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Stoner Engineering & Surveying
Engineering, Testing & Surveying

Date: June 30, 2015

To: Marcia L. Talvitie, P.E.
Environmental Protection Specialist II
DRMS-Durango Field Office
691 Co. Rd. 233, Suite A-2
Durango, CO 81301

From: Ryan Griglak, P.E.
Stoner Engineering & Surveying

Re: King Coal II – Preliminary "As-Built" Hydrology Analysis Permit C-1981-035

Enclosed is the preliminary "as-built" hydrological analysis for GCC Energy, LLC's King II Mine located at 6473 County Road 120, Hesperus, Colorado 81326. The analysis includes all the drainage control structures located on the site. The computer modeling was done with SEDCAD version 4.0. The information for the analysis was obtained from aerial topography supplemented with a detailed field survey.

The aerial topography has a much greater degree of accuracy than what was available for the original study. The basin size was slightly reduced and the soil properties modified to more accurately reflect the actual site conditions included the original report. Please see the enclosed information for the actual values. These changes resulted in an increase in the amount of run-off the East and West Clear Water Ditches experience during the design event. The increased flows do not exceed the capacity of either of the clear water ditches.

The minimum culvert installed on-site is a 16-inch CMP due to maintenance considerations. This results in the internal culverts being generally oversized from the results of the SEDCAD modeling. The detention pond has the necessary volume available to store the 25-year, 24-hour storm event.

Please let me know if you have any questions or comments in regards to the information provided.

Sincerely,

Ryan M. Griglak, P.E.

P.O. Box 1163 | 28 South Washington Street | Cortez, Colorado 81321
Tel 970.565.7483 | stonerengineer@frontier.net | Fax 970.565.7704

Basin ID Table

Disturbed Area Basins	Square Feet	Acres	Slopes	Vertical Distance	Horizontal (Length)	Hydrologic Soil Group	Soil Cover	Curve
A	204384	4.69	39.49	312.00	790	D	Forest with Liter	80
B1	50984	1.17	45.77	292.00	638	D	Forest with Liter	80
B2	33579	0.77	32.54	68.00	209	D	Forest with Liter	80
C1	128278	2.94	42.40	268.00	632	D	Forest with Liter	80
C2	28556	0.66	8.70	18.00	207	D	Forest with Liter	80
D	264127	4.42	36.23	288.00	795	D	Forest with Liter	85
D1	71242	1.64	3.41	12.00	352	D	Forest with Liter	85
E1	132366	3.04	3.88	30.00	773	D	Short Grass Pature	77
F1	24692	0.57	36.36	44.00	121	D	Forest with Liter	80
F2	67247	1.54	7.06	53.00	751	D	Forest with Liter	80
F3	39112	0.90	4.21	32.00	760	D	Forest with Liter	80
F4	58565	1.34	39.66	46.00	116	D	Nearly Bare	85
G	41261	0.95	18.01	58.00	322	D	Nearly Bare	87
H	65890	1.51	5.34	14.00	262	D	Nearly Bare	85
I	79657	1.83	0.63	4.00	633	D	Short Grass Pature	77
Totals	**1289940**	**29.61**						

Contributing Area Basins								
UD-4 West	4098996	94.1	8	660	8250	D	Forest with liter	80
UD-4 East	3031776	69.6	8	660	8250	D	Forest with liter	80
UD-4 Section A	1287198	29.55	40.29	309	767	D	Forest with liter	80
UD-4 Section B	163786	3.76	33.1	207	627	D	Forest with liter	80
UD-4 Cemetary	213444	4.9	24	210	875	D	Minimum Tillage	80
UD-4 Road	19602	0.45	14.88	32	215	D	Forest with liter	80
UD-2	227819	5.23	39.78	354	890	D	Forest with liter	80
UD-1 West	43265970	993.25	7.4	950	12830	C	Forest with liter	73
UD-1 East	654707	15.03	42.37	250	590	C	Forest with liter	73

Flow Schedule		
Clearwater Ditch (CWD) Flows	**Internal Ditch (ID) & Culvert (C) Flows**	
Basins UD-1 West, UD-1 East, UD-2, flow to CWD-2	Basin A flows to ID 1A	Basin F4 flows to ID 1E
Basins UD-4 East, UD-4 West flow to CWD-1A 0+00	ID 1A flows to C17	ID 1E flows to C12
CWD-1A 2+37 (D') flows to C-18	C17 flows to ID 00	Scalehouse walkway flows to C11
C18 flows to CWD-1A 8+38	Basin B1 flows to Basin B2	C11 & 12 flow to ID 4
Basin UD-4 Section A flows to CWD-1A	Basin B2 flows to C17A	Basin H flows to ID 4
CWD-1A flows to C3	C17A flows to ID 00	Small part of Basin H flows to C5
C3 flows to CWD-1A (South Section)	ID 00 flows to C16	C5 flows to ID 4
Pond flows to C4 A & B	C16 flows to ID 1B	ID 4 flow to C6
C4 A & B flow to CWD-1A (South Section)	ID 3 flows into ID-1B	C6 flows to Pond
Basin UD-4 Section B flows to CWD-1B	Basin C1 & C2 flow to ID-3	Basin I flows to pond
CWD-1B flows to C2	ID 1B flows to C15	Basin D flows to Basin D1
C2 flows to CWD-1A (South Section)	C15 flows to ID 1C	Basin D1 flows to ID 5B & Substation Drop
CWD-1A flows to Hay Gulch Ditch	ID 1C flows to C14	Substation Drop flows to C10
Hay Gulch Ditch flows to C1	C14 flows to ID 1D	C10 flows to Screen Drop
C1 flows under County Road 120 and off-mine site	Belt Galley flows to C20	Basin G flows to Screen Drop
Basin UD-4 Section "CEMETERY" flows to CWD-1C	C20 flows to ID6	Screen Drop flows to C8
Basin UD-4 Section "ROAD" flows to CWD-1C	Basin F1 & F2 flow to ID 1D	C8 flows to Connection Structure
CWD-1C flows to Cattle Guard	ID 6 flows to ID 1D	Basin E flows to ID 5A & Yard Drop
Cattle Guard flows to Hay Gulch Ditch	ID 1D flows to ID 1E	Yard Drop flows to C9
Hay Gulch Ditch flows to C1	Basin F3 flows to ID 2	C9 flows to Connection Structure
C1 flows under County Road 120 and off-mine site	ID 2 flows to C13	Connection Structure flows to C7
	C13 flows to ID 1E	C7 flows to Pond

Culvert ID	Description	Material	Lin.Ft.	Diam.-In.	Required Size - In.	Elev. In	Elev. Out	Drop	Slope	Manning's "n"	Required CFS
C-1	Under C.R. 120	CMP	82	48	42	7202.50	7200.33	2.17	2.65%	0.024	85.86
C-2	Under Haul Road	CMP	48	24	12	7215.94	7214.70	1.24	2.58%	0.024	4.38
C-3	Double Under Haul Road	CMP	49	2 x 24	36	7229.95	7227.78	2.17	4.43%	0.024	24.17
C-4A	Pond Emerg. Spillway-Top = 7233.64'	CMP	119	24	24	7227.85	7225.33	2.52	2.12%	0.024	1.244
C-4B	Pond Spillway-Top = 7232.73'	CMP	119	24	24	7227.85	7225.33	2.52	2.12%	0.024	15.647
C-5	Under Haul Road	CMP	118	24	N/A	7241.37	7238.74	2.63	2.23%	0.024	N/A
C-6	West Pond Inlet	CMP	99	24	18	7238.74	7236.60	2.14	2.16%	0.024	10.94
C-7	Connection Structure to East Pond Inlet	ADS-SMOOTH	265	24	15	7238.20	7237.03	1.17	0.44%	0.015	6.73
C-8	Screen Drop to Connection Structure	ADS-SMOOTH	60	24	12	7239.60	7238.30	1.30	2.17%	0.015	4.65
C-9	Yard Drop to Connection Structure	ADS-SMOOTH	202	24	12	7246.45	7238.30	8.15	4.03%	0.015	2.07
C-10	Substation Drop to Screen Drop	ADS-SMOOTH	167	24	15	7243.07	7241.00	2.07	1.24%	0.015	4.06
C-11	Scale House to Ditch D	CMP	40	16	N/A	7247.50	7243.72	3.78	9.45%	0.024	0
C-12	Stacker 1 to Ditch D	CMP	74	24	18	7245.16	7241.69	3.47	4.69%	0.024	9.39
C-13	Parking Lot to Stacker 1	CMP	60	18	10	7260.41	7258.04	2.37	3.95%	0.024	1.83
C-14	Upper Parking Lot to Lower Parking Lot	CMP	223	16	15	7280.77	7270.08	10.69	4.79%	0.024	5.27
C-15	Under Belt Portal Road	CMP	40	16	12	7284.22	7282.10	2.12	5.30%	0.024	2.76
C-16	3-Sided Building	CMP	106	16	10	7286.94	7283.61	3.33	3.14%	0.024	2.76
C-17	Shop to 3-Sided Building	CMP	100	18	12	7290.09	7286.62	3.47	3.47%	0.024	2.14
C-17A	Basin B1 & B2 to ID 00	HDPE	42	12	8	7287.40	7286.62	0.78	1.86%	0.024	1.4
C-18	West Clearwater Shop Bypass	ADS- CORRUGATED	255	24	21	7301.45	7290.63	10.82	4.24%	0.011	15.2
C-19	Pad 2 Culverts	CMP	20	24_x2	6	7256.00	7255.60	0.40	2.00%	0.024	1.19
C-20	Belt Galley	CMP	8.5	24	0	7306.00	7305.80	0.20	2.35%	0.024	0

Ditch ID	Station	Soil Type	Bottom Width-Ft.	Lin.Ft.	Slope	Hydraulic Radius	Manning's "n"	Required Flow CFS	Velocity	Required Depth	Actual Depth	Type	Ditch Material
CWD-1A	0+00 to 0+32 (A')	Unbarg Loam	3.8	32	6.90%	0.584	N/A	15.2	1.91	1.22	4.4	Trapezoidal	Grass Mixture
	0+32 to 1+18 (B')	Unbarg Loam	3.5	86	2.90%	0.7	N/A	15.2	2.66	1.47	3.5	Trapezoidal	Grass Mixture
	1+18 to 1+80 (C')	Unbarg Loam	3.3	62	6.80%	0.46	N/A	15.2	4.94	0.93	2	Trapezoidal	Grass Mixture
	1+80 to 2+37 (D')	Unbarg Loam	3.3	57	0.20%	1.3	N/A	15.2	1.11	2.57	2.6	Trapezoidal	Grass Mixture
	4+90 to 8+38 (E')	Unbarg Loam	4.3	348	4.20%	0.594	0.038	24.17	5.42	1.08	1.9	Trapezoidal	Rip Rap
	8+38 to 10+81 (F')	Unbarg Loam	2.2	243	2.20%	0.64	0.038	24.17	5.61	1.02	2.1	Trapezoidal	Rip Rap
	10+81 to 12+40 (G')	Unbarg Loam	1.6	159	6.10%	0.548	0.038	24.17	6.48	1.23	2.1	Trapezoidal	Rip Rap
	12+40 to 18+95 (H')	Unbarg Loam	1.6	655	3.60%	0.675	0.036	24.17	6.07	1.59	2.1	Trapezoidal	Rip Rap
CWD-1B	18+95 to 24+01 (I')	Unbarg Loam	2.3	506	4.10%	0.275	0.3	4.38	4.23	0.65	3	Trapezoidal	Graded Loam to Cobbles when noncollodial
CWD-1C	24+01 to 27+58 (J')	Unbarg Loam	2.7	357	4.30%	0.221	0.3	3.23	3.74	0.57	3	Trapezoidal	Graded Loam to Cobbles when noncollodial
CWD-1D	27+58 to 24+01 (J')	Unbarg Loam	2.7	12	13.40%	0.049	0.3	0.33	2.43	0.35	3	Trapezoidal	Graded Loam to Cobbles when noncollodial
Cattle Guard		Steele	6.5	35	0.50%	0.183	0.013	3.37	2.61	0.49	3	Trapezoidal	Steel
CWD-2	0+00 to 0+05 (A')	Unbarg Loam	3.8	5	19.10%	0.11	0.3	2.38	4.98	0.42	3	Trapezoidal	Graded Loam to Cobbles when noncollodial
	0+05 to 0+70 (B')	Unbarg Loam	5.79	65	17.70%	0.09	0.3	2.38	4.19	0.39	1.26	Trapezoidal	Graded Loam to Cobbles when noncollodial
	0+70 to 1+60 (C')	Unbarg Loam	3.91	90	6.20%	0.142	0.3	2.38	3.37	0.46	1.02	Trapezoidal	Graded Loam to Cobbles when noncollodial
	1+60 to 4+70 (D')	Unbarg Loam	4.79	310	1.70%	0.193	0.3	2.38	2.15	0.51	2.05	Trapezoidal	Graded Loam to Cobbles when noncollodial
	4+70 to 6+12 (E')	Unbarg Loam	3.11	142	0.60%	0.988	0.3	35.76	3.88	1.59	1.59	Trapezoidal	Graded Loam to Cobbles when noncollodial
	6+12 to 7+90 (F')	Unbarg Loam	7.23	178	0.90%	0.784	0.3	35.76	3.89	1.29	2.98	Trapezoidal	Graded Loam to Cobbles when noncollodial
	7+90 to 11+95 (G')	Unbarg Loam	7.62	405	3.00%	0.893	0.3	35.76	2.32	1.56	2.68	Trapezoidal	Graded Loam to Cobbles when noncollodial
	11+95 to 14+56 (H')	Unbarg Loam	5.34	261	1.80%	1.113	N/A	35.76	2.33	1.96	1.99	Trapezoidal	Grass Mixture
	14+56 to 18+00 (I')	Unbarg Loam	5.84	344	2.60%	0.699	N/A	35.76	2.58	1.74	1.79	Trapezoidal	Grass Mixture
	18+00 to 20+84 (J')	Unbarg Loam	6.18	284	2.90%	0.979	N/A	35.76	2.8	1.67	3.82	Trapezoidal	Grass Mixture
	20+84 to 22+20 (K')	Unbarg Loam	3.94	136	3.10%	0.719	N/A	35.76	1.38	1.6	1.6	Trapezoidal	Grass Mixture
	22+20 to 25+95 (L')	Unbarg Loam	1.98	375	1.50%	1.206	N/A	76.82	2.37	2.58	2.6	Trapezoidal	Grass Mixture
	25+95 to 26+61 (M')	Unbarg Loam	3.84	66	15.90%	0.814	0.3	76.82	9.25	1.53	7.29	Trapezoidal	Rip Rap
	26+61 to 31+87 (N')	Unbarg Loam	8.34	526	2.30%	0.495	0.03	85.86	4.75	1.11	6.21	Trapezoidal	Graded Loam to Cobbles when noncollodial
ID 00	Minimum	Unbarg Loam	2	9	2.10%	0.26	0.3	2.76	2.95	0.65	0.8	Trapezoidal	Graded Loam to Cobbles when noncollodial
ID 0	Minimum	Unbarg Loam	2	210	10.00%	0.13	0.3	1.4	4.03	0.45	0.8	Trapezoidal	Graded Loam to Cobbles when noncollodial
ID 1A	Minimum	Unbarg Loam	2	260	7.64%	0.17	0.3	2.14	4.25	0.51	0.8	Trapezoidal	Graded Loam to Cobbles when noncollodial
ID 1B	Minimum	Unbarg Loam	2	9	2.22%	0.35	0.3	5.27	3.65	0.79	0.8	Trapezoidal	Graded Loam to Cobbles when noncollodial
ID 1C	Minimum	Unbarg Loam	2	20	3.50%	0.31	0.3	5.27	4.29	0.73	0.8	Trapezoidal	Graded Loam to Cobbles when noncollodial
ID 1D	Minimum	Unbarg Loam	2	136	2.70%	0.346	0.3	6.18	4.82	0.77	0.8	Trapezoidal	Graded Loam to Cobbles when noncollodial
ID 1E	Minimum	Unbarg Loam	8.3	274	6.60%	0.222	0.3	9.39	4.68	0.53	0.8	Trapezoidal	Graded Loam to Cobbles when noncollodial
ID-2A	Minimum	Unbarg Loam	1.25	187	2.00%	0.21	0.025	1.09	3.27	0.58	0.8	Trapezoidal	Graded Loam to Cobbles when noncollodial
ID-2B	Minimum	Unbarg Loam	0.66	265	4.20%	0.22	0.3	1.83	3.77	0.67	0.8	Trapezoidal	Graded Loam to Cobbles when noncollodial
ID-3	Minimum	Unbarg Loam	1		10.00%	0.2	0.03	2.51	5.4	0.59	0.8	Trapezoidal	Graded Loam to Cobbles when noncollodial
ID 4	Minimum	Unbarg Loam	4	128	5.30%	0.372	0.3	10.94	5.05	0.75	0.8	Trapezoidal	Cobbles and Shales
ID-5A Sta. 1	Minimum	Unbarg Loam	3	75	2.00%	0.138	0.3	1.19	2.25	0.46	0.71	Trapezoidal	Shales and Hardpans
ID-5A Sta. 2	Minimum	Unbarg Loam	4	305	1.90%	0.51	N/A	2.07	1	1.07	1.1	Trapezoidal	Grass Mixture
ID 5B	Minimum	Unbarg Loam	3	329	2.00%	0.22	0.025	3.01	3.08	0.57	1.1	Trapezoidal	Shales and Hardpans
ID-6	Minimum	Unbarg Loam	2	160	12.00%	0.062	0.025	0.45	3.25	0.37	0.8	Trapezoidal	Course Gravel noncollidal

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Drainage Basin A to Pond 1 Flows

SedCad Modeling Starting from Drainage Basin A and Finishing at Pond 1, King II Mine

Joshua Chlopek

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	2.200 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#45	0.000	0.000	Basin A flows to Ditch ID-1A
Culvert	#2	==>	#43	0.000	0.000	Culvert C-17 flows to ID -00
Null	#3	==>	#4	0.000	0.000	Basin B1 flow to Basin B2
Null	#4	==>	#44	0.010	0.000	Basin B2 flows Culvert C-17A
Culvert	#5	==>	#46	0.000	0.000	Culvert C-16 flow to Culvert C-15
Null	#9	==>	#48	0.000	0.000	Basin C1 flows to Ditch 3
Null	#10	==>	#48	0.000	0.000	Basin C2 flows to Ditch 3
Channel	#11	==>	#46	0.000	0.000	Ditch 1B flow to Culvert C-14
Culvert	#12	==>	#47	0.000	0.000	Culvert C-15 Flows into Ditch 1C
Channel	#13	==>	#19	0.000	0.000	Ditch 1D flows to Ditch 1E
Culvert	#14	==>	#13	0.000	0.000	Culvert C-14 flow to Ditch 1D
Channel	#15	==>	#13	0.000	0.000	Ditch ID 6 Flows Into Ditch 1D
Null	#16	==>	#13	0.000	0.000	Basin F2 Flows into Ditch 1C
Null	#17	==>	#18	0.000	0.000	Basin F3 Flows into Ditch 2
Channel	#18	==>	#39	0.000	0.000	Ditch 2B Flows into Culvert C-13
Channel	#19	==>	#20	0.000	0.000	Ditch 1E Flows into Culvert C-12
Culvert	#20	==>	#21	0.000	0.000	Culvert C-12 Flows into Ditch 4
Channel	#21	==>	#22	0.000	0.000	Ditch ID-4 (Includes Basin H) flows into Culvert 6
Culvert	#22	==>	#37	0.000	0.000	Culvert 6 Flows into Pond 1
Null	#25	==>	#26	0.000	0.000	Basin E Flows Into Ditch 5A
Channel	#26	==>	#27	0.000	0.000	Ditch 5A Flows into Culvert C-9 (Yard Drop)
Culvert	#27	==>	#28	0.000	0.000	Culvert C-9 (Yard Drop) Flows C-7
Channel	#28	==>	#38	0.000	0.000	Ditch 5A* Flows into Culvert C-9
Culvert	#29	==>	#30	0.000	0.000	Culvert C-8 Flows into Culvert C-7
Culvert	#30	==>	#37	0.000	0.000	Culvert C-7 Flows into Pond 1
Null	#31	==>	#32	0.000	0.000	Basin D flows Into Ditch 5B
Channel	#32	==>	#34	0.000	0.000	Ditch 5B flows into Basin D1
Null	#34	==>	#35	0.000	0.000	Basin D flows into Culvert C-10
Culvert	#35	==>	#29	0.000	0.000	Culvert C-10 Flows into Culvert C-8
Pond	#37	==>	End	0.000	0.000	Pond 1 Flows to Outlet
Culvert	#38	==>	#30	0.000	0.000	Culvert C-9 Flows into Culvert C-7
Culvert	#39	==>	#19	0.000	0.000	Culvert C-13 to Ditch 1E
Channel	#41	==>	#18	0.000	0.000	Ditch 2A Flows into Ditch 2B
Culvert	#42	==>	#43	0.000	0.000	Culvert 17A flow to ID-00
Channel	#43	==>	#5	0.000	0.000	ID-00 flow to Culvert C-16
Channel	#44	==>	#42	0.000	0.000	ID-0 Flows to Culvert C-17A
Channel	#45	==>	#2	0.000	0.000	ID-1A flows to Culvert C-17
Channel	#46	==>	#12	0.000	0.000	Ditch 1B flows into Culver C-15

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#47	==>	#14	0.000	0.000	Ditch 1C flows into Culvert C-14
Channel	#48	==>	#11	0.000	0.000	Ditch 3 flows into Ditch 1B

#25
Null

#26
Chan'l

#27
Culvert

#28
Chan'l

#38
Culvert

#31
Null

#32
Chan'l

#34
Null

#35
Culvert

#29
Culvert

#30
Culvert

#41
Chan'l

#17
Null

#18
Chan'l

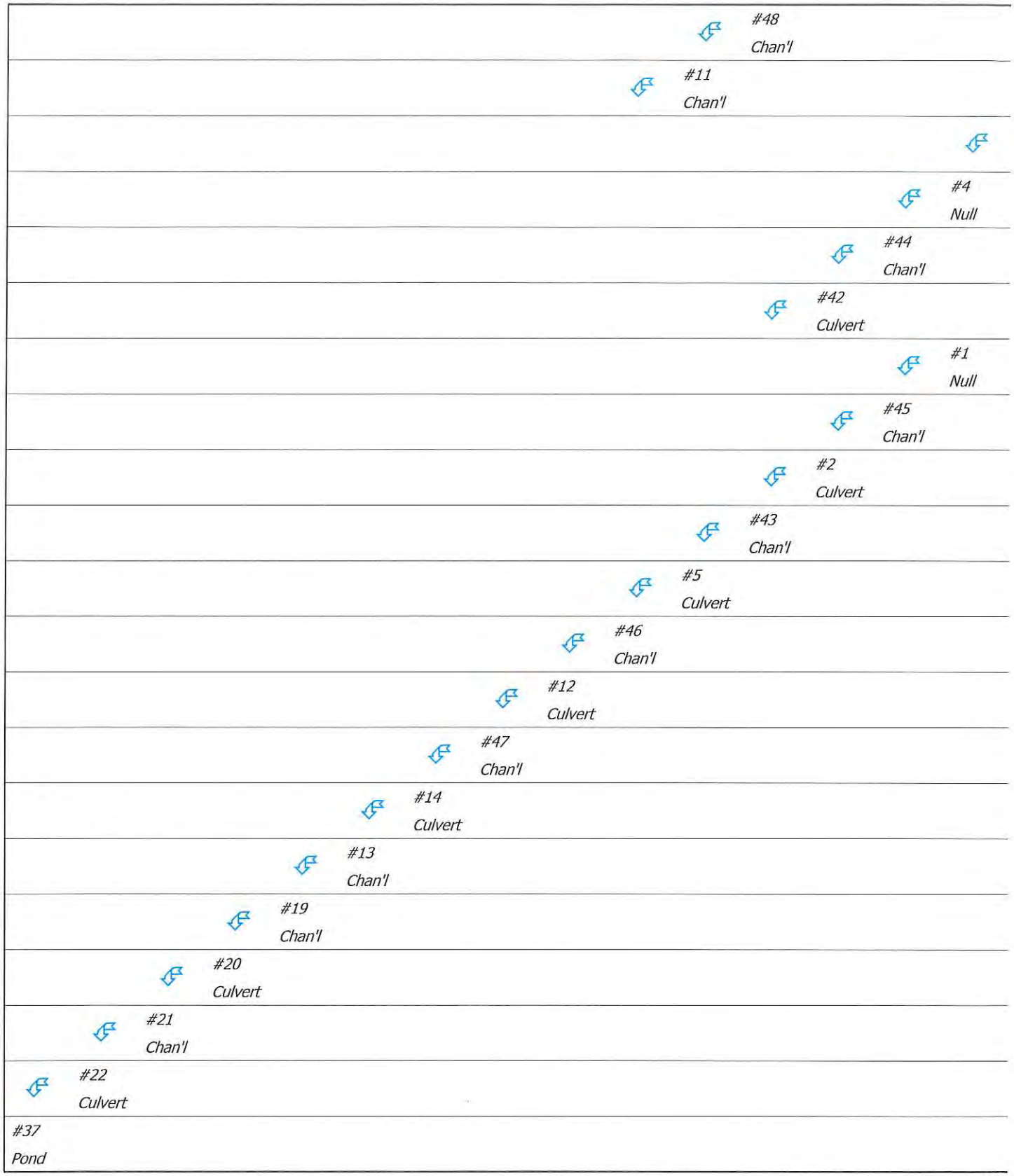
#39
Culvert

#16
Null

#15
Chan'l

#10
Null

#9
Null


#48
Chan'l
#11
Chan'l
#4
Null
#44
Chan'l
#42
Culvert
#1
Null
#45
Chan'l
#2
Culvert
#43
Chan'l
#5
Culvert
#46
Chan'l
#12
Culvert
#47
Chan'l
#14
Culvert
#13
Chan'l
#19
Chan'l
#20
Culvert
#21
Chan'l
#22
Culvert
#37
Pond

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#25	3.040	3.040	1.19	0.12
#26	0.000	3.040	1.19	0.12
#27	0.000	3.040	1.19	0.12
#28	0.950	3.990	2.07	0.20
#38	0.000	3.990	2.07	0.20
#31	4.420	4.420	3.01	0.28
#32	0.000	4.420	3.01	0.28
#34	1.640	6.060	4.06	0.39
#35	0.000	6.060	4.06	0.39
#29	0.950	7.010	4.65	0.46
#30	0.000	11.000	6.73	0.66
#41	0.877	0.877	1.09	0.09
#17	0.900	0.900	0.70	0.05
#18	0.000	1.777	1.79	0.14
#39	0.000	1.777	1.79	0.14
#16	1.540	1.540	0.62	0.07
#15	0.570	0.570	0.45	0.03
#10	0.660	0.660	0.52	0.04
#9	2.940	2.940	2.08	0.17
#48	0.000	3.600	2.51	0.21
#11	0.000	3.600	2.51	0.21
#3	1.170	1.170	0.83	0.07
#4	0.770	1.940	1.40	0.11
#44	0.000	1.940	1.40	0.11
#42	0.000	1.940	1.40	0.11
#1	4.690	4.690	2.14	0.22
#45	0.000	4.690	2.14	0.22
#2	0.000	4.690	2.14	0.22
#43	0.000	6.630	2.76	0.33
#5	0.000	6.630	2.76	0.33
#46	0.000	10.230	5.27	0.54
#12	0.000	10.230	5.27	0.54
#47	0.000	10.230	5.27	0.54
#14	0.000	10.230	5.27	0.54
#13	0.000	12.340	6.18	0.64
#19	1.340	15.457	9.35	0.88
#20	0.000	15.457	9.35	0.88

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#21		1.510	16.967	10.90	1.00
#22		0.000	16.967	10.90	1.00
#37	In	0.000	27.967	17.63	1.66
	Out			7.33	0.00

Structure Detail:

Structure #25 (Null)

Basin E Flows Into Ditch 5A

Structure #26 (Erodible Channel)

Ditch 5A Flows into Culvert C-9 (Yard Drop)

Trapezoidal Erodible Channel Inputs:

Material: Shales and hardpans

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.00	2.0:1	3.0:1	2.0	0.0250	0.30			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.19 cfs	
Depth:	0.16 ft	0.46 ft
Top Width:	3.78 ft	5.28 ft
Velocity:	2.25 fps	
X-Section Area:	0.53 sq ft	
Hydraulic Radius:	0.138 ft	
Froude Number:	1.06	

Structure #27 (Culvert)

Culvert C-9 (Yard Drop) Flows C-7

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
20.00	2.00	0.0240	4.00	0.00	0.90

Culvert Results:

Design Discharge = 1.19 cfs

Minimum pipe diameter: 1 - 8 inch pipe(s) required

Structure #28 (Vegetated Channel)

Ditch 5A Flows into Culvert C-9*

Trapezoidal Vegetated Channel Inputs:

Material: Grass mixture

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
4.00	1.8:1	7.8:1	1.9	D, B	0.30			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	2.07 cfs		2.07 cfs	
Depth:	0.36 ft	0.66 ft	0.77 ft	1.07 ft
Top Width:	7.43 ft	10.28 ft	11.29 ft	14.14 ft
Velocity:	1.00 fps		0.35 fps	
X-Section Area:	2.06 sq ft		5.86 sq ft	
Hydraulic Radius:	0.275 ft		0.512 ft	
Froude Number:	0.34		0.09	
Roughness Coefficient:	0.0864		0.3715	

Structure #38 (Culvert)

Culvert C-9 Flows into Culvert C-7

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
202.00	4.03	0.0240	3.00	0.00	0.90

Culvert Results:

Design Discharge = 2.07 cfs

Minimum pipe diameter: 1 - 10 inch pipe(s) required

Structure #31 (Null)

Basin D flows Into Ditch 5B

Structure #32 (Erodible Channel)

Ditch 5B flows into Basin D1

Trapezoidal Erodible Channel Inputs:

Material: Shales and hardpans

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.00	2.0:1	3.0:1	2.0	0.0250	0.30			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.01 cfs	
Depth:	0.27 ft	0.57 ft
Top Width:	4.33 ft	5.83 ft
Velocity:	3.08 fps	
X-Section Area:	0.98 sq ft	
Hydraulic Radius:	0.221 ft	
Froude Number:	1.14	

Structure #34 (Null)

Basin D flows into Culvert C-10

Structure #35 (Culvert)

Culvert C-10 Flows into Culvert C-8

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
167.00	1.24	0.0240	2.50	0.00	0.90

Culvert Results:

Design Discharge = 4.06 cfs

Minimum pipe diameter: 1 - 15 inch pipe(s) required

Structure #29 (Culvert)

Culvert C-8 Flows into Culvert C-7

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
60.00	2.17	0.0150	2.50	0.00	0.90

Culvert Results:

Design Discharge = 4.65 cfs

Minimum pipe diameter: 1 - 12 inch pipe(s) required

Structure #30 (Culvert)

Culvert C-7 Flows into Pond 1

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
265.00	0.44	0.0150	2.50	0.00	0.90

Culvert Results:

Design Discharge = 6.73 cfs

Minimum pipe diameter: 1 - 18 inch pipe(s) required

Structure #41 (Erodible Channel)

Ditch 2A Flows into Ditch 2B

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.25	1.3:1	1.3:1	2.0	0.0300	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.09 cfs	
Depth:	0.28 ft	0.58 ft
Top Width:	1.94 ft	2.69 ft
Velocity:	2.47 fps	
X-Section Area:	0.44 sq ft	
Hydraulic Radius:	0.206 ft	
Froude Number:	0.91	

Structure #17 (Null)

Basin F3 Flows into Ditch 2

Structure #18 (Erodible Channel)

Ditch 2B Flows into Culvert C-13

Trapezoidal Erodible Channel Inputs:

Material: Graded silts to cobbles when colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
0.66	1.8:1	1.8:1	4.2	0.0300	0.30			5.5

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.79 cfs	
Depth:	0.37 ft	0.67 ft
Top Width:	1.94 ft	2.99 ft
Velocity:	3.75 fps	
X-Section Area:	0.48 sq ft	
Hydraulic Radius:	0.223 ft	
Froude Number:	1.33	

Structure #39 (Culvert)

Culvert C-13 to Ditch 1E

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
60.00	3.95	0.0240	2.50	0.00	0.90

Culvert Results:

Design Discharge = 1.79 cfs

Minimum pipe diameter: 1 - 10 inch pipe(s) required

Structure #16 (Null)

Basin F2 Flows into Ditch 1C

Structure #15 (Erodible Channel)

Ditch ID 6 Flows Into Ditch 1D

Trapezoidal Erodible Channel Inputs:

Material: Coarse gravel noncolloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.00	1.0:1	1.0:1	12.0	0.0250	0.30			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.45 cfs	
Depth:	0.07 ft	0.37 ft
Top Width:	2.13 ft	2.73 ft
Velocity:	3.25 fps	
X-Section Area:	0.14 sq ft	
Hydraulic Radius:	0.062 ft	
Froude Number:	2.26	

Structure #10 (Null)

Basin C2 flows to Ditch 3

Structure #9 (Null)

Basin C1 flows to Ditch 3

Structure #48 (Erodible Channel)

Ditch 3 flows into Ditch 1B

Trapezoidal Erodible Channel Inputs:

Material: Graded silts to cobbles when colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.00	2.0:1	2.0:1	10.0	0.0300	0.30			5.5

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.51 cfs	
Depth:	0.29 ft	0.59 ft
Top Width:	2.17 ft	3.37 ft
Velocity:	5.40 fps	
X-Section Area:	0.47 sq ft	
Hydraulic Radius:	0.201 ft	
Froude Number:	2.05	

Structure #11 (Erodible Channel)

Ditch 1B flow to Culvert C-14

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
1.75	1.8:1	1.8:1	7.1	0.0300	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.51 cfs	
Depth:	0.25 ft	0.55 ft
Top Width:	2.63 ft	3.68 ft
Velocity:	4.54 fps	
X-Section Area:	0.55 sq ft	
Hydraulic Radius:	0.200 ft	
Froude Number:	1.74	

Structure #3 (Null)

Basin B1 flow to Basin B2

Structure #4 (Null)

Basin B2 flows Culvert C-17A

Structure #44 (Erodible Channel)

ID-0 Flows to Culvert C-17A

Trapezoidal Erodible Channel Inputs:

Material: Graded silts to cobbles when colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.00	2.0:1	2.0:1	10.0	0.0300	0.30			5.5

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	1.40 cfs	
Depth:	0.15 ft	0.45 ft
Top Width:	2.60 ft	3.80 ft
Velocity:	4.03 fps	
X-Section Area:	0.35 sq ft	
Hydraulic Radius:	0.130 ft	
Froude Number:	1.94	

Structure #42 (Culvert)

Culvert 17A flow to ID-00

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
43.00	2.00	0.0240	2.00	0.00	0.90

Culvert Results:

Design Discharge = 1.40 cfs

Minimum pipe diameter: 1 - 10 inch pipe(s) required

Structure #1 (Null)

Basin A flows to Ditch ID-1A

Structure #45 (Erodible Channel)

ID-1A flows to Culvert C-17

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.00	2.0:1	2.0:1	7.6	0.0300	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.14 cfs	
Depth:	0.21 ft	0.51 ft
Top Width:	2.84 ft	4.04 ft
Velocity:	4.25 fps	
X-Section Area:	0.51 sq ft	
Hydraulic Radius:	0.172 ft	
Froude Number:	1.77	

Structure #2 (Culvert)

Culvert C-17 flows to ID -00

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
100.00	3.47	0.0240	2.50	2.50	0.90

Culvert Results:

Design Discharge = 2.14 cfs

Minimum pipe diameter: 1 - 12 inch pipe(s) required

Structure #43 (Erodible Channel)

ID-00 flow to Culvert C-16

Trapezoidal Erodible Channel Inputs:

Material: Graded silts to cobbles when colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.00	2.0:1	2.0:1	2.1	0.0300	0.30			5.5

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.76 cfs	
Depth:	0.35 ft	0.65 ft
Top Width:	3.39 ft	4.59 ft
Velocity:	2.95 fps	
X-Section Area:	0.93 sq ft	
Hydraulic Radius:	0.263 ft	
Froude Number:	0.99	

Structure #5 (Culvert)

Culvert C-16 flow to Culvert C-15

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
100.00	3.14	0.0240	2.50	3.00	0.90

Culvert Results:

Design Discharge = 2.76 cfs

Minimum pipe diameter: 1 - 12 inch pipe(s) required

Structure #46 (Erodible Channel)

Ditch 1B flows into Culver C-15

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.00	2.0:1	2.0:1	2.2	0.0300	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	5.27 cfs	
Depth:	0.49 ft	0.79 ft
Top Width:	3.95 ft	5.15 ft
Velocity:	3.65 fps	
X-Section Area:	1.45 sq ft	
Hydraulic Radius:	0.346 ft	
Froude Number:	1.06	

Structure #12 (Culvert)

Culvert C-15 Flows into Ditch 1C

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
40.00	5.30	0.0240	2.50	2.00	0.90

Culvert Results:

Design Discharge = 5.27 cfs

Minimum pipe diameter: 1 - 15 inch pipe(s) required

Structure #47 (Erodible Channel)

Ditch 1C flows into Culvert C-14

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.00	2.0:1	2.0:1	3.5	0.0300	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	5.27 cfs	
Depth:	0.43 ft	0.73 ft
Top Width:	3.72 ft	4.92 ft
Velocity:	4.29 fps	
X-Section Area:	1.23 sq ft	
Hydraulic Radius:	0.313 ft	
Froude Number:	1.31	

Structure #14 (Culvert)

Culvert C-14 flow to Ditch 1D

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
223.00	4.79	0.0240	2.52	0.00	0.90

Culvert Results:

Design Discharge = 5.27 cfs

Minimum pipe diameter: 1 - 15 inch pipe(s) required

Structure #13 (Erodible Channel)

Ditch 1D flows to Ditch 1E

Trapezoidal Erodible Channel Inputs:

Material: Shales and hardpans

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.00	1.5:1	1.5:1	2.7	0.0250	0.30			6.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	6.18 cfs	
Depth:	0.47 ft	0.77 ft

	w/o Freeboard	w/ Freeboard
Top Width:	3.42 ft	4.32 ft
Velocity:	4.82 fps	
X-Section Area:	1.28 sq ft	
Hydraulic Radius:	0.346 ft	
Froude Number:	1.39	

Structure #19 (Erodible Channel)

Ditch 1E Flows into Culvert C-12

Trapezoidal Erodible Channel Inputs:

Material: Graded silts to cobbles when colloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
8.30	1.3:1	1.3:1	6.6	0.0300	0.30			5.5

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	9.35 cfs	
Depth:	0.23 ft	0.53 ft
Top Width:	8.88 ft	9.63 ft
Velocity:	4.67 fps	
X-Section Area:	2.00 sq ft	
Hydraulic Radius:	0.221 ft	
Froude Number:	1.73	

Structure #20 (Culvert)

Culvert C-12 Flows into Ditch 4

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
74.00	4.69	0.0150	3.00	0.00	0.90

Culvert Results:

Design Discharge = 9.35 cfs

Minimum pipe diameter: 1 - 18 inch pipe(s) required

Structure #21 (Erodible Channel)

Ditch ID-4 (Includes Basin H) flows into Culvert 6

Trapezoidal Erodible Channel Inputs:

Material: Cobbles and shingles

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
4.00	1.8:1	1.8:1	5.3	0.0350	0.30			5.5

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	10.90 cfs	
Depth:	0.45 ft	0.75 ft
Top Width:	5.58 ft	6.63 ft
Velocity:	5.04 fps	
X-Section Area:	2.16 sq ft	
Hydraulic Radius:	0.372 ft	
Froude Number:	1.43	

Structure #22 (Culvert)

Culvert 6 Flows into Pond 1

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
99.00	2.16	0.0150	4.00	0.00	0.90

Culvert Results:

Design Discharge = 10.90 cfs

Minimum pipe diameter: 1 - 18 inch pipe(s) required

Structure #37 (Pond)

Pond 1 Flows to Outlet

Pond Inputs:

Initial Pool Elev:	7,233.00 ft
Initial Pool:	3.76 ac-ft

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
24.00	5.15	24.00	119.00	2.12	0.0240	7,233.00	2

Pond Results:

Peak Elevation:	7,233.50 ft
Dewater Time:	0.75 days

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
7,226.17	0.025	0.000	0.000		
7,226.67	0.092	0.028	0.000		
7,227.17	0.201	0.099	0.000		
7,227.67	0.295	0.222	0.000		
7,228.17	0.407	0.397	0.000		
7,228.67	0.499	0.623	0.000		
7,229.17	0.599	0.898	0.000		
7,229.67	0.644	1.208	0.000		
7,230.17	0.690	1.541	0.000		
7,230.67	0.721	1.894	0.000		
7,231.17	0.753	2.263	0.000		
7,231.67	0.787	2.648	0.000		
7,232.17	0.822	3.050	0.000		
7,232.67	0.860	3.471	0.000		
7,232.73	0.865	3.523	0.000		
7,233.00	0.886	3.759	0.000		Spillway #1
7,233.17	0.899	3.911	1.364	15.10	
7,233.50	0.912	4.207	7.330	2.80	Peak Stage
7,233.64	0.920	4.338	9.976		
7,233.67	0.921	4.366	10.680		
7,233.80	0.927	4.486	13.528		

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Combined Total Discharge (cfs)
7,226.17	0.000	0.000
7,226.67	0.000	0.000
7,227.17	0.000	0.000
7,227.67	0.000	0.000
7,228.17	0.000	0.000
7,228.67	0.000	0.000
7,229.17	0.000	0.000
7,229.67	0.000	0.000
7,230.17	0.000	0.000
7,230.67	0.000	0.000
7,231.17	0.000	0.000
7,231.67	0.000	0.000
7,232.17	0.000	0.000
7,232.67	0.000	0.000
7,232.73	0.000	0.000
7,233.00	0.000	0.000
7,233.17	1.364	1.364
7,233.64	9.976	9.976
7,233.67	10.680	10.680
7,233.80	13.528	13.528

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#25	1	3.040	0.136	0.000	0.000	77.000	M	1.19	0.115
	Σ	**3.040**						**1.19**	**0.115**
#26	Σ	**3.040**						**1.19**	**0.115**
#27	Σ	**3.040**						**1.19**	**0.115**
#28	1	0.950	0.021	0.000	0.000	87.000	M	1.08	0.084
	Σ	**3.990**						**2.07**	**0.199**
#38	Σ	**3.990**						**2.07**	**0.199**
#31	1	4.420	0.145	0.000	0.000	85.000	M	3.01	0.283
	Σ	**4.420**						**3.01**	**0.283**
#32	Σ	**4.420**						**3.01**	**0.283**
#34	1	1.640	0.212	0.000	0.000	85.000	M	1.05	0.103
	Σ	**6.060**						**4.06**	**0.385**
#35	Σ	**6.060**						**4.06**	**0.385**
#29	1	0.950	0.021	0.000	0.000	85.000	M	0.98	0.074
	Σ	**7.010**						**4.65**	**0.460**
#30	Σ	**11.000**						**6.73**	**0.659**
#41	1	0.877	0.096	0.000	0.000	89.000	M	1.09	0.087
	Σ	**0.877**						**1.09**	**0.087**
#17	1	0.900	0.102	0.000	0.000	80.000	M	0.70	0.051
	Σ	**0.900**						**0.70**	**0.051**
#18	Σ	**1.777**						**1.79**	**0.138**
#39	Σ	**1.777**						**1.79**	**0.138**
#16	1	1.540	0.311	0.000	0.000	80.000	M	0.62	0.070
	Σ	**1.540**						**0.62**	**0.070**
#15	1	0.570	0.022	0.000	0.000	80.000	M	0.45	0.029
	Σ	**0.570**						**0.45**	**0.029**
#10	1	0.660	0.077	0.019	0.317	80.000	M	0.52	0.038
	Σ	**0.660**						**0.52**	**0.038**
#9	1	2.940	0.107	0.107	0.246	80.000	M	2.30	0.168

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**2.940**						**2.08**	**0.168**
#48	Σ	**3.600**						**2.51**	**0.206**
#11	Σ	**3.600**						**2.51**	**0.206**
#3	1	1.170	0.103	0.104	0.250	80.000	M	0.92	0.067
	Σ	**1.170**						**0.83**	**0.067**
#4	1	0.770	0.040	0.000	0.000	80.000	M	0.60	0.044
	Σ	**1.940**						**1.40**	**0.111**
#44	Σ	**1.940**						**1.40**	**0.111**
#42	Σ	**1.940**						**1.40**	**0.111**
#1	1	4.690	0.138	0.138	0.241	80.000	M	2.31	0.218
	Σ	**4.690**						**2.14**	**0.218**
#45	Σ	**4.690**						**2.14**	**0.218**
#2	Σ	**4.690**						**2.14**	**0.218**
#43	Σ	**6.630**						**2.76**	**0.329**
#5	Σ	**6.630**						**2.76**	**0.329**
#46	Σ	**10.230**						**5.27**	**0.535**
#12	Σ	**10.230**						**5.27**	**0.535**
#47	Σ	**10.230**						**5.27**	**0.535**
#14	Σ	**10.230**						**5.27**	**0.535**
#13	Σ	**12.340**						**6.18**	**0.635**
#19	1	1.340	0.005	0.000	0.000	85.000	M	1.38	0.105
	Σ	**15.457**						**9.35**	**0.878**
#20	Σ	**15.457**						**9.35**	**0.878**
#21	1	1.510	0.031	0.000	0.000	85.000	M	1.55	0.118
	Σ	**16.967**						**10.90**	**0.997**
#22	Σ	**16.967**						**10.90**	**0.997**
#37	Σ	**27.967**						**17.63**	**1.655**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	39.49	312.00	790.00	1.580	0.138
#1	**1**	**Time of Concentration:**					**0.138**
#3	1	1. Forest with heavy ground litter	45.77	292.00	638.00	1.710	0.103
#3	**1**	**Time of Concentration:**					**0.103**
#4	1	1. Forest with heavy ground litter	32.54	68.00	209.00	1.440	0.040
#4	**1**	**Time of Concentration:**					**0.040**
#9	1	1. Forest with heavy ground litter	42.40	268.00	632.00	1.640	0.107
#9	**1**	**Time of Concentration:**					**0.107**
#10	1	1. Forest with heavy ground litter	8.70	18.00	207.00	0.740	0.077
#10	**1**	**Time of Concentration:**					**0.077**
#15	1	1. Forest with heavy ground litter	36.36	44.00	121.00	1.520	0.022
#15	**1**	**Time of Concentration:**					**0.022**
#16	1	1. Forest with heavy ground litter	7.06	53.00	751.00	0.670	0.311
#16	**1**	**Time of Concentration:**					**0.311**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	4.21	32.00	760.02	2.050	0.102
#17	**1**	**Time of Concentration:**					**0.102**
#19	1	5. Nearly bare and untilled, and alluvial valley fans	39.66	46.00	116.00	6.290	0.005
#19	**1**	**Time of Concentration:**					**0.005**
#21	1	5. Nearly bare and untilled, and alluvial valley fans	5.34	14.00	262.00	2.310	0.031
#21	**1**	**Time of Concentration:**					**0.031**
#25	1	3. Short grass pasture	3.88	30.00	773.01	1.570	0.136
#25	**1**	**Time of Concentration:**					**0.136**
#28	1	5. Nearly bare and untilled, and alluvial valley fans	18.01	58.00	322.00	4.240	0.021
#28	**1**	**Time of Concentration:**					**0.021**
#29	1	5. Nearly bare and untilled, and alluvial valley fans	18.01	58.00	322.00	4.240	0.021
#29	**1**	**Time of Concentration:**					**0.021**
#31	1	1. Forest with heavy ground litter	36.23	288.00	795.00	1.520	0.145
#31	**1**	**Time of Concentration:**					**0.145**
#34	1	1. Forest with heavy ground litter	3.41	12.00	352.00	0.460	0.212
#34	**1**	**Time of Concentration:**					**0.212**
#41	1	5. Nearly bare and untilled, and alluvial valley fans	2.02	10.00	495.00	1.420	0.096
#41	**1**	**Time of Concentration:**					**0.096**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	39.49	312.00	790.00	1.580	0.138
#1	**1**	**Muskingum K:**					**0.138**
#3	1	1. Forest with heavy ground litter	45.45	290.00	638.00	1.700	0.104
#3	**1**	**Muskingum K:**					**0.104**
#9	1	1. Forest with heavy ground litter	42.40	268.00	632.00	1.640	0.107
#9	**1**	**Muskingum K:**					**0.107**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	8.70	18.00	207.00	2.940	0.019
#10	**1**	**Muskingum K:**					**0.019**

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Ditch CWD-1A SEDCad As-Built (Stations 0+00 to 18+95 (Culvert C-3 to CWD-2)

Upstream flows into CWD-1A to CWD-2

Joshua Chlopek

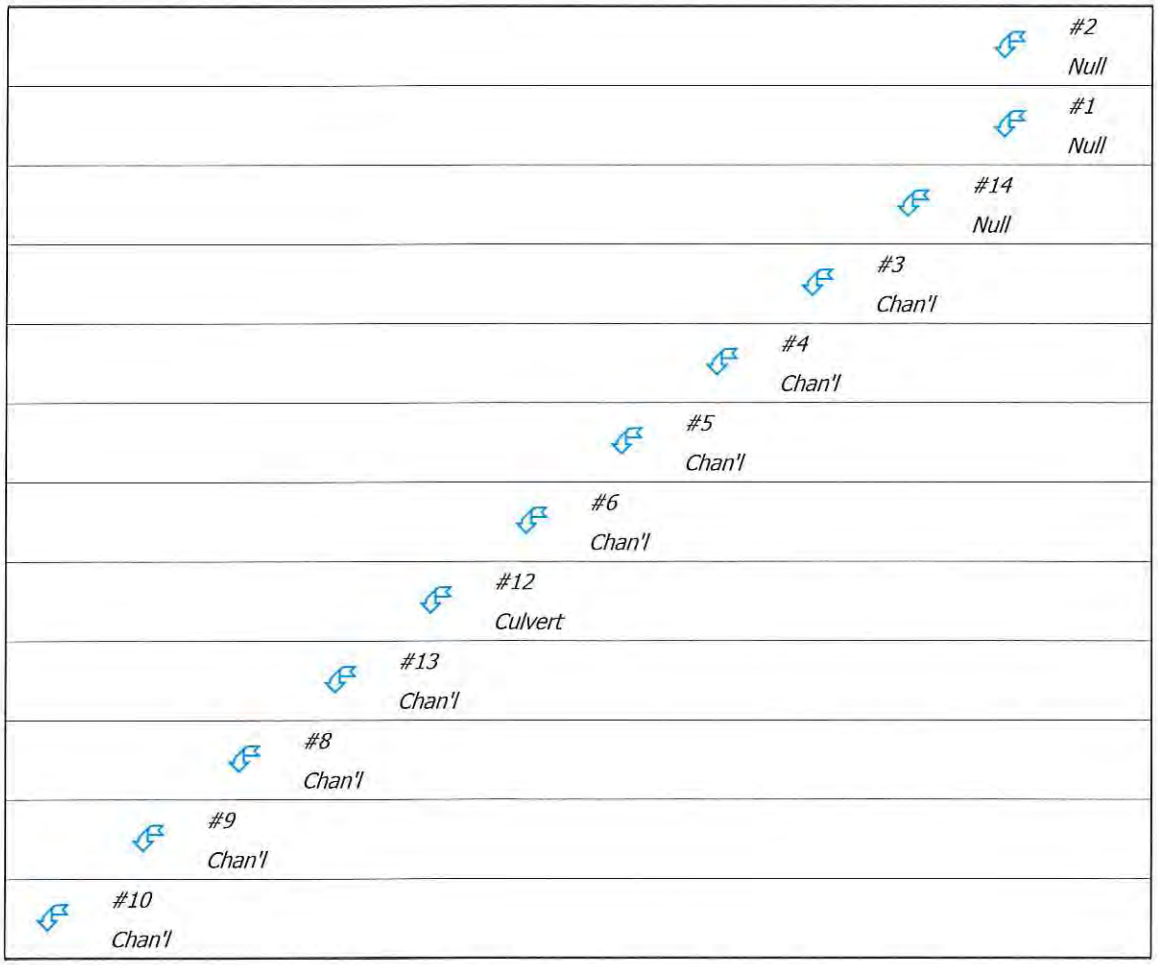
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	2.200 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#14	0.000	0.000	Basin West
Null	#2	==>	#14	0.000	0.000	Basin East
Channel	#3	==>	#4	0.000	0.000	Station 0+00 to Station 0+32 (A')
Channel	#4	==>	#5	0.000	0.000	Station 0+32 to Station 1+18 (B')
Channel	#5	==>	#6	0.000	0.000	Station 1+18 to Station 1+80 (C')
Channel	#6	==>	#12	0.000	0.000	Station 1+80 to Station 2+37 (D')
Channel	#8	==>	#9	0.000	0.000	Station 8+38 to Station 10+81 (F')
Channel	#9	==>	#10	0.000	0.000	Station 10+81 to Station 12+40 (G')
Channel	#10	==>	#11	0.000	0.000	Station 12+40 to Station 18+95 (H')
Culvert	#11	==>	End	0.000	0.000	Culvert C-3 to CWD-2
Culvert	#12	==>	#13	0.000	0.000	Culvert C-18 to Station 4+95
Channel	#13	==>	#8	0.000	0.000	Station 4+90 to 8+38 (E')
Null	#14	==>	#3	0.000	0.000	Flows Basin West and Basin East



#11

Culvert

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	69.600	69.600	6.46	3.18
#1	94.100	94.100	8.74	4.29
#14	0.000	163.700	15.20	7.47
#3	0.000	163.700	15.20	7.47
#4	0.000	163.700	15.20	7.47
#5	0.000	163.700	15.20	7.47
#6	0.000	163.700	15.20	7.47
#12	0.000	163.700	15.20	7.47
#13	29.550	193.250	24.17	9.86
#8	0.000	193.250	24.17	9.86
#9	0.000	193.250	24.17	9.86
#10	0.000	193.250	24.17	9.86
#11	0.000	193.250	24.17	9.86

Structure Detail:

Structure #2 (Null)

Basin East

Structure #1 (Null)

Basin West

Structure #14 (Null)

Flows Basin West and Basin East

Structure #3 (Vegetated Channel)

Station 0+00 to Station 0+32 (A')

Trapezoidal Vegetated Channel Inputs:

Material: Bermuda grass

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.60	2.1:1	8.3:1	6.9	D, C	0.30			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class C w/o Freeboard	Capacity Class C w/ Freeboard
Design Discharge:	15.20 cfs		15.20 cfs	
Depth:	0.57 ft	0.87 ft	0.68 ft	0.98 ft
Top Width:	9.52 ft	12.65 ft	10.65 ft	13.78 ft
Velocity:	4.08 fps		3.16 fps	
X-Section Area:	3.73 sq ft		4.82 sq ft	
Hydraulic Radius:	0.387 ft		0.447 ft	
Froude Number:	1.15		0.83	
Roughness Coefficient:	0.0507		0.0722	

Structure #4 (Vegetated Channel)

Station 0+32 to Station 1+18 (B')

Trapezoidal Vegetated Channel Inputs:

Material: Grass mixture

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.50	5.6:1	7.7:1	2.9	D, B	0.30			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	15.20 cfs		15.20 cfs	
Depth:	0.70 ft	1.00 ft	1.17 ft	1.47 ft
Top Width:	12.82 ft	16.81 ft	19.03 ft	23.03 ft
Velocity:	2.66 fps		1.16 fps	
X-Section Area:	5.71 sq ft		13.15 sq ft	
Hydraulic Radius:	0.442 ft		0.685 ft	
Froude Number:	0.70		0.25	
Roughness Coefficient:	0.0555		0.1710	

Structure #5 (Vegetated Channel)

Station 1+18 to Station 1+80 (C')

Trapezoidal Vegetated Channel Inputs:

Material: Bermuda grass

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.30	2.2:1	2.7:1	6.8	D, C	0.30			7.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class C w/o Freeboard	Capacity Class C w/ Freeboard
Design Discharge:	15.20 cfs		15.20 cfs	
Depth:	0.62 ft	0.92 ft	0.73 ft	1.03 ft
Top Width:	6.36 ft	7.84 ft	6.92 ft	8.40 ft
Velocity:	5.09 fps		4.07 fps	
X-Section Area:	2.99 sq ft		3.74 sq ft	
Hydraulic Radius:	0.453 ft		0.519 ft	
Froude Number:	1.31		0.97	
Roughness Coefficient:	0.0452		0.0618	

Structure #6 (Vegetated Channel)

Station 1+80 to Station 2+37 (D')

Parabolic Vegetated Channel Inputs:

Material: Grass mixture

Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
0.2	D, C	0.30			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class C w/o Freeboard	Capacity Class C w/ Freeboard
Design Discharge:	15.20 cfs		15.20 cfs	
Depth:	1.99 ft	2.29 ft	2.27 ft	2.57 ft
Top Width:	7.94 ft	8.52 ft	9.08 ft	9.67 ft
Velocity:	1.45 fps		1.11 fps	
X-Section Area:	10.52 sq ft		13.75 sq ft	
Hydraulic Radius:	1.135 ft		1.298 ft	
Froude Number:	0.22		0.16	
Roughness Coefficient:	0.0501		0.0717	

Structure #12 (Culvert)

Culvert C-18 to Station 4+95

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
255.00	4.24	0.0110	3.00	0.00	0.90

Culvert Results:

Design Discharge = 15.20 cfs

Minimum pipe diameter: 1 - 21 inch pipe(s) required

Structure #13 (Riprap Channel)

Station 4+90 to 8+38 (E')

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
4.30	2.0:1	1.5:1	4.2	0.30		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	24.17 cfs	
Depth:	0.78 ft	1.08 ft
Top Width:	7.10 ft	8.17 ft
Velocity:	5.42 fps	
X-Section Area:	4.46 sq ft	
Hydraulic Radius:	0.594 ft	
Froude Number:	1.21	
Manning's n:	0.0400	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Structure #8 (Riprap Channel)

Station 8+38 to Station 10+81 (F')

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
2.20	2.3:1	1.6:1	3.7	0.30		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	24.17 cfs	
Depth:	1.02 ft	1.32 ft
Top Width:	6.25 ft	7.44 ft
Velocity:	5.61 fps	
X-Section Area:	4.31 sq ft	
Hydraulic Radius:	0.640 ft	
Froude Number:	1.19	

	w/o Freeboard	w/ Freeboard
Manning's n:	0.0380	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Structure #9 (Riprap Channel)

Station 10+81 to Station 12+40 (G')

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
1.60	1.7:1	3.6:1	6.1	0.30		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	24.17 cfs	
Depth:	0.93 ft	1.23 ft
Top Width:	6.47 ft	8.04 ft
Velocity:	6.48 fps	
X-Section Area:	3.73 sq ft	
Hydraulic Radius:	0.548 ft	
Froude Number:	1.50	
Manning's n:	0.0380	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Structure #10 (Riprap Channel)

Station 12+40 to Station 18+95 (H')

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
1.00	0.5:1	2.7:1	3.6	0.30		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	24.17 cfs	
Depth:	1.29 ft	1.59 ft
Top Width:	5.17 ft	6.14 ft
Velocity:	6.07 fps	
X-Section Area:	3.98 sq ft	
Hydraulic Radius:	0.675 ft	
Froude Number:	1.22	
Manning's n:	0.0360	
Dmin:	2.00 in	
D50:	3.00 in	
Dmax:	4.50 in	

Structure #11 (Culvert)

Culvert C-3 to CWD-2

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
49.00	4.43	0.0150	2.50	0.00	0.90

Culvert Results:

Design Discharge = 24.17 cfs

Minimum pipe diameter: 1 - 36 inch pipe(s) required

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	69.600	3.227	3.227	0.147	80.000	M	6.68	3.176
	Σ	**69.600**						**6.46**	**3.176**
#1	1	94.100	3.227	3.227	0.147	80.000	M	9.03	4.294
	Σ	**94.100**						**8.74**	**4.294**
#14	Σ	**163.700**						**15.20**	**7.470**
#3	Σ	**163.700**						**15.20**	**7.470**
#4	Σ	**163.700**						**15.20**	**7.470**
#5	Σ	**163.700**						**15.20**	**7.470**
#6	Σ	**163.700**						**15.20**	**7.470**
#12	Σ	**163.700**						**15.20**	**7.470**
#13	1	29.550	0.133	0.133	0.242	89.000	M	25.22	2.393
	Σ	**193.250**						**24.17**	**9.863**
#8	Σ	**193.250**						**24.17**	**9.863**
#9	Σ	**193.250**						**24.17**	**9.863**
#10	Σ	**193.250**						**24.17**	**9.863**
#11	Σ	**193.250**						**24.17**	**9.863**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	8.00	660.00	8,250.00	0.710	3.227
#1	**1**	**Time of Concentration:**					**3.227**
#2	1	1. Forest with heavy ground litter	8.00	660.00	8,250.00	0.710	3.227
#2	**1**	**Time of Concentration:**					**3.227**
#13	1	1. Forest with heavy ground litter	40.29	309.00	767.00	1.600	0.133
#13	**1**	**Time of Concentration:**					**0.133**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	8.00	660.00	8,250.00	0.710	3.227
#1	**1**	**Muskingum K:**					**3.227**
#2	1	1. Forest with heavy ground litter	8.00	660.00	8,250.00	0.710	3.227
#2	**1**	**Muskingum K:**					**3.227**
#13	1	1. Forest with heavy ground litter	40.29	309.00	767.00	1.600	0.133
#13	**1**	**Muskingum K:**					**0.133**

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Ditch CWD-1B SedCAD As-Built (Stations 18+95 to 24+01)

Upstreams flows from CWD-1B to CWD-2 via Culvert C-2

Joshua Chlopek

GCC Energy
6473 CR 120
Hesperus, CO 81326

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	2 yr - 24 hr
Rainfall Depth:	2.200 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#2	==>	#3	0.000	0.000	Station 18+95 to 23+90
Culvert	#3	==>	End	0.000	0.000	Culvert C-2 to CWD-2

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	3.760	3.760	4.38	0.37
#3	0.000	3.760	4.38	0.37

Structure Detail:

Structure #2 (Erodible Channel)

Station 18+95 to 23+90

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.30	1.5:1	2.1:1	4.1	0.0300	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	4.38 cfs	
Depth:	0.35 ft	0.65 ft
Top Width:	3.58 ft	4.67 ft
Velocity:	4.23 fps	
X-Section Area:	1.04 sq ft	
Hydraulic Radius:	0.275 ft	
Froude Number:	1.39	

Structure #3 (Culvert)

Culvert C-2 to CWD-2

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
48.00	2.58	0.0150	3.00	0.00	0.90

Culvert Results:

Design Discharge = 4.38 cfs

Minimum pipe diameter: 1 - 12 inch pipe(s) required

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	3.760	0.120	0.120	0.230	89.000	M	4.66	0.374
	Σ	**3.760**						**4.38**	**0.374**
#3	Σ	**3.760**						**4.38**	**0.374**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	1. Forest with heavy ground litter	33.01	207.00	627.00	1.450	0.120
#2	**1**	**Time of Concentration:**					**0.120**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	1. Forest with heavy ground litter	32.96	207.00	628.00	1.450	0.120
#2	**1**	**Muskingum K:**					**0.120**

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CWD-1C and CWD-1D As-Built to CWD-2 via cattle guard

Joshua Chlopek

GCC Energy
6473 CR 120
Hesperus, CO 81326

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	2 yr - 24 hr
Rainfall Depth:	2.200 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.000	0.000	Cementary Basin Flows in to CWD-1c
Channel	#2	==>	#3	0.000	0.000	CWD-1C to Cattle Guard
Channel	#3	==>	End	0.000	0.000	Cattle Guard to CWD-2 Station 31+12
Channel	#4	==>	#3	0.000	0.000	CWD-1D to Cattle Guard

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	0.450	0.450	0.33	0.02
#1	4.900	4.900	3.23	0.28
#2	0.000	4.900	3.23	0.28
#3	0.000	5.350	3.37	0.30

Structure Detail:

Structure #4 (Erodible Channel)

CWD-1D to Cattle Guard

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.70	1.3:1	1.6:1	13.4	0.0300	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	0.33 cfs	
Depth:	0.05 ft	0.35 ft
Top Width:	2.85 ft	3.74 ft
Velocity:	2.43 fps	
X-Section Area:	0.14 sq ft	
Hydraulic Radius:	0.049 ft	
Froude Number:	1.93	

Structure #1 (Null)

Cementary Basin Flows in to CWD-1c

Structure #2 (Erodible Channel)

CWD-1C to Cattle Guard

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
2.70	1.3:1	2.7:1	4.3	0.0300	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.23 cfs	
Depth:	0.27 ft	0.57 ft

	w/o Freeboard	w/ Freeboard
Top Width:	3.77 ft	4.98 ft
Velocity:	3.74 fps	
X-Section Area:	0.86 sq ft	
Hydraulic Radius:	0.221 ft	
Froude Number:	1.38	

Structure #3 (Nonerodible Channel)

Cattle Guard to CWD-2 Station 31+12

Trapezoidal Nonerodible Channel Inputs:

Material: Metal, Smooth (Flume)

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.50	1.0:1	1.0:1	0.5	0.0130	0.30		

Nonerodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	3.37 cfs	
Depth:	0.19 ft	0.49 ft
Top Width:	6.89 ft	7.49 ft
Velocity:	2.61 fps	
X-Section Area:	1.29 sq ft	
Hydraulic Radius:	0.183 ft	
Froude Number:	1.06	

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#4	1	0.450	0.061	0.061	0.182	80.000	M	0.35	0.022
	Σ	**0.450**						**0.33**	**0.022**
#1	1	4.900	0.099	0.197	0.210	80.000	M	3.84	0.281
	Σ	**4.900**						**3.23**	**0.281**
#2	Σ	**4.900**						**3.23**	**0.281**
#3	Σ	**5.350**						**3.37**	**0.302**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	2. Minimum tillage cultivation	24.00	210.00	875.00	2.440	0.099
#1	**1**	**Time of Concentration:**					**0.099**
#4	1	1. Forest with heavy ground litter	14.88	32.00	215.00	0.970	0.061
#4	**1**	**Time of Concentration:**					**0.061**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	24.00	210.00	875.00	1.230	0.197
#1	**1**	**Muskingum K:**					**0.197**
#4	1	1. Forest with heavy ground litter	14.88	32.00	215.00	0.970	0.061
#4	**1**	**Muskingum K:**					**0.061**

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CWD-2 (East Clearwater Ditch) from Stations 0+00 to 31+87 (A'-N") including Culvert C-1

This Drainage System includes updated drainage basin for CWD-2, updated flows from CWD-1(A-D) and Pond.

Joshua Chlopek

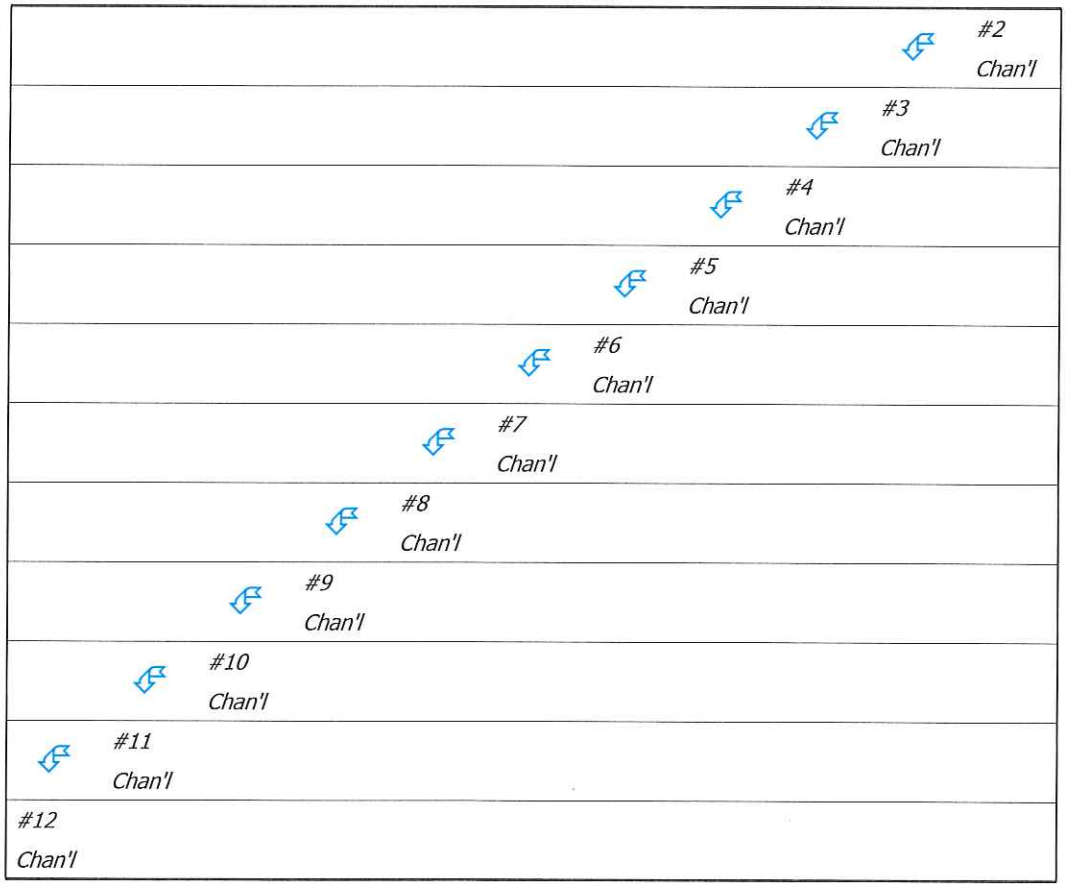
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	2.200 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#2	==>	#3	0.000	0.000	Station 0+00 to 0+05 (A')
Channel	#3	==>	#4	0.000	0.000	Station 0+05 to 0+70 (B')
Channel	#4	==>	#5	0.000	0.000	Station 0+70 to 1+60 (C')
Channel	#5	==>	#6	0.000	0.000	Station 1+60 to 4+70 (D')
Channel	#6	==>	#7	0.000	0.000	Station 4+70 to 6+12 (E')
Channel	#7	==>	#8	0.000	0.000	Station 6+12 to 7+90 (F')
Channel	#8	==>	#9	0.000	0.000	Station 7+90 to 11+95 (G')
Channel	#9	==>	#10	0.000	0.000	Station 11+95 to 14+56 (H')
Channel	#10	==>	#11	0.000	0.000	Station 14+56 to 18+00 (I')
Channel	#11	==>	#12	0.000	0.000	Station 18+00 to 20+84 (J')
Channel	#12	==>	End	0.000	0.000	Station 20+84 to 22+20 (K')



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#2	5.230	5.230	2.38	0.24
#3	0.000	5.230	2.38	0.24
#4	0.000	5.230	2.38	0.24
#5	0.000	5.230	2.38	0.24
#6	1,008.280	1,013.510	35.76	27.99
#7	0.000	1,013.510	35.76	27.99
#8	0.000	1,013.510	35.76	27.99
#9	0.000	1,013.510	35.76	27.99
#10	0.000	1,013.510	35.76	27.99
#11	0.000	1,013.510	35.76	27.99
#12	0.000	1,013.510	35.76	27.99

Structure Detail:

Structure #2 (Erodible Channel)

Station 0+00 to 0+05 (A')

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.80	2.3:1	1.8:1	19.1	0.0300	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.38 cfs	
Depth:	0.12 ft	0.42 ft
Top Width:	4.27 ft	5.48 ft
Velocity:	4.98 fps	
X-Section Area:	0.48 sq ft	
Hydraulic Radius:	0.110 ft	
Froude Number:	2.63	

Structure #3 (Erodible Channel)

Station 0+05 to 0+70 (B')

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
5.79	2.0:1	3.1:1	17.7	0.0300	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.38 cfs	
Depth:	0.09 ft	0.39 ft
Top Width:	6.27 ft	7.81 ft
Velocity:	4.19 fps	
X-Section Area:	0.57 sq ft	

	w/o Freeboard	w/ Freeboard
Hydraulic Radius:	0.090 ft	
Froude Number:	2.46	

Structure #4 (Erodible Channel)

Station 0+70 to 1+60 (C')

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.91	2.6:1	3.7:1	6.2	0.0300	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.38 cfs	
Depth:	0.16 ft	0.46 ft
Top Width:	4.92 ft	6.81 ft
Velocity:	3.37 fps	
X-Section Area:	0.71 sq ft	
Hydraulic Radius:	0.142 ft	
Froude Number:	1.57	

Structure #5 (Erodible Channel)

Station 1+60 to 4+70 (D')

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
4.79	1.7:1	2.2:1	1.7	0.0300	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	2.38 cfs	
Depth:	0.21 ft	0.51 ft
Top Width:	5.62 ft	6.78 ft
Velocity:	2.15 fps	

	w/o Freeboard	w/ Freeboard
X-Section Area:	1.11 sq ft	
Hydraulic Radius:	0.193 ft	
Froude Number:	0.85	

Structure #6 (Erodible Channel)

Station 4+70 to 6+12 (E')

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.11	1.6:1	1.8:1	0.6	0.0300	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	35.76 cfs	
Depth:	1.59 ft	1.89 ft
Top Width:	8.45 ft	9.46 ft
Velocity:	3.88 fps	
X-Section Area:	9.22 sq ft	
Hydraulic Radius:	0.988 ft	
Froude Number:	0.65	

Structure #7 (Erodible Channel)

Station 6+12 to 7+90 (F')

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
7.23	2.0:1	2.0:1	0.9	0.0300	0.30			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	35.76 cfs	
Depth:	0.99 ft	1.29 ft
Top Width:	11.26 ft	12.48 ft

	w/o Freeboard	w/ Freeboard
Velocity:	3.89 fps	
X-Section Area:	9.19 sq ft	
Hydraulic Radius:	0.784 ft	
Froude Number:	0.76	

Structure #8 (Vegetated Channel)

Station 7+90 to 11+95 (G')

Trapezoidal Vegetated Channel Inputs:

Material: Bermuda grass

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
7.62	2.3:1	5.1:1	3.0	D, B	0.30			8.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	35.76 cfs		35.76 cfs	
Depth:	0.79 ft	1.09 ft	1.26 ft	1.56 ft
Top Width:	13.51 ft	15.74 ft	16.94 ft	19.17 ft
Velocity:	4.26 fps		2.32 fps	
X-Section Area:	8.39 sq ft		15.42 sq ft	
Hydraulic Radius:	0.611 ft		0.893 ft	
Froude Number:	0.95		0.43	
Roughness Coefficient:	0.0435		0.1031	

Structure #9 (Vegetated Channel)

Station 11+95 to 14+56 (H')

Trapezoidal Vegetated Channel Inputs:

Material: Grass mixture

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
5.34	2.8:1	1.8:1	1.8	D, B	0.30			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	35.76 cfs		35.76 cfs	
Depth:	1.09 ft	1.39 ft	1.66 ft	1.96 ft
Top Width:	10.40 ft	11.80 ft	13.09 ft	14.49 ft
Velocity:	4.18 fps		2.33 fps	
X-Section Area:	8.55 sq ft		15.34 sq ft	
Hydraulic Radius:	0.788 ft		1.113 ft	
Froude Number:	0.81		0.38	
Roughness Coefficient:	0.0405		0.0915	

Structure #10 (Vegetated Channel)

Station 14+56 to 18+00 (I')

Trapezoidal Vegetated Channel Inputs:

Material: Grass mixture

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
5.84	2.9:1	2.3:1	2.6	D, B	0.30			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	35.76 cfs		35.76 cfs	
Depth:	0.93 ft	1.23 ft	1.44 ft	1.74 ft
Top Width:	10.75 ft	12.32 ft	13.39 ft	14.97 ft
Velocity:	4.61 fps		2.58 fps	
X-Section Area:	7.76 sq ft		13.84 sq ft	
Hydraulic Radius:	0.699 ft		0.994 ft	
Froude Number:	0.96		0.45	
Roughness Coefficient:	0.0408		0.0920	

Structure #11 (Vegetated Channel)

Station 18+00 to 20+84 (J')

Trapezoidal Vegetated Channel Inputs:

Material: Grass mixture

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
6.18	1.7:1	2.9:1	2.9	C, B	0.30			5.0

Vegetated Channel Results:

	Stability Class C w/o Freeboard	Stability Class C w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	35.76 cfs		35.76 cfs	
Depth:	1.03 ft	1.33 ft	1.37 ft	1.67 ft
Top Width:	10.93 ft	12.31 ft	12.46 ft	13.84 ft
Velocity:	4.04 fps		2.80 fps	
X-Section Area:	8.85 sq ft		12.76 sq ft	
Hydraulic Radius:	0.779 ft		0.979 ft	
Froude Number:	0.79		0.49	
Roughness Coefficient:	0.0530		0.0889	

Structure #12 (Vegetated Channel)

Station 20+84 to 22+20 (K')

Trapezoidal Vegetated Channel Inputs:

Material: Grass mixture

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Retardance Classes	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
3.94	2.5:1	22.1:1	3.1	D, B	0.30			5.0

Vegetated Channel Results:

	Stability Class D w/o Freeboard	Stability Class D w/ Freeboard	Capacity Class B w/o Freeboard	Capacity Class B w/ Freeboard
Design Discharge:	35.76 cfs		35.76 cfs	
Depth:	0.82 ft	1.12 ft	1.30 ft	1.60 ft
Top Width:	24.24 ft	31.64 ft	35.95 ft	43.34 ft
Velocity:	3.08 fps		1.38 fps	
X-Section Area:	11.61 sq ft		25.91 sq ft	
Hydraulic Radius:	0.478 ft		0.719 ft	
Froude Number:	0.78		0.29	
Roughness Coefficient:	0.0518		0.1518	

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#2	1	5.230	0.155	0.155	0.242	80.000	M	2.57	0.244
	Σ	**5.230**						**2.38**	**0.244**
#3	Σ	**5.230**						**2.38**	**0.244**
#4	Σ	**5.230**						**2.38**	**0.244**
#5	Σ	**5.230**						**2.38**	**0.244**
#6	1	993.250	5.241	5.241	0.143	73.000	M	35.98	27.226
	2	15.030	0.099	0.099	0.246	73.000	M	7.23	0.517
	Σ	**1,013.510**						**35.76**	**27.987**
#7	Σ	**1,013.510**						**35.76**	**27.987**
#8	Σ	**1,013.510**						**35.76**	**27.987**
#9	Σ	**1,013.510**						**35.76**	**27.987**
#10	Σ	**1,013.510**						**35.76**	**27.987**
#11	Σ	**1,013.510**						**35.76**	**27.987**
#12	Σ	**1,013.510**						**35.76**	**27.987**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	1. Forest with heavy ground litter	39.78	354.00	890.00	1.590	0.155
#2	**1**	**Time of Concentration:**					**0.155**
#6	1	1. Forest with heavy ground litter	7.40	950.00	12,830.03	0.680	5.241
#6	**1**	**Time of Concentration:**					**5.241**
#6	2	1. Forest with heavy ground litter	42.37	250.00	590.00	1.640	0.099
#6	**2**	**Time of Concentration:**					**0.099**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	1. Forest with heavy ground litter	39.78	354.00	890.00	1.590	0.155
#2	**1**	**Muskingum K:**					**0.155**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	1	1. Forest with heavy ground litter	7.40	950.00	12,830.00	0.680	5.241
#6	**1**	**Muskingum K:**					**5.241**
#6	2	1. Forest with heavy ground litter	42.37	250.00	590.00	1.640	0.099
#6	**2**	**Muskingum K:**					**0.099**

Structure Detail:

Structure #37 (Pond)

Pond 1 Flows to Outlet

Pond Inputs:

Initial Pool Elev:	7,232.73 ft
Initial Pool:	3.52 ac-ft

Drop Inlet

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)
24.00	7.17	24.00	119.00	2.12	0.0110	7,233.64

Drop Inlet

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)
24.00	6.56	24.00	119.00	2.12	0.0110	7,232.73

Pond Results:

Peak Elevation:	7,233.43 ft
Dewater Time:	0.70 days

Dewatering time is calculated from peak stage to lowest spillway

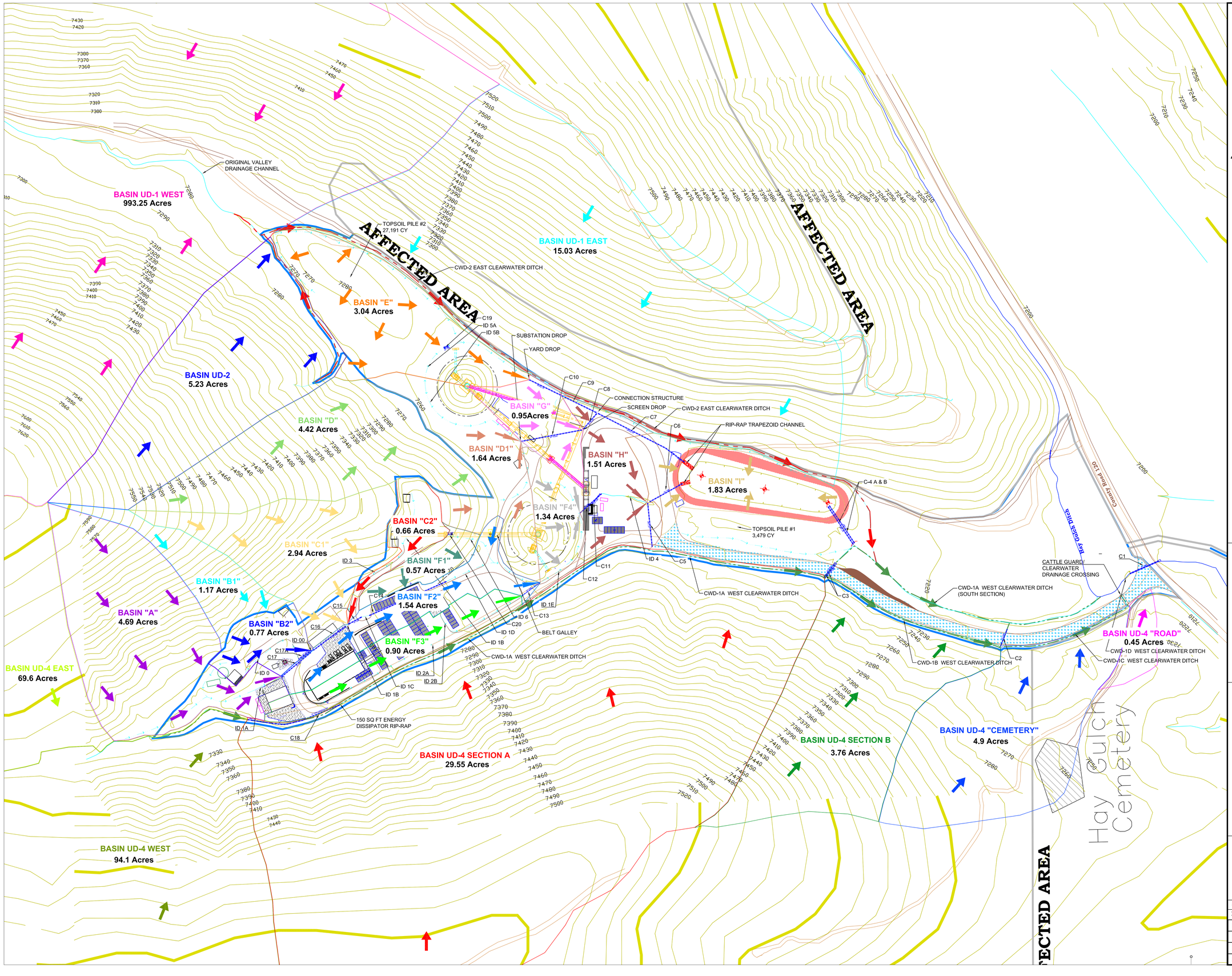
Elevation-Capacity-Discharge Table

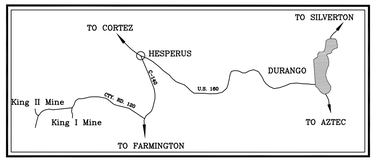
Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
7,226.17	0.025	0.000	0.000	
7,226.67	0.092	0.028	0.000	
7,227.17	0.201	0.099	0.000	
7,227.67	0.295	0.222	0.000	
7,228.17	0.407	0.397	0.000	
7,228.67	0.499	0.623	0.000	
7,229.17	0.599	0.898	0.000	
7,229.67	0.644	1.208	0.000	
7,230.17	0.690	1.541	0.000	
7,230.67	0.721	1.894	0.000	
7,231.17	0.753	2.263	0.000	
7,231.67	0.787	2.648	0.000	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
7,232.17	0.822	3.050	0.000		
7,232.67	0.860	3.471	0.000		
7,232.73	0.865	3.523	0.000		Spillway #2
7,233.00	0.886	3.759	2.733	14.95	
7,233.17	0.899	3.911	5.684	1.05	
7,233.43	0.909	4.145	10.477	0.90	Peak Stage
7,233.64	0.920	4.338	14.431		Spillway #1
7,233.67	0.921	4.366	14.766		
7,233.80	0.927	4.486	16.889		

Detailed Discharge Table

Elevation (ft)	Drop Inlet (cfs)	Drop Inlet (cfs)	Combined Total Discharge (cfs)
7,226.17	0.000	0.000	0.000
7,226.67	0.000	0.000	0.000
7,227.17	0.000	0.000	0.000
7,227.67	0.000	0.000	0.000
7,228.17	0.000	0.000	0.000
7,228.67	0.000	0.000	0.000
7,229.17	0.000	0.000	0.000
7,229.67	0.000	0.000	0.000
7,230.17	0.000	0.000	0.000
7,230.67	0.000	0.000	0.000
7,231.17	0.000	0.000	0.000
7,231.67	0.000	0.000	0.000
7,232.17	0.000	0.000	0.000
7,232.67	0.000	0.000	0.000
7,232.73	0.000	0.000	0.000
7,233.00	0.000	2.733	2.733
7,233.17	0.000	5.684	5.684
7,233.64	0.000	14.431	14.431
7,233.67	0.100	14.665	14.766
7,233.80	1.243	15.646	16.889





LEGEND

AREAL EXTENT OF SURFACE DISTURBANCE

TOTAL AREA OF DISTURBANCE = 25.50 ACRES

- SMALL AREA EXEMPTION #1
- SITE DRAINAGE
- CLEARWATER WEST
- CLEARWATER EAST
- CULVERT
- C-16 — CULVERT ID
- ID-2B — INTERNAL DITCH ID
- BASIN FLOWS
- NATURAL STREAM (EPHEMERAL)

REVISIONS

DATE	DESCRIPTION
06/30/15	Technical Revision No. 25 - Surface Hydrology As-Built Update
10/21/15	Technical Revision No. 25 - Adequacy Review #1 Response

0' 100' 200' 300'

Scale: 1" = 100'
Contour Interval = 2'

PRELIMINARY

I, _____, a professional engineer, certify that the information on this map is correct to the best of my knowledge and belief.

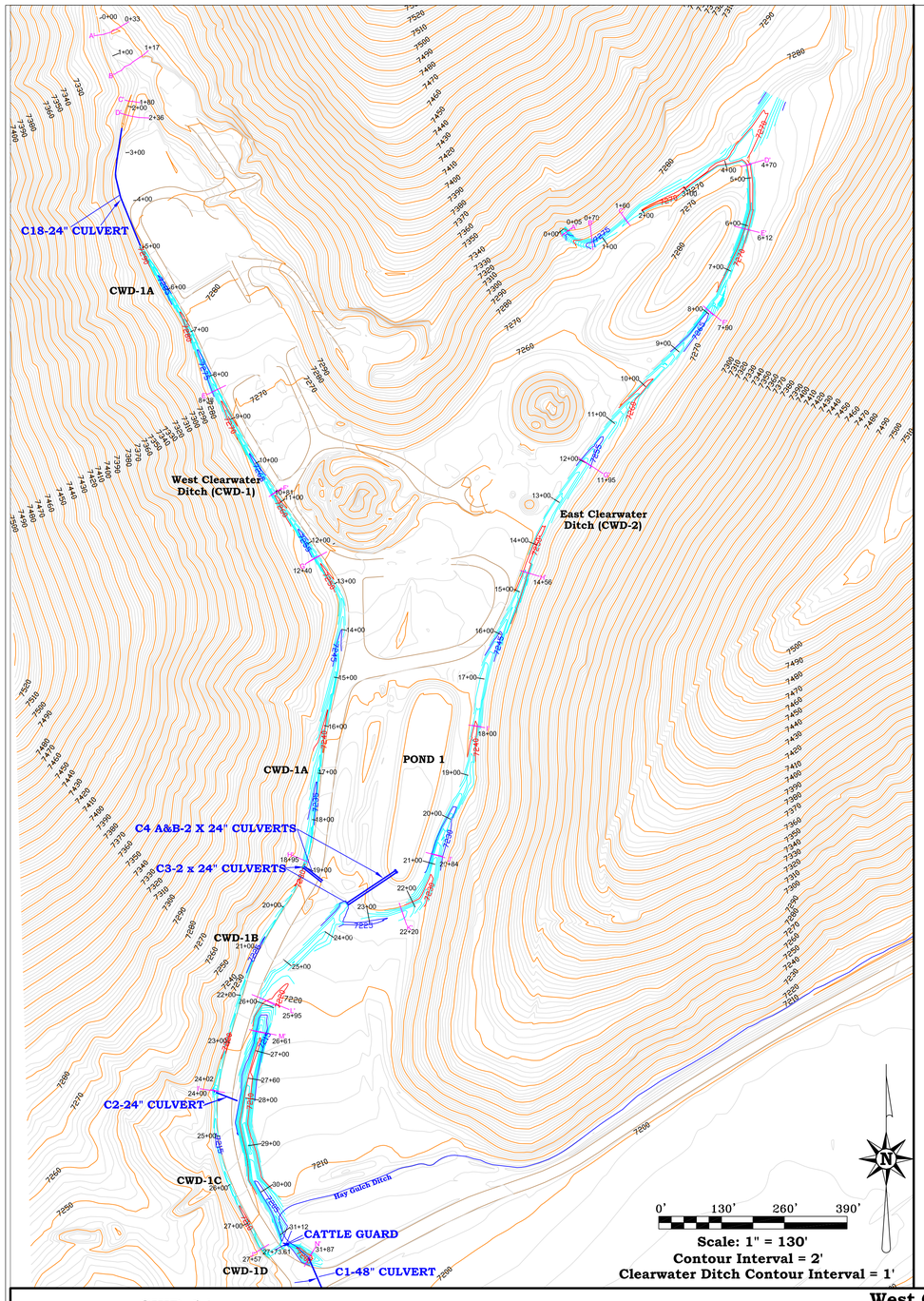
GCC Energy

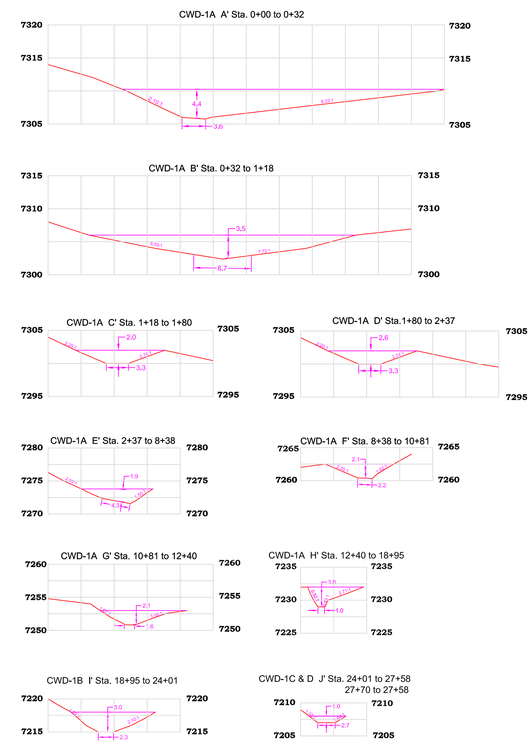
GCC Energy, LLC
6473 County Road 120
Hesperus, CO 81326
Colorado Mining Permit C-1981-035

King II-007A

Site Watershed Basins
Site Culvert Locations
Site Drainage Ditch Locations

Scale:	1" = 100'	Designed By:	Tom Bird
Date:	12/01/15	Drawn By:	Tom Bird
File Path:	Environmental\King II\Permit Maps		
File Name:	King II-007A Basins-Culverts-Ditches		
Plot Date:	12/01/15		
Plot Time:	3:55 pm		

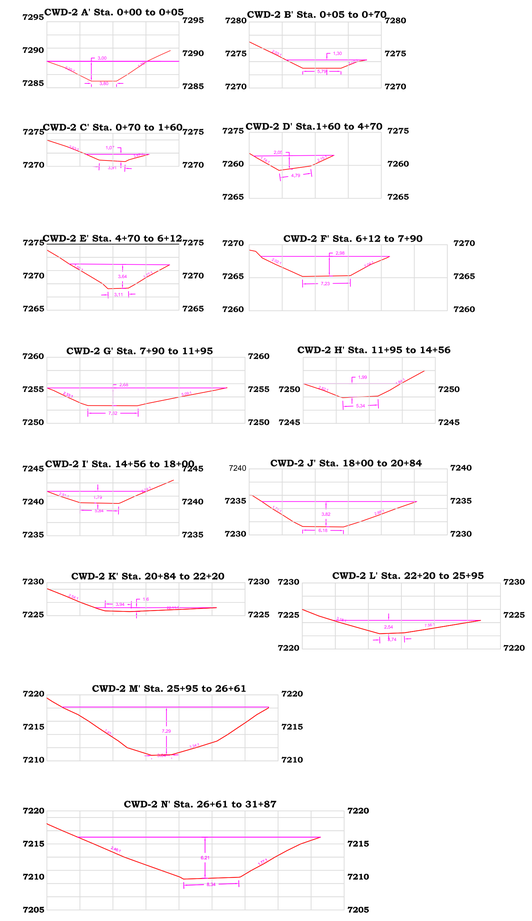




West Clearwater Ditch (CWD-1)

0' 10' 20' 30'

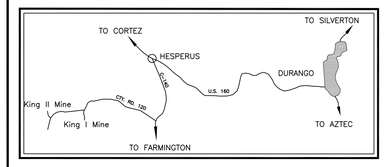
Scale: 1" = 10'



East Clearwater Ditch (CWD-2)

0' 10' 20' 30'

Scale: 1" = 10'



LEGEND

- 18" CMP — CULVERT
- CLEARWATER DITCH TOPO 1'
- CLEARWATER DITCH TOPO 5'
- CLEARWATER DITCH TOPO 10'

REVISIONS	
DATE	DESCRIPTION
06/30/15	Technical Revision No. 25 - Surface Hydrology As-Built Update
10/21/15	Technical Revision No. 25 - Adequacy Review #1 Response

PRELIMINARY

I, _____, a professional engineer, certify that the information on this map is correct to the best of my knowledge and belief.

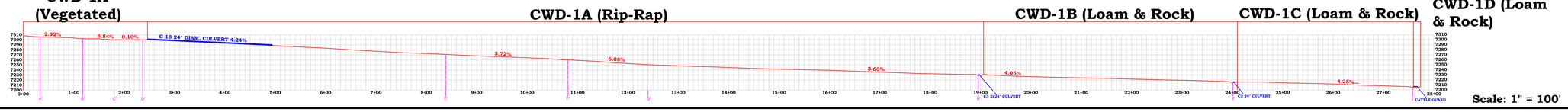
GCC Energy, LLC
6473 County Road 120
Hesperus, CO 81326
Colorado Mining Permit C-1981-035

King II-007B

Clearwater Ditch Details (As-Built)

Scale:	As Shown	Designed By:	J. McCourt
Date:	12/03/15	Drawn By:	J. McCourt
File Path:	Environmental\King II\Permit Maps		
File Name:	King II-007B Clearwater Ditches		
Plot Date:	12/03/15		
Plot Time:	3:55 pm		

West Clearwater Ditch (CWD-1 A-D)

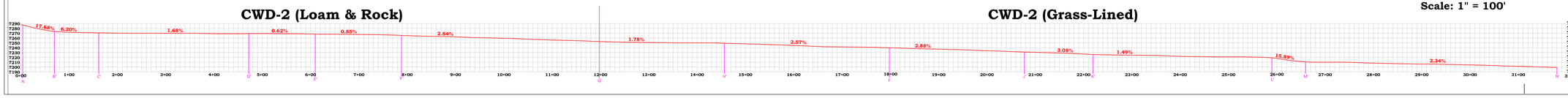


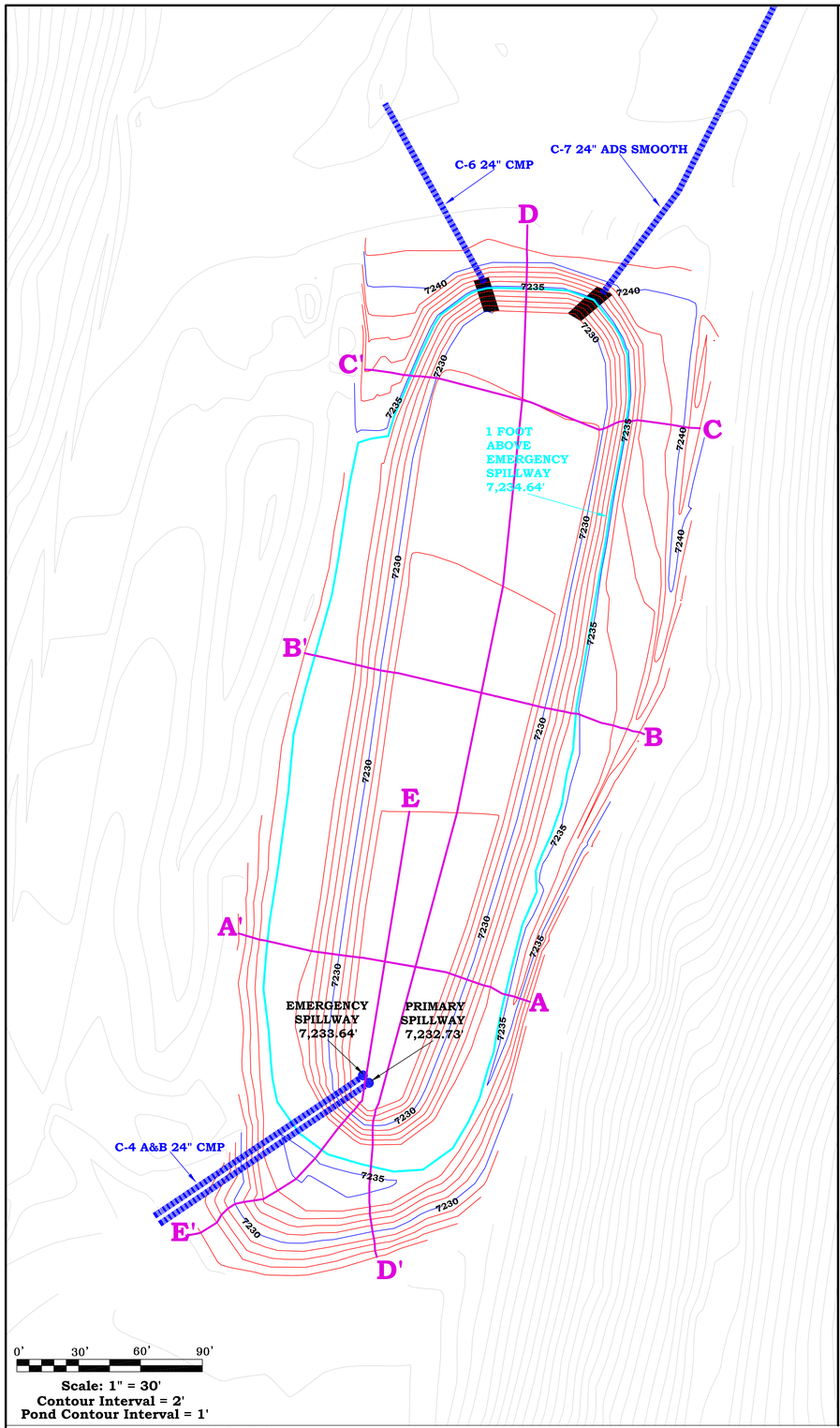
Scale: 1" = 100'

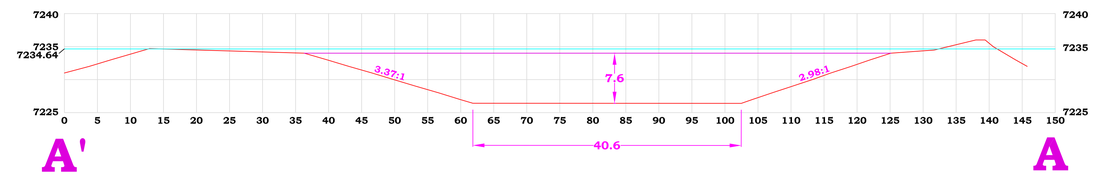
East Clearwater Ditch (CWD-2)

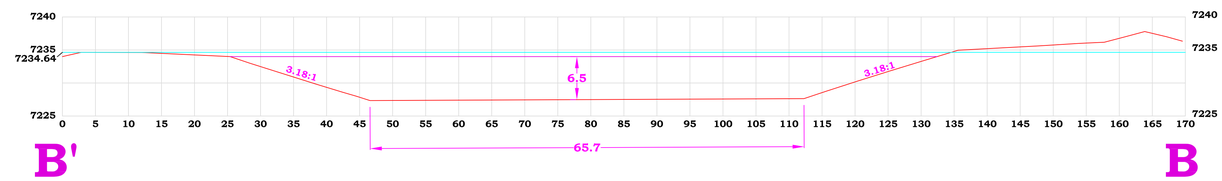
0' 100' 200' 300'

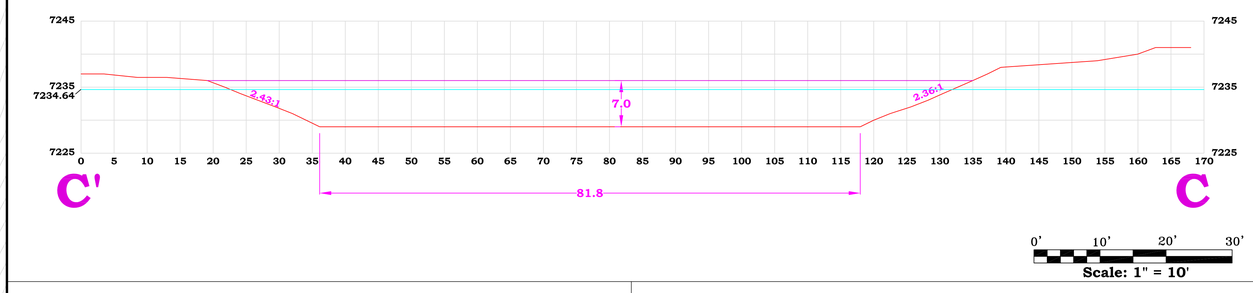
Scale: 1" = 100'

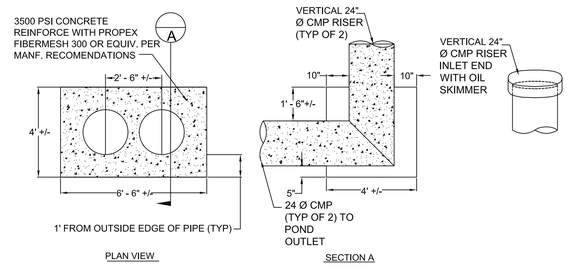


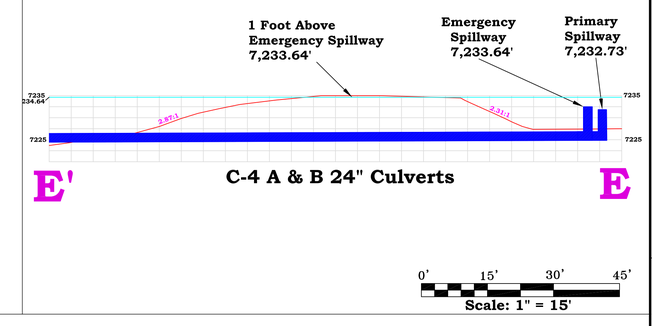


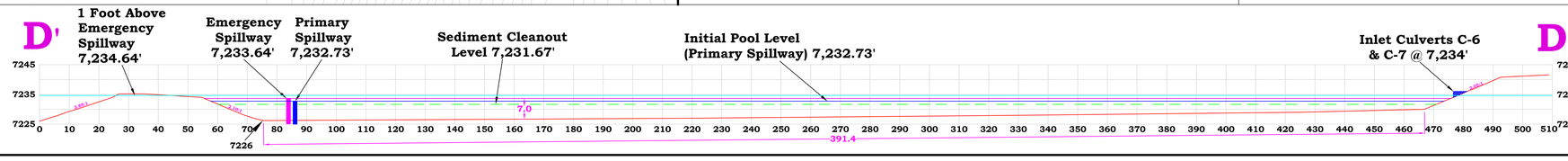


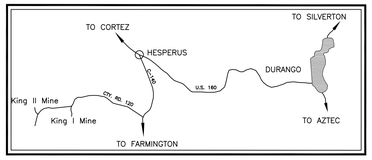






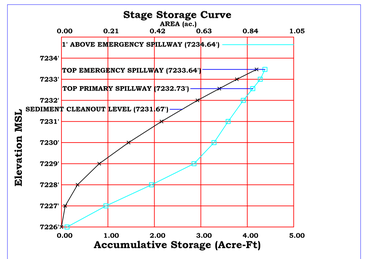






REVISIONS

DATE	DESCRIPTION
06/30/15	Technical Revision No. 25 - Surface Hydrology As-Built Update
12/07/15	Technical Revision No. 25 - Adequacy Review #1 Response



STORAGE VALUE COMPUTATIONS
Sediment Control Structure No. 1

ELEV. (ft)	Width (ft)	LENGTH (ft)	AREA (ac)	AVG. AREA (ac)	INTERVAL (ft)	STORAGE (ac-ft)	ACC. STORAGE (ac-ft)	STAGE INTERVAL (ft)
7226.17	N/A	N/A	0.0253					
7227.17	N/A	N/A	0.2010	0.1131	1.00	0.0800	0.0800	1.00
7228.17	N/A	N/A	0.4073	0.3042	1.00	0.2656	0.3457	2.00
7229.17	N/A	N/A	0.5992	0.5032	1.00	0.4670	0.8127	3.00
7230.17	N/A	N/A	0.6897	0.6444	1.00	0.6321	1.4448	4.00
7231.17	N/A	N/A	0.7535	0.7216	1.00	0.7097	2.1545	5.00
7232.17	N/A	N/A	0.8221	0.7878	1.00	0.7741	2.9286	6.00
7232.73	N/A	N/A	0.8648	0.8435	0.56	0.4697	3.3983	6.56
7233.17	N/A	N/A	0.8988	0.8605	0.44	0.3773	3.7756	7.00
7233.64	N/A	N/A	0.9200	0.9094	0.47	0.4246	4.2002	7.47
7233.80	N/A	N/A	0.9272	0.9130	0.16	0.1419	4.3421	7.63

Primary Spillway: 10.477 cfs @ 7232.73
Secondary Spillway: 16.891 cfs @ 7233.64

PRELIMINARY

I, _____, a professional engineer, certify that the information on this map is correct to the best of my knowledge and belief.

GCC Energy, LLC
6473 County Road 120
Hesperus, CO 81326
Colorado Mining Permit C-1981-035

King II-007C

Pond Details (As-Built)

Scale:	As Shown	Designed By:	J. McCourt
Date:	12/07/15	Drawn By:	J. McCourt
File Path:	Environmental\King II\Permit Maps		
File Name:	King II-007C Pond Details As-Built		
Plot Date:	12/07/15		
Plot Time:	3:55 pm		