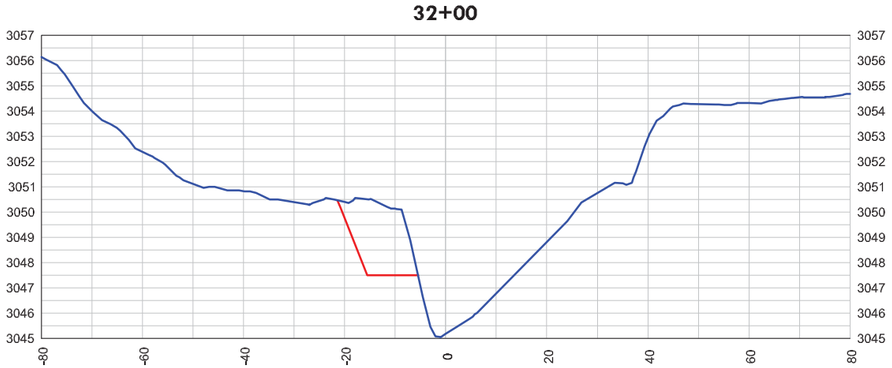

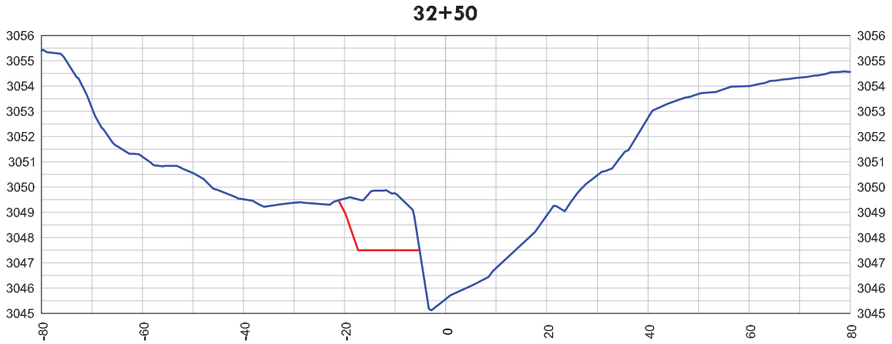

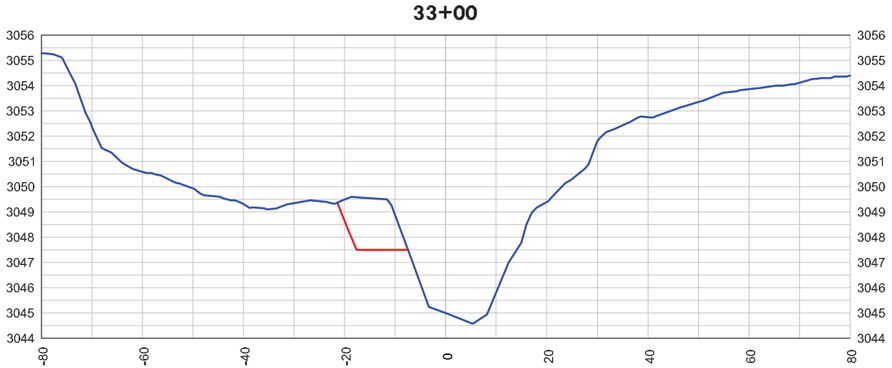

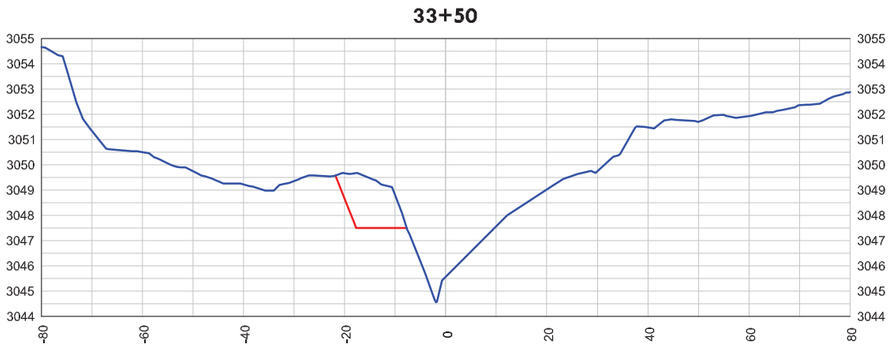

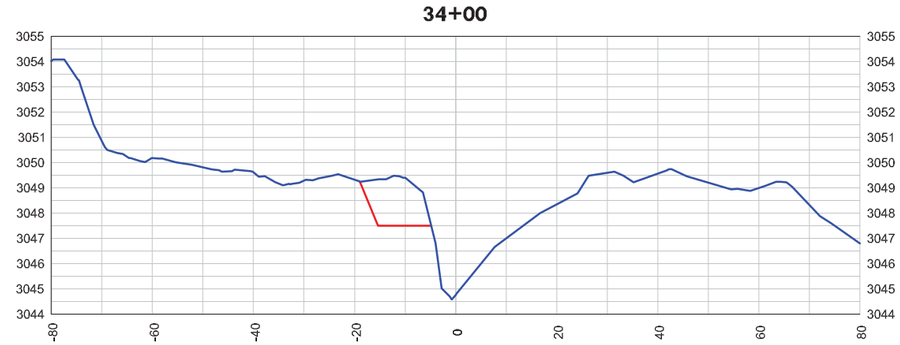

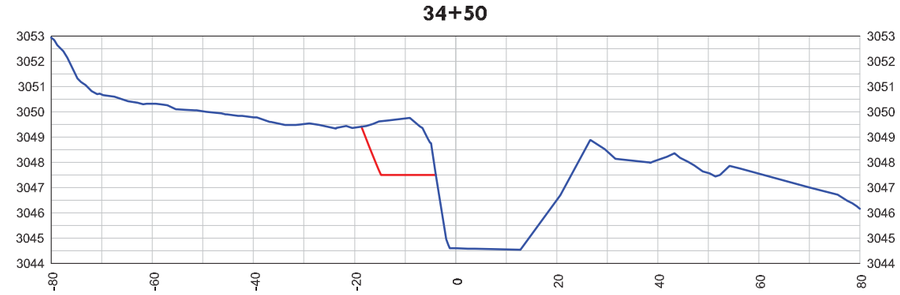

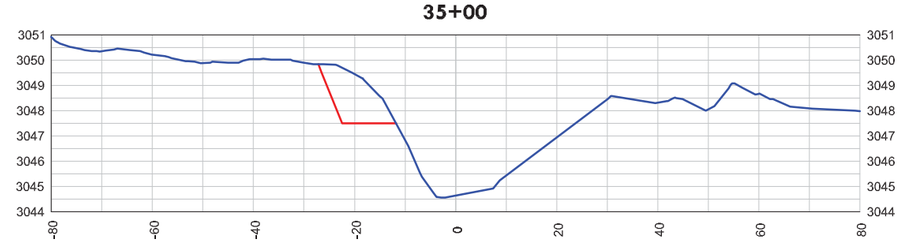

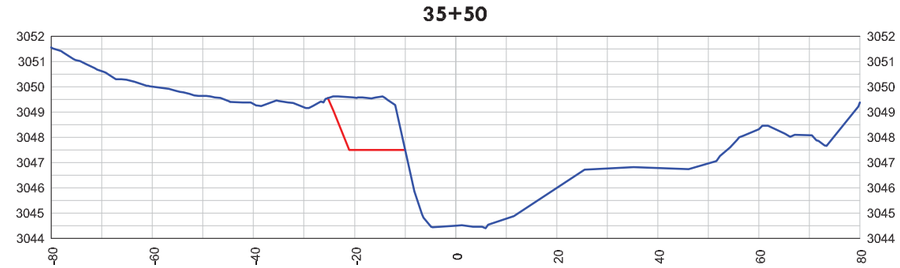

CROSS SECTION

0' 15' 30'

7' 3.5' 0'

LEGEND

EXISTING CROSS SECTIONS

PROPOSED FLOODPLAIN SURFACE

RIVER DESIGN GROUP, INC.

5098 Hwy 93 South
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tel.541.738.2920
fax.541.758.8524

CROSS SECTIONS - SITE 1

HASKILL CREEK
Reimer Bank Stabelization Project
Whitefish, Montana

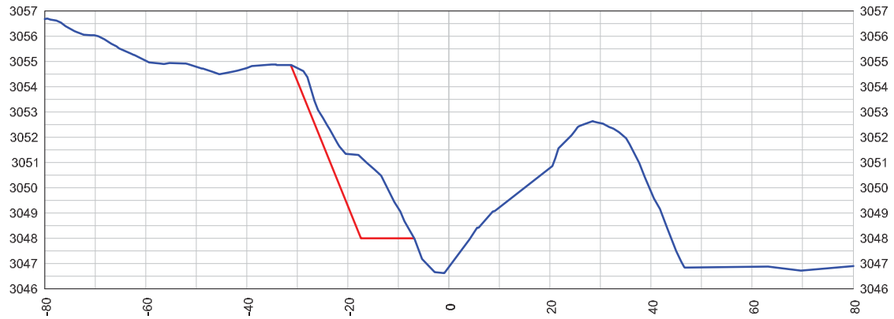
NO.	DATE	BY	DESCRIPTION	CHK
1	8-25-10	AB	CROSS-SECTIONS	JM

PROJECT NUMBER
RDG-10-042

SHEET NUMBER

XS-1

28+50



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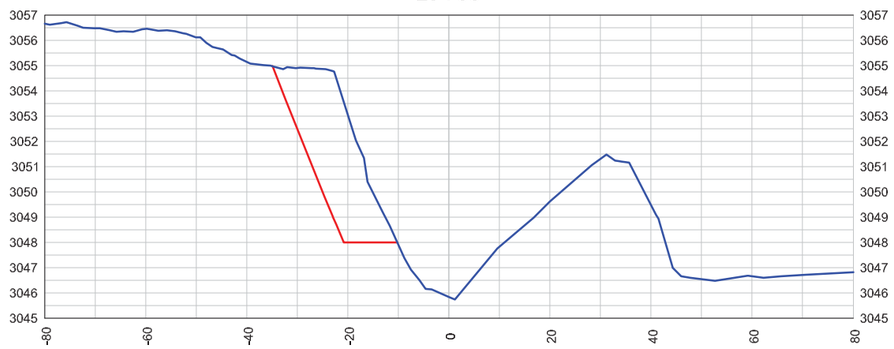

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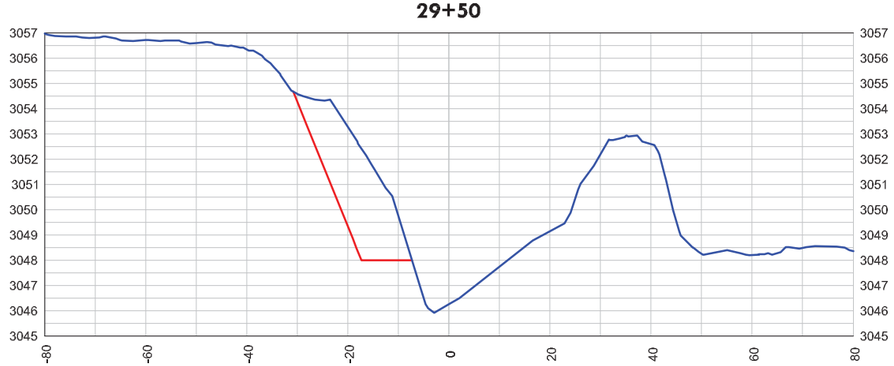

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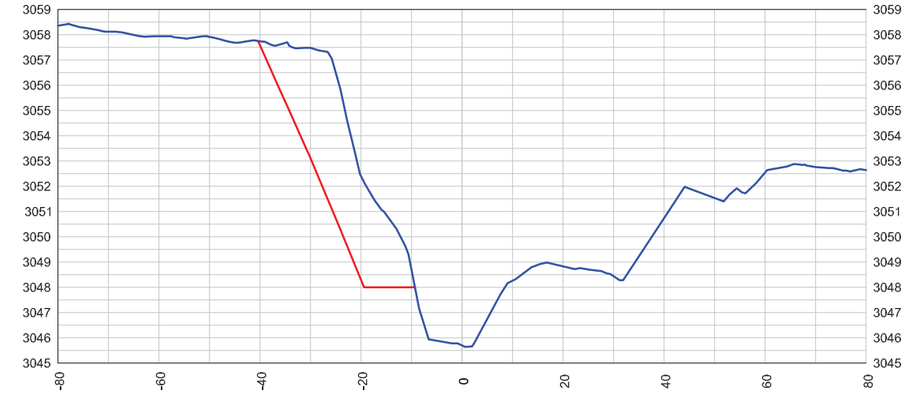

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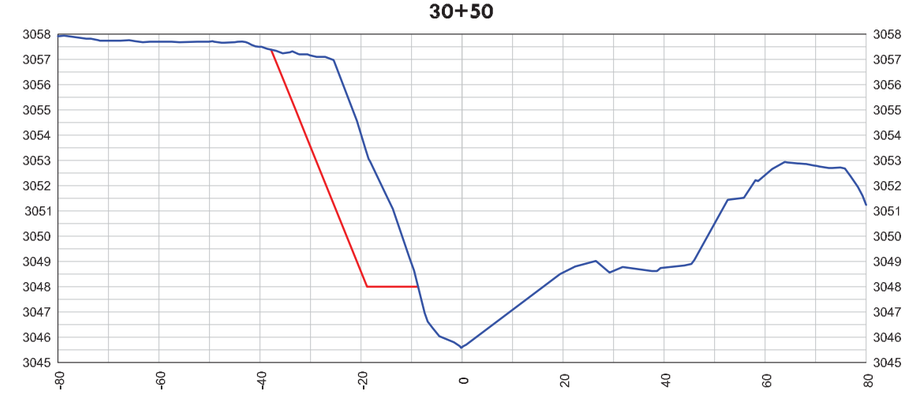

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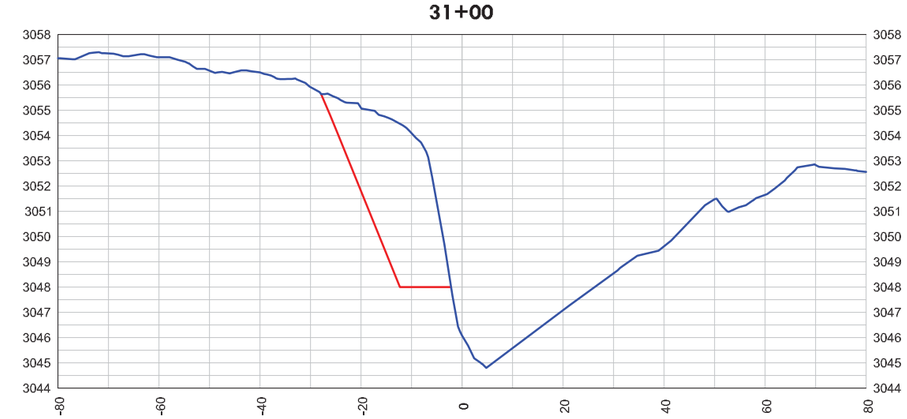

CROSS SECTION

0' 15' 30'

0' 3.5' 7'

LEGEND

EXISTING CROSS SECTIONS

PROPOSED FLOODPLAIN SURFACE

RIVER DESIGN GROUP, INC.

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CROSS SECTIONS - SITE 2

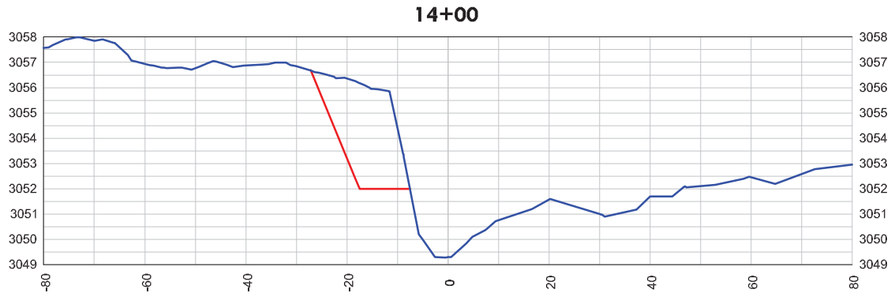
HASKILL CREEK
Reimer Bank Stabelization Project
Whitefish, Montana

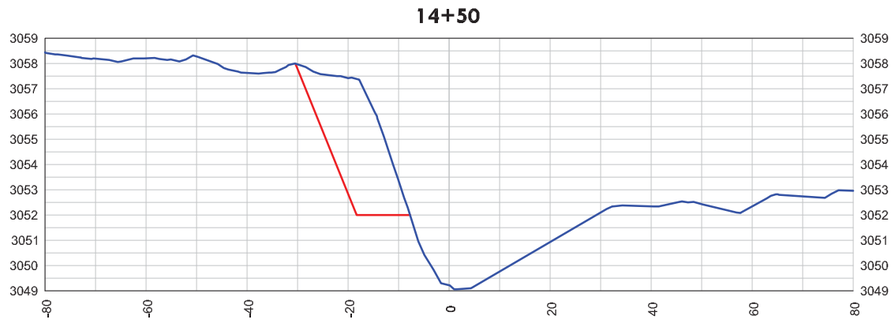
NO.	DATE	BY	DESCRIPTION	CHK
1	8-25-10	AB	CROSS-SECTIONS	JM

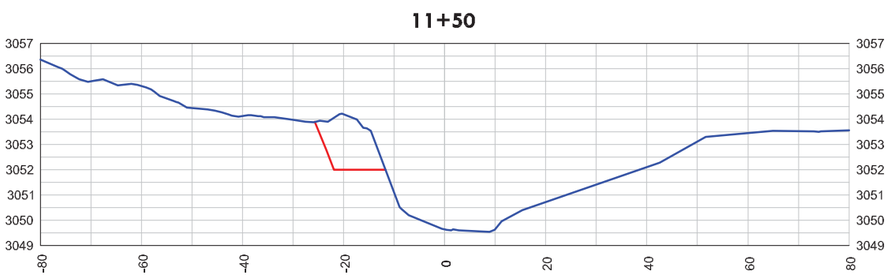
PROJECT NUMBER
RDG-10-042

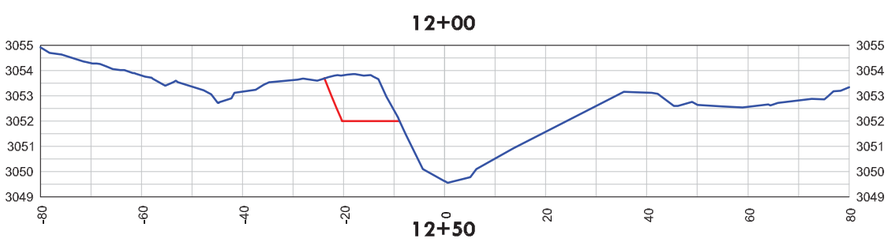
SHEET NUMBER

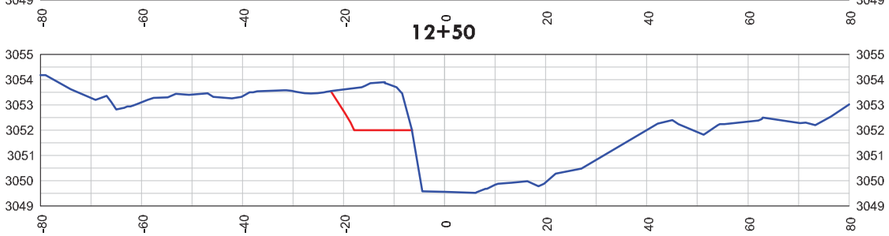
XS-2

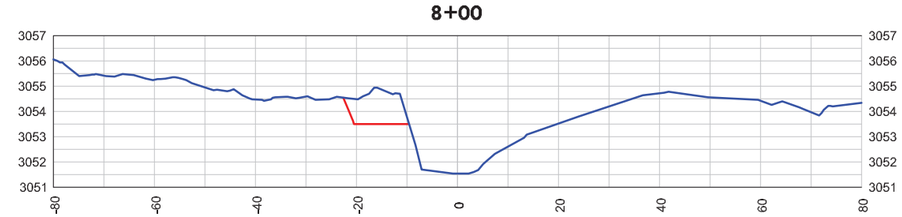


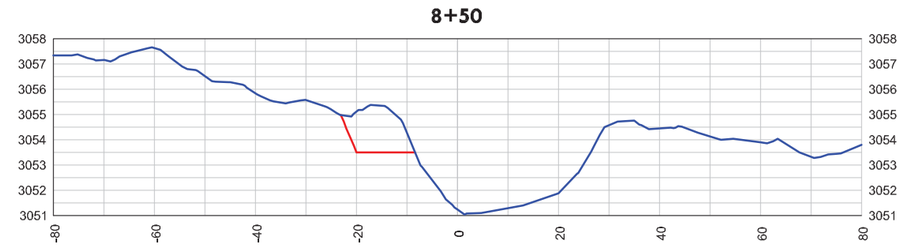


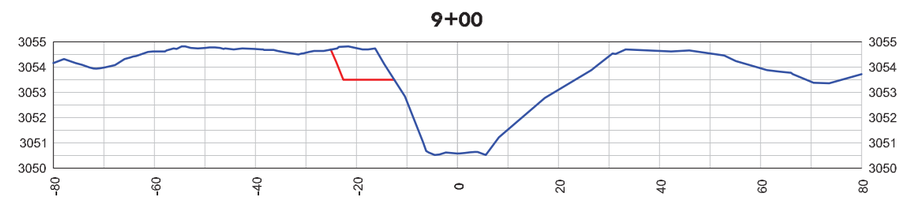


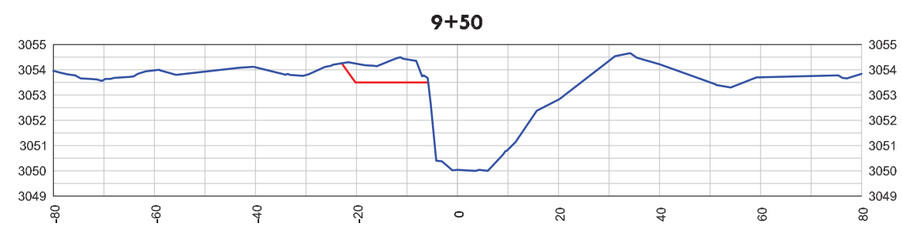


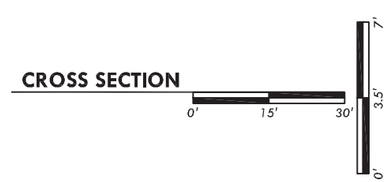












LEGEND

EXISTING CROSS SECTIONS

PROPOSED FLOODPLAIN SURFACE

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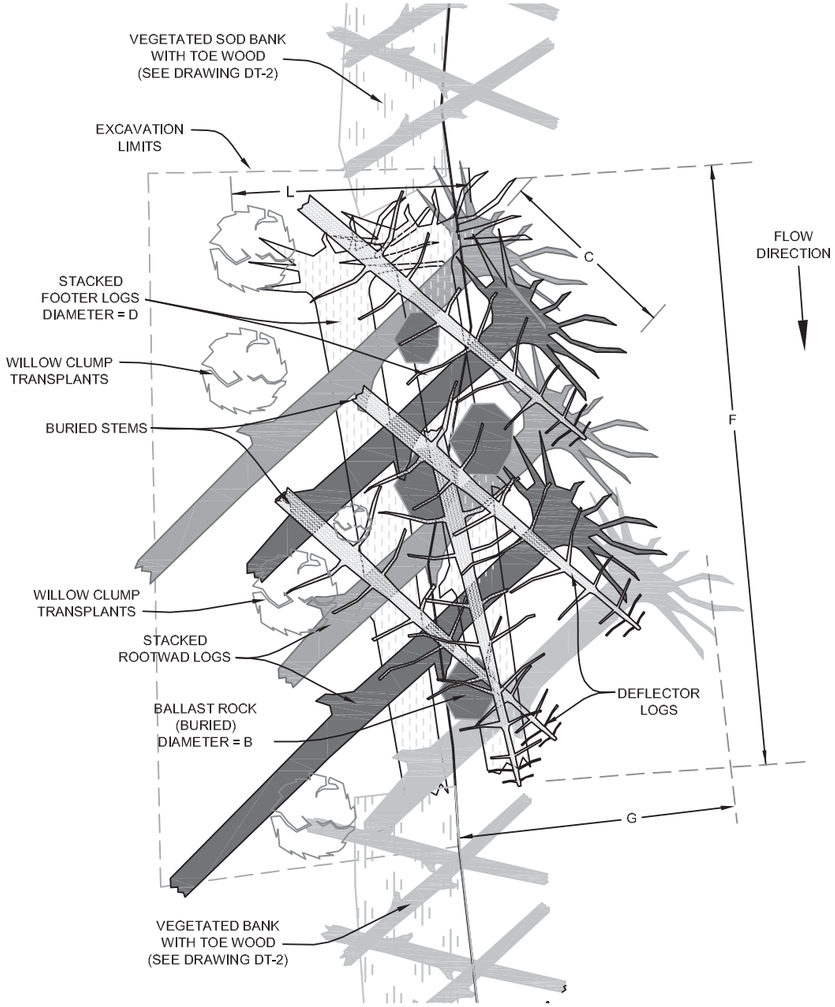
CROSS SECTIONS - SITE 4, 5, 6

HASKILL CREEK
Reimer Bank Stabelization Project
Whitefish, Montana

NO.	DATE	BY	DESCRIPTION	CHK
1	8-25-10	AB	CROSS-SECTIONS	JM

PROJECT NUMBER
RDG-10-042

SHEET NUMBER
XS-3



LARGE WOOD BANK STABILIZATION STRUCTURE
PLAN VIEW

NOT TO SCALE

EXAMPLE OF A LARGE WOOD HABITAT STRUCTURE BUILT ON HASKILL CREEK

DESIGN INTENT

The intent of the large wood structure is to provide bank stabilization by reducing near-bank stress and redirecting flow away from the bank. The structure is designed to allow fish passage at all flow levels and dissipate energy in the form of a downstream scour pool. The structure is typically placed in a pool feature. Structure performance is dependent upon placement within a sequence of other bank stabilization and grade control structures.

The structure is designed to be natural in appearance and shall be no higher than the adjacent bank elevation. The structure is designed to have no abrupt affect on the water surface profile at all flow levels. The structure extends approximately 5-10 feet into the channel, leaving 40 - 45 feet of the channel width unobstructed for bedload transport and recreational passage. Over time, the structure will decompose and/or become abandoned and buried in the floodplain as the channel migrates across the floodplain.

CONSTRUCTION NOTES

Excavate trench and set footer logs at specified depth. Use footer logs with minimum diameter and stem length as specified. Footer logs shall not have a rootfan. If possilbe, backfill up to top of footer logs with specified alluvial backfill. Douse backfill periodically with water to improve compaction and minimize void spaces.

Set rootwad logs on footer logs. Place logs stems sloping downward into bank from edge of water. Use rootwads with minimum rootfan diameter and stem length as specified. Backfill up to top of rootwad logs and place ballast rocks on top of rootwad logs at locations where rootwad logs intersect footer logs. Douse backfill periodically with water to improve compaction and minimize void spaces.

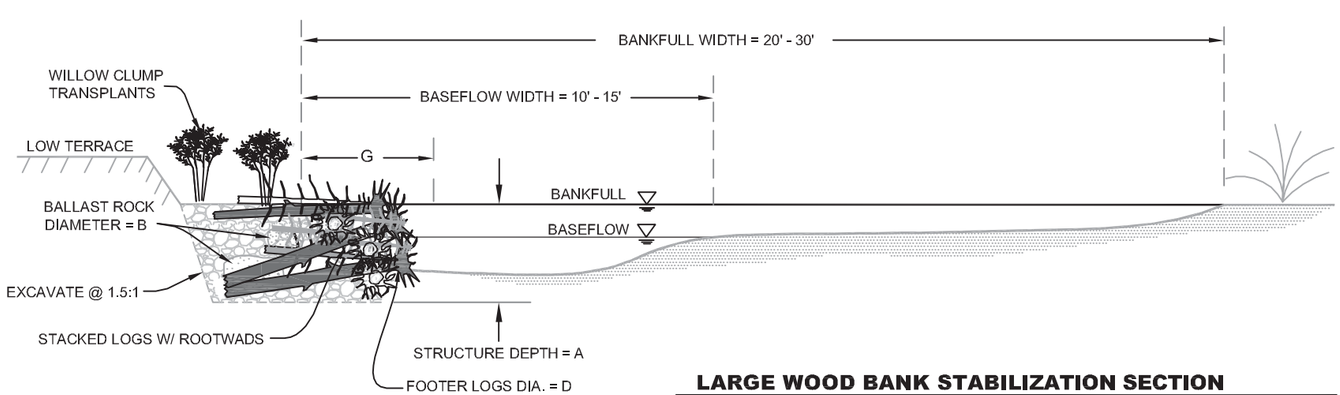
Add additional tier of footer logs and rootwad logs as described above. Cover ballast rocks and top of structure with alluvium as directed by engineer.

Place additional logs and woody debris into trench to act as deflector logs and additional ballasting. Number and size of habitat logs may vary from structures shown.

The Construction Manager shall inspect and approve all footer logs and rootwad logs prior to backfilling. Notify Construction Manager of any proposed changes prior to implementation. The Construction Manager reserves the right to modify structure design specifications during construction if warranted due to unforeseen conditions.

STRUCTURE DIMENSIONS

A = Structure Depth	5 ft
B = Ballast Rock Diameter	1.5-2.0 ft
C = Minimum Rootfan Diameter	3 ft
D = Footer Log Diameter	12-18 in
F = Average Structure Length	15-20 ft
G = Maximum Structure Projection	4-5 ft
H = Rootwad Stem Length	15 ft
J = Footer Log Stem Length	15 ft
L = Bank Key-in Distance	10-15 ft



LARGE WOOD BANK STABILIZATION SECTION
CROSS SECTION

NOT TO SCALE

MATERIAL SCHEDULE (PER STRUCTURE)

Item	Quantity	Dia. (in)	Length (ft)	Rootwad (Y/N)
Footer Log	4	12-18	15	Optional - 3-4 ft
Rootwad Log	6	12-18	15	Yes - 3 ft Dia. Min.
Deflector Log	2-3	6-12	15	Optional - 3-4 ft
Misc. Wood	4	3-6	15	No
CY of Rip-Rap	5	12-18		
CY of Alluvium	75			

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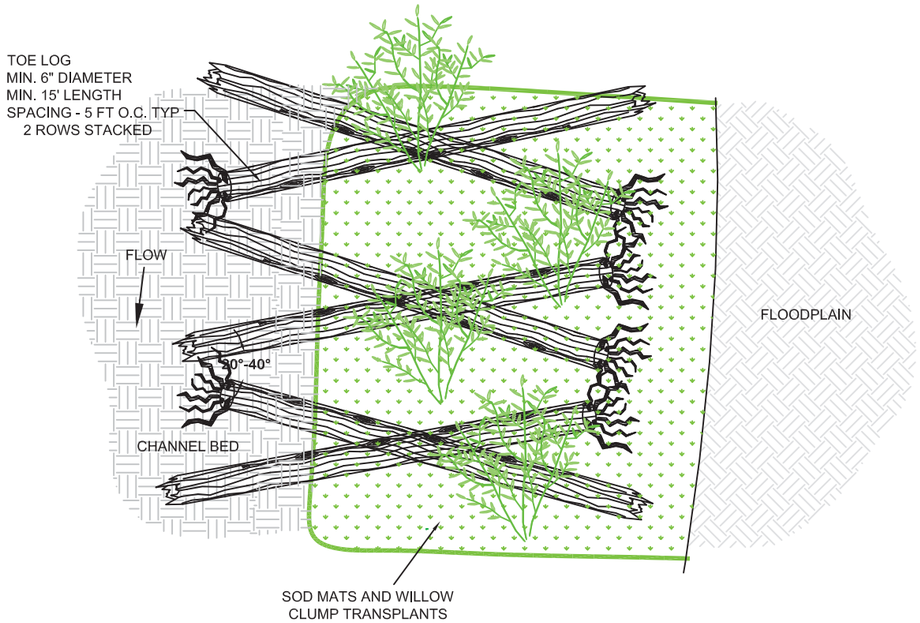
LARGE WOOD HABITAT STRUCTURE

HASKILL CREEK
Reimer Bank Stablization Project
Whitefish, Montana

NO.	DATE	BY	DESCRIPTION	CHK
1	9-13-10	NW	DESIGN	JM

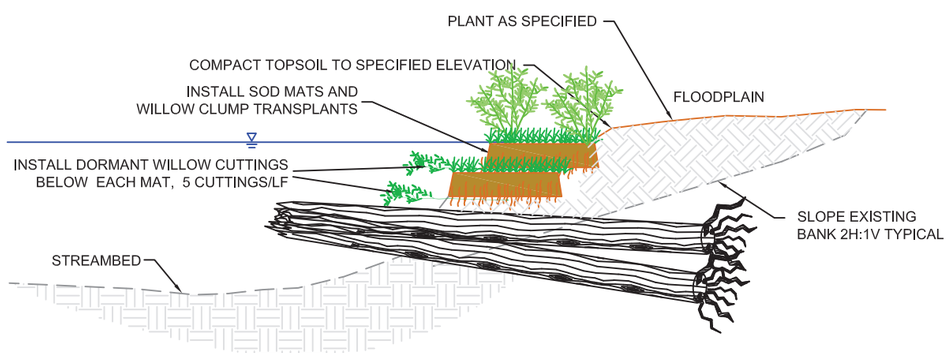
PROJECT NUMBER
RDG-10-034

SHEET NUMBER
DT-1



VEGETATED SOD BANK WITH TOE WOOD
PLAN VIEW

0 2.5' 5'



VEGETATED SOD BANK WITH TOE WOOD
CROSS SECTION

0 2.5' 5'

DESIGN INTENT

THE VEGETATED BANK WITH TOE LOG STRUCTURE IS A REVEGETATION TECHNIQUE USED TO SECURE THE BACK EDGE OF SOD MATS AND THE EDGE OF THE BANKFULL CHANNEL ALONG RIFFLE AND RUN SECTIONS OF THE CHANNEL. THE VEGETATED BANK WITH TOE LOG WILL PROVIDE ROUGHNESS ALONG THE CHANNEL BANK AND REDUCE POTENTIAL FOR BANK EROSION. DURING OVER BANK FLOWS, THE DENSELY BRANCHING WILLOWS AND SOD ON TOP OF THE TOE WOOD WILL TRAP SEDIMENTS AND NATIVE SEED, AND PROVIDE AN ENVIRONMENT FOR SEED TO GERMINATE AND GROW.

CONSTRUCTION NOTES

EXCAVATE A TRENCH PARALLEL TO THE TOE OF THE STREAMBANK DOWN TO SCOUR DEPTH. PLACE LOGS AND ROOTWADS INTO THE BOTTOM OF THE TRENCH. BACKFILL OVER THE LOGS AND ROOTWADS WITH 6-INCH PLUS ALLUVIUM AND COMPACT TO CREATE A BENCH.

PLACE A THIN LAYER OF GROWTH MEDIA ON TOP OF BENCH TO CREATE A ROOTING BED FOR VEGETATION. INSTALL SOD MATS AND/OR WILLOW CLUMP TRANSPLANTS DIRECTLY ON TOP OF THE CONSTRUCTED BENCH. SOD MATS SHALL BE PLACED AND COMPACTED TO MATCH THE DESIGN BANKFULL ELEVATION.

THE UPSTREAM AND DOWNSTREAM ENDS OF THE VEGETATED BANK WITH TOE LOG SHALL TRANSITION SMOOTHLY INTO A STABLE STREAMBANK TO REDUCE THE POTENTIAL FOR EROSION.

EXAMPLE OF A CONSTRUCTED VEGETATED BANK WITH LOG TOE

EXAMPLE OF A CONSTRUCTED VEGETATED BANK WITH LOG TOE

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VEGETATED SOD BANK WITH TOE WOOD

HASKILL CREEK
Reimer Bank Stabilization Project
Whitefish, Montana

NO.	DATE	BY	DESCRIPTION	CHK
1	9-13-10	NW	DESIGN	JM

PROJECT NUMBER
RDG-10-034

SHEET NUMBER
DT-2

BROWSE PROTECTORS

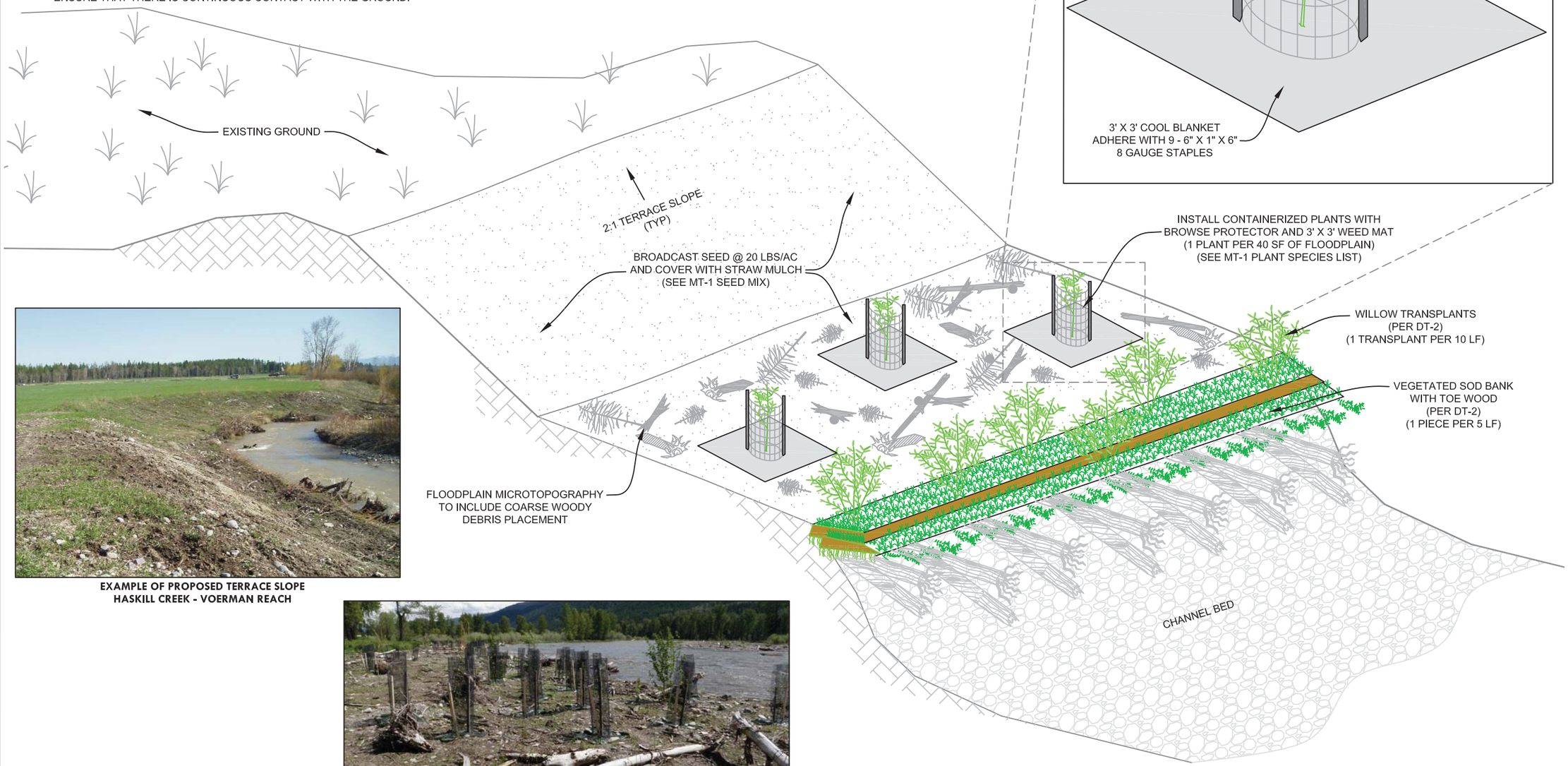
INDIVIDUAL BROWSE PROTECTORS SHOULD BE INSTALLED USING THE FOLLOWING GUIDELINES:

1. EACH BROWSE PROTECTOR SHOULD CONSIST OF 4 FOOT TALL BY 12 INCH DIAMETER (38 INCH CIRCUMFERENCE) TUBES CONSTRUCTED FROM RIGID PLASTIC MESH.
2. THE RIGID PLASTIC MESH TUBES SHOULD BE PLACED AROUND EACH PLANT AND SECURED TO A 2 INCH BY 2 INCH BY 48 INCH WOODEN STAKE USING 3 - 14 INCH UV STABILIZED RELEASABLE CABLE TIES. THE WOODEN STAKE SHOULD BE POUNDED INTO THE GROUND UNTIL IT IS SOLID. THE STAKE SHOULD BE ON THE OUTSIDE OF THE BROWSE PROTECTOR USING THE RELEASABLE CABLE TIES.
3. BROWSE PROTECTION SHOULD BE LEFT IN PLACE FOR AT LEAST 3 YEARS TO ALLOW PLANTED MATERIAL TO ESTABLISH DEEP, STABLE ROOTS AND DEVELOP ENOUGH GROWTH TO SURVIVE PERIODIC WILDLIFE BROWSE.
4. PERIOD MAINTENANCE OF BROWSE PROTECTORS MAY BE NECESSARY WHILE THEY ARE IN PLACE.

WEED AND VEGETATION COMPETITION MATTING

INDIVIDUAL WEED AND VEGETATION COMPETITION MATS SHOULD BE INSTALLED USING THE FOLLOWING GUIDELINES:

1. AFTER PLANT IS INSTALLED, SLIP BRUSH BLANKET OVER TOP OF THE PLANT TAKING CARE NOT TO DAMAGE THE PLANT.
2. POSITION BRUSH BLANKET EVENLY AROUND THE BASE OF THE PLANT.
3. SECURE CORNERS, MIDDLE SLIT (AROUND THE BASE OF THE PLANT), AND SIDES OF THE BRUSH BLANKET TO THE GROUND USING APPROXIMATELY 9- 6 BY 1 BY 6 INCH, 8 GAUGE STAPLES. MINIMIZE FOLDS IN THE BRUSH BLANKET AND ENSURE THAT THERE IS CONTINUOUS CONTACT WITH THE GROUND.



EXAMPLE OF PROPOSED TERRACE SLOPE
HASKILL CREEK - VOERMAN REACH

EXAMPLE OF AN ESTABLISHED FLOODPLAIN WITH CONTAINERIZED PLANTS AND MICROTOPOGRAPHY

STREAMBANK AND TERRACE REVEGETATION
CROSS SECTION
NTS

NOTE: ALL DISTURBED AREAS WILL BE SEEDED WITH A TWO-STAGE SEED MIX TO PROVIDE SHORT TERM EROSION CONTROL AND LONG-TERM SPECIES DIVERSITY. WEED MANAGEMENT ON ALL DISTURBED AREAS WILL BE IMPLEMENTED AS NEEDED.

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STREAMBANK AND TERRACE REVEGETATION PLAN

HASKILL CREEK
Reimer Bank Stabilization Project
Whitefish, Montana

NO.	DATE	BY	DESCRIPTION	CHK
1	9-13-10	NW	DESIGN	JM

PROJECT NUMBER
RDG-10-034

SHEET NUMBER
DT-3

Reimer - Haskill Creek Bank Stabilization Project Materials List

Site	Treated Bank Length (FT)	Created Floodplain Area (SF)	Terrace Slope Area (SF)	# of Stems	# Trees with Rootfans	CY Riprap	Earthwork (CY Cut)
1	410	4094	2310	82	0	0	360
2	290	2920	6534	58	18	15	993
3	137	1350	2090	27	18	15	316
4	175	1742	610	35	0	0	109
5	210	2090	1133	42	0	0	133
Total	**1222**	**12196**	**12677**	**244**	**36**	**30**	**1911**

Site	# Containerized Plantings	# Browse Protectors	# Weed Mats	# Stakes	# Willow Transplants	# Cuttings	CY Growth Media
1	102	82	82	164	21	2050	47
2	73	58	58	117	15	1450	70
3	34	27	27	54	7	685	25
4	44	35	35	70	9	875	17
5	52	42	42	84	11	1050	24
Total	**305**	**244**	**244**	**488**	**61**	**6110**	**184**

Site	# Sandbar Willow (1 gallon)	# Mountain Alder (1 gallon)	# Black Cottonwood (1 gallon)	Seed (lbs)
1	41	31	31	2.9
2	29	22	22	4.3
3	14	10	10	1.6
4	17	13	13	1.1
5	21	16	16	1.5
Total	**122**	**91**	**91**	**11.4**

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MATERIALS LIST

HASKILL CREEK
Reimer Bank Stabilization Project
Whitefish, Montana

NO.	DATE	BY	DESCRIPTION	CHK
1	9-13-10	NW	DESIGN	JM

PROJECT NUMBER
RDG-10-034

SHEET NUMBER
MT-1