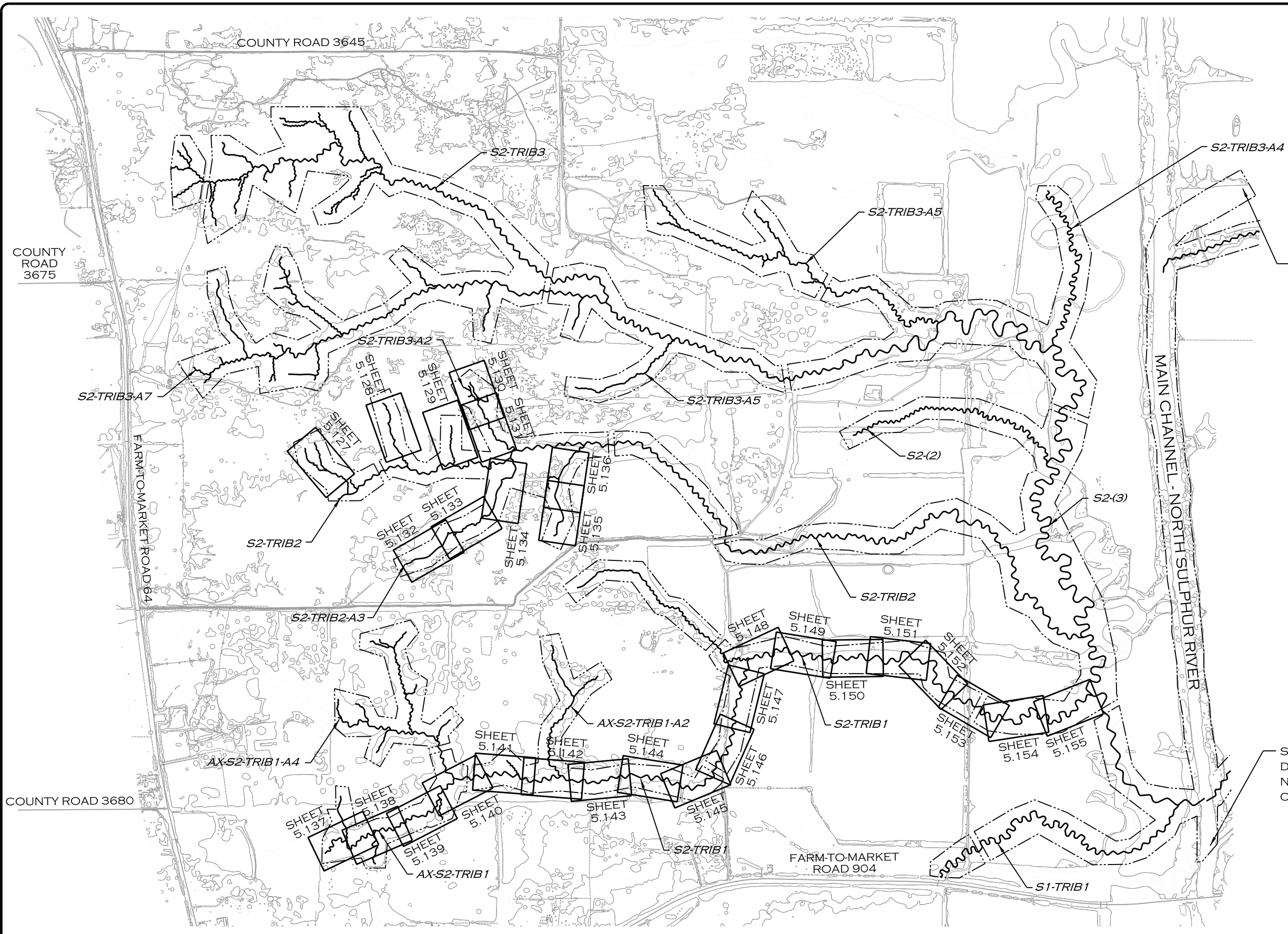
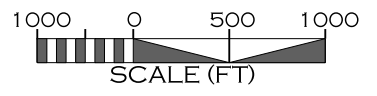


**OVERVIEW**  
S1 AND S2 REACHES



SEE VOLUME 4 DESIGN PLANS DEVELOPED BY FREESE AND NICHOLS, INC. FOR THE MAIN CHANNEL NORTH SULPHUR RIVER

SEE VOLUME 4 DESIGN PLANS DEVELOPED BY FREESE AND NICHOLS, INC. FOR THE MAIN CHANNEL NORTH SULPHUR RIVER



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1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:

**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
FANNIN COUNTY, TEXAS

PREPARED IN THE OFFICE OF:

**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
TOMBALL, TX 77377  
TEXAS REGISTERED ENGINEERING FIRM F-14997

PROJECT ENGINEER

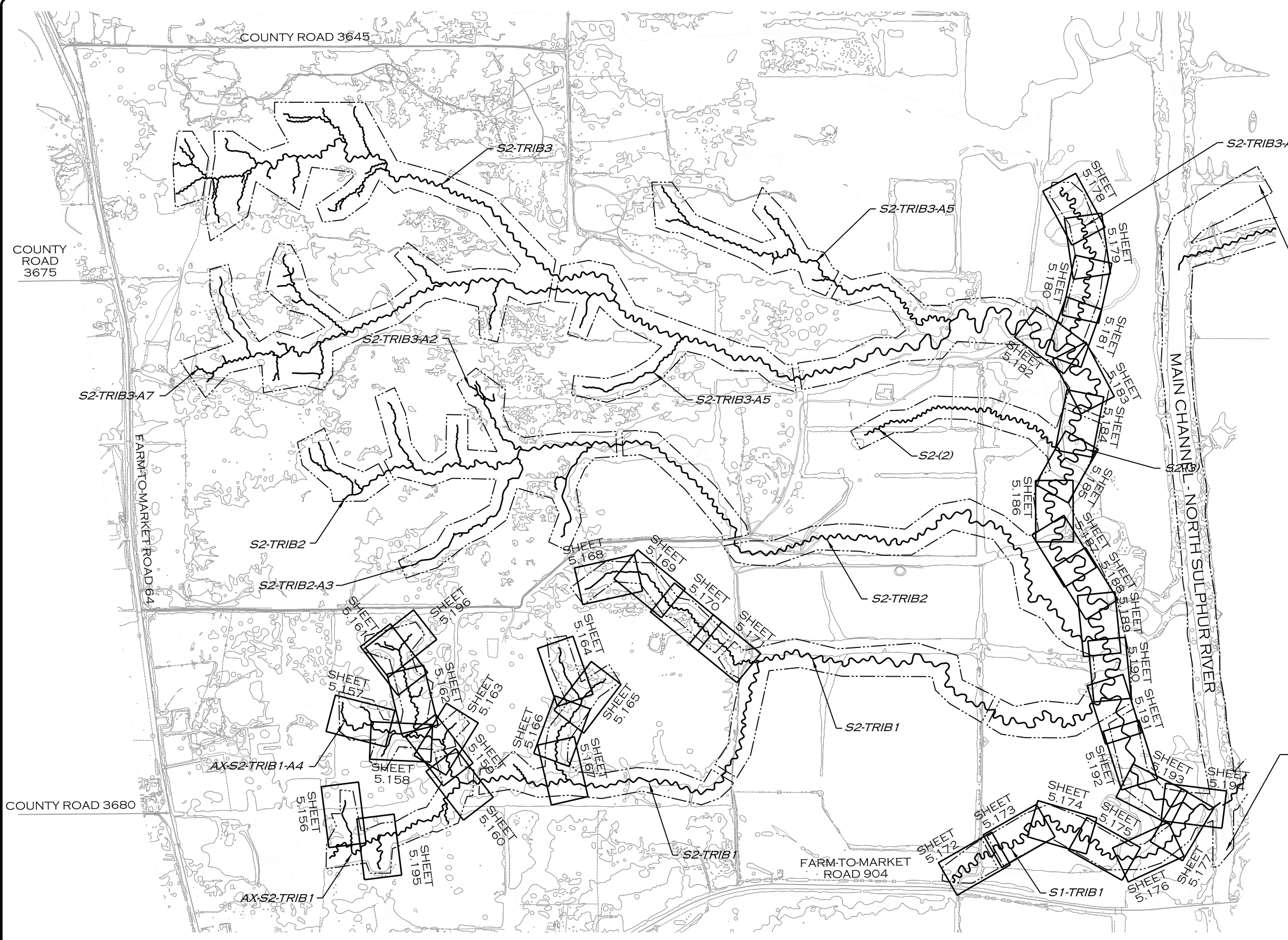
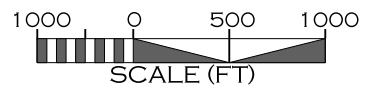
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S1 AND S2 REACHES



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# CONVENTIONAL SYMBOLS

	ROCK J-HOOK		EXISTING TREE
	ROCK VANE		EXISTING TREE LINE
	OFFSET ROCK CROSS VANE		EXISTING FENCE LINE
	ROCK CROSS VANE		EXISTING WATERS
	TEMPORARY SILT CHECK		— SF — SAFETY FENCE
	ROOT WAD		— TP — TAPE FENCE
	GRADE CONTROL LOG J-HOOK		—     — SILT FENCE
	LOG VANE		— - - - CONSERVATION EASEMENT (PRELIMINARY)
	LOG STEP		-- 20 -- EXISTING MAJOR CONTOUR
	ROCK STEP		----- EXISTING MINOR CONTOUR
	LOG CROSS VANE		— 20 — PROPOSED MAJOR CONTOUR
	CONSTRUCTED CASCADE		— 21 — PROPOSED MINOR CONTOUR
	CONSTRUCTED RIFFLE		----- LIMITS OF DISTURBANCE
	BOULDER CLUSTER		— - - - FLOODPLAIN BENCH
	LOG ROLLER		- - - - PROPERTY LINE
	GRADE CONTROL WOODY RIFFLE		..... ACCESS ROAD
	TOEWOOD WITH GEOLIFT		10+00   — STREAM THALWEG
	SOD MATS		— — — — STREAM TOP OF BANKS
	DEBRIS JAM		FOOT BRIDGE
	SINGLE WING DEFLECTOR		TEMPORARY STREAM CROSSING
	DOUBLE WING DEFLECTOR		PERMANENT FORD STREAM CROSSING
			⬇ TRANSPLANTED VEGETATION
			⊗ TREE REMOVAL
			⊕ TREE PROTECTION
			▩ GEOLIFT
			■ CHANNEL FILL
			■ COMPACTED CHANNEL PLUG
			▨ GRADE BANK 2:1 OR FLATTER
			⬢ EXISTING WETLANDS

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

# INDEX OF SHEETS

VOLUME NO. SHEET NO.  
VOL. 1 2.1

SYMBOLS / INDEX OF SHEETS

1 ..... TITLE SHEET

1.1 ..... OVERVIEW MITIGATION ZONES

1.2 ..... OVERVIEW MITIGATION ZONE A

1.3 ..... OVERVIEW T REACHES

1.4 - 1.8 ..... OVERVIEW S1 AND S2 REACHES

2.1 ..... CONVENTIONAL SYMBOLS / INDEX OF SHEETS

3.1-3.6 ..... DETAILS

4.1 - 4.2 ..... REPRESENTATIVE SECTIONS "B" TYPE CHANNELS

4.3 - 4.4 ..... REPRESENTATIVE SECTIONS "E" AND "C" TYPE CHANNELS

5.1 - 5.4 ..... T3-BAKER DESIGN

5.5 - 5.10 ..... T2-BAKER DESIGN

5.11 - 5.21 ..... T4 DESIGN

5.22 - 5.30, 5.36 - 5.37 ..... T5 DESIGN

5.30 - 5.35, 5.38 ..... T1 DESIGN

5.39 - 5.46 ..... T6 DESIGN

5.47 - 5.103, 5.178 - 5.182 ..... S2-TRIB3 / AX-S2-TRIB3 DESIGN

5.104 - 5.108, 5.182 - 5.194 ..... S2 DESIGN

5.109 - 5.136 ..... S2-TRIB2 DESIGN

5.137 - 5.171, 5.195 - 5.196 ..... S2-TRIB1 / AX-S2-TRIB1 DESIGN

5.172 - 5.177 ..... S1-TRIB1 DESIGN

6.1 ..... PLANTING PLAN SHEET GRID

6.2 - 6.50 ..... PLANTING PLAN

6.51 ..... PLANTING DETAILS AND NOTES

6.52 ..... PLANTING TABLES

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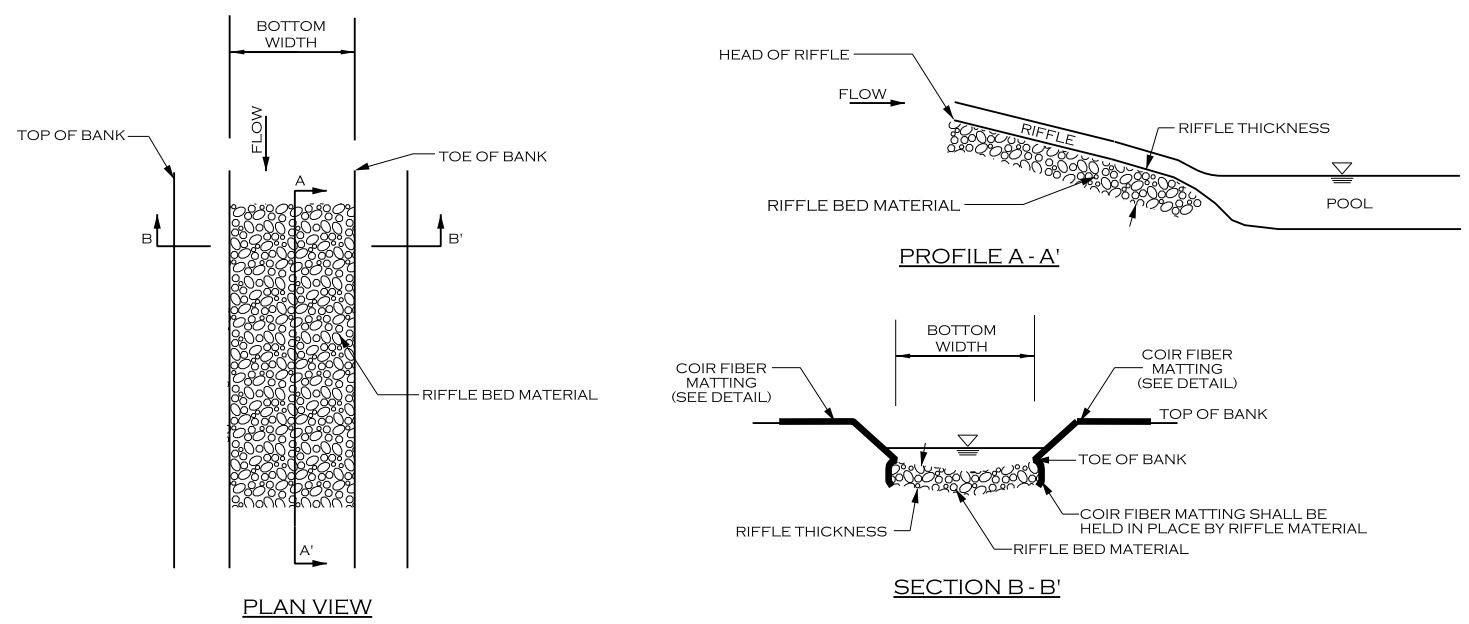
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PROJECT ENGINEER

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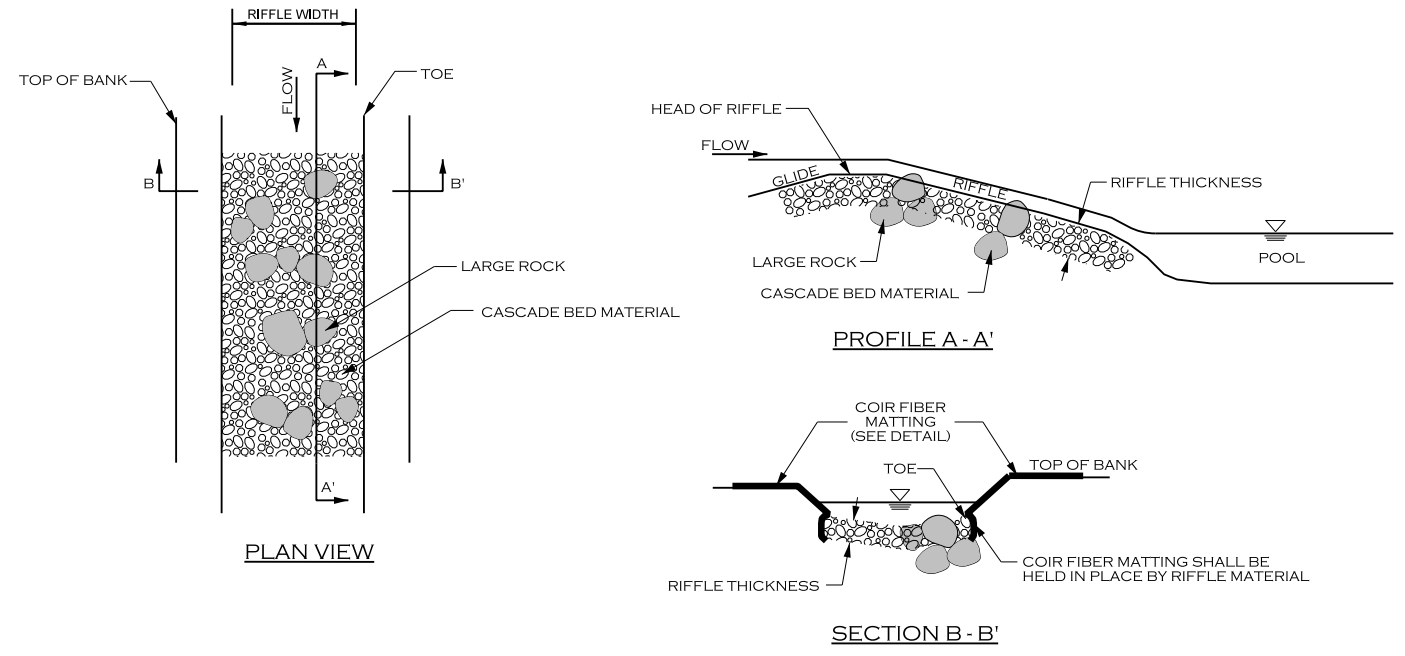
DETAILS

CONSTRUCTED RIFFLE



CONSTRUCTED RIFFLE SPECIFICATIONS	
MATERIALS:	SPECIFICATIONS:
RIFFLE BED MATERIAL	TYPE: GRANITE OR COMPARABLE SIZE: WELL GRADED MIX OF TXDOT/AASHTO MIX 1 AND WASHED #57 STONE THICKNESS: 16 INCHES MIN.
COIR FIBER MATTING	SEE MATTING DETAIL
<b>NOTES FOR CONSTRUCTED RIFFLE STRUCTURES:</b> 1. GRADE STREAMBED AND BANKS TO PROPOSED DIMENSIONS PER TYPICAL CROSS-SECTION AND PROFILE. 2. EXCAVATE TRENCH BELOW PROPOSED STREAMBED ELEVATION EQUAL TO OR GREATER THAN RIFFLE THICKNESS. 3. PLACE COIR FIBER MATTING ON BANKS AND LAY DOWN INTO TRENCH EXCAVATED FOR RIFFLE BED MATERIAL. 4. FILL TRENCH WITH RIFFLE BED MATERIAL TO FINAL DESIGN STREAM GRADE.	

CONSTRUCTED CASCADE



CONSTRUCTED CASCADE SPECIFICATIONS	
MATERIALS:	SPECIFICATIONS:
LARGE ROCKS	TYPE: GRANITE OR COMPARABLE SIZE: CLASS A1 THICKNESS: 24 INCHES MIN.
CASCADE BED MATERIAL	TYPE: GRANITE OR COMPARABLE SIZE: WELL GRADED MIX OF TXDOT/AASHTO MIX 1 AND MIX 2 THICKNESS: 16 INCHES MIN.
COIR FIBER MATTING	SEE MATTING DETAIL
<b>NOTES FOR CONSTRUCTED CASCADE STRUCTURES:</b> 1. GRADE STREAMBED AND BANKS TO PROPOSED DIMENSIONS PER TYPICAL CROSS-SECTION AND PROFILE. 2. EXCAVATE TRENCH BELOW PROPOSED STREAMBED ELEVATION EQUAL TO OR GREATER THAN RIFFLE THICKNESS. 3. PLACE COIR FIBER MATTING ON BANKS AND LAY DOWN INTO TRENCH EXCAVATED FOR RIFFLE BED MATERIAL. 4. FILL TRENCH WITH STONE TO FINAL DESIGN STREAM GRADE.	

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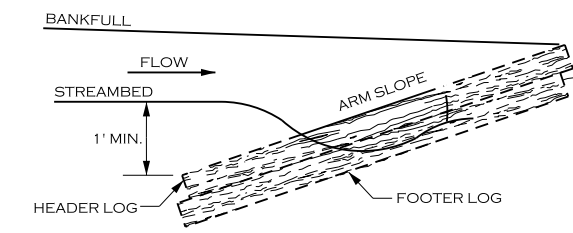
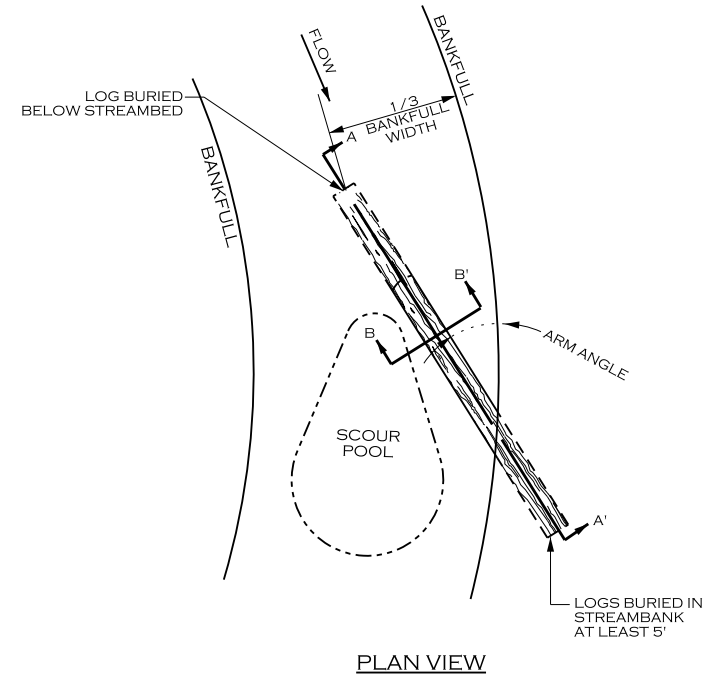
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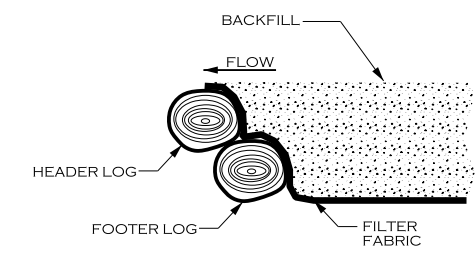
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DETAILS

LOG VANE



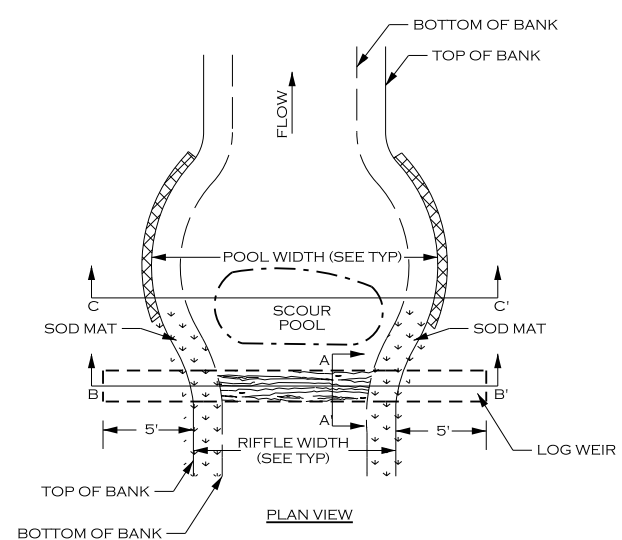
PROFILE VIEW A - A'



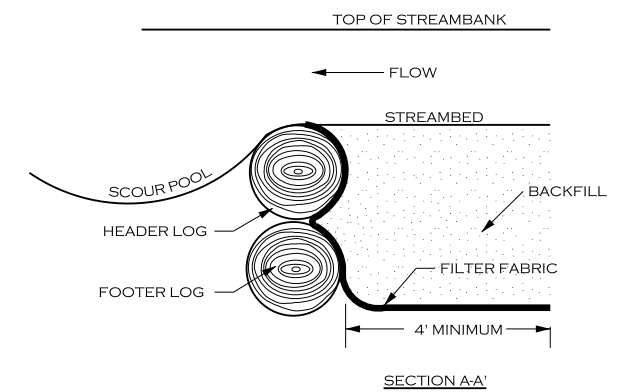
SECTION B - B'

LOG VANE SPECIFICATIONS	
MATERIALS:	SPECIFICATIONS:
LOGS	TYPE: HARDWOOD SIZE: 10 INCH Ø MIN. NUMBER OF HEADER LOGS: 1 NUMBER OF FOOTER LOGS: 1
FILTER FABRIC	TYPE: TYPE 2 NON-WOVEN WIDTH UPSTREAM: 4 FT MINIMUM
BACKFILL	ON-SITE ALLUVIUM
<b>NOTES FOR LOG VANE STRUCTURES:</b> 1. LOGS SHALL BE STRAIGHT, HARDWOOD, AND NOT ROTTEN. 2. SOIL SHALL BE COMPACTED WELL AROUND BURIED PORTIONS OF LOGS. 3. FILTER FABRIC SHALL BE NAILED TO THE LOG PRIOR TO PLACEMENT OF BACKFILL.	

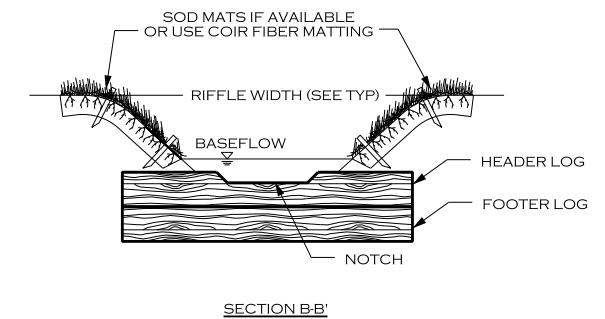
LOG STEP



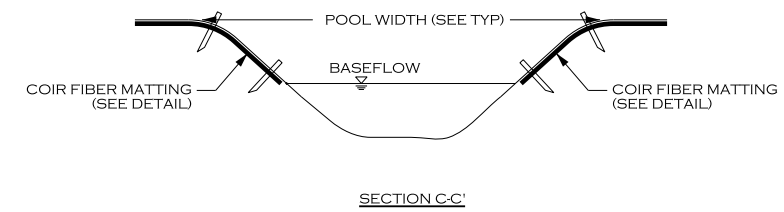
PLAN VIEW



SECTION A-A'



SECTION B-B'



SECTION C-C'

LOG STEP SPECIFICATIONS	
MATERIALS:	SPECIFICATIONS:
LOGS	TYPE: HARDWOOD SIZE: LENGTH - 2 x Wbkf. 1.2 INCH Ø MIN. NUMBER OF HEADER LOGS: 1 NUMBER OF FOOTER LOGS: 1
FILTER FABRIC	TYPE: TYPE 2 NON-WOVEN WIDTH UPSTREAM: 4 FT MINIMUM
BACKFILL	ON-SITE ALLUVIUM
<b>NOTES FOR LOG STEP STRUCTURES:</b> 1. LOGS SHALL BE RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED. 2. LOGS >24 INCHES IN DIAMETER MAY BE USED ALONE WITHOUT AN ADDITIONAL FOOTER LOG. FILTER FABRIC SHALL STILL BE USED TO SEAL AROUND LOG. 3. PLACE FOOTER LOGS FIRST AND THEN HEADER (TOP) LOG. SET HEADER LOG APPROXIMATELY 1 TO 2 INCHES ABOVE THE INVERT ELEVATION. 4. CUT A NOTCH IN THE HEADER LOG APPROXIMATELY 50 PERCENT OF THE CHANNEL BOTTOM WIDTH AND EXTENDING DOWN TO THE INVERT ELEVATION. 5. USE FILTER FABRIC TO SEAL GAPS BETWEEN LOGS. 6. PLACE TRANSPLANTS OR COIR FIBER MATTING FROM TOE OF STREAMBANK TO TOP OF STREAMBANK.	

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LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
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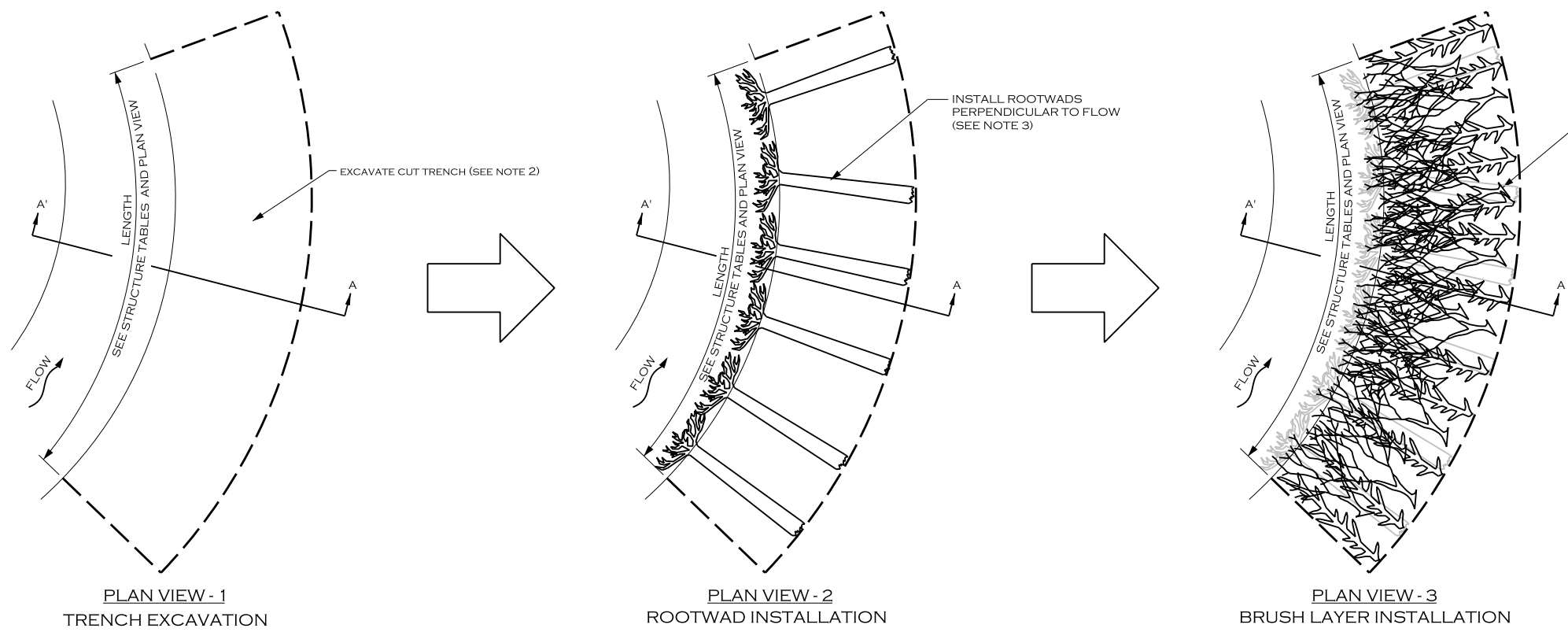
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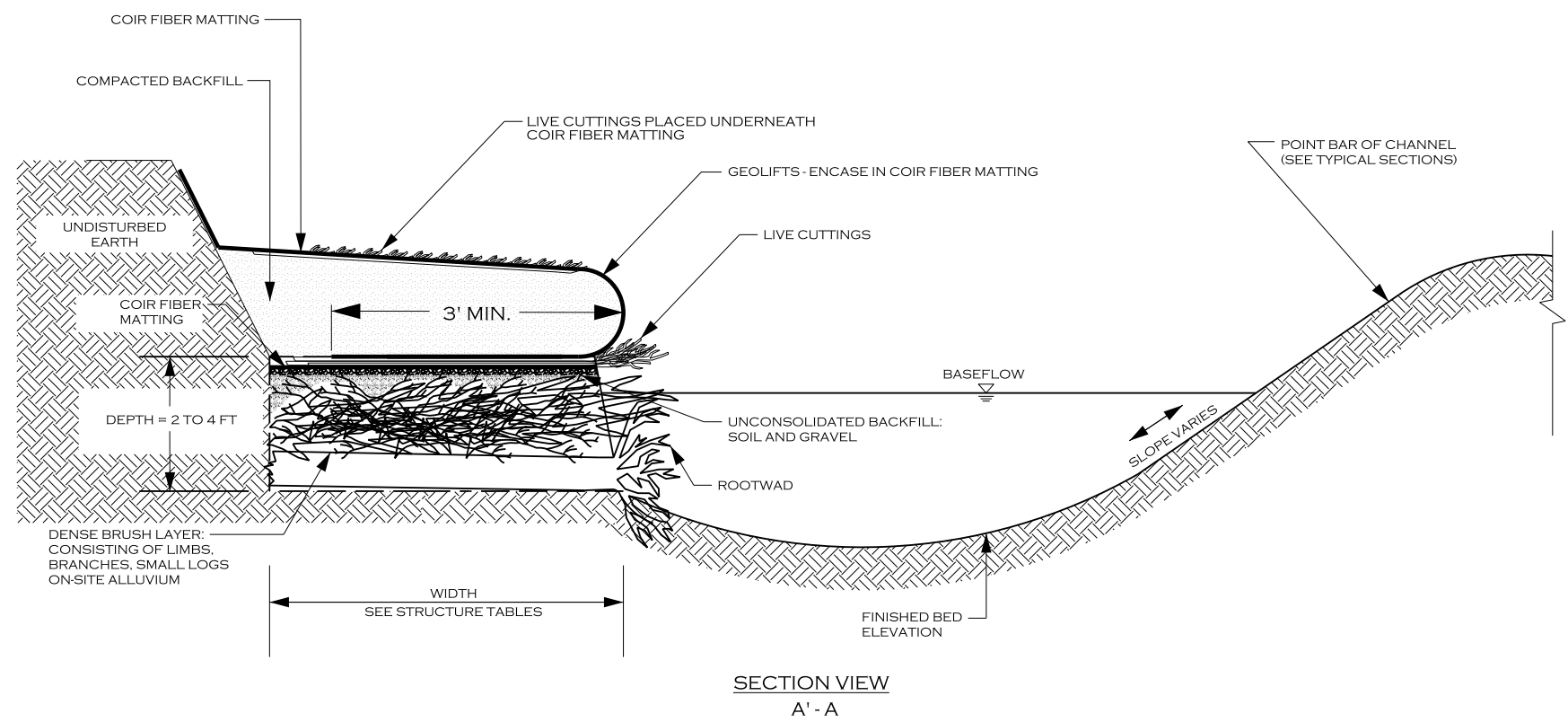
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DETAILS

TOE WOOD WITH GEOLIFT



INSTALL BRUSH MATERIAL (SEE NOTE 4). AFTER BRUSH LAYER HAS BEEN COMPLETED INSTALL SOIL LAYER (NOTE 5) AND COVER WITH COIR FIBER MATTING (NOTE 6). PLACE LIVE CUTTINGS IN LAYER ON TOP OF COIR FIBER MATTING (SEE NOTE 7).



TOE WOOD SPECIFICATIONS	
MATERIALS:	SPECIFICATIONS:
BRUSH MATERIAL	TYPE: HARDWOOD LIMBS AND SHRUBS SIZE: MIN. 5 FT LONG, 1 INCH DIAMETER
ROOTWAD MATERIAL	TYPE: HARDWOOD SIZE: MIN. 6 FT LONG MIN. 10 INCH DIAMETER
COIR FIBER MATTING	SEE MATTING DETAIL

- NOTES FOR TOE WOOD STRUCTURES:**
- DIG A TRENCH ALONG BANK WHERE TOE WOOD IS TO BE INSTALLED. IF TOE WOOD IS BEING PLACED IN A LOCATION WHERE THERE IS NOT EXISTING GROUND, PLACE FILL MATERIAL AND COMPACT TO FORM THE TRENCH FOR THE TOE WOOD MATERIALS.
  - EXCAVATE TRENCH BELOW TOEWOOD GRADE (PLAN VIEW 1).
  - INSTALL ROOTWADS PERPENDICULAR TO THE FLOW AS SHOWN IN PLAN VIEW 2.
  - INSTALL BRUSH MATERIAL INCLUDING BRANCHES, LOGS, AND BRUSH, AND AT LEAST 1" IN DIAMETER. LARGE MATERIALS AND SMALL MATERIALS SHALL BE MIXED, PLACED IN LAYERS NO MORE THAN 1 FOOT DEEP, COVERED IN A THIN LAYER OF ONSITE ALLUVIUM, AND COMPACTED BEFORE PLACING THE NEXT LAYER OF TOE WOOD MATERIAL. CONTINUE PLACING MATERIALS TO FORM A DENSE LAYER OF WOODY MATERIALS AND ONSITE ALLUVIUM TO THE DEPTH AND ELEVATIONS SPECIFIED.
  - PLACE AN UNCONSOLIDATED LAYER OF SOIL AND GRAVEL ON TOP OF BRUSH LAYER.
  - COVER SOIL AND GRAVEL LAYER IN COIR FIBER MATTING.
  - INSTALL LIVE CUTTINGS, INCLUDING BRANCHES AND BRUSH, AT LEAST 5 FEET IN LENGTH, AND AT LEAST 1 INCH IN DIAMETER.
  - CONSTRUCT GEOLIFTS OR PLACE TRANSPLANTS AS SPECIFIED OR DIRECTED BY THE ENGINEER TO REBUILD THE STREAMBANK ABOVE THE TOE WOOD LAYER.
  - IF CONSTRUCTION OCCURS IN THE GROWING SEASON, DO NOT INSTALL LIVE CUTTINGS. INSTEAD INSTALL LIVE STAKES IN GEOLIFTS DURING VEGETATION DORMANT SEASON.

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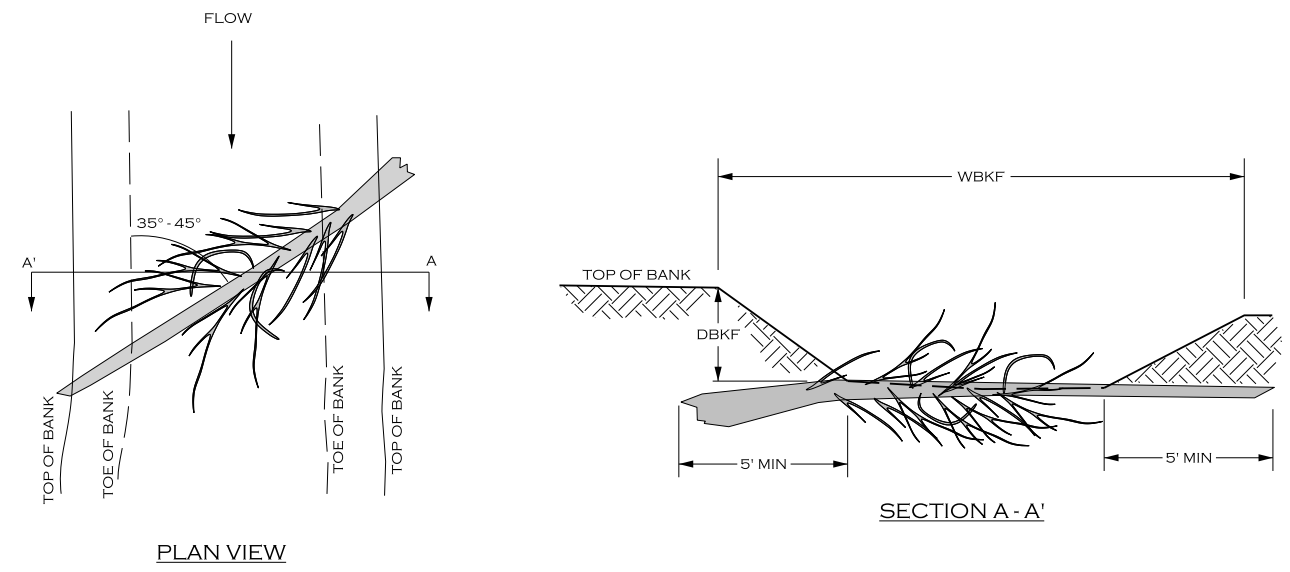
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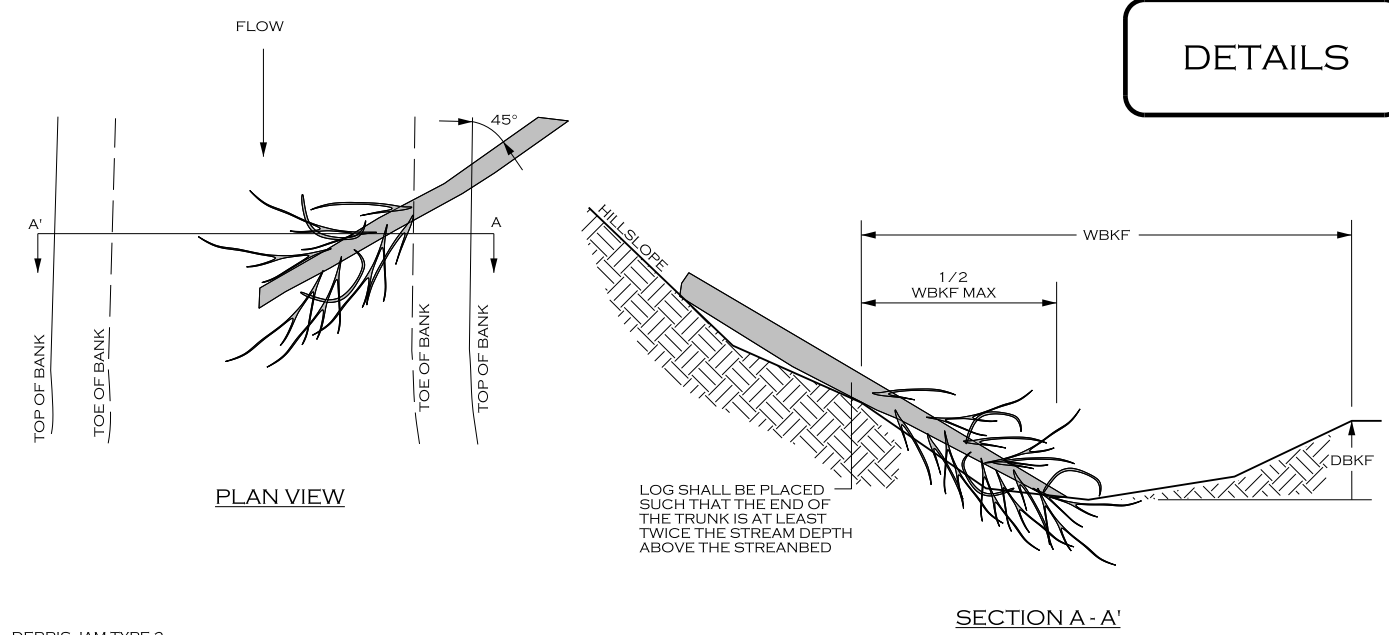
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DEBRIS JAM TYPE 1



- DEBRIS JAM TYPE 1**
1. DEBRIS JAM TYPE 1 INSTALLATIONS SHALL BE PLACED WITHIN STREAM RIFFLES TO TRAP DETRITUS AND ORGANIC MATTER AND KEEP IT IN CONTACT WITH FLOWING, AERATED WATER.
  2. TREE SHALL BE ANY NON-EVERGREEN TREE WITH BRANCHES, AT LEAST 8 INCHES DIAMETER, AND NOT ROTTEN.
  3. TREE SHALL HAVE CONSIDERABLE NUMBER OF BRANCHES THAT REMAIN EXPOSED AFTER INSTALLATION AND IN CONTACT WITH THE STREAM FLOW TO TRAP LEAVES AND DETRITUS FROM STREAM FLOW.
  4. TREE SHALL BE INSTALLED SO THAT THE TRUNK IS LEVEL WITH THE BED ELEVATION OF THE STREAM, SUCH THAT THE TRUNK DOES NOT POOL WATER IN FRONT OF THE STRUCTURE. BACKFULL AND COMPACT AROUND THE TRUNK AND INSTALLED TREE TO MINIMIZE VOIDS.

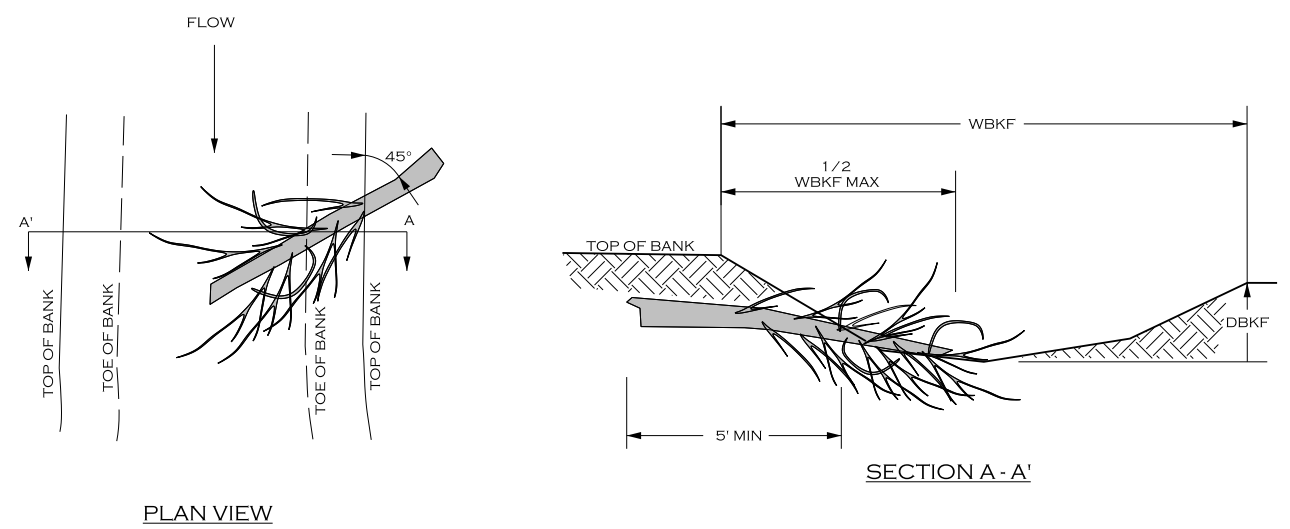
DEBRIS JAM TYPE 2



- DEBRIS JAM TYPE 2**
1. DEBRIS JAM TYPE 2 INSTALLATIONS SHALL BE PLACED AREAS WHERE THE STREAM FLOWS AGAINST A STEEP SLOPE. A TREE IS INSTALLED AS SHOWN TO CATCH DETRITUS AND ORGANIC MATTER AND KEEP IT IN CONTACT WITH STREAM FLOWS. THIS DEBRIS JAM MAY BE INSTALLED IN RIFFLE OR POOL LOCATIONS.
  2. TREE SHALL BE ANY NON-EVERGREEN TREE WITH BRANCHES, AT LEAST 8 INCHES DIAMETER, AND NOT ROTTEN.
  3. TREE SHALL HAVE CONSIDERABLE NUMBER OF BRANCHES THAT REMAIN EXPOSED AND IN CONTACT WITH THE STREAM FLOW AFTER INSTALLATION TO TRAP LEAVES AND DETRITUS FROM STREAM FLOW.
  4. TREE SHALL BE INSTALLED SO THAT THE TRUNK LIES UPON THE HILLSLOPE, AND IS ANCHORED TO THE HILLSLOPE TO PREVENT MOVEMENT DURING LARGE STREAM FLOWS. TREE SHALL BE CABLED TO A FRESHLY CUT STUMP OR ANOTHER LIVE TREE OF AT LEAST THE SAME SIZE.

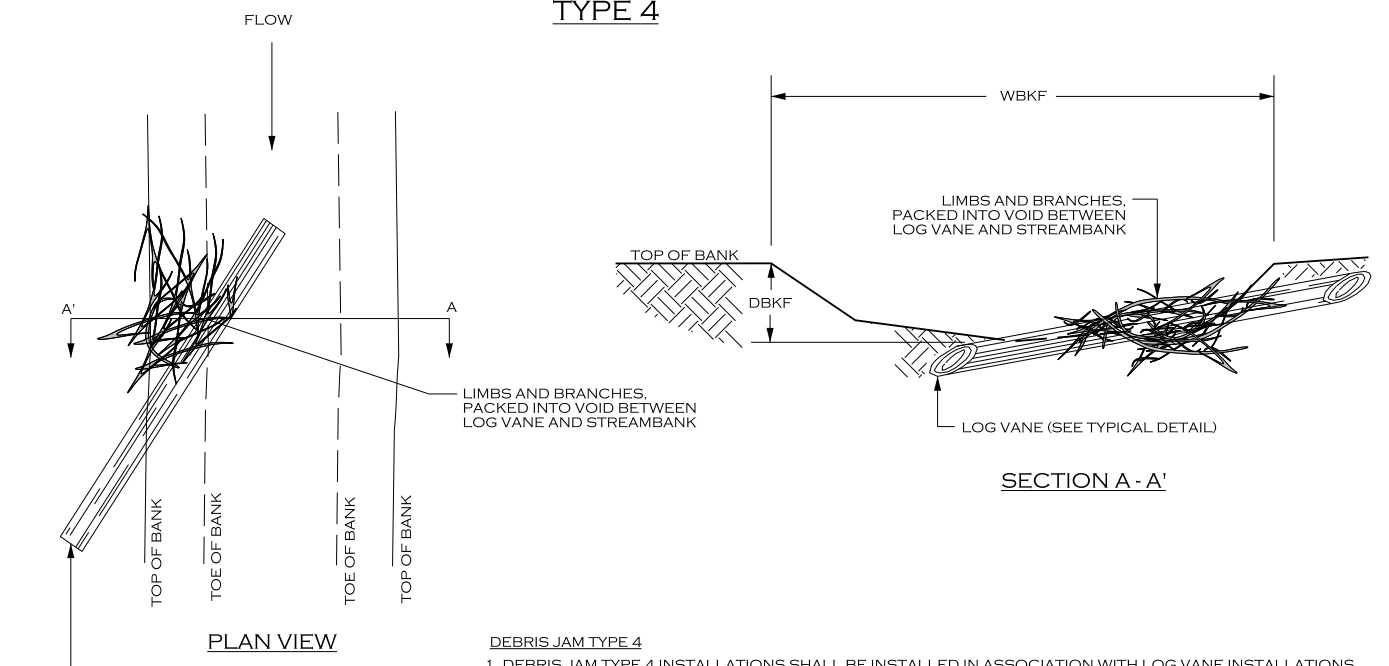
LOG SHALL BE PLACED SUCH THAT THE END OF THE TRUNK IS AT LEAST TWICE THE STREAM DEPTH ABOVE THE STREAMBED

DEBRIS JAM TYPE 3



- DEBRIS JAM TYPE 3**
1. DEBRIS JAM TYPE 3 INSTALLATIONS SHALL BE PLACED WITHIN STREAM RIFFLES OR POOLS TO TRAP DETRITUS AND ORGANIC MATTER AND KEEP IT IN CONTACT WITH FLOWING WATER.
  2. TREE SHALL BE ANY NON-EVERGREEN TREE WITH BRANCHES, AT LEAST 8 INCHES DIAMETER, AND NOT ROTTEN.
  3. TREE SHALL HAVE CONSIDERABLE NUMBER OF BRANCHES THAT REMAIN EXPOSED AFTER INSTALLATION AND IN CONTACT WITH THE STREAM FLOW TO TRAP LEAVES AND DETRITUS FROM STREAM FLOW.
  4. TREE SHALL BE INSTALLED SO THAT THE TRUNK IS IN CONTACT WITH THE STREAM BED. BACKFULL AND COMPACT AROUND THE TRUNK AND INSTALLED TREE TO MINIMIZE VOIDS.

DEBRIS JAM TYPE 4



- DEBRIS JAM TYPE 4**
1. DEBRIS JAM TYPE 4 INSTALLATIONS SHALL BE INSTALLED IN ASSOCIATION WITH LOG VANE INSTALLATIONS (SEE TYPICAL DETAIL FOR LOG VANE).
  2. LIMBS AND BRANCHES THAT FORM THE DEBRIS JAM SHALL VARY IN DIAMETER, BUT SHALL BE AT LEAST 3 FEET LONG WITH MULTIPLE BRANCHES TO PROMOTE ENTANGLING WHEN PACKED TOGETHER. LIMBS AND BRANCHES SHOULD BE A MIXTURE (APPROX. 50/50) OF RECENTLY CUT BRANCHES AND DEAD/DECAYING BRANCHES.
  3. PREPARE THE EXCAVATION FOR THE LOG VANE, THEN PLACE THE DEBRIS JAM PRIOR TO PLACING AND INSTALLING THE LOG VANE.
  4. WHEN INSTALLED, THE LOG VANE SHOULD PIN THE DEBRIS JAM TO THE STREAM BED AND BANK AND PREVENT EASY MOVEMENT DURING HIGH FLOW EVENTS.
  5. AFTER INSTALLATION, STREAM FLOW SHOULD BE IN CONTACT WITH THE DEBRIS JAM, IN ORDER TO TRAP ADDITIONAL DEBRIS AND ORGANIC MATTER.

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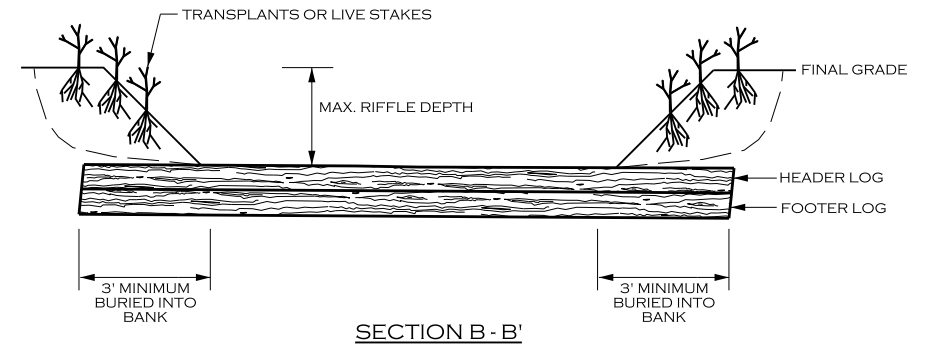
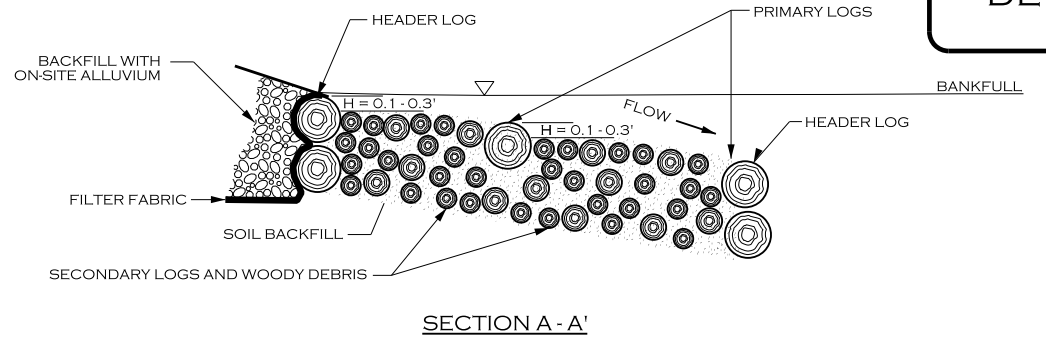
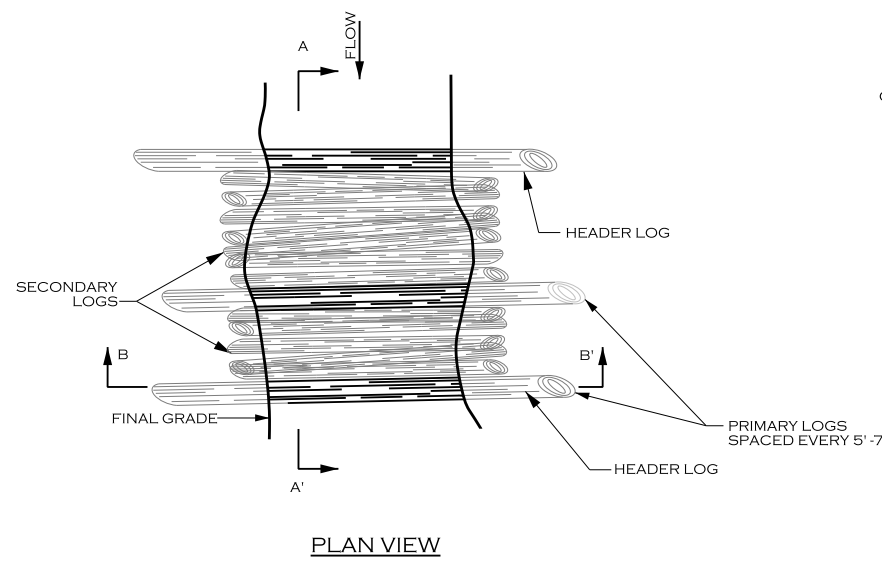
PROJECT ENGINEER

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PURPOSES ONLY

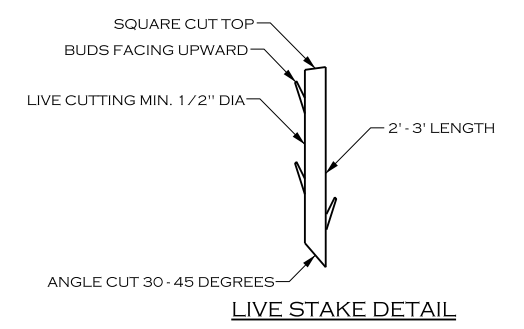
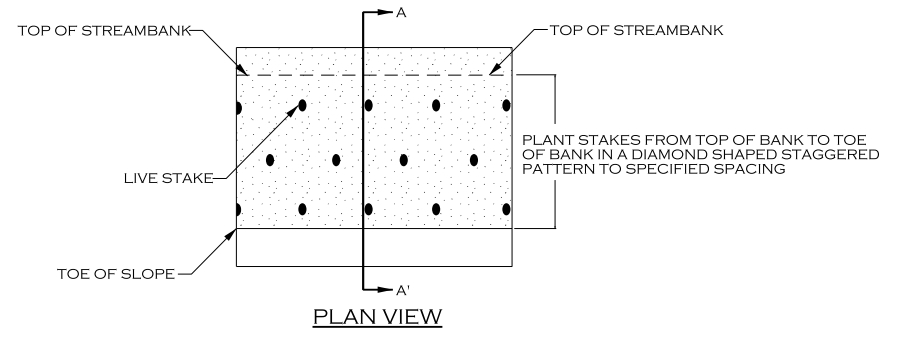
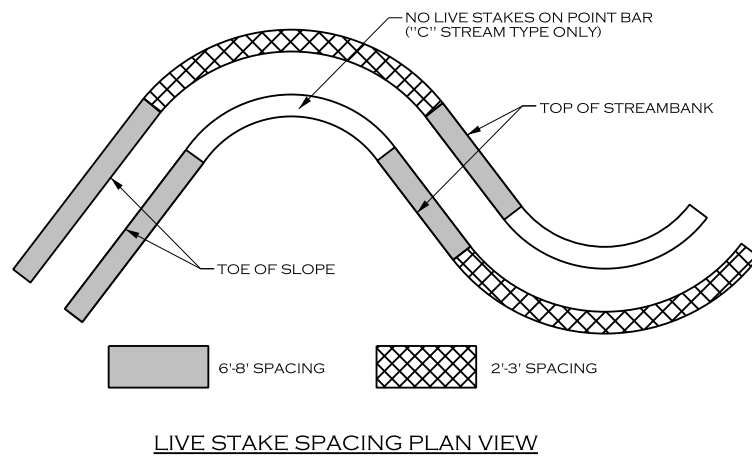
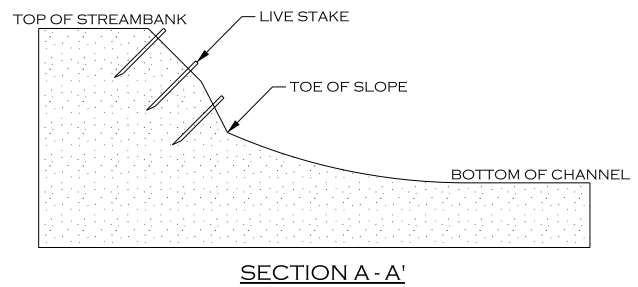
**DETAILS**

**WOODY RIFFLE**

WOODY RIFFLE	
MATERIALS:	SPECIFICATIONS:
LOGS	SEE NOTES BELOW
FILTER FABRIC	TYPE: TYPE 2 NON-WOVEN WIDTH UPSTREAM: 6 FT MINIMUM
BACKFILL	ON-SITE ALLUVIUM AND SOIL
<b>NOTES FOR WOODY RIFFLE STRUCTURES:</b> 1. PRIMARY LOGS SHALL BE AT LEAST 8" OR MORE IN DIAMETER, RELATIVELY STRAIGHT, AND RECENTLY HARVESTED AND EXTENDING INTO THE BANK 3' ON EACH SIDE. 2. SECONDARY LOGS SHALL BE AT LEAST 1" IN DIAMETER AND NO LARGER THAN 8", AND EXTEND INTO THE BANK 2 FEET ON EACH SIDE. WOOD MATERIAL SHALL BE VARYING DIAMETER TO ALLOW MATERIAL TO BE COMPACTED. 3. COIR FIBER MATTING CAN BE USED INSTEAD OF TRANSPLANTS OR LIVE STAKES, PER DIRECTION OF ENGINEER. 4. AFTER TRENCH HAS BEEN EXCAVATED A LAYER OF SECONDARY LOGS AND WOODY DEBRIS SHALL BE PLACED WITH MINIMAL GAPS. A LAYER OF ON-SITE ALLUVIUM SHALL BE APPLIED TO FILL VOIDS BETWEEN SECONDARY LOGS BEFORE ADDITIONAL LAYERS ARE PLACED.	



**LIVE STAKING**



- NOTES:**
1. STAKES SHALL BE CUT AND INSTALLED ON THE SAME DAY.
  2. DO NOT INSTALL STAKES THAT HAVE BEEN SPLIT.
  3. STAKES MUST BE INSTALLED WITH BUDS POINTING UPWARDS.
  4. STAKES SHALL BE INSTALLED PERPENDICULAR TO BANK.
  5. STAKES SHALL BE 1/2 TO 2 INCHES IN DIAMETER AND 2 TO 3 FT LONG.
  6. STAKES SHALL BE INSTALLED LEAVING 1/5 OF STAKE ABOVE GROUND.

REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:

**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
FANNIN COUNTY, TEXAS

PREPARED IN THE OFFICE OF:

**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
TOMBALL, TX 77377  
TEXAS REGISTERED ENGINEERING FIRM F-14997

PROJECT ENGINEER

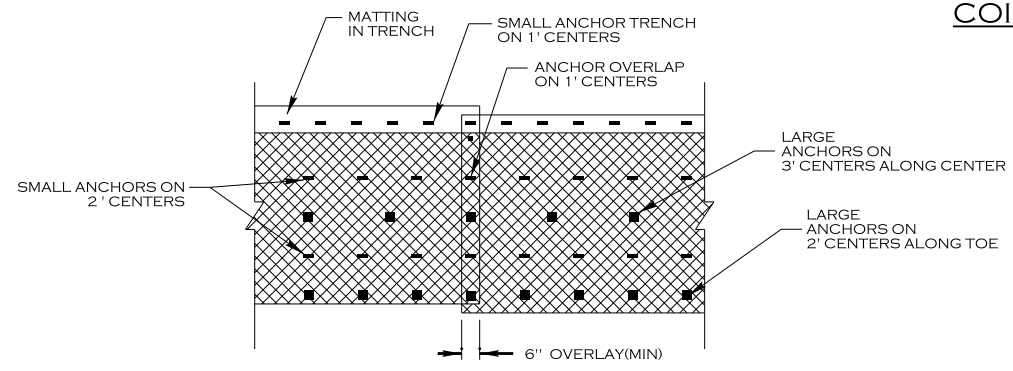
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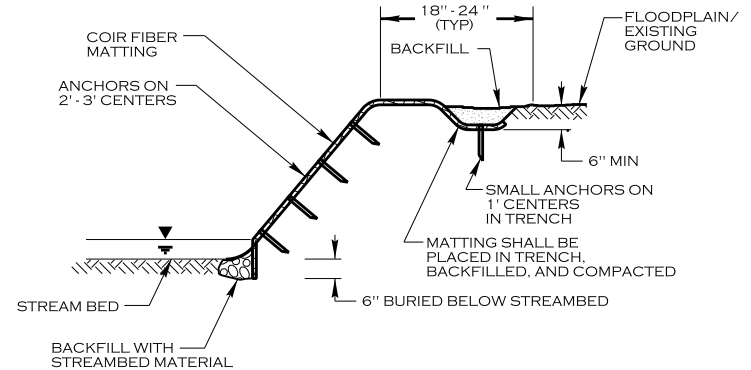


DETAILS

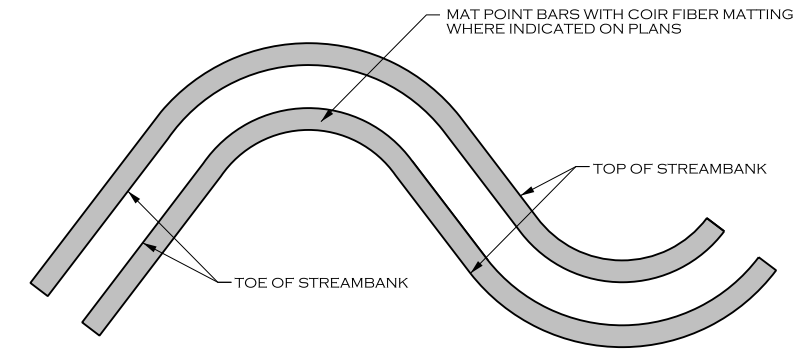
COIR FIBER MATTING



PLAN VIEW

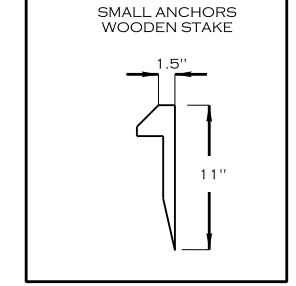
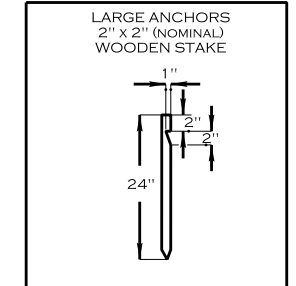


CROSS SECTION



SEE PLAN VIEW SHEET FOR MATTING LOCATIONS

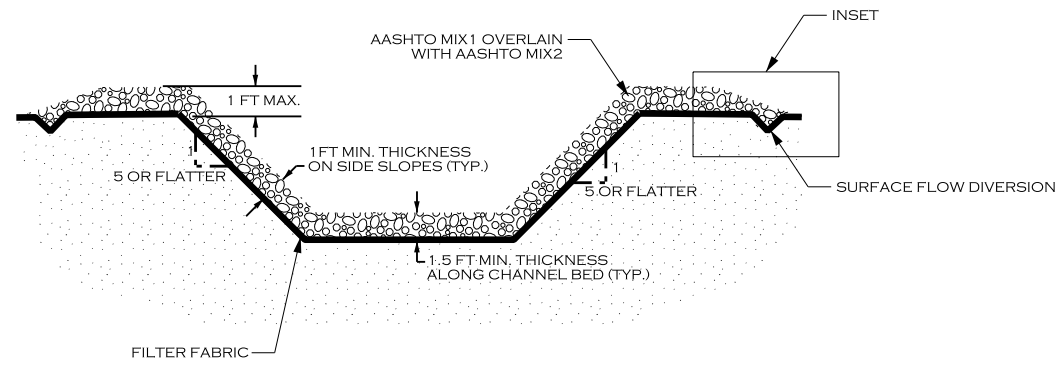
MATTING PLAN VIEW



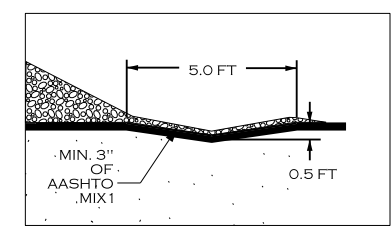
ANCHOR OPTIONS

NOTES:  
1. IN AREAS TO BE MATTED, ALL SEEDING, SOIL AMENDMENTS, AND SOIL PREPARATION MUST BE COMPLETED PRIOR TO PLACEMENT OF COIR FIBER MATTING.

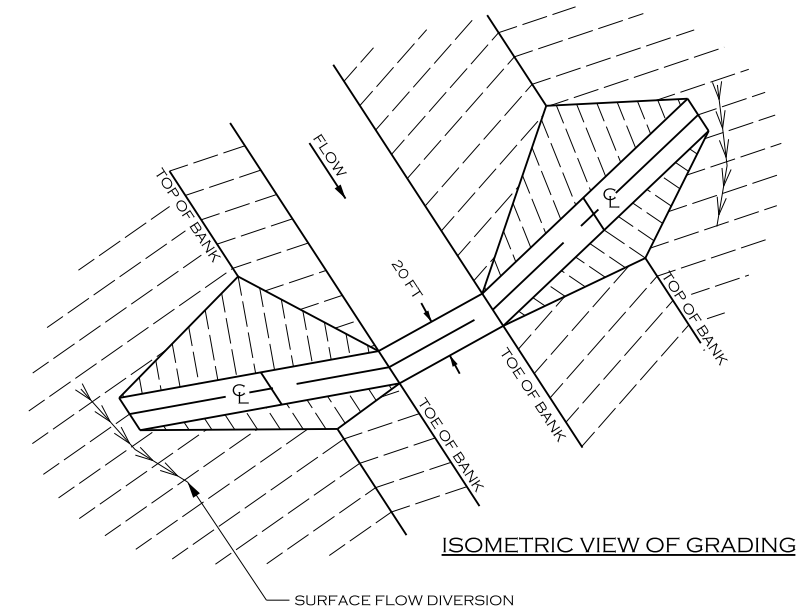
PERMANENT FORD STREAM CROSSING



CROSS SECTION



INSET



ISOMETRIC VIEW OF GRADING

NOTES:  
1. HAVE ALL NECESSARY MATERIALS AND EQUIPMENT ON-SITE BEFORE WORK BEGINS.  
2. MINIMIZE CLEARING AND EXCAVATION OF STREAMBANKS. COMPLETE ONE SIDE BEFORE STARTING ON THE OTHER SIDE.  
3. INSTALL STREAM CROSSING AT RIGHT ANGLE TO THE FLOW.  
4. DIVERT ALL SURFACE RUNOFF FROM CONSTRUCTION SITE ONTO UNDISTURBED AREAS ADJOINING THE STREAM.  
5. ALIGN ROAD APPROACHES WITH THE CENTERLINE OF THE CROSSING FOR A MINIMUM DISTANCE OF 30 FEET.  
6. GRADE SLOPES TO A 5:1 SLOPE OR FLATTER. TRANSPLANT SOD FROM ORIGINAL STREAMBANK ONTO SIDE SLOPES IF POSSIBLE.  
7. MAINTAIN CROSSING SO THAT RUNOFF IN THE CONSTRUCTION ROAD DOES NOT ENTER EXISTING CHANNEL.  
8. A STABILIZED PAD OF STONE BACKFILL, LINED WITH GEOTEXTILE FABRIC SHALL BE USED OVER ACCESS SLOPES.  
9. WIDTH OF THE CROSSING SHALL BE 20 FEET.  
10. INSPECT STREAM CROSSING AFTER RUNOFF - PRODUCING RAINS TO CHECK FOR BLOCKAGE IN CHANNEL, EROSION OF BANKS, CHANNEL SCOUR, STONE DISPLACEMENT, OR PIPING. MAKE ALL REPAIRS IMMEDIATELY TO PREVENT FURTHER DAMAGE TO INSTALLATION.

REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:

UPPER TRINITY REGIONAL WATER DISTRICT

900 N KEALY ST  
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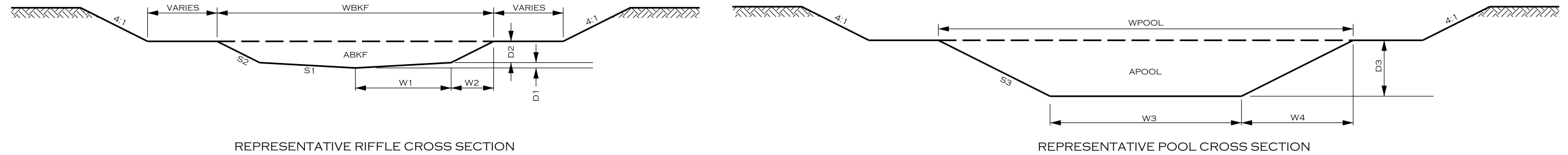
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REPRESENTATIVE SECTIONS  
"B" TYPE CHANNELS

VOLUME NO. SHEET NO.  
VOL. 1 4.1

REPRESENTATIVE SECTIONS



REPRESENTATIVE RIFFLE CROSS SECTION

REPRESENTATIVE POOL CROSS SECTION

B STREAM TYPE REPRESENTATIVE CROSS SECTION DIMENSIONS																	
Stream	Sheet Range	Station Range	RIFFLES								POOLS						
			ABKF	WBKF	W1	W2	D1	D2	S1	S2	APOOL	WPOOL	W3	W4	D3	S3	
AX-S2-TRIB1-A4-TRIBA-(1)	5.163	10+00 to 12+95	1.2	3.8	0.7	1.2	0.04	0.40	16:1	3:1	1.9	4.2	1.6	1.3	0.66	2:1	
AX-S2-TRIB1-A4-TRIBB-(2a)	5.161, 5.196	11+28 to 12+69	1.1	3.6	0.7	1.1	0.04	0.38	15:1	3:1	1.7	4.0	1.4	1.3	0.64	2:1	
AX-S2-TRIB1-A4-TRIBC-(2)	5.158	11+72 to 12+84	1.0	3.2	0.4	1.2	0.04	0.40	9:1	3:1	1.4	3.5	0.9	1.3	0.66	2:1	
AX-S2-TRIB1-A4-TRIBD-(1)	5.157	10+00 to 12+57	0.9	3.0	0.4	1.1	0.04	0.38	9:1	3:1	1.3	3.3	0.7	1.3	0.63	2:1	
AX-S2-TRIB1-A4-TRIBE-(1)	5.157	10+00 to 12+21	0.9	3.0	0.4	1.1	0.04	0.38	9:1	3:1	1.3	3.3	0.7	1.3	0.63	2:1	
AX-S2-TRIB1-A7-(1)	5.137, 5.156	10+00 to 13+59	1.2	4.4	1.1	1.1	0.03	0.35	34:1	3:1	2.1	4.8	2.4	1.2	0.58	2:1	
AX-S2-TRIB3-A10-(2)	5.76	12+18 to 14+53	1.2	3.8	0.7	1.2	0.04	0.40	16:1	3:1	1.9	4.2	1.6	1.3	0.66	2:1	
AX-S2-TRIB3-A10-B1-(1)	5.76	10+00 to 10+72	1.0	3.5	0.7	1.1	0.04	0.36	15:1	3:1	1.6	3.8	1.4	1.2	0.61	2:1	
AX-S2-TRIB3-A10-TRIBA-(1)	5.76	10+00 to 12+89	0.6	2.4	0.3	0.9	0.03	0.31	9:1	3:1	0.9	2.7	0.7	1.0	0.51	2:1	
AX-S2-TRIB3-A13-(2)	5.75	12+55 to 14+99	1.0	3.2	0.4	1.2	0.04	0.40	9:1	3:1	1.4	3.5	0.9	1.3	0.66	2:1	
AX-S2-TRIB3-A14-(2)	5.81	11+44 to 14+89	1.1	3.3	0.4	1.3	0.04	0.42	9:1	3:1	1.5	3.6	0.8	1.4	0.70	2:1	
AX-S2-TRIB3-A16-(2)	5.80	11+57 to 14+83	1.0	3.2	0.4	1.2	0.04	0.40	9:1	3:1	1.4	3.5	0.9	1.3	0.66	2:1	
AX-S2-TRIB3-A17-(1)	5.80	10+00 to 12+24	0.4	2.0	0.3	0.8	0.03	0.25	8:1	3:1	0.6	2.2	0.6	0.8	0.42	2:1	
AX-S2-TRIB3-A18-(0)	5.55, 5.79	10+00 to 12+76	1.3	3.9	0.7	1.2	0.05	0.41	15:1	3:1	2.0	4.3	1.5	1.4	0.69	2:1	
AX-S2-TRIB3-A19-(1)	5.55	10+00 to 12+32	1.6	4.4	0.8	1.4	0.05	0.46	16:1	3:1	2.5	4.8	1.8	1.5	0.77	2:1	
AX-S2-TRIB3-A20-(1)	5.55	10+00 to 12+05	1.8	5.4	1.4	1.3	0.05	0.42	29:1	3:1	3.2	5.9	3.1	1.4	0.70	2:1	
AX-S2-TRIB3-A7-TRIBA-(1)	5.95	10+00 to 14+01	1.2	3.5	0.4	1.3	0.04	0.44	9:1	3:1	1.7	3.8	0.8	1.5	0.73	2:1	
AX-S2-TRIB3-A7-TRIBA-(3)	5.96	16+33 to 17.32	1.6	4.4	0.8	1.4	0.05	0.46	16:1	3:1	2.5	4.8	1.8	1.5	0.77	2:1	
AX-S2-TRIB3-A7-TRIBA-AA-(1)	5.95	10+00 to 11+22	0.4	2.0	0.3	0.8	0.03	0.25	8:1	3:1	0.6	2.2	0.6	0.8	0.42	2:1	
AX-S2-TRIB3-A7-TRIBA-AC-(1)	5.95	10+00 to 10+79	0.4	2.0	0.3	0.8	0.03	0.25	8:1	3:1	0.6	2.2	0.6	0.8	0.42	2:1	
AX-S2-TRIB3-A7-TRIBA-AD-(1)	5.95	10+00 to 10+86	0.4	2.0	0.3	0.8	0.03	0.25	8:1	3:1	0.6	2.2	0.6	0.8	0.42	2:1	
AX-S2-TRIB3-A7-TRIBB-(1)	5.86, 5.99	10+00 to 12+90	1.4	4.1	0.8	1.3	0.05	0.43	16:1	3:1	2.2	4.5	1.7	1.4	0.72	2:1	
AX-S2-TRIB3-A7-TRIBB-AA-(1)	5.99	10+00 to 12.75	0.6	2.4	0.3	0.9	0.03	0.31	9:1	3:1	0.9	2.7	0.7	1.0	0.51	2:1	
AX-S2-TRIB3-A7-TRIBC-(1)	5.85	10+00 to 11+79	0.9	3.0	0.4	1.1	0.04	0.38	9:1	3:1	1.3	3.3	0.7	1.3	0.63	2:1	
AX-S2-TRIB3-A7-TRIBE-(1)	5.93 - 5.94	10+00 to 18+95	2.4	6.6	1.9	1.4	0.05	0.46	37:1	3:1	4.4	7.2	4.2	1.5	0.77	2:1	
AX-S2-TRIB3-A7-TRIBF-(1)	5.84	10+00 to 10+94	0.6	2.7	0.5	0.8	0.03	0.28	15:1	3:1	1.0	3.0	1.2	0.9	0.47	2:1	
AX-S2-TRIB3-A7-TRIBG-(1)	5.84	10+00 to 11+42	1.6	5.4	1.5	1.1	0.04	0.38	41:1	3:1	2.9	5.9	3.3	1.3	0.63	2:1	
S2-TRIB1-A1-(1)	5.168	10+00 to 14.71	1.7	5.2	1.4	1.2	0.05	0.41	30:1	3:1	3.0	5.7	2.9	1.4	0.68	2:1	
S2-TRIB1-A1-(2)	5.168 - 5.169	14+71 to 17.71	1.8	4.6	0.9	1.5	0.05	0.49	16:1	3:1	2.8	5.1	1.9	1.6	0.81	2:1	
S2-TRIB2-A1-(1)	5.135 - 5.136	10+00 to 16.49	1.3	3.9	0.7	1.2	0.05	0.41	15:1	3:1	2.0	4.3	1.5	1.4	0.69	2:1	

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REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
FANNIN COUNTY, TEXAS

PREPARED IN THE OFFICE OF:



**ECOSYSTEM PLANNING & RESTORATION**

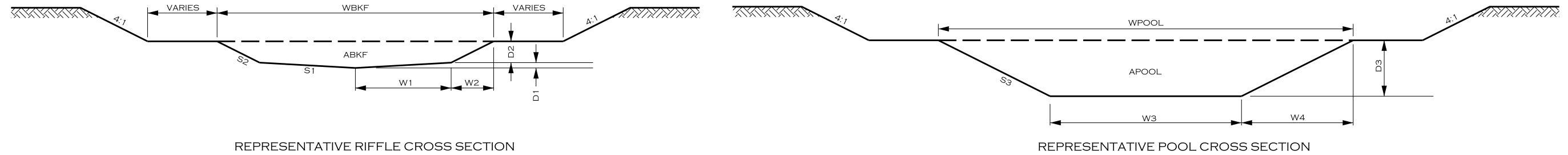
17575 N. ELDRIDGE PARKWAY, BLDG. C  
TOMBALL, TX 77377  
TEXAS REGISTERED ENGINEERING FIRM F-14997

PROJECT ENGINEER

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KEVIN TWEEDY PE#113620  
FOR REGULATORY REVIEW  
PURPOSES ONLY

REPRESENTATIVE SECTIONS  
"B" TYPE CHANNELS

REPRESENTATIVE SECTIONS



B STREAM TYPE REPRESENTATIVE CROSS SECTION DIMENSIONS																
Stream	Sheet Range	Station Range	RIFFLES								POOLS					
			ABKF	WBKF	W1	W2	D1	D2	S1	S2	APOOL	WPOOL	W3	W4	D3	S3
S2-TRIB2-A1-(2)	5.136	16+49 to 17+40	1.4	4.4	1.0	1.2	0.04	0.40	24:1	3:1	2.4	4.9	2.3	1.3	0.66	2:1
S2-TRIB2-A1-(3)	5.114, 5.136	17+40 to 21+09	1.6	4.7	1.1	1.3	0.04	0.43	25:1	3:1	2.7	5.2	2.4	1.4	0.71	2:1
S2-TRIB2-A2-(2)	5.130 - 5.131	11+29 to 15+79	1.7	4.5	0.8	1.4	0.06	0.47	15:1	3:1	2.7	5.0	1.8	1.6	0.79	2:1
S2-TRIB2-A2-(3)	5.112, 5.131	15+79 to 19+40	1.9	5.8	1.7	1.2	0.04	0.41	38:1	3:1	3.4	6.4	3.6	1.4	0.68	2:1
S2-TRIB2-A3-(1)	5.132 - 5.133	10+00 to 15.49	1.3	3.9	0.7	1.2	0.05	0.41	15:1	3:1	2.0	4.3	1.5	1.4	0.69	2:1
S2-TRIB2-A3-(4)	5.112, 5.134	21+61 to 28+01	3.2	7.6	2.2	1.6	0.06	0.53	37:1	3:1	5.8	8.3	4.7	1.8	0.89	2:1
S2-TRIB2-A4-(2)	5.110, 5.128	14.38 to 17+72	1.7	4.5	0.8	1.4	0.06	0.47	15:1	3:1	2.7	5.0	1.8	1.6	0.79	2:1
S2-TRIB2-B2-(1)	5.109, 5.127	13+55 to 17+14	1.3	3.9	0.7	1.2	0.05	0.41	15:1	3:1	2.0	4.3	1.5	1.4	0.69	2:1
S2-TRIB2-B4-(2)	5.111, 5.129	12+34 to 14+37	0.9	3.5	0.8	1.0	0.03	0.32	23:1	3:1	1.5	3.9	1.7	1.1	0.53	2:1
S2-TRIB3-A10-(2)	5.76 - 5.77	14+53 to 15+58	1.2	3.8	0.7	1.2	0.04	0.40	16:1	3:1	1.9	4.2	1.6	1.3	0.66	2:1
S2-TRIB3-A10-B1-(1)	5.76	10+70 to 11+93	1.0	3.2	0.4	1.2	0.04	0.40	9:1	3:1	1.4	3.5	0.9	1.3	0.66	2:1
S2-TRIB3-A5-B2-(1)	5.49	10+00 to 10+69	0.8	3.1	0.6	1.0	0.03	0.33	18:1	3:1	1.3	3.4	1.2	1.1	0.54	2:1
S2-TRIB3-A5-B3-(1)	5.49	10+00 to 10.67	0.4	2.0	0.3	0.8	0.03	0.25	8:1	3:1	0.6	2.2	0.6	0.8	0.42	2:1
S2-TRIB3-A5-B4-(1)	5.50	10+00 to 10+98	0.9	3.0	0.4	1.1	0.04	0.38	9:1	3:1	1.3	3.3	0.7	1.3	0.63	2:1
S2-TRIB3-A7-B3-(1)	5.89	10+00 to 11+12	1.0	3.2	0.4	1.2	0.04	0.40	9:1	3:1	1.4	3.5	0.9	1.3	0.66	2:1
S2-TRIB3-A7-B5-(1)	5.101	10+00 to 13+53	1.0	3.2	0.4	1.2	0.04	0.40	9:1	3:1	1.4	3.5	0.9	1.3	0.66	2:1
S2-TRIB3-A8-(1)	5.83	10+00 to 15+14	1.2	3.8	0.7	1.2	0.04	0.40	16:1	3:1	1.9	4.2	1.6	1.3	0.66	2:1
S2-TRIB3-A8-(2)	5.59, 5.83	15+14 to 18+73	1.5	4.2	0.8	1.4	0.04	0.45	17:1	3:1	2.4	4.7	1.7	1.5	0.74	2:1
S2-TRIB3-A9-(2)	5.78	11+30 to 15+76	1.2	3.8	0.7	1.2	0.04	0.40	16:1	3:1	1.9	4.2	1.6	1.3	0.66	2:1
S2-TRIB3-B1-(1)	5.59	10+00 to 12+83	0.9	3.0	0.4	1.1	0.04	0.38	9:1	3:1	1.3	3.3	0.7	1.3	0.63	2:1
T1-BAKER-(1)	5.33 - 5.35	38+09 to 52+91	7.5	11.6	3.4	2.4	0.09	0.81	36:1	3:1	13.7	12.8	7.4	2.7	1.36	2:1
T2-BAKER-(3)	5.9 - 5.10	37+83 to 44+81	4.2	8.7	2.5	1.8	0.07	0.61	38:1	3:1	7.7	9.6	5.6	2.0	1.01	2:1
T3-BAKER-(7)	5.3 - 5.4	24+69 to 28+99	4.6	9.1	2.6	1.9	0.07	0.64	39:1	3:1	8.4	10.0	5.8	2.1	1.06	2:1
T3-BAKER-TRIB1-(1)	5.1	10+00 to 11+55	0.8	2.8	0.3	1.1	0.04	0.36	9:1	3:1	1.1	3.1	0.7	1.2	0.59	2:1
T3-BAKER-TRIB1-(3a)	5.1 - 5.3	13+45 to 22+68	2.1	5.8	1.5	1.4	0.05	0.46	32:1	3:1	3.7	6.4	3.4	1.5	0.76	2:1
T3-BAKER-TRIB1-(3b)	5.3	22+68 to 24+69	2.2	6.3	1.8	1.3	0.05	0.44	37:1	3:1	4.0	6.9	3.9	1.5	0.73	2:1
T4-(4)	5.12 - 5.13	18+52 to 25+90	4.2	8.7	2.5	1.8	0.07	0.61	38:1	3:1	7.7	9.6	5.6	2.0	1.01	2:1
T4-(7)	5.16 - 5.18	44+02 to 54+17	5.5	9.9	2.9	2.1	0.07	0.70	39:1	3:1	10.0	10.9	6.3	2.3	1.16	2:1
T4-TRIB2-(2)	5.13, 5.21	25+03 to 30+19	2.5	6.7	1.9	1.4	0.05	0.47	38:1	3:1	4.6	7.4	4.2	1.6	0.78	2:1
T5-TRIB1-(1c)	5.23, 5.37	19+59 to 21+77	1.8	5.0	1.2	1.4	0.05	0.45	22:1	3:1	3.0	5.5	2.5	1.5	0.75	2:1

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REVISIONS				
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1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

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LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
FANNIN COUNTY, TEXAS

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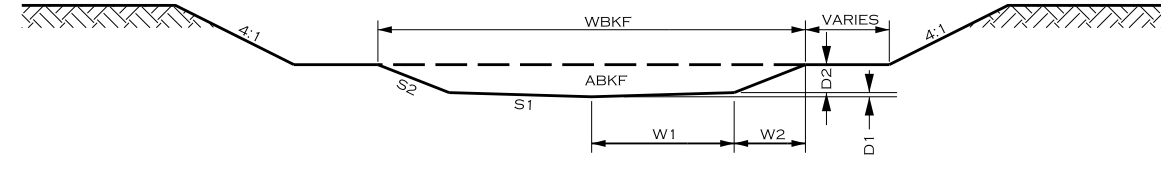
17575 N. ELDRIDGE PARKWAY, BLDG. C  
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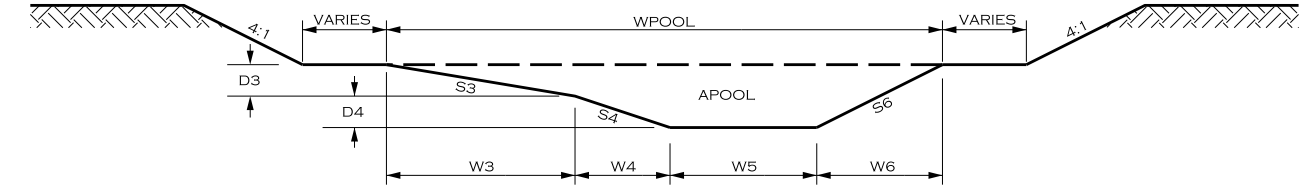
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REPRESENTATIVE SECTIONS  
"C" TYPE CHANNELS

REPRESENTATIVE SECTIONS



REPRESENTATIVE RIFFLE CROSS SECTION



REPRESENTATIVE POOL RIGHT CROSS SECTION

C STREAM TYPE REPRESENTATIVE CROSS SECTION DIMENSIONS																					
Stream	Sheet Range	Station Range	RIFFLES								POOLS										
			ABKF	WBKF	W1	W2	D1	D2	S1	S2	APOOL	WPOOL	W3	W4	W5	W6	D3	D4	S3	S4	S6
AX-S2-TRIB1-(1)	5.137 - 5.138	10+00 - 19+21	4.2	7.1	2.2	1.3	0.16	0.67	14:1	2:1	6.5	8.5	2.7	1.4	1.7	2.7	0.68	0.68	4:1	2:1	2:1
AX-S2-TRIB1-(2)	5.138 - 5.139	19+21 - 25+12	5.5	9.4	2.5	2.2	0.08	0.74	31:1	3:1	7.7	11.3	4.1	2.0	1.2	4.1	0.68	0.67	6:1	3:1	3:1
AX-S2-TRIB1-(3)	5.139 - 5.140	25+12 - 32+13	5.9	10.3	3.2	1.9	0.16	0.64	20:1	3:1	9.3	12.4	4.7	2.3	0.8	4.7	0.78	0.77	6:1	3:1	3:1
AX-S2-TRIB1-(4)	5.140 - 5.142	32+13 - 45+86	9.0	12.7	4.0	2.4	0.19	0.80	20:1	3:1	14.2	15.3	5.8	2.9	1.0	5.7	0.96	0.95	6:1	3:1	3:1
AX-S2-TRIB1-A2-(2)	5.165 - 5.167	17+90 - 26+67	3.1	7.0	1.9	1.7	0.06	0.56	31:1	3:1	4.4	8.5	3.1	1.5	0.9	3.0	0.51	0.50	6:1	3:1	3:1
AX-S2-TRIB1-A3-(1)	5.141	10+00 - 12+27	1.1	3.3	0.8	0.9	0.01	0.45	63:1	2:1	1.5	4.0	1.5	0.8	0.2	1.5	0.38	0.38	4:1	2:1	2:1
AX-S2-TRIB1-A4-(1a)	5.157 - 5.158	10+00 - 20+71	4.5	9.0	2.8	1.7	0.14	0.56	20:1	3:1	7.1	10.8	4.1	2.0	0.7	4.1	0.68	0.67	6:1	3:1	3:1
AX-S2-TRIB1-A4-(1b)	5.158 - 5.160	20+71 - 27+87	5.7	10.1	3.2	1.9	0.15	0.63	20:1	3:1	9.0	12.2	4.6	2.3	0.8	4.6	0.76	0.76	6:1	3:1	3:1
AX-S2-TRIB1-A4-TRIBB-(2b)	5.161 - 5.162	12+69 - 17+35	1.8	4.6	1.5	0.9	0.11	0.44	14:1	2:1	2.8	5.6	1.8	0.9	1.1	1.8	0.45	0.44	4:1	2:1	2:1
AX-S2-TRIB1-A4-TRIBB-(2c)	5.158, 5.162	17+35 - 23+27	2.0	5.3	1.1	1.6	0.04	0.53	28:1	3:1	2.6	6.3	2.2	1.3	0.2	2.6	0.44	0.43	5:1	3:1	3:1
AX-S2-TRIB1-A5-(1)	5.139	10+00 - 12+54	1.7	4.5	1.4	0.8	0.10	0.42	14:1	2:1	2.6	5.4	1.8	0.9	1.0	1.7	0.44	0.43	4:1	2:1	2:1
AX-S2-TRIB1-A7-(2)	5.137	13+59 - 15+13	4.1	7.0	2.2	1.3	0.16	0.66	14:1	2:1	6.3	8.4	2.7	1.3	1.7	2.7	0.67	0.67	4:1	2:1	2:1
AX-S2-TRIB3-(2a)	5.55 - 5.56	12+11 - 20+92	1.4	3.7	0.9	1.0	0.01	0.51	62:1	2:1	1.8	4.5	1.7	0.9	0.2	1.7	0.43	0.43	4:1	2:1	2:1
AX-S2-TRIB3-(2b)	5.56 - 5.58	20+92 - 31+28	5.4	9.9	3.1	1.8	0.15	0.62	20:1	3:1	8.4	11.8	4.4	2.2	0.7	4.4	0.74	0.74	6:1	3:1	3:1
AX-S2-TRIB3-A7-(2a)	5.84	11+40 - 13+82	1.7	4.5	1.4	0.8	0.10	0.42	14:1	2:1	2.6	5.4	1.8	0.9	1.0	1.7	0.44	0.43	4:1	2:1	2:1
AX-S2-TRIB3-A7-(2b)	5.84 - 5.85	13+82 - 17+03	2.7	7.0	2.2	1.3	0.11	0.44	20:1	3:1	4.3	8.4	3.2	1.6	0.5	3.2	0.53	0.52	6:1	3:1	3:1
AX-S2-TRIB3-A7-(2c)	5.85	17+03 - 18+79	4.1	8.6	2.7	1.6	0.13	0.54	20:1	3:1	6.4	10.3	3.9	1.9	0.6	3.9	0.65	0.64	6:1	3:1	3:1
AX-S2-TRIB3-A7-(4)	5.86 - 5.87	24+43 - 29+98	2.2	5.9	1.6	1.4	0.05	0.47	31:1	3:1	3.0	7.1	2.6	1.3	0.7	2.6	0.43	0.42	6:1	3:1	3:1
AX-S2-TRIB3-A7-TRIBA-(4)	5.96	17+31 - 21+88	1.6	4.4	1.4	0.8	0.10	0.41	14:1	2:1	2.5	5.3	1.7	0.8	1.1	1.7	0.42	0.42	4:1	2:1	2:1
AX-S2-TRIB3-A7-TRIBB-(2)	5.86	12+90 - 14+24	1.3	3.9	1.2	0.7	0.09	0.37	14:1	2:1	2.0	4.7	1.5	0.8	0.9	1.5	0.38	0.38	4:1	2:1	2:1
S1-TRIB1-(1a)	5.172 - 5.175	10+00 - 47+28	8.8	12.6	3.9	2.4	0.19	0.79	20:1	3:1	13.8	15.1	5.7	2.8	0.9	5.7	0.95	0.94	6:1	3:1	3:1
S1-TRIB1-(1b)	5.175 - 5.177	47+28 - 59+08	1.3	3.9	1.2	0.7	0.09	0.37	14:1	2:1	2.0	4.7	1.5	0.8	0.9	1.5	0.38	0.38	4:1	2:1	2:1
S2-(2a)	5.104 - 5.106	10+00 - 24+25	4.5	8.5	2.2	2.0	0.07	0.67	31:1	3:1	6.3	10.2	3.7	1.8	1.1	3.7	0.61	0.61	6:1	3:1	3:1
S2-(2b)	5.106 - 5.108, 5.185	24+25 - 42+10	4.2	8.7	2.7	1.6	0.13	0.54	20:1	3:1	6.5	10.4	3.9	2.0	0.6	3.9	0.65	0.65	6:1	3:1	3:1
S2-(3a)	5.182 - 5.189	10+00 - 89+79	13.9	15.8	4.9	3.0	0.24	0.99	20:1	3:1	21.8	19.0	7.1	3.5	1.2	7.1	1.19	1.18	6:1	3:1	3:1
S2-(3b)	5.189 - 5.191	89+79 - 102+75	16.4	17.2	5.4	3.2	0.26	1.07	20:1	3:1	25.7	20.6	7.7	3.9	1.3	7.7	1.29	1.29	6:1	3:1	3:1
S2-(3c)	5.191 - 5.194	102+75 - 121+56	20.2	19.1	6.0	3.6	0.29	1.19	20:1	3:1	31.8	22.9	8.6	4.3	1.5	8.6	1.43	1.43	6:1	3:1	3:1
S2-(3d)	5.194	121+56 - 124+10	22.4	20.1	6.3	3.8	0.31	1.25	20:1	3:1	35.1	24.1	9.1	4.5	1.5	9.0	1.51	1.50	6:1	3:1	3:1
S2-TRIB1-(1a)	5.142 - 5.144	45+86 - 54+64	9.6	13.1	4.1	2.5	0.20	0.82	20:1	3:1	15.1	15.8	5.9	2.9	1.0	5.9	0.99	0.98	6:1	3:1	3:1
S2-TRIB1-(1b)	5.144 - 5.148	54+64 - 80+75	10.3	13.6	4.3	2.6	0.21	0.85	20:1	3:1	16.1	16.3	6.1	3.1	1.0	6.1	1.02	1.02	6:1	3:1	3:1
S2-TRIB1-(2)	5.148 - 5.155	80+75 - 137+31	12.8	15.2	4.7	2.8	0.23	0.95	20:1	3:1	20.1	18.2	6.8	3.4	1.1	6.8	1.14	1.14	6:1	3:1	3:1
S2-TRIB1-A1-(3)	5.169 - 5.170	17+71 - 21+93	2.4	6.6	2.1	1.2	0.10	0.41	20:1	3:1	3.8	7.9	3.0	1.5	0.5	3.0	0.50	0.49	6:1	3:1	3:1
S2-TRIB1-A1-(4)	5.148, 5.170 - 5.171	21+93 - 35+12	3.2	7.6	2.4	1.4	0.12	0.47	20:1	3:1	5.0	9.1	3.4	1.7	0.6	3.4	0.57	0.57	6:1	3:1	3:1
S2-TRIB2-(1)	5.109	10+00 - 12+34	3.3	7.7	2.4	1.4	0.12	0.48	20:1	3:1	5.1	9.2	3.5	1.7	0.5	3.5	0.58	0.58	6:1	3:1	3:1
S2-TRIB2-(2)	5.109 - 5.110	12+34 - 16+86	4.8	9.3	2.9	1.7	0.14	0.58	20:1	3:1	7.6	11.2	4.2	2.1	0.8	4.2	0.70	0.69	6:1	3:1	3:1
S2-TRIB2-(3)	5.110	16+86 - 18+73	4.9	9.4	2.9	1.8	0.14	0.59	20:1	3:1	7.7	11.3	4.3	2.1	0.7	4.2	0.71	0.70	6:1	3:1	3:1
S2-TRIB2-(4)	5.110 - 5.112	18+73 - 28+19	5.6	10.0	3.1	1.9	0.15	0.63	20:1	3:1	8.7	12.0	4.6	2.3	0.7	4.5	0.76	0.75	6:1	3:1	3:1
S2-TRIB2-(5)	5.112 - 5.113	28+19 - 38+13	6.8	11.1	3.5	2.1	0.17	0.69	20:1	3:1	10.7	13.3	5.0	2.5	0.9	5.0	0.83	0.83	6:1	3:1	3:1
S2-TRIB2-(6)	5.113 - 5.116	38+13 - 55+04	7.4	11.5	3.6	2.2	0.18	0.72	20:1	3:1	11.5	13.8	5.2	2.6	0.8	5.2	0.87	0.86	6:1	3:1	3:1
S2-TRIB2-(7)	5.116 - 5.118	55+04 - 63+93	7.9	11.9	3.7	2.2	0.18	0.75	20:1	3:1	12.4	14.3	5.4	2.7	0.9	5.4	0.90	0.89	6:1	3:1	3:1

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REVISIONS				
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1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

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**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
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LAKE RALPH HALL MITIGATION  
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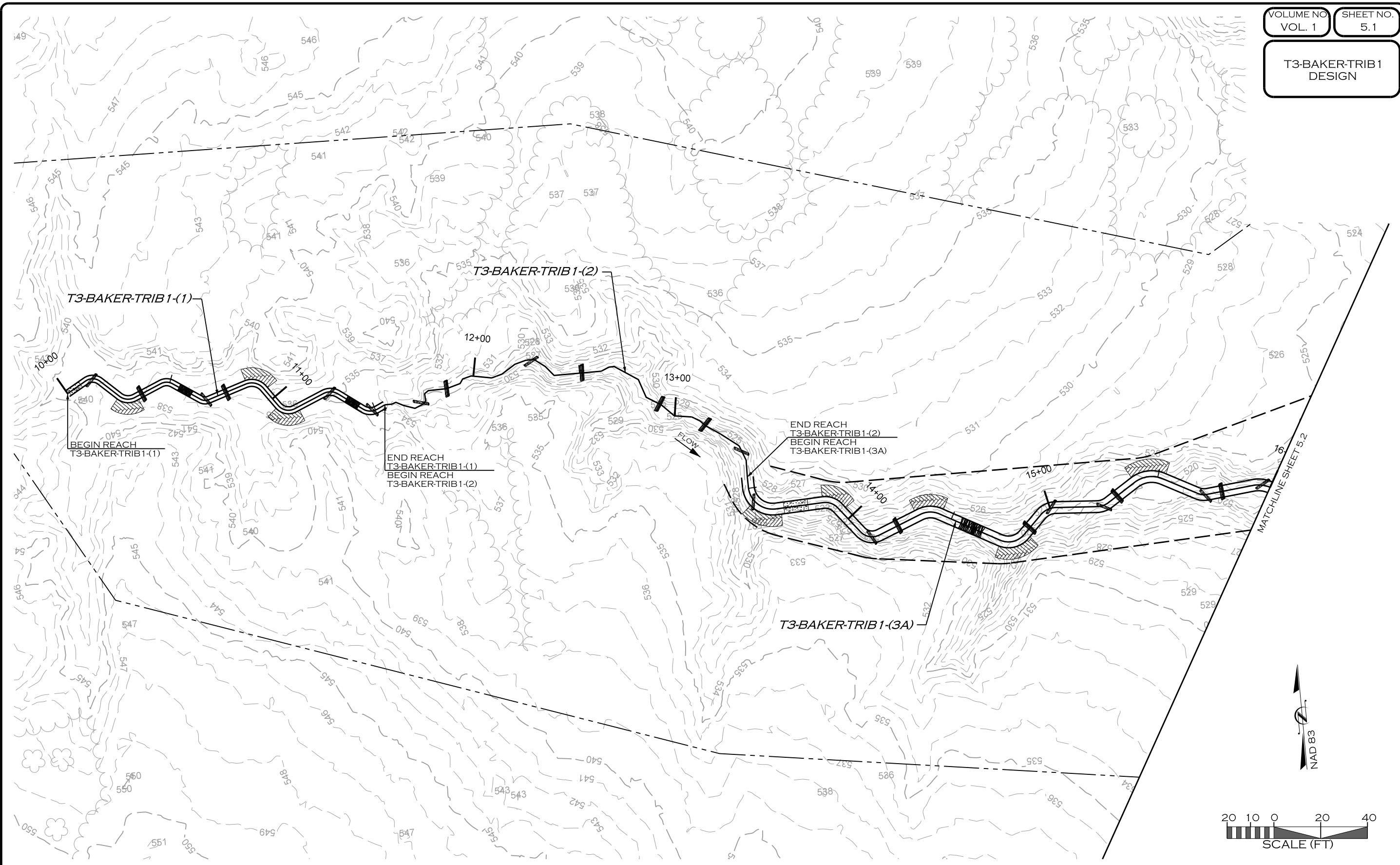
**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
TOMBALL, TX 77377  
TEXAS REGISTERED ENGINEERING FIRM F-14997

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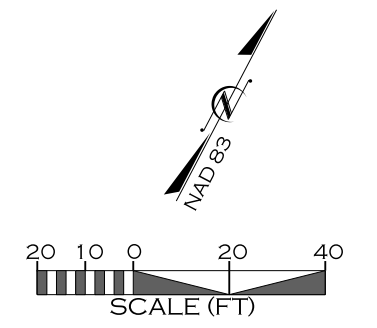
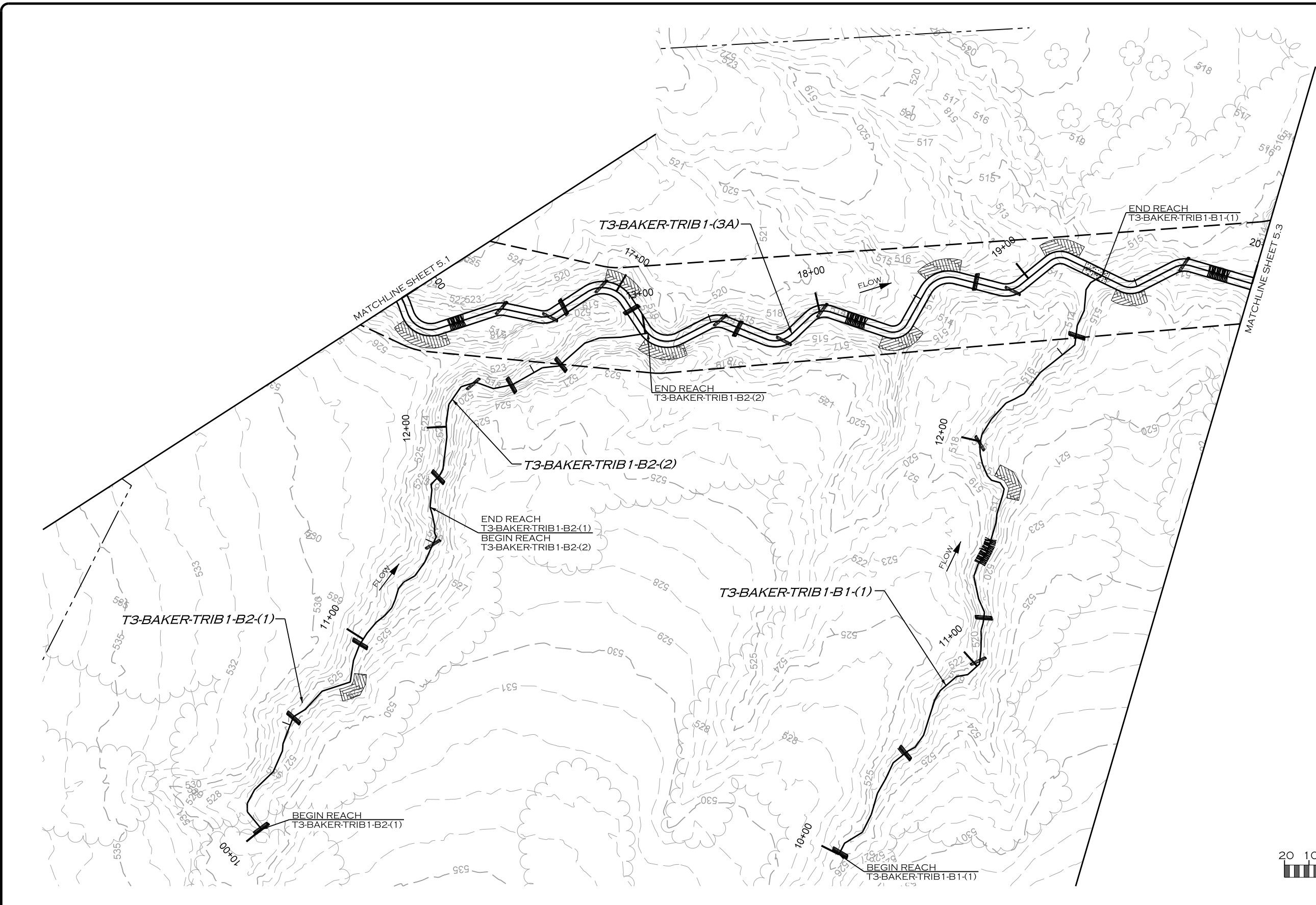


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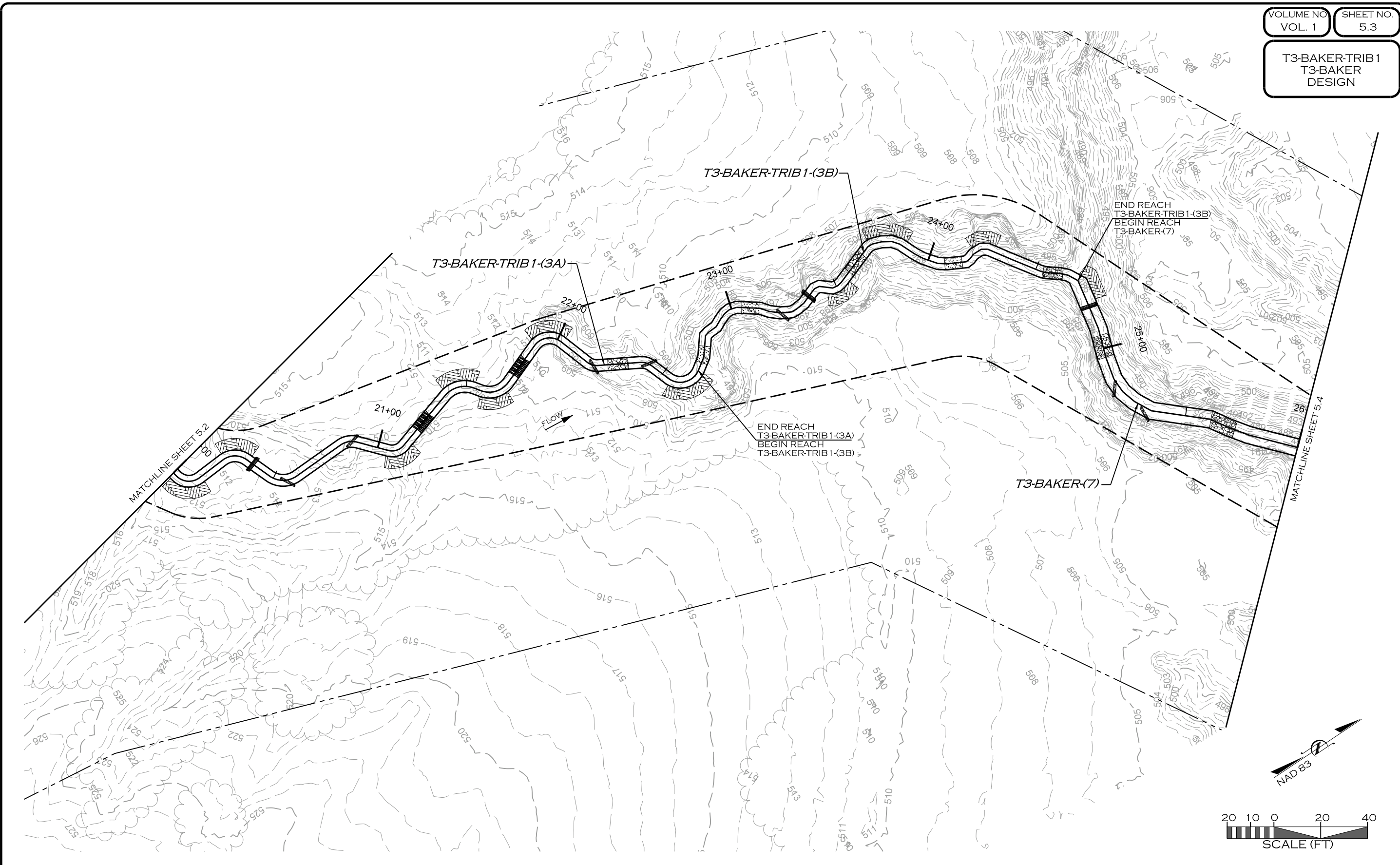


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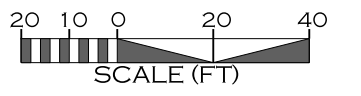
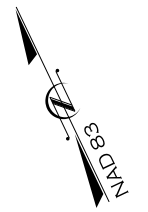


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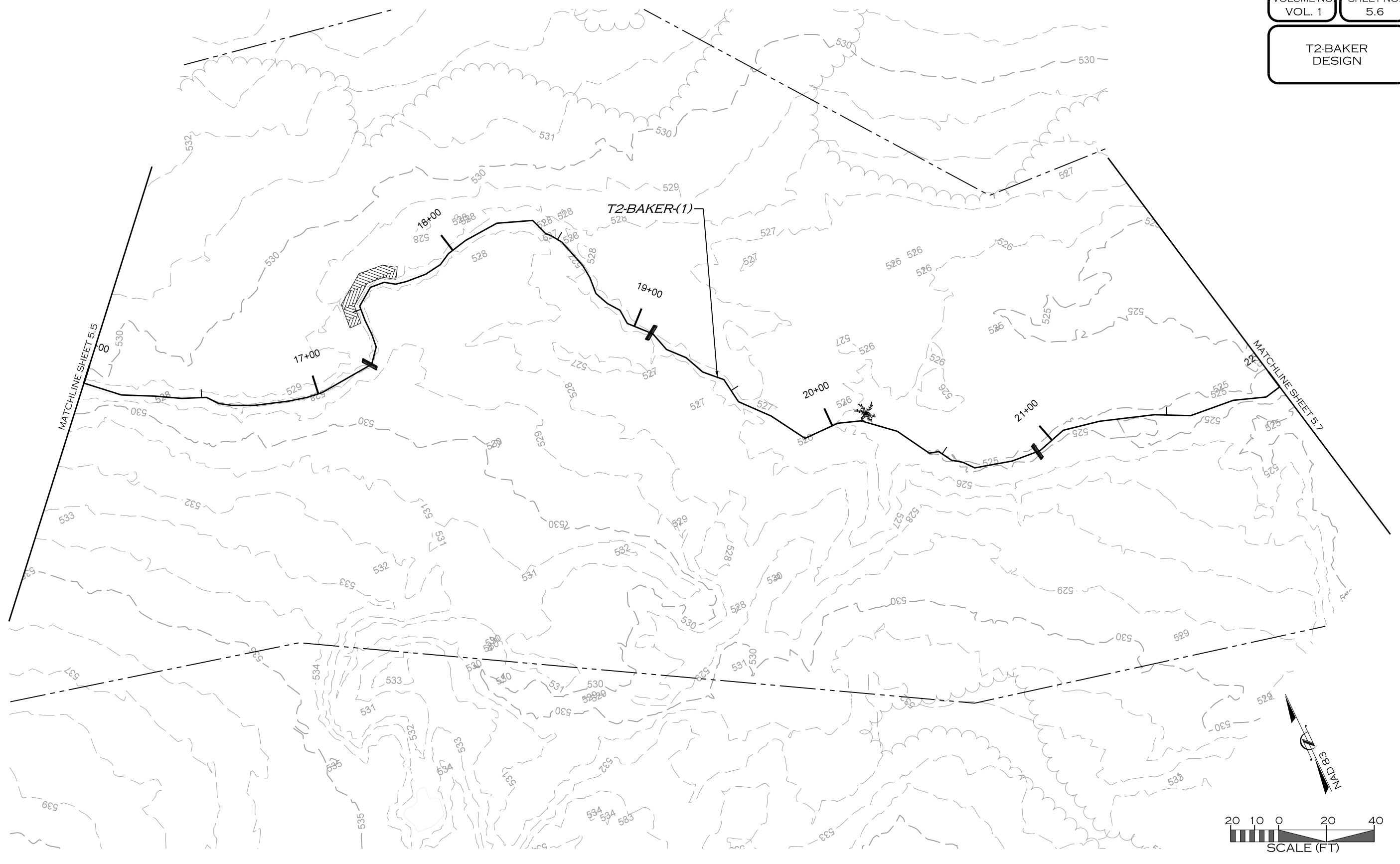


**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
TOMBALL, TX 77377  
TEXAS REGISTERED ENGINEERING FIRM F-14997

PROJECT ENGINEER

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REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
FANNIN COUNTY, TEXAS

PREPARED IN THE OFFICE OF:

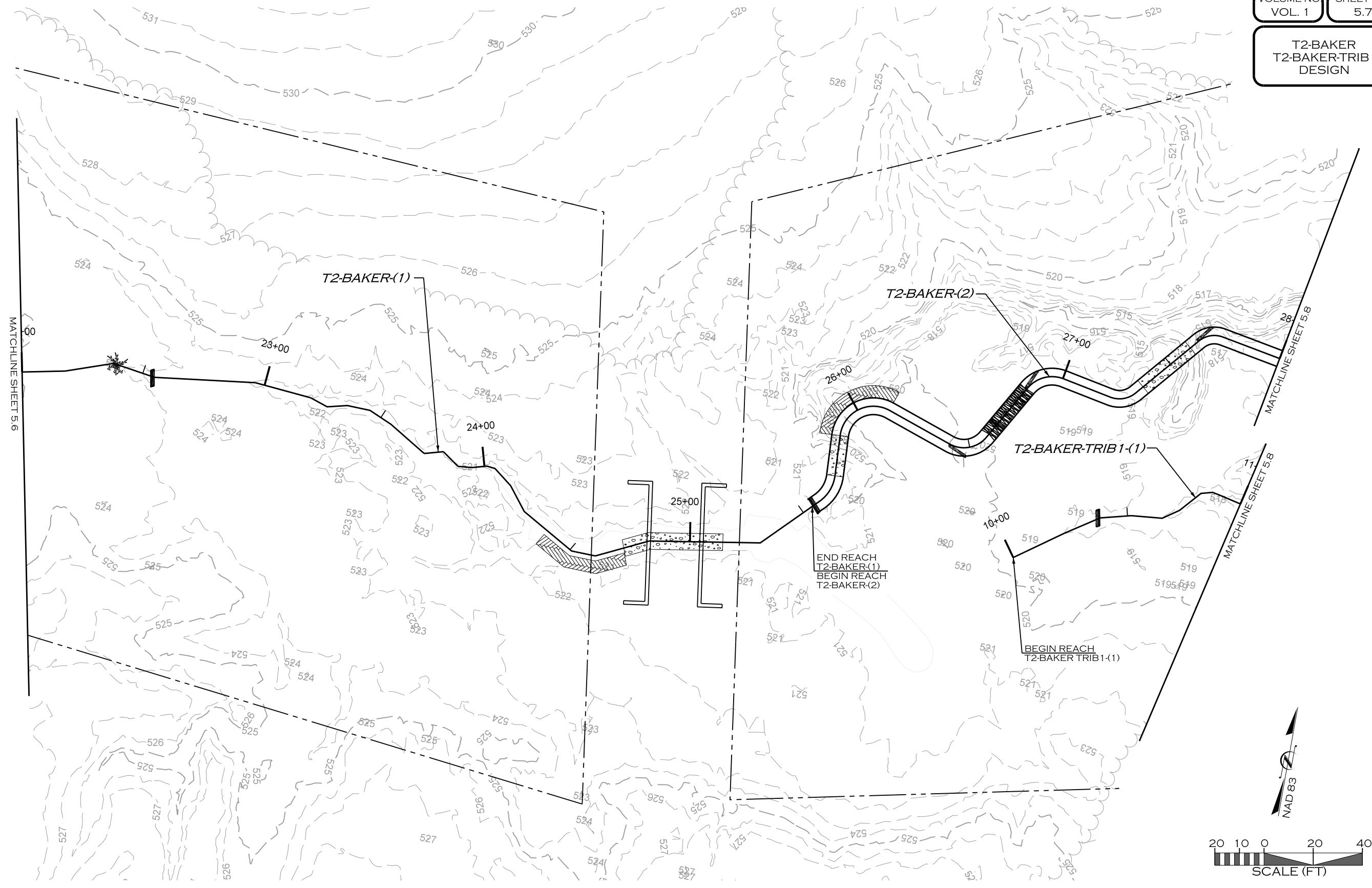


**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
TOMBALL, TX 77377  
TEXAS REGISTERED ENGINEERING FIRM F-14997

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REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
FANNIN COUNTY, TEXAS

PREPARED IN THE OFFICE OF:

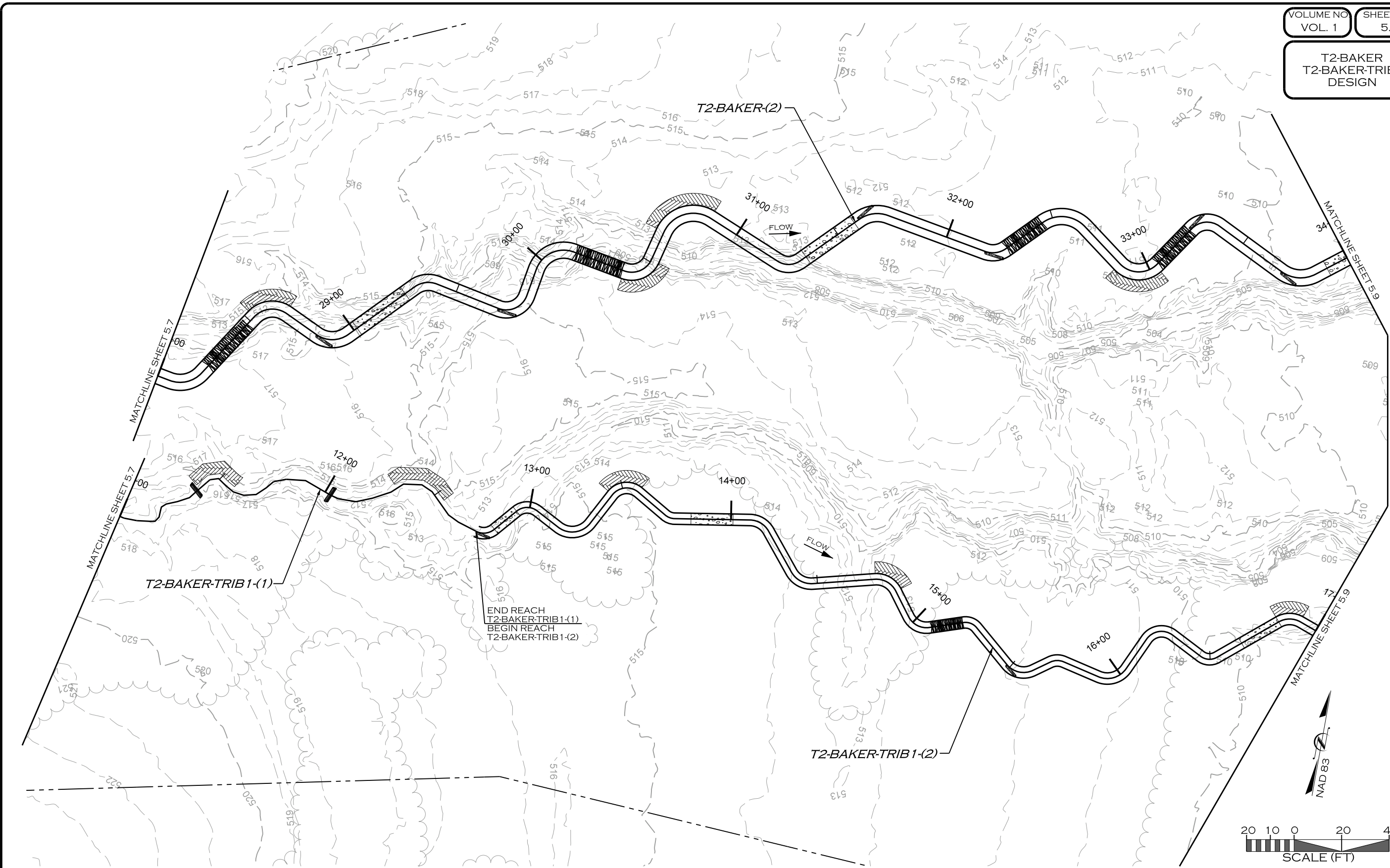


**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
TOMBALL, TX 77377  
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REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
FANNIN COUNTY, TEXAS

PREPARED IN THE OFFICE OF:

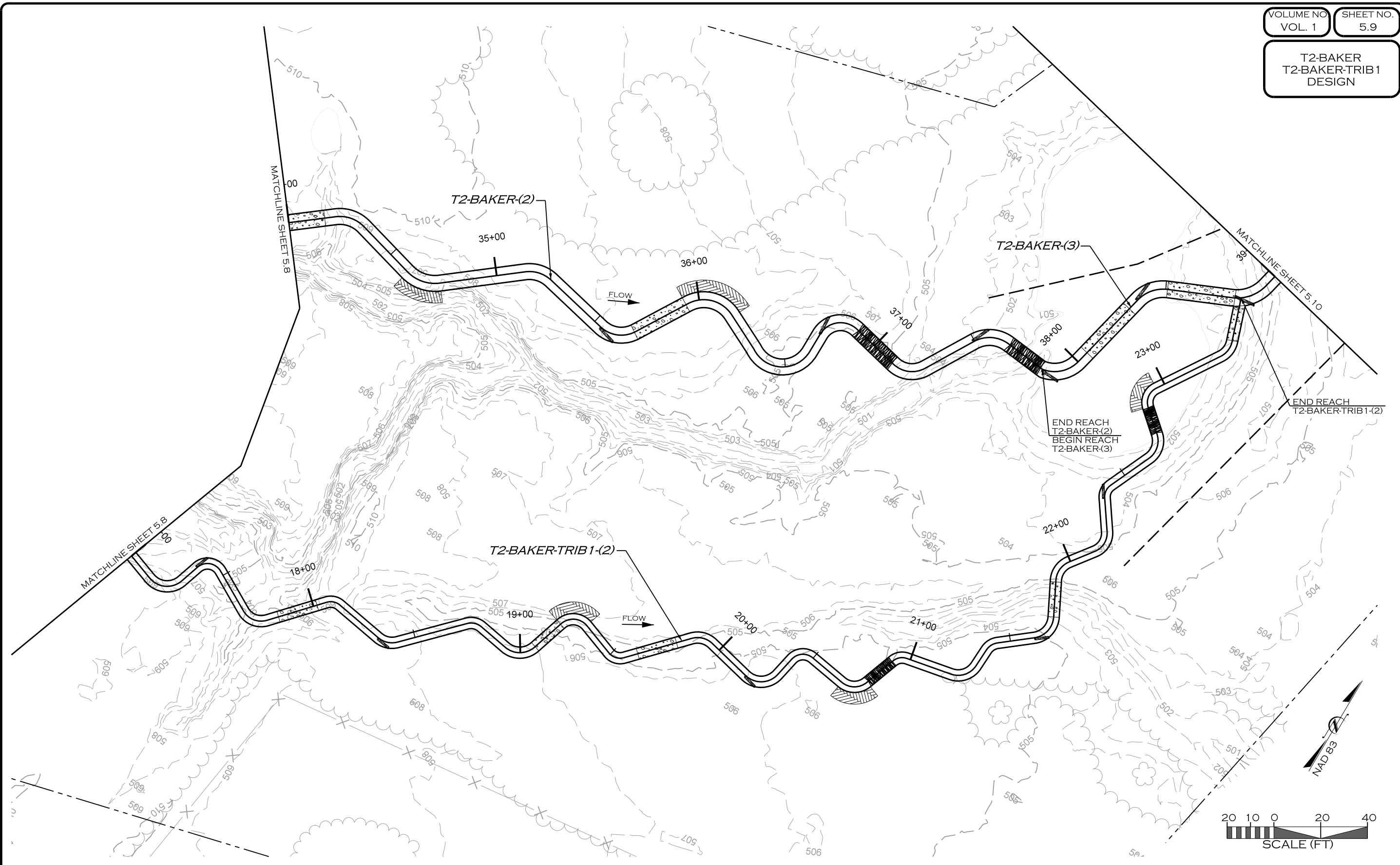


**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
TOMBALL, TX 77377  
TEXAS REGISTERED ENGINEERING FIRM F-14997

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REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
FANNIN COUNTY, TEXAS

PREPARED IN THE OFFICE OF:

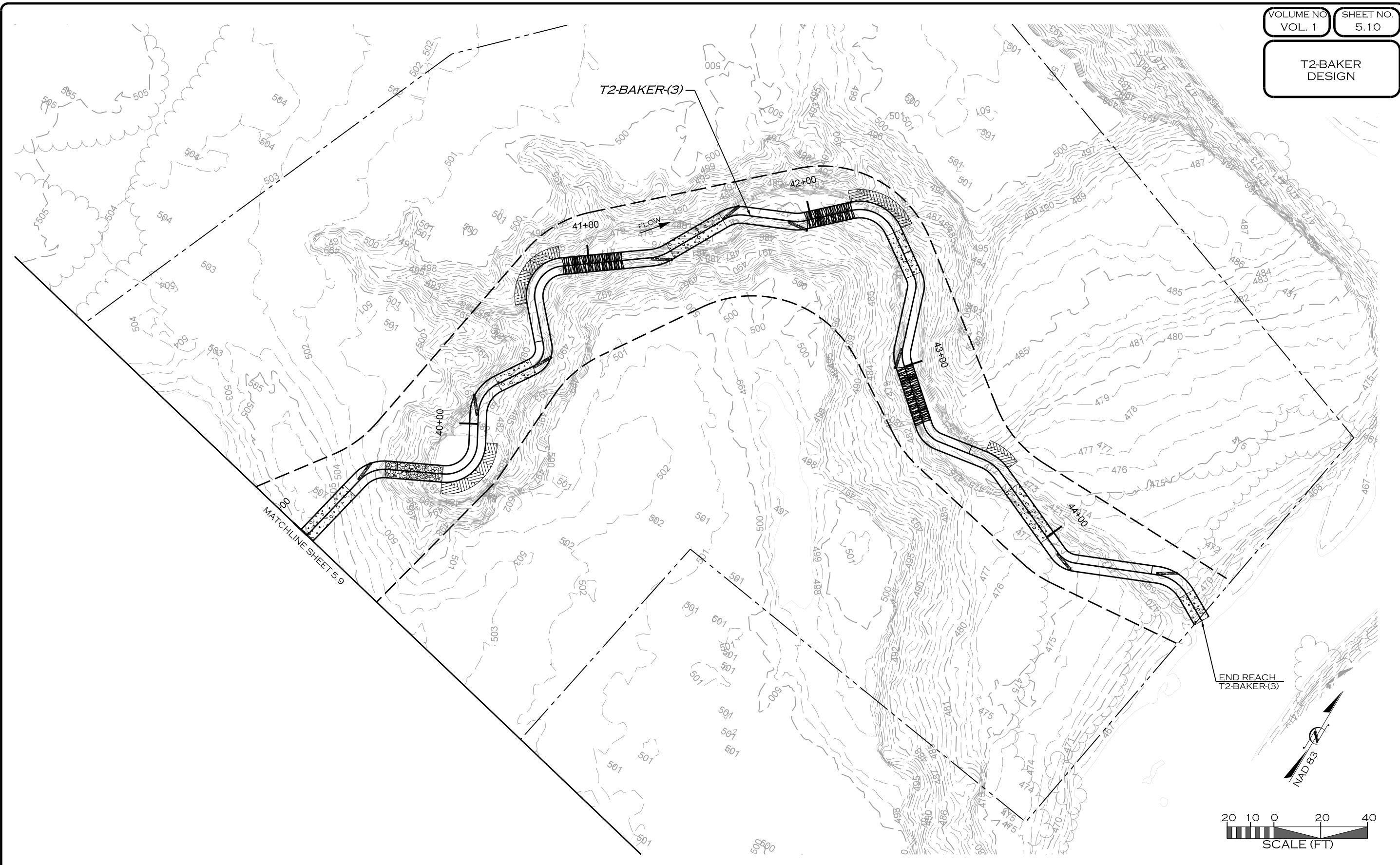


**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
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REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
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FANNIN COUNTY, TEXAS

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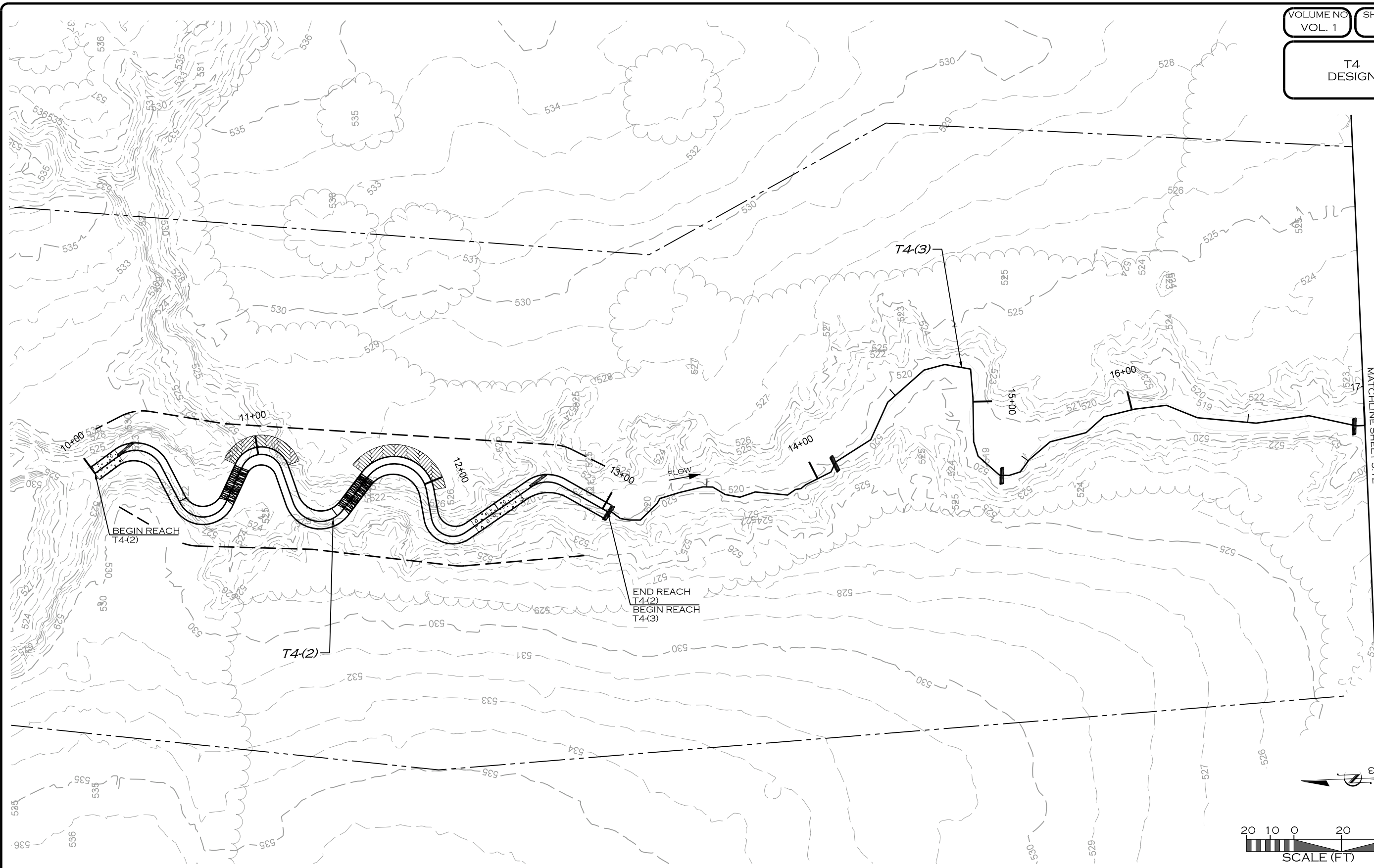


**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
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REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
FANNIN COUNTY, TEXAS

PREPARED IN THE OFFICE OF:



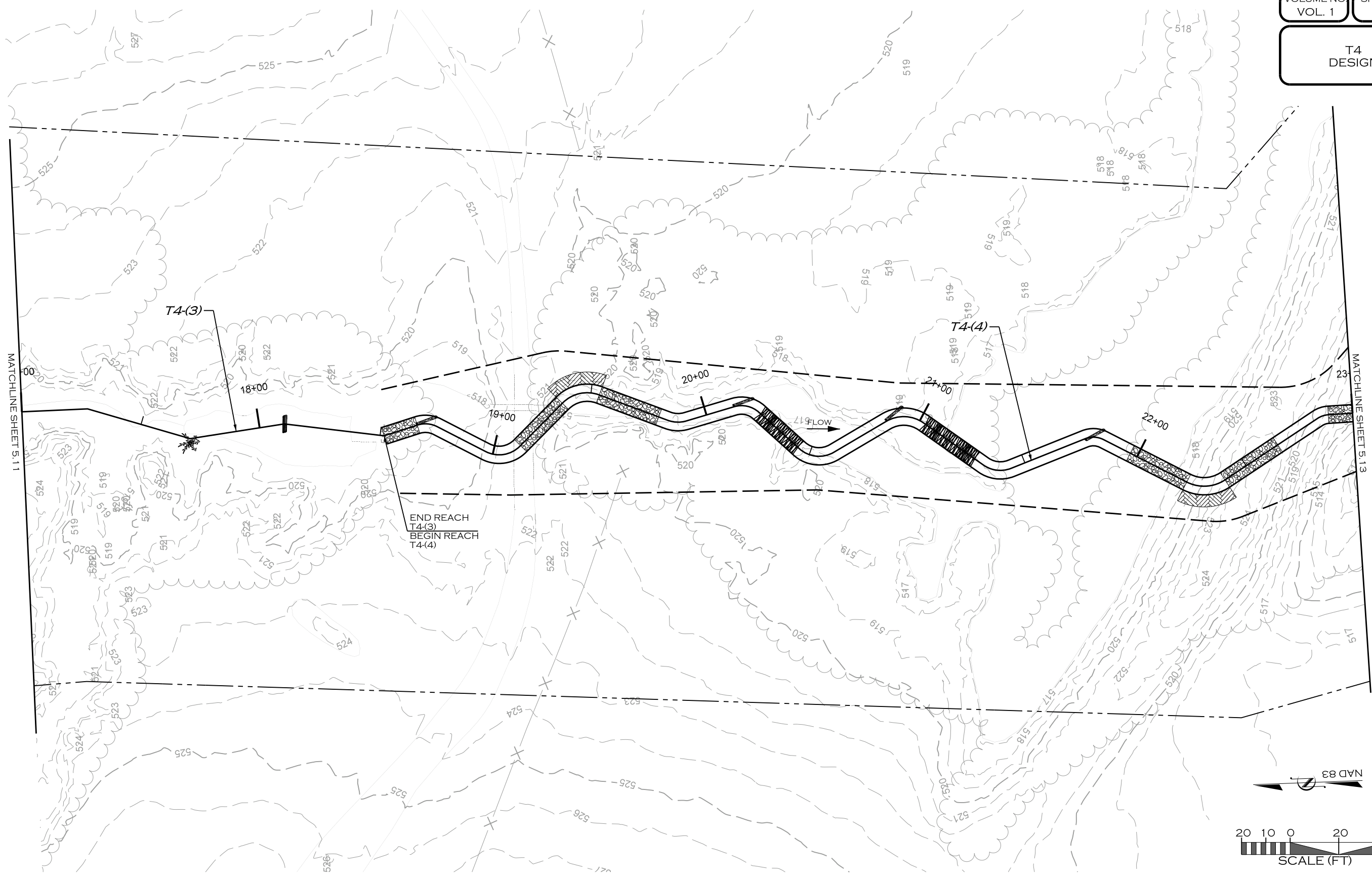
**ECOSYSTEM PLANNING & RESTORATION**

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REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
FANNIN COUNTY, TEXAS

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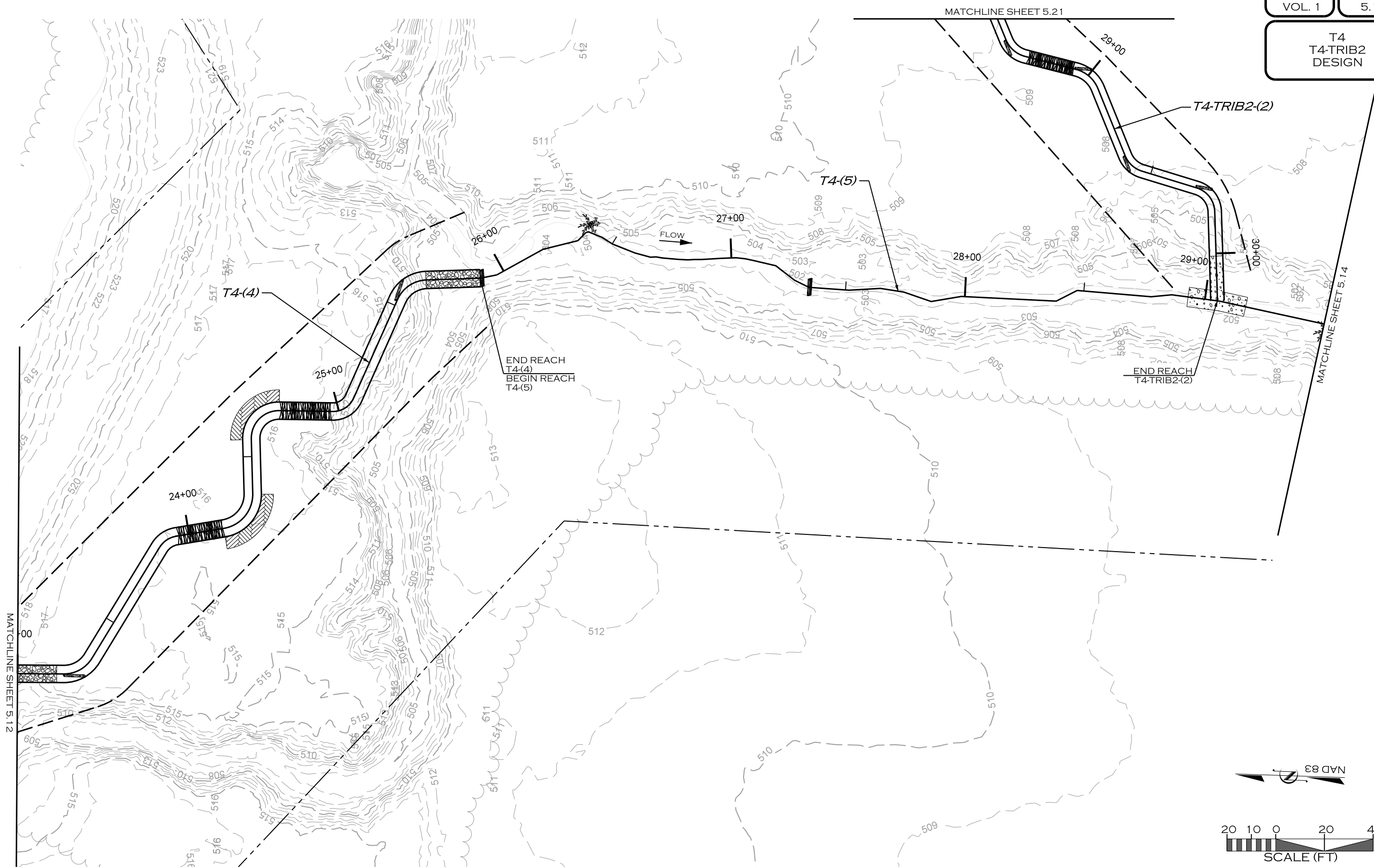


**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
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REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
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FANNIN COUNTY, TEXAS

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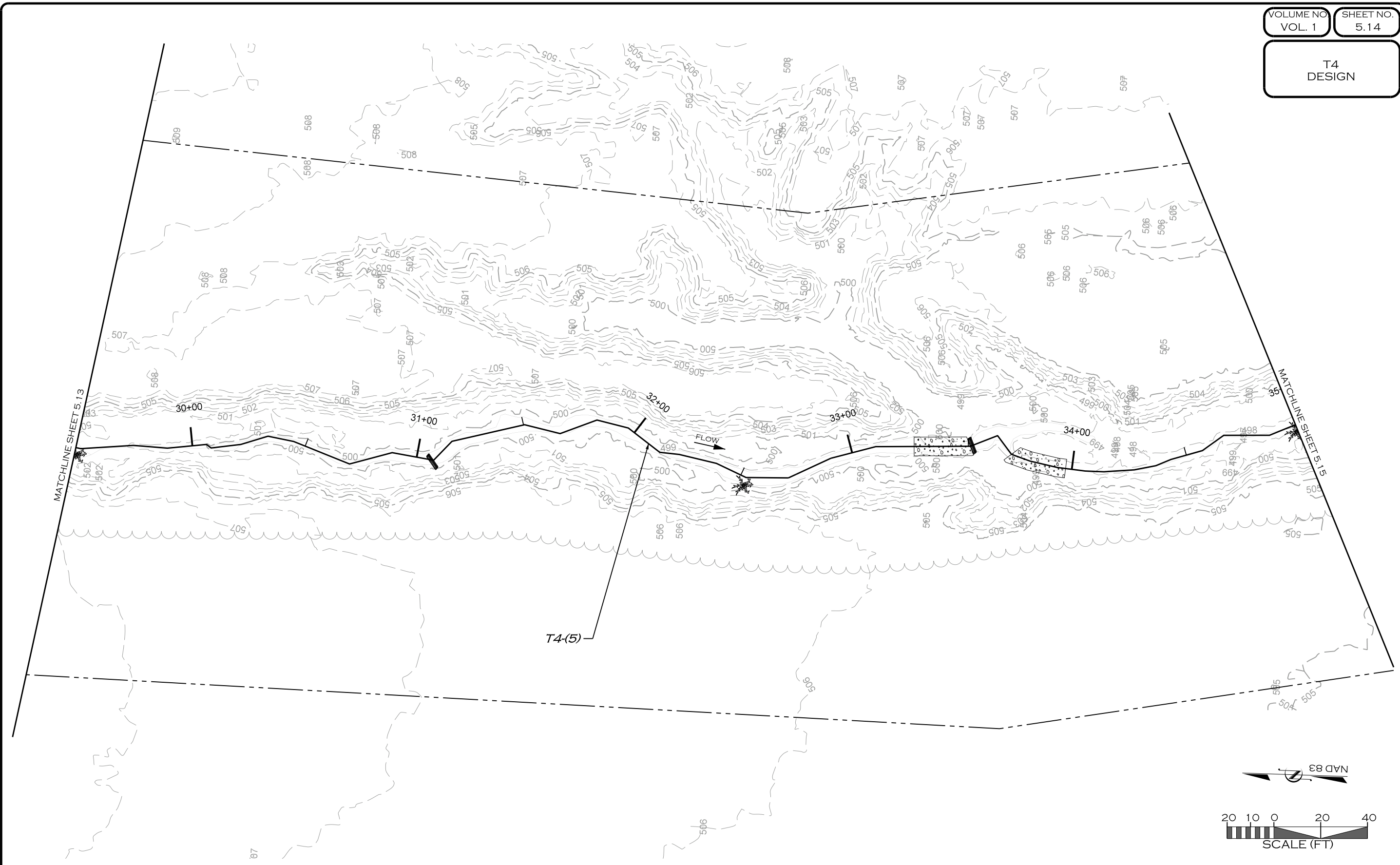


**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
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REVISIONS				
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1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
FANNIN COUNTY, TEXAS

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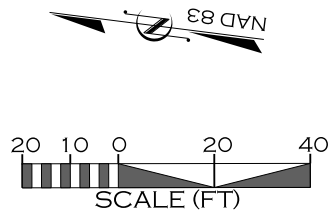
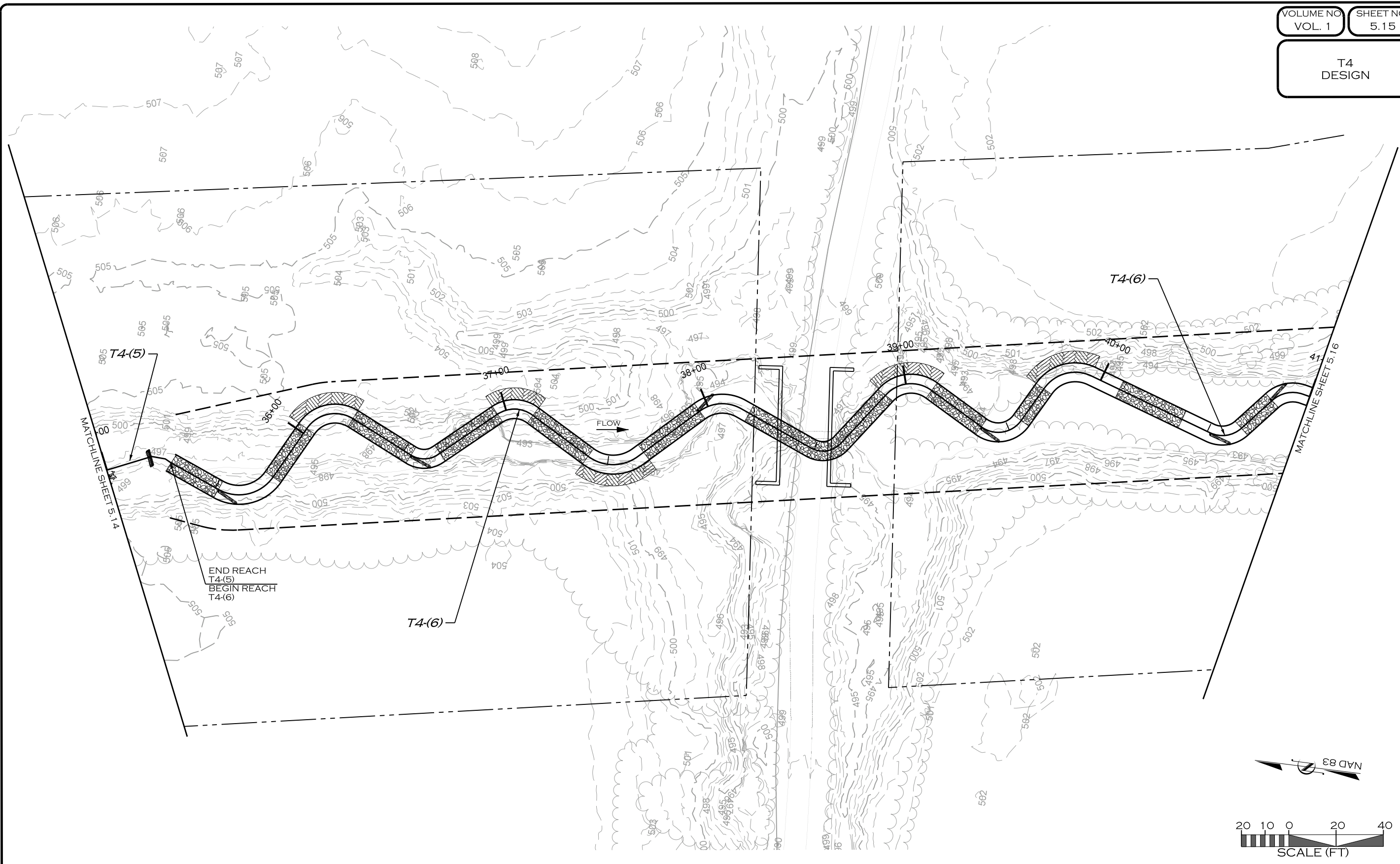


**ECOSYSTEM PLANNING & RESTORATION**

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REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
FANNIN COUNTY, TEXAS

PREPARED IN THE OFFICE OF:

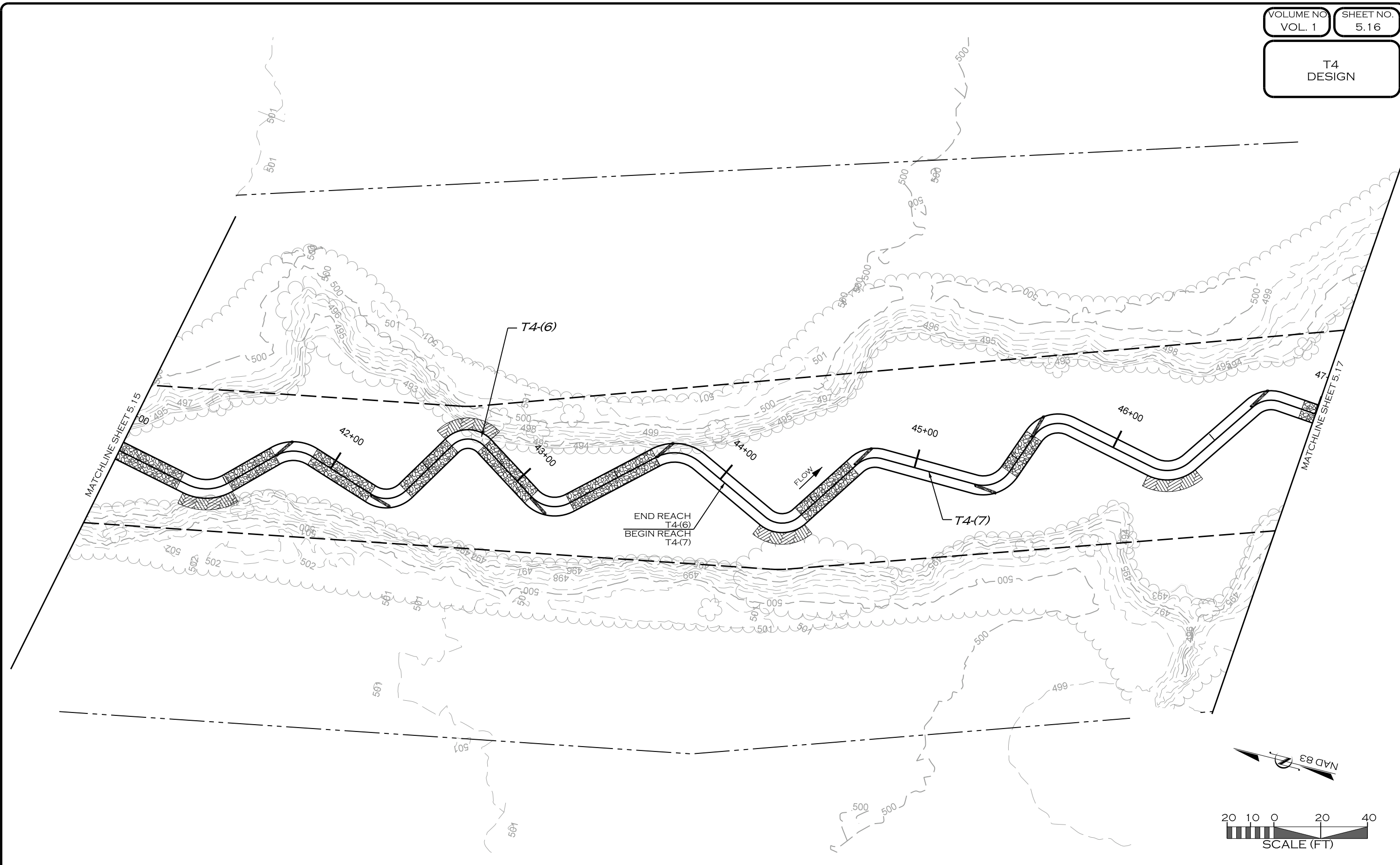


**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
TOMBALL, TX 77377  
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REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
FANNIN COUNTY, TEXAS

PREPARED IN THE OFFICE OF:

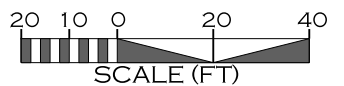
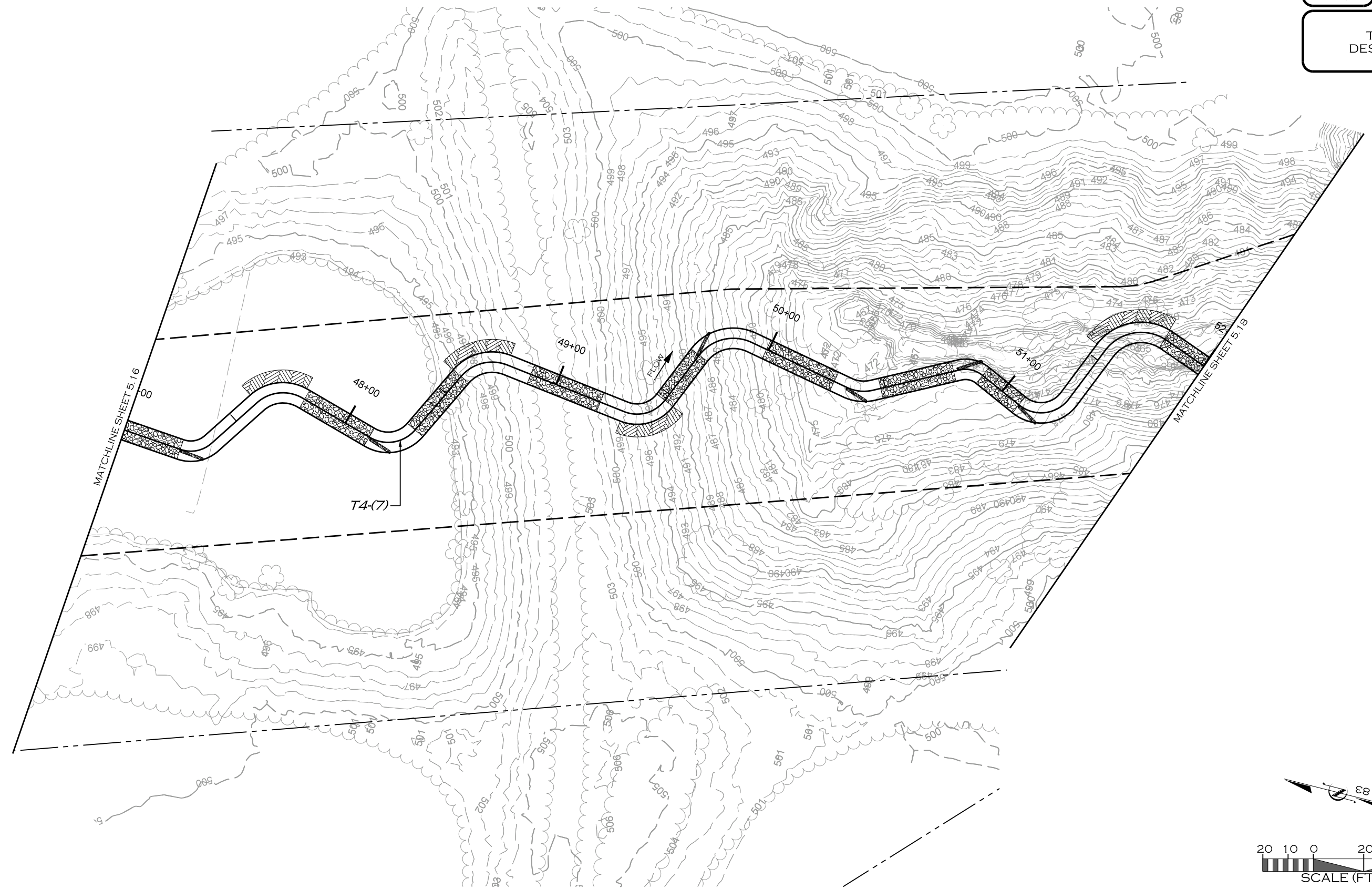


**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
TOMBALL, TX 77377  
TEXAS REGISTERED ENGINEERING FIRM F-14997

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REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
FANNIN COUNTY, TEXAS

PREPARED IN THE OFFICE OF:

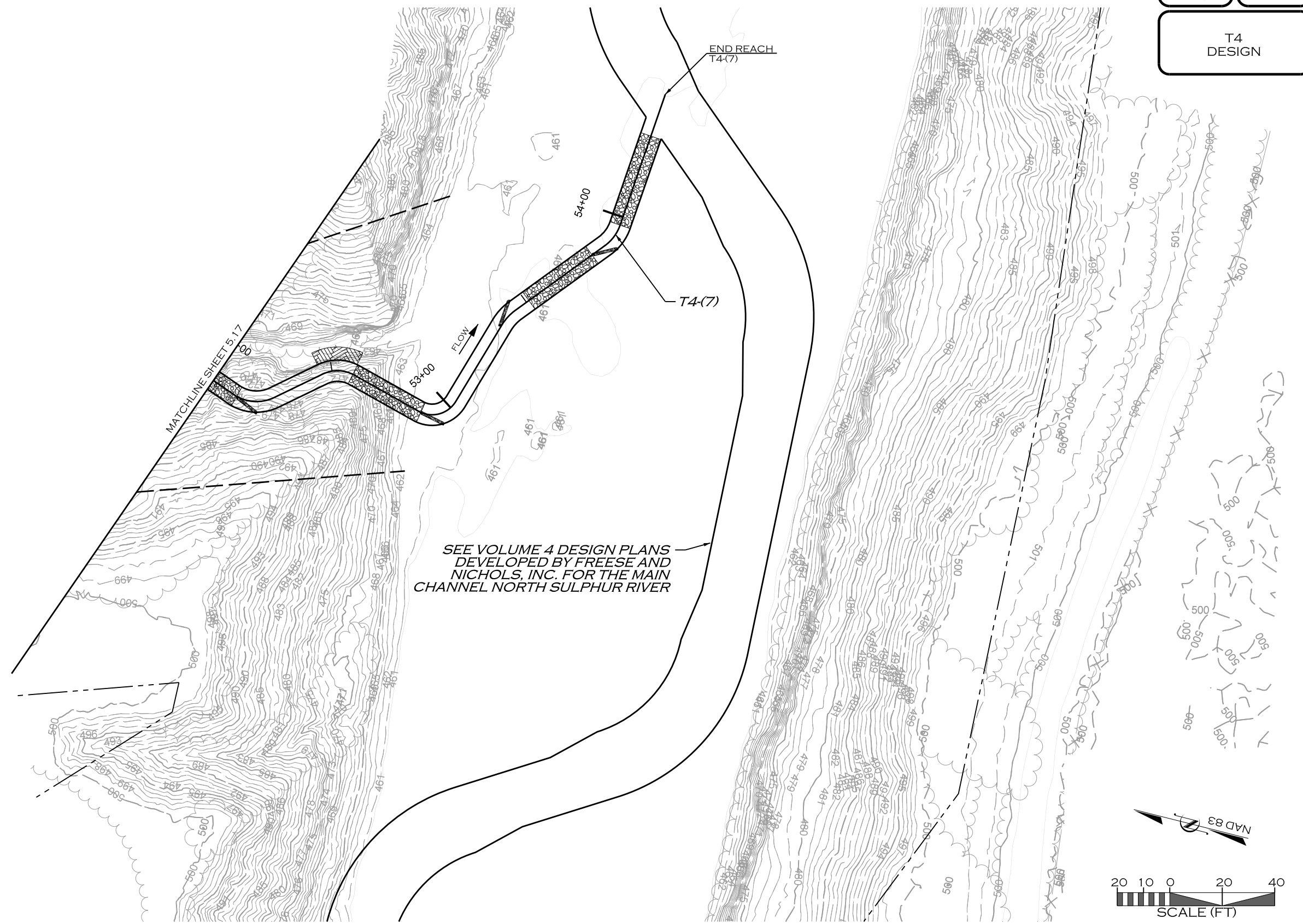


**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
TOMBALL, TX 77377  
TEXAS REGISTERED ENGINEERING FIRM F-14997

PROJECT ENGINEER

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REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
FANNIN COUNTY, TEXAS

PREPARED IN THE OFFICE OF:

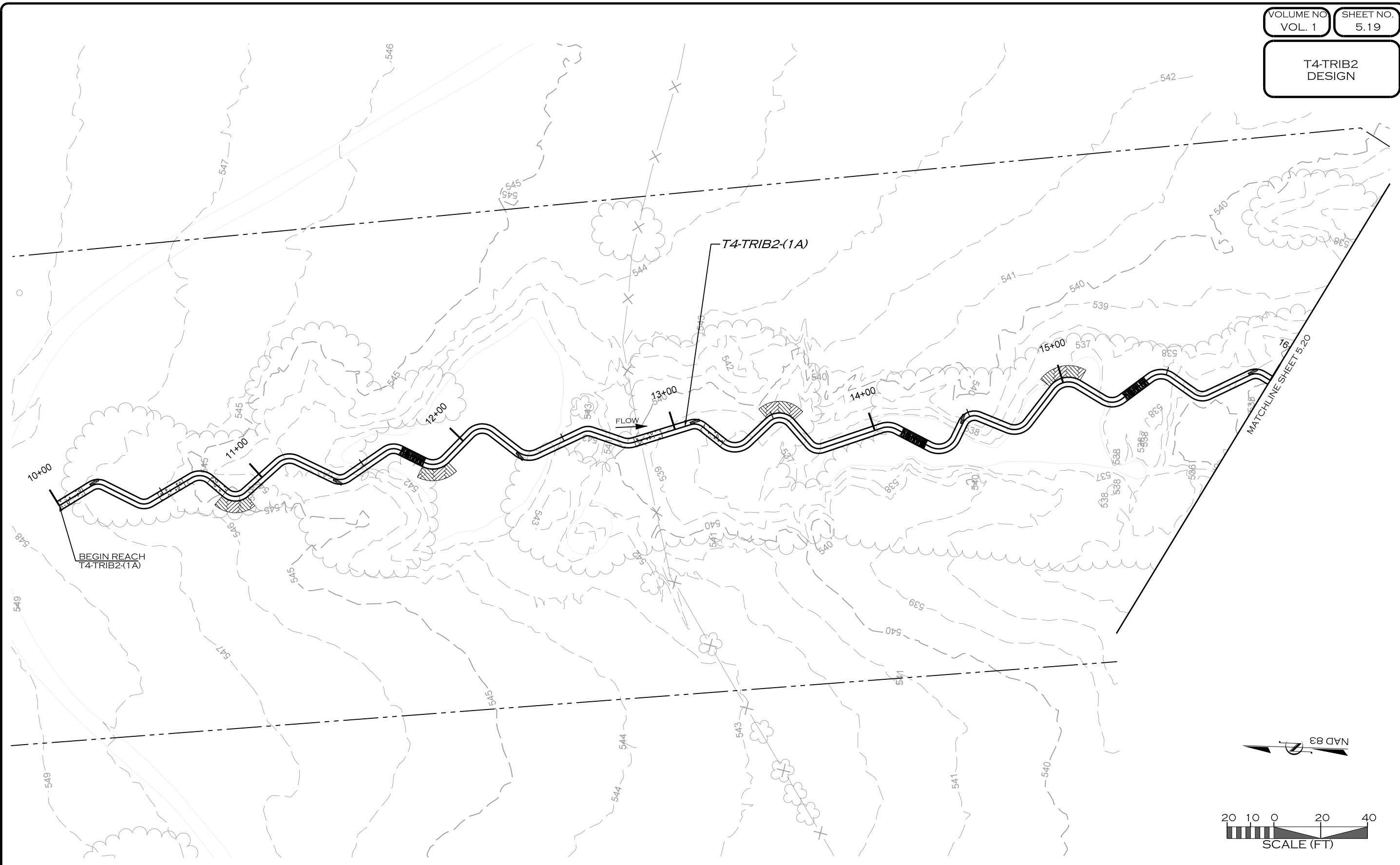


**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
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REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
FANNIN COUNTY, TEXAS

PREPARED IN THE OFFICE OF:



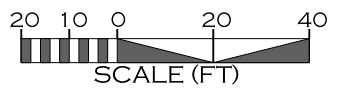
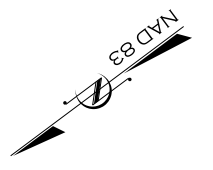
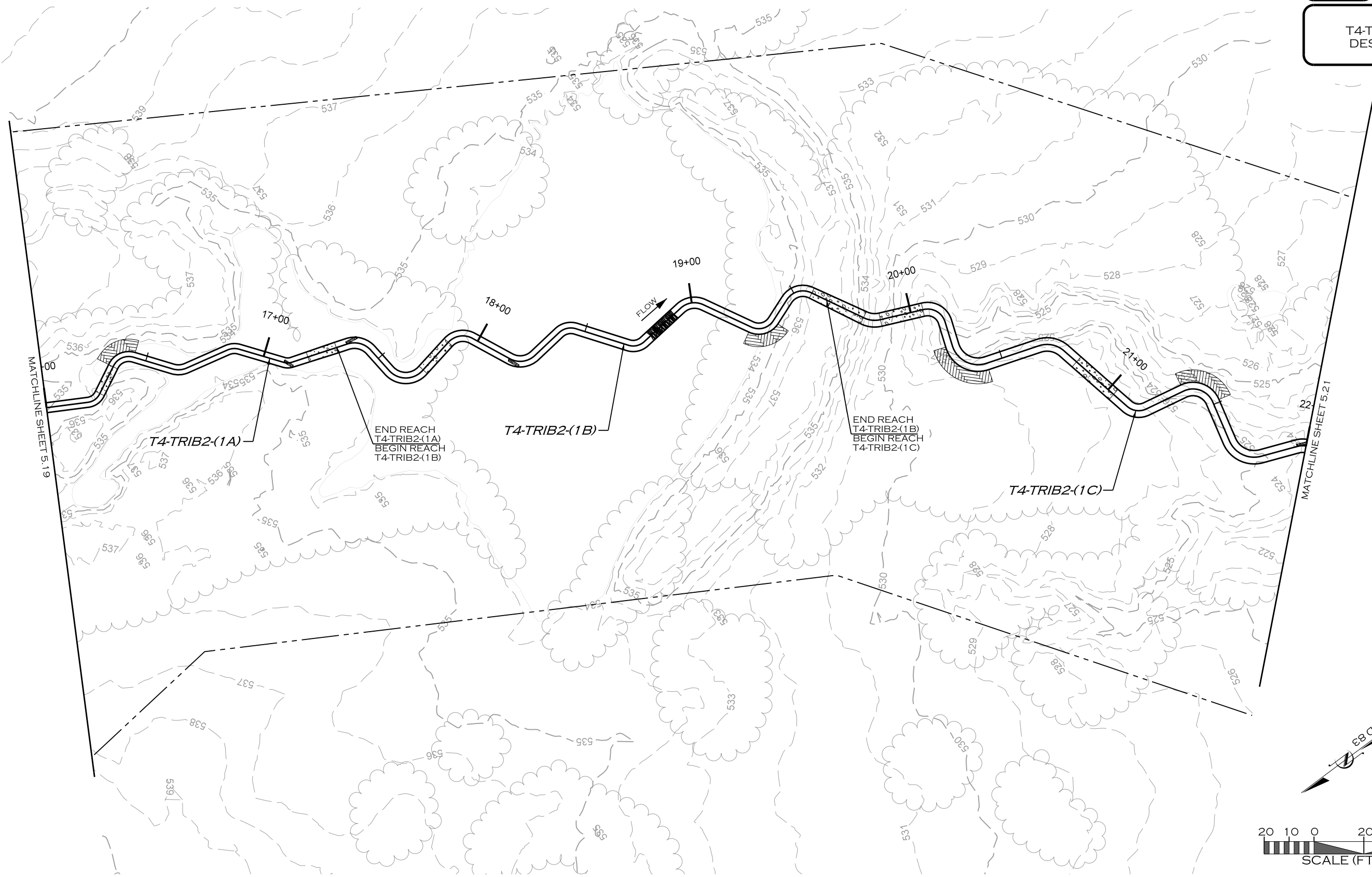
**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
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TEXAS REGISTERED ENGINEERING FIRM F-14997

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REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
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FANNIN COUNTY, TEXAS

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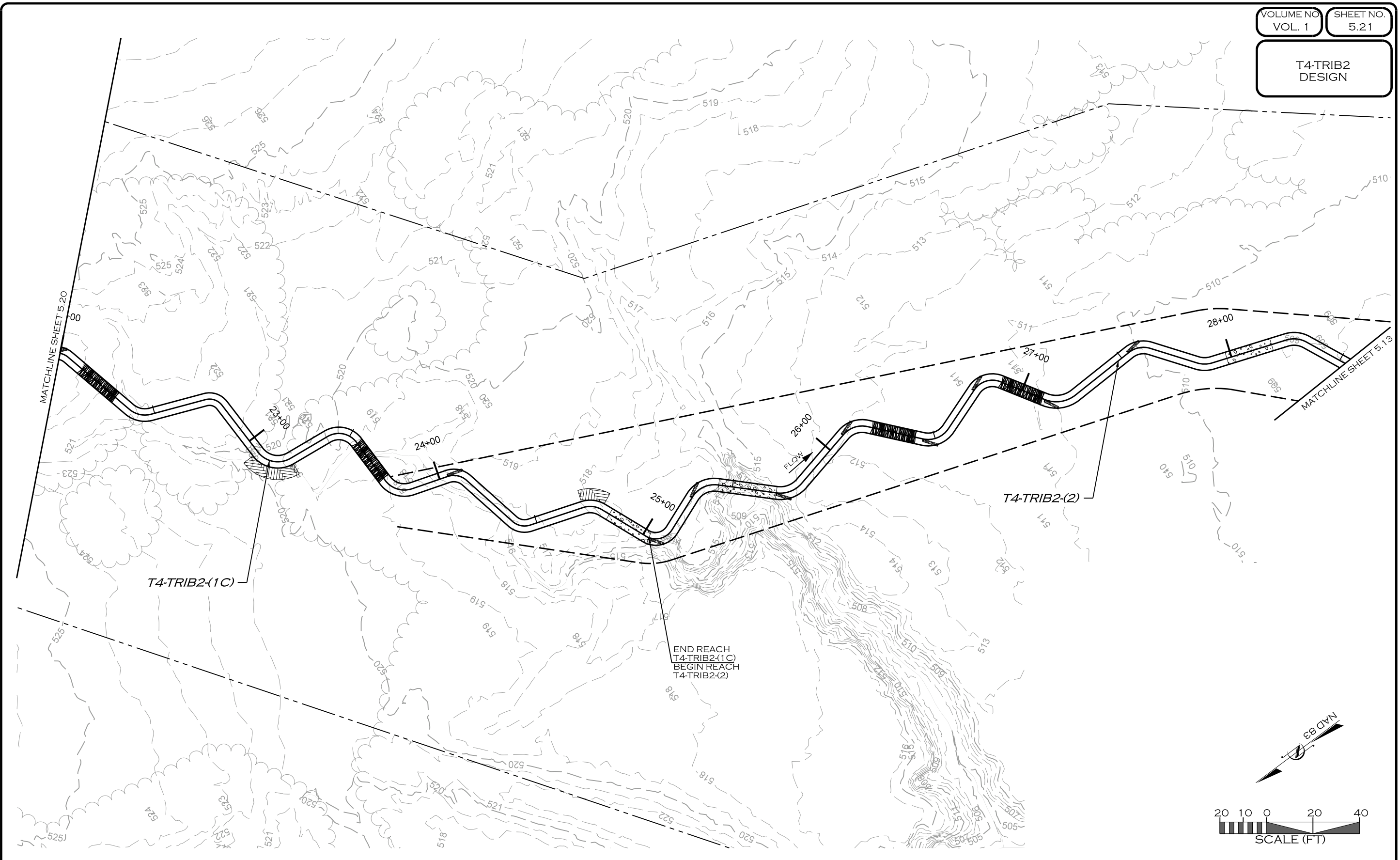


**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
TOMBALL, TX 77377  
TEXAS REGISTERED ENGINEERING FIRM F-14997

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REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
FANNIN COUNTY, TEXAS

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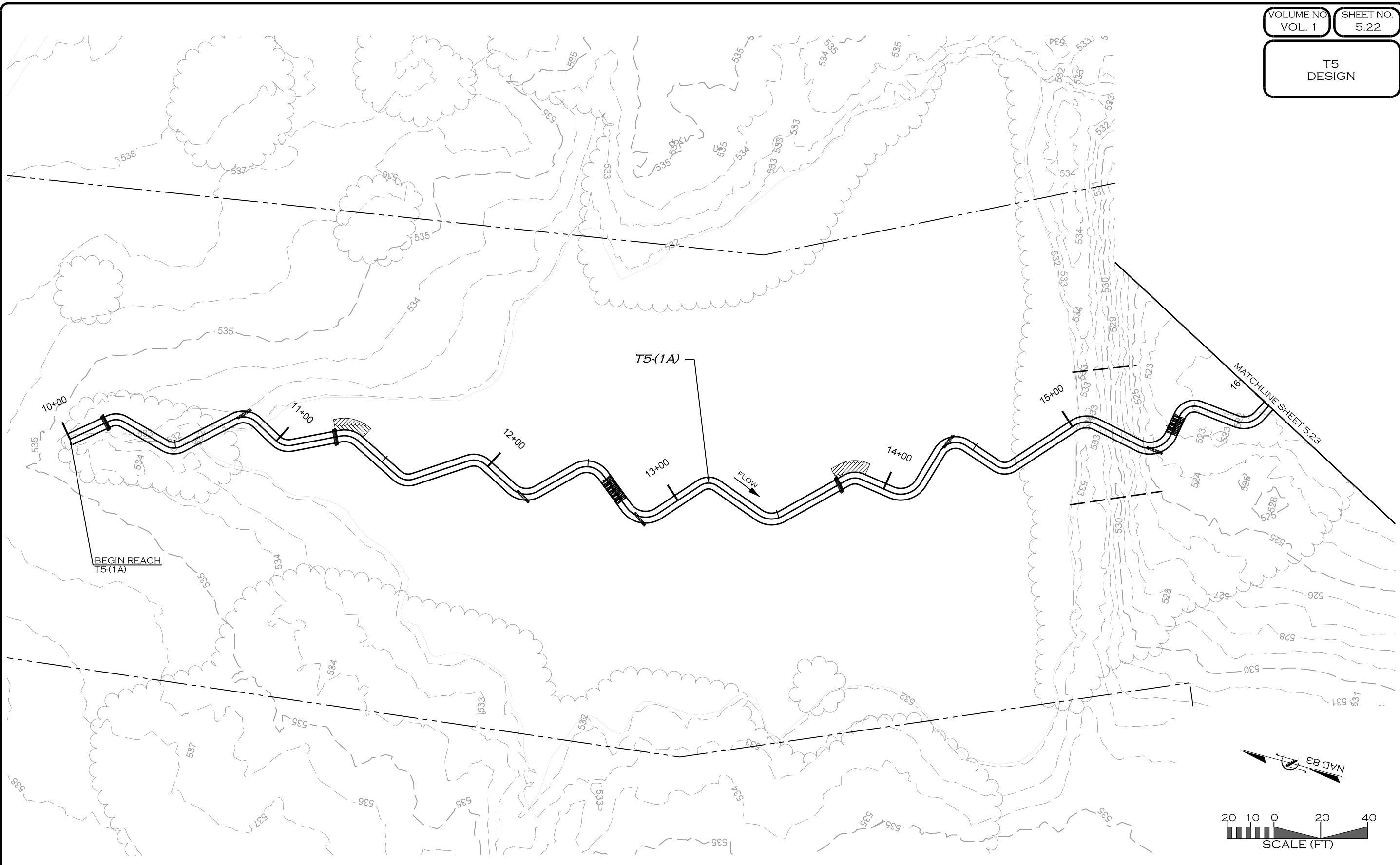


**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
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REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
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FANNIN COUNTY, TEXAS

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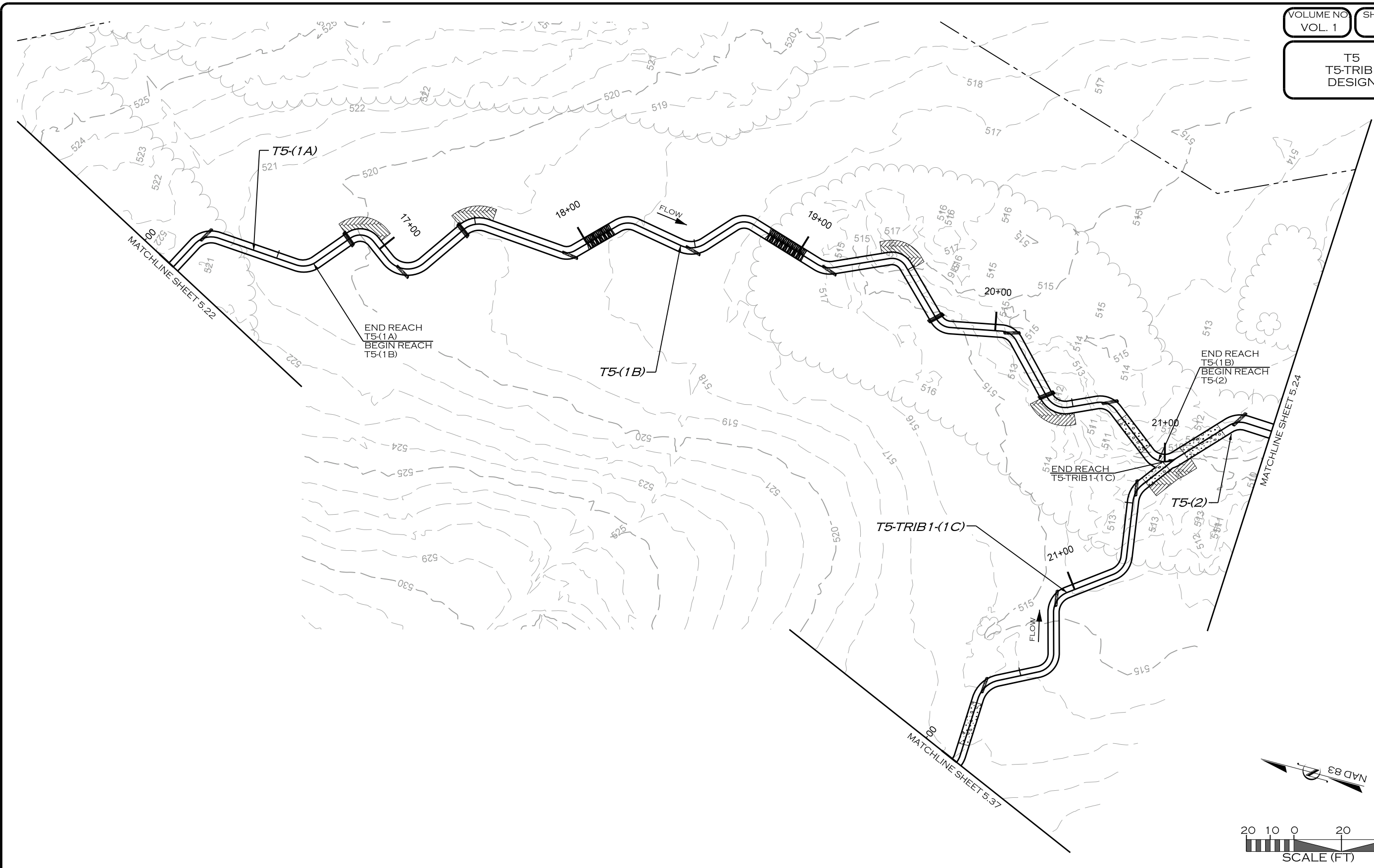


**ECOSYSTEM PLANNING & RESTORATION**

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PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

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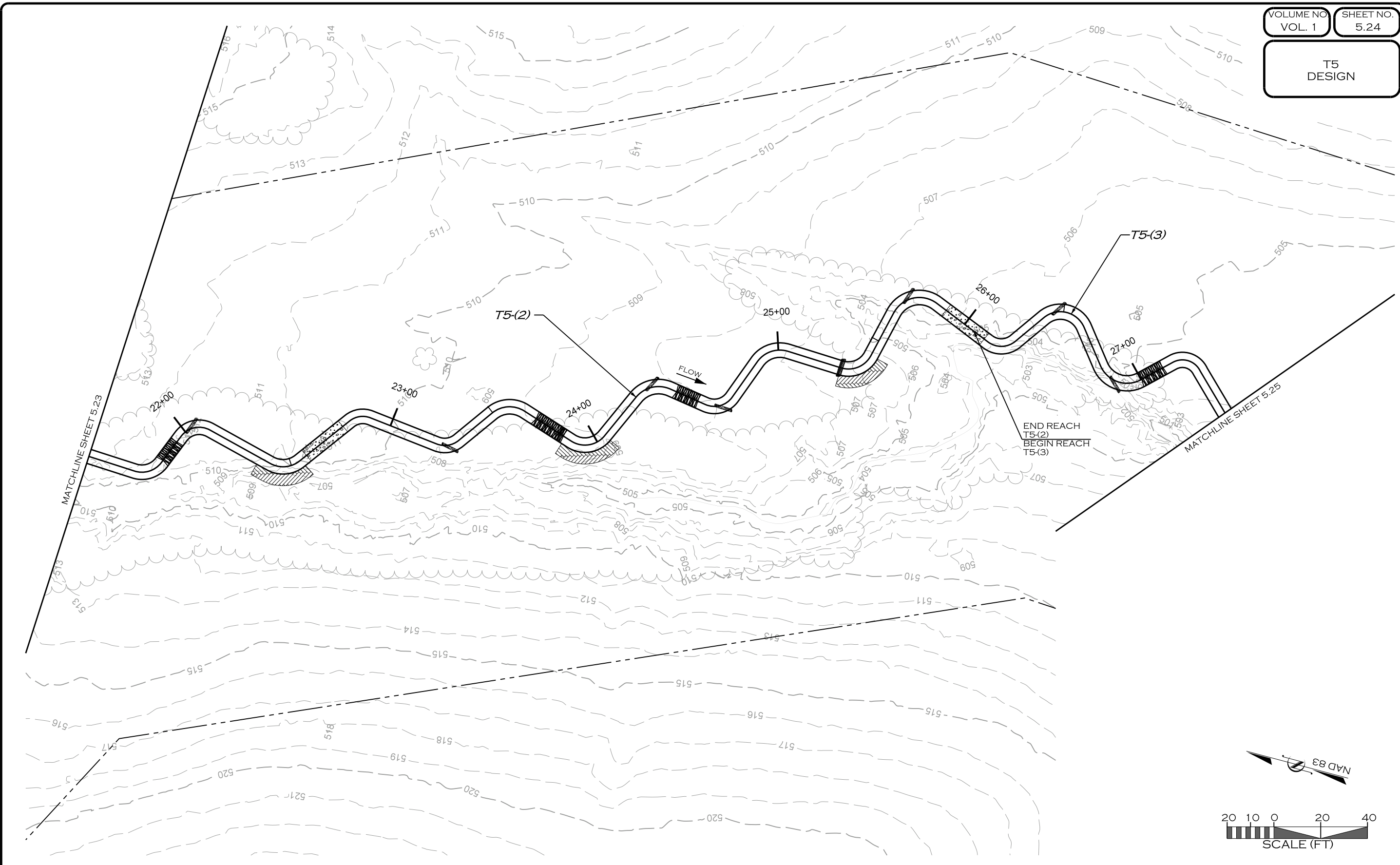


**ECOSYSTEM PLANNING & RESTORATION**

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REVISIONS				
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1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

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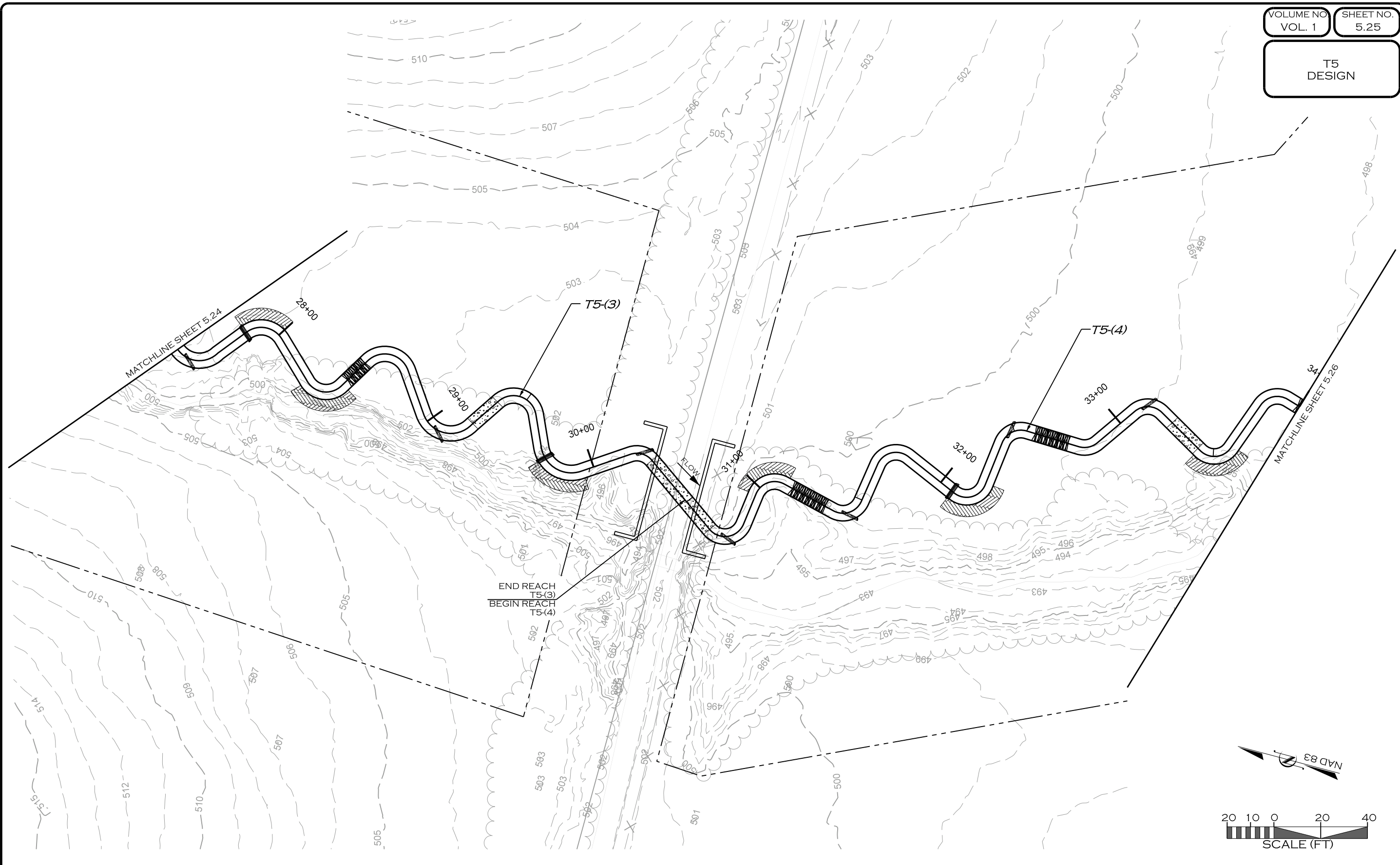


**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
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REVISIONS				
NO.	DESCRIPTION	ENGR.	APPROV.	DATE
1	DRAFT DESIGN PLANS	EMP	KLT	7/01/19

PREPARED FOR:



**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
LEWISVILLE, TX 75057

LAKE RALPH HALL MITIGATION  
MITIGATION ZONE A  
FANNIN COUNTY, TEXAS

PREPARED IN THE OFFICE OF:

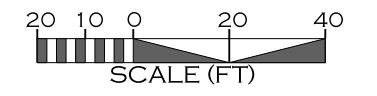
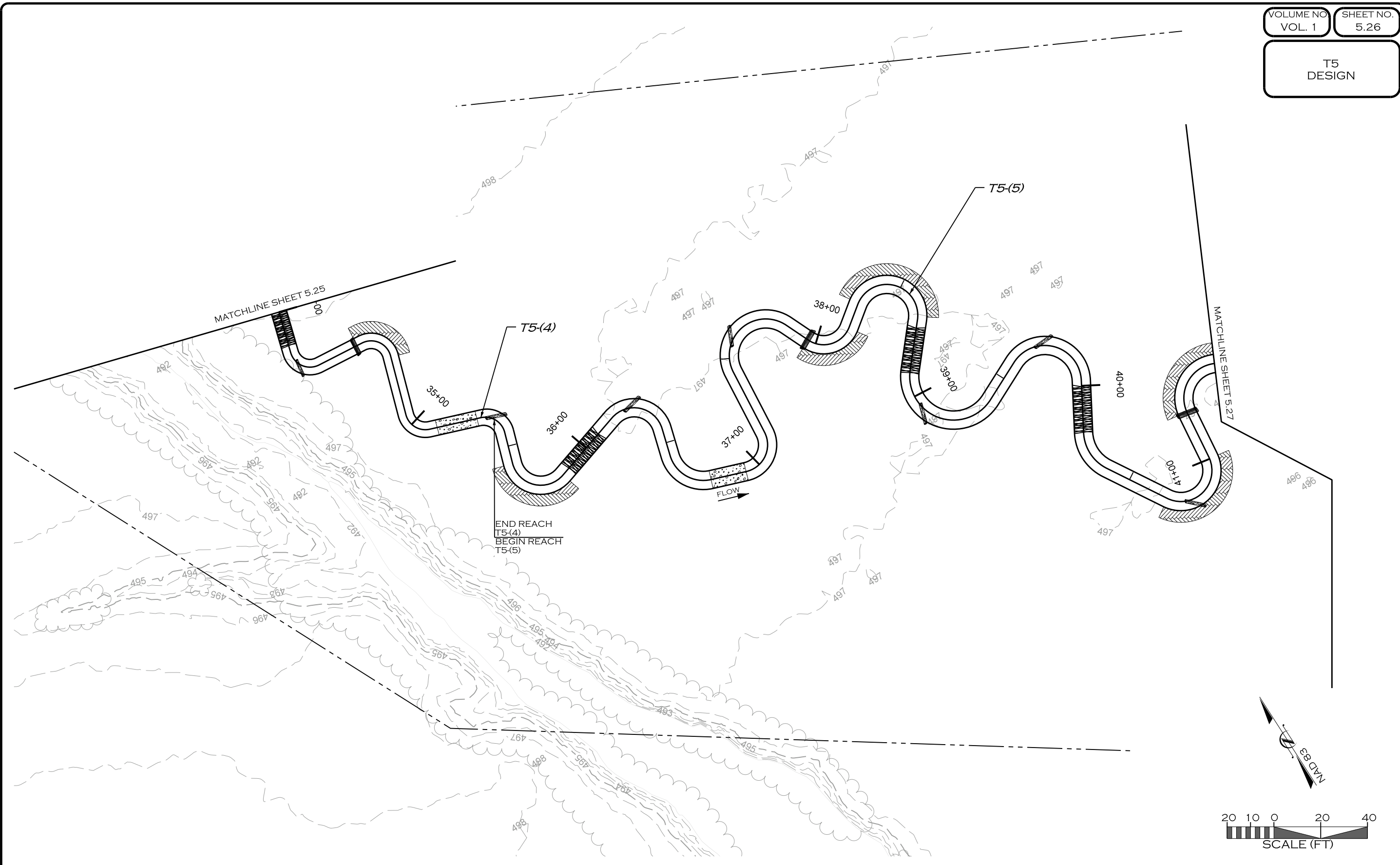


**ECOSYSTEM PLANNING & RESTORATION**

17575 N. ELDRIDGE PARKWAY, BLDG. C  
TOMBALL, TX 77377  
TEXAS REGISTERED ENGINEERING FIRM F-14997

PROJECT ENGINEER

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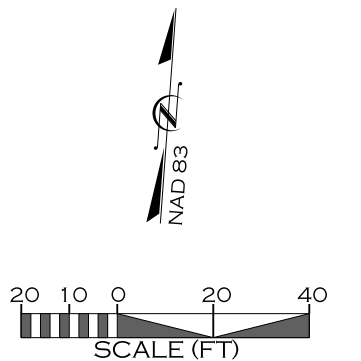
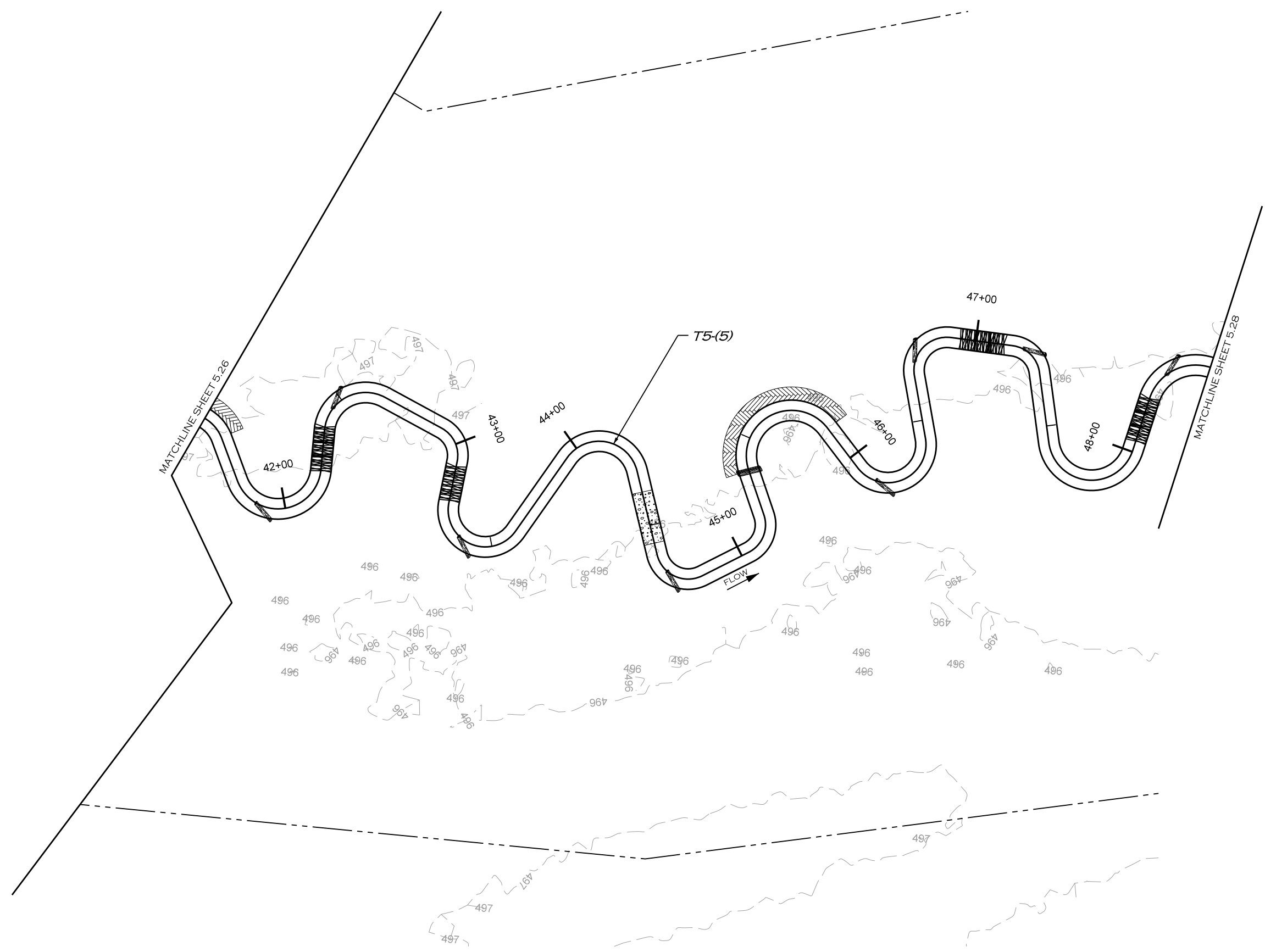


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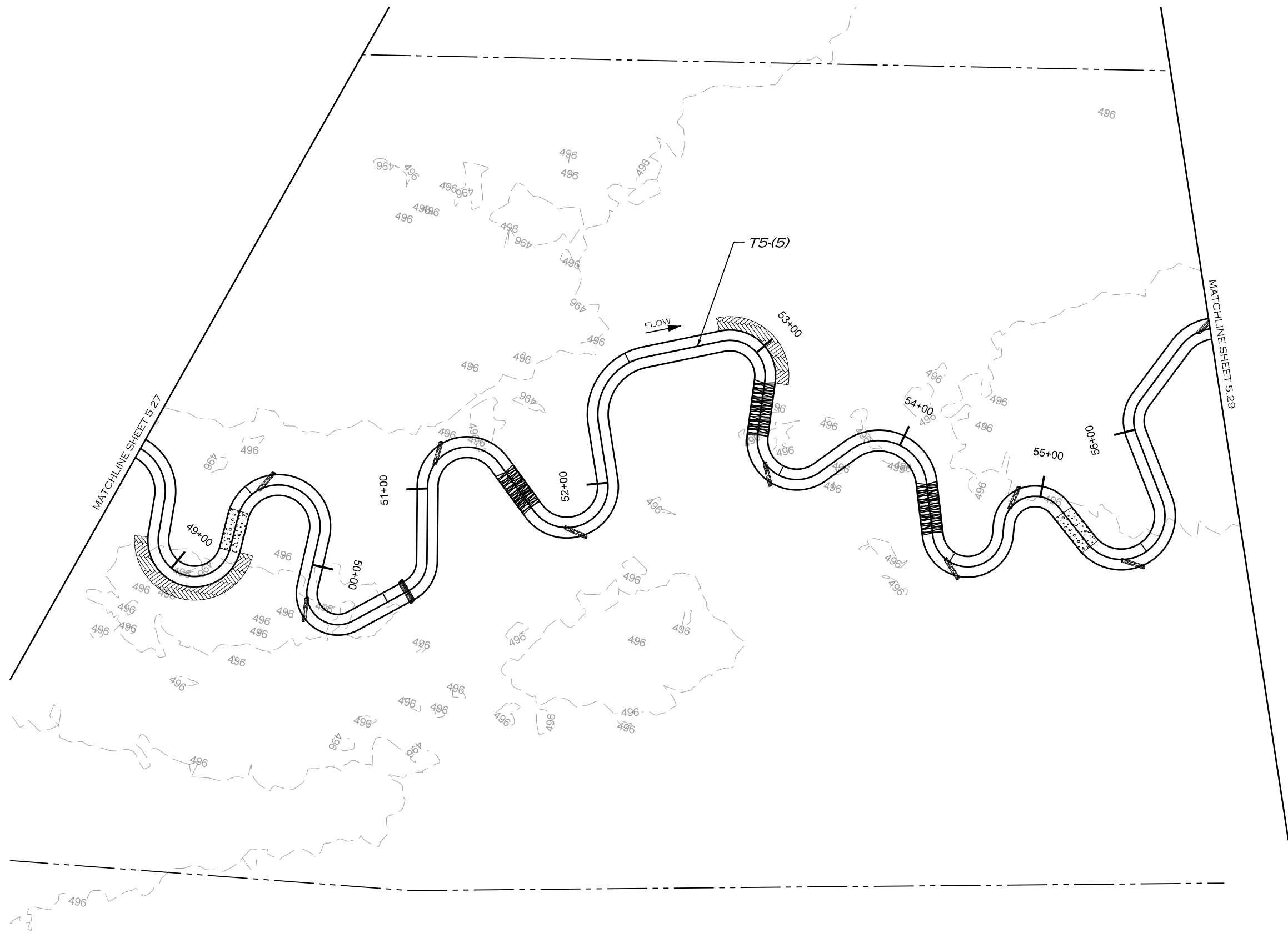
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**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
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LAKE RALPH HALL MITIGATION  
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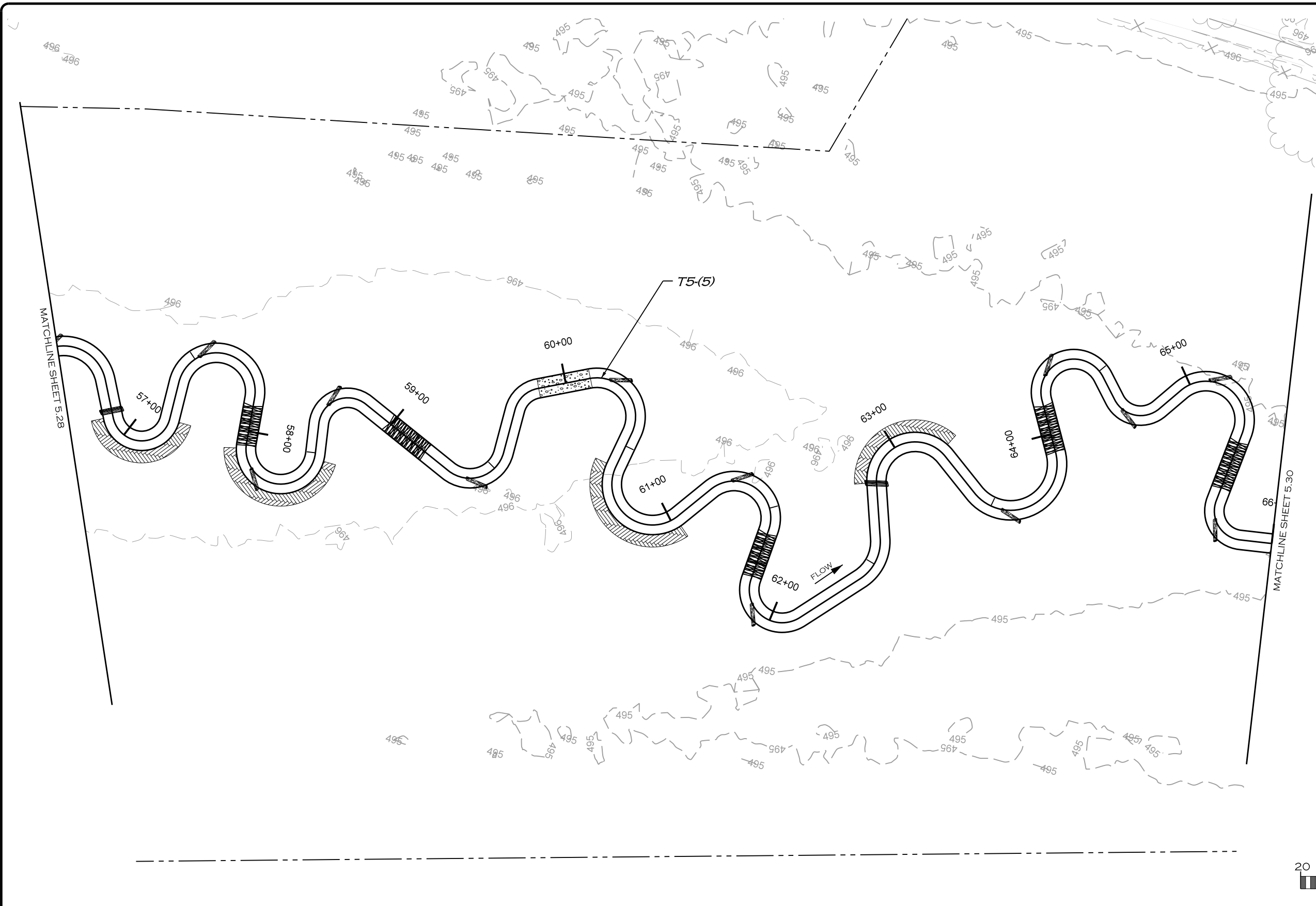


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900 N KEALY ST  
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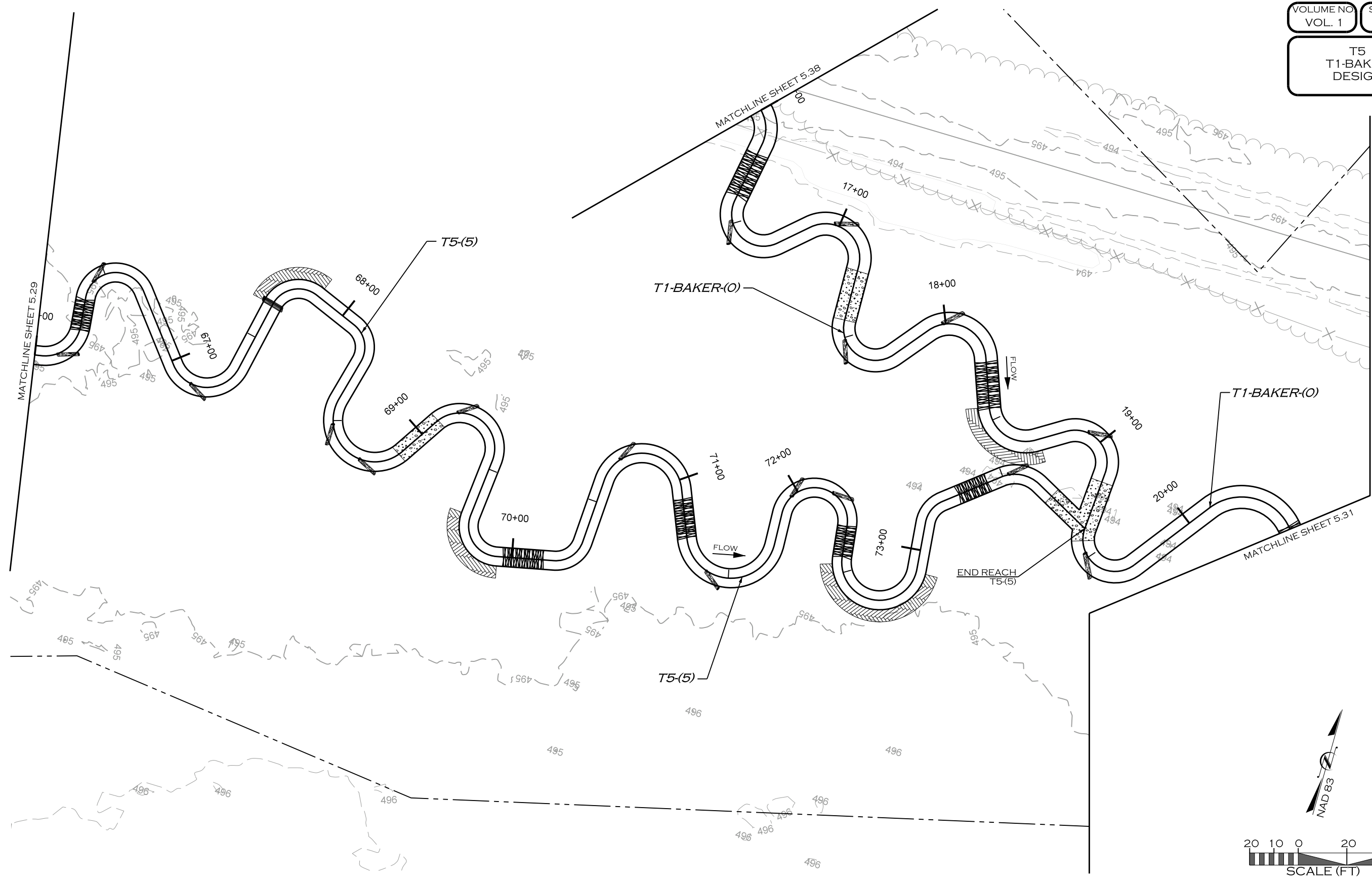


**ECOSYSTEM PLANNING & RESTORATION**

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**UPPER TRINITY REGIONAL WATER DISTRICT**

900 N KEALY ST  
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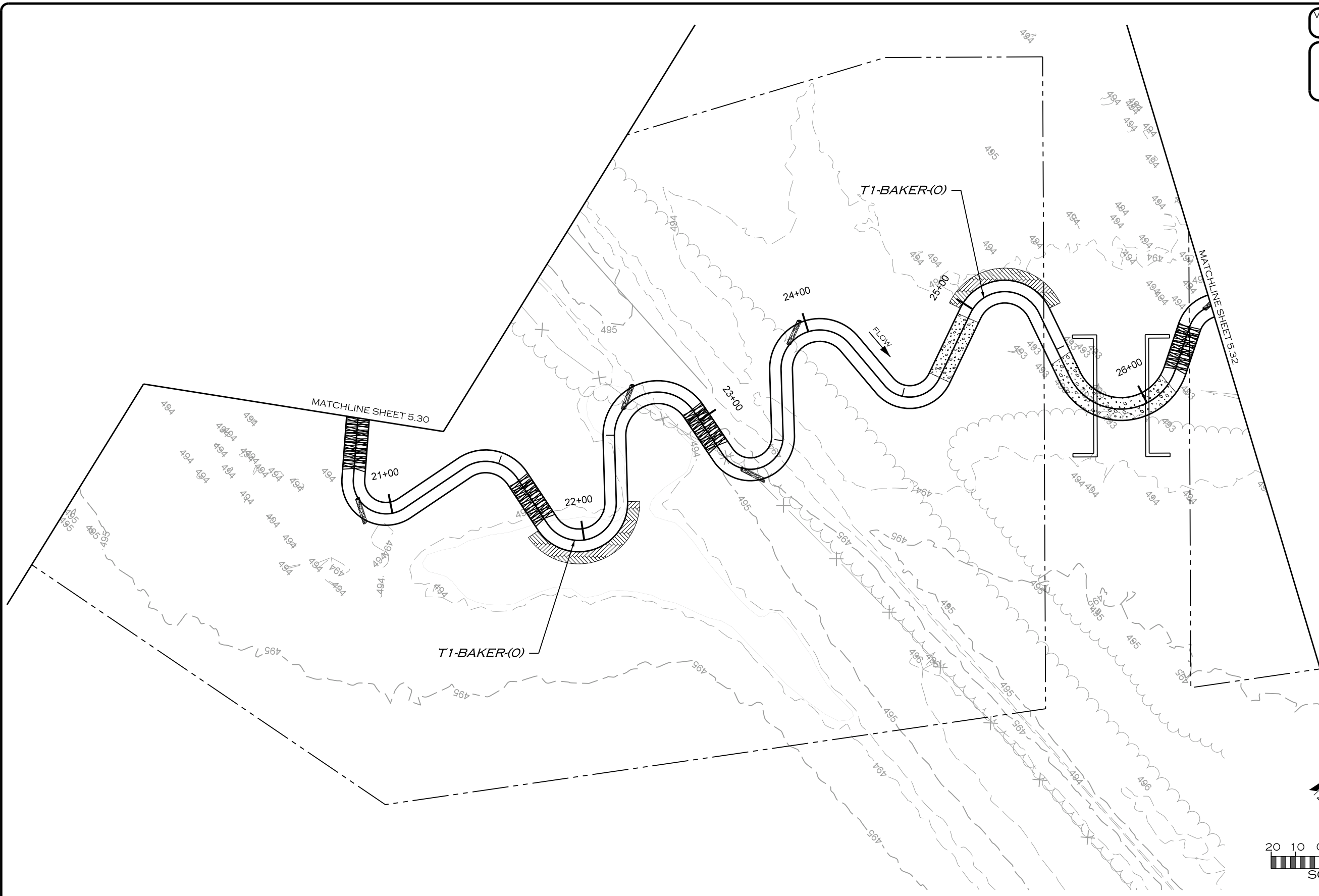
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T1-BAKER DESIGN



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**UPPER TRINITY REGIONAL WATER DISTRICT**

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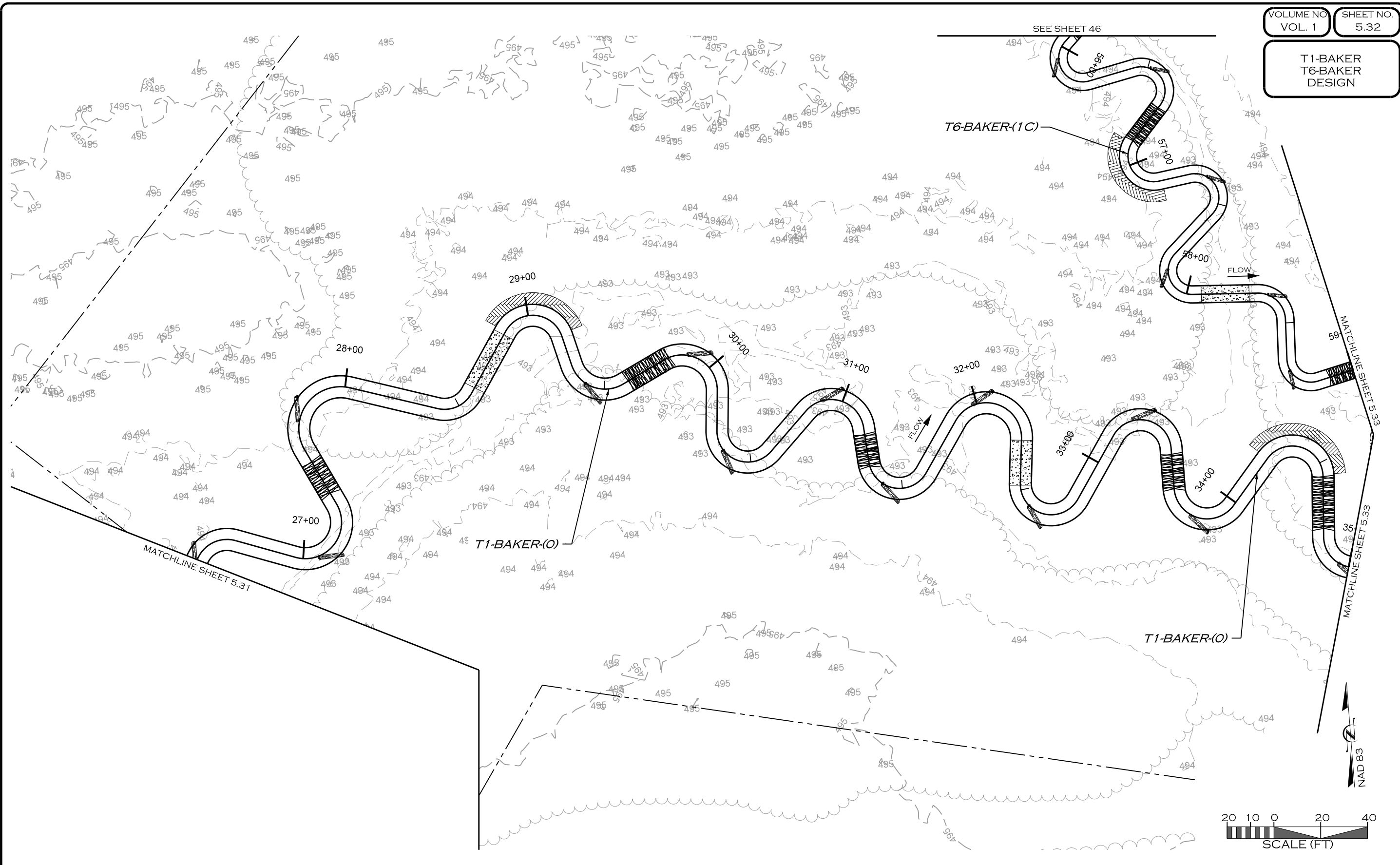


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