



**Washington State  
Department of Transportation**

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# **Geotechnical Design Manual**

**M 46-03.15**

December 2021

**Environmental and Regional Operations**  
Construction Division  
Geotechnical Office

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# Contents

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<b>Chapter 1</b>	<b>Geotechnical Operations and Administration</b>	<b>1-1</b>
1.1	Scope of Geotechnical Design, Construction, and Maintenance Support	1-1
1.2	Role of Offices Providing In-House Geotechnical Design, Construction, and Maintenance Support	1-3
1.3	Geotechnical Support within the WSDOT Project Management Process (PMP)	1-10
1.4	Geotechnical Report Review Process, Certification and Approval Requirements	1-14
1.5	Reports Produced by Consultants or other Agencies for WSDOT	1-18
1.6	Geotechnical Consultant Administration	1-19
1.7	Geotechnical Information Provided to Bidders	1-21
1.8	Sample Retention and Chain of Custody	1-23
1.9	Geotechnical Design Policies and their Basis	1-23
1.10	Geotechnical Construction Support Policies	1-25
1.11	Geotechnical Construction Submittal Review Policies	1-27
1.12	References	1-29
Appendix 1-A	Preliminary Geotechnical Engineering Services Scope of Work	1-A-1
Appendix 1-B	Geotechnical Engineering Services Scope of Work for PS&E-Level Design	1-B-1
<b>Chapter 2</b>	<b>Project Geotechnical Planning</b>	<b>2-1</b>
2.1	Overview	2-1
2.2	Preliminary Project Planning	2-1
2.3	Development of the Subsurface Exploration Plan	2-8
2.4	Development of the Laboratory Testing Plan	2-15
2.5	References	2-16
Appendix 2-A	Field Exploration Request Form	2-A-1

<b>Chapter 3</b>	<b>Field Investigation</b>	<b>3-1</b>
3-1	Overview	3-1
3-2	Activities and Policies – Before Exploration	3-1
3-3	Activities and Policies – During Exploration	3-7
3-4	Activities and Policies – After Exploration	3-10
3-5	Standard Penetration Test (SPT) Calibration	3-11
3-6	References	3-12
3-7	Appendices	3-12
Appendix 3-A	Daily Drill Report Form	3-13
Appendix 3-B	Portable Penetrometer Test Procedures	3-14
Appendix 3-C	Field Investigation Best Management Practices for Erosion and Spill Prevention	3-21
Appendix 3-D	Department of Natural Resources Memorandum of Understanding: Drilling Operations – State Owned Aquatic Lands	3-23
Appendix 3-E	Geotechnical Field Investigation and Contaminated Drilling Waste Management Procedures	3-29
Appendix 3-F	State Materials Laboratory Sample- Handling Policy for Contaminated and Potentially Contaminated Samples	3-30
Appendix 3-G	WSDOT Well Tracking Database Information to be Tracked	3-33
<b>Chapter 4</b>	<b>Soil and Rock Classification and Logging</b>	<b>4-1</b>
4.1	Overview	4-1
4.2	Soil Classification	4-1
4.3	Rock Classification	4-9
4.4	References	4-17
Appendix 4-A	Test Boring Legend	4-A-1

<b>Chapter 5</b>	<b>Engineering Properties of Soil and Rock</b>	<b>5-1</b>
5.1	Overview	5-1
5.2	The Geologic Stratum as the Basis for Property Characterization	5-1
5.3	Influence of Existing and Future Conditions on Soil and Rock Properties	5-2
5.4	Methods of Determining Soil and Rock Properties	5-2
5.5	In-Situ Field Testing	5-3
5.6	Laboratory Testing of Soil and Rock	5-6
5.7	Back-Analysis Based on Known Performance or Failure	5-9
5.8	Engineering Properties of Soil	5-11
5.9	Engineering Properties of Rock	5-14
5.10	Determination and Use of Soil Cohesion	5-15
5.11	Final Selection of Design Values	5-16
5.12	Selection of Design Properties for Engineered Materials	5-21
5.13	Properties of Predominant Geologic Units in Washington	5-24
5.14	Application of the Observational Method to Adjust Design Properties	5-42
5.15	References	5-42
<b>Chapter 6</b>	<b>Seismic Design</b>	<b>6-1</b>
6-1	Seismic Design Responsibility and Policy	6-1
6-2	Geotechnical Seismic Design Considerations	6-7
6-3	Seismic Hazard and Site Ground Motion Response Requirements	6-17
6-4	Seismic Geologic Hazards	6-27
6-5	Input for Structural Design	6-48
6-6	References	6-57
6-7	Appendices	6-63
	Appendix 6-A Site Specific Seismic Hazard and Site Response	6-A-1
	Appendix 6-B High Resolution Seismic Acceleration Maps	6-B-1
<b>Chapter 7</b>	<b>Slope Stability Analysis</b>	<b>7-1</b>
7.1	Overview	7-1
7.2	Development of Design Parameters and Other Input Data for Slope Stability Analysis	7-1
7.3	Design Requirements	7-2
7.4	Resistance Factors and Safety Factors for Slope Stability Analysis	7-4
7.5	References	7-5

<b>Chapter 8</b>	<b>Foundation Design</b> .....	<b>8-1</b>
8.1	Overview .....	8-1
8.2	Overall Design Process for Structure Foundations .....	8-1
8.3	Data Needed for Foundation Design .....	8-5
8.4	Foundation Selection Considerations .....	8-9
8.5	Overview of LRFD for Foundations .....	8-10
8.6	LRFD Loads, Load Groups and Limit States to be Considered .....	8-11
8.7	Resistance Factors for Foundation Design – Design Parameters .....	8-18
8.8	Resistance Factors for Foundation Design – Service Limit States .....	8-19
8.9	Resistance Factors for Foundation Design – Strength Limit States .....	8-19
8.10	Resistance Factors for Foundation Design – Extreme Event Limit States .....	8-19
8.11	Spread Footing Design .....	8-20
8.12	Driven Pile Foundation Design .....	8-27
8.13	Drilled Shaft Foundation Design .....	8-41
8.14	Micropiles .....	8-46
8.15	Proprietary Foundation Systems .....	8-46
8.16	Detention Vaults .....	8-46
8.17	References .....	8-48
Appendix 8-A	Approved Proprietary Foundation Systems (Vacant) .....	8-A-1
Appendix 8-B	Approved AASHTO LRFD Bridge Design Specifications Drill Shaft Design Provisions .....	8-B-1
<b>Chapter 9</b>	<b>Embankments</b> .....	<b>9-1</b>
9.1	Overview and Data Needed .....	9-1
9.2	Design Considerations .....	9-6
9.3	Stability Mitigation .....	9-15
9.4	Settlement Mitigation .....	9-28
9.5	Construction Considerations and PS&E Development .....	9-30
9.6	References .....	9-38
Appendix 9-A	Examples Illustrating Staged Fill Construction Design .....	9-A-1

<b>Chapter 10 Soil Cut Design</b>	<b>10-1</b>
10.1 Overview and Data Acquisition	10-1
10.2 Overall Design Considerations	10-5
10.3 Soil Cut Design	10-6
10.4 Use of Excavated Materials	10-11
10.5 Special Considerations for Loess	10-12
10.6 PS&E Considerations	10-19
10.7 References	10-20
Appendix 10-A Washington State Department of Transportation Loess Slope Design Checklist	10-A-1
<b>Chapter 11 Ground Improvement</b>	<b>11-1</b>
11.1 Overview	11-1
11.2 Development of Design Parameters and Other Input Data for Ground Improvement Analysis	11-2
11.3 Design Requirements	11-3
11.4 References	11-3
<b>Chapter 12 Rock Cut Design</b>	<b>12-1</b>
12.1 Overview	12-1
12.2 Development of Design Parameters and Other Input Data for Rock Cut Stability Analysis	12-1
12.3 Design Requirements	12-1
12.4 References	12-1
<b>Chapter 13 Landslide Analysis and Mitigation</b>	<b>13-1</b>
13.1 Overview	13-1
13.2 Development of Design Parameters and Other Input Data for Landslide Analysis	13-1
13.3 Design Requirements	13-1
13.4 References	13-1
<b>Chapter 14 Unstable Rockslope Analysis and Mitigation</b>	<b>14-1</b>
14.1 Overview	14-1
14.2 Development of Design Parameters and Other Input Data for Unstable Rockslope Analysis	14-1
14.3 Design Requirements	14-1
14.4 References	14-1

<b>Chapter 15</b>	<b>Abutments, Retaining Walls, and Reinforced Slopes</b>	<b>15-1</b>
15-1	Introduction and Design Standards	15-1
15-2	Overview of Wall Classifications and Design Process for Walls	15-2
15-3	Required Information	15-3
15-4	General Design Requirements	15-11
15-5	Wall Type Specific Design Requirements	15-23
15-6	Standard Plan Walls	15-57
15-7	Temporary Cut Slopes and Shoring	15-58
15-8	References	15-70
15-9	Appendices	15-74
Appendix 15-A	Preapproved Proprietary Wall and Reinforced Slope General Design Requirements and Responsibilities	15-A-1
Appendix 15-B	Preapproved Proprietary Wall/Reinforced Slope Design and Construction Review Checklist	15-B-1
Appendix 15-C	Wall/Reinforced Slope Systems Evaluation: Submittal Requirements	15-C-1
Appendix 15-D	Preapproved Proprietary Wall Systems	15-D-1
Appendix 15-E	MSE Wall Design Using the Stiffness Method	15-E-1
Appendix 15-F	Description of Typical Temporary Shoring Systems and Selection Considerations	15-F-1
Appendix 15-G	Testing and Acceptance Protocols for Tiebacks in Clay	15-G-1
Appendix 15-H	Preapproved Wall Appendix: Specific Requirements and Details for Hilfiker Welded Wire Faced Walls	15-H-1
Appendix 15-I	Vacant	15-I-1
Appendix 15-J	Preapproved Wall Appendix: Specific Requirements and Details for Reinforced Earth (RECO) Concrete Panel Walls	15-J-1
Appendix 15-K	Preapproved Wall Appendix: Specific Requirements and Details for Tensar ARES Walls	15-K-1
Appendix 15-L	Preapproved Wall Appendix: Specific Requirements and Details for Tensar MESA Walls	15-L-1
Appendix 15-M	Preapproved Wall Appendix: Specific Requirements and Details for Tensar Welded Wire Form Walls	15-M-1
Appendix 15-N	Preapproved Wall Appendix: Specific Requirements and Details for SSL Concrete Panel Walls	15-N-1
Appendix 15-O	Preapproved Wall Appendix: Specific Requirements and Details for Landmark Reinforced Soil Wall	15-O-1



Appendix 15-P	Preapproved Wall Appendix: Specific Requirements and Details for Allan Block Walls .....	15-P-1
Appendix 15-Q	Preapproved Wall Appendix: Specific Requirements and Details for Redi-Rock Positive Connection Walls .....	15-Q-1
Appendix 15-R	Preapproved Wall Appendix: Specific Requirements and Details for Lock and Load Walls .....	15-R-1
Appendix 15-S	Preapproved Wall Appendix: Specific Requirements and Details for KeyGrid Walls .....	15-S-1
Appendix 15-T	Preapproved Wall Appendix: Specific Requirements and Details for Basalite GEOWALL .....	15-T-1
<b>Chapter 16</b>	<b>Geosynthetic Design .....</b>	<b>16-1</b>
16.1	Overview .....	16-1
16.2	Development of Design Parameters for Geosynthetic Application .....	16-1
16.3	Design Requirements .....	16-2
16.4	References .....	16-2
<b>Chapter 17</b>	<b>Foundation Design for Signals, Signs, Noise Barriers, Culverts, and Buildings .....</b>	<b>17-1</b>
17.1	General .....	17-1
17.2	Foundation Design Requirements for Cantilever Signals, Strain Poles, Cantilever Signs, Sign Bridges, and Luminaires - General .....	17-4
17.3	Noise Barriers .....	17-11
17.4	Culverts .....	17-16
17.5	Buildings .....	17-17
17.6	References .....	17-20
<b>Chapter 18</b>	<b>Geotechnical Design for Marine Structure Foundations .....</b>	<b>18-1</b>
18.1	Overview .....	18-1
18.2	Design Philosophy .....	18-1
18.3	Load and Resistance Factors for Marine Structures Subject to Ship Impact .....	18-1
18.4	References .....	18-1
<b>Chapter 19</b>	<b>Infiltration Facility Design .....</b>	<b>19-1</b>
19.1	Overview .....	19-1
19.2	Geotechnical Investigation and Design for Infiltration Facilities .....	19-1
19.3	References .....	19-1

<b>Chapter 20 Unstable Slope Management</b> .....	<b>20-1</b>
20.1 Overview .....	20-1
20.2 References .....	20-1
<b>Chapter 21 Materials Source Investigation and Report</b> .....	<b>21-1</b>
21.1 Overview .....	21-1
21.2 Material Source Geotechnical Investigation .....	21-1
21.3 Materials Source Report .....	21-5
<b>Chapter 22 Geotechnical Project Development, Reports, and Support for Design-Build Projects</b> .....	<b>22-1</b>
22-1 Overview .....	22-1
22-2 Definitions .....	22-2
22-3 Purpose and Content of the Geotechnical Reports Included in the Contract Documents ..	22-6
22-4 Geotechnical and Other Reference Documents .....	22-11
22-5 Geotechnical RFP Development .....	22-13
22-6 Geotechnical Investigation During RFP Advertisement .....	22-13
22-7 Geotechnical Support for Design-Build Projects During RFP Advertisement and Post-Award .....	22-14
22-8 References .....	22-15
22-9 Appendices .....	22-15
Appendix 22-A Example Supplemental Geotechnical Boring Program ITP Language ..	22-A-1
<b>Chapter 23 Geotechnical Reporting and Documentation</b> .....	<b>23-1</b>
23.1 Overview and General Requirements .....	23-1
23.2 Report Certification and General Format .....	23-1
23.3 Geotechnical Office Report Content Requirements .....	23-7
23.4 Information to Be Provided in the Geotechnical Design File .....	23-21
23.5 Consultant Geotechnical Reports and Documentation Produced on Behalf of WSDOT ..	23-24
23.6 Summary of Geotechnical Conditions .....	23-25
Appendix 23-A PS&E Review Checklist .....	23-A-1
Appendix 23-B Typical Design Cross-Section for a Deep Foundation .....	23-B-1

## Appendix 15-D Preapproved Proprietary Wall Systems

The following wall systems are preapproved for use in WSDOT projects:

**Table 15-D-1** Preapproved Proprietary Walls

Wall Supplier	System Name and Appendix Location	System Description and Appendix Location	ASD/LFD or LRFD? <sup>1</sup>	Height, or Other Limitations	Year Initially Approved	Last Approved Update
<b>Hilfiker Retaining Walls</b> 1902 Hilfiker Lane Eureka, CA 95503-5711 707-443-5093	Welded Wire Retaining Wall <a href="#">Appendix 15-H</a>	Welded wire facing that is continuous with welded wire soil reinforcement	ASD/LFD	33 feet	Unknown	Approved 12/1/21 (submitted 9/15/03)
<b>The Reinforced Earth Co.</b> 9025 East Kenyon Ave. Suite 200 Denver, CO 80237 303-790-1481	Reinforced Earth Wall <a href="#">Appendix 15-J</a>	Precast concrete 5'x5' facing panels and steel strip soil reinforcement	LRFD	33 feet	1987	Approved 11/9/04
<b>Tensar Earth Technologies, Inc.</b> 2500 Northwinds Parkway Suite 500 Alpharetta, GA 30009 770-344-2090	ARES Wall <a href="#">Appendix 15-K</a>	Precast concrete 5'x5' facing panels and Tensar geogrid soil reinforcement	ASD/LFD	33 feet	1998	Approved 11/9/04
<b>Tensar Earth Technologies, Inc.</b> 2500 Northwinds Parkway Suite 500 Alpharetta, GA 30009 770-344-2090	MESA Wall <a href="#">Appendix 15-L</a>	Modular dry cast concrete block facing with Tensar geogrid soil reinforcement	ASD/LFD	33 feet	2000	Approved 11/9/04
<b>Tensar Earth Technologies, Inc.</b> 2500 Northwinds Parkway Suite 500 Alpharetta, GA 30009 770-344-2090	Welded Wire Form Wall <a href="#">Appendix 15-M</a>	Tensar geogrid wrapped face wall with welded wire facing form	ASD/LFD	33 feet*	2006	Approved 3/3/06
<b>SSL, LLC</b> 4740 Scotts Valley Dr., Suite E Scotts Valley, CA 95066 831-430-9300	MSEPlus Wall <a href="#">Appendix 15-N</a>	Precast concrete 5'x5' facing panels and steel welded wire strip soil reinforcement	LRFD	33 feet	1999	Approved 8/5/13
<b>Anchor Wall Systems, Inc.</b> 5959 Baker Rd, Suite 390 Minnetonka, MN 55345-5996 952-933-8855	Landmark <a href="#">Appendix 15-O</a>	Modular dry cast concrete block facing with Miragrid geogrid soil reinforcement	LRFD	33 feet	2012	Approved 4/2/12

\*If the vegetated face option is used for the Hilfiker Welded Wire Retaining Wall or the Tensar Welded Wire Form Wall, the maximum wall height shall be limited to 20 feet. Greater wall heights for the vegetated face option for these walls may be used on a case by case basis as a special design if approved by the State Geotechnical Engineer and the State Bridge Engineer.

<sup>1</sup> For those systems still identified as ASD/LFD, use of the current AASHTO LRFD Bridge Design Specifications is preferred.

Table 15-D-1 Preapproved Proprietary Walls

Wall Supplier	System Name and Appendix Location	System Description and Appendix Location	ASD/LFD or LRFD? <sup>1</sup>	Height, or Other Limitations	Year Initially Approved	Last Approved Update
<b>Allan Block Corporation</b> 7424 W. 78th St. Bloomington, MN 55439 952-835-5309	Allan Block Wall (battered face) <a href="#">Appendix 15-P</a>	Modular dry cast concrete block facing with Miragrid or Stratagrid geogrid soil reinforcement	LRFD	33 feet	2009	Approved 7/15/09
<b>Redi-Rock International LLC</b> 05481 US 31 South Charlevoix, MI 49720 866-222-8400	Redi-Rock PC (Positive Connection) Wall <a href="#">Appendix 15-Q</a>	Precast concrete block facing with Miragrid strip soil reinforcement	LRFD	33 feet	2015	Approved 8/3/15
<b>Lock and Load Retaining Walls LTD</b> 1681 Chestnut St., Suite 400 Vancouver, BC V6J 4M6 Canada 604-732-9990	Lock and Load Wall <a href="#">Appendix 15-R</a>	Precast concrete panel facing attached to wrapped face geogrid wall	LRFD	33 feet	2013	Approved 7/10/13
<b>Keystone Retaining Wall Systems, LLC</b> 4444 West 78 <sup>th</sup> St. Minneapolis, MN 55435 800-747-8971	Keystone Keygrid (Compac II and III Units) <a href="#">Appendix 15-S</a>	Modular dry cast concrete block facing with Miragrid geogrid soil reinforcement	LRFD	33 feet	2015	Approved 8/3/15
<b>Basalite Concrete Products, LLC</b> 3299 International Place Dupont, WA 98327-7707 253-964-5000	GEOWALL Structural Earth Retaining Wall <a href="#">Appendix 15-T</a>	Modular dry cast concrete block facing with Miragrid or Stratagrid geogrid soil reinforcement	LRFD	33 feet	2018	Approved 1/2/18

\*If the vegetated face option is used for the Hilfiker Welded Wire Retaining Wall or the Tensar Welded Wire Form Wall, the maximum wall height shall be limited to 20 feet. Greater wall heights for the vegetated face option for these walls may be used on a case by case basis as a special design if approved by the State Geotechnical Engineer and the State Bridge Engineer.

<sup>1</sup> For those systems still identified as ASD/LFD, use of the current AASHTO LRFD Bridge Design Specifications is preferred.

## **Appendix 15-H Preapproved Wall Appendix: Specific Requirements and Details for Hilfiker Welded Wire Faced Walls**

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In addition to the general design requirements provided in [Appendix 15-A](#), the following specific design requirements shall be met:

No HITEC or IDEA evaluation report is currently available for this wall system. Design procedures for specific elements of the wall system have been provided to WSDOT in a letter dated September 7, 2021. The design procedures used by Hilfiker Retaining Walls shall be in full conformance with the AASHTO [LRFD Bridge Design Specifications](#) (2020).

Regarding the soil reinforcement material, the minimum wire size acceptable for permanent walls is W4.5 for the longitudinal wires. For the transverse wires, the minimum wire size shall be W3.5. For all permanent walls, the welded wire shall be galvanized in accordance with the AASHTO LRFD specifications. For temporary walls, galvanization is not required, but the life of the wire shall be designed to be adequate for the intended life.

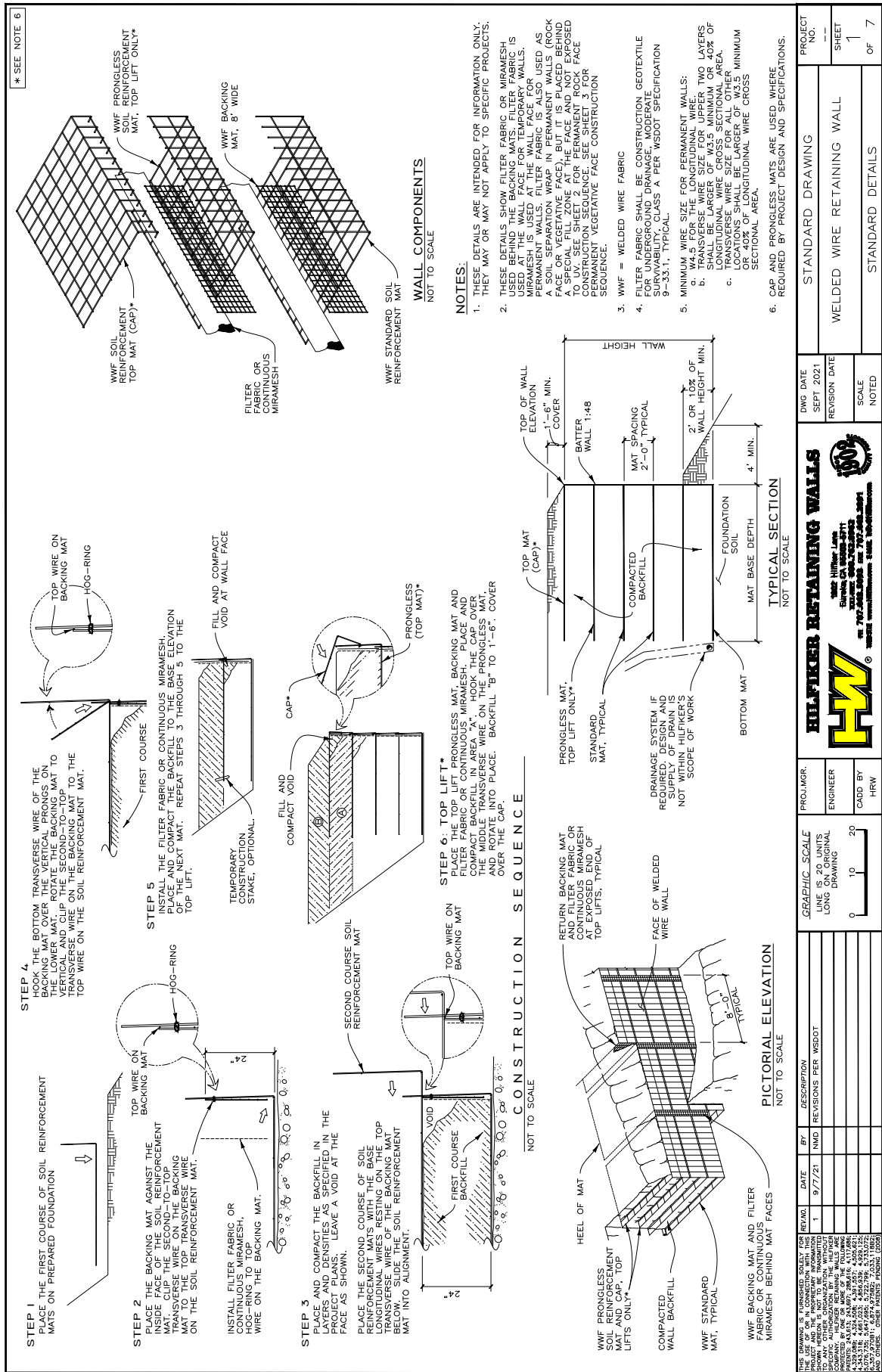
Regarding the backing mats used in the welded wire facing, the minimum clear opening dimension of the backing mat shall not exceed the minimum particle size of the wall facing backfill. The maximum particle size for the wall facing backfill shall be 6 inches.

The maximum vertical spacing of soil reinforcement shall be 24 inches.

The culvert penetration and obstruction avoidance details are preapproved up to a diameter of 4 feet. Larger diameter culverts or obstructions are not considered preapproved. This wall is also preapproved for use with traffic barriers.

This wall system is preapproved for a welded wire/gravel fill face for vertical to near vertical facing batter and welded wire vegetated face for wall face batters as steep as 6V:1H. This preapproval presumes that the facing tolerances in the WSDOT [Standard Specifications](#) Section 6-13.3(1) for welded wire faced walls are met.

The following standard details shall be used for the Hilfiker Welded Wire Faced Wall system:



\* SEE NOTE 6

DWG DATE	SEPT 2021	PROJECT NO.	
REVISION DATE		SHEET	1
SCALE	NOTED	OF	7
STANDARD DRAWING		WELDED WIRE RETAINING WALL	
STANDARD DRAWING		STANDARD DETAILS	

**HILFIKER RETAINING WALLS**

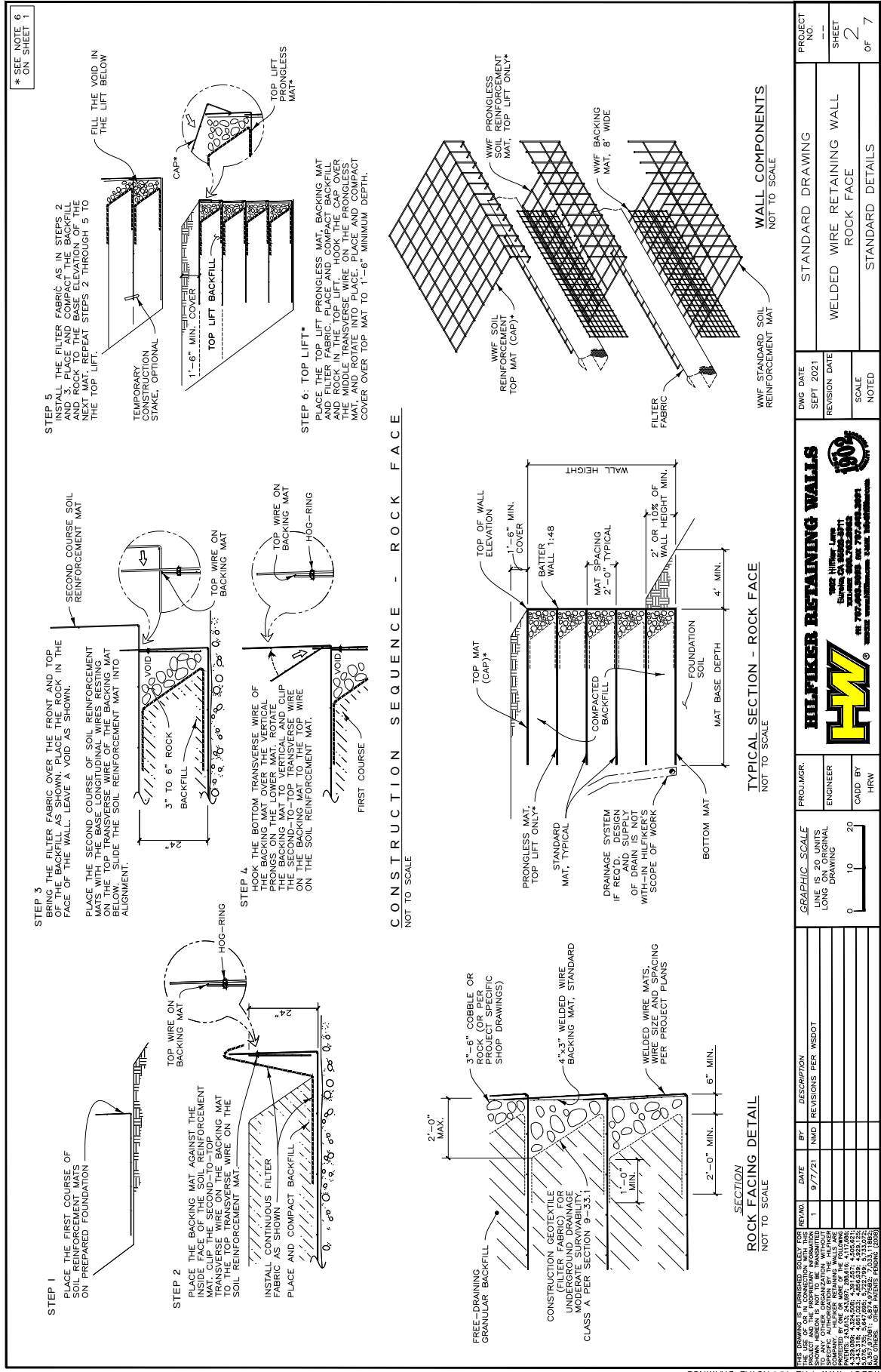
100 YEARS

1922 Hilfiker Lane  
Eureka, CA 95925-4911  
Tel: 709.446.8400 Fax: 709.446.1891  
www.hilfiker.com

PROJNGR.	
ENGINEER	
CADD BY	HRW

GRAPHIC SCALE	LINE IS 20 UNITS LONG	
0	10	20

REVISION	DATE	BY	DESCRIPTION
1	9/7/21	NMD	REVISIONS PER WSDOT



\* SEE NOTE 6 ON SHEET 1

**STEP 5**  
 PLACE 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.

TEMPORARY CONSTRUCTION STAKE, OPTIONAL

FILL THE VOID IN THE LIFT BELOW

1'-6" MIN. COVER

TOP LIFT BACKFILL

TOP LIFT PRONGLESS MAT\*

**STEP 6: TOP LIFT\***  
 PLACE THE TOP LIFT PRONGLESS MAT, BAKING MAT AND FILTER FABRIC. PLACE AND COMPACT BACKFILL AND ROCK TO THE BASE ELEVATION OF THE NEXT MAT. ROTATE THE MIDDLE TRANSVERSE WIRE ON THE PRONGLESS MAT, AND ROTATE INTO PLACE, PLACE AND COMPACT COVER OVER TOP MAT TO 1'-6" MINIMUM DEPTH.

**STEP 3**  
 BRING THE FILTER FABRIC OVER THE FRONT AND TOP FACE OF THE WALL. LEAVE A VOID AS SHOWN. PLACE THE SECOND COURSE OF SOIL REINFORCEMENT MATS WITH THE BASE LONGITUDINAL WIRES RESTING ON THE FIRST COURSE SOIL REINFORCEMENT MAT BELOW. SLIDE THE SOIL REINFORCEMENT MAT INTO ALIGNMENT.

3" TO 6" ROCK BACKFILL

VOID

SECOND COURSE SOIL REINFORCEMENT MAT

TOP WIRE ON BACKING MAT

VOID

**STEP 4**  
 HOOK THE BOTTOM TRANSVERSE WIRE OF PRONGS ON THE LOWER MAT. ROTATE THE BAKING MAT TO VERTICAL AND CLIP THE SECOND-TO-TOP TRANSVERSE WIRE ON THE SOIL REINFORCEMENT MAT.

HOO-RING

TOP WIRE ON BACKING MAT

HOO-RING

TOP WIRE ON BACKING MAT

VOID

FIRST COURSE

**STEP 1**  
 PLACE THE FIRST COURSE OF SOIL REINFORCEMENT MATS ON PREPARED FOUNDATION

TOP WIRE ON BACKING MAT

**STEP 2**  
 PLACE THE BAKING MAT AGAINST THE INSIDE FACE OF THE SOIL REINFORCEMENT MAT. CLIP THE SECOND-TO-TOP TRANSVERSE WIRE ON THE BAKING MAT TO THE TRANSVERSE WIRE ON THE SOIL REINFORCEMENT MAT.

HOO-RING

HOO-RING

INSTALL CONTINUOUS FILTER FABRIC AS SHOWN

PLACE AND COMPACT BACKFILL

VOID

3'-0" MAX.

FREE-DRAINING GRANULAR BACKFILL

CONSTRUCTION GEOTEXTILE (FILTER FABRIC) FOR UNDERGROUND DRAINAGE MATS PER SECTION 9-3.3.1

1'-0" MIN.

2'-0" MIN.

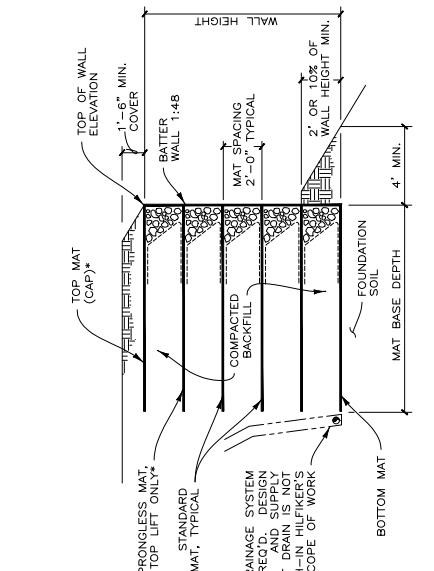
6" MIN.

3'-0" COBBLE OR ROCK (OR PER PROJECT-SPECIFIC SHOP DRAWINGS)

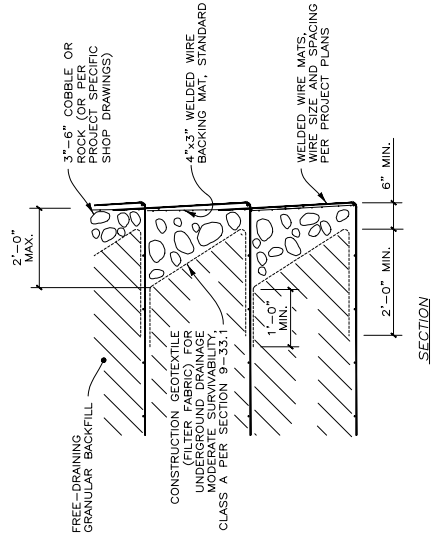
4\*33" WELDED WIRE BACKING MAT, STANDARD

WELDED WIRE MATS, WIRE SIZE AND SPACING PER PROJECT PLANS

CONSTRUCTION SEQUENCE - ROCK FACE  
 NOT TO SCALE

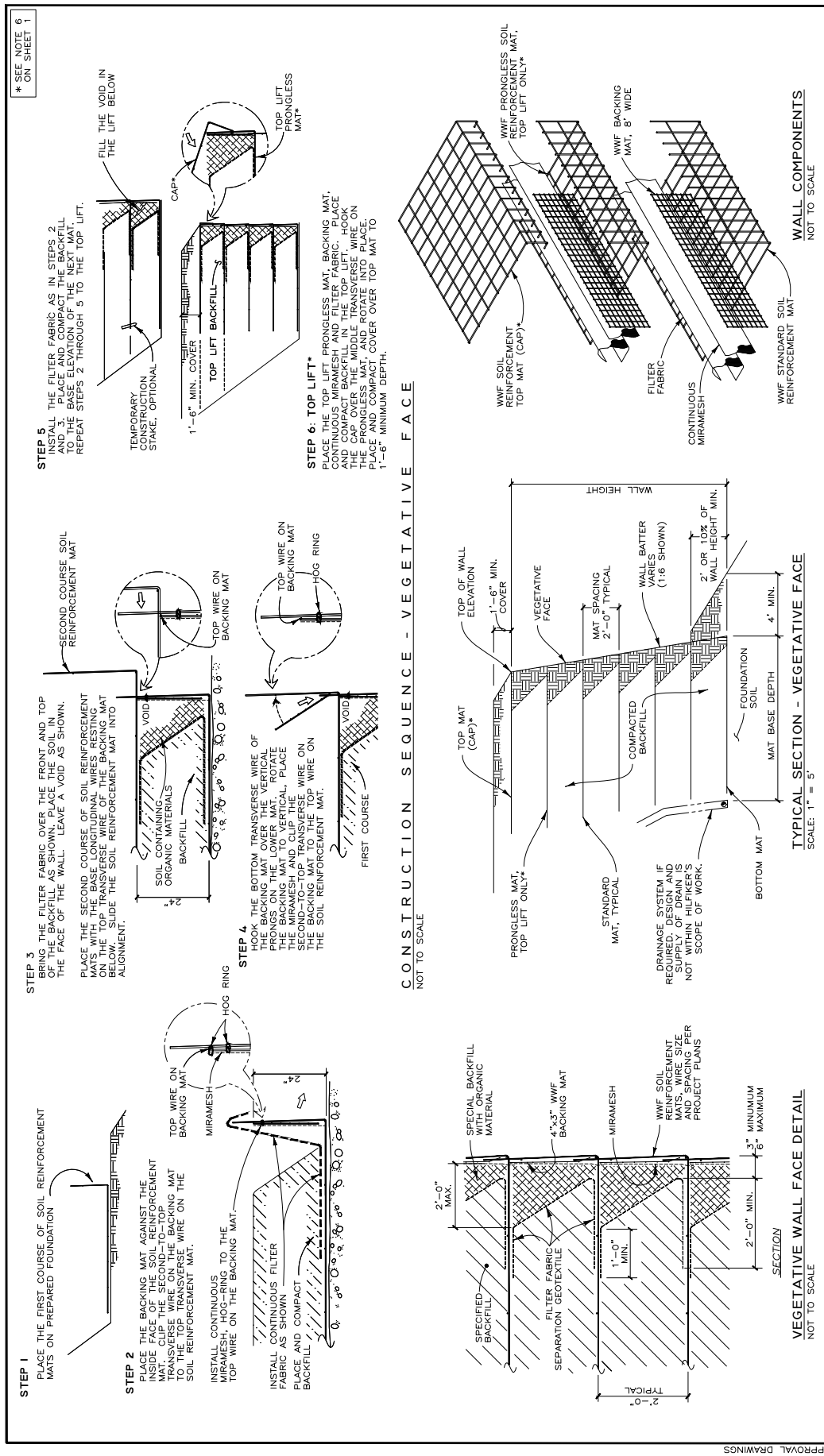


TYPICAL SECTION - ROCK FACE  
 NOT TO SCALE



SECTION ROCK FACING DETAIL  
 NOT TO SCALE

PROJECT NO.		STANDARD DRAWING	
SHEET 2		WELDED WIRE RETAINING WALL	
OF 7		ROCK FACE	
DWG DATE	SEPT 2021	SCALE	NOTED
REVISION DATE			
PROJ.MGR. ENGINEER CAD BY HRW		GRAPHIC SCALE LINE IS 20 UNITS LONG ON ORIGINAL DRAWING 0 10 20	
REVISION	DATE	DESCRIPTION	BY
1	9/7/21	NMD REVISIONS PER WSDOT	



\* SEE NOTE 6 ON SHEET 1

REV. NO.	DATE	BY	DESCRIPTION
1	9/7/21	NMD	REVISIONS PER WSDOT

PROJ. NO.	DWG. DATE	STANDARD DRAWING
3	SEPT 2021	WELDED WIRE RETAINING WALL

SHEET	REVISION DATE	SCALE	NOTED
3		NOTED	

PROJECT NO.	STANDARD DRAWING
3	WELDED WIRE RETAINING WALL

SHEET	STANDARD DETAILS
3	VEGETATIVE FACE

PROJ. NO.	ENGINEER	CADD BY
3	HRW	HRW

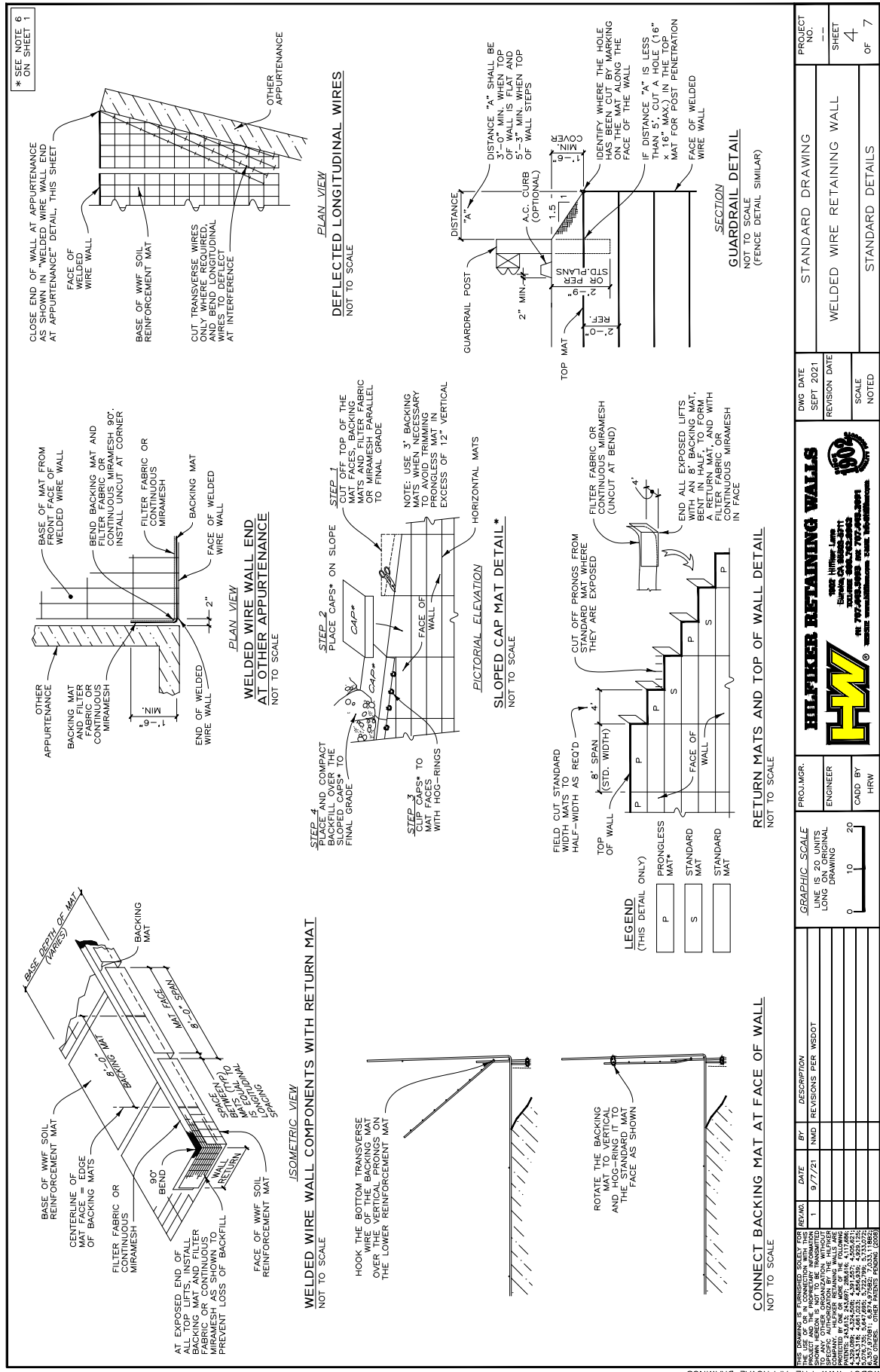
  

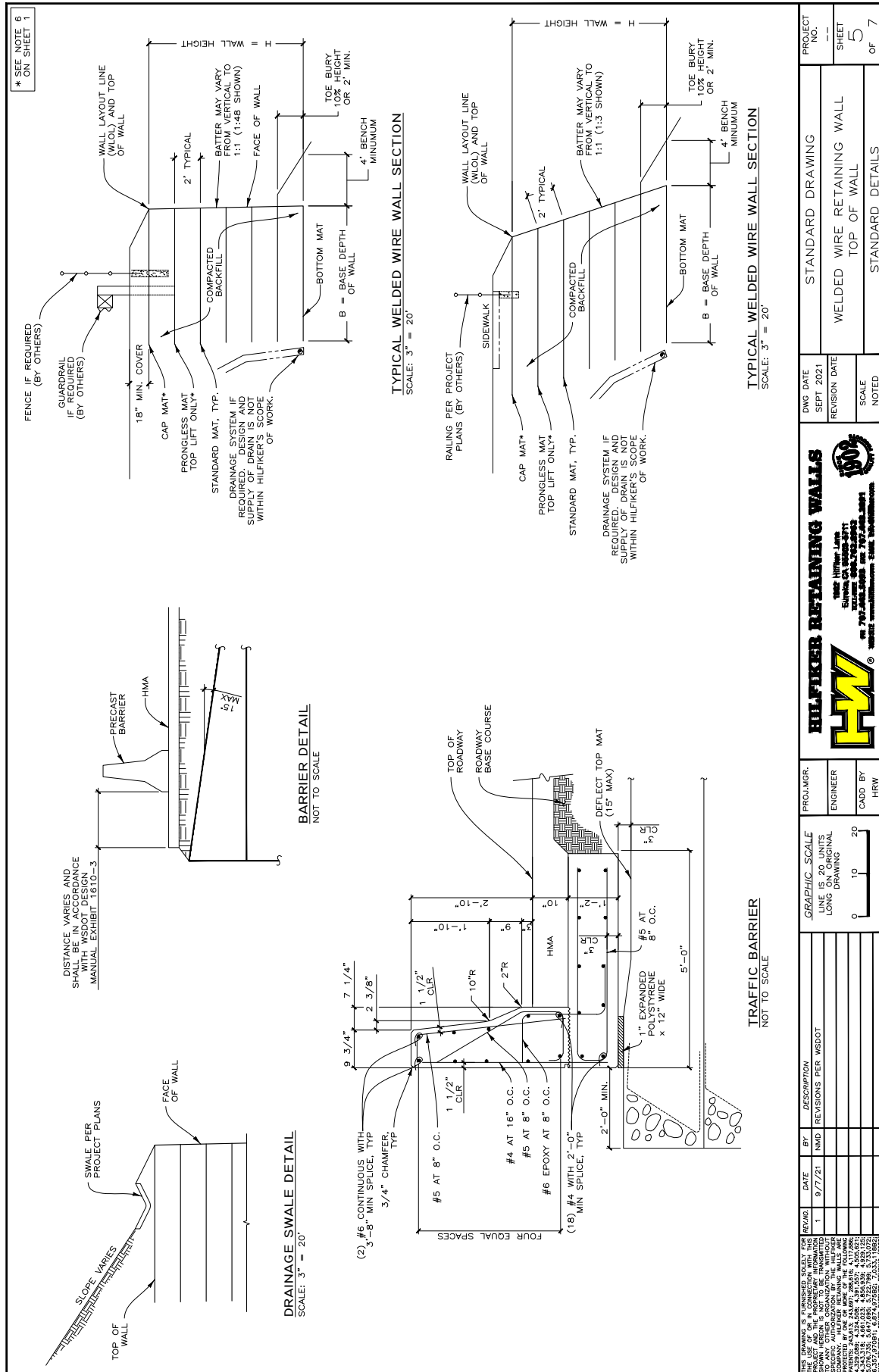
GRAPHIC SCALE  
LINE IS 20 UNITS LONG ON ORIGINAL DRAWING

0 10 20

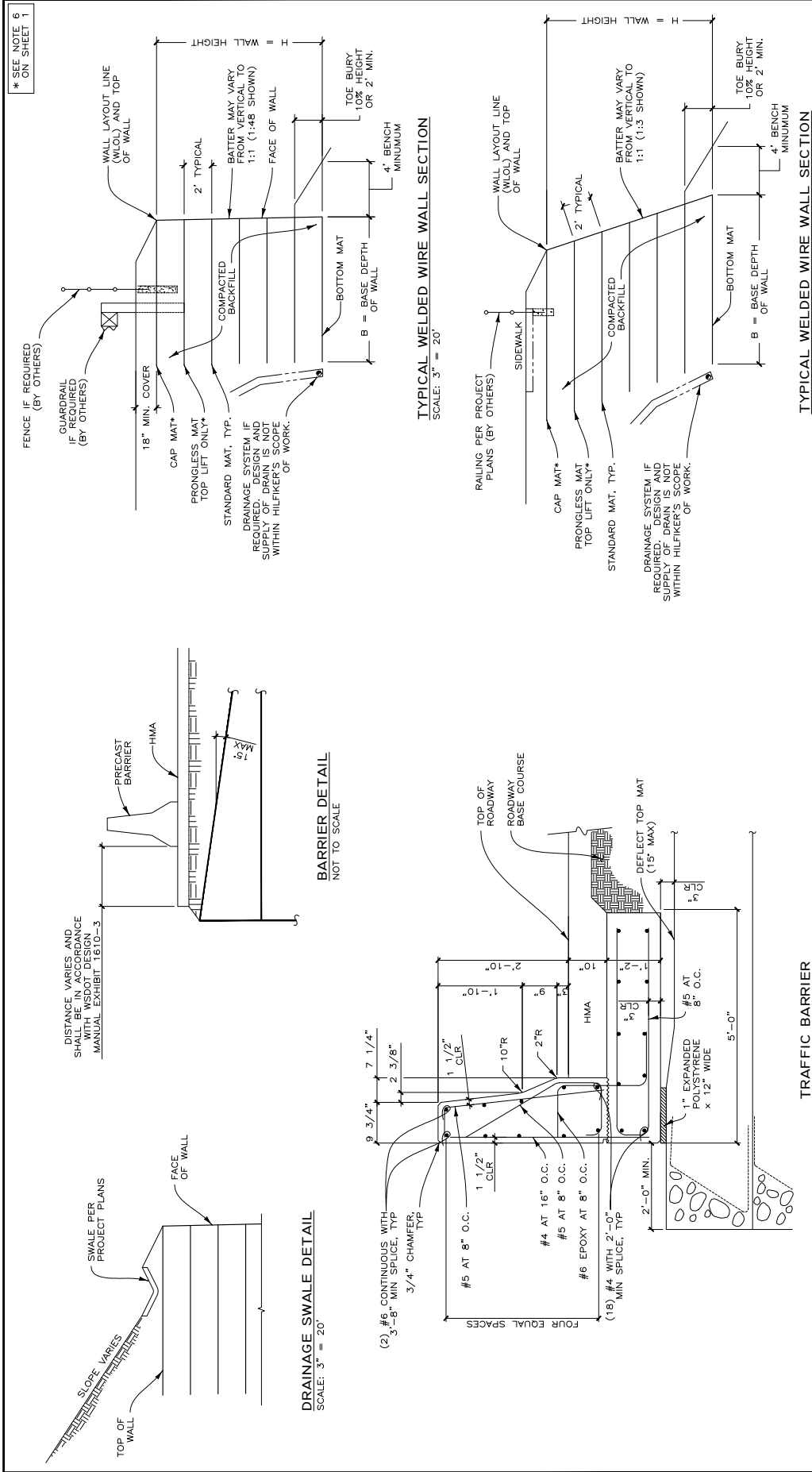
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PROJECT NO.		STANDARD DRAWING	
5		WELDED WIRE RETAINING WALL	
OF 7		TOP OF WALL	
SHEET		STANDARD DETAILS	
DWG DATE	REVISION DATE	SCALE	NOTED
SEPT 2021			
		PROJ.MGR. ENGINEER CADD BY HRW	
GRAPHIC SCALE LINE IS 20 UNITS LONG ON ORIGINAL DRAWING 0 10 20			
REV.	DATE	BY	DESCRIPTION
1	9/7/21	NMD	REVISIONS PER WSDOT
THIS DRAWING IS APPROVED AS SHOWN. THE USER SHALL BE RESPONSIBLE FOR VERIFYING THE ACCURACY OF THE INFORMATION PROVIDED AND FOR OBTAINING NECESSARY PERMITS AND APPROVALS FROM ALL APPLICABLE AGENCIES. THE USER SHALL BE RESPONSIBLE FOR OBTAINING NECESSARY PERMITS AND APPROVALS FROM ALL APPLICABLE AGENCIES. THE USER SHALL BE RESPONSIBLE FOR OBTAINING NECESSARY PERMITS AND APPROVALS FROM ALL APPLICABLE AGENCIES.			

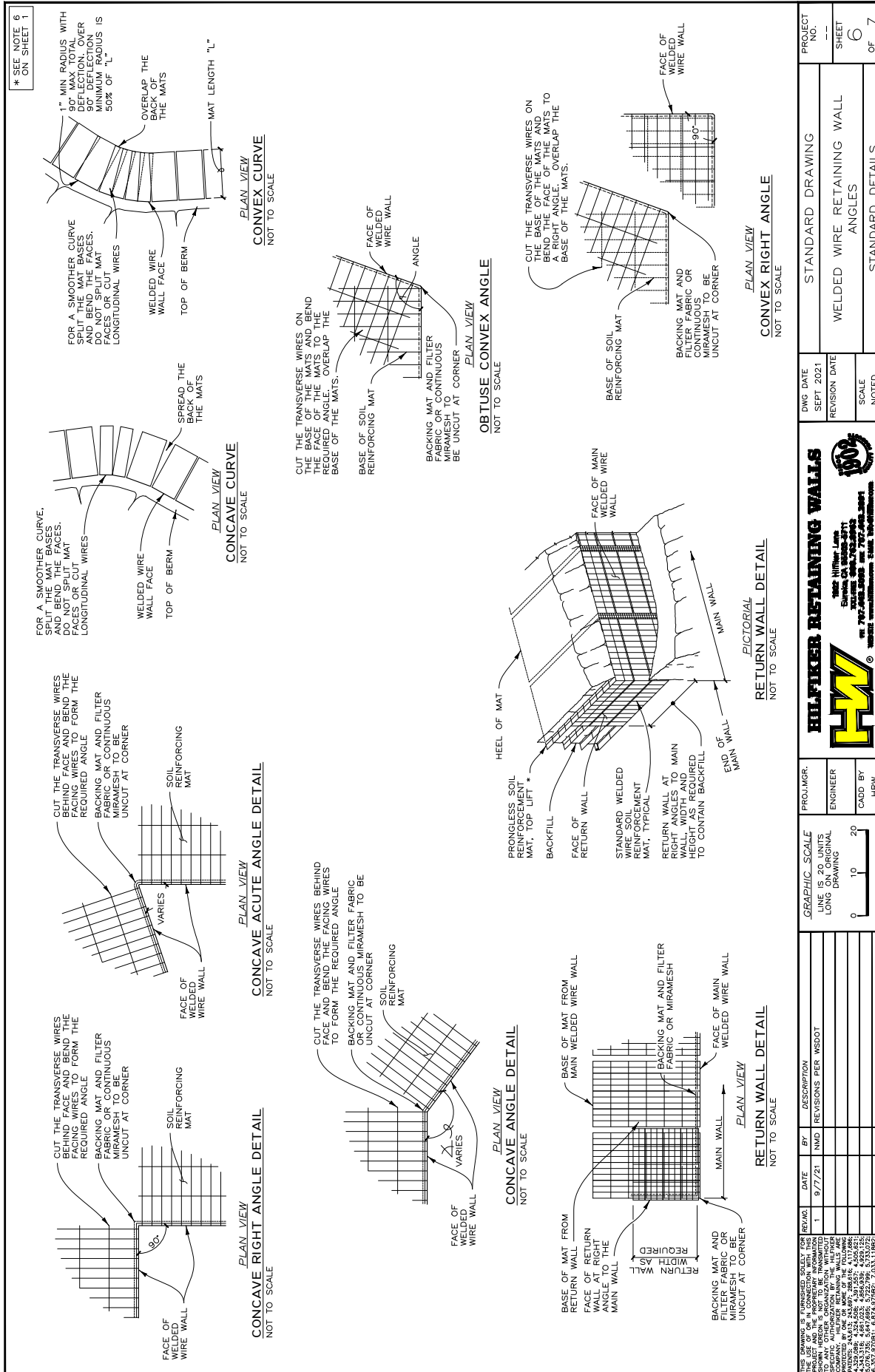


\* SEE NOTE 6 ON SHEET 1

TYPICAL WELDED WIRE WALL SECTION  
SCALE: 3" = 20'

TYPICAL WELDED WIRE WALL SECTION  
SCALE: 3" = 20'

PROJECT NO.		STANDARD DRAWING	
SHEET		WELDED WIRE RETAINING WALL	
5		TOP OF WALL	
OF 7		STANDARD DETAILS	
DWG DATE	REVISION DATE	PROJ. MGR.	SCALE
SEPT 2021		ENGINEER	NOTED
<p><b>HILFIKER RETAINING WALLS</b></p> <p><b>HW</b></p> <p>1800 Hilfiker Lane Baltimore, MD 21252-5771 Tel: 410-286-9200 Fax: 410-751-8244 www.hilfiker.com</p>			
GRAPHIC SCALE		PROJ. MGR.	
LINE IS 20 UNITS LONG ON ORIGINAL DRAWING		ENGINEER	
0 10 20		CADD BY	
		HRW	
REV. NO.	DATE	BY	DESCRIPTION
1	9/7/21	NMD	REVISIONS PER WSDOT



<p>THIS DRAWING IS FINISHED SOLELY FOR THE PROJECT AND THE PROPRIETARY INFORMATION OF THE ORGANIZATION WITHOUT TO ANY OTHER ORGANIZATION.</p> <p>COMPANY: HILFIKER RETAINING WALLS, INC.          ADDRESS: 1000 W. 10TH AVENUE, SUITE 100, DENVER, CO 80202          PHONE: 303.733.1122          FAX: 303.733.1122          E-MAIL: SALES@HILFIKER.COM          WWW.HILFIKER.COM</p>		<p>DWG DATE          SEPT 2021</p>	<p>STANDARD DRAWING</p>	<p>PROJECT NO.          ---</p>
<p>GRAPHIC SCALE          LINE IN ORIGINAL LONG DRAWING          0 10 20</p>	<p>PROJ. ENGINEER          CAD BY          HRW</p>	<p>REVISION DATE          SCALE          NOTED</p>	<p>WELDED WIRE RETAINING WALL ANGLES</p>	<p>SHEET          6          OF 7</p>
<p>RETURN WALL DETAIL</p>		<p>CONCAVE ACUTE ANGLE DETAIL</p>		<p>STANDARD DETAILS</p>
<p>RETURN WALL DETAIL</p>		<p>CONVEX ACUTE ANGLE DETAIL</p>		<p>STANDARD DETAILS</p>
<p>RETURN WALL DETAIL</p>		<p>CONVEX RIGHT ANGLE DETAIL</p>		<p>STANDARD DETAILS</p>

**\*\* MAX DIMENSIONS TO BE DETERMINED BY PROJECT-SPECIFIC SHOP DRAWINGS \*\***

**PIPE THROUGH BACK OF WALL**  
NOT TO SCALE

DEFLECT MATS ABOVE AND BELOW PIPE TO AVOID CONFLICT AROUND PIPE TO AVOID CONFLICT

24" PIPE (MAX)  
FACE OF WALL

**PLAN VIEW**  
NOT TO SCALE

FLAT BAR  
PIPE OR DRAIN INLET, 4'-0" MAX DIA\*\*  
BOLT BLOCKOUT TO THE TOP AND BOTTOM OF EACH MAT AS REQUIRED.  
CUT MAT WIRES AS NEEDED ONLY WITHIN LIMITS OF BLOCKOUT  
THREADED ROD

**SECTION**  
NOT TO SCALE

LONGITUDINAL WIRE, TYP  
FLAT BAR  
CARRIAGE BOLTS, TYP  
THREADED ROD, TYP

**SECTION**  
NOT TO SCALE

FLAT BAR  
LONGITUDINAL WIRE  
CARRIAGE BOLT  
TRANSVERSE WIRE

**NOTE:**  
DIMENSIONS OF THE FLAT BAR, RODS, DIMENSIONS OF THE BOLTS AND BOLTS TO BE DETERMINED BY PROJECT-SPECIFIC SHOP DRAWINGS.

**ANGLED PIPE PENETRATION**  
NOT TO SCALE

24" PIPE (MAX\*\*) THRU MAT BASE AND WALL FACE AT 45° MAX SKEW (VERT OR HORIZ)  
CUT ONLY TRANSVERSE WIRES AND DEFLECT LONGITUDINAL WIRES (15" MAX) AROUND PIPE  
BASE OF SOIL REINFORCEMENT MAT  
FACE OF WELDED WIRE WALL

**PLAN VIEW**  
NOT TO SCALE

48" MAX \*\*  
DROP INLET, JUNCTION BOX, PILING, ETC. (ROUND OR RECTANGULAR)  
CUT TRANSVERSE WIRES AS REQ'D AND DEFLECT LONGITUDINAL WIRES (15" MAX) AROUND OBSTRUCTION DO NOT CUT LONGITUDINAL WIRES.  
BASE OF SOIL REINFORCEMENT MAT  
FACE OF WELDED WIRE WALL

**MAT PENETRATION DETAIL**  
NOT TO SCALE

**PIPE THROUGH WALL FACE**  
NOT TO SCALE

ANY LARGE GAP AT THE TOP OF THE CULVERT MAY BE CLOSED WITH BACKING MAT AND FILTER FABRIC OR LONGITUDINAL WIRE CUT TO FIT, OR USE LARGER ROCKS  
LONGITUDINAL WIRE DO NOT CUT LONGITUDINAL WIRES AT ANY POINT OF THEIR LENGTH  
TRANSVERSE WIRE  
FACE OF WELDED WIRE WALL

AT THE LOWER SURFACE OF THE CULVERT, CUT THE TRANSVERSE WIRES ONLY IN THE LONGITUDINAL WIRES BACK TO FIT AGAINST THE CURVE OF THE CULVERT

**ELEVATION**  
NOT TO SCALE

NOTE: BACKING MATS AND FILTER FABRIC OR CONTINUOUS MIRAMESH (NOT SHOWN) ARE TO BE CUT OFF FLUSH WITH THE SIDES OF THE CULVERT

**PICTORIAL**  
NOT TO SCALE

CUT TRANSVERSE WIRES ONLY  
LIFT AND BEND LONGITUDINAL WIRES (15" MAX) TO FIT AROUND OBSTRUCTION; FOLD BACKING MAT AND SCREEN TO FIT.

**FITTING MATS TO OBSTRUCTION**  
NOT TO SCALE

**STANDARD DRAWING**  
WELDED WIRE RETAINING WALL  
OBSTRUCTIONS  
STANDARD DETAILS

**PROJECT NO.**  
7  
OF 7

**DWG DATE**  
SEPT 2021

**REVISION DATE**  
SCALE  
NOTED

**HILFIKER RETAINING WALLS**

**HW**

100% ORIGINAL LONG DRAWING

Graphic Scale: 2/3 ORIGINAL LONG DRAWING

0 10 20

PROJENGR: ENGINEER: CADD BY: HRW

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1	9/7/21	NMD	REVISIONS PER WSDOT

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