RETAINING WALL INSTALLATION GUIDE

LondonStone™

LondonLites™

Straight Face

LondonStone Steps

Rugged LondonStone

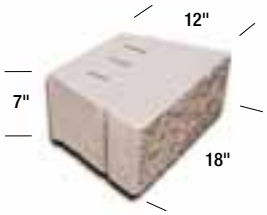
LondonStone™

Retaining wall systems

A Step Ahead of the Rest

LondonStone™ Product Line Specifications

7" LondonStone
7 x 16 x 12
Weight: 75 lbs.
Face Area: .78 sq. ft
Units per Cube: 27



7" Straight Face
7 x 18 x 12
Weight: 80 lbs.
Face Area: .88 sq. ft
Units per Cube: 27

4" Beveled Cap
4 x 16 x 12
Weight: 50 lbs.
Face Area: .44 sq. ft
Units per Cube: 45

Reversible Cap
4 x 18 x 10 1/2
Weight: 45 lbs.
Face Area: .50 sq. ft
Units per Cube: 60

Step Unit
7 x 16 x 20
Weight: 168 lbs.
Face Area: .78 sq. ft
Units per Cube: 12

Half Step
7 x 8 x 20
Weight: 84 lbs.
Face Area: .39 sq. ft
Units per Cube: 24

Decrowall
4 x 12 x 8
Weight: 25 lbs.
Face Area: .33 sq. ft
Units per Cube: 96

Decrowall Cap
2 5/8" x 8 x 8
Weight: 10 lbs.
Face Area: .14 sq. ft
Units per Cube: 208

Rugged LondonStone

Patent Pending

Rugged LondonStone is packaged as one unit in three different sizes. Rugged Cap is sold separately.

Rugged Cap
4 x 18 x 10 1/2
Weight: 45 lbs.
Face Area: .50 sq. ft
Units per Cube: 60

6" Rugged
7 x 6 x 12
Weight: 35 lbs.
Face Area: .29 sq. ft

12" Rugged
7 x 12 x 12
Weight: 68 lbs.
Face Area: .58 sq. ft

18" Rugged
7 x 18 x 12
Weight: 79 lbs.
Face Area: .88 sq. ft

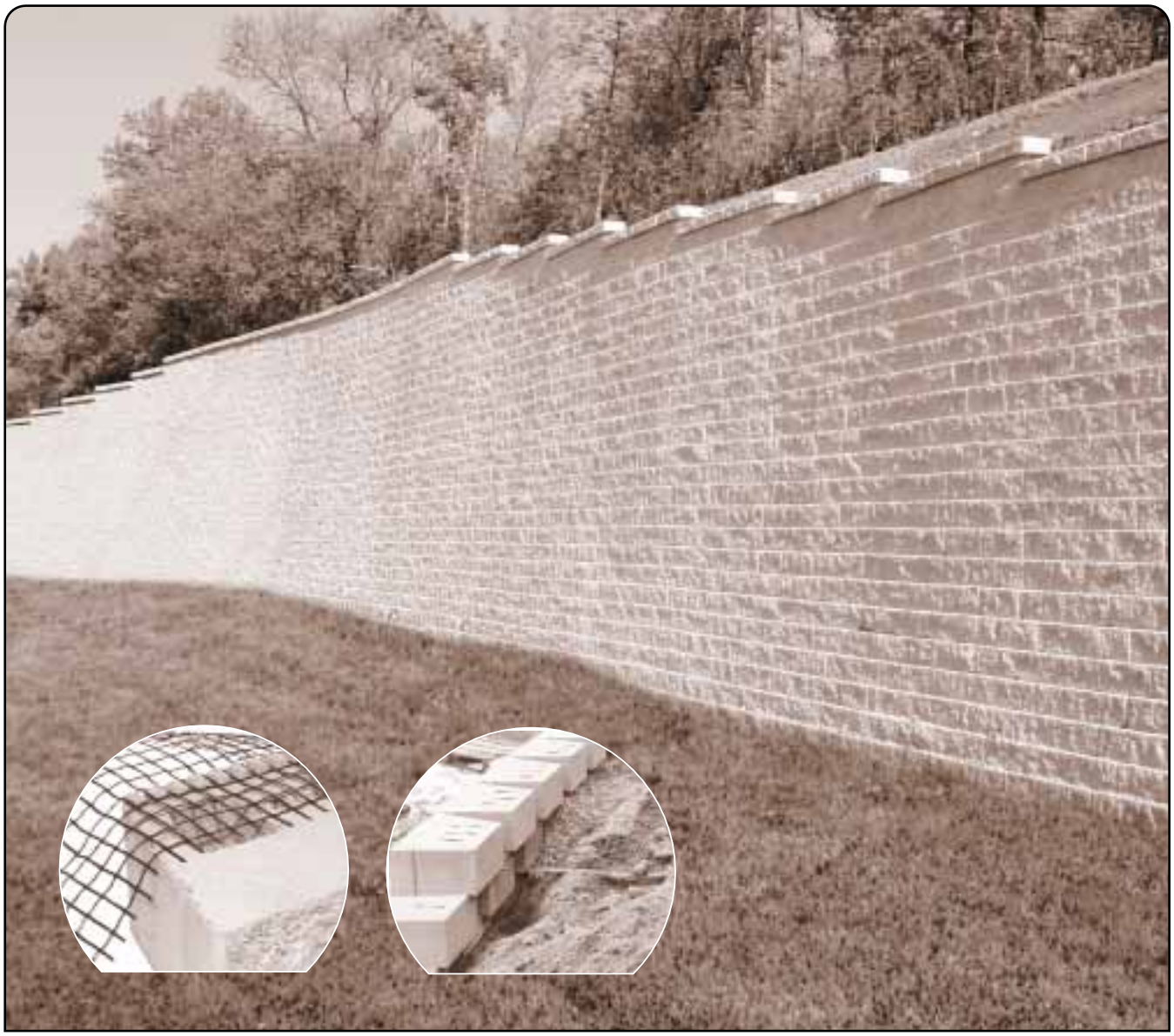
London Lites™ Patented

The only lite system...

- An affordable landscape lighting alternative
- Low voltage lighting system designed into all of our block sizes & colors
- Easy installation
- Safety feature of having a wall lit stairway or walkway
- Easy maintenance with a screw in lens cap on the front of the block

LondonStone™

Geogrid Retaining Wall System



A Step Ahead of the Rest

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RETAINING WALL WITH A LOAD

Surcharge loads on a retaining wall may be caused by a variety of sources, e.g., parking lots, bulk storage, buildings, and other retaining walls.

In general, if the source of surcharge is at least a distance twice the total height of the surcharged wall, its influence is minimal and may be safely
ignored in your design.

LONDONSTONE GRID LIP BLOCK: NO SLOPE WITH 250 PSF SURCHARGE

ϕ = 34° e.g. Sand / Gravel	Total Wall Height H	Exposed Wall Height H1	Embedment D	Number of Courses	Geogrid Type	Geogrid Length L								Number of Geogrid Layers
	(ft)	(ft)	(ft)	---	---	(ft)	GRID ELEVATION FROM FIRST COURSE BOTTOM							---
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	7'-0"	6'-6"	0'-6"	12	5XT	6'-6"	1'-2"	2'-11"	4'-8"	6'-5"				4
	8'-9"	7'-9"	1'- 0"	15	5XT	7'-0"	1'-9"	3'-6"	5'-10"	7'-0"				4
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ϕ = 30° e.g. Silty Sand	Total Wall Height H	Exposed Wall Height H1	Embedment D	Number of Courses	Geogrid Type	Geogrid Length L								Number of Geogrid Layers
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ϕ = 28° e.g. Sandy Silt / Lean Clay	Total Wall Height H	Exposed Wall Height H1	Embedment D	Number of Courses	Geogrid Type	Geogrid Length L								Number of Geogrid Layers
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Methodology: NCMA Design Manual for SRW, 2nd edition. Grid reinforcement LTDS = 1250 lbs/ft. γ = 120 pcf, Sliding SF = 1.5 Overturning SF = 2.0, Global stability checks not included, Soils compacted to min. 95% proctor, No additional surcharges on wall. No water loading. Level wall toe only.

OTHER STRUCTURES NEARBY

Loads due to structures such as buildings, parking lots, storage areas, etc. close to your wall can have an impact on final design. Depending on the circumstances, these loads may be classified either as live or dead, depending on their relative duration.

For example, slopes generally are considered dead loads, whereas loads coming from parking lots may be classified as live, due to their shorter duration. Dead loads, e.g., building loads, or loads from a tiered wall may contribute to the overall stability of the wall, depending on closeness to the wall edge. As a general rule, the closer to the wall edge the more likely it is that those loads may stabilize the wall, however, surcharges increase the stresses on both block and reinforcing grids. Keep in mind these facts will contribute to a balanced design.

Live loads, such as those resulting from bulk storage, vehicular traffic, etc. may act both as stabilizing and destabilizing forces in your design. Typically, a conservative design approach is to neglect any live loads as part of the resisting set of forces in design.

As a rule of thumb, surcharge loads that are at a distance of twice the height of a wall below can be neglected in a design.

SOILS

Soils are important not only because they will ultimately bear the weight of the wall structure you design, but also because their properties directly affect your design.

For example, typically well-graded coarse sands have better design properties than finer soils, like clay. Particles in these sands fill voids and interlock better than uniform granular soils or clays, resulting in stronger structures. Soils that are expansive, or organic (peats, etc.) should be avoided as fill material when building walls.

Also, granular soils that are too coarse or sharp should be avoided as fill material, since they may damage the reinforcing grid. If the site has unsuitable soils (disturbed soils, soft, expansive, chemically aggressive, etc.) they must be excavated and replaced with appropriate materials prior to any other work, before the wall is erected.

WATER

One crucial site characteristic that must be checked before any design is carried out is the presence of groundwater. The presence of a water table too close to the bottom of the foundation pad (less than 2/3 the height of the wall), or suspicion of a seasonally shifting water table can dramatically reduce the integrity of your wall if left unchecked.

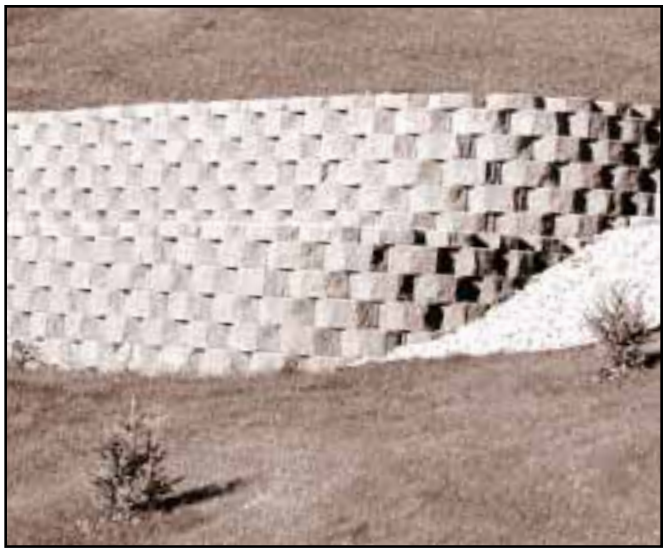
Also, be sure to check for the presence of waterways, or moving floodwaters that could cause scour of the foundation at the top of the wall. In addition, you must make sure that terrain features do not bring surface water near your wall. If that is the case, your design should include details to ensure water gets diverted from your structure. These include swales over and around the top of the wall, slopes, impervious soil tightly compacted at key locations, etc. These provisions should not be confused with internal drainage within the wall structure, typically comprised of granular aggregate drainage directly behind the wall face, drain tile pipes, and chimney drains behind the reinforced soil mass.

RETAINING WALL ON A SLOPE

The grid quantities in these tables should cover walls with back slopes up to and including 2.5:1. For more complex, steeper slopes contact your LondonStone representative.

When high runoff is anticipated, your design may call for a top drain swale or other means of diverting water before it enters the wall mass.

A licensed engineer should review your wall design if the toe is sloped or it has a body of water near it, such as detention ponds, etc.



LONDONSTONE GRID LIP BLOCK: 1:2_ SLOPE

ϕ = 34° e.g. Sand / Gravel	Total Wall Height H	Exposed Wall Height H1	Embedment D	Number of Courses	Geogrid Type	Geogrid Length L							Number of Geogrid Layers
	(ft)	(ft)	(ft)	---	---	(ft)	GRID ELEVATION FROM FIRST COURSE BOTTOM						---
	4'-8"	4'-2"	0'-6"	8	5XT	4'-0"	1'-2"	2'-11"					2
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	7'-0"	6'-6"	0'-6"	12	5XT	6'-0"	1'-9"	3'-6"	5'-3"				3
	8'-9"	7'-9"	1'- 0"	15	5XT	7'-0"	1'-9"	3'-6"	5'-3"	7'-0"			4
	10'-6"	9'-6"	1'- 0"	18	5XT	8'-6"	0'-7"	1'-9"	3'-6"	5'-3"	7'-0"	8'-9"	6
	11'-8"	10'-8"	1'- 0"	20	5XT	9'-0"	1'-2"	1'-9"	4'-8"	6'-5"	8'-2"	9'-11"	6

ϕ = 30° e.g. Silty Sand	Total Wall Height H	Exposed Wall Height H1	Embedment D	Number of Courses	Geogrid Type	Geogrid Length L							Number of Geogrid Layers
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ϕ = 28° e.g. Sandy Silt / Lean Clay	Total Wall Height H	Exposed Wall Height H1	Embedment D	Number of Courses	Geogrid Type	Geogrid Length L							Number of Geogrid Layers
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Methodology: NCMA Design Manual for SRW, 2nd edition. Grid reinforcement LTDS = 1250 lbs/ft. γ = 120 pcf, Sliding SF = 1.5 Overturning SF = 2.0, Global stability checks not included, Soils compacted to min. 95% proctor, No additional surcharges on wall. No water loading. Level wall toe only.

CONSTRUCTION PLANNING

One important aspect of your planning is accounting for the setback each successive course will have based upon the batter of your LondonStone wall. The batter makes your wall lean back at an angle of 6.11° from the vertical, or ≤" for every 7" of vertical wall unit. If this setback is not considered, your desired layout may be impossible to realize once the minimum radius of curvature of the LondonStone block has been reached.

This is especially important for tall walls with tight curves, but it should be considered for every wall you design. The following table should help you calculate the setback for each additional LondonStone course you lay out in your project.

LONDON STONE COURSES	WALL HEIGHT	WALL SETBACK
	ft-in	in
4	2'- 4"	3.13
5	2'-11"	4.52
6	3'-6"	5.65
7	4'-1"	6.78
8	4'-8"	7.91
9	5'-3"	9.04
10	5'-10"	10.17
11	6'-5"	11.30
12	7'-0"	12.43
13	7'-7"	13.56
14	8'-2"	14.69
15	8'-9"	15.82
16	9'-4"	16.95
17	9'-11"	18.08
18	10'-6"	19.21
19	11'-1"	20.34
20	11'-8"	21.47

Situation	Embedment
Level slope toe	H' / 20
Level slope (abutments)	H' / 10
3H : 1V slope toe	H' / 10
2H : 1V slope toe	H' / 7

* H' = exposed wall height

EXCAVATION/BASE PREPARATION

1. Foundation soil shall be examined to ensure that it is adequate for supporting the proposed retaining wall structure.

2. Foundation soil shall be excavated as required for base course leveling dimension as shown on the construction drawings.

3. Base materials should be to the depth and widths shown in the construction drawings with a minimum width of 24" and depth of 6". Embedment of the units is recommended and should coincide with the engineer specifications.

4. Granular inorganic material should be used for base material (i.e. class 5, recycled concrete…)

5. Compact with a mechanical plate compactor to 95% standard proctor.

6. Level compacted base material from side to side and front to back.

7. A drainage pipe should be installed on walls exceeding 4 feet. The drainage collection pipe should daylight into a storm sewer manhole or to a sloped area lower than the pipes behind the walls. The main collection drainpipe just behind the block facing shall be a minimum of 3" in diameter.

THE STANDARD RETAINING WALL

The basic retaining wall design consists of a straight wall segment with no slope or surcharge load behind it.

The tables on this page and the following pages for other loading conditions feature approximate quantities of reinforcing grid. Use these tables for estimating purposes only.

Quantities, positioning and lengths may vary. Curves, angles and other features may also have an impact on the final amounts of grid and LondonStone Grid Lip block needed. Contact your LondonStone representative for actual grid layout and sizing at the early stage of your planning.

These tables were prepared for the reinforcing grid type and specifications of the wall heights indicated. Other designs may be possible.

For taller walls, or walls under loading conditions or terrain different than those illustrated in this manual, a qualified design professional should be consulted.

All final designs should be reviewed and approved by a qualified licensed engineer (P.E.) prior to construction.

LONDONSTONE GRID LIP BLOCK: NO SLOPE NO SURCHARGE

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INSTALLING SUCCESSIVE COURSES OF SRW UNITS

1. Ensure the drainage aggregate is level with, or slightly below the top of the SRW unit.
2. Clean debris off of top of unit.
3. Stack the next row of block so the seams are offset from the blocks below. (A running bond pattern on the face of the wall is preferred but not required.)
4. Place and move LondonStone units to engage shear connector/lip and establish proper setback.
5. Sight down the wall line to ensure wall straightness. Adjust units as needed to form straight lines and smooth curves.
6. Place drainage aggregate and infill soil as stated previously.

STEPS

1. Most municipal building departments have code requirements for steps used in site construction. Check with local building officials for requirements.
2. Specify width of stairway. Various incremental dimensions are possible with unit modification. Each LondonStone step unit is 16" wide. Therefore, widths of 16", 32", 48", 64",… are possible without step-unit modification.
3. Calculate height and depth of stairway. The LondonStone step offers flexibility because tread lengths between 8" and 16" are attainable. Ex.: 12 step units (risers) x 7" = 84" (total height of stairway). With tread lengths of 16", total distance steps will travel = 196". With tread lengths of 12", total distance steps will travel = 152".

4. If steps are being built adjoining a LondonStone wall, use the same grade lines as used for the wall. If not, embed the step unit far enough to allow the next course of steps to align with the base course of wall.
5. Use the same base and backfill material as recommended for LondonStone units. (Base material = granular inorganic material compacted to 95% standard proctor) (Backfill material should be drainage material 3/4 rock)

Typical Daylight Through Wall Face Construction Detail

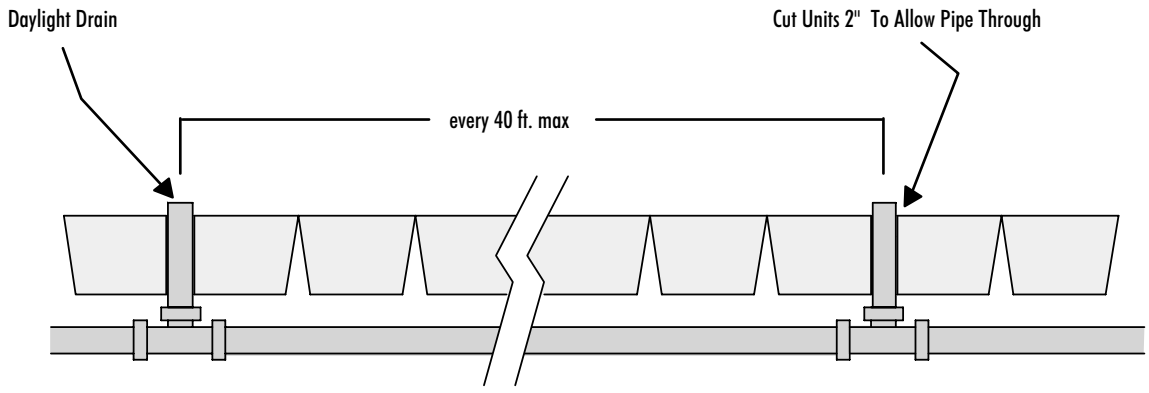


Figure B

USING THE GEOGRID SYSTEM

1. Install units up to the designated height of the first grid layer, making sure to backfill and compact behind the wall to a depth equal to the designed grid length.
2. Cut grid to design length as shown on the plans and install with design strength direction perpendicular to the wall face. Seams or overlaps of grid parallel to the wall face are not permitted.
3. Place next course of block on top of grid in a manner that forces LondonStone GridLip into grid squares.
4. Place a 8" layer of backfill soil on top of the grid and compact to a minimum 95% standard proctor density.
5. Only hand-operated equipment should be allowed within 3 feet of the wall. Track construction equipment shall not be operated on less than 6" of compacted infill material.

GEOGRID GRID LAYOUT IN CURVES AND CORNERS

Curves and corners in designs need additional considerations for the correct layout of the reinforcing grid. Interior corners will invariably force you to leave gaps between grid sheets, due to the curvature. To close these gaps, you should install additional reinforcement on places where gaps occur and on the next course above prior to backfilling [See Figure A].

In addition, square corners require that the 90° gap be filled with an extension of the reinforcing sheet equal to 25% of the total wall height, on alternate sides of the gap as you go up. [See Figure B]

In contrast, exterior corners will always cause reinforcing grids to overlap, which in turn dramatically reduces the load carrying capacity of the grid. To correct this, a minimum of 3" fill must be placed between sheets at those overlap areas prior to backfilling that lift, as shown in Figure C & D.

Inside Curve Grid Layout (TYP)

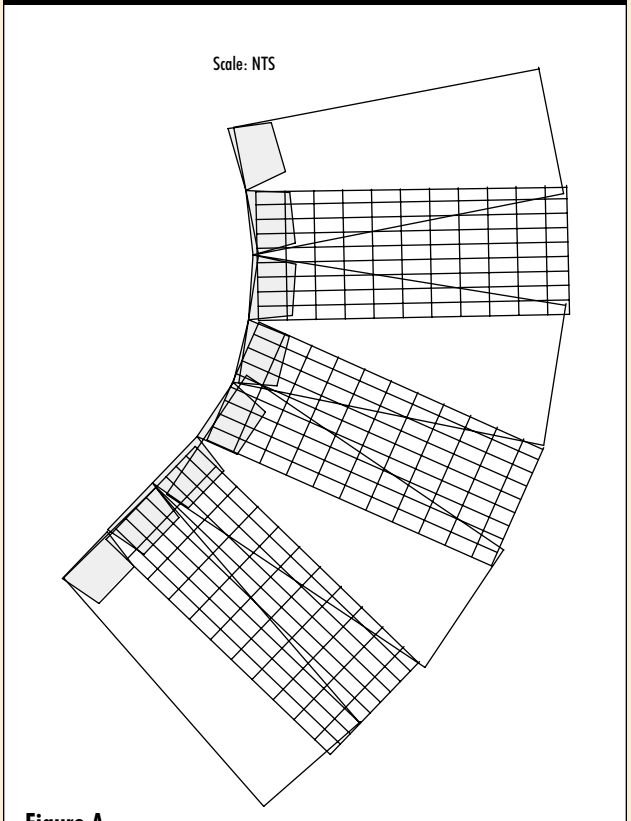


Figure A

Inside Square Corner Reinforcement Layout (TYP)

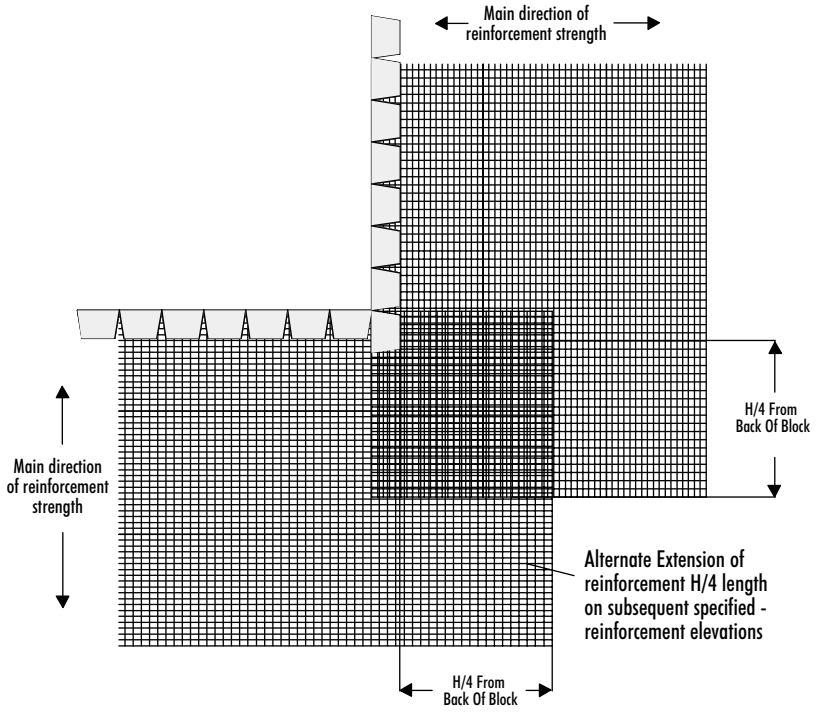


Figure B

Outside Square Corner Reinforcement Layout (TYP)

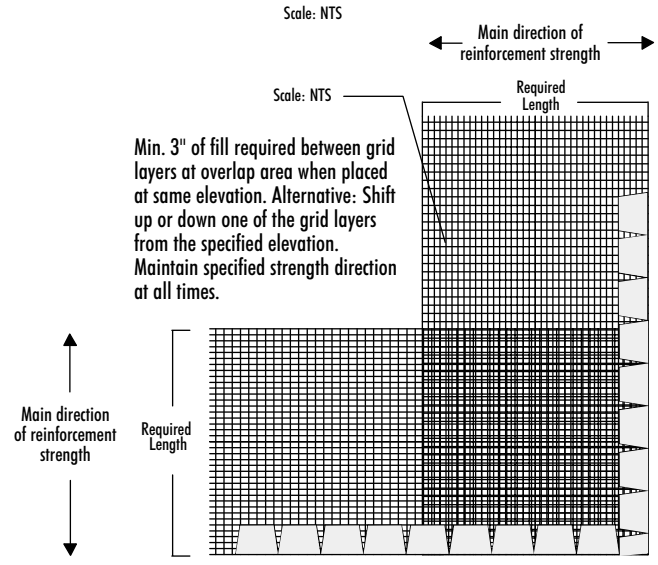
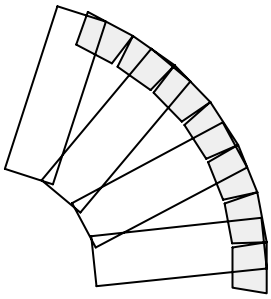


Figure D

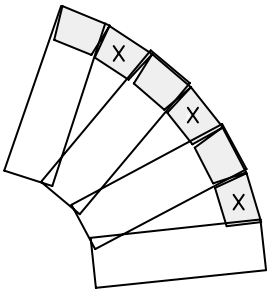
Outside Curve Grid Layout (TYP)

Scale: NTS

STEP #1:
Place grid so as to minimize overlap. Place 3" fill between any overlapping edges



STEP #2:
Install the next block course. Mark those blocks where there were gaps left in the grid below . Backfill and compact.



STEP #3:
Place grid over the areas where gaps were left. Backfill and compact. If overlapping, fill as in Step #1.

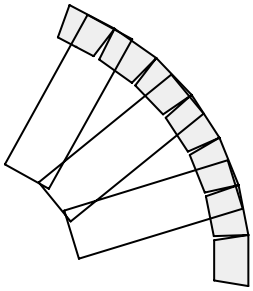


Figure C

CAPPING

1. Install 4" LondonStone Reversible Cap, 4" LondonStone Beveled Cap or 7" Round Cap (optional).
2. Make sure that the surfaces of the cap unit and unit the cap is being placed on are dry and free of debris.
3. Apply construction adhesive on cap unit and place on top course of wall.
4. The cap may be placed flush with the face of the wall, set back slightly or overhanging as much as one inch depending on aesthetics and design.

Standard System Installation Overview

SETTING THE FIRST COURSE

1. Begin at the lowest elevation of the wall.
2. The first course of LondonStone units shall be placed on the leveling pad and checked for level and alignment.

3. Installer should ensure that the units are in full contact with the base. Units are placed side by side for the full length of the wall.
4. Using a rubber mallet and a small amount of coarse sand, modify where necessary to ensure a straight and level base course.

5. Alignment may be done by means of a string line or offset from the base line.
6. Please note: The completed wall erection shall be within plus/minus 1.25" measured over a 10' distance in either a horizontal or vertical direction compared to the design line and grade control.

BACKFILL

1. All drainage material in the drainfield and infill soils within 3 feet of the wall must be properly compacted using a plate compactor or manual plate tamper.

2. Compact in maximum 7" lifts – i.e. compaction should occur with each course of LondonStone units set.
3. Place drainage aggregate behind and up to the height of the LondonStone wall.
4. Drainage aggregate shall be placed to a minimum thickness of 12" measured from the back of the LondonStone unit.
5. If required, install geotextile filter fabric between the compacted backfill material and compacted infill soil.

6. If using geogrid reinforcement, be sure to avoid using compacting equipment directly on geogrid. Place the next 7" lift of soil on top of the grid before compacting.

Recommended Construction Tolerances		
Vertical	± 1.25" / 10 ft	3" maximum
Horizontal	Straight lines: ± 1.25" / 10 ft	3" maximum
Rotation	From design wall batter: 2º	
Bulging	1.00" / 10 ft	

Typical Stepping-Up Grid Lip Construction Detail

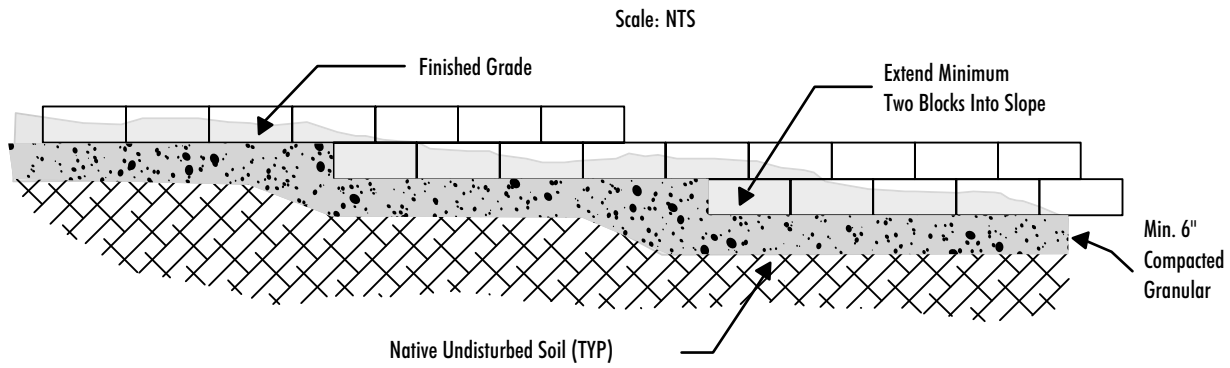
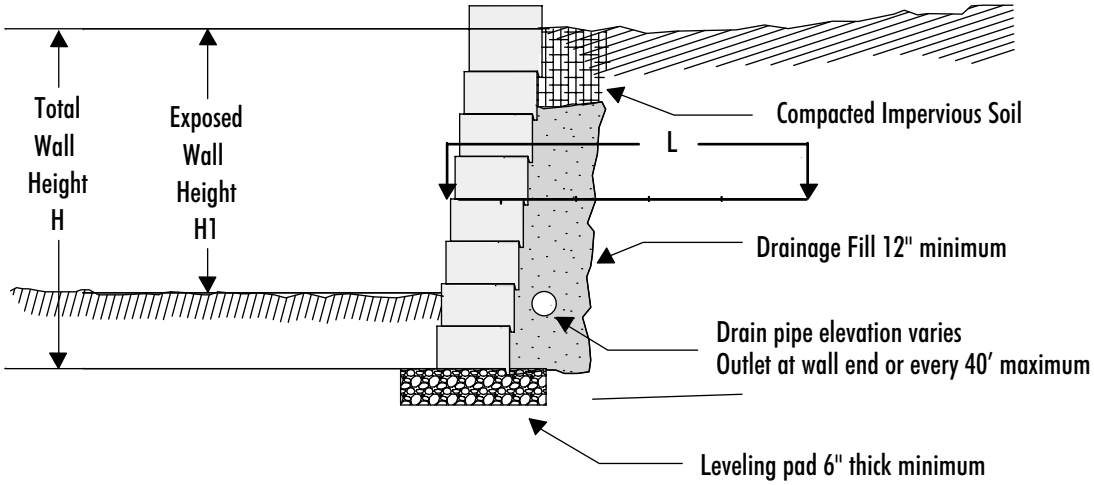
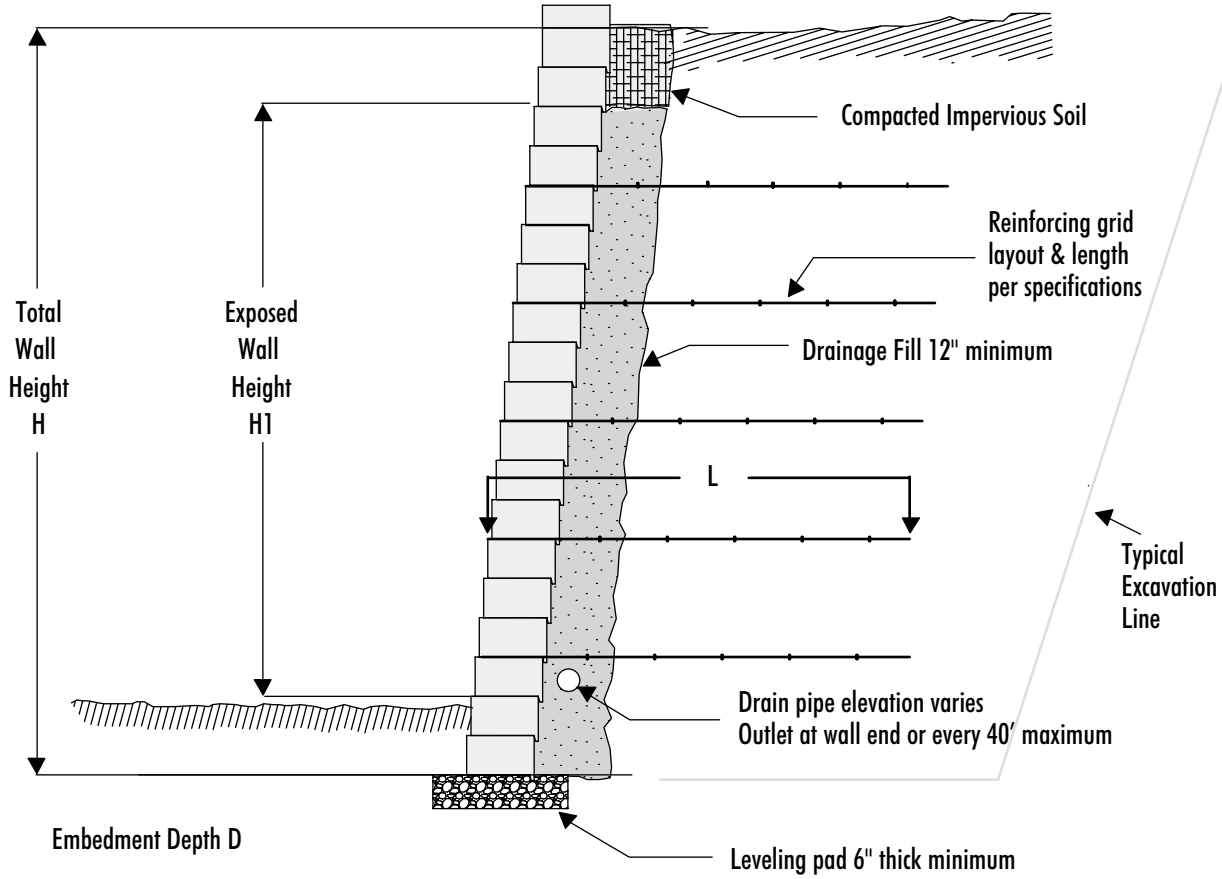


Figure A

Standard Wall Construction Details





LondonStone retaining walls are environmentally friendly and compliment any environment. It's the perfect solution for any residential or commercial landscape project.

UNREINFORCED WALLS

A retaining wall is a structure that resists the forces from a soil mass by virtue of its own weight. In many cases, a simple gravity wall (with no geogrid reinforcement required) will be all that is needed to retain a soil mass. The soil is kept in place by the sole weight of the stacked concrete blocks. Where this weight alone is not enough, the use of reinforcement grid brings together a larger mass of soil to counteract the pressures of the retained soil.

Generally, if the terrain is level, with appropriate soil, no surcharges, or water masses nearby, unreinforced walls can be built up to a height of 3.5 to 4 ft, depending on soil and terrain conditions. Otherwise, a complete review by a qualified licensed professional (P.E.) is strongly encouraged.

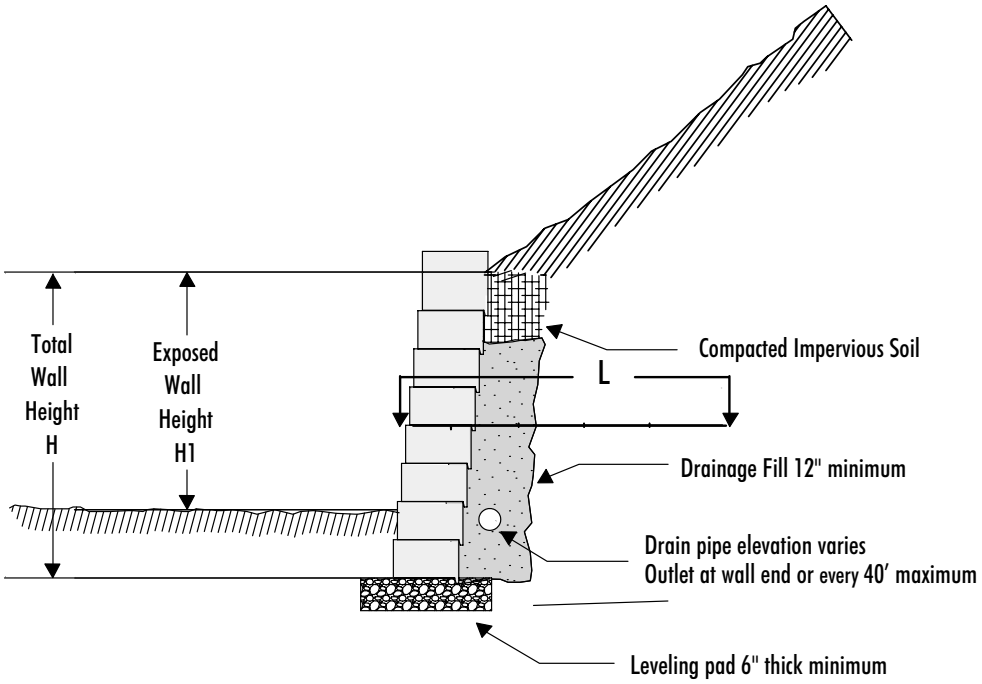
REINFORCED WALLS

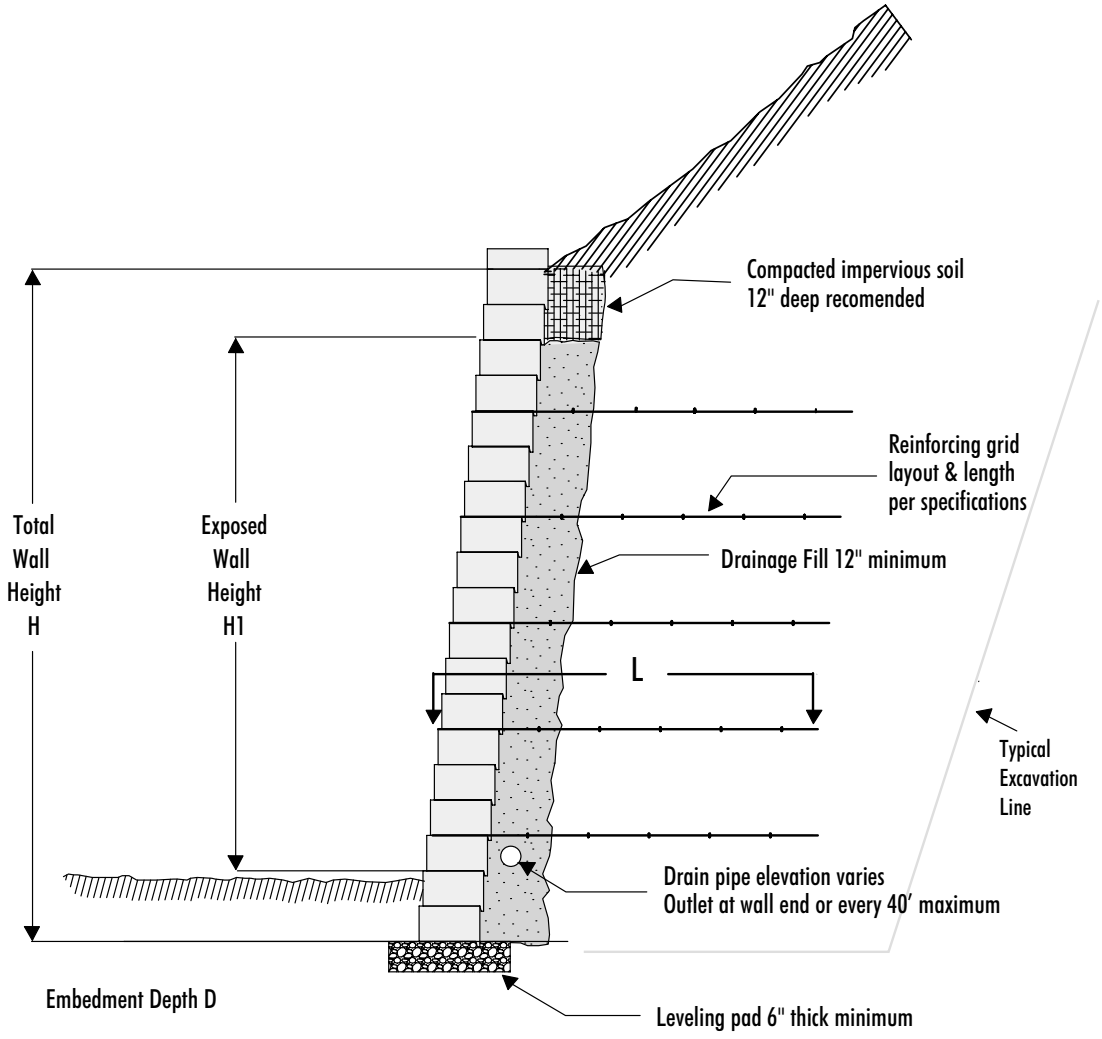
When your wall design calls for taller walls, or under special conditions, such as tiers, slopes, or surcharges behind the wall, reinforcing grid may be required to stabilize the wall. Grid layers work by bringing together a larger mass to aid the wall in resisting the forces exerted by the retained soil.

KEY POINTS TO CONSIDER BEFORE BEGINNING THE PROJECT

- Stepping up along a grade should be accomplished by embedding at least two LondonStone block units under the grade line, to ensure the full capacities of the block are available to the wall. (Page 6, Figure A)
- Drain pipe in your LondonStone Wall should have outlets, "daylight drains" or "weep holes" maximum every 40 ft. Your LondonStone units should be cut as indicated in the figure to ensure a quality finish. (Page 7, Figure B)
- Erosion at the top ends of the wall can be reduced by "curling" your wall top courses into the slope or bank as you progress toward the ends. However, in taller walls this may also increase the stress on the lower portions of the wall and may require additional support under the curled portion of the wall.
- In high runoff areas, you should consider finishing the top layer of backfill with a 6" layer of impervious soil, to prevent the runoff from saturating the filled portion of the soil behind the wall.
- In walls with a sloped backfill, large paved areas, or other conditions that may concentrate high runoff water, you may also consider the use of a drain swale, to help carry the runoff away from the wall. Consult your JME representative for more information.
- Finally, your design should include planning for utilities running through the wall or into the backfilled portion of it.

Sloped Backfill Wall Construction Details





Designing a wall involves more than just calculating the number of courses and amount of grid it will take to cover a desired length.

When bringing your project from idea to reality, careful planning at the early stages goes a long way toward minimizing costs, repairs and other project setbacks. Proper consideration of construction site features, obstacles and constraints is also essential for a cost-effective design, as all of these will influence your final product.

TERRAIN GEOMETRY

The first consideration when starting a wall design is to look at the site topography. Careful examination of changes in terrain elevation will help reduce excavation costs and plan for adequate drainage and other remedies to channel water away from your wall.

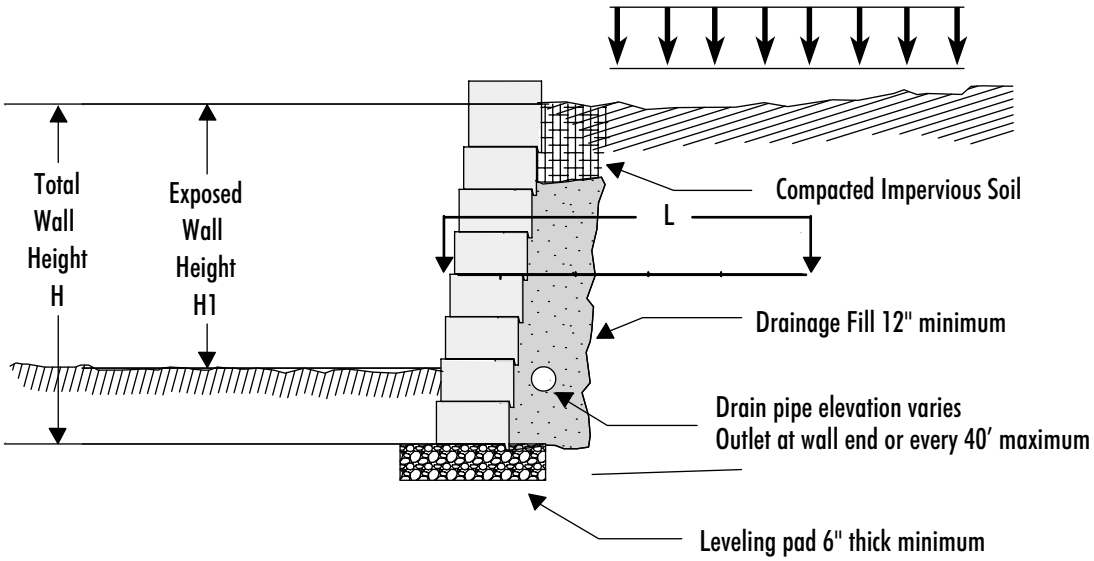
Other important aspects to consider at this stage are whether adjacent construction, waterways or other terrain features could have an effect on the design or performance of your wall over time.

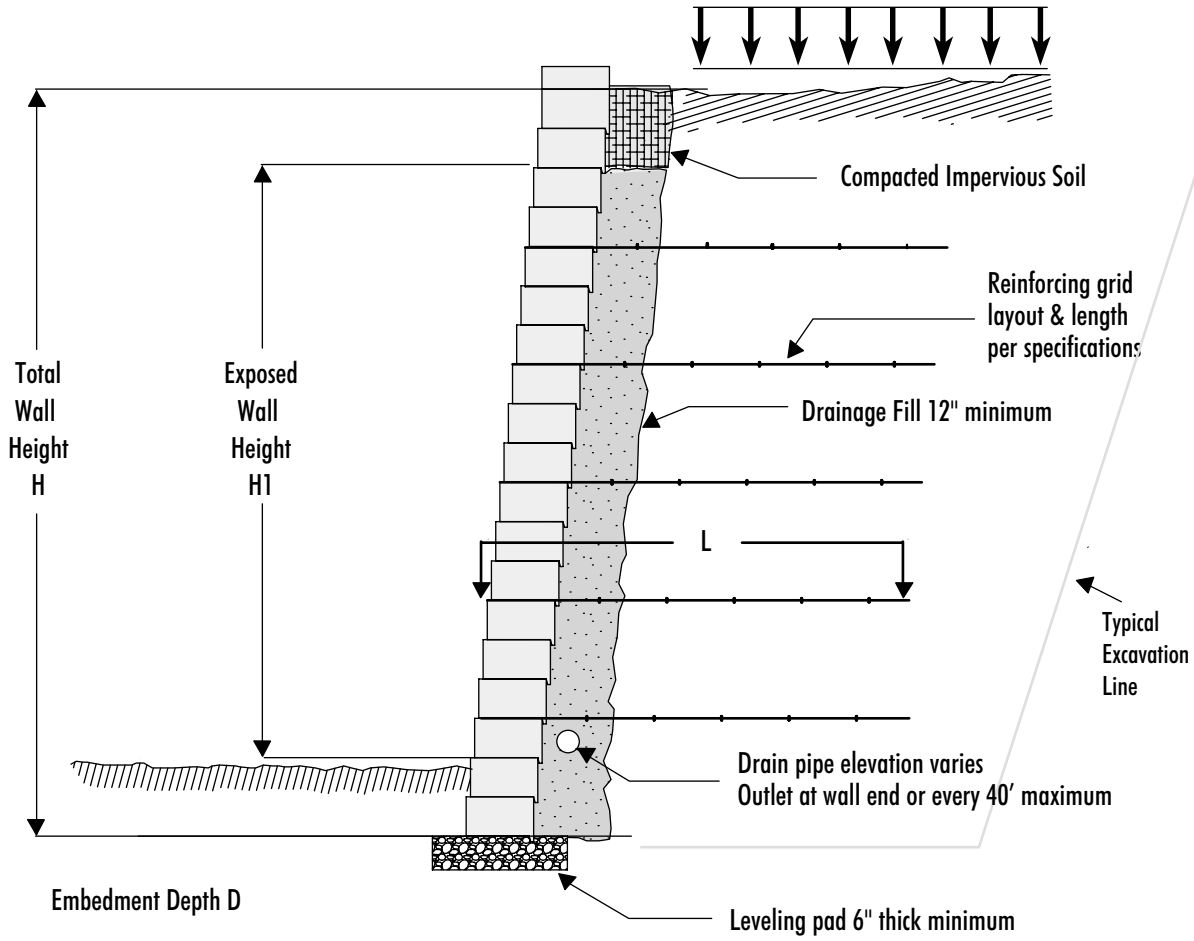
GRADING

A careful examination of terrain grading both above and below the planned wall is essential. Slopes above the wall create overloads on the wall, whereas a sloping grade at the wall footing typically decreases the available resistance to the design loads.

Grading can also create problems and challenge the good long-term performance of your wall if it channels or retains water on or near it.

Surcharge Wall Construction Details





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DISCLAIMER:

The suggested design materials presented in this manual are for estimating tasks and reference only. It is the user's responsibility to ensure that a final, project-specific design is reviewed, approved and sealed by a registered Professional Engineer, based on actual soil conditions. It is the project owner's responsibility to ensure the adequacy of the designed segmental retaining wall incorporated into the overall project through a specification. The specification should include factors which affect the overall integrity of the retaining wall such as location, interaction with other project components, and engineering aspects including but not limited to site soil bearing capacity, global slope stability, presence of underground or surface water, etc. Specification of excavation, trenching or any other construction procedures and corresponding safety specifications are the responsibility of the installer, who shall adhere to sound industry practice and provide additional support during construction if needed.

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