DESIGN NOTES

1. Design is based on the assumption that backfill within the reinforced soil mass, methods of construction and quality of materials conform to the requirements of FP'14 and the amending Special Contract Requirements.

2. Assumed Soil Characteristics:
   Welded Wire Wall Backfill:
   Unit Weight: 130 pcf
   Internal Friction Angle: 40°
   Retained Backfill:
   Unit Weight: 110 pcf
   Internal Friction Angle: 33°
   Foundation Soils:
   Unit Weight: 110 pcf
   Friction Angle for Sliding: 32°
   Cohesion: 200 psf

   SN - Retained Existing Soils - Post Pullout Testing:
   Unit Weight: 110 pcf
   Internal Friction Angle: 32 to 33°
   Cohesion = 75 to 200 psf
   Bond Stress = 3.1 to 10.4 psi

Typical Traffic Loading - 250 psf
Worst Case Bearing Pressure applied by MSE Wall to SN Truss Wall- @ 4' Height - 538 psf.

If actual characteristics, grades or dimensions of soil materials differ from those listed above or shown on the plans, Hilfiker Retaining walls shall be notified to evaluate the need to redesign.

3. If during construction, the wall location, structure location or loads are different than that proposed in this plan set and calculation package, HRW shall be notified to evaluate the need for a redesign.

4. The design requires a non-saturated backfill. Surface and sub-surface drainage control may be required to prevent saturation of the backfill or relieve hydrostatic pressures.

5. Welded Wire Wall Design Procedure:
   Mechanically Stabilized Earth walls and Reinforced Soil Slopes, FHWA report No. FHWA-NHI-00-043.

6. Spiralnail Wall Design Procedure:
   Geotechnical Engineering Circular No. 7 - Soil Nail Walls
   FHWA Report No. FHWA0-IF-03-017.

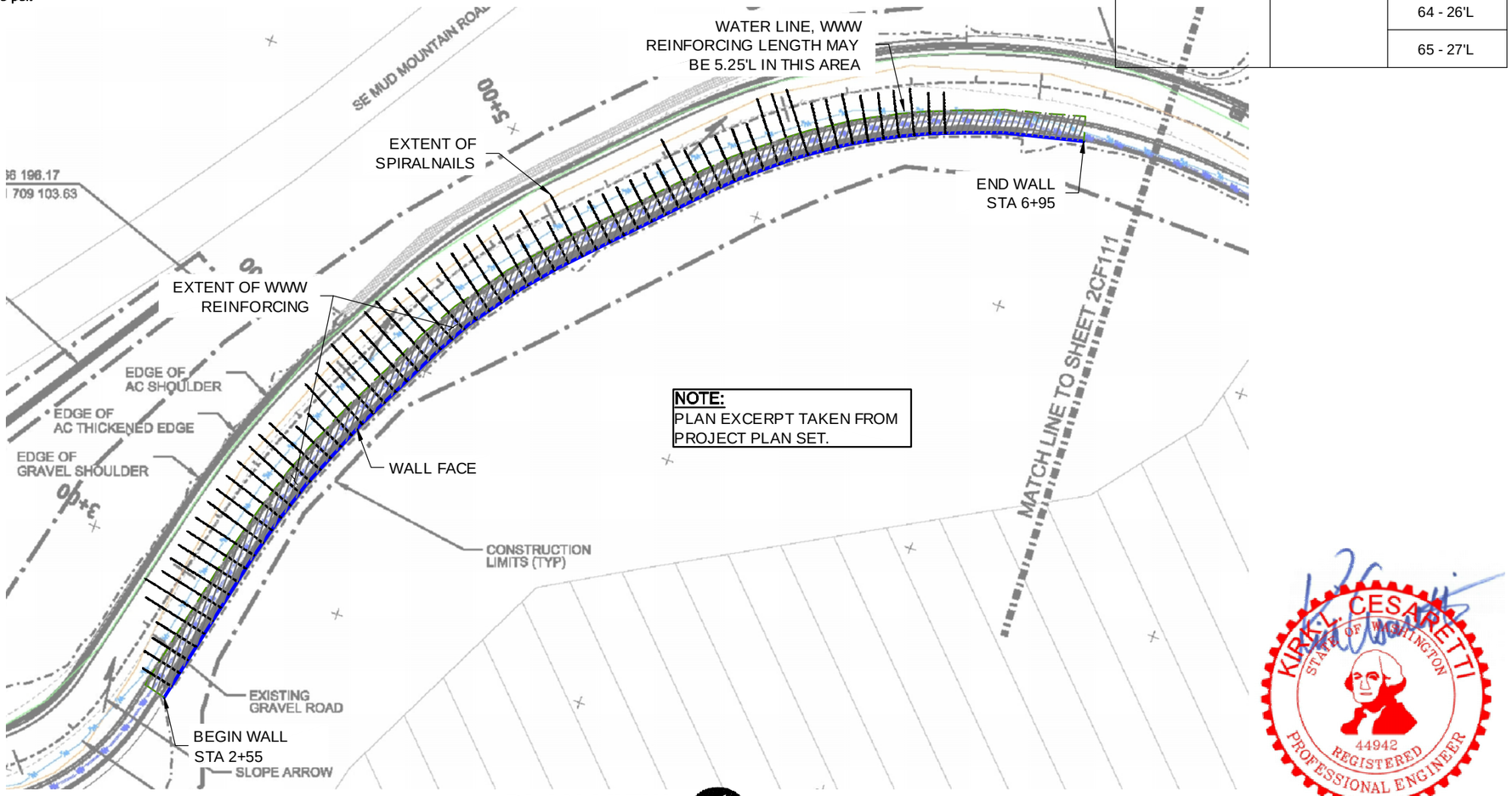
7. Hilfiker Retaining Walls shall be responsible only for the internal stability of the retaining wall.

8. Conflicts between the trusswall panels, pillasters or spiralnails and obstructions are resolved in the field by any combination of the following:
   a) Trimming the vertical truss wall panel wires and or bending vertical & horizontal wires to accommodate the penetration through the facing
   b) Trimming the bottom part of the pilaster
   c) Slight Re-orientation of the spiralnail angle or direction. If re-orientation of the pilaster or nails is more than one foot from the planned location, confirmation of the change shall be approved by CES.

9. This design is intended to be responsible for the internal stability of the retaining wall only, and not for global stability or foundation bearing capacity. The topography was provided by others. If the Topography is found different from what the design shows CES is to be notified immediately. CES is not responsible for job site drainage, safety and fall protection provisions including compliance with OSHA regulations, nor the Competent Person designated for daily inspection.

10. See Appendix for Spiralnail Pullout Test Procedure. The Test Nails approximate locations are shown on the Elevation View.

SUPPLIED QUANTITY		
WELDED WIRE WALL (SF)	SPIRALNAIL TRUSS FACING (SF)	SPIRALNAILS
1648	3396	2 - 12'L
		14 - 14'L
		44 - 15'L
		117 - 16'L
		6 - 20'L
		42 - 22'L
		64 - 26'L
		65 - 27'L



PLAN VIEW
SCALE: 1" = 50'

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KIRK L. CESARETTI — STATE OF WASHINGTON — 44942 — REGISTERED PROFESSIONAL ENGINEER

HW 190325CN

REV.NO.	DATE	BY	DESCRIPTION
	6-18-19	KLC	Initial .pdf Release
	7-11-19	KLC	Revised per new Topography
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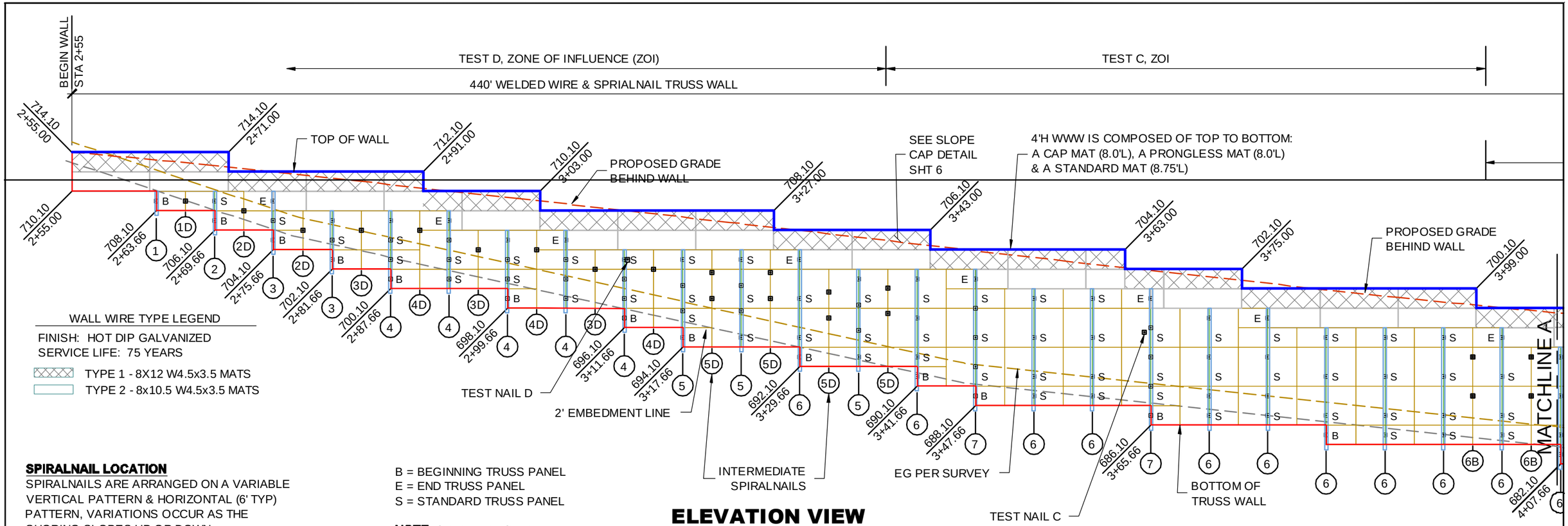
Mud Mountain Dam Fish Passage Facility
WWW & TRUSS WALL - PLAN VIEW & GENERAL NOTES

PROJECT	19-026
DATE	06-18-19
DESIGN	KLC
DRAWN	KLC

SHT 1 OF 8



SPIRALNAIL LOCATION

SPIRALNAILS ARE ARRANGED ON A VARIABLE VERTICAL PATTERN & HORIZONTAL (6' TYP) PATTERN, VARIATIONS OCCUR AS THE SHORING SLOPES UP OR DOWN.

EXISTING INFRASTRUCTURE

PIPING, UTILITIES, OR ANY OTHER UNDERGROUND ITEMS OR INFRASTRUCTURES MAY OR MAY NOT BE SHOWN. SPIRALNAILS WERE LOCATED ON THESE PLANS AS COULD BE BEST DETERMINED WTIH THE INFORMATION PROVIDED. PRECISE LOCATIONS SHALL BE ASCERTAINED IN THE FIELD PRIOR TO DRAWING APPROVAL AND CONFIRMED BY OTHERS. DESIGN APPROVAL WARRANTS NEITHER HILFIKER NOR CES WILL BE LIABLE FOR ANY DAMAGE CAUSED BY SPIRALNAIL INSTALLATIONS PERFORMED IN ACCORDANCE WITH THESE PLANS. CALL USA PRIOR TO ANY EXCAVATION OR NAIL INSTALLATION.

B = BEGINNING TRUSS PANEL
E = END TRUSS PANEL
S = STANDARD TRUSS PANEL

NOTE: SPIRALNAILS ARE SHOWN LARGER FOR CLARITY

ELEVATION VIEW

SCALE: 1" = 10'

TRUSS WALL PARAMETERS		
SECTION	HEIGHT	SPIRALNAIL
1	2'	1 - 12' @ 15°
2	4'	2 - 14' @ 15°
3	6'	3 - 15' @ 15°
4	8'	4 - 16' @ 15°
5	10'	4 - 22' @ 15°
6	12'	4 - 26' @ 15°
7	14'	5 - 27' @ 15°

PILASTER SPIRALNAILS PARAMETERS

TRUSS WALL PARAMETERS		
SECTION	HEIGHT	SPIRALNAIL
1D	2'	1 - 12' @ 15°
2D	4'	1 - 14' @ 15°
3D	6'	1 - 15' @ 15°
4D	8'	1 - 16' @ 15°
5D	10'	2 - 22' @ 15°

INTERMEDIATE SPIRALNAIL PARAMETERS

TRUSS WALL PARAMETERS		
SECTION	HEIGHT	SPIRALNAIL
4B	8'	2 - 16' @ 15°
5B	10'	2 - 22' @ 15°
6B	12'	2 - 27' @ 15°
7B	14'	4 - 27' @ 15°

INTERMEDIATE SPIRALNAIL PARAMETERS

WELDED WIRE WALL PARAMETERS		
Height of Wall (H) ft	Length of Cap & Prongless Mats (B_1) ft	Base Length of Mats (B_2) ft
≤4'	8.0'/5.0' in Pipe Area	8.75'/5.25' in Pipe Area

Cap & Top Mats (B1) are 8x12 W4.5x3.5 WWR (Type 1)
Standard Mats (B2) are: 8x10.5 W4.5x3.5 WWR (Type 2)

Finish: HOT DIP GALVANIZED - 75 Year Service Life

KIRK L. CESARETTI
STATE OF WASHINGTON
44942
REGISTERED
PROFESSIONAL ENGINEER

HW 190325CN

REV.NO.	DATE	BY	DESCRIPTION
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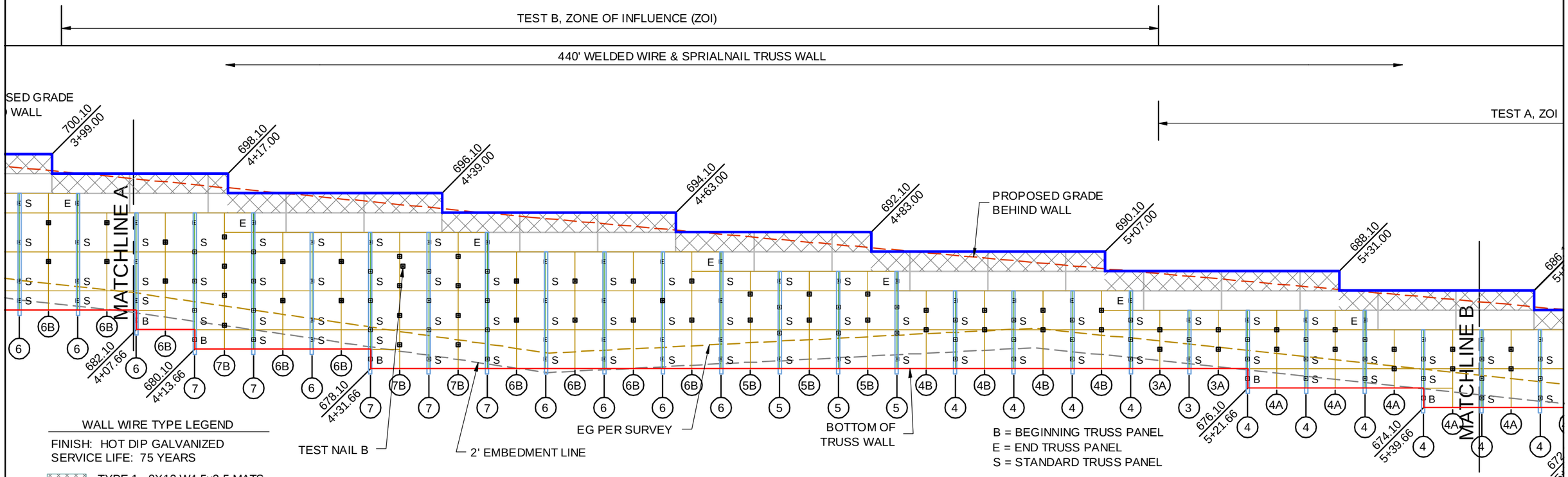
Mud Mountain Dam Fish Passage Facility

WWW & TRUSS WALL - ELEVATION VIEW

PROJECT	19-026
DATE	06-18-19
DESIGN	KLC
DRAWN	KLC

SHT 2 OF 8



ELEVATION VIEW (CONT'D)

SCALE: 1" = 10'

NOTE: SPIRALNAILS ARE SHOWN LARGER FOR CLARITY

SPIRALNAIL LOCATION

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TRUSS WALL PARAMETERS		
SECTION	HEIGHT	SPIRALNAIL
1	2'	1 - 12' @ 15°
2	4'	2 - 14' @ 15°
3	6'	3 - 15' @ 15°
4	8'	4 - 16' @ 15°
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6	12'	4 - 26' @ 15°
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PILASTER SPIRALNAILS PARAMETERS

TRUSS WALL PARAMETERS		
SECTION	HEIGHT	SPIRALNAIL
4B	8'	2 - 16' @ 15°
5B	10'	2 - 22' @ 15°
6B	12'	2 - 27' @ 15°
7B	14'	4 - 27' @ 15°

INTERMEDIATE SPIRALNAIL PARAMETERS

TRUSS WALL PARAMETERS		
SECTION	HEIGHT	SPIRALNAIL
2A	4'	1 - 20' @ 15°
3A	6'	2 - 15' @ 15°
4A	8'	2 - 16' @ 15°
5A	10'	2 - 22' @ 15°

INTERMEDIATE SPIRALNAIL PARAMETERS

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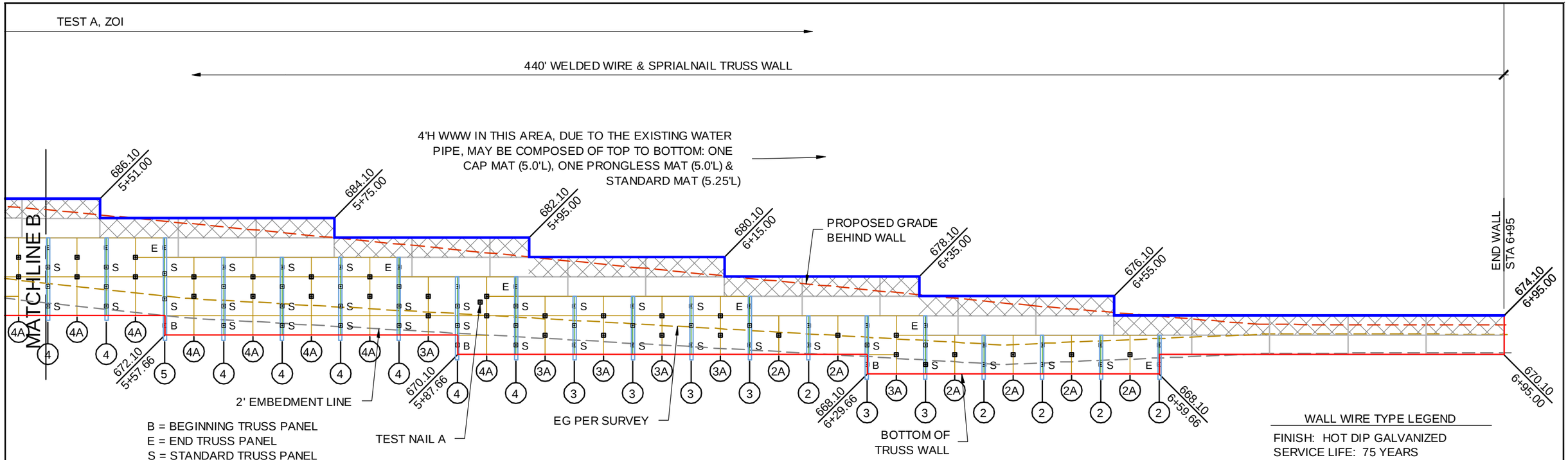
Mud Mountain Dam Fish Passage Facility

WWW & TRUSS WALL - ELEVATION VIEW (CONT'D)

PROJECT 19-026
DATE 06-18-19
DESIGN KLC
DRAWN KLC
SHT 3 OF 8



ELEVATION VIEW (CONT'D)

SCALE: 1" = 10'

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6	12'	4 - 26' @ 15°
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PILASTER SPIRALNAILS PARAMETERS

TRUSS WALL PARAMETERS		
SECTION	HEIGHT	SPIRALNAIL
2A	4'	1 - 20' @ 15°
3A	6'	2 - 15' @ 15°
4A	8'	2 - 16' @ 15°

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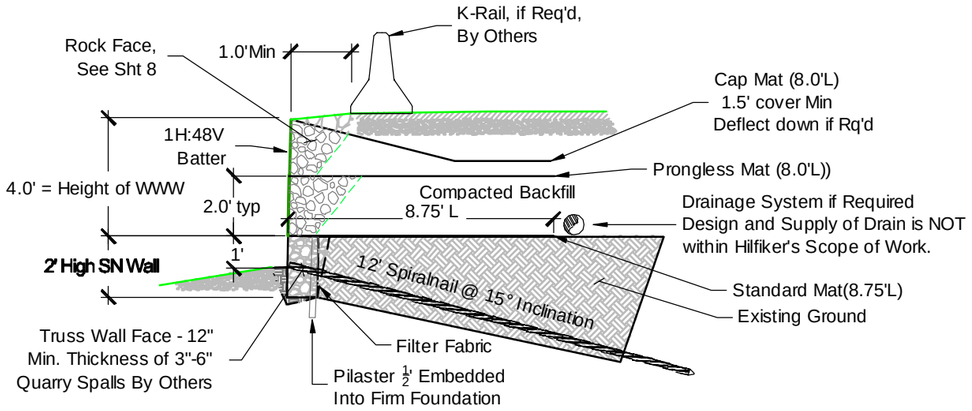
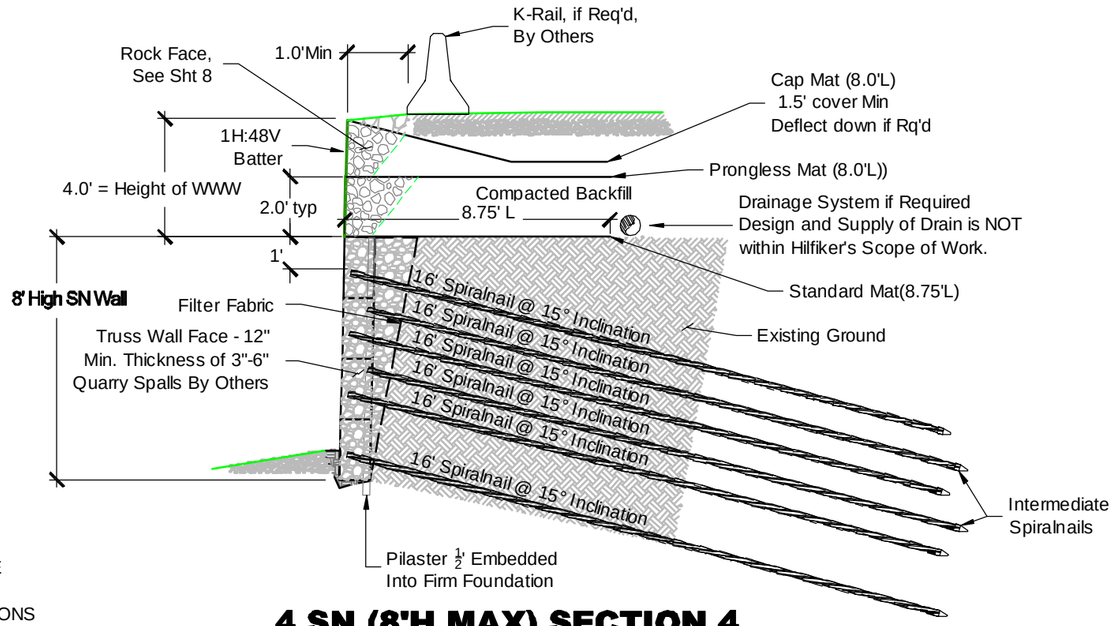
WWW & TRUSS WALL - ELEVATION VIEW (CONT'D)

PROJECT 19-026
DATE 06-18-19
DESIGN KLC
DRAWN KLC
SHT 4 OF 8



1 SN (2'H) SECTION 1

SCALE: 1" = 5'



4 SN (8'H MAX) SECTION 4

SCALE: 1" = 5'

NOTE:
THE CROSS SECTIONS SHOWN ARE REPRESENTATIVE, NOT ALL CROSS SECTIONS ARE SHOWN. ALL SECTIONS FOLLOW THE SAME BASIC GEOMETRY AS SHOWN. SEE TABLES ON SHT 2 - 4 FOR SPIRALNAIL LENGTHS AND INCLINATION ANGLE.

SPIRALNAIL INCLINATION
SPIRALNAILS MAYBE DRIVEN AT AS LITTLE AS 0° TO 40° TO AVOID UTILITIES OR INFRASTRUCTURE.

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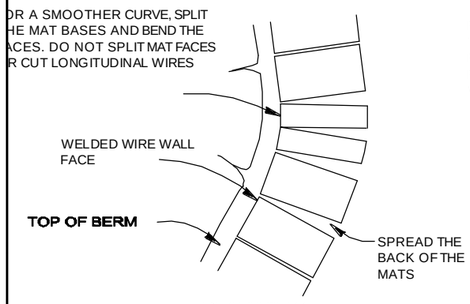
WWW & TRUSS WALL - CROSS SECTIONS

PROJECT	19-026
DATE	06-18-19
DESIGN	KLC
DRAWN	KLC

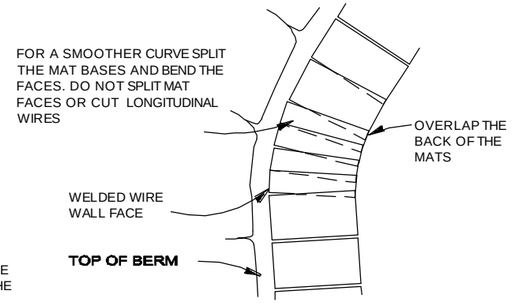
SHT 5 OF 8



PLAN VIEW

CONCAVE CURVE

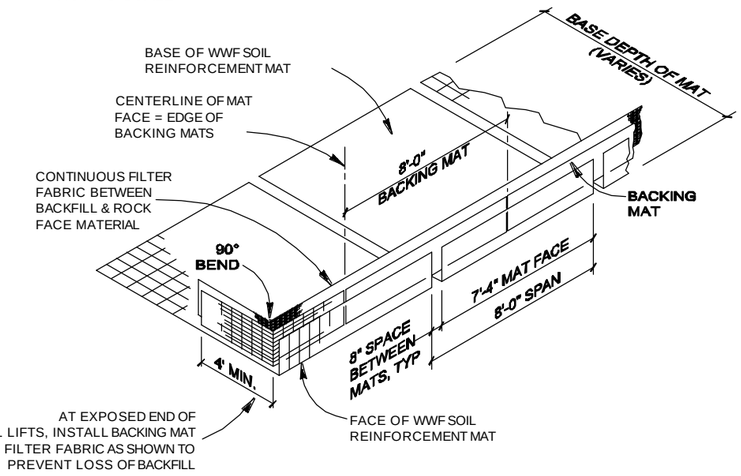
NOT TO SCALE



PLAN VIEW

CONVEX CURVE

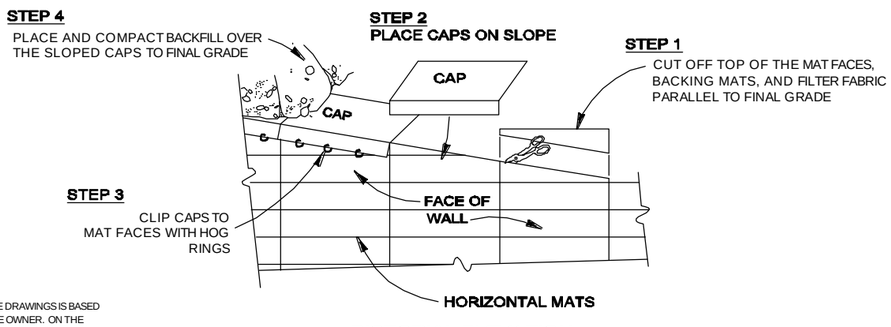
NOT TO SCALE



ISOMETRIC VIEW

WELDED WIRE WALL COMPONENTS WITH RETURN MAT

NOT TO SCALE



PICTORIAL ELEVATION

SLOPED CAP MAT DETAIL

NOT TO SCALE

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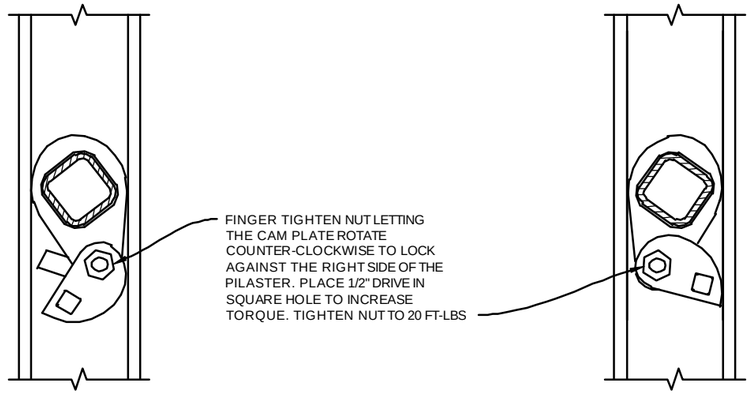
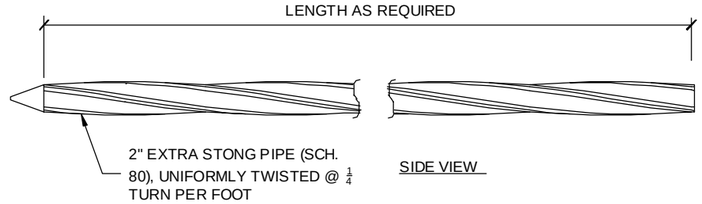


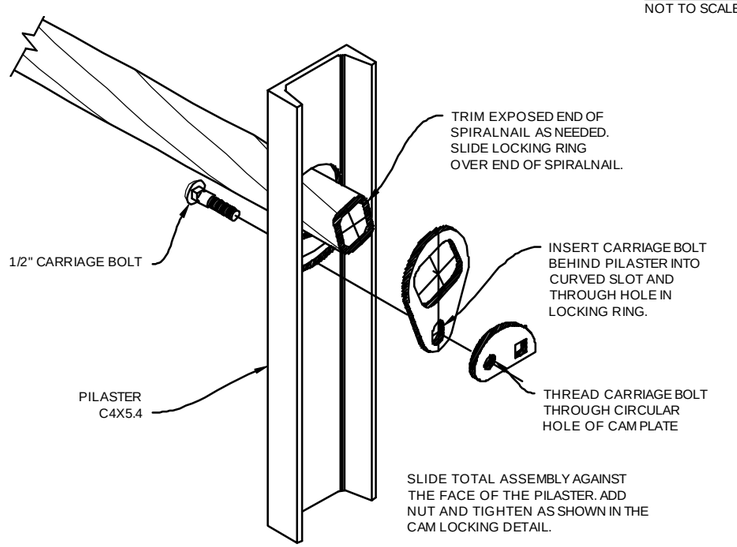
CAM LOCK LOCKING DETAIL

NOT TO SCALE



TRUSS WALL SPIRALNAIL

NOT TO SCALE



CAM LOCK ASSEMBLY

NOT TO SCALE

HW 190325CN

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WWW & TRUSS WALL - DETAILS

PROJECT	19-026
DATE	06-18-19
DESIGN	KLC
DRAWN	KLC

SHT 6 OF 8

IF PREPARED SOIL WILL SUPPORT PILASTERS, POSITION PILASTERS EVERY SIX FEET ALONG WALL LAYOUT LINE AND SET BOTTOM OF PILASTER INTO GROUND PER PROJECT PLANS.

IF PILASTERS CANNOT BE PRE-POSITIONED, PLACE START/END TRUSS ON PREPARED SLOPE FIRST THEN POSITION THE PILASTER CHANNEL AGAINST THE EDGE OF THE TRUSS AND SET BOTTOM OF PILASTER INTO GROUND PER PROJECT PLANS. DRIVE SPIRALNAILS THROUGH THE PILASTER INTO THE SOIL. PLACE CAM LOCK ON EACH SPIRALNAIL AND TIGHTEN TO TORQUE SPECIFICATIONS.

IF PILASTERS HAVE NOT BEEN PRE-POSITIONED, POSITION NEXT PILASTER AND SET INTO GROUND. PLACE THE STANDARD TRUSS BEHIND PILASTER AND OVERLAP PANEL AGAINST THE START/END TRUSS USING ZIP TIES OR TIE WIRE TO SECURE TRUSS IN PLACE. DRIVE IN SPIRALNAILS AND LOCK WITH CAM LOCKS.

CONTINUE ADDING STANDARD TRUSSES ALONG WALL ENDING AT FINAL PILASTER WITH A START/END TRUSS

POSITION START/END TRUSS, ADD PILASTER IF NEEDED, DRIVE IN SPIRALNAILS AND LOCK IN PLACE WITH CAM LOCKS.

SPIRAL TIE THE STIFFENERS ONTO THE STANDARD TRUSSES AT WIRE ON RIGHT SIDE OF PILASTER.

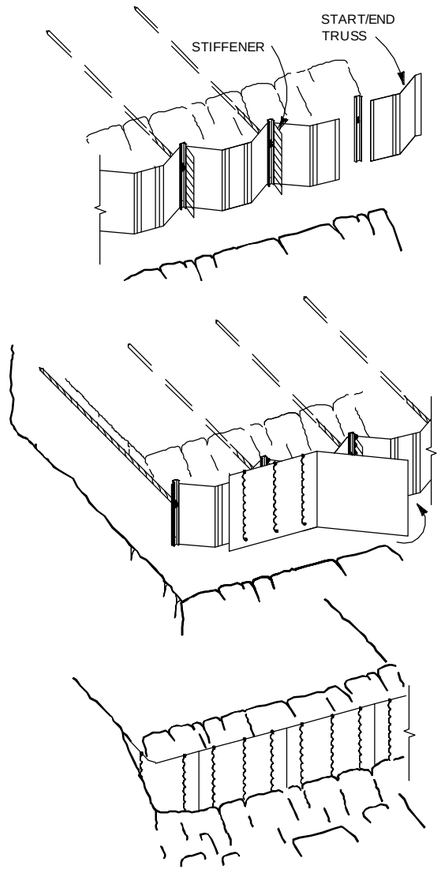
TO BEGIN FACING THE WALL, CENTER EDGES OF A FACING PANEL ON TRUSS OVERLAP. SPIRAL THE ENDS OF OVERLAP AND THE STIFFENER TO FACE PANEL.

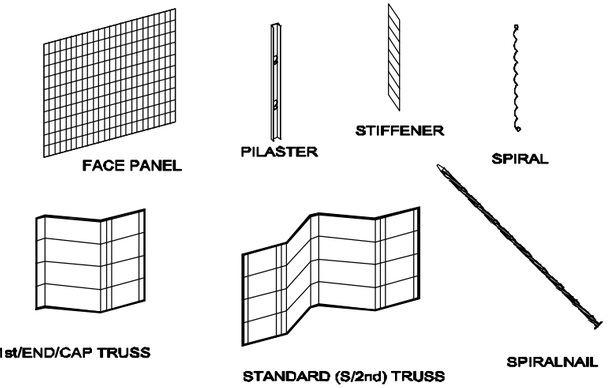
INSERT PRONGS OF SUBSEQUENT FACE PANELS BEHIND FINAL TRANSVERSE WIRE ON PREVIOUS FACING AND ROTATE INTO PLACE TO FORM INTERLOCKING CONNECTION.
SEE ENLARGED DETAIL.

FOR CLOSURE FACING AT EACH END OF WALL, BEND FACING PANEL PER PROJECT PLANS AND INSERT END OF PANEL AGAINST PREVIOUS FACING. FIELD FIT OPPOSITE END AND TRIM AS NEEDED AGAINST SLOPE. SPIRAL FACING TO START/END TRUSS PANEL AND TO STIFFENER. SEE END OF WALL TREATMENT DETAIL, THIS SHEET.

FILL AREA BEHIND WALL WITH BACKFILL PER PROJECT PLANS. COMPACT SOIL AGAINST FACE OF WALL FOR TOE BURY.

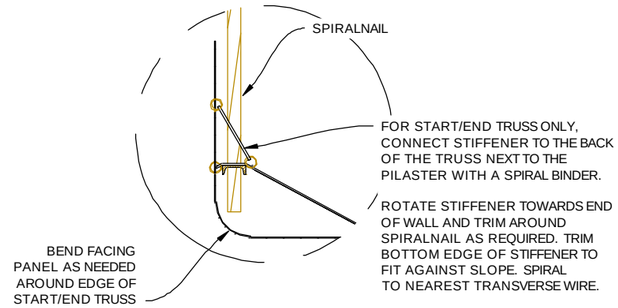
CONSTRUCTION SEQUENCE





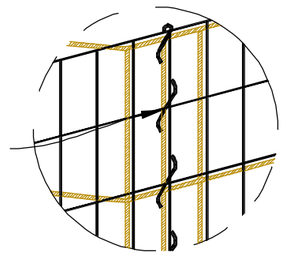
WALL COMPONENTS
NOT TO SCALE

GENERIC COMPONENTS SHOWN
FOR ILLUSTRATION PURPOSES ONLY

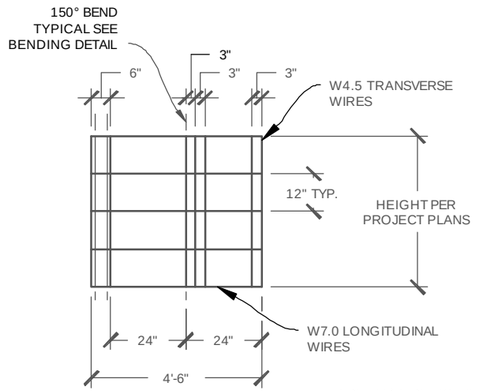


END OF WALL TREATMENT
NOT TO SCALE

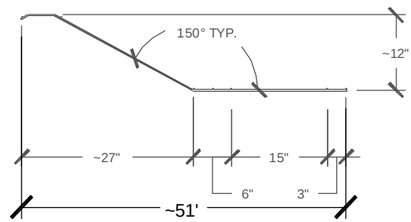
SPIRAL BINDER IS TO BE PLACED SO THAT IT ENCIRCLES BOTH THE HORIZONTAL AND VERTICAL WIRES AND PASSES IN FRONT OF THE HORIZONTAL WIRE IN THE FACE OF WALL AT EACH INTERSECTION.



SPIRAL BINDER ATTACHMENT
NOT TO SCALE



WIRE MAT SIZE AND SPACING
NOT TO SCALE



BENDING DETAILS
SCALE: 1/2"=1'

START/END TRUSS

HW 190325CN

REV.NO.	DATE	BY	DESCRIPTION
	6-18-19	KLC	Initial .pdf Release
	9-17-19	KLC	Revised per Plan Check Comments

HILFIKER RETAINING WALLS
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Mud Mountain Dam Fish Passage Facility

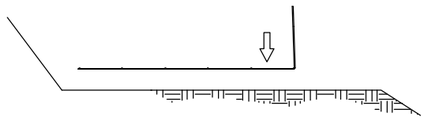
TRUSS WALL - CONSTRUCTION SEQUENCE & DETAILS

PROJECT	19-026
DATE	06-18-19
DESIGN	KLC
DRAWN	KLC

SHT 7 OF 8

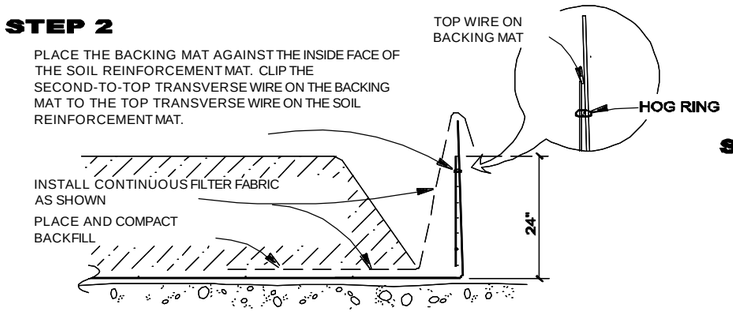
STEP 1

PLACE THE FIRST COURSE OF SOIL REINFORCEMENT MATS ON PREPARED FOUNDATION.



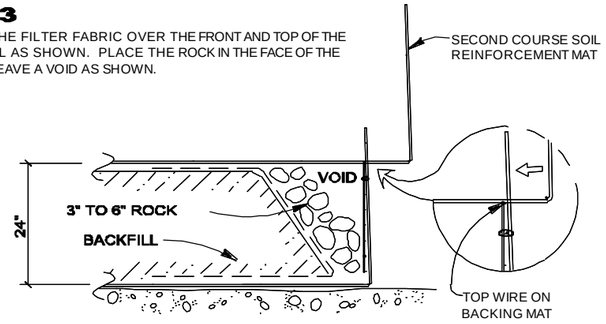
STEP 2

PLACE THE BACKING MAT AGAINST THE INSIDE FACE OF THE SOIL REINFORCEMENT MAT. CLIP THE SECOND-TO-TOP TRANSVERSE WIRE ON THE BACKING MAT TO THE TOP TRANSVERSE WIRE ON THE SOIL REINFORCEMENT MAT.



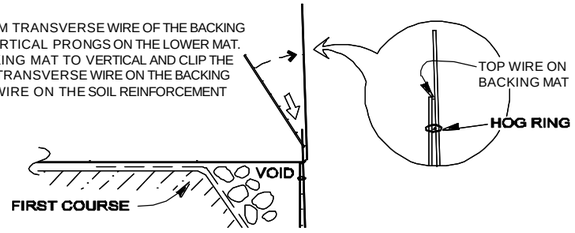
STEP 3

BRING THE FILTER FABRIC OVER THE FRONT AND TOP OF THE BACKFILL AS SHOWN. PLACE THE ROCK IN THE FACE OF THE WALL. LEAVE A VOID AS SHOWN.



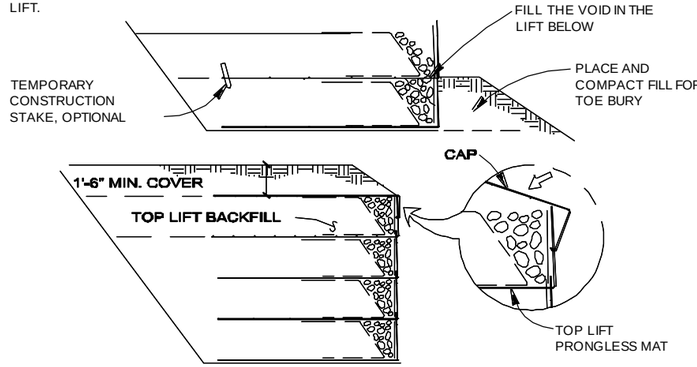
STEP 4

HOOK THE BOTTOM TRANSVERSE WIRE OF THE BACKING MAT OVER THE VERTICAL PRONGS ON THE LOWER MAT. ROTATE THE BACKING MAT TO VERTICAL AND CLIP THE SECOND-TO-TOP TRANSVERSE WIRE ON THE BACKING MAT TO THE TOP WIRE ON THE SOIL REINFORCEMENT MAT.



STEP 5

INSTALL THE FILTER FABRIC AS IN STEPS 2 AND 3. PLACE AND COMPACT THE BACKFILL AND ROCK TO THE BASE ELEVATION OF THE NEXT MAT. REPEAT STEPS 2 THROUGH 5 TO THE TOP LIFT.

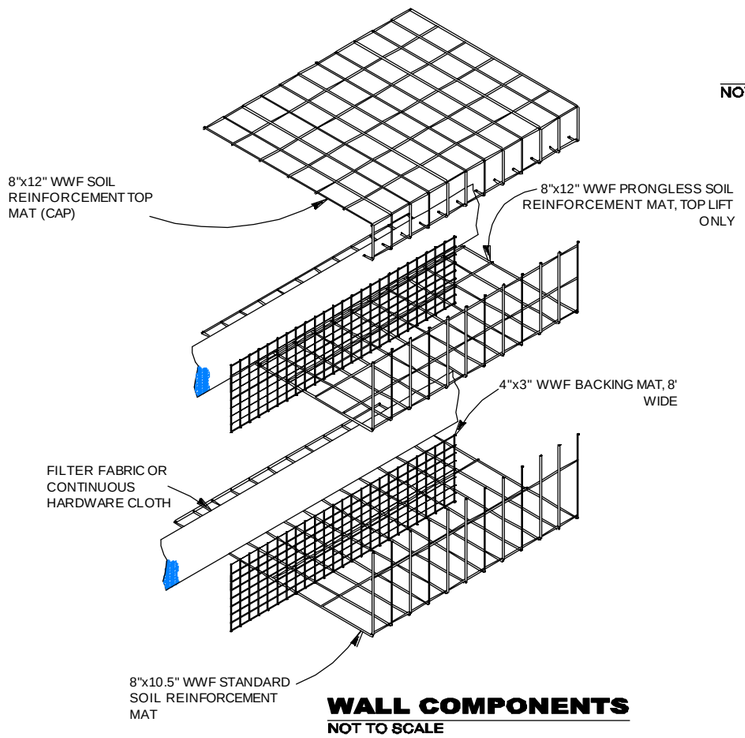


STEP 6: TOP LIFT

PLACE THE TOP LIFT PRONGLESS MAT, BACKING MAT AND FILTER FABRIC. PLACE AND COMPACT BACKFILL AND ROCK IN THE TOP LIFT. HOOK THE CAP OVER THE MIDDLE TRANSVERSE WIRE ON THE PRONGLESS MAT, AND ROTATE INTO PLACE. PLACE AND COMPACT COVER OVER TOP MAT TO 1'-6" MINIMUM DEPTH.

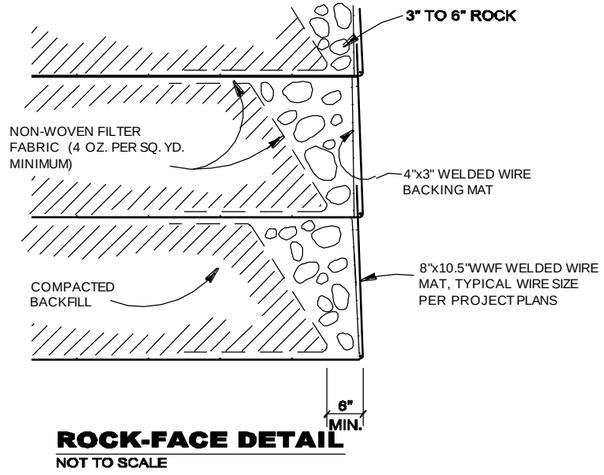
CONSTRUCTION SEQUENCE

NOT TO SCALE



WALL COMPONENTS

NOT TO SCALE



ROCK-FACE DETAIL

NOT TO SCALE

KIRK L. CESARETTI — STATE OF WASHINGTON — 44942 — REGISTERED PROFESSIONAL ENGINEER

HW 190325CN

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Mud Mountain Dam Fish Passage Facility

WWW CONSTRUCTION SEQUENCE & DETAILS

PROJECT 19-026
DATE 06-18-19
DESIGN KLC
DRAWN KLC
SHT 8 OF 8