

Executive Summary

TO:	Brent Soderlin, PE, CFM, Director of Public Works and Utilities, Littleton, Colorado (City)
FROM:	Tim Phelan, PE
SUBJECT:	Slaughterhouse Gulch Flume
DATE:	December 6, 2024
CC:	

Benesch recently conducted an inspection of the structure supporting the Slaughterhouse Gulch Flume located in Slaughterhouse Gulch Park within Littleton, Colorado. The inspection report, provided in **Appendix A**, identified the following concerns:

- Corrosion, holes, and leaks in multiple locations throughout the flume deck.
- Corroded and impacted steel members supporting the flume.
- Spalled concrete and a missing anchor bolt at the northern-most abutment.
- Undermining of the soil supporting the pier below the truss support resulting in 10 percent remaining bearing capacity. The undermining resulted from Slaughterhouse Gulch channel flows at the pier.
- Heavy vegetation growth under and around the structure.

Based on these observations, Benesch provided recommendations to stabilize the footings around the undermined pier and install riprap to prevent further erosion. The extent of the foundation support undermining is considered a serious condition that needs to be addressed prior to further undermining that could lead to a potential collapse of the structure in this location. In addition, Benesch recommended repairs of the flume exhibiting holes and leaks that can affect underlying structural components from prolonged moisture exposure and corrosion of the steel members. Furthermore, removal of the vegetation under and around the structure may result in a compromised structure as the vegetation grows.

Given the apparent age of the structure, Benesch retained the services of DS Environmental Consulting to test the accessible materials of the flume structure for lead based paint. Their report, provided in **Appendix B**, identified isolated areas "of lead paint higher than the State of Colorado regulatory levels" and recommended "lead safe' work practices are required when disturbing, removing, or impacting the tested components." It should be noted that not all elements could be accessed given the vegetation and height of the structure and additional testing may be required prior to conducting such work or ensuring that such work practices are implemented.

It is Benesch's understanding that the function of the flume to convey water will no longer be necessary in the near future, but the exact timeframe is currently in flux. To evaluate options of what to do with the structure once it has been decommissioned, the City requested Benesch to provide a rough order magnitude cost estimate for varying conditions to assist with their evaluation. It was also requested that Benesch consider the costs of maintaining the operable nature of the flume to convey water in some manner to be determined. **Appendix C** outlines the costs for the three conditions requested, as outlined below:

 Repair the existing structure per the observations and recommendations provided in the inspection report. These costs identified the necessary expenses to address the concerns identified, such as repair of the undermined pier, replace portions of the flume that leaked, clean and paint the corroded areas,



remove vegetation in the vicinity, patch concrete areas, install new anchor bolts, and address the impacted members.

- 2) Future standard maintenance costs to preserve the structure periodically (estimated to be approximately every 10 years). These costs included painting the entire structure, removing vegetation in the vicinity as it regrows, and replacing assumed areas that are anticipated to leak over time should the flume continue to carry water.
- 3) Costs to disassemble and reassemble the structure to another location for prominent display within the park. These costs were broken down into moving the truss and supports only, moving a single span of the flume support only, and miscellaneous elements that will need to be considered for the detachment and replacement of the structures. The total number of spans was considered as those that were not associated with being supported by concrete abutments or piers and provided a total price if all spans unsupported by abutments and piers were considered for displacement. Mechanical systems for pumping water through the flume were not considered in the cost estimate.

A 40% contingency was provided for the cost estimates to cover unknown factors that often occur when repairing or moving existing structures, to account for taxes, overhead, and profit, variability of current costs, as well as variability of future anticipated costs given the unknowns of when work on the structure may occur. As stated, these costs are a rough order magnitude for comparison purposes and may be easily adjusted to account for such changes in costs or any known costs available to the City.

Please feel free to contact us with any questions about this project.

Respectfully submitted,

TRAbla

Timothy "Tim" R. Phelan, PE Project Manager

Amar Jaishi, EIT, CBSI Designer

Appendix A: Structure Inspection Report Appendix B: Lead-Based Paint Inspection Report Appendix C: Costs Estimates

Appendix A: Structure Inspection Report



Routine Inspection Flume Structure Inspection and Inventory Report

Bridge Key: Slau	ughterhouse Gulch	Inspection Date 90:	07/30/2024		Sufficiency Rating:	N/A	Ş	SD
NBI Reporting ID:	Slaughterhouse Gulch	Main Mat/Design 43A/B:	3	09	Bridge Cost 94:	\$0		
Region/Sect 2E/2M:	Reg 1 MSec 5	Appr Mat/Design 44A/B:	3	03	Roadway Cost 95:	\$0		
Tran Region 2T:	6 Greater Denver	Main Spans Unit 45:	1		Total Cost 96:	\$0		
County Code 3:	005 Arapahoe	Approach Spans 46:	12		Year of Cost Estimate 97:			
		Horizontal Clrnc 47:	6.3 ft		Brdr Brdg Code/% 98A/B:	-	-	
Place Code 4:	45255 Littleton	Max Span 48:	48.0 ft		Border Bridge No. 99:			
		Structure Length 49:	230.2 ft		Defense Highway 100:	0	No	
Route (On/Under) 5A:	1 Route On Structure	Curb Width L/R 50A/B:	0.0 ft	0.0 ft	Parallel Structure 101:	N	No brid	ge exists
Signing Prefix 5B:	8 Other (describe)	Width Curb to Curb 51:	6.3 ft		Direction of Traffic 102:	0	No Vehic	les
Level of Service 5C:	0 None	Width Out to Out 52:	6.9 ft		Temporary Structr 103:			
Direction Suffix 5E:	0 N/A	Deck Area:	1588.38 sf		Highway Systems 104:	0	Not on N	HS
Feature Intersected 6:		Min Clr ovr Brdg 53:	99.9 ft		Fed Lands Hwy 105:	0	Not Appl	icable
Slaughterh	ouse Gulch	Min Undrclr Ref 54A:	N Not over	hwy/RR	Year Reconstructed 106:			
Facility Carried 7:		Min Underclr 54B:	0.0 ft		Deck Type 107:	9	Other	
City	Ditch	Min Lat Clrnce Ref R 55A:	N Not over	hwy/RR	Wearing Surface 108A:	0	None	
Alias Struc No. 8A:		Min Lat Undrclr R 55B:	0.0 ft		Membrane 108B:	9	Other	
		Min Lat Undrolr L 56:	0.0 ft		Deck Protection 108C:	0	None	
Parallel Struc No. 8P:		Deck Rating 58:	5 Fair		Truck ADT 109:			
		Superstructure Rating 59:	6 Satisfact	tory	Truck Net 110:	0	No	
Location 9:		Substructure Rating 60:	3 Serious		Pier Protection 111:			
Slaughterhous	se Gulch Park	Channel/Protectn Rtg 61:	6 Freq Min	or Dam	NBIS Length 112:	Y	Bridge Le	ength
Max Clearance 10:	99.9 ft	Culvert Rating 62:	N Not Appl	licable	Scour Critical 113:	2	Unstable	(Condition
Base Hwy Net 12:	0 Not on Base Ntwk	Operating Rtg Method 63:	5 No Ratin	ig	Scour Watch 113M:	N	No watch	1
LRS Inv Route 13A:	000000000	Operating Rating 64:			Future ADT 114:			
LRS Sub Route No 13B:	00	Operating Factor 64:	E No Dotio		Year of Future AD1 115:	0.01	04	- I. T
Latitude 16:	39" 37" U2.12"	Inv Rating Method 65:	5 INO RATIN	ig	CDOT Struct Type 120A:	SD1	Steel De	CK I russ
Longitude 17:	105 00 30.62	Inventory Rating 66:			CDOT Constr Type 120B:	00	Νοι Αρρι	Unknown
Toll Eacility 20:	2 On Toll Free Read	Asphalt/Fill Thick 66T:	0.0 in		Inspection Trip 122A.			
Custodian 21:	04 City/Municipal Hwy	Structure Evaluation 67:	3 Correct -	Intoler	Scheduling Status 1228:	0	Not appli	cable
Owner 22:	04 City/Municipal Hwy	Deck Geometry 68:	N Not Appli	licable	Maintenance Patrol 123:	0		cable
Eunctional Class 26:	19 Urban Local	Undrclr Vert/Horiz 69:	N Not Appl	licable	Expansion Dev/Type 124	0	None	
Year Built 27:	1901	Posting 70:	N Not Appl	licable	rdg Rail Type/Mod 125A/B:			
Lanes On 28A:	00	Water Adequacy 71:	8 Deck > a	approach	Posting Trucks 129A/B/C:	-	-	-
Lanes Under 28B:	00	Approach Alignment 72:	8 Desirable	e	Structure Rating Date 130:		1	1
ADT 29:	0	Type of Work 75A:			Special Equipment 133:	00	None	
Year of ADT 30:	1901	Work Done By 75B:			Vert Clr N/E 134A/B/C:	Х	99'	00'
Design Load 31:	0 Unknown/Other	Lngth of Imprvmt 76:	0.00 ft		Vert Clr S/W 135A/B/C:	Х	99'	00'
Apr Rdwy Width 32:	0.0 ft	Insp Team Indicator 90B:	Benesch		Vertical Clearance Date:	1/1/19	01	
Median 33:	0 No Median	Inspector Name 90C:	AJAISHI		Weight Limit Color 139:	0	White	
Skew 34:	0.00°	Frequency 91:	12 months		Struct Billing Type:			
Structure Flared 35:	0 No Flare	FC Frequency 92A:			Userkey 1, Insp System:			
Safety Rail 36A/B/C/D:	N N N N	UW Frequency 92B:			Userkey 4, Insp Sched:			
Rail Height 36H:	0.0 in	OS Frequency 92C:			Userkey 5, UW Sched:			
Hist Significance 37:	5 Not Eligible	FC Insp Date 93A:			Userkey 6, Pin Sched:			
Posting Status 41:	K Bridge closed	UW Insp Date 93B:			Inspection Key:			
Service On/under 42A/B:	0 5	OS Insp Date 93C:						



Routine Inspection Structure Inspection and Inventory Report

Element	Inspection Report						I	nspectio	on Date:	7/30/	2024
Elm/Env	Description	Unit	Total Qty	% in 1	CS 1	% in 2	CS 2	% in 3	CS 3	% in 4	CS 4
60/1	Other Deck	(SF)	1589	92%	1469	0%	0	5%	81	2%	39
Deck is a s	teel open half cylinder flume with	rubber	liner with (2) bolt ban	ds at eac	h joint and	d (1) inter	mediate b	olt band a	at 3 foot s	pacing;
painted gra Top: Mostly Bottom: Pa Span 5 nea Span 5 th Span 6 nea Span 8 has Span 9 has Span 11 bo 107/1 (2) C-chan spacing; pa Beam flang	ay. y covered with liner filled with wat int is peeling off throughout, prim ar Pier 6 has active leakage along rough 13 along bolt banks have is 9 feet from Pier 7 has 4.5 feet x 3 ar mid-point has 3 feet x 3 feet are s area of pinhole R2 corrosion wit s 6 feet long x 3 feet wide area of olt band near Pier 11 has 3 feet x Steel Open Girder nel beams with frequent web splic ainted gray. ges and webs have R1 corrosion to be the state of the	er, no r arily ald joints solated feet ard a of R4 h rust s impact 3 feet a (LF) ce plate through	major deficie ong joints. (1SF CS4). R2-R3 corro ea of R3-R4 4 corrosion (taining up to damage and area of R4 co <u>362</u> s welded to nout (362LF (ncies note osion (58S corrosion 9SF CS4 0 1 inch di d 3 inch d oprrosion (9 0% north bea CS2).	ed. F CS3). (14SF C). ameter (9 iameter (2 9SF CS4) 0 0 m and bo	S3). SF CS3). 2) corrosic 100% Ited to so	on holes (<u>362</u> uth beam	(20SF CS4 0% a; transver	4). 0 se bracinç	0% g at 3 feet	0
Span 12 bo	ottom flange has (2) open holes a	t (2) loc	ations.								
120/1	Steel Truss	(LF)	96	0%	0	100%	96	0%	0	0%	0
Span 6 is a Both trusse Active wate Truss 6A lo	a welded truss; painted gray. es lower chords have isolated R1 er leakage through diversion and so ower chord at mid-point has a 4 fo	corrosi water s oot upw	on throughou plashing Tru ard bend (4L	ut (96LF (Iss 6A Iow .F CS2 ov	CS2). /er chord. /erlap).						
205/1	R/Conc Column	(EA)	2	50%	1	50%	1	0%	0	0%	0
Pier 13 has East colum	s (2) trapezoidal columns. In on top has S2 scaling (1EA CS	2).									
207/1	Steel Tower	(LF)	100	66%	66	34%	34	0%	0	0%	0
Steel trestl Trestle dia Pier 3 trest Pier 7 mido Piers 9, 10	e sitting on concrete footings at a gonals, base plates, horizontal an le verticals have (2) open holes. dle horizontal member at weld cor , and 11 trestles have kickers wel	II piers d vertic nnectior ded be	except Pier cal members n is bent nort tween vertica	13. have isol th by 0.25 al column	ated R1 c inch (1Lf s and bea	corrosion = CS2). am bottorr	up to 3 fc n flange.	oot (33LF (CS2).		
215/1	R/Conc Abutment	(LF)	14	86%	12	0%	0	14%	2	0%	0
CIP abutm Abutment Abutment Abutment	ents with step outs for bearings. 14 along joint has active leakage. 14 west end has 8 inch x 1 foot x 3 14 east end has 8 inch x 20 inch x	3 inch c 5 inch	leep edge sp deep spall (oall (1LF (1LF CS3)	CS3).).						
220/1	R/Conc Pile Cap/Footing	(LF)	22	91%	20	0%	0	5%	1	5%	1
Concrete ti Concrete fo Pier 6 west (1EA CS4) Pier 6 east	rapezoidal footings under steel tre potings have S1 scaling. t footing south and west faces full footing south face fully exposed v	estles. y expos with no	sed with 36 i undermining	nch x 36 i g (1EA CS	inch deep	undermir	ing and	10 percent	t remainin	g bearing	capacity
311/1	Movable Bearing	(EA)	6	83%	5	0%	0	0%	0	17%	1
Moveable I Abutment ?	bearings at both abutments and P 14 east end bearing has missing a	ier 13. anchor	bolt and up t	o 40 perc	ent bearir	ng area lo	ss (1EA	CS4).			
313/1	Fixed Bearing	(EA)	22	100%	22	0%	0	0%	0	0%	0
Fixed bear No significa	ings at all piers except Pier 13. ant defects noted.							•			



Routine Inspection Structure Inspection and Inventory Report

Element	Inspection Report						1	nspectio	n Date:	7/30/2	2024
Elm/Env	Description	Unit	Total Qty	% in 1	CS 1	% in 2	CS 2	% in 3	CS 3	% in 4	CS 4
326/1	Wingwall	(EA)	4	100%	4	0%	0	0%	0	0%	0
Concrete v Wingwalls Northeast	vingwalls monolithic with abutmer have insignificant to medium crac wingwall has S2 scaling.	nts. cks with	n minor edge	spalls.							
501/1	Channel/Bank	(EA)	1	100%	1	0%	0	0%	0	0%	0
Flow is eas Inlet chanr Channel lir Channel ba Heavy veg Storm drai	st to west under Span 6 (Truss sp nel comes in and flows against Pie ned with large sized rocks with co ank has vertical erosion on downs etation growth under and around n at east side of Pier 5.	ban). er 6 cau ncrete stream the stru	using undern weir. side of struc ucture.	nining. ture.							
600/1	General Remarks										
Centennial High water	I Link Trail path runs under Span s r debris on both sides of flume inle	9. et.									
	Maintenance Reco	mmeno	lations			Qua	ntity	Da Recomr	ite nended	Mainte Cate	nance gory
Substructu	ıre-Rip Rap					2	EA	07/30	/2024	Seri	ous
Stabilize a	nd install riprap around Pier 6 foo	tings.								1	
Substructu	ire-Patch Spalls					120	SF	07/30	/2024	Hiç	gh
Patch hole	s and clean and paint corrosion o	n deck	underside.					-			
Channel-R	emove Debris					1	EA	07/30	/2024	Hiç	gh
Clear vege	tation under and around the struc	ture.									
Inspection	n Notes s): A. Jaishi, R. Spicer		Date: 07/30	/2024	Time: 7:2	24 AM	Temp: 6	7°	Weather	: Clear	Calm
Bridge No Inventory r East side i Superstructu	o tes route is south to north s upstream cture is named Beam/Truss A to E ire is numbered 1 through 14 from	א from v south	vest to east; to north	and truss	nodes nu	umber upp	per (U) or	lower (L)	0 to 8 fro	m south to	o north
Scope:											
▼ Ro	utine 🔽 Element 🔲 Fra	acture	Critical	🗖 Ui	nderwate	r 🗌	Other \$	Special			
Inspectior	n Date: 07/30/2024	Inspec	نه tor (Team L	ki eader): A.	JAISHI						









Flume looking northeast.



Flume looking southwest.







Elevation looking southwest.



Elevation looking southeast.







Elevation looking east (Spans 8, 9, and 10).



Elevation looking west (Spans 8, 9, and 10).







Elevation looking northeast towards Abutment 14.



Span 9 underside looking north.







Channel looking east upstream.



Channel looking west downstream.







Concrete weir across channel under Span 6.



Abutment 1 general.







Abutment 14 general.



Deck underside at bolt bands has R2-R3 corrosion, typical.







Deck underside in Span 8 along bolt band has R4 corrosion.



Deck underside in Span 8 has area of pinhole corrosion.







Deck underside in Span 9 has up to 3 inch diameter corrosion holes.



Deck underside in Span 9, 6 feet x 3 feet area of impact damage.







Deck underside in Span 11 has area of R4 corrosion.



Flume looking north (topside).







Flume looking southwest (topside).



Beam A has R1 corrosion, typical.







Moveable bearing at Pier 13, typical.



Abutment 14 east end spall with bearing area loss and missing connection.







Abutment 14 west end spall.



Pier 13 east column at top has S2 scaling.







Truss 6A lower chord bent upwards at mid-point looking east.



Truss 6A lower chord bent upwards at mid-point looking west.







Trestle diagonals have spotty R1 corrosion, typical.



Beam web splice connection at Pier 13, typical.







Pier 7 trestle middle horizontal member bent north.



Pier 10 trestle general.







Pier 12 trestle general.



Pier 6 east footing south face fully exposed with no undermining.







Pier 6 west footing undermined.



Pier 6 west footing has 10 percent remaining bearing capacity.







Pier 6 west footing undermined up to 20 inches vertically.



Northwest bearing between beam and abutment.







Northeast wingwall has S2 scaling.



Northwest end of structure with vegetation growth.







Storm drain at east side of Pier 5.



Appendix B: Lead-Based Paint Inspection Report



"The trusted choice for your environmental & industrial hygiene needs."

LEAD-BASED PAINT INSPECTION REPORT

Slaughterhouse Gulch Flume

39°37'02.1"N 105°00'36.8"W

Littleton, CO



Front Range 7555 W 10th Ave Suite A, Lakewood, CO 80214

Mountains PO Box 6864 Avon, CO 81620 Western Slope PO Box 3793 Aspen, CO 81612

Direct (303) 286-9094

- 1.0 Introduction
- 2.0 Definitions
- 3.0 Scope of Work
- 4.0 Inspector & Firm Certifications
- 5.0 Overview of Findings
- 6.0 Equipment Information
- 7.0 Inspection & Testing Procedures
- 8.0 Conclusion & Recommendations
- 9.0 Disclaimer & Limitations
- 10.0 Copyright Notice

APPENDIX A	XRF Data Table
APPENDIX B	Inspector & Firm Certificates

1.0 Introduction

Mr. Sean Work with DS Environmental Consulting (DS) performed a comprehensive lead-based paint (LBP) inspection and performed in situ X-Ray Florescence (XRF) testing to determine the presence of LBP on painted components of the Slaughterhouse Gulch Flume, running roughly east to west, spanning Slaughterhouse Gulch in Littleton, CO. The coordinates are 39°37'02.1"N 105°00'36.8"W.

The purpose of the inspection was to determine if any of the materials on the flume, or the immediate area around it, contains lead-based paint.

LBP was found on the deck of the flume.

Table 1 and Table 2 in Section 6.0 further details the materials that contain LBP and those that do not. The full table (Table 3), including all XRF readings, can be found in Appendix A.

2.0 Definitions

<u>Lead-based Paint (LBP)</u> is any paint having concentrations of lead greater than 1.0 mg/cm², which is also Colorado's action level.

<u>Paint</u> is any liquid mixture, usually of solid pigment in a liquid form, used as a decorative or protective coating. This includes, but is not limited to, primer, lacquer, polyurethane, wood stain, etc.

<u>X-Ray Florescence (XRF)</u> is a non-destructive analytical technique used to determine the elemental composition of materials. XRF analyzers determine the chemistry of a sample by measuring the fluorescent (or secondary) X-ray emitted from a sample when it is excited by a primary X-ray source.

3.0 Scope of Work

This inspection was comprehensive in its scope and included all areas and suspect, painted components on and in the immediate area of the flume. The LBP inspection did not constitute a hazard assessment.

Some components of the flume were inaccessible at the time of inspection; these materials must be assumed to have LBP until further testing is performed. Please refer to the photos in section 5.0 for more details.

*Should any material that would have been impossible to find during this inspection be discovered, that was not subject to this sampling, that material shall be assumed to be LBP if it is painted and must be sampled upon discovery.

4.0 Certifications

Mr. Work is a Colorado State Certified LBP Inspector, having EPA Accreditation #27686. DS Environmental Consulting is a Colorado State Certified Lead Evaluation Firm, license #16918. Mr. Work is certified to operate the Viken Pb200i XRF Lead Paint Spectrum Analyzers by the manufacturer (see Appendix B for certificates).

5.0 Overview of Findings

Read No.	Area	Structure	Paint Cond	Substrate	Paint Color	Lead (mg/cm²)	Result
14	Flume South End	Deck	Significantly Damaged	Metal	Silver	3.1	POS
18	Flume South End	Deck	Significantly Damaged	Metal	Silver	2.0	POS

Table 1: Components that Contain LBP

Table 2: Components that Do Not Contain LBP

Read No.	Area	Structure	Paint Cond	Substrate	Paint Color	Lead (mg/cm²)	Result
1	Flume North End	Wing wall	Intact	Concrete	Tan	0.4	Neg
2	Flume North End	Girder	Significantly Damaged	Metal	Silver	0.1	Neg
3	Flume North End	Deck	Significantly Damaged	Metal	Silver	0.1	Neg
4	Flume North End	Spanning Truss	Significantly Damaged	Metal	Silver	0.1	Neg
5	Flume North End	Spanning Truss	Significantly Damaged	Metal	Silver	0.1	Neg
6	Flume North End	Tower	Significantly Damaged	Metal	Silver	0.1	Neg
7	Flume central (near path)	Deck	Significantly Damaged	Metal	Silver	0.1	Neg
8	Flume central (near path)	Tower	Significantly Damaged	Metal	Silver	0.1	Neg
9	Flume Central (over creek)	Truss	Significantly Damaged	Metal	Silver	0.1	Neg
10	Flume South End	Sluice Wheel	Intact	Metal	Orange	0.0	Neg
11	Flume South End	Sluice Frame	Intact	Metal	Silver	0.1	Neg
12	Flume South End	Sluice Frame	Intact	Metal	Black	0.1	Neg
13	Flume South End	Wing wall	Intact	Concrete	Tan	0.3	Neg
15	Flume South End	Girder	Significantly Damaged	Metal	Silver	0.1	Neg
16	Flume South End	Spanning Truss	Significantly Damaged	Metal	Silver	0.1	Neg
17	Flume South End	Tower	Significantly Damaged	Metal	Silver	0.1	Neg





This component is identified as the Truss in this report. Negative



The vertical supports are identified as Towers in this report. Negative



These components are identified as spanning trusses in this report. Negative



The accessible sluice gate assembly. Negative



to have LBP components. Assumed LBP

6.0 Equipment Information

LBP concentrations were obtained using a Viken Pb200i XRF Lead Paint Spectrum Analyzer, which is approved by the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Housing and Urban Development (HUD) to determine the concentration of lead in paint.

The XRF was calibrated according to the manufacturer's Performance Characteristic Sheet (PCS). The XRF was calibrated using the calibration standard block of known 1.0 mg/cm² lead content as well as a standard block of known 0.0 mg/cm² lead content. Three (3) calibration readings of each block were taken before the inspection began as well as after the inspection was completed, every four hours of continuous use, and/or following a battery change.

7.0 Inspection & Testing Procedures

The LBP inspection and XRF testing were conducted by a State of Colorado accredited LBP Inspector qualified by experience, education, and training in approved LBP testing techniques. These procedures call for the visual inspection of the areas of concern and the collection of XRF readings for lead concentrations.

This inspection was performed in accordance with the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Housing and Urban Development (HUD) guidelines for lead-hazard inspections, as well as the State of Colorado Air Quality Control Commission Regulation No. 19 for the Control of Lead Hazards. The EPA's 40 CFR Part 745 Final Rule (January 5, 2001) set standards for the identification of dangerous levels of lead. The standards identify when lead-based paint, lead-contaminated dust, and lead-contaminated soil are hazards. It also establishes residential dust clean-up levels (post-abatement clearance levels) and set dust and soil sampling requirements. The lead-based paint readings were collected by XRF analyzation for the purpose of determining lead concentrations as mg/cm².

8.0 Conclusions & Recommendations

Concentrations of lead in paint higher than the State of Colorado regulatory levels were identified; therefore, "lead safe" work practices are required when disturbing, removing, or impacting the tested components. Some components could not be safely accessed and must be assumed to have LBP. Additional testing is required if new materials are discovered or the scope of work changes.

Regarding the deck, the only tested-positive LBP component, it should be noted that not every sampling of the homogeneous components came back as containing lead-based paint. The two tests that came back positive were on the South end of the flume, the 4th and 6th segments of the deck from the end, to be exact. However, it is not feasible to delineate the exact locations of LBP segments of the deck due to environmental conditions. Therefore, all segments should be assumed to have lead-based paint on them.

9.0 Disclaimer & Limitations

This limited-scope inspection does not constitute a lead-hazard assessment. Other areas not tested and conditions existing outside this scope of work may contain lead concentrations above the regulatory action levels. Consequently, to determine whether lead-based paint exists within other areas of the building, a full lead-based paint inspection must occur.

10.0 Copyright Notice

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APPENDIX A: XRF READINGS

Pre-ins	spection Calibration – Kn	own LBP Calibrat	ion Block			-	
Pre -in	spection Calibration – Kr	nown LBP Calibrat	ion Block			Average: 1.0	PASS
Pre -in	spection Calibration – Kr	nown LBP Calibrat	tion Block				
Pre -In	spection Calibration – Kr	nown Negative Ca	libration Block				DACC
Pre -in	spection Calibration – Ki	nown Negative Ca	libration Block			Average. 0.0	PASS
Read No.	Area	Structure	Paint Cond	Substrate	Paint Color	Lead (mg/cm²)	Result
1	Flume North End	Wing wall	Intact	Concrete	Tan	0.0	Neg
2	Flume North End	Girder	Significantly Damaged	Metal	Silver	0.0	Neg
3	Flume North End	Deck	Significantly Damaged	Metal	Silver	0.0	Neg
4	Flume North End	Spanning Truss	Significantly Damaged	Metal	Silver	0.0	Neg
5	Flume North End	Spanning Truss	Significantly Damaged	Metal	Silver	0.0	Neg
6	Flume North End	Tower	Significantly Damaged	Metal	Silver	0.0	Neg
7	Flume central (near path)	Deck	Significantly Damaged	Metal	Silver	0.0	Neg
8	Flume central (near path)	Tower	Significantly Damaged	Metal	Silver	0.0	Neg
9	Flume Central (over creek)	Truss	Significantly Damaged	Metal	Silver	0.0	Neg
10	Flume South End	Sluice Wheel	Intact	Metal	Orange	0.0	Neg
11	Flume South End	Sluice Frame	Intact	Metal	Silver	0.0	Neg
12	Flume South End	Sluice Frame	Intact	Metal	Black	0.0	Neg
13	Flume South End	Wing wall	Intact	Concrete	Tan	0.0	Neg
14	Flume South End	Deck	Significantly Damaged	Metal	Silver	3.1	POS
15	Flume South End	Girder	Significantly Damaged	Metal	Silver	0.0	Neg
16	Flume South End	Spanning Truss	Significantly Damaged	Metal	Silver	0.0	Neg
17	Flume South End	Tower	Significantly Damaged	Metal	Silver	0.0	Neg
18	Flume South End	Deck	Significantly Damaged	Metal	Silver	2.0	POS
Post-ir	spection Calibration – K	nown LBP Calibra	tion Block				
Post -i	nspection Calibration – k	nown LBP Calibra	ation Block			Average: 1.0	PASS
Post -i	nspection Calibration – k	nown LBP Calibra	ation Block				
Post -i	nspection Calibration – k	nown Negative C	alibration Block				
Post -i	nspection Calibration – k	nown Negative C	alibration Block			Average: 0.0	PASS
Post -i	nspection Calibration – k	nown Negative C	alibration Block				

APPENDIX B: INSPECTOR & FIRM CERTIFICATES



Appendix C: Cost Estimates Cost Estimate Calculations_Slaughterhouse

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<u> </u>			Computed by:	TRP			_ Da	ite:	11/22/2024		Sheet:	
🛛 🌌 benesch			Checked by:	APJ			Da	ite:	12/2/2024		Project No.:	1525-400003.01
			Project:	Slaught	terho	ouse Gulch	Flum	e, Littleton, C	0			
Version: 1			Element:	Repair	Cost	Estimate						
												4
Repair Recommendations	Maintenance	Date	Description	Unit	Б	Co Remove	st/U	nit Replace	Quantity	Total	Notes	Quantity Basis
Stabilize and install riprap around Pier 6 Footing	Serious	7/30/2024	FLOWABLE FILL	CY	\$	-	\$	400.00	1.00	\$ 400.00	Per Report 3'x3'x3' use 1 cu yd	Report
Stabilize and install riprap around Pier 6 Footing	Serious	7/30/2024	RIPRAP (9 IN)	CY	\$	-	\$	630.00	53.33	\$ 33,600.00	Width of Flume ~ 7' +3' for footings + 10' extend beyond footings x distance between Piers 6 & 7 = 48' x 1.5' depth of rip rap	Report
Patch holes on deck underside	High	7/30/2024	78 INCH EQUIVALENT CORREGATED STEEL PIPE ARCH	LF	\$	400.00	\$	1,100.00	27.0	\$ 40,500.00	Spans with 3' sections of rusted through areas noted in report at 9 locations for replacement using similar pricing for corregated steel pipe arch	Report
Replace rubber liner at replaced sections	High	7/30/2024	RUBBER LINER	SF	\$	5.00	\$	20.00	273.1	\$ 6,827.65	Surface area of flume trough over length of replaced panels	Report
Clean and paint corrosion on deck underside	High	7/30/2024	PAINT EXISTING STRUCTURE	SF	\$	-	\$	25.00	2328.5	\$ 58,212.07	10.125' long curved section x 230.2 ft length remove corrosion and paint	Report
Clear vegetation under and around structure	High	7/30/2024	CLEARING AND GRUBBING	ACRE	\$	-	\$	30,000.00	0.10	\$ 3,000.00	Removal of vegetation minimum area of 0.1 acre = 230 ft length = ~19' width on either side of tressel	Assumed
Forestry Services for Clearing and Grubbing	Low	7/30/2024	FORESTRY SERVICES	EA	\$	-	\$	50,000.00	1.0	\$ 50,000.00	Verify with Littleton for Forestry Services Requirements	Report
Clean and paint corrosion on channel supports	Low	7/30/2024	PAINT EXISTING STRUCTURE	SF	\$	-	\$	25.00	604.9	\$ 15,122.60	Paint 2 channels outside face = ~20" x 182.2 ft length	Report
Clean and paint corrosion on truss members	Low	7/30/2024	PAINT EXISTING STRUCTURE	SF	\$	-	\$	25.00	201.8	\$ 5,043.75	Paint 2 sides of 24 diagonals 8' LG and 12 verticals 5.25' LG of Truss Chords	Report
Bent truss member	Low	7/30/2024	ADJUST STRUCTURE	EA	\$	-	\$	3,000.00	1	\$ 3,000.00	Adjust 4-foot upward bend at lower chord of Truss A	Report
Concrete Abutment Patch	High	7/30/2024	CONCRETE PATCHING ON VERTICAL SURFACES - CLASS 2	SF	\$	100.00	\$	400.00	1.78	\$ 888.89	Abutment 14 Concrete Patching 8"x1'x3" and 8" x 20" x 5"	Report
Install Anchor Bolt	High	7/30/2024	INSTALL ANCHOR BOLT	EA	\$	-	\$	250.00	1.00	\$ 250.00	Abutment 14 install anchor bolt	

 Total
 \$
 216,844.97

 40% Contingency
 \$
 86,737.99
 Contingency covers unknowns, taxes, future costs, etc.

 Estimated Repair Cost
 \$
 303,582.96
 Contingency covers unknowns, taxes, future costs, etc.

Page 1 of 3

Cost Estimate Calculations_Slaughterhouse

	Computed by:	TRP	Date:	11/22/2024	Sheet:	
🛛 🥣 benesch	Checked by:	APJ	Date:	12/2/2024	Project No.:	1525-400003.01
	Project:	Slaughterhouse Gulch	Flume, Littleton,	со		
Version: 1	Element:	Maintenance Cost Est	imate ~ Every 10	/ears		

Maintananaa Baaammandatiana	Description	Unit		Cos	t/Ur	nit				Quantity Basis
Walltenance Recommendations	Description	Unit	Re	emove		Replace	Quantity	Total	Notes	
Replace deteriorated sections of metal flume	78 INCH EQUIVALENT CORREGATED STEEL PIPE	LF	\$	400.00	\$	1,100.00	6.0	\$ 9,000.00	Spans with 3' sections assumed at 2 locations for replacement	Report
	ARCH								using similar pricing for corregated steel pipe arch per	
									maintenance cycle	
Paint existing structure entirely	PAINT EXISTING STRUCTURE	SF	\$	-	\$	25.00	4778.9	\$ 119,472.78	Paint Structure	Report
Clear vegetation in, under, and around structure	CLEARING AND GRUBBING	ACRE	\$	-	\$	30,000.00	0.10	\$ 3,000.00	Removal of vegetation minimum area of 0.1 acre = 230 ft length	Assumed
									= ~19' width on either side of tressel	
Replace rubber liner	RUBBER LINER	SF	\$	5.00	\$	20.00	2328.5	\$ 58,212.07	Matches surface area of flume trough	Report
Forestry Services for Clearing and Grubbing	FORESTRY SERVICES	EA	\$	-	\$	50,000.00	1.0	\$ 50,000.00	Verify with Littleton for Forestry Services Requirements	Report

Maintenance costs are estimated to occur approximately every 10 years

 Total
 \$ 239,684.86

 40% Contingency
 \$ 95,873.94

 Contingency covers unknowns, taxes, future costs, etc.

Estimated Maintenance Cost \$ 335,558.80

Cost Estimate Calculations_Slaughterhouse

	Computed by:	TRP			Date:	11/22/2024			Sheet:	
🥌 benesch	Checked by:	APJ			Date:	12/2/2024			Project No.:	1525-400003.01
	Project:	Slaught	terhou	use Gulch Fl	ume, Littleton, C	0			-	
Version: 1	Element:	Movem	nent ()	ost Estimat	2					
	Lenen	Moven	iene e	ost Estimat	-					
Maintenance Recommendations	Description	Unit		Cos	t/Unit					Quantity Basis
	Decemption	onic	R	emove	Replace	Quantity		Total	Notes	
Dealers data denoted as ations of as atal flows of		L F	¢	100.00	Juantities		¢	10 500 00	On successful OL as attacks of much although and an extend in successful to	Devent
Replace deteriorated sections of metal filline to	78 INCH EQUIVALENT CORREGATED STEEL PIPE	LF	\$	400.00	\$ 1,100.00	9.0	Þ	13,500.00	Spans with 3 sections of rusted through areas noted in report at	кероп
truss	ARCH								corregated steel pipe arch	
Replace rubber liner throughout truss	RUBBER LINER	SF	\$	5.00	\$ 20.00	485.5	\$	12,138.05	Matches surface area of flume trough throughout truss length	Report
Paint existing truss structure entirely	PAINT EXISTING STRUCTURE	SF	\$	-	\$ 25.00	769.6	\$	19,240.80	Paint Truss Structure	Report
New Foundations for Truss	CONCRETE CLASS D	CY	\$	-	\$ 900.00	6.1	\$	5,466.67	New concrete foundations below Truss	Assumed
Disassemble and Reassemble Truss w/ 2 tressels	STRUCTURAL STEEL (REMOVE AND REPLACE)	LBS	\$	10.00	\$ 10.00	7276.7	\$	145,534.51	Move truss members to new location	Assumed
Disassemble and Reassemble Truss w/ 2	STRUCTURAL STEEL (NEW STEEL)	LBS	\$	-	\$ 20.00	727.7	\$	14,553.45	Assume 10% of existing steel needs to be replaced/repaired with	Assumed
tressels							<u> </u>		new material	
					Total to	move the truss	s\$	210,433.48		
					40%	Contingency	/\$	84,173.39	Contingency covers unknowns, taxes, future costs, etc.	
				Esti	mated Truss N	lovement Cost	t \$	294,606.88		
			T	vnical Sr	an Quantitio	2				
Replace deteriorated sections of metal flume fo	78 INCH FOLIIVALENT CORREGATED STEEL PIPE	I F	T \$	ypical Sp 400.00	an Quantitie	3 0	\$	4 500 00	Spans with 3' sections of rusted through areas noted in report	Report
Replace deteriorated sections of metal flume fo	78 INCH EQUIVALENT CORREGATED STEEL PIPE	LF	Т \$	ypical Sp 400.00	an Quantitie \$ 1,100.00	3.0	\$	4,500.00	Spans with 3' sections of rusted through areas noted in report assumed at 1 location for replacement of twical span using	Report
Replace deteriorated sections of metal flume fo a typical section	78 INCH EQUIVALENT CORREGATED STEEL PIPE ARCH	LF	T \$	ypical Sp 400.00	an Quantitie \$ 1,100.00	3.0	\$	4,500.00	Spans with 3' sections of rusted through areas noted in report assumed at 1 location for replacement of typical span using similar pricing for corregated steel pipe arch	Report
Replace deteriorated sections of metal flume fo a typical section	78 INCH EQUIVALENT CORREGATED STEEL PIPE ARCH RUBBER LINER	LF	5 \$ \$	ypical Sp 400.00	an Quantitie \$ 1,100.00	3.0	\$	4,500.00	Spans with 3' sections of rusted through areas noted in report assumed at 1 location for replacement of typical span using similar pricing for corregated steel pipe arch Matches surface area of flume trough throughout typical span	Report
Replace deteriorated sections of metal flume fo a typical section Replace rubber liner throughout span	78 INCH EQUIVALENT CORREGATED STEEL PIPE ARCH RUBBER LINER	LF SF	T \$ \$	ypical Sp 400.00 5.00	an Quantitie \$ 1,100.00 \$ 20.00	3.0 162.7	\$	4,500.00	Spans with 3' sections of rusted through areas noted in report assumed at 1 location for replacement of typical span using similar pricing for corregated steel pipe arch Matches surface area of flume trough throughout typical span length	Report Report
Replace deteriorated sections of metal flume fo a typical section Replace rubber liner throughout span Paint existing span structure entirely	78 INCH EQUIVALENT CORREGATED STEEL PIPE ARCH RUBBER LINER PAINT EXISTING STRUCTURE	LF SF SF	T \$ \$ \$	ypical Sp 400.00 5.00	an Quantitie \$ 1,100.00 \$ 20.00 \$ 25.00	3.0 162.7 602.4	\$	4,500.00 4,067.09	Spans with 3' sections of rusted through areas noted in report assumed at 1 location for replacement of typical span using similar pricing for corregated steel pipe arch Matches surface area of flume trough throughout typical span length Paint Structure	Report Report
Replace deteriorated sections of metal flume fo a typical section Replace rubber liner throughout span Paint existing span structure entirely New Foundations for one Tressle	78 INCH EQUIVALENT CORREGATED STEEL PIPE ARCH RUBBER LINER PAINT EXISTING STRUCTURE CONCRETE CLASS D	LF SF SF CY	T) \$ \$ \$ \$	ypical Sp 400.00 5.00 -	an Quantitie \$ 1,100.00 \$ 20.00 \$ 25.00 \$ 900.00	3.0 162.7 602.4 3.0	\$ \$ \$	4,500.00 4,067.09 15,060.73 2,733.33	Spans with 3' sections of rusted through areas noted in report assumed at 1 location for replacement of typical span using similar pricing for corregated steel pipe arch Matches surface area of flume trough throughout typical span length Paint Structure New concrete foundations below one tressel of span	Report Report Report Assumed
Replace deteriorated sections of metal flume fo a typical section Replace rubber liner throughout span Paint existing span structure entirely New Foundations for one Tressle Disassemble and Reassemble typical span w/ 2	78 INCH EQUIVALENT CORREGATED STEEL PIPE ARCH RUBBER LINER PAINT EXISTING STRUCTURE CONCRETE CLASS D STRUCTURAL STEEL (REMOVE AND REPLACE)	LF SF SF CY LBS	T) \$ \$ \$ \$ \$	ypical Sp 400.00 5.00 - - 10.00	an Quantitie \$ 1,100.00 \$ 20.00 \$ 25.00 \$ 900.00 \$ 10.00	3.0 162.7 602.4 3.0 1098.2	\$ \$ \$ \$	4,500.00 4,067.09 15,060.73 2,733.33 21,964.43	Spans with 3' sections of rusted through areas noted in report assumed at 1 location for replacement of typical span using similar pricing for corregated steel pipe arch Matches surface area of flume trough throughout typical span length Paint Structure New concrete foundations below one tressel of span Move span members to new location	Report Report Report Assumed Assumed
Replace deteriorated sections of metal flume fo a typical section Replace rubber liner throughout span Paint existing span structure entirely New Foundations for one Tressle Disassemble and Reassemble typical span w/ 7 tressel	78 INCH EQUIVALENT CORREGATED STEEL PIPE ARCH RUBBER LINER PAINT EXISTING STRUCTURE CONCRETE CLASS D STRUCTURAL STEEL (REMOVE AND REPLACE)	LF SF SF CY LBS	T) \$ \$ \$ \$ \$	ypical Sp 400.00 5.00 - - 10.00	an Quantitie \$ 1,100.00 \$ 20.00 \$ 25.00 \$ 900.00 \$ 10.00	3.0 3.0 162.7 602.4 3.0 1098.2	\$ \$ \$ \$	4,500.00 4,067.09 15,060.73 2,733.33 21,964.43	Spans with 3' sections of rusted through areas noted in report assumed at 1 location for replacement of typical span using similar pricing for corregated steel pipe arch Matches surface area of flume trough throughout typical span length Paint Structure New concrete foundations below one tressel of span Move span members to new location	Report Report Report Assumed Assumed
Replace deteriorated sections of metal flume fo a typical section Replace rubber liner throughout span Paint existing span structure entirely New Foundations for one Tressle Disassemble and Reassemble typical span w/ ' tressel Disassemble and Reassemble typical span w/ '	78 INCH EQUIVALENT CORREGATED STEEL PIPE ARCH RUBBER LINER PAINT EXISTING STRUCTURE CONCRETE CLASS D STRUCTURAL STEEL (REMOVE AND REPLACE) STRUCTURAL STEEL (NEW STEEL)	LF SF CY LBS LBS	T) \$ \$ \$ \$ \$ \$	ypical Sp 400.00 5.00 - - 10.00 -	an Quantitie \$ 1,100.00 \$ 20.00 \$ 25.00 \$ 900.00 \$ 10.00 \$ 20.00	S 3.0 162.7 602.4 3.0 1098.2 109.8	\$ \$ \$ \$ \$	4,500.00 4,067.09 15,060.73 2,733.33 21,964.43 2,196.44	Spans with 3' sections of rusted through areas noted in report assumed at 1 location for replacement of typical span using similar pricing for corregated steel pipe arch Matches surface area of flume trough throughout typical span length Paint Structure New concrete foundations below one tressel of span Move span members to new location Assume 10% of existing steel needs to be replaced/repaired with new material	Report Report Assumed Assumed Assumed
Replace deteriorated sections of metal flume fo a typical section Replace rubber liner throughout span Paint existing span structure entirely New Foundations for one Tressle Disassemble and Reassemble typical span w/ 7 tressel	78 INCH EQUIVALENT CORREGATED STEEL PIPE ARCH RUBBER LINER PAINT EXISTING STRUCTURE CONCRETE CLASS D STRUCTURAL STEEL (REMOVE AND REPLACE)	LF SF CY LBS LBS	T \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	ypical Sp 400.00 5.00 - - 10.00 -	an Quantitie \$ 1,100.00 \$ 20.00 \$ 25.00 \$ 900.00 \$ 10.00 \$ 20.00 Total to	5 3.0 162.7 602.4 3.0 1098.2 109.8 move one error	\$ \$ \$ \$ \$	4,500.00 4,067.09 15,060.73 2,733.33 21,964.43 2,196.44	Spans with 3' sections of rusted through areas noted in report assumed at 1 location for replacement of typical span using similar pricing for corregated steel pipe arch Matches surface area of flume trough throughout typical span length Paint Structure New concrete foundations below one tressel of span Move span members to new location Assume 10% of existing steel needs to be replaced/repaired with new material	Report Report Assumed Assumed Assumed
Replace deteriorated sections of metal flume fo a typical section Replace rubber liner throughout span Paint existing span structure entirely New Foundations for one Tressle Disassemble and Reassemble typical span w/ 7 tressel	78 INCH EQUIVALENT CORREGATED STEEL PIPE ARCH RUBBER LINER PAINT EXISTING STRUCTURE CONCRETE CLASS D STRUCTURAL STEEL (REMOVE AND REPLACE) STRUCTURAL STEEL (NEW STEEL)	LF SF CY LBS LBS	T) \$ \$ \$ \$ \$	ypical Sp 400.00 5.00 - - 10.00 -	an Quantitie \$ 1,100.00 \$ 20.00 \$ 25.00 \$ 900.00 \$ 10.00 \$ 20.00 \$ 20.00 \$ 10.00 \$ 20.00	3.0 3.0 162.7 602.4 3.0 1098.2 1098.2 109.8 move one spar	\$ \$ \$ \$ \$ \$	4,500.00 4,067.09 15,060.73 2,733.33 21,964.43 2,196.44 50,522.02 20,208.81	Spans with 3' sections of rusted through areas noted in report assumed at 1 location for replacement of typical span using similar pricing for corregated steel pipe arch Matches surface area of flume trough throughout typical span length Paint Structure New concrete foundations below one tressel of span Move span members to new location Assume 10% of existing steel needs to be replaced/repaired with new material	Report Report Assumed Assumed Assumed
Replace deteriorated sections of metal flume fo a typical section Replace rubber liner throughout span Paint existing span structure entirely New Foundations for one Tressle Disassemble and Reassemble typical span w/ ' tressel	78 INCH EQUIVALENT CORREGATED STEEL PIPE ARCH RUBBER LINER PAINT EXISTING STRUCTURE CONCRETE CLASS D STRUCTURAL STEEL (REMOVE AND REPLACE)	LF SF CY LBS LBS	T) \$ \$ \$ \$ \$	ypical Sp 400.00 5.00 - 10.00 -	an Quantitie \$ 1,100.00 \$ 20.00 \$ 25.00 \$ 900.00 \$ 10.00 \$ 20.00 Total to 40%	3.0 3.0 162.7 602.4 3.0 1098.2 109.8 move one spar Contingency Contingency	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500.00 4,067.09 15,060.73 2,733.33 21,964.43 2,196.44 50,522.02 20,208.81 70,730.83	Spans with 3' sections of rusted through areas noted in report assumed at 1 location for replacement of typical span using similar pricing for corregated steel pipe arch Matches surface area of flume trough throughout typical span length Paint Structure New concrete foundations below one tressel of span Move span members to new location Assume 10% of existing steel needs to be replaced/repaired with new material Contingency covers unknowns, taxes, future costs, etc.	Report Report Assumed Assumed Assumed
Replace deteriorated sections of metal flume fo a typical section Replace rubber liner throughout span Paint existing span structure entirely New Foundations for one Tressle Disassemble and Reassemble typical span w/ tressel Disassemble and Reassemble typical span w/ tressel	78 INCH EQUIVALENT CORREGATED STEEL PIPE ARCH RUBBER LINER PAINT EXISTING STRUCTURE CONCRETE CLASS D STRUCTURAL STEEL (REMOVE AND REPLACE) STRUCTURAL STEEL (NEW STEEL)	LF SF CY LBS LBS	T \$ \$ \$ \$ \$ \$	ypical Sp 400.00 5.00 - 10.00 - E	an Quantitie \$ 1,100.00 \$ 20.00 \$ 25.00 \$ 900.00 \$ 10.00 \$ 20.00 Total to 40% stimated Span Total n	3.0 162.7 602.4 3.0 1098.2 109.8 move one spar > Contingency Movement Cos mber of Spans	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500.00 4,067.09 15,060.73 2,733.33 21,964.43 2,196.44 50,522.02 20,208.81 70,730.83	Spans with 3' sections of rusted through areas noted in report assumed at 1 location for replacement of typical span using similar pricing for corregated steel pipe arch Matches surface area of flume trough throughout typical span length Paint Structure New concrete foundations below one tressel of span Move span members to new location Assume 10% of existing steel needs to be replaced/repaired with new material Contingency covers unknowns, taxes, future costs, etc.	Report Report Assumed Assumed Assumed
Replace deteriorated sections of metal flume fo a typical section Replace rubber liner throughout span Paint existing span structure entirely New Foundations for one Tressle Disassemble and Reassemble typical span w/ ' tressel Disassemble and Reassemble typical span w/ ' tressel	78 INCH EQUIVALENT CORREGATED STEEL PIPE ARCH RUBBER LINER PAINT EXISTING STRUCTURE CONCRETE CLASS D STRUCTURAL STEEL (REMOVE AND REPLACE)	LF SF CY LBS LBS	T \$ \$ \$ \$	ypical Sp 400.00 5.00 - 10.00 - E Total Cos	an Quantitie \$ 1,100.00 \$ 20.00 \$ 25.00 \$ 900.00 \$ 10.00 \$ 20.00 Total to 40% stimated Span Total n Total n t or Number c	3.0 162.7 602.4 3.0 1098.2 109.8 move one spar > Contingency Movement Coss imber of Spans f Spans Above	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500.00 4,067.09 15,060.73 2,733.33 21,964.43 2,196.44 50,522.02 20,208.81 70,730.83 9,00 636,577.48	Spans with 3' sections of rusted through areas noted in report assumed at 1 location for replacement of typical span using similar pricing for corregated steel pipe arch Matches surface area of flume trough throughout typical span length Paint Structure New concrete foundations below one tressel of span Move span members to new location Assume 10% of existing steel needs to be replaced/repaired with new material Contingency covers unknowns, taxes, future costs, etc. Does not include spans with abutments, new abutments omitted	Report Report Assumed Assumed Assumed
Replace deteriorated sections of metal flume fo a typical section Replace rubber liner throughout span Paint existing span structure entirely New Foundations for one Tressle Disassemble and Reassemble typical span w/ ' tressel Disassemble and Reassemble typical span w/ ' tressel	78 INCH EQUIVALENT CORREGATED STEEL PIPE ARCH RUBBER LINER PAINT EXISTING STRUCTURE CONCRETE CLASS D STRUCTURAL STEEL (REMOVE AND REPLACE) STRUCTURAL STEEL (NEW STEEL)	LF SF CY LBS LBS	T \$ \$ \$ \$	ypical Sp 400.00 5.00 - 10.00 - E Total Cos	an Quantitie \$ 1,100.00 \$ 20.00 \$ 25.00 \$ 900.00 \$ 10.00 \$ 20.00 Total to 40% stimated Span Total n Total n 0 40%	3.0 3.0 162.7 602.4 3.0 1098.2 1098.2 1098.2 1098.2 Vovement Cos where of Spans f Spans Above	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500.00 4,067.09 15,060.73 2,733.33 21,964.43 2,196.44 50,522.02 20,208.81 70,730.83 9.0 636,577.48	Spans with 3' sections of rusted through areas noted in report assumed at 1 location for replacement of typical span using similar pricing for corregated steel pipe arch Matches surface area of flume trough throughout typical span length Paint Structure New concrete foundations below one tressel of span Move span members to new location Assume 10% of existing steel needs to be replaced/repaired with new material Contingency covers unknowns, taxes, future costs, etc. Does not include spans with abutments, new abutments omitted	Report Report Assumed Assumed Assumed
Replace deteriorated sections of metal flume fo a typical section Replace rubber liner throughout span Paint existing span structure entirely New Foundations for one Tressle Disassemble and Reassemble typical span w/ tressel Disassemble and Reassemble typical span w/ tressel	78 INCH EQUIVALENT CORREGATED STEEL PIPE ARCH RUBBER LINER PAINT EXISTING STRUCTURE CONCRETE CLASS D STRUCTURAL STEEL (REMOVE AND REPLACE) STRUCTURAL STEEL (NEW STEEL)	LF SF CY LBS LBS	T S S S S S S	ypical Sp 400.00 5.00 - 10.00 - E Total Cos	an Quantitie \$ 1,100.00 \$ 20.00 \$ 25.00 \$ 25.00 \$ 900.00 \$ 10.00 \$ 20.00 Total to 40% stimated Span Total n Total n tor Number c ous Element \$ 20.00 000	3.0 162.7 602.4 3.0 1098.2 1098.2 1098.8 move one spar Contingency Vovement Cos umber of Spans f Spans Above S	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500.00 4,067.09 15,060.73 2,733.33 21,964.43 2,1964.43 50,522.02 20,208.81 70,730.83 9,0 636,577.48	Spans with 3' sections of rusted through areas noted in report assumed at 1 location for replacement of typical span using similar pricing for corregated steel pipe arch Matches surface area of flume trough throughout typical span length Paint Structure New concrete foundations below one tressel of span Move span members to new location Assume 10% of existing steel needs to be replaced/repaired with new material Contingency covers unknowns, taxes, future costs, etc. Does not include spans with abutments, new abutments omitted	Report Report Assumed Assumed Assumed
Replace deteriorated sections of metal flume for a typical section Replace rubber liner throughout span Paint existing span structure entirely New Foundations for one Tressle Disassemble and Reassemble typical span w/ ' tressel Disassemble and Reassemble typical span w/ ' tressel	78 INCH EQUIVALENT CORREGATED STEEL PIPE ARCH RUBBER LINER PAINT EXISTING STRUCTURE CONCRETE CLASS D STRUCTURAL STEEL (REMOVE AND REPLACE) STRUCTURAL STEEL (NEW STEEL)	LF SF CY LBS LBS	T \$ \$ \$ \$ \$ \$ \$ \$ \$	ypical Sp 400.00 5.00 - 10.00 - E Total Cos iiscellane	an Quantitie \$ 1,100.00 \$ 20.00 \$ 25.00 \$ 900.00 \$ 10.00 \$ 20.00 Total to 40% stimated Span Total n Total n total n Number c ous Element \$ 30,000.00	3.0 3.0 162.7 602.4 3.0 1098.2 1098.2 1098.2 0 Contingency Contingency vovement Coss move one spars f Spans Above S 0.20 0.20	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500.00 4,067.09 15,060.73 2,733.33 21,964.43 2,1964.43 50,522.02 20,208.81 70,730.83 9,0 636,577.48 6,000.00	Spans with 3' sections of rusted through areas noted in report assumed at 1 location for replacement of typical span using similar pricing for corregated steel pipe arch Matches surface area of flume trough throughout typical span length Paint Structure New concrete foundations below one tressel of span Move span members to new location Assume 10% of existing steel needs to be replaced/repaired with new material Contingency covers unknowns, taxes, future costs, etc. Does not include spans with abutments, new abutments omitted Removal of vegetation around existing and proposed areas	Report Report Assumed Assumed Assumed Assumed
Replace deteriorated sections of metal flume fo a typical section Replace rubber liner throughout span Paint existing span structure entirely New Foundations for one Tressle Disassemble and Reassemble typical span w/ / tressel Disassemble and Reassemble typical span w/ / tressel	78 INCH EQUIVALENT CORREGATED STEEL PIPE ARCH RUBBER LINER PAINT EXISTING STRUCTURE CONCRETE CLASS D STRUCTURAL STEEL (REMOVE AND REPLACE) STRUCTURAL STEEL (NEW STEEL) CLEARING AND GRUBBING FORESTRY SERVICES	LF SF CY LBS LBS	T \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	ypical Sp 400.00 5.00 - - 10.00 - E Total Cos iscellane	an Quantitie \$ 1,100.00 \$ 20.00 \$ 25.00 \$ 900.00 \$ 10.00 \$ 20.00 Total to 40% stimated Span Total n t for Number of ous Element \$ 30,000.00 \$ 50,000.00	3.0 3.0 162.7 602.4 3.0 1098.2 1098.2 1098.2 109.8 contingency Wovement Cossumber of Spans f Spans Above 5 0.20 1.0 1.0	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	4,500.00 4,067.09 15,060.73 2,733.33 21,964.43 2,196.44 50,522.02 20,208.81 70,730.83 9.0 636,577.48 6,000.00 50,000.00	Spans with 3' sections of rusted through areas noted in report assumed at 1 location for replacement of typical span using similar pricing for corregated steel pipe arch Matches surface area of flume trough throughout typical span length Paint Structure New concrete foundations below one tressel of span Move span members to new location Assume 10% of existing steel needs to be replaced/repaired with new material Contingency covers unknowns, taxes, future costs, etc. Does not include spans with abutments, new abutments omitted Removal of vegetation around existing and proposed areas Verify with Littleton for Forestry Services Requirements	Report Report Report Assumed Assumed Assumed Assumed Assumed Assumed Assumed Assumed

50,000.00	1.0	\$ 50,000.00	Verify with Littleton for Forestry Services Requirements
50,000.00	1.0	\$ 50,000.00	Verify with Littleton for Forestry Services Requirements

Total \$

40% Contingency \$ 42,400.00 Contingency covers unknowns, taxes, future costs, etc.

Estimated Cost \$ 148,400.00

Estimated Movement cost for the above scope and number of spans indicated \$ 1,079,584.36 Does not include spans with abutments, new abutments omitted from estimate

106,000.00