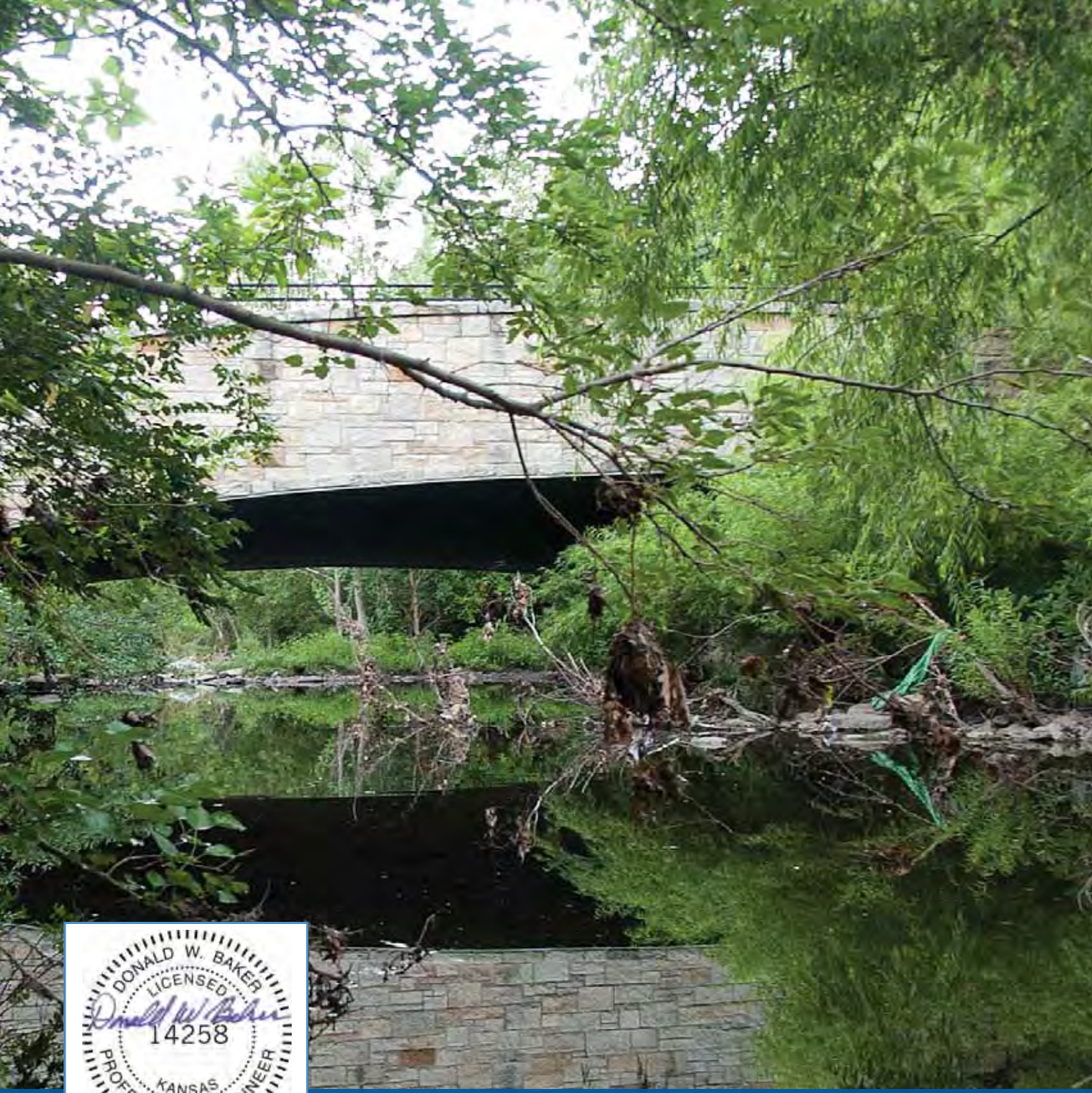


DONALD W. BAKER
LICENSED
14258
KANSAS
PROFESSIONAL ENGINEER

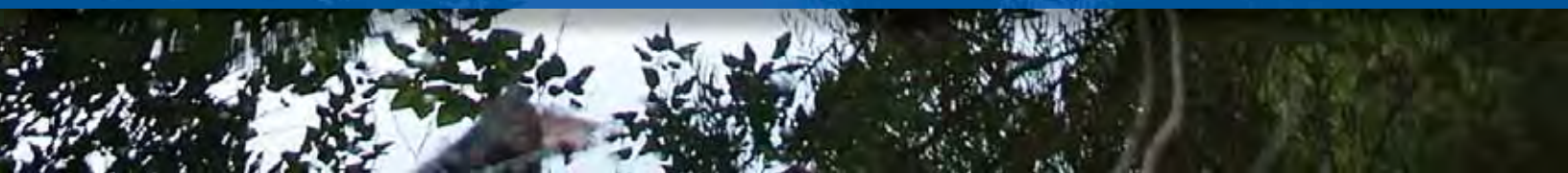
11-16-2018

WRS WATER RESOURCES SOLUTIONS

Johnson County SMAC Project No. BC-11-057
Brush Creek at Mission Road and 68th Street
Preliminary Engineering Study

Prepared for the City of Prairie Village

Nov. 16, 2018



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WRS WATER RESOURCES SOLUTIONS

3515 W. 75th St. ■ Suite 208 ■ Prairie Village, KS 66208 ■ (913) 302-1030 ■ Info@WRS-rc.com

Nov. 16, 2018

Keith Bredehoeft
Public Works Director
City of Prairie Village
3535 Somerset Drive
Prairie Village, KS 66208

Subject: Brush Creek at 68th Street and Mission Road Preliminary Engineering Study

Dear Mr. Bredehoeft:

Water Resources Solutions, LLC is pleased to present its preliminary engineering study outlining alternative solutions for the intermittent flooding of Brush Creek at Mission Road and 68th Street.

Within this preliminary engineering study report you will find, per Johnson County requirements, an executive summary; a general discussion, including background, existing conditions, standards, utility contacts and permits; a summary of findings, including project limits, hydrology and hydraulics, field investigations; a description of alternatives, which includes proposed improvements, utilities, rights-of-way and easements, effects on other cities and opinions of probable costs; recommendations, including evaluation of alternatives and recommended alternative; and flood problem rating forms.

If you have any questions or require additional information, please contact me at (913) 302-1030.

Sincerely,
Water Resources Solutions, LLC

Donald W. Baker, P.E., D. WRE, CPESC
Principal and Owner

11-16-2018

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EXECUTIVE SUMMARY

The City of Prairie Village has asked Water Resource Solutions to provide a preliminary engineering report of alternative options that will prevent or remedy flooding of residences along Brush Creek. The study includes evaluating three options:

1. Buy out the houses at risk of the 1% flood event and raise Mission Road high enough to prevent the 1% flood event from making it impassable.
2. Raise Mission Road high enough to prevent the 1% flood event from overtopping the road and flooding residences, converting the parking lot east of Mission Road into public park green space to serve as a stream bench.
3. Raise Mission Road high enough to prevent the 1% flood event from overtopping the road and flooding residents, retaining the parking lot east of Mission Road for use as a stream bench.

The recommended alternative is alternative No. 2. This recommendation is based on the following factors:

- The relative costs
- The relative likelihood of each option to prevent rather than merely mitigate the flooding
- The capability to protect the at-risk houses while allowing Mission Road to remain open for emergency-vehicle use during flood events.

I. PROJECT OVERVIEW

The Brush Creek at Mission Road and 68th Street project is located in Prairie Village, Kan., and is associated with flood risk mitigation improvements for Mission Road and five private homes.

A. FLOOD PROBLEM RATING TABLE

The Johnson County Stormwater Management Program Flood Problem Rating Table for the project is shown in Figure 1. Based on the flooding factors on the form, the project is rated at 175 points.

The first point category is number 2 – Flooding of Habitable Buildings. The points for this factor total 40 points. A frequency multiplier of 1 was chosen because of flooding of the homes in August 2017 and because the Effective FEMA model shows that four of the five flooded homes would flood or be at risk of flooding due to less than 1 foot freeboard during the 1% annual occurrence flood event. A severity multiplier of 1 was selected since the number of homes impacted is less than six.

The second point category selected is number 6 – Flooding Residential Streets of More Than 7 Inches. The total points for this factor is 135 points. A frequency multiplier of 3 was chosen because the water depth over Mission Road exceeded 7 inches for the three 2017 storms and because the modeling occurs at much less than a 20% annual occurrence flood event. A severity multiplier of 1.5 was selected because the flooded roadway restricts emergency vehicle access.

B. BACKGROUND

The City of Prairie Village has asked Water Resource Solutions to provide a preliminary engineering report of alternative options that will mitigate flooding to residences and an arterial street along Brush Creek.

Brush Creek runs parallel from south to north along Mission Road as it passes under the intersection of Mission Road and Tomahawk Road. Further north, the reach continues past a residential neighborhood at 68th Street. At 66th Street, Brush Creek turns northeast and runs along Indian Lane as it exits the City of Prairie Village.

The flooding issues for this project include the flooding of five homes by one major event in August 2017. Four of the five homes are shown to be at risk of flooding by the 1% annual occurrence flood event, according to the Effective FEMA model. Mission Road at this location is shown to flood by more

Table 1: Johnson County Stormwater Management Plan: Flood Problem Rating Table 1999
City: Prairie Village, Kansas **Basin & Watershed: Brush Creek**
Location: 68th Street and Mission Road **Description of Problem: Flooding**

Flood Problem Rating						
Factor No.	Factor Description	Eliminates Factor	Rating Points	Frequency Multiplier*	Severity Multiplier*	Total Points
1	Loss of Life		40			0
2	Flood of habitable building	3	40	1	1	40
3	Flooding of garages and outbuildings	2	20			0
4	Flooding of arterial street of more than 7 inches	5,6,7	30	3	1.5	135
5	Flooding of collector street of more than 7 inches	4,6,7	25			0
6	Flooding of residential street of more than 7 inches	4,5,7	20			0
7	Widespread or long-term ponding in streets	4,5,6	20			0
8	Erosion threatens habitable buildings, utilities, streets, bridges	9	30			0
9	Erosion significant in unmaintained areas	8	10			0
10	Erosion causes imminent drainage structure collapse	11,12	30			0
11	Erosion causes marginal drainage structure collapse	10,12	15			0
12	Erosion causes failure of drainage structure	10,11	10			0
13	Other cities receiving benefits		20			0
14	Other cities contributing to the flooding problem		10			0
		Project Total Points				175
		Estimated Total Project Cost				$2,262,523
		Priority Rating = Total Project Cost/Total Points				12,929

** See appendix for severity and frequency multiplier values*

than 7 inches for flood events less than the 20% annual occurrence flood, and it flooded three times in the Summer of 2017. The homes confirmed by the City of Prairie Village to have flooded at least twice during summer 2017 are illustrated in Figure 1. The flooded homes may have also flooded during the Oct. 4, 1998, flood event, but this flooding is unverified.

The project limits are along Brush Creek from approximately the intersection of Tomahawk Road and Mission Road to 67th Terrace and Mission Road.

C. EXISTING CONDITIONS

The drainage area to the Brush Creek reach at 68th Street is approximately 4.6 square miles. According to the Johnson County/FEMA model, the peak flow for the 1% annual exceedance flow event is approximately 7,141 cubic feet per second.

During the 100-year design storm event, the intersection of Mission Road and Tomahawk Road floods. The west side of Mission Road floods into the residential neighborhood from Tomahawk Road to West 67th Terrace. This flooding impedes the safe passage

of traffic and closes access of these roads to emergency vehicles. The lowest elevation of Mission Road between Tomahawk Road and West 67th Street is 903.2 feet. The FEMA Flood Insurance Rate Map (FIRM) Shows the 1% annual exceedance flow event water surface at this location between 908 to 907.1 feet.

These flood extents were reached for certain on July 27, 2017, when a 2% storm event caused flooding along Mission Road from Tomahawk Road to West 67th Terrace. The flooding on Mission Road was observed to be several feet deep. A second event during that summer produced similar flood extents and roadway flooding depth. Both events produced flooding on an arterial street of more than 7 inches. The City of Prairie Village also documented five residential homes on the west side of Mission Road that were flooded during these events. The addresses were 3907 68th Street, 6734 Mission Road, 6800 Mission Road, 3900 68th Terrace and 3906 68th Terrace.

An overall drainage area map, map of the flooded residences and a FEMA flood map for the project area are included in Figures 2, 3 and 4, respectively.

The Flood Problem Rating Table in Table 1 identifies 175.0 total project points. It should be noted a frequency multiplier of 3 was used because, as noted above, the flooding occurred three times during the summer of 2017. Water Resources Solutions believes the total points may be conservatively low. Further detailed analysis may identify additional drainage deficiencies and modify the rating table points.

D. STANDARDS

The Kansas City Chapter of the American Public Works Association Design Criteria Section 5600 will be the basis of design for this project. Any deviations from this standard will be noted during the design of the project.

The construction will be completed using the City of Prairie Village construction specifications and standard details. Additional details and specifications will be supplemented as necessary for the project.

Figure 1. Homes affected by flooding

3900 and 3906 West 68th Terrace

6800 Mission Road

3907 W. 68th St.

6734 Mission Road

Figure 2. Drainage area map

Table 2. Utility contacts

Google Fiber	Johnson County Wastewater	Kansas City Power & Light Co.	Spectrum
908 Broadway Boulevard Kansas City, MO 64105 Becky Davis (913) 725-8745 rebeccadavis@google.com	4800 Nall Avenue Mission, KS 66202 Mike Pillar (913) 715-8537 Mike.pillar@JCW.org	4400 East Front Street Kansas City, MO 64120 Gary Price (913) 894-3074 gary.price@ckpl.com	8221 W. 119th Street Overland Park, KS 66213 Alex Cashman (913) 915-0553 Charles.cashman@charter.com
Water One	**Kansas Gas Service**	**Southern Star Central Gas Pipeline**	**AT&T**
10747 Renner Boulevard Lenexa, KS 66216 Jan Hardie P (913) 895-5500 F (913) 895-1827 Jhardie@waterone.org	Engineering Department 11401 W. 89th Street Overland Park, KS 66214 Tony Cellitti (913) 599-8964 tcellitti@ksgas.com	8195 Cole Parkway Shawnee, Kansas 66227 P (913) 422-6300 F (913) 422-6330 Bob Bath Bob.a.bath@sscgp.com Justin Henke Justin.Henke@sscgp.com	9444 Nall Avenue Overland Park, KS 66207 Randy Gaskin (913) 383-6948 RG9513@att.com Darren Welch (816) 392-0353 DW9342@att.com
Consolidated Communications			
9701 Lackman Road Lenexa, KS 66219 Melissa Stringer (913) 322-6922			

E. UTILITY CONTACTS

The following utilities could be impacted by the project. Table 2 provides the contact information for these utilities.

- Kansas City Power & Light
- AT&T
- Time Warner Cable
- Google Fiber
- Kansas Gas Service
- WaterOne
- Consolidated Communications
- Southern Star Central Gas Pipeline
- Johnson County Wastewater

F. PERMITS

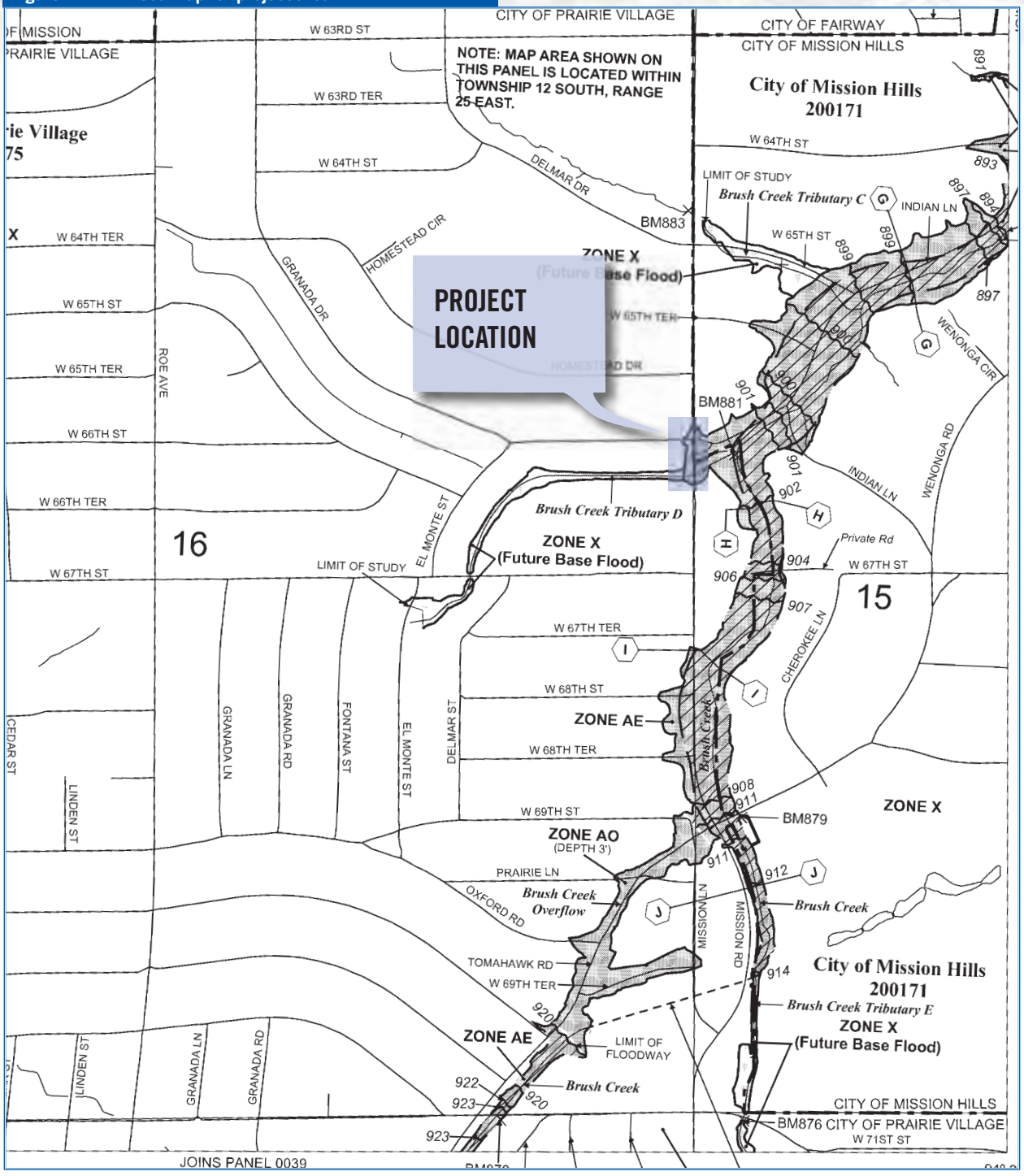
Potential environmental impact involved in at least one proposed alternative will be significant enough to require application to the U.S. Army Corps of Engineers for permitting under Section 404 of the Clean Water Act. In addition, at least one proposed alternative will necessitate requesting a Letter of Map Revision to the FEMA flood map to correct the flood zone boundary based upon changes to the hydraulics of the floodway as a result of the project improvements.

G. CONFORMANCE WITH WATERSHED STUDIES

This project falls within the Brush Creek portion of the Northeast Johnson County Watershed Study completed by Johnson County. The effective FEMA model was used as the basis of the model to identify the existing flooding conditions for the project. The proposed improvements for the alternatives studied were modeled using this existing conditions hydraulic model.

Figure 3. Map of flooded residences

Figure 4. FEMA flood map for project area



II. SUMMARY OF FINDINGS

A. PROJECT LIMITS

This project includes improvements along Brush Creek and Mission Road from Tomahawk Road and 67th Street, illustrated in Figure 5.

B. HYDROLOGY AND HYDRAULICS

This study's hydrology and hydraulics are based on the FEMA Effective Models. These models were used to evaluate the proposed improvements.

The Effective FEMA Model used as the basis to identify the existing flooding conditions showed the peak flow for the 1% annual exceedance flow event of approximately 7,141 cubic feet per second. This flowrate used for the hydraulic model was identified at reach station 2.753, which lies at the upstream start of the project limits. The hydraulics for this project were modeled using the U.S. Army Corps of Engineers' Hydrologic Engineering Center River Analysis System (HEC-RAS) software.

The results of the hydraulic analysis show that two of the five homes documented to have flooded during the summer 2017 2% storm events have low-opening elevations below the water surface elevation of the 100-year flood event. Two additional homes have low-opening elevations less than 1 foot above the 100-year flood event. The home address and associated elevations are shown in Table 3.

C. FIELD INVESTIGATIONS

On May 23, 2018, a field investigation was performed to determine whether any of the alternatives offered might raise particular issues. The only concerns discovered involve the utility poles located along Mission Road. Because each alternative proposes to raise the height of Mission Road, the resulting clearance distance beneath overhead power lines crossing the street may create potential for tall trucks to hit them. Power poles typical of those along Mission Road are illustrated in Figure 6.

Table 3. Comparison of low-opening elevations to the 100-year water surface elevations

Address	Low Opening/ Floor Elevation	100-Yr Surface Elevation
3906 W 68th Terrace	909.01	907.98
3900 W 68th Terrace	908.07	907.98
3907 W 68th Street	908.25	907.70
6800 Mission Road	906.93	907.70
6734 Mission Road	906.60	907.41

Figure 5. Project limits

D. IMPROVEMENT ALTERNATIVES

Three proposed alternative solutions to address flooding within the Brush Creek reach at Mission Road and 68th Street were developed as part of this report. A suggested fourth potential alternative was studied but ultimately discarded, which would have required building a flood wall on the east side of the Village Presbyterian Church, located at 6641 Mission Road. Water Resources Solutions' two-di-

Figure 6. Mission Road utility poles and power lines

mensional modeling suggested an approximate 200-foot flood wall could be a feasible option to mitigate flooding of the church without adverse upstream or downstream effects. However, the wall was considered too intrusive to the structure. Additionally, it would not qualify as FEMA-compliant and would require the entirety of the area to lie within a city drainage easement. Therefore, as studied it would not qualify for SMAC support funding. For those reasons, the alternative was deemed functionally impossible for this site.

The three proposed alternative solutions are described here, including, where appropriate, proposed improvements, utilities, rights-of-way and easements, effects on other cities and opinions of probable costs.

1. DESCRIPTION OF ALTERNATIVE 1

The first alternative proposed improvement would be to remove the at-risk houses from the flood plain by buying them out, and to prevent Mission Road from flooding by raising the elevation of Mission Road from Tomahawk Road to West 68th Street. The proposed houses for the buyout plan are shown in Figures 1 and 3.

The increase in elevation of Mission Road will prevent the water from topping over the street and closing it to traffic use. As part of this alternative, the parking lot east of Mission Road will have to be lowered and will essentially act as a bench for the stream.

Water Resources Solutions used the HEC-RAS methodology to determine the water surface elevation, with the raised elevation of Mission Road and the parking lot acting as a bench for Brush Creek during the 1% flood event.

a. Facilities

This alternative mitigates the flood risk for the five affected homes by purchasing and removing them from the floodplain. Additionally, it mitigates the impassable flooding to Mission Road between Tomahawk Road and West 68th Street by increasing the road elevation about 4.5 feet, to an elevation of 908.5 feet to 909 feet. The flood water elevation rises to 907 to 908 feet, allowing 1 foot of freeboard for the water surface elevation to the top of the roads after improvement.

Approximately 625 feet of road will have to be regraded and raised. The parking lot stretching along the east side of Mission Road will also need to be torn out and regraded. Streets connecting to Mission Road will also have to be regraded to accommodate the change in elevation. In conjunction with re-grading, the parking lot presently located on the east side of Mission Road can be either repaved to remain as parking lot or constructed into a park in accordance with the Prairie Village Park Masterplan.

b. Road/traffic

Mission Road between Tomahawk Road and West 68th Street will have to be closed for construction, and traffic will have to be redirected. The City of Mission Hills is aware of the conclusions of this preliminary engineering study and has agreed to coordinate future plans with the City of Prairie Village to accommodate construction-related traffic changes.

c. Utilities

Utility poles will have to be moved, and stormwater drainage will have to be improved to accommodate the roadway elevation change. Alternations to the utility poles along Mission Road will need to be con-

sidered, as raising the road by 4 feet may reduce the minimum vertical clearance beneath electrical lines.

d. Rights-of-way/easements

The City of Prairie Village has the right of way on Mission Road and sidewalks. The parcel that runs along the east side of Mission Road is owned by the city. The parking lot is within the right of way for the city to construct a park trail. The driveways of residences on the west side of Mission Road and, possibly, a portion of the Village Presbyterian Church parking lot will have to be replaced to accommodate the elevation change.

e. Preliminary drawing

A drawings of the houses proposed for buyout is shown in Figure 7. A preliminary drawing of the portion of this alternative that raises Mission Road is shown in Figure 8.

f. Opinion of probable cost

The appraised value of the five houses proposed to be bought out under this alternative was taken from Johnson County Appraiser's online land records and adjusted to current value using an inflation rate of 3%. The cost to raise the height of Mission Road assumes the existing parking lot will be replaced by park ground, as that is the relatively less expensive choice and also meets Prairie Village design standards. Using that data, the opinion of probable cost is $4,569,557.

g. Relationship to other city stormwater facilities

This project should affect no surrounding cities. Although changes will be made to the stormwater infrastructure, the models studied demonstrated that improvements from this alternative would not raise flood levels in neighboring Mission Hills nor change flow velocities of stormwater entering that city's system from Prairie Village.

h. Effects on Surrounding Cities

This alternative has been determined to not have any effect on flood conditions in the immediately neighboring City of Mission Hills or other cities.

i. Conformance with Current Design Standards

This alternative will meet the requirements of City of Prairie Village and Johnson County design standards.

Figure 7: Houses proposed for buyout plan

Table 4: Alternative 1 – Buy out at-risk houses and raise Mission Road - engineers opinion of probable construction cost

Item	Item Description	Unit	Quantity	Unit Cost	Total Cost
Residence Buyout Costs					
1	Clearing, Grubbing & Demolition	LS	1	$ 304,560.00	$ 304,560.00
2	Erosion and Sediment Control	LS	1	$ 15,230.00	$ 15,230.00
3	Mobilization	LS	1	$ 243,650.00	$ 243,650.00
4	Traffic Control	LS	1	$ 7,620.00	$ 7,620.00
5	6830 Mission Road	LS	1	$ 196,100.00	$ 196,100.00
6	6734 Mission Road	LS	1	$ 212,900.00	$ 212,900.00
7	6800 Mission Road	LS	1	$ 245,500.00	$ 245,500.00
8	3900 68th Terrace	LS	1	$ 190,200.00	$ 190,200.00
9	3901 68th Terrace	LS	1	$ 149,800.00	$ 149,800.00
10	House Demolition and Restoration	LS	5	$ 50,000.00	$ 250,000.00
				Subtotal	**$ 1,815,560.00**
				20% contingency	**$ 363,112.00**
				3% inflation on homes	**$ 29,835.00**
				Total construction cost	**$ 2,208,507.00**
				Design/consultant fee (10% of total construction cost, less residence costs)	**$ 98,527.00**
				Buyout subtotal	**$ 2,307,034.00**
Raising Mission Road Elevation Costs					
1	Clearing, Grubbing and Demolition	LS	1	$138,200.00	$138,200.00
2	Erosion and Sediment Control	LS	1	$55,280.00	$55,280.00
3	Mobilization	LS	1	$55,280.00	$55,280.00
4	Traffic Control	LS	1	$34,550.00	$34,550.00
5	Excavating, Filling and Grading - Fill *Inc. park grading*	CY	8,923	$15.00	$133,845.00
6	Excavating, Filling and Grading - Excavation *Inc. park grading*	CY	1,647	$10.00	$16,470.00
7	Asphalt Pavement *North side Tomahawk Rd through 67th Terr intersection. Inc. aggregate subgrade*	SY	6,292	$75.00	$471,900.00
8	Mill and Overlay	SY	360	$30.00	$10,800.00
9	Parking Lot Asphalt Pavement	SY	460	$75.00	$34,500.00
10	Curb and Gutter *Inc. parking areas and islands*	LF	2,020	$45.00	$90,900.00
11	Concrete Sidewalk *6-foot sidewalk west of Mission Rd; 8-foot, east*	SY	676	$35.00	$23,660.00

Item	Item Description	Unit	Quantity	Unit Cost	Total Cost
12	ADA-Compliant Ramps (All Types)	EA	4	$1,500.00	$6,000.00
13	Concrete Driveways and Approaches *Inc. church parking lot*	SY	2,381	$45.00	$107,145.00
14	Traffic Island Replacement/Landscaping	EA	2	$20,000.00	$40,000.00
15	Street Light Replacement	EA	6	$3,000.00	$18,000.00
16	Storm Sewer Structures	EA	20	$6,000.00	$120,000.00
17	Storm Sewer Pipe	LF	1,108	$63.00	$69,804.00
18	Rip Rap	SY	53.33	$100.00	$5333.00
19	Stormwater BMPs *Inc. stream landscape restoration*	EA	2	$25,000.00	$50,000.00
20	Sanitary Sewer Structures	EA	7	$5,500.00	$38,500.00
21	Sodding and Fertilizing *Inc. residential lawns bordering Mission Rd and park area east of Mission Rd*	SY	2,505	$6.00	$15,030.00
22	Residential landscaping	EA	1	$36,000	$36,000.00

Subtotal	**$1,571,197.00**
20% contingency	**$314,239.00**
Total construction cost	**$1,885,436.00**
Design/consultant fee (20% of total construction cost, less FEMA LoMAR costs) ***Inc. construction inspection and testing***	**$302,087.00**
FEMA LoMAR costs	**$75,000.00**
Raising Mission subtotal	**$2,262,523.00**
Alternative 1 Buyout homes and raise Mission Road total cost	**$4,569,557.00**

2. DESCRIPTION OF ALTERNATIVE 2

The second proposed improvement is to both protect the five at-risk residences and prevent flooding from closing Mission Road to traffic by raising the elevation of Mission Road from Tomahawk Road to West 68th Street. The increase in elevation will prevent the water from topping over the street and into the residences. The parking lot east of Mission Road will have to be lowered and will essentially act as a bench for the stream.

Water Resources Solutions used the HEC-RAS methodology to determine the water surface elevation, with the raised elevation of Mission Road and the parking lot acting as a bench for Brush Creek during the 1% flood event.

a. Facilities

Mission Road between Tomahawk Road and West 68th Street currently sits at an average elevation of 900 feet, with a low elevation of 903.2 feet. The flood water elevation rises to 907 to 908 feet, meaning the elevation of Mission Road will need to be raised to an elevation of 908.5 feet to 909 feet in order to be higher than the flood elevation. Reaching this target means Mission Road will need to be elevated by about 4.5 feet. Approximately 625 feet of road will have to be regraded and raised. The parking lot stretching along the east side of Mission Road will also need to be torn out and regraded. Streets connecting to Mission Road will also have to be regraded to accommodate the change in elevation. Figure 8 shows an aerial view of Mission Road and the houses on the west side

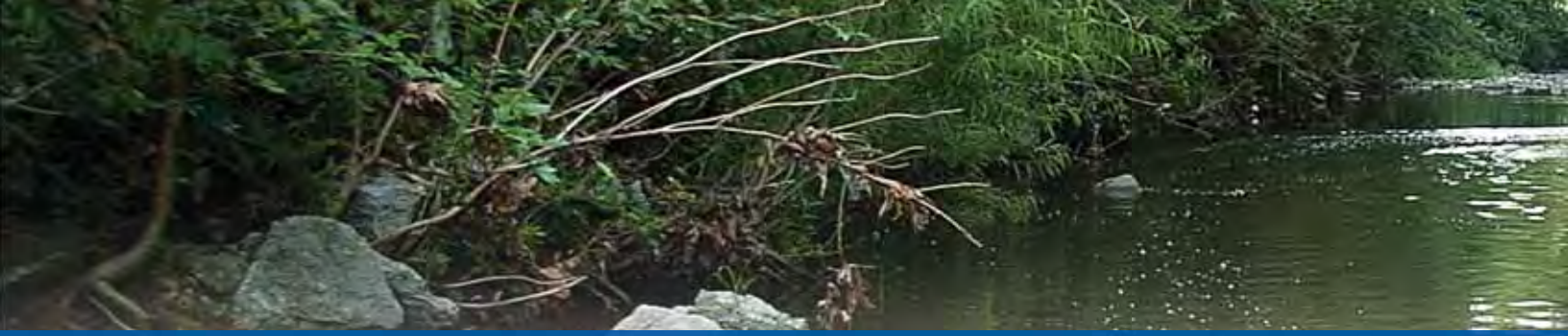


Figure 8: Plan view of Mission Road to be raised with park

that are at risk of flooding. Raising Mission Road will act as a barrier, preventing the water from reaching the houses. It will also allow 1 foot of freeboard for the water surface elevation to the top of the roads.

In conjunction with re-grading, the parking lot located on the east side of Mission Road can be constructed into a park in accordance with the Prairie Village Park Masterplan. This use also opens more opportunity for bioretention to be used at the park to improve water quality. The park would also connect well with Prairie Village's existing biking path.

The removal of the parking lot will also prevent risk to parked vehicles during a 100-year flood event. Because the parking lot area on the east side of Mission Road must be situated below the flood line in order to act as the necessary flood bench, it is ill-advised to use that area as a parking lot, due to the high risk for flooding to float away cars and passengers, posing unnecessary risk to the community and lives.

b. Road/traffic

Mission Road between Tomahawk Road and West 68th Street will have to be closed for construction, and traffic will have to be redirected. The City of Mission Hills is aware of the conclusions of this preliminary engineering study and has agreed to coordinate future plans with the City of Prairie Village to accommodate construction-related traffic changes.

c. Utilities

Utility poles will have to be moved,

Table 5: Alternative 2 – Raising Mission Road with park space - engineers opinion of probable construction cost

Item	Item Description	Unit	Quantity	Unit Cost	Total Cost
1	Clearing, Grubbing and Demolition	LS	1	$138,200.00	$138,200.00
2	Erosion and Sediment Control	LS	1	$55,280.00	$55,280.00
3	Mobilization	LS	1	$55,280.00	$55,280.00
4	Traffic Control	LS	1	$34,550.00	$34,550.00
5	Excavating, Filling and Grading - Fill *Inc. park grading*	CY	8,923	$15.00	$133,845.00
6	Excavating, Filling and Grading - Excavation *Inc. park grading*	CY	1,647	$10.00	$16,470.00
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8	Mill and Overlay	SY	360	$30.00	$10,800.00
9	Parking Lot Asphalt Pavement	SY	460	$75.00	$34,500.00
10	Curb and Gutter *Inc. parking areas and islands*	LF	2,020	$45.00	$90,900.00
11	Concrete Sidewalk *6-foot sidewalk west of Mission Rd; 8-foot, east*	SY	676	$35.00	$23,660.00
12	ADA-Compliant Ramps (All Types)	EA	4	$1,500.00	$6,000.00
13	Concrete Driveways and Approaches *Inc. church parking lot*	SY	2,381	$45.00	$107,145.00
14	Traffic Island Replacement/Landscaping	EA	2	$20,000.00	$40,000.00
15	Street Light Replacement	EA	6	$3,000.00	$18,000.00
16	Storm Sewer Structures	EA	20	$6,000.00	$120,000.00
17	Storm Sewer Pipe	LF	1,108	$63.00	$69,804.00
18	Rip Rap	SY	53.33	$100.00	$5333.00
19	Stormwater BMPs *Inc. stream landscape restoration*	EA	2	$25,000.00	$50,000.00
20	Sanitary Sewer Structures	EA	7	$5,500.00	$38,500.00
21	Sodding and Fertilizing *Inc. residential lawns bordering Mission Rd and park area east of Mission Rd*	SY	2,505	$6.00	$15,030.00
22	Residential landscaping	EA	1	$36,000	$36,000.00
	Subtotal				**$1,571,197.00**
	20% contingency				**$314,239.00**
	Total construction cost				**$1,885,436.00**
	Design/consultant fee (20% of total construction cost, less FEMA LoMAR costs) ***Inc. construction inspection and testing***				**$302,087.00**
	FEMA LoMAR costs				**$75,000.00**
	Raising Mission Road alternative 2 total cost				**$2,262,523.00**

and stormwater drainage will have to be improved to accommodate the roadway elevation change. Alternations to the utility poles along Mission Road will need to be considered, as raising the road by 4 feet may reduce the minimum vertical clearance beneath electrical lines.

d. Rights-of-way/easements

The City of Prairie Village has the right of way on Mission Road and sidewalks. The parcel that runs along the east side of Mission Road is owned by Prairie Village. The parking lot is within the right of way for the city to construct a park trail. The driveways of residences on the west side of Mission Road and, possibly, a portion of the Village Presbyterian Church parking lot will have to be replaced to accommodate the elevation change.

e. Preliminary drawings

A preliminary drawing for this alternative is shown in Figure 8.

f. Opinion of probable costs

Table 5 shows the engineer's opinion of probable costs for this alternative totals $2,262,523.00.

g. Relationship to other city stormwater facilities

This project should affect no surrounding cities. The models studied demonstrated that improvements for this alternative would not raise flood levels in neighboring Mission Hills nor change flow velocities of stormwater entering that city's system from Prairie Village.

h. Effects on surrounding cities

This alternative was determined to

Figure 9: Plan view of Mission Road to be raised with parking

have no effect on the neighboring City of Mission Hills.

i. Conformance with current design standards

This alternative will meet the requirements of City of Prairie Village and Johnson County design standards.

3. DESCRIPTION OF ALTERNATIVE 3

This proposed improvement would essentially be the same as Alternative 2, with the exception that a parking lot will occupy the lower bench area instead of a park. The amount of parking space has the potential to be reduced, as raising Mission Road will require a minimum slope that will decrease the width of the parking lot.

Barriers would have to be installed to prevent vehicles from falling into Brush Creek.

a. Facilities

Mission Road between Tomahawk Road and West 68th Street currently sits at an average elevation of 900 feet, with a low elevation of 903.2 feet. The flood water elevation rises to 907 to 908 feet, meaning the elevation of Mission Road will need to be raised to an elevation of 908.5 feet to 909 feet in order to be higher than the flood elevation. Reaching this target means Mission Road will need to be elevated by about 4.5 feet. Approximately 625 feet of road will have to be regraded and raised. The parking lot stretching along the east side of Mission Road will also need to be torn out and regraded. Streets connecting to Mission Road will also have to be regraded to accommodate the change in elevation. The parking lot stretching along the east side of Mission Road will also need to be torn out and regraded. Streets connecting to Mission Road will also have to be regraded to accommodate the change in elevation.

The parking lot located on the east side of Mission Road will need to be lowered and act as a flood bench. It is, therefore, recommended that a parking lot is ill-advised due to the high risk for flooding to float away cars and passengers, posing unnecessary risk to the community and lives. Existing City of Prairie Village policy forbids city parking lots from being constructed in a flood plain.

b. Road/traffic

Mission Road between Tomahawk Road and West 68th Street will have to be closed for construction and traffic will have to be redirected. The City of Mission Hills is aware of the conclusions of this preliminary engineering study and has agreed to coordinate future plans with the City of Prairie Village to accommodate construction-related traffic changes.

c. Utilities

Utility poles will have to be moved and stormwater drainage will have to be improved to accommodate the elevation change.

d. Rights-of-ways/easements

The driveway of residents will have to be replaced to accommodate the elevation change. The parking lot is within the right of way for the City to construct a park trail.

e. Preliminary drawings

The preliminary layout drawing for this alternative is shown in the Figure 9.

f. Opinions of probable cost

Table 6 shows the engineer's opinion of probable costs for this alternative is $2,614,854.00.

g. Relationship to other city stormwater facilities

This project should affect no surrounding cities. The models studied demonstrated improvements for this alternative would not raise flood levels in neighboring Mission Hills nor change flow velocities of stormwater entering that city's system from Prairie Village.

h. Effects on surrounding cities

This alternative was determined to have no effect on the neighboring City of Mission Hills.

i. Conformance with current design standards

This alternative will meet the requirements of Johnson County design stand-ards. It will not meet requirements of City of Prairie Village which prohibit locating city parking within a flood plain.

Table 7: Alternative 3 – Raising Mission Road with parking lot - engineers opinion of probable construction cost

Item	Item Description	Unit	Quantity	Unit Cost	Total Cost
1	Clearing, Grubbing and Demolition	LS	1	$300,000.00	$300,000.00
2	Erosion and Sediment Control	LS	1	$67,240.00	$67,240.00
3	Mobilization	LS	1	$67,240.00	$67,240.00
4	Traffic Control	LS	1	$42,030.00	$42,030.00
5	Excavating, Filling and Grading - Fill	CY	8,923	$15.00	$133,845.00
6	Excavating, Filling and Grading - Excavation	CY	1,647	$10.00	$16,470.00
7	Asphalt Pavement *North side Tomahawk Rd through 67th Terr intersection. Inc. aggregate subgrade*	SY	6,292	$75.00	$471,900.00
8	Mill and Overlay	SY	360	$30.00	$10,800.00
9	Parking Lot Asphalt Pavement	SY	1,246	$75.00	$93,450.00
10	Curb and Gutter *Inc. parking areas and islands*	LF	2,020	$45.00	$90,900.00
11	Concrete Sidewalk *6-foot sidewalk west of Mission Rd; 8-foot, east*	SY	676	$35.00	$23,660.00
12	ADA-Compliant Ramps (All Types)	EA	4	$1,500.00	$6,000.00
13	Concrete Driveways and Approaches *Inc. church parking lot*	SY	2,381	$45.00	$107,145.00
14	Traffic Island Replacement/Landscaping	EA	2	$20,000.00	$40,000.00
15	Street Light Replacement	EA	6	$3,000.00	$18,000.00
16	Storm Sewer Structures	EA	20	$6,000.00	$120,000.00
17	Storm Sewer Pipe	LF	1,108	$63.00	$69,804.00
18	Rip Rap	SY	53.33	$100.00	$5333.00
19	Stormwater BMPs *Inc. stream landscape restoration*	EA	2	$25,000.00	$50,000.00
20	Sanitary Sewer Structures	EA	7	$5,500.00	$38,500.00
21	Sodding and Fertilizing *Inc. residential lawns bordering Mission Rd*	SY	1,259	$6.00	$7,554.00
22	Residential landscaping	EA	1	$36,000	$36,000.00
	Subtotal				**$1,815,871.00**
	20% contingency				**$363,174.00**
	Total construction cost				**$2,179,045.00**
	Design/consultant fee (20% of total construction cost, less FEMA LoMAR costs) ***Inc. construction inspection and testing***				**$360,809.00**
	FEMA LoMAR costs				**$75,000.00**
	Raising Mission Road alternative 3 total cost				**$2,614,854.00**

III. RECOMMENDATIONS

This section provides recommendations for the proposed project.

A. EVALUATION OF ALTERNATIVES

All three alternatives provide a complete solution for the flooding issues associated with this project. The following section discusses each alternative.

1. ALTERNATIVE 1

Buying out the at-risk residences would be a costly alternative. Alternative 2 or 3 would equally accomplish the goal of solving the underlying flooding and keeping Mission Road open to emergency vehicle use during a 1% flood, even as they protect the vulnerable residences without demolishing them.

2. ALTERNATIVE 2

Alternative 2, raising Mission Road, would solve the issue of emergency vehicles accessing and using the road during the 1% flood event. In addition, the residences having flooding issues would no longer experience flooding. However, the church would still experience flooding. The addition of the park would make use of the space that was planned to be used as park space in the Prairie Village Park Master Plans. However, the park would still experience flooding, as the area will act as a flood bench.

3. ALTERNATIVE 3

Alternative 3 will solve the issue of flooding. However, any cars parked in the parking lot will have a high risk of getting flooded and washed down Brush Creek. For this reason, this alternative is highly advised against.

B. RECOMMENDED ALTERNATIVE

The recommended alternative would be to choose alternative 2. A new small park would better utilize the space in accordance with existing city plans and keep parked cars away from flood risk. A new park would bring other opportunities, such as bioretention for water quality. The raised Mission Road will prove sufficient elevation to prevent flooding to the residences.

IV. ACCEPTANCE BY CITIES within project limits

This project will not affect the City of Mission Hills, which lies directly to the east of the project and downstream of the project. The hydraulic modeling shows that the flood elevations are not increased for Mission Hills, and the velocities of the flows are not increased.

The City of Prairie Village has been in contact with Mission Hills. City representatives met with Mission Hills City Administrator Courtney Christensen to discuss the project and address Mission Hills' concerns.

Appendix

Johnson County Stormwater Management Plan
Flood Problem Rating Table 1999

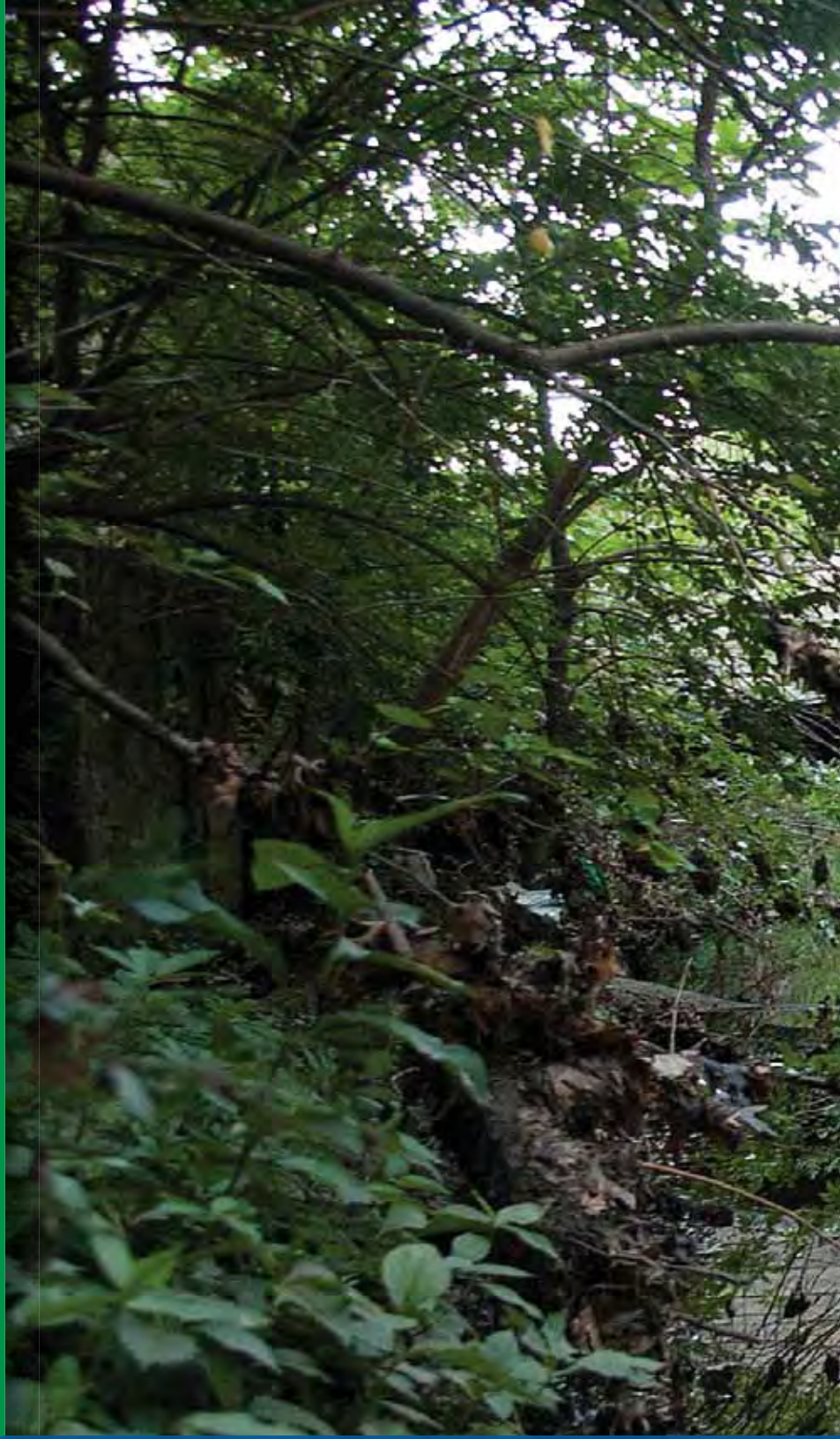
City: Prairie Village, Kansas Basin & Watershed Brush Creek
Location: 68th Street and Mission Road
Description of Problem: Flooding

Flood Problem Rating

Factor #	Factor Description	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	Total Points
1	Loss of Life		40			0
2	Flood of habitable building	3	40	1	1	40
3	Flooding of garages and outbuildings	2	20			0
4	Flooding of arterial street of more than 7 inches	5,6,7	30	3	1.5	135
5	Flooding of collector street of more than 7 inches	4,6,7	25			0
6	Flooding of residential street of more than 7 inches	4,5,7	20			0
7	Widespread or long-term ponding in streets	4,5,6	20			0
8	Erosion threatens habitable buildings, utilities, streets, bridges	9	30			0
9	Erosion significant in unmaintained areas	8	10			0
10	Erosion causes imminent drainage structure collapse	11,12	30			0
11	Erosion causes marginal drainage structure collapse	10,12	15			0
12	Erosion causes failure of drainage structure	10,11	10			0
13	Other cities receiving benefits		20			0
14	Other cities contributing to the flooding problem		10			0
	Project Toal Points					175
	Estimated Total Project Cost					
	Priority Rating = Total Project Cost/Total Points					0

Applies to #	Frequency Multiplier	Muliplier Value
2-7	One time in ten years or by 10- to 100-year design storm	1
2-7	Two times in ten years or by 5- to 10-year design storm	2
2-7	Three or more times in 10-years or less than under 5-year design storm	3
14	One city receiving benefit	1
13,14	Two cities receiving benefit or second city contributing to flooding problem	2
13,14	Three or more cities receving benfit or three or more cities contributing to the flooding problem	3

Applies to #	Severity Description	Muliplier Value
1	Number of deaths * = 1 for each death	*
2,3	1-5 buildings flooded historically or by the 100-year existing or future design flow	1
2,3	6-9 buildings flooded historically or by the 100-year existing or future design flow	2
2,3	10 or more buildings flooded historically or by 100-year existing or future design flow	3
4,5,6	Restricts emergency vehicles	1.5
8	Nuisance erosion creates maintenance problems	1
8	Moderate erosion, failure of structure or facility within next 5 years possible	2
8	Severe erosion, failure of structure or facility imminent	3
10-12	Collapse causes flooding of land by 100-year design storm	1
10-12	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
10-12	Collapse causes 1-3 habitable buildings to be flooded	2
10-12	Collapse causes 4-6 habitable buildings to be flooded	3
10-12	Collapse causes more than 6 habitable buildings to be flooded	4



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