

Leon Creek Watershed Interim Feasibility Study and Integrated Environmental Assessment

REPORT SUMMARY

Leon Creek Watershed Interim Feasibility Study
and Integrated Environmental Assessment,
San Antonio, Texas

Feasibility Scoping Meeting:	10 May 2010
Alternative Formulation Briefing:	24 April 2013
AFB Guidance Memorandum:	23 May 2013
TSP IRC	08 July 2013
Draft Report Guidance Memorandum:	15 January 2014
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CWRB Briefing:	27 March 2014
30-Day S&A Review start:	31 March 2014
30 Day S&A Review end:	02 May 2014

STUDY INFORMATION

Study Authority.

The Leon Creek Feasibility Study is in partial response to the Guadalupe and San Antonio Rivers and Tributaries, Texas, Resolution adopted by the Committee on Transportation and Infrastructure, U.S. House of Representatives, House Resolution docket 2547, March 11, 1998, which reads:

Resolved by the Committee on Transportation and Infrastructure of the United States House of Representatives, That, the Secretary of the Army is requested to review the report of the Chief of Engineers on the Guadalupe and San Antonio Rivers, Texas, published as House Document 344, 83rd Congress, 2nd Session, and other pertinent reports, with a view to determining whether any modifications to the recommendations contained therein are advisable at the present time, with particular reference to providing improvements in the interest of flood control, environmental restoration and protection, water quality, water supply, and allied purposes on the Guadalupe and San Antonio Rivers in Texas.

Study Sponsor.

San Antonio River Authority, a state-owned entity created by the Texas Legislature in 1937, is the non-federal sponsor for the feasibility study, under the terms of a feasibility cost sharing agreement with the Corps executed 20 September, 2004 and has indicated its willingness to sponsor project design and implementation.

Study Purpose and Scope.

The purpose of the study is to reduce the risk of flooding within the Leon Creek Watershed. The scope of this Interim Feasibility Study is to identify problems, needs, and opportunities; develop and evaluate alternatives; select a recommended plan; and provide a feasibility level design of the recommended plan and a feasibility report and integrated environmental assessment. The report will serve as a

decision document for Congressional Authorization of a project to reduce flood damages within the Leon Creek Watershed located on the west side of the city of San Antonio, Bexar County, Texas.

Project Location/Congressional District.

Leon Creek watershed is in western Bexar County in the greater San Antonio area. It originates in northwestern Bexar County and runs south-southeast for about 57 miles to its confluence with the Medina River which flows into the San Antonio River. The drainage area of the Leon Creek watershed is approximately 238 square miles. The study area includes outcrops of two major aquifers, Trinity and Edwards. Thin, rocky soils and fairly steep slopes characterize both areas. The Edwards Aquifer outcrop generally exhibits greater permeability and infiltration of rainfall than the Trinity Aquifer outcrop. Stream channels within both outcrops lose flow to karst features, such as fractures, sinkholes, and caves. Where it crosses the recharge zone, flow within the channel is relatively infrequent because of the loss of flow that percolates through the channel bottom to recharge the aquifer.

While the entire watershed is the study area, the flood damages are limited to the 0.2 percent annual exceedance probability (AEP) floodplain of Leon Creek and its tributaries. The 0.2 percent AEP floodplain (often referred to as the “500-year event”) contains approximately 32 square miles. The study area lies within the jurisdiction of Texas Congressional Districts 20 and 28, which are represented in the U.S. Congress by the Honorable Charles A. Gonzalez and the Honorable Henry Cuellar, respectively. The U.S. Senators for Texas are the Honorable John Cornyn and the Honorable Ted Cruz.

Prior Reports and Existing Water Projects.

A number of previously published studies and reports, prepared by USACE (Fort Worth District) and other entities, were used in developing this feasibility report. This section lists the reports and describes their relevance to the Water Resources Planning study for the Leon Creek Watershed.

U.S. Army Corps of Engineers.

Guadalupe and San Antonio River Basins, Texas Section 905(b) Analysis. U.S. Army Corps of Engineers, Fort Worth District, December 2000. This report identified potential projects within the Guadalupe and San Antonio River Basins that have a potential Federal interest. Study purposes were to investigate flood risk management, ecosystem restoration, watershed management, and water supply alternatives.

Leon Creek Interim Feasibility Study Alternative Description Report. Halff Associates, Inc., June 2009. This alternative evaluation report, prepared under contract to USACE, evaluated preliminary flood risk management alternatives for the Leon Creek Interim Feasibility Study.

Others.

Simulation of Streamflow and Water Quality in the Leon Creek Watershed, Bexar County, Texas, 1997-2004. U.S. Geological Survey Scientific Investigations Report, 2009. This report documented the use of the Hydrologic Simulation Program in Fortran (HSPF) model to simulate streamflow and water quality.

Conceptualization and Simulation of the Edwards Aquifer, San Antonio Region, Texas, SIR 2004-5277. U.S. Department of the Interior, U.S. Geological Survey, 2004. This report documented historic recharges into the Edwards Aquifer.

Diffuse-flow Conceptualization and Simulation of the Edwards Aquifer, San Antonio Region, Texas, SIR 2006-5319. U.S. Department of the Interior, U.S. Geological Survey, 2006. This report also documented recharges into the Edwards Aquifer.

Draft Edwards Aquifer Habitat Conservation Plan. Hicks & Company/RECON, March 2005. Prepared for the Edwards Aquifer Authority, this document outlines a habitat conservation plan for the threatened and endangered species associated with the Edwards Aquifer.

Leon Creek Watershed Master Plan Phase I – Final Report. AECOM, September 2008. This report documented the regional watershed planning by the San Antonio River Authority, City of San Antonio, and Bexar County to develop a comprehensive watershed management plan. Phase I of this effort analyzed possible detention alternatives in the Leon Creek Watershed. This report was used to screen detention alternatives that were not economically justified.

South Central Texas Regional Water Plan, Texas Water Development Board. 2011. This report documents the regional water planning to meet future water supply demand for a 21-county area including San Antonio.

Stream and Aquifer Biology of South-Central Texas - A Literature Review, 1973-97. Open File Report 99-243. U.S. Department of the Interior, U.S. Geological Survey, 2000. This report documented the biological resources within the streams and aquifers of Leon Creek.

Federal Interest.

The study provides a reduction in flood damages and reduction in risk from flooding that results from infrequent, high-intensity rainfall events which result in extremely rapid but relatively short-duration flood peaks associated with high velocity stream flows. The recommended plan has been identified as the National Economic Development Plan to address flood risk reduction for the study area.

STUDY OBJECTIVES

Problems and Opportunities.

Problems

1. Substantial flood damages in and around the city of San Antonio.
2. Short warning times and high velocity flood flows.

Opportunities

1. Reduce risk of flood damages in the Leon Creek Watershed.
2. Contribute to greater public awareness of the hazard presented by flood flows.
3. Restore natural hydraulic conditions in the Leon Creek Watershed.

Planning Objectives.

Following are the planning objectives for this study:

1. Reduce risk of flood damages within the Leon Creek Watershed.
2. Reduce risk to life, health, and welfare of Leon Creek Watershed residents by decreasing flood risk to the extent practicable.

Other initial objectives entailed ecosystem restoration and recreation but opportunities for these were limited. Additionally, the project's sponsor expressed a desire to concentrate on flood-risk management as an eventual outcome.

Planning Constraints.

Constraints are restrictions that limit the planning process, and they include legal and policy constraints that apply to every USACE study, as well as study-specific constraints that only apply to this study. To provide direction for the plan formulation efforts, the following constraints were taken into account:

1. Avoid impacts to natural water features, such as springs, seeps, and wetlands and avoid disruption to the natural character of the floodplains.
2. Avoid disruption to the natural character of the floodplains, where present in the Leon Creek watershed, to the extent practicable.
3. Minimize adverse impacts to the water supply and water quality at Government Canyon State Natural Area and the Edwards Aquifer.
4. Minimize the potential for wildlife-aircraft strikes due to the study area's proximity to Lackland Air Force Base.
5. Minimize adverse impacts to threatened and endangered species at Government Canyon State Natural Area and the Edwards Aquifer.

ALTERNATIVES

Plan Formulation Rationale.

The study considered a variety of alternatives to reduce flood risks within the Leon Creek Watershed. Economic justification was the primary criteria for screening these alternatives. Secondary criteria would screen anything that may potentially be unacceptable or have problematic environmental effects. The alternatives carried forward for final consideration were all determined to be economically viable (i.e. have annual benefits greater than the annual costs) and environmentally acceptable. The initial array of structural measures included regional and local detention, channel modification, levees, bypass channels, and overbank storage. In general, a hierarchical approach was employed during initial screening process with detention strategies, whether regional or on-site considered first with the location of these being taken from previous work done by SARA, the City of San Antonio, and Bexar County in the Leon Creek Watershed Master Plan. The primary reason for this approach is that much

of the Leon Creek flooding results from peak-on-peak flooding from tributaries making a detention approach highly appropriate. Detention would improve conditions to damage centers further downstream as well as the immediate vicinity of its location and was viewed as providing the maximum opportunity to benefit multiple portions of the study area simultaneously. Channelization was viewed as viable for some areas but not all due to extremely large flows requiring dropping the channel bottom by as much as 6 to 8 feet, a magnitude not considered feasible. Because of the urban nature of the watershed (given both space requirements and the probability of overtopping) levees were considered only for very specific locations. A bypass channel was considered in one area because of a natural oxbow specifically in a location subject to flooding and overbank storage was considered for only one damage center having a suitable location. Nonstructural measures were then considered for areas where structural solutions would not be feasible or implementable.

Management Measures and Alternative Plans.

The following table provides a snapshot of the initial array of structural alternatives by measure carried forward for next round of refinement. Two regional detention alternatives (11 and 12) were carried forward as were two levee scales (Alternatives 2 and 3), and the bypass channel on Leon Creek (Alternative 4). For the initial screening, virtually all of the alternatives that were screened out were screened out based on economics. Of the three showing positive net benefits but initially screened out, a smaller scale of Alternative 14 was considered due to considerable environmental and cultural concerns in the Government Canyon area but this scale was not economically justified. Alternative 18 showed very small net benefits and would not be expected to advance further screening. The benefits for Alternative 6 were thought to be overstated and therefore would not be economically justified. Following coordination with the sponsor this alternative was dropped from further consideration. Further evaluation of Alternative 11 showed that it was not competitive with the other competing alternative in the area (Alternative 12) and was subsequently dropped from further consideration. Nonstructural measures were initially considered at 16 areas of interest for the potential for permanent evacuation. Those showing to be economically viable were given further consideration. Additional consideration was given for two areas adjacent to each other for the possible addition of recreation to increase net benefits. A cursory recreation analysis showed that these areas would still not support an alternative that was economically justified and were consequently dropped from further consideration.

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Alternative	Name	Net Benefits (\$)	Screened Out?
Regional Detention			
9	Huebner Creek RSWF**	-251,050	Yes
11	DC-12 Helotes Creek RSWF	824,190	No
12	Helotes Quarry Pond	1,528,600	No
13	Government Canyon RSWF	-175,460	Yes
14	Government Canyon RSWF	1,063,930	Yes
17	Quarry at the Rim	-948,920	Yes
Local Detention			
7	Huebner Trib A Pond	-754,140	Yes
18	AOI-11 Ponds	1,050	Yes
Channel Modification			
5	Slick Ranch Crk Channel Mod	*	Yes
8	Huebner Channel Mod	-62,460	Yes
10	Helotes Channel Mod	-324,410	Yes
20	300' BW Channel – Leon R5	-600,230	Yes
21	200' BW Channel – Leon R5	-42,510	Yes
Levee			
2	Leon Creek 100-Year Levee	455,950	No
3	Leon Creek 500-Year Levee	1,144,220	No
6	Leon Trib F 500-Year Levee	45,320	Yes
15	Leon 100-Year Levee	-902,230	Yes
16	Leon 500-Year Levee	-143,960	Yes
19	Boerne Stage Rd Improvement	***	Yes
Bypass Channel			
4	Leon Creek Bypass Channel	887,710	No
Overbank Storage			
	Leon Creek Overbank Mod	-837,620	Yes

*Costs not calculated for this alternative

** Regional Storm Water Facility

*** Analysis consisted of incorporating the Boerne Stage Road Improvements (constructed by others) into the HEC-RAS model. No significant effect on water surface profiles observed

Final Array of Alternatives.

The final array of structural alternatives included the further refined alternatives analyzed at the Port San Antonio AOI (2) and the AOI at Helotes Creek (12). Variations in scale were analyzed to include levees that would address the 2 percent and the 0.2 percent AEP in the final array. Additionally, features including interior drainage and hydraulic mitigation as well as combinations with configurations of the bypass channel to reduce potential impacts to water surface elevations upstream due to the levee were analyzed. Additionally, a larger quarry at Helotes Creek was analyzed to see if net benefits would increase if more capacity was created. This final array is listed in the table below.

Table 1
Final Array of Structural Alternatives
October 2010 Price Levels/4.125 percent Federal Interest Rate

Alternative	Description	Annual Benefits	Annual Costs	Net Benefits
2B	1% AEP Levee w/int drainage	\$1,520,880	\$907,600	\$613,280
2B & 4C	Levee 2B/Channel 4C Combo	\$1,751,490	\$976,200	\$775,290
	2% AEP Levee and Hydraulic Mitigation	\$1,634,340	\$681,642	\$952,698
2B +	1% AEP Levee and Hydraulic Mitigation*	\$1,749,500	\$682,387	\$1,067,113
2B+ & 4C	1% AEP Levee and Hydraulic Mitigation and Bypass	\$1,750,260	\$866,343	\$883,917
3+	0.2% AEP Levee	\$1,933,800	\$1,329,800	\$604,000
	0.4% AEP Levee and Hydraulic Mitigation and Bypass	\$1,935,420	\$879,228	\$1,056,192
3 + 4C	0.2% AEP Levee and Hydraulic Mitigation and Bypass	\$1,938,090	\$937,227	\$1,000,863
12	Helotes Quarry Pond	\$2,026,620	\$554,625	\$1,471,995
12	Helotes Quarry Pond (Upper Bracket)	\$2,060,580	\$3,791,810	-\$1,731,230

*National Economic Development Plan

The final array of nonstructural alternatives included nine permanent evacuation scenarios over five different areas of interest. Only two showed to be economically justified both of which were in the same nonstructural area of interest, therefore, the one with the highest net benefits, the 4 percent AEP evacuation in NS-AOI 4 is selected to be included into the recommended plan. Price levels and interest rates for alternatives shown are those in effect at the time this analysis was conducted.

Table 2
Final Array of Nonstructural Alternatives
October 2010 Price Levels/4.125 percent Federal Interest Rate

Alternative	Net Benefits	Benefit-to-Cost Ratio
NS AOI 4 20% AEP	\$13,415	1.23
NS AOI 4 10% AEP	(\$2,464)	0.98
NS AOI 4 4% AEP	\$220,055	2.59
NS AOI 5 4% AEP	(\$208,834)	0.55
NS AOI 9 10% AEP	(\$41,090)	0.55
NS AOI 14 10% AEP	(\$148,232)	0.65
NS AOI 14 4% AEP	(\$170,505)	0.63
NS AOI 15 10% AEP	(\$41,528)	0.42
NS AOI 15 4% AEP	(\$39,443)	0.78

Comparison of Alternatives.

As laid out previously in this summary the objectives specified that a reduction in flood damages within the Leon Creek Watershed as well as reducing the risk to life, health, and welfare would be among the desired outcomes of the study. Residual damages within the Watershed would continue to be relatively high even with the recommended plan in place. Previous work by other entities familiar with Leon Creek along with USACE recognize that detention-type structures are an effective means of addressing the “flashy” nature of flooding associated with the watershed. However, implementing these types of measures in a manner that is economically justified has been the challenge. Constraints such as those associated with the Government Canyon State Natural Area have also limited those opportunities to have larger reductions in flood damages. Therefore, plan formulation efforts concentrated flood-risk reduction opportunities that are more localized in nature. The proposed levee alternative at the Port San Antonio area reduces flood damages by approximately 90 percent for that reach and account for 13 percent reduction in flood damages for the watershed. The proposed levee also has a 32 percent chance of being exceeded over the next 50 years. The proposed nonstructural component reduces damages by 9.3 percent for that reach and permanently removes structure and individuals from any potential flood risk. Short-term impacts associated with the construction of the proposed levee would occur in the Port San Antonio area but the long-term flooding benefits outweigh these short-term impacts.

Key Assumptions.

Key uncertainties were identified early in the study phase and monitored throughout the plan formulation process. These uncertainties are listed below with a description of the associated risk and the steps taken throughout the formulation process to reduce that risk.

1. Uncertainty about future hydrologic events such as stream flow and rainfall;
2. Uncertainty arising from the use of simplified models to describe complex hydraulic phenomena;
3. Economic and social uncertainty, particularly the relationship between depth and inundation damage, inaccuracies in estimates of structure values and locations, and the predictability of how the public will respond to a flood; and

4. Uncertainty about structural and geotechnical performance of water-control measures when subjected to rare storm events.

Uncertainty in the hydrology and hydraulics is addressed primarily by utilizing graphical exceedance probability functions which sets confidence limits for discharges at each discrete exceedance probability based on the equivalent record length. Uncertainty for hydrology and hydraulics is also addressed by assigning distributions to stage-damage functions. In the case of this study, the equivalent record length is set at 30 years and the error for the stage-damage functions is set at 0.5 feet. No fragility curves are assigned to the proposed levee since flooding durations are short and it would be overtopped regardless for those rare events. Economic uncertainties are similarly managed with normal distributions with standard errors assigned to the depth-damage functions and by defining uncertainty parameters for first floor corrections, structure and content values. Uncertainties are further handled by changing, if necessary, the number of Monte Carlo simulations and by varying the range of ordinates in the aggregated stage-damage functions.

Recommended Plan.

The Recommended Plan consists of a levee with hydraulic mitigation that will contain the one-percent annual exceedance probability event in combination with a non-structural permanent floodplain evacuation of four single-family residential structures and 32 townhouses being damaged at the four-percent annual exceedance probability event. The proposed earthen levee extends approximately 3,700 linear feet from high ground on the southeast side of the Jet Engine Test Cell Facility area at Port San Antonio and wraps around to S.W. Military Drive. A twelve-foot top width will provide a maintenance/patrol access route along the top with 3.5:1 (H:V) side slopes. The levee is aligned to provide adequate benching between the riverside toe and the Leon Creek channelization for stability reasons, as well as to avoid existing buildings on the Test Cell site. The grading of landside toe ditches to a proposed sump area will convey interior runoff. Included at the Jet Engine Test Cell Facility area is a soil-bentonite slurry wall to provide additional seepage control along the full length of the levee. Channelization at Leon Creek will extend approximately 2,850 linear feet and a 60-foot bottom width with variable side slopes.

The Recommended Plan includes mitigation for aquatic impacts associated with the channelization work in the Jet Engine Test Cell Facility area; this mitigation plan would utilize the same Natural Channel Design (NCD) concepts used in the Mission Reach and the Westside Creeks project to “self-mitigate” impacts to waters of the U.S. The NCD methods use vertical and horizontal structures in the form of cross vanes, rock weirs, J-hooks, or other natural material structures to maintain a neutral sediment transport balance for the creek. The NCD structures also recreate pool and riffle habitats with proper substrate to support a diverse community of aquatic organisms. Woodland vegetation would also be placed along the riparian corridor in order to mitigate for impacts to riparian woodlands. Additional native riparian plantings would occur in the existing grassland habitats along the southern edge of the lower portion of the constructed channel and downstream of the lower limits to mitigate for all riparian woodland impacts. As mentioned above, the channel work included in the Recommended Plan will include approximately 2,850 linear feet of naturally-designed channel, including one large and four small in-stream structures, and approximately 15.75 acres of riparian vegetation planting and invasive species control.

With a benefit to cost ratio of 1.7 to 1.0, the recommended plan has been identified as the National Economic Development (NED) plan for the study area.

Systems/Watershed Context.

A number of initiatives exist to manage residual flood risk in the watershed. The City of San Antonio and Bexar County both have “no rise” ordinances requiring increased runoff resulting from the proposed development not produce significant adverse impact to other properties to a point 2,000 feet downstream. The City also provides a Fee In Lieu Of (FILO) payment to the regional storm water fund in lieu of on-site detention as a mitigation option. Low Impact Development (LID) is encouraged by offering credit to developers who implement these types of best management practices. Additionally, SARA developed a sophisticated real-time flood warning system in partnership with Bexar County. The Leon Creek portion of this flood warning system became operational in late 2013.

Entities invited to be Cooperating Agencies include the US Fish and Wildlife Service (FWS), Texas Parks and Wildlife Department (TPWD), Texas Commission on Environmental Quality (TCEQ), and the Texas State Historic Preservation Office (SHPO). Additional Coordination has taken place with the Federal Aviation Administration (FAA) and the US Air Force (USAF) under the provisions of the MOA between the FAA, U.S. Air Force, U.S. Army, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service and U.S. Department of Agriculture to Address Aircraft-Wildlife Strikes. For the purposes of this study, USACE has served as the lead agency.

Environmental Operating Principles.

Within the Civil Works planning arena, the Environmental Operating Principles guide the identification, evaluation, and selection of plan components to encourage implementation of productive and sustainable projects. The Recommended Plan for the Leon Creek watershed embodies this approach and philosophy. Each of the Corps seven principles is discussed in more detail below;

- Foster Sustainability as a way of life throughout the organization: The Recommended plan includes a buyout component that removes susceptible properties from the floodplain and allows for development of open space and a more natural environment in an area that currently houses residential development. Sustainability principles will also be incorporated into the construction and demolition contracts of project features to minimize emissions, control runoff, and take advantage of recycling opportunities for construction debris.
- Proactively consider environmental consequences of all Corps activities and act accordingly; The environmental consequences of measures to reduce flood risks in the Leon Creek watershed have been carefully considered during the planning process. Measures within the Government Canyon portion of the watershed were dropped from consideration as a result of resource agency and public feedback indicating the high value of the existing resources. Minor aquatic impacts associated with the AOI-2 channel feature will be fully mitigated.
- Create mutually supporting economic and environmentally sustainable solutions: The buyout feature of the Recommended Plan demonstrates mutually supportive economic and environmental solutions, simultaneously reducing flood damages and risks by removing susceptible properties from the floodplain and providing the opportunity to restore a small

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portion of the floodplain to a more natural condition. Likewise, the mitigation features of the AOI-2 levee demonstrate that economic development and ecosystem functions need not be mutually exclusive.

- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the Corps which may impact human and natural environments: As discussed in Sections Four and Five of this report, the Recommended Plan fully complies with legal and policy requirements to consider the impact of Corps of Engineers' projects on the human and natural environment.
- Consider the environment in employing a risk management and systems approach throughout life cycles of projects and programs: Risk, uncertainty, and residual flood hazards are discussed in detail in Section 3 of this report. The analysis concludes that, notwithstanding the predictive errors and uncertainty inherent in water resources planning, we can be confident that the Recommended Plan is economically justified and consistent with the Federal objective to contribute to national economic development consistent with protecting the Nation's environment. Substantial risks affecting the quality of the human environment will remain after project implementation and will continue to be addressed by the project Sponsor through floodplain regulation, incentives for Low Impact Development, and operation of a regional flood warning system.
- Leverage scientific, economic and social knowledge to understand the environmental context and effects of Corps actions in a collaborative manner: Throughout the Leon Creek Watershed study, the PDT has consulted with resource agencies, local governments, and consultant firms in order to ensure that the best-available information was used in the planning process. Feedback received during the collaboration was utilized extensively in the screening process and in development of the project's mitigation features.
- Employ an open, transparent process that respects view of individuals and groups interested in Corps activities: Numerous public meetings and workshops have been held during the study process. Stakeholder groups and homeowners have been invited to participate and provide feedback. During the public meeting held in December 2013 to discuss the Draft Report and study recommendations, the input received was universally supportive of project implementation.

Peer Review.

A review plan was updated December 7, 2012. Reviews included District Quality Control, Agency Technical Review and Independent External Peer Review. Additional reviews included cost engineering review and certification, legal review and certification, and model review and approval. All required Peer Review certifications were provided with the final report submittal.

EXPECTED PROJECT PERFORMANCE

Project Costs.

The total project cost for the Recommended Plan is \$28,175,000. This includes \$5,872,000 for the non-structural alternative and \$22,303,000 for the structural alternative. The base cost of the Recommended Plan is \$23,177,000 with a contingency \$4,998,000.

**Table 3
Project Cost Summary
October 2013 Price Levels**

Feature	Total
Non Structural Measure	
Lands & Damages	\$4,779,000
Utility Relocations	742,000
Fish and Wildlife	98,000
Planning, Engineering & Design	154,000
Construction Management	99,000
Non Structural Subtotal	5,872,000
Structural Measure	
Lands & Damages	\$2,617,000
Relocations	619,000
Channels and Canals	9,065,000
Levee and Floodwalls	5,685,000
Fish and Wildlife Facilities	204,000
Preconstruction, Engineering & Design	2,506,000
Construction Management	1,607,000
Structural Subtotal	22,303,000
Total Cost Apportionment	\$28,175,000

Table 4
Equivalent Annual Benefits and Costs
(October 2013 Price Levels, 50-year Period of Analysis, 3.5% Discount Rate)

Investment Cost	
Total Project Construction Costs*	\$28,175,000
Interest During Construction	\$938,000
Total Investment Cost	\$28,750,000
Average Annual Costs	\$1,006,000
Interest and	
Amortization of Initial Investment	\$219,000
OMRR&R	\$59,000
Total Average Annual Costs	\$1,284,000
Average Annual Benefits	\$2,143,000
Net Annual Benefits	\$859,000
Benefit-Cost Ratio (3.5%)	1.7 to 1
Benefit to Cost Ratio (7%)**	0.9 to 1

* Financial Costs that include \$363,000 for relocation assistance not included in Economic Costs

** Per Executive Order 12893

Cost Sharing.

For nonstructural flood risk management projects, the non-Federal cost would be at least 35 percent of the total project flood risk management costs. The non-Federal sponsor would be responsible for 100 percent of the operation, maintenance, repair, rehabilitation, and replacement costs for the flood risk management portion of the project. The apportionment of costs is portrayed in the table below.

Table 5
Cost Apportionment in October 2013 Prices.

Feature	Federal	Non-Federal	Total
Nonstructural Measure			
Lands & Damages	\$671,000	\$4,108,000	\$4,779,000
Utility Relocations		742,000	742,000
Fish and Wildlife	98,000		98,000
Planning, Engineering & Design	154,000		154,000
Construction Management	99,000		99,000
Unadjusted Total	1,022,000	4,850,000	5,872,000
Adjustment to Achieve 65/35	2,795,000	(2,795,000)	
Nonstructural Subtotal	3,816,000	2,055,000	5,872,000
Structural Measure			
Lands & Damages		2,617,000	\$2,617,000
Relocations		619,000	619,000
Channels and Canals	9,065,000		9,065,000
Levee and Floodwalls	5,685,000		5,685,000
Fish and Wildlife Facilities	204,000		204,000
Preconstruction, Engineering & Design	2,506,000		2,506,000
Construction Management	1,607,000		1,607,000
Unadjusted Total	19,067,000	3,236,000	22,303,000
5% Cash Contribution	(1,115,000)	1,115,000	
Structural Subtotal	17,952,000	4,352,000	22,303,000
Sub-total	21,768,000	6,407,000	28,175,000
Adjustment to Achieve 65/35	(3,455,000)	3,455,000	
Total Cost Apportionment	\$18,314,000	\$9,861,000	\$28,175,000
Cost Percentage	65%	35%	100%

Project Implementation.

Project implementation is composed of two phases: Pre-construction Engineering and Design (PED) and Construction. The non-Federal sponsor and Government will enter into a legally binding agreement known as the Project Partnership Agreement (PPA) which specifies the responsibilities of both as well as cost sharing and execution of work.

Operation, Maintenance, Repair, Rehabilitation, and Replacement.

Under the terms of the Project Partnership Agreement, the San Antonio River Authority would accept the project following completion of construction and ensure its operation, maintenance, repair, rehabilitation, and replacement (OMRR&R), in accordance with Federal regulations. The major OMRR&R items include Regular maintenance of facilities, debris cleanup, and selective trimming in natural channel design areas.

OMRR&R costs are currently estimated at \$59,000 per year. After completion of the project, an Operation and Maintenance Manual for the River Authority would be prepared by the Corps, and periodic inspections would be conducted to ensure that all required maintenance was being performed. The following table a breakdown of the OMRR&R costs.

Table 6
Annual OMRR&R Costs for Recommended Plan in October 2013 Prices

Project Cost Items	Cost
Structural	
Regular Maintenance (Debris Cleanup)	\$15,000
Grounds Maintenance	\$15,000
Equipment Maintenance	\$10,000
Riparian Measures	\$10,000
Total Structural O&M	\$50,000
Nonstructural	
Grounds Maintenance	\$9,000
Total Nonstructural O&M	\$9,000
Total O&M	\$59,000

Key Social and Environmental Factors

The demographics of the study area are relatively similar to the demographics of Bexar County as a whole. The recommended plan would not have any disproportionate impacts to potentially protected populations in the study area and would therefore be in compliance with Executive Order 12898. Likewise, alternatives were screened not only for economic justification but also for potentially unacceptable or problematic environmental effects. The structural component of the recommended plan, which includes a channel modification of approximately 2,850 feet in length to facilitate hydraulic conveyance to address slight rises in water surface elevations caused by the levee, will be restored utilizing natural channel design features and riparian vegetation to mitigate for impacts to the aquatic and riparian habitats. Monitoring and adaptive management measures are being proposed for this component of the recommended plan. Evaluation of the success of the Leon Creek mitigation efforts will be assessed annually utilizing HEP and QHEI until all performance standards are met. Additionally, annual site assessments will be conducted and annual reports will be submitted following each monitoring year. The recommended plan also includes a nonstructural component calling for the permanent evacuation of four single-family residences and 32 townhouses. No mitigation will be required for this part of the plan. Impacts to resources from the recommended plan are expected to have temporary adverse impacts in the short-term as the project is constructed but long-term beneficial impacts once it is fully implemented.

Stakeholder Perspectives and Differences.

Public scoping meetings were held on 26 May 2009, 8 June 2011, and 4 Dec 2013. No major issues arose from these meetings and the public indicated its support of the study. The Public Notice of Environmental Assessment (EA) was issued on 1 November 2013. No comments were received. San Antonio River Authority (SARA), the non-Federal sponsor, supports the recommended plan and intends to participate in its implementation.

Environmental Compliance.

As an integrated report, this document meets the technical requirements for USACE feasibility reports and NEPA compliance. This Environmental Assessment is written pursuant to and complies with ER 200-2-2 (33 CFR Part 230): Environmental Quality - Procedures for Implementing the National Environmental Policy Act (NEPA) and 40 CFR Parts 1500 to 1508 the Council on Environmental Quality (CEQ) Regulations for Implementing the National Environmental Policy Act (NEPA). The Draft Finding of No Significant Impact is included in the report package.

State and Agency Review.

State and Agency begins 31 March and continues until 2 May 2014. To date, no significant issues or concerns have been raised.

Certification of Peer and Legal Review.

Agency Technical Review of the Interim Feasibility Report and Integrated EA was certified 6 March 2014.

Independent External Peer Review of the Interim Feasibility Report and Integrated EA was certified on 3 March 2014.

Legal Certification of the Interim Feasibility Report and Integrated EA is dated 25 February 2014.

Policy Compliance Review.

A policy compliance review was conducted on the FSM and AFB submittals and the draft and final Interim Feasibility Report and Integrated EA. All policy compliance issues have been resolved in the revised final Feasibility Report.