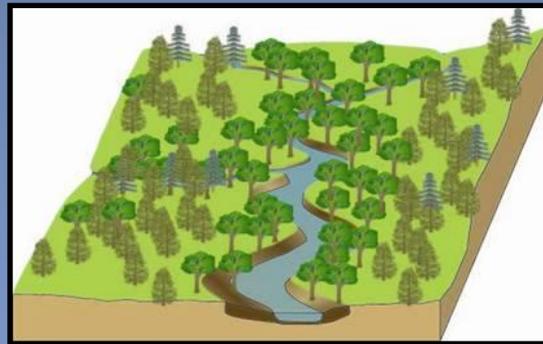
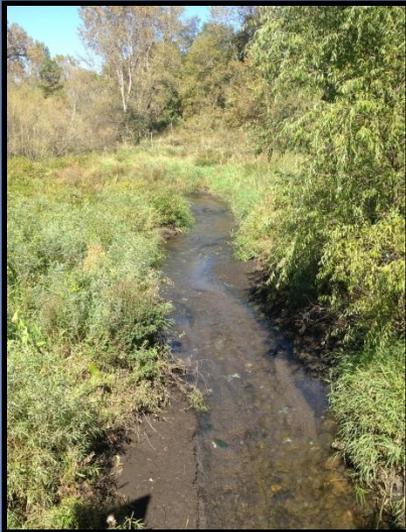


Urban Stream Stabilization



THE WAY IT WAS

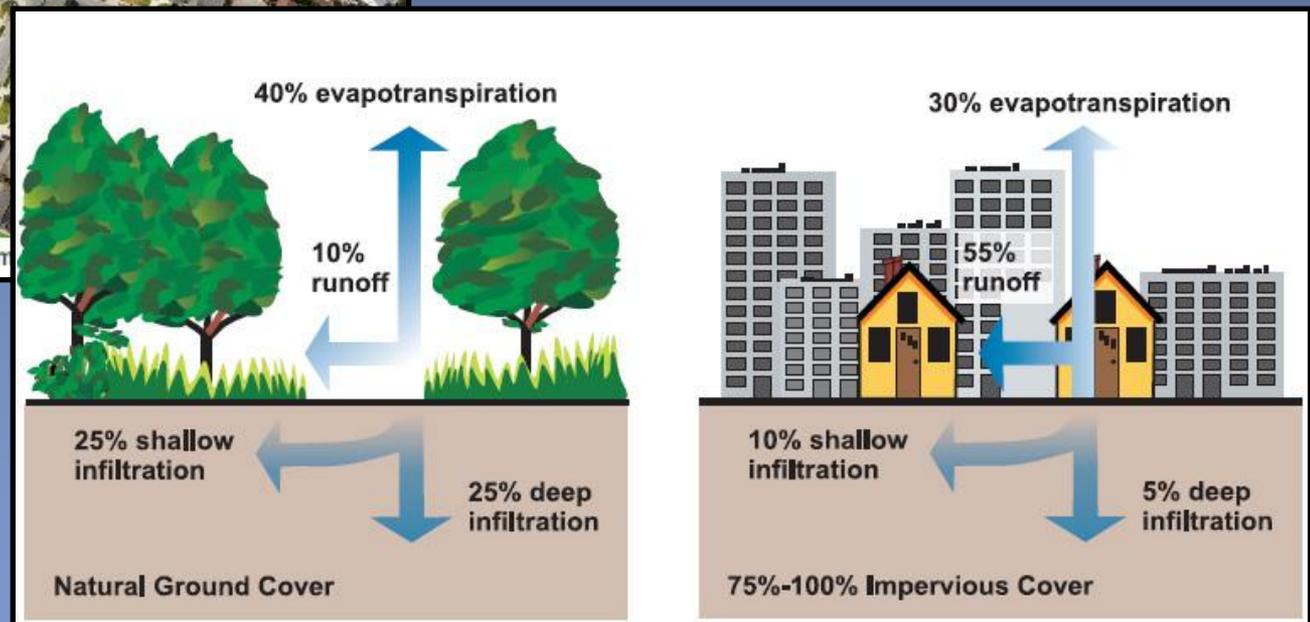
- *Pervious watersheds*
- *Significant retention of water within soils / wetlands*
- *Sinuuous stream channels*
- *Native soil and vegetation within system*



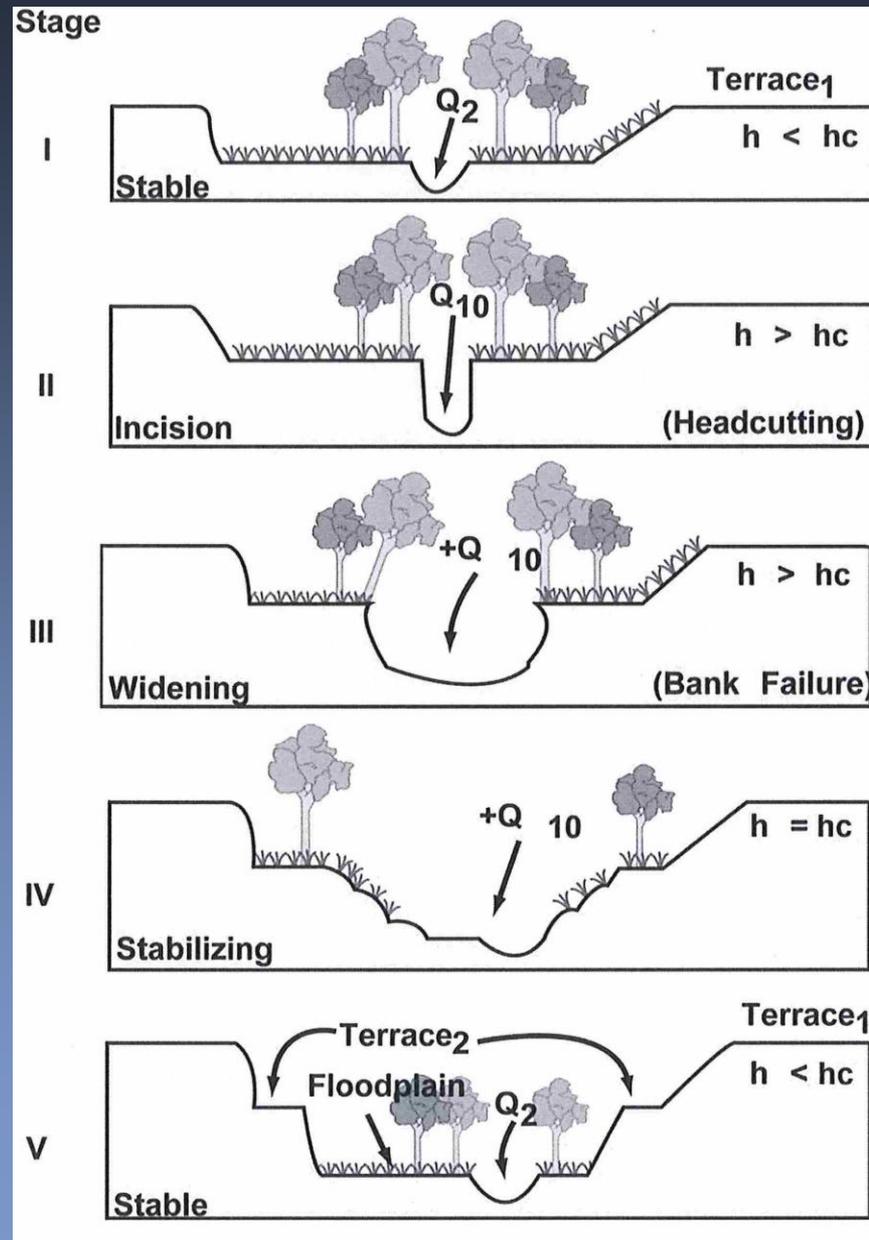
DEVELOPMENT AND IMPERVIOUS COVER



Upland development increased impervious cover



Channel Evolution Model



INFRASTRUCTURE AT RISK



A few examples of typical drivers for stream stabilization minor issues to major issues (ends of pipes and exposed sanitary sewer)



STREAMS AT RISK



Risk of sediment severely impacting water quality, risk of water quality. This is an example of bluff erosion that was prompted by development of a large mall upstream of the stream. This is located in Sioux City, IA.

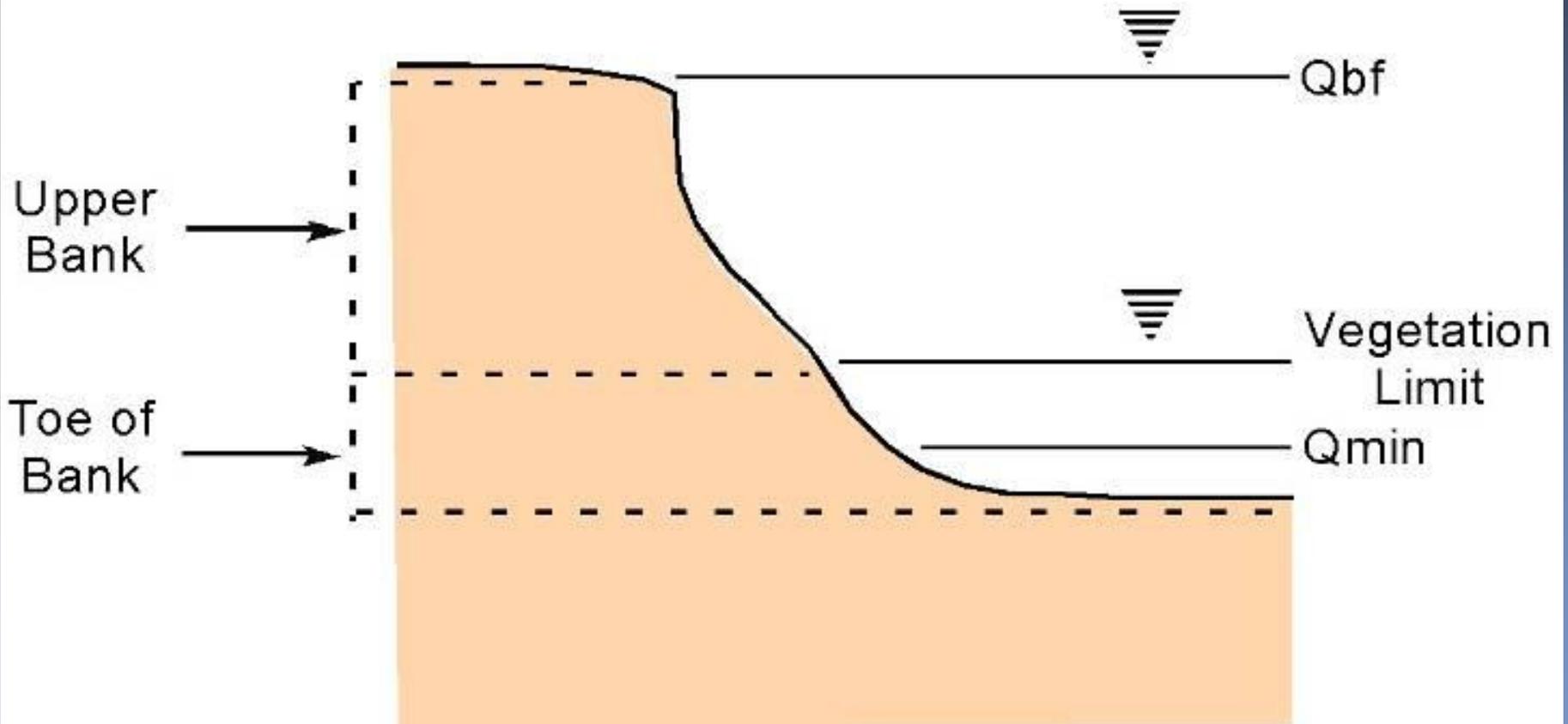
BANK EROSION

- Not all bank erosion is bad
- Erosion is a normal process
- Streams evolve their XS to fit a their flow regime



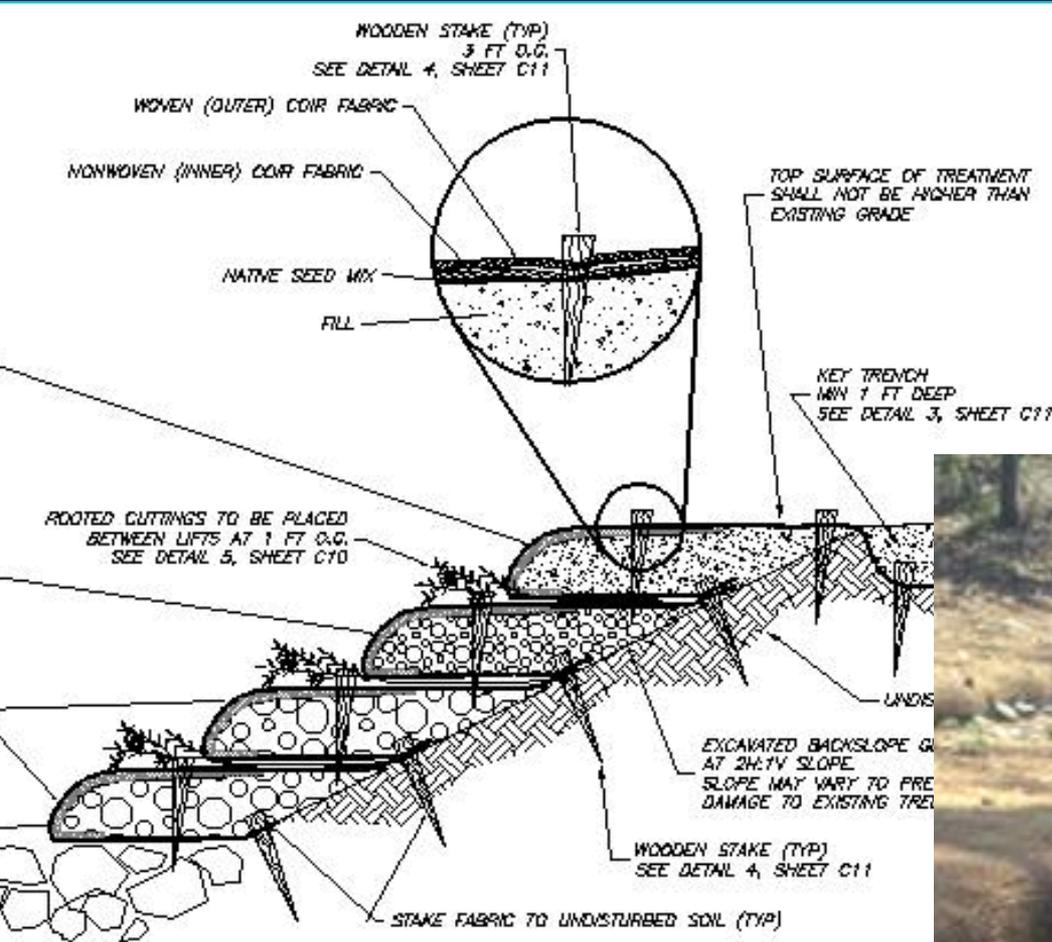
PARTS OF A BANK

Bank Design Components

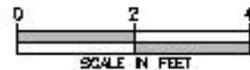


A quick primer on stream bank components. The critical area is typically the toe of the bank, where the highest erosive forces impact the stability of the slopes.

Soil encapsulation



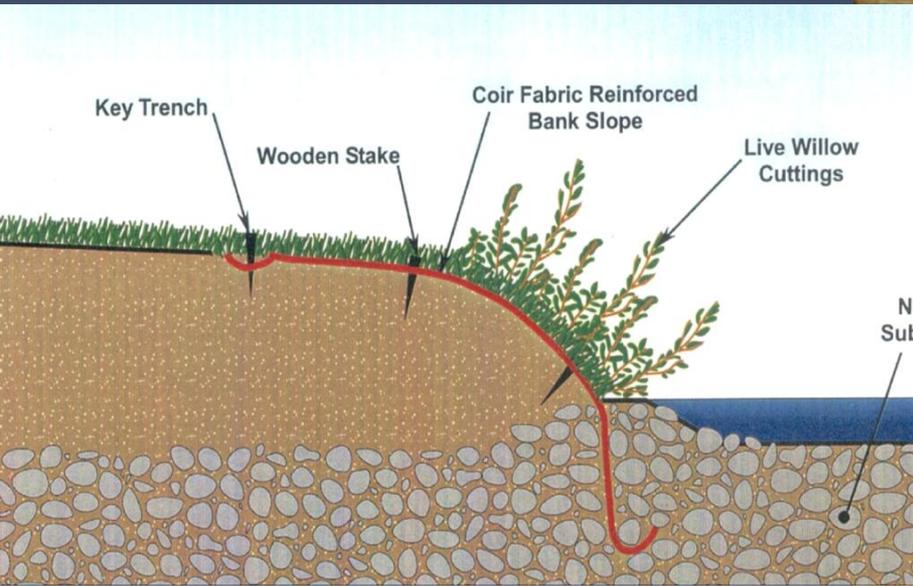
1 TYPICAL SECTION VIEW
C10 TYPE 1 BANK TREATMENT



Combination treatments

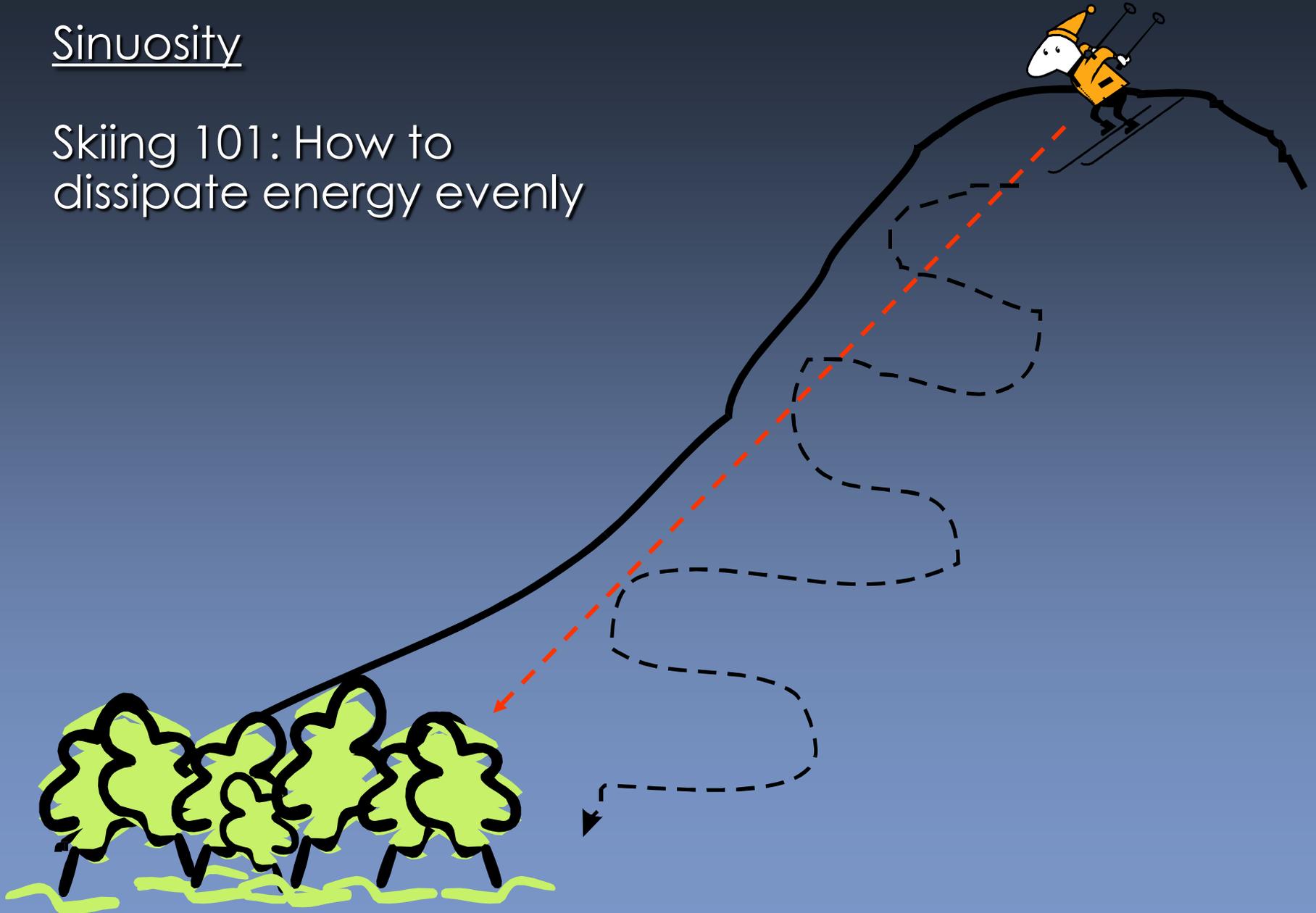


Simple grade and shape



Sinuosity

Skiing 101: How to
dissipate energy evenly



Grade control

- Steep riffle



A channel that is downcutting can sometimes be stabilized by bringing up the grade to reconnect the stream with the floodplain. This is often only feasible in conjunction with the more holistic watershed solutions mentioned previously.

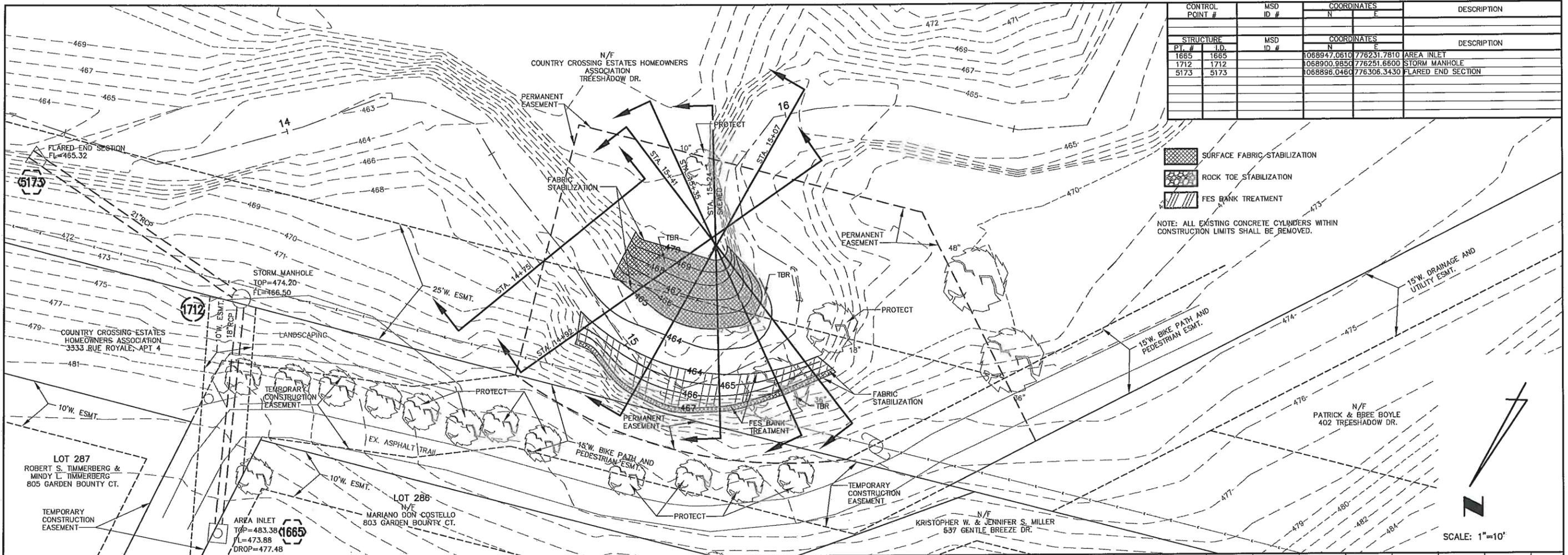


Combination treatments









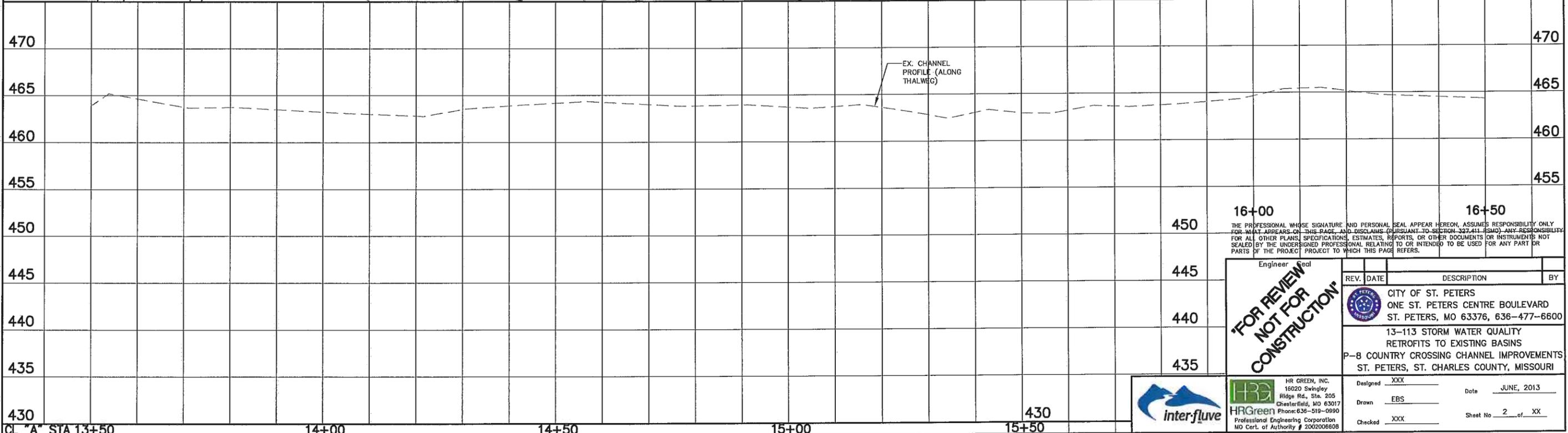
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1712	1712	1068900.9850	776251.6600	STORM MANHOLE
5173	5173	1068896.0460	776306.3430	FLARED END SECTION

- SURFACE FABRIC STABILIZATION
- ROCK TOE STABILIZATION
- FES BANK TREATMENT

NOTE: ALL EXISTING CONCRETE CYLINDERS WITHIN CONSTRUCTION LIMITS SHALL BE REMOVED.



SCALE: 1"=10'



450 16+00 16+50

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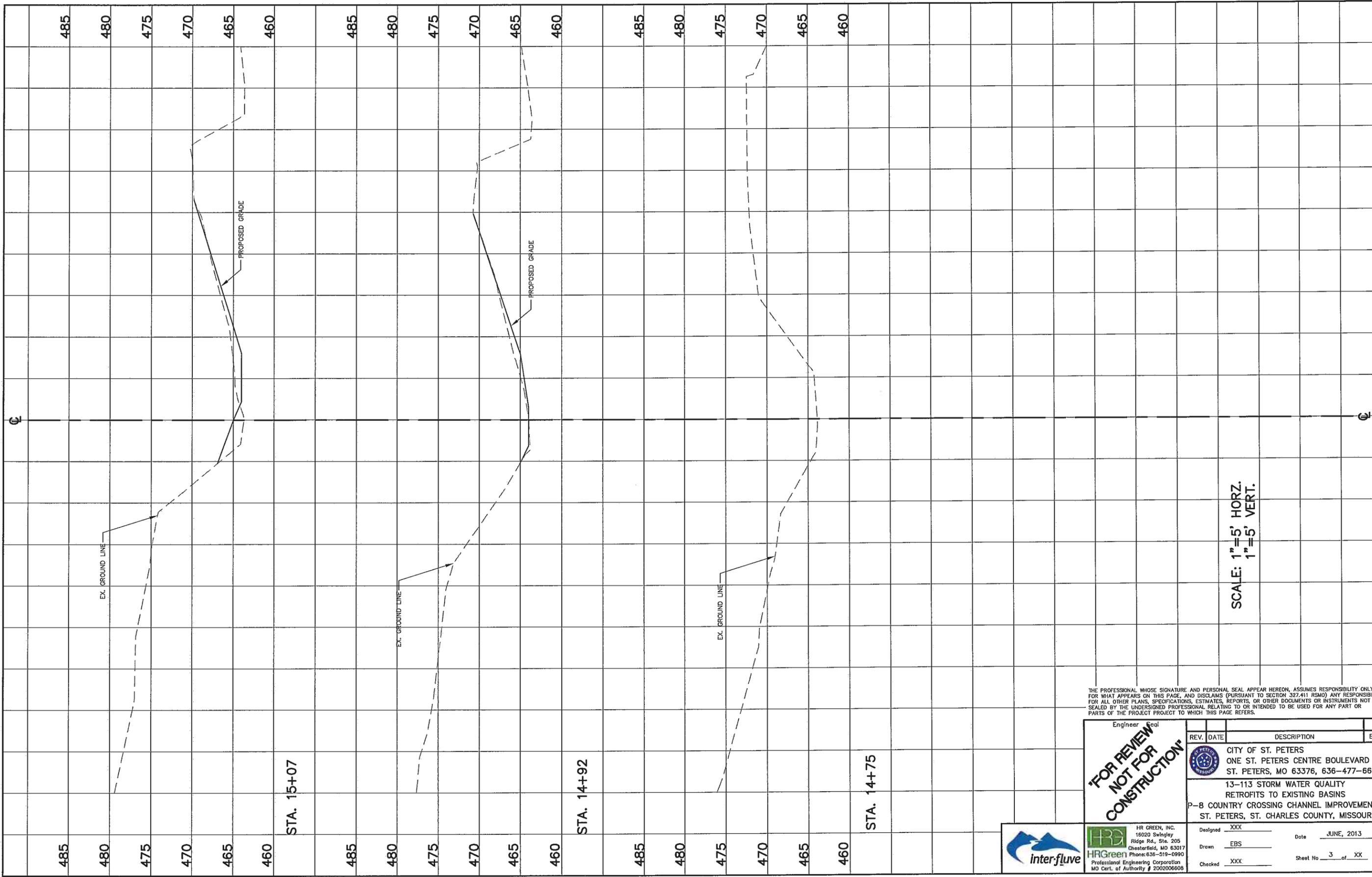
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		CITY OF ST. PETERS ONE ST. PETERS CENTRE BOULEVARD ST. PETERS, MO 63376, 636-477-6600	
		13-113 STORM WATER QUALITY RETROFITS TO EXISTING BASINS P-8 COUNTRY CROSSING CHANNEL IMPROVEMENTS ST. PETERS, ST. CHARLES COUNTY, MISSOURI	

Designed: XXX Date: JUNE, 2013
 Drawn: EBS
 Checked: XXX Sheet No. 2 of XX

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inter-fluve



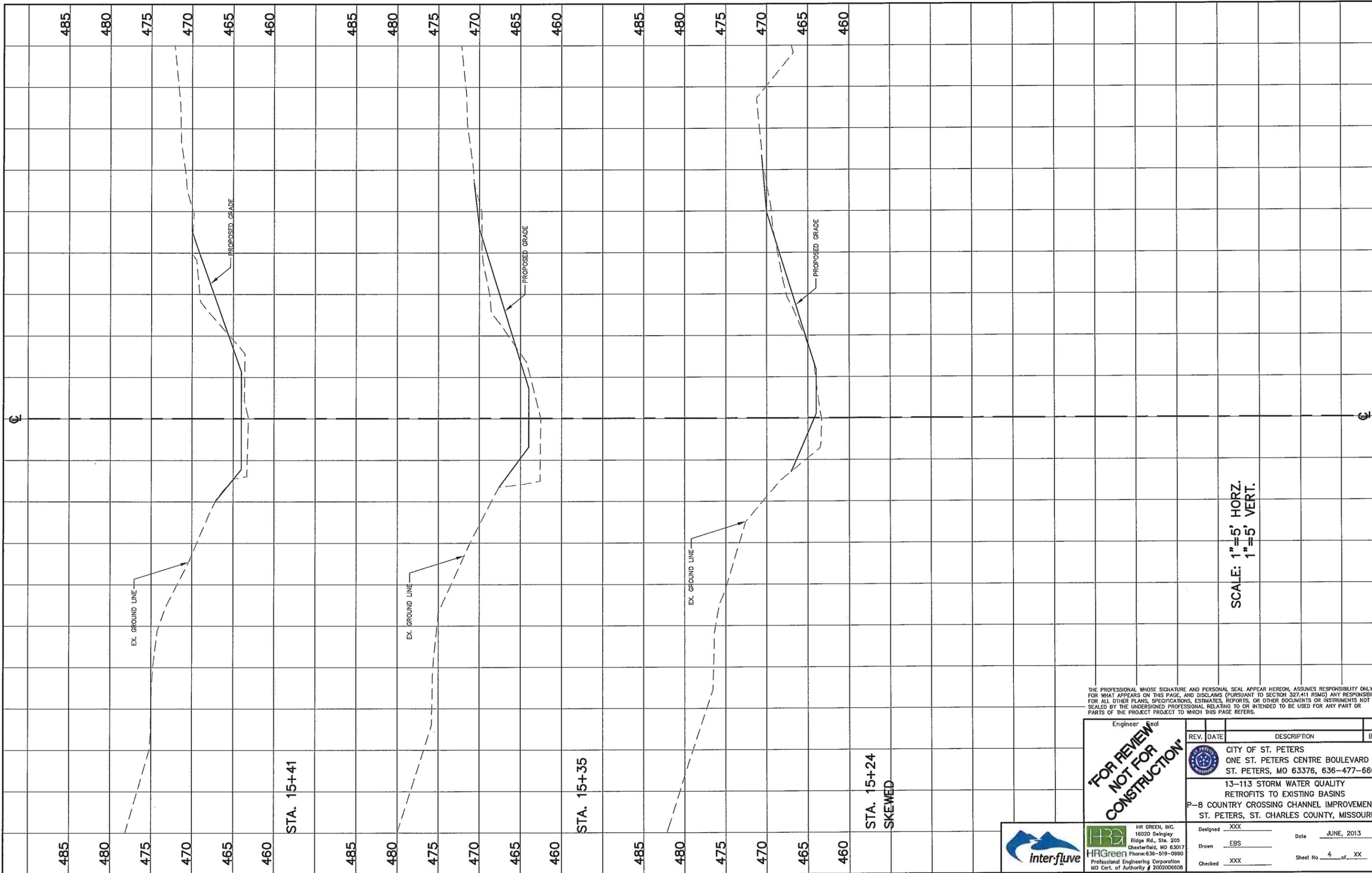
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1"=5' VERT.

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	DESIGNED: XXX DRAWN: EBS CHECKED: XXX	DATE: JUNE, 2013 SHEET NO. 3 OF XX



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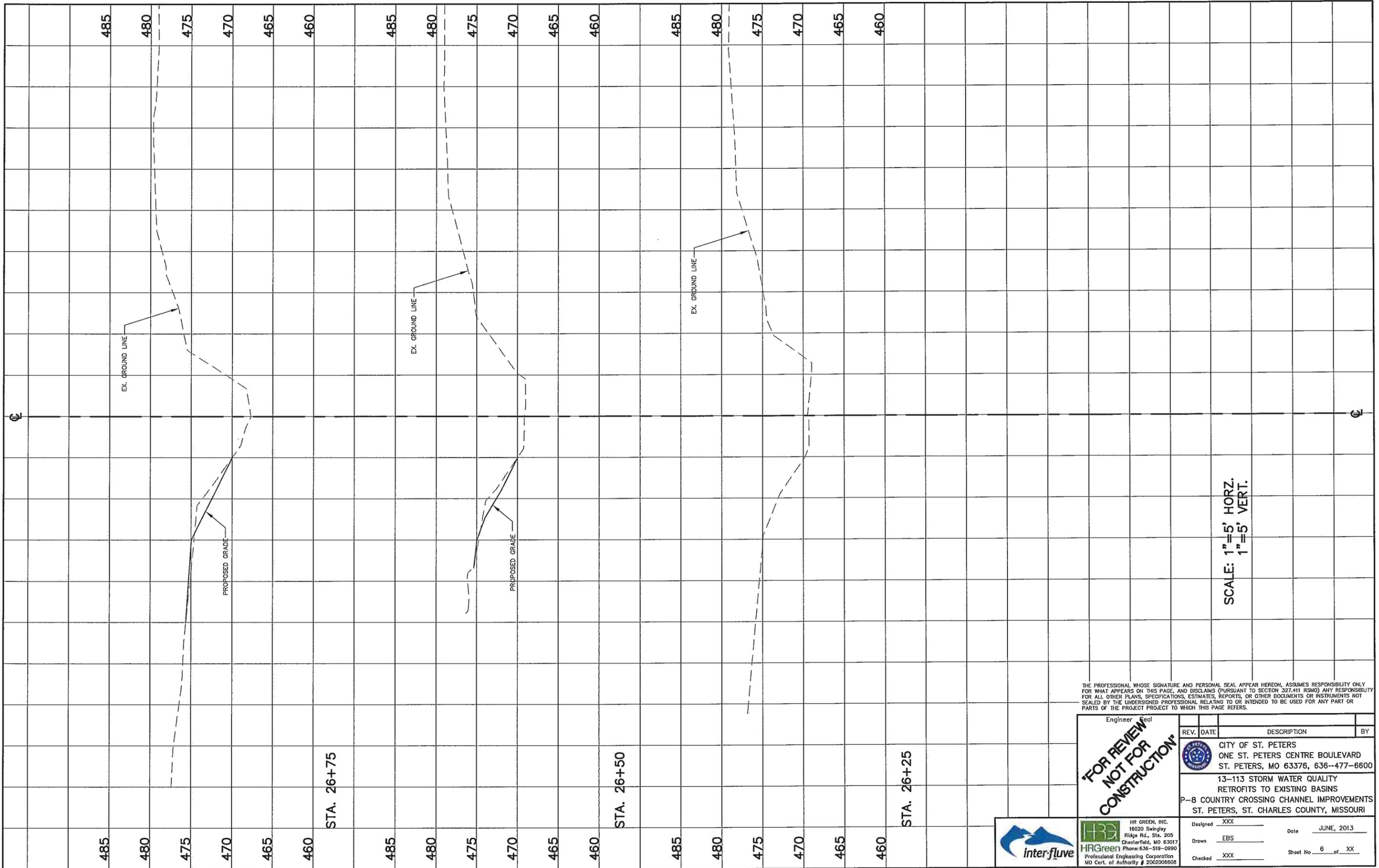
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	Designed XXX Drawn EBS Checked XXX	Date JUNE, 2013 Sheet No. 4 of XX			



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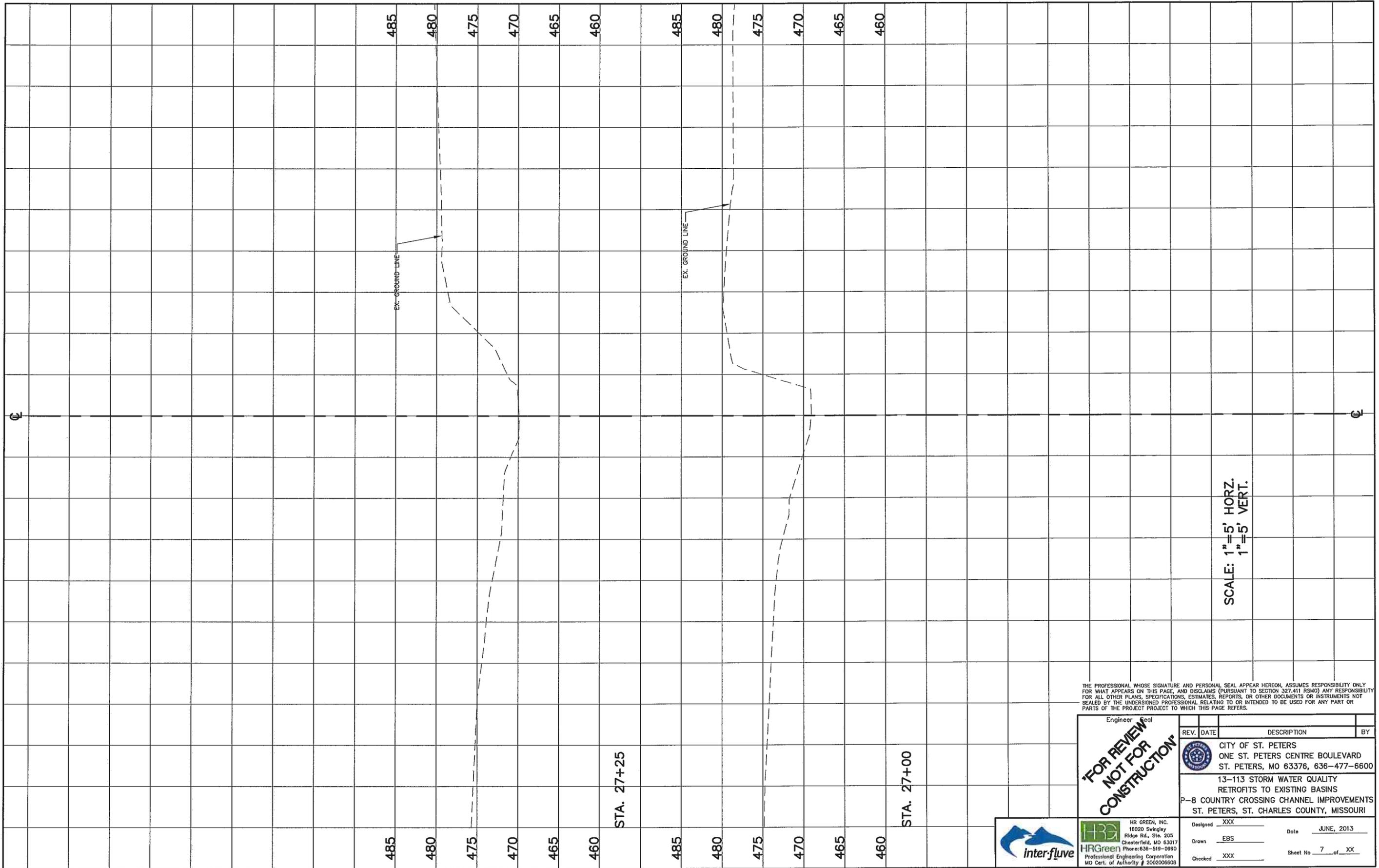


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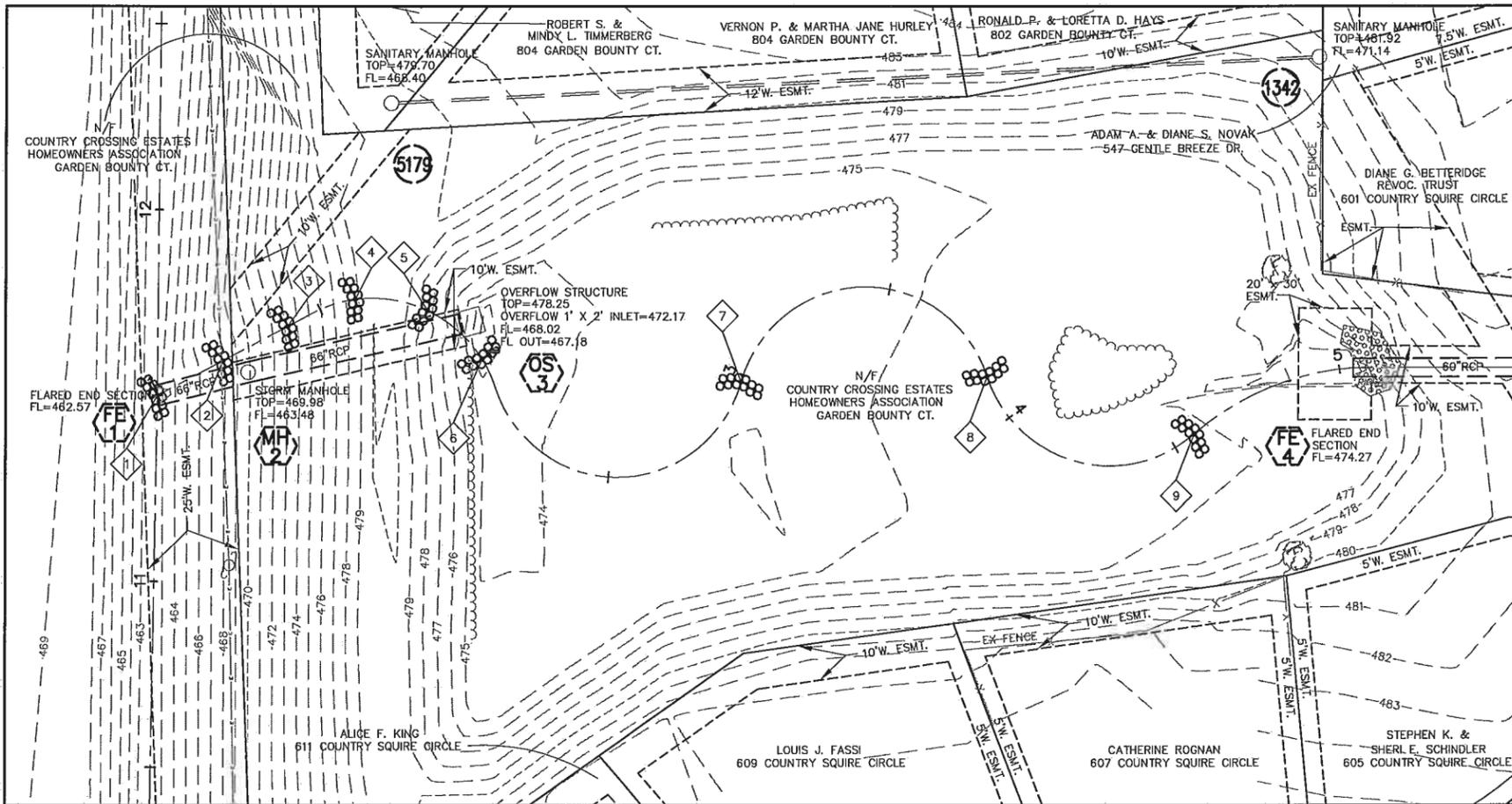


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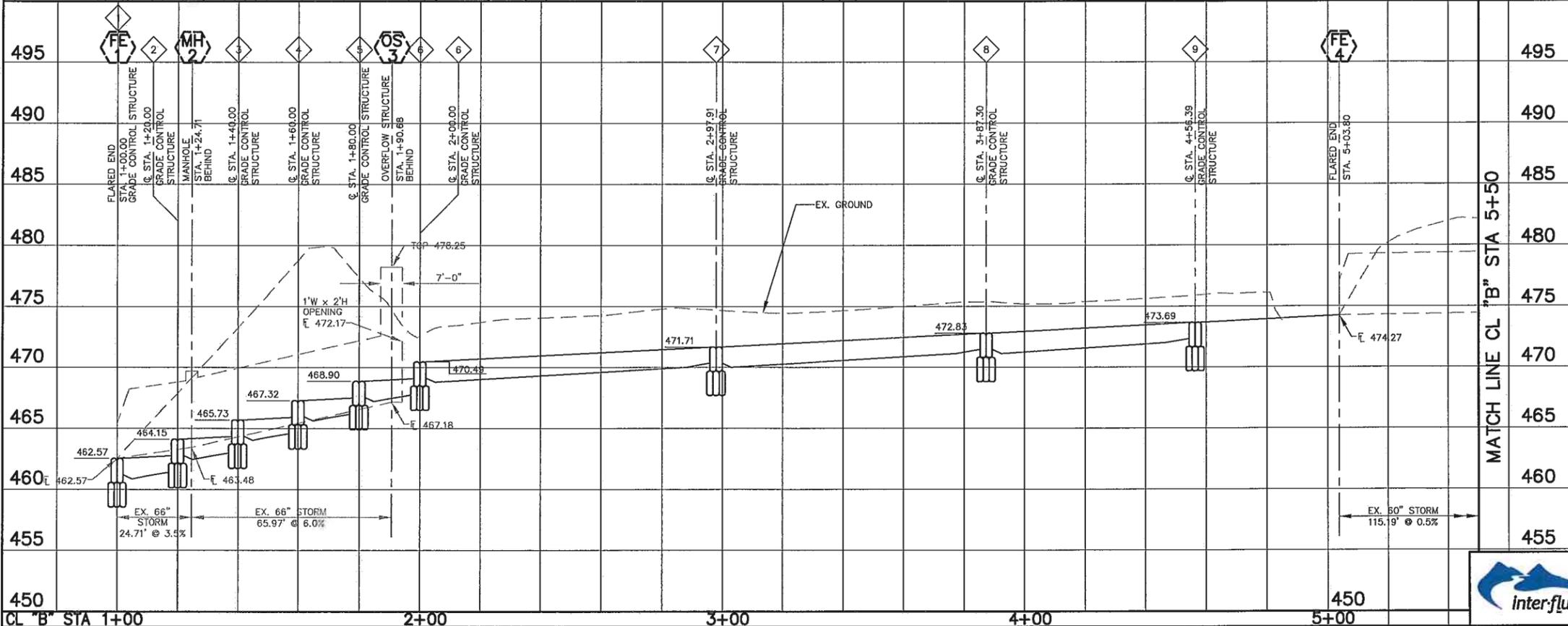
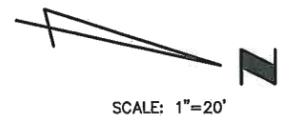
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Drawn	EBS	Checked	XXX
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CONTROL POINT #	MSD ID #	COORDINATES		DESCRIPTION
		N	E	
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1342	1342	1069259.7830	776416.1070	FLARED END SECTION
5014	FE1	1069232.6510	776336.4240	SANITARY MANHOLE
5176	MH2	1068943.8260	776493.4600	FLARED END SECTION
5179	5179	1068966.5310	776482.0550	STORM MANHOLE
		1068988.8980	776402.8960	SANITARY MANHOLE



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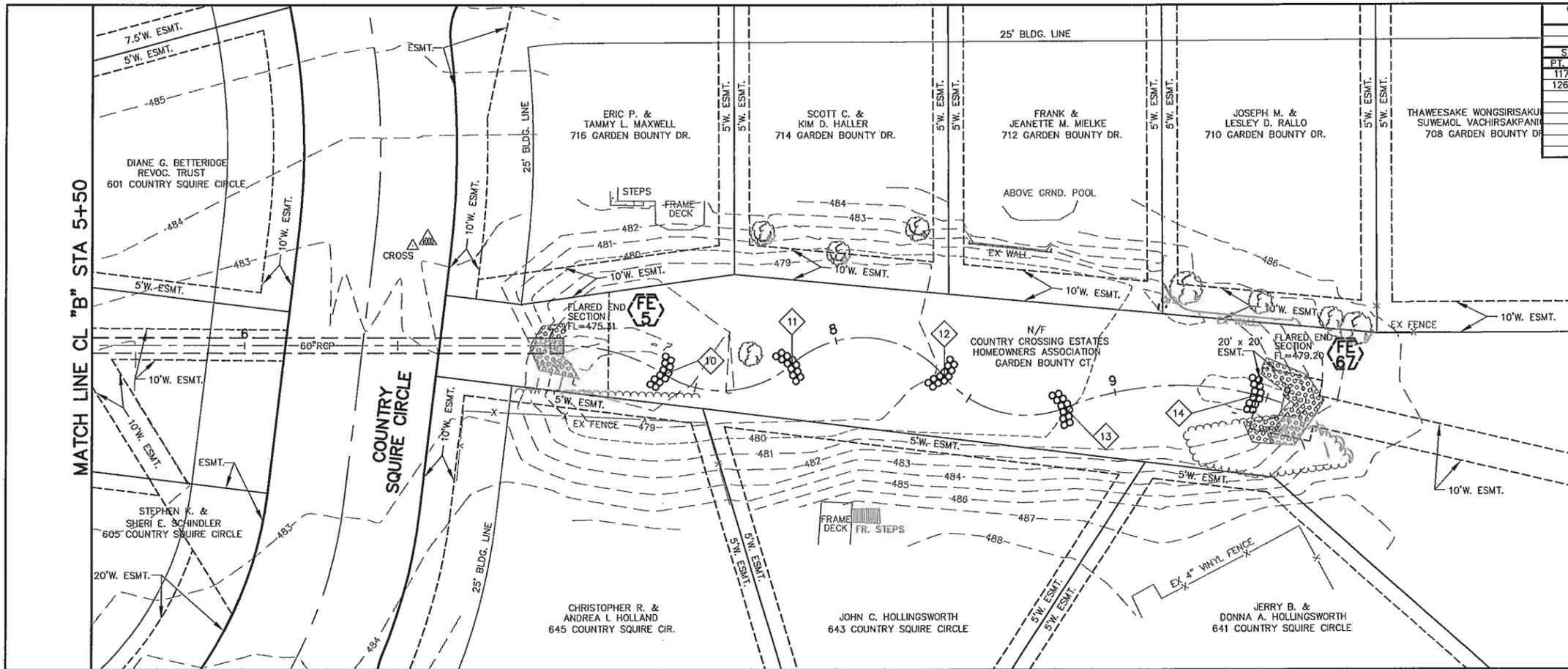
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REV. DATE	DESCRIPTION	BY

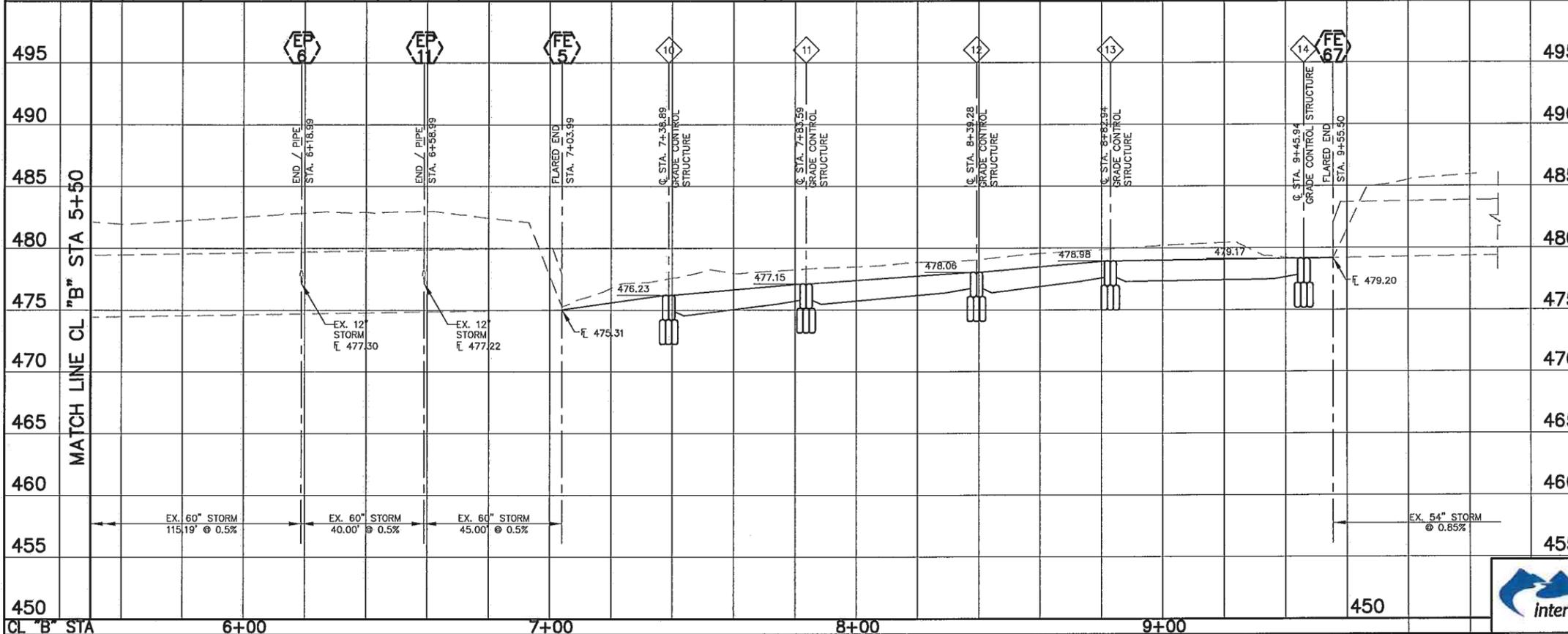
CITY OF ST. PETERS
 ONE ST. PETERS CENTRE BOULEVARD
 ST. PETERS, MO 63376, 636-477-6600
13-113 STORM WATER QUALITY
RETROFITS TO EXISTING BASINS
P-8 COUNTRY CROSSING CHANNEL IMPROVEMENTS
ST. PETERS, ST. CHARLES COUNTY, MISSOURI

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CONTROL POINT #	MSD ID #	COORDINATES		DESCRIPTION
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STRUCTURE	MSD ID #	COORDINATES		DESCRIPTION
PT. #	I.D.	N	E	
1171	FE67	1069688.9510	776340.6320	FLARED END SECTION
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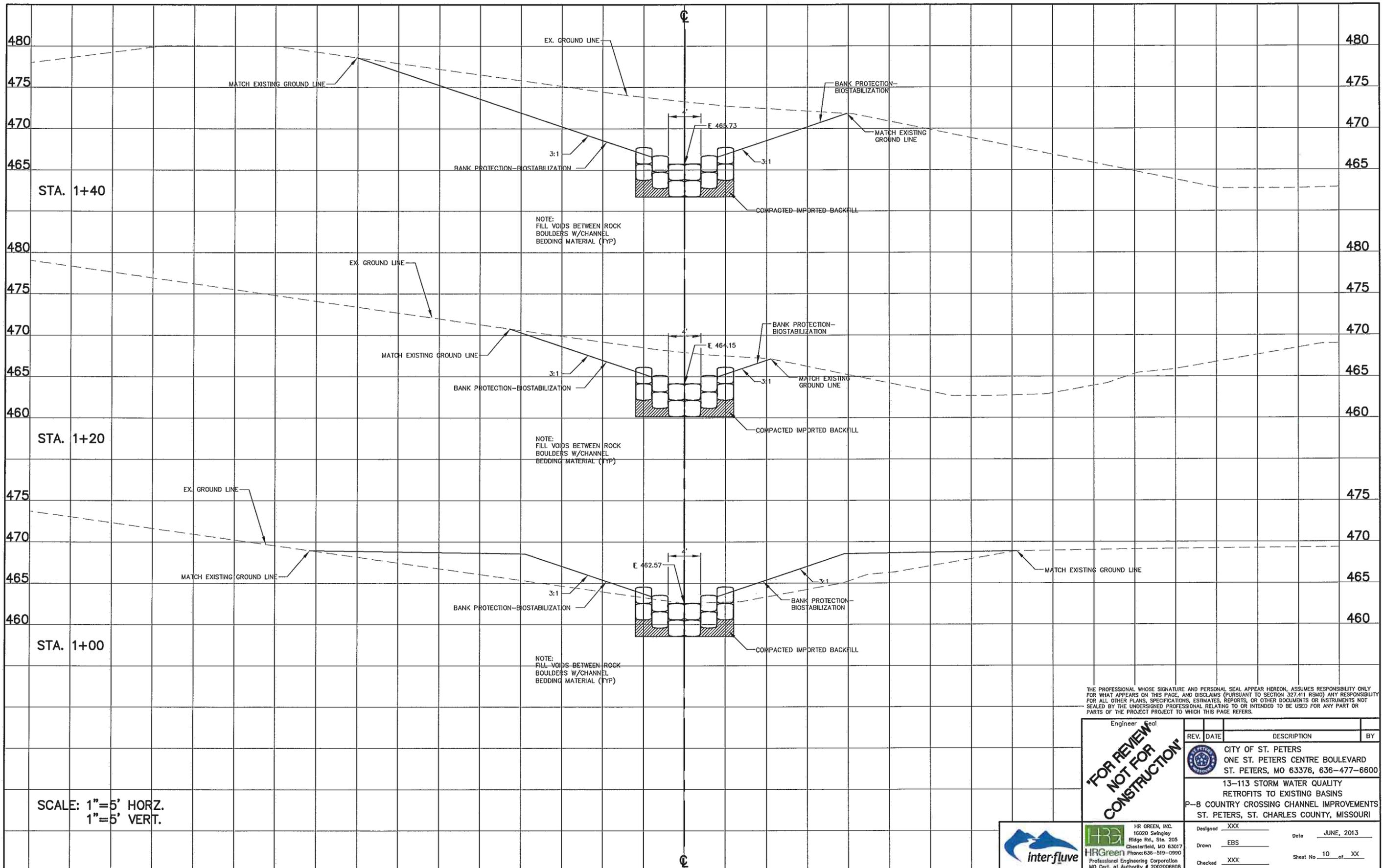
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CITY OF ST. PETERS
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 ST. PETERS, MO 63376, 636-477-6600

13-113 STORM WATER QUALITY
RETROFITS TO EXISTING BASINS
P-8 COUNTRY CROSSING CHANNEL IMPROVEMENTS
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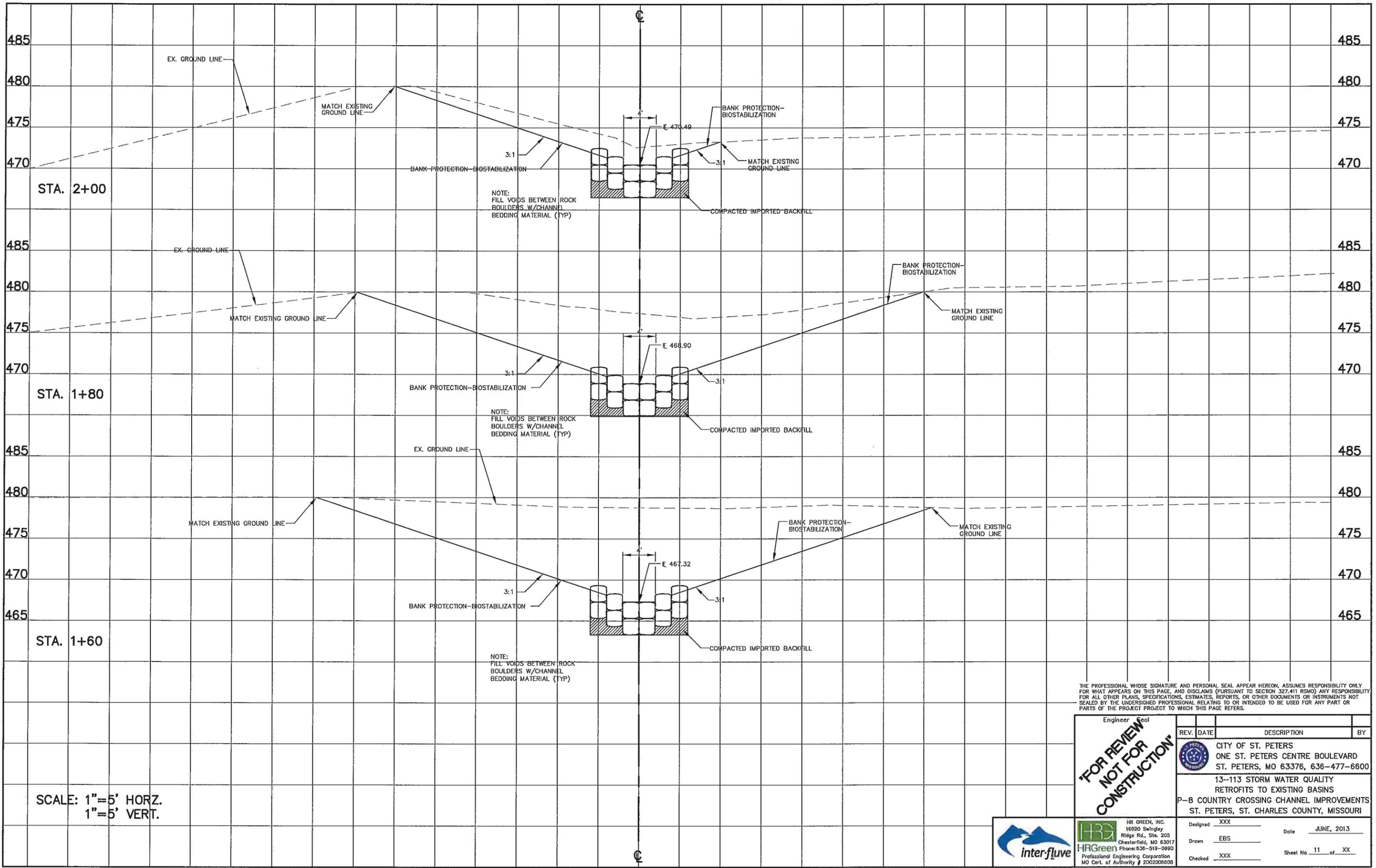
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	Checked XXXX			Sheet No. 10 of XX



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SCALE: 1"=5' HORZ.
1"=5' VERT.



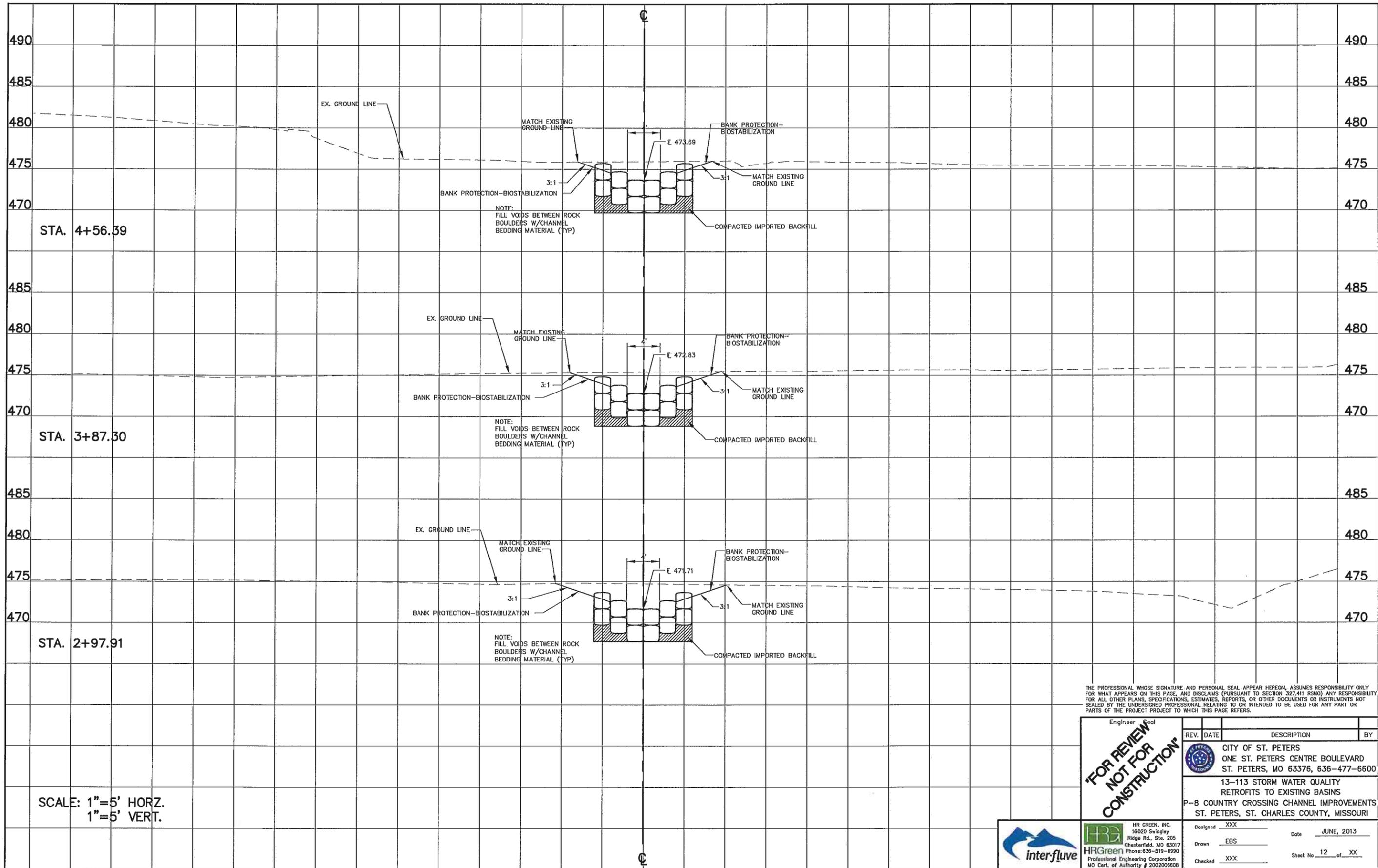
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<p>Designed: XXX</p> <p>Drawn: EBS</p> <p>Checked: XXX</p>	<p>Date: JUNE, 2013</p> <p>Sheet No. 11 of XX</p>									



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SCALE: 1"=5' HORZ.
1"=5' VERT.

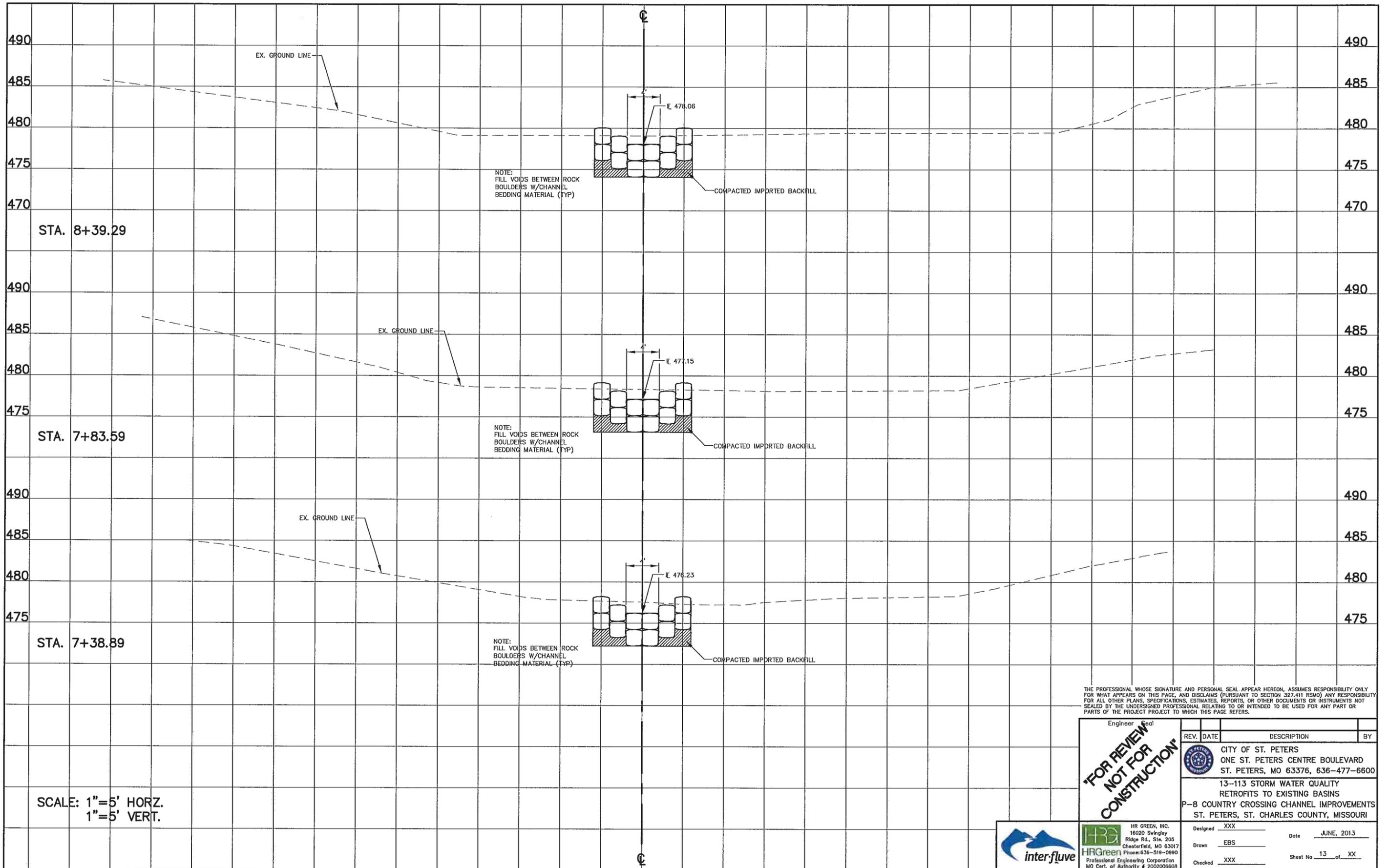


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	CITY OF ST. PETERS ONE ST. PETERS CENTRE BOULEVARD ST. PETERS, MO 63376, 636-477-6600		DESIGNED: XXX DATE: JUNE, 2013
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	CHECKED: XXX		SHEET NO. 12 OF XX



SCALE: 1"=5' HORZ.
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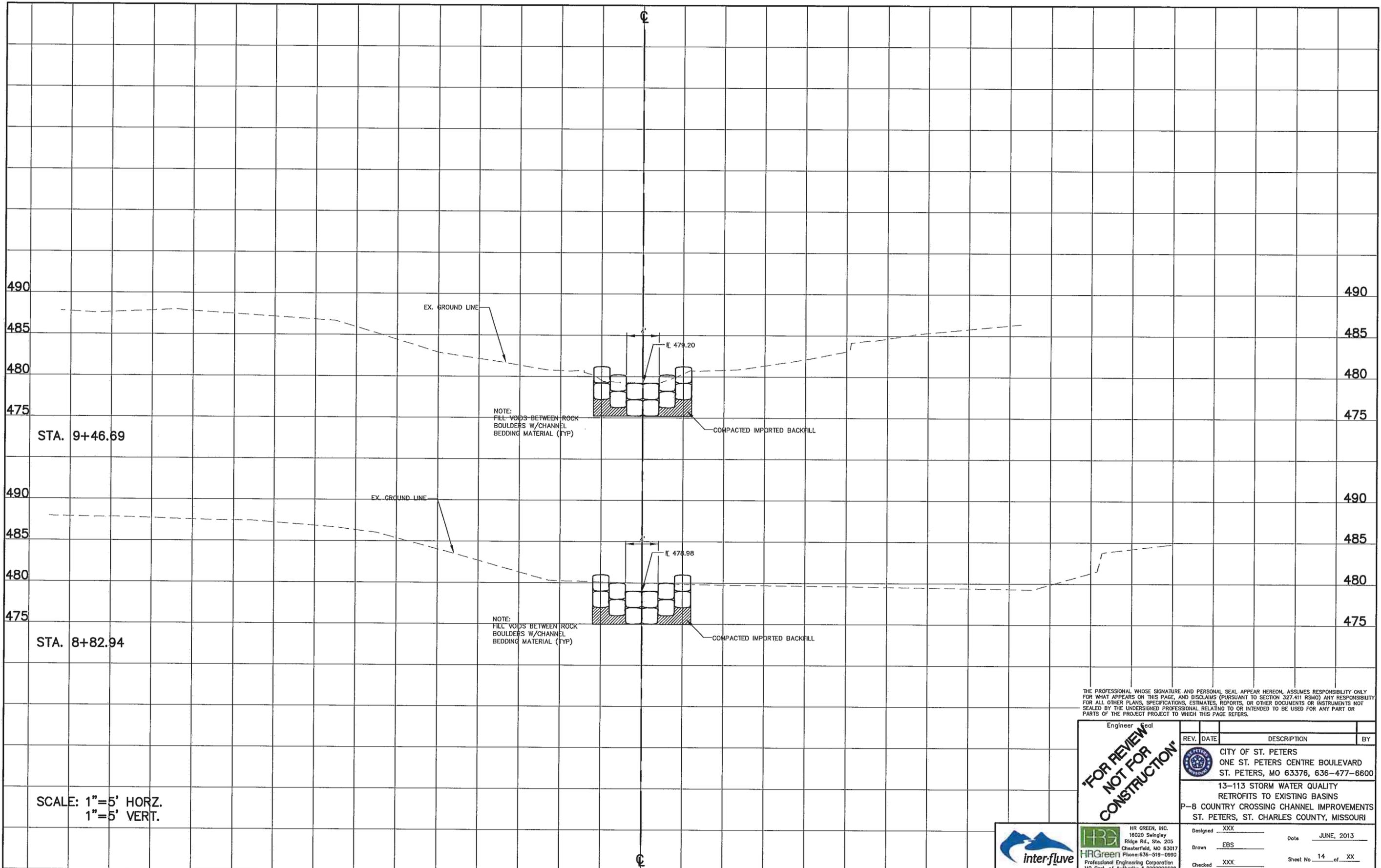
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NOTE:
FILL VOIDS BETWEEN ROCK
BOULDERS W/CHANNEL
BEDDING MATERIAL (TYP)

COMPACTED IMPORTED BACKFILL

NOTE:
FILL VOIDS BETWEEN ROCK
BOULDERS W/CHANNEL
BEDDING MATERIAL (TYP)

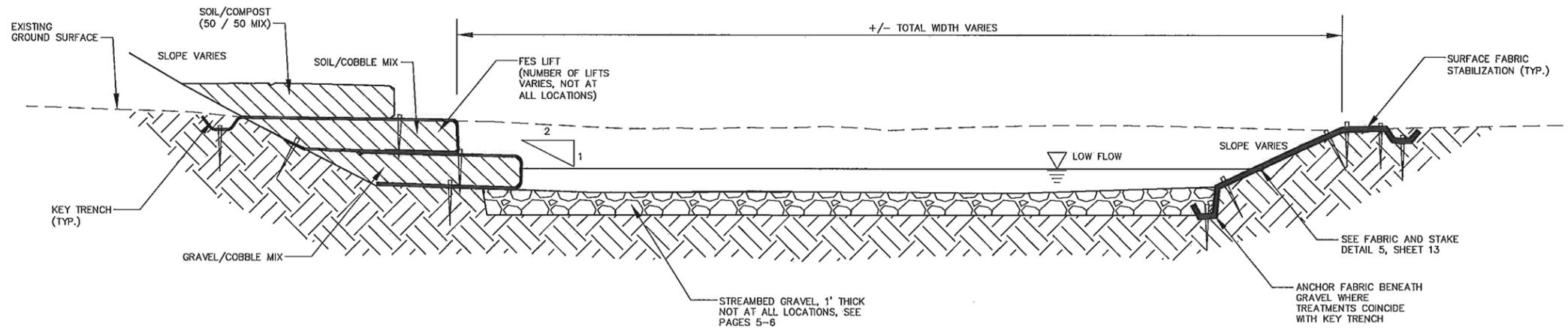
COMPACTED IMPORTED BACKFILL

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	DESIGNED XXX	DATE JUNE, 2013
	DRAWN EBS	SHEET NO. 14 OF XX
CHECKED XXX	MO. CERT. OF AUTHORITY # 200206608	HR GREEN, INC. 16020 Swingley Ridge Rd., Sta. 205 Chesterfield, MO 63017 Phone: 636-519-0990 Professional Engineering Corporation

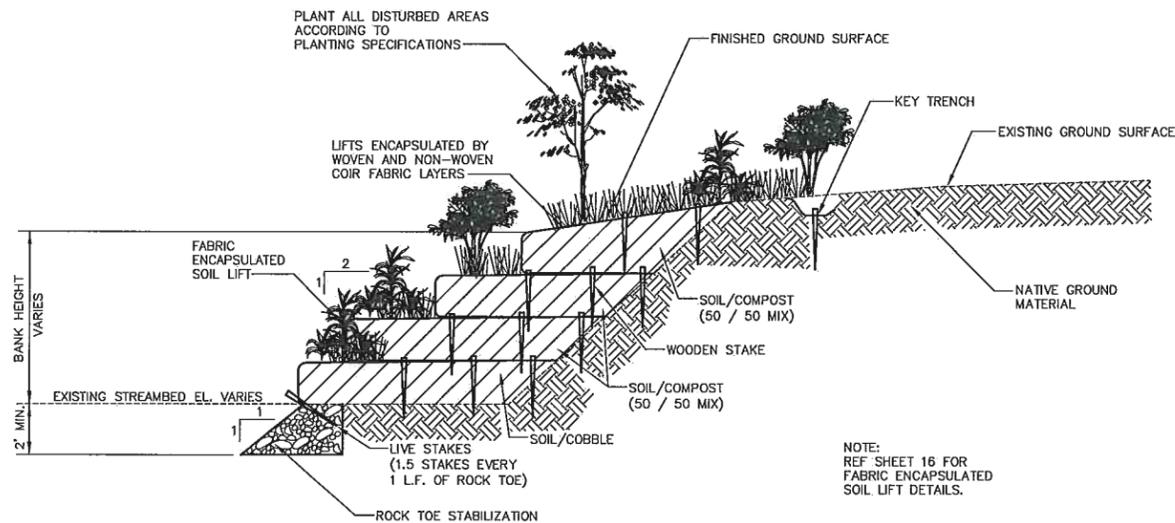


SCALE: 1"=5' HORZ.
1"=5' VERT.



TYPICAL CROSS SECTION - 14 ARBORSHADOW COURT

101



TYPICAL CROSS SECTION:
803 GARDEN BOUNTY COURT
(LEFT DESCENDING BANK)

102

NOT TO SCALE

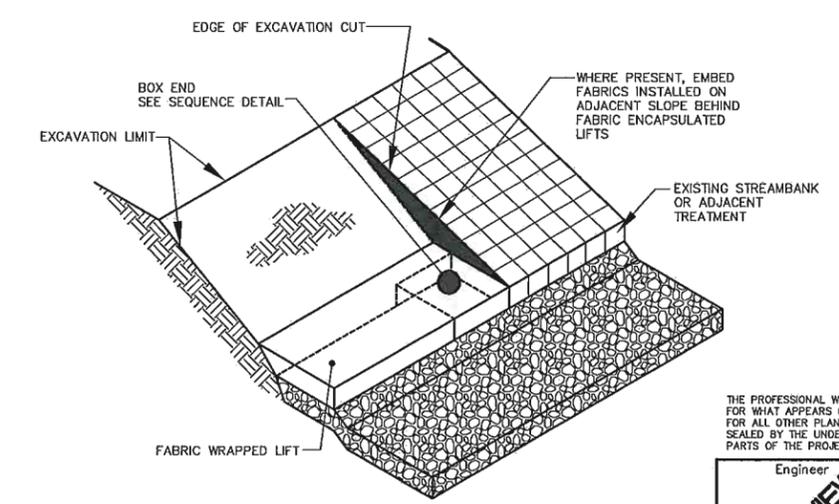
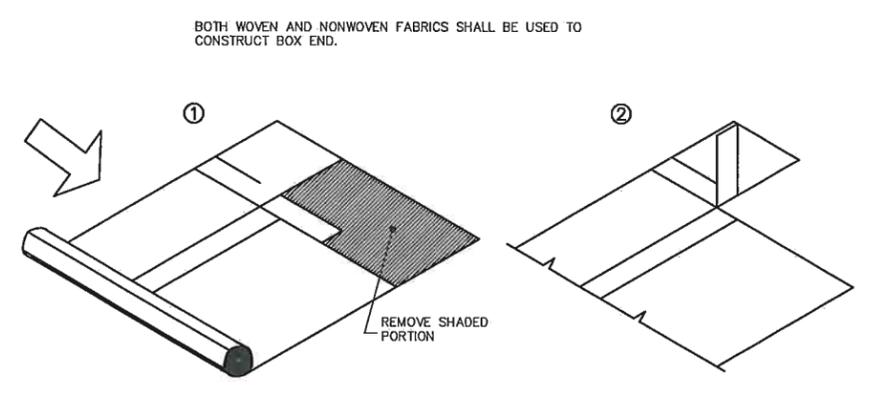
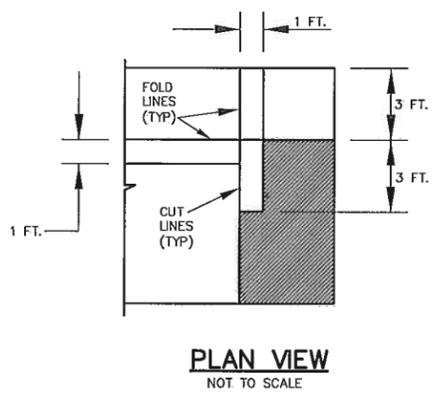
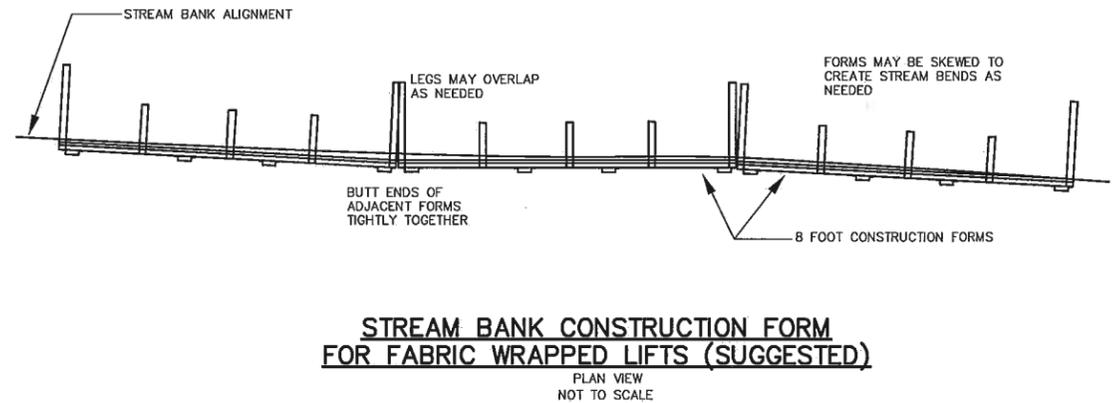
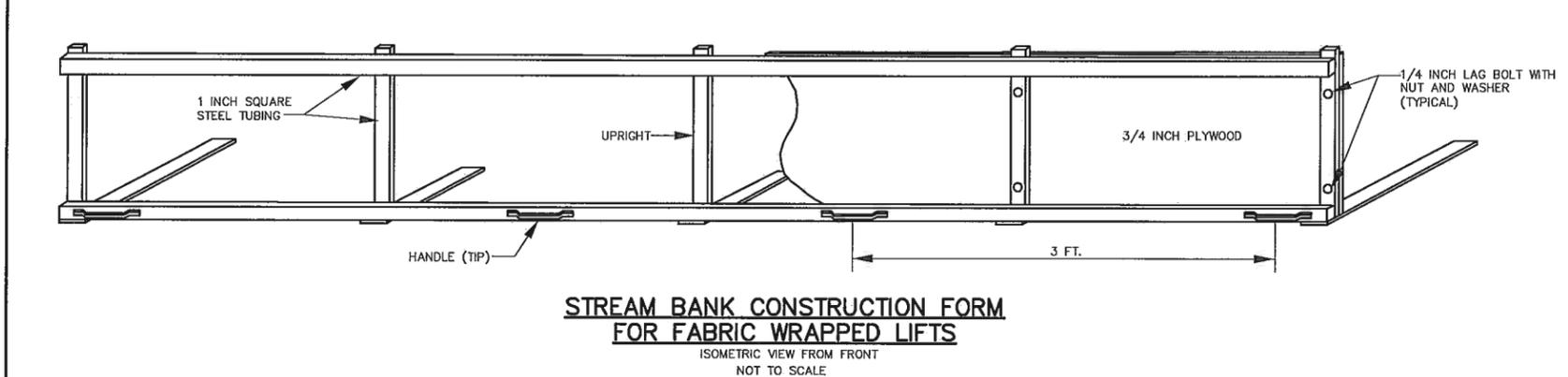
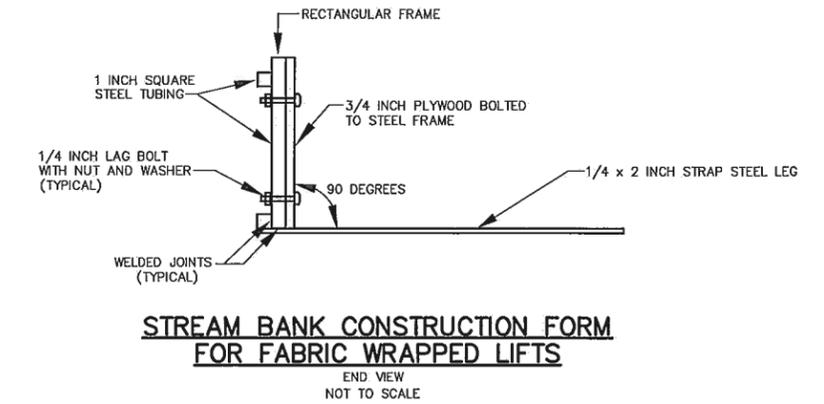
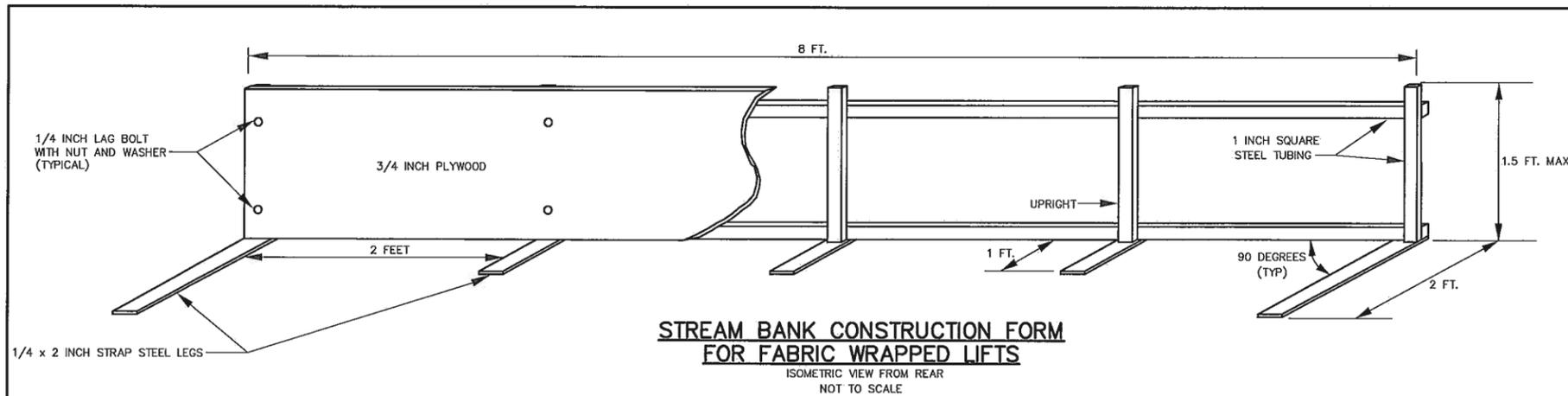
NOTE:
REF SHEET 16 FOR
FABRIC ENCAPSULATED
SOIL LIFT DETAILS.

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<p>FOR REVIEW NOT FOR CONSTRUCTION</p>	Engineer Seal		REV. DATE	DESCRIPTION	BY
			<p>CITY OF ST. PETERS ONE ST. PETERS CENTRE BOULEVARD ST. PETERS, MO 63376, 636-477-6600</p>		
			<p>13-113 STORM WATER QUALITY RETROFITS TO EXISTING BASINS P-8 COUNTRY CROSSING CHANNEL IMPROVEMENTS ST. PETERS, ST. CHARLES COUNTY, MISSOURI</p>		
			Designed	XXX	Date
Drawn	EBS	Sheet No	15 of XX		
Checked	XXX				



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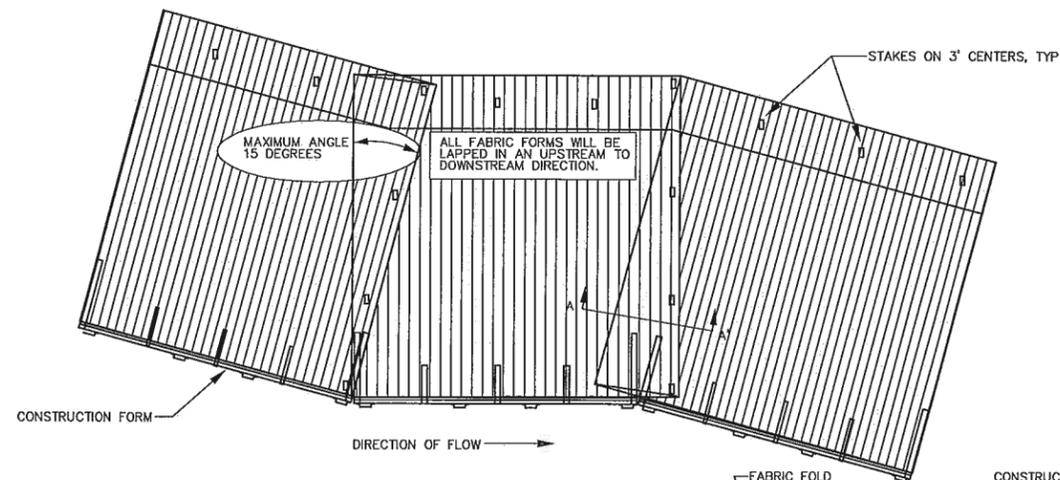


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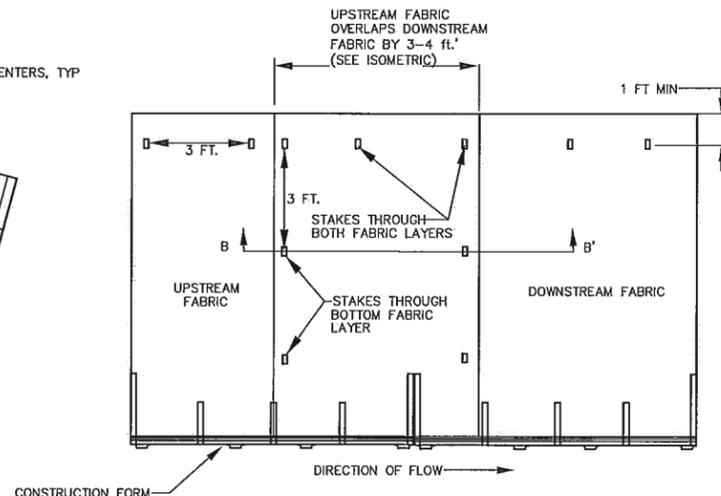
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		CITY OF ST. PETERS ONE ST. PETERS CENTRE BOULEVARD ST. PETERS, MO 63376, 636-477-6600	
		13-113 STORM WATER QUALITY RETROFITS TO EXISTING BASINS P-8 COUNTRY CROSSING CHANNEL IMPROVEMENTS ST. PETERS, ST. CHARLES COUNTY, MISSOURI	
Designed	XXX	Date	JUNE, 2013
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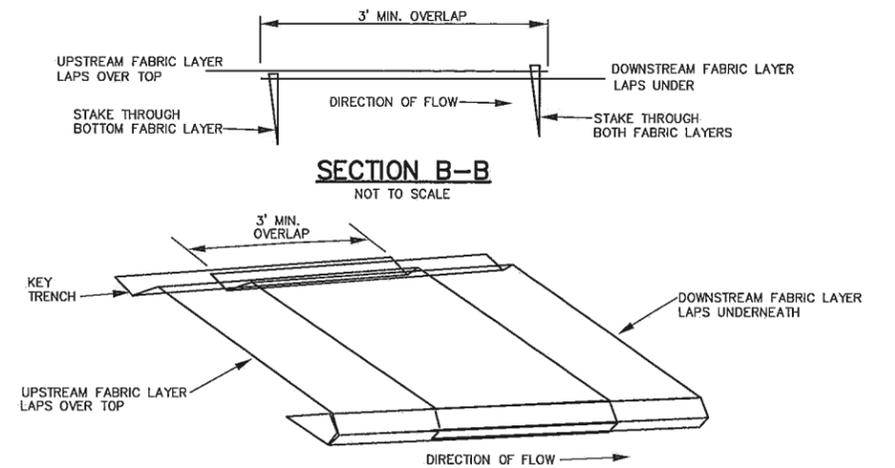
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PLAN VIEW FOLDING OF CONTINUOUS COIR FABRIC AT BENDS
NOT TO SCALE

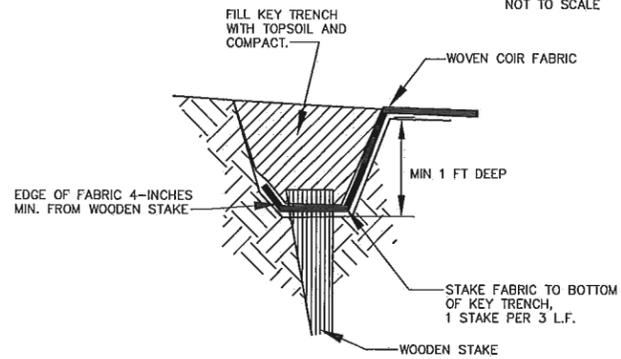


FABRIC JOINING DETAIL
NOT TO SCALE

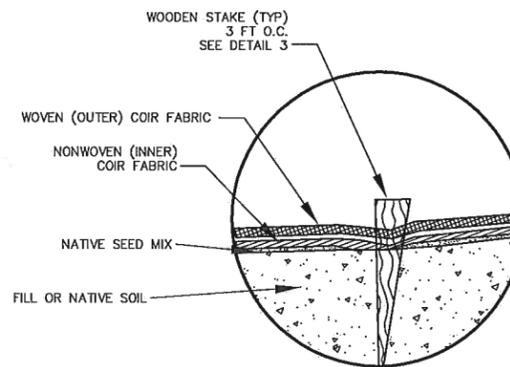


ISOMETRIC OF FABRIC JOINING DETAIL
NOT TO SCALE

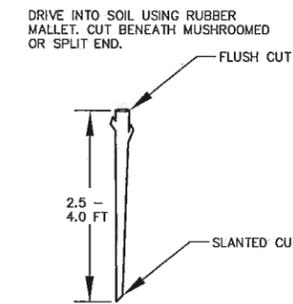
SECTION A-A'
NOT TO SCALE



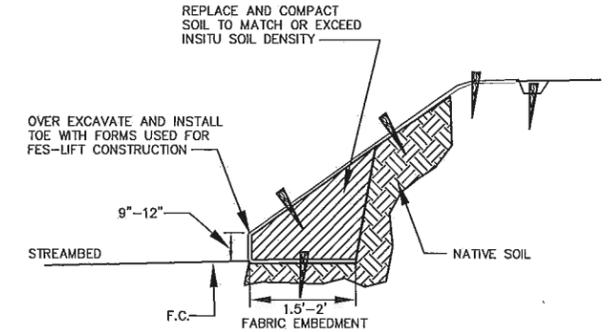
KEY TRENCH DETAIL TRENCH INTO SOIL OR STREAMBED
NOT TO SCALE



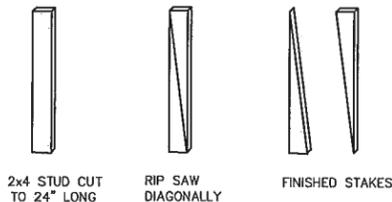
BIODEGRADABLE FABRICS AND STAKES
NOT TO SCALE



LIVE STAKE DETAIL
NOT TO SCALE



ALTERNATE TOE DETAIL SURFACE FABRIC TREATMENT
NOT TO SCALE



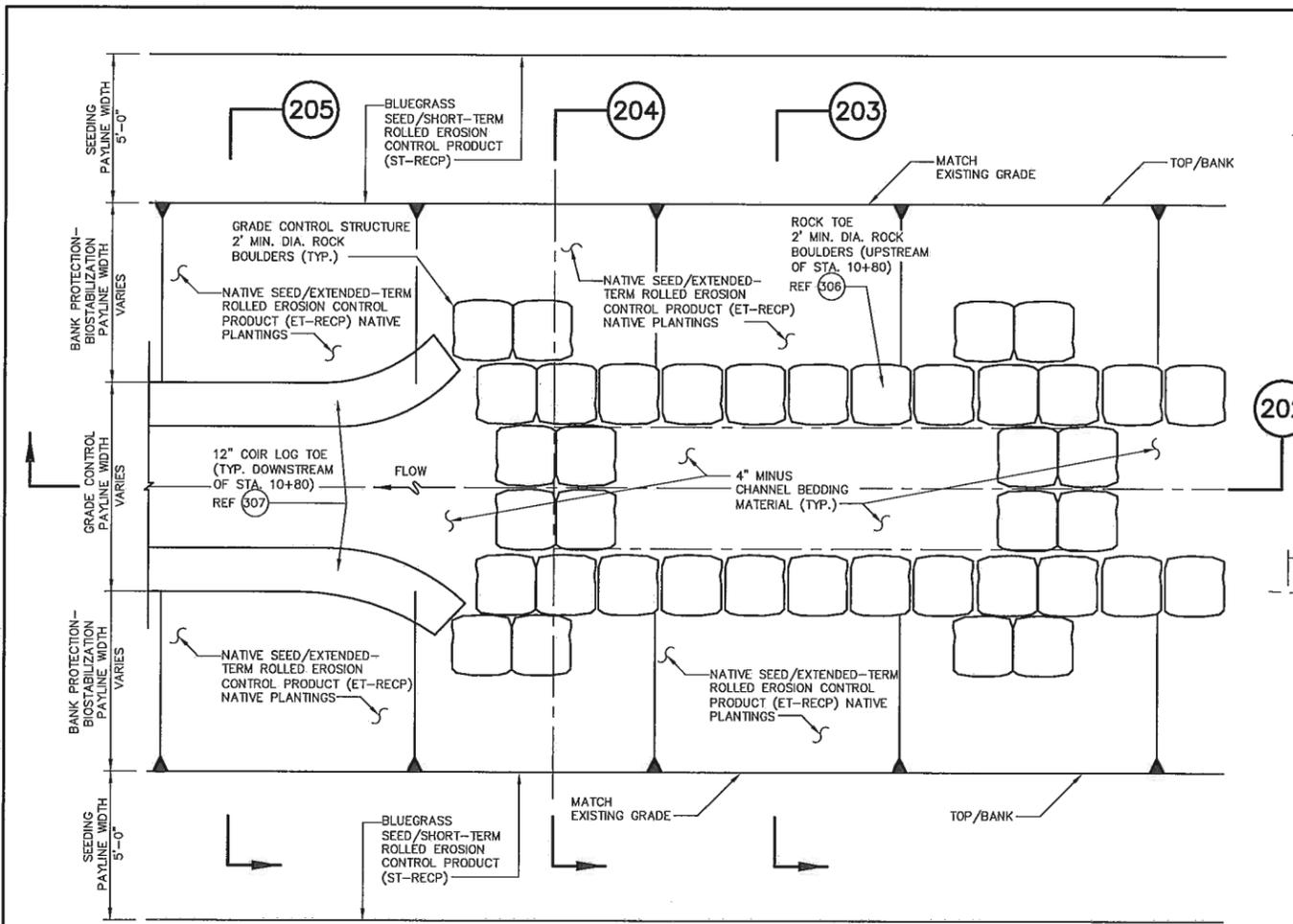
WOODEN STAKE FABRICATING DETAILS
NOT TO SCALE

GENERAL NOTES ON SECURING COIR FABRIC

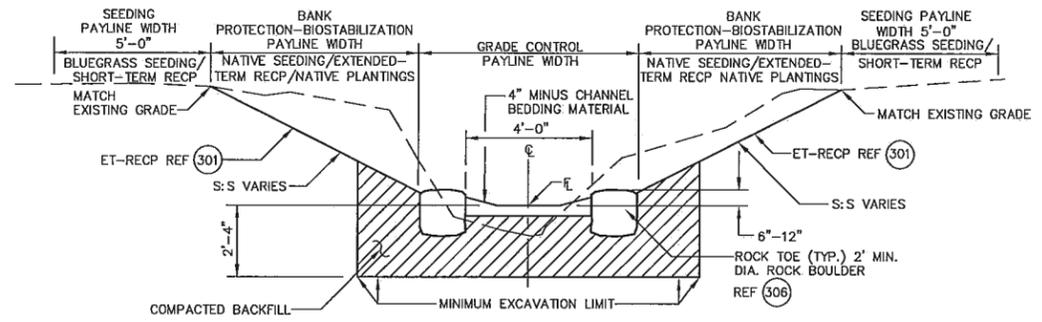
1. SECURE THE OUTER FABRIC (WOVEN), WITH A WOODEN STAKE THROUGH THE FABRIC ON 3 FOOT CENTERS (SEE DETAIL VIEWS 1&2). NOTE: THE HOLES FOR STAKES SHALL NOT BE PRECUT. ALLOW THE STAKE TO BREAK THE MINIMUM NUMBER OF STRANDS AS IT IS BEING DRIVEN. DRIVE STAKES SO THAT 2" TO 3" OF THE TOP OF STAKE IS LEFT EXPOSED.
2. FABRICATE THE WOODEN STAKES BY CUTTING 2x4 STUDS INTO 2 FOOT LENGTHS AND THEN RIPPING THE LENGTHS DIAGONALLY TO CREATE A TAPERED END. SEE STAKE FABRICATING DETAIL ON THIS SHEET.
3. FORMS MAY BE ANGLED TO CREATE BENDS IN THE LIFTS AS NEEDED. FABRIC SHALL BE FOLDED AT EACH BEND AS SHOWN IN DETAIL 1. NO BEND SHALL EXCEED A 15 DEGREE ANGLE. FOLDS SHALL BE MADE IN AN UPSTREAM TO DOWNSTREAM DIRECTION. STAKE THE FOLDS AS SHOWN IN SECTION A-A'.
4. OUTER FABRIC ENDS SHALL BE JOINED BY LAPPING THE UPSTREAM PIECE OF FABRIC OVER THE DOWNSTREAM PIECE AS SHOWN IN DETAIL 2. OVERLAPS SHALL BE A MINIMUM OF 3 FEET. INNER FABRIC ENDS SHALL BE BUTTED TOGETHER, NOT OVERLAPPED. OVERLAPS SHALL BE STAGGERED FROM LIFT TO LIFT BY A MINIMUM OF 15 FT.

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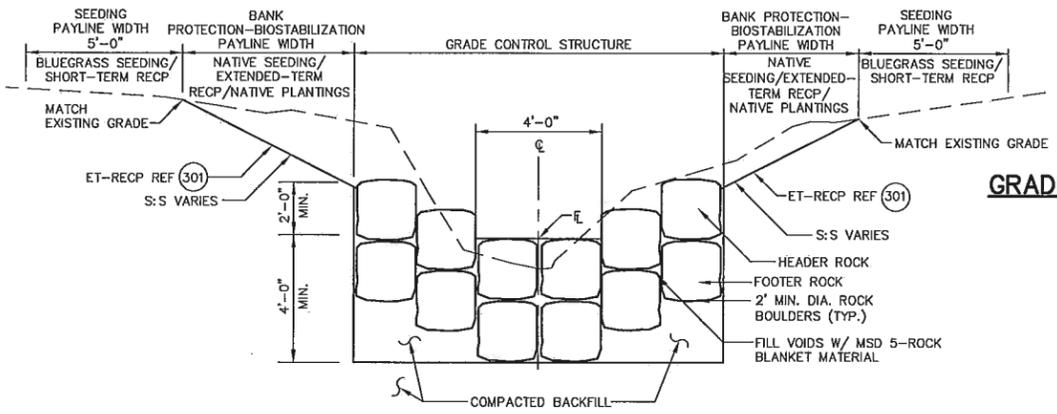
FOR REVIEW NOT FOR CONSTRUCTION	ENGINEER SEAL 	REV. DATE CITY OF ST. PETERS ONE ST. PETERS CENTRE BOULEVARD ST. PETERS, MO 63376, 636-477-6600	DESCRIPTION 13-113 STORM WATER QUALITY RETROFITS TO EXISTING BASINS P-8 COUNTRY CROSSING CHANNEL IMPROVEMENTS ST. PETERS, ST. CHARLES COUNTY, MISSOURI	BY
	DESIGNED XXX	DATE JUNE, 2013	DRAWN EBS	SHEET NO. 17 OF XX
	CHECKED XXX	HR GREEN, INC. 16020 Swingley Ridge Rd., Ste. 205 Chesterfield, MO 63017 Phone: 636-519-0990 Professional Engineering Corporation MO Cert. of Authority # 2002006608	interfluve	



TYPICAL PLAN 201
NOT TO SCALE



TYPICAL SECTION UPSTREAM OF STA. 10+80 203
NOT TO SCALE

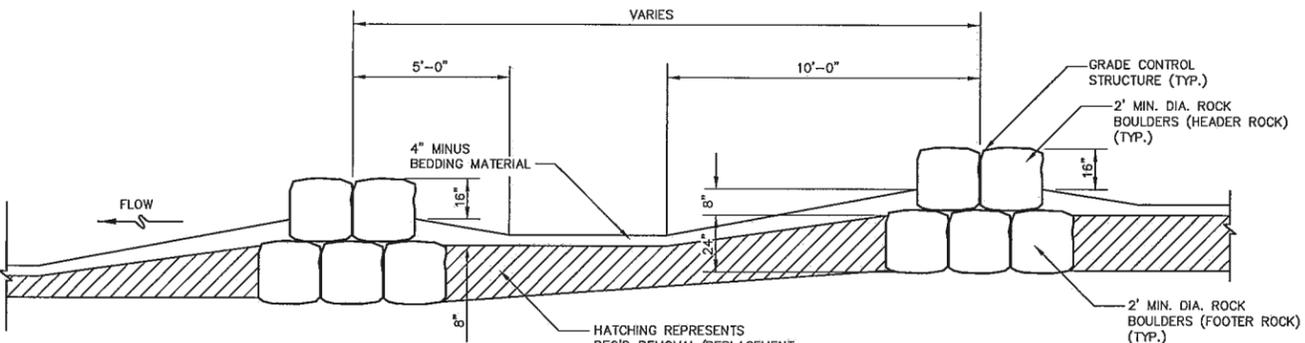


TYPICAL GRADE CONTROL STRUCTURE SECTION 204
NOT TO SCALE

GRADE CONTROL STRUCTURE NOTES:

1. GRADE CONTROL STRUCTURES CONSTRUCTED OF ROCK BOULDERS ARE TO BE TRENCHED INTO THE BED AND BANK OF THE CHANNEL TO THE LINES AND GRADES INDICATED ON THE PROJECT PLANS AND AS SPECIFIED IN THE PROJECT TECHNICAL SPECIFICATIONS.
2. CONSTRUCTION OF EACH GRADE CONTROL STRUCTURE SHALL BEGIN AT ITS CENTER AND PROCEED DOWNSTREAM INTO THE BANKS, UNLESS DEPICTED OTHERWISE ON THE PROJECT PLANS.
3. PLACE THE BASE OF OUTERMOST FOOTER ROCK BOULDERS SUCH THAT THE TOPS ARE APPROXIMATELY AT THE PROPOSED STREAMBED ELEVATION. THE ENDS OF GRADE CONTROL STRUCTURES SHALL BE FIRMLY ANCHORED BY 1 TO 2 BOULDERS IN THE BANKS.
4. MINIMIZE GAPS BETWEEN FOOTER ROCK BOULDERS. BACKFILL THE REMAINDER OF THE TRENCH WITH CHANNEL BEDDING MATERIAL.
5. PLACE HEADER ROCK BOULDERS ON TOP OF FOOTER ROCK BOULDERS AND CHANNEL BEDDING MATERIAL, SUCH THAT EACH ROCK BOULDER TOUCHES ADJACENT ROCK BOULDERS AND RESTS UPON TWO HALVES OF EACH FOOTER ROCK BOULDER BELOW IT, AND SO THAT THE HEADER ROCK BOULDER IS OFFSET IN THE UPSTREAM DIRECTION.
6. HEADER ROCK BOULDERS FORMING THE CREST SHALL EXTEND APPROXIMATELY 2- FEET ABOVE THE PROPOSED STREAMBED ELEVATION WITH GAPS BETWEEN INDIVIDUAL BOULDERS.
7. BACKFILL ANY VOIDS AROUND THE STRUCTURE WITH CHANNEL BEDDING MATERIAL TO FILL GAPS AND REDUCE PIPING OF WATER.
8. ROCK BOULDERS SHALL BE PLACED TIGHTLY AGAINST EACH BANK AT THE UPSTREAM AND DOWNSTREAM LIMITS OF ALL GRADE CONTROL STRUCTURES. THE ROCK BOULDERS SHALL BE KEYED INTO THE STREAM BANKS AND STREAMBED TO THE DEPTH SHOWN ON THE PROJECT PLANS. THE ROCK BOULDERS SHALL BE KEYED INTO SOIL THAT DOES NOT CONTAIN A CONTINUOUS LAYER OF NON-COHESIVE MATERIALS.

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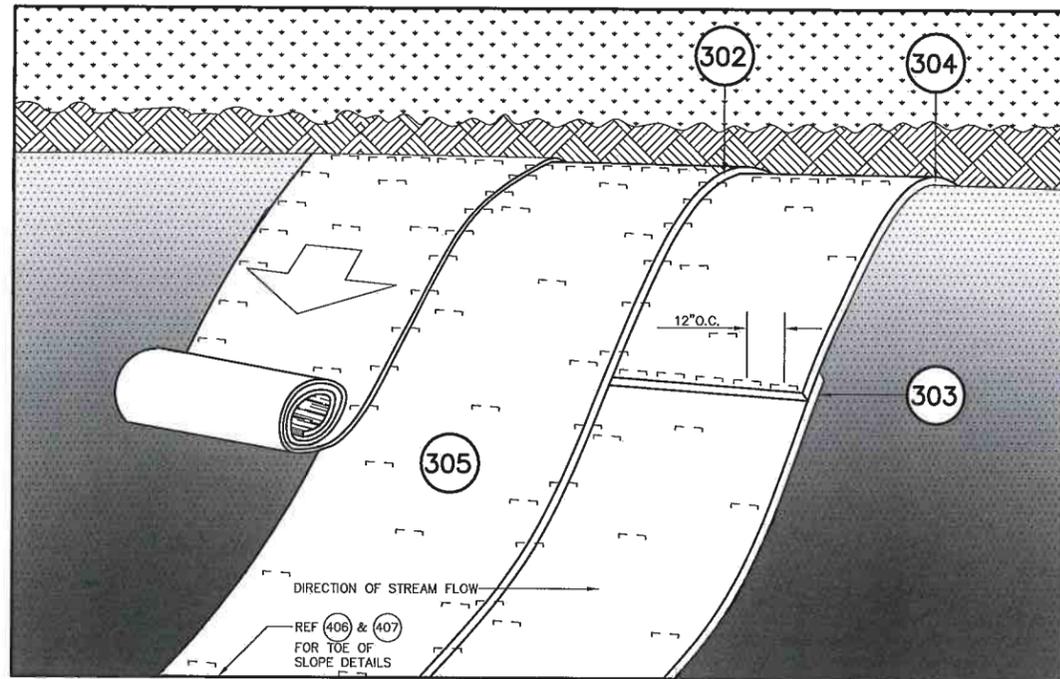
TYPICAL PROFILE 202
NOT TO SCALE

TYPICAL STEP POOL DETAILS

REV.	DATE	DESCRIPTION	BY
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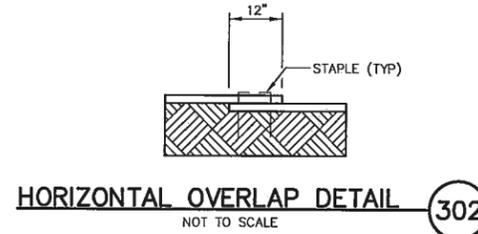


BANK ELEVATION (301)
NOT TO SCALE

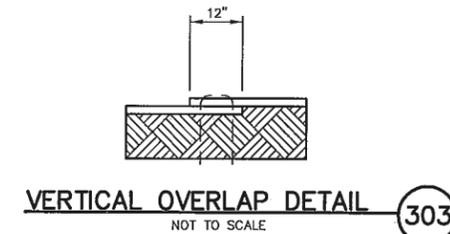
ROLLED EROSION CONTROL PRODUCT NOTES:

1. PREPARE SOIL BEFORE INSTALLING ROLLED EROSION CONTROL PRODUCT INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED.
2. ROLLED EROSION CONTROL PRODUCT AREAS SHALL BE SEEDED PRIOR TO INSTALLATION OF RECP AND PLANTED WITH LIVE STAKING AFTER INSTALLATION OF RECP.
3. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE RECP'S IN A 12" DEEP X 12" WIDE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL—FOLD REMAINING 24" PORTION OF RECP'S OVER COMPACTED SOIL. SECURE WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" PART ACROSS THE WIDTH OF THE RECP'S.
4. ROLL THE RECP ACROSS THE SLOPE. UNROLL RECP WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL RECP MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS SHOWN IN THE STAPLE PATTERN GUIDE. WHEN USING THE DOT SYSTEM, STAPLES SHOULD BE PLACED THROUGH EACH OF THE COLORED DOTS CORRESPONDING TO THE APPROPRIATE STAPLE PATTERN.
5. THE EDGES OF THE PARALLEL RECP'S MUST BE STAPLED WITH MINIMUM 12" OVERLAP. SHINGLE IN DIRECTION OF STREAM FLOW.
6. CONSECUTIVE RECP SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH A MINIMUM 12" OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" ON CENTER ACROSS ENTIRE RECP WIDTH.

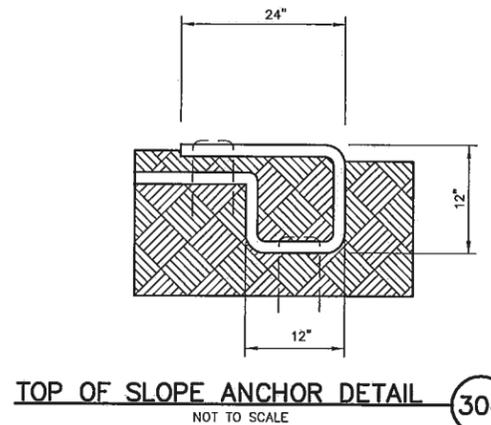
NOTE:
*IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 12" MAY BE NECESSARY TO PROPERLY SECURE THE RECP.



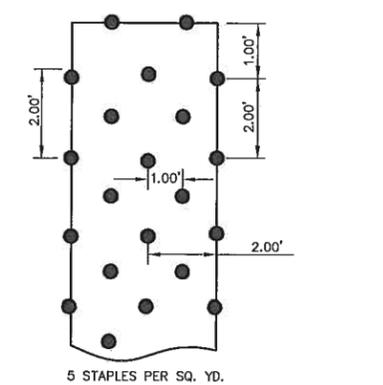
HORIZONTAL OVERLAP DETAIL (302)
NOT TO SCALE



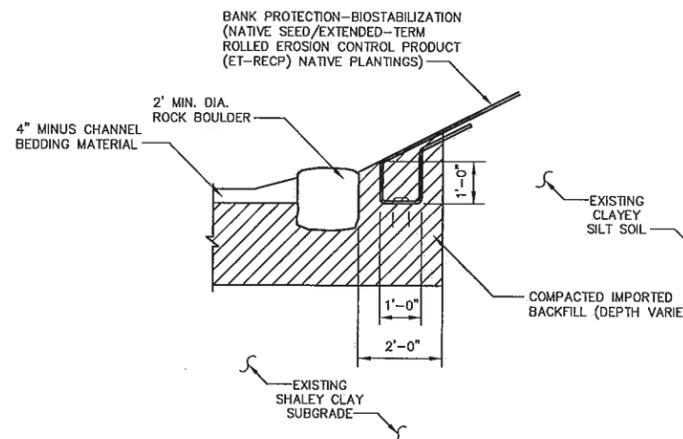
VERTICAL OVERLAP DETAIL (303)
NOT TO SCALE



TOP OF SLOPE ANCHOR DETAIL (304)
NOT TO SCALE



STAPLE PATTERN GUIDE (305)
NOT TO SCALE



TYPICAL TOE OF SLOPE DETAIL
UPSTREAM OF STATION 10+80 (306)
NOT TO SCALE

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EXTENDED-TERM ROLLED EROSION CONTROL PRODUCT (ET-RECP) INSTALLATION DETAILS