PRELIMINARY SWLIDS REPORT

ELNOKA CCRC

251 Elnoka Lane

SANTA ROSA, CA 95409

APN's 031-050-014, 031-050-018, 031-050-019, 031-061-003, 031-050-060 THOUGH 031-050-072

OAKMONT SENIOR LIVING LLC

B&R JOB # 2854.04

 $May\,2017$



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1. LID proposed Condition Exhibits

PROJECT DESCRIPTION

The Elnoka CCRC project is the site of the previously approved and partially implemented Three Bridges Lifecare Community. The project is located on State Highway 12, east of Melita Road in the City of Santa Rosa. The project site totals $68.73\pm$ acres on 17 parcels. The site is bounded my state Highway 12 to the north, Oakmont HOA to the east, Channel drive and residences to the North, and Melita Road and residences to the west.

The site's topography has moderate slopes averaging 19%. The site has a high point that runs east west, and divides the site approximately in half, north and south. Oakmont Creek flows east to west through the southerly portion of the site. The South Fork of Melita Creek runs east to west through the northerly portion of the site. The south Form of Melita Creek intersect with the main fork of Melita Creek on the western portion of the site. The northern portion of the site was previously graded by the Three Bridges Lifecare Community project in 1996/1997, an arch span culvert was built over the South Form of Melita Creek in conjunction with creek capacity/widening improvements that were constructed within the South Fork of Melita Creek. The site is primarily covered by annual grasses numerous trees mostly concentrated around each of the creeks that run through the project site. The site currently drains overland from the central high point running through the site, towards the existing creeks in their respective portions of the site. A storm drainage system was installed as part of the previously planned development, with outlets at both Melita South Fork and Melita creeks. The existing storm drainage system is intended to collect the increased stormwater flows from the developed site.

The Soil Map on the following page was generated using the USDA Natural Resource Conservation Service Web Soil Survey. The soil classification for the project area is a mixture of Tuscan cobbly Clay loam (TuE), Riverwash (RnA), Pleasanton loam (PnB), Pleasanton clay loam (PhB) and Manzanita gravelly silt loam (MbC). These soil types are classified as hydrologic soil group C except for Tuscan clay loam which is classified as D soil, and Riverwash. Riverwash has no hydrologic soil group, but given its listed properties as "well drained", a hydraulic soil Group of B has been assigned for the calculations in this report.

The project site will be developed to accommodate 14 senior living apartment buildings, a recreation center, 2 employee housing buildings, 74 cottages, and a care center facility. The exterior improvements will include a pool and patio area, as well as associated roadways, driveways, sidewalks, parking areas, landscaping, storm drainage, water (potable, fire protection, and irrigation) and sanitary sewer. The project is classified as a residential development and triggers these storm water requirements by creating over 10,000 ft² of new impervious surface.

Pollution Prevention Measures

The project design has incorporated pollution source controls intended to prevent pollutants from entering downstream drainage systems. These source controls include:

- Drainage inlets and structural BMP's will be fitted with gross pollutant (trash) racks and interceptor trays. Racks and trays will be regularly inspected and any captured debris removed and properly disposed of.
- The site landscape and hardscape will be professionally maintained, swept clean and with landscape leaves and debris removed on a regular schedule over the course of the year.
- Trash will be stored in a covered exterior trash enclosure. Local drainage will be routed away from the trash enclosure location.
- Vehicles will not be allowed to be washed or mechanically maintained on the site. All such activities will be required to occur off-site with encouragement of the use of commercial carwashes and car maintenance and repair shops.
- Landscape irrigation heads will be sized and tuned to avoid overspray and overwatering along with the selected use of drip irrigation.
- Capture and retention of at least the runoff from the 85th percentile storm event to the maximum extent practicable (MEP) of the entire site
- Routing excess intercepted runoff to sheet drain downslope through adjacent existing vegetation.

Types of BMP's

The MS4 Permit's goal is to treat, capture and infiltrate 100% of the runoff generated by the one inch deep 85th percentile 24-hour storm (design storm). The LID strategies and BMPs proposed for use on this project includes new tree planting, preservation of existing trees, bioretention planters, treepod bioretention structures and underground stormwater retention/infiltration basins. See text below for more details on proposed LID strategies and BMPs.

Interceptor Trees -New Tree Planting

Tree planting has been shown to reduce the amount of runoff that comes off a developed project Tree canopies intercept storm water before it contacts the ground and retain a significant volume of captured water on their leaves and branches allowing for evapotranspiration and providing runoff reduction benefits. While the most effective interceptor trees are large canopied evergreen trees, deciduous trees can also provide a measurable benefit. The proposed project includes the planting of many trees within the proposed Improvements. Interceptor tree credits are calculated into the site design by reducing the amount of tributary area that must be used to calculate treatment and volume capture. New deciduous trees provide a credit of 100 square feet, new evergreen trees provide 200 square feet. All interceptor tree credits calculations are completed with the Credit Calculator of the Storm Water Calculator.

Interceptor Trees -Preservation of Existing Trees

Preserving existing established tree canopies has been shown to reduce the amount of runoff that comes off a developed project. Existing tree canopies intercept storm water before it contacts the ground and retain a significant volume of captured water on their leaves and branches allowing for evapotranspiration and providing runoff reduction benefits. The proposed project will preserve many of the large oak trees that exist on the existing project site.

Interceptor tree credits are calculated into the site design by reducing the amount of tributary area that must be used to calculate treatment and volume capture. All interceptor tree credits calculations are completed with the Credit Calculator of the Storm Water Calculator.

Bioretention Planters

Bioretention planters will consist of excavated areas backfilled with permeable granular material, sandy loam and top soil. Planters will be landscaped with native vegetation that will maximize evapotranspiration. Bioretention areas are to be designed in general accordance with the City of Santa Rosa and County of Sonoma "Storm Water Low Impact Development Technical Design Manual". The proposed bioretention areas will be designed with 18" of a sandy loam mix over of class 2 permeable material. A perforated sub drain will be located near the top of the permeable material for priority 2 bioretention adjacent to paving areas. The permeable material will maximize storm water runoff retention and storm water infiltration.

Pervious Concrete Gutter/ Valley Gutter Bioretention Areas.

Proposed Pervious Concrete Gutter/Valley Gutter bioretention areas are designed in accordance with the City of Santa Rosa and County of Sonoma "Storm Water Low Impact Development Technical Design Manual". Proposed Pervious Concrete Gutter/Valley Gutter will be installed with a minimum of 18" of CU structural treatment soil over a perforated subdrain which will be install on top of another layer of class 2 permeable material. The upper layer of material will provide stormwater treatment and the lower layer of class 2 permeable material below the sub drain will provide storm water retention. The perforated sub drain will be installed to drain the upper layer of class 2 permeable material to prevent stormwater from entering the roadway subgrade and road section. The class 2 permeable material will maximize storm water runoff retention and storm water infiltration. Within each storm drain inlet that collects storm water from pervious concrete gutter/ valley gutter bioinfilltration areas there will be a trash collection bucket and Flogard catch basin insert filter that will collect trash and sediment before storm water is discharged the storm drain system.

Kristar Cudo Retention/Infiltration Basins

Kristar Cudo retention/infiltration basins systems will be connected to onsite treepod bioretention structures to provide a storm water treatment and storm water retention. The Kristar Cudo retention/infiltration basin is a modular system of stackable 2'x2'x2' cubes that creates an underground retention storage area that contains 95% void space. The top sides and bottom of the modular cubes are not enclosed and have a grated cover that allows storm water to infiltrate into the surrounding soils all sides. The Kristar Cudo modular cubes will be wrapped with a filter fabric and backfilled with a 1' thick section of drain rock on the top, bottom and all four sides to prevent the surround sediment from entering the modular storm water retention area. Each Kristar Cudo retention/infiltration basin will have at least one manhole opening to allow inspection, access and cleaning the voids contained within the modular Cudo retention and infiltration basin. The Kristar Cudo retention/infiltration basins functions similar to the retention portion of a standard bioretention planter but contain a greater quantity of voids. The Kristar Cudo basins will promote storm water infiltration and additional storm water treatment. The Kristar Cudo underground retention/infiltration basins that will be sized to capture the 100% Volume capture requirement of each area. At each storm drain outfall into the Kristar Cudo basins there will be a trash collection bucket and Flogard catch basin insert filter that will collect trash and sediment before storm water is discharged to the storm drain system.

Impervious Area Disconnection

Impervious area disconnection allow storm water from impervious areas, such as rooftops and pavement, to be directed to pervious natural or landscaped areas and infiltrate into the soil. All landscape areas where impervious area disconnections are proposed will be amended with compost (mixed into the soil with a rototiller) to a depth of 8 inches to allow for storm water treatment and infiltration before reaching a storm drain inlet. This BMP also slows the speed and amount of runoff from a site over conventional direct storm drain connections. All rooftop drainage for this project shall be disconnected from direct connection to the storm drain system and will be directed to storm drain treatment areas utilizing splash blocks or curb drains to paved areas that allow sheet flow to bio-retention areas.

Level of Treatment and Volume Capture

The design goal of 100% capture for the overall site will be achieved by routing 100% of event runoff (or as near to 100% as possible) through the various BMP's associated with each of the DMA's around the project. In addition, BMP's will be designed to retain at minimum the volume of runoff generated by the 1 inch deep 85th percentile event directed into each BMP before bypassing any excess runoff. A 100 square foot type B bioretention planter is proposed in the rear yard of almost all of the proposed cottages on the Elnoka project site (these areas are defined as DMA #60 (typ)). The type B bioretention planter to all of the cottages. The type B bioretention planters at each cottage will treat and retain the one inch 85% percentile storm event runoff from the cottage roof, patio and sidewalks. Each of the cottage driveways will

drain to the proposed site roads and the stormwater will be treated and retained by the proposed roadway BMP's

Maintenance Funding

BMPs shall be inspected and maintained as described in "Planter Strip Bioretention Inspection and Maintenance Checklist", "Porous Pavement Inspection and Maintenance Checklist" and "Interception Trench Inspection and Maintenance Checklist provided in the **LID** Manual Reference Documents Section. Structural BMP's such as the "Cudo" unit arrays shall be inspected and maintained in accordance with the operations and maintenance (O&M) manual published by the manufacturer. All associated costs for inspection or maintenance of the onsite best management practices (BMPs) shall be budgeted for this purpose and carried out by Oakmont Senior Living LLC., or its assigned successor(s).

FOR	OFFICE L	JSE ONLY	:
Does ⁻	this proje	ect require	permanent
storm	water Bl	MP's?	
	Y	Ν	

Date Submitted:



File No:	Quadrant									
Related Files:										
Set:										
Department Use Only										

2017 Storm Water LID Determination Worksheet

PURPOSE AND APPLICABILITY: Use this form to determine whether or not this project will need to incorporate permanent Storm Water Best Management Practices (BMP's) and submit a Storm Water Low Impact Development Submittal (SW LIDS) as required by the City's National Pollutant Discharge Elimination System Municipal Separate Storm Sewer Systems (NPDES MS4) only. Your project may still need to incorporate permanent storm water BMP's as required by other regulatory authority, such as, but not limited to CALGREEN or North Coast Regional Water Quality Control Board (NCRWQCB).

Part 1: Project Inforn	nation			
Elnoka CCRC			OSL Santa Rosa Pro	jects LLC
Project Name			Applicant (owner or deve	loper) Name
251 Elnoka Ave.			9240 Old Redwood Hyw,	Suite 200
Project Site Address			Applicant Mailing Addres	S
Santa Rosa/ Ca/ 9	95409		Windsor, Ca 95492	
Project City/State/Zip			Applicant City/State/Zip	
N/A			707-535-3500	
Permit Number(s) - (if	applicable)		Applicant Phone/Email/F	ax
Brelje & Race Cor	nsulting Engineers		475 Aviation Blvd, S	uite 120
Designer Name			Designer Mailing Addres	S
Santa Rosa, Ca, S	95403		707-576-1322/ Glea	son@brce.com
Designer City/State/Zi	р		Designer Phone/Email	
Type of Application	/Project:			
Subdivision	Grading Permit	Building Permit	Hillside Development	t
Design Review	Use Permit	Encroachment	Time Extensions	Other :

PART 2: Project Exemptions

1. Is this a project that creates or replaces *less than* 10,000 square feet of impervious surface¹, including all project phases and off-site improvements?

Yes No

¹ Impervious surface replacement, such as the reconstruction of parking lots or excavation to roadway subgrades, is not a routine maintenance activity. Reconstruction is defined as work that replaces surfaces down to the subgrade. Overlays, resurfacing, trenching and patching are defined as maintenance activities per section ?????

2017 Storm Water LID Determination Worksheet

- 2. Is this project a routine maintenance activity² that is being conducted to maintain original line and grade, hydraulic capacity, and original purpose of facility such as resurfacing existing roads and parking lots?
- 3. this project a stand alone pedestrian pathway, trail or off-street bike lane?

Yes No

4. Did you answer "YES" to any of the questions in Part 2?

YES: This project does *not* need to inclrporate permanent Storm Water BMP's as required by the NPDES MS4 Permit. **Please complete Section 4 and "Exemption Signature Section" on Page 4.**

NO: Proceed with worksheet.

Part 3: Project Triggers

Projects that Trigger Requirements:

Please answer the following questions to determine whether this project requires permanent Storm Water BMP's and the submittal of a SW LIDs as required by the NPDES MS4 Permit order # ???????

1. Does this project create or replace a combined total of 10,000 square feet or more of impervious surface¹ including all project phases and off-site improvements?

Yes No

- Does this project create or replace a combined total or 10,000 square feet or more of impervious streets, roads, highways, or freeway construction or reconstruction³? Yes No
- 3. Does this project create or replace a combined total of 1.0 acre or more of impervious surface¹ including all project phases and off-site improvements? Yes No
- 4. Did you answer "YES" to any of the above questions in Part 3?

YES: This project does *not* need to incorporate permanent Storm Water BMP's as required by the NPDES MS4 Permit. **Please complete Section 4 and "Exemption Signature Section" on Page 4**

NO: This project will *not* need to incorporate permanent Storm Water BMP's as required by the NPDES MS4 permit. **Please complete the Exemption Signature Section on Page 4**.

¹ Imprevious surface replacement, such as the reconstruction of parking lots or excavation to roadway subgrades, is not a routine maintence activity. Reconstruction is defined as work that replaces surfaces down to the subgrade. Overlays, resurfacint, trenching and patching are defined as maintenance activities.

^{2 &}quot;Rountine Maintenance Activity" includes activities such as overlays and/or resurfacing of existing roads or parking lots as well as trenching and patching activities and reroofing activities.

^{3 &}quot;Reconstruction" is defined as work that extends into the subgrade of a pavement section.

2017 Storm Water LID Determination Worksheet

Part 4: Project Description

1.	Total Project area:		square fo acres	square feet acres					
2.	Existing land use(s): (cheo	ck all that apply)							
	Commercial	Industrial	Residential	Public	Other				
	Description of buil	dings, significant	t site features (cre	eeks, wetlan	ds, heritage tre	es), etc.:			
3.	Existing impervious surface	e area:		square fe acres	eet				
4.	Proposed Land Use(s): (ch	neck all that appl ^y	y)						
	Commercial	Industrial	Residential	Public	Other				
	Description of buil	ldings, significant	t site features (cro	eeks, wetlan	ds, heritage tre	es), etc.:			

5. Proposed impervious surface area:

square feet acres

Acknowledgment Signature Section:

As the property owner or developer, I understand that this project is required to implement permanent Storm Water Best Management Practices and provide a Storm Water Low Impact Development Submittal (SW LIDS) as required by the City's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer Systems (MS4) Permit.* Any unknown responses must be resolved to determine if the project is subject to these requirements.

Applicant Signature

Date

Exemption Signature Section:

As the property owner or developer, I understand that this project as currently designed does not require permanent Storm Water BMP's nor the submittal of a Storm Water Low Impact Development Submittal (SW LIDS) as required by the City's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer Systems (MS4) Permit*. I understand that redesign may require submittal of a new Determination Worksheet and may require permanent Storm Water BMP's.

Applicant Signature

Date

* Your project may still need to incorporate permanent storm water BMP's as required by other regulatory authority, such as but not limited to CALGREEN or North Coast Regional Water Quality Control Board (NCRWQCB).

Implementation Requirements: All calculations shall be completed using the "Storm Water Calculator" available at: <u>www.srcity.org/stormwaterLID</u>

Hydromodification Control/100% Volume Capture: Capture (infiltration and/or reuse) of 100% of the volume of runoff generated by a 1.0" 24-hour storm event, as calculated using the "Urban Hydrology for Small Watersheds" TR-55 Manual method. 100% volume capture is the ideal condition and if achieved satisfies all requirements so that no additonal treatment is required. This is a retention requirement.

Treatment Requirement: Treatment of 100% of the flow calculated using the modified Rational Method and a known intensity of 0.20 inches per hour.

Delta Volume Capture Requirement: Capture (infiltration and/or reuse) of the increase in volume of storm water due to development generated by a 1.0" 24-hour storm event, as calculated using the "Urban Hydrology for Small Watersheds" TR-55 Manual method. This is a retention requirement.

	Best Management Practice (BMP)	Detail Sheet	Detail Title	ের্ব	be used	awith.	dwater tanina	tion netti	aints	une capure	revention	ority self	ected?	tipanation of section	Offer notes.	
	Living Roof	N/A	N/A		х	х	х		x x				X			
	Rainwater Harvesting	N/A	N/A		х	x	х		x				x			
Universal LID	Interceptor Trees	N/A	N/A		х	х	х			x			x			
Features- to be considered on	Vegetated Buffer Strip	UN-01	Vegetated Buffer Strip							x			x			
all projects.	Bovine Terrace	UN-02	Bovine Terrace		х					x			X			
	Impervious Area Disconnection	N/A	N/A		x	x	x			x			x			

						d with	Water	on	raints		obure	revention	Spriorit	4	notselection	dis.	
	Best			,	e USE	aroun	mino	On	Jes."	nem	ne int	N. N.	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		natio.	note	
	Management					5 / Å	³¹ .5	\$ / x	New 10	3 ¹¹ /3	un allutied	it when he		~ /.c	y uplati	other	
	Practice (BMP)	Detail Sheet	Detail Title	<u>/</u> 0	<u>/ *`</u>	/0/	/ 5*	1 20	/~`	<u> </u>		8 50	/ 40	14	_ {	/ 0*	
	Rain Garden	P1-01	Rain Garden						Х	Х				X			
Priority 1 and 1A BMPs - to be installed with	Roadside Bioretention	P1-02	Roadside Bioretention - no C & G						x	x				×			
no underdrains or liners. Must drain all stading	Vegetated Swale-with Bioretention	P1-06	Swale with Bioretention						x	x				x			
water within 72 hours.	Constructed Wetlands	N/A	N/A						х	x				x			
	Infiltration Trench	P1-07	Infiltration Trench						x	x			x				

	Best Management Practice (BMP)	Detail Sheet	Detail Title	तं	n be used	owith.	unater transition contraction contraction	Achieves.	atment	une cature pere	BNP select	priority	- NO	tipastin desetion	Othernote	
	Rain Garden	P2-01	Rain Garden					х	х		-		Χ			
		P2-02	Roadside Bioretinton - Flush Design Roadside					x	x			x				
Priority 2 BMPs- with subsurface	Roadside	P2-03	Roadside Bioretenion- Contiguous SW					x	x			x				
drains installed above the capture	Dioretention	P2-04	Roadside Bioretenion- Curb Opening					x	x				x			
volume.		P2-05	Roadside Bioretenion- No C & G					x	x				x			
	Pervious Pavement	P2-06	Vegetated Buffer Strip					x	x				x			
	Constructed Wetlands	N/A	N/A					x	х				x			

	Best Management Practice (BMP)	Detail Sheet	Detail Title	ঝে	n be used	with.	a water	ation onst	traints	atment	une capture	Hevention	In this provide the selected	ority 3. Ves N	s typenation of set	ection	Other mores.	
	Rain Garden	P3-01	Rain Garden		х	х	х		х					x				
Priority 3 BMPs-		P3-02	Roadside Bioretinton - Flush Design Roadside		x	x	х		x					X				
installed with subdrains and/or	Bioretention	P3-03	Roadside Bioretenion- Contiguous SW		x	x	x		x					x				
impermeable liner. Does not achieve		P3-04	Roadside Bioretenion- Curb Opening		x	x	x		x					x				
capture and must be used		P3-05	Roadside Bioretenion- No C & G		x	x	х		x	x		_		x				
as part of a treatment	Flow Through Planters													x				
train.	Pervious Pavement	P1-04	Vegetated Buffer Strip		х	x	х		x	х				x				
	Vegetated Swale	P3-07	Vegetated Swale		х	x	х		x	x				x				

	Best Management Practice (BMP)	কে	be use	dwith.	d Water	tion Act	raints	inent vol	une capure polition p	revention the selection	5 priorit	A NO	tipanetion of safetion	Other notes:	
Priority 4 BMPs- does not achieve	Tree Filter Unit		х	x	x		x					x			
and must be used as part of a treatment train.	Modular Bioretention		х	x	x		x					X			
Priority 5 BMPs- does not achieve	Chambered Separator Units		x	x	x		x					x			
volume capture and must be used	Centrifugal Separator Units		х	х	x		x					X			
as part of a	Trash Excluders	4	х	х	х		х					X			
treatment train.	Filter Inserts		Х	х	х		х					X			
Priority 6 BMPs-	Offset Program						N/A	N/A	N/A						
Other	Detention		Х												





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	

<u>Buff</u> <u>So</u>	fer Strips & Bovine Terraces [3] Enter area draining to a Buffer Strip or Bovine Terrace =	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



A15



Requirement 1: 100% Treatme	ent			INSTRUCTIONS:
Treatment of 100% of the flow generated	by 85th percentile 24 hour mean annual rain event (0.2 i	n/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 dev	eloped condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for P	ollution Prevention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]			
Input:				
	$A_r = 20,850 \text{ ft}^2 =$	0.47865 Acres		
	$C_{POST}^{[10]} = 0.60$			
	K ^[7] = 1.2			
		NOTE:		
Solution:		The Flow Rate calculate	ed here should only be used to size the	
		appropriate BMP. All as	ssociated overflow inlets and systems	
Q _{TREATMENT} = 0.06720 cfs	Q _{TREATMENT} = (0.2)(0.4787)(0.60)(1.17)	should be sized for the	Flood Control event.	



Requirement 2: Delta Volume (No increase in volume of runoff leaving th	Capture e site due to development for the 85th percentile 24 hour storr	m 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= $[(P*K)-(0.2*S)]^2$ 1ft	Where:		
[(P*K)+(0.8 * S)] ^ 12in	Q= Runoff depth (ft) [6]		
	P= Precipitation (in) = 0.92 0.92 inches in	n the Santa Rosa	
	K= Seasonal Precipitation Factor ^[7] area, based c	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.= Reduced Tributary Area including credit for Pollution	n Prevention 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 Volume
input: (Field data from drop down lieto	$A = 20.850 \text{ ft}^2$		Conture is not required
	K ^[7] 4 2		Capture is not required.
	R** - 1.2		$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE})$
Colored to day		aown Lists	
Select hydro	nogic soil type within tributary area = C: 0.05 - 0.15 in/hr infiltratio	on (transmission) rate	
Select predeve	Propriet ground cover description (*) = Woods (50%), grass (50%) c	Combination (orchard or tree farm) - Fair	
Select post deve	sopment ground cover description - Impervious - Paved Parking,	, Roonop, Driveways	
	CN _{POST} = 90.3		
OR	Composite Predevelopment $CN^{[9]} = 74$		
	Composite Post development CN ¹⁰⁷ = 94		
Solution:			
Pre Development Storm Water Rund	off Volume		
S _{PRE} = 3.51 in	$S_{PRE} = \frac{1000}{-10}$	Where:	
	74	S _{PRE} = Pre development potential maximum retention after runoff (in).	
Q _{PRE} = 0.00301 ft	$\Omega_{} = \frac{[(0.92*1.17)-(0.2*3.51)]^2}{1} \times \frac{1 \text{ ft}}{1}$	Q _{PRE} = Q in feet of depth as defined by the "Urban	
	(0.92*1.17)+(0.8 * 3.51) 12in	Hydrology For Small Watersheds" TR-55 Manual.	
V _{PRE} = 62.76 ft ³	V _{PRE} = (0.00301)(20,850)	V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Post Development Storm Water Run	off Volume		
S _{POST} = 0.61571 in	S _{POST} = <u>1000</u>	Where:	
	94 -10	S_{POST} = Post development potential maximum retention after runoff (in).	
		· F031 · · · · · · · · · · · · · · · · · · ·	
Q _{POST} = 0.04807 ft	Q_{POST} = [(0.92*1.17)-(0.2 * 0.62)] ² 1ft	$Q_{POST} = Q$ in feet of depth as defined by the "Urban	
	[(0.92*1.17)+(0.8*0.62)] X 12in	Hydrology For Small Watersheds" TR-55 Manual	
		,	
$V_{POST} = 1002.26 \text{ ft}^3$	V_{POST} = (0.04807)(20.850)	V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
Solution: Volume Capture Require	ement		
Increase in volume of storm	water that must be retained onsite (may be infiltrated or reuse	ed)	
	water that must be retained online (may be inilitated of redse		
N Delta Volume Capture= (Vpoor-V	Delta Volume Canture= (1.002.26) -	(62 76)	
		Where Where	
	9 50 st ³ Delta '	Volume Capture= The increase in volume of storm water generated by the 85th	
50	Noo II	percentile 24 hour storm event due to development that must be	
		retained onsite (may be infiltrated or reused).	





	Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connected Paved Area 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	
ſ	Interceptor Trees ^[2]	INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
	Number of new Evergreen Trees that qualify as interceptor trees= 0 New Evergreen Trees NOTE: Total Interceptor Area Area Reduction due to new Evergreen Trees= 0 ft² (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= 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 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	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 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% Treatme	nt			INSTRUCTIONS:
Treatment of 100% of the flow generated	by 85th percentile 24 hour mean annual rain event (0.2 i	n/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 deve	eloped condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pe	ollution Prevention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]			
Input:				
	$A_r = 24,049 \text{ ft}^2 =$	0.55209 Acres		
	$C_{POST}^{[10]} = 0.59$			
	K ^[7] = 1.2			
		NOTE:		
Solution:		The Flow Rate calculate	ed here should only be used to size the	
		appropriate BMP. All as	ssociated overflow inlets and systems	
Q _{TREATMENT} = 0.07622 cfs	Q _{TREATMENT} ⁼ (0.2)(0.5521)(0.59)(1.17)	should be sized for the	Flood Control event.	



<u>Requirement 2:</u> Delta Volume C	Capture		INSTRUCTIONS:
No increase in volume of runoff leaving the	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:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ⁵		Capture, this page of the calculator,
Q= $[(P*K)-(0.2*S)]^2$ 1ft	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 n local historical	
V = (O)(A)	Where:		NOTE
$\mathbf{v} = (\mathbf{w})(\mathbf{r}_{\mathbf{r}})$	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
Inputs (Disk data farm days days lists			equal to that generated before
Input. (Pick data from drop down lists)	$A_r = 24.049 \text{ ft}^2$		development, Requirement 2-Volume
	κ ^[7] = 1.2		$(C_{\text{res}} \leq C_{\text{res}})$
	Drop d	down Lists	(C POST S C PRE OF CIN POST S CIN PRE)
Select hydrol Select predevel	logic soil type within tributary area ^[0] = C: 0.05 - 0.15 in/hr infiltration	n (transmission) rate	
Select piedevel Select post devel	opment ground cover description ^[5] = Impervious - Paved Parking,	Rooftop, Driveways	
	CN _{PRE} = 76		
08	$CN_{POST} = 90.3$		
	Composite Predevelopment CN ^[9] = 94		
Solution:			
Pre Development Storm Water Runo	ff Volume		
S _{PRE} = 3.51 in	S _{PRE} = <u>1000</u> -10	Where:	
	74	S_{PRE} = Pre development potential maximum retention after runoff (in).	
Q _{PRF} = 0.00301 ft	$ = [(0.92^{*}1.17) \cdot (0.2^{*}3.51)]^{2} \times 1 $ ft	$Q_{PPF} = Q$ in feet of depth as defined by the "Urban	
	$\mathbf{Q}_{PRE} = \frac{1}{[(0.92^*1.17) + (0.8^*3.51)]} \times \frac{1}{12in}$	Hydrology For Small Watersheds" TR-55 Manual.	
V= 72.39 ft ³	$\mathbf{V}_{=}$ (0.00301)(24.040)	V = Dro Douglanmant Valuma of Storm Water Constant (# ³)	
• PRE- 72.33	$\bullet_{PRE^{-}}(0.00301)(24,049)$	*PRE Pre Development volume of Storm water Generated (it)	
Post Development Storm Water Run	off Volume		
S _{POST} = 0.67236 in	S _{POST} = <u>1000</u> -10	Where:	
	94	S _{POST} = Post development potential maximum retention after runoff (in).	
Q _{POST} = 0.04590 ft	\mathbf{Q}_{POST} = [(0.92*1.17)-(0.2 * 0.67)] ² \checkmark 1ft	Q _{POST} = Q in feet of depth as defined by the "Urban	
	[(0.92*1.17)+(0.8 * 0.67)] ^ 12in	Hydrology For Small Watersheds" TR-55 Manual.	
$V_{\text{post}} = 1103.85 \text{ ft}^3$	$V_{\text{post}} = (0.04590)(24.049)$	V_{post} = Post Development Volume of Storm Water Generated (ft ³)	
	- 2021 (0.04000)(24,040)		
Solution: Volume Capture Require	ment		
Increase in volume of storm	water that must be retained onsite (may be infiltrated or reused	ed).	
Delta Volume Capture= (V _{POST} -V	PRE) Delta Volume Capture= (1,103.85) - ((72.39)	
		Where:	
V _{DELTA} = 1031	.46 ft ³ Delta V	volume Capture= 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).	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Capture Goal; VGOAL		NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the <u>design goal</u>
$V_{\text{LID GOAL}} = \frac{2865.66}{\text{ft}^3} \text{ft}^3 \qquad \frac{\text{Where:}}{\text{Where:}}$		treatment only.	development condition Enter the
$V_{\text{LID GOAL}}$ = Required volume of the second	of soil in LID BMP.	1	percent porosity of the specified soil
$A_{\text{LID GOAL}} = 000.00$ it $A_{\text{LID GOAL}} = 1000000$ it $A_{\text{LID GOAL}} = 10000000000000000000000000000000000$	AP area for a given depth (below perforated pi	be if present).	and depth below perforated pipe (if
V _{GOAL} = 1,261 ft	3		present). The width and length entries will need to be interactively adjusted
Where:			until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $(D)(A_{LID GOAL})_{x 100}$ P= Porosity (enter as a decimal)			
V _{LID GOAL} D= Depth below perforated pipe if p W= Width (in decimal feet) L= Length (in decimal feet)	oresent (in decimal feet)		
Input: P= 04	as a decimal		
$D = \frac{3.2}{3.2} \text{ ft}$	Below perforated pipe if present		
W = 30.0 ft			
L = 30.0 ft			
Solution:			
Percent of Goal Achieved = 100.50 % = [(3.2 x 900) / 2,8	66] x 100		
			1
			INSTRUCTIONS:
LID BMP Sizing Tool Delta Volume Capture Requirement : Vorume		NOTE:	INSTRUCTIONS: The Delta Volume Capture sizing tool
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
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	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u>
LID BMP Sizing Tool Delta Volume Capture Requirement: VDELTA Formulas: VLID DELTA=((VDELTA))/(P) = #DIV/01] 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 continue. Enter the persent of personity
LID BMP Sizing Tool Delta Volume Capture Requirement: V _{DELTA} Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01 ft ³ V _{LID DELTA} = Required volume of V _{LID DELTA}	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below
LID BMP Sizing Tool Delta Volume Capture Requirement: V _{DELTA} Formulas: $V_{LID DELTA}$ =((V_{DELTA}))/(P) = #DIV/01 ft ³ Where: $V_{LID DELTA}$ =((V_{DELTA}))/(P) = 0.00 ft ² V _{LID DELTA} = Required volume of A _{LID DELTA} = Footprint of LID B	of soil in LID BMP /IP area for a given depth (below perforated pi	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width
LID BMP Sizing Tool Delta Volume Capture Requirement: V_{DELTA} Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/0! ft ³ Where: VLID DELTA = Required volume of ALID DELTA = Required volume of ALID DELTA = (W)(L) = 0.00 ft ² A_{LID DELTA} = Footprint of LID BR $V_{DELTA} = (W)(L) = $ 0.00 ft ² A_{LID DELTA} = Footprint of LID BR	of soil in LID BMP IP area for a given depth (below perforated pij 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 <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
LID BMP Sizing Tool Delta Volume Capture Requirement: V_{DELTA} Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/0!$ ft ³ Where: $A_{LID DELTA} = (W)(L) = 0.00$ ft ² $V_{LID DELTA} = Required volume of A_{LID DELTA} = Footprint of LID BR V_{DELTA} = (W)(L) = 0.00 ft2 V_{DELTA} = 1031.46 ft Where: W_{DELTA} = W_{DELTA} = W_{DELTA} $	of soil in LID BMP /IP area for a given depth (below perforated pi	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 <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
LID BMP Sizing Tool Delta Volume Capture Requirement: V_{DELTA} Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/0! ft ³ Where: $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² $V_{LID DELTA} = $ Required volume of $A_{LID DELTA} = $ Footprint of LID B! $V_{DELTA} = (W)(L) = $ 0.00 ft ² $V_{DELTA} = $ 1031.46 Percent of Requirement $(D)(A_{LID DELTA}) \times 100$ P= Porosity (enter as a decimal)	of soil in LID BMP MP area for a given depth (below perforated pi	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> <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 100%.
LID BMP Sizing Tool Delta Volume Capture Requirement: V_{DELTA} Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/0! ft^3 Uhere: A_{LID DELTA} = (W)(L) = 0.00 ft^2 A_{LID DELTA} = Required volume of A_{LID DELTA} = Footprint of LID BP V_{DELTA} = 1031.46 ft Percent of RequirementAchieved = \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100 PEPorosity (enter as a decimal) D = Depth below perforated pipe if percent of performance of the provided of the provide$	of soil in LID BMP MP area for a given depth (below perforated pi a present (in decimal feet)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Requirement: V _{DELTA} Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ Where: V_{LID DELTA} = Required volume of A_{LID DELTA} = Required volume of A_{LID DELTA} = Footprint of LID BR $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² V_{LID DELTA} = Footprint of LID BR VDELTA = [1031.46] ft VDELTA = [1031.46] ft Percent of Requirement Achieved $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} x 100$ P= Porosity (enter as a decimal) D= Depth below perforated pipe if p W= Width (in decimal feet) Undecimal feet)	of soil in LID BMP MP area for a given depth (below perforated pin s	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 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%.
LID BMP Sizing Tool Delta Volume Capture Requirement: V _{DELTA} Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/0!$ ft ³ Where: $A_{LID DELTA} = (W)(L) = 0.00$ ft ² $V_{LID DELTA} = \text{Required volume of A_{LID DELTA} = Footprint of LID BR Percent of Requirement (D)(A_{LID DELTA}) V_{DELTA} = 1031.46 ft Percent of Requirement (D)(A_{LID DELTA}) V_{DELTA} VLID DELTA V_{DELTA} V_{DELTA} = 1031.46 ft Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if p W = Width (in decimal feet) L= Length (in decimal feet) $	of soil in LID BMP MP area for a given depth (below perforated pi s	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Requirement: V_{DELTA} Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01$ ft ³ Where: $A_{LID DELTA} = (W)(L) = 0.00$ ft ² $V_{LID DELTA} = \text{Required volume of A_{LID DELTA} = Footprint of LID BH Percent of Requirement (D)(A_{LID DELTA}) V_{10D DELTA} = 1031.46 ft Percent of Requirement (D)(A_{LID DELTA}) V_{10D DELTA} Achieved = \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100 P = Porosity (enter as a decimal) D = Depth below perforated pipe if p W = Width (in decimal feet) L = Length (in decimal feet) L = Length P = 0.0 P = 0.0 $	of soil in LID BMP MP area for a given depth (below perforated pi s present (in decimal feet) as a decimal	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> <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 100%.
LID BMP Sizing Tool Delta Volume Capture Requirement: V_{DELTA} Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/0! ft^3$ Where: $V_{LID DELTA}=(V)(L) = 0.00 ft^2$ $A_{LID DELTA}=(W)(L) = 0.00 ft^2$ $V_{LID DELTA} = Footprint of LID BRV_{DELTA} = 1031.46 ft^2 Percent of RequirementAchieved = \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100 P= Porosity (enter as a decimal)D= Depth below perforated pipe if pW= Width (in decimal feet)L= Length (in decimal feet) Input: P = 0.0D = 0.0 ft $	of soil in LID BMP MP area for a given depth (below perforated pig s present (in decimal feet) as a decimal Below perforated pipe if present	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> <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 100%.
LID BMP Sizing Tool Delta Volume Capture Requirement: V_{DELTA} Formulas: $V_{UID DELTA}=((V_{DELTA}))/(P) = \#DIV/01$ ft ³ Where: $V_{UID DELTA}=(V)(L) = 0.00$ ft ² $A_{LID DELTA}=(W)(L) = 0.00$ ft ² $V_{LID DELTA} = Fequired volume of A_{LID DELTA} = Footprint of LID BR VDELTA=(W)(L) = 0.00 ft2 V_{DELTA} = Footprint of LID BR VDELTA=(W)(L) = 0.00 ft2 V_{DELTA} = 1031.46 ft Percent of Requirement Achieved = \frac{(D)(A_{LID DELTA})}{V_{UID DELTA}} \times 100 P= Porosity (enter as a decimal) D= Depth below perforated pipe if provide the text of te$	of soil in LID BMP MP area for a given depth (below perforated pig s present (in decimal feet) as a decimal Below perforated pipe if present	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> <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 100%.
LID BMP Sizing Tool Delta Volume Capture Requirement: V_{DELTA} Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/01 ft^3Where:A_{LID DELTA}=(W)(L) = 0.00 ft^2V_{LID DELTA} = Required volume of A_{LID DELTA} = Footprint of LID BIV_{DELTA}=(W)(L) = 0.00 ft^2V_{DELTA} = 1031.46 ft^2Percent of Requirement Achieved = \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} x 100P = Porosity (enter as a decimal) D = Depth below perforated pipe if provide the second seco$	of soil in LID BMP IP area for a given depth (below perforated pi s present (in decimal feet) as a decimal Below perforated pipe if present	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> <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 100%.
LID BMP Sizing Tool Delta Volume Capture Requirement: V_{DELTA} Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = \#DIV/0!$ ft ³ Where: $A_{LID DELTA}=(W)(L) = 0.00$ ft ² $V_{LID DELTA} = Required volume of A_{LID DELTA} = Footprint of LID Bt Percent of Requirement Achieved = \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} x 100 Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if provide the provide the provide the provided of the provided the provid$	of soil in LID BMP //P area for a given depth (below perforated pig present (in decimal feet) as a decimal Below perforated pipe if present	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> <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 100%.
LID BMP Sizing Tool Delta Volume Capture Requirement: V_{DELTA} Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/0! ft^3$ $A_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/0! ft^3$ Where: $V_{LID DELTA}= Required volume of A_{LID DELTA} = Footprint of LID BIN A_{LID DELTA}=(W)(L) = 0.00 ft^2 V_{DELTA} = 1031.46 ft Percent of Requirement Achieved = (D)(A_{LID DELTA}) V_{DELTA} = 1031.46 ft Where:P= Porosity (enter as a decimal)D= Depth below perforated pipe if provide the providet the provide the provide the provide the provide the provide the$	of soil in LID BMP MP area for a given depth (below perforated pi s present (in decimal feet) as a decimal Below perforated pipe if present	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> <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 100%.





Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connection Multiplier = 1	acted 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 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 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.



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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%
$Q_{TREATMENT}$ = (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 devel	oped condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pol	lution Prevention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^{1/J}			
<u>Input:</u>		1 11 1 1 1 1 1		
	$A_r = 48,548 \text{ ft} =$	1.11 Acres		
	C_{POST}			
	K ⁽²⁾ = 1.2	NOTE		
Solution				
<u>solution.</u>		The Flow Rate calculate	ed here should only be used to size the	
	$Q_{\text{TDEATMENT}} = (0.2)(1.11)(0.50)(1.17)$	should be sized for the	Elood Control event	
UREATMENT 0.15507 CIS	\sim (0.2)(1.11)(0.09)(1.17)	Should be sized for the		



Requirement 2: Delta Volume O No increase in volume of runoff leaving the	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not achieved; then Requirement 1-100%		
$\frac{Formulas:}{S = \frac{1000}{CN} - 10}$ $Q = \frac{[(P+K)-(0.2+S)]^2}{V} + \frac{1ft}{V}$	<u>Where:</u> S= Potential maximum retention after runoff (in) ^{5]} CN= Curve Number ^[5] <u>Where:</u>		Treatment, page 4 of the calculator, AND Requirement 2- Volume Capture, this page of the calculator, must be achieved.
[(P*K)+(0.8 * S)] 12in V= (Q)(A _r)	Q= Runoff depth (ft) ^[6] P= Precipitation (in) = 0.92 0.92 inches in the K= Seasonal Precipitation Factor ^[7] area, based on lo data.	e Santa Rosa ocal historical	NOTE:
Input: (Pick data from drop down lists	v= volume of Storm Water to be Retained (ft) A _r = Reduced Tributary Area including credit for Pollution Pre	evention Measures (ギ)	after development is less than or equal to that generated before development, Requirement 2-Volume
Select hydro	$A_r = \frac{48,548}{K^{[7]}} \pi^r$ $K^{[7]} = \frac{1.2}{Drop \ dov}$ blogic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration (t	vn Lists ransmission) rate	Capture is not required. (C _{POST} ≤ C _{PRE} or CN _{POST} ≤ CN _{PRE})
Select predeve Select post deve	lopment ground cover description ^[5] = Woods (50%), grass (50%) cont lopment ground cover description ^[5] = Impervious - Paved Parking, Ro $CN_{PRE} = \frac{76}{CN_{POST}} = 90.3$	bination (orchard or tree farm) - Fair oftop, Driveways	
<u>OR</u>	Composite Predevelopment CN $^{[9]}$ =74Composite Post development CN $^{[9]}$ =94		
Bra Development Storm Water Bung	Aff Volume		
S _{PRE} = 3.51 in	$S_{PRE} = \frac{1000}{74} -10$	$\frac{\text{Where:}}{\text{S}_{\text{PRE}}\text{=}} \text{ Pre development potential maximum retention after runoff (in).}$	
Q _{PRE} = 0.00301 ft	Q _{PRE} = $\frac{[(0.92^*1.17) - (0.2^*3.51)]^2}{[(0.92^*1.17) + (0.8^*3.51)]}$ X $\frac{1 \text{ft}}{12 \text{in}}$	Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{PRE} = 146.13 ft ³	V _{PRE} = (0.00301)(48,548)	$V_{\text{PRE}}\text{=}$ Pre Development Volume of Storm Water Generated (ft³)	
Post Development Storm Water Run S _{POST} = 0.68376 in	S _{POST} = <u>1000</u> 94 -10	<u>Where:</u> S _{POST} = Post development potential maximum retention after runoff (in).	
Q _{POST} = 0.04548 ft	$\mathbf{Q}_{\text{POST}} = \frac{[(0.92^{*}1.17) \cdot (0.2^{*}0.68)]^{2}}{[(0.92^{*}1.17) \cdot (0.8^{*}0.68)]} \times \frac{1\text{ft}}{12\text{in}}$	Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{POST} = 2207.96 ft ³	V _{POST} = (0.04548)(48,548)	$V_{\text{POST}}\text{=}$ Post Development Volume of Storm Water Generated (ft^3)	
Solution: Volume Capture Require	ement water that must be retained onsite (may be infiltrated or reused).		
$\overset{\omega}{\sim}$ Delta Volume Capture= (V _{POST} -V	/ _{PRE}) Delta Volume Capture= (2,207.96) - (14	6.13)	
V _{DELTA} = 2061	1.83 ft ³ Delta Volu	<u>wriere:</u> ume Capture= 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).	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Capt	ure Goal; V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the design goal
$V_{LID GOAL} = ((V_{GOAL}))/(P) = 5735.28$ ft ³	Where:	treatment only.	of 100% volume capture of the post
	V _{LID GOAL} = Required volume of soil in LID BMP.		percent porosity of the specified soil
$A_{\text{LID GOAL}}=(W)(L)=1554.72$	A _{LID GOAL} = Footprint of LID BMP area for a given depth (below perforated	pipe if present).	and depth below perforated pipe (if
	$V_{COAL} = 2.524 \text{ ft}^3$		present). The width and length entries
			will need to be interactively adjusted
	Where:		until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $(D)(A_{LID GOAL})$ x 100	P= Porosity (enter as a decimal)		
V _{LID GOAL}	D= Depth below perforated pipe if present (in decimal feet)		
	W= Width (in decimal feet)		
Input:	P = 0.4 as a decimal		
	D = 3.7 ft Below perforated pipe if present		
	W = 39.4 ft		
	L = 35.4 It		
Solution:		7	
Percent of Goal Achieved = 100.3	0 % = [(3.7 x 1,555) / 5,735] x 100		
LID BMD Sining Tool Dolto Volume Cont	ure Requirements V	NOTE	The Delta Volume Capture sizing tool
LID BIMP Sizing Tool Delta volume Capit	ite Requirement. V _{DELTA}	NOTE:	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the design
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = $ #DIV/0! ft ³	Where:	treatment only.	requirement of the delta volume
	V _{LID DELTA} = Required volume of soil in LID BMP		capture. Enter the percent of porosity
$A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$	A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated	pipe if present).	of the specified soil and depth below
	M		and length entries will need to be
	$V_{DELTA} = [2061.83]^{TC}$		and length entries will need to be
			interactively adjusted until "Percent of
	Where:		interactively adjusted until "Percent of Requirement achieved" reaches
Percent of Requirement (D)(A _{LID DELTA})	<u>Where:</u> P= Porosity (enter as a decimal)		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
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)		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
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)		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
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)		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
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) P = 0.0 as a decimal		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ <u>Input:</u>	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 = 0.0 D = 0.0 ft Below perforated pipe if present		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ <u>Input:</u>	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) D = D = 0.0 ft Below perforated pipe if present W = 0.0 ft		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ <u>Input:</u>	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 = 0.0 p = 0.0		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	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 = 0.0 D = 0.0 P = 0.0 ft Below perforated pipe if present U = 0.0 ft Below perforated pipe if present		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: Solution:	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 = 0.0 D = 0.0 H = 0.0		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ Input: Solution: Percent of Requirement Achieved = #DIV/01	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 = 0.0 D = 0.0 ft Below perforated pipe if present W = 0.0 ft Delow perforated pipe if present W = 0.0 ft Delow perforated pipe if present W = 0.0 ft Delow perforated pipe if present W = 0.0 ft Delow perforated pipe if present		interactively adjusted until "Percent of Requirement achieved" reaches 100%.





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=	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 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.



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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 ir	/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%
$Q_{\text{TREATMENT}}$ = (0.2 In/nr)(A_{r})(C_{POST})(K) CTS	Where:		The table of values can be found here	I reatment, this page of the calculator,
	CTREATMENT Design now rate required to be treated (crs)	lenged condition ^[10]	This smaller value should not be used	Capture page 5 of the calculator
	A = Reduced Tributery Area including credit for Re	lution Provention Measures (in Acros)	to size the overflow bypass.	must be achieved
	K = Seasonal Precipitation Factor ^[7]	indion revenuon measures (in Acres)		
Input:				
	$A_r = 12,728 \text{ ft}^2 =$	0.29219 Acres		
	C _{POST} ^[10] = 0.66			
	K ^[7] = 1.2			
		NOTE:		
Solution:		The Flow Rate calculate	ed here should only be used to size the	
Q _{TREATMENT} = 0.04513 cfs	$Q_{\text{TREATMENT}} = (0.2)(0.2922)(0.66)(1.17)$	appropriate BMP. All as should be sized for the	ssociated overflow inlets and systems Flood Control event.	



2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #4

Requirement 2: Delta Volume Capture No increase in volume of runoff leaving 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
Formulas:	Treatment, page 4 of the calculator
S = 1000 - 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
$Q = \frac{[(P+K)-(0.2+S)]^2}{10} + \frac{1ft}{10}$	
[(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= 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 ([#])	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
$A_r = 12.728 \text{ ft}^2$	Capture is not required
$\kappa^{(7)} = 1.2$	
Dron down Lists	$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE})$
Select hydrologic soil type within tributary area ⁽⁸⁾ = C: 0.05 - 0.15 in/hr infiltration (transmission) rate	
Select predevelopment ground cover description ^[5] = Woods (50%), grass (50%) combination (orchard or tree farm) - Fair	
Select post development ground cover description ^[5] = Impervious - Paved Parking, Rooftop, Driveways	
CN _{PRE} = 76	
CN _{POST} = 90.3	
OR Composite Predevelopment CN ^[9] = 74	
Composite Post development CN $^{[9]} = 96$	
Solution:	
Pre Development Storm Water Runoff Volume	
$S_{n-2} = \frac{3.51}{2}$ $S_{n-2} = 1000$ Where:	
74 Spre- Pre development potential maximum retention after runon	(in).
$Q_{22} = 0.02201$ ft $I(0.02^{+}1.47) (0.2^{+}3.51)$ 1ft $Q_{22} = 0.0201$ ft $I(0.02^{+}1.47) (0.2^{+}3.51)$	
$\mathbf{Q}_{PRE} = \underbrace{\mathbf{U}_{(0,0)}}_{(0,0)} \underbrace{\mathbf{U}_{(1,0)}}_{(1,0)} \underbrace{\mathbf{V}_{(1,0)}}_{(1,0)} \underbrace{\mathbf{V}_{(1,0)}}$	
$V_{\text{ppr}} = \frac{38.31}{10}$ H^3 $V_{\text{ppr}} = (0.00301)(12.728)$ $V_{\text{ppr}} = \text{Pre Development Volume of Storm Water Generated (H3)}$	
Post Development Storm Water Runoff Volume	
Spost= 0.38422 in Spost= 1000 Where	
-10 -10	ff (in)
$Q_{\text{POST}} = 0.06042$ ft $Q_{\text{POST}} = [(0.92^{*}1.17) \cdot (0.2^{*}0.38)]^2$ 1ft $Q_{\text{POST}} = 0$ in feet of depth as defined by the "Urban	
$V_{POST} = 769.03 \text{ ft}^3$ $V_{POST} = (0.06042)(12.728)$ $V_{POST} = Post Development Volume of Storm Water Generated (ft3)$	
Solution: Volume Capture Requirement	
Increase in volume of storm water that must be retained onsite (may be infiltrated or reused).	
ω	
^{CO} Delta Volume Capture= (V _{POST} -V _{PRE}) Delta Volume Capture= (769.03) - (38.31)	
Where:	
V _{DELTA} = 730.71 ft ³ Delta Volume Capture= The increase in volume of storm water generated by the 8	5th
percentile 24 hour storm event due to development that m	ust be
retained onsite (may be infiltrated or reused).	



LID BMP Sizing Tool: 100% Volume Capture Goal; V _{GOAL} Formulas: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 1957.22$ ft ³ $W_{LID GOAL} = ((V_{GOAL}))/(P) = 1957.22$ ft ³ $V_{LID GOAL} = (W)(L) = 484.88$ ft ² $V_{LID GOAL} = Required volume of soil in LID BMP.$ $A_{LID GOAL} = (W)(L) = 484.88$ ft ² $V_{GOAL} = 861$ 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 = $\frac{(D)(A_{LID GOAL})}{V_{LID GOAL}}$ x 100 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: $P =$ 0.4as a decimal $D =$ 4.0 ftBelow perforated pipe if present $W =$ 22.0 ft $L =$ 22.0 ft		
Solution: Percent of Goal Achieved = 100.09 % = [(4.0 x 485) / 1,957] x 100	7	
LID BMP Sizing Tool Delta Volume Capture Requirement: V_{DELTA} Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/0!$ ft ³ $W_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/0!$ ft ³ $V_{LID DELTA} = (W)(L) = @0.00$ ft ² $A_{LID DELTA} = (W)(L) = @0.00$ ft ² $A_{LID DELTA} = Footprint of LID BMP area for a given depth (below perforate V_{DELTA} = @730.71 ft3 $	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> <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 Beguirement achieved" reaches
Percent of Requirement = $\frac{(D)(A_{\text{LID DELTA}})}{x 100}$ P= Porosity (enter as a decimal)		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)		
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 = 0.0 ft Below perforated pipe if present W = 0.0 ft L = 0.0 ft		





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	





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.



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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 i	n/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 deve	loped condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Po	ollution Prevention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]			
Input:				
	$A_r = 22,393 \text{ ft}^2 =$	0.51407 Acres		
	$C_{POST}^{[10]} = 0.38$			
	K ^[7] = 1.2			
		NOTE:		
Solution:		The Flow Rate calculate	d here should only be used to size the	
		appropriate BMP. All as	ssociated overflow inlets and systems	
Q _{TREATMENT} = 0.04571 cfs	Q _{TREATMENT} = (0.2)(0.5141)(0.38)(1.17)	should be sized for the	Flood Control event.	

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Requirement 2: Delta Volume C No increase in volume of runoff leaving the	Capture	event.	INSTRUCTIONS: If the Design Goal of 100% Capture
$\frac{Formulas:}{S = \frac{1000}{CN} - 10}$ $Q = \frac{[(P+K)-(0.2+S)]^2}{[(P+K)+(0.8+S)]} \times \frac{1ft}{100}$	Where: S= Potential maximum retention after runoff (in) ^{5]} CN= Curve Number ^[5] Where: OF Page (from the maximum fill)		on page 3 of this calculator is not achieved; then Requirement 1-100% Treatment, page 4 of the calculator, AND Requirement 2- Volume Capture, this page of the calculator, must be achieved.
[(P*∩)*(0.6 × S)] 12in V= (Q)(A,)	Q - Runoff depth (ft) ¹⁰⁷ P = Precipitation (in) = 0.92 0.92 inches in the second	he Santa Rosa local historical	NOTE:
	V= Volume of Storm Water to be Retained (ft ³) A _r = Reduced Tributary Area including credit for Pollution P	Prevention Measures ([#])	If the amount of volume generated after development is less than or equal to that generated before
Input: (Pick data from drop down lists	or enter calculated values) $A_r = 22,393 \text{ ft}^2$ $K^{[7]} = 1.2$	sum Linta	development, Requirement 2-Volume Capture is not required. (C _{POST} ≤ C _{PRE} or CN _{POST} ≤ CN _{PRE})
Select hydrol Select predevel Select post devel	logic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration lopment ground cover description ^[5] = Woods (50%), grass (50%) com lopment ground cover description ^[5] = Impervious - Paved Parking, R CN _{PRE} = 76 CN _{PRE} = 90.3	(transmission) rate nbination (orchard or tree farm) - Fair cooftop, Driveways	
<u>OR</u>	Composite Predevelopment CN ^[9] = 74 Composite Post development CN ^[9] = 85		
Solution:	ff Volumo		
S _{PRE} = 3.51 in	$S_{PRE} = \frac{1000}{74} -10$	$\frac{Where:}{S_{PRE}}$ Pre development potential maximum retention after runoff (in).	
Q _{PRE} = 0.00301 ft	$\mathbf{Q}_{PRE} = \begin{array}{c} \frac{[(0.92^{*}1.17) - (0.2^{*}3.51)]^2}{[(0.92^{*}1.17) + (0.8^{*}3.51)]} & \times & \frac{1 \text{ft}}{12 \text{in}} \end{array}$	Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{PRE} = 67.40 ft ³	V _{PRE} = (0.00301)(22,393)	$V_{\text{PRE}}\text{=}$ Pre Development Volume of Storm Water Generated (ft³)	
Post Development Storm Water Run S _{POST} = 1.75 in	off Volume S _{POST} = <u>1000</u> -10 85	<u>Where:</u> S _{POST} = Post development potential maximum retention after runoff (in).	
Q _{POST} = 0.01776 ft	$\mathbf{Q}_{POST} = \frac{[(0.92^{*}1.17) \cdot (0.2^{*}1.75)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}1.75)]} \times \frac{1 \text{ft}}{12 \text{in}}$	Q _{POST} = <i>Q</i> in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{POST} = 397.70 ft ³	V _{POST} = (0.01776)(22,393)	$V_{\text{POST}}\text{=}$ Post Development Volume of Storm Water Generated (ft³)	
Solution: Volume Capture Require	ment water that must be retained onsite (may be infiltrated or reused)).	
⁴ Delta Volume Capture= (V _{POST} -V	PRE) Delta Volume Capture= (397.70) - (67.	.40)	
V _{DELTA} = 330	.30 ft ³ Deita Vo	<u>winere:</u> plume Capture= 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).	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Captu	ure Goal: V _{GOAL}	NOTE:	The 100% volume capture sizing tool
	- COAL	LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the design goal
$V_{\text{LID GOAL}} = ((V_{\text{GOAL}}))/(P) = 1109.47 \text{ ft}^3$	Where:	treatment only.	of 100% volume capture of the post
1	V _{LID GOAL} = Required volume of soil in LID BMP.		nercent porosity of the specified soil
$A_{\text{LID GOAL}}=(W)(L) = 595.36 \text{ ft}$	A _{LID GOAL} = Footprint of LID BMP area for a given depth (below perforated p	ipe if present).	and depth below perforated pipe (if
	$V_{cont} = 488$ ft ³		present). The width and length entries
	GOAL		will need to be interactively adjusted
	Where:		until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{\text{LID GOAL}})}{x 100}$	P= Porosity (enter as a decimal)		
V _{LID GOAL}	D= Depth below perforated pipe if present (in decimal feet)		
	V = VVIdtn (in decimal feet)		
Input:	P = 0.4 as a decimal		
	D = 1.9 ft Below perforated pipe if present		
	W = 24.4 ft		
	L - 24.4 It		
Solution:		7	
Percent of Goal Achieved = 101.96	% = [(1.9 x 595) / 1,109] x 100		
LID BMB Sizing Tool Dalta Volume Cantu	ro Poquiromont - V	NOTE	INSTRUCTIONS: The Delta Volume Capture sizing tool
LID BMP Sizing Tool Delta Volume Captu	re Requirement: V _{DELTA}	NOTE:	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size
LID BMP Sizing Tool Delta Volume Captur	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>
LID BMP Sizing Tool Delta Volume Captur Formulas: VLID DELTA=((VDELTA))/(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
LID BMP Sizing Tool Delta Volume Captur Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0! ft ³	re Requirement: 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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = $ #DIV/01 ft^3 $A_{LID DELTA}=(W)(L) = $ 0.00 ft^2	re Requirement: V _{DELTA} <u>Where:</u> 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	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width
LID BMP Sizing Tool Delta Volume Capture Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01 ft ³ A _{LID DELTA} =(W)(L) = 0.00 ft ²	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 p VDFLTA= 330.30 101 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 <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
LID BMP Sizing Tool Delta Volume Captur Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01 ft ³ A _{LID DELTA} =(W)(L) = 0.00 ft ²	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 p VDELTA = 330.30	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> <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
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/0!$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ²	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 p VDELTA= 330.30 Where: Where:	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ipe if present).	INSTRUCTIONS: 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
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement = $(D)(A_{LID DELTA}) \times 100$	<u>where:</u> $V_{LID DELTA}$ $V_{LID DELTA}$ Required volume of soil in LID BMP $A_{LID DELTA}$ Footprint of LID BMP area for a given depth (below perforated p V_{DELTA} 330.30 ft ³ Where: P= Porosity (enter as a decimal)	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ipe if present).	INSTRUCTIONS: 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 100%.
$\frac{\text{LID BMP Sizing Tool Delta Volume Capture}}{V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/01}{\#\text{DIV}/01} \text{ft}^{3}$ $A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{CLID DELTA}} \text{ft}^{2}$ $\frac{\text{Percent of Requirement}}{\text{Achieved}} = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	where: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP ALLD DELTA = Footprint of LID BMP area for a given depth (below perforated p V_{DELTA} = 330.30 ft ³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) With the (in the context of the pipe)	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ipe if present).	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 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%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01 \text{ ft}^3$ $A_{LID DELTA} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	where: $V_{LID DELTA}$ 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} = 330.30 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) We Width (in decimal feet) U Width (in decimal feet)	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ipe if present).	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 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%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01 \text{ ft}^3$ $A_{LID DELTA} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	where: $V_{LID DELTA}$ 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} = 330.30 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) Width (in decimal feet) L = Length (in decimal feet)	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ipe if present).	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 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%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	where: $V_{LID DELTA}$ Where: V_{DELTA} = Footprint of LID BMP area for a given depth (below perforated p V_{DELTA} = 330.30 ft ³ 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 = 0.0 as a decimal	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ipe if present).	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ <u>Input:</u>	The Requirement: V_{DELTA} 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} = 330.30 ft ³ 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 = 0.0 ft Below perforated pipe if present	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ipe if present).	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	The Requirement: V_{DELTA} 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} = 330.30 ft ³ Where: P = P = 0.0 ft Below perforated pipe if present (in decimal feet) U = 0.0 ft Below perforated pipe if present Below perforated pipe if present	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ipe if present).	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	The Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perforated p V_{DELTA} = 330.30 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= 0.0 ft Below perforated pipe if present U = 0.0 ft	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ipe if present).	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: Solution:	The Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perforated p V_{DELTA} = 330.30 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W = 0.0 ft Below perforated pipe if present U = 0.0 ft Below perforated pipe if present	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ipe if present).	INSTRUCTIONS: 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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = $ $A_{LID DELTA}=(W)(L) = $ 0.00 ft ² Percent of Requirement Achieved $M_{LID DELTA}$ X 100 Input: Solution: Percent of Requirement Achieved = #DIV/0!	The Requirement: V_{DELTA} 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} = 330.30 ft ³ 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 = 0.00 ft as a decimal P = 0.00 ft Below perforated pipe if present W = 0.00 ft Below perforated pipe if present W = 0.00 ft Below perforated pipe if present	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ipe if present).	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 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%.





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	





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	ent			INSTRUCTIONS:
Treatment of 100% of the flow generated	by 85th percentile 24 hour mean annual rain event (0.2 in	٦/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	AND Requirement 2- Volume
	C _{POST} = Rational method runoff coefficient for the deve	loped condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Po	ollution Prevention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]			
Input:				
	$A_r = 25,625 \text{ ft}^2 =$	0.58827 Acres		
	$C_{POST}^{[10]} = 0.51$			
	K ^[7] = 1.2			
		NOTE:		
Solution:		The Flow Rate calculate	ed here should only be used to size the	
		appropriate BMP. All as	ssociated overflow inlets and systems	
Q _{TREATMENT} = 0.07020 cfs	Q _{TREATMENT} = (0.2)(0.5883)(0.51)(1.17)	should be sized for the	Flood Control event.	

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Requirement 2: Delta Volume (Capture	event	INSTRUCTIONS:
Formulas: $S = \frac{1000}{200} - 10$	Where:	Gvon.	on page 3 of this calculator is not achieved; then Requirement 1-100% Treatment, page 4 of the calculator, AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ⁵ CN= Curve Number ^[5]		Capture, this page of the calculator,
Q= $[(P \star K) - (0.2 \star S)]^2 = \frac{1 ft}{1 + 1}$	Where:		must be achieved.
[(P+K)+(0.8 + S)] 1 2in	Q=Runoff depth (ft) [6]P=Precipitation (in) = 0.92 0.92 inches in tiK=Seasonal Precipitation Factor [7]area, based on	he Santa Rosa Iocal 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
Input: (Pick data from drop down lists	or enter calculated values) $A_r = \frac{25,625}{1000} \text{ft}^2$		equal to that generated before development, Requirement 2-Volume Capture is not required.
	K ^[7] = 1.2		$(C_{\text{POST}} \leq C_{\text{PDE}} \circ C \cap C$
		own Lists	(0 POST = 0 PRE 0. 0.1 POST = 0.1 PRE)
Select hydro Select predeve	lopment ground cover description ^[5] = Woods (50%), grass (50%) cor	(transmission) rate mbination (orchard or tree farm) - Fair	
Select post deve	lopment ground cover description [5] = Impervious - Paved Parking, R	Rooftop, Driveways	
	$CN_{PRE} = 76$		
OR	$Cn_{POST} = 90.3$		
	Composite Post development CN $^{[9]} = 90$		
Solution:			
Pre Development Storm Water Runo	off Volume		
S _{PRE} = <u>3.51</u> in	S _{PRE} ⁼ <u>1000</u> −10	$\frac{Where:}{S_{\text{PRE}}\text{=}} \text{ Pre development potential maximum retention after runoff (in).}$	
Q _{PRE} = 0.00301 ft	$\mathbf{Q}_{\mathbf{PRE}} = \frac{[(0.92^{*}1.17) - (0.2^{*}3.51)]^2}{[(0.92^{*}1.17) + (0.8^{*}3.51)]} \times \frac{1 \text{ft}}{12 \text{in}}$	Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{PRE} = 77.13 ft ³	V _{PRE} = (0.00301)(25,625)	V_{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Post Development Storm Water Run	off Volume		
S _{POST} = 1.06 in	S _{POST} = <u>1000</u> _10	Where:	
	90	S_{POST} = Post development potential maximum retention after runoff (in).	
Q _{POST} = 0.03236 ft	Q _{POST} = [(0.92*1.17)-(0.2 * 1.06)] ² X 1ft [(0.92*1.17)+(0.8 * 1.06)] X 12in	Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{POST} = 829.23 ft ³	V _{POST} = (0.03236)(25,625)	$V_{\text{POST}}\text{=}$ Post Development Volume of Storm Water Generated (ft^3)	
Solution: Volume Capture Require	ament water that must be retained onsite (may be infiltrated or reused	I).	
ن Delta Volume Capture= (V _{POST} -V	PRE) Delta Volume Capture= (829.23) - (77	.13)	
V _{DELTA} = 752	2.09 ft ³ Delta Vo	Where: olume Capture= 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).	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Capture	e Goal; V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the <u>design goal</u>
$V_{\text{LID GOAL}} = ((V_{\text{GOAL}}))/(P) = 2207.24 \text{ ft}^3$	Where:	treatment only.	of 100% volume capture of the post
	V _{LID GOAL} = Required volume of soil in LID BMP.		percent porosity of the specified soil
$A_{\text{LID GOAL}}=(\text{VV})(\text{L})=882.09$	$A_{LID GOAL}$ = Footprint of LID BMP area for a given depth (below p	perforated pipe if present).	and depth below perforated pipe (if
	$V_{GOAL} = 971$ ft ³		present). The width and length entries will need to be interactively adjusted
W	here:		until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $(D)(A_{LID GOAL})$ x 100	P= Porosity (enter as a decimal)		
V _{LID GOAL}	D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
	gat ()		
Input:	P = 0.4 as a decimal		
	D = 2.5 ft Below perforated pipe if preser	nt	
	$W = \frac{29.7}{29.7} \pi$		
	L - 23.7 It		
Solution:		7	
Percent of Goal Achieved = 100.31 %	= [(2.5 x 882) / 2,207] x 100		
UD DMD Oleiner Teist Delte Malines Orestere	Demointer M		The Delta Volume Capture sizing tool
LID BMP Sizing Tool Delta volume Capture	Requirement: V _{DELTA}	NOTE:	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID DMD to achieve the design
onnador			a LID BIVIP to achieve the design
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = $ #DIV/0! ft ³	Where:	treatment only.	requirement of the delta volume
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/0!}{\#\text{DIV}/0!} \text{ft}^3$	Where: V _{LID DELTA} = Required volume of soil in LID BMP	treatment only.	requirement of the delta volume capture. Enter the percent of porosity
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/0!}{\#\text{DIV}/0!} \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = \frac{0.00}{\#^2} \text{ft}^2$	<u>Where:</u> V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below p	treatment only.	requirement of the delta volume capture. Enter the percent of porosity of the specified soil and depth below
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/01}{\#\text{DIV}/01} \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = \frac{0.00}{\#\text{DIV}/01} \text{ft}^2$	Where: V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below p	treatment only.	requirement of the delta volume capture. Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/01}{\#\text{DIV}/01} \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = \frac{0.00}{\#\text{DIV}/01} \text{ft}^2$	Where: V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below p V _{DELTA} = 752.09	treatment only.	requirement of the delta volume 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
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/0!}{\#\text{DIV}/0!} \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = \boxed{0.00} \text{ft}^2$	Where: $V_{\text{LID DELTA}}$ Required volume of soil in LID BMP $A_{\text{LID DELTA}}$ Footprint of LID BMP area for a given depth (below p V_{DELTA} 752.09 ft ³	treatment only.	requirement of the delta volume 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
$V_{LID DELTA} = ((V_{DELTA}))/(P) = \frac{\#DIV/0!}{\#DIV/0!} ft^{3}$ $A_{LID DELTA} = (W)(L) = \underbrace{0.00}_{H^{2}} ft^{2}$ Percent of Requirement (D)(A _{LID DELTA})	Where: $V_{\text{LID DELTA}}$ $A_{\text{LID DELTA}}$ Footprint of LID BMP area for a given depth (below p V_{DELTA} 752.09 ft ³ here: P= Porosity (enter as a decimal)	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 interactively adjusted until "Percent of Requirement achieved" reaches 100%.
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/0!}{\#\text{DIV}/0!} \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{III}} \text{ft}^2$ Percent of Requirement Achieved = $\frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	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 p V_{DELTA} 752.09 ft ³ here: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet)	treatment only.	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 100%.
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/0!}{\#\text{DIV}/0!} \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{OLO}} \text{ft}^2$ Percent of Requirement Achieved = $\frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	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 p V_{DELTA} = 752.09 ft ³ here: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet)	treatment only.	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 100%.
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/01}{\#\text{DIV}/01} \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{OLO}} \text{ft}^2$ Percent of Requirement Achieved = $\frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	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 processing) V_{DELTA} = 752.09 ft 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)	treatment only.	requirement of the delta volume 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 100%.
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/01}{\#\text{DIV}/01} \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{O}} \text{ft}^2$ Percent of Requirement Achieved = $\frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	Where: $V_{\text{LID DELTA}}$ $A_{\text{LID DELTA}}$ Footprint of LID BMP area for a given depth (below provide the second secon	treatment only.	requirement of the delta volume 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 100%.
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/01}{\#\text{DIV}/01} \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{IIID DELTA}} \text{ft}^2$ $\frac{W}{\text{Percent of Requirement}}$ $Achieved = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ $\underline{\text{Input:}}$	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 processing) V_{DELTA} = 752.09 ft 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) P = 0.0 0.0 ft Below perforated pipe if present	treatment only.	requirement of the delta volume 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 100%.
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/01}{\#\text{DIV}/01} \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{O}} \text{ft}^2$ $Percent of Requirement Achieved = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ $\underline{Input:}$	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 processing) V_{DELTA} = 752.09 ft 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) P = 0.0 D = 0.0 Merein (ff Below perforated pipe if present (ff Below perforated pipe if perforated pip	treatment only.	requirement of the delta volume 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 100%.
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/01}{\#\text{DIV}/01} \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{O}} \text{ft}^2$ Percent of Requirement Achieved = $\frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ $\underline{\text{Input:}}$	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 processing) V_{DELTA} 752.09 ft 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) W= 0.00 ft Below perforated pipe if present W = 0.00 ft L = 0.00 ft	treatment only.	requirement of the delta volume 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 100%.
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/01}{\#\text{DIV}/01} \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{O}} \text{ft}^2$ $Percent of Requirement Achieved = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ $\underline{Input:}$	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 processing) V_{DELTA} 752.09 ft 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) W= 0.0 ft Below perforated pipe if present U = 0.0 ft U = 0.0 ft U = 0.0 ft U = 0.0 ft	treatment only.	requirement of the delta volume 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 100%.
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/01}{\text{ft}^3} \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{IT}^2} \text{ft}^2$ $Percent of Requirement \\ Achieved = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ $\underline{Input:}$	Where: $V_{LID DELTA}$ $A_{LID DELTA}$ Footprint of LID BMP area for a given depth (below processing) V_{DELTA} P Porosity (enter as a decimal) D Depth below perforated pipe if present (in decimal feet) W= $P =$ 0.0 F_{t} Below perforated pipe if present $W =$ 0.0 F_{t} Below perforated pipe if present	treatment only.	requirement of the delta volume 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 100%.
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))'(P) = \frac{\#\text{DIV}/01}{\#\text{DIV}/01} \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{III}} \text{ft}^2$ $Percent of Requirement}_{\text{Achieved}} = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ $\underline{Input:}_{\text{Percent of Requirement Achieved}} = \frac{\#\text{DIV}/01}{\%}\%$	Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below processing) V_{DELTA} = 752.09 ft ³ here: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W = 0.0 ft Below perforated pipe if present $W = 0.0 ft$ Below perforated pipe if present $W = 0.0 ft$	treatment only.	requirement of the delta volume 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 100%.





	_
Paved Area Disconnection [1] Paved Area Type (select from drop down list): Not Directly-connected Paved Area 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 Evergreen Trees that qualify as interceptor trees= 0 New Evergreen Trees NOTE: Total Interceptor Area Reduction due to new Evergreen Trees= Area Reduction due to new Evergreen Trees= 0 ft ² (200 ft ² /tree) 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= 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 tree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ² = Sum of areas managed by evergreen + deciduous + existing canopy	

Bu	ffer 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
<u>s</u>	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	
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% Treatme	nt			INSTRUCTIONS:
Treatment of 100% of the flow generated	by 85th percentile 24 hour mean annual rain event (0.2 ir	ı/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 deve	loped condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Po	Ilution Prevention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]			
Input:				
	$A_r = 25,490 \text{ ft}^2 =$	0.58517 Acres		
	$C_{POST}^{[10]} = 0.58$			
	K ^[7] = 1.2			
		NOTE:		
Solution:		The Flow Rate calculate	ed here should only be used to size the	
		appropriate BMP. All as	ssociated overflow inlets and systems	
Q _{TREATMENT} = 0.07942 cfs	Q _{TREATMENT} ⁼ (0.2)(0.5852)(0.58)(1.17)	should be sized for the	Flood Control event.	



Requirement 2: Delta Volume C No increase in volume of runoff leaving the	Capture Sale and the source of	n event.	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not achieved; then Requirement 1-100%
Formulas: $S = \frac{1000}{CN} - 10$	Where: S= Potential maximum retention after runoff (in) ^{5]} CN= Curve Number ^[5]		Treatment, page 4 of the calculator, AND Requirement 2- Volume Capture, this page of the calculator, must be achieved.
$Q = \frac{[(P + K) - (0.2 + S)]^2}{[(P + K) + (0.8 + S)]} \times \frac{1 ft}{12 in}$	Where: Q= Runoff depth (ft) ^[6] P= Precipitation (in) = 0.92 0.92 inches in K= Seasonal Precipitation Factor ^[7] area, based on	n the Santa Rosa nn local historical	
V= (Q)(A _r)	Where: Uata. V= Volume of Storm Water to be Retained (ft ³) A _r = Reduced Tributary Area including credit for Pollution	n Prevention Measures (ギ)	NOTE: If the amount of volume generated after development is less than or equal to that generated before
Input: (Pick data from drop down lists	or enter calculated values) $A_r = \underbrace{25,490}_{K^{[7]}} ft^2$ $\underbrace{1.2}_{R^{[7]}} ft^2$	down Lists	development, Requirement 2-Volume Capture is not required. (C _{POST} ≤ C _{PRE} or CN _{POST} ≤ CN _{PRE})
Select hydro Select predeve Select post deve	logic soil type within tributary area ^[9] = <mark>C: 0.05 - 0.15 in/hr infiltration</mark> lopment ground cover description ^[5] = <mark>Woods (50%), grass (50%) cc</mark> lopment ground cover description ^[5] = <mark>Impervious - Paved Parking,</mark> CN _{PRE} = <u>76</u>	n (transmission) rate ombination (orchard or tree farm) - Fair Rooftop, Driveways	
<u>OR</u>	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 74 Composite Post development CN ^[9] = 93		
Solution:			
S _{PRE} = 3.51 in	S _{PRE} = <u>1000</u> 74 -10	$\frac{\text{Where:}}{\text{S}_{\text{PRE}}\text{=}} \text{ Pre development potential maximum retention after runoff (in).}$	
Q _{PRE} = 0.00301 ft	$\mathbf{Q}_{\mathbf{PRE}} = \begin{array}{c} [(0.92^{*}1.17) \cdot (0.2^{*}3.51)]^2 \\ [(0.92^{*}1.17) + (0.8^{*}3.51)] \end{array} X \frac{1 \text{ft}}{12 \text{in}}$	Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{PRE} = 76.72 ft ³	V _{PRE} = (0.00301)(25,490)	$V_{\text{PRE}}\text{=}$ Pre Development Volume of Storm Water Generated (ft³)	
Post Development Storm Water Run	off Volume		
S _{POST} = 0.74114 in	S _{POST} = <u>1000</u> 93 ⁻10	$\frac{Where:}{S_{POST}}\text{= Post development potential maximum retention after runoff (in).}$	
Q _{POST} = 0.04305 ft	$\mathbf{Q}_{\text{POST}} = \frac{[(0.92^{*}1.17) - (0.2^{*}0.74)]^2}{[(0.92^{*}1.17) + (0.8^{*}0.74)]} \times \frac{1\text{ft}}{12\text{in}}$	Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{POST} = 1097.34 ft ³	V _{POST} = (0.04305)(25,490)	$V_{\text{POST}}\text{=}$ Post Development Volume of Storm Water Generated (ft^3)	
Solution: Volume Capture Require	ment water that must be retained onsite (may be infiltrated or reuse	ed).	
つ Delta Volume Capture= (V _{POST} -V	PRE) Delta Volume Capture= (1,097.34) - ((76.72)	
V _{DELTA} = 1020	1.62 ft ³ Delta V	Volume Capture= Volume Capture= percentile 24 hour storm event due to development that must be retained onsite (may be infiltrated or reused).	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Capt	ture Goal; V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the <u>design goal</u>
$V_{\text{LID GOAL}} = ((V_{\text{GOAL}}))/(P) = 2861.83$ ft ³	Where:	treatment only.	development condition Enter the
	V _{LID GOAL} = Required volume of soil in LID BMP.		percent porosity of the specified soil
$A_{\text{LID GOAL}} = (W)(L) = 650.25$	$A_{LID GOAL}$ = Footprint of LID BMP area for a given depth (below perforate	ed pipe if present).	and depth below perforated pipe (if
	$V_{GOAL} = 1.259 \text{ ft}^3$		present). The width and length entries
			will need to be interactively adjusted
	Where:		until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $(D)(A_{LID GOAL})$ x 100	P= Porosity (enter as a decimal)		
V _{LID GOAL}	D= Depth below perforated pipe if present (in decimal feet)		
	L= Lenath (in decimal feet)		
Input:	P = 0.4 as a decimal		
	D = 4.4 ft Below perforated pipe if present		
	L - 20.0 n		
Solution:		7	
Percent of Goal Achieved = 100.8	8 % = [(4.4 x 650) / 2,862] x 100		
LID BMB Sizing Tool Dolta Volume Cantu	re Requirement : V	NOTE	The Delta Volume Capture sizing tool
LID DIMP Sizing 1001 Deita volume capit	are Requirement. VDELTA	I ID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the design
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = $ #DIV/0! ft ³	Where:	treatment only.	requirement of the delta volume
	V _{LID DELTA} = Required volume of soil in LID BMP		<u>capture</u> . Enter the percent of porosity
$A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$	A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforate	ed pipe if present).	or the specified soil and depth below perforated nine (if present). The width
	$V = 1020 \text{ cm}^3$		and length entries will need to be
	VDELTA- 1020.02		interactively adjusted until "Percent of
	Where:		Requirement achieved" reaches
Percent of Requirement (D)(ALID DELTA)	Where: P= Porosity (enter as a decimal)		Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	<u>Where:</u> P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet)		Requirement achieved" reaches 100%.
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) I = Longth (in decimal feet)		Requirement achieved" reaches 100%.
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%.
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	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 = 0.0 as a decimal		Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ <u>Input:</u>	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 = 0.0 D = 0.0 ft Below perforated pipe if present		Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	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 = 0.0 ft Below perforated pipe if present W = 0.0 ft		Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ <u>Input:</u>	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 = 0.0 D = 0.0 ft Below perforated pipe if present W = 0.0 ft Below perforated pipe if present		Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ <u>Input:</u>	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 = 0.0 D = 0.0 M = 0.0 The second fit of the		Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: Solution: Beccent of Requirement Achieved = #DIV/01	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 = 0.0 D = 0.0 Ft Below perforated pipe if present W = 0.0 ft L = 0.0 ft D = 0.0 ft		Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: Solution: Percent of Requirement Achieved = #DIV/01	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) $P = 0.0$ D = 0.0 T H = 0.0 T 		Requirement achieved" reaches 100%.





Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connection Multiplier = 1	acted 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 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 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.



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Requirement 1: 100% Treatme	Int			INSTRUCTIONS:
Treatment of 100% of the flow generated	by 85th percentile 24 hour mean annual rain event (0.2 in	٦/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 deve	loped condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Po	ollution Prevention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]			
Input:				
	$A_r = 21,834 \text{ ft}^2 = 21,834 \text{ ft}^2$	0.50124 Acres		
	$C_{POST}^{[10]} = 0.47$			
	K ^[7] = 1.2			
		NOTE:		
Solution:		The Flow Rate calculate	ed here should only be used to size the	
		appropriate BMP. All as	ssociated overflow inlets and systems	
Q _{TREATMENT} = 0.05513 cfs	Q _{TREATMENT} = (0.2)(0.5012)(0.47)(1.17)	should be sized for the	Flood Control event.	
				1



Requirement 2: Delta Volume C No 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 achieved: then Bequirement 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		Capture, this page of the calculator
	CN= Curve Number ^[5]		must be achieved
Q= $[(P * K) - (0.2 * S)]^2$ _ <u>1ft</u>	Where:		must be achieved.
[(P*K)+(0.8 * S)]	Q= Runoff depth (ft) ^[6]		
	P= Precipitation (in) = 0.92 0.92 inches in t	the 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	or enter calculated values)		development, Requirement 2-Volume
	$A_r = 21,834 \text{ ft}^2$		Capture is not required.
	K ^[7] = 1.2		$(C \to S C \to C \cap C \cap S \to S \cap C \cap A)$
	Drop de	own Lists	(C POST S C PRE OF CIN POST S CIN PRE)
Select hydro	logic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration	(transmission) rate	
Select predeve	lopment ground cover description ^[5] = Woods (50%), grass (50%) cor	mbination (orchard or tree farm) - Fair	
Select post deve	lopment ground cover description ^[5] = Impervious - Paved Parking, F	Rooftop, Driveways	
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
OR	Composite Predevelopment CN ^[9] = 74		
	Composite Post development CN ^[9] = 89		
Solution:			
Pre Development Storm Water Runo	off Volume		
S _{PPE} = 3.51 in	S _{BBF} = 1000	Where:	
	74 -10	Spor= Pre development potential maximum retention after runoff (in)	
Q _{PPE} = 0.00301 ft	$ [(0.92^{*}1.17) - (0.2^{*}3.51)]^2 $, 1ft	$Q_{ppr} = Q$ in feet of depth as defined by the "Urban	
	$Q_{PRE} = \frac{(0.02 + 0.07)}{[(0.92*1.17)+(0.8*3.51)]} \times \frac{11}{12in}$	Hydrology For Small Watersheds" TR-55 Manual	
$V_{PRF} = \frac{65.72}{10}$ ft ³	V_{PRF} = (0.00301)(21.834)	V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Post Development Storm Water Run	off Volume		
S _{POST} = 1.27 in	S _{POST} = 1000	Where:	
	-10	Spect Post development potential maximum retention after runoff (in)	
Q _{POST} = 0.02694 ft	\mathbf{Q}_{POST} = [(0.92*1.17)-(0.2 * 1.27)] ² , 1ft	$Q_{POST} = Q$ in feet of depth as defined by the "Urban	
	$[(0.92^{*1.17})+(0.8^{*1.27})]$ 12in	Hydrology For Small Watersheds" TR-55 Manual.	
		,	
V _{POST} = 588.21 ft ³	V _{POST} = (0.02694)(21,834)	V _{POST} = Post Development Volume of Storm Water Generated (ff ³)	
		······································	
Solution: Volume Capture Require	ement		
Increase in volume of storm	water that must be retained onsite (may be infiltrated or reused	1).	
		- <i>1</i> -	
ت Delta Volume Capture= (۷۵۵۲-۷	Delta Volume Capture= (588.21) - (65	.72)	
		, Where:	
V _{DELTA} = 522	2.49 ft ³ Delta Ve	olume Capture= 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 Capture Formulas: $V_{LID GOAL} = ((V_{GOAL}))/(P) = 1587.43$ ft ³ $A_{LID GOAL} = (W)(L) = 324.00$ ft ² Percent of Goal Achieved $= \frac{(D)(A_{LID GOAL})}{V_{LID GOAL}} \times 100$	<u> <u> <u> </u> <u> </u></u></u>	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: Solution: Percent of Goal Achieved = 102.05 %	L= Length (in decimal feet) P = 0.4 as a decimal D = 5.0 ft Below perforated pipe if present W = 18.0 ft L = 18.0 ft = [(5.0 x 324) / 1,587] x 100	7	
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ²	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= 522.49	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. pe if present).	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 <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 of the specified soil and the percent of pe
Percent of Requirement Achieved = $\frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	h <u>ere:</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)		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		
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	acted 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 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 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.



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Requirement 1: 100% Treatment		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
1	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%
$Q_{\text{TREATMENT}} = (0.2 \text{ in/hr})(A_{\text{r}})(C_{\text{POST}})(K) \text{ cfs} \qquad Where:$	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 = 8,414 ft ² = 0.19316 Acres		
$C_{POST}^{(10)} = 0.50$		
κ ^[7] = 1.2		
NOTE:		
Solution: The Flow Rate calculated	here should only be used to size the	
appropriate BMP. All ass	sociated overflow inlets and systems	
QTREATMENT 0.02260 cfs QTREATMENT (0.2)(0.1932)(0.50)(1.17) should be sized for the Figure 1.10	lood Control event.	



			1
Requirement 2: Delta Volume C No increase in volume of runoff leaving the	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 = 1000 - 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]		Capture, this page of the calculator,
$\Omega = [(P_*K) - (0.2 * S)]^2$ 1ft	Where:		must be achieved.
$(P_*K) + (0.8 * S)$ X $\frac{1}{12in}$	$Q = D_{\text{upoff denth}} (ft)^{[6]}$		
	\sim Runon depth (ii) = 0.02 0.92 inches in :	the Santa Rosa	
	F = Frecipitation (iii) = 0.92 0.92 here has don	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
			equal to that generated before
Input: (Pick data from drop down lists	or enter calculated values)		development, Requirement 2-Volume
	$A_r = 8,414 \text{ ft}^2$		Canture is not required
	K ^[7] = 12		Suptare is not required.
	Dron d	ours Lieto	$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE})$
Calast hudes	Drop de Drop	(the second seco	
Select hydro	logic soli type within tributary area $r = \frac{1}{10000000000000000000000000000000000$	(transmission) rate	
Select predeve			
Select post deve	iopment ground cover description (*) = impervious - Paved Parking, F	Rooffop, Driveways	
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
OR	Composite Predevelopment CN ^[9] = 74		
	Composite Post development CN ^[9] = 92		
Solution:			
Pro Dovelopment Storm Water Pupe	off Volumo		
Pre Development Storm Water Kuno			
S _{PRE} = 3.51 in	$S_{PRE} = \frac{1000}{-10}$	Where:	
	74	S _{PRE} = Pre development potential maximum retention after runoff (in).	
Q _{PRE} = 0.00301 ft	\circ = [(0.92*1.17)-(0.2 * 3.51)] ² \checkmark 1ft	Q _{PRF} = Q in feet of depth as defined by the "Urban	
	$\mathbf{Q}_{PRE} = \frac{1}{[(0.92^{*}1.17) + (0.8^{*}3.51)]} = \frac{12}{12}$	Hvdrology For Small Watersheds" TR-55 Manual.	
		.,	
$V_{ppr} = 25.33 \text{ ft}^3$	$V_{\text{DBE}} = (0.00301)(8.414)$	Voor= Pre Development Volume of Storm Water Generated (ft ³)	
- PRE 20.00	-PRE (0.00001)(0,111)		
Post Development Storm Water Run	off Volume		
	S 1000		
Spost- 0.85776 In	Spost - 10	<u>vvnere:</u>	
	92	S _{POST} = Post development potential maximum retention after runoff (in).	
Q _{POST} = 0.03863 ft	$\mathbf{Q}_{POST} = [(0.92^{*}1.17) - (0.2^{*}0.86)]^{2} \times \frac{1 \text{ft}}{100000000000000000000000000000000000$	Q _{POST} = Q in feet of depth as defined by the "Urban	
	[(0.92*1.17)+(0.8 * 0.86)] 12in	Hydrology For Small Watersheds" TR-55 Manual.	
V _{POST} = 325.03 ft ³	V_{POST} = (0.03863)(8,414)	V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
Solution: Volume Capture Require	ement		
Increase in volume of storm			
^O Delta Volume Capture – (VV	() Delta Volume Capture= (225.02) (25	33)	
Deita volume Capture= (V _{POST} -V	PRE/ Delta volume Capture= (325.03) - (25	N/hara-	
V =	Delta V	<u>vvnere:</u> olume Capture= The Second	
V DELTA 299	J.71 ft°	include output - I ne increase in volume of storm water generated by the 85th	
		percentile 24 nour storm event due to development that must be rotained analite (may be infiltrated as rouged)	
		retained onsite (may be ininitiated of reused).	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Cap	<u>ture Goal;</u> V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the design goal
$V_{\text{LID GOAL}} = ((V_{\text{GOAL}}))/(P) = 854.21 \text{ ft}^3$	Where:	treatment only.	development condition Enter the
A = -(AV(1) - 204.40) ft ²	V _{LID GOAL} = Required volume of soil in LID BMP.		percent porosity of the specified soil
$A_{LID GOAL} = 204.43$	A _{LID GOAL} - Footprint of LID BMP area for a given depth (below perforated	a pipe il present).	and depth below perforated pipe (if
	$V_{GOAL} = 376 \text{ ft}^3$		present). The width and length entries
			will need to be interactively adjusted
	Where:		until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $(D)(A_{LID GOAL})$ x 100	P= Porosity (enter as a decimal)		
V _{LID GOAL}	D= Depth below perforated pipe if present (in decimal feet)		
	L= Length (in decimal feet)		
Input:	P = 0.4 as a decimal		
	D = 4.2 ft Below perforated pipe if present		
	VV = 14.3 ft		
Solution:		7	
Percent of Goal Achieved = 100.5	4 % = [(4.2 x 204) / 854] x 100		
	_		J
-			
LID BMP Sizing Tool Dolta Volume Cant	uro Boquiroment: V	NOTE	INSTRUCTIONS: The Delta Volume Capture sizing tool
LID BMP Sizing Tool Delta Volume Captu	ure Requirement: V _{DELTA}	NOTE: UD Sizing Tool only applicable for volume	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size
LID BMP Sizing Tool Delta Volume Captu	ure 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>
LID BMP Sizing Tool Delta Volume Capto <u>Formulas:</u> V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0! ft ³	ure 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
LID BMP Sizing Tool Delta Volume Capto Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01 ft ³	ure Requirement: 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
LID BMP Sizing Tool Delta Volume Capto Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/0! ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ²	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)	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforted pipe (if present). The width
LID BMP Sizing Tool Delta Volume Capto Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ²	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	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 <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
LID BMP Sizing Tool Delta Volume Capto Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01 ft ³ A _{LID DELTA} =(W)(L) = 0.00 ft ²	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 VDELTA 299.71	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 <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
LID BMP Sizing Tool Delta Volume Capto Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01 ft ³ A _{LID DELTA} =(W)(L) = 0.00 ft ²	Where: $V_{LID DELTA}$ 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 V_DELTA 299.71 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 <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
LID BMP Sizing Tool Delta Volume Capto Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement(D)(A_{LID DELTA}) = 400	Where: $V_{LID DELTA}$ VLID DELTA Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below perforated V_DELTA 299.71 ft ³ Where: 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 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 100%.
LID BMP Sizing Tool Delta Volume Capto Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/01 \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	ure Requirement : V_{DELTA} 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 V_{DELTA} = 299.71 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.	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captor Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/01 \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	Where: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below perforated VDELTA = 299.71 ft ³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) W= Width (in decimal feet) W= branch (in decimal feet)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captor Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/01 \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	Where: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below perforated VDELTA 299.71 ft ³ 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)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capto Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/01 \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ Input:	ure Requirement: V_{DELTA} 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 V_{DELTA} = 299.71 ft ³ 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 = 0.0 as a decimal	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capto Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ <u>Input:</u>	Where: V_LID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below perforated VDELTA= 299.71 ft ³ 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 = 0.0 0.0 ft	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> <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 100%.
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 Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Where: $V_{\text{LID DELTA}}$ Where: P= 299.71 ft ³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) W= 0.0 M= 0.0 Main as a decimal D= 0.0 Mither Below perforated pipe if present	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> <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 100%.
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 Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	where: $V_{LD DELTA}$ Where: $V_{LD DELTA}$ Pelcara 299.71 ft ³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= 0.0 ft Below perforated pipe if present (in decimal feet) Utility t_1 Below perforated pipe if present (in decimal feet) Use 0.0 ft Below perforated pipe if present (if present fit (if present fit fit for the pipe if present fit fit for the pipe if present fit fit for the pipe if present fit fit fit for the pipe if present fit fit for the pipe fit present fit fit for the pipe fit present fit fit for the pipe fit pipe fit present fit fit fit for the pipe fit pip	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> <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 100%.
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 Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	ure Requirement: V_{DELTA} Where: $V_{LD DELTA}$ = Required volume of soil in LID BMP $A_{LD DELTA}$ = Footprint of LID BMP area for a given depth (below perforated V_{DELTA} = 299.71 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) With: (in decimal feet) U = 0.0 ft Below perforated pipe if present W = 0.0 ft Below perforated pipe if present	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captu Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/01 \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ Input: Solution: Percent of Requirement Achieved = #DIV/01	EXAMPLE Underset Underset V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated) V _{DELTA} = 299.71 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) Width (in decimal feet) L = Length (in decimal feet) P = 0.0 ft Below perforated pipe if present (it decimal pipe if present ft decimal pipe if	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/(0)$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement $(D)(A_{LID DELTA})$ Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: Percent of Requirement Achieved = #DIV/01	EXAMPLE 1 UNET INFORMATION OF CONTRACT OF CONTRAC	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 <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 100%.





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	

[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.





Requirement 1: 100% Treatme	ent			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	AND Requirement 2- Volume
	C _{POST} = Rational method runoff coefficient for the developed condition	on ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Preven	tion Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]	· · · ·		
<u>Input:</u>	$A_{r} = \frac{39,220}{0.90037} \text{ ft}^{2} = \frac{0.90037}{0.54} \text{ k}^{(7)} = \frac{1.2}{0.54}$	cres		
		IOTE:		
Solution:	7 2	The Flow Rate calculate	ed here should only be used to size the ssociated overflow inlets and systems	
Q _{TREATMENT} = 0.11377 cfs	Q _{TREATMENT} ⁼ (0.2)(0.9004)(0.54)(1.17)	hould be sized for the	Flood Control event.	

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Requirement 2: Delta Volume C No increase in volume of runoff leaving the	Capture e 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: $S = \frac{1000}{CN} - 10$ $Q = \frac{[(P+K)-(0.2 + S)]^2}{2} + \frac{1ft}{2}$	<u>Where:</u> S= Potential maximum retention after runoff (in) ^{5]} CN= Curve Number ^[5] <u>Where:</u>		AND Requirement 2- Volume Capture, this page of the calculator, AND Requirement 2- Volume Capture, this page of the calculator, must be achieved.
[(P+K)+(0.8 + S)] 12in V= (Q)(A _r)	$ \begin{array}{l} Q = \mbox{ Runoff depth (ft)}^{[6]} \\ P = \mbox{ Precipitation (in)} = 0.92 inches in the set on the set on the set of the set o$	ne Santa Rosa local historical	NOTE:
	V= Volume of Storm Water to be Retained (ft^3) A _r = Reduced Tributary Area including credit for Pollution P	revention Measures (ť)	If the amount of volume generated after development is less than or equal to that generated before
Input: (Pick data from drop down lists	or enter calculated values) $A_r = \frac{39,220}{K^{[7]}} ft^2$ $K^{[7]} = \frac{1.2}{Drop do}$	wn Lists	development, Requirement 2-Volume Capture is not required. (C _{POST} ≤ C _{PRE} or CN _{POST} ≤ CN _{PRE})
Select hydro Select predeve Select post deve	logic soil type within tributary ared ^[8] = C: 0.05 - 0.15 in/hr infiltration (lopment ground cover description ^[5] = Woods (50%), grass (50%) com lopment ground cover description ^[5] = Impervious - Paved Parking, R CN _{PRE} = 76	(transmission) rate nbination (orchard or tree farm) - Fair ooftop, Driveways	
<u>OR</u>	$CN_{POST} = 90.3$ Composite Predevelopment CN ^[9] = 74 Composite Post development CN ^[9] = 92		
Solution:			
Pre Development Storm Water Runo S _{PRE} = <u>3.51</u> in	ff Volume S _{PRE} = <u>1000</u> −10	<u>Where:</u> S_{PRE} = Pre development potential maximum retention after runoff (in).	
Q _{PRE} = 0.00301 ft	$\mathbf{Q}_{PRE} = \begin{array}{c} \frac{[(0.92^{*}1.17) \cdot (0.2^{*}3.51)]^2}{[(0.92^{*}1.17) + (0.8^{*}3.51)]} & X & \frac{1 \mathrm{ft}}{12 \mathrm{in}} \end{array}$	Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{PRE} = 118.05 ^{ft³}	V _{PRE} = (0.00301)(39,220)	$V_{\text{PRE}}\text{=}$ Pre Development Volume of Storm Water Generated (ft³)	
Post Development Storm Water Run S _{POST} = 0.92896 in	off Volume S _{POST} = <u>1000</u> 92 -10	<u>Where:</u> S _{POST} = Post development potential maximum retention after runoff (in).	
Q _{POST} = 0.03629 ft	$\mathbf{Q}_{POST} = \frac{[(0.92^{*}1.17) \cdot (0.2^{*}0.93)]^{2}}{[(0.92^{*}1.17) + (0.8^{*}0.93)]} \times \frac{1 \text{ft}}{12 \text{in}}$	Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{POST} = 1423.29 ft ³	V _{POST} = (0.03629)(39,220)	$V_{\text{POST}}\text{=}$ Post Development Volume of Storm Water Generated (ft^3)	
Solution: Volume Capture Require	ement water that must be retained onsite (may be infiltrated or reused)).	
Delta Volume Capture= (V _{POST} -V	PRE) Delta Volume Capture= (1,423.29) - (1	18.05)	
V _{DELTA} = <mark>1305</mark>	5.24 ft ³ Delta Vo	Where: lume Capture= 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).	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Capt	ure Goal; V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the design goal
$V_{LID GOAL} = ((V_{GOAL}))/(P) = 3757.99$ ft ³	Where:	treatment only.	of 100% volume capture of the post
	V _{LID GOAL} = Required volume of soil in LID BMP.		development condition. Enter the
$A_{LID GOAL} = (W)(L) = 1914.06$ ft ²	A _{LID GOAL} = Footprint of LID BMP area for a given depth (below perfor	ated pipe if present).	and depth below perforated pipe (if
	$V_{GOAL} = 1,654$ ft ³		present). The width and length entries will need to be interactively adjusted
	Where:		until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $(D)(A_{LID GOAL})$ x 100	P= Porosity (enter as a decimal)		
V _{LID GOAL}	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 decimal		
	$D = \frac{2.0}{100}$ ft Below perforated pipe if present		
	$W = \frac{43.8}{100}$ ft		
	$L = \frac{43.8}{\pi}$		
Solution:		7	
Percent of Goal Achieved = 101.9	$- \frac{1}{2} \left(2.0 \times 1.014 \right) / 3.758 1 \times 100$	1	
	- [(2.0 x 1,914)/ 3,730] x 100		
			J
			INSTRUCTIONS
ILID BMP Sizing Tool Delta Volume Captu	re Requirement : Vorum	NOTE	The Delta Volume Capture sizing tool
LID BMP Sizing Tool Delta Volume Captu	<u>ire Requirement</u> : V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume	The Delta Volume Capture sizing tool helps the designer appropriately size
LID BMP Sizing Tool Delta Volume Captu Formulas:	<u>ire Requirement</u> : V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the design
LID BMP Sizing Tool Delta Volume Captu Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01 ft ³	<u>ure Requirement</u> : 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
LID BMP Sizing Tool Delta Volume Captu <u>Formulas:</u> V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0! ft ³	I <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.	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
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 perfor	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width
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	Ure 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 perfor VDELTA= 1305.24	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 <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
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	Utere: VLID DELTA VLID DELTA Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below perfor VDELTA 1305.24	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ated pipe if present).	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
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: $V_{\text{LID DELTA}}$ V_{LID DELTA} = Required volume of soil in LID BMP A_{LID DELTA} = Footprint of LID BMP area for a given depth (below perfor V_{DELTA} = 1305.24 ft ³ 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 <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 100%.
LID BMP Sizing Tool Delta Volume Captu Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/01 \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement $A_{\text{DELTA}} = (D)(A_{\text{LID DELTA}}) \times 100$	Underse V Where: V V_{LID DELTA} = Required volume of soil in LID BMP A_{LID DELTA} = Footprint of LID BMP area for a given depth (below perfor V_{DELTA} = 1305.24 tt ³ Where: P = Porosity (enter as a decimal) P = North before provide being (enter as a decimal)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captu Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01]$ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} x 100$	Where: $V_{\text{LID DELTA}}$ 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 perfor V_{DELTA} 1305.24 ft ³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) (in decimal feet)	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> <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 100%.
LID BMP Sizing Tool Delta Volume CaptuFormulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01]A_{LID DELTA} = (W)(L) = 0.00ft^2Percent of RequirementAchieved= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Where: $V_{\text{LID DELTA}}$ V_{LID DELTA} = Required volume of soil in LID BMP A_{LID DELTA} = Footprint of LID BMP area for a given depth (below perfor V_{DELTA} = 1305.24 ft ³ 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)	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> <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 100%.
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 Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Where: $V_{\text{LID DELTA}}$ V_{LID DELTA} = Required volume of soil in LID BMP A_{LID DELTA} = Footprint of LID BMP area for a given depth (below perfor V_{DELTA} = 1305.24 ft ³ 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)	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> <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 100%.
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 Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	with the second structure With the second structure Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perfor V_{DELTA} = 1305.24 ft ³ 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 = 0.0 as a decimal	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 <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 100%.
Eight big base is the second structure of the second structure The second structure <thte second="" structure<="" th=""> <thte second="" structure<="" th=""></thte></thte>	Where: V_LID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below perfor VDELTA= 1305.24 Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) With (in decimal feet) U With (in decimal feet) D= 0.0 ft Below perforated pipe if present	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 <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 100%.
Eight Sizing Tool Delta Volume Captu Formulas: V_LID DELTA=((V_DELTA))/(P) = #DIV/01] $A_{LID DELTA}=((W)(L) = 0.00]$ ft ³ A_{LID DELTA}=(W)(L) = 0.00] ft ² Percent of Requirement $(D)(A_{LID DELTA})$ Achieved $(D)(A_{LID DELTA})$ X 100 Input:	with the second state is the secon	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 <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 100%.
Eight by the second	with the second state is the secon	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> <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 100%.
LID BMP Sizing Tool Delta Volume Captu Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/01 \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ Input:	with the second state is a second state in the second state is a secon	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ated pipe if present).	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 100%.
Example 1 Event of Requirement Achieved Child Delta Volume Captu Percent of Requirement Achieved = #DIV/01 ft ³ Imput: Input: Input: Input:	ure Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perfor V_{DELTA} = 1305.24 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W = 0.0 ft Below perforated pipe if present (in decimal feet) U = 0.0 ft Below perforated pipe if present (in decimal feet) U = 0.0 ft Below perforated pipe if present (in decimal feet) U = 0.0 ft 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. ated pipe if present).	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 100%.
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 Percent of Requirement $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: Solution: Percent of Requirement Achieved = #DIV/01	Where: $V_{\text{LID DELTA}}$ $V_{\text{LID DELTA}}$ $V_{\text{LID DELTA}}$ Footprint of LID BMP area for a given depth (below perfor V_{DELTA} V_{DELTA} 1305.24 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L = 0.0 P = 0.0 0.0 ft Below perforated pipe if present it D = 0.0 ft Below perforated pipe if present it W = 0.0 0.0 ft Below perforated pipe if present it W = 0.0 it	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ated pipe if present).	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 100%.





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	





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	ז/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:		nydraulic 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 deve	loped condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Po	Ilution Prevention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]			
Input:				
	$A_r = $ 14,350 ft ² =	0.32943 Acres		
	C _{POST} ^[10] = 0.52			
	K ^[7] = 1.2			
		NOTE:		
Solution:		The Flow Rate calculate	ed here should only be used to size the	
		appropriate BMP. All as	ssociated overflow inlets and systems	
Q _{TREATMENT} = 0.04009 cfs	Q _{TREATMENT} = (0.2)(0.3294)(0.52)(1.17)	should be sized for the	Flood Control event.	



Requirement 2: Delta Volume C No increase in volume of runoff leaving the Formulas:	Sapture	event.	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not achieved; then Requirement 1-100% Treatment page 4 of the calculator
$S = \frac{1000}{CN} - 10$ $O = \frac{[(R,K) (0,2,.5)]^2}{10} = 10$	Where: S= Potential maximum retention after runoff (in) ^{5]} CN= Curve Number ^[5] Where:		AND Requirement 2- Volume Capture, this page of the calculator, must be achieved.
$\begin{bmatrix} (P * K) + (0.8 * S) \end{bmatrix} \times \frac{11}{12in}$	Q= Runoff depth (ft) ^[6] P= Precipitation (in) = 0.92 0.92 inches in the K= Seasonal Precipitation Factor ^[7] area, based on lead	ne Santa Rosa local historical	
V= (Q)(A _r)	Where: V= Volume of Storm Water to be Retained (ft ³) A _r = Reduced Tributary Area including credit for Pollution Pr	revention Measures (ť)	NOTE: If the amount of volume generated after development is less than or equal to that generated before
Input: (Pick data from drop down lists	or enter calculated values) $A_r = 14,350$ ft ² $K^{[7]} = 1.2$		development, Requirement 2-Volume Capture is not required. $(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE})$
Select hydro Select predeve Select post deve	logic soil type within tributary area ^[8] = $\frac{C}{C}$: 0.05 - 0.15 in/hr infiltration (1 lopment ground cover description ^[5] = Woods (50%), grass (50%) com lopment ground cover description ^[5] = $\frac{Woods}{CN_{PRE}} = \frac{76}{CN_{PRS}} = \frac{76}{90.3}$	wn Lists (transmission) rate Ibination (orchard or tree farm) - Fair ooftop, Driveways	
<u>OR</u>	Composite Predevelopment CN $^{[9]}$ = 74 Composite Post development CN $^{[9]}$ = 91		
Solution:			
S _{PRE} = 3.51 in	$S_{PRE} = \frac{1000}{74} -10$	$\frac{Where:}{S_{PRE}}$ Pre development potential maximum retention after runoff (in).	
Q _{PRE} = 0.00301 ft	$\mathbf{Q}_{PRE} = \begin{array}{c} [(0.92^{*}1.17) \cdot (0.2^{*}3.51)]^2 \\ [(0.92^{*}1.17) \cdot (0.8^{*}3.51)] \end{array} X \frac{1 \text{ft}}{12 \text{in}}$	Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{PRE} = 43.19 ^{ft³}	V _{PRE} = (0.00301)(14,350)	$V_{\text{PRE}}\text{=}$ Pre Development Volume of Storm Water Generated (ft3)	
Post Development Storm Water Run S _{POST} = 1.01 in	off Volume S _{POST} = <u>1000</u> 91 -10	<u>Where:</u> S_{POST} = Post development potential maximum retention after runoff (in).	
Q _{POST} = 0.03381 ft	$\mathbf{Q}_{\text{POST}} = \frac{[(0.92^{*}1.17) \cdot (0.2^{*}1.01)]^2}{[(0.92^{*}1.17) \cdot (0.8^{*}1.01)]} \times \frac{1\text{ft}}{12\text{in}}$	Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{POST} = 485.17 ft ³	V _{POST} = (0.03381)(14,350)	$V_{\text{POST}}\text{=}$ Post Development Volume of Storm Water Generated ($\text{ft}^3)$	
Solution: Volume Capture Require	<pre>#ment water that must be retained onsite (may be infiltrated or reused)</pre>		
Delta Volume Capture= (V _{POST} -V	PRE) Delta Volume Capture= (485.17) - (43.1	19)	
V _{DELTA} = 441	.98 ft ³ Delta Vol	<u>Where:</u> lume Capture= 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 Capture Goal; V _{GOAL} Formulas: $V_{LID GOAL}=((V_{GOAL}))/(P) = 1287.59$ ft ³ $V_{LID GOAL}=(W)(L) = 338.56$ ft ² $A_{LID GOAL}=(W)(L) = 338.56$ ft ² $V_{GOAL}= 567$ ft ³ Where: Percent of Goal Achieved = (D)(A_{LID GOAL}) $V_{COAL} = 9$ 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%.
$\frac{1}{V_{\text{LID GOAL}}} \times 100$ $\frac{1}$		
Solution: Percent of Goal Achieved = 100.97 % = [(3.8 x 339) / 1,288] x 100	7	
LID BMP Sizing Tool Delta Volume Capture Requirement: V_{DELTA} Formulas: $V_{UD DELTA}=((V_{DELTA}))/(P) = #DIV/0!$ ft ³ $V_{UD DELTA}=((V_{DELTA}))/(P) = #DIV/0!$ ft ³ Where: $V_{UD DELTA}= Required volume of soil in LID BMP$ $A_{LID DELTA}=(W)(L) = 0.00$ ft ² $V_{LID DELTA}= Required volume of soil in LID BMPA_{UD DELTA}= Footprint of LID BMP area for a given depth (below perforated performance) V_{DELTA}= 441.98 ft3 $	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 <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}) x 100 P= Porosity (enter as a decimal) Achieved = (D)(A _{LID DELTA}) x 100 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 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=	(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 managec	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.





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	ז/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%
$Q_{\text{TREATMENT}}$ = (0.2 In/nr)(A_{r})(C_{POST})(K) CTS	Where:		The table of values can be found here	I reatment, this page of the calculator,
	QTREATMENT - Design now rate required to be treated (crs)	lanad condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator
	A = Reduced Tributery Area including gredit for Re		to size the overflow bypass.	must be achieved
	K = Seasonal Precipitation Factor[7]	indion revention measures (in Acres)		
Input:				
	$A_r = 26,208 \text{ ft}^2 =$	0.60165 Acres		
	$C_{POST}^{[10]} = 0.55$			
	K ^(r) = 1.2	NOTE		
Solution		NOTE:		
Solution.		The Flow Rate calculate	ed here should only be used to size the	
Q _{TREATMENT} = 0.07743 cfs	Q _{TREATMENT} = (0.2)(0.6017)(0.55)(1.17)	should be sized for the	Flood Control event.	



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Requirement 2: Delta Volume Ca No increase in volume of runoff leaving the s	ו pture iite 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 = 1000 - 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
$Q = [(P \cdot K) - (0.2 \cdot S)]^2$ 1ft	Where:		must be achieved.
$[(P_*K)+(0.8 + S)] \times \frac{12in}{12in}$			
	\sim Runon depth (ii) = 0.02 0.02 inches in the	he Santa Posa	
	P = Precipitation (in) = 0.92 0.92 inches in the	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 Pr	Prevention Measures (#)	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
	$A_r = 26,208 \text{ ft}^2$		Capture is not required
	K ^[7] = 12		Capture to not required.
	Drop do	wen Liete	$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE})$
Select hydrolog	aic soil type within tributary area ^[8] = $C: 0.05 - 0.15$ in/hr infiltration ((transmission) rate	
	Solution the second se	phination (orchard or tree farm) - Fair	
Select post develop	pment ground cover description = mpervious - Paved Parking R	oofton Driveways	
	CN= 76	Soliop, Dirvenays	
08	Chipost = 50.5		
	personal contraction of the second se		
Solution:			
Bro Dovelonment Sterm Water Dunoff	Valuma		
S _{PRE} = 3.51 in	S _{PRE} = <u>1000</u> -10	Where:	
	74	S _{PRE} = Pre development potential maximum retention after runoff (in)	
Q _{PRE} = 0.00301 ft	$Q_{\text{part}} = \frac{[(0.92*1.17)-(0.2*3.51)]^2}{[(0.92*1.17)-(0.2*3.51)]^2} \times \frac{1\text{ft}}{1000}$	Q _{PRE} = Q in feet of depth as defined by the "Urban	
	[(0.92*1.17)+(0.8 * 3.51)] 12in	Hydrology For Small Watersheds" TR-55 Manual.	
- 2			
V _{PRE} = 78.89 ^{ft}	V _{PRE} = (0.00301)(26,208)	V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Post Development Storm Water Runof	if Volume		
S _{POST} = 0.88139 in	S _{POST} = <u>1000</u> 10	Where:	
	92 -10	S _{POST} = Post development potential maximum retention after runoff (in).
Q _{POST} = 0.03795 ft	Q_{POST} = [(0.92*1.17)-(0.2 * 0.88)] ² , 1ft	Q_{POST} = Q in feet of depth as defined by the "Urban	
	$[(0.92^{*}1.17)+(0.8^{*}0.88)]$ X 12in	Hydrology For Small Watersheds" TR-55 Manual.	
V _{POST} = 994.59 ft ³	V_{POST} = (0.03795)(26,208)	V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
		,	
Solution: Volume Capture Requirem	nent		
Increase in volume of storm wa	ater that must be retained onsite (may be infiltrated or reused)).	
00		·	
Delta Volume Capture= (V _{POST} -V _{PR})	Delta Volume Capture= (994.59) - (78.	89)	
	(1000) (1000)	, Where:	
V _{DELTA} = 915.7	1 ft ³ Delta Vo ^r	lume Capture= The increase in volume of storm water generated by the 85th	
	1 10	percentile 24 hour storm event due to development that must	be
		retained onsite (may be infiltrated or reused).	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Capture Goal; VGOAL		NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the <u>design goal</u>
$V_{\text{LID GOAL}} = ((V_{\text{GOAL}}))/(P) = 1645.11 \text{ ft}^3 \qquad Where:$		treatment only.	development condition Enter the
V _{LID GOAL} = Req	ired volume of soil in LID BMP.		percent porosity of the specified soil
$A_{\text{LID GOAL}} = \frac{320.00}{10} \text{ II} \qquad A_{\text{LID GOAL}} = F00$	print of LID BMP area for a given depth (below perforated p	ope if present).	and depth below perforated pipe (if
V _{GOAL} =	1,152 ft ³		present). The width and length entries
			will need to be interactively adjusted
Where:			until Percent of Goal equals 100%.
Percent of Goal Achieved = $(D)(A_{LID GOAL})$ x 100 P= Porosity (enter	as a decimal)		
V _{LID GOAL} D= Depth below perf	rated pipe if present (in decimal feet)		
L= Length (in deci	nal feet)		
Input:	U.7 as a decimal		
D=			
	40.0 ft		
Solution:		7	
Percent of Goal Achieved = 106.98 % = [(5.4	x 320) / 1,645] x 100		
I ID BMP Sizing Tool Dolta Volume Canture Pequirement :	1	NOTE:	The Delta Volume Capture sizing tool
LID BMP Sizing 1001 Delta Volume Capture Requirement.	DELTA	NOTE:	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the design
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \text{\#DIV/0!} \text{ft}^3 \qquad \text{Where:}$		treatment only.	requirement of the delta volume
V _{LID DELTA} = Req	ired volume of soil in LID BMP		capture. Enter the percent of porosity
$A_{\text{LID DELTA}}=(W)(L) = 0.00 \text{ ft}^2 \qquad A_{\text{LID DELTA}} = Foo$	print of LID BMP area for a given depth (below perforated p	ipe if present).	of the specified soil and depth below
У -	045 74 ft ³		and length entries will need to be
V _{DELTA} =	915./1		interactively adjusted until "Percent of
Where:			Requirement achieved" reaches
Percent of Requirement _ (D)(A _{LID DELTA}) _ 100 P= Porosity (enter	as a decimal)		100%.
Achieved V _{LID DELTA} X 100 D= Depth below perf	rated pipe if present (in decimal feet)		
W= Width (in deci	nal feet)		
L= Length (in dec	na leet)		
Input: P=	0.0 as a decimal		
D =	0.0 ft Below perforated pipe if present		
W =	0.0 ft		
L =	0.0 ft		
L=	0.0 ft		
L =			
L = <u>Solution:</u> Percent of Requirement Achieved = #DIV/0! % = =	0.0 ft 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=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=	¹ Allowed credit for existing tr	ree canopy = 50 % of actual canopy square footage	
Area Reduction = 0 ft ²	² = Sum of areas manager	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	





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 percentile 24 hour mean annual rain event (0.2 in/hr).	If the Design Goal of 100% Capture
The C value used for this calculation	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 <u>Where:</u> 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 he	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. = 19.862 ft ² = 0.45597 Acres	
$K^{[7]} = 1.2$	
NOTE:	
Solution: The Flow Rate calculated here should only be used to size the	
appropriate BMP. All associated overflow inlets and systems	
QTREATMENT 0.05762 cfs QTREATMENT (0.2)(0.4560)(0.54)(1.17) should be sized for the Flood Control event.	

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			7
Requirement 2: Delta Volume Control No increase in volume of runoff leaving the	apture 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%
Formulas:			Treatment, page 4 of the calculator
S = 1000 - 10	Where:		AND Requirement 2 Volume
CN	S= Potential maximum retention after runoff (in ^[5]		Conture, this near of the coloridation
011	$C_{\rm N}$ = Curve Number ^[5]		Capture, this page of the calculator,
$O = [(P,K) (0.2 + S)]^2$ 1#			must be achieved.
$\mathbf{X} = \underbrace{[[\mathbf{F} \cdot \mathbf{X}] - [(\mathbf{U} \cdot \mathbf{Z} \cdot \mathbf{S})]]}_{[(\mathbf{D} \cdot \mathbf{K}) + (\mathbf{D} \cdot \mathbf{S})]} \mathbf{X} = \underbrace{[[\mathbf{U} \cdot \mathbf{X}]}_{\mathbf{A} \cdot \mathbf{S}}$			
[(F*K)*(U.0 * 3)] 12IN	Grant depth (tt) ⁽¹⁾		
	P= Precipitation (in) = 0.92 0.92 inches in the	e Santa Kosa	
	K= Seasonal Precipitation Factor ^{1/1} area, based on lo	Juar historicar	
$V= (Q)(A_r)$	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	evention Measures (ť)	after development is less than or
	·		equal to that generated before
Input: (Pick data from drop down lists o	or enter calculated values)		development Peruirement 2 Volume
input (Fior data for dop downists o	$\Delta = \frac{19822}{\text{ft}^2}$		Conture is not requirement 2-volume
	√r - 13,002 "		Capture is not required.
	K ¹⁰ = 1.2		$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE})$
	Drop dov	vn Lists	
Select hydrolo	ogic soil type within tributary area ⁸¹ = C: 0.05 - 0.15 in/hr infiltration (1	transmission) rate	
Select predevelo	opment ground cover description ¹⁵¹ = Woods (50%), grass (50%) com	bination (orchard or tree farm) - Fair	
Select post develo	opment ground cover description ^[5] = Impervious - Paved Parking, Ro	ooftop, Driveways	
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
OR	Composite Predevelopment CN ^[9] = 74		
C	omposite Post development CN ^[9] = 92		
Solution:			
Pre Development Storm Water Runof	t Volume		
S _{PRE} = <u>3.51</u> in	$S_{PRE} = \frac{1000}{10}$	Where:	
	74	S _{PRE} = Pre development potential maximum retention after runoff (in).	
$Q_{\rm PPE} = 0.00301 \text{ff}$	$[(0.92*1.17)-(0.2*3.51)]^2$ 1ft	$Q_{\rm opc} = Q$ in feet of depth as defined by the "Urban	
	$Q_{PRE} = \frac{10002 + 177 + 1002 + 00077}{1(0.02*1.177 + 1008 * 3.51)} \times \frac{110}{1200}$	Hydrology For Small Watershade" TD-55 Manual	
	[(0.82 1.17)+(0.0 3.31)] 120	riyuruugy For Smail watersneus TR-00 Manual.	
$V_{} = 50.78 \text{ ft}^3$	$V_{} = (0.00301)(10.862)$	Verse Bro Development Volume of Storm Water Operated (#3)	
• PRE - 59.70	▼PRE- (0.00301)(19,002)	*PRE* Pre Development volume of Storm Water Generated (ft°)	
Boot Dovolonment Sterm Water Dur	Sff Volume		
Fost Development Storm water Rund			
S _{POST} = 0.92896 in	S _{POST} = <u>1000</u> ₋₁₀	Where:	
	92	S _{POST} = Post development potential maximum retention after runoff (in).	
Q _{POST} = 0.03629 ft	Q _{POST} = [(0.92*1.17)-(0.2 * 0.93)] ² , 1ft	Q _{POST} = Q in feet of depth as defined by the "Urban	
	[(0.92*1.17)+(0.8*0.93)] X 12in	Hydrology For Small Watersheds" TR-55 Manual.	
		,	
$V_{post} = 720.79 \text{ ft}^3$	V_{post} = (0.03629)(19.862)	Vpost= Post Development Volume of Storm Water Cenerated (ft ³)	
- 2031	-2051 (0.00020)(10,002)		
Solution: Volume Conture Beruire	mont		
Solution: volume Capture Require			
Increase in volume of storm v	vater that must be retained onsite (may be infiltrated or reused).		
93			
Delta Volume Capture= (V _{POST} -V _P)	RE) Delta Volume Capture= (720.79) - (59.7	78)	
		Where:	
V _{DELTA} = 661.	01 ft ³ Delta Volu	ume Capture= 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).	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Capture	Goal; V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the <u>design goal</u>
$V_{LID GOAL} = ((V_{GOAL}))/(P) = 1903.14$ ft ³	Where:	treatment only.	of 100% volume capture of the post
	V _{LID GOAL} = Required volume of soil in LID BMP.		percent porosity of the specified soil
$A_{\text{LID GOAL}} = (W)(L) = 449.44 \pi^{-1}$	A _{LID GOAL} = Footprint of LID BMP area for a given depth (bel	ow perforated pipe if present).	and depth below perforated pipe (if
	$V_{\text{GOAL}} = \frac{837}{\text{ft}^3}$		present). The width and length entries will need to be interactively adjusted
Wh			until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $(D)(A_{UD,GOAL})$	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 decimal		
<u>mput</u>	$D = \frac{4.2}{1000}$ ft Below perforated pipe if pr	resent	
	W = 21.2 ft		
	L = 21.2 ft		
Solution:		7	
Percent of Goal Achieved = 100.13 %	= [(4.2 x 449) / 1,903] x 100		
LID BMP Sizing Tool Dolta Volume Canture	Poquiromont · V	NOTE	INSTRUCTIONS: The Delta Volume Capture sizing tool
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
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	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u>
LID BMP Sizing Tool Delta Volume Capture Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0! 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
LID BMP Sizing Tool Delta Volume Capture	Requirement: 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 <u>capture</u> . Enter the percent of porosity
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ²	Where: VLID DELTA VLID DELTA Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below)	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below performed ping (if present). The width
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = $ #DIV/01 $A_{LID DELTA}=(W)(L) = $ 0.00 t^2	Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below)	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 <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
LID BMP Sizing Tool Delta Volume Capture	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) VDELTA= 661.01	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 <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
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ²	Requirement : VDELTA Where: VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below) VDELTA= 661.01	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 <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
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{UID DELTA}=((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{UID DELTA}=(W)(L) = 0.00$ ft ² Percent of Requirement (D)(A _{UID DELTA})	Requirement V_{DELTA} Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (beld VDELTA= 661.01 ft ³ ere: 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 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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Requirement : V_{DELTA} Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below) VDELTA= 661.01 ft ³ ere: 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.	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 <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 100%.
$\frac{\text{LID BMP Sizing Tool Delta Volume Capture}}{\text{Formulas:}} \\ V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\text{\#DIV/01}}{\text{\#DIV/01}} \text{ft}^{3} \\ A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{III}} \text{ft}^{2} \\ \text{Percent of Requirement}} \\ Achieved = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100 \\ \frac{\text{Wh}}{\text{Hercent}} = \frac{(D)(A_{\text{LID DELTA}})}{(D_{\text{LID DELTA}})} \times 100 \\ \frac{(D_{\text{LID DELTA}})}{(D_{\text{LID DELTA}})} = \frac{(D_{\text{LID DELTA}})}{(D_{\text{LID DELTA}})} \times 100 \\ \frac{(D_{\text{LID DELTA}})}{(D_{\text{LID DELTA}})} = \frac{(D_{\text{LID DELTA}})}{(D_{\text{LID DELTA}})} \times 100 \\ \frac{(D_{\text{LID DELTA}})}{(D_{\text{LID DELTA}})} = \frac{(D_{\text{LID DELTA}})}{(D_{\text{LID DELTA}})} \times 100 \\ \frac{(D_{\text{LID DELTA}})}{(D_{\text{LID DELTA}})} \times 100 \\ \frac{(D_{\text{LID DELTA}})}{(D_{\text{LID DELTA}})} = \frac{(D_{\text{LID DELTA}})}{(D_{\text{LID DELTA}})} \times 100 \\ \frac{(D_{\text{LID DELTA}})}{(D_{\text{LID DELTA}})} \times 100 \\ \frac{(D_{\text{LID DELTA}})}{(D_{\text{LID DELTA}})} \times 100 \\ \frac{(D_{\text{LID DELTA}})}{(D_{\text{LID DELTA}})} = \frac{(D_{\text{LID DELTA}})}{(D_{\text{LID DELTA}})} \times 100 \\ \frac{(D_{\text{LID DELTA})}}{(D_{\text{LID DELTA}})} \times 100 \\ \frac{(D_{\text{LID DELTA})}}{(D_{\text{LID DELTA})}} \times 100 \\ (D_{\text$	Requirement : V_{DELTA} Where: VLID DELTA= Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below V_DELTA = 661.01 ft ³ ere: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet)	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> <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ $M_{LID DELTA} = ((W)(L) = $ $M_{LID DELTA} = (W)(L) = $ $M_{LID DELTA} = $	Requirement : V_{DELTA} Where: VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below V_DELTA= 661.01 ft ³ ere: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)	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> <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ $\# DIV/0!$ ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 $M_{LID DELTA} = (W)(L) = (W)(L) = (W)(L) = (W)(L) = (W)(L) = (W)(L) = (W)(W)(L) = (W)(L) = (W)(W)(W)(W)(W) = (W)(W)(W)(W)(W) = (W)(W)(W)(W)(W)(W)(W) = (W)(W)(W)(W)(W)(W)(W) = (W)(W)(W)(W)(W)(W)(W)(W)(W)(W)(W)(W)(W)($	Requirement : V_{DELTA} Where: VLID DELTA = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below V_{DELTA} = 661.01 ft ³ 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)	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> <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement $A_{CHD DELTA} = $ $(D)(A_{LID DELTA})/V_{LID DELTA})$ Number of Requirement $A_{Chieved}$ $= $ Input:	Requirement: V_{DELTA} Where: VLID DELTA= Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below V_{DELTA} = 661.01 ft ³ ere: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) V= Width (in decimal feet) L = Length (in decimal feet) D = 0.0 as a decimal D = 0.0 the 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.	INSTRUCTIONS: 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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.000 ft ² Percent of Requirement $A_{Chieved}$ $=$ $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} x 100$ Input:	Requirement : V_DELTA Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below V_{DELTA} = 661.01 ft ³ ere: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= 0.0 ft 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.	INSTRUCTIONS: 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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Requirement : V_{DELTA} Where: VLID DELTA= Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below V_{DELTA} = 661.01 ft ³ 661.01 ere: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= 0.0 L = 0.0 the second fit Below perforated pipe if present	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/01 ft^3$ $A_{LID DELTA}=(W)(L) = 0.00 ft^2$ Percent of Requirement $(D)(A_{LID DELTA})/(V_{LID DELTA})$ Achieved $(D)(A_{LID DELTA})/(V_{LID DELTA})$ X 100 Input:	Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below V_{DELTA} = 661.01 ft ³ ere: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L = 0.00 ft 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.	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 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%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01 ft^3$ $A_{LID DELTA} = (W)(L) = 0.00 ft^2$ Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: Solution:	Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below V_{DELTA} = 661.01 ft ³ ere: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= 0.00 ft Below perforated pipe if present (in decimal feet) L = 0.00 ft	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 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%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01 ft^3$ $A_{LID DELTA} = (W)(L) = 0.00 ft^2$ Percent of Requirement $A_{Chieved} = \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: Solution: Percent of Requirement Achieved = #DIV/01 %	Requirement : V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below V_{DELTA} = 661.01 ft ³ 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) P = 0.00 ft as a decimal D = 0.00 ft Below perforated pipe if present $U = 0.00 ftU = 0.00 \text{ ft} Below perforated pipe if present U = 0.00 \text{ ft} as a decimal feet U = 0.00 \text{ ft} as a decimal feet U = 0.00 \text{ ft} as a decimal feet U = 0.00 \text{ ft} as a decimal feet U = 0.00 \text{ ft} as a decimal feet U = 0.00 \text{ ft} ft below perforated pipe if present U = 0.00 \text$	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 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%.





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	





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.





				· · · · · · · · · · · · · · · · · · ·
uirement 1: 100% Treatme	nt			INSTRUCTIONS:
ent 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
nula:			is smaller than the value used for	achieved; then Requirement 1-100%
_{ATMENT} = (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 co	ondition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution P	revention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]	, , , , , , , , , , , , , , , , , , ,		
<u>nput:</u>	$A_{r} = \frac{8,121}{0.186} \text{ ft}^{2} = \frac{0.186}{0.43} f$	Acres		
	N* - 1.2	NOTE		
ITION: IMENT ⁼ 0.01876 cfs	Q _{TREATMENT} ⁼ (0.2)(0.1864)(0.43)(1.17)	The Flow Rate calculate appropriate BMP. All a should be sized for the	ed here should only be used to size the ssociated overflow inlets and systems Flood Control event.	
	uirement 1: 100% Treatme ent of 100% of the flow generated nula: NTMENT= (0.2 in/hr)(A,)(C _{POST})(K) cfs nput: ution: 0.01876 cfs	uirement 1: 100% Treatment ent of 100% of the flow generated by 85th percentile 24 hour mean annual rain event (0.2 in/hr). nula: UTMENT = (0.2 in/hr)(A _r)(C _{POST})(K) cfs Where: QTREATMENT = Design flow rate required to be treated (cfs) C _{POST} = Rational method runoff coefficient for the developed co A _r = Reduced Tributary Area including credit for Pollution P K = Seasonal Precipitation Factor ^[7] nput: $A_r = \begin{bmatrix} 8,121 \\ 0.43 \\ K^{[7]} = \\ 1.2 \end{bmatrix}$ ft ² = ution: $Q_{TREATMENT} = (0.2)(0.1864)(0.43)(1.17)$	uirement 1: 100% Treatment ent of 100% of the flow generated by 85th percentile 24 hour mean annual rain event (0.2 in/hr). nula: $_{TTMENT}$ = (0.2 in/hr)(A _r)(C _{POST})(K) cfs Where: $Q_{TREATMENT}$ = Design flow rate required to be treated (cfs) C_{POST} = Rational method runoff coefficient for the developed condition ^{110]} A_r = Reduced Tributary Area including credit for Pollution Prevention Measures (in Acres) K = Seasonal Precipitation Factor ^[7] nput: A_r = $8,121 \ 0.18643$ Acres $C_{POST}^{110]} = 0.43 \ K^{[7]} = 1.2$ ntion: $NOTE$: The Flow Rate calculate appropriate BMP. All a should be sized for the size of	Lirement 1: 100% Treatment ent of 100% of the flow generated by 85th percentile 24 hour mean annual rain event (0.2 in/hr). nula: $_{TTMENT}^{T} = (0.2 in/hr)(A_{2})(C_{POST})(K) cfs$ Where: $_{TTMENT}^{T} = (0.2 in/hr)(A_{2})(C_{POST})(K) cfs$ Q_{TREATMENT}^{T} = Design flow rate required to be treated (cfs) $C_{POST}^{T} = Rational method runoff coefficient for the developed condition1(0) A = Reduced Tributary Area including credit for Pollution Prevention Measures (in Acres) K = Seasonal Precipitation Factor(7) nput: $

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Requirement 2: Delta Volume C No increase in volume of runoff leaving the	Capture	vent.	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not achieved; then Requirement 1-100%
<u>Formulas:</u> S = <u>1000</u> - 10 <u>CN</u>	<u>Where:</u> S= Potential maximum retention after runoff (in) ^{5]}		Treatment, page 4 of the calculator, AND Requirement 2- Volume
	CN= Curve Number ^[5]		must be achieved.
$Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) + (0.8 * S)]} \times \frac{1 \text{ft}}{12 \text{in}}$	$\frac{\text{Where:}}{\text{Q}=\text{Rupoff dopth (ft)}^{[6]}}$		
	P = Precipitation (in) = 0.92 0.92 0.92 inches in the area, based on low	e Santa Rosa 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 Poliution Pr	evention measures (r)	after development is less than or
Input: (Pick data from drop down lists	or enter calculated values) A _r = 8.121 ft ²		development, Requirement 2-Volume
	κ ^[7] = 1.2		$(C_{\text{POST}} \leq C_{\text{POST}} \circ C \cap C_{\text{POST}} \leq C_{\text{POST}})$
		wn Lists	(O POST - O PRE OF ON POST - ON PRE)
Select hydro Select predeve	logic soil type within tributary area = C: 0.05 - 0.15 in/hr infiltration (t lopment ground cover description ^[5] = Woods (50%), grass (50%) com	transmission) rate bination (orchard or tree farm) - Fair	
Select post deve	lopment ground cover description ^[5] = Impervious - Paved Parking, Rc	poftop, Driveways	
	CN _{PRE} = 76		
OP	$CN_{POST} = 90.3$		
	Composite Post development CN ^[9] = 87		
Solution:			
Pre Development Storm Water Runo	off Volume		
S _{PRE} = 3.51 in	S_{PRE}= <u>1000</u> 74 -10	$\frac{Where:}{S_{PRE}} = \text{Pre development potential maximum retention after runoff (in)}.$	
Q _{PRE} = 0.00301 ft	$\mathbf{Q}_{PRE} = \frac{[(0.92^{*}1.17) \cdot (0.2^{*}3.51)]^2}{[(0.92^{*}1.17) \cdot (0.8^{*}3.51)]} \times \frac{1\mathrm{ft}}{12\mathrm{in}}$	Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{PRE} = 24.44 ft ³	V _{PRE} = (0.00301)(8,121)	V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Bast Development Sterme Wester D			
Second Second Storm Water Run	Sreet 1000	Where	
	87 -10 87	S _{POST} = Post development potential maximum retention after runoff (in).	
Q _{POST} = 0.02324 ft	$\mathbf{Q}_{\text{POST}} = \frac{[(0.92^{*}1.17) \cdot (0.2^{*}1.44)]^2}{[(0.92^{*}1.17) \cdot (0.8^{*}1.44)]} \times \frac{1\text{ft}}{12\text{in}}$	Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{POST} = 188.73 ft ³	V _{POST} = (0.02324)(8,121)	$V_{\text{POST}}\text{=}$ Post Development Volume of Storm Water Generated ($\text{ft}^3)$	
Solution: Volume Capture Require	water that must be retained onsite (may be infiltrated or reused).		
Belta Volume Capture= (V _{POST} -V	PRE) Delta Volume Capture= (188.73) - (24.4	14) Whate	
V _{DELTA} = 164	L29 ft ³ Delta Volu	<u>wnere:</u> ume Capture= 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).	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Captu	ıre Goal; V _{GOAl}	NOTE:	The 100% volume capture sizing tool
······································		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the <u>design goal</u>
$V_{\text{LID GOAL}} = ((V_{\text{GOAL}}))/(P) = 515.31 \text{ ft}^3$	Where:	treatment only.	of 100% volume capture of the post
	V _{LID GOAL} = Required volume of soil in LID BMP.		percent porosity of the specified soil
$A_{\text{LID GOAL}}=(W)(L) = 368.64$	A _{LID GOAL} = Footprint of LID BMP area for a given depth (below perfora	ted pipe if present).	and depth below perforated pipe (if
	$V_{GOAL} = 227$ ft ³		present). The width and length entries will need to be interactively adjusted
	Where:		until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{x 100}$	P= Porosity (enter as a decimal)		
V _{LID} GOAL	D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet)		
Input:			
<u>input.</u>	P = 0.4 as a decimal D = 1.4 if Below perforated nine if present		
	$W = \frac{19.2}{\text{ft}}$		
	L = 19.2 ft		
Solution:		7	
Percent of Goal Achieved = 100.15	% = [(1.4 x 369) / 515] x 100		
			J
			INSTRUCTIONS
LID BMP Sizing Tool Dolta Volume Cantur	re Pequirement · V	NOTE	INSTRUCTIONS: The Delta Volume Capture sizing tool
LID BMP Sizing Tool Delta Volume Captur	re Requirement: V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size
LID BMP Sizing Tool Delta Volume Captur	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>
LID BMP Sizing Tool Delta Volume Captur Formulas: 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
LID BMP Sizing Tool Delta Volume Captur Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01 ft ³	re Requirement : 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 of the operation desil and death below
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ²	re Requirement: V _{DELTA} <u>Where:</u> V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perfora	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perfortated pipe (if present). The width
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA}=(W)(L) = $ 0.00 ft ²	Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below perfora	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 <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
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/0! ft^3$ $A_{LID DELTA}=(W)(L) = 0.00 ft^2$	Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALLID DELTA= Footprint of LID BMP area for a given depth (below perfora VDELTA= 164.29	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> <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
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ²	Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below perfora VDELTA = 164.29 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 <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
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement = (D)(A_{LID DELTA}) = 400	Where: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP A_{LID DELTA} = Footprint of LID BMP area for a given depth (below perfora V_{DELTA} = 164.29 ft ³ Where: 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 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 100%.
$\frac{\text{LID BMP Sizing Tool Delta Volume Capture}}{\text{Formulas:}} V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\text{\#DIV/01}}{\text{\#DIV/01}} \text{ft}^{3}$ $A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{NLD DELTA}} \text{ft}^{2}$ $\text{Percent of Requirement}_{\text{Achieved}} = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	The Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP A_{LID DELTA} = Footprint of LID BMP area for a given depth (below perfora V_{DELTA} = 164.29 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.	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01 ft^3$ $A_{LID DELTA} = (W)(L) = 0.00 ft^2$ Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	The Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP A_{LID DELTA} = Footprint of LID BMP area for a given depth (below perfora V_{DELTA} = 164.29 ft ³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) Where (in decimal feet) W= Width (in decimal feet) Weath (in decimal feet)	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 <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 100%.
LID BMP Sizing Tool Delta Volume CapturFormulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01] ft^3$ $A_{LID DELTA} = (W)(L) = 0.00 ft^2$ Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	The Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perfora V_{DELTA} = 164.29 ft ³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) U Undermal feet) U Undermal feet)	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 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%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement $A_{Chieved}$ $=$ $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	The Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perfora V_{DELTA} = 164.29 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) U = Length (in decimal feet) = 0.0 as a decimal = 0.0	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 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%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement $A_{Chieved}$ $=$ $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} x 100$ Input:	The Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perfora V_{DELTA} = 164.29 ft ³ 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) D = 0.0 ft Below perforated pipe if present	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{\text{LID DELTA}}=((V_{\text{DELTA}}))/(P) = #DIV/0! \text{ ft}^3$ $A_{\text{LID DELTA}}=(W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ Input:	The Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perfora V_{DELTA} = 164.29 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) We Width (in decimal feet) U = 0.0 ft Below perforated pipe if present (w = 0.0 ft	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/0! \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ Input:	The Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perfora V_{DELTA} = 164.29 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) We Width (in decimal feet) U = 0.0 ft Below perforated pipe if present as a decimal D = 0.0 ft Below perforated pipe if present If present	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/01 \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ Input:	The 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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = \#DIV/01]$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ² Percent of Requirement Achieved $M_{LID DELTA} = (D)(A_{LID DELTA})$ X 100 Input:	The Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perfora V_{DELTA} = 164.29 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) U = 0.0 ft Below perforated pipe if present U = 0.0 ft D = 0.0 ft D = 0.0 ft	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01] ft^3$ $A_{LID DELTA} = (W)(L) = 0.00$ ft² Percent of Requirement Achieved $M_{LID DELTA} = (W)(L) = 0.00$ ft² Imput: Solution: Percent of Requirement Achieved = #DIV/0!	The Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perfora V_{DELTA} = 164.29 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) U = 0.0 ft B = 0.0 ft	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ted pipe if present).	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 <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 100%.





Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connec Multiplier = 1	ted 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 new and existing trees. Enter the
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.	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 Area Reduction due to new Deciduous Trees=0ft ²	New Deciduous Trees	
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	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:
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%
$Q_{\text{TREATMENT}} = (0.2 \text{ In/nr})(A_r)(C_{\text{POST}})(K) \text{ cts}$	Where:		The table of values can be found here	I reatment, this page of the calculator,
	QTREATMENT Design flow rate required to be treated (cfs)		The table of values call be found here	Capture, page 5 of the calculator
	CPOST - Rational method runoff coefficient for the develo		to size the overflow bypass	must be achieved
	r = Reduced Tributary Area including credit for Pol K = Seasonal Precipitation Factor ^[7]	ution Prevention Measures (in Acres)	to onze the oremen syptice.	must be demeved.
<u>Input:</u>	$A_{r} = \frac{24,620}{0.59} \text{ ft}^{2} = \frac{1.2}{1.2}$	0.56520 Acres		
		NOTE:		
Solution:		The Flow Rate calculate	d here should only be used to size the	
Q _{TREATMENT} = 0.07803 cfs	Q _{TREATMENT} ⁼ (0.2)(0.5652)(0.59)(1.17)	appropriate BMP. All as should be sized for the	ssociated overflow inlets and systems Flood Control event.	



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Requirement 2: Delta Volume Capture No increase in volume of runoff leaving the 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 cabiaucd theo Deguirement 1 100%
Formulas:		Treatment nego 4 of the coloulator
S = 1000 - 10 Where		AND Dequirement 2 Volume
CN S= Potential maximum retention after runoff (in ^[5]		AND Requirement 2- volume
CN= Curve Number ^[5]		Capture, this page of the calculator,
$Q = [(P * K) - (0.2 * S)]^2$ 1ft Where:		must be achieved.
$[(P*K)+(0.8*S)] X = \frac{1}{12in} Q = Pupoff depth (ft)^{[6]}$		
P = Precipitation (in) = 0.92 0.92 inches in t	the Santa Rosa	
K= Sessonal Previolation Factor ^[7] area, based or	n local historical	
V= (O)(A) data.		NOTE
$\mathbf{v} = (\mathbf{u}_i)(\mathbf{x}_i)$ <u>vviiete.</u>		
V= Volume of Storm Water to be Retained (fr)	Prevention Measures (#)	If the amount of volume generated
A_r = Reduced inducting Area including Credit for Politiki	Frevenuori measures (1)	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
$A_r = 24,620 \pi$		Capture is not required.
K ⁽¹⁾ = 1.2		$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE})$
Drop d	Iown Lists	(TOOL THE TOOL THE)
Select hydrologic soil type within tributary area ^{8]} = C: 0.05 - 0.15 in/hr infiltration	n (transmission) rate	
Select predevelopment ground cover description ^[5] = Woods (50%), grass (50%) co	ombination (orchard or tree farm) - Fair	
Select post development ground cover description ^[5] = Impervious - Paved Parking, I	Rooftop, Driveways	
CN _{PRE} = 76		
CN _{POST} = 90.3		
OR Composite Predevelopment CN ^[9] = 74		
Composite Post development CN ^[9] = 94		
Solution:		
Pre Development Storm Water Runoff Volume		
$S_{\text{ppr}} = 351$ in $S_{\text{ppr}} = 1000$	Where:	
/4	S_{PRE} – Pre development potential maximum retention after runoir (in).	
$Q_{PRE} = 0.00301$ if $Q_{PRE} = \frac{[(0.92^{-1.17}) - (0.2^{-3.51})]^2}{100} \times \frac{100}{100}$	Q_{PRE} = Q in feet of depth as defined by the "Urban	
[(0.92*1.17)+(0.8 * 3.51)] 12in	Hydrology For Small Watersheds" TR-55 Manual.	
$V = \frac{7444}{10000000000000000000000000000000000$		
Ψ_{PRE} (0.00301)(24,020)	v_{PRE} – Pre Development Volume of Storm Water Generated (ft ^o)	
Post Davelenment Sterm Weter Bunoff Volume		
Spost= 0.68376 in Spost= 1000 -10	Where:	
94	S _{POST} = Post development potential maximum retention after runoff (in).	
$Q_{POST} = 0.04548$ ft $Q_{POST} = [(0.92^*1.17) - (0.2^*0.68)]^2 \times \frac{1 \text{ft}}{1 \text{ft}}$	Q _{POST} = Q in feet of depth as defined by the "Urban	
[(0.92*1.17)+(0.8 * 0.68)] 12in	Hydrology For Small Watersheds" TR-55 Manual.	
$V_{POST} = 1119.72$ ft ^o $V_{POST} = (0.04548)(24,620)$	V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
Solution: Volume Capture Requirement		
Increase in volume of storm water that must be retained onsite (may be infiltrated or reused	d).	
Delta Volume Capture= (V _{POST} -V _{PRE}) Delta Volume Capture= (1,119.72) - ((74.11)	
	Where:	
V _{DELTA} = 1045.61 ft ³ Delta V	olume Capture= 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).	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Capture Goal: Voou		NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the design goal
$V_{\text{LID GOAL}} = ((V_{\text{GOAL}}))/(P) = 2908.52 \text{ ft}^3$ Where:		treatment only.	of 100% volume capture of the post
	tequired volume of soil in LID BMP.		percent porosity of the specified soil
$A_{\text{LID GOAL}} = (W)(L) = \frac{948.64}{948.64} \text{ It} \qquad A_{\text{LID GOAL}} = F_{\text{COAL}}$	ootprint of LID BMP area for a given depth (below perf	forated pipe if present).	and depth below perforated pipe (if
V _{GOAL} =	1,280 ^{ft³}		present). The width and length entries will need to be interactively adjusted
Where:			until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $(D)(A_{LID GOAL})$ r 100 P= Porosity (ent	ter as a decimal)		
V _{LID GOAL} D= Depth below pe W= Width (in de L= Length (in de	erforated pipe if present (in decimal feet) ecimal feet) ecimal feet)		
Input: P=	0.4 as a decimal		
D = W =	3.1 ft Below perforated pipe if present		
L =	30.8 ft		
Solution:		7	
Percent of Goal Achieved = 101.11 % = [((3.1 x 949) / 2,909] x 100		
			J
			INSTRUCTIONS:
ILID BMP Sizing Tool Delta Volume Capture Requirement:	: VDELTA	NOTE:	The Delta Volume Capture sizing tool
LID BMP Sizing 1001 Delta Volume Capture Requirement	: V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume	The Delta Volume Capture sizing tool helps the designer appropriately size
Formulas:	: V _{delta}	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u>
LID BMP Sizing Tool Delta Volume Capture Requirement: Formulas: VLID DELTA=((VDELTA))/(P) = #DIV/01	: 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 capture. Enter the percent of porosity
LID BMP Sizing Tool Delta Volume Capture Requirement : Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/01 \text{ ft}^3 Where: V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = 0.00 \text{ ft}^2 + C_{\text{DELTA}} = R_1$	Equired volume of soil in LID BMP	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 capture. Enter the percent of porosity of the specified soil and depth below
LID BMP Sizing 1001 Delta Volume Capture Requirement : Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ Where: $A_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ VLID DELTA = Re $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² $A_{LID DELTA} = Fe $	Equired volume of soil in LID BMP	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width
LID BMP Sizing Tool Delta Volume Capture Requirement: Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ Where: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ Where: $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² $A_{LID DELTA} = Fc$ $V_{DELTA} = $ $V_{DELTA} = $ $V_{DELTA} = $: VDELTA Required volume of soil in LID BMP ootprint of LID BMP area for a given depth (below perf	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 <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
LID BMP Sizing Tool Delta Volume Capture Requirement: Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01$ ft ³ Where: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01$ ft ³ $V_{LID DELTA} = R_0$ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² $A_{LID DELTA} = F_0$ $V_{DELTA} = [$ $Where:$: VDELTA Required volume of soil in LID BMP ootprint of LID BMP area for a given depth (below perf 1045.61] ft ³	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> <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
$\frac{\text{LID BMP Sizing Tool Delta Volume Capture Requirement}}{V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV/01}}{\#\text{DIV/01}} \text{ft}^3 \qquad \frac{\text{Where:}}{V_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{Delta}} \text{ft}^2 \qquad A_{\text{LID DELTA}} = Fo$ $V_{\text{DELTA}} = \underbrace{W_{\text{Delta}}}_{\text{Percent of Requirement}} = \underbrace{(D)(A_{\text{LID DELTA}})}_{\text{X 100}} \times 100 \qquad P = \text{Porosity (entities)}$: V _{DELTA} tequired volume of soil in LID BMP ootprint of LID BMP area for a given depth (below perf 1045.61 ft ³ ter as a decimal)	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> <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 100%.
LID BMP Sizing 1001 Delta Volume Capture Requirement : Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) =$ #DIV/01 ft ³ Where: $A_{LID DELTA} = (W)(L) =$ 0.00 ft ² $A_{LID DELTA} = Fc$ $V_{DELTA} = (W)(L) =$ 0.00 ft ² $A_{LID DELTA} = Fc$ $V_{DELTA} =$ $V_{DELTA} =$ $V_{DELTA} =$ Percent of Requirement $(D)(A_{LID DELTA})$ x 100 P= Porosity (ent Achieved $V_{UID DELTA}$ x 100 D= Depth below pethe	: V _{DELTA} Required volume of soil in LID BMP ootprint of LID BMP area for a given depth (below perf 1045.61] ft ³ ter as a decimal) erforated pipe if present (in decimal feet)	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> <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 100%.
LID BMP Sizing 1001 Delta Volume Capture Requirement : Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01]$ ft ³ Where: $A_{LID DELTA} = (W)(L) = 0.00]$ ft ² $V_{LID DELTA} = R_{LID DELTA}$: VDELTA Required volume of soil in LID BMP cootprint of LID BMP area for a given depth (below perf 1045.61]ft ³ ter as a decimal) erforated pipe if present (in decimal feet) scimal feet) ecimal feet)	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> <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 100%.
LID BMP Sizing 1001 Delta Volume Capture Requirement : Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01$ ft ³ Where: $A_{LID DELTA} = (W)(L) = 0.00$ ft ² $V_{LID DELTA} = Re$ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² $V_{DELTA} = Fe$ Percent of Requirement $(D)(A_{LID DELTA})$ $V_{DELTA} = Fe$ Achieved $(D)(A_{LID DELTA})$ $V_{DELTA} = Fe$ Where: $P = Porosity$ (ent D = Depth below pe $W = Width$ (in de L = Length (in de L = Length (in de	 YDELTA Required volume of soil in LID BMP ootprint of LID BMP area for a given depth (below perf 1045.61] ft³ ter as a decimal) erforated pipe if present (in decimal feet) ecimal feet) ecimal feet) 	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> <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 100%.
LID BMP Sizing 1001 Delta Volume Capture Requirement : Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01$ ft ³ Where: $A_{LID DELTA} = (W)(L) = 0.00$ ft ² $V_{LID DELTA} = Fc$ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² $V_{DELTA} = Fc$ Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ $P = Porosity$ (entry with the delta constrained on the delta constr	 YDELTA Required volume of soil in LID BMP ootprint of LID BMP area for a given depth (below perf 1045.61 ft³ ter as a decimal) erforated pipe if present (in decimal feet) ecimal feet) ecimal feet) 0.0 as a decimal 0.0 ft Below perforated pipe if present 	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> <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 100%.
LID BMP Sizing 1001 Delta Volume Capture Requirement : Formulas: V_LID DELTA=((V_{DELTA}))/(P) = #DIV/01 ft ³ Where: V_LID DELTA=((V)(L) = 0.00 ft ² V_LID DELTA = Fc ALID DELTA=(W)(L) = 0.00 ft ² V_DELTA = Fc Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ P= Porosity (ent D= Depth below percent) (in de L= Length (in de L= Length (in de L= Length)) (in de L= Length) (i	 YDELTA Required volume of soil in LID BMP ootprint of LID BMP area for a given depth (below perf 1045.61] ft³ ter as a decimal) erforated pipe if present (in decimal feet) ecimal feet) as a decimal 0.0 ft Below perforated pipe if present 	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> <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 100%.
LID BMP Sizing 1001 Delta Volume Capture Requirement : Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01] ft^3$ Where: $A_{LID DELTA} = (W)(L) = 0.00] ft^2$ $V_{LID DELTA} = Rt$ $A_{LID DELTA} = (W)(L) = 0.00] ft^2$ $V_{DELTA} = Rt$ Percent of Requirement $(D)(A_{LID DELTA})$ $V_{DELTA} = Rt$ Percent of Requirement $(D)(A_{LID DELTA})$ $V_{DELTA} = Rt$ Value Delta $V_{DELTA} = Rt$ $V_{DELTA} = Rt$ Vertical State $V_{DELTA} = Rt$ $V_{DELTA} = Rt$ Volue Delta $V_{DELTA} = Rt$ $V_{DELTA} = Rt$ Vertical State Rt $V_{DELTA} = Rt$ Volue Delta Rt $V_{DELTA} = Rt$ Volue Delta Rt Rt Volue Delta Rt Rt Volue Delta Rt Rt Volue Delta Rt Rt Percent of Requirement $(D)(A_{LID DELTA}) = Rt$ Rt Percent of Requirement Rt Rt Rt Volue Delta Rt Rt Rt Rt Rt Rt Rt	 YDELTA Required volume of soil in LID BMP ootprint of LID BMP area for a given depth (below perf 1045.61 ft³ ter as a decimal) erforated pipe if present (in decimal feet) ecimal feet) ecimal feet) as a decimal 0.0 ft Below perforated pipe if present ft 	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 <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 100%.
LID BMP Sizing 1001 Delta Volume Capture Requirement : Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01$ ft ³ Where: $A_{LID DELTA} = (W)(L) = 0.00$ ft ² $V_{LID DELTA} = Fc$ $V_{DELTA} = (W)(L) = 0.00$ ft ² $V_{DELTA} = Fc$ Percent of Requirement $(D)(A_{LID DELTA})$ V_{10} Delta Achieved $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ $P = Porosity$ (ent Depth below part $Where:$ $P = Porosity$ (ent Depth below part $W = U$ U $A_{Chieved}$ $U_{ID DELTA} = V$ $V_{LID DELTA}$ Solution: $P = U$ $P = U$	Evenuired volume of soil in LID BMP ootprint of LID BMP area for a given depth (below perf 1045.61 ft ³ ter as a decimal) erforated pipe if present (in decimal feet) scimal feet) ecimal feet) 0.0 0.0 ft Below perforated pipe if present ft	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> <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 100%.
LID BMP Sizing 1001 Delta Volume Capture Requirement : Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01]$ ft ³ Where: $A_{LID DELTA} = (W)(L) = 0.00$ ft ² $V_{LID DELTA} = Fc$ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² $V_{DELTA} = Fc$ Percent of Requirement Achieved = $(D)(A_{LID DELTA})$ x 100 $Where:$ $P = Porosity (ent Delta Delta Delta)$ x 100 $D = Depth Delow percent (in det Delta)$ $W = U$ U $A_{chieved} = (D)(A_{LID DELTA})$ x 100 $P = Porosity (ent Delta)$ $D = Depth Delow percent (in det Delta)$ U $U = Depth Delow percent (in det Delta)$ $U = Depth Delta Percent (in det Delta)$ $D = Depth Delta Percent of Requirement Achieved = #DIV/01 \%$ $P = Detto Delta Percent Percent of Requirement Achieved = #DIV/01 \%$	Equired volume of soil in LID BMP cooprint of LID BMP area for a given depth (below perf 1045.61] ft ³ ter as a decimal) erforated pipe if present (in decimal feet) acimal feet) ecimal feet) 0.0 ft Below perforated pipe if present 0.0 ft HDIV/0!	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> <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 100%.





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 Solution:	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.





Requirement 1: 100% Treatme	ent			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
<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 co	ndition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Pr	evention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]			
Input:	$A_r = 24,684 \text{ ft}^2 = 0.566$	67 Acres		
	$C_{POST}^{(10)} = 0.53$ $\kappa^{(7)} = 1.2$			
		NOTE:		
Solution:		The Flow Rate calculate	ed here should only be used to size the ssociated overflow inlets and systems	
Q _{TREATMENT} = 0.07028 cfs	Q _{TREATMENT} ⁼ (0.2)(0.5667)(0.53)(1.17)	should be sized for the	Flood Control event.	

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Requirement 2: Delta Volume ON No increase in volume of runoff leaving the	Capture e site due to development for the 85th percentile 24 hour storm ev	vent.	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not
Formulas: $S = \frac{1000}{CN} - 10$ Where: $CN = Curve Number^{[5]}$ S= Potential maximum retention after runoff (in) ^[5] $Q = \frac{[(P+K)+(0.2+S)]^2}{[(P+K)+(0.8+S)]}$ X $\frac{1ft}{12in}$ Where: $Q = Runoff depth (ft)^{[6]}$ $Q = Runoff depth (ft)^{[6]}$ $Q = Runoff depth (ft)^{[6]}$			achieved; then Requirement 1-100% Treatment, page 4 of the calculator, AND Requirement 2- Volume Capture, this page of the calculator, must be achieved.
$V = (Q)(A_r)$	$\begin{array}{c} \label{eq:product} \end{tabular} P = \end{tabular} \end{tabular} P = \end{tabular} \end{tabular} P = \end{tabular} \end{tabular} P = \end{tabular} \end{tabular} \end{tabular} P = \end{tabular} \end{tabular} P = \end{tabular} \end{tabular} \end{tabular} \end{tabular} \end{tabular} P = \end{tabular} \end$	e Santa Rosa cal historical evention Measures ([#])	NOTE: If the amount of volume generated after development is less than or
Input: (Pick data from drop down lists	or enter calculated values) $A_r = 24,684 \text{ ft}^2$ $K^{(7)} = 1.2$ Drop dow	vn Lists	equal to that generated before development, Requirement 2-Volume Capture is not required. $(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE})$
Select hydro Select predeve Select post deve OR	logic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration (tr lopment ground cover description ^[5] = Woods (50%), grass (50%) comb lopment ground cover description ^[5] = Impervious - Paved Parking, Ro $CN_{PRE} = 76$ $CN_{PRST} = 90.3$ Composite Predevelopment CN ^[9] = 74	ransmission) rate bination (orchard or tree farm) - Fair oftop, Driveways	
Solution:	Composite Post development CN ^[9] = 93		
Pre Development Storm Water Runo	off Volume		
S _{PRE} = <u>3.51</u> in	$S_{PRE} = \frac{1000}{74} - 10$	$\frac{Where:}{S_{PRE}} = Pre \text{ development potential maximum retention after runoff (in).}$	
Q _{PRE} = 0.00301 ft	$\mathbf{Q}_{PRE} = \frac{[(0.92^{*}1.17) \cdot (0.2^{*}3.51)]^2}{[(0.92^{*}1.17) \cdot (0.8^{*}3.51)]} \times \frac{1 \mathrm{ft}}{12 \mathrm{in}}$	Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{PRE} = 74.30 ft ³	V _{PRE} = (0.00301)(24,684)	$V_{\text{PRE}}\text{=}$ Pre Development Volume of Storm Water Generated (ft³)	
Post Development Storm Water Run	off Volume		
S _{POST} = 0.77586 in	S _{POST} = <u>1000</u> 93 -10	<u>Where:</u> S _{POST} = Post development potential maximum retention after runoff (in).	
Q _{POST} = 0.04152 ft	Q _{POST} = $\frac{[(0.92^{*}1.17) - (0.2^{*}0.78)]^2}{[(0.92^{*}1.17) + (0.8^{*}0.78)]}$ X $\frac{1 \text{ft}}{12 \text{in}}$	Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{POST} = 1024.88 ft ³	V _{POST} = (0.04152)(24,684)	$V_{\text{POST}}\text{=}$ Post Development Volume of Storm Water Generated (ft^3)	
Solution: Volume Capture Require	ament water that must be retained onsite (may be infiltrated or reused).		
Delta Volume Capture= (V _{POST} -V	/ _{PRE}) Delta Volume Capture= (1,024.88) - (74	.30)	
V _{DELTA} = 950).58 ft ³ Deita Volu	Where: Ime Capture= 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).	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Captu	re Goal; V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the design goal
$V_{LID GOAL} = ((V_{GOAL}))/(P) = 2679.34 \text{ ft}^3$	Where:	treatment only.	of 100% volume capture of the post
4 ²	V _{LID GOAL} = Required volume of soil in LID BMP.		percent porosity of the specified soil
$A_{\text{LID GOAL}}=(W)(L) = 745.29 \text{ ft}$	A _{LID GOAL} = Footprint of LID BMP area for a given depth (below perfora	ated pipe if present).	and depth below perforated pipe (if
	$V_{GOAL} = $ 1,179 ft^3		present). The width and length entries will need to be interactively adjusted
	Where:		until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $(D)(A_{LID GOAL})$ × 100	P= Porosity (enter as a decimal)		
V _{LID GOAL}	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 decimal		
	D = 3.6 ft Below perforated pipe if present		
	W = 27.3 ft		
	L = 27.3 ft		
Solution		7	
Solution. Percent of Goal Achieved = 100 14	% - [(3.6 x 745) / 2.679] x 100	1	
			-
			5
LID BMP Sizing Tool Delta Volume Captur	e Requirement: V _{DELTA}	NOTE:	INSTRUCTIONS: The Delta Volume Capture sizing tool beins the designer appropriately size
LID BMP Sizing Tool Delta Volume Captur	e 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>
LID BMP Sizing Tool Delta Volume Captur	e 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
LID BMP Sizing Tool Delta Volume Captur Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0!]ft ³	<u>e 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
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/0!$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ²	<u>e Requirement</u> : V _{DELTA} <u>Where:</u> V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perform	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft^3 $A_{LID DELTA} = (W)(L) = $ 0.00 ft^2	Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below performance) VDELTA= 950.58	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 <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
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01] ft^3$ $A_{LID DELTA} = (W)(L) = 0.00 ft^2$	<u>e Requirement</u>: V_{DELTA} <u>Where:</u> $V_{\text{LID DELTA}}$ = Required volume of soil in LID BMP $A_{\text{LID DELTA}}$ = Footprint of LID BMP area for a given depth (below perform V_{DELTA} = 950.58 ft ³ <u>Where:</u>	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 <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
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01] ft^3$ $A_{LID DELTA} = (W)(L) = 0.00 ft^2$ Percent of Requirement = $(D)(A_{LID DELTA}) \times 100$	e Requirement: VDELTA Where: VLID DELTA= Required volume of soil in LID BMP ALID DELTA = VDELTA= 950.58 Where: 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 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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/0!] \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	<u>e Requirement</u>: V_{DELTA} <u>Where:</u> $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perform V_{DELTA} = 950.58 ft ³ <u>Where:</u> P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) We be the formation of the performance of the per	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/0!] \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below perform VDELTA= 950.58 P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/0! \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below perform VDELTA= 950.58 ft ³ 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)	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ated pipe if present).	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01 ft^3$ $A_{LID DELTA} = (W)(L) = 0.00 ft^2$ Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	E Requirement: V_{DELTA} <u>Where:</u> $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perform V_{DELTA} = 950.58 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) L = Length (in decimal feet) P = 0.0 as a decimal	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ated pipe if present).	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01 ft^3$ $A_{LID DELTA} = (W)(L) = 0.00 ft^2$ Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Example 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 perform V_{DELTA} 950.58 ft ³ 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 = $ 0.0 ft $D =$ 0.0 ft	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ated pipe if present).	INSTRUCTIONS: 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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01 ft^3$ $A_{LID DELTA} = (W)(L) = 0.00 ft^2$ Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	EXAMPLE EXAMPLE EXAMPLE EXAMPLE EXAMPLE EXAMPLE INTERPORT OF CONTRACT OF CON	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01] ft^3$ $A_{LID DELTA} = (W)(L) = 0.00 ft^2$ Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Example Where: V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perform $V_{DELTA} = 950.58$ ft ³ 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 = 0.0 D = 0.0 D = 0.0 C = 0.0	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ated pipe if present).	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: Solution:	EXAMPLE EXAMPLE EXAM	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 <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 100%.
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Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connection Multiplier = 1	acted 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 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 terraces. Runoff Must be direct to
Enter area draining to a Buffer Strip or Bovine Terrace = 0 ft* Buffer Factor = 0.7 Solution:	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.





L					· · · · · · · · · · · · · · · · · · ·
	Requirement 1: 100% Treatment	nt			INSTRUCTIONS:
ŀ	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
I				The C value used for this calculation	on page 3 of this calculator is not
I	Formula:			is smaller than the value used for	achieved; then Requirement 1-100%
L	$Q_{\text{TREATMENT}}$ = (0.2 in/hr)(A_{r})(C_{POST})(K) cfs	Where:		nydraulic Flood Control design.	I reatment, this page of the calculator
L		Q _{TREATMENT} = Design flow rate required to be treated (cfs)		The table of values can be found here	AND Requirement 2- Volume
L		C _{POST} = Rational method runoff coefficient for the developed con-	dition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
L		A _r = Reduced Tributary Area including credit for Pollution Pre	vention Measures (in Acres)	to size the overflow bypass.	must be achieved.
I		K = Seasonal Precipitation Factor ^[7]			
I	Input:	·			
I		$A_r = $ 13,521 $ft^2 = $ 0.3104	Acres		
I		C _{POST} ^[10] = 0.38			
I		K ^[7] = 1.2			
I			NOTE:		
I	Solution:		The Flow Rate calculate	ed here should only be used to size the	
I			appropriate BMP. All a	ssociated overflow inlets and systems	
	Q _{TREATMENT} = 0.02760 cfs	Q _{TREATMENT} = (0.2)(0.3104)(0.38)(1.17)	should be sized for the	Flood Control event.	

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2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #17

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Requirement 2: Delta Volume Capture No increase in volume of runoff leaving 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 exhipted these Description
Formulas	achieved; then Requirement 1-100%
	Treatment, page 4 of the calculator,
$S = 1000 \cdot 10$ where $S = Data i i l maximum rate for a final maximum rate for S^{[5]}$	AND Requirement 2- Volume
S = Potential maximum retention after runoff (in) ²	Capture, this page of the calculator,
	must be achieved.
$\mathbf{Q} = \underbrace{\left[\mathbf{P} \cdot \mathbf{K} \right] \left(\mathbf{Q} \ge \mathbf{K} \right]}_{\mathbf{W}} \times \underbrace{\mathbf{M}}_{\mathbf{W}} \underbrace{\mathbf{W}_{\text{here:}}}_{\mathbf{W}}$	
$[(P+K)+(0.8+S)] 12in \qquad \qquad Q= \text{Runoff depth (ft)}^{[6]}$	
P= Precipitation (in) = 0.92 0.92 inches in the Santa Rosa	
K= Seasonal Precipitation Factor ^[7] area, based on local historical	
$V = (Q)(A_{*})$ Where: <i>data</i> .	NOTE:
V = Volume of Storm Water to be Retained (ff3)	If the amount of volume generated
A = Reduced Tributary Area including credit for Pollution Prevention Measures (f')	after development is less than or
Insuit: (Did date from down lists as astro-ast	equal to that generated before
mput. (Pick data from drop down lists or enter calculated values)	development, Requirement 2-Volume
$A_r = \frac{13,521}{1000} \pi$	Capture is not required.
$K^{(I)} = 1.2$	$(C_{PODT} \leq C_{PDT} \circ CN_{PODT} \leq CN_{PDT})$
Drop down Lists	(O POST = O PRE OF OF POST = OF PRE)
Select hydrologic soil type within tributary area ⁽⁸⁾ = C: 0.05 - 0.15 in/hr infiltration (transmission) rate	
Select predevelopment ground cover description ^[5] = Woods (50%), grass (50%) combination (orchard or tree farm) - Fair	
Select post development ground cover description ^[5] = Impervious - Paved Parking, Rooftop, Driveways	
CN _{PRE} = 76	
CN _{POST} = 90.3	
OR Composite Predevelopment $CN^{[9]} = 74$	
Composite Post development CN $^{(9)} = $	
Solution:	
Pre Development Storm Water Runom Volume	
$S_{PRE} = 3.51 \text{ in } S_{PRE} = 1000 \text{ Where:}$	
74 S _{PRE} = Pre development potential maximum retention after runoff (in).	
Q_{PRE} = 0.00301 ft $[(0.92^{*1.17})-(0.2^{*3.51})]^2 $ Ift Q_{PRE} = Q in feet of depth as defined by the "Urban	
Q _{PRE} [−] (0.92*117)+(0.8 * 3.51) (0.92*117)+(0.8 * 3.51) 12in Hydrology For Small Watersheds" TR-55 Manual	
$V_{PPE} = 40.70$ ft ³ $V_{PPE} = (0.00301)(13.521)$ $V_{PPE} = Pre Development Volume of Storm Water Generated (ff3)$	
Post Development Storm Water Runoff Volume	
Spost= 131 in Spost= 1000 Where	
88 S _{POST} = Post development potential maximum retention after runoff (in).	
$\mathbf{Q}_{\text{POST}} = \underbrace{\mathbf{U}.\mathbf{U}20\mathbf{U}}_{\text{OST}} \mathbf{\pi} \qquad \mathbf{Q}_{\text{POST}} \underbrace{[(\underline{0}.\underline{9}.\underline{2}^{-1}.17)]_{(\underline{0}.\underline{2}^{-1}.31)]_{\underline{1}}}_{\text{T}} \mathbf{X} \xrightarrow{\mathrm{III}}_{\underline{1}} \qquad \mathbf{Q}_{\text{POST}} \underbrace{\mathbf{U}}_{\text{POST}} \underbrace{\mathbf{U}}_{\text{III}} \mathbf{D}_{\text{POST}} \underbrace{\mathbf{U}}_{\text{POST}} \underbrace{\mathbf{U}}_{\text{III}} \mathbf{D}_{\text{POST}} \underbrace{\mathbf{U}}_{\text{POST}} \mathbf{U$	
[(0.92*1.17)+(0.8 * 1.31)] 12in Hydrology For Small Watersheds" TR-55 Manual.	
V_{POST} = 351.82 m ⁻ V_{POST} = (0.02602)(13,521) V_{POST} = Post Development Volume of Storm Water Generated (ft ²)	
Solution: Volume Capture Requirement	
Increase in volume of storm water that must be retained onsite (may be infiltrated or reused).	
[∼] Delta Volume Capture= (V _{POST} -V _{PRE}) Delta Volume Capture= (351.82) - (40.70)	
Where:	
VDELTA = 311.12 ft ³ Delta Volume Capture= 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).	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Captur	re Goal; V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the design goal
$V_{\text{LID GOAL}}=((V_{\text{GOAL}}))/(P) = 952.00$ ft ³	Where:	treatment only.	development condition Enter the
$A_{\text{LID GOAL}} = (W)(L) = $ 620.01 ft^2	V _{LID GOAL} = Required volume of soil in LID BMP. A _{LID GOAL} = Footprint of LID BMP area for a given depth (below	perforated pipe if present).	percent porosity of the specified soil
			and depth below perforated pipe (if
	$V_{\text{GOAL}} = \frac{419}{1000}$ ft ³		will need to be interactively adjusted
V	Vhere:		until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $(D)(A_{LID GOAL})$ 100	P= Porosity (enter as a decimal)		
V _{LID GOAL}	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 decimal		
	D = 1.5 ft Below perforated pipe if prese	ent	
	$W = \frac{24.9}{1000} ft$		
	L = <u>24.9</u> π		
Solution:		7	
Percent of Goal Achieved = 100.30 %	= [(1.5 x 620) / 952] x 100		
			J
			INSTRUCTIONS:
LID BMP Sizing Tool Delta Volume Capture	e Requirement: V _{DELTA}	NOTE:	INSTRUCTIONS: The Delta Volume Capture sizing tool
LID BMP Sizing Tool Delta Volume Capture	e Requirement: V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size
LID BMP Sizing Tool Delta Volume Capture	e 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
LID BMP Sizing Tool Delta Volume Capture Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0! ft ³	<u>Where:</u>	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
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/0!$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ²	<u>e Requirement</u> : V _{DELTA} <u>Where:</u> V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. perforated pipe if present).	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present) The width
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/0!$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ²	End of the second state 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 VDELTA= 311.12 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 <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
LID BMP Sizing Tool Delta Volume Capture Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01 ft ³ A _{LID DELTA} =(W)(L) = 0.00 ft ²	<u>Where:</u> V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below V _{DELTA} = 311.12	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. perforated pipe if present).	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 <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 Bequirement achieved" reaches
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{UD DELTA} = ((V_{DELTA}))/(P) = #DIV/0! ft^3$ $A_{UD DELTA} = (W)(L) = 0.00 ft^2$	<u>e Requirement</u>: V_{DELTA} <u>Where:</u> $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below V_{DELTA} = 311.12 ft ³ <u>Vhere:</u>	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. perforated pipe if present).	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/0! \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	<u>e Requirement</u>: V_{DELTA} <u>Where:</u> $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below V_{DELTA} = <u>311.12</u> ft ³ <u>Vhere:</u> 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. perforated pipe if present).	INSTRUCTIONS: 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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/0! \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	2 Requirement: VDELTA Where: VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below VDELTA= 311.12 Prece Perorosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet)	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. perforated pipe if present).	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 <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 100%.
$\frac{\text{LID BMP Sizing Tool Delta Volume Capture}}{\text{Formulas:}} V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/0!}{\#\text{DIV}/0!} \text{ft}^{3}$ $A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{0.00} \text{ft}^{2}$ $Percent of Requirement Achieved = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	2 Requirement: V _{DELTA} Where: V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below V _{DELTA} = 311.12 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)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/01 \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved = $\frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	2 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 VDELTA= 311.12 ft ³ Vhere: P= P= 0.0 as a decimal P= 0.0	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. perforated pipe if present).	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/01] \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ Input:	<u>e Requirement</u>: V_{DELTA} <u>Where:</u> $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below V_{DELTA} = <u>311.12</u> ft ³ <u>Vhere:</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) P = D =	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. perforated pipe if present).	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/0! \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ Input:	EXAMPLE 1 Sequence if present is V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below V_{DELTA} = 311.12 ft ³ 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 = 0.0 ft as a decimal P = 0.0 ft as a decimal W = 0.0 ft as a decimal W = 0.0 ft as a decimal	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/01 \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ <u>Input:</u>	EXAMPLE 1 Sector 2 EXAMPLE 1 Sector 2	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. perforated pipe if present).	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	EXAMPLE 1 P = $\begin{bmatrix} 0.0 \\ 0.$	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. perforated pipe if present).	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01 \text{ ft}^3$ $A_{LID DELTA} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement $A_{Chieved} = (D)(A_{LID DELTA})/(D) = X 100$ Input: Yercent of Requirement Achieved = #DIV/01	EXAMPLE 1 Solution 2 A Requirement : V_{DELTA} A UD DELTA = Required volume of soil in LID BMP A LID DELTA = Footprint of LID BMP area for a given depth (below V DELTA = 311.12 ft ³ Yhere: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W = 0.0 ft as a decimal D = 0.0 ft as a decimal D = 0.0 ft Below perforated pipe if preset X = 0.0 ft Below perforated pipe if preset X = 0.0 ft Below perforated pipe if preset	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 <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 100%.





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) = $\frac{1}{1000} \text{ ft}^{2}$	





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	ent			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
l			The C value used for this calculation	on page 3 of this calculator is not
Formula: $(0, 0)$ is $(h_{2})(A_{2})(0) = \lambda(h_{2})(A_{2})$	All second		is smaller than the value used for bydraulic Flood Control design	achieved; then Requirement 1-100%
$Q_{\text{TREATMENT}} = (0.2 \text{ In/nr})(A_r)(C_{\text{POST}})(K) \text{ cts}$	where:		The table of values can be found here	AND Requirement 2. Volume
	CTREATMENT Design flow rate required to be treated (cis)	[10]	The lable of values call be found then	Conturo, page 5 of the coloulator
	C _{POST} = Rational method runoff coefficient for the developed condition	on ^{troj}	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prever	ntion Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]			
Input:				I
	$A_r = 12,302 \text{ ft}^2 = 0.28242 \text{ A}$	Acres		
	$C_{POST}^{[10]} = 0.46$			
	K ^[7] = 1.2			
		NOTE:		I
Solution:	1	The Flow Rate calculate	d here should only be used to size the	
	a	appropriate BMP. All as	ssociated overflow inlets and systems	
Q _{TREATMENT} = 0.03040 cfs	Q _{TREATMENT} = (0.2)(0.2824)(0.46)(1.17)	should be sized for the	Flood Control event.	I
	_			i de la constante de

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2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #18

Requirement 2: Delta Volume Capture No increase in volume of runoff leaving 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
Formulas	achieved; then Requirement 1-100%
	I reatment, page 4 of the calculator,
S = 1000 + 10 Where:	AND Requirement 2- Volume
S= Potential maximum retention after runoff (in)"	Capture, this page of the calculator,
$C = Curve \text{ number}^{(2)}$	must be achieved.
$Q = \frac{[12 \cdot K_1 - (0.2 \cdot S)]}{111} \times \frac{111}{11}$	
$[(P+K)+(0.8 + S)] 12in \qquad \qquad Q= \text{Runoff depth (ft)}^{[6]}$	
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= Volume of Storm Water to be Retained (ft^3)	If the amount of volume generated
A = Reduced Tributary Area including credit for Pollution Prevention Measures (f)	after development is less than or
()	aner development is less than or
Impute (Disk data from down lists as a store as louisted walks a)	equal to that generated before
input . (Pick data from drop down lists or enter calculated values)	development, Requirement 2-Volume
$A_{r} = 12,302 \pi$	Capture is not required.
$K^{(\prime)} = 1.2$	$(C_{\text{POOT}} \leq C_{\text{POT}} \text{ or } CN_{\text{POOT}} \leq CN_{\text{POT}})$
Drop down Lists	(0 POST = 0 PRE 0, OTT POST = OTT PRE)
Select hydrologic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration (transmission) rate	
Select predevelopment ground cover description ^[5] = Woods (50%), grass (50%) combination (orchard or tree farm) - Fair	
Select post development ground cover description ^[5] = Impervious - Paved Parking, Rooftop, Driveways	
CN _{PRE} = 76	
CN _{POST} = 90.3	
OR Composite Predevelopment $CN^{[9]} = 74$	
Composite Post development $(N^{[9]} = 91)$	
Solution	
Pre Development Storm Water Runoff Volume	
S_{PRE} 3.51 in S_{PRE} 100 Where:	
74 S _{PRE} = Pre development potential maximum retention after runoff (in).	
$Q_{PRE} = 0.00301$ ft $Q_{PRE} = Q$ in feet of depth as defined by the "Urban	
Upper [(0.92*1.17)+(0.8 * 3.51)] 12in Hydrology For Small Watersheds" TR-55 Manual,	
$V_{PRF} = 37.03 \text{ ft}^3$ $V_{PRF} = (0.00301)(12.302)$ $V_{PRF} = \text{Pre Development Volume of Storm Water Generated (ff^3)}$	
Post Development Storm Water Runoff Volume	
Spost= 1.01 in Spost= 1000 Where	
Si Spost- Post development potential maximum retention alter runoi (m).	
\mathbf{w}_{Post} 0.05301 If \mathbf{w}_{Post} 10.92 1.17 0.2 1.01 X X 11 C W _{\text{Post}} C in let of depin as defined by the Orban	
[(0.92*1.17)+(0.8 * 1.01)] 12in Hydrology For Small Watersheds" TR-55 Manual.	
V_{POST} 415.93 π^2 V_{POST} (0.03381)(12,302) V_{POST} Post Development Volume of Storm Water Generated (ft ³)	
Solution: Volume Capture Requirement	
Increase in volume of storm water that must be retained onsite (may be infiltrated or reused).	
⁶⁰ Delta Volume Capture= (V _{POST} -V _{PRE}) Delta Volume Capture= (415.93) - (37.03)	
Where:	
VDELTA = 378.90 ft ³ Delta Volume Capture = 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).	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Capt	ure Goal; V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the design goal
$V_{LID GOAL} = ((V_{GOAL}))/(P) = 1103.82 \text{ ft}^3$	Where:	treatment only.	of 100% volume capture of the post
	V _{LID GOAL} = Required volume of soil in LID BMP.		development condition. Enter the
$A_{LID GOAL} = (W)(L) = \frac{420.25}{\text{ft}^2}$	$A_{LID GOAL}$ = Footprint of LID BMP area for a given depth (below per	erforated pipe if present).	and depth below perforated pipe (if
	$V_{GOAL} = \frac{486}{ft^3}$		present). The width and length entries will need to be interactively adjusted
	Where:		until Percent of Goal equals 100%.
Percent of Goal Achieved = $(D)(A_{\text{LID GOAL}})$ x 100	P= Porosity (enter as a decimal)		
VLID GOAL	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 decimal		
	D = 2.6 ft Below perforated pipe if present	t	
	W = 20.5 ft		
	L = 20.5 ft		
Solution		7	
Percent of Goal Achieved = 100 51	$= [(2.6 \times 420) / 1.104] \times 100$	Ĩ	
			-
			INSTRUCTIONS:
LID BMP Sizing Tool Delta Volume Captu	re Requirement: V _{DELTA}	NOTE:	INSTRUCTIONS: The Delta Volume Capture sizing tool
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
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>
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 capture. Enter the percent of porceity
LID BMP Sizing Tool Delta Volume Captu Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0!]ft ³ AUD(4) 0001ft ²	Where: VILID DELTA= VLID 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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below
LID BMP Sizing Tool Delta Volume Captu Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = $ #DIV/0! ft ³ $A_{\text{LID DELTA}} = (W)(L) = $ 0.00 ft ²	I <mark>re Requirement</mark> : V _{DELTA} <u>Where:</u> V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below pe	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width
LID BMP Sizing Tool Delta Volume Captu Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0! ft ³ A _{LID DELTA} =(W)(L) = 0.00 ft ²	Where: VLID DELTA VLID DELTA Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below per VDELTA)	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 <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
LID BMP Sizing Tool Delta Volume Captu Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/0!$ ft ³ $A_{\text{LID DELTA}} = (W)(L) = 0.00$ ft ²	Where: VLID DELTA VLID DELTA Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below per VDELTA)	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 <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
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/0!$ ft ³ $A_{\text{LID DELTA}} = (W)(L) = 0.00$ ft ² Percent of Requirement (D)(Aupper ta)	Where: $V_{\text{LID DELTA}}$ Where: $V_{\text{LID DELTA}}$ = Footprint of LID BMP area for a given depth (below per V_{DELTA} = 378.90 ft ³ Where: P= Porosity (epter as a decimal)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/0!$ ft ³ $A_{\text{LID DELTA}} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved = $\frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	Where: $V_{\text{LID DELTA}}$ VLID DELTA ⁼ Required volume of soil in LID BMP A_{\text{LID DELTA}} Footprint of LID BMP area for a given depth (below per V_{DELTA} 378.90 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.	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/0!$ ft ³ $A_{\text{LID DELTA}} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved = $\frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	Where: $V_{\text{LID DELTA}}$ VLID DELTA ⁼ Required volume of soil in LID BMP A_{\text{LID DELTA}} Footprint of LID BMP area for a given depth (below per V_{DELTA} 378.90 ft ³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) Win decimal feet)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{\text{UD DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/01$ ft ³ $A_{\text{UD DELTA}} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved $= \frac{(D)(A_{\text{UD DELTA}})}{V_{\text{UD DELTA}}} \times 100$	where: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ Required volume of soil in LID BMP A_{LD DELTA} Footprint of LID BMP area for a given depth (below per V_{DELTA} 378.90 ft ³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) With (in decimal feet) U With (in decimal feet) U With (in decimal feet)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/01 \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	where: $V_{LD DELTA}$ VLID DELTA = Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below per $V_{DELTA} =$ 378.90 ft ³ 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)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Where: VLID DELTA = Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below per volume) VELTA = 378.90 ft ³ 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 = 0.0 as a decimal D = 0.0 the Below perforated pipe if present	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/0! \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ Input:	Where: VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below per ALID DELTA = Footprint of LID BMP area for a given depth (below per VDELTA = 378.90 ft ³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= 0.0 t as a decimal D= 0.0 t Below perforated pipe if present	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/(0)$ ft ³ $A_{\text{LID DELTA}} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ Input:	Where: VLID DELTA = Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below per ALID DELTA = \$1000000000000000000000000000000000000	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/01$ ft ³ $A_{\text{LID DELTA}} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ Input:	Where: VLID DELTA = Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below performing the second seco	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/0! ft^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 ft^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ Input: Solution:	Where: $V_{LID DELTA}$ VLID DELTA Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below per VDELTA 378.90 ft ³ Where: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) Width (in decimal feet) U Width (in decimal feet) L = Length (in decimal feet) as a decimal D = 0.0 ft Below perforated pipe if present	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/0!]$ ft ³ $A_{\text{LID DELTA}} = (W)(L) = 0.00$ ft ² Percent of Requirement achieved = $(D)(A_{\text{LID DELTA}})$ x 100 Input: Solution: N Percent of Requirement Achieved = #DIV/0!	matrix Where: VLID DELTA = Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below performed provided prov	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 <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 100%.





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	





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.





				l
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
			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:		nyaraunc Flood Control design.	I reatment, 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 conditi	on ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Preven	ntion Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]	· · · ·		
Input:	$A_{r} = 20,821 \text{ ft}^{2} = 0.47798 \text{ /}$ $C_{POST}^{[10]} = 0.36 \text{ /}$ $K^{[7]} = 1.2$	Acres		
		NOTE:		
Solution:	·	The Flow Rate calculate appropriate BMP,All as	ed here should only be used to size the ssociated overflow inlets and systems	
Q _{TREATMENT} = 0.04027 cfs	Q _{TREATMENT} ⁼ (0.2)(0.4780)(0.36)(1.17)	should be sized for the	Flood Control event.	

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Requirement 2: Delta Volume Capture No increase in volume of runoff leaving the site due to development for the 85th percentile 24 hour storm event. Formulas: S = 1000 - 10 Where: S = 000 - 10 S = Potential maximum retention after runoff (in) ⁵ CN = Curve Number ^[5]	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not achieved; then Requirement 1-100% Treatment, page 4 of the calculator, AND Requirement 2- Volume Capture, this page of the calculator, must be achieved.
$Q = \frac{(P+K)-(0.2+S)^2}{X} \frac{1 \text{ft}}{W \text{ here:}}$	
[(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	
$V = (Q)(A_r) \qquad \qquad Where: \qquad \qquad out a.$	NOTE:
V= Volume of Storm Water to be Retained (ft^3) A _r = Reduced Tributary Area including credit for Pollution Prevention Measures (f')	If the amount of volume generated after development is less than or equal to that generated before
Input: (Pick data from drop down lists or enter calculated values) $A_r = \frac{20,821}{K^{[7]}} ft^2$	development, Requirement 2-Volume Capture is not required. $(C_{POST} \le C_{PRE} \text{ or } CN_{POST} \le CN_{PRE})$
Drop down Lists	
Select hydrologic soli type within tributary area $' = C$: 0.05 - 0.15 in/hr inflitration (transmission) rate Select predevelopment around cover description ^[5] = Woods (50%) grass (50%) combination (orchard or tree farm) - Fair	
Select post development ground cover description ^[5] = Impervious - Paved Parking, Rooftop, Driveways	
CN _{PRE} = 76	
CN _{POST} = 90.3	
$\underline{OR} \qquad Composite Predevelopment CN^{[9]} = \underline{74}$	
Composite Post development CN ¹⁰¹ = 88	
Dre Development Storm Water Punoff Volume	
Same 1000 Million Same 1000	
The second secon	er runoff (in).
$\mathbf{Q}_{PRE} = \underbrace{0.00301}_{ft} ft \qquad \mathbf{Q}_{PRE} = \underbrace{\frac{[(0.92^*1.17) \cdot (0.2^*3.51)]^2}{[(0.92^*1.17) + (0.8^*3.51)]}}_{I(0.92^*1.17) + (0.8^*3.51)]} \times \underbrace{\frac{1 \mathrm{ft}}{12 \mathrm{in}}}_{I(I(I(I(I(I(I(I$	
V_{PRE} = 62.67 ft ³ V_{PRE} = (0.00301)(20,821) V_{PRE} = Pre Development Volume of Storm Water Generate	ated (ft ³)
Post Development Storm Water Runoff Volume	
$S_{POST} = 1.39 \text{ in } S_{POST} = 1000 \text{ Where:}$	
-10 S _{POST} = Post development potential maximum retention after	fter runoff (in).
$\mathbf{Q}_{\text{POST}} = \underbrace{0.02427}_{\text{I}} \text{ft} \qquad \mathbf{Q}_{\text{POST}} = \underbrace{\left[(0.92^{*}1.17) - (0.2^{*}1.39) \right]^{2}}_{\left[(0.92^{*}1.17) + (0.8^{*}1.39) \right]} \times \underbrace{\frac{1 \text{ft}}{12 \text{in}}}_{\text{Hydrology For Small Watersheds'' TR-55 Manual.}}$	
V_{POST} = 505.33 ft ³ V_{POST} = (0.02427)(20,821) V_{POST} = Post Development Volume of Storm Water General	rated (ft ³)
Solution: Volume Capture Requirement	
Increase in volume of storm water that must be retained onsite (may be infiltrated or reused).	
^C Delta Volume Capture= (V _{POST} -V _{PRE}) Delta Volume Capture= (505.33) - (62.67)	
Where: Delta Volume Capture: The increases in volume of stars write account of the	by the 95th
- DELTA 442.00 ft ^o Delta visione optication of storm water generated b percentile 24 hour storm event due to development retained onsite (may be inflitrated or reused).	nt that must be



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Captu	<u>ıre Goal;</u> V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the design goal
$V_{LID GOAL} = ((V_{GOAL}))/(P) = 1375.13$ ft ³	Where:	treatment only.	of 100% volume capture of the post
	$V_{\text{LID GOAL}}$ = Required volume of soil in LID BMP.		percent porosity of the specified soil
$A_{\text{LID GOAL}}=(W)(L) = 650.25$	A _{LID GOAL} = Footprint of LID BMP area for a given depth (below perfo	brated pipe if present).	and depth below perforated pipe (if
	$V_{GOAL} = \frac{605}{1000}$ ft ³		present). The width and length entries
			will need to be interactively adjusted
	Where:		until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{X} \times 100$	P= Porosity (enter as a decimal)		
V _{LID GOAL}	D= Depth below perforated pipe if present (in decimal feet)		
	L= Length (in decimal feet)		
<u>input:</u>	P = 0.4 as a decimal		
	$W = \frac{255}{100}$ ff		
	L = 25.5 ft		
Solution:		7	
Percent of Goal Achieved = 101.19	% = [(2.1 x 650) / 1,375] x 100		
I ID BMP Sizing Tool Delta Volume Captu	re Requirement : V	NOTE	The Delta Volume Capture sizing tool
LID Divit Olzing 1001 Deita Volume Capital	Te Requirement. VDELTA	LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the <u>design</u>
$V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/0!}{\#\text{DIV}/0!} \text{ft}^3$	Where:	treatment only.	requirement of the delta volume
 +2	$V_{LID DELTA}$ = Required volume of soil in LID BMP		<u>capture</u> . Enter the percent of porosity
$A_{\text{LID DELTA}}=(W)(L) = 0.00 \text{ ft}^2$	A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perfo	prated pipe if present).	perforated pipe (if present). The width
	$V_{-1} = 442.65 \text{ ft}^3$		and length entries will need to be
	DELIA 442.00		-
			interactively adjusted until "Percent of
	Where:		interactively adjusted until "Percent of Requirement achieved" reaches
Percent of Requirement $= \frac{(D)(A_{LID DELTA})}{(D)} + 100$	Where: P= Porosity (enter as a decimal)		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
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)		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
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%.
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%.
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) P = 0.0 as a decimal		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	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 = 0.0 D = 0.0 ft Below perforated pipe if present		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	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 = 0.0 ft Below perforated pipe if present W = 0.0 ft Below perforated pipe if present		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	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 = 0.0 ft Below perforated pipe if present U = 0.0 ft Below perforated pipe if present		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	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)D =D =0.0M =0.0ftL =0.0ft		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: Solution: Percent of Requirement Achieved = #DIV/01	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 = 0.0 p = 0.0 p = 0.0 p = 0.0 ft Below perforated pipe if present % = #DIV/0!		interactively adjusted until "Percent of Requirement achieved" reaches 100%.
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: Solution: Percent of Requirement Achieved = #DIV/01	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 = 0.0 D = 0.0 M = 0.0 <td></td> <td>interactively adjusted until "Percent of Requirement achieved" reaches 100%.</td>		interactively adjusted until "Percent of Requirement achieved" reaches 100%.





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 Area Reduction due to new Evergreen Trees= 0 ft ²	New Evergreen Trees NOTE: Total Interceptor Area (200 ft²/tree) 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.
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)	
Enter square footage of qualifying existing tree canopy = 0 Allowed reduction credit for existing tree canopy= 0 ft ²	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	nt			INSTRUCTIONS:
Treatment of 100% of the flow generated b	y 85th percentile 24 hour mean annual rain event (0.2 i	n/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/nr)(A _r)(C _{POST})(K) CTS	Where:		The table of values can be found here	I reatment, this page of the calculator,
	QTREATMENT Design flow rate required to be treated (cfs)	lanad condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator
	A = Reduced Tributery Area including aredit for P	eloped condition	to size the overflow bypass.	must be achieved
	K = Seasonal Precipitation Factor[7]	Silution revention measures (in Acres)		
Input:	$A_r = \frac{15,006}{C_{POST}} ft^2 = \frac{15,006}{0.46}$	0.34449 Acres		
	K ^[7] = 1.2			
		NOTE:		
Solution:		The Flow Rate calculate	ed here should only be used to size the	
Q _{TREATMENT} = 0.03708 cfs	Q _{TREATMENT} = (0.2)(0.3445)(0.46)(1.17)	appropriate BMP. All as should be sized for the	ssociated overflow inlets and systems Flood Control event.	



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Requirement 2: Delta Volume Canno increase in volume of runoff leaving the	apture 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%
Formulas:			Treatment, page 4 of the calculator
<u>s = 1000_10</u>	Where:		AND De suisses est 2. Malures
$S = \frac{1000}{CN} - 10$	<u>Where.</u>		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) *		Capture, this page of the calculator,
	CN= Curve Number		must be achieved.
$Q = [(P * K) - (0.2 * S)]^2 \times \frac{1ft}{1}$	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)	Where: data.		NOTE
$V = (Q)(A_r)$	where.		
	V= Volume of Storm Water to be Retained (ft [*])		If the amount of volume generated
	A _r = Reduced Tributary Area including credit for Pollution Pr	evention Measures (f)	after development is less than or
			equal to that generated before
Input: (Pick data from drop down lists o	or enter calculated values)		development Requirement 2-Volume
	$A_r = 15.006 \text{ ft}^2$		Canture is not required
	K ^[7] – 4.2		Capture is not required.
	n···= 1.2		$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE})$
	Drop dov	wn Lists	
Select hydrolo	ogic soil type within tributary area ^{8]} = C: 0.05 - 0.15 in/hr infiltration (1	transmission) rate	
Select predevelo	opment ground cover description ^[5] = Woods (50%), grass (50%) com	bination (orchard or tree farm) - Fair	
Select post develo	opment ground cover description ^[5] = Impervious - Paved Parking, Ro	ooftop, Driveways	
	CN _{DDE} = 76		
0.5			
C	composite Post development CN ^[9] = 91		
Solution:			
Pre Development Storm Water Runof	fVolume		
	P = 1000		
S _{PRE} = 3.51 in	$S_{PRE} = \frac{1000}{-10}$	Where:	
	74	S _{PRE} = Pre development potential maximum retention after runoff (in).	
Q _{PRF} = 0.00301 ft	$(0.92^{*}1.17) - (0.2^{*}3.51)^{2} \times 1$ ft	$Q_{\text{DDE}} = Q$ in feet of depth as defined by the "Urban	
	$Q_{PRE} = \frac{1}{(0.02 \times 1.17) \times (0.2 \times 2.51)} \times \frac{1}{12in}$	Hudrology For Small Watersheds" TP 55 Manual	
	$[(0.92 \ 1.17)^{+}(0.8 \ 3.51)] \qquad 12111$	Hydrology For Small Watersneus TR-55 Manual.	
	V = (0.00004)(45.000)		
V _{PRE} - 45.17	Ψ_{PRE} (0.00301)(15,006)	V _{PRE} - Pre Development Volume of Storm Water Generated (ft ^e)	
	<i>a</i> , <i>i</i>		
Post Development Storm Water Runo	off Volume		
S _{POST} = 1.01 in	S_{POST} = 1000	Where:	
	91 -10	S_{poor} = Post development potential maximum retention after runoff (in)	
	0.		
0=	$0 = [(0, 0, 0, 1, 1, 7), (0, 0, 1, 1, 0, 1)]^2 + \frac{1}{2}$	• - O in fact of donth as defined by the " little	
QPOST 0.03381 ft	$W_{POST} = \frac{[(0.92^{-1}.17)-(0.2^{-1}.01)]^2}{[(0.92^{-1}.01)]^2} \times \frac{111}{2}$	$Q_{POST} = Q$ in reet of depth as defined by the "Urban	
	[(0.92*1.17)+(0.8 * 1.01)] 12in	Hydrology For Small Watersheds" TR-55 Manual.	
V _{POST} = 507.35 ft ³	V _{POST} = (0.03381)(15,006)	V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
Solution: Volume Capture Requirer	ment		
Increase in volume of storm v	water that must be retained onsite (may be infiltrated or reused)		
	water that must be retained onsite (may be initiated of reused).		
		-	
Delta Volume Capture= (V _{POST} -V _P	RE) Delta Volume Capture= (507.35) - (45.1	17)	
		Where:	
V _{DELTA} = 462.	18 ft ³ Delta Volu	ume Capture= 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 PMD Sizing Tool: 100% Volume Cont		NOTE	INSTRUCTIONS: The 100% volume capture sizing tool
	ure Goal, V _{GOAL}	NOTE:	helps the designer appropriately size
Formulas:		LID Sizing Tool only applicable for volume	a LID BMP to achieve the design goal
1000000000000000000000000000000000000	Where ·	treatment only.	of 100% volume capture of the post
VLID GOAL - ((V GOAL)//(F) - 1340.43	Vup con = Required volume of soil in LID BMP		development condition. Enter the
$A_{\text{UD COAL}} = (W)(L) = \frac{750.76}{\text{ft}^2}$	$A_{\text{HD}COM}$ = Footprint of LID BMP area for a given depth (below perforated b)	ine if present)	percent porosity of the specified soil
		.po p. 000.1.).	and depth below perforated pipe (if
	$V_{GOAL} = 592 \text{ ft}^3$		present). The width and length entries
			will need to be interactively adjusted
	Where:		until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $(D)(A_{LID GOAL})$ x 100	P= Porosity (enter as a decimal)		
V _{LID GOAL}	D= Depth below perforated pipe if present (in decimal feet)		
	vv= vviatn (in decimal feet)		
Input:	P = 0.4 as a decimal		
	D = <u>1.8</u> ft Below perforated pipe if present		
	W = 27.4 ft		
	L = 27.4 ft		
Ochetiane		_	
Solution:		7	
Percent of Goal Achieved = 100.37	% = [(1.8 x /51) / 1,346] x 100		
			J
			INSTRUCTIONS:
LID BMP Sizing Tool Delta Volume Captu	re Requirement : V	NOTE:	INSTRUCTIONS: The Delta Volume Capture sizing tool
LID BMP Sizing Tool Delta Volume Captu	ire Requirement: V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size
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>
LID BMP Sizing Tool Delta Volume Captu <u>Formulas:</u> 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
LID BMP Sizing Tool Delta Volume Captur <u>Formulas:</u> V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0! ft ³	Ire Requirement: 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
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/01] \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ft}^2$	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 perfor	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 of the specified soil and depth below perforated pipe (if proceed). The width
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/01] \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ft}^2$	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 p	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 <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
LID BMP Sizing Tool Delta Volume Captur Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0!] ft ³ A _{LID DELTA} =(W)(L) = 0.00 ft ²	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 p VDELTA= 462.18	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 <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
LID BMP Sizing Tool Delta Volume Captu Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0!] ft ³ A _{LID DELTA} =(W)(L) = 0.00 ft ²	Where: V_LID DELTA= V_LID DELTA= Required volume of soil in LID BMP A_LID DELTA= Footprint of LID BMP area for a given depth (below perforated pick of the second sec	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 <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
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/0!] ft^3$ $A_{LID DELTA} = (W)(L) = 0.00] ft^2$ Percent of Requirement (D)(Autory to)	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= 462.18 Where: P= Percesity	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> <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/0!$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Where: V_LID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below perforated pictor) V_DELTA= 462.18 Where: P= Porosity (enter as a decimal) D= Depth below perforated pice if present (in decimal feet)	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> <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01 \text{ ft}^3$ $A_{LID DELTA} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Where: $V_{\text{LID DELTA}}$ $V_{\text{LID DELTA}}$ 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} 462.18 P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet)	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> <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01 \text{ ft}^3$ $A_{LID DELTA} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Intermet V Where: V V V V V V DELTA Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below perforated p V VDELTA 462.18 ft ³ Where: P 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)	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> <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01 \text{ ft}^3$ $A_{LID DELTA} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Where: $V_{\text{LID DELTA}}$ $V_{\text{LID DELTA}}$ 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} 462.18 ft ³ 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)	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> <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Intermediation 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} 462.18 ft ³ 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 = 0.0 as a decimal	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ipe if present).	INSTRUCTIONS: 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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Intermediation 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= 462.18 ft ³ 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 = 0.0 p = 0.0 p = 0.0 ft Below perforated pipe if present	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> <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Intermediation Where: VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below perforated provided pro	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ipe if present).	INSTRUCTIONS: 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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Intermediation Where: VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below perforated provided performing) VDELTA= 462.18 ft ³ Where: P= Porosity (enter as a decimal) D= Deth below perforated pipe if present (in decimal feet) W= 0.0 ft Below perforated pipe if present W= 0.0 ft Below perforated pipe if present W= 0.0 ft Below perforated pipe if present	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ipe if present).	INSTRUCTIONS: 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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Intermediation 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 462.18 ft ³ 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 = 0.0 as a decimal D = 0.0 ft Below perforated pipe if present W = 0.0 ft	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ipe if present).	INSTRUCTIONS: 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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: Solution: \Rightarrow Percent of Requirement Achieved = #DIV/01	with the second state in the secon	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ipe if present).	INSTRUCTIONS: 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 100%.





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.
Solution:	
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	ent			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
<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 cond	tion ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prev	ention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]	· · · · ·		
Input:				
	A _r = 43,427 ft ² = 0.99695	Acres		
	C _{POST} ^[10] = 0.34			
	K ^[7] = 1.2			
		NOTE:		
Solution:		The Flow Rate calculate	ed here should only be used to size the	
		appropriate BMP. All a	ssociated overflow inlets and systems	
Q _{TREATMENT} = 0.07932 cfs	Q _{TREATMENT} = (0.2)(0.9969)(0.34)(1.17)	should be sized for the	Flood Control event.	



2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #22

Requirement 2: Delta Volume Capture No increase in volume of runoff leaving the site due to a Formulas: S = 1000 - 10 CN	development for the 85th percentile 24 hour storm e Potential maximum retention after runoff (in) ^{6]} Curve Number ^[5]	event.	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not achieved; then Requirement 1-100% Treatment, page 4 of the calculator, AND Requirement 2- Volume Capture, this page of the calculator, must be achieved
Q= $[(P * K) - (0.2 * S)]^2$ _ 1ft Where:			inust be achieved.
[(P+K)+(0.8 + S)] X 12in Q	= Runoff depth (ft) ^[6] = Precipitation (in) = 0.92 = Seasonal Precipitation Factor ^[7] area, based on l	ne Santa Rosa local historical	
V= (Q)(A _r) Where:	data.		NOTE:
V A,	 Volume of Storm Water to be Retained (ft³) Reduced Tributary Area including credit for Pollution P 	revention Measures (ť)	If the amount of volume generated after development is less than or equal to that generated before
Input: (Pick data from drop down lists or enter calcu	ated values) $A_r = \frac{43,427}{K^{(7)}} ft^2$		development, Requirement 2-Volume Capture is not required. ($C_{POST} \le C_{PRE}$ or $CN_{POST} \le CN_{PRE}$)
	Drop do	wn Lists	
Select nydrologic soll type	within tributary area $= C_1^{(5)} = W_{00} ds (50\%) drass (50\%) com$	(transmission) rate	
Select post development groun	d cover description ^[5] = Impervious - Paved Parking, Re	ooftop, Driveways	
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
OR Composite P	redevelopment CN ^[9] = 80		
Composite Pos	st development CN ^[9] = 87		
Bro Dovelopment Storm Water Pupoff Volume			
S _{PRE} = 2.50 in	S _{PRE} = <u>1000</u> 80 -10	$\frac{\text{Where:}}{\text{S}_{\text{PRE}}\text{=}} \text{ Pre development potential maximum retention after runoff}$	(in).
Q _{PRE} = 0.00900 ft	$\mathbf{Q}_{PRE} = \begin{array}{c} \frac{[(0.92^{*}1.17) - (0.2^{*}2.50)]^2}{[(0.92^{*}1.17) + (0.8^{*}2.50)]} & X \frac{1\mathrm{ft}}{12\mathrm{in}} \end{array}$	Q _{PRE} ≓ Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{PRE} = 390.84 ft ³	V _{PRE} = (0.00900)(43,427)	V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Post Development Storm Water Runoff Volume	0 – 4000		
S _{POST} = 1.45 in	Spost <u>1000</u> -10 87	Where: S _{POST} = Post development potential maximum retention after runof	f (in).
Q _{POST} = 0.02304 ft	$\mathbf{Q}_{\text{POST}} = \frac{[(0.92^{*}1.17) \cdot (0.2^{*}1.45)]^2}{[(0.92^{*}1.17) \cdot (0.8^{*}1.45)]} \times \frac{1\text{ft}}{12\text{in}}$	Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{POST} = 1000.56 ft ³	V _{POST} = (0.02304)(43,427)	V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
Solution: Volume Capture Requirement	ust be retained onsite (may be infiltrated or reused)		
	act of retained oneste (may be initiated of reused)	·	
Delta Volume Capture= (V _{POST} -V _{PRE})	Delta Volume Capture= (1,000.56) - (39	90.84) Where:	
V _{DELTA} = 609.72 ft ³	Delta Vol	lume Capture= The increase in volume of storm water generated by the 84 percentile 24 hour storm event due to development that m retained onsite (may be infiltrated or reused).	5th ust be



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Capture	e Goal; V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the design goal
$V_{\text{LID GOAL}} = ((V_{\text{GOAL}}))/(P) = 2733.93 \text{ ft}^3$	Where:	treatment only.	of 100% volume capture of the post
	V _{LID GOAL} = Required volume of soil in LID BMP.		percent porosity of the specified soil
$A_{LID GOAL} = (W)(L) = 1274.49$ ft ²	$A_{LID GOAL}$ = Footprint of LID BMP area for a given depth (below	w perforated pipe if present).	and depth below perforated pipe (if
	V _{GOAL} = 1,203 ft ³		present). The width and length entries will need to be interactively adjusted
			until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $(D)(A_{UD,GOAL})$	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 decimal		
	D = 2.2 ft Below perforated pipe if pres	sent	
	W = <u>35.7</u> ft		
	L = <u>35.7</u> ft		
Solution		7	
Percent of Goal Achieved = 102 56 %	$= [(2, 2 \times 1, 274) / 2, 734] \times 100$	I I	
	- [(2.2 × 1,2/4)/2,/34] × 100		
			4
			INSTRUCTIONS:
LID BMP Sizing Tool Delta Volume Capture	Requirement: V _{DELTA}	NOTE:	INSTRUCTIONS: The Delta Volume Capture sizing tool
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
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 troot 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
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 capture. Enter the percent of porosity
LID BMP Sizing Tool Delta Volume Capture Formulas: VLID DELTA=((VDELTA))/(P) = #DIV/01 ft ³ A = -(MD(4)) = [0.00] ft ²	Mequirement: VDELTA Where: VLID DELTA= VLID 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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA}$ =((V_{DELTA}))/(P) = #DIV/01 ft ³ $A_{LID DELTA}$ =((W)(L) = 0.00 ft ²	Mere: VLID DELTA= Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below)	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA}=(W)(L) = $ 0.00 ft ²	Mere: VLID DELTA VLID DELTA Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below VDELTA 609.72	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 <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
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ²	Mere: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below VDELTA= 609.72	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 <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
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ² Percent of Requirement (D)(A _{LID DELTA})	Mere: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below VDELTA= 609.72 ft ³ 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 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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ² Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Merce: $V_{\text{LID DELTA}}$ 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 V_{DELTA} 609.72 ft ³ Percosity (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.	INSTRUCTIONS: 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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement $A_{CHD DELTA} = $ $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Mere: V_DELTA $V_{\text{LID DELTA}}$ Required volume of soil in LID BMP $A_{\text{LID DELTA}}$ Footprint of LID BMP area for a given depth (below V_{DELTA} 609.72 ft ³ Fere: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) We Width (in decimal feet)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Mere: V_DELTA $V_{LID DELTA}$ Required volume of soil in LID BMP $A_{LID DELTA}$ Footprint of LID BMP area for a given depth (below V_{DELTA} 609.72 ft ³ here: P 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)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement $A_{CHD DELTA} = $ $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Mere: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP A_{LID DELTA} = Footprint of LID BMP area for a given depth (below V_{DELTA} = 609.72 ft 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)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement $A_{Chieved}$ $=$ $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Mere: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP A_{LID DELTA} = Footprint of LID BMP area for a given depth (below V_{DELTA} = 609.72 ft³ Here: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) We Width (in decimal feet) U = Units 0.0 t = Length (in decimal feet) as a decimal D = 0.0 t = Below perforated pipe if present (in decimal fipe if present) Below perforated pipe if present)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement $A_{Chieved}$ $=$ $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} x 100$ Input:	Mere: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below VDELTA= 609.72 ft ³ Here: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= 0.0 ft Below perforated pipe if present W = 0.0	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement $A_{Chieved}$ $=$ $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Mere: $V_{LID DELTA}$ VLID DELTA = Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below VDELTA = 609.72 ft³ Mere: P = 0000 ft (in decimal feet) D = Depth below perforated pipe if present (in decimal feet) W = 0.00 ft (in decimal feet) D = 0.0 ft 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.	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/(0!)$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement $A_{Chieved} = \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Mere: $V_{LID DELTA}$ VLID DELTA = Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below VDELTA = 609.72 ft 3 Here: P = 0000 ft D = Depth below perforated pipe if present (in decimal feet) W = 0.0 as a decimal D = 0 0.0 ft 1 Below perforated pipe if present	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/(0)$ $A_{LID DELTA} = (W)(L) = 0.00$ ft^2 Percent of Requirement $A_{Chieved}$ $M_{LID DELTA}$ $A_{Chieved}$ $W_{LID DELTA}$ $M_{LID DELTA}$	Requirement: V_{DELTA} Where: $V_{LD DELTA}$ = Required volume of soil in LID BMP $A_{LD DELTA}$ = Footprint of LID BMP area for a given depth (below V_{DELTA} = 609.72 ft 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) W = 0.0 M = 0.0	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01 ft^3$ $A_{LID DELTA} = (W)(L) = 0.00 ft^2$ Percent of Requirement $A_{Chieved}$ $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: Solution: Percent of Requirement Achieved = #DIV/01 %	Requirement: V_{DELTA} Where: $V_{LD DELTA}$ = Required volume of soil in LID BMP $A_{LD DELTA}$ = Footprint of LID BMP area for a given depth (below V_{DELTA} = 609.72 ft ³ tere: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= 0.0 ft D = 0.0 ft Below perforated pipe if present u as a decimal D = 0.0 ft Below perforated pipe if present u = 0.0 ft Below perforated pipe if present u = 0.0 ft Below perforated pipe if present u = 0.0 ft Below perforated pipe if present u = 0.0 ft	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 <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 100%.





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= 0 Area Reduction due to new Evergreen Trees= 0 ft ² Number of new <i>Deciduous Trees</i> that qualify as interceptor trees= 0	New Evergreen Trees NOTE: Total Interceptor Area (200 ft²/tree) Reduction is limited to 50% of the physical tributary area. New Deciduous Trees New Deciduous Trees	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.
Area Reduction due to new Deciduous Trees=	(100 ft²/tree)	
Enter square footage of qualifying existing tree canopy = 0 Allowed reduction credit for existing tree canopy= 0 ft ²	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]	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.





Requirement 1: 100% Treatme	ent			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
<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 cond	tion ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prev	ention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]	· · · · ·		
Input:				
	A _r = 43,427 ft ² = 0.99695	Acres		
	C _{POST} ^[10] = 0.34			
	K ^[7] = 1.2			
		NOTE:		
Solution:		The Flow Rate calculate	ed here should only be used to size the	
		appropriate BMP. All a	ssociated overflow inlets and systems	
Q _{TREATMENT} = 0.07932 cfs	Q _{TREATMENT} = (0.2)(0.9969)(0.34)(1.17)	should be sized for the	Flood Control event.	



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Requirement 2: Delta Volume Capture No increase in volume of runoff leaving the site due to development for the 85th percentile 24 hour storm event. Formulas: S = 1000 - 10 Where: CN S= Potential maximum retention after runoff (in) ⁵	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not achieved; then Requirement 1-100% Treatment, page 4 of the calculator, AND Requirement 2- Volume Capture, this page of the calculator,
CN= Curve Number ^{10j}	must be achieved.
$ \begin{array}{c} Q = \underbrace{(P \cdot K) (0.2 \cdot S)!}_{(P \cdot M) (0.2 \cdot S)!} \times \underbrace{Ift}_{(P \cdot M)} & \underbrace{Where:}_{(P \cdot M) (0.2 \cdot S)!} \\ \end{array} $	
[(P+K)+(0.8 + S)] 12in Q= Runoff depth (ft) ¹⁰ 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= Volume of Storm Water to be Retained (ft^3) A _r = Reduced Tributary Area including credit for Pollution Prevention Measures (f')	If the amount of volume generated after development is less than or equal to that generated before
Input: (Pick data from drop down lists or enter calculated values) $A_r = \frac{43,427}{K^{[7]}} ft^2$ $K^{[7]} = \frac{1.2}{1.2}$	development, Requirement 2-Volume Capture is not required.
Drop down Lists	(C POST S C PRE OF CIN POST S CIN PRE)
Select hydrologic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration (transmission) rate	
Select predevelopment ground cover description ^[5] = Woods (50%), grass (50%) combination (orchard or tree farm) - Fair	
CN _{npc} = 76	
OR Composite Predevelopment CN ^[9] = 80	
Composite Post development CN ^[9] = 87	
Solution:	
Pre Develop <u>ment Storm Wat</u> er Runoff Volume	
$S_{PRE} = \underbrace{2.50}_{in} \text{ in } S_{PRE} = \underbrace{1000}_{80} -10 \qquad \underbrace{Where:}_{S_{PRE} = Pre \text{ development potential maximum retention after runoff (in).}}$	
$\mathbf{Q}_{PRE} = \underbrace{0.00900}_{(0.92*1.17)-(0.2*2.50)]^2}_{[(0.92*1.17)+(0.8*2.50)]} \times \underbrace{\frac{1 \text{ft}}{12 \text{in}}}_{\text{Hydrology For Small Watersheds" TR-55 Manual.}}$	
V_{PRF} = 390.84 ft ³ V_{PRF} = (0.00900)(43,427) V_{PRF} = Pre Development Volume of Storm Water Generated (ft ³)	
Post Development Storm Water Runoff Volume	
S _{POST} = <u>1.45</u> in S _{POST} = <u>1000</u> -10 <u>Where:</u>	
87 S _{POST} = Post development potential maximum retention after runoff (in).	
$\mathbf{Q}_{\text{POST}} = \underbrace{0.02304}_{\text{Ift}} \text{ft} \qquad \mathbf{Q}_{\text{POST}} = \underbrace{\left[(0.92^{*}1.17) - (0.2^{*}1.45) \right]^2}_{\left[(0.92^{*}1.17) + (0.8^{*}1.45) \right]} \times \underbrace{\frac{1 \text{ft}}{12 \text{in}}}_{\text{Hydrology For Small Watersheds" TR-55 Manual.}}$	
$V_{POST} = 1000.56$ ft ³ $V_{POST} = (0.02304)(43,427)$ $V_{POST} = Post Development Volume of Storm Water Generated (ft3)$	
Solution: Volume Capture Requirement	
Increase in volume of storm water that must be retained onsite (may be infiltrated or reused).	
Delta Volume Capture= (V _{POST} -V _{PRE}) Delta Volume Capture= (1,000.56) - (390.84)	
V _{DELTA} = 609.72 ft ³ Where: Delta Volume Capture= 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)	



		INSTRUCTIONS:
LID BMB Sizing Tool: 100% Volume Capture Goal: V	NOTE	The 100% volume capture sizing tool
LID DWP Sizing 1001. 100% volume capture Goal, v _{GOAL}	ID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:	based BMPs. Not required if site requires	a LID BMP to achieve the design goal
$V_{\rm UD}$ GOAL = ($V_{\rm GOAL}$)/(P) = 2733.93 ft ³ Where:	treatment only.	of 100% volume capture of the post
V _{LID GOAL} = Required volume of soil in LID BMP.		development condition. Enter the
A _{LID GOAL} =(W)(L) = 1274.49 ft ² A _{LID GOAL} = Footprint of LID BMP area for a given depth (below perforated pi	pe if present).	percent porosity of the specified soil
		and depth below perforated pipe (if
$V_{\text{GOAL}} = 1,203$ ft ²		will need to be interactively adjusted
		until "Percent of Goal" equals 100%
<u>Where</u>		
Percent of Goal Achieved = $\frac{(0)(ALD GOAL)}{x 100}$ x 100 Ver any x 100		
W= Width (in decimal feet)		
L= Length (in decimal feet)		
Input: P = 0.4 as a decimal		
$W = \frac{357}{4}$		
Solution:	7	
Percent of Goal Achieved = 102.56 % = [(2.2 x 1,274) / 2,734] x 100		
		INSTRUCTIONS:
LID BMP Sizing Tool Delta Volume Capture Requirement: V _{DELTA}	NOTE:	I ne Delta Volume Capture sizing tool
Formulaa	LID Sizing Tool only applicable for volume	a LID BMP to achieve the design
$\frac{POTITUIAS.}{V_{1}} = \frac{POTITUIAS}{V_{1}} $	treatment only.	requirement of the delta volume
Viub DeLta (V DeLta (V DeLta (V))	-	capture. Enter the percent of porosity
$A_{\text{UD DELTA}}$ = (W)(L) = 0.00 ft ² $A_{\text{UD DELTA}}$ = Footprint of LID BMP area for a given depth (below perforated pi	pe if present).	of the specified soil and depth below
	r - F 3	perforated pipe (if present). The width
$V_{\text{DELTA}} = 609.72 \text{ ft}^3$		and length entries will need to be
		Interactively adjusted until "Percent of Requirement achieved" reaches
Where:		100%
		10070.
Percent of Requirement = $\frac{(D)(A_{LID DELTA})}{N} \times 100$ P= Porosity (enter as a decimal)		
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet)		
$\begin{array}{l} \text{Percent of Requirement} \\ \text{Achieved} \end{array} = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100 \\ \end{array} \\ \begin{array}{l} \text{P= Porosity} (\text{enter as a decimal}) \\ \text{D= Depth below perforated pipe if present} (\text{in decimal feet}) \\ \text{W= Width} (\text{in decimal feet}) \\ \text{L= Length} (\text{in decimal feet}) \end{array}$		
$\begin{array}{l} \text{Percent of Requirement} \\ \text{Achieved} \end{array} = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100 \\ \end{array} \\ \begin{array}{l} \text{P= Porosity} (\text{enter as a decimal}) \\ \text{D= Depth below perforated pipe if present} (\text{in decimal feet}) \\ \text{W= Width} (\text{in decimal feet}) \\ \text{L= Length} (\text{in decimal feet}) \\ \end{array} \\ \end{array}$		
Percent of Requirement Achieved = (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= Length (in decimal feet) Input: P = 0.0 as a decimal		
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} x 100$ P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) 		
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} x 100$ P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet) Imput: P = 0.0 D = 0.0 Ft as a decimal Below perforated pipe if present (in decimal feet) Below perforated pipe if present (in decimal feet)		
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} x 100$ P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet) Imput: P = 0.0 D = 0.0 ft as a decimal Below perforated pipe if present Below perforated pipe if present ft		
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ 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) D= 0.0 ft Below perforated pipe if present W = 0.0 ft L = 0.0 ft Solution:		
Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ 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) D= 0.0 ft Below perforated pipe if present W = 0.0 ft Below perforated pipe if present		





		_
Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conn 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 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	
0 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.





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	AND Requirement 2- Volume
	C _{POST} = Rational method runoff coefficient for the developed condi	tion ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prev	ention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]			
Input:				
	$A_r = 23,920 \text{ ft}^2 = 0.54913$	Acres		
	$C_{POST}^{[10]} = 0.62$			
	K ^[7] = 1.2			
		NOTE		
Solution:		The Flow Pate calculate	ad hara should anly be used to size the	
<u>oolulion.</u>		appropriate RMP All a	ed here should only be used to size the	
QTREATMENT= 0.07967 cfs	$Q_{\text{TREATMENT}} = (0.2)(0.5491)(0.62)(1.17)$	should be sized for the	Flood Control event	
	\sim REALMENT (0.2)(0.0731)(0.02)(1.17)	Should be sized for the		



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Requirement 2: Delta Volume Capture No increase in volume of runoff leaving the site due to development for the 85th percent	e 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 = 1000 - 10 Where:			AND Requirement 2- Volume
CN S= Potential maximum retention after	unoff (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.
$[(P*K)+(0.8 * S)] X = Q = Pupoff dopth (ft)^{[6]}$			
Runon deput (t) = 0.02	0.02 inches in the Santa Posa		
F = Freepitation (iii) = 0.52	area based on local historical		
K= Seasonal Precipitation Factor	data		1077
$V= (Q)(A_r)$ Where:	uutu.		NOTE:
V= Volume of Storm Water to be Reta	ned (ft ³)		If the amount of volume generated
A _r = Reduced Tributary Area including	redit for Pollution Prevention Measures	s (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-Volume
A _r = 23.9	0 ft ²		Canture is not required
K ^[7] =	2		Capture is not required.
	E Duon doum Linto		$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE})$
	Drop down Lists		
Select hydrologic soil type within tributary area $= \frac{1}{5}$	5 in/hr infiltration (transmission) rate		
Select predevelopment ground cover description ⁽⁴⁾ = Woods (50)), grass (50%) combination (orchard	or tree farm) - Fair	
Select post development ground cover description ¹⁰ = Impervious	Paved Parking, Rooftop, Driveways		
CN _{PRE} =	6		
CN _{POST} = 9	.3		
OR Composite Predevelopment CN ^[9] =	0		
Composite Post development CN [9] =	6		
Solution:			
Pre Development Storm Water Runoff Volume			
S _{PRE} = 2.50 in S _{PRE} = <u>1000</u> -10	Where:		
80	S _{PRE} = Pre	development potential maximum retention after runoff (in	n).
$Q_{PRE} = 0.00900 \text{ ft}$ $Q_{PRE} = 0.00900 \text{ ft}$	$\frac{ ^2}{\sqrt{1}} \frac{1}{\sqrt{1}} \qquad Q_{PRE} = Q in$	feet of depth as defined by the "Urban	
(0.92*1.17)+(0.8 * 2.5	$\frac{1}{12in}$ Hyd	rology For Small Watersheds" TR-55 Manual.	
$V_{PRF} = 215.28 \text{ ft}^3$ $V_{PRF} = (0.00900)(23.920)$	V _{PRF} = Pre	Development Volume of Storm Water Generated (ft ³)	
Post Development Storm Water Runoff Volume			
Sport= 0.46025 in Sport= 1000	Where:		
	<u>Wildid.</u>		i-)
90	S _{POST} - POSI	t development potential maximum retention after runon (in).
	12 44 0 - 0		
$Q_{POST} = 0.05591 \pi$ $Q_{POST} = 10.02^{\circ} 1.17 - (0.2^{\circ} 0.40)$	$X \frac{\Pi }{\Omega}$ $Q_{POST} = Q I I I I I I I I I I I I I I I I I I$	feet of depth as defined by the "Urban	
[(0.92*1.17)+(0.8 * 0.4	5)] 12in Hyd.	rology For Small Watersheds" TR-55 Manual.	
V_{POST} = 1337.37 ft ^o V_{POST} = (0.05591)(23,920)	V _{POST} = Post	t Development Volume of Storm Water Generated (ft ³)	
Solution: Volume Capture Requirement			
Increase in volume of storm water that must be retained onsite (may be in	Itrated or reused).		
ភ			
$^{\omega}$ Delta Volume Capture= (V _{POST} -V _{PRE}) Delta Volume Capture	= (1,337.37) - (215.28)		
	Where:		
$V_{\text{DELTA}} = \frac{1122.09}{\text{ft}^3}$	Delta Volume Capture= The	increase in volume of storm water generated by the 85th	h
	perc	centile 24 hour storm event due to development that mus	t be
	retai	ined onsite (may be infiltrated or reused).	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Capt	ture Goal; V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the design goal
$V_{LID GOAL} = ((V_{GOAL}))/(P) = 3423.28 \text{ ft}^3$	Where:	treatment only.	of 100% volume capture of the post
	V _{LID GOAL} = Required volume of soil in LID BMP.		development condition. Enter the
$A_{LID GOAL} = (W)(L) = 1128.96$ ft ²	A _{LID GOAL} = Footprint of LID BMP area for a given depth (below perform	ated pipe if present).	and depth below perforated pipe (if
	$V_{GOAL} = \frac{1,506}{1,506} ft^3$		present). The width and length entries will need to be interactively adjusted
	Where:		until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $(D)(A_{LID GOAL})$ x 100	P= Porosity (enter as a decimal)		
V _{LID GOAL}	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 decimal		
	D = 3.1 ft Below perforated pipe if present		
	W = <u>33.6</u> ft		
	L = 33.6 ft		
Solution:		7	
Percent of Goal Achieved = 102.23	3 % = [(3.1 x 1,129) / 3,423] x 100	·	
			INSTRUCTIONS:
LID BMP Sizing Tool Delta Volume Captu	<u>ure Requirement</u> : V _{DELTA}	NOTE:	The Delta Volume Capture sizing tool
Formulae		LID Sizing Tool only applicable for volume	a LID BMP to achieve the design
Formulas: y' = -(y' = y'') = -(y' = y'') = -(y'' = y'')	Whore:	treatment only.	requirement of the delta volume
	Vue serve Required volume of soil in LID BMP		capture. Enter the percent of porosity
$A_{LID DELTA}=(W)(L) = 0.00 \text{ ft}^2$	$A_{\text{LID DELTA}}$ = Footprint of LID BMP area for a given depth (below perform	ated pipe if present).	of the specified soil and depth below
	$V_{-1} = \frac{1122.09}{10}$ ft ³		and length entries will need to be
	· DELIA		interactively adjusted until "Percent of
	Where:		Requirement achieved" reaches
Percent of Requirement = $\frac{(D)(A_{LID DELTA})}{100} \times 100$	P= Porosity (enter as a decimal)		100%.
Achieved V _{LID DELTA}	D= Depth below perforated pipe if present (in decimal feet)		
	D Depart below periorated pipe in precent (in decimal rect)		
	W= Width (in decimal feet) L = Length (in decimal feet)		
	W= Width (in decimal feet) L= Length (in decimal feet)		
Input:	W= Width (in decimal feet) L= Length (in decimal feet) P = 0.0 as a decimal		
Input:	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		
Input:	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		
<u>Input:</u>	W= 0.0 ft L = 0.0 ft L = 0.0 ft L = 0.0 ft		
Input: Solution:	W= Width (in decimal feet) L= Length (in decimal feet) P = $\begin{array}{c} 0.0 \\ 0.0 \\ 0.0 \\ t \\ L = \begin{array}{c} 0.0 \\ 0.0 \\ t \\ L = \begin{array}{c} 0.0 \\ 0.0 \\ t \\ t \end{array}$ Below perforated pipe if present		
Input: Solution: → Percent of Requirement Achieved = #DIV/01	W= Width (in decimal feet) L= Length (in decimal feet) D = 0.0 ft Below perforated pipe if present W = 0.0 ft L = 0.0 ft =		
Input: Solution: → Percent of Requirement Achieved = #DIV/0!	W = Width (in decimal feet) L = Length (in decimal feet) P = 0.0 as a decimal D = 0.0 ft Below perforated pipe if present W = 0.0 ft = 0		





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Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conn 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]	0 #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 Fa	actor) =	
Area Reduction =	0.00 ft ²	
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.





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
<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 her	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 N	Measures (in Acres) to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]		
<u>Input:</u>	$A_{r} = \frac{34,991}{0.53} \text{ ft}^{2} = \frac{0.80328}{\text{Acres}} \text{ Acres}$ $C_{\text{POST}}^{(10)} = \frac{0.53}{1.2}$ NOTE	Ξ:	
Solution:	The F	How Rate calculated here should only be used to size the	
Q _{TREATMENT} = 0.09962 cfs	Q _{TREATMENT} ⁼ (0.2)(0.8033)(0.53)(1.17)	bpriate BMP. All associated overflow inlets and systems Id be sized for the Flood Control event.	



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Requirement 2: Delta Volume Captur No increase in volume of runoff leaving the site du	re ue 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 = 1000 - 10 Wh	nere:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in ^{{5}]		Conture, this page of the coloulator
	CN = Curve Number[5]		Capture, this page of the calculator,
$O = [(P_*K)_*(0.2 + S)]^2$ 1ft W/b			must be achieved.
$\frac{(P_*K) + (0.8 + S)}{(P_*K) + (0.8 + S)} \times \frac{12}{12}$	$O = D + c \pi (c + c + c + c + c)^{[6]}$		
[(1 *(() (0.0 * 3)] [2]]]	Runoff depth (ft) ^(*)	the Carte Dees	
	P= Precipitation (in) = 0.92 0.92 inches in t	the Santa Rosa	
	K= Seasonal Precipitation Factor ¹¹ area, based on	nocal mistorical	
$V= (Q)(A_r)$ Wh	nere:		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 or enter	calculated values)		
mput. (Fick data from drop down lists of enter			development, Requirement 2-volume
	A _r - 34,991		Capture is not required.
	K ^{1/1} = 1.2		$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE})$
	Drop d	lown Lists	
Select hydrologic soi	il type within tributary area ^[8] = <mark>C: 0.05 - 0.15 in/hr infiltration</mark>	n (transmission) rate	
Select predevelopment	ground cover description ^[5] = Woods (50%), grass (50%) co	mbination (orchard or tree farm) - Fair	
Select post development	ground cover description ^[5] = Impervious - Paved Parking, F	Rooftop, Driveways	
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
OR Compo	osite Predevelopment CN ^[9] = 80		
Compos	ite Post development CN ^[9] = 93		
Solution:			
Pre Development Storm Water Runoff Volu	Ime		
S _{PRE} = 2.50 in	$S_{PRE} = \frac{1000}{-10}$	Where:	
	80	S _{PRE} = Pre development potential maximum retention after runoff (in).	
Q _{PRF} = 0.00900 ft	\sim [(0.92*1.17)-(0.2 * 2.50)] ² \sim 1ft	Q_{PPC} = Q in feet of depth as defined by the "Urban	
	$Q_{PRE} = \frac{1}{[(0.92*1.17)+(0.8*2.50)]} \times \frac{1}{12in}$	Hydrology For Small Watersheds" TR-55 Manual	
$V_{PPE} = 314.92 \text{ ft}^3$	V_{PPE} = (0,00900)(34,991)	V_{RRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Post Development Storm Water Runoff Vol	lume		
Sport= 0.76426 in	Sport= 1000	Where:	
00051-0.70420	-10	$\frac{\text{where}}{2}$	
	93	S _{POST} = Post development potential maximum retention after runoff (in).	
Q _{POST} - 0.04228 ft	$Q_{POST} = \frac{ (0.92^{-1.17}) - (0.2^{-0.76}) ^2}{ (0.92^{-1.17}) - (0.2^{-0.76}) ^2} \times \frac{1 \pi}{100}$	$Q_{POST} = Q$ in feet of depth as defined by the "Urban	
	[(0.92*1.17)+(0.8 * 0.76)] 12in	Hydrology For Small Watersheds" TR-55 Manual.	
3			
V _{POST} = 1479.42 ^{ft°}	V _{POST} = (0.04228)(34,991)	V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
Solution: Volume Capture Requirement			
Increase in volume of storm water t	hat must be retained onsite (may be infiltrated or reused	d).	
15			
^{CO} Delta Volume Capture= (V _{POST} -V _{PRE})		314.92)	
	Delta Volume Capture= (1,479.42) - (3		
	Delta Volume Capture= (1,479.42) - (3	Where:	
▼DELTA ⁻ 1164.50 ff ³	Delta Volume Capture= (1,479.42) - (3 Delta V	<u>Where:</u> /olume Capture= The increase in volume of storm water generated by the 85th	
▼DELTA ⁻ 1164.50 ft ³	Delta Volume Capture= (1,479.42) - (3 Delta V	<u>Where:</u> olume Capture= The increase in volume of storm water generated by the 85th percentile 24 hour storm event due to development that must be	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Capture	<u>Goal;</u> V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the <u>design goal</u>
$V_{LID GOAL} = ((V_{GOAL}))/(P) = 3862.53$ ft ³	Where:	treatment only.	of 100% volume capture of the post
4000 00 ⁶²	V _{LID GOAL} = Required volume of soil in LID BMP.		percent porosity of the specified soil
$A_{\text{LID GOAL}} = 1369.00$	A _{LID GOAL} = Footprint of LID BMP area for a given depth (b	below perforated pipe if present).	and depth below perforated pipe (if
	$V_{GOM} = 1.700 \text{ ft}^3$		present). The width and length entries
			will need to be interactively adjusted
Whe	ere:		until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $(D)(A_{LID GOAL})$ x 100	P= Porosity (enter as a decimal)		
V _{LID GOAL}	D= Depth below perforated pipe if present (in decimal feet)		
	V= Width (in decimal feet)		
	()		
Input:	P = 0.4 as a decimal		
	D = 2.8 ft Below perforated pipe if	present	
	$W = \frac{37.0}{27.0}$ ft		
	$L = \frac{37.0}{37.0} \pi$		
Solution:		7	
Percent of Goal Achieved = 100.66 %	= [(2.8 x 1,369) / 3,863] x 100		
			INSTRUCTIONS: The Delta Volume Capture sizing tool
LID BMP Sizing Tool Delta Volume Capture F	Requirement: V _{DELTA}	NOTE:	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size
LID BMP Sizing Tool Delta Volume Capture F	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>
LID BMP Sizing Tool Delta Volume Capture F Formulas: VIID DELTA=((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
LID BMP Sizing Tool Delta Volume Capture F Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0! ft ³	Requirement: V _{DELTA} Where: 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 <u>capture</u> . Enter the percent of porosity
LID BMP Sizing Tool Delta Volume Capture F Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/0!]$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ²	Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (b)	NOTE: <i>LID Sizing Tool only applicable for volume</i> <i>based BMPs. Not required if site requires</i> <i>treatment only.</i>	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below
LID BMP Sizing Tool Delta Volume Capture F Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/0!] ft^3$ $A_{LID DELTA} = (W)(L) = 0.00 ft^2$	Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (b)	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 <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
LID BMP Sizing Tool Delta Volume Capture F Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/0!] ft^3$ $A_{LID DELTA} = (W)(L) = 0.00 ft^2$	Where: V_DELTA $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (b) V_DELTA= 1164.50	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 <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
LID BMP Sizing Tool Delta Volume Capture F Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/0! \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$	Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (b) VDELTA= 1164.50	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 <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
LID BMP Sizing Tool Delta Volume Capture F Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/01 \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement (D)(A_{\text{LID DELTA}})	Requirement: V_{DELTA} Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (b V_DELTA= 1164.50 ft ³ 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 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 100%.
LID BMP Sizing Tool Delta Volume Capture F Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01 \text{ ft}^3$ $A_{LID DELTA} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Requirement: V_{DELTA} Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (b) VDELTA= 1164.50 ft ³ PP 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.	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture F Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01 \text{ ft}^3$ $A_{LID DELTA} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Requirement: V_{DELTA} Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (b VDELTA= 1164.50 Pre: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) We Width (in decimal feet) We Width (in decimal feet)	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 <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 100%.
$\frac{\text{LID BMP Sizing Tool Delta Volume Capture F}}{V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/0!}{\#\text{DIV}/0!} \text{ft}^{3}}$ $A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{IT}} \text{ft}^{2}$ $\frac{\text{Whe}}{\text{Percent of Requirement}}$ $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	Requirement: V_{DELTA} Where: VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (b V_{DELTA} T164.50 ft ³ 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)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture F Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/0! \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	Requirement: V_{DELTA} Where: $V_{LID DELTA}$ $V_{LID DELTA}$ Required volume of soil in LID BMP $A_{LID DELTA}$ Footprint of LID BMP area for a given depth (b) V_{DELTA} 1164.50 ft ³ ere: P P = Porosity (enter as a decimal) D D = Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L = Length (in decimal feet)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture F Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/0! \text{ ft}^3$ $A_{LID DELTA} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Requirement: V_{DELTA} Where: $V_{LID DELTA}$ $V_{LID DELTA}$ Required volume of soil in LID BMP $A_{LID DELTA}$ Footprint of LID BMP area for a given depth (b V_{DELTA} 1164.50 ft ³ ere: P P = Porosity (enter as a decimal) D D = Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L = Length (in decimal feet) D = 0.0 ft Below perforated pipe if	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture F Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (b V_{DELTA} = 1164.50 ft ³ Pre: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= $V = 0.0$ ft Below perforated pipe if gelow perforated pipe if the gelow perforated pipe if	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture F Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ $M_{LID DELTA} = (W)(L) = ($	Requirement: V_{DELTA} Where: $V_{LID DELTA}$ $V_{LID DELTA}$ Required volume of soil in LID BMP $A_{LID DELTA}$ Footprint of LID BMP area for a given depth (b V_{DELTA} 1164.50 ft ³ ere: P P= 0.0 ft Width (in decimal feet) (in decimal feet) L = 0.0 ft Below perforated pipe if Below perforated pipe if	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 <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 100%.
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LID BMP Sizing Tool Delta Volume Capture F Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01 \text{ ft}^3$ $A_{LID DELTA} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: Solution:	Requirement: V_{DELTA} Where: $V_{LID DELTA}$ $V_{LID DELTA}$ Required volume of soil in LID BMP $A_{LID DELTA}$ Footprint of LID BMP area for a given depth (b) V_{DELTA} 1164.50 ft ³ ere: P 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 = $ 0.0 ft $W = $ 0.0 ft $W = $ 0.0 ft	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture F Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01 \text{ ft}^3$ $A_{LID DELTA} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: D Percent of Requirement Achieved $= \#DIV/01 \%$	Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (b) V_{DELTA} = 1164.50 ft ³ Precision 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) $P = 0.0 \\ D = 0.0 \\ H = 0.0$	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 <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 100%.





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 Area Reduction due to new Evergreen Trees= 0 ft ²	New Evergreen Trees NOTE: Total Interceptor Area (200 ft²/tree) 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.
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)	
Enter square footage of qualifying existing tree canopy = 0 Allowed reduction credit for existing tree canopy= 0 ft ²	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	
	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% Treatme	ent			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	AND Requirement 2- Volume
	C _{POST} = Rational method runoff coefficient for the devel	oped condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pol	lution Prevention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]			
Input:				
	$A_r = 33,215 \text{ ft}^2 =$	0.76251 Acres		
	C _{POST} ^[10] = 0.45			
	K ^[7] = 1.2			
		NOTE:		
Solution:		The Flow Rate calculate	d here should only be used to size the	
		appropriate BMP. All as	ssociated overflow inlets and systems	
Q _{TREATMENT} = 0.08029 cfs	Q _{TREATMENT} = (0.2)(0.7625)(0.45)(1.17)	should be sized for the	Flood Control event.	



2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #25

Requirement 2: Delta Volume Capture No increase in volume of runoff leaving the site due to development for the 85th per	centile 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 = 1000 - 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
$Q = [(P * K) - (0.2 * S)]^2$ 1ft Where:			must be achieved.
$[(P K) + (0.8 * S)] X = Q = Pupoff donth (ft)^{[6]}$			
	0.02 inches in the Santa F	2053	
F – Flecipitation (iii) – 0.92	[7] area based on local histo	rical	
K= Seasonal Precipitation Factor	data	ilean ann an	1077
V= (Q)(A _r) <u>Where:</u>			NOTE:
V= Volume of Storm Water to be	Retained (ft ³)		If the amount of volume generated
A _r = Reduced Tributary Area inclu	ding credit for Pollution Prevention	Measures (f)	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, =	33.215 ft ²		Capture is not required
K ^[7] =	12		Capture is not required.
	1.2		$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE})$
	Drop down Lists	at a shareful	
Select hydrologic soil type within tributary area = C: 0.05	- 0.15 in/hr infiltration (transmis	sion) rate	
Select predevelopment ground cover description ^[5] = Woods	(50%), grass (50%) combination	(orchard or tree farm) - Fair	
Select post development ground cover description ^{eg} = Impervi	ous - Paved Parking, Rooftop, D	riveways	
CN _{PRE} =	76		
CN _{POST} =	90.3		
OR Composite Predevelopment CN ^[9] =	80		
Composite Post development CN ^[9] =	91		
Solution:			
Pre Development Storm Water Runoff Volume			
$S_{PRE} = 2.50 \text{ in } S_{PRE} = 1000 \text{ -10}$	When	<u>e:</u>	
80	S	SPRE= Pre development potential maximum retention after runoff	(in).
$Q_{PRE} = 0.00900 \text{ ft}$ $Q_{} = [(0.92*1.17)-(0.2*1.17)-($	<u>2.50)]² _x 1ft</u> C	<i>A</i> _{PRE} = Q in feet of depth as defined by the "Urban	
[(0.92*1.17)+(0.8	* 2.50)] 12in	Hydrology For Small Watersheds" TR-55 Manual.	
	/2		
V_{PRE} 298.94 ft ³ V_{PRE} (0.00900)(33.215)	ν.	PRF= Pre Development Volume of Storm Water Generated (ft ³)	
Post Development Storm Water Runoff Volume			
Spost= 1.04 in Spost= 1000	When	e.	
	<u></u>	- Doot douglopment notantial maximum retention after rung	ff (in)
51	O _F		n (m).
	1 0 4 12 14 0	= O in fact of doubh an defined by the Wildow	
$Q_{POST} = 0.03293 \pi$ $Q_{POST} = 10.921.17 - 10.2$	$\frac{1.04}{1}$ X $\frac{111}{10}$ Q _F	POST- Q in feet of depth as defined by the Orban	
[(0.92*1.17)+(0.8	* 1.04)] 12in	Hydrology For Small Watersheds" TR-55 Manual.	
v			
$V_{POST} = 1093.77 \pi^2 V_{POST} = (0.03293)(33,215)$	V _F	POST = Post Development Volume of Storm Water Generated (ft ³)	
Solution: Volume Capture Requirement			
Increase in volume of storm water that must be retained onsite (may be	be infiltrated or reused).		
16			
^{OT} Delta Volume Capture= (V _{POST} -V _{PRE}) Delta Volume Ca	apture= (1,093.77) - (298.94)		
	When	e:	
$V_{DELTA} = 794.83 \text{ ft}^3$	Delta Volume Cap	ture= The increase in volume of storm water generated by the 8	5th
		percentile 24 hour storm event due to development that m	ust be
		retained onsite (may be infiltrated or reused).	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Captur	e Goal; V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the design goal
$V_{LID GOAL} = ((V_{GOAL}))/(P) = 2907.82 \text{ ft}^3$	Where:	treatment only.	of 100% volume capture of the post
	V _{LID GOAL} = Required volume of soil in LID BMP.		percent porosity of the specified soil
$A_{LID GOAL} = (W)(L) = 702.25 \text{ ft}^{-1}$	A _{LID GOAL} = Footprint of LID BMP area for a given depth (below perform	ated pipe if present).	and depth below perforated pipe (if
	$V_{\text{GOAL}} = $ 1,279 ft^3		present). The width and length entries will need to be interactively adjusted
<u>N</u>	here:		until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $(D)(A_{LID GOAL})$ x 100	P= Porosity (enter as a decimal)		
V _{LID GOAL}	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 decimal		
<u>mput.</u>	D = 4.1 ft Below perforated pipe if present		
	W = 26.5 ft		
	L = 26.5 ft		
Solution:	V(1.1., 700) / 0.000 1., 100	7	
Percent of Goal Achieved = 99.98 %	$= [(4.1 \times 702)/2,908] \times 100$		
			J
			_
LID BMP Sizing Tool Delta Volume Capture	Requirement: V _{DELTA}	NOTE:	INSTRUCTIONS: The Delta Volume Capture sizing tool balas the designer appropriately size
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	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the design
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
LID BMP Sizing Tool Delta Volume Capture Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01 ft ³	Requirement: VDELTA Where: VLID DELTA= VLID 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
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ²	Requirement: VDELTA Where: VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below performation)	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present) The width
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01/ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00/ft ²	Where: VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below perform VDELTA= 794.83	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 <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
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01 ft^3$ $A_{LID DELTA} = (W)(L) = 0.00 ft^2$	Where: VLID DELTA Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below perform VDELTA T94.83 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 <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
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01 ft^3$ $A_{LID DELTA} = (W)(L) = 0.00 ft^2$ Percent of Requirement $= \frac{(D)(A_{LID DELTA})}{2} \times 100$	Requirement: V_{DELTA} Where: V_LID DELTA= V_LID DELTA= Required volume of soil in LID BMP A_LID DELTA= Footprint of LID BMP area for a given depth (below perform $V_{DELTA} =$ 794.83 ft ³ here: 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 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 100%.
$\frac{\text{LID BMP Sizing Tool Delta Volume Capture}}{\text{Formulas:}} V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\text{#DIV/01}}{\text{#DIV/01}} \text{ft}^{3}$ $A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{IC}} \text{ft}^{2}$ $Percent of Requirement = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	Requirement: V_{DELTA} Where: V_LID DELTA= V_LID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below performation of LID BMP area formation of LID BMP area formation of LID BMP	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ated pipe if present).	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 <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 100%.
$\frac{\text{LID BMP Sizing Tool Delta Volume Capture}}{\text{Formulas:}} V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\text{\#DIV/01}}{\text{\#DIV/01}} \text{ft}^{3}$ $A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}_{\text{ft}} \text{ft}^{2}$ $Percent of Requirement Achieved} = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	Mere: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below perform VDELTA T94.83 ft ³ here: P P Porosity (enter as a decimal) D D = Depth below perforated pipe if present (in decimal feet) W = Width (in decimal feet) U = Legoth (in decimal feet) L = Legoth (in decimal feet)	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 <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 100%.
$\frac{\text{LID BMP Sizing Tool Delta Volume Capture}}{\text{Formulas:}} V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/01}{\#\text{DIV}/01} \text{ft}^{3}$ $A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}{0.00} \text{ft}^{2}$ $Percent of Requirement Achieved} = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perform V_{DELTA} = 794.83 ft 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)	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 <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 100%.
$\frac{\text{LID BMP Sizing Tool Delta Volume Capture}}{\text{Formulas:}} V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \frac{\#\text{DIV}/01}{\#\text{DIV}/01} \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = \underbrace{0.00}{0.00} \text{ft}^2$ $Percent of Requirement}_{\text{Achieved}} = \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ $\underline{Input:}$	Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perform V_{DELTA} = 794.83 ft 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) P = 0.0 as a decimal	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 $A_{LID DELTA} = (W)(L) = $ 0.00 $A_{LID DELTA} = (W)(L) = $ 0.00 Percent of Requirement Achieved = $V_{LID DELTA} = (D)(A_{LID DELTA}) \times 100$ Input:	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 perform $V_{DELTA} =$ 794.83 ft ³ here: P= D= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet) D= 0.0 ft Below perforated pipe if present	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01$ $A_{LID DELTA} = (W)(L) = 0.00$ ft^2 Percent of Requirement Achieved $(D)(A_{LID DELTA})/(LID DELTA)$ X 100 Input:	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 perform VDELTA = 794.83 ft ³ here: P= P= 794.83 D= Deth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= Length (in decimal feet) D= 0.0 W= 0.0	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> <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Requirement: VDELTA Where: VLID DELTA= Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below perform $V_{DELTA} =$ 794.83 ft ³ here: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) W= 0.0 M= 0.0 0.0 ft Below perforated pipe if present W= 0.0 D= 0.0 ft Below perforated pipe if present	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement Achieved $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} x 100$ Input: Solution:	Requirement: VDELTA Where: VLID DELTA= Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below perform $V_{DELTA} =$ 794.83 ft 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) P = 0.0 Mathematical fit Below perforated pipe if present W = 0.0 ft Below perforated pipe if present	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/01$, ft ³ $A_{\text{LID DELTA}} = (W)(L) = 0.00$, ft ² Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ Input: $A_{\text{DELTA}} = (D)(A_{\text{DELTA}}) \times 100$	Requirement: VDELTA Where: VLID DELTA= NLID DELTA= Required volume of soil in LID BMP ALD DELTA = Footprint of LID BMP area for a given depth (below perform $V_{DELTA} =$ 794.83 ft ³ here: P= P = 794.83 ft ³ here: P= Dett below perforated pipe if present (in decimal feet) UW= Width (in decimal feet) L = 0.0 ft Below perforated pipe if present W = 0.0 ft L = 0.0 ft H = 0.0 ft	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. ated pipe if present).	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 <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 100%.





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 Area Reduction due to new Evergreen Trees= 0 ft ²	New Evergreen Trees NOTE: Total Interceptor Area (200 ft²/tree) 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.
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)	
Enter square footage of qualifying existing tree canopy = 0 Allowed reduction credit for existing tree canopy= 0 ft ²	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]	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 Buffer Factor = 0.7 Solution:	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.





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 i	n/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:		nydraulic Flood Control design.	I reatment, this page of the calculator,
	Q _{TREATMENT} = Design flow rate required to be treated (cfs)	110	I ne table of values can be found here	AND Requirement 2- Volume
	C _{POST} = Rational method runoff coefficient for the deve	eloped condition ^{10]}	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pe	ollution Prevention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor[7]			
Input:				
	A _r = 51,446 ft ⁺ =	1.18 Acres		
	$C_{POST}^{[10]} = 0.50$			
	K ^[/] = 1.2			
		NOTE:		
Solution:		The Flow Rate calculate	ed here should only be used to size the	
·		appropriate BMP. All as	ssociated overflow inlets and systems	
QTREATMENT 0.13818 cfs	Q _{TREATMENT} ⁼ (0.2)(1.18)(0.50)(1.17)	should be sized for the	Flood Control event.	



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			7
Requirement 2: Delta Volume Ca No increase in volume of runoff leaving the si	pture ite 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
<u>s = 1000_10</u>	W/boro:		AND Deminerate Q. Malures
$S = \frac{1000}{CN} - 10$	<u>where.</u>		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ^{-,}		Capture, this page of the calculator,
· · · · · · ·-	CN= Curve Number		must be achieved.
$Q = [(P * K) - (0.2 * S)]^2 \times \frac{1 ft}{1 + 1}$	Where:		
[(P*K)+(0.8 * S)] 12in	Q= Runoff depth (ft) ^[6]		
	P= Precipitation (in) = 0.92 0.92 inches in f	the Santa Rosa	
	K= Seasonal Precipitation Factor ^[7] area, based on	n 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
			equal to that generated before
Input: (Pick data from drop down lists or	enter calculated values)		development. Deswirement 2 Valume
mput. (Fick data from drop down ists of			development, Requirement 2-volume
	A _r = 51,440 It		Capture is not required.
	K ^(/) = 1.2		$(C_{\text{POOT}} \leq C_{\text{POC}} \text{ or } CN_{\text{POOT}} \leq CN_{\text{POC}})$
	Drop d	own Lists	$(0 p_{0ST} = 0 p_{RE} 0) 0 (1 p_{0ST} = 0) (1 p_{RE})$
Select hydrolog	ic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration	(transmission) rate	
Select predevelop	ment around cover description ^[5] = Woods (50%) grass (50%) co	mbination (orchard or tree farm) - Fair	
Select post develop	ment ground cover description ^[5] = Imporvious - Bayed Barking [Rooffon Drivoways	
		(concep, enveways	
	CN _{POST} = 90.3		
<u>OR</u> C	omposite Predevelopment CN ^[9] = 80		
Cor	mposite Post development CN ^[9] = 92		
Solution:			
	Malana		
Pre Development Storm Water Runom	volume		
S _{PRE} = 2.50 in	$S_{PRE} = \frac{1000}{10}$	Where:	
	80	S_{PRF} = Pre development potential maximum retention after runoff (in).	
		·///2	
0= 0.00000 #	[(0 02*1 17) (0 2 * 2 50)]2 1ft	0 = 0 in fact of doubt as defined by the "Urban	
QPRE 0.00900 II	$Q_{PRE} = \frac{ (0.92 + 17) - (0.2 + 2.50) }{ (0.92 + 17) - (0.2 + 2.50) } \times \frac{111}{ (0.92 + 17) - (0.2 + 2.50) }$		
	[(0.92*1.17)+(0.8 * 2.50)] 12in	Hydrology For Small Watersheds" TR-55 Manual.	
V _{PRE} = 463.01 ^{ft°}	V _{PRE} = (0.00900)(51,446)	V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Post Development Storm Water Runof	f Volume		
Spost= 0.86957 in	Spost= 1000	Where [.]	
	-10	C = Dest development establish maximum establish efter sureff (in)	
	92	S_{POST} = Post development potential maximum retention after runoff (in).	
Q _{POST} = 0.03829 ft	$\mathbf{Q}_{POST} = \frac{[(0.92^{*}1.17) - (0.2^{*}0.87)]^2}{[(0.92^{*}1.17) - (0.2^{*}0.87)]^2} \times \frac{1 \text{ft}}{1 \text{ft}}$	Q _{POST} = Q in feet of depth as defined by the "Urban	
	[(0.92*1.17)+(0.8 * 0.87)] 12in	Hydrology For Small Watersheds" TR-55 Manual.	
$V_{POST} = 1969.87 \text{ ft}^3$	$V_{POST} = (0.03829)(51.446)$	V _{POST} = Post Development Volume of Storm Water Generated (ff ³)	
1001			
Solution: Volume Conture Desulation	ont		
Solution. volume Capture Requirem			
Increase in volume of storm wa	ater that must be retained onsite (may be infiltrated or reused	ם).	
17			
Delta Volume Capture= (V _{POST} -V _{PRE})	Delta Volume Capture= (1,969.87) - (4)	463.01)	
	• • • • • • •	Where:	
	5 er ³ Delta V	olume Capture= The increase in volume of storm water generated by the 85th	
1000.00	an a	percentile 24 hour storm event due to development that must be	
		retained onsite (may be infiltrated or reused)	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Captu	ıre Goal; V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the <u>design goal</u>
$V_{LID GOAL} = ((V_{GOAL}))/(P) = 5179.68$ ft ³	Where:	treatment only.	development condition Enter the
$-0.00(1) = 1020.041^{10}$	$V_{\text{LID GOAL}}$ = Required volume of soil in LID BMP.	for the last of the second of	percent porosity of the specified soil
$A_{\text{LID GOAL}}=(VV)(L) = 1036.04$	A _{LID GOAL} = FOOTPRINT OF LID BMP area for a given depth (below per	rrorated pipe if present).	and depth below perforated pipe (if
	V _{GOAL} = 2,279 ft ³		present). The width and length entries will need to be interactively adjusted
			until "Percent of Goal" equals 100%.
Percent of Goal Achieved $= (D)(A_{\text{UD}COM})$	Where:		······································
	P Porosity (enter as a decimal)		
- LU GOAL	W= Width (in decimal feet) L= Length (in decimal feet)		
Input:	$P = 0.4 \qquad \text{as a decimal}$		
	D = 5.0 ft Below perforated pipe if present		
	V = 32.2 ft		
Solution:		7	
Percent of Goal Achieved = 100.09	% = [(5.0 x 1,037) / 5,180] x 100		
			INSTRUCTIONS:
LID BMP Sizing Tool Delta Volume Captur	re Requirement: V _{DELTA}	NOTE:	INSTRUCTIONS: The Delta Volume Capture sizing tool beins the designer appropriately size
LID BMP Sizing Tool Delta Volume Captur	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 design
LID BMP Sizing Tool Delta Volume Captur	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
LID BMP Sizing Tool Delta Volume Captur Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01 ft ³	<u>Where:</u> VIIID 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
LID BMP Sizing Tool Delta Volume Captur Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01] ft ³ A _{LID DELTA} =(W)(L) = 0.00] ft ²	re Requirement: V _{DELTA} Where: VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below per ALID 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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ²	Where: VLID DELTA VLID DELTA Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below per	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width and least approximation will end to be
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ²	Where: VLID DELTA VLID DELTA Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below per VDELTA 1506.85	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 <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
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ²	Where: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below per VDELTA 1506.85 Where: 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 <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
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement = (D)(A_{LID DELTA}) < 100	where: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP A_{LID DELTA} = Footprint of LID BMP area for a given depth (below per V_{DELTA} = 1506.85 ft ³ Where: 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 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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Where: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP A_{LID DELTA} = Footprint of LID BMP area for a given depth (below per V_{DELTA} = 1506.85 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.	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01 ft^3$ $A_{LID DELTA} = (W)(L) = 0.00 ft^2$ Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Where: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below per VDELTA = 1506.85 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) We Width (in decimal feet) V = Width (in decimal feet) V = Width (in decimal feet)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement $A_{Chieved}$ $=$ $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Where: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below per V_{DELTA} = 1506.85 ft ³ 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)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement $A_{Chieved}$ $=$ $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Mere: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below per V_{DELTA} = 1506.85 ft ³ Where: P = Porosity (enter as a decimal) Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L = Length (in decimal feet) P = 0.0 P = 0.0 as a decimal	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 <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 100%.
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LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	The 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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ² Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	The Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below per V_{DELTA} = 1506.85 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= Uidth (in decimal feet) L = 0.00 ft Below perforated pipe if present	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: VLID DELTA=((VDELTA))/(P) = #DIV/01 $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement 0.00 Achieved $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: $\frac{100000}{100}$	The Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below performation of the LID BMP area for a given depth (below performation of the LID BMP area for a given depth (below performation of the LID BMP area for a given depth (below performation of the LID BMP area for a given depth (below performation of the LID BMP area for a given depth (below performation of the LID BMP area for a given depth (below performation of the LID BMP area for a given depth (below performation of the LID BMP area for a given depth (below performation of the LID BMP area for a given depth (below performation of the LID BMP area for a given depth (below performation of the LID BMP area for a given depth (below performation of the LID BMP area for a given depth (below performation of the LID BMP area for a given depth (below performation of the LID BMP area for a given depth (below performation of the LID BMP area for a giv	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = \#DIV/01]$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00]$ ft ² Percent of Requirement $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: 3 Percent of Requirement Achieved = #DIV/01	Mere: $V_{LID DELTA}$ = Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below per VDELTA = 1506.85 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= 0.0 ft Below perforated pipe if present Watch (in decimal feet) as a decimal D = 0.0 ft Below perforated pipe if present W = 0.0 ft Below perforated pipe if present W = 0.0 ft Below perforated pipe if present W = 0.0 ft Below perforated pipe if present W = 0.0 ft Below perforated pipe if present W = 0.0 ft Below perforated pipe if present W = 0.0 ft Below perforated pipe if present	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 <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 100%.





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 Area Reduction due to new Evergreen Trees= 0 ft ²	New Evergreen Trees NOTE: Total Interceptor Area (200 ft²/tree) 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.
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)	
Enter square footage of qualifying existing tree canopy = 0 Allowed reduction credit for existing tree canopy= 0 ft ²	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]	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 Buffer Factor = 0.7 Solution:	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.





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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	AND Requirement 2- Volume
	C _{POST} = Rational method runoff coefficient for the developed cond	tion ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prev	ention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]	· · · ·		
Input:	·			
	$A_r = \frac{39,558}{1000} \text{ ft}^2 = \frac{0.90813}{1000}$	Acres		
	C _{POST} ^[10] = 0.45	1		
	K ^[7] = 1.2			
		NOTE:		
Solution:		The Flow Rate calculate	ed here should only be used to size the	
		appropriate BMP. All a	ssociated overflow inlets and systems	
Q _{TREATMENT} = 0.09563 cfs	$Q_{\text{TREATMENT}}$ (0.2)(0.9081)(0.45)(1.17)	should be sized for the	Flood Control event.	



			7
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	n 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= $[(P \cdot K) - (0.2 \cdot S)]^2$ 1ft	Where:		
[(P*K)+(0.8 * S)]	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	n local historical	
$V = (O)(A_{2})$	Where data.		NOTE:
	$\sqrt{-}$ Volume of Storm Water to be Retained (ft ³)		If the amount of volume concreted
	$\Delta =$ Reduced Tributary Area including credit for Pollution	Prevention Measures ([#])	If the amount of volume generated
	$\mu_{\rm r}$ = reduced moduly field modeling creation relation		aner development is less than of
Input: (Pick data from drop down lists (or optor coloulated values)		equal to that generated before
Input. (Fick data from drop down lists of			development, Requirement 2-volume
			Capture is not required.
	K ^(*) = 1.2		$(C_{POST} \leq C_{PRE} \text{ or } CN_{POST} \leq CN_{PRE})$
	Drop d	lown Lists	
Select hydrole	ogic soil type within tributary area ⁽⁰⁾ = C: 0.05 - 0.15 in/hr infiltration	n (transmission) rate	
Select predevelo	spment ground cover description $^{[0]} = \frac{Woods (50\%), grass (50\%) co}{100}$	ombination (orchard or tree farm) - Fair	
Select post develo	opment ground cover description ¹⁰ = Impervious - Paved Parking, F	Rooftop, Driveways	
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
OR	Composite Predevelopment CN ^[9] = 80		
C	Composite Post development CN ^[9] = 91		
Solution:			
Pre Development Storm Water Runof	ff Volume		
Sppc= 2.50 in	S _{PPE} = 1000	Where:	
	-10 80	Suc-= Pro development notential maximum retention after runoff (in)	
	00	OPRE- The development potential maximum retention after runon (in).	
0=		\bigcirc = \bigcirc in fact of donth as defined by the "1 lyber	
QPRE 0.00900 ft	$Q_{PRE} = \frac{1(0.92 \cdot 1.17) - (0.2 \cdot 2.50)^2}{1(0.92 \cdot 4.47) + (0.9 \cdot 4.9 \cdot 50)^2} \times \frac{11}{40}$	Q _{PRE} - Q in feet of depth as defined by the Orban	
	$[(0.92^{1.17})+(0.8^{2.50})]$ 12In	Hydrology For Small Watersneds" TR-55 Manual.	
VPRE 350.02	V PRE [−] (0.00900)(39,556)	VPRE- Pre Development volume of Storm Water Generated (IT)	
Post Development Storm Water Bung	off Volume		
SPOST ⁼ 1.05 in	Spost <u>1000</u> -10	Where:	
	91	S _{POST} = Post development potential maximum retention after runoff (in).	
	•	• · · · · · · · · ·	
Q _{POST} = 0.03264 ft	$Q_{POST} = \frac{[(0.92*1.17) - (0.2*1.05)]^2}{X} \frac{1ft}{X}$	Q _{POST} = Q in feet of depth as defined by the "Urban	
	[(0.92*1.17)+(0.8 * 1.05)] 12in	Hydrology For Small Watersheds" TR-55 Manual.	
- 2			
V _{POST} = 1291.17 ^{ft³}	V _{POST} = (0.03264)(39,558)	V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
Solution: Volume Capture Require	ment		
Increase in volume of storm	water that must be retained onsite (may be infiltrated or reused	d).	
17			
➤ Delta Volume Capture= (V _{POST} -V _F)	Delta Volume Capture= (1,291.17) - ((356.02)	
		Where:	
V _{DELTA} = 935	.15 ft ³ Delta V	olume Capture= 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).	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Captu	ıre Goal; V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the <u>design goal</u>
$V_{\text{LID GOAL}} = ((V_{\text{GOAL}}))/(P) = 3435.25$ ft ³	Where:	treatment only.	of 100% volume capture of the post
	V _{LID GOAL} = Required volume of soil in LID BMP.		percent porosity of the specified soil
$A_{\text{LID GOAL}}=(W)(L) = 973.44$	$A_{LID GOAL}$ = Footprint of LID BMP area for a given depth (below	w perforated pipe if present).	and depth below perforated pipe (if
	V _{GOAL} = 1,512 ft ³		present). The width and length entries will need to be interactively adjusted
	140		until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $(D)(A_{UDCOM})$	<u>Where:</u> P= Porosity (enter as a decimal)		
$\frac{1}{\sqrt{1000}} \frac{1}{\sqrt{1000}} x 100$	D= Denth below perforated pipe if present (in decimal feet)		
	W= Width (in decimal feet) L= Length (in decimal feet)		
Input:	P - 0.4 as a decimal		
<u>mput.</u>	$D = \frac{3.5}{1000}$ ft Below perforated pipe if pre-	sent	
	$W = \frac{31.2}{\text{ft}}$		
	L = 31.2 ft		
Solution:	2 /	7	
Percent of Goal Achieved = 100.31	% = $[(3.5 \times 973) / 3,435] \times 100$		
			J
			INSTRUCTIONS
ILID BMP Sizing Tool Delta Volume Captur	re Requirement : Vpr. 74	NOTE:	The Delta Volume Capture sizing tool
LID BMP Sizing Tool Delta Volume Captur	re Requirement: V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume	The Delta Volume Capture sizing tool helps the designer appropriately size
LID BMP Sizing Tool Delta Volume Captur	re Requirement: V _{DELTA}	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires	The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u>
LID BMP Sizing Tool Delta Volume Captur 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.	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
LID BMP Sizing Tool Delta Volume Captur Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01/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.	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
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ²	Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below)	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/0!$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ²	Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below VDELTA = 935.15	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 <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
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = $ #DIV/0! ft ³ $A_{LID DELTA}=(W)(L) = $ 0.00 ft ²	Where: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ Required volume of soil in LID BMP A_{LID DELTA} Footprint of LID BMP area for a given depth (below V_DELTA 935.15	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 <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 Deaujiement achieved" reachor
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ²	Te Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP A_{LID DELTA}= Footprint of LID BMP area for a given depth (below V_{DELTA}= 935.15 ft ³ 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 <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 100%
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/0! \text{ft}^3$ $A_{LID DELTA} = (W)(L) = 0.00 \text{ft}^2$ Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V} \times 100$	The Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below V_{DELTA} = 935.15 ft ³ Where: P = Porosity (enter as a decimal) P = Porthylecter (enter decimation of the provide of t	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	The Requirement: V_{DELTA} 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 V_{DELTA} = 935.15 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) (in decimal feet)	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> <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Where: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below VDELTA = 935.15 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) Weresting the decimal feet) Umbed with (in decimal feet) L = Length (in decimal feet)	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> <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	Where: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below V_{DELTA} = 935.15 ft ³ 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)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Where: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below VDELTA 935.15 Mere: P= Porosity (enter as a decimal) D= Depth below perforated pipe if present (in decimal feet) Width (in decimal feet) UWere: P= 0.0 D= Depth below perforated pipe if present (in decimal feet) Width (in decimal feet) UP Utility (in decimal feet) D= Depth Depth (in decimal feet) D= Depth (in decimal feet)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	Where: $V_{LID DELTA}$ VLID DELTA = Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below VDELTA = 935.15 935.15 ft ³ 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) D = 0.0 Mean Below perforated pipe if present	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	The Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below V_{DELTA} = 935.15 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= 0.0 Hard Hard Hard Free for the decimal feet) L = Length (in decimal feet) as a decimal D = 0.0 D = 0.0 Hard Hard Hard Hard Hard Hard Hard Hard	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 <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 100%.
Eight Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/(0)$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement $(D)(A_{LID DELTA})/(D)$ the second sec	Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below V_{DELTA} = 935.15 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= 0.0 Multiple as a decimal Below perforated pipe if present Below perforated pipe if present U = 0.0 ft Below perforated pipe if present	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement $A_{Chieved}$ $=$ $(D)(A_{LID DELTA})/(D) = (D)(D) = (D)(D)(D) = (D)(D)(D) = (D)(D) = (D)(D)(D) = (D)(D)(D)(D) = (D)(D)(D) = (D)(D)(D)(D) = (D)(D)(D) = (D)(D)(D)(D) = (D)(D)(D)(D)(D) = (D)(D)(D)(D)(D)(D) = (D)(D)(D)(D)(D)(D) = (D)(D)(D)(D)(D)(D)(D)(D) = (D)(D)(D)(D)(D)(D)(D)(D)(D)(D)(D)(D)(D)($	The Requirement: V_{DELTA} Where: $V_{\text{LID DELTA}} =$ Footprint of LID BMP area for a given depth (below $V_{\text{DELTA}} =$ 935.15 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) U = 0.0 ft Below perforated pipe if present (in decimal feet) 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.	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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/(0)$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: Solution: $= \frac{(D)(V_{LID DELTA})}{V_{LID DELTA}} = (D)(V$	EXAMPLE: Where: $V_{\text{LID DELTA}} = \text{Required volume of soil in LID BMP}$ $A_{\text{LID DELTA}} = \text{Footprint of LID BMP area for a given depth (below V_{\text{DELTA}} = \underbrace{935.15}_{0} \text{ft}^{3}Where:P = Porosity (enter as a decimal)D = Depth below perforated pipe if present (in decimal feet)W = Width (in decimal feet)L = Length (in decimal feet)P = \underbrace{0.0}_{0.0}_{0.0}_{0.0}_{0}_{0}_{0}_{0}_{0}_{0}_{0}_{0}_{0}_{$	NOTE: LID Sizing Tool only applicable for volume based BMPs. Not required if site requires treatment only. w perforated pipe if present).	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 100%.





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 →	




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.





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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	AND Requirement 2- Volume
	C _{POST} = Rational method runoff coefficient for the developed cond	ition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prev	ention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]			
Input:		-		
	$A_r = \frac{33,681}{1000} ft^2 = \frac{0.77321}{1000} ft^2$	Acres		
	$C_{POST}^{[10]} = 0.41$			
	K ^[7] = 1.2			
		NOTE:		
Solution:		The Flow Rate calculate	ed here should only be used to size the	
		appropriate BMP. All a	ssociated overflow inlets and systems	
Q _{TREATMENT} = 0.07418 cfs	Q _{TREATMENT} = (0.2)(0.7732)(0.41)(1.17)	should be sized for the	Flood Control event.	



2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #28

Requirement 2: Delta Volume Capture No increase in volume of runoff leaving the site due to c Formulas: $S = \frac{1000}{CN} - 10$ Where: CN:	Jevelopment for the 85th percentile 24 hour storm ex Potential maximum retention after runoff (in) ^{5]} Curve Number ^[5]	vent.	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not achieved; then Requirement 1-100% Treatment, page 4 of the calculator, AND Requirement 2- Volume Capture, this page of the calculator, must be achieved.
Q= $[(P*K)-(0.2*S)]^2 \times \frac{1ft}{2}$ Where:			
[(P*K)+(0.8 * S)] ^ 12in Q= P= K=	 Runoff depth (ft) ^[6] Precipitation (in) = 0.92 Seasonal Precipitation Factor^[7] <i>area</i>, based on lo 	ə Santa Rosa cal historical	
V= (Q)(A _r) <u>Where:</u>	data.		NOTE:
V: A _r a	 Volume of Storm Water to be Retained (ft³) Reduced Tributary Area including credit for Pollution Pre 	evention Measures (ť)	If the amount of volume generated after development is less than or equal to that generated before
Input: (Pick data from drop down lists or enter calcula	ated values) $A_r = \frac{33,681}{K^{[7]}} ft^2$ $K^{[7]} = \frac{1.2}{K^{[7]}}$		development, Requirement 2-Volume Capture is not required.
	Drop dow	vn Lists	(0 post = 0 pre 0, 0)(post = 0)(pre)
Select hydrologic soil type v	within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration (tr	ransmission) rate	
Select predevelopment ground Select post development ground	d cover description ^[5] = Woods (50%), grass (50%) comb	bination (orchard or tree farm) - Fair	
Select post development ground	$CN_{\text{DDE}} = 76$	onop, Driveways	
	CN _{POST} = 90.3		
OR Composite Pr	redevelopment CN ^[9] = 80		
Composite Pos	t development CN ^[9] = 89		
Solution:			
Pre Development Storm Water Runoff Volume			
S _{PRE} = 2.50 in	S _{PRE} = <u>1000</u> 80 -10	$\frac{Where:}{S_{\text{PRE}}\text{=}} \text{ Pre development potential maximum retention after runoff}$	(in).
Q _{PRE} = 0.00900 ft	$\mathbf{Q}_{PRE} = \begin{array}{c} [(0.92^{*}1.17) \cdot (0.2^{*}2.50)]^2 \\ [(0.92^{*}1.17) + (0.8^{*}2.50)] \end{array} X \frac{1 \mathrm{ft}}{12 \mathrm{in}}$	Q _{PRE} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{PRE} = 303.13 ft ³	V _{PRE} = (0.00900)(33,681)	V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Post Development Storm Water Runoff Volume	_		
S _{POST} = 1.20 in	S _{POST} = <u>1000</u> 89 -10	Where: S _{POST} = Post development potential maximum retention after runol	if (in).
Q _{POST} = 0.02863 ft	Q _{POST} = [(0.92*1.17)-(0.2 * 1.20)] ² X 1ft [(0.92*1.17)+(0.8 * 1.20)] X 12in	Q _{POST} = Q in feet of depth as defined by the "Urban Hydrology For Small Watersheds" TR-55 Manual.	
V _{POST} = 964.29 ft ³	V _{POST} = (0.02863)(33,681)	$V_{\text{POST}}\text{=}$ Post Development Volume of Storm Water Generated (ft ³)	
Solution: Volume Capture Requirement Increase in volume of storm water that mu	ust be retained onsite (may be infiltrated or reused).		
		(12)	
Deita volume Capture= (V _{POST} -V _{PRE})	Deita volume Capture= (964.29) - (303.	13) Where	
V _{DELTA} = 661.16 ft ³	Delta Volu	Intercent of the increase in volume of storm water generated by the 8 percentile 24 hour storm event due to development that m retained onsite (may be infiltrated or reused).	5th ust be



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Capt	ure Goal; V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the design goal
$V_{LID GOAL} = ((V_{GOAL}))/(P) = 2590.38 \text{ ft}^3$	Where:	treatment only.	of 100% volume capture of the post
	V _{LID GOAL} = Required volume of soil in LID BMP.		development condition. Enter the
$A_{LID GOAL} = (W)(L) = 650.25$ ft ²	A _{LID GOAL} = Footprint of LID BMP area for a given depth (below perfora	ated pipe if present).	and depth below perforated pipe (if
	$V_{} = 1140 \text{ ft}^3$		present). The width and length entries
	GOAL - I, I-O		will need to be interactively adjusted
	Where:		until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $(D)(A_{LID GOAL})$	P= Porosity (enter as a decimal)		
V _{LID GOAL} X 100	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 decimal		
	D = 4.0 ft Below perforated pipe if present		
	W = 25.5 ft		
	L = 25.5 ft		
Oslutions		_	
Solution:	e (/ 0 × 650) / 2 500 1 × 100	7	
Percent of Goal Achieved – 100.41	$7_0 = [(4.0 \times 650) / 2,590] \times 100$		
			J
			INSTRUCTIONS:
LID BMP Sizing Tool Delta Volume Captu	re Requirement: Vnet to	NOTE:	INSTRUCTIONS: The Delta Volume Capture sizing tool
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
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>
LID BMP Sizing Tool Delta Volume Captu Formulas: 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
LID BMP Sizing Tool Delta Volume Captu Formulas: 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 capture. Enter the percent of porosity of the specified soil and denth below
LID BMP Sizing Tool Delta Volume Captu Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/0!$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ²	<u>re Requirement</u> : V _{DELTA} <u>Where:</u> V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perform	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width
LID BMP Sizing Tool Delta Volume Captu Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/0! ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ²	where: VLD DELTA VLID DELTA= Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below perform Variation = 100 ftf 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 <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
LID BMP Sizing Tool Delta Volume Captu Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/0!$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ²	metric 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 perform VDELTA= 661.16	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 <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
LID BMP Sizing Tool Delta Volume Captu Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/0!$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ²	metric 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 perform VDELTA= 661.16 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 <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
LID BMP Sizing Tool Delta Volume Captu Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/0! ft^3$ $A_{LID DELTA}=(W)(L) = 0.00 ft^2$ Percent of Requirement $(D)(A_{LID DELTA}) \times 100$	matrix V_DELTA 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 perform V_{DELTA} = 661.16 ft ³ Where: 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 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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/0! \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$	re Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perfora V_{DELTA} = 661.16 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.	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	matrix V_DELTA Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perfora V_{DELTA} = 661.16 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) V = width (in decimal feet)	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 <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 100%.
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01$ ft ⁻³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ⁻² Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$	matrix VDELTA Where: VLID DELTA = Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below perfora VDELTA = 661.16 ft ³ 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)	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> <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 100%.
LID BMP Sizing Tool Delta Volume Captu Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	where: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perfora V_{DELTA} = 661.16 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) We Width (in decimal feet) U = Units 0.0 as a decimal	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captu Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	where: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perfora V_{DELTA} = 661.16 ft ³ 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) D = 0.0 the Below perforated pipe if present	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captu Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/0! \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ <u>Input:</u>	matrix V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perfora V_{DELTA} = 661.16 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= 0.0 ft 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.	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captu Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = #DIV/0! \text{ ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement Achieved $= \frac{(D)(A_{\text{LID DELTA}})}{V_{\text{LID DELTA}}} \times 100$ Input:	matrix V_DELTA Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perfora V_{DELTA} = 661.16 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= 0.0 ft Below perforated pipe if present W = 0.0 ft Below perforated pipe if present	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captu Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/0! ft^3$ $A_{LID DELTA}=(W)(L) = 0.00 ft^2$ Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	matrix V_DELTA Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perfora V_{DELTA} = 661.16 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= 0.0 ft D = 0.0 ft Below perforated pipe if present	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captu Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/0! ft^3$ $A_{LID DELTA} = (W)(L) = 0.00 ft^2$ Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: Solution:	matrix V_DELTA 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 VDELTA = 661.16 ft ³ Where: P = 661.16 ft ³ Where: P = Porosity (enter as a decimal) D = Depth below perforated pipe if present (in decimal feet) W= 0.0 ft D = 0.0 ft D = 0.0 ft D = 0.0 ft D = 0.0 ft	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 <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 100%.
LID BMP Sizing Tool Delta Volume Captu Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/0! ft^3$ $A_{LID DELTA}=(W)(L) = 0.00 ft^2$ Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: $D_{DELTA} = \frac{DIV/0!}{D}$	The Requirement: V_{DELTA} $\frac{Where:}{V_{LID DELTA}} = Required volume of soil in LID BMP A_{LID DELTA} = Footprint of LID BMP area for a given depth (below perforated V_{DELTA} = \underbrace{661.16}_{1.16} ft^3Where:P = Porosity (enter as a decimal)D = Depth below perforated pipe if present (in decimal feet)W = \underbrace{0.00}_{0.0} ft as a decimalD = \underbrace{0.00}_{0.0} ft$ as a decimal $W = \underbrace{0.00}_{0.0} ft$ as a decimal $W = \underbrace{0.00}_{0.0} ft$ Below perforated pipe if present $W = \underbrace{0.00}_{0.0} ft$ = #DIV/0!	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 <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 100%.





Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connected Paved Area 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:	
Area Reduction = 0.00 ft ²	
Interceptor Trees [2]	INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new Evergreen Trees that qualify as interceptor trees= 0 New Evergreen Trees NOTE: Area Reduction due to new Evergreen Trees= 0 ft² (200 ft²/tree) Total Interceptor Area Reduction is limited to 50% of the physical tributary area. 0 ft² (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= 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 tree canopy = 50 % of actual canopy square footage	2
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% Treatment	nt			INSTRUCTIONS:
Treatment of 100% of the flow generated b	y 85th percentile 24 hour mean annual rain event (0.2 i	n/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/nr)(A _r)(C _{POST})(K) CTS	Where:		The table of values can be found here	I reatment, this page of the calculator,
	QTREATMENT - Design flow rate required to be treated (crs)	lanad condition ^[10]	This smaller value should not be used	Capture page 5 of the calculator
	A = Reduced Tributery Area including gredit for R	Nution Brovention Measures (in Acros)	to size the overflow bypass.	must be achieved
	K = Seasonal Precipitation Factor[7]	Silution revention measures (in Acres)		
Input:	$A_r = \frac{22,085}{10}$ ft ² =	0.50700 Acres		
	$K^{[7]} = 1.2$			
		NOTE:		
Solution:		The Flow Rate calculate	ed here should only be used to size the	
Q _{TREATMENT} = 0.07474 cfs	Q _{TREATMENT} = (0.2)(0.5070)(0.63)(1.17)	appropriate BMP. All as should be sized for the	ssociated overflow inlets and systems Flood Control event.	



2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #29

Requirement 2: Delta Volume Capture No increase in volume of runoff leaving 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%
Formulas:	Treatment page 4 of the calculator
S = 1000 - 10 Where:	AND Requirement 2- Volume
$\frac{1}{1}$ S= Potential maximum retention after runoff (in ⁵⁾	Capture, this page of the calculator
CN= Curve Number ^[5]	Capture, this page of the calculator,
$O = \left[\left(P_{+} K \right) \left(0.2 + S \right) \right]^{2}$ 1ff Where:	must be achieved.
$\frac{1}{10} \frac{1}{10} \frac$	
$[(F^*K)^*(0.5^*G)]$ 12in Q ⁻ Runott depth (ft) ^{1/3}	
P= Precipitation (in) = 0.92 0.92 inches in the Santa Rosa	
K= Seasonal Precipitation Factor ^{1/1} area, based on local historical	
$V = (Q)(A_r)$ Where:	NOTE:
V= Volume of Storm Water to be Retained (f^3)	If the amount of volume generated
A = Reduced Tributary Area including credit for Pollution Prevention Measures ([#])	after development is less than or
	aner development is less than of
	equal to that generated before
input: (Pick data from drop down lists or enter calculated values)	development, Requirement 2-Volume
$A_r = 22,085$ ft ⁻	Capture is not required.
$K^{[7]} = 1.2$	
Drop down Lists	(C POST S C PRE OF CIN POST S CIN PRE)
Select hydrologic soil type within tributary ares $^{[8]} = [C: 0.05 - 0.15 in/hr infiltration (transmission) rate$	
Select redevelopment ground a bever description ⁵ = Woods (50%) grass (50%) combination (article farm) - Fair	
Select prot development ground over description ⁵ - Impagyious Payod Particip Poolfon Driverse	
Select post development ground cover description – mpervices - rated Parking, Robitop, Driveways	
CN _{POST} = 90.3	
OR Composite Predevelopment CN ¹⁹ = 80	
Composite Post development CN ^[9] = 96	
Solution:	
S_{PRE} 2.50 in S_{PRE} 100 10 Where:	
80 S _{PRE} = Pre development potential maximum retention after runoff (in).
$Q_{\text{PRF}} = 0.00900$ ft $[(0.92^*1.17)-(0.2^*2.50)]^2 \times 1$ ft $Q_{\text{PRF}} = Q_{\text{in feet of depth as defined by the "Urban}$	
$\mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf{U}_{PRE} = \begin{bmatrix} 100 & 921 & 17 \end{bmatrix} + (0.8 \times 2.50) \\ \mathbf$	
$V_{r-r} = 109.77$ [ft ³] $V_{r-r} = (0.0000)/(22.085)$ $V_{r-r} = Dro Douglopment Volume of Sterm Water Concerned (ft3)$	
Post Development Storm Water Punoff Volume	
S _{POST} = 0.41667 in S _{POST} = 1000 -10 Where:	
96 S _{POST} = Post development potential maximum retention after runoff	(in).
$Q_{POST} = 0.05811$ ft $Q_{POST} = [(0.92^{+}1.17) - (0.2^{+}0.42)]^2$, 1ft $Q_{POST} = Q$ in feet of depth as defined by the "Urban	
10.92*1 17)+(0.8 * 0.42) 12in Hydrology For Small Watersbeds" TR-55 Manual	
VPOST 1283.30 "VPOST (0.05811)(22,085) VPOST Post Development Volume of Storm Water Generated (ft")	
Solution: Volume Capture Requirement	
Increase in volume of storm water that must be retained onsite (may be infiltrated or reused).	
^{CO} Delta Volume Capture= (V _{POST} -V _{PRE}) Delta Volume Capture= (1.283.36) - (198.77)	
Where	
VDFLTA= 1084 59 c3 Delta Volume Capture= The increase in volume of storm water generated by the 85	th
percentile 24 hour storm event due to development that mu	st be
retained onsite (may be infiltrated or reused)	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Captu	<u>ure Goal;</u> V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the design goal
$V_{LID GOAL} = ((V_{GOAL}))/(P) = 3275.61 \text{ ft}^3$	Where:	treatment only.	of 100% volume capture of the post
	V _{LID GOAL} = Required volume of soil in LID BMP.		development condition. Enter the
$A_{\text{LID GOAL}}=(W)(L) = 750.76 \text{ ft}^2$	$A_{LID GOAL}$ = Footprint of LID BMP area for a given depth (below performance)	prated pipe if present).	and depth below perforated pipe (if
	$V_{\text{GOAL}} = $ 1,441 ft^3		present). The width and length entries will need to be interactively adjusted
	Where:		until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $\frac{(D)(A_{LID GOAL})}{X 100}$	P= Porosity (enter as a decimal)		
V _{LID GOAL}	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 decimal		
	D = 4.4 ft Below perforated pipe if present		
	W = 27.4 ft		
	L = 27.4 ft		
Solution		7	
Percent of Goal Achieved = 100.85	% = $[(4.4 \times 751) / 3.276] \times 100$,	
			1
LID BMP Sizing Tool Delta Volume Captur	re Requirement: V _{DELTA}	NOTE:	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size
LID BMP Sizing Tool Delta Volume Captur	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>
LID BMP Sizing Tool Delta Volume Captur	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
LID BMP Sizing Tool Delta Volume Captur Formulas: VLID DELTA=((VDELTA))/(P) = #DIV/01 ft ³	re Requirement: 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
LID BMP Sizing Tool Delta Volume Captur Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01 ft ³ A _{LID DELTA} =(W)(L) = 0.00 ft ²	re Requirement: V _{DELTA} <u>Where:</u> V _{LID DELTA} = Required volume of soil in LID BMP A _{LID DELTA} = Footprint of LID BMP area for a given depth (below perfo	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ²	Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below performance) VDELTA= 1084.59	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 <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
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ²	where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below performance) VDELTA= 1084.59 Where: 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 <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
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = #DIV/01 \text{ ft}^3$ $A_{LID DELTA} = (W)(L) = 0.00 \text{ ft}^2$ Percent of Requirement = $(D)(A_{LID DELTA}) = 100$	where: $V_{LID DELTA}$ Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP A_{LID DELTA} = Footprint of LID BMP area for a given depth (below performed by the second secon	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 <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 100%.
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LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = $ #DIV/01 ft ³ $A_{LID DELTA} = (W)(L) = $ 0.00 ft ² Percent of Requirement Achieved = $\frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input:	The Requirement: VDELTA Where: VLID DELTA = Required volume of soil in LID BMP ALID DELTA = Footprint of LID BMP area for a given depth (below performed to the second	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 <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 100%.
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LID BMP Sizing Tool Delta Volume Captur Formulas: $V_{LID DELTA}=((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{LID DELTA}=(W)(L) = 0.00$ ft ² Percent of Requirement Achieved $= \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} \times 100$ Input: Solution: \Rightarrow Percent of Requirement Achieved = #DIV/01	The Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below perfor V_{DELTA} = 1084.59 ft ³ 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) $P = \begin{bmatrix} 0.0 \\ 0.0 \\ ft \end{bmatrix}$ as a decimal $D = \begin{bmatrix} 0.0 \\ 0.0 \\ 0.0 \\ ft \end{bmatrix}$ Below perforated pipe if present $W = \begin{bmatrix} 0.0 \\ 0.0 \\ 0.0 \\ ft \end{bmatrix}$ as a decimal $W = \begin{bmatrix} 0.0 \\ 0.0 \\ 0.0 \\ ft \end{bmatrix}$	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 <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 100%.





Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-connected Paved Area 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]	INSTRUCTIONS: Calculates the area reductions credit due to interceptor trees. Includes both
Number of new Evergreen Trees that qualify as interceptor trees= 0 New Evergreen Trees NOTE: Area Reduction due to new Evergreen Trees= 0 ft² (200 ft²/tree) Total Interceptor Area Reduction due to new Evergreen Trees= 0 ft² (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=	
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	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	
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% Treatmo	ent			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
<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:		nydraulic 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	on ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Pollution Prever	tion Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]			
Input:				I
	$A_r = 25,456 \text{ ft}^2 = 0.58439 \text{ A}$	cres		
	$C_{POST}^{[10]} = 0.55$			l l
	K ^[7] = 1.2			
	1	IOTE:		
Solution:	7	he Flow Rate calculate	ed here should only be used to size the	
	a	ppropriate BMP. All as	ssociated overflow inlets and systems	
Q _{TREATMENT} = 0.07521 cfs	Q _{TREATMENT} = (0.2)(0.5844)(0.55)(1.17) s	hould be sized for the	Flood Control event.	I
				i de la constante d

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2854.04 Elnoka CCRC Brelje Race Consulting Engineers DMA #30

Requirement 2: Delta Volume Capture No increase in volume of runoff leaving the site due to d	levelopment 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%
			reatment, page 4 of the calculator,
$S = \frac{1000}{CN} - 10$ Where:	Detential maximum rotantian after support (- 15)		AND Requirement 2- Volume
			Capture, this page of the calculator,
$C_{\rm N} = C_{\rm N}^2 + C_{\rm N}^2 + C_{\rm N}^2$	= Curve Number **		must be achieved.
$Q = \frac{[(P + K) - (0.2 + S)]}{[(P + K) + (0.8 + S)]} \times \frac{\Pi (1 + S)}{40}$			
[(P*K)+(0.0 * 5)] 12m Q-	- Runoff depth (ft) ¹⁰	ha Canta Daga	
P=	= Precipitation (in) = 0.92 0.92 incres in the	ne Santa Rosa Jocal historical	
κ=	= Seasonal Precipitation Factor 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 (†)	after development is less than or
			equal to that generated before
Input: (Pick data from drop down lists or enter calcula	ated values)		development, Requirement 2-Volume
	$A_r = 25,456 \text{ ft}^2$		Capture is not required.
	K ^[7] = 1.2		$(C_{\text{res}} \leq C_{\text{res}} \text{ or } CN_{\text{res}} \leq CN_{\text{res}})$
	Drop do	own Lists	(O POST = O PRE OF ON POST = ON PRE)
Select hydrologic soil type w	within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltration	(transmission) rate	
Select predevelopment ground	d cover description ^[5] = Woods (50%), grass (50%) cor	mbination (orchard or tree farm) - Fair	
Select post development ground	d cover description ^[5] = Impervious - Paved Parking, R	Rooftop, Driveways	
	CN _{PRE} = 76		
	CN _{POST} = 90.3		
OR Composite Pr	edevelopment CN ^[9] = 80		
Composite Pos	t development CN ^[9] = 94		
Solution:			
Bro Dovelopment Storm Water Buneff Volume			
Pre Development Storm water Kunoff Volume	0 – 1000		
S _{PRE} = 2.50 in	S _{PRE} = <u>1000</u> -10	Where:	
	80	S_{PRE} = Pre development potential maximum retention after runoff (in).	
Q _{PRE} = 0.00900 ft	$Q_{\text{DDE}} = \frac{[(0.92*1.17) - (0.2 * 2.50)]^2}{1 \text{ X}} \times \frac{1 \text{ ft}}{1 \text{ ft}}$	Q_{PRE} = Q in feet of depth as defined by the "Urban	
	[(0.92*1.17)+(0.8 * 2.50)] 12in	Hydrology For Small Watersheds" TR-55 Manual.	
V _{PRE} = 229.10 ft ³	V _{PRE} = (0.00900)(25,456)	V _{PRE} = Pre Development Volume of Storm Water Generated (ft ³)	
Post Development Storm Water Runoff Volume			
S _{POST} = 0.68376 in	S _{POST} = <u>1000</u> 10	Where:	
	94	S _{POST} = Post development potential maximum retention after runoff (in).	
	-		
Q _{POST} = 0.04548 ft	Q _{POST} = [(0.92*1.17)-(0.2 * 0.68)] ² , 1ft	Q _{POST} = Q in feet of depth as defined by the "Urban	
	[(0.92*1.17)+(0.8*0.68)] X 12in	Hydrology For Small Watersheds" TR-55 Manual.	
$V_{POST} = 1157.74 \text{ ft}^3$	V_{POST} = (0.04548)(25.456)	V _{POST} = Post Development Volume of Storm Water Generated (ft ³)	
Solution: Volume Capture Requirement			
Increase in volume of storm water that mu	ist be retained onsite (may be infiltrated or reused	0	
	as be retained onlike (may be initiated of redsed	·/·	
Ö Delta Volume Capture= (Vacat-Vacat)	Delta Volume Capture= (1 157 74) - (2	229 10)	
		Where:	
VDELTA = 029.62 c.3	Delta Vo	Dlume Capture= The increase in volume of storm water generated by the 85th	
- DELTA		percentile 24 hour storm event due to development that must be	
		retained onsite (may be infiltrated or reused).	



			INSTRUCTIONS:
LID BMP Sizing Tool: 100% Volume Capture	e Goal <u>;</u> V _{GOAL}	NOTE:	The 100% volume capture sizing tool
		LID Sizing Tool only applicable for volume	helps the designer appropriately size
Formulas:		based BMPs. Not required if site requires	a LID BMP to achieve the design goal
$V_{LID GOAL} = ((V_{GOAL}))/(P) = 3007.28$ ft ³	Where:	treatment only.	of 100% volume capture of the post
	V _{LID GOAL} = Required volume of soil in LID BMP.		development condition. Enter the
$A_{LID GOAL} = (W)(L) = 761.76$ H ⁻	A _{LID GOAL} = Footprint of LID BMP area for a given depth (below pe	rforated pipe if present).	and depth below perforated pipe (if
	$V_{GOAL} = 1,323$ ft ³		present). The width and length entries will need to be interactively adjusted
W	here:		until "Percent of Goal" equals 100%.
Percent of Goal Achieved = $(D)(A_{LID GOAL})$ × 100	P= Porosity (enter as a decimal)		
VLID GOAL	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 decimal		
	D = 4.0 ft Below perforated pipe if present		
	W = 27.6 ft		
	L = 27.6 ft		
Solution		7	
Percent of Goal Achieved = 101 32 %	$= [(4.0 \times 762) / 3.007] \times 100$	1	
	- [(4.0 x 102)7 0,001] x 100		
LID BMP Sizing Tool Delta Volume Capture	Requirement: V _{DELTA}	NOTE:	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size
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	INSTRUCTIONS: The Delta Volume Capture sizing tool helps the designer appropriately size a LID BMP to achieve the <u>design</u>
LID BMP Sizing Tool Delta Volume Capture <u>Formulas:</u> V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0] 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
LID BMP Sizing Tool Delta Volume Capture Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/01]ft ³	Requirement: 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 <u>capture</u> . Enter the percent of porosity
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA}$ =((V_{DELTA}))/(P) = #DIV/0! ft ³ $A_{LID DELTA}$ =(W)(L) = 0.00 ft ²	Where: VLID DELTA= VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below per source)	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 <u>capture</u> . Enter the percent of porosity of the specified soil and depth below perforated pipe (if present). The width
LID BMP Sizing Tool Delta Volume Capture Formulas: V _{LID DELTA} =((V _{DELTA}))/(P) = #DIV/0!]ft ³ A _{LID DELTA} =(W)(L) = 0.00 ft ²	Mere: VLID DELTA= Required volume of soil in LID BMP ALID DELTA= Footprint of LID BMP area for a given depth (below pe VDELTA= 928.63 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 <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
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{UD DELTA}=((V_{DELTA}))/(P) = #DIV/01$ ft ³ $A_{UD DELTA}=(W)(L) = 0.00$ ft ²	Mere: VLID DELTA VLID DELTA Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below pe VDELTA 928.63 ft ³ here:	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 <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
LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{\text{LID DELTA}} = ((V_{\text{DELTA}}))/(P) = \#DIV/01] \text{ft}^3$ $A_{\text{LID DELTA}} = (W)(L) = 0.00 \text{ft}^2$ Percent of Requirement $= (D)(A_{\text{LID DELTA}}) = 0.00$	Mere: VLID DELTA VLID DELTA Required volume of soil in LID BMP ALID DELTA Footprint of LID BMP area for a given depth (below pe VDELTA 928.63 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 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 100%.
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LID BMP Sizing Tool Delta Volume Capture Formulas: $V_{LID DELTA} = ((V_{DELTA}))/(P) = \#DIV/01]$ ft ³ $A_{LID DELTA} = (W)(L) = 0.00$ ft ² Percent of Requirement $A_{Chieved} = \frac{(D)(A_{LID DELTA})}{V_{LID DELTA}} x 100$ Input: Solution:	Requirement: V_{DELTA} Where: $V_{LID DELTA}$ = Required volume of soil in LID BMP $A_{LID DELTA}$ = Footprint of LID BMP area for a given depth (below per V_{DELTA} = 928.63 ft ³ here: P= Depth below perforated pipe if present (in decimal feet) W= Width (in decimal feet) L= 0.0 P = 0.0 0.0 ft Below perforated pipe if present W = 0.0 0.0 ft	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 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%.
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Paved Area Disconnection ^[1] Paved Area Type (select from drop down list): Not Directly-conner 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] Number of new <i>Evergreen Trees</i> that qualify as interceptor trees= 0 Area Reduction due to new Evergreen Trees= 0 ft ²	New Evergreen Trees (200 ft ² /tree)	NOTE: Total Interceptor Area Reduction is limited to 50% of	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=	New Deciduous Trees	the physical tributary area.	
Area Reduction due to new Deciduous Trees=	(100 ft ² /tree)		
Allowed reduction credit for existing tree canopy=	Existing Tree Canopy 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	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% 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 develo	oped condition ^[10]	This smaller value should not be used	Capture, page 5 of the calculator,
	A _r = Reduced Tributary Area including credit for Poll	ution Prevention Measures (in Acres)	to size the overflow bypass.	must be achieved.
	K = Seasonal Precipitation Factor ^[7]			
Input:				
	$A_r = 14,563 \text{ ft}^2 = 14,563 \text{ ft}^2$	0.33432 Acres		
	$C_{POST}^{[10]} = 0.54$			
	K ^[/] = 1.2			
		NOTE:		
Solution:		The Flow Rate calculate	ed here should only be used to size the	
	0	appropriate BMP. All as	ssociated overflow inlets and systems	
QTREATMENT 0.04224 cfs	QTREATMENT ⁼ (0.2)(0.3343)(0.54)(1.17)	should be sized for the	Flood Control event.	



Requirement 2: Delta Volume (No increase in volume of runoff leaving th	INSTRUCTIONS: If the Design Goal of 100% Capture on page 3 of this calculator is not achieved; then Requirement 1-100%		
rormulas:	14.0		I reatment, page 4 of the calculator,
$S = \frac{1000}{2N} - 10$	Where:		AND Requirement 2- Volume
CN	S= Potential maximum retention after runoff (in) ³		Capture, this page of the calculator,
	CN= Curve Number ¹⁰		must be achieved.
$Q = \frac{[(P * K) - (0.2 * S)]^2}{[(P * K) - (0.2 * S)]^2} \times \frac{1 f f}{1 + 1}$	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	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.= Reduced Tributary Area including credit for Pollutio	on Prevention Measures (ť)	after development is less than or
	, ,		anel development is less than of
Input: (Pick data from drop down lists	or optor colculated values)		equal to that generated before
Input. (Pick data from drop down lists			development, Requirement 2-Volume
	$A_r = 14,563$ It		Capture is not required.
	K ^{1/1} = 1.2		$(C_{POST} \leq C_{PPE} \text{ or } CN_{POST} \leq CN_{PPE})$
	Droj	p down Lists	(FOST - FRE - FRE - FOST - FRE)
Select hydro	logic soil type within tributary area ^[8] = C: 0.05 - 0.15 in/hr infiltrat	ion (transmission) rate	
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 Parkin	g, Rooftop, Driveways	
	CN _{PRE} = 76	· · ·	
	CNpost = 90.3		
OR	Composite Predevelopment CN ^[9] = 80		
Solution			
<u>solution.</u>			
Pre Development Storm Water Rund	off Volume		
S _{PRF} = 2.50 in	S _{PRE} = 1000	Where:	
	80 -10	Spec= Pre development potential maximum retention after runoff (in)	
	00		
0 = 0.00000 #	[(0,02*1,17) (0,2 * 2,50)]2 10	O = O in fact of double on defined by the "Ulder	
αpre 0.00900 π	$Q_{PRE} = \frac{1(0.92 1.17) \cdot (0.2 2.50)}{10} \times \frac{11}{10}$		
	[(0.92*1.17)+(0.8 * 2.50)] 12in	Hydrology For Small Watersheds" TR-55 Manual.	
M	W		
$V_{PRE} = 131.07$	V _{PRE} = (0.00900)(14,563)	V _{PRE} = Pre Development Volume of Storm Water Generated (ft ²)	
Post Development Storm Water Run	ioπ volume		
S _{POST} = 0.72961 in	S _{POST} = <u>1000</u> 10	Where:	
	93	S _{POST} = Post development potential maximum retention after runoff (in).	
Q _{POST} = 0.04345 ft	$\mathbf{Q}_{POST} = [(0.92^{*}1.17) - (0.2^{*}0.73)]^2$, 1ft	$Q_{\text{post}} = Q$ in feet of depth as defined by the "Urban	
	I(0.92*1.17)+(0.8*0.73) X 12in	Hydrology For Small Watersheds" TR-55 Manual	
		ing all origin of onlaw trace of our of the individual	
$V_{} = 632.76 \text{ ft}^3$	$V_{\text{non-}} = (0.04345)(14.563)$	V= Rect Development Volume of Storm Water Concreted (ft ³)	
• POST - 032.70	· POST (0.0+3+3)(14,003)	·POST FUSE Development volume of Storm water Generated (IT)	
Solution: Volume Conture De mile			
Solution: volume Capture Require	ement		
Increase in volume of storm	water that must be retained onsite (may be infiltrated or reus	sed).	
201			
 Delta Volume Capture= (V_{POST}-V 	/ _{PRE}) Delta Volume Capture= (632.76) -	(131.07)	
		Where:	
V _{DELTA} = 50	1.70 ft ³ Delta	a Volume Capture= 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).	