

STREAM WISE ASSESSMENT PROTOCOL [+ EVALUATION CRITERIA]

FINAL PROGRAM OUTLINE, FEBRUARY 2021



PROGRAM OUTLINE: PROCESS FLOW CHART

HOST:
LOCAL WATERSHED ORGANIZATION
OR CONSERVATION DISTRICT



SPREAD THE WORD!
SOCIAL MEDIA & PRINT
AWARENESS CAMPAIGN



OUTREACH:
RECRUIT PARTICIPANTS



**STREAM WISE
ASSESSMENT PROTOCOL**

1. DESKTOP ASSESSMENT



2. FIELD VISIT FOR PROPERTY
ASSESSMENT & KEY MESSAGE
COMMUNICATION



1. [PRINT/DIGITAL]
FIELD EVAL. FORM

3. REPORT CERTIFICATE
& AWARD STATUS



2. [PRINT/DIGITAL]
CERTIFICATE OF
PARTICIPATION

5. FOLLOW UP ON
NEXT STEPS ONCE
COMPLETED &
REASSESSMENT

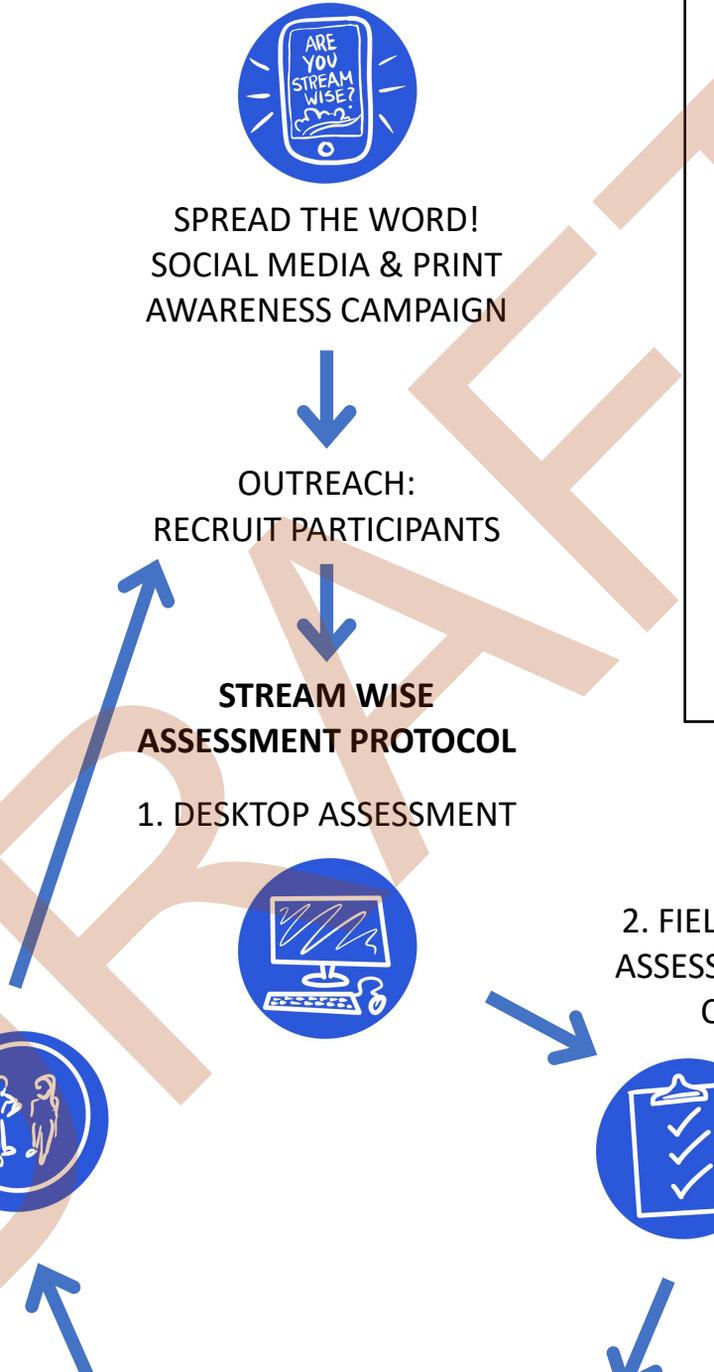
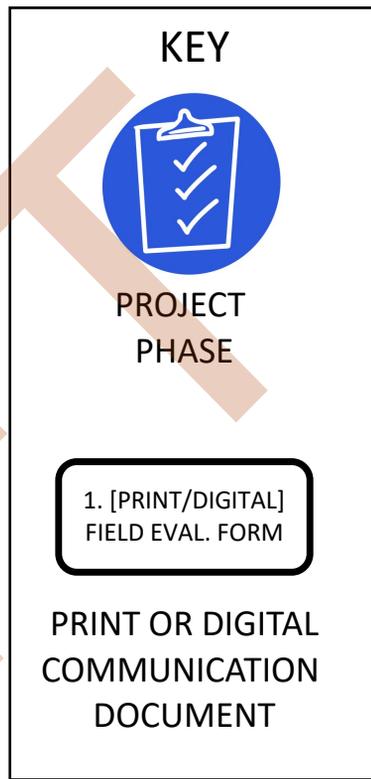


4. [SIGN] STREAM
WISE AWARD

4. COMMUNICATE
NEXT STEPS &
TECHNICAL ASSISTANCE
RESOURCES



3. [DIGITAL] NEXT
STEPS



Assessment Protocol – Overview of Steps

The following Assessment Protocol for properties on streams and rivers is based on research conducted on riparian buffer programs, regulations, and guidelines for Vermont, New York, and Quebec under a grant sponsored by the Lake Champlain Basin Program.

The goal of the Stream Wise Program is to involve local watershed organizations and conservation districts to inform and incentivize rural and urban riparian private landowners to protect and plant native vegetated buffers that can promote stream health and resiliency. This is accomplished through outreach, site assessment, and provision of a Stream Wise Award or Certificate of Participation with targeted recommendations and technical assistance to help property owners achieve Award status. This program is non-regulatory and completely voluntary.

The Assessment and subsequent Award or Certificate Protocol are as follows:

1. Desktop Assessment
2. Field Visit: Property Assessment & Key Message Communication
3. Report Award or Certificate Status
4. Communicate Next Steps & Technical Assistance Resources
5. Follow Up on Next Steps Once Completed & Reassess



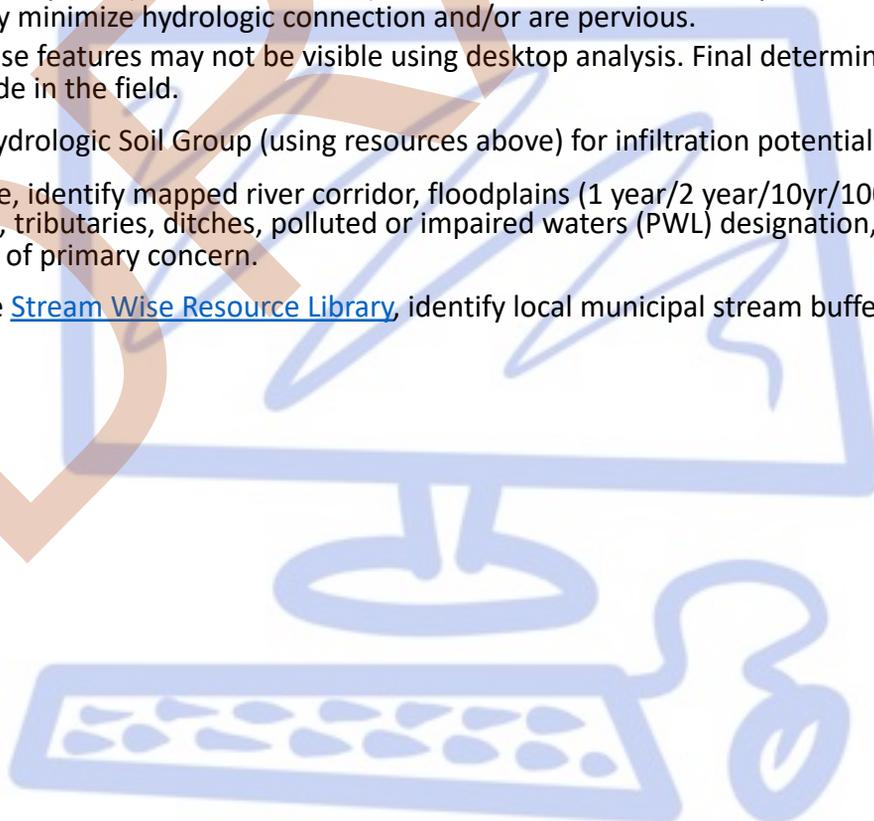
1. Desktop Assessment



Prior to conducting your field assessment, it's informative to conduct a Desktop Assessment of the property. This will prepare you for the assessment and help you contextualize site conditions, especially with respect to Buffer Width opportunities and constraints.

This Desktop Assessment Protocol uses the [Stream Wise Atlas](#) hosted by the Lake Champlain Basin Program.

- Record the Stream/River name and Basin from the Atlas.
- Using the Atlas' aerial imagery, measure the average riparian buffer width for the property. Estimate canopy cover for the buffer (70% is the average minimum for Stream Wise).
 - Determine the approximate parcel area (parcel coverage for VT is largely complete; in NY data availability varies by county; for QC, [use this parcel mapping site](#) (separate from the Atlas – choose the 'Free' access option) to determine size (use the linear measuring tool).
 - For properties UNDER 1 acre (0.40 hectares) with permanent (immovable) structures within 50' (15m) of the stream or river, a 30' (10m) buffer can be considered acceptable for an Award.
 - Otherwise, 50' (15m) is the minimum buffer width acceptable for an Award (provided other conditions are met).
- Measure both the impervious (roofs, pavement, patios, etc.) and pervious developed (lawn, gardens, other non-natural landscaping, etc.) surface area within the minimum buffer area. To qualify, less than 10% of the buffer can be developed (whether impervious or pervious).
 - Access paths (foot and vehicular) can be excluded from this requirement, provided they minimize hydrologic connection and/or are pervious.
 - These features may not be visible using desktop analysis. Final determination is made in the field.
- Assess Hydrologic Soil Group (using resources above) for infiltration potential.
- If possible, identify mapped river corridor, floodplains (1 year/2 year/10yr/100yr, wetlands, tributaries, ditches, polluted or impaired waters (PWL) designation, and the pollutant of primary concern.
- Using the [Stream Wise Resource Library](#), identify local municipal stream buffer regulations (if any).



2. Field Visit - Assessment



Background Information

Stream or River Name _____ Basin _____

Evaluator _____ Date _____

Property Owner(s) _____

Year-round mailing address _____

Site Assessment Property's Address _____

Phone Number _____

E-mail Addresses _____

Property Ownership (circle one): **Owned / Rented** For how long (years)? _____
Year-round / Seasonal

Permission to use Name in Outreach Materials? **Yes / No**

Photo Release to use images in Outreach Materials? **Yes / No** Signature _____

What do you value in your riparian area? E.g., fishing, swimming, wildlife, boating, aesthetics, etc.

Award Status

A property needs to meet Stream Wise Standards in all three categories to become Stream Wise and be given an Award sign.

Category

Meets

Does Not Meet

Buffer Width

Buffer Zones

Buffer Vegetation

Stream Wise Award

Award Sign given? **Yes / No**

Technical Assistance Follow Up & Next Steps Required? **Yes / No**

2. Field Visit - Assessment



Assessment Criteria Scoring:

For the Stream Wise Award, scoring categories are as follows:

- MEETS → All categories of criteria are satisfied
- DOES NOT MEET → Actions must be taken to align with criteria

A property needs to meet Stream Wise Standards in all three categories (Buffer Width, Buffer Zones, Buffer Vegetation) to become Stream Wise and be given an Award sign. In order to achieve a 'Meets' designation, all sub-criteria must be marked 'Meets' as well.

All properties will receive a Certificate of Participation, which will include a list of good features and practices in place and a list of recommended and/or required actions that need to be taken to achieve Stream Wise Award status. Once actions have been taken and all sections can be marked as 'Meets' criteria, an Award can be given.

A property that cannot meet the Stream Wise standard due to prohibitive site constraints or lack of cooperation by landowner are not eligible for an Award. Prohibitive site constraints that may disqualify a property from program participation include:

- Lack of ability to achieve minimum buffer width (permanent structures or other immovable development within minimum buffer) and/or development over 10% of buffer area
 - No development other than access paths can exist in the 15' (5m) Streamside Zone
- Hard armoring of bank with no option to vegetate (concrete or similar material retaining walls, rip rap with no vegetation)

Nearly all other buffer conditions can be remediated to align with Stream Wise Program standards, for example:

- Lack of plant species composition and structure (e.g., predominantly invasive species or singular or simple vertical/horizontal structure) can be remediated and restored
- Development can be eliminated, minimized, or moved
- Contributing upland runoff can be collected, infiltrated, or turned into sheet flow (versus channel flow)

See Technical Assistance Recommendations for resources and organizations to help property owners achieve Stream Wise Program standards. In the event that property owners can't achieve standards, other runoff mitigation or water quality programs may apply.

1. [PRINT/DIGITAL] FIELD EVALUATION FORM

2. Field Visit - Assessment



The following provides guidance for the criteria listed in the Field Form. All sub-criteria must be marked as 'Meets' for this category to be in compliance with Stream Wise Program goals.

1) Buffer Width:

Buffer width is one of the most critical criteria for Stream Wise. The minimum buffer width is the baseline, with an ideal buffer length being 100' (30m) or more. Buffer width should be measured from the mean high water mark. Some programs differentiate where to measure buffer width based on stream bank slope and height. For ease of site evaluation, this simpler method can be used. Mean high water mark can often be determined as the natural transition line from a predominance of aquatic plants to a predominance of terrestrial plants. If vegetation doesn't suffice to delineate mean high water mark, use physical clues like sediment deposition or flow line demarcation due to transport of debris by high water. See following pages for additional explanation.

1a. Buffer widths acceptable for Stream Wise are:

- 50' (15m) minimum *OR*
- 30' (10m) minimum *ONLY* if the parcel is under 1 acre (0.40 hectares) and there are constraining features such as permanent structures or other immovable objects within the 50' (15m) buffer. Where it *is* possible to achieve a 50' (15m) buffer on a small lot, seek to work with the property owner to do that.

1b. – There is a maximum of 10% of the minimum buffer area that is in existing impervious or pervious development, including lawn, structures, decks, patios, or other non-naturally vegetated areas. This development is **AT LEAST 15' (5m) FROM MEAN HIGH WATER MARK** (not in the Streamside Zone). This 10% does not include access paths.

1c. – All surface water runoff from developed areas within the buffer is captured and infiltrated or converted to dispersed sheet flow (not concentrated runoff points).

1d. - Foot paths or stairs are 6' (2m) wide or less and are minimized (e.g., remove unnecessary paths).

1e. - Vehicle access is 12' (4m) wide or less.

1f. Access points are pervious and infiltrating water or are hydrologically disconnected (all water runoff is diverted into vegetated areas, spread out, and infiltrated using switchbacks, water bars, crowned roads, turnouts, rock aprons, etc.). **NOTE:** Specifically for vehicle access paths – compacted gravel is not pervious. For these, pervious pavement and pavers (various types) could be used.

2. Field Visit - Assessment



Identifying the Mean or Ordinary High Water Mark (OHWM)

Typically, several indicators will be used to determine the mean high water mark. The goal is to determine "...that line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas." – Clean Water Act, Section 404

Examples:

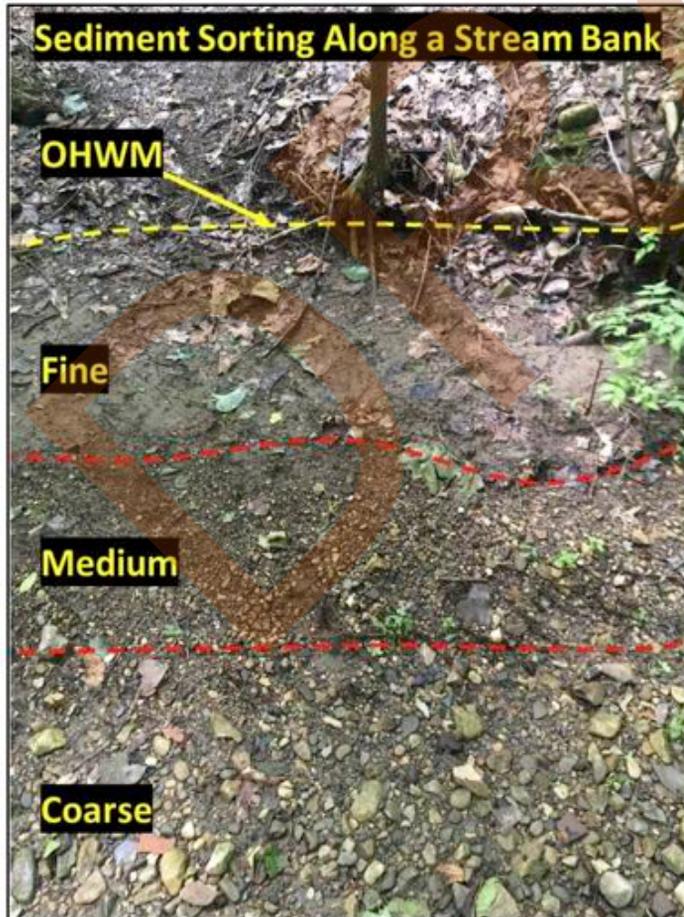


^ typical high water level



^ normal flow

Sediment sorting; Change in substrate:



Natural line impressed on the bank; Scouring:



2. Field Visit - Assessment



Change in plant Community >



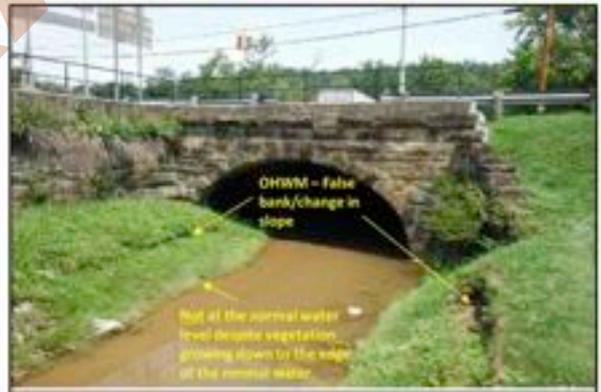
< Exposed root hair below intact soil



2. Field Visit - Assessment



Shelving:



Other indicators can include the following, being careful that they are not a result of extreme flooding, normal water levels, or other forces (wind, wildlife):

- Leaf litter disturbed or washed away
- Fluvial deposits
- Vegetation matted down, bent, or absent/destruction of vegetation
- Wracking/presence of litter and debris
- Water staining/deposition
- Moss/lichen trim line

Images and text from [Ordinary High Water Mark Identification Manual](#) Ohio Department of Transportation, 2019

2. Field Visit - Assessment



2) Buffer Zone:

Within the buffer, there are multiple zones that provide protection for the waterway. They are:

2a. - Streamside Zone – from mean high water mark to width of approximately 15' (5m), this is the most critical zone for stream protection as it protects the physical integrity of the bank while providing habitat for aquatic organisms, provides shade to moderate water temperature, and provides organic matter that serves as food for macroinvertebrates. The more native, densely vegetated, mature growth, and less disturbed this area is, the better. 15' (5m) is the absolute minimum for this zone.

2b. - Middle Zone – outside of 15' (5m) extending to approximately 50' (15m) minimum, this zone is key for pollutant removal through sediment filtration, deposition, and nutrient uptake through vegetation and soil processes. The wider and more intact (native, mature, complex) this Zone is, the better, though some select cutting can be done without adversely affecting function.

2c. - Upland Zone – beyond a minimum of 50' (15m), the Upland Zone's primary function is to convert any channelized runoff flows to dispersed sheet flows or infiltrate to groundwater so that the Middle Zone can absorb the runoff and its potential pollutants. The Upland Zone can be developed with pervious landscaping or impervious features like buildings, but all flows from it should be dispersed sheet flow.

2d. - Streambank Stability Considerations:

Streambank erosion can be a source of nutrient pollution to water bodies. There are two main causes for streambank erosion – upland runoff and in-stream/river flows. Upland runoff (i.e. concentrated or channelized flow from areas above the streambank) can erode the bank from the top down. In-stream/river flows will typically erode the streambank from the bottom of the slope and is due to factors such as natural stream/river adjustment over time, increased flows from development upstream or extreme flooding events, or undersized structures (culverts/bridges) increasing flow velocity.

See following page for additional explanation.

Stream Wise is only equipped to manage upland runoff-caused streambank erosion. Evaluate the area upland of the streambank to determine the cause of runoff (look for channelized flow or point-sources like pipes). Use an appropriate stormwater management feature to control runoff.

If the bank is 'hard armored' using concrete retaining walls or rip rap and there is no option to remove those features or convert them to a vegetated feature using bioengineering practices, the property may not be eligible for an Award. A Certificate can still be provided with recommendations for remediation.

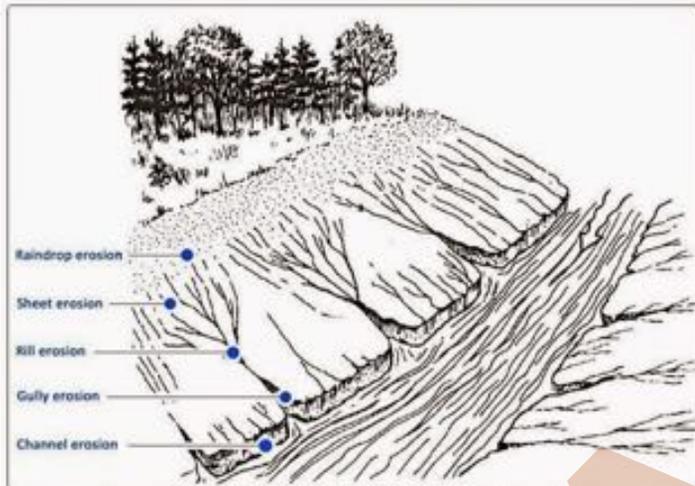
2. Field Visit - Assessment



Identifying erosion, channelization, and concentrated flows:

Erosion in the buffer (streamside and middle zones) or the upland zones is not acceptable for Stream Wise properties. Erosion can be caused by a lack of vegetation and soil stabilization and concentrated flow points (e.g., culverts, drainage pipe outlets), wind, and rain causing sheet, rill, and gully erosion (see erosion types graphic below).

Figure 1. The Five Types of Erosion

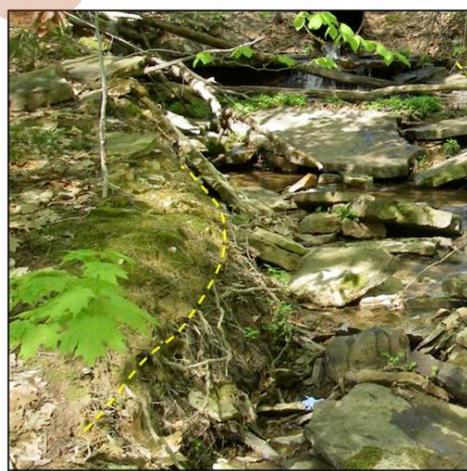


(Credit: 2002 Connecticut Guidelines for Soil Erosion and Sediment Control)



Streambank Gully, [USDA NRCS](#)

However, erosion within the stream channel is beyond the control of the landowner and is acceptable for Stream Wise properties. [Acceptable] erosion in the stream channel may look like this:



2. Field Visit - Assessment



3) Buffer Vegetation:

Buffer vegetation must be mature growth reflecting the local natural communities (forested, shrub herbaceous wetland), composed of mostly native species (regionally appropriate and representative of local natural communities), and complex in types of plants and diversity of species.

3a. – 5 Tiers are present unless lack of tiers is outside of the landowners control, e.g., deer grazing or natural occurring plant community does not have all 5 tiers, such as evergreen forest with little understory, wetland marsh/meadow, woody shrub swamp, rocky ledge with no duff, etc.

- 1. Canopy:** tall, mature deciduous and evergreen trees that create structure and canopy cover
- 2. Understory:** saplings/replacement trees, small understory trees and tall shrubs
- 3. Shrubs:** low-growing deciduous and evergreen woody shrubs
- 4. Groundcover/Herbaceous Layer:** Herbaceous vegetation (perennials, annuals, biennials), including native grasses, sedges, flowers, ferns, and mosses
- 5. Duff:** organic material on forest floor – leaves, twigs, dead plant material, woody biomass, mushrooms, etc.

3b. – **Native plant species should comprise 75% or greater of the buffer area.** The buffer should be comprised of mostly plants that are native to the local area or the region; encourage true native plant species over cultivars or 'nativars' of native plant species.

3c. - **Invasive species do not dominate the understory or threaten to dominate** (Remove invasive species physically where possible, seek technical assistance for other solutions).

3d. - **Disturbance in the buffer is minimized;** it is not mown, raked, or weed whacked; woody debris (dead trees, branches), leaves, and other organic matter are left to decompose and provide food sources in the buffer (removal of hazardous trees is allowed).

3e. - **Limited cutting for views and firewood/coppice is allowed in Middle Zone, *not*** Streamside Zone, e.g., limb branches up on lower 1/3 of tree for views instead of cutting entire tree; There is a minimum 70% canopy cover; There is no removal of vegetation (or duff) below 3' (1m) (removal of hazardous trees is allowed).

3f. - **There is no pesticide or herbicide use on the property unless recommended by a professional to remove invasive species.**

2. Field Visit - Assessment



3) Buffer Vegetation:

It will be necessary to identify native and invasive plant species during the site evaluation. The evaluator should be familiar with common native and invasive plant species found in riparian areas in their region. Native plant identification can serve as indicators of soil type, soil moisture, and natural plant communities. Invasive plant identification will help to determine prevention, suppression, and removal strategies. A plant identification guide may be helpful to bring into the field during evaluations. The following are some regional resources to help the evaluator in preparation for site visits and on-site plant identification:

Invasive Plant Species

VERMONT

- [Vermont Invasives](#) – landing page for Vermont resources on invasive species
- [VT ANR Invasive Species](#)
- [VT Fish & Wildlife Invasive Species Threats](#)

NEW YORK

- [Adirondack Park Invasive Plant Program \(APIPP\)](#) – Adirondack Partnership for PRISM
- [NYSDEC Partnerships for Regional Invasive Species Management \(PRISM\)](#) – Eight PRISMs across NYS

QUEBEC

- [Conseil québécois des espèces exotiques envahissantes](#) /Quebec Interdepartmental Committee on Invasive Species

Native Plant Species

LAKE CHAMPLAIN BASIN

- [The Nature Conservancy Northeast Habitat Map](#) – Identify forest types and larger habitat communities
- [Go Botany - Native Plant Trust Species Identification](#) – identify local and regional native plant species
- [Attention Flore / Nature Watch - Native Plant Identification](#) – citizen-driven plant identification in Canada

VERMONT

- [VT Agency of Natural Resources Atlas](#) – See Natural Communities Map Layers (primarily for ANR Lands)
- [VT Fish & Wildlife's Wetland, Woodland, Wildland Book](#) – Identify natural communities and plant species indicators
- [VT Agency of Natural Resources BioFinder Map](#) - Identify lands and waters that support important ecosystems, natural communities, and habitats, and species for conservation efforts

NEW YORK

- [NY Natural Heritage Program](#) – Clearinghouse of significant plant and animal communities in New York, see [New York Nature Explorer online tool](#)
- [Ecological Communities of New York State](#) – See [2014 Report](#) and [Environmental Resource Mapper](#)
- Ausable River Association Plant Inventory & Riparian Restoration Protocol Report (out in 2021)

QUEBEC

- [Ressources naturelles Québec - Zones de végétation et domaines bioclimatiques au Québec](#) / Vegetation Zones and Bioclimatic Domains in Quebec
- [Québec géographique - Portail de l'information géographique gouvernementale](#) / Government Geographic Information Portal
- [Atlas de la biodiversité du Québec](#) / Atlas of Quebec biodiversity

2. Field Visit – Key Messages



The following are Key Messages to help the evaluator communicate best practices to the property owner while conducting the Field Assessment. These will also align with the Stream Wise branding and awareness campaign (to be developed).

• Let the Buffer Be

- Protect existing vegetation – the most important trees are living trees
- Embrace the ‘messiness’ of natural vegetation, naturalistic is intentional
- Leave dead trees, woody debris, leaf litter and other plant material on the ground
- Minimize your impact, limit access and disturbance, but still enjoy your stream!
- Terms/Phrases: Do Not Disturb, Re-wild, Keep it Wild, Leave it Wild, Successional buffers are successful buffers, Every tree counts; Be A Stream Steward; Share the Shore

• Grow Native Buffers

- Widen the buffer – the wider the buffer, the cleaner the water! Diverse and extensive roots stabilize the streambank and protect soil (your land!) from eroding - cutting one tree can undermine the whole system
- Stop mowing! Allow succession of diverse native plant species
- Enhance the buffer: Plant diverse multi-tiered species of natives (trees, replacement trees, shrubs, herbaceous groundcovers), native plants are adapted to the climate and soils as well as fellow plants and insects – less maintenance for you!
- Remove invasives – invasives outcompete natives, create bare soil, and do not support native insects and fish
- Terms/Phrases: Less Lawn, More Leaves; Nature Knows Best; No-Mow; Mow-where-you-go; Plant Natives; Buffers for Blue Waters; Planting a buffer is an investment in our future

• Slow it, spread it, sink it

- Minimize upland water runoff and convert channelized flows to dispersed sheet flows
- Collect: rain barrels from roof gutter
- Slow Down: thick herbaceous (meadow) filter strip, vegetated on-contour swales
- Spread out: shallow bowl rain garden, infiltration basin
- Soak in: infiltration trenches and basins, vegetated swales, rain garden
- Buffers are most effective when receiving sheet flow, wider buffers have more surface area to capture sediments and nutrients in runoff that are harmful to streams

• Buffers benefit everyone

- Buffers provide flood resiliency protecting you, your family, your property, and your neighbor
- Vital highly biodiverse buffer habitat provide wildlife corridors, sources of food, and shelter along the shore. Woody debris create habitat for microorganisms that feed fish.
- Fish need shade! Trees and shrubs on the shoreline provide shade needed for aquatic habitats and maintain water temperatures
- Terms/Phrases: Roots for Resiliency; Fish Grow on Trees; Protect Your Property; We need the water, the water needs us; Water is Life; Stream Strong; Your stream community needs you!

• Buffers are beautiful

- Frame your view with trees
- Enjoy diverse native plants’ flowers, foliage, berries, and bark throughout the seasons
- Attract more birds and other beneficial species like butterflies and bees
- The land wants to be wooded, let it grow as it wants to be
- Terms/Phrases: Hang a hammock; Frame the View; Provide Pollinator habitat; Bird-friendly

2. Field Visit – Key Messages



The following practices are not required for inclusion in the Stream Wise Award program, but should be communicated and encouraged during a site assessment with the property owner:

- **Stream community**
 - Buffers are stronger together – spread the word!
 - ‘Bring a neighbor’ – group site assessments
 - The more Stream Wise properties, the more resilient the stream
- **Connectivity**
 - Buffer connectivity to adjacent neighboring buffers or nearby habitat patches (e.g., forests, fields)
 - Recommend to a neighbor!
 - Hydrologic connectivity
 - Removal of berms along stream to allow for functioning floodplain (seek technical assistance)
- **Mimic local natural plant communities**
 - observe natural areas upstream and downstream
 - notice what plant species are present, where they grow, and what other plants they grow near
 - Plant local natural plant communities in your buffer, see local resources (p.20) for help with identifying natural plant communities
- **Protect and enhance buffers along other waterways on property**, e.g., ditches, wet areas, ephemeral and intermittent streams
- **Identify waters of importance**, e.g., headwaters, critical floodplains, drinking water sources, etc.



3. Report Certificate & Award Status



Report to Property Owner:

Once the Field Assessment is complete, make sure to:

Record the results of the Field Form, along with Award or Certificate status in the Stream Wise Program database.

Award Properties:

1. Provide the landowner with an Award, which includes a summary report of positives features and practices and specific areas that could be voluntarily improved (e.g., widen buffer even more!).
2. Distribute the Award. If a property is clearly able to obtain the Award, distribute the Award while on site and make sure to photo document the site, the key features that led to the granting of the Award, and the giving of the Award (if the property owner is amenable to having their image recorded and shared as part of Program outreach efforts).

2. [PRINT/DIGITAL]
CERTIFICATION OF
PARTICIPATION WITH
SUMMARY REPORT

^See example on next page

4. [ENVIRONMENTAL]
STREAM WISE AWARD SIGN

Certificate Properties:

1. Provide the landowner with a Certificate of Participation, which includes a summary report of positives features and practices and specific areas that need to be improved to get an Award, if possible.
2. Communicate Next Steps, including a digital document of technical assistance resources that will be sent as a follow up, and the process for reassessment. The Certificate includes contact information for the local organization that can assist with implementation of more technical buffer remediation measures.
3. Provide the local organization or program with the name and contact information of the property owner so that staff can be aware of incoming contact or reach out as appropriate.

2. [PRINT/DIGITAL]
CERTIFICATION OF
PARTICIPATION WITH
SUMMARY REPORT

3. Report Certificate & Award Status



STREAM WISE CERTIFICATE OF PARTICIPATION



Name: _____ Address: _____

Thank you for participating in the Stream Wise Program! You are a valued member of your stream community in the _____ watershed. Based on your property evaluation, here is a quick summary of current stream wisdom and opportunities for more stream wisdom.

STREAM WISE CRITERIA: This property....

MEETS

CAN MEET WITH ACTIONS

GOOD PRACTICES

IMPROVEMENT AREAS

POSSIBLE SOLUTIONS

GOOD PRACTICES	IMPROVEMENT AREAS	POSSIBLE SOLUTIONS
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

We will follow up with you on next steps, including resources for technical assistance. Please don't hesitate to reach out for support in becoming a Stream Wise Property.

CONTACT: [Name, Email, Phone number, Host Organization]

2. [PRINT/DIGITAL] CERTIFICATION OF PARTICIPATION WITH SUMMARY REPORT



4. Communicate Next Steps & Technical Assistance Resources

Use the following resources in Section 4 - Communicate Next Steps & Technical Assistance Resources to ensure that property owners understand the Stream Wise Award process, as well as receive the necessary assistance and resources to achieve Award status if the property needs improvement in certain areas. The following section has sub-sections on:

- Sample Language for Summary Report
- Common Issues & Solutions – Width DIY Technical Resources Next Steps
- Common Issues & Solutions – Zones DIY Technical Resources Next Steps
- Common Issues & Solutions – Vegetation DIY Technical Resources Next Steps
- Regional Technical Assistance Resources (divided by state/province and resource type including written resources as well as regionally appropriate organizations to contact, divided by Basin and County)
- DIY Technical Assistance Glossary (quick reference guide for certain practices associated with property improvement to meet Stream Wise Award criteria)

Assemble the Summary Report for the property owner, drawing from these resources as needed. The intent of these resources is to provide the owner with the easiest, most appropriate means by which they can either effect riparian buffer improvements on their own or to give them the most appropriate organization to work with in order to accomplish necessary changes.

3. [DIGITAL] NEXT STEPS & TECHNICAL ASSISTANCE RESOURCES

4. Sample Language for Summary Report



- Buffer is not wide enough
 - Stop mowing / “No Mow”
 - Plant diverse multi-layered native vegetation
- There are not enough tiers of vegetation in the buffer
 - Do not cut anything below 3’
 - Do not rake leaves or mow/weed-whack in the buffer
 - Do not remove dead wood and plant material
 - Delineate new buffer edge until it is established
- There are a lot of invasives in the buffer
 - ID species; look up recommended options for removal, suppression, or containment; make a plan; follow removal plan; seek technical or professional assistance if the problem is pervasive or herbicide injections are necessary
- There is bare soil in the buffer
 - Seed with native riparian seed mix and cover with leaves, wood chips, mulch, straw, or erosion control matting if on a slope with sufficient space
 - Plant groundcovers and fast-growing woody species with extensive root systems
- There is erosion in the buffer
 - Capture upland runoff and spread it out, allowing it to soak in the ground; using practices such as native herbaceous (meadow mix) filter strips, on-contour vegetative swales, rain gardens, infiltration trenches and basins
- Upland water runoff is concentrated
- Paths are not minimized and wider than 6’ (2m) or 12’ (4m)
 - Narrow pathways and delineate new pathway with defined edge (e.g., rocks, temporary fencing, etc.)
 - Remediate compacted soil with aeration, seeding, planting, erosion control practices
- Paths convey runoff directly into stream
 - Redirect pathways to run across contour (switch backs) and direct runoff into a vegetated area, ideally to a depression or flat area for water to soak in slowly
 - Make pathways pervious where possible (gravel, peastone, geo cells, mulch, pervious pavers, board walk, wood or stone steps)
 - Install water bars to direct runoff off the path and into a vegetated area or rock apron
- There are many pathways to the stream
 - Pathways need to be minimized to what is necessary in order to ‘share the shore’. A few single track foot paths are okay, but
 - Limit access to one main pathway and vehicle access where possible
- There is a building or other structure (e.g. deck) that is in the buffer and takes up more than 10% of the buffer
 - This structure will have to be reduced in size or moved farther away from the stream and replaced with forested riparian buffer vegetation

4. Common Issues & Solutions - Width DIY Technical Resources Next Steps



Issue	Solution
<p>Buffer Isn't Wide Enough</p>	<p><i>Stop Mowing and Adopt a 'No Mow' Zone, Prevent Invasive plant species</i></p> <ul style="list-style-type: none"> The simplest way to establish a Riparian Buffer is to stop mowing and/or remove development from the buffer to allow vegetation to grow. If this is the method used to re-vegetate a riparian buffer, invasive species must be managed and not allowed to take over. Areas that have been disturbed (e.g., compacted soils, areas with fill, lawns treated with herbicides, eroded soils) and areas that have significant invasive species presence nearby are high risk for invasive species takeover. Invasive prevention and removal may be necessary, including planting native species to out-compete and removal of invasives. Vermont's Lake Wise Program has guidance for Establishing No-Mow Zones. New York DEC provides an excellent guide to Managing Invasive Plants in Riparian Areas. Quebec provides resources under the Pelouse Durable (Sustainable Lawn) program site. The Alliance for Chesapeake Bay also provides an in-depth Citizen's Guide to the Control of Invasive Plants in Wetland and Riparian Areas including special consideration for riparian areas and control techniques. <p><i>Plant diverse vegetation</i></p> <ul style="list-style-type: none"> Planting a native buffer will require selecting a variety of plant species adapted to the site (soils, sun/shade, wind, climate/hardiness, natural plant communities nearby, etc.), including trees, shrubs, and herbaceous perennials, sourcing the plants in container, balled & burlap (B&B), tube stock/tree pot, bare root, or live stake form, and planting them in a way that minimizes erosion, covers bare soil, and maximizes water retainment. The ideal time to plant is spring (April-June) or fall (September-October). Woody shrubs and trees can be planted when the ground is not frozen. Herbaceous perennials can be planted when leaves are on the trees (spring bud out – leaves falling). Watering is an important part of planting to ensure the greatest survival, plan on watering 1-3 times/week during dry spells for the first growing season, and 1 time/1-2 weeks during dry spells for the 2nd and 3rd growing season, as needed. Vermont's Lake Wise Program provides guidance on planting native buffers Planting & Maintaining Vegetation Areas. Winooski NRCDC's Vermont Trees for Streams Resource Guide provides an in-depth overview of restoring riparian buffers, including terminology and planning goals, site analysis considerations, plant material types, planting, and maintenance. Missisquoi Bay Watershed Organization/Organisme de Bassin Versant de la Baie Missisquoi (OBVBM) provides a comprehensive visual guide for restoring and planting streambanks, available in both French as Guide de mise en valeur riveraine and English (request from OBVBM). Vermont DEC provides planting specifications, plant sources, and technical assistance resources in the Planting Guidance for the Revegetation of Riparian Areas in Vermont. Information on planting natural plant communities and selecting native plant species can be found from VT DEC Lake Wise Program info sheet Planting & Re-Naturalizing Areas. The Federation of Vermont Lakes & Ponds provides a A Guide to Healthy Lakes Using Lakeshore Landscaping, including site planning, prepping, and planting information with design templates, sample planting plans, and a plant list. Lists of native plant species can be found in Vermont Lake Wise's Native Plant List, Lake George DIY Water Quality Native Plant Species Index, and the The Vermont Rain Garden Manual. Riparian natural plant communities can be found in VT Fish & Wildlife's Wetland, Woodland, Wildland Book.

4. Common Issues & Solutions - Width DIY Technical Resources Next Steps



Issue	Solution
<p>There is development in the buffer that needs to be managed</p>	<p><i>Structural Solutions:</i></p> <p><i>Roofs</i></p> <ul style="list-style-type: none"> • Drip Line Infiltration Trench & Dry Well: VT Guide to Stormwater for Homeowners (p. 21 & p. 19). For use primarily in well-drained soils. For sites with constrained space, these practices are ideal. • Vermont’s Lake Wise Program also has guidance for Dripline Trenches and Dry Wells (for Downspout Disconnection). • Rain Barrel: VT Guide to Stormwater for Homeowners (p. 17). For use with houses with guttered roofs and downspouts to disperse roof runoff. Must be used in connection with a plan for the collected water or stable area in which to disperse flows. • Rain Garden & Disconnection to Stable Vegetated Area or Vegetated Swale: VT Guide to Stormwater for Homeowners (p. 29 & 27). Ideal for outlet of rain barrel or for point of concentrated flow from rooftop. Soil must allow for some infiltration. See Vermont Rain Garden Manual for additional design details, soil testing, and appropriate species selection. • Vermont’s Lake Wise Program also has guidance for Rain Gardens and Vegetative Swales • Green Roof: VT Guide to Stormwater for Homeowners (p. 35). For flat or low-slope roofs only. Can be logistically difficult to install but aesthetically pleasing. • Many of these practices are also found in the French language Fiches sur l’aménagement et l’entretien des propriétés résidentielles. <p><i>Patios</i></p> <ul style="list-style-type: none"> • Permeable Pavers (or other Permeable Surface): VT Guide to Stormwater for Homeowners (p. 33). A variety of materials can be used to make an impervious surface permeable (or pervious). Ideal for sites with well drained soils. For decks within buffer, ensuring that underlying soils are uncompacted and well-drained can be sufficient to minimize runoff. • Vermont’s Lake Wise Program also has guidance for Pervious Pavement • Vegetated Swale & Infiltration Trench. VT Guide to Stormwater for Homeowners (p. 27 & p. 21). Features can be located at edge of patio where runoff collected (if patio is sloped). Swales can be used in soils that don’t infiltrate well to slow and spread runoff. Infiltration trenches are for sites with well drained soils. • Vermont’s Lake Wise Program also has guidance for Infiltration Trenches. • Rain Garden: VT Guide to Stormwater for Homeowners (p. 29) and Vermont Rain Garden Manual. Similar to Vegetated Swales and Infiltration Trenches, Rain Gardens can be used at the edge of patios (or decks) to either slow and spread runoff or infiltrate it. • Filter Berm: VT Guide to Stormwater for Homeowners (p. 25). For sloping sites with somewhat constrained space and poorly drained soils, filter berms can capture runoff and slow it before allowing it to drain through the filter berms porous soils. • As of January, 2021, Vermont’s Lake Wise Program is developing guidance for a Vegetated Berm.
<p>There is development in the buffer that needs to be managed</p>	<p><i>Behavioral:</i></p> <p><i>Lawns or Other Landscaping:</i></p> <ul style="list-style-type: none"> • Longer Grass & Low Mow Zone: VT Guide to Stormwater for Homeowners (p. 38 & p. 39) & Vermont’s ‘Raise the Blade’ Campaign. Where lawn can’t be eliminated, allowing grass to grow to 3” (or more), leaving grass clippings in place, and reducing or eliminating fertilizer and pesticide use will greatly reduce the impact of runoff from the lawn to the stream or river. • Vermont’s Lake Wise Program has guidance for Establishing No Mow Zones and Lake-Friendly Yard Maintenance (which is also applicable for many streams and rivers). • The Fund for Lake George’s DIY Water Quality: Minimize the Size of Grass Lawns has information on the negative impacts of lawns on waterways and recommendations for better lawn management. • Aeration: VT Guide to Stormwater for Homeowners (p. 38) & Vermont’s Raise the Blade Campaign. As lawns become compacted over time through use, aeration will increase infiltration of runoff into soils of any type.

4. Common Issues & Solutions - Width DIY Technical Resources Next Steps

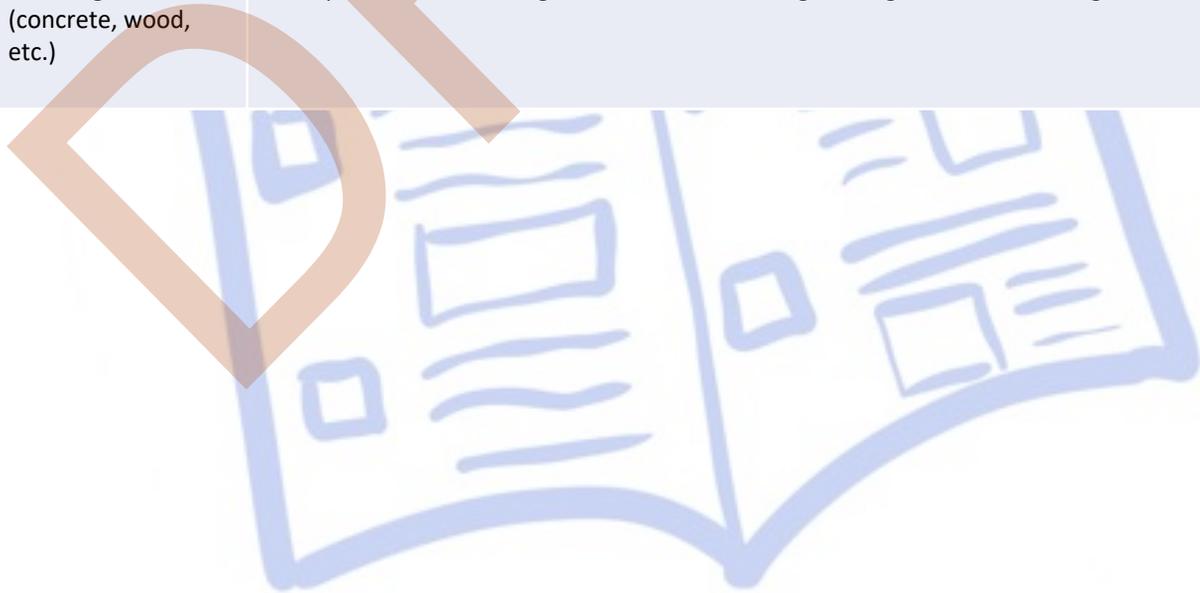


Issue	Solution
Vehicle Access is too wide, impervious, or creates an unnecessary channel connection to the stream or river	<ul style="list-style-type: none">• Vehicle Access must of minimal width (maximum 12' or 4m) and pervious if possible (permeable surfaces could include pervious pavers or porous concrete/asphalt). If not possible, concentrated flows should be minimized.• Water Bars: See below under Access Pathway for reference.• The VT Guide to Stormwater Management for Homeowners has a two-page section on Strategies for Rural Driveways (p. 41-42) which outlines additional strategies including spacing for ditch relief culverts for managing uphill flows to driveways, flow diffusers to culvert or water bar outlets, and a simplified guide to driveway shaping and surface stabilization techniques.• For additional options and practices see the Vermont Better Roads Manual and the New York Rural Roads Active Management Program manual (these manuals have considerable overlap) for more detailed design of water bars, driveway shaping and stabilization, turnout, ditch stabilization, and culvert design.• MRC Brome-Missisquoi also offers the Technical Guide – Environmental Management of Ditches to improve runoff from vehicle access paths.
Access Path is too wide, impervious, or there are multiple access paths	<ul style="list-style-type: none">• Access paths must be of minimal width (maximum 6' or 2m) and pervious (aerated grass, uncompacted gravel, crushed stone, or pervious pavers or similar). A few single track foot paths are okay, but limit access to one main pathway and vehicle access where possible. For steeper Access Paths that create concentrated flow to a stream or river, see below for strategies.• Vermont's Lake Wise Program has guidance for Planning Pathways, a resource which outlines general steps to take for pathway creation or improvement.• Water Bars: VT Guide to Stormwater Management for Homeowners (p. 23). Water bars serve to interrupt long stretches of concentrated flow using angled humps in the pathway with outlets on the downhill side. Outlets must be stable (using a small rain garden or simply a small hole can be sufficient).• Vermont's Lake Wise Program has guidance on Water Bars as well as Open Top Culverts and Rock Aprons which are used in the same way.• See also the Turnout guidance from Lake Wise for ideas on managing runoff near Access Paths and stabilizing outlets of waterbars or open top culverts.• Infiltration Stairs: VT Guide to Stormwater Management for Homeowners (p. 31). If access is provided by stairs, using stairs constructed of wooden retaining timbers with uncompacted gravel or stone between them can eliminate runoff from concrete stairs. If stairs are wooden, ensure that there are gaps in board to allow rain to pass through and that soil underneath stairs is uncompacted and allows runoff to infiltrate.• Vermont's Lake Wise Program has guidance on Infiltration Steps.

4. Common Issues & Solutions - Zones DIY Technical Resources Next Steps



Issue	Solution
Development outside the buffer is creating concentrated, channelized flow to the buffer	<ul style="list-style-type: none"> • See the Width section for strategies for controlling concentrated flow from development. • In certain cases, there may be existing drainage features (ditches, swales), designed to eliminate upland runoff to development that are routed directly to a stream or river. Outlets to the stream or river should be eliminated and flows from the feature should be dispersed prior to entering the riparian buffer using the appropriate technique from the Width section strategies.
There is erosion in the buffer or on the stream bank from some sort of concentrated, channelized flow to the buffer or stream bank	<ul style="list-style-type: none"> • Similar to the above issue, upland areas may be causing erosion over the stream or river bank. Evaluate if this is the case and implement one of the previously mentioned solutions.
The stream bank is hard armored with rip rap (and no vegetation or non-native vegetation)	<ul style="list-style-type: none"> • Use Quebec's Shoreline Management Guide (Guide de mise en valeur riveraine, p. 33-35) for guidance on installing new rip rap if unavoidable or planting vegetation in existing rip-rap (see also p. 65 for specific guidance for planting in stone rip rap). • See also the Vermont Lake Wise Program guidance for Resloping, Rock Toe and Rip Rap for additional information. • The Vermont Shoreline Stabilization Handbook has a additional detailed guidance on practices to be used in existing or proposed rip rap situations under the Biotechnical Section (p. 31) with instructions for vegetated rip rap and gabion walls and mattresses, and vegetated cribbing or live cribbing.
The stream bank is hard armored using an impervious retaining wall (concrete, wood, etc.)	<ul style="list-style-type: none"> • Use Quebec's Shoreline Management Guide (Guide de mise en valeur riveraine, p. 36-38) for guidance on developing a vertical 'shorewall' or other retaining wall. • Additionally the Vermont Shoreline Stabilization Handbook Biotechnical Section (p. 31) provides additional guidance on how to integrate vegetation in retaining walls.



4. Common Issues & Solutions – Vegetation DIY Technical Resources Next Steps



Issue	Solution
<p>The buffer is lacking the necessary five tiers of vegetation</p>	<ul style="list-style-type: none"> • Determine the tiers of vegetation that are not present and possible reasons for not being present, e.g., a mature Hemlock forest may not have any - or very few - shrubs and herbaceous groundcovers, which is a functioning forest ecosystem and can still be given the Stream Wise Award. However, if there is no shrub or herbaceous groundcover layer because the homeowner has been weed whacking and mowing in the buffer, then they must stop all disturbance and allow the shrub and herbaceous layer to return to be able to be awarded the Stream Wise Award. • Remediation practice for specific tiers is as follows: <ol style="list-style-type: none"> 1. There is no canopy or tall, mature trees: <ol style="list-style-type: none"> 1. Plant trees in bare root, tube stock/tree pot, container, or ball and burlap form, protect them from deer grazing by putting a wire fence around them if deer are prevalent, and water them regularly until established. 2. Select trees that will be well-adapted to the climate, soils (clay, sand, silt, loam, compacted, moisture levels), hardy to wind/ice/snow disturbances, potential flooding conditions (dependent on site), and amount of sun available. 2. There are no replacement sapling trees: <ol style="list-style-type: none"> 1. Plant seeds of existing trees (e.g., acorns from Oaks, samaras from Maples, cones from Speckled Alder, pits from Black Cherries, cones from Hemlocks, etc.). 2. Plant saplings of native trees existing in the buffer or nearby, or trees that would be well-adapted to the site. 3. Stop removing vegetation on the forest floor and allow saplings to grow. 3. There are no shrubs: <ol style="list-style-type: none"> 1. Plant native shrubs adapted to the site. 2. Stop removing brush from understory, do not cut anything below 3' (1m). 4. There are no herbaceous perennials or groundcovers / bare soil: <ol style="list-style-type: none"> 1. Allow duff layer to build up. 2. Aerate bare/compacted soils by poking holes with rake or scouring with rake and adding erosion control matting, leaves, or mulch. 3. Seed with native forest mix. 5. There is no duff layer / bare soil: <ol style="list-style-type: none"> 1. Do not remove leaves or mow. 2. Do not remove dead wood, plant material, and other debris. 3. Add leaves from lawn, wood chips, mulch, or erosion control matting to jump start the build-up of duff. • See 'Plant diverse vegetation' section for technical resource guidance.
<p>More than 25% of the buffer is composed of invasive species</p>	<ul style="list-style-type: none"> • ID species; look up recommended options for removal, suppression, or containment; make a plan for invasive species prevention, removal, suppression, or containment using proper mechanical or herbicidal practices; seek technical or professional assistance if the problem is pervasive. • Vermont DEC Lake Wise provides guidance on Managing Invasive Species in this info sheet. • New York DEC provides an excellent guide to Managing Invasive Plants in Riparian Areas. • The Alliance for Chesapeake Bay also provides an in-depth Citizen's Guide to the Control of Invasive Plants in Wetland and Riparian Areas including special consideration for riparian areas and control techniques. • Common Invasive Plant Lists for each region can be found at VT Invasive, NY Adirondack - Invasive Plant Program, and Conseil québécois des espèces exotiques envahissantes/Québec Invasive Species Council.

4. Regional Technical Assistance Resources



VERMONT

Riparian Restoration & Planting:

In Vermont, there are a variety of organizations that work with different programs for riparian restoration that can help property owners achieve stream buffers that will align with Stream Wise Program Award standards. They are:

[Vermont Association of Conservation Districts](#) (VACD) – the umbrella organization for regional Natural Resource Conservation Districts (NRCs) organized by region. Their riparian buffer efforts are known generally as Trees for Streams and is administered regionally by NRCs (and also by watershed organizations – see below). The program offers both technical assistance and funding to landowners interested in improving their riparian buffers. In addition, NRCs often hold annual [tree sales](#) offering subsidized purchases of native trees for riparian restoration. Member organizations are able to leverage a variety of funding (State of Vermont DEC, US Fish and Wildlife) to implement projects.

[Watersheds United Vermont](#) (WUV) – a statewide coalition of watershed organizations as well as NRCs involved in promoting water quality enhancement through a variety of resources. WUV organizations also participate in Trees for Streams and can provide technical assistance and potentially funding to property owners. Reaching out to WUV to find the most regionally appropriate organization with whom to speak regarding riparian buffer enhancement is a key first step in obtaining technical assistance for property owners.

Stormwater Management:

Managing runoff from a site is particularly important for sites where channelized or point-source flow exists to the riparian buffer and needs to be mitigated. The following programs conduct assessment and can leverage resources to help abate that runoff.

[BLUE](#) – the privately-run BLUE program can conduct stormwater assessments in the Lake Champlain Basin for homeowners as well as commercial properties. They are able to provide recommendations on stormwater management feature selection, location, and design.

[StormSmart](#) – originally developed by [Friends of the Mad River](#) and later adopted by [Friends of the Winooski River](#), StormSmart offers free assessment for property owners in the Winooski River watershed (of which the Mad River is a sub-watershed) and guidance and advice on how to manage runoff.

4. Regional Technical Assistance Resources



VERMONT

Conservation:

[VT DEC - River Corridor Easement Program](#): This program seeks to preserve not only the riparian buffer but also the entire river geomorphic corridor. This [brochure for landowners](#) succinctly explains how to participate. This program will generally require more area conserved than the Stream Wise Award buffer alone.

[Vermont River Conservancy – Conservation Easements](#): The non-profit Vermont River Conservancy may be able to accept and hold donated land in an easement, though standards above those required by the Stream Wise Program will apply.

[Vermont Land Trust](#): While not focused specifically on riparian land conservation, Vermont Land Trust may be a suitable partner for some parcels on a case-by-case basis for interested landowners.

Flood Resilience:

[Functioning Floodplain Initiative \(FFI\)](#): An initiative begun in 2020, the FFI is seeking to develop a toolset for mapping and tracking projects from the basin to the site scale that will aid in increasing flood resiliency. This toolset will ultimately be useful in contextualizing Stream Wise Program properties in Vermont with respect to encouraging certain property owners to adopt FFI standards.

4. Regional Technical Assistance Resources



NEW YORK

Riparian Restoration & Planting:

In New York, there are a variety of organizations that work with different programs for riparian restoration that can help property owners achieve stream buffers that will align with Stream Wise Program Award standards. They are:

[Soil and Water Conservation Districts \(SWCDs\)](#) – These districts carry out natural resource conservation programs relating to soil and water by providing technical assistance and programs to residents, land owners, agricultural producers, and municipalities. Programs related to stream buffers include annual tree and shrubs sales, riparian planting, stream restoration technical assistance, and procurement of federal funding for agricultural conservation practices and other restoration programs. Washington County SWCD has a Streambank Stabilization Program, providing technical assistance, construction oversight, and in some cases, coordination of funding toward these projects

[Champlain Watershed Improvement Coalition of New York \(CWICNY\)](#) – the umbrella organization for the 5 SWCDs within the Lake Champlain Basin (Clinton, Essex, Franklin, Warren, Washington Counties) and the Lake Champlain-Lake George Regional Planning Board (LCLGRP). This coalition involves public and private partnerships (NRCS, NYDEC, TNC, LCBP, US Fish & Wildlife) to complete projects reduce phosphorus loading in Lake Champlain and benefit watershed health.

[Trees for Tribs](#) - NYS DEC statewide program that works to reforest tributaries. The program is part of the Saratoga Tree Nursery, providing landowners, municipalities, and conservation organizations with free technical assistance and low- or no-cost native trees and shrubs to plant along streams to establish vegetated buffers. The Buffer in a Bag program provides landowners with a free bag of bare-root trees and shrubs to enhance streamside areas on their property.

[Adirondack Park Invasive Plant Program](#) – Serves as the Adirondack Partnership for Regional Invasive Species Management (PRISM), one of eight PRISMs across New York. APIPP is a partnership program founded in 1998 by The Nature Conservancy, New York State Department of Environmental Conservation (NYSDEC), New York State Department of Transportation and New York State Adirondack Park Agency, and it is housed under the Adirondack Chapter of The Nature Conservancy.

[Boquet River Association](#) – non-profit group local to the Boquet River that works in many areas of water quality, in particular stream bank stabilization through riparian restoration and planting.

4. Regional Technical Assistance Resources



NEW YORK

Conservation:

[The Lake Placid Land Conservancy](#) – Conservation easements for land in the Lake Placid, Ausable, and Saranac Watersheds can be donated or potentially sold to limit future development. Tax deductions are for the following resource categories: public recreation and/or education, significant natural habitat, open space for scenic enjoyment or pursuant to local government policy, and historic preservation.

[Adirondack Land Trust](#) – Works across the Adirondack Park and north to Canadian border to protect agricultural land in the Champlain Valley as well as wild and working forest land and shorelines to protect water quality and reduce flood risk specifically in Clinton, Essex, Franklin, Hamilton, Herkimer, Oneida, St. Lawrence, Warren and Washington counties.

[Adirondack Chapter of The Nature Conservancy](#) - The Chapter works in the Adirondack region to conserve lands, in some cases specifically focused on water quality. There are several chapters of The Nature Conservancy across New York State – see the web page section under Local News for more information and direct contact information.

[Lake George Land Conservancy](#) – The organization works in the Lake George region of the Adirondacks to conserve land through easements, with a specific focus on improving water quality in Lake George and its surrounding watershed.

Flood Resilience & Stream Channel Restoration:

[Ausable River Association](#) – The Healthy Streams program offers landowners and municipalities stream assessment and restoration technical assistance for stream channels, as well as stream buffers. The Climate-Ready-Culvert Program restores connectivity and stream health.

[Trout Unlimited](#) - The NYS Council of Trout Unlimited's (TU) strategic plan includes protection of intact, healthy streams to nurture healthy populations of wild trout, reconnection of trout streams, and restoration impacted streams. Stream restoration projects to improve channel stability, bank stabilization, sediment reduction, and habitat protection have been completed in partnership with state and non profit programs, including SWCDs, U.S. Fish & Wildlife, and local river and watershed associations.

[Lake George – Lake Champlain Regional Planning Board](#) – The Water Quality Program of the Regional Planning board has programs and affiliations with local organizations to implement flood resilience and stream channel restoration project.

4. Regional Technical Assistance Resources



QUEBEC

Riparian Restoration:

In Quebec, there are a variety of organizations that work with different programs for riparian restoration that can help property owners achieve stream buffers that will align with Stream Wise Program Award standards. In general for properties in Quebec, the first source for information and assistance should be the MRC for information on local regulations and assistance programs. They are:

MRC-Brome-Mississquoi – [Virage Eau](#) – [Virages Rivages](#) program – the Virage Eau and more specifically the Virages Rivages program is administered through the canton of Brome-Mississquoi and promotes the restoration and preservation of riparian buffers through information regarding local regulations, as well as assistance in obtaining vegetation for reestablishing a healthy buffer. The Virage Rivages program specifically distributes trees and shrubs for this purpose.

MRC-Memphremagog – [Bandes Riveraines](#) program – the canton of Memphremagog provides similar services and assistance as Brome-Mississquoi with respect to riparian buffers. In particular, this [leaflet](#) explains the need for and design of buffers, along with links to technical resources, notably the QuebecVert resource (see below) as well as more general information on how to plan and implement an effective buffer.

QuebecVert – [Bande Riveraine](#) program – this program offers a wealth of technical and planting expertise through their resources and guide, the '[Guide de bonnes pratiques: Aménagement et techniques de restauration des bandes riveraines](#)' should be considered as one of the best sources for actual implementation of a good riparian buffers on residential properties.

Stormwater Management:

Managing runoff from a site is particularly important for sites where channelized or point-source flow exists to the riparian buffer and needs to be mitigated. The following resources address stormwater management.

[Fiches sur l'AMÉNAGEMENT et l'ENTRETIEN des PROPRIÉTÉS RÉSIDENIELLES](#) – Very comprehensive guide on stormwater management with both structural and behavioral changes that can manage stormwater on residential properties. Many Best Management Practices (BMPs) found in the VT Stormwater Guide for Homeowners can also be found here in French.

[La Conceptions des jardins de pluie](#) – Excellent rain garden manual from Quebec with specific how-to instructions on sizing, species, and placement.

4. Regional Technical Assistance Resources



QUEBEC

Conservation:

[Natural Heritage Conservation Act](#) – this Act allows for the conservation of particularly valuable property through law, potentially leveraging a partnership for management of the land by a non-profit conservation organization. For certain Stream Wise properties in Quebec, this could be one avenue to achieve additional recognition and protection. Typically the conservation act requires a 25-year commitment.

[Nature Conservancy Canada](#) – the NCC is devoted to land conservation in Quebec at all scales. While smaller Stream Wise properties may not be of interest to this organization, larger, more significant properties may be, as would smaller properties linked together to form a larger riparian buffer area.

[Ducks Unlimited Canada](#) – Ducks Unlimited has a private property owner program for land conservation and assistance that may prove valuable to Stream Wise properties, in particular those that abut wetlands as well as streams or rivers.



4. Regional Technical Assistance Resources

DIY RIPARIAN RESTORATION & PLANTING

The following resources are designed to be used and understood by property owners. As such, they are not overly technical in nature. While they may not be sufficient for all properties to achieve Stream Wise Program standards, they will be adequate for many. As a Stream Wise Host, it would be useful to have a working familiarity with these documents.

Riparian Buffers and General Stream / River Information:

Comprehensive How-To Guides:

[Guide de mise en valeur riveraine](#) – This comprehensive guide (in French but available in English from OBVBM) describes a variety of ways in which landowners can observe their own property, assess it for issues, and implement strategies to ameliorate the effects of development on streams and rivers. Well laid out and comprehensive, this guide is effective and practical for both practitioners and landowners.

[QuebecVert – Bande Riveraine program](#) - QuébecVert, formerly FIHOQ (Interdisciplinary Federation of Ornamental Horticulture in Quebec), has the mission of representing and promoting the ornamental, environmental and food horticulture sector and promoting its growth with a view to sustainable development. Their Bande Riveraine program has many tools to creating effective riparian buffers. In particular their '[Guide de bonnes pratiques: Aménagement et techniques de restauration des bandes riveraines](#)' is particularly useful for landowners along streams and rivers. French only on the website.

[Shoreline Stabilization Handbook](#) – published by the Lake Champlain SeaGrant program, this handbook deals primarily with lakeshore erosion and stabilization. However, it presents various stabilization techniques, such as bioengineering practices like live staking and erosion control logs, in simple-to-understand terms. These practices can be used along stream banks to counter erosion and promote stability.

[Living in Harmony with Streams](#) – published by the Friends of the Winooski River, this guide is an effective resource for property owners in understanding stream function, as well as understanding broader restoration techniques. This guide does not necessarily have specific recommendations that property owners can follow on their own (i.e. specific Best Management Practices).



4. Regional Technical Assistance Resources

STORMWATER MANAGEMENT RESOURCES

[Vermont Guide to Stormwater for Homeowners and Small Businesses](#) – this guide can help Stream Wise Property owners identify and manage specific practices to mitigate runoff from developed areas of their property. In particular, guidance on access paths or stairs may prove especially valuable.

[New York Rural Roads Active Management Program \(RRAMP\)](#) & [Vermont Better Roads Manual](#) – these two resources can be used by either practitioners or property owners to aid in the design of access paths through the riparian buffer to the stream or river to minimize hydrologic connection using a variety of techniques. Note that many of the BMPs in the New York RRAMP manual were drawn originally from the Vermont Better Roads Manual.

[Vermont DEC Lake Wise Program](#) – similar to Stream Wise, Lake Wise has assembled a variety of technical assistance worksheets for management practices that may help manage runoff from developed surfaces on Stream Wise properties.

[Vermont Rain Garden Manual](#) – this Vermont-based manual gives property-owner friendly details on how to design and build simple, small rain gardens around residential development. This guide would be particularly useful in abating runoff point sources or concentrated flows from entering the riparian buffer, or mitigating development within the buffer.

[Fiches sur l'aménagement et l'entretien des propriétés résidentielles](#) – guide to water-friendly practices in French, covering BMPs for stormwater as well as good septic system design, low-mow practices, and general water quality issues for homeowners.

[La conceptions des jardins de pluie](#) – Step-by-step manual for rain garden design from placement to sizing and species selection.

Additional guidance for practitioners can be found in the [Stream Wise Program Resource Library](#) under the Technical Assistance Table. Guidance for practitioners is generally more technical in nature and therefore less suitable for direct distribution to property owners.



4. Regional Technical Assistance Resources

RIPARIAN BUFFERS AND GENERAL STREAM / RIVER INFORMATION

Other How-To Guides:

[Creating a Riparian Buffer -Tree Planting](#) – simple one-page guide from the Lake Champlain Committee on planting a riparian buffer. This guide may lack the details and guidance necessary to establish an effective buffer.

[OBVBM – Various Documents](#) – OBVBM has created several documents over the years which could be of help to property owners, in particular the '[Protecting shorelines, floodplains, and wetlands](#)' document, the '[Shorelines and Health – Public Awareness Sign](#)', the '[Waterline Property Owner's Guide](#)' which outlines good stewardship for owners along lakes and streams, and the '[Biomechanical Stabilization Fact Sheet](#)' which outlines practical measures that can be taken to stabilize stream banks.

[DIY Water Quality](#) – The Fund for Lake George created this how-to manual to protect water resources, including information on stream buffers, shoreline buffers, rain gardens, minimizing lawns, native plant species index, and site planning.

INVASIVE SPECIES

Invasive species spread rapidly and threaten native plant species and the health of stream ecosystems. They spread easily along streams and river corridors and are commonly found along streambanks. It is imperative to prevent and remove invasive species as much as possible to contain and prevent their spread. Invasive species can be very hard to remove and often require repeated and prolonged removal techniques, including mechanical/physical, suppression, and herbicide injection, depending on the type of species and the extent of the spread. Technical and professional assistance may be necessary. The following are some regional resources for invasive species:

VERMONT

- [Vermont Invasives](#) – landing page for Vermont resources on invasive species
- [VT Agency of Natural Resources - Invasive Species](#)
- [VT Fish & Wildlife - Threats from Invasive Species](#)

NEW YORK

- [Adirondack Park Invasive Plant Program \(APIPP\)](#) – Adirondack Partnership for PRISM
- [NYSDEC Partnerships for Regional Invasive Species Management \(PRISM\)](#) – Eight PRISMs across New York State

QUEBEC

- [Conseil québécois des espèces exotiques envahissantes](#) /Quebec Interdepartmental Committee on Invasive Species



4. Regional Technical Assistance Resources

Technical Assistance Organizations:

The following list of organizations are meant to be used primarily by the Stream Wise Host Organization to determine which local organization, whether a watershed organization, a conservation district, or soil and water conservation service, would be most appropriate as a partner for implementation of riparian buffer solutions. In some cases, there may be overlapping areas in which these organizations work.

It may be useful to determine which watershed a municipal boundary is in. [Use this interactive map hosted by the Lake Champlain Basin Program](#) to search for an address or zoom in to the area of interest for a particular site. This will help determine which local organization to contact if necessary.

Vermont (by Lake Champlain Basin):

Bold text indicates the primary organization for the area, if applicable.

Basin	Organization(s)
Missisquoi Basin (<i>Missisquoi, Trout, Pike, Rock Rivers, Black Creek, Lake Carmi</i>)	<ul style="list-style-type: none">• Orleans County NRCD• Franklin NRCD
Lamoille Basin (<i>Lamoille, Lee, Browns Rivers</i>)	<ul style="list-style-type: none">• Lamoille NRCD• Franklin County NRCD• Orleans County NRCD• Caledonia County NRCD
Winooski Basin (<i>Winooski, Dog, Mad, Laplatte Rivers, Stevens Brook, Jail Branch, Shelburne Pond</i>)	<ul style="list-style-type: none">• Winooski NRCD• Friends of the Winooski River• Friends of the Mad River
Otter/Lewis Basin (<i>Otter & Lewis Creeks</i>)	<ul style="list-style-type: none">• Otter Creek NRCD• Rutland NRCD• Bennington County NRCD
Poultney-Mettowee or South Lake Basin (<i>Poultney & Mettowee Rivers</i>)	<ul style="list-style-type: none">• Poultney Mettowee NRCD
Lake Direct (<i>Tributaries draining directly to the Lake</i>)	<ul style="list-style-type: none">• Franklin NRCD• Winooski NRCD• Otter Creek NRCD• Poultney Mettowee NRCD



4. Regional Technical Assistance Resources

Technical Assistance Organizations:

Vermont (by county):

County	Organization(s)
Grand Isle County	<ul style="list-style-type: none">• Grand Isle NRCD
Franklin County	<ul style="list-style-type: none">• Franklin County NRCD
Orleans County	<ul style="list-style-type: none">• Orleans County NRCD
Chittenden County	<ul style="list-style-type: none">• Winooski NRCD• Friends of the Winooski River
Lamoille County	<ul style="list-style-type: none">• Lamoille NRCD
Washington County	<ul style="list-style-type: none">• Winooski NRCD• Friends of the Winooski River
Caledonia County	<ul style="list-style-type: none">• Caledonia County NRCD
Orange County	<ul style="list-style-type: none">• Winooski NRCD• Orange County NRCD• White River Partnership (outside Lake Champlain Basin)
Addison County	<ul style="list-style-type: none">• Otter Creek NRCD
Rutland County	<ul style="list-style-type: none">• Rutland NRCD• Poultney Mettowee NRCD
Bennington County	<ul style="list-style-type: none">• Bennington County NRCD



4. Regional Technical Assistance Resources

Technical Assistance Organizations:

New York (by Lake Champlain Basin):

Basin	Organization(s)
Chazy Basin (<i>Great Chazy, North Branch, Little Chazy Rivers</i>)	<ul style="list-style-type: none">• Clinton County SWCD
Saranac Basin (<i>Saranac River & Lake</i>)	<ul style="list-style-type: none">• Franklin County SWCD• Essex County SWCD
Ausable Basin (<i>East Branch, West Branch, Lower Ausable, Little Ausable Rivers, Lake Placid</i>)	<ul style="list-style-type: none">• Ausable River Association• Clinton County SWCD
Boquet Basin (<i>North & East Branch of Boquet River</i>)	<ul style="list-style-type: none">• Boquet River Association (BRASS)• Essex County SWCD
South Basin (<i>Lake George</i>)	<ul style="list-style-type: none">• Lake George Association• Essex County SWCD

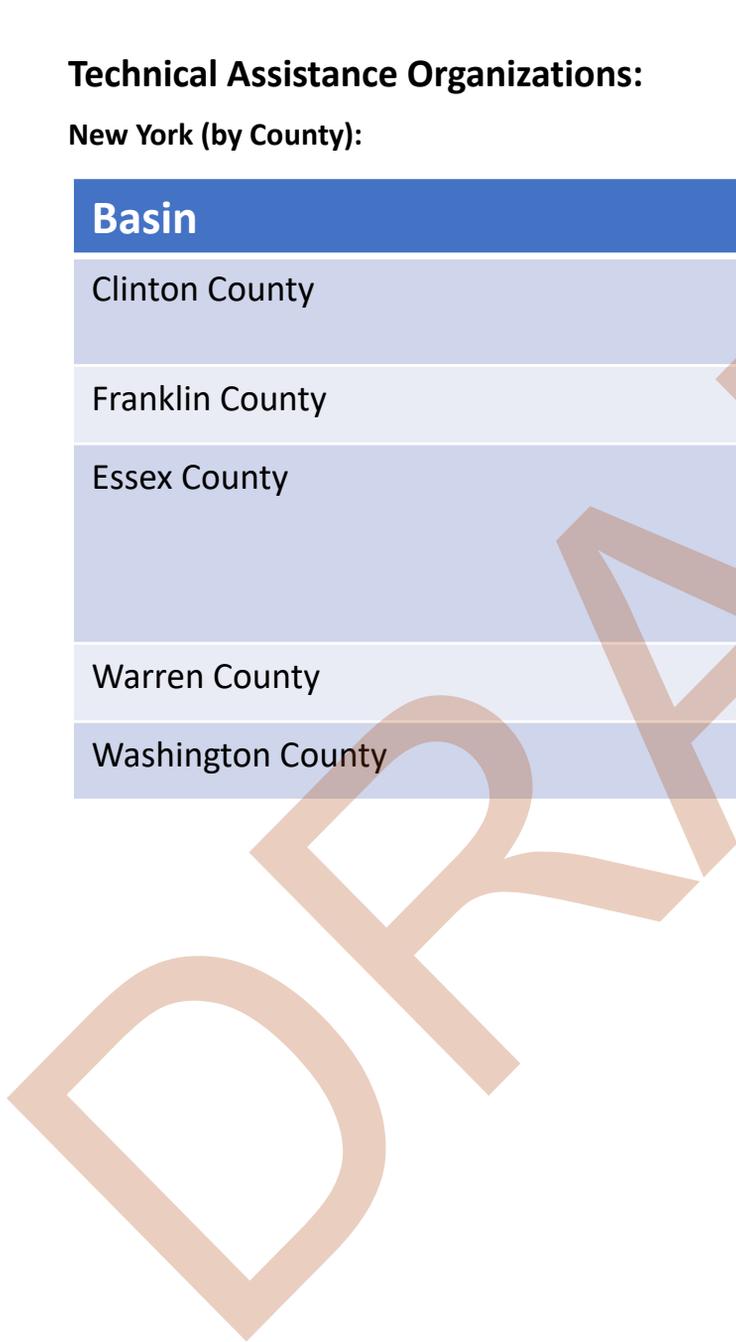


4. Regional Technical Assistance Resources

Technical Assistance Organizations:

New York (by County):

Basin	Organization(s)
Clinton County	<ul style="list-style-type: none">• Clinton County SWCD• Ausable River Association
Franklin County	<ul style="list-style-type: none">• Franklin County SWCD
Essex County	<ul style="list-style-type: none">• Essex County SWCD• Lake George Association• Boquet River Association (BRASS)
Warren County	<ul style="list-style-type: none">• Warren County SWCD
Washington County	<ul style="list-style-type: none">• Washington County SWCD





4. Regional Technical Assistance Resources

Technical Assistance Organizations:

Quebec (by Lake Champlain Basin):

Basin	Organization(s)
Missisquoi Basin (<i>Missisquoi, Pike, Rock Rivers</i>)	<ul style="list-style-type: none">Organisme de Bassin Versant de la Baie Missisquoi (OBVBM)

Quebec (by Canton):

Canton	Organization(s)
MRC-Brome-Missisquoi	<ul style="list-style-type: none">MRC-Brome-Missisquoi
MRC-Memphremagog	<ul style="list-style-type: none">MRC-Memphremagog

Additionally, property owners can contact their local municipal offices for guidance on local regulations and a list of contacts for consultants, designers, or landscape professionals who may be of assistance in achieving Stream Wise compliance.



4. DIY Technical Assistance Glossary

The following list of links provides easy access to a variety of useful practices that are generally easy to understand by both practitioners and property owners. Use this to quickly find and communicate these resources to property owners.

- > Establish a "No-Mow" Zone
 - > [Lake Wise BMP Fact Sheet - No-Mow Zones](#)
 - > [Lake George DIY Water Quality - Minimize Lawns](#)
- > Protect & Enhance a Native Forested Riparian Buffer
 - > [Lake George DIY Water Quality - Stream Buffers](#)
 - > [QC OBVBM - Guide de mise en valeur riveraine / Shoreline Management Guide](#)
 - > [VT Trees for Streams Resource Guide](#)
 - > [VT DEC - Planting Guidance for Revegetation of Riparian Areas](#)
 - > [VT Lake Wise BMP Fact Sheet - Plant & Maintain Vegetation](#)
 - > [VT NRCS Specification Guide Sheet for Riparian Forest Buffer](#)
 - > [VT NRCS Specification Guide Sheet for Tree & Shrub Establishment](#)
- > Establishing Native Plant Communities
 - > [VT Lake Wise BMP Fact Sheet - Planting & Re-Naturalizing Areas](#)
 - > [VT Lake Wise - Native Plant List](#)
 - > [Lake George DIY Water Quality - Grow Natives, Stop Invasives](#)
 - > [Lake George DIY Water Quality - Native Plant Species List](#)
 - > [VT Fish & Wildlife's Wetland, Woodland, Wildland Book](#)
- > Managing Invasives
 - > [VT Lake Wise BMP Fact Sheet - Invasives](#)
 - > [VT Invasives](#)
 - > [NY Adirondack - Invasive Plant Program](#)
 - > [Conseil québécois des espèces exotiques envahissantes/Québec Invasive Species Council](#)
 - > [NY DEC Managing Invasive Species Guide](#)
 - > [Alliance for the Chesapeake Bay "Citizen's Guide to the Control of Invasive Plants in Wetland and Riparian Areas"](#)
- > Build a Rain Garden
 - > [VT Rain Garden Manual](#)
 - > [Lake Wise BMP Fact Sheet - Rain Gardens](#)
 - > [Lake George DIY Water Quality - Rain Gardens](#)
 - > [VT DEC - Guide to Stormwater for Homeowners - Rain Gardens, Filter Berms, Disconnection to Vegetation](#)
 - > [La conception des jardins de pluie](#)
- > Planning & Re-directing Pathways
 - > [VT Lake Wise - Planning Pathways](#)
 - > [VT DEC - Guide to Stormwater for Homeowners](#)



4. DIY Technical Assistance Glossary

- > Intercept runoff from pathways, redirect, and infiltrate
 - > [VT DEC - Guide to Stormwater for Homeowners - Permeable Pavers, Waterbars, Infiltration Stairs](#)
 - > [VT Lake Wise BMP Fact Sheets – Waterbars](#)
 - > [VT Lake Wise BMP Fact Sheets - Open-top Culverts & Rock Aprons](#)
 - > [VT Lake Wise BMP Fact Sheets - Turnouts](#)
 - > [VT Lake Wise BMP Fact Sheets - Infiltration Steps](#)
- > Riparian Restoration Practices – Bioengineering, Living Shorelands, Soft-scaping Practices
 - > [Lake Champlain Shoreline Stabilization Handbook](#)
 - > [QC OBVBM - Guide de mise en valeur riveraine/Shoreline Management Guide](#)
 - > [NY DEC Shoreline Stabilization Techniques](#)
 - > [VT Lake Wise - BMP Fact Sheets](#)
- > Green Stormwater Infrastructure to capture and filter upland runoff
 - > [VLCT - GSI Sizing Tool](#)
 - > [VT DEC - Guide to Stormwater for Homeowners - Vegetated Swale, Infiltration Trench, Drywell, Green Roof](#)
 - > [VT Lake Wise - BMP Fact Sheets](#)
 - > OBV – Quebec’s [Fiches sur l’aménagement et l’entretien des propriétés résidentielles](#) (also contains lawn practices and riparian restoration information)
- > Roads
 - > [VT DEC - Guide to Stormwater for Homeowners - Strategies for Rural Driveways](#)
 - > [Vermont Better Roads Manual](#)
 - > [New York Rural Roads Active Management Program](#)
 - > [MRC Brome-Mississquoi – Technical Guide – Environmental Management of Ditches](#)
- > Lake-friendly Yard Management
 - > [VT DEC Lake Wise BMP Fact Sheets - Lake-friendly Yard Maintenance](#)
 - > [VT DEC - Guide to Stormwater for Homeowners - Aeration](#)
 - > [Vermont LCBP's Raise the Blade Campaign](#)
 - > [Quebec’s Pelouse Durable information](#)

5. Follow Up on Next Steps (Once Completed) & Reassessment



1. 2ND Property Evaluation after necessary actions taken

- Once a property owner has completed the necessary actions and enough time has passed for the physical conditions to pass the Stream Wise criteria (communicated with property owner via email or phone), a second property evaluation will take place to confirm criteria has been met and to give out the Stream Wise Award sign.

2. Re-assessment for Stream Wise Properties

- A questionnaire will be sent out to Stream Wise Award property owners 3-5 years (TBD) after initial assessment. An online survey and a print survey will be made available via email and physical mail. The survey will include questions about the stream buffer, observations made, further actions taken, further questions or recommendations for the program, and a self-certification of continuing compliance with Stream Wise criteria.
- The host organization will determine if an in-person re-visit of the property is desired and necessary, depending on capacity and participant needs, during Phase 2 and 3 of the program.

4. [ENVIRONMENTAL] STREAM WISE AWARD SIGN



Just for fun!

EXAMPLE PROPERTY: **BEFORE**



EXAMPLE PROPERTY: **AFTER**



Program Criteria – Glossary



Resources Relating to Program Criteria:

> 50' (15m) Min. Buffer / 30' (10m) Min. with qualifying conditions

Based on the buffer science literature, it seems that a target recommended buffer width should be a 100' (30m) wide forested riparian buffer (Sweeney, 2014; Hawes & Smith, 2005; Wenger, 1999; USDA NRCS 1998; USDA FS, 2017). However, given the reality of existing development and land uses within 100' (30m) of streams and rivers, there may need to be an alternative minimum recommended buffer width. Based on the literature, it seems a 30'-50' (10-15m) minimum buffer requirement is necessary to ensure the long-term protection of aquatic resources.

“The scientific literature appears to support that buffers of less than 35 feet cannot sustain long term protection of aquatic resources. To provide an array of functions then, buffers should be a minimum of 35 to 100 feet in width under most circumstances. Buffer widths toward the lower end of the range appear to provide some physical and biological components of the stream ecosystem, especially on small streams. Buffer widths at the upper end of the range are likely to provide protection of physical, chemical, and biological characteristics of the aquatic resource.” (USDA FS, 1997)

50' (15m) forested buffer minimum in regional regulations:

- Vermont:
 - Acceptable Management Practices (AMP) for Forestry Operations – for 0-10% slopes along streams
 - Act 250 – small to moderate sized streams with low risk of lateral or vertical channel adjustment, small floodplain requirements, low risk of erosion, and without significant wildlife travel corridors or riparian dependent species
 - Riparian Management for ANR Lands - Intermittent/Small Perennial Streams
 - VT DEC River Corridor Easement funds requirement
 - Vermont Trees for Streams program – 35' minimum width for planting projects
- New York:
 - Protection of Waters Regulatory Program - Permit required for disturbance within 50'
 - Wild, Scenic, and Recreational Rivers Act - Permits needed for cutting and disturbance within 100'
 - Adirondack Park Agency Act - Cutting limited within 35', minimum setbacks are at least 50'
 - NYSDEC Trees for Tribes recommends a minimum buffer width of 30' to 100' for private property where parcel boundaries and site layout allows
- Quebec
 - Ministry of Environment - For streams where slope is greater than 30% or less than 30% and riverbank more than 5m high
 - MRC Brome-Mississquoi - For streams where slope is greater than 25% or riverbank more than 5m high in urban areas and everywhere outside of urban areas

Program Criteria – Glossary



Resources Relating to Program Criteria:

> 15' (5m) Streamside Zone

A 15' (5m) streamside zone is commonly cited as the minimum to protect physical integrity and stabilize the streambank and protect the ecological integrity of the stream ecosystem by providing habitat to aquatic species (Hawes & Smith, 2005; USDA FS, 2017).

15' (5m) forested buffer minimum in regional programs:

- Vermont
 - VT DEC Lake Wise Award Program requires a 15' (5m) minimum of naturally vegetated lakeshore buffer to receive the award
- New York
 - NYS Forestry BMPs Field Guide protects a 15' (5m) minimum – forest cover maintained, disturbance and equipment excluded
- Quebec
 - Environmental Quality Act - Minimum for small, constrained lots with no extensive buffer possible
 - MRC Memphremagog minimum for all areas with no vegetation maintenance
 - Prime-Vert project planting width minimum

> Minimum 70% canopy cover

Studies find that greater densities of buffer vegetation cools water temperatures for water quality and vital aquatic habitat, with the densest (70-90%) ensuring cover for shallow water aquatic habitat (Garner et. al., 2017; Broadmeadow et. al., 2011).

Regional Examples:

- VT ANR recommends maintaining a 60% canopy cover during timber harvest to provide adequate shading and protect terrestrial habitat

> Maximum 10% of Buffer in development

Total impervious cover greater than 10% in a watershed can adversely affect aquatic environments. Directly connected impervious surfaces are more harmful on water quality, and a watershed with only 5% directly connected impervious area will experience adverse water quality impacts. It is important to disconnect water runoff to receiving water bodies and to keep development below 10% in the immediate streamside watershed (Schueler, 1994, 1995; Trinkaus, 2018; Center for Watershed Protection, 2003).

Program Criteria – Glossary



A search of the literature clearly suggests that buffer sizes necessary for adequate performance of specific buffer functions vary widely (USDA FS, 1998). "...The available field data are only sufficient to describe broad relationships between buffer width and function and remain inadequate for developing quantitative recommendations for defensible, variable-width buffers" (Sweeney, 2014, p. 576).

- **Bank Stabilization**
 - 33'-66' (Fisher and Fischenich, 2000)
 - 49'-98' (USACE, 1991)
 - 164' min. (ELI, 2003)
 - 52-164' (USACE, 1991)
 - 82' min. (ELI, 2003)
 - >98' for nitrate removal (Sweeney, 2014)
- **Prevent Erosion**
 - 30'-98' (Hawes & Smith, 2005)
- **Water quality**
 - 16'-98' (Fischer and Fischenich, 2000)
 - 50' (Palmstrom, 1991 via Chase, 1995)
 - 95'-150' (Welch, 1992 via Chase, 1995)
 - 328' min. (ELI, 2003)
- **Organic matter & debris**
 - 10'-33' (Fischer and Fischenich, 2000)
 - 10'-328' (Hawes & Smith, 2005)
 - 50' (Wenger, 1999)
 - 66'-102' (USACE, 1991)
 - 82'-328' (Broadmeadow and Nisbet, 2004)
 - 98' (Sweeney, 2014)
 - 164' min. (ELI, 2003)
- **Sediment trapping**
 - 30-200' (Fischer and Fischenich, 2000)
 - 33' (65% removal)-98' (85% removal) (Sweeney, 2014)
 - 33-148' (USACE, 1991)
 - 49-213' (Broadmeadow and Nisbet, 2004)
 - 82-328' (Wenger, 1999)
 - 98' min. (ELI, 2003)
- **Nutrient and pollution removal and retention**
 - 16'-98' (Fischer and Fischenich, 2000; Broadmeadow and Nisbet, 2004)
 - 16-164' (Hawes & Smith, 2005)
 - 50-100' (Wenger, 1999)
- **Terrestrial Wildlife Habitat**
 - 30'-656' (USACE, 1991)
 - 98'-1,640' (Fischer and Fischenich, 2000)
 - 150'-330'+ (Hawes & Smith, 2005)
 - 220'-574' (Wenger, 1999)
 - 328' min. (ELI, 2003)
- **Aquatic Habitat**
 - 33-64' (Broadmeadow and Nisbet, 2004)
 - 33-164' (Hawes & Smith, 2005)
 - 98' min. (USACE, 1991; Fischer and Fischenich, 2000)
 - >98' (Sweeney, 2014)
- **Temperature & microclimate regulation**
 - 30-230' (Hawes & Smith, 2005)
 - 33-66' (USACE, 1991)
 - 33-98' (Wenger, 1999)
 - 49-230' (Broadmeadow and Nisbet, 2004)
 - 66' (within 2 degrees C) - 98' (full protection) (Sweeney, 2014)
 - 98' min. (ELI, 2003)
- **Flood Attenuation**
 - 66'-492' (Fischer and Fischenich, 2000)
- **Pesticide retention**
 - 49-328' (Hawes & Smith, 2005; USACE, 1991; Wenger, 1999)

Program Criteria – Glossary



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