



Stream Wise Award Program

Task 2 – Establish Foundation: Final Resource Library Summary

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Introduction

In order to develop a regionally responsive Stream Wise Award Program which encourages private property owners to adopt and promote stream buffering protection and restoration practices on their property, an understanding of the resources related to stream buffering or other riparian protection practices is necessary. We have organized this library as follows:

- Region
 - Summary
 - Regulatory Requirements
 - Voluntary Incentives
 - Funding for Restoration
 - For Non-Commercial/Agricultural/Forestry Related Properties
 - For Commercial/Agricultural/Forestry Related Properties
 - Technical Assistance
 - Assessments
- Stream Buffer Literature Review
 - Terminology
 - Benefits
 - Best Practices
 - Buffer Zones
 - Buffer Widths
 - References

This document is not meant as an exhaustive academic literature review of all possible stream buffering or riparian restoration practices, but rather a foundation to serve as the basis for Program Outline development as a reference point for existing regulations, programs, and practices potentially available to incorporate in Stream Wise. Stream Wise Program development will avoid overlap, communicate existing resources, and fill the gaps needed to support riparian landowners to be good stewards of streams and rivers.

An Excel-based database, with embedded hyperlinks to relevant online documents, is the foundation for this summary and can be found as Attachment 2.1 – Final Resource Library. This spreadsheet, as organized with embedded links, is meant to serve as the basis for the Resource Library Web page and should be hosted on the chosen host organization's website for the final StreamWise Program.

Regional Summaries

The Lake Champlain Basin is divided into two U.S. States, Vermont and New York, and one Canadian Province, Quebec. We have divided up stream riparian buffer resources



using these administrative boundaries. Each region is further subdivided into Regulatory Requirements and Non-Regulatory Programs categories.

Vermont

Summary

The State of Vermont does not necessarily have one coherent regulation or set of regulations requiring buffers along streams and rivers. There are different regulations applied to certain types of development, agriculture, forestry, and on State owned lands such Agency of Natural Resources (ANR) lands. Additionally, many municipalities have zoning requirements which dictate what type of development can or cannot occur within riparian areas or flood prone zones.

A note on terminology – under the overarching umbrella of Vermont's Clean Water Standards regulations there are numerous management practices related to water quality. Depending on the sector, these management practices have different names to describe the suite of practices associated with achieving water quality standards for that sector. Commonly they are:

- Best Management Practices (BMPs): This suite of practices is applied to stormwater runoff management practices associated with developed lands outside of forestry and agriculture.
- Required Agricultural Practices (RAPs): This suite of practices is applied to runoff and water quality management associated with agricultural activities.
- Acceptable Management Practices (AMPs): This suite of practices is applied to runoff and water quality management associated with forestry activities.

Many times there is significant overlap between these practice types in that they accomplish similar end results with respect to runoff or water quality management (e.g. filtering runoff, infiltrating runoff, reducing or eliminating erosion, etc.).

The following table provides an overview of buffer types for lands owned by the Agency of Natural Resources. This is presented first as it is one of the more comprehensive buffer regulations within the State and could serve as a potential model for StreamWise Program criteria.

Stream Type	Buffer Width
Ephemeral / Small Stable Intermittent Streams (<0.1 mi ²):	No specific width given – adherence to VT's Agricultural Management Practices (AMPs) regarding stream protective strip distances required (min. 50' for buffer slopes 0-10% as measured from top of bank).



Intermittent / Small Perennial Streams (0.1 – 0.5 mi ² drainage):	Min. 50'
Perennial Streams / Rivers w/Narrow Floodplains:	Min. 100' & potentially geomorphic River Corridor
Perennial Streams / Rivers w/Broad Floodplains:	Min 100' & up geomorphic River Corridor or Floodplain

This table summary was derived from guidance provided by the document 'Riparian Management Guidelines for ANR Lands.'

This document also includes guidelines for riparian management zone objectives which are important as general guidelines. They are:

- Maintain native vegetation appropriate for the natural community of the site.
- Maximize shading of stream channel and incoming water sources to moderate water temperatures in adjacent and downstream receiving waters.
- Provide for natural recruitment woody material, including large wood features, to stream and riparian areas to develop and maintain stable and complex aquatic and riparian habitats.
- Provide natural rates of production, recruitment and retention of organic materials.
- Provide for the effective retention and infiltration of sediments and nutrients prior to entering adjacent surface waters.
- Maintain stable streambanks, channel dimensions, profile, planform and migration rates consistent with natural equilibrium conditions.
- Maintain stable shorelands consistent with natural conditions.
- Maintain natural hydrology and geomorphic processes.
- Provide habitat for riparian obligate species, or rare, threatened or endangered (RTE) species which may use riparian habitat, and species using riparian areas as travel corridors.

Pursuant to these objectives, ANR also lists the desired conditions, which should serve as a model for riparian buffers under this program. They are:

- Natural vegetation with species and structure appropriate to the natural community of the
- site. For sites that would be expected to have a forested natural community: community, appropriate species diversity, a range of tree ages and stem diameters (including large, old, young, small), vertical and horizontal structural complexity, and naturally abundant standing and downed dead trees of a range of species and diameters.
- Complete, continuous and diverse forest canopy, appropriate to the natural community of the site, to maximize temperature moderation function.
- Natural topography.



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- Forest floor comprised of natural duff layer providing for infiltration and diffuse overland treatment of surface runoff.
 - Complex instream, riparian and floodplain habitats comprised of large wood features which provide stable channel boundaries, including adequate roughness elements to moderate velocities and promote natural rates of sediment/organic material transport and retention.
 - Forest conditions characterized by native species, natural disturbance processes, unaltered soils and natural hydrology.
 - Connectivity to suitable upland habitats; streamside connectivity; hydrologic connectivity with other waterbodies.
 - Low risk of widespread windthrow.

Trees for Streams is the name applied to a variety of tree planting programs used by Vermont's Natural Resource Conservation Districts (NRCs). This work is funded by the Lake Champlain Basin Program (LCBP), VT Department of Environmental Conservation Buffer Planting Block Grants and Pur Projet, a private company. Additionally, many watershed groups (i.e. Friends of the Winooski, Friends of the Mad River, White River Partnership) also have riparian buffer planting programs that leverage similar funding. These plantings - depending on the funder - have different buffer planting requirements. For example the DEC requirements are:

Site Requirements and Performance Measures:

- Strategy or site location identified in Tactical Basin Plan or River Corridor Plan (or with approval of DEC Tactical Basin Planner)
- Must have at least 10-year O&M agreement

Buffer Requirements:

- Must be at least 35-feet wide
- Need to plant at least 300 stems per acre
- Must use native woody vegetation
- Must include species adapted to the soil and climate of the planting site
- Should have moderate to aggressive root and crown spread to occupy the site quickly
- Should be reasonably resistant to pests
- Should adhere to the USDA NRCS Forest Buffer Standards

Additional Recommendations:

- Consider using stock from Vermont grown nurseries
- Consider planting 3- to 5-foot trees (both this and the above recommendation have been shown to lead to lower mortality)
- Consider planting wider buffers (50 feet or greater) where appropriate and possible
- Consider planting more stems per acre (up to 400 stems/acre) for certain sites



Agricultural / silvicultural (forestry) activities have slightly different guidelines which can be summarized as follows:

- 25' minimum buffer on streams (can be harvested/grazed but not tilled, nor can fertilizer/compost be spread in that zone unless establishing perennial cover crops or buffers or soil tests indicate the need for fertilizer or additional nutrients – manure spreading is excluded from this zone)
- 10' minimum buffer on ditches (man-made water courses for drainage of fields)
- 25' minimum buffer for surface inlets (for piped infrastructure such as tile drains)
- Additional regulations govern certain types of specific activities.

Regulatory Requirements

Act 250 & Section 248

Act 250 (Land Use and Development Law) and Section 248 (site preparation law for the Public Utility Commission process) in Vermont recommends either a 50' or 100' buffer for streams dependent on the following factors:

- Physical characteristics of the site and the watercourse and its banks and floodplain;
- Aquatic and terrestrial populations and communities dependent on the watercourse and riparian corridor; and,
- Nature and extent of the proposed development and existing encroachments, including the potential for erosion and overland flow of pollutants.

The following table presents the summary of when to apply either a 50' or 100' buffer:

Function	50' Buffer Recommendation	100' Buffer Recommendation
Protection of channel and floodplain stability	Small to moderate sized streams that are at low risk for lateral or vertical channel adjustment and have small floodplain requirements.	Small to moderate sized streams with the potential for significant lateral or vertical channel adjustment. Streams with large belt width and floodplain requirements (includes most large rivers).
Protection of aquatic and terrestrial wildlife habitats	Aquatic populations dependent upon stream habitat and/or water quality either directly associated with or in close proximity to the project site.	Sites with significant wildlife travel corridor and/or identified riparian dependent species (e.g., riparian breeding birds), and/or significant natural communities either directly



	Project sites without significant wildlife travel corridor and/or riparian dependent species and/or significant natural communities identified on or in close proximity to the project site.	associated with or in close proximity to the project site.
Protection of water quality	Site soils and slope indicate low risk of erosion; proximity of project to receiving water and amount of resulting impervious cover indicate low potential for overland flow of pollutants.	Site characteristics indicate increased risk of erosion and/or potential for overland flow of pollutants.

Buffers width recommendations may be wider where:

- Rare, threatened, endangered, or sensitive species, sensitive significant natural communities, and/or necessary habitats (as defined in Appendix C) are either directly associated with or in close proximity to the project site; and
- Actively adjusting channels are undergoing channel lengthening and floodplain development. In determining the floodway area needed to protect channel stability the Agency may also apply the *Procedure on ANR Floodway Determination in Act 250*.

Buffer width recommendations may be narrower where:

- Riparian functions and values will be adequately protected by a narrower buffer, such as sites adjacent to small, stable intermittent streams; or
- The location and extent of existing encroachments severely limits the ecological benefits that would be derived from a wider buffer.

Act 64 - Agricultural Nonpoint Source Pollution Control Program - Required Agricultural Practices (RAPs)

The Vermont Clean Water Act ('Act 64') established RAPs for farming operations.

The general buffer requirements can be summarized as follows:

- 25' minimum buffer on streams (can be harvested/grazed but not tilled, nor can fertilizer/compost be spread in that zone unless establishing perennial cover crops or buffers or soil tests indicate the need for fertilizer or additional nutrients – manure spreading is excluded from this zone)
- 10' minimum buffer on ditches (man-made water courses for drainage of fields)
- 25' minimum buffer for surface inlets (for piped infrastructure such as tile drains)



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- Additional regulations govern certain types of specific activities.
 - Livestock must be excluded from streams, except at specified designated crossing points
 - Deceased animals must be buried 150' – 200' away from streams (depending on burial method)
 - Manure/waste storage tanks or ponds must be 200' away from streams

It should be noted that the term buffer used in conjunction with RAPs refers specifically to a zone of perennial vegetation that can be harvested. The rule makes no assertions or requirements as to species type (other than perennial) or complexity (grasses versus shrubs or trees, for example).

VT Department of Forest, Parks, and Recreation – Acceptable Management Practices (AMPs) for forestry operations

Vermont's AMPs for forestry operations from 2018 specify that 'forest buffers' adjacent to streams must follow the following guidelines:

- 50' (0-10% slope)
- 70' (11-20% slope)
- 90' (21-30% slope)
- 110' (31-40% slope)
 - Add 20' for each additional 10% slope

Stormwater Regulations (under Act 64)

Under Act 64's stormwater regulations, there are a several different measures that could be applied to stream riparian buffers.

Operational Stormwater Permit

The Operational permit governs all developed sites that create 0.5 acres of impervious cover or more (for new development) as well as a variety of other sites under its redevelopment criteria. With respect to stream buffers, the Operational permit stipulates that:

- Filter Strips or Vegetated Buffer widths must be equal to their contributing impervious area width (measured parallel with the gravity fall line)
- Maximum contributing length is 75' (impervious) or 150' (pervious)
- Maximum slope is either 8% (vegetated buffer) or 15% (filter strip)
- Generally, soils must be uncompacted and well-drained
- Rooftops draining to a 'vegetated simple disconnection' practice can be as narrow as 12' (maximum slope of 15%)
- Parking lots can not use simple disconnection



Construction General Permit (CGP)

The CGP governs construction activities that disturb soils as part of the construction process. Under the program's Standards and Specifications for Erosion Prevention and Sediment Control (EPSC) Appendix A – Risk Evaluation and Soils Evaluation the metric used for assessing disturbance risk sets the threshold at 50' from streams.

Municipal Roads General Permit (MRGP)

The MRGP governs all linear transportation projects governed by municipalities. The Better Roads Manual (formerly Better Backroads Manual) requires a minimum 50' buffer between roads (and their runoff) and streams where possible. If not possible, a variety of Best Management Practices (BMPs) can also be used.

Voluntary Incentives

Trees for Streams

The Trees for Streams program is an initiative used by Vermont's Association of Conservation Districts (VACD) to describe their riparian buffer planting and restoration activities (riparian buffer under this program refers specifically to the establishment of a tree-based forested riparian buffer as opposed to a vegetated (largely shrub-based) buffer or grassed filter strip, though guidance for Trees for Streams does advocate for the use of these latter two buffer types as complementary or supplementary practices. Sites are selected where the creation of a minimum 35' wide buffer is possible (from top of bank), sites are 0.5 acres or greater (though smaller sites may be deemed suitable), and stream/river reaches are relatively stable.

The program makes use of native trees and plantings appropriate to the site. An agreement to maintain the planting for 10 years is required.

Funding for these activities is available from a variety of sources as noted previously in the summary and can include VT DEC's Woody Buffer Block Grant program, the Lake Champlain Bains Program, and private sources as well, such as Pur Projet, a private company, as well as federal sources like the Partners for Fish and Wildlife Program (US Fish and Wildlife Service) for private, non-agricultural landowners. Agricultural landowners can potentially obtain funding through the Conservation Reserve Enhancement Program (CREP) and Environmental Quality Incentives Program (EQIP).

River Corridor Protection - Easement Program

The ANR Department of Environmental Conservation (DEC) has developed a River Management Program (RMP) to carry out river corridor protection to reduce flood hazards, improve water quality, and restore the ecological health of Vermont rivers.



The River Corridor Easement (RCE) includes deeded land use and channel management restrictions for protecting certain reaches of river. The DEC provides grants to qualified conservation organizations to purchase or receive donated river corridor easements. These organizations include the non-profit Vermont River Conservancy, the Vermont Land Trust, as well as local land trusts.

In order to obtain grant funding to implement an RCE held by a conservation organization, the following requirements must be met:

- A 50' buffer within the river corridor be maintained along all watercourses (moves with the channel).
- Agricultural and forestry activities may continue to occur outside the 50' buffer.
- Within the RCE area, there can be little to no manipulation of the natural watercourses (and associated wetlands or other water bodies).
- No new permanent structures or improvements (other than fences or at-grade fords for agricultural purposes) may be constructed.

Vermont Functioning Floodplain Initiative

From the web page:

A Functioning Floodplains Initiative is now underway in Vermont to identify nature-based projects through scoring, tracking, and mapping of floodplain and wetland functions and quantification of their social values.

The assessment, mapping, valuation, and tracking of alluvial streams and floodplains in the Lake Champlain basin to achieve the goals of the Functioning Floodplain Initiative (FFI) will involve collaboration among individuals working on relevant aspects of this overall effort. The Vermont Team (to date) consists of engineers, geomorphologists, hydrologists, ecologists, and geospatial scientists at state and federal agencies; local and national NGOs; researchers at the University of Vermont (UVM) who are studying various aspects of floodplains, river corridors, and wetlands; and consulting practitioners who regularly assess floodplain and river corridor condition, implement reconnection projects, and engage the public to identify and prioritize reconnection projects.

- Vermont Agency of Natural Resources
- Vermont Agency of Transportation
- U.S. Environmental Protection Agency, Region 1
- U.S. Fish and Wildlife Service, Partners for Fish and Wildlife
- The Nature Conservancy, Vermont Chapter
- Milone & MacBroom, Inc.
- Fitzgerald Environmental Associates
- South Mountain Research and Consulting
- Fluvial Matters, LLC



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- Stone Environmental, Inc.
 - University of Vermont
 - Gund Institute for Environment
 - Lake Champlain Basin Program
 - Lake Champlain Sea Grant Program
 - Vermont Water Resources and Lake Studies Center
 - Vermont EPSCoR Program

Riparian Management Guidelines for ANR Lands

These guidelines were developed specifically for use on the Vermont Agency of Natural Resource's lands (generally held by the Department of Forest, Parks, and Recreation). They are similar to Vermont's Act 250 regulations.

The table at the beginning of the 'Vermont' section describes these guidelines in more detail, but generally the requirement is for a 50' buffer on smaller intermittent or perennial streams with a 100' buffer for larger perennial streams.

VT DEC LakeWise Program

The Vermont Department of Environmental Conservation's LakeWise Program does not deal directly with riparian buffering for watercourses but rather provides resources and incentives for restoring and protecting areas around water bodies, specifically lakes and ponds.

There are four primary sections that LakeWise uses to evaluate a property for water quality. They are:

- **Driveways:** Criteria primarily address erosion issues on/around the driveway, as well as stabilization of runoff directed off the driveway surface.
- **Structures & Septic Systems:** Criteria primarily address roof runoff from primary structure and whether it enters the water body clean via a proper conveyance, the presence or absence of pets and pet waste, the location and condition of septic systems, on-site chemical storage tanks (i.e. heating oil, gas, or pesticides) and if they pose a threat to the water body, and auxiliary structure (decks, patios, etc., and whether they pose a threat to the water body.
- **Recreation Areas:** Criteria primarily address erosion and stability of stormwater flows, pesticide/herbicide use, lawn area minimization, preservation of natural topography and vegetation, garden mulching and species selection (non-invasives encouraged), and path hydrological connection (i.e. do not convey runoff directly to the water body).
- **Shores:** Criteria primarily address presence of vegetation along shoreline, tier structure of vegetation (canopy, shrub, understory, ground cover, and duff),



species types (non-invasive encouraged), sheet flow only to buffer, buffer width is sufficient to intercept flows, duff is maintained where possible, shoreline is stable (not eroding – hardscaping such as rip-rap or concrete can be used if needed), shallow water area is natural, pathways complement vegetated areas, and beach or lake access area is stable.

There is also a section specifically for **Undeveloped Shoreland**. Criteria for this are primarily concerned with low percent impervious cover and lawn or other cleared areas, roads and paths well maintained and not eroding, land is actually undisturbed (not cleared or grades in areas), and the property's conservation status (i.e. conserved with an entity like Vermont Land Trust).

This program is non-regulatory and, if property owners obtain sufficient points according to the criteria laid out above, are eligible to obtain a LakeWise Award for their property.

A regulatory corollary to this program is the Vermont Shoreland Protection Act (Chapter 49A of Title 10 1441) which guides all new development within 250' of mean water level on water bodies and applies on lakes and ponds greater than 10 acres in size. One of the core protections of this Act is the establishment of a minimum 100' setback from mean water level for development. In this zone, only limited disturbance can occur. Of note – some tree thinning can take place, based on a point system related to 25' x 25' plot size for the length of the Lakeside Zone and tree diameter within this Zone. This Vegetation Protection Standard (VPS) stipulates that at least five saplings per plot, plus all vegetation below 3' in height and the intact duff layer, must remain.

USFWS The Partners for Fish and Wildlife Program

The Lake Champlain Fish and Wildlife Conservation Office provides financial and technical assistance to design and implement riparian habitat restoration projects in Vermont. USFWS staff work with local partners to conduct site assessments and design restoration plans. Restoration plans are designed to benefit fish and wildlife species and are based on the historic natural community associated with the site's soils with an emphasis on early successional species that will set the stage for a successful transition to a mature riparian community. On average, the Vermont Partners for Fish and Wildlife Program plants 15,000 native trees and shrubs each year.

Residential Incentive Programs in Lake Champlain Basin

There are several incentive programs available to residents within the Lake Champlain Basin and several sub watersheds that provide site evaluations, technical assistance, and in some cases, financial incentive or funding to install green stormwater infrastructure practices to reduce stormwater runoff and pollution. The BLUE Certification



is available to some towns in Chittenden County and elsewhere in Vermont, the Let It Rain Stormwater Program is available to residents in the Lake Champlain Basin, and the Storm Smart Program is available to residents in the Mad River sub-watershed as well as the broader Winooski River watershed.

Funding for Restoration

For Non-Commercial/Agricultural/Forestry Related Properties

Vermont Association of Conservation Districts (VACD): Provides funding for conservation districts to work with landowners through the Trees for Streams initiatives leveraging a variety of grant resources.

VACD may leverage the [VT DEC's Clean Water Grants programs](#) to fund some of this work.

VT DEC – Clean Water Grants:

- **Ecosystem Restoration Grants:** These grants can be used for projects that improve water quality, specifically through the section devoted to natural resources restoration projects.
- **Partnership Project Development Block Grant:** This grant program can be used for landowners to implement projects that improve water quality.
- **Work Crew Grant Program:** This program is primarily aimed at on-the-ground implementation using specific non-profit work crews of high-priority projects. This funding may potentially be leveraged for buffering or restoration projects related to streams and rivers.

For Commercial/Agricultural/Forestry Related Properties

The Vermont Agency of Agriculture, Food, and Markets maintains a website that lists the majority of applicable funding programs that can provide assistance in implementing various water quality related BMPs. Programs include:

- [Capital Equipment Assistance Program](#)
- [Conservation Reserve Enhancement Program](#)
- [Farmstead Best Management Practices Program](#)
- [Environmental Quality Incentives Program](#)
- [EQIP-Assist Program](#)
- [Farm Agronomic Practices](#)
- [Grassed Waterway and Filter Strip Program](#)
- [Pasture and Surface Water Fencing Program](#)

Each program covers different practices related to water quality for agricultural (including forestry) activities.



Technical Assistance

Technical assistance for stream buffer BMPs fall into two main categories – Regulatory and Non-Regulatory.

Regulatory

Stormwater Management Manual

The BMPs that are most applicable to stream protection in Vermont's Stormwater Management Manual (VSWMM) are:

- Simple Disconnection:
 - The guidance states that disconnection to vegetation should be at least 12' wide (for rooftops) or equal to contributing width of impervious cover area. Contributing area should have a maximum slope of 15%. Parking lots cannot use simple disconnection.
- Filter Strips / Vegetated Buffers Guidance states that:
 - Buffer width must equal contributing area width.
 - Good soils (generally uncompacted)
 - Max contributing length = 75' (impervious)
 - Max contributing length = 150' (pervious)
 - Anything longer than this must have level spreader or other conveyance
 - Slope max of either 8% (veg buffer) or 15% veg filter strip)

Other BMPs in the VSWMM could potentially be used to manage runoff from developed areas to streams, though the technical requirements to design and construct them may be out of line with simple homeowner-developed solutions.

Vermont Standards and Specifications for Erosion and Sediment Control (EPSC)

These standards primarily apply to construction-related activities and include BMPs such as silt fences and vegetative stabilization for disturbed earth, which are less applicable to existing developed sites but may be useful in assisting property owners during construction near streams. Of note – the guidelines require that any disturbance within 50' of a stream be stabilized to the maximum extent possible (or be left alone entirely).

Municipal Roads General Permit (MRGP) - Better Roads Manual

The BMPs contained in this manual are primarily related to municipally-owned and controlled roads, though a specific Buffer Zone requirement stipulates a minimum 50' setback from streams (100' for lakes and ponds). Vermont's LakeWise program has adapted some of the Better Roads BMPs for roads and driveways that are privately maintained, generally following the same requirements and structure.



Required Agricultural Practices (RAPs)

The specific buffer requirements contained in Vermont's RAPs are as follows:

- Manure spreading - can't occur within 100' of top of slope of stream if field slope is greater than 10%
- Buffer widths must be as follows:
 - 10' on ditches
 - 25' on surface waters (natural)
 - 25' on surface inlets (tile drains or other)
 - Buffers can be harvested or grazed but no tilling or fertilizer/compost/manure spreading can occur within them
- Animals must be buried 150' - 200' away from surface waters
- Livestock must be excluded from streams (except for defined crossing points)
- Manure/waste storage must be 200' away from streams

Acceptable Management Practices (AMPs)

Forest Buffers related to forestry operations must be:

- 50' (0-10% slope)
- 70' (11-20% slope)
- 90' (21-30%)
- 110' (31-40%)

Non-Regulatory

LakeWise Program

LakeWise has a variety of 1-2 page BMP sheets listed on their website to mitigate water quality issues associated with development adjacent to lakes and ponds. It is important to note that LakeWise is not just a riparian buffering program, but addresses other runoff as well.

A simple, single-page listing for all of them can be seen [here](#). They are split into BMPs for Driveways, Recreation Areas, Structures and Septic Systems, and Shorefront.

The general structure and type of BMPs recommended in this guide are a good template for the potential StreamWise program.

Trees for Streams

The Trees for Streams program has a document entitled Vermont Trees for Streams Resource Guide that has extensive guidance on evaluating, sizing, siting, and implementing riparian buffers. Of all the guidance for this type of work, it is the most comprehensive for Vermont.



Guide to Stormwater for Homeowners and Small Businesses

A variety of BMPs for developed sites are contained in this guide. While none of them are specifically related to stream protection or buffering, the BMPs in this guide have been adapted from the Vermont Stormwater Management Manual to be more approachable by private property owners or small businesses. Notably, the guide contains a decision support tree for BMP selection, as well as simplified sizing and design guidelines.

Green Stormwater Infrastructure - Simplified Sizing Tool Fact Sheets

The Vermont League of Cities and Towns (VLCT) created this guide in partnership with the VT DEC as an effort to update the Vermont Model Low Impact Development Stormwater Management Bylaw, aimed at so-called sub-jurisdictional projects (those creating less than 0.5 acres of impervious cover). Sizing and design criteria are calibrated to meet the VSWMM's Water Quality Treatment Standard which treats the first inch of runoff from developed lands.

Among the various BMPs in this guide, the following is directly related to stream buffering:

- Non-rooftop Disconnection:
 - Filter Strips must be minimum 35' with a slope between 1-8%
 - Contributing area can't be more than 75' (impervious) in length or exceed 5000 sq. ft.
 - Less permeable soils will require more filter strip area

Planting Guidance for the Revegetation of Riparian Areas in Vermont

This document is not a comprehensive resource on design and siting of riparian buffering projects, but rather provides basic information and resources regarding planting densities, techniques and species for riparian revegetation projects in Vermont. It also outlines numerous nurseries or other resources to source planting material for projects of this nature.

Creating a Riparian Buffer - Tree Planting (Lake Champlain Committee)

This one-page fact sheet contains basic information on how to plant trees for riparian buffering, as well as suggestions for planting times and maintenance.

New York

Summary



The New York region of the Lake Champlain Basin includes 5 counties: most of Clinton, much of Essex, southwest portion of Franklin, eastern portion of Warren, and northern portion of Washington. There are 6 major tributaries including the Ausable River, Saranac River, Great Chazy River, Boquet River, Mettawee River, and Ticonderoga Creek and 4 large lakes, including Lake George, Upper Saranac Lake, Lower Saranac Lake, and Lake Placid.

There are no state-wide regulations protecting stream corridors and riparian buffers in New York. There are different regulations for waterways depending on where they are located and their protected status, based on a variety of human uses. The Environmental Conservation Law (ECL) governs the Protection of Waters Regulatory Program and the Wild, Scenic and Recreational Rivers Permit Program, which require permits for disturbance within streambanks and corridors of protected waterways, based on designations for human uses such as drinking, swimming, or fishing and ecological value such as wildlife habitat. These protections are the most comprehensive in the state and could serve as models for the Stream Wise Program.

Regulations for protected rivers and streams require the following riparian buffers:

Stream Type	Buffer Width
AA or A – waters used as sources of drinking water	Protected – permit required for disturbance within streambed or bank, typically 50' from mean high water line
B – waters used for swimming and other contact recreation	Protected – permit required for disturbance within streambed or bank, typically 50' from mean high water line
C – waters supporting fisheries and other non-contact recreation + (T) waters supporting trout population or (TS) trout spawning	Protected – permit required for disturbance within streambed or bank, typically 50' from mean high water line
Wild Rivers	No new structures and limited access within ¼ mile of river; Permits needed for cutting or disturbance within 100' of mean high water mark
Scenic Rivers	No new structures and limited access within 250' of mean high water mark; Permits needed for cutting or disturbance within 100' of mean high water mark
Recreational Rivers	No new structures and limited access within 150' of mean high water mark; Permits needed for cutting or disturbance within 100' of mean high water mark



NYS DEC requires permits for the disturbance of streambed or bank of protected waters across the state, including within the Adirondack Park. NYS DEC implements the Wild, Scenic, and Recreational Rivers Act for all designated rivers outside of the Adirondack Park and within state-owned lands in the Adirondack Park. The Adirondack Park Agency implements the Wild, Scenic, and Recreational Rivers Act for all private lands, including municipal lands, within the Park, except for Hamlet and Moderate Intensity Use land uses. Similarly, NYS DEC administers the Freshwater Wetlands Act outside of the Park while the APA administers it within the Park with lower thresholds for protection and different wetland delineations.

The Adirondack Park Agency Act governs land use and planning within the park and limits cutting and disturbance within a 35' buffer and enforces minimum setbacks for structures and septic systems for all lakes, ponds, and navigable waterways.

Beyond state park lands and designated protected waterways, there are some regulations relating to stream buffer protection applied to certain types of development and construction. Additionally, many municipalities have zoning requirements that may protect certain watercourses and require development setbacks to protect stream buffers.

NYS has Best Management Practices (BMPs) for water quality improvements in forestry and rural roads and stream crossings, and conservation practices for farms (USDA NRCS), but no regulations requiring the implementation of BMPs and conservation practices outside of protected river and stream corridors and state park waterways.

The NYDEC Trees for Tribes program provides grants to organizations and municipalities for large-scale streamside planting projects and native plant stock in the form of bare-root trees and shrubs to private landowners. Trees for Tribes recommends a minimum buffer width of 30' to 100' for private property sites where parcel boundaries and site layout allows.

Soil and Water Conservation Districts (SWCDs) are special purpose districts, authorized under NYS law and created to develop and carry out programs of soil, water and related natural resource conservation by providing technical assistance and programs to residents, land owners, agricultural producers, and municipalities. Programs related to stream buffers include riparian planting, stream restoration technical assistance, and procurement of federal funding for agricultural conservation practices and other restoration programs.

US Fish & Wildlife Service (FWS) and Trout Unlimited implement stream restoration programs for impacted streams to provide habitat for fish, channel stability, bank stabilization, and sediment reduction, among other purposes.

The SWCD programs, local watershed groups and river associations, Trout Unlimited Chapters, and Trees for Tribes will likely provide the local resources for technical assistance, planting programs, and funding partnerships to help Stream Wise participants get their stream buffers up to award-level.



Regulatory Requirements

Protection of Waters Program: Environmental Conservation Law, Article 15, Title 5

NYS DEC created the Protection of Waters Regulatory Program to protect water resources of the state based on a classification of various human uses. NYS DEC regulates disturbance within the bed and bank of a protected stream across the state. Disturbance typically includes any activity that alters, removes, or fills in soil or rock within the streambed or bank using heavy equipment; a more detailed list is included below.

Stream Type	Buffer Width
AA or A – waters used as sources of drinking water	Protected – permit required for disturbance within streambed or bank, typically 50' from mean high water line
B – waters used for swimming and other contact recreation	Protected – permit required for disturbance within streambed or bank, typically 50' from mean high water line
C – waters supporting fisheries and other non-contact recreation + (T) waters supporting trout population or (TS) trout spawning	Protected – permit required for disturbance within streambed or bank, typically 50' from mean high water line
C – waters supporting fisheries and other non-contact recreation	Not protected – no min. buffer
D – lowest classification and standard	Not protected – no min. buffer

Streams and small water bodies (less than 10 acres in surface area) located in the course of a stream with a classification of AA, A, B, or with a classification of C with a standard of (T) or (TS) are collectively referred to as "protected streams," and are subject to the stream protection provisions under the Protection of Waters regulations. Disturbance of the bed or banks of a protected stream or watercourse requires a Protection of Waters Permit.

Bank is defined as the "land area immediately adjacent to and which slopes toward the bed of a watercourse and which is necessary to maintain the integrity of the watercourse. A bank will not be considered to extend more than **50 feet horizontally from the mean high water line**; with the following exception: Where a generally uniformly slope of 45 degrees (100%) or greater adjoins the bed of a watercourse, the bank is extended to the crest of the slope or the first definable break in slope, either a natural or constructed (road, or railroad grade) feature lying generally parallel to the watercourse."

Some examples of activities requiring this permit are:



- Installing a culvert or bridge
- Digging or excavating
- Placing any fill material
- Installing a boat dock
- Stabilizing a streambank
- Installing utilities across a stream
- Building or removing a dam

The most common activities which are exempt from the requirement are:

- Disturbance of a protected stream conducted by a town or county government which enters into a written agreement with DEC in compliance with performance criteria that are protective of stream resources.
- Agricultural activities involving the crossing and re-crossing of a stream by livestock or farm equipment at an established crossing.
- Withdrawal of irrigation waters where no alteration of the stream bed or banks is required.
- Removal of fallen tree limbs or tree trunks where material can be cabled and pulled from the stream without disruption of the stream bed or banks, utilizing equipment placed on or above the stream bank (i.e., no in-stream use of equipment is necessary)

Wild, Scenic, and Recreational Rivers Act: Environmental Conservation Law, Article 15, Title 27

The Wild, Scenic and Recreational Rivers Act (WSRRA) designates and protects rivers and river corridors (land within 1/4 mile of the river) that are deemed to have outstanding scenic, ecological, recreational, historic, and scientific values. NYS DEC has jurisdiction of WSRRA outside of the Adirondack Park and for State Lands (forest preserve) within the Park. The APA has jurisdiction of WSRRA on all private lands, including municipal lands, within the Park.

Stream Type	Buffer Width
Wild Rivers (outside Hamlet or Moderate Intensity Lane Use Areas for APA and Community Designations for DEC)	Except as outlined below, no new structures and limited access within 1/4 mile of river; Permits needed for cutting or disturbance within 100' of mean high water mark
Scenic Rivers (outside Hamlet or Moderate Intensity Lane Use Areas for APA and Community Designations for DEC)	Except as outlined below, no new structures and limited access within 250' of mean high water mark; Permits needed



	for cutting or disturbance within 100' of mean high water mark
Recreational Rivers (outside Hamlet or Moderate Intensity Lane Use Areas for APA and Community Designations for DEC)	Except as outlined below, no new structures and limited access within 150' of mean high water mark; Permits needed for cutting or disturbance within 100' of mean high water mark

Scenic Rivers: E. Branch Ausable, North and South Forks of the Bouquet, and more.

Recreational Rivers: E. Branch Ausable, Main Branch Ausable, W. Branch Ausable, Bouquet, Min Branch Saranac, and more.

The requirements related to Wild, Scenic, and Recreational river corridors apply to all land uses outside the of the Adirondack Park, except for Community Designations and to Low Intensity Use, Rural Use, and Resource Management lands within the Adirondack Park. In general, lands designated Hamlet or Moderate Intensity Use are not subject to the permitting and other requirements noted in this section within the Adirondack Park. Community Designations of specific areas within recreational river areas are subject to less restrictions and existing hamlets, villages, and towns that existed at the time of the Act inclusion are grandfathered in.

No new structures are allowed within Wild river corridors (within 1/4 mile of river), except footbridges for nonmotorized open space recreational use; motorized vehicles are only allowable for necessary forest management. No new structures and limited access within 250' of mean high water mark for scenic rivers and 150' for recreational rivers, except for fences, poles, signs of less than two square feet in area, lean-tos, docks, bridges, and stream improvement structures for fishery management purposes are exempted from this requirement. Agricultural uses and structures are also generally exempted from these requirements.

Subdivisions are allowed within Scenic and Recreational river corridors pursuant of an Agency or DEC permit.

New land use and development is prohibited within Scenic and Recreational river corridors, except for the following:

- Single family dwellings, mobile homes, hunting and fishing cabins and other club structures, docks, and public and private roads may be established pursuant to an Agency permit.
- Bridges and stream improvement structures for fishery management purposes may be constructed pursuant to a permit from either the Agency or the Department of Environmental Conservation.



- Landscaping or grading not connected to another land use and ordinary repairs, maintenance, or interior alterations to an existing structure or use do not constitute new land use or development.

For New land use and development that is listed on the compatible use lists found in Section 805(3) of the APA Act may also be undertaken pursuant to an Agency permit. The excavation or placement of fill in a non-navigable Recreational river requires an Agency permit.

Cutting and disturbance of trees and other vegetation require a permit within 100 feet of the mean high water mark of a Wild, Scenic, and Recreational river, including the establishment of wood roads and trails for motorized open space recreation use and forest management. Timber management more than 100 feet from the mean high water mark is subject to restrictions established in Section 577.6(c) of Agency regulations, including a prohibition on the cutting of more than 15 acres in certain circumstances for Wild and Scenic rivers and a permit needed for the cutting of more than 15 acres in certain circumstances on Recreational rivers. No substance may be discharged into a Scenic, Wild, or Recreational river, except in compliance with water quality standards established by the Department of Environmental Conservation.

Study Rivers

Portions of the following rivers are designated as "study rivers" for possible inclusion under the Wild, Scenic and Recreational Rivers System Act: N. Branch Bouquet, N. Branch Saranac, and more.

Outside Hamlet and Industrial Use areas, subdivisions and new land use and development within study river corridors generally require an Agency permit.

Adirondack Park Agency Act

The Adirondack Park Agency Act (APAA) oversees land use and planning within the Adirondack Park. The APA designates The APA regulates shoreline cutting and structures and septic systems on lakes, ponds, and navigable streams and rivers.

Shoreline Cutting Restrictions

Except to allow for the removal of diseased vegetation and rotten or damaged trees, all vegetative cutting on a parcel with shoreline on a lake, pond, or navigable river or stream must comply with the following restrictions:

- Within 35' of the mean high water mark, no more than 30 percent of the trees in excess of six inches diameter at breast height (4.5' above ground) may be cut over any 10-year period.



- Within 6' of the mean high-water mark, no more than 30 percent of any vegetation may be removed.

Structure Setbacks

Any new structure exceeding 100 square feet in size must comply with minimum setbacks from the mean high water mark (the average annual high water level) of any lake or pond or any river or stream navigable by boat, including canoe:

- Hamlet - 50 feet
- Moderate Intensity Use - 50 feet
- Low Intensity Use - 75 feet
- Rural Use - 75 feet
- Resource Management - 100 feet

Structures that are only partially located within the setback, as well as individual structures that are attached to each other, are measured in their entirety for the purpose of implementing these restrictions. The setback is measured horizontally along the shortest line between any point of the structure and any point on the shoreline at the mean high water mark. The Agency will locate the mean high water mark upon request of any landowner contemplating development.

Any new leaching facility (including a seepage pit, drainage field, outhouse, or pit privy) receiving any form of household effluent must be set back at least 100 feet from any water body, including an intermittent stream with a defined bed and bank.

Freshwater Wetlands Act: Environmental Conservation Law, Article 24, Title 23 of Article 71

Threshold of Regulation

Except in the Adirondack Park, where the Adirondack Park Agency administers the Freshwater Wetlands Act and employs a lower threshold, a wetland must be 12.4 acres or larger for protection under the Freshwater Wetlands Act. Smaller wetlands may be protected when the commissioner determines they have unusual local importance in providing one or more of the functions described in Article 24 of the Environmental Conservation Law (see below). Adjacent areas are outside wetlands. They extend 100 feet from the wetland boundary, measured horizontally. In rare cases, this adjacent area distance measurement may be larger.

Regulated Activities

Under the Freshwater Wetlands Act, DEC regulates activities in freshwater wetlands and in their adjacent areas. DEC regulates such activities to prevent, or at least to minimize, impairment of wetland functions.



The wetland categories used in the regulations are identified by the types of vegetation present. The regulations identify

- classifications of uses
- procedures for conducting activities in wetlands
- requirements for conducting activities in wetlands

Almost any activity which may adversely impact the natural values of the wetlands or their adjacent areas is regulated. Some activities requiring a permit include:

- Construction of buildings, roadways, septic systems, bulkheads, dikes, or dams;
- Placement of fill, excavation, or grading;
- Modification, expansion, or extensive restoration of existing structures;
- Drainage, except for agriculture;
- Application of pesticides in wetlands.

Following are the most common activities exempted from regulation. No DEC permit is required for:

- Normal agricultural practices, except filling, clear cutting of trees, or construction of non-agricultural structures;
- The harvesting of natural products and recreational activities (fishing, hunting, trapping, hiking, swimming, picnicking, or firewood collection);
- Continuance of lawfully existing land uses;
- Routine maintenance of existing functional structures such as repairing broken docks, repainting structures, or resurfacing paved areas; and
- Selective cutting of trees and harvesting of fuel wood (not clear cutting).

Regulated Wetlands Defined in §802 of the Adirondack Park Agency Act, wetlands are "any land which is annually subject to periodic or continual inundation by water and commonly referred to as a bog, swamp or marsh which are either (a) one acre or more in size or (b) located adjacent to a body of water, including a permanent stream, with which there is free interchange of water at the surface, in which case there is no size limitation." Section 578.3 of the Agency's regulations provides additional wetland information, and the criteria for identifying wetland areas are provided in the New York State Wetland Delineation Manual (available at <http://www.apa.ny.gov>).

Wetland Permitting Under the Adirondack Park Agency Act and the Freshwater Wetlands Act, an Agency permit must be obtained for the following activities involving wetlands in the Adirondack Park:

- Draining, dredging, or excavating a wetland;
- Placing fill, including soil, stone, sand, gravel, mud, trash, structures, pilings, roads, or any other obstruction or substance, into a wetland;
- Clearcutting more than three acres;
- Releasing any form of pollution into a wetland, including pesticides and sewage effluent or other liquid waste;



NYS Stormwater Management Design Manual (2015)

Guidance for stormwater management practices to comply with state stormwater performance standards, a key component of the Phase II State Pollution Discharge Elimination System (SPDES) general permit for stormwater runoff from construction activities from all sizes of disturbance. Preservation of riparian buffers can help meet criteria for conservation of natural features to receive sheetflow runoff and provide buffers for Green Infrastructure planning, design, and construction. Activities subject to the SPDES Permit are as follows:

- Construction activities involving soil disturbances of one (1) or more acres; including disturbances of less than one acre that are part of a larger common plan of development or sale that will ultimately disturb one or more acres of land; excluding routine maintenance activity that is performed to maintain the original line and grade, hydraulic capacity or original purpose of a facility;
- Construction activities involving soil disturbances of less than one (1) acre where the Department has determined that a SPDES permit is required for stormwater discharges based on the potential for contribution to a violation of a water quality standard or for significant contribution of pollutants to surface waters of the State.
- Construction activities located in the watershed(s) identified in Appendix D that involve soil disturbances between five thousand (5,000) square feet and one (1) acre of land.

Chapter 5 Green Infrastructure Practices

5.1: Planning for GI: Preservation of Natural Features and Conservation Design

5.1.2: Preservation of Buffers - guidance to define, delineate, and preserve buffers

- Riparian Buffer Management Zones:
 - Streamside Zone - min. 25' width + wetlands and critical habitat
 - Middle Zone - Variable, min. 25'
 - Outer Zone - min. 25' setback from structure

5.3: Green Infrastructure Techniques

5.3.1: Conservation of Natural Areas - Conserved area must be at least 10,000 sq. ft., must preserve indefinitely, runoff cannot be directed into the buffer,

5.3.2: Sheetflow to Riparian Buffers or filter strips

- Maximum contribution length: 150' pervious cover or 75' impervious sheetflow (up to 3% slope) or level spreader



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- Riparian Buffers widths (fully vegetated) that can receive sheetflow based on slope:
 - 50' for <8% slope
 - 75' for 8-12% slope
 - 100' for 12-15% slope

Local Ordinances & Bylaws

Municipal regulations may be the only regulatory requirements for the protection of many riparian buffers. Local ordinances and bylaws may limit development and clearing in specific riparian zones.

NYS Office of Planning, Development, and Community Infrastructure in consultation with NYS DEC prepared a collection of model local laws, The Wetland and Watercourse Protection Measures, to increase resiliency in face of climate change, as required by the NYS Community Risk and Resiliency Act (2014). Protection of all land within...

- 100' of perennial stream centerline
- 50' of intermittent stream centerline
- 25' of other watercourses centerline
- 150' of mean high tide mark of tidal river

Lake George Park Commission

Environmental Conservation Law Section 43-0112 directs the Lake George Park Commission (LGPC) to develop regulations to guide preparation of local plans and regulatory programs. Municipalities within the Lake George Park must develop and implement plans and programs consistent with the model ordinances. If a municipality fails to do so, the LGPC assumes the authority to carry out regulations in that town. The LGPC is currently in the process of updating the Stormwater Regulations (public comment period closes November 27th, 2020).

The Stream Corridor Protection Regulations are being developed as a separate regulatory package to meet the intent of the Lake George Law, NYS ECL Article 43. The proposed stream corridor protections are as follows:

- 35' stream buffer protection/clearing standards, applying to DEC regulated streams
- Standards for stream crossings/culverts that mirror existing updated DEC permit conditions



Voluntary Incentives

Trees for Tribs

NYS DEC's Trees for Tribs is a statewide program that has been working to reforest tributaries since 2007. 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. The Grant Program is for non-profit organizations, academic institutions, and municipalities to conduct large-scale streamside planting projects in New York.

The Hudson River Estuary Trees for Tribs Program supports streamside planting in the Hudson Valley. Owners and managers of properties near streams in the Hudson Estuary Watershed may apply for assistance for planting projects.

Champlain Watershed Improvement Coalition of New York (CWICNY)

CWICNY includes 5 Soil and Water Conservation Districts within the Lake Champlain Basin (Clinton, Essex, Franklin, Warren, Washington Counties) and the Lake Champlain-Lake George Regional Planning Board (LCLGRP). The coalition goes beyond political boundaries and incorporates public sector and private citizen partnership to complete projects that benefit the watershed and reduce phosphorus loading in Lake Champlain. Partners include NYS DEC, USDA NRCS, LCBP, LCC, TNC, USFWS, NYS SWCC, and various river and lake associations, among other partners.

Trout Unlimited

The NYS Council of Trout Unlimited (TU) includes over 30 TU chapters across New York State, implementing TU's Strategic Plan for conservation using sound science and BMPs. The strategic plan includes protection of intact, healthy streams to nurture healthy populations of wild trout, reconnection of trout streams, and restoration impacted streams.

The Resource Management Team provides a database of NYS streams, evaluations, and restoration projects. Assessment manuals and guides include stream glossary, example problem site photos, culvert assessment, stream stability assessment, and stream visual assessment protocol among other assessment field guides.

The Nature Conservancy & Lake Placid Land Conservancy



The Nature Conservancy – Adirondack Chapter protects areas such as the Boquet River in Willsboro, NY, preserving the most intact major tributary draining into Lake Champlain.

The Lake Placid Land Conservancy conserves land through the donation or purchase of fee lands or perpetual conservation easements, utilizing IRS tax deductibility requirements 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.

Ausable River Restoration Program

The Ausable River Association has advanced several natural channel design stream restoration projects in partnership with the US Fish and Wildlife Service (USFWS) and the Adirondack Chapter of Trout Unlimited and other project-specific partners, such as landowners, towns, and SWCDs. The program goals includes establishing and implementing comprehensive plans for the restoration of geomorphic equilibrium and habitat diversity to the Ausable River. Flood resilience, increase in habitat, and a decrease/stabilization of water temperatures are key efforts.

Stream Stabilization Program, Washington County SWCD

The Washington County Soil and Water Conservation District works closely with farmers, landowners, municipalities, NYS DEC, and US Fish & Wildlife Service to evaluate and address streambank erosion problems. WCSWCD provides technical assistance, construction oversight, and in some cases, coordination of funding toward these projects. Possible funding sources include state, federal and private sources, such as Trout Unlimited or the Fish America Foundation.

Funding for Restoration

For Non-Commercial/Agricultural/Forestry Related Properties:

- New York State (NYS) grant programs that fund municipal projects include:
- [Water Quality Improvement Program \(WQIP\)](#): NYS DEC funds municipal projects that reduce polluted runoff, improve water quality and restore aquatic habitat. Protecting and restoring riparian buffers are a priority practice.
 - [Green Innovation Grant Program \(GIGP\)](#): NYS Environmental Facilities Corporation provides funding for municipal green infrastructure practices, including riparian buffers and restoring floodplains, streams, and wetlands.



For Commercial/Agricultural/Forestry Related Properties:

The NYS Department of Agriculture and Markets maintains a website of funding opportunities for agricultural landowners, found [here](#). The Soil and Water Conservation Committee, USDA Farm Service Agency, and USDA Natural Resources Conservation Service Program provide funding and financial incentive opportunities to farmers, ranchers, and private forest landowners. Funding opportunities are maintained on the Programs include:

- [Agricultural Nonpoint Source Abatement and Control Program \(AgNPS\)](#) – Cost-share program to help farmers reduce water pollution by providing technical and financial assistance to implement BMPs, riparian buffers prioritized
- [Conservation Reserve Enhancement Program \(CREP\)](#) – financial incentives for agricultural landowners to remove streamside farmland from production and convert to grasses, trees, and other vegetation or restore wetlands
- [Environmental Quality Incentives Program \(EQIP\)](#) – financial and technical assistance to help farmers implement conservation practices on farmland and non-industrial private forestland, including riparian buffers
- [Agricultural Environmental Management \(AEM\) Base Funding Program](#) – provides technical assistance to identify environmental risks on farms, solution planning and design, and obtaining financial assistance
- [Climate Resilient Farming Program](#) – project funding for mitigation and adaptation practices, including on-farm water management
- [Source Water Buffer Program](#) – purchase of conservation easements and projects that establish riparian buffers near critical water sources

Technical Assistance

BMPs for stream protection fall into two main categories – Regulatory and Non-Regulatory.

Regulatory:

Stormwater Management Design Manual

The BMPs that are most applicable to stream protection in New York's Stormwater Management Design Manual are:

- Preservation of Buffer: Define, delineate, and preserve naturally vegetated buffers along perennial streams, rivers, shorelines and wetlands
 - Include 100-year floodplain, steep banks, and freshwater wetlands
 - Minimum 25' undisturbed vegetative buffer is needed for even the smallest perennial streams
 - 50' or larger undisturbed buffer is ideal



- o Additional zones can be added to extend the total buffer to at least 75 feet from the edge of the stream
- o The buffer depth needed to perform properly will depend on the size of the stream and the surrounding conditions

Table 5.2 Riparian Buffer Management Zones (Source: Adapted from Schueler, 1995)

	Streamside Zone	Middle Zone	Outer Zone
Width	25' min. + wetlands and critical habitat	Variable, depending on stream order, slope, and 100-year floodplain (min. 25')	25' min. setback from structures
Vegetative Target	Perennial grasses on steep slopes, undisturbed mature forest. Reforest if necessary	Managed forest, some clearing allowed	Forest encouraged, but usually turfgrass
Allowable Uses	Very restricted (e.g., flood control, utility easements, footpaths)	Restricted (e.g., some recreational uses, some stormwater controls, bike paths)	Unrestricted (e.g., nonstructural residential uses, including lawn, garden, most stormwater controls)

Non-Regulatory

NYS DEC Nonpoint Source (NPS) Program

The three-zone concept is recommended for healthy buffers that can withstand flooding and provide the highest level of protection for streams.

- o **Zone 1 (min. 15' wide)** – water-tolerant native plant species with little to no harvesting provide streambank stabilization, food for macroinvertebrates, and shade to cool water temperatures
- o **Zone 2 (20-60' wide)** – upland from Zone 1, planted with native faster-growing, smaller, shade-tolerant tree or shrub species, absorbs water runoff and filters nutrients and pollutants, fast-growing plants uptake nutrients and store in woody biomass
- o **Zone 3 (15-60' wide)** – planted with native grasses, wildflowers, or other herbaceous plants, slow fast-moving water runoff and filter sediment
- o Total recommended buffer for all 3 Zones is **at least 100' to provide minimum protection for water quality and stream protection**
- o Wider buffers provide higher levels of stream protection and better wildlife habitat



- o Diversity of plants in each zone is key for resilience to severe weather, disturbance from wildlife, and invasive species or pests

NYS DOS Wetland and Watercourse Protection Measures

Model ordinance language for municipalities recommends minimum buffer widths for common stream management objectives:

- o Bank Stabilization – 98-164'
- o Retain Nitrogen and Phosphorus to protect water quality – 16-295'
- o Prevent erosion (sediment input) – 32-393'
- o Wildlife habitat – 98-5249'
- o Flood mitigation – 65-492'

The Nature Conservancy: Ecological Buffers

“Many factors influence the determination of a buffer width that is effective, including the targeted function of the buffer and landscape characteristics, like slope, geology, and vegetation. Width is not the only factor that determines buffer effectiveness; buffers that are continuous around the perimeter or along the length of a sensitive habitat area can be more effective than fragmented buffers in providing fish and wildlife habitat and preserving ecosystem health.”(p.1)

Effective buffer widths:

- o Erosion – 200'
- o Temperature – about 220'
- o Flood Control – about 220'
- o Organic matter and debris – 300'
- o Wildlife – 1300'

NYS Forestry Best Management Practices Field Guide

The Watershed Agricultural Forestry Council recommends Riparian Management Zones (RMZs) to provide a buffer between timber harvesting and water supplies.

- o **Zone 1 (min. 15' wide)** – disturbance is discouraged, equipment should be excluded except in designated crossing areas, forest cover should be maintained
- o **Zone 2 (20-85' wide, depending on slope)** – selective harvesting is allowed, an average of 60 square feet per acre of residual basal area or at least 50% canopy cover is recommended, trees should be felled away from streams, equipment operation is permissible but should be minimized, truck loads and skid trails should be limited to designated crossing areas

Slope Class (%)*	Zone 1	Zone 2	Total RMZ width
0-10%	15'	20'	35'
11-20%	15'	50'	65'



21-40%	15'	55'	75'
41-70%	15'	85'	100'

*Slope is measured running perpendicular to the water body

Rural Roads Active Management (RRAMP) Program Best Practices Manual

An undisturbed vegetative buffer for bank stabilization is recommended:

- o 50' minimum for streambanks
- o 100' minimum for lakeshores

Assessments

Statewide Riparian Opportunity Assessment Tools

NYS DEC and New York Natural Heritage Program provides a suite of tools to help identify and prioritize riparian (streamside) sites for restoration and protection. The assessment supports DEC's Trees for Tribes Program. The assessment utilizes geographical data in a suite of user-friendly, interactive online mapping and analysis tools for viewing comprehensive information about sub-watersheds and smaller catchments throughout the state. Geographical data layers include indicators of ecological health and stress such as land use, forest canopy cover, water quality, impervious surface, hydrology, connectivity, and habitat for rare species.

Trout Unlimited

The NYS Council of Trout Unlimited's Resource Management Team provides assessment manuals and guides include stream glossary, example problem site photos, culvert assessment, stream stability assessment, and stream visual assessment protocol among other assessment field guides.



Quebec

Summary

In general, Quebec's regulations require and programs recommend the following riparian buffers:

Site Condition	Buffer Width
Small, Constrained Lots (no extensive buffer possible)	5m minimum
Slope to stream/river less than 30% OR greater than 30% but river bank less than 5m high	10m
Slope to stream/river greater than 30% OR greater than 30% and river bank more than 5m high	15m
2-year Floodzone	No activity permitted in this zone (from high water line)
Floodplains (High Velocity Zone – 20yr flood Low Velocity Zone – 100yr flood)	Protected under various provisions
Agricultural Areas (UPA-Bandes Riveraines Program)	3m minimum (1m on top of bank minimum if high water line is on bank)

Quebec's municipalities (cantons and towns) have additional regulations and recommendations. In general, they are:

Governing Body	Site Condition	Buffer Width
MRC-Brome-Mississquoi	Urban Areas - Slope to stream/river less than 25%	10m (no lawn mowing 3m from top of bank)
MRC-Brome-Mississquoi	Urban Areas - Slope to stream/river greater than 25% AND river bank more than 5m high	15m (no lawn mowing 3m from top of bank)
MRC-Brome-Mississquoi	Outside Urban Areas	15m (no lawn mowing 3m from top of bank)
MRC-Brome-Mississquoi	Agricultural Areas	3m minimum (from high water line – min. 2m if high water line is on bank – vegetation cutting permitted)
MRC-Memphremagog	All Areas	5m (no vegetation maintenance)



Ville de Durham	Selby Lake (Lac de Selby) Only	3m (no maintenance and active revegetation)
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Regulatory Requirements

Quebec Ministry of the Environment

The Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains Environment Quality Act is a law that establishes the basic guidelines for buffer zones of various water bodies (including streams and rivers. The law requires:

- 5m minimum where nothing else is possible (small lots under redevelopment)
- 10m where slope is less than 30% OR slope greater than 30% but river bank less than 5m high
- 15m where slope is greater than 30% OR slope is greater than 30% with river bank greater than 5m high

All widths measured horizontally from high water mark (ligne des hautes eaux or LHE in French).

Floodplains are also protected under variety of national, provincial, and local controls, including provisions for high and low velocity zones (20-yr and 100-yr flood zones respectively) and the 2-year floodzone in which no activity is permitted. Floodplains can be determined by a variety of sources including Canadian national government mapping, provincial Quebec government mapping, or municipal planning/zoning maps. Any one can determine the boundary in a given situation.

MRC-Brome-Mississquoi

The Cadre réglementaire sur la gestion des eaux de surface et du contrôle de l'érosion (REGES - Regulatory framework for surface water management and erosion control in English) adopted by the canton in 2013 provides for cantonal level regulation of riparian buffer areas.

For urban areas -

10m when slope is <25%

15m when slope is >25% & greater than 5m high

No mowing is permitted within 3m of the top of bank

Outside of urban areas, the buffer increases to 15m, with a minimum 3m width from high water mark or lignes des hautes eaux (LHE) in agricultural areas (minimum 2m from top of bank if the LHE is on the bank). Some cutting of vegetation is permitted in this zone. If the area in agricultural production is sloped to the water course, the measurement for the width must be taken from the top of the slope.



MRC-Memphremagog

The canton has enforced buffer rules since 1987, with additions made in 2007. Generally they are:

- Minimum 5 - 7.5m buffer alongside streams and rivers, depending on slope (mowing is also prohibited)
- Up to 2m around an existing building can be mowed
- Otherwise, the same regulations stipulated by the province apply

Voluntary Incentives

Union des Producteurs Agricoles – Operations Bandes Riveraines

This organization is primarily a resource for agricultural producers in Quebec to better understand their obligations, options, and planning tools with respect to riparian buffers. The standard rule applied is a minimum 3m buffer from the high water mark (ligne des hautes eaux or LHE). Of note – if the slope between the high water mark and the top of slope is between 2 and 3 meters, an additional 1 meter must be added to the buffer (1m of 'flat' land).

This resource provides a suite of comprehensive planning tools for farmers, including advice on funding sources.

QuebecVert – Bandes Riveraines 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. The program was developed with input from FIHOQ, the Association Québécoise des Producteurs en Pépinière (AQPP) and Regroupement des Organisations de Bassin du Québec (ROBVQ), as well as various other stakeholders (consultants, nurseries, landscape professionals, as well as the Ministère de Développement durable, de l'Environnement, de la Faune et des Parcs (MDDEFP).

Though not a resource specifically designed for the Lake Champlain Basin, the guide is comprehensive and specific to Quebec. As such, it is a valuable resource for riparian buffers in Quebec.



Funding for Restoration

For Non-Commercial/Agricultural/Forestry Related Properties

For Commercial/Agricultural/Forestry Related Properties

Prime-Vert

Through its Prime-Vert program, the Quebec Department of Agriculture, Fisheries and Food (MAPAQ) supports producers who want to reduce diffuse pollution of agricultural origin in watercourses by developing a riparian strip enlarged.

Financial assistance covers 70% of eligible expenses (or 90% in the case of a collective approach recognized by the MAPAQ) up to \$ 50,000 (\$ 20,000 or \$ 30,000 depending on the component chosen) - [Development of windbreak hedges](#) , [Development of widened riparian strips](#) or [Development promoting biodiversity](#)), by farm for the duration of the 2013-2018 program. The Prime-Vert program covers mixed wide riparian strip projects (a row of trees / shrubs with herbaceous section) with a width of 5 to 25 meters, measured from the high water mark. Projects of tree or shrub riparian strips 5 to 10 meters wide are also eligible.

Eligible expenses

- Design of the enlarged riparian strip
- Purchase of trees and shrubs
- Setting up: labor, material and seed costs, as well as the cost of using or renting specialized machinery.
- Rodent and deer protection collars

Wildlife Habitat Enhancement - Quebec Wildlife Foundation

The Quebec Wildlife Foundation grants financial assistance to projects to protect and enhance wildlife habitats in small and medium-sized agricultural watersheds.

This program promotes interventions for the conservation of natural environments or the development of wildlife habitats of a collective nature. Although it is intended for public or private organizations, producers whose land is located on the territory of the targeted project can benefit from the aid granted.

The amount of financial assistance granted may cover up to 60% of the project costs up to \$ 30,000. Financial assistance cannot extend over more than two years.

Environment Canada's Habitat Stewardship Program for Species at Risk



This program funds projects aimed at protecting the habitats of species at risk as well as projects aimed at preventing other species from being threatened with extinction. This program is aimed at both organizations and individuals.

ALUS Canada Program

ALUS helps farmers and ranchers with the restoration of wetlands, reforestation, planting of windbreaks, installation of riparian buffer zones, management of sustainable drainage systems, creation of pollinator habitats and the implementation of other ecological projects on their property.

In addition, ALUS pays an annual payment to ensure the ongoing governance of each of its projects.

Technical Assistance

Protection des rives, du littoral et des plaines inondables

Created by the Ministère de Développement durable, de l'Environnement, de la Faune et des Parcs (MDDEFP), this guidebook, specifically Chapter 7, outlines various bioengineering practices for the stabilization of shorelines of all types.

Contrôle de l'érosion des cours d'eau

Created by the Ministère de Développement durable, de l'Environnement, de la Faune et des Parcs (MDDEFP) and the Ministère des Affaires municipales, des Régions et de l'Occupation du territoire (MAMROT), chapter 9 from the Guide de Gestion des Eaux Pluviales (Stormwater Management Manual) specifically on controlling erosion of river and stream banks.

This manual is generally more technical and designed to aid applicants in obtaining stormwater permits. As such, there are fewer specific BMPs listed in this chapter and more general principles related to controlling stream and river bank erosion.

QuebecVert

QuebecVert's 'Guide de bonnes pratiques Aménagement et techniques de restauration des bandes riveraines' (Guide to good practice: Planning and restoration techniques for riparian buffers) provides a useful guidebook for riparian buffer creation with specific BMPs as well as general planning principle.

In addition, QuebecVert has also produced the 'Repertoire des vegetaux recommande pour la vegetalisation des bandes riveraines du Quebec' (Directory of plants recommended for the vegetation of riparian strips in Quebec), which is a comprehensive listing of native species useful in creating effective riparian buffers,



specifically buffers with three different levels (grassy, low-lying vegetation, shrubs, and trees) that are considered to be ideal.

Virage Eau

MRC Brome-Mississquoi's Virage Eau program has a variety of links to various BMPs for riparian buffers as well as other water quality issues and other resources more specific to the canton. Notably, this program includes an action plan for integrated and sustainable water management planning, of which adoption and promotion of riparian buffer rules and programs plays a large part.

Les Bandes Riveraines

MRC Memphremagog has also adopted a riparian buffer program and provides a short (2-page guide which showcases some of the native riparian buffer species (adapted from the QuebecVert guide) that are preferable when planting a buffer.

Guide de mise en valeur riveraine

OBVBM provides this excellent guide for homeowners describing a variety of techniques to protect water quality and control erosion both along lakeshores as well as on stream / river fronts. This guide provides a simple method for evaluating each type of shore. Owners can then choose easy-to-apply solutions for their property. At the end of the guide, a management practices checklist allows owners to verify if protection principles are being applied on their property. Property owners can then set their own priorities for action. Should they require more information, references are suggested. This guide provides a simple method for evaluating each type of shore.

Owners can then choose easy-to-apply solutions for their property. At the end of the guide, a management practices checklist allows owners to verify if protection principles are being applied on their property. Property owners can then set their own priorities for action. Should they require more information, references are suggested.



Stream Buffer Literature Review

Summary:

The Stream Wise Program will not have the backing of widespread regulatory requirements unlike the Lake Wise Program that is backed by the Shoreland Protection Act. Stream Wise buffer recommendations will need to have sound scientific groundings to increase legitimacy and provide scientifically proven guidance.

Several government guides, studies, and literature reviews were selected to provide the scientific basis for stream buffer stewardship. This is not a comprehensive literature review but a selection of existing literature reviews and reputable handbooks and guides. These findings will inform award criteria and recommendations for protection, management, and enhancement of vegetated stream buffers.

Terminology:

Riparian zone/area or stream corridor – for the purposes of this program, riparian will refer to the ecosystems adjacent to flowing water, i.e., rivers and streams. Riparian zones and stream corridors refer to both the 'natural' ecosystems along waterways that



are distinct from upland areas as well as the area adjacent to the stream or river, regardless of the health of the ecosystems.

Forested riparian buffers - riparian buffers with a functional forest ecosystem. Forest buffers are recognized as the most beneficial of any type of buffer because of the multiple environmental benefits they provide. The use of forested zones near streams has long been recognized as an important strategy for improving water quality while simultaneously protecting or restoring the stream ecosystem. Forested riparian buffers should be clearly distinguished from vegetative or grassed filter strips commonly recommended as a best management practice (BMP) because of their ability to accomplish both water quality and ecological roles. (USDA FS). Can be defined as a protected forested zone along streams and rivers having a floral and faunal community distinct from upland areas and functions to buffer the impact of human land use activities (VT NRCD).

Buffer Strips - refers to a barrier of permanent vegetation between waterways and land uses such as agriculture or urban development (VT DEC). A variety of vegetation types may be utilized (USDA FS).

Riparian or stream buffers – the overarching term used to identify the area adjacent to streams and rivers that has some degree of protection, since the term buffer signifies a barrier that is protecting the waterway from the impact of human land use activities. Buffers should be designed to fulfill one or more of the following basic roles:

- protect fish and wildlife by supplying food, cover, and thermal protection; mitigate temperature and flow regime.
- help prevent upland sources of physical, chemical, and biological contaminants from reaching surface waters by trapping, filtering and converting sediments, nutrients, and chemicals.
- maintain the hydrologic, hydraulic, and ecological integrity of the stream channel and associated soil and vegetation (i.e. maintaining streambank stability and channel capacity) or improve integrity of the in-stream ecosystem so that it can more effectively process, sequester, or eliminate contaminants that do get into the stream.

(Wenger, 1999; Sweeney, 2016)

Benefits

Managers of riparian systems have long recognized the importance of riparian forest buffer strips, for the following reasons:

- Moderate water temperature
- Provide habitat for aquatic species with organic matter and woody debris
- Retain and remove sediments from runoff



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- Reduce nutrient loads of streams by retaining and removing phosphorus and nitrogen
 - Trap and remove other contaminants, such as pesticides
 - Stabilize streambanks and reducing channel erosion.
 - Reduce erosion caused by uncontrolled runoff.
 - Mitigate flooding
 - Provide terrestrial wildlife habitat
 - Protect fish habitat and spawning areas
 - Maintain aquatic food webs
 - Improve aesthetics of stream corridors
 - Offer recreational and educational opportunities

(USDA NRCS, 1998; Wenger, 1999; Schueler, 1995, USACE, 1991)

Buffer Best Practices

- Leave existing native vegetation, as well as woody debris and stumps
 - Habitat, erosion and sediment control, seed sources, microorganisms
- Plant only native species, prioritize hardy and well-adapted to the local area
- Restore natural patterns of plant community distribution, e.g., site-specific plant communities
- Vertical complexity - diversity of strata or foliage height, multi-layering of vegetation (groundcovers, herbaceous perennials, shrubs, understory trees and shrubs, replacement saplings, overstory/canopy trees)
- Horizontal complexity – diversity of plant distribution in relation to flood depth, duration, and frequency, as well as variations in soils and drainage condition results in different types of vegetation between edge and interior, edge effects create more diversity
- Staggered introduction of canopy, understory, replacement trees
- Dynamic plant communities change over time, differing regeneration strategies of particular vegetation types lead to characteristic patterns of plant succession following disturbances in which pioneer species well-adapted to bare soil and plentiful light are gradually replaced by longer-lived species that can regenerate under more shaded and protected conditions. □ patterns of natural succession should be planned for by planting hardy early-successional species to stabilize an eroding streambank, while planning for the eventual replacement of these species by longer-lived and higher-successional species.
- Pre-development vegetative target – observe natural communities along the stream corridor or neighboring riparian areas



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- Prioritize continuous buffer strips; maximize connectivity between surrounding ecosystems and functions, limit gaps, especially wide gaps
 - Prioritize protection of headwater streams and broad floodplains downstream
 - Exclude disturbance from the buffer zone, including dams, stream channelization, water diversions and extraction, heavy construction, impervious surfaces, logging roads, forest clear cutting, mining, septic tank drain fields, agriculture and livestock, waste disposal sites, and application of pesticides and fertilizers

(USDA NRCS, 1998; ELI, 2003; Wenger, 1999; Fischer & Fischenich, 2000; Broadmeadow & Nisbet, 2004)

Buffer Zones

The three-zone concept is recommended for healthy buffers that can withstand flooding and provide the highest level of protection for streams.

Overview

- **Zone 1: Streamside** – extending upland from edge of stream, primary purpose is to:
 - protect the physical integrity by stabilizing the streambank
 - protect ecological integrity of the stream ecosystem by providing habitat for aquatic organisms.

The vegetative target is mature riparian forest of diverse flood-tolerant native tree and shrub species that

- hold the soil together with strong roots to resist the erosive force of flowing water
- provide shade to moderate water temperatures, a deforested stream may be 10-20 degrees warmed than a forested buffer
- produce leaf litter/detritus, food for macroinvertebrates, and woody debris to slow water and create microenvironments and as a result, greater biodiversity
- filter and bind sediments and uptake of nutrients

Management includes:

- removal of invasive species
- logging and heavy equipment should be excluded except for stream crossings and stabilization work
- livestock excluded except for designed stream crossings

Recommended widths:

- 15' min. (NYS Nonpoint Source Program; Hawes & Smith, 2005; USDA FS, 2017)



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- **Zone 2: Middle** – extends from outward boundary of Zone 1, the primary purpose is to
 - Remove, transform, or store nutrients, sediments and other pollutants as surface runoff and groundwater
 - Provide necessary contact time and carbon energy source for buffering processes
 - Provide long-term sequestering of nutrients in the form of treesThe vegetative target is also mature forest, native faster-growing, smaller, shade-tolerant tree or shrub species, fast-growing plants uptake nutrients and store in woody biomass
 - Plants absorb water and uptake nutrients
 - Debris from trees slows and traps sediments
 - Removal of nutrients through microbial processes as a result of decaying organic matter
 - Denitrification by anaerobic organisms, result of organic material and moisture in forests
 - Nutrients are mineralized and less biologically available and readily stored in soils, degraded into simpler compounds, or synthesized into microbial biomass through a variety of microbial activity/degradation mechanismsManagement includes:
 - Selective harvesting and timber stand improvement (TSI) to maintain vigorous growth and leaf litter replacement and to remove nutrients and pollutants sequestered in wood
 - Maintain shade, leaf litter (duff layer), detritus, and large woody debrisRecommended widths:
 - Varies in width depending on stream order, extent of 100 yr floodplain, adjacent steep slopes, and protected wetland areas (USDA NRCS, 1998)
 - 20'-60' min. (NYS Nonpoint Source Program, NYS DEC)
 - 60' min. (Hawes & Smith, 2005, USDA FS, 2017)
 - **Zone 3: Outer Zone** – upslope of Zone 2, the buffer's buffer, the primary function is a grass filter strip or other control measures to
 - slow runoff
 - filter sediments
 - uptake nutrients
 - allow water to infiltrate into the ground



- convert concentrated flows to uniform, shallow, sheet flows using techniques such as grading and shaping and devices such as diversions, basins, and level spreaders

vegetative target is dense herbaceous perennial groundcovers, sometimes lawn or turfgrass, but ideally planted with grasses, forbs, wildflowers, or other herbaceous plants,

- protect wooded areas so that the forest buffer can perform at maximum potential
- minimize concentrated sources of runoff and create conditions for sheetflow to ensure effective sediment trapping in Zone 2
- spread flow
- over time removal efficiency decreases due to sediment deposits, need to periodically remove sediments and channels and re-establish vegetation

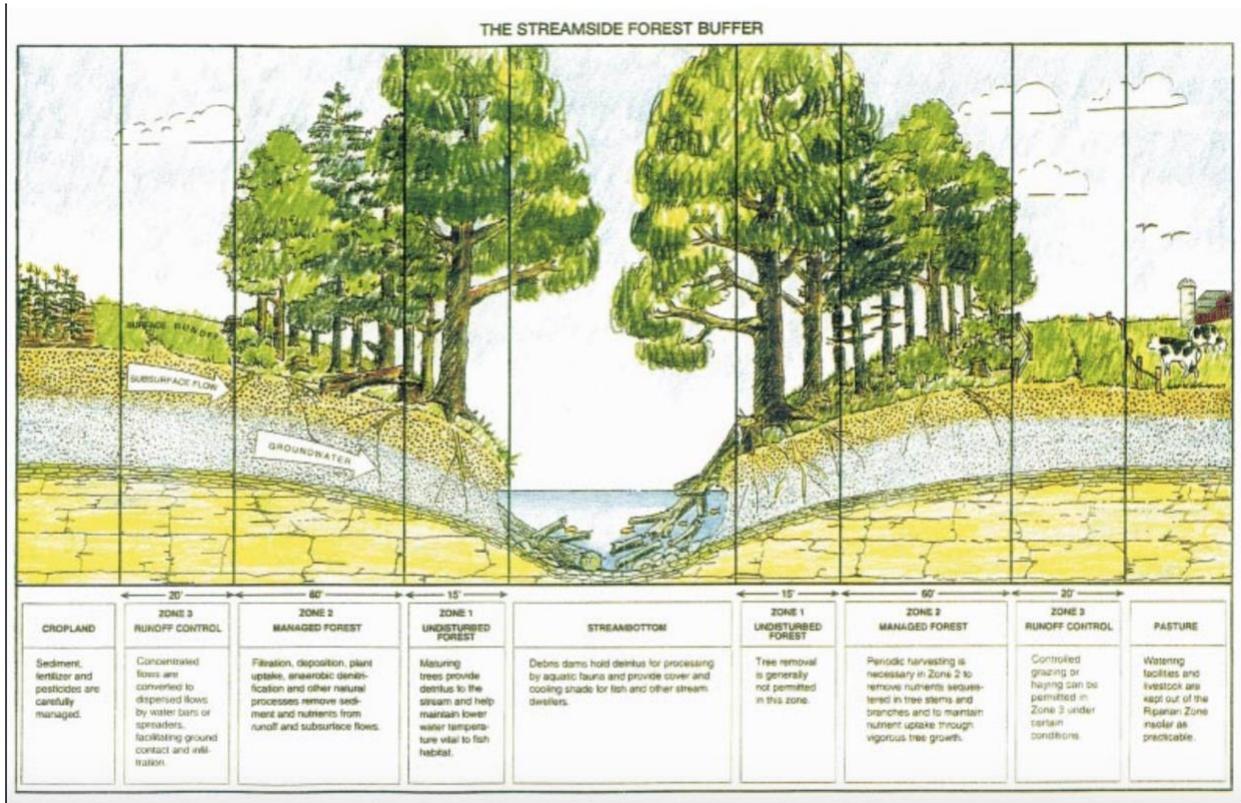
Management includes:

- Can include mowing and grazing to maintain vigorous growth, remove sequestered nutrients, and suppress weeds
- Sediment removal when needed (smothering plants)

Recommended widths:

- 15' -60' min. (NYS Nonpoint Source Program, NYSDEC)
- 25' min. setback (USDA NRCS, 1998)
- 30' min. (Hawes & Smith, 2005)
- 20' min. (USDA FS, 2017)

- **Total Buffer** - Wider buffers provide higher levels of stream protection and better wildlife habitat; Diversity of plants in each zone is key for resilience to severe weather, disturbance from wildlife, and invasive species or pests; concentrated flows and subsurface drains shall not bypass the buffer, but be converted to sheetflow or subsurface flows through slowing, spreading, and infiltration techniques to be filtered and treated by the buffer
 - 100' min. to provide minimum protection for water quality and stream protection (NYS Nonpoint Source Program; NYS DEC; Hawes & Smith, 2005; Wenger, 1999)
 - 75'-150', depending on soil capability class (USDA FS, 2017)
 - 50'-100', depending on stream order (perennial, intermittent, ephemeral)
 - Variable, can include full extent of 100-yr floodplain, all undeveloped steep slopes (greater than 25%), steep slopes (5-25%, at 4 additional feet per one percent increment of slope above 5%), or any adjacent delineated wetlands or critical habitats (USDA NRCS, 1998)



= Chesapeake Bay Riparian Handbook: A Guide for Establishing and Maintaining Riparian Forest Buffers. USDA Forest Service, 1997.

Buffer Widths

Buffer widths can be determined based on a fixed width or a variable width calculation that takes into account factors such as slope, erodibility, and even volume and velocity of upland surface runoff. For the purposes of this program, we are focused on a fixed width due to the benefits of clear and consistent messaging and modeling after existing programs in the region that utilize fixed widths.

Based on the literature, it seems that a target recommended buffer width for this program should be a 100' wide forested riparian buffer. However, given the reality of existing development and land uses within 100' of streams and rivers, there may need to be an alternative minimum recommended buffer. Based on the literature, it seems a 35'-50' minimum buffer requirement is necessary to ensure the long-term protection of aquatic resources.

The following are excerpts from selected studies, outlining buffer width recommendations:



“There is substantial agreement in the scientific community about the value of using vegetation to buffer valuable aquatic resources from the potential impacts of adjacent human use of the land. There is also general agreement that the greatest range of buffer benefits is provided when natural vegetation, like forests, are the target vegetation. However, there is often little agreement and much continuing research and debate over how to best achieve the level of protection needed and how to best delineate and manage a buffer. Of all questions related to practical use of riparian buffers, determining the appropriate minimum width of a buffer is certainly the most frequently discussed.

One of the important factors which determines the effectiveness of a buffer is its size or effective width. Buffers that are too narrow may still place water quality or aquatic resources at risk. They may also present problems with sustainability over the long term. Although wider is nearly always better, buffers that are wider than needed may unnecessarily restrict use of a portion of the land. Therefore, the need to determine “minimum” widths has been a primary focus of resource agencies and local governments for many years. Complicating the picture further, buffer size requirements are typically established by political acceptability and compromise rather than on scientific merit. It is likely that these debates will continue.

Various approaches and formulas have been devised to determine and evaluate the needed width of a riparian buffer. Establishing criteria that are scientifically based should be the goal of resource and conservation agencies.

Four criteria are generally discussed for determining the adequate width of riparian buffers for protection of streams. They are the:

1. Existing or potential value of the resource to be protected,
2. Site, watershed, and buffer characteristics,
3. Intensity of adjacent land use, and
4. Specific water quality and/or habitat functions desired.

If necessary, these scientific criteria can then be modified by the management objectives or constraints of a given landowner or land management agency. In this way, scientific criteria guide width decisions, but are modified by socioeconomic variables where the risk and benefits of the decisions can be identified and discussed.

The concept that “anything is better than nothing” will be raised. This is probably an accurate assessment when it comes to maintaining the functions of stable streambanks making some improvements in stream or shoreline habitat. However, It is important to recognize that for a riparian buffer to serve the water quality functions of buffering impacts from adjacent land use, a “critical mass” or sustainable width is often essential.

The most commonly prescribed minimum buffer widths for use in water quality and habitat maintenance are approximately 75 to 100 feet. 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)

"This survey found recommended buffer widths ranging from one meter [3.28'] up to 1600 meters [5,250'], with 75 percent of the values extending up to 100 meters [328'] (see "A Closer Look at Buffer Width" in Appendix E for further discussion)." (ELI, 2003)

"Nationally, urban stream buffers range from 20 to 200 ft. in width from each side of the stream according to a survey of 36 local buffer programs, with a median of 100 ft. (Schueler 1995). In general, a minimum base width of at least 100 feet is recommended to provide adequate stream protection." (USDA NRCS, 1998)

"All buffers provide some value, but the 2 primary factors in determining their effectiveness are type of vegetation and width of the buffer. The most effective buffers are forested and >30 m wide (98') for streams and rivers with naturally forested riparian areas" (Sweeney, 2016).

"Overall, buffers >30 m (98') wide are needed to protect the physical, chemical, and biological integrity of small streams" (Sweeney, 2014).

Criteria:

- Existing or potential value of the resource to be protected,
 - High value, e.g., value of fish habitat, drinking water, recreational use
 - Low value, e.g., high disturbance regime, dominated by invasives
- Site, watershed, and buffer characteristics,
 - Slope, rainfall, soil, soil moisture and wetlands, floodplain, vegetation
 - Enhance effectiveness, e.g., slopes <5%, contributing flow length <150', seeps/high water table/subsurface flow, permeable but not highly sandy soils, level spreaders or flow dispersal, organic matter/humus/mulch layer, entry runoff velocity <1.5' per second, routine maintenance, poorly drained soils with deep roots, forest and dense grass cover
 - Reduce effectiveness, e.g., slopes >5%, overland flow paths >300', flow path to deep or regional groundwater, compacted soils, concentrated storm flow, snowmelt/ice conditions/low organic soil, entry runoff velocity >5' per second, sediment buildup at entrance, shallow root systems, tall bunch grass, sparse vegetative cover
- Intensity of adjacent land use,
 - Highly impervious urban areas with more surface runoff and depleted groundwater and baseflow, agricultural fields with high nutrient rates in



- runoff, residential areas with potential lawn fertilizers, dog poop, invasive species
- Catchment size and hydraulic loading (Wenger, 1999)
- Specific water quality and/or habitat functions desired.

Review of Literature on Recommended Buffer Widths for Specific Functions:

A search of the literature clearly suggests that buffer sizes necessary for adequate performance of specific buffer functions vary widely. (USDA FS, 1998)

- **Bank Stabilization**
 - 33'-66' (Fisher and Fischenich, 2000)
 - 49'-98' (USACE, 1991)
 - 164' min. (ELI, 2003)
- **Prevent Erosion**
 - 30'-98' (Hawes & Smith, 2005)
 - 50' min (VLCT, 2007)
- **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)
- 52-164' (USACE, 1991)
- 82' min. (ELI, 2003)
- >98' for nitrate removal (Sweeney, 2014)
- **Terrestrial Wildlife Habitat**
 - 30'-656' (USACE, 1991)
 - 98'-1,640' (Fischer and Fisichenich, 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 Fisichenich, 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 Fisichenich, 2000)
- **Pesticide retention**
 - 49-328' (Hawes & Smith, 2005; USACE, 1991; Wenger, 1999)

"...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).

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