Attachment E: Culvert Sizing Report

Attachments A thru D are unchanged from original submission

Culvert Report

Project filename: Culvert Calculations.cst

Culvert Studio v 2.0.0.30

03-05-2025

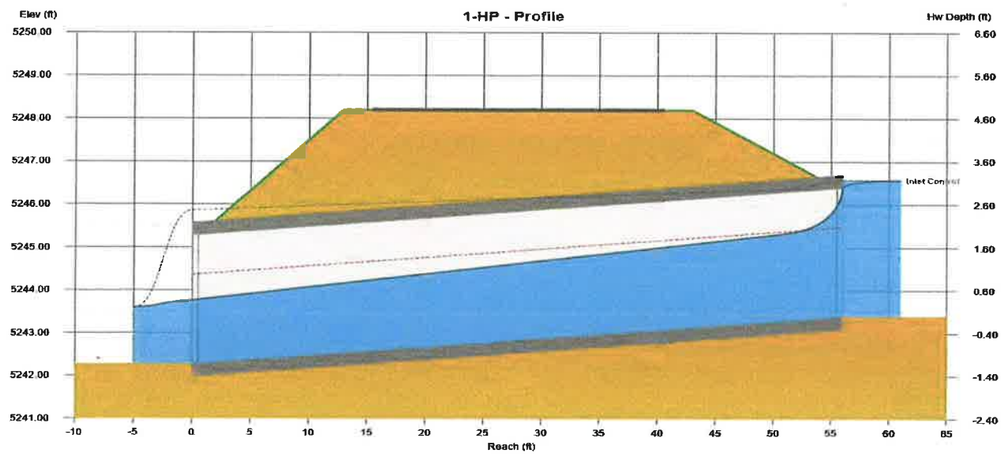
1-HP

Culvert 2

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5248.20 ft
Material	= Concrete	Crest Length	= 30.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5242.28 ft	Q Min	= 0.00 cfs
Length	= 56.0 ft	Q Max	= 81.00 cfs
Slope	= 0.020 ft/ft	Q Increment	= 8.10 cfs
Invert Elev. Up	= 5243.40 ft		
No. Barrels	= 2	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 1.06		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
81.00	81.00	0.00	11.62	7.73	17.8	25.0	5243.76	5245.48	5246.58



Culvert Report

Project filename: Culvert Calculations.cst

Culvert Studio v 2.0.0.30

03-05-2025

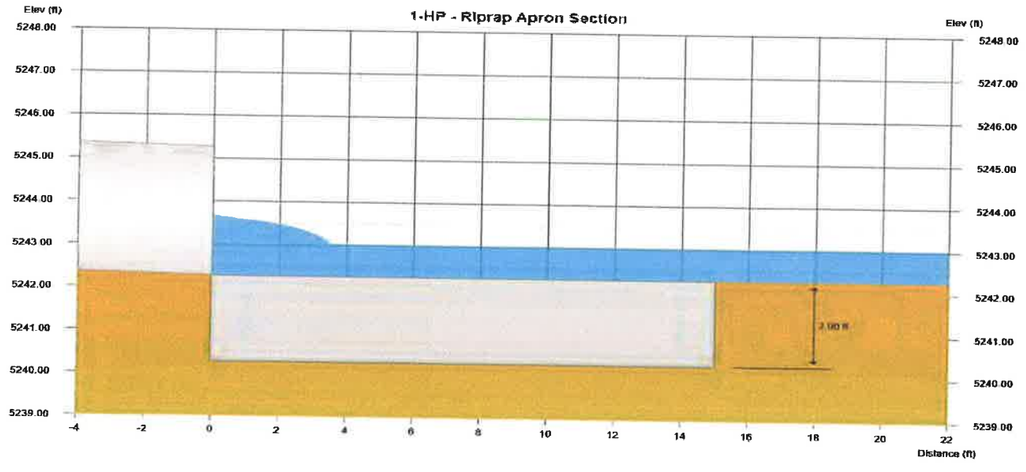
1-HP

Culvert 2

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5248.20 ft
Material	= Concrete	Crest Length	= 30.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5242.28 ft	Q Min	= 0.00 cfs
Length	= 56.0 ft	Q Max	= 81.00 cfs
Slope	= 0.020 ft/ft	Q Increment	= 8.10 cfs
Invert Elev. Up	= 5243.40 ft		
No. Barrels	= 2	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
81.00	81.00	0.00	11.62	7.73	15.00	22.05	2.00	10	4.89



FHWA Class 3, D50 = 10 in

Plan

Culvert Report

Project filename: Culvert Calculations.cst

Culvert Studio v 2.0.0.30

03-05-2025

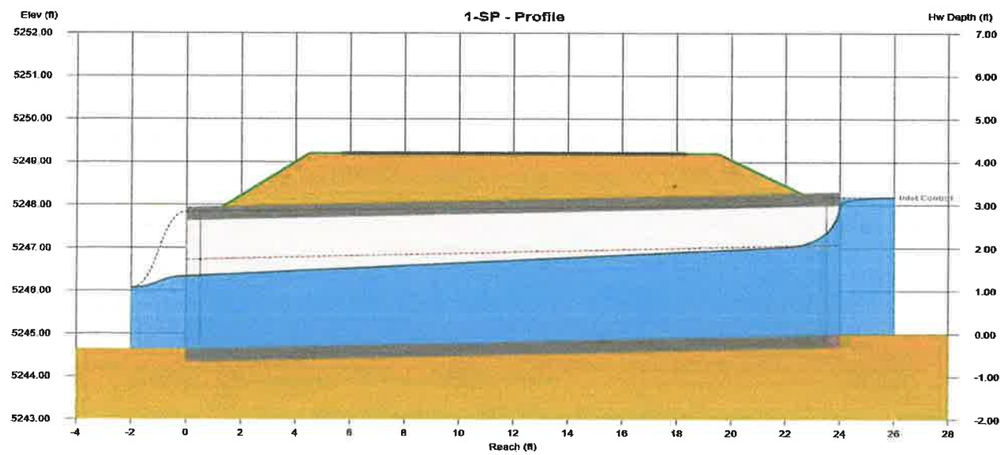
1-SP

Culvert 1

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 15.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5249.20 ft
Material	= Concrete	Crest Length	= 10.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5244.64 ft	Q Min	= 0.00 cfs
Length	= 24.00 ft	Q Max	= 81.00 cfs
Slope	= 0.015 ft/ft	Q Increment	= 8.10 cfs
Invert Elev. Up	= 5245.00 ft		
No. Barrels	= 2	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 1.06		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
81.00	81.00	0.00	9.85	7.73	20.3	25.0	5246.33	5247.08	5248.18



Culvert Report

Project filename: Culvert Calculations.cst

Culvert Studio v 2.0.0.30

03-05-2025

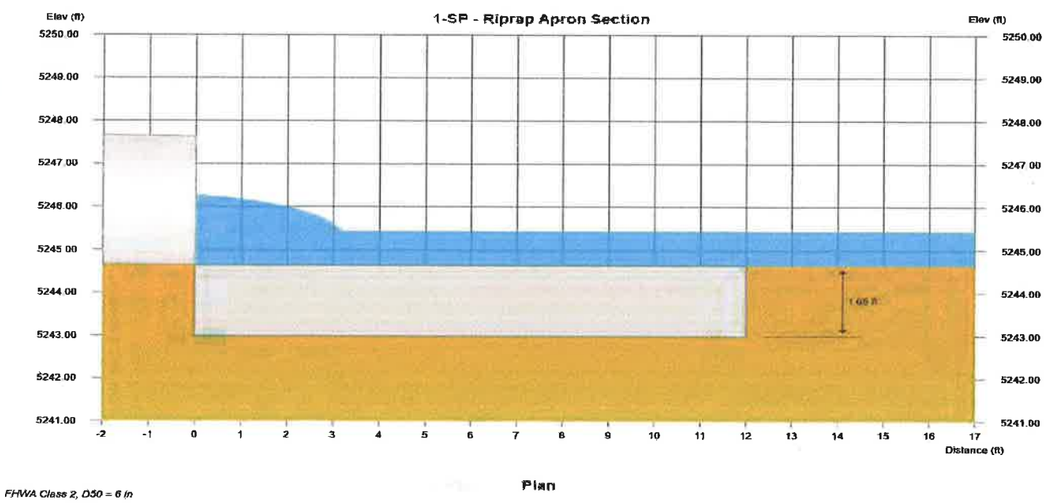
1-SP

Culvert 1

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 15.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5249.20 ft
Material	= Concrete	Crest Length	= 10.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5244.64 ft	Q Min	= 0.00 cfs
Length	= 24.00 ft	Q Max	= 81.00 cfs
Slope	= 0.015 ft/ft	Q Increment	= 8.10 cfs
Invert Elev. Up	= 5245.00 ft		
No. Barrels	= 2	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
81.00	81.00	0.00	9.85	7.73	12.00	20.04	1.65	6	5.05



Plan

FHWA Class 2, D50 = 6 in

Culvert Report

Project filename: Culvert Calculations.cst

Culvert Studio v 2.0.0.30

03-05-2025

2A-HB

Culvert 7

CULVERT

Shape	= Rect - Open Bottom
Inlet Edge	= Beveled
Material	= Concrete
Manning's n	= 0.012 (0.035 Bottom)
Rise (Inside height)	= 96 in
Span	= 120 in
Invert Elev. Down	= 5174.00 ft
Length	= 50.0 ft
Slope	= 0.020 ft/ft
Invert Elev. Up	= 5175.00 ft
No. Barrels	= 1
Plan Skew Angle	= 0 degrees

EMBANKMENT

Top Width	= 15.00 ft
Top Elevation	= 5184.80 ft
Crest Length	= 40.00 ft

DISCHARGE

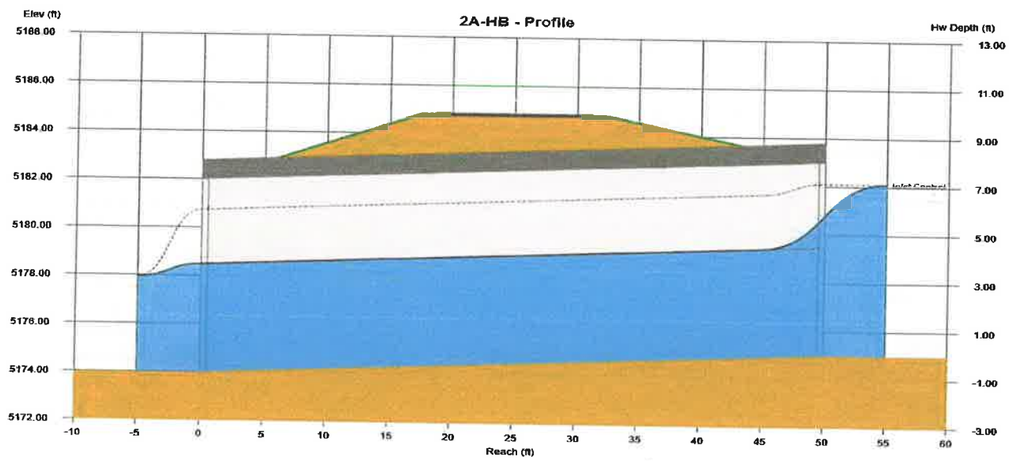
Method	= Qmin to Qmax
Q Min	= 0.00 cfs
Q Max	= 539.00 cfs
Q Increment	= 53.90 cfs

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.89		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
539.00	539.00	0.00	12.03	12.03	53.8	53.8	5178.48	5179.48	5182.11



Culvert Report

Project filename: Culvert Calculations.cst

Culvert Studio v 2.0.0.30

03-05-2025

2A-HB

Culvert 7

CULVERT

Shape	= Rect - Open Bottom
Inlet Edge	= Beveled
Material	= Concrete
Manning's n	= 0.012 (0.035 Bottom)
Rise (Inside height)	= 96 in
Span	= 120 in
Invert Elev. Down	= 5174.00 ft
Length	= 50.0 ft
Slope	= 0.020 ft/ft
Invert Elev. Up	= 5175.00 ft
No. Barrels	= 1
Plan Skew Angle	= 0 degrees

EMBANKMENT

Top Width	= 15.00 ft
Top Elevation	= 5184.80 ft
Crest Length	= 40.00 ft

DISCHARGE

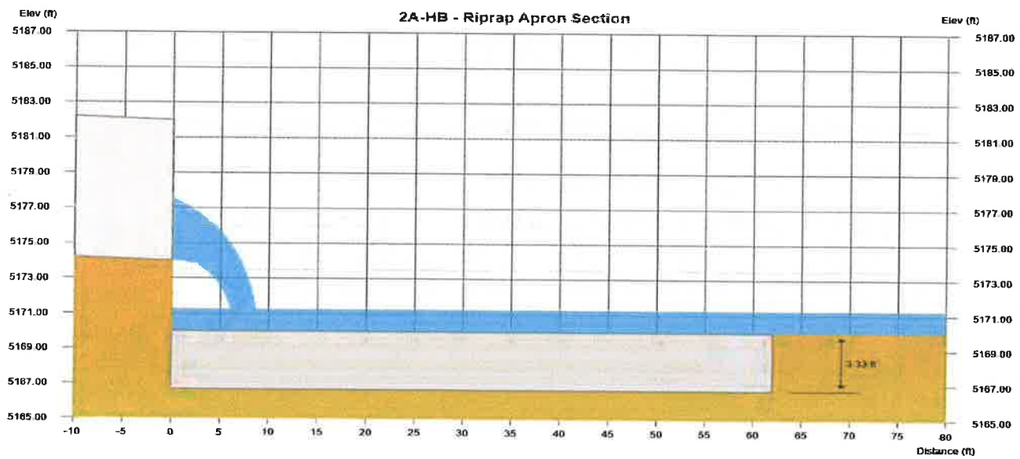
Method	= Qmin to Qmax
Q Min	= 0.00 cfs
Q Max	= 539.00 cfs
Q Increment	= 53.90 cfs

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
539.00	539.00	0.00	12.03	12.03	62.00	67.52	3.33	20	6.32



FHWA Class 5, D50 = 20 in

Plan

Culvert Report

Project filename: Culvert Calculations.cst

Culvert Studio v 2.0.0.30

03-05-2025

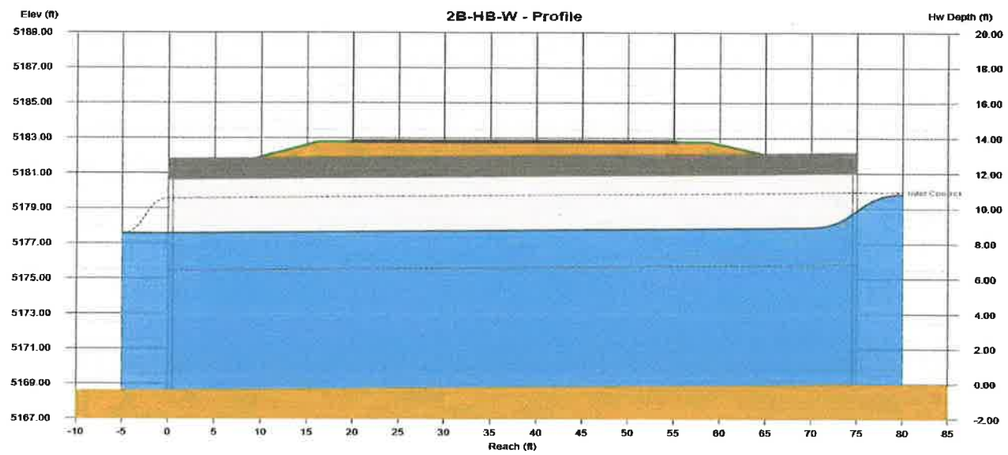
2B-HB-W

Culvert 5

CULVERT		EMBANKMENT	
Shape	= Rect - Open Bottom	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5182.80 ft
Material	= Concrete	Crest Length	= 50.00 ft
Manning's n	= 0.012 (0.035 Bottom)		
Rise (Inside height)	= 144 in	**DISCHARGE**	
Span	= 192 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5168.63 ft	Q Min	= 0.00 cfs
Length	= 75.0 ft	Q Max	= 1620.00 cfs
Slope	= 0.005 ft/ft	Q Increment	= 162.00 cfs
Invert Elev. Up	= 5169.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= -45 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.90		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
1620.00	1620.00	0.00	11.33	11.33	107.3	107.2	5177.57	5177.94	5179.82



Culvert Report

Project filename: Culvert Calculations.cst

Culvert Studio v 2.0.0.30

03-05-2025

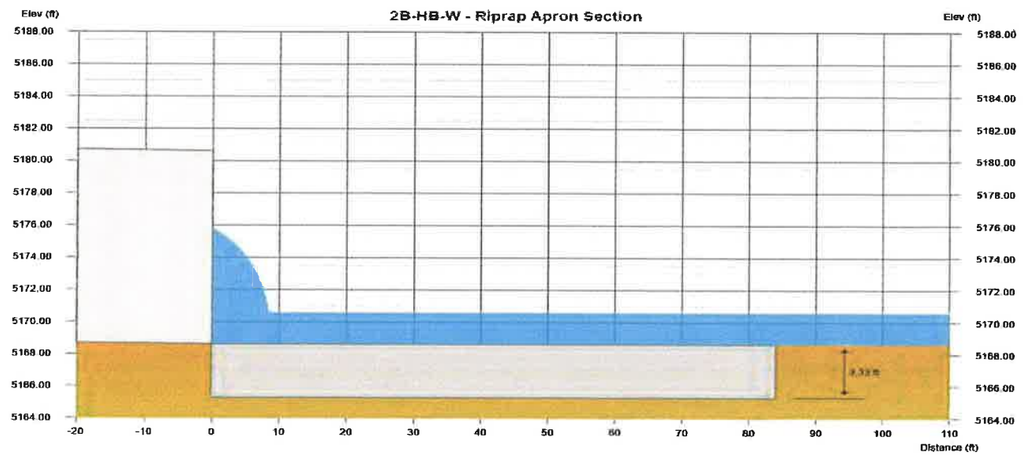
2B-HB-W

Culvert 5

CULVERT		EMBANKMENT	
Shape	= Rect - Open Bottom	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5182.80 ft
Material	= Concrete	Crest Length	= 50.00 ft
Manning's n	= 0.012 (0.035 Bottom)		
Rise (Inside height)	= 144 in	**DISCHARGE**	
Span	= 192 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5168.63 ft	Q Min	= 0.00 cfs
Length	= 75.0 ft	Q Max	= 1620.00 cfs
Slope	= 0.005 ft/ft	Q Increment	= 162.00 cfs
Invert Elev. Up	= 5169.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= -45 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
1620.00	1620.00	0.00	11.33	11.33	84.00	104.28	3.33	20	7.87



Plan

FHWA Class 5, D50 = 20 in

Culvert Report

Project filename: Culvert Calculations.cst

Culvert Studio v 2.0.0.30

03-05-2025

2B-SB-W

Culvert 6

CULVERT

Shape	= Rect - Open Bottom
Inlet Edge	= Beveled
Material	= Concrete
Manning's n	= 0.012 (0.035 Bottom)
Rise (Inside height)	= 144 in
Span	= 192 in
Invert Elev. Down	= 5170.75 ft
Length	= 50.0 ft
Slope	= 0.005 ft/ft
Invert Elev. Up	= 5171.00 ft
No. Barrels	= 1
Plan Skew Angle	= -45 degrees

EMBANKMENT

Top Width	= 15.00 ft
Top Elevation	= 5184.80 ft
Crest Length	= 50.00 ft

DISCHARGE

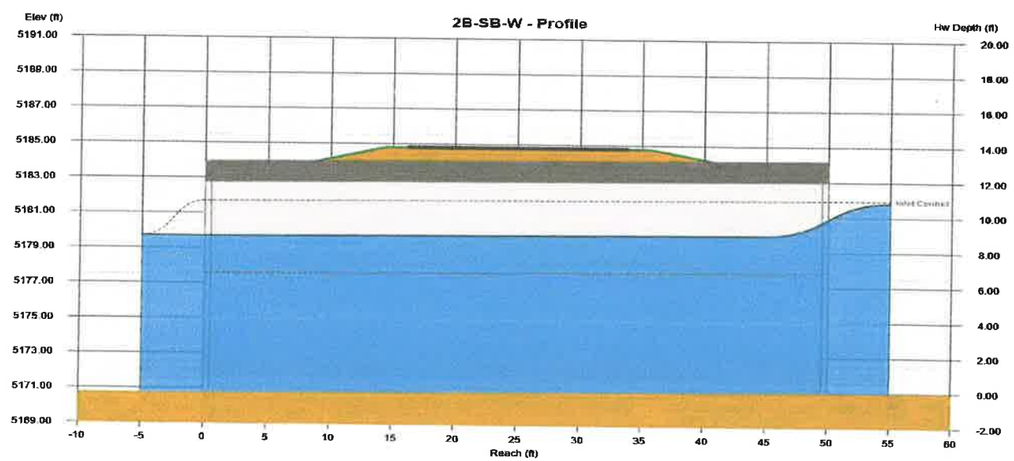
Method	= Qmin to Qmax
Q Min	= 0.00 cfs
Q Max	= 1620.00 cfs
Q Increment	= 162.00 cfs

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.90		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
1620.00	1620.00	0.00	11.33	11.32	107.3	107.3	5179.69	5179.94	5181.82



Culvert Report

Project filename: Culvert Calculations.cst

Culvert Studio v 2.0.0.30

03-05-2025

2B-SB-W

Culvert 6

CULVERT

Shape	= Rect - Open Bottom
Inlet Edge	= Beveled
Material	= Concrete
Manning's n	= 0.012 (0.035 Bottom)
Rise (Inside height)	= 144 in
Span	= 192 in
Invert Elev. Down	= 5170.75 ft
Length	= 50.0 ft
Slope	= 0.005 ft/ft
Invert Elev. Up	= 5171.00 ft
No. Barrels	= 1
Plan Skew Angle	= -45 degrees

EMBANKMENT

Top Width	= 15.00 ft
Top Elevation	= 5184.80 ft
Crest Length	= 50.00 ft

DISCHARGE

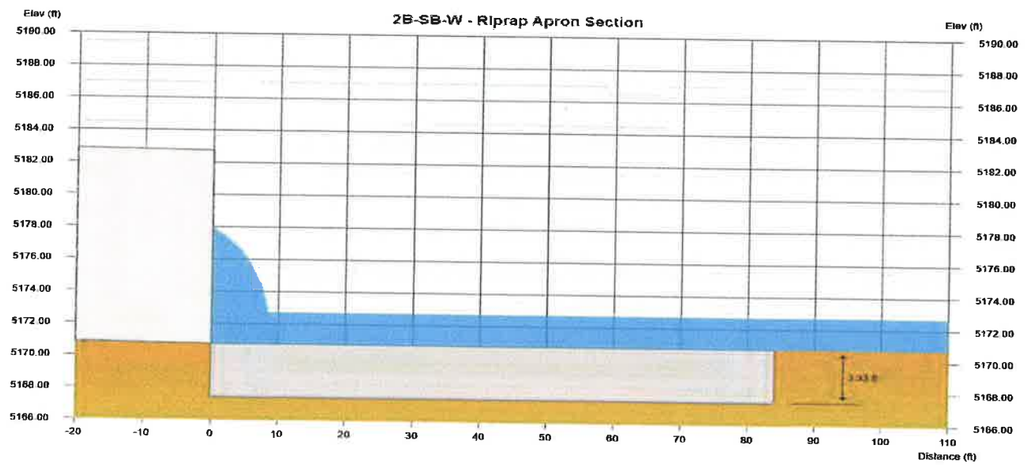
Method	= Qmin to Qmax
Q Min	= 0.00 cfs
Q Max	= 1620.00 cfs
Q Increment	= 162.00 cfs

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
1620.00	1620.00	0.00	11.33	11.32	84.00	104.28	3.33	20	7.87



FHWA Class 5, D50 = 20 in

Plan

Culvert Report

Project filename: Culvert Calculations.cst

Culvert Studio v 2.0.0.30

03-05-2025

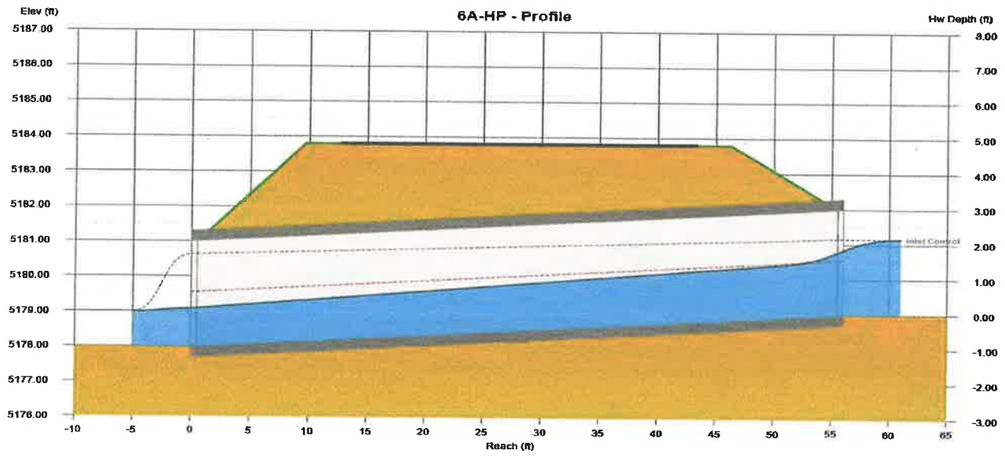
6A-HP

Culvert 9

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5183.80 ft
Material	= Concrete	Crest Length	= 10.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5177.99 ft	Q Min	= 0.00 cfs
Length	= 56.0 ft	Q Max	= 23.00 cfs
Slope	= 0.018 ft/ft	Q Increment	= 2.30 cfs
Invert Elev. Up	= 5179.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= -35 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.72		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
23.00	23.00	0.00	9.99	6.24	13.0	18.6	5179.08	5180.55	5181.16



Culvert Report

Project filename: Culvert Calculations.cst

Culvert Studio v 2.0.0.30

03-05-2025

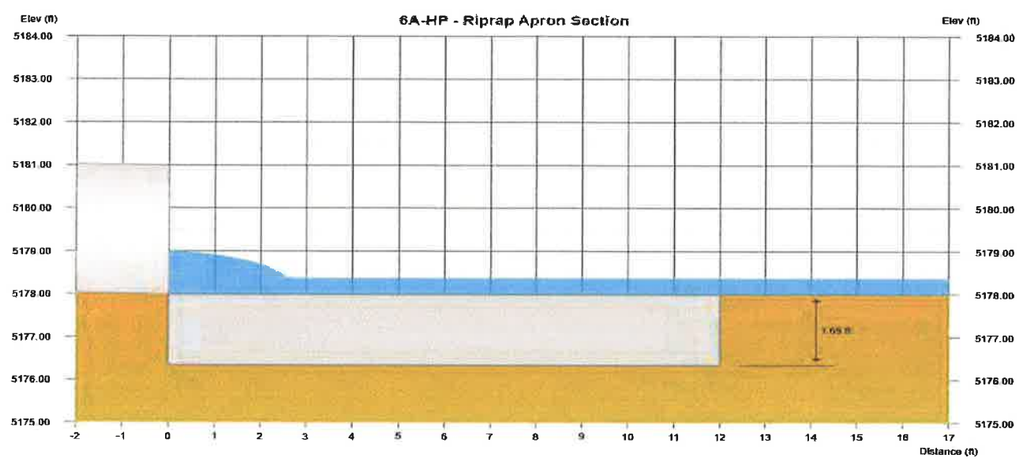
6A-HP

Culvert 9

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5183.80 ft
Material	= Concrete	Crest Length	= 10.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5177.99 ft	Q Min	= 0.00 cfs
Length	= 56.0 ft	Q Max	= 23.00 cfs
Slope	= 0.018 ft/ft	Q Increment	= 2.30 cfs
Invert Elev. Up	= 5179.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= -35 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
23.00	23.00	0.00	9.99	6.24	12.00	17.04	1.65	6	3.52



Plan

FHWA Class 2, D50 = 6 in

Culvert Report

Project filename: Culvert Calculations.cst

Culvert Studio v 2.0.0.30

03-05-2025

6A-SP

Culvert 10

CULVERT

Shape	= Circular
Inlet Edge	= Beveled
Material	= Concrete
Manning's n	= 0.012
Rise	= 36 in
Span	= 36 in
Invert Elev. Down	= 5180.75 ft
Length	= 24.00 ft
Slope	= 0.010 ft/ft
Invert Elev. Up	= 5181.00 ft
No. Barrels	= 1
Plan Skew Angle	= 0 degrees

EMBANKMENT

Top Width	= 15.00 ft
Top Elevation	= 5185.80 ft
Crest Length	= 10.00 ft

DISCHARGE

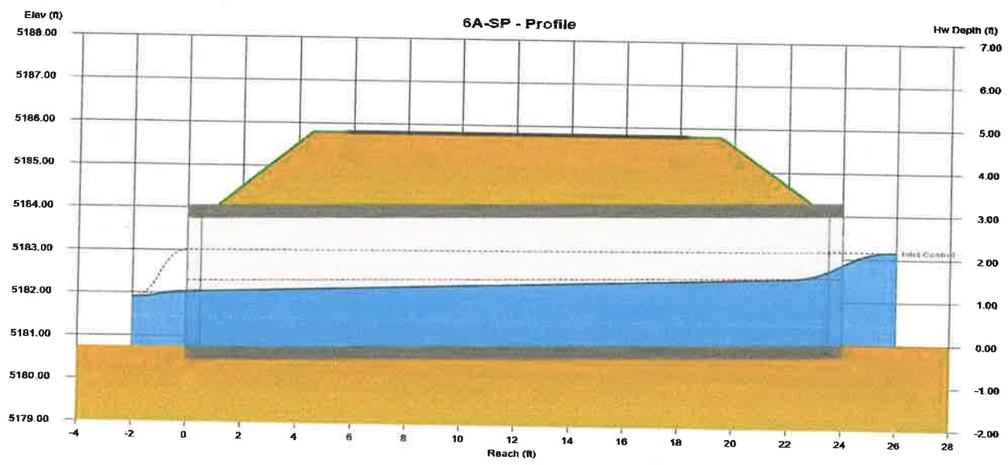
Method	= Qmin to Qmax
Q Min	= 0.00 cfs
Q Max	= 23.00 cfs
Q Increment	= 2.30 cfs

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.72		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
23.00	23.00	0.00	7.92	6.24	15.5	18.6	5182.04	5182.55	5183.17



Culvert Report

Project filename: Culvert Calculations.cst

Culvert Studio v 2.0.0.30

03-05-2025

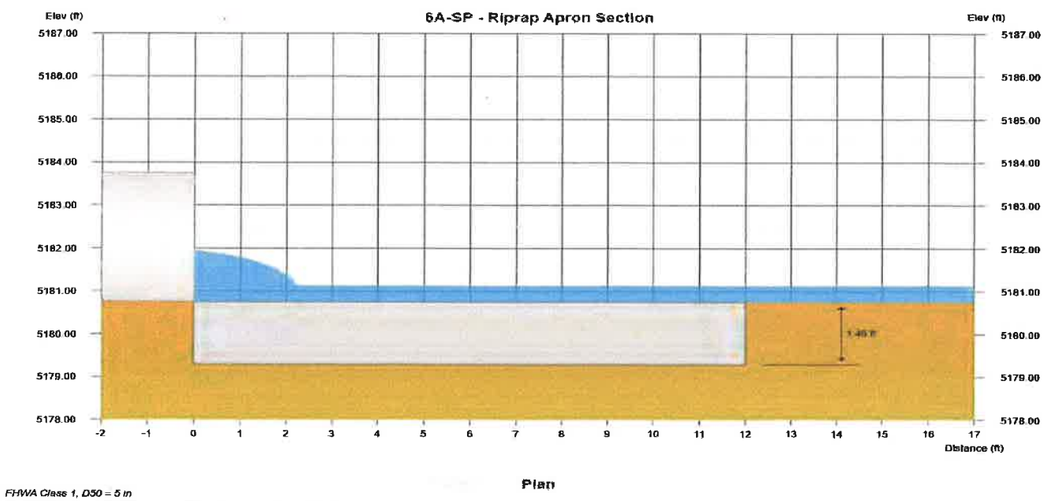
6A-SP

Culvert 10

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 15.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5185.80 ft
Material	= Concrete	Crest Length	= 10.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5180.75 ft	Q Min	= 0.00 cfs
Length	= 24.00 ft	Q Max	= 23.00 cfs
Slope	= 0.010 ft/ft	Q Increment	= 2.30 cfs
Invert Elev. Up	= 5181.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
23.00	23.00	0.00	7.92	6.24	12.00	17.04	1.46	5	3.52



FHWA Class 1, D50 = 5 in

Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

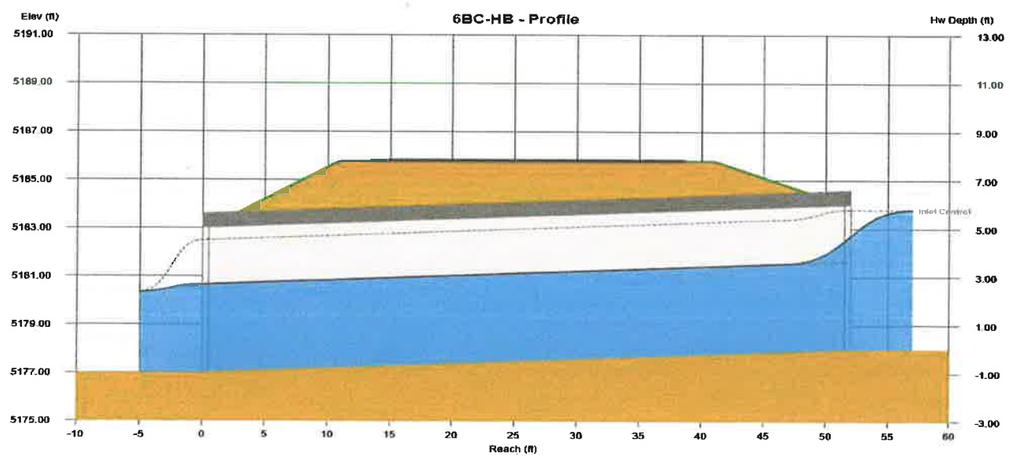
6BC-HB

Culvert 1

CULVERT		EMBANKMENT	
Shape	= Rect - Open Bottom	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5185.80 ft
Material	= Concrete	Crest Length	= 30.00 ft
Manning's n	= 0.012 (0.035 Bottom)		
Rise (Inside height)	= 72 in	**DISCHARGE**	
Span	= 96 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5177.01 ft	Q Min	= 0.00 cfs
Length	= 52.0 ft	Q Max	= 317.00 cfs
Slope	= 0.019 ft/ft	Q Increment	= 31.70 cfs
Invert Elev. Up	= 5178.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.97		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
317.00	317.00	0.00	10.86	10.86	43.8	43.8	5180.66	5181.65	5183.79



Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

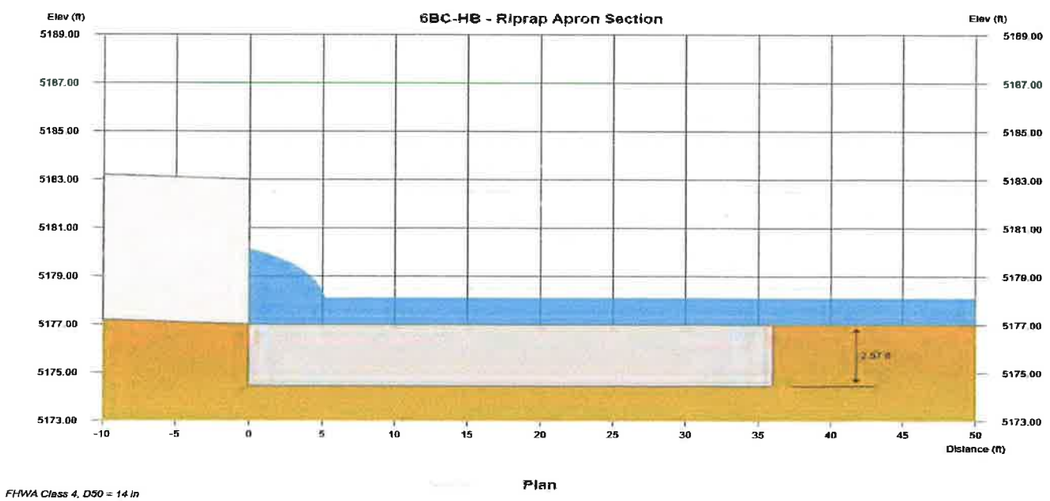
6BC-HB

Culvert 1

CULVERT		EMBANKMENT	
Shape	= Rect - Open Bottom	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5185.80 ft
Material	= Concrete	Crest Length	= 30.00 ft
Manning's n	= 0.012 (0.035 Bottom)		
Rise (Inside height)	= 72 in	**DISCHARGE**	
Span	= 96 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5177.01 ft	Q Min	= 0.00 cfs
Length	= 52.0 ft	Q Max	= 317.00 cfs
Slope	= 0.019 ft/ft	Q Increment	= 31.70 cfs
Invert Elev. Up	= 5178.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
317.00	317.00	0.00	10.86	10.86	36.00	48.12	2.57	14	5.93



Plan

FHWA Class 4, D50 = 14 in

Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

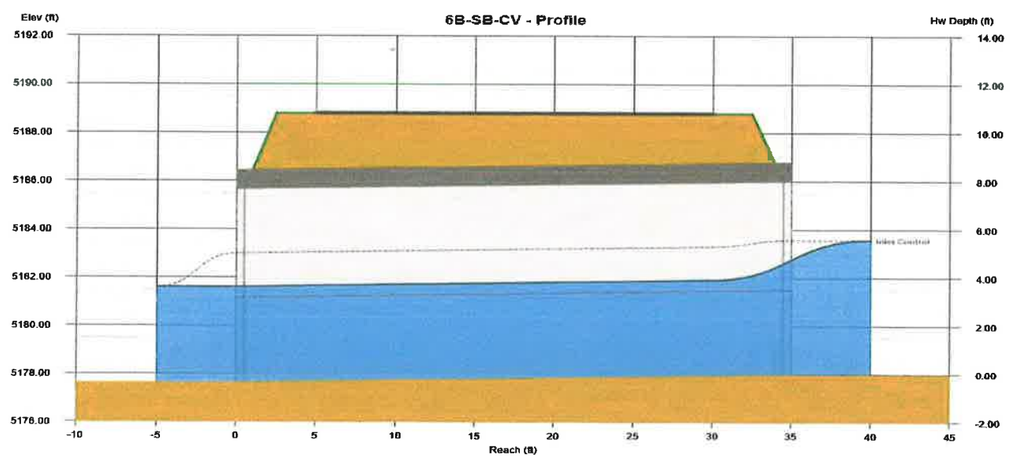
6B-SB-CV

Culvert 2

CULVERT		EMBANKMENT	
Shape	= Rect - Open Bottom	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5188.80 ft
Material	= Concrete	Crest Length	= 30.00 ft
Manning's n	= 0.012 (0.035 Bottom)		
Rise (Inside height)	= 96 in	**DISCHARGE**	
Span	= 96 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5177.65 ft	Q Min	= 0.00 cfs
Length	= 35.0 ft	Q Max	= 299.00 cfs
Slope	= 0.010 ft/ft	Q Increment	= 29.90 cfs
Invert Elev. Up	= 5178.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.70		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
299.00	299.00	0.00	9.44	9.44	47.5	47.5	5181.61	5181.96	5183.57



Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

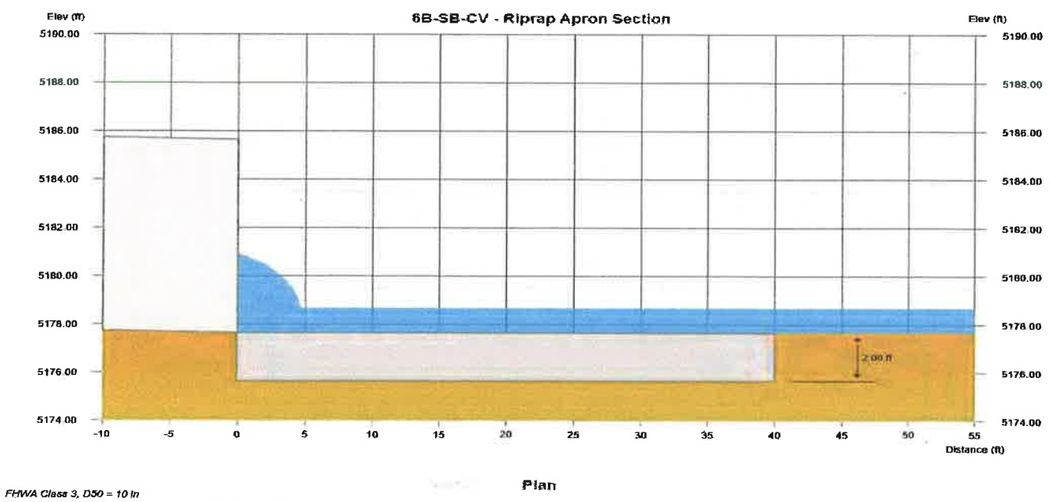
6B-SB-CV

Culvert 2

CULVERT		EMBANKMENT	
Shape	= Rect - Open Bottom	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5188.80 ft
Material	= Concrete	Crest Length	= 30.00 ft
Manning's n	= 0.012 (0.035 Bottom)		
Rise (Inside height)	= 96 in	**DISCHARGE**	
Span	= 96 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5177.65 ft	Q Min	= 0.00 cfs
Length	= 35.0 ft	Q Max	= 299.00 cfs
Slope	= 0.010 ft/ft	Q Increment	= 29.90 cfs
Invert Elev. Up	= 5178.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
299.00	299.00	0.00	9.44	9.44	40.00	50.80	2.00	10	5.72



Plan

FHWA Class 3, D50 = 10 in

Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

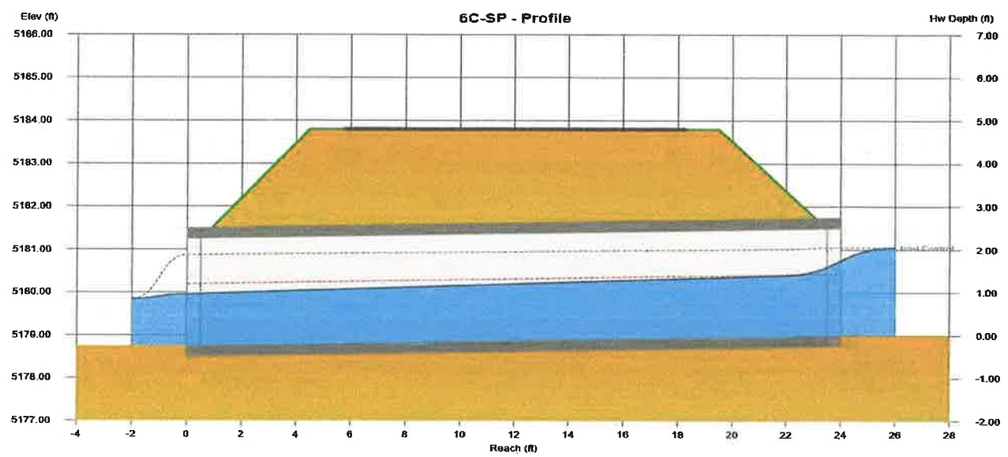
6C-SP

Culvert 3

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 15.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5183.80 ft
Material	= Concrete	Crest Length	= 10.00 ft
Manning's n	= 0.012		
Rise	= 30 in	**DISCHARGE**	
Span	= 30 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5178.75 ft	Q Min	= 0.00 cfs
Length	= 24.00 ft	Q Max	= 18.00 cfs
Slope	= 0.010 ft/ft	Q Increment	= 1.80 cfs
Invert Elev. Up	= 5179.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.82		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
18.00	18.00	0.00	7.68	6.14	14.5	17.3	5179.96	5180.44	5181.05



Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

6C-SP

Culvert 3

CULVERT

Shape	= Circular
Inlet Edge	= Beveled
Material	= Concrete
Manning's n	= 0.012
Rise	= 30 in
Span	= 30 in
Invert Elev. Down	= 5178.75 ft
Length	= 24.00 ft
Slope	= 0.010 ft/ft
Invert Elev. Up	= 5179.00 ft
No. Barrels	= 1
Plan Skew Angle	= 0 degrees

EMBANKMENT

Top Width	= 15.00 ft
Top Elevation	= 5183.80 ft
Crest Length	= 10.00 ft

DISCHARGE

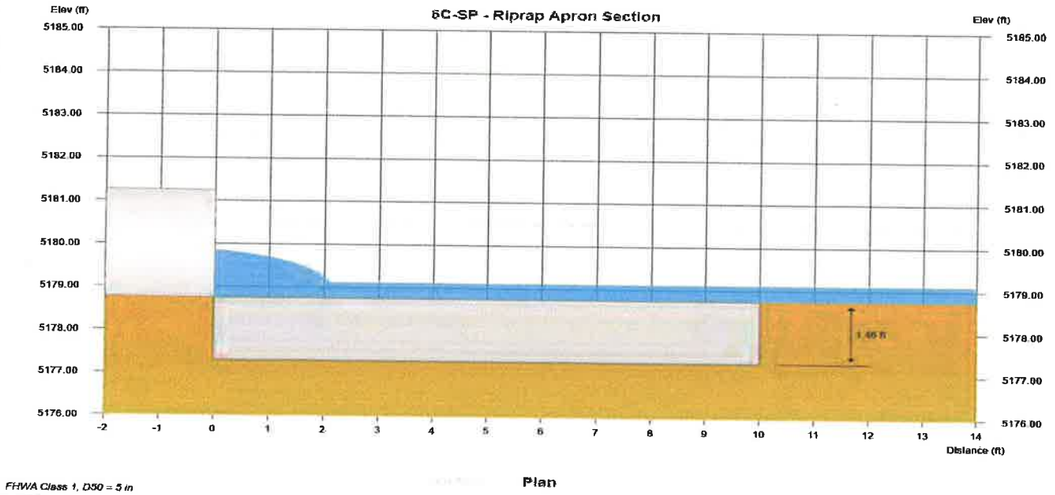
Method	= Qmin to Qmax
Q Min	= 0.00 cfs
Q Max	= 18.00 cfs
Q Increment	= 1.80 cfs

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
18.00	18.00	0.00	7.68	6.14	10.00	14.20	1.46	5	3.44



FHWA Class 1, D50 = 5 in

Plan

Culvert Report

Project filename: Culvert Calculations.cst

Culvert Studio v 2.0.0.30

03-05-2025

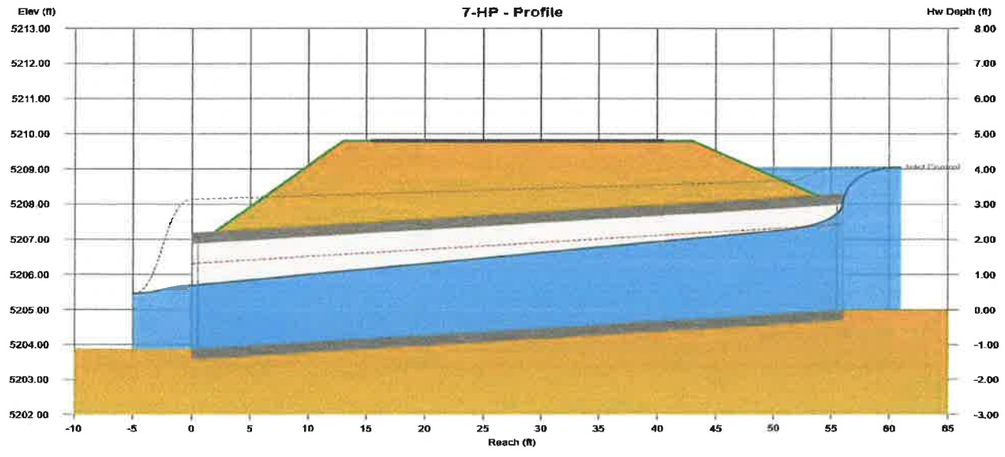
7-HP

Culvert 3

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5209.80 ft
Material	= Concrete	Crest Length	= 30.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5203.88 ft	Q Min	= 0.00 cfs
Length	= 56.0 ft	Q Max	= 223.00 cfs
Slope	= 0.020 ft/ft	Q Increment	= 22.30 cfs
Invert Elev. Up	= 5205.00 ft		
No. Barrels	= 4	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 1.35		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
223.00	223.00	0.00	12.55	9.09	21.7	29.2	5205.68	5207.43	5209.06



Culvert Report

Project filename: Culvert Calculations.cst

Culvert Studio v 2.0.0.30

03-05-2025

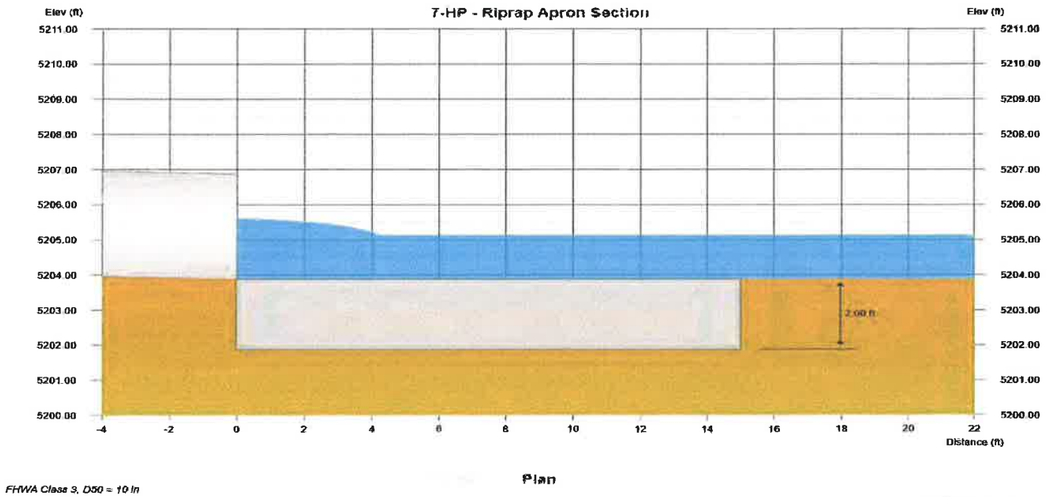
7-HP

Culvert 3

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5209.80 ft
Material	= Concrete	Crest Length	= 30.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5203.88 ft	Q Min	= 0.00 cfs
Length	= 56.0 ft	Q Max	= 223.00 cfs
Slope	= 0.020 ft/ft	Q Increment	= 22.30 cfs
Invert Elev. Up	= 5205.00 ft		
No. Barrels	= 4	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
223.00	223.00	0.00	12.55	9.09	15.00	28.05	2.00	10	6.31



Plan

FHWA Class 3, D50 = 10 in

Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

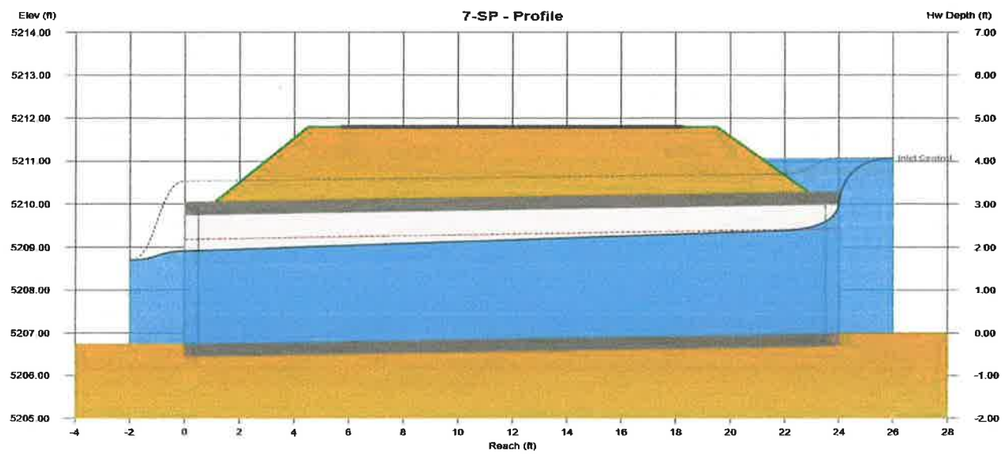
7-SP

Culvert 4

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 15.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5211.80 ft
Material	= Concrete	Crest Length	= 40.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5206.75 ft	Q Min	= 0.00 cfs
Length	= 24.00 ft	Q Max	= 223.00 cfs
Slope	= 0.010 ft/ft	Q Increment	= 22.30 cfs
Invert Elev. Up	= 5207.00 ft		
No. Barrels	= 4	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 1.36		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
223.00	223.00	0.00	10.24	9.09	25.9	29.2	5208.91	5209.43	5211.07



Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

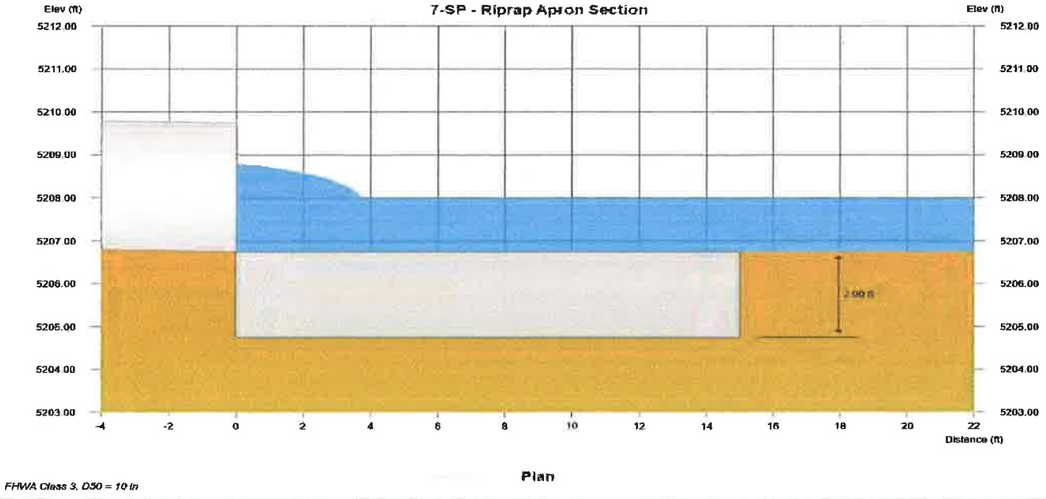
7-SP

Culvert 4

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 15.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5211.80 ft
Material	= Concrete	Crest Length	= 40.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5206.75 ft	Q Min	= 0.00 cfs
Length	= 24.00 ft	Q Max	= 223.00 cfs
Slope	= 0.010 ft/ft	Q Increment	= 22.30 cfs
Invert Elev. Up	= 5207.00 ft		
No. Barrels	= 4	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
223.00	223.00	0.00	10.24	9.09	15.00	28.05	2.00	10	6.31



FHWA Class 3, D50 = 10 in

Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

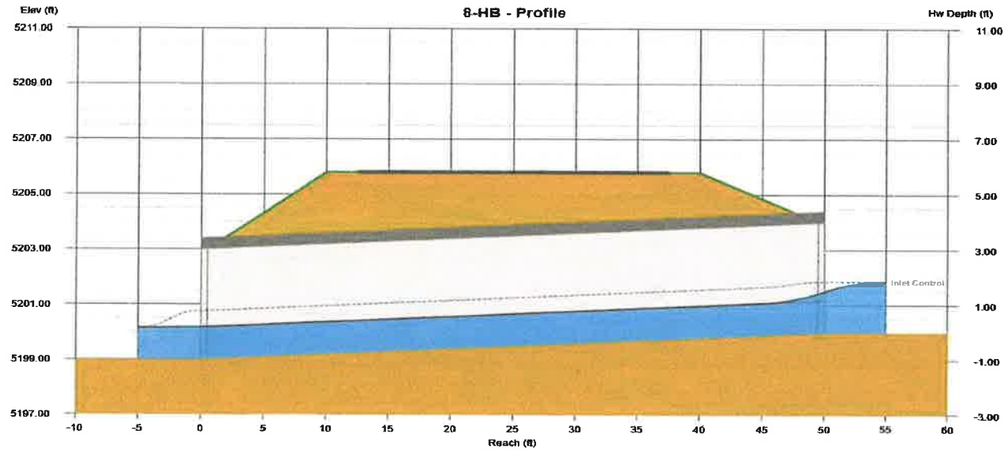
8-HB

Culvert 5

CULVERT		EMBANKMENT	
Shape	= Rect - Open Bottom	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5205.80 ft
Material	= Concrete	Crest Length	= 20.00 ft
Manning's n	= 0.012 (0.035 Bottom)		
Rise (Inside height)	= 48 in	**DISCHARGE**	
Span	= 72 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5199.00 ft	Q Min	= 0.00 cfs
Length	= 50.0 ft	Q Max	= 86.00 cfs
Slope	= 0.020 ft/ft	Q Increment	= 8.60 cfs
Invert Elev. Up	= 5200.00 ft		
No. Barrels	= 2	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.46		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
86.00	86.00	0.00	6.13	6.13	14.0	14.0	5200.17	5201.17	5201.85



Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

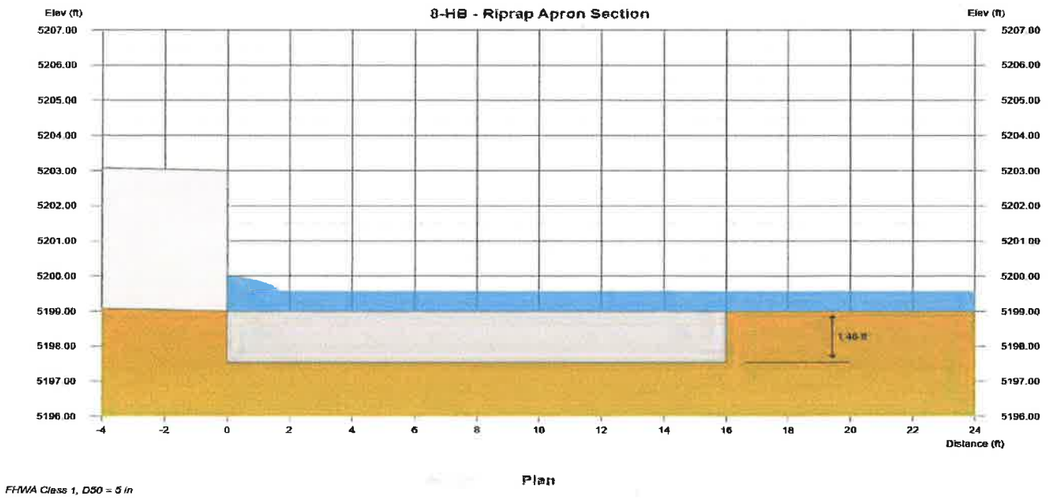
8-HB

Culvert 5

CULVERT		EMBANKMENT	
Shape	= Rect - Open Bottom	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5205.80 ft
Material	= Concrete	Crest Length	= 20.00 ft
Manning's n	= 0.012 (0.035 Bottom)		
Rise (Inside height)	= 48 in	**DISCHARGE**	
Span	= 72 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5199.00 ft	Q Min	= 0.00 cfs
Length	= 50.0 ft	Q Max	= 86.00 cfs
Slope	= 0.020 ft/ft	Q Increment	= 8.60 cfs
Invert Elev. Up	= 5200.00 ft		
No. Barrels	= 2	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
86.00	86.00	0.00	6.13	6.13	16.00	34.72	1.46	5	4.30



Plan

FHWA Class 1, D50 = 5 in

Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

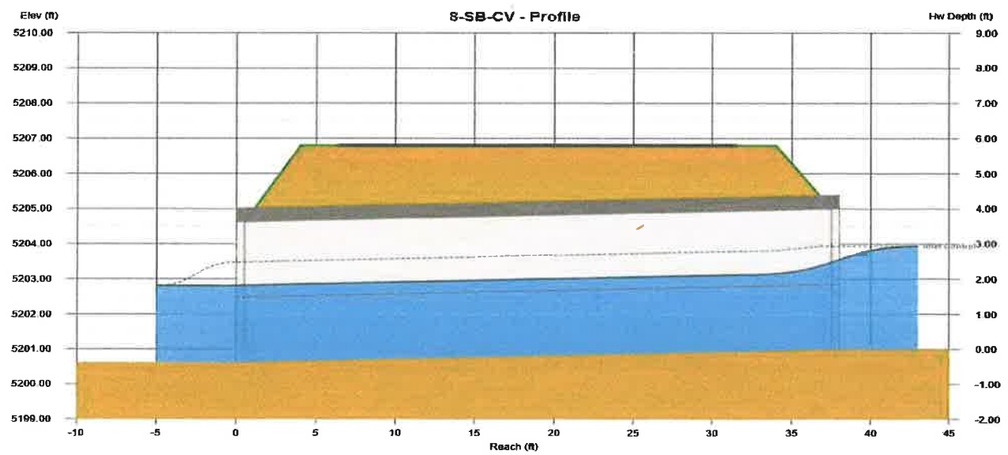
8-SB-CV

Culvert 6

CULVERT		EMBANKMENT	
Shape	= Rect - Open Bottom	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5206.80 ft
Material	= Concrete	Crest Length	= 30.00 ft
Manning's n	= 0.012 (0.035 Bottom)		
Rise (Inside height)	= 48 in	**DISCHARGE**	
Span	= 72 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5200.62 ft	Q Min	= 0.00 cfs
Length	= 38.0 ft	Q Max	= 86.00 cfs
Slope	= 0.010 ft/ft	Q Increment	= 8.60 cfs
Invert Elev. Up	= 5201.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.73		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
86.00	86.00	0.00	6.55	6.56	26.3	26.2	5202.81	5203.19	5203.94



Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

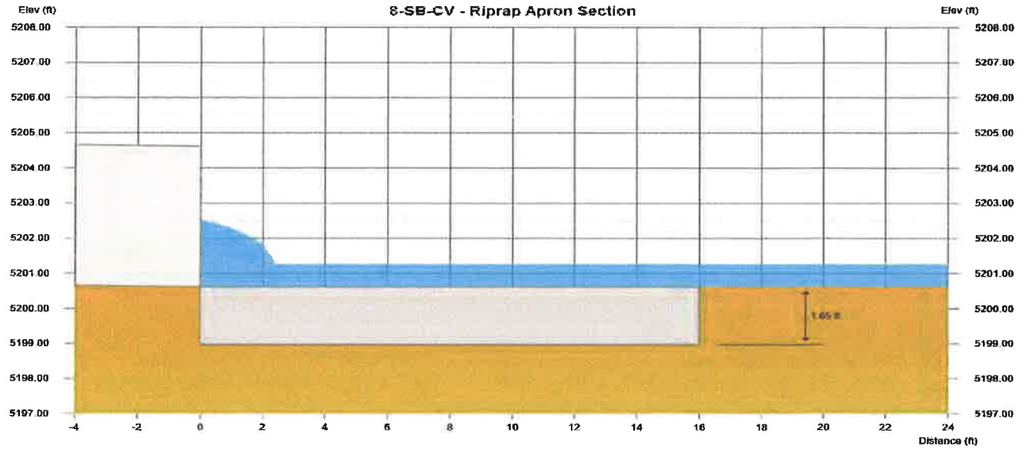
8-SB-CV

Culvert 6

CULVERT		EMBANKMENT	
Shape	= Rect - Open Bottom	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5206.80 ft
Material	= Concrete	Crest Length	= 30.00 ft
Manning's n	= 0.012 (0.035 Bottom)		
Rise (Inside height)	= 48 in	**DISCHARGE**	
Span	= 72 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5200.62 ft	Q Min	= 0.00 cfs
Length	= 38.0 ft	Q Max	= 86.00 cfs
Slope	= 0.010 ft/ft	Q Increment	= 8.60 cfs
Invert Elev. Up	= 5201.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
86.00	86.00	0.00	6.55	6.56	16.00	28.72	1.65	6	4.57



Plan

FHWA Class 2, D50 = 6 in

Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

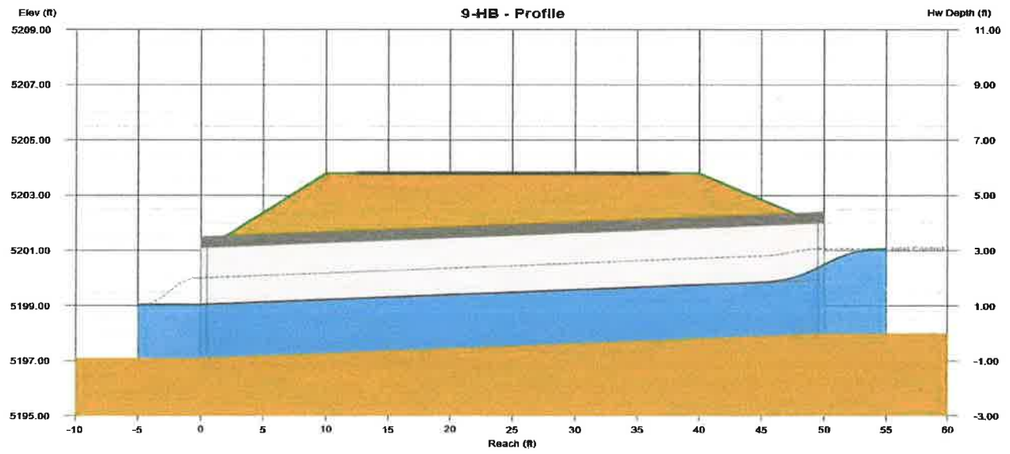
9-HB

Culvert 7

CULVERT		EMBANKMENT	
Shape	= Rect - Open Bottom	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5203.80 ft
Material	= Concrete	Crest Length	= 12.00 ft
Manning's n	= 0.012 (0.035 Bottom)		
Rise (Inside height)	= 48 in	**DISCHARGE**	
Span	= 48 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5197.10 ft	Q Min	= 0.00 cfs
Length	= 50.0 ft	Q Max	= 61.00 cfs
Slope	= 0.018 ft/ft	Q Increment	= 6.10 cfs
Invert Elev. Up	= 5198.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.77		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
61.00	61.00	0.00	7.86	7.85	23.3	23.3	5199.04	5199.94	5201.06



Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

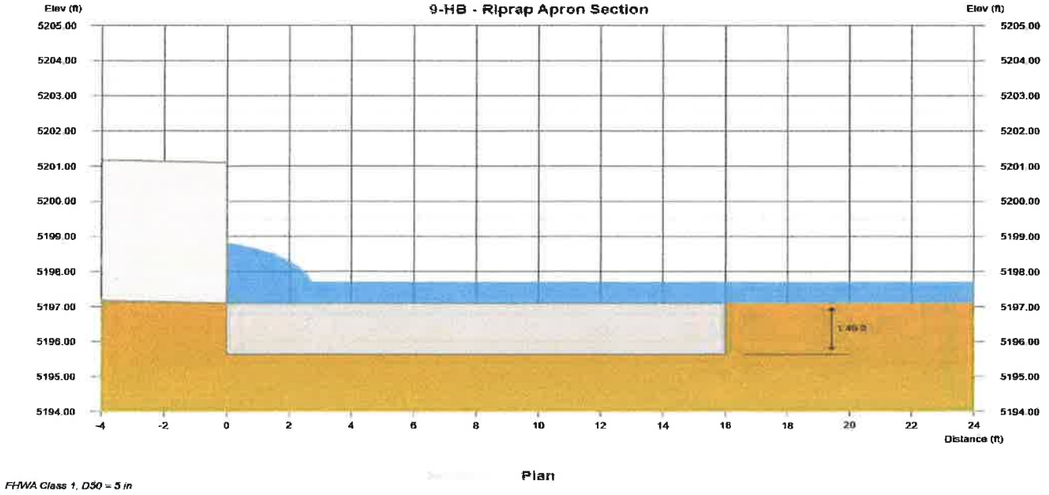
9-HB

Culvert 7

CULVERT		EMBANKMENT	
Shape	= Rect - Open Bottom	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5203.80 ft
Material	= Concrete	Crest Length	= 12.00 ft
Manning's n	= 0.012 (0.035 Bottom)		
Rise (Inside height)	= 48 in	**DISCHARGE**	
Span	= 48 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5197.10 ft	Q Min	= 0.00 cfs
Length	= 50.0 ft	Q Max	= 61.00 cfs
Slope	= 0.018 ft/ft	Q Increment	= 6.10 cfs
Invert Elev. Up	= 5198.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
61.00	61.00	0.00	7.86	7.85	16.00	22.72	1.46	5	4.41



Plan

FHWA Class 1, D50 = 5 in

Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

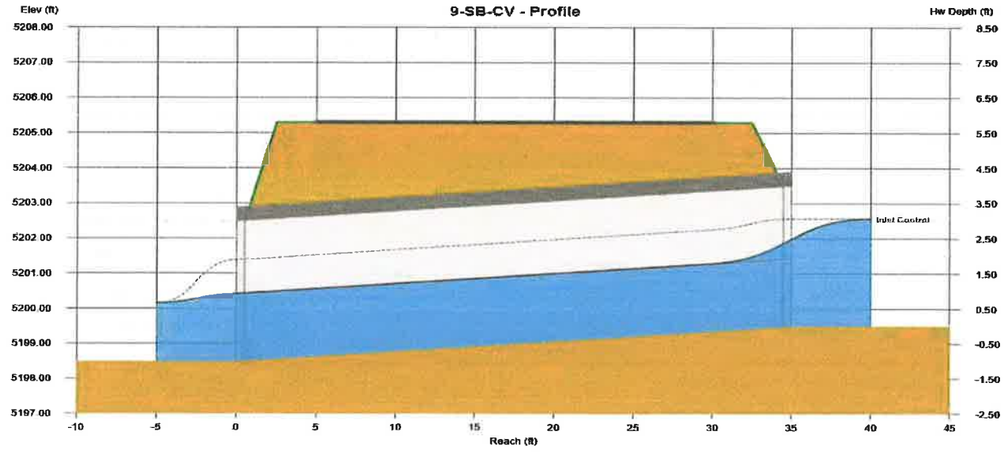
9-SB-CV

Culvert 8

CULVERT		EMBANKMENT	
Shape	= Rect - Open Bottom	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5205.30 ft
Material	= Concrete	Crest Length	= 12.00 ft
Manning's n	= 0.012 (0.035 Bottom)		
Rise (Inside height)	= 48 in	**DISCHARGE**	
Span	= 48 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5198.49 ft	Q Min	= 0.00 cfs
Length	= 35.0 ft	Q Max	= 61.00 cfs
Slope	= 0.029 ft/ft	Q Increment	= 6.10 cfs
Invert Elev. Up	= 5199.50 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.77		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
61.00	61.00	0.00	7.89	7.89	23.2	23.2	5200.42	5201.43	5202.56



Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

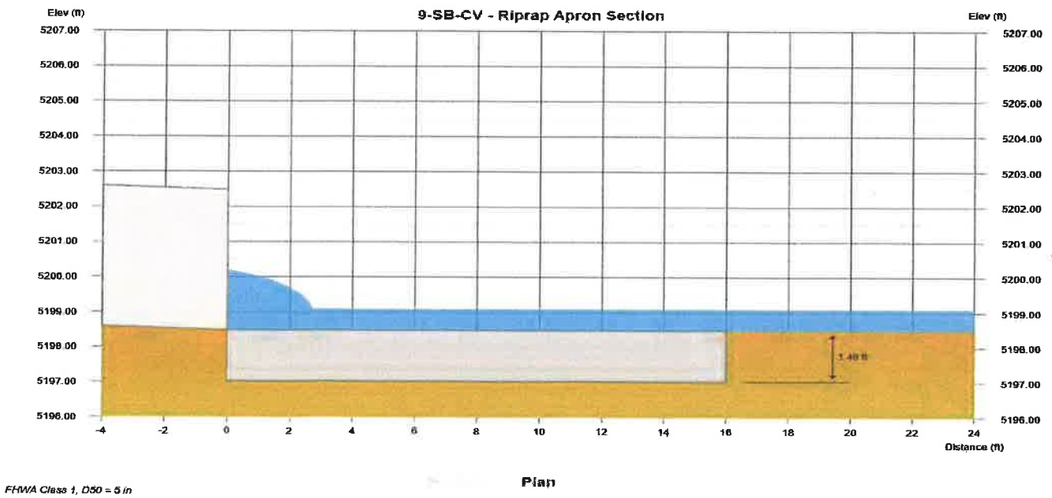
□-SB-CV

Culvert 8

CULVERT		EMBANKMENT	
Shape	= Rect - Open Bottom	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5205.30 ft
Material	= Concrete	Crest Length	= 12.00 ft
Manning's n	= 0.012 (0.035 Bottom)		
Rise (Inside height)	= 48 in	**DISCHARGE**	
Span	= 48 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5198.49 ft	Q Min	= 0.00 cfs
Length	= 35.0 ft	Q Max	= 61.00 cfs
Slope	= 0.029 ft/ft	Q Increment	= 6.10 cfs
Invert Elev. Up	= 5199.50 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
61.00	61.00	0.00	7.89	7.89	16.00	22.72	1.46	5	4.41



Plan

FHWA Class 1, D50 = 5 in

Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

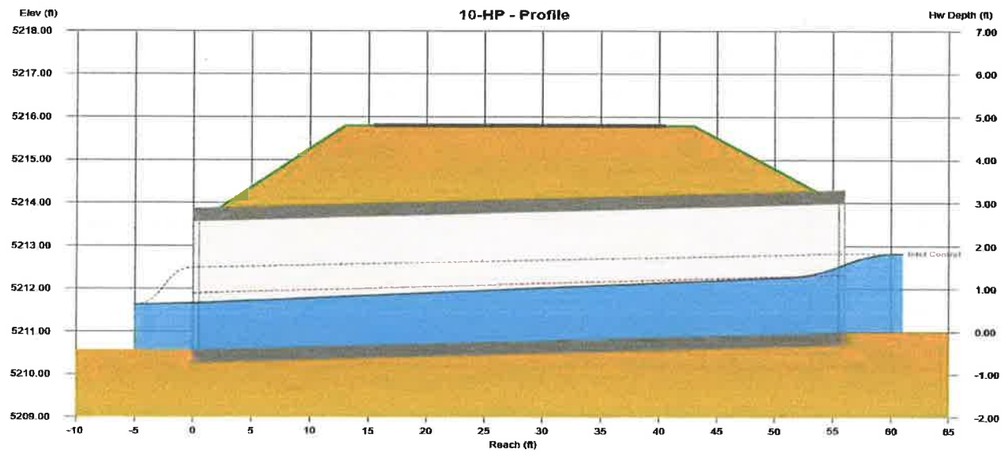
10-HP

Culvert 9

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5215.80 ft
Material	= Concrete	Crest Length	= 10.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5210.57 ft	Q Min	= 0.00 cfs
Length	= 56.0 ft	Q Max	= 17.00 cfs
Slope	= 0.008 ft/ft	Q Increment	= 1.70 cfs
Invert Elev. Up	= 5211.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.61		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
17.00	17.00	0.00	7.31	5.64	13.1	15.9	5211.66	5212.33	5212.82



Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

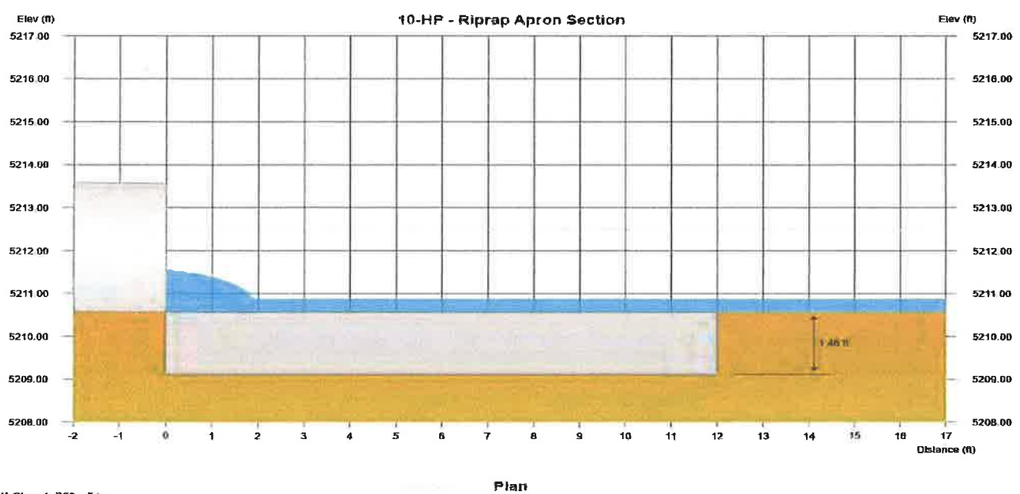
10-HP

Culvert 9

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5215.80 ft
Material	= Concrete	Crest Length	= 10.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5210.57 ft	Q Min	= 0.00 cfs
Length	= 56.0 ft	Q Max	= 17.00 cfs
Slope	= 0.008 ft/ft	Q Increment	= 1.70 cfs
Invert Elev. Up	= 5211.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
17.00	17.00	0.00	7.31	5.64	12.00	17.04	1.46	5	3.18



FHWA Class 1, D50 = 5 in

Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

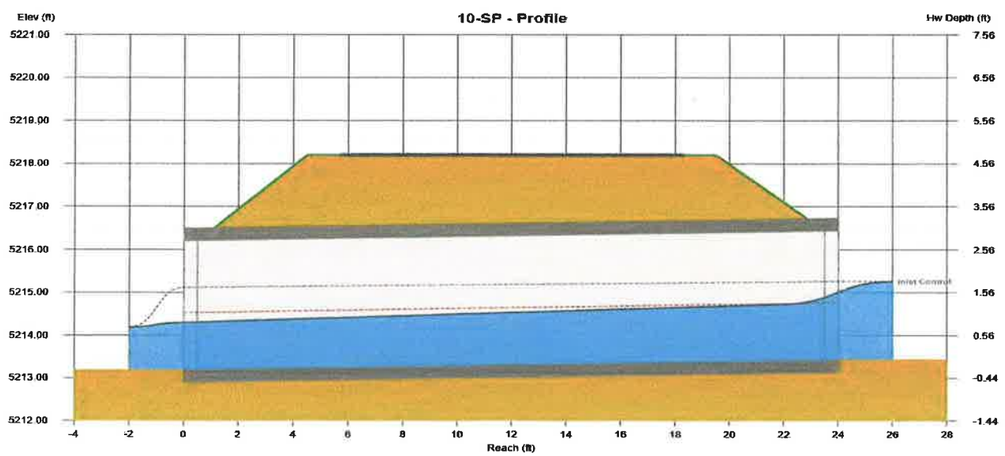
10-SP

Culvert 10

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 15.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5218.20 ft
Material	= Concrete	Crest Length	= 10.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5213.20 ft	Q Min	= 0.00 cfs
Length	= 24.00 ft	Q Max	= 17.00 cfs
Slope	= 0.010 ft/ft	Q Increment	= 1.70 cfs
Invert Elev. Up	= 5213.44 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.61		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
17.00	17.00	0.00	7.25	5.64	13.2	15.9	5214.30	5214.77	5215.26



Culvert Report

Project filename: Culvert Calculations 2.cst

Culvert Studio v 2.0.0.30

03-05-2025

10-SP

Culvert 10

CULVERT

Shape	= Circular
Inlet Edge	= Beveled
Material	= Concrete
Manning's n	= 0.012
Rise	= 36 in
Span	= 36 in
Invert Elev. Down	= 5213.20 ft
Length	= 24.00 ft
Slope	= 0.010 ft/ft
Invert Elev. Up	= 5213.44 ft
No. Barrels	= 1
Plan Skew Angle	= 0 degrees

EMBANKMENT

Top Width	= 15.00 ft
Top Elevation	= 5218.20 ft
Crest Length	= 10.00 ft

DISCHARGE

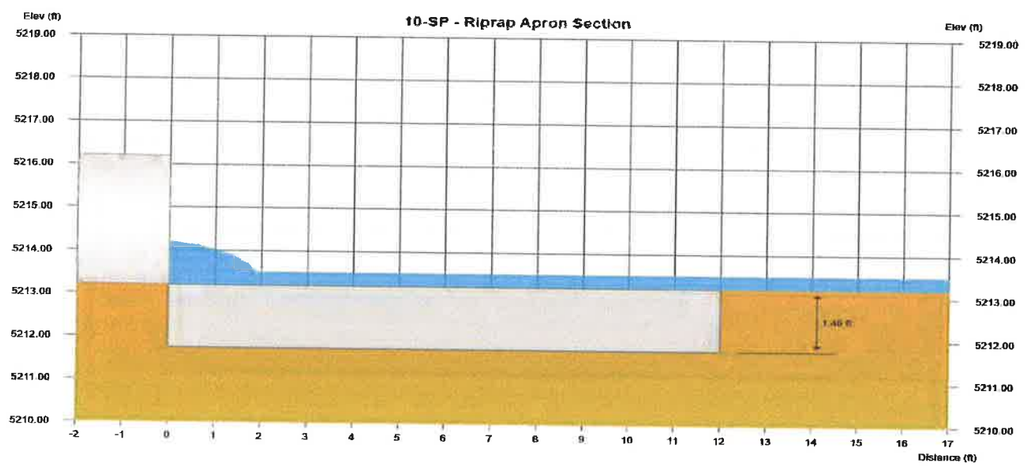
Method	= Qmin to Qmax
Q Min	= 0.00 cfs
Q Max	= 17.00 cfs
Q Increment	= 1.70 cfs

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
17.00	17.00	0.00	7.25	5.64	12.00	17.04	1.46	5	3.18



FHWA Class 1, D50 = 5 in

Plan

Culvert Report

Project filename: Culvert Calculations 3.cst

Culvert Studio v 2.0.0.30

03-05-2025

11-HP

Culvert 1

CULVERT

Shape	= Circular
Inlet Edge	= Beveled
Material	= Concrete
Manning's n	= 0.012
Rise	= 36 in
Span	= 36 in
Invert Elev. Down	= 5209.50 ft
Length	= 56.0 ft
Slope	= 0.036 ft/ft
Invert Elev. Up	= 5211.50 ft
No. Barrels	= 1
Plan Skew Angle	= 0 degrees

EMBANKMENT

Top Width	= 30.00 ft
Top Elevation	= 5216.30 ft
Crest Length	= 10.00 ft

DISCHARGE

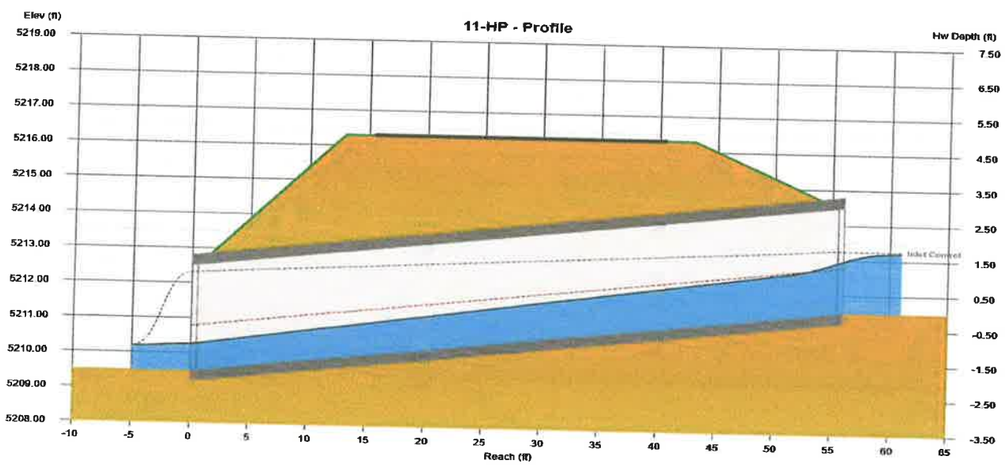
Method	= Qmin to Qmax
Q Min	= 0.00 cfs
Q Max	= 16.00 cfs
Q Increment	= 1.60 cfs

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.57		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
16.00	16.00	0.00	11.50	5.55	9.0	15.4	5210.25	5212.78	5213.22



Culvert Report

Project filename: Culvert Calculations 3.cst

Culvert Studio v 2.0.0.30

03-05-2025

11-HP

Culvert 1

CULVERT

Shape	= Circular
Inlet Edge	= Beveled
Material	= Concrete
Manning's n	= 0.012
Rise	= 36 in
Span	= 36 in
Invert Elev. Down	= 5209.50 ft
Length	= 56.0 ft
Slope	= 0.036 ft/ft
Invert Elev. Up	= 5211.50 ft
No. Barrels	= 1
Plan Skew Angle	= 0 degrees

EMBANKMENT

Top Width	= 30.00 ft
Top Elevation	= 5216.30 ft
Crest Length	= 10.00 ft

DISCHARGE

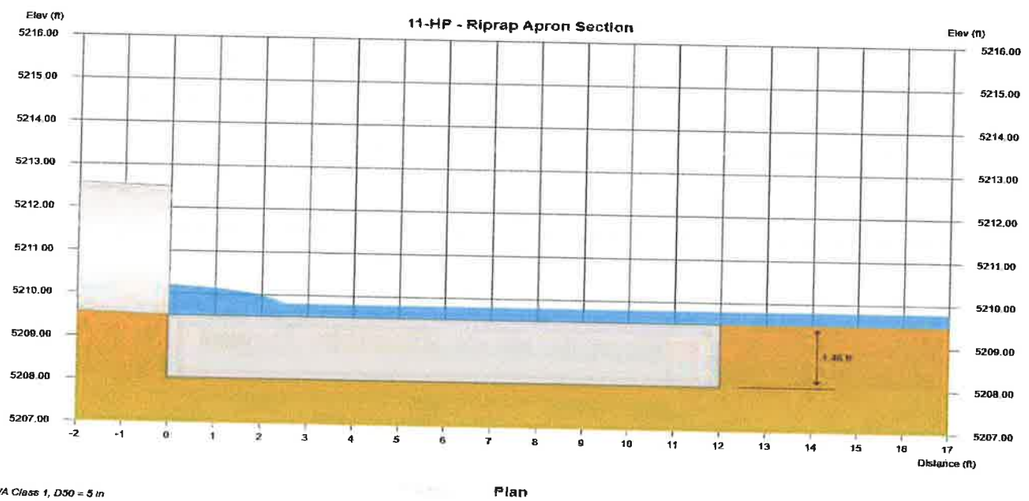
Method	= Qmin to Qmax
Q Min	= 0.00 cfs
Q Max	= 16.00 cfs
Q Increment	= 1.60 cfs

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
16.00	16.00	0.00	11.50	5.55	12.00	17.04	1.46	5	3.12



FHWA Class 1, D50 = 5 in

Plan

Culvert Report

Project filename: Culvert Calculations 3.cst

Culvert Studio v 2.0.0.30

03-05-2025

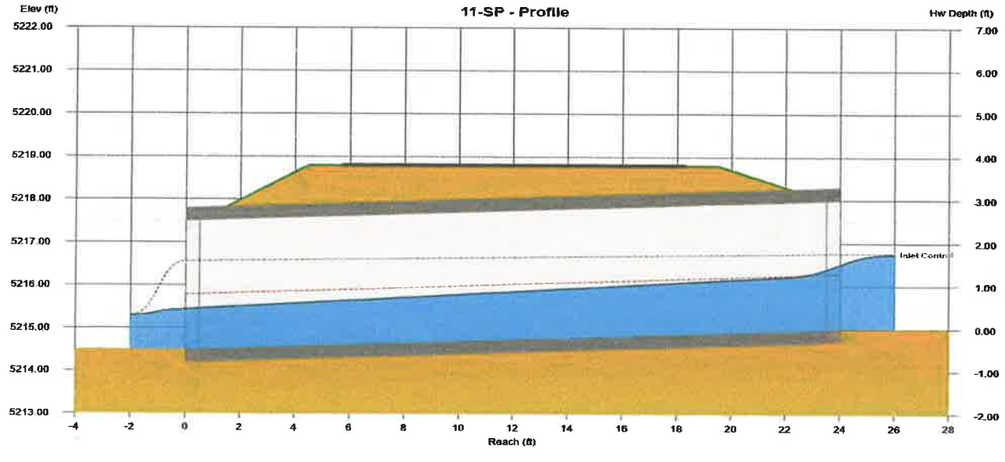
11-SP

Culvert 2

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 15.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5218.80 ft
Material	= Concrete	Crest Length	= 10.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5214.50 ft	Q Min	= 0.00 cfs
Length	= 24.00 ft	Q Max	= 16.00 cfs
Slope	= 0.021 ft/ft	Q Increment	= 2.00 cfs
Invert Elev. Up	= 5215.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.58		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
16.00	16.00	0.00	8.50	5.55	11.2	15.4	5215.44	5216.28	5216.74



Culvert Report

Project filename: Culvert Calculations 3.cst

Culvert Studio v 2.0.0.30

03-05-2025

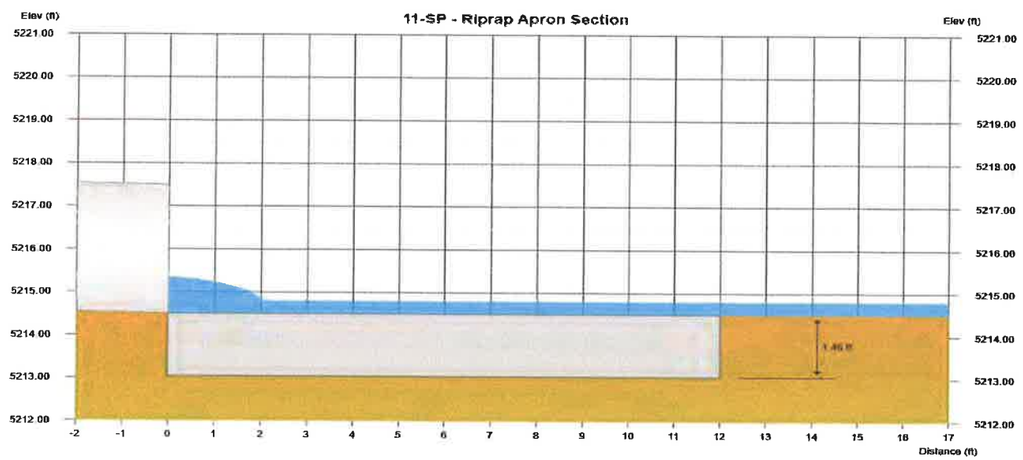
11-SP

Culvert 2

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 15.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5218.80 ft
Material	= Concrete	Crest Length	= 10.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5214.50 ft	Q Min	= 0.00 cfs
Length	= 24.00 ft	Q Max	= 16.00 cfs
Slope	= 0.021 ft/ft	Q Increment	= 2.00 cfs
Invert Elev. Up	= 5215.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
16.00	16.00	0.00	8.50	5.55	12.00	17.04	1.46	5	3.12



Plan

FHWA Class 1, D50 = 5 in

Culvert Report

Project filename: Culvert Calculations 3.cst

Culvert Studio v 2.0.0.30

03-05-2025

12-HP

Culvert 3

CULVERT

Shape	= Circular
Inlet Edge	= Beveled
Material	= Concrete
Manning's n	= 0.012
Rise	= 30 in
Span	= 30 in
Invert Elev. Down	= 5215.88 ft
Length	= 56.0 ft
Slope	= 0.020 ft/ft
Invert Elev. Up	= 5217.00 ft
No. Barrels	= 1
Plan Skew Angle	= 0 degrees

EMBANKMENT

Top Width	= 30.00 ft
Top Elevation	= 5221.80 ft
Crest Length	= 10.00 ft

DISCHARGE

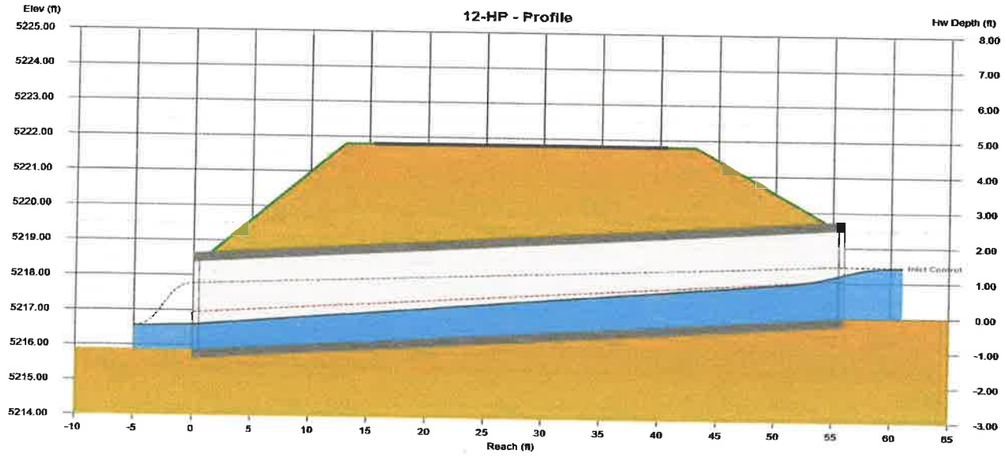
Method	= Qmin to Qmax
Q Min	= 0.00 cfs
Q Max	= 10.00 cfs
Q Increment	= 1.00 cfs

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.58		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
10.00	10.00	0.00	8.70	5.03	8.5	12.7	5216.59	5218.06	5218.44



Culvert Report

Project filename: Culvert Calculations 3.cst

Culvert Studio v 2.0.0.30

03-05-2025

12-HP

Culvert 3

CULVERT

Shape	= Circular
Inlet Edge	= Beveled
Material	= Concrete
Manning's n	= 0.012
Rise	= 30 in
Span	= 30 in
Invert Elev. Down	= 5215.88 ft
Length	= 56.0 ft
Slope	= 0.020 ft/ft
Invert Elev. Up	= 5217.00 ft
No. Barrels	= 1
Plan Skew Angle	= 0 degrees

EMBANKMENT

Top Width	= 30.00 ft
Top Elevation	= 5221.80 ft
Crest Length	= 10.00 ft

DISCHARGE

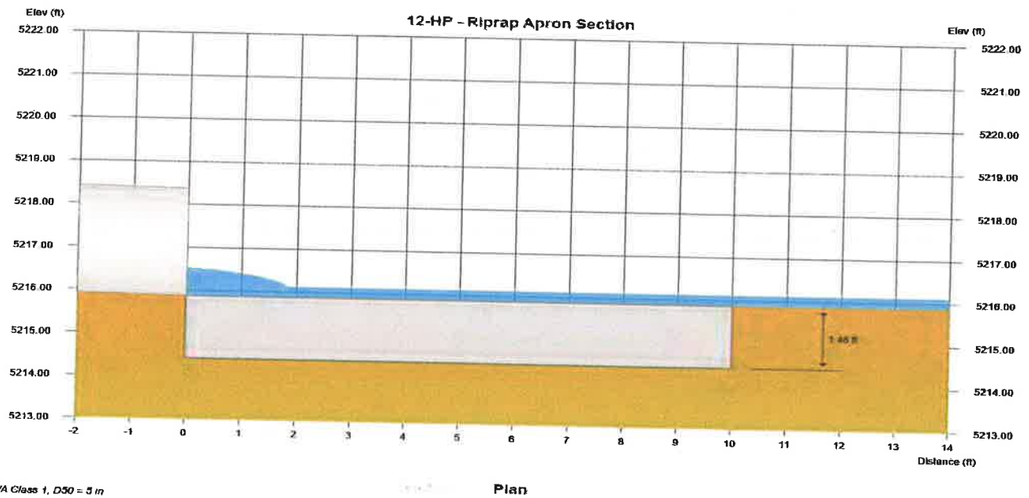
Method	= Qmin to Qmax
Q Min	= 0.00 cfs
Q Max	= 10.00 cfs
Q Increment	= 1.00 cfs

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
10.00	10.00	0.00	8.70	5.03	10.00	14.20	1.46	5	2.84



FHWA Class 1, D50 = 5 in

Plan

Culvert Report

Project filename: Culvert Calculations 3.cst

Culvert Studio v 2.0.0.30

03-05-2025

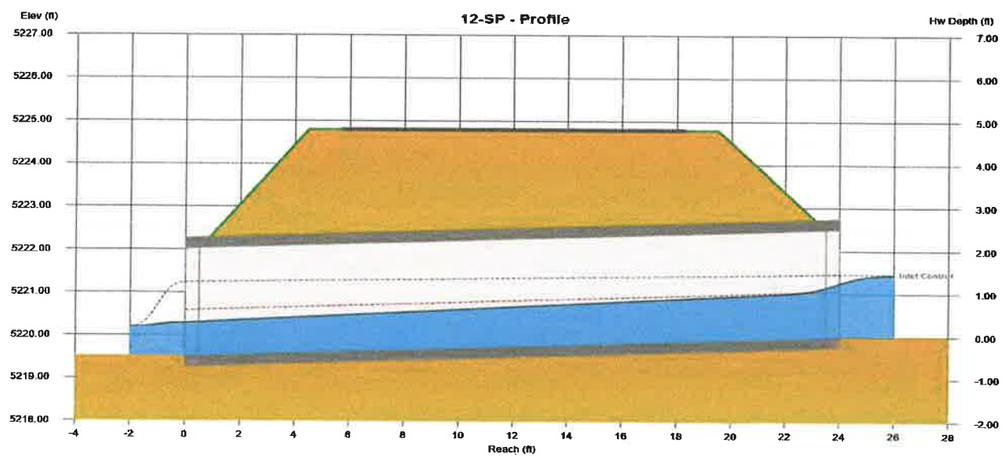
12-SP

Culvert 4

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 15.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5224.80 ft
Material	= Concrete	Crest Length	= 10.00 ft
Manning's n	= 0.012		
Rise	= 30 in	**DISCHARGE**	
Span	= 30 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5219.52 ft	Q Min	= 0.00 cfs
Length	= 24.00 ft	Q Max	= 10.00 cfs
Slope	= 0.020 ft/ft	Q Increment	= 1.00 cfs
Invert Elev. Up	= 5220.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.58		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
10.00	10.00	0.00	7.81	5.03	9.2	12.7	5220.29	5221.06	5221.44



Culvert Report

Project filename: Culvert Calculations 3.cst

Culvert Studio v 2.0.0.30

03-05-2025

12-SP

Culvert 4

CULVERT

Shape	= Circular
Inlet Edge	= Beveled
Material	= Concrete
Manning's n	= 0.012
Rise	= 30 in
Span	= 30 in
Invert Elev. Down	= 5219.52 ft
Length	= 24.00 ft
Slope	= 0.020 ft/ft
Invert Elev. Up	= 5220.00 ft
No. Barrels	= 1
Plan Skew Angle	= 0 degrees

EMBANKMENT

Top Width	= 15.00 ft
Top Elevation	= 5224.80 ft
Crest Length	= 10.00 ft

DISCHARGE

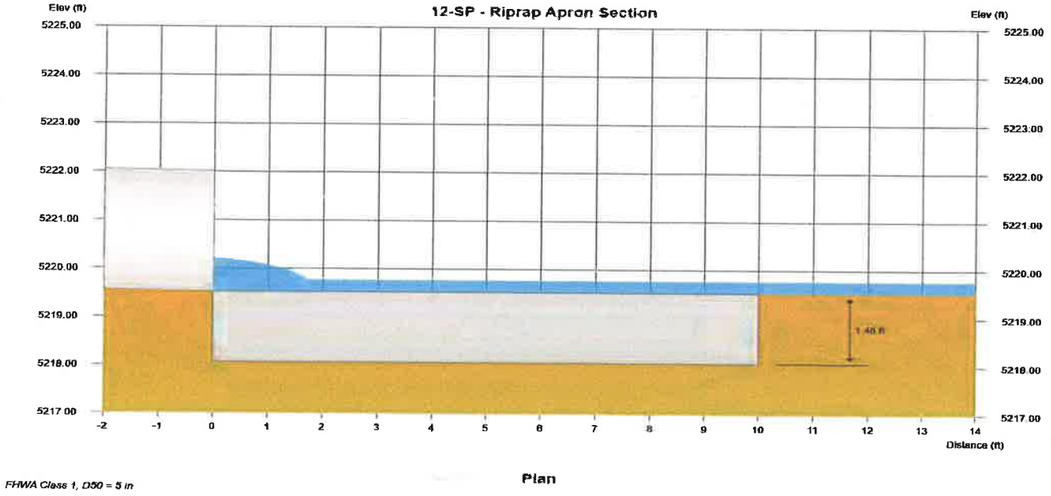
Method	= Qmin to Qmax
Q Min	= 0.00 cfs
Q Max	= 10.00 cfs
Q Increment	= 1.00 cfs

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
10.00	10.00	0.00	7.81	5.03	10.00	14.20	1.46	5	2.84



Plan

FHWA Class 1, D50 = 5 in

Culvert Report

Project filename: Culvert Calculations 3.cst

Culvert Studio v 2.0.0.30

03-05-2025

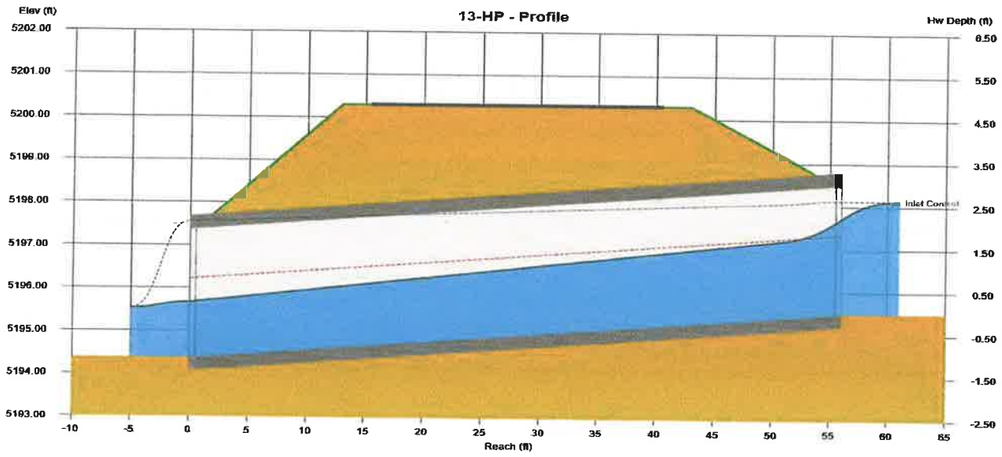
13-HP

Culvert 5

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 30.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5200.30 ft
Material	= Concrete	Crest Length	= 10.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5194.38 ft	Q Min	= 0.00 cfs
Length	= 56.0 ft	Q Max	= 64.00 cfs
Slope	= 0.020 ft/ft	Q Increment	= 6.40 cfs
Invert Elev. Up	= 5195.50 ft		
No. Barrels	= 2	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.88		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
64.00	64.00	0.00	11.02	7.04	15.5	22.1	5195.67	5197.34	5198.14



Culvert Report

Project filename: Culvert Calculations 3.cst

Culvert Studio v 2.0.0.30

03-05-2025

13-HP

Culvert 5

CULVERT

Shape	= Circular
Inlet Edge	= Beveled
Material	= Concrete
Manning's n	= 0.012
Rise	= 36 in
Span	= 36 in
Invert Elev. Down	= 5194.38 ft
Length	= 56.0 ft
Slope	= 0.020 ft/ft
Invert Elev. Up	= 5195.50 ft
No. Barrels	= 2
Plan Skew Angle	= 0 degrees

EMBANKMENT

Top Width	= 30.00 ft
Top Elevation	= 5200.30 ft
Crest Length	= 10.00 ft

DISCHARGE

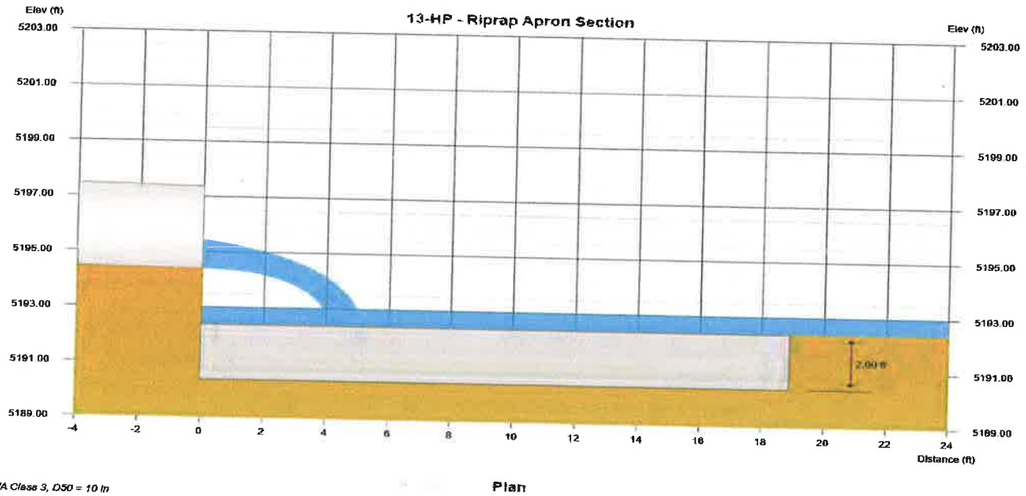
Method	= Qmin to Qmax
Q Min	= 0.00 cfs
Q Max	= 64.00 cfs
Q Increment	= 6.40 cfs

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
64.00	64.00	0.00	11.02	7.04	18.89	22.05	2.00	10	4.53



FHWA Class 3, D50 = 10 in

Plan

Culvert Report

Project filename: Culvert Calculations 3.cst

Culvert Studio v 2.0.0.30

03-05-2025

13-SP

Culvert 6

CULVERT

Shape	= Circular
Inlet Edge	= Beveled
Material	= Concrete
Manning's n	= 0.012
Rise	= 36 in
Span	= 36 in
Invert Elev. Down	= 5196.52 ft
Length	= 24.00 ft
Slope	= 0.020 ft/ft
Invert Elev. Up	= 5197.00 ft
No. Barrels	= 2
Plan Skew Angle	= 0 degrees

EMBANKMENT

Top Width	= 15.00 ft
Top Elevation	= 5200.80 ft
Crest Length	= 10.00 ft

DISCHARGE

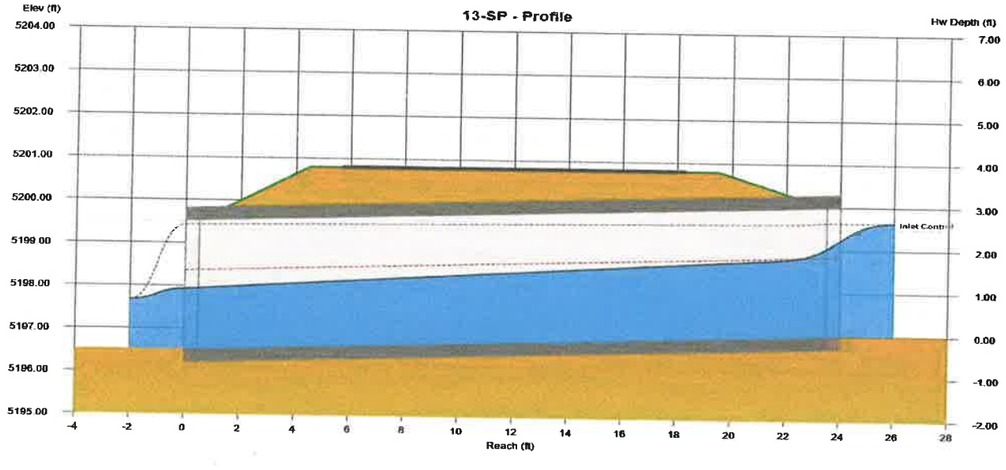
Method	= Qmin to Qmax
Q Min	= 0.00 cfs
Q Max	= 64.00 cfs
Q Increment	= 6.40 cfs

TAILWATER

Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 0.88		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
64.00	64.00	0.00	9.81	7.04	16.9	22.1	5197.93	5198.84	5199.64



Culvert Report

Project filename: Culvert Calculations 3.cst

Culvert Studio v 2.0.0.30

03-05-2025

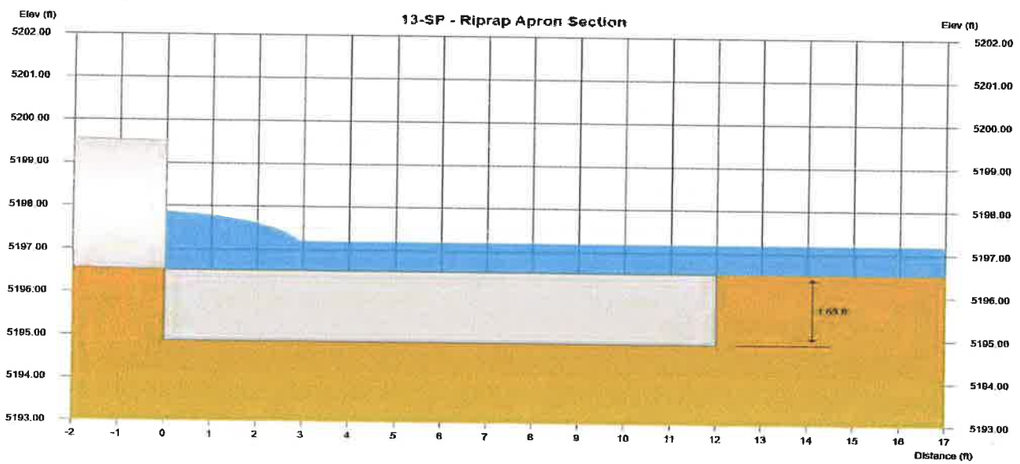
13-SP

Culvert 6

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 15.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5200.80 ft
Material	= Concrete	Crest Length	= 10.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5196.52 ft	Q Min	= 0.00 cfs
Length	= 24.00 ft	Q Max	= 64.00 cfs
Slope	= 0.020 ft/ft	Q Increment	= 6.40 cfs
Invert Elev. Up	= 5197.00 ft		
No. Barrels	= 2	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
64.00	64.00	0.00	9.81	7.04	12.00	20.04	1.65	6	4.67



FHWA Class 2, D50 = 6 in

Plan

Culvert Report

Project filename: Culvert Calculations.cst

Culvert Studio v 2.0.0.30

03-05-2025

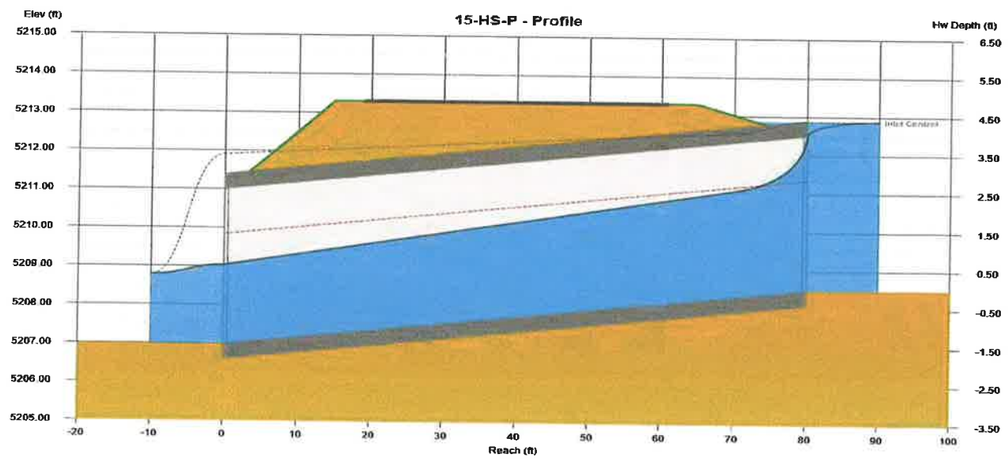
15-HS-P

Culvert 4

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 50.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5213.30 ft
Material	= Concrete	Crest Length	= 50.00 ft
Manning's n	= 0.012		
Rise	= 48 in	**DISCHARGE**	
Span	= 48 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5207.00 ft	Q Min	= 0.00 cfs
Length	= 80.0 ft	Q Max	= 437.00 cfs
Slope	= 0.019 ft/ft	Q Increment	= 43.70 cfs
Invert Elev. Up	= 5208.50 ft		
No. Barrels	= 5	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 1.09		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
437.00	437.00	0.00	13.58	9.16	24.5	34.1	5209.04	5211.34	5212.87



Culvert Report

Project filename: Culvert Calculations.cst

Culvert Studio v 2.0.0.30

03-05-2025

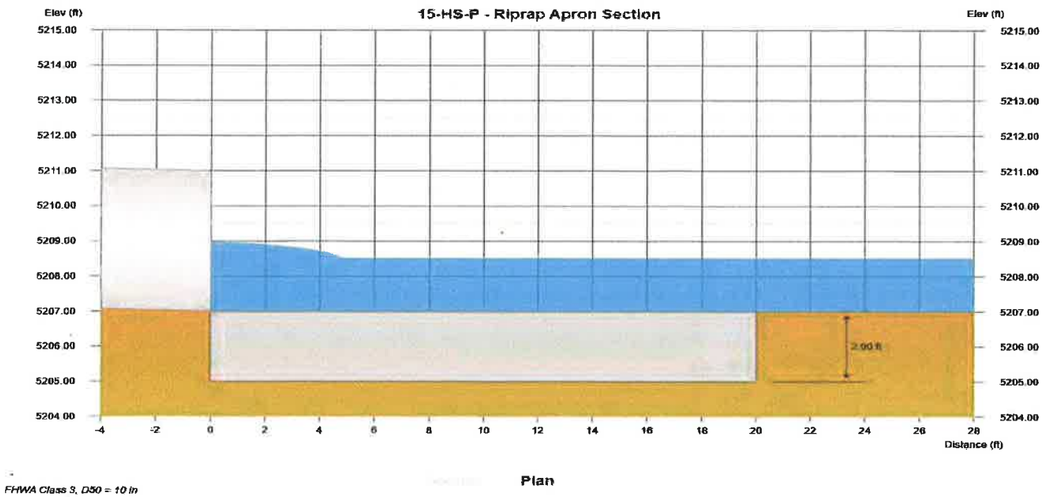
15-HS-P

Culvert 4

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 50.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5213.30 ft
Material	= Concrete	Crest Length	= 50.00 ft
Manning's n	= 0.012		
Rise	= 48 in	**DISCHARGE**	
Span	= 48 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5207.00 ft	Q Min	= 0.00 cfs
Length	= 80.0 ft	Q Max	= 437.00 cfs
Slope	= 0.019 ft/ft	Q Increment	= 43.70 cfs
Invert Elev. Up	= 5208.50 ft		
No. Barrels	= 5	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
437.00	437.00	0.00	13.58	9.16	20.00	41.40	2.00	10	6.93



Plan

FHWA Class 3, D50 = 10 in

Culvert Report

Project filename: Culvert Calculations 3.cst

Culvert Studio v 2.0.0.30

03-05-2025

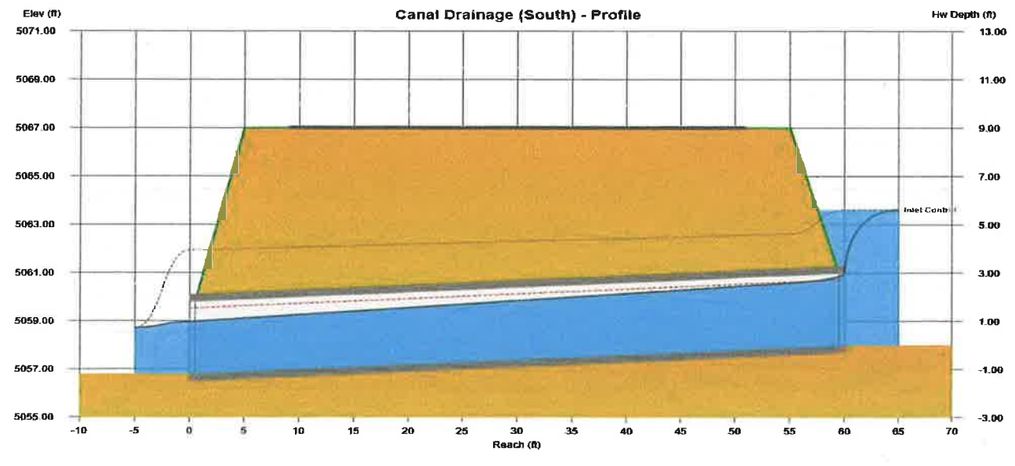
Canal Drainage (South)

Culvert 8

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 50.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5067.00 ft
Material	= Concrete	Crest Length	= 20.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5056.80 ft	Q Min	= 1.00 cfs
Length	= 60.0 ft	Q Max	= 150.00 cfs
Slope	= 0.020 ft/ft	Q Increment	= 15.00 cfs
Invert Elev. Up	= 5058.00 ft		
No. Barrels	= 2	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 1.87		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
151.00	151.00	0.00	13.82	11.18	26.0	32.7	5058.97	5060.73	5063.61



Culvert Report

Project filename: Culvert Calculations 3.cst

Culvert Studio v 2.0.0.30

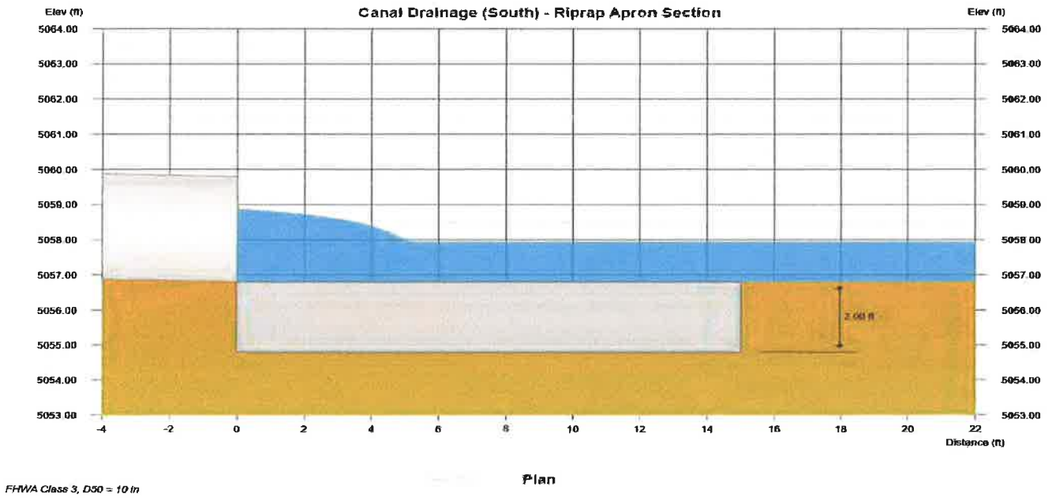
03-05-2025

Canal Drainage (South) — Culvert 8

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 50.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5067.00 ft
Material	= Concrete	Crest Length	= 20.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5056.80 ft	Q Min	= 1.00 cfs
Length	= 60.0 ft	Q Max	= 150.00 cfs
Slope	= 0.020 ft/ft	Q Increment	= 15.00 cfs
Invert Elev. Up	= 5058.00 ft		
No. Barrels	= 2	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
151.00	151.00	0.00	13.82	11.18	15.00	22.05	2.00	10	6.01



Plan

FHWA Class 3, D50 = 10 in

Culvert Report

Project filename: Culvert Calculations 3.cst

Culvert Studio v 2.0.0.30

03-05-2025

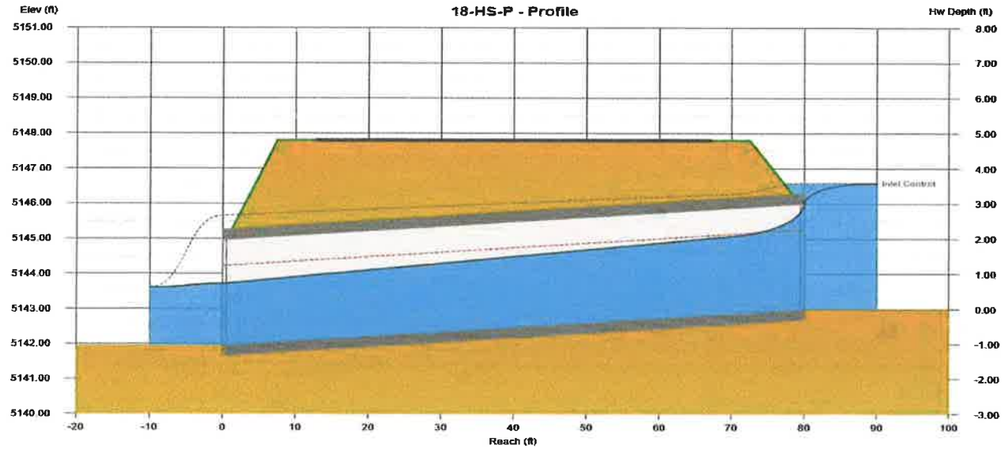
18-HS-P

Culvert 7

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 65.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5147.80 ft
Material	= Concrete	Crest Length	= 10.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5141.96 ft	Q Min	= 0.00 cfs
Length	= 80.0 ft	Q Max	= 48.00 cfs
Slope	= 0.013 ft/ft	Q Increment	= 4.80 cfs
Invert Elev. Up	= 5143.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Depth		HGL @ Hw/D = 1.19		
Total	Culvert	Over Top	Down	Up	Down	Up	Down	Up	Hw
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(in)	(in)	(ft)	(ft)	(ft)
48.00	48.00	0.00	11.19	8.39	21.0	27.2	5143.71	5145.26	5146.58



Culvert Report

Project filename: Culvert Calculations 3.cst

Culvert Studio v 2.0.0.30

03-05-2025

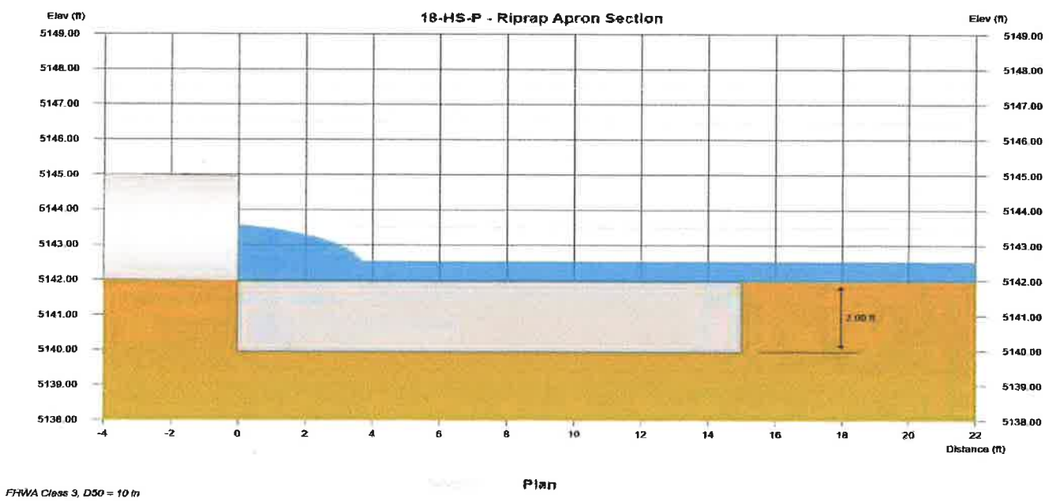
18-HS-P

Culvert 7

CULVERT		EMBANKMENT	
Shape	= Circular	Top Width	= 65.00 ft
Inlet Edge	= Beveled	Top Elevation	= 5147.80 ft
Material	= Concrete	Crest Length	= 10.00 ft
Manning's n	= 0.012		
Rise	= 36 in	**DISCHARGE**	
Span	= 36 in	Method	= Qmin to Qmax
Invert Elev. Down	= 5141.96 ft	Q Min	= 0.00 cfs
Length	= 80.0 ft	Q Max	= 48.00 cfs
Slope	= 0.013 ft/ft	Q Increment	= 4.80 cfs
Invert Elev. Up	= 5143.00 ft		
No. Barrels	= 1	**TAILWATER**	
Plan Skew Angle	= 0 degrees	Tailwater Elevation	= Normal Depth

CALCULATION SAMPLE

Discharge			Velocity		Riprap Apron Design				
Total	Culvert	Over Top	Down	Up	Length	Width	Depth	D50	Velocity
(cfs)	(cfs)	(cfs)	(ft/s)	(ft/s)	(ft)	(ft)	(ft)	(in)	(ft/s)
48.00	48.00	0.00	11.19	8.39	15.00	19.05	2.00	10	4.32



Plan

FHWA Class 3, D50 = 10 in

Attachment F: Haul and Service Road & Conveyor Crossing Plans

MTAC

HAUL AND SERVICE ROADS & CONVEYOR CROSSING PLANS

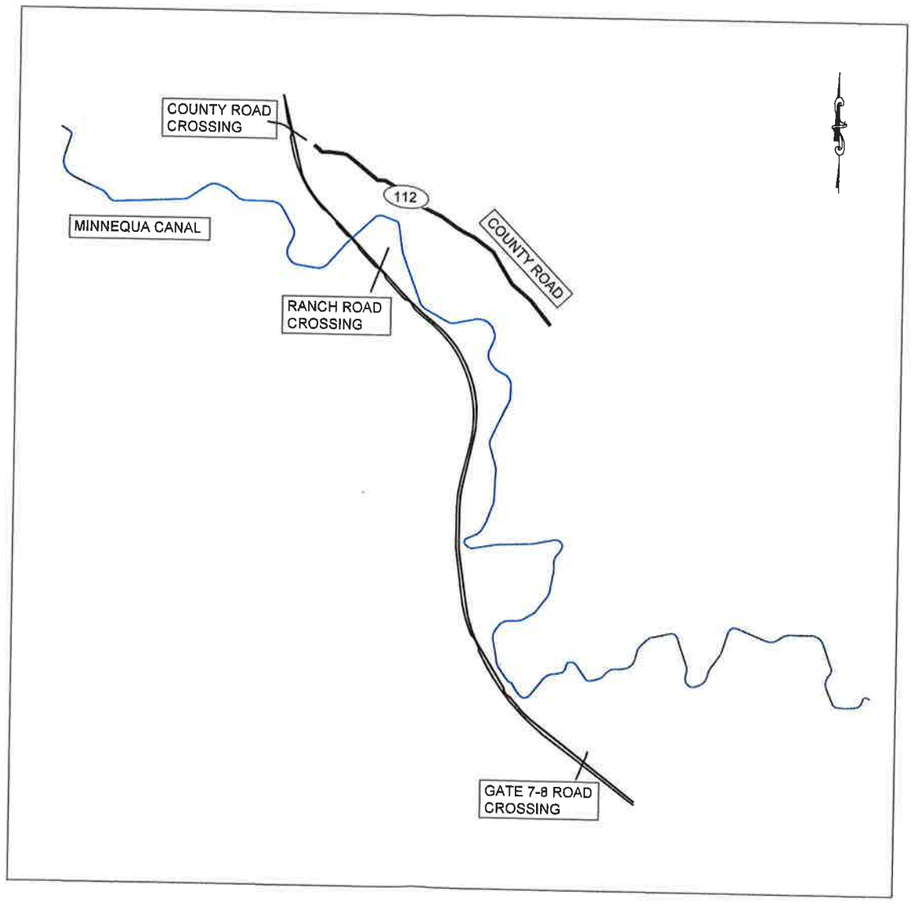
PROJECT NO: 24 -9781

FREMONT COUNTY, COLORADO

TABULATION OF LENGTH		
STATION	LINEAR FEET	
	US HWY	MAJOR STRUCTURE
TOTAL		

DESIGN ELEMENT	VALUE
MAXIMUM GRADE (%)	8
FILL SLOPE	2H:1V
CUT SLOPE	2.6H:1V
CROSS SLOPE (%CROWN)	2
HAUL ROAD(HR) BERM HEIGHT (FT)	5
SERVICE ROAD(SR) BERM HEIGHT (FT)	2
MTAC HR WIDTH[1] (FT)	30
MTAC SR WIDTH[1] (FT)	15
MTAC HR CROSSING WIDTH (FT)	23
MTAC SR CROSSING WIDTH (FT)	15
MTAC SR+HR BRIDGE CROSSING WIDTH (FT)	48
RED CREEK CROSSING (RCC) HR WIDTH[1] (FT)	50
RCC SR WIDTH[1] (FT)	15
RCC HR BRIDGE WIDTH (FT)	56
MTAC HR DESIGN SPEED[2] (MPH)	45
MTAC SR DESIGN SPEED[2] (MPH)	30
HR HORIZONTAL RADIUS MINIMUM (FT)	400
SR HORIZONTAL RADIUS MINIMUM (FT)	150
HR & SR, COUNTY ROAD CROSSINGS (STOP SIGNS)	AT GRADE
ROAD 112 CONVEYOR (CNVYR) CROSSING HEIGHT (FT)	18
RANCH ROAD CNVYR CROSSINGS (2 TOTAL.) (FT)	16

Notes: (1) Running surface width
(2) Reduced at box and bridge crossings



PROJECT LOCATION MAP

Scale: 1"=500'

SHEET NO.	INDEX OF SHEETS
1	COVER SHEET
2	GENERAL NOTES
3	OVERALL SITE PLAN
4A	HAUL ROAD PLAN & PROFILE
4B	HAUL ROAD PLAN & PROFILE
4C	HAUL ROAD PLAN & PROFILE
5	ROAD SECTIONS
6A	TYPICAL DETAILS -1
6B	TYPICAL DETAILS -2

NO.	REVISION	APPV'D	DATE
1	REV1		
2	REV2		
3	REV3		
4	REV4		

MTAC
HAUL & SERVICE ROADS
COVER SHEET
FREMONT COUNTY, COLORADO

DESIGNED BY: Andy Jesik
DRAWN BY:
CHECKED BY: Amarender K
PROJECT NUMBER: 24-9781

Jesik
800 W. 8th Street
Pueblo, Colorado 81003
(719) 582-5588
WWW.JESIK.US

DATE: 03-03-2025

SCALE:

SHEET: 1 OF 9

SOUTH AND NORTH P&P.dwg
3/3/25

PROJECT DESCRIPTION

THIS PROJECT IS LOCATED IN FREMONT COUNTY, COLORADO. THE WORK CONSISTS OF CONSTRUCTION OF HAUL ROAD, CONVEYOR BELT AND SERVICE ROAD FOR MAINTENANCE WITHIN THE 250 FEET WIDE CORRIDOR OF HOLCIM PROPERTY. DRAINAGE STRUCTURES ARE DESIGNED ACCORDING TO THE FLOW DATA FROM THE DRAINAGE REPORT PROVIDED BY HOLCIM, JURISDICTIONAL LIMITATIONS AND WILDLIFE CROSSING REQUIREMENTS. OVERHEAD CROSSINGS ARE DESIGNED WHERE THE CONVEYOR BELT CROSSED COUNTY ROAD AND RANCH ROAD. AT GRADE CROSSINGS ARE DESIGNED FOR HAUL AND SERVICE ROADS.

GENERAL NOTES

1. IT IS PERMITTED TO USE OR DITSTURB ONLY 0.5 ACRES OF WETLAND WITHIN THE WHOLE PROPERTY FOR THIS PROJECT.
2. THE HAUL AND SERVICE ROADS FORM AN INTERSECTION AT THEIR JUNCTION WITH THE COUNTY AND RANCH ROADS.
3. CLEARANCE FOR CONVEYOR BELT OVER COUNTY, RANCH ROAD IS 16' AND FOR MINNEQUA CANAL SERVICE ROADS IS 15'
4. THE GRADING OF ROADS, CROSSINGS, RIPRAPS OR APRONS SHOULD NOT CROSS THE PROPERTY LINE
5. TRAFFIC AT INTERSECTIONS IS CONTROLLED BY STOP SIGNS
6. SMALL TO MEDIUM SIZED WILDLIFE CROSSINGS ARE USED FOR HAUL AND SERVICE ROADS. LARGE WILDLIFE CROSSINGS ARE USED FOR THE CONVEYOR BELT.
7. WATER SHALL BE USED AS A DUST PALLIATIVE WHERE REQUIRED. LOCATIONS SHALL BE AS DIRECTED BY THE ENGINEER. WATER AS DUST PALLIATIVE AND NAY OTHER WETTING SHALL BE INCLUDED IN THE WORK AND WILL NOT BE PAID FOR SEPARATELY.
8. THE CONTRACTOR SHALL REMOVE DELETERIOUS MATERIAL FROM ALL SURFACES TO BE PAVED. REMOVAL OF DELETERIOUS MATERIAL AND VEGETATION SHALL NOT BE PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF THE PROJECT.
9. THE CONTRACTOR SHALL MAINTAIN DRAINAGE DURING CONSTRUCTION.
10. ALL SURVEYING THE NECESSARY TO COMPLETE THE WORK SHALL BE DONE BY THE CONTRACTOR. THE WORK WILL BE PAID FOR AS CONSTRUCTION SURVEYING, LUMP SUM.
11. THE CONTRACTOR SHALL COMPLY WITH ARTICLE 1.5 OF TITLE 9 C.R.S. "EXCAVATION REQUIREMENTS" WHEN EXCAVATING OR GRADING IS PLANNED IN THE AREA OF UNDERGROUND UTILITY FACILITIES. THE CONTRACTOR SHALL NOTIFY ALL AFFECTED UTILITIES AT LEAST TWO (2) BUSINESS DAYS, NOT INCLUDING THE ACTUAL DAY OF NOTICE. PRIOR TO COMMENCING SUCH OPERATIONS, THE CONTRACTOR SHALL CONTACT THE UTILITY NOTIFICATION CENTER OF COLORADO (UNCC) AT 811 OR 1-800-922-1987, TO HAVE LOCATION OF UNCC REGISTERED LINES MARKED. ALL OTHER UNDERGROUND FACILITIES SHALL BE LOCATED BY CONTACTING THE RESPECTIVE OWNER. UTILITY SERVICE LATERAL SHALL ALSO BE LOCATED PRIOR TO BEGINNING EXCAVATION OR GRADING.
12. IN ACCORDANCE WITH ARTICLE 1.5 OF TITLE 9, SECTION 103, C.R.S., EXISTING UTILITY FACILITIES ARE DEPICTED IN THE PLAN SHEETS AS REFERENCED BY THE QUALITY LEVEL NOTED THEREIN PURSUANT TO THE ASCE STANDARD GUIDELINE FOR THE COLLECTION AND DEPICTION OF EXISTING SUBSURFACE UTILITY DATA (CI/ASCE 38-02) THE CONTRACTOR SHALL NOT BE RELIEVED OF ITS RESPONSIBILITY TO COMPLY WITH THE REQUIREMENTS SET FORTH THEREIN AND SHALL NOT RELY SOLELY ON THE PLANS AND SPECIFICATIONS WHEN COMPLETING ITS WORK WITH RESPECT TO EXISTING BURIED UTILITIES.
13. THE CONTRACTOR SHALL CONSULT THE UTILITY PROJECT SPECIAL PROVISIONS FOR ADDITIONAL INFORMATION RELATED TO UTILITIES AND WORK TO BE PERFORMED AS PART OF THE PROJECT.

ENVIRONMENTAL NOTES

14. THE CONTRACTOR SHALL LIMIT CONSTRUCTION ACTIVITIES TO THOSE AREAS WITHIN THE LIMITS OF DISTURBANCE AND/OR LIMITS OF ABC SHOULDER MATERIAL SHOWN ON THE PLANS. ANY DISTURBANCE BEYOND THESE LIMITS SHALL BE RESTORED TO ORIGINAL CONDITION BY THE CONTRACTOR AT THE CONTRACTORS EXPENSE. CONSTRUCTION ACTIVITIES IN ADDITION TO NORMAL CONSTRUCTION PROCEDURE SHALL INCLUDE THE PARKING OF VEHICLES OR EQUIPMENT, DISPOSAL OF LITTER AND OTHER ACTION WHICH WOULD ALTER EXISTING CONDITIONS.
15. BEST MANAGEMENT PRACTICES (BMP) WILL BE IMPLEMENTED BEFORE, DURING, AND FOLLOWING CONSTRUCTION TO MANAGE SEDIMENT. STRUCTURAL AND/OR NON-STRUCTURAL EROSION AND SEDIMENT CONTROL DEVICES WILL BE USED TO PREVENT THE MOVEMENT OF SEDIMENT FROM EXPOSED AREAS.
16. TEMPORARY STAGING AREAS FOR CONSTRUCTION EQUIPMENT AND MATERIALS WILL UTILIZE PREVIOUSLY DISTURBED AREAS SUCH AS ROADS, GRAVELED PARKING AREAS, AND SHOULDER PULL OUTS AND SHALL BE PRE-APPROVED BY THE ENGINEER. COORDINATION FOR TEMPORARY USE AREAS WILL NOT BE MEASURED AND PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE COST OF WORK. MAJOR REPAIRS TO CONSTRUCTION EQUIPMENT WILL BE PERFORMED OFFSITE, WHERE PRACTICAL. THE CONTRACTOR SHALL NOT PARK ANY VEHICLES OR EQUIPMENT IN ANY DISTURBED AREAS NOT APPROVED BY THE ENGINEER.
17. TEMPORARY STAGING SHALL BE ON THE OWNERS PROPERTY

NO.	REVISION	APPV'D	DATE
1	REV1		
2	REV2		
3	REV3		
4	REV4		

MTAC
HAUL & SERVICE ROADS
GENERAL NOTES
FREMONT COUNTY, COLORADO

DESIGNED BY	DRAWN BY	CHECKED BY	PROJECT NUMBER
Andy Jesik	IDV	Amarender K	24-9781

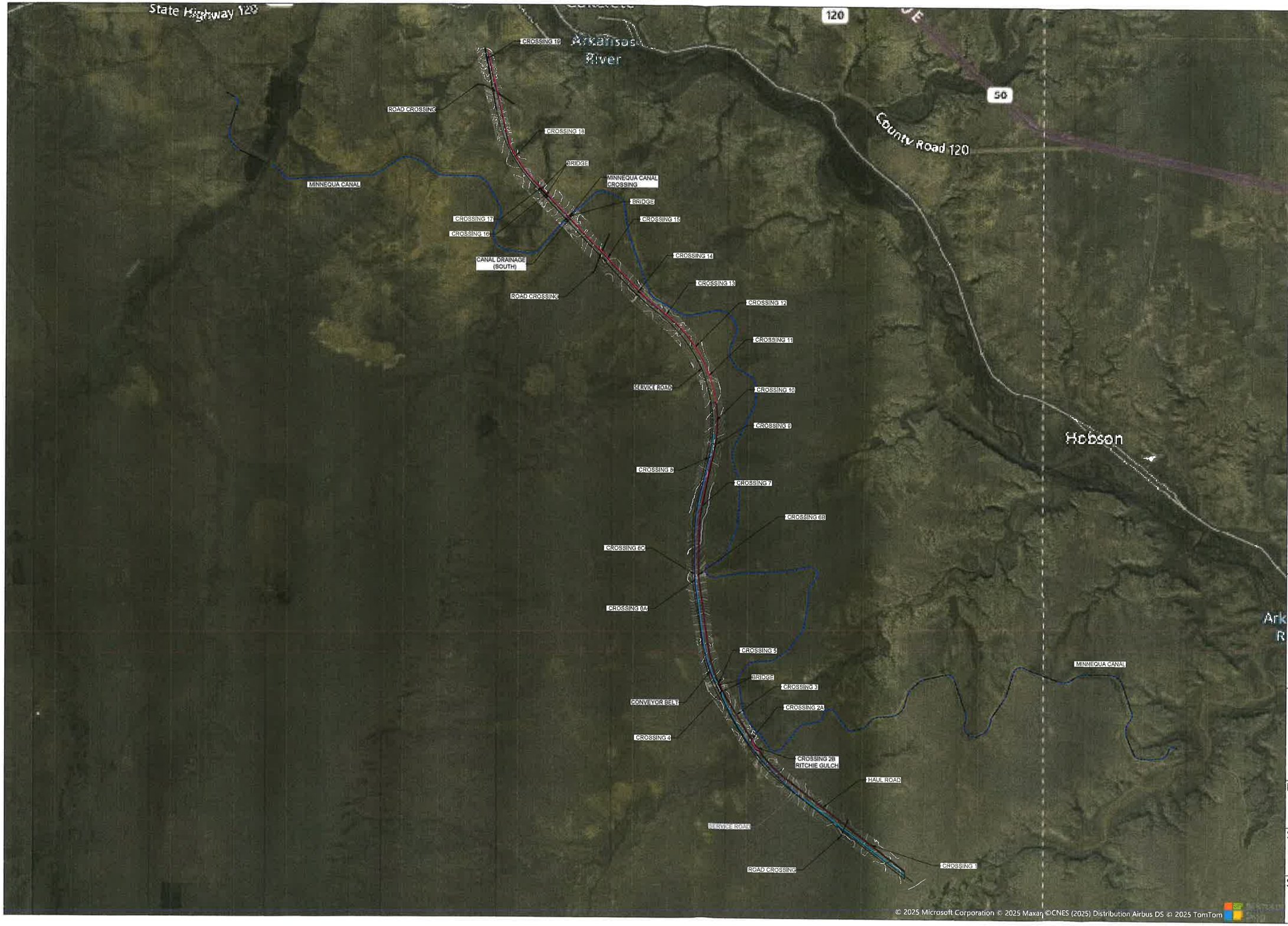
Jesik
800 W. 8th Street
Pueblo, Colorado 81003
(719) 582-5588
WWW.JESIK.US

DATE 03-03-2025

SCALE NTS

SHEET 2
2 OF 9

SOUTH AND NORTH P&P.dwg
3/3/25



SOUTH AND NORTH P&P.dwg

3/3/25

NO.	REVISION	APPV'D	DATE
1	REV1		
2	REV2		
3	REV3		
4	REV4		

MTAC
HAUL & SERVICE ROADS
OVERALL SITE PLAN

FREMONT COUNTY, COLORADO

DESIGNED BY	DRAWN BY	CHECKED BY	PROJECT NUMBER
Andy Jesik		Amarender K.	24-9781

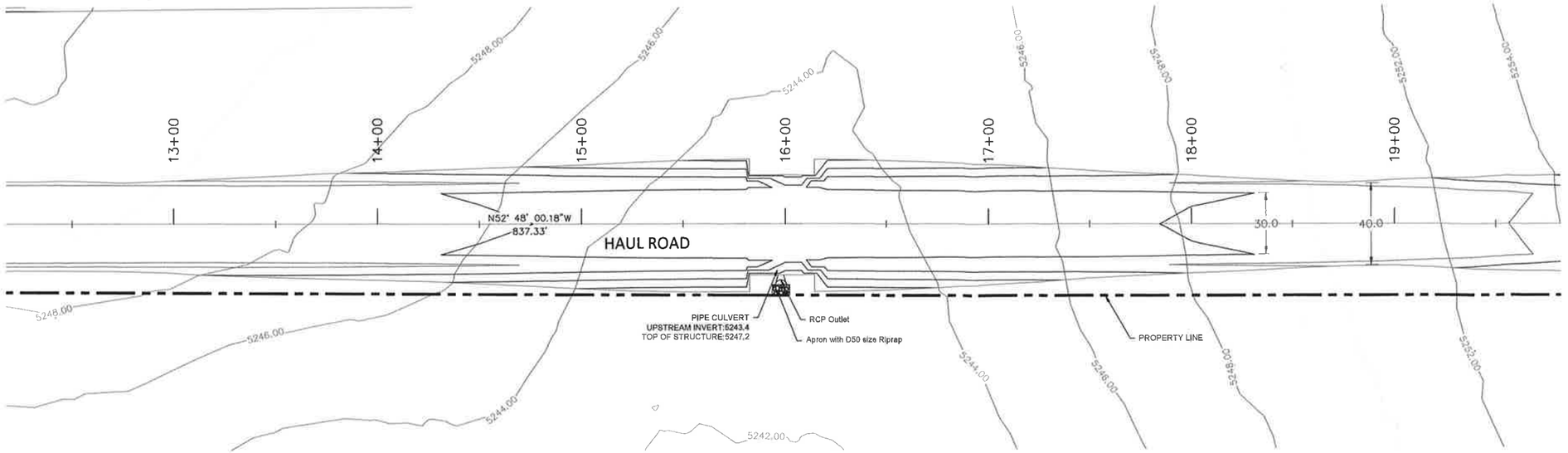
Jesik
800 W. 8th Street
Pueblo, Colorado 81003
(719) 582-5588
WWW.JESIK.US

DATE: 03-03-2025

SCALE: 1"=125'

SHEET: 3

3 OF 9



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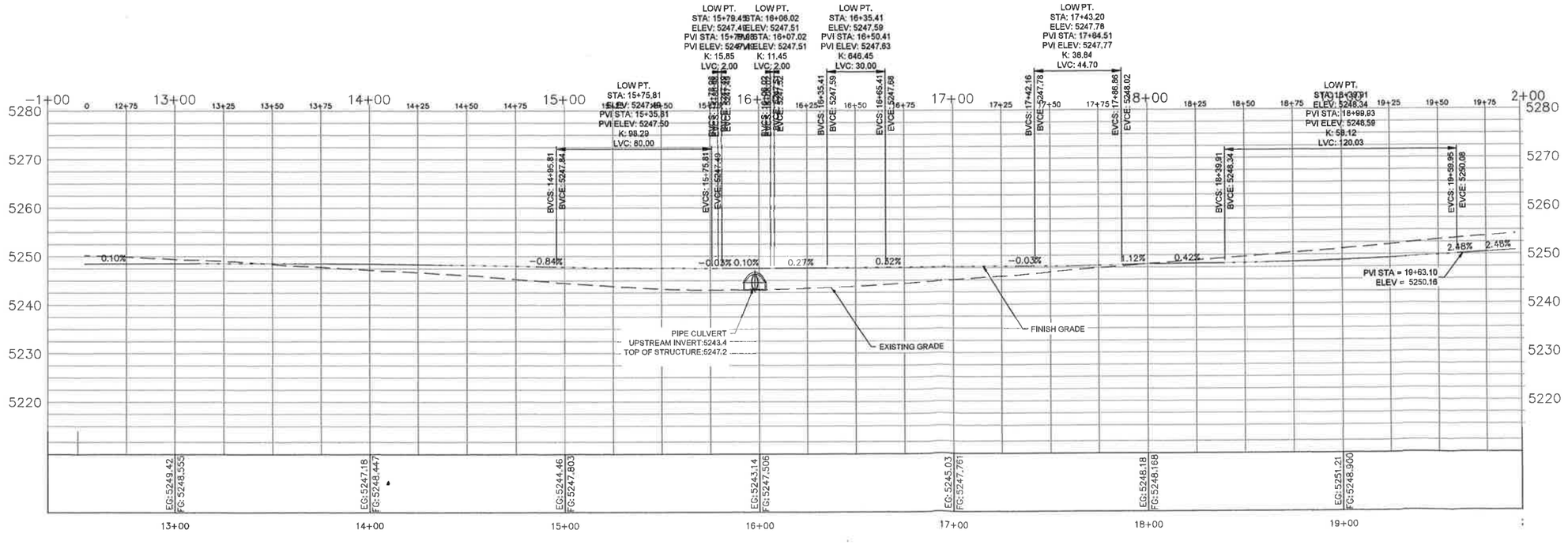
Scale: 1" = 30 FT



PROFILE
Vertical Scale: 1" = 8 FT
Horizontal Scale: 1" = 30 FT

CROSSING 1

NO.	REVISION	APPV'D	DATE
1	REV1		
2	REV2		
3	REV3		
4	REV4		

MTAC
HAUL & SERVICE ROADS
HAUL ROAD
PLAN AND PROFILE
FREMONT COUNTY, COLORADO

DESIGNED BY: ANDY JESIK
DRAWN BY
CHECKED BY: AMARENDER K
PROJECT NUMBER: 24-9781

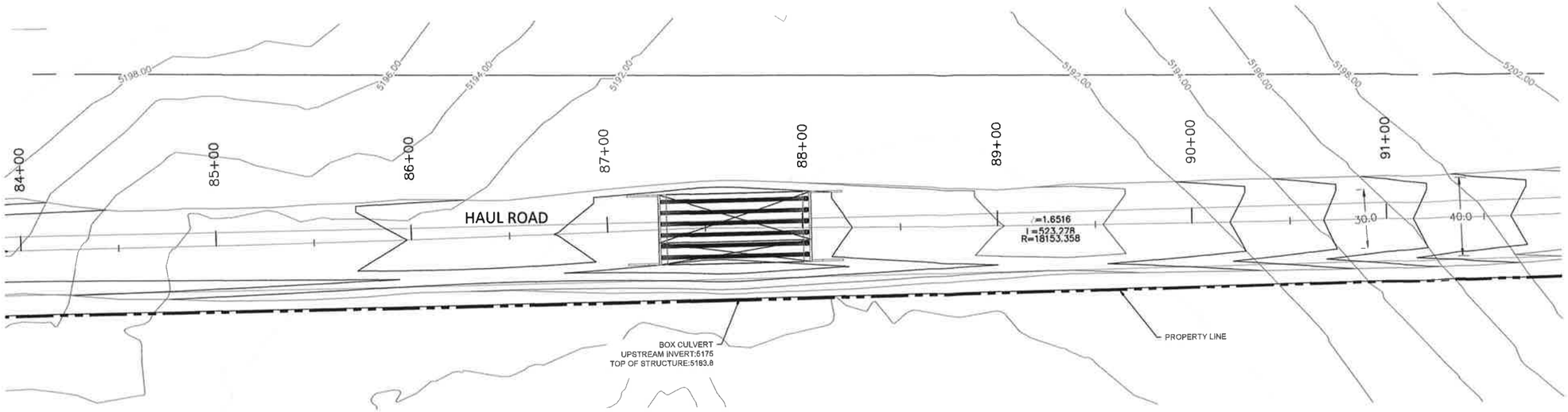
Jesik
800 W. 8th Street
Pueblo, Colorado 81003
(719) 582-5588
WWW.JESIK.US

DATE
03-03-2025

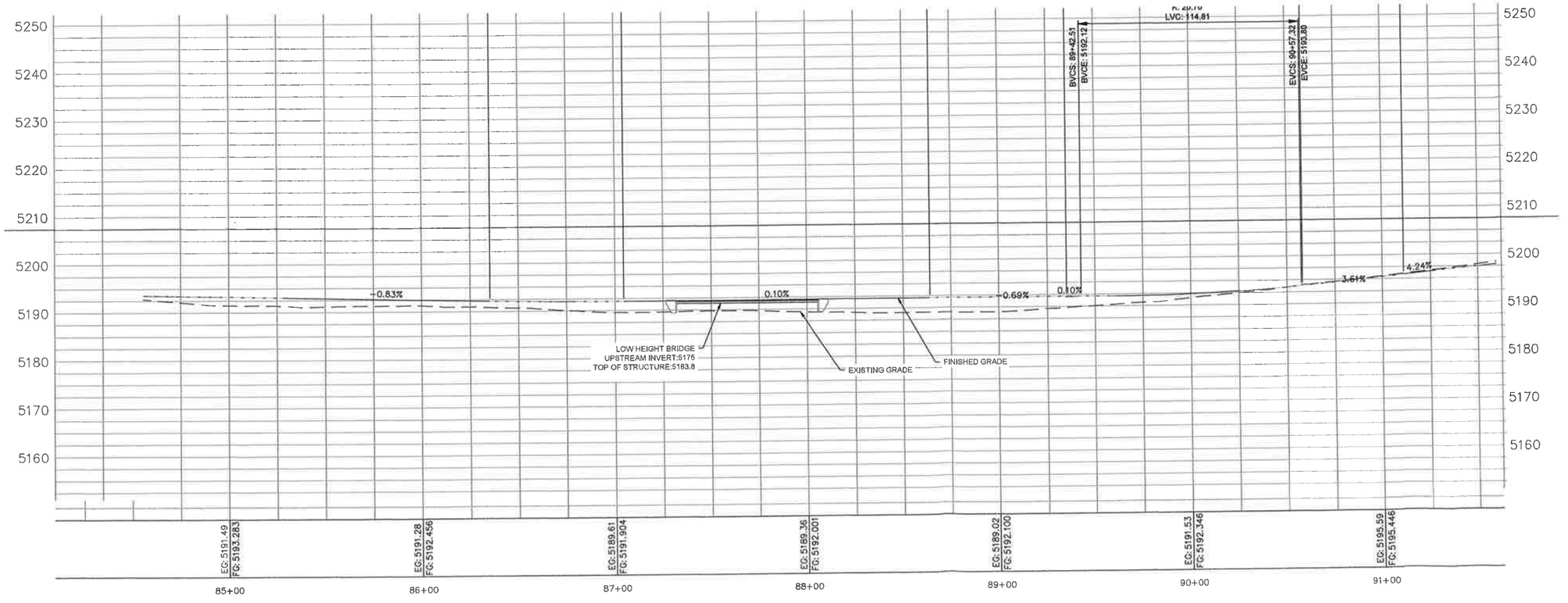
SCALE
VERT: 1" = 8'
HORIZ: 1" = 30'

SHEET
4A
4 OF 9

MTAC HAUL & SERVICE ROADS.dwg
3/3/25



PLAN
Scale: 1" = 30 FT



PROFILE
Vertical Scale: 1" = 8 FT
Horizontal Scale: 1" = 30 FT

CROSSING 3

NO.	REVISION	APPV'D	DATE
1	REV1		
2	REV2		
3	REV3		
4	REV4		

MTAC
HAUL & SERVICE ROADS
HAUL ROAD
PLAN AND PROFILE
FREMONT COUNTY, COLORADO

DESIGNED BY: ANDY JESIK
DRAWN BY
CHECKED BY: AMARENDER K
PROJECT NUMBER: 24-9781

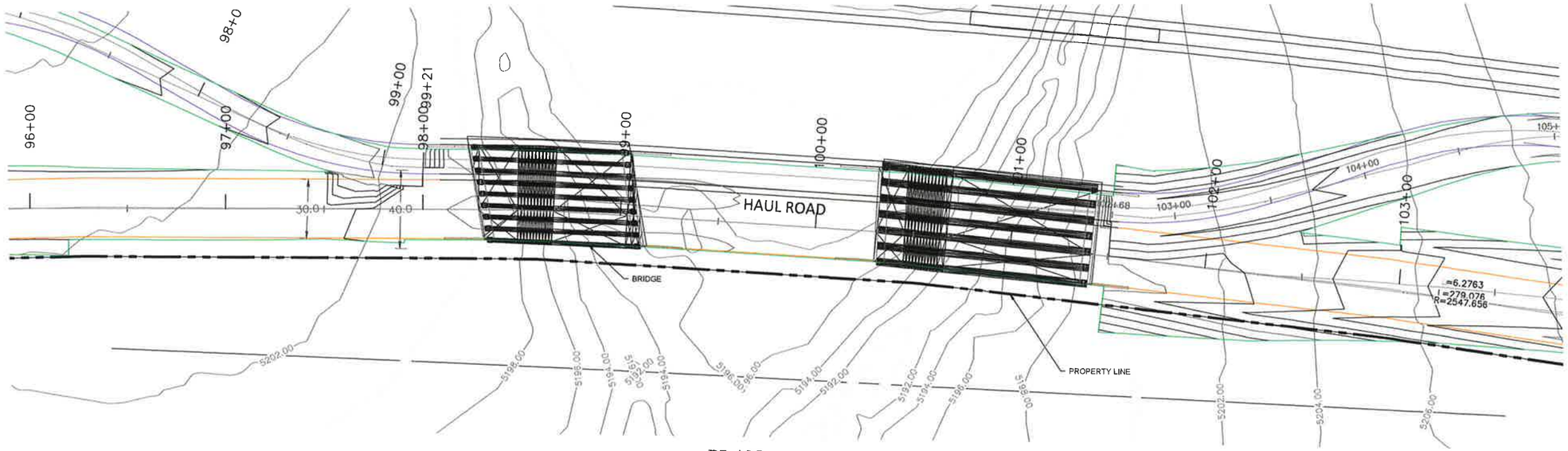
Jesik
800 W. 8th Street
Pueblo, Colorado 81003
(719) 582--5588
WWW.JESIK.US

DATE
03-03-2025

SCALE
VERT: 1" = 8'
HORIZ: 1' = 30'

SHEET
4B
5 OF 9

MTAC HAUL & SERVICE ROADS.dwg
3/3/25



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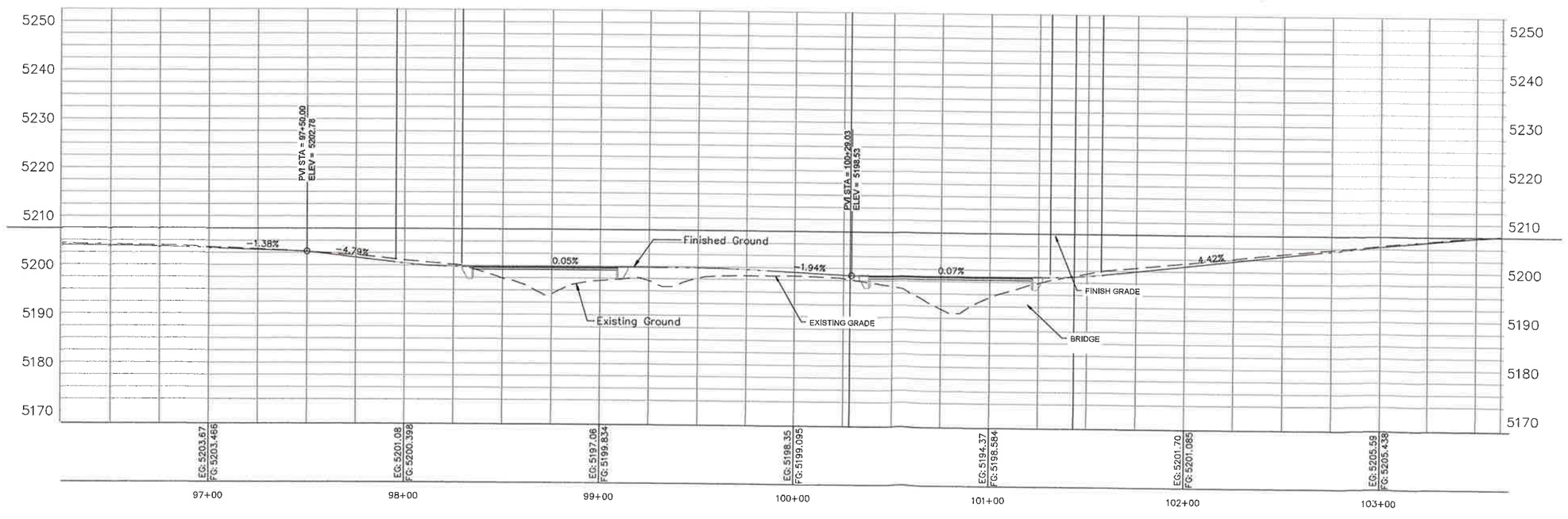


PROFILE
Vertical Scale: 1" = 8 FT
Horizontal Scale: 1" = 30 FT

CROSSINGS 4 & 5

NO.	REVISION	APPV'D	DATE
1	REV1		
2	REV2		
3	REV3		
4	REV4		

MTAC
HAUL & SERVICE ROADS
HAUL ROAD
PLAN AND PROFILE
FREMONT COUNTY, COLORADO

DESIGNED BY: ANDY JESIK
DRAWN BY
CHECKED BY: AMARENDER K
PROJECT NUMBER: 24-9781

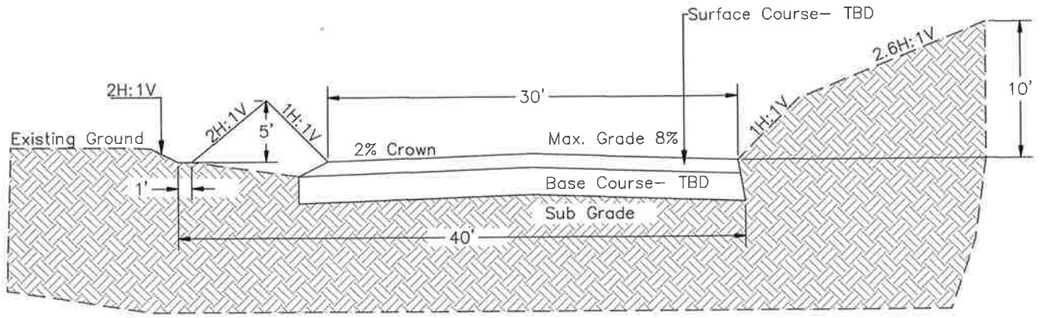
Jesik
800 W. 8th Street
Pueblo, Colorado 81003
(719) 582-5588
WWW.JESIK.US

DATE
03-03-2025

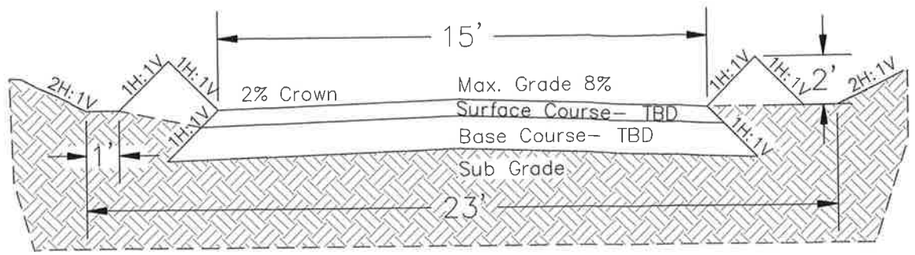
SCALE
VERT: 1" = 8'
HORIZ: 1' = 30'

SHEET
4C
6 OF 9

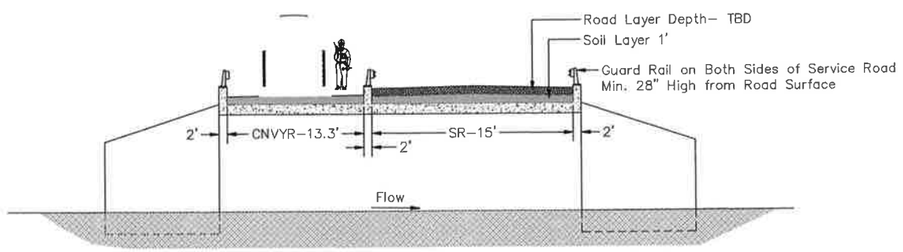
MTAC HAUL & SERVICE ROADS.dwg
3/3/25



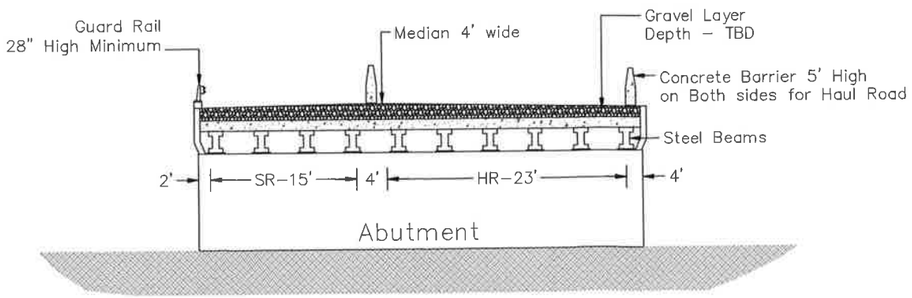
Haul Road Section



Service Road Section



Box Culvert for Service Road and Conveyor Belt



Bridge Section for Haul and Service Road

NO.	REVISION	APPV'D	DATE
1	REV1		
2	REV2		
3	REV3		
4	REV4		

MTAC
HAUL & SERVICE ROADS
ROAD SECTIONS

FREMONT COUNTY, COLORADO

DESIGNED BY	Andy Jesik
DRAWN BY	
CHECKED BY	Amarender K
PROJECT NUMBER	24-9781

Jesik
800 W. 8th Street
Pueblo, Colorado 81003
(719) 582–5588
WWW.JESIK.US

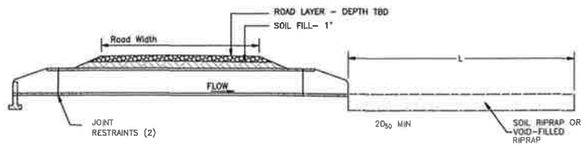
DATE 03–03–2025

SCALE NTS

SHEET 5 OF 9

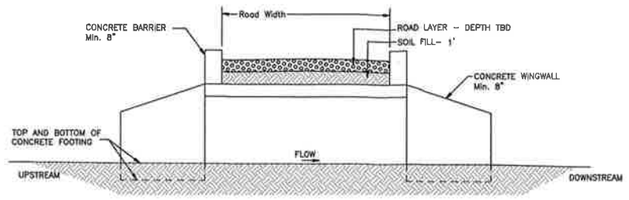
SOUTH AND NORTH P&P.dwg

3/3/25



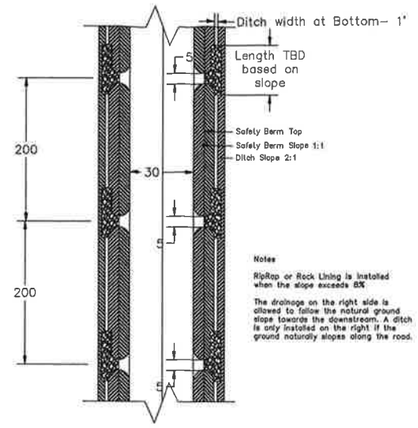
PROFILE
NTS

PIPE CULVERT

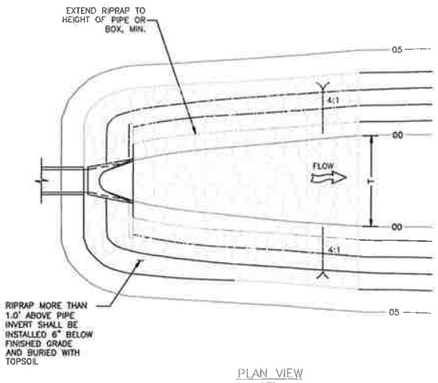


PROFILE

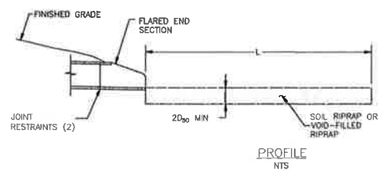
BOX CULVERT-PROFILE



BERM BREAKS- PLAN

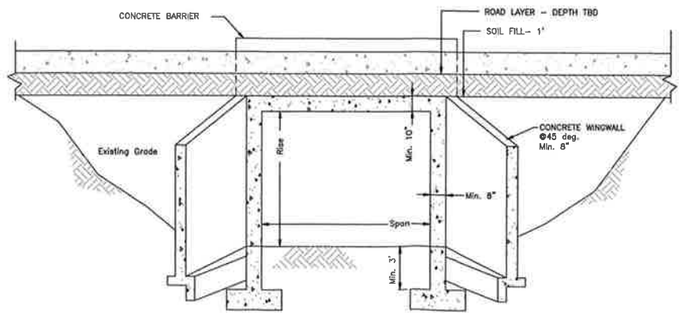


PLAN VIEW
NTS



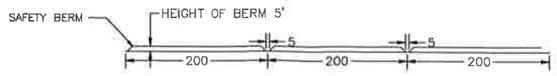
PROFILE
NTS

RIP RAP APRON DETAIL



SECTION

BOX CULVERT-SECTION



BERM BREAKS- PROFILE

NO.	REVISION	APPV'D	DATE
1	REV1		
2	REV2		
3	REV3		
4	REV4		

MTAC
HAUL & SERVICE ROADS

TYPICAL DETAILS

FREMONT COUNTY, COLORADO

DESIGNED BY	DRAWN BY	CHECKED BY	PROJECT NUMBER
Andy Jesik		Amarender K	24-9781

Jesik
800 W. 8th Street
Pueblo, Colorado 81003
(719) 582–5588
WWW.JESIK.US

DATE
03–03–2025

SCALE
NTS

SHEET
6A
8 OF 9

SOUTH AND NORTH P&P.dwg
3/3/25

TYPICAL DETENTION POND OUT

SCALE: NTS

TYPICAL POND OUTLET & EMBANK

SCALE: NTS

NO.	REVISION	APPV'D	DATE
1	REV1		
2	REV2		
3	REV3		
4	REV4		

MTAC
HAUL & SERVICE ROADS

TYPICAL DETAILS

FREMONT COUNTY, COLORADO

DESIGNED BY Andy Jesik
DRAWN BY
CHECKED BY Amarender K
PROJECT NUMBER 24-9781

Jesik
800 W. 8th Street
Pueblo, Colorado 81003
(719) 582-5588
WWW.JESIK.US

DATE 03-03-2025

SCALE NTS

SHEET 6B

9 OF 9

3/3/25 SOUTH AND NORTH P&P.dwg

CUP Exhibit 3.9 Noxious Weed Control Plan

FREMONT COUNTY WEED MANAGEMENT
201 N 6th St, Room 118
Cañon City, CO 81212
719-276-7317
brittany.pierce@fremontco.com

Integrated Weed Management Plan

Project Name: Ranch Land Pit #1/Red Creek Major Mod DATE 09/28/2020

Address (or location of property): Sections 24 & 25 of T20S, R68W, Fremont County, CO

List of Noxious Weeds and Control Plan:

Noxious Weeds Present Control Measures:
Reference "Guideline for Weed Management Plans April 2015"

State Law requires all landowners to manage noxious weed on their property. The following weeds under Colorado Noxious Weed Act, if present, are considered a threat to the economic and environmental value of our state lands. These listed under the Noxious Weed Act shall be managed under the provisions of this article. The following species under this act that have been identified in this county and should be managed in the appropriate manner as mandated throughout the term of the permit and thereafter.

"List A" species - These are rare noxious weed species that are subject to eradication upon confirmed identification during any interval of reclamation to the site. Such List A species confirmed in Fremont County may include, but are not limited to:

*Myrtle Spurge, *Japanese Knotweed, *Giant Reed, *Elongated Mustard

"List B" species - These are noxious weed species distributed throughout the State of Colorado and are subject to eradication, containment, or suppression in order to halt continued spread. Species identified within Fremont County may include, but are not limited to:

Absinth Wormwood, Black Henbane, Bouncingbet, *Bull Thistle, *Canada Thistle, Common Teasel, *Dalmatian Toadflax, Dame's Rocket, *Diffuse Knapweed, Eurasian Watermilfoil, *Hoary Cress, *Houdstongue, Hybrid Knapweed, Hybrid Toadflax, Jointed Goatgrass, *Leafy Spurge, *Musk Thistle, Oxeye Daisy, Perennial Pepperweed, *Russian Knapweed, Russian-olive, *Salt Cedar, Scentless Chamomile, Scotch Thistle, *Spotted Knapweed, *Yellow Toadflax.

"List C" species - Are well-established noxious weed species and are widespread throughout the State for which control is only recommended. Common species in Fremont County include, but are not limited to:

Chicory, Common Burdock, Common Mullein, Downy Brome, Field Bindweed, Halogeton, Johnsongrass, Perennial Sowthistle, Poison Hemlock, Puncturevine, Redstem Filaree

Identification and treatment can be conducted through Fremont County Weed Management or a recommended partnering agency. Please see Fremont County Weed Control's booklet, "Guideline for Weed Management Plans" for more details such as herbicide rates and specifics about weed control methods.

Fremont County Weed Management is operated by Qualified Licensed Applicators under the Department of Agriculture. Any management or treatment involving chemical treatment should be carried out as indicated on the label. The label is the law. Any information on management planning or about receiving cost share that is available to the public, can be discussed with the department to confirm eligibility.

*These weed species receive priority for cost share funding.

Other Required Action: The vicinity of the proposed planning area is a known location for noxious weed infestations of tamarisk (salt cedar), Russian olive, Canada thistle and hoary cress species. Other noxious species could present themselves on site during any point of time and should also be addressed as stated in the Control Plan. In the event any 'List A' or large populations of 'List B' species are observed, a site visit would be recommended during peak growing season to discuss further management plans. In order to do this, please consider all factors in choosing a time (such as weather, presence of actively growing plants, and operation plans or activities). Any additional questions or concerns in completing this management plan please contact Fremont County Weed Management to discuss available options. (719-276-7317)

Michael B. Joelle — Applicant Signature — 07/21/2023 — Date

Michael B. Joelle — Owner/Manager Signature — 07/21/2023 — Date

Brittany Pierce

Brittany Pierce
Fremont County Weed Management Representative

September, 28 2020
Date

CUP Exhibit 3.10 Owners within 500 ft.

Parcel Number	Owner	Owner's Address	Parcel Address
99924557	Ranch Land LLC	9990 East Cactus Scottsdale, AZ 85260 and 3925 Hill Circle Colorado Springs, CO 80904	NA
3937000000005	CF&I Steel LP	PO Box 316 Pueblo, CO 81002	NA Minnequa Canal

CUP Exhibit 3.11 Roadway Impact Analysis Form

Fremont County Department of Planning and Zoning
Roadway Impact Analysis Form

This form shall be used in conjunction with any applications submitted in accordance with Section 8 of the Fremont County Zoning Resolution and or Section VI of the Fremont County Subdivision Regulations. This form is considered a minimum application submittal item and shall be required to be provided at the time of application submittal. This form is intended to provide the minimum items that must be addressed in the roadway impact analysis. The form can be expanded or attachments can be made to further address the roadway impact of the proposed use. **If the estimated average daily traffic increase is less than thirty (30) vehicle trips per day (*one trip to be considered as a single or one-direction vehicle movement with either the origin or the destination [exiting or entering] inside the subject property*) as per the Institute of Transportation Engineers, Trip Generation Handbook, Second Edition or subsequent editions for the entire development, as estimated by the project engineer, then a Roadway Impact Analysis will not be required to be completed by an engineer. In such situations other minimum items shall be addressed by the applicant.**

1. Project Name Red Creek Quarry formerly Ranch Land Rock Pit #1 CUP 02-3

2. Type of application:
   - ☐ Zone Change #1
   - ☐ Zone Change #2 – Use Designation Plan
   - ☐ Zone Change #2 – Final Development Plan
   - ☐ Commercial Development Plan
   - ☐ Commercial Development Modification
   - ☐ Expansion of an existing Business or Industrial Use
   - ☐ Special Review Use Permit
   - ☒ Conditional Use Permit
   - ☐ Temporary Use Permit
   - ☐ Change of Use of Property
   - ☐ Subdivision Preliminary Plan

3. Engineer: 3 Rocks Engineering Address: 430 Main Street
   City: Canon City State: CO Zip Code: 81212
   Telephone #: (719)430-5333 Facsimile #: ( ) Email ronn@3rocksengineering.com

4. Provide a detailed description of the proposed use:
   Red Creek Quarry (RCQ) will the be limestone source for the cement plant whens Bear Creek Quarry is mined out. RCQ will be accessed by an interior Materials Transport and Access Corridor on private property between the cement plant and RCQ. Mining and equipment will be consistent with Holcim's current operation.

5. Provide the estimated average daily traffic to be generated by the proposed use(s), using the Institute of Transportation Engineers, Trip Generation Handbook, Second Edition or subsequent editions. The estimated volumes of traffic to be generated by the proposed use(s) shall include as a minimum, the average weekday traffic volume and the peak-hour (*morning and afternoon*) traffic volumes. Specify the number of trips in each category. (*one trip to be considered as a single or one-direction vehicle movement with either the origin or the destination [exiting or entering] inside the subject property*) **No new daily traffic will be generated.**
   Residential: 0 daily, _____ peak-hour am, _____ peak-hour pm _____
   Employee: 0 daily, _____ peak-hour am, _____ peak-hour pm _____

Red Creek Quarry is a new limestone source that will be operated by Holcim; by Holcim employees . No new traffic trips will be generated by this project as personnel from Bear Creek Quarry will operate Red Creek Quarry. All personnel and equipment will use the plant access on Hwy 120.

Customer: 0 daily, _____ peak-hour am, _____ peak-hour pm

Truck generated by the proposed use: 0 daily, _____ peak-hour am, _____ peak-hour pm

Delivery – required by the use: 0 daily, _____ peak-hour am, _____ peak-hour pm

Total Vehicle Trips: 0 daily, _____ peak-hour am, _____ peak-hour pm

I certify that based on the proposed use(s) the total vehicle trips using the Institute of Transportation Engineers, Trip Generation Handbook, Second Edition or subsequent editions will average less than thirty (30) trips per day based on any fourteen (14) day time frame.

Ronald G Nies
cn=Ronald G Nies, c=US, o=3 Rocks Engineering, email=ronn@3rocksengineering.com
03/11/24

Date 3/11/24 Seal

COLORADO REGISTERED RONALD G. NIES 3/11/24 30594 PROFESSIONAL ENGINEER

Colorado Licensed Professional Engineer

If the above has been certified, then the applicant can complete the form and acknowledgement. completed by the applicant only the questions marked by asterisk (*) are required to be answered.

NOTE: If the additional information provided warrants improvements to the roadway system, even though the traffic generated by the proposed use is less than thirty (30) trips per day, such improvements will be required. If in the future the use exceeds an average of thirty (30) trips per day a complete analysis could be required.

6. *What is the general location of the subject property?
Sections 24 and 25, T20S, R68W of the 6th Principal Meridian in Fremont County CO.

7. *What are the names and/or the numbers of the public roadways that serve the site?
CO Hwy 120

Provide a site plan drawing that shows the subject property, its proposed access points and all public roadways within a one-half (½) mile radius of the subject property, marked as Exhibit 7.1. [X] An exhibit has been attached.

8. *What is the classification, according to the Fremont County Master Plan, of the roadway from which the project site will gain access to the public transportation system?
[ ] Expressway or Freeway --- [X] Major Arterial --- [ ] Arterial --- [ ] Collector --- [ ] Local

9. *Do the roadways in question lie within a three (3) mile radius of any incorporated town or city limits or the boundary of another County? [X] Yes --- [ ] No
If yes, provide the name(s) of the jurisdiction(s): City of Florence
In addition if a new roadway is to be constructed, how will it comply with the transportation plan in effect for the municipality?

10. *Will this project require a Fremont County Driveway Access Permit or a Colorado Department of Transportation (CDOT) State Highway Access Permit? [ ] Yes --- [X] No
Please explain:

11. *Will the project require construction of, or improvement to any roadway maintained by the CDOT?
☐ Yes --- ☒ No
If yes, will the proposed construction or improvement be in compliance with CDOT's "5 Year Transportation Plan"? ☐ Yes --- ☐ No Please Explain _____

Has CDOT required that the applicant provide a traffic study? ☐ Yes --- ☐ No
If yes, a copy of the study shall be attached to this application, marked as Exhibit 11.1. ☐ An exhibit has been attached.

12. *Will the project require construction of, or improvement to any roadway currently maintained or proposed to be maintained by the County? ☐ Yes --- ☒ No
If yes, what would be the social, economic, land use, safety and environmental impacts and effects of the new roadway on the existing transportation system and neighborhood?_____

13. *Are any roadways proposed to be vacated or closed in conjunction with the proposed project? ☐
Yes --- ☒ No
If yes, please explain._____

14. *Is the proposed project site adjacent to or viewable from any portion of the Gold Belt Tour Scenic Byway or other scenic corridor designated by the Master Plan? ☐ Yes --- ☒ No
If yes, identify the byway and or scenic corridor:_____
If yes, explain how the scenic quality will be affected by the proposed project._____

If yes, what measures will be taken to not have a negative impact on the byway and or scenic corridor?_____

15. *Will the proposed project gain access to the public transportation system via 3rd, 9th, K and or R Streets in the Penrose-Beaver Park Area of the County? ☐ Yes --- ☒ No

16. *Does the subject property have frontage on a public roadway? ☐ Yes --- ☒ No
If answered no, then documentation evidencing a "right of access" to the subject property for the proposed use shall be attached marked as Exhibit 16.1. ☒ An exhibit has been attached. If answered no, then please explain what the right of access consists of: Holcim secured an access corridor during the purchase of the limestone resource.

17. *What is the right-of-way width of the public roadway(s) that serve the site? 100 ft.

18. *What is the surface type of the public roadway(s) that serve the site? Concrete and asphalt

19. *What is the surface width of the public roadway(s) that serve the site? 40 ft

20. *What are the existing drainage facilities for the public roadway(s) that serve the site?
Culverts and bar ditches

21. *Does the public roadway(s) that serves the site have curb and gutter? ☐ Yes --- ☒ No
If answered yes, what is the type of curb and gutter?

22. *Does the public roadway(s) that serves the site have adjacent sidewalks or other pedestrian ways?
☐ Yes --- ☒ No
If answered yes, what is the width(s) and surface type(s)?

23. *How many access points will the subject property have to public roadways? One

24. *Will the proposed roadways that access the public roadways intersect the public roadways other than at perpendicular? ☐ Yes --- ☒ No
If answered yes, please explain:

25. *What are the sight distances, in all directions, from the subject property access point(s) along the public roadway that serves the site? (*mark and provide distance for each that is applicable*)
☐ Northerly, site distance: ☐ Southerly, site distance:
☒ Easterly, site distance: 400 ft. ☒ Westerly, site distance: 1000 ft.

26. *What are the distances from the subject property access point(s), in all directions, to the nearest intersection with another public roadway along the public roadway that serves the site? (*mark and provide distance for each that is applicable*)
☐ Northerly, distance: ☐ Southerly, distance:
☒ Easterly, distance: 3.75 miles ☒ Westerly, distance: 2200 ft

27. *What are the distances from the subject property access point(s), in all directions, to the nearest driveway(s) along the public roadway that serves the site? (*mark and provide distance for each that is applicable*)
☐ Northerly, distance: ☐ Southerly, distance:
☐ Easterly, distance: ☒ Westerly, distance: 1000 ft

28. *What are the distances from the subject property access point(s), in all directions, to the nearest blind curve(s) along the public roadway that serves the site? (*mark and provide distance for each that is applicable*)
☐ Northerly, distance: ☐ Southerly, distance:
☒ Easterly, distance: 400 ft. ☒ Westerly, distance: 1000 ft

29. *What are the distances from the subject property access point(s), in all directions, to the nearest blind hill(s) along the public roadway that serves the site? (*mark and provide distance for each that is applicable*)

☐ Northerly, distance: _____ ☐ Southerly, distance: _____

☒ Easterly, distance: 400 ft ☐ Westerly, distance: _____

30. *Identify any and all hazardous conditions with regard to the public roadway(s) that provide access to the subject property in the general area of the subject property: No hazardous conditions exist regarding this public road access.

If the public roadway(s) that currently serve the subject property have any hazardous conditions, then recommendations shall be made for improvements that will decrease the hazardous conditions on the public roadway(s): _____

31. *Explain what effect the proposed use will have on the existing traffic in the neighborhood. If no change is expected, please explain why no change is expected: No change is expected to traffic in the neighborhood. Please refer to the comment in the top margin of Page 2 of this form.

32. *Will the proposed use, due to the increase in traffic or the type of vehicle traffic generated by the proposed use, change the level and or type of required maintenance for the public roadway(s) that serve the site? ☐ Yes --- ☐ No, (*please explain*) NA

If the proposed use, due to the increase in traffic or the type of vehicle traffic generated by the proposed use, changes the level and or type of required maintenance for the public roadway(s) that serve the site, then recommendations shall be made that would lessen the maintenance impact for the entity in control of maintenance of the public roadway(s): _____

Note: If improvements are required, it may be mandatory that such improvement be installed prior to final approval of the application.

33. *Are new roadways proposed to be constructed, on or off site, in association with the proposed project? ☒ Yes --- ☐ No If yes, provide evidence that the roadways will be constructed to conform to natural contours in order to minimize soil disturbance, cut and fills, protect drainageways and not create to unstable slopes. The interior Material Transport and Access Corridor will be constructed according to guidance from DRMS, CPW, ACE and MSHA.

34. Provide an analysis of the existing traffic volumes on the adjacent roadway system, including the average weekday traffic (*vehicles per day*) and the weekday peak-hour traffic (*vehicles per hour – am and pm*), showing the dates and times of traffic counts or source utilized for traffic volume counts. Determine the existing level of service or percentage of roadway capacity currently in use.

Roadway name or # _____ average weekday traffic_____
Weekday peak-hour traffic _____ am _____ dates _____ times
Weekday peak-hour traffic _____ pm _____ dates _____ times
Current level of service - % of roadway in use_____
_____

Roadway name or # _____ average weekday traffic _____

Weekday peak-hour traffic _____ am _____ dates _____ times

Weekday peak-hour traffic _____ pm _____ dates _____ times

Current level of service / % of roadway in use_____
_____

Roadway name or # _____ average weekday traffic _____
Weekday peak-hour traffic _____ am _____ dates _____ times
Weekday peak-hour traffic _____ pm _____ dates _____ times
Current level of service / % of roadway in use_____
_____

35. Provide an estimate of the probable traffic directional distribution from and to the subject property based on the proposed use(s) and assignment of the estimated traffic volumes to the adjacent roadway network. Estimate the future background and resulting total traffic volumes (*including the estimated generated traffic due to the proposed use*) on the adjacent roadway system for a twenty (20) year design period, showing volumes for both left and right turn movements as well as through traffic._____
_____
_____

36. Determine the projected future levels of service or percentage of roadway capacity to be in use at the subject property's access points and key adjacent intersections. Provide recommendations for street and access improvements if any portions of the roadways do not have the capacity to accept the additional estimated traffic volumes. All necessary improvements will be required to be designed, completed and accepted by the County prior to any final action regarding the application.

_____
_____
_____
_____
_____

37. Please provide any additional information considered by the Certifying Engineer to be pertinent to the roadway impact in association with the proposed project:_____

_____

_____

_____

_____

I hereby certify that the foregoing information was prepared by myself or under my direct supervision and is true and correct to the best of my knowledge and belief.

_____ Date _____ SEAL

Colorado Licensed Professional Engineer

If not completed by an Engineer, then the following acknowledgement shall be signed by the applicant and/or owner.

By signing this Application, the Applicant, or the agent/representative acting with due authorization on behalf of the Applicant, hereby certifies that all information contained in the application and any attachments to the Application, is true and correct to the best of Applicant's knowledge and belief.

Applicant understands that any required private or public improvements imposed as a contingency for approval of the application may be required as a part of the approval process.

Fremont County hereby advises Applicant that if any material information contained herein is determined to be misleading, inaccurate or false, the Board of Commissioners may take any and all reasonable and appropriate steps to declare actions of the Board regarding the Application to be null and void.

Signing this Application is a declaration by the Applicant to conform to all plans, drawings, and commitments submitted with or contained within this Application, provided that the same is in conformance with the Fremont County Zoning Resolution.

Hamza Mekhfi		March 28, 2024
Applicant Printed Name	Signature	Date
Hamz Mekhfi		March 28, 2024
Owner Printed Name	Signature	Date

CUP Exhibit 3.13 Master Plan Compliance

The subject property is located in the Plains Planning District of the 2015 Fremont County Master Plan.

Objectives

F1. The proposed mining is will be conducted to be protective of water quality and wildlife habitat. The subject parcels are surrounded by Ranch Land LLC, substantially isolated from recreators with the exception of hunters with permission to be on the private land.

F1.1 Holcim has conducted groundwater and surface water baseline quality and quantity characterization investigations. Water monitoring will continue throughout the life of the mine with DRMS.

F1.2 Holcim obtained input from CO DWR, and US ACE while preparing the CO DRMS application. Agency recommendations are incorporated into the DRMS 112 permit application.

F1.3 Brown and Caldwell prepared a stormwater drainage report for the project and it is included in the county application.

F1.4 Brown and Caldwell performed a wildlife investigation/survey of the mine area. CPW visited the site and prepared recommendations that were incorporated in the DRMS 112 permit application.

F1.5 Development will not occur within the flood hazard area of the Arkansas River.

F2. The proposed mining is a long term limestone resource for Holcim. Reclamation will return the mined area to rangeland for cattle and wildlife habitat that will maintain the rural character.

CUP Exhibit 3.14 Surrounding Land Use Compatibility

The Ranch Land LLC ranch includes two areas currently permitted for mining. Mining and cattle ranching are the principal land uses on the ranch.

Legal Description of Materials Transport and Access Corridor:

A Parcel of land located in parts of Sections 20, 21, 28 and 29, Township 19 South, Range 68 West of the Sixth Principal Meridian, County of Fremont, State of Colorado, more particularly described as follows:
Beginning at a point on the North line of the Southeast Quarter of said Section 20, and considering said North line to bear N89° 09' 19"E, with all bearings herein relative thereto, and from which the Southwest corner of said Section 20 bears S62° 00' 36" West a distance of 5805.37 feet;
Thence N13° 22' 46"W a distance of 284.95 feet;
Thence N76° 37' 14"E a distance of 273.19 feet;
Thence S13° 22' 46"E a distance of 346.36 feet to said North line of the Southeast Quarter of said Section 20;
Thence continuing S13° 22' 46"E a distance of 3928.22 feet to a point from which the Northwest Corner of said Section 28 bears N40° 59' 05"W a distance of 1538.33 feet;
Thence N89° 41' 57"W a distance of 281.17 feet;
Thence N13° 22' 46"W a distance of 3923.14 feet to the Point of Beginning,

And A strip of land located within Section 28, the Northeast one-quarter of the Northeast one-quarter of Section 33, Section 34, T19S, R68W of the 6th P.M. and Section 3, Section 10, the Southwest one-quarter of Section 14, the East one-half of Section 15 and the North one-half of Section 23, T20S, R68W of the 6th P.M., County of Fremont, State of Colorado and being more particularly described as lying 125.00 feet on each side of the following described centerline.
Beginning at point within said Section 28 from which the Northwest corner of Section 28 bears N36°48'18"W, a distance of 1449.43 feet; thence S27°05'30"E, a distance of 113.81 feet to a point at the beginning of a curve to the left, said curve having a radius of 5682.00 feet, a central angle of 16°50'42" and a chord bearing of S 35°30'51"E; thence along said curve, Southeasterly an arc distance of 1670.52 feet; thence S 43° 56'12"E, a distance of 5704.94 feet to a point at the beginning of a curve to the left, said curve having a radius of 3875.50 feet; a central angle of 07°22'29" and a chord bearing of S 47°37"27"E; thence along said curve, Southeasterly an arc distance of 498.84 feet;
thence S 51°18'41"E, a distance of 850.39 feet to a point at the beginning of a curve to the right, said curve having a radius of 5017.00 feet; a central angle of 61°48'57" and a chord bearing of S20°24'13"E;
thence along said curve Southeasterly an arc distance of 5412.78 feet to a point at the beginning of a curve to the right, said curve having a radius of 12013.00 feet, a central angle of 02°55'07" and a chord bearing of S 11°57'49'W; thence along said curve Southwesterly an arc distance of 611.94 feet;
thence S 13°25'22"W, a distance of 1182.22 feet to a point at the beginning of a curve to the left, said curve having a radius of 7160.00 feet; a central angle of 13°07'12" and a chord bearing of S06°51'46"W; thence along said curve Southerly an arc distance of 1639.55 feet;
thence S 00°18'10"W, a distance of 1167.38 feet, to a point at the beginning of a curve to the left, said curve having a radius of 4943.00 feet; a central angle of 08°58'53" and a chord bearing of S 04°11'16"E; thence along said curve Southerly an arc distance of 774.84 feet;
thence S 08°40'43"E, a distance of 2273.99 feet to a point at the beginning of a curve to the left, said curve having a radius of 5030.00 feet; a central angle of 23°12'03" and a chord bearing of S20°16'44"E; thence along said curve Southeasterly an arc distance of 2036.81 feet; thence S 31°52'46"E, a distance of 2080.29 feet to a point at the beginning of a curve to the left, said curve having a radius of 5100.00 feet; a central angle of 20°42'32" and a chord bearing of S 42°14'02"E; thence along said curve Southeasterly an arc distance of 1843.33 feet; thence S 52°35'18"E, a distance of 5789.81 feet to a point on the East line of the Northeast one quarter of Section 23, T20S, R68W, 6th P.M.,
from which point the Northeast corner of said Section 23 bears N00°05'49"W, a distance 2341.06 feet, said point being the Point of Terminus of this description.
Containing 219.60 acres of land, more or less.

Legal Description of Red CreekQuarry:

Section 24 and Section 25, T20S, R68W of the 5th P.M., County of Fremont, State of Colorado. Said parcel contains 1,271.7 acres, more or less.

NOTATIONS

Item g - Acreage of subject property is 1,492 acres.
Item l - The parcel does not contain existing structures. All structures are proposed.
Item o - Typical parking space dimensions for standard pick-up truck 9 feet by 30 feet
Typical parking space dimensions for large equipment 12 feet by 32 feet
Item p - The proposed use does not require designated loading areas
Item q - The proposed use will rely on the existing access from State Hwy 120, the Holcim plant main entrance
Item r - The proposed use does not have designated pedestrian areas or walkways
Item t - See FIRM maps in the Drainage Plan Attachment C
Item u - Lighting for parking lot and building height 16 feet and LED downcast lighting. Lights on secondary crusher 44 feet height and LED downcast lighting. Lights will be installed along on the conveyor and MTAC every 1 mile.
Item v - DRMS and MSHA signage will be 4 feet by 3 feet and will be posted at south end of the MTAC on west side of the Section 24
Item z - There are no designated open spaces on the subject property

	Minimum Lot Size	Maximum Lot Coverage	Maximum Building Height	Minimum Lot Width	Minimum Front Setback	Minimum Rear Setback	Minimum Side Setback
Residential 3	18 acres	7%	45 ft.	500 ft.	75 ft.	50 ft.	50 ft.
Proposed	1492 acres	<0.0000002%	45 ft.	25 ft.	8,332 ft.	2,086 ft.	393 ft.

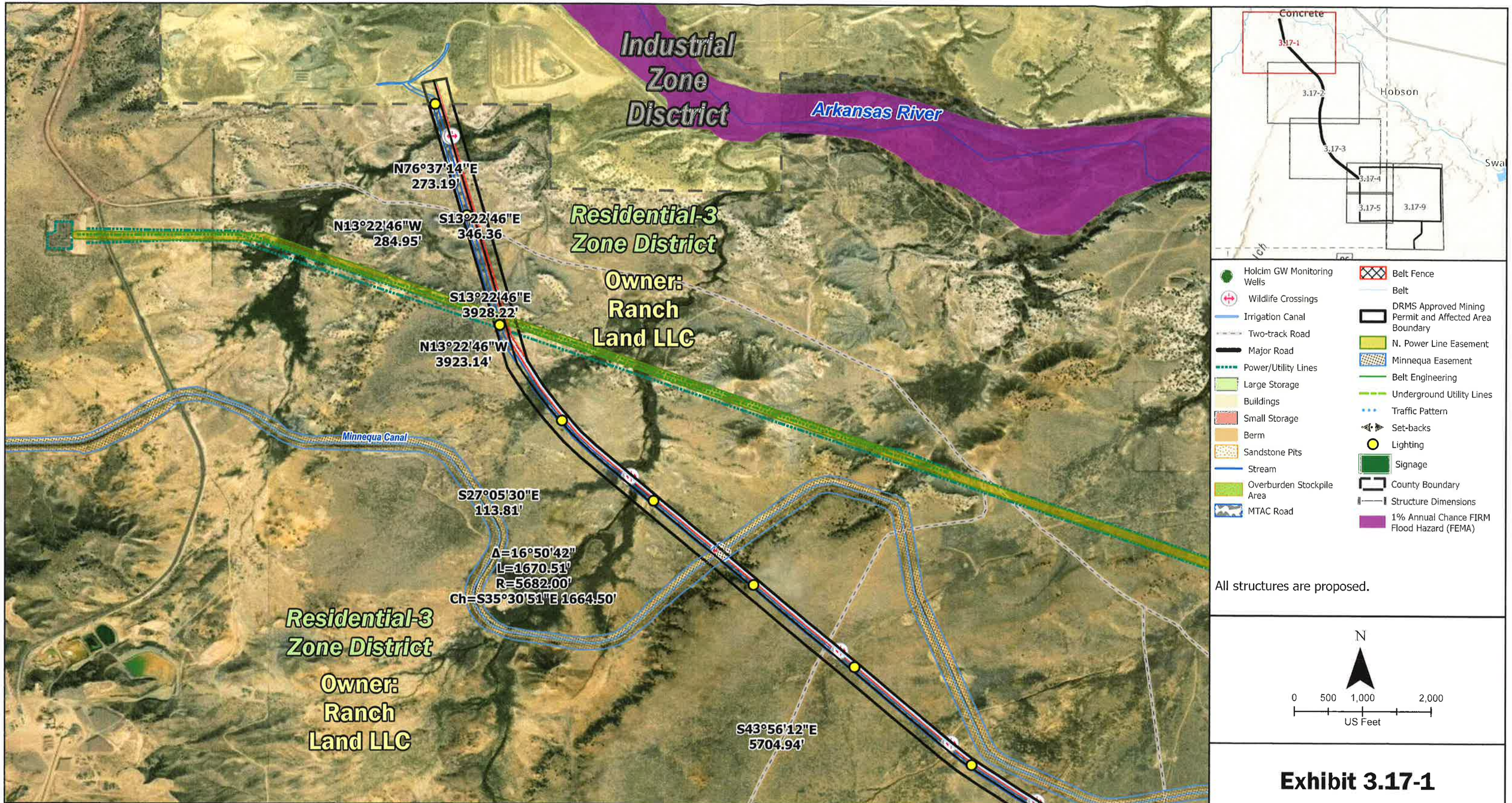


Exhibit 3.17-1

HOLCIM

Conditional Use Permit for Red Creek Quarry

Spatial Reference Name: NAD 1983 UTM Zone 13N	Prepared by:
	Approved by: M.T.
Data Source: Holcim, USGS-GAP Analysis Project, ESRI	Date: Mar 04, 2025
	Scale 1" = 1,333 '

S43°56'12"E
5704.94'

Δ=7°22'29"
L=498.83'
R=3875.50'
Ch=S47°37'27"E 498.48'

S51°18'41"E
850.39'

Δ=61°48'57"
L=5412.79'
R=5017.00'
Ch=S20°24'12"E 5154.06'

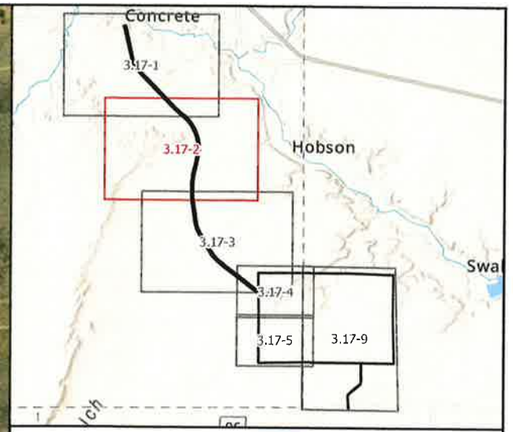
Residential-3
Zone District

Owner:
Ranch
Land LLC

Δ=2°55'07"
L=611.93'
R=12013.00'
Ch=S11°57'50"W 611.87'
S13°25'23"W
1182.22'

Δ=13°07'12"
L=1639.55'
R=7160.00'
Ch=S06°51'47"W 1635.97'

Minnequa Canal



- Holcim GW Monitoring Wells
- Wildlife Crossings
- Irrigation Canal
- Two-track Road
- Major Road
- Power/Utility Lines
- Large Storage
- Buildings
- Small Storage
- Berm
- Sandstone Pits
- Stream
- Overburden Stockpile Area
- MTAC Road
- Belt Fence
- Belt
- DRMS Approved Mining Permit and Affected Area Boundary
- N. Power Line Easement
- Minnequa Easement
- Belt Engineering
- Underground Utility Lines
- Traffic Pattern
- Set-backs
- Lighting
- Signage
- County Boundary
- Structure Dimensions
- 1% Annual Chance FIRM Flood Hazard (FEMA)

All structures are proposed.

N

0 500 1,000 2,000
US Feet

Exhibit 3.17-2

HOLCIM

Conditional Use Permit for Red Creek Quarry

Spatial Reference Name: NAD 1983 UTM Zone 13N	Prepared by:
	Approved by: M.T.
Data Source: Holcim, USGS-GAP Analysis Project, ESRI	Date: Mar 04, 2025
	Scale 1" = 1,333 '

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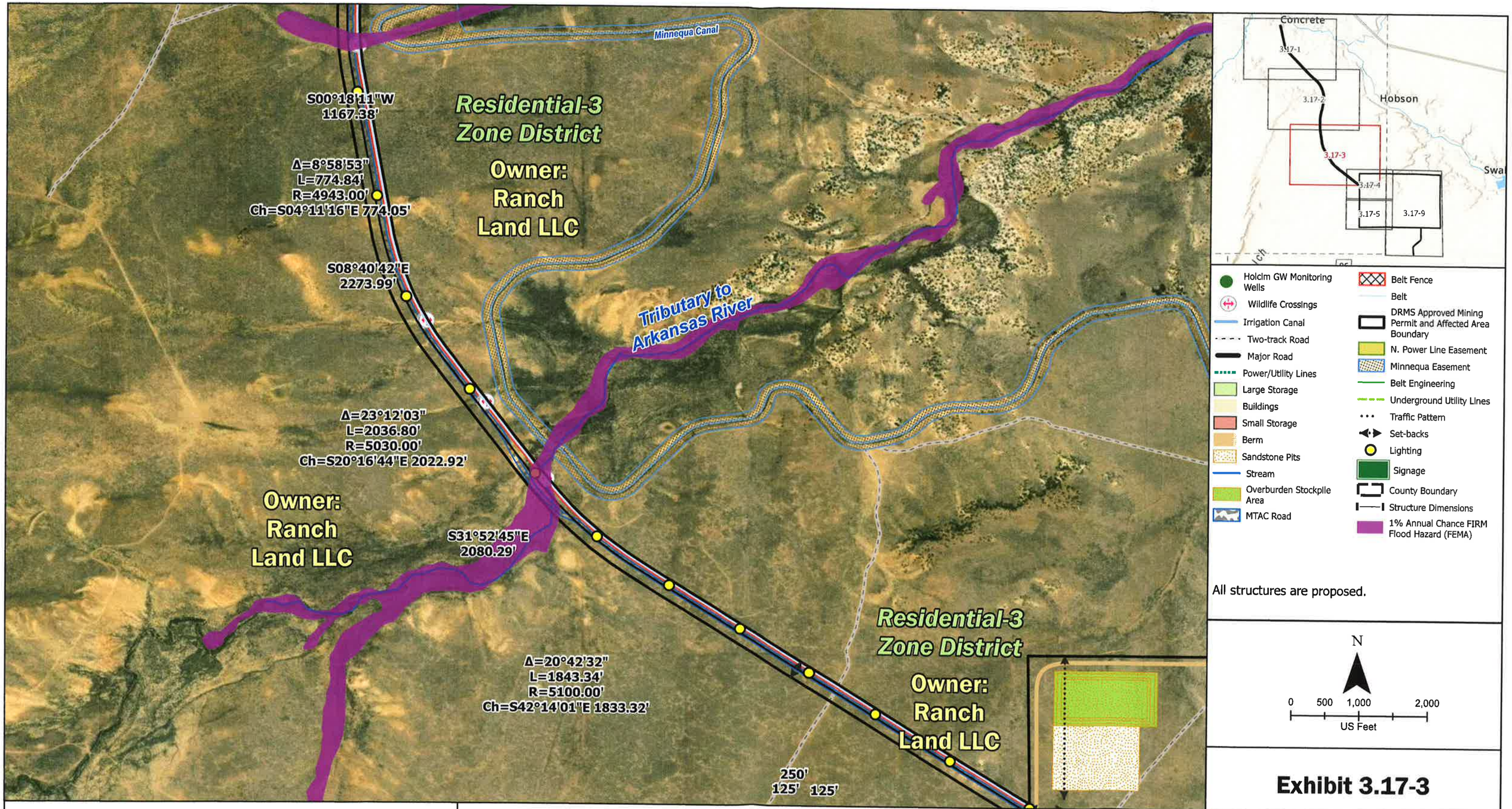


Exhibit 3.17-3

HOLCIM

Conditional Use Permit for Red Creek Quarry

Spatial Reference Name: NAD 1983 UTM Zone 13N	Prepared by:
	Approved by: M.T.
Data Source: Holcim, USGS-GAP Analysis Project, ESRI	Date: Mar 04, 2025
	Scale 1" = 1,333 '

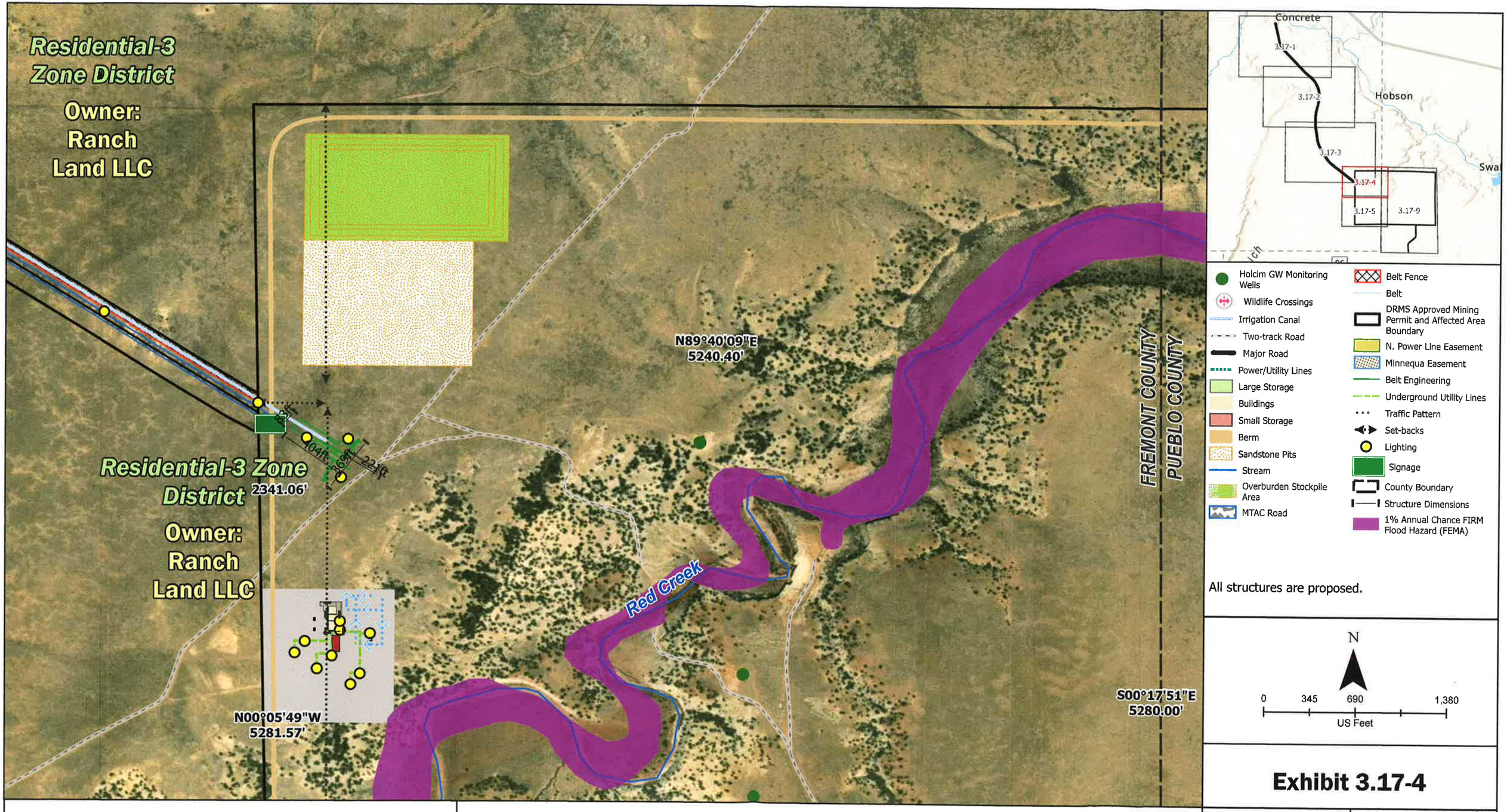
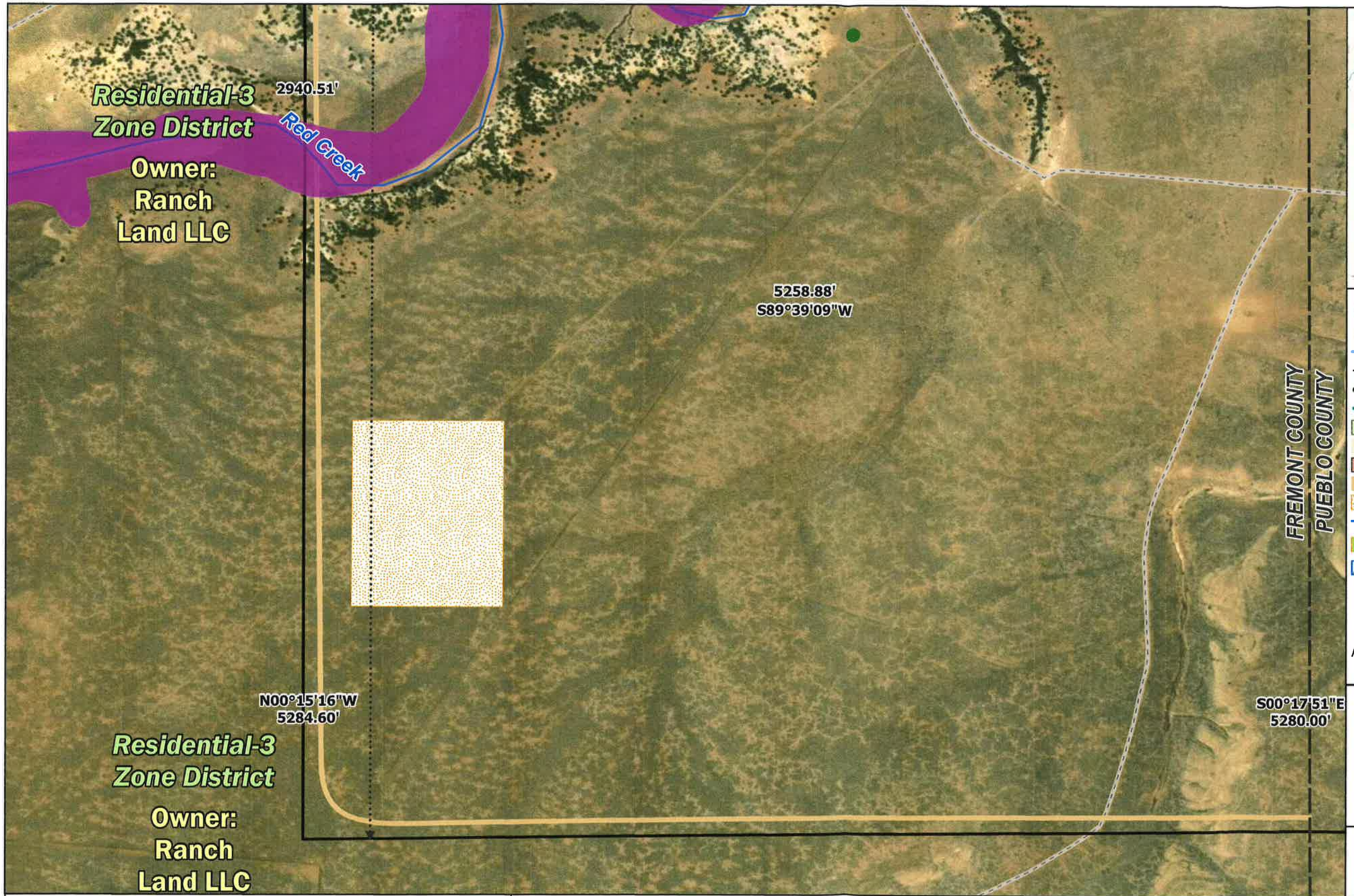


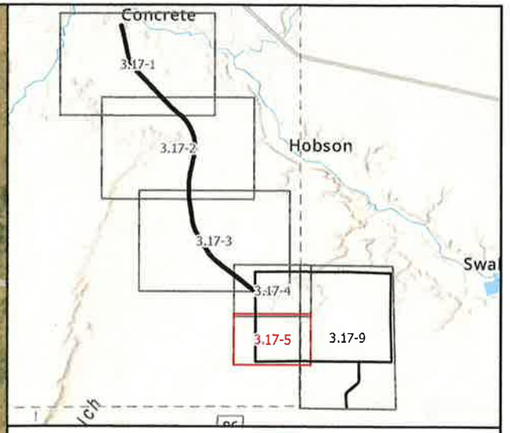
Exhibit 3.17-4

HOLCIM

Conditional Use Permit for Red Creek Quarry

Spatial Reference Name: NAD 1983 UTM Zone 13N	Prepared by:
	Approved by: M.T.
Data Source: Holcim, USGS-GAP Analysis Project, ESRI	Date: Mar 04, 2025
	Scale 1" = 683 '





- Holcim GW Monitoring Wells
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- Buildings
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- Berm
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- Stream
- Overburden Stockpile Area
- MTAC Road
- Belt Fence
- Belt
- DRMS Approved Mining Permit and Affected Area Boundary
- N. Power Line Easement
- Minnequa Easement
- Belt Engineering
- Underground Utility Lines
- Traffic Pattern
- Set-backs
- Lighting
- Signage
- County Boundary
- Structure Dimensions
- 1% Annual Chance FIRM Flood Hazard (FEMA)

All structures are proposed.

N

0 345 690 1,380

US Feet

Exhibit 3.17-5

HOLCIM

Conditional Use Permit for Red Creek Quarry

Spatial Reference
Name: NAD 1983 UTM Zone 13N

Data Source: Holcim, USGS-GAP Analysis Project, ESRI

Prepared by:

Approved by: M.T.

Date: Mar 04, 2025

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Exhibit 3.17-6

HOLCIM

Conditional Use Permit for Red Creek Quarry

Spatial Reference Name: NAD 1983 UTM Zone 13N	Prepared by:
	Approved by: M.T.
Data Source: Holcim, USGS-GAP Analysis Project, ESRI	Date: Mar 04, 2025
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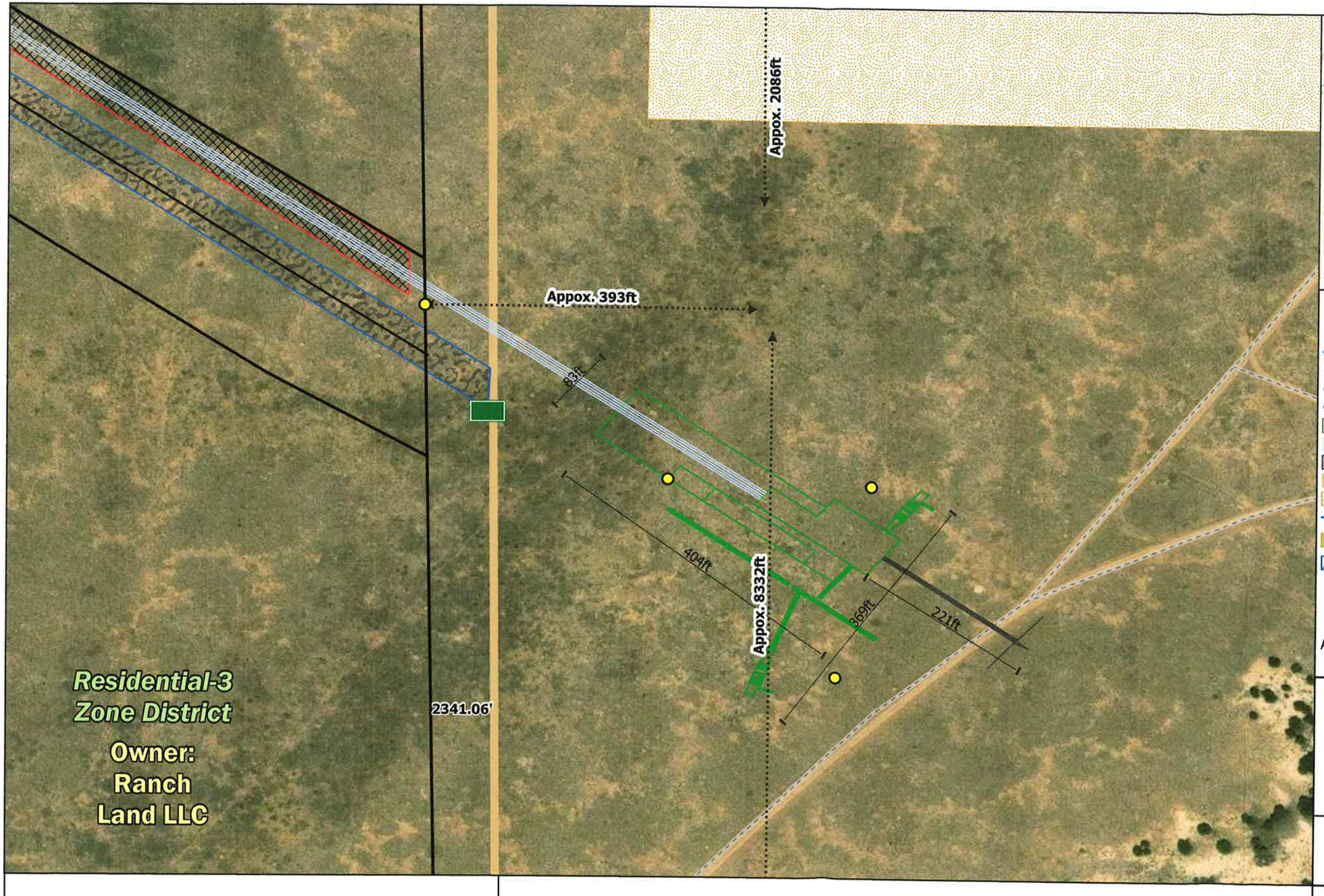

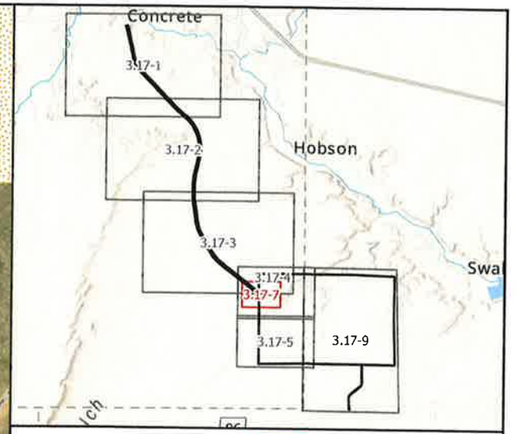

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- N. Power Line Easement
- Minnequa Easement
- Belt Engineering
- Underground Utility Lines
- Traffic Pattern
- Set-backs
- Lighting
- Signage
- County Boundary
- Structure Dimensions

All structures are proposed.

N

0 75 150 300

US Feet

Exhibit 3.17-7

HOLCIM

Conditional Use Permit for Red Creek Quarry

Spatial Reference Name: NAD 1983 UTM Zone 13N	Prepared by:
	Approved by: M.T.
Data Source: Holcim, USGS-GAP Analysis Project, ESRI	Date: Mar 04, 2025
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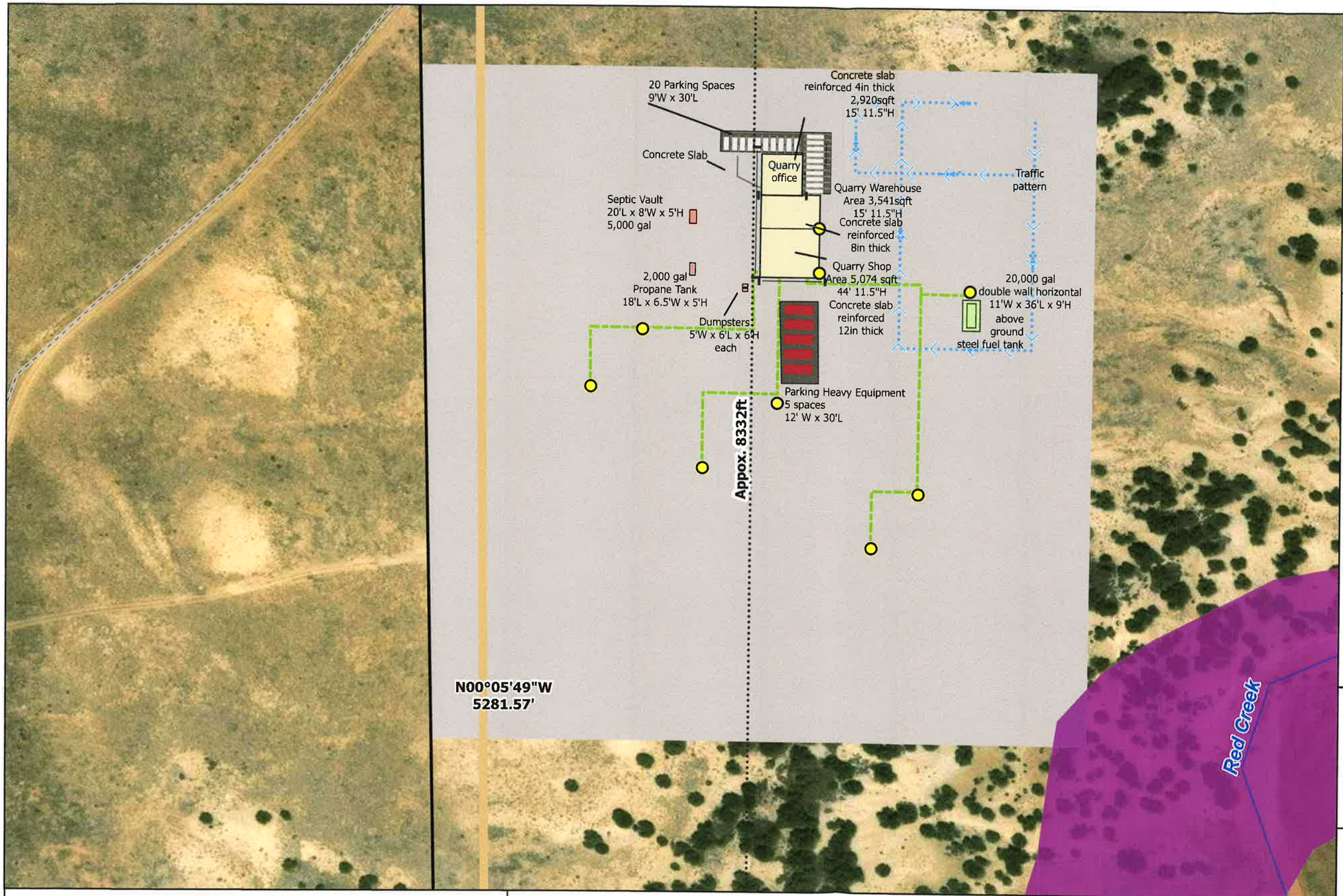

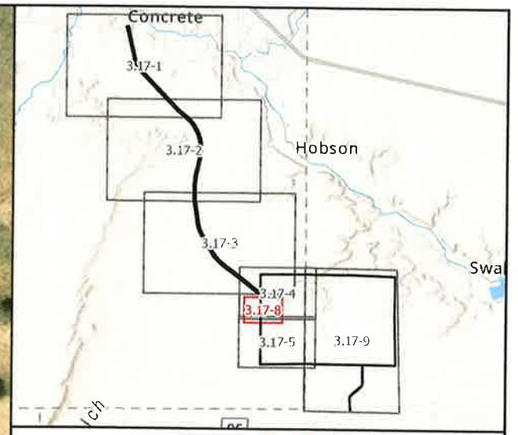

- Holcim GW Monitoring Wells
- Wildlife Crossings
- Irrigation Canal
- Two-track Road
- Major Road
- Power/Utility Lines
- Large Storage
- Buildings
- Small Storage
- Berm
- Sandstone Pits
- Stream
- Overburden Stockpile Area
- MTAC Road
- Belt Fence
- Belt
- DRMS Approved Mining Permit and Affected Area Boundary
- N. Power Line Easement
- Minnequa Easement
- Belt Engineering
- Underground Utility Lines
- Traffic Pattern
- Set-backs
- Lighting
- Signage
- County Boundary
- Structure Dimensions
- 1% Annual Chance FIRM Flood Hazard (FEMA)

All structures are proposed.

N

0 75 150 300

US Feet

Exhibit 3.17-8

HOLCIM

Conditional Use Permit for Red Creek Quarry

Spatial Reference Name: NAD 1983 UTM Zone 13N	Prepared by:
	Approved by: M.T.
Data Source: Holcim, USGS-GAP Analysis Project, ESRI	Date: Mar 04, 2025
	Scale 1" = 150 '

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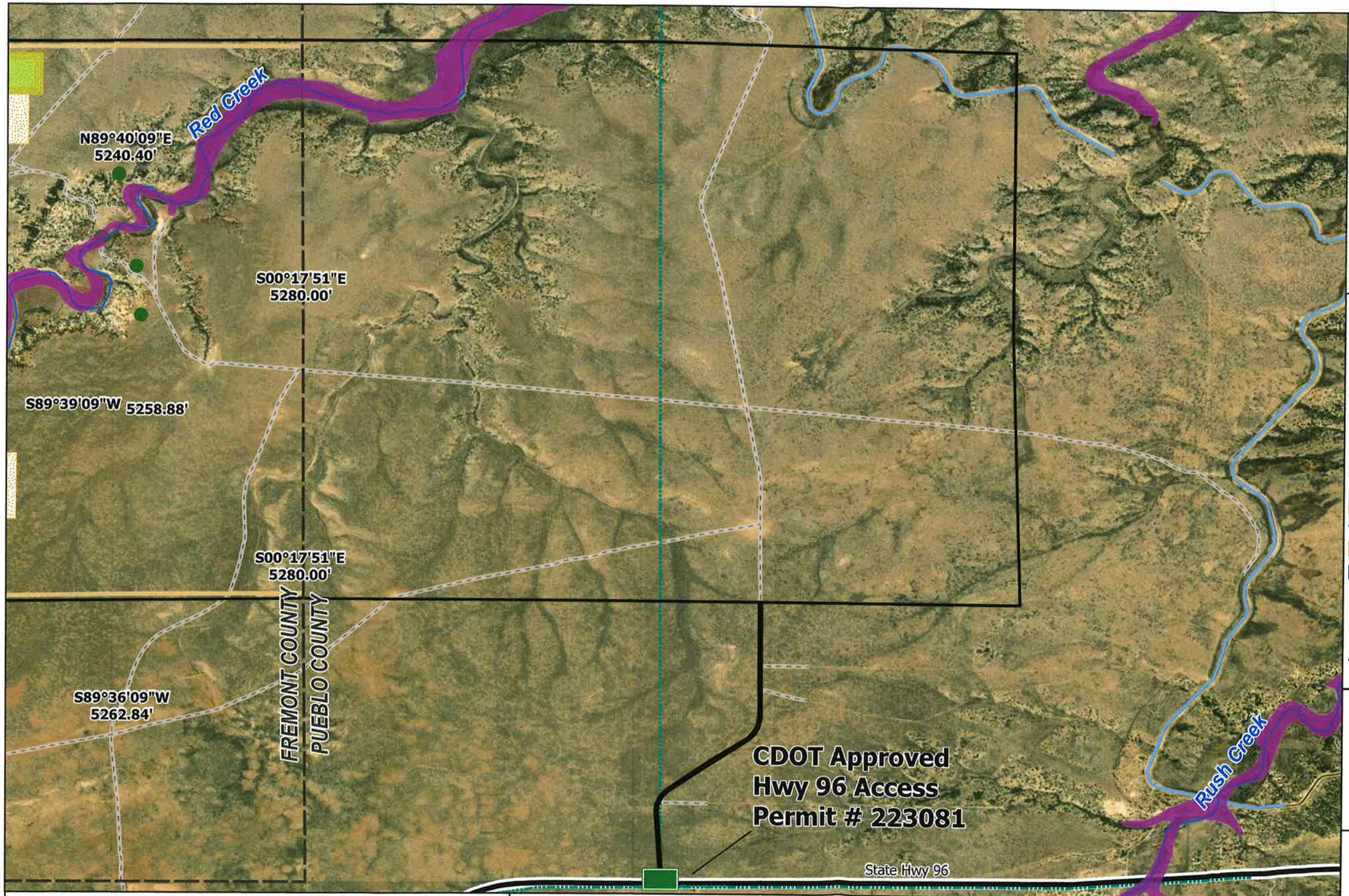

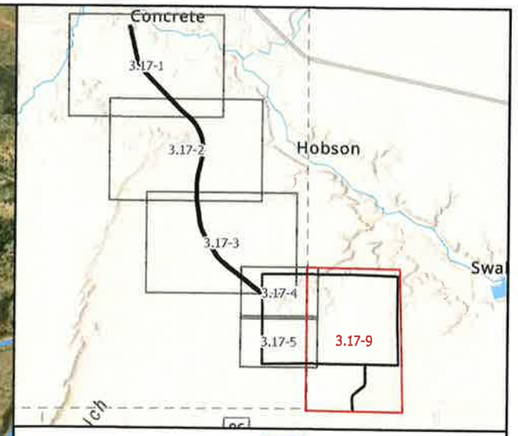

- Holcim GW Monitoring Wells
- Wildlife Crossings
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- Belt Engineering
- Underground Utility Lines
- Traffic Pattern
- Set-backs
- Lighting
- Signage
- County Boundary
- Structure Dimensions
- 1% Annual Chance FIRM Flood Hazard (FEMA)

All structures are proposed.

N

0 500 1,000 2,000

US Feet

Exhibit 3.17-9

HOLCIM

Conditional Use Permit for Red Creek Quarry

Spatial Reference Name: NAD 1983 UTM Zone 13N	Prepared by:
	Approved by: M.T.
Data Source: Holcim, USGS-GAP Analysis Project, ESRI	Date: Mar 04, 2025
	Scale 1" = 1,917 '

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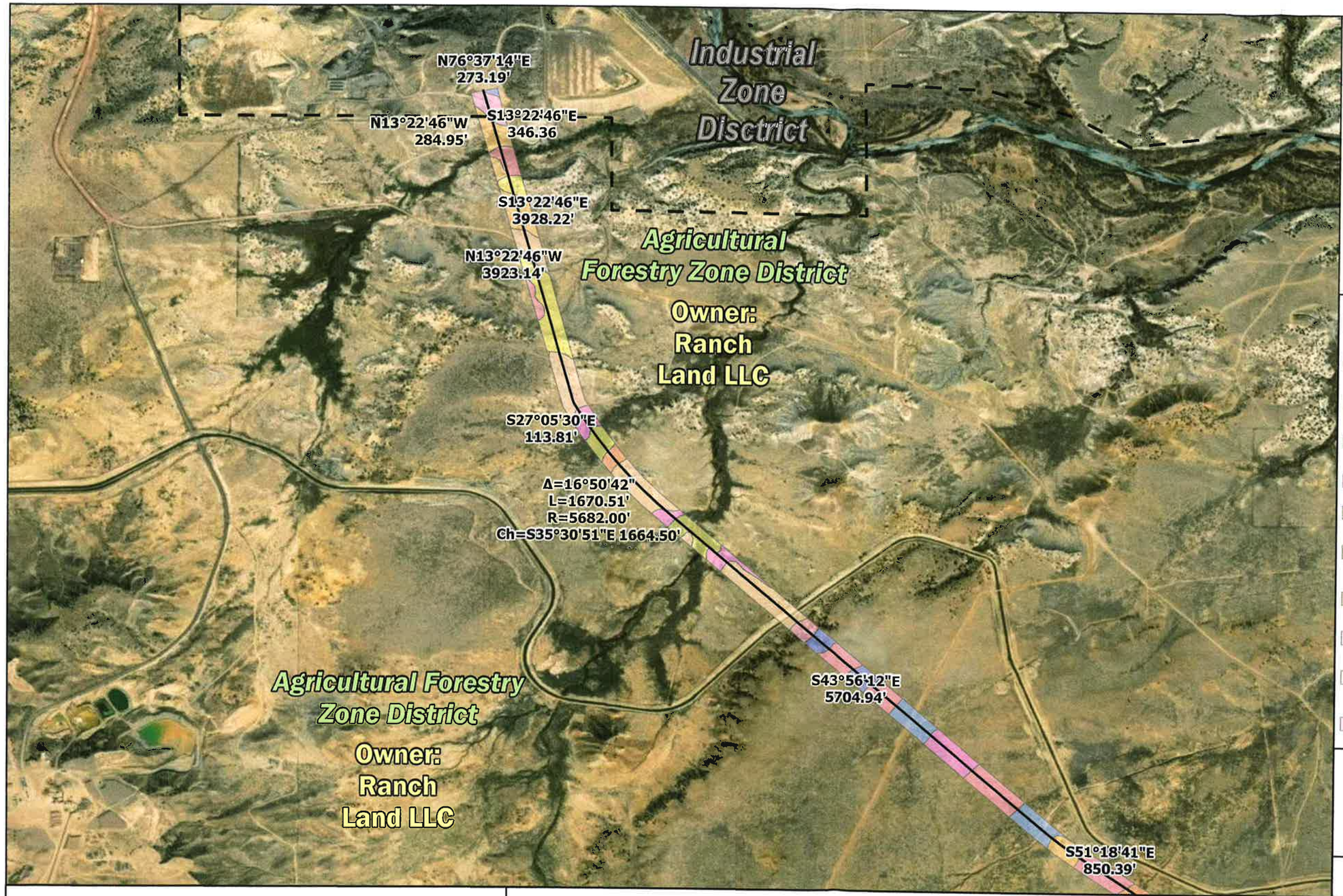
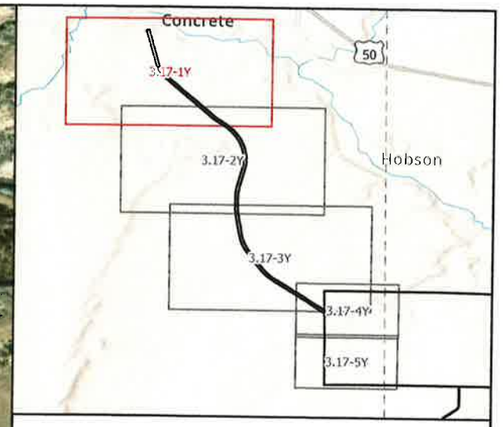




- Kim loam, 0 to 3 percent slopes
- Kim loam, 3 to 8 percent slopes
- Kim-Cascajo complex, 2 to 15 percent slopes
- Manvel silt loam, 0 to 2 percent slopes
- Manvel silt loam, 2 to 6 percent slopes
- Manvel silty clay loam, saline
- Penrose-Midway-Rock outcrop complex, 10 to 45 percent slopes
- Penrose-Minnequa complex, 1 to 15 percent slopes
- Shanta loam, dry, 0 to 3 percent slopes
- Shingle loam, 3 to 20 percent slopes
- Shingle very cobbly sandy loam, 10 to 40 percent slopes

N

0 500 1,000 2,000

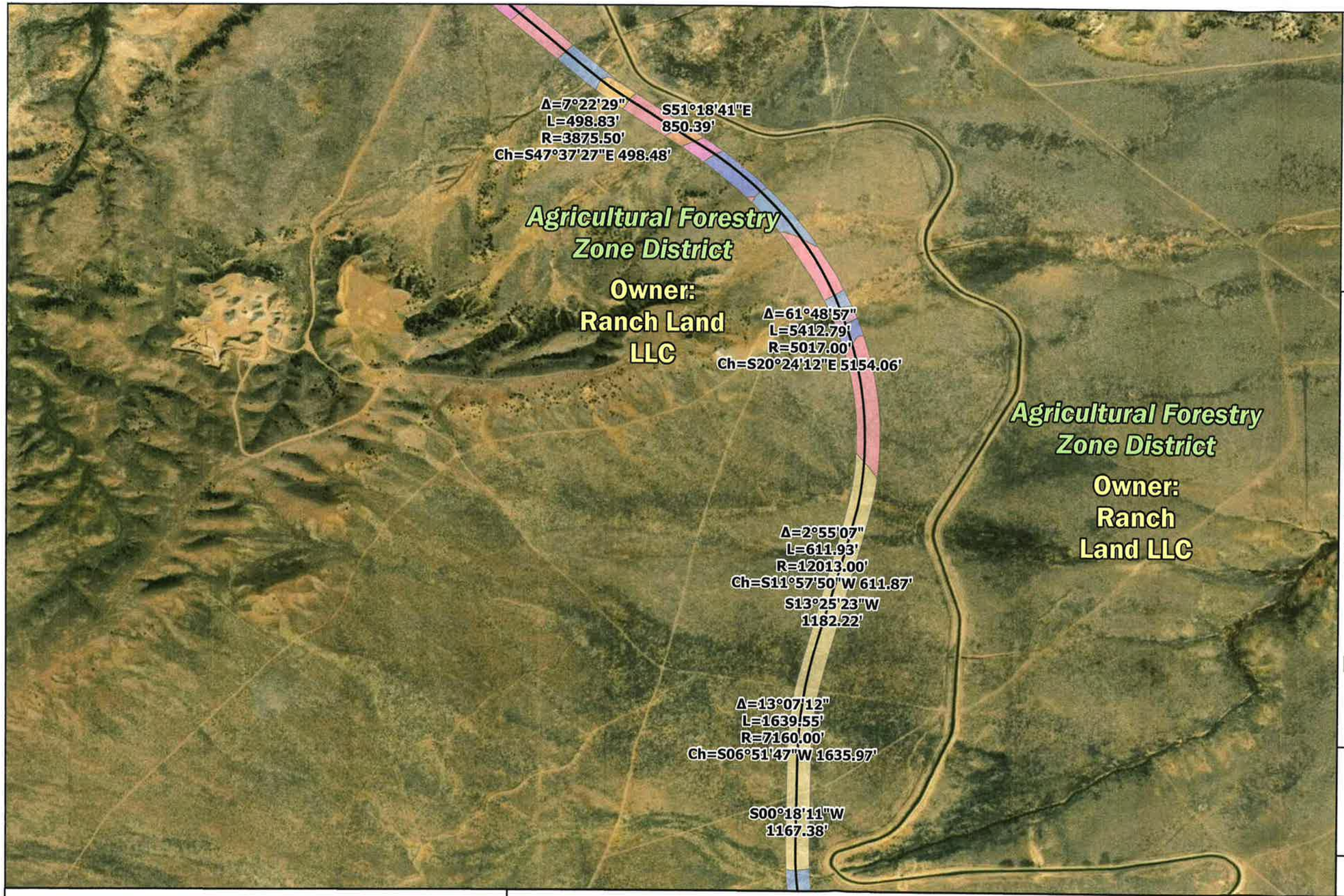
Feet

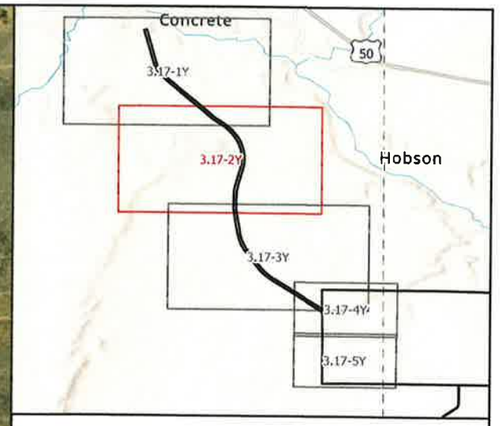
Exhibit 3.17-1 Y

HOLCIM

Conditional Use Permit for Holcim Red Creek Quarry
Soils Information

Spatial Reference Name: GCS WGS 1984 GCS: GCS WGS 1984	Prepared by:
	Approved by: M.T.
Data Source: Holcim, USGS-GAP Analysis Project, ESRI	Date: May 10, 2024
	Scale 1" = 1,333'





- Kim loam, 0 to 3 percent slopes
- Kim loam, 3 to 8 percent slopes
- Kim-Cascajo complex, 2 to 15 percent slopes
- Manvel silt loam, 0 to 2 percent slopes
- Manvel silt loam, 2 to 6 percent slopes
- Penrose-Minnequa complex, 1 to 15 percent slopes
- Shingle very cobbly sandy loam, 10 to 40 percent slopes
- Wilid silt loam, 0 to 3 percent slopes

N

0 500 1,000 2,000

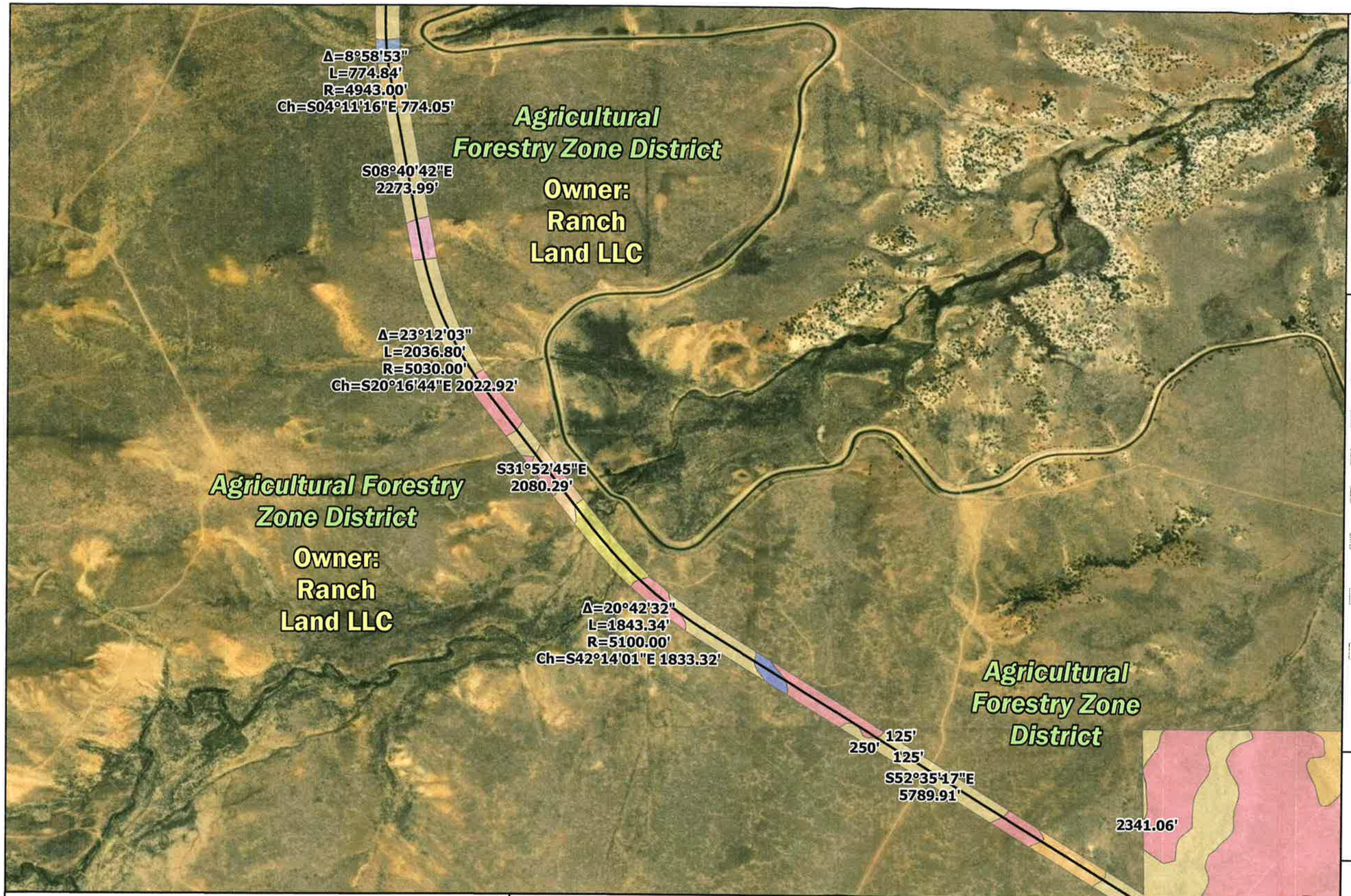
Feet

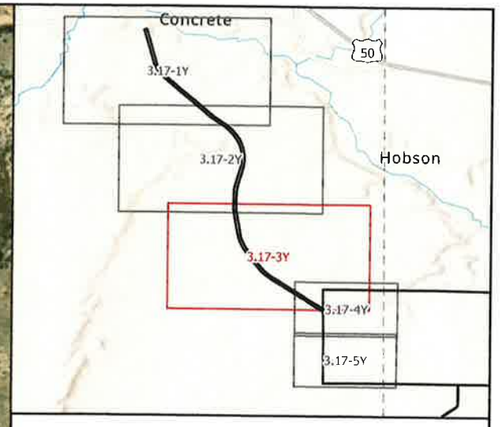
Exhibit 3.17-2 Y

HOLCIM

Conditional Use Permit for Holcim Red Creek Quarry
Soils Information

Spatial Reference Name: GCS WGS 1984 GCS: GCS WGS 1984	Prepared by:
	Approved by: M.T.
Data Source: Holcim, USGS-GAP Analysis Project, ESRI	Date: May 10, 2024
	Scale 1" = 1,333'





- Kim-Cascajo complex, 2 to 15 percent slopes
- Manvel silt loam, 0 to 2 percent slopes
- Manvel silt loam, 2 to 6 percent slopes
- Manvel silty clay loam, saline
- Penrose-Minnequa complex, 1 to 15 percent slopes
- Shingle loam, 3 to 20 percent slopes
- Shingle very cobbly sandy loam, 10 to 40 percent slopes
- Wilid silt loam, 0 to 3 percent slopes

N

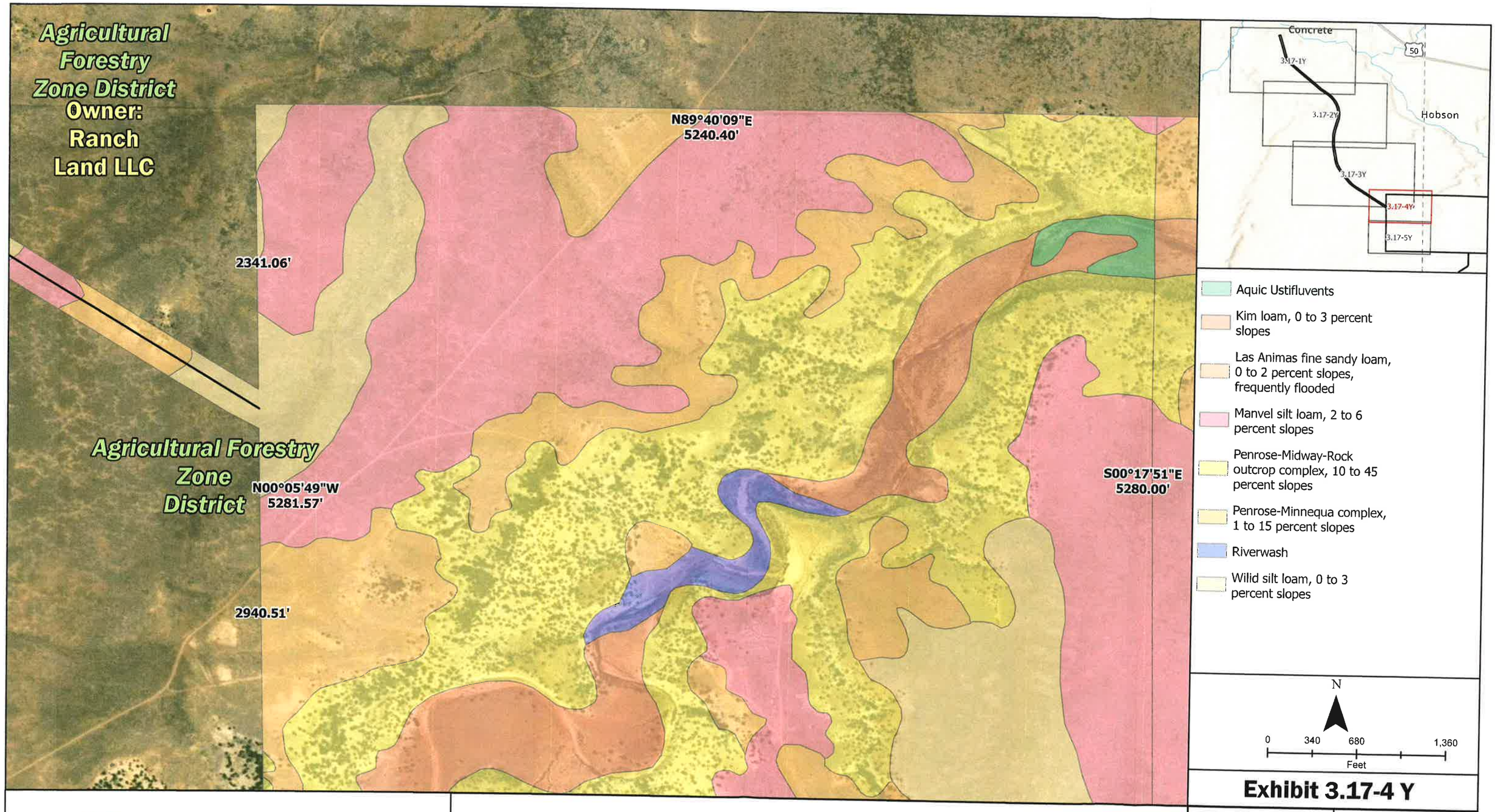
0 500 1,000 2,000
Feet

Exhibit 3.17-3 Y

HOLCIM

Conditional Use Permit for Holcim Red Creek Quarry
Soils Information

Spatial Reference Name: GCS WGS 1984 GCS: GCS WGS 1984	Prepared by:
	Approved by: M.T.
Data Source: Holcim, USGS-GAP Analysis Project, ESRI	Date: May 10, 2024
	Scale 1" = 1,333'

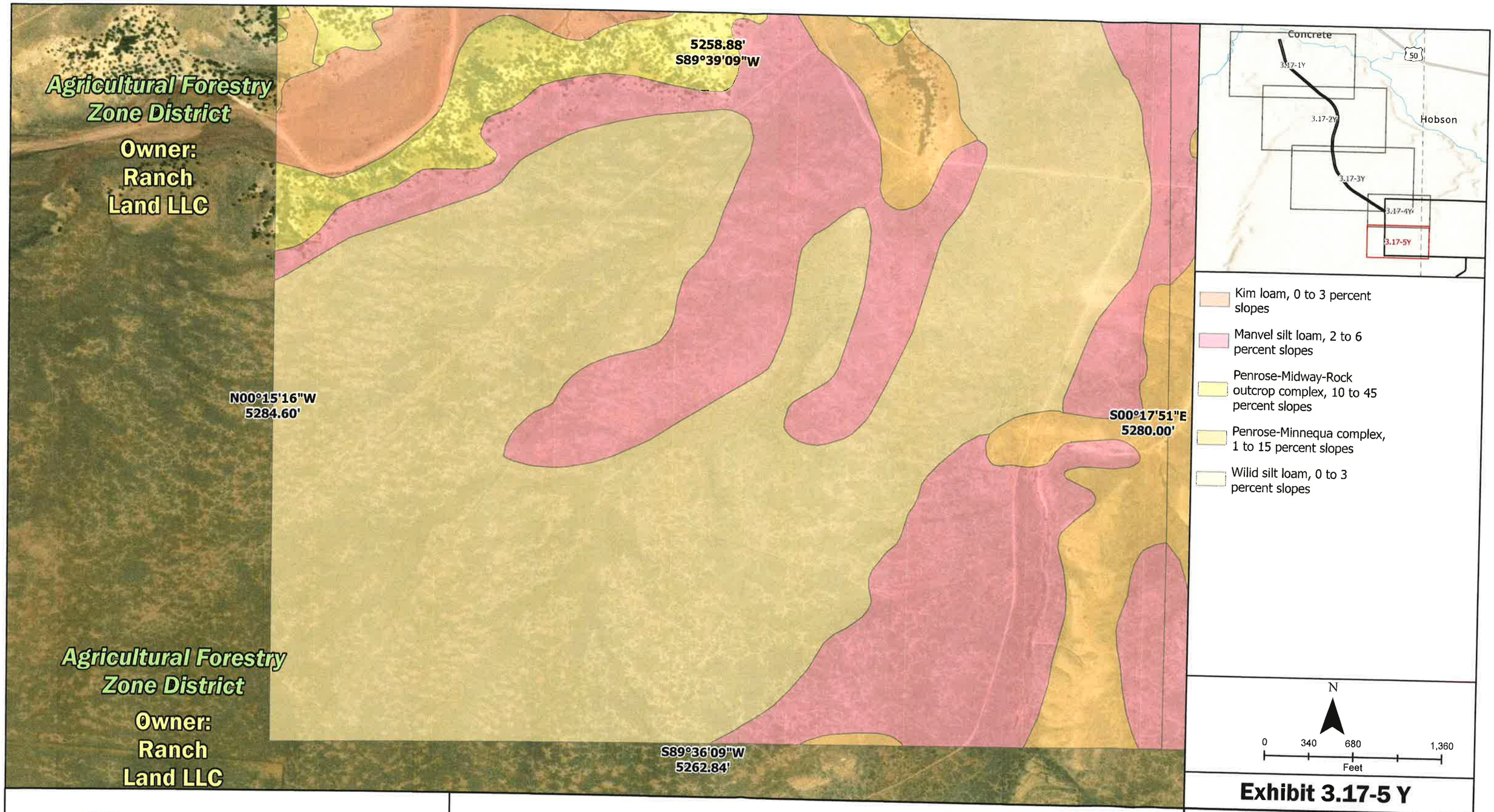


HOLCIM

Conditional Use Permit for Holcim Red Creek Quarry
Soils Information

Exhibit 3.17-4 Y

Spatial Reference Name: GCS WGS 1984 GCS: GCS WGS 1984	Prepared by:
	Approved by: M.T.
Data Source: Holcim, USGS-GAP Analysis Project, ESRI	Date: May 10, 2024
	Scale 1" = 683'



HOLCIM

Conditional Use Permit for Holcim Red Creek Quarry
Soils Information

Exhibit 3.17-5 Y

Spatial Reference Name: GCS WGS 1984 GCS: GCS WGS 1984	Prepared by:
	Approved by: M.T.
Data Source: Holcim, USGS-GAP Analysis Project, ESRI	Date: May 10, 2024
	Scale 1" = 683'

CUP Exhibit 3.22 Corporate Ownership

OFFICE OF THE SECRETARY OF STATE
OF THE STATE OF COLORADO

CERTIFICATE OF FACT OF GOOD STANDING

I, Jena Griswold, as the Secretary of State of the State of Colorado, hereby certify that, according to the records of this office,

HOLCIM (US) INC.

is an entity formed or registered under the law of Delaware , has complied with all applicable requirements of this office, and is in good standing with this office. This entity has been assigned entity identification number 19901009684 .

This certificate reflects facts established or disclosed by documents delivered to this office on paper through 04/29/2024 that have been posted, and by documents delivered to this office electronically through 05/01/2024 @ 14:05:42 .

I have affixed hereto the Great Seal of the State of Colorado and duly generated, executed, and issued this official certificate at Denver, Colorado on 05/01/2024 @ 14:05:42 in accordance with applicable law. This certificate is assigned Confirmation Number 15999493 .

Jena Griswold

Secretary of State of the State of Colorado

**********End of Certificate**********

Notice: A certificate issued electronically from the Colorado Secretary of State's website is fully and immediately valid and effective. However, as an option, the issuance and validity of a certificate obtained electronically may be established by visiting the Validate a Certificate page of the Secretary of State's website, https://www.coloradosos.gov/biz/CertificateSearchCriteria.do entering the certificate's confirmation number displayed on the certificate, and following the instructions displayed. Confirming the issuance of a certificate is merely optional and is not necessary to the valid and effective issuance of a certificate. For more information, visit our website, https://www.coloradosos.gov click "Businesses, trademarks, trade names" and select "Frequently Asked Questions."

CUP Exhibit 3.24 Owner Authorization to Consultant

March 1, 2024

Fremont County
Department of Planning and Zoning
615 Macon Avenue, Room 210
Cañon City, CO 81212

RE: Red Creek Quarry
Authorization to Represent Applicant/Property Owner

To Whom It May Concern;

I, Hamza Mekhfi, of Holcim (US) Incorporated, with corporate office address of 3500 US Highway 120, Florence, CO 81226 , hereby grant authorization to Dr. Angela Bellantoni of Environmental Alternatives, Inc. with address of P.O. Box 326, Cañon City, CO 81212 to represent Holcim (US) Inc. to Fremont County for application submission, review and due process of a Conditional Use Permit for Red Creek Quarry.

Hamza Mekhfi, Plant Manger

CUP Exhibit 3.28 Hazardous Materials List

Description	Quantity (gallons)	Location	Secondary containment
Diesel Fuel	20,000	Outside shop	Double walled tank with crash bollards
Motor Oil	440 (8-55 gallon drums)	Inside shop	Spill containment pallets
Transmission Oil	330 (6-55 gallon drums)	Inside shop	Spill containment pallets
Hydraulic Oil	440 (8-55 gallon drums)	Inside shop	Spill containment pallets
Diesel Exhaust Fluid	660 (2-330 gallon tones)	Inside shop	Spill dikes

CUP Exhibit 3.29 DRMS Reclamation Plan

CUP Exhibit 3.29 Reclamation Plan

CO DRMS 112 Permit Exhibit E: Reclamation Plan (Rule 6.4.5) Section 2.5

Post-mining land use will be rangeland, consistent with post-mining land use of BCQ. Rangeland will blend successfully with the vicinity land uses and post-mining land uses of the area mines. In addition, rangeland is suitable for the challenges of semi-arid high desert conditions of the area. Reclamation will improve available forage for cattle.

This reclamation plan is in addition to the reclamation plans for BCQ and the Plant Area that were approved by the Division in the original BCQ application (M-1977-344) and AM-01. Due to the extensive life of RCQ, 100 years, Holcim intends to initially post bond for Sections 24 and 25 in Fremont County or approximately 30 years of quarry material. The bond will include reclamation for the conveyor and conveyor service road, quarry infrastructure and approximately 1000 acres of limestone and sandstone mining disturbance. The access road from the plant to RCQ and the Hwy 96 access road will not be reclaimed. At approximately year 20, Holcim will notify DRMS that a bond estimate for reclamation of anticipated disturbance in the subsequent 1000 acres will be forthcoming. Holcim will adjust the bond as appropriate in response to DRMS inspection, comments and recommendations. Bonding adjustments will continue in like manner for the life of the mine.

All natural material above the translime geologic layer will be salvaged. Native plant growth material ranges in thickness from 0 inches where limestone outcrops to eight inches deep. The plant growth material will be segregated from the overburden and stockpiled along the perimeter in berms approximately 10 feet high and 100 feet inside the permit boundary. All overburden above the translime layer will be salvaged for use in construction of the perimeter berm and final reclamation. The perimeter berms will be seeded with a temporary seed mix to stabilize the surface. Stockpiling will continue until approximately Year 20 when contemporaneous reclamation will commence.

Reclamation will occur contemporaneously with mining after Year 20 and continue in like manner through the life of the mine. At the end of mining, all reclamation will be completed within two years. Reclamation will include sloping benches, backfilling the sandstone pit and bringing up the elevation of the mine floor. An abundance of overburden exists to the extent that the lowest two benches will be completely backfilled thus raising the elevation of the mine floor .

Two distinct reclamation efforts will be implemented to reclaim RCQ. The mined out area will be reclaimed beginning in Year 20 using stockpiled overburden and plant growth material using traditional equipment. At the end of the life of the mine, RCQ infrastructure including buildings, conveyor corridor and utilities will be demolished, and footprint reclaimed.

Because of the 100-year life of the mine and ever-changing costs of reclamation tasks, Holcim suggests a phase bonding approach. Holcim proposes submitting a bond for the conveyor and access corridor, Sections 24 and 25 in Parcel 3, and the access to Hwy 96. This area will be developed and mined for 20 to 30 years. After Year 20, Holcim will review the bond to progress into Pueblo County sections for subsequent years.

2.5.1 Reclamation of Material Extraction Areas

Reclamation of mined out sections of the mine will begin by rebuilding slopes using the salvaged overburden. A mined out area will be marked by up to 4 benches or 140 feet of highwall. Haul trucks will transport the stockpiled overburden to the toe of the benches. Bulldozers will push the overburden into

the bench forming slopes 3H:1V or gentler (Figures 2.5.1-1). Excess overburden after rebuilding slopes will be used to elevate the pit floor.

When the slopes are stable and the pit floor is at a suitable elevation, the area will be prepared for seeding. The rebuilt slopes and pit floor will be graded with a motor grader and compacted. The topsoil will be loaded into haul trucks with a loader and distributed over the graded areas to a depth ranging from 4 to 6 inches.

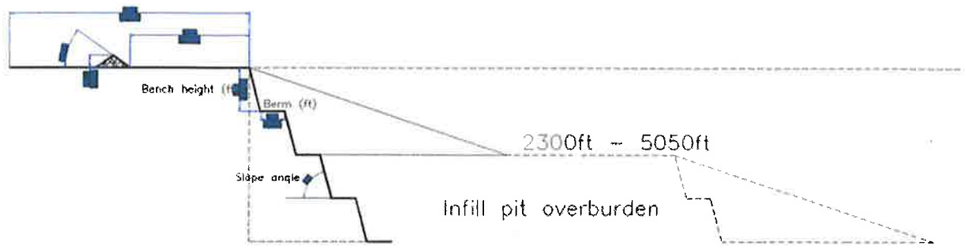


Figure 2.5.1-1 Cross-section of benched highwall and final reclamation slope 3H:1V

While distributing the plant growth material, erosion furrows will be contoured into the bench slopes to mitigate erosion. The furrows will be contoured parallel to the edge of the bench and approximately midway between the edge of the bench to the highwall. Erosion furrows are preferred to straw waddles since they can remain after reclamation vegetation takes hold. This increases precipitation infiltration time for the new and ultimately established vegetation.

Seeding will occur either in the fall or spring with the seed mix presented in Table 2.5.1-1. This seed mix was approved by DRMS in the AM-01 for BCQ. Seed will be broadcast at the rate of 111.5 pounds of live seed per acre, mulched with certified weed free straw, two tons per acre, and tracked into place with a dozer. Fertilizer was not recommended by NRCS. A noxious weed program will utilize chemical weed control if noxious weeds start establishing in the affected land areas that are not controlled by mowing.

Table 2.5.1-1 NRCS Reclamation Seed Mix

Species	Variety	Required PLS* Rate/Acre	% of Species in Mixture	PLS Seeding Rate Per Species/Acre
Sideoats gramma	Niner, El Reno	18.0	20	3.6
Crested Wheatgrass	Hycrest	10.0	20	2.0
Indian Ricegrass	Nezpar	12.5	15	1.9
Mammath Wildrye	Volga	30.0	20	6.0
Alkali Sacaton	None specified	3.0	10	0.3
Streambank Wheatgrass	Sodar	22.0	10	2.2
Alfalfa	Ladak	16.0	5	0.8
		111.5 PLS/Acre		

*PLS – Pounds live seed per acre

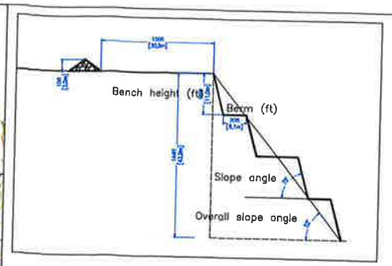
2.5.2 Reclamation of Mine Infrastructure

Once mining ceases, all infrastructure including conveyor system, buildings, and utility infrastructure will be removed from the permit area. The metal buildings will be disassembled and scrapped to a metal recycler. Utility lines will be excavated and electricity distribution poles removed. The septic vault will be drained, excavated and placed in the concrete scrap stockpile. The conveyor will be disassembled; either sold, transported to another Holcim quarry or scrapped. The crushers and screens will be sold or transported to another Holcim quarry. Concrete structures such as conveyor supports, building slabs, septic vault, etc. will be stockpiled and eventually crushed and used as backfill in final slope rebuilding.

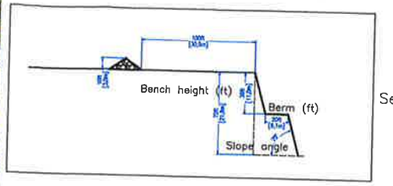
The infrastructure footprint including parking lots, buildings pads and conveyor support pads will be ripped with an excavator or loader equipped with a claw. The ground will be ripped to a depth of 1 foot, then graded and contoured with a motor grader. Seed bed preparation and seeding will proceed as described above.

Fremont County

Pueblo County

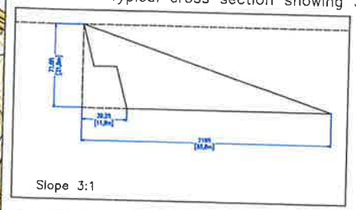


Section showing 4 benches

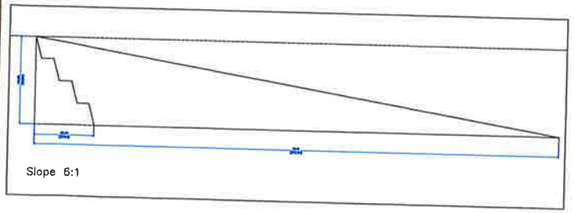


Section showing 2 benches

Typical cross section showing 3:1 and 6:1 slopes

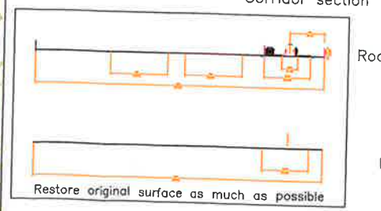


Slope 3:1



Slope 6:1

Corridor section



Road in operation
Road wide: 39ft
Road thicknes: 8.5in

Reclamation

County boundary

Holcim property

Minnequa canal

SHEET 1 OF 1

HOLCIM

Exhibit F Final Reclamation Map	Portland – Red Creek Quarry Permit No M1977–344 COLORADO STATE PLANE NORTH NAD83 NAVD88	DRAWN	JULIO VILLON
		CHECKED	MIKE TOELLE
		DATE	08/19/2023
		SCALE:	1"=750'