APPENDIX H
MONITORING AND ADAPTIVE MANAGEMENT PLAN

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MODIFED DALLAS FLOODWAY PROJECT
MONITORING AND ADAPTIVE MANAGEMENT PLAN

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Acronyms and Abbreviations

ARMP	Aquatic Resources Management Plan
BVP	Balanced Vision Plan
IBI	index (or indices) of biotic integrity
MAMT	Monitoring and Adaptive Management Team
MDFP	Modified Dallas Floodway Project
PAR	Planning Aid Report
PED	pre-construction, engineering and design
TPWD	Texas Parks and Wildlife Department
TXRAM	Texas Rapid Assessment Method
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service

1.0 OVERVIEW

1.1 MODIFIED DALLAS FLOODWAY PROJECT

The Modified Dallas Floodway Project (MDFP) is a flood risk management and ecosystem restoration project that would result in functional lifts of bottomland hardwood, emergent wetland, and aquatic riverine habitat quality. Based on habitat assessments conducted by United States Fish and Wildlife Service (USFWS), Texas Parks and Wildlife Department (TPWD), and United States Army Corps of Engineers (USACE) staff, the future with project conditions would result in an increase of 269 to 290 habitat units upon maturation of the habitat features (see Appendix F in USACE 2014a). Because there is an ecological lift in habitat quality for all the habitat types of concern, no habitat mitigation is required for this plan.

A Phase II presence/absence mussel survey has identified eleven mussel species utilizing riverine habitats within the study area, including the state threatened Texas pigtoe (*Fusconaia askewi*). To avoid and/or minimize adverse impacts to mussels and other sensitive aquatic resources during construction of the realigned river channel, development of an Aquatic Resources Management Plan (ARMP) has been initiated in consultation with the USFWS, TPWD, and the City of Dallas. The focus of the ARMP is on avoidance and minimization, including measures such as limiting disturbance to the river channel in those locations where the new and old channel alignments overlap and leaving cut off segments of the river channel to serve as mussel and aquatic species refugia sites during construction. Due to challenges associated with project site conditions, efforts to relocate mussels and other sensitive aquatic resources during dewatering of the river will be limited in scope and cost.

Baseline fisheries surveys within the study area indicate that the diversity of fish species in Trinity River and existing floodway ponds is high and that the same fish species are also located in both upstream and downstream river reaches. Similarly, as noted above, surveys indicate that at least eleven mussel species are utilizing the riverine habitats within the study area and in the upstream Elm Fork reach of the Trinity River. It is anticipated that upon construction completion of the realigned river channel segments, the same aquatic species that occur currently will repopulate the modified river channel. To verify this assumption, the ARMP calls for aquatic species population and community monitoring after project completion, as applicable.

1.2 BALANCED VISION PLAN

Implementation of the remaining, non-federal elements of the Balanced Vision Plan (BVP) would result in the physical loss of between 58.31 acres and 82.41 acres of wetland habitat that is not included in the MDFP for the Proposed Action with either of the Parkway or no Parkway design variations, respectively. The City of Dallas is the proponent for these elements and would be responsible for 100% of the costs of implementation of these features and any subsequent mitigation requirements. It has been determined that the City of Dallas will purchase credits from an appropriate regional wetland mitigation bank to ensure no net loss of acreage or function resulting from implementation of the non-Federal elements identified in the BVP.

2.0 INTRODUCTION

This document outlines the feasibility level Monitoring and Adaptive Management Plan for the MDFP Study Ecosystem Restoration and Habitat Enhancement within the Dallas Floodway Project. This plan

identifies and describes the monitoring and adaptive management activities proposed for the Proposed Action and duration. This plan will be further refined in the pre-construction, engineering, and design (PED) phase as specific design details are made available.

This MDFP Monitoring and Adaptive Management Plan describes and justifies that monitoring and adaptive management needed under the alternatives identified in the Feasibility Report (USACE 2014a) prepared for the Dallas Floodway Project. The plan outlines how the results of the project-specific monitoring program would be used to adaptively manage the project, including specification of conditions that will define project success.

The primary intent of this Monitoring and Adaptive Management Plan is to develop monitoring and adaptive management actions appropriate for the project's restoration goals and objectives. The presently identified management actions permit estimation of the adaptive management program costs and duration for the MDFP. This plan is based on currently available data and information developed during the Feasibility Study (USACE 20014a), USFWS Planning Aid Report (PAR) and Fish and Wildlife Coordination Act Letter (see Appendix G in USACE 2014), and the 404(b)(1) analysis (see Appendix L in USACE 2014b).

Uncertainties remain regarding the exact project features details. Components of the Monitoring and Adaptive Management Plan were estimated using currently available information. Uncertainties will be further refined in PED, and additional detail regarding monitoring and adaptive management activities may be added, as appropriate, along with a more refined cost breakdown.

3.0 AUTHORITY AND PURPOSE

Proposed actions including ecosystem restoration are required to include a plan for monitoring the success of the restoration (Section 2039, Water Resources Development Act of 2007): "*Monitoring includes the systematic collection and analysis of data that provides information useful for assessing project performance, determining whether ecological success has been achieved, or whether adaptive management may be needed to attain project benefits*." Section 2039 also directs that a Contingency Plan (Adaptive Management Plan) be developed for all ecosystem restoration projects.

4.0 PROJECT GOALS AND OBJECTIVES

The City of Dallas' overall goal is to create an environment that brings residents and development closer to a healthier TRC without diminishing the long-term effectiveness of the Dallas Floodway Project.

The objectives prepared during the course of developing the BVP by the City of Dallas results in diverse and potentially conflicting objectives of:

- Providing improved flood risk management for the full length of the TRC in a way that also allows for the achievement of environmental, recreational, mobility, and economic goals;
- Implementing environmental responsibility, restoration, and proper management initiatives in the midst of an urban setting;
- Creating a recreation and urban open space amenity that does not interfere with vehicular traffic or periodic floodwaters;
- Meeting stated regional transportation goals in a way that supports economic development and air quality improvement; and

- Creating community and economic opportunities for the neighborhoods bordering the Trinity River and thus, forming the centerpiece for a major urban region (December 2003, amended March 2004).

While the City of Dallas had broad goals for the entire TRC, the Corps is somewhat limited to determining what combination of the BVP and IDP Projects best align with Corps missions and objectives for recommending the Modified Dallas Floodway Project under Section 5141 of WRDA 2007. The overarching Corps goal is to improve the existing Dallas Floodway Project and ensure the flood risk function of the project. The following are objectives to address the problems and opportunities identified in the previous section for both the Section 5141 of WRDA 2007 and Comprehensive Analysis:

- Ensure the reliability and integrity of the current infrastructure and improve the functioning to further reduce residual flood risk to property while promoting life safety for the Dallas Floodway Project over a 50-year period of analysis.
- Reduce the risk of flooding due to interior drainage.
- Restore to the extent possible the aquatic and riparian ecosystem of the Trinity River within the boundaries of the Dallas Floodway Project over a 50-year period of analysis.
- Review the recreation, transportation, and other local features so ensure they meet Corps engineering and safety standards and are compatible with the MDFP by not impacting the functioning or integrity of the system.

4.1 MODIFIED DALLAS FLOODWAY PROJECT

4.1.1 Management and Restoration Actions

The Proposed Action is described in detail in Chapter 4 of the Dallas Floodway Project Feasibility Report (USACE 2014a) and Chapter 2 of the Dallas Floodway Project Environmental Impact Statement (USACE 2014b). The MDFP Ecosystem Restoration and Habitat Enhancement components include the modification to the course of the Trinity River, the restoration of native herbaceous species in riparian understory and grassland habitats in limited areas associated with the river realignment, and the construction of and/or improvements to approximately 84 acres of emergent wetlands and 25 acres of bottomland hardwoods (Table 1).

Table 1. Modified Dallas Floodway Project Ecosystem Restoration Components

Restoration Component		*Habitat Type*	*Acres of Habitat*
River	Realignment and Modification	Aquatic Riverine	201
Wetlands	Corinth Wetlands	Emergent Wetland	84
Bottomland Hardwood	Bottomland Hardwood	Bottomland Hardwood	25

A description of the ecosystem components follows below.

4.1.1.1 River Modification

Past channelization and clearing of the Floodway, along with urbanization, has significantly degraded the natural terrestrial and aquatic habitat of the Floodway. The Trinity River now reflects little of its historic course, water quality, or habitat. Prior to the 1920s, the Trinity River's course through the City of Dallas included significant meandering consistent with a river of its geologic age. The construction of the Dallas

Floodway Levee System essentially eliminated these meanders, and with it, high-value habitat and connections to adjacent ecosystems (USACE 2000).

Aquatic habitat in the Dallas Floodway area is limited as most of this reach of the Trinity River flows through a constructed channel. The banks are denuded and contain sparse vegetation. The sediment consists of slippery, clayey mud to fine sand. Bridge supports, concrete blocks, undercut banks, channel snags, and channel bed shape irregularities all provide limited aquatic habitat in the form of shelter, feeding zones, invertebrate colonization sites, and nursery pools (USACE 2000).

A major ecosystem restoration feature proposed by the MDFP is the creation of sinuosity (i.e., bends) in the main channel of the river, with the goal of creating a more "natural" river. Approximately 8 miles of river channel would be realigned, from the confluence of the West and Elm Forks of the Trinity River downstream to the Dallas Area Rapid Transit Rail Bridge. While the existing channel pattern and channel profile would be altered substantially, the intent is to preserve the existing average slope of the channel profile while mimicking historical conditions.

The realigned river channel would encompass approximately 200 acres of aquatic riverine habitat and have a stable channel pattern that would avoid encroaching within 200 feet of where the toe of the levee would be upon completion of the proposed 4:1 widening. The channel pattern would be offset from other MDFP features by a distance sufficient to allow channel adjustments to occur without impacting other features over the life of the project. Where this is not possible, the channel would be strengthened, using bioengineering approaches that incorporate native vegetation and other natural materials.

To minimize the extent of channel bank armoring required in the channel realignment design, the channel pattern would be offset from all sensitive MDFP features by the maximum migration corridor width described in the Geomorphic Assessment and Basis of Design document (City of Dallas 2009a). Terrace elevations would be set in relation to water surface elevations at effective flow frequencies, with stable slopes given local hydraulic, geotechnical, and vegetation conditions, and would include adequate terrace drainage. Landscape terrace elevations would be constructed to provide river access and views with safe and accessible slopes.

River terraces would be constructed along the banks of the realigned Trinity River and are intended to provide the functions and values of forested wetlands. This would be achieved by designing the river terraces to be graded to an elevation that would be completely inundated by river flows for at least 10 consecutive days during the growing season (i.e., from February 22 to December 11) for greater than 50% of the years (e.g., greater than 25 years out of 50 years). These areas would also be designed to include appropriate soil requirements to meet the proposed wetland conditions and planted with wetland plants considered typical for natural forested wetlands within the vicinity of the study area. Lower elevation (i.e., at or below the base flow water surface elevation) terraces would not be vegetated as frequent inundation would not support vegetation. Conversely, the landscape terraces set at a higher elevation would be vegetated. Species, locations, and planting density on higher geomorphic terraces and landscape terraces would be based on local inundation frequency, hydraulics, geotechnical conditions, channel roughness requirements and orientation of the terrace to the river channel and other project features.

River slopes would be designed based on local hydraulic conditions, maximum water force during high flows, local geotechnical conditions, proximity to other MDFP features, and existing or proposed vegetation. Typical bank slopes would be designed for river reaches with similar conditions and would extend the length of a given reach. Transitions between different bank types would be designed to withstand hydraulic discontinuities and changes in water levels and energy.

The final design of all river modification features would satisfy all applicable standards for channel modifications within the Floodway. These include, but are not limited to, requirements of USACE, the City of Dallas, and Texas Commission on Environmental Quality.

4.1.1.2 Corinth Wetlands

A small element of these emergent wetlands already exist in part at the southeast edge of the project, just before the Trinity River flows into the Great Trinity Forest, but are of poor habitat quality. Under the BVP Component, there would be two separate wetlands (one on the "island" between the Trinity River and Oxbow Lake and one between the Trinity River and West Levee) that would be enhanced/restored through grading and planting with native North Texas wetland species in appropriate numbers and diversity (as identified in City of Dallas 2009b). These areas would be inundated when flow in the Trinity River reaches 15,000 cubic feet per second (correlating to an approximately 1.5 year return interval). The two wetlands would account for a total of approximately 84 acres of emergent wetlands. Locally available sedges, water-willow (*Justicia americana*), softstem bulrush (*Schoenoplectus tabernaemontani*), water pennywort (*Hydrocotyle umbellata*), switchgrass, smartweeds (*Polygonum* sp.), and buttonbush (*Cephalanthus occidentalis*) will be planted.

4.1.1.3 Bottomland Hardwoods

Bottomland hardwoods are areas dominated by deciduous trees, usually along streams, and that are occasionally flooded. Depending on the frequency of flooding, bottomland hardwood may be riparian or forested wetland habitat. In optimum conditions, this cover type provides food, cover, nesting habitat, and living space to riparian forest dependent species. Large trees provide important nesting habitat and escape cover for birds and other animals within the Floodway. Large mast producing trees and shrubs provide food for forages. Brush piles and snags provide necessary food, cover, and shelter for a variety of species. Riparian forest habitats are essential in maintaining biodiversity and providing important wildlife travel corridors. The majority of the bottomland hardwoods would be planted along the Floodway near the new Trinity River Channel. Native mast producing trees and shrubs, such as pecan (*Carya illinoinensis*), bur oak (*Quercus macrocarpa*), black walnut (*Juglans nigra*), wild plum (*Prunus mexicana*), sumac (*Rhus* sp.), and Texas hawthorne (*Crataegus texana*) should be planted in the expanded portion of the bottomland hardwoods to improve canopy cover and food base for native wildlife. The bottomland hardwood habitat type includes the forested wetland restoration on the 15 river terraces accounting for 25 acres of forested wetlands.

4.1.2 Implementation

Pre-construction, construction, and post construction monitoring would be conducted by utilizing a Monitoring and Adaptive Management Team (MAMT) consisting of representatives of the USACE, City of Dallas, and contracted personnel.

Monitoring will focus on evaluating project success and guiding adaptive management actions by determining if the project has met Performance Standards identified below. Performance Standards are the criteria that any proposed restoration or enhancement must meet to be considered successful. Validation monitoring will involve various degrees of quantitative monitoring aimed at verifying that restoration objectives have been achieved for both biological and physical resources. Effectiveness monitoring will be implemented to confirm that project construction elements perform as designed. Monitoring will be carried out until the project has been determined to be successful (performance standards have been met).

Habitat quality monitoring objectives are tied to original baseline measurements that were performed for emergent wetlands, bottomland hardwoods, and grasslands during USFWS Habitat Evaluation Procedure surveys from 2004 to 2006. These data are included in the 2014 PAR (see Appendix G of the Feasibility Report [USFWS 2014a]).

Wetland monitoring will also include Texas Rapid Assessment Method (TXRAM) evaluations (refer to the 404(b)(1) in Appendix L of the EIS [USACE 2014b]). A functional assessment for Regulatory Program needs (i.e., TXRAM) was applied to assess these features and generated TXRAM scores ranging from 53 to 61 for emergent wetlands in the Floodway (Halff Associates 2011). These scores reflect the baseline conditions of the existing wetlands to be restored, enhanced, or relocated. Existing wetlands exhibit poor hydrologic connectivity, limited buffers, and the topographic and vegetative simplicity and homogeneity. These conditions limit the value of emergent wetlands to wildlife.

Aquatic riverine baseline data was extrapolated from 2004 Assessment of Trinity River Fisheries within the Proposed Dallas Flood Control Project Area Index of Biotic Integrity (IBI) (USFWS 2014a). Open water baseline surveys were conducted in 2010 and are included in the Lentic (open water) IBI (see 2014 PAR in Appendix G of the Feasibility Report [USFWS 2014a]).

Adaptive management measures will be considered upon the first instance of failure to meet a performance standard. Performance standards are included in Sections 4.1.2.1 and 4.1.2.2. Metrics and specific adaptive measure triggers may be refined during PED.

Due to the stochastic variability of environmental factors affecting the successful implementation of the proposed restoration measures, establishing a firm target year for successfully attaining the restoration performance standards is problematic. Assuming restoration activities occur under average climatic conditions, performance standards should be satisfied in three to ten years. The reason for the extension of the performance standards timeframe beyond the “normal” five year time period is due to the phasing of the river realignment construction with the associated river terraces. The successful establishment of bottomland hardwood species requires at least five years of monitoring due to their slow growth and development. As noted above, restoration of the bottomland hardwood habitat type is dependent on the construction of the river terraces as an element of the river realignment activities. As currently planned, the river relocation activities would be implemented in three phases, consisting of 2 to 3 mile long segments. Each of these three phases would begin and end at an intersection with the existing channel. The proposed river relocation activities are anticipated to last approximately 3 years. But because there are being built by segments, it is imperative that planting of a herbaceous layer begin immediately upon completion of each segment in order to stabilize the disturbed soils and minimize erosion, which is especially critical in a area prone to flooding. The woody component, i.e. trees and shrubs, would not be planted until there is successful establishment of the herbaceous layer so that extends initial tree planting to year 2 post construction for each river realignment segment. Table 2 below presents a graphic representation of project and monitoring phasing, thereby showing why an extended period for project monitoring and adaptive management will be required for the MDFP. As the performance standards in an area are achieved, the O&M phase of the project would begin and monitoring and adaptive management costs for that area would not be further expended.

Table 2. Monitoring Period for Bottomland Hardwood Establishment

River Segments	*Monitoring Period – Post Construction Phase**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
One	Herbaceous vegetation monitoring & planting of BH species	BH monitoring – year one	BH monitoring – year two	BH monitoring – year three	BH monitoring – year 4	BH monitoring – year 5 (complete)		
Two		Herbaceous vegetation monitoring & planting of BH species	BH monitoring – year one	BH monitoring – year two	BH monitoring – year three	BH monitoring – year 4	BH monitoring – year 5 (complete)	
Three			Herbaceous vegetation monitoring & planting of BH species	BH monitoring – year one	BH monitoring – year two	BH monitoring – year three	BH monitoring – year 4	BH monitoring – year 5 (complete)

Note: *Construction phase is assumed to include initial establishment of herbaceous vegetation over a one year period of time.

In addition to the 8 year monitoring period required for bottomland hardwoods, the District would like to reserve the potential for extending the monitoring and adaptive management phase for this project by an additional two years for a total of ten years to have the chance to be able to monitor the results of any adaptive management changes made the later monitoring years of River Segment 3.

4.1.2.1 Vegetation

Metrics compiled during PAR surveys will be used for baseline vegetation data. Table 3 presents the vegetation monitoring criteria (i.e., the criterion being measured), performance standards for that criterion, and adaptive management strategies available for meeting those performance standards. In addition the frequency and duration of adequate hydrology must be documented and soils investigated for evidence of redoximorphic features as well as soil color, texture, etc. Data collection and analysis must be accomplished by a qualified individual proficient in wetland delineation and functional assessment techniques with conclusions discussed in each report.

Table 3. Success Criteria and Adaptive Management Techniques for Habitat Restoration

Measurement	*Performance Standard*	*Adaptive Management*
Aquatic Riverine		
Non-native invasive species	< 10% canopy cover of non-native species at a sampling point; and no areas > 0.25 acres in size with > 10% non-native or noxious weed species after 5 years	Chemical and mechanical removal; integrated pest management; biological control
Emergent Wetlands		
Aquatic and emergent vegetation	> 50% relative cover by native wetland indicator species (i.e., OBL, FACW, or FAC) after 3 years	Supplemental planting/seeding; modification of plant species composition; amending the soil; alter hydrology
Non-native invasive species	< 10% canopy cover of non-native species at a sampling point; and no areas > 0.25 acres in size with > 10% non-native or noxious weed species after 5 years	Chemical and mechanical removal; integrated pest management; biological control
Bottomland Hardwoods		
Riparian vegetation along the river banks (River terraces).	> 25% tree canopy cover within the river terraces after 10 years.	Supplemental bank planting; modify woody species composition or location; allow natural succession of native woody species that meet the planting criteria; increased irrigation
Woody stem density	150 stems per acre	Replacement of dead woody vegetation; modify woody species composition or location within the assigned habitat category area; allow natural succession of native woody species
Hard mast producing trees	> 75% of the tree species numbers	Replacement of dead woody vegetation, replanting of hard mast producing tree species if percentage is too low
Soft mast producing trees	< 25% of the tree species numbers	Removal of individuals if percentage is too high
Non-native invasive species	No non-native, invasive tree species; < 10% absolute cover of non-native species	Chemical and mechanical removal; integrated pest management; biological control

Random sampling locations distributed throughout the restoration areas will be sampled utilizing methods presented in Table 4. Within each feature, the mean of each metric will be calculated and compared to the performance standard to determine whether adaptive management measures should be considered.

Table 4. Monitoring and Adaptive Management Vegetation Sampling Methodology

Metric	*Methodology*
Relative Percent Cover of Native Wetland Indicator Species	Percent cover estimated by averaging all quadrat sampling plot data. Meter square quadrats to be established along 1-meter by 50-meter transects spaced at 150-meter intervals along the length of the wetland site. Minimum of 3 quadrat sampling plots per transect. Sampling to be done yearly starting year 1 post-planting during middle of growing season.
Emergent Wetlands Non-native invasive species	Species names, numbers and wetland indicator types to be recorded for each quadrat sampled as referenced above.
Tree Canopy Cover	Percent canopy cover estimated by averaging densitometer readings taken while facing in each of the four cardinal directions. Sampling to be done once after year 10 post-planting during the middle of the growing season at 2 sampling sites per acre.
Tree Density, % Hard- and Soft-Mast Species, & % Non-Native Invasive Species	Number and species of trees recorded within a 10 meters by 100 meters transect along the riparian corridor during the middle of the growing season. Transects to be spaced at 100 meter intervals perpendicular to river channel on each BH planted river terrace. Sampling to take place yearly starting at year 2 post-planting.

4.1.2.2 Aquatic Riverine Hydrology

The channel design of the Trinity River is designed to mimic natural stream flow systems with riffle, pool, and run sections where appropriate and processes such as sediment transport, energy dissipation, and channel formation. This design mirrors other C6 stream types in the Trinity watershed as defined by Rosgen (1996). The channel would be constructed with water bodies with shelved floors of variable depths and appropriate substrates such as boulders and cobbles, where possible, to provide adequate habitat cover and spawning conditions. Having a canopy overhang, which would shade the water's edges (i.e. river banks), would improve habitat conditions. Sediment transport, bank erosion, and re-deposition of sediments will be monitored. Table 5 presents the monitoring criteria, performance standards for that criterion, and adaptive management strategies available for meeting the performance standards for the riverine hydrology. The performance standards for sinuosity, width to depth ratio, and the entrenchment ratio (2 X maximum depth/bankfull width) are based on the morphological characteristics of a C6 stream type (Rosgen, 1996). Although significant streambed scour may occur during flooding events, the dynamic nature of the channel should allow sedimentation in the scoured areas during periods of normal and low flows. Therefore, scour chains will be used to assess the equilibrium or imbalance of erosive and sedimentary forces of the river. Monitoring should be conducted at 5 monumented locations within each river realignment section showing upstream, cross section, and downstream views on an annual basis. Assessment of channel stability by a qualified individual is required to be discussed in each monitoring report.

Table 5. Success Criteria and Adaptive Management Techniques for Riverine Habitat Restoration

Measurement	*Performance Standard*	*Adaptive Management*
Sinuosity	> 1.2	Modify bioengineering measures to balance sediment transport and stabilize channel
Width/Depth Ratio	> 12	
Entrenchment Ratio	> 2.2	
Bank Erosion	Net loss of < 5% of terraces as determined by survey and/or bank erosion pins	
Streambed Scour	No net change in aggradation or degradation of streambed as measured by scour chains	

4.1.3 Reporting

For each feature, evaluation of the success of the restoration will be assessed annually until all performance standards are met. Different components of the MDFP will be monitored according to different schedules, in different seasons and with different frequencies as appropriate to the feature of interest. The results, however, will be consolidated in an annual report by the MAMT. The report will be submitted to the USFWS, TPWD, the USACE, City of Dallas, and other interested parties by January 31 following each monitoring year. Permanent locations for photographic documentations will be established within each feature to provide a visual record of habitat development over time. This photographic log will be incorporated into the annual monitoring report.

4.1.4 Monitoring and Adaptive Management Costs

Costs to be incurred during PED and construction phases include creating and implementing a detailed monitoring and adaptive management plan for planting, monitoring, and maintenance of lake, emergent wetland, riparian scrub, and bottomland hardwood vegetation and habitat success standards.

It is intended that monitoring conducted under the Dallas Floodway BVP Study ecosystem restoration and habitat enhancement would utilize centralized data management, data analysis, and reporting functions associated with a SharePoint® site. All data collection activities will follow consistent and standardized processes established in the detailed monitoring and adaptive management plan. Cost estimates will include monitoring equipment, photo point establishment, data collection, quality assurance/quality control, data analysis, assessment, and reporting for the proposed monitoring elements. Unless otherwise noted, costs will begin at the onset of the PED phase and will be budgeted as construction costs. Costs for monitoring and adaptive management associated with project elements that are part of the Federal Recommended Plan are presented in Table 6. Cost calculations for post-construction monitoring for the Federal Recommended Plan are displayed as a ten-year (maximum) total. If ecological success is determined prior to ten years post-construction, the monitoring program will cease and costs will decrease accordingly. The current total estimate for implementing the monitoring and adaptive management plan for the Federal Recommended Plan is approximately $3,447,380.

Costs for monitoring and adaptive management of project elements for which the City of Dallas is the proponent would be estimated at the time of project design and included in the City Section 408 package to be submitted to the USACE for authorization to construct. Costs for data collection are consistent with the overall spatial extent of the project area incorporate contingencies to cover uncertainties resulting from the implementation of adaptive management measures.

Table 6. Preliminary Cost Estimates for Implementation of the Monitoring and Adaptive Management Plan

Category	*Activities*	*# years*	*Cost/Year*	*Total*
Monitoring				
Planning and Management	Monitoring workgroup, drafting detailed monitoring plan, development of performance measures	1		$248,230
Data Collection	Vegetation and Hydrology	10	$120,545	$1,205,450
Data Analysis	Assessment of Monitoring Data and Performance Standards	10	$32,320	$323,200
Adaptive Management Program				
Planning	Develop detailed adaptive management plan and establish program	1		$256,150
Management	Management of the Adaptive Management Program	10	$117,010	$1,170,100
Database Management	Database development, management, and maintenance	10	$24,425	$244,250
			Total	**$3,447,380**

4.2 BALANCED VISION PLAN

Section 2039 of the Water Resources Development Act of 2007 requires federal ecosystem restoration projects to develop and implement a monitoring and adaptive management plan; however, this requirement does not extend to non-federal betterments. Therefore, a monitoring and adaptive management plan is not required for the non-federal components of the BVP Study proposed by the City of Dallas.

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