SCOPE

SCOPE INCLUDES STRUCTURAL DESIGN AND DETAILING OF GRAVITY AND REINFORCED SEGMENTED CONCRETE BLOCK RETAINING WALLS. THE WALLS DEPICTED IN THIS DOCUMENT ARE TO BE INSTALLED IN RESIDENTIAL AND LIGHT COMMERCIAL APPLICATIONS. EACH SPECIFIC WALL INSTALLATION IS TO MEET THE CONDITIONS AND ASSUMPTIONS OF OUR DESIGN AND SPECIFICATIONS. ALL OTHER SITE CONDITIONS REQUIRE SITE SPECIFIC DESIGNS. ALL CONSTRUCTION IS TO BE DONE IN ACCORDANCE WITH THIS DOCUMENT, STANDARD INDUSTRY PRACTICE, AND THE REQUIREMENTS OF ALL APPLICABLE CODES. SPECIFIC SITE PLANS ARE OUTSIDE THE SCOPE OF THIS DOCUMENT. THE AFFIXED SEAL HERE IS FOR THE FULL DOCUMENT SET SPECIFIED IN THE INDEX.

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S6 - S10	BLOCK UNIT DIMENSIONS
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S12	GRAVITY WALL w/ SLOPING BACKFILL
S13	GRAVITY WALL w/ SURCHARGE LOAD
S14 - S15	REINFORCED WALL w/ LEVEL BACKFILL
S16 - S17	REINFORCED WALL w/ SLOPING BACKFILL
S18 - S19	REINFORCED WALL w/ SURCHARGE LOAD
S20 - S21	TIEBACK WALL W/ LEVEL BACKFILL
S22 - S23	TIEBACK WALL w/ SLOPING BACKFILL
S24 - S25	TIEBACK WALL w/ SURCHARGE LOAD
S26	TIEBACK DETAIL AND REQUIRED CAPACITIES

I hereby certify that this plan, specification or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of South Dakota.

Print Na	me:	Neil A. Groon	
Signed:	Nei	a. Drion	
Date: _	6/22/07	SD License Number:	8609

Checked By: DGS

Approved By: NAG



State: SD Zip Code

lune 22, 2007

Monster Blocks Index & Certification		Midwest Ready Mix 1405 East Highway 50 Vermillion, SD 57069				
Ulteigengineers	5201 East River Road Suite 308 Minneapolis, Minnesota 55421 Phone: 763.571.2500 Fax: 763.571.1168 Web: www.ulteig.com Bismarck - Detroit Lakes - Fargo - Minneapolis - Sloux Falls	JOB SITE INFORMATION (to be filled out by the contractor) Owner: Street Address:	Revision	Date	Description	

SPECIFICATION FOR SEGMENTAL RETAINING WALL SYSTEMS

PART 1: GENERAL

1.1 SECTION INCLUDES

- A. RETAINING WALL CONSTRUCTED OF MODULAR CONCRETE BLOCK UNITS
- B. LEVELING PAD BASE
- C. DRAINAGE AGGREGATE
- D. BACKFILL
- E. GEOSYNTHETIC REINFORCEMENT FABRIC AS REQUIRED
- F. EMBEDDED EARTH ANCHORS AS REQUIRED
- G. DRAINAGE PIPE

1.2 REFERENCE STANDARDS

A. SEGMENTAL RETAINING WALL UNITS

- 1. ASTM C 1372 STANDARD SPECIFICATION FOR SEGMENTAL RETAINING WALL UNITS
- 2. **ASTM C 140 STANDARD TEST METHODS OF SAMPLING AND TESTING CONCRETE MASONRY UNITS**
- 3. ACI 318-05 BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE

B. GEOSYNTHETIC REINFORCEMENT

- 1. **ASTM D 4595** TENSILE PROPERTIES OF GEOTEXTILES BY THE WIDE-WIDTH STRIP METHOD
- 2. **ASTM D 5262** TEST METHOD FOR EVALUATING THE UNCONFINED CREEP BEHAVIOR OF GEOSYNTHETICS
- 3. GRI:GG1 SINGLE RIB GEOGRID TENSILE STRENGTH
- 4. GRI:GG5 GEOGRID PULLOUT

C. SOILS

- 1. ASTM D 698- MOISTURE DENSITY RELATIONSHIP FOR SOILS, STANDARD METHOD
- 2. ASTM D 422 GRADATION OF SOILS
- 3. ASTM D 424- ATTERBERG LIMITS OF SOIL

D. DRAINAGE PIPE

- 1. ASTM D 3034 SPECIFICATION FOR POLYVINYL CHLORIDE (PVC) PLASTIC PIPE
- 2. ASTM D 1248 SPECIFICATION FOR CORRUGATED PLASTIC PIPE

E. ENGINEERING DESIGN

- 1. "NCMA DESIGN MANUAL FOR SEGMENTAL RETAINING WALLS", SECOND EDITION
- 2. INTERNATIONAL BUILDING CODE 2006
- 3. DESIGN FACTORS OF SAFETY:
 - A. SLIDING 1.5
 - B. OVERTURNING 1.5
 - C. BEARING 3.0
 - D. INTERNAL STABILITY 1.5
 - E. LOCAL STABILITY 1.5
 - F. GLOBAL STABILITY N/A
- 4. GLOBAL STABILITY OF SITE IS NOT ADDRESSED IN THE FOLLOWING DESIGN. ADEQUACY OF SITE SOIL CONDITIONS FOR BEARING CAPACITY AND OVERALL STABILITY ARE THE RESPONSIBILITY OF THE CONTRACTOR /OWNER. A GEOTECHNICAL ENGINEER MAY BE CONTACTED TO DETERMINE THE ABOVE.

1.3 DELIVERY, STORAGE AND HANDLING

A. CONTRACTOR IS TO PREVENT EXCESSIVE MUD, WET CONCRETE, EPOXIES, AND LIKE MATERIALS THAT MAY AFFIX THEMSELVES, FROM COMING IN CONTACT WITH MATERIALS.

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B. CONTRACTOR IS TO PROTECT MATERIALS FROM DAMAGE. DAMAGED MATERIALS SHALL NOT BE INCORPORATED INTO THE RETAINING WALL.

PART 2: MATERIALS

2.1 SEGMENTAL RETAINING WALL UNITS

- A. SEGMENTED RETAINING WALL UNITS ARE TO BE LANDSCAPE BLOCKS MANUFACTURED BY MIDWEST READY MIX OF SOUTH DATKOTA AS DIMENSIONED ON THE STRUCTURAL DRAWINGS
- B. CONCRETE USED FOR CONSTRUCTION OF BLOCK UNITS IS TO HAVE A MINIMUM COMPRESSION STRENGTH OF 4,000 PSI AT 28 DAYS. ENTRAINED AIR CONTENT IS TO BE BETWEEN 5 AND 7%.
- C. BLOCK UNITS FACE IS TO BE OF APPROXIMATE STRAIGHT GEOMETRY.
- D. BLOCK UNITS ARE TO BE STRUCTURALLY SOUND AND FREE OF CRACKS OR OTHER DEFECTS THAT WOULD PREVENT THE PROPER PLACING OF THE UNIT OR SIGNIFICANTLY IMPAIR THE STRENGTH OR PERMANENCE OF THE STRUCTURE.

2.2 GEOSYNTHETIC REINFORCEMENT

- A. GEOSYNTHETIC REINFORCEMENT IS TO CONSIST OF GEOGRIDS OR GEOTEXTILES
 MANUFACTURED AS A SOIL REINFORCEMENT ELEMENT. THE MANUFACTURERS/SUPPLIERS
 OF THE GEOSYNTHETIC REINFORCEMENT ARE TO HAVE DEMONSTRATED CONSTRUCTION OF
 SIMILAR SIZE AND TYPES OF SEGMENTAL RETAINING WALLS ON PREVIOUS PROJECTS.
- B. GEOSYNTHETIC TYPES IN ACCORDANCE WITH THE ENGINEERED DESIGN INCLUDE:

MIRAFI - MIRAGRID 5XT STRATA SYSTEMS - STRATAGRID 350 SYNTEEN TECHNICAL FABRICS - SF55

CONTACT ULTEIG ENGINEERS FOR APPROVED GEOSYNTHETIC REINFORCEMENT ALTERNATIVES.

2.3 LEVELING PAD BASE

A. AGGREGATE BASE: CRUSHED STONE OR GRANULAR FILL MEETING THE FOLLOWING GRADATION AS DETERMINED IN ACCORDANCE WITH ASTM D448:

SIEVE SIZE	PERCENT PASSING
1 INCH	100
NO. 4	35 TO 70
NO. 40	10 TO 35
NO. 200	3 TO 10

- 1. BASE THICKNESS: DEPTH AS SHOWN ON STRUCTURAL DRAWINGS (MINIMUM COMPACTED THICKNESS).
- B. OPTIONAL CONCRETE BASE: LEAN CONCRETE OF APPROXIMATE 3" THICKNESS WITH A MINIMUM COMPRESSION STRENGTH OF 2,500 PSI AT 28 DAYS.

2.4 DRAINAGE AGGREGATE

A. DRAINAGE AGGREGATE IS TO BE ANGULAR, 1 INCH MINUS CLEAN STONE OR GRANULAR FILL MEETING THE FOLLOWING GRADATION AS DETERMINED IN ACCORDANCE WITH ASTM D422

SIEVE SIZE	PERCENT PASSING	
1 INCH	100	
3/4 INCH	75-100	
NO. 4	0-60	
NO. 40	0-50	
NO. 200	0-5	

2.5 DRAINAGE PIPE

A. THE DRAINAGE COLLECTION PIPE IS TO BE A PERFORATED OR SLOTTED PVC, OR CORRUGATED HDPE PIPE. THE DRAINAGE PIPE MAY BE WRAPPED WITH A GEOTEXTILE TO FUNCTION AS A FILTER.

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B. DRAINAGE PIPE IS TO BE MANUFACTURED IN ACCORDANCE WITH ASTM D 3034 AND/OR ASTM D 1248.

2.6 BACKFILL

- A. BACKFILL MATERIAL IS TO BE AS SHOWN ON THE STRUCTURAL DRAWINGS. THE ASSUMED PROPERTIES OF EACH SOIL TYPE ARE AS FOLLOWS:
 - 1. SAND
 - A. SOIL CLASSES GW, GP, SW, & SP.
 - B. EFFECTIVE INTERNAL SOIL FRICTION ANGLE OF 34 DEGREES USED IN DESIGN.
 - C. SOIL UNIT WEIGHT APPROXIMATELY 120 PCF.
 - 2. SANDY CLAY/SILTY SAND
 - A. SOIL CLASSES GM, GC, SM, SM-SC, & ML.
 - B. EFFECTIVE INTERNAL SOIL FRICTION ANGLE OF 30 DEGREES USED IN DESIGN.
 - C. SOIL UNIT WEIGHT APPROXIMATELY 120 PCF.
 - 3. LEAN CLAY
 - A. SOIL CLASSES SC, ML-CL, & INORGANIC CL.
 - B. SOIL INTERNAL SOIL FRICTION ANGLE APPROXIMATELY 26 DEGREES.
 - C. SOIL UNIT WEIGHT APPROXIMATELY 115 PCF.
- B. MAXIMUM ALLOWABLE PARTICLE SIZE OF BACKFILL MATERIAL IS 2 INCHES.
- C. FAT OR SWELLING CLAYS ARE NOT TO BE PLACED BEHIND RETAINING WALL OR WITHIN A 1 TO 1 PROJECTION OF THE INFLUENCE ZONE.

2.7 EMBEDDED SOIL ANCHORS

- A. ANCHORS ARE TO BE INSTALLED TO A MINIMUM TENSILE CAPACITY IN ACCORDANCE WITH THIS DOCUMENT.
- B. THE ANCHORS ARE TO BE OF APPROPRIATE MATERIAL OR COATED WITH APPROPRIATE MATERIAL FOR SUSTAINED BELOW GRADE USE.

PART 3: EXECUTION

4.1 EXCAVATION

A. CONTRACTOR IS TO VERIFY LOCATION OF EXISTING STRUCTURES AND UTILITIES PRIOR TO EXCAVATION. CONTRACTOR IS TO ENSURE ALL SURROUNDING STRUCTURES ARE PROTECTED FROM THE EFFECTS OF WALL EXCAVATION. EXCAVATION SUPPORT, IF REQUIRED, IS THE RESPONSIBILITY OF THE CONTRACTOR.

4.2 FOUNDATION PREPARATION

A. LEVELING PAD IS TO BE PLACED ON NATIVE SOIL WITH AN ALLOWABLE BEARING CAPACITY OF AT LEAST 2,000 PSF, OR AN ENGINEERED FILL CAPABLE OF ACHIEVING THE REQUIRED CAPACITY AND COMPACTED TO 95% OF STANDARD PROCTOR DENSITY.

4.3 LEVELING PAD CONSTRUCTION

- A. LEVELING PAD IS TO BE PLACED AS SHOWN ON THE STRUCTURAL DRAWINGS IN TERMS OF WIDTH AND DEPTH
- B. LEVELING PAD IS TO BE COMPACTED TO 95% OF STANDARD PROCTOR OR 90% OF MODIFIED PROCTOR TO ENSURE A LEVEL, HARD SURFACE ON WHICH TO PLACE THE FIRST COURSE BLOCKS. PAD IS TO BE PLACED AT THE PROPER ELEVATION TO ENSURE THE FINAL ELEVATION SHOWN ON THE STRUCTURAL DRAWINGS. WELL-GRADED SAND MAY BE USED TO SMOOTH THE TOP ½ INCH ON THE LEVELING PAD (WHEN USING GRAVEL PAD).

4.4 BLOCK UNIT INSTALLATION

A. FIRST COURSE OF BLOCK UNITS IS TO BE PLACED ON THE LEVELING PAD. THE UNITS ARE TO BE LEVELED SIDE-TO-SIDE, FRONT-TO-REAR AND WITH ADJACENT UNITS, AND ALIGNED TO ENSURE CONTACT WITH THE LEVELING PAD. NO SIGNIFICANT GAPS ARE TO BE LEFT BETWEEN THE FRONTS OF ADJACENT UNITS.

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- B. THE BACKFILL IN FRONT AND BACK OF ENTIRE BASE ROW IS TO BE PLACED AND COMPACTED TO FIRMLY ANCHOR THE BLOCK UNITS IN PLACE. CHECK ALL UNITS AGAIN FOR LEVEL AND ALIGNMENT.
- C. ALL EXCESS DEBRIS IS TO BE CLEANED FROM TOP OF UNITS AND THE NEXT COURSE OF UNITS INSTALLED ON TOP OF THE UNITS BELOW.
- D. POSITION BLOCK UNITS IN A STAGGERED PATTERN WITH THE SEAMS OF BLOCKS BELOW. BLOCK UNITS ARE TO BE PLACED FULLY FORWARD SO KNOB AND GROOVE ARE ENGAGED. CHECK EACH BLOCK FOR PROPER ALIGNMENT AND LEVEL.
- E. PLACE DRAINAGE MEDIA AND BACKFILL BEHIND WALL AS SHOWN ON THE STRUCTURAL DRAWINGS. ENSURE PROPER PLACEMENT OF FILTER FABRIC AND GEOSYNTHETIC REINFORCEMENT. IF REQUIRED.

4.5 GEOSYNTHÉTIC REINFORCEMENT PLACEMENT

- A. PLACE GEOSYNTHETIC REINFORCEMENT AT THE ELEVATIONS AND TO THE EXTENT SHOWN ON THE STRUCTURAL DRAWINGS.
- B. LAY GEOSYNTHETIC REINFORCEMENT HORIZONTALLY ON COMPACTED BACKFILL AND ATTACHED TO THE WALL UNITS. PULL REINFORCEMENT TAUT AND ANCHOR PRIOR TO BACKFILL PLACEMENT ON THE REINFORCEMENT.
- C. ORIENT GEOSYNTHETIC REINFORCEMENT WITH THE HIGHEST STRENGTH AXIS PERPENDICULAR TO THE WALL ALIGNMENT. REINFORCEMENT IS TO BE CONTINUOUS BEHIND WALL FOR FULL EMBEDMENT LENGTH WITH NO SPLICE POINTS.
- D. TRACKED CONSTRUCTION EQUIPMENT SHALL NOT BE OPERATED DIRECTLY ON THE GEOSYNTHETIC REINFORCEMENT. A MINIMUM OF 6 INCHES OF BACKFILL IS REQUIRED PRIOR TO OPERATION OF TRACKED VEHICLES OVER THE GEOSYNTHETIC.

4.6 DRAINAGE MATERIALS

- A. DRAINAGE AGGREGATE SHALL BE PLACED IN ACCORDANCE WITH THE STRUCTURAL DRAWINGS.
- B. DRAINAGE COLLECTION PIPES SHALL BE INSTALLED TO ENSURE GRAVITY FLOW OF WATER AWAY FROM BASE OF RETAINING WALL. PROVIDE OUTLETS TO DAYLIGHT OR STORM SEWER IF PERMITTED, AS REQUIRED.

4.7 BACKFILL PLACEMENT

- A. PLACE, SPREAD, AND COMPACT BACKFILL IN SUCH A MANNER THAT MINIMIZES THE DEVELOPMENT OF SLACK IN THE GEOSYNTHETIC REINFORCEMENT AND OTHER DAMAGE.
- B. PLACE AND COMPACT REINFORCED BACKFILL IN LIFTS NOT TO EXCEED 6 INCHES WHEN HAND COMPACTION IS USED, OR 8 TO 10 INCHES WHEN HEAVY COMPACTION EQUIPMENT IS USED. DECREASE LIFT THICKNESS WHERE NECESSARY TO ACHIEVE REQUIRED DENSITY.
- C. COMPACT REINFORCED BACKFILL TO 95 PERCENT OF THE MAXIMUM DENSITY AS DETERMINED BY ASTM D 698.
- D. ALLOW ONLY LIGHTWEIGHT HAND-OPERATED EQUIPMENT WITHIN 3 FEET FROM THE REAR OF THE MODULAR CONCRETE UNIT.
- E. DO NOT OPERATE TRACKED CONSTRUCTION EQUIPMENT DIRECTLY UPON THE GEOSYNTHETIC REINFORCEMENT. A MINIMUM FILL THICKNESS OF 6 INCHES IS REQUIRED PRIOR TO OPERATION OF TRACKED VEHICLES OVER THE GEOSYNTHETIC. TRACKED VEHICLE TURNING SHOULD BE KEPT TO A MINIMUM TO PREVENT TRACKS FROM DISPLACING THE FILL AND DAMAGING THE GEOSYNTHETIC.

4.8 EMBEDDED EARTH ANCHOR PLACEMENT

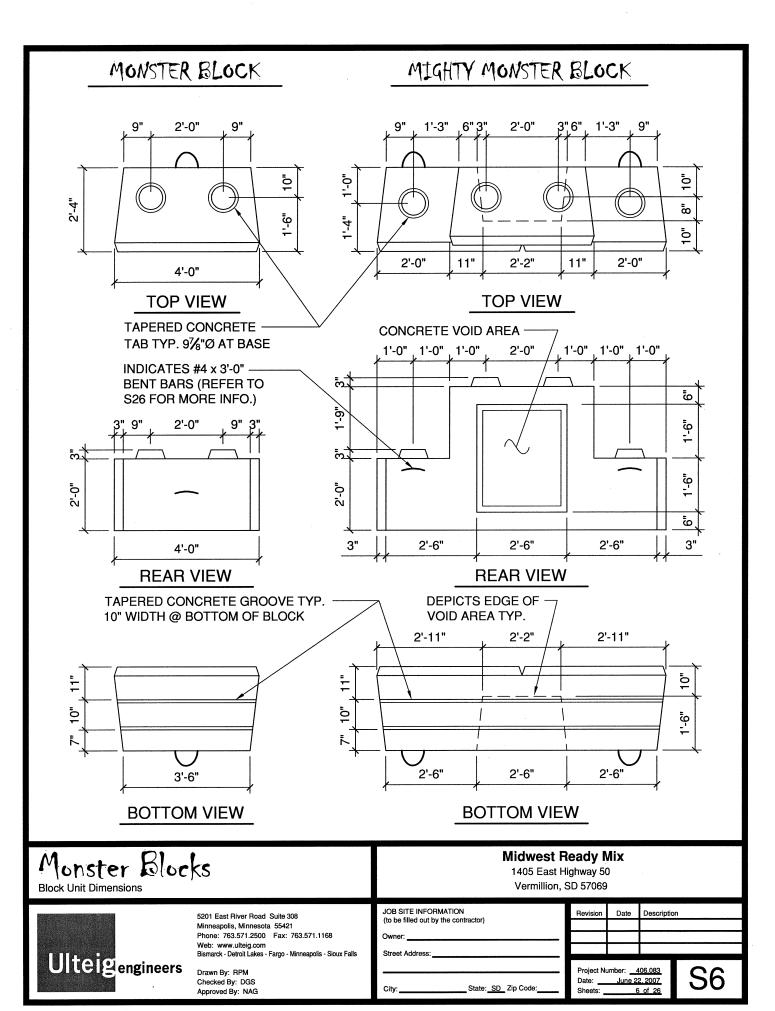
A. CONTACT ULTEIG FOR SITE SPECIFIC ANCHOR LOCATION MAP. ANCHOR PLACEMENT WILL VARY WITH BLOCK SIZE AND SITE SPECIFIC VARIABLES.

4.9 CONSTRUCTION TOLERANCES

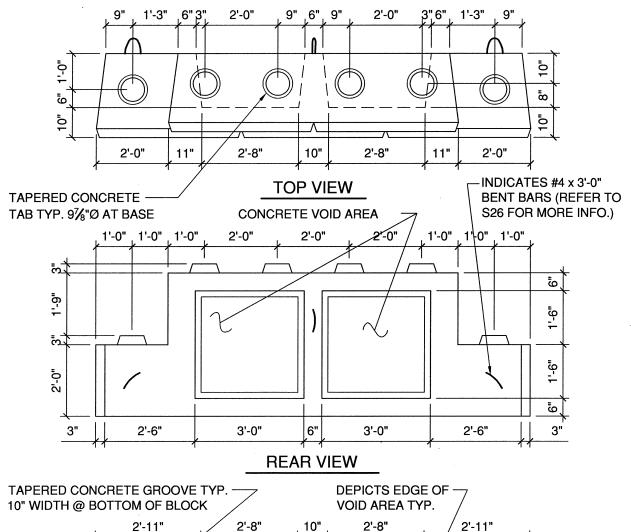
- A. VERTICAL ALIGNMENT WITHIN 1 ½ INCHES OF LEVEL OVER A 10 FOOT DISTANCE
- B. WALL BATTER WITHIN 2 DEGREES OF SHOWN ON STRUCTURAL DRAWINGS
- C. HORIZONTAL ORIENTATION GAPS BETWEEN ADJACENT UNITS LESS THAN ½ INCH

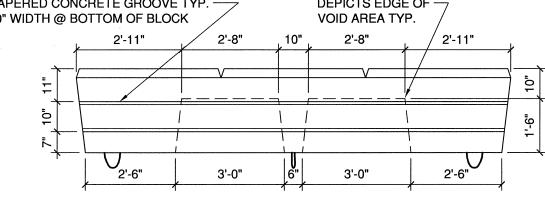
END OF SECTION

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Ulteig engineers	Drawn By: RPM Checked By: DGS Approved By: NAG	City: State: <u>SD</u> Zip Code:	Project No Date: Sheets:	umber:4 June 2		35



MEGA MONSTER BLOCK





BOTTOM VIEW

Monster	Blocks

Block Unit Dimensions

Midwest Ready Mix

1405 East Highway 50 Vermillion, SD 57069



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Project Number: 406.083

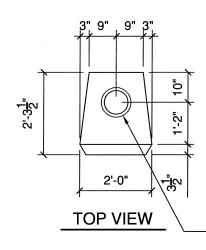
Date: June 22, 2007

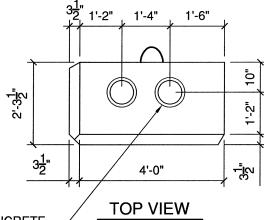
Sheets: 7 of 26

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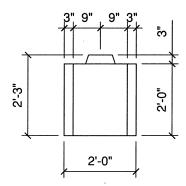
HALF BLOCK

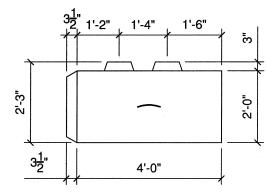
FULL CORNER BLOCK





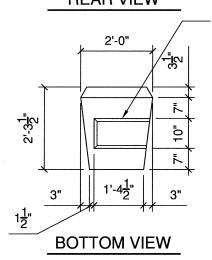
TAPERED CONCRETE TAB TYP. 97/8"Ø AT BASE

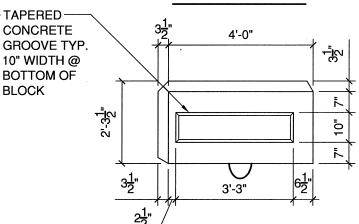




REAR VIEW

REAR VIEW





Monster Blocks

Midwest Ready Mix

BOTTOM VIEW

Block Unit Dimensions

1405 East Highway 50 Vermillion, SD 57069

Date:

Ulteig engineers

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FULL ANGLE BLOCK TOP ANGLE BLOCK INDICATES 6" -1'-0" 1'-03" 1'-11\frac{1}{4}" $2'-0\frac{3}{4}"$ 1'-11¹/₄" RECESSED AREA 37. 2-O 2'-3<u>1</u>" -<u>"</u>[c 4'-0" -<u></u>[6 4'-0" **TOP VIEW TOP VIEW TAPERED CONCRETE** TAB TYP. 97/8"Ø AT BASE 1'-0" 1'-0<u>3</u>" $2'-0\frac{3}{4}"$ 1'-11\frac{1}{4}" 1'-11¹/₄" ကြ ē 2'-3" 2-0 <u>-</u>-6 4'-0" 4'-0" **REAR VIEW REAR VIEW TAPERED CONCRETE** GROOVE TYP. 4'-0" 4'-0" 10" WIDTH @ Ę 2<mark>1</mark>-**BOTTOM OF BLOCK** -2'-3<u>1</u>" 2'-3<mark>1</mark>" <u>-</u>0 3'-9¹/₂" 3'-8¹/₂" **BOTTOM VIEW BOTTOM VIEW** Monster Blocks **Midwest Ready Mix** 1405 East Highway 50 Vermillion, SD 57069 **Block Unit Dimensions** JOB SITE INFORMATION Description 5201 East River Road Suite 308 Minneapolis, Minnesota 55421 Phone: 763.571.2500 Fax: 763.571.1168

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City:

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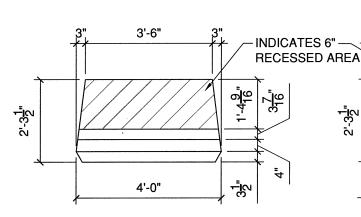
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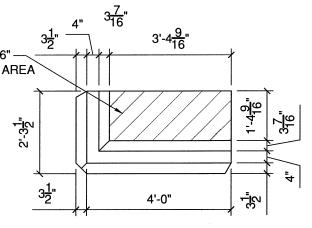
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FULL TOP CAP BLOCK

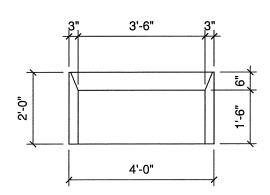
FULL TOP CAP CORNER BLOCK

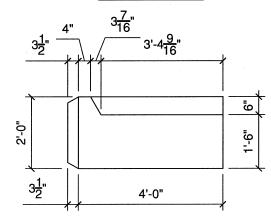


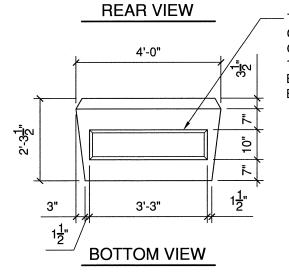


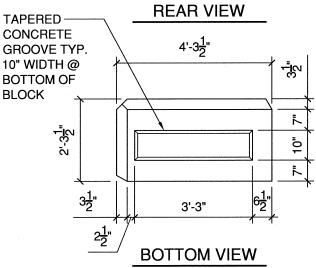
TOP VIEW

TOP VIEW









Monster Blocks

Midwest Ready Mix

Block Unit Dimensions

1405 East Highway 50 Vermillion, SD 57069



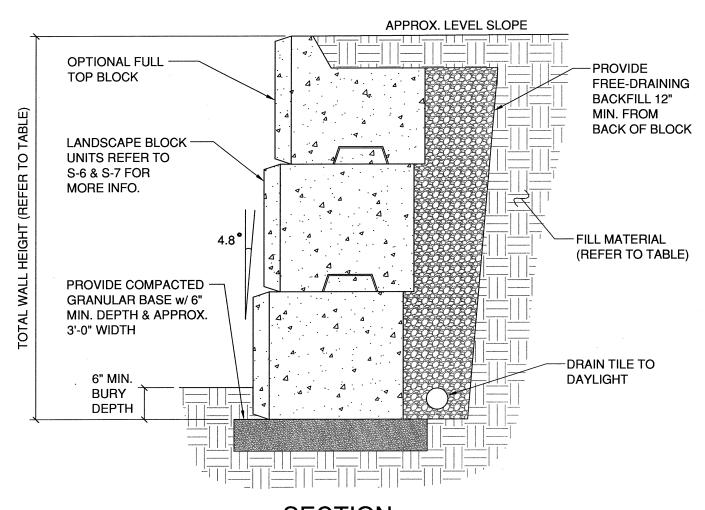
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Revision	Date	Description

Project Number: <u>406.083</u>
Date: <u>June 22, 2007</u>
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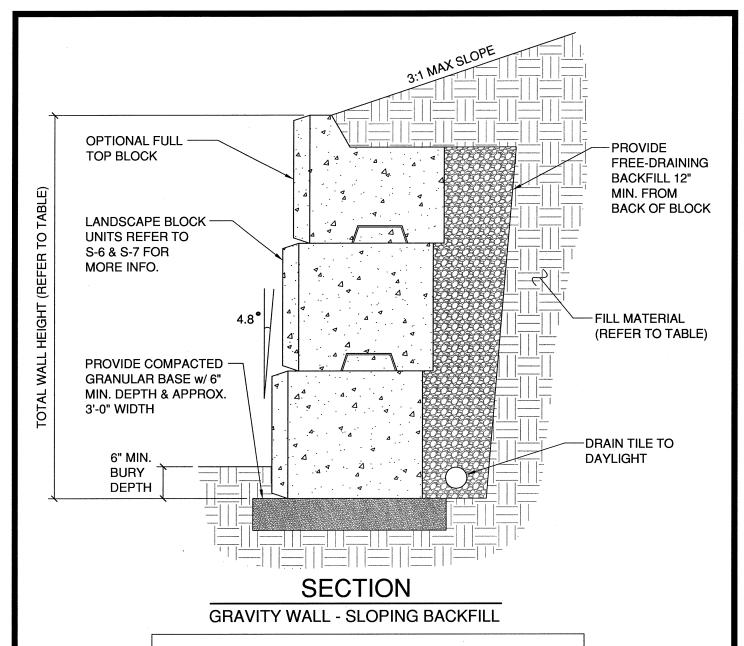


SECTION

GRAVITY WALL - LEVEL BACKFILL

GRAVITY RETAINING WALLS						
SOIL TYPE CLASSIFICATIONS MAX. WALL HEIGHT						
SAND	8'-0"					
SANDY CLAY	6'-0"					
LEAN CLAY SC, ML-CL, & CL 6'-0"						
FAT & ORGANIC S	FAT & ORGANIC SWELLING CLAYS MUST BE REPLACED w/ ABOVE					

Monster Blocks Gravity Wall - Level Backfill		Midwest Ready Mix 1405 East Highway 50 Vermillion, SD 57069				
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Ulteig engineers	Bismarck - Detroit Lakes - Fargo - Minneapolis - Sloux Falls Drawn By: RPM Checked By: DGS Approved By: NAG	Street Address: City: State: _SD_ Zip Code:	Project No Date: Sheets:	June 2		S11



GRAVITY RETAINING WALLS						
SOIL TYPE CLASSIFICATIONS MAX. WALL HEIGHT						
SAND	6'-0"					
SANDY CLAY	6'-0"					
LEAN CLAY SC, ML-CL, CL 4'-0"						
FAT & ORGANIC S	SWELLING CLAYS MUST BE F	REPLACED w/ ABOVE				

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Gravity Wall - Sloping Backfill

Midwest Ready Mix

1405 East Highway 50 Vermillion, SD 57069



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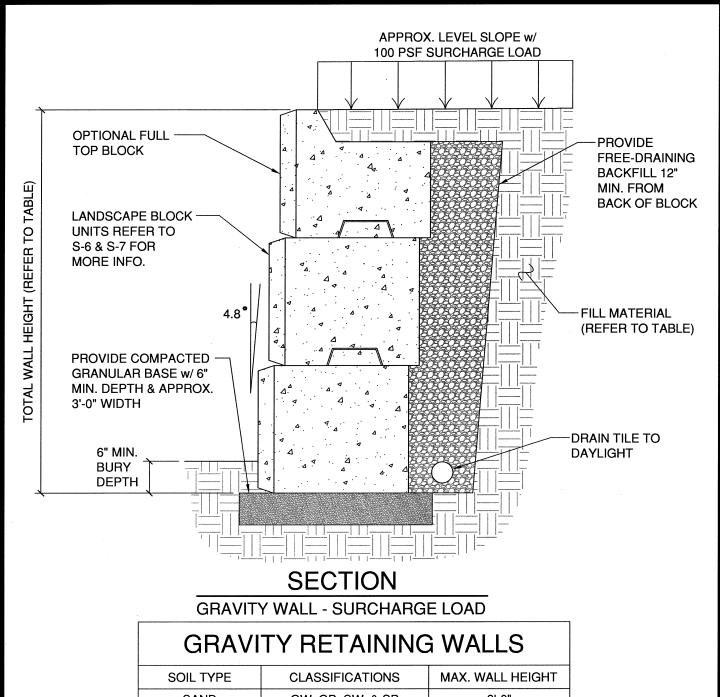
Drawn By: RPM Checked By: DGS Approved By: NAG

JOB SITE INFORMATION (to be filled out by the contractor)	
Owner:	
Street Address:	

State: SD Zip Code

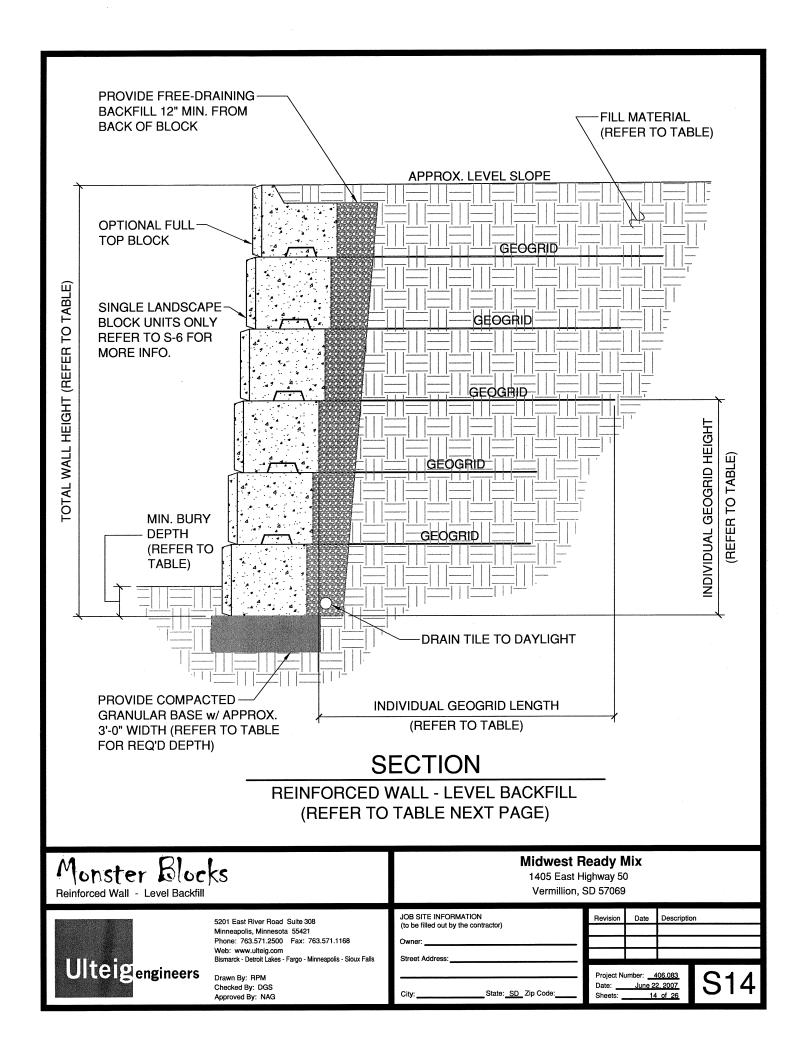
Revision	Date	Description

Project Number: 406.083 June 22, 2007 Date:



GRAVITY RETAINING WALLS						
SOIL TYPE CLASSIFICATIONS MAX. WALL HEIGHT						
SAND	8'-0"					
SANDY CLAY GM, GC, SM, SM-CL, & ML 6'-0"						
LEAN CLAY SC, ML-CL, & CL 6'-0"						
FAT & ORGANIC S	WELLING CLAYS MUST BE F	REPLACED w/ ABOVE				

Midwest Ready Mix Monster Blocks 1405 East Highway 50 Gravity Wall - Surcharge Load Vermillion, SD 57069 JOB SITE INFORMATION Revision Description 5201 East River Road Suite 308 (to be filled out by the contractor) Minneapolis, Minnesota 55421 Phone: 763.571.2500 Fax: 763.571.1168 Web: www.ulteig.com Bismarck - Detroit Lakes - Fargo - Minneapolis - Sioux Falls Street Address: **Ulteig**engineers Drawn By: RPM Project Number: _406.083 Checked By: DGS Approved By: NAG June 22, 2007 Date: State: SD Zip Code: Citv:



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- GEOGRID MUST BE EMBEDDED A MINIMUM OF 1'-6" INTO BLOCK TO BLOCK INTERFACE ZONE TYPICAL.

REINFORCED RETAINING WALLS - LEVEL BACKFILL								
SAND SOIL (GW, GP, SW, & SP - \$\phi_DESKN = 34\circ\$)								
MAX. WALL	MIN. BURY	MIN. BASE		HEI	GHT OF	GEOGF	RID	
HEIGHT	DEPTH	DEPTH						
			2'-0"	4'-0"	6'-0"	8'-0"		
10'-0"	6"	6"	4'-0"	4'-0"	5'-0"	7'-0"		
101.01			2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	
12'-0"	8"	8"	4'-0"	4'-0"	5'-0"	6'-0"	8'-0"	
4.41.011			2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"
14'-0" 8"	8"	5'-0"	5'-0"	5'-0"	6'-0"	8'-0"	9'-0"	

REINFORCED RETAINING WALLS - LEVEL BACKFILL								
SANDY CLAY (GM, GC, SM, SM-SC, & ML - фоеsien = 30°)								
MAX. WALL MIN. BURY MIN. BASE HEIGHT OF GEOGRID								
HEIGHT	DEPTH	DEPTH		LEN	NGTH OF	GEOGI	RID	
01.01			2'-0"	4'-0"	6'-0"			
8'-0"	8'-0" 6"	6"	4'-0"	4'-0"	6'-0"			
401.011			2'-0"	4'-0"	6'-0"	8'-0"		
10'-0"	6"	6"	4'-0"	4'-0"	6'-0"	7'-0"		
401.011			2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	
12'-0"	8"	8"	5'-0"	5'-0"	6'-0"	7'-0"	9'-0"	
		2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"	
14'-0"	8"	8"	6'-0"	6'-0"	6'-0"	7'-0"	9'-0"	10'-0"

REINFORCED RETAINING WALLS - LEVEL BACKFILL									
LEAN CLAY (SC, ML-SC, & CL - φ _{DESIGN} = 26°)									
MAX. WALL	MIN. BURY	MIN. BURY MIN. BASE HEIGHT OF GEOGRID							
HEIGHT	DEPTH	DEPTH		LEN	IGTH OF	GEOG	RID		
01.011	8'-0" 6" 6"	011	2'-0"	4'-0"	6'-0"				
8-0		ρ	4'-0"	5'-0"	7'-0"				
401.011		8"	2'-0"	4'-0"	6'-0"	8'-0"			
10'-0"	8"		4'-0"	5'-0"	7'-0"	8'-0"			
401.011	0.11	011	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"		
12-0	12'-0" 8"	8"	5'-0"	5'-0"	7'-0"	8'-0"	10'-0"		
1.41.01	40"	011	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"	
14'-0" 10"	8"	7'-0"	7'-0"	7'-0"	8'-0"	10'-0"	11'-0"		

Monster	Blocks
Reinforced Wall - Le	evel Backfill

Midwest Ready Mix

1405 East Highway 50 Vermillion, SD 57069



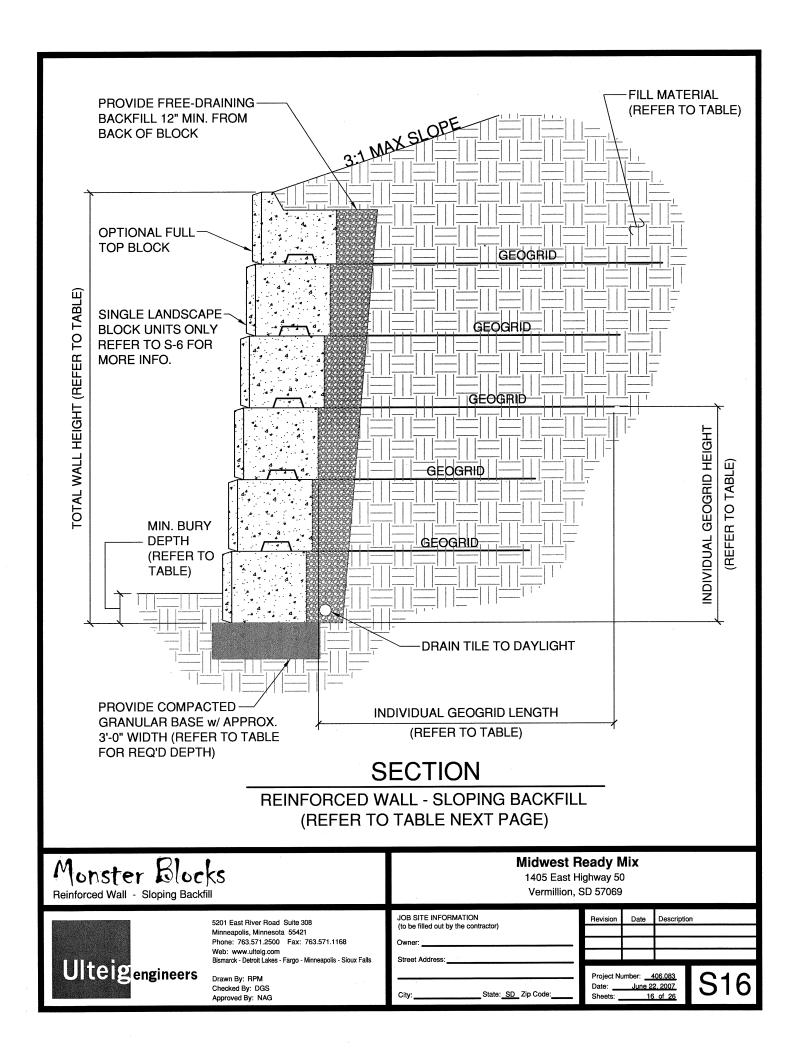
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Drawn By: RPM Checked By: DGS Approved By: NAG

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Revision	Date	Description

Project Number: 406.083 June 22, 2007 Date: ___



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- 2. GEOGRID MUST BE EMBEDDED A MINIMUM OF 1'-6" INTO BLOCK TO BLOCK INTERFACE ZONE TYPICAL.

REINFORCED RETAINING WALLS - 3:1 SLOPING BACKFILL									
SAND SOIL (GW, GP, SW, & SP - $\phi_{\text{DESKN}} = 34^{\circ}$)									
MAX. WALL	MIN. BURY	MIN. BASE		HEI	IGHT OF	GEOGF	RID		
HEIGHT	DEPTH	DEPTH		LEN	NGTH OF	GEOGI	RID		
01.01	CII.	CII.	2'-0"	4'-0"	6'-0"				
8'-0" 6"	6.	6"	4'-0"	4'-0"	6'-0"				
401.01		011	2'-0"	4'-0"	6'-0"	8'-0"			
10'-0"	6"	6"	4'-0"	4'-0"	6'-0"	7'-0"			
401.01	011	0"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"		
12-0	12'-0" 8"	8"	5'-0"	5'-0"	6'-0"	7'-0"	9'-0"		
4.41.01	0.11	011	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"	
14'-0" 8"	8"	6'-0"	6'-0"	6'-0"	7'-0"	9'-0"	10'-0"		

REINFORCED RETAINING WALLS - 3:1 SLOPING BACKFILL									
SANDY CLAY (GM, GC, SM, SM-SC, & ML - фоскон = 30°)									
MAX. WALL	MIN. BURY	MIN. BASE		HEI	GHT OF	GEOGF	RID		
HEIGHT	DEPTH	DEPTH	LENGTH OF GEOGRID						
01.011		6"	2'-0"	4'-0"	6'-0"				
8'-0"	6"		4'-0"	5'-0"	7'-0"				
401.08		6"	2'-0"	4'-0"	6'-0"	8'-0"			
10'-0"	6"		4'-0"	5'-0"	7'-0"	8'-0"	-		
401.01	0.1	611	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"		
12'-0"	12'-0" 8"	8"	5'-0"	5'-0"	7'-0"	8'-0"	10'-0"		
4.41.01		" 8"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"	
14'-0" 10"	10"		7'-0"	7'-0"	7'-0"	9'-0"	10'-0"	12'-0"	

REINFORCED RETAINING WALLS - 3:1 SLOPING BACKFILL										
	LEAN CLAY (SC, ML-SC, & CL - \$\phi_DESIGN = 26\circ\$)									
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF GEOGRID LENGTH OF GEOGRID							
CI OII		011	2'-0"	4'-0"						
6'-0"	6"	6"	5'-0"	6'-0"						
9' 0"		6"	2'-0"	4'-0"	6'-0"					
8'-0"	6"		5'-0"	6'-0"	8'-0"					
10'-0"	8"	0"	2'-0"	4'-0"	6'-0"	8'-0"				
10-0	8"	8"	5'-0"	6'-0"	8'-0"	10'-0"				
401.011	40"	0,1	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"			
12'-0" 10"	8"	6'-0"	7'-0"	8'-0"	10'-0"	12'-0"				
4.41.01	40"	4011	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"		
14'-0" 12"	10"	8'-0"	8'-0"	8'-0"	10'-0"	12'-0"	14'-0"			

Monster	Blocks
Reinforced Wall - S	

Midwest Ready Mix

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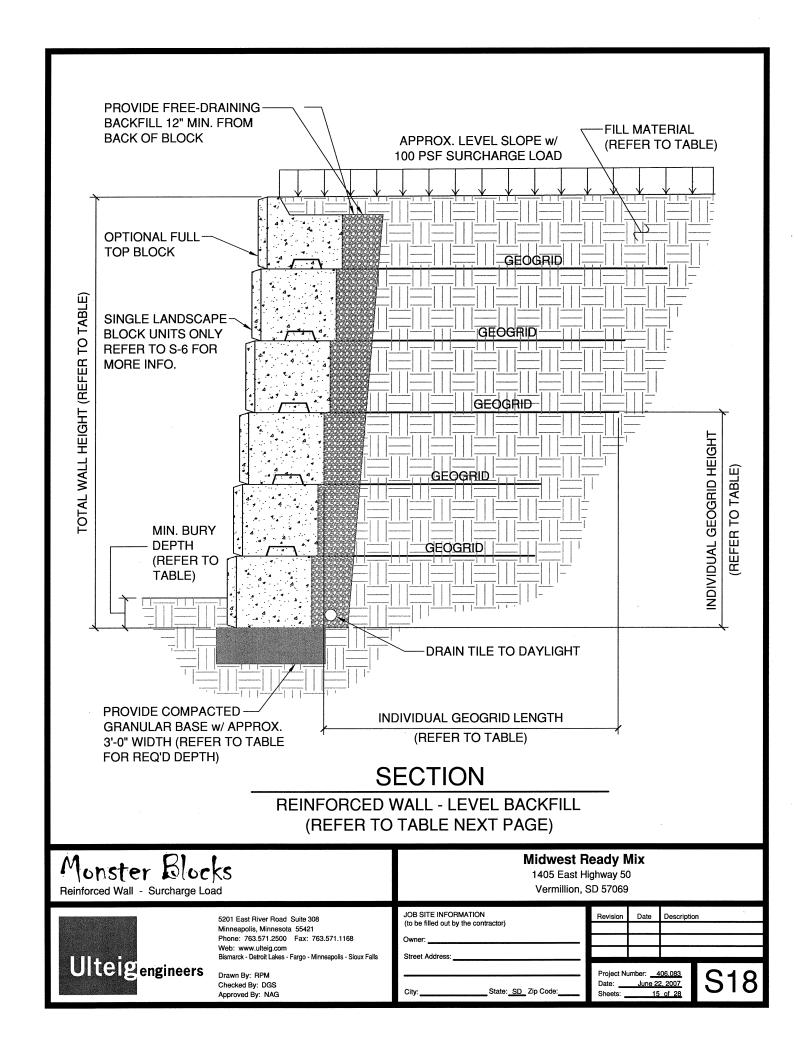
Drawn By: RPM Checked By: DGS Approved By: NAG

JOB SITE INFORMATION (to be filled out by the contractor)	
Owner:	_
Street Address:	

State: SD Zip Code:

Project Numbe	r: <u>406.083</u>	
Date:Jı	ine 22, 2007	.

Description



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REINFORCED RETAINING WALLS - SURCHARGE LOAD										
SAND SOIL (GW, GP, SW, & SP - \$\phi_\text{DESIGN} = 34\circ\)										
MAX. WALL	MIN. BURY	MIN. BASE		HEI	GHT OF	GEOGF	RID			
HEIGHT	DEPTH	DEPTH	LENGTH OF GEOGRID							
10'-0" 6"		2'-0"	4'-0"	6'-0"	8'-0"					
	6"	6"	4'-0"	4'-0"	5'-0"	7'-0"				
401.011	0.11	0.1	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"			
12'-0"	8"	3" 8"	4'-0"	5'-0"	5'-0"	7'-0"	8'-0"			
14'-0" 8"	011	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"			
	8" 8"	6'-0"	6'-0"	6'-0"	7'-0"	8'-0"	10'-0"			

REINFORCED RETAINING WALLS - SURCHARGE LOAD									
SANDY CLAY (GM, GC, SM, SM-SC, & ML - фоссоон = 30°)									
MAX. WALL		HEIGHT OF GEOGRID							
HEIGHT	DEPTH	DEPTH		LEN	IGTH OF	- GEOGI	RID		
8'-0"	01.011	6"	2'-0"	4'-0"	6'-0"				
8-0	6"		4'-0"	5'-0"	7'-0"				
10' 0"		8"	2'-0"	4'-0"	6'-0"	8'-0"			
10'-0"	8"		4'-0"	5'-0"	6'-0"	8'-0"			
401.01	0"	0"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"		
12'-0" 8"	8"	5'-0"	6'-0"	6'-0"	7'-0"	9'-0"			
1.41.01	40"	0"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"	
14'-0" 10"	8"	7'-0"	7'-0"	7'-0"	7'-0"	9'-0"	11'-0"		

REINFORCED RETAINING WALLS - SURCHARGE LOAD										
	LEAN CLAY (SC, ML-SC, & CL - φ _{DESSON} = 26°)									
MAX. WALL MIN. BURY MIN. BASE HEIGHT OF GEOGRID										
HEIGHT	DEPTH	DEPTH		LEN	IGTH OF	GEOG	RID			
01.01	011		2'-0"	4'-0"	6'-0"					
8'-0" 8"	8"	5'-0"	5'-0"	8'-0"						
401.011		8"	2'-0"	4'-0"	6'-0"	8'-0"				
10'-0"	8"		5'-0"	5'-0"	7'-0"	9'-0"				
401.011	400	8"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"			
12-0	12'-0" 10" 8		6'-0"	6'-0"	7'-0"	9'-0"	11'-0"			
14'-0" 12"	40"	40"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"		
	12"	10"	8'-0"	8'-0"	8'-0"	8'-0"	10'-0"	12'-0"		

City:

Monster	Blocks
Reinforced Wall - St	urcharge Load

Midwest Ready Mix

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Drawn By: RPM Checked By: DGS Approved By: NAG

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Street Address:	
	•

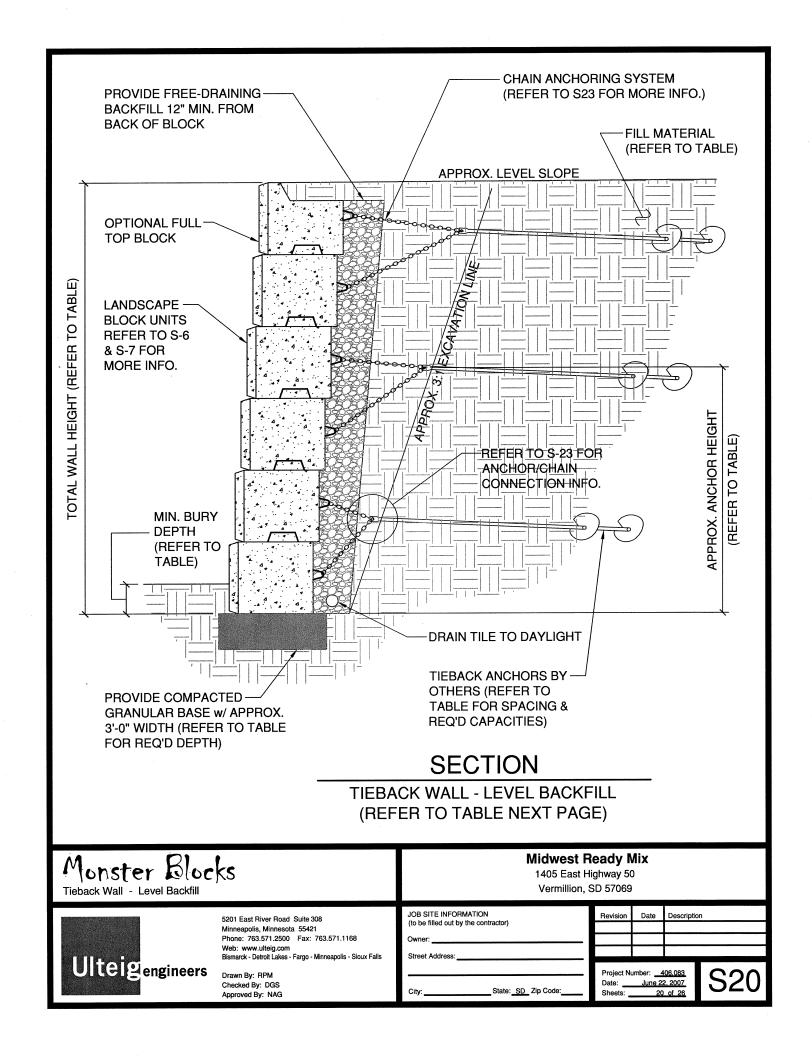
State: SD Zip Code:

Revision	Date	Description

Project Number: <u>406.083</u>

Date: <u>June 22, 2007</u>

Sheets: <u>19 of 26</u>



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TIEBACK RETAINING WALL - LEVEL BACKFILL								
	SAND SOIL (GW, GP, SW, & SP - фоевон = 34°)							
MAX. WALL MIN. BURY MIN. BASE HEIGHT OF ANCHOR								
HEIGHT	DEPTH	DEPTH	ANCHO	OR SYSTEM - SF	PACING			
40101		6" 6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"				
10'-0" 6"	6.		A - 12' O.C.	B - 12' O.C.				
401.01	8"	8"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"			
12'-0" 8"	8		A - 8' O.C.	A - 12 O.C.	B - 12' O.C.			
14'-0"	8"	0,1	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"			
		8" 8"		A - 12 O.C.	B - 12 O.C.			

TIEBACK RETAINING WALL LEVEL BACKFILL						
	SANDY CLA	AY (GM, GC, SM	, SM-SC, & ML F	ф _{резки} = 30°)		
MAX. WALL	MIN. BURY	MIN. BASE	HE	IGHT OF ANCH	OR	
HEIGHT	DEPTH	DEPTH	ANCHO	OR SYSTEM - SE	PACING	
8'-0"	6"	64	2>0" TO 4'-0"	6'-0" TO 8'-0"		
0-0	0		A - 12' O.C.	B - 12 O.C.		
10'-0"	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"		
			A - 10' O.C.	B - 12' O.C.	·	
12'-0"	0"	8"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"	
12-0			A - 6' O.C.	A - 12' O.C.	B - 12' O.C.	
14'-0"	of	9"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"	
14-0			A - 6' O.C.	A - 12' O.C.	B - 12' O.C.	

	TIEBACK RETAINING WALL - LEVEL BACKFILL									
4	LEAN CLAY (SC, ML-SC, & CL - poesion = 26°)									
1	MAX. WALL	MIN. BURY MIN. BASE HEIGHT OF ANCHOR								
	HEIGHT	DEPTH	DEPTH	ANCHO	ANCHOR SYSTEM - SPACING					
	8'-0"	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"					
Ĭ	8-0		0	A - 10' O.C.	B - 12' O.C.					
		C"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"					
4	10-0	10'-0" 6"		A - 8' O.C.	B - 12' O.C.					
	12'-0"	8"	8"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"				
A.	12-10	8	0	A - 6' O.C.	A - 12' O.C.	B - 12' O.C.				
	1410"		011	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"				
•	14'-0"	14'-0" 8" 8"		A - 5' O.C.	A - 10' O.C.	B - 12' O.C.				

Monster	Blocks
The board AAV-II I seem	LD = -Len

Tieback Wall - Level Backfill

Midwest Ready Mix

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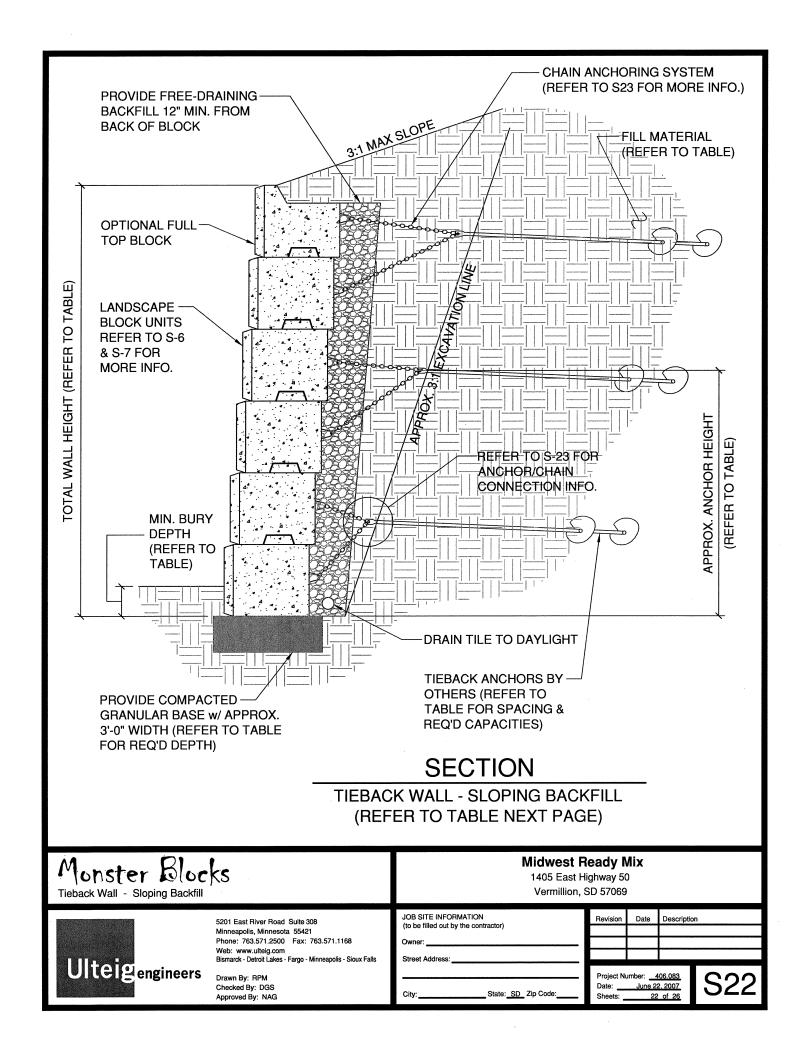
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Revision	Date	Description

Project Number: 406.083 Date: June 22, 2007 21 of 26 Sheets:



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TIEBACK RETAINING WALL - 3:1 SLOPING BACKFILL						
	SAND	SOIL (GW, GP,	SW, & SP - фоезко	. = 34°)		
MAX. WALL	MIN. BURY	MIN. BASE	HE	IGHT OF ANCH	OR	
HEIGHT	DEPTH	DEPTH	ANCHO	OR SYSTEM - SF	PACING	
01.01	CII.	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	4	
8-0	8'-0" 6"	0	A - 12' O.C.	B - 12' O.C.		
401.01	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"		
10'-0"	6"	6	A - 8' O.C.	B - 12' O.C.		
12'-0"	8"	8"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"	
12-0	8	8	A - 6' O.C.	A - 12' O.C.	B - 12' O.C	
14'-0"	8"	8"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"	
			A - 5' O.C.	A - 10' O.C.	B 12' O.C.	

TIEBACK RETAINING WALL - 3 SLOPING BACKFILL							
	SANDY CLA	AY (GM, GC, SM	SM-SC, & ML	фоезкан = 30°)			
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH		IGHT OF ANCH			
8'-0"	6"	6*	2-0" TO 4'-0" A - 10' O 6	6'-0" TO 8'-0" B - 12' O.C.			
10'-0"	6"	64	2'-0" TO 4'-0" A - 6' O.C.	6'-0" TO 8'-0" B - 12' O.C.			
12'-0"	8,"	8"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"		
0			A - 5' O.C.	A - 10' O.C.	B - 12' O.C.		
14'-0"		6,	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"		
14-0			A - 4' O.C.	A - 8' O.C.	A - 12' O.C.		

	TIEBACK RETAINING WALL - 3:1 SLOPING BACKFILL							
	LEAN CLAY (SC, ML-SC, & CL - фоезион = 26°)							
	MAX. WALL MIN. BURY		MIN. BASE	HEIGHT OF ANCHOR				
	HEIGHT	DEPTH	DEPTH	ANCHOR SYSTEM - SPACING				
-465	6'-0"	6"	6"	2'-0" TO 4'-0"				
	0-0	0	0	A - 8' O.C.				
	8'-0"	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"			
4		U		A - 6' O.C.	B - 12' O.C.			
	10'-0" 6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"				
			A - 5' O.C.	A - 12' O.C.				
·		8"	8"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"		
2000	12-0	12-0 8		A - 4' O.C.	A - 10' O.C.	A - 12' O.C.		
,	14'-0"	8"	8"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"		
	14-0		0	A - 4' O.C.	A - 6' O.C.	A - 12' O.C.		

Monster Blocks Tieback Wall - Sloping Backfill

Midwest Ready Mix

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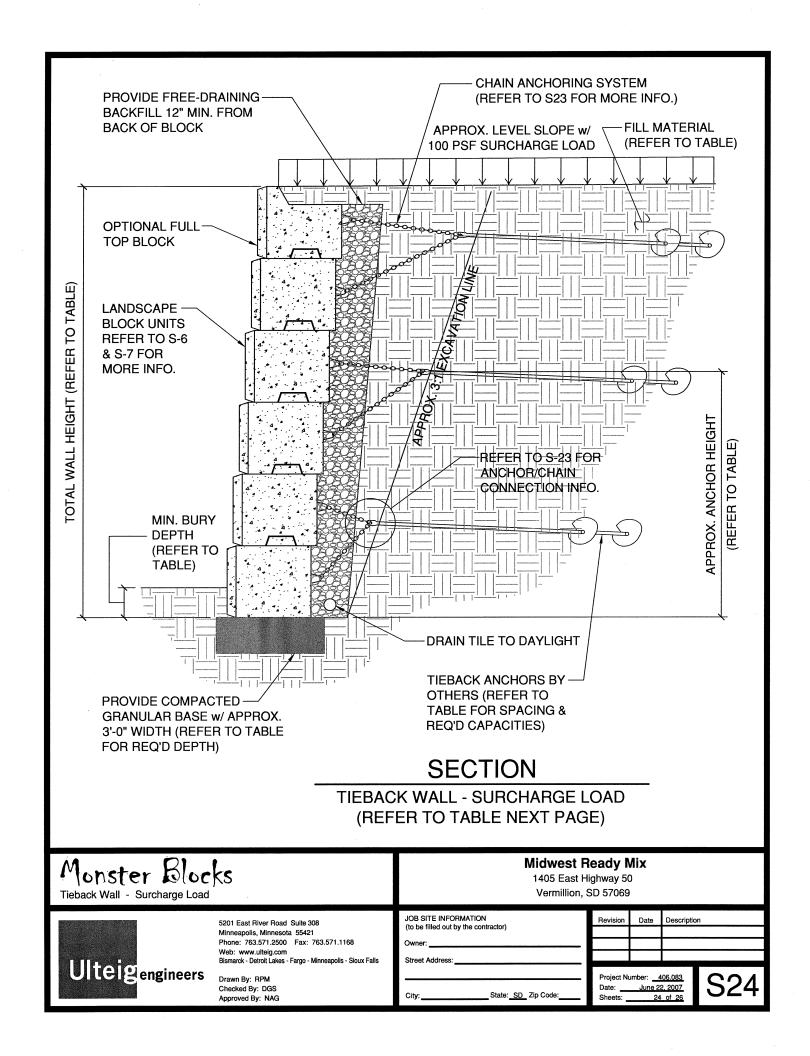
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TIEBACK RETAINING WALL - SURCHARGE LOAD								
	SAND SOIL (GW, GP, SW, & SP - \$\phi_{DESIGN} = 34\circ\$)							
MAX. WALL	MIN. BURY	MIN. BURY MIN. BASE		HEIGHT OF ANCHOR				
HEIGHT	DEPTH	DEPTH	ANCHOR SYSTEM - SPAC		PACING			
401.01	10'-0" 6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"				
10-0			A - 10' O.C.	B - 12' O.C.				
12'-0"	8"	8"	2'-0" TO 4'-0"	6'-0" TO 8'-0"				
12-0	•		A - 8' O.C.	A - 12' O.C.	B - 12' O.C.			
14'-0"	8" 8"	0"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"			
14-0		A - 6' O.C.	A - 12' O.C.	B - 12' O.C.				

			The state of the s			
	TIEBACK RETAINING WALL - SURCHARGE LOAD					
	SANDY CLAY (GM, GC, SM, SM-SC, & ML - poesion = 30°)					
MAX. WALL	MAX. WALL MIN. BURY MIN. BASE HEIGHT OF				OR	
HEIGHT	DEPTH	DEPTH	ANCHO	OR SYSTEM - SE	PACING	
8'-0"	6"	Con The Control of th	2'-0" TO 4'-0"	6'-0" TO 8'-0"		
0-0			A - 10 O.C.	B 12' O.C.		
10'-0"	Can Can	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"		
10-0			A - 8 O.C.	A - 12' O.C.		
12'-0"	QH	8"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"	
12-0			A - 6' O.C.	A - 12' O.C.	B - 12' O.C.	
14'-0"	8"	8"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"	
14-0			A - 5' O.C.	A - 10' O.C.	B - 12' O.C.	

		7						
d		TIEBACK RETAINING WALL - SURCHARGE LOAD						
po-	LEAN CLAY (SC, ML-SC, & CL - фовзон = 26°)							
	MAX. WALL	MAX. WALL MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF ANCHOR				
	HEIGHT			ANCHOR SYSTEM - SPACING				
	01.01	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"			
	8-0	8'-0" 6"	В	A - 8' O.C.	B - 12' O.C.			
	101011	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"			
	10-0	0	D	A - 6' O.C.	A - 12' O.C.			
	12'-0"	12'-0" 8"	8"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"		
h	12-0 8		. *	A - 5' O.C.	A - 10' O.C.	B - 12' O.C.		
	14' 0"	0"	8" 8"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"		
	14-U"	14'-0" 8"		A - 4' O.C.	A - 8' O.C.	A - 12' O.C.		

Monster	Blocks
Tieback Wall - Surc	harge Load

Midwest Ready Mix

1405 East Highway 50

Vermillion, SD 57069



5201 East River Road Suite 308 Minneapolis, Minnesota 55421 Phone: 763.571.2500 Fax: 763.571.1168 Web: www.ulteig.com Bismarck - Detroit Lakes - Fargo - Minneapolis - Sioux Falls

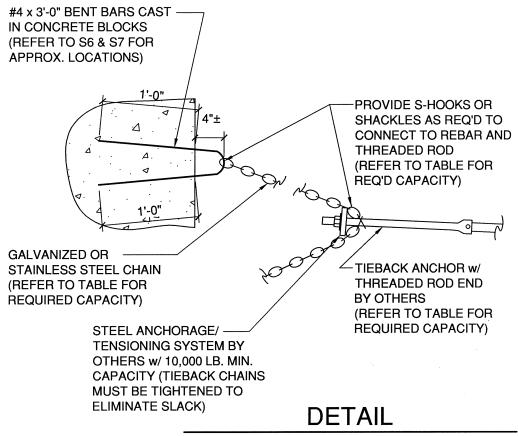
Drawn By: RPM Checked By: DGS Approved By: NAG

	ed out by the contractor)
Owner: _	
Street A	ldress:

State: SD Zip Code

Project Number: 406.083 Date: June 22, 2007 25 of 26

Description



CHAIN/ANCHOR TIEBACK SYSTEM (REFER TO TABLE BELOW)

TIEBACK SYSTEM COMPONENTS					
REQUIRED CHAIN/S-HOOK CAPACITY	REQUIRED ANCHOR CAPACITY				
10,000 LBS.	20,000 LBS.				
6,000 LBS.	12,000 LBS.				
	REQUIRED CHAIN/S-HOOK CAPACITY 10,000 LBS.				

CHAIN/S-HOOK CAPACITIES ARE LISTED AS ALLOWABLE WORKING LOADS. ANCHOR CAPACITIES ARE LISTED AS ULTIMATE INSTALLED VALUES AND INCLUDE A FACTOR OF SAFETY OF 2.

Monster Blocks Tieback Detail & Required Capacities		Midwest Ready Mix 1405 East Highway 50 Vermillion, SD 57069					
Ulteigengineers	5201 East River Road Suite 308 Minneapolis, Minnesota 55421 Phone: 763.571,2500 Fax: 763.571.1168 Web: www.ulteig.com Bismarck - Detroit Lakes - Fargo - Minneapolis - Sioux Falls Drawn By: RPM Checked By: DGS Approved By: NAG	JOB SITE INFORMATION (to be filled out by the contractor) Owner: Street Address: City: State: Sta	Project No Date:	umber: 40i June 22,		S26	