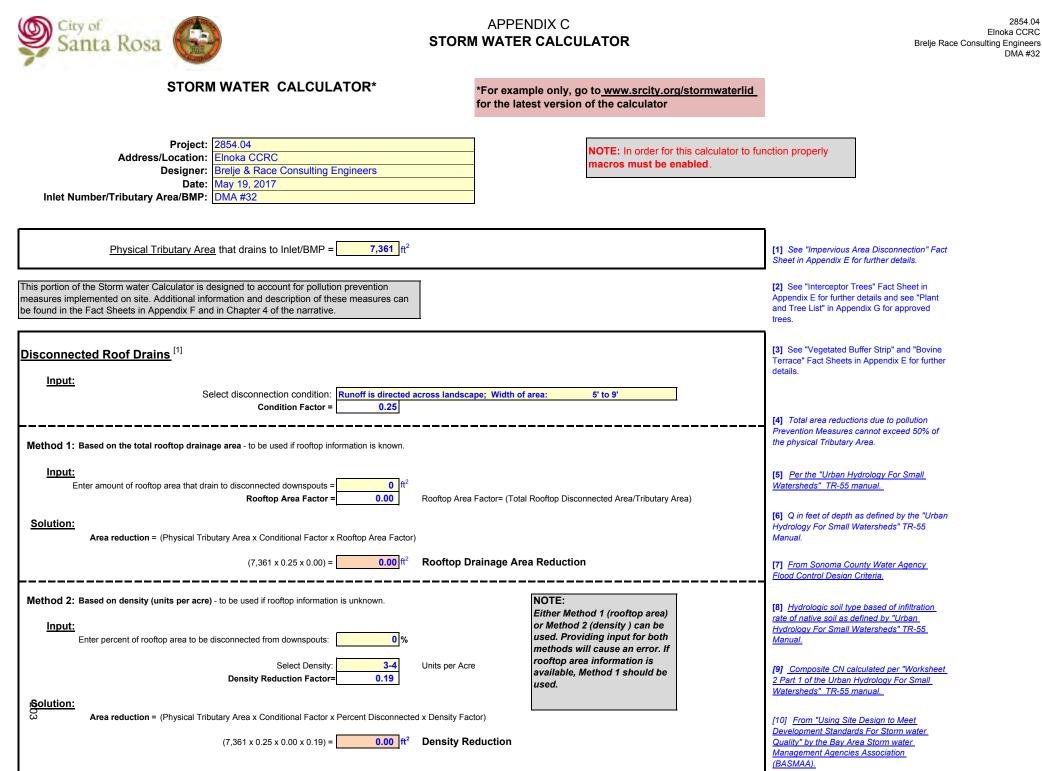


LID BMP Sizing Tool: 100% Volume Capt Formulas: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 1648.93$ ft ³ $A_{LID GOAL} = (W)(L) = 441.00$ ft ²	ure Goal; V_{GOAL} Where: $V_{LID GOAL}$ = Required volume of soil in LID BMP. $A_{LID GOAL}$ = Footprint of LID BMP area for a given depth (below perforated pi V_{GOAL} = 726 ft ³ Where:	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> <u>of 100% volume capture of the post</u> <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
Input:	P = 0.4 as a decimalD = 3.8 ftBelow perforated pipe if presentW = 21.0 ftL = 21.0 ft		
Solution: Percent of Goal Achieved = 101.63	% = [(3.8 x 441) / 1,649] x 100	7	
LID BMP Sizing Tool Delta Volume Captu		NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
	Ire Requirement : VDELTA Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below perforated pi VDELTA= 501.70	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be
Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0! ft ³	Where: $V_{\text{LID DELTA}}$ Required volume of soil in LID BMP $A_{\text{LID DELTA}}$ = Footprint of LID BMP area for a given depth (below perforated pi	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width
Formulas: $V_{LID DELTA}$ =((V_{DELTA}))/(P) = #DIV/0! ft^3 $A_{LID DELTA}$ =(W)(L) = 0.00 ft^2	Where: $V_{\text{LID DELTA}}$ = Required volume of soil in LID BMP $A_{\text{LID DELTA}}$ = Footprint of LID BMP area for a given depth (below perforated pi V_{DELTA} = 501.70 ft ³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet)	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Requirement achieved" reaches

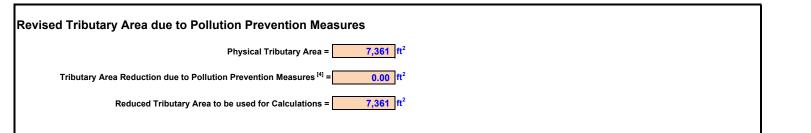




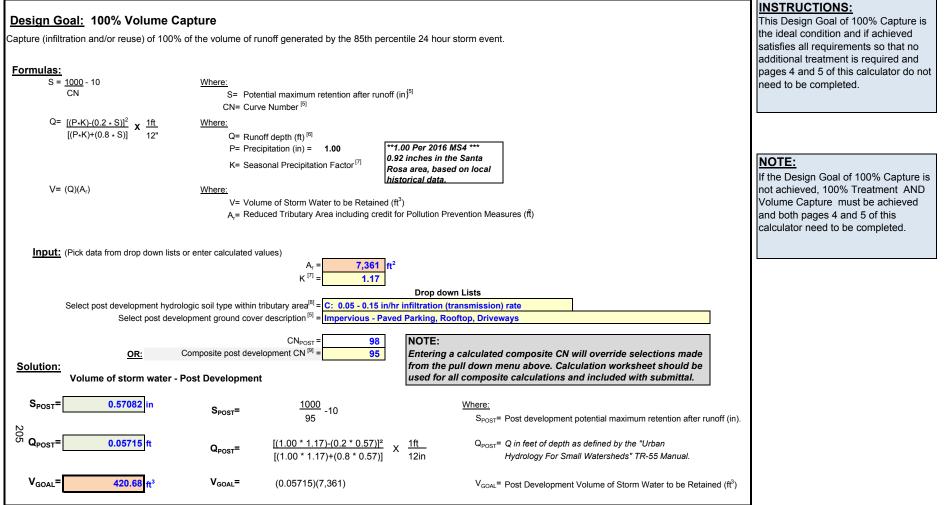
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conne Multiplier = 1	sted Paved Area	INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²		
Area Reduction = 0.00 ft ²		
nterceptor Trees ^[2]		INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees NOTE: Total Interceptor Area (200 ft²/tree) Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=	New Deciduous Trees	
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)	
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy	
Allowed reduction credit for existing tree canopy= 0 ft ²	Allowed credit for existing tree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ² Buffer Factor = 0.7	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) = Area Reduction = 0.00 ft ²	





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.



Release 7 Rev. 1 5/23/2017



Requirement 1: 100% Treatme	nt			INSTRUCTIONS:
Treatment of 100% of the flow generated b	by 85th percentile 24 hour mean annual rain event (0.2 in/hr).		C value note:	If the Design Goal of 100% Capture
				on page 3 of this calculator is not
Formula:				achieved; then Requirement 1-100%
$Q_{TREATMENT}$ = (0.2 in/hr)(A_r)(C_{POST})(K) cfs	Where:			Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	[10]	The table of values can be found here	Capture, page 5 of the calculator,
	C_{POST} = Rational method runoff coefficient for the developed condition			must be achieved.
	A _r = Reduced Tributary Area including credit for Pollution Preven K = Seasonal Precipitation Factor ^[7]	tion Measures (in Acres)	to size the overnow bypass.	inust be achieved.
Input:	R - Seasonal Precipitation Factor			
<u>mput.</u>	$A_r = $ 7,361 $ft^2 =$ 0.16899 A	cres		
	C _{POST} ^[10] = 0.59			
	K ^[7] = 1.2			
	N	IOTE:		
Solution:	7	he Flow Rate calculate	d here should only be used to size the	
		••••	ssociated overflow inlets and systems	
Q _{TREATMENT} = 0.02333 cfs	$Q_{\text{TREATMENT}}$ = (0.2)(0.1690)(0.59)(1.17)	hould be sized for the	Flood Control event.	

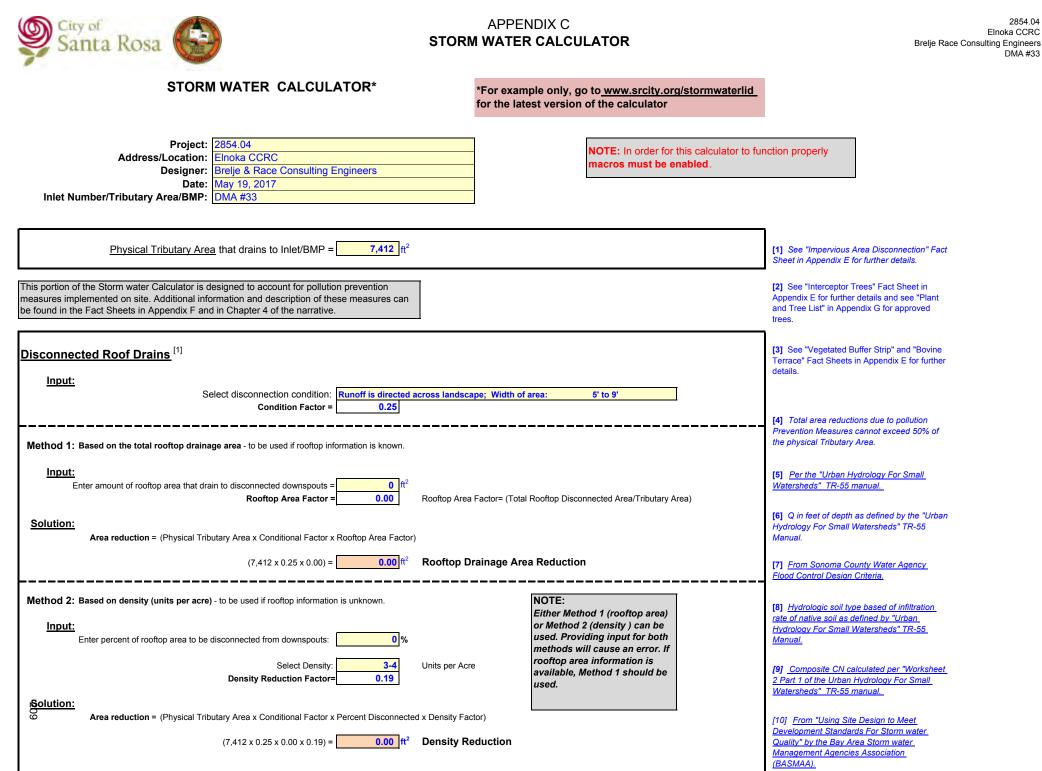


2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #32

s morease in volume of runoil leaving	Capture the site due to development for the 85th percentile 24 hour storm event.	INSTRUCTIONS: If the Design Goal of 100% Capt on page 3 of this calculator is no achieved; then Requirement 1-10
Formulas:		Treatment, page 4 of the calculation
S = <u>1000</u> - 10	Where:	
CN	S= Potential maximum retention after runoff (in) ⁵	AND Requirement 2- Volume
	CN= Curve Number ^[5]	Capture, this page of the calculation
$- (0, 0, 0, 0)^2$		must be achieved.
$Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} \times \frac{1 \text{ft}}{12 \text{in}}$	Where:	
[(P*K)+(0.8 * S)] 12in	Q ⁼ Runoff depth (ft) ^[6]	
	P= Precipitation (in) = 0.92 0.92 inches in the Santa Rosa	
	K= Seasonal Precipitation Factor ^[7] area, based on local historical	
$V=(Q)(A_r)$	Where:	NOTE:
$V = (Q)(\Lambda_{\rm f})$		
	V= Volume of Storm Water to be Retained (ft ³)	If the amount of volume generate
	A _r = Reduced Tributary Area including credit for Pollution Prevention Meas	after development is less than or
		equal to that generated before
Input: (Pick data from drop down list	ts or enter calculated values)	development, Requirement 2-Vo
<u> </u>	A _r = 7,361 ft ²	
		Capture is not required.
	K ^[7] = 1.2	$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{F}$
	Drop down Lists	(Crost - Cree of Ortpost - Ortp
Select hvo	rologic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration (transmission)	rate
	velopment ground cover description ^[5] = Woods (50%), grass (50%) combination (orch	
	velopment ground cover description ^[5] = Impervious - Paved Parking, Rooftop, Drivew	
Select post de		ays
	CN _{PRE} = 76	
	CN _{POST} = 90.3	
<u>OR</u>	Composite Predevelopment CN ^[9] = 80	
	Composite Post development CN ^[9] = 95	
Solution: e Develop <u>ment Storm Wat</u> er Ru	noff Volume	
Solution: re Development Storm Water Run S _{PRE} = 2.50 in	noff Volume S _{PRE} = <u>1000</u> _10 <u>Where:</u>	Pre development potential maximum retention after runoff (in).
Solution: e Develop <u>ment Storm Wat</u> er Ru	Spre= 1000 80 -10 Where: Spre= Qpre= [(0.92*1.17)-(0.2*2.50)] ² X 1ft Qpre=	Pre development potential maximum retention after runoff (in). Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.
Solution: e Development Storm Water Ru S _{PRE} = 2.50 in	Spref Volume Spref 1000 Where: Q_{PRE} $\frac{1000}{80}$ -10 Spref Spref Q_{PRE} $\frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]}$ X $\frac{1ft}{12in}$ Q_{PRE}	Q in feet of depth as defined by the "Urban
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.25 ft ³	Spre= $\frac{1000}{80}$ -10 Where: Spre= Q_{PRE}= $\frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]}$ X $\frac{1ft}{12in}$ Q_{PRE}= V_{PRE}= $(0.00900)(7,361)$ V = 100000000000000000000000000000000000	Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.25 ft ³ ost Development Storm Water Run	SPRE= $\frac{1000}{80}$ -10Where: SPRE= Q_{PRE} $\frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]}$ X $\frac{1ft}{12in}$ Q_{PRE} V_{PRE} $(0.00900)(7,361)$ V_{PRE} unoff Volume	Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.25 ft ³	SPRE= $\frac{1000}{80}$ -10Where: SPRE= Q_{PRE} $\frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]}$ X $\frac{1ft}{12in}$ Q_{PRE} V_{PRE} $(0.00900)(7,361)$ V_{PRE} unoff Volume	Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.
Solution: a Development Storm Water Runger S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 66.25 ft ³ st Development Storm Water Runger	Spre= $\frac{1000}{80}$ -10 Where: Spre= Q_{PRE} $\frac{[(0.92^*1.17) - (0.2 * 2.50)]^2}{[(0.92^*1.17) + (0.8 * 2.50)]}$ X $\frac{1ft}{12in}$ Q_{PRE} = V_{PRE} $(0.00900)(7,361)$ V _{PRE} = V_{PRE} = $\frac{1000}{-10}$ Where:	Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.
Solution: e Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 66.25$ ft ³ st Development Storm Water Run	Spre= $\frac{1000}{80}$ -10 Where: Spre= Q_{PRE} $\frac{[(0.92^*1.17) - (0.2 * 2.50)]^2}{[(0.92^*1.17) + (0.8 * 2.50)]}$ X $\frac{1ft}{12in}$ Q_{PRE} = V_{PRE} $(0.00900)(7,361)$ V _{PRE} = V_{PRE} = $\frac{1000}{-10}$ Where:	Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. Pre Development Volume of Storm Water Generated (ft ³)
Solution: a Development Storm Water Rung S_{PRE} 2.50 in Q_{PRE} 0.00900 ft V_{PRE} 66.25 ft ³ st Development Storm Water Rung S_{POST} 0.57082 in	Spref Volume Spref $\frac{1000}{80}$ -10 Where: Spref Qpref = $\frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]}$ X $\frac{1ft}{12in}$ Qpref Vpref = $(0.00900)(7,361)$ Vpref Vpref Vpref unoff Volume Spost = $\frac{1000}{95}$ -10 $\frac{Where:}{Spost}$	Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. Pre Development Volume of Storm Water Generated (ft ³) Post development potential maximum retention after runoff (in).
Solution: a Development Storm Water Runger S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 66.25 ft ³ st Development Storm Water Runger	Spref Volume Spref $\frac{1000}{80}$ -10 Where: Spref Qpref = $\frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]}$ X $\frac{1ft}{12in}$ Qpref Vpref = $(0.00900)(7,361)$ Vpref Vpref Vpref unoff Volume Spost = $\frac{1000}{95}$ -10 $\frac{Where:}{Spost}$	Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. Pre Development Volume of Storm Water Generated (ft ³) Post development potential maximum retention after runoff (in). Q in feet of depth as defined by the "Urban
Solution: a Development Storm Water Rung S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.25 ft ³ st Development Storm Water Rung S_{POST} = 0.57082 in	$ \begin{array}{c} \textbf{Noff Volume} \\ \textbf{S}_{PRE} = & \frac{1000}{80} -10 & \frac{Where:}{S_{PRE}} \\ \textbf{Q}_{PRE} = & \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^2}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times & \frac{1\text{ft}}{12\text{in}} & Q_{PRE} \\ \textbf{V}_{PRE} = & (0.00900)(7,361) & V_{PRE} \\ \textbf{S}_{POST} = & \frac{1000}{95} -10 & \frac{Where:}{S_{POST}} \\ \textbf{Q}_{POST} = & \frac{[(0.92^{*}1.17) - (0.2^{*}0.57)]^2}{Q_{POST}} \times & \frac{1\text{ft}}{It} & Q_{POST} \\ \end{array} $	Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. Pre Development Volume of Storm Water Generated (ft ³) Post development potential maximum retention after runoff (in).
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.25 ft ³ vest Development Storm Water Run S_{POST} = 0.57082 in	Spref Volume Spref 1000 80 Where: Spref Q_{PRE} $\frac{1000}{80}$ -10 $\frac{Where:}{S_{PRE}}$ Q_{PRE} $\frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]}$ X $\frac{1ft}{12in}$ Q_{PRE} V_{PRE} $(0.00900)(7,361)$ V_{PRE} V_{PRE} unoff Volume S_{POST} $\frac{1000}{95}$ -10 $\frac{Where:}{S_{POST}}$ Q_{POST} $\frac{[(0.92*1.17)-(0.2*0.57)]^2}{[(0.92*1.17)+(0.8*0.57)]}$ X $\frac{1ft}{12in}$ Q_{POST}	Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. Pre Development Volume of Storm Water Generated (ft ³) Post development potential maximum retention after runoff (in). Q in feet of depth as defined by the "Urban
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.25 ft ³ ost Development Storm Water Run S_{POST} = 0.57082 in Q_{POST} = 0.05037 ft	Spref $\frac{1000}{80}$ -10 Where: Spref Q_{PRE} $\frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]}$ X $\frac{1ft}{12in}$ Q_{PREf V_{PRE} $(0.00900)(7,361)$ V V_{PREf Q_{PREf unoff Volume Spost $\frac{1000}{95}$ -10 Where: Spost Spost Q_{POST} $\frac{[(0.92*1.17) - (0.2*0.57)]^2}{[(0.92*1.17) + (0.8*0.57)]}$ X $\frac{1ft}{12in}$ Q _{POST}	Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. Pre Development Volume of Storm Water Generated (ft ³) Post development potential maximum retention after runoff (in). Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.25 ft ³ ost Development Storm Water Run S_{POST} = 0.57082 in Q_{POST} = 0.05037 ft V_{POST} = 370.77 ft ³ Solution: Volume Capture Require	Spref Volume S_{PRE} $\frac{1000}{80}$ -10 Where: Spref Q_{PRE} $\frac{[(0.92^*1.17) - (0.2^*2.50)]^2}{[(0.92^*1.17) + (0.8^*2.50)]}$ X $\frac{1ft}{12in}$ Q_{PRE} V_{PRE} $(0.00900)(7,361)$ V_{PRE} V_{PRE} unoff Volume S_{POST} $\frac{1000}{95} -10$ $\frac{Where:}{S_{POST}}$ Q_{POST} $\frac{[(0.92^*1.17) - (0.2^*0.57)]^2}{[(0.92^*1.17) + (0.8^*0.57)]}$ X $\frac{1ft}{12in}$ V_{POST} $(0.05037)(7,361)$ V_{POST} V_{POST}	Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. Pre Development Volume of Storm Water Generated (ft ³) Post development potential maximum retention after runoff (in). Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.
Solution: e Development Storm Water Rut S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.25 ft ³ ost Development Storm Water Rut S_{POST} = 0.57082 in Q_{POST} = 0.05037 ft V_{POST} = 370.77 ft ³ Solution: Volume Capture Required	Spref Volume Spref $\frac{1000}{80}$ -10 Where: Spref Q_{PRE} $\frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]}$ X $\frac{1ft}{12in}$ Q_{PRE} V_{PRE} $(0.00900)(7,361)$ V_{PRE} Where: Spost= $\frac{1000}{95}$ -10 Where: Spost= Q_{POST} $\frac{[(0.92*1.17)-(0.2*0.57)]^2}{[(0.92*1.17)+(0.8*0.57)]}$ X $\frac{1ft}{12in}$ Q_{POST} = V_{POST} $(0.05037)(7,361)$ V_{POST} X $\frac{1ft}{12in}$ Q_{POST} = Wrement Send $(0.05037)(7,361)$ V_{POST} $(0.05037)(7,361)$ V_{POST}	Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. Pre Development Volume of Storm Water Generated (ft ³) Post development potential maximum retention after runoff (in). Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.
Solution: te Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.25 ft ³ ost Development Storm Water Run S_{POST} = 0.57082 in Q_{POST} = 0.05037 ft V_{POST} = 370.77 ft ³ Solution: Volume Capture Require	Spref $\frac{1000}{80}$ -10 Where: Spref Q_{PRE} $\frac{1000}{(0.92^*1.17) \cdot (0.2 * 2.50)]^2}$ X $\frac{1ft}{12in}$ Q_{PRE} V_{PRE} $(0.00900)(7.361)$ V_{PRE} V_{PRE} V_{PRE} unoff Volume S_{POST} $\frac{1000}{95} -10$ $Where:$ Q_{POST} $\frac{1000}{95} -10$ $\frac{Where:}{S_{POST}}$ Q_{POST} $\frac{1000}{95} -10$ X V_{POST} $\frac{0.05037}{(0.92^*1.17) \cdot (0.2 * 0.57)]^2}$ X $\frac{1ft}{12in}$ Q_{POST} V_{POST} $(0.05037)(7,361)$ V_{POST} V_{POST} V_{POST} Interment m water that must be retained onsite (may be infiltrated or reused). $-V_{PRE}$ Delta Volume Capture = (370.77) - (66.25)	Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. Pre Development Volume of Storm Water Generated (ft ³) Post development potential maximum retention after runoff (in). Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.
Solution: e Development Storm Water Rut S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.25 ft ³ ost Development Storm Water Rut S_{POST} = 0.57082 in Q_{POST} = 0.57082 in Q_{POST} = 370.77 ft ³ Solution: Volume Capture Requires in volume of stor Delta Volume Capture (V_{POST} = 0.00000000000000000000000000000000000	Spref 1000 80 Where: Spref Qpref $[(0.92*1.17)-(0.2*2.50)]^2$ X 1ft 12in Qpref Qpref $[(0.92*1.17)+(0.8*2.50)]$ X 1ft 12in Qpref Vpref $(0.00900)(7,361)$ Vpref Vpref unoff Volume Spost = 1000 95 -10 Where: Spost = Where: Spost = Qpost = $(0.092*1.17)-(0.2*0.57)]^2$ X 1ft 12in Qpost = Qpost = $(0.092*1.17)+(0.8*0.57)]^2$ X 1ft 12in Qpost = Vpost = $(0.05037)(7,361)$ Vpost = 1ft Qpost = irement m water that must be retained onsite (may be infiltrated or reused). Vpost = 1ft 1ft	Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. Pre Development Volume of Storm Water Generated (ft ³) Post development potential maximum retention after runoff (in). Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.



LID BMP Sizing Tool: 100% Volume Capt Formulas: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 956.09 \text{ ft}^3$ $A_{LID GOAL} = (W)(L) = 549.90 \text{ ft}^2$ Percent of Goal Achieved $= \frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	Where: $V_{LID \ GOAL}$ = Required volume of soil in LID BMP. $A_{LID \ GOAL}$ = Footprint of LID BMP area for a given depth (below perforated pint) V_{GOAL} = 421 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet)	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. pe if present).	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Input:	W= Width (in decimal feet) L= Length (in decimal feet) P = 0.4 as a decimal D = 1.7 ft Below perforated pipe if present W = 23.5 ft ft		
Solution: Percent of Goal Achieved = 100.08	% = [(1.7 x 550) / 956] x 100	7	
			INSTRUCTIONS:
LID BMP Sizing Tool Delta Volume Captu Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01 ft ³ A _{LID DELTA} =(W)(L) = 0.00 ft ²	Where: V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated pi V _{DELTA} = 304.52	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. pe if present).	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> <u>requirement of the delta volume</u> <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of
$\frac{\text{Formulas:}}{V_{\text{LID DELTA}}=((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/01}{\#\text{DIV}/01} ft^3$	Where: V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated pi	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> <u>requirement of the delta volume</u> <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be

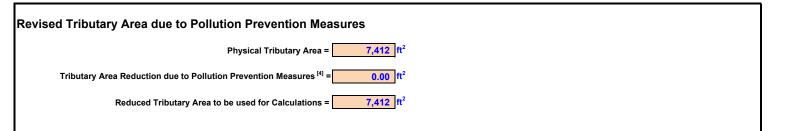




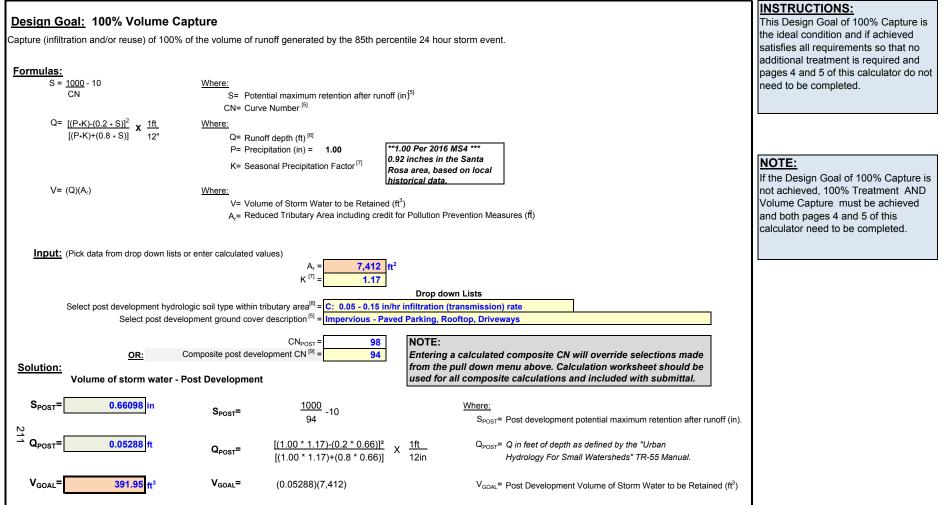
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conne Multiplier = 1	ected Paved Area		INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²			
Area Reduction = 0.00 ft ²			
Interceptor Trees ^[2] Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0	T	NOTE: Fotal Interceptor Area	INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area
Area Reduction due to new Evergreen Trees=0ft ²	(LEE WALL)	Reduction is limited to 50% of he physical tributary area.	of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Deciduous Trees=0 ft ²	New Deciduous Trees (100 ft ² /tree)		
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy		
Allowed reduction credit for existing tree canopy=	Allowed credit for existing tree of	canopy = 50 % of actual canopy square fool	age
Area Reduction = 0 ft ²	= Sum of areas managed by	y evergreen + deciduous + existing can	рру

Buffer Strips & Bovine Terraces ^[3]	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine
Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ²	terraces. Runoff Must be direct to these features as sheet flow. Enter
Buffer Factor = 0.7	the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) =	
Area Reduction = 0.00 ft ²	





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.



Release 7 Rev. 1 5/23/2017



			·
Requirement 1: 100% Treatme	nt		INSTRUCTIONS:
Treatment of 100% of the flow generated	by 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
		The C value used for this calculation	on page 3 of this calculator is not
Formula:		is smaller than the value used for	achieved; then Requirement 1-100%
$Q_{TREATMENT}$ = (0.2 in/hr)(A_r)(C_{POST})(K) cfs	Where:	hydraulic Flood Control design.	Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	Capture, page 5 of the calculator,
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used to size the overflow bypass.	must be achieved.
	A _r = Reduced Tributary Area including credit for Pollution Prevention Measures (in K = Seasonal Precipitation Factor ^[7]	Acres) to size the overnow bypass.	indst be achieved.
Input:	K - Seasonal Precipitation Factor		
<u>mput.</u>	A _r = 7,412 ft ² = 0.17016 Acres		
	$C_{POST}^{(10)} = 0.63$		
	κ ^[7] = 1.2		
	NOTE:		
Solution:	The Flow Rate ca	Iculated here should only be used to size the	
		. All associated overflow inlets and systems	
Q _{TREATMENT} = 0.02508 cfs	Q _{TREATMENT} = (0.2)(0.1702)(0.63)(1.17) should be sized	for the Flood Control event.	

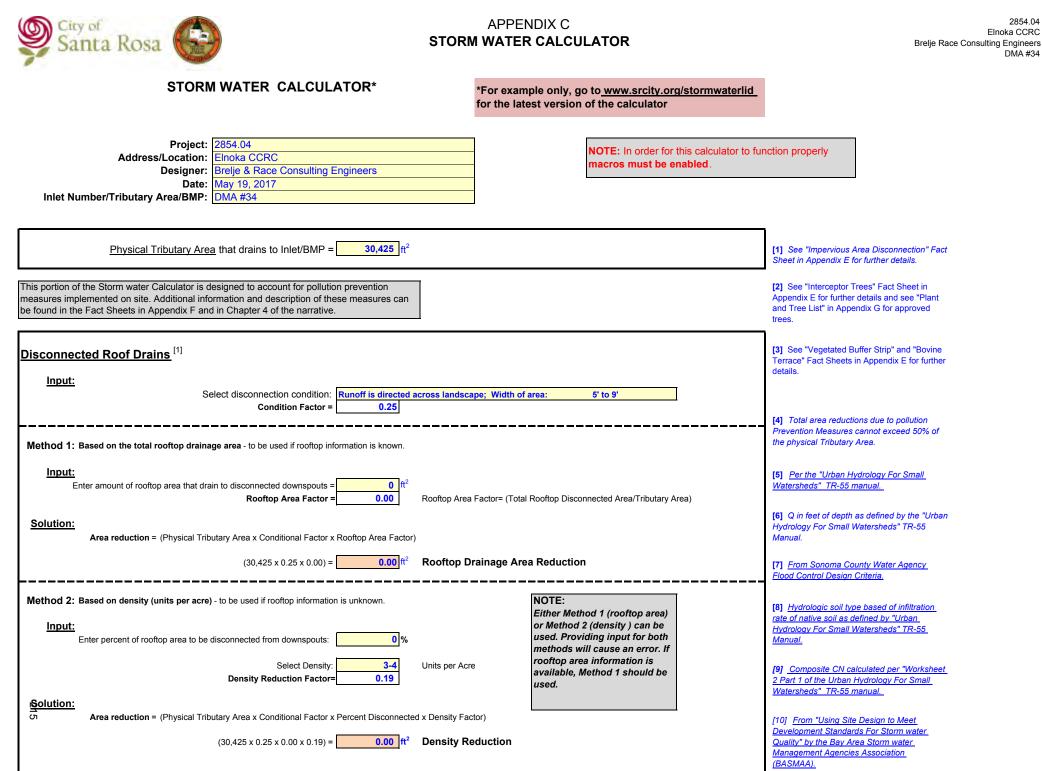


2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #33

equirement 2: Delta Volume	• Capture the site due to development for the 85th percentile 24 hour storm e	event	INSTRUCTIONS: If the Design Goal of 100% Capture
			on page 3 of this calculator is not achieved; then Requirement 1-100
Formulas:			Treatment, page 4 of the calculator
S = <u>1000</u> - 10	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ^{5]}		Capture, this page of the calculator
	CN= Curve Number ^[5]		must be achieved.
$\begin{array}{r} Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} \times \frac{1 \text{ft}}{12 \text{in}} \end{array}$	Where:		
[(P*K)+(0.8 * S)] ^ 12in	Q= Runoff depth (ft) ^[6]		
	P= Precipitation (in) = 0.92 0.92 inches in th	he Santa Rosa	
	K= Seasonal Precipitation Factor ^[7] area, based on l	local historical	
$V=(Q)(A_r)$	Where: data.		NOTE:
	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A _r = Reduced Tributary Area including credit for Pollution P	Prevention Measures (۲)	after development is less than or
			equal to that generated before
Input: (Pick data from drop down lis	sts or enter calculated values)		development, Requirement 2-Volur
·	$A_r = 7,412 \text{ ft}^2$		Capture is not required.
	κ ^[7] = 1.2		
		own Lists	$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE}$
Select hvd	drologic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration		
	evelopment ground cover description ^[5] = Woods (50%), grass (50%) con		
Select post de	evelopment ground cover description ^[5] = Impervious - Paved Parking, R	looftop. Driveways	
	CN _{PRE} = 76 CN _{POPT} = 90.3		
OR	CN _{POST} = 90.3		
OR	CN _{POST} = 90.3 Composite Predevelopment CN ^[9] = 80		
OR Solution:	CN _{POST} = 90.3		
Solution:	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 94		
<u>Solution:</u> re Develop <u>ment Storm Wat</u> er Rur	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 94 noff Volume		
Solution:	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 94 noff Volume	Where:	(10)
<u>Solution:</u> re Develop <u>ment Storm Wat</u> er Rur	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 94 noff Volume		(in).
Solution: re Development Storm Water Rur S _{PRE} = 2.50 in	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 94 moff Volume $S_{PRE} = \frac{1000}{80} -10$	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff	(in).
<u>Solution:</u> re Develop <u>ment Storm Wat</u> er Rur	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 94 moff Volume $S_{PRE} = \frac{1000}{80} -10$	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban	(in).
Solution: re Development Storm Water Rur S _{PRE} = 2.50 in	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 94 noff Volume	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff	(in).
Solution: re Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 94 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	(in).
Solution: re Development Storm Water Rur S _{PRE} = 2.50 in	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 94 moff Volume $S_{PRE} = \frac{1000}{80} -10$	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban	(in).
Solution: re Development Storm Water Rur S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 94 Composite Post development CN ^[9] = 94 Composite Post deve	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	(in).
Solution: re Development Storm Water Rur S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.71 ft ³ ost Development Storm Water Ru	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 94 Composite Post development CN ^[9] = 94 Composite Post deve	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff Q _{PRE} = <i>Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.</i> V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	(in).
Solution: re Development Storm Water Rur S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.71 ft ³	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 94 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.8*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(7,412)$ unoff Volume $S_{POST} = 1000 -10$	Where: S _{PRE} = Pre development potential maximum retention after runoff Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where:	
Solution: re Development Storm Water Rur S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.71 ft ³ ost Development Storm Water Ru	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 94 Composite Post development CN ^[9] = 94 Composite Post deve	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff Q _{PRE} = <i>Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.</i> V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Solution: re Development Storm Water Rur S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.71 ft ³ ost Development Storm Water Ru S_{POST} = 0.66098 in	$\begin{aligned} & \sum_{\text{NPOST}} = \underbrace{90.3}_{80} \\ & \text{Composite Predevelopment CN}^{[9]} = \underbrace{90.3}_{80} \\ & \text{Composite Post development CN}^{[9]} = \underbrace{90.3}_{80} \\ & \text{Spree} = \underbrace{1000}_{80}_{90}_{90}_{-10} \\ & \text{Composite Post development CN}^{[9]} = \underbrace{90.3}_{94} \\ & \text{Composite Post development CN}^{[9]} = \underbrace{90.3}_{94} \\ & \text{Composite Post development CN}^{[9]} = \underbrace{90.3}_{94} \\ & \text{Composite Post development CN}^{[9]} = \underbrace{90.3}_{80}_{-10} \\ & \text{Composite Post development CN}^{[9]} = \underbrace{90.3}_{80}_{-10} \\ & \text{Composite Post development CN}^{[9]} = \underbrace{90.3}_{80}_{-10} \\ & \text{Composite Post development CN}^{[9]} = \underbrace{90.3}_{94}_{-10} \\ & \text{Composite Post development CN}^{[9]} = \underbrace{90.3}_{80}_{-10} \\ & Composite $	Where: SPRE= Pre development potential maximum retention after runoff Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff	
Solution: re Development Storm Water Rur S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.71 ft ³ ost Development Storm Water Ru	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 94 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(7,412)$ unoff Volume $S_{POST} = \frac{1000}{94} -10$ $Q_{POST} = [(0.92*1.17) - (0.2 * 0.66)]^2 \times \frac{1 \text{ft}}{12}$	Where: SPRE= Pre development potential maximum retention after runoff Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff Q _{POST} = Q in feet of depth as defined by the "Urban	
Solution: re Development Storm Water Rur S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.71 ft ³ ost Development Storm Water Ru S_{POST} = 0.66098 in	$\begin{aligned} & \sum_{\text{NPOST}} = \underbrace{90.3}_{80} \\ & \text{Composite Predevelopment CN}^{[9]} = \underbrace{90.3}_{80} \\ & \text{Composite Post development CN}^{[9]} = \underbrace{90.3}_{80} \\ & \text{Spree} = \underbrace{1000}_{80}_{90}_{90}_{-10} \\ & \text{Composite Post development CN}^{[9]} = \underbrace{90.3}_{94} \\ & \text{Composite Post development CN}^{[9]} = \underbrace{90.3}_{94} \\ & \text{Composite Post development CN}^{[9]} = \underbrace{90.3}_{94} \\ & \text{Composite Post development CN}^{[9]} = \underbrace{90.3}_{80}_{-10} \\ & \text{Composite Post development CN}^{[9]} = \underbrace{90.3}_{80}_{-10} \\ & \text{Composite Post development CN}^{[9]} = \underbrace{90.3}_{80}_{-10} \\ & \text{Composite Post development CN}^{[9]} = \underbrace{90.3}_{94}_{-10} \\ & \text{Composite Post development CN}^{[9]} = \underbrace{90.3}_{80}_{-10} \\ & Composite $	Where: SPRE= Pre development potential maximum retention after runoff Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff	
Solution: re Development Storm Water Rur S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.71 ft ³ ost Development Storm Water Ru S_{POST} = 0.66098 in Q_{POST} = 0.04633 ft	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 94 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(7,412)$ unoff Volume $S_{POST} = \frac{1000}{94} -10$ $Q_{POST} = \frac{1000}{94} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.8 * 0.66)]^2}{[(0.92*1.17) + (0.8 * 0.66)]} \times \frac{1ft}{12in}$	Where: S _{PRE} = Pre development potential maximum retention after runoff Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	ff (in).
Solution: re Development Storm Water Rur S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.71 ft ³ ost Development Storm Water Ru S_{POST} = 0.66098 in	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 94 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(7,412)$ unoff Volume $S_{POST} = \frac{1000}{94} -10$ $Q_{POST} = [(0.92*1.17) - (0.2 * 0.66)]^2 \times \frac{1 \text{ft}}{12}$	Where: SPRE= Pre development potential maximum retention after runoff Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff Q _{POST} = Q in feet of depth as defined by the "Urban	ff (in).
Solution: re Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.71 ft ³ ost Development Storm Water Run S_{POST} = 0.66098 in Q_{POST} = 0.04633 ft V_{POST} = 343.40 ft ³	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 94 Composite Post development CN ^[9] = 94 Composite Post deve	Where: S _{PRE} = Pre development potential maximum retention after runoff Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	ff (in).
Solution: re Development Storm Water Rur S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.71 ft ³ ost Development Storm Water Ru S_{POST} = 0.66098 in Q_{POST} = 0.04633 ft V_{POST} = 343.40 ft ³ Solution: Volume Capture Require	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 94 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(7,412)$ unoff Volume $S_{POST} = \frac{1000}{94} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.66)]^2}{[(0.92*1.17) + (0.8 * 0.66)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.04633)(7,412)$ irement	Where: S _{PRE} = Pre development potential maximum retention after runoff Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ²)	ff (in).
Solution: re Development Storm Water Rur S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.71 ft ³ ost Development Storm Water Ru S_{POST} = 0.66098 in Q_{POST} = 0.04633 ft V_{POST} = 343.40 ft ³ Solution: Volume Capture Require Increase in volume of store	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 94 Composite Post development CN ^[9] = 94 Composite Post deve	Where: S _{PRE} = Pre development potential maximum retention after runoff Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ²)	ff (in).
Solution: re Development Storm Water Rur S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.71 ft ³ ost Development Storm Water Ru S_{POST} = 0.66098 in Q_{POST} = 0.04633 ft V_{POST} = 343.40 ft ³ Solution: Volume Capture Requisit Increase in volume of stor	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 94 Composite Post development CN ^[9] = 94 Composite Post deve	Where: S _{PRE} = Pre development potential maximum retention after runoff Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ²)).	ff (in).
Solution: re Development Storm Water Rur S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 66.71 ft ³ ost Development Storm Water Ru S_{POST} = 0.66098 in Q_{POST} = 0.04633 ft V_{POST} = 343.40 ft ³ Solution: Volume Capture Require Increase in volume of store	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 94 Composite Post development CN ^[9] = 94 Composite Post deve	Where: S _{PRE} = Pre development potential maximum retention after runoff Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³) V _{POST} = Post Development Volume of Storm Water Generated (ft ³)). .71)	ff (in).
Solution: re Development Storm Water Rur S_{PRE} 2.50 in Q_{PRE} 0.00900 ft V_{PRE} 66.71 ft ³ ost Development Storm Water Ru S_{POST} 0.66098 in Q_{POST} 0.04633 ft V_{POST} 343.40 ft ³ Solution: Volume Capture Require Increase in volume of stor Notestime Capture (V_{POST}) Delta Volume Capture (V_POST)	$CN_{POST} = 90.3 \\ \hline Omposite Predevelopment CN ^{[9]} = 94$ Noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(7,412)$ Unoff Volume $S_{POST} = \frac{1000}{94} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.66)]^2}{[(0.92*1.17) + (0.8 * 0.66)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.04633)(7,412)$ irement I'm water that must be retained onsite (may be infiltrated or reused) $-V_{PRE})$ Delta Volume Capture = (343.40) - (66.	Where: SPRE= Pre development potential maximum retention after runoff Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development potential maximum retention after runoff Q _{POST} = Post development potential maximum retention after runoff Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ²)). 71) Where:	ff (in).
Solution: re Development Storm Water Rur S_{PRE} 2.50 in Q_{PRE} 0.00900 ft V_{PRE} 66.71 ft ³ ost Development Storm Water Ru S_{POST} 0.66098 in Q_{POST} 0.04633 ft V_{POST} 343.40 ft ³ Solution: Volume Capture Require Increase in volume of stor Notestime Capture (V_{POST}) Delta Volume Capture (V_POST)	$CN_{POST} = 90.3 \\ \hline Omposite Predevelopment CN ^{[9]} = 94$ Noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(7,412)$ Unoff Volume $S_{POST} = \frac{1000}{94} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.66)]^2}{[(0.92*1.17) + (0.8 * 0.66)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.04633)(7,412)$ irement I'm water that must be retained onsite (may be infiltrated or reused) $-V_{PRE})$ Delta Volume Capture = (343.40) - (66.	Where: S _{PRE} = Pre development potential maximum retention after runoff Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³) V _{POST} = Post Development Volume of Storm Water Generated (ft ³)). .71)	ff (in).



LID BMP Sizing Tool: 100% Volume Captu Formulas: $V_{LID GOAL}=((V_{GOAL}))/(P) = 890.79$ ft ³ $A_{LID GOAL}=(W)(L) = 488.41$ ft ²	Where: $V_{\text{LID GOAL}}$ = Required volume of soil in LID BMP. $A_{\text{LID GOAL}}$ = Footprint of LID BMP area for a given depth (below perforated pick) V_{GOAL} = 392 ft ³ Where:	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
<u>Input:</u>	P = 0.4 as a decimalD = 1.9 ftBelow perforated pipe if presentW = 22.1 ftL = 22.1 ft		
Solution: Percent of Goal Achieved = 104.18	% = [(1.9 x 488) / 891] x 100	7	
LID BMP Sizing Tool Delta Volume Captur		NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
	where: VLID DELTA Where: VLID DELTA= Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below perforated p VDELTA = 276.69	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be
Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01 ft ³	Where: V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated performance)	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width
Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ $\#DIV/0!$ ft^3 $A_{LID DELTA} = (W)(L) = $ 0.00 ft^2	Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perforated p V_{DELTA} = 276.69 ft ³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet)	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Requirement achieved" reaches

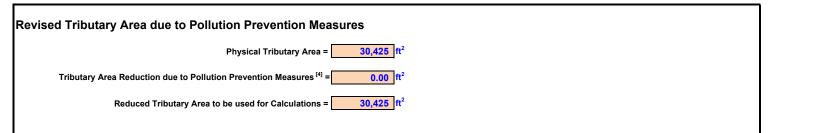




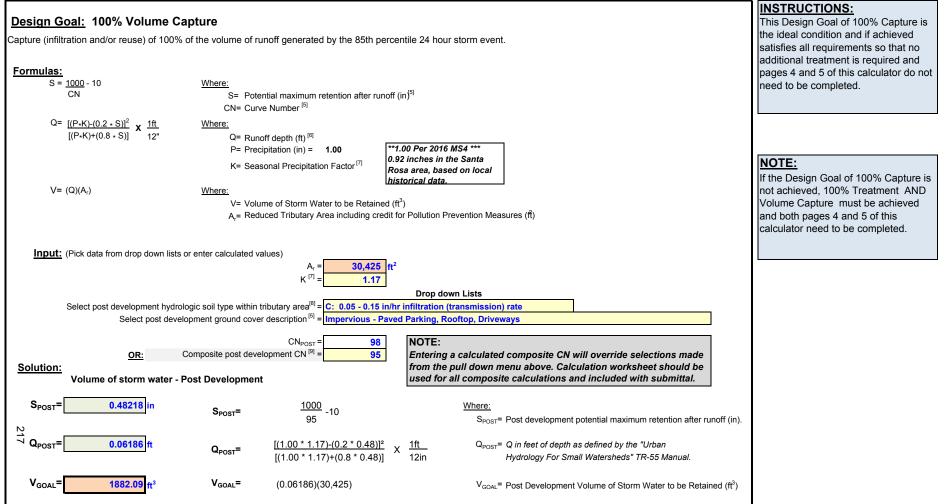
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conne Multiplier = 1	sted Paved Area	INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²		
Area Reduction = 0.00 ft ²		
nterceptor Trees ^[2]		INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees NOTE: Total Interceptor Area (200 ft²/tree) Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=	New Deciduous Trees	
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)	
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy	
Allowed reduction credit for existing tree canopy= 0 ft ²	Allowed credit for existing tree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed by evergreen + deciduous + existing canopy	

Buffer Strips	& Bovine Terraces [3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 Buffer Factor = 0.7	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter the area draining to these features.
<u>Solution:</u> Area రా	a Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) = Area Reduction = 0.00 ft ²	





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.



Release 7 Rev. 1 5/23/2017



Requirement 1: 100% Treatme	nt		INSTRUCTIONS:
Treatment of 100% of the flow generated I	by 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
		The C value used for this calculation	on page 3 of this calculator is not
Formula:		is smaller than the value used for	achieved; then Requirement 1-100%
Q _{TREATMENT} = (0.2 in/hr)(A _r)(C _{POST})(K) cfs	Where:	hydraulic Flood Control design.	Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	•
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prevention Measures (in A	cres) to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]		
Input:			
	$A_r = 30,425$ ft ² = 0.69846 Acres		
	$C_{POST}^{[10]} = 0.61$		
	κ ^[7] = <u>1.2</u>		
	NOTE:		
Solution:		Iculated here should only be used to size the	
Q _{TREATMENT} = 0.09970 cfs		All associated overflow inlets and systems or the Flood Control event.	
	STREATMENT (0.2/(0.0000/(0.01)(1.17))		

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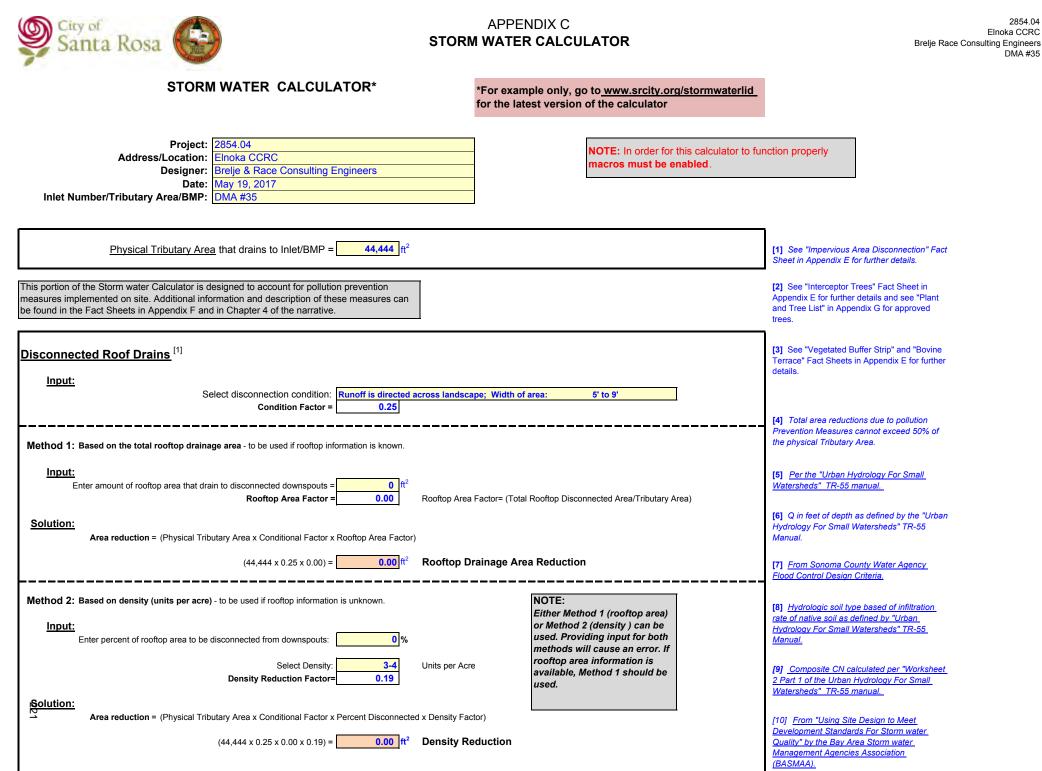


2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #34

	pture te due to development for the 85th percentile 24 hour storm e	event.	INSTRUCTIONS: If the Design Goal of 100% Captur on page 3 of this calculator is not
			achieved; then Requirement 1-100
Formulas:			Treatment, page 4 of the calculato
$S = \frac{1000}{201} - 10$	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ⁵		Capture, this page of the calculato
	CN= Curve Number ^[5]		must be achieved.
$Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} \times \frac{1 \text{ft}}{12 \text{in}}$	Where:		
[(P*K)+(0.8 * S)] 12in	Q= Runoff depth (ft) ^[6]		
	P= Precipitation (in) = 0.92 0.92 inches in the	e Santa Rosa	
	K= Seasonal Precipitation Factor ^[7] area, based on lo	ocal historical	
M = (O)(A)	data.		NOTE:
$V= (Q)(A_r)$	Where:		
	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A _r = Reduced Tributary Area including credit for Pollution Pr	revention Measures (f)	after development is less than or
			equal to that generated before
Input: (Pick data from drop down lists or e	enter calculated values)		development, Requirement 2-Volu
	$A_r = 30,425 \text{ ft}^2$		Capture is not required.
	K ^[7] = 1.2		
			$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PR}$
_	Drop dov		
Select hydrologi	ic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration (t	transmission) rate	
	ment ground cover description ^[5] = <mark>Woods (50%), grass (50%) com</mark>		
Select post developm	ment ground cover description ^[5] = Impervious - Paved Parking, Ro	poftop, Driveways	
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
OR Co	omposite Predevelopment CN ^[9] = 80		
	nposite Post development CN ^[9] = 95		
Solution:			
	Volume S _{PRE} = <u>1000</u> -10	$\frac{\text{Where:}}{\text{S}_{\text{PRE}}\text{=}} \text{ Pre development potential maximum retention after runoff (in).}$	
e Development Storm Water Runoff \			
e Development Storm Water Runoff \ S _{PRE} = 2.50 in	S _{PRE} = <u>1000</u> 80 -10	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Q _{PRE} = 0.00900 ft	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(30,425)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
e Development Storm Water Runoff V S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 273.83 ft ³ post Development Storm Water Runoff	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(30,425)$ F Volume	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
e Development Storm Water Runoff V $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 273.83$ ft ³	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(30,425)$ F Volume	SPRE= Pre development potential maximum retention after runoff (in). QPRE= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE= Pre Development Volume of Storm Water Generated (ft ³) Where: Where:	
e Development Storm Water Runoff V S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 273.83 ft ³ ost Development Storm Water Runoff	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(30,425)$ F Volume	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
e Development Storm Water Runoff V S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 273.83 ft ³ post Development Storm Water Runoff S_{POST} = 0.48218 in	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(30.425)$ F Volume $S_{POST} = \frac{1000}{95} -10$	SPRE= Pre development potential maximum retention after runoff (in). QPRE= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE= Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST= Post development potential maximum retention after runoff (in).	
e Development Storm Water Runoff V S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 273.83 ft ³ ost Development Storm Water Runoff	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(30.425)$ F Volume $S_{POST} = \frac{1000}{95} -10$	SPRE= Pre development potential maximum retention after runoff (in). QPRE= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE= Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST= Post development potential maximum retention after runoff (in). QPOST= Q in feet of depth as defined by the "Urban	
e Development Storm Water Runoff V S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 273.83 ft ³ post Development Storm Water Runoff S_{POST} = 0.48218 in	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(30,425)$ F Volume	SPRE= Pre development potential maximum retention after runoff (in). QPRE= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE= Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST= Post development potential maximum retention after runoff (in).	
e Development Storm Water Runoff V S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 273.83 ft ³ post Development Storm Water Runoff S_{POST} = 0.48218 in	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(30.425)$ F Volume $S_{POST} = \frac{1000}{95} -10$	SPRE= Pre development potential maximum retention after runoff (in). QPRE= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE= Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST= Post development potential maximum retention after runoff (in). QPOST= Q in feet of depth as defined by the "Urban	
e Development Storm Water Runoff V S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 273.83 ft ³ post Development Storm Water Runoff S_{POST} = 0.48218 in Q_{POST} = 0.05485 ft V_{POST} = 1668.81 ft ³ <u>Solution:</u> Volume Capture Requirement Increase in volume of storm wa	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) \cdot (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(30,425)$ $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) \cdot (0.2^{*}0.48)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}0.48)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.05485)(30,425)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
The Development Storm Water Runoff V S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 273.83 ft ³ Dost Development Storm Water Runoff S_{POST} = 0.48218 in Q_{POST} = 0.05485 ft V_{POST} = 1668.81 ft ³ Solution: Volume Capture Requirement	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) \cdot (0.2 * 2.50)]^2}{[(0.92^{*}1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(30,425)$ FVolume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) \cdot (0.2 * 0.48)]^2}{[(0.92^{*}1.17) + (0.8 * 0.48)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.05485)(30,425)$ ent there that must be retained onsite (may be infiltrated or reused).	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
The Development Storm Water Runoff V S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 273.83 ft ³ Dost Development Storm Water Runoff S_{POST} = 0.48218 in Q_{POST} = 0.05485 ft V_{POST} = 1668.81 ft ³ Solution: Volume Capture Requirement Increase in volume of storm wa	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(30,425)$ $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2^{*}0.48)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}0.48)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.05485)(30,425)$ ent there that must be retained onsite (may be infiltrated or reused).	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	



LID BMP Sizing Tool: 100% Volume Captur Formulas: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 4277.48$ ft ³ $A_{LID GOAL} = (W)(L) = 1544.49$ ft ²	Where: $V_{LID \ GOAL}$ V_LID \ GOAL Required volume of soil in LID BMP. A_LID \ GOAL Footprint of LID BMP area for a given depth (below perforated pip V_GOAL = 1,882 It It	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. pe if present).	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
Input:	P = 0.4 as a decimalD = 2.8 ftBelow perforated pipe if presentW = 39.3 ftL = 39.3 ft		
Solution: Percent of Goal Achieved = 101.10 %	6 = [(2.8 x 1,544) / 4,277] x 100	7	
LID BMP Sizing Tool Delta Volume Capture	Requirement: V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
$A_{LID DELTA}=(W)(L) = 0.00 \text{ ft}^2$	V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated pip V _{DELTA} = 1394.99 ft ³	pe if present).	<u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	<u>/here:</u> P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		Requirement achieved" reaches 100%.
Input:	P =0.0as a decimalD =0.0ftBelow perforated pipe if presentW =0.0ftL =0.0ft		
Solution: N Percent of Requirement Achieved = #DIV/0! 9	6 = #DIV/0!		

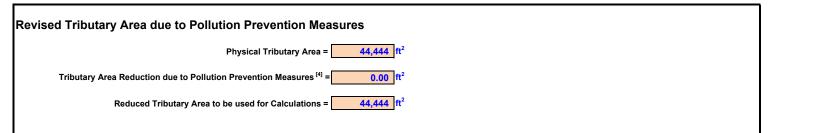




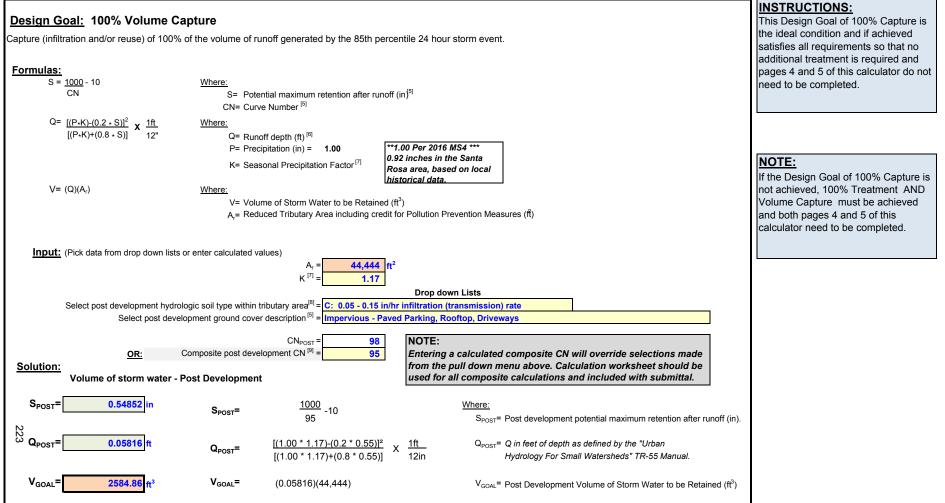
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conne Multiplier = 1	INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.		
Enter area of alternatively designed paved area: 0 ft ²			
Area Reduction = 0.00 ft ²			
nterceptor Trees ^[2]			INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees (200 ft ² /tree)	NOTE: Total Interceptor Area Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0	New Deciduous Trees		
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)		
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy		
Allowed reduction credit for existing tree canopy=	Allowed credit for existing tr	ree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas manage [,]	d by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ² Buffer Factor = 0.7	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter the area draining to these features.
Solution: Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) = Area Reduction = 0.00 ft ² N N N	





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.



Release 7 Rev. 1 5/23/2017



Requirement 1: 100% Treatment			INSTRUCTIONS:
Treatment of 100% of the flow generated by 85t	th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
		The C value used for this calculation	on page 3 of this calculator is not
<u>Formula:</u>		is smaller than the value used for	achieved; then Requirement 1-100%
	<u>Nhere:</u>		Treatment, this page of the calculator,
QT	TREATMENT = Design flow rate required to be treated (cfs)	The table of values can be found here	
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prevention Measures (i	n Acres) to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]		
Input:	$A_r = $ 44,444 $ft^2 = $ 1.02 Acres C_{POST} $^{[10]} = $ 0.60		
	κ ^[7] = 1.2		
	NOTE:		
Solution:		calculated here should only be used to size the IP. All associated overflow inlets and systems	
Q _{TREATMENT} = 0.14325 cfs		d for the Flood Control event.	

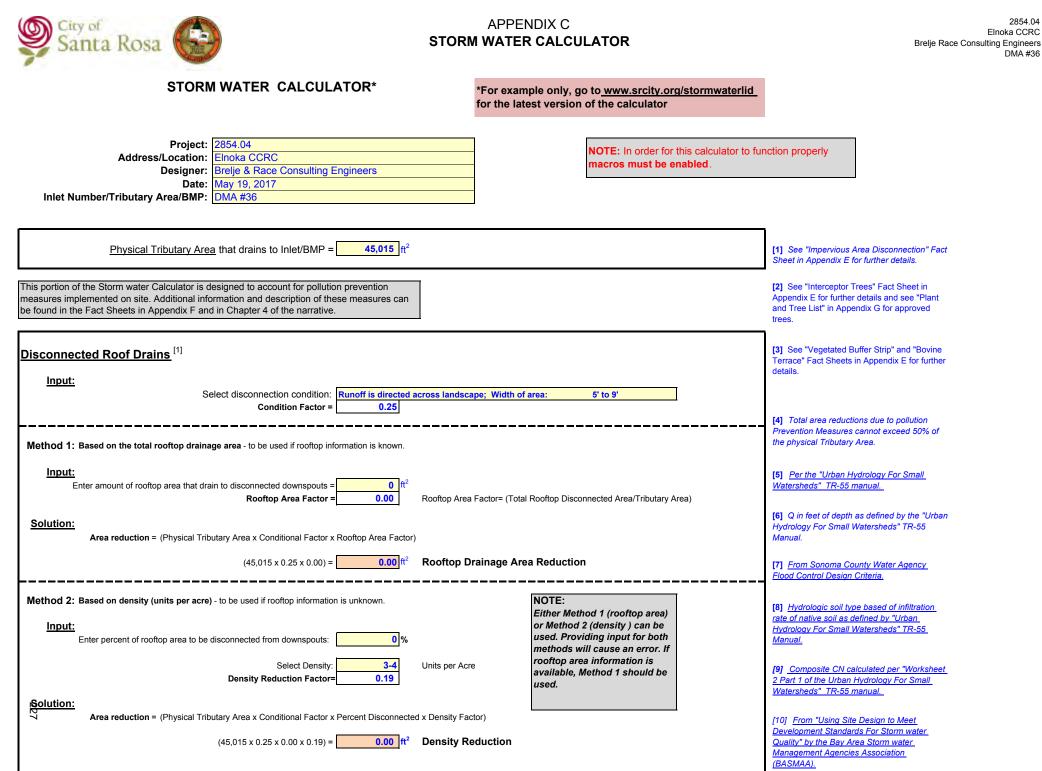


2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #35

Requirement 2: Delta Volume (Capture		INSTRUCTIONS:
	e site due to development for the 85th percentile 24 hour storm e	event.	If the Design Goal of 100% Capture
· ·			on page 3 of this calculator is not
			achieved; then Requirement 1-100
Formulas:			Treatment, page 4 of the calculator
S = 1000 - 10	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ^{5]}		
	CN= Curve Number ^[5]		Capture, this page of the calculator
$Q = [(P * K) - (0.2 * S)]^2$ 1ft	Where:		must be achieved.
$Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} \times \frac{1 \text{ft}}{12 \text{in}}$	Q= Runoff depth (ft) ^[6]		
	P = Precipitation (in) = 0.92 0.92 inches in th	e Santa Rosa	
	K= Seasonal Precipitation Factor ^[7] area, based on l		
	data.		NOTE
$V= (Q)(A_r)$	Where:		NOTE:
	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A _r = Reduced Tributary Area including credit for Pollution P	revention Measures (ť)	after development is less than or
			equal to that generated before
Input: (Pick data from drop down lists	or enter calculated values)		development, Requirement 2-Volui
·	$A_r = $ 44,444 ft ²		Capture is not required.
	K ^[7] = 1.2		
		um Linto	$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE}$
Calast budes	Drop do logic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration (
	elopment ground cover description ^[5] = Woods (50%), grass (50%) com		
Select post deve	elopment ground cover description ^[5] = Impervious - Paved Parking, Ro	bottop, Driveways	
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
<u>OR</u>	$CN_{POST} = 90.3$ Composite Predevelopment $CN^{[9]} = 80$		
	CN _{POST} = 90.3		
	$CN_{POST} = 90.3$ Composite Predevelopment $CN^{[9]} = 80$		
	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95		
Solution: re Development Storm Water Rund	CN _{POST} = 90.3 Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95	Where:	
Solution: re Development Storm Water Rund	CN _{POST} = 90.3 Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95		
Solution: re Development Storm Water Rund	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 Off Volume	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff (ir).
Solution: re Development Storm Water Rund S _{PRE} = 2.50 in	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (ir).
Solution: re Development Storm Water Rund	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (ir Q_{PRE} = Q in feet of depth as defined by the "Urban).
Solution: Pre Development Storm Water Rund S _{PRE} = 2.50 in	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95	S_{PRE} = Pre development potential maximum retention after runoff (ir).
Solution: re Development Storm Water Rund $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^*1.17) - (0.2^*2.50)]^2}{[(0.92^*1.17) + (0.8^*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$	S _{PRE} = Pre development potential maximum retention after runoff (ir Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.).
Solution: re Development Storm Water Rund S _{PRE} = 2.50 in	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (ir Q_{PRE} = Q in feet of depth as defined by the "Urban).
Solution: Tre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 400.00 ft ³	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(44,444)$	S _{PRE} = Pre development potential maximum retention after runoff (ir Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.).
Solution: The Development Storm Water Rund $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 400.00$ ft ³ Post Development Storm Water Rund	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(44,444)$ hoff Volume	S _{PRE} = Pre development potential maximum retention after runoff (ir Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)).
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 400.00	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(44,444)$ hoff Volume $S_{POST} = \frac{1000}{-10} -10$	S _{PRE} = Pre development potential maximum retention after runoff (ir Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) <u>Where:</u>	
Solution: re Development Storm Water Rund $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 400.00$ ft ³ rost Development Storm Water Rund	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(44,444)$ hoff Volume	S _{PRE} = Pre development potential maximum retention after runoff (ir Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Solution: Tre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 400.00 ft ³ Post Development Storm Water Rund S_{POST} = 0.54852 in	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(44,444)$ hoff Volume $S_{POST} = \frac{1000}{95} -10$	S _{PRE} = Pre development potential maximum retention after runoff (ir Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (
Solution: The Development Storm Water Rund $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 400.00$ ft ³ Post Development Storm Water Rund	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(44,444)$ hoff Volume $S_{POST} = \frac{1000}{95} -10$	S _{PRE} = Pre development potential maximum retention after runoff (ir Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (Q _{POST} = Q in feet of depth as defined by the "Urban	
Solution: Tre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 400.00 ft ³ Post Development Storm Water Rund S_{POST} = 0.54852 in	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(44,444)$ hoff Volume $S_{POST} = \frac{1000}{-10} -10$	S _{PRE} = Pre development potential maximum retention after runoff (ir Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (
Solution: Pre Development Storm Water Rund S_{PRE} Q_{PRE} 0.00900 ft V_{PRE} 400.00 ft ³ Post Development Storm Water Rund S_{POST} 0.54852 in	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2 * 2.50)]^{2}}{[(0.92^{*}1.17) + (0.8 * 2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(44,444)$ hoff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2 * 0.55)]^{2}}{[(0.92^{*}1.17) + (0.8 * 0.55)]} \times \frac{1\text{ft}}{12\text{in}}$	S _{PRE} = Pre development potential maximum retention after runoff (ir Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (Q _{POST} = Q in feet of depth as defined by the "Urban	
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Solution: Pre Development Storm Water Rund S_{PRE} Q_{PRE} 0.00900 ft V_{PRE} 400.00 ft ³ Post Development Storm Water Rund S_{POST} 0.54852 in Q_{POST} 0.05132 ft V_{POST} 2280.87 ft ³	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2 * 2.50)]^{2}}{[(0.92^{*}1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(44,444)$ hoff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2 * 0.55)]^{2}}{[(0.92^{*}1.17) + (0.8 * 0.55)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.05132)(44,444)$	S _{PRE} = Pre development potential maximum retention after runoff (ir Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: Pre Development Storm Water Rund S_{PRE} Q_{PRE} 0.00900 ft V_{PRE} 400.00 ft ³ Post Development Storm Water Rund S_{POST} 0.54852 in	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2 * 2.50)]^{2}}{[(0.92^{*}1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(44,444)$ hoff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2 * 0.55)]^{2}}{[(0.92^{*}1.17) + (0.8 * 0.55)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.05132)(44,444)$	S _{PRE} = Pre development potential maximum retention after runoff (ir Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: Tre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE}= 0.00900 ft V_{PRE} = 400.00 ft ³ Post Development Storm Water Rund S_{POST} = 0.54852 in Q_{POST}= 0.05132 ft V_{POST} = 2280.87 ft ³ Solution: Volume Capture Require Increase in volume of storm	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2 * 2.50)]^{2}}{[(0.92^{*}1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(44,444)$ hoff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2 * 0.55)]^{2}}{[(0.92^{*}1.17) + (0.8 * 0.55)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.05132)(44,444)$	SPRE Pre development potential maximum retention after runoff (ir QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³)	
Solution: Tre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE}= 0.00900 ft V_{PRE} = 400.00 ft ³ Post Development Storm Water Rund S_{POST} = 0.54852 in Q_{POST}= 0.05132 ft V_{POST} = 2280.87 ft ³ Solution: Volume Capture Require Increase in volume of storm	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2 * 2.50)]^2}{[(0.92^{*}1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(44,444)$ hoff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2 * 0.55)]^2}{[(0.92^{*}1.17) + (0.8 * 0.55)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.05132)(44,444)$ hement	SPRE Pre development potential maximum retention after runoff (ir QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³)	
Solution: Pre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE}= 0.00900 ft V_{PRE} = 400.00 ft ³ Post Development Storm Water Rund S_{POST} = 0.54852 in Q_{POST}= 0.05132 ft V_{POST} = 2280.87 ft ³ Solution: Volume Capture Required	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) + (0.2 * 2.50)]^2}{[(0.92^{*}1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(44,444)$ for Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2 * 0.55)]^2}{[(0.92^{*}1.17) + (0.8 * 0.55)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.05132)(44,444)$ erment water that must be retained onsite (may be infiltrated or reused)	S _{PRE} = Pre development potential maximum retention after runoff (ir Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
Solution: Tre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE}= 0.00900 ft V_{PRE} = 400.00 ft ³ Post Development Storm Water Rund S_{POST} = 0.54852 in Q_{POST}= 0.05132 ft V_{POST} = 2280.87 ft ³ Solution: Volume Capture Required Increase in volume of storm	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2 * 2.50)]^{2}}{[(0.92^{*}1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(44,444)$ hoff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2 * 0.55)]^{2}}{[(0.92^{*}1.17) + (0.8 * 0.55)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.05132)(44,444)$ Herment In water that must be retained onsite (may be infiltrated or reused) $V_{PRE} = 0 = 0$ $V_{PRE} = 0$	SPRE Pre development potential maximum retention after runoff (ir QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) 0.000) Where:	n).
Solution: Tre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE}= 0.00900 ft V_{PRE} = 400.00 ft ³ Post Development Storm Water Rund S_{POST} = 0.54852 in Q _{POST} = 0.05132 ft V _{POST} = 2280.87 ft ³ Solution: Volume Capture Required Increase in volume of storm Note that the storm of the st	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2 * 2.50)]^{2}}{[(0.92^{*}1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(44,444)$ hoff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2 * 0.55)]^{2}}{[(0.92^{*}1.17) + (0.8 * 0.55)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.05132)(44,444)$ Herment In water that must be retained onsite (may be infiltrated or reused) $V_{PRE} = 0 = 0$ $V_{PRE} = 0$	SPRE Pre development potential maximum retention after runoff (ir QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) 0.000) Where:	n).
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LID BMP Sizing Tool: 100% Volume Capture Formulas: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 5874.69 \text{ ft}^3$ $A_{LID GOAL} = (W)(L) = 2787.84 \text{ ft}^2$ Wh	Where: $V_{LID GOAL}$ Required volume of soil in LID BMP. $A_{LID GOAL}$ Footprint of LID BMP area for a given depth (below perforated pip V_{GOAL} = 2,585 ft ³	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. pe if present).	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
<u>Input:</u>	P =0.4as a decimalD =2.1ftBelow perforated pipe if presentW =52.8ftL =52.8ft		
Solution: Percent of Goal Achieved = 101.55 %	= [(2.1 x 2,788) / 5,875] x 100	7	
LID BMP Sizing Tool Delta Volume Capture I Formulas: VILID PELTA=((VDELTA))/(P) = #DIV/01] ft ³	Requirement: V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
Formulas:		LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of
Formulas: $V_{LID DELTA}$ =((V_{DELTA}))/(P) = #DIV/01 $A_{LID DELTA}$ =(W)(L) = 0.00ft²Percent of Requirement Achieved= $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}}$ x 100	Where: VLID DELTA= Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below perforated piped)	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> <u>requirement of the delta volume</u> <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be
Formulas: $V_{LID DELTA}$ =((V_{DELTA}))/(P) = #DIV/01 $A_{LID DELTA}$ =(W)(L) = 0.00ft²Percent of Requirement Achieved= $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}}$ x 100	Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perforated pip V_{DELTA} = 1880.87 ft ³ ere: P= Porosity (enter as a decimal) D= Depth below perforated pip if present (in decimal feet) W= Width (in decimal feet)	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> <u>requirement of the delta volume</u> <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Requirement achieved" reaches

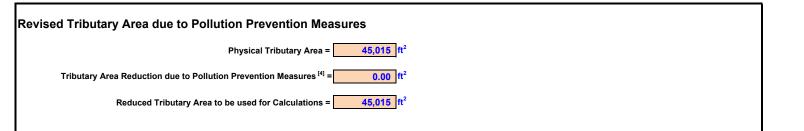




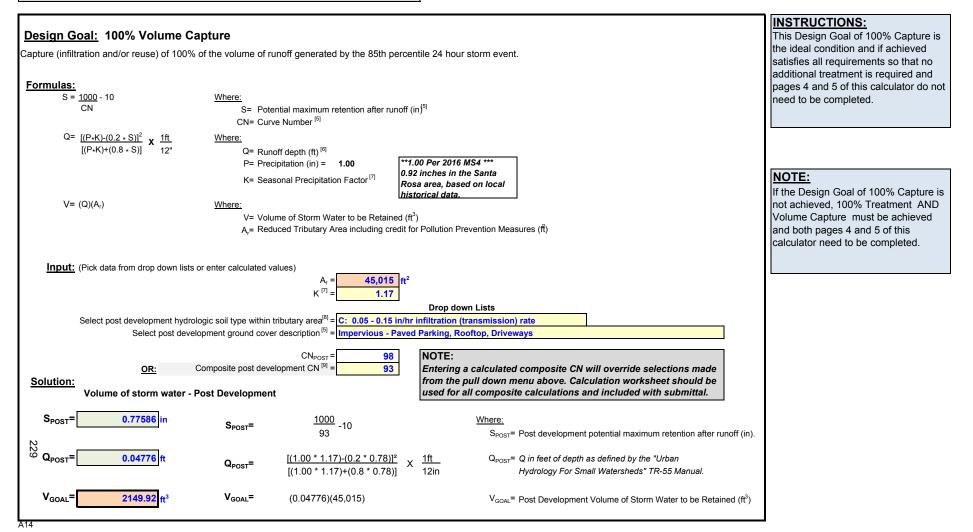
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conne Multiplier = 1	INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.		
Enter area of alternatively designed paved area: 0 ft ²			
Area Reduction = 0.00 ft ²			
Interceptor Trees ^[2] Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0	T	NOTE: Fotal Interceptor Area	INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area
Area Reduction due to new Evergreen Trees=0ft ²	(LEE WALL)	Reduction is limited to 50% of he physical tributary area.	of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Deciduous Trees=0 ft ²	New Deciduous Trees (100 ft ² /tree)		
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy		
Allowed reduction credit for existing tree canopy= 0 ft ²	Allowed credit for existing tree of	canopy = 50 % of actual canopy square fool	age
Area Reduction = 0 ft ²	= Sum of areas managed by	y evergreen + deciduous + existing can	рру

Buffer Strips & Bovine Terraces ^[3]	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to
Enter area oraining to a Burrer Strip or Bovine Terrace = 0 it	these features as sheet flow. Enter the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) =	
Area Reduction = 0.00 ft ²	I





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.





Requirement 1: 100% Treatme	nt		INSTRUCTIONS:
Treatment of 100% of the flow generated b	by 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
		The C value used for this calculation	on page 3 of this calculator is not
Formula:		is smaller than the value used for	achieved; then Requirement 1-100%
$Q_{TREATMENT}$ = (0.2 in/hr)(A_r)(C_{POST})(K) cfs	Where:	hydraulic Flood Control design.	Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	•
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prevention Mea	asures (in Acres) to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]		
Input:	$A_r = $ $C_{POST}^{100} = $ $C_{POST}^$		
	κ ^[7] = 1.2		
	NOTE:		
Solution:	appropr	w Rate calculated here should only be used to size the rate BMP. All associated overflow inlets and systems	
Q _{TREATMENT} = 0.12816 cfs	Q _{TREATMENT} = (0.2)(1.03)(0.53)(1.17) should a	be sized for the Flood Control event.	

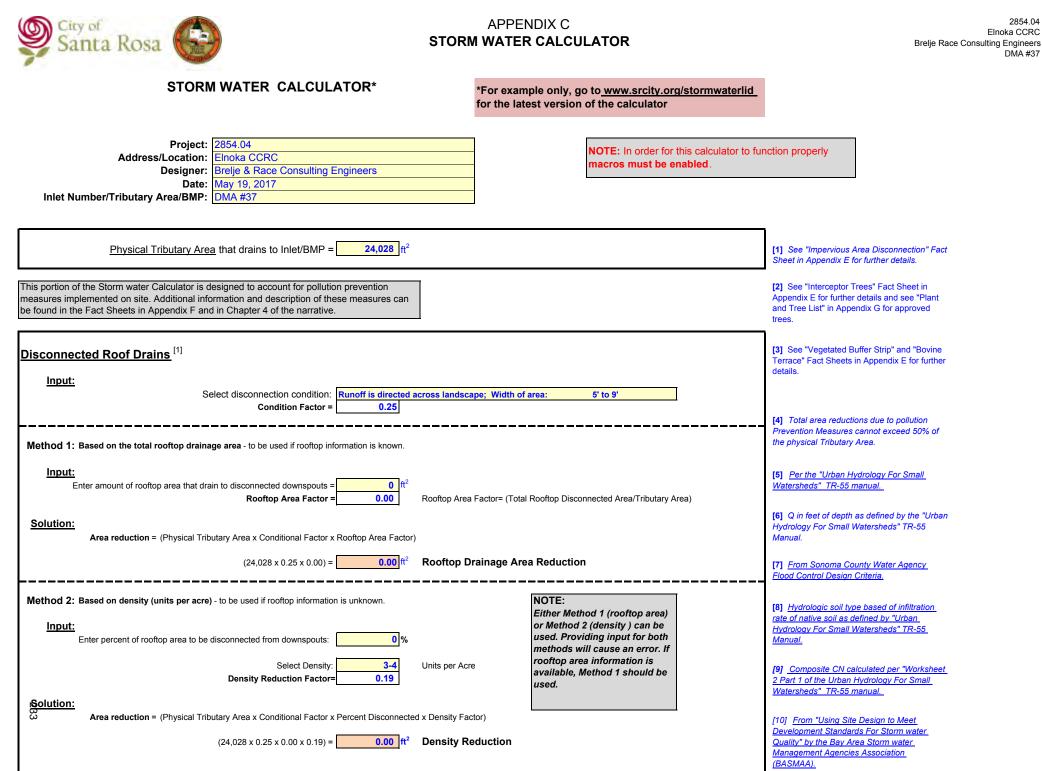


2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #36

equirement 2: Delta Volume increase in volume of runoff leaving the second s	Capture he site due to development for the 85th percentile 24 hour storm	event.	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not achieved; then Requirement 1-100%
ormulas:			Treatment, page 4 of the calculator,
S = <u>1000</u> - 10	Where:		
CN	S= Potential maximum retention after runoff (in) ⁵		AND Requirement 2- Volume
SN SN	CN= Curve Number ^[5]		Capture, this page of the calculator,
			must be achieved.
$\begin{array}{r} Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} \times \frac{1 \text{ft}}{12 \text{in}} \end{array}$	Where:		
[(P*K)+(0.8 * S)] 12in	Q= Runoff depth (ft) ^[6]		
	P= Precipitation (in) = 0.92 0.92 inches in t	he Santa Rosa	
	K= Seasonal Precipitation Factor ^[7] area, based on	local historical	
	data.		NOTE
$V= (Q)(A_r)$	Where:		NOTE:
	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A _r = Reduced Tributary Area including credit for Pollution F	Prevention Measures (ť)	after development is less than or
Immute (Districts for a data data dist			equal to that generated before
Input: (Pick data from drop down list			development, Requirement 2-Volun
	$A_r = 45,015 \text{ ft}^2$		Capture is not required.
	K ^[7] = 1.2		
		um Lista	$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE}$
.		own Lists	
Select hydr	rologic soil type within tributary area ^[8] = $\frac{C: 0.05 - 0.15 \text{ in/hr infiltration}}{C: 0.05 - 0.15 \text{ in/hr infiltration}}$	(transmission) rate	
	relopment ground cover description ^[5] = Woods (50%), grass (50%) cor		
Select post dev	elopment ground cover description ^[5] = Impervious - Paved Parking, F	ooftop, Driveways	
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
OR	Composite Predevelopment CN ^[9] = 80		
<u>OR</u>	Composite Post development CN $^{[9]} = 93$		
Solution:	Composite Post development CN ^[9] = 93		
<u>Solution:</u> e Develop <u>ment Storm Wat</u> er Run	Composite Post development CN ^[9] = 93 off Volume		
Solution:	Composite Post development CN ^[9] = 93 off Volume	Where:	
Solution: Development Storm Water Run	Composite Post development CN ^[9] = 93 off Volume		
Solution: Development Storm Water Run	Composite Post development CN ^[9] = 93 off Volume	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff (in)	
Solution: e Development Storm Water Run S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in)	
Solution: Development Storm Water Run	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$		
Solution: Development Storm Water Run S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in) Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: Development Storm Water Run S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 93 off Volume	S_{PRE} = Pre development potential maximum retention after runoff (in)	
olution: Development Storm Water Run S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$	S _{PRE} = Pre development potential maximum retention after runoff (in) Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: Development Storm Water Run S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in) Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 405.14$ ft ³	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(45,015)$	S _{PRE} = Pre development potential maximum retention after runoff (in) Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 405.14$ ft ³	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(45,015)$	S _{PRE} = Pre development potential maximum retention after runoff (in) Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: a Development Storm Water Run S_{PRE} Q_{PRE} 0.00900 ft V_{PRE} 405.14 ft ³ st Development Storm Water Run	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(45,015)$ noff Volume	 S_{PRE}= Pre development potential maximum retention after runoff (in) Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	
Solution: Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 405.14$ ft ³	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(45,015)$ noff Volume	S _{PRE} = Pre development potential maximum retention after runoff (in) Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where:	
Solution: Development Storm Water Run S_{PRE} Q _{PRE} 0.00900 ft V _{PRE} 405.14 ft ³ st Development Storm Water Ru	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(45,015)$ noff Volume	 S_{PRE}= Pre development potential maximum retention after runoff (in) Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 405.14 ft ³ vst Development Storm Water Ru S_{POST} = 0.77586 in	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(45,015)$ noff Volume $S_{POST} = \frac{1000}{93} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in) Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where:	
Solution: a Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 405.14 ft ³ st Development Storm Water Run S_{POST} = 0.77586 in	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(45,015)$ noff Volume $S_{POST} = \frac{1000}{93} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in) Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in)	
Solution: a Development Storm Water Run S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 405.14 ft ³ st Development Storm Water Ru S _{POST} = 0.77586 in	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(45,015)$ noff Volume $S_{POST} = \frac{1000}{93} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in) Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban	
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 405.14 ft ³ st Development Storm Water Run S_{POST} = 0.77586 in	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(45,015)$ noff Volume	S _{PRE} = Pre development potential maximum retention after runoff (in) Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in)	
Solution: Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 405.14$ ft ³ st Development Storm Water Ru $S_{POST} = 0.77586$ in $Q_{POST} = 0.04152$ ft	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(45,015)$ noff Volume $S_{POST} = \frac{1000}{93} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.78)]^2}{[(0.92*1.17) + (0.8 * 0.78)]} \times \frac{1 \text{ft}}{12 \text{in}}$	SPRE Pre development potential maximum retention after runoff (in) QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in Hydrology For Small Watersheds" TR-55 Manual.	
Solution: Development Storm Water Run S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 405.14 ft ³ St Development Storm Water Run S _{POST} =	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(45,015)$ noff Volume $S_{POST} = \frac{1000}{93} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in) Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban	
Solution: a Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 405.14 ft ³ st Development Storm Water Ru S_{POST} = 0.77586 in Q_{POST} = 0.04152 ft	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(45,015)$ noff Volume $S_{POST} = \frac{1000}{93} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.78)]^2}{[(0.92*1.17) + (0.8 * 0.78)]} \times \frac{1 \text{ft}}{12 \text{in}}$	SPRE Pre development potential maximum retention after runoff (in) QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in Hydrology For Small Watersheds" TR-55 Manual.	
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Solution: a Development Storm Water Run S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 405.14 ft ³ st Development Storm Water Run S _{POST} = 0.77586 in Q _{POST} = 0.04152 ft V _{POST} = 1869.02 ft ³ Solution: Volume Capture Requisit Increase in volume of storm	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(45,015)$ noff Volume $S_{POST} = \frac{1000}{93} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.78)]^2}{[(0.92*1.17) + (0.8 * 0.78)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.04152)(45,015)$	S _{PRE} = Pre development potential maximum retention after runoff (in) Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
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Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 405.14 ft ³ st Development Storm Water Run S_{POST} = 0.77586 in Q_{POST} = 0.04152 ft V_{POST} = 1869.02 ft ³ Solution: Volume Capture Requisit Increase in volume of storm	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(45,015)$ noff Volume $S_{POST} = \frac{1000}{93} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.78)]^2}{[(0.92*1.17) + (0.8 * 0.78)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.04152)(45,015)$ rement n water that must be retained onsite (may be infiltrated or reused	S _{PRE} = Pre development potential maximum retention after runoff (in) Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development potential maximum retention after runoff (in V _{POST} = Post Development Volume of Storm Water Generated (ft ³)).	
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 405.14 ft ³ ost Development Storm Water Ru S_{POST} = 0.77586 in Q_{POST} = 0.04152 ft V_{POST} = 1869.02 ft ³ Solution: Volume Capture Require Increase in volume of storm	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.8 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(45,015)$ noff Volume $S_{POST} = \frac{1000}{93} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.78)]^2}{[(0.92*1.17) + (0.8 * 0.78)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.04152)(45,015)$ rement n water that must be retained onsite (may be infiltrated or reused	S _{PRE} = Pre development potential maximum retention after runoff (in) Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Post development potential maximum retention after runoff (in Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)). :05.14)	
Solution: e Development Storm Water Run S_{PRE} 2.50 in Q_{PRE} 0.00900 ft V_{PRE} 405.14 ft ³ st Development Storm Water Run S_{POST} 0.77586 in Q_{POST} 0.04152 ft V_{POST} 1869.02 ft ³ Solution: Volume Capture Require Increase in volume of storm Delta Volume Capture= (V _{POST}	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(45,015)$ noff Volume $S_{POST} = \frac{1000}{93} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.78)]^2}{[(0.92*1.17) + (0.8 * 0.78)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.04152)(45,015)$ rement In water that must be retained onsite (may be infiltrated or reused V_{PRE}) Delta Volume Capture = (1,869.02) - (4)	S _{PRE} = Pre development potential maximum retention after runoff (in) Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³) .0 .05.14) Where:	
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 405.14 ft ³ ost Development Storm Water Run S_{POST} = 0.77586 in Q_{POST} = 0.04152 ft V_{POST} = 1869.02 ft ³ Solution: Volume Capture Require Increase in volume of storm Delta Volume Capture= (V _{POST} -	Composite Post development CN ^[9] = 93 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(45,015)$ noff Volume $S_{POST} = \frac{1000}{93} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.78)]^2}{[(0.92*1.17) + (0.8 * 0.78)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.04152)(45,015)$ rement In water that must be retained onsite (may be infiltrated or reused V_{PRE}) Delta Volume Capture = (1,869.02) - (4)	S _{PRE} = Pre development potential maximum retention after runoff (in) Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Post development potential maximum retention after runoff (in Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)). :05.14)).



LID BMP Sizing Tool: 100% Volume Capt Formulas: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 4886.17$ ft ³ $A_{LID GOAL} = (W)(L) = 2116.00$ ft ²	Where: V _{LID GOAL} = Required volume of soil in LID BMP. A _{LID GOAL} = Footprint of LID BMP area for a given depth (below perforated pi V _{GOAL} =	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal of 100% volume capture of the post</u> <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
<u>Input:</u>	P =0.4as a decimalD =2.3ftBelow perforated pipe if presentW =46.0ftL =46.0ft		
Solution: Percent of Goal Achieved = 101.34	% = [(2.3 x 2,116) / 4,886] x 100	7	
LID BMP Sizing Tool Delta Volume Captu Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0!] ft ³	Ire Requirement: V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
$A_{\text{LID DELTA}}=(W)(L) = \boxed{0.00} \text{ft}^2$	$V_{\text{LID DELTA}}$ = Required volume of soil in LID BMP $A_{\text{LID DELTA}}$ = Footprint of LID BMP area for a given depth (below perforated pi V_{DELTA} = 1463.89 ft ³	ipe if present).	capture. Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		Requirement achieved" reaches 100%.
<u>Input:</u>	P =0.0as a decimal $D =$ 0.0ftBelow perforated pipe if present $W =$ 0.0ftL =0.0ft		
Solution: N Percent of Requirement Achieved = #DIV/0!	% = #DIV/0!		

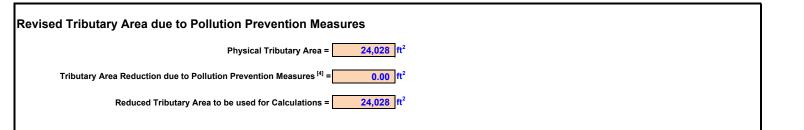




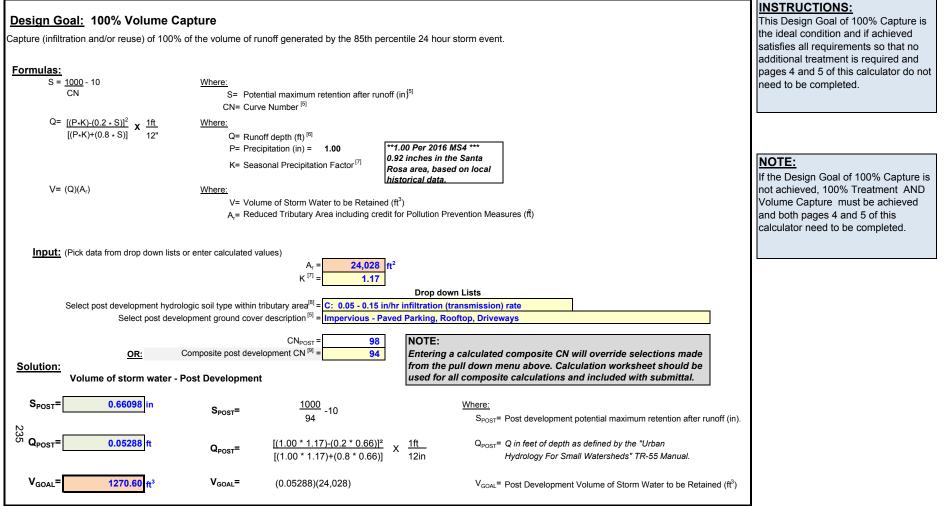
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conne Multiplier = 1	ected Paved Area		INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²			
Area Reduction = 0.00 ft ²			
Interceptor Trees ^[2] Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0	New Evergreen Trees	NOTE: Total Interceptor Area	INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area
Area Reduction due to new Evergreen Trees=0ft ²		Reduction is limited to 50% of the physical tributary area.	of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Deciduous Trees=0 ft ²	New Deciduous Trees (100 ft ² /tree)		
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy		
Allowed reduction credit for existing tree canopy= 0 ft ²	Allowed credit for existing tre	ee canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed	by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3]	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine
Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ²	terraces. Runoff Must be direct to these features as sheet flow. Enter
Buffer Factor = 0.7	the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) =	
Area Reduction = 0.00 ft ²	
- 22 - 4	-





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.



Release 7 Rev. 1 5/23/2017



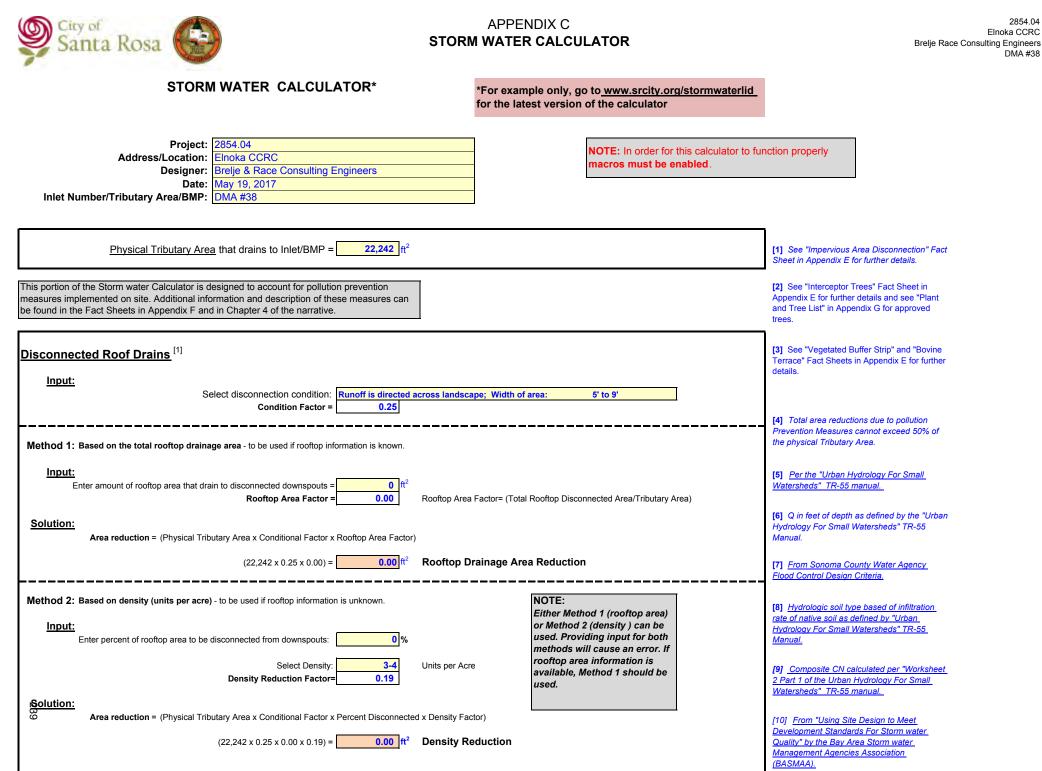
Requirement 1: 100% Treatment	nt		INSTRUCTIONS:
	y 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
Formula		The C value used for this calculation is smaller than the value used for	on page 3 of this calculator is not
Formula: Q _{TREATMENT} = (0.2 in/hr)(A _r)(C _{POST})(K) cfs	Where:	hydraulic Flood Control design.	achieved; then Requirement 1-100% Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	AND Requirement 2- Volume
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]		Capture, page 5 of the calculator,
	A_r = Reduced Tributary Area including credit for Pollution Prevention	Measures (in Acres) to size the overflow bypass.	must be achieved.
Innuti	K = Seasonal Precipitation Factor ^[7]		
Input:	A _r = 24,028 ft ² = 0.55161 Acre	s	
	C _{POST} ^[10] = 0.56	-	
	K ^[7] = 1.2		
	NOT	TE:	
Solution:		Flow Rate calculated here should only be used to size the	
Q _{TREATMENT} = 0.07228 cfs		ropriate BMP. All associated overflow inlets and systems uld be sized for the Flood Control event.	
	STREATMENT (0.2)(0.0010)(0.00)(1.17)		



Entrantisti CN See Excession maximum releasion after runof (sy ^{TI} CN Vertex (see Excession Procession (see See See Sec Sec Sec Sec Sec Sec Sec S	Requirement 2: Delta Volume C No increase in volume of runoff leaving the	apture site due to development for the 85th percentile 24 hour storm	event.	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not
s = <u>000</u> . 10 <u>View</u> S = <u>0000</u> . 10 <u>View</u> C = Corre Number ¹¹ C = Correstion (n) = <u>0.32</u> N = <u>0.32</u> <i>inclusion</i> (n) = <u>0.32</u> C = Numori equation (n) = <u>0.32</u> N = <u>0.32</u> <i>inclusion</i> (n) = <i>0.32</i> N = <u>0.32</u> N = <u>0.32</u> N = <u>0.32</u> N = <u>0.32</u> N =	Formulaci			achieved; then Requirement 1-1009
CN Sector Production and the rundit (n) ¹⁰ CP (IPACH(0.2 - S1) ² × 1n P Propriorition (n) = 0.2 (PACH(0.2 - S1) ² × 1n P Proprimition (n) = 0.2 (PACH(0.2 - S1) ² × 1				Treatment, page 4 of the calculator,
Cive Ourse Number ^(a)				
G = <u>(f2kU02.5)</u> <u>1</u> <u>10</u> <u>Where</u> (FPk(4)(0.8-5)] × <u>11</u> <u>10</u> <u>Where</u> V = (O)(A) <u>Where</u> Sole of production of the Board of the Board (ft) A = <u>24,028</u> ft ² 1.2 <u>Drodown Lists</u> Sole of production where to be Reasonal (ft) A = <u>24,028</u> ft ² 1.2 <u>Drodown Lists</u> Sole of production where the Reasonal (ft) Sole of production production provide (ft) Sole of production (ft) Sole	CN			Capture, this page of the calculator,
P= Pecipitation (m) = 0.02 Seasonal Pecipitation Provention and Provide State Resist V = (Q)(A) V= (Q)(A)	2			must be achieved.
P= Procipitation (m) = 0.92 K = Seasonal Procipitation = the seasonal or local historical data. V = (Q(A) View (Q(A)) View (Q(A))	$Q = [(P * K) - (0.2 * S)]^2 \times \frac{1 ft}{1}$	Where:		
Ke Samonal Proceptation Flactor [™] area, based on local historical data. V = (Q)(A) Where: A = Reduced Tibulary Area including credit for Pollution Prevention Measures (f) A = Reduced Tibulary Area including credit for Pollution Prevention Measures (f) A = Reduced Tibulary Area including credit for Pollution Prevention Measures (f) A = 12, 2 NOTE: The amount of volume gener aler development is less than arequire that development 2- Capture is not requirement 2- increase in notwine flow is not requirement 2- increase in notwine of storm Water fund for the stime in this us the related on site (may be infiltrat	[(P*K)+(0.8 * S)] 12in	Q= Runoff depth (ft) ^[6]		
$V = (Q(A)) \qquad \text{Where:} \\ V = (Q(A)) \qquad Values of Storm Water to be Relation (tf) \\ A = Reduced Tributary and the including coaling for Pollution Prevention Measures (f) \\ A = Reduced Tributary and the including coaling for Pollution Prevention Measures (f) \\ A = Reduced Tributary and the including coaling for Pollution Prevention Measures (f) \\ Input: (Pick data from drop down lists or enter calculated values) A^{\frac{1}{2}} = \frac{24,028}{1,2} \text{ th}^2Select predevelopment provid cover descriptionR =Select predevelopment ground cover descriptionR =(Constraint for Mater Number 1000 and (cochard or tree farm) - FairSelect predevelopment ground cover descriptionR =(Comparise Predevelopment (Cover =Comparise Predevelopment (CN) =Comparise Predevelopment (CN) =(Note =Comparise Predevelopment (CN) =(Note =(Cover =$		P= Precipitation (in) = 0.92 0.92 inches in t	the Santa Rosa	
$V = (0 A)$ $V = (0 A)$ $V = Volume of Storm Water to be Retained (t2) A, a Reduced Tributary Area including credit for Pollution Prevention Measures (f) Input: (Pick data from drop down lists or enter calculated values) A = \frac{24,028}{1.2} V_{re} = \frac{1000}{1.0} V_{re} = \frac{1000}{1.0$			n local historical	
Le Volume of Storn Water to be Related (P) A= Relaced Tributary Acade including credit for Pollution Prevention Measures (f) If the amount of volume generate (f) Input: (Pick data from drop down lists or enter calculated values) A=	$V = (Q)(A_r)$	Where data.		NOTE:
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	V –	D-11-37	Where:	
V _{DELTA} = 896.97 ft ³ Delta Volume Capture= The increase in volume of storm water generated by the 85th	VDELTA ⁼ 896	97 ft ³ Delta Vi	The increase in volume of storm water generated by the 85th	
percentile 24 hour storm event due to development that must be retained onsite (may be infiltrated or reused).				



LID BMP Sizing Tool: 100% Volume Capt Formulas: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 2887.73 \text{ ft}^3$ $A_{LID GOAL} = (W)(L) = 1099.59 \text{ ft}^2$	Where: $V_{LID GOAL}$ Required volume of soil in LID BMP. $A_{LID GOAL}$ = Footprint of LID BMP area for a given depth (below perforated p V_{GOAL} = 1,271 ft ³	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> <u>of 100% volume capture of the post</u> <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet) P = as a decimal		
Solution: Percent of Goal Achieved = 100.53	$D = \frac{2.6}{100} \text{ ft} \qquad \text{Below perforated pipe if present}$ $W = \frac{33.2}{100} \text{ ft}$ $L = \frac{33.2}{100} \text{ ft}$ $W = \frac{1000}{100} \text{ ft}$	7	
LID BMP Sizing Tool Delta Volume Captu Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0! ft ³	<u>re Requirement</u> : V _{DELTA} <u>Where:</u> V _{LID DELTA} = Required volume of soil in LID BMP	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume capture. Enter the percent of porosity
$A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{ft}^2} \text{ft}^2$ Percent of Requirement Achieved = $\frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated p V _{DELTA} = 896.97 ft ³ <u>Where:</u> P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet)	ipe if present).	of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Requirement achieved" reaches 100%.
<u>Input:</u>	W= Width (in decimal feet) L= Length (in decimal feet) D = 0.0 as a decimal D = 0.0 ft Below perforated pipe if present W = 0.0 ft L = 0.0 ft		
Solution: N Percent of Requirement Achieved = #DIV/0!			

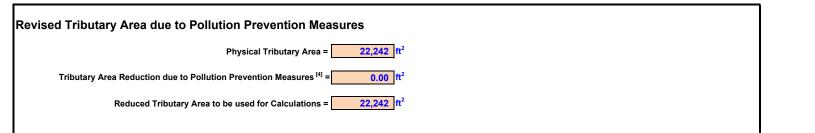




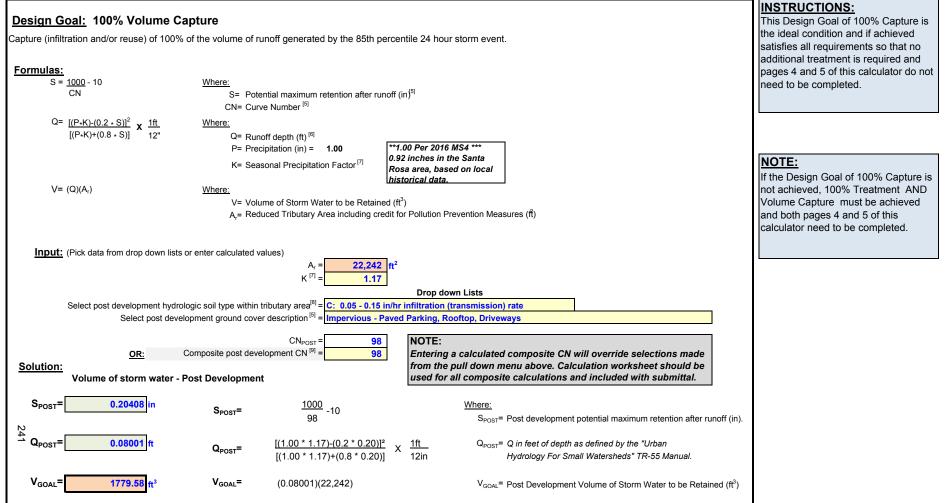
		_
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connection Multiplier = 1	ected Paved Area	INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²		
Area Reduction = 0.00 ft ²		
Interceptor Trees ^[2]		INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees NOTE: Total Interceptor Area (200 ft²/tree) Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0	New Deciduous Trees	
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)	
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy	
Allowed reduction credit for existing tree canopy=	Allowed credit for existing tree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ²	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to
Buffer Factor = 0.7	these features as sheet flow. Enter the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) =	
Area Reduction = 0.00 ft ²	
	7





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.





Requirement 1: 100% Treatment	nt		INSTRUCTIONS:
Treatment of 100% of the flow generated b	by 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
		The C value used for this calculation	on page 3 of this calculator is not
<u>Formula:</u>			achieved; then Requirement 1-100%
$Q_{\text{TREATMENT}}$ = (0.2 in/hr)(A_{r})(C_{POST})(K) cfs	Where:		Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	•
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prevention Measure	es (in Acres) to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]		
Input:	$A_r = 22,242$ ft ² = 0.51061 Acres $C_{POST}^{[10]} = 0.70$		
	K ^[7] = 1.2		
	NOTE:		
Solution:	appropriate	ate calculated here should only be used to size the BMP. All associated overflow inlets and systems	
Q _{TREATMENT} = 0.08364 cfs	Q _{TREATMENT} (0.2)(0.5106)(0.70)(1.17) should be s	ized for the Flood Control event.	

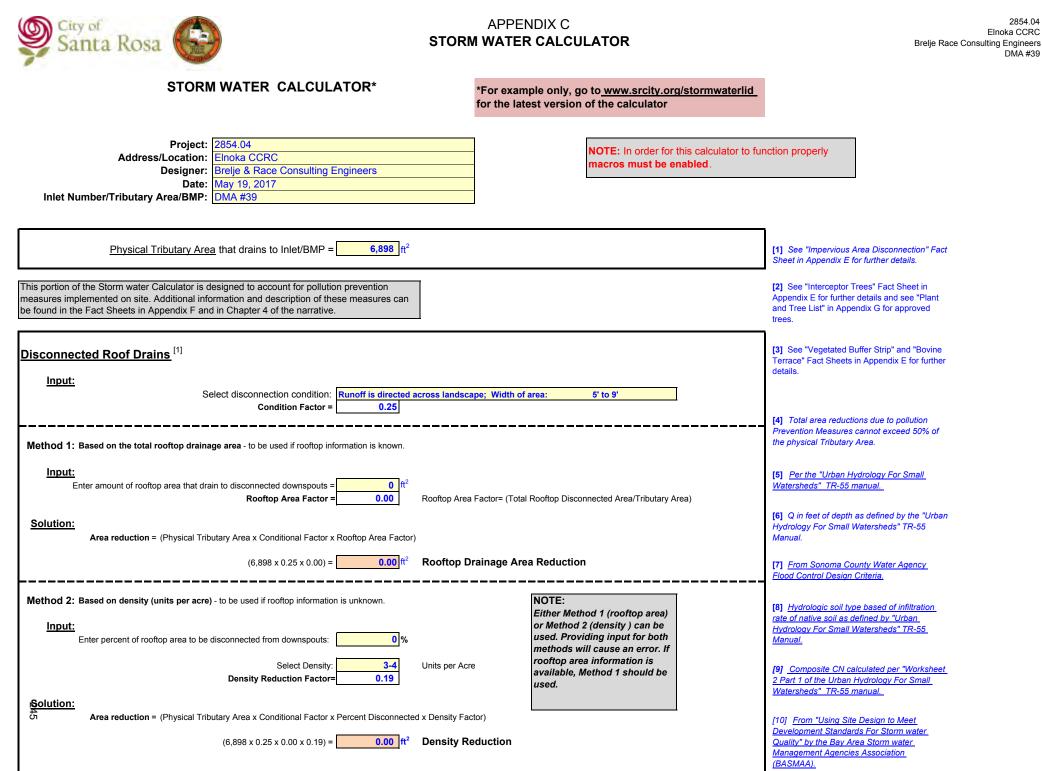


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tequirement 2: Delta Volume o increase in volume of runoff leaving the	Capture le site due to development for the 85th percentile 24 hour storm e	event.	INSTRUCTIONS: If the Design Goal of 100% Captur on page 3 of this calculator is not
Formulas:			achieved; then Requirement 1-100
	Whore		Treatment, page 4 of the calculato
S = <u>1000</u> - 10 CN	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ^{5]} CN= Curve Number ^[5]		Capture, this page of the calculato
			must be achieved.
$Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} \times \frac{1 \text{ft}}{12 \text{in}}$	Where:		
[(P*K)+(0.8 * S)] 12in	Q ⁼ Runoff depth (ft) ^[6]		
	P= Precipitation (in) = 0.92 0.92 inches in th		
	K= Seasonal Precipitation Factor ^[7] area, based on l	local historical	
$V=(Q)(A_r)$	Where: data.		NOTE:
	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A_r = Reduced Tributary Area including credit for Pollution P	revention Measures (ť)	•
	$r_{\rm Yr}$ = reduced ributally field including clear for relation		after development is less than or
In marte (Dist. data for a data data di			equal to that generated before
Input: (Pick data from drop down lists			development, Requirement 2-Volu
	$A_r = 22,242$ ft ²		Capture is not required.
	K ^[7] = 1.2		$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PR}$
		wn Lists	O POST - O PRE OF ON POST - ON PR
Select hvdr	ologic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration		
Select predevi	elopment ground cover description ^[5] = Woods (50%), grass (50%) con	bination (orchard or tree farm) - Fair	
	elopment ground cover description ^[5] = Impervious - Paved Parking, R		
	CN _{PRE} = 76	concep, shronayo	
	CN _{PRE} 70 CN _{POST} = 90.3		
	CINPOST - 90.3		
OR	Composite Predevelopment CN ^[9] = 80		
OR Solution:	Composite Predevelopment CN ^[9] = 80		
Solution:	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98		
Solution: e Development Storm Water Rund	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98	Where:	
Solution:	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98	<u>Where:</u>	
Solution: e Development Storm Water Rund	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98	$\frac{Where:}{S_{PRE}} = Pre development potential maximum retention after runoff (in).$	
<u>Solution:</u> re Development Storm Water Rund S _{PRE} = 2.50 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$		
<u>Solution:</u> e Develop <u>ment Storm Wat</u> er Rund	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$		
Solution: re Development Storm Water Rund S _{PRE} = 2.50 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: e Development Storm Water Rund S _{PRE} = 2.50 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: e Development Storm Water Rund S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: e Development Storm Water Rund S _{PRE} = 2.50 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 200.18 ft ³	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $\mathbf{S}_{PRE} = \frac{1000}{80} -10$ $\mathbf{Q}_{PRE} = \frac{[(0.92*1.17) \cdot (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $\mathbf{V}_{PRE} = (0.00900)(22,242)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 200.18 ft ³ ost Development Storm Water Run	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(22,242)$	 S_{PRE}= Pre development potential maximum retention after runoff (in). Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	
Solution: e Development Storm Water Rune $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 200.18$ ft ³	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(22,242)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) <u>Where:</u>	
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 200.18 ft ³ ost Development Storm Water Run	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(22,242)$	 S_{PRE}= Pre development potential maximum retention after runoff (in). Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 200.18 ft ³ ost Development Storm Water Rund S_{POST} = 0.20408 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(22,242)$ hoff Volume $S_{POST} = \frac{1000}{98} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) <u>Where:</u>	
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Solution: e Development Storm Water Rune S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 200.18 ft ³ ost Development Storm Water Rune S_{POST} = 0.20408 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(22,242)$ hoff Volume $S_{POST} = \frac{1000}{98} -10$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST Post development potential maximum retention after runoff (in) QPOST Q in feet of depth as defined by the "Urban	
Solution: re Development Storm Water Rung S_{PRE} 2.50 in Q_{PRE} 0.00900 ft V_{PRE} 200.18 ft ³ ost Development Storm Water Rung S_{POST} 0.20408 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(22,242)$	SPRE= Pre development potential maximum retention after runoff (in). QPRE= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE= Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST= Post development potential maximum retention after runoff (in)	
Solution: te Development Storm Water Rund $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 200.18$ ft ³ Development Storm Water Rund $S_{POST} = 0.20408$ in $Q_{POST} = 0.07240$ ft	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{+}1.17) - (0.2 * 2.50)]^2}{[(0.92^{+}1.17) + (0.8 * 2.50)]} \times \frac{1 ft}{12 in}$ $V_{PRE} = (0.00900)(22,242)$ hoff Volume $S_{POST} = \frac{1000}{98} -10$ $Q_{POST} = \frac{[(0.92^{+}1.17) - (0.2 * 0.20)]^2}{[(0.92^{+}1.17) + (0.8 * 0.20)]} \times \frac{1 ft}{12 in}$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in) QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	·
Solution: re Development Storm Water Rung S_{PRE} 2.50 in Q_{PRE} 0.00900 ft V_{PRE} 200.18 ft ³ ost Development Storm Water Rung S_{POST} 0.20408 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(22,242)$ hoff Volume $S_{POST} = \frac{1000}{98} -10$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST Post development potential maximum retention after runoff (in) QPOST Q in feet of depth as defined by the "Urban	
Solution: te Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 200.18 ft ³ ost Development Storm Water Rund S_{POST} = 0.20408 in Q_{POST} = 0.07240 ft V_{POST} = 1610.32 ft ³	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{+}1.17) - (0.2 * 2.50)]^2}{[(0.92^{+}1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(22,242)$ hoff Volume $S_{POST} = \frac{1000}{98} -10$ $Q_{POST} = \frac{[(0.92^{+}1.17) - (0.2 * 0.20)]^2}{[(0.92^{+}1.17) + (0.8 * 0.20)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.07240)(22,242)$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in) QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: te Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 200.18 ft ³ ost Development Storm Water Rund S_{POST} = 0.20408 in Q_{POST} = 0.07240 ft V_{POST} = 1610.32 ft ³ Solution: Volume Capture Require	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{+}1.17) - (0.2 * 2.50)]^2}{[(0.92^{+}1.17) + (0.8 * 2.50)]} \times \frac{1 ft}{12 in}$ $V_{PRE} = (0.00900)(22,242)$ hoff Volume $S_{POST} = \frac{1000}{98} -10$ $Q_{POST} = \frac{[(0.92^{+}1.17) - (0.2 * 0.20)]^2}{[(0.92^{+}1.17) + (0.8 * 0.20)]} \times \frac{1 ft}{12 in}$ $V_{POST} = (0.07240)(22,242)$ ement	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in) Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 200.18 ft ³ Dost Development Storm Water Rund S_{POST} = 0.20408 in Q_{POST} = 0.07240 ft V_{POST} = 1610.32 ft ³ Solution: Volume Capture Require Increase in volume of storm	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{+}1.17) - (0.2 * 2.50)]^2}{[(0.92^{+}1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(22,242)$ hoff Volume $S_{POST} = \frac{1000}{98} -10$ $Q_{POST} = \frac{[(0.92^{+}1.17) - (0.2 * 0.20)]^2}{[(0.92^{+}1.17) + (0.8 * 0.20)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.07240)(22,242)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in) Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
Solution: te Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 200.18 ft ³ Dost Development Storm Water Rund S_{POST} = 0.20408 in Q_{POST} = 0.07240 ft V_{POST} = 1610.32 ft ³ Solution: Volume Capture Require Increase in volume of storm	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(22,242)$ hoff Volume $S_{POST} = \frac{1000}{98} -10$ $Q_{POST} = \frac{[(0.92*1.17)+(0.2*0.20)]^2}{[(0.92*1.17)+(0.8*0.20)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.07240)(22,242)$ ement is water that must be retained onsite (may be infiltrated or reused)	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in) Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³) V _{POST} = Post Development Volume of Storm Water Generated (ft ³) V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
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V _{GOAL} = 1,780 ft ³	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the design qoal of 100% volume capture of the post development condition. Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{\text{LID GOAL}})}{V_{\text{LID GOAL}}} \times 100$ $V_{\text{LID GOAL}} \times 100$ P = Porosity (enter as a decimal) D = Depth below perforated pipe if present W = Width (in decimal feet) L = Length (in decimal feet)	(in decimal feet)
	decimal v perforated pipe if present
Solution: Percent of Goal Achieved = 100.34 % = [(2.8 x 1,449) / 4,045] x	7
LID BMP Sizing Tool Delta Volume Capture Requirement: V _{DELTA} Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0! ft ³ Where:	NOTE: INSTRUCTIONS: LID Sizing Tool only applicable for volume The Delta Volume Capture sizing tool based BMPs. Not required if site requires a LID BMP to achieve the design treatment only. requirement of the delta volume
V _{LID DELTA} = Required volume of soil in L	ID BMP for a given depth (below perforated pipe if present).
$\begin{array}{l} \text{Percent of Requirement} \\ \text{Achieved} \end{array} = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} x \ 100 \end{array} \\ \begin{array}{l} \frac{\text{Where:}}{P= \text{Porosity}} & \text{(enter as a decimal)} \\ D= \text{Depth below perforated pipe if present} \\ W= \text{Width} & \text{(in decimal feet)} \\ L= \text{Length} & \text{(in decimal feet)} \end{array} \end{array}$	Requirement achieved" reaches 100%.
	desimal
Input: P = 0.0 as a d D = 0.0 ft Below W = 0.0 ft L = 0.0 ft	v perforated pipe if present

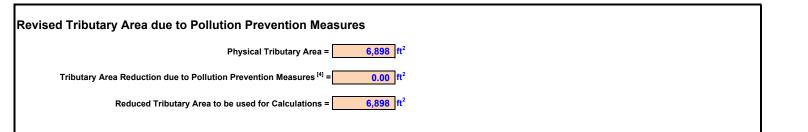




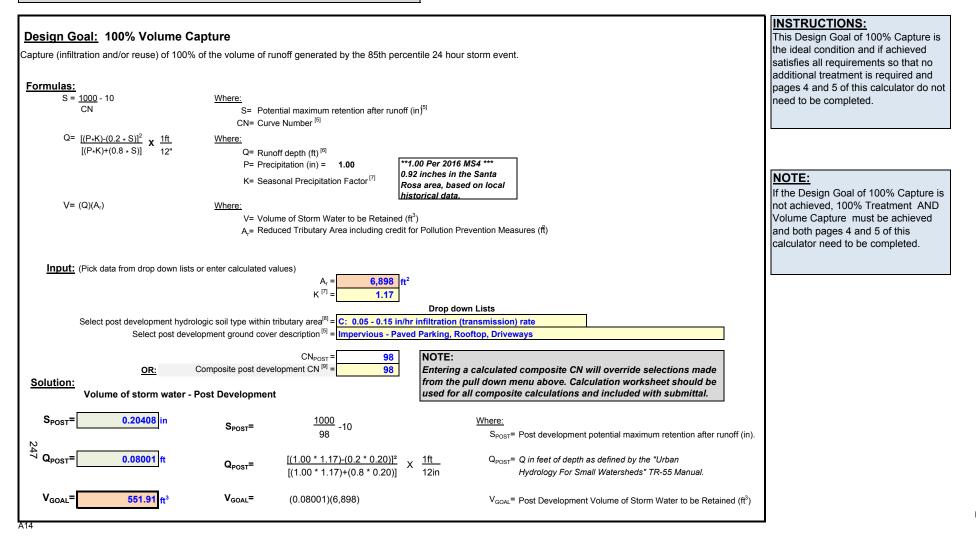
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conne Multiplier = 1	ected Paved Area		INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²			
Area Reduction = 0.00 ft ²			
nterceptor Trees ^[2]			INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees (200 ft ² /tree)	NOTE: Total Interceptor Area Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0	New Deciduous Trees		
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)		
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy		
Allowed reduction credit for existing tree canopy=	Allowed credit for existing tr	ree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas manage [,]	d by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ² Buffer Factor = 0.7	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) = Area Reduction = 0.00 ft²	
6	





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.



Release 7 Rev. 1 5/23/2017



Requirement 1: 100% Treatme	nt		INSTRUCTIONS:
	by 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
Formula:		The C value used for this calculation is smaller than the value used for	on page 3 of this calculator is not achieved; then Requirement 1-100%
Q _{TREATMENT} = (0.2 in/hr)(A _r)(C _{POST})(K) cfs	Where:	hydraulic Flood Control design.	Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	•
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prevention Measures (in	Acres) to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]		
Input:	$A_r = $ 6,898 ft ² = 0.15836 Acres $C_{POST}^{[10]} = $ 0.70 $K^{[7]} = $ 1.2		
	NOTE:		
<u>Solution:</u> Q _{TREATMENT} = <u>0.02594</u> cfs	appropriate BMF	Inculated here should only be used to size the All associated overflow inlets and systems for the Flood Control event.	

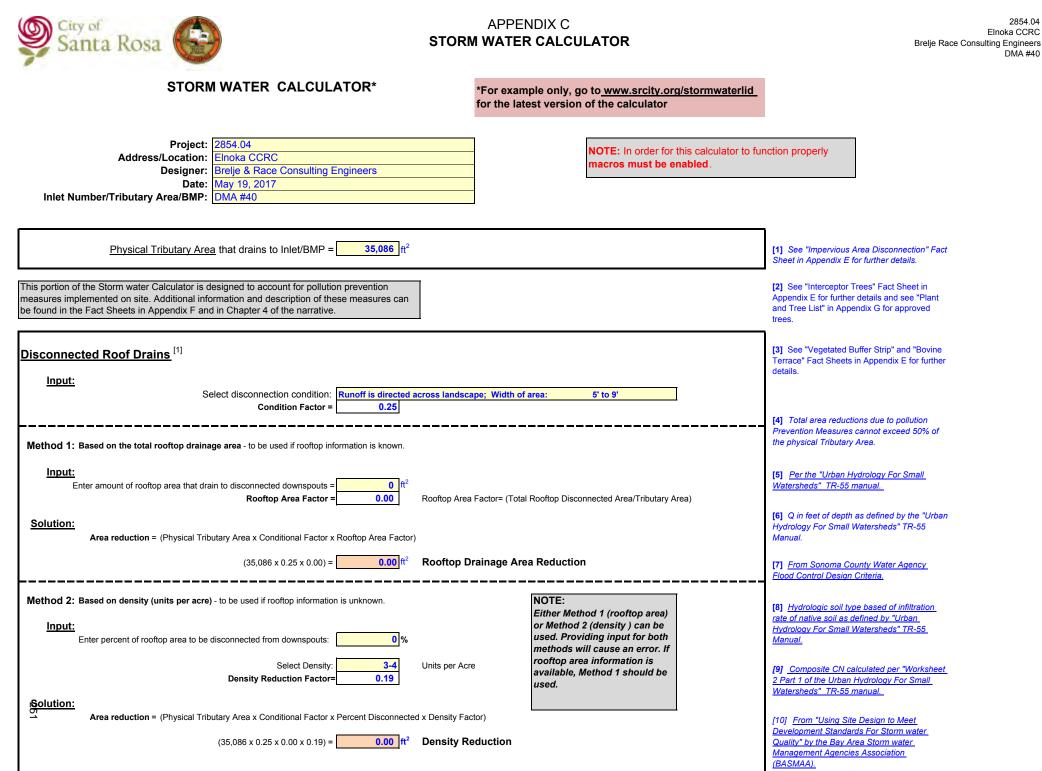


2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #39

	e Capture g the site due to development for the 85th percentile 24 hour storm event.	INSTRUCTIONS: If the Design Goal of 100% Captur on page 3 of this calculator is not achieved: then Requirement 1 100
ormulas:		achieved; then Requirement 1-100 Treatment, page 4 of the calculato
S = <u>1000</u> - 10	Where:	
CN	S= Potential maximum retention after runoff (in ⁵⁾	AND Requirement 2- Volume
	$CN = Curve Number^{[5]}$	Capture, this page of the calculato
		must be achieved.
$Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} \times \frac{1 \text{ft}}{12 \text{in}}$	Where:	
[(P*K)+(0.8 * S)] 12in	Q= Runoff depth (ft) ^[6]	
	P= Precipitation (in) = 0.92 0.92 inches in the Santa Rosa	
	K= Seasonal Precipitation Factor ^[7] area, based on local historical	
$V=(Q)(A_r)$	Where: data.	NOTE:
$V = (Q)(n_{\rm f})$		
	V= Volume of Storm Water to be Retained (f^3)	If the amount of volume generated
	A_{r} = Reduced Tributary Area including credit for Pollution Prevention Measures (ℓ)	after development is less than or
		equal to that generated before
Input: (Pick data from drop down li	lists or enter calculated values)	development, Requirement 2-Volu
() · · · · · · · · · · · · · · · · · ·	$A_r = \frac{6,898}{1000} ft^2$	
		Capture is not required.
	$\kappa^{(7)} = 1.2$	$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PR}$
	Drop down Lists	(- FOST - OFRE 0. 0. FOST - OTPR
Select hv	ydrologic soil type within tributary area ⁽⁸⁾ = C: 0.05 - 0.15 in/hr infiltration (transmission) rate	
	levelopment ground cover description ^[6] = Woods (50%), grass (50%) combination (orchard or tree farm) - Fair	
	levelopment ground cover description ^[5] = Impervious - Paved Parking, Rooftop, Driveways	
Select post de		
	CN _{PRE} = 76	
	CN _{POST} = 90.3	
OR	Composite Predevelopment CN ^[9] = 80	
	Composite Post development CN ^[9] = 98	
Solution:		
Solution: e Development Storm Water Ru	unoff Volume	
e Development Storm Water Ru	unoff Volume S _{PRE} = <u>1000</u> -10 <u>Where:</u>	
e Development Storm Water Ru S _{PRE} = 2.50 in	unoff Volume $S_{PRE} = \frac{1000}{80} -10$ $\frac{Where.}{S_{PRE}}$ Pre development potential maximum retention after runoff (in).	
e Development Storm Water Ru S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 62.08 ft ³	unoff Volume S_{PRE} = $\frac{1000}{80}$ -10 Where: S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = $\frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]}$ X $\frac{1ft}{12in}$ Q_{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE} = (0.00900)(6,898) V_{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
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e Development Storm Water Ru S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 62.08 ft ³ ost Development Storm Water R	unoff Volume S_{PRE} = $\frac{1000}{80}$ -10 Where: S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = $\frac{[(0.92^{*}1.17) + (0.2 * 2.50)]^2}{[(0.92^{*}1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ Q_{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE} = $(0.00900)(6,898)$ V_{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Runoff Volume S_{Posr} = $\frac{1000}{-10}$ Where:	
e Development Storm Water Ru S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 62.08 ft ³ to the Development Storm Water R S_{POST} = 0.20408 in	unoff Volume $\mathbf{S}_{PRE} = \frac{1000}{80} -10$ Where: $\mathbf{S}_{PRE} = \operatorname{Pre}$ development potential maximum retention after runoff (in). $\mathbf{Q}_{PRE} = \frac{[(0.92^{\pm}1.17) - (0.2 \pm 2.50)]^2}{[(0.92^{\pm}1.17) + (0.8 \pm 2.50)]} \times \frac{1 \operatorname{ft}}{12 \operatorname{in}}$ $\mathbf{Q}_{PRE} = Q$ in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. $\mathbf{V}_{PRE} = (0.00900)(6,898)$ $\mathbf{V}_{PRE} = \operatorname{Pre}$ Development Volume of Storm Water Generated (ft ³)Runoff Volume $\mathbf{S}_{POST} = \frac{1000}{98} -10$ $\frac{Where:}{S_{POST}} = \operatorname{Post}$ development potential maximum retention after runoff (in).	
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e Development Storm Water Ru S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 62.08 ft ³ post Development Storm Water R S_{POST} = 0.20408 in	unoff Volume $\mathbf{S}_{PRE} = \frac{1000}{80} -10$ Where: Sprest = Pre development potential maximum retention after runoff (in). $\mathbf{Q}_{PRE} = \frac{[(0.92^{*}1.17) + (0.2^{*}2.50)]^2}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1ft}{12in}$ $\mathbf{Q}_{PRE} = Q$ in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. $\mathbf{V}_{PRE} = (0.00900)(6,898)$ $\mathbf{V}_{PRE} = Pre Development Volume of Storm Water Generated (ft2)Runoff Volume\mathbf{S}_{POST} = \frac{1000}{98} -10\mathbf{Where:}Spost = Post development potential maximum retention after runoff (in).$	
e Development Storm Water Ru S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 62.08 ft ³ ost Development Storm Water R S_{POST} = 0.20408 in Q_{POST} = 0.07240 ft	unoff Volume $\mathbf{S}_{PRE} = \frac{1000}{80} -10$ Where: $\mathbf{S}_{PRE} = \operatorname{Pre}$ development potential maximum retention after runoff (in). $\mathbf{Q}_{PRE} = \frac{[(0.92^{\pm}1.17) - (0.2 \pm 2.50)]^2}{[(0.92^{\pm}1.17) + (0.8 \pm 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $\mathbf{Q}_{PRE} = \operatorname{Pre}$ development potential maximum retention after runoff (in). $\mathbf{Q}_{PRE} = (0.00900)(6,898)$ $\mathbf{V}_{PRE} = (0.00900)(6,898)$ $\mathbf{V}_{PRE} = \operatorname{Pre}$ Development Volume of Storm Water Generated (ft ³)Runoff Volume $\mathbf{S}_{POST} = \frac{1000}{98} -10$ $\frac{Where:}{8} -10$ $\frac{Where:}{8} -10$ $\mathbf{Q}_{POST} = \frac{1000}{98} -10$ $\frac{Where:}{12 \text{in}}$ $\frac{Where:}{8} -10$ $\mathbf{Q}_{POST} = \frac{1000}{98} -10$ $\frac{Where:}{12 \text{in}}$ $\mathbf{Q}_{POST} = \operatorname{Post}$ development potential maximum retention after runoff (in). $\mathbf{Q}_{POST} = \frac{1000}{98} -10$ $\frac{Where:}{12 \text{in}}$ $\frac{Where:}{8} -10$ $\mathbf{Q}_{POST} = Post$ development potential maximum retention after runoff (in). $\mathbf{Q}_{POST} = \operatorname{Post}$ $\mathbf{Q}_{POST} = \operatorname{Post}$ development potential maximum retention after runoff (in). $\mathbf{Q}_{POST} = \frac{1000}{98} -10$ $\mathbf{X} = \frac{111}{12 \text{in}}$ $\mathbf{Q}_{POST} = \operatorname{Q}$ in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
e Development Storm Water Ru S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 62.08 ft ³ st Development Storm Water R S_{POST} = 0.20408 in	unoff Volume $\mathbf{S}_{PRE} = \frac{1000}{80} -10$ Where: $\mathbf{S}_{PRE} = \operatorname{Pre}$ development potential maximum retention after runoff (in). $\mathbf{Q}_{PRE} = \frac{[(0.92^{\pm}1.17) - (0.2 \pm 2.50)]^2}{[(0.92^{\pm}1.17) + (0.8 \pm 2.50)]} \times \frac{1 \operatorname{ft}}{12 \operatorname{in}}$ $\mathbf{Q}_{PRE} = Q$ in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. $\mathbf{V}_{PRE} = (0.00900)(6,898)$ $\mathbf{V}_{PRE} = \operatorname{Pre}$ Development Volume of Storm Water Generated (ft ³)Runoff Volume $\mathbf{S}_{POST} = \frac{1000}{98} -10$ $\frac{Where:}{S_{POST}} = \operatorname{Post}$ development potential maximum retention after runoff (in).	
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e Development Storm Water Ru S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 62.08 ft ³ ost Development Storm Water R S_{POST} = 0.20408 in Q_{POST} = 0.07240 ft V_{POST} = 499.42 ft ³ Solution: Volume Capture Requ	unoff Volume $\mathbf{S}_{PRE} = \frac{1000}{80} \cdot 10$ Where: $\mathbf{S}_{PRE} = \operatorname{Pre} \operatorname{development} \operatorname{potential} \operatorname{maximum} \operatorname{retention} \operatorname{after} \operatorname{runoff}(in).$ $\mathbf{Q}_{PRE} = \frac{1000}{(0.92^*1.17) + (0.8^*2.50)]} \times \frac{1 \operatorname{ft}}{12 \operatorname{in}}$ $\mathbf{Q}_{PRE} = \operatorname{Qin} \operatorname{feet} \operatorname{of} \operatorname{depth} \operatorname{as} \operatorname{defined} \operatorname{by} \operatorname{the} "Urban Hydrology For Small Watersheds" TR-55 Manual.$ $\mathbf{V}_{PRE} = (0.00900)(6,898)$ $\mathbf{V}_{PRE} = \operatorname{Pre} \operatorname{Development} \operatorname{Volume} \operatorname{of} \operatorname{Storm} \operatorname{Water} \operatorname{Generated}(\operatorname{ft}^3)$ Runoff Volume $\mathbf{S}_{Post} = \frac{1000}{98} \cdot 10$ $\mathbf{Where:}$ $\mathbf{S}_{Post} = \operatorname{Post} \operatorname{development} \operatorname{potential} \operatorname{maximum} \operatorname{retention} \operatorname{after} \operatorname{runoff}(in).$ $\mathbf{Q}_{Post} = \frac{1000}{98} \cdot 10$ $\mathbf{Where:}$ $\mathbf{S}_{Post} = \operatorname{Post} \operatorname{development} \operatorname{potential} \operatorname{maximum} \operatorname{retention} \operatorname{after} \operatorname{runoff}(in).$ $\mathbf{Q}_{Post} = (0.07240)(6,898)$ $\mathbf{X} \frac{1 \operatorname{ft}}{12 \operatorname{in}}$ $\mathbf{Q}_{Post} = \operatorname{Q} \operatorname{in} \operatorname{feet} \operatorname{of} \operatorname{depth} \operatorname{as} \operatorname{defined} \operatorname{by} \operatorname{the} "Urban Hydrology For Small Watersheds" TR-55 Manual.$ $\mathbf{V}_{Post} = (0.07240)(6,898)$ $\mathbf{V}_{Post} = \operatorname{Post} \operatorname{Development} \operatorname{Volume} \operatorname{of} \operatorname{Storm} \operatorname{Water} \operatorname{Generated}(\operatorname{ft}^3)$	
e Development Storm Water Ru S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 62.08 ft ³ ost Development Storm Water R S_{POST} = 0.20408 in Q_{POST} = 0.07240 ft V_{POST} = 499.42 ft ³ <u>Solution:</u> Volume Capture Requires the store of store store in volume of store store in volume of store store in volume of store store store in volume of store st	unoff Volume $\mathbf{S}_{PRE} = \frac{1000}{80} -10$ Where: $\mathbf{S}_{PRE} = \operatorname{Pre}$ development potential maximum retention after runoff (in). $\mathbf{Q}_{PRE} = \frac{[(0.92^{*}1.17) + (0.2 * 2.50)]^2}{[(0.92^{*}1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $\mathbf{Q}_{PRE} = Q$ in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. $\mathbf{V}_{PRE} = (0.00900)(6.898)$ $\mathbf{V}_{PRE} = \operatorname{Pre}$ Development Volume of Storm Water Generated (ft ³)Runoff Volume $\mathbf{S}_{POST} = \frac{1000}{98} -10$ $\frac{Where:}{S_{POST} = \operatorname{Post}}$ Post development potential maximum retention after runoff (in). $\mathbf{Q}_{POST} = \frac{[(0.92^{*}1.17) + (0.2 * 0.20)]^2}{[(0.92^{*}1.17) + (0.8 * 0.20)]} \times \frac{1ft}{12in}$ $\mathbf{Q}_{POST} = Q$ in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. $\mathbf{V}_{POST} = (0.07240)(6.898)$ $\mathbf{V}_{POST} = \operatorname{Post}$ Development volume of Storm Water Generated (ft ³)uirement $\mathbf{V}_{POST} = \operatorname{Post}$ Development Volume of Storm Water Generated (ft ³)	
e Development Storm Water Ru S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 62.08 ft ³ Dost Development Storm Water R S_{POST} = 0.20408 in Q_{POST} = 0.07240 ft V_{POST} = 499.42 ft ³ Solution: Volume Capture Requires in volume of sto	unoff Volume $S_{PRE} = \frac{1000}{80} -10$ Where: $S_{PRE} = Pre development potential maximum retention after runoff (in).Q_{PRE} = \begin{bmatrix} (0.92*1.17)+(0.2*2.50)]^2 \\ [(0.92*1.17)+(0.8*2.50)] \end{bmatrix} \times \frac{1ft}{12in}Q_{PRE} = Q in feet of depth as defined by the "UrbanHydrology For Small Watersheds" TR-55 Manual.V_{PRE} = (0.00900)(6,898)V_{PRE} = Pre Development Volume of Storm Water Generated (ft3)Runoff VolumeS_{POST} = \frac{1000}{98} -10Where:S_{POST} = Post development potential maximum retention after runoff (in).Q_{POST} = \frac{1000}{98} -10Where:S_{POST} = Post development potential maximum retention after runoff (in).Q_{POST} = \frac{1000}{98} -10Where:S_{POST} = Post development potential maximum retention after runoff (in).Q_{POST} = [(0.92*1.17)+(0.2*0.20)]^2[(0.92*1.17)+(0.8*0.20)]\times \frac{1ft}{12in}Q_{POST} = Post development potential maximum retention after runoff (in).W_{POST} = (0.07240)(6,898)V_{POST} = Post Development Volume of Storm Water Generated (ft3)uirementorm water that must be retained onsite (may be infiltrated or reused).V_{POST} = Post Development Volume of Storm Water Generated (ft3)S_{T} - V_{PRE}Delta Volume Capture = (499.42) - (62.08)$	
e Development Storm Water Ru S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 62.08 ft ³ Dost Development Storm Water R S_{POST} = 0.20408 in Q_{POST} = 0.07240 ft V_{POST} = 499.42 ft ³ <u>Solution:</u> Volume Capture Requ Increase in volume of sto Delta Volume Capture (V _{POS})	unoff Volume $\mathbf{S}_{PRE} = \frac{1000}{80} \cdot 10$ Where: $\mathbf{S}_{PRE} = \operatorname{Pre} development potential maximum retention after runoff (in).\mathbf{Q}_{PRE} = \frac{1000}{[(0.92^*1.17)+(0.2^*2.50)]^2} \times \frac{1\text{ft}}{12\text{in}}\mathbf{Q}_{PRE} = \operatorname{Pre} development potential maximum retention after runoff (in).\mathbf{Q}_{PRE} = (0.00900)(6.898)\mathbf{V}_{PRE} = \operatorname{Pre} \operatorname{Development Volume of Storm Water Generated (ft^3)Runoff Volume\mathbf{S}_{POST} = \frac{1000}{98} \cdot 10\mathbf{Where:}\mathbf{Q}_{POST} = \frac{1000}{98} \cdot 10\mathbf{Where:}\mathbf{Q}_{POST} = \frac{1000}{98} \cdot 10\mathbf{Where:}\mathbf{Q}_{POST} = \frac{1(0.92^*1.17)+(0.2^*0.20)]^2}{[(0.92^*1.17)+(0.8^*0.20)]} \times \frac{1\text{ft}}{12\text{in}}\mathbf{Q}_{POST} = \operatorname{Post} development potential maximum retention after runoff (in).\mathbf{Q}_{POST} = (0.07240)(6.898)\mathbf{V}_{POST} = \operatorname{Post} development Volume of Storm Water Generated (ft^3)uirementorm water that must be retained onsite (may be infiltrated or reused).\mathbf{V}_{POST} = \operatorname{Post} Development Volume of Storm Water Generated (ft^3)$	



LID BMP Sizing Tool: 100% Volume Capt Formulas: $V_{LID GOAL}=((V_{GOAL}))/(P) = 1254.34$ ft ³ $A_{LID GOAL}=(W)(L) = 540.10$ ft ²	ure Goal; V_{GOAL} Where: $V_{LID GOAL}$ = Required volume of soil in LID BMP. $A_{LID GOAL}$ = Footprint of LID BMP area for a given depth (below perforated pip V_{GOAL} = 552 ft ³ Where:	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. pe if present).	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
<u>Input:</u>	P = 0.4 as a decimalD = 2.3 ftBelow perforated pipe if presentW = 23.2 ftL = 23.2 ft		
Solution: Percent of Goal Achieved = 100.76	% = [(2.3 x 540) / 1,254] x 100	7	
LID BMP Sizing Tool Delta Volume Captu Formulas: VLID DELTA=((VDELTA))/(P) = #DIV/01 ft ³	re Requirement: V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
$A_{LID DELTA}=(W)(L) = \boxed{0.00} \text{ft}^2$	$V_{\text{LID DELTA}}$ = Required volume of soil in LID BMP $A_{\text{LID DELTA}}$ = Footprint of LID BMP area for a given depth (below perforated pip V_{DELTA} = 437.33 ft ³	pe if present).	<u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		Requirement achieved" reaches 100%.
Input:	P =0.0as a decimalD =0.0ftBelow perforated pipe if presentW =0.0ftL =0.0ft		
Solution: Percent of Requirement Achieved = #DIV/0!	% = #DIV/0!		

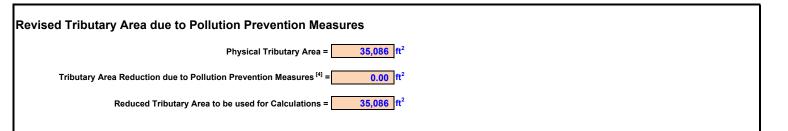




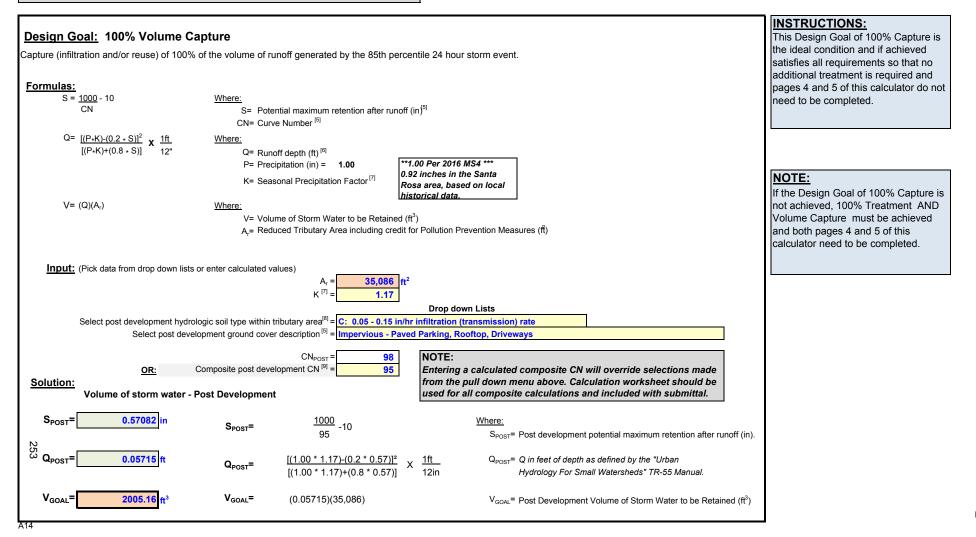
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connec Multiplier = 1	cted Paved Area		INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²			
Area Reduction = 0.00 ft ²			
nterceptor Trees ^[2]			INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees (200 ft ² /tree)	NOTE: Total Interceptor Area Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0	New Deciduous Trees		
Area Reduction due to new Deciduous Trees= 0 ft ²	(100 ft ² /tree)		
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy		
Allowed reduction credit for existing tree canopy= 0 ft ²	Allowed credit for existing tr	ree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed	d by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ² Buffer Factor = 0.7	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) = Area Reduction = 0.00 ft ²	
25 N	_





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.



Release 7 Rev. 1 5/23/2017



Requirement 1: 100% Treatment	nt			INSTRUCTIONS:
Treatment of 100% of the flow generated b	y 85th percentile 24 hour mean annual rain event (0.2 in/hr).		C value note:	If the Design Goal of 100% Capture
			The C value used for this calculation	on page 3 of this calculator is not
Formula:			is smaller than the value used for	achieved; then Requirement 1-100%
Q _{TREATMENT} = (0.2 in/hr)(A _r)(C _{POST})(K) cfs	Where:		hydraulic Flood Control design.	Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)		The table of values can be found here	AND Requirement 2- Volume
	C _{POST} = Rational method runoff coefficient for the developed condition ^{[10}	D]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Preventior	n Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]	, , , , , , , , , , , , , , , , , , ,		
<u>Input:</u>	$A_{r} = \frac{35,086}{0.80546} \text{ Acre}$ $C_{POST}^{[10]} = \frac{0.59}{K^{[7]}} = \frac{1.2}{0.80546} \text{ Acre}$			
Solution: Q _{treatment} = 0.11120 cfs	The app	Flow Rate calculated	d here should only be used to size the sociated overflow inlets and systems Flood Control event.	

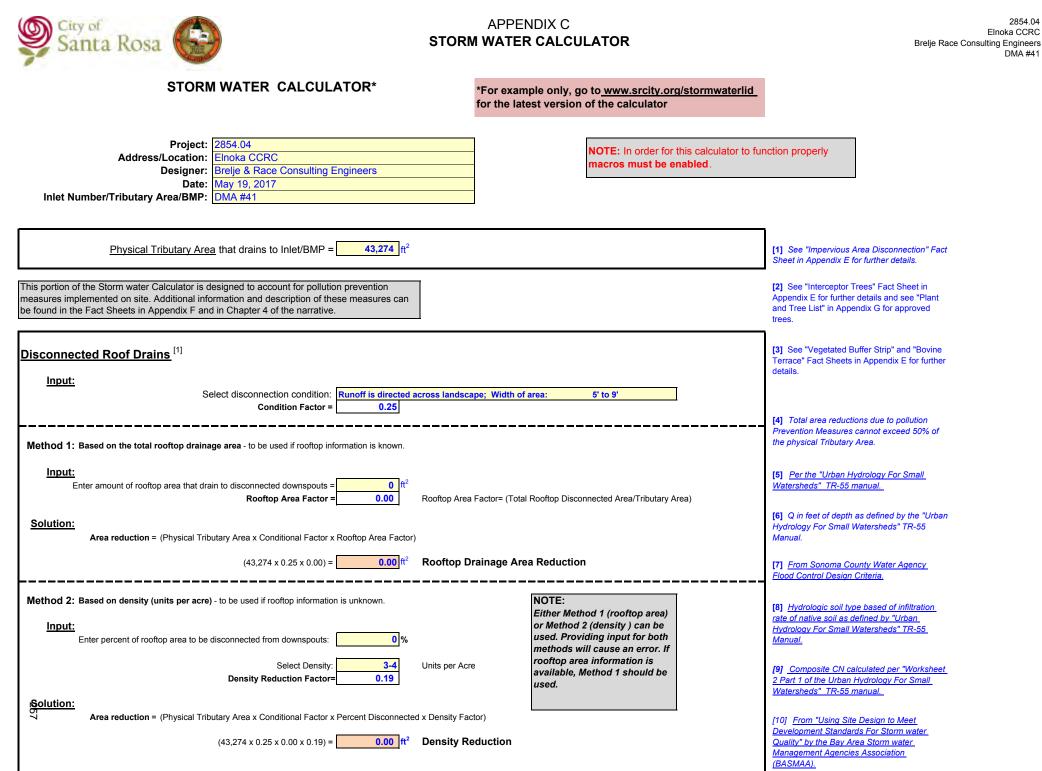
254



Requirement 2: Delta Volume (Capture e site due to development for the 85th percentile 24 hour	r storm event	INSTRUCTIONS: If the Design Goal of 100% Capture
o increase in volume of runon leaving in	e site due to development for the optim percentile 24 nour	storn event.	on page 3 of this calculator is not
			achieved; then Requirement 1-100%
Formulas:			Treatment, page 4 of the calculator,
S = <u>1000</u> - 10 CN	Where:		AND Requirement 2- Volume
	S= Potential maximum retention after runoff (in) ^[5] CN= Curve Number ^[5]		Capture, this page of the calculator, must be achieved.
$Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} \times \frac{1 \text{ft}}{12 \text{in}}$	Where:		
$[(P*K)^{+}(0.6*S)]$ 12In	$Q^{=}$ Runoff depth (ft) ^[6] P= Precipitation (in) = 0.92 0.92 inc.	ches in the Santa Rosa	
		ased on local historical	
$V=(Q)(A_r)$	Where: data.		NOTE:
	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A_r = Reduced Tributary Area including credit for Po	ollution Prevention Measures (ビ)	after development is less than or
			equal to that generated before
Input: (Pick data from drop down lists	or enter calculated values)		development, Requirement 2-Volume
	$A_r = 35,086 \text{ ft}^2$		Capture is not required.
	K ^[7] = 1.2		$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE})$
		Drop down Lists	, root the root there y
	blogic soil type within tributary area ^[8] = $\frac{C: 0.05 - 0.15 \text{ in/hr infill}}{C: 0.05 - 0.15 \text{ in/hr infill}}$		
Select predeve	elopment ground cover description ^[5] = <mark>Woods (50%), grass (5(</mark> elopment ground cover description ^[5] = <mark>Impervious - Paved Par</mark>	0%) combination (orchard or tree farm) - Fair	
Select post deve	CN _{PRE} = 76	Thing, Roonop, Driveways	
	CN _{POST} = 90.3		
OR	Composite Predevelopment CN ^[9] = 80		
	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95		
Solution:	Composite Post development CN ^[9] = 95		
Solution: Pre Development Storm Water Rund	Composite Post development CN ^[9] = 95		
Solution:	Composite Post development CN ^[9] = 95 off Volume S _{PRE} = <u>1000</u> -10	Where:	
Solution: Pre Development Storm Water Rund	Composite Post development CN ^[9] = 95	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: re Development Storm Water Rund	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: Pre Development Storm Water Rund S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 95 off Volume S _{PRE} = <u>1000</u> -10	S_{PRE} = Pre development potential maximum retention after runoff (in).	
<u>Solution:</u> re Development Storm Water Rund S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: Pre Development Storm Water Rund S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ff}}{12}$ $V_{PRE} = (0.00900)(35,086)$	SPRE= Pre development potential maximum retention after runoff (in). ft Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: re Development Storm Water Runc $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 315.77$ ft ³ rost Development Storm Water Runch	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1fr}{12}$ $V_{PRE} = (0.00900)(35,086)$ noff Volume	SPRE Pre development potential maximum retention after runoff (in). ft Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³)	
Solution: Pre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 315.77 ft ³	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ff}}{12}$ $V_{PRE} = (0.00900)(35,086)$	SPRE= Pre development potential maximum retention after runoff (in). ft Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: Pre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 315.77 ft ³ Post Development Storm Water Rund S_{POST} = 0.57082 in	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ff}}{12}$ $V_{PRE} = (0.00900)(35,086)$ hoff Volume $S_{POST} = \frac{1000}{95} -10$	SPRE Pre development potential maximum retention after runoff (in). ft Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in)	
Solution: Pre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 315.77 ft ³ Post Development Storm Water Rund S_{POST} = 0.57082 in	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{fr}}{12}$ $V_{PRE} = (0.00900)(35,086)$ noff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.57)]^2}{95} \times \frac{1 \text{fr}}{12}$	SPRE Pre development potential maximum retention after runoff (in). ft Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in)	
Solution: Pre Development Storm Water Rund S_{PRE} 2.50 in Q _{PRE} 0.00900 ft V _{PRE} 315.77 ft ³ Post Development Storm Water Rund S _{POST} 0.57082 in	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ff}}{12}$ $V_{PRE} = (0.00900)(35,086)$ noff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = [(0.92*1.17) - (0.2 * 0.57)]^2 \times \frac{1 \text{ff}}{12}$	SPRE Pre development potential maximum retention after runoff (in). ft Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Q _{POST} Post development potential maximum retention after runoff (in) ft Q _{POST} Q in feet of depth as defined by the "Urban	
Solution: Pre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 315.77 ft ³ Post Development Storm Water Rund S_{POST} = 0.57082 in Q_{POST} =	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{+}1.17) + (0.2^{+}2.50)]^{2}}{[(0.92^{+}1.17) + (0.8^{+}2.50)]} \times \frac{1 \text{ff}}{12}$ $V_{PRE} = (0.00900)(35,086)$ noff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92^{+}1.17) + (0.2^{+}0.57)]^{2}}{[(0.92^{+}1.17) + (0.8^{+}0.57)]} \times \frac{1 \text{ff}}{12}$ $V_{POST} = (0.05037)(35,086)$	SPRE Pre development potential maximum retention after runoff (in). ft Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Secont Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: Pre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 315.77 ft ³ Post Development Storm Water Rund S_{POST} = 0.57082 in Q_{POST} = 0.05037 ft V_{POST} = 1767.28 ft ³ Solution: Volume Capture Require Increase in volume of storm	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{+}1.17) + (0.2^{+}2.50)]^{2}}{[(0.92^{+}1.17) + (0.8^{+}2.50)]} \times \frac{1 \text{ff}}{12}$ $V_{PRE} = (0.00900)(35,086)$ noff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92^{+}1.17) + (0.2^{+}0.57)]^{2}}{[(0.92^{+}1.17) + (0.8^{+}0.57)]} \times \frac{1 \text{ff}}{12}$ $V_{POST} = (0.05037)(35,086)$	SPRE Pre development potential maximum retention after runoff (in). ft Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Storm development potential maximum retention after runoff (in) ft Q _{POST} = Qin feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. Vprost= Post Development Volume of Storm Water Generated (ft ³)	·
Solution: Pre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE}= 0.00900 ft V_{PRE} = 315.77 ft ³ Post Development Storm Water Rund S_{POST} = 0.57082 in Q _{POST} = 0.05037 ft V_{POST} = 1767.28 ft ³ Solution: Volume Capture Required	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1fi}{12}$ $V_{PRE} = (0.00900)(35,086)$ noff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92*1.17)+(0.2*0.57)]^2}{[(0.92*1.17)+(0.8*0.57)]} \times \frac{1fi}{12}$ $V_{POST} = (0.05037)(35,086)$ ement water that must be retained onsite (may be infiltrated or the second secon	S_{PRE} = Pre development potential maximum retention after runoff (in). ft_2 Q_{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in) ft_2in Q_{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. verset S_{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. Verset Post Development Volume of Storm Water Generated (ft ³) reused). .28) - (315.77)	
Solution: Pre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 315.77 ft ³ Post Development Storm Water Rund S_{POST} = 0.57082 in Q_{POST} = 0.05037 ft V_{POST} = 1767.28 ft ³ Solution: Volume Capture Require Increase in volume of storm Delta Volume Capture= V	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1fr}{12}$ $V_{PRE} = (0.00900)(35,086)$ noff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92*1.17)+(0.2*0.57)]^2}{[(0.92*1.17)+(0.8*0.57)]} \times \frac{1fr}{12}$ $V_{POST} = (0.05037)(35,086)$ ement Invater that must be retained onsite (may be infiltrated or the theory of theory of the theory of the	SPRE Prece Prece	
Solution: Pre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 315.77 ft ³ Post Development Storm Water Rund S_{POST} = 0.57082 in Q_{POST} = 0.05037 ft V_{POST} = 1767.28 ft ³ Solution: Volume Capture Require Increase in volume of storm Delta Volume Capture= V	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1fr}{12}$ $V_{PRE} = (0.00900)(35,086)$ noff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92*1.17)+(0.2*0.57)]^2}{[(0.92*1.17)+(0.8*0.57)]} \times \frac{1fr}{12}$ $V_{POST} = (0.05037)(35,086)$ ement Invater that must be retained onsite (may be infiltrated or the theory of theory of the theory of the	S_{PRE} = Pre development potential maximum retention after runoff (in). ft_2 Q_{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in) ft_2in Q_{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. verset S_{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. Verset Post Development Volume of Storm Water Generated (ft ³) reused). .28) - (315.77)	



LID BMP Sizing Tool: 100% Volume Capt Formulas: $V_{LID GOAL}=((V_{GOAL}))/(P) = 2864.52$ ft ³ $A_{LID GOAL}=(W)(L) = 528.00$ ft ²	ure Goal; V_{GOAL} Where: $V_{LID GOAL}$ = Required volume of soil in LID BMP. $A_{LID GOAL}$ = Footprint of LID BMP area for a given depth (below perforated pi V_{GOAL} =	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet) P = 0.7 as a decimal		
Solution:	$D = \frac{5.5}{5.5} \text{ ft} \qquad \text{Below perforated pipe if present}$ $W = \frac{8.0}{66.0} \text{ ft}$	7	
Percent of Goal Achieved = 101.38	% = [(5.5 x 528) / 2,865] x 100		INSTRUCTIONS:
LID BMP Sizing Tool Delta Volume Capture Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01] ft ³	re Requirement: V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
$A_{LID DELTA}=(W)(L) = 0.00 \text{ ft}^2$	V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated pi V _{DELTA} = 1451.51 ft ³	ipe if present).	<u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
<u>Input:</u>	P =0.0as a decimalD =0.0ftBelow perforated pipe if presentW =0.0ftL =0.0ft		
Solution: Percent of Requirement Achieved = #DIV/0!	% = #DIV/0!		

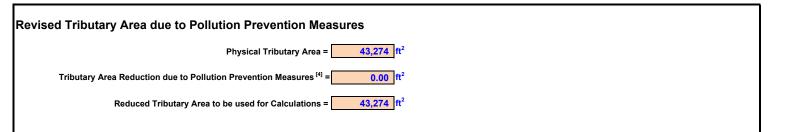




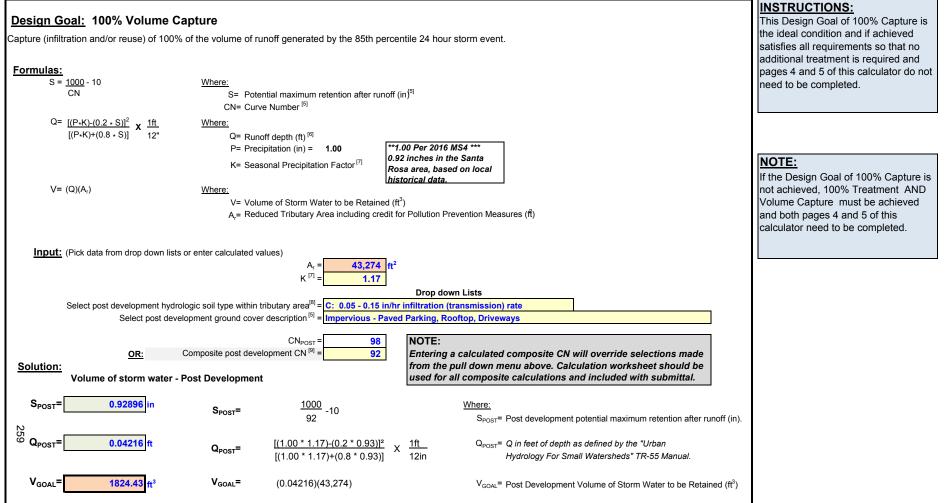
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connec Multiplier = 1	cted Paved Area		INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²			
Area Reduction = 0.00 ft ²			
nterceptor Trees ^[2]			INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees (200 ft ² /tree)	NOTE: Total Interceptor Area Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0	New Deciduous Trees		
Area Reduction due to new Deciduous Trees= 0 ft ²	(100 ft ² /tree)		
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy		
Allowed reduction credit for existing tree canopy= 0 ft ²	Allowed credit for existing tr	ree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed	d by evergreen + deciduous + existing canopy	

Buffer -	Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ² Buffer Factor = 0.7	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter the area draining to these features.
	Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) = Area Reduction = 0.00 ft ²	
258		1





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.



Release 7 Rev. 1 5/23/2017



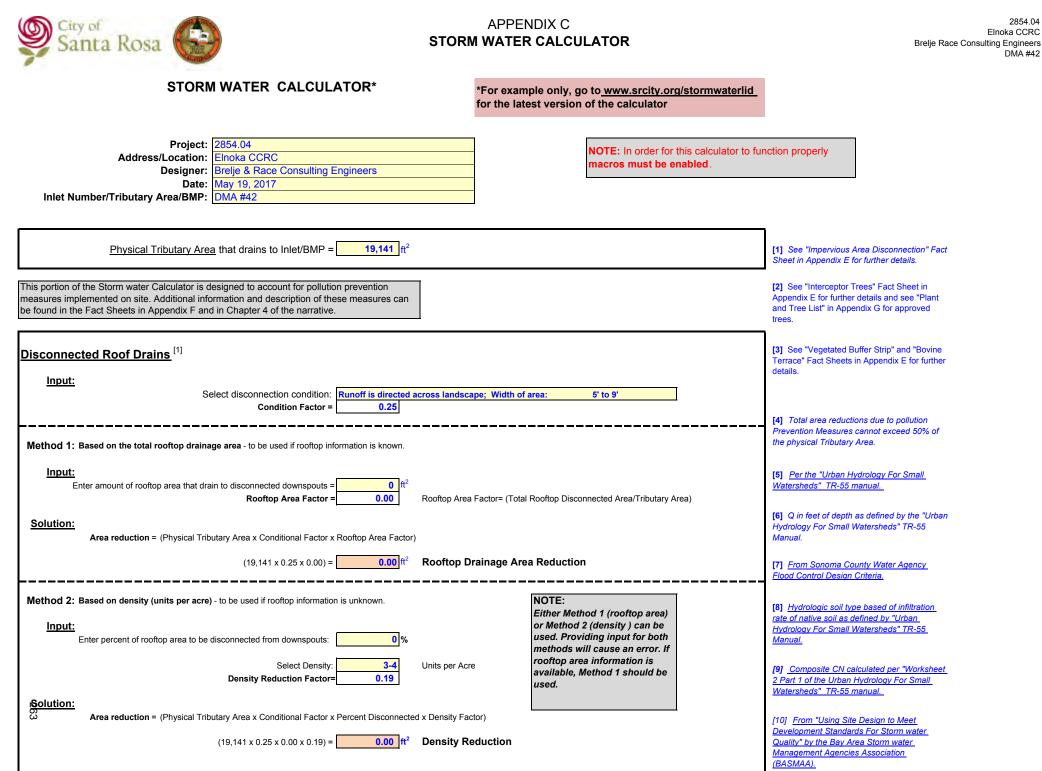
Requirement 1: 100% Treatme	nt		
	by 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
Formula		The C value used for this calculation is smaller than the value used for	on page 3 of this calculator is not
Formula: Q _{TREATMENT} = (0.2 in/hr)(A _r)(C _{POST})(K) cfs	Where:	hydraulic Flood Control design.	achieved; then Requirement 1-100% Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found her	
	C _{POST} = Rational method runoff coefficient for the developed condition ¹¹		Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Preventio	n Measures (in Acres) to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]		
Input:	A _r = 43,274 ft ² = 0.99343 Acre		
	$C_{POST}^{[10]} = 0.60$		
	κ ^[7] = 1.2		
	NO	TE:	
Solution:		Flow Rate calculated here should only be used to size the	
0		propriate BMP. All associated overflow inlets and systems	
Q _{TREATMENT} = 0.13948 cfs	Q _{TREATMENT} = (0.2)(0.9934)(0.60)(1.17)	ould be sized for the Flood Control event.	4



Requirement 2: Delta Volun lo increase in volume of runoff leavin		nt for the 85th percentile 24 hour stor	rm event.	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not
Formulas:				achieved; then Requirement 1-100%
S = <u>1000</u> - 10	Where:			Treatment, page 4 of the calculator,
CN		maximum retention after runoff (in) 5		AND Requirement 2- Volume
	CN= Curve Nur			Capture, this page of the calculator,
$O = [(P,K) (0.2, S)]^2$ 1ft		liber		must be achieved.
$Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} \times \frac{1 \text{ft}}{12 \text{in}}$		[6]		
[(F*K)+(0.8 * 3)] 12In	i tanon ao		in the Origin Design	
	•		in the Santa Rosa on local historical	
	K= Seasonal	Precipitation Factor ^[7] area, based data.	on local historical	
$V=(Q)(A_r)$	Where:	uala.		NOTE:
	V= Volume of	f Storm Water to be Retained (ft ³)		If the amount of volume generated
		Tributary Area including credit for Pollutic	on Prevention Measures (ť)	after development is less than or
		, ,		equal to that generated before
Input: (Pick data from drop down	lists or optor calculated values))		-
Input. (Fick data from drop down	Thisis of effet calculated values)			development, Requirement 2-Volume
		$A_r = 43,274 \text{ ft}^2$		Capture is not required.
		K ^[7] = 1.2		$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE})$
		Drop	o down Lists	(= FOST = = FRE OF OFFOST = OFFPRE)
		ary area ^[8] = C: 0.05 - 0.15 in/hr infiltrati		
Select pre	edevelopment ground cover desc	cription ^[5] = Woods (50%), grass (50%)	combination (orchard or tree farm) - Fair	
Select post	development ground cover desc	cription ^[5] = Impervious - Paved Parking	g, Rooftop, Driveways	
•		CN _{PRE} = 76		
		CN _{POST} = 90.3		
	Composite Predevelopme			
OR				
	Composite Post developme			
OR Solution:				
Solution:	Composite Post developme			
Solution: re Development Storm Water R	Composite Post developme	ent CN ^[9] = 92	Where.	
Solution:	Composite Post developme	ent CN ^[9] = 92	<u>Where:</u>	
Solution: e Development Storm Water R	Composite Post developme		$\frac{Where:}{S_{\text{PRE}}}$ Pre development potential maximum retention after runoff (in).	
<u>Solution:</u> re Development Storm Water R S _{PRE} = 2.50 in	Composite Post developme Runoff Volume S _{PRE} =	ent CN ^[9] = 92 $\frac{1000}{80}$ -10		
Solution: e Development Storm Water R	Composite Post developme Runoff Volume S _{PRE} =	ent CN ^[9] = 92 $\frac{1000}{80}$ -10		
<u>Solution:</u> re Development Storm Water R S _{PRE} = 2.50 in	Composite Post developme Runoff Volume S _{PRE} =	ent CN ^[9] = 92	S_{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: re Development Storm Water R S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Post developme Runoff Volume S _{PRE} =	ent CN ^[9] = 92 $\frac{1000}{80}$ -10	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: e Development Storm Water R S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Post developme Runoff Volume S _{PRE} = Q _{PRE} =	ent CN ^[9] = 92 $\frac{1000}{80}$ -10	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: e Development Storm Water R S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Post developme Runoff Volume S _{PRE} = Q _{PRE} =	ent CN ^[9] = 92 $\frac{1000}{80}$ -10 $\frac{1000}{80} -10$ $\frac{1000}{80} -10$ $\frac{1000}{80}$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: re Development Storm Water R $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 389.47$ ft ³	Composite Post developme Runoff Volume S_{PRE} = $Q_{PRE} = \begin{bmatrix} I \\ I \end{bmatrix}$ $V_{PRE} = (I)$	ent CN ^[9] = 92 $\frac{1000}{80}$ -10 $\frac{1000}{80} -10$ $\frac{1000}{80} -10$ $\frac{1000}{80}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: The Development Storm Water R $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 389.47$ ft ³ Dost Development Storm Water	Composite Post developme Runoff Volume $Q_{PRE} = \begin{bmatrix} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	ent CN ^[9] = 92 $\frac{1000}{80}$ -10 $\frac{((0.92*1.17)-(0.2*2.50)]^2}{((0.92*1.17)+(0.8*2.50)]}$ X $\frac{1 \text{ft}}{12 \text{in}}$ 0.00900)(43,274)	 S_{PRE}= Pre development potential maximum retention after runoff (in). Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	
Solution: e Development Storm Water R $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 389.47$ ft ³	Composite Post developme Runoff Volume S_{PRE} = $Q_{PRE} = \begin{bmatrix} I \\ I \end{bmatrix}$ $V_{PRE} = (I)$	ent CN ^[9] = 92 $\frac{1000}{80}$ -10 $\frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ 0.00900)(43,274) $\frac{1000}{2}$ -10	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: Where:	
Solution: The Development Storm Water R $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 389.47$ ft ³ Dost Development Storm Water	Composite Post developme Runoff Volume $Q_{PRE} = \begin{bmatrix} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	ent CN ^[9] = 92 $\frac{1000}{80} -10$ $\frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $0.00900)(43,274)$	 S_{PRE}= Pre development potential maximum retention after runoff (in). Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	
Solution: re Development Storm Water R S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 389.47 ft ³ ost Development Storm Water S_{POST} = 0.92896 in	Composite Post developme Runoff Volume $Q_{PRE} = \begin{bmatrix} I \\ I \end{bmatrix}$ $V_{PRE} = (I)$ Runoff Volume $S_{POST} = \begin{bmatrix} I \\ I \end{bmatrix}$	ent CN ^[9] = 92 $\frac{1000}{80}$ -10 $\frac{1000}{80}$ -10 $\frac{1000}{80}$ -10 $\frac{1000}{100}$ -10 0.00900)(43,274) $\frac{1000}{92}$ -10	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in)	
Solution: re Development Storm Water R $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 389.47$ ft ³ post Development Storm Water	Composite Post developme Runoff Volume $Q_{PRE} = \begin{bmatrix} I \\ I \end{bmatrix}$ $V_{PRE} = (I)$ Runoff Volume $S_{POST} = \begin{bmatrix} I \\ I \end{bmatrix}$	ent CN ^[9] = 92 $\frac{1000}{80}$ -10 $\frac{1000}{80}$ -10 $\frac{1000}{80}$ -10 $\frac{1000}{100}$ -10 0.00900)(43,274) $\frac{1000}{92}$ -10	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: Where:	
Solution: re Development Storm Water R S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 389.47 ft ³ tost Development Storm Water S_{POST} = 0.92896 in	Composite Post developme Runoff Volume $Q_{PRE} = \begin{bmatrix} I \\ Q_{PRE} \end{bmatrix}$ $V_{PRE} = (0)$ Runoff Volume $S_{POST} = \begin{bmatrix} I \\ Q_{POST} \end{bmatrix}$	ent CN ^[9] = 92 $\frac{1000}{80} -10$ $\frac{((0.92^{*}1.17) - (0.2^{*}2.50))^{2}}{((0.92^{*}1.17) + (0.8^{*}2.50))} \times \frac{1 \text{ft}}{12 \text{in}}$ $0.00900)(43,274)$ $\frac{1000}{92} -10$ $\frac{1000}{92} -10$ $\frac{((0.92^{*}1.17) - (0.2^{*}0.93))^{2}}{(0.92^{*}1.17) - (0.2^{*}0.93))^{2}} \times \frac{1 \text{ft}}{12 \text{in}}$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST Post development potential maximum retention after runoff (in)	
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Solution: re Development Storm Water R S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 389.47 ft ³ Dost Development Storm Water S_{POST} = 0.92896 in Q_{POST} = 0.03629 ft V_{POST} = 1570.41 ft ³ Solution: Volume Capture Record	Composite Post developme Runoff Volume Q_{PRE} = Q_{PRE} = V_{PRE} = V_{PRE} = Q_{POST} = Q_{POST} = V_{POST} = Quirement	ent CN ^[9] = 92 $\frac{1000}{80} -10$ $\frac{1000}{10} -10$ $\frac{1000}{10} -10$ $\frac{1000}{10} -10$ $\frac{1000}{92} -10$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in) QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³)	
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Solution: re Development Storm Water R S_{PRE} Q_{PRE} 0.00900 ft V_{PRE} 389.47 ft ³ ost Development Storm Water S_{POST} 0.92896 in Q_{POST} 0.03629 ft V_{POST} 1570.41 ft ³ Solution: Volume Capture Reconnection increase in volume of signal point point point of signal point point point of signal point poi	Composite Post developme Runoff Volume Q_{PRE} = Q_{PRE} = V_{PRE} = V_{PRE} = V_{PRE} = Q_{POST} = Q_{POST} = V_{POST} = Quirement torm water that must be retained	ent CN ^[9] = 92 $\frac{1000}{80} -10$ $\frac{((0.92*1.17) + (0.2 * 2.50)]^2}{((0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $0.00900)(43,274)$ $\frac{1000}{92} -10$ $\frac{((0.92*1.17) + (0.2 * 0.93)]^2}{((0.92*1.17) + (0.8 * 0.93)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $0.03629)(43,274)$ ined onsite (may be infiltrated or reus Delta Volume Capture= (1,570.41)	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in) QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) Sed). - (389.47)	
Solution: re Development Storm Water R S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 389.47 ft ³ ost Development Storm Water S_{POST} = 0.92896 in Q_{POST} = 0.03629 ft V_{POST} = 1570.41 ft ³ Solution: Volume Capture Rec Increase in volume of st Delta Volume Capture = (V _{PC}	Composite Post developme Runoff Volume Q_{PRE} = Q_{PRE} = U_{PRE} = U_{PRE} = Q_{POST} = Q_{POST} = U_{POST} = (Quirement torm water that must be retained $DST^{-}V_{PRE}$)	ent CN ^[9] = 92 $\frac{1000}{80} -10$ $\frac{((0.92*1.17) + (0.2 * 2.50)]^2}{((0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $0.00900)(43,274)$ $\frac{1000}{92} -10$ $\frac{((0.92*1.17) + (0.2 * 0.93)]^2}{((0.92*1.17) + (0.8 * 0.93)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $0.03629)(43,274)$ ined onsite (may be infiltrated or reus Delta Volume Capture= (1,570.41)	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in) Hydrology For Small Watersheds" TR-55 Manual. VPRE Post development potential maximum retention after runoff (in) Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) Sed). - (389.47) Where:	



LID BMP Sizing Tool: 100% Volume Capture Formulas: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 4146.44$ ft ³ $A_{LID GOAL} = (W)(L) = 1672.81$ ft ²	<u>re Goal;</u> V_{GOAL} <u>Where:</u> $V_{LID GOAL}$ = Required volume of soil in LID BMP. $A_{LID GOAL}$ = Footprint of LID BMP area for a given depth (below perforated pint) $V_{GOAL} = 1,824$ ft ³ Where:	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. pe if present).	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> <u>of 100% volume capture of the post</u> <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} x 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
Input:	P = 0.4 as a decimalD = 2.5 ftBelow perforated pipe if presentW = 40.9 ftL = 40.9		
Solution: Percent of Goal Achieved = 100.86	% = [(2.5 x 1,673) / 4,146] x 100	7	
LID BMP Sizing Tool Delta Volume Captur	<u>e Requirement</u> : V _{DELTA}	<u>NOTE:</u> LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
A _{LID DELTA} =(W)(L) = 0.00 ft ²	V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated pi V _{DELTA} = 1180.95 ft ³	pe if present).	<u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Requirement achieved" reaches
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		100%.
Input:	P =0.0as a decimalD =0.0ftBelow perforated pipe if presentW =0.0ftL =0.0ft		
Solution: N Percent of Requirement Achieved = #DIV/0!	% = #DIV/0!		

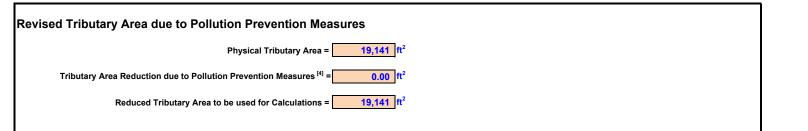




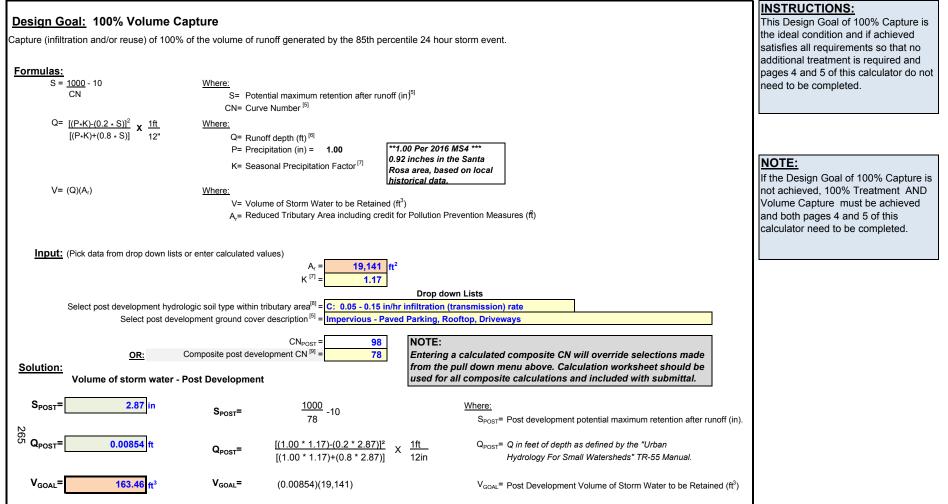
		_
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connection Multiplier = 1	ected Paved Area	INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²		
Area Reduction = 0.00 ft ²		
Interceptor Trees ^[2]		INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees NOTE: Total Interceptor Area (200 ft²/tree) Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0	New Deciduous Trees	
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)	
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy	
Allowed reduction credit for existing tree canopy=	Allowed credit for existing tree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ²	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter
Buffer Factor = 0.7	the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) =	
Area Reduction = 0.00 ft ²	





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.





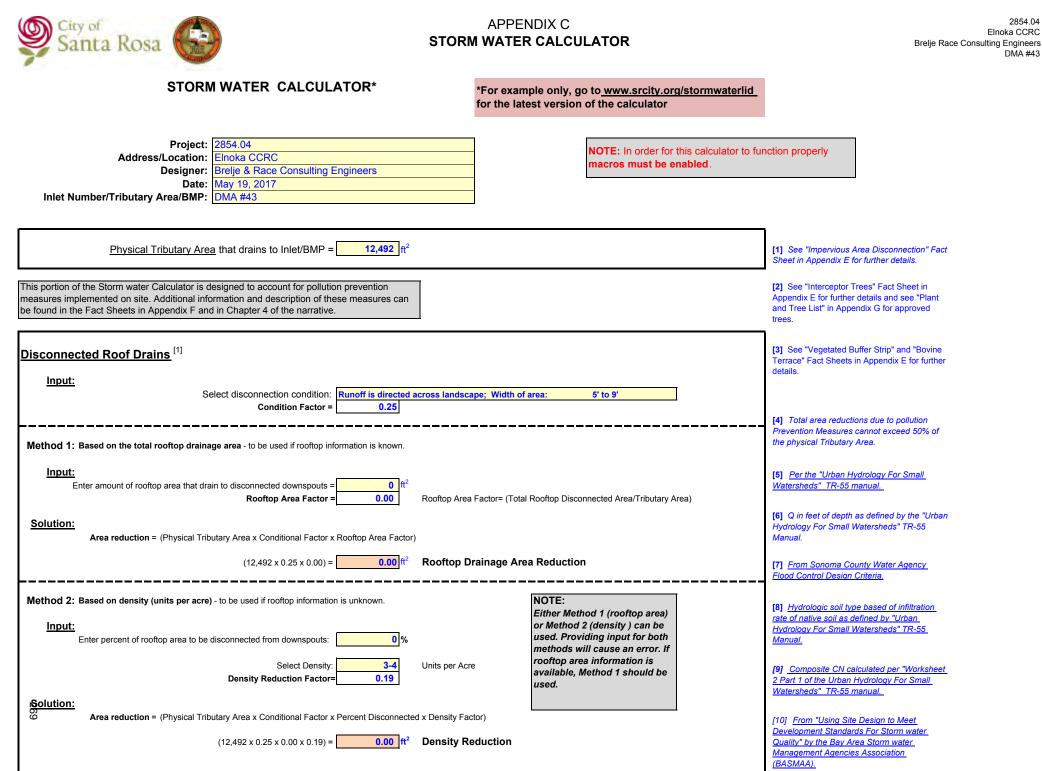
Requirement 1: 100% Treatme	nt		INSTRUCTIONS:
	by 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
Formula		The C value used for this calculation is smaller than the value used for	on page 3 of this calculator is not
Formula: Q _{TREATMENT} = (0.2 in/hr)(A _r)(C _{POST})(K) cfs	Where:	hydraulic Flood Control design.	achieved; then Requirement 1-100% Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	AND Requirement 2- Volume
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prevention Measures	(in Acres) to size the overflow bypass.	must be achieved.
Input:	K = Seasonal Precipitation Factor[7]		
mputi	A _r = 19,141 ft ² = 0.43942 Acres		
	C _{POST} ^[10] = 0.37		
	κ ^[7] = 1.2		
Solution:	NOTE:		
Solution.		e calculated here should only be used to size the BMP. All associated overflow inlets and systems	
Q _{TREATMENT} = 0.03804 cfs		red for the Flood Control event.	



o morease in volume of fution leaving the	apture site due to development for the 85th percentile 24 hour storm	event.	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not achieved; then Requirement 1-100%
Formulas:			Treatment, page 4 of the calculator,
S = <u>1000</u> - 10	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ⁵		Capture, this page of the calculator,
	CN= Curve Number ^[5]		must be achieved.
$Q = \frac{[(P \cdot K) - (0.2 \cdot S)]^2}{[(P \cdot K) + (0.8 \cdot S)]} \times \frac{1 \text{ft}}{12 \text{in}}$	Where:		must be achieved.
[(P*K)+(0.8 * S)] X 12in	Q= Runoff depth (ft) [6]		
	P= Precipitation (in) = 0.92 0.92 inches in t	he Santa Rosa	
	K= Seasonal Precipitation Factor ^[7] area, based on	local historical	
$V= (Q)(A_r)$	Where: data.		NOTE:
	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A_r = Reduced Tributary Area including credit for Pollution F	Prevention Measures (ť)	after development is less than or
	, ,, ,		equal to that generated before
Input: (Pick data from drop down lists of	or enter calculated values)		-
	$A_r = \frac{19,141}{12000} ft^2$		development, Requirement 2-Volur
	$K^{[7]} = 1.2$		Capture is not required.
			$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE}$
Colort hudrol	Drop do ogic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration	own Lists	
		nbination (orchard or tree farm) - Fair	
•	opment ground cover description ^[5] = Impervious - Paved Parking, F		
Select post develo	$CN_{PRE} = 76$	tooltop, Driveways	
	$CN_{PRST} = 90.3$		
<u>OR</u>	$Composite Predevelopment CN^{[9]} = 80$		
UN			
	Composite Post development CN ^[9] = 78		
Solution:			
Solution: re Development Storm Water Runot	ff Volume	Whore	
Solution:	ff Volume S _{PRE} = <u>1000</u> _10	Where:	
Solution: e Development Storm Water Runot	ff Volume	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: e Development Storm Water Runof S _{PRE} = 2.50 in	ff Volume S _{PRE} = <u>1000</u> 80 -10	S_{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: e Development Storm Water Runot	ff Volume S _{PRE} = <u>1000</u> 80 -10	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: e Development Storm Water Runof S _{PRE} = 2.50 in	ff Volume S _{PRE} = <u>1000</u> _10	S_{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: e Development Storm Water Runof S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	ff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1\text{ft}}{12\text{in}}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: e Development Storm Water Runof S _{PRE} = 2.50 in	ff Volume S _{PRE} = <u>1000</u> 80 -10	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: e Development Storm Water Runot S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 172.27 ft ³	ff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(19,141)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: e Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 172.27 ft ³ Dest Development Storm Water Runof	ff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(19,141)$ off Volume	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³)	
Solution: e Development Storm Water Runof $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 172.27$ ft ³	ff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(19,141)$ off Volume	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: Where:	
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Solution: e Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 172.27 ft ³ post Development Storm Water Runof S_{POST} = 2.87 in	ff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(19,141)$ off Volume $S_{POST} = \frac{1000}{78} -10$	SPRE= Pre development potential maximum retention after runoff (in). QPRE= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE= Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST= Post development potential maximum retention after runoff (in).	
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Solution: e Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 172.27 ft ³ ost Development Storm Water Runof S_{POST} = 2.87 in Q_{POST} = 0.00624 ft	ff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(19,141)$ off Volume $S_{POST} = \frac{1000}{78} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 2.87)]^2}{[(0.92*1.17) + (0.8 * 2.87)]} \times \frac{1 \text{ft}}{12 \text{in}}$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
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Solution: te Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 172.27 ft ³ ost Development Storm Water Runof S_{POST} = 2.87 in Q_{POST} = 0.00624 ft V_{POST} = 119.44 ft ³	ff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) + (0.8^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(19,141)$ off Volume $S_{POST} = \frac{1000}{78} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) + (0.8^{*}2.87)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.87)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{POST} = (0.00624)(19,141)$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
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Solution: re Development Storm Water Rundf S_{PRE} 2.50 in Q_{PRE} 0.00900 ft V_{PRE} 172.27 ft ³ Dost Development Storm Water Rundf S_{POST} 2.87 in Q_{POST} 0.00624 ft V_{POST} 119.44 ft ³ Solution: Volume Capture Require Increase in volume of storm V Delta Volume Capture = (V_{POST} - V_F	ff Volume $\mathbf{S}_{PRE} = \frac{1000}{80} -10$ $\mathbf{Q}_{PRE} = \frac{[(0.92^{*}1.17) + (0.2^{*}2.50)]^2}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1ft}{12in}$ $\mathbf{V}_{PRE} = (0.00900)(19,141)$ Doff Volume $\mathbf{S}_{POST} = \frac{1000}{78} -10$ $\mathbf{Q}_{POST} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.87)]^2}{[(0.92^{*}1.17) + (0.8^{*}2.87)]} \times \frac{1ft}{12in}$ $\mathbf{V}_{POST} = (0.00624)(19,141)$ ment water that must be retained onsite (may be infiltrated or reused one) \mathbf{W}_{PRE} Delta Volume Capture = (119.44) - (17)	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) VPOST Post Development Volume of Storm Water Generated (ft ³)). 2.27) Where: Where:	
Solution: te Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 172.27 ft ³ Dost Development Storm Water Runof S_{POST} = 2.87 in Q_{POST} = 0.00624 ft V_{POST} = 119.44 ft ³ Solution: Volume Capture Require Increase in volume of storm	ff Volume $\mathbf{S}_{PRE} = \frac{1000}{80} -10$ $\mathbf{Q}_{PRE} = \frac{[(0.92^{*}1.17) + (0.2^{*}2.50)]^2}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1ft}{12in}$ $\mathbf{V}_{PRE} = (0.00900)(19,141)$ Doff Volume $\mathbf{S}_{POST} = \frac{1000}{78} -10$ $\mathbf{Q}_{POST} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.87)]^2}{[(0.92^{*}1.17) + (0.8^{*}2.87)]} \times \frac{1ft}{12in}$ $\mathbf{V}_{POST} = (0.00624)(19,141)$ ment water that must be retained onsite (may be infiltrated or reused one) \mathbf{W}_{PRE} Delta Volume Capture = (119.44) - (17)	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³)). 2.27)	



LID BMP Sizing Tool: 100% Volume Capture Formulas: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 371.51$ ft ³ $A_{LID GOAL} = (W)(L) = 670.81$ ft ²	Where: V _{LID GOAL} = Required volume of soil in LID BMP. A _{LID GOAL} = Footprint of LID BMP area for a given depth (below perforated pinere: V _{GOAL} = 163	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> <u>of 100% volume capture of the post</u> <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
<u>Input:</u>	P =0.4as a decimalD =1.0ftBelow perforated pipe if presentW =25.9ftL =25.9ft		
Solution: Percent of Goal Achieved = 180.56 %	= [(1.0 x 671) / 372] x 100	7	
LID BMP Sizing Tool Delta Volume Capture Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0!]ft ³	Where:	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume capture. Enter the percent of porosity
$A_{LID DELTA}=(W)(L) = $ 0.00 ft ²	$V_{LID DELTA}$ = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated pi	ipe if present).	of the specified soil and depth below
	V _{DELTA} = -52.82916 ft ³		perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Requirement achieved" reaches
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	V _{DELTA} = -52.82916ft ³ here: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	n <u>ere:</u> P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet)		perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Requirement achieved" reaches

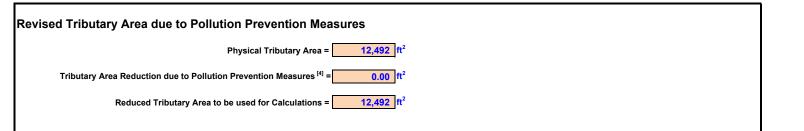




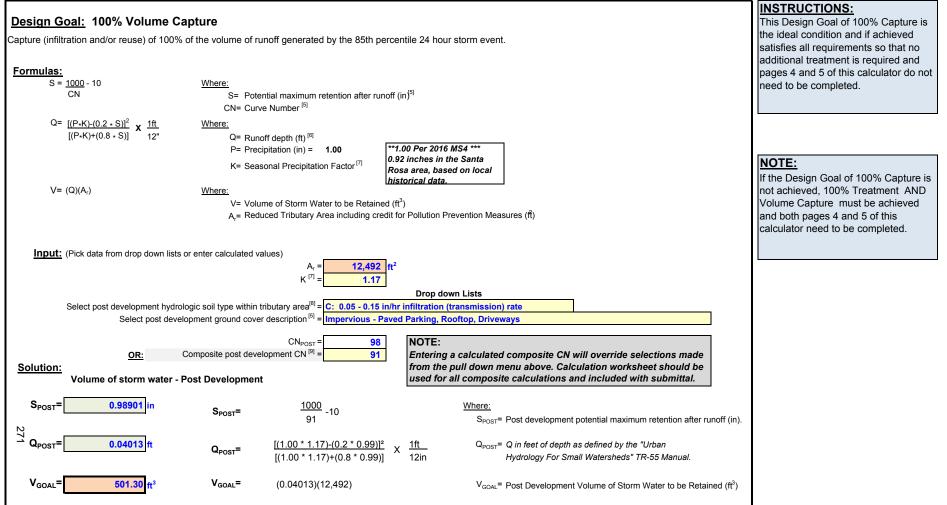
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conne Multiplier = 1	ected Paved Area		INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²			
Area Reduction = 0.00 ft ²			
Interceptor Trees ^[2] Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0	New Evergreen Trees	NOTE: Total Interceptor Area	INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area
Area Reduction due to new Evergreen Trees=0ft ²		Reduction is limited to 50% of the physical tributary area.	of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Deciduous Trees=0 ft ²	New Deciduous Trees (100 ft ² /tree)		
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy		
Allowed reduction credit for existing tree canopy= 0 ft ²	Allowed credit for existing tre	ee canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed	by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ²	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to
Buffer Factor = 0.7	these features as sheet flow. Enter the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) =	
Area Reduction = 0.00 ft ²	





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.



Release 7 Rev. 1 5/23/2017



Requirement 1: 100% Treatmen	ıt		INSTRUCTIONS:
Treatment of 100% of the flow generated b	y 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
		The C value used for this calculation	on page 3 of this calculator is not
Formula:		is smaller than the value used for	achieved; then Requirement 1-100%
Q _{TREATMENT} = (0.2 in/hr)(A _r)(C _{POST})(K) cfs	Where:	hydraulic Flood Control design.	Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	AND Requirement 2- Volume
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prevention Measures (in Acres) to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]	·	
<u>Input:</u>	$A_{r} = \frac{12,492}{0.28678} \text{Acres}$ $C_{POST}^{[10]} = \frac{0.59}{1.2}$ $K^{[7]} = \frac{1.2}{1.2}$ NOTE:		
Solution: Q _{treatment} = 0.03959 cfs	The Flow Rate appropriate Bl	calculated here should only be used to size the MP. All associated overflow inlets and systems d for the Flood Control event.	

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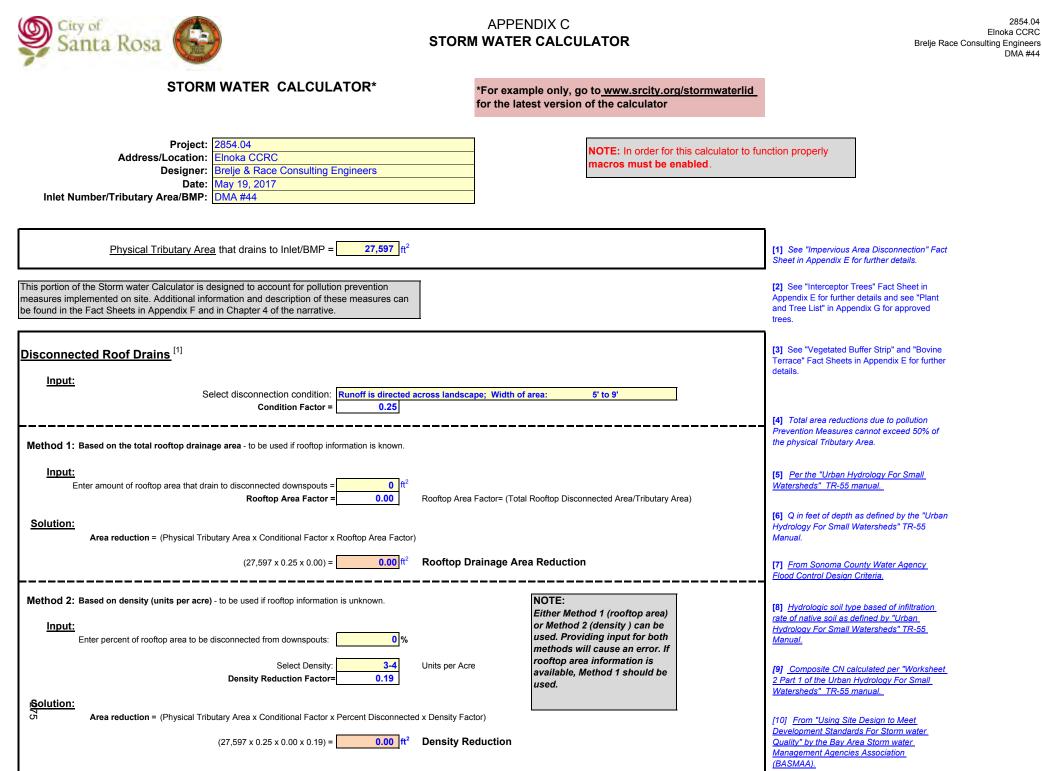


2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #43

	ture e due to development for the 85th percentile 24 hour storm e	event.	INSTRUCTIONS: If the Design Goal of 100% Captur on page 3 of this calculator is not
			achieved; then Requirement 1-100
ormulas:			Treatment, page 4 of the calculato
S = <u>1000</u> - 10	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ^{5]}		Capture, this page of the calculato
	CN= Curve Number ^[5]		must be achieved.
$\Omega = [(P_*K) - (0.2 * S)]^2$ 1ft	Where:		must be achieved.
$\begin{array}{r} Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} \times \frac{1 ft}{12 in} \end{array}$			
[(1 * (1) * (0.0 * 0)] [2]]	Q = Runoff depth (ft) ^[6]		
	P= Precipitation (in) = 0.92 0.92 inches in th		
	K= Seasonal Precipitation Factor ^[7] area, based on l	ocal historical	
$V=(Q)(A_r)$	Where: data.		NOTE:
	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A_r = Reduced Tributary Area including credit for Pollution Pi	revention Measures (#)	-
	Ar= Reduced Tribulary Area including credit for Poliditon Pr	levenuori measures (1)	after development is less than or
			equal to that generated before
Input: (Pick data from drop down lists or e	nter calculated values)		development, Requirement 2-Volu
	$A_r = 12,492 \text{ ft}^2$		Capture is not required.
	K ^[7] = 1.2		
			$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PR}$
	Drop do		
Select hydrologic	soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration (transmission) rate	
	nent ground cover description ^[5] = Woods (50%), grass (50%) com		
	nent ground cover description ^[5] = Impervious - Paved Parking, Ro		
	$CN_{PRE} = 76$	sonop, Shronayo	
	CN _{POST} = 90.3		
OR Co	mposite Predevelopment CN ^[9] = 80		
Com	posite Post development CN ^[9] = 91		
Solution: e Development Storm Water Runoff V S _{PRE} = 2.50 in		<u>Where:</u> Spec= Pre development potential maximum retention after runoff (in)	
<u>Solution:</u> e Develop <u>ment Storm Wat</u> er Runoff V		$\frac{Where:}{S_{PRE}}$ = Pre development potential maximum retention after runoff (in).	
<u>Solution:</u> e Develop <u>ment Storm Wat</u> er Runoff V			
Solution: e Development Storm Water Runoff V S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	$S_{PRE} = \frac{1000}{80} - 10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: e Development Storm Water Runoff V S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: e Development Storm Water Runoff V S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(12,492)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: e Development Storm Water Runoff V S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 112.43 ft ³ ost Development Storm Water Runoff	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(12,492)$ Volume	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Solution: e Development Storm Water Runoff V S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 112.43 ft ³	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(12,492)$ Volume	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where:	
Solution: e Development Storm Water Runoff V SPRE= 2.50 in QPRE= 0.00900 ft VPRE= 112.43 ft ³ vst Development Storm Water Runoff	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(12,492)$ Volume	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Solution: e Development Storm Water Runoff V S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 112.43 ft ³ post Development Storm Water Runoff S_{POST} = 0.98901 in	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(12,492)$ Volume $S_{POST} = \frac{1000}{91} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where:	
Solution: e Development Storm Water Runoff V S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 112.43 ft ³ st Development Storm Water Runoff S_{POST} = 0.98901 in	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(12,492)$ Volume $S_{POST} = \frac{1000}{91} -10$ $Q_{POST} = \frac{[(0.92*1.17)-(0.2*0.99)]^2}{91} \times \frac{1\text{ft}}{12}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where:	
Solution: a Development Storm Water Runoff V S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 112.43 ft ³ st Development Storm Water Runoff S_{POST} = 0.98901 in	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(12,492)$ Volume $S_{POST} = \frac{1000}{91} -10$ $Q_{POST} = \frac{[(0.92*1.17)-(0.2*0.99)]^2}{91} \times \frac{1\text{ft}}{12}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban	
Solution: e Development Storm Water Runoff V S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 112.43 ft ³ post Development Storm Water Runoff S_{POST} = 0.98901 in	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(12,492)$ Volume $S_{POST} = \frac{1000}{91} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in).	
Solution: e Development Storm Water Runoff V S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 112.43 ft ³ ost Development Storm Water Runoff S_{POST} = 0.98901 in Q_{POST} = 0.03441 ft	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(12,492)$ Volume $S_{POST} = \frac{1000}{91} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*0.99)]^2}{[(0.92*1.17) + (0.8*0.99)]} \times \frac{1 \text{ft}}{12 \text{in}}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: e Development Storm Water Runoff V S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 112.43 ft ³ post Development Storm Water Runoff S_{POST} = 0.98901 in	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(12,492)$ Volume $S_{POST} = \frac{1000}{91} -10$ $Q_{POST} = \frac{[(0.92*1.17)-(0.2*0.99)]^2}{91} \times \frac{1\text{ft}}{12}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban	
Solution: e Development Storm Water Runoff V S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 112.43 ft ³ ost Development Storm Water Runoff S_{POST} = 0.98901 in Q_{POST} = 0.03441 ft V_{POST} = 429.85 ft ³ Solution: Volume Capture Requirement of storm water	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(12,492)$ Volume $S_{POST} = \frac{1000}{91} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*0.99)]^2}{[(0.92*1.17) + (0.8*0.99)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.03441)(12,492)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
Solution: e Development Storm Water Runoff V S_{PRE} = 2.50 in Q_{PRE}= 0.00900 ft V_{PRE} = 112.43 ft ³ post Development Storm Water Runoff S_{POST} = 0.03441 ft V_{POST} = 429.85 ft ³ Solution: Volume Capture Requirement	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(12,492)$ Volume $S_{POST} = \frac{1000}{91} -10$ $Q_{POST} = \frac{[(0.92*1.17)+(0.2*0.99)]^2}{[(0.92*1.17)+(0.8*0.99)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{POST} = (0.03441)(12,492)$ ent er that must be retained onsite (may be infiltrated or reused)	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
Solution: e Development Storm Water Runoff V S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 112.43 ft ³ Dost Development Storm Water Runoff S_{POST} = 0.98901 in Q_{POST} = 0.03441 ft V_{POST} = 429.85 ft ³ Solution: Volume Capture Requirement Increase in volume of storm water	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 ft}{12 in}$ $V_{PRE} = (0.00900)(12,492)$ Volume $S_{POST} = \frac{1000}{91} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*0.99)]^2}{[(0.92*1.17) + (0.8*0.99)]} \times \frac{1 ft}{12 in}$ $V_{POST} = (0.03441)(12,492)$ and er that must be retained onsite (may be infiltrated or reused) Delta Volume Capture = (429.85) - (112)	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	



LID BMP Sizing Tool: 100% Volume Capture Goal; V _{GOAL} Formulas: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 1139.33$ ft ³ Where: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 338.56$ ft ² $V_{LID GOAL} = Required volume of soil in LID BMP.$ $A_{LID GOAL} = (W)(L) = 338.56$ ft ² $A_{LID GOAL} = Footprint of LID BMP area for a given depth (below performed on the second of the second on the second of the second on the second of the second of the second on the second of the second on the second of the second on the second on the second of the second$	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> <u>of 100% volume capture of the post</u> <u>development condition.</u> Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = (D)(A _{LID GOAL}) x 100 V _{LID GOAL} x 100 D= Depth below perforated pipe if present (in decimal feet) U Width (in decimal feet) L= Length (in decimal feet) D= 0.4 as a decimal		
$D = 3.4 \text{ ft} Below perforated pipe if present}$ $W = 18.4 \text{ ft}$ $L = 18.4 \text{ ft}$ Solution: Percent of Goal Achieved = 101.03 % = [(3.4 \times 339) / 1, 139] \times 100	7	
LID BMP Sizing Tool Delta Volume Capture Requirement: V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size
Formulas: V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/01) ft ³ Where: $A_{LID DELTA}=(W)(L) = 0.00$ ft ² $V_{LID DELTA}=$ Required volume of soil in LID BMP $A_{LID DELTA}=(W)(L) = 0.00$ ft ² $A_{LID DELTA}=$ Footprint of LID BMP area for a given depth (below performance)	based BMPs. Not required if site requires treatment only.	a LID BMP to achieve the <u>design</u> <u>requirement of the delta volume</u> <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be
$V_{DELTA} = 317.42 \text{ ft}^{3}$ Percent of Requirement Achieved = $\frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ $\frac{Where:}{P = \text{Porosity} \text{ (enter as a decimal)}}{D = \text{Depth below perforated pipe if present} \text{ (in decimal feet)}}{W = \text{Width} \text{ (in decimal feet)}}$		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
Input: $P =$ 0.0as a decimal $D =$ 0.0ftBelow perforated pipe if present $W =$ 0.0ft $L =$ 0.0ft		
Solution: Percent of Requirement Achieved = #DIV/0! % = #DIV/0!		

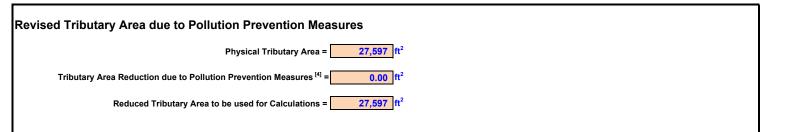




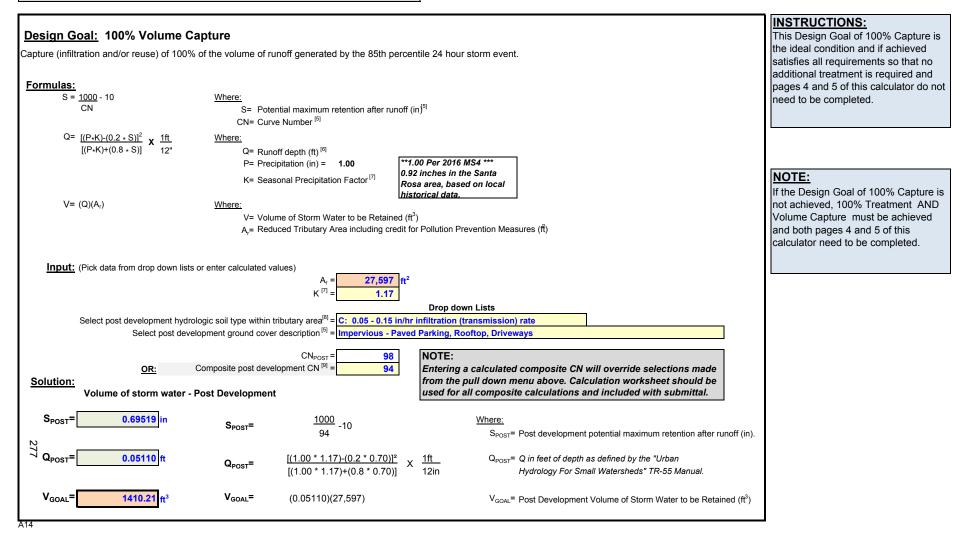
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connec Multiplier = 1	cted Paved Area		INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²			
Area Reduction = 0.00 ft ²			
nterceptor Trees ^[2]			INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees (200 ft ² /tree)	NOTE: Total Interceptor Area Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0	New Deciduous Trees		
Area Reduction due to new Deciduous Trees= 0 ft ²	(100 ft ² /tree)		
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy		
Allowed reduction credit for existing tree canopy= 0 ft ²	Allowed credit for existing tr	ree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed	d by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ² Buffer Factor = 0.7	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) = Area Reduction = 0.00 ft²	
б б	1





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.



Release 7 Rev. 1 5/23/2017



Requirement 1: 100% Treatme	nt		INSTRUCTIONS:
Treatment of 100% of the flow generated b	by 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
		The C value used for this calculation	on page 3 of this calculator is not
Formula:		is smaller than the value used for	achieved; then Requirement 1-100%
$Q_{TREATMENT}$ = (0.2 in/hr)(A_r)(C_{POST})(K) cfs	Where:	hydraulic Flood Control design.	Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prevention Measures	(in Acres) to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]		
Input:			
	$A_r = 27,597$ ft ² = 0.63354 Acres		
	$C_{POST}^{[10]} = 0.59$		
	κ ^[/] = <u>1.2</u>		
Oslutian	NOTE:		
<u>Solution:</u>		e calculated here should only be used to size the	
Q _{TREATMENT} = 0.08747 cfs		MP. All associated overflow inlets and systems ed for the Flood Control event.	
	SiteAlment (0.2)(0.0000)(0.00)(1.17)		

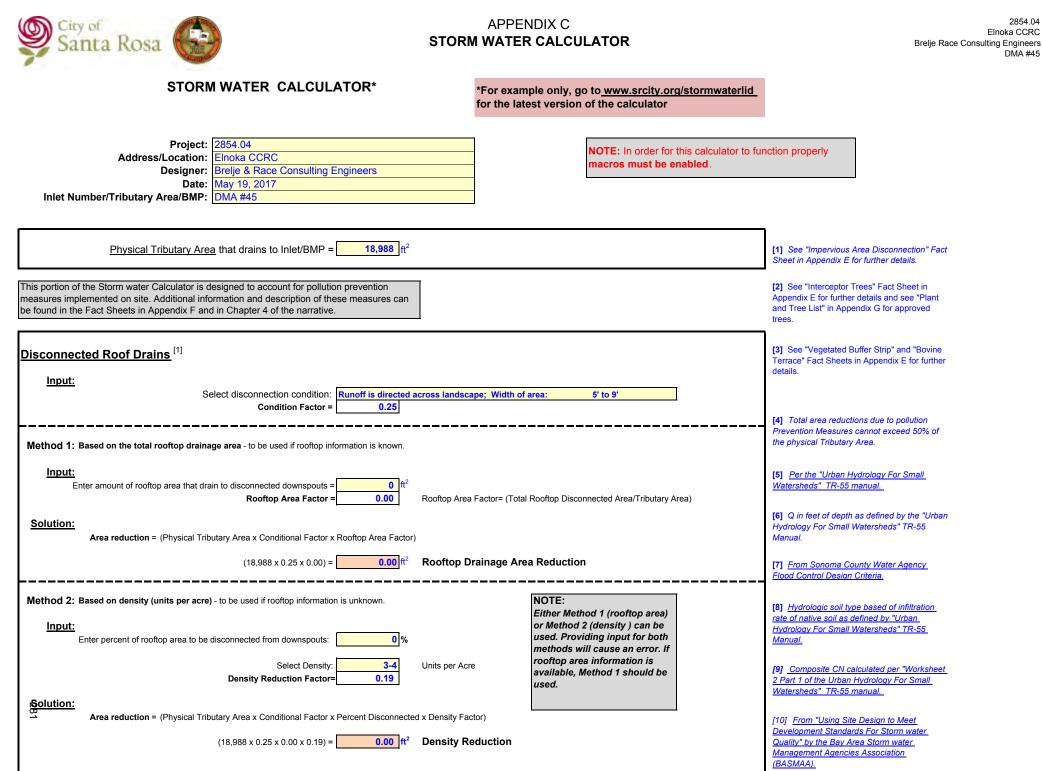
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<u>Requirement 2:</u> Delta Volume (Capture		INSTRUCTIONS:
	e site due to development for the 85th percentile 24 hour storm	event.	If the Design Goal of 100% Capture
			on page 3 of this calculator is not
Formulas:			achieved; then Requirement 1-100%
S = <u>1000</u> - 10	Where:		Treatment, page 4 of the calculator,
CN	S= Potential maximum retention after runoff (in) ⁵⁾		AND Requirement 2- Volume
	CN= Curve Number ^[5]		Capture, this page of the calculator, must be achieved.
$Q = \frac{[(P \cdot K) - (0.2 \cdot S)]^2}{[(P \cdot K) + (0.8 \cdot S)]} \times \frac{1 \text{ft}}{4 \text{cm}}$	Where:		must be achieved.
[(P K) + (0.8 * S)] X 12in	Q= Runoff depth (ft) ^[6]		
	P= Precipitation (in) = 0.92 0.92 inches in	the Santa Rosa	
	K= Seasonal Precipitation Factor ^[7] area, based or	local historical	
V= (Q)(A _r)	Where: data.		NOTE:
	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A_r = Reduced Tributary Area including credit for Pollution	Prevention Measures (ť)	-
	, y		after development is less than or equal to that generated before
Input: (Pick data from drop down lists	s or enter calculated values)		
	$A_r = \frac{27,597}{1000} \text{ft}^2$		development, Requirement 2-Volum
	$K_{r}^{(7)} = 1.2$		Capture is not required.
		own Lists	$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE}$
Select bydr	blogic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration		
	elopment ground cover description ^[5] = Woods (50%), grass (50%) co		
	elopment ground cover description ^[5] = Impervious - Paved Parking, I		
	CN _{PRE} = 76	(conop, phrondy)	
	CN _{POST} = 90.3		
	ULPOSI UL		
OR	Composite Predevelopment CN ^[9] = 80		
OR	Composite Predevelopment CN $^{[9]} = 80$ Composite Post development CN $^{[9]} = 94$		
<u>OR</u> Solution:	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 94		
Solution:	Composite Post development CN ^[9] = 94		
Solution: re Development Storm Water Rund	Composite Post development CN ^[9] = 94	Where:	
Solution:	Composite Post development CN ^[9] = 94		
Solution: re Development Storm Water Rund	Composite Post development CN ^[9] = 94	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff (in).	
<u>Solution:</u> re Development Storm Water Rund S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 94 off Volume $S_{PRE} = \frac{1000}{80} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in).	
<u>Solution:</u> re Development Storm Water Rund S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 94 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = <i>Q</i> in feet of depth as defined by the "Urban	
<u>Solution:</u> re Development Storm Water Rund S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 94	S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: re Development Storm Water Rund S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Post development CN ^[9] = 94 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = <i>Q</i> in feet of depth as defined by the "Urban	
Solution: re Development Storm Water Rund $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft	Composite Post development CN ^[9] = 94 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^*1.17) - (0.2^*2.50)]^2}{[(0.92^*1.17) + (0.8^*2.50)]} \times \frac{1ft}{12in}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: re Development Storm Water Rund $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 248.37$ ft ³	Composite Post development CN ^[9] = 94 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2 * 2.50)]^{2}}{[(0.92^{*}1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(27,597)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: re Development Storm Water Rund $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 248.37$ ft ³ ost Development Storm Water Run	Composite Post development CN ^[9] = 94 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(27,597)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: re Development Storm Water Rund $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 248.37$ ft ³ ost Development Storm Water Rund	Composite Post development CN ^[9] = 94 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(27,597)$ hoff Volume	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: Where:	
Solution: re Development Storm Water Rund $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 248.37$ ft ³ ost Development Storm Water Rund	Composite Post development CN ^[9] = 94 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^*1.17) - (0.2 * 2.50)]^2}{[(0.92^*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(27,597)$ noff Volume $S_{POST} = \frac{1000}{-10}$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³)	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 248.37 ft ³ ost Development Storm Water Rund S_{POST} = 0.69519 in	Composite Post development CN ^[9] = 94 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(27,597)$ hoff Volume $S_{POST} = \frac{1000}{94} -10$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: Where:	
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Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 248.37 ft ³ ost Development Storm Water Rund S_{POST} = 0.69519 in	Composite Post development CN ^[9] = 94 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(27,597)$ hoff Volume $S_{POST} = \frac{1000}{94} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.70)]^2}{94} \times \frac{1ft}{12in}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 248.37 ft ³ ost Development Storm Water Rund S_{POST} = 0.04465 ft	Composite Post development CN ^[9] = 94 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(27,597)$ noff Volume $S_{POST} = \frac{1000}{94} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2^{*}0.70)]^{2}}{94} \times \frac{1\text{ft}}{12}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban	
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Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 248.37 ft ³ ost Development Storm Water Rund S_{POST} = 0.69519 in Q_{POST} = 0.04465 ft V_{POST} = 1232.21 ft ³ Solution: Volume Capture Require Increase in volume of storm	Composite Post development CN ^[9] = 94 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) + (0.2 * 2.50)]^{2}}{[(0.92^{*}1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(27,597)$ noff Volume $S_{POST} = \frac{1000}{94} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2 * 0.70)]^{2}}{[(0.92^{*}1.17) + (0.8 * 0.70)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.04465)(27,597)$ ement	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³)	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 248.37 ft ³ ost Development Storm Water Rund S_{POST} = 0.69519 in Q_{POST} = 0.04465 ft V_{POST} = 1232.21 ft ³ Solution: Volume Capture Require Increase in volume of storm	Composite Post development CN ^[9] = 94 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) + (0.2 * 2.50)]^{2}}{[(0.92^{*}1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(27,597)$ noff Volume $S_{POST} = \frac{1000}{94} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) + (0.2 * 0.70)]^{2}}{[(0.92^{*}1.17) + (0.8 * 0.70)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.04465)(27,597)$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³)	
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Solution: Tre Development Storm Water Rund S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 248.37 ft ³ Post Development Storm Water Rund SPOST= 0.69519 in Q _{POST} = 0.04465 ft V _{POST} = 1232.21 ft ³ Solution: Volume Capture Requir Increase in volume of storm	Composite Post development CN ^[9] = 94 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(27,597)$ hoff Volume $S_{POST} = \frac{1000}{94} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.70)]^2}{[(0.92*1.17) + (0.8 * 0.70)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.04465)(27,597)$ ement envater that must be retained onsite (may be infiltrated or reused value) $V_{PRE} = 0 = 0$ Delta Volume Capture = (1,232.21) - (1)	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) I). 248.37) Where: Where:	
Solution: Tre Development Storm Water Rund S_{PRE} 2.50 in Q _{PRE} 0.00900 ft V_{PRE} 248.37 ft ³ Post Development Storm Water Rund SPOST 0.69519 in Q _{POST} 0.04465 ft V _{POST} 1232.21 ft ³ Solution: Volume Capture Require Increase in volume of storm Note that the storm of the store	Composite Post development CN ^[9] = 94 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(27,597)$ hoff Volume $S_{POST} = \frac{1000}{94} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.70)]^2}{[(0.92*1.17) + (0.8 * 0.70)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.04465)(27,597)$ ement envater that must be retained onsite (may be infiltrated or reused value) $V_{PRE} = 0 = 0$ Delta Volume Capture = (1,232.21) - (1)	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) I). 248.37) Where: Where:	
Solution: re Development Storm Water Rund S_{PRE} 2.50 in Q_{PRE} 0.00900 ft V_{PRE} 248.37 ft ³ ost Development Storm Water Rund S_{POST} 0.69519 in Q_{POST} 0.04465 ft V_{POST} 1232.21 ft ³ Solution: Volume Capture Require Increase in volume of storm Note that the storm of the storm of the storm Note that the storm of the storm of the storm of the storm Note that the storm of the storm o	Composite Post development CN ^[9] = 94 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(27,597)$ hoff Volume $S_{POST} = \frac{1000}{94} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.70)]^2}{[(0.92*1.17) + (0.8 * 0.70)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.04465)(27,597)$ ement envater that must be retained onsite (may be infiltrated or reused value) $V_{PRE} = 0 = 0$ Delta Volume Capture = (1,232.21) - (1)	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) I). 248.37)	



LID BMP Sizing Tool: 100% Volume Capt Formulas: $V_{LID GOAL}=((V_{GOAL}))/(P) = 2014.58$ ft ³ $A_{LID GOAL}=(W)(L) = 368.00$ ft ²	Where: VLID GOAL= Required volume of soil in LID BMP. ALID GOAL = Footprint of LID BMP area for a given depth (below perforated performance) V_GOAL = 1,410 ft ³ Where:	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
Input:	P =0.7as a decimalD =5.5ftBelow perforated pipe if presentW =8.0ftL =46.0ft		
Solution: Percent of Goal Achieved = 100.47	% = [(5.5 x 368) / 2,015] x 100	7	
LID BMP Sizing Tool Delta Volume Captu Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01] ft ³	Ire Requirement: V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
$A_{LID DELTA}=(W)(L) = \boxed{0.00} ft^2$	V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated p V _{DELTA} = 983.83 ft ³	pipe if present).	<u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Deputyment optimud" specifies
$A_{\text{LID DELTA}}=(W)(L) = \underbrace{0.00}_{\text{ft}} \text{ft}^2$ Percent of Requirement Achieved = $\frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated performance)	pipe if present).	of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be
	A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated p V _{DELTA} = 983.83 ft ³ <u>Where:</u> P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet)	pipe if present).	of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Requirement achieved" reaches

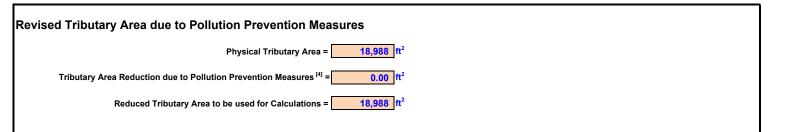




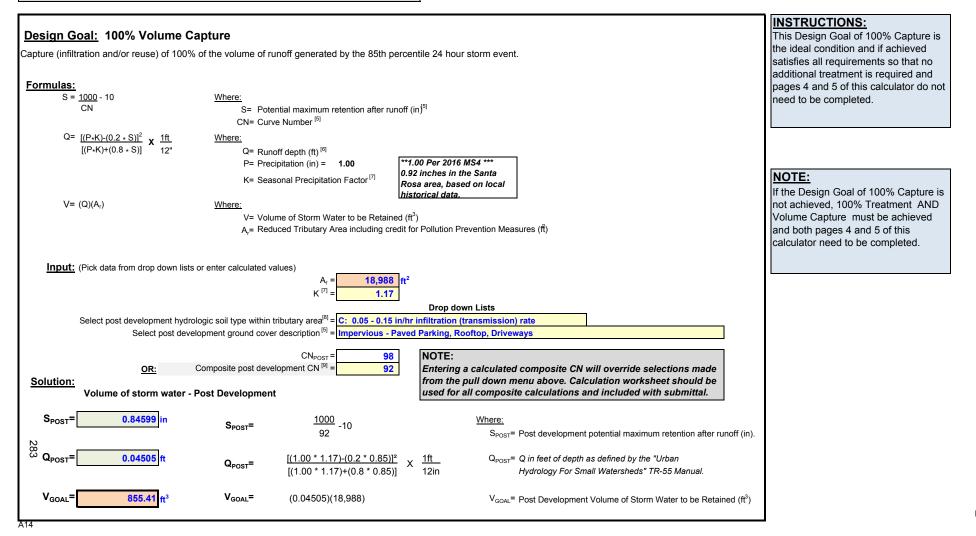
		_
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connection Multiplier = 1	ected Paved Area	INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²		
Area Reduction = 0.00 ft ²		
Interceptor Trees ^[2]		INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees NOTE: Total Interceptor Area (200 ft²/tree) Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0	New Deciduous Trees	
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)	
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy	
Allowed reduction credit for existing tree canopy=	Allowed credit for existing tree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ²	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter
Buffer Factor = 0.7	the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) =	
Area Reduction = 0.00 ft ²	





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.



Release 7 Rev. 1 5/23/2017



Requirement 1: 100% Treatme	nt		INSTRUCTIONS:
Treatment of 100% of the flow generated I	by 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
		The C value used for this calculation	on page 3 of this calculator is not
<u>Formula:</u>		is smaller than the value used for	achieved; then Requirement 1-100%
$Q_{TREATMENT}$ = (0.2 in/hr)(A_r)(C_{POST})(K) cfs	Where:	hydraulic Flood Control design.	Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	AND Requirement 2- Volume
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prevention Measure	s (in Acres) to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]		
Input:	A _r = 18,988 ft ² = 0.43590 Acres C _{POST} ^[10] = 0.56 K ^[7] = 1.2		
	NOTE:		
Solution: Q _{TREATMENT} = 0.05712 cfs	The Flow Ra appropriate	te calculated here should only be used to size the BMP. All associated overflow inlets and systems zed for the Flood Control event.	

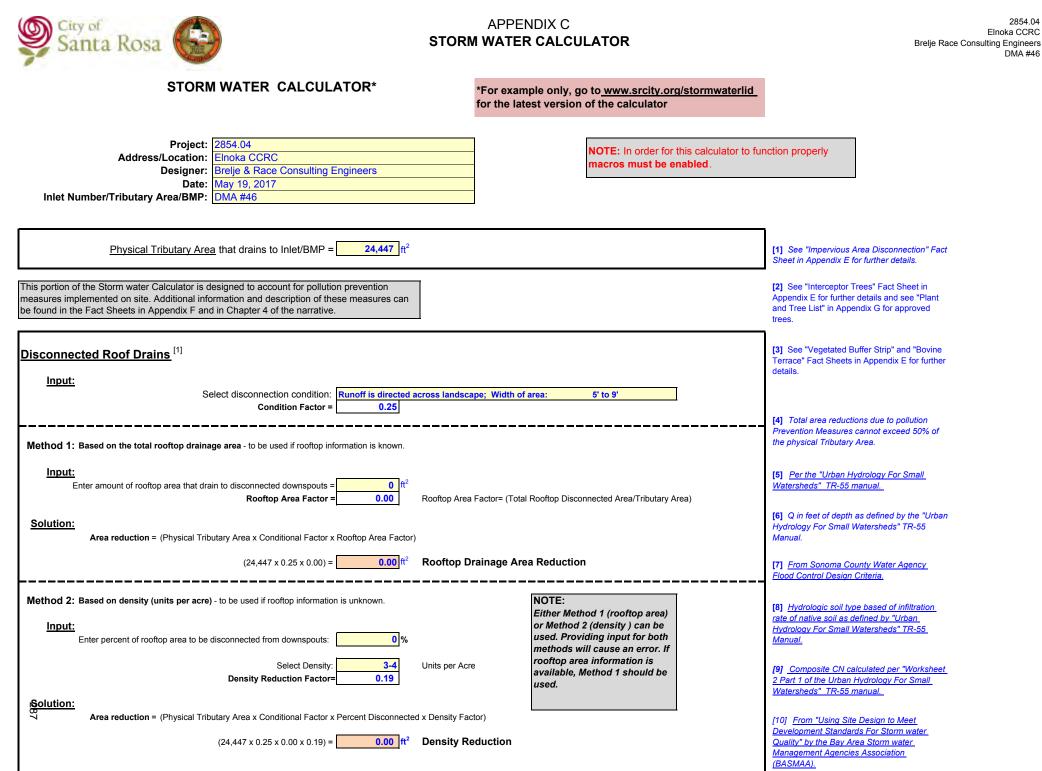


2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #45

	Capture he site due to development for the 85th percentile 24 hour storm even	ent.	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not achieved; then Requirement 1-100%
ormulas:			Treatment, page 4 of the calculator,
S = <u>1000</u> - 10	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ^{5]}		
	CN= Curve Number ^[5]		Capture, this page of the calculator
$O = I(D K) (0.2 C)^2 = 10^4$			must be achieved.
$Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} \times \frac{1ft}{12in}$	Where:		
[(P*K)+(0.8 * 5)] 12in	Q= Runoff depth (ft) ^[6]		
	P= Precipitation (in) = 0.92 0.92 inches in the S		
	K= Seasonal Precipitation Factor ^[7] area, based on loca	al historical	
$V=(Q)(A_r)$	Where: data.		NOTE:
- (-)(-))	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A_r = Reduced Tributary Area including credit for Pollution Prev	vention Measures (#)	-
	A_r - Reduced Hibblely Area including creation rollation rec		after development is less than or
			equal to that generated before
Input: (Pick data from drop down lis			development, Requirement 2-Volun
	A _r = 18,988 ft ²		Capture is not required.
	κ ^[7] = 1.2		
	Drop down	liete	$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE}$
Calact bud	rologic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration (tra		
	velopment ground cover description ^[5] = Woods (50%), grass (50%) combin		
Select post dev	velopment ground cover description ^[5] = Impervious - Paved Parking, Roof	ftop, Driveways	
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
	101		
OR	Composite Predevelopment CN ^[9] = 80		
<u>OR</u>	Composite Predevelopment CN $^{[9]} = \frac{80}{92}$		
Solution:	Composite Post development CN ^[9] = 92		
Solution: e Development Storm Water Rur	Composite Post development CN ^[9] = 92	Whore	
Solution:	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = 1000 -10$	<u>Where:</u>	
Solution: Development Storm Water Rur	Composite Post development CN ^[9] = 92	Where: S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: Development Storm Water Rur S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = 1000 -10$		
Solution: Development Storm Water Rur S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$		
Solution: Development Storm Water Rur S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: Development Storm Water Run S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = 1000 -10$	S _{PRE} = Pre development potential maximum retention after runoff (in).	
olution: Development Storm Water Run S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Post development CN ^[9] = 92 noff Volume $\mathbf{S}_{PRE} = \frac{1000}{80} -10$ $\mathbf{Q}_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: Development Storm Water Rur S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: e Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 170.89$ ft ³	Composite Post development CN ^[9] = 92 S _{PRE} = $\frac{1000}{80} -10$ $\mathbf{Q}_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $\mathbf{V}_{PRE} = (0.00900)(18,988)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: a Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE}= 0.00900 ft V_{PRE} = 170.89 ft ³ st Development Storm Water Run	Composite Post development CN ^[9] = 92 S _{PRE} = $\frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(18,988)$ unoff Volume	 S_{PRE}= Pre development potential maximum retention after runoff (in). Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	
Solution: Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 170.89$ ft ³	Composite Post development CN ^[9] = 92 S _{PRE} = $\frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(18,988)$ unoff Volume	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: Development Storm Water Run S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 170.89 ft ³ st Development Storm Water Run	Composite Post development CN ^[9] = 92 S _{PRE} = $\frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(18,988)$ unoff Volume	 S_{PRE}= Pre development potential maximum retention after runoff (in). Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	
Solution: a Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 170.89 ft ³ st Development Storm Water Run S_{POST} = 0.84599 in	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(18,988)$ noff Volume $S_{POST} = \frac{1000}{92} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where:	ĸ
Solution: P Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 170.89 ft ³ St Development Storm Water Run S_{POST} = 0.84599 in	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(18,988)$ noff Volume $S_{POST} = \frac{1000}{92} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in	λ.
Solution: Development Storm Water Run S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 170.89 ft ³ st Development Storm Water Run	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(18,988)$ noff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17)-(0.2*0.85)]^2}{92} \times \frac{1 \text{ft}}{12}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban	k.
Solution: a Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 170.89 ft ³ st Development Storm Water Run S_{POST} = 0.84599 in	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(18,988)$ noff Volume $S_{POST} = \frac{1000}{92} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in	k
Solution: a Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 170.89 ft ³ st Development Storm Water Run S_{POST} = 0.84599 in Q_{POST} = 0.03898 ft	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(18,988)$ unoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.85)]^2}{[(0.92*1.17) + (0.8 * 0.85)]} \times \frac{1ft}{12in}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ²) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	k
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Solution: a Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE}= 0.00900 ft V_{PRE} = 170.89 ft ³ st Development Storm Water Run S_{POST} = 0.84599 in Q _{POST} = 0.03898 ft V_{POST} = 740.15 ft ³	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(18,988)$ unoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.85)]^2}{[(0.92*1.17) + (0.8 * 0.85)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03898)(18,988)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ²) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	λ.
Solution: a Development Storm Water Run S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V_{PRE} = 170.89 ft ³ st Development Storm Water Run SPOST= 0.84599 in Q _{POST} = 740.15 ft ³ Solution: Volume Capture Require	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(18,988)$ nnoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.85)]^2}{[(0.92*1.17) + (0.8 * 0.85)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.03898)(18,988)$ rement	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ²) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	λ.
Solution: a Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE}= 0.00900 ft V_{PRE} = 170.89 ft ³ st Development Storm Water Run S_{POST} = 0.84599 in Q_{POST}= 0.03898 ft V_{POST} = 740.15 ft ³ Solution: Volume Capture Requind Increase in volume of storm	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(18,988)$ nnoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.85)]^2}{[(0.92*1.17) + (0.8 * 0.85)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.03898)(18,988)$ rement	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ²) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	k.
Solution: Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 170.89 ft ³ st Development Storm Water Run S_{POST} = 0.84599 in Q_{POST} = 0.03898 ft V_{POST} = 740.15 ft ³ Solution: Volume Capture Requind Increase in volume of storm	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(18,988)$ unoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.85)]^2}{[(0.92*1.17) + (0.8 * 0.85)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03898)(18,988)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ²) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	k.
Solution: Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 170.89 ft ³ st Development Storm Water Run S_{POST} = 0.84599 in Q_{POST} = 0.03898 ft V_{POST} = 740.15 ft ³ Solution: Volume Capture Requind Increase in volume of storm	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(18,988)$ moff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.85)]^2}{[(0.92*1.17) + (0.8 * 0.85)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03898)(18,988)$ rement m water that must be retained onsite (may be infiltrated or reused).	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	x.
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 170.89 ft ³ ost Development Storm Water Run S_{POST} = 0.84599 in Q_{POST} = 0.03898 ft V_{POST} = 740.15 ft ³ Solution: Volume Capture Requind Increase in volume of storm	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(18,988)$ moff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.85)]^2}{[(0.92*1.17) + (0.8 * 0.85)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03898)(18,988)$ rement m water that must be retained onsite (may be infiltrated or reused).	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³) 9)	K.
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 170.89 ft ³ ost Development Storm Water Run S_{POST} = 0.84599 in Q_{POST} = 0.03898 ft V_{POST} = 740.15 ft ³ Solution: Volume Capture Requind Increase in volume of storm Delta Volume Capture = (V _{POST})	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(18,988)$ moff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.85)]^2}{[(0.92*1.17) + (0.8 * 0.85)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03898)(18,988)$ rement m water that must be retained onsite (may be infiltrated or reused). V_{PRE}) Delta Volume Capture = (740.15) - (170.85)	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ²) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³) 9) Where:	λ.
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 170.89 ft ³ ost Development Storm Water Run S_{POST} = 0.84599 in Q_{POST} = 0.03898 ft V_{POST} = 740.15 ft ³ Solution: Volume Capture Requind Increase in volume of storm Delta Volume Capture = (V _{POST})	Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(18,988)$ moff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.85)]^2}{[(0.92*1.17) + (0.8 * 0.85)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03898)(18,988)$ rement m water that must be retained onsite (may be infiltrated or reused). V_{PRE}) Delta Volume Capture = (740.15) - (170.85)	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³) 9)	



LID BMP Sizing Tool: 100% Volume Capture Goal; V _{GOAL} Formulas: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 1944.11$ ft ³ Where: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 1944.11$ ft ³ Where: $A_{LID GOAL} = (W)(L) = 547.56$ ft ² V _{LID GOAL} = Required volume of soil in LID BMP. $A_{LID GOAL} = (W)(L) = 547.56$ ft ² $A_{LID GOAL} = Footprint of LID BMP area for a given depth (below perforated pinters) V_{GOAL} = 855 ft3 Where: $	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. pe if present).	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> <u>of 100% volume capture of the post</u> <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = (D)(ALID GOAL) x 100 P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) D= Depth below perforated pipe if present (in decimal feet) L= Length (in decimal feet) L= Length (in decimal feet) L= 0 D = 0 M= 0 3.6 W = 0 23.4		
L = 23.4 ft <u>Solution:</u> Percent of Goal Achieved = 101.39 % = [(3.6 x 548) / 1,944] x 100	7	INSTRUCTIONS:
LID BMP Sizing Tool Delta Volume Capture Requirement: V_{DELTA} Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/0!]$ ft ³ $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/0!]$ ft ³ $V_{LID DELTA} = (W)(L) = 0.00$ ft ² $A_{LID DELTA} = (W)(L) = 0.00$ ft ² $V_{DELTA} = Footprint of LID BMP area for a given depth (below perforated piper to the second provide to the second part of the second provide to the second part of the second pa$	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. pe if present).	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> <u>requirement of the delta volume</u> <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of
Percent of Requirement = (D)(A_LID DELTA) V_LID DELTA x 100 P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= L=		Requirement achieved" reaches 100%.
$\frac{\text{Input:}}{D = 0.0 \text{ ft}}$ $\frac{D = 0.0 \text{ ft}}{0.0 \text{ ft}}$ $\frac{Solution:}{Below perforated pipe if present}$		

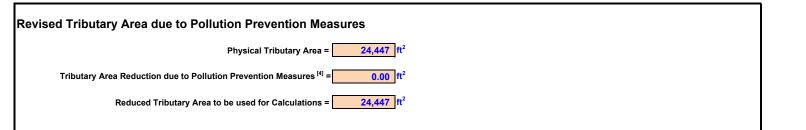




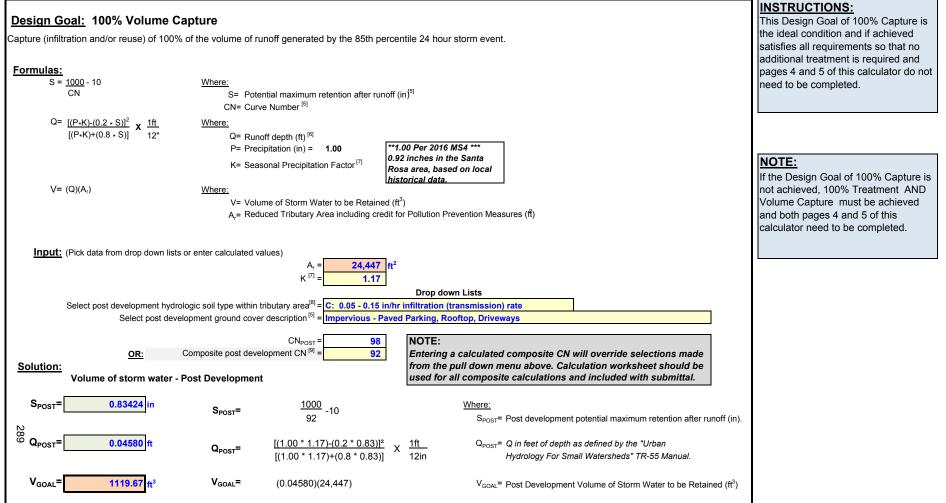
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conne Multiplier = 1	cted Paved Area	INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²		
Area Reduction = 0.00 ft ²		
Interceptor Trees ^[2] Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=	New Evergreen Trees NOTE:	INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both new and existing trees. Enter the number of new deciduous and
Area Reduction due to new Evergreen Trees=	(200 ft ² /tree) Total Interceptor Area Reduction is limited to 50% of the physical tributary area.	evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=	New Deciduous Trees	
Area Reduction due to new Deciduous Trees=	(100 ft²/tree)	
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy	
Allowed reduction credit for existing tree canopy=	Allowed credit for existing tree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ²	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter
Buffer Factor = 0.7	the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) =	
Area Reduction = 0.00 ft ²	





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.





Requirement 1: 100% Treatment				INSTRUCTIONS:
Treatment of 100% of the flow generated by 85th percent	rcentile 24 hour mean annual rain event (0.2 in/hr).		C value note:	If the Design Goal of 100% Capture
			The C value used for this calculation	on page 3 of this calculator is not
Formula:			is smaller than the value used for	achieved; then Requirement 1-100%
Q _{TREATMENT} = (0.2 in/hr)(A _r)(C _{POST})(K) cfs Where:	<u>r</u>		hydraulic Flood Control design.	Treatment, this page of the calculator,
Q _{TREATMEN}	ENT ⁼ Design flow rate required to be treated (cfs)		The table of values can be found here	AND Requirement 2- Volume
C _{POS}	DET = Rational method runoff coefficient for the developed condition	[10]	This smaller value should not be used	Capture, page 5 of the calculator,
A	Ar = Reduced Tributary Area including credit for Pollution Prevention	ion Measures (in Acres)	to size the overflow bypass.	must be achieved.
ł	K = Seasonal Precipitation Factor ^[7]	, ,		
Input:	$A_{r} = 24,447 \text{ ft}^{2} = 0.56123 \text{ Act}$ $C_{POST}^{(10)} = 0.61 \text{ K}^{(7)} = 1.2 \text{ Act}$	res DTE:		
Solution: Q _{TREATMENT} = 0.08011 cfs Q	Th ap	ne Flow Rate calculated	d here should only be used to size the sociated overflow inlets and systems flood Control event.	
Q _{TREATMENT} = 0.08011 cfs Q	Q _{TREATMENT} ⁼ (0.2)(0.5612)(0.61)(1.17)	ould be sized for the F	Flood Control event.	

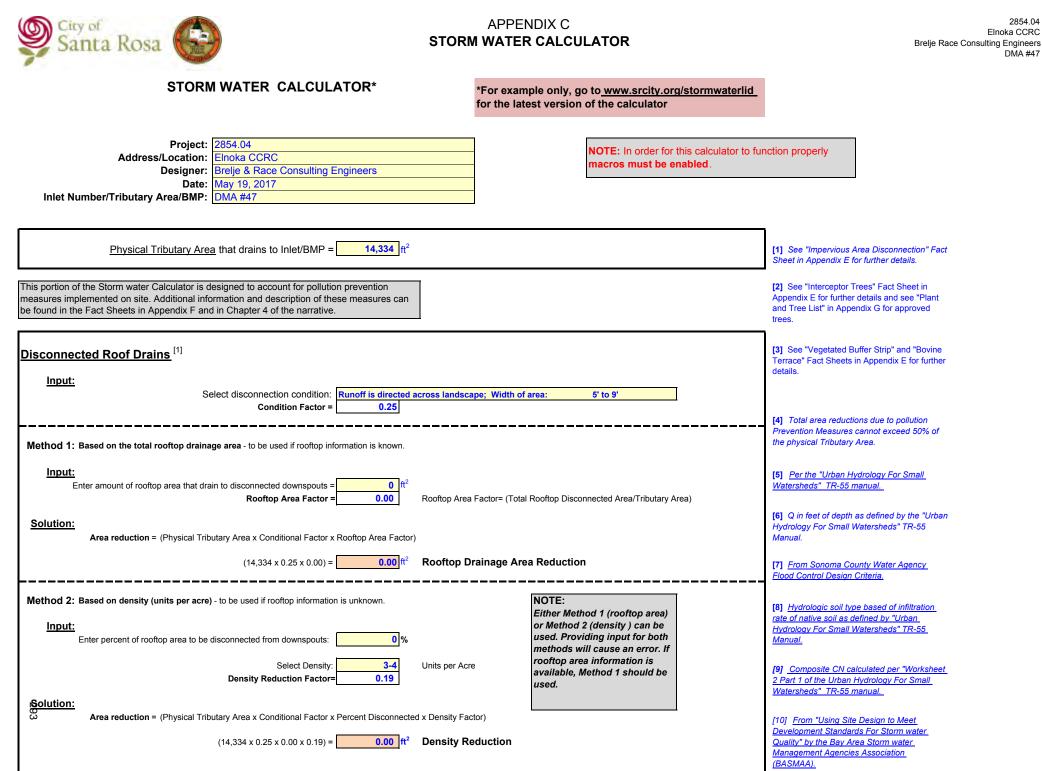
290



	N = 1.4		INIOTOLIOTIONO
Requirement 2: Delta Volume (Capture esite due to development for the 85th percentile 24 hour sto	rm event	INSTRUCTIONS:
increase in volume of runom leaving th	e site due to development for the 85th percentile 24 hour sto	im event.	If the Design Goal of 100% Capture
			on page 3 of this calculator is not
Formulaa			achieved; then Requirement 1-100%
Formulas:			Treatment, page 4 of the calculator,
$S = \frac{1000}{201} - 10$	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ⁵		Capture, this page of the calculator,
	CN= Curve Number ^[5]		must be achieved.
$Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} \times \frac{1 \text{ft}}{12 \text{in}}$	Where:		
[(P*K)+(0.8 * S)] 12in	Q= Runoff depth (ft) ^[6]		
		in the Santa Rosa	
		l on local historical	
$V=(Q)(A_r)$	Where: data.		NOTE:
	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A_r = Reduced Tributary Area including credit for Pollutio	on Prevention Measures (ピ)	after development is less than or
			equal to that generated before
Input: (Pick data from drop down lists	or enter calculated values)		-
mput. (Fick data nom drop down lists			development, Requirement 2-Volum
	$A_r = 24,447 \text{ ft}^2$		Capture is not required.
	K ^[7] = 1.2		$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE}$
		p down Lists	
	logic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltrat		
Select predeve	lopment ground cover description ^[5] = Woods (50%), grass (50%)	combination (orchard or tree farm) - Fair	
Select post deve	lopment ground cover description ^[5] = Impervious - Paved Parking	g, Rooftop, Driveways	
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
<u>OR</u>	CN _{POST} = 90.3 Composite Predevelopment CN ^[9] = 80		
	Composite Predevelopment CN ^[9] = 80		
	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92		
<u>Solution:</u> re Develop <u>ment Storm Wat</u> er Rund	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92	Where:	
Solution:	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume S_{PRE} = 1000 -10		
Solution: re Development Storm Water Rund	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: re Development Storm Water Rund S _{PRE} = 2.50 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in).	
<u>Solution:</u> re Develop <u>ment Storm Wat</u> er Rund	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
<u>Solution:</u> re Development Storm Water Rund S _{PRE} = 2.50 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume S_{PRE} = 1000 -10	S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: re Development Storm Water Rund S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{+}1.17) - (0.2 + 2.50)]^2}{[(0.92^{+}1.17) + (0.8 + 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: re Development Storm Water Rund S _{PRE} = 2.50 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: re Development Storm Water Runc S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 220.02 ft ³	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(24,447)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: re Development Storm Water Runc S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 220.02 ft ³ ost Development Storm Water Runc	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(24,447)$	 S_{PRE}= Pre development potential maximum retention after runoff (in). Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	
Solution: re Development Storm Water Runc $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 220.02$ ft ³	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(24,447)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: re Development Storm Water Runc S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 220.02 ft ³ ost Development Storm Water Runc	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(24,447)$	 S_{PRE}= Pre development potential maximum retention after runoff (in). Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	
Solution: re Development Storm Water Runc S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 220.02 ft ³ ost Development Storm Water Runc S_{POST} = 0.83424 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(24,447)$ off Volume $S_{POST} = \frac{1000}{92} -10$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: Where:	
Solution: re Development Storm Water Runc S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 220.02 ft ³ ost Development Storm Water Runc S_{POST} = 0.83424 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(24,447)$ off Volume $S_{POST} = \frac{1000}{92} -10$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: Where:	
Solution: re Development Storm Water Runc S_{PRE} 2.50 in Q _{PRE} 0.00900 ft V_{PRE} 220.02 ft ³ ost Development Storm Water Runc S_{POST} 0.83424 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(24,447)$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST Post development potential maximum retention after runoff (in).	
Solution: re Development Storm Water Runc S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 220.02 ft ³ ost Development Storm Water Runc S_{POST} = 0.83424 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(24,447)$ hoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = [(0.92*1.17) - (0.2 * 0.83)]^2 \times \frac{1ft}{12in}$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 220.02 ft ³ ost Development Storm Water Rund S_{POST} = 0.83424 in Q_{POST} =	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(24,447)$ hoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = [(0.92*1.17) - (0.2 * 0.83)]^2 \times \frac{1ft}{12in}$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban	
Solution: re Development Storm Water Rund $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 220.02$ ft ³ ost Development Storm Water Run $S_{POST} = 0.83424$ in $Q_{POST} = 0.03969$ ft	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $\mathbf{S}_{PRE} = \frac{1000}{80} -10$ $\mathbf{Q}_{PRE} = \frac{[(0.92^{*}1.17) + (0.2 * 2.50)]^2}{[(0.92^{*}1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $\mathbf{V}_{PRE} = (0.00900)(24,447)$ hoff Volume $\mathbf{S}_{POST} = \frac{1000}{92} -10$ $\mathbf{Q}_{POST} = \frac{[(0.92^{*}1.17) + (0.2 * 0.83)]^2}{[(0.92^{*}1.17) + (0.8 * 0.83)]} \times \frac{1 \text{ft}}{12 \text{in}}$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 220.02 ft ³ ost Development Storm Water Rund S_{POST} = 0.83424 in Q_{POST} = 0.03969 ft V_{POST} = 970.30 ft ³	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(24,447)$ hoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.83)]^2}{[(0.92*1.17) + (0.8 * 0.83)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03969)(24,447)$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 220.02 ft ³ ost Development Storm Water Rund S_{POST} = 0.83424 in Q_{POST} = 0.03969 ft V_{POST} = 970.30 ft ³ Solution: Volume Capture Required	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(24,447)$ off Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.83)]^2}{[(0.92*1.17) + (0.8 * 0.83)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03969)(24,447)$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³)	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 220.02 ft ³ ost Development Storm Water Rund S_{POST} = 0.83424 in Q_{POST} = 0.03969 ft V_{POST} = 970.30 ft ³ Solution: Volume Capture Required Increase in volume of storm	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(24,447)$ hoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.83)]^2}{[(0.92*1.17) + (0.8 * 0.83)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03969)(24,447)$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³)	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 220.02 ft ³ ost Development Storm Water Rund S_{POST} = 0.83424 in Q_{POST} = 0.03969 ft V_{POST} = 970.30 ft ³ Solution: Volume Capture Required Increase in volume of storm	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(24,447)$ off Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17)+(0.2*0.83)]^2}{[(0.92*1.17)+(0.8*0.83)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03969)(24,447)$ ement water that must be retained onsite (may be infiltrated or reuse	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) Sed). Sed).	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V_{PRE} = 220.02 ft ³ ost Development Storm Water Rund S_{POST} = 0.83424 in Q _{POST} = 0.03969 ft V_{POST} = 970.30 ft ³ Solution: Volume Capture Required Increase in volume of storm	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(24,447)$ the form off Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.83)]^2}{[(0.92*1.17) + (0.8 * 0.83)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03969)(24,447)$ ement water that must be retained onsite (may be infiltrated or reuse	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) Sed). (220.02)	
Solution: re Development Storm Water Rund S_{PRE} 2.50 in Q _{PRE} 0.00900 ft V_{PRE} 220.02 ft ³ ost Development Storm Water Rund S_{POST} 0.83424 in Q _{POST} 0.03969 ft V _{POST} 970.30 ft ³ Solution: Volume Capture Require Increase in volume of storm 2 Delta Volume Capture	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(24,447)$ off Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.83)]^2}{[(0.92*1.17) + (0.8 * 0.83)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03969)(24,447)$ sement water that must be retained onsite (may be infiltrated or reuse V_{PRE}) Delta Volume Capture = (970.30) - 10000000000000000000000000000000000	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) Sed). (220.02) Where: Where:	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V_{PRE} = 220.02 ft ³ ost Development Storm Water Rund S_{POST} = 0.83424 in Q _{POST} = 0.03969 ft V_{POST} = 970.30 ft ³ Solution: Volume Capture Require Increase in volume of storm Delta Volume Capture= (V _{POST} -	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(24,447)$ off Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.83)]^2}{[(0.92*1.17) + (0.8 * 0.83)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03969)(24,447)$ sement water that must be retained onsite (may be infiltrated or reuse V_{PRE}) Delta Volume Capture = (970.30) - 10000000000000000000000000000000000	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) Sed). (220.02)	



LID BMP Sizing Tool: 100% Volume Capture Formulas: $V_{LID GOAL}=((V_{GOAL}))/(P) = 2544.71$ ft ³ $A_{LID GOAL}=(W)(L) = 696.96$ ft ² Wh	<u>Where:</u> $V_{LID GOAL}$ Required volume of soil in LID BMP. $A_{LID GOAL}$ Footprint of LID BMP area for a given depth (below perforated pince) V_{GOAL} 1,120 ft ³	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. pe if present).	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> <u>of 100% volume capture of the post</u> <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
Input: Solution:	P = 0.4 as a decimal D = 3.7 ft Below perforated pipe if present W = 26.4 ft L = 26.4 ft	7	
Percent of Goal Achieved = 101.34 %	= [(3.7 x 697) / 2,545] x 100	1	
LID BMP Sizing Tool Delta Volume Capture Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01 ft ³	Requirement: V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
$A_{LID DELTA}=(W)(L) = 0.00 \text{ ft}^2$	$V_{\text{LID DELTA}}$ = Required volume of soil in LID BMP $A_{\text{LID DELTA}}$ = Footprint of LID BMP area for a given depth (below perforated pip V_{DELTA} = 750.28 ft ³	pe if present).	<u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	ere: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		Requirement achieved" reaches 100%.
<u>Input:</u>	P =0.0as a decimalD =0.0ftBelow perforated pipe if presentW =0.0ftL =0.0ft		
Solution: N Percent of Requirement Achieved = #DIV/01 %	= #DIV/0!		

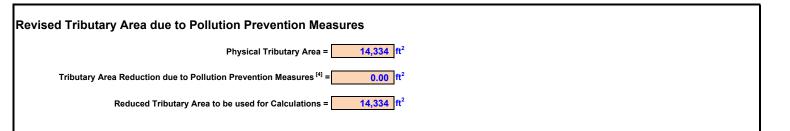




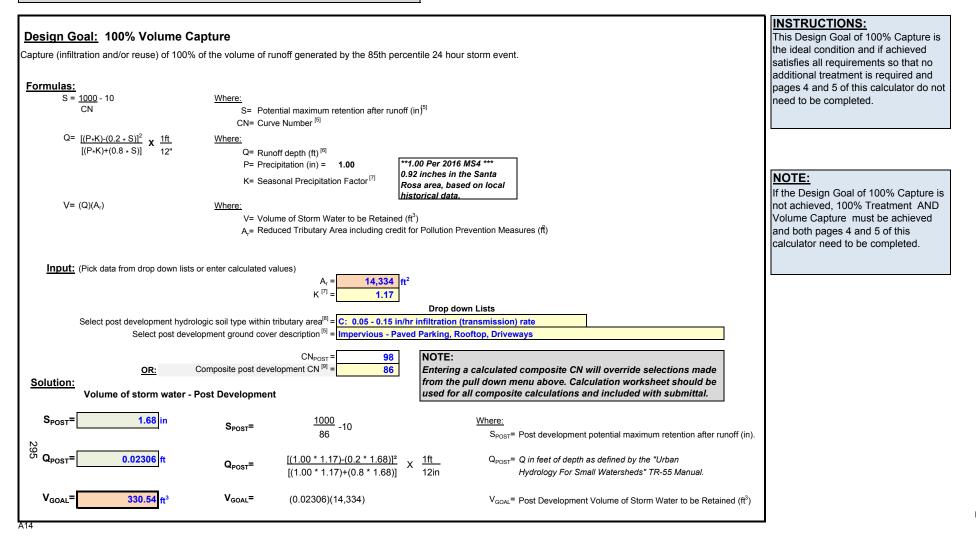
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connec Multiplier = 1	cted Paved Area		INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²			
Area Reduction = 0.00 ft ²			
nterceptor Trees ^[2]			INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees (200 ft ² /tree)	NOTE: Total Interceptor Area Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0	New Deciduous Trees		
Area Reduction due to new Deciduous Trees= 0 ft ²	(100 ft ² /tree)		
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy		
Allowed reduction credit for existing tree canopy= 0 ft ²	Allowed credit for existing tr	ree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed	d by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces [3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft² Buffer Factor = 0.7	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) = Area Reduction = 0.00 ft ²	





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.



Release 7 Rev. 1 5/23/2017



Requirement 1: 100% Treatmen	nt		INSTRUCTIONS:
Treatment of 100% of the flow generated b	y 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
		The C value used for this calculation	on page 3 of this calculator is not
Formula:		is smaller than the value used for	achieved; then Requirement 1-100%
Q _{TREATMENT} = (0.2 in/hr)(A _r)(C _{POST})(K) cfs	Where:	hydraulic Flood Control design.	Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	AND Requirement 2- Volume
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prevention Measures (in Ac	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor[7]	,	
<u>Input:</u>	$A_{r} = 14,334 \text{ ft}^{2} = 0.32906 \text{ Acres}$ $C_{POST}^{[10]} = 0.50 \text{ K}^{[7]} = 1.2$ NOTE:		
Solution: Q _{treatment} = 0.03850 cfs	The Flow Rate cale appropriate BMP.	ulated here should only be used to size the All associated overflow inlets and systems • the Flood Control event.	

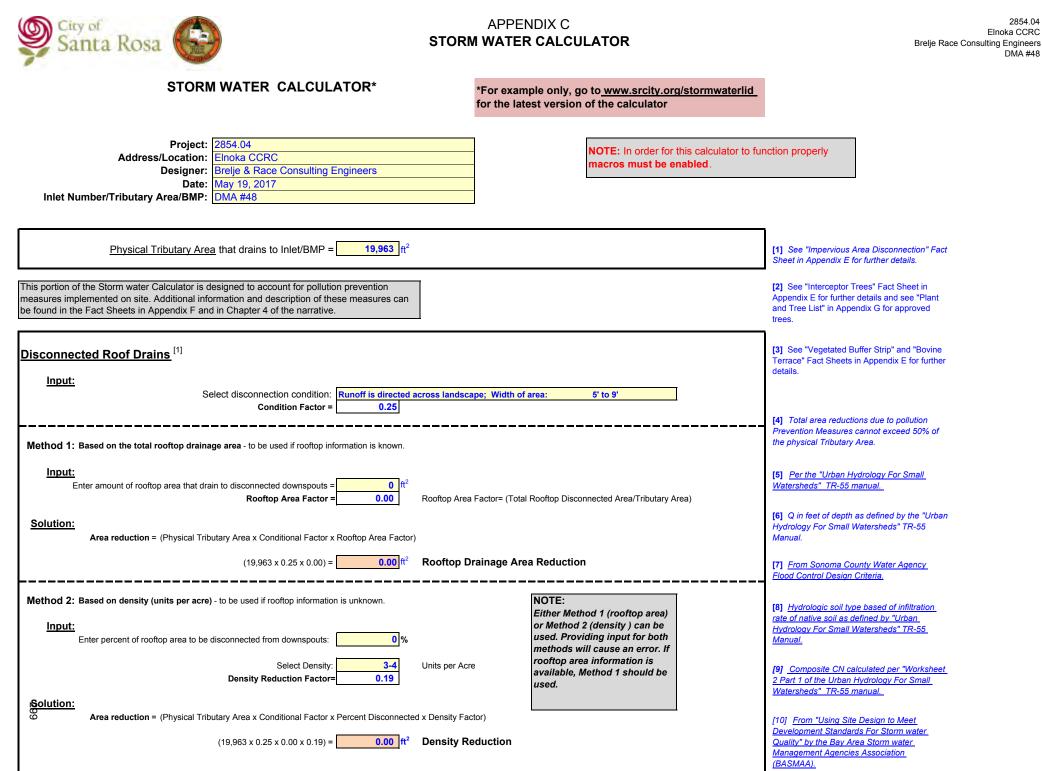
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Doguiromont 2: Dolto Valumo C			
<u>Requirement 2:</u> Delta Volume C		stars and	INSTRUCTIONS:
No increase in volume of runoff leaving the	site due to development for the 85th percentile 24 hour	storm event.	If the Design Goal of 100% Capture on page 3 of this calculator is not
			achieved; then Requirement 1-100%
Formulas:			Treatment, page 4 of the calculator,
S = <u>1000</u> - 10	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ⁵		Capture, this page of the calculator,
	CN= Curve Number ^[5]		must be achieved.
$Q = \frac{[(P \cdot K) - (0.2 \cdot S)]^2}{[(P \cdot K) + (0.8 \cdot S)]} \times \frac{1 \text{ft}}{12 \text{in}}$	Where:		
[(P*K)+(0.8 * S)] 12in	Q= Runoff depth (ft) ^[6]	hes in the Santa Rosa	
		nes in the Santa Rosa nsed on local historical	
	data.		NOTE:
$V= (Q)(A_r)$	Where:		
	V= Volume of Storm Water to be Retained (ft ³) A,= Reduced Tributary Area including credit for Pol	Ilution Prevention Measures (ℓ)	If the amount of volume generated
	$\Delta_{\rm r}$ = reduced moduly field moduling oreal for the		after development is less than or
Input: (Pick data from drop down lists of	or enter calculated values)		equal to that generated before development, Requirement 2-Volume
	$A_r = \frac{14,334}{14,334}$ ft ²		Capture is not required.
	K ^[7] = 1.2		
		Drop down Lists	$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE})$
Select hvdrol	ے ogic soil type within tributary area ^[8] = <mark>C: 0.05 - 0.15 in/hr infilt</mark>		
	opment ground cover description ^[5] = Woods (50%), grass (50		
	opment ground cover description ^[5] = Impervious - Paved Parl		
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
<u>OR</u>	Composite Predevelopment CN ^[9] = 80		
	Composite Post development CN ^[9] = 86		
Solution:			
Pre Development Storm Water Runot			
S _{PRE} = 2.50 in	$S_{PRE} = \frac{1000}{200} -10$	Where:	
	80	S _{PRE} = Pre development potential maximum retention after runoff (in).	
Q _{PRE} = 0.00900 ft			
ΔPRE 0.00900 π	$\mathbf{Q}_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^2}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1 \text{ftr}}{12}$	t Q _{PRE} = Q in feet of depth as defined by the "Urban	
	[(0.92 1.17)+(0.8 2.30)] 12	2in Hydrology For Small Watersheds" TR-55 Manual.	
V _{PPE} = 129.01 ft ³			
V _{PRE} = 129.01 ft ³	[(0.021.17)*(0.0 2.00)] 12 V _{PRE} = (0.00900)(14,334)	Vin Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
	V _{PRE} = (0.00900)(14,334)		
Post Development Storm Water Rund	V _{PRE} = (0.00900)(14,334)		
	V _{PRE} = (0.00900)(14,334)	V_{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Post Development Storm Water Rund S _{POST} = 1.68 in	V_{PRE} = (0.00900)(14,334) off Volume S_{POST} = $\frac{1000}{86}$ -10	V_{PRE} = Pre Development Volume of Storm Water Generated (ft ³) <u>Where:</u> S_{POST} = Post development potential maximum retention after runoff (in).	
Post Development Storm Water Rund	V_{PRE} = (0.00900)(14,334) off Volume S_{POST} = $\frac{1000}{86}$ -10	V_{PRE} = Pre Development Volume of Storm Water Generated (ft ³) <u>Where:</u> S_{POST} = Post development potential maximum retention after runoff (in).	
Post Development Storm Water Rund S _{POST} = 1.68 in	V _{PRE} = (0.00900)(14,334) off Volume S _{POST} = <u>1000</u> -10	V_{PRE} = Pre Development Volume of Storm Water Generated (ft ³) <u>Where:</u> S_{POST} = Post development potential maximum retention after runoff (in).	
Post Development Storm Water Rund S _{POST} = 1.68 in Q _{POST} = 0.01887 ft	$V_{PRE} = (0.00900)(14,334)$ off Volume $S_{POST} = \frac{1000}{86} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*1.68)]^2}{[(0.92*1.17) + (0.8*1.68)]} \times \frac{1\text{fft}}{12}$	V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) <u>Where:</u> S _{POST} = Post development potential maximum retention after runoff (in). <u>t</u> Q _{POST} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Post Development Storm Water Rund S _{POST} = 1.68 in	V_{PRE} = (0.00900)(14,334) off Volume S_{POST} = $\frac{1000}{86}$ -10	V_{PRE} = Pre Development Volume of Storm Water Generated (ft ³) <u>Where:</u> S_{POST} = Post development potential maximum retention after runoff (in).	
Post Development Storm Water Rund $S_{POST} = 1.68$ in $Q_{POST} = 0.01887$ ft $V_{POST} = 270.48$ ft ³	$V_{PRE} = (0.00900)(14,334)$ off Volume $S_{POST} = \frac{1000}{86} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*1.68)]^2}{[(0.92*1.17) + (0.8*1.68)]} \times \frac{1\text{ft}}{12}$ $V_{POST} = (0.01887)(14,334)$	V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) <u>Where:</u> S _{POST} = Post development potential maximum retention after runoff (in). <u>t</u> Q _{POST} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Post Development Storm Water Rund $S_{POST} = 1.68$ in $Q_{POST} = 0.01887$ ft $V_{POST} = 270.48$ ft ³ <u>Solution:</u> Volume Capture Require	$V_{PRE} = (0.00900)(14,334)$ off Volume $S_{POST} = \frac{1000}{86} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*1.68)]^2}{[(0.92*1.17) + (0.8*1.68)]} \times \frac{1\text{ft}}{12}$ $V_{POST} = (0.01887)(14,334)$ ment	V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) <u>Where:</u> S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
Post Development Storm Water Rund S _{POST} = 1.68 in Q _{POST} = 0.01887 ft V _{POST} = 270.48 ft ³ <u>Solution:</u> Volume Capture Require Increase in volume of storm	$V_{PRE} = (0.00900)(14,334)$ off Volume $S_{POST} = \frac{1000}{86} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*1.68)]^2}{[(0.92*1.17) + (0.8*1.68)]} \times \frac{1\text{ft}}{12}$ $V_{POST} = (0.01887)(14,334)$	V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) <u>Where:</u> S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
Post Development Storm Water Rund S _{POST} = 1.68 in Q _{POST} = 0.01887 ft V _{POST} = 270.48 ft ³ Solution: Volume Capture Require Increase in volume of storm	$V_{PRE} = (0.00900)(14,334)$ off Volume $S_{POST} = \frac{1000}{86} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*1.68)]^2}{[(0.92*1.17) + (0.8*1.68)]} \times \frac{1\text{ft}}{12}$ $V_{POST} = (0.01887)(14,334)$ ment water that must be retained onsite (may be infiltrated or r	$V_{PRE} = \text{Pre Development Volume of Storm Water Generated (ft3)}$ $\frac{Where:}{S_{POST}} = \text{Post development potential maximum retention after runoff (in).}$ $Q_{POST} = Q \text{ in feet of depth as defined by the "Urban}$ $Hydrology For Small Watersheds" TR-55 Manual.$ $V_{POST} = \text{Post Development Volume of Storm Water Generated (ft3)}$ reused).	
Post Development Storm Water Rund S _{POST} = 1.68 in Q _{POST} = 0.01887 ft V _{POST} = 270.48 ft ³ <u>Solution:</u> Volume Capture Require Increase in volume of storm	$V_{PRE} = (0.00900)(14,334)$ off Volume $S_{POST} = \frac{1000}{86} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*1.68)]^2}{[(0.92*1.17) + (0.8*1.68)]} \times \frac{1 \text{ft}}{12}$ $V_{POST} = (0.01887)(14,334)$ ment water that must be retained onsite (may be infiltrated or r	$V_{PRE} = \text{Pre Development Volume of Storm Water Generated (ft3)}$ $\frac{Where:}{S_{POST} = \text{Post development potential maximum retention after runoff (in).}}{S_{POST} = Q \text{ in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.}}$ $V_{POST} = \text{Post Development Volume of Storm Water Generated (ft3)}$ reused). $B_{1} - (129.01)$	
Post Development Storm Water Rund S_{POST} = 1.68 in Q_{POST} = 0.01887 ft V_{POST} = 270.48 ft ³ Solution: Volume Capture Require Increase in volume of storm of Delta Volume Capture = $(V_{POST}-V_{POST})$	$V_{PRE} = (0.00900)(14,334)$ off Volume $S_{POST} = \frac{1000}{86} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2^{*}1.68)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}1.68)]} \times \frac{1ft}{12}$ $V_{POST} = (0.01887)(14,334)$ ment water that must be retained onsite (may be infiltrated or r $P_{PRE})$ Delta Volume Capture= (270.48)	$V_{PRE} = \text{Pre Development Volume of Storm Water Generated (ft3)}$ $\frac{Where:}{S_{POST}} = \text{Post development potential maximum retention after runoff (in).}$ $\frac{L}{2\text{in}} = \frac{Q_{\text{in} \text{ feet of depth as defined by the "Urban}}{Hydrology For Small Watersheds" TR-55 Manual.}$ $V_{POST} = \text{Post Development Volume of Storm Water Generated (ft3)}$ reused). $3) - (129.01)$ Where:	
Post Development Storm Water Rund S _{POST} = 1.68 in Q _{POST} = 0.01887 ft V _{POST} = 270.48 ft ³ Solution: Volume Capture Require Increase in volume of storm of Delta Volume Capture = (V _{POST} -V _P)	$V_{PRE} = (0.00900)(14,334)$ off Volume $S_{POST} = \frac{1000}{86} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2^{*}1.68)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}1.68)]} \times \frac{1ft}{12}$ $V_{POST} = (0.01887)(14,334)$ ment water that must be retained onsite (may be infiltrated or r $P_{PRE})$ Delta Volume Capture= (270.48)	$V_{PRE} = \text{Pre Development Volume of Storm Water Generated (ft3)}$ $\frac{Where:}{S_{POST} = \text{Post development potential maximum retention after runoff (in).}}{S_{POST} = Q \text{ in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.}}$ $V_{POST} = \text{Post Development Volume of Storm Water Generated (ft3)}$ reused). $B_{1} - (129.01)$	



LID BMP Sizing Tool: 100% Volume Capture Formulas: $V_{LID GOAL}=((V_{GOAL}))/(P) = 751.23$ ft ³ $A_{LID GOAL}=(W)(L) = 249.64$ ft ²	Ure Goal: V_{GOAL} $\frac{Where:}{V_{LID GOAL}} = Required volume of soil in LID BMP.$ $A_{LID GOAL} = Footprint of LID BMP area for a given depth (below perforated pin) V_{GOAL} = \underbrace{331}_{} ft^{3} Where:$	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. pe if present).	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> <u>of 100% volume capture of the post</u> <u>development condition.</u> Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet) P = as a decimal		
Solution: Percent of Goal Achieved = 101.02	D = 3.0 ft Below perforated pipe if present W = 15.8 ft L = 15.8 ft % = [(3.0 x 250) / 751] x 100	7	
LID BMP Sizing Tool Delta Volume Captu	re Requirement: V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size
$\frac{\text{Formulas:}}{V_{\text{LID DELTA}}=((V_{\text{DELTA}}))/(P) = \frac{\text{\#DIV/0!}}{\text{\#DIV/0!}} \text{ft}^{3}$ $A_{\text{LID DELTA}}=(W)(L) = \boxed{0.00} \text{ft}^{2}$	Where: VLID DELTA= Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below perforated pines)	based BMPs. Not required if site requires treatment only.	a LID BMP to achieve the <u>design</u> <u>requirement of the delta volume</u> <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	VDELTA 141.48 ft³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
<u>Input:</u>	P =0.0as a decimalD =0.0ftBelow perforated pipe if presentW =0.0ftL =0.0ft		
Solution: N Percent of Requirement Achieved = #DIV/0!	% = #DIV/0!		

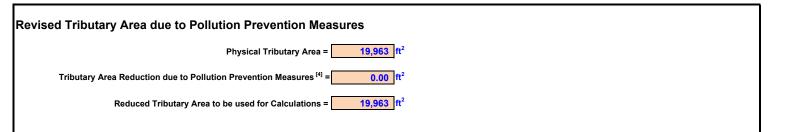




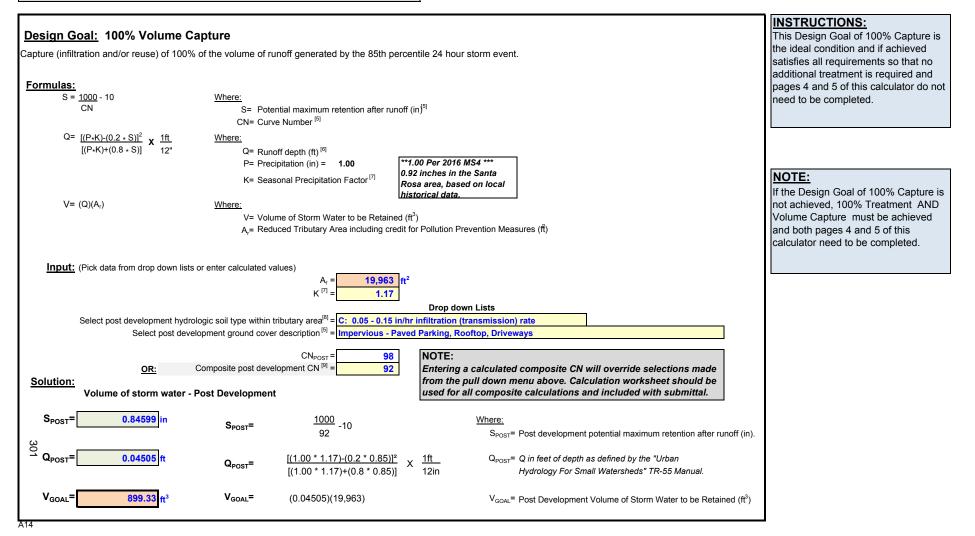
		_
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connection Multiplier = 1	ected Paved Area	INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²		
Area Reduction = 0.00 ft ²		
Interceptor Trees ^[2]		INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees NOTE: Total Interceptor Area (200 ft²/tree) Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0	New Deciduous Trees	
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)	
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy	
Allowed reduction credit for existing tree canopy=	Allowed credit for existing tree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed by evergreen + deciduous + existing canopy	

Buffer	Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ²	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter the area draining to these features.
Soluti	Buffer Factor = 0.7	, , , , , , , , , , , , , , , , , , ,
ω	Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) = Area Reduction = 0.00 ft ²	
0		





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.



Release 7 Rev. 1 5/23/2017



Requirement 1: 100% Treatme	nt		INSTRUCTIONS:
Treatment of 100% of the flow generated b	by 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
		The C value used for this calculation	on page 3 of this calculator is not
Formula:		is smaller than the value used for	achieved; then Requirement 1-100%
Q _{TREATMENT} = (0.2 in/hr)(A _r)(C _{POST})(K) cfs	Where:	hydraulic Flood Control design.	Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	AND Requirement 2- Volume
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prevention Measures (in Acre	s) to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]		
Input:	A _r = 19,963 ft^2 = 0.45829 Acres C _{POST} ^[10] = 0.56 K ^[7] = 1.2		
	NOTE:		
Solution: Q _{TREATMENT} = 0.06005 cfs	appropriate BMP. A	lated here should only be used to size the Il associated overflow inlets and systems the Flood Control event.	

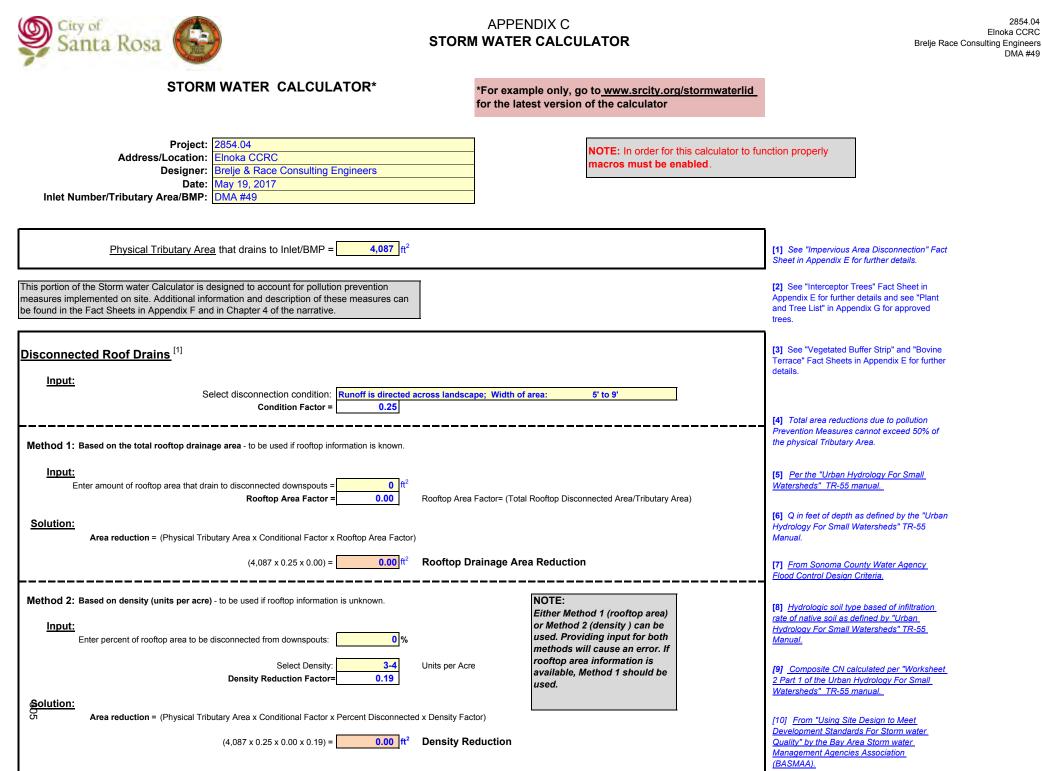
302



	apture site due to development for the 85th percentile 24 hour storm	event.	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not
Formulas:			achieved; then Requirement 1-100%
S = <u>1000</u> - 10	Where:		Treatment, page 4 of the calculator,
CN	S= Potential maximum retention after runoff (in) ⁵		AND Requirement 2- Volume
	CN= Curve Number ^[5]		Capture, this page of the calculator,
$O = [(P,K) (0.2, S)]^2$ 1ft	Where:		must be achieved.
$\begin{array}{r} Q = & \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} X & \frac{1 f t}{12 i n} \end{array}$			
$[(P*K)^+(0.6*5)]$ 12in	Q = Runoff depth (ft) ^[6]		
	P= Precipitation (in) = 0.92 0.92 inches in t K= Seasonal Precipitation Eactor ^[7] area, based on		
	K= Seasonal Precipitation Factor ^[7] area, based on data.	iocai historicai	
$V=(Q)(A_r)$	Where:		NOTE:
	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A _r = Reduced Tributary Area including credit for Pollution I	Prevention Measures (ť)	after development is less than or
			equal to that generated before
Input: (Pick data from drop down lists o	r enter calculated values)		development, Requirement 2-Volun
	$A_r = 19,963 \text{ ft}^2$		Capture is not required.
	K ^[7] = 1.2		
		own Lists	$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE}$
Select hydrole	brop a brop a gic soil type within tributary area ⁽⁸⁾ = $C: 0.05 - 0.15$ in/hr infiltration		
	pment ground cover description ^[5] = Woods (50%), grass (50%) co		
Select piedeveld	pment ground cover description ^[5] = Impervious - Paved Parking, F	Reoffen Drivewave	
Select post develo	CN _{PRE} = 76	Contop, Driveways	
0.7	CN _{POST} = 90.3		
	Composite Predevelopment CN ^[9] = 80		
	10 0 10 10 10 10 10 10 10 10 10 10 10 10		
C	omposite Post development CN ^[9] = 92		
	omposite Post development CN ^[9] = 92		
Solution:			
C <u>Solution:</u> re Develop <u>ment Storm Wat</u> er Runof	f Volume	Where:	
Solution:	f Volume S _{PRE} = <u>1000</u> _10	Where:	
Solution: re Development Storm Water Runof	f Volume	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: re Development Storm Water Runof S _{PRE} = 2.50 in	f Volume S _{PRE} = <u>1000</u> -10 80	S _{PRE} = Pre development potential maximum retention after runoff (in).	
C <u>Solution:</u> re Develop <u>ment Storm Wat</u> er Runof	f Volume S _{PRE} = <u>1000</u> -10 80	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: re Development Storm Water Runof S _{PRE} = 2.50 in	f Volume S _{PRE} = <u>1000</u> _10	S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: e Development Storm Water Runof S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	f Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: re Development Storm Water Runof S _{PRE} = 2.50 in	f Volume S _{PRE} = <u>1000</u> -10 80	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: re Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 179.67 ft ³	f Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(19,963)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: re Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 179.67 ft ³ ost Development Storm Water Runof	f Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(19,963)$ off Volume	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³)	
Solution: The Development Storm Water Runof $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 179.67$ ft ³	f Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(19,963)$ off Volume $S_{POST} = \frac{1000}{-10} -10$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: Where:	
Solution: re Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 179.67 ft ³ post Development Storm Water Runo	f Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(19,963)$ off Volume	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³)	
Solution: re Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 179.67 ft ³ ost Development Storm Water Runof S_{POST} = 0.84599 in	f Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(19,963)$ off Volume $S_{POST} = \frac{1000}{92} -10$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: Where:	
Solution: re Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 179.67 ft ³ ost Development Storm Water Runof	f Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(19,963)$ off Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.85)]^2}{92} \times \frac{1 \text{ft}}{12}$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: Where:	
Solution: re Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 179.67 ft ³ ost Development Storm Water Runof S_{POST} = 0.84599 in	f Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(19,963)$ off Volume $S_{POST} = \frac{1000}{-10} -10$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST Post development potential maximum retention after runoff (in).	
Solution: re Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 179.67 ft ³ ost Development Storm Water Runof S_{POST} = 0.84599 in	f Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(19,963)$ off Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.85)]^2}{92} \times \frac{1 \text{ft}}{12}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban	
Solution: re Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 179.67 ft ³ ost Development Storm Water Runof S_{POST} = 0.84599 in Q_{POST} = 0.03898 ft	f Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(19,963)$ off Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.85)]^2}{92} \times \frac{1 \text{ft}}{12}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban	
Solution: re Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 179.67 ft ³ Development Storm Water Runof SPOST= 0.84599 in Q _{POST} = 0.03898 ft	f Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(19,963)$ off Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.85)]^2}{[(0.92*1.17) + (0.8 * 0.85)]} \times \frac{1 \text{ft}}{12 \text{in}}$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: re Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 179.67 ft ³ Dost Development Storm Water Runof S_{POST} = 0.84599 in Q_{POST} = 0.03898 ft V_{POST} = 778.16 ft ³	f Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(19,963)$ off Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*0.85)]^2}{[(0.92*1.17) + (0.8*0.85)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{POST} = (0.03898)(19,963)$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: re Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 179.67 ft ³ Dost Development Storm Water Runof S_{POST} = 0.84599 in Q_{POST} = 0.03898 ft V_{POST} = 778.16 ft ³ Solution: Volume Capture Requirer	f Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(19,963)$ off Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.85)]^2}{[(0.92*1.17) + (0.8 * 0.85)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.03898)(19,963)$ ment	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³)	
Solution: re Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 179.67 ft ³ ost Development Storm Water Runof S_{POST} = 0.84599 in Q_{POST} = 0.03898 ft V_{POST} = 778.16 ft ³ Solution: Volume Capture Requirer Increase in volume of storm v	f Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(19,963)$ off Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*0.85)]^2}{[(0.92*1.17) + (0.8*0.85)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{POST} = (0.03898)(19,963)$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³)	
Solution: re Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 179.67 ft ³ ost Development Storm Water Runof S_{POST} = 0.84599 in Q_{POST} = 0.03898 ft V_{POST} = 778.16 ft ³ Solution: Volume Capture Requirer Increase in volume of storm v	f Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(19.963)$ off Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*0.85)]^2}{[(0.92*1.17) + (0.8*0.85)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.03898)(19.963)$ ment vater that must be retained onsite (may be infiltrated or reused	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) I). POST	
Solution: re Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 179.67 ft ³ ost Development Storm Water Runof S_{POST} = 0.84599 in Q_{POST} = 0.03898 ft V_{POST} = 778.16 ft ³ Solution: Volume Capture Requirer	f Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(19.963)$ off Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*0.85)]^2}{[(0.92*1.17) + (0.8*0.85)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.03898)(19.963)$ ment vater that must be retained onsite (may be infiltrated or reused	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) I). 9.67)	
Solution: re Development Storm Water Runof S_{PRE} 2.50 in Q_{PRE} 0.00900 ft V_{PRE} 179.67 ft ³ ost Development Storm Water Runof S_{POST} 0.84599 in Q_{POST} 0.03898 ft V_{POST} 778.16 ft ³ Solution: Volume Capture Requirer Increase in volume of storm v Work Delta Volume Capture= (V_{POST}-V_P)	f Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(19.963)$ off Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*0.85)]^2}{[(0.92*1.17) + (0.8*0.85)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03898)(19.963)$ ment vater that must be retained onsite (may be infiltrated or reused marks) RE Delta Volume Capture = (778.16) - (17)	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) I). 9.67) Where: Where:	
Solution: re Development Storm Water Runof S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 179.67 ft ³ Dost Development Storm Water Runof S_{POST} = 0.84599 in Q_{POST} = 0.03898 ft V_{POST} = 778.16 ft ³ Solution: Volume Capture Requirer Increase in volume of storm v W W Delta Volume Capture= V	f Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(19.963)$ off Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*0.85)]^2}{[(0.92*1.17) + (0.8*0.85)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03898)(19.963)$ ment vater that must be retained onsite (may be infiltrated or reused marks) RE Delta Volume Capture = (778.16) - (17)	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) I). 9.67)	



LID BMP Sizing Tool: 100% Volume Capt Formulas: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 2043.94$ ft ³ $A_{LID GOAL} = (W)(L) = 718.24$ ft ²	ure Goal; V _{GOAL} Where: V _{LID GOAL} = Required volume of soil in LID BMP. A _{LID GOAL} = Footprint of LID BMP area for a given depth (below perforated pi V _{GOAL} = 899 Where:	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
Input:	P =0.4as a decimalD =2.9ftBelow perforated pipe if presentW =26.8ftL =26.8ft		
Solution: Percent of Goal Achieved = 101.91	% = [(2.9 x 718) / 2,044] x 100	7	
LID BMP Sizing Tool Delta Volume Captu		NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
	Where: VLID DELTA VLID DELTA Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below perforated pi VDELTA 598.49	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be
Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0!) ft ³	Where: V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated pi	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width
Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/0! ft^3$ $A_{LID DELTA} = (W)(L) = 0.00 ft^2$	Where: V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated pi V _{DELTA} = 598.49 ft ³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet)	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Requirement achieved" reaches

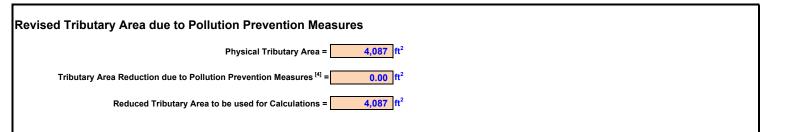




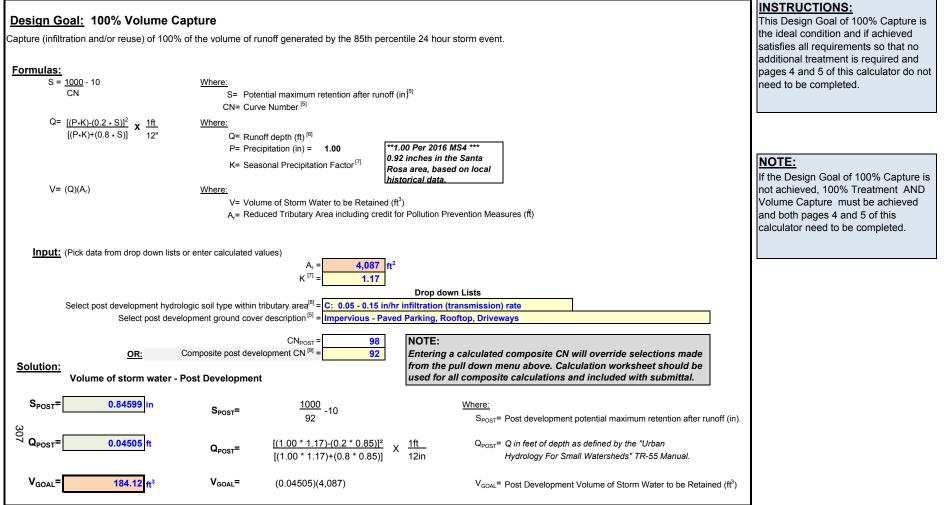
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connec Multiplier = 1	cted Paved Area		INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²			
Area Reduction = 0.00 ft ²			
nterceptor Trees ^[2]			INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees (200 ft ² /tree)	NOTE: Total Interceptor Area Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0	New Deciduous Trees		
Area Reduction due to new Deciduous Trees= 0 ft ²	(100 ft ² /tree)		
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy		
Allowed reduction credit for existing tree canopy= 0 ft ²	Allowed credit for existing tr	ree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed	d by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ² Buffer Factor = 0.7	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) = Area Reduction = 0.00 ft ² σ	





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.



Release 7 Rev. 1 5/23/2017



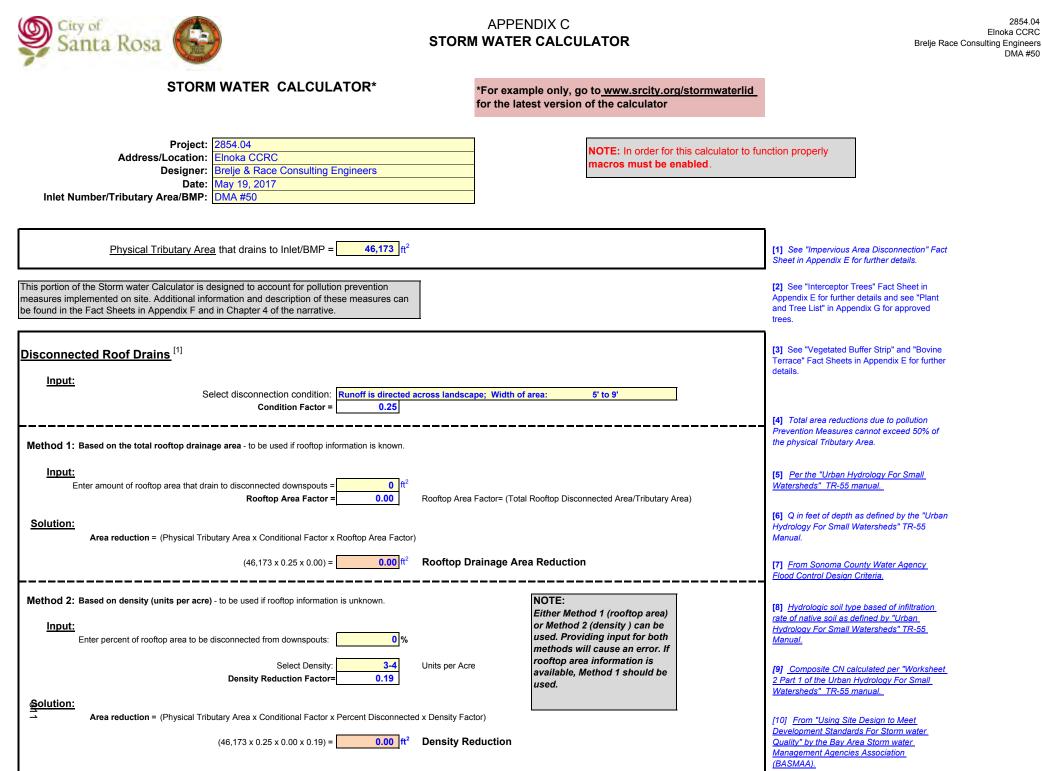
Requirement 1: 100% Treatment	nt		INSTRUCTIONS:
	y 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
Formula:		The C value used for this calculation is smaller than the value used for	on page 3 of this calculator is not achieved; then Requirement 1-100%
$Q_{\text{TREATMENT}}$ (0.2 in/hr)(A _r)(C _{POST})(K) cfs	Where:	hydraulic Flood Control design.	Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	AND Requirement 2- Volume
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]		Capture, page 5 of the calculator,
	A_r = Reduced Tributary Area including credit for Pollution Prevention	Measures (in Acres) to size the overflow bypass.	must be achieved.
Innert	K = Seasonal Precipitation Factor ^[7]		
Input:	A _r = 4.087 ft ² = 0.09382 Acres		
	$C_{POST}^{[10]} = 0.56$		
	K ^[7] = 1.2		
	NOT	E:	
Solution:		Flow Rate calculated here should only be used to size the	
0		opriate BMP. All associated overflow inlets and systems	
Q _{TREATMENT} = 0.01229 cfs	Q _{TREATMENT} = (0.2)(0.0938)(0.56)(1.17)	IId be sized for the Flood Control event.	



lo increase in volume of runoff leaving the	apture site due to development for the 85th percentile 24 hour storm	n event.	INSTRUCTIONS: If the Design Goal of 100% Capture
			on page 3 of this calculator is not
Formulaa			achieved; then Requirement 1-100%
Formulas:	Million and		Treatment, page 4 of the calculator,
S = <u>1000</u> - 10 CN	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff $(in)^{5}$		Capture, this page of the calculator,
	CN= Curve Number ^[5]		must be achieved.
$Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) - (0.2 * S)]^2} \times \frac{1ft}{1}$	Where:		
[(P*K)+(0.8 * S)] 12in	Q= Runoff depth (ft) ^[6]		
		the Santa Rosa	
	K= Seasonal Precipitation Factor ^[7] area, based of data.	n local historical	
$V= (Q)(A_r)$	Where:		NOTE:
	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A _r = Reduced Tributary Area including credit for Pollution	Prevention Measures (ť)	after development is less than or
			equal to that generated before
Input: (Pick data from drop down lists o	r enter calculated values)		development, Requirement 2-Volum
<u> </u>	$A_r = 4.087 \text{ ft}^2$		Capture is not required.
	K ^[7] = 1.2		
		davum linta	$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE}$
Onland In dealer		down Lists	
	gic soil type within tributary area ^[8] = $\frac{C}{C} = 0.05 - 0.15$ in/hr infiltration		
	pment ground cover description ^[5] = Woods (50%), grass (50%) co		
Select post develo	pment ground cover description ^[5] = Impervious - Paved Parking,	Rooftop, Driveways	
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
	Composite Predevelopment CN ^[9] = 80		
C	omposite Post development CN ^[9] = 92		
Solution:			
a Dovolonment Sterm Water Door of	f Volume		
e Development Storm water Runot			
		Whore:	
S _{PRE} = 2.50 in		Where:	
re Development Storm Water Runof S _{PRE} = 2.50 in		Where: S _{PRE} = Pre development potential maximum retention after runoff (in).	
S _{PRE} = 2.50 in	$S_{PRE} = \frac{1000}{80} - 10$	S _{PRE} = Pre development potential maximum retention after runoff (in).	
•	$S_{PRE} = \frac{1000}{80} - 10$		
S _{PRE} = 2.50 in		S _{PRE} = Pre development potential maximum retention after runoff (in).	
S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1ft}{12in}$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
S _{PRE} = 2.50 in	$S_{PRE} = \frac{1000}{80} - 10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
$S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 36.78$ ft ³	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(4,087)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
$S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 36.78$ ft ³	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(4,087)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
$S_{PRE} = \underbrace{2.50}_{in}$ $Q_{PRE} = \underbrace{0.00900}_{ft}$ $V_{PRE} = \underbrace{36.78}_{ft^3}$ ost Development Storm Water Rund	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(4,087)$ ff Volume	 S_{PRE}= Pre development potential maximum retention after runoff (in). Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	
$S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 36.78$ ft ³	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(4,087)$ Iff Volume $S_{POST} = \frac{1000}{-10} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where:	
$S_{PRE} = \underbrace{2.50}_{in}$ $Q_{PRE} = \underbrace{0.00900}_{ft}$ $V_{PRE} = \underbrace{36.78}_{ft^3}$ ost Development Storm Water Rund	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(4,087)$ ff Volume	 S_{PRE}= Pre development potential maximum retention after runoff (in). Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	
$S_{PRE} = \underbrace{2.50}_{in}$ $Q_{PRE} = \underbrace{0.00900}_{ft}$ $V_{PRE} = \underbrace{36.78}_{ft^3}$ ost Development Storm Water Rund $S_{POST} = \underbrace{0.84599}_{in}$ in	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(4,087)$ ff Volume $S_{POST} = \frac{1000}{92} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in).	
$S_{PRE} = \underbrace{2.50}_{in}$ $Q_{PRE} = \underbrace{0.00900}_{ft}$ $V_{PRE} = \underbrace{36.78}_{ft^3}$ ost Development Storm Water Rund	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(4,087)$ $ff \text{ Volume}$ $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*0.85)]^2}{92} \times \frac{1 \text{ft}}{12}$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST= Post development potential maximum retention after runoff (in). QPOST= Q in feet of depth as defined by the "Urban	
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S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 36.78 ft ³ post Development Storm Water Rund S_{POST} = 0.84599 in Q_{POST} = 0.03898 ft	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(4,087)$ ff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2^{*}0.85)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}0.85)]} \times \frac{1 \text{ft}}{12 \text{in}}$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
$S_{PRE} = \underbrace{2.50}_{in}$ $Q_{PRE} = \underbrace{0.00900}_{ft}$ $V_{PRE} = \underbrace{36.78}_{ft^3}$ ost Development Storm Water Rund $S_{POST} = \underbrace{0.84599}_{in}$ in	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(4,087)$ $ff \text{ Volume}$ $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*0.85)]^2}{92} \times \frac{1 \text{ft}}{12}$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST= Post development potential maximum retention after runoff (in). QPOST= Q in feet of depth as defined by the "Urban	
$S_{PRE} = \underbrace{2.50}_{in}$ $Q_{PRE} = \underbrace{0.00900}_{ft}$ $V_{PRE} = \underbrace{36.78}_{ft^3} \text{ft}^3$ ost Development Storm Water Rund $S_{POST} = \underbrace{0.84599}_{in} \text{in}$ $Q_{POST} = \underbrace{0.03898}_{ft} \text{ft}^3$	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(4,087)$ ff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2^{*}0.85)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}0.85)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03898)(4,087)$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
$S_{PRE} = \underbrace{2.50}_{in}$ $Q_{PRE} = \underbrace{0.00900}_{ft}$ $V_{PRE} = \underbrace{36.78}_{ft^3}$ $Development Storm Water Runds S_{POST} = \underbrace{0.84599}_{in} Q_{POST} = \underbrace{0.03898}_{ft} V_{POST} = \underbrace{159.31}_{ft^3} Solution: Volume Capture Required$	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) + (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(4,087)$ ff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) + (0.2^{*}0.85)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}0.85)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03898)(4,087)$ <pre>ment</pre>	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Post development potential maximum retention after runoff (in). V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
$S_{PRE} = \underbrace{2.50}_{in}$ $Q_{PRE} = \underbrace{0.00900}_{ft}$ $V_{PRE} = \underbrace{36.78}_{ft^3}$ $Dost Development Storm Water Runce$ $S_{POST} = \underbrace{0.84599}_{in}$ $Q_{POST} = \underbrace{0.03898}_{ft}$ $V_{POST} = \underbrace{159.31}_{ft^3}$ $\underline{Solution:} Volume Capture Required Increase in volume of storm Volume Odd Volume Od$	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(4,087)$ ff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2^{*}0.85)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}0.85)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03898)(4,087)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Post development potential maximum retention after runoff (in). V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
$S_{PRE} = \underbrace{2.50}_{in}$ $Q_{PRE} = \underbrace{0.00900}_{ft}$ $V_{PRE} = \underbrace{36.78}_{ft}^{ft}$ ost Development Storm Water Rund $S_{POST} = \underbrace{0.84599}_{in}$ $Q_{POST} = \underbrace{0.03898}_{ft}$ $V_{POST} = \underbrace{159.31}_{in}^{ft}$ Solution: Volume Capture Required Increase in volume of storm v	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) + (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(4,087)$ ff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) + (0.2^{*}0.85)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}0.85)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03898)(4,087)$ <pre>ment</pre>	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Post Development Volume of Storm Water Generated (ft ³) V _{POST} = Post Development Volume of Storm Water Generated (ft ³) v _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
$S_{PRE} = \underbrace{2.50}_{in}$ $Q_{PRE} = \underbrace{0.00900}_{ft}$ $V_{PRE} = \underbrace{36.78}_{ft^3}$ $Dost Development Storm Water Runce$ $S_{POST} = \underbrace{0.84599}_{in}$ $Q_{POST} = \underbrace{0.03898}_{ft}$ $V_{POST} = \underbrace{159.31}_{ft^3}$ $\underline{Solution:} Volume Capture Required Increase in volume of storm Volume Odd Volume Od$	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) + (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(4,087)$ ff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) + (0.2^{*}0.85)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}0.85)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03898)(4,087)$ <pre>ment</pre>	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Post Development Volume of Storm Water Generated (ft ³) V _{POST} = Post Development Volume of Storm Water Generated (ft ³) v _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
$S_{PRE} = \underbrace{2.50}_{in}$ $Q_{PRE} = \underbrace{0.00900}_{ft}$ $V_{PRE} = \underbrace{36.78}_{ft} ft^{3}$ ost Development Storm Water Runce $S_{POST} = \underbrace{0.84599}_{in}$ $Q_{POST} = \underbrace{0.03898}_{ft}$ $V_{POST} = \underbrace{159.31}_{in} ft^{3}$ Solution: Volume Capture Required Increase in volume of storm v	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1 ft}{12 in}$ $V_{PRE} = (0.00900)(4,087)$ Iff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2^{*}0.85)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}0.85)]} \times \frac{1 ft}{12 in}$ $V_{POST} = (0.03898)(4,087)$ ment vater that must be retained onsite (may be infiltrated or reuse response to the second se	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³) vd). 6.78) Where:	
$S_{PRE} = \underbrace{2.50}_{\text{in}}$ $Q_{PRE} = \underbrace{0.00900}_{\text{ft}}$ $V_{PRE} = \underbrace{36.78}_{\text{ft}^3}$ ost Development Storm Water Rund $S_{POST} = \underbrace{0.84599}_{\text{in}}$ $Q_{POST} = \underbrace{0.03898}_{\text{ft}}$ $V_{POST} = \underbrace{159.31}_{\text{in}}$ $\underbrace{\text{Solution: Volume Capture Requirem}_{\text{increase in volume of storm V}}$ $Delta Volume Capture = (V_{POST} - V_{POST})$	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1 ft}{12 in}$ $V_{PRE} = (0.00900)(4,087)$ Iff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2^{*}0.85)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}0.85)]} \times \frac{1 ft}{12 in}$ $V_{POST} = (0.03898)(4,087)$ ment vater that must be retained onsite (may be infiltrated or reuse response to the second se	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³) vd). 6.78) Where:	
$S_{PRE} = \underbrace{2.50}_{\text{in}}$ $Q_{PRE} = \underbrace{0.00900}_{\text{ft}}$ $V_{PRE} = \underbrace{36.78}_{\text{ft}^3}$ ost Development Storm Water Rund $S_{POST} = \underbrace{0.84599}_{\text{in}}$ $Q_{POST} = \underbrace{0.03898}_{\text{ft}}$ $V_{POST} = \underbrace{159.31}_{\text{ft}^3}$ <u>Solution:</u> Volume Capture Required Increase in volume of storm v \bigcup_{0}^{00} Delta Volume Capture = (V_{POST} - V_{POST})	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} \times \frac{1 ft}{12 in}$ $V_{PRE} = (0.00900)(4,087)$ Iff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92^{*}1.17) - (0.2^{*}0.85)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}0.85)]} \times \frac{1 ft}{12 in}$ $V_{POST} = (0.03898)(4,087)$ ment vater that must be retained onsite (may be infiltrated or reuse response to the second se	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Post Development Potential maximum retention after runoff (in). Q _{POST} = Post Development Potential maximum retention after runoff (in). 0 Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³) ed). 6.78)	



LID BMP Sizing Tool: 100% Volume Capt Formulas: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 263.03$ ft ³ $A_{LID GOAL} = (W)(L) = 48.00$ ft ²	Where: $V_{LID GOAL}$ Required volume of soil in LID BMP. A_LID GOAL = Footprint of LID BMP area for a given depth (below perforated pi V_GOAL = 184	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. pe if present).	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
Input:	P = 0.7 as a decimal D = 5.5 ft W = 4.0 ft L = 12.0 ft		
Solution: Percent of Goal Achieved = 100.3	% = [(5.5 x 48) / 263] x 100	7	
LID BMP Sizing Tool Delta Volume Captu		NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
$V_{LID DELTA} = ((V_{DELTA}))/(P) = \frac{\#DIV/0!}{\#DIV/0!} ft^{3}$ $A_{LID DELTA} = (W)(L) = \boxed{0.00} ft^{2}$	Where: V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated pi V _{DELTA} = 122.53		<u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
Input:	P = 0.0 as a decimal D = 0.0 ft Below perforated pipe if present W = 0.0 ft L = 0.0 ft		
Solution: ω Percent of Requirement Achieved = #DIV/01	% = #DIV/0!		

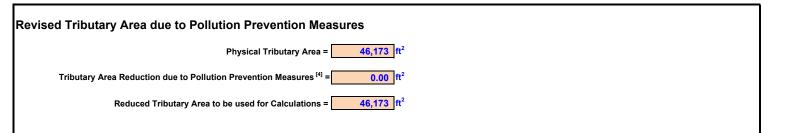




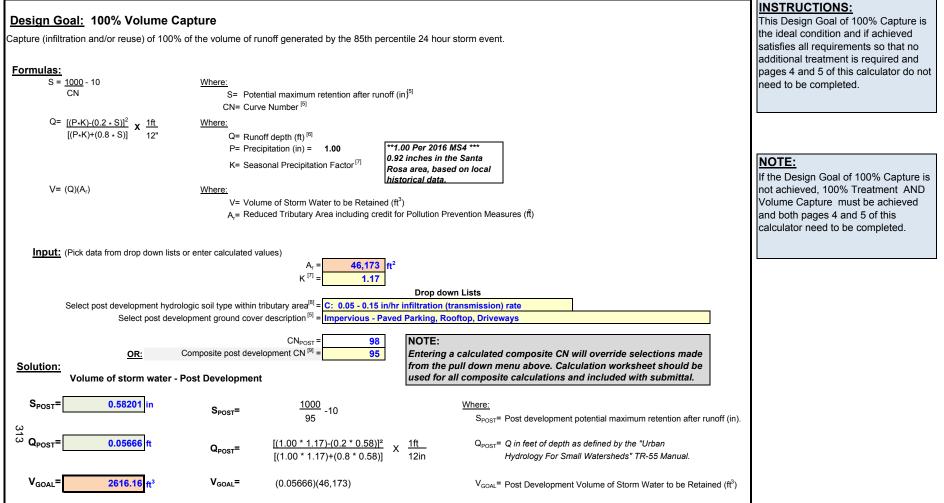
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conne Multiplier = 1	ected Paved Area		INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²			
Area Reduction = 0.00 ft ²			
Interceptor Trees ^[2] Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=	T	NOTE: Fotal Interceptor Area	INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area
Area Reduction due to new Evergreen Trees=0ft ²	(LEE WALL)	Reduction is limited to 50% of he physical tributary area.	of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Deciduous Trees=0 ft ²	New Deciduous Trees (100 ft ² /tree)		
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy		
Allowed reduction credit for existing tree canopy= 0 ft ²	Allowed credit for existing tree of	canopy = 50 % of actual canopy square fool	age
Area Reduction = 0 ft ²	= Sum of areas managed by	y evergreen + deciduous + existing can	рру

Buffer Strips & Bovine Terraces ^[3]	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine
Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ²	terraces. Runoff Must be direct to these features as sheet flow. Enter
Buffer Factor = 0.7 Solution:	the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) =	
Area Reduction = 0.00 ft ²	
2	-





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.





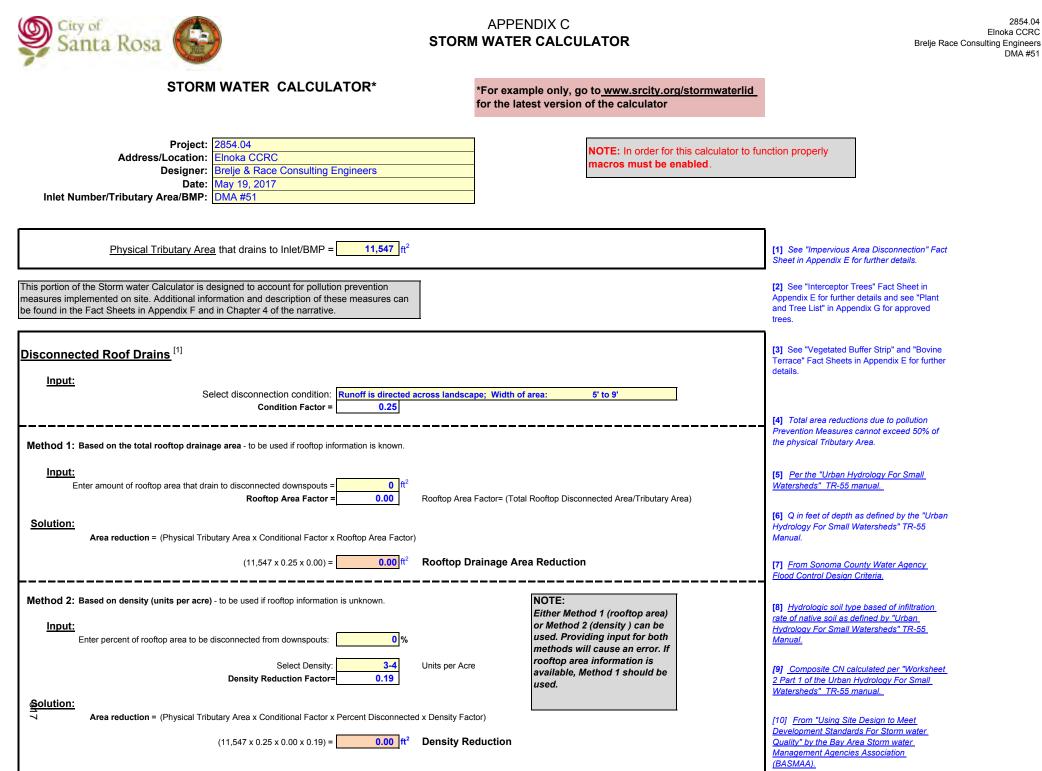
Requirement 1: 100% Treatme	nt		INSTRUCTIONS:
Treatment of 100% of the flow generated b	by 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
		The C value used for this calculation	on page 3 of this calculator is not
Formula:		is smaller than the value used for	achieved; then Requirement 1-100%
$Q_{TREATMENT}$ = (0.2 in/hr)(A_r)(C_{POST})(K) cfs	Where:		Treatment, this page of the calculator,
	Q _{TREATMENT} Design flow rate required to be treated (cfs)	The table of values can be found here	
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]		Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prevention Measures (in	Acres) to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]		
Input:	$A_{r} = \frac{46,173}{0.61} \text{ ft}^{2} = \frac{1.06}{0.61} \text{ Acres}$ $K^{(7)} = \frac{1.2}{0.61} \text{ ft}^{2} = \frac{1.2}{0.61} \text{ ft}^{$		
	NOTE:		
Solution: Q _{TREATMENT} = 0.15130 cfs	appropriate BM	alculated here should only be used to size the P. All associated overflow inlets and systems for the Flood Control event.	



Requirement 2: Delta Volume	Capture		INSTRUCTIONS:
	he site due to development for the 85th percentile 24 hour storm	event.	If the Design Goal of 100% Capture on page 3 of this calculator is not achieved; then Requirement 1-100%
Formulas:			Treatment, page 4 of the calculator,
S = 1000 - 10	Where:		AND Requirement 2- Volume
CN IS	S= Potential maximum retention after runoff (in) ⁵		Capture, this page of the calculator,
	CN= Curve Number ^[5]		must be achieved.
$Q = [(P * K) - (0.2 * S)]^2$ 1ft	Where:		must be achieved.
$\begin{array}{r} Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} \times \frac{1 f t}{12 i n} \end{array}$	Q= Runoff depth (ft) ^[6]		
	P = Precipitation (in) = 0.92 0.92 inches in table	he Santa Rosa	
	K= Seasonal Precipitation Factor ^[7] area, based on		
	data		NOTE
$V= (Q)(A_r)$	Where:		NOTE:
	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A _r = Reduced Tributary Area including credit for Pollution F	Prevention Measures (f)	after development is less than or
			equal to that generated before
Input: (Pick data from drop down lists	s or enter calculated values)		development, Requirement 2-Volume
	$A_r = \frac{46,173}{1000} ft^2$		Capture is not required.
	K ^[7] = 1.2		
		own Lists	$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE})$
Soloot hudr	ologic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration		
	elopment ground cover description ^[5] = Woods (50%), grass (50%) cor		
Select post deve	elopment ground cover description ^[5] = Impervious - Paved Parking, R	coontop, Driveways	
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
	[0]		
<u>OR</u>	Composite Predevelopment CN ^[9] = 80		
<u>OR</u>	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95		
OR Solution:			
	Composite Post development CN ^[9] = 95		
Solution: Pre Development Storm Water Rund	Composite Post development CN ^[9] = 95 off Volume	Where:	
Solution:	Composite Post development CN ^[9] = 95 off Volume	Where:	
Solution: Pre Development Storm Water Rund	Composite Post development CN ^[9] = 95	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: Pre Development Storm Water Rund S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: Pre Development Storm Water Rund	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: Pre Development Storm Water Rund S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 95 off Volume	S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: Pre Development Storm Water Rund S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Post development CN ^[9] = 95 off Volume $\mathbf{S}_{PRE} = \frac{1000}{80} -10$ $\mathbf{Q}_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1\text{ft}}{12\text{in}}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: Pre Development Storm Water Rund S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: Pre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE}= 0.00900 ft V_{PRE} = 415.56 ft ³	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(46,173)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: Pre Development Storm Water Rund S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(46,173)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: Pre Development Storm Water Rund S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 415.56 ft ³ Post Development Storm Water Rund	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(46,173)$ noff Volume	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: Pre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 415.56 ft ³ Post Development Storm Water Rund	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(46,173)$ noff Volume $S_{POST} = \frac{1000}{-10} -10$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ²) Where: Where:	
Solution: Pre Development Storm Water Rund S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 415.56 ft ³ Post Development Storm Water Rund	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(46,173)$ noff Volume	 S_{PRE}= Pre development potential maximum retention after runoff (in). Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	
Solution: Pre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 415.56 ft ³ Post Development Storm Water Rund S_{POST} = 0.58201 in	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(46,173)$ noff Volume $S_{POST} = \frac{1000}{95} -10$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST Post development potential maximum retention after runoff (in	
Solution: Pre Development Storm Water Rund S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 415.56 ft ³ Post Development Storm Water Rund	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(46,173)$ noff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = [(0.92*1.17) - (0.2 * 0.58)]^2 \times \frac{1 \text{ft}}{12}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban	
Solution: Pre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 415.56 ft ³ Post Development Storm Water Rund S_{POST} = 0.58201 in	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(46,173)$ noff Volume $S_{POST} = \frac{1000}{95} -10$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST Post development potential maximum retention after runoff (in	
Solution: Pre Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 415.56 ft ³ Post Development Storm Water Rund S_{POST} = 0.58201 in Q_{POST} = 0.04990 ft	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(46,173)$ noff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.58)]^2}{[(0.92*1.17) + (0.8 * 0.58)]} \times \frac{1 \text{ft}}{12 \text{in}}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
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Solution: Pre Development Storm Water Rund S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V_{PRE} = 415.56 ft ³ Post Development Storm Water Rund S_{POST} = 0.58201 in Q _{POST} = 0.04990 ft V_{POST} = 2304.03 ft ³ Solution: Volume Capture Requir Increase in volume of storm	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(46,173)$ noff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92*1.17)-(0.2*0.58)]^2}{[(0.92*1.17)+(0.8*0.58)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.04990)(46,173)$ rement in water that must be retained onsite (may be infiltrated or reused V_{PRE}) Delta Volume Capture= (2,304.03) - (4)	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ²) Where: SPOST SPOST Post development potential maximum retention after runoff (in Hydrology For Small Watersheds" TR-55 Manual. VPRE Post development potential maximum retention after runoff (in Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) V). 1). 415.56) Where:	
Solution: Pre Development Storm Water Rund S_{PRE} 2.50 in Q _{PRE} 0.00900 ft V_{PRE} 415.56 ft ³ Post Development Storm Water Rund S_{POST} 0.58201 in Q _{POST} 0.04990 ft V_{POST} 2304.03 ft ³ Solution: Volume Capture Require Increase in volume of storm Solution: Delta Volume Capture= (V _{POST} -V	Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(46,173)$ noff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92*1.17)-(0.2*0.58)]^2}{[(0.92*1.17)+(0.8*0.58)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.04990)(46,173)$ rement in water that must be retained onsite (may be infiltrated or reused V_{PRE}) Delta Volume Capture= (2,304.03) - (4)	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ²) Where: SPOST SPOST Post development potential maximum retention after runoff (in Hydrology For Small Watersheds" TR-55 Manual. VPRE Post development potential maximum retention after runoff (in Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) V). 1). 415.56) Where:	
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LID BMP Sizing Tool: 100% Volume Capt Formulas: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 3737.37$ ft ³ $A_{LID GOAL} = (W)(L) = 680.00$ ft ²	ure Goal; V_{GOAL} Where: $V_{LID GOAL}$ = Required volume of soil in LID BMP. $A_{LID GOAL}$ = Footprint of LID BMP area for a given depth (below perforated p V_{GOAL} = 2,616 ft ³ Where:	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
<u>Input:</u>	P = 0.7 as a decimalD = 5.5 ftBelow perforated pipe if presentW = 10.0 ftL = 68.0 ft		
Solution: Percent of Goal Achieved = 100.07	% = [(5.5 x 680) / 3,737] x 100	7	
LID BMP Sizing Tool Delta Volume Captu Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0!] ft ³	<u>re Requirement</u> : V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
$A_{LID DELTA}=(W)(L) = 0.00 ft^2$	$V_{\text{LID DELTA}}$ = Required volume of soil in LID BMP $A_{\text{LID DELTA}}$ = Footprint of LID BMP area for a given depth (below perforated p V_{DELTA} = 1888.48 ft ³	ipe if present).	capture. Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Requirement achieved" reaches
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		100%.
Input:	P =0.0as a decimalD =0.0ftBelow perforated pipe if presentW =0.0ftL =0.0ft		
<u>Solution:</u> ພ Percent of Requirement Achieved = <mark>#DIV/0!</mark> ອ	% = #DIV/0!		

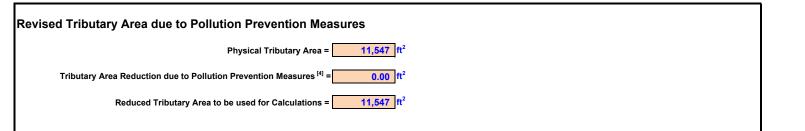




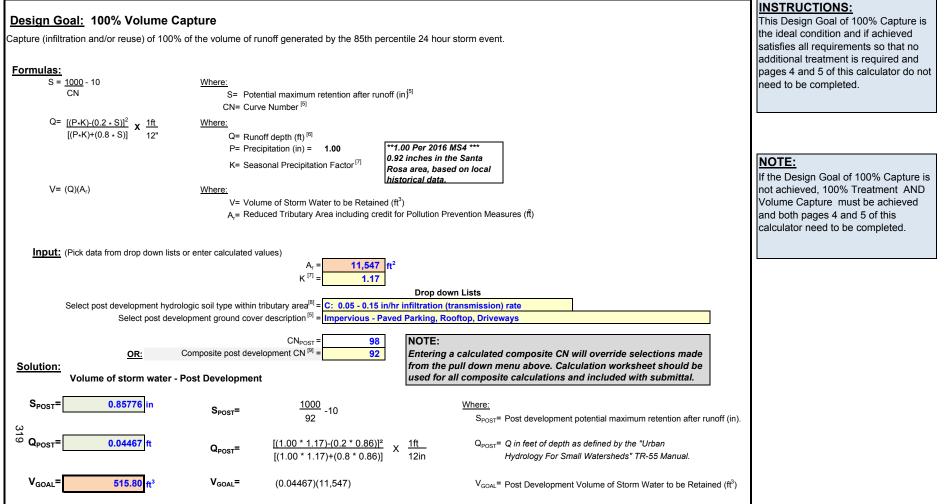
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connect Multiplier = 1	ed Paved Area	INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²		
Area Reduction = 0.00 ft ²		
	New Evergreen Trees NOTE: Total Interceptor Area	INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area
Area Reduction due to new Evergreen Trees= 0 ft ² Number of new <i>Deciduous Trees</i> that qualify as interceptor trees= 0	(200 ft ² /tree) Reduction is limited to 50% of the physical tributary area.	of existing trees.
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)	
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy	
Allowed reduction credit for existing tree canopy=	Allowed credit for existing tree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ²	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to
Buffer Factor = 0.7	these features as sheet flow. Enter the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) =	
Area Reduction =0.00 ft ²	
α	—





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.





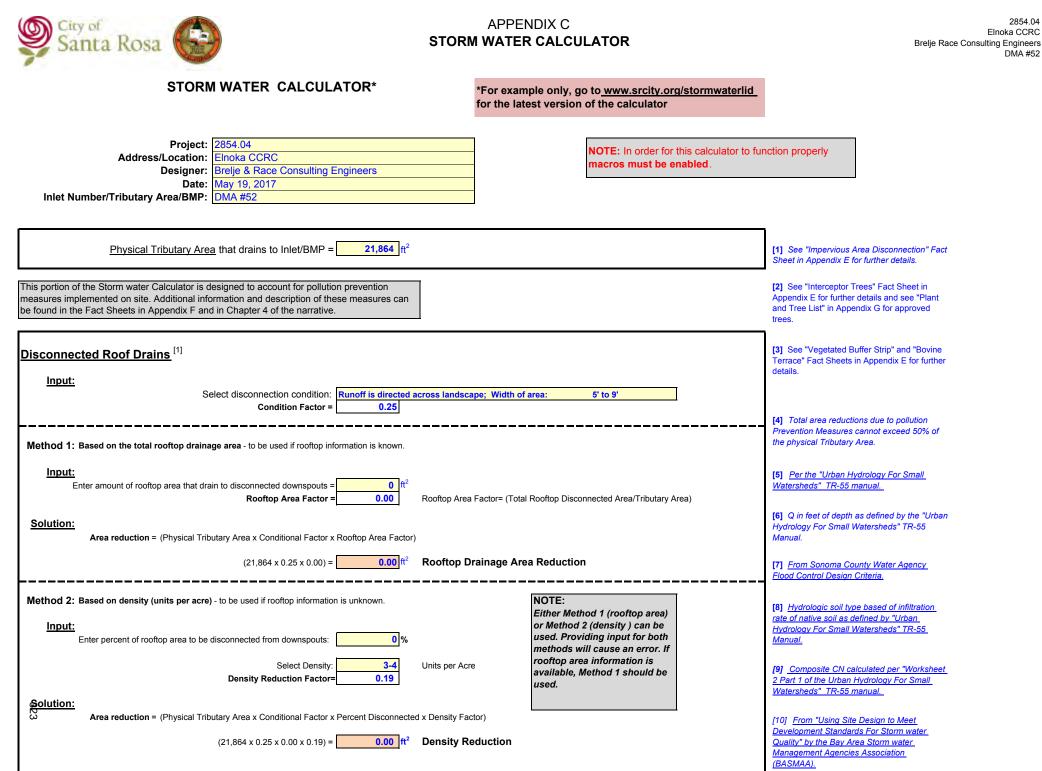
Requirement 1: 100% Treatment	nt		INSTRUCTIONS:
Treatment of 100% of the flow generated b	y 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
Formula:		The C value used for this calculation is smaller than the value used for	on page 3 of this calculator is not achieved; then Requirement 1-100%
$Q_{\text{TRFATMENT}}$ (0.2 in/hr)(A_{r})(C_{POST})(K) cfs	Where:	hydraulic Flood Control design.	Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found h	
	C _{POST} = Rational method runoff coefficient for the developed condition		
	A _r = Reduced Tributary Area including credit for Pollution Preventio	on Measures (in Acres) to size the overflow bypass.	must be achieved.
lanat	K = Seasonal Precipitation Factor ^[7]		
Input:	A _r = 11,547 ft ² = 0.26508 Acr	29	
	$C_{POST}^{[10]} = 0.50$		
	κ ^[7] = 1.2		
	NC	DTE:	
Solution:		e Flow Rate calculated here should only be used to size the	
Q		propriate BMP. All associated overflow inlets and systems	
Q _{TREATMENT} = 0.03101 cfs	Q _{TREATMENT} = (0.2)(0.2651)(0.50)(1.17)	ould be sized for the Flood Control event.	-



equirement 2: Delta Volume	Capture the site due to development for the 85th percentile 24 hour storm e	vent.	INSTRUCTIONS: If the Design Goal of 100% Capture
			on page 3 of this calculator is not
			achieved; then Requirement 1-100
ormulas:			Treatment, page 4 of the calculate
S = <u>1000</u> - 10	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ⁵		Capture, this page of the calculate
	CN= Curve Number ^[5]		must be achieved.
$Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} \times \frac{1 \text{ft}}{12 \text{in}}$	Where:		
[(P*K)+(0.8 * S)] 12in	Q= Runoff depth (ft) [6]		
	P= Precipitation (in) = 0.92 0.92 inches in the	e Santa Rosa	
	K= Seasonal Precipitation Factor ^[7] area, based on lo	ocal historical	
$V=(Q)(A_r)$	Where: data.		NOTE:
$\mathbf{v} = (\mathbf{a})(\mathbf{r},\mathbf{r})$	V= Volume of Storm Water to be Retained (ft ³)		
	A_r = Reduced Tributary Area including credit for Pollution Pr	evention Measures ([#])	If the amount of volume generated
	A_r = Reduced Hibblidity Area including clean for Policiton Fi	evention measures (1)	after development is less than or
			equal to that generated before
Input: (Pick data from drop down lis			development, Requirement 2-Volu
	$A_r = 11,547$ ft ²		Capture is not required.
	K ^[7] = 1.2		
	Drop dov	vn Lists	$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PR})$
Select hud	rologic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration (t		
	velopment ground cover description ^[5] = Woods (50%), grass (50%) com		
Select piede	velopment ground cover description ^[5] = Impervious - Paved Parking, Ro		
Select post de		onop, Driveways	
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
OR	Composite Predevelopment CN ^[9] = 80		
	Composite Predevelopment CN ^[9] = 80		
Solution:	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92		
Solution: e Development Storm Water Run	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92	Where:	
Solution:	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92	Where:	
Solution: e Development Storm Water Run	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: e Development Storm Water Run S _{PRE} = 2.50 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$		
Solution: Development Storm Water Run	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$		
Solution: e Development Storm Water Run S _{PRE} = 2.50 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92	S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: b Development Storm Water Run S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: Development Storm Water Run S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: Development Storm Water Run S _{PRE} = 2.50 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: e Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 103.92$ ft ³	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(11,547)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: a Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 103.92$ ft ³ st Development Storm Water Ru	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(11,547)$ unoff Volume	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Solution: Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 103.92$ ft ³	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(11,547)$ unoff Volume	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: Where:	
Solution: Development Storm Water Run S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 103.92 ft ³ st Development Storm Water Run	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(11,547)$ unoff Volume	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 103.92 ft ³ st Development Storm Water Run S_{POST} = 0.85776 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(11,547)$ unoff Volume $S_{POST} = \frac{1000}{92} -10$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: Where:).
Solution: P Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 103.92 ft ³ St Development Storm Water Run S_{POST} = 0.85776 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(11,547)$ unoff Volume $S_{POST} = \frac{1000}{92} -10$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: Where:	λ.
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 103.92 ft ³ ost Development Storm Water Run S_{POST} = 0.85776 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(11,547)$ unoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = [(0.92*1.17) - (0.2 * 0.86)]^2 \times \frac{1 \text{ft}}{12}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in)).
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 103.92 ft ³ st Development Storm Water Run S_{POST} = 0.85776 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(11,547)$ unoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = [(0.92*1.17) - (0.2 * 0.86)]^2 \times \frac{1ft}{12}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in), Q _{POST} = Q in feet of depth as defined by the "Urban).
Solution: Development Storm Water Rur S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 103.92 ft ³ st Development Storm Water Ru S_{POST} = 0.85776 in Q_{POST} = 0.03863 ft	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{+}1.17) - (0.2 * 2.50)]^2}{[(0.92^{+}1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(11,547)$ unoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92^{+}1.17) - (0.2 * 0.86)]^2}{[(0.92^{+}1.17) + (0.8 * 0.86)]} \times \frac{1ft}{12in}$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in), QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	λ.
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 103.92 ft ³ st Development Storm Water Run S_{POST} = 0.85776 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(11,547)$ unoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = [(0.92*1.17) - (0.2 * 0.86)]^2 \times \frac{1 \text{ft}}{12}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in), Q _{POST} = Q in feet of depth as defined by the "Urban	λ.
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 103.92 ft ³ st Development Storm Water Run S_{POST} = 0.85776 in Q_{POST} = 0.03863 ft V_{POST} = 446.06 ft ³	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 hoff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{+}1.17) - (0.2 * 2.50)]^2}{[(0.92^{+}1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(11,547)$ unoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92^{+}1.17) - (0.2 * 0.86)]^2}{[(0.92^{+}1.17) + (0.8 * 0.86)]^2} \times \frac{1ft}{12in}$ $V_{POST} = (0.03863)(11,547)$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.).
Solution: a Development Storm Water Rur S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 103.92 ft ³ st Development Storm Water Ru S_{POST} = 0.85776 in Q_{POST} = 0.03863 ft V_{POST} = 446.06 ft ³ Solution: Volume Capture Require	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 hoff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{+}1.17) - (0.2 * 2.50)]^2}{[(0.92^{+}1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(11,547)$ Honoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92^{+}1.17) - (0.2 * 0.86)]^2}{[(0.92^{+}1.17) + (0.8 * 0.86)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03863)(11,547)$ Herement	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in), QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³)	
Solution: a Development Storm Water Run S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 103.92 ft ³ st Development Storm Water Run SPOST= 0.85776 in Q _{POST} = 0.03863 ft V _{POST} = 446.06 ft ³ Solution: Volume Capture Require Increase in volume of store	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 hoff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{+}1.17) - (0.2 * 2.50)]^2}{[(0.92^{+}1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(11,547)$ unoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92^{+}1.17) - (0.2 * 0.86)]^2}{[(0.92^{+}1.17) + (0.8 * 0.86)]^2} \times \frac{1ft}{12in}$ $V_{POST} = (0.03863)(11,547)$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in), QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³)).
Solution: Development Storm Water Run S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 103.92 ft ³ st Development Storm Water Run SPOST= 0.85776 in Q _{POST} = 446.06 ft ³ Solution: Volume Capture Require Increase in volume of store	Composite Predevelopment CN ^[9] = $\frac{80}{92}$ noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(11.547)$ moff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17)+(0.2*0.86)]^2}{[(0.92*1.17)+(0.8*0.86)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03863)(11.547)$ irrement m water that must be retained onsite (may be infiltrated or reused).	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in); QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³)	λ.
Solution: a Development Storm Water Run S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 103.92 ft ³ st Development Storm Water Run SPOST= 0.85776 in Q _{POST} = 0.03863 ft V _{POST} = 446.06 ft ³ Solution: Volume Capture Require Increase in volume of store	Composite Predevelopment CN ^[9] = $\frac{80}{92}$ noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(11.547)$ moff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17)+(0.2*0.86)]^2}{[(0.92*1.17)+(0.8*0.86)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03863)(11.547)$ irrement m water that must be retained onsite (may be infiltrated or reused).	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in); QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³)	κ.
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 103.92 ft ³ ost Development Storm Water Run S_{POST} = 0.85776 in Q_{POST} = 0.03863 ft V_{POST} = 446.06 ft ³ Solution: Volume Capture Require Increase in volume of stor	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(11,547)$ unoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.86)]^2}{[(0.92*1.17) + (0.8 * 0.86)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03863)(11,547)$ irrement m water that must be retained onsite (may be infiltrated or reused). $-V_{PRE}$ Delta Volume Capture = (446.06) - (103)	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) 92) Where:	
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 103.92 ft ³ ost Development Storm Water Run S_{POST} = 0.85776 in Q_{POST} = 0.03863 ft V_{POST} = 446.06 ft ³ Solution: Volume Capture Require Increase in volume of stor Delta Volume Capture (V_{POST} = 0.02000 ft	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(11,547)$ unoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.86)]^2}{[(0.92*1.17) + (0.8 * 0.86)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03863)(11,547)$ irrement m water that must be retained onsite (may be infiltrated or reused). $-V_{PRE}$ Delta Volume Capture = (446.06) - (103)	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in). QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) 92) Where:	
Solution: e Development Storm Water Run S_{PRE} 2.50 in Q_{PRE} 0.00900 ft V_{PRE} 103.92 ft ³ Dost Development Storm Water Run S_{POST} 0.85776 in Q_{POST} 0.03863 ft V_{POST} 446.06 ft ³ Solution: Volume Capture Require Increase in volume of stor Delta Volume Capture= (V _{POST}	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(11,547)$ unoff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.86)]^2}{[(0.92*1.17) + (0.8 * 0.86)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03863)(11,547)$ irrement m water that must be retained onsite (may be infiltrated or reused). $-V_{PRE}$ Delta Volume Capture = (446.06) - (103)	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in); QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) 92) 92)	



LID BMP Sizing Tool: 100% Volume Captor Formulas: $V_{LID GOAL}=((V_{GOAL}))/(P) = 1172.28$ ft ³ $A_{LID GOAL}=(W)(L) = 600.25$ ft ²	ure Goal; V_{GOAL} Where: $V_{LID GOAL}$ = Required volume of soil in LID BMP. $A_{LID GOAL}$ = Footprint of LID BMP area for a given depth (below perforated pi V_{GOAL} = 516 ft ³ Where:	NOTE: <i>LID Sizing Tool only applicable for volume</i> <i>based BMPs. Not required if site requires</i> <i>treatment only.</i> ipe if present).	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
<u>Input:</u>	P =0.4as a decimalD =2.0ftBelow perforated pipe if presentW =24.5ftL =24.5ft		
Solution: Percent of Goal Achieved = 102.41	% = [(2.0 x 600) / 1,172] x 100	7	
LID BMP Sizing Tool Delta Volume Captu	re Requirement: V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u>
	Where: V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated pi	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width
Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01/ft ³	Where: V _{LID DELTA} = Required volume of soil in LID BMP	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume <u>capture</u> . Enter the percent of porosity of the specified soil and depth below
Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 $A_{LID DELTA} = (W)(L) = $ 0.00ft ²	Where: V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated pi V _{DELTA} = 342.14 ft ³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet)	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> <u>requirement of the delta volume</u> <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Requirement achieved" reaches

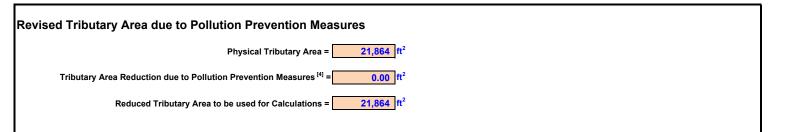




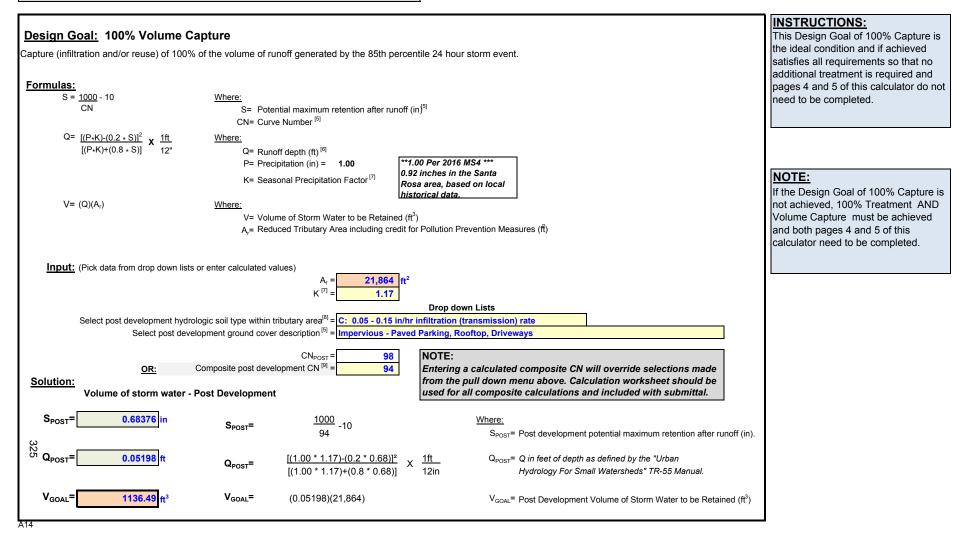
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conne Multiplier = 1	ected Paved Area		INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²			
Area Reduction = 0.00 ft ²			
Interceptor Trees ^[2] Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0	T	NOTE: Fotal Interceptor Area	INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area
Area Reduction due to new Evergreen Trees=0ft ²	(LEE WALL)	Reduction is limited to 50% of he physical tributary area.	of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Deciduous Trees=0 ft ²	New Deciduous Trees (100 ft ² /tree)		
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy		
Allowed reduction credit for existing tree canopy=	Allowed credit for existing tree of	canopy = 50 % of actual canopy square fool	age
Area Reduction = 0 ft ²	= Sum of areas managed by	y evergreen + deciduous + existing can	рру

Buffer Strips & Bovine Terraces ^[3]	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine
Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ²	terraces. Runoff Must be direct to these features as sheet flow. Enter
Buffer Factor = 0.7	the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) =	
Area Reduction = 0.00 ft² ω	
	4





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.





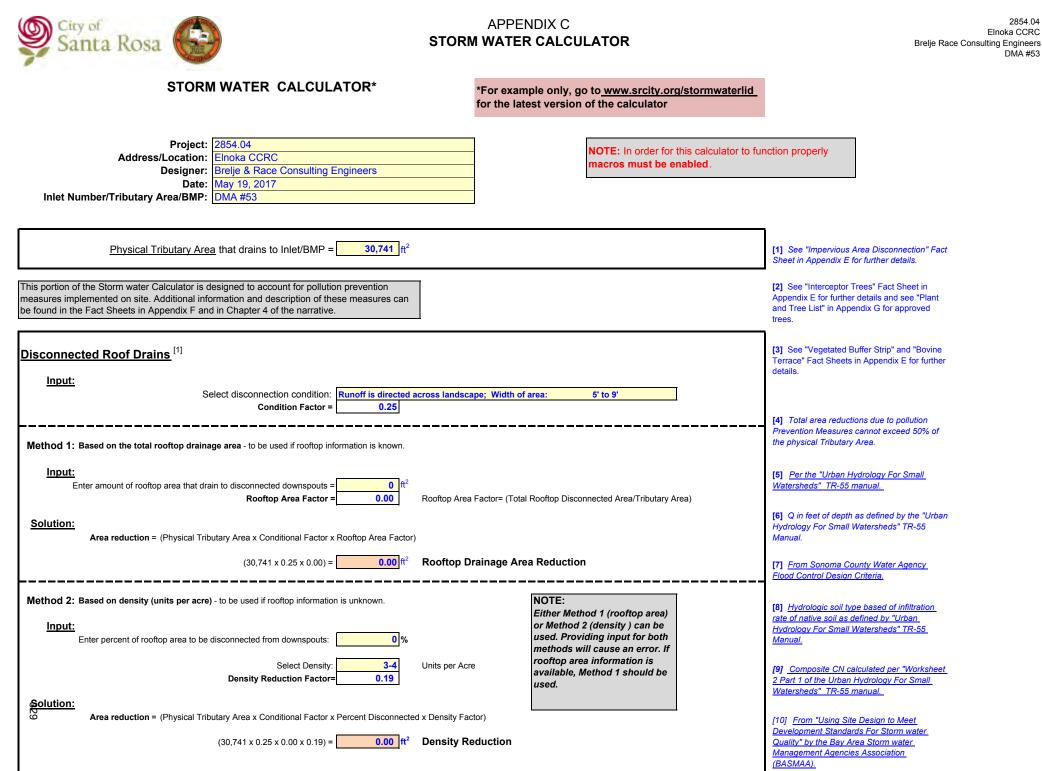
			·
Requirement 1: 100% Treatment	nt		INSTRUCTIONS:
Treatment of 100% of the flow generated b	y 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
		The C value used for this calculation	on page 3 of this calculator is not
Formula:		is smaller than the value used for	achieved; then Requirement 1-100%
$Q_{TREATMENT}$ = (0.2 in/hr)(A_r)(C_{POST})(K) cfs	Where:	hydraulic Flood Control design.	Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	
	C_{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator, must be achieved.
	A _r = Reduced Tributary Area including credit for Pollution Prevention Measures (in Acres	to size the overflow bypass.	must be achieved.
lumente	K = Seasonal Precipitation Factor ⁷⁷		
Input:	A, = 21,864 ft ² = 0.50193 Acres		
	[7]		
	κ ^(/) = <u>1.2</u>		
Solution:		a fact have a baseled a why has seen of fact a size of the	
<u>Solution.</u>		ated here should only be used to size the I associated overflow inlets and systems	
Q _{TREATMENT} = 0.06460 cfs		he Flood Control event.	



	apture site due to development for the 85th percentile 24 hour storm e	event.	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not
			achieved; then Requirement 1-100
Formulas:			Treatment, page 4 of the calculator
S = <u>1000</u> - 10	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ⁵		Capture, this page of the calculator
	CN= Curve Number ^[5]		must be achieved.
Q= $\frac{[(P*K)-(0.2*S)]^2}{[(P*K)+(0.8*S)]} \times \frac{1ft}{12in}$	Where:		must be domeved.
[(P*K)+(0.8 * S)] X 12in	Q= Runoff depth (ft) ^[6]		
	P= Precipitation (in) = 0.92 0.92 inches in th	e Santa Rosa	
	K= Seasonal Precipitation Factor ^[7] area, based on l		
	data		NOTE
$V= (Q)(A_r)$	Where:		NOTE:
	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A _r = Reduced Tributary Area including credit for Pollution Presented and Presented	revention Measures (ť)	after development is less than or
			equal to that generated before
Input: (Pick data from drop down lists or	renter calculated values)		development, Requirement 2-Volu
	$A_r = 21,864 \text{ ft}^2$		
			Capture is not required.
			$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PR}$
	Drop do		
Select hydrolog	gic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration (transmission) rate	
Select predevelo	pment ground cover description ^[5] = Woods (50%), grass (50%) com	bination (orchard or tree farm) - Fair	
Select post develo	pment ground cover description ^[5] = Impervious - Paved Parking, Ro	poftop, Driveways	
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
	Composite Predevelopment CN $^{[9]} = 80$		
	pomposite Post development CN $^{[9]}$ = 94		
Solution:		<u>Where:</u> S _{PRF} = Pre development potential maximum retention after runoff (in).	
<u>Solution:</u> re Develop <u>ment Storm Wat</u> er Runoff	Volume S _{PRE} = <u>1000</u> 80 -10	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
<u>Solution:</u> re Development Storm Water Runoff S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Volume	S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: re Development Storm Water Runoff S _{PRE} = 2.50 in	Volume S _{PRE} = <u>1000</u> 80 -10	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: re Development Storm Water Runoff $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 196.78$ ft ³	Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(21,864)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: re Development Storm Water Runoff S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 196.78 ft ³ post Development Storm Water Runoff	Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(21,864)$ ff Volume	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Solution: e Development Storm Water Runoff $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 196.78$ ft ³	Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(21,864)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: re Development Storm Water Runoff S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 196.78 ft ³ ost Development Storm Water Runof S_{POST} = 0.68376 in	Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(21,864)$ ff Volume $S_{POST} = \frac{1000}{94} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in)	
Solution: re Development Storm Water Runoff S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 196.78 ft ³ post Development Storm Water Runoff	Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(21,864)$ ff Volume $S_{POST} = \frac{1000}{94} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban	
Solution: re Development Storm Water Runoff S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 196.78 ft ³ ost Development Storm Water Runof S_{POST} = 0.68376 in	Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(21,864)$ ff Volume	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in)	
Solution: re Development Storm Water Runoff S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 196.78 ft ³ Dost Development Storm Water Runof S _{POST} = 0.68376 in	Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(21,864)$ ff Volume $S_{POST} = \frac{1000}{94} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban	
Solution: re Development Storm Water Runoff S_{PRE} 2.50 in Q_{PRE} 0.00900 ft V_{PRE} 196.78 ft ³ ost Development Storm Water Runor S_{POST} 0.68376 in Q_{POST} 0.04548 ft ³ Solution: Volume Capture Requiren Increase in volume of storm w	Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 ft}{12 in}$ $V_{PRE} = (0.00900)(21,864)$ ff Volume $S_{POST} = \frac{1000}{94} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*0.68)]^2}{[(0.92*1.17) + (0.8*0.68)]} \times \frac{1 ft}{12 in}$ $V_{POST} = (0.04548)(21,864)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
Solution: re Development Storm Water Runoff S_{PRE} 2.50 in Q_{PRE} 0.00900 ft V_{PRE} 196.78 ft ³ ost Development Storm Water Runof S_{POST} 0.68376 in Q_{POST} 0.04548 ft V_{POST} 994.37 Solution: Volume Capture Requirem	Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(21,864)$ ff Volume $S_{POST} = \frac{1000}{94} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.68)]^2}{[(0.92*1.17) + (0.8 * 0.68)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.04548)(21,864)$ nent rater that must be retained onsite (may be infiltrated or reused)	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Post Development Volume of Storm Water Generated (ft ³)	
Solution: re Development Storm Water Runoff S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 196.78 ft ³ ost Development Storm Water Runof SPOST= 0.68376 in QPOST= 0.04548 ft ³ Solution: Volume Capture Requirem Increase in volume of storm w	Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(21,864)$ ff Volume $S_{POST} = \frac{1000}{94} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.68)]^2}{94} \times \frac{1ft}{12in}$ $V_{POST} = (0.04548)(21,864)$ nent vater that must be retained onsite (may be infiltrated or reused) M_{E} Delta Volume Capture = (994.37) - (196)	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Post Development Volume of Storm Water Generated (ft ³)	



$V_{GOAL} = \underbrace{1,136}_{\text{ft}^3}$	NOTE: INSTRUCTIONS: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the design goal of 100% volume capture of the post development condition. Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = (D)(A _{LID GOAL}) V _{LID GOAL} x 100 V _{LID GOAL} x 100 D= Depth below perforated pipe if present W= Width (in decimal feet) L= Length (in decimal feet)	(in decimal feet)
	decimal w perforated pipe if present
Solution: Percent of Goal Achieved = 99.99% = [(3.4 x 751) / 2,583] x	7
LID BMP Sizing Tool Delta Volume Capture Requirement: V _{DELTA} Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01 ft ³ Where:	NOTE: INSTRUCTIONS: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the design requirement of the delta volume.
V _{LID DELTA} = Required volume of soil in	for a given depth (below perforated pipe if present). of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of
$\begin{array}{l} \text{Percent of Requirement} \\ \text{Achieved} \end{array} = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100 \end{array} \\ \begin{array}{l} \text{Where:} \\ \text{P= Porosity} (\text{enter as a decimal}) \\ \text{D= Depth below perforated pipe if present} \\ \text{W= Width} (\text{in decimal feet}) \\ \text{L= Length} (\text{in decimal feet}) \end{array} \end{array}$	(in decimal feet)
	decimal w perforated pipe if present
Solution: ω Percent of Requirement Achieved = #DIV/0! % = #DIV/0!	

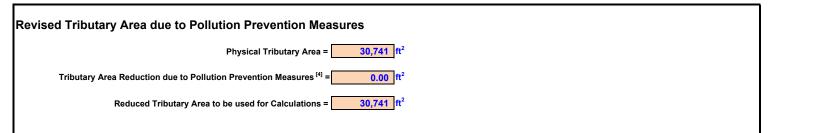




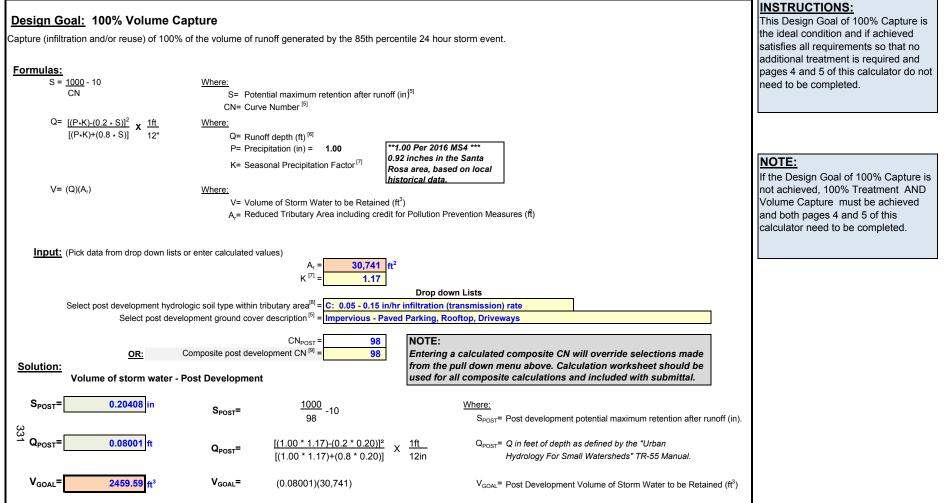
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conne Multiplier = 1	sted Paved Area	INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²		
Area Reduction = 0.00 ft ²		
nterceptor Trees ^[2]		INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees NOTE: Total Interceptor Area (200 ft²/tree) Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=	New Deciduous Trees	
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)	
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy	
Allowed reduction credit for existing tree canopy= 0 ft ²	Allowed credit for existing tree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ² Buffer Factor = 0.7	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) = Area Reduction = 0.00 ft ² ↔	





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.





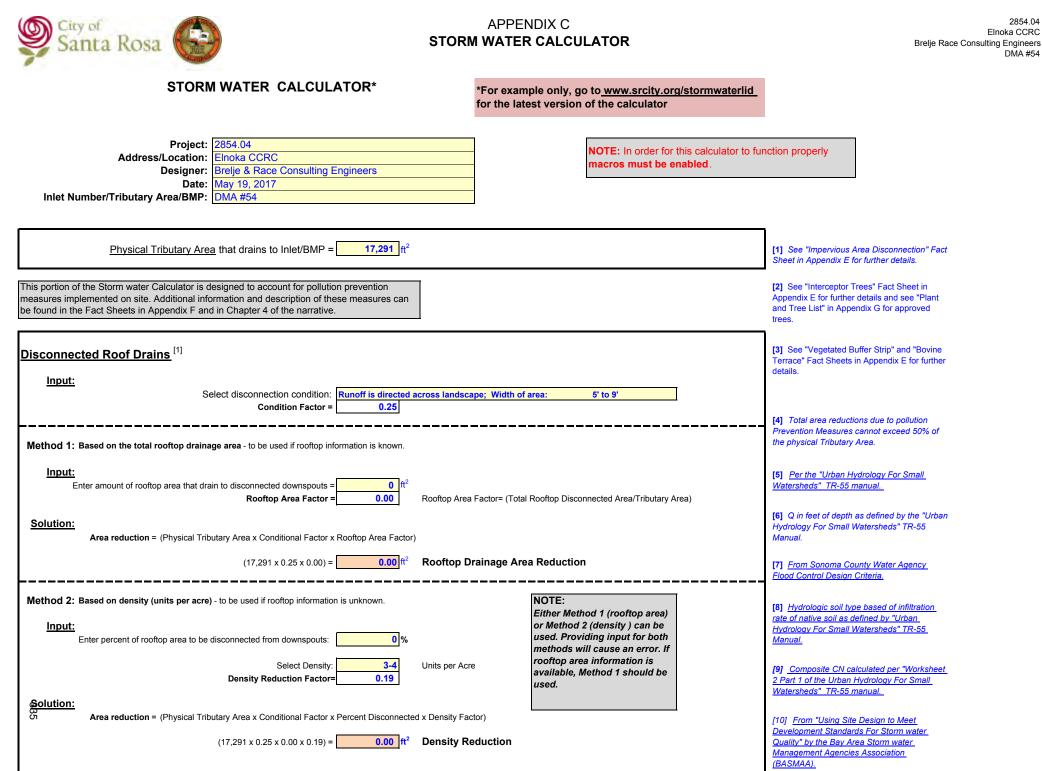
	_		NOT DU OTIONO.
Requirement 1: 100% Treatme			INSTRUCTIONS:
Treatment of 100% of the flow generated b	by 85th percentile 24 hour mean annual rain event (0.2 in/hr).	<u>C value note:</u>	If the Design Goal of 100% Capture
Formula:		The C value used for this calculation is smaller than the value used for	on page 3 of this calculator is not achieved; then Requirement 1-100%
Q _{TREATMENT} = (0.2 in/hr)(A _r)(C _{POST})(K) cfs	Where:		Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prevention Measures (in Ad	res) to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]		
Input:	$A_{r} = \frac{30,741}{0.70572} \text{ Acres}$ $C_{POST}^{(10)} = \frac{0.70}{1.2}$ $K^{(7)} = \frac{1.2}{1.2}$ NOTE:		
Solution:			
Q _{TREATMENT} = 0.11560 cfs	appropriate BMP.	culated here should only be used to size the All associated overflow inlets and systems r the Flood Control event.	



	pture site due to development for the 85th percentile 24 hour storm e	event.	INSTRUCTIONS: If the Design Goal of 100% Captur on page 3 of this calculator is not
			achieved; then Requirement 1-100
ormulas:			Treatment, page 4 of the calculator
S = <u>1000</u> - 10	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ⁵		Capture, this page of the calculator
	CN= Curve Number ^[5]		
$\Omega = [(P_*K)_{-}(0.2 * S)]^2$ 1ft	Where:		must be achieved.
	Q = Runoff depth (ft) ^[6] P = Precipitation (in) = 0.92 0.92 inches in the	a Santa Basa	
	K= Seasonal Precipitation Factor ^[7] area, based on lo	Jean Mistorica	
$V= (Q)(A_r)$	Where:		NOTE:
	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A _r = Reduced Tributary Area including credit for Pollution Pr	revention Measures (ť)	after development is less than or
			equal to that generated before
Input: (Pick data from drop down lists or	enter calculated values)		development, Requirement 2-Volu
	$A_r = \frac{30,741}{1000} \text{ft}^2$		
			Capture is not required.
	K ^[7] = 1.2		$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PR}$
	Drop dov		
Select hydrolog	gic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration (1	transmission) rate	
Select predevelop	oment ground cover description ^[5] = Woods (50%), grass (50%) com	bination (orchard or tree farm) - Fair	
Select post develop	oment ground cover description ^[5] = Impervious - Paved Parking, Ro	poftop, Driveways	
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
<u>OR</u> C	Composite Predevelopment CN $^{[9]} = 80$		
	proposite Predevelopment CN $^{[9]}$ = 98		
Joiuuoll.			
<u>Solution:</u> e Development Storm Water Runoff S _{PRE} = 2.50 in	Volume S _{PRE} = <u>1000</u> -10 <u>80</u> -10	$\frac{Where:}{S_{PRE}}$ Pre development potential maximum retention after runoff (in).	
e Development Storm Water Runoff			
e Development Storm Water Runoff S _{PRE} = 2.50 in	$S_{PRE} = \frac{1000}{80} - 10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
e Development Storm Water Runoff S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 276.67 ft ³	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(30,741)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
e Development Storm Water Runoff S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 276.67 ft ³ ost Development Storm Water Runof	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(30,741)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
e Development Storm Water Runoff S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 276.67 ft ³	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(30,741)$	SPRE= Pre development potential maximum retention after runoff (in). QPRE= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE= Pre Development Volume of Storm Water Generated (ft ³) Where: Where:	
e Development Storm Water Runoff S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 276.67 ft ³ ost Development Storm Water Runof	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(30,741)$ If Volume	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
e Development Storm Water Runoff S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 276.67 ft ³ post Development Storm Water Runoff S_{POST} = 0.20408 in	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(30,741)$ If Volume $S_{POST} = \frac{1000}{98} -10$	SPRE= Pre development potential maximum retention after runoff (in). QPRE= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE= Pre Development Volume of Storm Water Generated (ft ³) Where: Where:	
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e Development Storm Water Runoff S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 276.67 ft ³ ost Development Storm Water Runof S_{POST} = 0.20408 in Q_{POST} = 0.07240 ft V_{POST} = 2225.65 ft ³ <u>Solution:</u> Volume Capture Requirem Increase in volume of storm wa	$S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{+}1.17) - (0.2^{+}2.50)]^2}{[(0.92^{+}1.17) + (0.8^{+}2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(30,741)$ If Volume $S_{POST} = \frac{1000}{98} -10$ $Q_{POST} = \frac{[(0.92^{+}1.17) - (0.2^{+}0.20)]^2}{[(0.92^{+}1.17) + (0.8^{+}0.20)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.07240)(30,741)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
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LID BMP Sizing Tool: 100% Volume Captu Formulas: $V_{LID GOAL}=((V_{GOAL}))/(P) = 5589.97$ ft ³ $A_{LID GOAL}=(W)(L) = 1398.76$ ft ²	Where: $V_{LID GOAL}$ V_LID GOAL Required volume of soil in LID BMP. A_LID GOAL = Footprint of LID BMP area for a given depth (below perforated pi V_GOAL = 2,460 ft ³ Where:	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. pe if present).	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
<u>Input:</u>	P = 0.4 as a decimal D = 4.0 ft Below perforated pipe if present W = 37.4 ft L = 37.4 ft		
Solution: Percent of Goal Achieved = 100.09	% = [(4.0 x 1,399) / 5,590] x 100	7	
LID BMP Sizing Tool Delta Volume Capture	<u>e Requirement</u> : V _{DELTA}	<u>NOTE:</u> LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
$A_{LID DELTA}=(W)(L) = \boxed{0.00} ft^2$	V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated pi V _{DELTA} = 1948.98 ft ³	pe if present).	<u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Requirement achieved" reaches
Percent of Requirement Achieved = $\frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		100%.
<u>Input:</u>	P = 0.0 as a decimal D = 0.0 ft Below perforated pipe if present W = 0.0 ft L = 0.0 ft		
Solution: ω Percent of Requirement Achieved = #DIV/0!	% = #DIV/0!		

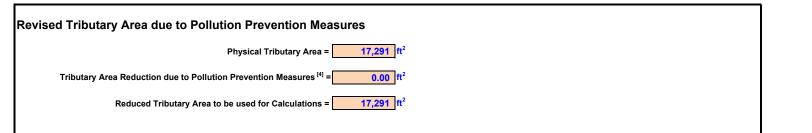




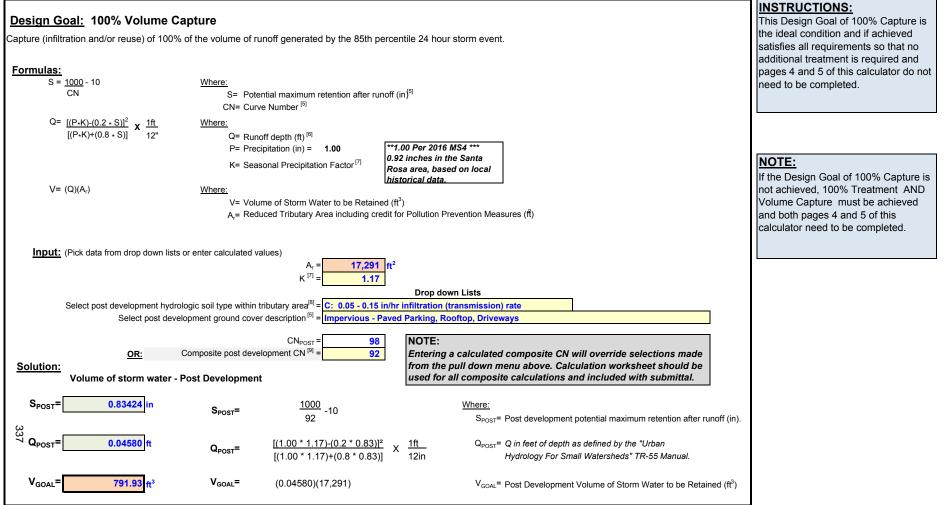
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connec Multiplier = 1	cted Paved Area		INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²			
Area Reduction = 0.00 ft ²			
nterceptor Trees ^[2]			INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees (200 ft ² /tree)	NOTE: Total Interceptor Area Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0	New Deciduous Trees		
Area Reduction due to new Deciduous Trees= 0 ft ²	(100 ft ² /tree)		
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy		
Allowed reduction credit for existing tree canopy= 0 ft ²	Allowed credit for existing tr	ree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed	d by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ² Buffer Factor = 0.7	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) = Area Reduction = 0.00 ft²	
	1





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.





Requirement 1: 100% Treatmen	ıt		INSTRUCTIONS:
Treatment of 100% of the flow generated b	y 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
		The C value used for this calculation	on page 3 of this calculator is not
Formula:		is smaller than the value used for	achieved; then Requirement 1-100%
Q _{TREATMENT} = (0.2 in/hr)(A _r)(C _{POST})(K) cfs	Where:	hydraulic Flood Control design.	Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	AND Requirement 2- Volume
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	Ar = Reduced Tributary Area including credit for Pollution Prevention Measures (in	Acres) to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]	·	
<u>Input:</u>	$A_{r} = 17,291 \text{ ft}^{2} = 0.39695 \text{ Acres}$ $C_{POST}^{[10]} = 0.61 \text{ K}^{[7]} = 1.2$ NOTE:		
Solution: Q _{treatment} = 0.05666 cfs	The Flow Rate of appropriate BM	calculated here should only be used to size the P. All associated overflow inlets and systems for the Flood Control event.	

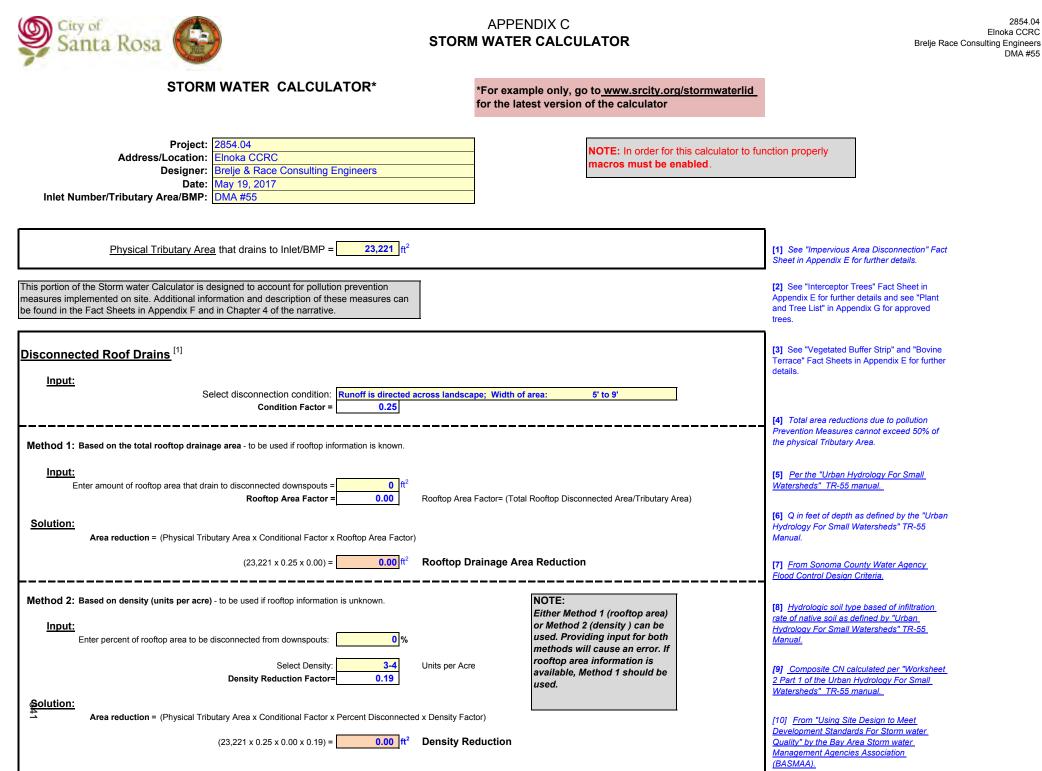
338



<u>equirement 2:</u> Delta Volume			INSTRUCTIONS:
o increase in volume of runoff leaving the	he site due to development for the 85th percentile 24 hour storm	event.	If the Design Goal of 100% Capture on page 3 of this calculator is not
			achieved; then Requirement 1-100
ormulas:			Treatment, page 4 of the calculator
S = <u>1000</u> - 10	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ^{5]}		Capture, this page of the calculato
	CN= Curve Number ^[5]		must be achieved.
Q= $[(P * K) - (0.2 * S)]^2$ 1ft	Where:		must be domeved.
$Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} \times \frac{1 \text{ft}}{12 \text{in}}$	Q= Runoff depth (ft) [6]		
	P = Precipitation (in) = 0.92 0.92 inches in the formula of the second se	ne Santa Rosa	
	K= Seasonal Precipitation Factor ^[7] area, based on		
	data.		NOTE
$V= (Q)(A_r)$	Where:		NOTE:
	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A _r = Reduced Tributary Area including credit for Pollution F	revention Measures (ť)	after development is less than or
			equal to that generated before
Input: (Pick data from drop down list	s or enter calculated values)		development, Requirement 2-Volu
, · · · · · · · · · · · · · · · · ·	A _r = 17,291 ft ²		Capture is not required.
			Capture is not required.
			$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PR}$
		wn Lists	
	rologic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration		
		nbination (orchard or tree farm) - Fair	
Select post dev	relopment ground cover description ^[5] = Impervious - Paved Parking, R	ooftop, Driveways	
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
OP	Composite Predevelopment CN 2 - 80		
<u>OR</u> Solution:	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 92		
Solution: re Development Storm Water Run	Composite Post development CN ^[9] = 92 off Volume		
Solution:	Composite Post development CN ^[9] = 92 off Volume	Where:	
Solution: e Develop <u>ment Storm Wat</u> er Run	Composite Post development CN ^[9] = 92 off Volume	<u>Where:</u> S_{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: re Development Storm Water Run	Composite Post development CN ^[9] = 92 off Volume		
Solution: e Develop <u>ment Storm Wat</u> er Run	Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: e Development Storm Water Run S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: re Development Storm Water Run S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 92 off Volume	S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: e Development Storm Water Run S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: re Development Storm Water Run S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: The Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 155.62$ ft ³	Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(17,291)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: e Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 155.62$ ft ³ post Development Storm Water Ru	Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(17,291)$ noff Volume	 S_{PRE}= Pre development potential maximum retention after runoff (in). Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 155.62 ft ³	Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 ft}{12 in}$ $V_{PRE} = (0.00900)(17,291)$ noff Volume $S_{POST} = \frac{1000}{-10} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 155.62 ft ³ ost Development Storm Water Ru	Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(17,291)$ noff Volume	 S_{PRE}= Pre development potential maximum retention after runoff (in). Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	
Solution: The Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 155.62$ ft ³ Dost Development Storm Water Ru	Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(17,291)$ noff Volume $S_{POST} = \frac{1000}{92} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) <u>Where:</u>	
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 155.62 ft ³ ost Development Storm Water Ru S_{POST} = 0.83424 in	Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(17,291)$ noff Volume $S_{POST} = \frac{1000}{92} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) <u>Where:</u>	·
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 155.62 ft ³ ost Development Storm Water Ru S_{POST} = 0.83424 in	Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(17,291)$ noff Volume $S_{POST} = \frac{1000}{92} -10$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST Post development potential maximum retention after runoff (in), QPOST Qpost Q in feet of depth as defined by the "Urban	
Solution: Te Development Storm Water Run S_{PRE} 2.50 in Q _{PRE} 0.00900 ft V_{PRE} 155.62 ft ³ Dost Development Storm Water Run S _{POST}	Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 ft}{12 in}$ $V_{PRE} = (0.00900)(17,291)$ noff Volume $S_{POST} = \frac{1000}{-10} -10$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST Post development potential maximum retention after runoff (in)	·
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Solution: te Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 155.62 ft ³ ost Development Storm Water Run S_{POST} = 0.83424 in Q_{POST} = 0.03969 ft V_{POST} = 686.28 ft ³	Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(17,291)$ noff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 0.83)]^2}{[(0.92*1.17) + (0.8 * 0.83)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.03969)(17,291)$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in), QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
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Solution: The Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 155.62$ ft ³ Dost Development Storm Water Ru $S_{POST} = 0.83424$ in $Q_{POST} = 0.03969$ ft $V_{POST} = 686.28$ ft ³ Solution: Volume Capture Require Increase in volume of storm	Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1 ft}{12 in}$ $V_{PRE} = (0.00900)(17,291)$ noff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17)+(0.2*0.83)]^2}{[(0.92*1.17)+(0.8*0.83)]} \times \frac{1 ft}{12 in}$ $V_{POST} = (0.03969)(17,291)$ rement In water that must be retained onsite (may be infiltrated or reused	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in); QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) 0. Storn 0. Storn	
Solution: re Development Storm Water Run S_{PRE} 2.50 in Q_{PRE} 0.00900 ft V_{PRE} 155.62 ft ³ Dost Development Storm Water Run S_{POST} 0.83424 in Q_{POST} 0.03969 ft V_{POST} 686.28 ft ³ Solution: Volume Capture Require Increase in volume of storm West of Volume Capture (V _{POST})	Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(17,291)$ noff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.83)]^2}{[(0.92*1.17) + (0.8 * 0.83)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03969)(17,291)$ rement In water that must be retained onsite (may be infiltrated or reused $V_{PRE})$ Delta Volume Capture = (686.28) - (153)	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in), QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) 0. Storm Water Generated (ft ³) 0. Storm Water Generated (ft ³) 0. Storm Water Generated (ft ³)	·
Solution: te Development Storm Water Run S_{PRE} 2.50 in Q_{PRE} 0.00900 ft V_{PRE} 155.62 ft ³ Dost Development Storm Water Run S_{POST} 0.83424 in Q_{POST} 0.03969 ft V_{POST} 686.28 ft ³ Solution: Volume Capture Require Increase in volume of storm 30 Delta Volume Capture= (V _{POST}	Composite Post development CN ^[9] = 92 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(17,291)$ noff Volume $S_{POST} = \frac{1000}{92} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.83)]^2}{[(0.92*1.17) + (0.8 * 0.83)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.03969)(17,291)$ rement In water that must be retained onsite (may be infiltrated or reused $V_{PRE})$ Delta Volume Capture = (686.28) - (153)	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in); QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPOST Post Development Volume of Storm Water Generated (ft ³) 0. Storn 0. Storn	



$A_{LID GOAL} = (W)(L) = \frac{739.84}{V_{GO}} ft^2 \qquad A_{LID GOAL} = V_{GO}$		NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
x 100	y (enter as a decimal) below perforated pipe if present (in decimal feet) (in decimal feet) (in decimal feet)		
Input:	P =0.4as a decimalD =2.4ftBelow perforated pipe if presentW =27.2ftL =27.2ft		
Solution: Percent of Goal Achieved = 100.30 %	= [(2.4 x 740) / 1,800] x 100	7	
LID BMP Sizing Tool Delta Volume Capture Requires		NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
$A_{\text{LID DELTA}}=(W)(L) = 1$	ELTA ⁼ Required volume of soil in LID BMP ELTA ⁼ Footprint of LID BMP area for a given depth (below perforated pip LTA ⁼ 530.66 ft ³	e if present).	<u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of
$\begin{array}{l} \text{Percent of Requirement} \\ \text{Achieved} \end{array} = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} x \ 100 \\ \begin{array}{l} \frac{\text{Where:}}{P=\text{Porosit}} \\ D=\text{Depth} \\ W=\text{Width} \\ L=\text{Length} \end{array}$	elow perforated pipe if present (in decimal feet) (in decimal feet)		Requirement achieved" reaches 100%.
Input:	P = 0.0 as a decimal D = 0.0 ft Below perforated pipe if present W = 0.0 ft L = 0.0 ft		
Solution: ω Percent of Requirement Achieved = #DIV/0! %	= #DIV/0!		

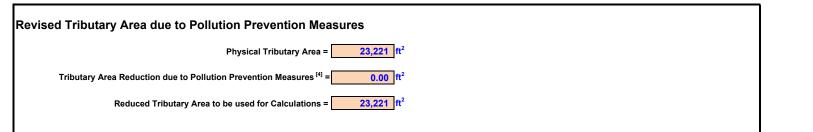




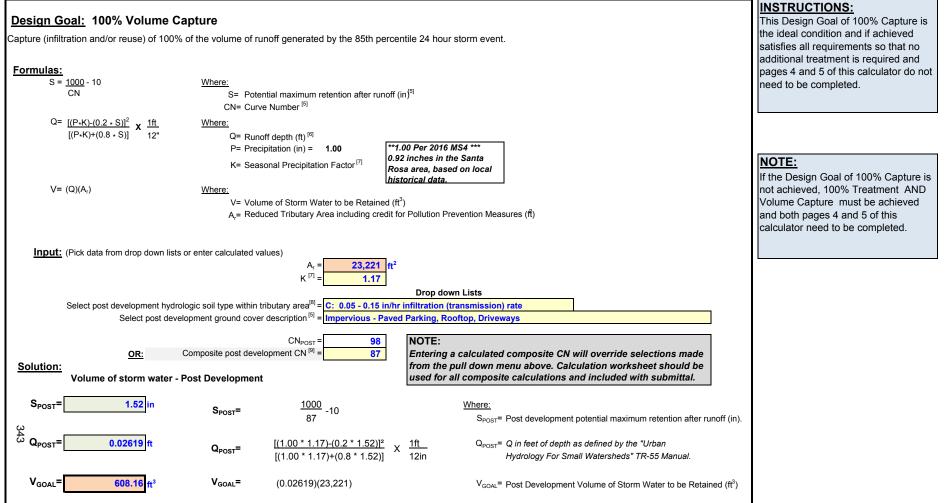
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conne Multiplier = 1	ected Paved Area		INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²			
Area Reduction = 0.00 ft ²			
Interceptor Trees ^[2]			INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees (200 ft ² /tree)	NOTE: Total Interceptor Area Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=	New Deciduous Trees		
Area Reduction due to new Deciduous Trees= 0 ft ²	(100 ft ² /tree)		
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy		
Allowed reduction credit for existing tree canopy=	Allowed credit for existing tr	ree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas manage [,]	d by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ² Buffer Factor = 0.7	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) = Area Reduction = 0.00 ft ² φ	
]





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.





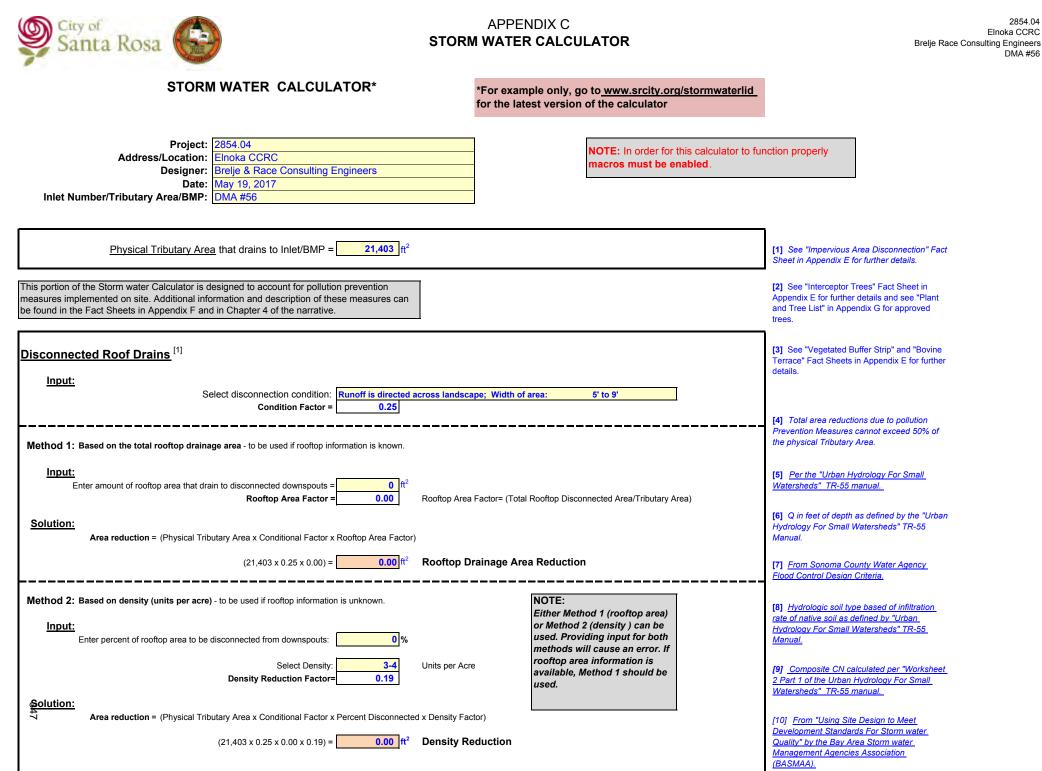
Requirement 1: 100% Treatme	nt		INSTRUCTIONS:
Treatment of 100% of the flow generated b	by 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
		The C value used for this calculation	on page 3 of this calculator is not
<u>Formula:</u>		is smaller than the value used for	achieved; then Requirement 1-100%
$Q_{\text{TREATMENT}}$ = (0.2 in/hr)(A_r)(C_{POST})(K) cfs	Where:	hydraulic Flood Control design.	Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	•
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prevention Measure	sures (in Acres) to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]		
Input:	$A_{r} = 23,221 \text{ ft}^{2} = 0.53308 \text{ Acres}$ $C_{POST}^{(10)} = 0.52 \text{ K}^{(7)} = 1.2$		
	к ^и = <u>1.2</u>		
Solution:			
Q _{TREATMENT} = 0.06487 cfs	appropria	Rate calculated here should only be used to size the ate BMP. All associated overflow inlets and systems e sized for the Flood Control event.	



Requirement 2: Delta Volume (to increase in volume of runoff leaving the	Capture e site due to development for the 85th percentile 24 hour storm	event.	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not
Formulas:			achieved; then Requirement 1-100
	Whore:		Treatment, page 4 of the calculator
S = <u>1000</u> - 10 CN	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff $(in)^{5}$		Capture, this page of the calculator
	CN= Curve Number ^[5]		must be achieved.
$Q= \frac{[(P*K)-(0.2*S)]^2}{[(P*K)+(0.8*S)]} \times \frac{1ft}{12in}$	Where:		
[(P*K)+(0.8 * S)] 12in	Q= Runoff depth (ft) ^[6]		
	P= Precipitation (in) = 0.92 0.92 inches in t		
	K= Seasonal Precipitation Factor ^[7] area, based on	local historical	
$V=(Q)(A_r)$	Where: data.		NOTE:
	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A _r = Reduced Tributary Area including credit for Pollution F	Prevention Measures (#)	-
	$\Delta_{\rm r}$ = reduced moduly field moduling or call for relation r		after development is less than or
			equal to that generated before
Input: (Pick data from drop down lists			development, Requirement 2-Volu
	$A_r = 23,221 \text{ ft}^2$		Capture is not required.
	K ^[7] = 1.2		$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE}$
		own Lists	O POST = O PRE OF ON POST = ON PRE
Select hvdro	logic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration		
Select predeve	lopment ground cover description ^[5] = Woods (50%), grass (50%) cor	nbination (orchard or tree farm) - Fair	
	lopment ground cover description ^[5] = Impervious - Paved Parking, R		
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
OR	Composite Predevelopment CN ^[9] = 80		
	Composite Predevelopment CN ^[9] = 80		
Solution:	Composite Predevelopment CN ^[9] = <u>80</u> Composite Post development CN ^[9] = <u>87</u>		
Solution: re Development Storm Water Rund	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87	Where.	
Solution:	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87	Where:	
Solution: re Development Storm Water Rund	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87	<u>Where:</u> S _{PRE} ≡ Pre development potential maximum retention after runoff (in).	
Solution: re Development Storm Water Rund S _{PRE} = 2.50 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$		
Solution: re Development Storm Water Rund	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$		
<u>Solution:</u> re Development Storm Water Rund S _{PRE} = 2.50 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in).	
<u>Solution:</u> re Development Storm Water Rund S _{PRE} = 2.50 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: re Development Storm Water Rund S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: re Development Storm Water Rund S _{PRE} = 2.50 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: re Development Storm Water Rund $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 208.99$ ft ³	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(23,221)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 208.99 ft ³ ost Development Storm Water Rund	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(23,221)$	 S_{PRE}= Pre development potential maximum retention after runoff (in). Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	
Solution: re Development Storm Water Rund $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 208.99$ ft ³	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(23,221)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where:	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 208.99 ft ³ post Development Storm Water Rund	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(23,221)$	 S_{PRE}= Pre development potential maximum retention after runoff (in). Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	κ
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Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 208.99 ft ³ oost Development Storm Water Rund S_{POST} = 1.52 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(23,221)$ hoff Volume $S_{POST} = \frac{1000}{87} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where:	
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Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 208.99 ft ³ ost Development Storm Water Rund S_{POST} = 1.52 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(23,221)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in) Q _{POST} = Q in feet of depth as defined by the "Urban	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 208.99 ft ³ ost Development Storm Water Rund S_{POST} = 1.52 in Q_{POST} = 0.02169 ft	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(23,221)$ hoff Volume $S_{POST} = \frac{1000}{87} -10$ $Q_{POST} = \frac{[(0.92*1.17) + (0.2 * 1.52)]^2}{[(0.92*1.17) + (0.8 * 1.52)]} \times \frac{1ft}{12in}$	SPRE Pre development potential maximum retention after runoff (in). QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff (in) QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
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Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 208.99 ft ³ ost Development Storm Water Rund S_{POST} = 1.52 in Q_{POST} = 0.02169 ft V_{POST} = 503.66 ft ³ Solution: Volume Capture Require	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{+}1.17) + (0.2 + 2.50)]^2}{[(0.92^{+}1.17) + (0.8 + 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(23,221)$ hoff Volume $S_{POST} = \frac{1000}{87} -10$ $Q_{POST} = \frac{[(0.92^{+}1.17) + (0.2 + 1.52)]^2}{[(0.92^{+}1.17) + (0.8 + 1.52)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.02169)(23,221)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in) Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 208.99 ft ³ ost Development Storm Water Rund S _{POST} = 1.52 in Q _{POST} = 0.02169 ft V _{POST} = 503.66 ft ³ Solution: Volume Capture Require Increase in volume of storm	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(23,221)$ hoff Volume $S_{POST} = \frac{1000}{87} -10$ $Q_{POST} = \frac{[(0.92*1.17)+(0.2*1.52)]^2}{[(0.92*1.17)+(0.8*1.52)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.02169)(23,221)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in) Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	· ·
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 208.99 ft ³ ost Development Storm Water Rund S_{POST} = 1.52 in Q_{POST} = 0.02169 ft V_{POST} = 503.66 ft ³ Solution: Volume Capture Require Increase in volume of storm	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(23,221)$ the form off Volume $S_{POST} = \frac{1000}{87} -10$ $Q_{POST} = \frac{[(0.92*1.17)+(0.2*1.52)]^2}{[(0.92*1.17)+(0.8*1.52)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.02169)(23,221)$ ement water that must be retained onsite (may be infiltrated or reused	$\begin{split} & \mathbf{S}_{PRE} = Pre \ development \ potential \ maximum \ retention \ after \ runoff \ (in). \\ & \mathbf{Q}_{PRE} = $\mathbf{Q} \ in \ feet \ of \ depth \ as \ defined \ by \ the \ "Urban \\ & $Hydrology \ For \ Small \ Watersheds" \ TR-55 \ Manual. \\ & \mathbf{V}_{PRE} = $Pre \ Development \ Volume \ of \ Storm \ Water \ Generated \ (ft^3) \\ & $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $$	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 208.99 ft ³ ost Development Storm Water Rund S_{POST} = 1.52 in Q_{POST} = 0.02169 ft V_{POST} = 503.66 ft ³ Solution: Volume Capture Require Increase in volume of storm	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)+(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(23,221)$ the form off Volume $S_{POST} = \frac{1000}{87} -10$ $Q_{POST} = \frac{[(0.92*1.17)+(0.2*1.52)]^2}{[(0.92*1.17)+(0.8*1.52)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.02169)(23,221)$ ement water that must be retained onsite (may be infiltrated or reused	$\begin{split} & \mathbf{S}_{PRE} = Pre \ development \ potential \ maximum \ retention \ after \ runoff \ (in). \\ & \mathbf{Q}_{PRE} = $\mathbf{Q} \ in \ feet \ of \ depth \ as \ defined \ by \ the \ "Urban \\ & $Hydrology \ For \ Small \ Watersheds" \ TR-55 \ Manual. \\ & \mathbf{V}_{PRE} = $Pre \ Development \ Volume \ of \ Storm \ Water \ Generated \ (ft^3) \\ \hline \\ & $\frac{Where:}{S_{POST}$ = $Post \ development \ potential \ maximum \ retention \ after \ runoff \ (in) \\ & \mathbf{Q}_{POST} = $Post \ development \ potential \ maximum \ retention \ after \ runoff \ (in) \\ & Q_{POST} = $Q \ in \ feet \ of \ depth \ as \ defined \ by \ the \ "Urban \\ & $Hydrology \ For \ Small \ Watersheds" \ TR-55 \ Manual. \\ & V_{POST} = $Post \ Development \ Volume \ of \ Storm \ Water \ Generated \ (ft^3) \\ & V_{POST} = $Post \ Development \ Volume \ of \ Storm \ Water \ Generated \ (ft^3) \\ & N_{POST} = $Post \ Development \ Volume \ of \ Storm \ Water \ Generated \ (ft^3) \\ & N_{POST} = $Post \ Development \ Volume \ of \ Storm \ Water \ Generated \ (ft^3) \\ & N_{POST} = $Post \ Development \ Volume \ of \ Storm \ Water \ Generated \ (ft^3) \\ & N_{POST} = $Post \ Development \ Volume \ Of \ Storm \ Water \ Generated \ Moter \ Of \ Storm \ Water \ Generated \ Moter \ Moter \ Moter \ Moter \ Storm \ Moter \ Moter \ Ooted \ Moter \ Moter \ Moter \ Ooted \ Moter \ Mot$	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 208.99 ft ³ ost Development Storm Water Rund S_{POST} = 1.52 in Q_{POST} = 0.02169 ft V_{POST} = 503.66 ft ³ Solution: Volume Capture Require Increase in volume of storm	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(23,221)$ hoff Volume $S_{POST} = \frac{1000}{87} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 1.52)]^2}{[(0.92*1.17) + (0.8 * 1.52)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.02169)(23,221)$ ement water that must be retained onsite (may be infiltrated or reused V_{PRE}) Delta Volume Capture = (503.66) - (20)	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in) Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development potential maximum retention after runoff (in) Q _{POST} = Post Development Potential maximum retention after runoff (in) Q _{POST} = Post Development Potential maximum retention after runoff (in) Q _{POST} = Post Development Potential maximum retention after runoff (in) Q _{POST} = Post Development Volume of Storm Water Generated (ft ³)). 8.99) Where:	
Solution: re Development Storm Water Rund S_{PRE} 2.50 in Q _{PRE} 0.00900 ft V_{PRE} 208.99 ft ³ ost Development Storm Water Rund S_{POST} 1.52 in Q _{POST} 0.02169 ft V_{POST} 503.66 ft ³ Solution: Volume Capture Require Increase in volume of storm Webst Webst Webst Webst Vebst Vebst Vebst Solution: Volume Capture Require Increase in volume of storm Vebst Vebst Vest	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(23,221)$ hoff Volume $S_{POST} = \frac{1000}{87} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 1.52)]^2}{[(0.92*1.17) + (0.8 * 1.52)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.02169)(23,221)$ ement water that must be retained onsite (may be infiltrated or reused V_{PRE}) Delta Volume Capture = (503.66) - (20)	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in) Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development potential maximum retention after runoff (in) Q _{POST} = Post Development Potential maximum retention after runoff (in) Q _{POST} = Post Development Potential maximum retention after runoff (in) Q _{POST} = Post Development Potential maximum retention after runoff (in) Q _{POST} = Post Development Volume of Storm Water Generated (ft ³)). 8.99) Where:	
Solution: re Development Storm Water Rund S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V_{PRE} = 208.99 ft ³ ost Development Storm Water Rund S_{POST} = 1.52 in Q _{POST} = 0.02169 ft V_{POST} = 503.66 ft ³ Solution: Volume Capture Require Increase in volume of storm Webst Webst Webst Webst Webst Webst Solution: Volume Capture Require Increase in volume of storm Webst Webst <	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 87 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(23,221)$ hoff Volume $S_{POST} = \frac{1000}{87} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 1.52)]^2}{[(0.92*1.17) + (0.8 * 1.52)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.02169)(23,221)$ ement water that must be retained onsite (may be infiltrated or reused V_{PRE}) Delta Volume Capture = (503.66) - (20)	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in) Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³) V _{POST} = Post Development Volume of Storm Water Generated (ft ³)). 8.99)	



LID BMP Sizing Tool: 100% Volume Capture Formulas: $V_{LID GOAL}=((V_{GOAL}))/(P) = 1382.18$ ft ³ $A_{LID GOAL}=(W)(L) = 778.41$ ft ²	ure Goal; V_{GOAL} Where: $V_{LID GOAL}$ = Required volume of soil in LID BMP. $A_{LID GOAL}$ = Footprint of LID BMP area for a given depth (below perforated pi V_{GOAL} = 608 ft ³ Where:	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{\text{LID GOAL}})}{V_{\text{LID GOAL}}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
<u>Input:</u>	P =0.4as a decimalD =1.8ftBelow perforated pipe if presentW =27.9ftL =27.9ft		
Solution: Percent of Goal Achieved = 101.37	% = [(1.8 x 778) / 1,382] x 100	7	
LID BMP Sizing Tool Delta Volume Captu	<u>re Requirement</u> : V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u>
	Where: $V_{LID DELTA}$ Required volume of soil in LID BMP A_{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated picture)	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be
Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0! ft ³	<u>Where:</u> V _{LID DELTA} ≕ Required volume of soil in LID BMP	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width
Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/0!ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00ft ²	Where: V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated pi V _{DELTA} = 294.67 ft ³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet)	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> <u>requirement of the delta volume</u> <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Requirement achieved" reaches

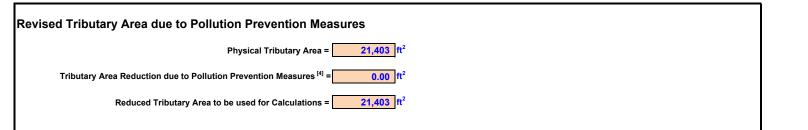




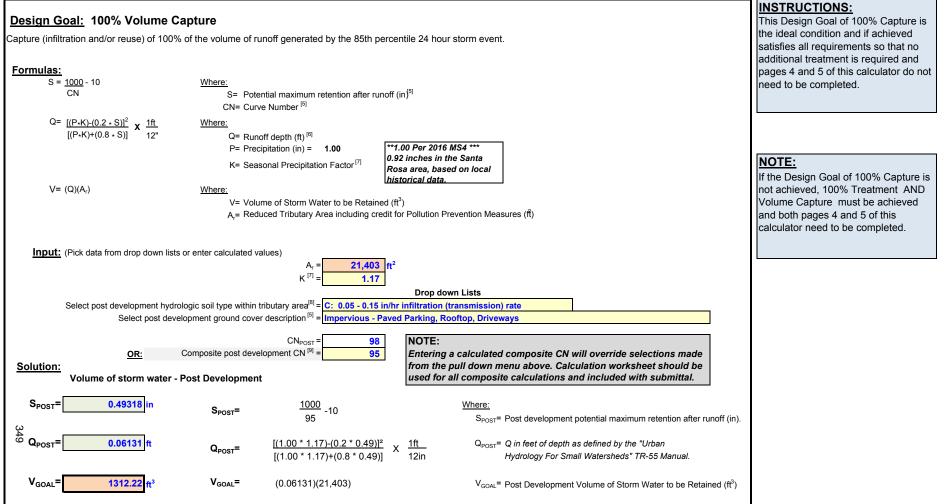
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conne Multiplier = 1	sted Paved Area	INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²		
Area Reduction = 0.00 ft ²		
nterceptor Trees ^[2]		INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees NOTE: Total Interceptor Area (200 ft²/tree) Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=	New Deciduous Trees	
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)	
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy	
Allowed reduction credit for existing tree canopy= 0 ft ²	Allowed credit for existing tree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed by evergreen + deciduous + existing canopy	

[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ² Buffer Factor = 0.7	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) = Area Reduction =0.00 ft ²	





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.



Release 7



Requirement 1: 100% Treatmen	nt		INSTRUCTIONS:
Treatment of 100% of the flow generated by	y 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
		The C value used for this calculation	on page 3 of this calculator is not
Formula:		is smaller than the value used for	achieved; then Requirement 1-100%
Q _{TREATMENT} = (0.2 in/hr)(A _r)(C _{POST})(K) cfs	Where:	hydraulic Flood Control design.	Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	AND Requirement 2- Volume
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prevention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]		
Input:	$A_{r} = 21,403 \text{ ft}^{2} = 0.49135 \text{ Acres}$ $C_{POST}^{[10]} = 0.66 \text{ K}^{[7]} = 1.2$		
Solution: Q _{TREATMENT} = 0.07588 cfs		ed here should only be used to size the associated overflow inlets and systems a Flood Control event.	

350

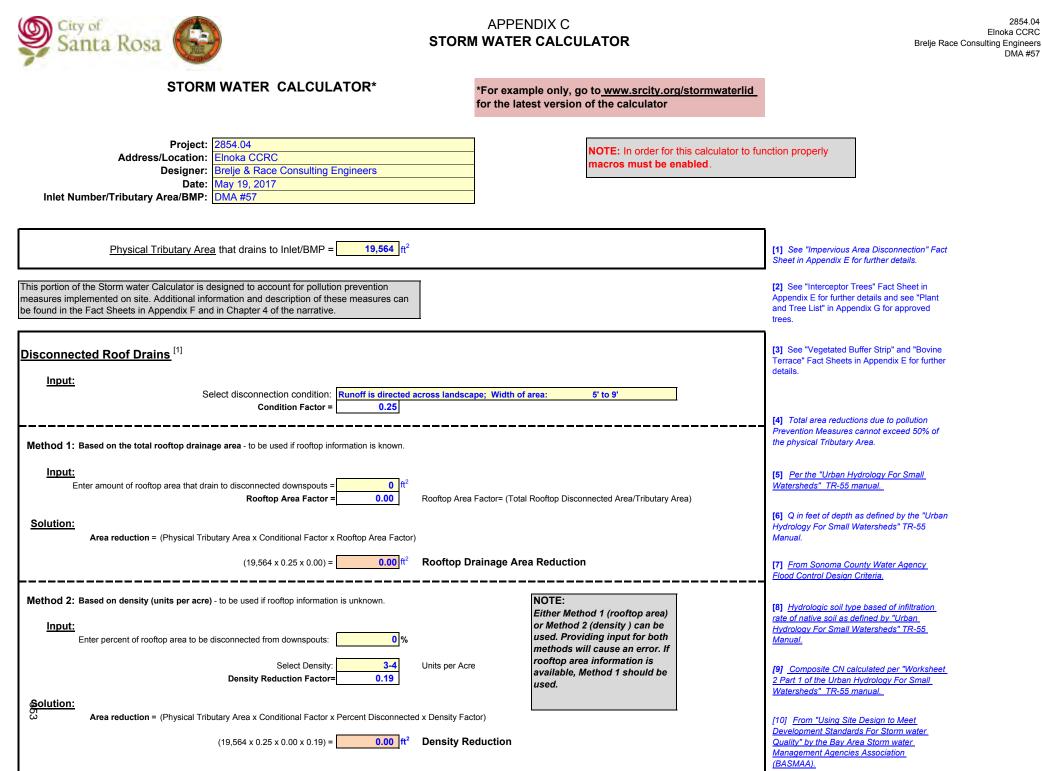


2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #56

Requirement 2: Delta Volume	Capture		INSTRUCTIONS:
	he site due to development for the 85th percentile 24 hour storm e	event.	If the Design Goal of 100% Captur
.	p		on page 3 of this calculator is not
			achieved; then Requirement 1-100
Formulas:			Treatment, page 4 of the calculato
S = 1000 - 10	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ⁵		
	CN= Curve Number ^[5]		Capture, this page of the calculato
$\Omega = [(P_*K)_*(0.2 + S)]^2$ 1ft	Where:		must be achieved.
$Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} \times \frac{1 \text{ft}}{12 \text{in}}$			
	$Q^{=}$ Runoff depth (ft) ^[6] P= Precipitation (in) = 0.92 0.92 inches in th	a Santa Basa	
	F = Precipitation (in) = 0.92 0.92 <i>increasing in the second s</i>		
	data.		NOTE
$V= (Q)(A_r)$	Where:		NOTE:
	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A _r = Reduced Tributary Area including credit for Pollution P	revention Measures (#)	after development is less than or
			equal to that generated before
Input: (Pick data from drop down lists	s or enter calculated values)		development, Requirement 2-Volu
	$A_r = 21,403 \text{ ft}^2$		Capture is not required.
	K ^[7] = 1.2		
	Drop do	wn Liete	$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE})$
Select hydro	ologic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration (
	elopment ground cover description ^[5] = Woods (50%), grass (50%) com		
	elopment ground cover description ^[5] = Impervious - Paved Parking, Re		
		boltop, briveways	
	CN = 76		
	$CN_{PRE} = 76$		
	CN _{POST} = 90.3		
OR	CN _{POST} = 90.3 Composite Predevelopment CN ^[9] = 80		
OR	CN _{POST} = 90.3		
OR Solution:	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95		
<u>OR</u> <u>Solution:</u> re Develop <u>ment Storm Wat</u> er Rund	CN _{POST} = 90.3 Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95	Where	
OR Solution:	CN _{POST} = 90.3 Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95	<u>Where:</u>	
<u>OR</u> <u>Solution:</u> re Develop <u>ment Storm Wat</u> er Rund	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff (in).
OR Solution: re Development Storm Water Rund S _{PRE} = 2.50 in	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$	$S_{\text{PRE}}\text{=}$ Pre development potential maximum retention after runoff (in).
<u>OR</u> <u>Solution:</u> re Develop <u>ment Storm Wat</u> er Rund	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in Q_{PRE} = Q in feet of depth as defined by the "Urban).
OR Solution: re Development Storm Water Rund S _{PRE} = 2.50 in	CN _{POST} = 90.3 Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95	$S_{\text{PRE}}\text{=}$ Pre development potential maximum retention after runoff (in).
$\frac{OR}{Solution:}$ The Development Storm Water Rund $S_{PRE} = \underbrace{2.50}_{in}$ in $Q_{PRE} = \underbrace{0.00900}_{it}$	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^*1.17) - (0.2^*2.50)]^2}{[(0.92^*1.17) + (0.8^*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$	S _{PRE} = Pre development potential maximum retention after runoff (in Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.).
OR Solution: re Development Storm Water Rund S _{PRE} = 2.50 in	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in Q_{PRE} = Q in feet of depth as defined by the "Urban).
$\frac{OR}{Solution:}$ The Development Storm Water Rund $S_{PRE} = \underbrace{2.50}_{in} in$ $Q_{PRE} = \underbrace{0.00900}_{ft} ft^{3}$	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(21,403)$	S _{PRE} = Pre development potential maximum retention after runoff (in Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.).
$\frac{OR}{Solution:}$ The Development Storm Water Rund $S_{PRE} = \underbrace{2.50}_{in} \text{ in}$ $Q_{PRE} = \underbrace{0.00900}_{ft} \text{ ft}$ $V_{PRE} = \underbrace{192.63}_{ft} \text{ ft}^{3}$ The Development Storm Water Rund	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(21,403)$ moff Volume	 S_{PRE}= Pre development potential maximum retention after runoff (in Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³)).
$\frac{OR}{Solution:}$ te Development Storm Water Rund S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 192.63 ft ³	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(21,403)$ noff Volume $S_{POST} = \frac{1000}{-10} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) <u>Where:</u>	
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$\frac{OR}{Solution:}$ The Development Storm Water Rund $S_{PRE} = \underbrace{2.50}_{in}$ $Q_{PRE} = \underbrace{0.00900}_{it}$ $V_{PRE} = \underbrace{192.63}_{it} ft^{3}$ The Development Storm Water Rund $S_{POST} = \underbrace{0.49318}_{in}$	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(21,403)$ moff Volume $S_{POST} = \frac{1000}{95} -10$	 S_{PRE}= Pre development potential maximum retention after runoff (in Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) <u>Where:</u> S_{POST}= Post development potential maximum retention after runoff (in Storm Vater Vate	
$\frac{OR}{Solution:}$ The Development Storm Water Rund $S_{PRE} = \underbrace{2.50}_{in} in$ $Q_{PRE} = \underbrace{0.00900}_{ft} ft^{3}$ $V_{PRE} = \underbrace{192.63}_{ft^{3}} ft^{3}$ The Development Storm Water Rund	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(21,403)$ moff Volume $S_{POST} = \frac{1000}{95} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban	
$\frac{OR}{Solution:}$ re Development Storm Water Rund $S_{PRE} = \underbrace{2.50}_{in}$ $Q_{PRE} = \underbrace{0.00900}_{it}$ $V_{PRE} = \underbrace{192.63}_{it} ft^{3}$ ost Development Storm Water Run $S_{POST} = \underbrace{0.49318}_{in}$ in	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(21,403)$ noff Volume $S_{POST} = \frac{1000}{-10} -10$	 S_{PRE}= Pre development potential maximum retention after runoff (in Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) <u>Where:</u> S_{POST}= Post development potential maximum retention after runoff (in Sport) 	
$\frac{OR}{Solution:}$ re Development Storm Water Rund $S_{PRE} = \underbrace{2.50}_{in}$ $Q_{PRE} = \underbrace{0.00900}_{it}$ $V_{PRE} = \underbrace{192.63}_{it} ft^{3}$ ost Development Storm Water Run $S_{POST} = \underbrace{0.49318}_{in}$ in	$C_{N_{POST}} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(21,403)$ noff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*0.49)]^2}{[(0.92*1.17) + (0.8*0.49)]} \times \frac{1 \text{ft}}{12 \text{in}}$	S _{PRE} = Pre development potential maximum retention after runoff (in Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
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$\begin{tabular}{lllllllllllllllllllllllllllllllllll$	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{+}1.17) - (0.2 * 2.50)]^2}{[(0.92^{+}1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(21,403)$ noff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92^{+}1.17) - (0.2 * 0.49)]^2}{[(0.92^{+}1.17) + (0.8 * 0.49)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.05433)(21,403)$ rement	S _{PRE} = Pre development potential maximum retention after runoff (in Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
$\frac{OR}{Solution:}$ re Development Storm Water Rund $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 192.63$ ft ³ ost Development Storm Water Rund $S_{POST} = 0.49318$ in $Q_{POST} = 0.05433$ ft $V_{POST} = 1162.82$ ft ³ <u>Solution:</u> Volume Capture Require Increase in volume of storm	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{+}1.17) - (0.2 * 2.50)]^2}{[(0.92^{+}1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(21,403)$ noff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92^{+}1.17) - (0.2 * 0.49)]^2}{[(0.92^{+}1.17) + (0.8 * 0.49)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.05433)(21,403)$	S _{PRE} = Pre development potential maximum retention after runoff (in Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
$\frac{OR}{Solution:}$ re Development Storm Water Rund $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 192.63$ ft ³ ost Development Storm Water Rund $S_{POST} = 0.49318$ in $Q_{POST} = 0.05433$ ft $V_{POST} = 1162.82$ ft ³ <u>Solution:</u> Volume Capture Require Increase in volume of storm	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{+}1.17) + (0.2 * 2.50)]^{2}}{[(0.92^{+}1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(21,403)$ moff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92^{+}1.17) + (0.2 * 0.49)]^{2}}{[(0.92^{+}1.17) + (0.8 * 0.49)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.05433)(21,403)$ rement in water that must be retained onsite (may be infiltrated or reused)	S _{PRE} = Pre development potential maximum retention after runoff (in Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
$\frac{OR}{Solution:}$ re Development Storm Water Rund $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 192.63$ ft ³ ost Development Storm Water Rund $S_{POST} = 0.49318$ in $Q_{POST} = 0.05433$ ft $V_{POST} = 1162.82$ ft ³ <u>Solution:</u> Volume Capture Require Increase in volume of storm	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{+}1.17) + (0.2 * 2.50)]^{2}}{[(0.92^{+}1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(21,403)$ moff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92^{+}1.17) + (0.2 * 0.49)]^{2}}{[(0.92^{+}1.17) + (0.8 * 0.49)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{POST} = (0.05433)(21,403)$ rement in water that must be retained onsite (may be infiltrated or reused)	S _{PRE} = Pre development potential maximum retention after runoff (in Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
$\frac{OR}{Solution:}$ The Development Storm Water Rund $S_{PRE} = 2.50 \text{ in}$ $Q_{PRE} = 0.00900 \text{ ft}$ $V_{PRE} = 192.63 \text{ ft}^{3}$ $Oost Development Storm Water Rund S_{POST} = 0.49318 \text{ in} Q_{POST} = 0.05433 \text{ ft} V_{POST} = 1162.82 \text{ ft}^{3} \frac{Solution:}{Increase in volume of storm} \frac{W_{POST}}{W_{POST}} = 0.00000 \text{ ft}$	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(21,403)$ moff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.49)]^2}{[(0.92*1.17) + (0.8 * 0.49)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.05433)(21,403)$ rement in water that must be retained onsite (may be infiltrated or reused) V_{PRE} Delta Volume Capture = (1,162.82) - (19)	S _{PRE} = Pre development potential maximum retention after runoff (in Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³) . 92.63) Where:	n).
$\frac{OR}{Solution:}$ The Development Storm Water Rund $S_{PRE} = 2.50 \text{ in}$ $Q_{PRE} = 0.00900 \text{ ft}$ $V_{PRE} = 192.63 \text{ ft}^{3}$ $Oost Development Storm Water Rund S_{POST} = 0.49318 \text{ in} Q_{POST} = 0.05433 \text{ ft} V_{POST} = 1162.82 \text{ ft}^{3} \frac{Solution:}{Increase in volume of storm} \frac{W_{POST}}{W_{POST}} = 0.00000 \text{ ft}$	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(21,403)$ moff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.49)]^2}{[(0.92*1.17) + (0.8 * 0.49)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.05433)(21,403)$ rement in water that must be retained onsite (may be infiltrated or reused) V_{PRE} Delta Volume Capture = (1,162.82) - (19)	S _{PRE} = Pre development potential maximum retention after runoff (in Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³) . 92.63) Where: ume Capture= The increase in volume of storm water generated by the 85th	n).
$\frac{OR}{Solution:}$ The Development Storm Water Rund $S_{PRE} = 2.50 \text{ in}$ $Q_{PRE} = 0.00900 \text{ ft}$ $V_{PRE} = 192.63 \text{ ft}^{3}$ $Oost Development Storm Water Rund S_{POST} = 0.49318 \text{ in} Q_{POST} = 0.05433 \text{ ft} V_{POST} = 1162.82 \text{ ft}^{3} \frac{Solution:}{Increase in volume of storm} \frac{W_{POST}}{W_{POST}} = 0.00000 \text{ ft}$	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 95 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) + (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(21,403)$ moff Volume $S_{POST} = \frac{1000}{95} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.49)]^2}{[(0.92*1.17) + (0.8 * 0.49)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.05433)(21,403)$ rement in water that must be retained onsite (may be infiltrated or reused) V_{PRE} Delta Volume Capture = (1,162.82) - (19)	S _{PRE} = Pre development potential maximum retention after runoff (in Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³) . 92.63) Where:	n).



LID BMP Sizing Tool: 100% Volume Capt Formulas: $V_{LID GOAL}=((V_{GOAL}))/(P) = 2982.31$ ft ³ $A_{LID GOAL}=(W)(L) = 800.89$ ft ²	<u>Where:</u> V _{LID GOAL} = Required volume of soil in LID BMP. A _{LID GOAL} = Footprint of LID BMP area for a given depth (below perforated pi V _{GOAL} = 1,312 Where:	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
Input:	P = 0.4 as a decimalD = 3.7 ftBelow perforated pipe if presentW = 28.3 ftL = 28.3 ft		
Solution: Percent of Goal Achieved = 100.44	% = [(3.7 x 801) / 2,982] x 100	7	
LID BMP Sizing Tool Delta Volume Captu Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01 ft ³	re Requirement: V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
$A_{LID DELTA}=(W)(L) = 0.00 \text{ ft}^2$	$V_{\text{LID DELTA}}$ = Required volume of soil in LID BMP $A_{\text{LID DELTA}}$ = Footprint of LID BMP area for a given depth (below perforated pi V_{DELTA} = 970.20 ft ³	ipe if present).	<u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		Requirement achieved" reaches 100%.
<u>Input:</u>	P =0.0as a decimalD =0.0ftBelow perforated pipe if presentW =0.0ftL =0.0ft		
Solution: ^{CD} Percent of Requirement Achieved = #DIV/0!	% = #DIV/0!		

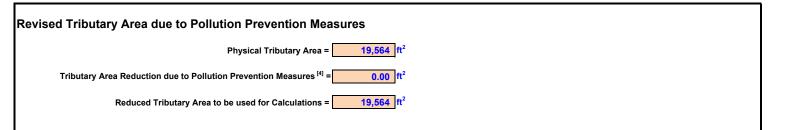




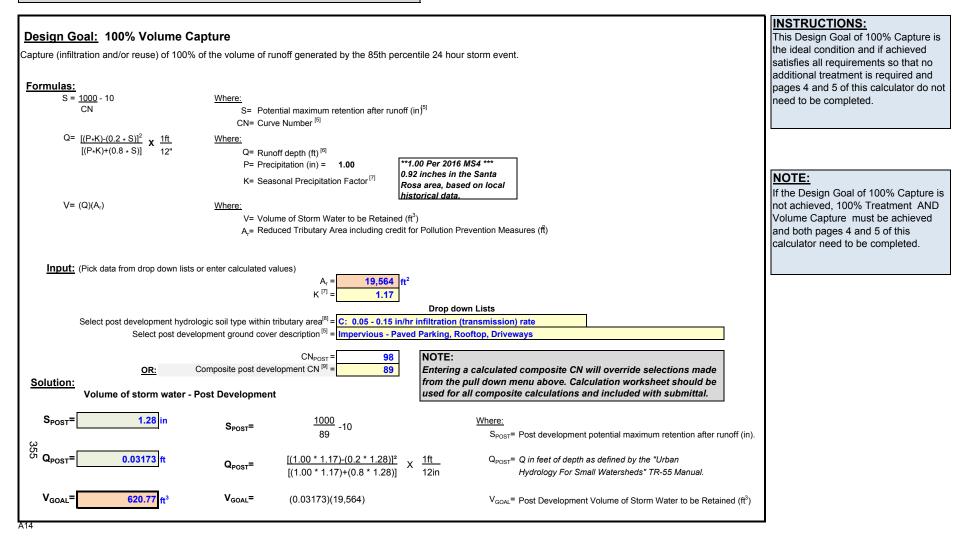
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conne Multiplier = 1	sted Paved Area	INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²		
Area Reduction = 0.00 ft ²		
nterceptor Trees ^[2]		INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees NOTE: Total Interceptor Area (200 ft²/tree) Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=	New Deciduous Trees	
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)	
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy	
Allowed reduction credit for existing tree canopy= 0 ft ²	Allowed credit for existing tree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ² Buffer Factor = 0.7	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) = Area Reduction = 0.00 ft²	





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.



Release 7 Rev. 1 5/23/2017



Requirement 1: 100% Treatmer	nt		INSTRUCTIONS:
	y 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
Formula		The C value used for this calculation is smaller than the value used for	on page 3 of this calculator is not
Formula: Q _{TREATMENT} = (0.2 in/hr)(A _r)(C _{POST})(K) cfs	Where:	hydraulic Flood Control design.	achieved; then Requirement 1-100% Treatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	AND Requirement 2- Volume
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prevention Measure	s (in Acres) to size the overflow bypass.	must be achieved.
lumente	K = Seasonal Precipitation Factor ⁷⁷		
Input:	A, = 19.564 ft ² = 0.44913 Acres		
	$C_{POST}^{[10]} = 0.47$		
	K ^[7] = 1.2		
	NOTE:		
Solution:		te calculated here should only be used to size the	
		BMP. All associated overflow inlets and systems	
Q _{TREATMENT} = 0.04940 cfs	Q _{TREATMENT} ⁼ (0.2)(0.4491)(0.47)(1.17) should be si	zed for the Flood Control event.	

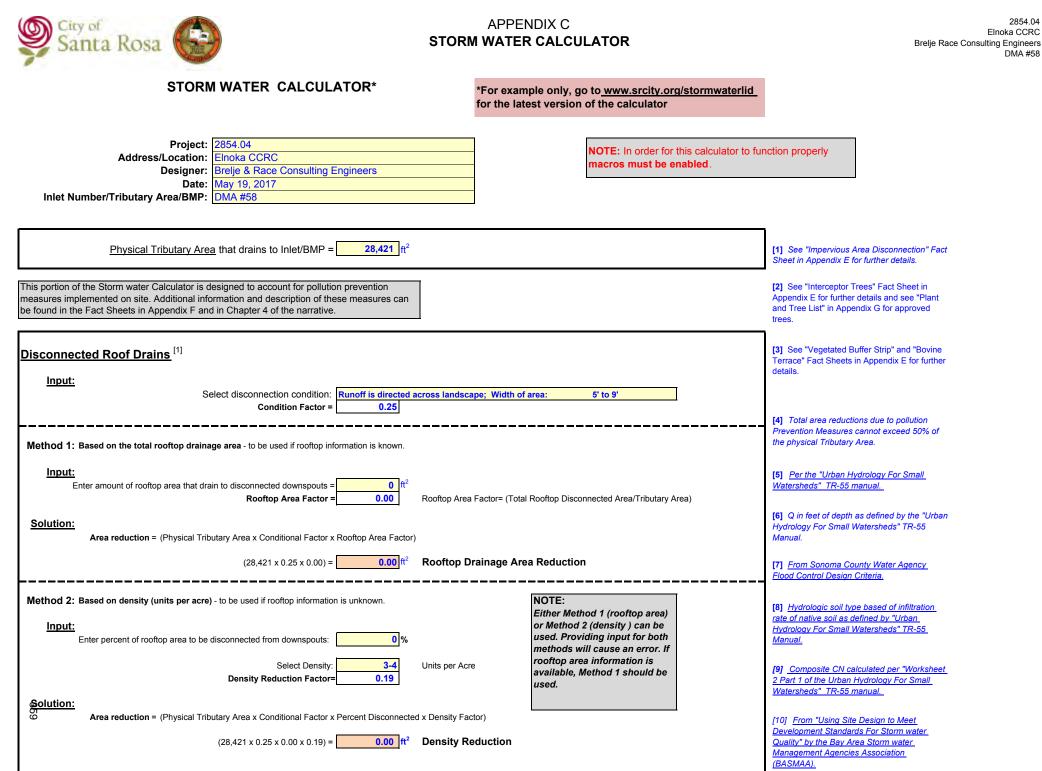


2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #57

equirement 2: Delta Volume o increase in volume of runoff leaving the	Capture he site due to development for the 85th percentile 24 hour storm e	vent.	INSTRUCTIONS: If the Design Goal of 100% Captur
			on page 3 of this calculator is not
			achieved; then Requirement 1-100
ormulas:	18.0		Treatment, page 4 of the calculate
S = <u>1000</u> - 10 CN	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff $(in)^{5}$		Capture, this page of the calculate
	CN= Curve Number ^[5]		must be achieved.
$\frac{Q= [(P*K)-(0.2*S)]^2}{[(P*K)+(0.8*S)]} \times \frac{1ft}{12in}$	Where:		
[(P*K)+(0.8 * S)] 12in	Q= Runoff depth (ft) [6]		
	P= Precipitation (in) = 0.92 0.92 inches in the	e Santa Rosa	
	K= Seasonal Precipitation Factor ^[7] area, based on lo	ocal historical	
$V=(Q)(A_r)$	Where: data.		NOTE:
• (=)(=)	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generate
	A_r = Reduced Tributary Area including credit for Pollution Pr	evention Measures ([#])	•
	A_r = Reduced modulary Area including credit for Foliation F		after development is less than or
• • • • • • • • •			equal to that generated before
Input: (Pick data from drop down list			development, Requirement 2-Volu
	$A_r = 19,564 ft^2$		Capture is not required.
	K ^[7] = 1.2		
	Drop dov	vn Lists	$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PR}$
Select hvdr	ologic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration (1		
	elopment ground cover description ^[5] = Woods (50%), grass (50%) com		
Select pieder	elopment ground cover description ^[5] = Impervious - Paved Parking, Ro	ofton Driveways	
	CN _{PRE} = 76	onop, briveways	
	CN _{POST} = 90.3		
OR	Composite Predevelopment CN ^[9] = 80		
	Composite Predevelopment CN [9] 80 Composite Post development CN [9] 89		
Solution:	Composite Post development CN ^[9] = 89		
Solution: e Develop <u>ment Storm Wat</u> er Run	Composite Post development CN ^[9] = 89 off Volume	Where	
Solution:	Composite Post development CN ^[9] = 89 off Volume	<u>Where:</u>	
Solution: e Develop <u>ment Storm Wat</u> er Run	Composite Post development CN ^[9] = 89 off Volume	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: e Development Storm Water Run S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 89 off Volume $S_{PRE} = \frac{1000}{80} -10$		
Solution: • Development Storm Water Run	Composite Post development CN ^[9] = 89 off Volume $S_{PRE} = \frac{1000}{80} -10$		
Solution: e Development Storm Water Run S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 89 off Volume	S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: Development Storm Water Run S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Post development CN ^[9] = 89 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: Development Storm Water Run S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Post development CN ^[9] = 89 off Volume $\mathbf{S}_{PRE} = \frac{1000}{80} -10$ $\mathbf{Q}_{PRE} = \frac{[(0.92^*1.17) - (0.2^*2.50)]^2}{[(0.92^*1.17) + (0.8^*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: Development Storm Water Run S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 89 off Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: e Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 176.08$ ft ³	Composite Post development CN ^[9] = 89 off Volume $\mathbf{S}_{PRE} = \frac{1000}{80} -10$ $\mathbf{Q}_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $\mathbf{V}_{PRE} = (0.00900)(19,564)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 176.08$ ft ³ st Development Storm Water Ru	Composite Post development CN ^[9] = 89 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(19,564)$ noff Volume	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Solution: Development Storm Water Run S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 176.08 ft ³	Composite Post development CN ^[9] = 89 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(19,564)$ noff Volume	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where:	
Solution: Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 176.08$ ft ³ st Development Storm Water Ru	Composite Post development CN ^[9] = 89 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(19,564)$ noff Volume	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 176.08 ft ³ st Development Storm Water Ru S_{POST} = 1.27 in	Composite Post development CN ^[9] = 89 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(19,564)$ noff Volume $S_{POST} = \frac{1000}{89} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where:	
Solution: Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 176.08 ft ³ st Development Storm Water Ru S_{POST} =	Composite Post development CN ^[9] = 89 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(19,564)$ noff Volume $S_{POST} = \frac{1000}{89} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where:	
Solution: e Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 176.08 ft ³ vst Development Storm Water Run S_{POST} = 1.27 in	Composite Post development CN ^[9] = 89 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(19,564)$ noff Volume $S_{POST} = \frac{1000}{89} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in).	
Solution: a Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 176.08 ft ³ st Development Storm Water Ru S_{POST} = 1.27 in	Composite Post development CN ^[9] = 89 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(19,564)$ noff Volume	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban	
Solution: e Development Storm Water Run $S_{PRE} = 2.50$ in $Q_{PRE} = 0.00900$ ft $V_{PRE} = 176.08$ ft ³ st Development Storm Water Ru $S_{POST} = 1.27$ in $Q_{POST} = 0.02694$ ft	Composite Post development CN ^[9] = 89 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92^{+}1.17) - (0.2 * 2.50)]^2}{[(0.92^{+}1.17) + (0.8 * 2.50)]} \times \frac{1 \text{ft}}{12 \text{in}}$ $V_{PRE} = (0.00900)(19,564)$ noff Volume $S_{POST} = \frac{1000}{89} -10$ $Q_{POST} = \frac{[(0.92^{+}1.17) - (0.2 * 1.27)]^2}{[(0.92^{+}1.17) + (0.8 * 1.27)]} \times \frac{1 \text{ft}}{12 \text{in}}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
Solution: a Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 176.08 ft ³ st Development Storm Water Ru S_{POST} = 1.27 in	Composite Post development CN ^[9] = 89 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(19,564)$ noff Volume $S_{POST} = \frac{1000}{89} -10$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban	
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LID BMP Sizing Tool: 100% Volume Captor Formulas: $V_{LID GOAL}=((V_{GOAL}))/(P) = 1410.83$ ft ³ $A_{LID GOAL}=(W)(L) = 1089.00$ ft ²	ure Goal; V_{GOAL} $\frac{Where:}{V_{LID GOAL}}$ $V_{LID GOAL}$ $V_{LID GOAL}$ Required volume of soil in LID BMP. $A_{LID GOAL}$ Footprint of LID BMP area for a given depth (below perforated p V_{GOAL} 621 ft ³ Where:	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
<u>Input:</u>	P = 0.4 as a decimal D = 1.3 ft Below perforated pipe if present W = 33.0 ft L = 33.0 ft		
Solution: Percent of Goal Achieved = 100.35	% = [(1.3 x 1,089) / 1,411] x 100	7	
LID BMP Sizing Tool Delta Volume Captu <u>Formulas:</u> V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0! ft ³	re Requirement: V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
Formulas:		LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of
Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0! ft ³	Where: V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated performance)	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be
Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/0! $A_{LID DELTA} = (W)(L) = $ 0.00ft ²	Where: $V_{\text{LID DELTA}}$ = Required volume of soil in LID BMP $A_{\text{LID DELTA}}$ = Footprint of LID BMP area for a given depth (below perforated p V_{DELTA} = 350.98 ft ³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet)	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Requirement achieved" reaches

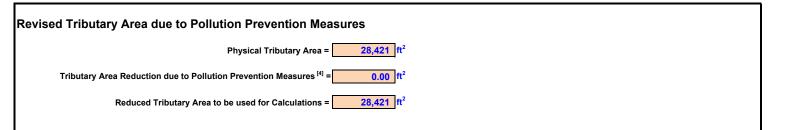




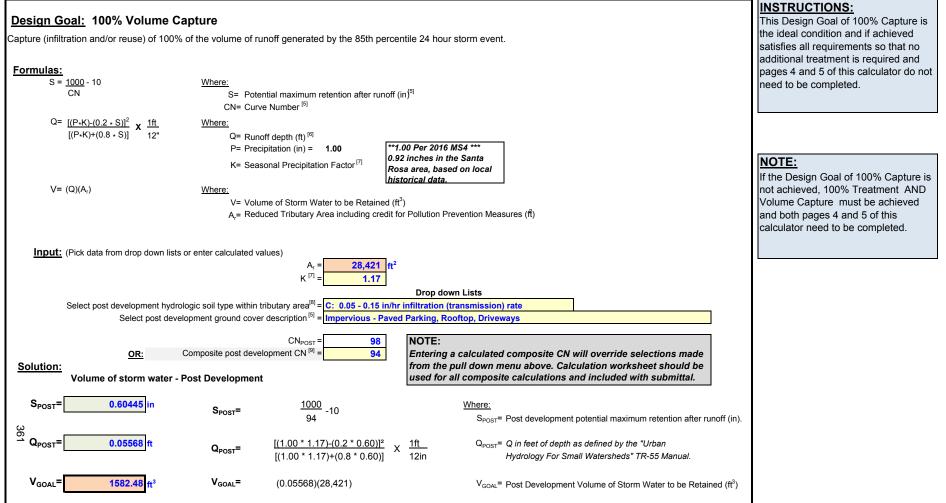
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conne Multiplier = 1	ected Paved Area		INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²			
Area Reduction = 0.00 ft ²			
nterceptor Trees ^[2]			INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees (200 ft ² /tree)	NOTE: Total Interceptor Area Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0	New Deciduous Trees		
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)		
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy		
Allowed reduction credit for existing tree canopy=	Allowed credit for existing to	ree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas manage [,]	d by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ² Buffer Factor = 0.7	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter the area draining to these features.
Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) = Area Reduction = 0.00 ft ²	
	_





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.





De autore at 1, 100% Tre starte	-		INSTRUCTIONS:
Requirement 1: 100% Treatment Treatment of 100% of the flow generated b	n t vy 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
		The C value used for this calculation	on page 3 of this calculator is not
Formula: Q _{TREATMENT} = (0.2 in/hr)(A _r)(C _{POST})(K) cfs	Where:	is smaller than the value used for hydraulic Flood Control design.	achieved; then Requirement 1-100% Treatment, this page of the calculator,
CIREATMENT (0.2 mm), () (0.0 post), () 0.0	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	10
	C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prevention Measures (in Acres) K = Seasonal Precipitation Factor ^[7]	to size the overflow bypass.	must be achieved.
<u>Input:</u>	$A_{r} = \underbrace{28,421}_{C_{POST}^{[10]} = \underbrace{0.61}_{K^{[7]} = \underbrace{1.2}} ft^{2} = \underbrace{0.65246}_{NOTE:}$		
Solution: Q _{TREATMENT} = 0.09313 cfs		ted here should only be used to size the associated overflow inlets and systems e Flood Control event.	

Release 7 Rev. 1 5/23/2017

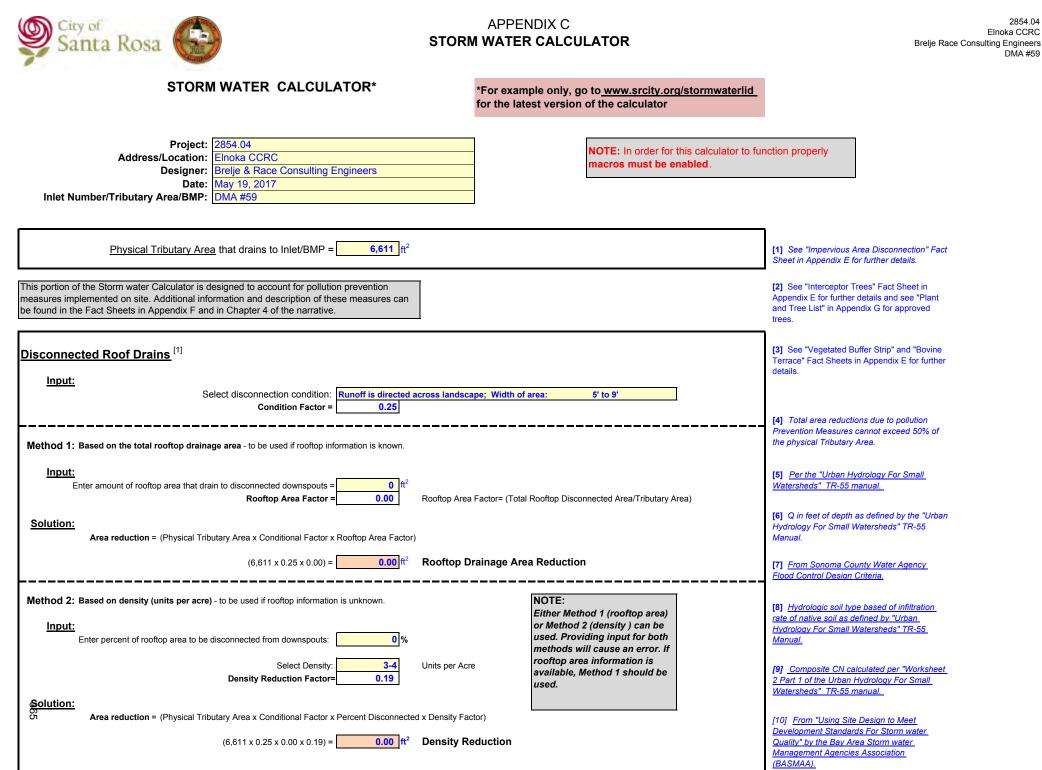


2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #58

	Capture the site due to development for the 85th percentile 24 hour storm	event.	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not achieved; then Requirement 1-100%
ormulas:			Treatment, page 4 of the calculator,
S = <u>1000</u> - 10	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ⁵		
	CN= Curve Number ^[5]		Capture, this page of the calculator,
$O = I(D K) (0.2 S)^2 = 10^4$			must be achieved.
$Q= \frac{[(P*K)-(0.2*S)]^2}{[(P*K)+(0.8*S)]} \times \frac{1ft}{12in}$	Where:		
[(P*K)+(0.8 * 5)] 12in	Q= Runoff depth (ft) ^[6]		
	P= Precipitation (in) = 0.92 0.92 inches in t		
	K= Seasonal Precipitation Factor ^[7] area, based on	local historical	
$V=(Q)(A_r)$	Where: data.		NOTE:
• (=)(=))	V= Volume of Storm Water to be Retained (ft ³)		If the amount of volume generated
	A _r = Reduced Tributary Area including credit for Pollution F	Prevention Measures (\vec{t})	-
	A_r = Reduced Hibbitary Area including credit for Foliation F	revention measures (r)	after development is less than or
			equal to that generated before
Input: (Pick data from drop down li	sts or enter calculated values)		development, Requirement 2-Volum
	$A_r = \frac{28,421}{1000} ft^2$		Capture is not required.
	K ^[7] = 1.2		
			$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE}$
		own Lists	
Select hy	drologic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration	(transmission) rate	
	evelopment ground cover description ^[5] = Woods (50%), grass (50%) co		
Select post de	evelopment ground cover description ^[5] = Impervious - Paved Parking, F	ooftop, Driveways	
	CN _{PRE} = 76	· · ·	
	CN _{POST} = 90.3		
	Composite Predevelopment CN ^[9] = 80		
	Composite Predevelopment CN ^{es} = 80		
OR			
<u>OR</u>	Composite Post development CN ^[9] = 94		
Solution:	Composite Post development CN ^[9] = 94		
Solution: Development Storm Water Ru	Composite Post development CN ^[9] = 94		
Solution:	Composite Post development CN ^[9] = 94	Where:	
<u>olution:</u> Develop <u>ment Storm Wat</u> er Ru	Composite Post development CN ^[9] = 94	<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff (in).	
<u>solution:</u> Develop <u>ment Storm Wat</u> er Ru	Composite Post development CN ^[9] = 94		
Solution: Development Storm Water Ru S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 94 noff Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in).	
<u>olution:</u> Develop <u>ment Storm Wat</u> er Ru	Composite Post development CN ^[9] = 94 noff Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Bolution: Development Storm Water Ru S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 94	S_{PRE} = Pre development potential maximum retention after runoff (in).	
olution: Development Storm Water Ru S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Post development CN ^[9] = 94 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
olution: Development Storm Water Ru S _{PRE} = 2.50 in	Composite Post development CN ^[9] = 94 noff Volume $S_{PRE} = \frac{1000}{80} -10$	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
olution: Development Storm Water Ru S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Post development CN ^[9] = 94 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
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Solution: a Development Storm Water Ru S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 255.79 ft ³ ast Development Storm Water R S_{POST} = 0.60445 in Q_{POST} = 0.04898 ft V_{POST} = 1392.06 ft ³ Solution: Volume Capture Requires in volume of stor Delta Volume Capture (V_{POST})	Composite Post development CN ^[9] = 94 noff Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2*2.50)]^2}{[(0.92*1.17) + (0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(28,421)$ unoff Volume $S_{POST} = \frac{1000}{94} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2*0.60)]^2}{[(0.92*1.17) + (0.8*0.60)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.04898)(28,421)$ there is that must be retained onsite (may be infiltrated or reused in that must be retained onsite (may be infiltrated or reused in that whether is the retained onsite (may be infiltrated or reused in that whether is the retained onsite (may be infiltrated or reused in the retained onsite (may be infiltrated or reused in the retained onsite (may be infiltrated or reused in the retained onsite (may be infiltrated or reused in the retained onsite (may be infiltrated or reused in the retained onsite (may be infiltrated or reused in the retained onsite (may be infiltrated or reused in the retained onsite (may be infiltrated or reused in the retained onsite (may be infiltrated or reused in the retained onsite (may be infiltrated or reused in the retained onsite (may be infiltrated or reused in the retained onsite (may be infiltrated or reused in the retained onsite (may be infiltrated or reused in the retained onsite (may be infiltrated or reused in the retained onsite (may be infiltrated or reused in the retained onsite (may be infiltrated or reused in the retained onsite (may be infiltrated or reused in the retained on the re	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in) Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post Development Volume of Storm Water Generated (ft ³) V _{POST} = Post Development Volume of Storm Water Generated (ft ³) V _{POST} = Post Development Volume of Storm Water Generated (ft ³)). 255.79)	



LID BMP Sizing Tool: 100% Volume Capt Formulas: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 3596.55$ ft ³ $A_{LID GOAL} = (W)(L) = 1075.84$ ft ²	ure Goal; V_{GOAL} Where: $V_{LID GOAL}$ = Required volume of soil in LID BMP. $A_{LID GOAL}$ = Footprint of LID BMP area for a given depth (below perforated pi V_{GOAL} = 1,582 ft ³ Where:	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. pe if present).	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
<u>Input:</u>	P =0.4as a decimalD = 3.4 ftBelow perforated pipe if presentW = 32.8 ftL = 32.8 ft		
Solution: Percent of Goal Achieved = 101.70	% = [(3.4 x 1,076) / 3,597] x 100	7	
LID BMP Sizing Tool Delta Volume Captur	<u>re Requirement</u> : V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
$A_{LID DELTA}=(W)(L) = \boxed{0.00} ft^2$	$V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perforated pi V_{DELTA} = 1136.27 ft ³	pe if present).	<u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		Requirement achieved" reaches 100%.
<u>Input:</u>	P = 0.0 as a decimal D = 0.0 ft Below perforated pipe if present W = 0.0 ft L = 0.0 ft		
Solution: ω Percent of Requirement Achieved = #DIV/0!	% = #DIV/0!		

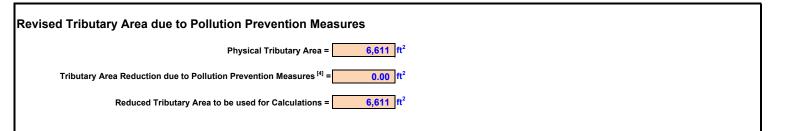




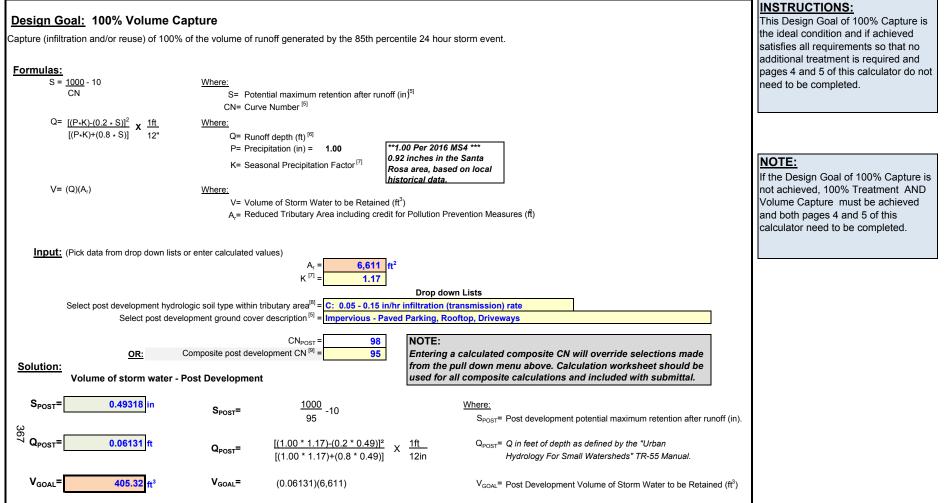
		_
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connection Multiplier = 1	ected Paved Area	INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Enter area of alternatively designed paved area: 0 ft ²		
Area Reduction = 0.00 ft ²		
Interceptor Trees ^[2]		INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new <i>Evergreen Trees</i> that qualify as interceptor trees=0 Area Reduction due to new Evergreen Trees=0ft ²	New Evergreen Trees NOTE: Total Interceptor Area (200 ft²/tree) Reduction is limited to 50% of the physical tributary area.	new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees=0	New Deciduous Trees	
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)	
Enter square footage of qualifying existing tree canopy = 0	Existing Tree Canopy	
Allowed reduction credit for existing tree canopy=	Allowed credit for existing tree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	= Sum of areas managed by evergreen + deciduous + existing canopy	

Buffer Strips & Bovine Terraces ^[3] Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ² Buffer Factor = 0.7	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine terraces. Runoff Must be direct to these features as sheet flow. Enter the area draining to these features.
Solution: Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) = Area Reduction = 0.00 ft ² Φ	





This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.



Release 7 Rev. 1 5/23/2017



	Requirement 1: 100% Treatment	nt		INSTRUCTIONS:
ŀ	Treatment of 100% of the flow generated b	y 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
			The C value used for this calculation	on page 3 of this calculator is not
	Formula:		is smaller than the value used for	achieved; then Requirement 1-100%
	Q _{TREATMENT} = (0.2 in/hr)(A _r)(C _{POST})(K) cfs	Where:	hydraulic Flood Control design.	Treatment, this page of the calculator,
		Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	AND Requirement 2- Volume
		C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
		A _r = Reduced Tributary Area including credit for Pollution Prevention Measure	es (in Acres) to size the overflow bypass.	must be achieved.
		K = Seasonal Precipitation Factor ^[7]	· · · ·	
	<u>Input:</u>	$A_{r} = \underbrace{6,611}_{C_{POST}} ft^{2} = \underbrace{0.15177}_{Acres} Acres$ $K^{[7]} = \underbrace{1.2}_{K} NOTE:$		
	Solution: Q _{TREATMENT} = 0.02344 cfs	The Flow R appropriate	ate calculated here should only be used to size the BMP. All associated overflow inlets and systems ized for the Flood Control event.	

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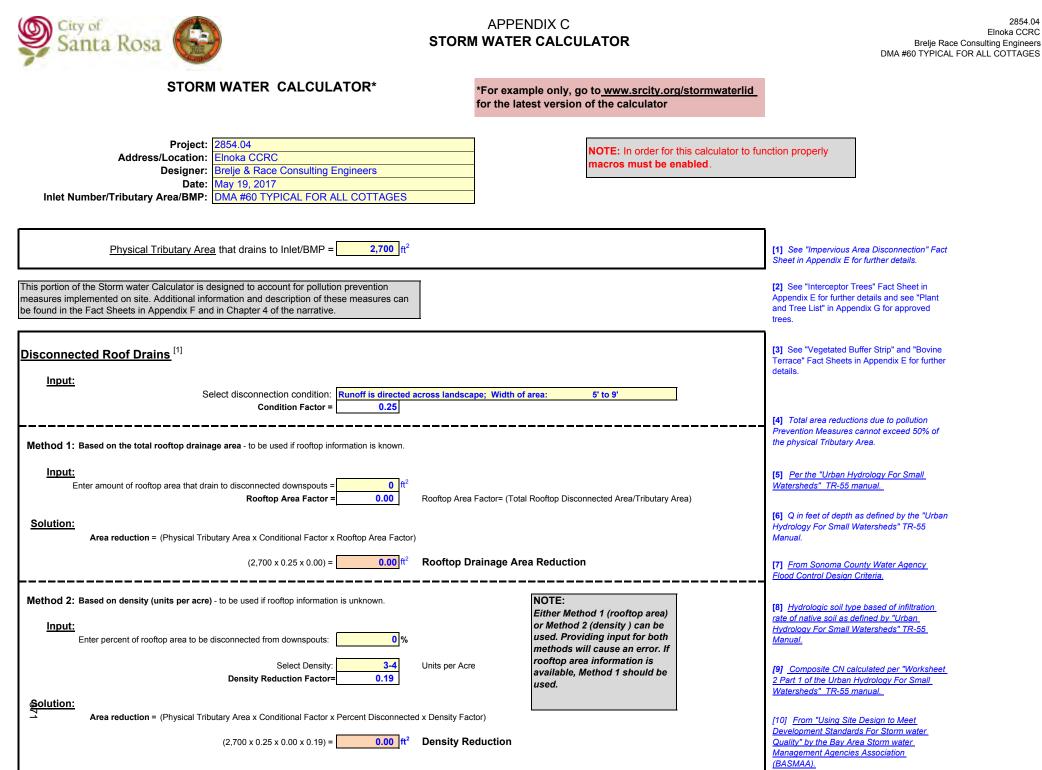


2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #59

equirement 2: Delta			ent for the 85th percen	tile 24 hour storn	n event.	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not
						achieved; then Requirement 1-100
ormulas:						Treatment, page 4 of the calculator
S = <u>1000</u> - 10	<u>\</u>	Where:				AND Requirement 2- Volume
CN			maximum retention after	runoff (in) ^{5]}		Capture, this page of the calculator
	2	CN= Curve Nu	umber ^[5]			must be achieved.
$Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]}$	$\frac{1}{2} \times \frac{1 \text{ft}}{1}$	Where:				
[(P*K)+(0.8 * S)])] 12in	Q= Runoff de	,			
			tion (in) = 0.92		the Santa Rosa	
		K= Seasonal	I Precipitation Factor ^[7]	area, based o data.	n local historical	
$V= (Q)(A_r)$	<u>1</u>	Where:				NOTE:
			of Storm Water to be Retain			If the amount of volume generated
		A _r = Reduced	Tributary Area including	credit for Pollution	Prevention Measures (ť)	after development is less than or
						equal to that generated before
Input: (Pick data from c	drop down lists or en	ter calculated values				development, Requirement 2-Volu
				11 ^{ft²}		Capture is not required.
			K ^[7] =	.2		$(C_{POST} \le C_{PRE} \text{ or } CN_{POST} \le CN_{PRI}$
				Drop o	down Lists	O POST = O PRE OF ON POST S ON PRE
	Select hydrologic s	soil type within tribut	ary area ^[8] = C: 0.05 - 0.			
Ş	Select predevelopme	ent ground cover des			ombination (orchard or tree farm) - Fair	
Se	Select post developme	ent ground cover des	scription ^[5] = Impervious	- Paved Parking,	Rooftop, Driveways	
			CN _{PRE} =	76		
			CN _{POST} =	0.3		
	OR Com	nposite Predevelopm		80		
		nposite Predevelopm posite Post developm		80 95		
Solution:						
	Comp	oosite Post developm				
e Development Storm	Comp	olume	nent CN ^[9] =		Where:	
e Development Storm \	Comp	oosite Post developm	nent CN ^[9] =		<u>Where:</u>	6-)
e Development Storm	Comp	olume			<u>Where:</u> S _{PRE} = Pre development potential maximum retention after runoff	(in).
e Development Storm V S _{PRE} =	Comp Water Runoff Vo 2.50 in	olume S _{PRE} =	nent CN ^[9] =	95	S_{PRE} = Pre development potential maximum retention after runoff	(in).
e Development Storm V S _{PRE} =	Comp	olume S _{PRE} =	nent CN ^[9] =	95	S_{PRE} = Pre development potential maximum retention after runoff Q_{PRE} = Q in feet of depth as defined by the "Urban	(in).
e Development Storm V S _{PRE} =	Comp Water Runoff Vo 2.50 in	olume S _{PRE} =	nent CN ^[9] =	95	S_{PRE} = Pre development potential maximum retention after runoff	(in).
e Development Storm V S _{PRE} =	Comp Water Runoff Vo 2.50 in 0900 ft	olume S _{PRE} = Q _{PRE} =	thent CN ^[9] = $\frac{1000}{80}$ -10 [(0.92*1.17)-(0.2 * 2.5 [(0.92*1.17)+(0.8 * 2.5)]	95	S _{PRE} = Pre development potential maximum retention after runoff Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	(in).
e Development Storm V S _{PRE} =	Comp Water Runoff Vo 2.50 in	olume S _{PRE} = Q _{PRE} =	nent CN ^[9] =	95	S_{PRE} = Pre development potential maximum retention after runoff Q_{PRE} = Q in feet of depth as defined by the "Urban	(in).
Pe Development Storm V S _{PRE} = 2 Q _{PRE} = 0.00 V _{PRE} = 55	Comp Water Runoff Vo 2.50 in 0900 ft 59.50 ft ³	olume S _{PRE} = Q _{PRE} = V _{PRE} = (thent CN ^[9] = $\frac{1000}{80}$ -10 [(0.92*1.17)-(0.2 * 2.5 [(0.92*1.17)+(0.8 * 2.5)]	95	S _{PRE} = Pre development potential maximum retention after runoff Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	(in).
e Development Storm V S _{PRE} =	Comp Water Runoff Vo 2.50 in 0900 ft 59.50 ft ³ n Water Runoff V	oosite Post developm olume S _{PRE} = Q _{PRE} = V _{PRE} = (Volume	tent CN ^[9] = $\frac{1000}{80}$ -10 [(0.92*1.17)-(0.2 * 2.5 [(0.92*1.17)+(0.8 * 2.5] (0.00900)(6,611)	95	 S_{PRE}= Pre development potential maximum retention after runoff Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	(in).
e Development Storm V S _{PRE} =	Comp Water Runoff Vo 2.50 in 0900 ft 59.50 ft ³	olume S _{PRE} = Q _{PRE} = V _{PRE} = (tent CN ^[9] = $\frac{1000}{80}$ -10 [(0.92*1.17)-(0.2 * 2.5 [(0.92*1.17)+(0.8 * 2.5] (0.00900)(6,611)	95	SPRE Pre development potential maximum retention after runoff QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: Where:	
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re Development Storm V SPRE= 2 QPRE= 0.00 VPRE= 55 Dost Development Storm SPOST= 0.49	Comp Water Runoff Vo 2.50 in 0900 ft 59.50 ft ³ n Water Runoff V 9318 in	olume S _{PRE} = Q _{PRE} = V _{PRE} = (Volume S _{POST} =	tent CN ^[9] = $\frac{1000}{80}$ -10 [(0.92*1.17)-(0.2 * 2.5 [(0.92*1.17)+(0.8 * 2.5 (0.00900)(6,611) $\frac{1000}{95}$ -10	95 0)] ² X <u>1ft</u> 50)] 12in	SPRE Pre development potential maximum retention after runoff QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST Post development potential maximum retention after runoff	
The Development Storm V S_{PRE} = 2 Q_{PRE} = 0.00 V_{PRE} = 55 Dost Development Storm S_{POST} = 0.49	Comp Water Runoff Vo 2.50 in 0900 ft 59.50 ft ³ n Water Runoff V	olume Q _{PRE} = V _{PRE} = V _{PRE} = V _{PRE} = (Volume S _{POST} = Q _{POST} =	tent CN ^[9] = $\frac{1000}{80}$ -10 $\frac{[(0.92*1.17)-(0.2*2.5)}{[(0.92*1.17)+(0.8*2.5)]}$ (0.00900)(6,611) $\frac{1000}{95}$ -10 $\frac{[(0.92*1.17)-(0.2*0.4)]}{[(0.92*1.17)-(0.2*0.4)]}$	95 0)] ² X <u>1ft</u> 50)] X 12in 9)] ² X <u>1ft</u>	SPRE Pre development potential maximum retention after runoff QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST Spost Post development potential maximum retention after runoff QPOST Q in feet of depth as defined by the "Urban	
S _{PRE} 2 Q _{PRE} 0.00 V _{PRE} 55 Dost Development Storm S _{POST}	Comp Water Runoff Vo 2.50 in 0900 ft 59.50 ft ³ n Water Runoff V 9318 in	olume Q _{PRE} = V _{PRE} = V _{PRE} = V _{PRE} = (Volume S _{POST} = Q _{POST} =	tent CN ^[9] = $\frac{1000}{80}$ -10 [(0.92*1.17)-(0.2 * 2.5 [(0.92*1.17)+(0.8 * 2.5 (0.00900)(6,611) $\frac{1000}{95}$ -10	95 0)] ² X <u>1ft</u> 50)] X 12in 9)] ² X <u>1ft</u>	SPRE Pre development potential maximum retention after runoff QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST Post development potential maximum retention after runoff	
The Development Storm N $S_{PRE} = 2$ $Q_{PRE} = 0.00$ $V_{PRE} = 55$ Dost Development Storm $S_{POST} = 0.49$ $Q_{POST} = 0.05$	Comp Water Runoff Vo 2.50 in 0900 ft 59.50 ft ³ n Water Runoff V 9318 in 5433 ft	posite Post developm olume Q_{PRE} = V_{PRE} = (Volume S_{POST} = Q_{POST} =	tent CN ^[9] = $\frac{1000}{80}$ -10 $\frac{[(0.92^{*}1.17) - (0.2^{*}2.5)]}{[(0.92^{*}1.17) + (0.8^{*}2.5)]}$ (0.00900)(6,611) $\frac{1000}{95}$ -10 $\frac{[(0.92^{*}1.17) - (0.2^{*}0.4)]}{[(0.92^{*}1.17) + (0.8^{*}0.4)]}$	95 0)] ² X <u>1ft</u> 50)] X 12in 9)] ² X <u>1ft</u>	SPRE Pre development potential maximum retention after runoff QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
re Development Storm V S_{PRE} = 2 Q_{PRE} = 0.00 V_{PRE} = 55 Dost Development Storm S_{POST} = 0.49 Q_{POST} = 0.05	Comp Water Runoff Vo 2.50 in 0900 ft 59.50 ft ³ n Water Runoff V 9318 in	posite Post developm olume Q_{PRE} = V_{PRE} = (Volume S_{POST} = Q_{POST} =	tent CN ^[9] = $\frac{1000}{80}$ -10 $\frac{[(0.92*1.17)-(0.2*2.5)}{[(0.92*1.17)+(0.8*2.5)]}$ (0.00900)(6,611) $\frac{1000}{95}$ -10 $\frac{[(0.92*1.17)-(0.2*0.4)]}{[(0.92*1.17)-(0.2*0.4)]}$	95 0)] ² X <u>1ft</u> 50)] X 12in 9)] ² X <u>1ft</u>	SPRE Pre development potential maximum retention after runoff QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST Spost Post development potential maximum retention after runoff QPOST Q in feet of depth as defined by the "Urban	
Pe Development Storm V S_{PRE} = 2 Q_{PRE} = 0.00 V_{PRE} = 55 Dost Development Storm S_{POST} = 0.49 Q_{POST} = 0.05 V_{POST} = 355	Comp Water Runoff Vo 2.50 in 0900 ft 59.50 ft ³ n Water Runoff V 9318 in 5433 ft 59.18 ft ³	posite Post developm olume Q_{PRE} = V_{PRE} = V_{PRE} = V_{POST} = V_{POST} = (tent CN ^[9] = $\frac{1000}{80}$ -10 $\frac{[(0.92^{*}1.17) - (0.2^{*}2.5)]}{[(0.92^{*}1.17) + (0.8^{*}2.5)]}$ (0.00900)(6,611) $\frac{1000}{95}$ -10 $\frac{[(0.92^{*}1.17) - (0.2^{*}0.4)]}{[(0.92^{*}1.17) + (0.8^{*}0.4)]}$	95 0)] ² X <u>1ft</u> 50)] X 12in 9)] ² X <u>1ft</u>	SPRE Pre development potential maximum retention after runoff QPRE Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. VPRE Pre Development Volume of Storm Water Generated (ft ³) Where: SPOST SPOST Post development potential maximum retention after runoff QPOST Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
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LID BMP Sizing Tool: 100% Volume Capt Formulas: $V_{LID GOAL}=((V_{GOAL}))/(P) = 921.18$ ft ³ $A_{LID GOAL}=(W)(L) = 441.00$ ft ²	Where: $V_{LID GOAL}$ = Required volume of soil in LID BMP. $A_{LID GOAL}$ = Footprint of LID BMP area for a given depth (below perforated pi V_{GOAL} = 405	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
Input:	P =0.4as a decimalD =2.1ftBelow perforated pipe if presentW =21.0ftL =21.0ft		
Solution: Percent of Goal Achieved = 100.53	% = [(2.1 x 441) / 921] x 100	7	
LID BMP Sizing Tool Delta Volume Captu	<u>ire Requirement</u> : V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u>
$V_{LID DELTA} = ((V_{DELTA}))/(P) = \frac{\#DIV/0!}{\#DIV/0!} ft^{3}$ $A_{LID DELTA} = (W)(L) = \boxed{0.00} ft^{2}$	Where: V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated pi	treatment only.	requirement of the delta volume <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be
Percent of Requirement Achieved = $\frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	VDELTA= 299.68 ft ³ Where: P= Porosity (enter as a decimal)		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
Achieved V _{LID DELTA}	D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet) P = 0.0 as a decimal		
	$D = \frac{0.0}{0.0} \text{ ft} \qquad \text{Below perforated pipe if present}$ $W = \frac{0.0}{0.0} \text{ ft}$ $L = \frac{0.0}{0.0} \text{ ft}$		
Solution: ω Percent of Requirement Achieved = #DIV/0!	% = #DIV/0!		

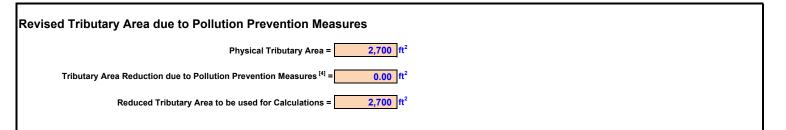




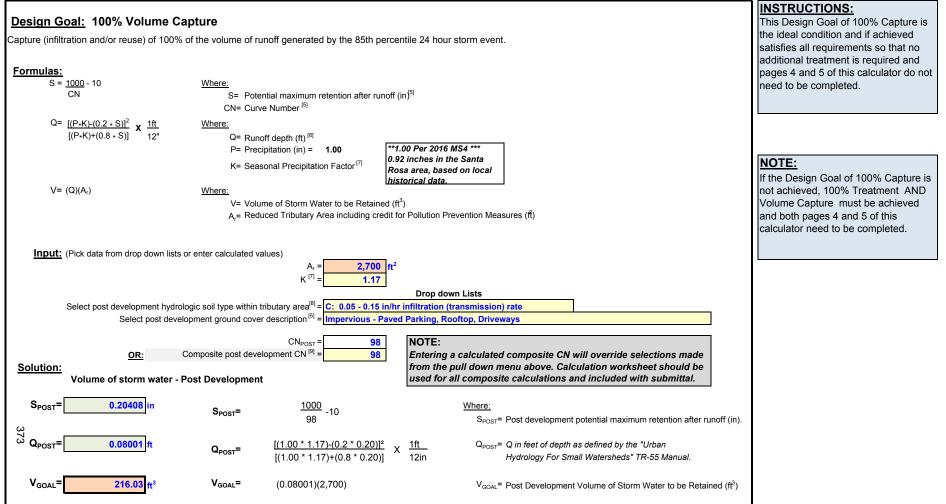
Paved Area Disconnection [1] Paved Area Type (select from drop down list): Multiplier = Multiplier Enter area of alternatively designed paved area: Area Reduction = Area Reduction =	1	cted Paved Area		INSTRUCTIONS: Calculates the area reduction credit for driveways designed to minimize runoff. Enter type and area of alternate design.
Interceptor Trees ^[2] Number of new <i>Evergreen Trees</i> that qualify as interceptor trees= Area Reduction due to new Evergreen Trees=		New Evergreen Trees (200 ft ² /tree)	NOTE: Total Interceptor Area Reduction is limited to 50% of the physical tributary area.	INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both new and existing trees. Enter the number of new deciduous and evergreen trees and the canopy area of existing trees.
Number of new <i>Deciduous Trees</i> that qualify as interceptor trees= Area Reduction due to new Deciduous Trees=		New Deciduous Trees (100 ft ² /tree)		
Enter square footage of qualifying existing tree canopy = Allowed reduction credit for existing tree canopy=		Existing Tree Canopy Allowed credit for existing tr	ee canopy = 50 % of actual canopy square footag	e
Area Reduction =	0 ft ²	= Sum of areas managed	by evergreen + deciduous + existing canop	y

	Buffer Strips & Bovine Terraces ^[3]	INSTRUCTIONS: Calculates the area reduction credit due to buffer strips and/or bovine
	Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft ²	terraces. Runoff Must be direct to these features as sheet flow. Enter
	Buffer Factor = 0.7 Solution:	the area draining to these features.
	<u>solution.</u>	
	Area Reduction = (Area draining to Buffer Strip or Bovine Terrace) x (Buffer Factor) =	
	Area Reduction = 0.00 ft ²	
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This worksheet calculates the quantity of storm water that needs to be addressed (captured and/or treated) to comply with the NPDES Storm Water Permit issued to the City of Santa Rosa and County of Sonoma by the North Coast Regional Water Quality Control Board.





				1.
	Requirement 1: 100% Treatmen	nt		INSTRUCTIONS:
ŀ	Treatment of 100% of the flow generated b	y 85th percentile 24 hour mean annual rain event (0.2 in/hr).	C value note:	If the Design Goal of 100% Capture
			The C value used for this calculation	on page 3 of this calculator is not
	Formula:		is smaller than the value used for	achieved; then Requirement 1-100%
	Q _{TREATMENT} = (0.2 in/hr)(A _r)(C _{POST})(K) cfs	Where:	hydraulic Flood Control design.	Treatment, this page of the calculator,
		Q _{TREATMENT} = Design flow rate required to be treated (cfs)	The table of values can be found here	AND Requirement 2- Volume
		C _{POST} = Rational method runoff coefficient for the developed condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
		A _r = Reduced Tributary Area including credit for Pollution Prevention Measures	(in Acres) to size the overflow bypass.	must be achieved.
		K = Seasonal Precipitation Factor ^[7]		
	Input:			
		A _r = 2,700 ft ² = 0.06198 Acres		
		$C_{POST}^{[10]} = 0.70$		
		K ^[7] = 1.2		
		NOTE:		
	Solution:	The Flow Rate	e calculated here should only be used to size the	
			BMP. All associated overflow inlets and systems	
	Q _{TREATMENT} = 0.01015 cfs		ed for the Flood Control event.	

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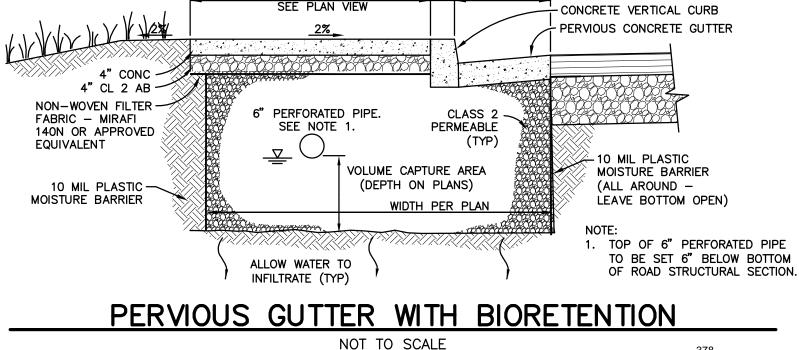
Paguiramant 2. Dalta Valuesa	Conturo		INSTRUCTIONS:
Requirement 2: Delta Volume to increase in volume of runoff leaving the	Capture he site due to development for the 85th percentile 24 hour storm e	vent.	If the Design Goal of 100% Capture
			on page 3 of this calculator is not
			achieved; then Requirement 1-100%
Formulas:			Treatment, page 4 of the calculator,
S = <u>1000</u> - 10 CN	Where: S= Potential maximum retention after runoff (in) ^{5]}		AND Requirement 2- Volume
CIV	CN= Curve Number ^[5]		Capture, this page of the calculator,
Q= $[(P*K)-(0.2*S)]^2$ 1ft	Where:		must be achieved.
$Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} \times \frac{1 \text{ft}}{12 \text{in}}$	Q= Runoff depth (ft) ^[6]		
	P= Precipitation (in) = 0.92 0.92 inches in the		
	K= Seasonal Precipitation Factor ^[7] area, based on lo	ical historical	1077
$V= (Q)(A_r)$	Where:		NOTE:
	V= Volume of Storm Water to be Retained (ft ³) A _r = Reduced Tributary Area including credit for Pollution Pr	evention Measures (²)	If the amount of volume generated
	$\Delta_{\rm r}$ = reduced initially field including orbit for induction is		after development is less than or equal to that generated before
Input: (Pick data from drop down lists	s or enter calculated values)		development, Requirement 2-Volume
·	$A_r = \frac{2,700}{1000} ft^2$		Capture is not required.
	K ^[7] = 1.2		$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE}$
	Drop dov		(C FUST - C FRE OF ON POST - ON PRE)
	blogic soil type within tributary area ^[8] = $\frac{C: 0.05 - 0.15 \text{ in/hr infiltration (t}}{1000 \text{ c}}$	ransmission) rate	
	elopment ground cover description ^[5] = Woods (50%), grass (50%) com elopment ground cover description ^[5] = Impervious - Paved Parking, Ro		
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
<u>OR</u>	Composite Predevelopment CN ^[9] = 80		
Solution:	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98		
Solution: Pre Development Storm Water Run	Composite Predevelopment CN ^[9] = <u>80</u> Composite Post development CN ^[9] = <u>98</u>		
Solution:	Composite Predevelopment CN ^[9] = <u>80</u> Composite Post development CN ^[9] = <u>98</u>	Where:	
Solution: Pre Development Storm Water Run	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98	<u>Where:</u> S _{PRE} ≂ Pre development potential maximum retention after runoff (in).	
<u>Solution:</u> Pre Development Storm Water Run S _{PRE} = 2.50 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume S_{PRE} = $\frac{1000}{80}$ -10	S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: Pre Development Storm Water Run	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume S_{PRE} = $\frac{1000}{80}$ -10	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
<u>Solution:</u> Pre Development Storm Water Run S _{PRE} = 2.50 in Q _{PRE} = 0.00900 ft	Composite Predevelopment CN ^[9] = <u>80</u> Composite Post development CN ^[9] = <u>98</u>	S _{PRE} = Pre development potential maximum retention after runoff (in).	
Solution: Pre Development Storm Water Run S _{PRE} = 2.50 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume S_{PRE} = $\frac{1000}{80}$ -10	S_{PRE} = Pre development potential maximum retention after runoff (in). Q_{PRE} = Q in feet of depth as defined by the "Urban	
Solution: Pre Development Storm Water Run S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 24.30 ft ³	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1\text{ft}}{12\text{in}}$ $V_{PRE} = (0.00900)(2,700)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q <i>in feet of depth as defined by the "Urban</i> <i>Hydrology For Small Watersheds" TR-55 Manual.</i>	
Solution: Pre Development Storm Water Run S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 24.30 ft ³ Post Development Storm Water Run	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(2,700)$	 S_{PRE}= Pre development potential maximum retention after runoff (in). Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	
Solution: Pre Development Storm Water Run S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 24.30 ft ³	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(2,700)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where:	
Solution: Pre Development Storm Water Run S_{PRE} = 2.50 in Q _{PRE} = 0.00900 ft V _{PRE} = 24.30 ft ³ Post Development Storm Water Run	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(2,700)$	 S_{PRE}= Pre development potential maximum retention after runoff (in). Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) 	
Solution: Pre Development Storm Water Run S_{PRE} 2.50 in Q_{PRE} 0.00900 ft V _{PRE} 24.30 ft ³ Post Development Storm Water Run S _{POST}	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(2,700)$ noff Volume $S_{POST} = \frac{1000}{98} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.20)]^2}{98} \times \frac{1ft}{12in}$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where:	
Solution: Pre Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE}= 0.00900 ft V _{PRE} = 24.30 ft ³ Post Development Storm Water Run S _{POST} = 0.20408 in	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17)-(0.2*2.50)]^2}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(2,700)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in).	
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Solution: Pre Development Storm Water Run S_{PRE} = 2.50 in Q_{PRE} = 0.00900 ft V_{PRE} = 24.30 ft ³ Post Development Storm Water Run S_{POST} = 0.20408 in Q_{POST} = 0.07240 ft V_{POST} = 195.48 ft ³	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(2,700)$ hoff Volume $S_{POST} = \frac{1000}{98} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.20)]^2}{[(0.92*1.17) + (0.8 * 0.20)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.07240)(2,700)$	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
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Solution: Pre Development Storm Water Run S_{PRE} 2.50 in Q _{PRE} 0.00900 ft V_{PRE} 24.30 ft ³ Post Development Storm Water Run S_{POST} 0.20408 in Q _{POST} 0.07240 ft V_{POST} 195.48 ft ³ Solution: Volume Capture Requir Increase in volume of storm 3 Delta Volume Capture= $(V_{POST})^{-1}$	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(2,700)$ hoff Volume $S_{POST} = \frac{1000}{98} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.20)]^2}{[(0.92*1.17) + (0.8 * 0.20)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.07240)(2,700)$ rement In water that must be retained onsite (may be infiltrated or reused). M_{PRE} Delta Volume Capture = (195.48) - (24.3)	 S_{PRE}= Pre development potential maximum retention after runoff (in). Q_{PRE}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{PRE}= Pre Development Volume of Storm Water Generated (ft³) Where: S_{POST}= Post development potential maximum retention after runoff (in). Q_{POST}= Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V_{POST}= Post Development Volume of Storm Water Generated (ft³) Where: 	
Solution: Pre Development Storm Water Run S_{PRE} 2.50 in Q _{PRE} 0.00900 ft V_{PRE} 24.30 ft ³ Post Development Storm Water Run S_{POST} 0.20408 in Q _{POST} 0.07240 ft V _{POST} 195.48 ft ³ Solution: Volume Capture Requir Increase in volume of storm 3 Delta Volume Capture= V _{POST}	Composite Predevelopment CN ^[9] = 80 Composite Post development CN ^[9] = 98 off Volume $S_{PRE} = \frac{1000}{80} -10$ $Q_{PRE} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{[(0.92*1.17) + (0.8 * 2.50)]} \times \frac{1ft}{12in}$ $V_{PRE} = (0.00900)(2,700)$ hoff Volume $S_{POST} = \frac{1000}{98} -10$ $Q_{POST} = \frac{[(0.92*1.17) - (0.2 * 0.20)]^2}{[(0.92*1.17) + (0.8 * 0.20)]} \times \frac{1ft}{12in}$ $V_{POST} = (0.07240)(2,700)$ rement In water that must be retained onsite (may be infiltrated or reused). M_{PRE} Delta Volume Capture = (195.48) - (24.3)	S _{PRE} = Pre development potential maximum retention after runoff (in). Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³) Where: S _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual. V _{POST} = Post development potential maximum retention after runoff (in). Q _{POST} = Post Development Volume of Storm Water Generated (ft ³) V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	



LID BMP Sizing Tool: 100% Volume Capture Goal; V _{GOAL} Formulas: V_LID GOAL=((V_GOAL))/(P) = 490.97) ft ³ Where: $A_{LID GOAL}=(W)(L) = 100.00$ ft ² $V_{LD GOAL}=$ Required volume of soil in LID BMP. $A_{LID GOAL}=(W)(L) = 100.00$ ft ² $V_{LD GOAL}=$ Footprint of LID BMP area for a given depth (below perforated performed of the second performance) Verset Percent of Goal Achieved = (D)(A _{LID GOAL}) × 100	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. pipe if present).	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> <u>of 100% volume capture of the post</u> <u>development condition.</u> Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
VLID GOAL D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet) L= Length P = 0.4 as a decimal		
$D = \frac{4.9}{\text{ft}} \text{Below perforated pipe if present}$ $W = \frac{5.0}{\text{ft}}$ $L = \frac{20.0}{\text{ft}}$ Solution:	7	
Percent of Goal Achieved = 100.62 % = [(4.9 x 100) / 491] x 100		INSTRUCTIONS:
LID BMP Sizing Tool Delta Volume Capture Requirement: VDELTA Formulas: VLID DELTA=((VDELTA))/(P) = #DIV/0! ft ³ Where: Where:	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
$A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{ft}^2} \text{ft}^2 \qquad \qquad V_{\text{LID DELTA}} = \text{Required volume of soil in LID BMP}$ $A_{\text{LID DELTA}} = \text{Footprint of LID BMP area for a given depth (below perforated point)}$ $V_{\text{DELTA}} = \underbrace{171.18}_{\text{ft}^3} \text{ft}^3$	pipe if present).	<u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of
$\begin{array}{l} \text{Percent of Requirement} \\ \text{Achieved} \end{array} = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} x \ 100 \end{array} \\ \begin{array}{l} \frac{\text{Where:}}{P= \ \text{Porosity}} & (\text{enter as a decimal}) \\ D= \ \text{Depth below perforated pipe if present} & (\text{in decimal feet}) \\ W= \ \text{Width} & (\text{in decimal feet}) \\ L= \ \text{Length} & (\text{in decimal feet}) \end{array} \end{array}$		Requirement achieved" reaches 100%.
Input: $P =$ 0.0as a decimal $D =$ 0.0ftBelow perforated pipe if present $W =$ 0.0ft $L =$ 0.0ft		
Solution: ω Percent of Requirement Achieved = #DIV/0! % = #DIV/0!		



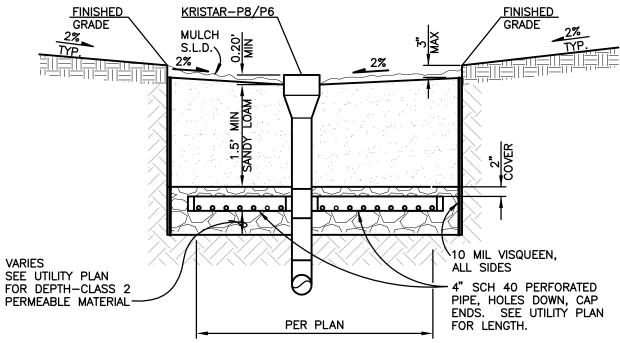
LID BMP Sizing Tool: 100% Volume Capt Formulas: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 2593.46$ ft ³ $A_{LID GOAL} = (W)(L) = 600.25$ ft ² Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	Example 2 Where: $V_{LID \ GOAL}$ = Required volume of soil in LID BMP. $A_{LID \ GOAL}$ = Footprint of LID BMP area for a given depth (below perforated p $V_{GOAL} = \underbrace{1,141}_{1,141} \text{ft}^3$ <u>Where:</u> P= Porosity (enter as a decimal)	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The 100% volume capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design goal</u> of 100% volume capture of the post <u>development condition</u> . Enter the percent porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Goal" equals 100%.
V _{LID GOAL}	D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
<u>Input:</u>	P =0.4as a decimal $D =$ 4.3ftBelow perforated pipe if present $W =$ 24.5ft $L =$ 24.5ft		
Solution: Percent of Goal Achieved = 100.45	5% = [(4.3 x 600) / 2,593] x 100		
LID BMP Sizing Tool Delta Volume Captu Formulas: Vup grup=((Verup))/(P) = #DIV/01 ft ³		NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> requirement of the delta volume
	Where: V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated performance)	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> <u>requirement of the delta volume</u> <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width
$\frac{\text{Formulas:}}{V_{\text{LID DELTA}}=((V_{\text{DELTA}}))/(P) = \#\text{DIV}/0! \text{ft}^3$	Where: V _{LID DELTA} = Required volume of soil in LID BMP	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> <u>requirement of the delta volume</u> <u>capture</u> . Enter the percent of porosity of the specified soil and depth below
Formulas: $V_{LID DELTA}$ =((V_{DELTA}))/(P) = #DIV/0! $A_{LID DELTA}$ =(W)(L) = 0.00ft ²	Where: $V_{\text{LID DELTA}}$ = Required volume of soil in LID BMP $A_{\text{LID DELTA}}$ = Footprint of LID BMP area for a given depth (below perforated p V_{DELTA} = 939.50 ft ³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet)	LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only.	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u> <u>requirement of the delta volume</u> <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and length entries will need to be interactively adjusted until "Percent of Requirement achieved" reaches



DISTANCE VARIES

6"

24"

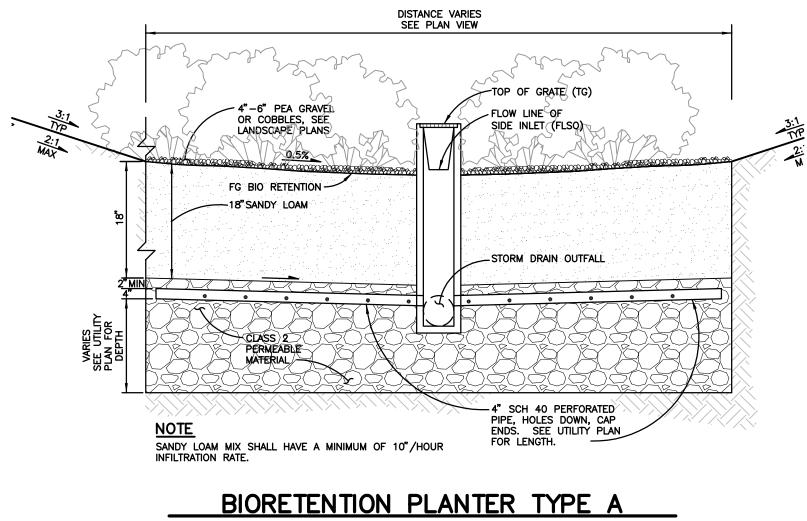


NOTE

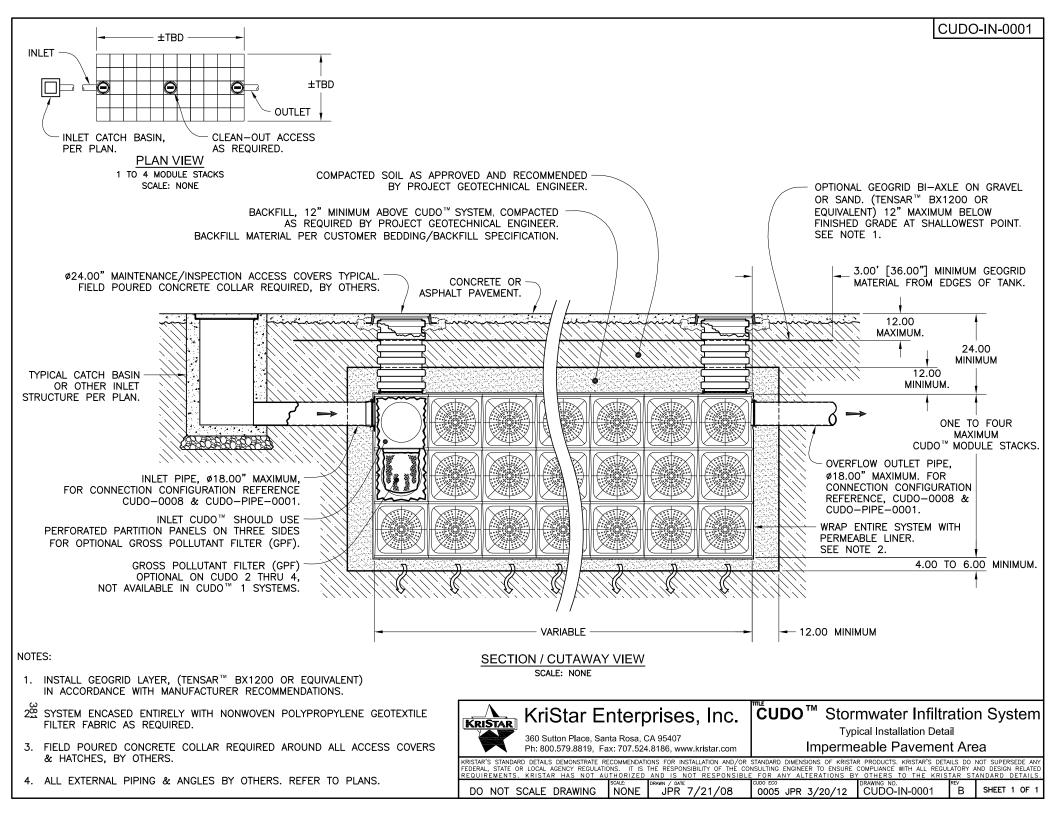
SANDY LOAM MIX SHALL HAVE A MINIMUM OF 10"/HOUR INFILTRATION RATE.

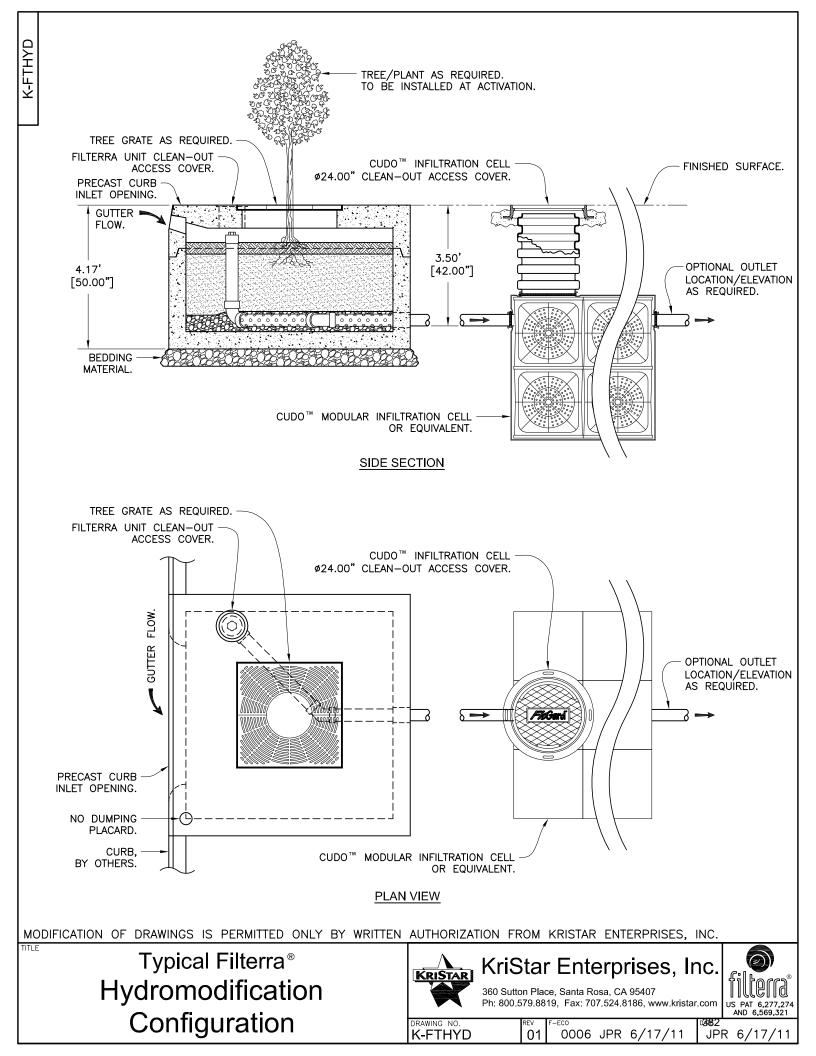
BIOINFILTRATION PLANTER TYPE B

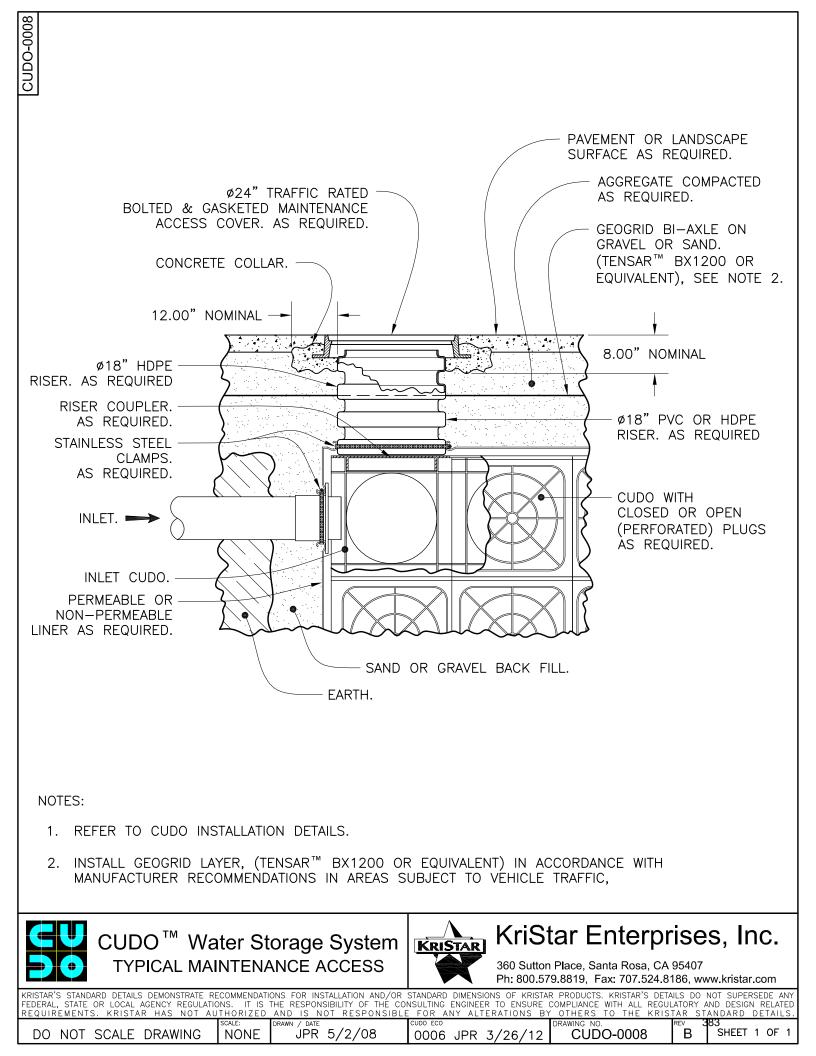
NOT TO SCALE

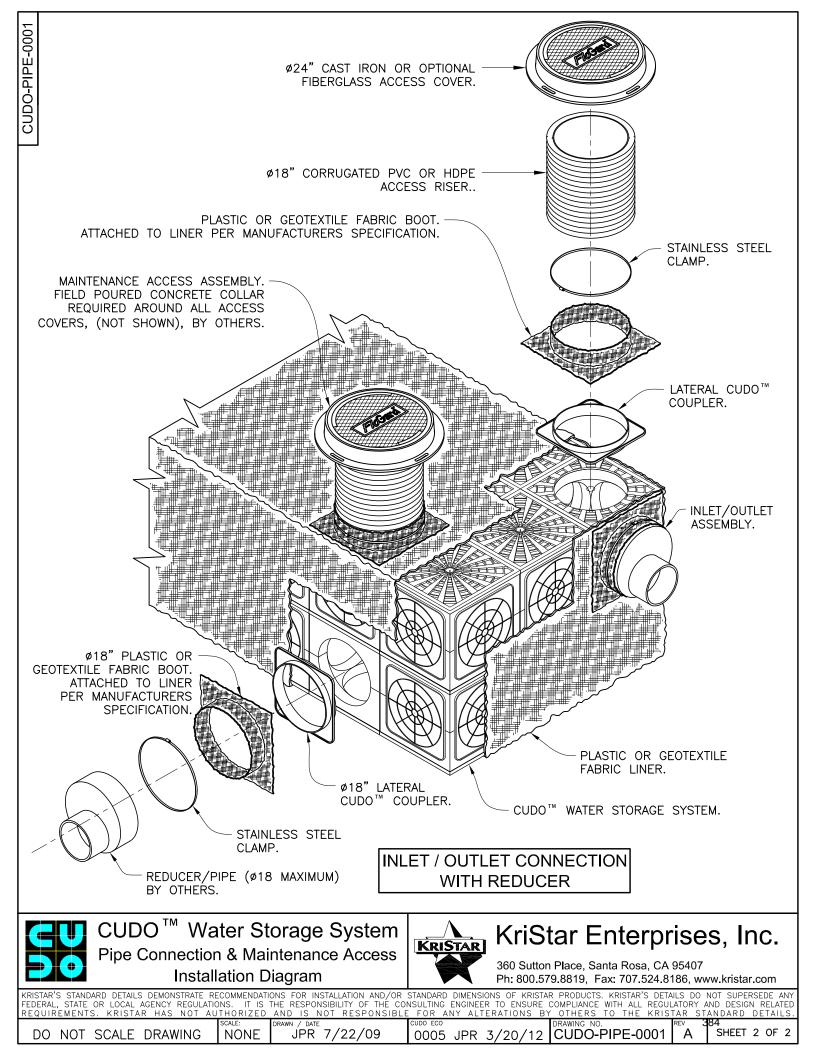


NOT TO SCALE









Planter Strip Bioretention

Inspection and Maintenance Checklist (aka: Street Rain Garden, Roadside Bioretention, Bioretention Cell)

Date of Inspection	.:
Inspector(s):	
BMP ID #:	
Property Owner:	

Location Description:

Type of Inspection: Pre-rainy Season (PRS) Rainy Season (RS) After-rainy Season (ARS)

This Inspection and Maintenance Checklist is to be used in conjunction with its corresponding LID Factsheet and Maintenance Plan. Please review these documents before performing the field inspection.

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	Comments (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
	RS	Is there standing or pooling of water in the Bioretention area after 3 days of dry weather?		 Check perforated pipe outlet for obstruction or damage. * Flush perforated pipe to remove obstructions/sediment. * 	
Drainage		Is water not draining into catch basin from the overflow pipe during a high intensity storm? *		 Remove and replace the first few inches of topsoil. Remove soil and inspect perforated pipe. Repair or replace perforated pipe, replace with new soil and regrade. 	
Drai	PRS RS ARS	Is there sediment visible in the gutter?		• In dry weather, use a mechanical sweeper or a Vactor truck to clean gutter pan.	
	RS	Is there water flowing in the pervious concrete gutter section during a low intensity storm? *		 In wet weather, use a Vactor truck to clean gutter pan. 	

* If perforated pipe is present.

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	Comments (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
	RS ARS	Is there under cutting or washouts along the sidewalks and/or curbs abutting the planter strip?		 Fill in eroded areas and regrade. 	
	RS ARS	Is there channelization (gully) forming along the length of the planter area?		• Fill in eroded areas and regrade.	
	RS ARS	Is there accumulation of sediment (sand, dirt, mud) in the planter?		 Remove sediment and check the grading. Add replacement soil and/or mulch. 	
Erosion	PRS RS ARS	Is the mulch unevenly distributed in the planter area?		 Redistribute and add additional mulch if needed. Regrade planter area. 	
	PRS RS ARS	Are there voids or deep holes present? Is there sediment present in the catch basin and in the overflow pipe?		 Check the perforated pipe for damage.* 	
	PRS RS ARS	Is there evidence of animal activity such as holes or dirt mounds from digging or borrowing?		 Repair and fill in damage areas. Rodent control activities must be in accordance with applicable laws and do not affect any protected species. 	

* If perforated pipe is present.

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	Comments (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
	PRS RS ARS	Is the vegetation clogging the inlet flow areas?		• Trim and/or remove the excess vegetation.	
Vegetation	PRS RS ARS	Is the mulch distributed evenly throughout the planter area?		 Redistribute and add additional mulch if needed. Regrade planter area. 	
Vege	PRS RS ARS	Are there dead or dry plants/weeds? Is the vegetation over grown?		 Remove dead and/or dry vegetation. Replace as needed. Remove or trim any vegetation that is causing a visual barrier, trip, and or obstruction hazard. 	

Inspection Category	When to Inspect	Maintenance Issue	Is the Issue Present?	Require Maintenance	Comments (Describe maintenance completed and if needed maintenance was not conducted, note when it will be done)
	PRS RS ARS	Is there debris/trash in the planter area?		 Remove all trash and debris. 	
	PRS RS ARS	Is graffiti present?		• Remove all graffiti from the area.	
General	PRS RS ARS	Are there missing or disturbed aesthetics features?		 Replace and/or reposition aesthetics features to original placement. Placement should not disrupt flow characteristics/design. 	
BMP G	PRS RS ARS	Is the vegetation irrigation functional?		 Repaired broken missing spray/drip emitters. Reposition and/or adjust to eliminate over spray and/or over watering. 	
	PRS RS ARS	Are the aesthetic features firmly secured in placed?		 Repair and/or replace loose or damage features. 	
	PRS RS ARS	Check for damage sidewalk, curb, gutter, and catch basin including uplift and settling.		 Remove and replace damaged areas. 	



CUDO[™] Stormwater Cube

(Underground Retention / Detention / Infiltration / Water Reuse Systems)

Operations and Maintenance Manual

CUDO[™] Stormwater Cube – Modular Stormwater Systems

Description / Basic Function

CUDO[™] is a modular stormwater system comprised of a grouping of modular polypropylene or concrete cubes that when constructed form an underground storage area for stormwater. This system can be used for infiltration, retention, detention or water reuse. CUDO[™] can help achieve runoff detainment and storage to help attenuate the peak flow to pre-construction levels and can help conform to current Low Impact Development requirements.

Infiltration

The purpose of a CUDO[™] infiltration system is to capture stormwater runoff, store the runoff, and then allow it to percolate into the ground via the open space area of the cubes and perforations in the side wall. The system is backfilled with a Class I material defined by ASTM D2321 as a cleaned open graded rock or a Class II permeable sand. The rock or sand provide additional storage capacity but also allow for a percolation interface with the native material. The ground water is "recharged" with this type of system.

Detention

The purpose of a CUDO[™] detention system is to capture stormwater runoff, store the runoff, and then allow it to be released at a controlled rate through an appropriately sized orifice control. A detention system helps attenuate the peak flow from the site assuring that pre-development runoff flows are not exceeded as a result of the development. A CUDO[™] detention requires the cubes to be encapsulated with an impermeable liner for the polypropylene system or the seams of the concrete system to be sealed with a water proof mastic.

Retention

A CUDO[™] retention system is a hybrid system. It is a combination of a detention system and an infiltration system. A retention system is utilized to attenuate peak flow as well as promote groundwater re-charge. A retention system is outfitted with an overflow pipe at the top of the system which allows the system to fill for infiltration but also outlet if the ground is saturated.

Water Reuse

The purpose of a water-reuse CUDO[™] system is to capture and store water for future use. The system is constructed in a similar fashion to a detention system but instead of a controlled outlet the system is constructed with an emergency overflow. A water reuse system is a LID device that helps attenuate peak flows as well as conserve water. Water may be reused through an active pump system or passive irrigation.

Inspection/Cleanout Ports

Inspection and cleanout ports are 18-inch diameter vertical risers connected to the uppermost polypropylene CUDO[™] cubes or up to 30-inch manhole access connected to the concrete CUDO[™]. They are used for entrance into the system, or for access to place vacuum truck hoses or water-jetting devices or CCTV equipment. Ports are strategically located near inlet and outlet pipes and in other areas or probable deposition in the system. It is recommended to keep surface level access lids sealed and bolted at all times when the system is in service.

Inlet Bay

Some systems are configured so that pretreatment of the stormwater occurs within the CUDO[™] system. In this case the CUDO[™] system will house an inlet bay. The inlet bay is separated from the rest of the CUDO[™] system by sidewall plugs and is intended to separate gross pollutants, trash and debris and floatables from the CUDO[™] system and pre-treatment device. The bay contains its own sump area and unique access ports.

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Maintenance Overview for CUDO

State and Local regulations require that stormwater storage systems be maintained and serviced on a recurring basis. The purpose of maintaining a clean and obstruction free CUDO[™] system is to ensure the system performs the intended function of the primary design. Trash and debris, floatables, gross pollutants and sediment can build up in the CUDO[™] leading to clogging of the native soil interface or blockage of the inlet or outlet pipes. This can cause the system to function improperly by limiting storage volume, limiting the design percolation rates or impeding flow in and out of the system. Downstream and upstream, areas could run the risk of flooding and deleterious environmental impact.

Recommended Frequency of Service

It is recommended that the CUDO[™] stormwater systems be serviced on a regularly occurring basis. Ultimately the frequency depends on the amount of runoff, pollutant loading, and interference from trash, debris and gross pollutants as well as proper maintenance of upstream pretreatment devices. However, it is recommended that each installation be inspected at least two times per year to assess service needs.

Recommended Timing of Service

Guidelines for the timing of service are as follows:

- 1. For areas with a definite rainy season the system should be serviced prior to and following the rainy season.
- 2. For areas subject to year-round rainfall service should occur on a regularly occurring basis. (A minimum of two times per year.)
- 3. For areas with winter snow and summer rain the system should be serviced prior to and after the snow season.
- 4. For installed devices that are subject to dry weather flows only (i.e. wash racks, parking garages, etc...) the unit should be serviced on a regularly occurring basis. (A minimum of two times per year.)

Inspection

An inspection should be performed when the system is new. This allows the owner to establish a baseline condition for comparison to future inspections. Sediment build up can typically be monitored without entering the system. (No confined space entry.) Initial and subsequent inspection data should be recorded and filed for reference. Some regulatory agencies require that the results of the inspections be documented and reported. Inspection reports should comply with regulatory requirements and be submitted as required.

Inspection Procedures

- 1. Locate the inspection, cleanout and access ports. Inspection and cleanout ports are typically 18-inch diameter. Access ports are typically 24-inch or 30-inch diameter. Pictures should be taken to document the location or a site map should be generated to detail the as-built locations of the ports.
- 2. Unbolt and remove the access port lids.
- 3. Insert a measuring device into the opening making note of a point of reference to determine the quantity of sediment and other accumulated material. If access is required to measure, ensure only certified confined space entry personnel having appropriate equipment are allowed to enter the system.
- 4. In addition, for accessible concrete CUDO[™] systems personnel should utilize appropriate confined space entry procedures to enter the system and photograph its condition.
- 5. Inspect inlet and outlet locations for obstructions. Obstructions should be removed at this time.
- 6. Inspect the structural components of the system.
- 7. Fill in the CUDO[™] Inspection/Maintenance Data Sheet and send a copy to the regulatory agency if necessary.

Disinfection of Water Reuse System

Periodic disinfection of water held for reuse may be required to abate bacteria and algae growth. This may be done using calcium hypochlorite tablets or by the addition of an ozone generator in a small recirculation system.

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Maintenance

Cleanout of the CUDO[™] system should be considered if there is sediment buildup of two or more inches at over 50% of the inspection ports. Cleaning shall be performed if sediment buildup is two inches or more over 75% of the system floor. In the event of a spill of a foreign substance, cleanout of the system should be considered.

Maintenance Procedures

- 1. Locate the inspection, cleanout and access ports. Inspection and cleanout ports are typically 18-inch diameter. Access ports are typically 24-inch or 30-inch diameter. Pictures should be taken to document the location or a site map should be generated to detail the as-built locations of the ports.
- 2. Unbolt and remove the access port lids.
- 3. Measure the sediment buildup at each port. If access is required to measure ensure only certified confined space entry personnel having appropriate equipment are allowed to enter the system.
- 4. A thorough cleaning of the system (inlets, outlets, ports, and inlet bays) shall be performed by either a vacuum truck or by manual methods.
- 5. Inspect inlet and outlet locations for obstructions. Obstructions should be removed at this time.
- 6. Inspect the structural components of the system.
- 7. Fill in the CUDO[™] Inspection/Maintenance Data Sheet and send a copy to the regulatory agency if necessary.

Inspection / Maintenance Requirements

Listed below are some recommendations for equipment and training for personnel to inspect and maintain a CUDO[™] system.

Personnel –	OSHA Confined Space Entry Training is a prerequisite for entrance into a system. In the state of California personnel should be CalOSHA certified.
Equipment –	Record Taking (pen, paper, voice recorder)
	Proper Clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
	Flashlight
	Tape Measure
	Measuring Stick
	Pry Bar
	Traffic Control (Flagging, barricades, signage, cones, etc.)
	First aid materials
	Debris and Contaminant collectors
	Debris and Contaminant containers
	Vacuum Truck

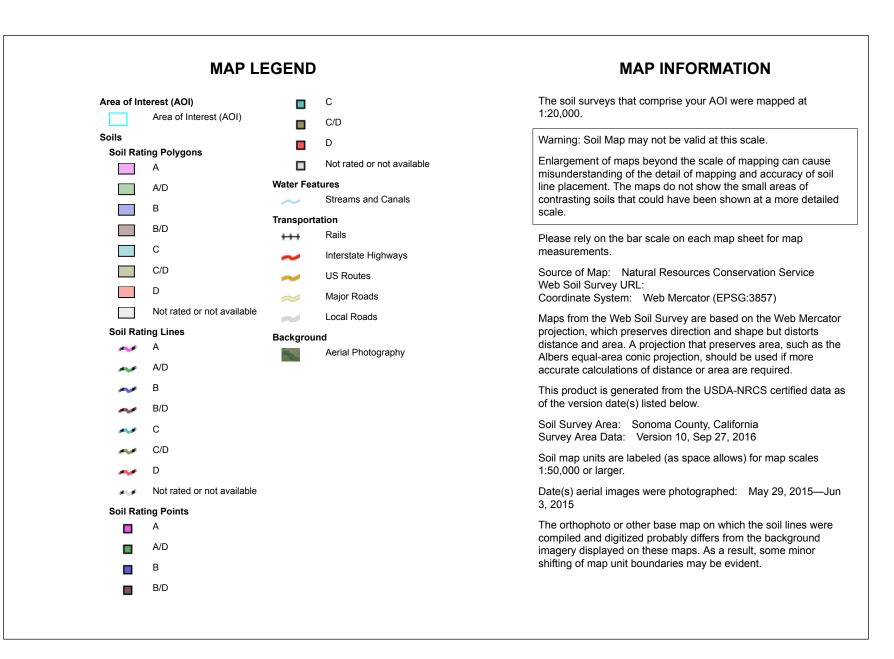
Disposal of Gross Pollutants, Hydrocarbons, and Sediment

The collected gross pollutants, hydrocarbons, and sediment shall be offloaded from the vacuum truck into DOT approved containers for disposal. Once in the container the maintenance contractor has possession and is responsible for disposal in accordance with local, state and federal agency requirements.

Note: As the generator, the landowner is ultimately responsible for the proper disposal of the collected materials. Because the material likely contains petroleum hydrocarbons, heavy metals, and other harmful pollutants, the materials must be treated as EPA class 2 Hazardous Waste. Proper disposal is required.

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Hydrologic Soil Group

Hydr	Hydrologic Soil Group— Summary by Map Unit — Sonoma County, California (CA097)					
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI		
GIE	Goulding cobbly clay loam, 15 to 30 percent slopes	D	0.2	0.3%		
MbC	Manzanita gravelly silt loam, 0 to 9 percent slopes	С	4.7	6.7%		
PeC	Pleasanton loam, 2 to 9 percent slopes, MLRA 14	С	8.9	12.9%		
PhB	Pleasanton clay loam, 2 to 5 percent slopes	С	11.0	15.8%		
RnA	Riverwash		12.1	17.5%		
TuE	Tuscan cobbly clay loam, 9 to 30 percent slopes	D	32.4	46.8%		
Totals for Area of Inter	est	69.3	100.0%			

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

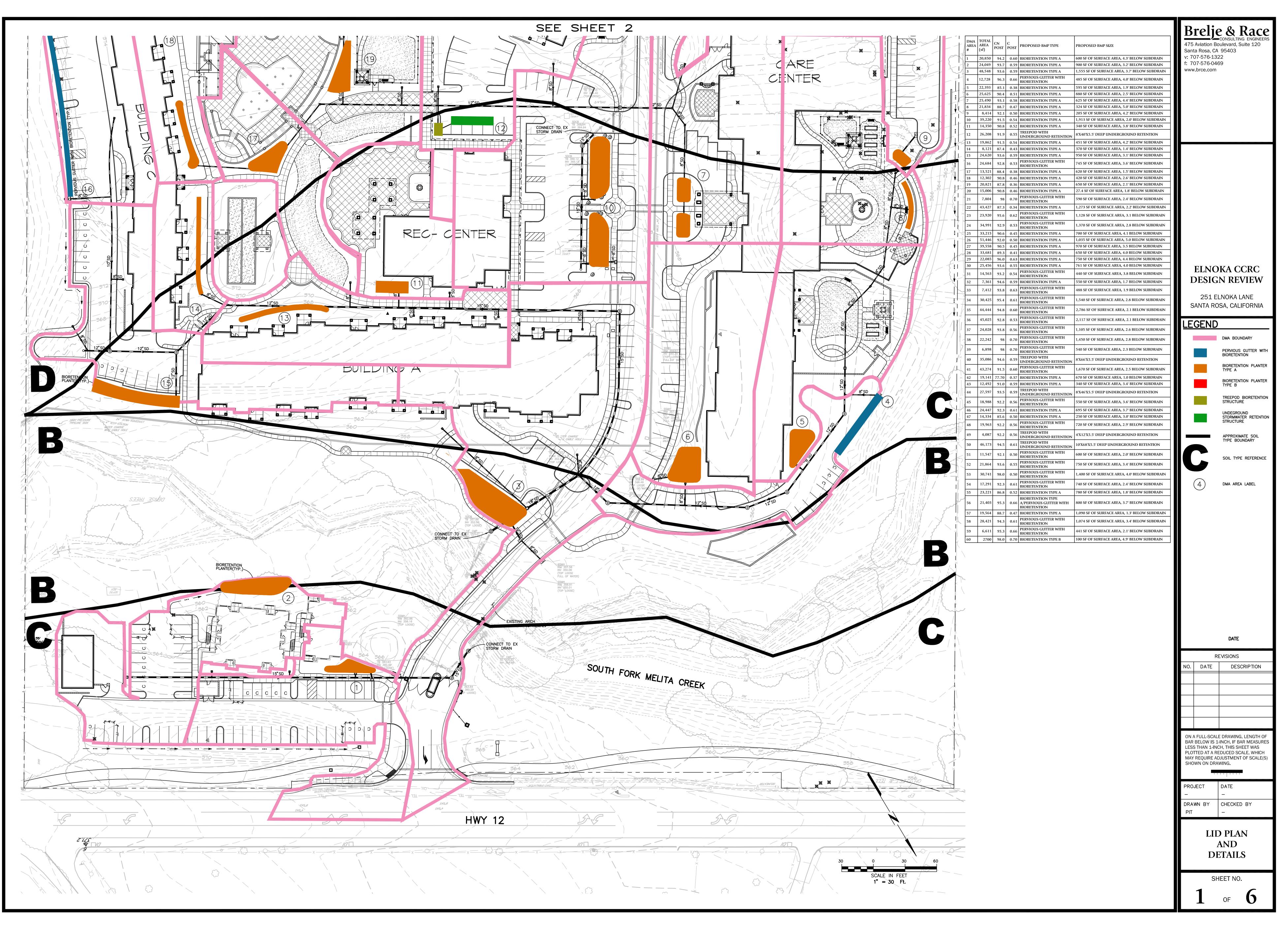
Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

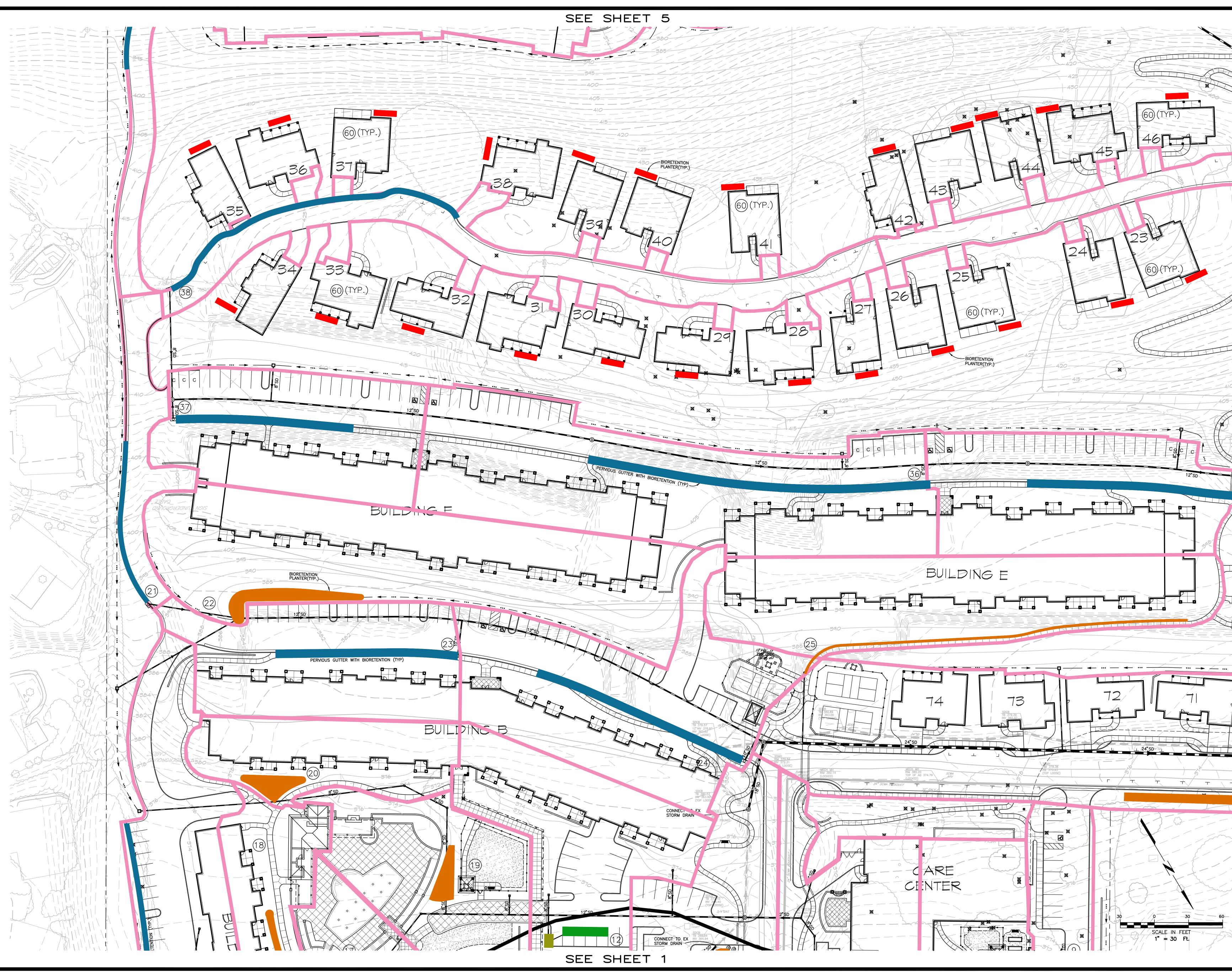
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

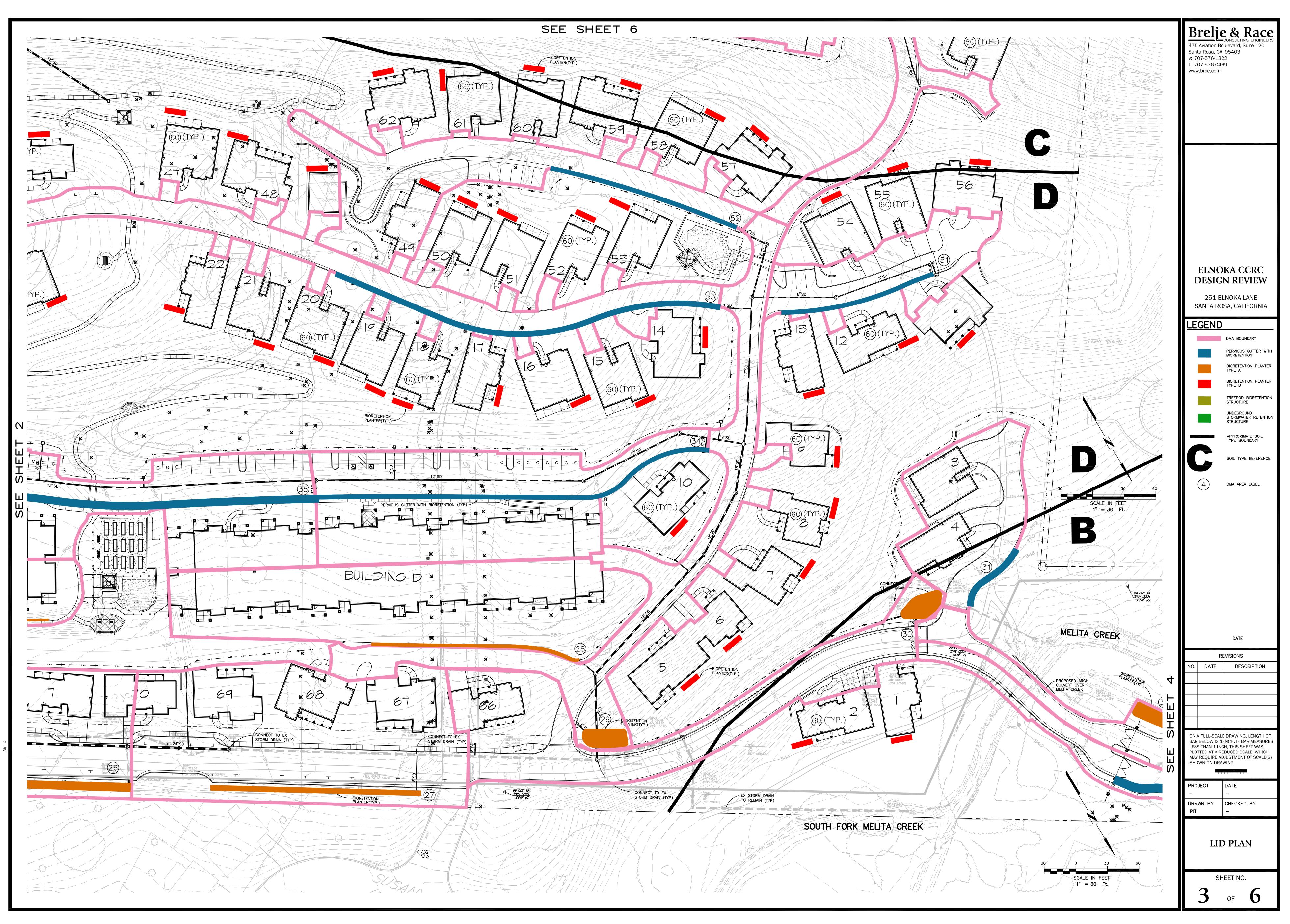
Aggregation Method: Dominant Condition Component Percent Cutoff: None Specified Tie-break Rule: Higher



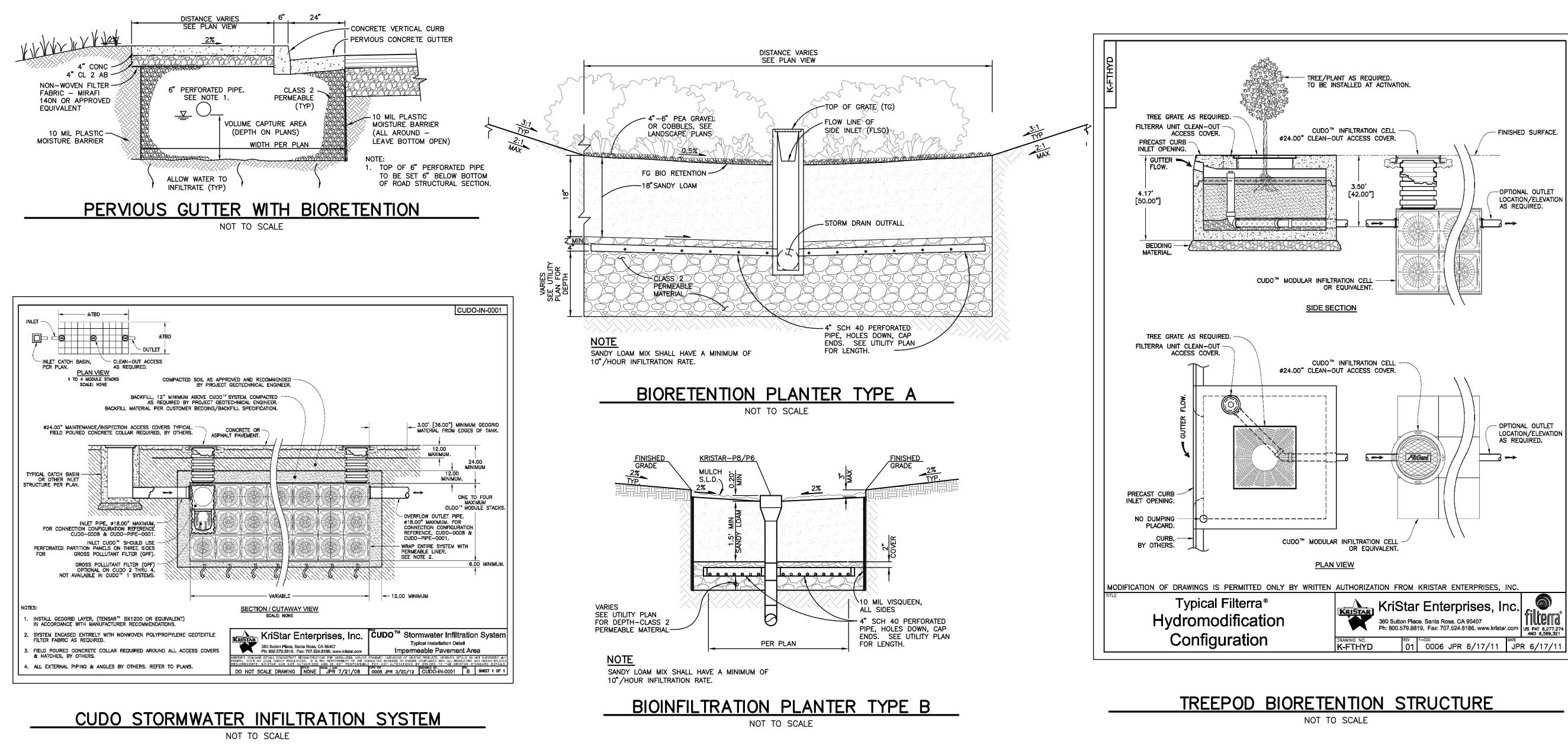


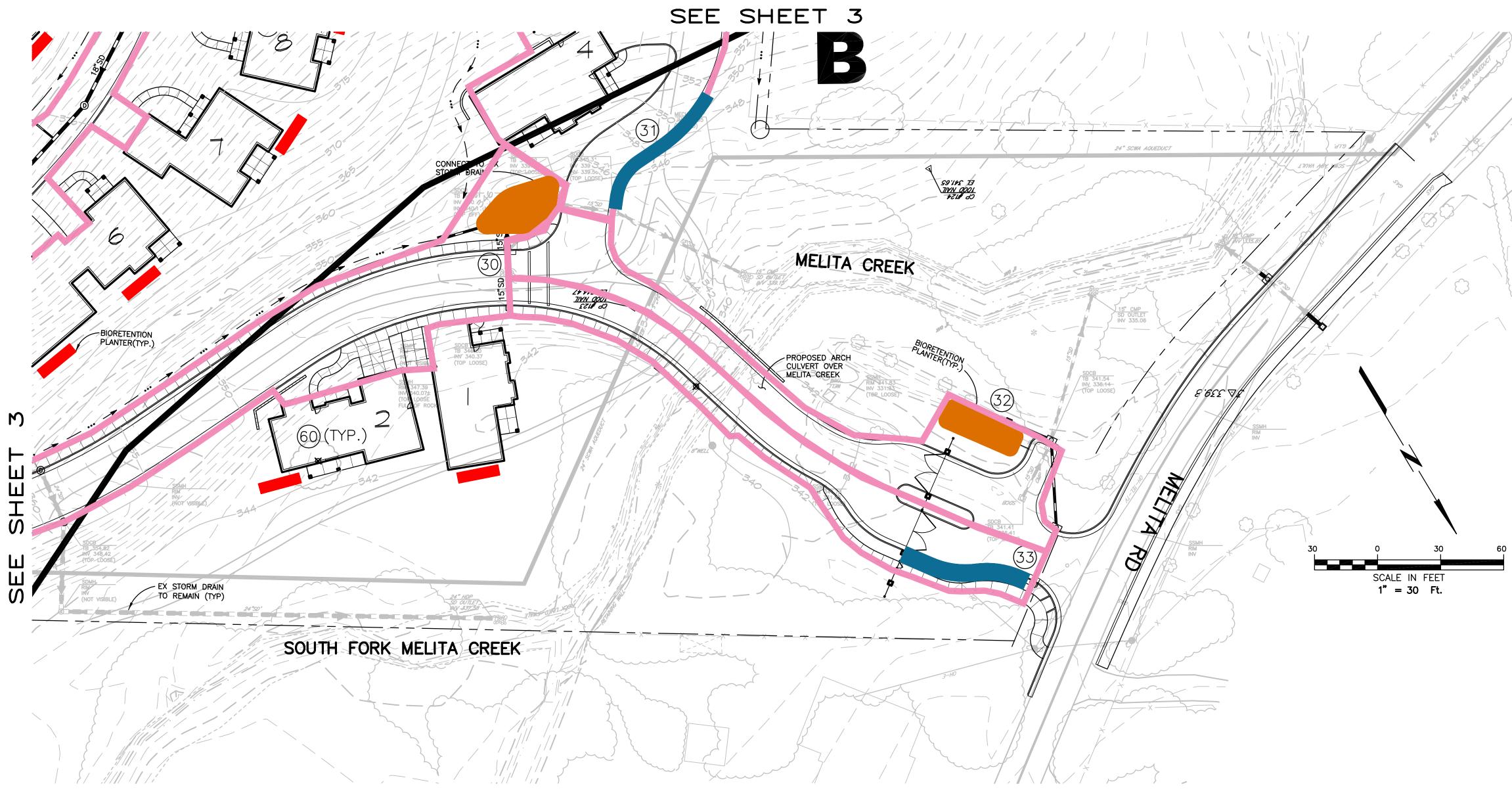


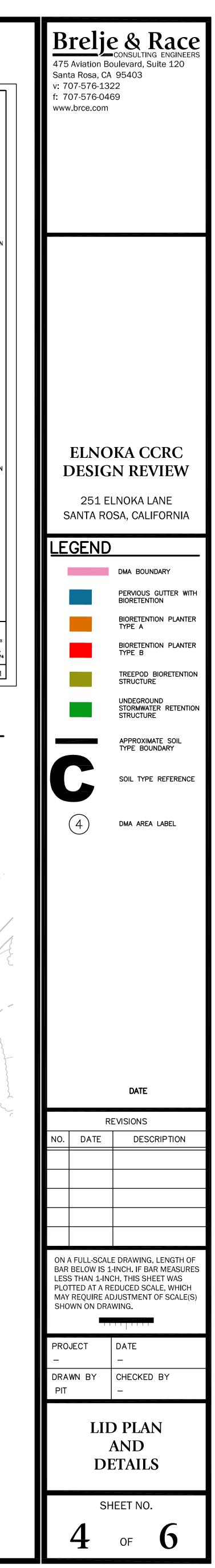
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	DATE
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	BAR BELOW IS 1-INCH. IF BAR MEASURES LESS THAN 1-INCH, THIS SHEET WAS PLOTTED AT A REDUCED SCALE, WHICH MAY REQUIRE ADJUSTMENT OF SCALE(S) SHOWN ON DRAWING.
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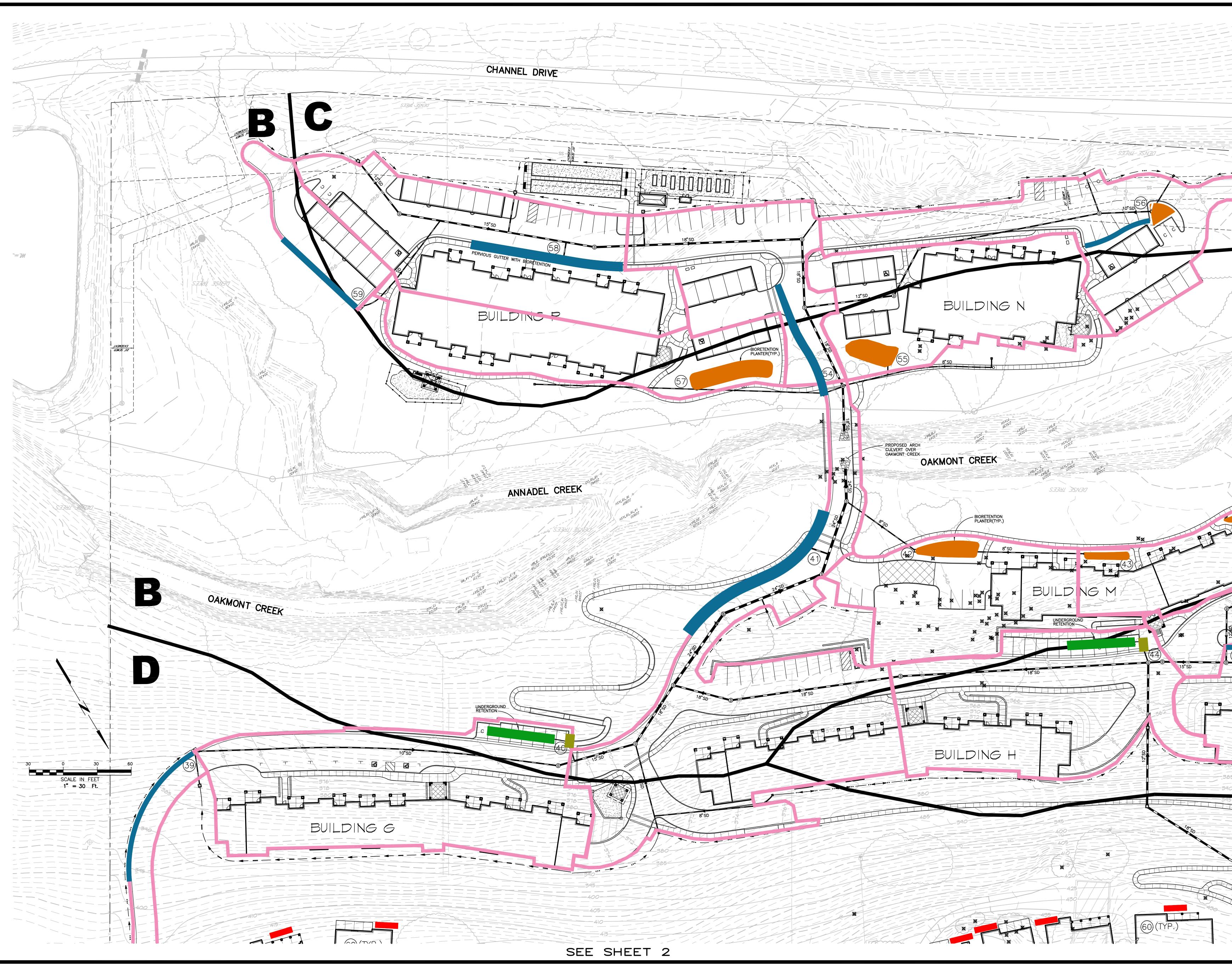


DMA AREA #	TOTAL AREA (sf)	CN POST	C POST	PROPOSED BMP TYPE	PROPOSED BMP SIZE
1	20,850	94.2	0.60	BIORETENTION TYPE A	600 SF OF SURFACE AREA, 4.3' BELOW SUBDRAIN
2	24,049	93.7	0.59	BIORETENTION TYPE A	900 SF OF SURFACE AREA, 3.2' BELOW SUBDRAIN
3	48,548	93.6	0.59	BIORETENTION TYPE A	1,555 SF OF SURFACE AREA, 3.7' BELOW SUBDRAIN
4	12,728	96.3	0.66	PERVIOUS GUTTER WITH BIORETENTION	485 SF OF SURFACE AREA, 4.0' BELOW SUBDRAIN
5	22,393	85.1	0.38	BIORETENTION TYPE A	595 SF OF SURFACE AREA, 1.9' BELOW SUBDRAIN
6	25,625	90.4	0.51	BIORETENTION TYPE A	880 SF OF SURFACE AREA, 2.5' BELOW SUBDRAIN
7	25,490	93.1	0.58	BIORETENTION TYPE A	625 SF OF SURFACE AREA, 4.4' BELOW SUBDRAIN
8	21,834	88.7	0.47	BIORETENTION TYPE A	324 SF OF SURFACE AREA, 5.0' BELOW SUBDRAIN
9	8,414	92.1	0.50	BIORETENTION TYPE A	205 SF OF SURFACE AREA, 4.2' BELOW SUBDRAIN
10	39,220	91.5	0.54		1,913 SF OF SURFACE AREA, 2.0' BELOW SUBDRAIN
11	14,350	90.8	0.52		340 SF OF SURFACE AREA, 3.8' BELOW SUBDRAIN
12	26,208	91.9	0.55	TREEPOD WITH UNDERGROUND RETENTION	8'X40'X5.5' DEEP UNDERGROUND RETENTION
13	19,862	91.5	0.54	BIORETENTION TYPE A	451 SF OF SURFACE AREA, 4.2' BELOW SUBDRAIN
14	8,121	87.4	0.43	BIORETENTION TYPE A	370 SF OF SURFACE AREA, 1.4' BELOW SUBDRAIN
15	24,620	93.6	0.59		950 SF OF SURFACE AREA, 3.1' BELOW SUBDRAIN
16	24,684	92.8	0.53	PERVIOUS GUTTER WITH BIORETENTION	745 SF OF SURFACE AREA, 3.6' BELOW SUBDRAIN
17	13,521	88.4	0.38	BIORETENTION TYPE A	620 SF OF SURFACE AREA, 1.5' BELOW SUBDRAIN
18	12,302	90.8	0.46	BIORETENTION TYPE A	420 SF OF SURFACE AREA, 2.6' BELOW SUBDRAIN
19	20,821	87.8	0.36	BIORETENTION TYPE A	650 SF OF SURFACE AREA, 2.1' BELOW SUBDRAIN
20	15,006	90.8	0.46	BIORETENTION TYPE A	27.4 SF OF SURFACE AREA, 1.8' BELOW SUBDRAIN
21	7,804	98	0.70	PERVIOUS GUTTER WITH	590 SF OF SURFACE AREA, 2.4' BELOW SUBDRAIN
22	43,427	87.3	0.34	BIORETENTION BIORETENTION TYPE A	1,273 SF OF SURFACE AREA, 2.2' BELOW SUBDRAIN
	,			PERVIOUS GUTTER WITH	
23	23,920	95.6	0.62	BIORETENTION	1,128 SF OF SURFACE AREA, 3.1 BELOW SUBDRAIN
24	34,991	92.9	0.53	PERVIOUS GUTTER WITH BIORETENTION	1,370 SF OF SURFACE AREA, 2.8 BELOW SUBDRAIN
25	33,215	90.6	0.45		700 SF OF SURFACE AREA, 4.1 BELOW SUBDRAIN
26	51,446	92.0	0.50		1,035 SF OF SURFACE AREA, 5.0 BELOW SUBDRAIN
27	39,558	90.5	0.45	BIORETENTION TYPE A	970 SF OF SURFACE AREA, 3.5 BELOW SUBDRAIN
28	33,681	89.3	0.41	BIORETENTION TYPE A	650 SF OF SURFACE AREA, 4.0 BELOW SUBDRAIN
29	22,085	96.0	0.63	BIORETENTION TYPE A	750 SF OF SURFACE AREA, 4.4 BELOW SUBDRAIN
30	25,456	93.6	0.55	BIORETENTION TYPE A	761 SF OF SURFACE AREA, 4.0 BELOW SUBDRAIN
31	14,563	93.2	0.54	PERVIOUS GUTTER WITH	440 SF OF SURFACE AREA, 3.8 BELOW SUBDRAIN
32	7,361	94.6	0.59	BIORETENTION BIORETENTION TYPE A	550 SF OF SURFACE AREA, 1.7 BELOW SUBDRAIN
				PERVIOUS GUTTER WITH	
33	7,412	93.8	0.63	BIORETENTION	488 SF OF SURFACE AREA, 1.9 BELOW SUBDRAIN
34	30,425	95.4	0.61	PERVIOUS GUTTER WITH BIORETENTION	1,540 SF OF SURFACE AREA, 2.8 BELOW SUBDRAIN
35	44,444	94.8	0.60	PERVIOUS GUTTER WITH	2,786 SF OF SURFACE AREA, 2.1 BELOW SUBDRAIN
55	11,111	74.0	0.00	BIORETENTION	
36	45,025	92.8	0.53	PERVIOUS GUTTER WITH BIORETENTION	2,117 SF OF SURFACE AREA, 2.1 BELOW SUBDRAIN
37	24,028	93.8	0.56	PERVIOUS GUTTER WITH BIORETENTION	1,105 SF OF SURFACE AREA, 2.6 BELOW SUBDRAIN
20	22,242	0.0	0.70	PERVIOUS GUTTER WITH	
38	22,242	98	0.70	BIORETENTION PERVIOUS GUTTER WITH	1,450 SF OF SURFACE AREA, 2.8 BELOW SUBDRAIN
39	6,898	98	0.70	BIORETENTION	540 SF OF SURFACE AREA, 2.3 BELOW SUBDRAIN
40	35,086	94.6	0.59	TREEPOD WITH UNDERGROUND RETENTION	8'X66'X5.5' DEEP UNDERGROUND RETENTION
41	43,274	91.5	0.60	PERVIOUS GUTTER WITH	1,670 SF OF SURFACE AREA, 2.5 BELOW SUBDRAIN
				BIORETENTION	
42	19,141	77.70	0.37	BIORETENTION TYPE A	670 SF OF SURFACE AREA, 1.0 BELOW SUBDRAIN
43	12,492	91.0	0.59	BIORETENTION TYPE A TREEPOD WITH	340 SF OF SURFACE AREA, 3.4' BELOW SUBDRAIN
44	27,597	93.5	0.59	UNDERGROUND RETENTION	8'X46'X5.5' DEEP UNDERGROUND RETENTION
45	18,988	92.2	0.56	PERVIOUS GUTTER WITH BIORETENTION	550 SF OF SURFACE AREA, 3.6' BELOW SUBDRAIN
46	24,447	92.3	0.61	BIORETENTION TYPE A	695 SF OF SURFACE AREA, 3.7' BELOW SUBDRAIN
47	14,334	85.6	0.50		250 SF OF SURFACE AREA, 3.0' BELOW SUBDRAIN
48	19,963	92.2	0.56	PERVIOUS GUTTER WITH	720 SF OF SURFACE AREA, 2.9' BELOW SUBDRAIN
				BIORETENTION TREEPOD WITH	
49	4,087	92.2	0.56	UNDERGROUND RETENTION	4'X12'X5.5' DEEP UNDERGROUND RETENTION
50	46,173	94.5	0.61	TREEPOD WITH UNDERGROUND RETENTION	10'X68'X5.5' DEEP UNDERGROUND RETENTION
51	11,547	92.1	0.50	PERVIOUS GUTTER WITH	600 SF OF SURFACE AREA, 2.0' BELOW SUBDRAIN
-				BIORETENTION PERVIOUS GUTTER WITH	
52	21,864	93.6	0.55	BIORETENTION	750 SF OF SURFACE AREA, 3.4' BELOW SUBDRAIN
53	30,741	98.0	0.50	PERVIOUS GUTTER WITH BIORETENTION	1,400 SF OF SURFACE AREA, 4.0' BELOW SUBDRAIN
F 4	17.001	0.7 -		PERVIOUS GUTTER WITH	
54	17,291	92.3	0.61	BIORETENTION	740 SF OF SURFACE AREA, 2.4' BELOW SUBDRAIN
55	23,221	86.8	0.52	BIORETENTION TYPE A	780 SF OF SURFACE AREA, 1.8' BELOW SUBDRAIN
56	21,403	95.3	0.66	,	800 SF OF SURFACE AREA, 3.7' BELOW SUBDRAIN
57	19,564	88.7	0.47	BIORETENTION BIORETENTION TYPE A	1,090 SF OF SURFACE AREA, 1.3' BELOW SUBDRAIN
				PERVIOUS GUTTER WITH	
58	28,421	94.3	0.61	BIORETENTION	1,074 SF OF SURFACE AREA, 3.4' BELOW SUBDRAIN
	6,611	95.3	0.66	PERVIOUS GUTTER WITH	441 SF OF SURFACE AREA, 2.1' BELOW SUBDRAIN
59	0,011	50.0		BIORETENTION	

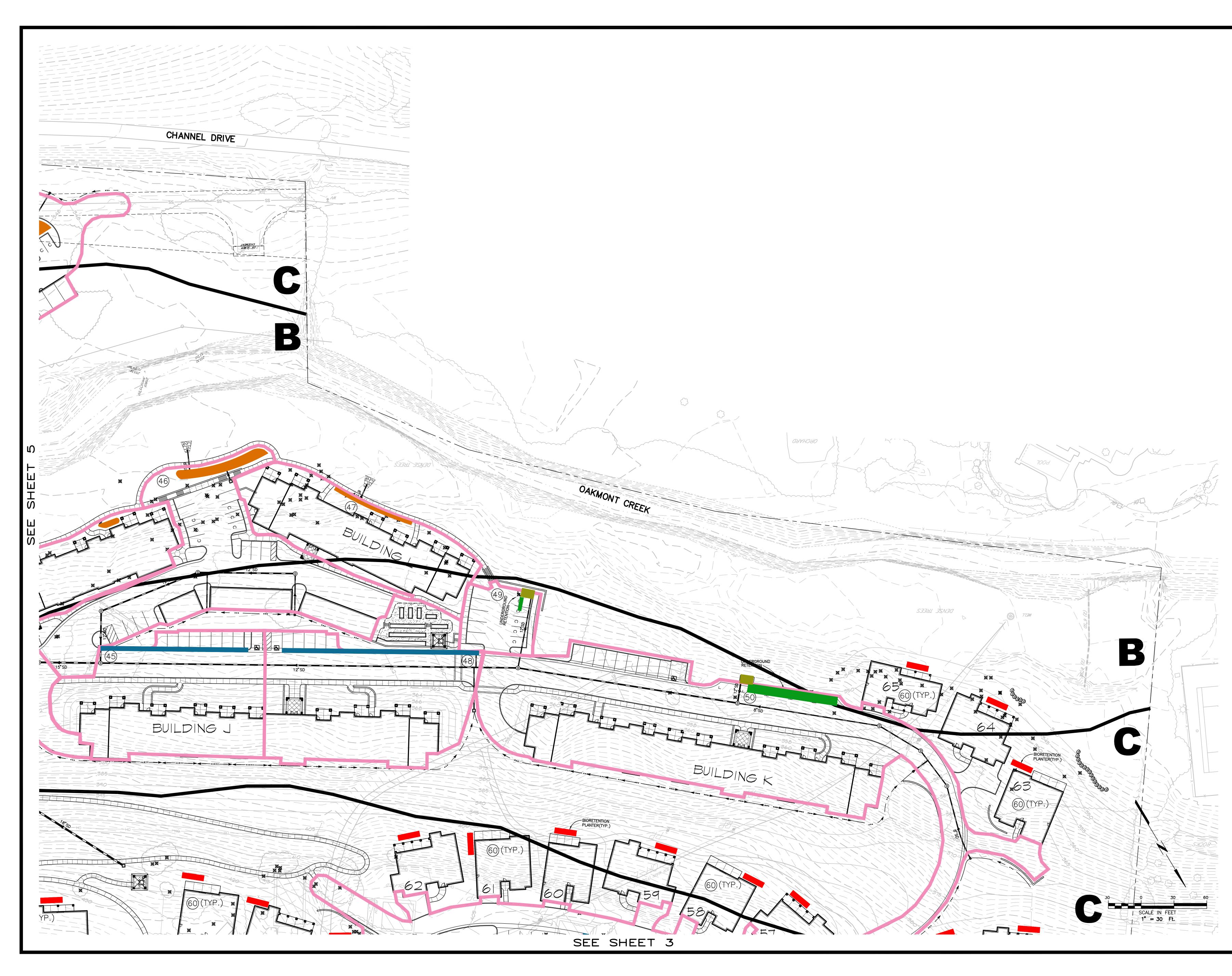








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