Lower Colorado River Basin, Phase I, Texas
Interim Feasibility Report
and Integrated Environmental Assessment

Volume II, Onion Creek

REVISED FINAL

Prepared by:

U.S. Army Corps of Engineers
Fort Worth District
P.O. Box 17300
Fort Worth, Texas 76102

8 December 2006

Lower Colorado River Basin, Phase I, Texas
Draft Interim Feasibility Report and Integrated Environmental Assessment

Volume III, Onion Creek

TABLE OF CONTENTS

Description **Page**

CHAPTER 1: INTRODUCTION
*** STUDY AUTHORITY 1-1**
*** STUDY PURPOSE NEED AND SCOPE 1-2**
STUDY PURPOSE 1-2
NEED 1-2
SCOPE 1-2
STUDY PARTICIPANTS AND COOPERATION 1-2
PRIOR STUDIES AND REPORTS 1-3
A PARSIMONIOUS MODEL 1-3
BARTON SPRINGS WATERSHED 1-3
RETROFIT MASTERPLAN
ENGINEERING ASSESSMENT AND ENVIRONMENTAL 1-3
INVENTORY AND ISSUES REPORT
ARTIFICIAL RECHARGE ENHANCEMENT
ONION CREEK, HAYS COUNTY, TEXAS
ONION CREEK FLOOD CONTROL STUDY 1-3
ONION CREEK/LOWER COLORADO 1-3
RIVER BASIN, TEXAS, RECONNAISSANCE STUDY
PROGRAMMATIC ENVIRONMENTAL IMPACT 1-3
STATEMENT FOR FLOOD DAMAGE REDUCTION
AND ECOSYSTEM RESTORATION, LOWER
COLORADO RIVER BASIN, COLORADO RIVER,
TEXAS, AUGUST 2005
REGIONAL DETENTION AND CULVERT 1-4
REPLACEMENT FOR WILLIAMSON CREEK WATERSHED
STATUS REPORT, COLORADO BASIN, TEXAS 1987 1-4
THE TEXAS STATEWIDE INVENTORY OF 1-4
FLOOD PROTECTION NEEDS, MAY 1990
WALNUT AND WILLIAMSON CREEKS, ... 1-4
EXPANDED FLOOD PLAIN INFORMATION STUDY
WATER FOR TEXAS 1-4
WATER RESOURCES DEVELOPMENT 1-4
IN TEXAS 1971, 1981, 1988, 1989, 1991, 1995
WATERSHED PROTECTION MASTER PLAN 1-5
WILLIAMSON AND ONION CREEKS, AUSTIN, TEXAS 1-5
WILLIAMSON CREEK EROSION ASSESSMENT 1-5
*** NATIONAL ENVIRONMENTAL POLICY ACT REQUIREMENTS 1-5**

Note: This report includes an integrated environmental assessment (EA) within the report text; paragraphs required for compliance with the National Environmental Policy Act (NEPA) are noted by an asterisk (*) in the Table of Contents.

Description **Page**

*** CHAPTER 2: STUDY AREA / AFFECTED ENVIRONMENT**
STUDY AREA 2-1
ONION CREEK WATERSHED 2-1
WILLIAMSON CREEK WATERSHED 2-2
LAND USE 2-5
PHYSIOGRAPHY 2-5
GEOLOGY 2-6
HYDROLOGY 2-6
CLIMATOLOGY 2-6
POPULATION AND INCOME 2-6
AIR QUALITY 2-7
BIOLOGICAL RESOURCES 2-7
Riparian Vegetation 2-7
Onion Creek Watershed 2-7
Williamson Creek Watershed 2-8
Riparian Woodland 2-8
Parkland 2-9
Shrubland/Transitional Woodlands 2-10
Grassland 2-10
Residential 2-10
Wildlife Resources 2-10
Onion Creek Watershed 2-10
Williamson Creek Watershed 2-11
Threatened and Endangered Species 2-12
Barton Springs Salamander 2-12
Black-capped Vireo 2-12
Golden-cheeked Warbler 2-13
Whooping Crane 2-13
Austin Blind Salamander 2-13
AQUATIC RESOURCES 2-13
Aquatic Habitat 2-13
Onion Creek 2-13
Williamson Creek 2-14
Groundwater 2-14
Water Quality 2-15
HAZARDOUS, TOXIC AND RADIOACTIVE WASTES (HTRW) 2-15
CULTURAL RESOURCES 2-16
OTHER SOCIAL CONCERNS 2-17
Socioeconomics 2-17
Traffic 2-17
Noise 2-17
Lighting 2-18
RECREATION 2-18
Regional Recreational Resources 2-18
Local Recreational Resources 2-20
City of Austin Master Planning Efforts 2-21
Neighborhood Parks 2-22
School Parks 2-22
District Parks 2-22
Metropolitan Parks 2-24
Greenbelts and Greenways 2-24
Existing Facilities near Areas of Interest 2-24

Description **Page**

CHAPTER 3: IDENTIFICATION OF PROBLEMS AND NEEDS
*** IDENTIFICATION OF FLOODING PROBLEM 3-1**
PROBABILITIES OF FLOOD EVENTS 3-1
HISTORIC FLOODS 3-1
June 1981 Floods 3-2
October 1998 Flood 3-2
November 2001 Flood *3-3*
ECONOMIC REACHES 3-4
DEPTHS OF FLOODING 3-5
*** SOCIAL AND ECONOMIC ANALYSIS 3-6**
STRUCTURES AND INVESTMENT IDENTIFIED 3-6
SINGLE OCCURRENCE FLOOD LOSSES 3-6
EXPECTED ANNUAL DAMAGES 3-6
*** IDENTIFICATION OF ECOSYSTEM DEGRADATION 3-12**
HABITAT EVALUATION 3-12
Evaluation Of Riparian Habitat 3-12
ENVIRONMENTAL SETTING OF AREAS OF INTEREST 3-13
Timber Creek 3-14
General 3-14
Riparian Resources 3-14
Aquatic Resources 3-15
Onion Creek Forest/Yarrabee Bend 3-15
General 3-15
Riparian Resources 3-16
Aquatic Resources 3-16
Bluff Springs Road/Perkins Valley 3-17
General 3-17
Riparian Resources 3-17
Aquatic Resources 3-18
Onion Creek Subdivision 3-18
General 3-18
Riparian Resources 3-18
Aquatic Resources 3-19
Bear/Onion Confluence 3-19
General 3-19
Riparian Resources 3-19
Aquatic Resources 3-20
Williamson Creek 3-21
General 3-21
Riparian Resources 3-21
Aquatic Resources 3-22
*** EXISTING DEGRADATION TO THE ECOSYSTEM 3-23**
*** IDENTIFICATION OF EXISTING RECREATIONAL RESOURCES 3-24**
RECREATION SURVEY AND EXISTING DEMAND 3-24
*** FUTURE WITHOUT PROJECT CONDITIONS 3-24**
*** IDENTIFICATION OF NEEDS AND OPPORTUNITIES 3-26**
FLOODING NEEDS AND OPPORTUNITIES 3-26
ECOSYSTEM NEEDS AND OPPORTUNITIES 3-26
Ecosystem Needs 3-26
Ecosystem Restoration Opportunities 3-27
Hazardous, Toxic and Radioactive Wastes 3-27
RECREATIONAL NEEDS AND OPPORTUNITIES 3-27
DEVELOPMENT OF PROBLEM STATEMENT 3-28

Description **Page**

CHAPTER 4: PLAN FORMULATION
*** PLANNING OBJECTIVES 4-1**
PLANNING CONSTRAINTS 4-2
*** CRITERIA AND METHODOLOGIES FOR FORMULATION 4-2**
TECHNICAL CRITERIA 4-2
ECONOMIC CRITERIA 4-3
NATIONAL ECOSYSTEM RESTORATION (NER) CRITERIA 4-4
MULITPLE PURPOSE PROJECT CRITERIA 4-4
ENVIRONMENTAL AND SOCIAL CRITERIA 4-5
BENEFITS METHODOLOGY 4-6
Permanent Evacuation (Non-Structural) 4-6
Structural Plans 4-7
Ecosystem Restoration 4-7
Recreation Benefits Methods 4-7
COSTS METHODOLOGY 4-8
*** INITIAL SCREENING OF ALTERNATIVES 4-8**
ECONOMICS AND PRICE LEVELS 4-9
NO ACTION ALTERNATIVE 4-9
NONSTRUCTURAL ALTERNATIVES 4-10
Floodplain Management 4-10
Flood Forecast and Warning 4-10
Flood Proofing 4-11
Floodplain Evacuation 4-11
Timber Creek 4-12
Onion Creek Forest/Yarrabee Bend 4-12
Bluff Springs Road/Perkins Valley 4-13
Onion Creek Subdivision 4-13
Bear/Onion Confluence 4-13
Williamson Creek 4-13
STRUCTURAL ALTERNATIVES 4-14
General 4-14
Regional Detention 4-15
Timber Creek 4-15
Onion Creek Forest/Yarrabee Bend 4-16
Bluff Springs Road/Perkins Valle 4-16
Onion Creek Subdivision 4-18
Bear/Onion Confluence 4-18
Williamson Creek 4-18
PRELIMINARY SCREENING ANALYSIS SUMMARY 4-19
Timber Creek 4-20
Onion Creek Forest/Yarrabee Bend 4-20
Bluff Springs Road/Perkins Valley 4-21
Onion Creek Subdivision 4-21
Bear/Onion Confluence 4-21
Williamson Creek 4-21
VALUE ENGINEERING 4-21

Description **Page**

*** DETAILED INVESTIGATION OF ALTERNATIVES 4-22**
GENERAL 4-22
UPDATED FUTURE WITHOUT-PROJECT CONDITIONS 4-22
ECOSYSTEM RESTORATION 4-23
Onion Creek 4-26
Ecosystem Restoration Only 4-26
Combined Ecosystem Restoration 4-27
Williamson Creek 4-27
Ecosystem Restoration Only 4-27
Combined Non-Structural Ecosystem Restoration 4-28
Combined Structural Ecosystem Restoration 4-28
Summary of Ecosystem Restoration 4-30
REGIONAL DETENTION 4-31
TIMBER CREEK 4-31
No Action 4-31
Combined Plan 4-32
Environmental Impacts 4-33
Cultural Resources 4-34
HTRW 4-34
ONION CREEK FOREST/YARRABEE BEND 4-36
No Action 4-36
Structural Alternatives: Combination Levee, ... 4-36
Floodwall, Diversions, Channel Modifications
Environmental Impacts 4-38
Cultural Resources) 4-38
HTRW 4-38
Combined Plan A (4%) 4-38
Environmental Impacts 4-41
Cultural Resources 4-42
HTRW 4-42
Combined Plan B (1%) 4-42
Environmental Impacts 4-43
Cultural Resources 4-43
HTRW 4-43
BEAR/ONION CONFLUENCE 4-45
General 4-45
No Action 4-46
Permanent Evacuation: 4% ACE Zone 4-46
Environmental Impacts 4-47
Cultural Resources 4-48
HTRW 4-48
Combined Plan 4-48
Environmental Impacts 4-50
Cultural Resources 4-50
HTRW 4-50
WILLIAMSON CREEK 4-50
General 4-50
No Action 4-51
Floodproofing 4-51
Environmental Impacts 4-51
Cultural Resources 4-52
HTRW 4-52

Description **Page**

Structural Plan (Standalone) 4-52
Environmental impacts 4-54
Cultural Resources 4-55
HTRW 4-55
Combined Plan – Structural 4-55
Environmental Impacts 4-57
Cultural Resources 4-58
HTRW 4-58
Combined plan--- Non-Structural 4-58
Environmental Impacts 4-60
Cultural Resources 4-60
HTRW 4-61
SUMMARY OF FINAL ARRAY OF ALTERNATIVES 4-61

*** IDENTIFICATION OF THE NED/NER PLAN 4-63**
* **SELECTION OF THE TENTATIVELY SELECTED PLAN 4-64**
TIMBER CREEK 4-64
ONION CREEK FOREST/YARRABEE BEND 4-64
BEAR/ONION CONFLUENCE 4-64
WILLIAMSON CREEK 4-64
*** COST APPORTIONMENT – NED/NER PLAN AND RECOMMENDED PLAN 4-65**

CHAPTER 5: TENTATIVELY SELECTED PLAN
TENTATIVELY SELECTED PLAN FEATURES 5-1
TIMBER CREEK 5-1
Flood Damage Reduction and Recreation 5-1
Ecosystem Restoration 5-2
ONION CREEK FOREST/YARRABEE BEND 5-3
Flood Damage Reduction and Recreation 5-3
Ecosystem Restoration 5-4
BEAR/ONION CONFLUENCE 5-5
Flood Damage Reduction 5-5
Ecosystem Restoration 5-5
WILLIAMSON CREEK 5-6
Flood Damage Reduction and Recreation 5-6
Ecosystem Restoration 5-7
SUMMARY 5-8
IMPORTANCE OF RESTORATION PLAN OUTPUTS 5-9
TECHNICAL RECOGNITION 5-9
INSTITUTIONAL RECOGNITION 5-12
PUBLIC RECOGNITION 5-14

Description **Page**

*** ENVIRONMENTAL EFFECTS OF THE RECOMMENDED PLAN 5-15**
LAND USE 5-15
GEOLOGY AND SOILS 5-15
HYDROLOGY 5-16
AIR QUALITY 5-16
BIOLOGICAL RESOURCES 5-16
Riparian Vegetation 5-16
Wildlife Resources 5-18
Threatened and Endangered Species 5-19
Barton Springs Salamander 5-19
Black-capped Vireo 5-19
Golden-cheeked Warbler 5-19
Whooping Crane 5-19
Austin Blind Salamander 5-19
AQUATIC RESOURCES 5-20
Aquatic Habitat 5-20
WATER QUALITY 5-21
GROUNDWATER 5-22
HAZARDOUS, TOXIC, AND RADIOACTIVE WASTES 5-22
CULTURAL RESOURCES 5-22
OTHER SOCIAL EFFECTS 5-23
Public Health and Safety 5-23
Public Services 5-24
Recreation and Public Access 5-24
Traffic 5-24
Noise 5-24
Lighting 5-25
Vibrations 5-25
Socioeconomics 5-26
MITIGATION 5-26
Mitigation Analysis by Reach 5-26
Heartwood Reach 5-26
Radam Reach 5-26
Broken Bow Reach 5-27
Bayton Loop Reach 5-27
Proposed Mitigation Areas 5-27
Analysis Summary 5-27
CUMULATIVE IMPACTS 5-28
Existing Corps Flood Control Projects 5-28
Boggy Creek Flood Protection Project 5-28
Existing Projects of Others in the Basin 5-28
Urban Growth and Expansion 5-28
Reasonably Foreseeable Projects of Others 5-29
Urban Growth and Expansion *5-29*
City of Austin Projects *5-29*
Transportation Projects 5-29
Reasonably Foreseeable Corps Projects 5-29
Wharton Interim Feasibility Study *5-29*
Shoal Creek Interim Feasibility Study *5-29*
Walnut Creek Interim Feasibility Study 5-29
Highland Lakes Interim Feasibility Study *5-30*
Boggy Creek Section 14 Study *5-30*

Description **Page**

Cumulative Effects by Resource 5-30
Land Use *5-30*
Geology and Soils *5-30*
Hydrology *5-30*
Air Quality 5-30
Biological Resources 5-31
Terrestrial Resources 5-31
Wildlife Resources 5-31
Threatened and Endangered Species 5-31
Aquatic Resources 5-31
Aquatic Habitat 5-31
Water Quality 5-31
Ground Water 5-32
Hazardous, Toxic and Radioactive Wastes 5-32
Cultural Resources 5-32
Other Social Effects 5-32
Public Heath and Safety 5-32
Public Services 5-32
Recreational and Public Access 5-32
Traffic 5-33
Noise 5-33
Lighting 5-33
Socioeconomics 5-33
*** ENVIRONMENTAL COMPLIANCE 5-33**
ENDANGERED SPECIES ACT OF 1973 5-33
CLEAN WATER ACT – SECTION 404 5-33
EXECUTIVE ORDER 11988 – FLOOD PLAIN MANAGEMENT 5-34
EXECUTIVE ORDER 11990 – PROTECTION OF WETLANDS 5-34
EXECUTIVE ORDER 12898, FEDERAL ACTIONS TO ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW INCOME POPULATIONS 5-34
ADVISORY CIRCULAR 150-5200-33 – HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS 5-35
*** ECONOMIC ANALYSIS 5-37**
COST ANALYSIS 5-37
PROJECTED FIRST COST 5-37
ANNUALIZED COST 5-37
ECONOMIC SUMMARY 5-38
Socioeconomic Effect of the Recommended Plan 5-43
PROJECT COST SHARING 5-44
FLOOD CONTROL 5-44
ECOSYSTEM RESTORATION 5-44
RECREATIONAL DEVELOPMENT 5-44
MONITORING AND ADAPTIVE MANAGEMENT 5-44
OPERATION, MAINTENANCE, REPAIR, REHABILITATION, AND REPLACEMENT 5-45
DIVISION OF PLAN RESPONSIBILITIES 5-46
IMPLEMENTATION SCHEDULE AND EXPENDITURE SCHEDULE 5-46
COST APPORTIONMENT 5-46
NON-FEDERAL RESPONSIBILITIES (ITEMS OF LOCAL COOPERATION) 5-50
FULLY FUNDED COST ESTIMATE 5-54

Description **Page**

FINANCIAL ANALYSIS 5-55
NON-FEDERAL FINANCIAL PLANNING 5-60
ABILITY-TO PAY ANALYSIS 5-61

*** CHAPTER 6: FINAL RECOMMENDED PLAN**
FINAL RECOMMENDED PLAN FEATURES 6-1
TIMBER CREEK 6-1
ONION CREEK FOREST/YARRABEE BEND 6-1
WILLIAMSON CREEK 6-1
ENVIRONMENTAL EFFECTS OF THE FINAL RECOMMENDED PLAN 6-1
ENVIRONMENTAL COMPLIANCE 6-1
ENDANGERED SPECIES ACT OF 1973 6-2
CLEAN WATER ACT – SECTION 404 6-2
EXECUTIVE ORDER 11988 – FLOOD PLAIN MANAGEMENT 6-2
EXECUTIVE ORDER 11990 – PROTECTION OF WETLANDS 6-2
EXECUTIVE ORDER 12898, FEDERAL ACTIONS TO 6-2
ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY
POPULATIONS AND LOW INCOME POPULATIONS
ADVISORY CIRCULAR 150-5200-33 – HAZARDOUS 6-3
WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS
SECTION 106 COMPLIANCE 6-3
ECONOMIC ANALYSIS 6-6
UPDATED ECONOMICS 6-6
COST APPORTIONMENT 6-6
NON-FEDERAL RESPONSIBILITIES 6-8
(ITEMS OF LOCAL COOPERATION)
FULLY FUNDED COST ESTIMATE 6-8

*** CHAPTER 7: PUBLIC INVOLVEMENT, REVIEW AND CONSULTATION**
PUBLIC INVOLVEMENT 6-1
PURPOSE OF PROGRAM 6-1
PARTICIPANTS 6-1
PUBLIC WORKSHOPS 6-1
PUBLIC REVIEW 6-3
AGENCY COORDINATION 6-3
COMMENTS AND RESPONSES 6-5

CHAPTER 8: LIST OF PREPARERS

CHAPTER 9: DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

APPENDICES

Appendix

***A**	**Economics**
***B**	**Environmental**
***C**	**Cultural**
***D**	**USFWS Coordination Act Report**
***E**	**Real Estate Plan**
***F**	**Recreation**
***G**	**Engineering**
***H**	**Correspondence**

FIGURES

FIGURE NO.	TITLE	PAGE
2-1	Onion Creek Watershed Location Map	2-3
2-2	Designated Areas of Interest	2-4
2-3	Regional Recreation Resources – 100 Mile Radius from Austin	2-19
2-4	City Of Austin Planning Regions	2-21
2-5	City Of Austin Parks and Preserves	2-23
3-1	1998 Flood in Heartwood Edition	3-2
3-2	1998 Flood Event in Radam Showing Extensive Content Damage	3-3
3-3	2001 Flood Event in Timber Creek	3-3
3-5	Economic Reaches	Back of Chapter 3
3-6A	Onion Creek Depth of Flooding Timber Creek – 25-yr	Back of Chapter 3
3-6B	Onion Creek Depth of Flooding Timber Creek – 100-yr	Back of Chapter 3
3-7A	Onion Creek Depth of Flooding Yarrabee – 25-yr	Back of Chapter 3
3-7B	Onion Creek Depth of Flooding Yarrabee – 100-yr	Back of Chapter 3
3-8B	B/O Confluence Depth of Flooding – 100-yr	Back of Chapter 3
3-9A	Williamson Creek Depth of Flooding Heartwood – 25-yr	Back of Chapter 3
3-9B	Williamson Creek Depth of Flooding Heartwood – 100-yr	Back of Chapter 3
3-10A	Williamson Creek Depth of Flooding Radam – 25-yr	Back of Chapter 3
3-11B	Williamson Creek Depth of Flooding Broken Bow – 100-yr	Back of Chapter 3
4-1	Timber Creek Current Property Ownership Status	Back of Chapter 4
4-2	Onion Creek Forest/Yarrabee Bend, Phase I Permanent Evacuation Plan	Back of Chapter 4
4-3	Bluff Springs Road/Perkins Valley, Phase I Permanent Evacuation Plan	Back of Chapter 4
4-4	Onion Creek Subdivision, Phase I Permanent Evacuation Plan	Back of Chapter 4
4-5	Bear/Onion Confluence, Phase I Permanent Evacuation Plan	Back of Chapter 4
4-6	Timber Creek, Phase I Structural Plan	Back of Chapter 4
4-7	Onion Creek Forest/Yarrabee Bend, Phase I Structural Plan	Back of Chapter 4
4-8	Bluff Springs Road/Perkins Valley, Phase I Structural Plan	Back of Chapter 4
4-9	Onion Creek Subdivision, Phase I Structural Plan	Back of Chapter 4

FIGURES

FIGURE NO.	TITLE	PAGE
4-10	Bear/Onion Confluence, Phase I Structural Plan	Back of Chapter 4
4-11	Williamson Creek, Phase I 25-year Floodplain Heartwood Reach	Back of Chapter 4
4-12	Williamson Creek, Phase I 25-year Floodplain Radam/Salem Walk Reach	Back of Chapter 4
4-13	Williamson Creek, Phase I 25-year Floodplain Broken Bow/Buckskin Reach	Back of Chapter 4
4-14	Williamson Creek, Phase I 25-year Floodplain Bayton Loop Reach	Back of Chapter 4
4-15	Onion Creek IFS, Phase IIA Regional Detention Alternative	Back of Chapter 4
4-16	Timber Creek, Phase IIA Non-Structural Combined Plan	Back of Chapter 4
4-17	Onion Creek Forest/Yarrabee Bend, Phase IIA Combined Plan A (4%) Structures to be Acquired	Back of Chapter 4
4-18	Onion Creek Forest/Yarrabee Bend, Phase IIA Combined Plan A (4%) Conceptual Recreation Plan	Back of Chapter 4
4-19	Onion Creek Forest/Yarrabee Bend, Phase IIA Combined Plan B (1%) Conceptual Recreation Plan	Back of Chapter 4
4-20	Bear/Onion Confluence, Phase IIA Combined Plan	Back of Chapter 4
4-21B	Williamson Creek, Phase IIA Plan A Radam Reach	Back of Chapter 4
4-21C	Williamson Creek, Phase IIA Plan A Broken Bow Reach	Back of Chapter 4
4-21D	Williamson Creek, Phase IIA Plan A Bayton Loop Reach	Back of Chapter 4
4-22A	Williamson Creek, Phase IIA Plan B Heartwood Reach	Back of Chapter 4
4-22B	Williamson Creek, Phase IIA Plan B Radam Reach	Back of Chapter 4
4-22C	Williamson Creek, Phase IIA Plan B Broken Bow Reach	Back of Chapter 4
4-22D	Williamson Creek, Phase IIA Plan B Bayton Loop Reach	Back of Chapter 4
4-23A	Williamson Creek, Phase IIA Plan C Heartwood Reach	Back of Chapter 4
4-23B	Williamson Creek, Phase IIA Plan C Radam Reach	Back of Chapter 4
4-23C	Williamson Creek, Phase IIA Plan C Broken Bow Reach	Back of Chapter 4
4-23D	Williamson Creek, Phase IIA Plan C Bayton Loop Reach	Back of Chapter 4
4-24	Omitted	Back of Chapter 4
4-25A	Williamson Creek, Phase IIA Structural Combined Plan Heartwood Reach	Back of Chapter 4
4-25B	Williamson Creek, Phase IIA Structural Combined Plan Radam Reach	Back of Chapter 4

FIGURES

FIGURE NO.	TITLE	PAGE
4-25C	Williamson Creek, Phase IIA Structural Combined Plan Broken Bow Reach	Back of Chapter 4
4-25D	Williamson Creek, Phase IIA Structural Combined Plan Bayton Loop Reach	Back of Chapter 4
4-26A	Williamson Creek, Phase IIA Non-Structural Combined Plan	Back of Chapter 4
4-26B	Williamson Creek, Phase IIA Non-Structural Combined Plan	Back of Chapter 4
4-26C	Williamson Creek, Phase IIA Non-Structural Combined Plan	Back of Chapter 4
4-26D	Williamson Creek, Phase IIA Non-Structural Combined Plan	Back of Chapter 4
5-1	Timber Creek Current Property Ownership Status	Back of Chapter 5
5-2	Recommended Plan, Timber Creek	Back of Chapter 5
5-3	Timber Creek Recommended Ecosystem Restoration Plan	Back of Chapter 5
5-4	Onion Creek Forest/Yarrabee Bend, Recommended Buyout	Back of Chapter 5
5-5	Onion Creek Forest/Yarrabee Bend, Recommended Conceptual Recreation Plan	Back of Chapter 5
5-6	Onion Creek Forest/Yarrabee Bend, Recommended Ecosystem Restoration Plan	Back of Chapter 5
5-7A	Williamson Creek, Recommended Benching Plan Heartwood Reach	Back of Chapter 5
5-7B	Williamson Creek, Recommended Benching Plan Radam Reach	Back of Chapter 5
5-7C	Williamson Creek, Recommended Benching Plan Broken Bow Reach	Back of Chapter 5
5-7D	Williamson Creek, Recommended Benching Plan Bayton Loop Reach	Back of Chapter 5
5-8A	Williamson Creek, Recommended ER Plan Heartwood Reach	Back of Chapter 5
5-8B	Williamson Creek, Recommended ER Plan Radam Reach	Back of Chapter 5
5-8C	Williamson Creek, Recommended ER Plan Broken Bow Reach	Back of Chapter 5
5-8D	Williamson Creek, Recommended ER Plan Bayton Loop Reach	Back of Chapter 5
5-9	Williamson Creek Mitigation Area	Back of Chapter 5

TABLES

TABLES NO.	TITLE	PAGE
2-1	Onion Creek Interim Feasibility Study Areas of Interest	2-1
2-2	Land Use Classification	2-5
2-3	Regional Demographics Statistics	2-7
2-4	Federally Listed T&E Species That Could Occur In the Study Area	2-12
2-5	Barton Springs Edwards Aquifer Recharge	2-15
2-6	Regional Recreation Resources – 100 Mile Radius from Austin	2-20
2-7	City Of Austin's Park Types	2-22
2-8	Parks within 5 Miles of Timber Creek	2-25
2-9	Parks within 5 Miles Of Onion Creek Forest/Yarrabee Bend	2-26
2-9	Continued Parks within 5 Miles of Onion Creek Forest/Yarrabee Bend	2-27
2-10	Parks within 5 Miles of Bluff Springs Area	2-28
2-10	Continued Parks within 5 Miles of Bluff Springs Area	2-29
2-11	Parks within 5 Miles of Onion Creek Subdivision	2-30
2-11	Continued Parks within 5 Miles of Onion Creek Subdivision	2-31
2-12	Parks within 5 Miles of Bear/Onion Confluence Site	2-32
2-13	Williamson Creek Area – Parks Within Vicinity (5 Mile Radius)	2-33
2-13	Continued Williamson Creek Area – Parks within Vicinity (5 Mile Radius)	2-34
2-13	Continued Williamson Creek Area – Parks within Vicinity (5 Mile Radius)	2-35
2-13	Continued Williamson Creek Area – Parks within Vicinity (5 Mile Radius)	2-36
3-1	Probabilities of Flood Events	3-1
3-2	Summary of Historic Flood Events	3-2
3-2	Areas of Interest	3-5
3-4	Floodplain Investment: Structures And Contents Onion Creek	3-7
3-5	Floodplain Investment: Structures And Contents Williamson Creek	3-8
3-6	Total Single Event and Expected Annual Damages – Onion Creek Onion Creek Reaches	3-9
3-6	Continued Total Single Event and Expected Annual Damages – Onion Creek Onion Creek Reaches	3-10
3-7	Total Single Event and Expected Annual Damages – Williamson Creek	3-11
3-10	Existing Habitat Suitability Indices and Habitat Units	3-13

TABLES

TABLES NO.	TITLE	PAGE
4-1	Williamson Creek Number of Structures And Investment For 4% Ace Preliminary Buy-Out	4-14
4-2	Williamson Creek Phase I Preliminary Analysis Summary of Costs and Benefits by Sub-Reach	4-19
4-3	Phase I Preliminary Analysis Summary of Flood Damage Identified For Detailed Investigations	4-20
4-4	Existing Conditions and Future Without Project Existing Cover Type Habitat Suitability Indices and Habitat Units by Areas of Interest	4-23
4-4	Continued Existing Conditions and Future Without Project Existing Cover Type Habitat Suitability Indices and Habitat Units by Area of Interest	4-24
4-5	Summary of Incremental Analysis	4-30
4-6	Timber Creek Summary of Costs for Combination Plan	4-34
4-7	Timber Creek Benefit Computations for Combination Plan	4-35
4-8	Phase IIa Alternatives Analysis Onion Creek Forest/Yarrabee Bend Summary of Costs and Benefits for Various Diversions	4-37
4-9	Onion Creek Forest/Yarrabee Bend Summary Of Costs for Combination Plan A	4-40
4-10	Detailed Alternative Analysis Onion Creek Forest/Yarrabee Bend Benefit-Cost for Combination Plan A (4%) (Excluding Ecosystem Restoration)	4-41
4-11	Onion Creek Forest/Yarrabee Bend Benefit-Cost for Combination Plan B (1% Ace)	4-44
4-12	Detailed Alternative Analysis Onion Creek Forest/Yarrabee Bend Summary of Costs for Combination Plan B (1% Ace)	4-45
4-13	Detailed Alternative Analysis Bear/Onion Confluence Permanent Evacuation 4% Ace Stand Alone	4-47
4-14	Detailed Alternative Analysis Bear/Onion Confluence Permanent Evacuation 4% Ace	4-47
4-15	Detailed Alternative Analysis Bear/Onion Confluence Annual Ecosystem Restoration Costs Before Scrb	4-49
4-16	Bear/Onion Confluence Cost Allocation For Combination Plan Separable Costs Remaining Benefits Method	4-49
4-17	Williamson Creek Net Annual Benefits Standalone Structural Plans by Reach	4-53
4-18	Detailed Alternative Analysis Williamson Creek Standalone Structural Plan Summary of Costs	4-53
4-19	Detailed Alternative Analysis Williamson Creek Standalone Structural Plan Benefit-Cost	4-54
4-20	Detailed Alternative Analysis Williamson Creek Combined Structural Plan Summary of Costs	4-56
4-21	Williamson Creek Cost Allocation for Combined Structural Plan	4-57

TABLES

TABLES NO.	TITLE	PAGE
4-22	Detailed Alternative Analysis Williamson Creek Combined Non-Structural Plan Summary of Costs	4-59
4-23	Williamson Creek Cost Allocation for Non-Structural Combined Plan	4-60
4-24	Summarized Final Array of Detailed Alternatives Grouped By Area of Interest	4-62
4-25	Cost Apportionment –Tentatively Selected Plan	4-65
5-1	Pertinent Data Tentatively Selected Plan Timber Creek	5-2
5-2	Pertinent Data Tentatively Selected Plan Onion Creek Forest/Yarrabee Bend	5-4
5-3	Bear/Onion Confluence Separable Cost Remaining Benefits Analysis	5-5
5-4	Proposed Excavation by Reach	5-6
5-5	Pertinent Data Tentatively Selected Williamson Creek	5-7
5-6	Pertinent Data Tentatively Selected Plan	5-8
5-7	Species Listed In Bird Conservation Region 20	5-13
5-8	Acres of Vegetation on Onion Creek To Be Restored As Riparian Woodlands	5-17
5-9	Acres of Vegetation on Williamson Creek To Be Restored As Riparian Woodlands	5-17
5-10	Acres of Impacted Vegetation on Williamson Creek From Implementation of the Tentatively Selected Plan	5-17
5-11	Future With and Without Project AAHU for the Tentatively Selected	5-18
5-12	Average Daily Noise Exposure Levels (8-Hour Twa) Of Heavy Equipment Operators and Associated Laborers in Dba	5-25
5-13	Relationship of Plan to Environmental Protection Statutes and Other Environmental Requirements	5-36
5-14	Equivalent Annual Damages	5-37
5-15	Cost Estimate Summary for the Tentatively Selected Plan	5-38
5-16	Economic Summary of the Tentatively Selected Timber Creek	5-39
5-17	Economic Summary of the Tentatively Selected Onion Creek Forest/Yarrabee Bend	5-40
5-18	Economic Summary of the Tentatively Selected Plan Williamson Creek	5-41
5-19	Economic Summary Total Tentatively Selected Plan	5-42
5-20	Economic Summary of the Ecosystem Restoration	5-43
5-21	Estimated Cost of Adaptive Management	5-43
5-22	Breakdown of OMRR&R Costs for the Recommended Plan	5-46
5-23	Cost Apportionment for the Tentatively Selected Plan Timber Creek	5-47
5-24	Cost Apportionment for the Tentatively Selected Plan Onion Creek Forest/Yarrabee Bend	5-48
5-25	Cost Apportionment for the Tentatively Selected Plan Williamson Creek	5-49

TABLES

TABLES NO.	TITLE	PAGE
5-26	Cost Apportionment for the Total Tentatively Selected Plan	5-50
5-27	Fully Funded Cost Estimate for the Tentatively Selected Plan	5-54
5-28	Financial Indicator Rating Key	5-56
5-29	Current Community Financial Indicator Values For The City Of Austin	5-57
5-30	Current Community Financial Indicator Values For Travis County	5-58
5-31	City Of Austin Summary of Financial Capability	5-59
5-32	Travis County Summary of Financial Capability	5-60
6-1	Relationship of Plan to Environmental Protection Statutes And Other Environmental Requirements	6-5
6-2	Cost Estimate Summary for the Recommended Plan	6-6
6-3	Economic Summary, Total Recommended Plan	6-7
6-4	Cost Apportionment for the Recommended Plan	6-8
6-5	Fully Funded Cost Estimate for the Recommended Plan	6-8
8-1	List of Preparers	8-1

Note: This report includes an integrated environmental assessment (EA) within the report text; paragraphs required for compliance with the National Environmental Policy Act (NEPA) are noted by an asterisk (*) in the Table of Contents.

Lower Colorado River Basin, Phase I, Texas
Draft Interim Feasibility Report and Integrated Environmental Assessment

Volume III, Onion Creek

TABLE OF CONTENTS

Description **Page**

CHAPTER 1: INTRODUCTION
*** STUDY AUTHORITY 1-1**
*** STUDY PURPOSE NEED AND SCOPE 1-2**
STUDY PURPOSE 1-2
NEED 1-2
SCOPE 1-2
STUDY PARTICIPANTS AND COOPERATION 1-2
PRIOR STUDIES AND REPORTS 1-3
A PARSIMONIOUS MODEL 1-3
BARTON SPRINGS WATERSHED 1-3
RETROFIT MASTERPLAN
ENGINEERING ASSESSMENT AND ENVIRONMENTAL 1-3
INVENTORY AND ISSUES REPORT
ARTIFICIAL RECHARGE ENHANCEMENT
ONION CREEK, HAYS COUNTY, TEXAS
ONION CREEK FLOOD CONTROL STUDY 1-3
ONION CREEK/LOWER COLORADO 1-3
RIVER BASIN, TEXAS, RECONNAISSANCE STUDY
PROGRAMMATIC ENVIRONMENTAL IMPACT 1-3
STATEMENT FOR FLOOD DAMAGE REDUCTION
AND ECOSYSTEM RESTORATION, LOWER
COLORADO RIVER BASIN, COLORADO RIVER,
TEXAS, AUGUST 2005
REGIONAL DETENTION AND CULVERT 1-4
REPLACEMENT FOR WILLIAMSON CREEK WATERSHED
STATUS REPORT, COLORADO BASIN, TEXAS 1987 1-4
THE TEXAS STATEWIDE INVENTORY OF 1-4
FLOOD PROTECTION NEEDS, MAY 1990
WALNUT AND WILLIAMSON CREEKS, ... 1-4
EXPANDED FLOOD PLAIN INFORMATION STUDY
WATER FOR TEXAS 1-4
WATER RESOURCES DEVELOPMENT 1-4
IN TEXAS 1971, 1981, 1988, 1989, 1991, 1995
WATERSHED PROTECTION MASTER PLAN 1-5
WILLIAMSON AND ONION CREEKS, AUSTIN, TEXAS 1-5
WILLIAMSON CREEK EROSION ASSESSMENT 1-5
*** NATIONAL ENVIRONMENTAL POLICY ACT REQUIREMENTS 1-5**

Note: This report includes an integrated environmental assessment (EA) within the report text; paragraphs required for compliance with the National Environmental Policy Act (NEPA) are noted by an asterisk (*) in the Table of Contents.

Description **Page**

*** CHAPTER 2: STUDY AREA / AFFECTED ENVIRONMENT**
STUDY AREA 2-1
ONION CREEK WATERSHED 2-1
WILLIAMSON CREEK WATERSHED 2-2
LAND USE 2-5
PHYSIOGRAPHY 2-5
GEOLOGY 2-6
HYDROLOGY 2-6
CLIMATOLOGY 2-6
POPULATION AND INCOME 2-6
AIR QUALITY 2-7
BIOLOGICAL RESOURCES 2-7
Riparian Vegetation 2-7
Onion Creek Watershed 2-7
Williamson Creek Watershed 2-8
Riparian Woodland 2-8
Parkland 2-9
Shrubland/Transitional Woodlands 2-10
Grassland 2-10
Residential 2-10
Wildlife Resources 2-10
Onion Creek Watershed 2-10
Williamson Creek Watershed 2-11
Threatened and Endangered Species 2-12
Barton Springs Salamander 2-12
Black-capped Vireo 2-12
Golden-cheeked Warbler 2-13
Whooping Crane 2-13
Austin Blind Salamander 2-13
AQUATIC RESOURCES 2-13
Aquatic Habitat 2-13
Onion Creek 2-13
Williamson Creek 2-14
Groundwater 2-14
Water Quality 2-15
HAZARDOUS, TOXIC AND RADIOACTIVE WASTES (HTRW) 2-15
CULTURAL RESOURCES 2-16
OTHER SOCIAL CONCERNS 2-17
Socioeconomics 2-17
Traffic 2-17
Noise 2-17
Lighting 2-18
RECREATION 2-18
Regional Recreational Resources 2-18
Local Recreational Resources 2-20
City of Austin Master Planning Efforts 2-21
Neighborhood Parks 2-22
School Parks 2-22
District Parks 2-22
Metropolitan Parks 2-24
Greenbelts and Greenways 2-24
Existing Facilities near Areas of Interest 2-24

Description **Page**

CHAPTER 3: IDENTIFICATION OF PROBLEMS AND NEEDS
*** IDENTIFICATION OF FLOODING PROBLEM 3-1**
PROBABILITIES OF FLOOD EVENTS 3-1
HISTORIC FLOODS 3-1
June 1981 Floods 3-2
October 1998 Flood 3-2
November 2001 Flood *3-3*
ECONOMIC REACHES 3-4
DEPTHS OF FLOODING 3-5
*** SOCIAL AND ECONOMIC ANALYSIS 3-6**
STRUCTURES AND INVESTMENT IDENTIFIED 3-6
SINGLE OCCURRENCE FLOOD LOSSES 3-6
EXPECTED ANNUAL DAMAGES 3-6
*** IDENTIFICATION OF ECOSYSTEM DEGRADATION 3-12**
HABITAT EVALUATION 3-12
Evaluation Of Riparian Habitat 3-12
ENVIRONMENTAL SETTING OF AREAS OF INTEREST 3-13
Timber Creek 3-14
General 3-14
Riparian Resources 3-14
Aquatic Resources 3-15
Onion Creek Forest/Yarrabee Bend 3-15
General 3-15
Riparian Resources 3-16
Aquatic Resources 3-16
Bluff Springs Road/Perkins Valley 3-17
General 3-17
Riparian Resources 3-17
Aquatic Resources 3-18
Onion Creek Subdivision 3-18
General 3-18
Riparian Resources 3-18
Aquatic Resources 3-19
Bear/Onion Confluence 3-19
General 3-19
Riparian Resources 3-19
Aquatic Resources 3-20
Williamson Creek 3-21
General 3-21
Riparian Resources 3-21
Aquatic Resources 3-22
*** EXISTING DEGRADATION TO THE ECOSYSTEM 3-23**
*** IDENTIFICATION OF EXISTING RECREATIONAL RESOURCES 3-24**
RECREATION SURVEY AND EXISTING DEMAND 3-24
*** FUTURE WITHOUT PROJECT CONDITIONS 3-24**
*** IDENTIFICATION OF NEEDS AND OPPORTUNITIES 3-26**
FLOODING NEEDS AND OPPORTUNITIES 3-26
ECOSYSTEM NEEDS AND OPPORTUNITIES 3-26
Ecosystem Needs 3-26
Ecosystem Restoration Opportunities 3-27
Hazardous, Toxic and Radioactive Wastes 3-27
RECREATIONAL NEEDS AND OPPORTUNITIES 3-27
DEVELOPMENT OF PROBLEM STATEMENT 3-28

Description **Page**

CHAPTER 4: PLAN FORMULATION
*** PLANNING OBJECTIVES 4-1**
PLANNING CONSTRAINTS 4-2
*** CRITERIA AND METHODOLOGIES FOR FORMULATION 4-2**
TECHNICAL CRITERIA 4-2
ECONOMIC CRITERIA 4-3
NATIONAL ECOSYSTEM RESTORATION (NER) CRITERIA 4-4
MULITPLE PURPOSE PROJECT CRITERIA 4-4
ENVIRONMENTAL AND SOCIAL CRITERIA 4-5
BENEFITS METHODOLOGY 4-6
Permanent Evacuation (Non-Structural) 4-6
Structural Plans 4-7
Ecosystem Restoration 4-7
Recreation Benefits Methods 4-7
COSTS METHODOLOGY 4-8
*** INITIAL SCREENING OF ALTERNATIVES 4-8**
ECONOMICS AND PRICE LEVELS 4-9
NO ACTION ALTERNATIVE 4-9
NONSTRUCTURAL ALTERNATIVES 4-10
Floodplain Management 4-10
Flood Forecast and Warning 4-10
Flood Proofing 4-11
Floodplain Evacuation 4-11
Timber Creek 4-12
Onion Creek Forest/Yarrabee Bend 4-12
Bluff Springs Road/Perkins Valley 4-13
Onion Creek Subdivision 4-13
Bear/Onion Confluence 4-13
Williamson Creek 4-13
STRUCTURAL ALTERNATIVES 4-14
General 4-14
Regional Detention 4-15
Timber Creek 4-15
Onion Creek Forest/Yarrabee Bend 4-16
Bluff Springs Road/Perkins Valle 4-16
Onion Creek Subdivision 4-18
Bear/Onion Confluence 4-18
Williamson Creek 4-18
PRELIMINARY SCREENING ANALYSIS SUMMARY 4-19
Timber Creek 4-20
Onion Creek Forest/Yarrabee Bend 4-20
Bluff Springs Road/Perkins Valley 4-21
Onion Creek Subdivision 4-21
Bear/Onion Confluence 4-21
Williamson Creek 4-21
VALUE ENGINEERING 4-21

Description **Page**

*** DETAILED INVESTIGATION OF ALTERNATIVES 4-22**
GENERAL 4-22
UPDATED FUTURE WITHOUT-PROJECT CONDITIONS 4-22
ECOSYSTEM RESTORATION 4-23
Onion Creek 4-26
Ecosystem Restoration Only 4-26
Combined Ecosystem Restoration 4-27
Williamson Creek 4-27
Ecosystem Restoration Only 4-27
Combined Non-Structural Ecosystem Restoration 4-28
Combined Structural Ecosystem Restoration 4-28
Summary of Ecosystem Restoration 4-30
REGIONAL DETENTION 4-31
TIMBER CREEK 4-31
No Action 4-31
Combined Plan 4-32
Environmental Impacts 4-33
Cultural Resources 4-34
HTRW 4-34
ONION CREEK FOREST/YARRABEE BEND 4-36
No Action 4-36
Structural Alternatives: Combination Levee, ... 4-36
Floodwall, Diversions, Channel Modifications
Environmental Impacts 4-38
Cultural Resources) 4-38
HTRW 4-38
Combined Plan A (4%) 4-38
Environmental Impacts 4-41
Cultural Resources 4-42
HTRW 4-42
Combined Plan B (1%) 4-42
Environmental Impacts 4-43
Cultural Resources 4-43
HTRW 4-43
BEAR/ONION CONFLUENCE 4-45
General 4-45
No Action 4-46
Permanent Evacuation: 4% ACE Zone 4-46
Environmental Impacts 4-47
Cultural Resources 4-48
HTRW 4-48
Combined Plan 4-48
Environmental Impacts 4-50
Cultural Resources 4-50
HTRW 4-50
WILLIAMSON CREEK 4-50
General 4-50
No Action 4-51
Floodproofing 4-51
Environmental Impacts 4-51
Cultural Resources 4-52
HTRW 4-52

Description **Page**

Structural Plan (Standalone) 4-52
Environmental impacts 4-54
Cultural Resources 4-55
HTRW 4-55
Combined Plan – Structural 4-55
Environmental Impacts 4-57
Cultural Resources 4-58
HTRW 4-58
Combined plan--- Non-Structural 4-58
Environmental Impacts 4-60
Cultural Resources 4-60
HTRW 4-61
SUMMARY OF FINAL ARRAY OF ALTERNATIVES 4-61

*** IDENTIFICATION OF THE NED/NER PLAN 4-63**
* **SELECTION OF THE TENTATIVELY SELECTED PLAN 4-64**
TIMBER CREEK 4-64
ONION CREEK FOREST/YARRABEE BEND 4-64
BEAR/ONION CONFLUENCE 4-64
WILLIAMSON CREEK 4-64
*** COST APPORTIONMENT – NED/NER PLAN AND RECOMMENDED PLAN 4-65**

CHAPTER 5: TENTATIVELY SELECTED PLAN
TENTATIVELY SELECTED PLAN FEATURES 5-1
TIMBER CREEK 5-1
Flood Damage Reduction and Recreation 5-1
Ecosystem Restoration 5-2
ONION CREEK FOREST/YARRABEE BEND 5-3
Flood Damage Reduction and Recreation 5-3
Ecosystem Restoration 5-4
BEAR/ONION CONFLUENCE 5-5
Flood Damage Reduction 5-5
Ecosystem Restoration 5-5
WILLIAMSON CREEK 5-6
Flood Damage Reduction and Recreation 5-6
Ecosystem Restoration 5-7
SUMMARY 5-8
IMPORTANCE OF RESTORATION PLAN OUTPUTS 5-9
TECHNICAL RECOGNITION 5-9
INSTITUTIONAL RECOGNITION 5-12
PUBLIC RECOGNITION 5-14

Description **Page**

*** ENVIRONMENTAL EFFECTS OF THE RECOMMENDED PLAN 5-15**
LAND USE 5-15
GEOLOGY AND SOILS 5-15
HYDROLOGY 5-16
AIR QUALITY 5-16
BIOLOGICAL RESOURCES 5-16
Riparian Vegetation 5-16
Wildlife Resources 5-18
Threatened and Endangered Species 5-19
Barton Springs Salamander 5-19
Black-capped Vireo 5-19
Golden-cheeked Warbler 5-19
Whooping Crane 5-19
Austin Blind Salamander 5-19
AQUATIC RESOURCES 5-20
Aquatic Habitat 5-20
WATER QUALITY 5-21
GROUNDWATER 5-22
HAZARDOUS, TOXIC, AND RADIOACTIVE WASTES 5-22
CULTURAL RESOURCES 5-22
OTHER SOCIAL EFFECTS 5-23
Public Health and Safety 5-23
Public Services 5-24
Recreation and Public Access 5-24
Traffic 5-24
Noise 5-24
Lighting 5-25
Vibrations 5-25
Socioeconomics 5-26
MITIGATION 5-26
Mitigation Analysis by Reach 5-26
Heartwood Reach 5-26
Radam Reach 5-26
Broken Bow Reach 5-27
Bayton Loop Reach 5-27
Proposed Mitigation Areas 5-27
Analysis Summary 5-27
CUMULATIVE IMPACTS 5-28
Existing Corps Flood Control Projects 5-28
Boggy Creek Flood Protection Project 5-28
Existing Projects of Others in the Basin 5-28
Urban Growth and Expansion 5-28
Reasonably Foreseeable Projects of Others 5-29
Urban Growth and Expansion *5-29*
City of Austin Projects *5-29*
Transportation Projects 5-29
Reasonably Foreseeable Corps Projects 5-29
Wharton Interim Feasibility Study *5-29*
Shoal Creek Interim Feasibility Study *5-29*
Walnut Creek Interim Feasibility Study 5-29
Highland Lakes Interim Feasibility Study *5-30*
Boggy Creek Section 14 Study *5-30*

Description **Page**

Cumulative Effects by Resource 5-30
Land Use *5-30*
Geology and Soils *5-30*
Hydrology *5-30*
Air Quality 5-30
Biological Resources 5-31
Terrestrial Resources 5-31
Wildlife Resources 5-31
Threatened and Endangered Species 5-31
Aquatic Resources 5-31
Aquatic Habitat 5-31
Water Quality 5-31
Ground Water 5-32
Hazardous, Toxic and Radioactive Wastes 5-32
Cultural Resources 5-32
Other Social Effects 5-32
Public Heath and Safety 5-32
Public Services 5-32
Recreational and Public Access 5-32
Traffic 5-33
Noise 5-33
Lighting 5-33
Socioeconomics 5-33
*** ENVIRONMENTAL COMPLIANCE 5-33**
ENDANGERED SPECIES ACT OF 1973 5-33
CLEAN WATER ACT – SECTION 404 5-33
EXECUTIVE ORDER 11988 – FLOOD PLAIN MANAGEMENT 5-34
EXECUTIVE ORDER 11990 – PROTECTION OF WETLANDS 5-34
EXECUTIVE ORDER 12898, FEDERAL ACTIONS TO ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW INCOME POPULATIONS 5-34
ADVISORY CIRCULAR 150-5200-33 – HAZARDOUS WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS 5-35
*** ECONOMIC ANALYSIS 5-37**
COST ANALYSIS 5-37
PROJECTED FIRST COST 5-37
ANNUALIZED COST 5-37
ECONOMIC SUMMARY 5-38
Socioeconomic Effect of the Recommended Plan 5-43
PROJECT COST SHARING 5-44
FLOOD CONTROL 5-44
ECOSYSTEM RESTORATION 5-44
RECREATIONAL DEVELOPMENT 5-44
MONITORING AND ADAPTIVE MANAGEMENT 5-44
OPERATION, MAINTENANCE, REPAIR, REHABILITATION, AND REPLACEMENT 5-45
DIVISION OF PLAN RESPONSIBILITIES 5-46
IMPLEMENTATION SCHEDULE AND EXPENDITURE SCHEDULE 5-46
COST APPORTIONMENT 5-46
NON-FEDERAL RESPONSIBILITIES (ITEMS OF LOCAL COOPERATION) 5-50
FULLY FUNDED COST ESTIMATE 5-54

Description **Page**

FINANCIAL ANALYSIS 5-55
NON-FEDERAL FINANCIAL PLANNING 5-60
ABILITY-TO PAY ANALYSIS 5-61

*** CHAPTER 6: FINAL RECOMMENDED PLAN**
FINAL RECOMMENDED PLAN FEATURES 6-1
TIMBER CREEK 6-1
ONION CREEK FOREST/YARRABEE BEND 6-1
WILLIAMSON CREEK 6-1
ENVIRONMENTAL EFFECTS OF THE FINAL RECOMMENDED PLAN 6-1
ENVIRONMENTAL COMPLIANCE 6-1
ENDANGERED SPECIES ACT OF 1973 6-2
CLEAN WATER ACT – SECTION 404 6-2
EXECUTIVE ORDER 11988 – FLOOD PLAIN MANAGEMENT 6-2
EXECUTIVE ORDER 11990 – PROTECTION OF WETLANDS 6-2
EXECUTIVE ORDER 12898, FEDERAL ACTIONS TO 6-2
ADDRESS ENVIRONMENTAL JUSTICE IN MINORITY
POPULATIONS AND LOW INCOME POPULATIONS
ADVISORY CIRCULAR 150-5200-33 – HAZARDOUS 6-3
WILDLIFE ATTRACTANTS ON OR NEAR AIRPORTS
SECTION 106 COMPLIANCE 6-3
ECONOMIC ANALYSIS 6-6
UPDATED ECONOMICS 6-6
COST APPORTIONMENT 6-6
NON-FEDERAL RESPONSIBILITIES 6-8
(ITEMS OF LOCAL COOPERATION)
FULLY FUNDED COST ESTIMATE 6-8

*** CHAPTER 7: PUBLIC INVOLVEMENT, REVIEW AND CONSULTATION**
PUBLIC INVOLVEMENT 6-1
PURPOSE OF PROGRAM 6-1
PARTICIPANTS 6-1
PUBLIC WORKSHOPS 6-1
PUBLIC REVIEW 6-3
AGENCY COORDINATION 6-3
COMMENTS AND RESPONSES 6-5

CHAPTER 8: LIST OF PREPARERS

CHAPTER 9: DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

APPENDICES

Appendix

***A**	**Economics**
***B**	**Environmental**
***C**	**Cultural**
***D**	**USFWS Coordination Act Report**
***E**	**Real Estate Plan**
***F**	**Recreation**
***G**	**Engineering**
***H**	**Correspondence**

FIGURES

FIGURE NO.	TITLE	PAGE
2-1	Onion Creek Watershed Location Map	2-3
2-2	Designated Areas of Interest	2-4
2-3	Regional Recreation Resources – 100 Mile Radius from Austin	2-19
2-4	City Of Austin Planning Regions	2-21
2-5	City Of Austin Parks and Preserves	2-23
3-1	1998 Flood in Heartwood Edition	3-2
3-2	1998 Flood Event in Radam Showing Extensive Content Damage	3-3
3-3	2001 Flood Event in Timber Creek	3-3
3-5	Economic Reaches	Back of Chapter 3
3-6A	Onion Creek Depth of Flooding Timber Creek – 25-yr	Back of Chapter 3
3-6B	Onion Creek Depth of Flooding Timber Creek – 100-yr	Back of Chapter 3
3-7A	Onion Creek Depth of Flooding Yarrabee – 25-yr	Back of Chapter 3
3-7B	Onion Creek Depth of Flooding Yarrabee – 100-yr	Back of Chapter 3
3-8B	B/O Confluence Depth of Flooding – 100-yr	Back of Chapter 3
3-9A	Williamson Creek Depth of Flooding Heartwood – 25-yr	Back of Chapter 3
3-9B	Williamson Creek Depth of Flooding Heartwood – 100-yr	Back of Chapter 3
3-10A	Williamson Creek Depth of Flooding Radam – 25-yr	Back of Chapter 3
3-11B	Williamson Creek Depth of Flooding Broken Bow – 100-yr	Back of Chapter 3
4-1	Timber Creek Current Property Ownership Status	Back of Chapter 4
4-2	Onion Creek Forest/Yarrabee Bend, Phase I Permanent Evacuation Plan	Back of Chapter 4
4-3	Bluff Springs Road/Perkins Valley, Phase I Permanent Evacuation Plan	Back of Chapter 4
4-4	Onion Creek Subdivision, Phase I Permanent Evacuation Plan	Back of Chapter 4
4-5	Bear/Onion Confluence, Phase I Permanent Evacuation Plan	Back of Chapter 4
4-6	Timber Creek, Phase I Structural Plan	Back of Chapter 4
4-7	Onion Creek Forest/Yarrabee Bend, Phase I Structural Plan	Back of Chapter 4
4-8	Bluff Springs Road/Perkins Valley, Phase I Structural Plan	Back of Chapter 4
4-9	Onion Creek Subdivision, Phase I Structural Plan	Back of Chapter 4

FIGURES

FIGURE NO.	TITLE	PAGE
4-10	Bear/Onion Confluence, Phase I Structural Plan	Back of Chapter 4
4-11	Williamson Creek, Phase I 25-year Floodplain Heartwood Reach	Back of Chapter 4
4-12	Williamson Creek, Phase I 25-year Floodplain Radam/Salem Walk Reach	Back of Chapter 4
4-13	Williamson Creek, Phase I 25-year Floodplain Broken Bow/Buckskin Reach	Back of Chapter 4
4-14	Williamson Creek, Phase I 25-year Floodplain Bayton Loop Reach	Back of Chapter 4
4-15	Onion Creek IFS, Phase IIA Regional Detention Alternative	Back of Chapter 4
4-16	Timber Creek, Phase IIA Non-Structural Combined Plan	Back of Chapter 4
4-17	Onion Creek Forest/Yarrabee Bend, Phase IIA Combined Plan A (4%) Structures to be Acquired	Back of Chapter 4
4-18	Onion Creek Forest/Yarrabee Bend, Phase IIA Combined Plan A (4%) Conceptual Recreation Plan	Back of Chapter 4
4-19	Onion Creek Forest/Yarrabee Bend, Phase IIA Combined Plan B (1%) Conceptual Recreation Plan	Back of Chapter 4
4-20	Bear/Onion Confluence, Phase IIA Combined Plan	Back of Chapter 4
4-21B	Williamson Creek, Phase IIA Plan A Radam Reach	Back of Chapter 4
4-21C	Williamson Creek, Phase IIA Plan A Broken Bow Reach	Back of Chapter 4
4-21D	Williamson Creek, Phase IIA Plan A Bayton Loop Reach	Back of Chapter 4
4-22A	Williamson Creek, Phase IIA Plan B Heartwood Reach	Back of Chapter 4
4-22B	Williamson Creek, Phase IIA Plan B Radam Reach	Back of Chapter 4
4-22C	Williamson Creek, Phase IIA Plan B Broken Bow Reach	Back of Chapter 4
4-22D	Williamson Creek, Phase IIA Plan B Bayton Loop Reach	Back of Chapter 4
4-23A	Williamson Creek, Phase IIA Plan C Heartwood Reach	Back of Chapter 4
4-23B	Williamson Creek, Phase IIA Plan C Radam Reach	Back of Chapter 4
4-23C	Williamson Creek, Phase IIA Plan C Broken Bow Reach	Back of Chapter 4
4-23D	Williamson Creek, Phase IIA Plan C Bayton Loop Reach	Back of Chapter 4
4-24	Omitted	Back of Chapter 4
4-25A	Williamson Creek, Phase IIA Structural Combined Plan Heartwood Reach	Back of Chapter 4
4-25B	Williamson Creek, Phase IIA Structural Combined Plan Radam Reach	Back of Chapter 4

FIGURES

FIGURE NO.	TITLE	PAGE
4-25C	Williamson Creek, Phase IIA Structural Combined Plan Broken Bow Reach	Back of Chapter 4
4-25D	Williamson Creek, Phase IIA Structural Combined Plan Bayton Loop Reach	Back of Chapter 4
4-26A	Williamson Creek, Phase IIA Non-Structural Combined Plan	Back of Chapter 4
4-26B	Williamson Creek, Phase IIA Non-Structural Combined Plan	Back of Chapter 4
4-26C	Williamson Creek, Phase IIA Non-Structural Combined Plan	Back of Chapter 4
4-26D	Williamson Creek, Phase IIA Non-Structural Combined Plan	Back of Chapter 4
5-1	Timber Creek Current Property Ownership Status	Back of Chapter 5
5-2	Recommended Plan, Timber Creek	Back of Chapter 5
5-3	Timber Creek Recommended Ecosystem Restoration Plan	Back of Chapter 5
5-4	Onion Creek Forest/Yarrabee Bend, Recommended Buyout	Back of Chapter 5
5-5	Onion Creek Forest/Yarrabee Bend, Recommended Conceptual Recreation Plan	Back of Chapter 5
5-6	Onion Creek Forest/Yarrabee Bend, Recommended Ecosystem Restoration Plan	Back of Chapter 5
5-7A	Williamson Creek, Recommended Benching Plan Heartwood Reach	Back of Chapter 5
5-7B	Williamson Creek, Recommended Benching Plan Radam Reach	Back of Chapter 5
5-7C	Williamson Creek, Recommended Benching Plan Broken Bow Reach	Back of Chapter 5
5-7D	Williamson Creek, Recommended Benching Plan Bayton Loop Reach	Back of Chapter 5
5-8A	Williamson Creek, Recommended ER Plan Heartwood Reach	Back of Chapter 5
5-8B	Williamson Creek, Recommended ER Plan Radam Reach	Back of Chapter 5
5-8C	Williamson Creek, Recommended ER Plan Broken Bow Reach	Back of Chapter 5
5-8D	Williamson Creek, Recommended ER Plan Bayton Loop Reach	Back of Chapter 5
5-9	Williamson Creek Mitigation Area	Back of Chapter 5

TABLES

TABLES NO.	TITLE	PAGE
2-1	Onion Creek Interim Feasibility Study Areas of Interest	2-1
2-2	Land Use Classification	2-5
2-3	Regional Demographics Statistics	2-7
2-4	Federally Listed T&E Species That Could Occur In the Study Area	2-12
2-5	Barton Springs Edwards Aquifer Recharge	2-15
2-6	Regional Recreation Resources – 100 Mile Radius from Austin	2-20
2-7	City Of Austin's Park Types	2-22
2-8	Parks within 5 Miles of Timber Creek	2-25
2-9	Parks within 5 Miles Of Onion Creek Forest/Yarrabee Bend	2-26
2-9	Continued Parks within 5 Miles of Onion Creek Forest/Yarrabee Bend	2-27
2-10	Parks within 5 Miles of Bluff Springs Area	2-28
2-10	Continued Parks within 5 Miles of Bluff Springs Area	2-29
2-11	Parks within 5 Miles of Onion Creek Subdivision	2-30
2-11	Continued Parks within 5 Miles of Onion Creek Subdivision	2-31
2-12	Parks within 5 Miles of Bear/Onion Confluence Site	2-32
2-13	Williamson Creek Area – Parks Within Vicinity (5 Mile Radius)	2-33
2-13	Continued Williamson Creek Area – Parks within Vicinity (5 Mile Radius)	2-34
2-13	Continued Williamson Creek Area – Parks within Vicinity (5 Mile Radius)	2-35
2-13	Continued Williamson Creek Area – Parks within Vicinity (5 Mile Radius)	2-36
3-1	Probabilities of Flood Events	3-1
3-2	Summary of Historic Flood Events	3-2
3-2	Areas of Interest	3-5
3-4	Floodplain Investment: Structures And Contents Onion Creek	3-7
3-5	Floodplain Investment: Structures And Contents Williamson Creek	3-8
3-6	Total Single Event and Expected Annual Damages – Onion Creek Onion Creek Reaches	3-9
3-6	Continued Total Single Event and Expected Annual Damages – Onion Creek Onion Creek Reaches	3-10
3-7	Total Single Event and Expected Annual Damages – Williamson Creek	3-11
3-10	Existing Habitat Suitability Indices and Habitat Units	3-13

TABLES

TABLES NO.	TITLE	PAGE
4-1	Williamson Creek Number of Structures And Investment For 4% Ace Preliminary Buy-Out	4-14
4-2	Williamson Creek Phase I Preliminary Analysis Summary of Costs and Benefits by Sub-Reach	4-19
4-3	Phase I Preliminary Analysis Summary of Flood Damage Identified For Detailed Investigations	4-20
4-4	Existing Conditions and Future Without Project Existing Cover Type Habitat Suitability Indices and Habitat Units by Areas of Interest	4-23
4-4	Continued Existing Conditions and Future Without Project Existing Cover Type Habitat Suitability Indices and Habitat Units by Area of Interest	4-24
4-5	Summary of Incremental Analysis	4-30
4-6	Timber Creek Summary of Costs for Combination Plan	4-34
4-7	Timber Creek Benefit Computations for Combination Plan	4-35
4-8	Phase IIa Alternatives Analysis Onion Creek Forest/Yarrabee Bend Summary of Costs and Benefits for Various Diversions	4-37
4-9	Onion Creek Forest/Yarrabee Bend Summary Of Costs for Combination Plan A	4-40
4-10	Detailed Alternative Analysis Onion Creek Forest/Yarrabee Bend Benefit-Cost for Combination Plan A (4%) (Excluding Ecosystem Restoration)	4-41
4-11	Onion Creek Forest/Yarrabee Bend Benefit-Cost for Combination Plan B (1% Ace)	4-44
4-12	Detailed Alternative Analysis Onion Creek Forest/Yarrabee Bend Summary of Costs for Combination Plan B (1% Ace)	4-45
4-13	Detailed Alternative Analysis Bear/Onion Confluence Permanent Evacuation 4% Ace Stand Alone	4-47
4-14	Detailed Alternative Analysis Bear/Onion Confluence Permanent Evacuation 4% Ace	4-47
4-15	Detailed Alternative Analysis Bear/Onion Confluence Annual Ecosystem Restoration Costs Before Scrb	4-49
4-16	Bear/Onion Confluence Cost Allocation For Combination Plan Separable Costs Remaining Benefits Method	4-49
4-17	Williamson Creek Net Annual Benefits Standalone Structural Plans by Reach	4-53
4-18	Detailed Alternative Analysis Williamson Creek Standalone Structural Plan Summary of Costs	4-53
4-19	Detailed Alternative Analysis Williamson Creek Standalone Structural Plan Benefit-Cost	4-54
4-20	Detailed Alternative Analysis Williamson Creek Combined Structural Plan Summary of Costs	4-56
4-21	Williamson Creek Cost Allocation for Combined Structural Plan	4-57

TABLES

TABLES NO.	TITLE	PAGE
4-22	Detailed Alternative Analysis Williamson Creek Combined Non-Structural Plan Summary of Costs	4-59
4-23	Williamson Creek Cost Allocation for Non-Structural Combined Plan	4-60
4-24	Summarized Final Array of Detailed Alternatives Grouped By Area of Interest	4-62
4-25	Cost Apportionment –Tentatively Selected Plan	4-65
5-1	Pertinent Data Tentatively Selected Plan Timber Creek	5-2
5-2	Pertinent Data Tentatively Selected Plan Onion Creek Forest/Yarrabee Bend	5-4
5-3	Bear/Onion Confluence Separable Cost Remaining Benefits Analysis	5-5
5-4	Proposed Excavation by Reach	5-6
5-5	Pertinent Data Tentatively Selected Williamson Creek	5-7
5-6	Pertinent Data Tentatively Selected Plan	5-8
5-7	Species Listed In Bird Conservation Region 20	5-13
5-8	Acres of Vegetation on Onion Creek To Be Restored As Riparian Woodlands	5-17
5-9	Acres of Vegetation on Williamson Creek To Be Restored As Riparian Woodlands	5-17
5-10	Acres of Impacted Vegetation on Williamson Creek From Implementation of the Tentatively Selected Plan	5-17
5-11	Future With and Without Project AAHU for the Tentatively Selected	5-18
5-12	Average Daily Noise Exposure Levels (8-Hour Twa) Of Heavy Equipment Operators and Associated Laborers in Dba	5-25
5-13	Relationship of Plan to Environmental Protection Statutes and Other Environmental Requirements	5-36
5-14	Equivalent Annual Damages	5-37
5-15	Cost Estimate Summary for the Tentatively Selected Plan	5-38
5-16	Economic Summary of the Tentatively Selected Timber Creek	5-39
5-17	Economic Summary of the Tentatively Selected Onion Creek Forest/Yarrabee Bend	5-40
5-18	Economic Summary of the Tentatively Selected Plan Williamson Creek	5-41
5-19	Economic Summary Total Tentatively Selected Plan	5-42
5-20	Economic Summary of the Ecosystem Restoration	5-43
5-21	Estimated Cost of Adaptive Management	5-43
5-22	Breakdown of OMRR&R Costs for the Recommended Plan	5-46
5-23	Cost Apportionment for the Tentatively Selected Plan Timber Creek	5-47
5-24	Cost Apportionment for the Tentatively Selected Plan Onion Creek Forest/Yarrabee Bend	5-48
5-25	Cost Apportionment for the Tentatively Selected Plan Williamson Creek	5-49

TABLES

TABLES NO.	TITLE	PAGE
5-26	Cost Apportionment for the Total Tentatively Selected Plan	5-50
5-27	Fully Funded Cost Estimate for the Tentatively Selected Plan	5-54
5-28	Financial Indicator Rating Key	5-56
5-29	Current Community Financial Indicator Values For The City Of Austin	5-57
5-30	Current Community Financial Indicator Values For Travis County	5-58
5-31	City Of Austin Summary of Financial Capability	5-59
5-32	Travis County Summary of Financial Capability	5-60
6-1	Relationship of Plan to Environmental Protection Statutes And Other Environmental Requirements	6-5
6-2	Cost Estimate Summary for the Recommended Plan	6-6
6-3	Economic Summary, Total Recommended Plan	6-7
6-4	Cost Apportionment for the Recommended Plan	6-8
6-5	Fully Funded Cost Estimate for the Recommended Plan	6-8
8-1	List of Preparers	8-1

Note: This report includes an integrated environmental assessment (EA) within the report text; paragraphs required for compliance with the National Environmental Policy Act (NEPA) are noted by an asterisk (*) in the Table of Contents.