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
S11	GRAVITY WALL w/ LEVEL BACKFILL
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 Name: Neil A. Groon

Signed: Neil A. Groon

Date: 6/22/07 SD License Number: 8609

Monster Blocks

Index & Certification

Midwest Ready Mix
1405 East Highway 50
Vermillion, SD 57069

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5201 East River Road Suite 308
Minneapolis, Minnesota 55421
Phone: 763.571.2500 Fax: 763.571.1168
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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: SD Zip Code: _____

Revision	Date	Description

Project Number: 406.083
Date: June 22, 2007
Sheets: 1 of 26

S1

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.

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.

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.

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 GEOSYNTHETIC 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

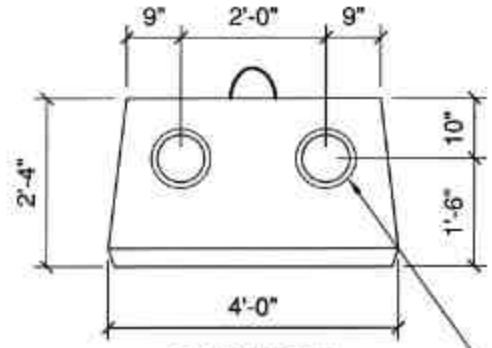
A. VERTICAL ALIGNMENT – WITHIN 1 ⅛ INCHES OF LEVEL OVER A 10 FOOT DISTANCE

B. WALL BATTER – WITHIN 2 DEGREES OF SHOWN ON STRUCTURAL DRAWINGS

C. HORIZONTAL ORIENTATION – GAPS BETWEEN ADJACENT UNITS LESS THAN ½ INCH

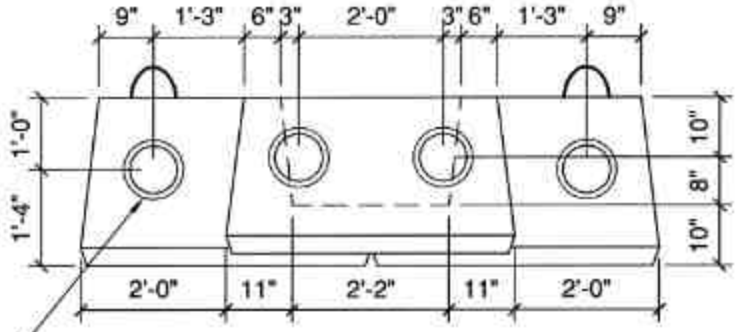
END OF SECTION

MONSTER BLOCK



TOP VIEW

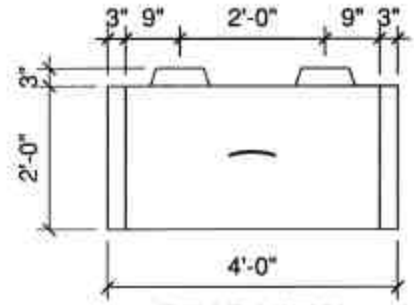
MIGHTY MONSTER BLOCK



TOP VIEW

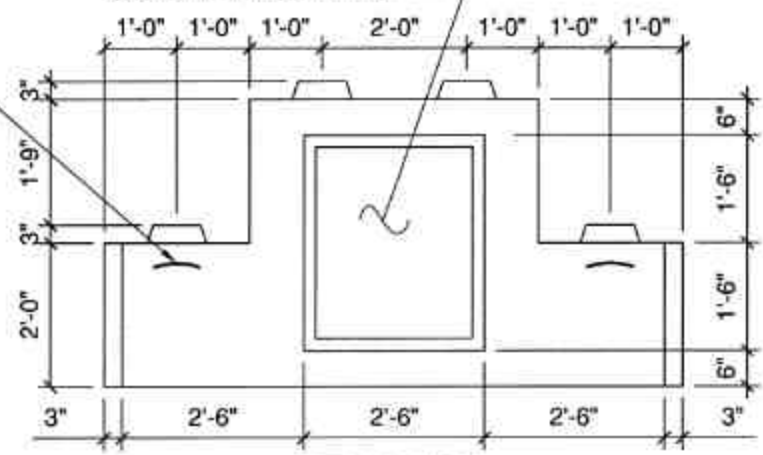
TAPERED CONCRETE TAB TYP. 9⅞"Ø AT BASE

INDICATES #4 x 3'-0" BENT BARS (REFER TO S26 FOR MORE INFO.)



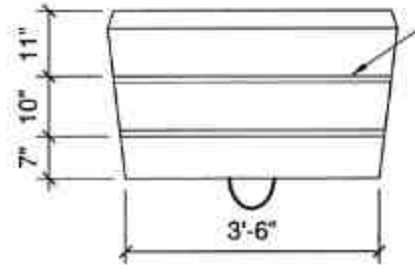
REAR VIEW

CONCRETE VOID AREA



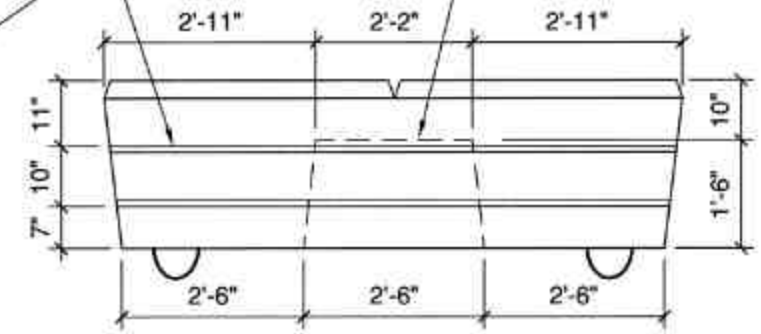
REAR VIEW

TAPERED CONCRETE GROOVE TYP. 10" WIDTH @ BOTTOM OF BLOCK



BOTTOM VIEW

DEPICTS EDGE OF VOID AREA TYP.



BOTTOM VIEW

Monster Blocks

Block Unit Dimensions

Midwest Ready Mix
1405 East Highway 50
Vermillion, SD 57069

Ulteig engineers

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: _____

_____

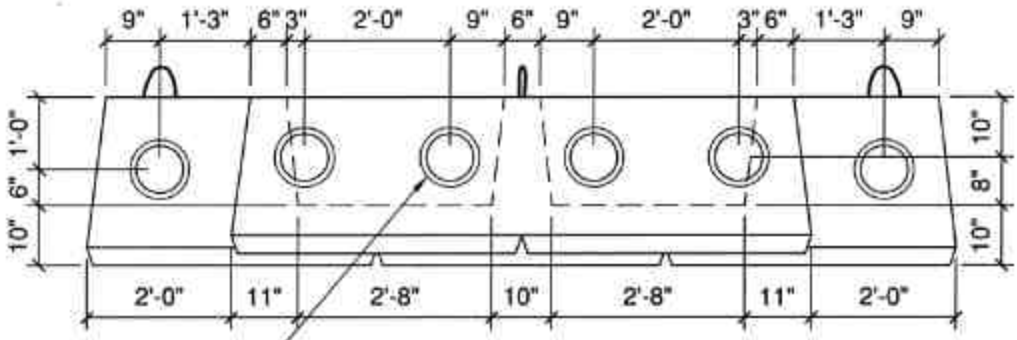
City: _____ State: SD Zip Code: _____

Revision	Date	Description

Project Number: 406.093
Date: June 22, 2007
Sheets: 6 of 26

S6

MEGA MONSTER BLOCK

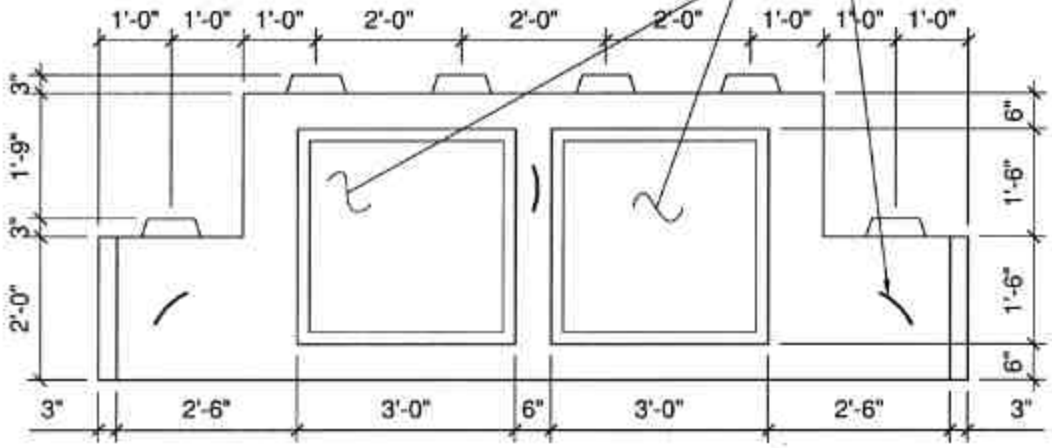


TOP VIEW

TAPERED CONCRETE TAB TYP. 9⅞"Ø AT BASE

CONCRETE VOID AREA

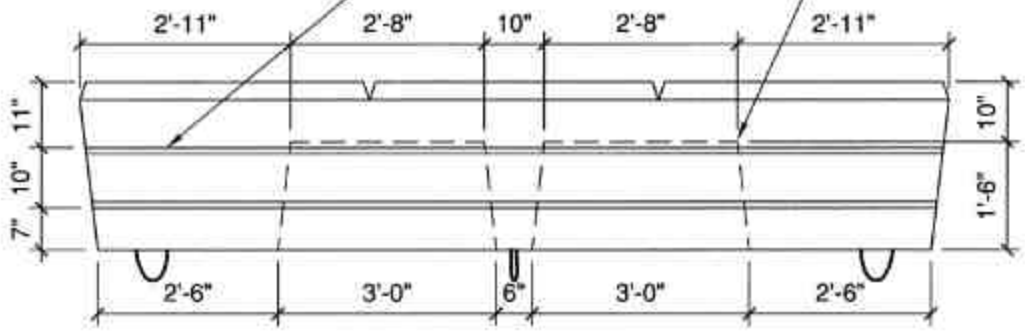
INDICATES #4 x 3'-0" BENT BARS (REFER TO S26 FOR MORE INFO.)



REAR VIEW

TAPERED CONCRETE GROOVE TYP. 10" WIDTH @ BOTTOM OF BLOCK

DEPICTS EDGE OF VOID AREA TYP.



BOTTOM VIEW

Monster Blocks

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1405 East Highway 50
Vermillion, SD 57069

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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: _____

_____

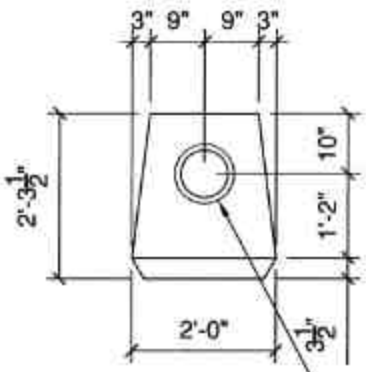
City: _____ State: SD Zip Code: _____

Revision	Date	Description

Project Number: 406.063
Date: June 22, 2007
Sheets: 7 of 26

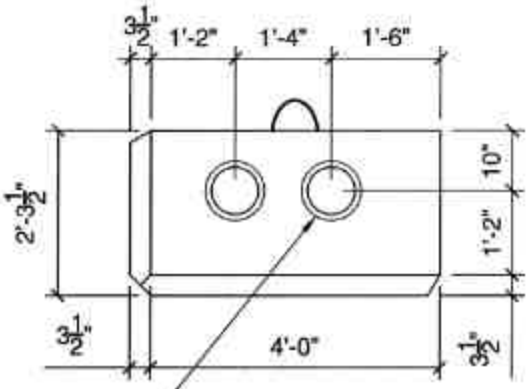
S7

HALF BLOCK



TOP VIEW

FULL CORNER BLOCK



TOP VIEW

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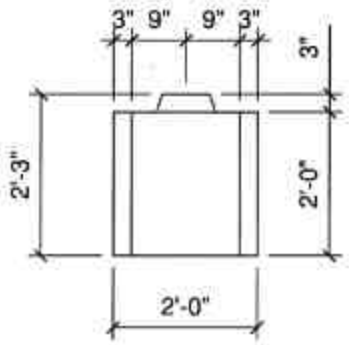

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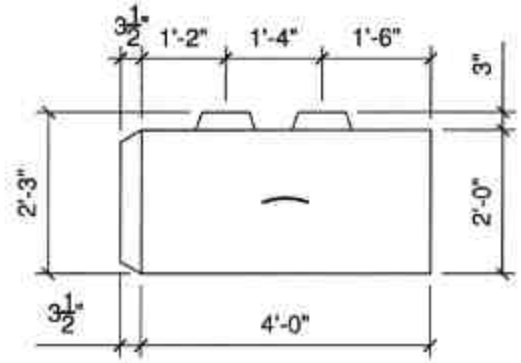
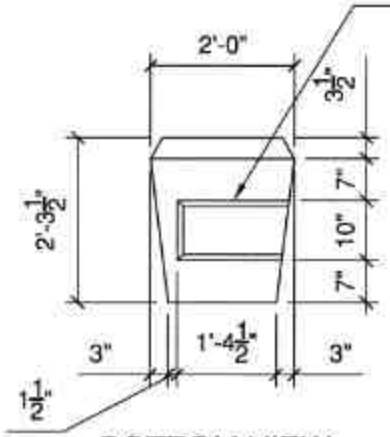
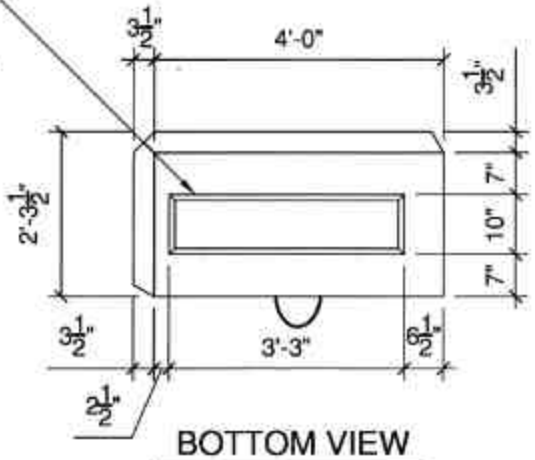


REAR VIEW

TAPERED CONCRETE GROOVE TYP. 10" WIDTH @ BOTTOM OF BLOCK



BOTTOM VIEW



BOTTOM VIEW

Monster Blocks

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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: _____

_____

City: _____ State: SD Zip Code: _____

Revision	Date	Description

Project Number: 436.083
Date: June 22, 2007
Sheets: 8 of 26

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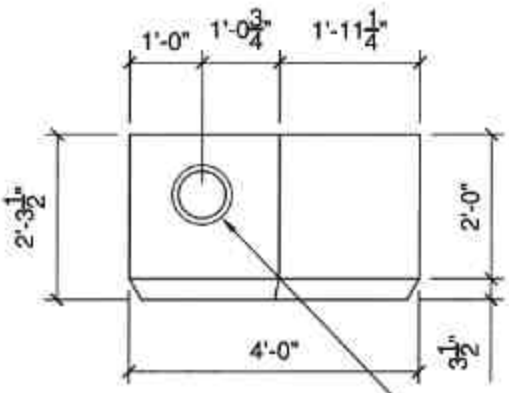
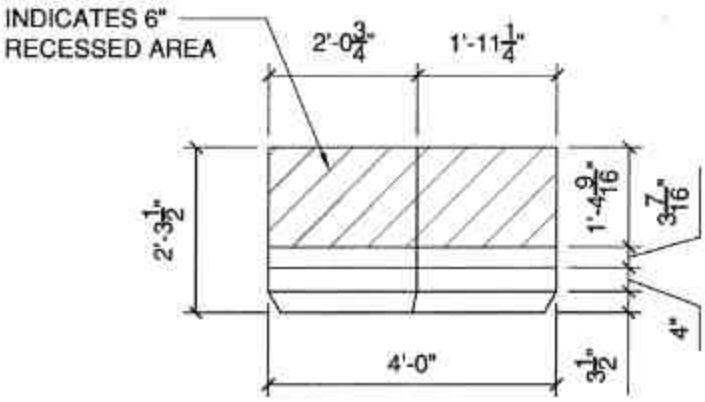
FULL ANGLE BLOCK



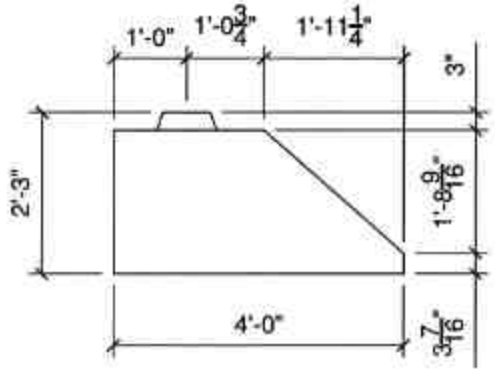
TOP VIEW

TOP ANGLE BLOCK

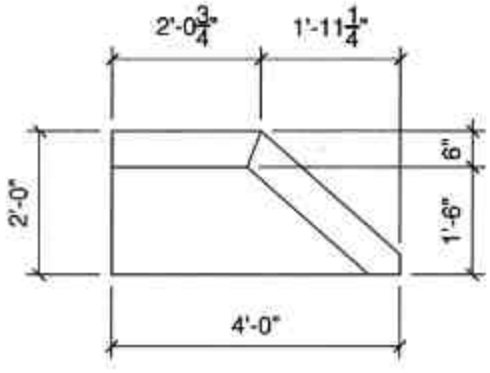


TOP VIEW

TAPERED CONCRETE TAB TYP. 9 7/8"Ø AT BASE

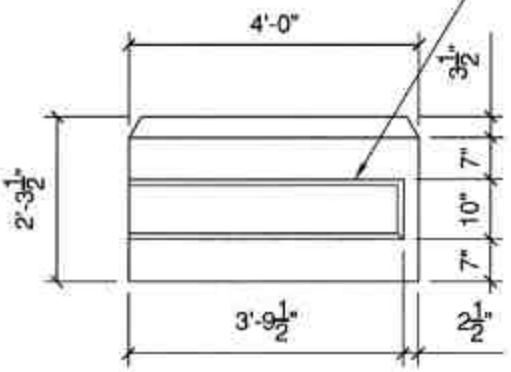


REAR VIEW

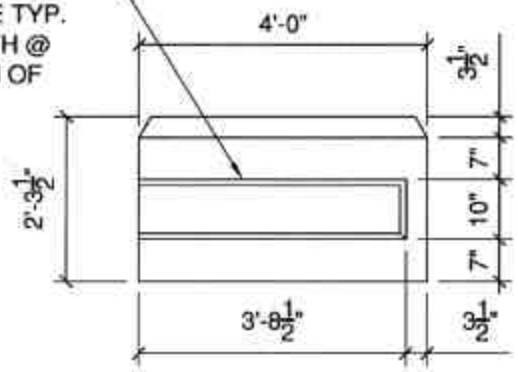


REAR VIEW

TAPERED CONCRETE GROOVE TYP. 10" WIDTH @ BOTTOM OF BLOCK



BOTTOM VIEW



BOTTOM VIEW

Monster Blocks

Block Unit Dimensions

Midwest Ready Mix
1405 East Highway 50
Vermillion, SD 57069

Ulteig engineers

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: SD Zip Code: _____

Revision	Date	Description

Project Number: 406.083
Date: June 22, 2007
Sheets: 9 of 35

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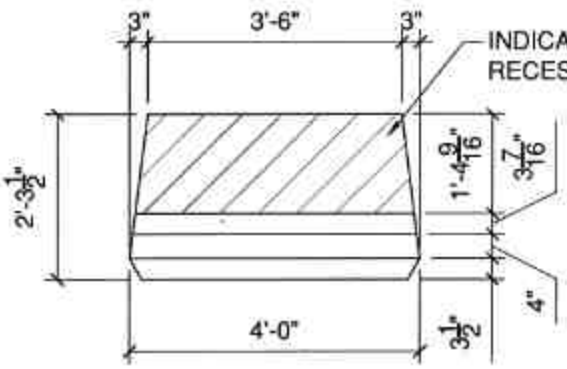
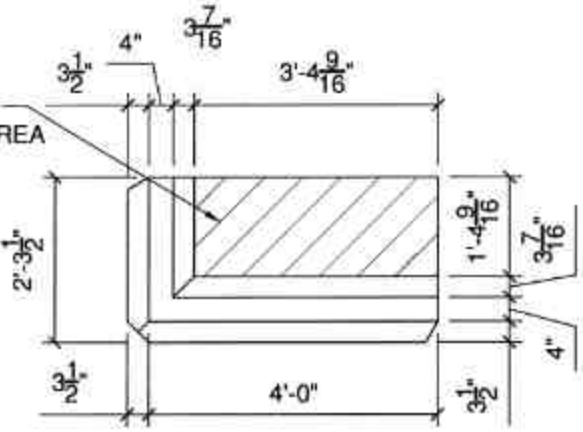
FULL TOP CAP BLOCK

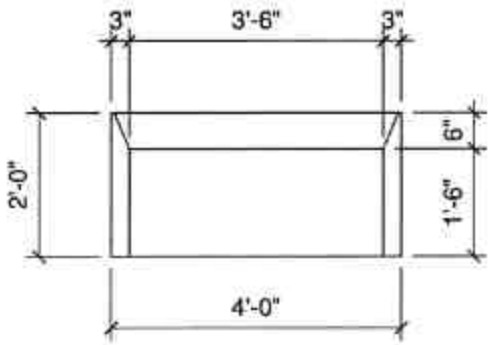


TOP VIEW

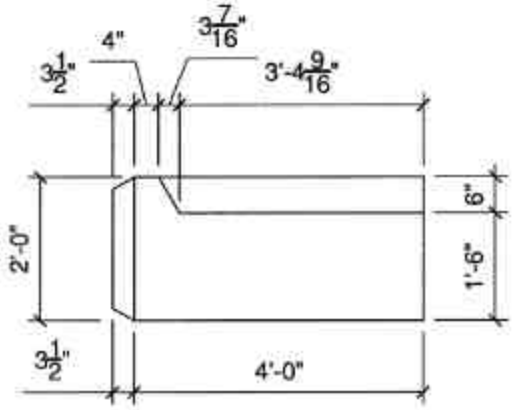
FULL TOP CAP CORNER BLOCK



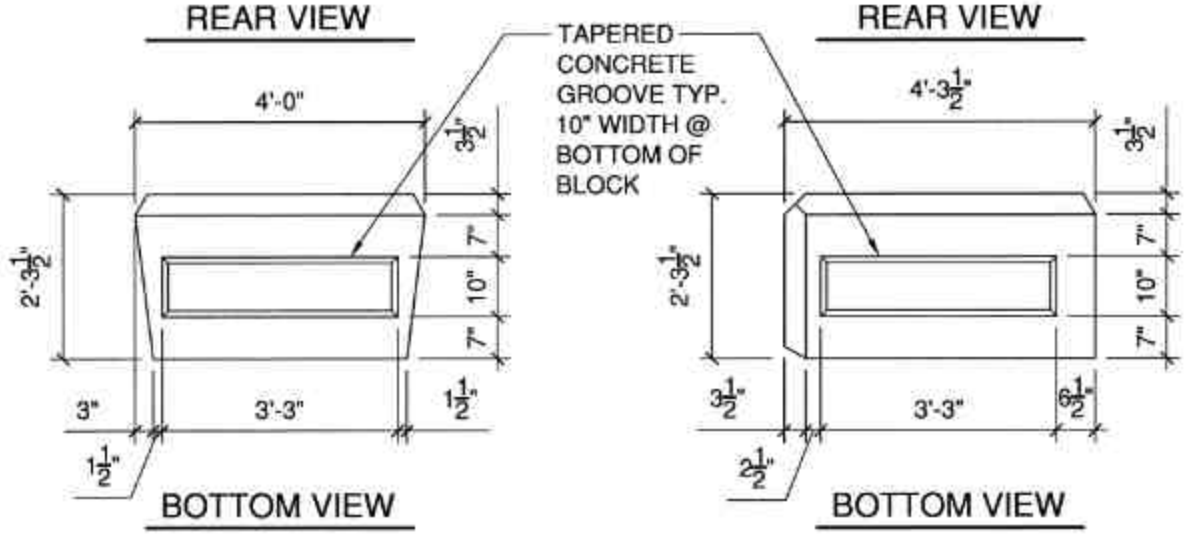
TOP VIEW



REAR VIEW



REAR VIEW



BOTTOM VIEW

BOTTOM VIEW

Monster Blocks

Block Unit Dimensions

Midwest Ready Mix
1405 East Highway 50
Vermillion, SD 57069

Ulteig engineers

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Minneapolis, Minnesota 55421
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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: _____

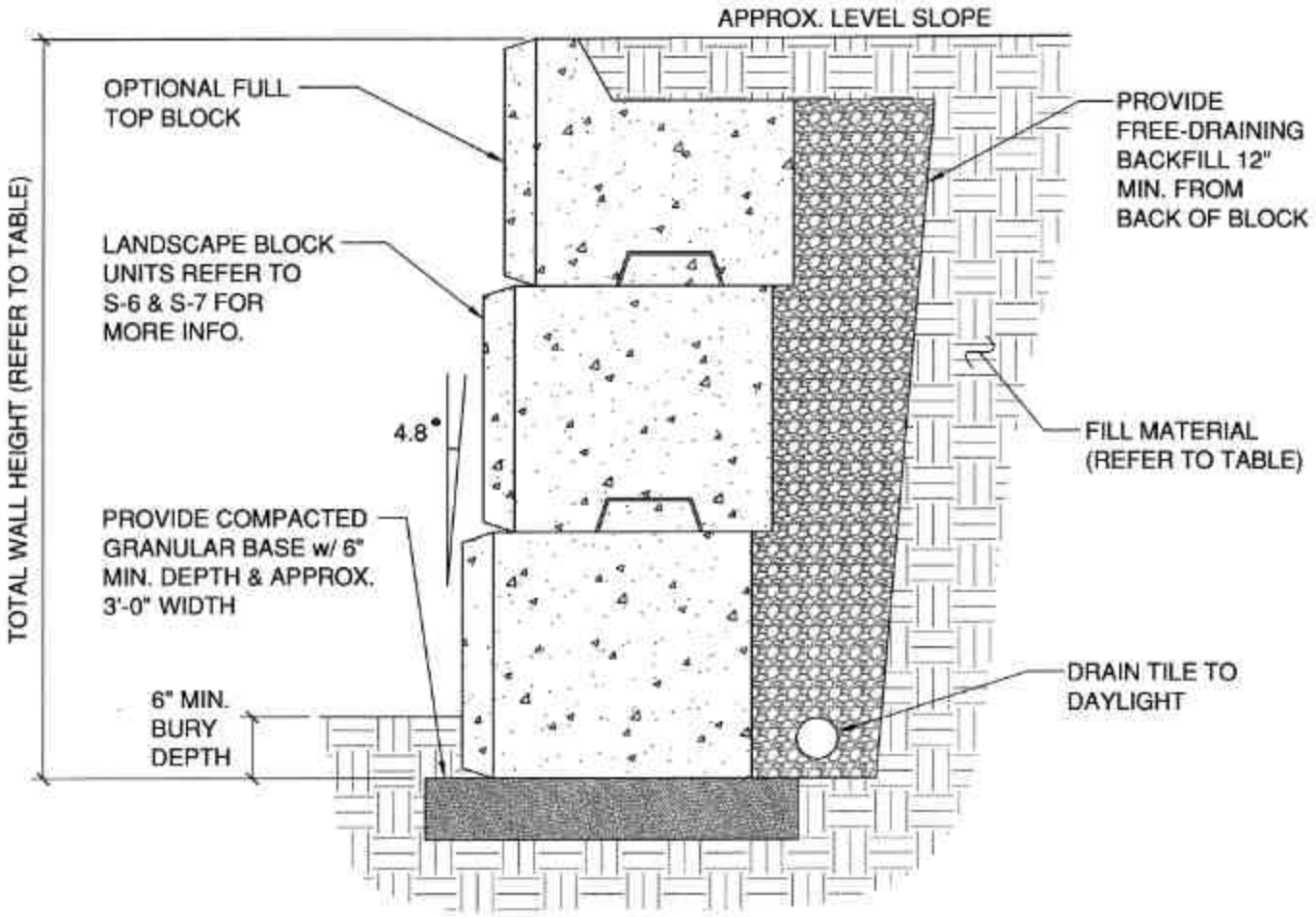
_____

City: _____ State: SD Zip Code: _____

Revision	Date	Description

Project Number: 406.083
Date: June 22, 2007
Sheets: 10 of 26

S10



SECTION

GRAVITY WALL - LEVEL BACKFILL

GRAVITY RETAINING WALLS

SOIL TYPE	CLASSIFICATIONS	MAX. WALL HEIGHT
SAND	GW, GP, SW, & SP	8'-0"
SANDY CLAY	GM, GC, SM, SM-CL, & ML	6'-0"
LEAN CLAY	SC, ML-CL, & CL	6'-0"
FAT & ORGANIC SWELLING CLAYS MUST BE REPLACED w/ ABOVE		

Monster Blocks
Gravity Wall - Level Backfill

Midwest Ready Mix
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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: SD Zip Code:

Revision	Date	Description

Project Number: 406.083
Date: June 22, 2007
Sheets: 11 of 29

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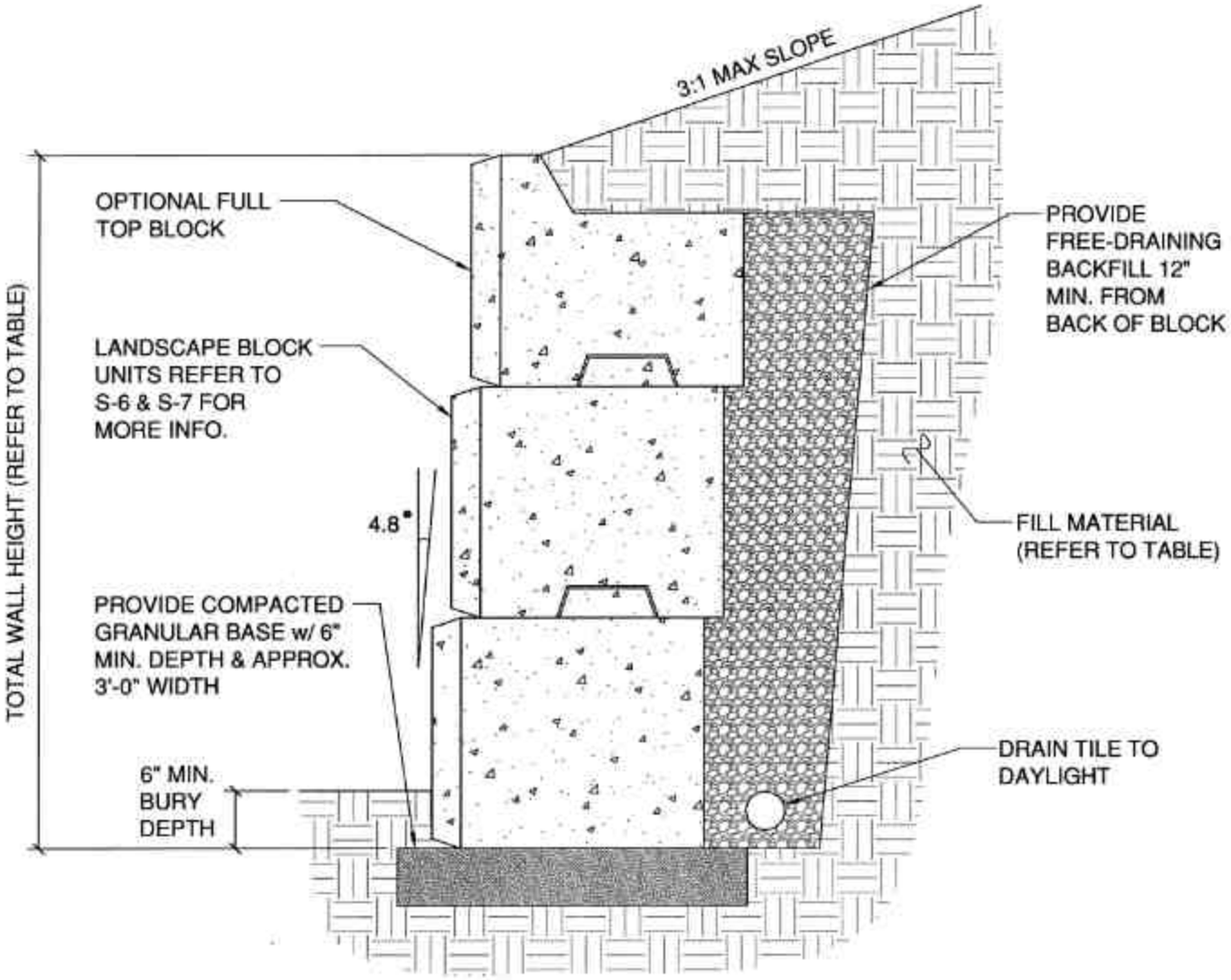

SECTION

GRAVITY WALL - SLOPING BACKFILL

GRAVITY RETAINING WALLS		
SOIL TYPE	CLASSIFICATIONS	MAX. WALL HEIGHT
SAND	GW, GP, SW, & SP	6'-0"
SANDY CLAY	GM, GC, SM, SM-CL, & ML	6'-0"
LEAN CLAY	SC, ML-CL, CL	4'-0"
FAT & ORGANIC SWELLING CLAYS MUST BE REPLACED w/ ABOVE		

Monster Blocks
Gravity Wall - Sloping Backfill

Midwest Ready Mix
1405 East Highway 50
Vermillion, SD 57069

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Web: www.ulteig.com
Bismarck - Detroit Lakes - Fargo - Minneapolis - Sioux Falls

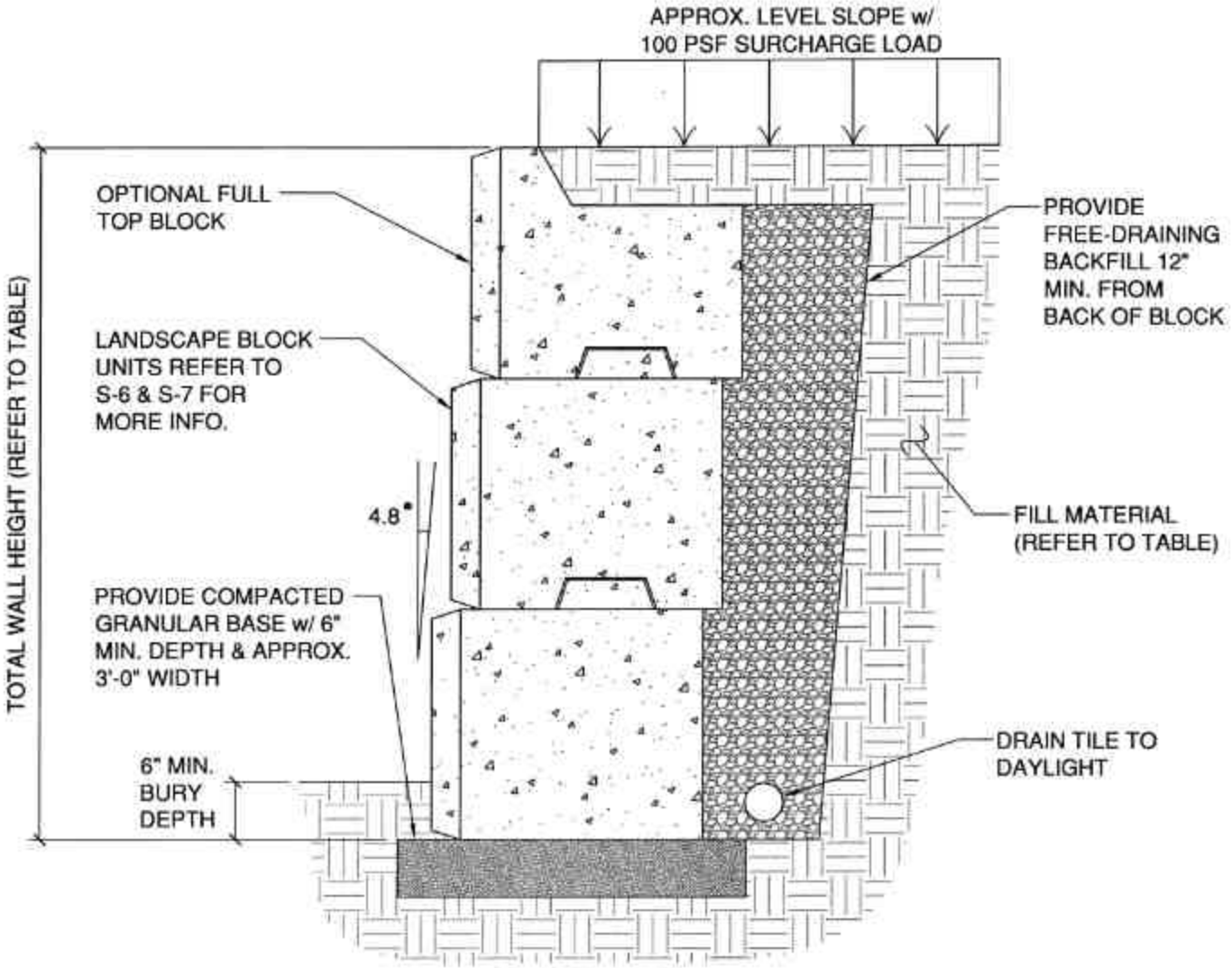
Drawn By: RPM
Checked By: DGS
Approved By: NAG

JOB SITE INFORMATION
(to be filled out by the contractor)
Owner:
Street Address:
City: State: SD Zip Code:

Revision	Date	Description

Project Number: 406.080
Date: June 22, 2007
Sheets: 12 of 24

S12



SECTION

GRAVITY WALL - SURCHARGE LOAD

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

Monster Blocks
Gravity Wall - Surcharge Load

Midwest Ready Mix
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Web: www.ulteig.com
Bismarck - Detroit Lakes - Fargo - Minneapolis - Sioux Falls

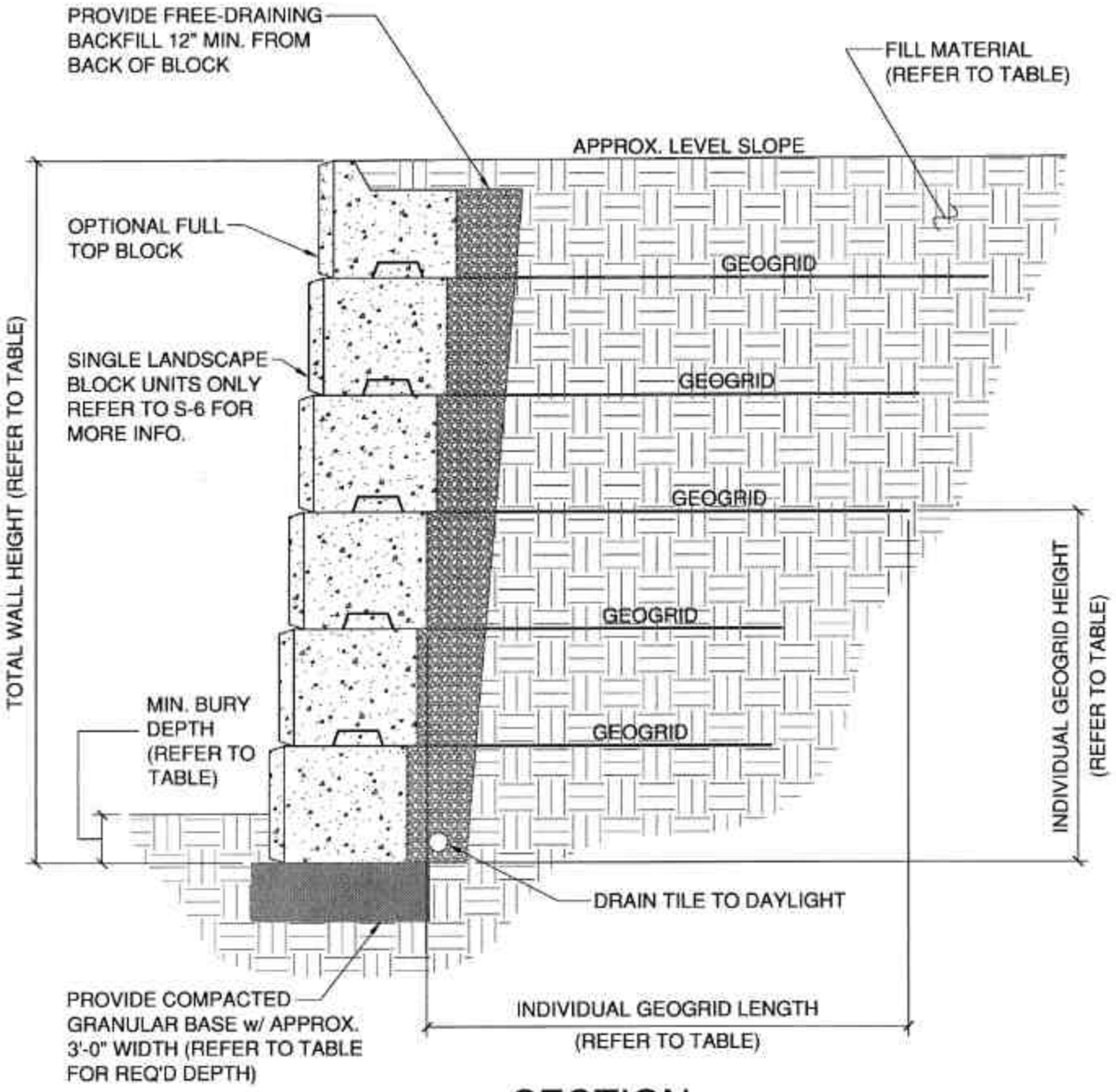
Drawn By: RPM
Checked By: DGS
Approved By: NAG

JOB SITE INFORMATION
(to be filled out by the contractor)
Owner: _____
Street Address: _____
_____
City: _____ State: SD Zip Code: _____

Revision	Date	Description

Project Number: 406.083
Date: June 22, 2007
Sheets: 13 of 26

S13



SECTION

REINFORCED WALL - LEVEL BACKFILL
(REFER TO TABLE NEXT PAGE)

Monster Blocks
Reinforced Wall - Level Backfill

Midwest Ready Mix
1405 East Highway 50
Vermillion, SD 57069

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Web: www.ulteig.com
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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:
City: State: SD Zip Code:

Revision	Date	Description

Project Number: 406.083
Date: June 22, 2007
Sheets: 14 of 26

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NOTES

1. TABLES BELOW ARE DIVIDED INTO SAND, SANDY CLAY, AND LEAN CLAY SOIL TYPES. FAT OR ORGANIC SWELLING CLAYS MUST BE REPLACED WITH ONE OF THE PREVIOUS TYPES.
2. 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 - ϕ_{DESIGN} = 34°)								
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF GEOGRID / LENGTH OF GEOGRID					
10'-0"	6"	6"	2'-0"	4'-0"	6'-0"	8'-0"		
			4'-0"	4'-0"	5'-0"	7'-0"		
12'-0"	8"	8"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	
			4'-0"	4'-0"	5'-0"	6'-0"	8'-0"	
14'-0"	8"	8"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"
			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 - ϕ_{DESIGN} = 30°)								
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF GEOGRID / LENGTH OF GEOGRID					
8'-0"	6"	6"	2'-0"	4'-0"	6'-0"			
			4'-0"	4'-0"	6'-0"			
10'-0"	6"	6"	2'-0"	4'-0"	6'-0"	8'-0"		
			4'-0"	4'-0"	6'-0"	7'-0"		
12'-0"	8"	8"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	
			5'-0"	5'-0"	6'-0"	7'-0"	9'-0"	
14'-0"	8"	8"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"
			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 HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF GEOGRID / LENGTH OF GEOGRID					
8'-0"	6"	6"	2'-0"	4'-0"	6'-0"			
			4'-0"	5'-0"	7'-0"			
10'-0"	8"	8"	2'-0"	4'-0"	6'-0"	8'-0"		
			4'-0"	5'-0"	7'-0"	8'-0"		
12'-0"	8"	8"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	
			5'-0"	5'-0"	7'-0"	8'-0"	10'-0"	
14'-0"	10"	8"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"
			7'-0"	7'-0"	7'-0"	8'-0"	10'-0"	11'-0"

Monster Blocks
Reinforced Wall - Level Backfill

Midwest Ready Mix
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Vermillion, SD 57069

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Web: www.ulteig.com
Bismarck - Detroit Lakes - Fargo - Minneapolis - Sioux Falls

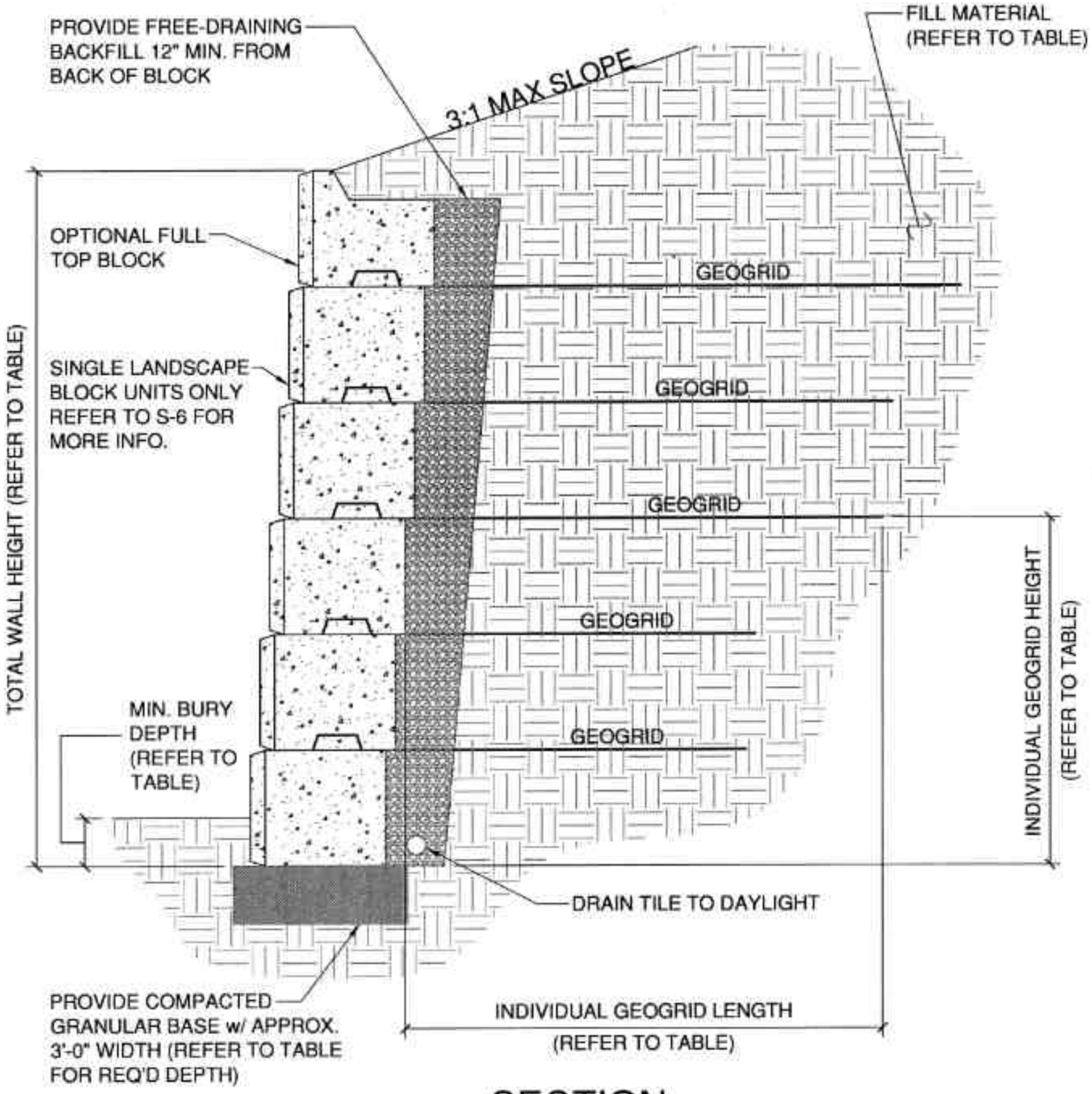
Drawn By: RPM
Checked By: DGS
Approved By: NAG

JOB SITE INFORMATION
(to be filled out by the contractor)
Owner: _____
Street Address: _____
_____
City: _____ State: SD Zip Code: _____

Revision	Date	Description

Project Number: 406.003
Date: June 22, 2007
Sheets: 15 of 26

S15



SECTION

REINFORCED WALL - SLOPING BACKFILL
(REFER TO TABLE NEXT PAGE)

Monster Blocks
Reinforced Wall - Sloping Backfill

Midwest Ready Mix
1405 East Highway 50
Vermillion, SD 57069

Ulteig engineers
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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: SD Zip Code: _____

Revision	Date	Description

Project Number: 406.083
Date: June 22, 2007
Sheets: 16 of 26

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NOTES

1. TABLES BELOW ARE DIVIDED INTO SAND, SANDY CLAY, AND LEAN CLAY SOIL TYPES. FAT OR ORGANIC SWELLING CLAYS MUST BE REPLACED WITH ONE OF THE PREVIOUS TYPES.
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 - ϕ_{min} = 34°)								
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF GEOGRID / LENGTH OF GEOGRID					
8'-0"	6"	6"	2'-0"	4'-0"	6'-0"			
			4'-0"	4'-0"	6'-0"			
10'-0"	6"	6"	2'-0"	4'-0"	6'-0"	8'-0"		
			4'-0"	4'-0"	6'-0"	7'-0"		
12'-0"	8"	8"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	
			5'-0"	5'-0"	6'-0"	7'-0"	9'-0"	
14'-0"	8"	8"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"
			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 - ϕ_{min} = 30°)								
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF GEOGRID / LENGTH OF GEOGRID					
8'-0"	6"	6"	2'-0"	4'-0"	6'-0"			
			4'-0"	5'-0"	7'-0"			
10'-0"	6"	6"	2'-0"	4'-0"	6'-0"	8'-0"		
			4'-0"	5'-0"	7'-0"	8'-0"		
12'-0"	8"	8"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	
			5'-0"	5'-0"	7'-0"	8'-0"	10'-0"	
14'-0"	10"	8"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"
			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 - ϕ_{min} = 26°)								
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF GEOGRID / LENGTH OF GEOGRID					
6'-0"	6"	6"	2'-0"	4'-0"				
			5'-0"	6'-0"				
8'-0"	6"	6"	2'-0"	4'-0"	6'-0"			
			5'-0"	6'-0"	8'-0"			
10'-0"	8"	8"	2'-0"	4'-0"	6'-0"	8'-0"		
			5'-0"	6'-0"	8'-0"	10'-0"		
12'-0"	10"	8"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	
			6'-0"	7'-0"	8'-0"	10'-0"	12'-0"	
14'-0"	12"	10"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"
			8'-0"	8'-0"	8'-0"	10'-0"	12'-0"	14'-0"

Monster Blocks
Reinforced Wall - Sloping Backfill

Midwest Ready Mix
1405 East Highway 50
Vermillion, SD 57069

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Phone: 763.571.2500 Fax: 763.571.1168
Web: www.ulteig.com
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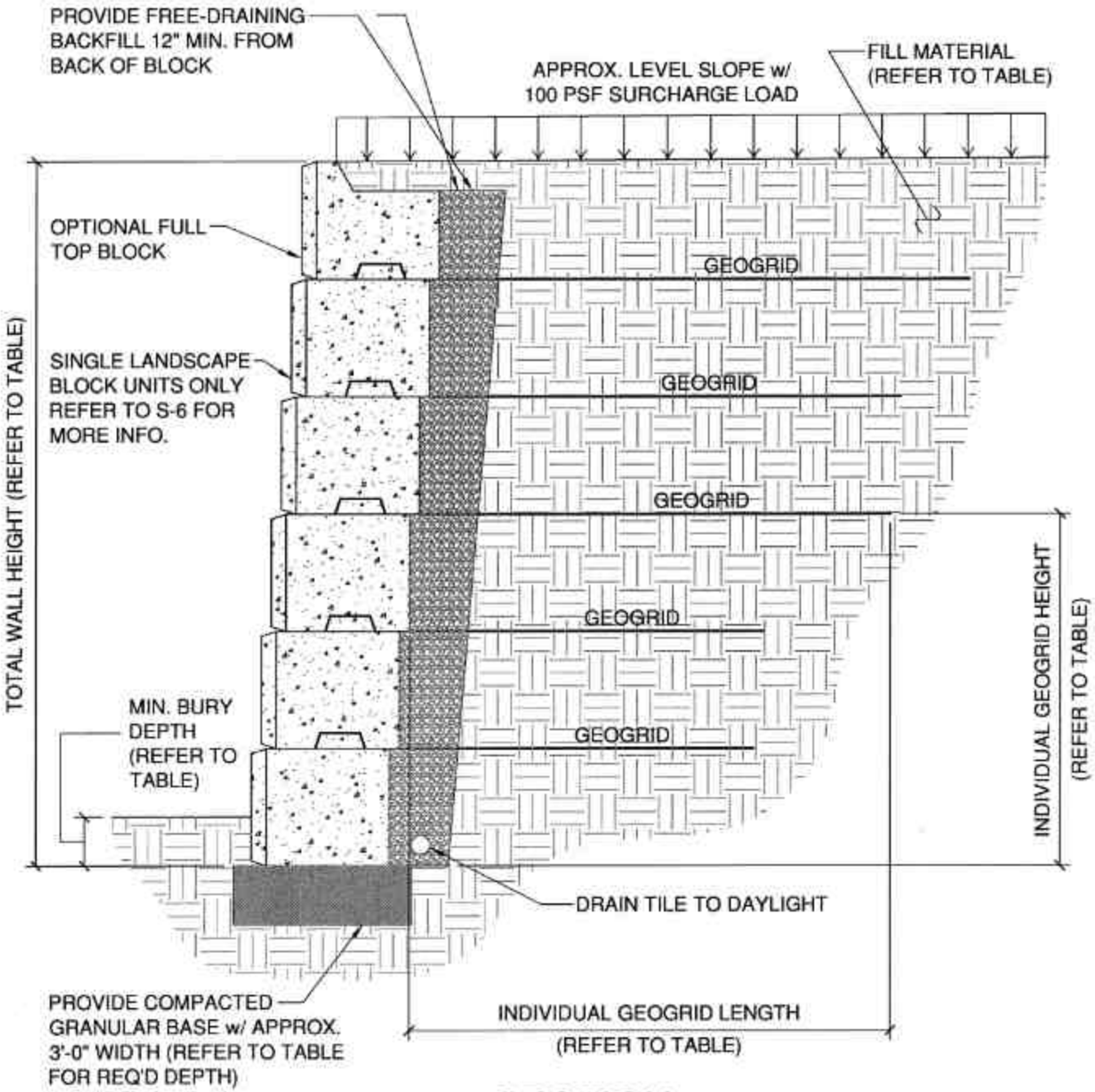
Drawn By: RPM
Checked By: DGS
Approved By: NAG

JOB SITE INFORMATION
(to be filled out by the contractor)
Owner:
Street Address:
City: State: SD Zip Code:

Revision	Date	Description

Project Number: 405.085
Date: June 22, 2007
Sheets: 17 of 35

S17



SECTION

REINFORCED WALL - LEVEL BACKFILL
(REFER TO TABLE NEXT PAGE)

Monster Blocks
Reinforced Wall - Surcharge Load

Midwest Ready Mix
1405 East Highway 50
Vermillion, SD 57069

Ulteig engineers
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Web: www.ulteig.com
Bismarck - Detroit Lakes - Fargo - Minneapolis - Sioux Falls

Drawn By: RPM
Checked By: DGG
Approved By: NAG

JOB SITE INFORMATION
(to be filled out by the contractor)
Owner:
Street Address:
City: State: SD Zip Code:

Revision	Date	Description

Project Number: 406.083
Date: June 22, 2007
Sheets: 15 of 26

S18

NOTES

1. TABLES BELOW ARE DIVIDED INTO SAND, SANDY CLAY, AND LEAN CLAY SOIL TYPES. FAT OR ORGANIC SWELLING CLAYS MUST BE REPLACED WITH ONE OF THE PREVIOUS TYPES.
2. GEOGRID MUST BE EMBEDDED A MINIMUM OF 1'-6" INTO BLOCK TO BLOCK INTERFACE ZONE TYPICAL.

REINFORCED RETAINING WALLS - SURCHARGE LOAD								
SAND SOIL (GW, GP, SW, & SP - ϕ_{soil} = 34°)								
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF GEOGRID / LENGTH OF GEOGRID					
10'-0"	6"	6"	2'-0"	4'-0"	6'-0"	8'-0"		
			4'-0"	4'-0"	5'-0"	7'-0"		
12'-0"	8"	8"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	
			4'-0"	5'-0"	5'-0"	7'-0"	8'-0"	
14'-0"	8"	8"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"
			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 - ϕ_{soil} = 30°)								
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF GEOGRID / LENGTH OF GEOGRID					
8'-0"	6"	6"	2'-0"	4'-0"	6'-0"			
			4'-0"	5'-0"	7'-0"			
10'-0"	8"	8"	2'-0"	4'-0"	6'-0"	8'-0"		
			4'-0"	5'-0"	6'-0"	8'-0"		
12'-0"	8"	8"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	
			5'-0"	6'-0"	6'-0"	7'-0"	9'-0"	
14'-0"	10"	8"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"
			7'-0"	7'-0"	7'-0"	7'-0"	9'-0"	11'-0"

REINFORCED RETAINING WALLS - SURCHARGE LOAD								
LEAN CLAY (SC, ML-SC, & CL - ϕ_{soil} = 26°)								
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF GEOGRID / LENGTH OF GEOGRID					
8'-0"	8"	8"	2'-0"	4'-0"	6'-0"			
			5'-0"	5'-0"	8'-0"			
10'-0"	8"	8"	2'-0"	4'-0"	6'-0"	8'-0"		
			5'-0"	5'-0"	7'-0"	9'-0"		
12'-0"	10"	8"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	
			6'-0"	6'-0"	7'-0"	9'-0"	11'-0"	
14'-0"	12"	10"	2'-0"	4'-0"	6'-0"	8'-0"	10'-0"	12'-0"
			8'-0"	8'-0"	8'-0"	8'-0"	10'-0"	12'-0"

Monster Blocks
Reinforced Wall - Surcharge Load

Midwest Ready Mix
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Vermillion, SD 57069

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Web: www.ulteig.com
Bismarck - Detroit Lakes - Fargo - Minneapolis - Sioux Falls

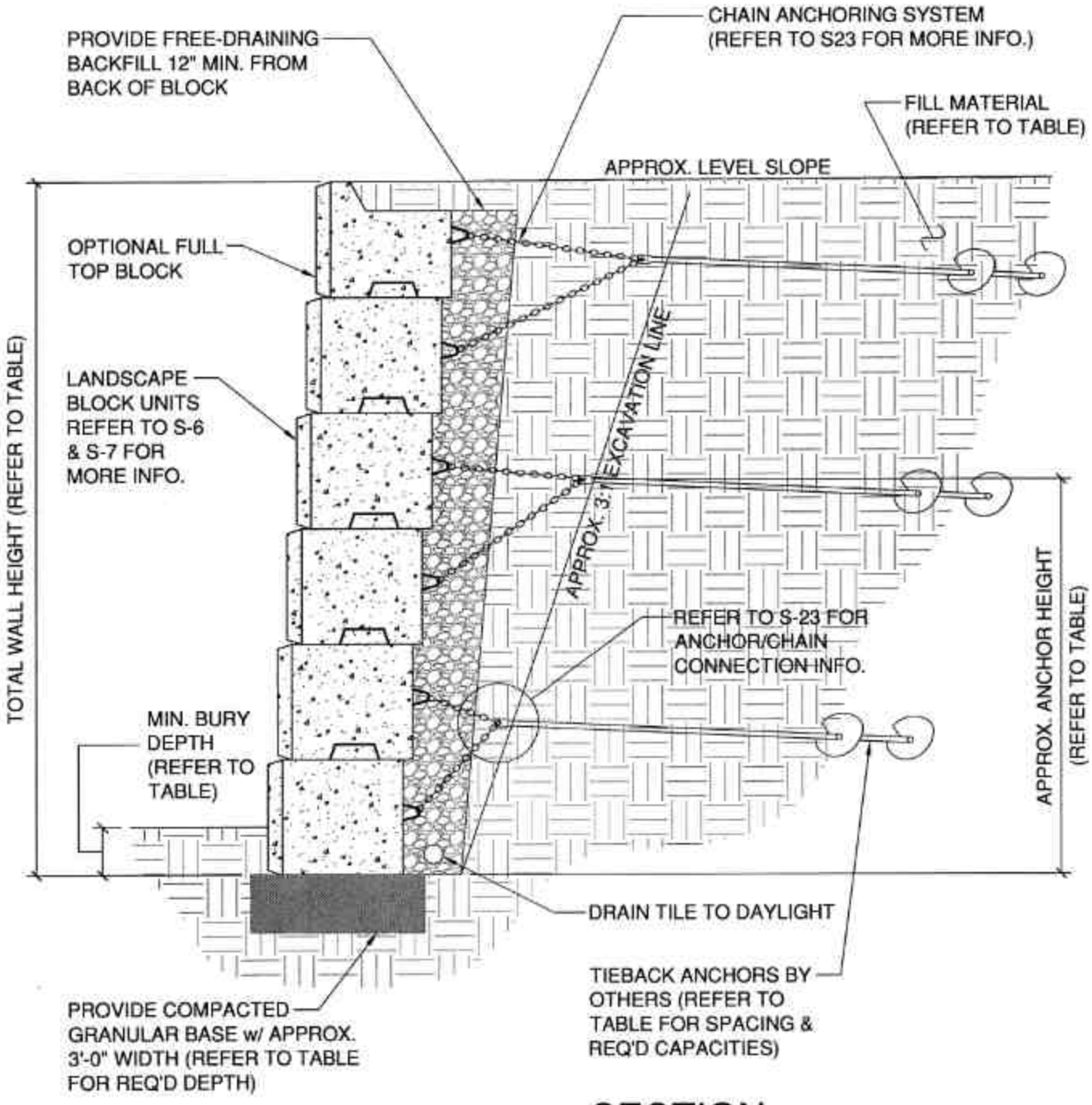
Drawn By: RPM
Checked By: DGS
Approved By: NAG

JOB SITE INFORMATION
(to be filled out by the contractor)
Owner: _____
Street Address: _____
_____
City: _____ State: SD Zip Code: _____

Revision	Date	Description

Project Number: 406.083
Date: June 22, 2007
Sheets: 19 of 26

S19



SECTION

TIEBACK WALL - LEVEL BACKFILL
(REFER TO TABLE NEXT PAGE)

Monster Blocks
Tieback Wall - Level Backfill

Midwest Ready Mix
1405 East Highway 50
Vermillion, SD 57069

Ulteig engineers
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: SD Zip Code:

Revision	Date	Description

Project Number: 400.093
Date: June 22, 2007
Sheets: 20 of 25

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NOTES

1. TABLES BELOW ARE FOR BIDDING PUPRPOSES ONLY. EXACT ANCHOR SPACING AND PLACEMENT IS SITE DEPENDENT. CONTACT ULTEIG FOR MORE INFORMATION.
2. TABLES BELOW ARE DIVIDED INTO SAND, SANDY CLAY, AND LEAN CLAY SOIL TYPES. FAT OR ORGANIC SWELLING CLAYS MUST BE REPLACED WITH ONE OF THE PREVIOUS TYPES.
3. REFER TO S-23 FOR REQUIREMENTS OF ANCHOR SYSTEMS A AND B LISTED IN THE TABLES..

TIEBACK RETAINING WALL - LEVEL BACKFILL					
SAND SOIL (GW, GP, SW, & SP - ϕ_{block} = 34°)					
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF ANCHOR		
			ANCHOR SYSTEM - SPACING		
10'-0"	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	
			A - 12' 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 - 8' 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 - 8' O.C.	A - 12' O.C.	B - 12' O.C.

TIEBACK RETAINING WALL - LEVEL BACKFILL					
SANDY CLAY (GM, GC, SM, SM-SC, & ML - ϕ_{block} = 30°)					
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF ANCHOR		
			ANCHOR SYSTEM - SPACING		
8'-0"	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-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"	6"	8"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"
			A - 5' 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 - 6' O.C.	A - 12' O.C.	B - 12' O.C.

TIEBACK RETAINING WALL - LEVEL BACKFILL					
LEAN CLAY (SC, ML-SC, & CL - ϕ_{block} = 26°)					
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF ANCHOR		
			ANCHOR SYSTEM - SPACING		
8'-0"	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	
			A - 10' O.C.	B - 12' O.C.	
10'-0"	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	
			A - 8' O.C.	B - 12' O.C.	
12'-0"	6"	8"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 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"
			A - 5' O.C.	A - 10' O.C.	B - 12' O.C.

Monster Blocks
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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: SD Zip Code:

Revision	Date	Description

Project Number: 405.083
Date: June 22, 2007
Sheets: 21 of 26

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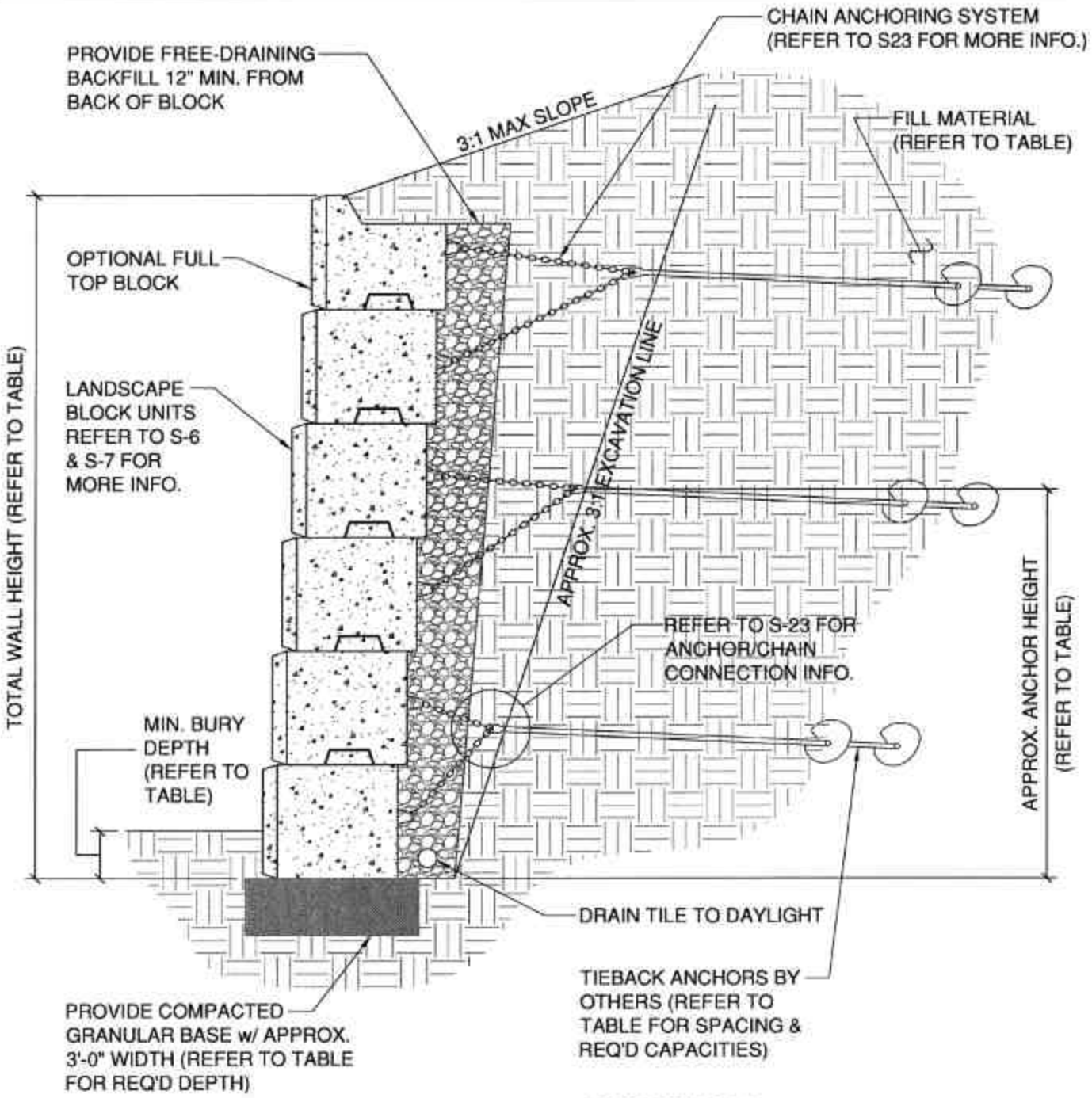

SECTION

TIEBACK WALL - SLOPING BACKFILL
(REFER TO TABLE NEXT PAGE)

Monster Blocks
Tieback Wall - Sloping Backfill

Midwest Ready Mix
1405 East Highway 50
Vermillion, SD 57069

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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: SD Zip Code: _____

Revision	Date	Description

Project Number: 426.093
Date: June 22, 2007
Sheets: 22 of 26

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NOTES

1. TABLES BELOW ARE FOR BIDDING PUPRPOSES ONLY. EXACT ANCHOR SPACING AND PLACEMENT IS SITE DEPENDENT. CONTACT ULTEIG FOR MORE INFORMATION.
2. TABLES BELOW ARE DIVIDED INTO SAND, SANDY CLAY, AND LEAN CLAY SOIL TYPES. FAT OR ORGANIC SWELLING CLAYS MUST BE REPLACED WITH ONE OF THE PREVIOUS TYPES.
3. REFER TO S-23 FOR REQUIREMENTS OF ANCHOR SYSTEMS A AND B LISTED IN THE TABLES..

TIEBACK RETAINING WALL - 3:1 SLOPING BACKFILL					
SAND SOIL (GW, GP, SW, & SP - ϕ_{assume} = 34°)					
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF ANCHOR		
			ANCHOR SYSTEM - SPACING		
8'-0"	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	
			A - 12' O.C.	B - 12' O.C.	
10'-0"	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	
			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 - 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 - 3:1 SLOPING BACKFILL					
SANDY CLAY (GM, GC, SM, SM-SC, & ML - ϕ_{assume} = 30°)					
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF ANCHOR		
			ANCHOR SYSTEM - SPACING		
8'-0"	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	
			A - 10' O.C.	B - 12' O.C.	
10'-0"	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	
			A - 6' 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 - 5' O.C.	A - 10' 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 - 4' O.C.	A - 8' O.C.	A - 12' O.C.

TIEBACK RETAINING WALL - 3:1 SLOPING BACKFILL					
LEAN CLAY (SC, ML-SC, & CL - ϕ_{assume} = 26°)					
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF ANCHOR		
			ANCHOR SYSTEM - SPACING		
6'-0"	6"	6"	2'-0" TO 4'-0"		
			A - 8' O.C.		
8'-0"	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	
			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.	
12'-0"	8"	8"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"
			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"
			A - 4' O.C.	A - 6' O.C.	A - 12' O.C.

Monster Blocks
Tieback Wall - Sloping Backfill

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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: SD Zip Code:

Revision	Date	Description

Project Number: 496.083
Date: June 22, 2007
Sheets: 23 of 26

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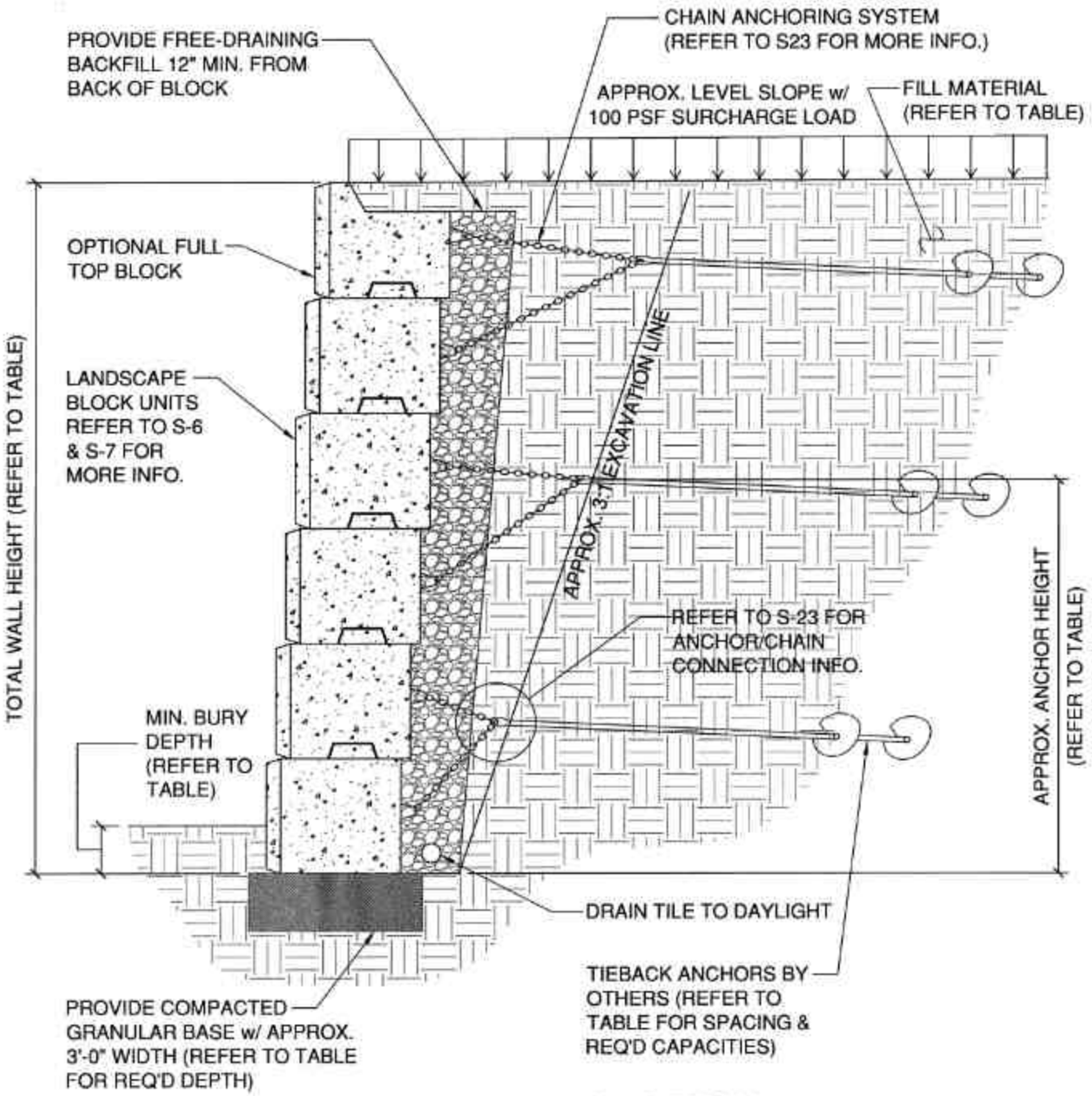

SECTION

TIEBACK WALL - SURCHARGE LOAD
(REFER TO TABLE NEXT PAGE)

Monster Blocks
Tieback Wall - Surcharge Load

Midwest Ready Mix
1405 East Highway 50
Vermillion, SD 57069

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5201 East River Road Suite 308
Minneapolis, Minnesota 55421
Phone: 763.571.2500 Fax: 763.571.1158
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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: SD Zip Code:

Revision	Date	Description

Project Number: 406.093
Date: June 29, 2007
Sheets: 24 of 26

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NOTES

1. TABLES BELOW ARE FOR BIDDING PUPRPOSES ONLY. EXACT ANCHOR SPACING AND PLACEMENT IS SITE DEPENDENT. CONTACT ULTEIG FOR MORE INFORMATION.
2. TABLES BELOW ARE DIVIDED INTO SAND, SANDY CLAY, AND LEAN CLAY SOIL TYPES. FAT OR ORGANIC SWELLING CLAYS MUST BE REPLACED WITH ONE OF THE PREVIOUS TYPES.
3. REFER TO S-23 FOR REQUIREMENTS OF ANCHOR SYSTEMS A AND B LISTED IN THE TABLES..

TIEBACK RETAINING WALL - SURCHARGE LOAD					
SAND SOIL (GW, GP, SW, & SP - ϕ_{soil} = 34°)					
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF ANCHOR		
			ANCHOR SYSTEM - SPACING		
10'-0"	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	
			A - 10' 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 - 8' 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 - 6' O.C.	A - 12' O.C.	B - 12' O.C.

TIEBACK RETAINING WALL - SURCHARGE LOAD					
SANDY CLAY (GM, GC, SM, SM-SC, & ML - ϕ_{soil} = 30°)					
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF ANCHOR		
			ANCHOR SYSTEM - SPACING		
8'-0"	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	
			A - 10' O.C.	B - 12' O.C.	
10'-0"	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	
			A - 8' O.C.	A - 12' O.C.	
12'-0"	8"	8"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 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"
			A - 5' O.C.	A - 10' O.C.	B - 12' O.C.

TIEBACK RETAINING WALL - SURCHARGE LOAD					
LEAN CLAY (SC, ML-SC, & CL - ϕ_{soil} = 26°)					
MAX. WALL HEIGHT	MIN. BURY DEPTH	MIN. BASE DEPTH	HEIGHT OF ANCHOR		
			ANCHOR SYSTEM - SPACING		
8'-0"	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	
			A - 8' O.C.	B - 12' O.C.	
10'-0"	6"	6"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	
			A - 6' O.C.	A - 12' O.C.	
12'-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.
14'-0"	8"	8"	2'-0" TO 4'-0"	6'-0" TO 8'-0"	10'-0" TO 12'-0"
			A - 4' O.C.	A - 8' O.C.	A - 12' O.C.

Monster Blocks
Tieback Wall - Surcharge Load

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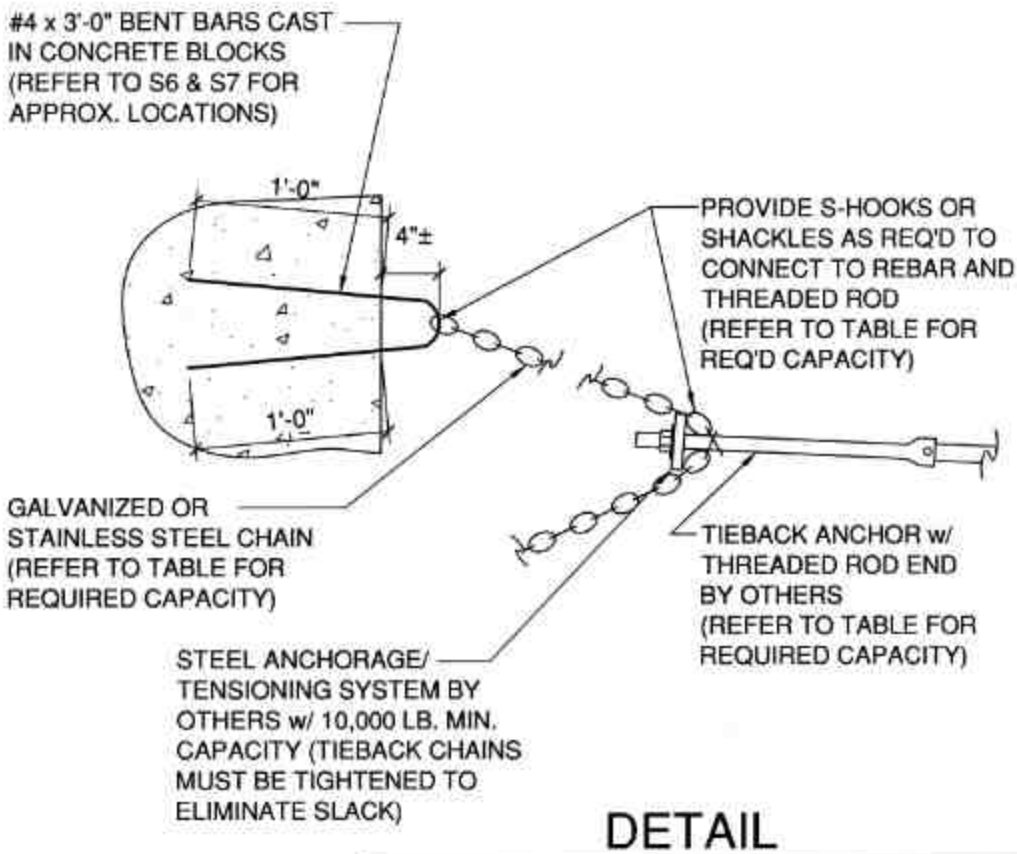
Drawn By: RPM
Checked By: DGS
Approved By: NAG

JOB SITE INFORMATION
(to be filled out by the contractor)
Owner: _____
Street Address: _____
_____
City: _____ State: SD Zip Code: _____

Revision	Date	Description

Project Number: 466.083
Date: June 22, 2017
Sheets: 25 of 26

S25



DETAIL

CHAIN/ANCHOR TIEBACK SYSTEM
(REFER TO TABLE BELOW)

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

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JOB SITE INFORMATION
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Owner: _____
Street Address: _____
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City: _____ State: SD Zip Code: ____

Revision	Date	Description

Project Number: 406.093
Date: June 22, 2007
Sheets: 26 of 26

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