

**HAZARD MITIGATION PROPOSAL**

DISASTER	APPLICANT	PROJ / PW	FIPS NO.	CATEGORY
DR-4332 TX	San Augustine, City of	34081/	405-65024-00	C

**Project #34081 references the following 4 DI's**

A)	DI 49637	Golden Way Street	GPS: 31.532843, -94.112619
B)	DI 49638	Milam Street	GPS: 31.541501, -94.102701
C)	DI 49639	Bierhalter Street	GPS: 31.536828, -94.107356
D)	DI 49640	Park Street	GPS: 31.534740, -94.110620

**A) DI 49637 Golden Way Street**

During the incident period of August 23, 2017 to September 15, 2017 flood waters compromised and washed away the asphalt surface, base, and subbase of the road. The single 48-inch CMP half-ellipse culvert and the two 30-inch CMP circular relief culverts, each 28 feet long, became separated from the headwalls and started to compact due to heavy flood waters and internal fill piping. Reference the DDD in Grants Manager (GM) for complete details.

a) **Total repair cost of damage elements being protected (reference attached ST34081-4332DR-TX-Estimate-City of San Augustine\_Mitigation.xlsx for details) = \$32,308.24**

b) **Hazard Mitigation Scope of Work**

In order to prevent future damages from a similar event, the applicant has requested following mitigation measures :

- Replace the existing three culvert system with an 8' x 8' box culvert with wing walls.

Items needed if the HMP is approved and completed (reference attached ST34081-4332DR-TX-Estimate-City of San Augustine\_Mitigation.xlsx for details):

ADD a 8' x 8' x 32' box culvert with reinforced cast-in-place (CIP) concrete wing walls to match existing grade, including engineering services: \$34,153.89

*Subtotal of items needed if the HMP is approved = \$34,153.89*

Items not needed if the HMP is approved and completed (reference attached ST34081-4332DR-TX-Estimate-City of San Augustine\_Mitigation.xlsx for details):

DEDUCT CMP AR Gal Des 5, 28 LF @ \$102.06/LF, TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 Line 460 6012: \$2,857.68

DEDUCT CMP (Gal STL 30 In), 56 LF @ \$88.00/LF, TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 Line 460 004: \$4,928.00

DEDUCT CLC Conc (Headwall), 12.47 CY @ \$713.63/CY, TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 Line: 420 6054: \$8,901.17

*Subtotal of items not needed if the HMP is approved = (\$16,686.85)*

**Net hazard mitigation cost = \$34,153.89 - \$16,686.85 = \$17,467.04**

c) **Cost Effectiveness**

Since the net hazard mitigation cost / total repair cost of damage elements being protected = \$17,467.04 / \$32,308.24 x 100 = 54% < 100 %, this HMP is cost effective per FEMA Public Assistance Program and Policy Guide FP 104-009-2, and Appendix J. General, 1. Drainage Structures, Replacement Structures.

ITEM	CODE	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	COST
1	0909	A) Drainage and sewage piping, box culvert, precast, 8' long, 8'x8'	32	LF	\$640.61	\$20,499.60
2	0909	A) Concrete retaining wall, reinforced, level backfill, 8' high, 4' 3" base, 10" thick	53.2	LF	\$168.11	\$8,943.41
3	0909	A) Engineering fees for Golden Way box culvert	1	LS	\$4,710.88	\$4,710.88
4	0909	A) Subtotal of Items not needed if the HMP is approved (to be added back to PW if mitigation is not approved/completed)	1	LS	-\$16,686.85	(\$16,686.85)
5	0909	B) Headwall, 1-1/2 to 1 slop soil, C.I.P. conc., 42" pipe, 4' long wing walls	2	EA	\$2,851.99	\$5,703.98
6	0909	C) Headwall, 1-1/2 to 1 slop soil, C.I.P. conc., 30" pipe, 3' long wing walls	1	EA	\$1,995.18	\$1,995.18
7	0909	D) Headwall, 1-1/2 to 1 slop soil, C.I.P. conc., 30" pipe, 3' long wing walls	1	EA	\$1,995.18	\$1,995.18
<b>Total In-Kind Repair/Replacement Cost of Damaged Element(s)</b>					\$60,701.85	
<b>HMP Cost Effectiveness (% of Total Eligible Cost)</b>					44.75%	
<b>Eligibility</b>					100% Rule	
					<b>Total HMP Cost</b>	
						<b>\$27,161.38</b>
<b>Michael J. Jackson</b>			<b>Agency</b>		<b>Date</b>	
406 Mitigation Specialist			FEMA			
<b>RECOMMENDED BY (SIGNATURE)</b>			<b>TITLE</b>		<b>Agency</b>	
					<b>Date</b>	
<b>CONCURRENCE BY STATE INSPECTOR</b>			<b>Agency</b>		<b>Date</b>	
<b>CONCURRENCE BY APPLICANT</b>			<b>Agency</b>		<b>Date</b>	

NOTE: Signature by the Federal Inspector is not an approval of this work, and signature by the state and Local Representative is not a commitment to perform the work.

**HAZARD MITIGATION PROPOSAL (HMP) CONTINUATION**

DISASTER		APPLICANT		PROJ / PW	FIPS NO.	CATEGORY
DR-4332	TX	San Augustine, City of		34081/	405-65024-00	C

**SCOPE OF WORK:**

**B) DI 49638 Milam Street**

During the incident period of August 23, 2017 to September 15, 2017 flood waters compromised and washed away the asphalt surface, base, and subbase of the road. The 24-foot long, 42-inch concrete circular culvert collapsed due to the excessive stresses caused by the storm. Reference the DDD in GM for complete details.

a) **Total repair cost of damage elements being protected (reference attached ST34081-4332DR-TX-Estimate-City of San Augustine\_Mitigation.xlsx for details) = \$13,896.28**

b) **Hazard Mitigation Scope of Work**

In order to prevent future damages from a similar event, the applicant has requested the following mitigation measures:

- Install concrete headwalls with wing walls to the upstream and downstream sides of the culvert.

Items needed if the HMP is approved and completed (reference attached ST34081-4332DR-TX-Estimate-City of San Augustine\_Mitigation.xlsx for details):

ADD CIP concrete headwalls with 4-foot long wing walls to the upstream and downstream side of the 42-inch concrete culvert: \$5,703.98

*Subtotal of items needed if the HMP is approved = \$5,703.98*

**Net hazard mitigation cost = \$5,703.98**

c) **Cost Effectiveness**

Since the net hazard mitigation cost / total repair cost of damage elements being protected = \$5,703.98 / \$13,896.28 x 100 = 41% < 100 %, this HMP is cost effective per FEMA Public Assistance Program and Policy Guide FP 104-009-2, and Appendix J. General, 1. Drainage Structures, Erosion Control.

**3) DI 49639 Bierhalter Street**

During the incident period of August 23, 2017 to September 15, 2017 flood waters and heavy vehicle traffic compromised and washed away the asphalt surface, base, and subbase of the road. The 22-foot long, 30-inch CMP circular culvert was also damaged and needs to be replaced. Reference the DDD for complete details.

a) **Total repair cost of damage elements being protected (reference attached ST34081-4332DR-TX-Estimate-City of San Augustine\_Mitigation.xlsx for details) = \$12,043.00**

b) **Hazard Mitigation Scope of Work**

In order to prevent future damages from a similar event, the applicant has requested the following mitigation measure:

- Install a concrete headwall with wing walls to the upstream side of the culvert.

Items needed if the HMP is approved and completed (reference attached ST34081-4332DR-TX-Estimate-City of San Augustine\_Mitigation.xlsx for details):

ADD CIP concrete headwalls with 3-foot long wing walls to the upstream side of the 30-inch CMP culvert: \$1,995.18

*Subtotal of items needed if the HMP is approved = \$1,995.18*

**Net hazard mitigation cost = \$1,995.18**

c) **Cost Effectiveness**

Since the net hazard mitigation cost / total repair cost of damage elements being protected = \$1,995.18 / \$12,043.00 x 100 = 17% < 100 %, this HMP is cost effective per FEMA Public Assistance Program and Policy Guide FP 104-009-2, and Appendix J. General, 1. Drainage Structures, Erosion Control.

TECHNICAL SPECIALIST FOR MITIGATION (SIGNATURE)		Agency	Date
RECOMMENDED BY (SIGNATURE)	TITLE	Agency	Date
CONCURRENCE BY STATE INSPECTOR		Agency	Date
CONCURRENCE BY APPLICANT		Agency	Date

*NOTE: Signature by the Federal Inspector is not an approval of this work, and signature by the state and Local Representative is not a commitment to perform the work.*

**HAZARD MITIGATION PROPOSAL (HMP) CONTINUATION**

DISASTER	APPLICANT	PROJ / PW	FIPS NO.	CATEGORY
DR-4332 TX	San Augustine, City of	34081/	405-65024-00	C

**SCOPE OF WORK:**

**4) DI 49640 Park Street**

During the incident period of August 23, 2017 to September 15, 2017 flood waters undercut the base of the road at the culvert from the upstream side causing a 16-inch by 36-inch sinkhole in the asphalt road. The culvert was not damaged. Reference the DDD for complete details.

a) **Total repair cost of damage elements being protected (reference attached ST34081-4332DR-TX-Estimate-City of San Augustine\_Mitigation.xlsx for details) = \$2,454.33**

b) **Hazard Mitigation Scope of Work**  
 In order to prevent future damages from a similar event, the applicant has requested the following mitigation measure:

- Install a concrete headwall with wing walls to the upstream side of the culvert.

Items needed if the HMP is approved and completed

ADD CIP concrete headwalls with 3-foot long wing walls to the upstream side of the 30-inch CMP culvert:  
 \$1,995.18

*Subtotal of items needed if the HMP is approved = \$1,995.18*  
**Net hazard mitigation cost = \$1,995.18**

c) **Cost Effectiveness**  
 Since the net hazard mitigation cost / total repair cost of damage elements being protected =  
 $\$1,995.18 / \$2454.33 \times 100 = 81\% < 100\%$ , this HMP is cost effective per FEMA Public Assistance Program and Policy Guide FP 104-009-2, and Appendix J. General, 1. Drainage Structures, Erosion Control.

General Comment. If this HMP is approved and the Applicant desires to change the Scope of Work, the Applicant must apply for a change in the SOW so FEMA can review to ensure program and EHP compliance. If this HMP is approved, and the mitigation is not performed, the Applicant must apply for a change in the SOW and de-obligation of the HMP funding. Applicant refusal or failure to complete the work of the HMP may limit future FEMA funding of repairs at the site in the event that a similar disaster event results in similar damage at the site.

References  
 ST34081-4332DR-TX-Estimate-City of San Augustine\_Mitigation.xlsx

TECHNICAL SPECIALIST FOR MITIGATION (SIGNATURE)	Agency	Date
RECOMMENDED BY (SIGNATURE)	TITLE	Agency
CONCURRENCE BY STATE INSPECTOR	Agency	Date
CONCURRENCE BY APPLICANT	Agency	Date

*NOTE: Signature by the Federal Inspector is not an approval of this work, and signature by the state and Local Representative is not a commitment to perform the work.*

## A) DI 49637 Golden Way Street GPS: 31.532843, -94.112619

WORK TO BE COMPLETED		A) BRIDGE/CULVERT AND ROADWAY AT GOLDEN WAY STREET									
Location	Source	Reference No.	Description	L(FT)	W(FT)	D(FT)	unit	Calc. Quant. (Rounded)	Unit cost	Cost	Notes
			<b>Area A1</b>								
			Replace Asphalt Surface	6.00	4.00	0.17	CF	4.00			The culvert repairs listed below require excavation and asphalt roadway demolition that include Area 1. Area 1 road repairs are incidental and included in the culvert repairs listed below.
			Replace Base	6.00	4.00	0.50	CF	12.00			
			Replace Sub-base	6.00	4.00	0.33	CF	8.00			
											<b>Subtotal Area 1 - Costs are included in Culvert Repair Below.</b>
			<b>Area A2</b>								
			Replace Asphalt Surface	19.00	3.00	0.17	CF	9.50			The culvert repairs listed below require excavation and asphalt roadway demolition that include Area 2. Area 2 road repairs are incidental and included in the culvert repairs listed below.
			Replace Base	19.00	3.00	0.50	CF	28.50			
			Replace Sub-base	19.00	3.00	1.33	CF	76.00			
											<b>Subtotal Area 2 - Costs are included in Culvert Repair Below.</b>
			<b>Area A3</b>								
			Replace Asphalt Surface	14.00	6.00	0.17	CF	14.00			The culvert repairs listed below require excavation and asphalt roadway demolition that include Area 3. Area 3 road repairs are incidental and included in the culvert repairs listed below.
			Replace Base	14.00	6.00	0.50	CF	42.00			
			Replace Sub-base	14.00	6.00	3.50	CF	294.00			
											<b>Subtotal Area 3 - Costs are included in Culvert Repair Below.</b>
			<b>Culvert Damage</b>								
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	502-6026	Traffic Control				EA	1.00	\$ 1,555.00	\$ 1,555.00	Repair includes excavation across entire road. Not enough road width to perform the work in two phases that would leave 1/2 Road operational. The work will shut down approximately 400 LF of through traffic on Golden Way Street. Work is in residential area of town. This will require detour signage at a minimum of two intersection, notification to emergency services, and may require an engineered traffic plan.
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	500-6033	Equipment Move In				EA	5.00	\$ 427.19	\$ 2,135.96	Two Pieces of Excavating, Loading, and Lifting Equipment + One Piece of Compaction Equipment + One Piece of Grading equipmnet, asphalt paver = 5 Total Move In
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	500-6033	Equipment Move Out				EA	5.00	\$ 427.19	\$ 2,135.96	Two Pieces of Excavating, Loading, and Lifting Equipment + One Piece of Compaction Equipment + One Piece of Grading equipmnet, asphalt paver = 5 Total Move Out
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	105-6015	Demolition Asphalt Paving (2 IN HMAc + 6 IN Base )	40.00	18.50		SY	82.22	\$ 10.57	\$ 869.09	Excavation and removal of existing CMP culverts will require the demolition of existing asphalt paving that is equal to the work area defined in SI Report -Attachment labeled WO 4493-DI 49637. This area also includes the asphalt road repairs that are defined as Area 1, Area 2, and Area 3. The costs for Area 1, Area 2, and Area 3 are included and incidental to the costs for culvert repairs.
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	540-2031	Remove and Reset Metal Guard Rail Fence	40.00			LF	40.00	\$ 8.00	\$ 320.00	Culvert repairs will require the removal and reset of existing guardrails. 20 LF of guardrail on each side of the road. For defined work area.
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	104-6064	Demolition- Conc -Remove Headwall/Wingwall both sides	69.20	7.30	0.67	CY	12.47	\$ 101.07	\$ 1,260.61	Headwall/Wingwall assembly is presumed to be cast in place concrete due to the atypical storm pipe arrangement. Best practices would be to remove and replace- will not match up with new pipe. Headwall/Wingwall assembly = 34.6 FT Long x 7.3 FT High x 0.67 FT thick = 6.2677 CY. There is a Headwall/Wingwall Assembly for each side of the road. Best practice and cost effective to bring new headwall to
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	400-6005	Structural Excavation, bedding, and backfill for CMP	23.50	18.50	6.42	CY	108.55	\$ 28.13	\$ 3,053.25	Excavate existing road embankment, remove existing CMP culverts, approximately 6.42 feet deep. Since excavation exceeds four foot depth, the slopes of the excvation will need to be sloped with 1.5:1.0 FT safety side slopes. Top surface area of excavation to be 34ft x 18.5 ft. Bottom of excavation to be 13 FT wide to allow 1FT spacing between storm pipe for proper backfill placement. Price includes haul off of excavated materials. This item includes bedding and backfill for proposed CMP. This item includes cofferdaming of existing ditch.

Mitigation measures include replacing 3 culverts with a box culvert, CIP concrete wing walls, and engineering services.

**A) DI 49637 Golden Way Street GPS: 31.532843, -94.112619 (cont.)**

Replaced by mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	460 6012	CMP AR Gal Des 5	28.00			LF	28.00	\$ 102.06	\$ 2,857.68	TXDOT Spec Design Size Chart page 640
Replaced by mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	460 6004	CMP (Gal STL 30 In)	28.00			LF	28.00	\$ 88.00	\$ 2,464.00	One 30 inch CMP Culvert
Replaced by mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	460 6004	CMP (Gal STL 30 In)	28.00			LF	28.00	\$ 88.00	\$ 2,464.00	One 30 inch CMP Culvert
Replaced by mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	420 6054	CL C Conc (Headwall)	69.20	7.30	0.67	CY	12.47	\$ 713.63	\$ 8,901.17	Headwall/Wingwall assembly = 34.6 FT Long x 7.3 FT High x 0.67 FT thick = 6.2677 CY. There is a Headwall/Wingwall Assembly for each side of the road. Cost effective to replace heavy timbers with CIP. Bring top of headwall to road surface elevation in lieu of replacing wooden timbers at top of headwall.
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	247 6061	6" Limestone Sub-Base	40.00	18.50		SY	82.22	\$ 13.75	\$ 1,130.56	Best practice and cost effective-Place aggregate base in lieu of stabilized sub-base.
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	247 6061	6" Limestone Base	40.00	18.50		SY	82.22	\$ 13.75	\$ 1,130.56	6 IN aggregate base under 2 IN asphalt paving
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	351 6012	Flex Pavement Repair (2" ) Asphalt Surface	40.00	18.50		SY	82.22	\$ 24.69	\$ 2,030.42	2" Type D Asphalt Surface Course. Bid item includes protection of prepared subgrade, prime and tack coats, asphalt material, labor, and equipment. Application rate of 110 lbs per SY * IN depth
Mitigation measures to be installed	RS Means Q1 2018 Data (Assembly)	G30201103060	Drainage and sewage piping, box culvert, precast, 8' long, 8' x 8', excavation and backfill excluded				L.F.	32.00	\$ 640.61	\$ 20,499.60	Excavation and backfill of culvert assumed to be comparable to that of removing and replacing to pre-disaster conditions.
Mitigation measures to be installed	RS Means Q1 2018 Data	334211600250	Public storm utility drainage piping, concrete, box culvert, precast, base price, 8' long, 8' x 8', excludes excavation or backfill	32.00			LF	32.00	\$ 640.61	\$ 20,499.60	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data (Assembly)	G20402101400	Concrete retaining wall, reinforced, level backfill, 8' high, 4'-3" base, 10" thick				L.F.	53.20	\$ 168.11	\$ 8,943.41	Headwall/Wingwall assembly = 34.6 LF - 8 LF (for box culvert) = 26.6 LF. There is a Headwall/Wingwall Assembly for each side of the road. Bring top of headwall to road surface elevation.
Mitigation measures to be installed	RS Means Q1 2018 Data	033113704900	Structural concrete, placing, walls, direct chute, 8" thick, includes leveling (strike off) & consolidation, excludes material				C.Y.	14.52	\$ 17.31	\$ 251.38	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	312323160050	Fill by borrow and utility bedding, for pipe and conduit, crushed or screened bank run gravel, excludes compaction				L.C.Y.	11.70	\$ 25.68	\$ 300.55	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	334116350040	Subdrainage piping, corrugated plastic tubing, perforated or plain, in rolls, 4" diameter, excludes excavation and backfill				L.F.	53.20	\$ 1.42	\$ 75.78	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	033113701900	Structural concrete, placing, continuous footing, shallow, direct chute, includes leveling (strike off) & consolidation, excludes material				C.Y.	6.97	\$ 13.01	\$ 90.65	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	031113450150	C.I.P. concrete forms, footing, continuous wall, plywood, 4 use, includes erecting, bracing, stripping and cleaning				SFCA	106.40	\$ 4.17	\$ 444.17	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	031113854750	C.I.P. concrete forms, retaining wall, battered, job built plywood, to 8' high, 4 use, includes erecting, bracing, stripping and cleaning				SFCA	851.20	\$ 4.53	\$ 3,852.96	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	032111600700	Reinforcing steel, in place, walls, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories				Ton	0.43	\$ 1,287.48	\$ 547.95	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	033529600020	Concrete finishing, walls, includes breaking ties and patching voids				S.F.	425.60	\$ 0.59	\$ 250.47	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	033113350150	Structural concrete, ready mix, heavyweight, 3000 psi, includes local aggregate, sand, Portland cement (Type I) and water, delivered, excludes all additives and treatments				C.Y.	21.49	\$ 145.61	\$ 3,129.50	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	011131100090	Architectural fees, for new construction, maximum				LS	\$ 4,710.88		\$ 4,710.88	16% of project cost
											<b>Subtotal Culvert Damage</b>
										\$ 32,308.24	<b>DI 49637 Total (Return to pre-disaster condition)</b>
										\$ 49,775.28	<b>DI 49637 Total (With mitigation measures)</b>
										54%	<b>Cost effectiveness of mitigation measures</b>

Mitigation measures include replacing 3 culverts with a box culvert, CIP concrete wing walls, and engineering services.

## B) DI 49638 Milam Street GPS: 31.541501, -94.102701

Work To Be Completed		B) Milam Street Culvert and Roadway									
Location	Source	Reference No.	Description	L(FT)	W(FT)	D(FT)	unit	Calc. Quant. (Rounded)	Unit cost	Cost	Notes
			Milam Street								
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	502-6026	Traffic Control				EA	1.00	\$ 1,555.00	\$ 1,555.00	Will have to shut down road - Includes Detour signs, flagmen, EMS notifications.
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	500-6033	Equipment Move In				EA	4.00	\$ 427.19	\$ 1,708.77	One Piece of Excavating, Loading, and Lifting Equipment + One piece of Compaction Equipment + One Piece of Grading equipmnet +, asphalt paver = 4 Total Move In
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	500-6033	Equipment Move Out				EA	4.00	\$ 427.19	\$ 1,708.77	One Piece of Excavating, Loading, and Lifting Equipment + One piece of Compaction Equipment + One Piece of Grading equipmnet +, asphalt paver = 4 Total Move Out
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	400-6005	Structural Excavation	13.000	24.000	6.000	CY	69.33	\$ 28.13	\$ 1,950.09	Excavate washout area for installation of new 42 IN RCP. Excavation should allow for 1 FT aggregate wrap around culvert for bedding and backfill. With 4 IN Depth Asphalt road the culvert excavation is 6FT depth. Bottom of trench dimensions are 24 FT long x 6 FT width. With 1.5:1 safety side slopes the top of trench excavation is 24 FT long x 20 FT Wide. Item includes disposal of excavation and existing culvert
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	464 6009	RC Pipe (CL III) (42 IN)	24.000			LF	24.00	\$ 167.67	\$ 4,023.97	
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	247 2002	Aggregate Base	8.000	20.000	3.500	CY	20.74	\$ 75.00	\$ 1,555.56	Best practice-cost effective to use aggregate base material for culvert backfill/cover and asphalt paving base course.
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018	351 6051	Flex Pavement Repair 4 Inch	20.000	24.000	0.333	SY	53.33	\$ 26.14	\$ 1,394.13	4" Type D Asphalt - Asphalt repair based on top of excavation required for culvert repair.
<b>Mitigation measures to be installed</b>	<b>RS Means Q1 2018 Data (Assembly)</b>	<b>G30303102040</b>	<b>Headwall, 1-1/2 to 1 slope soil, CIP concrete, 42" pipe, 4' long wing walls</b>				Ea.	2.00	\$ 2,851.99	\$ 5,703.98	
Mitigation measures to be installed	RS Means Q1 2018 Data	033113702400	Structural concrete, placing, spread footing, direct chute, under 1 C.Y., includes leveling (strike off) & consolidation, excludes material				C.Y.	8.40	\$ 28.34	\$ 238.02	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	312323131300	Backfill, bulk, up to 300' haul, dozer backfilling, excludes compaction				L.C.Y.	56.00	\$ 1.54	\$ 86.24	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	032111602450	Reinforcing steel, in place, dowels, deformed, A615, grade 60, longer and heavier, add				Lb.	118.00	\$ 1.38	\$ 162.90	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	312316130500	Excavating, trench or continuous footing, common earth, 3/4 C.Y. excavator, 6' to 10' deep, excludes sheeting or dewatering				B.C.Y.	56.00	\$ 7.10	\$ 397.63	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	031113300050	C.I.P. concrete forms, culvert, square or rectangular, 5' to 8', 2 use, includes erecting, bracing, stripping and cleaning				SFCA	455.00	\$ 7.90	\$ 3,596.09	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	033113350150	Structural concrete, ready mix, heavyweight, 3000 psi, includes local aggregate, sand, Portland cement (Type I) and water, delivered, excludes all additives and treatments				C.Y.	8.40	\$ 145.61	\$ 1,223.10	Component of above assembly.
										\$ 13,896.28	DI 49638 Total (Return to pre-disaster condition)
										\$ 19,600.27	DI 49638 Total (With mitigation measures)
										41%	Cost effectiveness of mitigation measures

Mitigation measures include installing headwalls on the upstream and downstream side of the culvert.

**C) DI 49639 Bierhalter Street GPS: 31.536828, -94.107356**

Location	Work to Be Completed Source	Reference No.	C) Bierhalter Street Description	L(FT)	W(FT)	D(FT)	unit	Calc. Quant.	Unit cost	Cost	Notes
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 (Assumed)	502-6026	Traffic Control				EA	1.00	\$ 1,555.00	\$ 1,555.00	Will have to shut down road - Includes Detour signs, flagmen, EMS notifications.
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 (Assumed)	500-6033	Equipment Move In				EA	3.00	\$ 427.19	\$ 1,281.57	Backhoe, Compactor, Asphalt Laydown=3Pieces In
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 (Assumed)	500-6033	Equipment Move Out				EA	3.00	\$ 427.19	\$ 1,281.57	No mobilization Out -Single Day Project
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 (Assumed)	105 6015	Demo Existing Asphalt Paving (2" Asphalt + 8 Inch Base)	25.00	12.00	0.83	SY	33.33	\$ 10.57	\$ 352.38	Demo existing asphalt paving.
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 (Assumed)	400 6001	Road Excavation for Culvert Replacement	22.00	5.00	4.50	CY	18.33	\$ 28.16	\$ 516.33	Trench Width=3FT for pipe-1 FT side backfill-1ft side backfill=5 ft total width. Trench Depth=0.50FT culvert bedding-3ft Pipe-1FT culvert height-1FT backfill cover top of pipe. Total depth = 4.5 FT depth after removal of existing asphalt paving.
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 (Assumed)	104 6025	Remove Headwall	25.00	8.00	0.50	CY	3.70	\$ 184.00	\$ 681.47	
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 (Assumed)	460 6004	Replace CMP 30 IN Dia	22.00			LF	22.00	\$ 88.00	\$ 1,936.00	
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 (Assumed)	420 6054	Replace Headwall (Cast in Place)	25.00	8.00	0.50	CY	3.70	\$ 713.63	\$ 2,643.07	
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 (Assumed)	132 6001	Replace Backfill (Culvert and Headwall) Ordinary Fill	14.00	6.00	4.00	CY	12.44	\$ 33.71	\$ 419.51	Backfill material for culvert and headwall.
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 (Assumed)	247 6041	Replace Base	25.00	12.00	0.67	CY	7.41	\$ 68.16	\$ 504.86	
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 (Assumed)	351 6012	Flex Pavement Repair (2" ) Asphalt Surface	25.00	12.00	0.17	CY	1.85	\$ 470.46	\$ 871.22	TxDOT 351 6012 Bid Item Unit Price= \$ 26.13673/SY = \$470.46 per CY = \$17.4244 per CF
Mitigation measures to be installed	RS Means Q1 2018 Data (Assembly)	G30303102000	Headwall, 1-1/2 to 1 slope soil, CIP concrete, 30" pipe, 3' long wing walls				Ea.	1.00	\$ 1,995.18	\$ 1,995.18	
Mitigation measures to be installed	RS Means Q1 2018 Data	312316130500	Excavating, trench or continuous footing, common earth, 3/4 C.Y. excavator, 6' to 10' deep, excludes sheeting or dewatering				B.C.Y.	28.00	\$ 7.10	\$ 198.81	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	031113300050	C.I.P. concrete forms, culvert, square or rectangular, 5' to 8', 2 use, includes erecting, bracing, stripping and cleaning				SFCA	156.75	\$ 7.90	\$ 1,238.87	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	032111602450	Reinforcing steel, in place, dowels, deformed, A615, grade 60, longer and heavier, add				Lb.	45.00	\$ 1.38	\$ 62.12	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	033113350150	Structural concrete, ready mix, heavyweight, 3000 psi, includes local aggregate, sand, Portland cement (Type I) and water, delivered, excludes all additives and treatments				C.Y.	2.60	\$ 145.61	\$ 378.58	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	033113702400	Structural concrete, placing, spread footing, direct chute, under 1 C.Y., includes leveling (strike off) & consolidation, excludes material				C.Y.	2.60	\$ 28.34	\$ 73.67	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	312323131300	Backfill, bulk, up to 300' haul, dozer backfilling, excludes compaction				L.C.Y.	28.00	\$ 1.54	\$ 43.12	Component of above assembly.
										\$ 12,043.00	Total DI 49639 (Return to pre-disaster condition)
										\$ 14,038.18	Total DI 49639 (With mitigation measures)
										17%	Cost effectiveness of mitigation measures

Mitigation measure is to install a headwall on the upstream side of the culvert.

## D) DI 49640 Park Street GPS: 31.534740, -94.110620

D) Park Street											
Location	Work To Be Completed	Reference No.	Description	L(FT)	W(FT)	D(FT)	unit	Calc. Quant. (Rounded)	Unit cost	Cost	Notes
			Park Street								
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 (Assumed)	502-6026	Traffic Control				EA	1.00	\$ 1,555.00	\$ 1,555.00	Minor Traffic Control Patch is on side edge of road and does not require closure of the road. Flagman for One day shift.
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 (Assumed)	500-6033	Equipment Move In				EA	2.00	\$ 427.19	\$ 854.38	1 machine, typ Backhoe, compactor
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 (Assumed)										
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 (Assumed)	247 2002	Install 18 inch LS Base	1.33	3.00	3.00	CF	12.00	\$ 2.78	\$ 33.33	TxDoOT Bid Item 247 2002 Unit Price 75.00 per CY
Installed in conjunction with mitigation measures.	TXDOT Average Low Bid Unit Prices Maintenance April 30, 2018 (Assumed)	351 6012	Flex Pavement Repair (2" ) Asphalt Surface	1.33	3.00	0.17	CF	0.67	\$ 17.42	\$ 11.62	TXDOT 351 6012 Bid Item Unit Price= \$ 26.13673/SY = \$470.46 per CY = \$17.4244 per CF
Mitigation measures to be installed	RS Means Q1 2018 Data (Assembly)	G30303102000	Headwall, 1-1/2 to 1 slope soil, CIP concrete, 30" pipe, 3' long wing walls				Ea.	1.00	\$ 1,995.18	\$ 1,995.18	
Mitigation measures to be installed	RS Means Q1 2018 Data	312316130500	Excavating, trench or continuous footing, common earth, 3/4 C.Y. excavator, 6' to 10' deep, excludes sheeting or dewatering				B.C.Y.	28.00	\$ 7.10	\$ 198.81	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	031113300050	C.I.P. concrete forms, culvert, square or rectangular, 5' to 8', 2 use, includes erecting, bracing, stripping and cleaning				SFCA	156.75	\$ 7.90	\$ 1,238.87	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	032111602450	Reinforcing steel, in place, dowels, deformed, A615, grade 60, longer and heavier, add				Lb.	45.00	\$ 1.38	\$ 62.12	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	033113350150	Structural concrete, ready mix, heavyweight, 3000 psi, includes local aggregate, sand, Portland cement (Type I) and water, delivered, excludes all additives and treatments				C.Y.	2.60	\$ 145.61	\$ 378.58	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	033113702400	Structural concrete, placing, spread footing, direct chute, under 1 C.Y., includes leveling (strike off) & consolidation, excludes material				C.Y.	2.60	\$ 28.34	\$ 73.67	Component of above assembly.
Mitigation measures to be installed	RS Means Q1 2018 Data	312323131300	Backfill, bulk, up to 300' haul, dozer backfilling, excludes compaction				L.C.Y.	28.00	\$ 1.54	\$ 43.12	Component of above assembly.
										\$ 2,454.33	Total DI 49640 (Return to pre-disaster condition)
										\$ 4,449.51	Total DI 49640 (With mitigation measures)
										81%	Cost effectiveness of mitigation measures

Mitigation measure is to install a headwall on the upstream side of the culvert.