US Army Corps of Engineers®

River Des Peres – University City
2013 Economic Update

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Executive Summary

The University City, River des Peres General Reevaluation Study focuses on a 2 mile reach of an urban stream that poses a challenging planning situation. A 1988 Feasibility Report recommended a U-Shaped channel for flood control purposes. The project was not implemented due to funding constraints and local sponsor concerns. The St. Louis District Corps of Engineers (MVS) and University City entered into a design agreement in 2004 to reevaluate this branch of the river. Upon new hydraulics and hydrology (H&H) data collection and analysis; it was determined that 1988 plan would induce flooding downstream of the project area, thus making that plan not acceptable. The Product Delivery Team (PDT) then shifted its focus to a non-structural approach that considered flood warning systems, buy-outs and flood proofing. In September 2008 the area experienced an approximately 10-year flood event that resulted in the deaths of two individuals and devastating flood damages. This flood event has acted as a catalyst for a long- flood risk management solution by the sponsor, the USACE and the community. Missouri SEMA has already funded the buy-out of 26 single family homes in the most flood prone areas that also see the highest velocities of water during flash flood episodes. This economic update was performed to ensure that a viable project remained. There are a total of 275 structures in the 100-year floodplain, with expected annualized flood damage being $3.1M. Upon economic and real estate analysis it was determined that flood-proofing was not a viable option. A buy-out of 97 structures in the 5-year floodplain has a BCR of approximately 2.1. A buy-out of 158 structures in the 10-year floodplain has not proved feasible in the past and will be revisited later in the planning process.

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1.0 Study Purpose

The purpose of this current effort is to review and affirm or modify the non-structural alternative previously considered in the General Reevaluation study effort. This was done in recognition of changes which have occurred since the study was suspended.

2.0 Study Background

2.1 Project Authority

Construction or implementation of the River des Peres, Missouri, project was authorized by Section 101(a) (17) of the Water Resources Development Act of 1990 (Public Law 101-640). The authorizing language states:

> *SEC. 101. PROJECT AUTHORIZATIONS.*
>
> *(a) Projects With Report of the Chief of Engineers.--Except as provided in this subsection, the following projects for water resources development and conservation and other purposes are authorized to be carried out by the Secretary substantially in accordance with the plans, and subject to the conditions, recommended in the respective reports designated in this subsection:*
>
> > *(17) River des Peres, Missouri.--The project for flood control, River Des Peres, Missouri: Report of the Chief of Engineers, dated May 23, 1989, at a total cost of $21,318,000, with an estimated first Federal cost of $15,846,000 and an estimated first non-Federal cost of $5,472,000.*

The Report of the Chief of Engineers cited in the project authorization recommended flood damage reduction features for implementation in the University City Branch and the Deer Creek Branch of the River des Peres and the Kirkwood Branch of Gravois Creek (Gravois Creek is a tributary to the River des Peres). The Energy and Water Development Appropriations Act for Fiscal Year 2004 (Public Law 108-137) included funds for the Government to initiate design of the University City Branch features. A Design Agreement between the Government and Non-Federal Sponsor was executed on 30 June, 2004.

2.2 Prior Studies and Reports

1988 Feasibility Study

This study resulted in the following recommended plan, consisting of both flood control measures and a recreation component.

The recommended plan consisted of a channel modification for 2.53 miles of the University City Branch of Upper River des Peres between river miles 0.97 and 3.5. The work would consist of widening the channel and lining the streambank with either riprap or gabions depending upon the amount of top-width available. Riprap would be used where development is not too much of a constraint while gabions will be used where it is. A hiking and biking trail would occupy one side of the channel modification project right-of-way.

3.0 **Hydraulic Modeling of River Des Peres in University City**

3.1 Study Area

The stretch of creek that was modeled is located primarily in University City, Missouri. The computer model begins at the entrance to the large tunnels that carry the water underneath Forest Park in the City of St. Louis, and ends approximately ½ mile upstream of Dielmann Road in Olivette, Missouri. This can be seen in Figure 1 below.

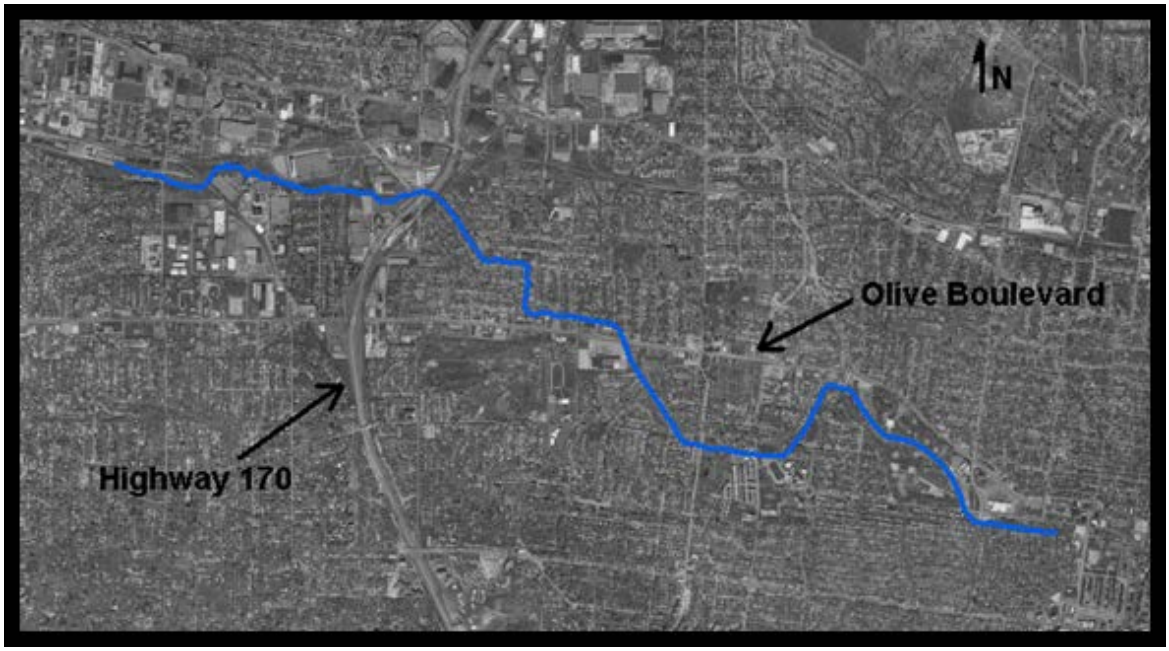


Figure 1 – Location of Study (Upper RDP in Blue)

3.2 Hydraulic Analysis

The old HEC-2 hydraulic model for Upper RDP, developed in the late 1980's and early 1990's, was converted into HEC-RAS version 3.1.2 for this study. To update the model to existing conditions, cross section surveys were taken in 2003 along several reaches that have changed over since the 1988 report. The locations were as follows:

- RM 1.653 – RM 1.853
  - This reach is between Hanley Road and North & South Road.

- RM 2.416 – RM 3.485
  - This reach is between Olive Boulevard and Kempland Avenue.
  - Bridge surveys were also completed in this reach, including Hafner Road, 82nd Boulevard, and the Footbridge at Appleton Drive.

Once the surveys were received by the District Office, the model was updated to reflect the changes that have been made to the channel by the Metropolitan Sewer District (MSD).

Figure 4 – Picture of Channel Improvements between RM 2.828 and RM 3.485

3.3 Results

The hydraulic analysis performed in 2006 year was unchanged for this report. Because the alternative being re-examined does not directly modify any of the existing creek flows, the future with project and future without project hydraulic conditions were assumed to be the same as the existing condition. While the profiles would change in the with-project condition as impervious materials (such as homes

and driveways) were replaced with pervious ones (soils and vegetation), the H&H engineers indicated that the change would not be significant enough to greatly affect the economic analysis for buyouts and relocations.

4.0 Economics

4.1 Economics Reaches

The following reaches (Table 1) were developed to break up the Area of Interest (AOI) into manageable portions. These reaches do not directly correlate to the H&H reaches identified in Section 3. Table 1 provides a description of the reach and corresponding stream stationing (by river mile).

Table 1. Economic Reaches

River Des Peres - University City		
RDP New Reaches	**Upstream**	**Downstream**
Vernon to Kingsland	0.391	0.000
Midland to Vernon	1.151	0.392
Hanley to Midland	1.863	1.152
Olive to Hanley	2.396	1.864
82nd to Olive	2.816	2.397
I-170 to 82nd	3.532	2.817

4.2 Structure Inventory

For this update, AOI was determined in ArcMap by capturing any structure within 50 meters of the 10-year floodplain. This buffer was done in an attempt to ensure any and all structures impacted by flooding on this portion of River Des Peres, were identified. To determine the economic value of the AOI, a structure inventory was completed. The available county assessor information was obtained and accounted for the bulk of the information for the survey.

The data provided by the assessor's office was already classified, valuated, and mapped in GIS. A windshield survey was performed for each of the 820 structures in the AOI. The information collected during the windshield survey was used to identify the first floor elevations, construction materials, and use of each structure. This data was used as input for the Marshall and Swift (M&S) Residential and Commercial Estimator programs. These programs combine the field information with depreciation tables to estimate the depreciated replacement value (DRV) for each structure. The DRV is used to identify the replacement cost for a structure in its current condition, based on the type and quantity of the construction materials. All structure values in this report are expressed as DRVs, except for the costs used for the buyout plan. That estimate was derived using the appraised values provided by the county assessor. Table 2 displays the structure count and average value, by category, for each economic reach.

Table 2. Total Structure Inventory

River Des Peres – University City					
Damage Reach	**Data Category**	**Residential**	**Commercial**	**Public**	**Total**
Vernon to Kingsland	Structures	77	0	0	77
	Average Value	*$124,222*	*$ -*	*$ -*	$9,565,100
Midland to Vernon	Structures	74	9	7	90
	Average Value	*$96,234*	*$51,867*	*$556,786*	$11,485,600
Hanley to Midland	Structures	143	5	3	151
	Average Value	*$128,101*	*$85,340*	*$1,448,400*	$23,090,400
Olive to Hanley	Structures	169	4	2	175
	Average Value	*$ 86,098*	*$761,875*	*$103,900*	$17,805,900
82nd to Olive	Structures	95	13	1	109
	Average Value	*$72,537*	*$137,023*	*$120,400*	$8,792,700
I-170 to 82nd	Structures	217	1	0	218
	Average Value	*$41,569*	*$3,100*	*$ -*	$9,023,500
Total	**Structures**	**775**	**32**	**13**	**820**
	Average Value	***$84,473***	***$178,919***	***$659,300***	**$79,763,200**

**Depreciated Replacement Values calculated by Marshall and Swift Estimator Software*
**October 2013 Price Levels*

The economist assigned structures to the respective reaches, after combining the hydrology and hydraulic data, LiDAR data and first floor elevation (FFE) estimates in HEC-FDA (the Corps' standard flood damage analysis software). A structure was identified as residing within a particular reach if the mean stage for that event was within 3 inches of the mean FFE. The decision to use 3 inches was based on judgment, in an effort to provide additional confidence in the selection of structures recommended for a buyout plan. Of the 98 structures within the 5 year floodplain, 97 structures were considered for a buyout plan. The single structure that was not considered was a public structure that would most likely be addressed through other means.

Table 3. Structure Inventory by Reach

River Des Peres – University City			
Damage Reach	**5 Year**	**10 Year**	**100 Year**
Vernon to Kingsland	0	5	7
Midland to Vernon	2	14	25
Hanley to Midland	19	29	65
Olive to Hanley	73	84	116
82nd to Olive	4	26	49
I-170 to 82nd	0	0	13
Total	98	158	275
**One public structure fell within the 5 year floodplain but was not included in the buyout plan. This structure is located at 975 Pennsylvania Ave. and is a garage unit likely used for maintenance storage.*			

4.2.1 Residential Structure Values

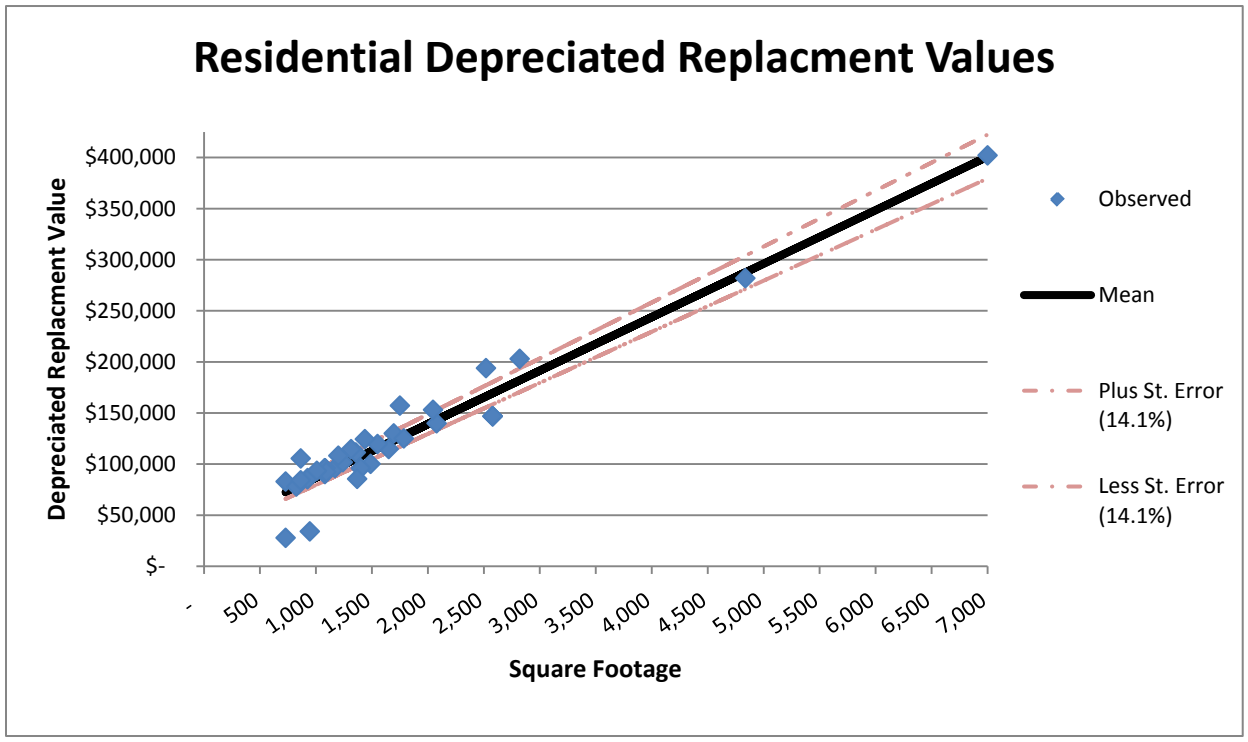
Since the assessor data was almost complete, regression analysis was used to estimate the depreciated replacement values (DRV). This was deemed the most efficient way to estimate DRVs for the entire population. The M&S Residential Estimator was run on a random 5% sample from the residential category. The selection of a sample size this small was confirmed adequate after reviewing the results. For each of the 38 structures, the DRV was calculated based on a combination of field observations and assessor data. After the DRVs were obtained for each structure in the sample, a regression was run with the assessor's square footage for residential structures (SQFT) as the independent variable and the DRV as the dependent variable. This regression resulted in the following equation:

Residential DRV = $34,357.14 + ($52.36 x SQFT)

R^2 = 93%, std. error of intercept = $4,860.41 (p-value = 0.0000), std. error of coefficient = $2.37 (p-value = .0000)

In short, the square footage of the residence accounts for 93% of the variability in the DRV. This equation was then applied to each individual residential structure within the total (assessed structure) population to determine the DRV. The standard error for residential structure values is 14.1%. The regression results are displayed below in Figure 2, as well as the error bounds. On average, the 2013 DRV estimates were 30% higher than the 2012 appraisal estimates from the assessors. A difference of 30% is not uncommon and is often driven by market prices. The majority of the residential construction in this area is older (an average construction year of 1951 for this sample) and it would be cheaper to purchase an existing home than to replace it with like materials.

Figure 2. Regression Analysis for Residential Structures



The above regression methodology was used to estimate the DRV for apartments and homes within the population of assessor provided structures. For more exact results, Marshall and Swift could be run on the entire population, but it was not deemed necessary since the regression performed accounted for 93% of the cost variability.

4.2.2 Commercial, Industrial and Public Structure Values

The regression method utilized for residential structures was not attempted for the commercial, industrial, and public (CIP) categories. With only a single CIP structure in the 5 year floodplain, it was determined that utilizing the Appraised Improvement Value from the assessor would be more than adequate to evaluate the 5 year buyout plan. With more time and funding, more data could be collected and a regression analysis might be possible, but a sensitivity analysis was performed instead.

The sensitivity analysis was completed on these structure values by adjusting the level of depreciation and some of the unknown construction components. This standard error accounts for the risk and uncertainty in the commercial structure values and is estimated at 25%.

4.2.3 Structure Content Values

The residential content damages are provided within the standard curves provided by the Corps' Institute for Water Resources. The CIP content values are estimated to be 100% of the value of the corresponding structure and were developed from fieldwork done for similar regional studies.

4.2.4 Elevation Estimates

During the windshield survey, the first floor elevations were estimated using the stair counting method. On average, each step is about 8 inches high. If there are 3 steps to get into the front door, the first floor elevation is 2 feet. This is a standard method for estimating first floor elevations in the field.

The first floor elevations were then paired with LiDAR elevations using GIS. Vertical accuracy of this data set is about (+/-) 1 foot with a standard deviation of 0.5 feet.

4.3 Benefit Analysis

4.3.1 Stage-Damage Relationships

In order to calculate the damages from the inundation of structures (and associated contents) that would occur at each stage, two relationships were developed: depth-damage relationships and stage-frequency relationships. The depth-damage relationship is the amount of damage that will occur to structures (and associated contents) as the elevation of the water (or stage) rises. The stage frequency relationship is the probability of the water stages reaching various levels for each hydrologic reach.

The uncertainties associated with the development of these relationships are addressed by risk-based analysis. A range of possible values, with a maximum and a minimum value, or a standard deviation, was calculated for each economic variable (structure and content values, first floor elevation, and depth-damage relationships). These statistics were entered into the Hydrologic Engineering Center's Flood Damage Analysis Program (HEC-FDA version 1.2.5a) to calculate the uncertainty or error surrounding the elevation - or stage-damage curves. The program also used the number of years that stages were recorded at a given gage to determine the hydrologic uncertainty surrounding the stage-frequency curves. The possible occurrences of each variable were derived through the use of Monte Carlo simulation, which used randomly selected numbers to simulate the values of the selected variables from within the established ranges and distributions. For each variable, a sample was used from within the range of possible values. Within each sample, or iteration, a different value was selected. The number of iterations performed affects the simulation execution time and the quality and accuracy of the results.

The sum of all sampled values, divided by the number of samples, yielded the expected value, or mean. This process was conducted simultaneously for each economic and hydrologic variable. The resulting mean and probability distributions formed a comprehensive picture of all possible outcomes.

Table 4 displays the stage-damage relationships for the 20%, 10%, 2%, 1% and 0.2% annual chance exceedence events (commonly referred to as the 5-year, 10-year, 50-year, 100-year, and 500-year flood events) for the 6 economic reaches.

Table 4. Without Project Stage-Damage Relationships at October 2013 Price Levels

Stage-Damage Relationships[1] Vernon to Kingsland					
Exceedence		Damage by Category (thousands)			
Probability	Stage	Residential	Commercial	Public	Total
0.2	502.22	$72	$0	$0	$72
0.1	503.59	$369	$0	$0	$369
0.02	505.12	$1,142	$0	$0	$1,142
0.01	505.64	$1,372	$0	$0	$1,372
0.002	508.30	$3,938	$0	$0	$3,938
[1]*HEC-FDA output with uncertainty*					

Stage-Damage Relationships[1] Midland to Vernon					
Exceedence		Damage by Category (thousands)			
Probability	Stage	Residential	Commercial	Public	Total
0.2	509.05	$124	$24	$26	$174
0.1	511.52	$374	$73	$78	$526
0.02	513.83	$1,319	$259	$275	$1,854
0.01	514.35	$2,094	$411	$437	$2,941
0.002	517.04	$3,567	$700	$744	$5,011
[1]*HEC-FDA output with uncertainty*					

Stage-Damage Relationships[1] Hanley to Midland					
Exceedence		Damage by Category (thousands)			
Probability	Stage	Residential	Commercial	Public	Total
0.2	513.08	$791	$11	$2	$803
0.1	515.16	$1,990	$27	$4	$2,021
0.02	518.59	$4,935	$66	$10	$5,010
0.01	520.03	$6,398	$86	$12	$6,496
0.002	522.95	$10,846	$145	$21	$11,012
[1]*HEC-FDA output with uncertainty*					

Table 4. Continued…

Stage-Damage Relationships[1] Olive to Hanley					
Exceedence		Damage by Category (thousands)			
Probability	Stage	Residential	Commercial	Public	Total
0.2	527.52	$3,197	$0	$5	$3,202
0.1	529.40	$5,198	$0	$8	$5,206
0.02	531.82	$8,465	$0	$13	$8,478
0.01	532.52	$9,464	$0	$15	$9,479
0.002	535.22	$12,684	$0	$20	$12,704
[1]*HEC-FDA output with uncertainty*					

Stage-Damage Relationships[1] 82nd street to Olive Blvd					
Exceedence		Damage by Category (thousands)			
Probability	Stage	Residential	Commercial	Public	Total
0.2	530.83	$785	$29	$9	$823
0.1	532.48	$1,759	$66	$20	$1,845
0.02	535.38	$3,554	$133	$41	$3,728
0.01	536.12	$4,112	$154	$47	$4,314
0.002	538.86	$6,079	$228	$70	$6,377
[1]*HEC-FDA output with uncertainty*					

Stage-Damage Relationships[1] I-170 to 82nd street					
Exceedence		Damage by Category (thousands)			
Probability	Stage	Residential	Commercial	Public	Total
0.2	537.03	$2	$0	$0	$2
0.1	538.44	$130	$0	$0	$131
0.02	540.47	$1,431	$1	$0	$1,432
0.01	541.03	$1,983	$1	$0	$1,985
0.002	543.74	$3,899	$3	$0	$3,902
[1]*HEC-FDA output with uncertainty*					

The stage-damage relationships displayed in Table 4 and Table 5 are products of the structure data and stage-frequency analysis for the without and with project conditions respectively. For example, a 20% chance exceedence (5-year) event at the Hanley to Midland reach of University City would be expected to result in $791,000 (Table 4) in structure and content damages, in the without project condition. For the with-project condition, we would expect this same event would be reduced to $365,000 (Table 5) in structure and content damages.

Table 5. With Project Stage-Damage Relationships at October 2013 Price Levels

Stage-Damage Relationships[1] Vernon to Kingsland					
Exceedence		Damage by Category (thousands)			
Probability	Stage	Residential	Commercial	Public	Total
0.2	502.22	$72	$0	$0	$72
0.1	503.59	$369	$0	$0	$369
0.02	505.12	$1,142	$0	$0	$1,142
0.01	505.64	$1,372	$0	$0	$1,372
0.002	508.30	$3,938	$0	$0	$3,938

[1] *HEC-FDA output with uncertainty*

Stage-Damage Relationships[1] Midland to Vernon					
Exceedence		Damage by Category (thousands)			
Probability	Stage	Residential	Commercial	Public	Total
0.2	509.05	$83	$20	$21	$123
0.1	511.51	$311	$74	$78	$463
0.02	513.83	$1,190	$281	$298	$1,769
0.01	514.35	$1,916	$453	$480	$2,848
0.002	517.04	$3,295	$778	$825	$4,899

[1] *HEC-FDA output with uncertainty*

Stage-Damage Relationships[1] Hanley to Midland					
Exceedence		Damage by Category (thousands)			
Probability	Stage	Residential	Commercial	Public	Total
0.2	513.10	$365	$8	$1	$374
0.1	515.17	$1,063	$25	$4	$1,090
0.02	518.61	$3,436	$76	$11	$3,433
0.01	520.03	$4,518	$103	$15	$4,635
0.002	522.97	$8,385	$189	$27	$8,604

[1] *HEC-FDA output with uncertainty*

Table 5. Continued…

Stage-Damage Relationships[1] Olive to Hanley					
Exceedence		Damage by Category (thousands)			
Probability	Stage	Residential	Commercial	Public	Total
0.2	527.54	$272	$0	$2	$274
0.1	529.41	$1,037	$0	$9	$1,046
0.02	531.83	$2,775	$0	$24	$2,798
0.01	532.52	$3,351	$0	$29	$3,379
0.002	535.23	$5,465	$0	$47	$5,512
[1]*HEC-FDA output with uncertainty*					

Stage-Damage Relationships[1] 82nd street to Olive Blvd					
Exceedence		Damage by Category (thousands)			
Probability	Stage	Residential	Commercial	Public	Total
0.2	530.83	$372	$25	$8	$404
0.1	532.48	$955	$64	$19	$1,038
0.02	535.38	$2,378	$158	$48	$2,585
0.01	536.12	$2,851	$190	$58	$3,098
0.002	538.86	$4,585	$305	$93	$4,983
[1]*HEC-FDA output with uncertainty*					

Stage-Damage Relationships[1] I-170 to 82nd street					
Exceedence		Damage by Category (thousands)			
Probability	Stage	Residential	Commercial	Public	Total
0.2	537.03	$2	$0	$0	$2
0.1	538.44	$130	$0	$0	$131
0.02	540.47	$1,431	$1	$0	$1,432
0.01	541.03	$1,983	$1	$0	$1,985
0.002	543.74	$3,899	$3	$0	$3,902
[1]*HEC-FDA output with uncertainty*					

4.3.2 Depth-Damage Curves

For residential structures, curves developed by the Institute for Water Resources (IWR) were used. These are standardized curves widely used for flood damage analysis. Commercial, Industrial, Public, and Agricultural curves were taken from the Saint Paul District's work done for the Fargo-Moorhead Feasibility Study (2011). Similar structures were identified and depth-damage curves were selected accordingly.

4.3.3 Damage Reduction by Plan

Expected annual inundation damages reduced and distributed for the AOI are presented in Table 6. These damage totals are based on structure and content values alone (as well as an "other" damage category for residential structures accounting for emergency and other costs as presented in the Fargo Moorhead Feasibility Study). The expected annual damage reduced by the completed project is $1,804,800.

The Probability Damage Reduced Exceeds Indicated Values portion of Table 6 is to provide error bounds on the benefit estimates. Given the uncertainty associated with all of the inputs into the HEC-FDA model, we are 75% certain the average annual benefits produced by the proposed 5 year buyout plan will exceed $1,253,400.

Table 6. Expected Annual Damages

Damage Reach	Without Project Damages	With Project Damages	Damages Reduced (Benefits)	Probability Damage Reduced Exceeds Indicated Values		
				0.75	0.5	0.25
Vernon to Kingsland	$ 116,200	$ 116,200	$ -	$ -	$ -	$ -
Midland to Vernon	$ 179,600	$ 157,900	$ 21,600	$ 15,500	$ 20,700	$ 26,700
Hanley to Midland	$ 669,500	$ 386,500	$ 282,900	$ 185,100	$ 270,700	$ 364,800
Olive to Hanley	$ 1,571,500	$ 277,000	$ 1,294,500	$ 926,900	$ 1,259,800	$ 1,631,200
82nd to Olive	$ 493,200	$ 287,400	$ 205,800	$ 125,900	$ 199,100	$ 273,900
I-170 to 82nd	$ 89,800	$ 89,800	$ -	$ -	$ -	$ -
Total	**$ 3,119,700**	**$ 1,317,900**	**$ 1,804,800**	**$ 1,253,400**	**$ 1,750,300**	**$ 2,296,600**
**HEC-FDA Output at October 2013 Price Levels*						

4.4 Cost Analysis

The rough costs for the buyout plan were assembled using appraised values from the county and demolition estimates provided by University City from previous buyout efforts. A 25% contingency was added to this estimate. In addition to the value of the structure and the demolition cost, rough estimates for moving expenses and a replacement housing allowance was included. Of the 97 structures identified as buyout targets, all are residential. The structures included in the buyout plan are included in Attachment 1.

The interest during construction (IDC) was calculated based on a 3 year construction schedule. There are no additional OMRR&R costs associated with this project. The project's current first cost estimate is $19,224,300. With a total IDC of $1,007,300, the average annual cost comes to $870,200 (FDR of 3. 5%).

The original plans were compared to determine which maximized net benefits in 2010. This report was to confirm the viability of the 5 year buyout plan, then chosen as the NED plan. Table 7 displays the

planning level estimate of total costs for the plan, Table 8 displays the planning level average annual cost, and Table 9 displays the planning level average annual net benefits.

Table 7. Preliminary Total Construction Cost Estimate

Total Construction Cost	
River Des Peres	**5 Year Buyout**
Total Project	**$19,403,100**
Vernon to Kingsland	$0
Midland to Vernon	$221,600
Hanley to Midland	$4,451,700
Olive to Hanley	$11,123,600
82nd to Olive	$3,606,200
I-170 to 82nd	$0
October 2013 Price Levels	

Table 8. Preliminary Average Annual Cost Estimate

Average Annual Construction Cost	
River Des Peres	**5 Year Buyout**
Total Project	**$870,200**
Vernon to Kingsland	$0
Midland to Vernon	$9,938
Hanley to Midland	$199,645
Olive to Hanley	$498,860
82nd to Olive	$161,727
I-170 to 82nd	$0
October 2013 Price Levels	

Table 9. Preliminary Average Annual Net Benefits

Average Annual Net Benefits	
River Des Peres	**5 Year Buyout**
Total Project	**$934,600**
Vernon to Kingsland	$0
Midland to Vernon	$11,662
Hanley to Midland	$83,255
Olive to Hanley	$795,640
82nd to Olive	$44,073
I-170 to 82nd	$0
October 2013 Price Levels	

4.5 Benefit Cost Ratios

The average annual benefits listed below are an estimate of the risk reduced from removing the identified structures from the floodplain. These benefits are based solely on damage to structures and the contents. No effort was made to quantify business losses or disruptions caused by flooding.

The average annual benefit for the project is estimated at $1,795,300, with an average annual cost of $870,200 (FDR of 3.5%), resulting in a total BCR of 2.1 (FDR of 3.5%).

Table 10. Benefit to Cost Ratio at the 5-year Buyout Plan at 3.5%

River Des Peres	BCR	AA Benefits	AA Cost
Total Project	**2.1**	**$1,804,800**	**$870,200**
Vernon to Kingsland	-	$0	$0
Midland to Vernon	2.2	$21,600	$9,938
Hanley to Midland	1.4	$282,900	$199,645
Olive to Hanley	2.6	$1,294,500	$498,860
82nd to Olive	1.3	$205,800	$161,727
I-170 to 82nd	-	$0	$0
IDC costs were included			

5.0 Conclusions

This is currently a draft report updating the economic analysis. In any future analyses, the total number of structures to be included in a 5-year buyout plan may fluctuate along with the corresponding costs, benefits and BCRs. Based on this preliminary update, the 5 year buyout remains a feasible plan.

Once University City reviews this document, a meeting will be arranged to discuss the plan presented within this draft report. If additional explanation or clarification is needed, the report will be modified. A final version of this report will be provided to University City.

If University City would like to pursue Corps involvement in a buyout plan (or any other flood risk management plan), the suspended General Reevaluation study will need to be completed. University City would need to provide 25% of the costs to complete the study. Additional information about re-starting the General Reevaluation study can be provided at the City's request.

Attachment 1.

5-Year Floodplain Buyout Addresses

Economic Reach	Address	Street Name	Parcel Locator	Structure Use
Midland to Vernon	1208	Waldron Ave	17J511505	residential
Hanley to Midland	1131	Wilson Ave	17J420052	residential
Hanley to Midland	1135	Wilson Ave	17J420117	residential
Hanley to Midland	1139	Wilson Ave	17J420162	residential
Hanley to Midland	1143	Wilson Ave	17J420205	residential
Hanley to Midland	1149	Wilson Ave	17J420250	residential
Hanley to Midland	1153	Wilson Ave	17J420315	residential
Hanley to Midland	1157	Wilson Ave	17J420337	residential
Hanley to Midland	1163	Wilson Ave	17J421097	residential
Hanley to Midland	7467	Shaftesbury Ave	17J130201	residential
Hanley to Midland	1059	Wilson Ave	17J130256	residential
Hanley to Midland	1063	Wilson Ave	17J130322	residential
Hanley to Midland	1067	Wilson Ave	17J130399	residential
Hanley to Midland	1075	Wilson Ave	17J130498	residential
Hanley to Midland	1079	Wilson Ave	17J130520	residential
Hanley to Midland	1083	Wilson Ave	17J130603	residential
Hanley to Midland	1087	Wilson Ave	17J130652	residential
Hanley to Midland	7471	Shaftesbury Ave	17J130223	residential
Hanley to Midland	1035	N. Hanley Rd	17J130069	residential
Hanley to Midland	1039	N. Hanley Rd	17J131158	residential

Economic Reach	Address	Street Name	Parcel Locator	Structure Use
Olive to Hanley	1050	Mona Drive	17K340421	residential
Olive to Hanley	1054	Mona Drive	17K340476	residential
Olive to Hanley	1058	Mona Drive	17K340511	residential
Olive to Hanley	1062	Mona Drive	17K340603	residential
Olive to Hanley	1066	Mona Drive	17K340713	residential
Olive to Hanley	1070	Mona Drive	17K340751	residential
Olive to Hanley	1074	Mona Drive	17K330923	residential
Olive to Hanley	1078	Mona Drive	17K330994	residential
Olive to Hanley	1086	Mona Drive	17K331159	residential
Olive to Hanley	1090	Mona Drive	17K331214	residential
Olive to Hanley	1096	Mona Drive	17K331236	residential
Olive to Hanley	1100	Mona Drive	17K610043	residential
Olive to Hanley	1106	Mona Drive	17K610098	residential
Olive to Hanley	1110	Mona Drive	17K610142	residential
Olive to Hanley	1114	Mona Drive	17K610241	residential
Olive to Hanley	1118	Mona Drive	17K610285	residential
Olive to Hanley	1124	Mona Drive	17K610328	residential

Economic Reach	Address	Street Name	Parcel Locator	Structure Use
Olive to Hanley	1129	Glenside Lane	17K610438	residential
Olive to Hanley	1133	Glenside Lane	17K610449	residential
Olive to Hanley	1137	Glenside Lane	17K610483	residential
Olive to Hanley	1141	Glenside Lane	17K610548	residential
Olive to Hanley	1145	Glenside Lane	17K610571	residential
Olive to Hanley	1149	Glenside Lane	17K610625	residential
Olive to Hanley	1153	Glenside Lane	17K610681	residential
Olive to Hanley	1142	Glenside Lane	17K610647	residential
Olive to Hanley	1146	Glenside Lane	17K610702	residential
Olive to Hanley	1150	Glenside Lane	17K610746	residential
Olive to Hanley	1074	Groby Road	17K611022	residential
Olive to Hanley	1090	Groby Road	17K610494	residential
Olive to Hanley	1059	Raisher Drive	17K610186	residential
Olive to Hanley	1063	Raisher Drive	17K610263	residential
Olive to Hanley	1067	Raisher Drive	17K610306	residential
Olive to Hanley	1071	Raisher Drive	17K610373	residential
Olive to Hanley	1075	Raisher Drive	17K610362	residential
Olive to Hanley	1050	Raisher Drive	17K331281	residential
Olive to Hanley	1054	Raisher Drive	17K610032	residential
Olive to Hanley	1058	Raisher Drive	17K610076	residential
Olive to Hanley	1062	Raisher Drive	17K610119	residential
Olive to Hanley	1066	Raisher Drive	17K610153	residential
Olive to Hanley	1070	Raisher Drive	17K610218	residential
Olive to Hanley	1066	Groby Road	17K610296	residential
Olive to Hanley	1070	Groby Road	17K610351	residential
Olive to Hanley	1051	Raisher Drive	17K610108	residential
Olive to Hanley	1055	Raisher Drive	17K610131	residential
Olive to Hanley	7835	Ahern Ave	17K331072	residential
Olive to Hanley	7839	Ahern Ave	17K331160	residential
Olive to Hanley	7843	Ahern Ave	17K331203	residential
Olive to Hanley	7847	Ahern Ave	17K331258	residential
Olive to Hanley	7851	Ahern Ave	17K331292	residential
Olive to Hanley	7855	Ahern Ave	17K331247	residential
Olive to Hanley	7744	Ahern Ave	17K341301	residential
Olive to Hanley	7748	Ahern Ave	17K331302	residential
Olive to Hanley	7750	Ahern Ave	17K331313	residential
Olive to Hanley	7720	Drexel Drive	17K340762	residential
Olive to Hanley	7724	Drexel Drive	17K340773	residential
Olive to Hanley	7728	Drexel Drive	17K340805	residential
Olive to Hanley	7732	Drexel Drive	17K340784	residential
Olive to Hanley	7740	Drexel Drive	17K340872	residential
Olive to Hanley	7737	Drexel Drive	17K341103	residential
Olive to Hanley	7741	Drexel Drive	17K341125	residential
Olive to Hanley	7745	Drexel Drive	17K331182	residential
Olive to Hanley	1050	Wilshire Ave	17K340454	residential

Economic Reach	Address	Street Name	Parcel Locator	Structure Use
Olive to Hanley	1054	Wilshire Ave	17K340531	residential
Olive to Hanley	1051	Wilshire Ave	17K340487	residential
Olive to Hanley	1057	Wilshire Ave	17K340564	residential
Olive to Hanley	1061	Wilshire Ave	17K340696	residential
Olive to Hanley	7901	Glenside Place	17K610779	residential
Olive to Hanley	7915	Glenside Place	17K610768	residential
Olive to Hanley	7921	Glenside Place	17K610757	residential
Olive to Hanley	1087	Groby Road	17K610559	residential
Olive to Hanley	1091	Groby Road	17K610614	residential
Olive to Hanley	1095	Groby Road	17K610658	residential
Olive to Hanley	7925	Glenside Place	17K610735	residential

Economic Reach	Address	Street Name	Parcel Locator	Structure Use
82nd to Olive	1215	Westover Court	17K541204	res(Hafner apts) 16 units
82nd to Olive	8082-a.k.a. 8011	Hafner Court	17K541194	res(Hafner apts) 64 units