ROUTE 231 WATER ACCESS | **SITE DESIGN**

TO: Hanae Garrison, Royal River Conservation Trust
FROM: Mindee Goodrum, FB Environmental Associates
SUBJECT: **Route 231 Water Access Improvements, Technical Assistance Site Design Report**
DATE: June 10, 2026
CC: Amelia Wallis and Forrest Bell, FB Environmental Associates

Site Location

The Intervale Preserve, owned and managed by the Royal River Conservation Trust, covers 328-acres in total within New Gloucester, conserving important habitat in the Royal River watershed and providing various recreational opportunities. The Route 231 parcel of the Intervale Preserve currently contains an informal access trail providing hand-carry boat access to the Royal River. The earthen path is mowed by the Royal River Conservation Trust, and currently receives light use. The trail has a light covering of grass, with clay soils exposed in areas. The trail steeply slopes down from Route 231 at about a 16% grade before flattening out along the floodplain of the Royal River. Sections of the riverbank are eroded. The access trail exhibits minor erosion. The Royal River Conservation Trust seeks to improve the design and safety of the trail for recreational users, mitigate current and future erosion, and help protect the banks of the Royal River. All activities will take place within 75 feet of the Royal River.

Description of Identified Problems

FB Environmental (FBE) technical staff and project partners from the Royal River Conservation Trust completed a walkthrough of the trail on April 9, 2026. Existing site photos are provided in Attachment 1.

Stormwater runoff, trail compaction, and a lack of stormwater management measures have created minor sheet flow erosion along the Royal River access trail. It is anticipated that this erosion will worsen over time if more users begin to use the trail. Additionally, without a clearly defined access point along the river, human use is exacerbating natural erosion processes along the riverbank.

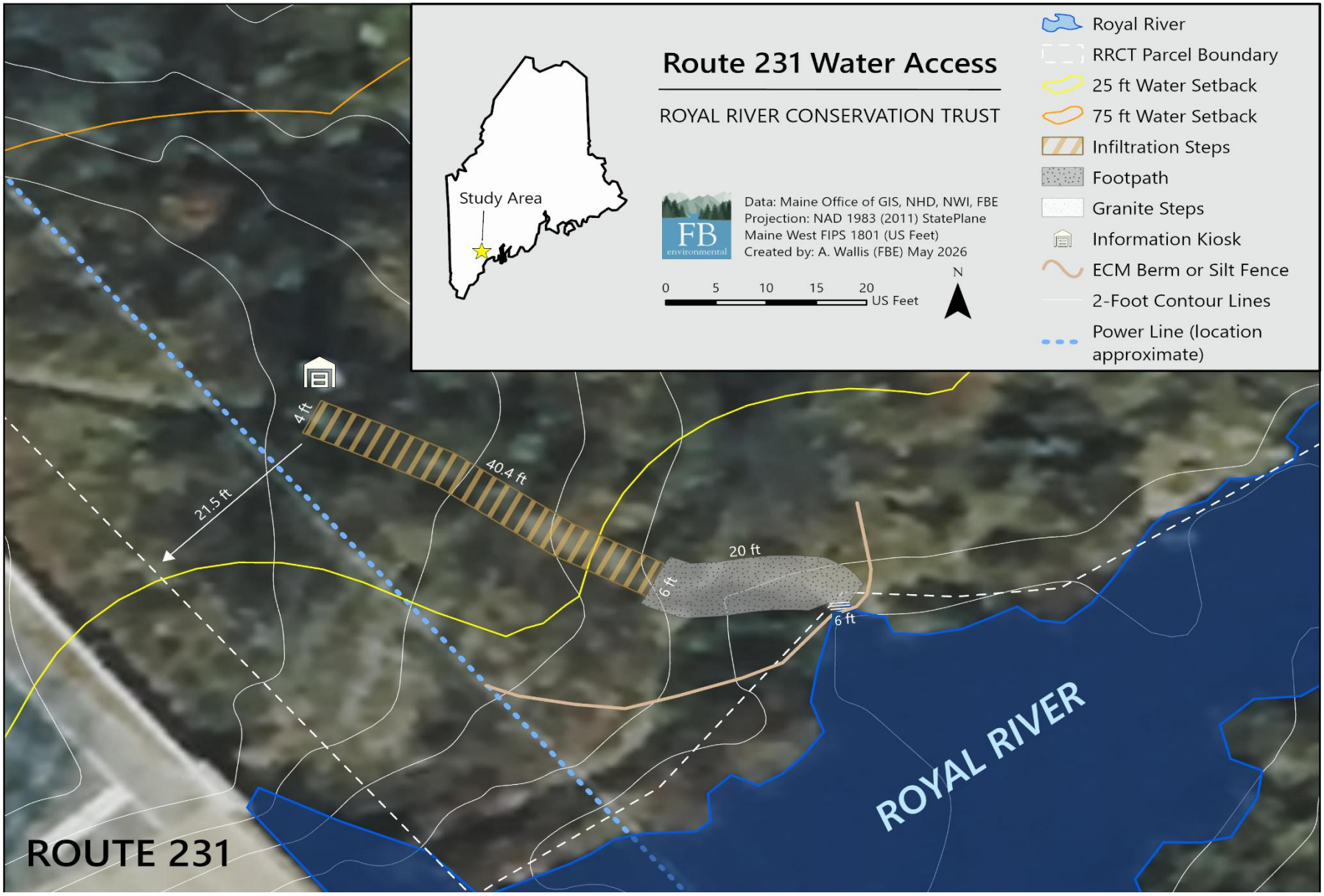


Figure 1. Recommended solutions at the Route 231 water access site of the Intervale Preserve.

RECOMMENDED SOLUTIONS

To improve the access trail, FBE's approach entails installing a section of infiltration steps along the sloped portion of the trail to help capture stormwater runoff, clearly define the trail's path to improve visitor use, and establish a safer surface than the existing slippery clay soils (Figure 1). Native plants will be added along the sides of the stairs to buffer stormwater, mitigate erosion, improve habitat, and reduce unwanted foot traffic off of the trail. A short section of granite slab stairs will be added down by the edge of the Royal River. Infiltration steps would not be effective in this area of active floodplain. Dogwood live stakes, harvested on site from existing shrubs, will be added along eroding sections of the riverbank to promote long-term stabilization.

Design sketches for recommended solutions are provided in Attachment 2.

INFILTRATION STEPS

Add infiltration steps from the existing trail kiosk to the edge of the floodplain, approximately 40.4 feet. The infiltration steps will be constructed with 6"x6" timbers, lined with a non-woven geotextile fabric, and filled with ¾" crushed stone. The steps will be stabilized with rebar for additional security. Installation should follow the guidelines in the Maine Conservation Fact Sheets for Homeowners: Infiltration Steps (Attachment 3). The steps should not exceed six feet in width. The sides of the stairs should be stabilized with erosion control mulch and native plants.

GRANITE STEPS

Adjacent to the bank of the Royal River, granite steps will be installed to provide hand-carry boat access to the river. The stairs should not exceed six feet in width and will extend to include one step below the high-water line of the Royal River to provide safe access for recreational users. A layer of crushed stone and geotextile fabric should be installed below the granite steps to promote drainage and stabilization. See Figure 5 for an example cross section. Steps should not extend below the low mean water line.

FOOTPATH

Connecting the infiltration steps and granite steps across the flat section of the floodplain, a footpath will be constructed of crushed stone. The stone should be contained within a geocell grid. The path should not exceed six feet in width.

BANK STABILIZATION

Dense dogwood live stakes along the eroded section of the riverbank will be added. Live stakes should be installed when the plants are dormant and the ground is not frozen, typically late October or early spring. There is a healthy existing population of dogwood on site that can be used to harvest live stakes for this project. A biodegradable erosion control blanket may also be used above the high water line of the river to help stabilize the bank. Installation of live stakes should be done by hand and according to the instructions in the Maine Conservation Fact Sheets for Homeowners Series: Live Staking (Attachment 4). RRCT's volunteer Trail Crew will collect and plant the dogwood live stakes.

Required Permits

Due to this project's location being within 75 feet of the Royal River, it is anticipated that a permit from the Maine Department of Environmental Protection (DEP) through the Natural Resources Protection Act (NRPA) will be required. The project as designed adheres to the standards of a NRPA Permit-by-Rule (PBR) Section 15: Public Boat Ramps. Work below the high water mark should occur during low water level periods conforming to the in-stream work window between July 15 and October 1. This project is also partially located within the Resource Protection District of the Town of New Gloucester. Based on the Town's Zoning Ordinance, and communication with the local Code Enforcement Officer, a permit and site plan review will be required on the town level. The contractor should provide a sketch of the final designs and how they fit onto existing site conditions.

IMPORTANT NOTE: Please call DigSafe (811) at least 72 business hours before any digging begins. They will visit the property to mark the specific location of underground utilities to avoid.

Erosion and Sedimentation Control

The contractor must provide suitable erosion and sedimentation controls during construction as required by Maine's Erosion and Sediment Control Law, the Natural Resource Protection Act, and the Town of New Gloucester Shoreland Zoning regulations. The hired contractor must also be certified in erosion control practices by the Maine DEP.

The preferred erosion and sedimentation control for this site is an erosion control mulch berm at least 12" high and 24" wide, installed along the downslope edge of work. Acceptable alternatives include a silt fence or erosion control socks. Controls must be in place prior to the start of construction activities. Please note that these recommendations are not intended for winter construction; additional controls or density may be required if construction occurs in winter months (defined as October 15 – May 1).

Materials and Costs

An initial list of materials necessary to construct the trail improvements as described is provided below. These estimates should be considered preliminary and are to be refined by the contractor. It is expected that the contractor will lead purchasing and coordination of delivery of the materials needed for the project.

- Non-woven geotextile fabric, approximately 40-45 feet
- ¾" crushed stone, approximately 3-5 cubic yards
- 6"x6" pressure-treated lumber for 41 feet of infiltration steps (20-25 steps)
- Geocell grid to line approximately 20 feet of footpath
- ½" rebar (18" length), 40-50 pieces
- Granite steps, number depends on size of stone. Cannot exceed 6 feet in width.
- Erosion control mulch for along the sides of the infiltration steps, 1-2 cubic yards

- Erosion control mulch to provide erosion and sedimentation control of the project site during construction

Work at this site will be funded by grant funding awarded to the Royal River Conservation Trust through the Maine Trails Program. Costs for improvements at this site should not exceed:

- Contracted Labor $4,500
- Materials $4,923.93

ATTACHMENT 1: SITE PHOTOS

Photo 1. Existing mowed path leading to the Royal River facing Route 231/Intervale Road.

Photo 2. Existing mowed path leading to the Royal River along Route 231/Intervale Road (facing the river).

Photo 3. Bank erosion at existing launch location.

Photo 4. View of the lower launch path looking upslope.

ATTACHMENT 2: DESIGN SKETCHES

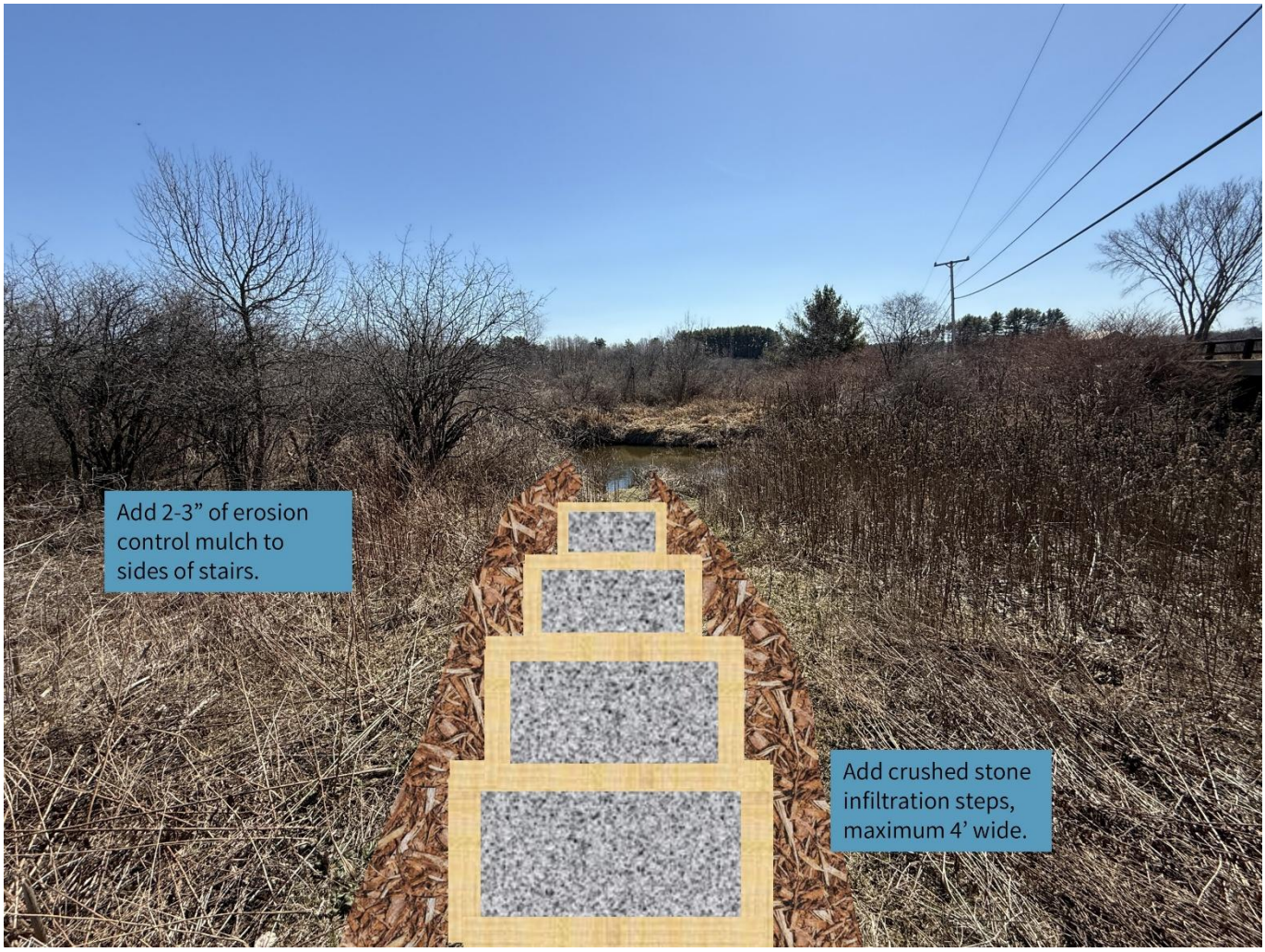


Figure 2. View of proposed infiltration steps from the top of the slope facing the Royal River.

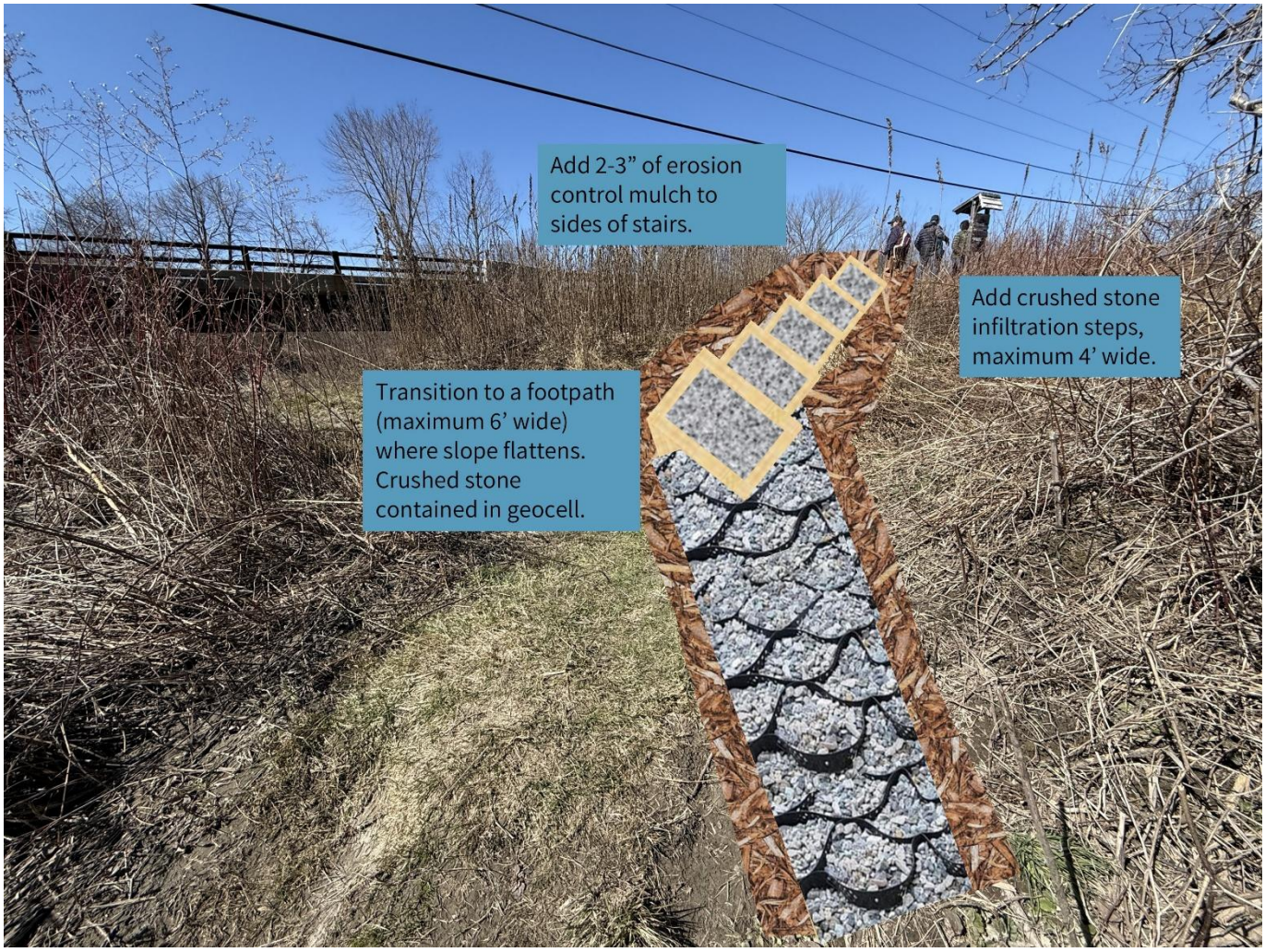


Figure 3. View of the proposed infiltration steps and footpath from mid slope facing Route 231/Intervale Road.

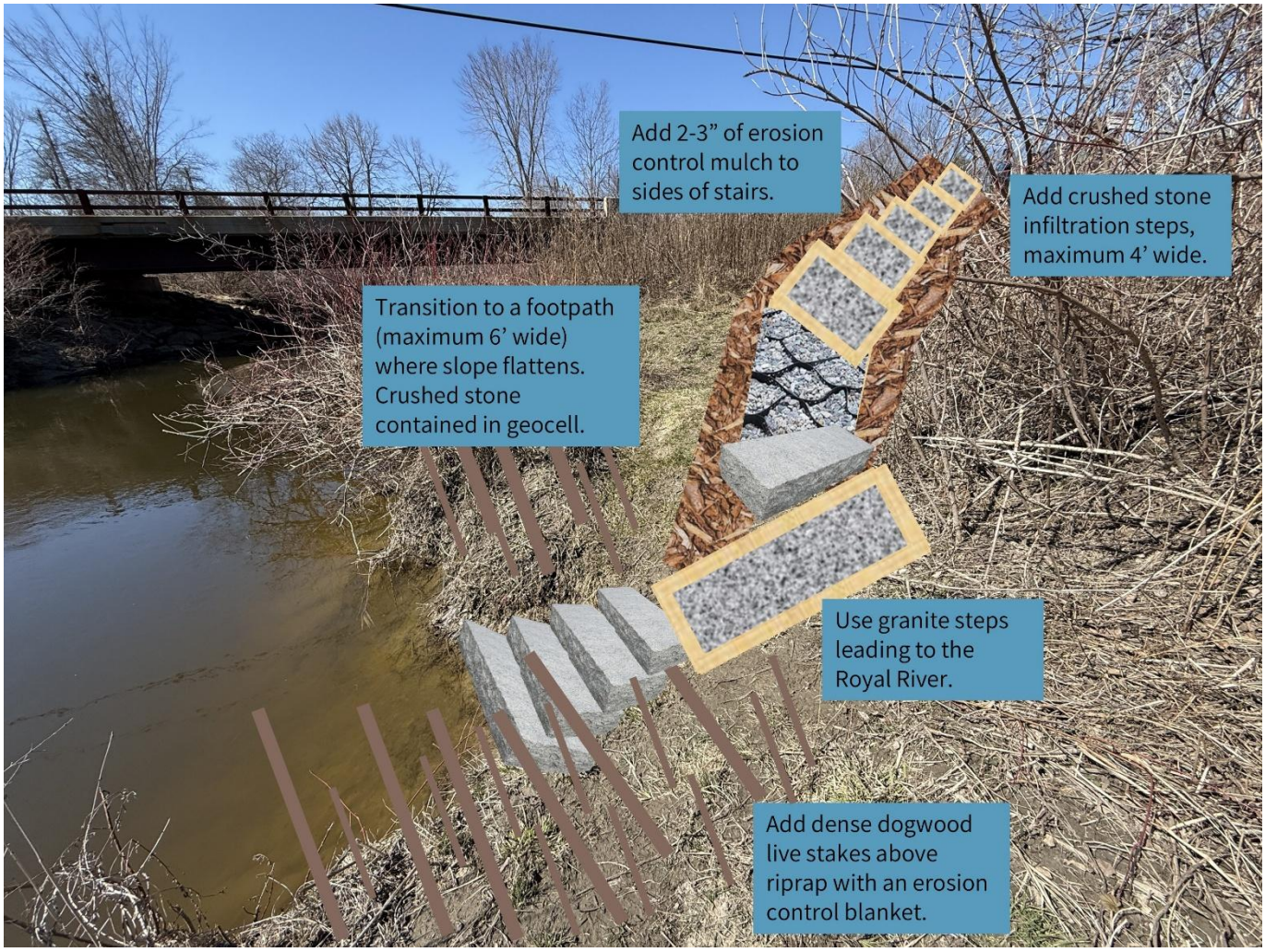


Figure 4. View of the proposed infiltration steps, footpath, granite steps, and dogwood live stakes bank stabilization along the Royal River.

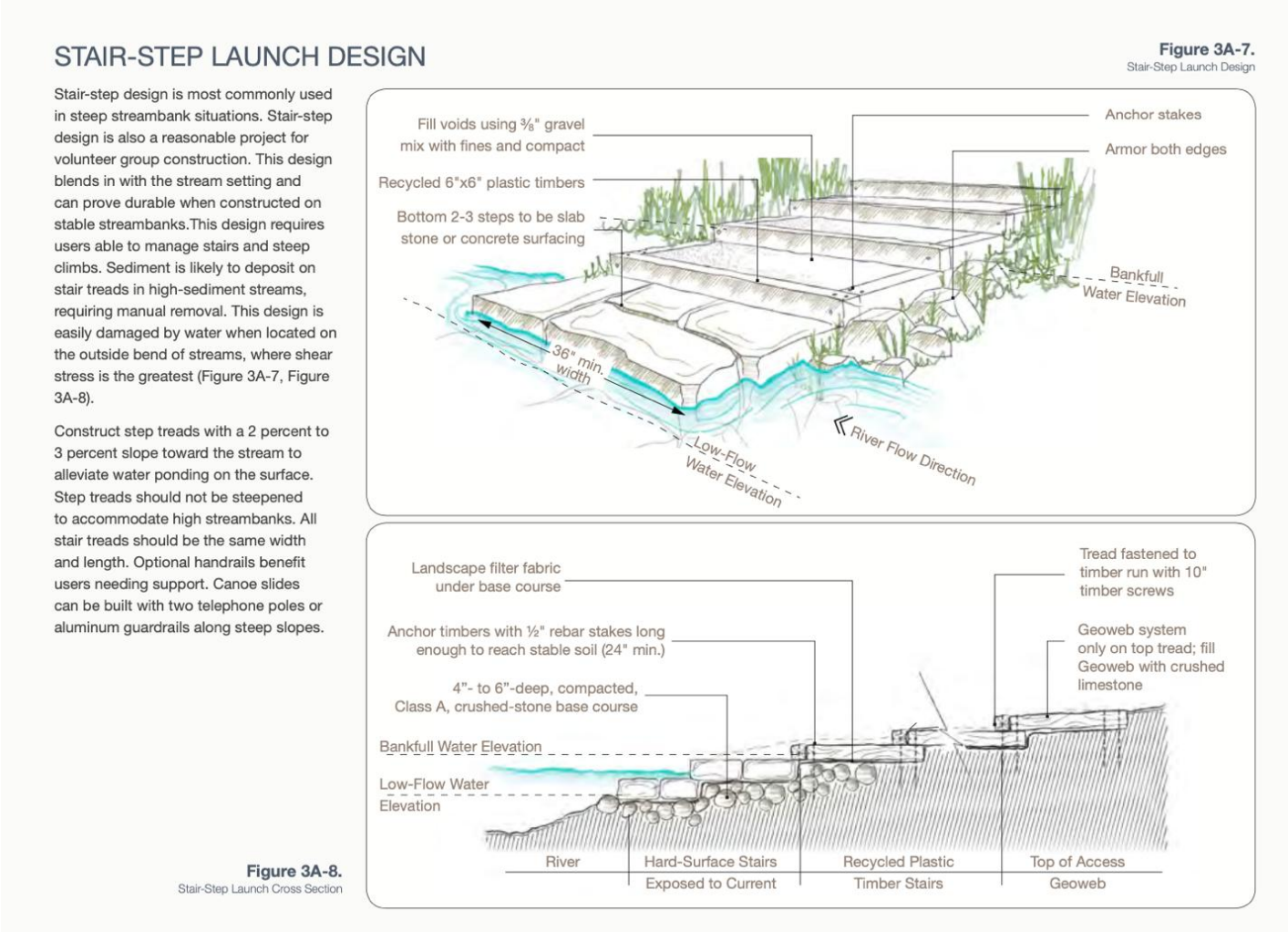


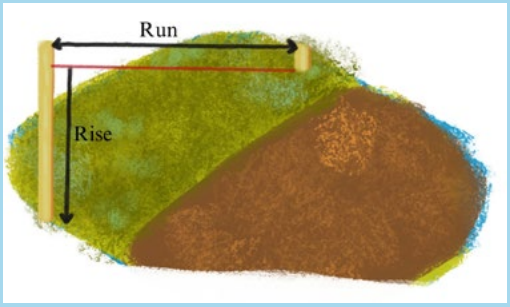
Figure 5. Example cross section for granite steps. Design from: *Developing Water Trails in Iowa, Mimi Wagner, Iowa State University Department of Landscape Architecture and Nate Hoogeveen, Iowa Department of Natural Resources. June 2010.* Note that the stair-steps in this project should be made from granite, not plastic timbers and gravel as depicted in this example.

ATTACHMENT 3: INFILTRATION STEPS FACT SHEET

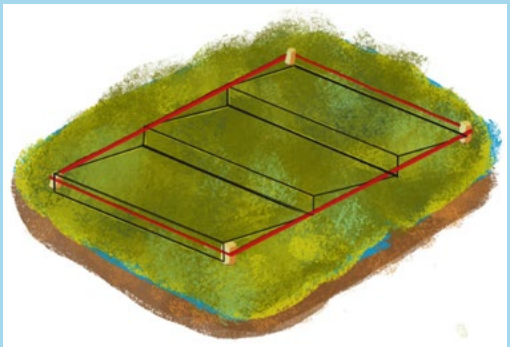
Infiltration Steps

Retrofit existing steps by excavating behind each step and adding crushed stone.

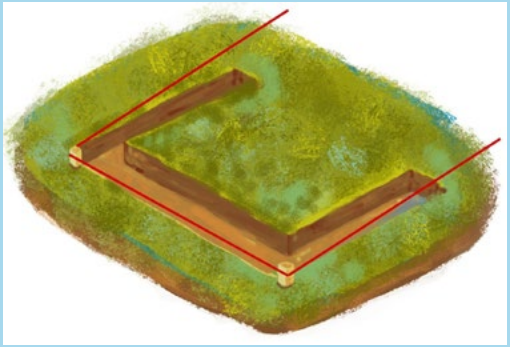
Diagrams: Carolina Swindel



Step 1: Calculate the Rise and Run



Step 2: Stake Out the Steps



Step 3: Excavate the First Step

Purpose:

Infiltration steps use crushed stone to slow down and infiltrate runoff on moderate to steep paths. For steeper (45°) slopes or areas where rocks or surface roots make it difficult to set infiltration steps in the ground, consider building a wooden stairway.

Materials:

- Crushed stone or pea stone
- Pressure Treated or cedar timbers
- Steel Rebar
- Galvanized spikes

Crushed stone and pea stone can be purchased from gravel pits. Contact your local Soil and Water Conservation District for suppliers of non-woven geotextile fabric. Pressure treated timbers, cedar landscape timbers, and steel rebar can be purchased from lumber and hardware stores. Some stores will cut rebar to the specified length for a small fee. Otherwise, rebar can be cut with a hacksaw, grinder and cutting wheel, etc.

Installation:

1. Calculate the Rise and Run

First, measure the rise (overall height) and run (overall length) of the slope you are installing steps on. The step height is determined by the thickness of the timber. Assuming a 6" thickness, divide the rise by 6 and round off to the nearest whole number to determine the number of steps. Divide the run by the number of steps to determine step depth (distance between steps). A comfortable width will be at least 15".

2. Stake Out the Steps

Choose a step width. A 4' width is comfortable for one person. Paths must be less than 6' wide in the shoreland zone. Drive stakes at each corner of the stairway and stretch string between them to outline the steps. Spray paint or sprinkle sand or flour on the ground to mark the outline.

3. Excavate the First Step

Starting at the bottom, dig a trench for the first timber. Next, dig trenches for the side timbers, which need to be long enough to extend 6" past the next step's riser. Check to make sure the trenches are level.

Note: Infiltration steps may not require side timbers, especially if the steps are in an eroded pathway where the surrounding land is higher. In this case, extend the timbers into the adjacent banks so water will not go around the steps.

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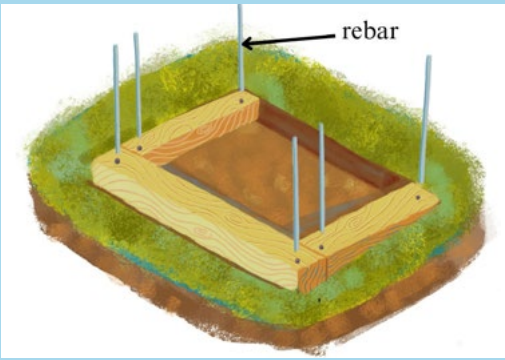
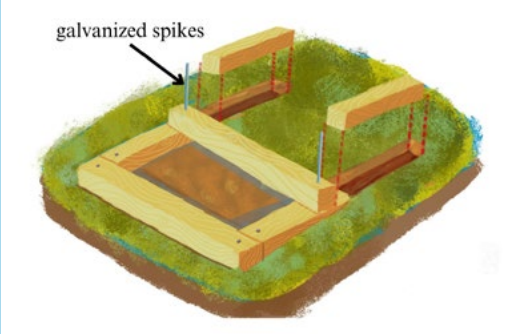
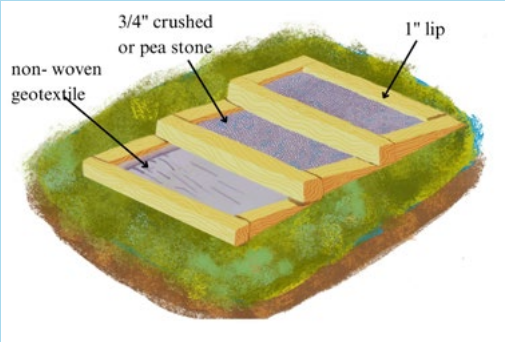


Step 4: Cut the Timbers



Step 5: Build the Next Step



Step 6: Lay Down Geotextile Fabric and Backfill with Stone

Steps should be paired with plantings or mulch to prevent side scour.

4. Cut the Timbers

Cut the riser timber to length, then measure and cut the side timbers. Drill ½" diameter holes 6" from the ends of each timber. Position the step, then remove or add soil as needed to level it. Anchor the step by driving 18" long pieces of ½" diameter steel rebar through the holes and into the ground. Make sure the rebar is flush or slightly recessed since the edges may be sharp. Set the side timbers in place, and level and anchor them.

Shovel out the soil inside the step to create a surface roughly level with the bottom of the timbers. Additional soil can be removed to provide more area for infiltration. Make sure to dispose of excavated soil away from wetlands and waterbodies.

5. Build the Next Step

Measure from the front of the first riser to precisely locate the second riser. Dig a trench for the riser, and trench back into the hill for the sides, as before. Set the riser roughly in place with the ends resting on the side timbers below. The riser should be attached to the side timbers below it with 12" galvanized spikes. Drill a pilot hole about 5" into the riser, and spike the riser into the side timbers below. Set the side timbers, drill ½" holes and pound in 18" rebar pieces into the ground as with the first step.

Excavate between the sides, as before. Continue up the hillside in this fashion. When installing the top step, cut the side timbers 6" shorter than the ones on the lower steps - these timbers do not need the extra length since no stairs will rest on them.

6. Lay Down Geotextile Fabric and Backfill with Stone

Line the area inside each set of timbers with non-woven geotextile fabric. This felt-like fabric will allow water to percolate through but will separate the stone from the underlying soil. Make sure the fabric is long enough to extend a few inches up the sides of the timbers.

Fill each step with ¾" crushed stone or pea stone until it is about 1" below the top of the timber. This lip will break up water flow and encourage infiltration. Pea stone is comfortable for bare feet but may be more expensive. Paving stones can also be set into crushed stone to provide a smooth surface for bare feet - as long as ample crushed stone is exposed to allow infiltration.

Seed and/or mulch bare soil adjacent to the steps, or plant this area with shrubs and groundcover plants to soften the edges and help prevent erosion.

Maintenance:

- Replace rotten timbers as needed.
- If the crushed stone or pea stone becomes filled up with sediment over time, remove, clean out sediment and replace.

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This project was funded, in part, by the United States Environmental Protection Agency

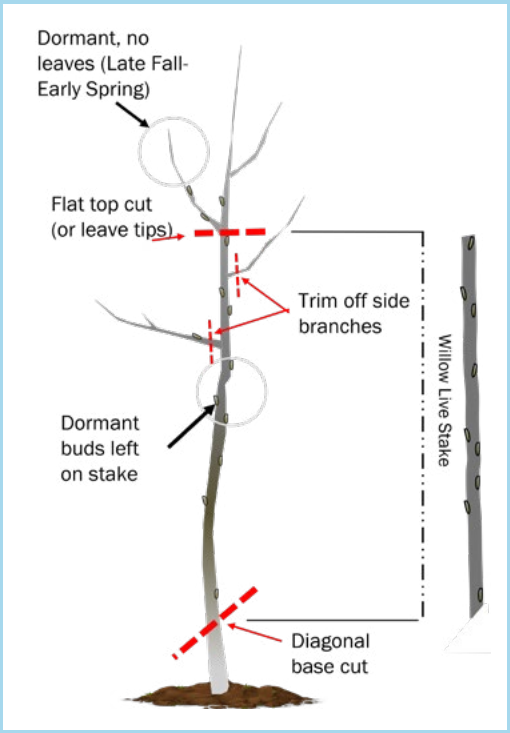
Portland Water District

From Sebago Lake to Casco Bay

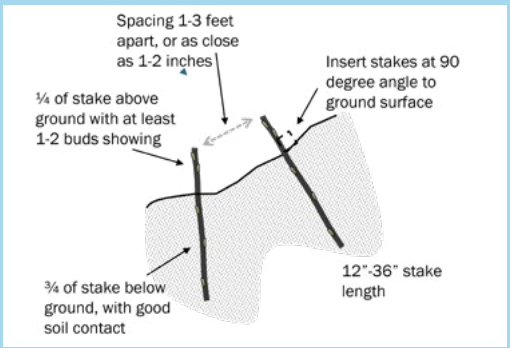
ATTACHMENT 4: LIVE STAKING FACT SHEET

Live Staking

Using clippers to harvest dormant dogwood live stakes.



How to cut a live stake.



How to plant a live stake.

Purpose:

Live stakes are woody shrub cuttings that root once planted along the banks of streams, lakes, and other resources. Live stakes make a good, low-cost source of plant materials for stabilizing banks and restoring shoreland vegetation. Live stakes are also used for slope stabilization, erosion control, carbon sequestration, and for living fencing and structures.

Materials:

Timing of Collection & Installation

For best results, live stakes should be harvested and planted while the plant is dormant in late October until the ground is frozen, or in the spring before plants start to leaf-out. Stakes can be installed while the ground is still workable in Fall, installed immediately after harvest in early spring, or stored for use later in the growing season.

If stakes are properly-installed while dormant, with good soil contact, you can expect 50-80% success on average, depending on species. Some native willow species will also root after leaf-out, however, all leaves should be stripped off prior to installation. Expect lower success with this method.

Harvesting Wild Live Stakes

Live stakes can be collected from wild established/mature plants. This is a very cost-effective option, but make sure that permission is granted by property owners before gathering cuttings off a healthy parent plant. Some of the best native species to use for live stakes are pussy willows and other native willows, American elder, redosier dogwood, and grey dogwood. These shrubs have strong root systems to stabilize banks, are naturally found along lakes and streams, and can grow from cuttings without much assistance. Live stakes, like other plants, should be planted in areas with suitable soils, moisture and sunlight. For more information on plant identification visit the website: plants.USDA.gov.

When gathering live stakes, make sure part of the thick end of the branches are at 3/8 inch in diameter (the larger the diameter the better). Make a straight cut at the narrow end of the branch (toward the tip of the branch). At the thicker end (toward the trunk) cut the branch at an angle, so that it makes a point. This way you will know which end is up and it will also be easier to drive the stakes into the ground. If the wrong end of the branch is put in the ground the stake will die. Once a cut has been made, remove all side branches and leaves. This will help prevent the stakes from drying. Stakes should be 12-18 inches long, although longer cuttings can also be used. Keep in mind that the more of the plant is exposed to the air, the quicker it may dry out.

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Slope stabilization using live stakes of dogwood & willow with coir blanket and slope interruption to control temporary erosion.

Site pictured above following construction and first growing season.

Purchasing Live Stakes
Local nurseries may carry live stakes for purchase but advance notice is generally required. Live stakes are also available for purchase online. Just ensure that the plant species are native to Maine.

Installation:

1. The site should be prepared before planting the live stakes. Invasive and competing vegetation should be cut back avoiding the use of herbicides to protect water quality.
2. Push (or use a rubber mallet) to carefully drive the pointed end of each live stake into the soil. If the stake doesn't go into the ground easily, use a metal rod (rebar) to first create a hole the length of the stake. Insert so that ¾ of the stake length will be buried ¼ Stake length exposed (including a few buds) sticking out of the ground. Ensure good soil contact between soil and stake.
3. If the stake will be shaded by surrounding vegetation, use longer stakes and leave one foot sticking above the ground. If a willow stake gets too much shade, it will drop its new leaves and die. The side branches, or whips, that were snipped off during the collection process will grow nicely if they are planted in very moist areas at the edges of streams and wetlands. Push them into the ground as far as they will go without breaking.
4. Live stakes can be placed as far as 1-3 feet apart or in dense, close formations for some techniques.

NOTE: In conjunction with live staking, cover bare soil with erosion control mulch (ECM) or annual grasses and hay mulch to hold the soil and help prevent weed establishment until the stakes are established.

Livestake-Ready Maine Native Plants:

Name	Size	Sun
Buttonbush *Cephalanthus occidentalis*	Shrub, 6-8 feet tall	Full sun to partial shade in moist to wet soils
Silky Dogwood *Cornus amomum*	Shrub, 6-9 feet tall	Prefers partial sun
Gray Dogwood *Cornus racemosa*	Shrub, up to 6 feet tall	Full sun, partial shade
Redosier Dogwood *Cornus sericea*	Shrub, 6-9 feet tall	Full sun, partial sun, shade
Bebb willow *Salix bebbiana*	Shrub, up to 10 feet tall	Part sun
Pussy willow *Salix discolor*	Shrub or small tree, 10-15 feet tall	Full to partial sun
Missouri River willow *Salix eriocephala*	Shrub, 7-13 feet tall	Full sun
Shining willow *Salix lucida*	Shrub or tree, 12-20 feet, fast growing	Part sun
Black willow *Salix nigra*	Tree,70-80 feet can be pruned to maintain shrub form	Full to partial sun
White Meadowsweet *Spirea alba*	Shrub, 2-3 feet	Full sun, part shade
American Elderberry *Sambucus canadensis*	Shrub, 5-10 feet	Full sun, part shade
Ninebark *Physocarpus opulifolius*	Shrub, 3-9 feet	Full sun, light shade

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