

CHAPTER 5

SELECTION OF THE RECOMMENDED PLAN

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This chapter presents data and rationale supporting designation of the Recommended Plan. The results of the plan formulation process, as described in the preceding chapter, were derived from preliminary cost estimates and economic benefits assuming current conditions. The costs and benefits presented in this chapter are not comparable to those shown in chapter 4, Plan Formulation, for the following reasons:

- The costs presented in this chapter reflect more detailed design and analysis of the proposed project's flood control, environmental mitigation, environmental restoration, and recreation features, and were estimated at April 1998 prices levels. Economic analyses were performed utilizing the fiscal year (FY) 1998 Federal interest rate of 7-1/8%.
- The economic benefits presented in this chapter reflect average annual equivalent benefits, which account for future changes in urbanization and hydrology. Comparatively, the benefits shown in chapter 4 were expected average annual benefits, which do not incorporate future conditions.
- The economic benefits in this chapter also include the addition of insurance subsidy benefits, defined as the annual savings in operating expenses for the administration of the flood insurance programs, due to the implementation of the proposed project.

In addition to these differences, a risk-based analysis was incorporated into all assumptions and benefit calculations. This type of analysis was also used in the latter phases of the plan formulation process, as explained on page 4-22 of this document. Traditional expression of the frequency of flood events has been in terms of the recurrence interval in years, such as, the "100-Year Flood". The more appropriate expression of the probability of a particular flood magnitude is in terms of "percent chance exceedance", especially as it relates to a risk-based analysis. Therefore, the "100-Year Flood", which is defined as "the magnitude of flooding which has a 1 percent probability of being equaled or exceeded in any given year" would be expressed as the "1 percent chance flood". For comparison purposes, the nine flood events computed for this study, traditionally referred to as the 1-year, 2-year, 5-year, 10-year, 25-year, 50-year, 100-year, 500-year, and the Standard Project Flood (SPF), would be referred to, in probabilistic terms, as the 99 percent, 50 percent, 20 percent, 10 percent, 4 percent, 2 percent, 1 percent, 0.2 percent chance flood, and the SPF, respectively. Although the analyses contained herein were performed as risk-based analyses, results of these investigations are expressed in traditional terms for the benefit of the reader.

OPTIMIZATION OF THE LAMAR AND CADILLAC HEIGHTS LEVEES

Although the SPF Lamar and 100-year Cadillac Heights Levees were deemed incrementally justified in the preceding chapter, more detailed analysis was conducted to ensure optimization of the levee heights, thereby validating their proper inclusion in the Tentative Federally Supportable Plan.

CADILLAC HEIGHTS LEVEE

Height Limitations

The Cadillac Heights Levee being proposed as part of the Tentative Federally Supportable Plan, known as the "100-year levee," was set to a profile corresponding to elevation 412.15 at the economic index point. This compares to a Standard Project Flood (SPF) elevation of approximately 419.85, a difference of 7.7 feet. A key engineering constraint limits the levee from any further increases in height without adverse impacts upstream. Hydraulic analyses indicate that a higher levee in the Cadillac Heights area begins to cause an increase in the upstream SPF profile, which is the design profile for the existing Dallas Floodway. As shown in the incremental analysis of the SPF levee for Cadillac Heights, the economic analysis is extremely sensitive to changes in upstream conditions,

primarily due to the billions of dollars in property being protected by the Dallas Floodway. Thus, any increase in upstream water surface for the SPF design flow immediately squelches any hope of higher net benefits for the Cadillac Heights Levee.

Inelastic Levee Costs

As a general rule, levee features have a certain amount of initial, constant costs which can be attributed to lands, easements, interior drainage requirements, relocations, etc. A significant variable in computing costs for various levee heights is usually the amount of select fill required. However, due to the chain of wetlands excavation, the proposed project is rather unique in this regard. Overall, there is actually an excess of material which, unless used in some way, must be hauled away and disposed. The detailed cost analysis indicates that it costs more to haul and dispose the excess material than it does to place it as select fill in the Cadillac Heights Levee. As a result, the cost curve for levee heights below elevation 412.15 is highly inelastic.

The inelastic levee costs were validated by computing a detailed cost of a levee with two feet less height than the previously investigated 100-year levee. The lower levee was estimated to have an incremental first cost (added to the chain of wetlands) of \$4,795,400. This is \$320,000 more than the higher levee.

There is, however, a point at which a substantial increase in levee length would be required to provide closure. This is the primary reason for the increased cost of the levee with index elevation 421.85.

Benefit Analysis

The computer program HEC-FDA was used to determine the amount of gross benefits which would be foregone in the Cadillac Heights area if a levee of two feet less height were constructed. The analysis indicates that residual damages (year 2000 only analyzed) would increase, thereby reducing benefits, by \$51,600. Additionally, floodplain user benefits totaling \$15,500 could no longer be claimed because no structures would be removed from FEMA's 100-year floodplain. Total benefits foregone would be approximately \$67,100 annually.

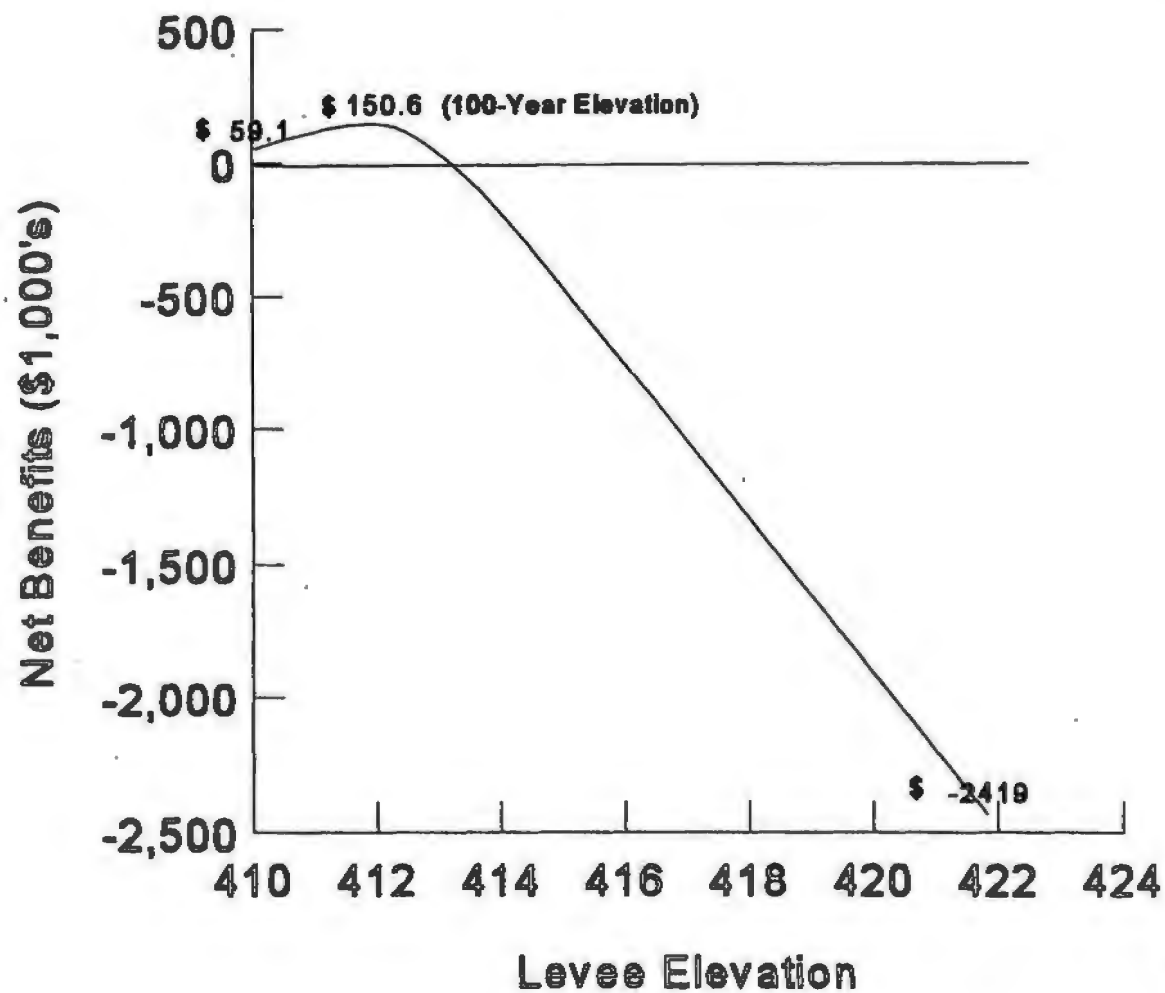
Conclusion

Net benefits continue to increase as the Cadillac Heights Levee increases, fueled by a unique scenario where benefits increase and costs decrease for a higher levee providing protection around Cadillac Heights. However, at a height roughly equal to that of the levee currently being proposed as part of the Tentative Federally Supportable Plan, hydraulic impacts upstream result in an abrupt downturn in the total benefits being achieved. This is summarized in the optimization table 5-1 shown below, and graphically represented in the optimization curve in figure 5-1. This analysis confirms the inclusion of the 100-year Cadillac Heights Levee in the Tentative Federally Supportable Plan.

Table 5-1
Cadillac Heights Levee
Incremental Costs and Benefits for Various Heights
(April 1998 prices, 7.125% interest, 50-year period of analysis)

Levee Elevation at Index Point	Incremental First Costs	Annualized Cost	Incremental Benefits	Net Benefits of Levee
410.15	\$4,795,400	\$364,100	\$408,700	\$44,600
412.15	\$4,474,900	\$339,700	\$475,800	\$136,100
421.85	\$9,112,700	\$691,700	(\$1,738,800)	(\$2,430,500)

* Interest during construction not included



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**OPTIMIZATION CURVE -
CADILLAC HEIGHTS LEVEE**

FIGURE 5-1

LAMAR LEVEE

As with the Cadillac Heights Levee, the Locally Preferred Plan calls for a levee of sufficient height to provide essentially the same level protection as was originally provided by the existing Dallas Floodway. However, the two levees differ substantially in their performance and effects to upstream areas. The design of the Lamar Street Levee is such that the critical breach elevation of the existing East Levee, located immediately upstream and adjoining the Lamar Levee, is increased by constructing the Lamar Levee to the same height as the existing East Levee. Significant benefits are realized by the Lamar Levee as a result. If, however, the height of the Lamar Levee is decreased, benefits to the upstream reach are also decreased. To validate this assumption, a Lamar Street Levee with 3.1 feet less height than the proposed Tentative Federally Supportable Plan was analyzed. This height matches the current critical breach elevation of the East Levee in the existing Floodway. No levee with a height greater than the Tentative Federally Supportable Plan was analyzed, as this is also the levee height of the Locally Preferred Plan.

Costs of a Lower Levee

The costs associated with a lower levee protecting the Lamar Street area would increase in a similar manner to those of the Cadillac Heights Levee described above, when analyzed on an incremental basis with the chain of wetlands. Due to the amount of excess material present, the incremental cost to construct a lower levee is actually greater than the cost of a higher levee. The first cost of the Lamar Street Levee with a height of 3.1 feet less than the assumed Tentative Federally Supportable Plan is \$18,511,200. This is \$498,700 more than the cost of the higher levee.

Benefit Analysis

The computer program HEC-FDA was again used to determine the amount of gross benefits which would be foregone if a Lamar Street Levee of 3.1 feet less height were constructed. The analysis indicates that residual damages (year 2000 only analyzed) would increase (benefits would decrease) by \$2,471,600.

Conclusion

Table 5-2 compares the costs and benefits of a levee protecting the Lamar Street area for two heights, the greater of which is the proposed Tentative Federally Supportable Plan as well as the Locally Preferred Plan. Since the higher levee is the largest plan being pursued by the sponsor, and in accordance with Planning Guidance Letter 97-10, no levee with a greater height than this was analyzed. The comparison shown in the table, and presented in figure 5-2, clearly indicates that the levee height identified in the proposed Tentative Federally Supportable Plan achieves higher net benefits.

Table 5-2
Lamar Street Levee
Incremental Costs and Benefits for Various Heights
(April 1998 prices, 7.125% interest, 50-year period of analysis)

Levee Elevation at Index Point	Incremental First Costs	Annualized Cost	Incremental Benefits	Net Benefits of Levee
417.90	\$18,511,200	\$1,405,300	\$134,500	(\$1,270,800)
421.00	\$18,012,500	\$1,367,400	\$2,606,100	\$1,238,700

* Cost of Existing Rochester Park Levee not included

** Interest during construction not included

This analysis confirms the inclusion of the SPF Lamar Levee, as did the analysis of the 100-year Cadillac Heights Levee, in the Tentative Federally Supportable Plan.

CONFIRMATION OF INCREMENTAL JUSTIFICATION

Due to the development of more detailed designs and cost estimates for the TFSP and the LPP, a re-analysis of the flood control components of these plans was performed to confirm incremental justification. The costs and benefits of the IH-45 proposal have been included in the chain of wetlands increment for this analysis.

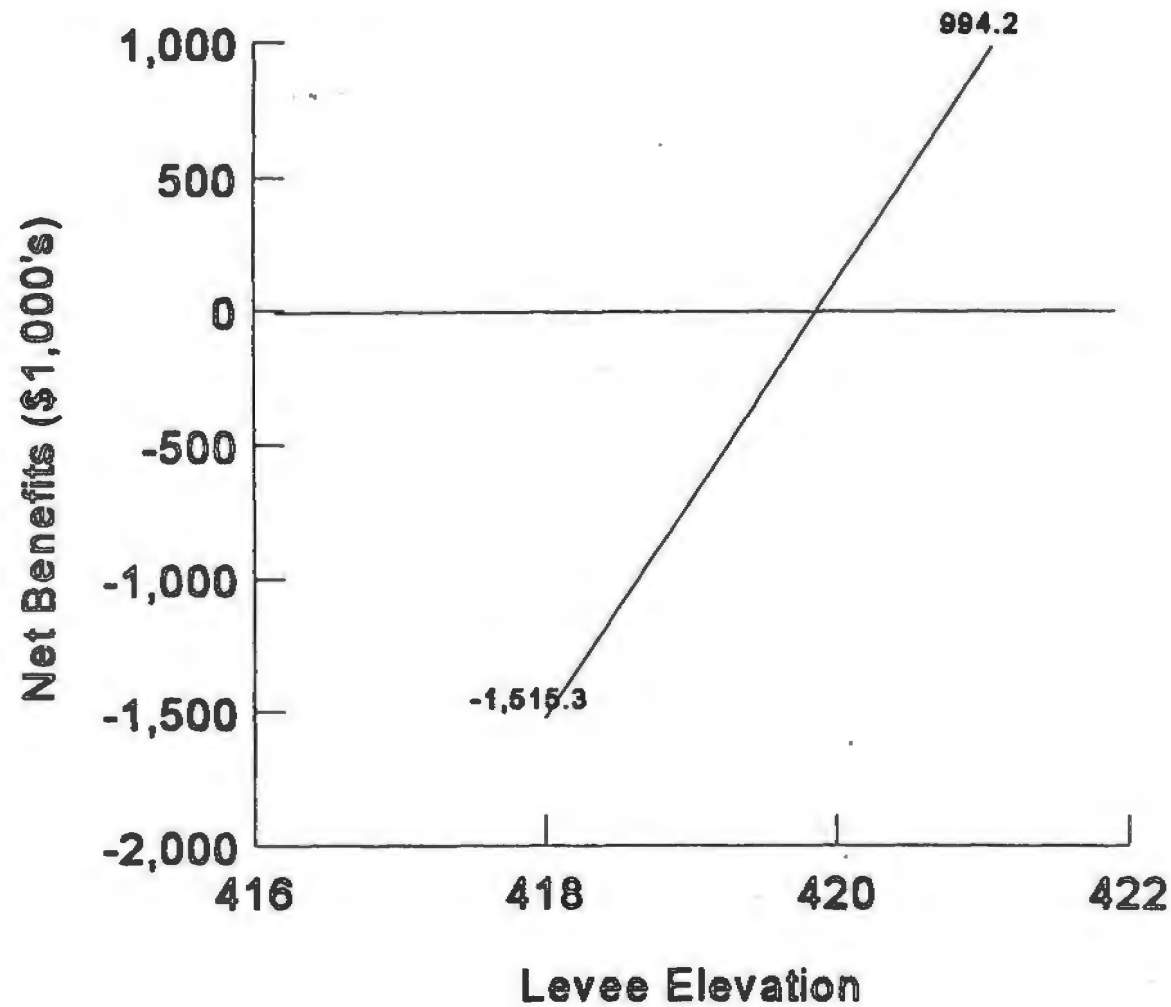
Equivalent annual damages (EAD) were calculated for the TFSP and the LPP to account for changes in urbanization and hydrology. The analysis was performed over a 50-year period from the year 2000 to 2050. All remaining economic analyses presented in this report reflect equivalent annual damages.

In addition to direct inundation reduction benefits to both the immediate study area and the upstream Dallas Floodway area, an annual savings in administration of the flood insurance programs operating expenses would be realized for any structures removed from the 100-year (one percent annual chance of exceedance) floodplain. Estimates of these savings were calculated for each increment of these plans, and incorporated into the overall flood control benefits.

Due to the magnitude and complexity of the proposed plans, phased construction is anticipated. The "Interest During Construction" (IDC) used for the economic analyses was, therefore, calculated in such a manner as to reflect this phased construction, as shown in table 5-3.

Table 5-3
Computation of Interest During Construction
For Incremental Analysis
(April 1998 prices, 7.125% interest, 50-year period of analysis)

Plan	First Cost	Construction Period (months)	Interest During Construction
Chain of Wetlands Only	\$56,034,200	21	\$3,514,100
Chain of Wetlands + Lamar	\$74,046,700		\$3,601,500
Phase 1	\$38,803,400	15	\$1,718,000
Phase 2	\$35,243,300	18	\$1,883,500
Chain of Wetlands, Lamar and 100-year Cadillac Heights (TFSP)	\$78,521,600		\$3,840,600
Phase 1	\$38,803,400	15	\$1,718,000
Phase 2	\$39,717,300	18	\$2,122,600
Chain of Wetlands, Lamar and SPF Cadillac Heights (LPP)	\$83,159,400		\$4,499,800
Phase 1	\$38,803,400	15	\$1,718,000
Phase 2	\$44,356,000	21	\$2,781,800



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TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION

**OPTIMIZATION CURVE -
LAMAR LEVEE**

FIGURE 5-2

It was assumed that, if the chain of wetlands were the only increment of this project to actually be implemented, construction would be performed under one contract. As shown in table 5-3, the IDC for this effort would total approximately \$3.5 million.

It was decided that the addition of levee work, however, would most effectively be designed and managed by breaking the construction into phases. The lower swale, downstream of IH-45, was viewed as the most favorable element to be constructed first. Hydraulic impacts to other project areas would be minimal, and any minor adjustments to design would not likely significantly affect other project features, such as the levees. The cost of constructing the lower swale was estimated at \$38.8 million, yielding an IDC amount of approximately \$1.7 million. This construction is shown as Phase 1 in table 5-3, for each plan.

For each added increment of the TFSP and the LPP, the incremental cost difference between total construction and the construction of the lower swale is shown as Phase 2, with corresponding IDC amounts. The IDC calculated for each phase of a plan were then added to determine total IDC for implementation of that particular plan.

Table 5-4 presents the incremental economic analysis for the flood control features of the TFSP and the LPP. As shown, the Lamar Levee remains economically justified, with \$369,400 in net annual flood control benefits and a BCR of 1.17. The 100-year Cadillac Heights Levee also remains economically justified, with \$62,900 in net annual flood control benefits and a BCR of 1.15. The SPF Cadillac Heights Levee is not incrementally justified.

BASIS FOR REQUEST FOR EXCEPTION

Based on these findings, the only difference between the Tentative Federally Supportable Plan and the Locally Preferred Plan would be the incremental height difference between the 100-year (.01 probability of exceedance) Cadillac Heights Levee and the SPF (.00125 probability of exceedance) levee. The corresponding incremental cost difference between the two plans would be the responsibility of the local sponsor, unless an exception is granted from ASA(CW), allowing full Federal participation in the LPP.

In light of sensitive social equity issues which would arise from the city's support for building a project providing less protection to the neighborhood on one side of the river than on the other, the city requested full Federal participation in the LPP, which would include the non-justified increment of the Cadillac Heights Levee from the 100-year level of protection to the SPF level. The following sections provide comparative data between the two plans, and rationale for such an exception.

ECONOMIC COMPARISON OF PLANS

Table 5-5 presents a side-by-side comparison of the proposed TFSP and the LPP. As a total system, the Tentative Federally Supportable Plan would have net annual flood control benefits of \$6.8 million, with a BCR of 1.81. Comparatively, the LPP would have net annual flood control benefits of \$4.1 million, with a BCR of 1.46. These lower net benefits for the LPP would be attributable to higher water surface elevations caused by greater confinement of extreme-event flows with SPF levees.

DIFFERENCES BETWEEN THE TENTATIVE FEDERALLY SUPPORTABLE PLAN AND THE LPP

The improvements which the LPP would give to the project area above the Tentative Federally Supportable Plan are as follows:

- The LPP would provide a higher level of protection to the project area (Cadillac Heights).
- The Tentative Federally Supportable Plan would leave a portion of the study area subject to flooding from major events above 100-year frequencies. Comparatively, the LPP would provide SPF protection to the major damage centers within the study area. With implementation of the LPP, 287 structures in the Cadillac Heights area would no longer be at risk from the SPF event. Construction of the Tentative Federally Supportable Plan would allow that 207 structures would no longer be at risk from the 100-year flood event within the same area, but would leave 271 structures subject to inundation in SPF events.
- The Tentative Federally Supportable Plan would provide lower levels of protection to one side of the river, while the LPP would provide equal SPF protection to both sides.
- The environmental impacts to critical natural resources, such as bottomland hardwoods and/or wetlands, would not increase when going from the Tentative Federally Supportable Plan to the LPP.
- The LPP would add \$0.5 million in annual costs and would reduce annual net benefits by \$2.7 million. The length of the Cadillac Heights levee is 1.1 miles (TFSP) and 2.25 miles (LPP).
- The Tentative Federally Supportable Plan would not fully offset the adverse hydraulic impacts to the residential areas in the Floodway Extension area that have resulted from construction of upstream portions of the existing Dallas Floodway and from upstream changes in watershed development. The LPP would fully offset these impacts.

Trade-offs exist between the two plans. The Tentative Federally Supportable Plan offers more net flood damage reduction benefits, whereas, the LPP offers flood protection greater than 100-year at a small increase in cost.

The LPP would reduce expected annual flood damages in the study area by \$13.1 million from baseline conditions. Comparatively, the Tentative Federally Supportable Plan would reduce expected annual flood damages by \$15.3 million, or \$2.2 million more. The LPP would reduce flood protection for extreme events upstream in the existing Dallas Floodway, while increasing the level of protection for rare, but relatively more frequent events, to the people in the Cadillac Heights neighborhood.

Table 5-4
Incremental Analysis of the TFSP and LPP - Flood Control Only
(April 1998 prices, 7.125% interest, 50-year period of analysis)

Description	Chain of Wetlands	Chain of Wetlands Plus SPF Lamar	SPF Lamar Incremental	Tentative Federally Supportable Plan	100-Year Cadillac Incremental	Locally Preferred Plan	SPF Cadillac Incremental
INVESTMENT							
Estimated First Cost	\$56,034,200	\$74,046,700	\$18,012,500	\$78,521,600	\$4,474,900	\$83,159,400	\$9,112,700
Interest During Construction	\$3,514,100	\$3,601,500	\$87,400	\$3,840,600	\$239,100	\$4,499,800	\$898,300
Cost of Non-Federal Levees	\$14,220,000	\$23,120,000	\$8,900,000	\$23,120,000	\$0	\$23,120,000	\$0
Investment Cost	\$73,768,300	\$100,768,200	\$26,999,900	\$105,482,200	\$4,714,000	\$110,779,200	\$10,011,000
ANNUAL CHARGES							
Interest	\$5,256,000	\$7,179,800	\$1,991,300	\$7,779,300	\$347,700	\$8,169,900	\$738,300
Amortization	\$173,900	\$237,500	\$58,400	\$228,200	\$10,200	\$239,700	\$21,700
O&M (\$/year)	\$199,000	\$386,000	\$187,000	\$441,000	\$55,000	\$527,000	\$141,000
Replacements	\$0	\$0	\$0	\$0	\$0	\$0	\$0
TOTAL ANNUAL CHARGES	\$5,628,900	\$7,803,300	\$2,236,700	\$8,448,500	\$412,900	\$8,936,600	\$901,000
ANNUAL BENEFITS							
Inundation Reduction	\$3,798,200	\$4,876,700	\$1,078,500	\$5,337,000	\$460,300	\$5,286,800	\$410,100
Insurance Subsidy	\$30,500	\$78,700	\$48,200	\$94,200	\$15,500	\$94,200	\$15,500
Existing Dallas Floodway	\$7,311,400	\$8,790,800	\$1,479,400	\$8,790,800	\$0	\$6,626,400	(\$2,164,400)
IH-45 Proposal	\$1,043,500	\$1,043,500	\$0	\$1,043,500	\$0	\$1,043,500	\$0
TOTAL ANNUAL BENEFITS	\$12,183,600	\$14,789,700	\$2,606,100	\$15,265,500	\$475,800	\$13,050,900	(\$1,738,800)
NET ANNUAL BENEFITS	\$6,554,700	\$6,986,400	\$369,400	\$6,817,000	\$62,900	\$4,114,300	(\$2,639,800)
BENEFIT - COST RATIO	2.16	1.90	1.17	1.61	1.16	1.46	-1.93

NOTE: Costs and benefits shown are not comparable to those presented in tables 4-27 and 4-28, due to the incorporation, in this table, of more detailed cost estimates, the addition of insurance subsidy benefits, and the inclusion of average annual equivalent benefits, which account for future changes in urbanization and hydrology.

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Table 5-5
Benefit-Cost Comparison of Tentative Federally Supportable Plan and LPP
Flood Control Only
(April 1998 prices, 7.125% interest, 50-year period of analysis)

Project Alternatives Include Land/Mitigation & HTRW Costs	TFSP	LPP
INVESTMENT		
Estimated First Cost	\$78,521,600	\$83,159,400
Interest During Construction	\$3,840,600	\$4,499,800
Cost of Non-Federal Levees	\$23,120,000	\$23,120,000
Investment Cost	\$105,482,200	\$110,779,200
ANNUAL CHARGES		
Interest	\$7,779,300	\$8,169,900
Amortization	\$228,200	\$239,700
Operation/Maintenance (\$/year)	\$441,000	\$527,000
Replacements	\$0	\$0
TOTAL ANNUAL CHARGES	\$8,448,500	\$8,936,600
ANNUAL BENEFITS		
Inundation Reduction	\$5,337,000	\$5,286,800
Insurance Subsidy	\$94,200	\$94,200
Existing Dallas Floodway	\$8,790,800	\$6,626,400
IH-45 Proposal	\$1,043,500	\$1,043,500
TOTAL BENEFITS	\$15,265,500	\$13,050,900
NET BENEFITS	\$6,817,000	\$4,114,300
BENEFIT-COST RATIO	1.51	1.46

OTHER SPECIAL CONSIDERATIONS

- The original Dallas Floodway Extension project, authorized in 1965, contained levees, channels, and lake features designed to provide SPF protection to both the northern and southern portions of the city of Dallas. The Locally Preferred Plan would provide for similar outputs at a lower total project cost. The estimated cost of the authorized improvements to the Dallas Floodway Extension area, at April 1998 price levels, would be \$199.2 million. The TFSP, at the same price levels, was estimated to cost \$118.5 million, including \$23.1 million for compatible portions of previously constructed non-Federal levees. The LPP was estimated to cost \$123.2 million, including \$23.1 million for compatible portions of previously constructed non-Federal levees.
- The existing Dallas Floodway (which consists of levees and channels) was built in the 1950's to the SPF level of protection. The upstream channels convey flood waters downstream more quickly and the upstream levees confine flood waters which previously spread out over the upstream floodplain. Both factors have raised the downstream water surfaces and led to more severe flooding in the Dallas Floodway Extension area when storm events occur.

- The DFE areas to receive increased flood protection include Cadillac Heights, Joppa, South Dallas, and Lamar Street Industrial area. These areas are mainly low income minority residential neighborhoods and light industrial facilities.
- Flood records clearly demonstrate the need for downstream improvements. Over the years repeated flooding has caused losses of life, and led to significant financial losses to residences, businesses, and infrastructure in the Dallas Floodway Extension area. In addition, repeated flooding has created undesirable physical conditions within the area forcing some people and businesses to relocate from the area. Such conditions have also prevented economic growth and adversely affected community economic health.
- The Texas Department of Transportation initiated a Major Investment Study of the traffic congestion in the Dallas area in June 1996. This study recommends improvements estimated to cost in excess of \$1 billion, and include a road way (Trinity Parkway Reliever) within the existing floodway and extend southward utilizing a portion of the proposed Dallas Floodway Extension project. Construction of the SPF levee around the Cadillac Heights area would protect both existing roads as well as any new improvements from catastrophic flood events.

ASA(CW) DECISION REGARDING REQUEST FOR EXCEPTION

This section describes the pertinent information submitted to the ASA(CW) for use in making a decision regarding the Request for Exception. It is noted that the plan identified as the Tentative Federally Supportable Plan (TFSP) in the preceding sections, and in Chapter 4, of this report, was referred to as the Federally Supportable Plan in the April 1998 draft GRR/EIS. This designation was in accordance with the District's interpretation of current policy guidelines. The formal Request for Exception, and all supplemental information submitted to the Office of the ASA(CW) subsequent to the release of the draft GRR/EIS, as discussed below, reflect the designation of this plan (which includes the one percent Cadillac Heights Levee) as the Federally Supportable Plan. The final decision regarding the appropriately designated Federally Supportable Plan is presented below.

FORMAL SUBMITTAL OF REQUEST FOR EXCEPTION

On June 3, 1998, a formal Request for Exception was submitted by the Fort Worth District, Corps of Engineers, to the Southwestern Division Commander, which presented comparative data between the Federally Supportable Plan (as identified in the draft GRR/EIS) and the Locally Preferred Plan, and recommended that the request be granted, thereby allowing the LPP to be constructed with full Federal cost sharing. This request, accompanied by the Division Commander's endorsement, is included in Appendix M herein. This document contained the information shown in the "BASIS FOR REQUEST FOR EXCEPTION" section above, and additional information required by paragraph 5.17 of ER 1105-2-100. The pertinent information contained in the request, beyond that previously presented, included the following:

- **Urban Flood Protection:** Neither the FSP nor the LPP would leave urban areas within the post-project 100-year floodplain, although the confidence limits applied to the protection of Cadillac Heights would be rather low. The FSP would, however, leave a portion of the study area, including the Cadillac Heights area, subject to flooding from major events above the one percent probability of exceedance.

- **Cost Sharing Impacts:** Based on the data and price levels presented in the draft GRR/EIS, table 5-6 presents the total Federal / non-Federal cost apportionment data, after application of the levee credit, for the FSP, the LPP with an exception, and the LPP without an exception.

Table 5-6
Comparative Cost Apportionment Data in
Request for Exception
(April 1998 prices)

Cost Apportionment	FSP *	LPP With Exception	LPP Without Exception
Federal Cost	\$101,019,300	\$102,216,600	\$101,019,300
Non-Federal Cost	\$17,470,200	\$20,942,600	\$22,139,900
Total Cost	\$118,489,500	\$123,159,200	\$123,159,200

* FSP, as identified in the April 1998 draft GRR/EIS, which included the one percent Cadillac Heights Levee

- **Residual Damages:** The SPF Cadillac Heights Levee in the LPP is less likely to overtop and fail due to its increased height relative to the one percent levee in the FSP. Annual residual damages from the Trinity River, in the Cadillac Heights area, would be \$100,500 with the one percent levee and \$17,100 with the SPF levee. Annual residual damages for the entire project area would be \$6.0 million with the one percent levee and \$8.2 million with the SPF levee.
- **Concentration of Damages:** The proposed Lamar Levee is justified at the SPF level. Implementing the Cadillac Heights Levee at a comparatively lower height would cause flood damages to concentrate in the Cadillac Heights area when flood events exceed the one percent annual chance of exceedance (ACE).
- **Characteristics of Protected Area:** The Cadillac Heights Levee would protect an area with a mix of commercial, residential, and public infrastructure facilities. However, the primary beneficiaries of the increased flood protection would be the residents. The sponsor's commitment to providing equal protection to the residents is highlighted by their desire to pursue higher flood protection for Cadillac Heights, while electing not to pursue increased flood protection to the city-owned Central Wastewater Treatment Plant.
- **Concerns of Others:** The sponsor was very concerned about the social inequity and public acceptability issues that construction of the FSP could generate. Social inequity is already an issue due to perceptions that the Dallas Floodway project shifted flood damages from the central business district to low-income and minority neighborhoods.

The Request for Exception was reviewed by Headquarters, U.S. Army Corps of Engineers (HQUSACE), and forwarded to the Office of the Assistant Secretary of the Army (Civil Works), by letter dated August 18, 1998. This letter, which is included in Appendix M herein, provided additional discussion regarding the FSP (as identified in the draft GRR/EIS) and the LPP, and identified three cost sharing options, as presented below:

- **Federally Supportable Plan (FSP):** The FSP would restore SPF level of protection to the existing Federal levees, would provide the same to the Lamar Street Community, but would only provide protection from the 1.0% ACE (100-year) flood for the Cadillac Heights Community. With implementation of the FSP, a flood event greater than the 1.0% ACE flood would overtop at the Cadillac Heights Levee and subject the community to a real possibility of loss of life. The Cadillac Heights Levee, being lower, would overtop prior to the other higher levees. A 1.0% ACE flood would likely overtop the proposed FSP Cadillac Heights Levee. About 131 residential and 29 commercial structures would incur damages, putting approximately 328 people at risk. The maximum flood depth, which is measured at the lowest protected structure, would be 10.7 feet. A Standard Project Flood would overtop the FSP at the Cadillac Heights levee by over 9 feet. About 215 residential and 66 commercial structures would incur damages, putting approximately 538 people at risk. The maximum flood depth would be approximately 20 feet.
- **Locally Preferred Plan (LPP):** The LPP would provide the same level of protection to the Cadillac Heights Community as would be provided to the Lamar Levee, and to the East and West Levees of the existing Dallas Floodway. Current risk and uncertainty modeling programs, which calculate levels of confidence only up to a 0.2% ACE (500-year) flood, show that these levees would provide protection from the 0.2% ACE (500-year) flood, with confidence levels varying from 86% to 92%. They would pass the SPF with lesser confidence levels. It is likely that the LPP will be the recommended plan in the final report, as the sponsor is not willing to implement the FSP. The non-Federal sponsor is fully aware that the LPP would provide a lesser, but consistent level of protection for the four leveed areas. In all cases, the level of protection that would be provided by the LPP would be far greater than that provided without a project. The community is willing to accept this trade-off condition. The Sponsor, and community at large, do not feel that the Federally Supportable Plan (as identified in the draft GRR/EIS) is implementable because of the social impacts that are evident; that is, providing a lower level of protection, and higher risk of loss of life, to the low-income, minority community of Cadillac Heights.
- **Options:**
 1. Construct the FSP with traditional cost sharing (75% Federal; 25% non-Federal).
 2. Construct the LPP at 100 percent non-Federal cost above the FSP level.
 3. Construct the LPP at full traditional cost sharing (75% Federal; 25% non-Federal).

The recommendation of HQUSACE was for selection of Option 3, as it was felt that not only would the FSP be socially unacceptable from the sponsor's point of view, but the economic cost of the LPP should not be weighed against the increased risk to life in a low-income, minority community, while a higher level of protection and lower risk to life would be provided to the rest of the community. By selecting the LPP, emphasis would be placed on lives, people, equality and implementability.

SUPPLEMENTAL INFORMATION

Prior to finalizing a decision regarding the request for exception, additional information was requested by the office of the ASA(CW). This supplemental information was provided, as seen in Appendix M, and included the following: a tabularized listing of flow capacity (design discharge) and level of protection for the authorized plan, for existing conditions, and for future conditions without the project, with the FSP, and with the LPP; data regarding levels of confidence for the various levees; hydrologic conditions (current or future) upon which the levels of confidence are

based; information regarding whether the FSP Cadillac Heights Levee would meet FEMA certification requirements; determination of whether the Cadillac Heights Levee is needed to mitigate the effects of other elements of the project; and, comparative socio-economic data between the Cadillac Heights neighborhood and the city of Dallas.

In response to these requests, the following information was provided:

- Table 5-7 presents the flow capacity and level of protection for various scenarios and provides a general understanding of the changing conditions.

**Table 5-7
Flow Capacity and Level of Protection
for Various Scenarios**

Scenario	Flow Capacity (cfs)		Level of Protection	
Existing Dallas Floodway (1960)	226,000 (design)		SPF	
Authorized Plan	270,000 (design)		SPF	
Current Conditions	212,000		550-year (Floodway only)	
Year 2050 without Project	192,000		400-year (Floodway only)	
Year 2000 with FSP	Cadillac	Remainder	Cadillac	Remainder
	115,200	269,200	100	SPF
Year 2000 with LPP	269,200		SPF	

- Two tables in the GRR/EIS (Tables D-34 and D-35 in Appendix D) provide the levels of confidence for the levees in the FSP and the LPP, respectively. These tables do not provide confidence levels for the SPF. The model used for the computation, HEC-FDA, does not provide this information primarily because the SPF varies in frequency from watershed to watershed. Table 5-8 presents a comparative summary of the levels of confidence for passage of the 100-year (1% ACE) and the 500-year (0.2% ACE) flood events in the critical reaches (Cadillac Heights, Lamar Street, East Levee of existing Floodway, West Levee of existing Floodway) of the study area with implementation of the FSP and the LPP.

**Table 5-8
Levels of Confidence for Levees**

Levee / Reach	FSP		LPP	
	100-Year Flood (1% ACE)	500-Year Flood (0.2% ACE)	100-Year Flood (1% ACE)	500-Year Flood (0.2% ACE)
Lamar	98%	80%	99%	92%
Cadillac Heights	34%	5%	99%	91%
East Levee	99%	92%	99%	86%
West Levee	99%	90%	99%	86%

- The levels of protection cited in the Request for Exception are based on year 2000 hydrology. Year 2050 hydrology was used in the development of average annual equivalent economic damages. In summary, the LPP would provide essentially consistent levels of protection to all reaches except the Central Wastewater Treatment Plant (CWWTP). The FSP would provide consistent levels of protection to all reaches except the CWWTP and Cadillac Heights. If the FSP were built, the 100-year Cadillac Heights Levee would be the only urban flood levee within the Fort Worth District to have a design level lower than SPF.
- The height of the Cadillac Heights Levee in the FSP was derived during the economic optimization process, without regard to the FEMA certification requirements. For this levee to meet FEMA's requirements, it would have to be approximately three feet higher than formulated. Therefore, the economic benefits (\$15,500) previously attributed to the FSP Cadillac Heights for reduction in administration costs for insurance subsidy programs would be invalid. This reduction in benefits, however, would not change the economic feasibility of the levee.
- It is the District's belief that the Cadillac Heights Levee would not be constructed as mitigation for other project elements, and that from an economic and hydraulic perspective, this levee is a separable element. However, from the public perspective, its separability is questionable due to the public belief that the lower Cadillac Heights Levee was designed as a safety valve to protect the Central Business District and the north side of the Trinity River at the expense of the minority population in the poorer Cadillac Heights neighborhood.
- Table 5-9, provided by the City of Dallas, presents comparative socio-economic data between the Cadillac Heights neighborhood and city as a whole.

Table 5-9
Comparative Socio-Economic Data -
Cadillac Heights vs. City of Dallas

	Cadillac Heights	City of Dallas
Number of Homes	416	479,622
High / Low Price of Homes	\$53,500 / \$3,960	\$11,949,900 / NA
Average Appraised Value	\$17,500	\$64,700
Percent Homeowners	51.5%	44.1%
Percent Single-Family Units	64.9%	47.5%
Percent Multi-Family Units	31.0%	50.4%
Number of Persons	1,168	1,052,300
Percent Persons Under 18	35.5%	25.0%
Percent Persons Over 65	6.8%	9.7%
Total Percent Hispanic	58.0%	20.3%
Total Percent Black	40.9%	29.5%
Total Percent White	1.0%	47.7%
Total Percent Without High School Degree	73.4%	26.5%
Total Percent Unemployed	9.1%	7.4%
Average Income	\$15,089	\$27,489
Percent Households on Public Assistance	35.4%	5.7%
Number of Persons Below Poverty Level	46.6%	17.8%

FINAL IDENTIFICATION OF FEDERALLY SUPPORTABLE PLAN

Upon evaluation of the request to recommend a Standard Project Flood (SPF) level of protection for the DFE project, and based upon the data submitted in support of this recommendation, the Assistant Secretary of the Army (Civil Works), by letter dated November 9, 1998, decided that the project providing a consistent SPF level of protection did not require an exception to policy guidelines, but is the Federally Supportable Plan. In other words, the Locally Preferred Plan is the Federally Supportable Plan.

This decision was made for the following reasons. First, the alternative levee for the Cadillac Heights neighborhood would not meet the Federal Emergency Management Agency standards for protecting the area from a flood that would have a 1.0 percent annual chance of exceedance (ACE), nor would it provide an acceptable level of reliability, particularly when compared with other project elements. Second, the alternative levee for Cadillac Heights would allow continued damages in this area from major, although infrequent floods (greater than the 1.0% ACE), due to the construction of other project levees. Finally, Congress has already authorized the project, including the Cadillac Heights Levee, at a SPF level of protection.

IDENTIFICATION OF THE RECOMMENDED PLAN

In accordance with the decision of the Assistant Secretary of the Army (Civil Works) designating the Locally Preferred Plan as the Federally Supportable Plan, this plan is therefore designated the Recommended Plan, and is recommended for implementation. This plan would consist of the following elements:

- **Chain of Wetlands:** The chain of wetlands increment would consist of upper and lower swales, separated at Interstate Highway (IH) 45. The upper swale would have an average 400-foot bottom width and would extend from Cedar Creek to the oxbow lake at IH-45, a distance of about 1.5 miles. The lower swale would have an average 600-foot bottom width, would extend between IH-45 and Loop 12, a distance of about 2.2 miles, and would be aligned through the Linfield Landfill and Sleepy Hollow Golf Course to minimize impacts to forested areas and nearby residential areas. Excavated wetlands and vegetative plantings would be added as environmental restoration features within the footprint of the swales to form a "chain of wetlands."
- **Channel Realignment at IH-45:** The channel realignment at IH-45, as proposed by TxDOT, would allow the river to flow within a wider span of the IH-45 bridge which was better designed to accommodate river flows. This realignment would reduce the risk of catastrophic failure of this vital bridge, and would significantly reduce current annual maintenance costs associated with debris removal around the bridge columns.
- **SPF Lamar Levee:** This increment would include construction of an earthen levee providing SPF protection (.00125 probability of exceedance) for the Lamar Street area. This levee would extend from the existing Dallas Floodway East Levee to the previously constructed Rochester Park Levee, a distance of 2.9 miles.
- **SPF Cadillac Heights Levee:** This increment would include an earthen levee and providing SPF protection (.00125 probability of exceedance) for the Cadillac Heights area. This levee would extend from near Cedar Creek to the Central Wastewater Treatment Plant (CWWTP), would utilize and raise a portion of the northwest corner of the CWWTP Levee, and would extend to high ground near the intersection of Kiest Boulevard and McGowan Avenue, a total distance of approximately 2.2 miles.

- **Non-Federal Levees:** In addition to the levees described above, the Recommended Plan would also include the costs and benefits of the portions of the previously constructed non-Federal levees. The total cost for the compatible portions of these levees was estimated at \$23.1 million (\$14.2 million for the CWWTP Levee upgrade and \$8.9 million for the compatible portion of the Rochester Park Levee).
- **Recreation Features:** The Recommended Plan would include recreation amenities compatible with the regional recreation master plan, including hike/bike trails, equestrian trails, nature trails and pavilions.

At April 1998 price levels, the flood control first cost of the Recommended Plan was estimated at approximately \$78.5 million, plus \$23.1 million for the non-Federal levees, for a total economic flood control first cost of \$101.6 million. Annual flood control costs were estimated at \$8.4 million, with net annual flood control benefits of \$6.8 million, and a BCR of 1.81.

Additional details and costs for the Recommended Plan are presented in Chapter 6 of this document.

