Design Information

Minimum Fill Requirements

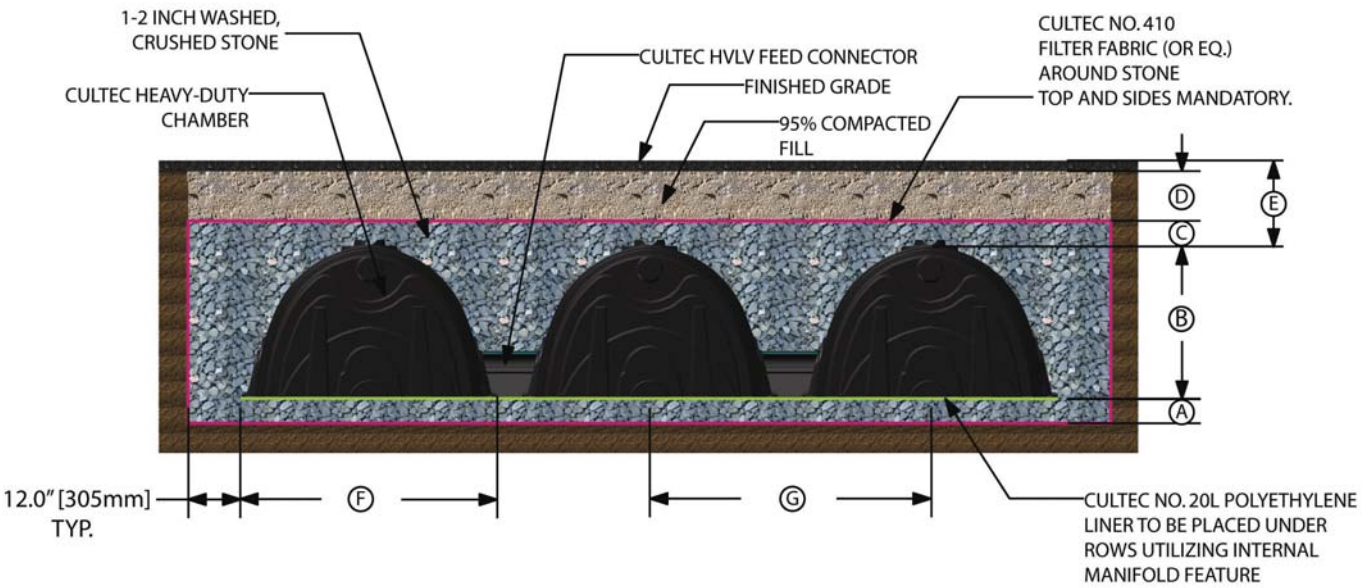
These requirements are for paved traffic applications only. If these models and design parameters do not meet your needs, please call CULTEC's Technical Department at 1-800-4-CULTEC, Ext. 2003 (1-800-428-5832, Ext. 2003) for further information and assistance.

Refer to CULTEC's most current installation instructions for further details including but not limited to acceptable fill materials and vehicle loads.

Table 1

	See Fig. 1	Contactor® 100HD	Recharger® 150HD	Recharger® 280HD	Recharger® 330XLHD	Recharger® V8HD
Typical Center to Center Spacing	G	3.33′ 1.02 m	3.25′ 0.99 m	4.33′ 1.32 m	4.83′ 1.47 m	5.5′ 1.68 m
Chamber width	F	36″ 914 mm	33″ 838 mm	47″ 1194 mm	52″ 1321 mm	60″ 1524 mm
Max. depth of cover allowed above crown of chamber	E	14′ 4.27 m	14′ 4.27 m	14′ 4.27 m	12′ 3.66 m	12′ 3.66 m
Min. depth required of 95% Compacted Fill for Paved Traffic Application	D	8″ 203 mm	8″ 203 mm	8″ 203 mm	10″ 254 mm	12″ 305 mm
Min. depth of stone required above units for traffic applications	C	6″ 152 mm	6″ 152 mm	6″ 152 mm	6″ 152 mm	6″ 152 mm
Chamber height	B	12.5″ 318 mm	18.5″ 470 mm	26.5″ 673 mm	30.5″ 775 mm	32″ 813 mm
Min. depth of stone base	A	6″ 152 mm	6″ 152 mm	6″ 152 mm	6″ 152 mm	6″ 152 mm

Fig. 1



Design Information

System Sizing Calculations

For more detailed calculations you may use our MS-Excel based CULTEC Stormwater Design Calculator at **www.cultec.com** or contact our Technical Department for free design assistance.

We are also modeled in HydroCAD®, BOSS International's StormNET®, Bentley Systems' PondPack® and Streamline Technologies' ICPR® modeling software.

Separate calculations will be listed for the Recharger® V8 series because of its unique chamber length characteristics.

For Recharger V8HD System Sizing Calculations, refer to Pages 20-24.

Other models are available, ask our Technical Department if you need further information.

Bed Area and Quantity of Stone Required will be increased by the required min. 1 foot (305 mm) stone border and installed chamber length adjustments - *not calculated below.*

Volume of Excavation will be increased by the required min. 1 foot (305 mm) stone border and final backfill requirements - *not included below.*

Determine the Required Storage Volume (V_s)

Required Storage Volume (Vs) = Given

Determine the Number of Chambers Required (C)

Number of Chambers Required (C) C = Required Storage Volume ÷ Chamber and Stone Base Storage per Unit

$C = V_s \div D_u$

Table 2

	Bare Chamber Storage	Chamber and Stone Base Storage per Unit (D_u) 6" 152 mm	12" 305 mm	18" 457 mm
Contactor® 100HD	14 ft^3 0.4 m^3	28.81 ft^3 0.82 m^3	33.81 ft^3 0.96 m^3	38.81 ft^3 1.10 m^3
Recharger® 150HD	19.88 ft^3 0.56 m^3	36.71 ft^3 1.04 m^3	41.58 ft^3 1.18 m^3	46.46 ft^3 1.32 m^3
Recharger® 280HD	42.55 ft^3 1.21 m^3	64.46 ft^3 1.83 m^3	70.53 ft^3 2 m^3	76.59 ft^3 2.17 m^3
Recharger® 330XLHD	52.21 ft^3 1.48 m^3	79.26 ft^3 2.24 m^3	86.03 ft^3 2.44 m^3	92.79 ft^3 2.63 m^3

This is an approximation only. Actual number of chambers required may be reduced when stone border storage and chamber length adjustments per row are calculated. The Chamber and Stone Base Storages above are based on the installed chamber length, stone base as listed in the table, 6" (152 mm) stone above the unit and typical center to center spacing. Assumes 40% stone void.

Design Information

System Sizing Calculations - *continued*

Determine the Required Bed Area (A)

Bed Area (A) $A = \text{Number of Chambers} \times \text{Surface Area Required per Unit}$

$A = C \times A_c$

Table 3

	Typical Center to Center Spacing	Surface Area Required per Unit (A_c)
Contactor® 100HD	3.33′	25 ft²
	1.02 m	2.32 m²
Recharger® 150HD	3.25′	24.38 ft²
	0.99 m	2.26 m²
Recharger® 280HD	4.33′	30.33 ft²
	1.32 m	2.82 m²
Recharger® 330XLHD	4.83′	33.83 ft²
	1.47 m	3.14 m²

Surface area per unit is based on the installed chamber length and typical center to center spacing. Chamber length adjustments per row and stone border requirements are not calculated.

Determine the Stone Required (V_{st})

Quantity of Stone Required (V_{st}) $V_{st} = \text{Number of Chambers Required} \times \text{Stone Required per Chamber}$

$V_{st} = C \times S_c$

Table 4

	Stone Required per Chamber Based on Stone Foundation Depth (S_c)		
	6” 152 mm	12” 305 mm	18” 457 mm
Contactor® 100HD	1.37 yd³	1.84 yd³	2.30 yd³
	1.05 m³	1.40 m³	1.76 m³
Recharger® 150HD	1.56 yd³	2.01 yd³	2.46 yd³
	1.19 m³	1.54 m³	1.88 m³
Recharger® 280HD	2.03 yd³	2.59 yd³	3.15 yd³
	1.55 m³	1.98 m³	2.41 m³
Recharger® 330XLHD	2.50 yd³	3.13 yd³	3.76 yd³
	1.91 m³	2.39 m³	2.87 m³

Based on installed chamber length. Assumes stone base as listed in table above, 6” (152 mm) stone above the units and typical center to center spacing. Chamber length adjustments per row and stone border requirements are not calculated.

System Sizing Calculations - *continued*

Determine the Volume of Excavation (E_x)

Volume of Excavation (E_x) E_x = Bed Area x Min. Effective Depth

$E_x = A \times D_c$

Table 5

	Min. Effective Depth Determined by Stone Base (D_c)		
	6” 152 mm	12” 305 mm	18” 457 mm
Contactor® 100HD	2.04’ 0.62 m	2.54’ 0.77 m	3.04’ 0.93 m
Recharger® 150HD	2.54’ 0.77 m	3.04’ 0.93 m	3.54’ 1.08 m
Recharger® 280HD	3.21’ 0.98 m	3.71’ 1.13 m	4.21’ 1.28 m
Recharger® 330XLHD	3.54’ 1.08 m	4.04’ 1.23 m	4.54’ 1.38 m

Based on stone base as listed, chamber height, and minimum fill requirements for paved, traffic application. The “Minimum Effective Depth” does not take into consideration any additional fill requirements or final grade materials above the 6” (152 mm) of stone above the units.

Design Information

Additional Calculations

Once you have determined your bed layout (number of rows wide x number of chambers per row), you can then proceed to these calculations.

How to Calculate Bed Length (L_b)

Bed Length (L_b)

L_b = [(# of Chambers per Row x Installed Chamber Length) + Chamber Length Adjustment per Row] + (2 x Stone Border Width)

L_b = [(# of Chambers per Row x L_{ul}) + L_a] + (2 x 1′ (0.3 m))

Table 6

	Installed Chamber Length (L_{ul})	Chamber Length Adjustment per Row (L_a)
Contactor® 100HD	7.5′ 2.29 m	0.5′ 0.15 m
Recharger® 150HD	7.5′ 2.29 m	1′ 0.3 m
Recharger® 280HD	7′ 2.13 m	1′ 0.3 m
Recharger® 330XLHD	7′ 2.13 m	1.5′ 0.45 m

A typical stone border is 1' (0.3 m) wide around the perimeter of the chamber bed.

How to Calculate Bed Width (W_b)

Bed Width (W_b)

W_b *U.S.* = (# of Chambers Wide x Min. Center to Center Spacing) + [2 ((12″ - Min. Chamber Spacing Between Rows)/12)]

W_b *U.S.* = (# of Chambers Wide x D_{uw}) + [2((12″ - C_{sp})/12)]

W_b *Metric* = (# of Chambers Wide x Min. Center to Center Spacing) + [2 ((305 mm - Min. Chamber Spacing Between Rows)/1000)]

W_b *Metric* = (# of Chambers Wide x D_{uw}) + [2 ((305 mm - C_{sp})/1000)]

Table 7

	Min. Center to Center Spacing (D_{uw})	Min. Chamber Spacing Between Rows (C_{sp})
Contactor® 100HD	3.33′ 1.02 m	4″ 102 mm
Recharger® 150HD	3.25′ 0.99 m	6″ 152 mm
Recharger® 280HD	4.33′ 1.32 m	5″ 127 mm
Recharger® 330XLHD	4.83′ 1.47 m	6″ 152 mm

Design Information

Additional Calculations - *continued*

How to Calculate Actual Bed Area (A_a)

Actual Bed Area (A_a)

A_a = Bed Length x Bed Width

$A_a = L_b \times W_b$

How to Calculate Filter Fabric Required (F_b)

Filter Fabric Required (F_b)

F_b = [((Bed Width x Min. Effective Depth) x 2 Endwalls) + ((Bed Length x Min. Effective Depth) x 2 Sidewalls) + (Actual Bed Area x 2 layers)] + 15% for waste

$F_b = [((W_b \times D_c) \times 2) + ((L_b \times D_c) \times 2) + (A_a \times 2)] + 15\%$

This calculates Filter Fabric for top, sides and bottom of system. Filter Fabric is mandatory for the top and sides of the storm-water system; it is recommended for the bottom of the system.

How to Calculate CULTEC No. 20L™ Polyethylene Liner Required (P)

CULTEC No. 20L™ Polyethylene Liner Required (P)

P *For Retention Systems (one side only)* = 2 x Bed Width

P *For Retention Systems (one side only)* = 2 x W_b

P *For Detention Systems (two sides)* = 4 x Bed Width

P *For Detention Systems (two sides)* = 4 x W_b

This is based on a 5' (1.52 m) wide roll. Calculates liner runs at 10' (3.05 m) wide and spanning the width of the bed.

How to Calculate HVLV™ Feed Connectors Required (H)

HVLV™ Feed Connectors Required (H) =

H *For Retention Systems (one side only)* = Number of Rows Wide - 1

H *For Retention Systems (one side only)* = R-1

H *For Detention Systems (two sides)* = (2 x Number of Rows Wide) - 2

H *For Detention Systems (two sides)* = (2 x R) - 2

Design Information

CULTEC Stormwater System Worksheet

Project: Location: Calculated By:

CULTEC Chamber model proposed for this design *(check one)*: Date:

- □ Contactor 100HD
- □ Recharger 150HD
- □ Recharger 280HD
- □ Recharger 330XLHD

System Requirements	Calculation	Circle Unit of Measure	
Required Storage Volume (V_s)	= Given		
	= _____	ft^3	m^3
Number of chambers required (C)	= $V_s \div D_u$ (See Table 2, pg. 14)		
	= _____V_s ÷ _____D_u	pieces	
Required Bed Area (A)	= C x A_c (See Table 3, pg. 15)		
	= _____C x _____A_c	ft^2	m^2
Stone Required (V_{st})	= C x S_c (See Table 4, pg. 15)		
	= _____C x _____S_c	yd^3	m^3
Volume of Excavation (E_x)	= A x D_c (See Table 5, pg. 16)		
	= _____A x _____D_c	yd^3	m^3

These are to be used as quick calculations only. Stone borders and chamber length adjustments are not calculated and will affect each system requirement.

For more detailed calculations you may use our MS-Excel based CULTEC Stormwater Design Calculator at **www.cultec.com** or contact our Technical Department at 1-800-428-5832 for free design assistance.

Cost Estimate	Quantity	Cost	Total
Chambers (C)	_____ x	$_____/Chamber =	= $_____
Stone (V_{st})	_____ x	$_____ / yd^3 m^3	= $_____
Excavation (E_x)	_____ x	$_____/ yd^3 m^3	= $_____
		Subtotal	= $_____
Cost per ft^3 (m^3)	= Subtotal ÷ Required Storage Volume (V_s)		= $_____

Some additional items required but not included are: manifold, polyethylene liner, and filter fabric.

Design Information

System Sizing Calculations for Recharger™ V8HD

Determine the Required Storage Volume (V_s)

Required Storage Volume (V_s) = Given

Determine the Desired Bed Width (W_{bd})

Desired Bed Width (W_{bd}) = Given

Determine the Number of Rows Wide the System Will Have (R)

Number of Rows Wide (R)

R = ROUND DOWN (Desired Bed Width - (2 x Width of Additional Stone on Sidewalls of Stone Border)) ÷ Typical Center to Center Spacing

R = ROUND DOWN (W_{bd} - (2 x W_{ab})) ÷ C_{sp}

Table 8

	Typical Center to Center Spacing (C_{sp})	Width of Additional Stone on Sidewalls of Stone Border - Outside of Design Unit (W_{ab})
Recharger® V8HD	5.5′ 1.68 m	0.75' 0.23 m

Determine the Number of Starter and End Chambers Required (C_{se})

Number of Starter Units Required (S)

S = Number of Rows Wide

S = R

Number of End Units Required (E)

E = Number of Rows Wide

E = R

Total Number of Starter and End Units Required (C_{se})

C_{se} = Number of Starter Units Required + Number of End Units Required

C_{se} = S + E

Determine the Number of Intermediate Chambers Required (I)

Storage Provided by Starter and End Units (V_{se})

V_{se} = Total Number of Starter and End Units Required x Chamber and Stone Base Storage per Starter or End

V_{se} = C_{se} x D_u

Storage Required by Intermediate Units (V_i)

V_i = Required Storage Volume - Storage Provided by Starter and End Units

V_i = V_s - V_{se}

DESIGN

Design Information

System Sizing Calculations for Recharger® V8HD - *continued*

Number of Intermediate Chambers Required (I)

I = Storage Required by Intermediate Units ÷ Chamber and Stone Base Storage per Intermediate

$= V_i \div D_u$

Table 9

	Bare Chamber Storage	Chamber and Stone Base Storage (D_u) 6" 152 mm	12" 305 mm	18" 457 mm
Recharger® V8SHD Starter or V8EHD End	39.78 ft^3	60.84 ft^3	65.88 ft^3	70.92 ft^3
	1.13 m^3	1.72 m^3	1.87 m^3	2.01 m^3
Recharger® V8IHD Intermediate	65.09 ft^3	99.56 ft^3	107.81 ft^3	116.06 ft^3
	1.84 m^3	2.82 m^3	3.05 m^3	3.29 m^3

This is an approximation only. Actual number of chambers required may be reduced when stone border storage and chamber length adjustments per row are calculated.

The Chamber and Stone Base Storages above are based on the installed chamber length, stone base as listed in the table, 6" (152 mm) stone above the unit and typical center to center spacing. Assumes 40% stone void.

Determine the Required Bed Area (A)

Bed Area (A)

A = (Total Number of Starter and End Chambers x Surface Area Required per Unit) + (Number of Intermediate Units Required x Surface Area per Unit)

$A = (C_{se} \times A_c) + (I \times A_c)$

Table 10

	Typical Center to Center Spacing	Surface Area (A_c)
Recharger® V8SHD Starter or V8EHD End	5.5′	25.21 ft^2
	1.68 m	2.34 m^2
Recharger® V8IHD Intermediate	5.5'	41.25 ft^2
	1.68 m	3.83 m^2

Surface area per unit is based on the installed chamber length and typical center to center spacing. Chamber length adjustments per row are not calculated.

Determine the Stone Required (V_{st})

Quantity of Stone Required (V_{st})

V_{st} =(Total Number of Starter and End Chambers Required x Stone Required per Chamber) + (Number of Intermediate Units Required x Stone Required per Chamber)

$V_{st} = (C_{se} \times S_c) + (I \times S_c)$

System Sizing Calculations for Recharger® V8HD - *continued*

Table 11

	Stone Required per Chamber Based on Stone Foundation Depth (S_c)		
	6” 152 mm	12” 305 mm	18” 457 mm
Recharger® V8SHD Starter or V8EHD End	1.95 yd^3	2.42 yd^3	2.88 yd^3
	1.49 m^3	1.85 m^3	2.20 m^3
Recharger® V8IHD Intermediate	3.19 yd^3	3.95 yd^3	4.72 yd^3
	2.44 m^3	3.02 m^3	3.61 m^3

Based on installed chamber length. Assumes stone base as listed in table above, 6” (152 mm) stone above the units and typical center to center spacing. Stone border requirements are not calculated above.

Determine the Volume of Excavation (E_x)

Volume of Excavation (E_x) E_x = Bed Area x Min. Effective Depth

$E_x = A \times D_c$

Table 12

	Min. Effective Depth Determined by Stone Base (D_c)		
	6” 152 mm	12” 305 mm	18” 457 mm
Recharger® V8HD	3.67’	4.17’	4.67’
	1.12 m	1.27 m	1.42 m

Based on stone base as listed, chamber height, and minimum fill requirements for paved, traffic application. The “Minimum Effective Depth” does not take into consideration any additional fill requirements or final grade materials above the 6” (152 mm) of stone above the units.

Design Information

Additional Calculations for Recharger® V8HD

Once you have determined your bed layout (number of rows wide x number of chambers per row), you can then proceed to these calculations.

How to Calculate Bed Length (L_b)

Number of Intermediate Units per Row (I_r)

I_r = Number of Intermediate Units Required ÷ Number of Rows

$I_r = I \div R$

Bed Length (L_b)

L_b = (2 x Installed Chamber Length of Starter Unit) + (# of Intermediate Chambers per Row x Installed Chamber Length of Intermediate Unit) + (2 x Stone Border Width)

$L_b = (2 \times L_{ul}) + (I_r \times L_{ul}) + (2 \times 1' (0.3\ m))$

Table 13

	Installed Chamber Length (L_{ul})
Recharger® V8SHD Starter or V8EHD End	4.58′ 1.40 m
Recharger® V8IHD Intermediate	7.5' 2.29 m

A typical stone border is 1' (0.3 m) wide around the perimeter of the chamber bed.

How to Calculate Bed Width (W_b)

Bed Width (W_b)

W_b *U.S.* = (# of Rows Wide x Min. Center to Center Spacing) + [2 ((12″ - Min. Chamber Spacing Between Rows)/12)]

W_b *U.S.* = $(R \times D_{uw}) + [2((12'' - C_{sp})/12)]$

W_b *Metric* = (# of Rows Wide x Min. Center to Center Spacing) + [2 ((305 mm - Min. Chamber Spacing Between Rows)/1000)]

W_b *Metric* = (# of Chambers Wide x D_{uw}) + [2 ((305 mm - C_{sp})/1000)]

Table 14

	Min. Center to Center Spacing (D_{uw})	Min. Chamber Spacing Between Rows (C_{sp})
Recharger® V8HD	5.5′ 1.68 m	6″ 152 mm

How to Calculate Actual Bed Area (A_a)

Actual Bed Area (A_a)

A_a = Bed Length x Bed Width

$A_a = L_b \times W_b$

Additional Calculations for Recharger® V8HD - *continued*

How to Calculate Filter Fabric Required (F_b)

Filter Fabric Required (F_b)

F_b = [((Bed Width x Min. Effective Depth) x 2 Endwalls) + ((Bed Length x Min. Effective Depth) x 2 Sidewalls) + (Actual Bed Area x 2 layers)] + 15% for waste

$F_b = [((W_b \times D_c) \times 2) + ((L_b \times D_c) \times 2) + (A_a \times 2)] + 15\%$

This calculates Filter Fabric for top, sides and bottom of system. Filter Fabric is mandatory for the top and sides of the storm-water system; it is recommended for the bottom of the system.

How to Calculate CULTEC No. 20L™ Polyethylene Liner Required (P)

CULTEC No. 20L™ Polyethylene Liner Required (P)

P *For Retention Systems (one side only)* = 2 x Bed Width

P *For Retention Systems (one side only)* = 2 x W_b

P *For Detention Systems (two sides)* = 4 x Bed Width

P *For Detention Systems (two sides)* = 4 x W_b

This is based on a 5' (1.52 m) wide roll. Calculates liner runs at 10' (3.05 m) wide and spanning the width of the bed.

How to Calculate HVLV™ Feed Connectors Required (H)

HVLV™ Feed Connectors Required (H)

H *For Retention Systems (one side only)* = Number of Rows Wide - 1

H *For Retention Systems (one side only)* = R-1

H *For Detention Systems (two sides)* = (2 x Number of Rows Wide) - 2

H *For Detention Systems (two sides)* = (2 x R) - 2

Design Information

CULTEC Recharger® V8HD Stormwater System Worksheet

Project: Location: Calculated By:

CULTEC Chamber model proposed for this design: Recharger V8HD Date:

System Requirements	Calculation	Circle Unit of Measure
Required Storage Volume (V_s)	= Given	
	= _____	ft^3 m^3
Desired Bed Width (W_{bd})	= Given	
	= _____	ft m
Number of Rows Wide (R)	= ROUND DOWN (W_{bd} - (2 x W_{ab})) ÷ C_{sp} (See Table 8, pg. 20)	
	= ROUND DOWN (_____W_{bd} - (2 x _____W_{ab})) ÷ _____C_{sp}	Rows
Number of Starter and End Chambers Required (C_{se})	= 2 x R	
	= 2 x _____R	pieces
Storage Provided by Starter and End Units (V_{se})	= C_{se} x D_u (See Table 9, pg. 21)	
	= _____C_{se} x _____D_u	ft^2 m^2
Storage Required by Intermediate Units (V_i)	= V_s - V_{se}	
	= _____V_s - _____V_{se}	ft^2 m^2
Number of Intermediate Chambers Required (I)	= V_i ÷ D_u (See Table 9, pg. 21)	
	= _____V_i ÷ _____D_u	pieces
Required Bed Area (A)	= (C_{se} x A_c) + (I x A_c) (See Table 10, pg. 21)	
	= (_____C_{se} x _____A_c) + (_____I x _____A_c)	ft^2 m^2
Stone Required (V_{st})	= (C_{se} x S_c) + (I x S_c) (See Table 11, pg. 22)	
	= (_____C_{se} x _____S_c) + (_____I x _____S_c)	yd^3 m^3
Volume of Excavation (E_x)	= A x D_c (See Table 12, pg. 22)	
	= _____A x _____D_c	yd^3 m^3

These are to be used as quick calculations only. Stone borders and chamber length adjustments are not calculated and will affect each system requirement. For more detailed calculations you may use our MS-Excel based CULTEC Stormwater Design Calculator at **www.cultec.com** or contact our Technical Department at 1-800-428-5832 for free design assistance.

Cost Estimate	Quantity	Cost	Total
Starter & End Chambers (C_{se})	_____ x	$_____/Chamber =	= $_____
Intermediate Chambers (I)	_____ x	$_____/Chamber =	= $_____
Stone (V_{st})	_____ x	$_____ / (circle one) yd^3 m^3	= $_____
Excavation (E_x)	_____ x	$_____/ (circle one) yd^3 m^3	= $_____
		Subtotal	= $_____
Cost per ft^3 (m^3)	= Subtotal ÷ Required Storage Volume (V_s)		= $_____

Some additional items required but not included are: manifold, polyethylene liner, and filter fabric.