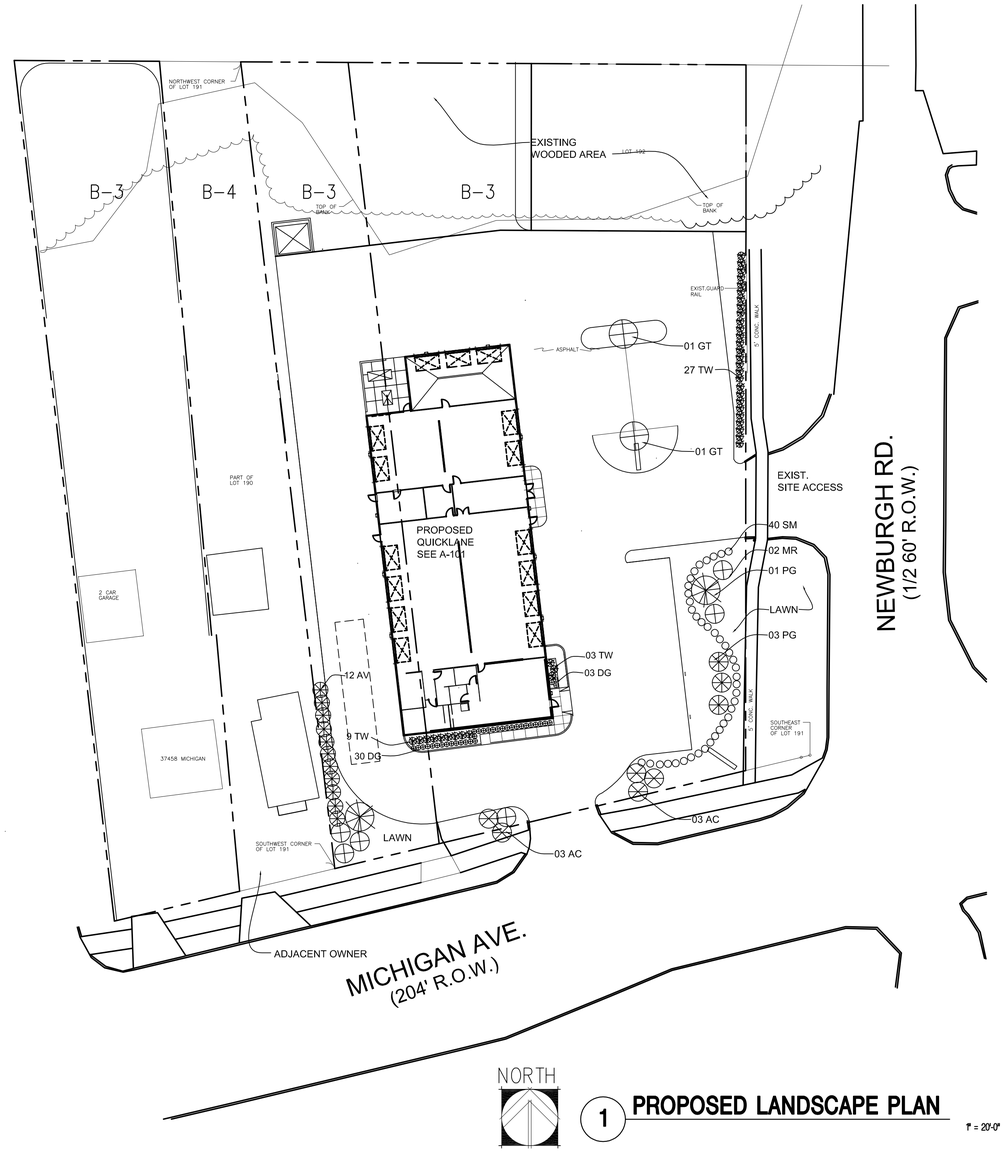


1 **PROPOSED LANDSCAPE PLAN** 1" = 20'-0"

REFER TO L-101 FOR DETAILS & NOTES

PLANT SCHEDULE

TAG	QTY.	BOTANICAL NAME	COMMON NAME	SIZE	SPACING	ROOT	HT/SPD	COMMENTS
AC	06	AMELANCHIER X.G. 'AUTUMN BRILLIANCE	AUTUMN BRILLIANCE SERVICEBERRY	MULTISTEM	AS SHOWN	B&B	6'-7' HT.	5 STEMS MIN.
GT	02	GLEDITSIA T. 'SKYLINE'	SKYLINE HONEY LOCUST	2.5"	AS SHOWN	B&B		SINGLE STRAIGHT TRUNK
MR	02	MALUS 'RED JEWEL'	RED JEWEL CRABAPPLE	1.5"	AS SHOWN	B&B		SINGLE STRAIGHT TRUNK
PG	01	PICEA GLAUCA	WHITE SPRUCE		AS SHOWN	B&B	7'-8' HT.	SINGLE STRAIGHT TRUNK
AV	12	THUJA OCCIDENTALS	ARBOR VITAE		AS SHOWN	B&B	7'-8' HT.	SINGLE STRAIGHT TRUNK
DG	33	DEUTZIA GRACILIS	SLENDER DEUTZIA		AS SHOWN	CONT.	24" HT.	
SM	40	SYRINGA M. 'PALIBIN'	DWARF KOREAN LILAC		AS SHOWN	B&B	30" HT.	
TW	39	TAXUS 'WARDII'	WARDS YEW		AS SHOWN	B&B	36" HT.	

prepared by:

UNDER THE SUN
ARCHITECTURAL LLC
11022 Mourning Dove Lane
South Lyon . MI . 48178

notice

project title

DEMMER QUICKLANE
37410 MICHIGAN AVE.
WAYNE, MI

sheet title

QUICKLANE LANDSCAPE PLAN

DO NOT SCALE DRAWINGS
USE FIGURED DIMENSIONS ONLY

seal & signature

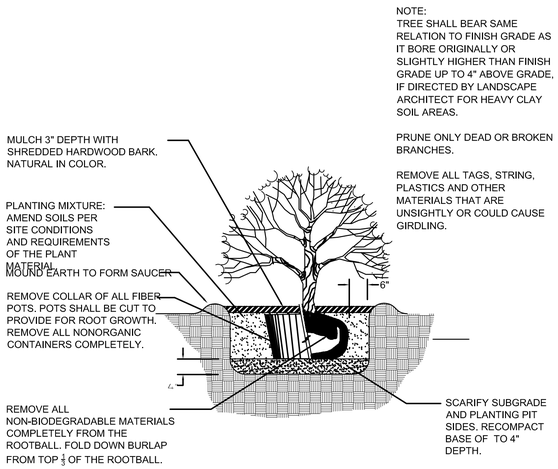
project number

13004

drawn	USA
approved	USA

issued	date
SITE PLAN APPROVAL	09-24-2013
SDP Resubmittal	02-03-2014

SHEET
L-100



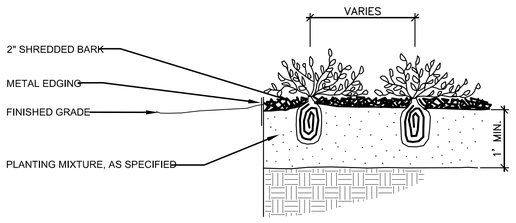
NOTE:
TREE SHALL BEAR SAME RELATION TO FINISH GRADE AS IT BORE ORIGINALLY OR SLIGHTLY HIGHER THAN FINISH GRADE UP TO 4" ABOVE GRADE, IF DIRECTED BY LANDSCAPE ARCHITECT FOR HEAVY CLAY SOIL AREAS.

PRUNE ONLY DEAD OR BROKEN BRANCHES.

REMOVE ALL TAGS, STRING, PLASTICS AND OTHER MATERIALS THAT ARE UNSIGHTLY OR COULD CAUSE GIRDLING.

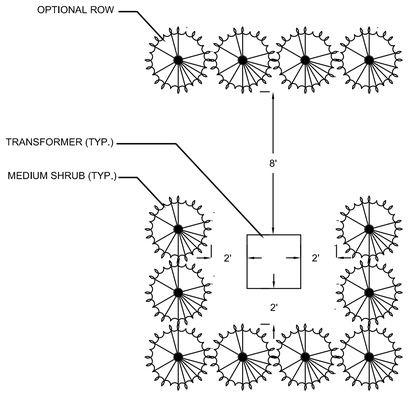
SHRUB PLANTING DETAIL

NOT TO SCALE



PERENNIAL PLANTING DETAIL

Not to scale



TRANSFORMER SCREENING DETAIL

Not to scale

NOTE:
GUY DECIDUOUS TREES ABOVE 3"CAL.. STAKE DECIDUOUS TREES BELOW 3" CAL.

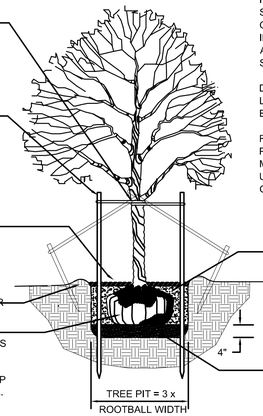
STAKE TREES AT FIRST BRANCH USING 2"-3" WIDE BELT-LIKE NYLON OR PLASTIC STRAPS. ALLOW FOR SOME MINIMAL FLEXING OF THE TREE. REMOVE AFTER ONE YEAR.

2" X 2" HARDWOOD STAKES, MIN. 36" ABOVE GROUND FOR UPRIGHT, 18" IF ANGLED. DRIVE STAKES A MIN. 18" INTO UNDISTURBED GROUND OUTSIDE ROOTBALL. REMOVE AFTER ONE YEAR.

MULCH 4" DEPTH WITH SHREDDED HARDWOOD BARK. NATURAL IN COLOR. LEAVE 3" CIRCLE OF BARE SOIL AT BASE OF TREE TRUNK.

MOUND EARTH TO FORM SAUCER

REMOVE ALL NON-BIODEGRADABLE MATERIALS COMPLETELY FROM THE ROOTBALL. CUT DOWN WIRE BASKET AND FOLD DOWN BURLAP FROM TOP 1/2 OF THE ROOTBALL.



NOTE:
TREE SHALL BEAR SAME RELATION TO FINISH GRADE AS IT BORE ORIGINALLY OR SLIGHTLY HIGHER THAN FINISH GRADE UP TO 6" ABOVE GRADE, IF DIRECTED BY LANDSCAPE ARCHITECT FOR HEAVY CLAY SOIL AREAS.

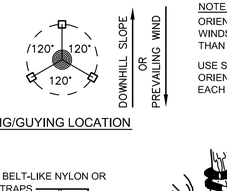
DO NOT PRUNE TERMINAL LEADER. PRUNE ONLY DEAD OR BROKEN BRANCHES.

REMOVE ALL TAGS, STRING, PLASTICS AND OTHER MATERIALS THAT ARE UNSIGHTLY OR COULD CAUSE GIRDLING.

PLANTING MIXTURE: AMEND SOILS PER SITE CONDITIONS AND REQUIREMENTS OF THE PLANT MATERIAL.

SCARIFY SUBGRADE AND PLANTING PIT SIDES. RECOMPACT BASE OF TO 4" DEPTH.

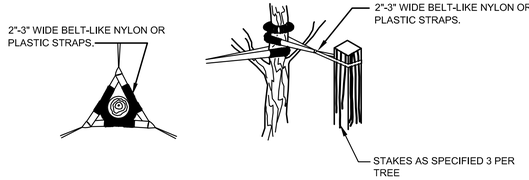
DECIDUOUS TREE PLANTING DETAIL



NOTE:
ORIENT STAKING/GUYING TO PREVAILING WINDS, EXCEPT ON SLOPES GREATER THAN 3:1 ORIENT TO SLOPE.

USE SAME STAKING/GUYING ORIENTATION FOR ALL PLANTS WITHIN EACH GROUPING OR AREA

STAKING/GUYING LOCATION



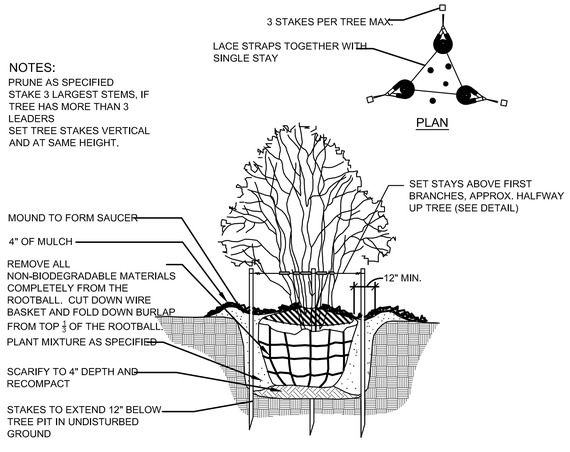
GUYING DETAIL

STAKING DETAIL

TREE STAKING DETAIL

Not to scale

NOTES:
PRUNE AS SPECIFIED
STAKE 3 LARGEST STEMS, IF TREE HAS MORE THAN 3 LEADERS
SET TREE STAKES VERTICAL AND AT SAME HEIGHT.



MULTI-STEM TREE PLANTING DETAIL

Not to scale

NOTE:
GUY EVERGREEN TREES ABOVE 12' HEIGHT. STAKE EVERGREEN TREE BELOW 12' HEIGHT.

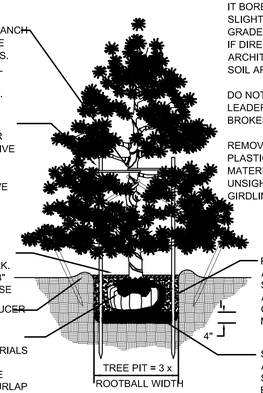
STAKE TREES AT FIRST BRANCH USING 2"-3" WIDE BELT-LIKE NYLON OR PLASTIC STRAPS. ALLOW FOR SOME MINIMAL FLEXING OF THE TREE. REMOVE AFTER ONE YEAR.

2" X 2" HARDWOOD STAKES, MIN. 36" ABOVE GROUND FOR UPRIGHT, 18" IF ANGLED. DRIVE STAKES A MIN. 18" INTO UNDISTURBED GROUND OUTSIDE ROOTBALL. REMOVE AFTER ONE YEAR.

MULCH 4" DEPTH WITH SHREDDED HARDWOOD BARK. NATURAL IN COLOR. LEAVE 3" CIRCLE OF BARE SOIL AT BASE OF TREE TRUNK.

MOUND EARTH TO FORM SAUCER

REMOVE ALL NON-BIODEGRADABLE MATERIALS COMPLETELY FROM THE ROOTBALL. CUT DOWN WIRE BASKET AND FOLD DOWN BURLAP FROM TOP 1/2 OF THE ROOTBALL.



NOTE:
TREE SHALL BEAR SAME RELATION TO FINISH GRADE AS IT BORE ORIGINALLY OR SLIGHTLY HIGHER THAN FINISH GRADE UP TO 6" ABOVE GRADE, IF DIRECTED BY LANDSCAPE ARCHITECT FOR HEAVY CLAY SOIL AREAS.

DO NOT PRUNE TERMINAL LEADER. PRUNE ONLY DEAD OR BROKEN BRANCHES.

REMOVE ALL TAGS, STRING, PLASTICS AND OTHER MATERIALS THAT ARE UNSIGHTLY OR COULD CAUSE GIRDLING.

PLANTING MIXTURE: AMEND SOILS PER SITE CONDITIONS AND REQUIREMENTS OF THE PLANT MATERIAL.

SCARIFY SUBGRADE AND PLANTING PIT SIDES. RECOMPACT BASE OF TO 4" DEPTH.

EVERGREEN TREE PLANTING DETAIL

LANDSCAPE NOTES:

1. ALL PLANT MATERIALS ARE TO BE INSTALLED TO THE SOUND PLANTING PROCEDURES OF THE AMERICAN STANDARD FROM NURSERY STOCK.

2. ALL PLANT MATERIALS SHALL BE INSTALLED BETWEEN MARCH 15th AND NOVEMBER 15th.

3. ALL PLANT MATERIALS ARE TO BE NORTHERN NURSERY GROWN NO.1 GRADE AND INSTALLED ACCORDING TO ACCEPTED PLANTING PROCEDURES. ALL PLANT MATERIALS SHALL CONFORM TO THE CURRENT AAN STANDARDS FOR NURSERY STOCK. THEY SHALL BE PLANTED ACCORDING TO THE CITY OF NOVI PLANTING DETAILS AND SPECIFICATIONS.

4. ALL TREES SHALL HAVE A CENTRAL LEADER AND A RADIAL BRANCHING STRUCTURE. PARK GRADE TREES ARE NOT ACCEPTABLE. ALL TREES SHALL BE BALLED AND BURLAPPED (B&B).

5. ANY DECIDUOUS CANOPY TREES WITH BRANCHES THAT MIGHT TEND TO DEVELOP INTO "V" CROTCHES SHALL BE SUBORDINATED SO AS NOT TO BECOME DOMINANT BRANCHES.

6. MULCH SHALL BE NATURAL COLOR, FINELY SHREDDED HARDWOOD BARK FOR ALL PLANTINGS. 4" THICK FOR TREES IN 4-FOOT DIAMETER CIRCLE WITH 3" PULLED AWAY FROM TRUNK. 3" THICK FOR SHRUBS AND SHRUB BEDS AND 2" THICK BARK FOR PERENNIALS.

7. ALL PLANT MATERIAL SHALL BE WARRANTIED FOR TWO (2) FULL YEARS AFTER DATE OF ACCEPTANCE BY THE CITY. ALL UNHEALTHY AND DEAD MATERIAL SHALL BE REPLACED WITHIN ONE (1) YEAR OR THE NEXT APPROPRIATE PLANTING PERIOD WHICH EVER COMES FIRST.

8. ALL PLANT MATERIAL SHALL BE MAINTAINED IN A HEALTHY GROWING CONDITION, INCLUDING WATERING, CULTIVATION, WEED CONTROL AND SOIL ENRICHMENTS AS MAY BE NECESSARY.

9. ANY SUBSTITUTIONS OR DEVIATIONS FROM THE LANDSCAPE PLAN MUST BE APPROVED IN WRITING BY THE CITY OF NOVI PRIOR TO INSTALLATION.

10. ALL TREE WRAP, STAKES, AND GUYS MUST BE REMOVED BY JULY 1ST FOLLOWING THE FIRST WINTER SEASON AFTER INSTALLATION.

11. ALL LANDSCAPE AREAS ARE TO BE MAINTAINED IN HEALTHY GROWING CONDITION FREE OF DEBRIS AND REFUSE AND IN CONFORMANCE WITH THE APPROVED LANDSCAPE PLAN.

12. CONTRACTOR TO REMOVE All CONSTRUCTION DEBRIS AND EXCESS MATERIALS FROM THE SITE PRIOR TO FINAL ACCEPTANCE.

13. THE PROVIDER OF THE FINANCIAL GUARANTEE FOR THE LANDSCAPE INSTALLATION SHALL BE FULLY RESPONSIBLE FOR COMPLETION OF THE LANDSCAPE INSTALLATION AND MAINTENANCE PER THE APPROVED LANDSCAPE PLAN AND APPLICABLE CITY ORDINANCES.

14. ALL LANDSCAPED AREAS TO BE IRRIGATED. IRRIGATION PLAN ISSUED AS A DEFERRED SUBMITTAL.

15. INSTALL PROFESSIONAL LANDSCAPE EDGE ALL AREAS WHERE GRASS ABUTS PLANTING AREAS.

prepared by:

UNDER THE SUN
ARCHITECTURAL LLC
11022 Mourning Dove Lane
South Lyon . MI . 48178

project title

DEMMER QUICKLANE

37410
MICHIGAN AVE.
WAYNE, MI

sheet title

QUICKLANE LANDSCAPE PLAN

DO NOT SCALE DRAWINGS
USE FIGURED DIMENSIONS ONLY

seal & signature

project number

13004

drawn	USA
approved	USA

issued	date
SITE PLAN APPROVAL	09-24-2013
SDP Resubmittal	02-03-2014

SHEET
A-101

AGS
APPLIED GEOTECHNICAL SERVICES, INC.

February 14, 2014

Mr. Scott A. Schumacher, Director of Engineering
GLA Surveyors and Engineers
8495 North Territorial Road
Plymouth, Michigan 48170

RE: Keystone Segmental Retaining Wall (SRW) Design
Proposed Jack Demmer Ford
37410 Michigan Avenue
Wayne, Michigan
AGS Project No. 14-1009 - Rev. 1

Dear Mr. Schumacher:

In accordance with your request, Applied Geotechnical Services, Inc. (AGS) has revised our engineering calculations and analyses and typical cross section design sketches to reflect the presence of the concrete curb adjacent to the walls and the limited distance from the back of Wall No. 1 to the west property line of the subject parcel. Our revised analyses and sketches include a maximum 4-foot tall, vertical wall using Keystone Standard® units for Wall No. 1 and a maximum 5.67-foot tall wall using Keystone Compac® units for Wall No. 2. Our stability analyses for the proposed retaining walls includes bearing capacity, sliding, overturning, geogrid reinforcement pullout, shear, and bending failure mechanisms in acccordance with the NCMA Design Manual for Segmental Retaining Walls 3rd Edition design guidelines. Our calculations indicate the design retaining wall sections will have adequate safety factors with respect to these failure mechanisms if the wall and geogrid reinforcement is constructed in accordance with our recommendations presented in the attached sheets. The design is based on the assumption suitable bearing soils are present below the wall.

We hope this information is sufficient for your present needs. Thank you for the opportunity to provide our services to you on this project. If there are any questions regarding this letter, please contact us.

Respectfully,

APPLIED GEOTECHNICAL SERVICES, INC.

Jefferey T. Anagnostou, P.E., C.P.G.
Geotechnical Engineer/Principal

STATE OF MICHIGAN
JEFFEREY ANAGNOSTOU
ENGINEER
No. 38129
LICENSED PROFESSIONAL ENGINEER

Encl: Retaining Wall Location Plan, Typical Wall Cross Sections, Construction Notes, & Standard Details (pp. 1-6) , Supporting Calculations (pp. 7-16).
2 pc: encl.

Applied Geotechnical Services, Inc.
15798 Riverside, Livonia, Michigan 48154
Tel/Fax: 734-293-5077

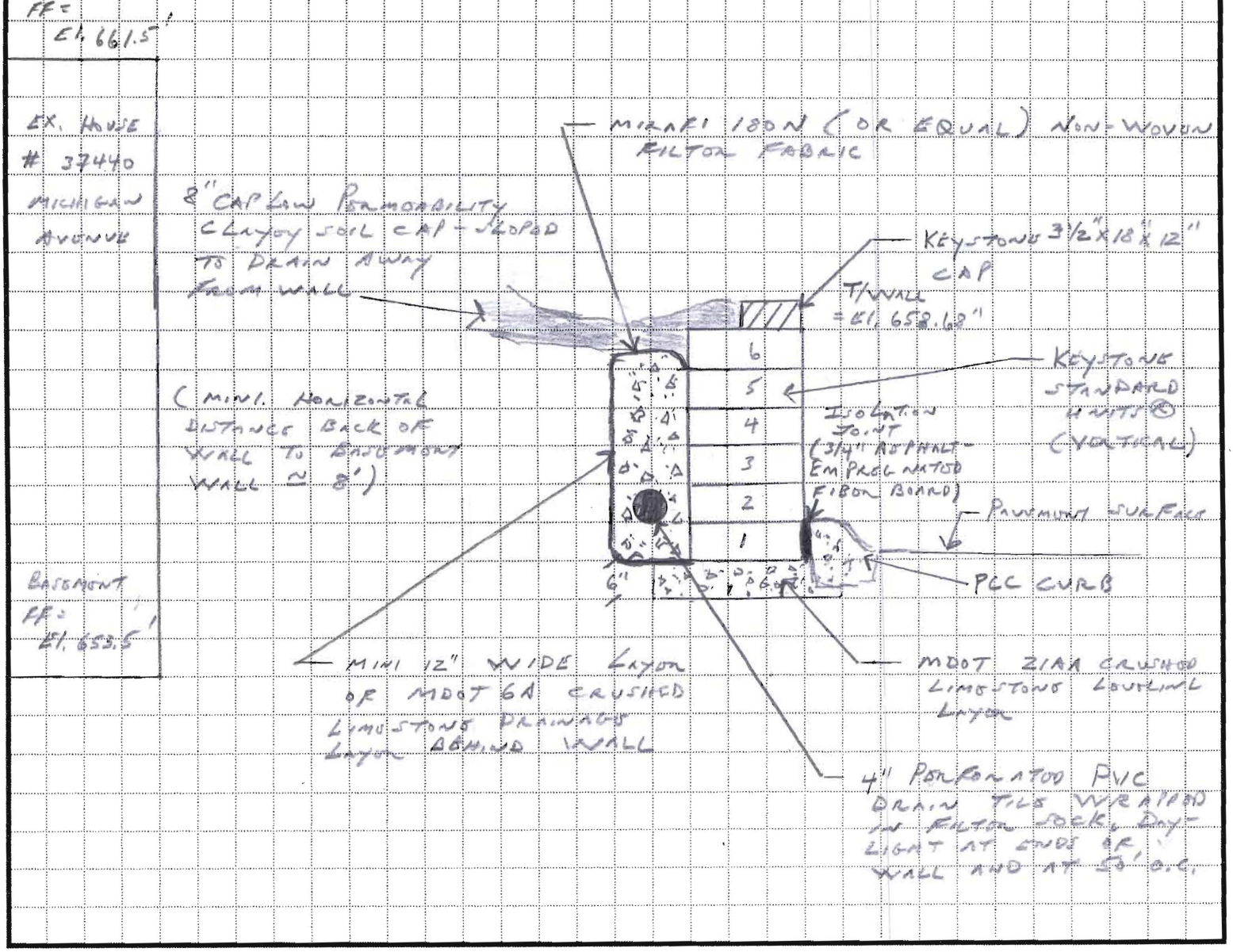
AGS
APPLIED GEOTECHNICAL SERVICES, INC

PROJECT NAME: Jack Dommon Ford Keystone SRW's SHEET: 1 OF 16

SUBJECT: SRW DESIGN PROJECT NO. 14-1009

DATE: 2/2014 BY: JAA CHECKED: JM

I. WALL No. 1 - TYPICAL CROSS-SECTION FOR KEYSTONE STANDARD® UNITS SRW (MAXIMUM WALL HGT = 40') :



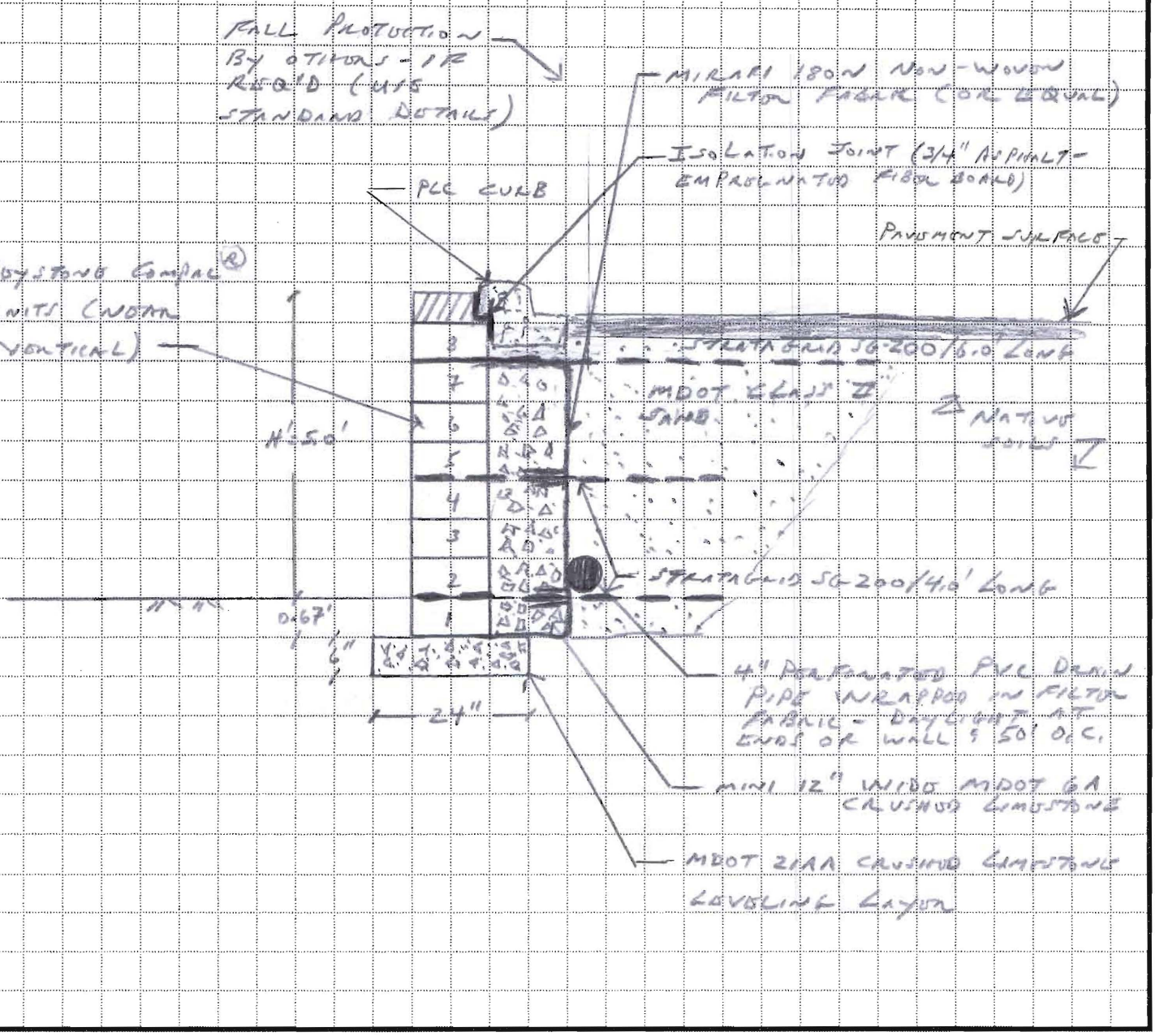
Applied Geotechnical Services, Inc.
15798 Riverside, Livonia, Michigan 48154
Tel/Fax: 734-293-5077

PROJECT NAME: Jack Dommon Pond Keystone SRW's SHEET: 2 OF 16

SUBJECT: SRW Design PROJECT NO. 141009

DATE: 2/2014 BY: JTA CHECKED: JTA

I. WALL No. 2 - Typical Cross Section for Keystone Compac® Units SRW (Maximum Wall Ht = 5.67')



Applied Geotechnical Services, Inc.
15798 Riverside, Livonia, Michigan 48154
Tel/Fax: 734-293-5077

PROJECT NAME: Jack Demmon Ford Keystone SRW's SHEET: 3 OF 16

SUBJECT: SRW Design PROJECT NO. 14-1009

DATE: 2/2014 BY: JTA CHECKED: _____

Construction Notes:

1) For Wall No.1, Blocks to consist of Keystone Standard® units placed with 8V:1H wall batter. For Wall No. 2, Blocks to consist of Keystone Compac® units placed in near vertical position.

2) Design Surcharge Live Loads: Wall No. 1 = 50 psf, Wall No. 2 = 250 psf

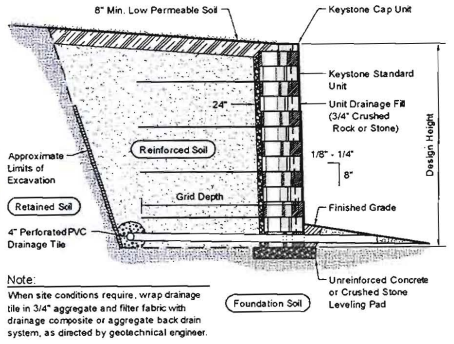
3) Walls must be supported on suitable native soils or engineered fill approved by Project Geotechnical Engineer.

4) Leveling Layer to consist of MDOT 21AA crushed Limestone, Reinforced fill to consist of MDOT Class II sand. Compact Leveling Layer & Reinforced fill to min. 95% of Modified Proctor Maximum Dry Density values.

5) Keystone standard details and recommendations must be followed.

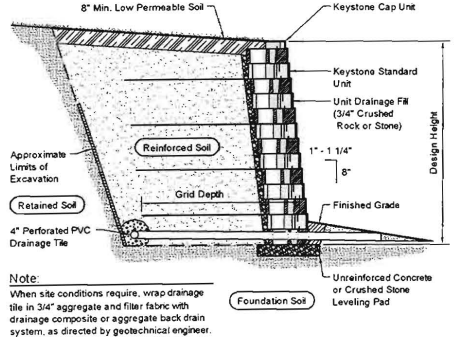
6) Fall Protection Railings to be designed by others per Federal, State and Local code requirements.

WALL NO. 1 – KEYSTONE STANDARD® UNITS



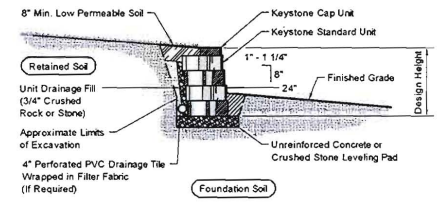
Note:
When site conditions require, wrap drainage tile in 3/4" aggregate and filter fabric with drainage composite or aggregate back drain system, as directed by geotechnical engineer.

Typical Reinforced Wall Section
Standard Unit - Near Vertical Setback



Note:
When site conditions require, wrap drainage tile in 3/4" aggregate and filter fabric with drainage composite or aggregate back drain system, as directed by geotechnical engineer.

Typical Reinforced Wall Section
Standard Unit - 1" Setback

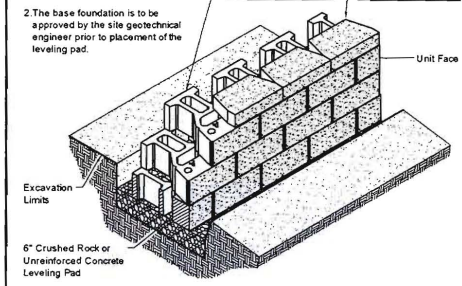


Typical Gravity Wall Section
Standard Unit - 1" Setback

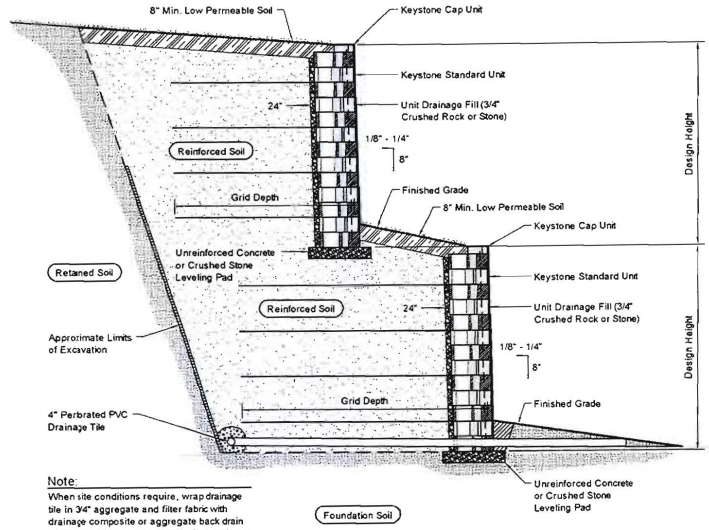
Base Leveling Pad Notes:

1. The leveling pad is to be constructed of crushed stone or 2,000 psi± unreinforced concrete
2. The base foundation is to be approved by the site geotechnical engineer prior to placement of the leveling pad.

Standard Unit		Cap Unit	
Width:	18"	Width:	18"
*Depth:	21 1/2"	*Depth:	10 1/2"
Height:	8"	Height:	4"
*Weight:	125 lbs	*Weight:	50 lbs

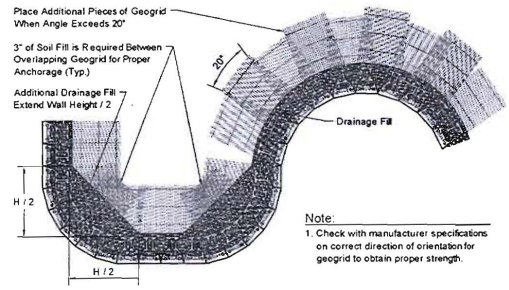


Standard Unit/Base Pad Isometric Section View
* Dimensions & Weight May Vary by Region



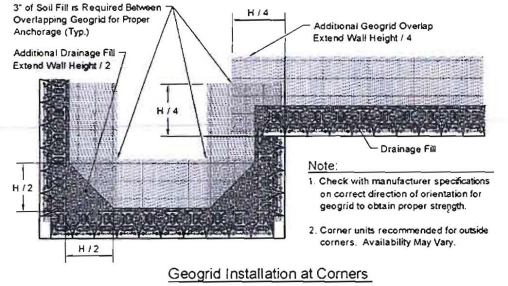
Note:
When site conditions require, wrap drainage tile in 3/4" aggregate and filter fabric with drainage composite or aggregate back drain system, as directed by geotechnical engineer.

Typical Reinforced Tiered Wall Section
Standard Unit - Near Vertical Setback



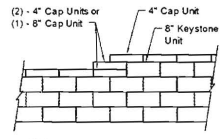
Note:
1. Check with manufacturer specifications on correct direction of orientation for geogrid to obtain proper strength.

Geogrid Installation on Curves



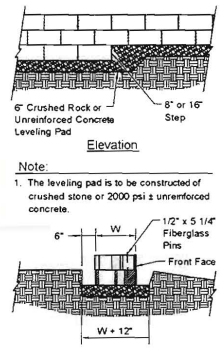
Note:
1. Check with manufacturer specifications on correct direction of orientation for geogrid to obtain proper strength.
2. Corner units recommended for outside corners. Availability May Vary.

Geogrid Installation at Corners



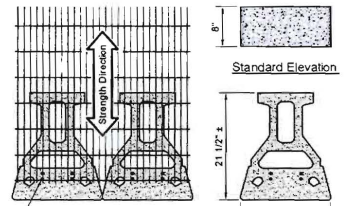
Note:
1. Secure all cap units with Keystone Kapseal or equal.

Top of Wall Steps



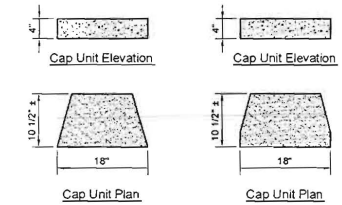
Note:
1. The leveling pad is to be constructed of crushed stone or 2000 psi ± unreinforced concrete.

Leveling Pad Detail



Grid & Pin Connection

Standard Unit
* Dimensions May Vary by Region



Universal Cap Unit Option
* Dimensions & Availability Will Vary by Region

Straight Split Cap Unit Option
* Dimensions & Availability Will Vary by Region

Design is for internal stability of the KEYSTONE wall structure only. External stability, including but not limited to foundation and slope stability is the responsibility of the Owner. The design is based on the assumption that the materials within the retained mass, methods of construction, and quality of materials conform to KEYSTONE's specification for this project.

This drawing is being furnished for this specific project only. Any party accepting this document does so in confidence and agrees that it shall not be duplicated in whole or in part, nor disclosed to others without the consent of Keystone Retaining Wall Systems, Inc.

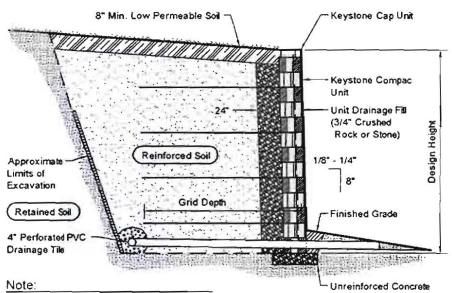
No.	Date	Revision	By

KEYSTONE RETAINING WALL SYSTEMS
A CONTECH COMPANY
4444 W 78th Street
Minneapolis, MN 55435
952-897-1040

Designed By: RKM	Title: Standard Unit 21 - Straight Face Details		Date:
Checked By: CDM	Project: Keystone Retaining Wall Systems Typical Wall Details		Project No:
Scale: No Scale			Drawing No:

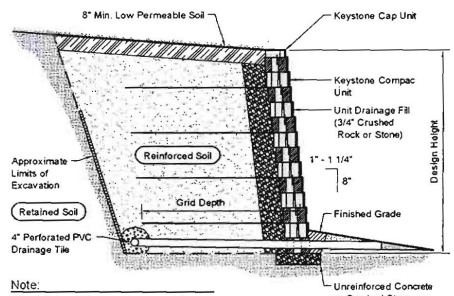
P. 4/16

WALL NO. 2 - KEYSTONE COMPAC® UNITS



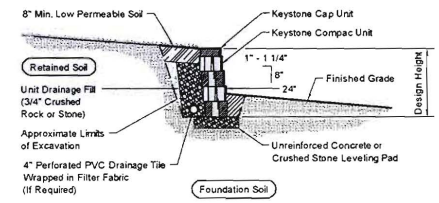
Note:
When site conditions require, wrap drainage tile in 3/4" aggregate and filter fabric with drainage composite or aggregate back drain system, as directed by geotechnical engineer.

Typical Reinforced Wall Section
Compac Unit - Near Vertical Setback



Note:
When site conditions require, wrap drainage tile in 3/4" aggregate and filter fabric with drainage composite or aggregate back drain system, as directed by geotechnical engineer

Typical Reinforced Wall Section
Compac Unit - 1" Setback



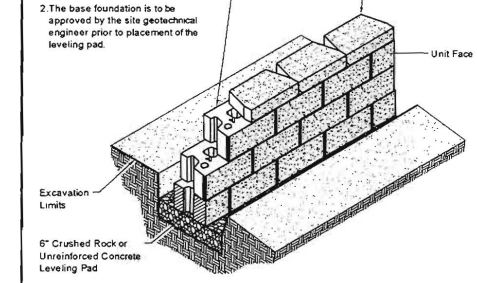
Typical Gravity Wall Section
Compac Unit - 1" Setback

Base Leveling Pad Notes:

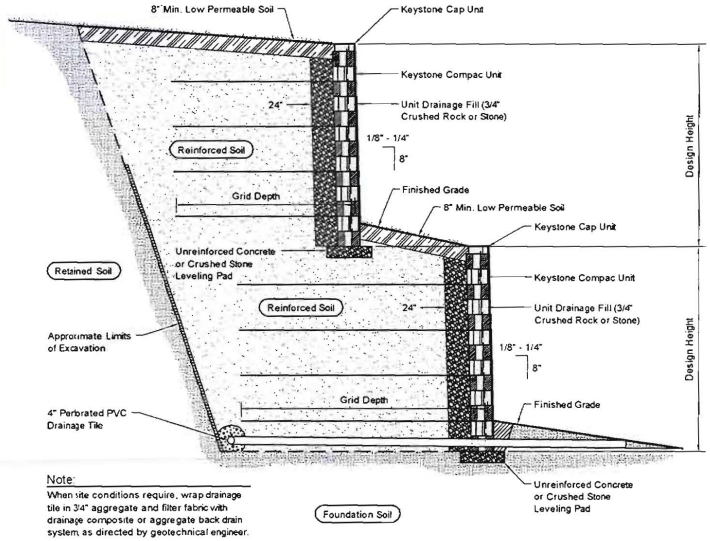
1. The leveling pad is to be constructed of crushed stone or 2,000 psi± unreinforced concrete
2. The base foundation is to be approved by the site geotechnical engineer prior to placement of the leveling pad.

Compac Unit	
Width:	18"
*Depth:	12"
Height:	8"
*Weight:	90 lbs

Cap Unit	
Width:	18"
*Depth:	10 1/2"
Height:	4"
*Weight:	50 lbs

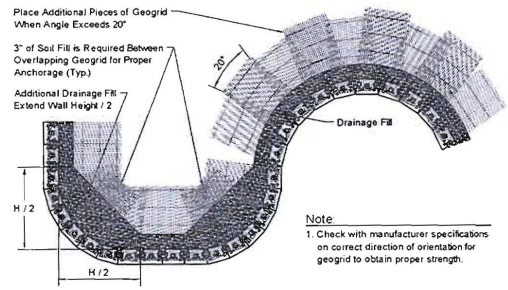


Compac Unit/Base Pad Isometric Section View
* Dimensions & Weight May Vary by Region



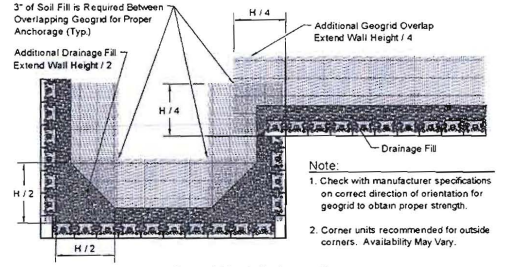
Note:
When site conditions require, wrap drainage tile in 3/4" aggregate and filter fabric with drainage composite or aggregate back drain system, as directed by geotechnical engineer.

Typical Reinforced Tiered Wall Section
Compac Unit - Near Vertical Setback



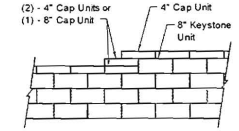
Note:
1. Check with manufacturer specifications on correct direction of orientation for geogrid to obtain proper strength.

Geogrid Installation on Curves



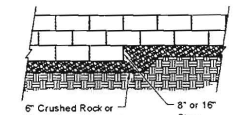
Note:
1. Check with manufacturer specifications on correct direction of orientation for geogrid to obtain proper strength.
2. Corner units recommended for outside corners. Availability May Vary.

Geogrid Installation at Corners



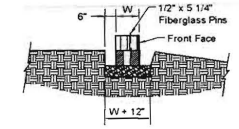
Note:
1. Secure all cap units with Keystone Kapseal or equal.

Top of Wall Steps



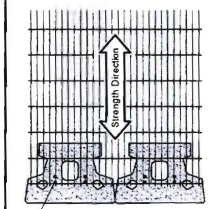
Elevation

Note:
1. The leveling pad is to be constructed of crushed stone or 2000 psi ± unreinforced concrete.



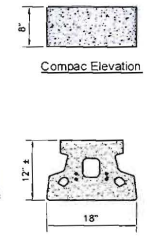
Section

Leveling Pad Detail

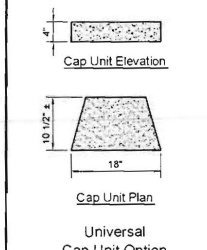


Geogrid is to be Placed on Level Backfill and Extended Over the Fiberglass Pins. Place Next Unit. Pull Grid Taught and Backfill. Stake as required.

Grid & Pin Connection



Compac Unit
* Dimensions May Vary by Region



Universal Cap Unit Option
* Dimensions & Availability Will Vary by Region

Straight Split Cap Unit Option
* Dimensions & Availability Will Vary by Region

Design is for internal stability of the KEYSTONE wall structure only. External stability, including but not limited to foundation and slope stability is the responsibility of the Owner. The design is based on the assumption that the materials within the retained mass, methods of construction, and quality of materials conform to KEYSTONE's specification for this project.

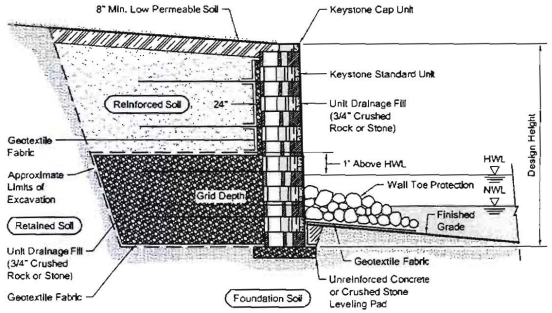
This drawing is being furnished for this specific project only. Any party accepting this document does so in confidence and agrees that it shall not be duplicated in whole or in part, nor disclosed to others without the consent of Keystone Retaining Wall Systems, Inc.

No.	Date	Revision	By

KEYSTONE
A CONTECH COMPANY
4444 W 78th Street
Minneapolis, MN 55435
952-897-1040

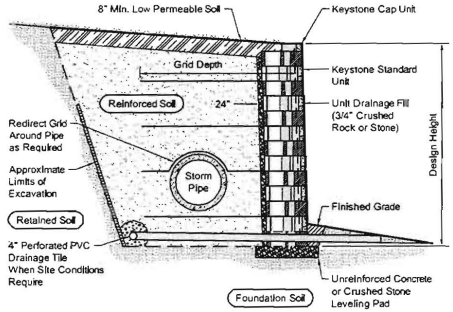
Designed By: RKM	Title: Compac Unit - Straight Face Details		Date:
Checked By: CDM	Project: Keystone Retaining Wall Systems Typical Wall Details		Project No:
Scale: No Scale			Drawing No:

WALL NOS. 1 & 2 CONCEPTUAL DETAILS & RAILING POST INSTALLATION



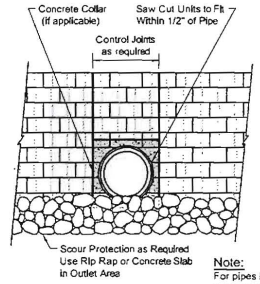
Typical Reinforced Water Wall Section

Standard Unit - Near Vertical Setback

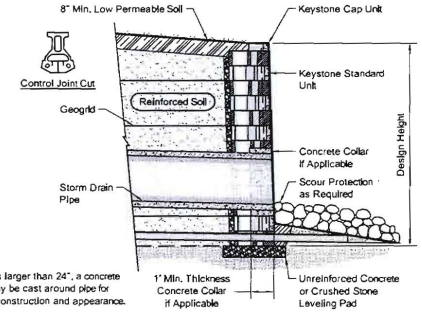


Wall Section with Pipe in Reinforced Zone

Standard Unit - Near Vertical Setback



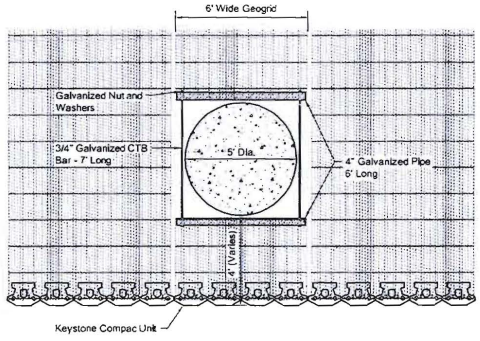
Typical Pipe Outlet Detail



Note:
For pipes larger than 24", a concrete collar may be cast around pipe for ease of construction and appearance.

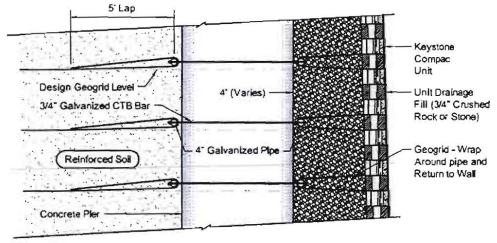
Typical Pipe Outlet Section

Standard Unit - Near Vertical Setback



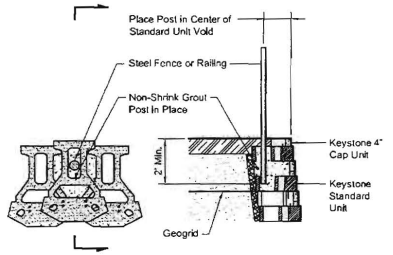
Wall Plan at Pier / Manhole

Compac Unit



Wall Section at Pier / Manhole

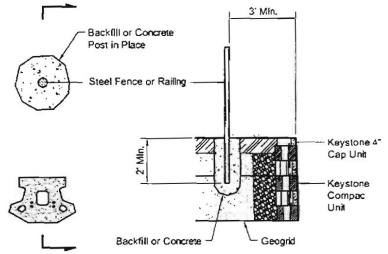
Compac Unit - Near Vertical Setback



Fence Plan Detail

Fence SectionDetail

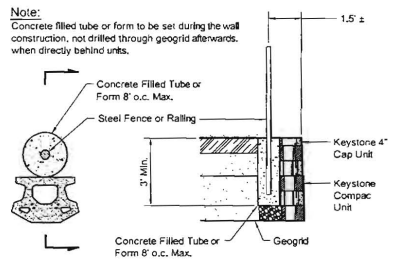
Standard Unit - 1" Setback



Fence Plan Detail

Fence SectionDetail

Compac Unit - Near Vertical Setback

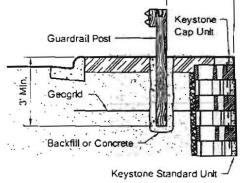


Fence Plan Detail

Fence Section & Plan Detail

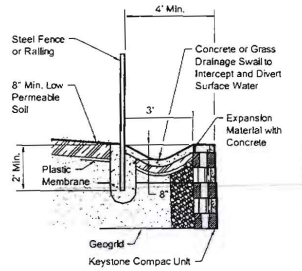
Compacll Unit - Near Vertical Setback

Note:
1. Auger through geogrid layers.
2. Backfill or concrete guardrail post in place.



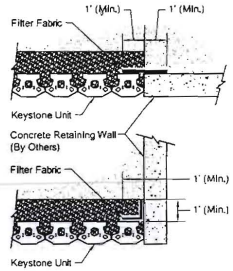
Typical Guardrail Detail

Standard Unit - Near Vertical Setback Shown



Drainage Swale Detail

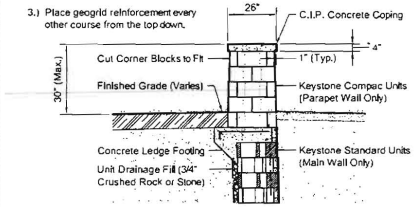
Compac Unit - Near Vertical Setback Shown



Connection Details

Compac Unit - Shown

Note:
1.) Corner units will need to be cut to size for each course to maintain proper batter and alignment.
2.) Secure corner with Keystone Kapseal adhesive or other bonding agent, or by drilling pin holes in each adjoining unit.
3.) Place geogrid reinforcement every other course from the top down.



Parapet End Detail

Near Vertical Setback Shown

Design is for internal stability of the KEYSTONE wall structure only. External stability, including but not limited to foundation and slope stability is the responsibility of the Owner. The design is based on the assumption that the materials within the retained mass, methods of construction, and quality of materials conform to KEYSTONE's specification for this project.

This drawing is being furnished for this specific project only. Any party accepting this document does so in confidence and agrees that it shall not be duplicated in whole or in part, nor disclosed to others without the consent of Keystone Retaining Wall Systems, Inc.

No.	Date	Revision	By

KEYSTONE RETAINING WALL SYSTEMS
A CENTEC COMPANY
4444 W 78th Street
Minneapolis, MN 55435
952-897-1040

Designed By:	RKM
Checked By:	CDM
Scale:	No Scale
Title:	Conceptual Details
Project:	Keystone Retaining Wall Systems Typical Wall Details
Date:	
Project No:	
Drawing No:	

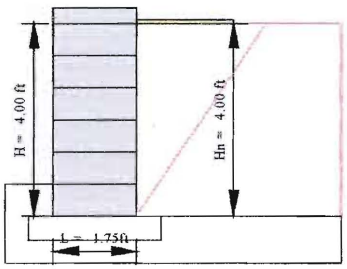
P. 6/16

RETAINING WALL DESIGN

KeyWall_2012 Version 3.7.2 Build 10

Project: *Jack Demmer Ford Keystone SRWs*
Project No: *14-1009*
Case: *Case 1*
Design Method: *NCMA 3rd Edition (parallelogram soil interface)*

Date: *2/9/2014*
Designer: *AGS, Inc.*



Design Parameters

Soil Parameters:	**ϕ deg**	**c psf**	**γ pcf**
Retained Zone	*30*	*0*	*120*
Foundation Soil	*30*	*0*	*120*
Unit Fill:	*Crushed Stone, 1 inch minus*		

Minimum Design Factors of Safety

sliding:	1.50	pullout:	1.50	uncertainties:	1.50
overturning:	1.50	shear:	1.50	connection:	1.50
bearing:	2.00	bending:	1.50		

Design Preferences

Friction in Base Grid Ten

Analysis: **Case: Case 1**

Wall No. 1 - Standard Units Max H = 4.0'

Unit Type:	Standard 21" / 120.00 pcf	Wall Batter: 0.00 deg (Hinge Ht N/A)
Leveling Pad:	Crushed Stone	
Wall Ht:	4.00 ft	embedment: 0.67 ft
Level Backfill	Offset: 0.00 ft	
Surcharge:	LL: 50 psf uniform surcharge	DL: 0 psf uniform surcharge
	Load Width: 2.00 ft	Load Width: 100.00 ft

Results:	**Sliding**	**Overturning**	**Bearing**	**Shear**	**Bending**
Factors of Safety:	2.28	1.67	5.49	N/A	N/A

Calculated Bearing Pressure: *764 / 764 psf*
Eccentricity at base: 0.52 ft

NOTE: THESE CALCULATIONS ARE FOR PRELIMINARY DESIGN ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION WITHOUT REVIEW BY A QUALIFIED ENGINEER

DETAILED CALCULATIONS

Project: *Jack Demmer Ford Keystone SRWs* **Date:** *2/9/2014*
Project No: *14-1009* **Designer:** *AGS, Inc.*
Case: *Case 1*
Design Method: *NCMA 3rd Edition (parallelogram soil interface)*

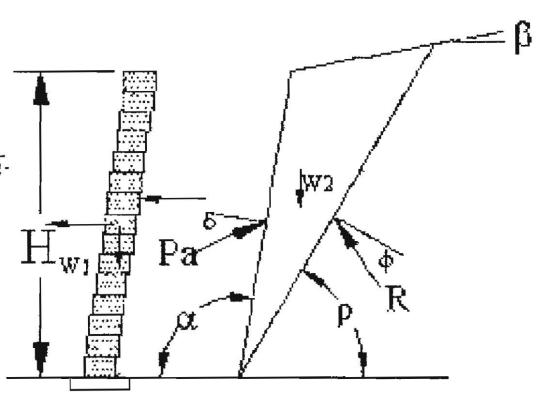
Soil Parameters:	**ϕ deg**	**c psf**	**γ pcf**
Retained Zone	*30*	*0*	*120*
Foundation Soil	*30*	*0*	*120*

Leveling Pad: ***Crushed Stone***

Modular Concrete Unit: *Standard 21"*
Depth: *1.75 ft* **In-Place Wt:** *120 pcf*

Geometry
Earth Pressures:

$$k_a = \frac{\sin^2(\alpha+\phi)}{\sin^2\alpha\,\sin(\alpha-\delta)\left[1+\sqrt{\frac{\sin(\phi+\delta)\sin(\phi-\beta)}{\sin(\alpha-\delta)\sin(\alpha+\beta)}}\right]^2}$$



External

ϕ = 30 deg
α = 90.00 deg
β = 0.00 deg
δ = 20.00 deg
ka = 0.297

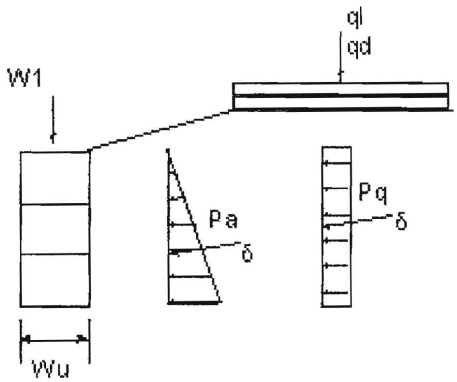
Hinge Height: Hinge Ht= Not applicable

Calculated Reactions

$Pa = 0.5\ H\ (\gamma H\ ka - 2c\sqrt{ka})$ $\quad Pq = q\ H\ ka$

$Pa_h = Pa \cos(\delta)$ $\quad Pq_h = Pq \cos(\delta)$

$Pa_v = Pa \sin(\delta)$ $\quad Pq_v = Pq \sin(\delta)$



Reactions are:

Area	Force	Arm-x	Arm-y	Moment
W1	*840.00*	*[0.875]*	*2.000*	*735.00*
Pa_h	*268.21*	*1.750*	*[1.333]*	*-357.61*
Pql_h	*41.40*	*4.000*	*[2.000]*	*-82.79*
Sum V =	*840.00*		*Sum Mr =*	*735.00*
Sum H =	*309.60*		*Sum Mo =*	*-440.40*

Calculate Sliding at the base:
Horizontal Earth Pressure (Df) = 309.60 ppf
Base Sliding Resistance, RF = 705 ppf
Factor of Safety = Rf/Df = 2.28
Calculate Overturning about base:
Driving Moment (Dm) = -440.40
Resisting Moment (Rm) = 735.00
Factor Of Safety Of Overturning = Rm / Dm = 1.67

Calculate eccentricity at base: [no surcharge]
Sum Moments = 295
Sum Vertical = 840
Base Length = 1.75
e = 0.524

Calculate Ultimate Bearing based on shear:
where:

Nq = 18.40
Nc = 30.14
Ng = 22.40 (ref. Vesic(1973, 1975) eqns)
Qult = 4198 psf

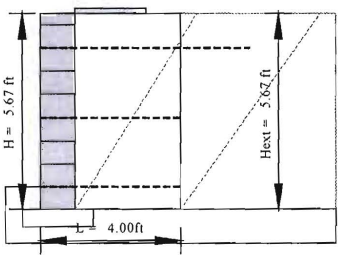
Equivalent footing width, B' = L -2e + Lvlpad depth= 1.20
Bearing pressure = sumV/B' = 764 psf
Factor Of Safety For Bearing Qult Bearing= 5.49

RETAINING WALL DESIGN

KeyWall_2012 Version 3.7.2 Build 10

Project: *Jack Demmer Ford Keystone SRWs*
Project No: *14-1009*
Case: *Case 1*
Design Method: *NCMA 3rd Edition (parallelogram soil interface)*

Date: *2/9/2014*
Designer: *AGS, Inc.*



Design Parameters

Soil Parameters:	**ϕ deg**	**c psf**	**γ pcf**
Reinforced Fill	*34*	*0*	*120*
Retained Zone	*30*	*0*	*120*
Foundation Soil	*30*	*0*	*120*

Reinforced Fill Type: *Sand, Silt or Clay*
Unit Fill: *Crushed Stone, 1 inch minus*

Minimum Design Factors of Safety

sliding:	1.50	pullout:	1.50	uncertainties:	1.50
overturning:	2.00	shear:	1.50	connection:	1.50
bearing:	2.00	bending:	1.50		

Design Preferences

Friction in Base Grid Ten

Reinforcing Parameters: *Mirafi XT Geogrids (Min RFcr,RFd,RFid Defaults)*

	Tult	*RFcr*	*RFd*	*RFid*	*LTDS*	*FS*	*Tal*	*Ci*	*Cds*
3XT	*3500*	*2.00*	*1.10*	*1.25*	*1273*	*1.50*	*848*	*0.90*	*0.90*

Analysis: ***Case: Case 1***

Wall No. 2 - Compac Units Max H = 5.67'

Unit Type:	*Compac / 120.00 pcf*	*Wall Batter: 0.00 deg (Hinge Ht N/A)*
Leveling Pad:	*Crushed Stone*	
Wall Ht:	*5.67 ft*	*embedment: 0.67 ft*
Level Backfill	*Offset: 0.00 ft*	
Surcharge:	*LL: 250 psf uniform surcharge*	*DL: 0 psf uniform surcharge*
	Load Width: 2.00 ft	*Load Width: 100.00 ft*

Results:

	Sliding	***Overturning***	***Bearing***	***Shear***	***Bending***
Factors of Safety:	*3.17*	*5.80*	*6.97*	*7.74*	*1.76*

Calculated Bearing Pressure: *902 / 822 psf*
Eccentricity at base: 0.21 ft
Reinforcing: (ft & lbs/ft)

Layer	**Height**	**Length**	**Calc. Tension**	**Reinf. Type**	**Allow Ten Tal**	**Pk Conn Tcl**	**Pullout FS**
3	*4.67*	*6.0*	*174*	*3XT*	*848 ok*	*424 ok*	*1.78 ok*
2	*2.67*	*4.0*	*286*	*3XT*	*848 ok*	*572 ok*	*2.07 ok*
1	*0.67*	*4.0*	*230*	*3XT*	*848 ok*	*721 ok*	*8.22 ok*

Reinforcing Quantities (no waste included):
3XT 1.56 sy/ft

NOTE: THESE CALCULATIONS ARE FOR PRELIMINARY DESIGN ONLY AND SHOULD NOT BE USED FOR CONSTRUCTION WITHOUT REVIEW BY A QUALIFIED ENGINEER

DETAILED CALCULATIONS

Project: *Jack Demmer Ford Keystone SRWs* **Date:** *2/9/2014*
Project No: *14-1009* **Designer:** *AGS, Inc.*
Case: *Case 1*
Design Method: *NCMA 3rd Edition (parallelogram soil interface)*

Soil Parameters:	**ϕ deg**	**c psf**	**γ pcf**
Reinforced Fill	*34*	*0*	*120*
Retained Zone	*30*	*0*	*120*
Foundation Soil	*30*	*0*	*120*

Leveling Pad: ***Crushed Stone***

Modular Concrete Unit: *Compac*
Depth: *1.00 ft* **In-Place Wt:** *120 pcf*

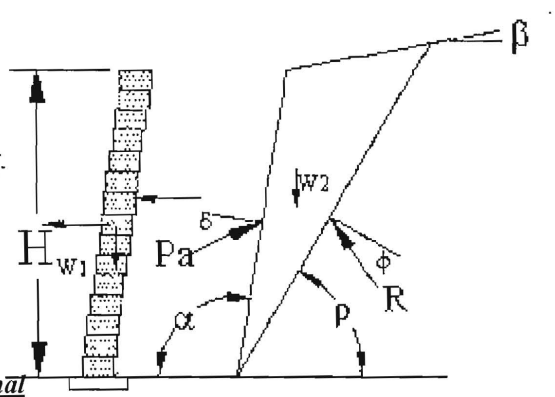
Geometry

Internal Stability
(Horizontal geometry)
Height: 5.67 ft
BackSlope:
Angle: 0.0 deg
Height: 0.00 ft
Batter: 0.00deg
Surcharge:
Dead Load: 0.00 psf
Live Load: 250.00 psf
Base width: 4.0 ft

External Stability
(Horizontal geometry)
Height: 5.67 ft
Angle: 0.00 deg
Height: 0.00 ft
Batter: 0.00deg
Dead Load: 0.00 psf
Live Load:250.00 psf

Earth Pressures:

$$k_a = \frac{\sin^2(\alpha+\phi)}{\sin^2\alpha\,\sin(\alpha-\delta)\left[1+\sqrt{\frac{\sin(\phi+\delta)\sin(\phi-\beta)}{\sin(\alpha-\delta)\sin(\alpha+\beta)}}\right]^2}$$



Internal		***External***	
ϕ	= 34 deg	ϕ	= 30 deg
α	= 90.00 deg	α	= 90.00 deg
β	= 0.00 deg	β	= 0.00 deg
δ	= 22.67 deg	δ	= 30.00 deg
H	= 5.67 ft		
ka	= 0.254	ka	= 0.297

Hinge Height: Hinge Ht= Not applicable

Reinforcing Parameters: *Mirafi XT Geogrids (Min RFcr,RFd,RFid Defaults)*

	Tult	RFcr	RFd	RFid	LTDS	FS	Tal	Ci	Cds
3XT	*3500*	*2.00*	*1.10*	*1.25*	*1273*	*1.50*	*848*	*0.90*	*0.90*

Connection Parameters: Mirafi XT Geogrids

	Frictional 1	Break Pt	Frictional 2
3XT	*Tcl= Ntan(42.80) + 525*	*1100*	*Tcl= Ntan(11.10) +1328*

Unit Shear Data

Shear = N tan(40.00)
Inter-Unit ShearShear = N tan(26.90) + 769.00

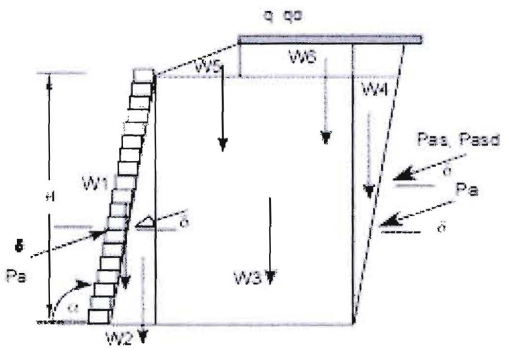
Calculated Reactions

effective sliding length = 4.00 ft

$Pa := 0.5H \cdot (\gamma \cdot H \cdot ka - 2c \cdot \sqrt{ka})$ $\quad P_q := q \cdot H \cdot ka$

$Pa_h := Pa \cdot \cos(\delta)$ $\quad Pq_h := P_q \cdot \cos(\delta)$

$Pa_v := Pa \cdot \sin(\delta)$ $\quad Pq_v := P_q \cdot \sin(\delta)$



Reactions are:

Area	Force	Arm-x	Arm-y	Moment
W1	*680.40*	*[0.500]*	*2.835*	*340.20*
W3	*2041.20*	*[2.500]*	*2.835*	*5103.00*
ql	*500.00*	*[2.500]*	*5.670*	*1250.00*
Pa_h	*496.43*	*4.000*	*[1.890]*	*-938.25*
Pql_h	*0.00*	*4.000*	*[2.835]*	*0.00*
Sum V =	*3221.60*		*Sum Mr =*	*6693.20*
Sum H =	*496.43*		*Sum Mo =*	*-938.25*

Calculate Sliding at Base

For Sliding, Vertical Force = W1+W2+W3+W4+W5+W6+qd	= 2722
The resisting force within the rein. mass , Rf_1	= N tan(34)
	= 1836
The resisting force at the foundation, Rf_2	= N tan(30.00)
	= 1571
The driving forces, Df, are the sum of the external earth pressures:	
Pa_h + Pql_h + Pqd_h	= 496
the Factor of Safety for Sliding is Rf_2/Df	= 3.17

Calculate Overturning:

Overturning moment: Mo = Sum Mo	= -938
Resisting moment: Mr = Sum Mr	= 5443
Factor of Safety of Overturning: Mr/Mo	= 5.80

Calculate eccentricity at base: with Surcharge / without Surcharge
Sum Moments = 5755 / 4505
Sum Vertical = 3222/2722
Base Length = 4.00
e = 0.214 / 0.345

Calculate Ultimate Bearing based on shear:
where:

Nq = 18.40
Nc = 30.14
Ng = 22.40 (ref. Vesic(1973, 1975) eqns)
Qult = 6282 psf

Equivalent footing width, B' = L -2e = 3.57 / 3.31
Bearing pressure = sumV/B' = 902 psf / 822 psf [bearing is greatest with liveload]
Factor of Safety for bearing = Qult/bearing= 6.97

Calculate Tensions in Reinforcing:
The tensions in the reinforcing layer, and the assumed load at the connection,
is the vertical area supported by each respective layer, Sv.Column [7] is '2c sqrt(ka)'.

Table of Results ppf

[1] Layer	[2] Depth zi	[3] h1	[4] ka/rho	[5] Pa	[6] (Pas+Pasd)	[7] c	[8] (5+6)cos(d)-7	[9] Ti	[10] Tcl	[11] Tsc
3	1.00	1.00	0.254/58	61	127	0	174	174	424	N/A
2	3.00	3.00	0.254/58	183	127	0	286	286	572	N/A
1	5.00	4.67	0.254/58	190	59	0	230	230	721	N/A

Calculate sliding on the reinforcing:

The shear value is the lessor of base-shear or inter-unit shear.

[1] Layer	[2] Depth zi	[3] N	[4] Li	[5] Cds	[6] τ	[7] RF	[8] ka	[9] Pa	[10] Pas+Pasd	[11] DF	[12] FS
3	*1.00*	*602*	*5.00*	*0.90*	*830*	*1196*	*0.297*	*18*	*0*	*16*	*76.91*
2	*3.00*	*1081*	*3.00*	*0.90*	*952*	*1608*	*0.297*	*161*	*0*	*139*	*11.55*
1	*5.00*	*1801*	*3.00*	*0.90*	*1074*	*2167*	*0.297*	*446*	*0*	*387*	*5.61*

Calculate pullout of each layer

The FoS (R*/S*) of pullout is calculated as the individual layer pullout (Rf) divided by the tension (Df) in that layer.
The angle of the failure plane is: 31.65 degrees from vertical.

[1] Layer	[2] Depth zi	[3] Le	[4] SumV	[5] Ci	[6] POi	[7] Ti	[8] FS_PO
3	*1.00*	*2.12*	*256*	*0.90*	*310*	*174*	*1.78*
2	*3.00*	*1.36*	*489*	*0.90*	*594*	*286*	*2.07*
1	*5.00*	*2.59*	*1554*	*0.90*	*1887*	*230*	*8.22*

Check Shear & Bending at each layer

Bending on the top layer is the FOS of overturning of the Units
(Most surcharge loads need to be moved back from the face.)

[1] Layer	*[2] Depth zi*	*[3] Si*	*[4] DM*	*[5] Pv*	*[6] RM*	*[7] FS_b*	*[8] DS*	*[9] RS*	*FS_Sh*
3	*1.00*	*1.00*	*34*	*120*	*60*	*1.76*	*73*	*830*	*11.37*
2	*3.00*	*2.00*	*60*	*240*	*220*	*3.69*	*121*	*952*	*7.84*
1	*5.00*	*2.00*	*70*	*480*	*380*	*5.46*	*139*	*1074*	*7.74*