

Harnessing Rainwater From Stemflow Collars To Aid In Restoration Efforts

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INTRODUCTION/BACKGROUND

The Honolulu Board of Water Supply (BWS) has been conducting Canopy Interception (CI) studies on the island of O'ahu since 2017. One component of the CI study is Stemflow (SF). This is done by putting a collar around selected trees to measure the amount of rain captured by the canopy that flows down the trunks to the ground (Information about the BWS CI studies can be found at boardofwatersupply.com).

Over the years, staff observed significant amounts of SF captured from non-native trees and thought it would be ideal to utilize this characteristic trait of non-native trees to capture rainfall and redirect it for restoration efforts. Capturing SF can supplement or potentially replace the need to transport water to restoration sites, minimizing helicopter costs and staff impacts.



METHODS

Collars were placed around tree trunks using duct seal- a claylike material used to plug holes/gaps in duct work such as A/C units.

Knead the duct seal until it is pliable, then roll out a long length about 1 inch thick to press on to the trunk at waist to chest height for ease of installation and maintenance. Keep the thickness as consistent as possible. The top surface should be even with no low spots and have a slight angle towards the tubing to allow the water to easily drain. Smooth out any gaps between the trunk and duct seal ring.



Secure the tubing to the trunk with wire below the collar to prevent it from falling out of the collar during installation. It is recommended not to embed the wire in the duct seal in case the wire needs to be adjusted or removed as the tree grows. The tubing should be long enough to sit securely inside the catchment container.



Wrap the base cove around the duct seal and allow the ends to overlap at least a couple inches. The base cove should be snug, but not too tight – or it will compress the duct seal ring, and not too loose – or gaps will cause leakage.



Secure the base cove with wire. Do not over tighten the wire. It will distort the duct seal, or the wire might break. Place duct seal in the base cove seam inside of the collar.

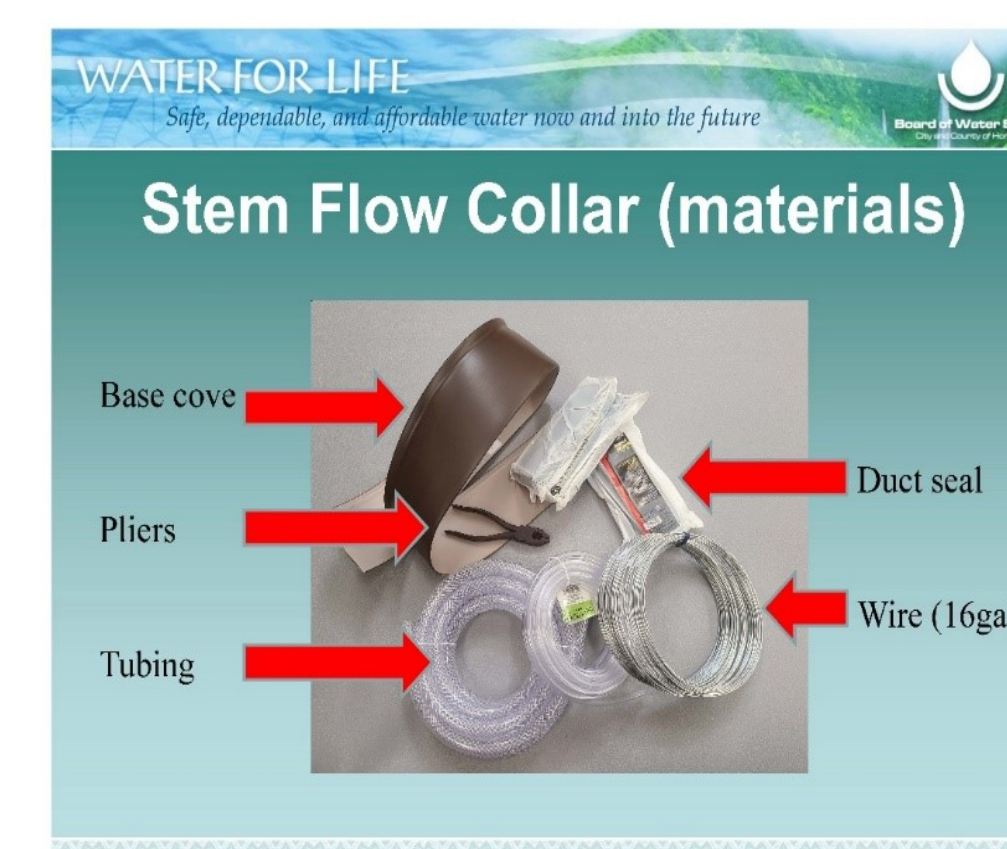


Pour water into the collar to test for leaks and check to see if water is draining into the tubing.

MATERIALS/EQUIPMENT

The materials needed are minimal, and the bulkiest item is the water storage container. Depending on the size, it can be moved to another location fairly- easily once the plants are established.

The following materials were used to construct Stemflow collars: Vinyl tubing, Duct seal, Vinyl base cove (flooring material), Galvanized wire, Pliers with wire cutter.



ESTIMATED COST (2022)*

ITEM	DESCRIPTION	COST PER ITEM	COST PER TREE (5IN DIA)
Vinyl tubing	½in OD x 3/8in ID x 20ft	\$8.70	\$0.44
Vinyl tubing	7/8in OD x 5/8in ID x 10ft	\$22.60	\$7.80
Duct seal	1lb block	\$3.83	\$11.49
Vinyl base cove	4in x 48in	\$3.00	\$3.00
Galvanized wire	16ga 200ft	\$7.50	\$0.16
		TOTAL	\$22.89

OD- outer diameter; ID- inner diameter; ga- gage

*Estimated Cost is just for the collar. It does not include cost of container or tools used.

MAINTENANCE

Storing water in open containers can breed mosquitoes. Covering the containers with a window screen secured to the opening will prevent the catchments from becoming mosquito breeding grounds. When feasible, another option is to add guppies to eat mosquito larvae. A couple drops of dish soap or bleach (amount depends on container size) can also be used. Maintenance is needed to keep the screen free of debris. Frequency will depend on the type of canopy cover. During dry season, clean debris from empty containers and do repairs if needed.



If wire is used to secure the tubing to the tree, the tubing should be checked a few times a year to ensure the tubing is not compromised as the tree grows. Disturbance to the duct seal may lead to leaks and the collar may need to be redone.

Collar and Tubing should be checked during each visit to see if it is clear of obstructions and drains properly.



LESSONS LEARNED ALONG THE WAY

Base Cove Placement



It is important to place the base cove high enough around the duct seal to create a reservoir to allow the collected stemflow time to drain into the tubing. The picture shows the base cove placement too low on the duct seal. There is no reservoir, and water can run off the top of the collar draining into the tubing.

Tubing

Smaller diameter tubing can plug quickly due to debris or algae growing inside. Clear tubing can develop algae quickly. Covering the tubing can reduce the growth.



Other Collar Materials (Failed Attempts)



Wood epoxy- relatively easy to shape, but cracks will develop as the tree expands and contracts.



Spray foam- very hard to control and shape. It was a big mess.



Silicone- made for wet conditions/ waterproof, but Has a long cure time. It is difficult to create a thick, smooth surface.

Tree Selection/Bark Type

Ideal trees to collar have smooth bark with fairly even diameter- not too many indentations or bulges at the collar site. Ideally, tree canopy should stand alone and not meld with the canopy of nearby trees. Water may be redirected water towards the other tree trunks.

Trees with rough textured bark, covered with lichen, or had indentations were hard to get a good seal and tended to leak.



Tip: Observe which trees have water streaming down the trunk when it is raining.

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