Losses Avoided due to Home Acquisitions in Austin, Minnesota

Analysis of 163 Acquisitions on Cedar River

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In cooperation with:
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Minnesota Department of Public Safety - Division of Emergency Management

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(Cover Photograph – Aerial view of July-2000 flooding in Austin, MN.)
(Courtesy: Nate Howard, Photographer, Austin Post Bulletin)

Losses Avoided due to Home Acquisitions in Austin, Minnesota
Analysis for 163 Acquisitions on Cedar River
(Post-Disaster Cost Effectiveness Evaluation of Hazard Mitigation)

Executive Summary

Under the provisions of the Stafford Act, the Federal Emergency Management Agency (FEMA) has funded numerous mitigation projects to lesson damage to property and alleviate the suffering of residents in disaster-impacted communities. This report presents the results of the post-disaster "*losses avoided analysis*" as a direct result of the acquisitions since the two floods of 1978.

The City of Austin has a documented history of severe flooding since the early 1900's. The U.S. Army Corp of Engineers (USACE) has studied the flooding over the years. They have concluded that structural solutions are not cost effective *[1]*. The City has implemented an acquisition and relocation strategy to remove residents and homes from the floodplain.

The first "Homes Acquisition Project" in the City of Austin was implemented following the flood of 1978. This acquisition project was funded through a Community Development Block Grant (CDBG) provided by the U.S. Department of Housing and Urban Development (HUD) to the Housing & Redevelopment Authority of Austin, MN (HRA). HRA acquired 58 homes along the Cedar River in the City of Austin with $1.7 million received from HUD.

Again the City of Austin was flooded (twice) in 1993, the year of major floods along the Missouri and the Mississippi rivers in the mid-western United States. The flooding damage led to a federal disaster declaration. The Hazard Mitigation Grant Program (HMGP) was co-administered by the Minnesota Division of Emergency Management (MNDEM) and FEMA. Under HMGP, utilizing Minnesota Department of Natural (MNDNR) Resources and HUD Community Development Block Grants as match funds, 105 residential properties were acquired. This report presents the losses avoided on all 163 properties acquired since 1978.

The mission of the flood buyouts in the City of Austin was to permanently mitigate the repetitive flooding of homes along the Cedar River through acquisition and relocation. The implementation of the buyout program had the following key objectives:

1. Voluntary buyout of homes with the most severe and repetitive flooding problems,
2. Offer pre-flood fair market value to homeowners who experienced severe flooding,
3. Auction the acquired sound structures for relocation outside the floodplains and use the proceeds to acquire more flood damaged homes,
4. Improve floodwater discharges by removing structures from the floodway,
5. Convert such land into permanent open space, thereby reducing flood levels and the consequential threats to remaining residents of the floodplain.

This report documents some of the direct savings resulting from the federally funded acquisition projects. Numerous floods have occurred since the implementation of these

projects, and the resulting losses avoided for the multiple flooding events are presented. Measuring losses avoided is a quantitative method for depicting the financial savings realized by the community, local government, state government and FEMA as a direct result of the mitigation projects.

The analyses shows that the buyouts implemented under the HUD funding have avoided losses of more than $3.9 million on an investment of $1.7 million (normalized to $4.51 million) since 1978. This saving in disaster costs represents greater than 80% return on mitigation investment. The HMGP acquisitions in the aftermath of the 1993 floods have avoided losses of more than $2.5 million on a total investment of $5.5 million (normalized to $7 million). This saving due to losses avoided resulted from the flood of 2000 and the return on investment is more than 36%. The HMGP funded acquisitions were cost-shared by the City of Austin (25%) and by FEMA (75%).

Introduction

The Federal Emergency Management Agency (FEMA) has invested billions of dollars in hazard mitigation programs throughout the hazard prone areas of the United States. One of the key components in building disaster resistant communities has been funding projects in the disaster struck areas via the Hazard Mitigation Grant Program (HMGP). During the HMGP project approval process, FEMA evaluates the cost effectiveness of the proposed project by performing benefit cost analysis. The benefits of the proposed project have to exceed the costs for FEMA to consider a project for approval.

After the projects are approved and completed, and later, when another disaster strikes, FEMA often documents the effectiveness of the projects, the resulting reports are called *"Success Stories"*. These success stories are a useful mechanism to qualitatively demonstrate the benefits of a mitigation project. Also, there is a need for developing tools to quantify the effectiveness of any given mitigated project after its completion. The losses avoided methodology used in this report is a step in that direction. This approach for quantifying the savings derived from acquisition of homes in a floodplain was developed and used for 735 acquisitions in Birmingham, Alabama last year *[2]*.

The objective of this report is to present the results of the losses avoided analysis performed on approximately 163 residential structures acquired in Austin, MN since 1978. This analysis incorporates the savings derived due to losses avoided to the structure, its contents, and displacement related costs. The analysis also incorporates the potential savings derived from avoided costs for individual assistance (source: NEMIS, IA-IFG summary report, DR-993-MN), and infrastructure clean up (streets, sewers, debris pick-up) (source: NEMIS, DSR P.5 – Obligation Report, DR-993-MN) in the residential areas where properties were acquired and removed.

Based on the current National Flood Insurance Program (NFIP)/ Community Rating System (CRS) verification the City of Austin has 3,461 credit points. This translates into a CRS Classification of 5 *[3]*. Nationwide, there are about 980 communities participating in the NFIP/CRS program. The current CRS ratings range from 3 to 9, 3 being the highest score to date. Only one community in the nation has a score of 3. Less than 20 communities have a *CRS Classification better than 5*. This analysis also incorporates savings in flood insurance premium (federally subsidized pre-FIRM structures under the NFIP), as the structures are permanently removed from the floodplain.

Finally, the report also documents the history of insurance claims by the owners of the acquired properties in the City of Austin (source: FEMA Bureau-net database).

Acquisition programs have direct and indirect costs, including the short-term costs of acquisition, the long-term costs associated with maintaining the lots once the land is cleared, and the loss of property tax revenue unless replacement housing is built in the community. Benefits generally include increased public safety, reduced evacuation requirements, and the elimination of flood insurance claims (if the structures were insured). *Table – 1* provides a listing of numerous repetitive costs that are not quantified for the analysis in this report.

Table – 1: Disaster related repetitive costs not reflected in the Losses avoided analysis

Community/ County	Response and Recovery
- Disruption of daily life - Pain and suffering - Human stress - Impact on mental health - Impact on physical health - Irreplaceable heirlooms - Environmental Impact - Physical impact on business - Disruption of economic base - Impact on education	- Evacuation - Immediate food/shelter - Temporary housing - Debris removal and clean-up - Public health issues - Activation and deployment - Administrative costs

Background

The City of Austin, Minnesota, the county seat of Mower County, is located in southeast Minnesota. Incorporated in March of 1868, the City serves as a trading and service center for the surrounding agricultural area. The largest employer in the City is Hormel Corporation, manufacturer of processed foods like, SPAM and Hormel Chili. The City has an estimated population of 22,500.

Figure – 1 shows the three (3) bodies of water as they meet in the City of Austin, MN. The Cedar River takes a southerly course through the City of Austin. Dobbins Creek joins the Cedar River from the east, just downstream from Oakland Avenue. Turtle Creek joins the Cedar River from the west just downstream from the community wastewater treatment facility. Industrial, commercial, and residential developments occupy the floodplain areas of the three streams within the City limits of Austin.

Figure - 1 also shows the scope of acquisitions since 1978 in the City. Past floods have inundated portions of the floodplain area and substantially greater areas are within reach of potentially greater floods. The major floods historically have resulted from either a combination of snowmelts and heavy rainfall or heavy rainfall alone over the watershed upstream from Austin.

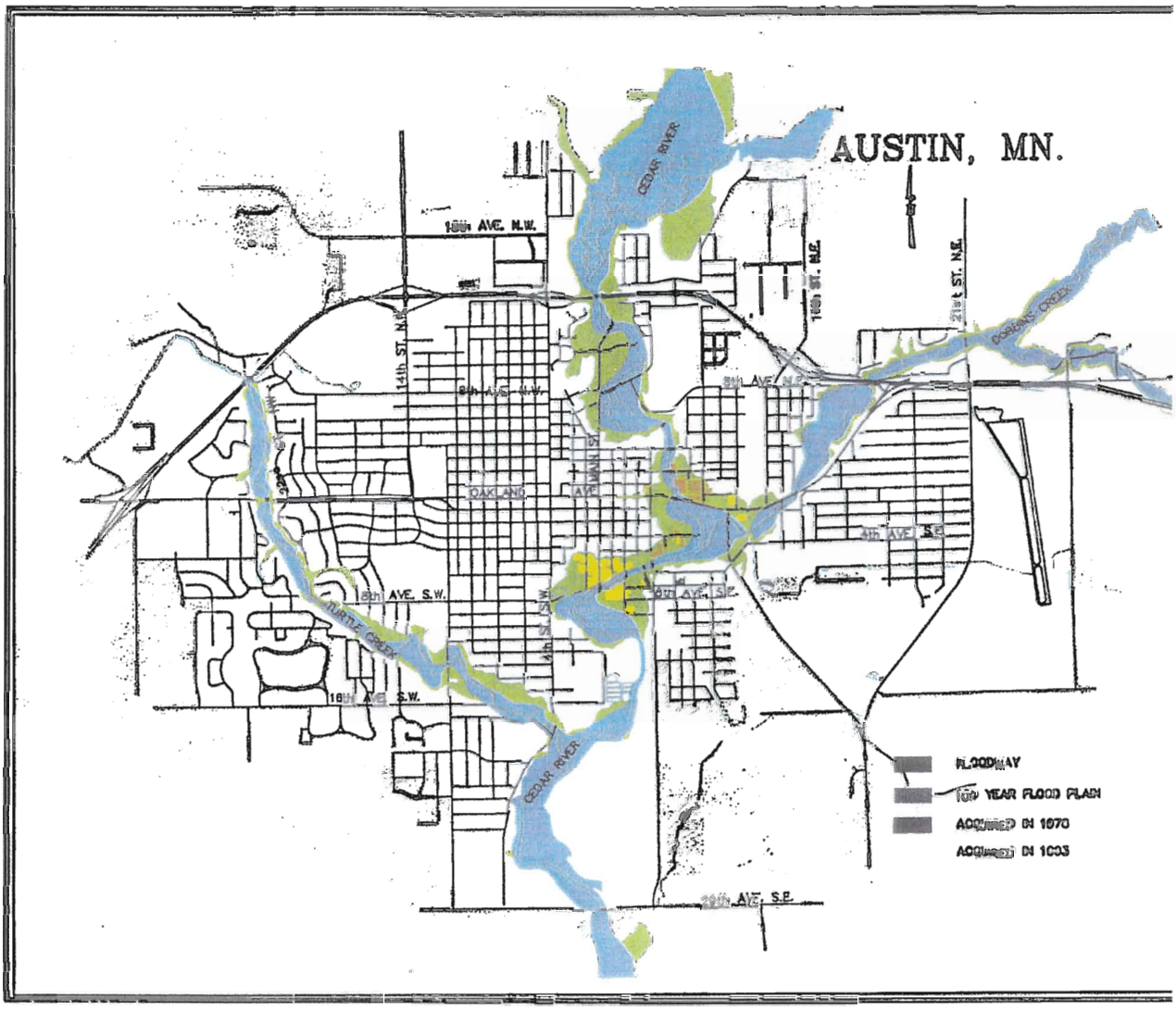

Figure – 1: Drawing of City of Austin showing Cedar River, Dobbins Creek and Turtle Creek along with their floodplains.

Figure – 2 zooms into the section of the floodplain where most of the acquisitions have occurred. The properties acquired after the floods of 1978 are highlighted in brown and the yellow colored properties indicate the acquisitions after the 1993 floods under the FEMA-HMGP program.

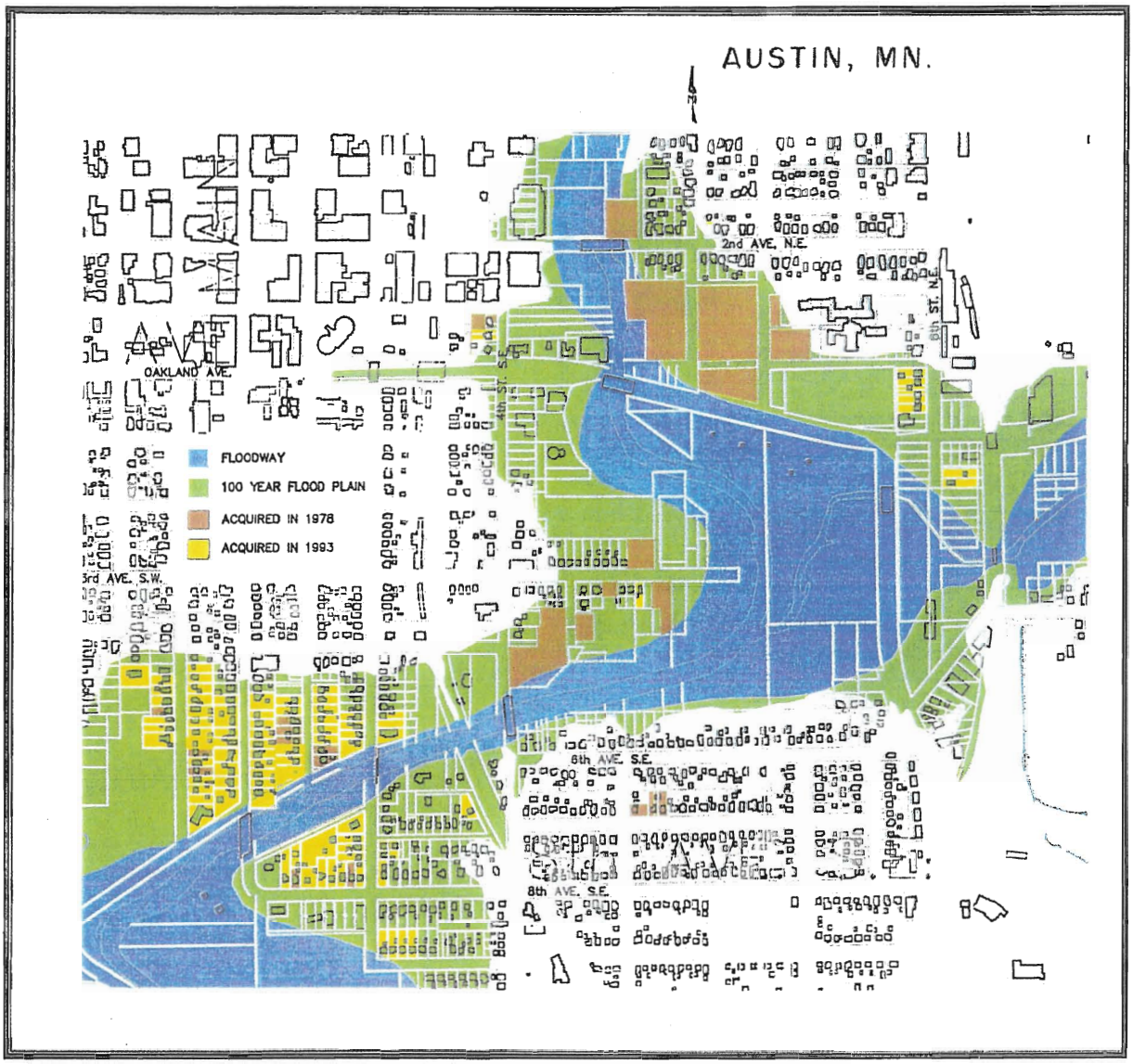

Figure 2: Most of the acquisitions are implemented near downtown Austin.

The flood-prone areas in Austin are subject to flash floods and floods of short duration. During the floods of 1978 the river rose by six feet above flood stage in three hours. This rapid rise of water greatly limits many of the flood-proofing options, and is threatening to life and safety. The record flood flow to date on the Cedar River in Austin occurred on July 10, 2000. The maximum discharge in the acquisition area was 15,500 cubic feet per second and it produced a gauge height of 23.4 feet. *Table-2* lists the history, level of inundation and damage estimates for some of the recent floods. These measurements were taken by the USGS gage in the inundation area (upstream of

TABLE - 2

Austin's Recent Major Floods

Year	Month	Crest Height (ft)	Above Mean Sea Level (ft)	Maximum Discharge (cfs)	Flood Type	Federal Disaster	Damage Estimate	Comments
1945	March	16.7	1184.4	7,750	10 yr		Not Available	3 homes flood
1950	March	17.9	1185.6	8,800	30 yr		Not Available	50 basements flood, homes isolated
1961	March	17.1	1185.1	8,290	30 yr		Not Available	homes isolated
1962	March	17.2	1185	9,530	40 yr		Not Available	100's of homes flood, 20 homes evacuated
1965	March	18.87	1186.69	8,410	40 yr		$1 million	50 homes evacuated
1978	July	21.9	1189.93	12,400	100 yr	HUD Block Grant	$12 million (FACTS)	400 homes flood, 25 commercial properties
1983	July	18.3	1186	8,690	30 yr			rose rapidly
1988	October	18.1	1185.8			FEMA Section-1362		Flooding of low lying areas
1993	April	17.9	1185.69	9,530	30 yr			Minor flooding
1993	August	21.25	1189.09	10,800	100 yr	FEMA-DR-993-MN	$2.6 million (76% residential)	Major flood, 450 homes damaged
2000	July	23.4	1191.25	15,500	500 yr	FEMA-DR-1333-MN		150 homes flood

Flood Watch	11 feet
Flood Stage:	13 feet

Summary of Discharges in Acquisition Area
(Upstream of confluence of Cedar River/Turtle Creek)

Flood	Discharge (cfs)	Elevation (ft)
10 yr	7200	1187
50 yr	11000	1190.4
100 yr	12500	1191
500 yr	15600	1194

Sources:
Reference 1
Reference 5
Reference 6
Reference 7

confluence of Cedar River and Turtle Creek) shown in *Figure – 2*. *Table –2* also lists the types of flood events and identifies the floods leading to federal disaster declarations.

A. Impact on Quality of Life

Major and frequent flooding has been a part of life in Austin since records have been kept. There is pictorial documentation of devastating floods since the early 1900's. On an average the City of Austin experiences a flood every four to five years. Until about 30 years ago the flooding was most severe in the month of March due to melting snow and rains. In recent years, the pattern and severity of the flooding has increased. Most of the major flooding now occurs in the summer months of June or July. *Figure – 3* graphically show's the maximum flood discharge for the recent major floods in Austin, MN.

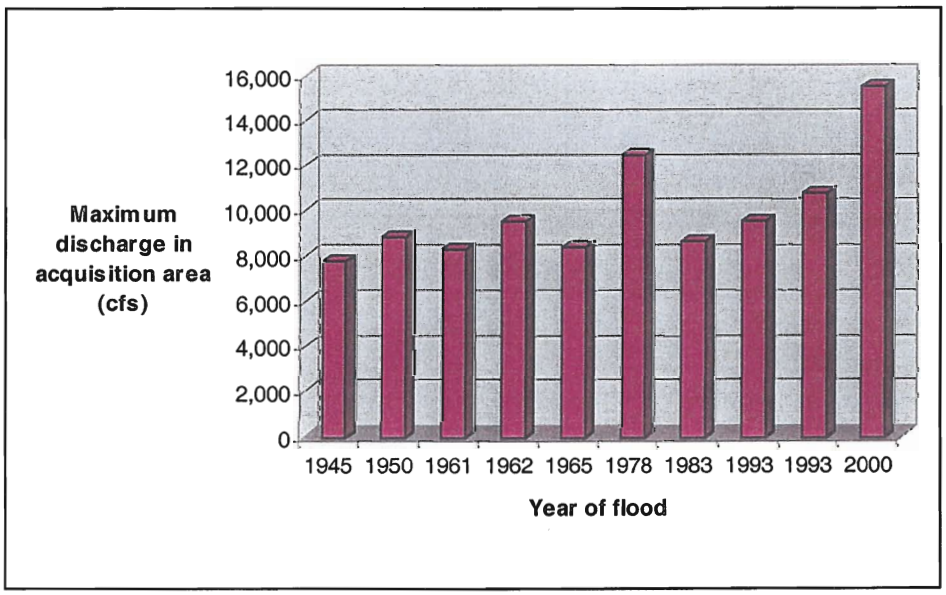

Figure 3 – Maximum flood discharge in cubic feet per second (cfs) for the major floods since 1978.

Some of the reasons for the increase in severity of the floods are:

(1) Extensive tiling of the farmland up-stream,
(2) Systematic and fast drainage of the farmland using perforated pipes,
(3) Development along the river bank up-stream,
(4) And rise in the water table up-stream along the river and creek banks.

The impact on the quality of life following the floods is devastating. The citizens of Austin have historically taken an active role in organizing and assisting various city, state and federal agencies in addressing the challenges presented by repetitive flooding. The

100-year floods of 1978 severely impacted more than 400 homes along the Cedar River in Austin.

Figure 4 – Record flooding of a neighborhood in Austin from Cedar River during July 2000.

Figure – 4 shows flood water in a neighborhood during the record flood of July 2000. Since 1978, Alice Snater has been an active citizen in the community working to address the chronic problems caused by flooding. Mrs. Snater is one of the many residents whose homes were acquired following the flood of 1993 in the City of Austin. Her experiences and feelings as a flood victim paint a graphic picture of the impact of floods on residents. She said;

"The flood water in the homes is not just water, it is actually mud laden dirty water. Cleanup is very difficult as the carpets are laden with mud. The mud is so fine that it penetrates behind the baseboards and into the wall. The dampness lasts for a long time and the musk and mold smell never goes away. The psychological help provided by the Red Cross and FEMA is well worth it and such assistance helps overcome the shock and the desperate feeling of helplessness. The various human feelings and emotions are very similar to experiencing a death in the family."

Figure 5 – Flooding of July 2000 in neighborhood after acquisition of 1993

B. Floodplain Management

The City of Austin has implemented a flood warning policy. This policy establishes steps and procedures that are to be followed when high water from the Cedar River, Dobbins Creek or Turtle Creek poses a threat to the City of Austin. The policy identifies three stages of notification actions: flood alert, flood watch, and flood warning. These stages are based on river gauge readings from gauges throughout Mower and Freeborn Counties.

On December 23, 1971 the City of Austin adopted Floodplain Zoning Ordinance No. 1213 *[4]*. This ordinance is designed to minimize losses in the flood hazard areas, by regulating the use of land, location of construction, and use of buildings and other structures in the floodplains of Austin.

The City of Austin has participated in the National Flood Insurance Program (NFIP) since 1971 and its Community Rating (CRS) has improved significantly over time. The community also has a flood warning system for high flows on the Cedar River. Summarized below are the key features of the City's floodplain management strategy in the special flood hazard area (SFHA) of Austin:

1. *Building Data:* A recent inventory of the floodplain revealed that there are 137 structures in the area. All of the buildings are 'pre-FIRM", meaning they were built prior to the adoption of the flood insurance rate maps in December of 1971. The elevations of all of these structures are on file in the Office of the City Engineer.

2. *Development Trends:* There has been no new development in the floodplain. The trend has been towards the removal of structures in the flood prone areas, primarily motivated by the acquisitions since 1978. The City has approximately 200 acres of controlled open space in the floodplain. The City also has a shore land management ordinance that controls erosion and an annual stream maintenance program.

3. *Development Constraints:* The City has been acquiring and removing structures using the funding provided by FEMA and HUD since 1978. The vacated land is regulated by an ordinance that prohibits structures from being built on these lots. Also, the City's floodplain zoning ordinance requires substantially damaged structures to be repaired or rebuilt in conformance with the floodplain ordinance. The ordinance discourages building because of the flood proofing and elevation requirements. *Figure – 5* show's a neighborhood in Austin where homes were removed after the 1993 floods.

4. *Critical Facilities:* There are two critical facilities, the sewage treatment plant and the electric power plant, in the floodplain. Traditionally such facilities are on the bank of a river, or lake, because the treated water is released in the river or lake.

5. *Community Goals:* The ultimate goal for the City is to acquire and remove all structures in the floodplain. They also plan to prohibit any future structures in the floodplain. The land would be developed as part of the City of Austin Linear Park System *(see Figure – 6).*

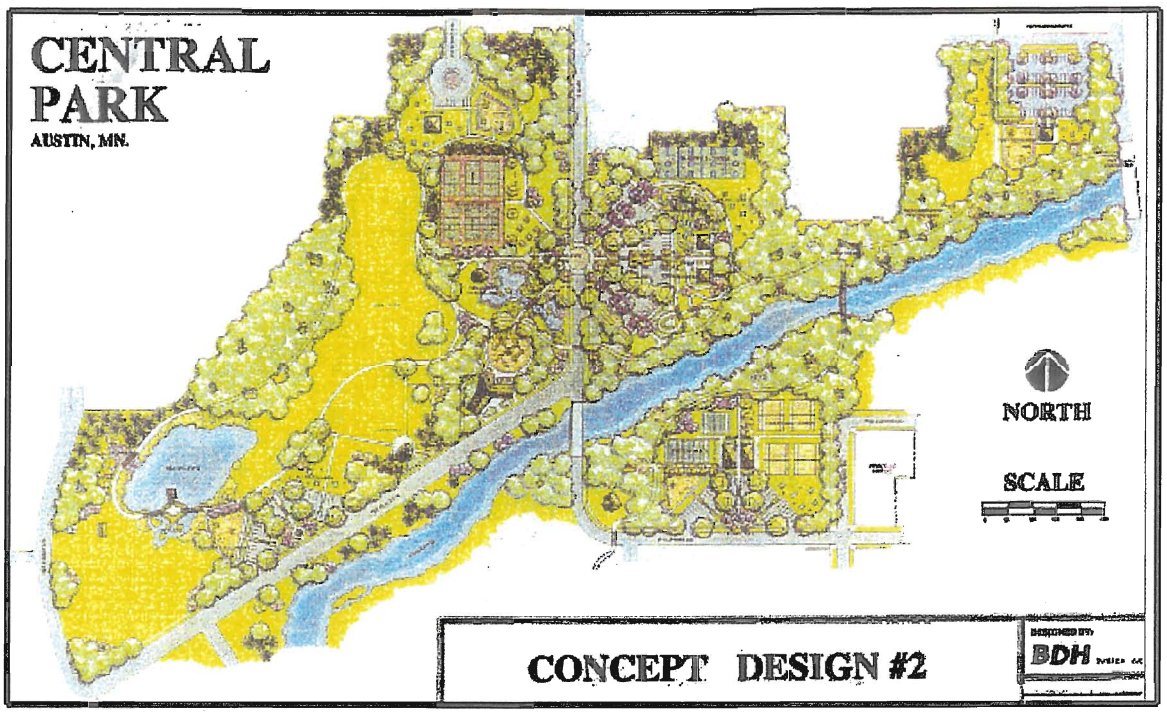

Figure 6 – Proposed Central Park on the land acquired after 1993 floods.

C. History of Mitigation Strategies

During the floods of July 1978, the City of Austin experienced extensive flooding along the Cedar River and Dobbins Creek. Approximately 400 homes, 25 commercial structures and 11 industries sustained flood damages. The U. S. Army Corps of Engineers (USACE), Rock Island District conducted a feasibility study to evaluate the alternatives to reduce flood damages in Austin.

A large group of concerned citizens formed the Floodway Action Citizens Task Source (FACTS). This group assisted in the feasibility study efforts by providing data for the economic evaluations. They were also knowledgeable as to the community's preference of the possible solutions. Both structural and non-structural alternatives were evaluated including the alternative of, "No Federal Action." The USACE study concluded that the benefit-cost analyses for various potential structural and non-structural solutions were not cost-effective *[1].*

Soon after the completion of the above study by the USACE, the City of Austin applied for, and subsequently received, a Community Development Block Grant from the U. S. Department of Housing and Urban Development (HUD). This grant of $1.7 million was for relocation of residents from the low-lying flood prone areas. This grant helped fund acquisition and relocation of approximately 58 families. Following the floods of 1993, FEMA, through the Minnesota Division of Emergency Management, funded the acquisition of approximately 100 homes in the City of Austin. In 1992, FEMA updated its Flood Insurance Study (FIS) of the City of Austin. This study provides updated information useful in conducting the benefit cost analysis required to approve the HMGP acquisition project following the floods of 1993 *[5].*

D. Typical Damage to Homes due to the Floods of 1993 and 2000

Most single-family homes in the City of Austin have basements. Typically, all the residential utilities and the related equipment are installed in basements. This includes the furnace or boiler, water heater, washer and dryer, refrigerator, freezer and the electrical panel and wiring. Flooding of the basement generally damages most of this equipment, which then has to be replaced. The average cost for replacing these items is about $4000. Many of these homes also had their basements partly furnished. The furnishings included vinyl and/or carpet flooring, family room furniture, children's toys, cabinets, etc. The depth of floodwater and damage experienced by the level of flooding is referred to as "depth-damage function" (DDF). The actual depth of flooding is incorporated in the modified depth-damage function table, utilized to determine the losses avoided in this report *[see Appendix A].*

The summer of 2000 flood was the highest flood of record. It crested about two feet higher than the floods of 1993. Many homes had developed cracks and structural failures of the basement after the 1993 floods. Most of these homes were acquired under the HMGP project that followed. Six homes were substantially damaged in the year 2000 flood.

E. Acquisition Project Implementation

After the 1978 floods, it became apparent to the City of Austin that repetitive flooding of homes and businesses had to be addressed. The City requested help from the USACE to either dredge the Cedar River, or to engineer and implement an effective flood control project. The USACE studied the issues and concluded that the various structural and non-structural solutions were not cost effective. The residents were disappointed, but the City through its Housing and Redevelopment Authority (HRA) received a Community Development Block Grant from the U. S. Department of Housing and Urban Development (HUD). This grant of $1.7 million was used by the City to acquire 58 properties in the floodplain.

Thus, following the 1978 floods the City pioneered the usage of federal funds to acquire properties in the floodplain. The Housing and Redevelopment Authority (HRA) of Austin managed and implemented this project. Homeowners were given the option to relocate their structures outside the floodplain. The homes that were structurally sound were auctioned off with the condition that they would be moved out of the floodplain. The monies raised via the auction were recycled to fund more acquisitions. Again after the 1993 floods, Hazard Mitigation Grant Program (HMGP) funds were used by the City of Austin to acquire homes. This project was also managed and implemented by HRA of Austin.

For continuity purposes homes were acquired in blocks, along the Cedar River in the 100-year floodplain. The cleared lots were deeded back to the City and the land will be incorporated into the City's Linear Park System, presently in the planning stage, *Figure-6* show's the sketch of the concept design for the Central Park, a node in the Linear Park System.

Economic Analysis – Cost Effectiveness

Determination of losses avoided in subsequent disasters due to hazard mitigation is done to quantify savings resulting from implementing a mitigation project. Pre-project benefit-cost analysis identifies projected benefits. *Benefit-cost analysis* can be considered as foresight and *losses avoided analysis* can be compared to hindsight. *Measuring losses avoided* is a quantitative method for determining the financial savings realized by the community, resulting directly from the mitigation project.

To perform the losses avoided calculations, detailed data was collected from the City of Austin's HRA office and the City Engineer's office *[6].* The multiple flood-related losses avoided (savings) were calculated for actual events. Each flood is considered as an independent event for calculating the losses avoided. The cost savings are very significant and clearly illustrate the financial benefits of these acquisition projects.

Losses Avoided Methodology and Results

The losses avoided calculations include damage to structure, damage to contents, displacement costs, FEMA Individual Assistance (IA) costs, and FEMA Public Assistance including infrastructure cleanup and emergency services costs (categories A and B). The federal disaster Individual Assistance Program is administered by FEMA through the state. This program includes housing assistance, individual and family grants (IFG) and other aid programs to severely impacted residents. The Infrastructure or Public Assistance Program is primarily directed to assist the state and local communities with costs of disaster response and recovery including emergency work, disaster related clean up and repairs to public infrastructure and buildings.

The calculations for the damage to a structure, its contents and displacement costs are based on the modified depth damage function tables (DDF) that reflect the types and level of damages historically experienced in Austin. To keep the losses avoided analysis consistent with the benefit cost analysis the same federally mandated discount rates of 5% and 7% were used. Also, for the economic analysis performed in this report, the various costs and losses avoided are normalized to 2001 dollars. Most homes were double story structures with basements. The finished basements were furnished and included several utilities. These included furnace or boiler, water heater, washer and dryer, refrigerator, freezer and the electrical panel and wiring. Basement flooding generally damaged most of this equipment. Some structures also experienced foundation failures and damage to the basement walls due to the inward hydrostatic pressure.

A. Data Collection

After the flood disaster of July 2000, the information described below was collected and/or developed. The data gathering phase for this analysis was extensive and required detailed data for about 165 properties that were acquired since 1978. The raw data was processed, screened and used for further calculations.

Vulnerability data include building depth damage function (DDF), contents damage function, displacement costs *(See Appendix A).*

Mitigation costs include property cost, relocation cost, appraisal fees, demolition cost (including asbestos abatement), title fee, legal fee, and project management cost.

Historical flood hazard data includes flood elevation, flood insurance study data, and repetitive damage information from the National Flood Insurance Program (NFIP) databases.

Building data includes project completion date, property address, structure type, and first-floor elevation (FFE).

B. Computation of Losses Avoided

Briefly presented in this section is a listing of the various pieces of information needed and the procedure used to compute the losses avoided from subsequent floods after the acquisitions of homes in the floodplain. To determine the losses avoided in flood prone areas, it is necessary to first identify the following data:

1. Fair market value of each home before the flood,
2. Number of years since the implementation of the project,
3. Discount rate (federal),
4. First floor elevation of each structure,
5. Base flood elevation,
6. Flood elevation for each subsequent flood,
7. Building depth-damage function table,
8. Content depth-damage function table, and
9. Displacement depth-damage function.

The above data was acquired, measured or developed for all the 163 properties. Next the data was subjected to quality control, verification, and cross -checked. Finally, the data was entered in spreadsheets and processed using formulas listed in tables three and four.

The total acquisition cost for each property was determined using formulas presented in *Table - 3.* The *losses avoided calculations* were performed using the formula in *Table-4.*

Table – 3: Formulas for determination of total acquisition costs

Type of Property	Formula – Total acquisition cost
Homes with Tenants	Purchase price + Demolition cost + Appraisal fee + Title/Legal fee + Project management fee + Relocation cost
Owner Occupied Homes or Vacant Homes	Purchase price + Demolition cost + Appraisal fee + Title/Legal fee + Project management fee
Vacant Lots	Purchase price + Title/Legal fee + Project management fee

Table – 4: Formula for determination of losses avoided

Formula for Losses Avoided Determination	Usage of Depth – Damage Function (see Appendix A) and previous experience in disaster costs in Austin, MN
Damage to structure	(Bldg. DDF) X (Property value)
+ Damage to contents	(Content DDF) X (Content value)
+ Displacement cost	(Number of days displaced) X (cost)
+ avoided individual assistance cost	DR-993-MN-1993 Austin experience
+ avoided infrastructure cost	DR-993-MN-1993 Austin experience
+ savings in (pre-FIRM) insurance premium	Homeowner premium + FIA subsidy

C. Summary of Losses Avoided

Analysis of the data in this report shows that the buy-outs after the 1978 floods have avoided losses of more than 80% (normalized savings of $3.9 million on an investment of $4.87 million in 2001 dollars). The actual investment after the 1978 floods was $1.7 million funded by HUD through a Block Grant to the City of Austin. These estimates are normalized to the year-2001 for the acquisitions after 1978 floods (a duration of 20-years).

The flooding of October 1988 was declared as a Federal disaster. The acquisition of four homes was directly administered by FEMA, under Section 1362 of FEMA regulations. The cost of this acquisition was $215,928 (normalized) and the losses avoided are $286,791 (normalized). In the aftermath of the 1993 floods, HMGP acquisitions avoided losses of more than $2.6 million on a total investment of $5.5 million (normalized to $7 million). This return on investment is more than 36%. The HMGP funded acquisitions are cost-shared (25%) by the City of Austin and 75% by FEMA. The above savings are determined due to losses avoided following the flood of 2000.

The discount rate used is 7% to keep the assumptions consistent with FEMA's benefit-cost analysis model. Summary of the direct losses avoided resulting from acquisitions in Austin, MN is presented in *Table-5*. For detailed results of losses avoided, please refer to Appendices B, C and D. *Appendix B* presents the total losses avoided for the 101 acquired properties following the floods of 1993. *Appendix C* presents the total losses avoided for the 58 properties acquired following the flood of 1978. Finally, *Appendix D* presents the losses avoided for the four properties acquired after the flood of 1988.

Table – 5: Summary of normalized losses avoided due to acquisitions in Austin, MN

Funding Sources	Total Acquisition Cost	Total Losses Avoided	% of Losses Avoided to Acquisition Cost
HUD (after 1978)	$4,876,952	$3,909,314	80.2%
FEMA/ City of Austin (after 1993)	$7,042,314	$2,568,982	36.5%
FEMA/ City of Austin (after 1988)	$215,928	$286,791	124%

(Note: Dollars normalized to the year 2001 for all acquisition projects. The discount rate used for this normalization is 7%.)

Conclusion

This report documents some of the direct savings resulting from the Federal and State funded acquisition projects. Numerous floods have occurred since the implementation of these projects, and the resulting losses avoided for the multiple flooding events are presented.

The calculation of losses avoided is a detailed quantitative method used to perform a post-mitigation, HMGP project review. Analysis of losses avoided following subsequent floods helps to quantify some of the benefits (savings) resulting from previously implemented mitigation projects. As compared to the pre-project benefit-cost analysis, it identifies some of the actual losses avoided. Thus, measuring losses avoided is a methodology for calculating the financial savings realized by the community as a direct result of the mitigation project.

In Austin, MN losses avoided analysis has demonstrated the economic viability of the 163-property acquisitions. During the first phase, in a time span of about 20 years, the investment of $1.7 million (normalized to $4.8 million to year 2001) from HUD has saved more than $3.9 million in losses avoided. Later, in the aftermath of 1993 floods, an investment of $5.5 million (normalized to $7 million to the year 2001), with the hazard mitigation grant program has saved $2.6 million.

The above result, from the *losses avoided* analysis has demonstrated the economic viability of the various acquisition projects implemented in Austin, Minnesota since 1978.

References

1. Austin, Minnesota, Summary of Findings, Iowa-Cedar River Basin, USACE, Rock Island District, IL, August 1979.

2. Losses Avoided in Birmingham, Alabama (Analysis of 735 Acquisitions on Village Creek), FEMA Region IV, Atlanta, GA, October 2000.

3. Community Rating System (CRS) Verification Report (NFIP/CRS # 275228), date of verification visit: June 28, 2000, date of report: February 14, 2001.

4. Floodplain Zoning Ordinance No. 1213, City of Austin Building Code, Austin, MN, 1971.

5. Flood Insurance Study, City of Austin, Mower County, MN, FEMA, 1992.

6. Austin City Engineer's Office, (communication with Jon Erichson 93) below, Primary source of First floor elevation data of structures in floodplain).

7. Housing and Redevelopment Authority of Austin, 308 Second Ave. NE, Austin, MN, 55912 (communications with Thomas Smith (1) below, Primary source for detailed cost information on acquisition of homes).

8. FEMA Region-V Office, 6th Floor, 536 S. Clark Street, Chicago, IL 60605 (Jeanne Kern, Norbert Schwartz and Shabbar Saifee).

Key Contacts

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APPENDICES

Appendix A

Flood Depth-Damage Table Used

(For One-Story Homes w/Basement)

Flood Depth (ft)	Bldg (DDF)	Contents (DDF)	Displacement (days)
-8	1%	1%	0
-7	6%	1%	0
-6	6%	1%	7
-5	6%	2%	7
-4	7%	2%	7
-3	8%	2%	7
-2	8%	6%	7
-1	8%	12%	7
0	16%	17%	15
1	23%	33%	15
2	27%	41%	31
3	35%	44%	62
4	40%	45%	93
5	60%	60%	124
6	100%	65%	254
7	100%	66%	302
8	100%	66%	302

Sample Calculation:

Flood Elevation	1192 ft
First Floor Elevation	1190 ft
Flood Depth	2 ft
Building DDF	27%
Contents DDF	41%
Displacement period	31

		Event	July 2000 flood crests at various locations							
	1207	(feet)	1192	1186	1189	1195	1193			
No.	Street		1st floor. Elev.	Norm. Acquisition Cost	Normalised Losses Avoided	Loss Avoided	Structure	Contents	Displacement	IFG (1993)
				(7% for 4 yrs.)	(7% for 1 yr.)					
1	S. Main		1193.0	$55,592	$17,280	$16,149	$11,451	$4,199	$500	
2	S. Main		1189.0	$123,276	$48,703	$45,517	$32,916	$11,568	$1,032	
3	S. Main		1190.0	$74,164	$22,874	$21,377	$15,276	$5,601	$500	
4	S. Main		1192.0	$83,583	$13,622	$12,731	$10,202	$2,296	$233	$2,618
5	S. Main		1189.5	$54,405	$18,558	$17,344	$11,206	$5,105	$1,032	$2,118
6	S. Main		1191.0	$72,437	$17,150	$16,028	$12,710	$2,818	$500	$2,059
7	S. Main		1191.0	$60,131	$14,327	$13,390	$10,551	$2,340	$500	
8	S. Main		1190.0	$59,952	$18,593	$17,376	$12,349	$4,528	$500	
9	S. Main		1190.0	$95,752	$29,376	$27,455	$19,723	$7,232	$500	
10	S. Main		1191.0	$75,439	$17,839	$16,672	$13,237	$2,935	$500	
11	S. Main		1191.0	$88,185	$20,762	$19,404	$15,473	$3,431	$500	
12	S. Main		1191.5	$85,805	$15,313	$14,312	$10,474	$3,338	$500	$3,119
13	S. Main		1191.0	$57,024	$13,615	$12,724	$10,006	$2,219	$500	
14	S. Main		1191.5	$81,271	$14,532	$13,582	$9,920	$3,162	$500	$2,141
15	S. Main		1191.8	$59,355	$9,746	$9,108	$7,245	$1,630	$233	
16	S. Main		1192.0	$62,538	$10,255	$9,584	$7,634	$1,718	$233	
17	S. Main		1192.2	$61,725	$6,094	$5,696	$3,767	$1,695	$233	
18	S. Main		1192.0	$71,045	$11,616	$10,856	$8,672	$1,951	$233	
19	S. Main		1191.7	$76,033	$12,414	$11,602	$9,281	$2,088	$233	
20	1st Ave NE		1194.6	$49,542	$3,727	$3,483	$3,024	$227	$233	
21	1st St. SE		1192.5	$60,737	$6,001	$5,608	$3,707	$1,668	$233	
22	1st St. SE		1191.7	$62,702	$10,281	$9,609	$7,654	$1,722	$233	
23	1st St. SE		1191.3	$52,103	$9,509	$8,887	$6,360	$2,027	$500	$298
24	1st St. SE		1189.6	$53,162	$16,548	$15,465	$10,950	$4,015	$500	
25	1st St. SE		1189.4	$50,259	$17,228	$16,101	$10,352	$4,716	$1,032	
26	1st St. SE		1190.0	$49,313	$15,388	$14,382	$10,158	$3,724	$500	
27	1st St. SE		1190.3	$67,456	$18,651	$17,430	$11,836	$5,095	$500	
28	1st St. SE		1190.2	$50,121	$13,995	$13,079	$8,795	$3,785	$500	$298

No.	Street	1st floor. Elev.	Norm. Acquisition Cost	Normalised Losses Avoided	Loss Avoided	Structure	Contents	Displacement	IFG (1993)
			(7% for 4 yrs.)	(7% for 1 yr.)					
29	1st St. SE	1189.5	$52,318	$17,888	$16,718	$10,777	$4,909	$1,032	$363
30	1st St. SE	1189.8	$68,009	$21,020	$19,645	$14,009	$5,137	$500	
31	1st St. SW	1192.8	$36,542	$11,542	$10,786	$7,527	$2,760	$500	$1,765
32	1st St. SW	1191.6	$77,062	$12,579	$11,756	$9,406	$2,116	$233	$1,089
33	1st St. SW	1191.6	$49,923	$8,237	$7,698	$6,094	$1,371	$233	$750
34	1st St. SW	1188.2	$18,430	$9,460	$8,842	$4,921	$1,856	$2,065	$894
35	1st St. SW	1191.7	$47,418	$7,836	$7,323	$5,788	$1,302	$233	
36	1st St. SW	1190.0	$68,452	$21,153	$19,769	$14,100	$5,170	$500	$750
37	1st St. SW	1191.6	$44,564	$7,379	$6,897	$5,440	$1,224	$233	$785
38	1st St. SW	1190.6	$35,292	$8,630	$8,065	$6,193	$1,373	$500	$250
39	1st St. SW	1191.1	$80,288	$14,363	$13,423	$9,800	$3,124	$500	
40	1st St. SW	1189.5	$16,867	$6,516	$6,089	$3,474	$1,583	$1,032	$363
41	1st St. SW	1190.7	$50,155	$12,039	$11,251	$8,800	$1,951	$500	$363
42	1st St. SW	1187.7	$84,625	$38,959	$36,411	$25,824	$8,522	$2,065	$750
43	1st St. SW	1198.4	$87,483	$5,677	$5,305	$4,672	$400	$233	
44	1st St. SW	1189.2	$51,849	$17,738	$16,577	$10,680	$4,865	$1,032	$363
45	1st St. SW	1189.5	$65,579	$22,143	$20,694	$13,508	$6,154	$1,032	
46	1st St. SW	1189.4	$64,951	$21,941	$20,506	$13,379	$6,095	$1,032	$750
47	1st St. SW	1189.2	$51,409	$17,597	$16,446	$10,589	$4,824	$1,032	
48	1st. St. NE	1200.1	$92,259	$38,509	$35,990	$24,634	$9,291	$2,065	
49	2nd St. SE	1192.0	$91,267	$36,343	$33,966	$24,369	$8,564	$1,032	
50	2nd St. SE	1189.5	$88,295	$29,430	$27,505	$18,187	$8,285	$1,032	
51	2nd St. SE	1192.0	$71,420	$28,680	$26,804	$19,070	$6,702	$1,032	
52	2nd St. SE	1191.7	$96,303	$15,657	$14,633	$11,755	$2,645	$233	$363
53	2nd St. SE	1191.9	$36,738	$6,127	$5,726	$4,484	$1,009	$233	
54	2nd St. SE	1191.3	$49,758	$9,105	$8,509	$6,074	$1,936	$500	
55	2nd St. SE	1189.9	$30,176	$9,624	$8,994	$6,216	$2,279	$500	$4,574
56	2nd St. SE	1191.0	$67,961	$31,723	$29,647	$20,739	$6,844	$2,065	
57	2nd St. SE	1191.7	$46,498	$19,058	$17,811	$12,416	$4,363	$1,032	
58	2nd St. SE	1191.5	$49,421	$21,654	$20,237	$13,196	$4,977	$2,065	

No.	Street	1st floor. Elev.	Norm. Acquisition Cost (7% for 4 yrs.)	Normalised Losses Avoided (7% for 1 yr.)	Loss Avoided	Structure	Contents	Displacement	IFG (1993)
59	2nd St. SE	1191.3	$43,399	$19,285	$18,023	$11,588	$4,370	$2,065	
60	2nd St. SW	1191.3	$86,026	$36,057	$33,698	$22,970	$8,663	$2,065	$1,654
61	2nd. Dr. SW	1190.5	$85,737	$40,756	$38,090	$26,163	$8,830	$3,097	
62	3rd Ave SE	1193.8	$48,983	$11,770	$11,000	$8,595	$1,906	$500	
63	4th St. NE	1194.3	$50,451	$9,224	$8,621	$6,158	$1,963	$500	
64	4th St. SE	1193.9	$97,446	$22,887	$21,389	$17,098	$3,791	$500	
65	7th Pl. SE	1201.0	$68,717	$27,637	$25,829	$18,348	$6,448	$1,032	
66	7th Pl. SE	1201.0	$24,039	$10,386	$9,707	$6,419	$2,256	$1,032	
67	7th Pl. SE	1201.0	$77,851	$10,386	$9,707	$20,787	$7,305	$1,032	
68	7th Pl. SE	1201.5	$83,690	$31,163	$29,125	$17,239	$7,853	$1,032	$4,023
69	8th Ave SE	1187.5	$63,564	$31,074	$29,041	$19,397	$6,547	$3,097	
70	8th Ave SE	1188.0	$72,032	$33,491	$31,300	$21,981	$7,254	$2,065	
71	8th Ave SE	1188.0	$47,641	$22,898	$21,400	$14,538	$4,798	$2,065	$250
72	8th Ave SE	1189.9	$74,177	$22,877	$21,381	$15,279	$5,602	$500	
73	8th Ave SE	1190.0	$44,386	$29,944	$27,985	$20,317	$4,571	$3,097	
74	8th Ave SE	1190.0	$58,859	$38,628	$36,101	$26,942	$6,062	$3,097	
75	8th Ave SE	1190.0	$60,800	$39,792	$37,189	$27,830	$6,262	$3,097	
76	9th Ave SE	1189.9	$68,307	$44,296	$41,398	$31,267	$7,035	$3,097	
77	9th Ave SE	1190.1	$49,060	$24,739	$23,121	$14,971	$5,053	$3,097	
78	9th Ave SE	1190.8	$54,507	$25,880	$24,187	$16,633	$5,489	$2,065	
79	9th Ave SE	1190.8	$64,630	$30,276	$28,295	$19,722	$6,508	$2,065	
80	9th Pl. SW	1190.1	$56,335	$27,916	$26,090	$17,191	$5,802	$3,097	
81	10th St. SE	1190.6	$92,593	$21,773	$20,349	$16,247	$3,603	$500	
82	10th St. SE	1190.6	$62,968	$29,554	$27,621	$19,215	$6,341	$2,065	

No.	Street	1st floor. Elev.	Norm. Acquisition Cost (7% for 4 yrs.)	Normalised Losses Avoided (7% for 1 yr.)	Loss Avoided	Structure	Contents	Displacement	IFG (1993)
83	10th St. SE	1190.9	$25,449	$13,261	$12,393	$7,766	$2,563	$2,065	$298
84	10th St. SE	1187.5	$26,314	$14,806	$13,837	$8,030	$2,710	$3,097	
85	10th St. SE	1193.5	$80,991	$22,286	$20,828	$14,211	$6,117	$500	
86	16th Ave NE	1194.9	$74,590	$12,183	$11,386	$9,105	$2,049	$233	
Losses Avoided Calculations for Mower County (outside the City of Austin)									
1	1st. Dr. SE	1188.0	$83,209	$38,344	$35,836	$25,392	$8,379	$2,065	
2	1st. Dr. SE	1188.0	$72,559	$33,719	$31,513	$22,142	$7,307	$2,065	
3	1st. Dr. SE	1187.0	$62,711	$40,939	$38,261	$28,705	$6,459	$3,097	
4	1st. Dr. SE	1188.0	$53,612	$25,491	$23,823	$16,360	$5,399	$2,065	
5	1st. Dr. SE	1186.0	$162,847	$63,981	$59,795	$43,482	$15,281	$1,032	
6	1st. Dr. SE	1183.0	$118,421	$46,828	$43,765	$31,620	$11,112	$1,032	
7	RR1	1184.0	$178,380	$54,265	$50,715	$36,743	$13,472	$500	
8	RR1	1204.1	$119,765	$39,526	$36,940	$24,669	$11,238	$1,032	
9	RR1	1206.4	$105,762	$18,751	$17,524	$12,910	$4,115	$500	
10	RR1	1205.6	$84,502	$19,917	$18,614	$14,827	$3,288	$500	
11	RR1	1203.5	$123,896	$50,957	$47,623	$33,082	$12,477	$2,065	
12	RR1	1204.0	$124,650	$49,233	$46,012	$33,283	$11,697	$1,032	
13	RR1	1205.0	$89,415	$27,467	$25,670	$18,418	$6,753	$500	
14	RR1	1205.0	$129,715	$39,606	$37,015	$26,719	$9,797	$500	
15	RR1	1204.8	$125,025	$38,194	$35,695	$25,753	$9,443	$500	
		Total Costs	**$7,042,430**	**$2,265,051**	**$2,116,870**				**$33,048**

No.	Street	1st floor Elev.	Norm. Acquisition Cost (7% for 4 yrs.)	Normalised Losses Avoided (7% for 1 yr.)	Loss Avoided	Structure	Contents	Displacement	IFG (1993)

Summary of Losses Avoided from Flood of July 2000

(All monies are normalized to Year 2001)

Losses Avoided due to Acquisition of Residential Structures	$2,265,051
Non-Expenditures due to Avoided City Services	$268,570
Non-Expenditures due to Avoided Individual Assistance	$35,361
Total Losses Avoided	$2,568,982
Total Project Cost	$7,042,430
Loss Avoided Vs Acquisition Costs	36.5%
FEMA - HMGP 75% Share	$5,281,822
City of Austin 25% Share	$1,760,607

(Funded by HUD Community Development Block Grant)

Losses Avoided during the floods of July 2000, August 1993, April 1993 and July 1983

			Flood Event	Jul-00	August 1993	April 1993	July 1983
			Flood Crest (ft)	1195	1193	1190	1191
No.	Street	1ST Flr. Elev.	Norm. Acq Cost	Normalised Losses Avoided			
			(5% for 20 yrs.)	(7% for 1 yr.)	(7% for 8 yrs.)	(7% for 8 yrs.)	(7% for 18 yrs.)
1	1st St. SE	1190.0	$70,734	$24,280	$23,440	$9,378	$27,008
2	1st St. SE	1190.2	$76,572	$19,834	$21,261	$6,152	$22,270
3	1st St. SE	1187.8	$54,692	$35,407	$31,353	$13,927	$36,443
4	1st St. SW	1189.8	$110,441	$36,049	$35,602	$14,418	$41,221
5	1st St. SW	1187.5	$93,022	$55,701	$54,080	$25,447	$64,094
6	2nd Ave NE	1195.9	$56,250	$2,472	$3,533	$2,695	$5,517
7	2nd Ave SE	1190.0	$102,683	$33,749	$33,225	$13,433	$38,444
8	2nd Ave SE	1187.5	$52,270	$36,013	$33,496	$15,076	$39,072
9	3rd Ave SE	1192.5	$146,462	$24,317	$20,870	$8,557	$19,072
10	3rd Ave SE	1192.9	$117,276	$17,986	$15,285	$6,932	$13,636
11	3rd Ave SE	1192.4	$147,789	$24,527	$21,052	$8,631	$19,238
12	3rd Ave SE	1187.5	$82,783	$50,755	$48,909	$22,841	$57,807
13	4th St. SE	1196.4	$94,723	$3,993	$5,062	$3,864	$8,390
14	4th St. SE	1191.6	$246,624	$48,147	$45,735	$14,135	$31,576
15	5th St. SE	1192.0	$48,290	$10,316	$9,645	$3,090	$6,816
16	5th St. SE	1192.6	$80,130	$12,458	$10,571	$4,863	$9,566
17	5th St. SE	1192.3	$104,009	$17,589	$15,070	$6,193	$13,772
18	5th St. SE	1189.5	$85,436	$31,292	$30,214	$12,532	$37,495

			Flood Event	Jul-00	August 1993	April 1993	July 1983
			Flood Crest (ft)	1195	1193	1190	1191
No.	Street	1ST Flr. Elev.	Norm. Acq Cost	Normalised Losses Avoided			
			(5% for 20 yrs.)	(7% for 1 yr.)	(7% for 8 yrs.)	(7% for 8 yrs.)	(7% for 18 yrs.)
19	6th St. NE	1196.8	$41,657	$1,694	$2,451	$1,699	$4,131
20	6th St. NE	1196.6	$41,657	$1,694	$2,451	$1,699	$4,131
21	6th St. NE	1196.7	$41,657	$1,694	$2,451	$1,699	$4,131
22	6th St. NE	1196.4	$41,657	$1,896	$2,451	$1,699	$4,131
23	7th St. NE	1190.0	$40,330	$15,268	$14,127	$5,519	$16,125
24	7th St. NE	1189.5	$119,929	$42,142	$40,980	$17,245	$51,951
25	7th St. NE	1191.5	$57,577	$13,401	$13,125	$4,054	$9,296
26	7th St. NE	1191.6	$117,276	$23,475	$22,198	$6,932	$15,428
27	7th St. NE	1192.8	$60,761	$9,576	$8,112	$3,784	$7,444
28	7th St. NE	1192.0	$100,029	$20,185	$19,060	$5,971	$13,275
29	7th St. NE	1193.5	$109,316	$15,038	$8,612	$5,780	$12,764
30	7th St. NE	1192.0	$23,084	$5,508	$5,059	$1,686	$3,670
31	7th St. NE	1193.6	$49,617	$6,157	$3,549	$2,842	$6,223
32	7th St. NE	1192.0	$52,270	$11,075	$10,370	$3,311	$7,313
33	7th St. NE	1192.0	$53,597	$11,328	$10,611	$3,385	$7,479
34	7th St. NE	1193.9	$52,270	$6,458	$3,718	$2,973	$6,514
35	7th St. NE	1193.1	$150,442	$20,495	$11,701	$7,805	$17,269
36	7th St. NE	1195.4	$87,559	$4,345	$5,277	$3,973	$8,149
37	8th Ave SE	1188.8	$81,321	$43,116	$31,563	$15,656	$39,914
38	8th Ave SE	1190.4	$82,409	$21,093	$22,746	$6,591	$23,838
39	8th St. NE	1191.0	$46,963	$12,285	$12,080	$3,381	$12,514
40	8th St. NE	1191.3	$110,643	$23,715	$24,431	$7,422	$17,137
41	8th St. NE	1192.3	$137,175	$22,845	$19,601	$8,040	$17,913
42	8th St. NE	1191.7	$100,029	$20,185	$19,060	$5,971	$13,275
43	8th St. NE	1191.4	$92,069	$20,105	$20,474	$6,243	$14,393
44	8th St. NE	1191.0	$50,943	$13,139	$13,031	$3,633	$13,507

			Flood Event	Jul-00	August 1993	April 1993	July 1983
			Flood Crest (ft)	1195	1193	1190	1191
No.	Street	1ST Flr. Elev.	Norm. Acq Cost	Normalised Losses Avoided			
			(5% for 20 yrs.)	(7% for 1 yr.)	(7% for 8 yrs.)	(7% for 8 yrs.)	(7% for 18 yrs.)
45	8th St. NE	1191.0	$100,029	$23,669	$24,760	$6,749	$25,763
46	E. Oakland	1189.0	$109,316	$56,437	$41,207	$20,750	$53,073
47	E. Oakland	1189.7	$69,516	$23,919	$23,066	$9,224	$26,572
48	E. Oakland	1189.7	$52,270	$18,807	$17,784	$7,035	$20,399
49	E. Oakland	1190.1	$133,196	$32,051	$35,671	$10,406	$37,489
50	E. Oakland	1192.2	$46,963	$8,548	$7,275	$3,016	$6,651
51	E. Oakland	1189.6	$100,295	$33,041	$32,494	$13,130	$37,589
52	E. Oakland	1191.2	$36,350	$9,275	$8,603	$2,707	$6,159
53	E. Oakland	1192.1	$111,969	$18,850	$16,157	$6,636	$14,766
54	E. Oakland	1191.9	$96,049	$19,426	$18,336	$5,750	$12,779
55	E. Oakland	1191.6	$80,130	$16,389	$15,439	$4,863	$10,791
56	E. Oakland	1191.9	$54,923	$11,581	$10,852	$3,459	$7,644
57	E. Oakland	1193.0	$88,089	$13,643	$11,581	$5,306	$10,438
58	E. Oakland	1189.0	$85,436	$45,074	$32,981	$16,405	$41,848
	TOTALS		**$4,876,952**	**$1,203,506**	**$1,103,899**	**$446,598**	**$1,155,312**

Losses Avoided to Residential Structures	$3,909,314
Total Acquisition Costs	$4,876,952
Loss Avoided Vs Acquisition Costs	80.2%

Appendix D

Losses Avoided to homes acquired after 1988 floods in Austin, MN

Direct Acquisition by FEMA under Section-1362 after flood of 1988

Losses Avoided to acquired homes due to floods of July 2000, August 1993 and April 1993

				Flood Event	Jul-00	August 1993	April 1993
				Flood Crest (ft)	1195	1193	1190
No.	Street	1ST Flr. Elev	Norm. Acq Cost	Acquisition Cost	Normalised Losses Avoided		
			(5% for 12 yrs.)		(7% for 1 yr.)	(7% for 8 yrs.)	(7% for 8 yrs.)
1	1st St. SE	1190.4	$50,514	$28,128	$19,416	$20,767	$6,007
2	1st St. SE	1189.0	$48,089	$26,778	$38,228	$28,024	$12,929
3	1st St. SW	1191.3	$52,674	$29,331	$17,336	$17,439	$4,939
4	8th Ave SE	1188.8	$64,651	$36,000	$49,872	$36,454	$17,381
	TOTALS		**$215,928**		**$124,852**	**$102,684**	**$41,255**

Losses Avoided to Residential Structures	$268,791
Total Acquisition Costs	$215,928
Losses Avoided Vs Acquisition Costs	124%

Appendix E

Glossary of Terms

Acquisition: Mitigation measure in which the owner's interest in the building is purchased and the building demolished. Acquisitions are assumed to be 100% effective mitigation measures at all flood depths. Also known as a "buyout".

Acquisition Cost: The sum of all direct costs to purchase a property plus other costs such as demolition, asbestos abatement costs, appraisal fees, title fees, legal fees, and project management cost.

Automated Disaster Assistance Management System (ADAMS): FEMA's previous generation project processing computer program. NEMIS has replaced ADAMS.

Avoided Losses: A methodology used after a disaster to quantify damage losses that were avoided as a direct result of the implementation of mitigation project(s). Types of avoided damages include; building damages, contents' damages, displacement costs, individual assistance costs and some infrastructure related damages.

Benefit-Cost Ratio: The ratio of the present value of benefits to project costs for a mitigation project. The benefits are the present value of the sum of the expected annual avoided damages over the lifetime of the mitigation project.

Building Damage: The estimated damages to a structure, expressed as a percentage of the building's replacement value. Building damages include both structural and non-structural elements (mechanical, electrical, and plumbing systems) but exclude building's contents.

Building Depth-Damage Function (DDF): Indicates the building's vulnerability to flood damage by showing the estimated building damage for the range of flood depths.

Community Rating System (CRS): Is a grading system used the Federal Insurance Administrator to determine the flood insurance premium for structures in a given community that participates in the National Flood Insurance Program (NFIP).

Contents Damage: The estimated damages to the building's contents, expressed as a percentage of the total content's replacement value. Contents damages includes furniture, carpets, and other items specific to individual tenants' usage, but exclude mechanical, electrical, and plumbing systems which are non-structural components of the building.

Contents Depth-Damage Function (DDF): Indicates the content's vulnerability to flood damage by showing the estimated contents damage for the range of flood depths.

Discount Rate: An interest rate that accounts for the time value of money. The discount rate is used to convert expected annual benefits over the lifetime of a project to

a net present value. For Federally funded hazard mitigation projects, U.S. Office of Management and Budget (OMB) determines the discount rate.

Displacement Costs: The product of costs per month and the expected period for which the building will be unusable due to flood damage. Displacement costs are incurred when owners are displaced to a temporary site while flood-related damage to the original building is repaired and include costs for rent and other displacement expenses.

Damage Survey Report (DSR): Documentation corresponding to infrastructure claims by the impacted communities and state. Serves as the "application" for emergency response and permanent repair funding for public facilities and approved non-profit agencies. It documents the details and cost of damage to public facilities resulting from a federally declared disaster.

First Floor Elevation (FFE): The first floor elevation of the building is the elevation of the top of the finished flooring of the lowest finished floor, as defined by the Federal Insurance Administration in compiling flood damage data.

Flood Depth: The flood depth used in the flood depth-damage table (See Appendix A) is the difference between the flood elevation and the first floor elevation.

Flood Depth-Damage Table: A table that displays the estimated damage by flood depth for the six classes of building types plus the "other" classification included in the calculations (See Appendix A).

Flood Plain: The normally dry land adjacent to a body of water, such as a river, stream, creek, lake, or ocean that is susceptible to inundation of floodwaters.

Floodway: The central portion of the floodplain that carries the greatest portion of the water in a flood. Obstructions in the floodway will result in increased flood levels upstream.

Individual Assistance (IA) Program: A variety of FEMA programs under which impacted residents of a community receive direct federal financial assistance following a federal disaster declaration. It includes housing assistance and IFG funding.

Individual Family Grant (IFG): Last resort funding source for home repairs, replacement of personal property, medical bills, funeral expenses.

National Emergency Management Information System (NEMIS): The comprehensive database and emergency management computer programs used by FEMA for comprehensive disaster management.

National Flood Insurance Program (NFIP): A federally managed and subsidized flood insurance program by FEMA.

One Hundred (100)-Year Flood: The flood elevation that has a one-percent chance of being equaled or exceeded in any given year. It is also called as the base flood elevation.