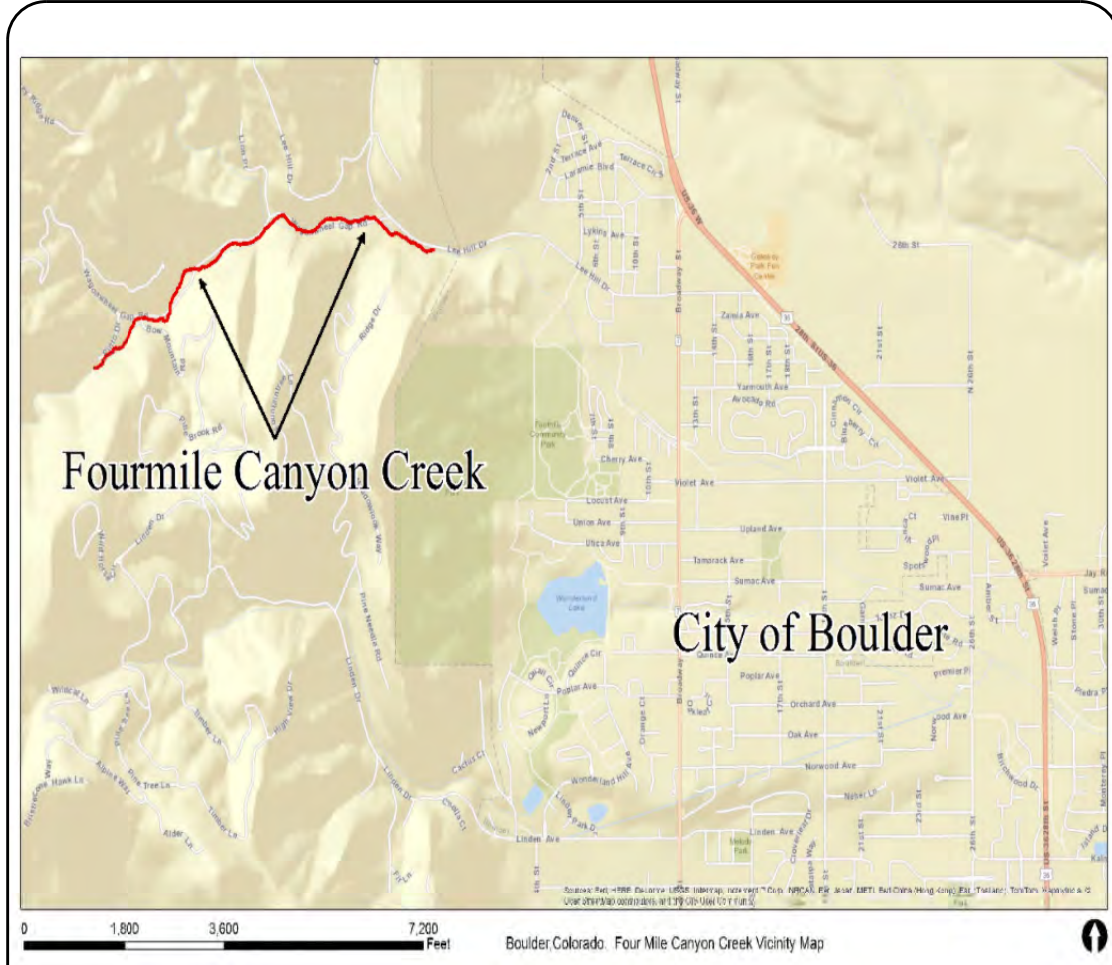


PROJECT: 138200 FOURMILE CANYON CREEK

STATE	BAKER PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
CO	138200	1	14



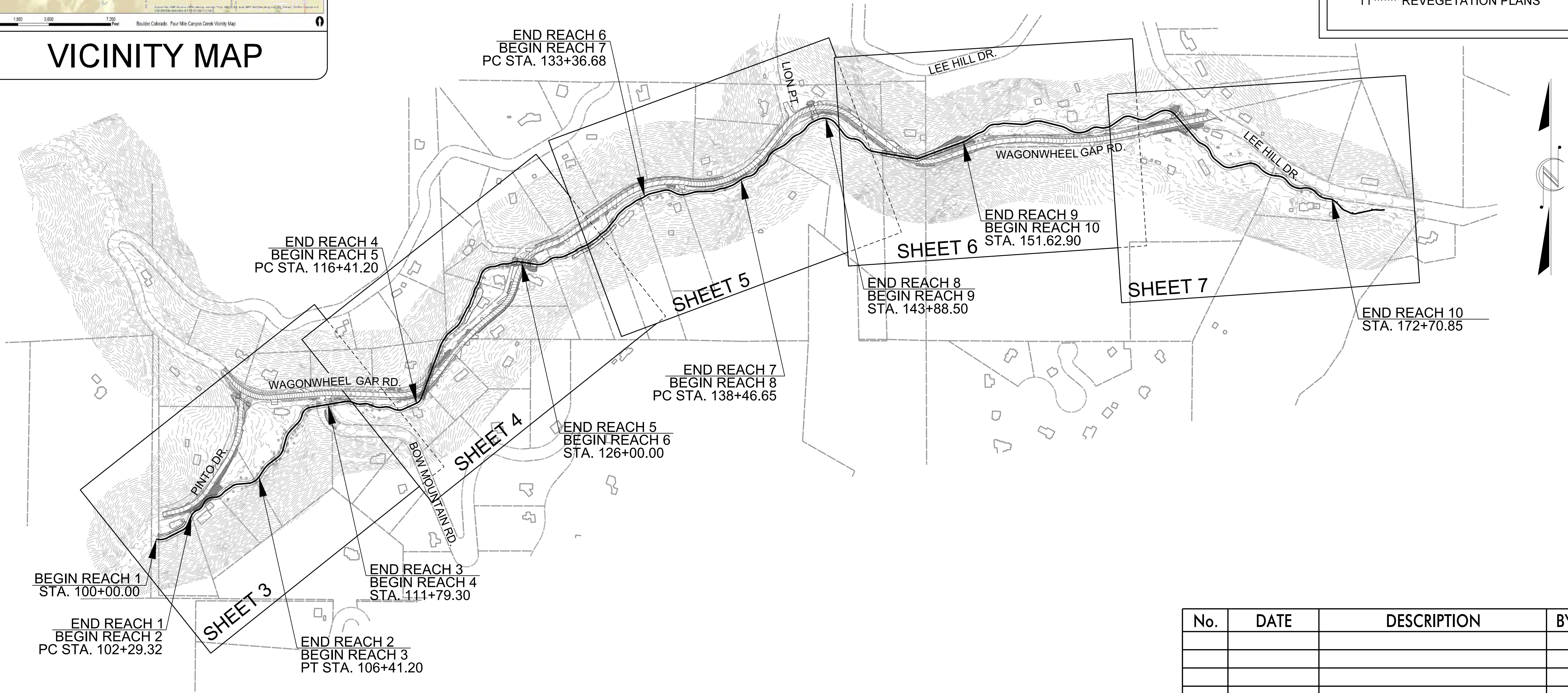
VICINITY MAP

FOURMILE CANYON CREEK

LOCATION: WAGONWHEEL GAP ROAD AND LEE HILL DRIVE
TO ANNE U WHITE TRAIL HEAD

TYPE OF WORK: PRELIMINARY (30%) STREAM RESTORATION PLANS

INDEX OF SHEETS	
1	TITLE SHEET
1-A	STREAM CONVENTIONAL SYMBOLS GENERAL NOTES
2 - 2B	DETAILS
3 - 7	PLAN SHEETS
8 - 10	PROFILE SHEETS
11	REVEGETATION PLANS



No.	DATE	DESCRIPTION	BY	APPROVED

PRELIMINARY DESIGN DATA

	UPSTREAM OF LION POINT	DOWNSIDE OF LION POINT
DESIGN REACH LENGTH	= 4,389	2,882 ft
BANKFULL XSEC AREA	= 24	28 sq ft
BANKFULL WIDTH	= 23.5	25 ft
AVERAGE BANKFULL DEPTH	= 1.02	1.08 ft
WD RATIO	= 23	23
DRAINAGE AREA	= 4.97	7.19 sq mi

PREPARED FOR
BOULDER COUNTY
DEPARTMENT OF TRANSPORTATION



CONTACT: STACEY PROCTOR

Michael Baker

Michael Baker Engineering Inc.
165 South Union Boulevard, Suite 200
Lakewood, COLORADO 80228
Phone: 720.514.1100
Fax: 720.514.1120

INTERNATIONAL

TBD
LETTING DATE:

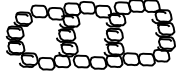
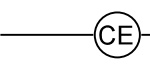
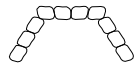
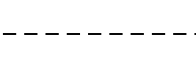




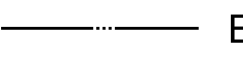

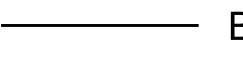
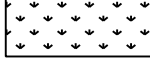
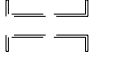
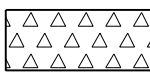



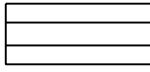
LUCAS BABBITT, PE, CFM
PROJECT ENGINEER

PROJECT ENGINEER

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

SIGNATURE: P.E.

STREAM CONVENTIONAL SYMBOLS

	OUTLET PROTECTION		CONSERVATION EASEMENT
	ROCK CROSS VANE		EXISTING MAJOR CONTOUR
	CONSTRUCTED RIFFLE		EXISTING MINOR CONTOUR
	LOG VANE		EXISTING DICIDUOUS
	EXISTING STREAM ALIGNMENT		EXISTING CONIFEROUS
	BANKFULL CHANNEL EXTENTS		LIVE STAKES
	EXISTING ROAD CROSSING		TREE PLANTING
	PROPOSED ROAD CROSSING		BOULDER BANK PROTECTION
	POOL		TOE WOOD BANK PROTECTION

**NOTE: ALL ITEMS ABOVE MAY NOT BE USED ON THIS PROJECT

GENERAL NOTES

1. THE CONTRACTOR IS REQUIRED TO INSTALL INSTREAM STRUCTURES USING A TRACK HOE WITH A HYDRAULIC THUMB OF SUFFICIENT SIZE TO PLACE BOULDERS 6' X 5' X 4', LOGS, AND ROOTWADS.
2. WORK IS BEING PERFORMED AS AN ENVIRONMENTAL RESTORATION PLAN. THE CONTRACTOR SHOULD MAKE ALL REASONABLE EFFORTS TO REDUCE SEDIMENT LOSS AND MINIMIZE DISTURBANCE OF THE SITE WHILE PERFORMING THE CONSTRUCTION WORK.
3. SOME DETAIL DRAWINGS SHOWN IN THIS PLAN SET MAY NOT BE USED IN FINAL DESIGN.
4. CONTRACTOR SHOULD CALL UTILITY NOTIFICATION CENTER OF COLORADO 2 - BUSINESS DAYS IN ADVANCE BEFORE DIGGING, GRADING, OR EXCAVATION FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.
5. PROPOSED CHANNEL ALIGNMENT IS INTENDED TO CAUSE MINIMAL DISTURBANCE TO THE EXISTING TREES AND VEGETATION. THE ON-SITE ENGINEER RESERVES THE RIGHT TO MAKE FIELD-FIT CHANGES TO THESE PLANS AND DETAILS TO FURTHER REDUCE DISTURBANCE.

BAKER PROJECT REFERENCE NO.

138200

SHEET NO.

1A

PROJECT ENGINEER

PRELIMINARY PLANS
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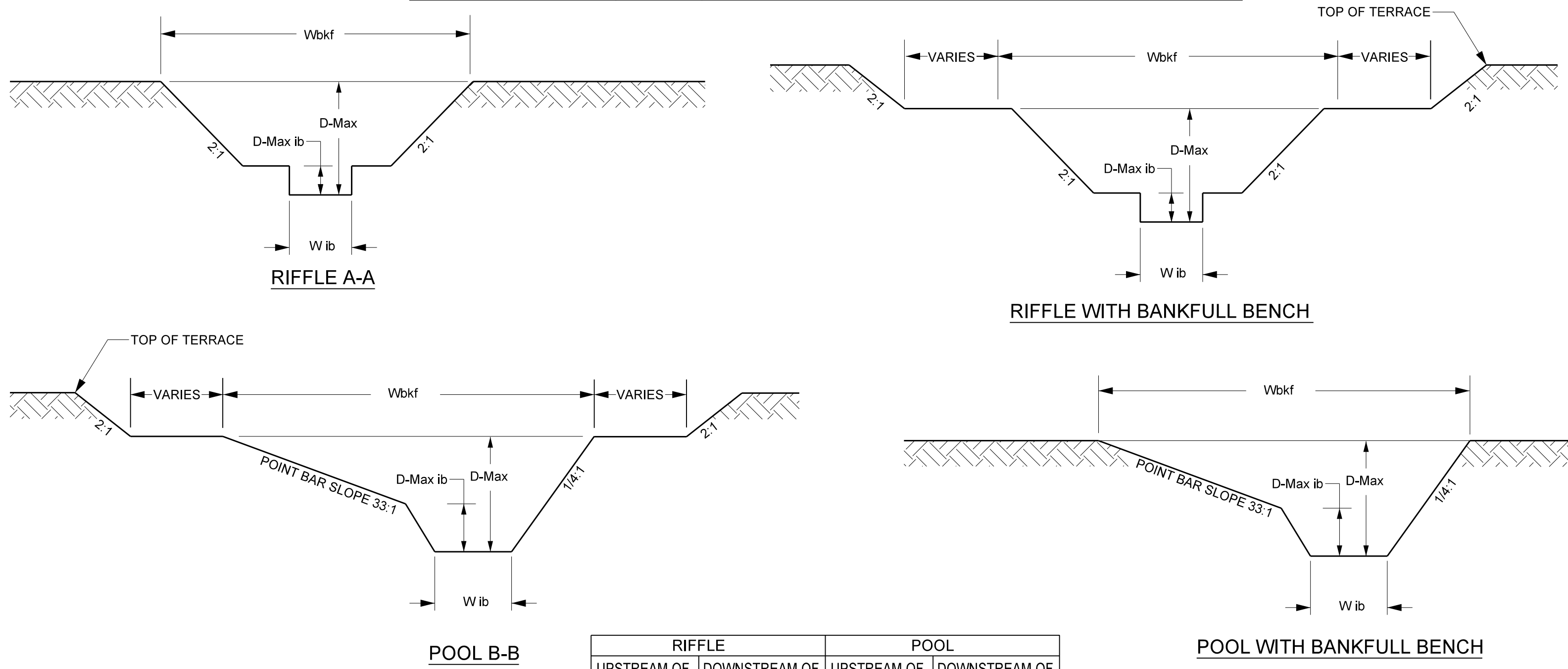
Michael Baker

Michael Baker Engineering Inc.
165 South Union Boulevard, Suite 200
Lakewood, COLORADO 80226
Phone: 720.514.1100
Fax: 720.514.1120

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NOTES

TYPICAL RIFFLE, POOL, AND BANKFULL BENCH CROSS SECTIONS

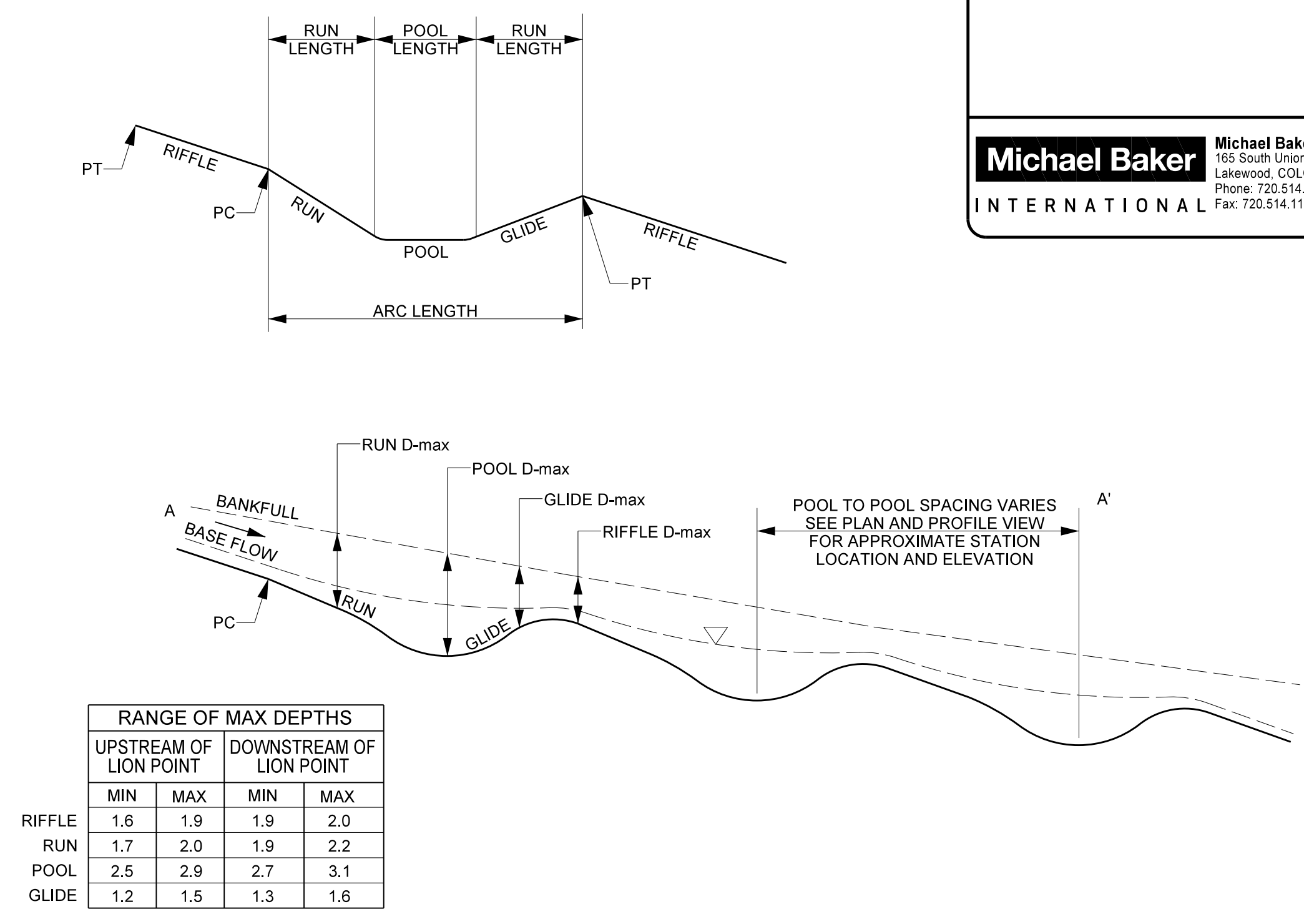


- NOTES:
1. DURING CONSTRUCTION CORNERS OF DESIGN CHANNEL WILL BE ROUNDED AND A THALWEG WILL BE SHAPED PER DIRECTION OF ENGINEER.
 2. POOL SHOWN ABOVE IS RIGH BANK POOL ONLY.

RIFFLE		POOL	
UPSTREAM OF LION POINT	DOWNSTREAM OF LION POINT	UPSTREAM OF LION POINT	DOWNSTREAM OF LION POINT
23.5	25.0	23.5	25.0
1.02	1.08	1.3	1.4
1.9	2.0	2.9	3.1
23	23	18	18
24	28	30	35
13	14	11	12
0.40	0.45	1.0	1.1
0.40	0.45	1.0	1.1
33	31	11	11
5.2	6.3	11.0	13.2

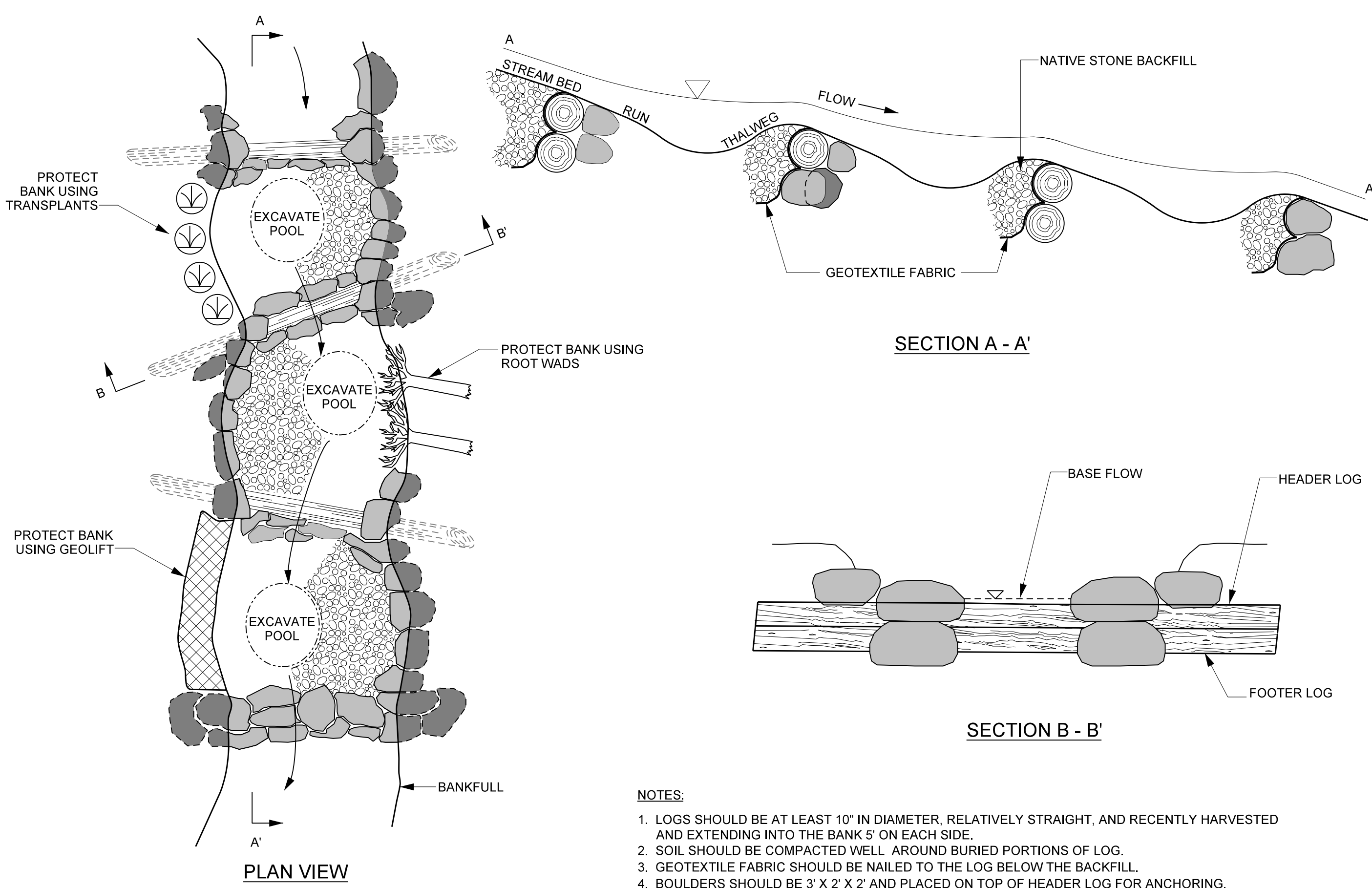
WIDTH OF BANKFULL (Wbkf)
AVERAGE DEPTH (D)
MAXIMUM DEPTH (D-Max)
WIDTH TO DEPTH RATIO (Wbkf / D)
BANKFULL XSEC AREA
INNER BERM WIDTH (Wib)
INNER BERM AVERAGE DEPTH (D ib)
INNER BERM MAX DEPTH (D-Max ib)
INNER BERM W/D RATIO (Wib/D ib)
INNER BERM AREA (A ib)

TYPICAL PROFILE SECTION



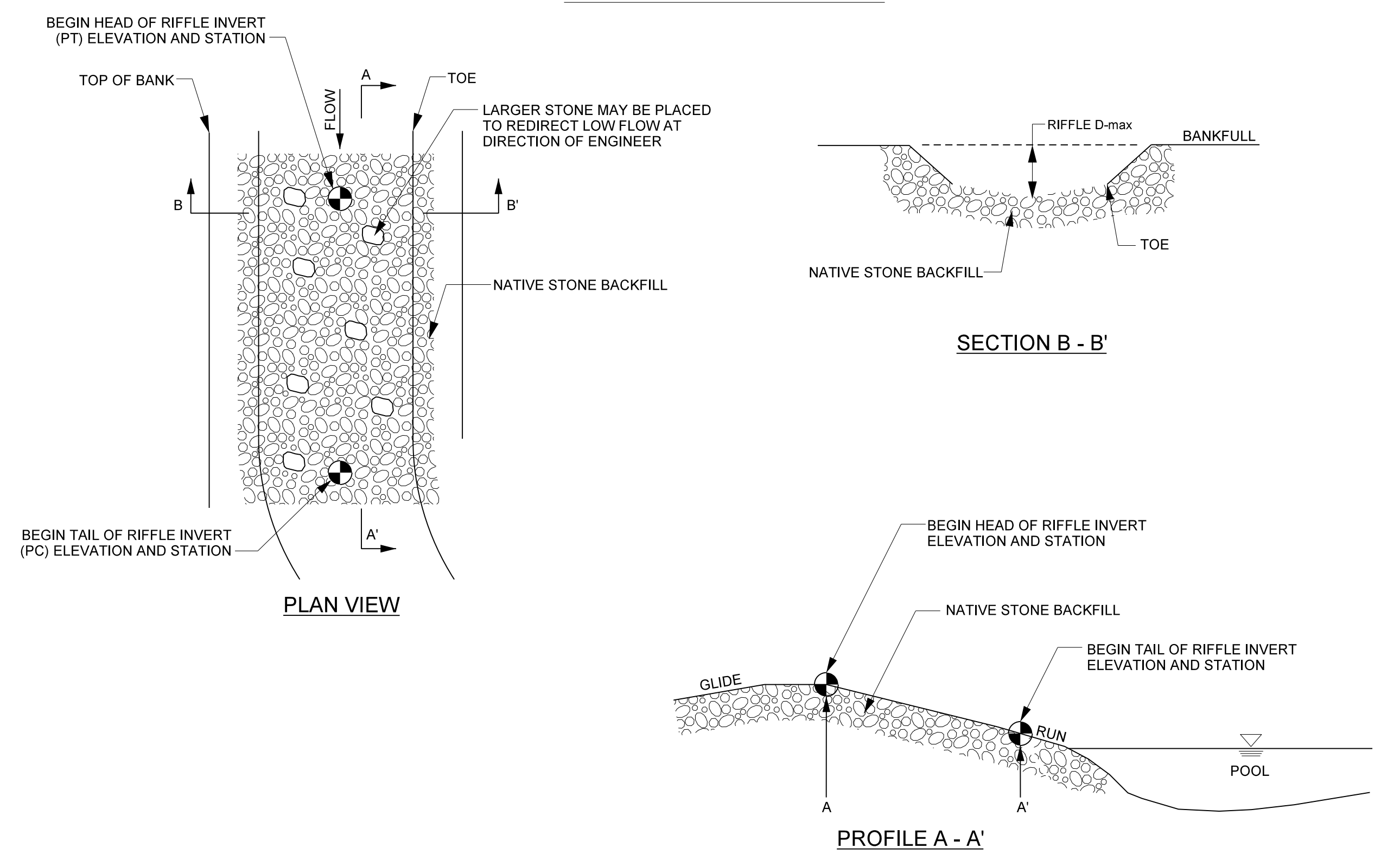
RANGE OF MAX DEPTHS			
UPSTREAM OF LION POINT	DOWNSTREAM OF LION POINT	UPSTREAM OF LION POINT	DOWNSTREAM OF LION POINT
MIN	MAX	MIN	MAX
1.6	1.9	1.9	2.0
1.7	2.0	1.9	2.2
2.5	2.9	2.7	3.1
1.2	1.5	1.3	1.6

LOG AND ROCK STEP / POOL



- NOTES:
1. LOGS SHOULD BE AT LEAST 10" IN DIAMETER, RELATIVELY STRAIGHT, AND RECENTLY HARVESTED AND EXTENDING INTO THE BANK 5' ON EACH SIDE.
 2. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG.
 3. GEOTEXTILE FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
 4. BOULDERS SHOULD BE 3' X 2' X 2' AND PLACED ON TOP OF HEADER LOG FOR ANCHORING.
 5. TRANSPLANTS CAN BE USED INSTEAD OF BOULDERS, PER DIRECTION OF ENGINEER.

CONSTRUCTED RIFFLE



- NOTES:
1. UNDERCUT CHANNEL BED ELEVATION AS NEEDED TO ALLOW FOR LAYERS OF STONE TO ACHIEVE FINAL GRADE.
 2. INSTALL STONE BACKFILL, COMPACTED TO GRADE.
 3. FINAL CHANNEL BED SHAPE SHOULD BE ROUNDED, SMOOTH, AND CONCAVE, WITH THE ELEVATION OF THE BED 0.2 FT DEEPER IN THE CENTER THAN AT THE EDGES.
 4. NOT ALL RIFFLE LOCATIONS SHOWN ON PLANS NEED TO BE COMPLETELY RECONSTRUCTED, SOME JUST NEED TO BE RESHAPED.

BAKER PROJECT REFERENCE NO.
138200

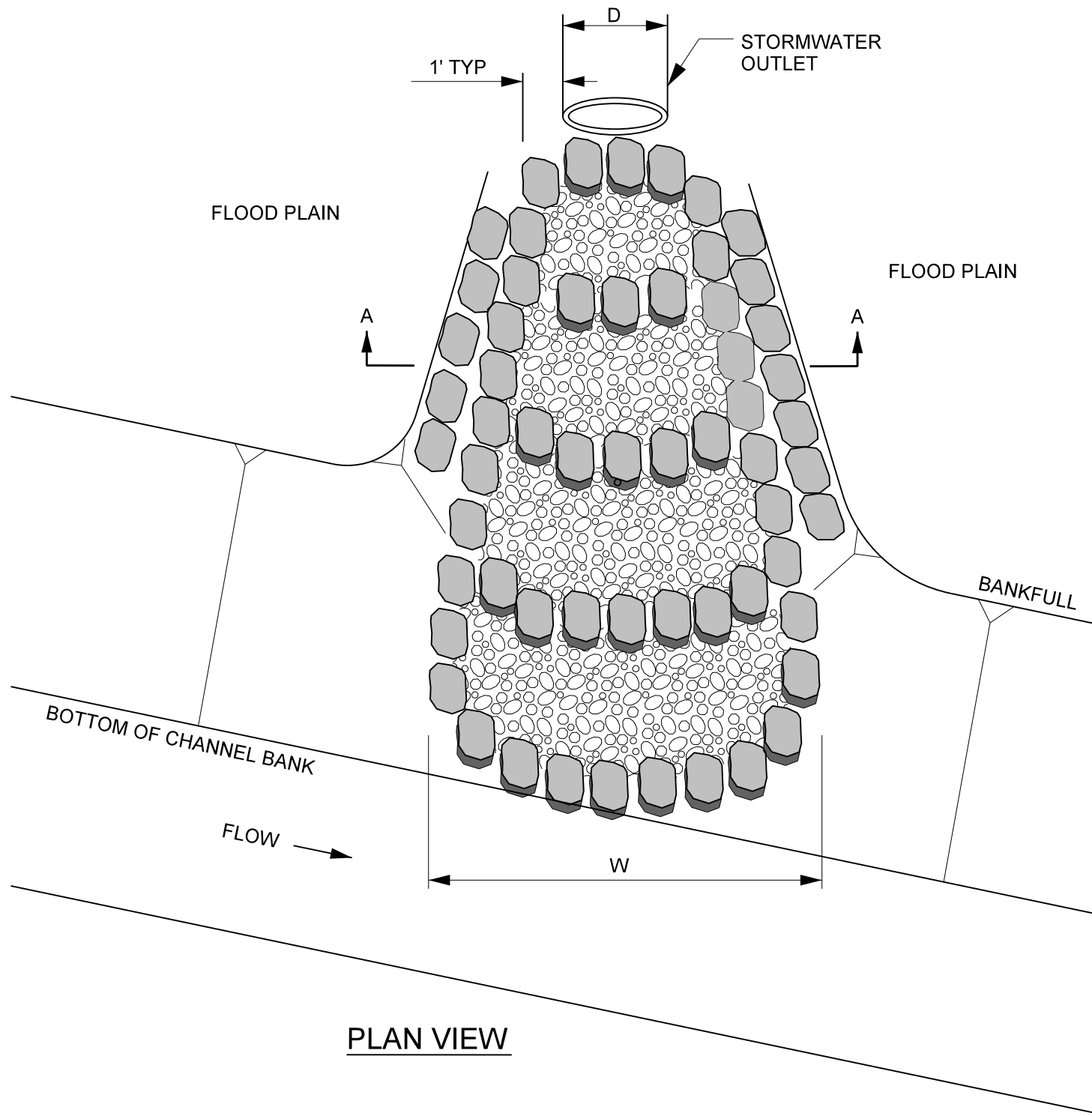
SHEET NO.
2

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

Michael Baker Michael Baker Engineering Inc.
165 South Union Boulevard, Suite 200
Lakewood, COLORADO 80228
Phone: 720.514.1100
INTERNATIONAL Fax: 720.514.1120

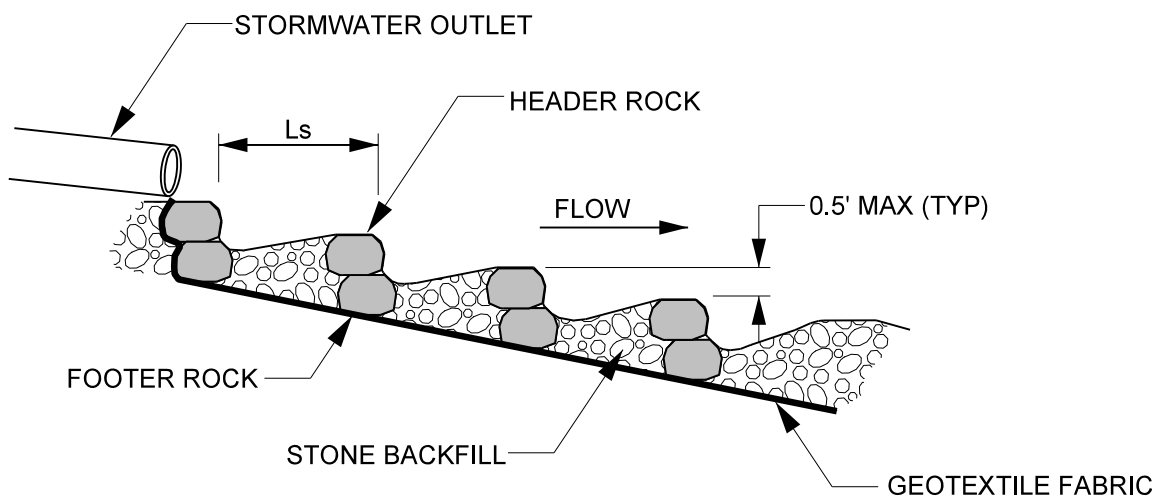
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OUTLET PROTECTION

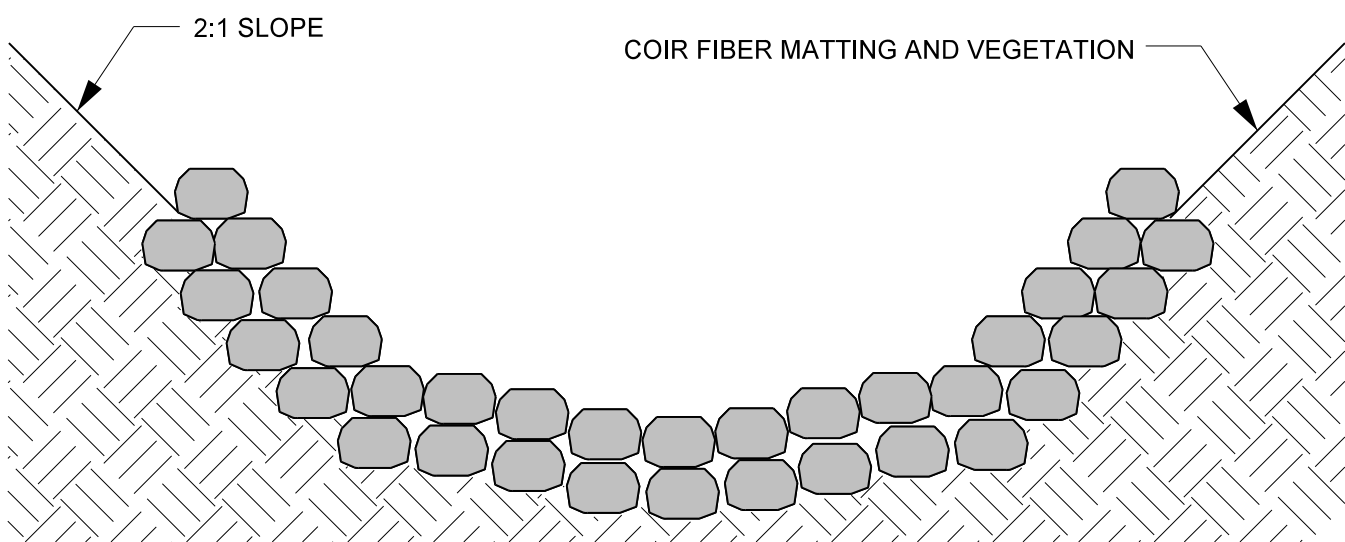


PLAN VIEW

D	Ls	BED MATERIAL	W
		CLASS B	
		CLASS B	
		CLASS B	
		2-3' BOULDER	

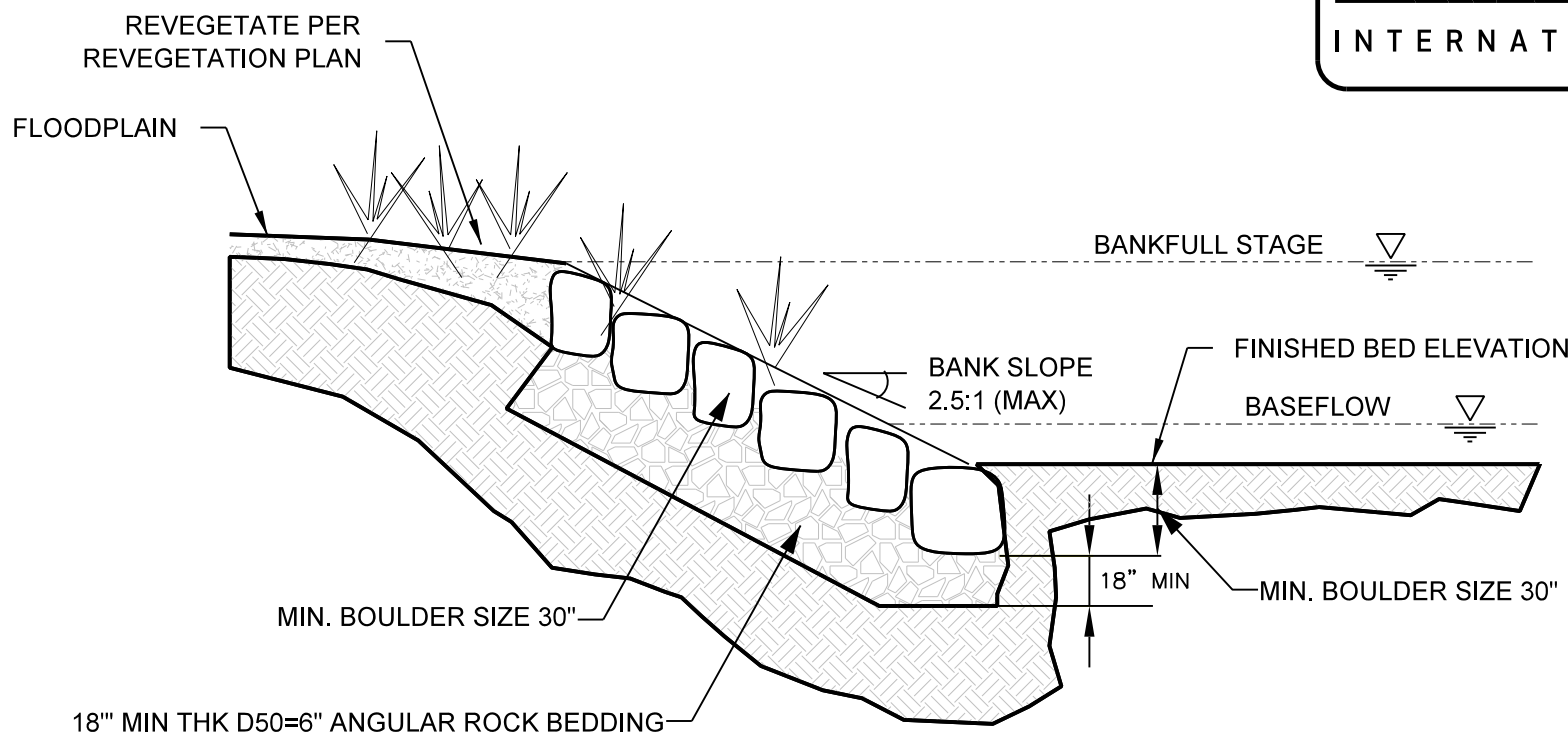


PROFILE VIEW



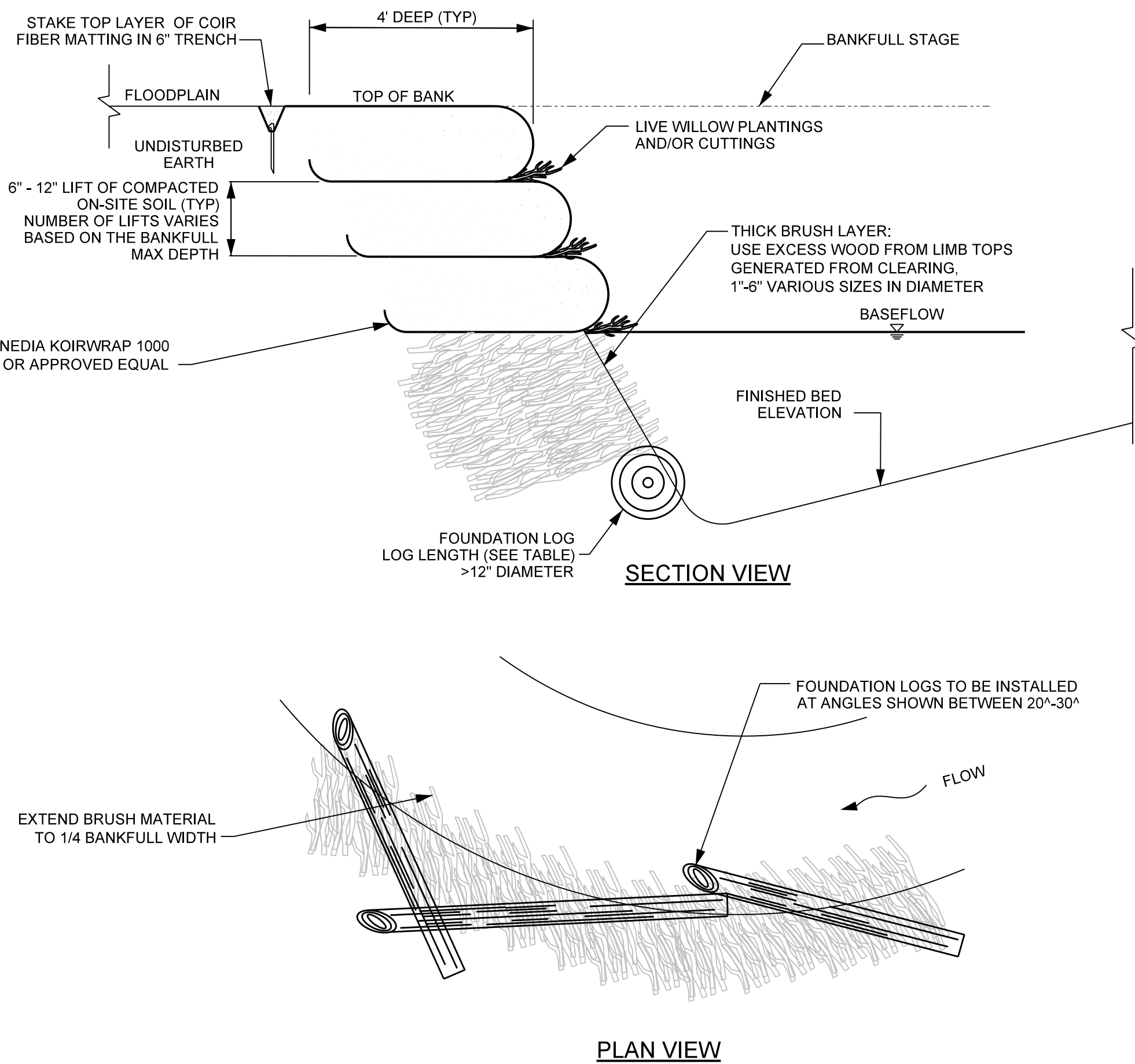
CROSS SECTION A - A

STACKED BOULDER BANK PROTECTION

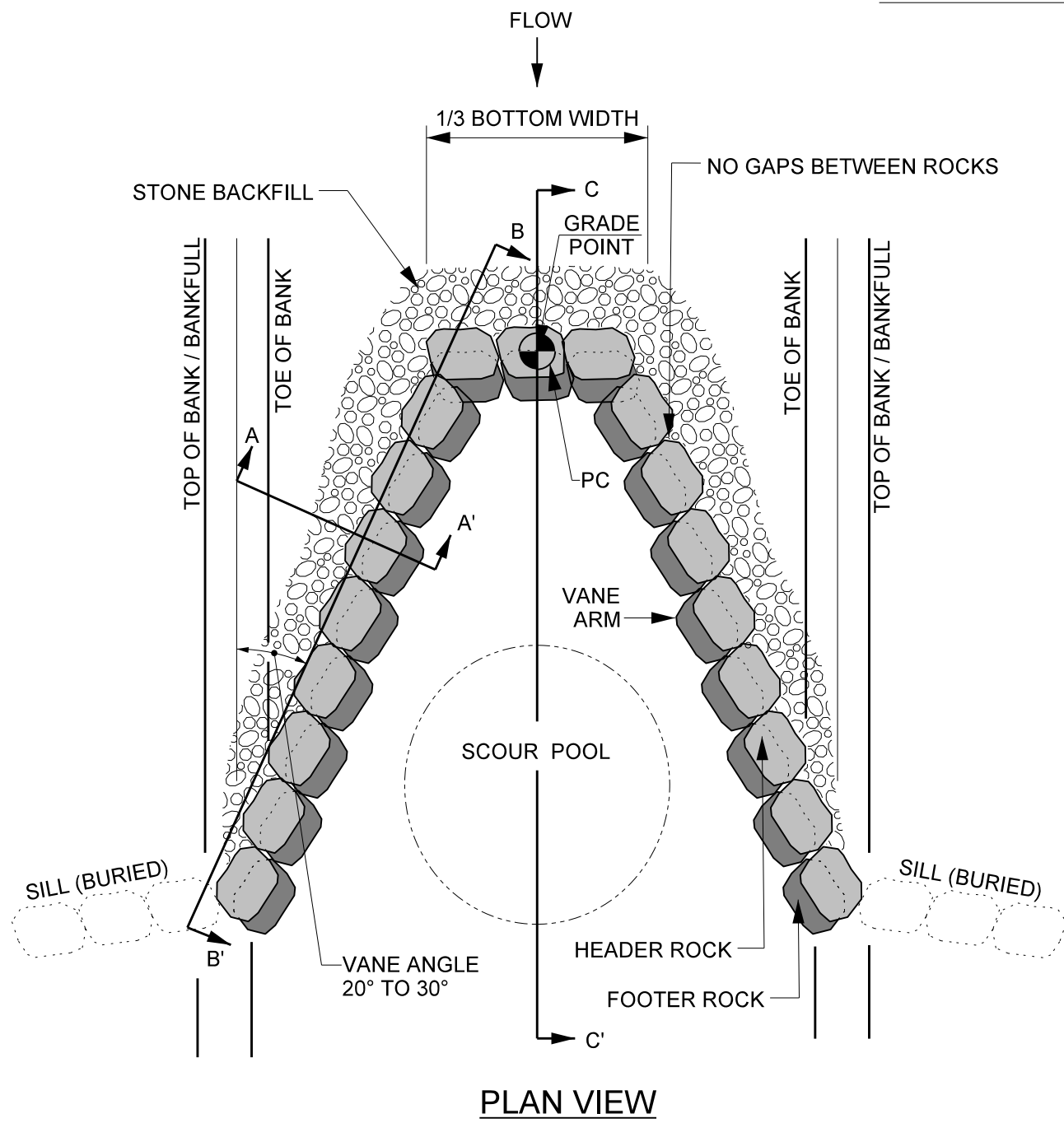


STACKED BOULDER BANK PROTECTION W/ PLANTINGS INCORPORATED

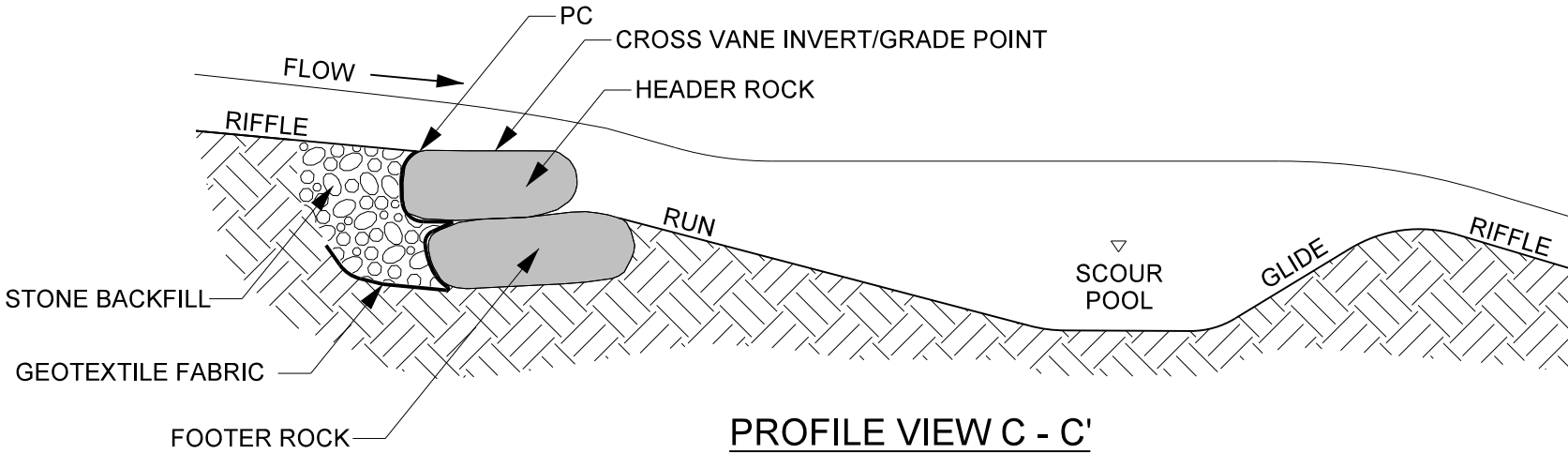
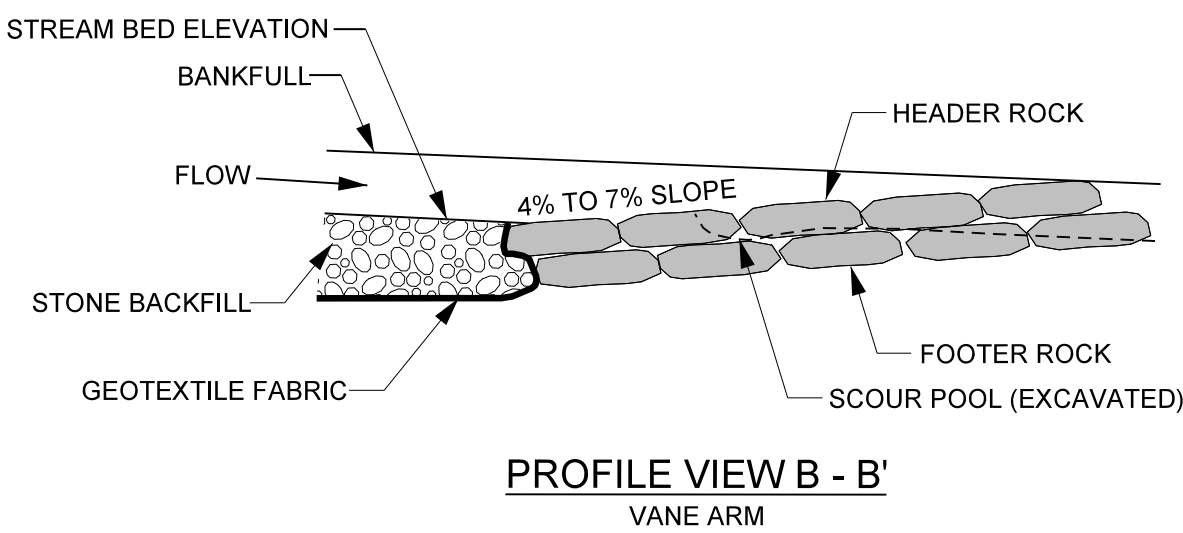
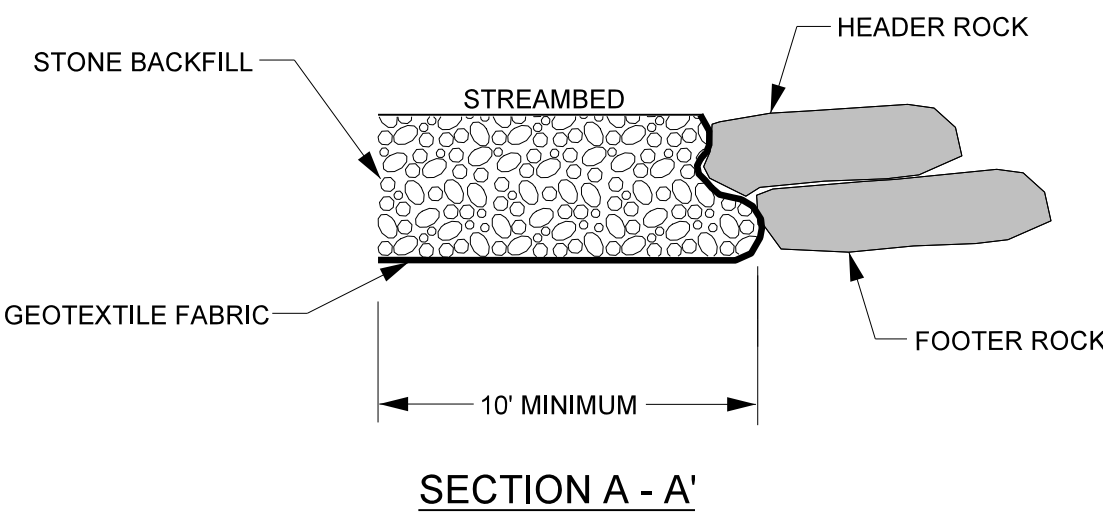
TOE WOOD WITH SOIL WRAPPED LIFT



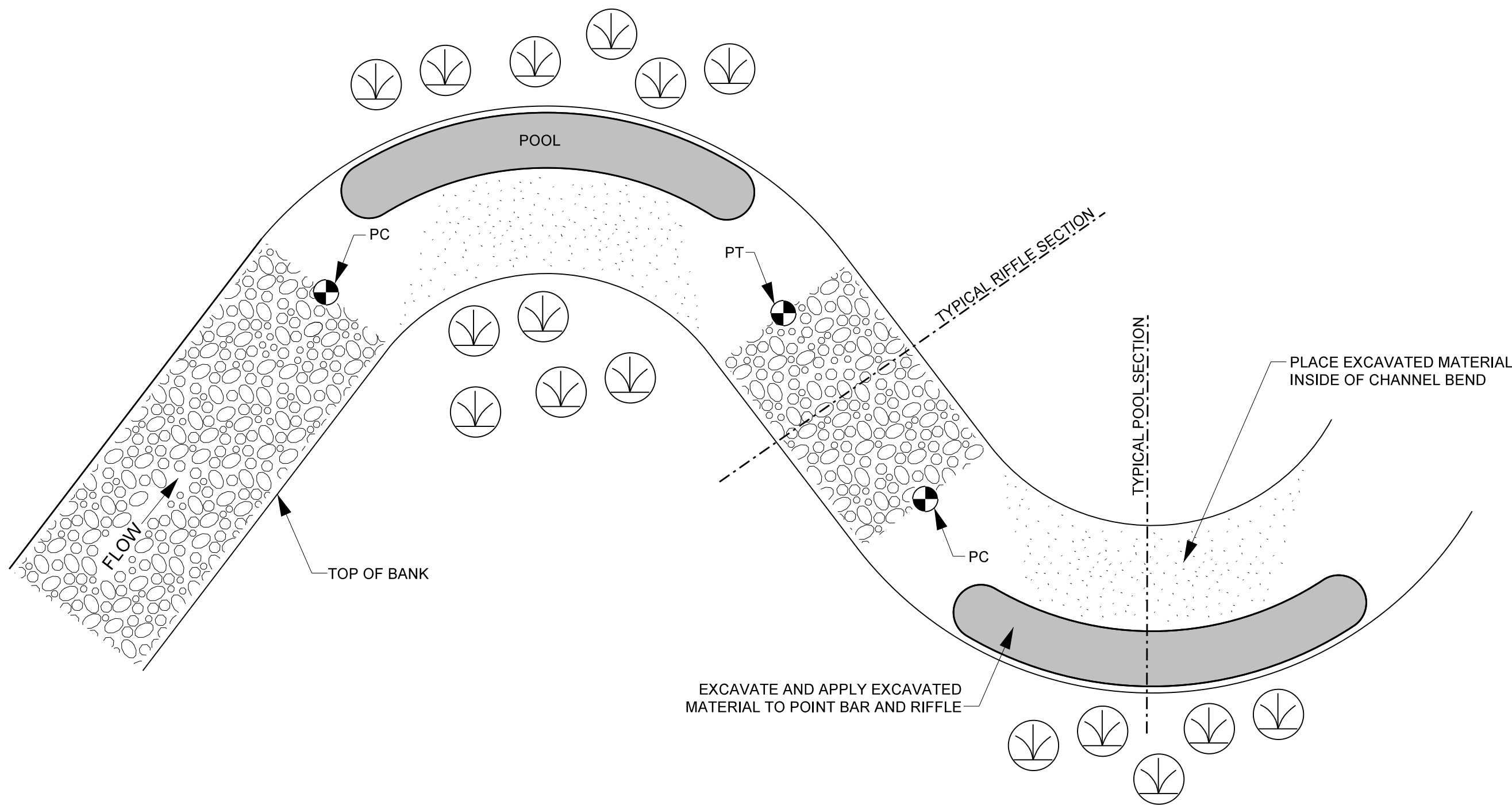
ROCK CROSS VANE



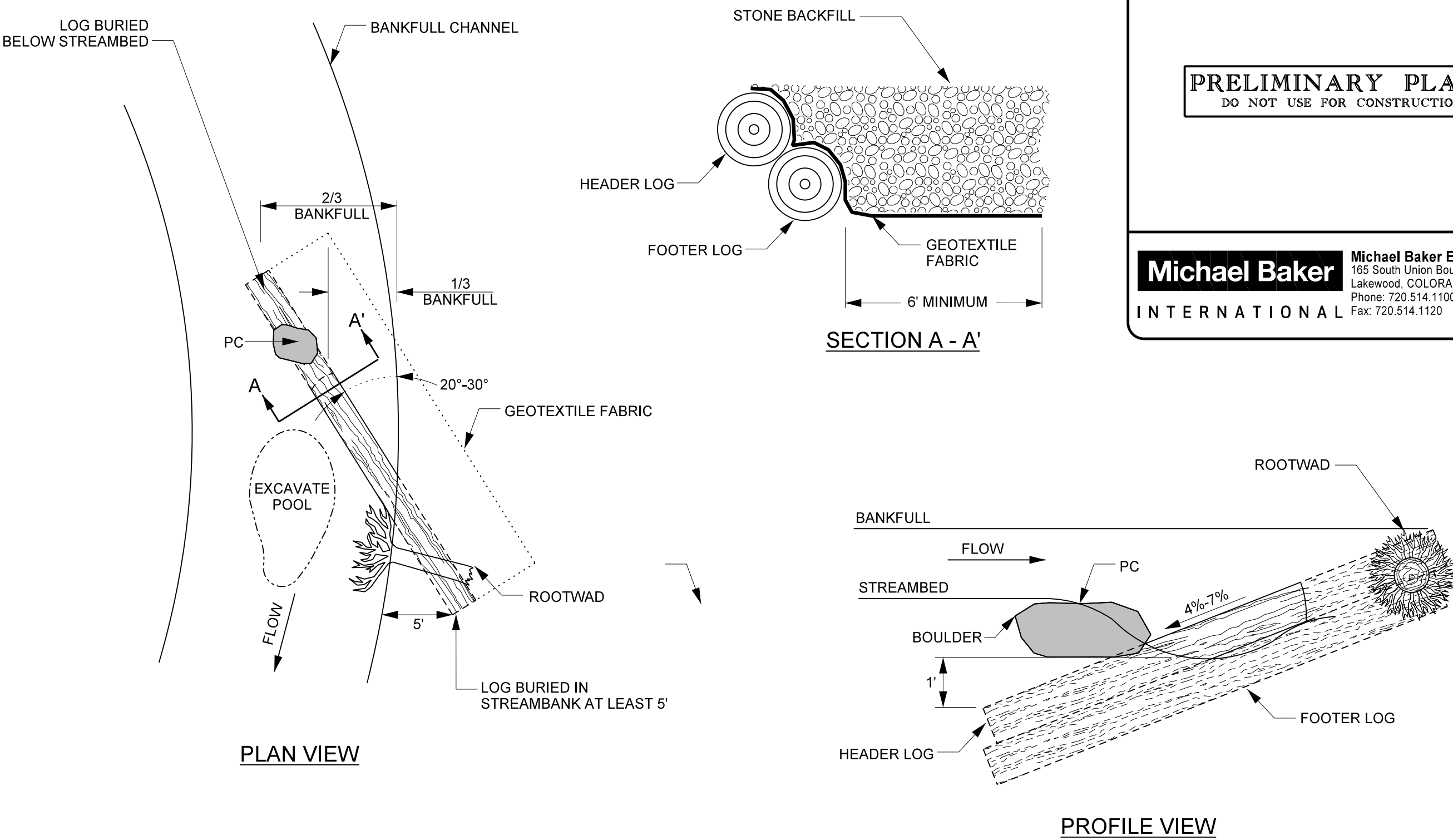
- NOTES FOR ALL VANE STRUCTURES:
1. INSTALL BEGINNING AT THE TOP OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF TEN FEET.
 2. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAMBANK.
 3. START AT BANK AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
 4. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
 5. AN EXTRA ROCK CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
 6. USE HAND PLACED STONE TO FILL GAPS ON UPSTREAM SIDE OF HEADER AND FOOTER ROCKS.
 7. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER ROCK.



CONSTRUCTED POOL AND POINT BAR



LOG VANE

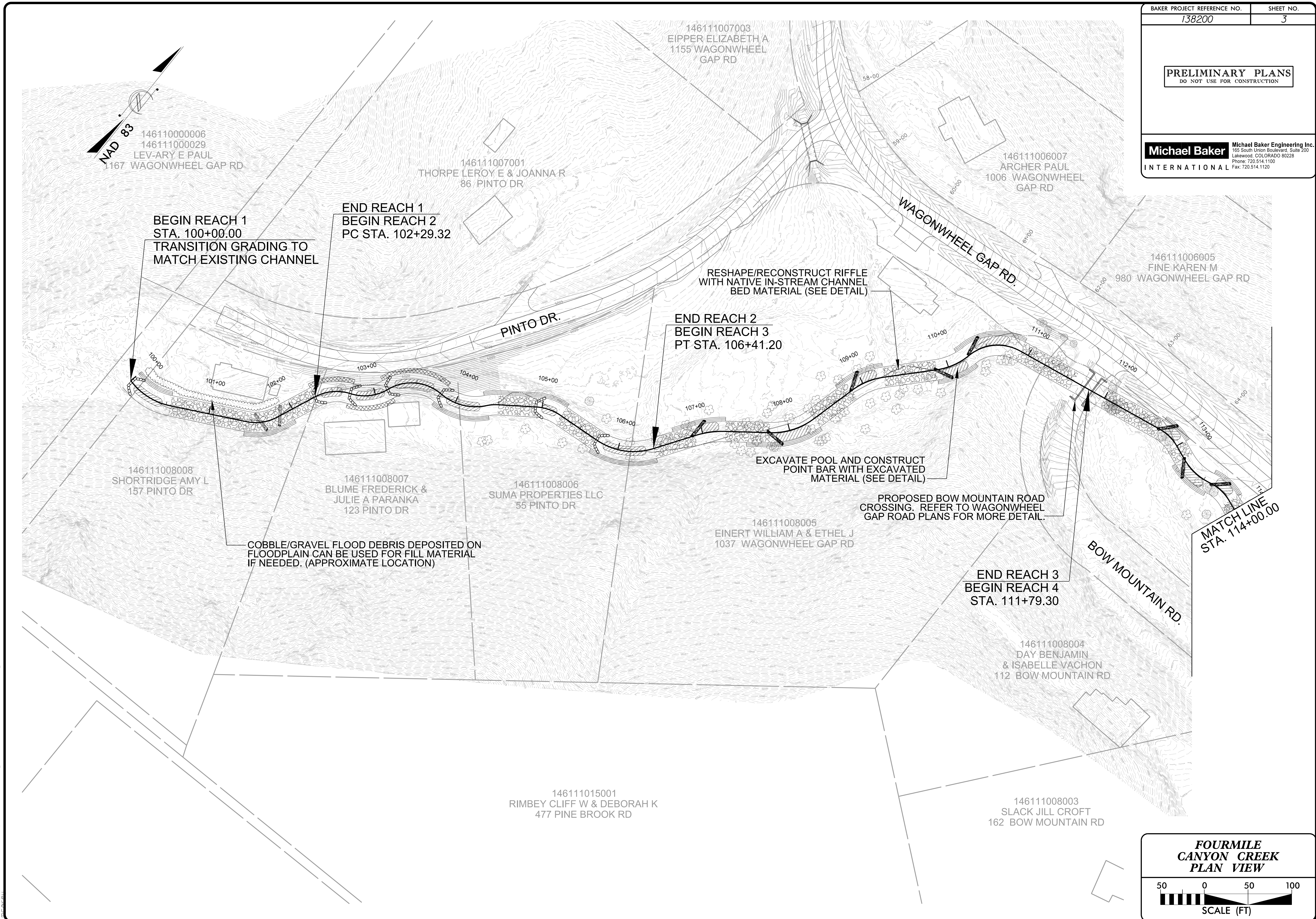


- NOTES:
1. LOGS SHOULD BE AT LEAST 10" IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
 2. BOULDERS MUST BE OF SUFFICIENT SIZE TO ANCHOR LOGS.
 3. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOGS.
 4. ROOTWADS SHOULD BE PLACED BENEATH THE HEADER LOG AND PLACED SO THAT IT LOCKS THE HEADER LOG INTO THE BANK. SEE ROOTWAD DETAIL.
 5. BOULDER SHOULD BE PLACED ON TOP OF HEADER LOG FOR ANCHORING.
 6. GEOTEXTILE FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
 7. TRANSPLANTS CAN BE USED INSTEAD OF ROOTWADS, PER DIRECTION OF ENGINEER.

BAKER PROJECT REFERENCE NO.	SHEET NO.
138200	2B
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	
Michael Baker <small>Michael Baker Engineering Inc.</small> 165 South Union Boulevard, Suite 200 Lakewood, COLORADO 80226 Phone: 720.514.1100 Fax: 720.514.1120	

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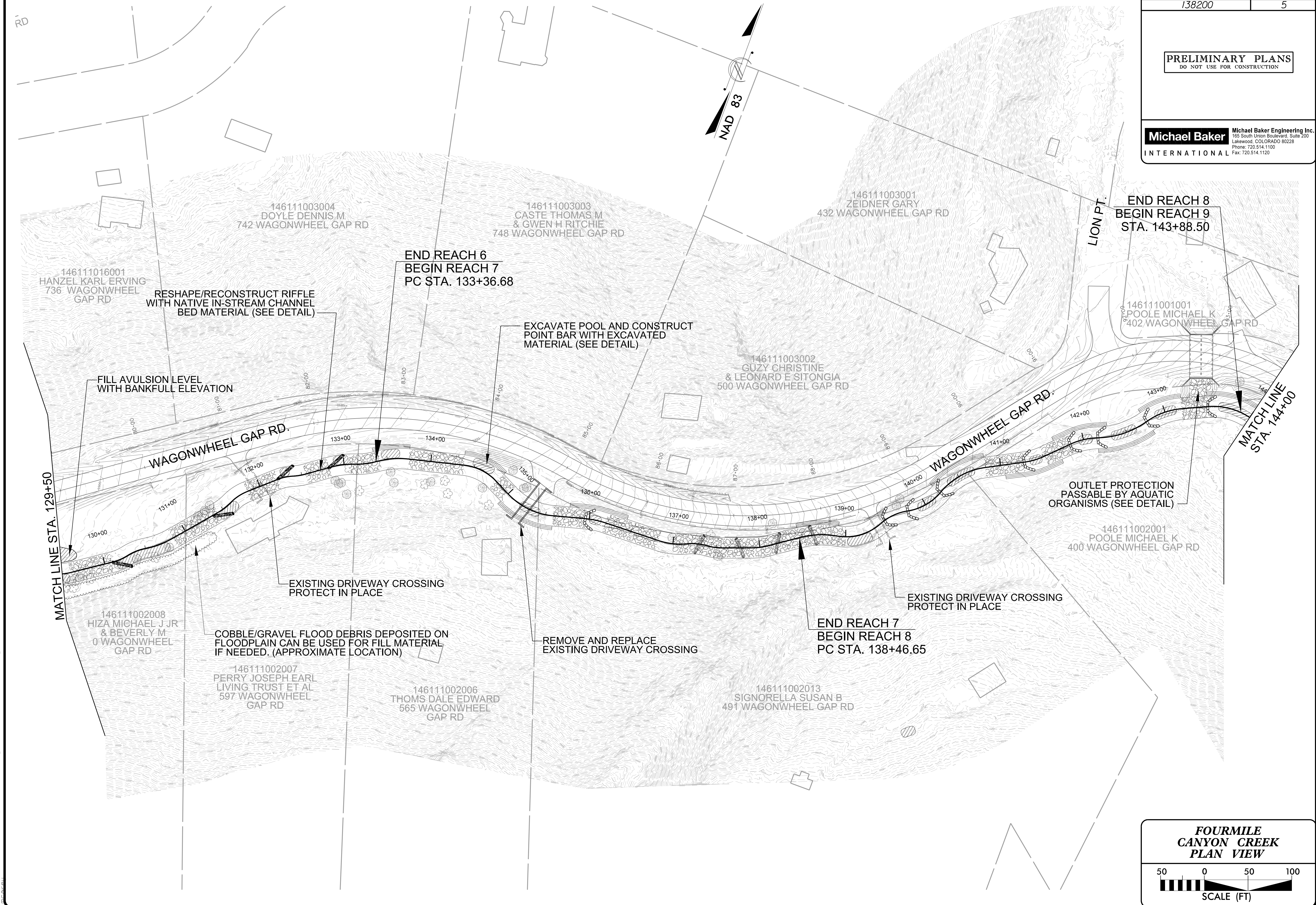
Michael Baker INTERNATIONAL
Michael Baker Engineering Inc.
165 South Union Boulevard, Suite 200
Lakewood, COLORADO 80226
Phone: 720.514.1100
Fax: 720.514.1120



**FOURMILE
CANYON CREEK
PLAN VIEW**

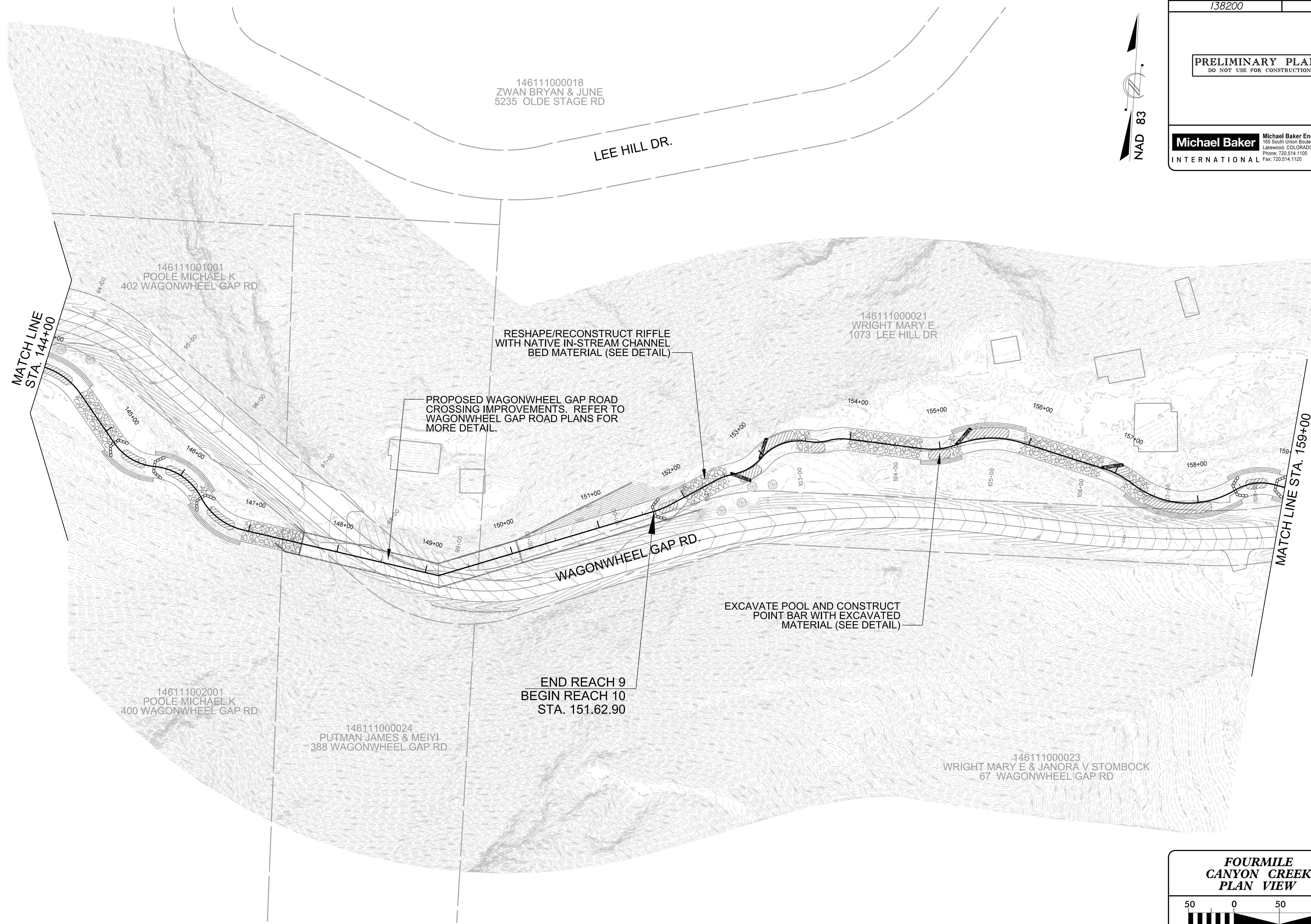


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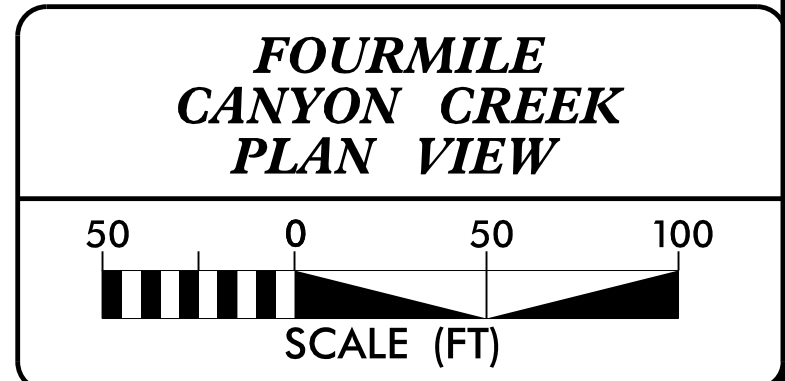
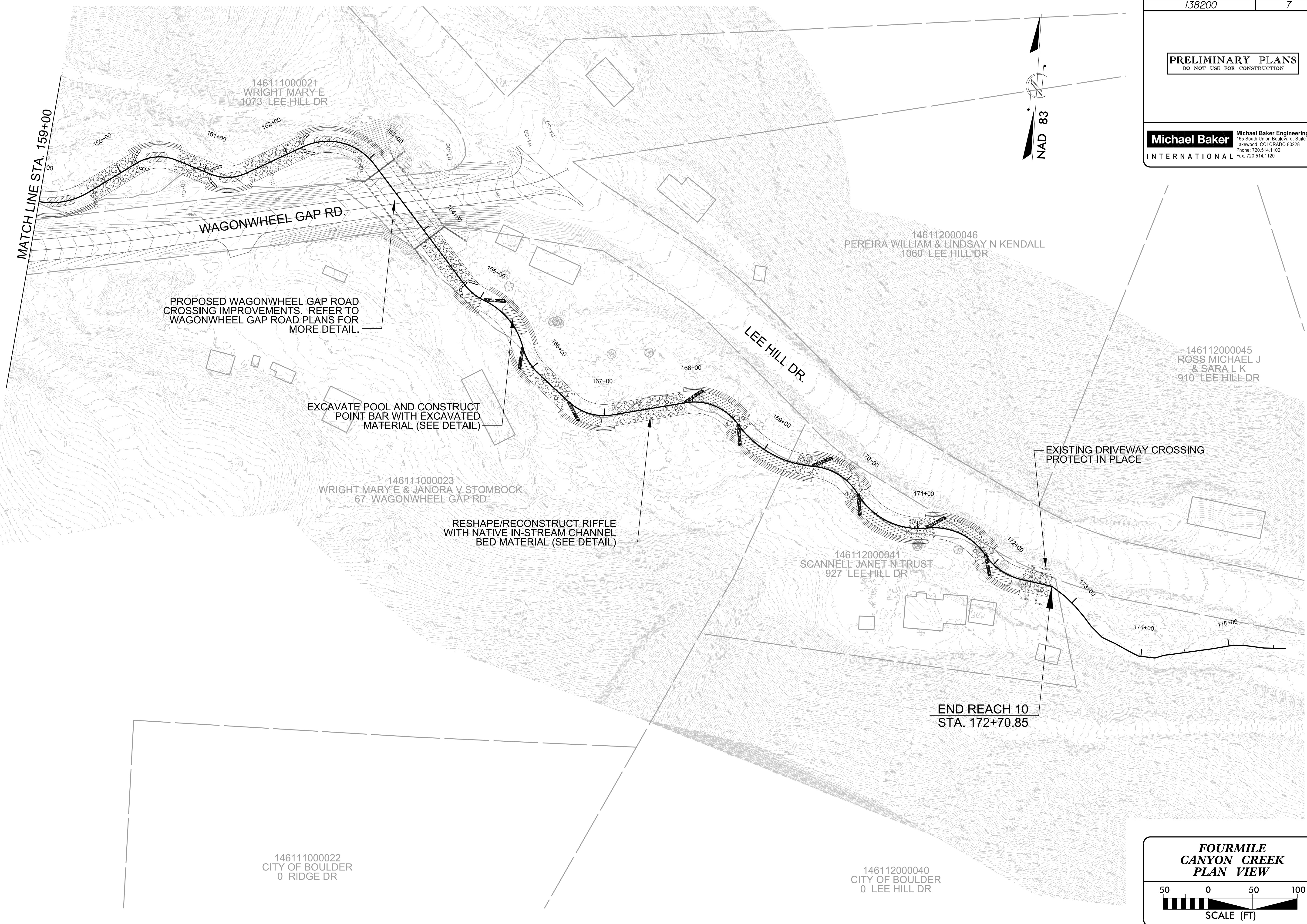


BAKER PROJECT REFERENCE NO.	SHEET NO.
138200	6
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FOURMILE CANYON CREEK PLAN VIEW

50 0 50 100
SCALE (FT)

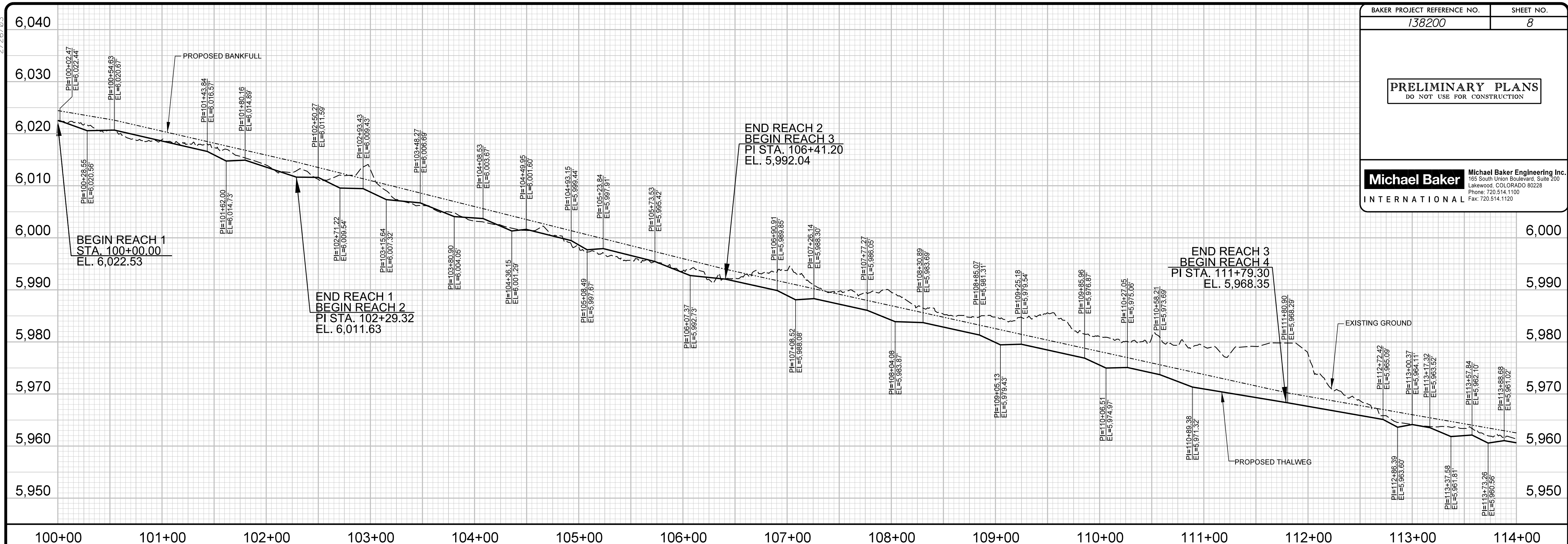
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PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION	
Michael Baker <small>Michael Baker Engineering Inc. 165 South Union Boulevard, Suite 200 Lakewood, COLORADO 80226 Phone: 720.514.1100 Fax: 720.514.1120</small>	
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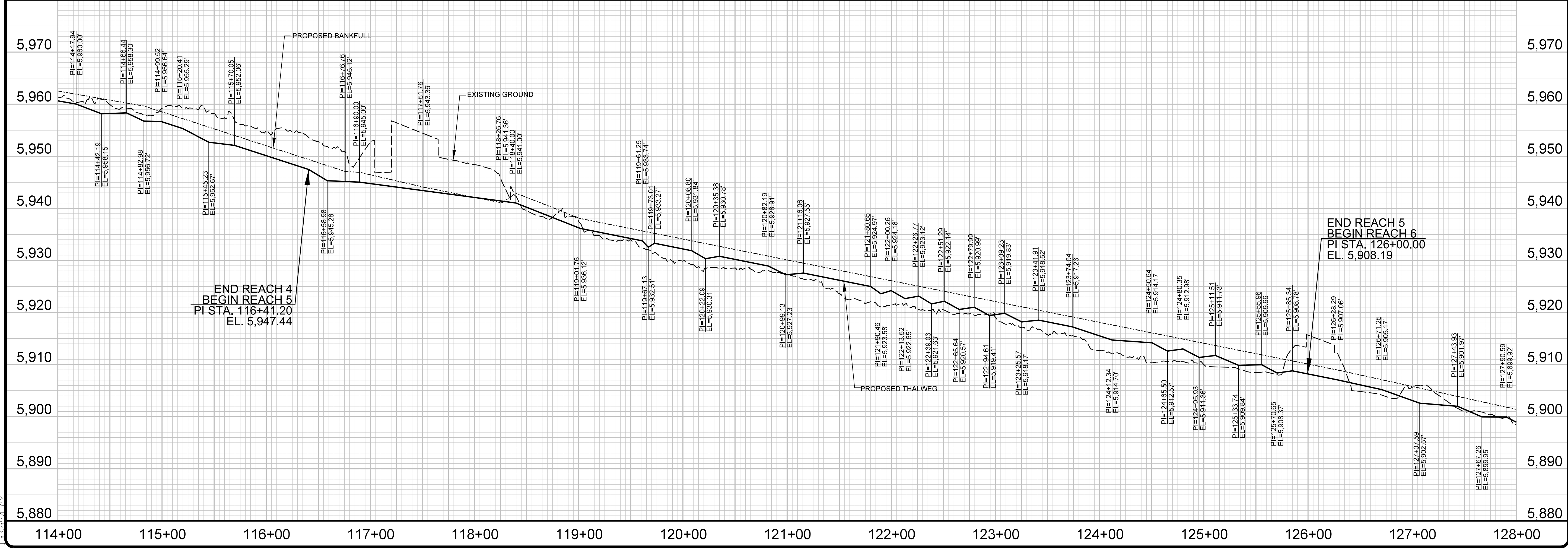
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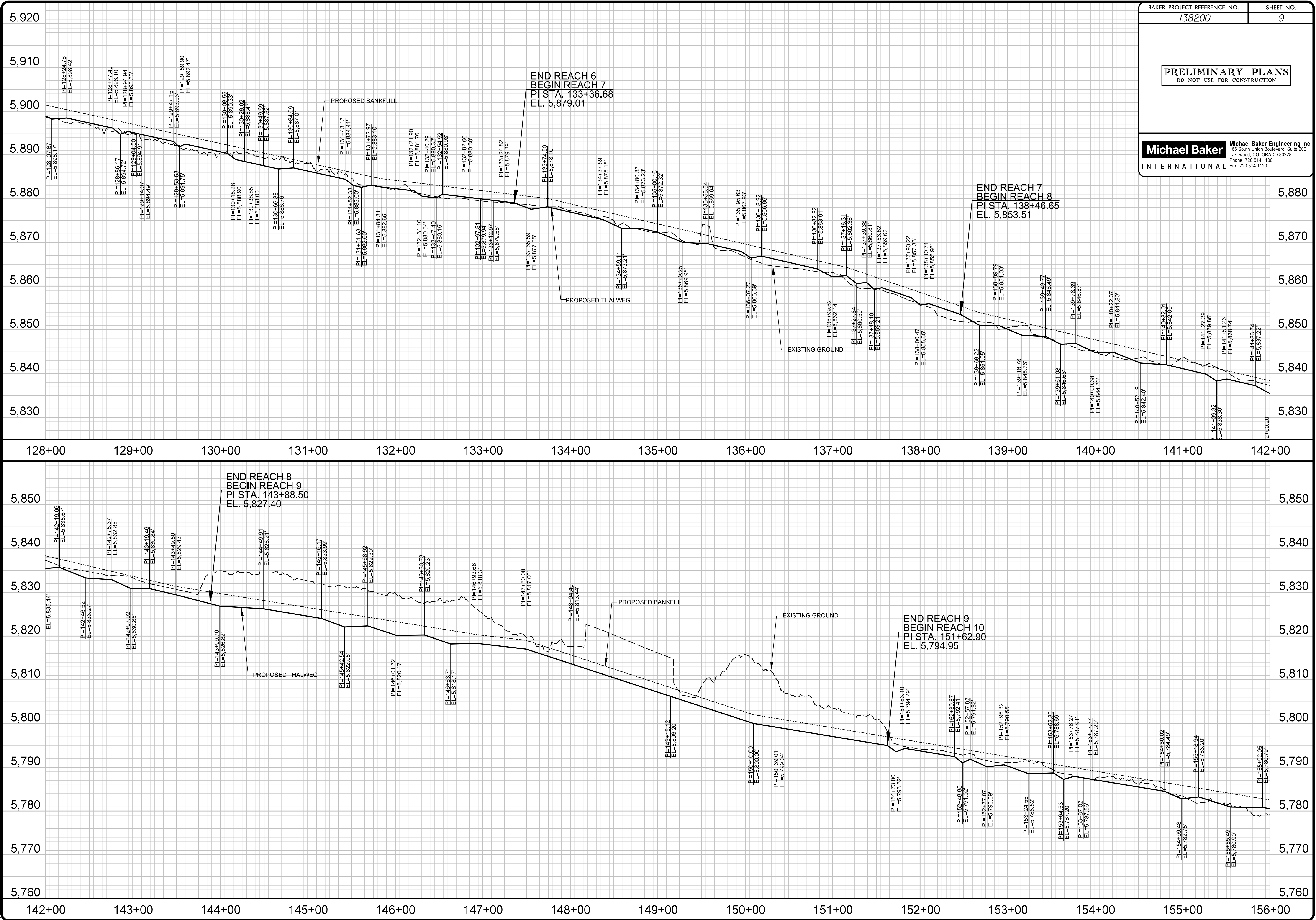
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BAKER PROJECT REFERENCE NO.	SHEET NO.
138200	8
<div>PRELIMINARY PLANS</div> <div>DO NOT USE FOR CONSTRUCTION</div>	
<div>Michael Baker</div> <div>Michael Baker Engineering Inc. 165 South Union Boulevard, Suite 200 Lawrence, CA 94045-80228 Phone: 720.514.1100 Fax: 720.514.1120</div>	

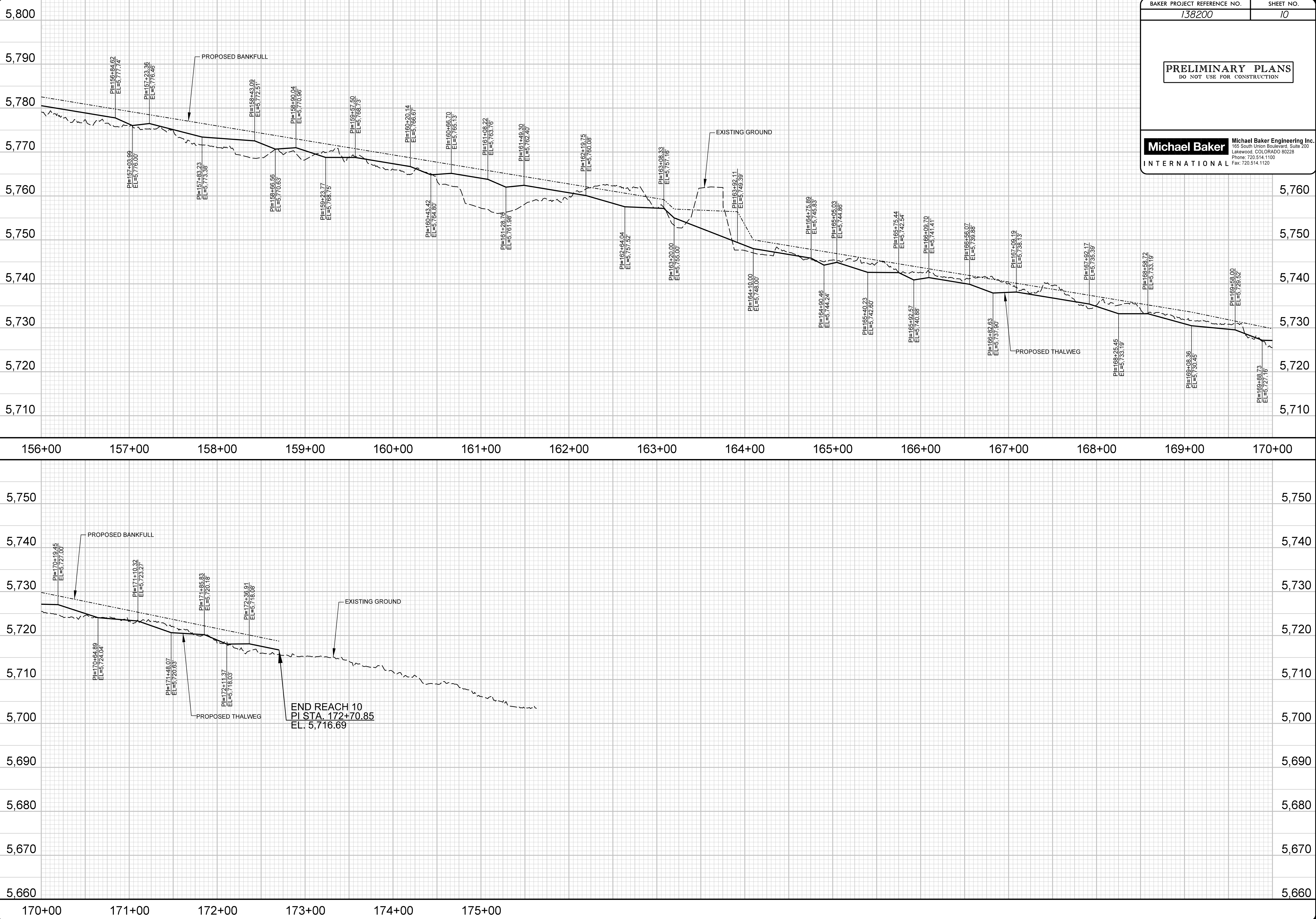


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138200	10

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165 South Union Boulevard, Suite 200
Lakewood, CO 80228
Phone: 720.514.1100
Fax: 720.514.1120

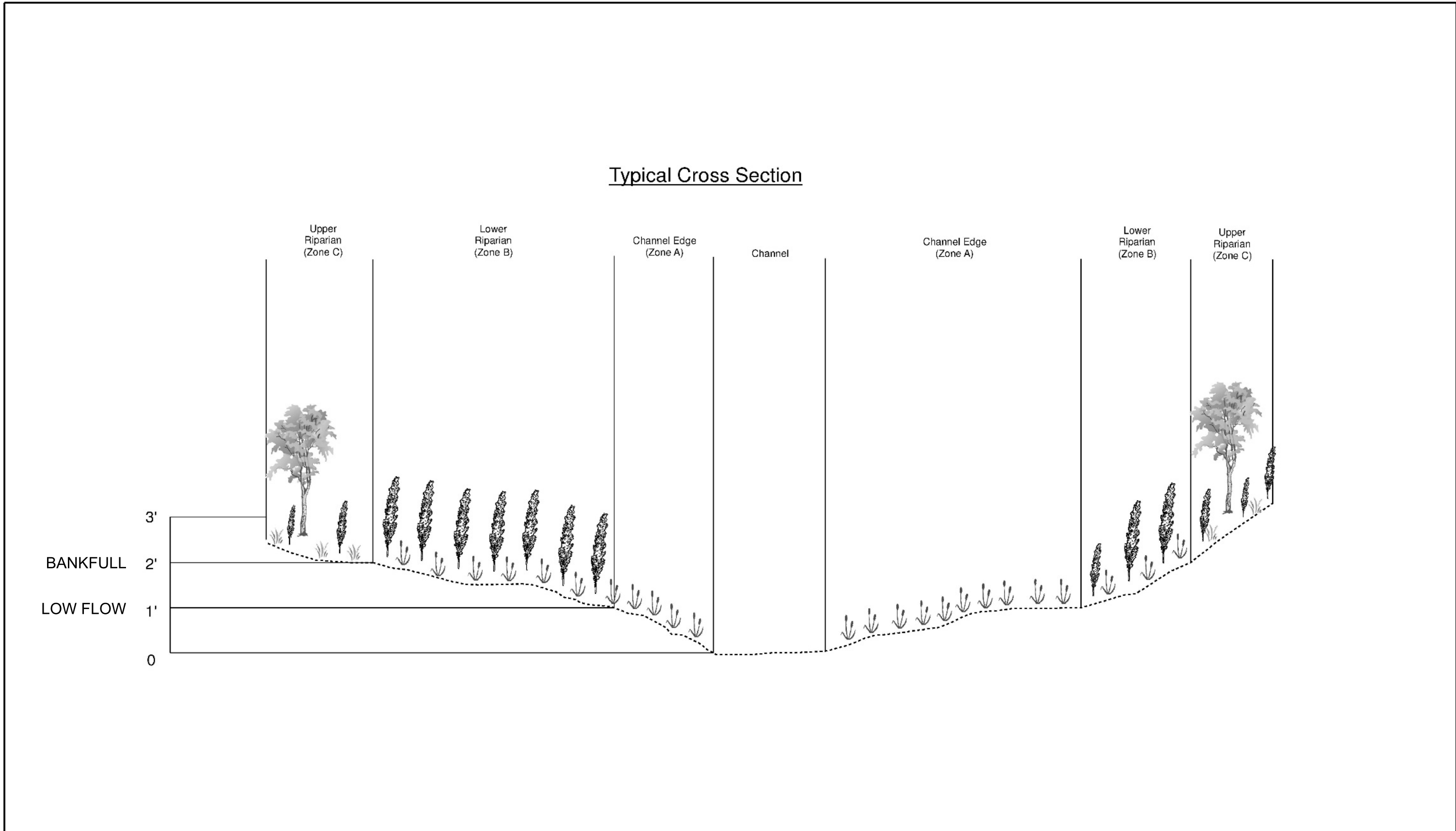
PRELIMINARY PLANS

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Michael Baker Engineering Inc.
165 South Union Boulevard, Suite 200
Lakewood, COLORADO 80226
Phone: 720.514.1100
Fax: 720.514.1120

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REVEGETATION PLANTING ZONES FOR DESIGN REACHES				
REACH	CHANNEL EDGE ZONE A	LOWER RIPARIAN ZONE B	UPPER RIPARIAN ZONE C	RIPARIAN SEED
1		X	X	X
2		X	X	X
3		X	X	X
4	X	X	X	X
5	X	X	X	X
6	X	X	X	X
7	X	X	X	X
8	X	X	X	X
9	X	X	X	X
10	X	X	X	X

X = INDICATES TYPE OF PLANTINGS TO BE APPLIED TO EACH REACH

Table 1: Plants Needed for Restoration ¹			
Common Name	Scientific Name	Plant Size (cubic inch)	Plants per Acre
Zone A: Channel Edge²			
Nebraska sedge	<i>Carex nebrascensis</i>	10	882
Emory's sedge	<i>Carex emoryi</i>	10	1,470
Creeping spikerush	<i>Eleocharis palustris</i>	10	882
Baltic rush	<i>Juncus balticus</i>	10	1,470
Red-tinge bulrush	<i>Scirpus microcarpus</i>	10	882
		Total	5,586
Zone B: Lower Riparian²			
Peachleaf willow	<i>Salix amygdaloides</i>	40	1,000
Peachleaf willow	<i>Salix amygdaloides</i>	3' cutting	500
Narrowleaf willow	<i>Salix exigua</i>	40	2,500
Narrowleaf willow	<i>Salix exigua</i>	3' cutting	500
Dewystem willow	<i>Salix irrorata</i>	40	2,000
Dewystem willow	<i>Salix irrorata</i>	3' cutting	500
		Total	7,000
Zone C: Upper Riparian³			
Rubber rabbitbrush	<i>Ericameria nauseosus</i>	40	50
Narrowleaf cottonwood	<i>Populus angustifolia</i>	40	500
Plains cottonwood	<i>Populus deltoides</i>	40	500
American plum	<i>Prunus americana</i>	40	75
Chokecherry	<i>Prunus virginiana</i>	40	75
Common snowberry	<i>Symphoricarpos alba</i>	40	75
Golden current	<i>Ribes aureum</i>	40	50
Woods' rose	<i>Rosa woodsii</i>	40	75
		Total	1,400

¹Zone A is 0-1', Zone B is 1-2', and Zone C is 2-2.5' above channel; planting will only occur in discrete pockets based on final grading
²Based on approximately 3-foot centers
³Based on approximately 6-foot centers

Table 2: Riparian Seed Mix ¹						
¹ Nomenclature follows PLANTS Database (NRCS 2015); seeding rate based on hand-broadcasting; any substitutions must be native to Colorado and from a US or Canada seed source.						
Type	Common Name	Scientific Name	Variety ²	Seeds per Pound ³	Seeds per Square Foot	Pounds of Pure Live Seed/Acre
Graminoids	Indian ricegrass	<i>Achnatherum hymenoides</i>	Pulama	141,000	3.9	1.2
	Sideoats grama	<i>Bouteloua curtipendula</i>	Butte or Pierre	191,000	5.3	1.2
	Blue grama ³	<i>Bouteloua gracilis⁴</i>	Birds Eye, Alma, or Lovington	825,000	11.4	0.6
	Slender wheatgrass	<i>Elymus trachycaulus</i>	White River or San Luis	159,000	4.4	1.2
	Idaho fescue ²	<i>Festuca idahoensis⁴</i>	Winchester	450,000	8.3	0.8
	Fowl mannagrass	<i>Glyceria striata</i>	-	180,000	8.3	2.0
	Needle and thread	<i>Hesperostipa comata</i>	-	115,000	5.3	2.0
	Prairie junegrass ³	<i>Koeleria macrantha⁴</i>	-	2.3 million	5.3	0.1
	Baltic rush ³	<i>Juncus balticus⁴</i>	-	10.9 million	25.0	0.1
	Torrey's rush ³	<i>Juncus torreyi⁴</i>	-	12.3 million	28.2	0.1
	Green needlegrass	<i>Nassella viridula</i>	Cucharas or Lodorm	181,000	4.2	1.0
	Western wheatgrass	<i>Pascopyrum smithii</i>	Arriba	110,000	10.1	4.0
	Fowl bluegrass ³	<i>Poa palustris²</i>	-	3.2 million	7.3	0.1
	Sandberg bluegrass ³	<i>Poa secunda²</i>	Sims Mesa or High Plains	1 million	6.9	0.3
	Bluebunch wheatgrass	<i>Pseudoroegneria spicata</i>	P7	140,000	6.4	2.0
	Little bluestem	<i>Schizachyrium scoparium</i>	Pastura, Cimarron, or Camper	260,000	6.0	1.0
	Prairie cordgrass	<i>Spartina pectinata</i>	-	197,000	4.5	1.0
	Common yarrow ³	<i>Achillea millefolium⁴</i>	-	2.7 million	6.2	0.1
	Rocky Mountain bee plant	<i>Cleome serrulata</i>	-	66,000	3.0	2.0
	Golden tickseed ³	<i>Coreopsis tinctoria⁴</i>	-	1.4 million	3.2	0.1
Forbs	Blanketflower	<i>Gaillardia aristata</i>	Meriweather	132,000	1.5	0.5
	Showy goldeneye ³	<i>Helianthus multiflorus⁴</i>	-	1 million	2.3	0.1
	Rocky Mountain penstemon	<i>Penstemon strictus</i>	Bandera	490,000	2.2	0.2
	American vetch	<i>Vicia americana</i>	-	33,000	0.8	1.0
Bulk	Rice hulls	-	-	-	-	2.3
				Total	170.0	25.0

²Sources: NRCS 2015, Granite Seed 2015, Western Native Seed 2015, NSN 2015
³Bag separately if drill-seeding

- Notes:
- All planting zones will be seeded with the Riparian Seed Mix (Table 2). Seeding will only be performed between September 1 and when the ground is frozen, and when the ground is thawed and June 1, unless approved by a qualified ecologist.
 - Woody plants (Zones B and C) will be installed in discrete pockets. The exact locations will be based on the final grading and determined after grading is complete.
 - Compost (300 cubic yards per acre) will be mixed with native soil in discrete pockets within the restoration areas. Exact locations will be determined by the presence of adequate native soil.
 - Compost will have the following characteristics:
 - pH: 5.5-8.0
 - Moisture content: 35-55 percent
 - Particle size: pass through 1-inch screen or smaller
 - Stability: stable to highly stable, providing nutrients for plant growth
 - Maturity/growth screening: demonstrate ability to enhance plant growth
 - Soluble salt concentration: 2.5 dS (mmhos/cm) or less preferred
 - Organic matter content: 30-70 percent
 - Suggested compost source: A-1 Organic, Eaton, Colorado 970-454-3492 or an approved equal.
 - All willow cuttings must be harvested while dormant and planted within 3 to 14 days (after soaking—completely submerged)
 - All containerized plants will be inspected by a qualified ecologist prior to planting. Any dead, dying, stressed, or badly "rootbound" plants will be rejected.
 - A qualified ecologist will direct and supervise all plantings
 - All seed will be hand-broadcast and lightly raked by hand to encourage contact with the soil

- All seeded areas will be mulched with certified weed-free straw and tackified with a cellulose-based tackifier (or hydromulched). No hay mulch will be used on the site.
- No fertilizers will be used on the site
- In an attempt to avoid the continued spreading of noxious weeds, all discrete populations of Colorado List A or B noxious weeds found in or within 100 feet of the restoration area will be sprayed with the appropriate herbicide(s) prior to construction
- All finish grades will be rough (plus or minus 4 inches), and all straight edges and right angles will be avoided
- No equipment will be allowed in the restoration area after seeding or planting.
- Any trees to be removed for the project will be removed during the non-nesting season for migratory birds (between September 1 and March 31)
- All best management practices (BMPs) used shall be selected, installed, implemented, and maintained according to good engineering, hydrologic and pollution control practices.
- The use of chemicals such as soil stabilizers, dust palliatives, herbicides, growth inhibitors, fertilizers, deicing salts, etc., shall be in accordance with the manufacturer's recommended application rates, frequency, and instructions. These chemicals shall not be used, stored, or stockpiled within 50 horizontal feet of Fourmile Canyon Creek.
- Construction equipment, fuels, lubricants, and other petroleum distillates shall not be stored or stockpiled within 50 horizontal feet of Fourmile Canyon Creek. Equipment fueling and servicing shall occur only within approved designated areas.