingency Allocation (% of total)**	**Contingency Allocation $**
2.2.5 25 Utility Relocation - Transmission Lines	9,266,254	$4,249,308.71	46%	6%	$4,949,015.60
2.3 04 Dams	42,239,100				
2.3.1 05 Samuels Avenue Dam	30,949,414	$4,864,697.58	16%	6%	$5,665,736.68
2.3.2 10 Marine Creek Low Water Dam/Lock	11,289,686	$2,632,165.42	23%	3%	$3,065,587.52
2.4 06 Fish and Wildlife Facilities	10,835,246				
2.4.1 10 Riverside Oxbow/Gateway	10,166,517	$811,360.24	8%	1%	$ 944,961.82
2.4.2 05 Rockwood Park	668,729	$86,490.23	13%	0%	$ 100,732.03
2.5 08 Roads, Railroads and Bridges	70,579,566				
2.5.1 05 Henderson Bridge and Roadway	19,398,453	$3,078,673.13	16%	4%	$3,585,618.84
2.5.2 10 White Settlement Bridge and Roadway	14,813,840	$2,312,620.40	16%	3%	$2,693,425.03
2.5.3 15 Main Street Bridge and Roadway	19,594,591	$3,019,358.37	15%	4%	$3,516,537.09
2.5.4 20 White Settlement Extension Bridge and Roadway	4,705,205	$772,553.16	16%	1%	$ 899,764.62
2.5.5 25 Other Street Modifications	2,841,232	$229,689.05	8%	0%	$ 267,510.50
2.5.6 30 Riverside Oxbow Park	5,934,883	$566,678.47	10%	1%	$ 659,989.84
2.5.7 35 Riverside Gateway Park	1,196,511	$112,131.82	9%	0%	$ 130,595.86
2.5.8 40 Bypass Channel Pedestrian Bridges	2,094,852	$167,820.25	8%	0%	$ 195,454.15
2.6 13 Pumping Plants	5,622,722				
2.6.1 05 Stormwater Pumping Facility	5,622,722	$658,170.02	12%	1%	$ 766,546.73
2.7 14 Recreation Facilities	22,269,848				
2.7.1 05 Water Feature	12,264,109	$996,911.11	8%	1%	$1,161,066.18
2.7.2 10 Samuels Avenue	308,904	$21,350.59	7%	0%	$ 24,866.26
2.7.3 15 Marine Creek	3,180,897	$219,849.84	7%	0%	$ 256,051.13
2.7.4 20 Ham Branch	39,958	$3,006.88	8%	0%	$ 3,502.00
2.7.5 25 Riverside Park	594,394	$31,933.03	5%	0%	$ 37,191.24
2.7.6 30 Rockwood Park - West	156,711	$10,934.08	7%	0%	$ 12,734.53
2.7.7 35 Riverside Oxbow/Gateway Park	5,724,877	$313,925.16	5%	0.41%	$ 365,617.24
2.8 15 Flood Control and Diversion Structures	12,116,580				
2.8.1 10 Trinity Point	12,116,580	$2,302,889.07	19%	3%	$2,682,091.30
2.9 30 Planning, Engineering, and Design	32,717,096	$2,607,877.92	8%	3%	$3,037,300.75
2.10 31 Construction Management	40,432,378	$1,068,991.81	3%	1%	$1,245,015.96
2.11 33 HTRW	24,822,555				
2.11.1 Environmental Assessments	2,628,880	$758,874.83	29%	1%	$ 883,833.97
2.11.2 Site Remediation	19,832,531	$5,725,026.99	29%	7%	$6,667,731.11
2.11.3 Remediation Program Management	2,361,144	$681,587.87	29%	1%	$ 793,820.65

TABLE 6 – COST RISK FACTOR SENSITIVITY ANALYSIS	
Risk Factor (Number & Description)	**Contribution to Variance**
1.5: Material Cost (High Historic Volatility)	13.2%
6.1: Design Changes - Channels	9.3%
1.4: Fuel Cost	8.5%
8: HTRW	7.0%
5: Number of Contract Owners; Contract Capacity	7.0%
4: Contract Packaging/Size	6.4%
1.1: Craft Labor Cost	5.6%
1.3: Equipment Cost (ex fuel)	5.2%
14.2: Technical Complexity - Roadway Bridges	5.2%
6.2: Design Changes - Roadway Bridges	5.1%
2: Land Acquisition Cost	3.7%
14.1: Technical Complexity - Flood Control and Diversion Structures	3.3%
6.5: Design Changes - Flood Control and Diversion Structures	3.3%
10: Relocation	2.6%
3: 138 kV Transmission Line Relocation	2.1%
6.3: Design Changes - Samuels Avenue Dam	1.9%
6.6: Design Changes - Valley Storage	1.7%
15: Contract Acquisition Strategy - Federal	1.6%
6.8: Design Changes - Planning, Engineering and Design	1.5%
6.9: Design Changes - Utilities	1.4%
14.3: Technical Complexity - Dams	1.3%
12.1: Utilities - City	0.5%
14.4: Technical Complexity - Levees and Floodwalls	0.5%
1.2: General Material Cost	0.4%
16: Equipment Productivity	0.4%
All Other Risk Factors	1.4%

4.3 Schedule Contingency

Overall project schedule contingency was quantified as 154 working days based on P80. Table 7 provides the implied, overall project schedule contingencies calculated for various levels of confidence. A sensitivity analysis for critical path and near critical path tasks is provided as Table 8.

The results of the stress tests used to identify critical path and near critical path tasks are presented in Appendix E. The probability density functions used to quantify schedule risk factors are presented in Appendix F. The *Monte Carlo* simulation report generated by Crystal Ball for schedule contingency analysis is provided as Appendix G.

5. Risk Management Recommendations

As stated earlier, it is important to note that the risk register can be an effective tool for managing risks throughout the lifecycle of the FWCC Project. As such, it is recommended that the risk register be updated as the project progresses through planning and implementation. Furthermore, CSRA should be considered within the context of an overall lifecycle risk management process. Likewise, risk management is generally most effectively employed as one of the key elements of project performance measurement, assessment and planning.

In functional terms, project risk management is a process of identifying risk factors, analyzing and quantifying the properties of those risk factors, mitigating the impact of the factors on planned project performance, and developing and implementing a risk management plan. Figure 2 provides a process map for risk management. It is important to note that many elements of the risk management process have been performed as part of the CSRA and the tools necessary to periodically update the CSRA during the project lifecycle have been developed.

An important next step in the risk management process is to develop a risk management plan that will facilitate control of risk factors and their potential impacts throughout the project lifecycle. The risk register and sensitivity analyses conducted as part of the CSRA should be used as a guide to help ensure that future risk management efforts are both appropriate and cost beneficial.

Effectively managing a project throughout its lifecycle generally requires a systematic approach to planning, implementation, measurement, and assessment that interfaces with the strategic objectives, constraints and contexts of the project sponsors and stakeholders. While the risk management process is just one part of the overall project planning processes illustrated in Figure 3, it is best incorporated (particularly prior to project implementation) in a cyclical and iterative manner with the other planning processes so as to refine project plans with a goal of increasing project performance certainty.

TABLE 7 – TOTAL PROJECT SCHEDULE CONTINGENCY		
Baseline Schedule Completion Date		8/16/2018
Confidence Level	**Completion Date**	**Contingency (working days)**
0%	12/12/2017	-178
10%	7/20/2018	-20
20%	9/5/2018	15
30%	10/9/2018	39
40%	11/8/2018	61
50%	12/7/2018	82
60%	1/7/2019	103
70%	2/7/2019	126
80%	3/19/2019	154
90%	5/14/2019	194
100%	7/15/2020	500

TABLE 8 – SCHEDULE SENSITIVITY ANALYSIS	
Task (Number & Description)	**Contribution to Variance**
10.1.4 Construction	30.2%
6.2.7 Construct Bridge	16.2%
8.3.5 Tie-in Levee/Walls	11.5%
13.3 Construction	10.0%
8.3.4 Retaining Walls	8.9%
6.2.4 Relocate TXU 138 kV Overhead	8.4%
6.3.6 Construct Bridge	4.1%
8.2.4 Retaining Walls	2.5%
8.2.5 Tie-in Levee/Walls	1.8%
6.2.1 Concept Selection & Development	1.4%
10.3.4 Construction	1.4%
6.3.1 Concept Selection & Development	1.2%
6.3.2 Design	0.7%
10.2.4 Construction	0.6%
3.2.2 Acquisition	0.5%
13.4 CM	0.2%
3.2.1 Appraisals, Surveys, Engr, Legal	0.2%
6.3.3 Review TxDOT	0.1%
6.4.2 R-O-W Dedication	0.1%
6.3.4 Procurement	0.0%
6.3.5 Construct Temporary Detour	0.0%

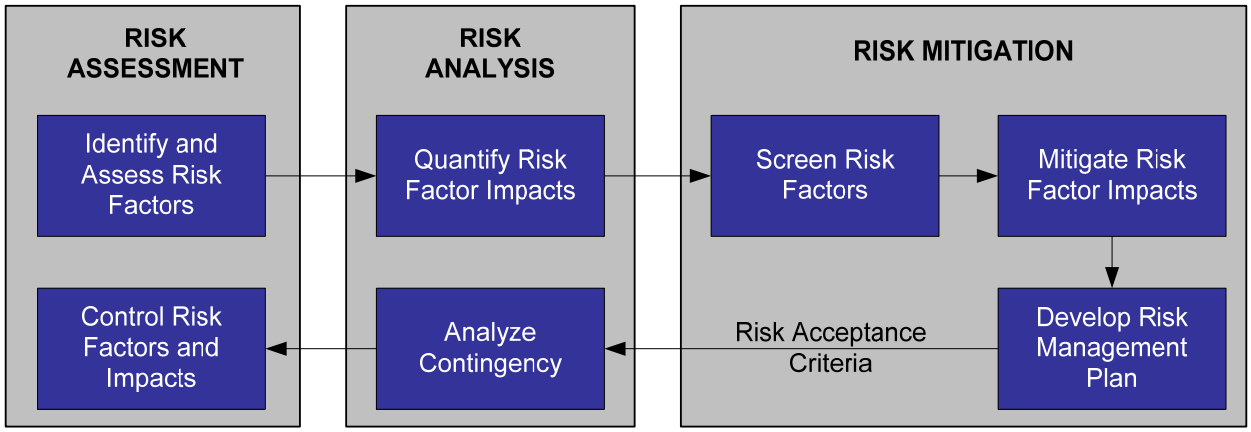


FIGURE 2 – PROJECT RISK MANAGMENT PROCESS MAP

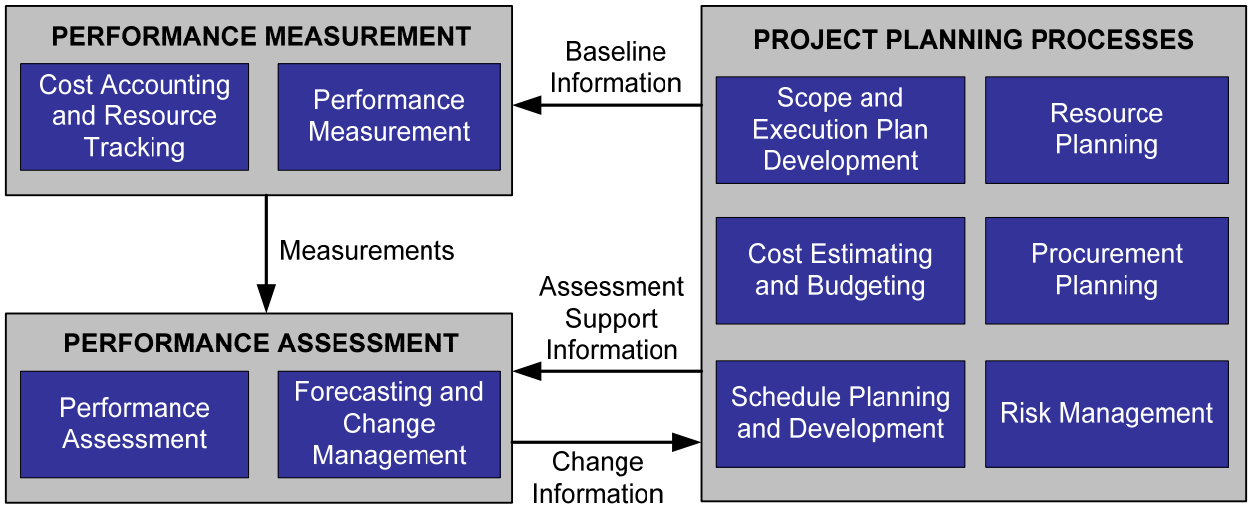


FIGURE 3 – PROJECT PERFORMANCE MEASUREMENT, ASSESSMENT AND PLANNING PROCESS MAP

Appendix A
Cost Estimate

FWCC.UPD
Fort Worth Central City - Preliminary Design
Escalation to 2007

Estimated by	Nick Agnew, CDM
Designed by	
Prepared by	Marc Schlebusch, CDM
Preparation Date	3/31/2008
Effective Date of Pricing	10/31/2007
Estimated Construction Time	2,600 Days

This report is not copyrighted, but the information contained herein is For Official Use Only.

Description **Page**

Library Properties ..... **i**
Project Notes ..... **ii**
Markup Properties ..... **xii**
Project Cost Summary Report **1**
1 01 Federal 220 1
1.1 01 Lands and Damages 1
1.1.1 10 Property Acquisition 1
1.1.2 15 Property Relocations 1
1.2 03 Reservoirs 1
1.2.1 05 Valley Storage 1
1.3 06 Fish and Wildlife Facilities 5
1.3.1 15 Ham Branch 5
1.4 11 Levees and Floodwalls 5
1.4 11 Levees and Floodwalls 6
1.4.1 Bypass Channel - North 6
1.4.2 Bypass Channel - South 6
1.5 15 Flood Control and Diversion Structures 7
1.5.1 05 Clear Fork 7
1.5.2 15 TRWD 8
1.6 18 Cultural Resource Preservation 9
1.7 30 Planning, Engineering, and Design 9
1.8 31 Construction Management 9
2 02 Non-Federal 9
2.1 01 Lands and Damages 9
2.1.1 05 Property Acquistion Assistance 10
2.1.2 10 Property Acquisition 10
2.1.3 15 Property Relocations 10
2.2 02 Relocations 10
2.2.1 05 Mobilization and Demobilization 10
2.2.2 10 General Demolition and Site Preparation 10
2.2.3 15 Utility Relocation - Sanitary Sewer, Potable Water, Storm Sewer and Natural Gas 10
2.2.3 15 Utility Relocation - Sanitary Sewer, Potable Water, Storm Sewer and Natural Gas 11
2.2.4 20 Utility Relocation - Electrical and Communication 11
2.2.5 25 Utility Relocation - Transmission Lines 12
2.3 04 Dams 12
2.3.1 05 Samuels Avenue Dam 12
2.3.2 10 Marine Creek Low Water Dam/Lock 12
2.3.2 10 Marine Creek Low Water Dam/Lock 13
2.4 06 Fish and Wildlife Facilities 13
2.4.1 10 Riverside Oxbow/Gateway 13
2.4.2 05 Rockwood Park 13

Description **Page**

2.5 08 Roads, Railroads and Bridges 13
2.5.1 05 Henderson Bridge and Roadway 14
2.5.2 10 White Settlement Bridge and Roadway 14
2.5.3 15 Main Street Bridge and Roadway 15
2.5.4 20 White Settlement Extension Bridge and Roadway 15
2.5.5 25 Other Street Modifications 15
2.5.6 30 Riverside Oxbow Park 15
2.5.6 30 Riverside Oxbow Park 16
2.5.7 35 Riverside Gateway Park 16
2.5.8 40 Bypass Channel Pedesterian Bridges 16
2.6 13 Pumping Plants 16
2.6.1 05 Stormwater Pumping Facility 16
2.7 14 Recreation Facilities 17
2.7.1 05 Water Feature 17
2.7.2 10 Samuels Avenue 18
2.7.3 15 Marine Creek 18
2.7.4 20 Ham Branch 18
2.7.5 25 Riverside Park 18
2.7.5 25 Riverside Park 19
2.7.6 30 Rockwood Park - West 19
2.7.7 35 Riverside Oxbow/Gateway Park 19
2.8 15 Flood Control and Diversion Structures 20
2.8.1 10 Trinity Point 20
2.9 30 Planning, Engineering, and Design 20
2.10 31 Construction Management 21
2.11 33 HTRW 21
2.11.1 Envrionmental Assessments 21
2.11.2 Site Remediation 21
2.11.3 Remediation Program Management 21
2.11.3 Remediation Program Management 22

Designed by

Estimated by
Nick Agnew, CDM
Prepared by
Marc Schlebusch, CDM

Design Document	
Document Date	1/31/2005
District	Fort Worth
Contact	Saji Alummuttil
Budget Year	2008
UOM System	Original

Direct Costs
LaborCost
EQCost
MatlCost
SubBidCost

Timeline/Currency

Preparation Date	3/31/2008
Escalation Date	9/30/2007
Eff. Pricing Date	10/31/2007
Estimated Duration	2600 Day(s)
Currency	US dollars
Exchange Rate	1.000000

Costbook CB06EB: MII English Cost Book 2006

Labor LB06NatFD: Labor National 2006
Note: http://www.wdol.gov/

Labor Rates
LaborCost1
LaborCost2
LaborCost3
LaborCost4

Equipment EP03R06: MII Equipment Region 6 2005
Note: Area factors updated with Region 6 2007 area and shipping factors.

06 SOUTHWEST

Sales Tax	0.00
Working Hours per Year	1,590
Labor Adjustment Factor	0.91
Cost of Money	4.75
Cost of Money Discount	25.00
Tire Recap Cost Factor	1.50
Tire Recap Wear Factor	1.80
Tire Repair Factor	0.15
Equipment Cost Factor	1.00
Standby Depreciation Factor	0.50

Fuel

Electricity	0.100
Gas	3.150
Diesel Off-Road	2.681
Diesel On-Road	3.192

Shipping Rates

Over 0 CWT	14.74
Over 240 CWT	14.51
Over 300 CWT	12.25
Over 400 CWT	10.94
Over 500 CWT	5.87
Over 700 CWT	5.39
Over 800 CWT	4.17

Date	Author	Note
3/31/2008	Schlebusch	1.0 PROJECT BACKGROUND The Central City Project is located within the vicinity of the downtown area of Fort Worth, Texas, along the West Fork and Clear Fork of the Trinity River and consists of a bypass channel, levee system, and associated improvements to divert flood flows around a segment of the existing floodway system. The original project estimate was prepared in January 2005 using Micro Computer Aided Cost Engineering System (MCACES) for Windows (MFW) software and subsequently updated in April 2005 based upon U. S. Army Corps of Engineers (USACE) comments. A Final Environmental Impact Statement (FEIS) was completed for the Central City Project in January 2006 and the Project Report was completed in March 2006. The Record of Decision (ROD) was signed, and the Project Report recommending the Community-Based Alternative was endorsed as being technically sound and environmentally acceptable, by the Assistant Secretary Army (ASA) for Civil Works (CW) on 7 April 2006. Section 116 of Public Law 108-447, dated 8 December 2004, authorized USACE's participation in construction of the Central City Project. Within that specific authorization, a subset which can be constructed by the USACE and the local sponsor, identified as the USACE's project, was defined at $110,000,000 federal cost and a $220,000,000 total project cost. The non-federal sponsor is the Tarrant Regional Water District (TRWD) and the City of Fort Worth is one of the local partners. These entities are also sponsors for the Riverside Oxbow Ecosystem Restoration Project. An Interim Feasibility Report and Integrated Environmental Assessment were completed in April 2003 for the Riverside Oxbow Project. The cost estimate, MCACES dated April 2003, was prepared as part of the Riverside Oxbow Feasibility Study. A Finding of No Significant Impact (FONSI) was signed by the Acting Fort Worth District Commander on 22 May 2003. On 29 May 2003 the recommended Plan for the Riverside Oxbow was approved by the Chief of Engineers. By letter dated 22 June 2006, the City of Fort Worth requested that the USACE's conduct an evaluation of the potential benefits of modifying the Central City Project to incorporate the Riverside Oxbow Ecosystem Restoration project area to accommodate valley storage requirements. In response to that letter request, the USACE's initial evaluation suggested the concept merited additional study which resulted in the preparation of a Supplemental EIS and supporting Technical Appendices. The following is a brief summary of each of the categories and work elements. Additional detail can be found in the Upper Trinity River Central City FEIS, Appendix C - Volume I Report and Volume II Plans dated January 2005 and in Supplement No.1 to the Final Environmental Impact Statement, Appendix C- Volume I Report and Volume II Supplemental Plans dated August 2007. 2.0 WORK ELEMENTS The cost estimate is formatted to be consistent with the Civil Works Breakdown Structure (CWBS). Using the CWBS the project has been segregated into fifteen (15) categories. Categories are further divided into additional sub-elements as appropriate to provide additional information and detail to individual items. Features of the modified Central City Project were developed by assessing the elements from two previous studies to determine the benefits merging certain elements. For this estimate features, quantities, construction approaches and plans were obtained largely from these prior studies with appropriate additions and deletions as required by the Modified Plan. 2.1 LAND (01) 2.1.1 ASSUMPTIONS This category includes costs associated with the acquisition of property for the project. The costs were tabulated by the major work element for which it will be acquired and property acquisition assistance costs. The four (4) major work elements are: bypass channel, water feature, valley storage (Riverside/Gateway and Marine Creek. The costs associated with each element of work were determined after review of the mass appraisals performed by James K. Norwood, Certified Real Estate Appraiser. Appraisals were performed on the Central City Project on behalf of the Tarrant Regional Water District and at the Riverside Oxbow/Gateway on behalf of the USACE. Estimated costs in this estimate are based on the best known information at the time of the estimate and may vary from the amounts in the Norwood appraisals given modifications in the project footprint. Costs were normalized to the baseline 2007 by factors provided by the Real Estate Division USACE Fort Worth District. A factor of 6% per year was used for land values and a 15% flat rate was used for administrative fees. Property acquisition assistance costs are included for consulting fees, legal assistance, and other permitting, subordinated fees, licenses that will be incurred as part of the land acquisition activity. These costs are for additional analysis, planning, acquisition documents and proceedings including any additional appraisals and possible condemnation proceedings. Base cost for these assistance cost was estimated at 13% of the Property Acquisition Cost and allocated at 5.2% Consulting, 5.2% Legal, and 2.6% Permitting & Licensing. A contingency was not been provided on these

Date	Author	Note
3/31/2008	Schlebusch	costs as they are considered separate consulting costs. Landowner relocation costs were provided by a separate independent relocation study. This category includes anticipated costs for the relocation and moving of current property owners and tenants on the affected property. Costs for relocations of persons and businesses under this section are based on the report prepared by Pinnacle Consulting Management Group, Inc dated February 2, 2005. Costs were adjusted to baseline 2007 cost utilizing factors provided by Pinnacle Group of 4% compounded annually. 2.1.2 REFERENCES James K. Norwood, Central City Trinity River Project (Bypass Channel), Updated Mass Appraisal, Phase I Real Property Acquisition, 16 November 2004 _____, Central City Trinity River Project (Interior Water Feature), Updated Mass Appraisal, Phase II Real Property Acquisition, 7 September 2004 _____, Central City Trinity River Project (Valley Storage), Updated Mass Appraisal, Phase III Real Property Acquisition, 9 December 2004 _____, Central City Trinity River Project (Marine Creek), Updated Mass Appraisal, Phase IV Real Property Acquisition, 9 December 2004 Pinnacle Consulting, Relocation Needs Assessment, 2 February 2005 _____, Property and Relocation Escalation Factors, Email dated 7 February 2008 2.2 RELOCATION (02) 2.2.1 ASSUMPTIONS Utility relocations are required for the construction of the project. A variety of utility lines including sewers, storm sewers, water mains, gas mains, electrical and cable will need to be relocated and/or demolished. Existing utilities were contacted, maps obtained and impacted utilities identified. City and franchise utility owners were contacted regarding location and costs for major relocations. Cost for the relocation of the 138 kilovolt (kV) transmission line provided by TXU Electric. Construction Costs for these items have been included in this section. This section also includes the demolition of structures and paving in the bypass channel and the water feature areas. Approximately 1,583,575 square feet of light industrial buildings will be demolished. The average building height was assumed to be 20 feet tall with 7.5% of building volume requiring disposal. Concrete paving was assumed to be 8-inch thick with approximately 48,780 square yards required for removal. Asphalt paving was assumed to be 6-inch thick with approximately 127,800 square yards of material removal. It is the intent of the local sponsors to develop a recycling and reuse plan to reduce landfill waste. Concrete debris may be used as armor in non-visible areas or crushed and used as fill during site construction. Demolition debris that cannot be recycled or reused beneficially will be hauled to the City of Fort Worth construction debris landfill on Bennen Avenue or the TRWD disposal area. There will be no disposal fees associated with construction debris disposed at either facility. 2.2.2 REFERENCES Internal CDM Memorandum, Bypass Channel Building Demo Memorandum, 15 April 2005. TXU Energy Service Quote for Relocating 138 kVA Line, Email dated 14 January 2005.

Date	Author	Note
3/31/2008	Schlebusch	2.3 RESERVOIRS (03)

2.3.1 ASSUMPTIONS
Samuels Avenue and University Drive are the two original locations which were identified for Valley Storage improvements. The Supplemental EIS added the Rockwood West, Ham Branch, Riverside Park, and the Riverside Oxbow/Gateways sites. Demolition of minor structures inherent to construction activities will be conducted as needed. It is the intent of the local sponsors to develop a recycling and reuse plan to reduce landfill waste. Demolition debris will be recycled or reused beneficially to reduce costs to the extent practicable. Demolition debris that cannot otherwise be used onsite will be hauled to the City of Fort Worth construction debris landfill on Bennen Avenue or the TRWD disposal area. There will be no disposal fees associated with construction debris disposed at either facility. Site improvements include removing unnecessary structures, site grading to allow for more valley storage and construction of new levees. In addition, new flood control structures, seeding and utility replacements are included in the expected costs. The University Drive site primarily consists of roadway and grade modifications/improvements. Borrow material required for University Drive site will be imported from the bypass channel and valley storage sites. For each of the Valley Storage excavation sites spoils/disposal areas were identified for haul-off of excavated materials. For major sites such as Riverside/Gateway, where haul routes incorporate public roadways, allowances were provided for street sweeping and restoration.

2.3.2 REFERENCES
Internal CDM Memorandum, Proposed Valley Storage Haul Routes for Modified Project,
9 November 2007.

2.4 DAMS (04)

2.4.1 ASSUMPTIONS
Downstream of the bypass channel a new dam structure will be constructed on the West Fork Trinity River. The dam will consist of seven (7) leaf gates placed into a concrete support structure. Three (3) sluice gates will also be provided in the bottom of the dam to assist in the control of upstream water levels. The concrete structure will have a maintenance access bridge to provide maintenance access to the leaf gates on the top of the dam and will be supported on a series of drilled shafts anchored in a bedrock foundation. A sheet piling system is proposed as a positive cut-off for seepage and as part of the construction sequencing plan.

A low water fixed broad crest weir dam is proposed on Marine Creek in near proximity to the Samuels Avenue Dam. The dam will be constructed of roller compacted concrete with a cast-in-place concrete cap on all portions above the stilling basin. Driven sheet piling will be used for seepage cut-off. A small lock structure for pleasure boats is proposed for connectivity between the Marine Creek and Samuels Dam impoundments. The lock will be a reinforced concrete structure with miter gates.

2.4.2 REFERENCES
General Electric Hydro Quote, Dam and Isolation Gates, 21 May 2004.

Rodney Hunt Quote, Locks, 2007.

2.5 FISH AND WILDLIFE FACILITIES (06)

2.5.1 ASSUMPTIONS
Fish and wildlife facilities include costs to restore and improve the various habitats at several valley storage sites. The primary locations for ecosystem features are Rockwood Park, Ham Branch and Riverside Oxbow/Gateway. The improvements that are included are seeding (both normal Bermuda grass and grassland/wetlands) and tree plantings. Excavations included with the development of valley storage capacity include the opening of the old Sycamore Creek Oxbow and excavation of the old Riverside Oxbow. In addition, 50,000 cubic yards of earthwork is included at the Rockwood site for the restoration of an existing oxbow. Costs for Ecosystem development including Riparian Forest, Wetlands, and Grasslands were prepared by the Environmental Branch USACE Fort Worth District.

2.5.2 REFERENCES

Date	Author	Note
3/31/2008	Schlebusch	USACE – Fort Worth District, 18 November 2005.

2.6 ROADS AND BRIDGES (08)

2.6.1 ASSUMPTIONS

A. Henderson Bridge and Roadway

Henderson Bridge will be a 6 lane standard bridge approximately 700 feet long with 10 feet wide concrete walks on both sides. Elevated embankments will lead up to the bridge on both sides of the future channel. The embankments will be supported by concrete retaining walls. The roadways will be constructed of concrete and include street lighting, pavement marking and signage. Construction of the roadway will require a temporary roadway detour.

B. White Settlement Bridge and Roadway

White Settlement Bridge will be a 4 lane standard bridge approximately 735 feet long with 10 feet wide concrete walks on both sides. Elevated embankments will lead up to the bridge on both sides of the future channel. The embankments will be supported by concrete retaining walls. The roadways will be constructed of concrete and include street lighting, pavement marking and signage. Construction of the roadway will require a temporary roadway. Installation of the final traffic signal for the White Settlement and Henderson Street intersection are included under this task.

C. Main Street Bridge and Roadway

Main Street Bridge will be a 4 lane designer (cable stayed) bridge approximately 406 feet long with 10 feet wide concrete walks on both sides. Elevated embankments will lead up to the bridge on both sides of the future channel. The embankments will be supported by concrete retaining walls. The roadways will be constructed of concrete. The roadways will be constructed of concrete and include street lighting, pavement marking and signage. Construction of the roadway will require a roadway detour onto an existing roadway.

D. White Settlement at Water Feature Bridge and Roadway

The White Settlement Bridge will be a 4 lane standard bridge approximately 450 feet long with 10 feet wide concrete walks on both sides. The bridge will cross the expanded Water Feature Elevated embankments will lead up to the bridge on both sides of the future channel. The embankments will be supported by concrete retaining walls. The roadways will be constructed of concrete. The roadways will be constructed of concrete and include street lighting, pavement marking and signage.

E. Beech Street Bridge

The existing Beech Street Bridge will be replaced with a 4 lane standard bridge approximately 115 feet long supported on drilled shafts. Elevated embankments will lead up to the bridge on both sides of the existing old oxbow channel. The interior embankments will be lined with concrete slope protection. The roadways will be constructed of concrete and pavement markings and signage.

F. Park Roads and Bridge

Costs are provided for over 4950 feet of two lane park entrance and roadways, 48,060 square feet of parking and one two lane park road bridge 103 ft in length.

G. Other Street Modifications

Additional costs were provided to perform modifications to the various local streets that will be affected by the construction of the channel. These modifications include providing turnouts, dead ends and patching of existing roads and drainage system. A contingency of 20% was included on Road and Bridge costs.

2.6.2 REFERENCES

TCB Independent Quote for Bridges Based on Texas Department of Transportation Guidance.

Contech Bridge Solutions Quote for Riverside Oxbow Pedestrian Bridges, 3 October 2007.

USACE, Beach Street/Park Road Bridge Quantities, Riverside Feasibility Study for LPP, MCACES Cost Estimate dated 7 April 2003.

Date	Author	Note
3/31/2008	Schlebusch	

2.7 LEVEES AND FLOODWALLS (11)

2.7.1 ASSUMPTIONS
Bypass Channel construction was been broken into two separate areas; North and South. The channel will consist of an excavated center channel with a new earthen levee constructed on the west side of the channel and multi-level reinforced concrete floodwalls on the east side. Both sides of the channel will have recreational paths for pedestrian access. All excess excavation material will be stockpiled in the future development area for use during construction of the flood control gates, backfill behind the retaining walls and White Settlement roadway embankment. Two pedestrian crossings will be constructed across the new channel and the West Fork Trinity River (just prior to the intersection with the new channel). Both pedestrian crossings will be designed to act as water breaks during a flood event.

2.8 STORMWATER PUMPING FACILITY (13)

2.8 ASSUMPTIONS
A Stormwater Pumping Facility will be included in the project to maintain the water level inside the water feature area during high water period rainfall events on the West Fork. This facility will be located adjacent to the TRWD Gate and will be constructed at the same time as the gate structure. The facility will contain a total of four (4) 45,000 gallon per minute pumps and be constructed of a concrete wet well and a masonry building. An emergency generator will be shared with the TRWD gate structure. In addition, access and parking will be provided adjacent to the site.

2.9 RECREATION FACILITIES (14)

2.9.1 ASSUMPTIONS
A. Valley Storage Sites
For the Rockwood West, Samuels Avenue and Ham Branch Valley storage Sites the recreational facilities consist of the replacement of concrete trails.

B. Water Feature
A water feature will be constructed at the existing confluence of the West Fork Trinity River and the Clear Fork Trinity River. The Water Feature area will be constructed with concrete retaining walls and walks. Recirculation pumps and housings are also included in the estimate to assist in the circulation of water in the interior area. A preliminary design had not been developed at the time of the estimate.

C. Marine Creek
Modifications will be made to Marine Creek, upstream of Samuel Avenue Dam, in order to ensure that pedestrian access will be available once the dam is constructed and the water impoundment is created. The modifications include construction of concrete retaining walls and new walks, lighting, and pedestrian bridge.

D. Riverside Park
Costs include the reconstruction of existing parking and new entrance roads. Allowances are provided for new athletic fields lighting, or relocations depending upon the final design and park plan.

E. Riverside/Gateway Park
In addition to the hard and soft trail system and two pedestrian bridges a number of special construction items have been included. The design of these facilities has yet to be determined so these items are shown as standard unit cost from RS MEANS based upon approximate foot prints. These include a 1,000 square feet concession stand with restrooms, 1,500 square feet splash park, four covered basketball courts, and bleachers. Allowances for electrical service, and lighting are provided.

2.10 FLOOD CONTROL & DIVERSION STRUCTURES (15)

2.10.1 ASSUMPTIONS

Date	Author	Note
3/31/2008	Schlebusch	Three (3) gate control structures (Clear Fork, Trinity Point and TRWD) will be constructed for the project. All three (3) structures will be constructed of concrete with battered foundation piles providing support to bedrock. The Clear Fork gate will also have a sheet pile cutoff wall. Each gate will have one large (24 feet x 17 feet) vertical roller gate and at least one small (12 feet x 10 feet) vertical roller gate (Trinity Point Gate - two). The large gate will be used for normal water control and boat access to the interior area, while the smaller gate(s) will be used to seal off pedestrian access during flooding conditions. Gates can be inspected when open through internal access areas. In addition, each gate will have an enclosed control room and instrumentation system for monitoring the gates. Budgetary information on gate construction and installation costs was provided by General Electric Hydro. 2.10.2 REFERENCES General Electric Hydro Quote, Dam and Isolation Gates, 21 May 2004. 2.11 CULTURAL RESOURCE PRESERVATION (18) 2.11.1 ASSUMPTIONS These costs were determined by USACE in accordance with the requirements contained in the Programmatic Agreement between the USACE and Texas Historical Commission. 2.12 DESIGN SURVEY, TESTING AND LEGAL (21) 2.12.1 ASSUMPTIONS This category includes anticipated costs for design survey, project control, geotechnical exploration and testing, independent construction materials testing and legal assistance fees. The costs are divided into two main tasks: 1) Design Survey and Testing and 2) Legal Fees. Costs under this category are based on a percentage of the total construction cost with contingency. Based on the complexity, magnitude, and duration of the project the costs have been assumed as approximately 1.3% for Design Survey and Testing services and 1.0% for Legal Fees for a total of 2.3% for this category. No contingency was included on these costs. 2.13 PLANNING, ENGINEERING & DESIGN (30) 2.13.1 ASSUMPTIONS This category includes anticipated costs for design and permitting including but not limited to development of final designs, contract bid packages, cost estimation, engineering services during construction, environmental permitting, and permit fees. The costs are divided into two main tasks: 1) A/E Design Fees and 2) Permits, Fees, and Licenses. Costs under this category are based on a percentage of the total construction cost with contingency. Based on the complexity, magnitude, and duration of the project the costs have been assumed as approximately 5.0% for A/E Design Fees and 1.7% for Permits, Fees and Licenses for a total of 6.7% for this category. No contingency was included on these costs. 2.14 CONSTRUCTION MANAGEMENT (31) 2.14.1 ASSUMPTIONS This category includes anticipated costs for program management and construction management. A. Program Management This category includes anticipated costs for program management services during the design and construction of the project. Program management services are anticipated, but not limited to be: Agency Coordination/Management, Standards Development, Maintenance of Project Records and Base Files, Funding/ Grants and Cost Accounting, Contract Procurement, Project Schedule Maintenance, and Closeout. Costs under this category are based on a percentage of the total construction cost with contingency. Based on the complexity, magnitude, and duration of the project the costs have been assumed as approximately 4.9% for this category. No contingency was included on these costs. Program management was not included in for the Federal portion of this work.

Date	Author	Note
3/31/2008	Schlebusch	B. Construction Management This category includes anticipated costs for construction management including but not limited to costs for: meetings (pre-con, progress, post-con), field coordination, inspection, survey control, contract modifications, payment request processing. Costs under this category are based on a percentage of the total construction cost with contingency. Based on the complexity, magnitude, and duration of the project the costs have been assumed as approximately 4.6% for this category. No contingency was included on these costs. 2.14 HTRW (33) 2.14.1 ASSUMPTIONS The HTRW category includes costs for environmental services and remediation on the project and was developed based on the results of the environmental records review completed for the potentially impacted properties during the initial EIS phase. For the Phase I and Phase II site assessments the following allowances were used: Update the Phase I EIS data, 173 parcels at an cost of $1,000/ site; Phase II site assessments assumed 106 sites at $9,200/site: soil and groundwater testing 1350 samples at $335/sample and 413 samples at $430/sample; asbestos surveys estimated at 50 building at $1,150/structure Environmental remediation costs for the project were developed primarily for the potentially impacted properties within the proposed bypass channel at each of the sites with records indicating potential release of petroleum or hazardous chemicals. Costs include, but are not limited to, the following: - Investigation of assumed contaminated sites; - Excavation and disposal of underground storage tanks (USTs) and accompanying contaminated soils; - Placement of short-term groundwater recovery/treatment systems at locations with leaking USTs (LUSTs)/USTs; - Excavation and disposal of assumed volumes of contaminated soil based on the number of databases that each site appears within; - Analytical costs for characterization of the contaminated soils for disposal and confirmation of complete removal; and - Engineering design fees and administrative costs for following required regulatory guidelines and submittal of appropriate reports to regulatory agencies. Asbestos abatement costs were calculated based on factoring the total square footage buildings to be removed to determine office type space within the total building footprint which would likely contain asbestos. Of the total of 1.5 million square feet of buildings to be demolished, 50 % is assumed to be finished and of that amount 20% was assumed to contain asbestos. Abatement unit price were then used from MEANS Environmental Remediation Book to determine the estimated asbestos abatement cost. The HTRW construction costs are based on the best available information at this time and will be updated and refined as design development is advanced and more information can be obtained within the project footprint. 2.14.2 REFERENCES Internal CDM Memorandum, Asbestos Abatement Estimate, 22 May 2005. Accutest Quote, Laboratory Testing, 5 September 2006. 3.0 ENVIRONMENTAL CONCERNS General environmental concerns (for example, sediment and erosion control) during construction will be addressed through better management practices (BMPs). Hazardous materials will be addressed through Phase I and II environmental assessments during property acquisition. Any properties that are in need of remediation will be addressed as described in Section 2.14 above. 4.0 ESTIMATED CONSTRUCTION DURATION: The project duration (for bond calculation purposes) is assumed to have a duration of approximately 10 years or 2,600 (working day is defined as an 8-hour day Monday through Friday excluding major holidays). It is assumed that actual project duration is approximately 240 months from notice to proceed (NTP). The NTP date and field mobilization date are unknown at this phase of the conceptual planning. The midpoint of the construction project has been estimated based on an assumed NTP date of 2008.

Date	Author	Note
3/31/2008	Schlebusch	5.0 ESTIMATE PREPARATION: This cost estimate was prepared using the MCACES Second Generation software (MII). The following supporting databases were used in the preparation of the cost estimate: LB06NatFD (Labor National 2006), EP03R06 (MII Equipment Cost Book for Region 6 2005), and CB06EB (MII English Cost Book 2006). The quantities used in the estimate preparation were determined from the conceptual plans (drawings) for the work. This cost estimate assumes that all the necessary equipment, labor, and material will be available for the project because it is located in Fort Worth, Texas and near Dallas, Texas both of which are major metropolitan areas. The structure of the estimate is organized according to the CWBS in accordance with Engineer Regulation for Civil Works Cost Engineering (ER 1110-2-1302), 31 March 1994. The costs presented in this estimate are considered to have an accuracy range of +50/-30. All estimates are prepared by qualified estimating staff within the CDM Constructors division of CDM. During the estimating process an ongoing review of all work takes place as the estimate is being prepared. At the completion of all estimates, the Regional Chief Estimator performs a quality assurance review of the estimate, to verify that it is within the standard guidelines of CDM Constructors. 5.1 LABOR RATES: This estimate is based on the latest available/supported MCACES MII labor rate database (LB06NatFD), which has been updated using the 31 August 2007 Davis Bacon Wage Determinations for the Fort Worth, Texas for the base and fringe rates. In addition, payroll taxes and insurance have been updated for each laborer using the following 2007 factors: - Federal/State Unemployment Taxes: 6.17% (0.8% Federal/5.37% State) - Social Security Taxes: 7.65% - Workmen's Compensation: 10.29% No overtime was assumed for this estimate. 5.2 EQUIPMENT RATES: This estimate is based on the latest available/supported MCACES MII equipment rate database (EP03R06), which has been updated using the latest Region 6 (Texas) Area Factors, as provided in Appendix B of Engineering Pamphlet EP 1110-1-8, dated 31 July 2007. The Area Factors were further adjusted to account for current fuel costs (gasoline and diesel) at the time of estimate preparation and therefore the equipment rates used in the estimate more accurately represent current 2007 prices. The sales tax for this estimate was set at 0% because Texas state sales tax is exempt from government sponsored work. 5.3 CONTRACTORS/SUBCONTRACTORS: The procurement plan for this project currently assumes the work will be performed by a minimum of 11 General Contractors: GENERAL CONTRACTOR Bridge and Roadway General Contractor – Henderson, Main, and White Settlement Bridge and Roadway General Contractor – Beach Street Bridge and Roadway General Contractor – White Settlement Extension and Bridge Bypass Channel and Levees General Contractor Isolation Gate General Contractor – Trinity Point Isolation Gate General Contractor – Clear Fork and TRWD Ham Branch Ecosystem General Contractor Riverside Gateway General Contractor Dam General Contractor

Date	Author	Note
3/31/2008	Schlebusch	Valley Storage General Contractor Environmental Remediation General Contractor The estimate assumes that the following Subcontractors to the General Contractors: SUBCONTRACTOR Bridge and Roadway Subcontractor Building Subcontractor Concrete Subcontractor Dam Subcontractor Demolition Subcontractor Drilling/Caisson Subcontractor Electrical Subcontractor Electrical Utility Subcontractor Environmental Remediation Subcontractor Gate Control Structures Subcontractor Hauling Subcontractor Landscape Subcontractor Mechanical Subcontractor Transportation Subcontractor Water and Sewer Utility Subcontractor The following General Contractor overhead, profit, and bond markups are assumed: Home Office Overhead (HOOH) = 3% Field Office Overhead (JOOH) = 10% Profit = 8% Bond = 2.5% For each of the subcontractors, the following subcontractor overhead,profit, and bond markups are assumed: Home Office Overhead (HOOH) = 3% Field Office Overhead (JOOH) = 2% Profit = 8% Bond = 2.5% The General Contractor also applies their markups on work done by the subcontractor. 5.4 PROJECT OWNER MARKUPS: The owner also has markups on the project level that are applied after contractor markups. These markups are included below. The previous MCACES MFW estimates were prepared in 2005 dollars. The costs in the MII estimate are escalated to 10/31/2007 based on the Civil Works Construction Cost Index revised 09/30/2007. The effective date for the estimate is 10/31/2007. Project owner markups (escalation to midpoint of construction and contingency) beyond 2007 were not applied in the MCACES MII estimate but rather in a separate Total Project Summary table. Escalation to midpoint and contingency was not applied within the MCACES MII estimate, but rather applied in a separate total project summary. A rate of 6% per year

Date	Author	Note
3/31/2008	Schlebusch	was used to escalate real estate costs for the project ot midpoint. The real estate escalation rate of 6% per year was provided by USACE and James K. Norwood, Certified Real Estate Appraiser. A rate of 3.5% per year was used to escalate construction costs for the project to midpoint. The 3.5% per year escalation rate was based on research using the Construction Cost Index (CCI). Because of the duration and scheduling of the project different midpoints of construction were used for the major components of the work. For the base estimate contingency was applied to lands and damages property acquisition and owner relocations and all construction features. Total project contingency was quantified using the August 2007 USACE Cost and Schedule Risk Analysis Process guidance and is based on Monte Carlo simulation of the cost estimate using Crystal Ball software. The cost risk analysis served to quantify contingency based on an eighty percent level of confidence and corresponds directly to the risk register prepared by the project delivery team. Total project contingency was quantitatively allocated to individual project features based on dollar-weighted relative risk as measured by the standard deviation of the feature-specific Crystal Ball forecast. Government sponsored work is exempt from sales tax in the state of Texas. 5.5 DETAIL COST SOURCES: The MCACES MII supporting databases (labor, equipment, materials, and UPB) were used whenever possible for this cost estimate. Direct detail costs were derived using several sources of cost information. The following are the reference codes used in the detail section to identify sources and are listed in order of usage within the estimate: 1) MCACES MII English Cost Book 2006 (UPB) (as listed by database ID) Note: Labor, equipment and crews' databases have been updated to 2007 using current cost data. 2) Allowances, estimator's judgment, vendor quotes or costs based on previous work by CDM (no code listed) 3) CostWorks 2008 from RS Means "0000000000" 6.0 RISK ANALYSIS The overall risk management process for the project involves (1) identifying risk factors, (2) analyzing and quantifying the properties of those risk factors, (3) mitigating the impact of the factors on planned project performance, and (4) developing and implementing a risk management plan. While the risk management process is just one part of the overall project planning process, it is incorporated in a concurrent and iterative manner with the other planning processes so as to refine project plans with a goal of increasing performance certainty. The first two elements of the risk management process (identifying risk factors; analyzing and quantifying the properties of those risk factors) have been performed in accordance with the Cost and Schedule Risk Analysis Process described in the August 2007 guidance developed by the USACE Walla Walla District.

Direct Cost Markups	**Category**	**Method**
Productivity	Productivity	Productivity
Overtime	Overtime	Overtime

	Days/Week	*Hours/Shift*	*Shifts/Day*	*1st Shift*	*2nd Shift*	*3rd Shift*
Standard	*5.00*	*8.00*	*1.00*	*8.00*	*0.00*	*0.00*
Actual	*5.00*	*8.00*	*1.00*	*8.00*	*0.00*	*0.00*

Day	*OT Factor*	*Working*	*OT Percent*	*FCCM Percent*
Monday	*1.50*	*Yes*	*0.00*	*0.00*
Tuesday	*1.50*	*Yes*		
Wednesday	*1.50*	*Yes*		
Thursday	*1.50*	*Yes*		
Friday	*1.50*	*Yes*		
Saturday	*1.50*	*No*		
Sunday	*2.00*	*No*		

Sales Tax	TaxAdj	Running % on Selected Costs
MatlCost		

Contractor Markups	**Category**	**Method**
JOOH	JOOH	Running %
JOOH - Subcontractor (Small Tools)	JOOH	% of Labor
JOOH - Subcontractor	JOOH	JOOH (Calculated)
HOOH	HOOH	Running %
HOOH - Subcontractor	Allowance	Running %
Profit	Profit	Running %
Profit - Subcontractor	Allowance	Running %
Bond	Bond	Running %
Bond - Subcontractor	Bond	Running %
Excise Tax	Excise	Running %

Owner Markups	**Category**	**Method**
Escalation 0407 - 15 Floodway Control	Escalation	Escalation
Escalation 0507 - 02 Relocations	Escalation	Escalation
Escalation 0507 - 03 Reservoirs	Escalation	Escalation
Escalation 0507 - 04 Dams	Escalation	Escalation

	StartDate	*StartIndex*	*EndDate*	*EndIndex*	*Escalation*
Escalation 0407 - 15 Floodway Control	*5/21/2004*	*571.55*	*10/31/2007*	*674.67*	*18.04*
Escalation 0507 - 02 Relocations	*2/18/2005*	*617.37*	*10/31/2007*	*685.22*	*10.99*
Escalation 0507 - 03 Reservoirs	*1/31/2005*	*648.68*	*10/31/2007*	*710.72*	*9.56*
Escalation 0507 - 04 Dams	*1/31/2005*	*598.72*	*10/31/2007*	*674.88*	*12.72*

Escalation 0507 - 05 Locks

Escalation		Escalation		
StartDate	*StartIndex*	*EndDate*	*EndIndex*	*Escalation*
1/31/2005	*599.22*	*10/31/2007*	*678.42*	*13.22*

Escalation 0507 - 06 Fish and Wildlife

Escalation		Escalation		
StartDate	*StartIndex*	*EndDate*	*EndIndex*	*Escalation*
1/31/2005	*597.79*	*1/31/2008*	*674.67*	*12.86*

Escalation 0507 - 08 Roads and Bridges

Escalation		Escalation		
StartDate	*StartIndex*	*EndDate*	*EndIndex*	*Escalation*
1/31/2005	*617.37*	*10/31/2007*	*685.22*	*10.99*

Escalation 0507 - 11 Levees and Floodwalls

Escalation		Escalation		
StartDate	*StartIndex*	*EndDate*	*EndIndex*	*Escalation*
1/31/2005	*618.00*	*10/31/2007*	*694.08*	*12.31*

Escalation 0507 - 13 Pumping Plant

Escalation		Escalation		
StartDate	*StartIndex*	*EndDate*	*EndIndex*	*Escalation*
1/31/2005	*603.75*	*10/31/2007*	*694.02*	*14.95*

Escalation 0507 - 14 Recreation Facilities

Escalation		Escalation		
StartDate	*StartIndex*	*EndDate*	*EndIndex*	*Escalation*
1/31/2005	*603.75*	*10/31/2007*	*694.02*	*14.95*

Escalation 0507 - 15 Floodway Control

Escalation		Escalation		
StartDate	*StartIndex*	*EndDate*	*EndIndex*	*Escalation*
1/31/2005	*597.76*	*10/31/2007*	*674.67*	*12.87*

Escalation 0507 - 18 Cultural

Escalation		Escalation		
StartDate	*StartIndex*	*EndDate*	*EndIndex*	*Escalation*
1/31/2005	*603.75*	*10/31/2007*	*694.02*	*14.95*

Escalation 0507 - 19 Buildings

Escalation		Escalation		
StartDate	*StartIndex*	*EndDate*	*EndIndex*	*Escalation*
1/31/2005	*603.75*	*10/31/2007*	*694.02*	*14.95*

Escalation 0507 - 33 HTRW

Escalation		Escalation		
StartDate	*StartIndex*	*EndDate*	*EndIndex*	*Escalation*
1/31/2005	*604.49*	*10/31/2007*	*682.63*	*12.93*

Escalation 0607 - 02 Relocations

Escalation		Escalation		
StartDate	*StartIndex*	*EndDate*	*EndIndex*	*Escalation*
1/31/2006	*643.94*	*10/31/2007*	*685.22*	*6.41*

Escalation 0607 - 03 Reservoirs

Escalation		Escalation		
StartDate	*StartIndex*	*EndDate*	*EndIndex*	*Escalation*
1/31/2006	*668.01*	*10/31/2007*	*710.72*	*6.39*

Escalation 0607 - 04 Dams

Escalation

Escalation

StartDate	StartIndex	EndDate	EndIndex	Escalation
1/31/2006	631.20	10/31/2007	674.88	6.92

Escalation 0607 - 05 Locks — Escalation — Escalation

StartDate	StartIndex	EndDate	EndIndex	Escalation
1/31/2006	630.30	10/31/2007	678.42	7.63

Escalation 0607 - 06 Fish and Wildlife — Escalation — Escalation

StartDate	StartIndex	EndDate	EndIndex	Escalation
1/31/2006	630.14	10/31/2007	674.67	7.07

Escalation 0607 - 08 Roads and Bridges — Escalation — Escalation

StartDate	StartIndex	EndDate	EndIndex	Escalation
1/31/2006	643.94	10/31/2007	685.22	6.41

Escalation 0607 - 11 Levees — Escalation — Escalation

StartDate	StartIndex	EndDate	EndIndex	Escalation
1/31/2006	651.23	10/31/2007	694.08	6.58

Escalation 0607 - 13 Pumping Plant — Escalation — Escalation

StartDate	StartIndex	EndDate	EndIndex	Escalation
1/31/2006	638.50	10/31/2007	694.02	8.70

Escalation 0607 - 14 Recreation — Escalation — Escalation

StartDate	StartIndex	EndDate	EndIndex	Escalation
1/31/2006	638.50	10/31/2007	694.02	8.70

Escalation 0607 - 15 Floodway Control — Escalation — Escalation

StartDate	StartIndex	EndDate	EndIndex	Escalation
1/31/2006	630.14	10/31/2007	674.67	7.07

Escalation 0607 - 18 Cultural Resource — Escalation — Escalation

StartDate	StartIndex	EndDate	EndIndex	Escalation
1/31/2006	638.50	10/31/2007	694.02	8.70

Escalation 0607 - 19 Buildings — Escalation — Escalation

StartDate	StartIndex	EndDate	EndIndex	Escalation
1/31/2006	638.50	10/31/2007	694.02	8.70

Escalation 0607 - 33 HTRW — Escalation — Escalation

StartDate	StartIndex	EndDate	EndIndex	Escalation
1/31/2006	638.08	10/31/2007	682.63	6.98

Contingency - Lands and Damages	Contingency	Running %
Contingency	Contingency	Running %
SIOH	SIOH	Running %

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
Project Cost Summary Report			**34,436,556**	**30,392,375**	**47,897,906**	**283,214,667**	**233,419,764**	**474,784,054**	**31,959,573**	**506,743,626**
1 01 Federal 220	**1.00**	**LS**	**15,793,456**	**19,524,688**	**23,525,268**	**60,813,451**	**79,846,330**	**149,771,957**	**9,336,959**	**159,108,916**
(Note: Section 116 of Public Law 108-447, dated 8 December 2004, authorized USACE's participation in construction of the Central City Project. Within that specific authorization, a subset which can be constructed by the USACE and the local sponsor, identified as the USACE's project, was defined at $110,000,000 federal cost and a $220,000,000 total project cost.)										
1.1 01 Lands and Damages	**1.00**	**LS**	**0**	**0**	**0**	**31,183,334**	**0**	**31,183,334**	**0**	**31,183,334**
(Note: This category includes costs associated with the acquisition of property for the project. The costs were tabulated by the major work element for which it will be acquired and property acquisition assistance costs. The four (4) major work elements are: bypass channel, water feature, valley storage (Riverside/Gateway and Marine Creek. The costs associated with each element of work were determined after review of the mass appraisals performed by James K. Norwood, Certified Real Estate Appraiser. Appraisals were performed on the Central City Project on behalf of the Tarrant Regional Water District and at the Riverside Oxbow/Gateway on behalf of the USACE. Estimated costs in this estimate are based on the best known information at the time of the estimate and may vary from the amounts in the Norwood appraisals given modifications in the project footprint. Costs were normalized to the baseline 2007 by factors provided by the Real Estate Division USACE Fort Worth District. A factor of 6% per year was used for land values and a 15% flat rate was used for administrative fees. Landowner relocation costs were provided by a separate independent relocation study. This category includes anticipated costs for the relocation and moving of current property owners and tenants on the affected property. Costs for relocations of persons and businesses under this section are based on the report prepared by Pinnacle Consulting Management Group, Inc dated February 2, 2005. Costs were adjusted to baseline 2007 cost utilizing factors provided by Pinnacle Group of 4% compounded annually.)										
1.1.1 10 Property Acquisition	**1.00**	**LS**	**0**	**0**	**0**	**26,568,716**	**0**	**26,568,716**	**0**	**26,568,716**
1.1.2 15 Property Relocations	**1.00**	**LS**	**0**	**0**	**0**	**4,614,618**	**0**	**4,614,618**	**0**	**4,614,618**
1.2 03 Reservoirs	**1.00**	**LS**	**6,026,803**	**13,602,961**	**6,868,235**	**2,542,600**	**32,511,328**	**40,776,715**	**2,492,081**	**43,268,795**
(Note: Samuels Avenue and University Drive are the two original locations which were identified for Valley Storage improvements. The Supplemental EIS added the Rockwood West, Ham Branch, Riverside Park, and the Riverside Oxbow/Gateways sites. Demolition of minor structures inherent to construction activities will be conducted as needed. It is the intent of the local sponsors to develop a recycling and reuse plan to reduce landfill waste. Demolition debris will be recycled or reused beneficially to reduce costs to the extent practicable. Demolition debris that cannot otherwise be used onsite will be hauled to the City of Fort Worth construction debris landfill on Bennen Avenue or the TRWD disposal area. There will be no disposal fees associated with construction debris disposed at either facility. Site improvements include removing unnecessary structures, site grading to allow for more valley storage and construction of new levees. In addition, new flood control structures, seeding and utility replacements are included in the expected costs. The University Drive site primarily consists of roadway and grade modifications/improvements. Borrow material required for University Drive site will be imported from the bypass channel and valley storage sites. For each of the Valley Storage excavation sites spoils/disposal areas were identified for haul-off of excavated materials. For major sites such as Riverside/Gateway, where haul routes incorporate public roadways, allowances were provided for street sweeping and restoration.)										
1.2.1 05 Valley Storage	**1.00**	**LS**	**6,026,803**	**13,602,961**	**6,868,235**	**2,542,600**	**32,511,328**	**40,776,715**	**2,492,081**	**43,268,795**
1.2.1.1 05 Samuels Avenue Sites	**1.00**	**LS**	**621,925**	**2,433,689**	**866,191**	**0**	**4,108,605**	**5,153,140**	**170,445**	**5,323,585**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
(Note: An estimated volume of 737,000 BCY of soil and 130,000 BCY of rock will be excavated from the Samuels Avenue north and south sites. The estimated excavation volume from the Samuels Avenue north site is 552,000 BCY (422,000 BCY soil and 130,000 BCY rock). The estimated excavation volume from the Samuels Avenue south site is 315,000 BCY. All the excavated material from the Samuels Avenue north site will be hauled to the city landfill site. All the excavated material will be hauled to the city impound lot. Soil will be dumped, spread, and compacted at each site.)										
1.2.1.1.1 Mobilization and Demobilization	**1.00**	**LS**	**4,439**	**9,863**	**0**	**0**	**17,391**	**21,812**	**0**	**21,812**
1.2.1.1.2 Site Preparation	**1.00**	**LS**	**172,220**	**533,692**	**2,257**	**0**	**762,145**	**955,905**	**61,082**	**1,016,988**
			0.22	*1.56*	*0.00*	*0.00*	*1.84*	*2.31*		*2.31*
1.2.1.1.3 Excavation and Hauling	**867,000.00**	**BCY**	**188,599**	**1,351,042**	**0**	**0**	**1,598,795**	**2,005,258**	**0**	**2,005,258**
			0.13	*0.32*	*0.00*	*0.00*	*0.48*	*0.60*		*0.60*
1.2.1.1.4 Fill Placement and Compaction	**767,000.00**	**BCY**	**98,858**	**246,191**	**0**	**0**	**365,727**	**458,707**	**0**	**458,707**
(Note: Spread and compact dumped fill from Samuels Avenue sites. An estimated 506,400 LCY hauled to the city landfill and 378,000 LCY hauled to the city impound lot.)										
1.2.1.1.5 Drainage	**1.00**	**LS**	**4,175**	**13**	**15,457**	**0**	**23,355**	**29,293**	**1,872**	**31,165**
1.2.1.1.6 Site Restoration	**1.00**	**LS**	**153,633**	**292,888**	**848,478**	**0**	**1,341,192**	**1,682,165**	**107,490**	**1,789,655**
1.2.1.2 10 University Drive	**1.00**	**LS**	**348,972**	**300,121**	**1,560,753**	**325,000**	**2,944,607**	**3,693,217**	**259,436**	**3,952,653**
(Note: Excavated material (an estimated 130,000 BCY) from the Rockwood Park - West site will be brought to the University Drive site. Soil from the Rockwood Park - West site will be spread and compacted.)										
1.2.1.2.1 Mobilization and Demobilization	**1.00**	**LS**	**935**	**2,037**	**0**	**0**	**3,616**	**4,535**	**0**	**4,535**
1.2.1.2.2 Site Preparation	**1.00**	**LS**	**139,773**	**170,952**	**760**	**0**	**387,998**	**486,639**	**31,096**	**517,735**
			0.13	*0.43*	*0.00*	*0.00*	*0.59*	*0.74*		*0.79*
1.2.1.2.3 Fill Placement and Compaction	**130,000.00**	**BCY**	**17,438**	**55,800**	**0**	**0**	**76,885**	**96,431**	**6,162**	**102,593**
(Note: Spread and compact dumped fill from Rockwood Park West (130,000 BCY).)										
1.2.1.2.4 Site Restoration	**1.00**	**LS**	**12,605**	**26,185**	**60,930**	**0**	**112,717**	**141,373**	**9,034**	**150,406**
1.2.1.2.5 Pavement, Sidewalks, Curbs, and Gutter	**1.00**	**LS**	**67,161**	**18,242**	**928,926**	**25,000**	**1,194,772**	**1,498,520**	**96,749**	**1,595,270**
1.2.1.2.6 Retaining Wall	**1.00**	**LS**	**78,370**	**18,811**	**249,051**	**0**	**406,334**	**509,637**	**32,566**	**542,203**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
1.2.1.2.7 Drainage and Sewerage	**1.00**	**LS**	**32,691**	**8,095**	**321,087**	**0**	**420,222**	**527,056**	**42,814**	**569,869**
1.2.1.2.8 Electrical	**1.00**	**LS**	**0**	**0**	**0**	**300,000**	**342,063**	**429,026**	**41,015**	**470,041**
1.2.1.3 15 Ham Branch	**1.00**	**LS**	**89,950**	**72,219**	**177,705**	**194,000**	**606,968**	**761,278**	**61,097**	**822,375**
(Note: An estimated 3,000 BCY of material will be excavated and used for the Ham Branch Levee. Soil will be dumped, spread, and compacted at each site.)										
1.2.1.3.1 Mobilization and Demobilization	**1.00**	**LS**	**2,336**	**5,195**	**0**	**0**	**9,157**	**11,485**	**0**	**11,485**
1.2.1.3.2 Site Preparation	**1.00**	**LS**	**15,061**	**33,829**	**760**	**0**	**55,264**	**69,313**	**4,429**	**73,742**
			0.44	*1.62*	*0.00*	*0.00*	*2.27*	*2.85*		*3.04*
1.2.1.3.3 Excavation and Hauling	**3,000.00**	**BCY**	**1,315**	**4,874**	**0**	**0**	**6,824**	**8,559**	**547**	**9,106**
			0.13	*0.43*	*0.00*	*0.00*	*0.59*	*0.74*		*0.74*
1.2.1.3.4 Fill Placement and Compaction	**19,000.00**	**BCY**	**2,549**	**8,155**	**0**	**0**	**11,237**	**14,094**	**0**	**14,094**
(Note: Spread and compact dumped fill from Ham Branch (3,000 BCY) and Riverside Park (16,000 BCY) sites. Excavation and hauling of material from Riverside Park is included in the costs for Valley Storage - Riverside Park.)										
1.2.1.3.5 Site Restoration	**1.00**	**LS**	**5,082**	**6,675**	**21,205**	**0**	**35,126**	**44,056**	**2,815**	**46,872**
1.2.1.3.6 Pavement, Sidewalks, Curbs, and Gutter	**1.00**	**LS**	**11,607**	**9,011**	**95,499**	**0**	**135,074**	**169,414**	**10,826**	**180,239**
1.2.1.3.7 Retaining Walls	**1.00**	**LS**	**52,000**	**4,480**	**60,240**	**194,000**	**354,286**	**444,357**	**42,480**	**486,837**
1.2.1.4 20 Riverside Park	**1.00**	**LS**	**406,192**	**740,598**	**280,781**	**149,400**	**1,790,572**	**2,245,791**	**129,451**	**2,375,242**
(Note: An estimated total volume of 302,000 BCY at Riverside Park will be excavated and hauled to the Ham Branch Levee (16,000 BCY) and the city land fill/city impound lot (286,000 BCY). Soil will be dumped, spread, and compacted at each site.)										
1.2.1.4.1 Mobilization and Demobilization	**1.00**	**LS**	**2,570**	**5,652**	**0**	**0**	**10,002**	**12,545**	**0**	**12,545**
1.2.1.4.2 Site Preparation	**1.00**	**LS**	**75,995**	**123,825**	**20,930**	**0**	**251,931**	**315,979**	**20,191**	**336,170**
			0.73	*1.50*	*0.00*	*0.49*	*3.10*	*3.89*		*4.14*
1.2.1.4.3 Excavation and Hauling	**302,000.00**	**BCY**	**219,057**	**453,951**	**0**	**149,400**	**936,667**	**1,174,797**	**75,070**	**1,249,867**
			0.13	*0.43*	*0.00*	*0.00*	*0.59*	*0.74*		*0.74*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
1.2.1.4.4 Fill Placement and Compaction	**286,000.00**	**BCY**	**38,353**	**122,713**	**0**	**0**	**169,089**	**212,076**	**0**	**212,076**
(Note: Spread and compact dumped fill from Riverside Park (286,000 BCY) at the city landfill and city impound lot. Placement and compaction of material hauled for the Ham Branch Levee is included in the costs for Valley Storage - Ham Branch.)										
1.2.1.4.5 Site Restoration	**1.00**	**LS**	**15,414**	**16,967**	**85,831**	**0**	**128,856**	**161,615**	**10,327**	**171,942**
1.2.1.4.6 Drainage	**1.00**	**LS**	**16,820**	**8,394**	**59,358**	**0**	**100,387**	**125,909**	**8,046**	**133,954**
1.2.1.4.7 Electrical	**1.00**	**LS**	**37,982**	**9,094**	**114,662**	**0**	**193,640**	**242,869**	**15,818**	**258,687**
1.2.1.5 25 Rockwood Park - West	**1.00**	**LS**	**280,179**	**546,271**	**140,167**	**99,600**	**1,181,106**	**1,481,379**	**98,620**	**1,580,000**
(Note: An estimated total volume of 148,000 BCY at Rockwood Park - West will be excavated and hauled to the University Drive site (130,000 BCY) and the bypass channel (18,000 BCY).)										
1.2.1.5.1 Mobilization and Demobilization	**1.00**	**LS**	**1,869**	**4,142**	**0**	**0**	**7,310**	**9,168**	**586**	**9,754**
1.2.1.5.2 Site Preparation	**1.00**	**LS**	**91,280**	**186,415**	**43,066**	**0**	**335,871**	**421,259**	**26,918**	**448,178**
			1.07	*2.12*	*0.00*	*0.67*	*4.45*	*5.59*		*5.97*
1.2.1.5.3 Excavation and Hauling	**148,000.00**	**BCY**	**158,381**	**313,397**	**0**	**99,600**	**659,230**	**826,827**	**56,794**	**883,621**
			2,414.45	*8,312.27*	*0.00*	*0.00*	*11,231.76*	*14,087.22*		*14,987.39*
1.2.1.5.4 Fill Placement and Compaction	**1.00**	**EA**	**2,414**	**8,312**	**0**	**0**	**11,232**	**14,087**	**900**	**14,987**
1.2.1.5.5 Site Restoration	**1.00**	**LS**	**26,233**	**34,004**	**97,101**	**0**	**167,463**	**210,037**	**13,421**	**223,459**
1.2.1.6 30 Riverside Oxbow/Gateway	**1.00**	**LS**	**4,279,586**	**9,510,063**	**3,842,638**	**1,774,600**	**21,879,470**	**27,441,909**	**1,773,032**	**29,214,941**
1.2.1.6.1 Riverside Oxbow	**1.00**	**LS**	**3,588,943**	**7,035,270**	**3,436,449**	**1,376,200**	**17,669,233**	**22,161,300**	**1,435,601**	**23,596,900**
(Note: An estimated total volume of 2,212,000 BCY at Riverside Oxbow will be excavated and hauled to the old wastewater treatement plant (WWTP) site (1,074,000 BCY) and the1st Street Landfill site (1,138,000 BCY). Soil will be dumped, spread, and compacted at each site.)										
1.2.1.6.1.1 Mobilization and Demobilization	**1.00**	**LS**	**3,505**	**7,758**	**0**	**0**	**13,697**	**17,179**	**1,098**	**18,276**
1.2.1.6.1.2 Site Preparation	**1.00**	**LS**	**337,584**	**1,062,424**	**19,650**	**0**	**1,524,438**	**1,911,998**	**122,177**	**2,034,174**
			1.02	*1.95*	*0.00*	*0.43*	*3.99*	*5.01*		*5.33*

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
1.2.1.6.1.3 Excavation and Hauling	**2,212,000.00**	**BCY**	**2,267,133**	**4,318,571**	**0**	**946,200**	**8,827,684**	**11,071,955**	**707,498**	**11,779,453**
			0.13	*0.44*	*0.00*	*0.00*	*0.60*	*0.75*		*0.80*
1.2.1.6.1.4 Fill Placement and Compaction	**2,212,000.00**	**BCY**	**296,709**	**970,241**	**0**	**0**	**1,329,013**	**1,666,889**	**106,514**	**1,773,404**
1.2.1.6.1.5 Site Restoration	**1.00**	**LS**	**135,032**	**163,673**	**705,637**	**0**	**1,054,331**	**1,322,375**	**84,500**	**1,406,875**
1.2.1.6.1.6 Pavement, Sidewalks, Curbs, and Gutter	**1.00**	**LS**	**548,980**	**512,605**	**2,711,162**	**430,000**	**4,920,070**	**6,170,904**	**413,814**	**6,584,718**
1.2.1.6.2 Gateway	**1.00**	**LS**	**690,643**	**2,474,793**	**406,189**	**398,400**	**4,210,237**	**5,280,610**	**337,431**	**5,618,041**
(Note: An estimated total volume of 861,000 BCY at Riverside Gateway will be excavated and hauled to the Beach Street Fill site (316,000 BCY), the old wastewater treatement plant (WWTP) site (441,000 BCY) and the hydraulic embankment site (104,000 BCY). Soil will be dumped, spread, and compacted at each site.)										
1.2.1.6.2.1 Mobilization and Demobilization	**1.00**	**LS**	**5,841**	**13,090**	**0**	**0**	**23,010**	**28,860**	**1,844**	**30,705**
1.2.1.6.2.2 Site Preparation	**1.00**	**LS**	**228,617**	**733,360**	**4,650**	**0**	**1,037,187**	**1,300,872**	**83,126**	**1,383,998**
			0.29	*1.44*	*0.00*	*0.46*	*2.34*	*2.93*		*3.12*
1.2.1.6.2.3 Excavation and Hauling	**861,200.00**	**BCY**	**252,055**	**1,241,677**	**0**	**398,400**	**2,013,116**	**2,524,912**	**161,342**	**2,686,254**
			0.13	*0.43*	*0.00*	*0.00*	*0.59*	*0.75*		*0.79*
1.2.1.6.2.4 Fill Placement and Compaction	**861,200.00**	**BCY**	**115,481**	**372,583**	**0**	**0**	**512,220**	**642,442**	**41,052**	**683,494**
1.2.1.6.2.5 Site Restoration	**1.00**	**LS**	**86,176**	**113,359**	**396,884**	**0**	**615,177**	**771,574**	**49,304**	**820,878**
1.2.1.6.2.6 Drainage	**1.00**	**LS**	**2,473**	**724**	**4,655**	**0**	**9,526**	**11,948**	**763**	**12,712**
1.3 06 Fish and Wildlife Facilities	**1.00**	**LS**	**441**	**44**	**1,066**	**213,197**	**214,838**	**269,457**	**34,652**	**304,109**
(Note: Fish and wildlife facilities include costs to restore and improve the various habitats at several valley storage sites. The primary locations for ecosystem features are Rockwood Park, Ham Branch and Riverside Oxbow/Gateway. The improvements that are included are seeding (both normal Bermuda grass and grassland/wetlands) and tree plantings. Excavations included with the development of valley storage capacity include the opening of the old Sycamore Creek Oxbow and excavation of the old Riverside Oxbow. In addition, 50,000 cubic yards of earthwork is included at the Rockwood site for the restoration of an existing oxbow. Costs for Ecosystem development including Riparian Forest, Wetlands, and Grasslands were prepared by the Environmental Branch USACE Fort Worth District.)										
1.3.1 15 Ham Branch	**1.00**	**LS**	**441**	**44**	**1,066**	**213,197**	**214,838**	**269,457**	**34,652**	**304,109**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
1.4 11 Levees and Floodwalls	**1.00**	**LS**	**6,621,342**	**5,158,184**	**13,675,339**	**0**	**29,861,028**	**37,452,628**	**3,672,525**	**41,125,152**
(Note: Bypass Channel construction was been broken into two separate areas; North and South. The channel will consist of an excavated center channel with a new earthen levee constructed on the west side of the channel and multi-level reinforced concrete floodwalls on the east side. Both sides of the channel will have recreational paths for pedestrian access. All excess excavation material will be stockpiled in the future development area for use during construction of the flood control gates, backfill behind the retaining walls and White Settlement roadway embankment. Two pedestrian crossings will be constructed across the new channel and the West Fork Trinity River (just prior to the intersection with the new channel). Both pedestrian crossings will be designed to act as water breaks during a flood event.)										
1.4.1 Bypass Channel - North	**1.00**	**LS**	**3,024,394**	**2,501,552**	**5,983,308**	**0**	**13,507,391**	**16,941,389**	**1,639,152**	**18,580,541**
1.4.1.1 Mobilization and Demobilization	**1.00**	**LS**	**5,140**	**11,373**	**0**	**0**	**20,083**	**25,189**	**1,657**	**26,846**
1.4.1.2 Site Preparation	**1.00**	**LS**	**188**	**22**	**465**	**0**	**714**	**896**	**59**	**955**
1.4.1.3 Excavation, Hauling, and Placement	**1.00**	**LS**	**824,764**	**2,171,978**	**1,767,509**	**0**	**5,310,609**	**6,660,730**	**423,829**	**7,084,559**
(Note: The valley fill is the portion of levees and berms around the Valley Storage sites. The levee fill is located adjacent to the Bypass Channels to adjust the channel walls for flood conditions. The retaining wall fill is estimated in the earthwork portion. The gate fill is located at one of the three gates. The remainder of fill is assumed to be used as fill for road projects. Fill volumes were determined in bank cubic yard (BCY), loose cubic yard (LCY), and embankment cubic yard (ECY) units of measure. A bulking factor of 1.2 was assumed for converting BCY to LCY. A compaction factor of 0.9 was assumed for converting LCY to ECY.)										
1.4.1.4 Pavement, Sidewalks, Curbs, and Gutter	**1.00**	**LS**	**65,452**	**0**	**275,246**	**0**	**403,437**	**506,004**	**33,295**	**539,299**
1.4.1.5 Retaining Walls	**1.00**	**LS**	**2,098,316**	**297,683**	**3,756,570**	**0**	**7,497,917**	**9,404,120**	**1,157,647**	**10,561,767**
(Note: Lower retaining wall is approximately 4,028 feet long. The footing is 16’ wide and 1’-6” thick. The wall is 1’-2” thick and 12’ high. Middle retaining wall is approximately 4,028 feet long. The footing is 11’-6” wide and 1’-6” thick. The wall is 1’-2” thick and 11’-6” high. Upper retaining wall is approximately 3,678 feet long. The footing is between 6’-6” and 11’-3” wide and between 1’-6” and 1’-8” thick. The wall is between 1’-2” and 1’-5.5” thick and between 7’-6” and 11’-4” high.)										
			176.38	*25.84*	*325.84*	*0.00*	*642.68*	*806.06*		*905.29*
1.4.1.5.1 Lower Wall	**3,678.00**	**LF**	**648,730**	**95,025**	**1,198,453**	**0**	**2,363,762**	**2,964,703**	**364,955**	**3,329,658**
			171.95	*23.23*	*289.41*	*0.00*	*592.08*	*742.60*		*834.01*
1.4.1.5.2 Middle Wall	**4,028.00**	**LF**	**692,597**	**93,575**	**1,165,735**	**0**	**2,384,881**	**2,991,192**	**368,216**	**3,359,407**
			187.93	*27.08*	*345.68*	*0.00*	*682.54*	*856.06*		*961.45*
1.4.1.5.3 Upper Wall	**4,028.00**	**LF**	**756,989**	**109,083**	**1,392,381**	**0**	**2,749,274**	**3,448,225**	**424,477**	**3,872,702**
1.4.1.6 Site Restoration	**1.00**	**LS**	**30,534**	**20,496**	**183,518**	**0**	**274,631**	**344,451**	**22,665**	**367,116**
1.4.2 Bypass Channel - South	**1.00**	**LS**	**3,596,949**	**2,656,631**	**7,692,031**	**0**	**16,353,637**	**20,511,239**	**2,033,372**	**22,544,611**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
1.4.2.1 Mobilization and Demobilization	**1.00**	**LS**	**5,374**	**11,900**	**0**	**0**	**21,007**	**26,347**	**1,734**	**28,081**
1.4.2.2 Site Preparation	**1.00**	**LS**	**188**	**22**	**465**	**0**	**714**	**896**	**59**	**955**
1.4.2.3 Excavation, Hauling, and Placement	**1.00**	**LS**	**777,352**	**2,252,182**	**2,308,663**	**0**	**5,890,762**	**7,388,377**	**486,155**	**7,874,532**
(Note: The valley fill is the portion of levees and berms around the Valley Storage sites. The levee fill is located adjacent to the Bypass Channels to adjust the channel walls for flood conditions. The retaining wall fill is estimated in the earthwork portion. The gate fill is located at one of the three gates. The remainder of fill is assumed to be used as fill for road projects. Fill volumes were determined in bank cubic yard (BCY), loose cubic yard (LCY), and embankment cubic yard (ECY) units of measure. A bulking factor of 1.2 was assumed for converting BCY to LCY. A compaction factor of 0.9 was assumed for converting LCY to ECY.)										
1.4.2.4 Pavement, Sidewalks, Curbs, and Gutter	**1.00**	**LS**	**86,620**	**0**	**364,267**	**0**	**533,918**	**669,657**	**44,063**	**713,720**
1.4.2.5 Retaining Walls	**1.00**	**LS**	**2,684,588**	**365,654**	**4,752,125**	**0**	**9,513,805**	**11,932,509**	**1,468,892**	**13,401,401**
(Note: Lower retaining wall is approximately 4,200 feet long. The footing is 16’ wide and 1’-6” thick. The wall is 1’-2” thick and 12’ high. Middle retaining wall is approximately 4,150 feet long. The footing is 11’-6” wide and 1’-6” thick. The wall is 1’-2” thick and 11’-6” high. Upper retaining wall is approximately 4,150 feet long. The footing is between 11’-3” and 16’ wide and between 1’-8” and 1’-10” thick. The wall is between 1’-5.5” and 1’-9” thick and between 11’-4” and 15’-2” high.)										
			244.99	*37.50*	*490.31*	*0.00*	*937.52*	*1,175.86*		*1,320.61*
1.4.2.5.1 Lower Wall	**4,150.00**	**LF**	**1,016,708**	**155,625**	**2,034,776**	**0**	**3,890,692**	**4,879,827**	**600,707**	**5,480,533**
			211.85	*23.23*	*305.42*	*0.00*	*664.99*	*834.05*		*936.72*
1.4.2.5.2 Middle Wall	**4,150.00**	**LF**	**879,185**	**96,407**	**1,267,499**	**0**	**2,759,689**	**3,461,288**	**426,084**	**3,887,372**
			187.78	*27.05*	*345.20*	*0.00*	*681.77*	*855.09*		*960.36*
1.4.2.5.3 Upper Wall	**4,200.00**	**LF**	**788,695**	**113,623**	**1,449,851**	**0**	**2,863,424**	**3,591,395**	**442,101**	**4,033,496**
1.4.2.6 Site Restoration	**1.00**	**LS**	**42,826**	**26,873**	**266,512**	**0**	**393,431**	**493,453**	**32,469**	**525,923**
1.5 15 Flood Control and Diversion Structures	**1.00**	**LS**	**3,144,870**	**763,499**	**2,980,628**	**8,431,440**	**17,259,136**	**21,646,944**	**3,048,962**	**24,695,906**
(Note: Three (3) gate control structures (Clear Fork, Trinity Point and TRWD) will be constructed for the project. All three (3) structures will be constructed of concrete with battered foundation piles providing support to bedrock. The Clear Fork gate will also have a sheet pile cutoff wall. Each gate will have one large (24 feet x 17 feet) vertical roller gate and at least one small (12 feet x 10 feet) vertical roller gate (Trinity Point Gate - two). The large gate will be used for normal water control and boat access to the interior area, while the smaller gate(s) will be used to seal off pedestrian access during flooding conditions. Gates can be inspected when open through internal access areas. In addition, each gate will have an enclosed control room and instrumentation system for monitoring the gates. Budgetary information on gate construction and installation costs was provided by General Electric Hydro.)										
1.5.1 05 Clear Fork	**1.00**	**LS**	**1,293,742**	**380,809**	**1,324,103**	**4,295,720**	**8,219,509**	**10,309,163**	**1,465,747**	**11,774,910**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
1.5.1.1 Mobilization and Demobilization	1.00	LS	6,608	9,298	0	0	18,526	23,236	1,643	24,878
1.5.1.2 Site Preparation	1.00	LS	32,403	47,106	22,795	0	105,319	132,095	9,339	141,434
1.5.1.3 Excavation, Hauling, and Placement	1.00	LS	104,479	235,936	423,001	0	782,057	980,880	71,167	1,052,047
(Note: Embankment road....)										
1.5.1.4 Pavement, Sidewalks, Curbs and Gutter	1.00	LS	103	163	7,920	0	9,358	11,737	830	12,567
1.5.1.5 Training Walls	1.00	LS	1,142,975	84,860	835,304	0	2,352,411	2,950,467	379,725	3,330,192
1.5.1.6 Mechanical	1.00	LS	1,837	154	10,511	0	14,703	18,441	1,304	19,745
1.5.1.7 Finishes	1.00	LS	0	0	0	1,110,000	1,265,633	1,587,396	204,298	1,791,694
1.5.1.8 Flood Control Structures	1.00	LS	147	115	0	2,830,720	3,227,949	4,048,593	728,665	4,777,258
1.5.1.9 Electrical, Controls, and Instrumentation	1.00	LS	13	0	37	355,000	404,833	507,755	65,344	573,098
1.5.1.10 Site Restoration	1.00	LS	5,176	3,177	24,536	0	38,719	48,563	3,433	51,996
1.5.2 15 TRWD	1.00	LS	1,851,128	382,690	1,656,525	4,135,720	9,039,627	11,337,781	1,583,215	12,920,995
1.5.2.1 Mobilization and Demobilization	1.00	LS	6,608	9,298	0	0	18,526	23,236	1,643	24,878
1.5.2.2 Site Preparation	1.00	LS	52,403	62,106	27,795	0	150,928	189,298	13,383	202,682
1.5.2.3 Excavation, Hauling, and Placement	1.00	LS	139,314	237,229	538,361	0	940,591	1,179,718	85,225	1,264,943
1.5.2.4 Pavement, Sidewalks, Curbs and Gutter	1.00	LS	103	163	7,920	0	9,358	11,737	830	12,567
1.5.2.5 Training Walls	1.00	LS	1,645,400	70,440	1,046,743	0	3,149,924	3,950,733	508,459	4,459,192
1.5.2.6 Mechanical	1.00	LS	1,964	163	11,134	0	15,599	19,565	1,383	20,948
1.5.2.7 Finishes	1.00	LS	0	0	0	1,110,000	1,265,633	1,587,396	204,298	1,791,694
1.5.2.8 Flood Control Structures	1.00	LS	147	115	0	2,830,720	3,227,949	4,048,593	728,665	4,777,258

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
1.5.2.9 Electrical, Controls, and Instrumentation	1.00	LS	13	0	37	195,000	222,400	278,941	35,895	314,836
1.5.2.10 Site Restoration	1.00	LS	5,176	3,177	24,536	0	38,719	48,563	3,433	51,996
1.6 18 Cultural Resource Preservation	1.00	LS	0	0	0	1,020,000	0	1,020,000	88,740	1,108,740
(Note: These costs were determined by USACE in accordance with the requirements contained in the Programmatic Agreement between the USACE and Texas Historical Commission.)										
1.7 30 Planning, Engineering, and Design	1.00	LS	0	0	0	11,345,131	0	11,345,131	0	11,345,131
(Note: This category includes anticipated costs for design and permitting including but not limited to development of planning, engineering and design, independent technical review (ITR), cost estimation, value engineering (VE), contract bid packages, engineering services during construction, planning during construction, environmental permitting, and permit fees. The costs are divided into three main tasks: 1) A/E Design Fees; 2) Permits, Fees, and Licenses; 3) Survey and Testing; and 4) Legal Costs. Costs under this category are based on a percentage of the total construction cost with contingency. Based on the complexity, magnitude, and duration of the project the costs have been assumed as approximately 5.0% for A/E Design Fees and 1.7% for Permits, Fees and Licenses for a total of 6.7% for this category.)										
1.8 31 Construction Management	1.00	LS	0	0	0	6,077,749	0	6,077,749	0	6,077,749
(Note: Construction management includes, but is not limited to, costs for: meetings (pre-construction, progress, post-con), field coordination, inspection, survey control, contract modifications, payment request processing. Costs under this category are based on a percentage of the total construction cost with contingency. Based on the complexity, magnitude, and duration of the project the costs have been assumed as approximately 4.6% for this category.)										
2 02 Non-Federal	1.00	LS	18,643,100	10,867,688	24,372,638	222,401,216	153,573,434	325,012,097	22,622,613	347,634,710
(Note: The non-federal sponsor is the Tarrant Regional Water District (TRWD) and the City of Fort Worth is one of the local partners. These entities are also sponsors for the Riverside Oxbow Ecosystem Restoration Project.)										
2.1 01 Lands and Damages	1.00	LS	0	0	0	53,111,628	0	53,111,628	0	53,111,628

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
(Note: This category includes costs associated with the acquisition of property for the project. The costs were tabulated by the major work element for which it will be acquired and property acquisition assistance costs. The four (4) major work elements are: bypass channel, water feature, valley storage (Riverside/Gateway and Marine Creek. The costs associated with each element of work were determined after review of the mass appraisals performed by James K. Norwood, Certified Real Estate Appraiser. Appraisals were performed on the Central City Project on behalf of the Tarrant Regional Water District and at the Riverside Oxbow/Gateway on behalf of the USACE. Estimated costs in this estimate are based on the best known information at the time of the estimate and may vary from the amounts in the Norwood appraisals given modifications in the project footprint. Costs were normalized to the baseline 2007 by factors provided by the Real Estate Division USACE Fort Worth District. A factor of 6% per year was used for land values and a 15% flat rate was used for administrative fees. Property acquisition assistance costs are included for consulting fees, legal assistance, and other permitting, subordinated fees, licenses that will be incurred as part of the land acquisition activity. These costs are for additional analysis, planning, acquisition documents and proceedings including any additional appraisals and possible condemnation proceedings. Base cost for these assistance cost was estimated at 13% of the Property Acquisition Cost and allocated at 5.2% Consulting, 5.2% Legal, and 2.6% Permitting & Licensing. A contingency was not been provided on these costs as they are considered separate consulting costs. Landowner relocation costs were provided by a separate independent relocation study. This category includes anticipated costs for the relocation and moving of current property owners and tenants on the affected property. Costs for relocations of persons and businesses under this section are based on the report prepared by Pinnacle Consulting Management Group, Inc dated February 2, 2005. Costs were adjusted to baseline 2007 cost utilizing factors provided by Pinnacle Group of 4% compounded annually. A uniform contingency of 10% was included on the Landowner Relocation costs to account for market fluctuations.)										
2.1.1 05 Property Acquistion Assistance	**1.00**	**LS**	**0**	**0**	**0**	**7,239,991**	**0**	**7,239,991**	**0**	**7,239,991**
2.1.2 10 Property Acquisition	**1.00**	**LS**	**0**	**0**	**0**	**28,406,743**	**0**	**28,406,743**	**0**	**28,406,743**
2.1.3 15 Property Relocations	**1.00**	**LS**	**0**	**0**	**0**	**17,464,894**	**0**	**17,464,894**	**0**	**17,464,894**
2.2 02 Relocations	**1.00**	**LS**	**3,290,320**	**5,280,826**	**2,103,693**	**10,553,410**	**21,735,374**	**30,177,032**	**2,710,958**	**32,887,990**
(Note: Utility relocations are required for the construction of the project. A variety of utility lines including sewers, storm sewers, water mains, gas mains, electrical and cable will need to be relocated and/or demolished. Existing utilities were contacted, maps obtained and impacted utilities identified. City and franchise utility owners were contacted regarding location and costs for major relocations. Cost for the relocation of the 138 kilovolt (kV) transmission line provided by TXU Electric. Construction Costs for these items have been included in this section. A contingency of 20% was included on these costs. This section also includes the demolition of structures and paving in the bypass channel and the water feature areas. Approximately 1,583,575 square feet of light industrial buildings will be demolished. The average building height was assumed to be 20 feet tall with 7.5% of building volume requiring disposal. Concrete paving was assumed to be 8-inch thick with approximately 48,780 square yards required for removal. Asphalt paving was assumed to be 6-inch thick with approximately 127,800 square yards of material removal. It is the intent of the local sponsors to develop a recycling and reuse plan to reduce landfill waste. Concrete debris may be used as armor in non-visible areas or crushed and used as fill during site construction. Demolition debris that cannot be recycled or reused beneficially will be hauled to the City of Fort Worth construction debris landfill on Bennen Avenue or the TRWD disposal area. There will be no disposal fees associated with construction debris disposed at either facility.)										
2.2.1 05 Mobilization and Demobilization	**1.00**	**LS**	**2,912**	**4,623**	**0**	**0**	**8,157**	**10,230**	**0**	**10,230**
2.2.2 10 General Demolition and Site Preparation	**1.00**	**LS**	**2,063,564**	**4,447,424**	**51,100**	**0**	**6,950,331**	**9,650,074**	**643,855**	**10,293,929**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
2.2.3 15 Utility Relocation - Sanitary Sewer, Potable Water, Storm Sewer and Natural Gas	1.00	LS	591,770	634,611	1,307,528	4,264,230	6,856,579	9,519,905	924,122	10,444,027
2.2.3.1 Sanitary Sewer	1.00	LS	199,496	227,976	157,985	3,303,840	3,905,888	5,423,067	574,562	5,997,629
2.2.3.1.1 Site Work	1.00	LS	117,642	197,992	50,000	0	379,787	527,310	41,749	569,059
2.2.3.1.2 Piping and Appurtenances	1.00	LS	81,854	29,985	107,985	3,303,840	3,526,101	4,895,757	532,813	5,428,570
2.2.3.2 Potable Water	1.00	LS	75,093	93,040	42,500	331,740	548,145	761,063	77,033	838,097
2.2.3.2.1 Site Work	1.00	LS	62,593	88,040	35,000	0	191,405	265,753	22,599	288,352
2.2.3.2.2 Piping and Appurtenances	1.00	LS	12,500	5,000	7,500	331,740	356,740	495,310	54,435	549,744
2.2.3.3 Storm Sewer	1.00	LS	184,197	213,464	1,042,043	0	1,470,450	2,041,622	136,400	2,178,022
2.2.3.3.1 Site Work	1.00	LS	70,237	117,932	30,000	0	226,590	314,606	24,936	339,541
2.2.3.3.2 Outfall Collection System	1.00	LS	4,506	1,492	32,950	0	39,872	55,359	3,549	58,908
2.2.3.3.3 Piping and Appurtenances	1.00	LS	109,455	94,040	979,093	0	1,203,987	1,671,657	107,916	1,779,573
2.2.3.4 Natural Gas Distribution and Transmission	1.00	LS	72,984	85,132	40,000	628,650	832,096	1,155,310	120,867	1,276,177
2.2.3.4.1 Site Work	1.00	LS	50,484	77,632	25,000	0	158,446	219,991	18,076	238,067
2.2.3.4.2 Piping and Appurtenances	1.00	LS	22,500	7,500	15,000	628,650	673,650	935,318	102,791	1,038,110
2.2.3.5 Equipment	1.00	LS	60,000	15,000	25,000	0	100,000	138,843	15,259	154,102
2.2.4 20 Utility Relocation - Electrical and Communication	1.00	LS	625,510	188,473	745,064	289,180	1,906,690	2,647,312	226,236	2,873,548
2.2.4.1 Site Work	1.00	LS	205,530	73,634	134,000	101,680	537,289	745,990	54,284	800,274
2.2.4.2 Electrical	1.00	LS	419,980	114,839	611,064	187,500	1,369,401	1,901,322	171,952	2,073,274
2.2.4.2.1 Electrical Distribution	1.00	LS	94,573	11,528	242,627	187,500	556,396	772,519	61,442	833,961
2.2.4.2.2 Cable TV	1.00	LS	5,138	2,202	6,263	0	14,675	20,376	1,306	21,682

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
2.2.4.2.3 Fiber Optic	1.00	LS	7,335	1,109	10,175	0	20,181	28,020	1,796	29,816
2.2.4.2.4 Telephone	1.00	LS	62,933	0	102,000	0	178,149	247,347	15,855	263,202
2.2.4.2.5 Miscellaneous	1.00	LS	250,000	100,000	250,000	0	600,000	833,060	91,553	924,614
2.2.5 25 Utility Relocation - Transmission Lines	1.00	LS	6,564	5,694	0	6,000,000	6,013,617	8,349,509	916,745	9,266,254
2.2.5.1 Site Work	1.00	LS	6,564	5,694	0	0	13,617	18,907	1,212	20,119
2.2.5.2 Electrical	1.00	LS	0	0	0	6,000,000	6,000,000	8,330,602	915,533	9,246,135
2.3 04 Dams	1.00	LS	7,302,513	2,413,522	7,008,219	13,043,000	30,135,365	37,796,708	4,442,392	42,239,100

(Note: Downstream of the bypass channel a new dam structure will be constructed on the West Fork Trinity River. The dam will consist of seven (7) leaf gates placed into a concrete support structure. Three (3) sluice gates will also be provided in the bottom of the dam to assist in the control of upstream water levels. The concrete structure will have a maintenance access bridge to provide maintenance access to the leaf gates on the top of the dam and will be supported on a series of drilled shafts anchored in a bedrock foundation. A sheet piling system is proposed as a positive cut-off for seepage and as part of the construction sequencing plan. A low water fixed broad crest weir dam is proposed on Marine Creek in near proximity to the Samuels Avenue Dam. The dam will be constructed of roller compacted concrete with a cast-in-place concrete cap on all portions above the stilling basin. Driven sheet piling will be used for seepage cut-off. A small lock structure for pleasure boats is proposed for connectivity between the Marine Creek and Samuels Dam impoundments. The lock will be a reinforced concrete structure with miter gates.)

2.3.1 05 Samuels Avenue Dam	1.00	LS	4,877,804	1,776,020	4,231,597	10,907,000	22,070,242	27,681,182	3,268,232	30,949,414
2.3.1.1 Mobilization and Demobilization	1.00	LS	5,015	9,223	0	0	15,309	19,201	1,329	20,530
2.3.1.2 Site Preparation	1.00	LS	1,200,852	1,072,646	483,770	0	2,993,371	3,754,379	272,082	4,026,462
2.3.1.3 Earthwork	1.00	LS	183,089	347,066	20,864	100,000	690,189	865,656	67,178	932,834
2.3.1.4 Pavement, Sidewalks, Curbs and Gutter	1.00	LS	0	0	0	40,000	40,000	50,169	6,382	56,551
2.3.1.5 Retaining Walls	1.00	LS	3,481,750	343,400	3,693,963	792,000	8,311,113	10,424,055	1,325,940	11,749,995
2.3.1.6 Finishes	1.00	LS	0	0	0	350,000	350,000	438,981	55,838	494,819
2.3.1.7 Flood Control Structures	1.00	LS	0	0	0	8,330,000	8,330,000	10,447,744	1,328,953	11,776,697
2.3.1.8 Buildings	1.00	LS	0	0	0	1,045,000	1,045,000	1,310,671	166,717	1,477,389
2.3.1.9 Electrical	1.00	LS	7,098	3,685	33,000	250,000	295,261	370,325	43,813	414,138

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
2.3.2 10 Marine Creek Low Water Dam/Lock	1.00	LS	2,424,709	637,502	2,776,623	2,136,000	8,065,122	10,115,526	1,174,160	11,289,686
2.3.2.1 Mobilization and Demobilization	1.00	LS	4,143	8,089	0	0	13,118	16,453	0	16,453
2.3.2.2 Site Preparation	1.00	LS	394,830	363,525	127,585	0	966,482	1,212,192	84,049	1,296,241
2.3.2.3 Earthwork	1.00	LS	14,970	29,596	20,800	0	68,546	85,972	3,675	89,647
2.3.2.4 Retaining Walls	1.00	LS	2,010,767	236,292	2,463,238	756,000	5,471,977	6,863,123	839,949	7,703,072
2.3.2.5 Flood Control Structures	1.00	LS	0	0	165,000	1,300,000	1,465,000	1,837,448	233,723	2,071,172
2.3.2.6 Electrical	1.00	LS	0	0	0	80,000	80,000	100,338	12,763	113,102
2.4 06 Fish and Wildlife Facilities	1.00	LS	126,422	202,581	142,103	6,416,460	6,942,391	9,638,017	1,197,229	10,835,246

(Note: Fish and wildlife facilities include costs to restore and improve the various habitats at several valley storage sites. The primary locations for ecosystem features are Rockwood Park, Ham Branch and Riverside Oxbow/Gateway. The improvements that are included are seeding (both normal Bermuda grass and grassland/wetlands) and tree plantings. Excavations included with the development of valley storage capacity include the opening of the old Sycamore Creek Oxbow and excavation of the old Riverside Oxbow. In addition, 50,000 cubic yards of earthwork is included at the Rockwood site for the restoration of an existing oxbow. Costs for Ecosystem development including Riparian Forest, Wetlands, and Grasslands were prepared by the Environmental Branch USACE Fort Worth District.)

2.4.1 10 Riverside Oxbow/Gateway	1.00	LS	23,330	46,955	465	6,416,460	6,492,180	9,013,445	1,153,072	10,166,517
2.4.1.1 Mobilization and Demobilization	1.00	LS	1,168	2,425	0	0	3,844	4,821	341	5,162
2.4.1.2 Earthwork	1.00	LS	22,162	44,530	465	6,416,460	6,488,336	9,008,625	1,152,731	10,161,355
2.4.2 05 Rockwood Park	1.00	LS	103,092	155,626	141,638	0	450,211	624,572	44,157	668,729
2.4.2.1 Mobilization and Demobilization	1.00	LS	1,168	2,425	0	0	3,844	4,821	341	5,162
2.4.2.2 Earthwork	1.00	LS	68,374	134,480	465	0	217,927	302,578	21,392	323,970
2.4.2.3 Site Restoration	1.00	LS	33,550	18,721	141,173	0	228,440	317,174	22,424	339,598
2.5 08 Roads, Railroads and Bridges	1.00	LS	3,317,297	925,266	8,548,320	38,065,665	50,983,881	63,945,564	6,634,002	70,579,566

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
(Note: A. Henderson Bridge and Roadway Henderson Bridge will be a 6 lane standard bridge approximately 700 feet long with 10 feet wide concrete walks on both sides. Elevated embankments will lead up to the bridge on both sides of the future channel. The embankments will be supported by concrete retaining walls. The roadways will be constructed of concrete and include street lighting, pavement marking and signage. Construction of the roadway will require a temporary roadway detour. B. White Settlement Bridge and Roadway White Settlement Bridge will be a 4 lane standard bridge approximately 735 feet long with 10 feet wide concrete walks on both sides. Elevated embankments will lead up to the bridge on both sides of the future channel. The embankments will be supported by concrete retaining walls. The roadways will be constructed of concrete and include street lighting, pavement marking and signage. Construction of the roadway will require a temporary roadway. Installation of the final traffic signal for the White Settlement and Henderson Street intersection are included under this task. C. Main Street Bridge and Roadway Main Street Bridge will be a 4 lane designer (cable stayed) bridge approximately 406 feet long with 10 feet wide concrete walks on both sides. Elevated embankments will lead up to the bridge on both sides of the future channel. The embankments will be supported by concrete retaining walls. The roadways will be constructed of concrete. The roadways will be constructed of concrete and include street lighting, pavement marking and signage. Construction of the roadway will require a roadway detour onto an existing roadway. D. White Settlement at Water Feature Bridge and Roadway The White Settlement Bridge will be a 4 lane standard bridge approximately 450 feet long with 10 feet wide concrete walks on both sides. The bridge will cross the expanded Water Feature Elevated embankments will lead up to the bridge on both sides of the future channel. The embankments will be supported by concrete retaining walls. The roadways will be constructed of concrete. The roadways will be constructed of concrete and include street lighting, pavement marking and signage. E. Beech Street Bridge The existing Beech Street Bridge will be replaced with a 4 lane standard bridge approximately 115 feet long supported on drilled shafts. Elevated embankments will lead up to the bridge on both sides of the existing old oxbow channel. The interior embankments will be lined with concrete slope protection. The roadways will be constructed of concrete and pavement markings and signage. F. Park Roads and Bridge Costs are provided for over 4950 feet of two lane park entrance and roadways, 48,060 square feet of parking and one two lane park road bridge 103 ft in length. G. Other Street Modifications Additional costs were provided to perform modifications to the various local streets that will be affected by the construction of the channel. These modifications include providing turnouts, dead ends and patching of existing roads and drainage system.)										
2.5.1 05 Henderson Bridge and Roadway	**1.00**	**LS**	**637,909**	**268,998**	**2,006,716**	**11,067,500**	**14,011,776**	**17,574,003**	**1,824,450**	**19,398,453**
2.5.1.1 Mobilization and Demobilization	**1.00**	**LS**	**2,912**	**4,623**	**0**	**0**	**8,157**	**10,230**	**656**	**10,886**
2.5.1.2 Earthwork	**1.00**	**LS**	**67,242**	**146,727**	**465**	**0**	**228,471**	**286,555**	**18,368**	**304,923**
2.5.1.3 Pavement, Sidewalks, Curbs, and Gutter	**1.00**	**LS**	**77,755**	**65,648**	**1,465,501**	**65,000**	**1,689,898**	**2,119,523**	**139,595**	**2,259,118**
2.5.1.4 Drainage	**1.00**	**LS**	**0**	**0**	**0**	**502,500**	**502,500**	**630,251**	**69,265**	**699,516**
2.5.1.5 Bridges	**1.00**	**LS**	**490,000**	**52,000**	**540,750**	**10,500,000**	**11,582,750**	**14,527,444**	**1,596,566**	**16,124,010**
2.5.2 10 White Settlement Bridge and Roadway	**1.00**	**LS**	**549,440**	**178,411**	**1,099,061**	**8,831,500**	**10,674,760**	**13,388,615**	**1,425,225**	**14,813,840**
2.5.2.1 Mobilization and Demobilization	**1.00**	**LS**	**2,912**	**4,623**	**0**	**0**	**8,157**	**10,230**	**656**	**10,886**
2.5.2.2 Earthwork	**1.00**	**LS**	**37,699**	**95,798**	**465**	**0**	**141,837**	**177,896**	**11,403**	**189,299**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
2.5.2.3 Pavement, Sidewalks, Curbs, and Gutter	1.00	LS	38,454	28,090	579,602	152,500	806,498	1,011,535	73,600	1,085,134
2.5.2.4 Drainage	1.00	LS	0	0	0	300,000	300,000	376,269	41,352	417,621
2.5.2.5 Bridges	1.00	LS	470,375	49,900	518,994	8,379,000	9,418,269	11,812,685	1,298,214	13,110,899
2.5.3 15 Main Street Bridge and Roadway	1.00	LS	492,566	86,428	974,435	12,537,400	14,099,043	17,683,456	1,911,135	19,594,591
2.5.3.1 Mobilization and Demobilization	1.00	LS	2,912	4,623	0	0	8,157	10,230	656	10,886
2.5.3.2 Earthwork	1.00	LS	3,822	10,572	465	0	15,655	19,636	1,259	20,894
2.5.3.3 Pavement, Sidewalks, Curbs, and Gutter	1.00	LS	33,332	23,233	474,720	45,000	583,080	731,318	49,462	780,780
2.5.3.4 Drainage	1.00	LS	0	0	0	150,000	150,000	188,135	20,676	208,811
2.5.3.5 Bridges	1.00	LS	452,500	48,000	499,250	12,342,400	13,342,150	16,734,138	1,839,082	18,573,220
2.5.4 20 White Settlement Extension Bridge and Roadway	1.00	LS	173,358	58,217	705,118	2,458,900	3,409,784	4,276,657	428,548	4,705,204
2.5.4.1 Mobilization and Demobilization	1.00	LS	2,912	4,623	0	0	8,157	10,230	656	10,886
2.5.4.2 Earthwork	1.00	LS	3,776	10,509	465	0	15,537	19,487	1,249	20,736
2.5.4.3 Pavement, Sidewalks, Curbs, and Gutter	1.00	LS	52,520	28,619	563,287	0	655,070	821,609	52,665	874,274
2.5.4.4 Drainage	1.00	LS	10,400	3,467	26,928	250,000	292,933	367,406	37,912	405,318
2.5.4.5 Bridges	1.00	LS	103,750	11,000	114,438	2,208,900	2,438,088	3,057,925	336,066	3,393,991
2.5.5 25 Other Street Modifications	1.00	LS	24,639	24,754	358,627	1,645,000	2,058,055	2,581,277	259,955	2,841,232
2.5.5.1 Mobilization and Demobilization	1.00	LS	935	1,968	0	0	3,102	3,891	249	4,141
2.5.5.2 Pavement, Sidewalks, Curbs, and Gutter	1.00	LS	23,705	22,786	358,627	1,005,000	1,414,953	1,774,678	171,488	1,946,166
2.5.5.3 Drainage	1.00	LS	0	0	0	90,000	90,000	112,881	12,406	125,286
2.5.5.4 Electrical	1.00	LS	0	0	0	550,000	550,000	689,827	75,812	765,639

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
2.5.6 30 Riverside Oxbow Park	1.00	LS	1,385,433	271,548	2,604,700	25,365	4,328,895	5,429,435	505,448	5,934,883
2.5.6.1 Mobilization and Demobilization	1.00	LS	2,912	4,623	0	0	8,157	10,230	656	10,886
2.5.6.2 Site Preparation	1.00	LS	87,019	78,592	0	0	183,591	230,265	14,760	245,025
2.5.6.3 Pavement, Sidewalks, Curbs, and Gutter	1.00	LS	74,651	49,303	904,767	0	1,043,869	1,309,253	83,923	1,393,176
2.5.6.4 Bridges	1.00	LS	1,220,850	139,030	1,699,934	25,365	3,093,279	3,879,686	406,109	4,285,795
2.5.6.4.1 Park Road Bridge	1.00	LS	112,069	29,097	292,991	16,665	455,883	571,783	49,956	621,739
2.5.6.4.2 Beach Street Bridge	1.00	LS	1,108,782	109,934	1,406,943	8,700	2,637,395	3,307,903	356,153	3,664,056
2.5.7 35 Riverside Gateway Park	1.00	LS	51,975	34,255	799,664	0	896,513	1,124,435	72,076	1,196,511
2.5.7.1 Mobilization and Demobilization	1.00	LS	935	1,968	0	0	3,102	3,891	249	4,141
2.5.7.2 Pavement, Sidewalks, Curbs, and Gutter	1.00	LS	51,041	32,287	799,664	0	893,411	1,120,544	71,827	1,192,371
2.5.8 40 Bypass Channel Pedesterian Bridges	1.00	LS	1,978	2,655	0	1,500,000	1,505,054	1,887,686	207,166	2,094,852
2.5.8.1 Mobilization and Demobilization	1.00	LS	1,978	2,655	0	0	5,054	6,339	406	6,746
2.5.8.2 Bridges	1.00	LS	0	0	0	1,500,000	1,500,000	1,881,347	206,760	2,088,106
2.6 13 Pumping Plants	1.00	LS	686,415	193,800	1,670,561	705,000	3,558,204	4,939,462	683,260	5,622,722

(Note: A Stormwater Pumping Facility will be included in the project to maintain the water level inside the water feature area during high water period rainfall events on the West Fork. This facility will be located adjacent to the TRWD Gate and will be constructed at the same time as the gate structure. The facility will contain a total of four (4) 45,000 gallon per minute pumps and be constructed of a concrete wet well and a masonry building. An emergency generator will be shared with the TRWD gate structure. In addition, access and parking will be provided adjacent to the site.)

2.6.1 05 Stormwater Pumping Facility	1.00	LS	686,415	193,800	1,670,561	705,000	3,558,204	4,939,462	683,260	5,622,722
2.6.1.1 Mobilization and Demobilization	1.00	LS	2,445	3,502	0	0	6,468	8,112	706	8,818
2.6.1.2 Earthwork	1.00	LS	71,923	83,355	39,395	0	209,794	291,285	25,342	316,627

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
2.6.1.3 Buildings	1.00	LS	188,765	56,574	1,043,727	645,000	2,061,086	2,861,681	403,796	3,265,476
2.6.1.3.1 Masonary	1.00	LS	6,587	154	7,075	0	17,305	24,027	2,090	26,117
2.6.1.3.2 Metals	1.00	LS	75,871	8,029	77,511	0	202,542	281,216	24,466	305,681
2.6.1.3.3 Thermal and Moisture	1.00	LS	797	28	18,241	0	21,931	30,450	2,649	33,100
2.6.1.3.4 Finishes	1.00	LS	0	0	20,000	0	22,804	31,662	4,733	36,396
2.6.1.3.5 Equipment	1.00	LS	105,508	48,363	920,900	100,000	1,175,089	1,631,533	240,869	1,872,402
2.6.1.3.6 Electrical, Controls, and Instrumentation	1.00	LS	0	0	0	545,000	621,414	862,793	128,988	991,780
2.6.1.4 Concrete Footings, Slabs, and Retaining Walls	1.00	LS	409,325	40,460	429,384	0	1,002,437	1,391,817	208,077	1,599,894
2.6.1.5 Pavement, Sidewalks, Curbs, and Gutter	1.00	LS	1,789	441	34,666	0	42,477	58,976	6,550	65,526
2.6.1.6 Drainage	1.00	LS	11,389	8,793	117,596	0	159,079	220,870	23,569	244,440
2.6.1.7 Site Restoration	1.00	LS	781	675	5,794	60,000	76,864	106,720	15,221	121,942
2.7 14 Recreation Facilities	1.00	LS	3,097,369	1,478,175	3,741,807	4,659,100	14,226,334	19,654,383	2,615,465	22,269,848

(Note: A. Valley Storage Sites For the Rockwood West, Samuels Avenue and Ham Branch Valley storage Sites the recreational facilities consist of the replacement of concrete trails. B. Water Feature A water feature will be constructed at the existing confluence of the West Fork Trinity River and the Clear Fork Trinity River. The Water Feature area will be constructed with concrete retaining walls and walks. Recirculation pumps and housings are also included in the estimate to assist in the circulation of water in the interior area. A preliminary design had not been developed at the time of the estimate. A contingency of 20% was included on these costs. C. Marine Creek Modifications will be made to Marine Creek, upstream of Samuel Avenue Dam, in order to ensure that pedestrian access will be available once the dam is constructed and the water impoundment is created. The modifications include construction of concrete retaining walls and new walks, lighting, and pedestrian bridge. A contingency of 20% was included on these costs. D. Riverside Park Costs include the reconstruction of existing parking and new entrance roads. Allowances are provided for new athletic fields lighting, or relocations depending upon the final design and park plan. E. Riverside/Gateway Park In addition to the hard and soft trail system and two pedestrian bridges a number of special construction items have been included. The design of these facilities has yet to be determined so these items are shown as standard unit cost from RS MEANS based upon approximate foot prints. These include a 1,000 square feet concession stand with restrooms, 1,500 square feet splash park, four covered basketball courts, and bleachers. Allowances for electrical service, and lighting are provided.)

2.7.1 05 Water Feature	1.00	LS	2,255,506	1,234,041	2,043,303	1,550,000	7,793,740	10,819,072	1,445,037	12,264,109
2.7.1.1 Mobilization and Demobilization	1.00	LS	4,439	9,657	0	0	15,046	18,871	1,642	20,513
2.7.1.2 Earthwork	1.00	LS	584,675	1,048,675	212,699	0	1,970,841	2,736,381	238,065	2,974,447

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
2.7.1.3 Retaining Walls	1.00	LS	1,666,000	175,200	1,829,450	0	4,185,312	5,811,028	868,749	6,679,777
2.7.1.4 Mechanical	1.00	LS	0	0	0	1,050,000	1,050,000	1,457,855	217,949	1,675,805
2.7.1.5 Electrical, Controls, and Instrumentation	1.00	LS	0	0	0	500,000	570,105	791,553	118,337	909,890
2.7.1.6 Site Restoration	1.00	LS	392	510	1,154	0	2,437	3,383	294	3,678
2.7.2 10 Samuels Avenue	1.00	LS	32,352	7,493	134,715	0	205,204	284,180	24,724	308,903
2.7.2.1 Mobilization and Demobilization	1.00	LS	1,635	3,478	0	0	5,464	6,853	596	7,449
2.7.2.2 Earthwork	1.00	LS	1,133	1,997	295	0	3,665	5,089	443	5,531
2.7.2.3 Pavement, Sidewalks, Curbs, and Gutter	1.00	LS	29,584	2,018	134,420	0	196,076	272,238	23,685	295,923
2.7.3 15 Marine Creek	1.00	LS	592,881	87,252	708,710	408,000	2,032,073	2,788,090	392,807	3,180,897
2.7.3.1 Mobilization and Demobilization	1.00	LS	5,015	9,223	0	0	15,309	19,201	1,670	20,872
2.7.3.2 Site Preparation	1.00	LS	33,564	16,363	295	75,000	132,134	183,460	22,469	205,929
2.7.3.3 Earthwork	1.00	LS	2,441	4,945	0	80,000	87,907	122,053	17,561	139,614
2.7.3.4 Pavement, Sidewalks, Curbs, and Gutter	1.00	LS	25,492	1,739	115,830	0	168,959	234,588	20,409	254,997
2.7.3.5 Retaining Walls	1.00	LS	500,625	51,900	545,494	0	1,251,972	1,738,280	259,873	1,998,153
2.7.3.6 Electrical, Controls, and Instrumentation	1.00	LS	0	0	0	100,000	114,021	158,311	23,667	181,978
2.7.3.7 Site Restoration	1.00	LS	3,243	1,082	20,341	0	28,883	40,102	3,489	43,591
2.7.3.8 Bridges	1.00	LS	22,500	2,000	26,750	153,000	232,888	292,095	43,668	335,763
2.7.4 20 Ham Branch	1.00	LS	4,960	3,617	14,765	0	26,925	36,760	3,198	39,958
2.7.4.1 Mobilization and Demobilization	1.00	LS	1,402	2,952	0	0	4,654	5,837	508	6,344
2.7.4.2 Earthwork	1.00	LS	411	451	465	0	1,413	1,961	171	2,132
2.7.4.3 Pavement, Sidewalks, Curbs, and Gutter	1.00	LS	3,147	215	14,300	0	20,859	28,962	2,520	31,481

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
2.7.5 25 Riverside Park	1.00	LS	17,815	7,384	101,187	205,000	380,928	528,160	66,234	594,394
2.7.5.1 Mobilization and Demobilization	1.00	LS	1,635	3,478	0	0	5,464	6,853	596	7,449
2.7.5.2 Earthwork	1.00	LS	601	970	295	0	1,992	2,766	241	3,007
2.7.5.3 Pavement, Sidewalks, Curbs, and Gutter	1.00	LS	15,579	2,936	100,892	0	139,729	194,005	16,878	210,883
2.7.5.4 Electrical, Controls, and Instrumentation	1.00	LS	0	0	0	205,000	233,743	324,537	48,518	373,055
2.7.6 30 Rockwood Park - West	1.00	LS	17,122	6,399	65,646	0	104,363	144,168	12,543	156,710
2.7.6.1 Mobilization and Demobilization	1.00	LS	1,635	3,478	0	0	5,464	6,853	596	7,449
2.7.6.2 Pavement, Sidewalks, Curbs, and Gutter	1.00	LS	14,383	981	65,351	0	95,326	132,354	11,515	143,869
2.7.6.3 Earthwork	1.00	LS	1,104	1,940	295	0	3,573	4,961	432	5,393
2.7.7 35 Riverside Oxbow/Gateway Park	1.00	LS	176,732	131,989	673,482	2,496,100	3,683,100	5,053,953	670,924	5,724,877
2.7.7.1 Riverside Oxbow	1.00	LS	141,302	43,168	580,335	2,421,100	3,372,747	4,623,781	626,078	5,249,859
2.7.7.1.1 Mobilization and Demobilization	1.00	LS	5,015	9,223	0	0	15,309	19,201	1,670	20,872
2.7.7.1.2 Earthwork	1.00	LS	11,014	22,266	127,058	0	162,668	225,854	19,649	245,503
2.7.7.1.3 Pavement, Sidewalks, Curbs, and Gutter	1.00	LS	67,817	1,871	323,887	0	464,288	644,633	56,083	700,716
2.7.7.1.4 Bridges	1.00	LS	45,000	4,000	53,500	270,000	424,728	532,707	79,640	612,347
2.7.7.1.5 Recreation Amenities	1.00	LS	0	0	0	1,834,800	1,834,800	2,547,498	380,851	2,928,349
2.7.7.1.6 Electrical, Controls, and Instrumentation	1.00	LS	0	0	0	188,300	214,702	298,099	44,566	342,665
2.7.7.1.7 Drainage	1.00	LS	2,366	1,046	16,870	88,000	124,019	172,192	23,688	195,880
2.7.7.1.8 Mechanical	1.00	LS	10,090	4,763	59,020	40,000	132,233	183,596	19,931	203,527
2.7.7.2 Gateway Park	1.00	LS	35,430	88,822	93,148	75,000	310,353	430,172	44,846	475,018

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
2.7.7.2.1 Mobilization and Demobilization	1.00	LS	1,635	3,478	0	0	5,464	6,853	596	7,449
2.7.7.2.2 Site Preparation	1.00	LS	21,377	68,908	0	0	94,764	131,574	11,447	143,021
2.7.7.2.3 Earthwork	1.00	LS	12,417	16,436	93,148	0	124,610	173,012	15,052	188,064
2.7.7.2.4 Buildings	1.00	LS	0	0	0	75,000	85,516	118,733	17,751	136,484
2.8 15 Flood Control and Diversion Structures	1.00	LS	822,763	373,518	1,157,935	5,139,240	8,433,646	10,577,741	1,538,839	12,116,580

(Note: Three (3) gate control structures (Clear Fork, Trinity Point and TRWD) will be constructed for the project. All three (3) structures will be constructed of concrete with battered foundation piles providing support to bedrock. The Clear Fork gate will also have a sheet pile cutoff wall. Each gate will have one large (24 feet x 17 feet) vertical roller gate and at least one small (12 feet x 10 feet) vertical roller gate (Trinity Point Gate - two). The large gate will be used for normal water control and boat access to the interior area, while the smaller gate(s) will be used to seal off pedestrian access during flooding conditions. Gates can be inspected when open through internal access areas. In addition, each gate will have an enclosed control room and instrumentation system for monitoring the gates. Budgetary information on gate construction and installation costs was provided by General Electric Hydro.)

2.8.1 10 Trinity Point	1.00	LS	822,763	373,518	1,157,935	5,139,240	8,433,646	10,577,741	1,538,839	12,116,580
2.8.1.1 Mobilization and Demobilization	1.00	LS	6,608	9,298	0	0	18,526	23,236	1,643	24,878
2.8.1.2 Site Preparation	1.00	LS	32,483	47,106	22,965	0	105,585	132,429	13,727	146,156
2.8.1.3 Excavation, Hauling, and Placement	1.00	LS	135,483	251,065	513,123	0	924,627	1,159,696	83,809	1,243,505
2.8.1.4 Pavement, Sidewalks, Curbs and Gutter	1.00	LS	103	163	7,920	0	9,358	11,737	830	12,567
2.8.1.5 Training Walls	1.00	LS	641,125	62,420	581,535	0	1,465,261	1,837,776	219,086	2,056,862
2.8.1.6 Mechanical	1.00	LS	1,571	132	7,819	0	11,240	14,097	997	15,094
2.8.1.7 Finishes	1.00	LS	0	0	0	1,110,000	1,265,633	1,587,396	204,298	1,791,694
2.8.1.8 Flood Control Structures	1.00	LS	202	158	0	3,674,240	4,189,864	5,255,057	945,673	6,200,729
2.8.1.9 Electrical, Controls, and Instrumentation	1.00	LS	13	0	37	355,000	404,833	507,755	65,344	573,098
2.8.1.10 Site Restoration	1.00	LS	5,176	3,177	24,536	0	38,719	48,563	3,433	51,996
2.9 30 Planning, Engineering, and Design	1.00	LS	0	0	0	32,717,096	0	32,717,096	0	32,717,096

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
(Note: This category includes anticipated costs for design and permitting including but not limited to development of final designs, contract bid packages, cost estimation, engineering services during construction, environmental permitting, and permit fees. The costs are divided into two main tasks: 1) A/E Design Fees and 2) Permits, Fees, and Licenses. Costs under this category are based on a percentage of the total construction cost with contingency. Based on the complexity, magnitude, and duration of the project the costs have been assumed as approximately 5.0% for A/E Design Fees and 1.7% for Permits, Fees and Licenses for a total of 6.7% for this category.)										
2.10 31 Construction Management	**1.00**	**LS**	**0**	**0**	**0**	**40,432,378**	**0**	**40,432,378**	**0**	**40,432,378**
(Note: This category includes anticipated costs for program management and construction management. A. Program Management This category includes anticipated costs for program management services during the design and construction of the project. Program management services are anticipated, but not limited to be: Agency Coordination/Management, Standards Development, Maintenance of Project Records and Base Files, Funding/ Grants and Cost Accounting, Contract Procurement, Project Schedule Maintenance, and Closeout. Costs under this category are based on a percentage of the total construction cost with contingency. Based on the complexity, magnitude, and duration of the project the costs have been assumed as approximately 4.9% for this category. No contingency was included on these costs. B. Construction Management This category includes anticipated costs for construction management including but not limited to costs for: meetings (pre-con, progress, post-con), field coordination, inspection, survey control, contract modifications, payment request processing. Costs under this category are based on a percentage of the total construction cost with contingency. Based on the complexity, magnitude, and duration of the project the costs have been assumed as approximately 4.6% for this category.)										
2.11 33 HTRW	**1.00**	**LS**	**0**	**0**	**0**	**17,558,239**	**17,558,239**	**22,022,088**	**2,800,467**	**24,822,555**
(Note: The HTRW category includes costs for environmental services and remediation on the project and was developed based on the results of the environmental records review completed for the potentially impacted properties during the initial EIS phase. For the Phase I and Phase II site assessments the following allowances were used: Update the Phase I EIS data, 173 parcels at an cost of $1,000/ site; Phase II site assessments assumed 106 sites at $9,200/site: soil and groundwater testing 1350 samples at $335/sample and 413 samples at $430/sample; asbestos surveys estimated at 50 building at $1,150/structure Environmental remediation costs for the project were developed primarily for the potentially impacted properties within the proposed bypass channel at each of the sites with records indicating potential release of petroleum or hazardous chemicals. Costs include, but are not limited to, the following: - Investigation of assumed contaminated sites; - Excavation and disposal of underground storage tanks (USTs) and accompanying contaminated soils; - Placement of short-term groundwater recovery/treatment systems at locations with leaking USTs (LUSTs)/USTs; - Excavation and disposal of assumed volumes of contaminated soil based on the number of databases that each site appears within; - Analytical costs for characterization of the contaminated soils for disposal and confirmation of complete removal; and - Engineering design fees and administrative costs for following required regulatory guidelines and submittal of appropriate reports to regulatory agencies. Asbestos abatement costs were calculated based on factoring the total square footage buildings to be removed to determine office type space within the total building footprint which would likely contain asbestos. Of the total of 1.5 million square feet of buildings to be demolished, 50 % is assumed to be finished and of that amount 20% was assumed to contain asbestos. Abatement unit price were then used from MEANS Environmental Remediation Book to determine the estimated asbestos abatement cost. The HTRW construction costs are based on the best available information at this time and will be updated and refined as design development is advanced and more information can be obtained within the project footprint.)										
2.11.1 Envrionmental Assessments	**1.00**	**LS**	**0**	**0**	**0**	**1,889,200**	**1,889,200**	**2,369,493**	**259,387**	**2,628,880**
2.11.2 Site Remediation	**1.00**	**LS**	**0**	**0**	**0**	**14,002,039**	**14,002,039**	**17,561,791**	**2,270,740**	**19,832,531**

Description	Quantity	UOM	LaborCost	EQCost	MatlCost	SubBidCost	CostToPrime	ContractCost	Escalation	ProjectCost
2.11.3 Remediation Program Management	**1.00**	**LS**	**0**	**0**	**0**	**1,667,000**	**1,667,000**	**2,090,803**	**270,341**	**2,361,144**

Appendix B
Schedule

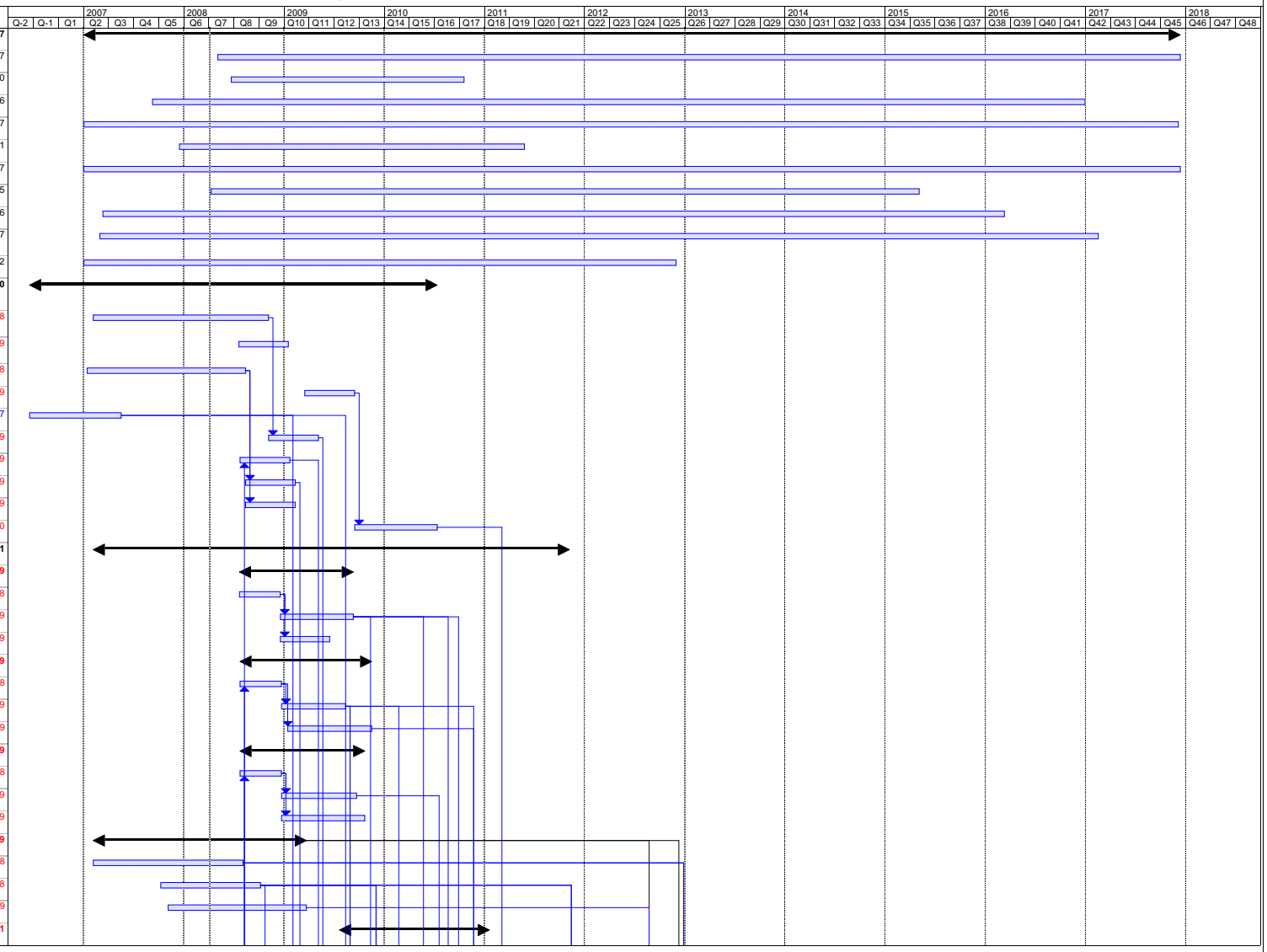
FORT WORTH CENTRAL CITY

Preliminary Project Schedule

Preliminary Draft for MII Est. April 1, 2008

TRWD
City of Fort Worth
USACE
Others

ID	Task Name	Start	Finish
1	**Program Management**	**Wed 1/3/07**	**Tue 12/12/17**
2	Maintain Master Schedule	Mon 5/5/08	Tue 12/12/17
3	Permitting	Mon 6/23/08	Tue 10/19/10
4	Project Budget	Mon 9/10/07	Fri 12/30/16
5	Agency Coordination	Wed 1/3/07	Tue 12/5/17
6	Standards Development	Mon 12/17/07	Fri 5/27/11
7	Funding Assistance	Wed 1/3/07	Tue 12/12/17
8	Project Update USACE / CDC Models -	Fri 4/11/08	Tue 5/5/15
9	Maintain Base Survey - Control File	Tue 3/13/07	Fri 3/11/16
10	Contract Management Design/Construction	Fri 3/2/07	Thu 2/16/17
11	Legal Assistance	Wed 1/3/07	Fri 11/30/12
12	**Real Property Environmental Assessment**	**Mon 6/19/06**	**Tue 7/13/10**
13	Ph I Site Assessments - Henderson Priority Properties	Tue 2/6/07	Wed 11/5/08
14	Ph I Site Assessments - White Settlement/Main Roadway Properties	Mon 7/21/08	Fri 1/16/09
15	Ph I Site Assessments - Channel/Mitigation	Mon 1/15/07	Wed 8/13/08
16	Ph I Site Assessments - Interior	Wed 3/18/09	Tue 9/15/09
17	Asbestos Surveys	Mon 6/19/06	Fri 5/18/07
18	Ph II Site Assessments - Henderson/Priority	Thu 11/6/08	Wed 5/6/09
19	Ph II Site Assessments WS/Main Roadway	Fri 7/25/08	Thu 1/22/09
20	Ph II Site Assessments -Channel	Thu 8/14/08	Wed 2/11/09
21	Ph II Site Assessments -Mitigation	Thu 8/14/08	Wed 2/11/09
22	Ph II Site Assessments - Interior	Wed 9/16/09	Tue 7/13/10
23	**Property Acquisition & Relocation**	**Tue 2/6/07**	**Mon 11/7/11**
24	**Roadway & Bridges - Henderson Priority**	**Wed 7/23/08**	**Thu 9/10/09**
25	Appraisals, Surveys, Engr, Legal	Wed 7/23/08	Thu 12/18/08
26	Acquisition	Fri 12/19/08	Thu 9/10/09
27	Relocations	Fri 12/19/08	Tue 6/16/09
28	**Roadway & Bridges -White Settlement**	**Fri 7/25/08**	**Mon 11/16/09**
29	Appraisals, Surveys, Engr, Legal	Fri 7/25/08	Mon 12/22/08
30	Acquisition	Tue 12/23/08	Thu 8/13/09
31	Relocations	Thu 1/15/09	Mon 11/16/09
32	**Roadway & Bridges - Main**	**Fri 7/25/08**	**Thu 10/22/09**
33	Appraisals, Surveys, Engr, Legal	Fri 7/25/08	Mon 12/22/08
34	Acquisition	Tue 12/23/08	Tue 9/22/09
35	Relocations	Tue 12/23/08	Thu 10/22/09
36	**Channel Alignment**	**Tue 2/6/07**	**Mon 3/23/09**
37	Appraisals, Surveys, Engr, Legal	Tue 2/6/07	Mon 8/4/08
38	Acquisition	Wed 10/10/07	Tue 10/7/08
39	Relocations	Tue 11/6/07	Mon 3/23/09
40	**Water Feature**	**Thu 7/23/09**	**Wed 1/19/11**



Notes: Task, Split, Progress, Milestone, Summary, Rolled Up Task, Rolled Up Split, Rolled Up Milestone, Rolled Up Progress, External Tasks, Project Summary, External Milestone, Deadline

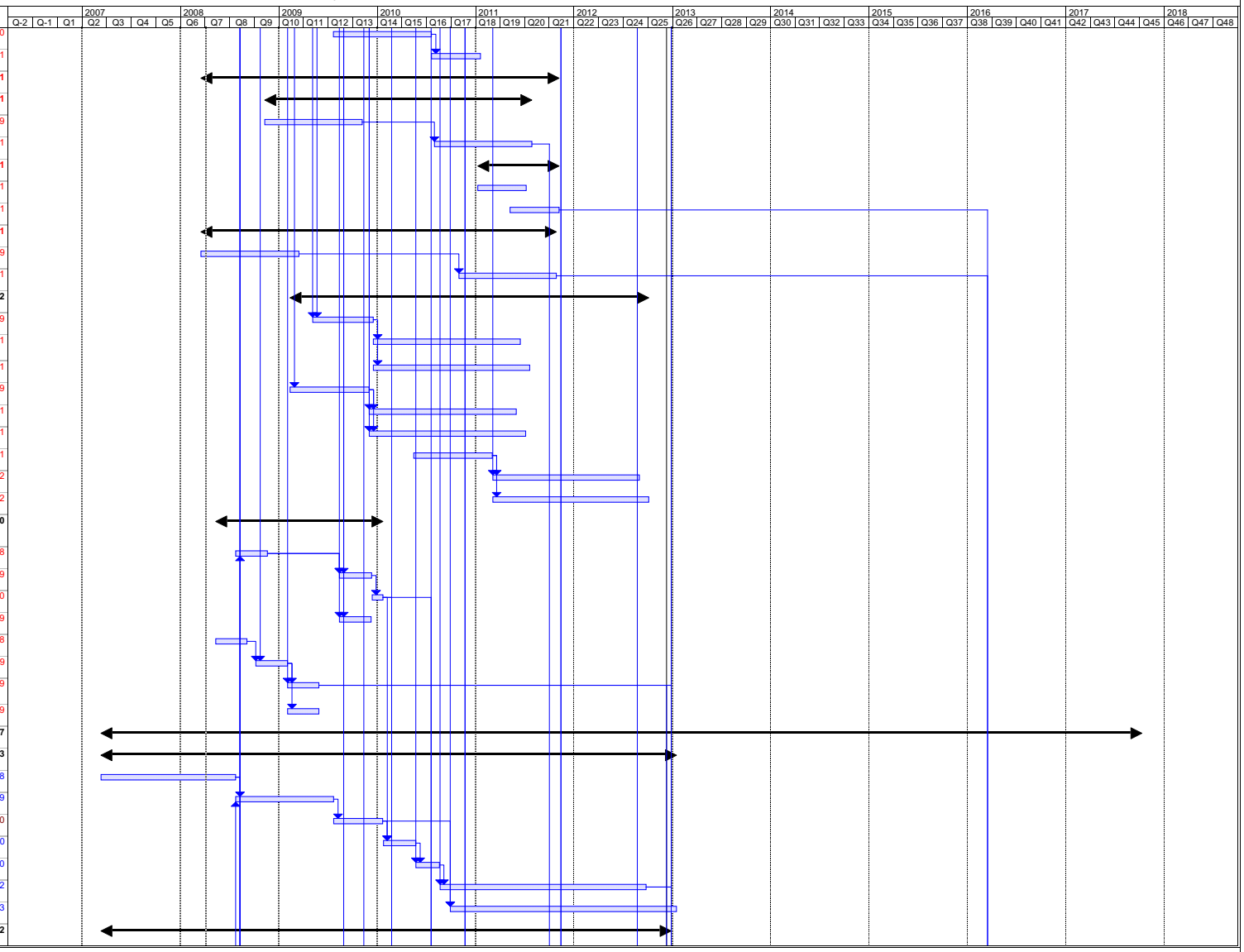
FORT WORTH CENTRAL CITY

Preliminary Project Schedule

Preliminary Draft for MII Est. April 1, 2008

TRWD
City of Fort Worth
USACE
Others

ID	Task Name	Start	Finish
41	Appraisals, Surveys, Engr, Legal	Thu 7/23/09	Wed 7/21/10
42	Acquisition	Thu 7/22/10	Wed 1/19/11
43	**Mitigation Sites**	**Tue 3/18/08**	**Mon 11/7/11**
44	**University Dr.**	**Mon 11/10/08**	**Fri 7/29/11**
45	Appraisals, Surveys, Engr, Legal	Mon 11/10/08	Fri 11/6/09
46	Acquisition	Mon 8/2/10	Fri 7/29/11
47	**Samuels/Marine Creek Dams**	**Mon 1/10/11**	**Mon 11/7/11**
48	Appraisals, Surveys, Engr, Legal	Mon 1/10/11	Fri 7/8/11
49	Acquisition	Tue 5/10/11	Mon 11/7/11
50	**Riverside Oxbow/Gateway**	**Tue 3/18/08**	**Fri 10/28/11**
51	Appraisals, Surveys, Engr, Legal	Tue 3/18/08	Mon 3/16/09
52	Acquisition	Mon 11/1/10	Fri 10/28/11
53	**Environmental Remediation**	**Thu 2/12/09**	**Fri 10/5/12**
54	Design & Approvals Bridge/ Roadway	Thu 5/7/09	Thu 12/17/09
55	Remediation/Removal/Disposal (Bridge/ Roadway)	Fri 12/18/09	Thu 6/16/11
56	CM Remed. (Bridge/ Roadway)	Fri 12/18/09	Thu 7/21/11
57	Design & Approvals Channel	Thu 2/12/09	Wed 12/2/09
58	Remediation/Removal/Disposal Channel	Thu 12/3/09	Wed 6/1/11
59	CM Remed. Channel	Thu 12/3/09	Wed 7/6/11
60	Design & Approvals (Mitigation/Other)	Mon 5/17/10	Fri 3/4/11
61	Remediation/Removal/Disposal (Mitigation/C	Mon 3/7/11	Fri 8/31/12
62	CM Remed. (Mitigation/Other)	Mon 3/7/11	Fri 10/5/12
63	**Demolition - Removal/Disposal Structures**	**Mon 5/12/08**	**Fri 1/22/10**
64	Plans/Procurement Demo- (Bridge/ Roadway	Fri 7/25/08	Wed 11/19/08
65	Asbestos Removal	Fri 8/14/09	Fri 12/11/09
66	Remove/Dispose Structures (Bridge/ Roadwa	Mon 12/14/09	Fri 1/22/10
67	CM Demolition	Fri 8/14/09	Wed 12/9/09
68	Plans/Procurement Demo Primary Channel	Mon 5/12/08	Thu 9/4/08
69	Asbestos Removal	Wed 10/8/08	Mon 2/2/09
70	Remove/Dispose Structures Primary Channel	Tue 2/3/09	Fri 5/29/09
71	CM Demolition	Tue 2/3/09	Fri 5/29/09
72	**Bridge Contracts**	**Tue 3/13/07**	**Tue 10/10/17**
73	**Henderson - Bridge & Roadway**	**Tue 3/13/07**	**Wed 1/16/13**
74	Concept Selection & Development	Tue 3/13/07	Thu 7/24/08
75	Design	Fri 7/25/08	Thu 7/23/09
76	Review -TxDOT	Fri 7/24/09	Thu 1/21/10
77	Procurement	Mon 1/25/10	Mon 5/24/10
78	Construct Temporary Detour	Tue 5/25/10	Fri 8/20/10
79	Construct Bridge	Mon 8/23/10	Tue 9/25/12
80	CM	Thu 9/30/10	Wed 1/16/13
81	**White Settlement- Bridge & Roadw**	**Tue 3/13/07**	**Thu 12/27/12**



Notes:

Task		Progress		Summary		Rolled Up Split		Rolled Up Progress		Project Summary		Deadline
Split		Milestone		Rolled Up Task		Rolled Up Milestone		External Tasks		External Milestone	

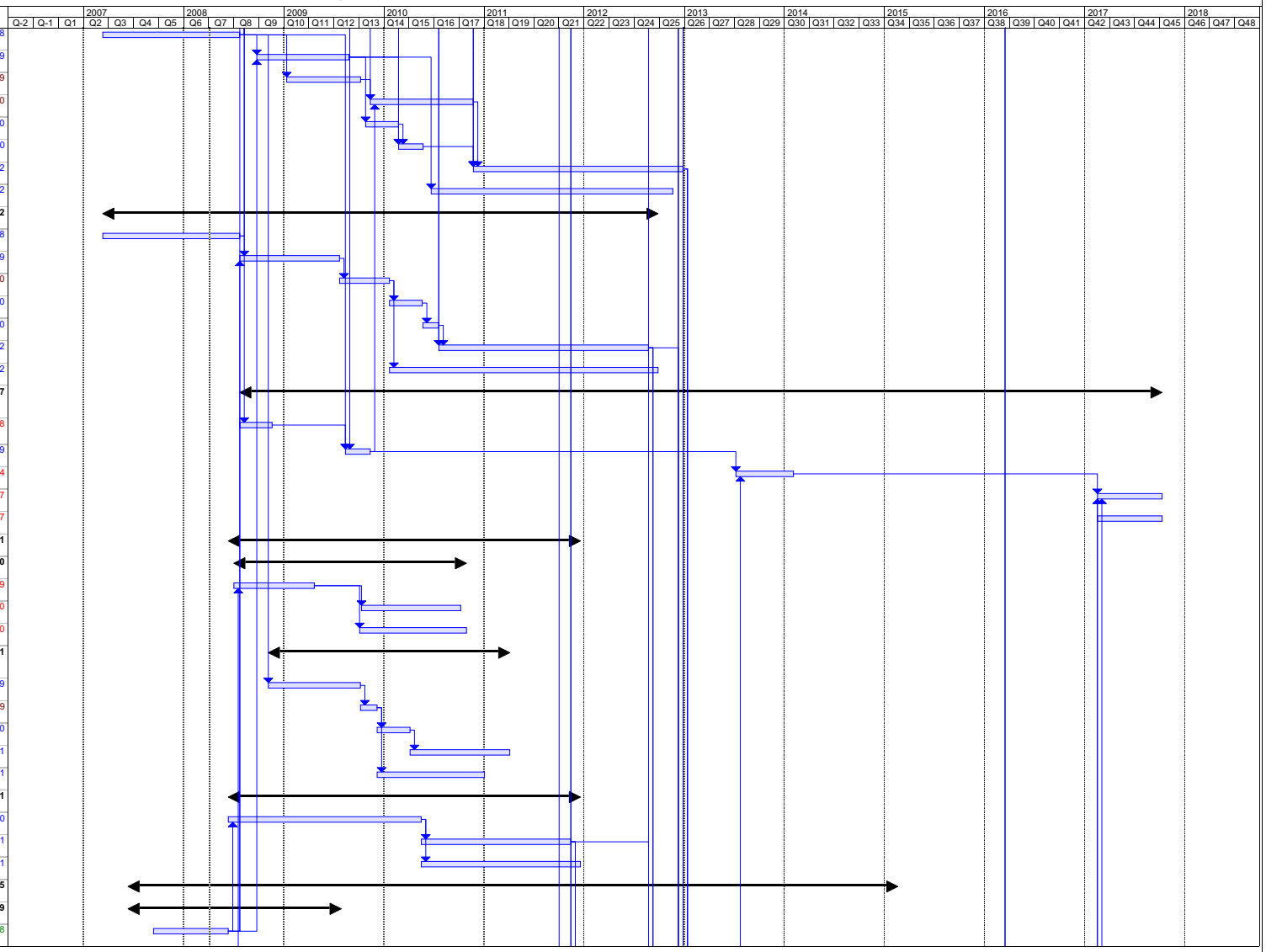
FORT WORTH CENTRAL CITY

Preliminary Project Schedule

Preliminary Draft for MII Est. April 1, 2008

TRWD
City of Fort Worth
USACE
Others

ID	Task Name	Start	Finish
82	Concept Selection & Development	Tue 3/13/07	Thu 7/24/08
83	Design Roadway/Bridge	Thu 9/25/08	Wed 8/26/09
84	Design TXU Relocation	Mon 1/12/09	Thu 10/8/09
85	Relocate TXU 138 kV Overhead	Fri 11/13/09	Tue 11/23/10
86	Procurement	Tue 10/27/09	Tue 2/23/10
87	Construct Temporary Detour	Wed 2/24/10	Mon 5/24/10
88	Construct Bridge	Wed 11/24/10	Thu 12/27/12
89	CM	Wed 6/23/10	Tue 11/20/12
90	**Main Street - Bridge**	**Tue 3/13/07**	**Thu 9/27/12**
91	Concept Selection & Development	Tue 3/13/07	Thu 7/24/08
92	Design	Fri 7/25/08	Thu 7/23/09
93	Review TxDOT	Fri 7/24/09	Thu 1/21/10
94	Procurement	Fri 1/22/10	Fri 5/21/10
95	Construct Temporary Detour	Mon 5/24/10	Tue 7/20/10
96	Construct Bridge	Wed 7/21/10	Thu 8/23/12
97	CM	Fri 1/22/10	Thu 9/27/12
98	**White Settlement Extension and Bridge**	**Fri 7/25/08**	**Tue 10/10/17**
99	Roadway Extension Alignment East & Bridge Crossing (Prel.)	Fri 7/25/08	Wed 11/19/08
100	R-O-W Dedication	Fri 8/14/09	Thu 11/12/09
101	Design Extension & Bridge	Tue 7/9/13	Mon 2/3/14
102	Construction Extension & Bridge	Fri 2/17/17	Tue 10/10/17
103	CM Extension	Fri 2/17/17	Tue 10/10/17
104	**Local Streets and Utilities**	**Fri 6/13/08**	**Mon 12/19/11**
105	**Local Street Modifications**	**Thu 7/3/08**	**Fri 10/29/10**
106	Design	Thu 7/3/08	Wed 4/22/09
107	Construction	Mon 10/12/09	Fri 10/8/10
108	CM	Mon 10/5/09	Fri 10/29/10
109	**Henderson/White Settlement Intersection**	**Thu 11/6/08**	**Tue 4/5/11**
110	Design	Thu 11/6/08	Wed 10/7/09
111	TxDOT Review	Thu 10/8/09	Mon 12/7/09
112	Procurement	Tue 12/8/09	Tue 4/6/10
113	Construction	Wed 4/7/10	Tue 4/5/11
114	CM	Tue 12/8/09	Mon 1/3/11
115	**Utility Relocations**	**Fri 6/13/08**	**Mon 12/19/11**
116	Design	Fri 6/13/08	Mon 5/17/10
117	Construction	Tue 5/18/10	Mon 11/14/11
118	CM	Tue 5/18/10	Mon 12/19/11
119	**Bypass Channel, Levees, & Walls**	**Wed 6/13/07**	**Thu 2/19/15**
120	**Design**	**Wed 6/13/07**	**Wed 7/29/09**
121	Geometric/Hydraulic Design	Fri 9/14/07	Thu 6/12/08



Notes: Task, Split, Progress, Milestone, Summary, Rolled Up Task, Rolled Up Split, Rolled Up Milestone, Rolled Up Progress, External Tasks, Project Summary, External Milestone, Deadline

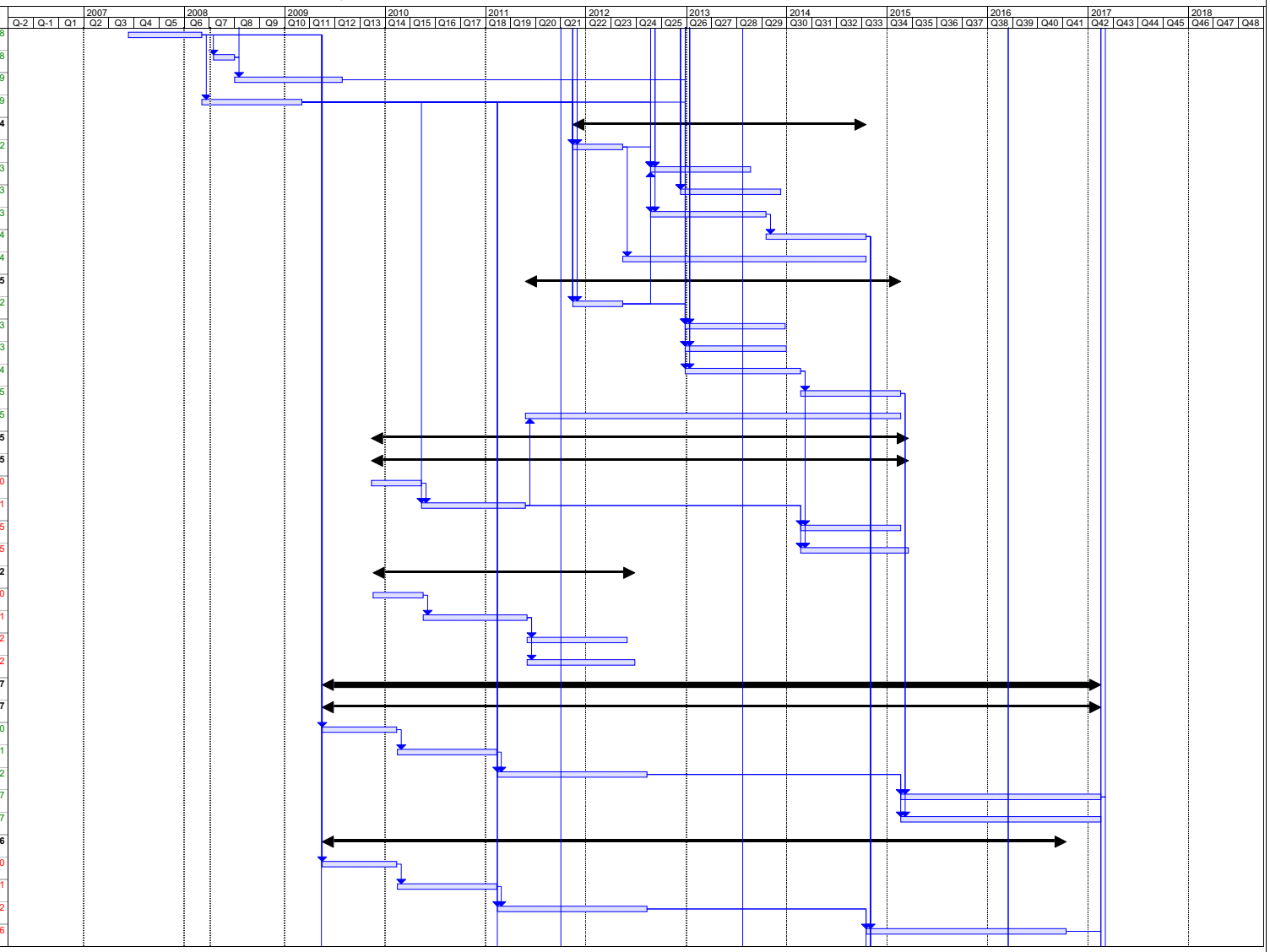
FORT WORTH CENTRAL CITY

Preliminary Project Schedule

Preliminary Draft for MII Est. April 1, 2008

TRWD
City of Fort Worth
USACE
Others

ID	Task Name	Start	Finish
122	Geotechnical	Wed 6/13/07	Wed 3/5/08
123	Preliminary Design Civil/Structural	Thu 4/17/08	Wed 7/2/08
124	Design Civil	Thu 7/3/08	Wed 7/29/09
125	Design Hard Edge Retaining Walls	Thu 3/6/08	Wed 3/4/09
126	**Lower (North) Channel**	**Tue 11/15/11**	**Thu 10/16/14**
127	Procurement	Tue 11/15/11	Mon 5/14/12
128	Excavation	Fri 8/24/12	Thu 8/22/13
129	Levees & Embankments	Tue 12/11/12	Tue 12/10/13
130	Retaining Walls	Fri 8/24/12	Thu 10/17/13
131	Tie-in Levee/Walls	Fri 10/18/13	Thu 10/16/14
132	CM	Tue 5/15/12	Thu 10/16/14
133	**Upper (South) Channel**	**Fri 5/27/11**	**Thu 2/19/15**
134	Procurement	Tue 11/15/11	Mon 5/14/12
135	Excavation	Fri 12/28/12	Thu 12/26/13
136	Levees & Embankments	Fri 12/28/12	Mon 12/30/13
137	Retaining Walls	Fri 12/28/12	Thu 2/20/14
138	Tie-in Levee/Walls	Fri 2/21/14	Thu 2/19/15
139	CM	Fri 5/27/11	Thu 2/19/15
140	**Pedestrian Bridges**	**Fri 11/13/09**	**Thu 3/19/15**
141	**Upper Bypass**	**Fri 11/13/09**	**Thu 3/19/15**
142	Prel.Concept Design	Fri 11/13/09	Thu 5/13/10
143	Design	Fri 5/14/10	Thu 5/26/11
144	Construction	Fri 2/21/14	Thu 2/19/15
145	CM	Fri 2/21/14	Thu 3/19/15
146	**West Fork**	**Thu 11/19/09**	**Wed 6/27/12**
147	Prel. Concept Design	Thu 11/19/09	Wed 5/19/10
148	Design	Thu 5/20/10	Wed 6/1/11
149	Construction	Thu 6/2/11	Wed 5/30/12
150	CM	Thu 6/2/11	Wed 6/27/12
151	**Isolation Gates**	**Mon 5/18/09**	**Thu 2/16/17**
152	**Clear Fork Gate**	**Mon 5/18/09**	**Thu 2/16/17**
153	Geotechnical	Mon 5/18/09	Fri 2/12/10
154	Preliminary Civil/Structural	Mon 2/15/10	Fri 2/11/11
155	Design	Mon 2/14/11	Fri 8/10/12
156	Construction	Fri 2/20/15	Thu 2/16/17
157	CM	Fri 2/20/15	Thu 2/16/17
158	**TRWD Gate**	**Mon 5/18/09**	**Thu 10/13/16**
159	Geotechnical	Mon 5/18/09	Fri 2/12/10
160	Preliminary Civil/Structural	Mon 2/15/10	Fri 2/11/11
161	Design	Mon 2/14/11	Fri 8/10/12
162	Construction	Fri 10/17/14	Thu 10/13/16



Notes:

Task		Progress		Summary		Rolled Up Split		Rolled Up Progress		Project Summary		Deadline	
Split		Milestone		Rolled Up Task		Rolled Up Milestone		External Tasks		External Milestone			

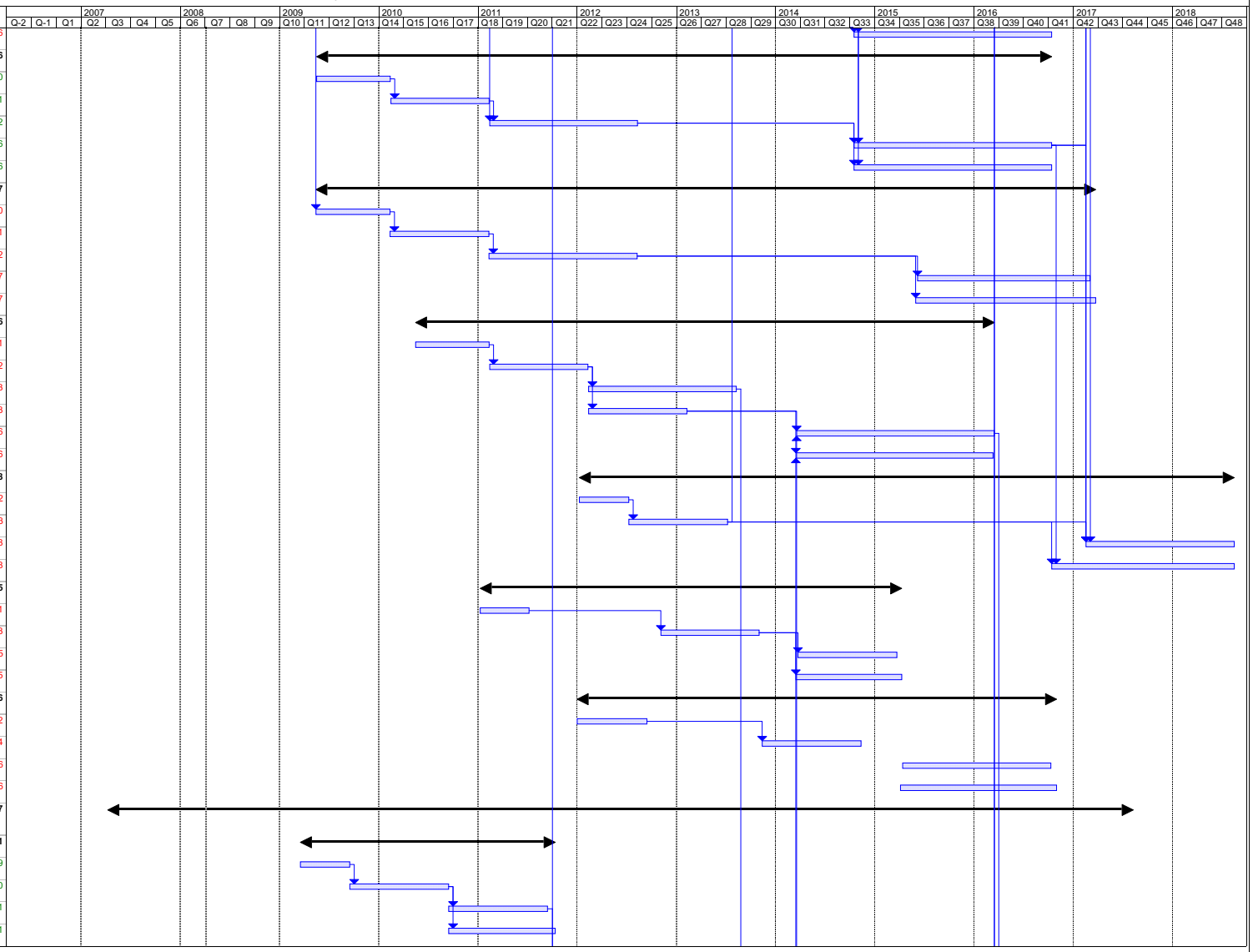
FORT WORTH CENTRAL CITY

Preliminary Project Schedule

Preliminary Draft for MII Est. April 1, 2008

TRWD
City of Fort Worth
USACE
Others

ID	Task Name	Start	Finish
163	CM	Fri 10/17/14	Thu 10/13/16
164	**West Fork Gate**	**Mon 5/18/09**	**Thu 10/13/16**
165	Geotechnical	Mon 5/18/09	Fri 2/12/10
166	Preliminary Civil/Structural	Mon 2/15/10	Fri 2/11/11
167	Design	Mon 2/14/11	Fri 8/10/12
168	Construction	Fri 10/17/14	Thu 10/13/16
169	CM	Fri 10/17/14	Thu 10/13/16
170	**Stormwater Pump Station**	**Fri 5/15/09**	**Fri 3/24/17**
171	Geotechnical	Fri 5/15/09	Thu 2/11/10
172	Preliminary Civil/Structural	Fri 2/12/10	Thu 2/10/11
173	Design	Fri 2/11/11	Thu 8/9/12
174	Construction	Mon 6/8/15	Fri 3/3/17
175	CM	Mon 6/1/15	Fri 3/24/17
176	**Samuel's and Marine Creek Dams**	**Mon 5/17/10**	**Wed 3/16/16**
177	Geotechnical	Mon 5/17/10	Fri 2/11/11
178	Peliminary Civil Structural	Mon 2/14/11	Fri 2/10/12
179	Design	Mon 2/13/12	Fri 8/9/13
180	Physical Model	Mon 2/13/12	Fri 2/8/13
181	Construction	Thu 3/20/14	Wed 3/16/16
182	CM	Mon 3/17/14	Fri 3/11/16
183	**Interior Water Feature**	**Tue 1/10/12**	**Thu 8/16/18**
184	Prelim. Design/Geotech.	Tue 1/10/12	Mon 7/9/12
185	Design	Tue 7/10/12	Mon 7/8/13
186	Construction	Fri 2/17/17	Thu 8/16/18
187	CM	Fri 10/14/16	Thu 8/16/18
188	**Marine Creek Reconstruction**	**Mon 1/10/11**	**Fri 4/10/15**
189	Prelim. Design/Geotech.	Mon 1/10/11	Fri 7/8/11
190	Design	Mon 11/5/12	Fri 11/1/13
191	Construction	Tue 3/25/14	Mon 3/23/15
192	CM	Mon 3/17/14	Fri 4/10/15
193	**Recirculation System**	**Mon 1/2/12**	**Mon 10/31/16**
194	Prelim. Design/Geotech.	Mon 1/2/12	Fri 9/14/12
195	Design	Wed 11/13/13	Tue 11/11/14
196	Construction	Tue 4/14/15	Mon 10/10/16
197	CM	Mon 4/6/15	Mon 10/31/16
198	**Valley Storage/Ecosystem Mitigation.**	**Tue 4/10/07**	**Wed 8/9/17**
199	**Rockwood West**	**Thu 3/19/09**	**Wed 10/12/11**
200	Concept Design	Thu 3/19/09	Wed 9/16/09
201	Design Rockwood	Thu 9/17/09	Wed 9/15/10
202	Construction Rockwood	Thu 9/16/10	Wed 9/14/11
203	CM Rockwood	Thu 9/16/10	Wed 10/12/11



Notes: Task, Split, Progress, Milestone, Summary, Rolled Up Task, Rolled Up Split, Rolled Up Milestone, Rolled Up Progress, External Tasks, Project Summary, External Milestone, Deadline

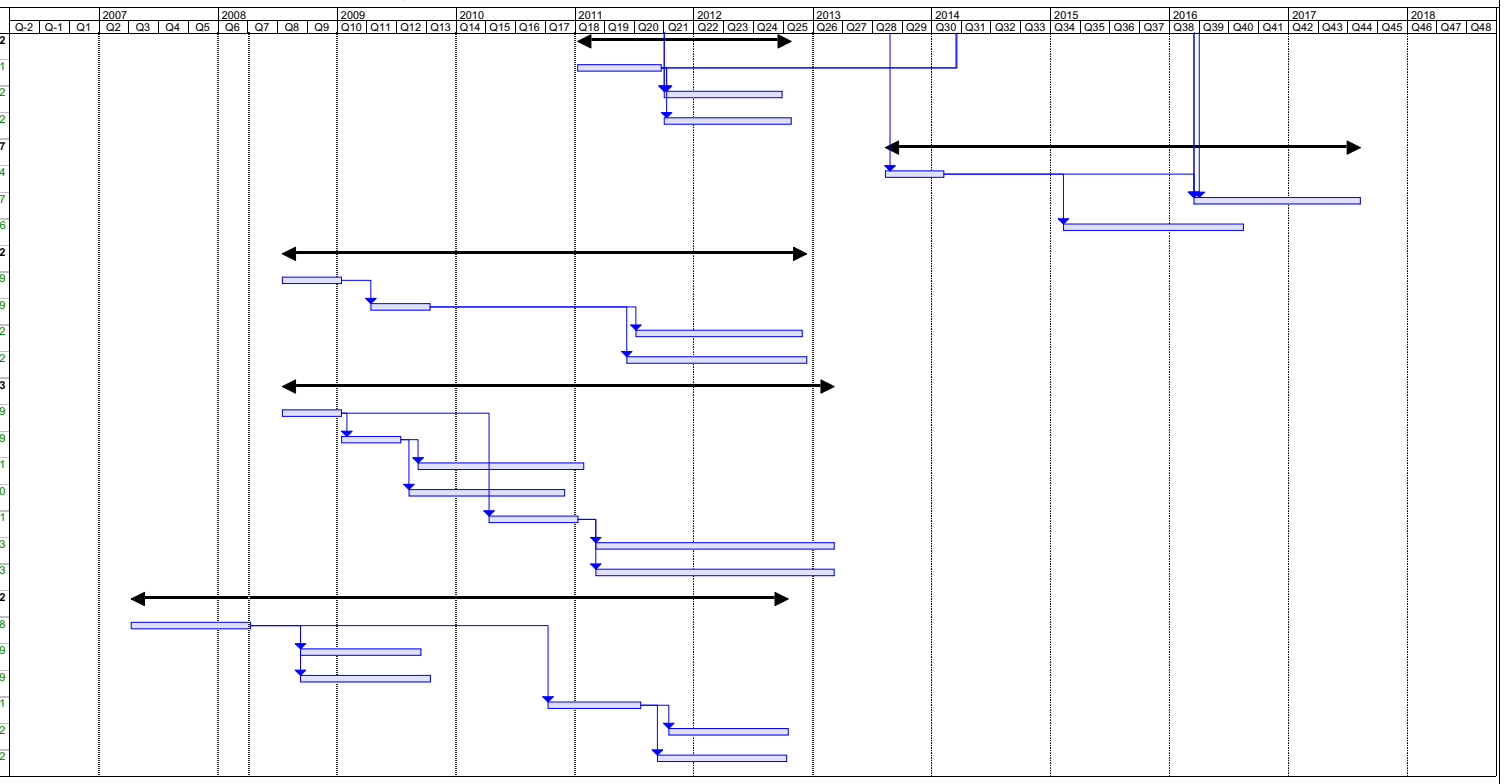
FORT WORTH CENTRAL CITY

Preliminary Project Schedule

Preliminary Draft for MII Est. April 1, 2008

TRWD
City of Fort Worth
USACE
Others

ID	Task Name	Start	Finish
204	**University Site**	**Mon 1/10/11**	**Fri 10/26/12**
205	Design University	Mon 1/10/11	Fri 9/23/11
206	Construction University	Mon 10/3/11	Fri 9/28/12
207	CM University	Mon 10/3/11	Fri 10/26/12
208	**Samuels Sites**	**Mon 8/12/13**	**Wed 8/9/17**
209	Design Samuels	Mon 8/12/13	Fri 2/7/14
210	Construction Samuels	Thu 3/17/16	Wed 8/9/17
211	CM Samuels	Tue 2/10/15	Mon 8/15/16
212	**Riverside Park**	**Thu 7/17/08**	**Thu 12/13/12**
213	Riverside Master Plan	Thu 7/17/08	Wed 1/14/09
214	Design Riverside	Wed 4/15/09	Tue 10/13/09
215	Construction Riverside	Fri 7/8/11	Thu 11/29/12
216	CM Riverside	Fri 6/10/11	Thu 12/13/12
217	**Riverside/Gateway**	**Thu 7/17/08**	**Thu 3/7/13**
218	Riverside/Gateway Master Plan	Thu 7/17/08	Wed 1/14/09
219	Design Riverside/Gateway Phase I	Thu 1/15/09	Wed 7/15/09
220	Construction Riverside/Gateway Phase	Mon 9/7/09	Fri 1/28/11
221	CM Riverside/Gateway Phase I	Mon 8/10/09	Tue 11/30/10
222	Design Riverside/Gateway Phase II	Tue 4/13/10	Mon 1/10/11
223	Construction Riverside/Gateway Phase	Mon 3/7/11	Thu 3/7/13
224	CM Riverside/Gateway Phase II	Mon 3/7/11	Thu 3/7/13
225	**Ham Branch**	**Tue 4/10/07**	**Wed 10/17/12**
226	Design Ham Branch Ecosystem	Tue 4/10/07	Thu 4/10/08
227	Construction Ham Branch Ecosystem	Thu 9/11/08	Tue 9/15/09
228	CM Ham Branch Ecosystem	Thu 9/11/08	Wed 10/14/09
229	Design Ham Branch Valley Storage	Mon 10/11/10	Fri 7/22/11
230	Construction Ham Branch Valley Storage	Mon 10/17/11	Wed 10/17/12
231	CM Ham Branch Valley Storage	Mon 9/12/11	Fri 10/12/12



Notes: Task, Split, Progress, Milestone, Summary, Rolled Up Task, Rolled Up Split, Rolled Up Milestone, Rolled Up Progress, External Tasks, Project Summary, External Milestone, Deadline

Appendix C
Cost Risk Factor Probability Distributions

Crystal Ball Report - Assumptions

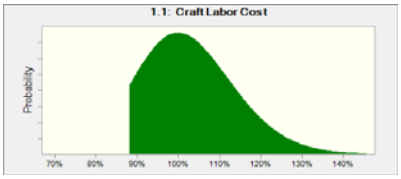
Worksheet: [FWCC Cost Risk Analysis.xls]Risk Impact Table

Assumption: 1.1: Craft Labor Cost **Cell: E6**

Lognormal distribution with parameters:

Mean	102%
Std. Dev.	12%

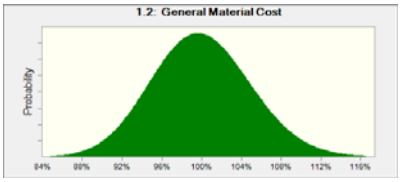
Selected range is from 88% to Infinity



Assumption: 1.2: General Material Cost **Cell: E7**

Lognormal distribution with parameters:

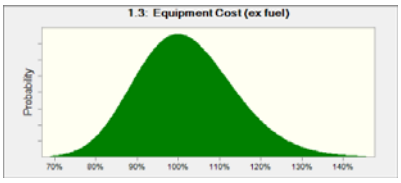
Mean	100%
Std. Dev.	5%



Assumption: 1.3: Equipment Cost (ex fuel) **Cell: E8**

Lognormal distribution with parameters:

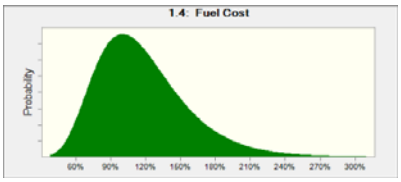
Mean	102%
Std. Dev.	12%



Assumption: 1.4: Fuel Cost **Cell: E9**

Lognormal distribution with parameters:

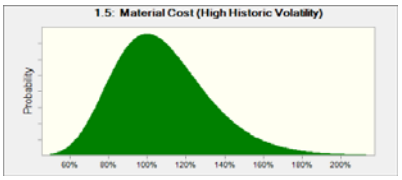
Mean	118%
Std. Dev.	40%



Assumption: 1.5: Material Cost (High Historic Volatility) **Cell: E10**

Lognormal distribution with parameters:

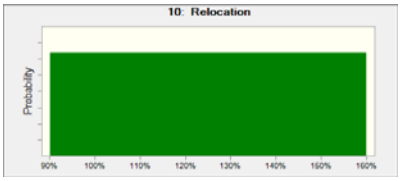
Mean	108%
Std. Dev.	25%



Assumption: 10: Relocation **Cell: E33**

Uniform distribution with parameters:

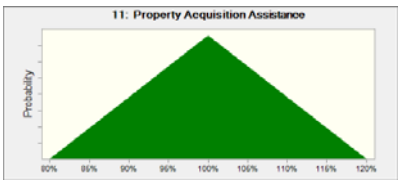
Minimum	90%
Maximum	160%



Assumption: 11: Property Acquisition Assistance **Cell: E34**

Triangular distribution with parameters:

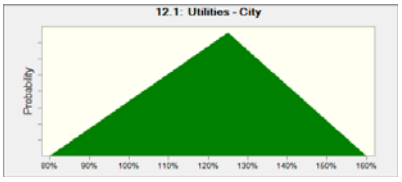
Minimum	80%
Likeliest	100%
Maximum	120%



Assumption: 12.1: Utilities - City **Cell: E36**

Triangular distribution with parameters:

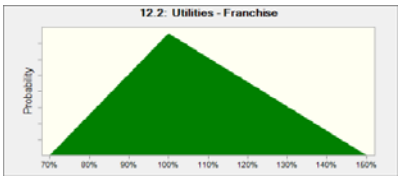
Minimum	80%
Likeliest	125%
Maximum	160%



Assumption: 12.2: Utilities - Franchise **Cell: E37**

Triangular distribution with parameters:

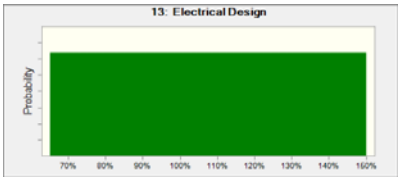
Minimum	70%
Likeliest	100%
Maximum	150%



Assumption: 13: Electrical Design **Cell: E38**

Uniform distribution with parameters:

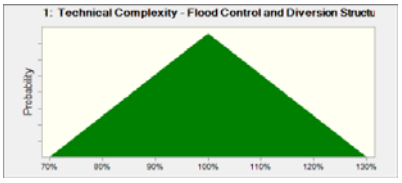
Minimum	65%
Maximum	150%



Assumption: 14.1: Technical Complexity - Flood Control and Diversion Structures **Cell: E40**

Triangular distribution with parameters:

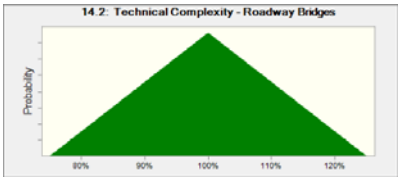
Minimum	70%
Likeliest	100%
Maximum	130%



Assumption: 14.2: Technical Complexity - Roadway Bridges **Cell: E41**

Triangular distribution with parameters:

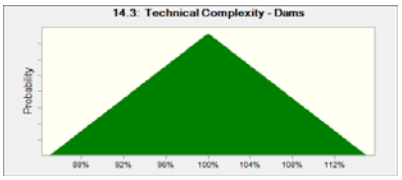
Minimum	75%
Likeliest	100%
Maximum	125%



Assumption: 14.3: Technical Complexity - Dams **Cell: E42**

Triangular distribution with parameters:

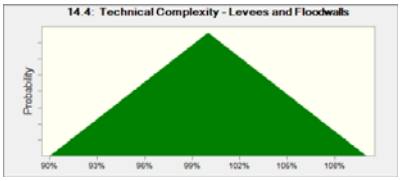
Minimum	85%
Likeliest	100%
Maximum	115%



Assumption: 14.4: Technical Complexity - Levees and Floodwalls **Cell: E43**

Triangular distribution with parameters:

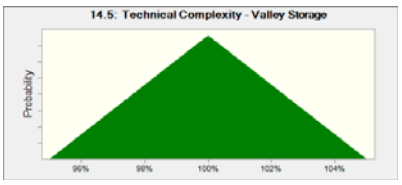
Minimum	90%
Likeliest	100%
Maximum	110%



Assumption: 14.5: Technical Complexity - Valley Storage **Cell: E44**

Triangular distribution with parameters:

Minimum	95%
Likeliest	100%
Maximum	105%



Assumption: 15: Contract Acquisition Strategy - Federal **Cell: E45**

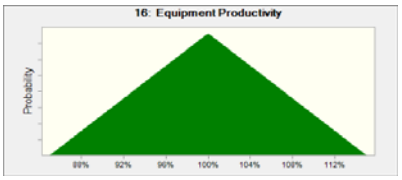
Triangular distribution with parameters:

Minimum	100%
Likeliest	100%
Maximum	110%

Assumption: 16: Equipment Productivity **Cell: E46**

Triangular distribution with parameters:

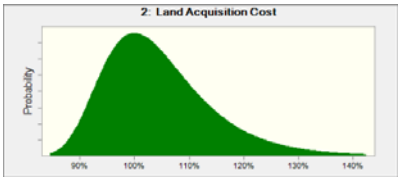
Minimum	85%
Likeliest	100%
Maximum	115%



Assumption: 2: Land Acquisition Cost **Cell: E11**

Maximum Extreme distribution with parameters:

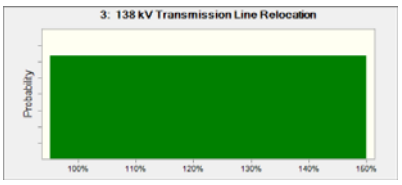
Likeliest	100%
Scale	8%



Assumption: 3: 138 kV Transmission Line Relocation **Cell: E12**

Uniform distribution with parameters:

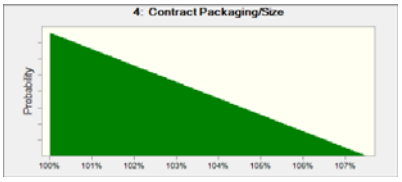
Minimum	95%
Maximum	150%



Assumption: 4: Contract Packaging/Size **Cell: E13**

Triangular distribution with parameters:

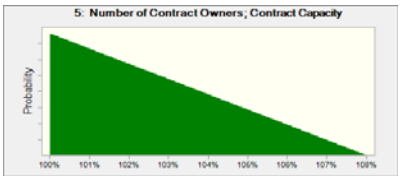
Minimum	100%
Likeliest	100%
Maximum	108%



Assumption: 5: Number of Contract Owners; Contract Capacity **Cell: E14**

Triangular distribution with parameters:

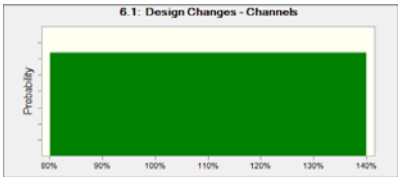
Minimum	100%
Likeliest	100%
Maximum	108%



Assumption: 6.1: Design Changes - Channels **Cell: E16**

Uniform distribution with parameters:

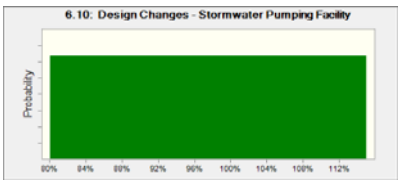
Minimum	80%
Maximum	140%



Assumption: 6.10: Design Changes - Stormwater Pumping Facility **Cell: E25**

Uniform distribution with parameters:

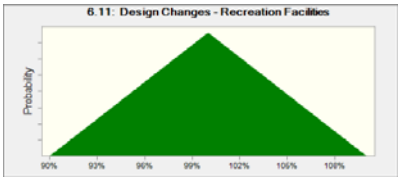
Minimum	80%
Maximum	115%



Assumption: 6.11: Design Changes - Recreation Facilities **Cell: E26**

Triangular distribution with parameters:

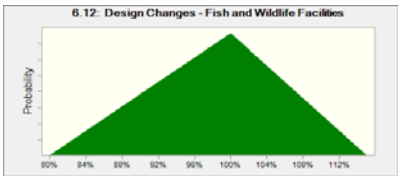
Minimum	90%
Likeliest	100%
Maximum	110%



Assumption: 6.12: Design Changes - Fish and Wildlife Facilities **Cell: E27**

Triangular distribution with parameters:

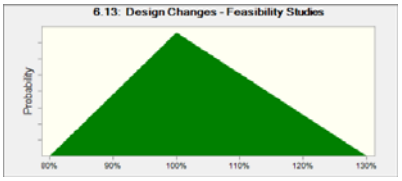
Minimum	80%
Likeliest	100%
Maximum	115%



Assumption: 6.13: Design Changes - Feasibility Studies **Cell: E28**

Triangular distribution with parameters:

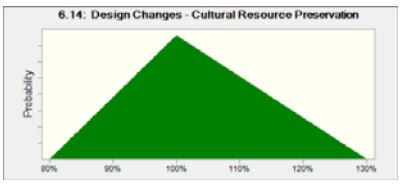
Minimum	80%
Likeliest	100%
Maximum	130%



Assumption: 6.14: Design Changes - Cultural Resource Preservation **Cell: E29**

Triangular distribution with parameters:

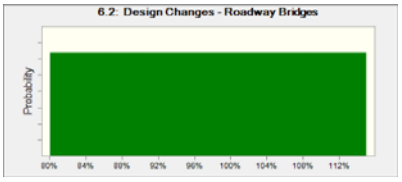
Minimum	80%
Likeliest	100%
Maximum	130%



Assumption: 6.2: Design Changes - Roadway Bridges **Cell: E17**

Uniform distribution with parameters:

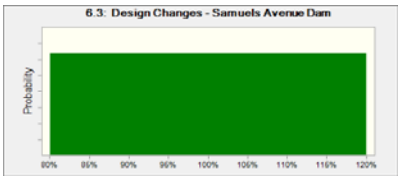
Minimum	80%
Maximum	115%



Assumption: 6.3: Design Changes - Samuels Avenue Dam **Cell: E18**

Uniform distribution with parameters:

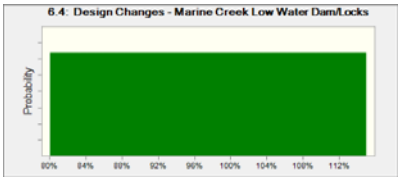
Minimum	80%
Maximum	120%



Assumption: 6.4: Design Changes - Marine Creek Low Water Dam/Locks **Cell: E19**

Uniform distribution with parameters:

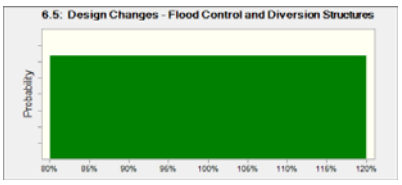
Minimum	80%
Maximum	115%



Assumption: 6.5: Design Changes - Flood Control and Diversion Structures **Cell: E20**

Uniform distribution with parameters:

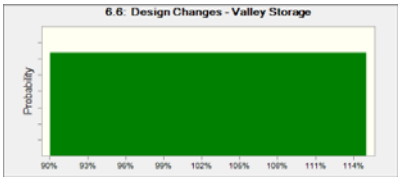
Minimum	80%
Maximum	120%



Assumption: 6.6: Design Changes - Valley Storage **Cell: E21**

Uniform distribution with parameters:

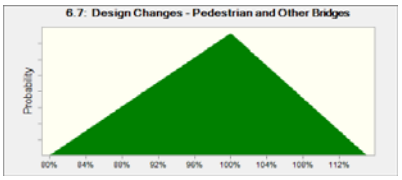
Minimum	90%
Maximum	115%



Assumption: 6.7: Design Changes - Pedestrian and Other Bridges **Cell: E22**

Triangular distribution with parameters:

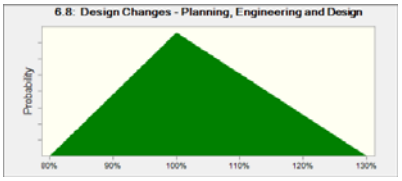
Minimum	80%
Likeliest	100%
Maximum	115%



Assumption: 6.8: Design Changes - Planning, Engineering and Design **Cell: E23**

Triangular distribution with parameters:

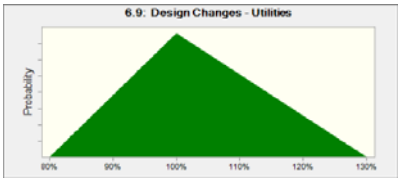
Minimum	80%
Likeliest	100%
Maximum	130%



Assumption: 6.9: Design Changes - Utilities **Cell: E24**

Triangular distribution with parameters:

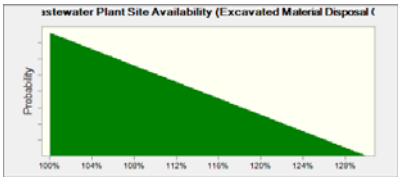
Minimum	80%
Likeliest	100%
Maximum	130%



Assumption: 7: Wastewater Plant Site Availability (Excavated Material Disposal Costs) **Cell: E30**

Triangular distribution with parameters:

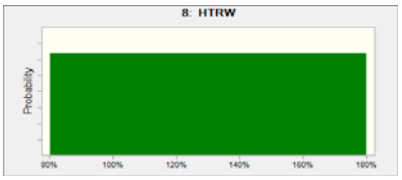
Minimum	100%
Likeliest	100%
Maximum	130%



Assumption: 8: HTRW **Cell: E31**

Uniform distribution with parameters:

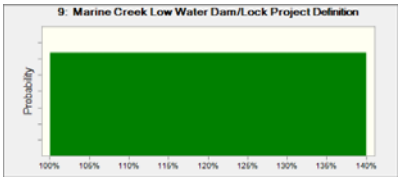
Minimum	80%
Maximum	180%



Assumption: 9: Marine Creek Low Water Dam/Lock Project Definition **Cell: E32**

Uniform distribution with parameters:

Minimum	100%
Maximum	140%



End of Assumptions

Appendix D
Cost Contingency Simulation Report

Crystal Ball Report - Full
Simulation started on 3/31/2008 at 15:16:03
Simulation stopped on 3/31/2008 at 15:29:45

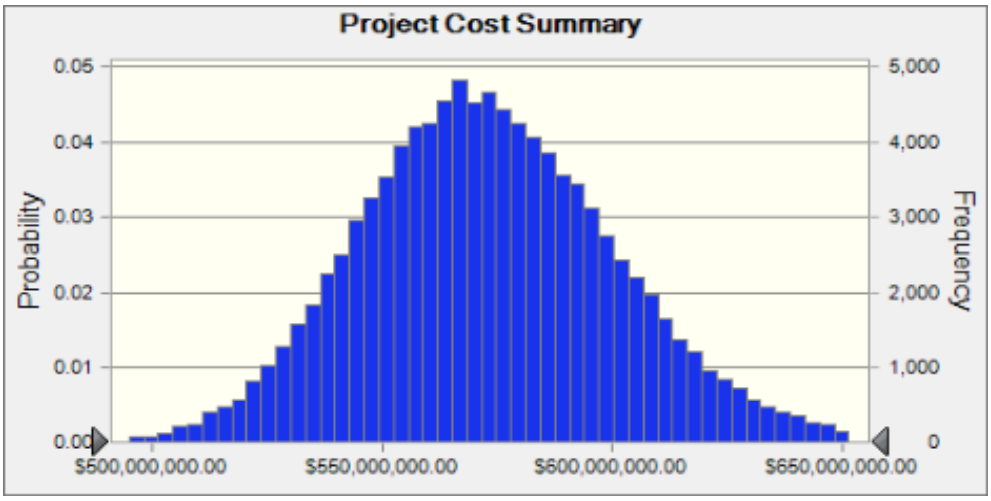
Run preferences:	
Number of trials run	100,000
Monte Carlo	
Random seed	
Precision control on	
Confidence level	95.00%
Run statistics:	
Total running time (sec)	822.41
Trials/second (average)	122
Random numbers per sec	4,621
Crystal Ball data:	
Assumptions	38
Correlations	0
Correlated groups	0
Decision variables	0
Forecasts	51

Forecasts

Worksheet: [FWCC Cost Risk Analysis.xls]Crystal Ball Forecasts

Forecast: Project Cost Summary **Cell: C5**

Summary:
Entire range is from $467,794,905.34 to $716,281,925.90
Base case is $506,743,627.18
After 100,000 trials, the std. error of the mean is $88,403.61



Statistics:	Forecast values
Trials	100,000
Mean	$573,094,049.50
Median	$571,831,792.53
Mode	---
Standard Deviation	$27,955,676.80
Variance	$781,519,865,105,582.00
Skewness	0.2681
Kurtosis	3.16
Coeff. of Variability	0.0488
Minimum	$467,794,905.34
Maximum	$716,281,925.90
Range Width	$248,487,020.56
Mean Std. Error	$88,403.61

Forecast: Project Cost Summary (cont'd) **Cell: C5**

Percentiles:	Forecast values
0%	$467,794,905.34
10%	$538,169,116.83
20%	$549,395,026.56
30%	$557,717,759.66
40%	$564,976,142.44
50%	$571,831,680.63
60%	$578,897,983.00
70%	$586,827,731.43
80%	$596,111,405.04
90%	$609,352,258.89
100%	$716,281,925.90

End of Forecasts

Assumptions

Worksheet: [FWCC Cost Risk Analysis.xls]Risk Impact Table

Assumption: 1.1: Craft Labor Cost **Cell: E6**

Lognormal distribution with parameters:

Mean	102%
Std. Dev.	12%

Selected range is from 88% to Infinity

Assumption: 1.2: General Material Cost **Cell: E7**

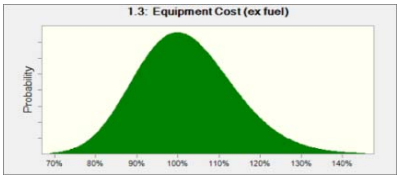
Lognormal distribution with parameters:

Mean	100%
Std. Dev.	5%

Assumption: 1.3: Equipment Cost (ex fuel) **Cell: E8**

Lognormal distribution with parameters:

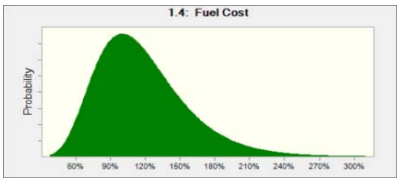
Mean	102%
Std. Dev.	12%



Assumption: 1.4: Fuel Cost **Cell: E9**

Lognormal distribution with parameters:

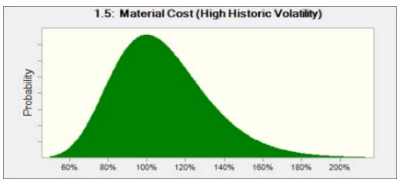
Mean	118%
Std. Dev.	40%



Assumption: 1.5: Material Cost (High Historic Volatility) **Cell: E10**

Lognormal distribution with parameters:

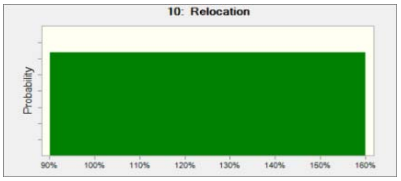
Mean	108%
Std. Dev.	25%



Assumption: 10: Relocation **Cell: E33**

Uniform distribution with parameters:

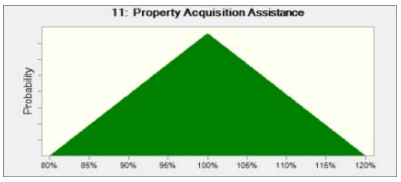
Minimum	90%
Maximum	160%



Assumption: 11: Property Acquisition Assistance **Cell: E34**

Triangular distribution with parameters:

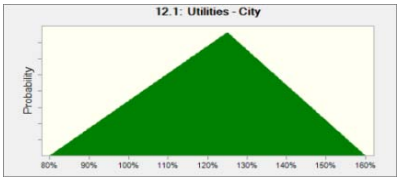
Minimum	80%
Likeliest	100%
Maximum	120%



Assumption: 12.1: Utilities - City **Cell: E36**

Triangular distribution with parameters:

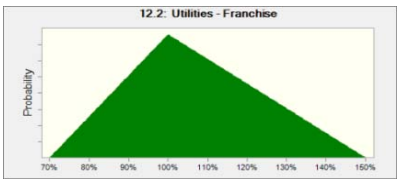
Minimum	80%
Likeliest	125%
Maximum	160%



Assumption: 12.2: Utilities - Franchise **Cell: E37**

Triangular distribution with parameters:

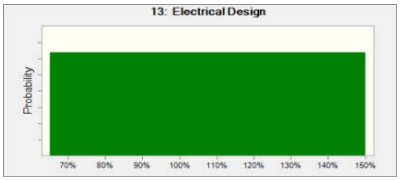
Minimum	70%
Likeliest	100%
Maximum	150%



Assumption: 13: Electrical Design **Cell: E38**

Uniform distribution with parameters:

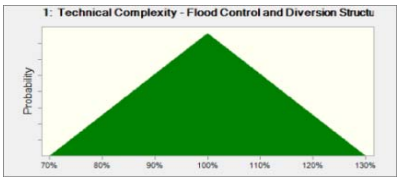
Minimum	65%
Maximum	150%



Assumption: 14.1: Technical Complexity - Flood Control and Diversion Structures **Cell: E40**

Triangular distribution with parameters:

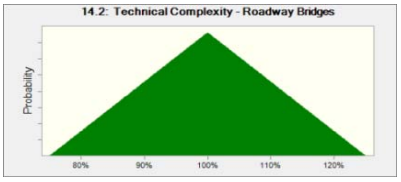
Minimum	70%
Likeliest	100%
Maximum	130%



Assumption: 14.2: Technical Complexity - Roadway Bridges **Cell: E41**

Triangular distribution with parameters:

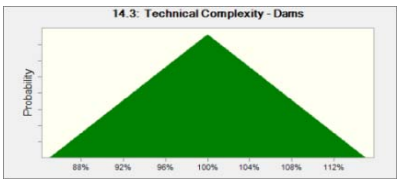
Minimum	75%
Likeliest	100%
Maximum	125%



Assumption: 14.3: Technical Complexity - Dams **Cell: E42**

Triangular distribution with parameters:

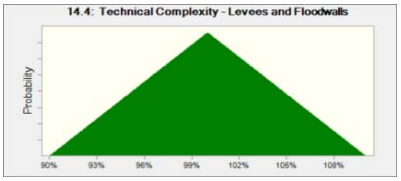
Minimum	85%
Likeliest	100%
Maximum	115%



Assumption: 14.4: Technical Complexity - Levees and Floodwalls **Cell: E43**

Triangular distribution with parameters:

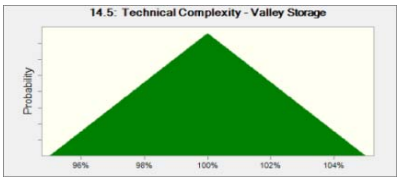
Minimum	90%
Likeliest	100%
Maximum	110%



Assumption: 14.5: Technical Complexity - Valley Storage **Cell: E44**

Triangular distribution with parameters:

Minimum	95%
Likeliest	100%
Maximum	105%



Assumption: 15: Contract Acquisition Strategy - Federal **Cell: E45**

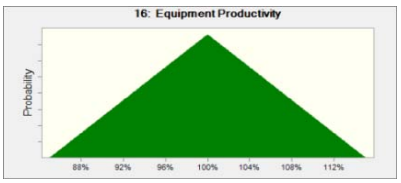
Triangular distribution with parameters:

Minimum	100%
Likeliest	100%
Maximum	110%

Assumption: 16: Equipment Productivity **Cell: E46**

Triangular distribution with parameters:

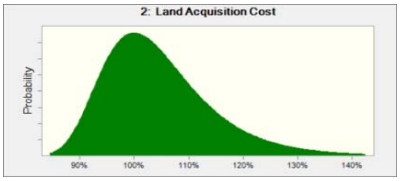
Minimum	85%
Likeliest	100%
Maximum	115%



Assumption: 2: Land Acquisition Cost **Cell: E11**

Maximum Extreme distribution with parameters:

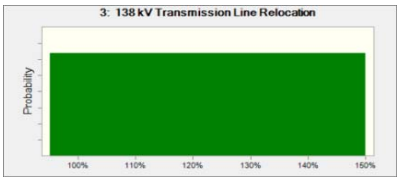
Likeliest	100%
Scale	8%



Assumption: 3: 138 kV Transmission Line Relocation **Cell: E12**

Uniform distribution with parameters:

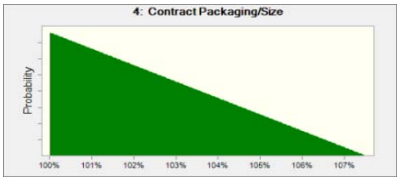
Minimum	95%
Maximum	150%



Assumption: 4: Contract Packaging/Size **Cell: E13**

Triangular distribution with parameters:

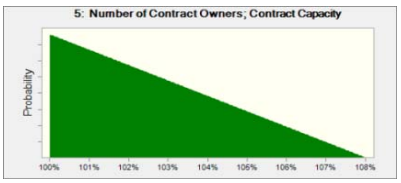
Minimum	100%
Likeliest	100%
Maximum	108%



Assumption: 5: Number of Contract Owners; Contract Capacity **Cell: E14**

Triangular distribution with parameters:

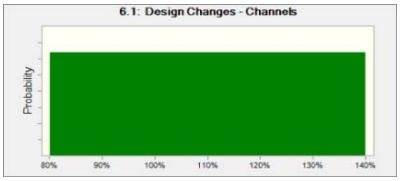
Minimum	100%
Likeliest	100%
Maximum	108%



Assumption: 6.1: Design Changes - Channels **Cell: E16**

Uniform distribution with parameters:

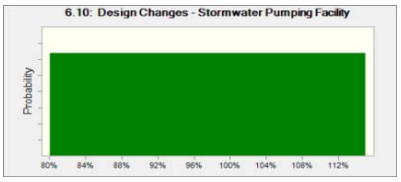
Minimum	80%
Maximum	140%



Assumption: 6.10: Design Changes - Stormwater Pumping Facility **Cell: E25**

Uniform distribution with parameters:

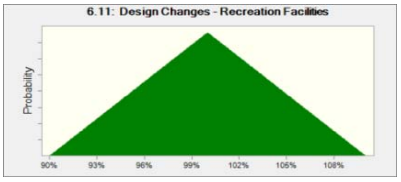
Minimum	80%
Maximum	115%



Assumption: 6.11: Design Changes - Recreation Facilities **Cell: E26**

Triangular distribution with parameters:

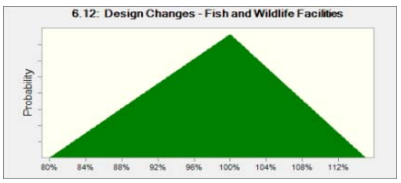
Minimum	90%
Likeliest	100%
Maximum	110%



Assumption: 6.12: Design Changes - Fish and Wildlife Facilities **Cell: E27**

Triangular distribution with parameters:

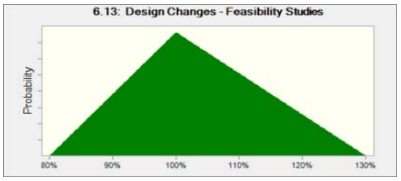
Minimum	80%
Likeliest	100%
Maximum	115%



Assumption: 6.13: Design Changes - Feasibility Studies **Cell: E28**

Triangular distribution with parameters:

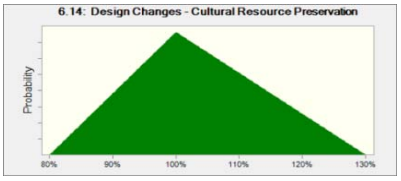
Minimum	80%
Likeliest	100%
Maximum	130%



Assumption: 6.14: Design Changes - Cultural Resource Preservation **Cell: E29**

Triangular distribution with parameters:

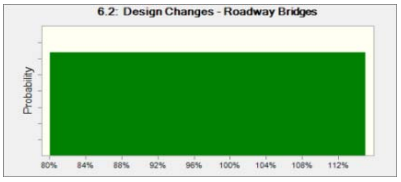
Minimum	80%
Likeliest	100%
Maximum	130%



Assumption: 6.2: Design Changes - Roadway Bridges **Cell: E17**

Uniform distribution with parameters:

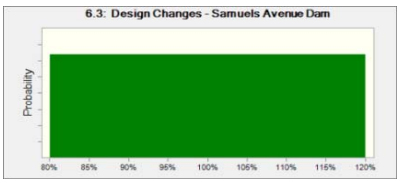
Minimum	80%
Maximum	115%



Assumption: 6.3: Design Changes - Samuels Avenue Dam **Cell: E18**

Uniform distribution with parameters:

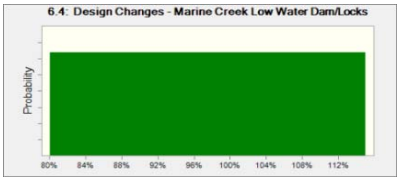
Minimum	80%
Maximum	120%



Assumption: 6.4: Design Changes - Marine Creek Low Water Dam/Locks **Cell: E19**

Uniform distribution with parameters:

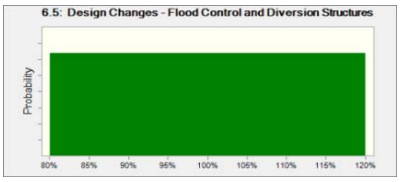
Minimum	80%
Maximum	115%



Assumption: 6.5: Design Changes - Flood Control and Diversion Structures **Cell: E20**

Uniform distribution with parameters:

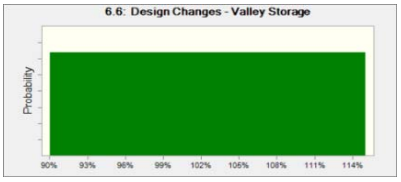
Minimum	80%
Maximum	120%



Assumption: 6.6: Design Changes - Valley Storage **Cell: E21**

Uniform distribution with parameters:

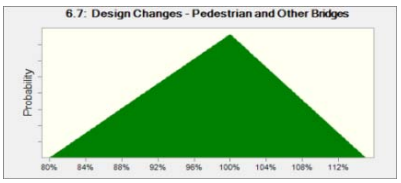
Minimum	90%
Maximum	115%



Assumption: 6.7: Design Changes - Pedestrian and Other Bridges **Cell: E22**

Triangular distribution with parameters:

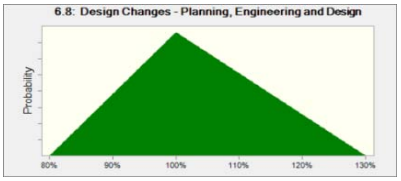
Minimum	80%
Likeliest	100%
Maximum	115%



Assumption: 6.8: Design Changes - Planning, Engineering and Design **Cell: E23**

Triangular distribution with parameters:

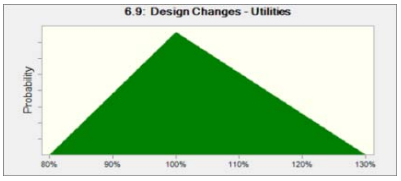
Minimum	80%
Likeliest	100%
Maximum	130%



Assumption: 6.9: Design Changes - Utilities **Cell: E24**

Triangular distribution with parameters:

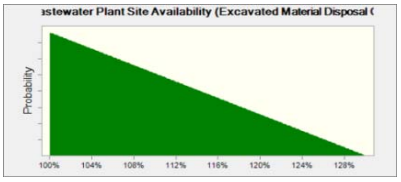
Minimum	80%
Likeliest	100%
Maximum	130%



Assumption: 7: Wastewater Plant Site Availability (Excavated Material Disposal Costs) **Cell: E30**

Triangular distribution with parameters:

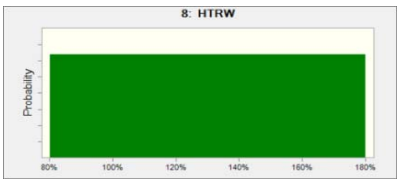
Minimum	100%
Likeliest	100%
Maximum	130%



Assumption: 8: HTRW **Cell: E31**

Uniform distribution with parameters:

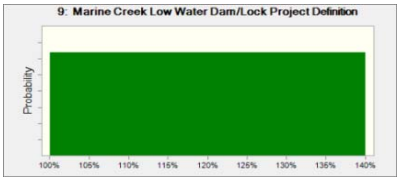
Minimum	80%
Maximum	180%



Assumption: 9: Marine Creek Low Water Dam/Lock Project Definition **Cell: E32**

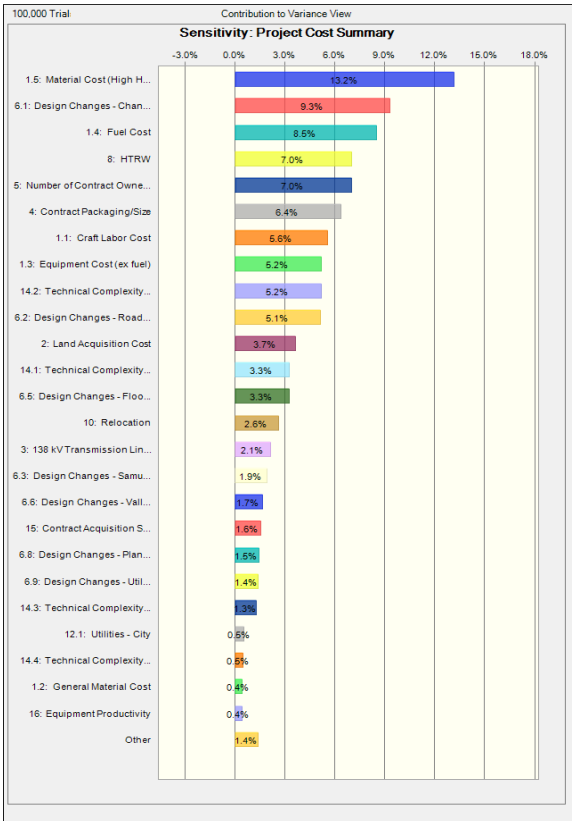
Uniform distribution with parameters:

Minimum	100%
Maximum	140%



End of Assumptions

Sensitivity Charts



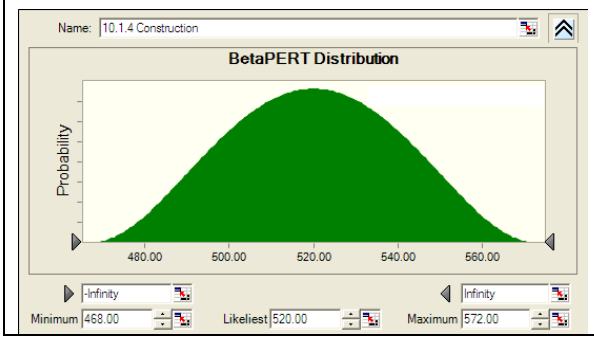
Appendix E
Schedule Critical Path Stress Tests

FWCC SCHEDULE SENSITIVITY ANALYSIS
Ten Percent Critical Path Stress Test*

WBS	Element	Task	Contribution to Variance	Deterministic Critical Path	Deterministic Slack (days)
10.1.4	Clear Fork Gate	Construction	40.7%	Yes	0
13.3	Interior Water Feature	Construction	22.6%	Yes	0
6.2.7	White Settlement Bridge & Roadway	Construct Bridge	16.0%	Yes	0
8.3.5	Upper (South) Channel	Tie-in Levee/Walls	9.7%	Yes	0
8.3.4	Upper (South) Channel	Retaining Walls	4.6%	Yes	0
6.2.4	White Settlement Bridge & Roadway	Relocate TXU 138 kV Overhead	3.6%	Yes	0
6.2.1	White Settlement Bridge & Roadway	Concept Selection & Development	1.5%	Yes	0
3.2.2	Roadway & Bridges -White Settlement	Acquisition	0.7%	Yes	0
3.2.1	Roadway & Bridges -White Settlement	Appraisals, Surveys, Engr., Legal	0.2%	Yes	0
6.4.2	White Settlement Extension and Bridge	R-O-W Dedication	0.1%	Yes	0
All Other Tasks			0.2%	N/A	N/A

*All schedule tasks assumed to have plus/minus ten percent duration uncertainty based on a BetaPERT distribution.

Example:



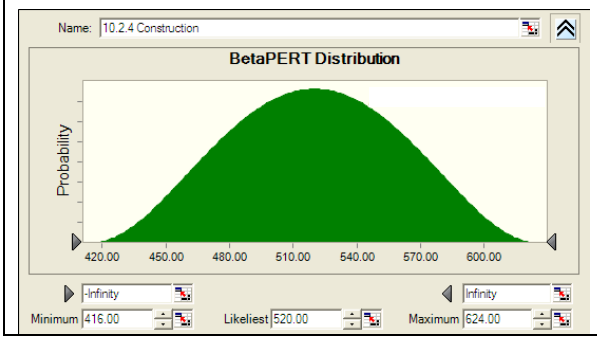
Monte Carlo Simulation Results		
Deterministic Finish Date:		8/16/2018
Confidence Level	Finish Date	Contingency (work days)
80%	10/8/2018	38.0

FWCC SCHEDULE SENSITIVITY ANALYSIS
Twenty Percent Critical Path Stress Test*

WBS	Element	Task	Contribution to Variance	Deterministic Critical Path	Deterministic Slack (days)
10.1.4	Clear Fork Gate	Construction	35.2%	Yes	0
13.3	Interior Water Feature	Construction	24.8%	Yes	0
6.2.7	White Settlement Bridge & Roadway	Construct Bridge	15.0%	Yes	0
8.3.5	Upper (South) Channel	Tie-in Levee/Walls	8.7%	Yes	0
8.3.4	Upper (South) Channel	Retaining Walls	4.5%	Yes	0
6.2.4	White Settlement Bridge & Roadway	Relocate TXU 138 kV Overhead	3.4%	Yes	0
6.3.6	Main Street - Bridge	Construct Bridge	2.1%	No	83
6.2.1	White Settlement Bridge & Roadway	Concept Selection & Development	1.3%	Yes	0
10.3.4	West Fork Gate	Construction	0.9%	No	83
3.2.2	Roadway & Bridges -White Settlement	Acquisition	0.8%	Yes	0
8.2.4	Lower (North) Channel	Retaining Walls	0.7%	No	83
6.3.1	Main Street - Bridge	Concept Selection & Development	0.7%	No	83
8.2.5	Lower (North) Channel	Tie-in Levee/Walls	0.6%	No	83
6.3.2	Main Street - Bridge	Design	0.5%	No	83
13.4	Interior Water Feature	CM	0.2%	No	83
10.2.4	TRWD Gate	Construction	0.1%	No	88
6.3.3	Main Street - Bridge	Review TxDOT	0.1%	No	83
3.2.1	Roadway & Bridges -White Settlement	Appraisals, Surveys, Engr., Legal	0.1%	Yes	0
6.4.2	White Settlement Extension and Bridge	R-O-W Dedication	0.1%	Yes	0
All Other Tasks			0.2%	N/A	N/A

*All schedule tasks assumed to have plus/minus twenty percent duration uncertainty based on a BetaPERT distribution.

Example:



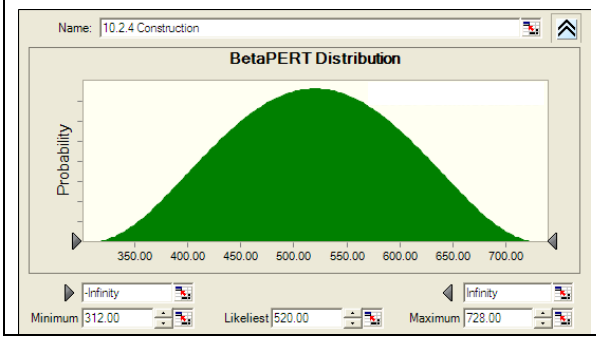
Monte Carlo Simulation Results		
Deterministic Finish Date:		8/16/2018
Confidence Level	Finish Date	Contingency (work days)
80%	12/12/2018	85.0

FWCC SCHEDULE SENSITIVITY ANALYSIS
Forty Percent Critical Path Stress Test*

WBS	Element	Task	Contribution to Variance	Deterministic Critical Path	Deterministic Slack (days)
13.3	Interior Water Feature	Construction	25.2%	Yes	0
10.1.4	Clear Fork Gate	Construction	24.8%	Yes	0
6.2.7	White Settlement Bridge & Roadway	Construct Bridge	12.5%	Yes	0
6.3.6	Main Street - Bridge	Construct Bridge	9.0%	No	83
8.3.5	Upper (South) Channel	Tie-in Levee/Walls	5.9%	Yes	0
8.3.4	Upper (South) Channel	Retaining Walls	3.7%	Yes	0
10.3.4	West Fork Gate	Construction	3.3%	No	83
6.2.4	White Settlement Bridge & Roadway	Relocate TXU 138 kV Overhead	3.0%	Yes	0
8.2.4	Lower (North) Channel	Retaining Walls	2.5%	No	83
8.2.5	Lower (North) Channel	Tie-in Levee/Walls	2.1%	No	83
6.3.2	Main Street - Bridge	Design	1.9%	No	83
6.3.1	Main Street - Bridge	Concept Selection & Development	1.5%	No	83
6.2.1	White Settlement Bridge & Roadway	Concept Selection & Development	1.1%	Yes	0
13.4	Interior Water Feature	CM	0.9%	No	83
10.2.4	TRWD Gate	Construction	0.9%	No	88
3.2.2	Roadway & Bridges -White Settlement	Acquisition	0.6%	Yes	0
6.3.3	Main Street - Bridge	Review TxDOT	0.4%	No	83
6.3.4	Main Street - Bridge	Procurement	0.2%	No	83
3.2.1	Roadway & Bridges -White Settlement	Appraisals, Surveys, Engr., Legal	0.1%	Yes	0
6.4.2	White Settlement Extension and Bridge	R-O-W Dedication	0.1%	Yes	0
6.3.5	Main Street - Bridge	Construct Temporary Detour	0.1%	No	83
All Other Tasks			0.2%	N/A	N/A

*All schedule tasks assumed to have plus/minus forty percent duration uncertainty based on a BetaPERT distribution.

Example:



Monte Carlo Simulation Results		
Deterministic Finish Date:		8/16/2018
Confidence Level	Finish Date	Contingency (work days)
80%	5/20/2019	198.0

Appendix F
Schedule Risk Factor Probability Distributions

Crystal Ball Report - Assumptions
Simulation started on 4/2/2008 at 20:29:09
Simulation stopped on 4/2/2008 at 20:35:54

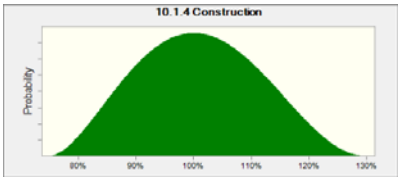
Assumptions

Worksheet: [FWCC Schedule Risk Model.xls]Risk Impact Table

Assumption: 10.1.4 Construction **Cell: E22**

BetaPERT distribution with parameters:

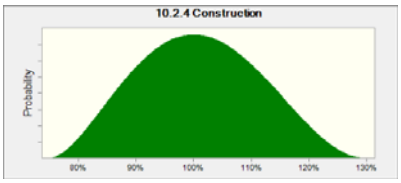
Minimum	75%
Likeliest	100%
Maximum	130%



Assumption: 10.2.4 Construction **Cell: E23**

BetaPERT distribution with parameters:

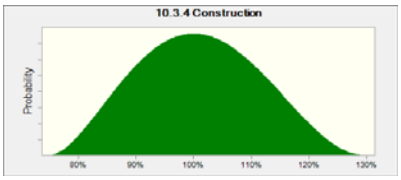
Minimum	75%
Likeliest	100%
Maximum	130%



Assumption: 10.3.4 Construction **Cell: E24**

BetaPERT distribution with parameters:

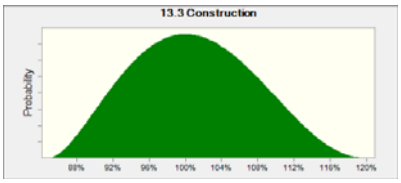
Minimum	75%
Likeliest	100%
Maximum	130%



Assumption: 13.3 Construction **Cell: E25**

BetaPERT distribution with parameters:

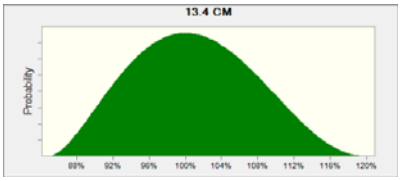
Minimum	85%
Likeliest	100%
Maximum	120%



Assumption: 13.4 CM **Cell: E26**

BetaPERT distribution with parameters:

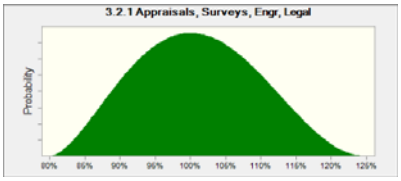
Minimum	85%
Likeliest	100%
Maximum	120%



Assumption: 3.2.1 Appraisals, Surveys, Engr, Legal **Cell: E6**

BetaPERT distribution with parameters:

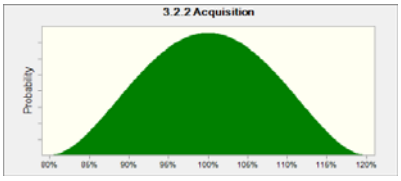
Minimum	80%
Likeliest	100%
Maximum	125%



Assumption: 3.2.2 Acquisition **Cell: E7**

BetaPERT distribution with parameters:

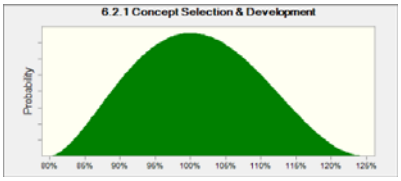
Minimum	80%
Likeliest	100%
Maximum	120%



Assumption: 6.2.1 Concept Selection & Development **Cell: E8**

BetaPERT distribution with parameters:

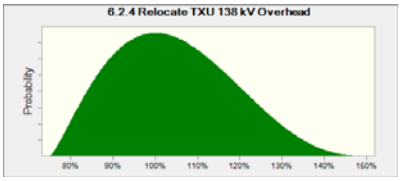
Minimum	80%
Likeliest	100%
Maximum	125%



Assumption: 6.2.4 Relocate TXU 138 kV Overhead **Cell: E9**

BetaPERT distribution with parameters:

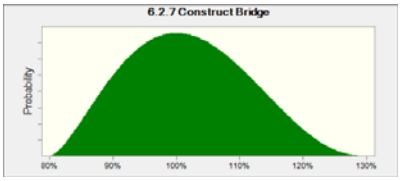
Minimum	75%
Likeliest	100%
Maximum	150%



Assumption: 6.2.7 Construct Bridge **Cell: E10**

BetaPERT distribution with parameters:

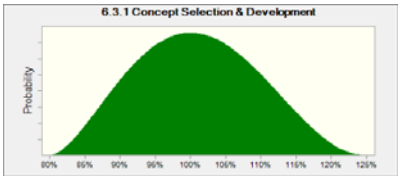
Minimum	80%
Likeliest	100%
Maximum	130%



Assumption: 6.3.1 Concept Selection & Development **Cell: E11**

BetaPERT distribution with parameters:

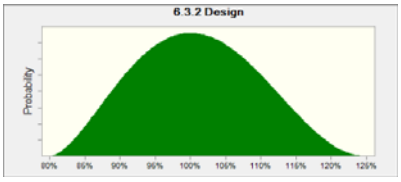
Minimum	80%
Likeliest	100%
Maximum	125%



Assumption: 6.3.2 Design **Cell: E12**

BetaPERT distribution with parameters:

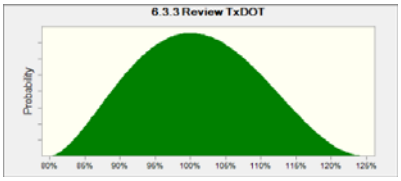
Minimum	80%
Likeliest	100%
Maximum	125%



Assumption: 6.3.3 Review TxDOT **Cell: E13**

BetaPERT distribution with parameters:

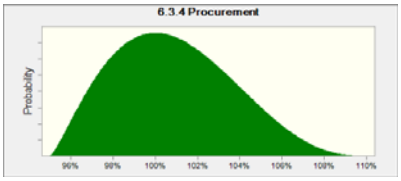
Minimum	80%
Likeliest	100%
Maximum	125%



Assumption: 6.3.4 Procurement **Cell: E14**

BetaPERT distribution with parameters:

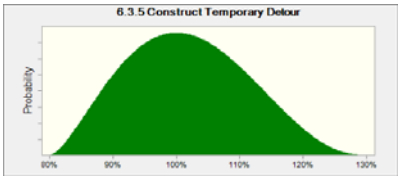
Minimum	95%
Likeliest	100%
Maximum	110%



Assumption: 6.3.5 Construct Temporary Detour **Cell: E15**

BetaPERT distribution with parameters:

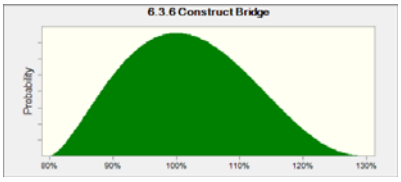
Minimum	80%
Likeliest	100%
Maximum	130%



Assumption: 6.3.6 Construct Bridge **Cell: E16**

BetaPERT distribution with parameters:

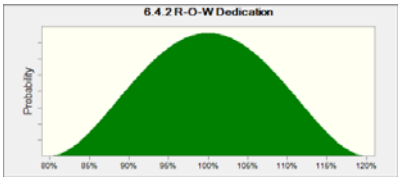
Minimum	80%
Likeliest	100%
Maximum	130%



Assumption: 6.4.2 R-O-W Dedication **Cell: E17**

BetaPERT distribution with parameters:

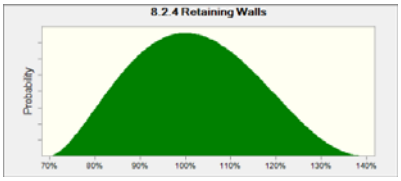
Minimum	80%
Likeliest	100%
Maximum	120%



Assumption: 8.2.4 Retaining Walls **Cell: E18**

BetaPERT distribution with parameters:

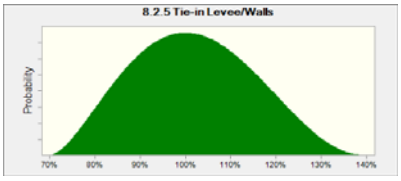
Minimum	70%
Likeliest	100%
Maximum	140%



Assumption: 8.2.5 Tie-in Levee/Walls **Cell: E19**

BetaPERT distribution with parameters:

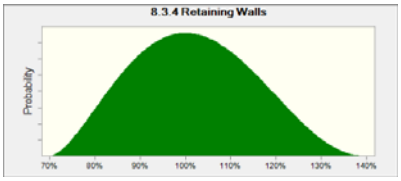
Minimum	70%
Likeliest	100%
Maximum	140%



Assumption: 8.3.4 Retaining Walls **Cell: E20**

BetaPERT distribution with parameters:

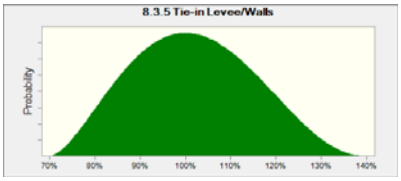
Minimum	70%
Likeliest	100%
Maximum	140%



Assumption: 8.3.5 Tie-in Levee/Walls **Cell: E21**

BetaPERT distribution with parameters:

Minimum	70%
Likeliest	100%
Maximum	140%



End of Assumptions

Appendix G
Schedule Contingency Simulation Report

Crystal Ball Report - Full
Simulation started on 4/2/2008 at 20:29:09
Simulation stopped on 4/2/2008 at 20:35:54

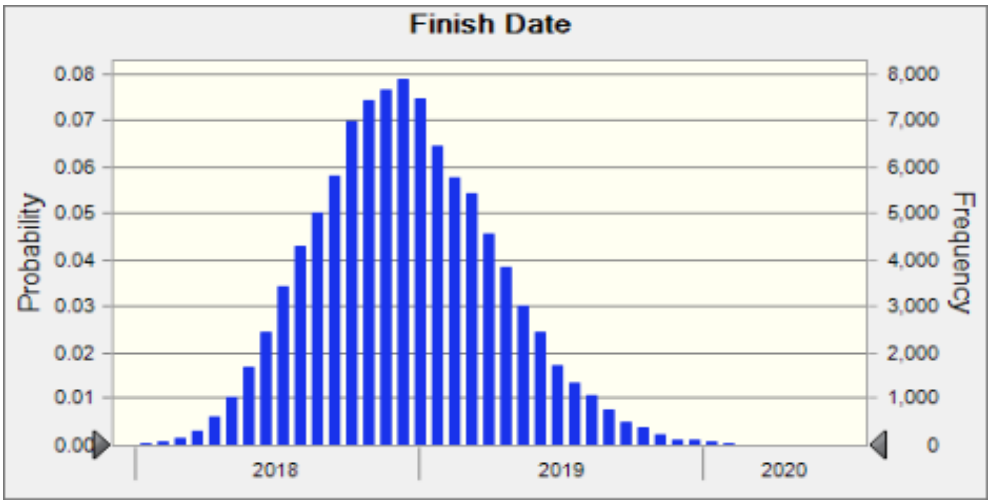
Run preferences:	
Number of trials run	100,000
Monte Carlo	
Random seed	
Precision control on	
Confidence level	95.00%
Run statistics:	
Total running time (sec)	404.77
Trials/second (average)	247
Random numbers per sec	5,188
Crystal Ball data:	
Assumptions	21
Correlations	0
Correlated groups	0
Decision variables	0
Forecasts	1

Forecasts

Worksheet: [FWCC Schedule Risk Model.xls]Schedule Risk Model

Forecast: Finish Date **Cell: F5**

Summary:
Entire range is from 12/12/2017 to 7/15/2020
Base case is 8/16/2018
After 100,000 trials, the std. error of the mean is 12/30/1899



Statistics:	Forecast values
Trials	100,000
Mean	12/13/2018
Median	12/7/2018
Mode	11/13/2018
Standard Deviation	4/24/1900
Variance	7/9/1936
Skewness	0.3016
Kurtosis	3.08
Coeff. of Variability	0.0027
Minimum	12/12/2017
Maximum	7/15/2020
Range Width	8/3/1902
Mean Std. Error	1/0/1900

Forecast: Finish Date (cont'd) **Cell: F5**

Percentiles:	Forecast values
0%	12/12/2017
10%	7/20/2018
20%	9/5/2018
30%	10/9/2018
40%	11/8/2018
50%	12/7/2018
60%	1/7/2019
70%	2/7/2019
80%	3/19/2019
90%	5/14/2019
100%	7/15/2020

End of Forecasts

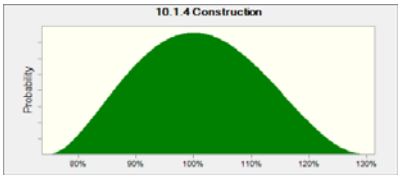
Assumptions

Worksheet: [FWCC Schedule Risk Model.xls]Risk Impact Table

Assumption: 10.1.4 Construction **Cell: E22**

BetaPERT distribution with parameters:

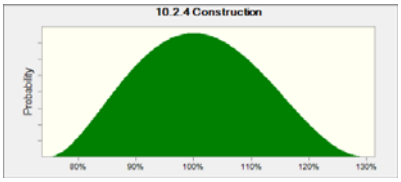
Minimum	75%
Likeliest	100%
Maximum	130%



Assumption: 10.2.4 Construction **Cell: E23**

BetaPERT distribution with parameters:

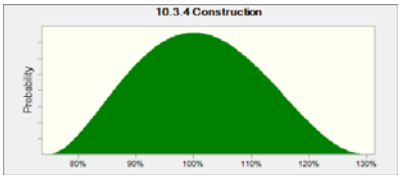
Minimum	75%
Likeliest	100%
Maximum	130%



Assumption: 10.3.4 Construction **Cell: E24**

BetaPERT distribution with parameters:

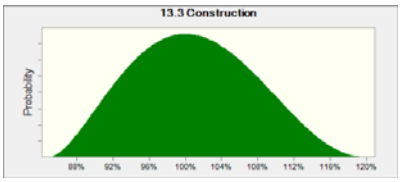
Minimum	75%
Likeliest	100%
Maximum	130%



Assumption: 13.3 Construction **Cell: E25**

BetaPERT distribution with parameters:

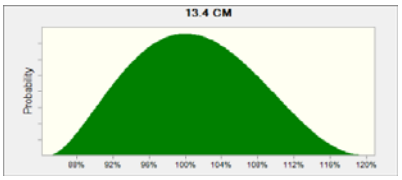
Minimum	85%
Likeliest	100%
Maximum	120%



Assumption: 13.4 CM **Cell: E26**

BetaPERT distribution with parameters:

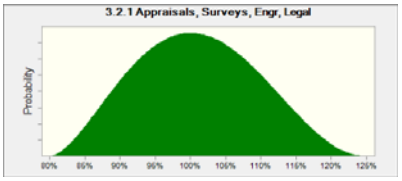
Minimum	85%
Likeliest	100%
Maximum	120%



Assumption: 3.2.1 Appraisals, Surveys, Engr, Legal **Cell: E6**

BetaPERT distribution with parameters:

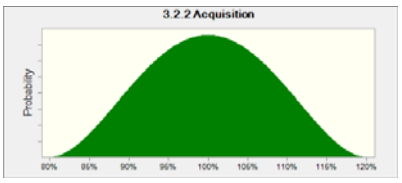
Minimum	80%
Likeliest	100%
Maximum	125%



Assumption: 3.2.2 Acquisition **Cell: E7**

BetaPERT distribution with parameters:

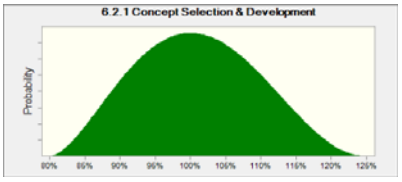
Minimum	80%
Likeliest	100%
Maximum	120%



Assumption: 6.2.1 Concept Selection & Development **Cell: E8**

BetaPERT distribution with parameters:

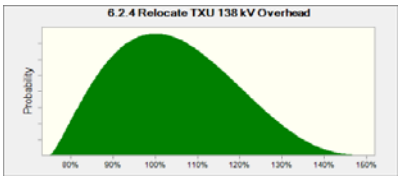
Minimum	80%
Likeliest	100%
Maximum	125%



Assumption: 6.2.4 Relocate TXU 138 kV Overhead **Cell: E9**

BetaPERT distribution with parameters:

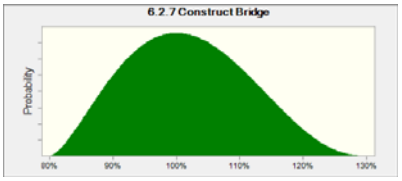
Minimum	75%
Likeliest	100%
Maximum	150%



Assumption: 6.2.7 Construct Bridge **Cell: E10**

BetaPERT distribution with parameters:

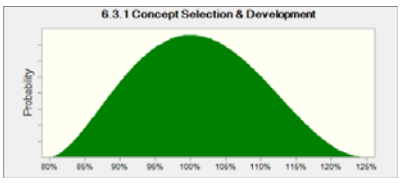
Minimum	80%
Likeliest	100%
Maximum	130%



Assumption: 6.3.1 Concept Selection & Development **Cell: E11**

BetaPERT distribution with parameters:

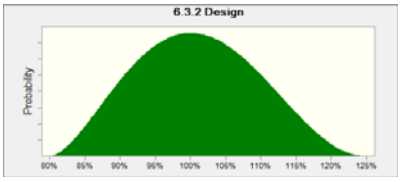
Minimum	80%
Likeliest	100%
Maximum	125%



Assumption: 6.3.2 Design **Cell: E12**

BetaPERT distribution with parameters:

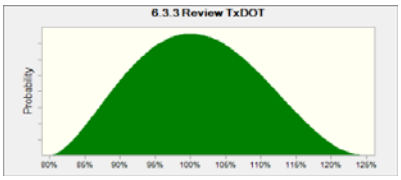
Minimum	80%
Likeliest	100%
Maximum	125%



Assumption: 6.3.3 Review TxDOT **Cell: E13**

BetaPERT distribution with parameters:

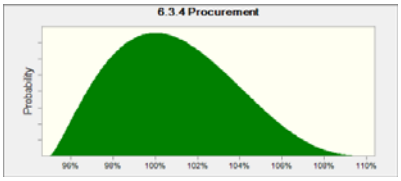
Minimum	80%
Likeliest	100%
Maximum	125%



Assumption: 6.3.4 Procurement **Cell: E14**

BetaPERT distribution with parameters:

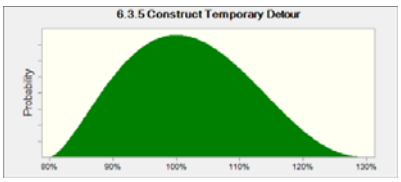
Minimum	95%
Likeliest	100%
Maximum	110%



Assumption: 6.3.5 Construct Temporary Detour **Cell: E15**

BetaPERT distribution with parameters:

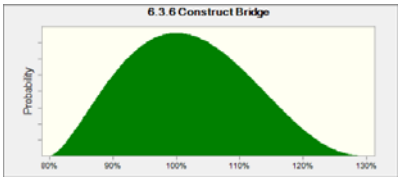
Minimum	80%
Likeliest	100%
Maximum	130%



Assumption: 6.3.6 Construct Bridge **Cell: E16**

BetaPERT distribution with parameters:

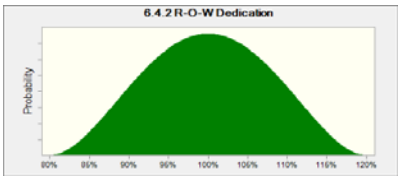
Minimum	80%
Likeliest	100%
Maximum	130%



Assumption: 6.4.2 R-O-W Dedication **Cell: E17**

BetaPERT distribution with parameters:

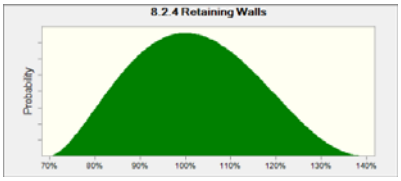
Minimum	80%
Likeliest	100%
Maximum	120%



Assumption: 8.2.4 Retaining Walls **Cell: E18**

BetaPERT distribution with parameters:

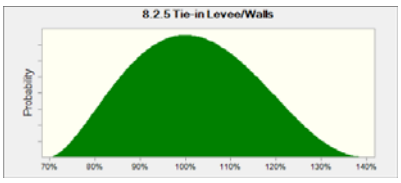
Minimum	70%
Likeliest	100%
Maximum	140%



Assumption: 8.2.5 Tie-in Levee/Walls **Cell: E19**

BetaPERT distribution with parameters:

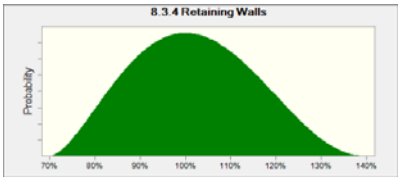
Minimum	70%
Likeliest	100%
Maximum	140%



Assumption: 8.3.4 Retaining Walls **Cell: E20**

BetaPERT distribution with parameters:

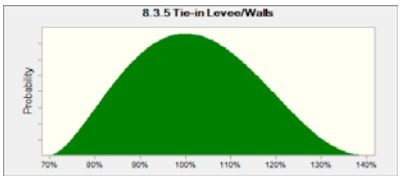
Minimum	70%
Likeliest	100%
Maximum	140%



Assumption: 8.3.5 Tie-in Levee/Walls **Cell: E21**

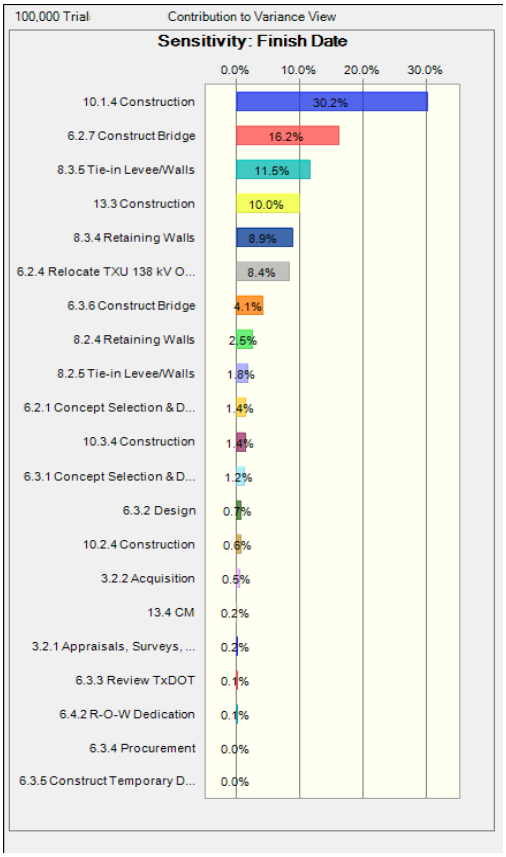
BetaPERT distribution with parameters:

Minimum	70%
Likeliest	100%
Maximum	140%



End of Assumptions

Sensitivity Charts



End of Sensitivity Data