MEMO

DRAFT

olsson

TO: City of Joplin
Attn: Steven Martinez
602 S. Main Street
Joplin, MO 64801

FROM: Eric Shelton, PE
Aaron Boll, EI

RE: Joplin Stormwater Masterplan – Project Prioritization Scoring
Olsson Project No. 020-2337

DATE: December 10, 2020

Introduction

Olsson analyzed potential stormwater projects throughout the City of Joplin. Olsson developed the list of projects from known stormwater problems given to Olsson by the City of Joplin and new feedback from several community stormwater meetings and questionnaires. Hundreds of residents attended these meetings and submitted stormwater questionnaires. The projects were then ordered by magnitude to focus on the projects that require engineering analysis and detailed cost estimates. Smaller projects may often be completed by city staff and may be replace-in-kind projects which required little analysis. Olsson analyzed the top 25 projects by identifying existing conditions and developing conceptual solutions. The projects were then ranked via Olsson's project prioritization scoring which provides a score based on the benefits provided by the project and the benefit to cost ratio. A higher score means the project will have a greater flood reduction benefit and a higher benefit to cost ratio. The purpose of ranking projects is to give the City of Joplin a quantifiable and objective process in prioritizing projects based on their benefit to maximize the value of the city's stormwater funds. Olsson's prioritization is meant to be a tool for the city to use to understand project's anticipated stormwater benefit and is not a comprehensive view of political, economic, opportunistic, and other factors that may otherwise affect which projects are implemented first. The "other factors" category notes additional project benefits outside of flood control and additional funding sources. When these factors are present the benefit to cost ratio will be higher than the stormwater benefit to cost ratio.

Methodology

The scoring matrix assigns points to seven different category factors. The points for each category factor were multiplied by frequency and severity multipliers for the total possible benefit. The total possible benefit is then multiplied by the percent of the problem that is anticipated to be solved by the proposed conceptual solution. For example, if 50% of flooding homes can be protected, only 50% of the total possible benefit points are earned. The total points from the factors were then added up to provide the project's total benefit points. In the event of a tie, the "other factors" section was used to break the tie.

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The seven category factors were 1) loss of life 2) property flooding 3) street flooding 4) structure and property erosion 5) erosion causing failure to drainage structures 6) system condition, and 7) recreation benefit. Available rating points for each category varied to reflect the impact to the community. Loss of life received the most potential points. Flooding of habitable buildings received the same points as arterial street flooding. Street flooding was given more points compared to yard flooding to reflect the broad impact to the community. Table 1 shows the project benefit rating table that was used to score each project.

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10				
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20				
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						

Table 1: Example Project Benefit Rating Table (Blank)

Frequency multipliers were used to capture the significance of repetitive flooding losses. Frequency multipliers only applied to property flooding, street flooding, and system condition. To determine the frequency multiplier for flooding, it is necessary to know the return period of the storm event or the number of times it has flooded in 10 years. The more frequent or likely to flood, the higher the multiplier. The system condition frequency multiplier applied a multiplier value of one per 100 feet of system replaced to account the expanded risk associated with a large system that is in poor condition. The system condition frequency multiplier led to high system condition scores for large infrastructure replacement projects such as Old Willow Branch and 1st Street and Joplin Avenue. These high scores reflect the need for these projects in terms of the impact that a failure would have to storm drainage and nearby infrastructure.

Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Table 2: Frequency Multipliers

Severity multipliers where used to reflect the magnitude of the flooding problems by applying a multiplier for the number of structures flooding, the depth of street flooding, and the risk associated with the system failure. The largest multiplier applied to loss of life. Property flooding received a 0.5 multiplier per building flooded. Street flooding received multipliers based upon either depth of street flooding or restrictions to emergency vehicles. Street flooding depths more than three feet received the maximum street flooding multiplier of three. Erosion threatening habitable buildings, utilities, streets, and bridges received multipliers from one to three. Imminent failure of structures received the max erosion multiplier of three. Erosion causing failure to drainage structures received severity multipliers from one to four. The greater the multiplier mean more properties flood from the failure of the drainage structure.

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Table 3: Severity Multipliers

The "percent of the issue resolved" multiplier is a measure of effectiveness of the project. Some projects may help with the stormwater issue but not completely resolve the problem. The percent credit given was based on the percent of flood or erosion reduction achieved based on the number of structures removed or percent of necessary base flood level reduction. Also, the factor received a 100 percent if the project met City of Joplin design requirements.

Finally, the "other factors" category was used for tie breakers between projects. The four "other factors" were benefits to other infrastructure, outside cost support, regional benefit, and aesthetics. Each project received a "yes" or "no" score for these factors.

Prioritization Scoring

A project prioritization score was calculated to rank the projects based on the stormwater benefit they provide and the benefit to cost ratio for the project. Smaller projects that may not provide a large benefit to the community can still be important projects and are many times easier to complete. This scoring approach provides opportunities for projects both large and small to score well.

The total prioritization score consists of up to 50 points for the benefit score and up to 50 points for the benefit to cost ratio score. Project were ranked by their benefit score and the assigned zero to 50 points based on their ranking. For example, the highest ranked project would receive 50 points, while the 25th ranked project would receive only two points.

A benefit to cost ratio was calculated using the stormwater benefit score discussed above and dividing by the total project cost. This ratio was then normalized so that the highest B/C ratio was set to 100. One hundred was chosen so the B/C metric is not confused with other benefit to cost metrics where any value greater than one is considered a justifiable project. Projects were ranked in order of their benefit to cost ratio and once again assigned up to 50 points based on their ranking.

Points for benefits and benefit to cost ration were added to calculate a total prioritization score. Finally, projects were ranked based on their total prioritization score.

Conclusion

Olsson analyzed 25 projects out of nearly 84 potential stormwater projects receive from the City of Joplin and community meetings. The 25 projects were scored to measure the benefit to the community. Project benefit points were given to seven different category factors with frequency and severity multipliers and percent of the issue resolved by the project. Projects were ranked based on a project prioritization score which accounted for the impact to the community, effectiveness of the project and the relative cost of the project in terms of the benefit to cost ratio. The score will provide the City of Joplin an objective and quantifiable means of selecting projects, since funds are finite.

Joplin Stormwater Master Plan
Project Overview

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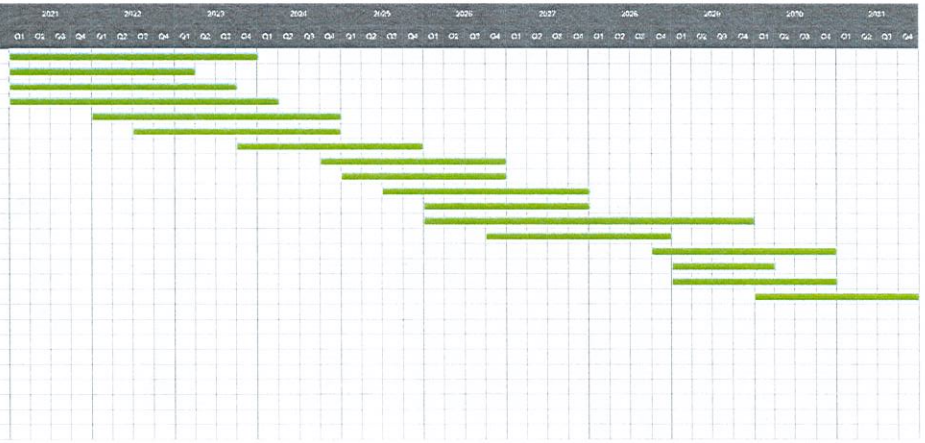
Project Name	Type	Prioritization Rank	Total Prioritization Score	Benefit Score	Dimensionless B/C Ratio	Estimate (2021)	Estimate (2031)	Design/ Construction Year	Anticipated Cost in Design/Construction Year	Total Money Remaining (assuming $30M budget)	Notes
Minor System Improvements	Annual Expense	N/A	N/A	N/A	N/A	$ 961,850.00	$ 1,102,653.23	N/A	N/A	$29,038,150.00	
Ditch and Detention Pond Maintenance	Annual Expense	N/A	N/A	N/A	N/A	$ 3,000,000.00	$ 3,439,163.79	N/A	N/A	$26,038,150.00	
Catch Basin and Closed System Maintenance	Annual Expense	N/A	N/A	N/A	N/A	$ 2,500,000.00	$ 2,865,969.83	N/A	N/A	$23,538,150.00	
Economic Development and Emergency Funds	Annual Expense	N/A	N/A	N/A	N/A	$ 1,500,000.00	$ 1,719,581.90	N/A	N/A	$22,038,150.00	
9th Street & St. Louis Avenue	Culvert/Ditch	1	88	153	100	$ 237,000.00	$ 319,000.00	2027	$ 282,990.39	$21,755,159.61	
1st Street & Joplin Avenue***	Rehabilitation	2	78	300	20	$ 2,295,000.00	$ 3,084,000.00	2030	$ 163,096.65	$21,592,062.96	Concept Study Only
17th Street & Annie Baxter Avenue	Ditch	3	74	130	32	$ 632,000.00	$ 849,000.00	2026	$ 732,661.21	$20,859,401.74	
17th Street & Mina Avenue	Storm Sewer	4	68	220	17	$ 1,992,000.00	$ 2,677,000.00	2023	$ 2,113,312.80	$18,746,088.94	
Twin Hill Estates	Culvert/Ditch	5	68	100	40	$ 386,000.00	$ 519,000.00	2022	$ 397,580.00	$18,348,508.94	High B/C Ratio and low cost justify fitting on this cycle.
Texas Avenue (11th - 15th Street)	Storm Sewer	6	66	150	19	$ 1,238,000.00	$ 1,664,000.00	2027	$ 1,478,236.74	$16,870,272.20	
26th Street Twin Culverts	Culvert /Ditch	7	66	113	29	$ 595,000.00	$ 800,000.00	2030	$ 776,340.04	$16,093,932.16	High B/C Ratio and low cost justify fitting on this cycle.
Beale Avenue & Zora Street	Ditch	8	66	60	64	$ 146,000.00	$ 196,000.00	2026	$ 169,254.01	$15,924,678.14	High B/C Ratio and low cost justify fitting on this cycle.
17th Street & Iowa Avenue	Storm Sewer	9	64	210	17	$ 1,927,000.00	$ 2,590,000.00	2025	$ 2,168,855.48	$13,755,822.66	
I-44 Culvert Addition***	Culvert	10	62	368	10	$ 5,598,000.00	$ 7,523,000.00	2029	$ 7,091,378.92	$6,664,443.75	Concept Study Funds Shifted to Sunnyvale Project. This row is for design and construction. Additional Funding sources will be required.
Durham Acres (Missouri Avenue)	Storm Sewer	11	58	180	13	$ 2,092,000.00	$ 2,811,000.00	2024	$ 2,285,984.88	$4,378,458.86	
Euclid Avenue	Ditch/Storm Sewer	12	58	120	18	$ 1,021,000.00	$ 1,372,000.00	2030	$ 1,332,173.42	$3,046,285.44	
Old Willow Branch***	Rehabilitation	13	54	530	6	$ 13,293,000.00	$ 17,865,000.00	2030	$ 489,289.94	$2,556,995.50	Concept Study Only
33rd Street & Jackson Avenue	Ditch	14	54	60	22	$ 424,000.00	$ 570,000.00	2022	$ 436,720.00	$2,120,275.50	High B/C Ratio and low cost justify fitting on this cycle.
Carolina Circle Cul-de-sac Ditch	Storm Sewer	15	54	30	51	$ 92,000.00	$ 124,000.00	2028	$ 113,148.40	$2,007,127.10	High B/C Ratio and low cost justify fitting on this cycle.
Sunnyvale (Lloyd Addition) and I-44 Culvert Study	Storm Sewer	16	34	127	7	$ 2,712,000.00	$ 3,645,000.00	2024	$ 2,963,475.62	($956,348.52)	Include additional 175k for concept study of I-44 culvert addition. Additional benefits from I-44 culvert additional project are included in the project scoring
34th Street & Joplin Avenue	Storm Sewer	17	52	55	29	$ 291,000.00	$ 391,000.00	2032	$ 402,812.06	($1,359,160.58)	May not fit on this cycle.
26th Street & McCoy Avenue	Storm Sewer	18	48	30	42	$ 110,000.00	$ 148,000.00	2032	$ 152,265.73	($1,511,426.30)	May not fit on this cycle.
East Town	Culvert/Storm Sewer	19	40	90	12	$ 1,216,000.00	$ 1,634,000.00	2024	$ 1,328,756.03	($2,840,182.33)	Outside funding may allow to fit on this cycle
12th Street & Wall Avenue	Rehabilitation	20	38	40	18	$ 352,000.00	$ 473,000.00	2032	$ 487,250.32	($3,327,432.66)	May not fit on this cycle.
Massachusetts Avenue & Murphy Boulevard	Ditch	21	34	60	10	$ 967,000.00	$ 1,300,000.00	2032	$ 1,338,554.15	($4,665,986.81)	May not fit on this cycle.
Garvin Park Ditch	Storm Sewer	22	30	35	14	$ 379,000.00	$ 509,000.00	2032	$ 524,624.64	($5,190,611.45)	May not fit on this cycle.
Cleveland Court	Ditch	23	22	50	7	$ 1,061,000.00	$ 1,426,000.00	2032	$ 1,468,672.14	($6,659,283.58)	May not fit on this cycle.
20th Street & Rhode Island Avenue	Culvert/Ditch	24	16	30	9	$ 527,000.00	$ 708,000.00	2032	$ 729,491.25	($7,388,774.83)	May not fit on this cycle.
Colorado Drive	Ditch	25	4	10	2	$ 998,000.00	$ 1,341,000.00	2032	$ 1,381,465.40	($8,770,240.24)	May not fit on this cycle.
Total						$ 40,581,000.00	$ 54,538,000.00				

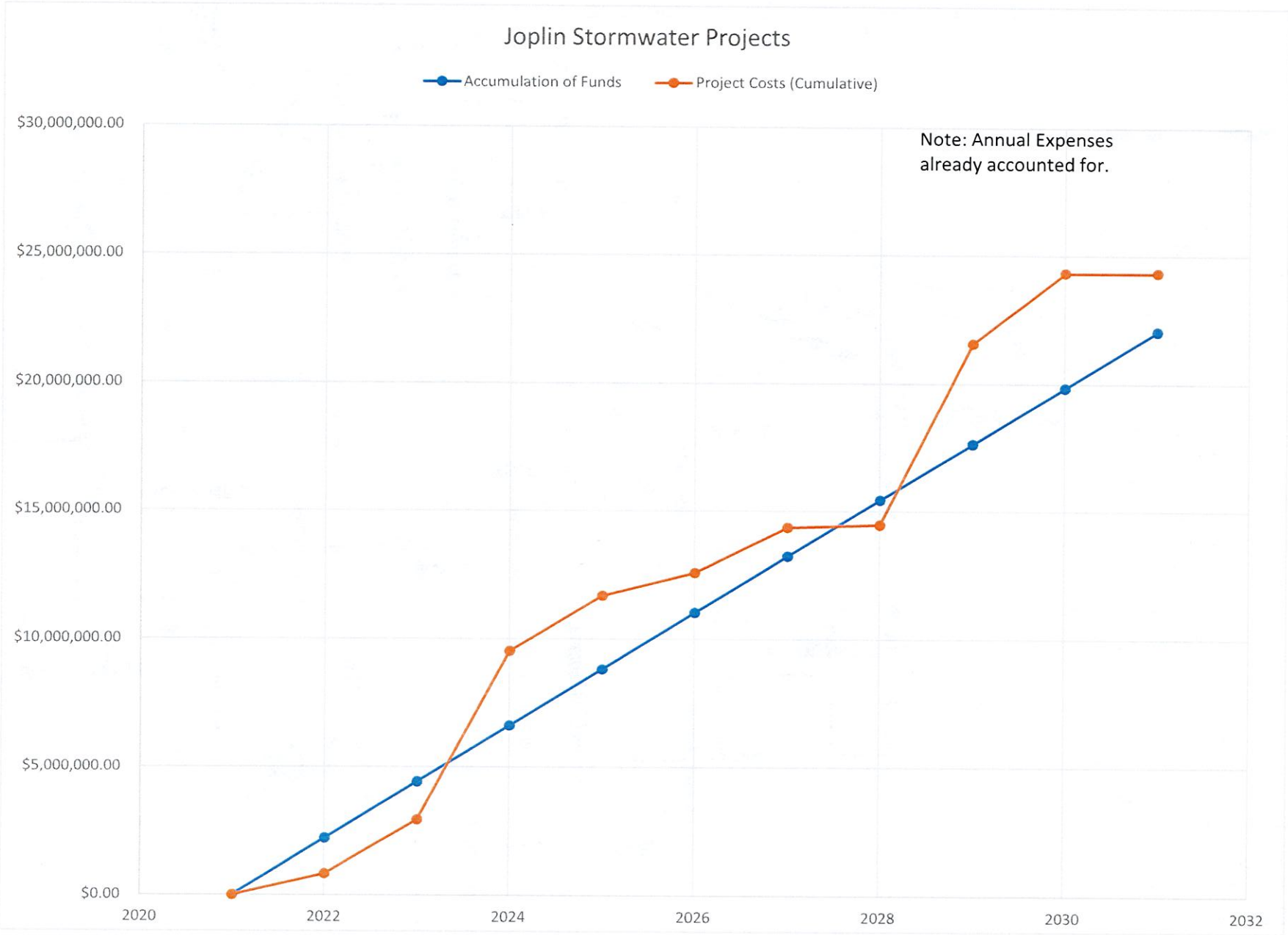
***Total Project Cost is shown. Concept study/design is recommended in this 10-year cycle.

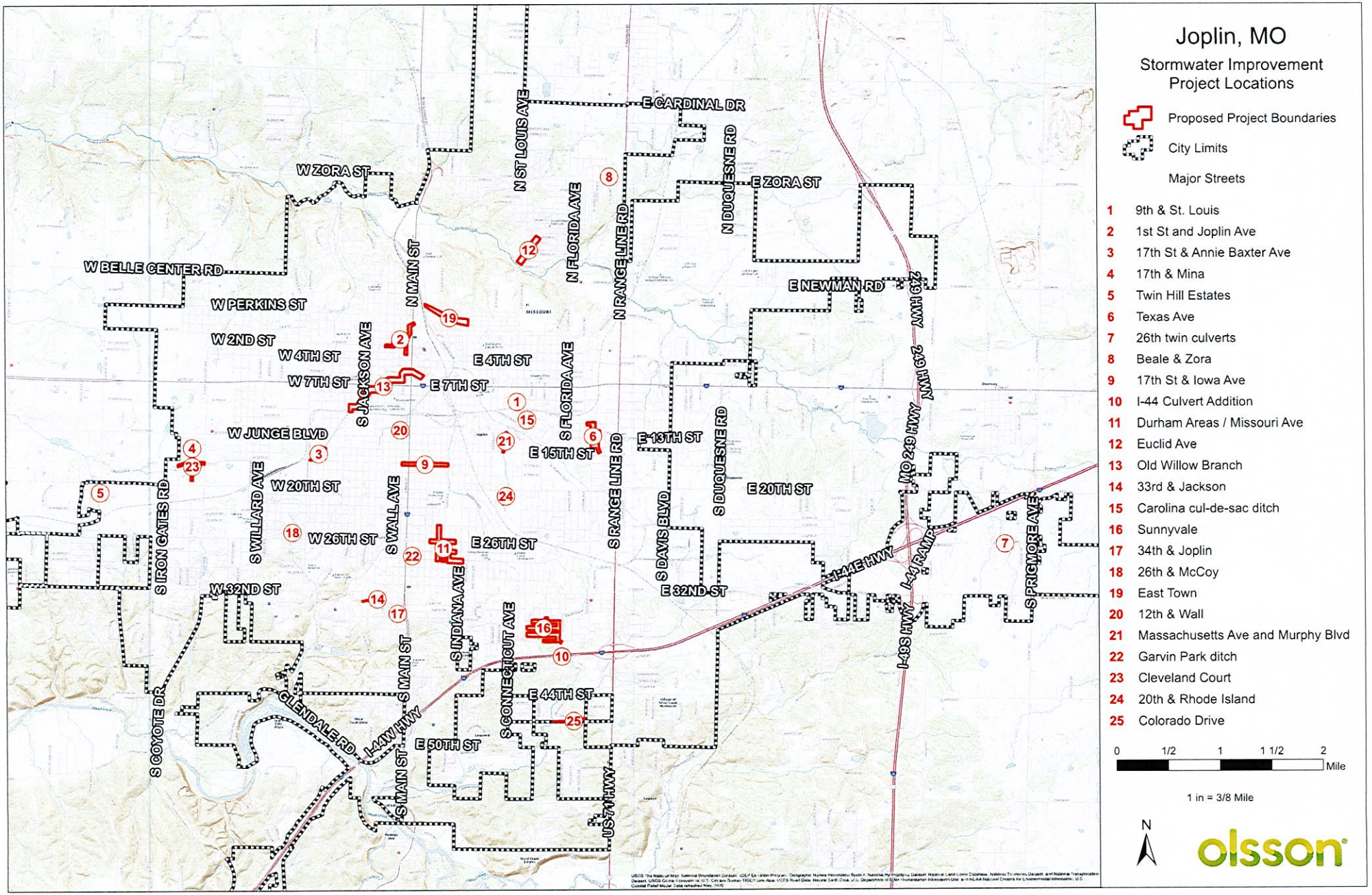
Joplin Stormwater Capital Improvement Projects

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Prioritized Ranking	Task Name	Utility, Permitting, and ROW issues	Comments
1	17th Street & Mina Avenue		12 months contracts, 9 months utilities and ROW, 15 months design and construction
2	Twin Hill Estates		12 months contracts, 6 months utilities and ROW, 9 months design and construction
3	33rd Street & Jackson Avenue		12 months contracts, 9 months utilities and ROW, 12 months design and construction
4	Sunnyvale (Lloyd Addition) & I-44 Culvert Concept Design		12 months contracts, 9 months utilities and ROW, 18 months design and construction
5	East Town		12 months contracts, 9 months utilities and ROW, 15 months design and construction
6	Durham Acres (Missouri Avenue)		12 months contracts, 6 months utilities and ROW, 12 months design and construction
7	17th Street & Iowa Avenue		12 months contracts, 6 months utilities and ROW, 9 months design and construction
8	Beale Avenue & Zora Street		12 months contracts, 6 months utilities and ROW, 9 months design and construction
9	17th Street & Annie Baxter Avenue		12 months contracts, 3 months utilities and ROW, 9 months design and construction
10	Texas Avenue (11th - 15th Street)		12 months contracts, 6 months utilities and ROW, 12 months design and construction
11	9th Street & St. Louis Avenue		12 months contracts, 3 months utilities and ROW, 9 months design and construction
12	I-44 Culvert Addition		12 months contracts, 18 months utilities and ROW, 18 months design and construction
13	Carolina Circle Cul-de-sac Ditch		12 months contracts, 6 months utilities and ROW, 9 months design and construction
14	Euclid Avenue		12 months contracts, 6 months utilities and ROW, 9 months design and construction
15	1st Street & Joplin Avenue - Concept Design		6 months contracts/ 9month design
16	26th Street Twin Culverts		12 months contracts, 3 months utilities and ROW, 9 months design and construction
17	Old Willow Branch - Concept Design		6 months contracts/ 18 month design
18	34th Street & Joplin Avenue		
19	26th Street & McCoy Avenue		
20	12th Street & Wall Avenue		
21	Massachusetts Avenue & Murphy Boulevard		
22	Garvin Park Ditch		
23	Cleveland Court		
24	20th Street & Rhode Island Avenue		
25	Colorado Drive		




Joplin Stormwater Projects
Accumulation of Funds
Project Costs (Cumulative)
Note: Annual Expenses already accounted for.
$30,000,000.00
$25,000,000.00
$20,000,000.00
$15,000,000.00
$10,000,000.00
$5,000,000.00
$0.00
2020
2022
2024
2026
2028
2030
2032



Joplin, MO

Stormwater Improvement Project Locations

Proposed Project Boundaries

City Limits

Major Streets

1 9th & St. Louis
2 1st St and Joplin Ave
3 17th St & Annie Baxter Ave
4 17th & Mina
5 Twin Hill Estates
6 Texas Ave
7 26th twin culverts
8 Beale & Zora
9 17th St & Iowa Ave
10 I-44 Culvert Addition
11 Durham Areas / Missouri Ave
12 Euclid Ave
13 Old Willow Branch
14 33rd & Jackson
15 Carolina cul-de-sac ditch
16 Sunnyvale
17 34th & Joplin
18 26th & McCoy
19 East Town
20 12th & Wall
21 Massachusetts Ave and Murphy Blvd
22 Garvin Park ditch
23 Cleveland Court
24 20th & Rhode Island
25 Colorado Drive

0 1/2 1 1 1/2 2 Mile

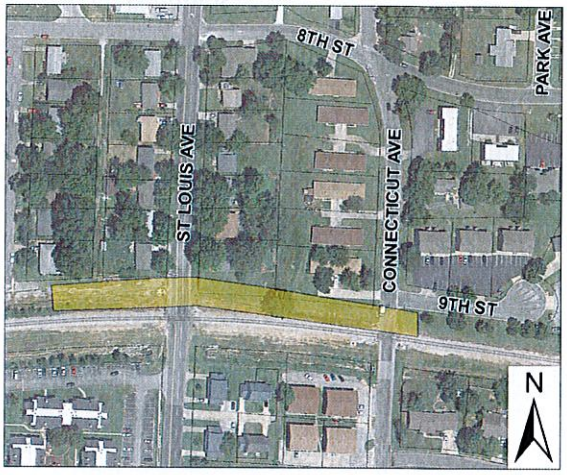
1 in = 3/8 Mile

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Project Name: 9th Street & St. Louis Avenue

Project ID: 7-5



Pertinent Data Summary

Watershed: Joplin Creek East

Priority #: 1

Design Capacity: N/A

Estimated Cost: $237,000

Topographic (Section): 27N 33W Section 11 & 12

Existing Problem Description

Three properties have experienced flooding from undersized culverts and a ditch at Connecticut Avenue and St. Louis Avenue just north of the Missouri Pacific Railroad near 9th Street. Both culverts are 24 inches. The capacity for these culverts is near a 2-year storm event. Both intersections have had significant flooding. The ditch just east of St. Louis Avenue is very flat and shallow. Water will pool at this area before overtopping the roadway. The ditch west of St. Louis has capacity to carry a 100-year storm event but has experienced a lot of erosion.

Recommended Improvements

Description: Install a 2-foot by 2-foot box culvert under Connecticut Avenue. Retain the existing 24-inch culvert. The extra culvert will increase the capacity to a 25-year storm event. Excavate a ditch downstream of Connecticut Avenue to St. Louis Avenue. The bottom width of the channel will need to be 5 feet with 4:1 side slope. Depth will be 2.5 feet with a channel slope of at least 2.0 percent. Install a 36-inch reinforced concrete pipe under St. Louis Avenue. Retain the existing 24-inch culvert. Streambank stabilization downstream of St. Louis Avenue will be necessary.

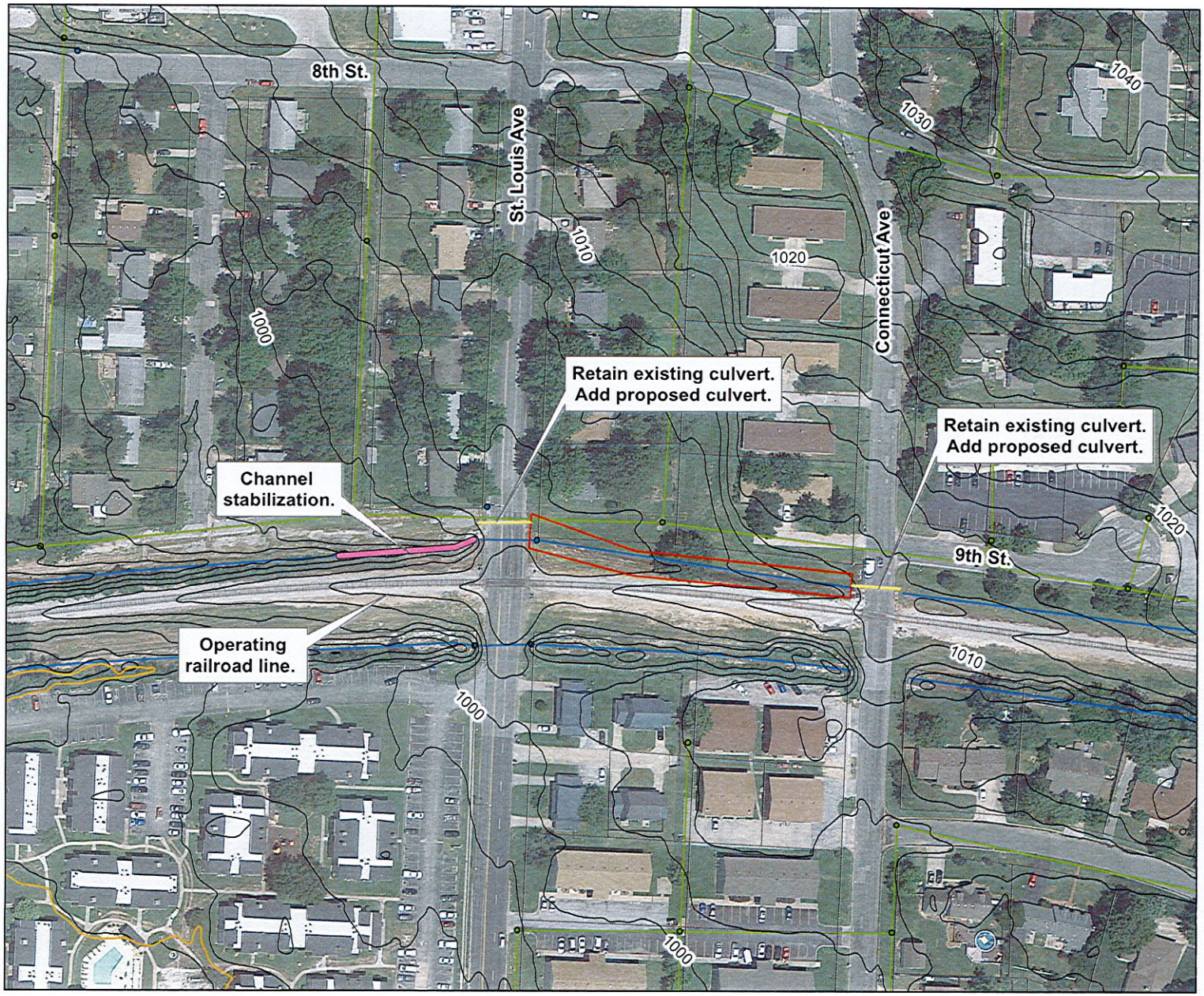
Permitting: Permitting from the Missouri Pacific Railroad and a 404 nationwide permit is anticipated.

Utility Relocations: The culvert and drainage ditch layouts seek to avoid utilities as much as possible. The St. Louis Avenue culvert is new a sanitary sewer line. Also, both culverts are near overhead electric. Sanitary sewer depths are unknown and could reduce capacity of the proposed design or require relocation of overhead electric and sanitary sewer lines during final design

ROW Acquisition: The proposed ditch layouts was identified to stay within existing right-of-way, where possible. Additional right-of-way may be needed at the northeast property at the intersection of St. Louis Avenue and the railroad. Additional

right-of-way will be determined based on boundary survey and final design solutions.

Downstream Controls: The drainage ditch continues for 1,100 feet before discharging into Joplin Creek.



9th Street & St. Louis Avenue

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Channel Stabilization
- Proposed Storm Sewer
- Proposed Channel Improvements
- Floodplain
- 2ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 50 100 200 Feet

1 inch = 100 feet

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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
9th Street & St. Louis Avenue

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 10,000.00	$ 10,000.00
Erosion Control	LS	1	$ 3,000.00	$ 3,000.00
Demolition	LS	1	$ 4,500.00	$ 4,500.00
24" RCP	LF	60	$ 100.00	$ 6,000.00
24" FES	EA	2	$ 1,250.00	$ 2,500.00
2' x 2' RCB	LF	60	$ 200.00	$ 12,000.00
Concrete Wingwalls and Apron for 2' x 2' Box Culvert	EA	2	$ 5,000.00	$ 10,000.00
Channel Stabilization	LF	135	$ 300.00	$ 40,500.00
Excavation (Trapezoidal Channel)	LF	350	$ 150.00	$ 52,500.00
			Subtotal	$ 141,000.00
			Utility Relocation (10%)	$ 14,100.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration	$ 40,000.00
			Right of Way (5%)	$ 7,050.00
			Construction Contingency (25%)	$ 35,250.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 237,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 319,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Joplin Creek East

Location: 9th Street & St. Louis Avenue

Description of Problem: Undersized culverts and nuisance flooding

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10	3		100%	30
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25	3	1.5	100%	112.5
7	Flooding of residential street of more than 7 inches	5,6,8	20				
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				10
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						**152.5**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: 1st Street & Joplin Avenue (Williamsburg)

Project ID: 7-2



Pertinent Data Summary

Watershed: Joplin Creek East

Priority #: 2

Design Capacity: N/A

Estimated Cost: $125,000 (Concept Study)

$2,295,000 (Total Project Cost)

Topographic (Section): 28N 33W Section 2, 3

Existing Problem Description

The 1st and Joplin box culvert is nearly a century old. It is a 4-foot by 4-foot box culvert located at the intersection of 3rd Street and Joplin Avenue and travels to the north and east to the intersection of B Street and Main Street. There is a west branch that starts at the intersection of 2nd Street and Byers Avenue and connects to the main branch at 1st Street and Joplin Avenue. The box culvert has started to deteriorate. Remediation will require replacement of a portion or all of the box culvert. If the box culvert collapsed, it would cause flooding for many properties on the northside of downtown. The box culvert intersects several utility corridors for sanitary sewer, gas, water, and electric.

Recommended Improvements

Description: The first step in rehabilitating 1st and Joplin box culvert is to conduct a study. This study should evaluate the existing system condition, feasibility of replacement along the current alignment, identify additional alignment alternatives, and develop an opinion of probable cost for each alternative. The study will determine if the project will need to be constructed in phases. The estimate for this project is based on prices to replace the existing box culvert with identical sizes. It is intended to only provide an order of magnitude for the total project.

Permitting: To be determined in the conceptual study.

Utility Relocations: Conflicts with sanitary sewer, water, gas, and electric do exist. Exact conflicts to be further identified in the conceptual study.

ROW Acquisition: The proposed storm sewer layout should follow the existing layout where possible. Exact right-of-way needs to be further identified in the conceptual study.

Downstream Controls: The culvert joins a double box culvert and flows to the east under a twin railroad track just before discharging into Joplin Creek.

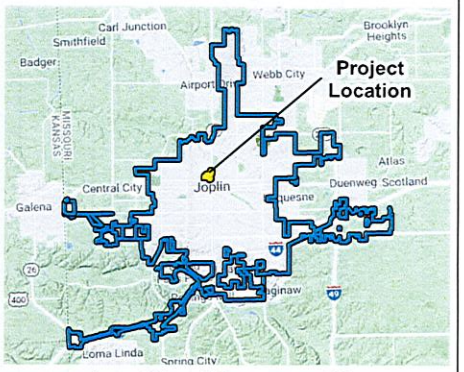


1st Street and Joplin Avenue (Williamsburg)

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Storm Inlets
- Proposed Storm Sewer
- 10ft Contours
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 100 200 400 Feet

1 inch = 200 feet

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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
1st Street & Joplin Avenue

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 85,000.00	$ 85,000.00
Erosion Control	LS	1	$ 30,000.00	$ 30,000.00
Demolition	LS	1	$ 40,000.00	$ 40,000.00
18" RCP	LF	350	$ 75.00	$ 26,290.00
24" RCP	LF	381	$ 100.00	$ 38,090.00
36" RCP	LF	731	$ 135.00	$ 98,730.00
4' x 4' RCB	LF	631	$ 400.00	$ 252,490.00
5' x 6' RCB	LF	960	$ 550.00	$ 528,140.00
Type D Curb Inlet	EA	3	$ 3,300.00	$ 9,900.00
Junction Box	EA	9	$ 3,000.00	$ 27,000.00
Pavement Repair	SY	3123	$ 50.00	$ 156,150.00
Sidewalk Repair	SY	260	$ 60.00	$ 15,600.00
Driveway Repair	SY	42	$ 75.00	$ 3,150.00
Curb & Gutter	LF	1313.00	$ 30.00	$ 39,390.00
			Subtotal	$ 1,349,930.00
			Utility Relocation (10%)	$ 134,990.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration (25%)	$ 337,480.00
			Right of Way (10%)	$ 134,990.00
			Construction Contingency (25%)	$ 337,480.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 2,295,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 3,084,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Joplin Creek East

Location: 1st Street & Joplin Avenue (Williamsburg)

Description of Problem: Failing Storm Sewer

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10				
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20				
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10	30		100%	300
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						**300**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

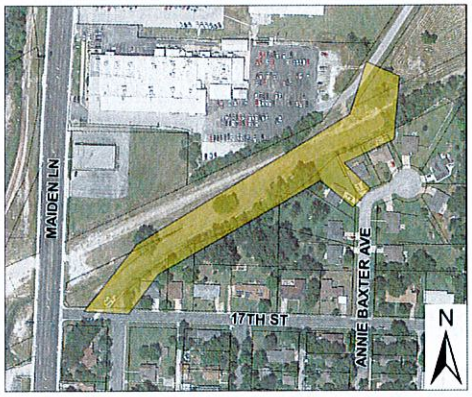
Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: 17th Street & Annie Baxter Avenue

Project ID: 6-3



Pertinent Data Summary

Watershed: Joplin Creek West

Priority #: 3

Design Capacity: 385 cfs (100-year, Main Channel) 45 cfs (100-year, Lateral Swale)

Estimated Cost: $632,000

Topographic (Section): 27N 33W Section 10

Existing Problem Description

Three residences on the north end of the cul-de-sac of 17th Street and Annie Baxter Avenue experienced flooding in the Spring of 2019 on two separate occasions. An existing open ditch located just northeast of the intersection of 17th Street and Maiden Lane conveys a significant amount of stormwater runoff from the surrounding area and an existing storm sewer system discharges into the open ditch near the Annie Baxter cul-de-sec. Recent improvements along Maiden Lane included widening and improving the stormwater system along the street. Since these improvements, the existing open ditch has not been improved to account for a possible increase in runoff. The area draining to the open ditch is around 125 acres and the ditch is severely undersized to convey even the 2-year storm. In the 2019, residents on the north end of the Annie Baxter Avenue cul-de-sac reported both structural flooding from the open ditch overtopping and at least 2 inches of street flooding possibly caused by storm sewer backwater. The storm sewer inlet has the capacity to convey the 25-year storm event, but no overland swale exists to convey higher flows.

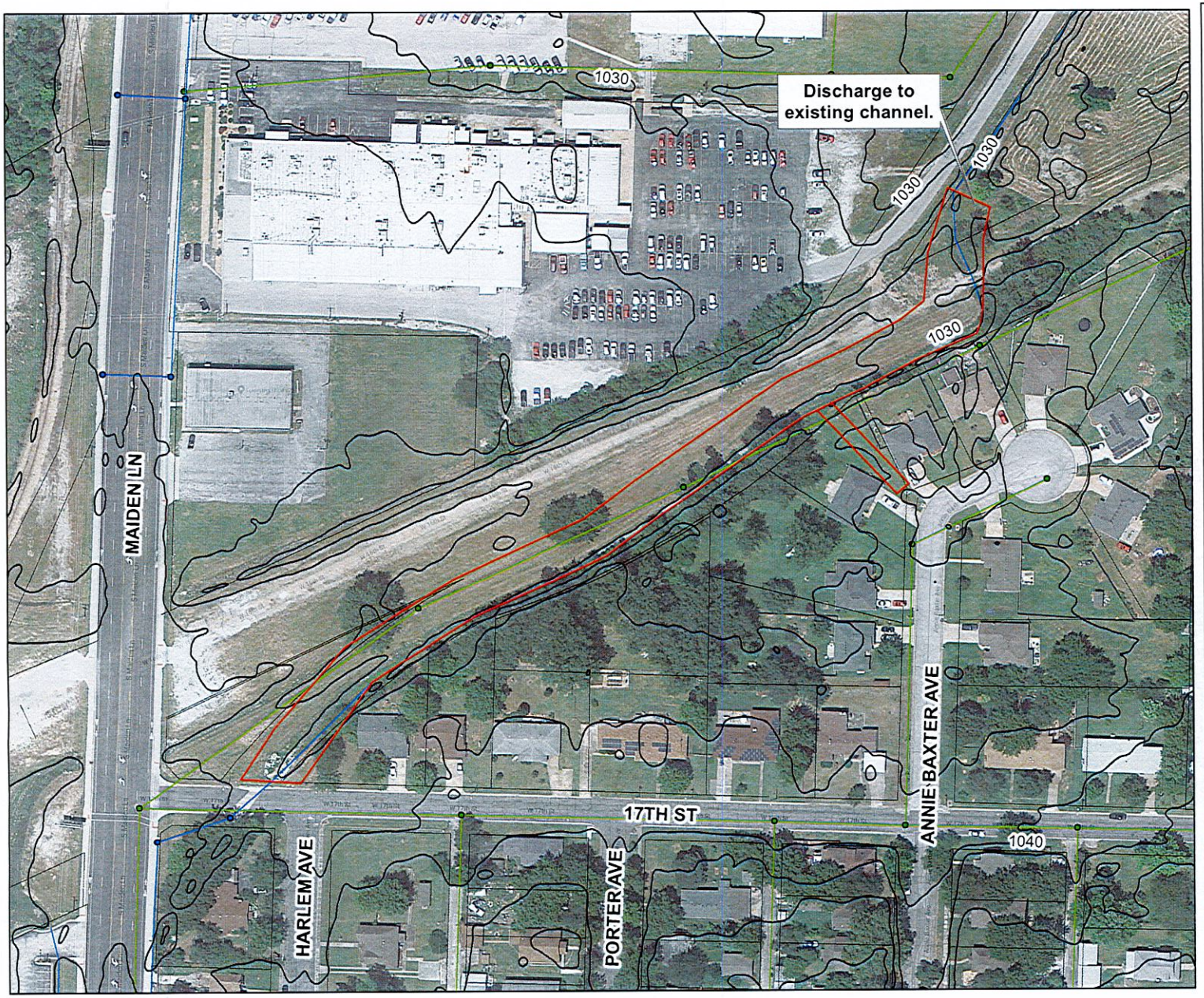
Recommended Improvements

Description: The open ditch has a very shallow slope and is constrained vertically, so it must be widened to the north to improve capacity. Install a trapezoidal channel with a 40-foot bottom width, depth of 1-foot and 8:1 side slope. It will only convey a 2-year storm event but it's the best option given the vertical constraints and nearby abandoned railroad tracks to the north. Install an overland lateral swale above the existing storm sewer that runs between two homes and outlets into the open ditch. The trapezoidal channel will have a 5-foot bottom width, depth of 2 feet and 3:1 side slope. The swale will convey a 100-year storm event with 1-foot of freeboard per the City of Joplin's requirements.

Permitting: A 404 nationwide permit is anticipated.

Utility Relocations: A sanitary sewer line runs parallel to the abandoned railroad. Sanitary sewer depths are unknown and could limit the proposed design or require relocation of sanitary sewer lines during final design.

ROW Acquisition:	The proposed open ditch improvements should stay within existing ROW where possible. Additional right-of-way or a temporary construction easement may be required for the lateral swale between two homes and will be determined based on boundary survey and final design solutions.
Downstream Controls:	An existing culvert just downstream of the proposed open ditch improvements may hinder the capacity of the ditch and cause backwater issues. The culvert flows to the north under an apparent abandoned railroad line. The size and capacity of this culvert is unknown.



17th Street & Annie Baxter Avenue

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Channel Improvements
- Floodplain
- 2ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Culverts
- Sanitary Sewer Manholes
- Sanitary Sewer



0 50 100 200 Feet

1 inch = 100 feet

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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
17th Street & Annie Baxter Avenue

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 15,000.00	$ 15,000.00
Erosion Control	LS	1	$ 5,000.00	$ 5,000.00
Demolition	LS	1	$ 10,000.00	$ 10,000.00
Channel Restoration	LF	1139	$ 300.00	$ 341,700.00
			Subtotal	$ 371,700.00
			Utility Relocation (10%)	$ 37,170.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration (25%)	$ 92,930.00
			Right of Way (10%)	$ 37,170.00
			Construction Contingency (25%)	$ 92,930.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 632,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 849,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Joplin Creek West

Location: 17th Street & Annie Baxter Avenue

Description of Problem: Street and structure flooding

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30	3	1	100%	90
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10				
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20	2	1	100%	40
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						**130**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

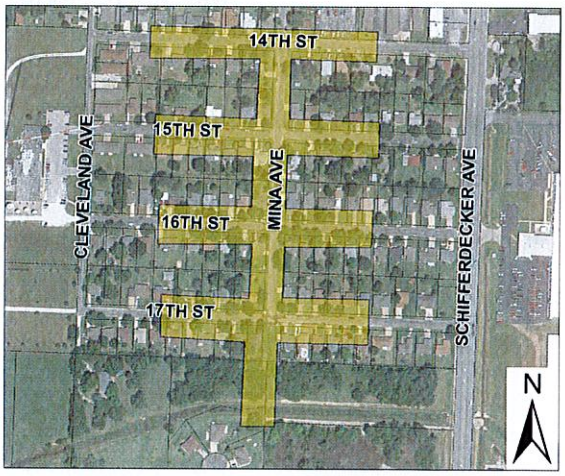
Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: 17th Street & Mina Avenue

Project ID: 5-1



Pertinent Data Summary

Watershed: Country Club

Priority #: 4

Design Capacity: 70 cfs (10-year)

Estimated Cost: $1,992,000

Topographic (Section): 27N 33W Section 08

Existing Problem Description

More than 10 properties have flooded along Mina Avenue between 17th & 13th Street. There have been multiple events were vehicles flooded and Mina Avenue became impassible. Mina Avenue begins flooding for storm events less than the 2-year return period storm. Standing water is common even during more frequent rainfall events. The entire drainage area of the neighborhood is more than 30 acres. Land use is single family residential. Stormwater naturally flows to Mina Avenue which is the center of this neighborhood. Runoff is conveyed through curb and gutter. No enclosed storm sewer exists. Drainage discharges to a ditch located at the intersection of 17th Street and Mina Avenue. This ditch drains via two culverts into an unnamed tributary of Short Creek. This drainage ditch and the intersection of 17th Street and Mina Avenue are located in the floodplain.

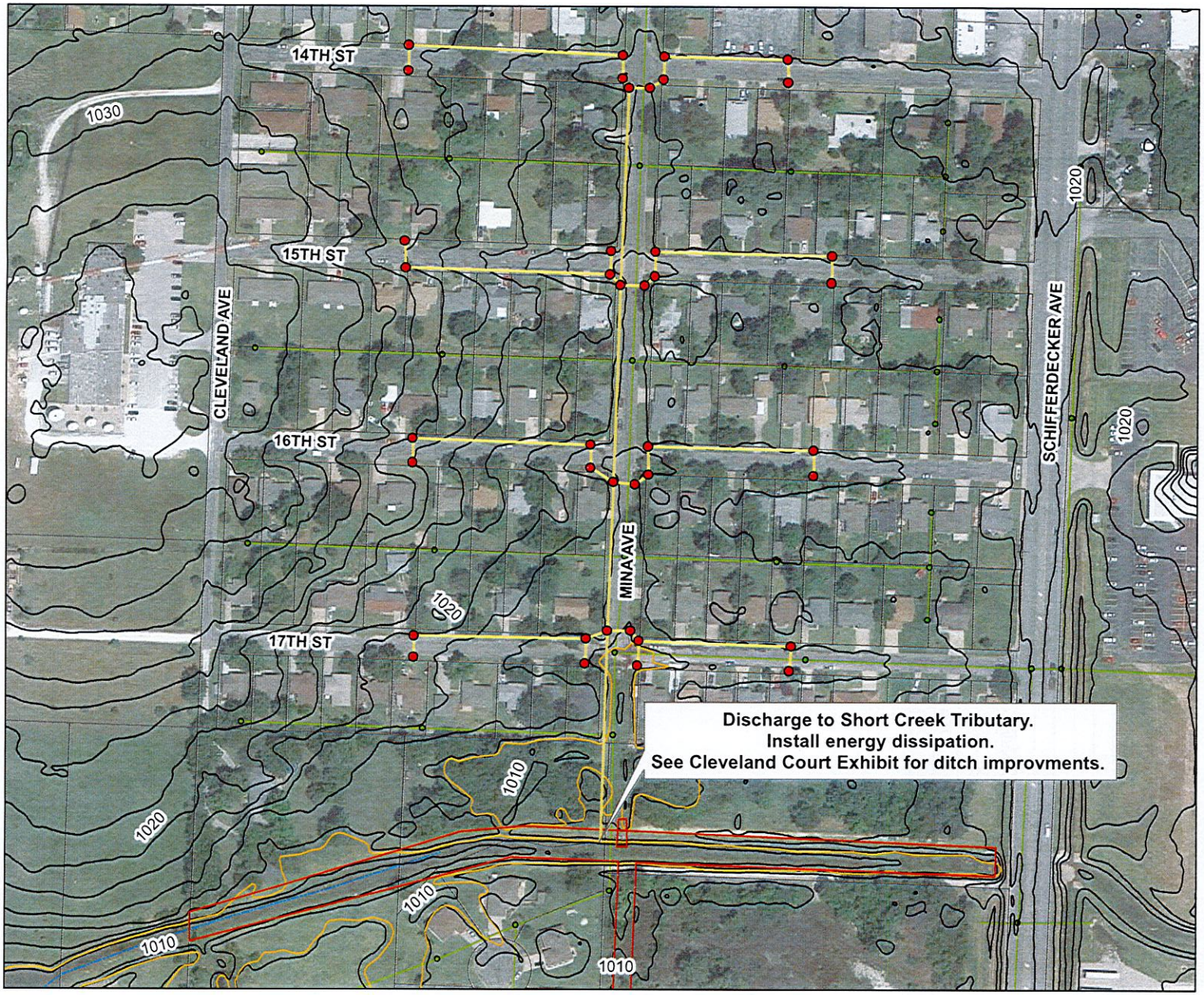
Recommended Improvements

Description: Storm sewer installed along Mina Avenue from 17th Street to 14th Street will have a design capacity equivalent to the 10-year storm event. The storm sewer will discharge through twin 3-foot by 3-foot box culverts into the unnamed tributary for Short Creek just downstream of 17th Street and Mina Avenue. Downstream of 17th Street and Mina Avenue remove the two existing culverts and improve the ditch which drains into the unnamed tributary for Short Creek. This will convey surcharge to the storm sewer for storm events greater than 10-year return periods.

Permitting: Floodplain development permit for grading in the floodplain and a 404 nationwide permit.

Utility Relocations: The storm sewer layout seeks to avoid utilities as much as possible. Conflicts with overhead electric on the west side of Mina Avenue do exist. Also, proposed storm sewer crosses sanitary sewer at several locations. Sanitary sewer and water line depths are unknown and may require relocation during final design to achieve the storm sewer design capacity.

ROW Acquisition:	The proposed storm sewer layout was identified to stay within existing right-of-way, where possible. Additional right-of-way may be required downstream of 17th Street and Mina Avenue and where storm sewer cuts the corners at intersections. Extents of additional right-of-way will be determined based on boundary survey and final design solutions.
Downstream Controls:	Without ditch improvements downstream of 17th Street and Mina Avenue, the design capacity of the system will be limited to the 10-year return period. 17th Street and Mina Avenue is located in the floodplain from the unnamed tributary for Short Creek. Storm sewer and ditch improvements will not eliminate flooding during 100-year storms.

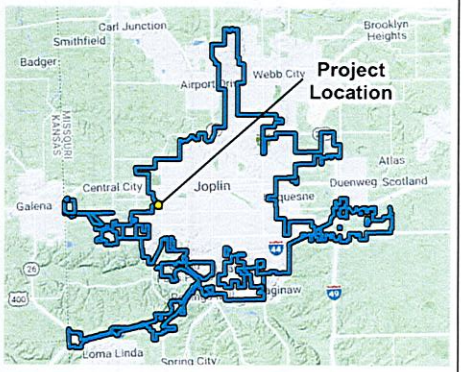


17th Street & Mina Avenue

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Storm Inlets
- Proposed Storm Sewer
- Proposed Channel Improvements
- Floodplain
- 2ft Contours
- Streams
- Parcels
- Sanitary Sewer Manholes
- Sanitary Sewer



0 75 150 300 Feet

1 inch = 150 feet

N

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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
17th Street & Mina Avenue

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 70,000.00	$ 70,000.00
Erosion Control	LS	1	$ 25,000.00	$ 25,000.00
Demolition	LS	1	$ 35,000.00	$ 35,000.00
15" RCP	LF	432	$ 65.00	$ 28,080.00
18" RCP	LF	2185	$ 75.00	$ 163,875.00
24" RCP	LF	532	$ 100.00	$ 53,200.00
2' x 2' RCB	LF	313	$ 200.00	$ 62,600.00
3' x 3' RCB	LF	1216	$ 300.00	$ 364,800.00
Type D Curb Inlet	EA	40	$ 3,300.00	$ 132,000.00
Concrete Wingwalls and Apron for 3' x 3' Box Culvert	EA	1	$ 5,000.00	$ 5,000.00
Pavement Repair	SY	2215	$ 55.00	$ 121,825.00
Curb & Gutter	LF	2420	$ 30.00	$ 72,600.00
Driveway Repair	SY	480	$ 35.00	$ 16,800.00
Excavation (Trapezoidal Channel)	LF	45	$ 150.00	$ 6,750.00
Seeding	AC	0.7	$ 20,000.00	$ 14,000.00
			Subtotal	$ 1,171,530.00
			Utility Relocation (15%)	$ 175,730.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration (25%)	$ 292,880.00
			Right of Way (5%)	$ 58,580.00
			Construction Contingency (25%)	$ 292,880.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 1,992,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 2,677,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Country Club

Location: 17th Street & Mina Avenue

Description of Problem: Street flooding

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10	3		100%	30
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20	3	3	100%	180
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				10
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						220

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

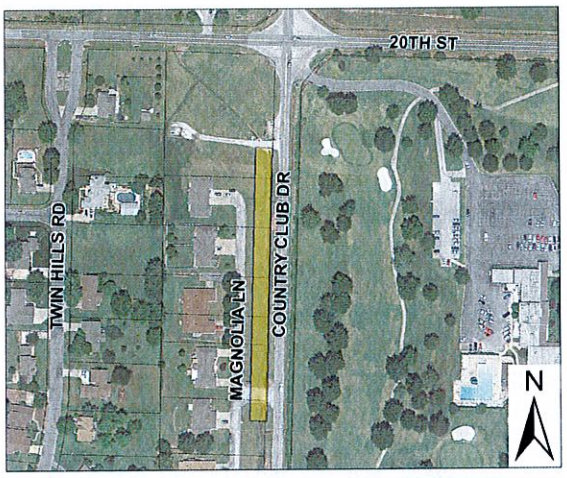
Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: Twin Hills Estates

Project ID: 18-1



Pertinent Data Summary

Watershed: Short Creek

Priority #: 5

Design Capacity: N/A

Estimated Cost: $386,000

Topographic (Section): 27N 33W Section 18

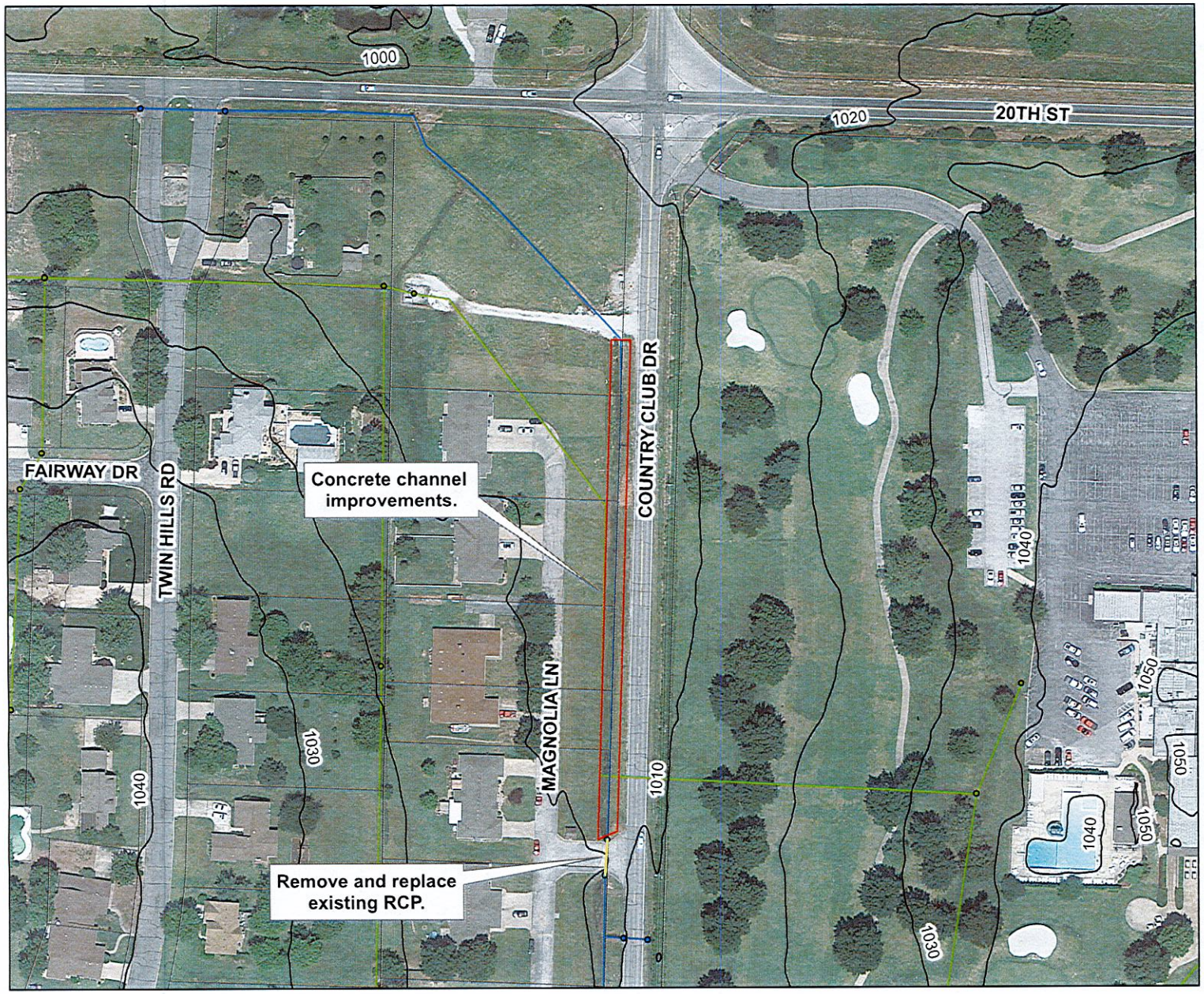
Existing Problem Description

An existing culvert, west of the County Club golf course, spans under a bridge that provides access to residents of properties along Magnolia Lane. A large amount of the surface runoff at this crossing comes from the golf course to the east. The existing RCP culvert is undersized and causes the bridge connecting Black Cat Road and Mongolia Lane to overtop frequently during rain events. An unimproved ditch downstream of the culvert conveys the stormwater for approximately 500 feet until it reaches another undersized culvert. The sizes of both culverts are estimated to be 48-inch RCPs. The above ground collection system continues and begins to run west along 20th Street with similarly sized culverts at each drive crossing. Upon review of aerial imagery, it appears that a scour pool has formed in the natural channel just downstream of the first crossing. Contours also suggest the channel slope between the first and second culvert is very shallow, causing backwater problems at the upstream culvert and reducing its conveyance abilities.

Recommended Improvements

Description:	Remove the upstream culvert and damaged roadway and replace with a similar sized RCP culvert. It doesn't appear improvement of the culvert size would be effective due to downstream controls. Replace the natural open channel between the two culverts with a concrete channel, to improve conveyance and prevent further backwater issues at the culvert crossing.
Permitting:	No permitting is anticipated.
Utility Relocations:	The channel layout seeks to avoid utilities as much as possible. A sanitary sewer line runs parallel for a portion of the open channel. Sanitary sewer line depths are unknown and could reduce capacity of the proposed design or require relocation.
ROW Acquisition:	The proposed storm sewer layout was identified to stay within existing right-of-way, where possible. Additional right-of-way may be required and will be determined based on boundary survey and final design solutions.

Downstream Controls: The improved channel will discharge into the downstream above ground collection system with unimproved channels and possibly undersized culvert crossings.

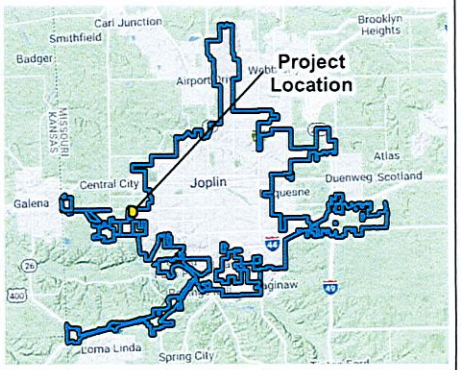


Twin Hills Estates

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Channel Improvements
- Proposed Storm Sewer
- 10ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 50 100 200 Feet

1 inch = 100 feet

N

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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
Twin Hills Estates

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 15,000.00	$ 15,000.00
Erosion Control	LS	1	$ 5,000.00	$ 5,000.00
Demolition	LS	1	$ 10,000.00	$ 10,000.00
48" RCP	LF	38	$ 155.00	$ 5,890.00
Pavement Repair	SY	314	$ 55.00	$ 17,270.00
Curb & Gutter	LF	168	$ 30.00	$ 5,040.00
Concrete Channel	LF	530	$ 300.00	$ 159,000.00
			Subtotal	$ 217,200.00
			Utility Relocation (15%)	$ 32,580.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration	$ 60,000.00
			Right of Way (10%)	$ 21,720.00
			Construction Contingency (25%)	$ 54,300.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 386,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 519,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Short Creek

Location: Twin Hills Estates

Description of Problem: Undersized culvert

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10				
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20	3	1.5	100%	90
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				10
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						**100**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

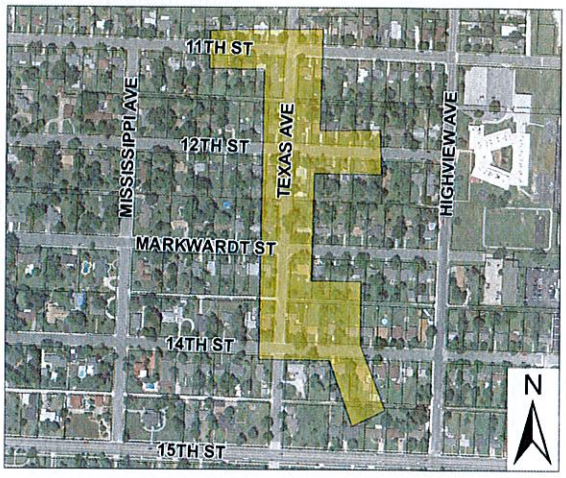
Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: Texas Avenue (11th – 15th Street)

Project ID: 7-1



Pertinent Data Summary

Watershed: Joplin Creek East

Priority #: 6

Design Capacity: 170 cfs (10-year)

Estimated Cost: $1,238,000

Topographic (Section): 27N 33W Section 12

Existing Problem Description

More than 10 properties have flooded along Texas Avenue between 11th and 15th Streets. The intersection of Texas Avenue and 13th Street floods the most since it is located in a sump. The entire drainage area of the neighborhood is nearly 100 acres. Land use is primarily single family residential with commercial to the east near Ridge Line Road. The center of the watershed is oriented from the intersection of Texas Avenue and 13th Street and then to the southeast between Texas and Highview Avenue. Runoff is conveyed through curb and gutter and existing storm sewer. The enclosed system is only located at the intersections of Texas Avenue and 13th Street and runs southeast. It discharges to an open culvert north of 15th Street which also receives runoff by an open channel from the east. The culvert flows south, discharging into an open channel south of 15th Street between Texas and Highview Avenue. Flooding is a result of limited and undersized storm sewer.

Recommended Improvements

Description: Install storm sewer from 11th to 14th Street and along Texas Avenue. Install a 6-foot by 3-foot box culvert at the intersection of Texas Avenue and 13th Street. It will follow the path of the existing storm sewer, discharging to the open culvert north of 15th Street. The proposed storm sewer system will have a design capacity equivalent to the 10-year storm event.

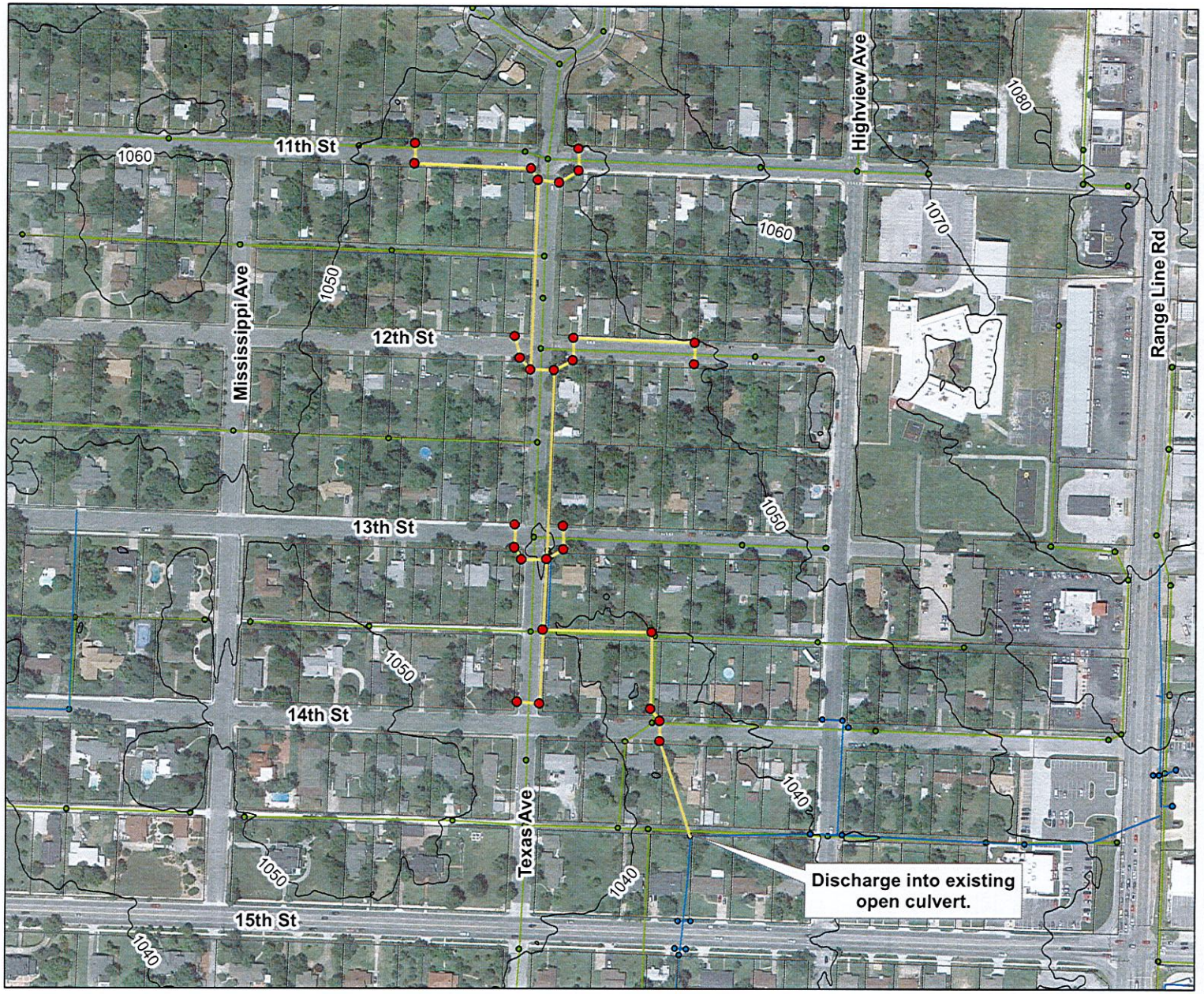
Permitting: No permitting is anticipated.

Utility Relocations: The storm sewer layout seeks to avoid utilities as much as possible. Multiple sanitary sewer crossings exist on Texas Avenue. The proposed storm sewer has significant conflicts with sanitary sewer and overhead electric north of 14th Street and east of Texas Avenue. Sanitary sewer, water, and gas line depths are unknown and may require relocation during final design to achieve the storm sewer design capacity.

ROW Acquisition: The proposed storm sewer layout was identified to stay within existing right-of-way, where possible. Additional right-of-way may be required south of 13th Street. It is unknown whether easements exist for existing storm sewer or if

those easements will be adequate for the proposed storm sewer. Extents of additional right-of-way will be determined based on boundary survey and final design solutions.

Downstream Controls: The capacity of the open culvert north of 15th Street is unknown. Any culvert less than 9-foot by 3-foot would be undersized for the 10-year storm event. The open channel south of 15th Street can convey a 25-year storm event. The culvert downstream of this open channel would need to be a 12-foot by 4-foot culvert to convey the 10-year storm event.

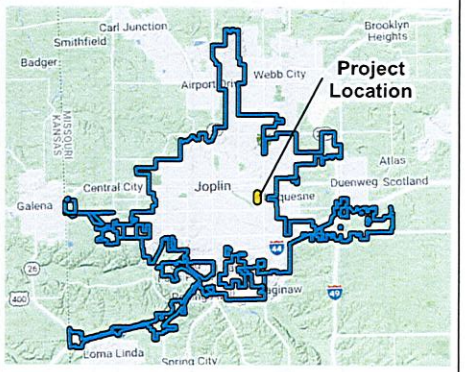


Texas Avenue (11th - 15th Street)

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Storm Inlets
- Proposed Storm Sewer
- Floodplain
- 10ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 100 200 400 Feet

1 inch = 200 feet

N

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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
Texas Avenue (11th - 15th Street)

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 45,000.00	$ 45,000.00
Erosion Control	LS	1	$ 15,000.00	$ 15,000.00
Demolition	LS	1	$ 25,000.00	$ 25,000.00
15" RCP	LF	328	$ 65.00	$ 21,290.00
18" RCP	LF	857	$ 75.00	$ 64,310.00
24" RCP	LF	171	$ 100.00	$ 17,070.00
36" RCP	LF	452	$ 135.00	$ 61,030.00
4' x 4' RCB	LF	731	$ 400.00	$ 292,520.00
6' x 4' RCB	LF	68	$ 500.00	$ 34,060.00
Type D Curb Inlet	EA	26	$ 3,300.00	$ 85,800.00
Junction Box	EA	1	$ 3,000.00	$ 3,000.00
Pavement Repair	SY	644	$ 55.00	$ 35,440.00
Sidewalk Repair	SY	42	$ 35.00	$ 1,460.00
Curb & Gutter	LF	178	$ 30.00	$ 5,340.00
Driveway Repair	SY	228	$ 35.00	$ 7,980.00
Seeding	AC	0.7	$ 20,000.00	$ 13,670.00
			Subtotal	$ 727,970.00
			Utility Relocation (10%)	$ 72,800.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration (25%)	$ 181,990.00
			Right of Way (10%)	$ 72,800.00
			Construction Contingency (25%)	$ 181,990.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 1,238,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 1,664,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Joplin Creek East

Location: Texas Avenue (11th - 15th Street)

Description of Problem: Street flooding

Project Benefit Rating

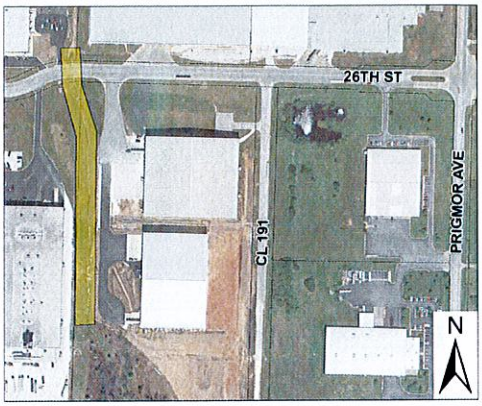
Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10	3		100%	30
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20	3	2	100%	120
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						**150**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4



Project Name: 26th Street Twin Culverts (Industrial Park)

Project ID: 9-1

Pertinent Data Summary

Watershed: Turkey Creek East

Priority #: 7

Design Capacity: 1055 cfs (100-year; Channel Improvements)

589 cfs (10-year; Culvert Crossing)

Estimated Cost: $595,000

Topographic (Section): 27N 32W Section 15

Existing Problem Description

Two 30-inch culverts convey water under 26th Street in the Crossroads Industrial Park, just west of County Road 190. The culverts were originally designed to convey the 10-year storm event during the early developmental stages of the industrial park. As development has continued in the area, peak flows at this crossing have increased and the capacity of the culverts has reduced to less than a 2-year storm event. The amount of drainage area that is conveyed by this crossing is approximately 310 acres. Minor storm events currently make the road impassable and negatively impact neighboring businesses.

Recommended Improvements

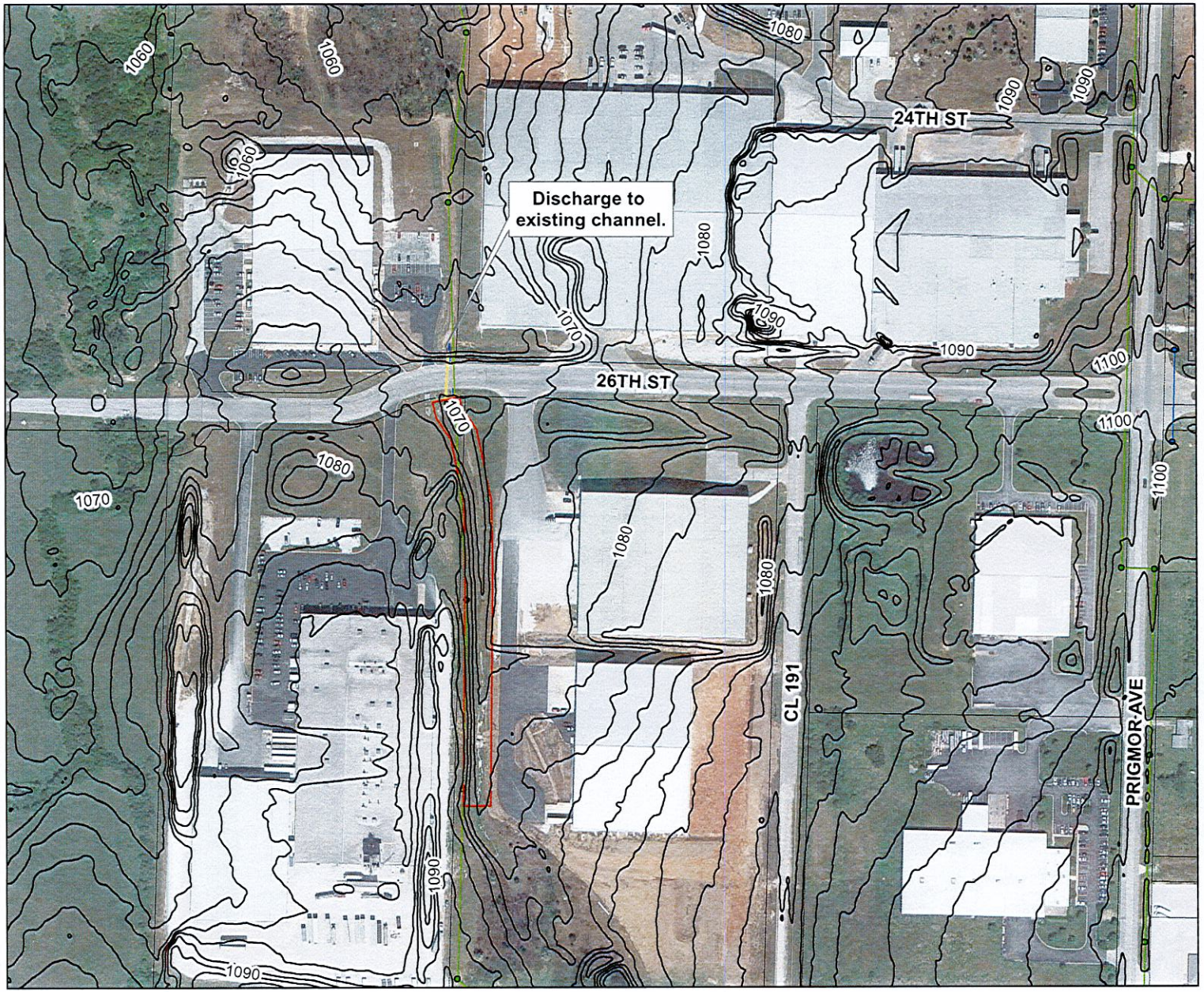
Description: Replace the existing double 30-inch culvert with an 8-foot by 4-foot double box culvert. This culvert will be designed to convey the 10-year storm event. The channel upstream of the crossing will also be improved with a trapezoidal channel. The channel will have a bottom width of 20 feet with 5:1 side slope. The depth of the channel will be 2.75 feet with a channel slope of at least 0.7 percent.

Permitting: A 404 nationwide permit is anticipated.

Utility Relocations: The storm sewer and ditch layout seek to avoid utilities as much as possible. A sanitary sewer line runs parallel to the ditch and crosses just upstream of the culvert. A portion of this line will likely need to be replaced. Also, a gas line crosses at the culvert. Sanitary sewer and gas line depths are unknown and could reduce capacity of the proposed design or require relocation of sanitary sewer and gas lines during final design.

ROW Acquisition: The proposed channel and culvert layout was identified to stay within existing right-of-way, where possible. It is unknown whether there are easements for the channel. If none exist, additional right-of-way will be needed and will be determined based on boundary survey and final design solutions.

Downstream Controls: The proposed RCB will discharge into an existing channel of unknown capacity which may experience flooding with increased flows.

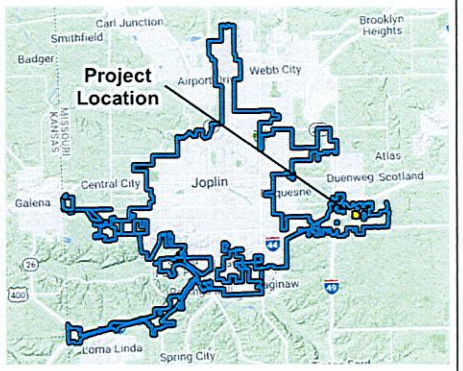


26th Street Twin Culverts

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Channel Improvements
- Proposed Storm Sewer
- 2ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 100 200 400 Feet

1 inch = 200 feet

N

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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
26th Street Twin Culverts

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 15,000.00	$ 15,000.00
Erosion Control	LS	1	$ 5,000.00	$ 5,000.00
Demolition	LS	1	$ 7,500.00	$ 7,500.00
8' x 4' Double RCB	LF	99	$ 1,200.00	$ 118,800.00
Concrete Wing Walls and Apron for 8' x 4' Box Culvert	EA	2	$ 7,500.00	$ 15,000.00
Pavement Repair	SY	150	$ 55.00	$ 8,250.00
Concrete Street Gutter	SY	58	$ 35.00	$ 2,030.00
Curb & Gutter	LF	246	$ 30.00	$ 7,380.00
Excavation (Trapezoidal Channel)	LF	873	$ 150.00	$ 130,950.00
Seeding	AC	2	$ 20,000.00	$ 40,000.00
			Subtotal	$ 349,910.00
			Utility Relocation (10%)	$ 34,990.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration (25%)	$ 87,480.00
			Right of Way (10%)	$ 34,990.00
			Construction Contingency (25%)	$ 87,480.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 595,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 800,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Turkey Creek East

Location: 26th Street Twin Culverts (Industrial Park)

Description of Problem: Undersized culvert and ditch

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10				
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25	3	1.5	100%	112.5
7	Flooding of residential street of more than 7 inches	5,6,8	20				
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						112.5

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

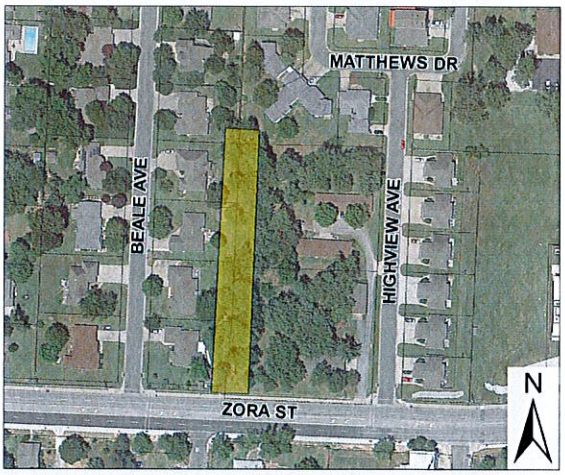
Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: Beale Avenue & Zora Street

Project ID: 17-1



Pertinent Data Summary

Watershed: Baker's Branch (Oakland)

Priority #: 8

Design Capacity: N/A

Estimated Cost: $146,000

Topographic (Section): 28N 33W Section 25

Existing Problem Description

Four residents north of Zora Street and east of Beale Avenue have reported damage to stand-alone structures such as storage sheds and privacy fences due to large volumes of surface runoff in back yards. There is no existing channel to direct the back yard runoff. The surface runoff is captured just north of Zora Street by an area inlet that discharges into the existing stormwater system.

Recommended Improvements

Description:	Install a swale in the back yards of the four residents to direct the surface flow during large rain events. The swale will direct flow to the south and discharge into the existing area inlet.
Permitting:	No permitting is anticipated.
Utility Relocations:	No known utility conflicts in the project location. Any utilities could reduce capacity of the proposed design or require relocation.
ROW Acquisition:	It is unknown if right-of-way exists. If none exists, it will be required and will be determined based on boundary survey and final design solutions.
Downstream Controls:	The proposed swale will discharge into the existing stormwater system along Zora Street.

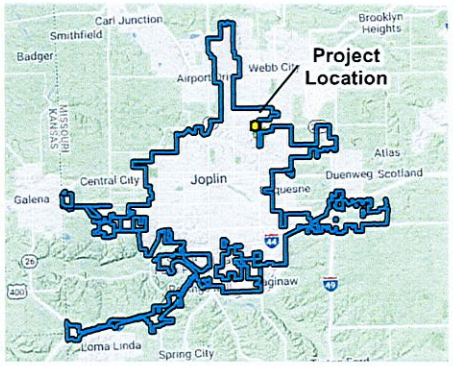


Beale Avenue & Zora Street

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Channel Improvements
- 10ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 37.5 75 150 Feet

1 inch = 75 feet

N

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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
Beale Street & Zora Street

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 5,000.00	$ 5,000.00
Erosion Control	LS	1	$ 2,000.00	$ 2,000.00
Demolition	LS	1	$ 3,000.00	$ 3,000.00
Excavation (Trapezoidal Channel)	LF	453	$ 150.00	$ 67,950.00
			Subtotal	$ 77,950.00
			Utility Relocation (15%)	$ 11,690.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration	$ 25,000.00
			Right of Way (15%)	$ 11,690.00
			Construction Contingency (25%)	$ 19,490.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 146,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 196,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Baker's Branch (Oakland)

Location: Beale Avenue & Zora Street

Description of Problem: Nuisance backyard flooding

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20	3	1	100%	60
4	Nuisance flooding of yards	2,3	10				
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20				
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						**60**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: 17th Street & Iowa Avenue

Project ID: 6-4



Pertinent Data Summary

Watershed: Joplin Creek West

Priority #: 9

Design Capacity: NA

Estimated Cost: $1,927,000

Topographic (Section): 27N 33W Section 11

Existing Problem Description

A portion of the Iowa Avenue branch stormwater system along 17th Street, west of Iowa Street, has deteriorated over time and failed during a rain event in the spring of 2019. The failure was most likely caused by invert corrosion of the old CMP over time. A portion of the pipe east of Iowa Street where the system discharges into Joplin Creek was recently replaced.

Recommended Improvements

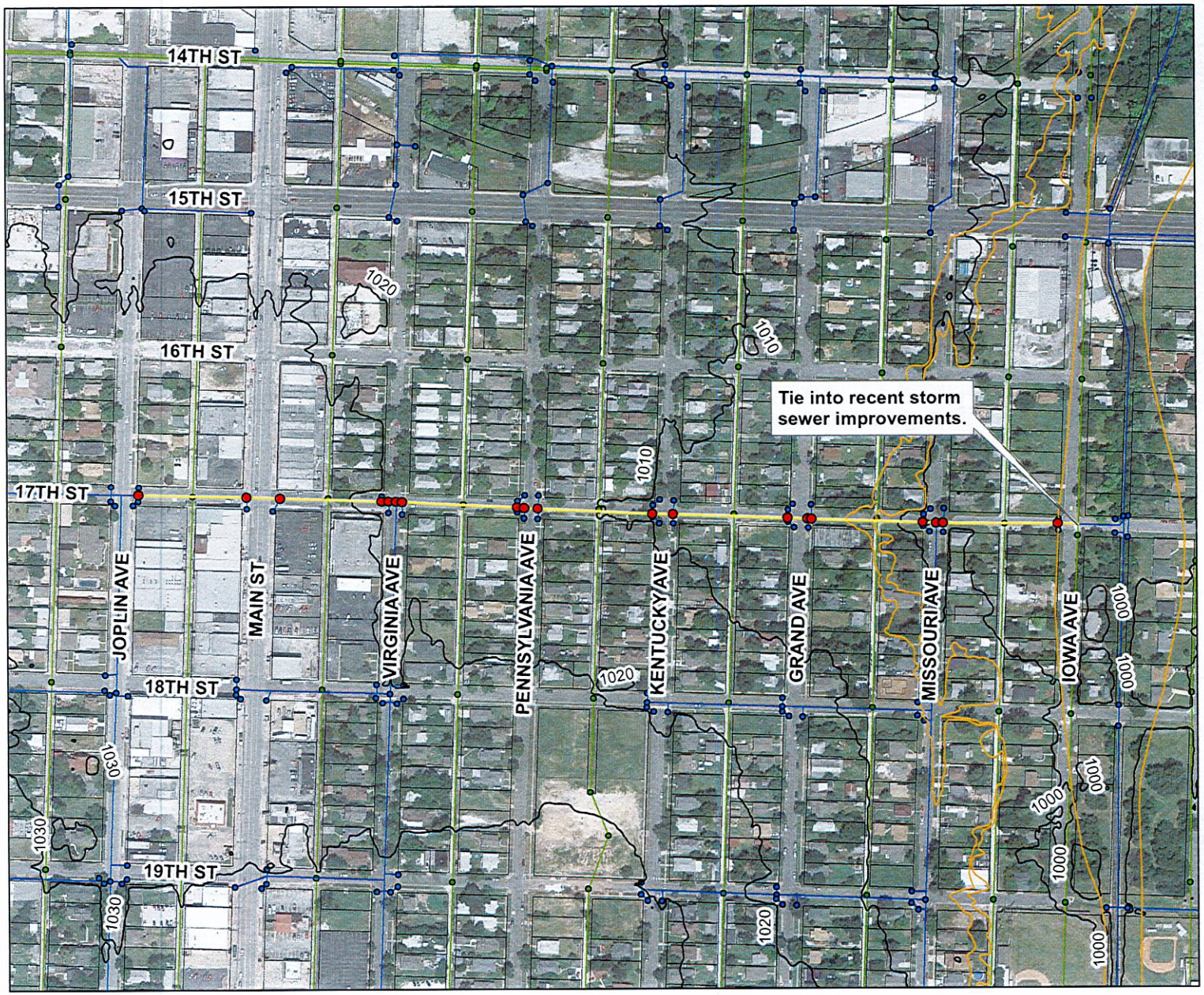
Description: Replace the existing 72-inch CMP with a 72-inch RCP. The pipe will be replaced from Iowa Street to Joplin Avenue, where the system transitions from a 72-inch CMP to a 48-inch CMP. It will follow the path of the existing storm sewer, connecting to the recently replaced pipe east of Iowa Street.

Permitting: No permitting is anticipated

Utility Relocations: The storm sewer layout seeks to avoid utilities as much as possible. The layout crosses sanitary sewer eight times. Also, the layout crosses water and gas lines. Sanitary sewer, gas, and water line depths are unknown and could reduce capacity of the proposed design or require relocation of sanitary sewer, gas, and water lines during final design.

ROW Acquisition: The proposed storm sewer layout was identified to stay within existing right-of-way, where possible. Additional right-of-way is not anticipated but will be determined based on boundary survey and final design solutions.

Downstream Controls: The recently replaced culvert size and capacity is unknown. The downstream culvert size and tail water elevation of Joplin Creek will affect the capacity of the system.



17th Street & Iowa Avenue

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Storm Inlets
- Proposed Storm Sewer
- Floodplain
- 10ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 125 250 500 Feet

1 inch = 225 feet

N

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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
17th Street & Iowa Avenue

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 45,000.00	$ 45,000.00
Erosion Control	LS	1	$ 15,000.00	$ 15,000.00
Demolition	LS	1	$ 20,000.00	$ 20,000.00
72" RCP	LF	2223	$ 350.00	$ 778,050.00
Junction Box	EA	19	$ 3,000.00	$ 57,000.00
Pavement Repair	SY	2573	$ 55.00	$ 141,520.00
Sidewalk Repair	SY	709	$ 35.00	$ 24,820.00
Driveway Repair	SY	100	$ 35.00	$ 3,500.00
Curb & Gutter	LF	1542	$ 30.00	$ 46,260.00
Seeding	AC	0.13	$ 20,000.00	$ 2,600.00
			Subtotal	$ 1,133,750.00
			Utility Relocation (10%)	$ 113,380.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration (25%)	$ 283,440.00
			Right of Way (10%)	$ 113,380.00
			Construction Contingency (25%)	$ 283,440.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 1,927,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 2,590,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Joplin Creek West

Location: 17th Street & Iowa Avenue

Description of Problem: Failing Storm Sewer

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10				
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20				
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10	21		100%	210
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						**210**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: I-44 Culvert Addition

Project ID: 1-2



Pertinent Data Summary

Watershed: Silver Creek

Priority #: 10

Design Capacity: 1,300 cfs (100-year)

Estimated Cost: $175,000 (Conceptual Study) $5,773,000 (Total Project Cost)

Topographic (Section): 27N 33W Section 24

Existing Problem Description

Flooding problems along and near Brownell Avenue in Sunnyvale are the result of an undersized 7-foot by 7-foot box culvert under I-44 which conveys Silver Creek Tributary II. Construction crews built the culvert in the 1950s along with I-44. Development over the past 60 years has diminished the culvert capacity to less than a 10-year storm event before flooding along Brownell Avenue occurs. The Sunnyvale neighborhood was constructed low relative to the culvert elevation. Many of the properties located in the floodplain in Sunnyvale are due to the undersized box culvert.

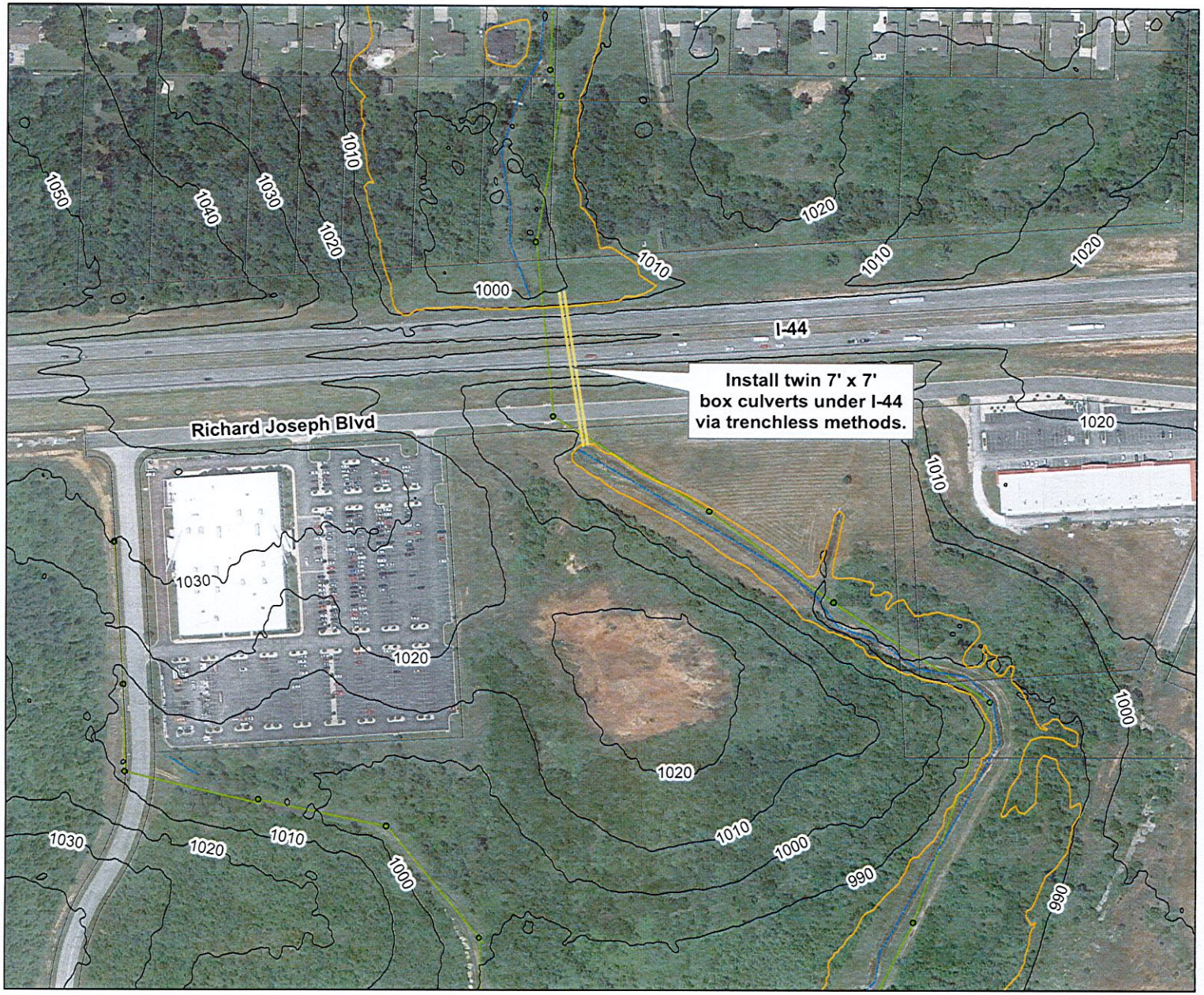
Recommended Improvements

Description: Conduct a hydraulic study to see if additional culverts under I-44 cause increases in water surface elevations beyond the confluence of Silver Creek, affecting downstream properties along Silver Creek. The study should also analyze the cost-benefit of various culvert alternatives with different trenchless installation techniques and explore the possibility of using the culvert for a trail crossing. Install the best cost-benefit culvert via trenchless techniques. Install flood control channel improvements downstream of I-44 to the confluence of Silver Creek to offset increase in peak flows. Necessity of further flood control improvements will be determined in the conceptual study. If feasible, install trail from 36th Street to 44th Street along Silver Creek Tributary II and Silver Creek. The estimate is based upon the two 7-foot by 7-foot box culverts alternative. This option will virtually eliminate headwater backing up to the intersection of 36th Street and Brownell Avenue except during a 500-year storm event.

Permitting: Floodplain development permit for grading in the floodplain and a section 404 nationwide permit.

Utility Relocations: Relocation of the existing 24" sanitary sewer line is likely. Although alternate alignments and profiles may be considered during the conceptual study. Conflicts with gas and water do exist along Richard Joseph Boulevard. Relocation during final design may be necessary to achieve the storm sewer design capacity.

ROW Acquisition:	Additional right-of-way will be needed downstream of I-44 along Silver Creek Tributary II to convey the increased flow. The extents of right-of-way will be determined based on boundary survey and final design solutions.
Downstream Controls:	The confluence with Silver Creek is 0.4 miles from I-44.
Alternative Solutions:	The conceptual study should identify multiple alternatives. Another option is to install three 72-inch reinforced concrete pipes. This option would prevent headwater from backing up to the intersection of 36th Street and Brownell Avenue during a 100-year storm event.

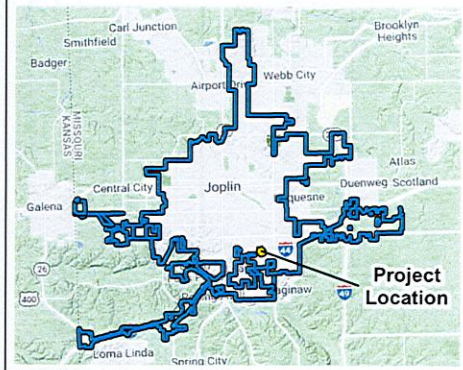


I-44 Culvert Addition

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Storm Sewer
- Floodplain (eff. 11/01/2020)
- 10ft Contours
- Parcels
- Streams
- Sanitary Sewer Manholes
- Sanitary Sewer



0 100 200 400 Feet

1 inch = 200 feet

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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
I-44 Culvert Addition

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 100,000.00	$ 100,000.00
Erosion Control	LS	1	$ 50,000.00	$ 50,000.00
7' x 7' RCB Trenchless Installation	LF	660	$ 3,000.00	$ 1,980,000.00
7' x 7' RCB	LF	660	$ 700.00	$ 462,000.00
Concrete Wingwalls and Apron for 7' x 7' Box Culvert	EA	4	$ 7,500.00	$ 30,000.00
Channel Improvements	LF	2000	$ 300.00	$ 600,000.00
Trail	SY	3945	$ 60.00	$ 236,700.00
Seeding	AC	2	$ 20,000.00	$ 40,000.00
			Subtotal	$ 3,498,700.00
			Utility Relocation (10%)	$ 349,870.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration (25%)	$ 874,680.00
			Right of Way (5%)	$ 174,940.00
			Construction Contingency (25%)	$ 874,680.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 5,773,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 7,758,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Silver Creek

Location: I-44 Culvert Addition

Description of Problem: Undersized culvert

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30	3	3	75%	202.5
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10				
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20	3	3	75%	135
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				10
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				20
	Project Total Benefit Points						**367.5**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

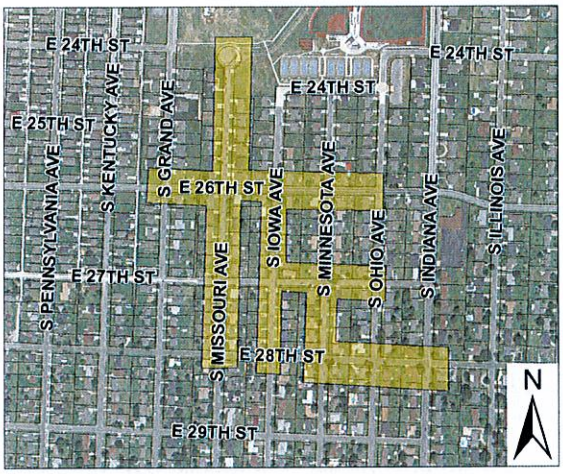
Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	Y
Aesthetics	Y

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: Durham Acres/Missouri Avenue

Project ID: 6-1



Pertinent Data Summary

Watershed: Joplin Creek West

Priority #: 11

Design Capacity: 210 cfs (10-year)

Estimated Cost: $2,092,000

Topographic (Section): 27N 33W Section 14

Existing Problem Description

More than 20 properties have flooded in Durham Acres and Missouri Avenue. Street ponding up to 12 inches has been reported during intense storms. Video from 2019 shows Missouri Avenue north of 26th Street flooding with 12 inches of swift flowing water. The entire drainage area of the neighborhood is more than 90 acres primarily single family residential. Runoff travels east and west to Missouri Avenue. It is then conveyed in Missouri Avenue through curb and gutter and existing storm sewer. The existing enclosed system is only located along the intersections of Iowa and Missouri Avenue and 26th Street. It then runs parallel to Missouri Avenue. The drainage ditch at the end of Missouri Avenue is the outfall. Limited and undersized storm sewer causes flooding. The current enclosed system cannot convey a 2-year storm event.

Recommended Improvements

Description: Install storm sewer throughout the drainage area. Retain the 36-inch culvert parallel to Missouri Avenue. Install an additional 4-foot by 4-foot box culvert parallel to the 36-inch culvert. Both the 4-foot by 4-foot box culvert and 36-inch culvert will junction with a 6-foot by 4-foot box culvert which will discharge at the end of Missouri Avenue into the open channel. The proposed storm sewer system will have a design capacity equivalent to the 10-year storm event.

Permitting: No permitting is anticipated.

Utility Relocations: The storm sewer layout seeks to avoid utilities as much as possible. Multiple sanitary sewer conflicts exist. Most of the conflicts are on 28th Street and 26th Street. A few streetlights will need to be relocated with the proposed layout. Also, the water line along Missouri Avenue runs parallel to the proposed storm sewer and may need relocation. Sanitary sewer, water, and gas line depths are unknown and may require relocation during final design to achieve the storm sewer design capacity.

ROW Acquisition: The proposed storm sewer layout was identified to stay within existing right-of-way, where possible. Additional right-of-way at the back of existing right-of-way

may be required and will be determined based on boundary survey and final design solutions.

Downstream Controls: The capacity of the drainage ditch downstream of the Missouri Avenue cul-de-sac will influence the capacity of this storm system. The open channel was recently designed and constructed with Joplin High School in 2014. Downstream tailwater was assumed to be crown of pipe.

Alternative Solutions: A 6-foot by 4-foot box culvert could be used along Missouri Avenue downstream of 26th Street instead of the existing 36-inch culvert and a 4-foot by 4-foot box culvert.

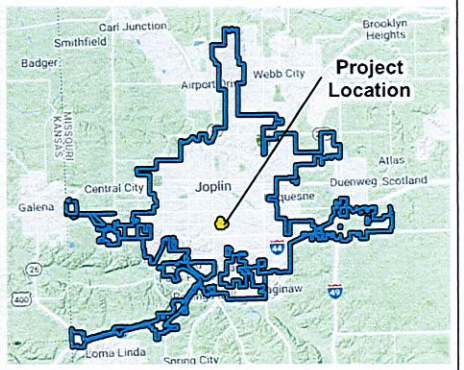


Durham Acres/Missouri Avenue

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Storm Inlets
- Proposed Storm Sewer
- Floodplain
- 10ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 125 250 500 Feet

1 inch = 250 feet

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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
Durham Acres (Missouri Avenue)

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 80,000.00	$ 80,000.00
Erosion Control	LS	1	$ 25,000.00	$ 25,000.00
Demolition	LS	1	$ 40,000.00	$ 40,000.00
15" RCP	LF	480	$ 65.00	$ 31,220.00
18" RCP	LF	2411	$ 75.00	$ 180,860.00
24" RCP	LF	1521	$ 100.00	$ 152,140.00
36" RCP	LF	739	$ 135.00	$ 99,820.00
48" RCP	LF	309	$ 155.00	$ 47,870.00
4' x 4' RCB	LF	731	$ 400.00	$ 292,520.00
6' x 4' RCB	LF	68	$ 500.00	$ 34,060.00
Type D Curb Inlet	EA	36	$ 3,300.00	$ 118,800.00
Junction Box	EA	2	$ 3,000.00	$ 6,000.00
Concrete Wingwalls and Apron for 6' x 4' Box Culvert	EA	1	$ 5,000.00	$ 5,000.00
Pavement Repair	SY	1359	$ 55.00	$ 74,750.00
Sidewalk Repair	SY	9	$ 35.00	$ 310.00
Curb & Gutter	LF	836	$ 30.00	$ 25,080.00
Driveway Repair	SY	760	$ 35.00	$ 26,590.00
Seeding	AC	1.4	$ 20,000.00	$ 27,840.00
			Subtotal	$ 1,267,860.00
			Utility Relocation (10%)	$ 126,790.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration (25%)	$ 316,970.00
			Right of Way (5%)	$ 63,390.00
			Construction Contingency (25%)	$ 316,970.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 2,092,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 2,811,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Joplin Creek West

Location: Durham Acres/Missouri Avenue

Description of Problem: Street flooding

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10	3		100%	30
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25	3	2	100%	150
7	Flooding of residential street of more than 7 inches	5,6,8	20				
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						**180**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: Euclid Avenue

Project ID: 10-1



Pertinent Data Summary

Watershed: Turkey Creek Central

Priority #: 12

Design Capacity: 165 cfs (100-year, Ditch) 45 cfs (100-year, Storm Sewer)

Estimated Cost: $1,021,000

Topographic (Section): 28N 33W Section 36

Existing Problem Description

More than 30 properties have flooded along Euclid Avenue and the parallel alley east of Euclid Avenue from Odessa Street to Kensington Street. The primary stormwater conveyance is the ditch on the west side of Euclid Avenue. Runoff from the east is directed to this ditch via pipe at the intersection of Euclid Avenue and Odessa Street. Neighbors reported the ditch west of Euclid overtopped during a 25-year storm event. The ditch has not been maintained and several driveway culverts are undersized. On the east side of Euclid Avenue is a small ditch which conveys runoff from the road downstream of Odessa Street. Residents along the alley parallel to Euclid Avenue say the alley floods during heavy rain events. The alley is a major corridor for sanitary sewer, gas, and overhead electric.

Recommended Improvements

Description: Improve the ditch on the west side of Euclid Avenue. A trapezoidal channel with a 5-foot bottom width, depth of 3.5 feet, and 3:1 side slope will convey a 100-year storm event with 1-foot of freeboard per City of Joplin requirements. Install driveway culverts of 5-feet by 2.5-feet. Convert the ditch on the east side of Euclid Avenue to an enclosed storm sewer with a 30-inch RCP. Curb inlets will be installed on the east side of Euclid Avenue. Placement of the storm sewer and elimination of the open ditch on the east side of Euclid Avenue will allow sidewalk improvements. To avoid utility relocation costs for utilities in the alley, curb inlets will be placed on the southwest side at the intersections of Nashville Street to Kensington Street and the alley. Curb will be installed on the south side of the intersections with a roll curb at the alley entrance, creating a sump at the curb inlet. The inlets will drain into the enclosed system along Euclid Avenue.

Permitting: Floodplain development permit for grading in the floodplain.

Utility Relocations: The storm sewer and ditch layout seek to avoid utilities as much as possible. The sanitary sewer at the intersection of Nashville Street and Euclid Avenue could limit the depth of the drainage ditch and/or conflict with the proposed storm sewer on the east side of Euclid Avenue. Additional conflicts with water, gas, and overhead electric do exist. Sanitary sewer, water, and gas line depths are

	unknown and may require relocation during final design to achieve the storm sewer design capacity.
ROW Acquisition:	The proposed storm sewer and ditch layout was identified to stay within existing right-of-way, where possible. Minor sections of additional right-of-way may be required for the enlarged drainage channel and storm sewer along Euclid Avenue. New right-of-way extents will be determined based on boundary survey and final design solutions.
Downstream Controls:	The capacity of the culvert at the intersection of St. Louis Avenue and Euclid Avenue is unknown. The size of this culvert will impact the capacity of the ditch on the west side of Euclid Avenue. Also, both the ditch and enclosed storm sewer discharge into the floodplain of Turkey Creek.

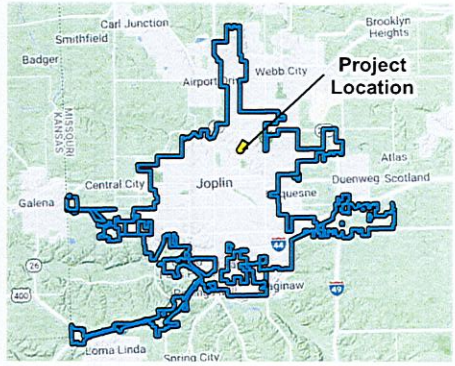


Euclid Avenue

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Storm Inlets
- Proposed Storm Sewer
- Proposed Channel Improvements
- Floodplain
- 10ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
Euclid Avenue

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 35,000.00	$ 35,000.00
Erosion Control	LS	1	$ 15,000.00	$ 15,000.00
Demolition	LS	1	$ 20,000.00	$ 20,000.00
15" RCP	LF	637	$ 65.00	$ 41,400.00
18" RCP	LF	120	$ 75.00	$ 8,980.00
24" RCP	LF	698	$ 100.00	$ 69,790.00
30" RCP	LF	480	$ 120.00	$ 57,550.00
5' x 2.5' RCB	LF	61	$ 375.00	$ 22,770.00
Type D Curb Inlet	EA	9	$ 3,300.00	$ 29,700.00
Excavation (Trapezoidal Channel)	LF	1146	$ 150.00	$ 171,900.00
Turf Reinforcement Mat	SY	3463	$ 10.00	$ 34,630.00
Pavement Repair	SY	131	$ 55.00	$ 7,210.00
Sidewalk Improvements	SY	1416	$ 35.00	$ 49,550.00
Curb & Gutter	LF	1806	$ 30.00	$ 54,180.00
Driveway Repair	SY	255	$ 35.00	$ 8,930.00
Seeding	AC	0.10	$ 20,000.00	$ 1,920.00
			Subtotal	$ 628,510.00
			Utility Relocation (7.5%)	$ 47,140.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration (25%)	$ 157,130.00
			Right of Way (5%)	$ 31,430.00
			Construction Contingency (25%)	$ 157,130.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 1,021,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 1,372,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Turkey Creek Central

Location: Euclid Avenue

Description of Problem: Street and yard flooding

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10	3		100%	30
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20	3	1.5	100%	90
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						120

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

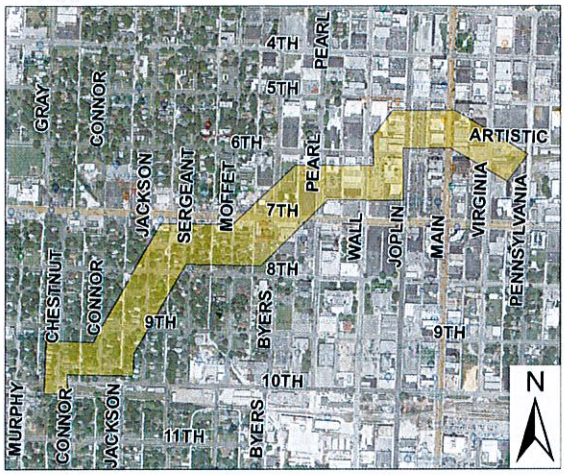
Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: Old Willow Branch

Project ID: 6-2



Pertinent Data Summary

Watershed: Joplin Creek West

Priority #: 13

Design Capacity: N/A

Estimated Cost: $375,000 (Concept Study) $13,293,000 (Total Project Cost)

Topographic (Section): 28N 33W Section 2, 3, 10

Existing Problem Description

Old Willow Branch is an extensive enclosed system built a century ago. It starts at the intersection of 10th Street and Chestnut Avenue and travels to the northeast through downtown before it discharges into an open channel near the intersection of 6th Street and Pennsylvania Avenue. Pictures show the box culvert has deteriorated. Rebar is exposed with sides and bottoms eroded out. Old Willow Branch and New Willow Branch has a combined capacity of a 25-year storm event. If Old Willow Branch were to fail, many properties would flood in and around downtown. Also, several buildings are located over the box culvert. A collapse would also impact these buildings. The box culvert intersects several utility corridors for sanitary sewer, gas, water, and electric.

Recommended Improvements

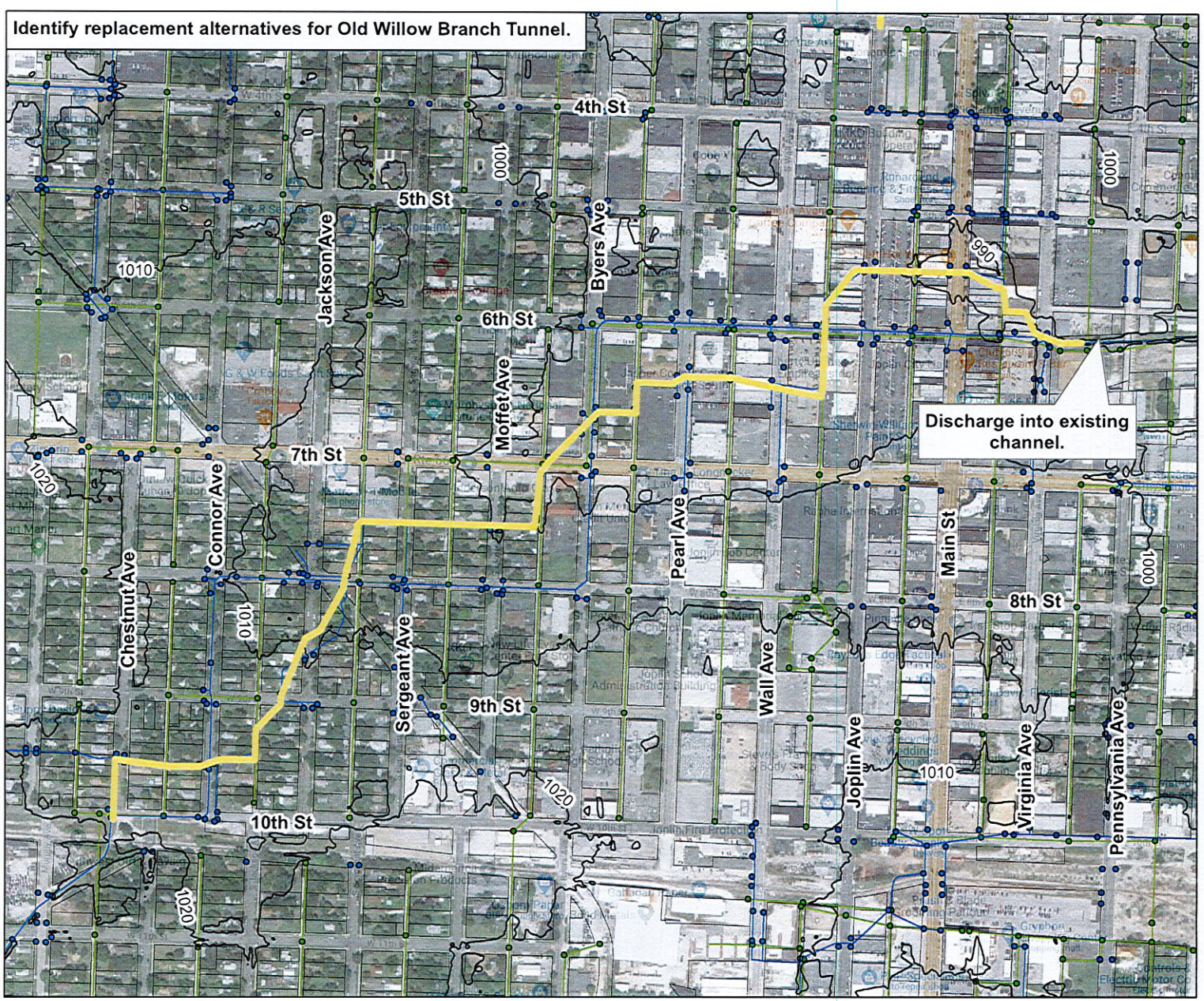
Description: The first step in rehabilitating Old Willow Branch is to conduct a study. This study should evaluate the existing system condition, feasibility of replacement along the current alignment, identify additional alignment alternatives, and develop an opinion of probable cost for each alternative. The box culvert under buildings may need to be abandoned and filled with slurry and replaced with a new layout. The project will need to be completed in several phases. The estimate for this project is based on prices to replace the existing box culvert with identical sizes and fill segments located under buildings with slurry. It is intended to only provide an order of magnitude for the total project.

Permitting: To be determined in the conceptual study.

Utility Relocations: Utility impacts and conflicts with existing buildings are expected to be significant. Exact conflicts to be further identified in the conceptual study.

ROW Acquisition: Right-of-way requirements are expected to be significant. Exact right-of-way needs to be further identified in the conceptual study.

Downstream Controls: The culvert discharges into an open channel. This channel flows through multiple culverts before discharging into Joplin Creek.

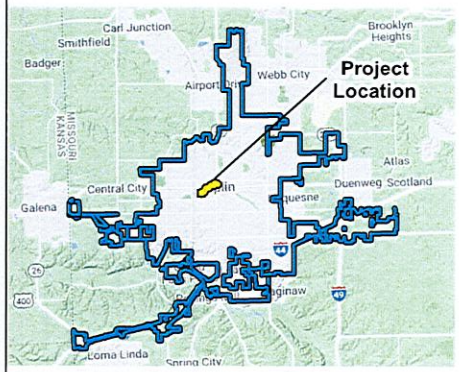


Old Willow Branch

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Existing Old Willow Branch Tunnel
- Floodplain
- 10ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 175 350 700 Feet

1 inch = 350 feet

N

olsson

Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
Old Willow Branch

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 450,000.00	$ 450,000.00
Erosion Control	LS	1	$ 150,000.00	$ 150,000.00
Demolition	LS	1	$ 110,000.00	$ 110,000.00
Abandonment (Flowable Fill)	CY	8458	$ 300.00	$ 2,537,290.00
8' x 3' RCB	LF	980	$ 550.00	$ 538,800.00
9' x 5' RCB	LF	1208	$ 700.00	$ 845,480.00
12' x 4' RCB	LF	3135	$ 800.00	$ 2,508,200.00
Pavement Repair	SY	4463	$ 55.00	$ 245,470.00
			Subtotal	$ 7,385,240.00
			Utility Relocation (15%)	$ 1,107,790.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration (25%)	$ 1,846,310.00
			Right of Way (15%)	$ 1,107,790.00
			Construction Contingency (25%)	$ 1,846,310.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 13,293,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 17,865,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Joplin Creek West

Location: Old Willow Branch

Description of Problem: Failing Storm Sewer

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10				
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20				
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10	53		100%	530
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						**530**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

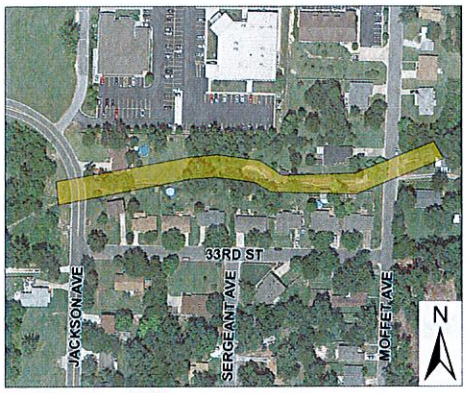
Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: 33rd Street & Jackson Avenue

Project ID: 3-1



Pertinent Data Summary

Watershed: Water Works

Priority #: 14

Design Capacity: 226 cfs (100-year, channel upstream Jackson Avenue)
142 cfs (100-year, channel upstream Moffet Avenue)

Estimated Cost: $424,000

Topographic (Section): 27N 33W Section 22

Existing Problem Description

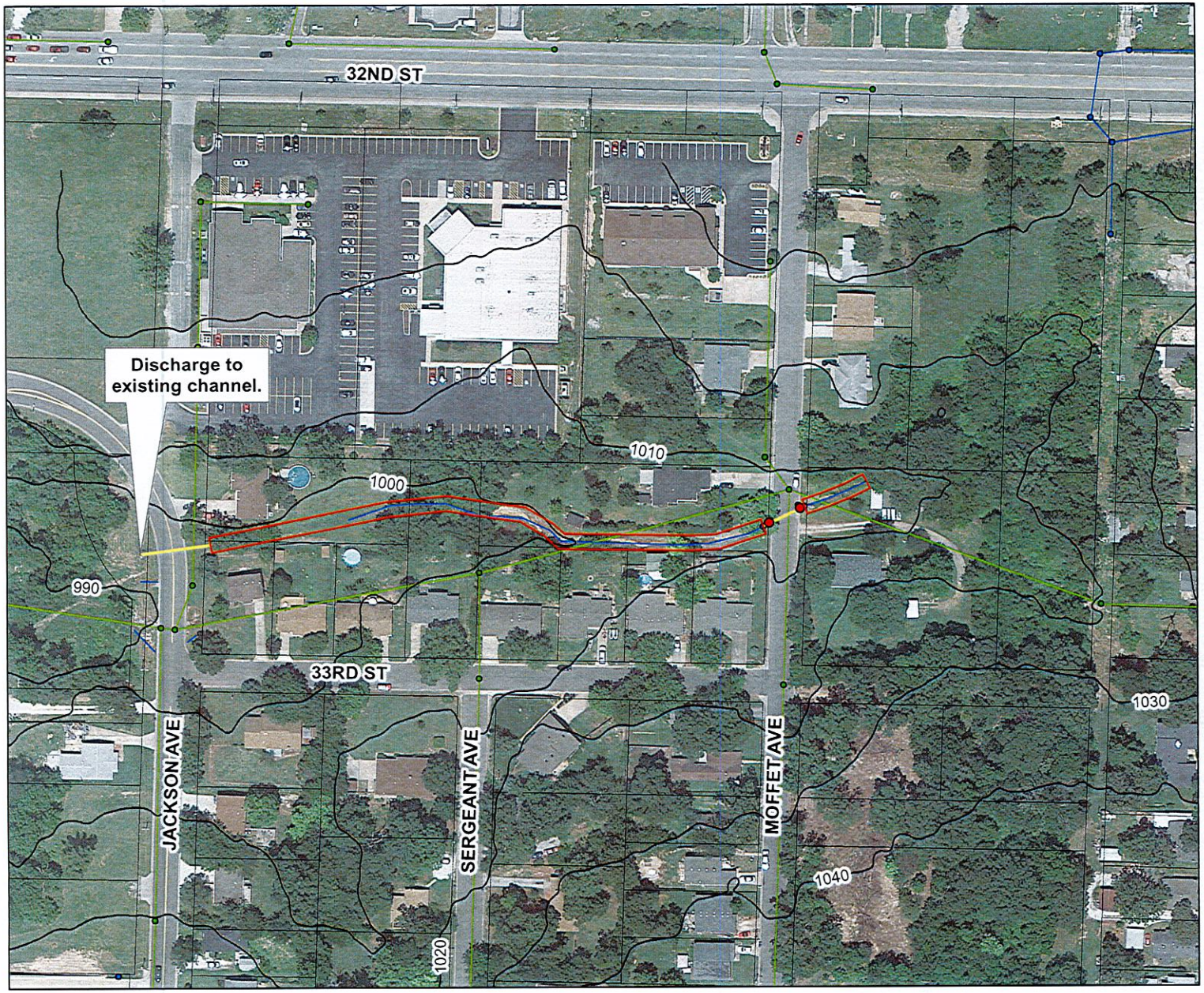
Many residents have reported flooding issues caused by an unimproved open channel running between Jackson Avenue and Moffet Avenue, just North of 33rd Street. The channel runs through 10 properties where residents have reported extensive nuisance flooding of backyards and structural flooding of sheds during rainfall events at or exceeding a 10-year storm event. No residential structure flooding has been reported to date. An upstream 36-inch RCP conveys water under Moffet Avenue. A large downstream RCP culvert designed to convey most of the channel flow and a smaller overflow pipe connected to a street inlet both exist under Jackson Avenue. The size of both pipes is unknown, but the larger RCP is estimated to have a 60-inch diameter. The 60-inch RCP is able to convey a 25-year storm event without overtopping but is not utilized to its full capacity as the natural channel just before Jackson Avenue is very flat with undefined side slopes, resulting in low capacity. This inefficient drainage ditch causes backwater issues on properties upstream of the Jackson Avenue culvert. The entrance of the Moffet Avenue culvert and about 70 feet of the downstream channel is a concrete channel which transitions into a natural channel. The concrete channel is sized to convey the 100-year storm event with no freeboard, but channel erosion and overgrowth has reduced its capacity. The natural channel upstream of Moffet Avenue is undersized and only conveys the 10-year storm event with no freeboard. The 36-inch RCP under Moffet is undersized and does not have the capacity to convey a 2-year design storm.

Recommended Improvements

Description: Replace the existing 36-inch CMP under Moffet Avenue with a 48-inch RCP. The channel upstream and downstream of Moffet Avenue will be replaced with a concrete channel with a bottom width of 4 feet, height of 1.5 feet, and 4:1 side slope. The channel will convey the 100-year storm event but have no freeboard, due to the proximity of several homes. The 60-inch CMP under Jackson Avenue will be replaced with a pipe of the same size, but the upstream invert of the pipe will be dropped 3 feet to allow a constant upstream concrete channel slope of around 2 percent.

Permitting: A 404 nationwide permit is anticipated.

Utility Relocations:	Sanitary sewer and gas lines cross the channel and may limit the capacity of improvements and the ability to lower the flowline. Sanitary sewer and gas line depths are unknown and could reduce capacity of the proposed design or require relocation of sanitary sewer or gas lines during final design.
ROW Acquisition:	The proposed channel layout was identified to stay within existing right-of-way, where possible. It is unknown whether a drainage easement exists for the ditch between Moffet Avenue and Jackson Avenue. Additional right-of-way may be required and will be determined based on boundary survey and final design solutions.
Downstream Controls:	The Jackson Avenue culvert discharges into a downstream channel that may affect the capacity of the culvert.
Alternative Solutions:	The proposed concrete channel could be constructed as a natural channel. The bottom width of the trapezoidal channel will need to be 10 feet with 3:1 side slope and a depth of 2 feet. The capacity of the proposed ditch is a 100-year storm event with no freeboard. The size of a natural channel with 1-foot of freeboard is not possible in this area without a channel with vertical walls, due to the proximity of the houses.

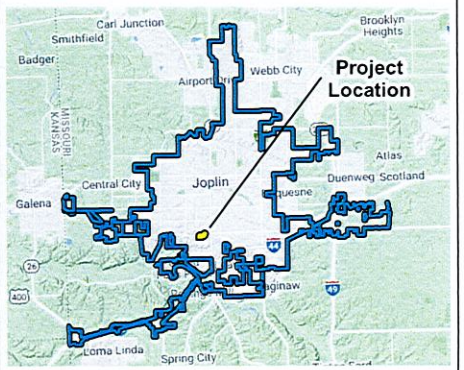


33rd Street & Jackson Avenue

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Channel Improvements
- Proposed Storm Inlets
- Proposed Storm Sewer
- 10ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 50 100 200 Feet

1 inch = 100 feet

N

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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
33rd Street & Jackson Avenue

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 15,000.00	$ 15,000.00
Erosion Control	LS	1	$ 5,000.00	$ 5,000.00
Demolition	LS	1	$ 10,000.00	$ 10,000.00
48" RCP	LF	50	$ 155.00	$ 7,750.00
48" FES	EA	2	$ 2,400.00	$ 4,800.00
60" RCP	LF	72	$ 190.00	$ 13,680.00
60" FES	EA	2	$ 3,500.00	$ 7,000.00
Pavement Repair	SY	112	$ 55.00	$ 6,160.00
Curb & Gutter	LF	112	$ 30.00	$ 3,360.00
Seeding	AC	0.50	$ 20,000.00	$ 10,000.00
Type D Curb Inlet	EA	2	$ 3,300.00	$ 6,600.00
Concrete Channel	LF	668	$ 240.00	$ 160,320.00
			Subtotal	$ 249,670.00
			Utility Relocation (10%)	$ 24,970.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration (25%)	$ 62,420.00
			Right of Way (10%)	$ 24,970.00
			Construction Contingency (25%)	$ 62,420.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 424,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 570,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Water Works

Location: 33rd Street & Jackson Avenue

Description of Problem: Ditch erosion and nuisance yard flooding

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10	3		100%	30
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20	1	1	100%	20
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				10
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						**60**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: Carolina Circle Cul-de-sac Ditch

Project ID: 7-6



Pertinent Data Summary

Watershed: Joplin Creek East

Priority #: 15

Design Capacity: 16 cfs (10-year)

Estimated Cost: $92,000

Topographic (Section): 27N 33W Section 12

Existing Problem Description

An existing unimproved open channel runs between several houses west of Carolina Circle cul-de-sac with a capacity equal to roughly a 2-year storm event. It is estimated that up to four residential properties have experienced flooding during a 5-year storm event. The open ditch starts at the west corner of the Carolina Circle cul-de-sac and connects to a street inlet along Connecticut Avenue.

Recommended Improvements

Description: Replace the existing unimproved open channel with an enclosed storm sewer. Install a 24-inch RCP along the existing layout of the open channel. It will convey a 50-year storm event. The storm pipe will connect to the existing inlet along Connecticut Avenue. Install a double curb inlet at the sump of the Carolina Circle cul-de-sac along with an area inlet in the middle of the proposed storm sewer reach.

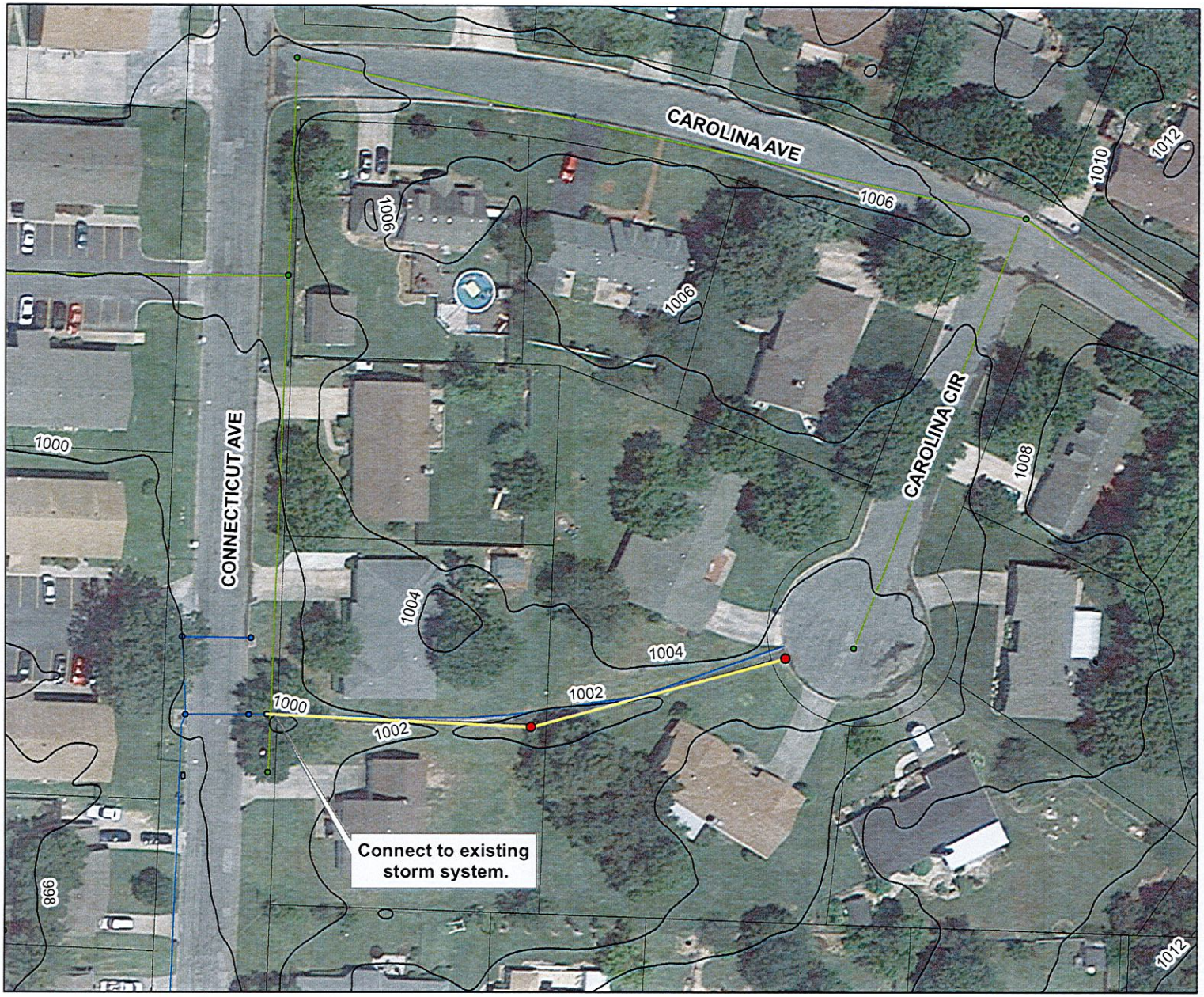
Permitting: No permitting is anticipated

Utility Relocations: The storm sewer layout follows the existing open ditch and seeks to avoid utilities as much as possible. The proposed storm sewer crosses sanitary sewer, gas, and water lines where it connects to existing storm sewer on Connecticut Avenue. Sanitary sewer, gas, and water line depths are unknown and could reduce capacity of the proposed design or require relocation of sanitary sewer, gas, and water lines during final design.

ROW Acquisition: It is unknown whether the City of Joplin has easements for the existing drainage ditch. If no easements exist, additional right-of-way will be needed and will be determined based on boundary survey and final design solutions.

Downstream Controls: The proposed 24-inch RCP will discharge into an existing system with a smaller pipe diameter of 15 to 18 inches. This reduction in pipe size will constrict the capacity of the system but can be improved in the future.

Alternative Solutions: The proposed storm sewer pipe could be constructed as a natural channel. The bottom width of the trapezoidal channel will need to be 2 feet with 3:1 side slope and a depth of 2.25 feet. The capacity of the proposed natural channel is a 100-year storm event with 1-foot of freeboard.

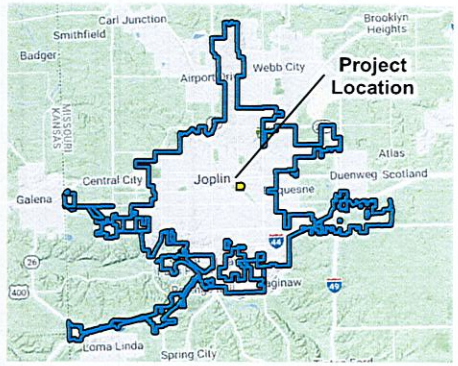


Carolina Circle Cul-de-sac Ditch

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Storm Inlets
- Proposed Storm Sewer
- 2ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 25 50 100 Feet

1 inch = 50 feet

N

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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
Carolina Circle Cul-de-sac Ditch

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 2,500.00	$ 2,500.00
Erosion Control	LS	1	$ 1,000.00	$ 1,000.00
Demolition	LS	1	$ 1,500.00	$ 1,500.00
24" RCP	LF	277	$ 80.00	$ 22,160.00
Type D Curb Inlet	EA	2	$ 3,300.00	$ 6,600.00
Area Inlet	EA	1	$ 4,000.00	$ 4,000.00
Sod	AC	0.06	$ 96,800.00	$ 5,810.00
Sewer Encasement	LF	10	$ 100.00	$ 1,000.00
			Subtotal	$ 44,570.00
			Utility Relocation (10%)	$ 4,460.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration	$ 25,000.00
			Right of Way (15%)	$ 6,690.00
			Construction Contingency (25%)	$ 11,140.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 92,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 124,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Joplin Creek East

Location: Carolina Circle Cul-de-sac Ditch

Description of Problem: Nuisance Flooding

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10	3		100%	30
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20				
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						30

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

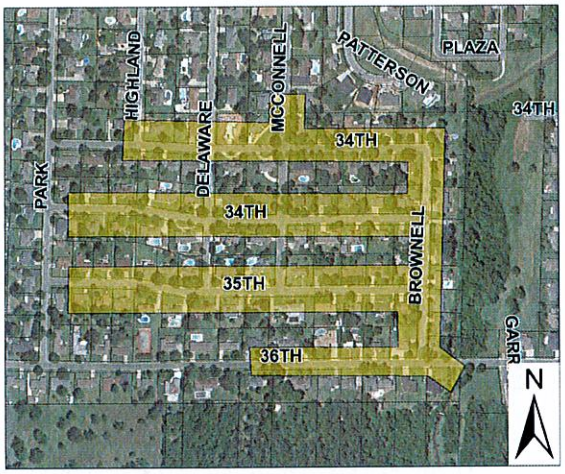
Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: Sunnyvale (Lloyd Addition) Storm Sewer Improvements

Project ID: 1-1



Pertinent Data Summary

Watershed: Silver Creek

Priority #: 16

Design Capacity: 150 cfs (10-year)

Estimated Cost: $2,537,000

Topographic (Section): 27N 33W Section 24

Existing Problem Description

More than 20 properties have flooded in Sunnyvale (Lloyd Addition). Several feet of water have been documented along the intersections of 36th Street & Brownell Avenue and 34th Place and Brownell Avenue in 2015 and 2019. Also, nuisance flooding has been reported along many other intersections in the neighborhood. The entire drainage area of the neighborhood is 70 acres. Land use is single family residential. Stormwater naturally flows east to Silver Creek Tributary II which is adjacent to the properties along Brownell Avenue. Runoff is conveyed through curb and gutter. No enclosed storm sewer exists except at the intersection of 36th Street and Brownell. Flooding is a result of no underground stormwater conveyance and a floodplain issue with Silver Creek Tributary II caused by insufficient culvert capacity at I-44. Many of the properties located along Brownell Avenue are located in the floodplain.

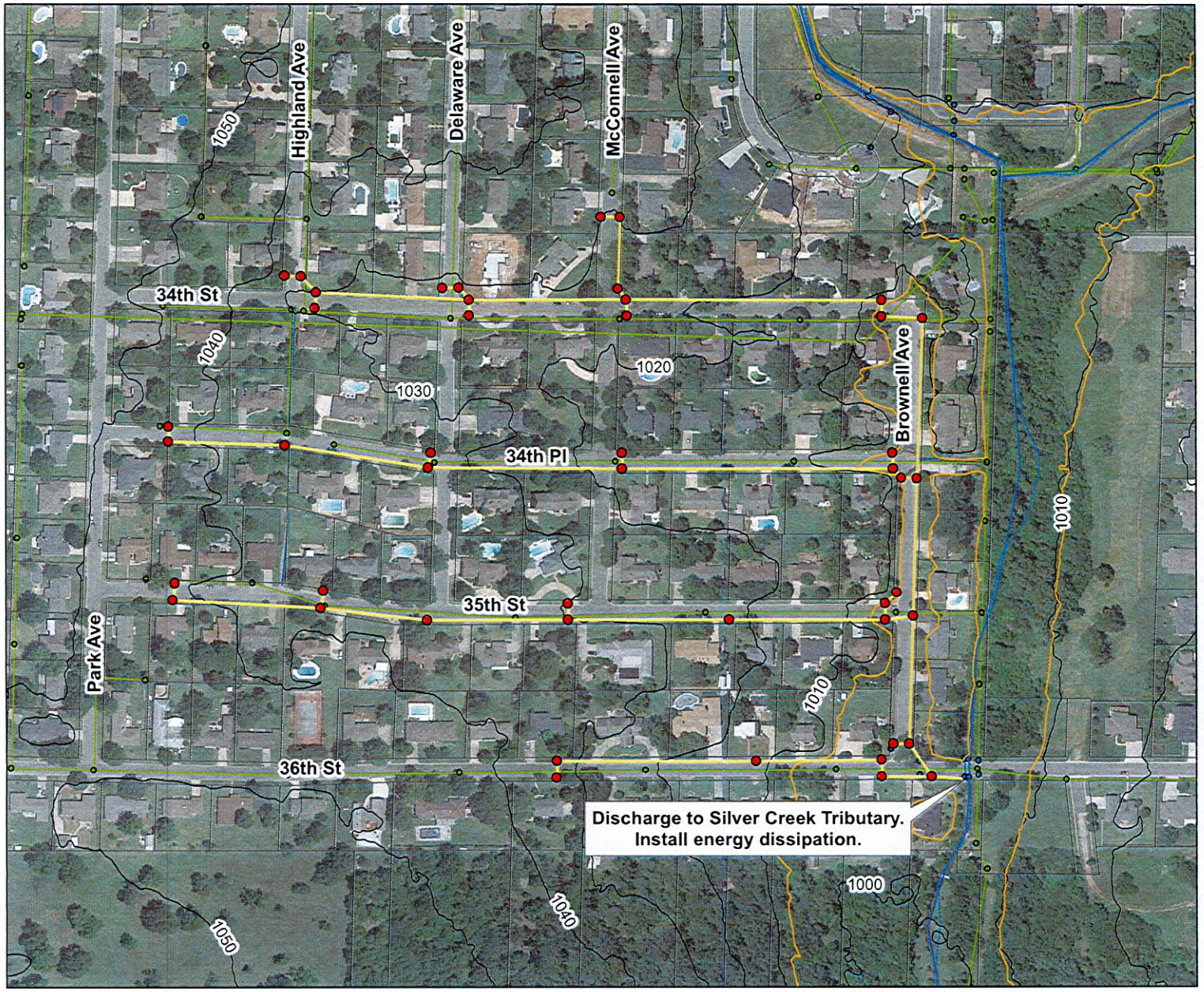
Recommended Improvements

Description: Installed storm sewer along 34th Street to 36th Street and Brownell Avenue will improve flooding from storm events 10-years or less. The storm sewer will discharge through a 6-foot by 4-foot box culvert into Silver Creek Tributary II just downstream of 36th Street culvert. During 10-year storm events, street flooding along Brownell Avenue from 34th Place to 36th Street will persist but in a reduced capacity due to backwater from the I-44 culvert for Silver Creek Tributary II. A potential solution to the headwater flooding is discussed in alternative solutions.

Permitting: Floodplain development permit for grading in the floodplain and a 404 nationwide permit.

Utility Relocations: The storm sewer layout seeks to avoid utilities as much as possible. Sanitary sewer lines along 34th Place and 35th Street travel down the middle of the street parallel to proposed storm sewer. Relocation of these sanitary sewer lines are possible. Water lines along 34th Street run parallel to proposed storm sewer and may need to be relocated. In addition, streetlight and gas conflicts do exist.

	Relocation during final design may be necessary to achieve the storm sewer design capacity.
ROW Acquisition:	The proposed storm sewer layout was identified to stay within existing right-of-way, where possible. Minor sections of additional right-of-way may be required and will be determined based on boundary survey and final design solutions.
Downstream Controls:	The 7-foot by 7-foot box culvert for Silver Creek Tributary II under I-44 is undersized. During a 10-year storm, ponding from the I-44 culvert floods 36th Street.
Alternative Solutions:	See I-44 Culvert Addition project.

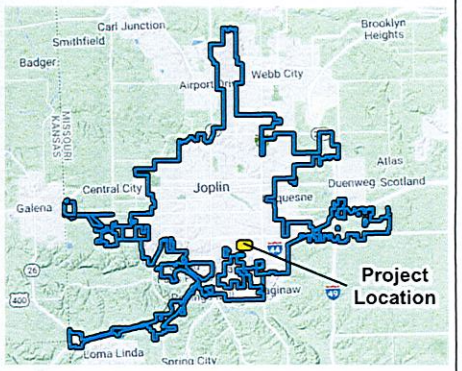


Sunnyvale (Lloyd Addition)

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Storm Inlets
- Proposed Storm Sewer
- Floodplain (eff. 11/01/2020)
- 10ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 100 200 400 Feet

1 inch = 200 feet

N

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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
Sunnyvale (Lloyd Addition)

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 50,000.00	$ 50,000.00
Erosion Control	LS	1	$ 20,000.00	$ 20,000.00
Demolition	LS	1	$ 50,000.00	$ 50,000.00
15" RCP	LF	470	$ 65.00	$ 30,550.00
18" RCP	LF	1895	$ 75.00	$ 142,125.00
24" RCP	LF	1338	$ 100.00	$ 133,800.00
36" RCP	LF	2272	$ 135.00	$ 306,720.00
48" RCP	LF	343	$ 155.00	$ 53,165.00
4' x 4' RCB	LF	333	$ 400.00	$ 133,200.00
6' x 4' RCB	LF	65	$ 500.00	$ 32,500.00
Type D Curb Inlet	EA	47	$ 3,300.00	$ 155,100.00
Concrete Wingwalls and Apron for 6' x 4' Box Culvert	EA	1	$ 5,000.00	$ 5,000.00
Pavement Repair	SY	3950	$ 55.00	$ 217,250.00
Curb & Gutter	LF	4960	$ 30.00	$ 148,800.00
Driveway Repair	SY	1070	$ 35.00	$ 37,450.00
Seeding	AC	1.1	$ 20,000.00	$ 22,000.00
			Subtotal	$ 1,537,660.00
			Utility Relocation (10%)	$ 153,770.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration (25%)	$ 384,420.00
			Right of Way (5%)	$ 76,880.00
			Construction Contingency (25%)	$ 384,420.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 2,537,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 3,410,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Silver Creek

Location: Sunnyvale (Lloyd Addition)

Description of Problem: Street and structure flooding

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30	3	3	10%	27
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10				
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20	3	3	50%	90
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				10
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						**127**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

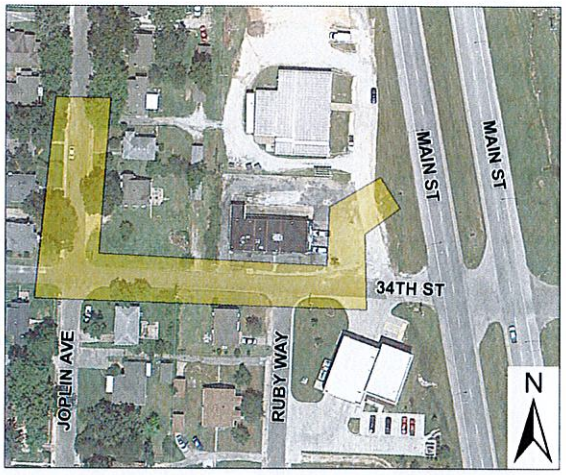
Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: 34th Street & Joplin Avenue

Project ID: 3-3



Pertinent Data Summary

Watershed: Water Works

Priority #: 17

Design Capacity: 27 cfs (100-year)

Estimated Cost: $291,000

Topographic (Section): 27N 33W Section 22

Existing Problem Description

Five properties have flooded along Joplin Avenue near the sump just north of 34th Street. The four curb inlets located in this sump are undersized and in poor condition. The pipe size these inlets discharge into is unknown. During heavy rains, the sump fills up and overflows down an alley way to the east. In 2019, the business downstream of the alley way reported structural flooding from a 25-year storm event. A sanitary sewer manhole is located in the middle of the four curb inlets.

Recommended Improvements

Description: Replace the four curb inlets at the sump. A 24-inch RCP would convey a 100-year storm event. The storm sewer will connect to an existing grate inlet in the parking lot of the convenience store located at the intersection of 34th Street and Main Street before discharging into the open channel along Main Street. If the existing storm sewer is adequately sized, only the curb inlets will need to be replaced.

Permitting: No permitting is anticipated

Utility Relocations: The storm sewer layout seeks to avoid utilities as much as possible. A sanitary sewer line is located near the curb inlets. Also, the proposed storm sewer crosses sanitary sewer, water, and gas lines on 34th Street. Sanitary sewer, gas, and water line depths are unknown and could reduce capacity of the proposed design or require relocation of sanitary sewer, gas, and water lines during final design.

ROW Acquisition: The proposed storm sewer and ditch layout was identified to stay within existing right-of-way, where possible. New right-of-way extents may be needed in the parking lot of the convenience store and will be determined based on boundary survey and final design solutions.



34th Street & Joplin Avenue

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Storm Inlets
- Proposed Storm Sewer
- 2ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 50 100 200 Feet

1 inch = 100 feet

N

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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
34th Street & Joplin Avenue

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 10,000.00	$ 10,000.00
Erosion Control	LS	1	$ 4,000.00	$ 4,000.00
Demolition	LS	1	$ 5,000.00	$ 5,000.00
15" RCP	LF	50	$ 65.00	$ 3,250.00
18" RCP	LF	20	$ 75.00	$ 1,500.00
24" RCP	LF	603	$ 100.00	$ 60,300.00
24" FES	EA	1	$ 1,250.00	$ 1,250.00
Type D Inlets	EA	4	$ 3,300.00	$ 13,200.00
Grate Inlet	EA	1	$ 3,300.00	$ 3,300.00
Junction Box	EA	2	$ 3,000.00	$ 6,000.00
Pavement Repair	SY	820	$ 55.00	$ 45,100.00
Curb & Gutter	LF	410	$ 30.00	$ 12,300.00
Driveway Repair	SY	5	$ 35.00	$ 180.00
Seeding	AC	0	$ 20,000.00	$ 2,000.00
Sidewalk	SY	70	$ 35.00	$ 2,450.00
			Subtotal	$ 169,830.00
			Utility Relocation (10%)	$ 16,980.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration	$ 45,000.00
			Right of Way (10%)	$ 16,980.00
			Construction Contingency (25%)	$ 42,460.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 291,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 391,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Water Works

Location: 34th Street & Joplin Avenue

Description of Problem: Street flooding

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30	1	0.5	100%	15
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10				
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20	2	1	100%	40
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						**55**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

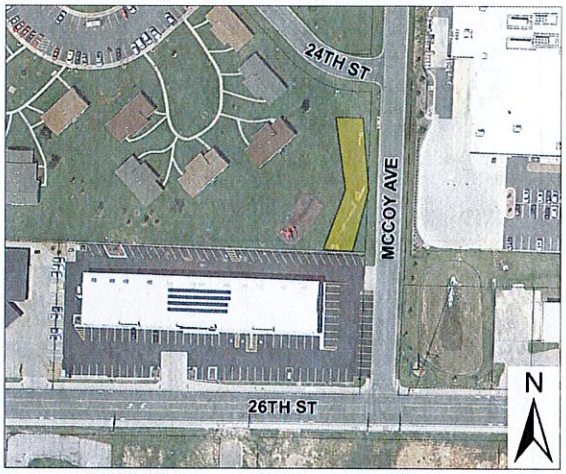
Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: 26th Street & McCoy Avenue

Project ID: 3-4



Pertinent Data Summary

Watershed: Water Works

Priority #: 18

Design Capacity: N/A

Estimated Cost: $110,000

Topographic (Section): 27N 33W Section 16

Existing Problem Description

A 60-inch RCP running south under 1701 West 26th Street is fed by an open channel which is fed by a 36-inch RCP and a 48-inch CMP. The 48-inch CMP has a discharge capacity of 83 cfs and is designed to convey the 25-year storm event. The 36-inch RCP has a discharge capacity of 69 cfs and is designed to convey the 10-year storm event. The 60-inch RCP is designed to convey the 100-year storm event but is not operating at full capacity due to the open channel upstream. A difference in grade between the culvert and channel flowline combined with a metal grate at the mouth of the 60-inch RCP is limiting the discharge capacity of the pipe. The loss in discharge capacity has caused more headwater upstream of the pipe, as well as localized flooding.

Recommended Improvements

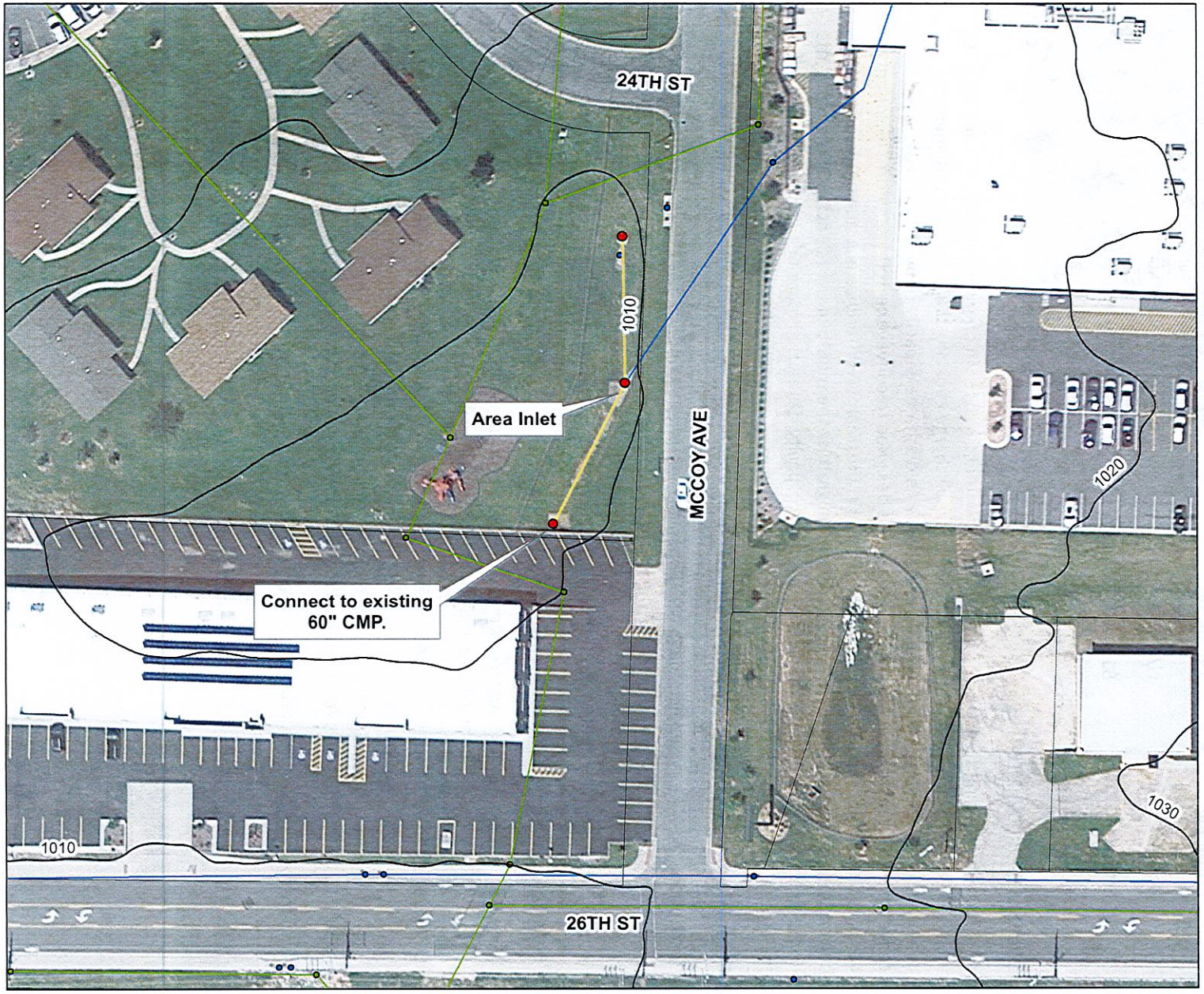
Description: Replace the existing open channel with an underground storm system. Extend the 60-inch RCP upstream and connect it with the 48-inch CMP. Extend the 36-inch RCP to the junction box for the 60-inch RCP and 48-CMP. Install an area inlet to drain the adjacent playground.

Permitting: No permitting is anticipated

Utility Relocations: The storm sewer layout seeks to avoid utilities as much as possible. No utility conflicts are anticipated for this project.

ROW Acquisition: The proposed storm sewer layout was identified to stay within existing right-of-way, where possible. It is unknown if there are existing easements for the open channel. If there are none, additional right-of-way will be required and will be determined based on boundary survey and final design solutions.

Downstream Controls: The proposed underground system will connect to the existing storm sewer system.



26th Street & McCoy Avenue

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Storm Inlets
- Proposed Storm Sewer
- 10ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 25 50 100 Feet

1 inch = 50 feet

N

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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
26th Street & McCoy Avenue

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 5,000.00	$ 5,000.00
Erosion Control	LS	1	$ 1,000.00	$ 1,000.00
Demolition	LS	1	$ 1,500.00	$ 1,500.00
36" RCP	LF	84	$ 135.00	$ 11,340.00
60" RCP	LF	78	$ 190.00	$ 14,820.00
Junction Box	EA	2	$ 3,000.00	$ 6,000.00
Area Inlet	EA	1	$ 4,000.00	$ 4,000.00
Seeding	AC	0.20	$ 20,000.00	$ 4,000.00
Fill	CY	1000	$ 15.00	$ 15,000.00
			Subtotal	$ 62,660.00
			Utility Relocation	$ -
			Survey, Engineering, Permitting, Construction Observation, Construction Administration	$ 25,000.00
			Right of Way (10%)	$ 6,270.00
			Construction Contingency (25%)	$ 15,670.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 110,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 148,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Water Works

Location: 26th Street & McCoy Avenue

Description of Problem: Storm sewer extension

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10	3		100%	30
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20				
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						**30**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

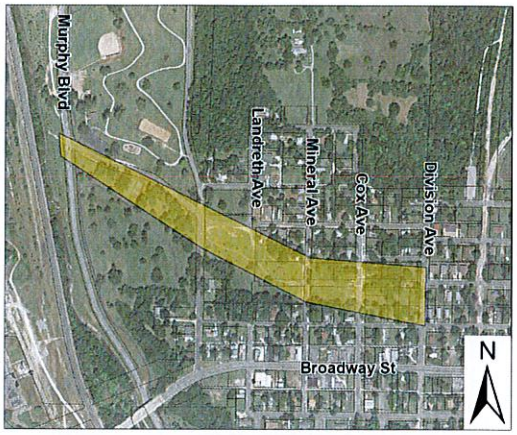
Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: East Town

Project ID: 7-4



Pertinent Data Summary

Watershed: Joplin Creek East

Priority #: 19

Design Capacity: 365-405 cfs (25-50-year, RBC) 130 cfs (10-year, 42" RCP)

Estimated Cost: $1,216,000

Topographic (Section): 27N 33W Section 2

Existing Problem Description

Two properties flood along the drainage ditch which starts at the intersection of Valley Street and Division Avenue. Extensive storm sewer conveys over 80 acres to the ditch located at the intersection of Valley Street and Division Avenue. Three culverts discharge into the ditch. The culvert coming from the northeast is undersized and can only convey a 2-year storm event. The other culverts are able to convey a 50-year storm event. The downstream ditch is undersized and begins to flood the structure at this intersection in less than a 2-year storm events. Nuisance flooding occurs along the ditch until it reaches Joplin Creek East. The culverts from Cox Avenue to Murphy Boulevard are undersized and can only convey a 2-year storm event before flooding the street. The undersized culvert for Mineral Avenue floods the structure on the west side of Mineral Avenue during 10-year storm events or greater. No other structure floods because several structures have been removed and park property is located along the drainage ditch from Mineral Avenue until it discharges into Joplin Creek East. The culvert at Murphy Boulevard discharges into the floodplain

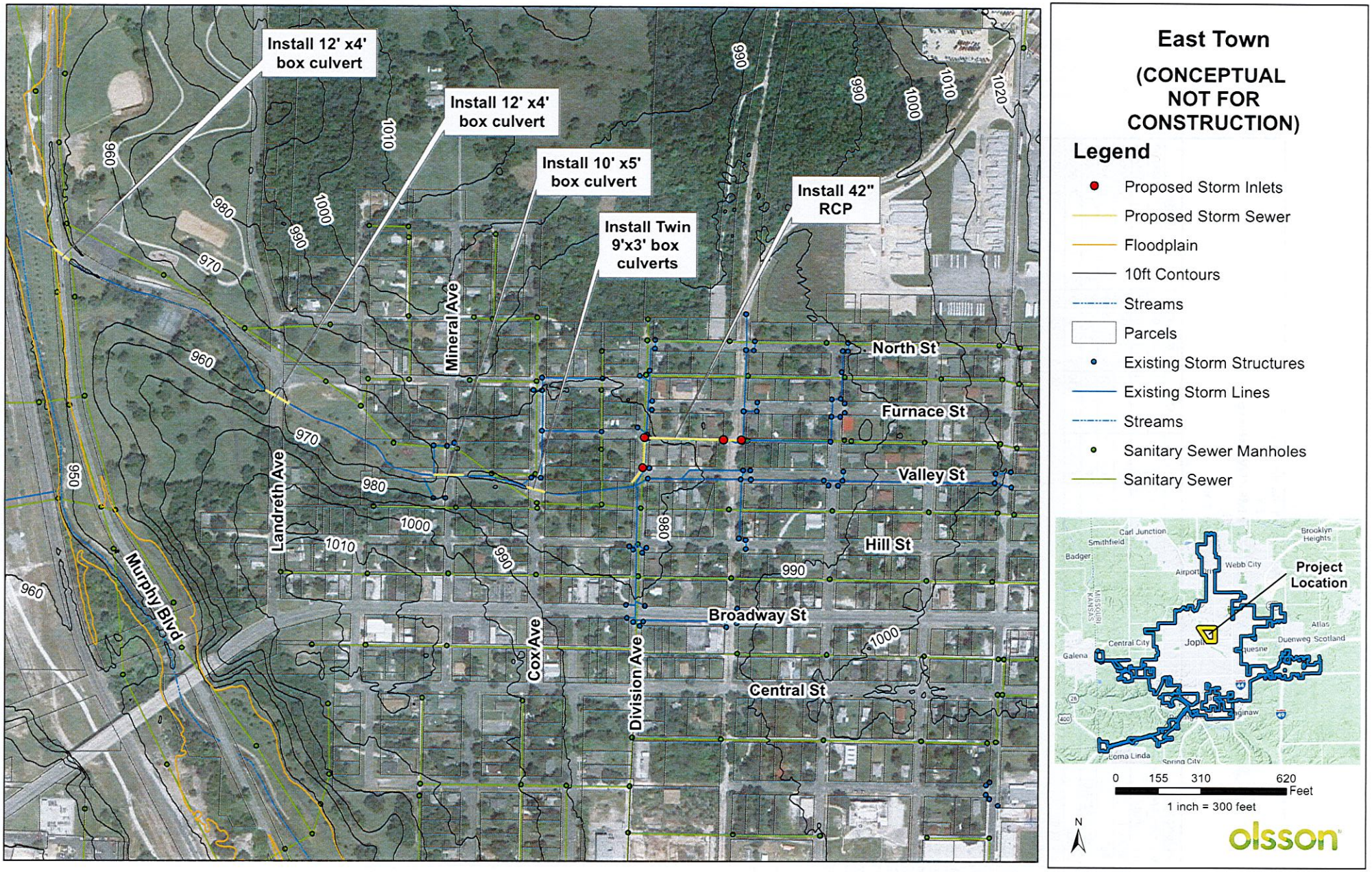
Recommended Improvements

Description: Improve the ditch between Division and Cox Avenue. A trapezoidal channel with a 15-foot bottom width, depth of 4 feet, and 3:1 side slope will convey a 100-year storm event with 1-foot of freeboard per City of Joplin requirements. Install twin 9-foot by 3-foot box culverts under Cox Avenue. Install a 10-foot by 5-foot box culvert under Mineral Avenue. Install a 12-foot by 4-foot box culvert under Landreth Avenue and Murphy Boulevard. All of these culverts will convey a 25 – 50-year storm event.

Permitting: A section 404 nationwide permit and floodplain development permit are anticipated.

Utility Relocations: Water and gas lines intersect Cox, Mineral, and Landreth Avenue culverts. Also, there is one sanitary sewer crossing in the ditch between Division and Cox Avenues. Sanitary sewer, water and gas line depths are unknown and could limit the proposed design or require relocation of lines during final design.

ROW Acquisition:	Right-of -way acquisition of the property that floods at the intersection of Valley Street and Division Avenue will be required. No other right-of-way acquisition is anticipated.
Downstream Controls:	Joplin Creek East is 120 feet downstream of Murphy Boulevard culvert.
Alternative Solutions:	Ditch improvements between Division and Cox Avenues might be more expensive than buying out the property at the intersection of Valley Street and Division Avenue. Purchasing this property might be a more cost-effective option.



East Town

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Storm Inlets
- Proposed Storm Sewer
- Floodplain
- 10ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Streams
- Sanitary Sewer Manholes
- Sanitary Sewer

0 155 310 620 Feet

1 inch = 300 feet

N

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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
East Town

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 40,000.00	$ 40,000.00
Erosion Control	LS	1	$ 15,000.00	$ 15,000.00
Demolition	LS	1	$ 20,000.00	$ 20,000.00
42" RCP	LF	465	$ 145.00	$ 67,430.00
Jack & Bore 42" RCP	LF	65	$ 1,750.00	$ 113,750.00
9' x 3' RCB	LF	130	$ 600.00	$ 78,000.00
10' x 5' RCB	LF	106	$ 750.00	$ 79,500.00
12' x 4' RCB	LF	163	$ 800.00	$ 130,400.00
42" FES	EA	1	$ 2,100.00	$ 2,100.00
Concrete Wingwalls and Apron for Twin 9' x 3' Box Culvert	EA	2	$ 10,000.00	$ 20,000.00
Concrete Wingwalls and Apron for 10' x 5' Box Culvert	EA	2	$ 10,000.00	$ 20,000.00
Concrete Wingwalls and Apron for 12' x 4' Box Culvert	EA	4	$ 10,000.00	$ 40,000.00
Curb & Gutter	LF	254	$ 30.00	$ 7,620.00
Pavement Repair	SY	476	$ 55.00	$ 26,200.00
Sidewalk Repair	SY	7	$ 35.00	$ 250.00
Seeding	AC	0.27	$ 20,000.00	$ 5,330.00
Fence	LF	280.00	$ 35.00	$ 9,800.00
			Subtotal	$ 675,380.00
			Utility Relocation (10%)	$ 67,540.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration (25%)	$ 168,850.00
			Right of Way (20%)	$ 135,080.00
			Construction Contingency (25%)	$ 168,850.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 1,216,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 1,634,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Joplin Creek East

Location: East Town

Description of Problem: Undersized culverts

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20	3	0.5	100%	30
4	Nuisance flooding of yards	2,3	10				
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20	3	1	100%	60
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						**90**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

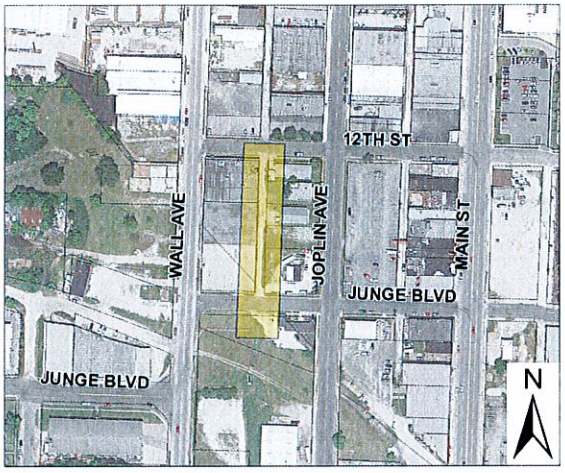
Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	Y
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: 12th Street & Wall Avenue

Project ID: 6-5



Pertinent Data Summary

Watershed: Joplin Creek West

Priority #: 20

Design Capacity: N/A

Estimated Cost: $352,000

Topographic (Section): 28N 33W Section 10

Existing Problem Description

The 12th Street and Wall Avenue box culvert is aged and has deteriorated to the point it needs remediation. The existing culvert is a 6-foot by 4-foot reinforced box culvert. It is located just east of Wall Avenue in the alley way between 12th Street and Junge Boulevard. Remediation will require either rehabilitation or replacement. If the box culvert collapsed, it could cause flooding for more than five properties along with safety and potential damage to adjacent buildings. The alley way where the box culvert is located is a utility corridor for sanitary sewer and overhead electric.

Recommended Improvements

Description:	The first step is to determine whether remediation or replacement is the best option. The estimate for this project is based on prices to replace the existing box culvert with identical size. The proximity of existing buildings to the alley way will be a challenge for either remediation or replacement.
Permitting:	No permitting is anticipated
Utility Relocations:	Conflicts with overhead electric do exist. A sanitary sewer line runs parallel to the culvert to the east.
ROW Acquisition:	No right-of-way besides temporary construction easements are anticipated.
Downstream Controls:	The culvert connects to an 8-foot by 4-foot box culvert. This box culvert flows north.

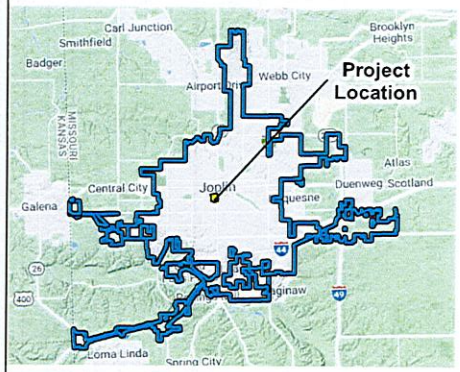


12th Street & Wall Avenue

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Storm Sewer
- 2ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 50 100 200 Feet

1 inch = 100 feet

N

olsson

olsson

Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
12th Street & Wall Avenue

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 15,000.00	$ 15,000.00
Erosion Control	LS	1	$ 5,000.00	$ 5,000.00
Demolition	LS	1	$ 10,000.00	$ 10,000.00
6' x 4' RCB	LF	326	$ 500.00	$ 163,000.00
Concrete Wingwalls and Apron for 6' x 4' Box Culvert	EA	1	$ 5,000.00	$ 5,000.00
Pavement Repair	SY	125	$ 55.00	$ 6,880.00
Curb & Gutter	LF	20	$ 30.00	$ 600.00
Gravel	SY	460	$ 15.00	$ 6,900.00
Seeding	AC	0.05	$ 20,000.00	$ 1,000.00
			Subtotal	$ 213,380.00
			Utility Relocation (10%)	$ 21,340.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration (25%)	$ 53,350.00
			Right of Way (5%)	$ 10,670.00
			Construction Contingency (25%)	$ 53,350.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 352,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 473,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Joplin Creek West

Location: 12th Street & Wall Avenue

Description of Problem: Failing storm sewer

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10				
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20				
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10	4		100%	40
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						**40**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: Massachusetts Avenue & Murphy Boulevard

Project ID: 7-3



Pertinent Data Summary

Watershed: Joplin Creek East

Priority #: 21

Design Capacity: N/A

Estimated Cost: $967,000

Topographic (Section): 27N 33W Section 11

Existing Problem Description

Seven properties have reported nuisance flooding along Massachusetts Avenue from Joplin Creek. The creek is located to the west behind the houses on Massachusetts Avenue. Nuisance flooding has been limited to City of Joplin property on Parr Hill Park. No structural flooding has been reported by any residents. Heavy rain events cause nuisance flooding along Joplin Creek. The highwater table exacerbates and extends the effects in the overbank flooding for extended periods of time. Also, the streambank has deteriorated and needs stabilization.

Recommended Improvements

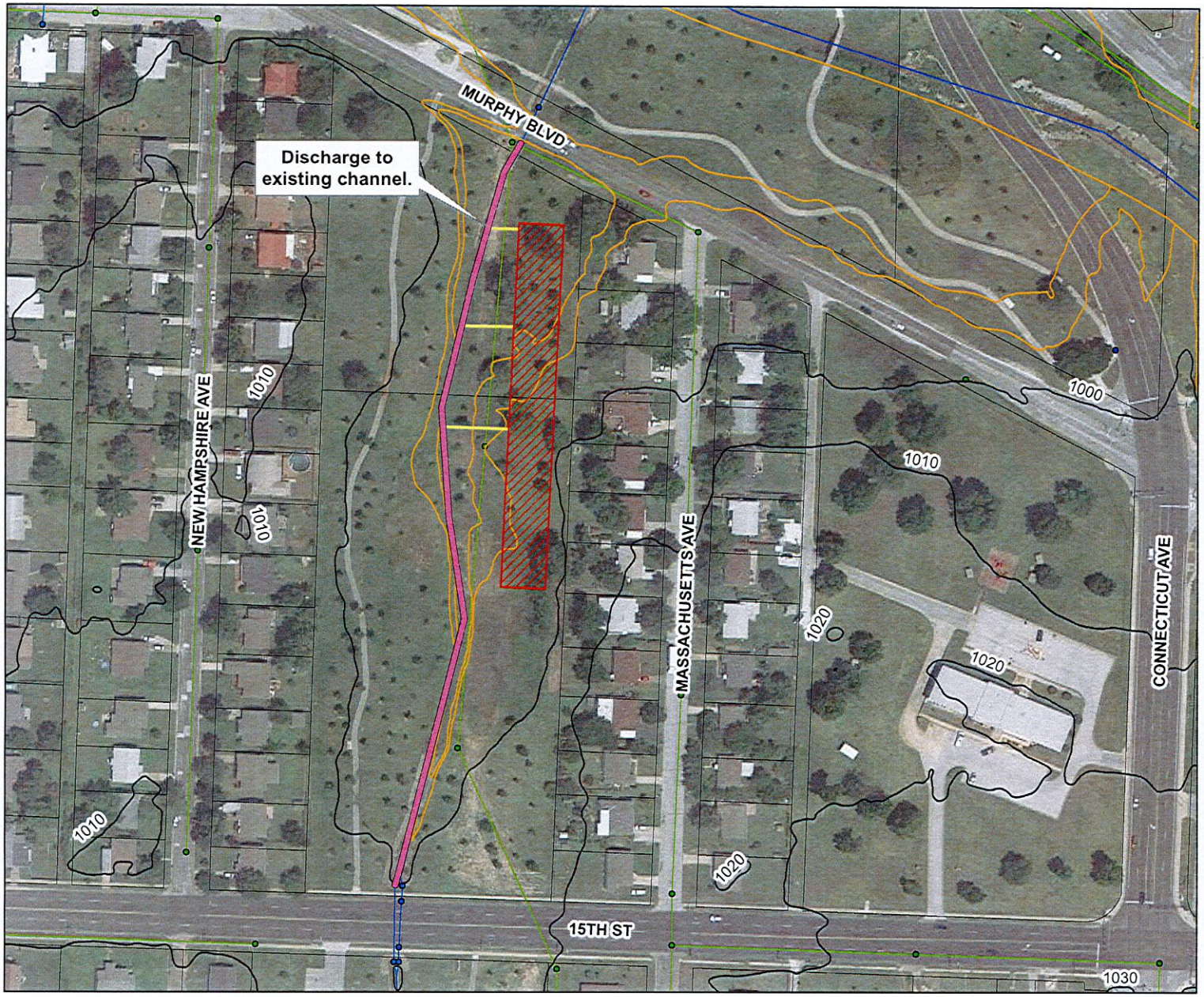
Description: Restore the channel from 15th Street to Murphy Boulevard to bring a natural stream alignment and restore vegetation along the streambank. Install French drains and a geotextile cellular confinement in the east overbank to stabilize the soil and reduce nuisance groundwater.

Permitting: Floodplain development permit for grading in the floodplain and a 404 nationwide permit.

Utility Relocations: One sanitary sewer line runs parallel to Joplin Creek in the overbank. Sanitary sewer depths are unknown and could limit the proposed design or require relocation of sanitary sewer lines during final design.

ROW Acquisition: No right-of-way acquisition is anticipated. The improvements will stay within existing right-of-way with Parr Hill Park.

Downstream Controls: The project is located in the floodplain. Downstream control is the Murphy Boulevard culvert.

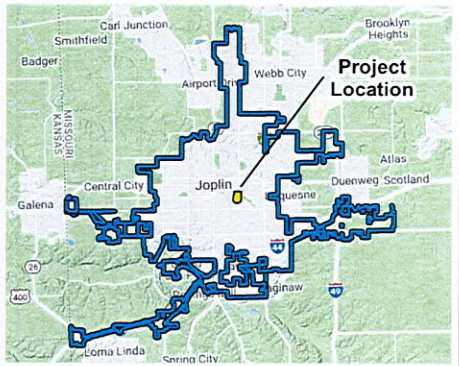


Massachusetts Avenue & Murphy Boulevard

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Channel Stabilization
- Proposed Soil Stabilization
- Proposed Storm Sewer
- Floodplain
- 10ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 75 150 300 Feet

1 inch = 125 feet

N

olsson

Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
Massachusetts Avenue & Murphy Boulevard

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 35,000.00	$ 35,000.00
Erosion Control	LS	1	$ 15,000.00	$ 15,000.00
Demolition	LS	1	$ 20,000.00	$ 20,000.00
Cellular Confinement Geotextile and French Drains	SY	3406	$ 65.00	$ 221,397.22
Channel Stabilization	LF	1009	$ 300.00	$ 302,700.00
Native Plants	LS	1	$ 30,000.00	$ 30,000.00
			Subtotal	$ 624,097.22
			Utility Relocation (5%)	$ 31,200.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration (25%)	$ 156,020.00
			Right of Way	$ -
			Construction Contingency (25%)	$ 156,020.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 967,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 1,300,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Joplin Creek East

Location: Massachusetts Avenue & Murphy Boulevard

Description of Problem: Streambank restoration & nuisance flooding

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10	3		100%	30
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20				
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				10
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10			100%	
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				20
	Project Total Benefit Points						**60**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	Y

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: Garvin Park Ditch

Project ID: 3-2



Pertinent Data Summary

Watershed: Water Works

Priority #: 22

Design Capacity: 325 cfs (50-year)

Estimated Cost: $379,000

Topographic (Section): 27N 33W Section 14

Existing Problem Description

An existing open channel with steep side slopes and rough concrete cuts diagonally through Garvin Park, causing a hazard for citizens using the park. The open channel divides several main features of the park and causes citizens to either cross the existing bridge spanning the middle of the channel or cross the channel itself and put their safety at risk. Park staff must also regularly maintain the open channel to ensure optimal performance and safety of the channel.

Recommended Improvements

Description: Replace the existing channel with an 8-foot by 5-foot reinforced concrete box culvert. The buried box culvert will eliminate the current risks that are present due to the open channel. A buried system will also connect all the features for the park, providing more open space for citizens to enjoy or for the construction of future park features. Less maintenance will also be required by Park staff. Park funds may be used for this improvement.

Permitting: Jurisdictional determination is needed to determine if a 404 permit is needed.

Utility Relocations: Utility impacts should be minimal since the alignment will follow the existing open channel. The light near the middle of the ditch will need to be removed and replace upon completion of the stormwater improvements.

ROW Acquisition: The proposed storm sewer layout was identified to stay within the park limits, where possible. No right of way acquisition is anticipated for this project.

Downstream Controls: The proposed RCB will discharge into the existing storm sewer system of the same box size.

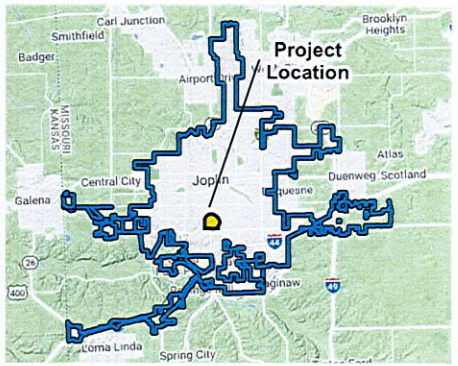


Garvin Park Ditch

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Storm Sewer
- 2ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 25 50 100 Feet

1 inch = 50 feet

N

olsson

Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
Garvin Park Ditch

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 15,000.00	$ 15,000.00
Erosion Control	LS	1	$ 5,000.00	$ 5,000.00
Demolition	LS	1	$ 10,000.00	$ 10,000.00
8' x 5' RCB	LF	326	$ 650.00	$ 211,900.00
Seeding	AC	0.18	$ 20,000.00	$ 3,600.00
			Subtotal	$ 245,500.00
			Utility Relocation (5%)	$ 12,280.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration	$ 60,000.00
			Right of Way	$ -
			Construction Contingency (25%)	$ 61,380.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 379,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 509,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Water Works

Location: Garvin Park Ditch

Description of Problem: Storm sewer extension

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10				
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20				
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5	3		100%	15
14	Recreation benefit		20				20
	Project Total Benefit Points						**35**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	Y
Aesthetics	Y

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: Cleveland Court

Project ID: 5-2



Pertinent Data Summary

Watershed: Country Club

Priority #: 23

Design Capacity: N/A

Estimated Cost: $1,061,000

Topographic (Section): 27N 33W Section 08

Existing Problem Description

More than 12 properties have experienced nuisance flooding from the ditch east of Cleveland Court north of 20th Street and from the unimproved ditch which is north of Cleveland Court and west of Schifferdecker Avenue. The unimproved ditch is an unnamed tributary for Short Creek. The reason for the flooding issues for the ditch east of Cleveland Court is because the channel is not well defined and meanders across properties with fences. For this reason, the capacity of the ditch is unknown. The drainage area is nearly 9 acres. The unnamed tributary for Short Creek has a capacity of a 25-year storm event with no freeboard. The existing channel is well defined but has thick vegetation. The slope of this channel is only 0.3 percent. The drainage area is 670 acres. The section of the creek is located in the floodplain.

Recommended Improvements

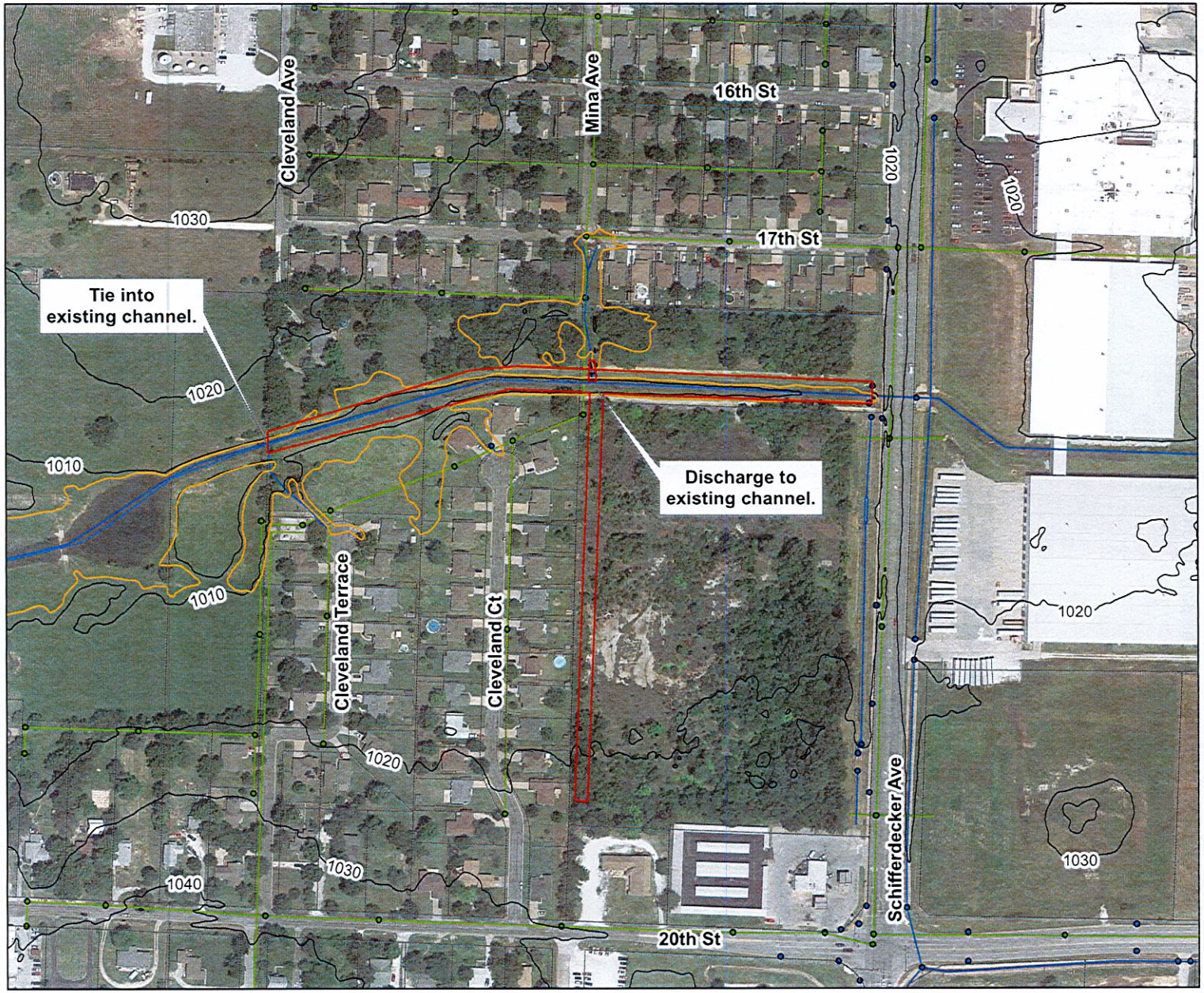
Description: Dig a trapezoidal drainage ditch east of Cleveland Court behind the residential properties with a 7.5-foot bottom width, depth of 2 feet, and 4:1 side slope. The capacity of the proposed ditch will be a 100-year storm event with 1-foot of freeboard. For the unnamed tributary for Short Creek, replace the existing channel with a concrete channel. This ditch will convey a 100-year storm with 1-foot of freeboard.

Permitting: Floodplain development permit for grading in the floodplain and a 404 nationwide permit.

Utility Relocations: The drainage ditch layout seeks to avoid utilities as much as possible. A sanitary sewer line crosses the unnamed tributary for Short Creek just south of Mina Avenue. Overhead electric also exists near the proposed ditch east of Cleveland Court. Sanitary sewer depths are unknown and could reduce capacity of the proposed design or require relocation of overhead electric and sanitary sewer lines during final design

ROW Acquisition: The proposed ditch layouts was identified to stay within existing right-of-way, where possible. Additional right-of-way may be required particularly for the

	ditch east of Cleveland Court and will be determined based on boundary survey and final design solutions.
Downstream Controls:	Downstream of the drainage ditch is Short Creek. Tailwater from Short Creek will impact capacities of each proposed ditch.
Alternative Solutions:	The drainage ditch for the unnamed tributary for Short Creek could be constructed as a natural channel. The bottom width of the trapezoidal channel would need to be 60 feet with 4:1 side slope. Depth would be 5.5 feet. The capacity of the proposed ditch is a 100-year storm event with 1-foot of freeboard.

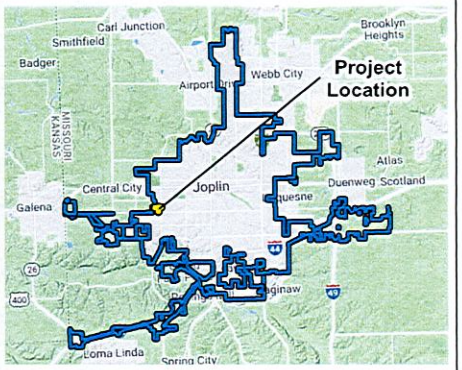


Cleveland Court

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Ditch
- Floodplain
- 10ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 100 200 400 Feet

1 inch = 200 feet

N

olsson

olsson

Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
Cleveland Court

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 25,000.00	$ 25,000.00
Erosion Control	LS	1	$ 10,000.00	$ 10,000.00
Demolition	LS	1	$ 15,000.00	$ 15,000.00
Concrete Channel	LF	1294	$ 330.00	$ 427,020.00
Excavation (Trapezoidal Channel)	LF	860	$ 150.00	$ 129,000.00
			Subtotal	$ 606,020.00
			Utility Relocation (10%)	$ 60,600.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration (25%)	$ 151,510.00
			Right of Way (15%)	$ 90,900.00
			Construction Contingency (25%)	$ 151,510.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 1,061,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 1,426,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Country Club

Location: Cleveland Court

Description of Problem: Streambank restoration & structure flooding

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10	3		100%	30
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20	1	1	100%	20
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						**50**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

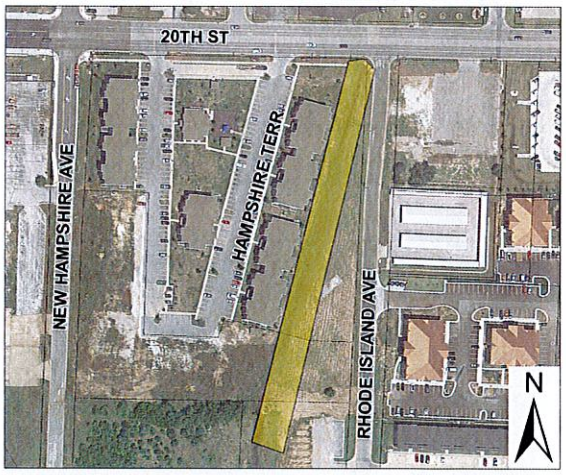
Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: 20th Street & Rhode Island Avenue

Project ID: 7-7



Pertinent Data Summary

Watershed: Joplin Creek East

Priority #: 24

Design Capacity: 475 cfs (100-year)

Estimated Cost: $527,000

Topographic (Section): 27N 33W Section 11 & 14

Existing Problem Description

Two properties have flooded along the ditch west of Rhode Island Avenue south of 20th Street. Due to increased sedimentation and development in the 280-acre watershed, capacity of the ditch has decreased to a 10-year storm event. The culverts downstream of the ditch at 20th Street were recently re-built. Three 8-foot by 3-foot box culverts were constructed. The third barrel (west culvert) is intentionally obstructed by concrete since right-of-way could not be acquired downstream of 20th Street. The capacity of the existing twin box culverts is a 25-year storm event.

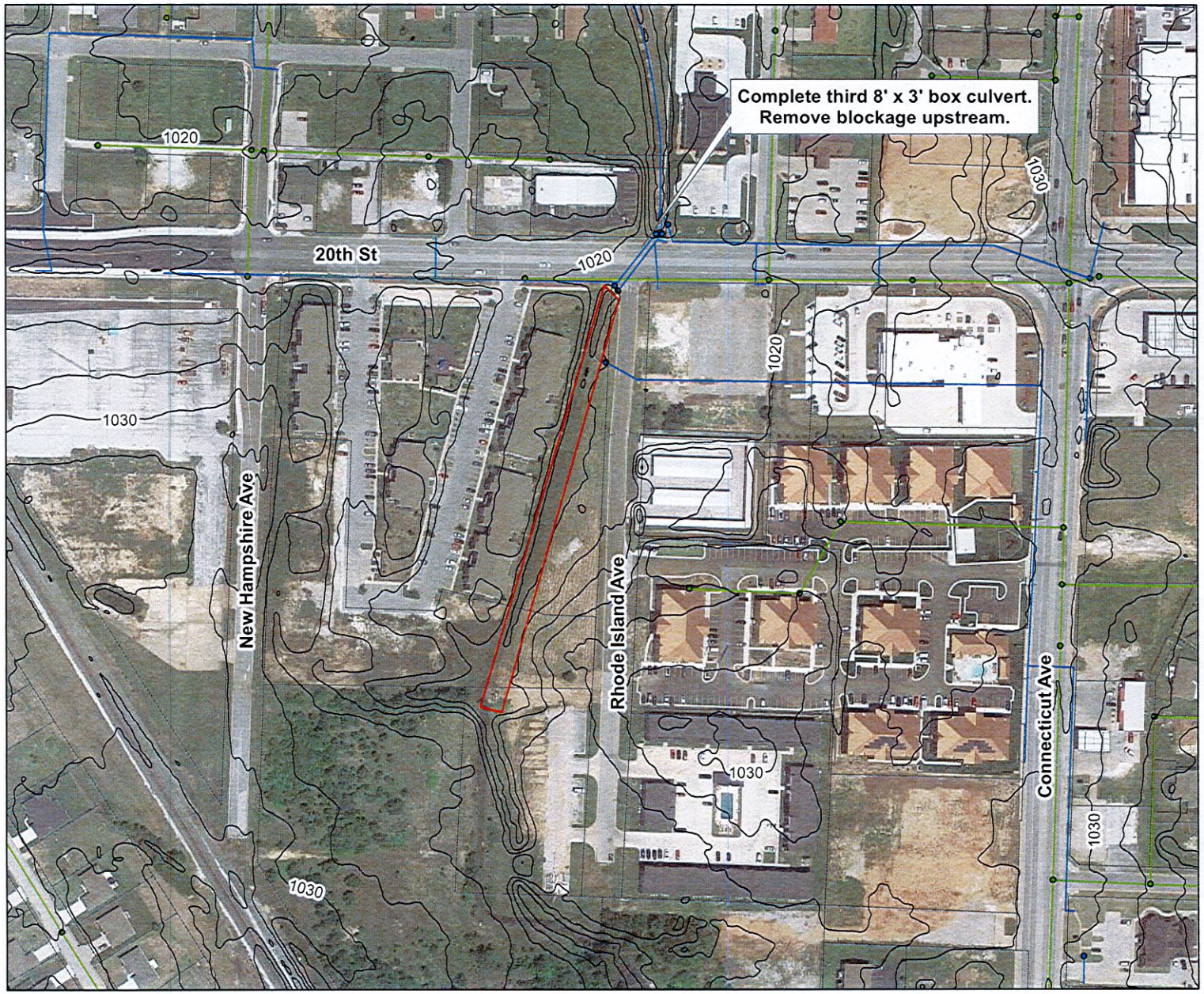
Recommended Improvements

Description: Improve the ditch on the west side of Rhode Island by installing a concrete channel. A trapezoidal channel with a 10-foot bottom width, depth of 4 feet, and 5:1 side slope will convey a 100-year storm event with 1-foot of freeboard per City of Joplin requirements. Remove the concrete obstructions for the third box culvert and complete construction of the third culvert cell. The culvert will convey a 100-year storm event without overtopping.

Permitting: A 404 nationwide permit might be needed. A jurisdictional determination will be needed.

Utility Relocations: The storm sewer and ditch layout seek to avoid utilities as much as possible. The downstream culvert crosses a water line. A sanitary line crosses near the upstream culvert but no excavation is expected to remove the blockage from the third culvert cell. Sanitary sewer and water line depths are unknown and could reduce capacity of the proposed design or require relocation of sanitary sewer and water lines during final design.

ROW Acquisition: Acquisition of right-of-way downstream of 20th Street will be needed to utilize the third box culvert. Also, it is unknown if there are existing easements for the existing channel. If none exist, additional right-of-way will be needed. New right-of-way extents will be determined based on boundary survey and final design solutions.

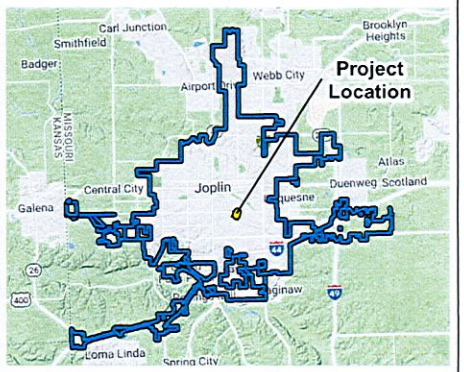


20th Street & Rhode Island Avenue

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Channel Improvements
- 2ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 75 150 300 Feet

1 inch = 150 feet

N

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Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
20th Street & Rhode Island Avenue

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 15,000.00	$ 15,000.00
Erosion Control	LS	1	$ 10,000.00	$ 10,000.00
Demolition	LS	1	$ 10,000.00	$ 10,000.00
8' x 3' RCB	LF	20	$ 550.00	$ 11,000.00
Concrete Wingwalls and Apron for 8' x 3' Box Culvert	EA	1	$ 5,000.00	$ 5,000.00
Excavation	CY	700	$ 20.00	$ 14,000.00
Concrete Channel	LF	700	$ 350.00	$ 245,000.00
			Subtotal	$ 310,000.00
			Utility Relocation (10%)	$ 31,000.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration (25%)	$ 77,500.00
			Right of Way (10%)	$ 31,000.00
			Construction Contingency (25%)	$ 77,500.00
			2021 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 527,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 708,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Joplin Creek East

Location: 20th Street & Rhode Island Avenue

Description of Problem: Undersized ditch and culvert expansion

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10	3		100%	30
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
6	Flooding of collector street of more than 7 inches	5,7,8	25				
7	Flooding of residential street of more than 7 inches	5,6,8	20				
8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						**30**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

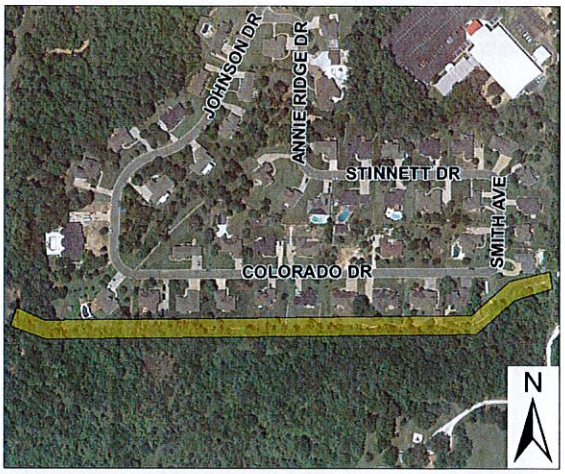
Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
2,3	No. of buildings flooded historically or by 100-year design storm	0.5/bldg
5,6,7,8	Restricts emergency vehicles	1.5
5,6,7,8	Flooding of street between 1-3 feet	2
5,6,7,8	Flooding of street more than 3 feet	3
9	Nuisance erosion creates maintenance problems	1
9	Moderate erosion, failure of structure or facility within next 5 years possible	2
9	Severe erosion, failure of structure or facility imminent	3
11	Collapse causes flooding of land by 100-year design storm	1
11	Collapse causes flooding of garages/outbuildings by 100-year design storm	1.5
11	Collapse causes 1-3 habitable buildings to be flooded	2
11	Collapse causes 4-6 habitable buildings to be flooded	3
11	Collapse causes more than 6 habitable buildings to be flooded	4

Project Name: Colorado Drive

Project ID: 1-3



Pertinent Data Summary

Watershed: Silver Creek

Priority #: 25

Design Capacity: 235 cfs (100-year, Ditch)

Estimated Cost: $998,000

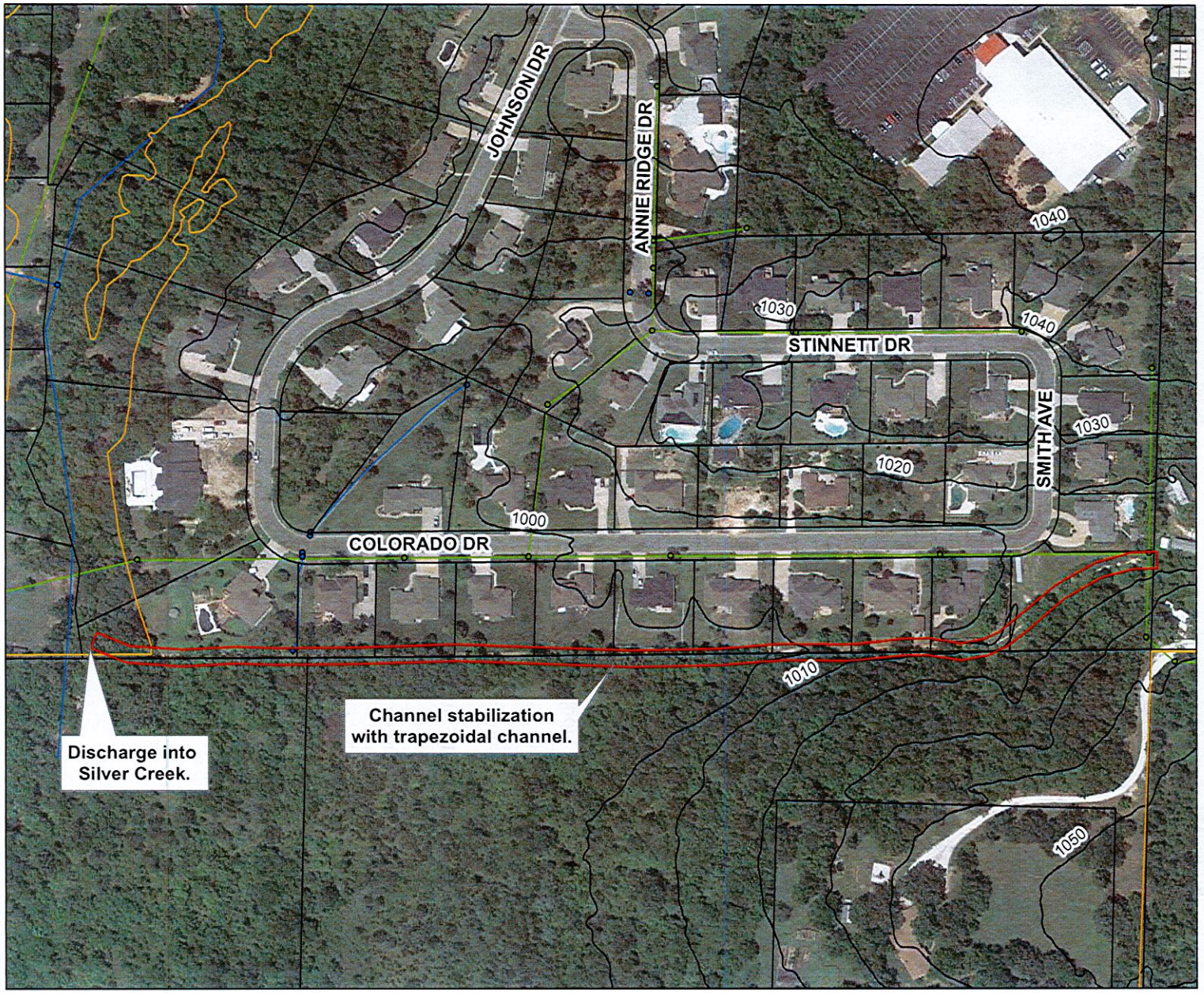
Topographic (Section): 27N 33W Section 25

Existing Problem Description

An unimproved open channel runs east to west behind 10 properties just south of Colorado Drive. The amount of area draining to this ditch is approximately 64 acres with a peak 100-year storm event of around 235 cfs. The open channel discharges into Silver Creek. No structural flooding has been reported by residents along Colorado Drive, however, scouring and erosion of property during heavy rain events has been reported. There is potential for structural damage in the future if the channel is not stabilized.

Recommended Improvements

Description:	Stabilize the existing open channel that runs behind the 10 properties along Colorado Drive to mitigate further erosion and property damage. The channel will have a bottom width of 8 feet with 3:1 side slope. The depth of the channel will be 3 feet with an average channel slope of 3 percent. The capacity of the channel will be a 100-year storm event with 1-foot of freeboard.
Permitting:	Jurisdictional determination is needed to determine if a 404 permit is needed. Floodplain development permit for grading in the floodplain
Utility Relocations:	The storm sewer layout seeks to avoid utilities as much as possible. No utility conflicts are anticipated for this project.
ROW Acquisition:	It is unknown if there are existing easements for the open channel. If there are none, additional right-of-way will be required and will be determined based on boundary survey and final design solutions.
Downstream Controls:	The proposed improved channel will discharge into Silver Creek.



Colorado Drive

(CONCEPTUAL NOT FOR CONSTRUCTION)

Legend

- Proposed Channel Improvements
- Floodplain
- 10ft Contours
- Streams
- Parcels
- Existing Storm Structures
- Existing Storm Lines
- Sanitary Sewer Manholes
- Sanitary Sewer



0 75 150 300 Feet

1 inch = 150 feet

N

olsson

olsson

Opinion of Probable Costs
for
STORMWATER IMPROVEMENTS
for
Colorado Drive

Description	Unit	Qty	Unit Price	Extension
Mobilization and Bonds	LS	1	$ 35,000.00	$ 35,000.00
Erosion Control	LS	1	$ 15,000.00	$ 15,000.00
Demolition	LS	1	$ 20,000.00	$ 20,000.00
Channel Stabilization	LF	1723	$ 300.00	$ 516,900.00
			Subtotal	$ 586,900.00
			Utility Relocation (10%)	$ 58,690.00
			Survey, Engineering, Permitting, Construction Observation, Construction Administration (25%)	$ 146,730.00
			Right of Way (10%)	$ 58,690.00
			Construction Contingency (25%)	$ 146,730.00
			2021TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 998,000.00**
			2031 TOTAL OPINION OF PROBABLE CONSTRUCTION COST	**$ 1,341,000.00**

Stormwater Management Plan
Project Rating Table

City of Joplin, MO Basin & Watershed: Silver Creek

Location: Colorado Drive

Description of Problem: Streambank restoration

Project Benefit Rating

Factor #	Description of Problems Addressed by Project	Eliminates Factor	Rating Points	Frequency Multiplier	Severity Multiplier	% Resolved by Project*	Total Points
1	Loss of Life		40				
2	Flooding of habitable building	3,4	30				
3	Flooding of garages and outbuildings	2,4	20				
4	Nuisance flooding of yards	2,3	10				
5	Flooding of arterial street of more than 7 inches	6,7,8	30				
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8	Widespread or long-term ponding in streets	5,6,7	20				
9	Erosion threatens habitable buildings, utilities, streets, bridges	10	30				
10	Erosion to streambank/backyard	9	10				10
11	Erosion causes failure of drainage structure		10				
12	System condition rated "Poor"	13	10				
13	System condition rated "Fair"	12	5				
14	Recreation benefit		20				
	Project Total Benefit Points						**10**

** % flood or erosion reduction achieved based on # structures removed or % of necessary base flood level reduction; 100% if meets City of Joplin design requirements*

Applies to #	Frequency Multiplier	Multiplier Value
2-8	One time in ten years or by 10- to 100-year design storm	1
2-8	Two times in ten years or by 5- to 10-year design storm	2
2-8	Three or more times in 10 years or less than under 5-year design	3
12,13	One multiplier point per 100' of system replaced	1

Other Factors	Y or N?
Benefits other infr.	N
Outside cost support	N
Regional benefits	N
Aesthetics	N

Applies to #	Severity Description	Multiplier Value
1	Number of known deaths *=1 for each death	8
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