

2008 Iowa Mitigation Success Story – Avoided Losses through Property Acquisition and Relocation for Open Space

Summary

The State of Iowa has acquired over 1500 properties in special flood hazard areas over the past two decades to mitigate the adverse effects of riverine flooding on property owners and communities. The goal of this study was to evaluate the losses avoided as a result of implementation of these mitigation measures completed in Iowa prior to the catastrophic flooding event that occurred in 2008. These measures removed structures in special flood hazard areas and returned the property to open space through acquisition/demolition and acquisition/relocation projects.

In this study of 12 Iowa communities, a total of \$98,707,041 in losses were avoided due to past mitigation measures that converted property to open space/green space. All of these communities suffered from past flood events and the 703 properties included would have flooded again due to the magnitude and severity of the 2008 floods. An average of \$140,408 in present day costs was avoided for each property that was converted to open space. Comparing the total net present value (or the present day costs to acquire past properties) which equals \$45,016,192, to the total losses avoided (which are considered to be our benefits in this study) results in a positive benefit cost ratio of 2.19. This study illustrates the losses avoided due to past mitigation efforts and the importance of continuing to implement mitigation measures in the State of Iowa. Funding sources from these mitigation projects includes the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance, Repetitive Flood Claims, Pre-Disaster Mitigation program, Community Development Block Grants (CDBG), and State and Local funds. The State is in the process of acquiring approximately 2000 additional flood prone properties through the HMGP, CDBG, and other programs.

Methodology for Loss Avoidance Study

Communities that have been included in this study are those that have had a significant number of acquisitions from past events and experienced at least a 100+ year flood event in 2008. The reasonable assumption is that properties which were mitigated during past disaster declarations would have been impacted again in the 2008 disaster due to the magnitude of the event. The results confirm that structures on those properties would have sustained substantial damage and/or been destroyed. Significant losses were avoided because the properties had previously been acquired and converted to green space.

The net present value of past projects was calculated in order to determine the losses that were avoided by acquiring these properties. This value is used as the cost figure in the final Benefit-Cost ratio and was necessary so that current costs could be compared to current benefits.

Total 2008 losses avoided are the benefits in the final Benefit-Cost ratio. This figure is comprised of avoided costs for replacement value, contents, and displacement. Below is an explanation of how all figures were derived.

Net Present Value (2008) of Past Projects - COSTS

The Net Present Value of past projects was determined by using an inflation calculator that is built into FEMA Benefit Cost Analysis Software version 3.0. Using this software, a user can convert costs of previous projects into current dollars.

First, the “current year” is entered into the module (2008 is the year for which present values were needed). Next the costs of all previous projects are entered into a table along with the year that the project was approved. Functions within the module convert the previous costs into “Current Dollars”. The table allows for several entries in cases where there were multiple projects completed by a community in different years.

Once the Net Present Value was found for each project in each community, the results were entered into a chart that shows each community’s projects, the corresponding year, and the current value of each project’s initial cost.

Community	Old Damage Estimate	Disaster Year/FEMA approval Date	Damage Estimate (Current 2008 dollars)
Cedar Falls	\$55,000	1998	\$73,485
Cedar Falls	\$2,200,051	1999	\$2,870,568
Cedar Falls	\$3,694,551	1994	\$5,432,370
Cedar Falls	\$756,040	2000	\$957,729
Dunkerton	\$742,526	1999	\$968,828
Dunkerton	\$106,361	2002	\$127,001
Dunkerton	\$285,426	2000	\$361,569
Waverly	\$60,996	2002	\$72,832
Waverly	\$59,893	2001	\$73,661
Waverly	\$351,362	1999	\$458,448
Shell Rock	\$73,779	2005	\$80,620
Shell Rock	\$528,503	1999	\$689,577
Dyersville	\$236,932	1999	\$309,143
Dyersville	\$53,990	2002	\$64,467
Dyersville	\$154,182	2006	\$163,572
Dyersville	\$488,067	2000	\$618,269
Dyersville	\$675,862	2003	\$783,509
Charles City	\$206,415	1999	\$269,325
Charles City	\$254,197	2002	\$303,525
Marion	\$147,589	2003	\$171,096
Marion	\$1,142,544	1994	\$1,679,966
City of Des Moines	\$2,371,390	1999	\$3,094,126
City of Des Moines	\$1,690,258	1993	\$2,550,145
Davenport	\$1,892,421	2002	\$2,259,650
Davenport	\$110,565	2001	\$135,981
Davenport	\$156,091	1994	\$229,512
Chelsea	\$1,167,298	1995	\$1,668,638
Chelsea	\$58,250	2002	\$69,554
Louisa County	\$9,772,868	1994	\$14,369,765
Des Moines County	\$650,361	2002	\$776,565
Des Moines County	\$2,331,394	1995	\$3,332,699

2008 Replacement Values (Losses Avoided) – BENEFIT

Since data is not available to determine replacement values for structures acquired in past acquisition projects, average replacement values for current projects were found and substituted. Square footage per structure is the first element required to find replacement value. For each community, an average square footage per structure was calculated. The square footage for all residences to be acquired was divided by the total number of properties to find this figure. This average square footage per structure was then applied to past projects.

For Marion and Dunkerton that did not have a 2008 project, a total square footage for all 2008 project properties was calculated and divided by the total number of 2008 properties.

Replacement cost per square foot is also necessary to determine replacement value. For this study, \$110 per square foot was found to be an accurate yet conservative building replacement cost per square foot. The figure is based on information provided by several Iowa communities for use in benefit-cost analysis of current acquisition projects. The majority of communities documented that replacement cost per square foot is \$120; however a minority used values between \$95 and \$120.

Average square footage per structure multiplied by \$110 replacement cost per square foot gives the average replacement value per structure. The per structure replacement value is multiplied by the number of past acquisitions to find the total replacement value loss avoided per community.

Community	Total Area of structures in 2008 project (Sq. ft.)	Total Number of structures in 2008 project	Average Square feet of 2008 property	Building Replacement Cost (per sq. ft.)	Average Replacement Value
Cedar Falls	103,690	122	850	\$110	\$93,491
Dunkerton	329,378	303	1,087	\$110	\$119,576
Waverly	88,021	69	1,276	\$110	\$140,323
Shell Rock	3,331	4	833	\$110	\$91,603
Dyersville	42,668	27	1,580	\$110	\$173,833
Charles City	19,510	17	1,148	\$110	\$126,241
Marion	329,378	303	1,087	\$110	\$119,576
City of Des Moines	10,361	12	863	\$110	\$94,976
Davenport	6,039	5	1,208	\$110	\$132,858
Chelsea	3,431	3	1,144	\$110	\$125,803
Louisa County	29,864	30	995	\$110	\$109,501
Des Moines County	22,463	14	1,605	\$110	\$176,495

Example (Cedar Falls):

103,690 (total area (sq. ft.) in 2008 project)/122 (# of structures in 2008 project) = 850 sq. ft. (average sq. ft. of Cedar Falls property)

850 (average sq. footage of property) x \$110 (building replacement cost per sq. ft.) = \$93,491 (average replacement value)

\$93,491 (avg. replacement value) x 184 (# of properties in past projects) = \$17,202,341 (total replacement value)

2008 Contents Value (Losses Avoided) - BENEFIT

Based on the Benefit Cost Analysis software (v4.5.5), the FEMA standard contents value (default) for residential buildings is equal to 100% of the building replacement value. To align with FEMA standard processes in analyzing contents value as a benefit, the same approach was used in this study. The total contents value is multiplied by a percentage which represents the portion of total contents value actually lost due to flooding. The percentage used in this study mirrors FEMA's BCA Software in that it is determined by the flood depth and corresponds to the Depth Damage Functions chart (see below).

To incorporate the depth damage function into this contents value method, a standard for the type of structure (1 or 2 story, with or without basement) and flooding depth needs to be determined. Iowa houses tend to vary between one and two story and basements are standard. The depth damage functions (see below) for a one story home are higher than those for a two story for flood depths below 12 feet. In order to keep estimates of benefits conservative the depth damage functions for a two story home with a basement were used.

PROJECT: Depth Damage Function Example, STRUCTURE: Depth Damage Function Example
MITIGATION TYPE: Flood - Acquisition

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STRUCTURE INFORMATION

Total size of building (sf) * (For nonresidential building, input square footage for the first floor only. If a Library Depth Damage Function is used, see Help)

Value of building (BRV) (\$/sf) *

Total value of building (BRV)

Demolition damage threshold (%)

Is the building Residential? * Yes No

RESIDENTIAL STRUCTURE DETAILS

Riverine / Coastal A

Select Building Type

One Story Mobile Home

Two or More Stories Other

Split Level

Select foundation type *

Does the building have a basement? *

Yes No

Coastal V *

With Obstruction Without Obstruction

See the following page for depth damage function information with the above inputs

Because of the extreme nature of the 2008 floods, over three feet of standing water (often much more) could be found in the vast majority of houses affected. 86% of the homes acquired in 2008 were rendered substantially damaged, and in turn a very high percentage of the contents in each home were destroyed. If we determine contents value lost to flooding using the same method as the BCA Module, at a conservative three foot flood depth, 17.7% is the depth damage function for a two story home with a basement. In order to compare, a one story home with a basement would result in a depth damage

function of 24.7%. The contents values for each community were derived from multiplying the total average replacement value by 17.7%.

PROJECT: Depth Damage Function Example, STRUCTURE: Depth Damage Function Example
 MITIGATION TYPE: Flood - Acquisition

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RESIDENTIAL STRUCTURE INFORMATION

Depth Damage Function Type * Default Library Custom

Select Depth Damage Function (DDF) * USACE Generic

Displacement Costs Default (\$1.44/sf/month) \$ 2,160.00
 OR User-entered (\$/month) \$ 0.00
 One-Time displacement costs (\$) \$ 0.00

Building Contents Default (100% BRV) \$ 165,000.0
 OR User-entered (\$) \$ 0.00

Loss of Rent Rent (\$/month) \$ 0.00

Utilities or other contents in the crawspace (if any) \$ 0.00

Depth Damage Functions *

Flood Depth (ft)	Before Mitigation (Pct)	Before Mitigation (\$)	After Mitigation (Pct)	After Mitigation (\$)
-2.0	8.4%	\$13,860	0.0%	\$0
-1.0	10.1%	\$16,665	0.0%	\$0
0.0	11.9%	\$19,635	0.0%	\$0
1.0	13.8%	\$22,770	0.0%	\$0
2.0	15.7%	\$25,905	0.0%	\$0
3.0	17.7%	\$29,205	0.0%	\$0
4.0	19.8%	\$32,670	0.0%	\$0
5.0	22.0%	\$36,300	0.0%	\$0
6.0	24.3%	\$40,095	0.0%	\$0
7.0	26.7%	\$44,055	0.0%	\$0
8.0	29.1%	\$48,015	0.0%	\$0
9.0	31.7%	\$52,305	0.0%	\$0
10.0	34.4%	\$56,760	0.0%	\$0
11.0	37.2%	\$61,380	0.0%	\$0
12.0	40.0%	\$66,000	0.0%	\$0
13.0	43.0%	\$70,950	0.0%	\$0
14.0	46.1%	\$76,065	0.0%	\$0
15.0	49.3%	\$81,345	0.0%	\$0
16.0	52.6%	\$86,790	0.0%	\$0

The above depth damage function for contents was used in this study (two or more stories, with basement at flood depth of three feet)

Example (Louisa County):

Total square footage for Louisa County project is 29,864 feet/30 homes = Average square footage of 995 995 sq. feet x \$110 replacement building cost (per sq. foot) = average replacement value of \$109,501

\$109,501 x 167 properties in past buyouts = \$18,286,723 (total replacement value of past properties)
 \$18,286,723 x 17.7% (17.7% for depth damage function) = \$3,236,750 (total contents loss avoided)

2008 Displacement Costs Avoided - BENEFIT

The methodology for calculating the displacement benefit in this study is the same as what is used in the Benefit Cost Analysis software (v4.5.5). The module uses \$1.44 per square foot/month as the standard default value.

According to the depth damage function portion of the module, the number of days a flooded occupant is displaced is based on the flood depth. The default value the module uses is \$1.44 per square foot/month. To incorporate this value into the study, it was necessary to determine the \$ value per square foot per day. This was done by finding a standard number of days per month (365 days/12 months=30.41). \$1.44 was then divided by the average number of days per month to give the amount per square foot (\$.0473) allowed per day for the default value.

As stated above in the contents method, a conservative 3 foot flood depth was used to incorporate the depth damage function into the calculation. This is a conservative flood depth considering the majority of the properties were substantially damaged and it was a 500+ year event in many communities. As explained in the contents section a two story house with a basement is common in Iowa and using this structure type allows for a more conservative calculation for this study. When using these variables in the Benefit Cost Analysis module the depth damage function allows for 135 days of displacement costs as shown in the image below.

PROJECT: Depth Damage Function Example, STRUCTURE: Depth Damage Function Example
MITIGATION TYPE: Flood - Acquisition

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RESIDENTIAL STRUCTURE INFORMATION

Depth Damage Function Type * Default Library Custom Select Depth Damage Function (DDF) * USACE Generic

Displacement Costs Default (\$1.44/sf/month) \$ 2,160.00 **Building Contents** Default (100% BRV) \$ 165,000.0 Loss of Rent User-entered (\$/month) \$ 0.00
OR User-entered (\$/month) \$ 0.00 OR User-entered (\$) \$ 0.00 Rent (\$/month) \$ 0.00

One-Time displacement costs (\$) \$ 0.00 Utilities or other contents in the crawlspace (if any) \$ 0.00

Depth Damage Functions *

Building Contents **Displacement** Loss Of Function

Flood Depth (ft)	Before Mitigation (Days)	Before Mitigation (\$)	After Mitigation (Days)	After Mitigation (\$)
-2.0	0.0	\$0	0.0	\$0
-1.0	0.0	\$0	0.0	\$0
0.0	0.0	\$0	0.0	\$0
1.0	45.0	\$3,196	0.0	\$0
2.0	90.0	\$6,391	0.0	\$0
3.0	135.0	\$9,587	0.0	\$0
4.0	180.0	\$12,782	0.0	\$0
5.0	225.0	\$15,978	0.0	\$0
6.0	270.0	\$19,174	0.0	\$0
7.0	315.0	\$22,369	0.0	\$0
8.0	360.0	\$25,565	0.0	\$0
9.0	405.0	\$28,761	0.0	\$0
10.0	450.0	\$31,956	0.0	\$0
11.0	495.0	\$35,152	0.0	\$0
12.0	540.0	\$38,347	0.0	\$0
13.0	585.0	\$41,543	0.0	\$0
14.0	630.0	\$44,739	0.0	\$0
15.0	675.0	\$47,934	0.0	\$0
16.0	720.0	\$51,130	0.0	\$0

The last factor in determining the displacement benefit is the average square footage of a property in each community. As explained in the replacement value methodology, the total square footage of the 2008 project was calculated for each community and divided by the number of properties included in the 2008 project.

To calculate the average displacement benefit for each community the average square footage was multiplied by the \$.0473 per square foot/day (default used in module reduced to per day). This amount is then multiplied by 135 days as shown in the depth damage function for a two story house with a basement that had a 3 foot flood depth.

To calculate the total displacement benefit for a community the average is multiplied by the number of properties in past projects.

Community	Average Square Feet of 2008 properties	Displacement Costs per day (based on \$1.44/sq ft/month default)	Number of days displaced for 3 ft flood depth (damage function)	Average Displacement Benefit Per Property
Cedar Falls	850	\$0.0473	135	\$5,431
Dunkerton	1,087	\$0.0473	135	\$6,947
Waverly	1,276	\$0.0473	135	\$8,152
Shell Rock	833	\$0.0473	135	\$5,322
Dyersville	1,580	\$0.0473	135	\$10,099
Charles City	1,148	\$0.0473	135	\$7,334
Marion	1,087	\$0.0473	135	\$6,947
City of Des Moines	863	\$0.0473	135	\$5,518
Davenport	1,208	\$0.0473	135	\$7,718
Chelsea	1,144	\$0.0473	135	\$7,309
Louisa County	995	\$0.0473	135	\$6,362
Des Moines County	1,605	\$0.0473	135	\$10,254

Example (Charles City):

1,148 (avg. square footage of structure) x \$.0473 (displacement costs per day) x 135 days (for 3 feet flood depth in two story home with basement) = \$7,334 in total average displacement benefit for Charles City property

\$7,334 (average displacement benefit) x 9 (properties included in past projects) = \$66,007 total displacement benefit for Charles City

Additional Losses Avoided

Additional losses were avoided due to past mitigation projects that were not included in the above study due to their subjectivity and the difficulty in assigning an accurate dollar figure. These avoided losses are, however, worth mentioning.

Past acquisition/relocation and demolition projects remove considerable burden from those involved in the recovery effort for floods that follow. When homes and their residents are not flooded due to having participated in a mitigation project, there are no displaced citizens or need to provide replacement housing, or individual assistance, or to rehabilitate their home in a flood zone.

The eliminated risk to life and safety is also hard to describe in terms of a dollar figure, as well as potential water rescue, emergency shelter / temporary housing (such as FEMA trailers) and the suffering and emotional anguish of the inhabitants of flooded homes.

It should also be mentioned that this study took into consideration only the larger past Iowa buyout projects in communities that experienced a minimum 100 year flood event in 2008 and therefore does not include the comprehensive list of past property acquisitions statewide. It also only took into consideration the 2008 flood event. Substantial additional losses were avoided throughout the state due to smaller projects from other events.

Community Summary

Cedar Falls: In 1993 and 1999 the City of Cedar Falls experienced severe flooding under declared disasters 0996, 1277, and 1282. They acquired a total of 184 properties as a result of those disasters. The total project cost for the past acquisitions was \$6,705,642.

In 2008, the USGS Stream flow Data Station in Waterloo (located approximately 9 miles from Cedar Falls) reported that the area had experienced a 500+ year flood event with a drainage area of over 5,000 square miles. With the data collected in this study it is estimated that over \$21 million was saved during the 2008 flood event due to past acquisitions that took place. A combination of past acquisitions and current 2008 acquisitions shows that over 300 properties will be acquired by the City of Cedar Falls. These mitigation measures will allow the city to return extensive areas of the floodplain into open space and completely discontinue city services to these areas preventing even more future losses.

Cedar Falls Loss Avoidance Map

The attached map displays an area in northern Cedar Falls that has been the focus of several acquisition projects in the city since 1993. Though not representative of all properties acquired by the city, a majority of acquisitions did take place in this area, with a total of 129 properties confirmed as being acquired in the area prior to the 2008 flood.

The area experienced complete inundation during the 2008 flood, with high water marks up to 866 feet above sea level, and ground elevations ranging from 855 feet to 860 feet above sea level. Therefore it is reasonable to project that each of the 129 properties previously acquired would have been destroyed during the 2008 floods had it not been for acquisition and removal of the structures.

Dunkerton: In 1999 the City of Dunkerton experienced major flooding in May and July. Disaster 1277 was declared for May and 1282 for July, both of which included Black Hawk County. In cooperation with HSEMD and FEMA, the city identified and acquired 28 total properties (24 under disaster 1277 and 4 under disaster 1282) that were the hardest hit and most vulnerable to future flooding. The total project cost was \$1,134,313.

In 2008, the USGS Stream flow Data Station in Waterloo (located approximately 10 miles from Dunkerton) reported the area had experienced a 500+ year flooding event with a drainage area of over 5,000 square miles. But due to the past acquisition projects, water washed over open floodplain that no longer contained residential structures and the city did not need to pursue an additional acquisition project. It is estimated that over \$4 million was saved due to past acquisition projects.

Waverly: The City of Waverly suffered extensive flooding in 1999 under disaster declaration 1282. The city acquired 12 properties as a result of this disaster. The total project cost for this project was \$472,251.

In 2008, the USGS Stream flow Data Station in Shell Rock (located around 6 miles from Waverly) listed a 300+ year flood event with a drainage area of over 1,700 square miles. According to this study \$2,079,753 was saved due to past acquisitions.

Shell Rock: The City of Shell Rock acquired 11 properties due to the 1999 declared disaster 1282 for severe flooding. It cost \$602,282 in 1999 to acquire these properties. According to the 2008 USGS Stream flow Data Station in Shell Rock the city suffered a 300+ year flood event. Due to past acquisitions only 4 properties are being acquired in the current 2008 project despite the fact that they had such a large event. It is estimated that they saved over \$1 million due to past acquisitions.

Dyersville: The City of Dyersville acquired 17 properties in 1999 and 2002 over a span of 3 declared disasters (1277, 1282, and 1420). Mitigation funds invested in past projects totaled over \$1.5 million. According to the USGS Stream flow Data Station in Manchester (18 miles from Dyersville) this area had a 100 year flood event with a drainage area of 275 square miles. This study estimates that losses avoided totaled \$3,649,898.

Charles City: The City of Charles City acquired 9 properties in the 1999 declared disasters 1277 and 1282. It cost over \$400,000 to acquire those properties in 1999 and 2002 when the grants were awarded.

Charles City experienced record flooding in 2008 with a flood crest of 25.5 feet (major flood stage is 18 feet). When comparing these flood levels to the Flood Insurance Study flood profiles Charles City experienced at least a 500 year flood event. The city is currently acquiring 17 properties due to the 2008 floods. If the city would not have acquired the past properties and converted them to green space it is estimated it could have caused an additional \$1.4 million in damages (losses avoided).

Marion: The City of Marion can be looked at as very similar to Dunkerton. Disaster declarations 0996 (1993) and 1420 (2002) resulted in the city acquiring 15 total properties and converting them to open space in the floodplain. Project costs were \$1,290,133.

2008 flooding affected the Cedar Rapids area (Marion and Cedar Rapids are adjacent cities) as seriously as anywhere in the state. A 500+ year event with a drainage area over 6,500 square miles was reported, yet no additional properties in Marion needed to be acquired. Approximately \$2.2 million was saved.

City of Des Moines: While past mitigation efforts did not entirely eliminate the need for acquisitions in the City of Des Moines due to flooding in 2008, they did drastically reduce the required efforts. Due to 2008 flooding, only 13 properties needed to be acquired after the city experienced a 100 year flood event. Des Moines acquired 109 properties in past projects – 83 in disaster 0996 (1993) and 26 in disaster 1230 (1998) which saved an estimated \$12,786,163 had those properties not been acquired and converted to open space previously.

Davenport: The City of Davenport acquired 45 properties in 1993 and 2001 due to the declared disasters for severe flooding (0996 and 1367). The project costs were over \$2 million. In 2008 the Mississippi River crested around 21 feet which is 6 feet over the flood stage. More specifically Duck Creek which runs through central Davenport topped 4 feet over the flood stage. When comparing the flood crest levels to the flood profile in the Flood Insurance Study it is clear that Davenport had at least a 100 year event. It is estimated that \$7,384,156 was saved due to past acquisitions in the City of Davenport.

Chelsea: The City of Chelsea acquired 50 properties in the 1993 declared disaster 0996. The project cost over \$1 million in mitigation funds. In 2008 the Iowa River surpassed its flood stage cresting at 22 feet. This caused the flooding of Chelsea, IA. For a week the town could only be reached by boat and many of the primary facilities in the town were closed and people were evacuated. Due to a lack of stream gauge data for the City of Chelsea, an evaluation of stream gauge data was referenced for 8 communities along the Iowa River. These communities were upstream and downstream from Chelsea and had an average flood depth of 4.9 feet above the major flood stages. All of these 8 communities experienced record flooding and based on the data available the same conclusion is made for the City of Chelsea. This study estimates that due to past acquisitions \$7,768,958 was saved due to losses avoided.

Louisa County: The large number of past acquisitions in Louisa County resulted in savings of approximately \$22 million after the 2008 event, which completely inundated almost 30 square miles of flood prone area in southern Louisa and northern Des Moines counties. The county had acquired 167 properties in 1993 during disaster declaration 0996. At the time, these 167 properties were acquired for \$9,772,868. The county is in the process of acquiring an additional 31 properties that were destroyed as a result of the 2008 flood event. But this is a far cry from what would have been necessary had the previous projects not been completed, especially considering the breadth of floodwater inundation in the most recent disaster.

Des Moines County: 56 properties were acquired in past disasters (46 in Disaster 0996 – 1993 and 10 in Disaster 1367 – 2001). The county was hit very hard in 2008 – as stated above 30 square miles was covered in deep water, and has a current project to acquire several properties. However the savings due to past acquisitions is still significant – over \$12 million in damage was mitigated.

2008 Iowa Mitigation Success Story

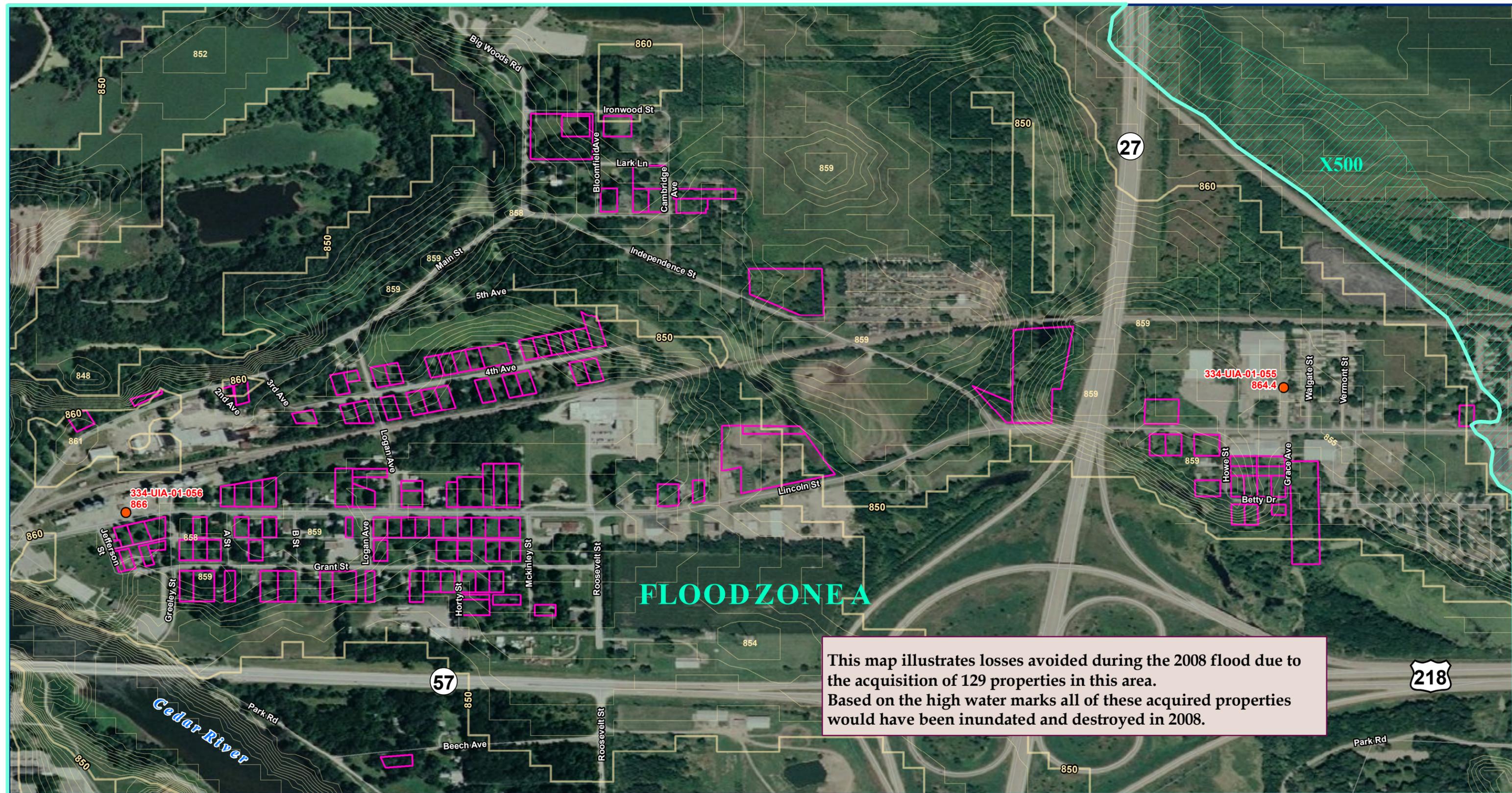
Property Acquisition Projects - Avoided Losses Table

Iowa Location	County	Flood Event	Number of Properties	Mitigation Funds Invested	Year Grant Award	Cost			Contents	Benefit			
						NPV Mitigation Funds Invested	Average Replacement Value	Total Replacement Value		Average Displacement Benefit	Total Displacement Benefit	Losses Avoided (Replacement Value plus contents and displacement)	Benefit/Cost Ratio
City of Cedar Falls	Black Hawk	'93+'99	184	\$ 6,705,642	1994, 1998, 1999, 2000	\$9,334,151	\$ 93,491	\$ 17,202,341	\$ 3,044,814	\$ 5,431	\$ 999,383	\$21,246,538	2.28
City of Dunkerton	Black Hawk	1999	28	\$ 1,134,313	1999, 2000,	\$1,457,398	\$ 119,576	\$ 3,348,133	\$ 592,620	\$ 6,947	\$ 194,512	\$4,135,265	2.84
City of Waverly	Bremer	1999	12	\$ 472,251	1999, 2001, 2002	\$604,941	\$ 140,323	\$ 1,683,880	\$ 298,047	\$ 8,152	\$ 97,826	\$2,079,753	3.44
City of Shell Rock	Butler	1999	11	\$ 602,282	1999, 2005	\$770,197	\$ 91,603	\$ 1,007,628	\$ 178,350	\$ 5,322	\$ 58,539	\$1,244,516	1.62
City of Dyersville	Dubuque	99+02	17	\$ 1,609,033	1999, 2000, 2002, 2003, 2006	\$1,938,959	\$ 173,833	\$ 2,955,154	\$ 523,062	\$ 10,099	\$ 171,682	\$3,649,898	1.88
City of Charles City	Floyd	1999	9	\$ 460,612	1999, 2002	\$572,849	\$ 126,241	\$ 1,136,171	\$ 201,102	\$ 7,334	\$ 66,007	\$1,403,279	2.45
City of Marion	Linn	93+02	15	\$ 1,290,133	1994, 2003	\$1,851,062	\$ 119,576	\$ 1,793,643	\$ 317,475	\$ 6,947	\$ 104,203	\$2,215,320	1.20
City of Des Moines	Polk	93+98	109	\$ 4,061,648	1993, 1999	\$5,644,271	\$ 94,976	\$10,352,366	\$ 1,832,369	\$ 5,518	\$ 601,428	\$12,786,163	2.27
City of Davenport	Scott	93+02	45	\$ 2,159,077	1994, 2001, 2002	\$2,625,143	\$ 132,858	\$ 5,978,610	\$ 1,058,214	\$ 7,718	\$ 347,332	\$7,384,156	2.81
City of Chelsea	Tama	1993	50	\$ 1,225,548	1995, 2002	\$1,738,192	\$ 125,803	\$ 6,290,167	\$ 1,113,360	\$ 7,309	\$ 365,432	\$7,768,958	4.47
Louisa County		1993	167	\$ 9,772,868	1994	\$14,369,765	\$ 109,501	\$18,286,723	\$ 3,236,750	\$ 6,362	\$ 1,062,381	\$22,585,853	1.57
Des Moines County		93+01	56	\$ 2,981,755	1995, 2002	\$4,109,264	\$ 176,495	\$ 9,883,720	\$ 1,749,418	\$ 10,254	\$ 574,202	\$12,207,341	2.97
Total properties mitigated prior to 2008:			703	\$ 32,475,162		\$ 45,016,192						\$98,707,041	2.19

Note: Losses avoided are from Property Acquisition or Structural Relocation for Open Space/Green Space mitigation measures and consider only losses avoided as a result of the 2008 flood event for selected communities.

Cedar Falls Acquired Properties

100/500 Year Flood Zones with Contours and High Water Marks from 2008 Flood



This map illustrates losses avoided during the 2008 flood due to the acquisition of 129 properties in this area. Based on the high water marks all of these acquired properties would have been inundated and destroyed in 2008.

Legend

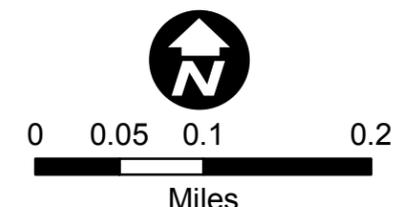
- High Water Marks '08
- Contour 1 ft
- Contour 10 ft
- Acquired Properties

Flood Zones

- 100-year
- 500-year



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 S. Williams, 05/04/2010
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