

Vermont Granite Museum Ecological Restoration Plan

Prepared for the

Vermont Granite Museum
and its supporting partner,
Friends of the Winooski River

By
DuBois & King, Inc.

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Vermont Watershed Grant
Vermont Agency of Natural Resources
Department of Fish and Wildlife



INTRODUCTION

Existing Site conditions

The Vermont Granite Museum property is located along Vermont Route 302 in Barre, just west of the City, as shown on the attached Location Map, Figure 1. It is the only large property with public access along Route 302 between the City of Barre and Montpelier to the west, and so is of high value for open space and recreational opportunity. The property consists of two parcels, as shown on the Town tax map, Figure 2. The larger parcel #7 is approximately 12 acres in size, while the smaller parcel #720 is approximately 0.6 acre in size. The larger parcel is bounded by the railroad to the north, the Stevens Branch of the Winooski River to the south, and private property to the east. The smaller parcel is bounded by the railroad, Route 302 and Jones Brothers Way.

The property includes the 25,000 square foot Vermont Granite Museum building (formerly the Jones Brothers Manufacturing plant), a footprint and artifacts of destroyed sections of the Jones Brothers buildings, and parking in the eastern third of the land, with open space historically used for waste granite disposal in the western two-thirds. The Stevens Branch, forming the southern boundary of the property, is unexpectedly aesthetically pleasing and biologically intact, given its location within and just downstream of a highly developed city-scape. An intermittent, unnamed tributary to the Stevens Branch enters the western portion of the site from the north and flows southwesterly through the site to its confluence with the Stevens Branch (see Natural Resource Atlas map, Figure 3).

The above-referenced Natural Resource Atlas map shows no known/mapped natural resources of concern within the project area. However, an on-site investigation has identified a large wetland at the western end of the property which has been determined by the Vermont Wetlands Office to be “Class II,” thus State-jurisdictional as well as Federal-jurisdictional.

A preliminary design for a sculpture garden and path, with parking off of Route 302, at the western end of the site is shown on the Restoration Plan Overview, Figure 4. A regional multi-use path approaches to within 400’ of the property to the east. An extension of the multi-use path is planned within the Museum property, and will connect to the eastern end of the sculpture garden path.

Existing Permits

The 2002 Land Use Permit (#5W1366-1) for the site requires the maintenance of a 50’ riparian buffer along the edge of the Stevens Branch, and prohibits disturbance there with the exception of plantings and placement of isolated sculptures.

State Stormwater Permit 5594-9010 defines stormwater discharge points and treatment mechanisms.

Purpose and Need for Restoration Plan

The goals of this plan are to:

- Create a comprehensive ecological restoration plan for the natural areas on the 12-acre site;
- Promote responsible use of the property;
- Maintain and enhance public recreational opportunities, including access to the river;

- Limit impacts to the valuable natural resources of the site;
- Restore and enhance the site's natural resources within the context of planned uses.

The restoration plan is intended to give the VGM a framework for stewardship of their land and to guide them in the applications of environmental restoration and interpretation while they integrate the historic value of the Vermont Granite Museum and associated lands, create a public display of granite sculpture, and conduct adaptive reuse of the land for public recreational opportunities.

SITE INVESTIGATIONS

Field reviews, supported by existing information reviews, were undertaken by a DuBois & King, Inc. Field Naturalist and by several State regulatory and resource agency representatives. The results of those reviews follow.

Natural History Overview

The VGM is located roughly at the border between the Northern Green Mountains and the Northern Vermont Piedmont biophysical regions of the State, both of which are dominated by northern hardwood forests. The majority of the VGM property has been significantly altered by the disposal of granite "grout" (waste granite ranging in size from large blocks to fine material) over many decades. The grout appears to have compacted in certain areas to create relatively impervious surfaces, such as in the area of Class II wetland where drainage is impeded. In other areas, the texture is coarser, and the soil more well-drained to droughty. The vegetation on the site is varied, responding to the varying water regimes, with a mix of native and introduced species.

Existing vegetation

The banks and existing riparian corridor of the Stevens Branch are dominated by white ash, linden and white birch (upland tree species) and black willow, elm, northern white cedar, cottonwood, red maple, silver maple, yellow birch and box elder (wetland tree species). A grove of fairly mature northern white cedar trees occurs along the riverbank in the location of an existing footpath in the southwestern area of the site, where an improved river access is proposed. Shrubs include ninebark, staghorn sumac, honeysuckle and alternate-leaved dogwood (upland species) and silky dogwood, meadowsweet and alder (wetland species).

The intermittent streambanks are dominated by black cherry, white ash, hop-hornbeam, white birch and quaking aspen (upland tree species) and black willow, cottonwood and box elder (wetland tree species). Shrubs include sumac, alternate-leaved dogwood, Japanese barberry and honeysuckle (upland) and alder, highbush cranberry, red-osier and silky dogwoods and European buckthorn (wetland).

The open field and early successional areas include scattered woody plants including willow, quaking aspen, pasture juniper, alder, white birch, white oak, multi-flora rose, balsam fir, buckthorn and northern white cedar. The herbaceous layer includes Queen Anne's lace, Canada and giant goldenrods, knapweed, deertongue, groundnut, black-eyed Susan, strawberry, marsh fern and cinnamon fern.

Invasive Species

A large colony of giant reed (“Phragmites”) and some purple loosestrife occur within the Class II wetland. Woody invasive species on the site include honeysuckle, buckthorn, Japanese barberry, multi-flora rose and autumn olive, which occur as scattered plants within the open areas on the site and within the riparian corridor. Herbaceous invasives scattered throughout the open areas include knapweed, forget-me-not, wild phlox and yellow iris.

Wetlands

A 0.9-acre (+/-) wetland is dominated by a colony of invasive giant reed (*Phragmites australis*). Beneath the giant reed and in the surrounding land is a variety of native herbaceous species, including sedges, woolgrass, creeping Jenny, scouring rush, marsh fern, dark-green bulrush, swamp candles, New England aster and sensitive fern.

Fisheries

According to the Vermont Department of Fish and Wildlife, this stretch of the Stevens Branch contains a surprisingly good fishery resource and diversity of fish species, given the amount of development along the banks in the region. Fish species include populations of wild (naturally reproducing) brown trout, rainbow trout, brook trout, blacknose dace, longnose dace, longnose sucker, pumpkinseed, white sucker, creek chub and common shiner.

Rare, threatened and endangered species

No rare, threatened or endangered species are mapped on the VANR Natural Resource Atlas (see Figure 3), and none were observed during field review.

Vermont Fish and Wildlife Zoologist Mark Ferguson notes the presence of an uncommon fish species, the Alleghany pearl dace, farther upstream in the Stevens Branch, and states, “It could inhabit this reach, or, if not, restoration to improve habitat might encourage it to reestablish here.”

Soils

The soils on the property are mapped by the NRCS as “Urban land-Udipsamments complex, occasionally flooded.” This soil type consists of urban land and areas where much of the original soil has been altered, removed or covered with fill material. On-site field observations confirmed this description, with granite blocks observed randomly protruding from the ground as a result of the historic dumping of waste granite on the site, both in large blocks and fine material.

Topography

The topography of the majority of the site is quite flat, with the exception of steep banks generally 8-14’ high along the Stevens Branch and more gently-sloped banks of 6-8’ high along the unnamed tributary. See Figure 5 for LIDAR 2’ contour mapping.

Stormwater

The site is bound by the railroad along the northern border, which serves as a drainage break for most of the property, preventing off-site runoff from Route 302 and areas further to the north from draining directly across the Museum's site. The southern boundary of the site is defined by the Stevens Branch. A small unnamed tributary runs parallel to the rail line near the middle portion of the site and then bisects the Museum property prior to its confluence with the Stevens Branch.

Stormwater drainage within the site is all overland flow; there are no closed drainage systems. While the southernmost portion of the property flows south and directly into the Stevens Branch, much of the site drains back toward the north. Stormwater will either infiltrate into the ground or flow overland to the Stevens Branch or the unnamed tributary. A general schematic of overall flow patterns is provided in Figure 6, Drainage and Soils Memo.

The existing 3.5 acres of impervious surfaces associated with the building, access drives and parking areas on the site are covered by a State Stormwater Permit 5594-9010 (see Figure 6). The Stormwater Permit identifies two discharge points, each with a different treatment mechanism. The first discharge point covers the distributed, overland flow being conveyed to the Stevens Branch, with treatment provided in the vegetated buffer to Stevens Branch. The second discharge point is located in the center of the vegetated area within the parking area, which is an infiltration area that drains into a rock dry well.

Floodway and Floodplain

Floodway is mapped as extending approximately 25 to 50 feet onto VGM land along the banks of the Stevens Branch. The 100-year floodplain extends onto the site in the western portion and along the intermittent stream channel. Mapping of the floodway and floodplain is provided in Figure 7. Construction of the sculpture garden path and changes to the culvert on the intermittent stream will require a City of Barre Flood Hazard Area Development Permit.

STATE AGENCY COMMENTS

State Agency representatives who reviewed the site provided their comments, included in their entirety as Appendix A. The comments are summarized below.

Washington County Forester Dan Singleton walked the site in November, 2014, and made the following recommendations:

- Invasive species management in a band of river buffer along the Stevens Branch, as shown in yellow on an NRA map in Figure 8. Supplemental plantings of desirable species could be accomplished there following invasive species control to increase the success of the invasives treatment. County Forester can make recommendations for species choices and sources, once a plan is agreed upon. The NRCS *Specification Guide Sheet for Riparian Forest Buffer (391)* (see Figure 9) is also recommended as guidance for plantings.
- Other than the supplemental plantings described above, vegetation management is not required in the yellow area on Figure 8, as the trees appear healthy and are currently providing an appropriate river buffer.

- Selective mowing, leaving islands of small trees for structure and aesthetic appeal, of an area along Route 302 (see area in blue on Figure 8) to keep the area in early successional/ shrubland habitat. Mowing should be scheduled on a 5 year rotation.
- Replacement of the existing undersized culvert on the unnamed tributary with a pedestrian bridge.

Vermont Fisheries Biologist Bret Ladago walked the site in September 2014, and made the following recommendations:

- The diverse fish species, as well as other aquatic communities, would benefit from the restoration of riparian buffer. Buffers provide a host of essential functions and values including shading, shelter, filtration, streambank stability and recruitment of natural wood and organic materials.
- The Vermont Agency of Natural Resources' *Riparian Buffer Guidance* would recommend a 100' undisturbed buffer along the Stevens Branch, measured from the top of the bank. However, due to limited space between the railroad and the river, and a previously approved Act 250 permit, a riparian buffer of 50 feet minimum should be maintained.
- The shoreline within the project area should be maintained in its natural state and restoration of the riparian area measuring 100' from the top of the bank should be considered where feasible.
- In areas of limited existing riparian buffer, the Department recommends two courses of large caliper (2-3") trees be planted along the top of the streambank to accelerate the benefit of the riparian restoration to aquatic resources.
- A narrow area of roughly 300 feet of shoreline along the eastern edge of the restoration area (see Figure 10) contains highly degraded buffer, probably due to the relatively steep slope and use of stone fill. Native plant species tolerant of shallow, rocky soils should be considered for planting in this area.
- The removal of sediments above the culvert at the unnamed tributary should proceed with caution. Testing of the sediments for contamination prior to removal should be considered.
- A naturally vegetated 50 foot buffer should be maintained along the tributary banks.
- Encroachment into the riparian buffer for future fire engine access should be avoided, in accordance with the Land Use permit conditions.
- Viewing and river access areas should be limited to one or two developed paths, and all other foot paths should be abandoned.
- Interpretive signs explaining the benefits of a naturally vegetated buffer and encouraging responsible use of the river are recommended to help minimize impact.
- Additional clearing of vegetation around the old foundation near the existing museum building for interpretive purposes should be limited, and should not occur within the 50 foot riparian buffer.
- The multi-use path should be located outside of the 50 foot riparian buffer.

Vermont Wildlife Biologist John Austin is familiar with the site, and made the following recommendations:

- Restore as much of the site to a forested or shrub habitat condition as possible.
- The best values the site will provide, given the context of development around it and the Stevens Branch, are for building flood resilience and mitigating impacts from soil disturbance that affects erosion of the stream banks.

- Native trees and shrubs such as willows, alders, box elders and silver maple are good candidates for plantings.

Vermont State Botanist Bob Popp made the following recommendations:

- Try to determine what community(ies) would naturally have occurred on the site, and attempt to recreate that (those) using native species.
- Use locally sourced plants as much as possible.
- Restore the riparian area along the river to benefit wildlife habitat and corridor movement as well as water quality.
- Ninebark observed on the site is not considered an invasive species, although it does seem to be spreading from cultivation and advancing from farther south and west.

Vermont Zoologist/Herpetologist Mark Ferguson made the following recommendations:

- The Alleghany pearl dace, an uncommon fish, is reported from farther upstream in the Stevens Branch, and might also inhabit this reach. If not, restoration to improve habitat might encourage it to re-establish here.
- Actions which reduce steambank erosion, improve riparian vegetation and improve in-stream habitat generally benefit fish species.

Vermont Fish and Wildlife Technician Tim Appleton is familiar with the site and made the following recommendations by telephone communication:

- During trail development, maintain the tree canopy as much as possible.
- Plant trees for shade and organic matter sources.
- Riparian zone improvements will benefit the overall health of the river, including downstream stretches.

Vermont Monitoring, Assessment and Planning Program Watershed Coordinator Karen Bates made the following recommendations by telephone communication:

- Review the existing Stevens Branch river corridor study.
- The goal on the property should be to create recreational opportunities without impinging on the river corridor.
- Consider using woody vegetation to treat stormwater where it enters the property.
- Consider diffusing the stormwater runoff from Route 302, allowing more sheetflow onto the property.
- Consider creation of a gravel wetland to treat stormwater on the property

Vermont District Wetlands Ecologist Shannon Morrison visited the site in July 2013, and made the following recommendations:

- The wetland at the western end of the property is Class II and subject to the Vermont Wetland Rules. Impact to the wetland or its 50 foot buffer would require a Vermont State Wetlands Permit.

- Impact to buffer would likely be permissible, provided that it did not involve clearing in an intact wooded area.
- On December 15, 2014, Ms. Morrison recommended that the cutting regime for the giant reed control should allow for the function of the wetland to persist. It should allow for dense vegetation overall to be maintained at a certain height—the area should not be turned into lawn. Management of the giant reed should occur at a time of year that will suppress the giant reed and not spread its seed.

In addition to State Agency comments, a field review and comments were received from a retired Natural Resources Conservation Service (NRCS, Federal Agency under the U.S. Department of Agriculture). The comments are summarized below:

Ellen Sivret, retired NRCS employee visited the site on August 15, 2014

- Maintain and promote the native species on the site.
- Maintain and promote the regeneration of northern white cedar in the northwestern portion of the site.
- Consult with the County Forester regarding recommendations for riparian buffer plantings.
- Consult NRCS Riparian Forest Buffer Specification Guide Sheet and related guidance.

We note the many recommendations for a 50' or wider riparian buffer along the Stevens Branch, and for a 50' riparian buffer along the intermittent tributary. Buffers will be established and protected to the degree practicable in light of previous Land Use permit approvals.

RECOMMENDATIONS

In light of the site's existing environmental conditions, existing land uses, and the overall goals of the Vermont Granite Museum Director and Advisory Board, we make the following recommendations for projects to accomplish those goals. The projects are divided into the three categories of Maintenance, Low Impact Activities and More Significant Undertakings, based upon the amount of financial commitment and labor required.

Maintenance Activities

- Annual invasive species monitoring

Monitoring for invasive species should be accomplished annually. Training for monitoring is discussed in the Low Impact Activities section below.

Cost= \$100.00

- Annual stormwater system inspection

Annual stormwater inspections are required by the Stormwater Permit for the site.

Cost= \$312.00

- Re-certification of Stormwater Permit

Re-certification of the existing stormwater permit is required every five years. The next re-certification to be required for VGM is due Jan. 24, 2017.

Cost per re-certification= \$312.00

- Cleaning of bird boxes

Cleaning and repair of boxes to be accomplished by the end of February.

Cost= \$100.00 per year

- Sign maintenance

Annual maintenance of the granite welcome sign is not anticipated.

Annual maintenance of the interpretive signs could include straightening up if the support posts shift or applying fresh coats of protective finish.

Cost= \$100.00/year

- Mowing/Brush-hogging of the early successional field

Mowing/brush-hogging should be accomplished on a 5-year rotation in the areas indicated on the plan (approximately 0.8 acres). The purpose is to maintain the majority of the western portion of the site in an early successional vegetative community. This will maintain vegetative diversity on the site while still providing opportunities for passive recreation. It will also maintain visibility of the sculpture garden and path, which is important for both aesthetic reasons and for prevention of vandalism. Mowing should avoid patches of young trees considered desirable by the Vermont Granite Museum. Of particular interest to maintain is a stand of northern white cedar regeneration as shown on the Restoration Plan Overview.

Cost: \$800 per year.

- Semi-annual mowing within sculpture garden loop.

The area shown in blue on the plan (approximately 0.4 ac.) on the Restoration Plan Overview should be mowed semi-annually, (once cleared, see below) to maintain visibility/vandalism protection for the sculptures along the path, as well as to provide a smooth surface for recreational activities such as Frisbee.

Cost: \$376 per year.

- Annual clearing of River Access #1 and #2

Clearing of fallen trees and cutting of new growth should be accomplished annually to maintain the two river access paths. Clearly identifying and maintaining two river access points is intended to minimize multiple, unauthorized accesses.

River Access #1 is an existing informal footpath, but will require some initial work, discussed under Low Impact Activities, below. River Access #2 is an existing informal footpath used primarily for fishing. Minimal clearing will be required.

Cleared trees to be bucked up. All cleared materials to be left on-site.

Cost= \$488 per year.

Low Impact Activities

- Invasive species control
 - Giant reed control within the Class II wetland by a licensed herbicide applicator using a chemical control method, or by an invasive species control contractor using strictly manual cutting, is recommended. The control of the giant reed must ensure the maintenance of the existing native herb layer beneath the giant reed. The control must be addressed in a State of Vermont Individual Wetlands Permit application. The area of the main colony of giant reed is currently approximately 4,000 SF, and the area of additional scattered shoots to be controlled is approximately 10,000 SF.

The sizes of the areas to be controlled may change, depending on the timing of initiation of the control. Thus, costs are approximate, and should be confirmed with contractors immediately prior to treatment.

Chemical control of giant reed is best accomplished in late summer.

The cost for chemical initial control of a heavy infestation (e.g., the main colony) is \$950.00/acre. The cost for chemical initial control of a light infestation (e.g., the area of scattered shoots) is \$350.00/acre.

Follow-up chemical control in subsequent years is likely to be required, but would be less expensive. Actual cost to be determined by effectiveness of initial control.

Cost= \$350 for chemical initial control, \$150.00 for subsequent years.

Manual control of giant reed can be accomplished by repeated cuttings. This would require five days of control in 2015. Future years' control will depend upon the success of the initial control and specific site conditions, and is estimated at two days per year.

Cost= \$1,600 for initial manual control, \$730 for subsequent years' manual control.

- Japanese knotweed control is best accomplished in late summer, and can be accomplished by chemical or manual means. Knotweed propagules are transported by flood waters. Thus, populations may become established repeatedly, despite control efforts, and the amount of knotweed to be controlled in any one year must be determined by a site visit that year. Knotweed control has been accomplished previously on the site, and the amount of knotweed on the site in 2014 was minimal (less than 0.1 acre).

Chemical control can be accomplished for \$1,100.00/acre for a heavy infestation or \$400.00/acre for a light infestation.

Cost= \$110.00 for heavy infestation, \$40.00 for light infestation, for 0.1 acre.

Manual control assumes one day per year. Cost of miscellaneous items and reporting assumed to be included in giant reed control pricing.

Cost= \$300/year.

- Woody species control includes honeysuckle, Japanese barberry, common buckthorn, autumn olive and multi-flora rose. These can be controlled by chemical or manual methods. These species are scattered across the site in small numbers. The size of the combined populations is estimated at 0.2 acre for 2014.

Chemical control can be accomplished for these species for \$450.00/acre for heavy infestations or \$110.00 for light infestations. Control can be generally be accomplished in mid-June to late October, but in late July for cut stump applications for buckthorn.

Cost= \$90.00 for chemical control, assuming 0.2 acre of heavy infestation.

Manual control can be accomplished in one day for the initial control. Cost of miscellaneous items and reporting assumed to be included in giant reed control pricing.

Cost= \$300 for manual control, assuming 0.2 acre of heavy infestation.

The control contractor is to provide training to VGM staff for performance of annual monitoring, and control if practicable, following initial Contractor control. Total costs per year for subsequent control will depend upon success of initial control, site conditions that year, number of species controlled each year, number of visits required based upon best time of control. Mobilization costs (planning, travel) will be required for each visit in addition to the cost of actual control.

Control of scattered herbaceous invasives, such as knapweed, forget-me-not, wild phlox and yellow iris should be addressed by the Contractor during final cost-estimating.

- Vermont State Individual Wetland Permit Application

The application should treat all impacts to Class II wetland and buffer, including sculpture garden, granite blocks and invasive species control. The permit will likely include a requirement for five years of post-construction invasive species monitoring, control and reporting. Cost for Wetland Permit application preparation: \$1,500.00.

Cost for five-year monitoring and reporting= \$200.00/year.

- US Army Corps of Engineers Wetland Permit Application

The work within the wetland as currently proposed would total less than 3,000 square feet of impact, and would therefore qualify for a Vermont General Permit, Category 1.

Cost= \$94.00

- Clearing of River Access #1

Minimal clearing of a 50' path between the sculpture garden path and the river at Access #1 will improve the visibility into the access area and the safety of the visiting public, and will help to reduce unauthorized uses of the area. Clearing should focus on the removal of brush and low limbs to the extent practicable, and should avoid cutting of northern white cedar trees to the degree practicable. Cleared vegetation to be removed off-site or burned on-site.

Cost: \$800

- Wildlife enhancements

Three bluebird boxes to be placed as shown on the plan. Spacing between boxes to be at least 300'. Each box to be mounted on an 8' minimum length cedar post, with box bottom 4-6' above ground. Opening to be facing treeline and within 50' of a tree. Predator guards are recommended.

Cost per box= \$65.00 (\$40.00 for materials, \$25.00 labor to install)

- Riparian Buffer Plantings

The western portion of the site has an existing 50' vegetated riparian buffer, with a diversity of native trees and shrubs. Additional riparian buffer plantings are not required here, except for replanting where invasive species are removed. Such replanting should be at a rate of 200 plants (mix of trees and shrubs) per acre. Recommended species are early successional, and are species already found within the riparian buffer. Recommended tree species include red maple, grey birch, white birch, white pine, silver maple, cottonwood, balsam poplar and quaking aspen. Recommended shrub species include highbush cranberry, silky dogwood, red-osier dogwood and alder. Plants used should replicate those naturally occurring in the immediate area of the replanting to the degree possible, in an effort to match the species to localized field conditions.

The area to be replanted will depend upon the area of invasives removed. Plant material should be obtained from local nurseries if possible. The Intervale Center in Burlington, Vermont is highly recommended. Plants should be bare root stock, 4' tall. Costs are based upon NRCS per-stem guidelines, as follows: \$4.00 per stem, \$4.00 labor per stem.

Cost= \$1,600/acre

In the middle of the VGM property and along the Stevens Branch is an area centered on the proposed Overlook Picnic Area where riparian buffer planting is recommended. The area is approximately 340' long by 50' wide (0.4 acre) in size (see area outlined in yellow on the Restoration Plan Overview, Figure 4). It is currently very sparsely vegetated, due to harsh conditions associated with a granite waste substrate. Along the bank of the Stevens Branch, these harsh conditions are intensified by the steep, south-facing slope.

Because of the extremely poor soil conditions, the creation of planting pockets and addition of imported soil is recommended where possible. Along the steep bank, soil can be packed into existing crevices among the granite waste. On the plateau above the bank, planting pockets should be created by digging out 6" diameter X 6" depth holes in workable substrate, and backfilling with imported soil. If substrate is too impenetrable for hand preparation of planting pockets, mechanical methods (e.g., jack-hammering) may be required.

Because the vegetation is currently so sparse and competition from grasses is reduced, the recommended planting rate is 400 stems per acre. Because the water stress will be high and the amount of available soil low, small stock of 1' height is recommended. Recommended species are early successional species, and include several which are already present in the vicinity, to maximize the likelihood of success.

Recommended tree species include balsam poplar, white birch, grey birch, quaking aspen, disease-resistant elm, red maple and cottonwood. Recommended shrub species include native shrubby willows, sumac, alder, silky dogwood and red-osier dogwood. The VGM should determine placement of shrubs v. trees in light of competing goals of visual access to river (favoring shrubs) and development of riparian buffer with maximum environmental values (favoring mix of trees and shrubs).

Plant material should be obtained from local nurseries if possible. The Intervale Center in Burlington, Vermont is highly recommended. Plants should be bare root stock, 1' tall. Costs are based upon NRCS per-stem guidelines, as follows: \$1.00 per stem, \$4.00 labor per stem. In addition, one cubic yard of landscape backfill material will be required for the planting pockets, and additional labor will be required to dig and fill the pockets.

Cost= \$1,330 for hand-digging, \$1,885 with jack-hammering

- Overlook Picnic Area Interpretive Sign

An interpretive sign at the Overlook Picnic Area could enhance the visitors' experience by describing the historical context of the property. It could also promote public awareness and

appreciation of the land and waters by providing information on the site's natural history and resource management.

Cost= \$2,000

- Accessible path to Overlook Picnic Area

An accessible, crushed stone path from the sculpture garden path to the overlook is recommended.

Cost= \$750

- River Access #1 Interpretive Sign

An interpretive sign along the sculpture garden path at the beginning of River Access #1 would direct visitors to an attractive grove of northern white cedar trees and to a natural, wooded section of river corridor. If desired, the sign could also address the natural history of the site, such as native vegetation, wildlife and fish.

Cost= \$2,000

More Significant Undertakings

- Clearing, grubbing, seeding within sculpture garden loop.

The area shown in blue on the Resoration Plan Overview (approximately 0.4 acre) should be cleared and grubbed, smoothed, and then seeded and mulched with a conservation mix, to provide visibility/ vandalism protection for the sculptures along the path, as well as to provide a smooth surface for future mowing and for recreational activities such as Frisbee.

Cost: \$9,760

- Row of Access-Prevention Granite Blocks at northwestern entrance

A row of granite blocks is recommended along approximately 90 linear feet at the eastern and southern sides of the entrance to the parking lot to prevent vehicle access to the open land and sculpture garden path. Fifteen blocks are to be spaced three feet apart.

Cost= \$4,125

- Culvert replacement on intermittent stream

The existing 5'-wide culvert located on the intermittent stream and 500' downstream from Route 302 is undersized and obstructed. Given the contributing drainage area of 0.6 square mile, a 10' span would be more appropriate for sediment and debris passage as well as enhanced flood resiliency.

The channel could be effectively spanned with a 10'3" X 6'9" aluminum pipe arch culvert. The culvert should be recessed below the streambed by 2-3 feet to provide a natural channel bottom while still leaving adequate open area for flows and debris.

Alternatively, the stream could be spanned with a bridge. Benefits of using a bridge include a larger opening than a culvert would provide, and the opportunity to feature granite blocks in the structure. A cost-effective and durable bridge could be constructed using a pre-fabricated steel superstructure with a timber deck that rests on stacked concrete or granite block abutments.

Cost for culvert= \$15,000 to \$20,000

Cost for bridge= \$20,000

This stream crossing is within the 100-year floodplain, and so would require a City Flood Hazard Area Development Permit. Because the drainage area is greater than 0.5 square mile, it would also require a VT DEC Stream Alteration Permit.

Cost for Flood Hazard Permit application= \$800.00

Cost for Stream Alteration Permit application= \$400.00

- Dredge intermittent stream channel to keep Route 302 culvert open

The Route 302 culvert at the northern boundary of the VGM property has only 2-3 feet of vertical opening, due to the current streambed elevation at the railroad crossing. On-going sedimentation in the vicinity of this culvert is to be expected due to natural deposition associated with the change in gradient of the watershed, with steep slopes to the north of Route 302 and very gentle slopes on the VGM property floodplain. In order to keep the Route 302 culvert open, dredging will be needed in the downstream channel.

While some dredging of the channel was accomplished by the City of Barre in 2014, we recommend additional dredging. If the culvert discussed above is replaced, the 500' of channel between the Route 302 culvert and the downstream (VGM) culvert should be over-excavated and widened to create a localized deposition area. By accumulating sediment in this area and removing it as necessary, the impact of the dredging will be more limited in scope. Future dredging would be limited to within 100' of the Route 302 culvert, and would be likely to be needed every five years, depending upon the severity of storms.

Cost of one-time 500' of dredging= \$5,000

Cost of future 5-year recurrence dredging following culvert replacement= \$2,500 per dredging.

If the VGM culvert is not replaced, dredging of the channel within 100' of the Route 302 culvert should be accomplished bi-annually, again, depending on storm events.

Cost of bi-annual dredging= \$2,500 per dredging.

- Accessible path and river overlook

An accessible path from the Museum building driveway to an overlook at the top of the Stevens Branch bank is recommended to allow visitors to enjoy the natural as well as the cultural history of the site. See Figure 11, Plantings and Overlooks. Cost includes granite pavers, labor, crushed gravel for path. Three crabapples to help define the site are costed separately.

Cost= \$10,500 (pavers, labor, gravel)

Cost= \$1,362 (crabapples)

- Welcome Sign

A granite welcome sign at Jones Brothers Way is recommended. A design has been approved by the Act 250 permit.

Cost= \$5,000-10,000

- Plantings at northeastern end of property

- Planting of 10 disease-resistant elms, sugar maple, red maple and/or linden trees at northeastern corner of site and along Jones Brothers Way is recommended. Deciduous trees to be 2.75-3" caliper, 15' height, planted 75' on center. Planting of five large evergreen trees (5-6' height, white spruce and/or white pine recommended) at the terminus of the plantings in the northeastern corner of the site is also recommended.

Cost= \$9,560

- Plantings or granite blocks at northwestern end of property

- Planting of eight of disease-resistant elms, sugar maple, red maple and/or linden trees along the property line in the northwest corner is recommended. Plants to be 2.75-3" caliper, 15' height, planted 75' on center.

Cost = \$6,032

- Alternatively, granite blocks could be used to define the edge of the Museum property. The length of the row of blocks could be up to 500'. The spacing of the blocks, and associated cost, can be determined by the VGM. The cost per block for material, delivery and installation is \$275.00.

Cost= \$2,750 for 50' spacing, or \$5,500 for 25' spacing.

- Overlook/ Picnic Site development

This site is a natural location for an overlook/ picnic site. Dense granite waste substrate in this area has kept vegetation minimal. That, in combination with the height of land, produces a good view of the Stevens Branch and surrounding land. A granite picnic table and benches, granite post and chain fence, a landward-side row of area-defining granite blocks and a crushed gravel surface are recommended. See Plantings and Overlooks, Figure 11.

- 65' granite post and chain fence

To be installed along river edge of overlook picnic site.

Cost= \$1,300

- 80' row of granite blocks

Thirteen 2.5 cubic foot granite blocks to be installed in a semi-circle, with 3' spacing between blocks, along landward side of overlook picnic site.

Cost= \$3,575 (13 blocks X \$275/block for material, delivery and installation)

- Granite picnic table and benches

Cost = \$800

Additional Recommendations

An annual site visit by the Washington County Forester and the Friends of the Winooski River is recommended for maintenance guidance regarding the riparian areas.

On-going coordination with the Vermont Stream Alteration Engineer and the City of Barre is recommended in relation to work upstream of the VGM on the Stevens Branch and the unnamed tributary. Particular care should be directed towards the City's sewage facility on the opposite bank of the Stevens Branch from the VGM.

The stormwater infiltration basin at the parking area in the eastern part of the property should be maintained to ensure that water from the parking area continues to flow into it. Additional impervious surfaces would require an amendment to the existing Stormwater Permit.

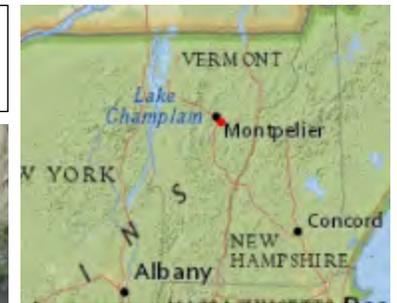
Soil testing is recommended as a supplement to the existing information on the site's soils, and could likely be accomplished by an NRCS soil scientist at no cost to the VGM.

The giant reed on the western portion of the site is said to have been brought in with fill of unknown origin. Tests for heavy metals and nutrients are recommended, especially in light of potential future

recreation on the site. The Vermont State laboratory might be willing to accomplish these tests at no cost to the VGM.

Coordination with the Vermont Rural Fire Protection Program is recommended. The Stevens Branch is located only 165' from the 25,000 square foot Vermont Granite Museum building, and could be a valuable resource for fire protection. Any access to the river for fire protection should be carefully evaluated to minimize impacts to resources such as the riparian buffer.

Figures



LEGEND

Town Boundary

1: 7,665
January 29, 2015



NOTES

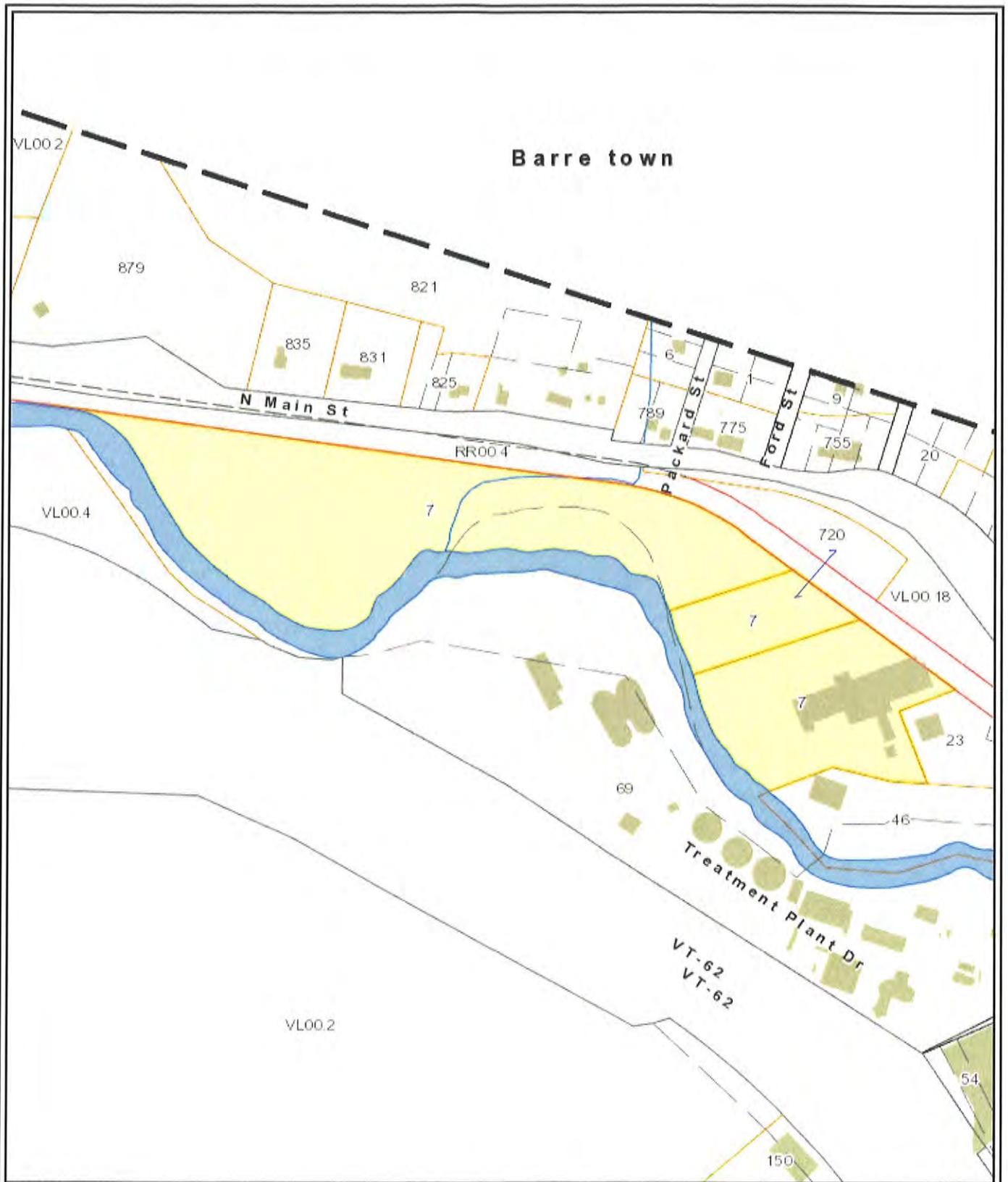
Map created using ANR's Natural Resources Atlas
VGM Location Map

Figure 1, NRA Location Map.

389.0 0 194.00 389.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 639 Ft. 1cm = 77 Meters
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Barre City, VT
 1 Inch = 287 Feet
 August 14, 2014

Figure 2, Tax map.



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www.cai-tech.com





Natural Resources Atlas

Vermont Agency of Natural Resources

vermont.gov



231.0 0 116.00 231.0 Meters
WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 380 Ft. 1cm = 46 Meters
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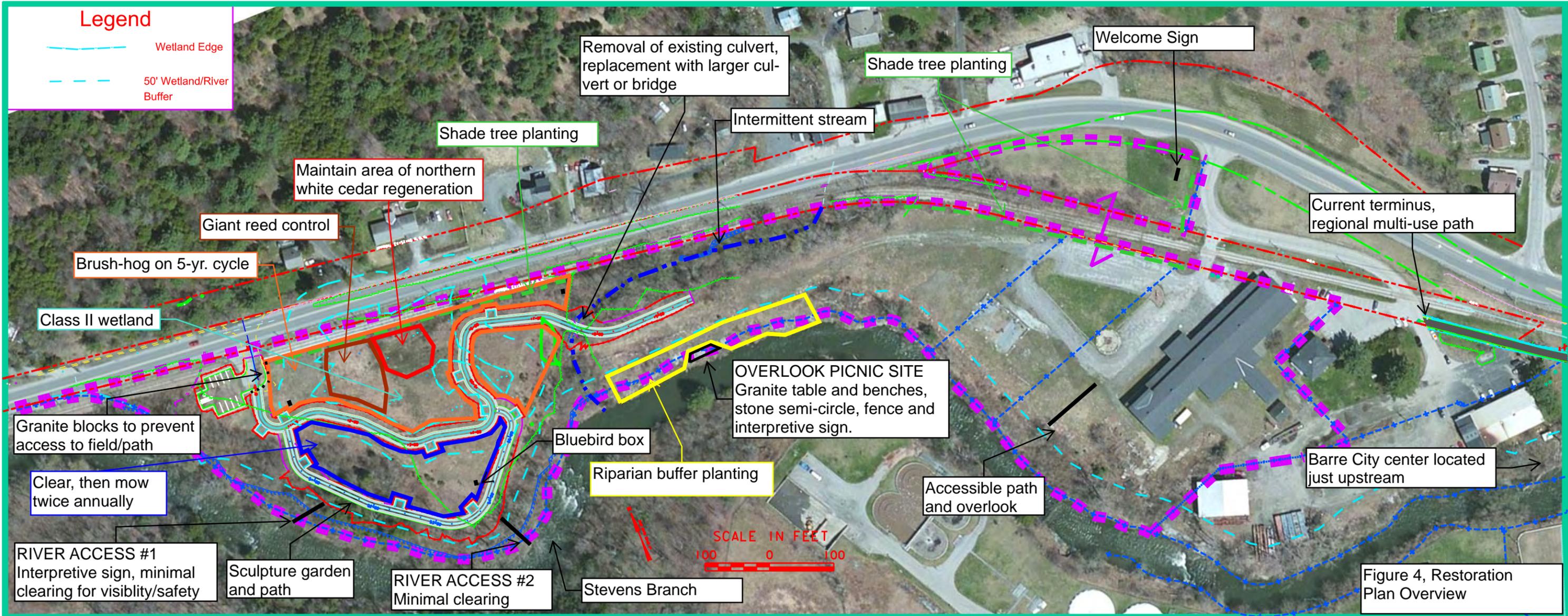
LEGEND

- Rare Threatened Endangered
 - Threatened or Endangered
 - Rare
- Significant Natural Community
 - Animal
 - Plant
 - Natural Community
- Uncommon Species and Other
- Deer Wintering Areas
- Natural Communities on ANR I
 - Acidic Riverside Outcrop
 - Alder Swamp
 - Alluvial Shrub Swamp
 - Alpine Meadow
 - Alpine Peatland
 - Beaver Wetland (Non-NC)
 - Black Spruce Swamp
 - Black Spruce Woodland Bog
 - Boreal Acidic Cliff
 - Boreal Calcareous Cliff
 - Boreal Outcrop
 - Boreal Talus Woodland
 - Butturbush Swamp
 - Calcareous Red Maple-Tamarack
 - Calcareous Riverside Outcrop
 - Calcareous Riverside Seep
 - Cattail Marsh

NOTES

Map created using ANR's Natural Resources Atlas

Figure 3, NRA natural resources.





TECHNICAL MEMORANDUM

(122650L)

Date: December 9, 2014
To: Charlotte Brodie
Subject: Vermont Granite Museum – Review of existing drainage & soils

On October 8, 2014, I visited the Vermont Granite Museum site in Barre, with the intent of reviewing the existing topography and drainage.

The site is bound by the railroad along the northern border, which serves as a drainage break for most of the property, preventing off-site runoff from Route 302 and areas further to the north from draining directly across the Museum's site. The southern boundary of the site is defined by the Stevens Branch. A small unnamed tributary runs parallel to the rail line near the middle portion of the site and then bisects the Museum property prior to its confluence with the Stevens Branch.

Drainage within the site is all overland flow; there are no closed drainage systems. While the southernmost portion of the property flows south and directly into the Stevens Branch, much of the site drains back toward the north. Stormwater will either infiltrate into the ground or flow overland to the Stevens Branch or the unnamed tributary. A general schematic of overall flow patterns is attached to this memo.

The existing 3.5 acres of impervious surfaces associated with the building, access drives, and parking areas on the site are covered by a State Stormwater Permit 5594-9010, effective January 24, 2012 (copy attached). This permit identifies two discharge points, each with a different treatment mechanism. The first discharge point covers the distributed, overland flow being conveyed to the Stevens Branch, with treatment provided in the vegetated buffer to Stevens Branch. The second discharge point is located in the center of the vegetated area within the parking area, which is an infiltration area that drains into a rock dry well. These treatment areas are also depicted on the attached schematic.

The soils on the property are characterized by the NRCS as being Urban land-Udipsammets complex, occasionally flooded, as shown on the attached soils map. On-site field observations confirm this description, with additional notes of granite blocks randomly protruding from the ground as a result of the historic dumping of waste granite on the site, both in large blocks and fine material.

**Figure 6, Drainage and
Soils Memo**



LEGEND

- Town Boundary

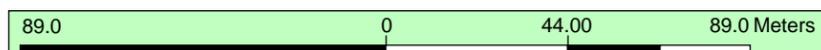
General Drainage Map and Stormwater Treatment Features from Permit 5594-9010

1: 1,750
1in = 146 ft.
1cm = 18 meters



NOTES

Map created using ANR's Natural Resources Atlas



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THIS MAP IS NOT TO BE USED FOR NAVIGATION

Permit Number 5594-9010
Project ID Number BR01-0264

VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION
AUTHORIZATION TO DISCHARGE UNDER
GENERAL PERMIT 3-9010

A determination has been made that the applicant:

Vermont Granite Museum of Barre
P.O. Box 282
Barre, VT 05641
(Impervious area: 3.5 acres)

meets the criteria necessary for inclusion under General Permit 3-9010. Hereinafter the named applicant shall be referred to as the permittee. Subject to the conditions of General Permit No. 3-9010, the permittee is authorized to discharge stormwater from the Vermont Granite Museum (VGM) of Barre located at 7 Jones Brother Way in Barre City, Vermont to the Stevens Branch as previously described and modified in Individual Permit No. 1-1524:

Manner of Discharge:

S/N 001: Stormwater runoff from the access road to the overflow parking area is conveyed via overland flow to the swale north of the VGM entrance and then discharges to Stevens Branch. Stormwater runoff from the parking area north of the Memorial Walkway and the drafting pad is conveyed via overland flow and thru a vegetated buffer to Stevens Branch. Stormwater runoff from the southern portion of the building and the parking area south of the VGM building is conveyed via overland flow and then through a vegetated buffer to Stevens Branch.

S/N 002: Stormwater runoff from the northern portion of the building, parking area and access loop located between the VGM building and the railroad tracks will be conveyed overland to an infiltration area and rock dry well inside the access loop with eventual discharge to groundwater in the Stevens Branch watershed.

Compliance with General Permit 3-9010 and this Authorization

The permittee shall comply with this authorization and all the terms and conditions of General Permit 3-9010, including the payment of annual operating fees to the Department. A billing statement for such fees will be sent to the permittee each year. The first year's statement is enclosed. Any permit non-compliance, including a failure to pay the annual operating fee, constitutes a violation of 10 V.S.A. Chapter 47 and may be grounds for an enforcement action or revocation of this authorization to discharge.

Transferability

This authorization to discharge is not transferable to any person except in compliance with Part VI.D. of General Permit 3-9010. A copy of General Permit 3-9010 is available from the Department via the internet at http://www.vtwaterquality.org/stormwater/htm/sw_3-9010.htm

Changes to Permitted Development

In accordance with Part V.G. of General Permit 3-9010, the permittee shall notify the Department of any planned development or facility expansions or changes that may result in new or increased stormwater discharges. The Department shall determine the appropriateness of continued inclusion under General Permit 3-9010 by the modified development or facility.

Annual Inspection and Report

The stormwater collection, treatment and control system authorized herein shall be properly operated and maintained. An inspection shall be conducted between the conclusion of spring snow melt and June 15th of each year. The inspection shall evaluate the operation and maintenance and condition of the stormwater collection, treatment and control system. The permittee shall prepare an annual inspection report on a form available from the Department. The permittee shall submit an inspection report to the Department by July 15th of each year or by July 30th if performed by a utility or municipality pursuant to a duly adopted stormwater management ordinance.

Restatement of Compliance

Every 5 years, the permittee shall submit to the Department a written statement signed by a designer that the stormwater collection, treatment and control system authorized herein is properly operating and maintained. The first re-statement of compliance is due January 24, 2017. Failure to submit a designer's restatement of compliance shall constitute a violation of General Permit 3-9010 and may result in the revocation of this authorization to discharge.

Recording in Land Use Records: The permittee shall record a one-page notice of issuance of this discharge permit in the local land records within fourteen (14) days of issuance of this authorization to discharge on the form provided by the Secretary, per §18-312 of Stormwater Management Rule. The permittee shall provide a copy of the recording to the Secretary within fourteen (14) days of the permittee's receipt of the copy of the recording from the local land records.

Rights to Appeal to the Environmental Court

Pursuant to 10 V.S.A. Chapter 220, any appeal of this decision must be filed with the clerk of the Environmental Court within 30 days of the date of the decision. The appellant must attach to the Notice of Appeal the entry fee of \$250.00, payable to the state of Vermont. The Notice of Appeal must specify the parties taking the appeal and the statutory provision under which each party claims party status; must designate the act or decision appealed from; must name the Environmental Court; and must be signed by the appellant or their attorney. In addition, the appeal must give the address or location

and description of the property, project or facility with which the appeal is concerned and the name of the applicant or any permit involved in the appeal. The appellant must also serve a copy of the Notice of Appeal in accordance with Rule 5(b)(4)(B) of the Vermont Rules for Environmental Court Proceedings. For further information, see the Vermont Rules for Environmental Court Proceedings, available on line at www.vermontjudiciary.org. The address for the Environmental Court is 2418 Airport Road, Suite 1, Barre, VT 05641 (Tel. # 802-828-1660).

Effective Date and Expiration Date of this Authorization

This authorization to discharge shall become effective on January 24, 2012 and shall continue until January 24, 2022. The permittee shall reapply for coverage at least sixty (60) days prior to January 24, 2022.

Dated at Winooski, VT this 24th day of January, 2012.

David K. Mears, Commissioner
Department of Environmental Conservation

By 
Padraic Monks, Stormwater Program Manager
Stormwater Management Program

**NOTICE OF ISSUANCE OF STORMWATER DISCHARGE PERMIT
BY THE VERMONT DEPARTMENT OF ENVIRONMENTAL
CONSERVATION**

Notice is hereby given that an individual stormwater discharge permit or an authorization to discharge pursuant to a general stormwater discharge permit has been issued by the Vermont Department of Environmental Conservation to Permittee(s) named herein for the discharge of stormwater runoff from impervious surfaces (e.g. roadways, rooftops, parking lots, walkways) pursuant to 10 V.S.A. Section 1264 for the property identified below. The permit/authorization requires treatment and control of stormwater runoff, long-term maintenance of the treatment and control structures and payment of yearly operational fees.

Permittee(s): _____

Permit/Authorization Number: _____

911 Address of Property: _____

Name of condominium, subdivision or planned community association (if applicable):

Signature of Permittee or Authorized Representative: _____

Printed Name of Permittee or Authorized Representative: _____

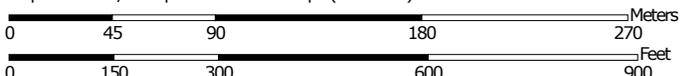
Date of Signature: _____

Recording information: Municipal clerks - please index this document listing the State of Vermont, Department of Environmental Conservation as "Grantee". Please index this document listing the above named Permittee(s) as "Grantor(s)". Additionally, if this notice lists the name of a condominium, subdivision or planned community association, please list the named association as an additional "Grantor".

Soil Map—Washington County, Vermont
(Vermont Granite Museum site)



Map Scale: 1:3,280 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Washington County, Vermont
Survey Area Data: Version 17, Sep 24, 2014

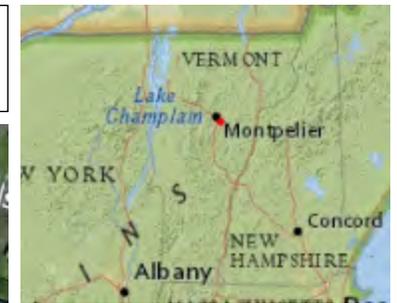
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 1, 2011—Sep 26, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Washington County, Vermont (VT023)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
17B	Cabot silt loam, 3 to 8 percent slopes	0.8	1.8%
18C	Cabot silt loam, 8 to 15 percent slopes, very stony	6.6	14.2%
55B	Nicholville silt loam, 3 to 8 percent slopes	4.4	9.4%
66C	Vershire-Dummerston complex, 8 to 15 percent slopes, rocky	5.4	11.7%
67E	Glover-Vershire complex, 35 to 60 percent slopes, very rocky	0.5	1.0%
92D	Buckland loam, 15 to 25 percent slopes	8.3	17.9%
104	Urban land-Udipsamments complex, occasionally flooded	18.3	39.4%
W	Water	2.1	4.6%
Totals for Area of Interest		46.4	100.0%



LEGEND

- DFIRM Panels
- DFIRM PRELIMINARY Panels
- DFIRM Floodways

Special Flood Hazard Areas (A Counties)

- AE (1-percent annual chance flood)
- A (1-percent annual chance floodpl)
- AO (1-percent annual chance zone feet)
- 0.2-percent annual chance flood ha
- Town Boundary

1: 3,832
January 28, 2015

NOTES

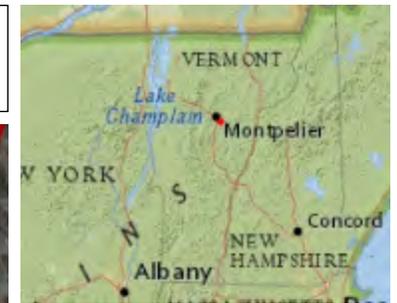
Map created using ANR's Natural Resources Atlas; Floodway and Floodplain

195.0 0 98.00 195.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 319 Ft. 1cm = 38 Meters
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Figure 7, Floodway and Floodplain



LEGEND

- Parcels (where available)
- Town Boundary

NOTES

Map created using ANR's Natural Resources Atlas

Figure 8, County Forester Recommendations.

124.0 0 62.00 124.0 Meters

WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 204 Ft. 1cm = 24 Meters
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1: 2,448
December 2, 2014

SPECIFICATION GUIDE SHEET
for Riparian Forest Buffer (391)

SCOPE:

This work will consist of establishing adapted and compatible native trees and shrubs adjacent to and up gradient from watercourses or waterbodies. The purpose for this practice may include creating shade to improve aquatic habitat, provide riparian habitat, provide for a source of detritus and large woody debris, reduce excess sediment and other pollutants in surface and shallow groundwater, reduce pesticide drift, restore riparian plant communities, and increase carbon storage.

GENERAL SPECIFICATIONS APPLICABLE TO ALL PURPOSES

To be able to plan for the restoration of a riparian area one must understand what its functions are and where it lies in the landscape. A good definition defines the **riparian area** as “the aquatic ecosystem and the portions of the adjacent terrestrial ecosystem that directly affect or are affected by the aquatic environment. This includes streams, rivers, lakes, and bays and their adjacent side channels, flood plain, and wetlands. In specific cases, the riparian area may also include a portion of the hillslope that directly serves as streamside habitats for wildlife.”

The Three Zone System

A three-zone system has been developed to help plan riparian forest buffers. This three-zone concept is intended to be flexible in order to achieve both resource protection and landowner objectives.

All buffers, as a minimum, will consist of Management Zones 1 and 2. The minimum width of these combined 2 zones, for all purposes, is 35 feet. Wider buffers are encouraged and may be required depending on the purpose. Wider buffers will provide more functions and values than narrow strips. Forested buffers that will connect two or more forested patches are considered corridors for wildlife. Minimum widths for travel corridors for wildlife are 50 feet where it is an identified objective of the practice.

Zone 1

This zone begins at top of bank and will contain trees and shrubs needed to provide aquatic shade, bank stability, detritus, large woody debris, and retain nutrients bound to soils. Large woody debris and tree roots in the water create habitat complexity and niches for invertebrates and aquatic organisms. Detritus such as leaves, twigs and fruit seeds

entering the water and held by woody debris provide a base to the aquatic food chain.

Zone 1 is most subject to inundation. Species with the greatest tolerance to these conditions are listed in VT Forestry Technical Note 2 – VT Tree and Shrubs for Conservation. Silver maple, black willow, boxelder, alder, dogwood, and eastern cottonwood have evolved in and are best suited for these conditions in most locations throughout Vermont floodplains. Silver maple floodplain forests and alluvial shrub swamps are two natural community types that are commonly the target for restoration with this practice. The fast growth rate and brittle habit of these species withstand the periodic trauma of heavy floods. Instead of washing away and exposing unstabilized banks, these species shed branches, regrowing from the remaining trunk. Because of their fast growth rate, they are established relatively easily and rapidly reach canopy closure. These species facilitate the important goal of stream shading and promote establishment of the riparian forest buffer.

The minimum width for this zone for all purposes is 15 feet from top of bank.

Zone 2

This zone is landward of Zone 1 and will contain the trees and shrubs and other vegetation needed to filter runoff and provide uptake of nutrients and pollutants. Together, Zone 1 and 2 will provide a travel corridor and habitat for wildlife in addition to providing shade and a source of woody debris.

Zone 2 can include commercially viable canopy species such as red oak and sugar maple where site conditions permit; areas with high terraces and drier conditions. More flood and wet soil tolerant species, similar to Zone 1, will likely be necessary in Zone 2 depending on the natural community and soil moisture. Generally, for most buffers being planned and implemented in Vermont, Zone 2 is functionally an extension of Zone 1. Except in very wide buffers or near abrupt slope breaks, the species used for both zones will be essentially the same. An understory of shrubs will provide additional shade and structure to Zone 2. Where shading needs for the water body are met, the transition from Zone 2 to 3 can be planted with early successional species such as elderberry, dogwoods, and viburnums to limit the encroachment of invasive plants into Zone 2 and to provide a soft edge between the grass and forest

habitats. **The minimum width for this zone for all purposes is 20 feet.**

Zone 3

This zone is landward of Zone 2 and consists of a strip of grass or herbaceous cover to spread, slow and filter runoff which may be transporting sediment, nutrients, and pesticides off cropland or other erosive areas. **The minimum width for this zone, where necessary, is 15 feet.**

Additional Specifications to Reduce Excess Amounts of Sediment, Organic Material, Nutrients and Pesticides in Surface Runoff and Reduce Excess Nutrients and Other Chemicals in Shallow Ground Water Flow

The riparian forest buffer will consist of Zones 1, 2 and, in some cases, Zone 3. Establishment of Zone 3 filter area will be required where there is sheet flow from cropland toward the forest buffer and stream. A hundred foot buffer has been shown to provide even greater water quality benefits and may be necessary depending on site conditions.

Fast growing species with high nutrient uptake potential should be favored for Zone 2. Zone 2 width will be expanded beyond the 20 foot minimum where necessary to capture excess nutrients, accommodate topography (slope) of the site and or accommodate stream adjustment processes (see Unstable River Channels section).

Where Zone 3 is required, the total combined buffer width shall be no less than 50 feet. Zone 3 will be established and managed according to the Filter Strip Specification Sheet 393.

Unstable River Channels

Planning buffers on unstable river channels requires a greater level of analysis. Many rivers in Vermont are undergoing adjustments due to past and current alterations and managements. Establishing a riparian forest buffer must account for the nature of these systems and for the extent of adjustment and change that could be expected. This will require using geomorphic assessment data and consultations with river scientists or other resource professionals. This consultation will help verify the form and extent of the instability.

Where an unstable channel exists on a project area and where Phase 1 assessments have been completed, use the defined river corridor from the

internet based **River Management Stream Geomorphic Assessment Data Viewer** (Mapserve) as the potential foot print of the buffer area which may be refined with site visits. The corridor is intended to include the area that will allow for stream equilibrium condition to develop and stabilize over the long term.

Where there is no phase 1 data, a river corridor can be defined using the belt-width approach. See the DEC River Management 'Defining River Corridors Fact Sheet.' Adding an additional channel width on each side of the stream belt-width will approximate the river corridor for planning purposes.

Plantings should be set back from the top of bank and eroding channel commensurate with the rate of erosion. Bioengineering using stakes and wattles may help to slow the rate of erosion and aid in woody establishment on the buffer.

Additional Specifications to Maintain or Restore Water Temperatures and Provide Large Woody Debris

The riparian forest buffer will consist of Zones 1 and 2 and the total combined width will be a minimum of 35 feet. Zone 1 will be planted to fast growing, tall species that will quickly address the lack of shading and provide large woody debris. Canopy density should be kept at least at 80 percent coverage. Maximum shading ability is reached within a width of 80 feet, with 90 percent of the maximum reached within 55 feet.

Large woody debris (>4 inch diameter) usually originates within 60 feet of the stream. Ideally, streams supporting fish should have 75 to 200 pieces of large woody debris per stream mile.

Additional Specifications to Provide Fish and Wildlife Habitat

The riparian forest buffer will consist of Zones 1 and 2 and the total combined buffer width shall be no less than 50 feet. This will require that Zone two be expanded beyond the minimum to 35 feet. Zone 3 will be used in addition to Zones 1 and 2 where excess nutrients, sediments, etc. are also a concern. Buffers more 100 feet wide or more are recommended as they provide the most fish and wildlife habitat value. See Table 1 for more information about species or groups and buffer requirements. Design buffers to meet or exceed the minimum requirements of local species of concern.

Design buffers to connect upland habitats and wetlands if possible. Numerous species that use aquatic and riparian/wetland habitats will also use upland habitats at some point of their life cycle (e.g. wood turtle).

Planting Plan

The planting plan will be recorded on the approved VT NRCS 391 Job Sheet and will include the natural community type, species and sizes, numbers to be planted for the restoration, spacing, specifications for protection if applicable, and any associated bioengineering that will compliment the tree and shrub establishment. A pre-planting meeting will be held on site with the planters to ensure that the planting plan is properly followed based upon the site conditions.

Riparian forest buffers will be designed to meet the intended purpose of the practice and will also mimic natural plant communities native to the site. Locally developed, native Vermont plant materials or seeds should be considered for planting. See VT Forestry Technical Note 2 – VT Trees and Shrubs for Conservation for more information. Do not order or plant species developed outside of Vermont which are uncommon or rare in the State. This will maintain the genetic integrity of this species in Vermont. Plant a minimum of 5 species of trees and or shrubs for each site. For specifications on tree and shrub planting see Tree and Shrub Establishment (612) Specification Guide Sheet.

Determining Natural Plant Community

Various tools are available to assist in determining the natural community type and species typical of a specific site. The primary reference for determining natural community and species composition is Wetland Woodland Wildland – A Guide to the Natural Communities of Vermont. The companion reference is the Vermont NRCS Soil Series of Vermont and their associated Natural Communities found within section IIA of the electronic Field Office Technical Guide (eFOTG).

Steps: For a given site, the planner may determine the soil series from the County Soil Survey or onsite review. Next, refer to the Soil Series Natural Community guide and find the soil series; read across the table to find the natural community typical of that soil series. Refer to Wetlands Woodlands Wildland for more information about the natural communities including tree and shrub species.

It is also important for the planner to evaluate nearby plant communities on similar site conditions to determine what is appropriate or typical for the specific site. There may be inclusions of other non-forested communities such as emergent shallow marsh or sedge meadows which may provide good habitat diversity in concert with the forested areas. These naturally open communities should not be planted to trees without consideration.

Finally, the planting plan will also need to account for the availability of plant materials. Some species are difficult to grow locally and may be better established through natural regeneration on site.

Note: Be aware of local potential pathogens or pests known to be associated with plant materials that may be ordered from outside Vermont. For example, hemlock should generally not be imported due to wooly adelgid concerns.

Site Planning

Once the appropriate natural community and species are determined for the site, it is important to have a planting plan that specifies how and where different species will be planted based upon site conditions. It is not a good practice to indiscriminately plant species, regardless of habit, across the entire buffer area unless site conditions are uniform. There may be a good amount of variability in soil moisture, herbaceous vegetation height, and topography across this buffer area that should be planned for in the planting plan. For example, if there is a low floodplain or depressions within the buffer area, the planner will need to specify that species adapted to wet soils and inundation be planted in these locations and more upland species at the higher sites. Live stakes and wattles may be a good alternative to tree planting in very wet sites that are frequently flooded. This specific planting information should be made clear to the contracted planters at the pre-planting meeting on site. For information about tree species habits and characteristics and species suitable for bioengineering refer to VT Forestry Technical Note 2 – VT Trees and Shrubs for Conservation and the Tree and Shrub Establishment (612) Specification Guide Sheet.

Natural Regeneration

Natural regeneration can be a cost effective way to allow riparian forest buffer establishment and plant succession to occur on site. It is a slower process than planting but it is one that will select the most suitable species for the site and there is no concern about origins of the growing stock. However, it may not provide uniform stem density and closed canopy coverage for the site in as short a period of time as planting.

Determine if natural regeneration can successfully meet the purpose of the riparian forest buffer. If closed canopy conditions throughout the entire buffer area are required in a short period of time; then natural regeneration may not be the best choice. Recognize that natural regeneration has limitations and that certain buffer functions such as shading, nutrient uptake, habitat corridors, natural communities may need to be met with a planted buffer.

The first step in determining if natural regeneration will meet the purpose of the buffer is to determine how many stems per acre and what species are currently present. This can be done by using the Systematic Line Plot Cruise developed by the Maryland Department of Natural Resources Forest Service or other methods. For detailed description of this process see VT Forestry Technical 1 – Stems per Acre Line Plot.

Natural Regeneration Specifications

Where other buffer functions have been accounted for within the zones, then 150 existing woody stems per acre on site will be considered an established riparian forest buffer. Invasive plants will not be included in this count. This number of stems will approximate the number of stems that are expected to survive from a minimum planting of 200 stems per acre (see Plant Spacing and Density). Generally 75% survival is expected for a planted riparian forest buffer.

Once woody stems have been established it should lead to further regeneration through changes in the site condition (shading favoring trees and shrubs), seed dispersal by birds and mammals and root suckering. This additional regeneration will meet or exceed stems/acre on many planted buffers in Vermont.

Pay careful attention to Zone 1 of the Buffer when considering using natural regeneration instead of planting. This is a critical zone for development of

favorable aquatic habitat and conditions. There should be very good evidence of natural regeneration in this Zone. Where there is not, plant accordingly even if the minimum numbers of stems per acre are present.

When considering potential establishment through natural regeneration, consider the site conditions and potential for establishment. Dense sod will likely need to be harrowed while idle crop fields or pastures may be well suited. Often pastures have some woody component that has been suppressed.

Consider the surrounding riparian areas or forest areas for seed sources. Natural regeneration is not a good option if the buffer area is surrounded by agricultural land with no favorable seed sources or potential for vegetative reproduction. Where there are perches for birds (e.g. fence posts, trees on site, etc.) there is a better likelihood of colonization for some woody species; in particular, shrubs whose fruits are fed upon by birds will be seeded into these areas.

When planning for natural regeneration to occur in the buffer, consider mode of dispersal, distance between seed source and target area, seed source strength (number and size of mature seed bearing specimens) and seed size. Generally, heavy seeded species will disperse short distances (one study found 150 feet or less) while wind and bird dispersed seeds may travel greater distances (same study found 450 feet or less). Obviously all seeds can travel greater distances but the probabilities are less. See Tree and Shrub Establishment Specification Sheet 612 (Table 1) for examples of seed sizes and dispersal mechanisms for various trees and shrubs.

Wind and bird dispersed seeds will be most likely to colonize a site with some stems present. Where there are no perching sites in a buffer, wind dispersed seeds will be the primary form of regeneration. Heavy seeded species such as oak and hickory will take longer to naturally establish; particularly over longer distances. Consider planting species such as oak and hickory in regenerating buffers to aid in establishment where they are a component of the targeted natural community.

Buffers that are not planted may persist in an early successional state for decades. This may provide good habitat for certain species of concern in the Northeast (e.g. shrubland birds) but it can also provide favorable conditions for invasive plants such as buckthorn and honeysuckle. Monitoring is important to prevent their initial establishment.

Plant Spacing and Density

In mature riparian floodplain forests, canopy tree stem density is roughly 150 stems per acre, indicating a tree spacing of 16 to 18 feet. Conversely, in an alluvial shrub swamp there may be thousands of stems per acre. Determine what plant spacing and density best meets the purpose of the buffer and best matches the natural community. It is likely that in many cases it is not feasible to plant to meet the natural condition stems per acre in some shrub natural communities so the goal should be to plant in a manner that will allow for succession to this natural community condition.

Initial plant to plant densities for trees and shrubs will depend on their potential height at 20 years of age. Riparian forest buffers are expected to reach crown closure at 10-20 years when stocked at the minimal level of 200 tall trees an acre (greater than 25 feet). Heights may be estimated based on:

- Performance of the individual species (or comparable species) in nearby areas on similar sites.
- Predetermined and documented heights from VT Forestry Technical Note 1 – VT Trees and Shrubs for Conservation.

When establishing a new planted buffer, a minimum of two staggered rows of trees and or shrubs will be established along the water body. Generally this will be within Zone 1. Favor species that will provide shading in a short amount of time. See VT Forestry Technical Note 2 – VT Trees and Shrubs for Conservation.

Planting density should be higher than the final stem density desired, to allow for losses due to competition, stress, and animal damage. Generally, 75% is the expected survival rate for planted buffers. For a floodplain forest, a minimum of 200 plants are needed to be planted per acre to ensure 150 stems per acre. Natural regeneration is also expected to contribute trees and shrubs. In a study in Maryland of 130 buffer sites, 36% of total stocking of woody species was from natural regeneration.

Plant Types/ Community	Plants per Acre	Plant-to-Plant Spacing (Feet)
Shrub Community – shrub dominated, mostly shrubs	450 to 300	10 to 12
Forest Community – tree dominated, mix of trees and shrubs	300 to 200	12 to 15

Plant a mix of trees and shrubs to add habitat value; even when planting the minimum 200 stems per acre. When planting the minimum number of trees and shrubs together in a forest community, do not exceed 25% shrubs in the planting plan. Except in narrow buffers (35-50 feet), it is unlikely necessary to have tall trees for shading on the entire buffer. Adding shrubs to the planting will provide a successional component and important habitat value for wildlife. Adding vertical strata (shrub layer) to the vegetative community will increase the available niches to be used by more species of wildlife. For buffers greater than 50 feet, up to 25% of the buffer area may be left open and intermixed with planting areas. This approach would work well with planting clumps of shrubs. Individual open areas should not exceed 1/10 acre in size. Species of concern such as wood turtles will use open areas for foraging or basking; particularly in or near alluvial shrub swamps.

Establishment Period

The riparian forest buffer will be considered established when 75% of the planted trees and shrubs are alive after 2 growing seasons. If, after 2 growing seasons, there are less than 75% live planted trees on site and natural regeneration has not made up the loss of stems, then re-planting will be necessary.

For Natural Regeneration, assuming other buffer purposes have been accounted for, then 150 existing woody stems per acre on site will be considered an established riparian forest buffer. No additional planting will be necessary unless specified by the planner.

Planting trees and shrubs is not required in all cases where existing stem density is less than 150 per acre. Sites that have evidence of regeneration, where there is a high likelihood of attaining the minimum 150 stems per acre in two growing seasons do not require planting. For instance, a crop field that has initial establishment of silver maple seedlings (not required density) adjacent to mature silver maples will likely exceed the minimum 150 stems per acre through natural regeneration in two growing seasons simply by stopping tillage and herbicide application. Also, a heavily grazed pasture with a 100 native woody stems per acre may easily reach 150 stems per acre in two growing seasons simply by removing livestock. If, after 2 growing seasons, there are less than 150 live native woody stems per acre on site then planting will be necessary.

Direct Seeding Guidelines

Refer to Tree and Shrub Establishment (612) Specification Guide Sheet for information regarding direct seeding. Plant enough seeds to reach the desired stems per acre. Be aware that mortality is generally much higher when direct seeding.

Site Preparation/Weed Control for Buffer Establishment

Refer to Tree and Shrub Establishment (612) Specification Guide Sheet for information regarding site preparation and weed control.

Planting Dates

Refer to Tree and Shrub Establishment (612) Specification Guide Sheet for information regarding planting dates for seeds, seedlings, cuttings and larger planting stock.

Planting Requirements/Techniques

Refer to Tree and Shrub Establishment (612) Specification Guide Sheet for information regarding planting requirements and techniques.

Plant Protection

Refer to Tree and Shrub Establishment (612) Specification Guide Sheet for information regarding protection for planting stock.

REFERENCES:

Buffers for Habitat - Riparian Buffers for the Connecticut River Watershed Fact Sheet Number 4 1998. Connecticut River Joint Commission (CRJC). <http://www.crjc.org/riparianbuffers.htm>

Buffer Maintenance and Monitoring. 2004. Alliance for the Chesapeake Bay. <http://www.acb-online.org/pubs.cfm>

Chesapeake Bay riparian handbook: a guide for establishing and maintaining riparian forest buffers. 1997. Palone, R.S. and A.H. Todd (editors.) USDA Forest Service. NA-TP-02-97. Radnor, PA.

Riparian Buffers and Corridors – Technical Papers. 2005. VT Agency of Natural Resources.

Riparian Forest Buffers - Function and Design for Protection and Enhancement of Water Resources, NA-PR-07-91. 1991 David J. Welsch. USDA Forest Service, Northeastern Area State and Private Forestry, St. Paul, MN. http://www.na.fs.fed.us/spfo/pubs/n_resource/buffer/cover.htm

Riparian Forest Buffer Success and Survival in Maryland. 2001. Maryland DNR Forest Service. Research Report DNR/FS-01-01.

Tree dispersal among forest fragments: II – Dispersal abilities and biogeographical controls. 2002. Nina Hewitt and Martin Kellman. Journal of Biogeography, 29:351-363.

Table 1. Riparian Forest Buffer Widths for Fish and Wildlife

SPECIES	DESIRED WIDTH (in feet)
Wildlife dependent on wetlands or watercourses	30-600'
Bald eagle, nesting heron, cavity nesting ducks	600
Pileated woodpecker	450
Beaver, dabbling ducks, mink	300
Bobcat, red fox, fisher, otter, muskrat	330
Amphibians and reptiles	100-330
Belted kingfisher	100-200
 Songbirds	 40-660
Scarlet tanager, American redstart, rufous-sided towhee	660
Brown thrasher, hairy woodpecker, red-eyed vireo	130
Blue jay, black capped chickadee, downy woodpecker	50
Cardinal	40
 Cold water fisheries	 100-300

Source - Connecticut River Joint Commission (CRJC) Buffers for Habitat - in the series *Riparian Buffers for the Connecticut River Watershed*

Table 2. Natural Community types associated with rivers and lakes.

Open Upland Shores	Open Wet Shores	Marshes and Sedge Meadows	Shrub Swamps	Floodplain Forests and Swamps
Riverside Outcrop	Outwash Plain Pondshore	Shallow Emergent Marsh	Alluvial Shrub Swamp	Lakeside Floodplain Forest
Erosional River Bluff	River Mud Shore	Sedge Meadow	Sweet Gale Shoreline Swamp	Red or Silver Maple-Green Ash Swamp
Lake Shale or Cobble Beach	River Sand or Gravel Shore	Cattail Marsh		Red Maple-Northern White Cedar Swamp
Lake Sand Beach	River Cobble Shore	Deep Broadleaf Marsh		Silver Maple-Ostrich Fern Riverine Floodplain Forest
Sand Dune	Calcareous Riverside Seep	Wild Rice Marsh		Silver Maple-Sensitive Fern Riverine Floodplain Forest
	Rivershore Grassland	Deep Bulrush Marsh		Sugar Maple-Ostrich Fern Riverine Floodplain Forest
	Lakeshore Grassland			

Source – Riparian Buffers and Corridors – VTANR

Table 3.
Number of Trees per Acre by Various Methods of Spacing

Spacing (feet)	Trees (number)	Spacing (feet)	Trees (number)	Spacing (feet)	Trees (number)
2x2	10,890	7x9	691	12x15	242
3x3	4,840	7x10	622	12x18	202
4x4	2,722	7x12	519	12x20	182
4x5	2,178	7x15	415	12x25	145
4x6	1,815	8x8	681	13x13	258
4x7	1,556	8x9	605	13x15	223
4x8	1,361	8x10	544	13x20	168
4x9	1,210	8x12	454	13x25	134
4x10	1,089	8x15	363	14x14	222
5x5	1,742	8x25	218	14x15	207
5x6	1,452	9x9	538	14x20	156
5x7	1,245	9x10	484	14x25	124
5x8	1,089	9x12	403	15x15	194
5x9	968	9x15	323	15x20	145
5x10	871	10x10	436	15x25	116
6x6	1,210	10x12	363	16x16	170
6x7	1,037	10x15	290	16x20	136
6x8	908	10x18	242	16x25	109
6x9	807	11x11	360	18x18	134
6x10	726	11x12	330	18x20	121
6x12	605	11x15	264	18x25	97
6x15	484	11x20	198	20x20	109
7x7	889	11x25	158	20x25	87
7x8	778	12x12	302	25x25	70

Source - Chesapeake Bay riparian handbook

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Roxbury, Vermont 05669
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Figure 1. Previously filled area with degraded buffer



Figure 2. Unnamed tributary stream crossing

**Figure 10, VT F&W
Fisheries Comments**



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Figure 3. Proposed fire engine access



Figure 4. Area of vegetation clearing



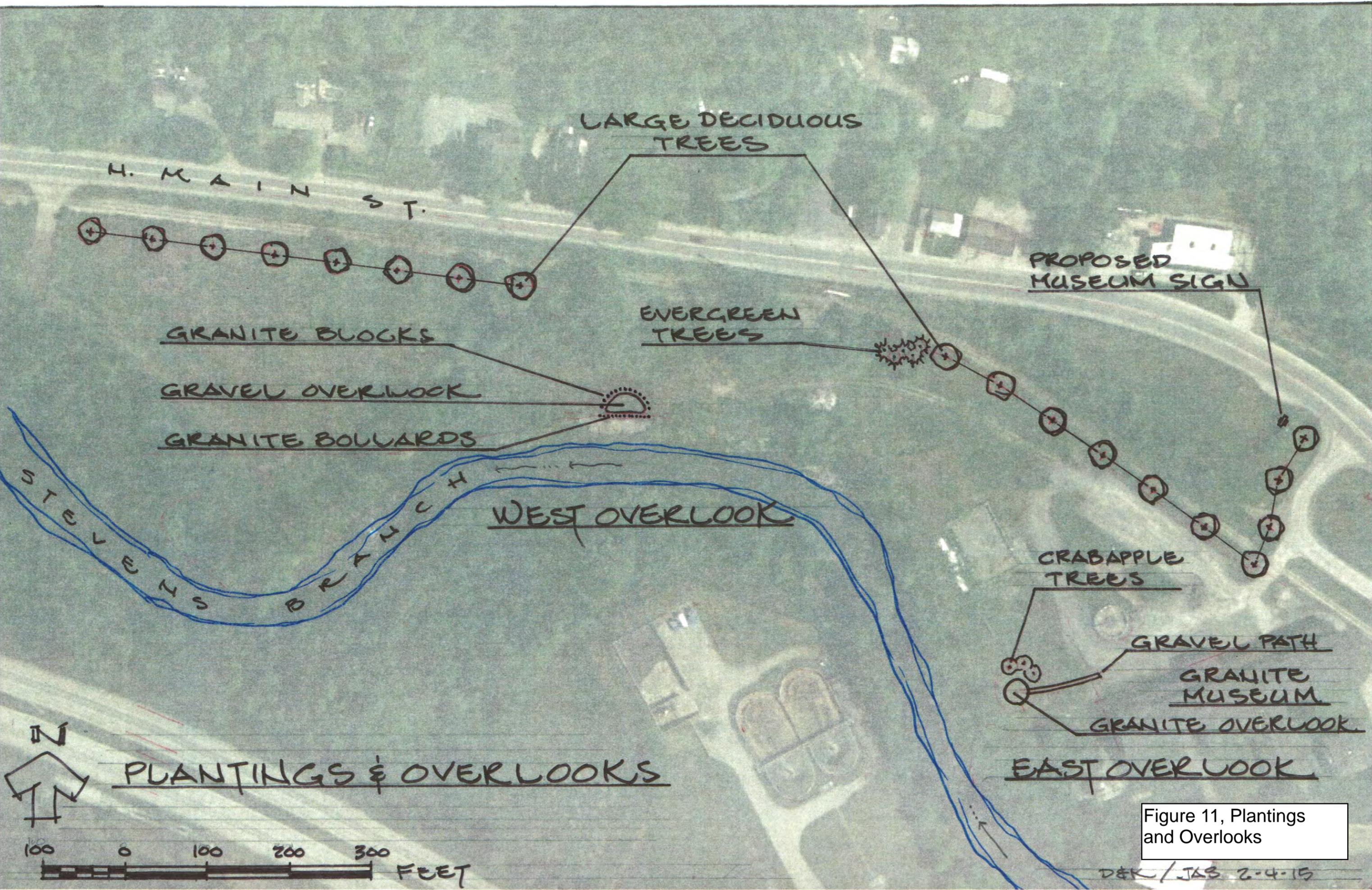


Figure 11, Plantings and Overlooks

D&K / JAS 2-4-15

Appendix A



Charlotte Brodie <cbrodie@dubois-king.com>

RE: VT Granite Museum

Singleton, Dan <Dan.Singleton@state.vt.us>
To: Patricia Meriam <agelessp@charter.net>
Cc: Charlotte Brodie <cbrodie@dubois-king.com>

Tue, Dec 2, 2014 at 2:45 PM

Patty,

Here are my notes from our visit.

In the Yellow area (see map) I would recommend that the invasive plants continue to be managed against. Keeping these populations under control will ensure the success of native vegetation in the area. If the funding and desire is there, after the invasive treatment has been conducted in an area, supplemental planting of desired species could increase success of the invasive treatment (I would look to friends of the Winooski or other conservation groups for assistance). Other than that I don't see the need for any other vegetative management in that area. Trees that are established seem healthy and seem to meet the needs of the landowner.

In the Blue area I would recommend mowing every few years after Aug 1st to maintain the area in a shrubland type habitat. Within the area some islands of small trees would remain for structure and aesthetic appeal. Also within this area I would encourage invasive plant management as well.

Lastly, I would strongly recommend looking into any sort of funding that may help remove the existing culvert and replace it with a pedestrian bridge. The current structure is quite undersized and will be a maintenance issue in the future for BGM.

Please let me know if you need anything else or something more elaborate.

Dan

From: Patricia Meriam [<mailto:agelessp@charter.net>]
Sent: Wednesday, November 05, 2014 2:05 PM
To: Singleton, Dan
Subject: VT Granite Museum

Dan,

I am writing to invite you to do a site visit at the museum property. Charlotte Brodie said you would be willing to give her notes on our early succession areas.

Please give me a call to schedule h 476-4275, c 793-5964

2/3/2015

DuBois & King, Inc. Mail - RE: VT Granite Museum

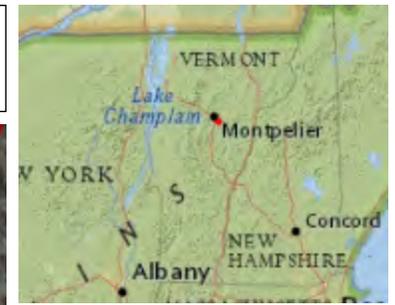
Patty Meriam

Board Chair, VGM/SAS



BGM Map.pdf

657K



LEGEND

- Parcels (where available)
- Town Boundary

NOTES

Map created using ANR's Natural Resources Atlas
County Forester Recommendations.

124.0 0 62.00 124.0 Meters
WGS_1984_Web_Mercator_Auxiliary_Sphere 1" = 204 Ft. 1cm = 24 Meters
© Vermont Agency of Natural Resources THIS MAP IS NOT TO BE USED FOR NAVIGATION

DISCLAIMER: This map is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. ANR and the State of Vermont make no representations of any kind, including but not limited to, the warranties of merchantability, or fitness for a particular use, nor are any such warranties to be implied with respect to the data on this map.

1: 2,448
December 2, 2014



Charlotte Brodie <cbrodie@dubois-king.com>

RE: Vermont Granite Museum, Barre; VTFW comments

Ladago, Bret <Bret.Ladago@state.vt.us>

Fri, Oct 24, 2014 at 10:46 AM

To: Charlotte Brodie <cbrodie@dubois-king.com>

Cc: Patricia Meriam <agelessp@charter.net>, Ann Smith <ann@winooskiriver.org>

Good morning,

I have attached comments following a site visit last month. Please let me know if you have any additional questions.

Have a good weekend,

Bret Ladago

Fisheries Biologist

Vermont Department of Fish and Wildlife

3902 Roxbury Road

Roxbury, VT 05669

[\(802\) 485-7566](tel:(802)485-7566)



 **5W1366 - 1 Barre Granite Museum Fisheries comments.pdf**
756K

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District Fisheries Office
3902 Roxbury Road
Roxbury, Vermont 05669
www.VtFishandWildlife.com

[phone] 802-485-7566

Agency Of Natural Resources

TO: Charlotte Brodie; DuBois & King Inc.

FROM: Bret Ladago; Fisheries Biologist

DATE: October 15, 2014

SUBJECT: Barre Granite Museum - Aquatic Resource Assessment

I was contacted by Charlotte Brodie from DuBois & King Inc. to provide fisheries related information and habitat improvement recommendations for the property owned by the Granite Museum in the City of Barre. This parcel contains roughly 2,000ft of shoreline of The Stevens Branch of the Winooski River. A site visit was conducted on September 26, 2014 with Executive Director Patricia Meriam.

This stretch of the Stevens Branch contains a diversity of fish species including populations of wild (naturally reproducing) brown trout, rainbow trout, brook trout, blacknose dace, longnose dace, longnose sucker, pumpkinseed, white sucker, creek chub, and common shiner. These species, along with other aquatic communities benefit from a properly functioning riparian buffer. Riparian Buffers provide a host of essential functions and values including shading, shelter, filtration, streambank stability, and recruitment of natural wood and organic materials. These benefits are realized not only within the protected stream reach, but also in its downstream receiving waters. The current riparian condition along much of the the Stevens Branch in Barre is highly degraded and any additional restoration would be beneficial.

For a stream the size and nature of the Stevens Branch, the Agency's *Riparian Buffer Guidance* would recommend a 100-foot undisturbed buffer measured from the top of the bank, however, due to limited space between the railroad and River, and a previously approved Act 250 permit (#5W1366-1), a riparian buffer of 50ft minimum (measured inland from the top of the bank) should be maintained. According to the permit Findings of Fact (Section 6086 (a)(1)(E)Streams): "*No disturbance will take place within 50ft of the streambanks with the exceptions of plantings or placement of isolated sculptures .*" The shoreline associated with the project should be maintained in its natural state and restoration of the riparian area measuring 100' from the top of the bank should be considered where feasible.

Goals:

To establish a mature, forested, and functioning riparian area with a diversity of native trees and understory vegetation.

To promote responsible use of property and access to the river while limiting overall impact.



General Comments:

In areas with limited riparian buffer, the Department generally recommends that two courses of large caliper (2-3") trees are planted along the top of the streambank to accelerate the benefit of the riparian restoration to aquatic resources.

A narrow area of roughly 300ft of shoreline along the eastern edge of the 12 acre natural area (figure 1) contains highly degraded buffer. The lack of shoreline vegetation is likely due to the relatively steep slope and use of stone fill. Native plant species tolerant of shallow, rocky soils should be considered for planting in this area.

An unnamed perennial tributary crosses the property through a culvert (figure 2). At the time of the site visit, the flow went subsurface before it reached the culvert. A large amount of fine sediment has accumulated near the crossing limiting surface flow. According to Steve Micheli (Assistant Director of The City of Barre Public Works), some of this sediment will be removed and transported off-site in November 2014. This structure is owned by the Granite Museum and future maintenance may not fall to the City's responsibility. Restoration of this tributary is needed, however, due to the high degree of impact and development upstream of the crossing, any plans to alter the system should proceed with caution. You may want consider testing the sediment for contaminants before removing it from the stream bed. A naturally vegetated 50ft buffer should also be maintained around this tributary.

Future fire engine access to the river and within the buffer was mentioned during the site visit (figure 3), however, a dry hydrant has been previously installed on this property. I would recommend redesign of this project to avoid encroachment into the riparian buffer. This action would not be consistent with the current Act 250 permit conditions.

Viewing and river access areas should be limited to one or two developed paths. All other foot paths should be abandoned. Interpretative signs explaining the benefits of a naturally vegetated buffer and encouraging responsible use of the river may help to minimize impact.

At the time of the site visit, some vegetation clearing had occurred surrounding an old foundation (figure 4). A plan to highlight the historical significance of these remnants is understood; however, any additional clearing should be minimized and should not occur within 50ft from the top of the streambank.

The most recent map provided by DuBois & King Inc. (Figure 5) does not include buffer measurements. The bike path should not be constructed within 50ft from the top of the streambank. You may also want to contact the Department of Environmental Conservation's River Management division (Gretchen Alexander 802.490.6150) for a determination of river corridor requirements.

Thank you for the opportunity to provide comments on this project during its planning phase. Our Department appreciates your interest and efforts to enhance this important aquatic resource. Let me know if you have any additional questions.



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Figure 1. Previously filled area with degraded buffer



Figure 2. Unnamed tributary stream crossing



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Figure 3. Proposed fire engine access



Figure 4. Area of vegetation clearing



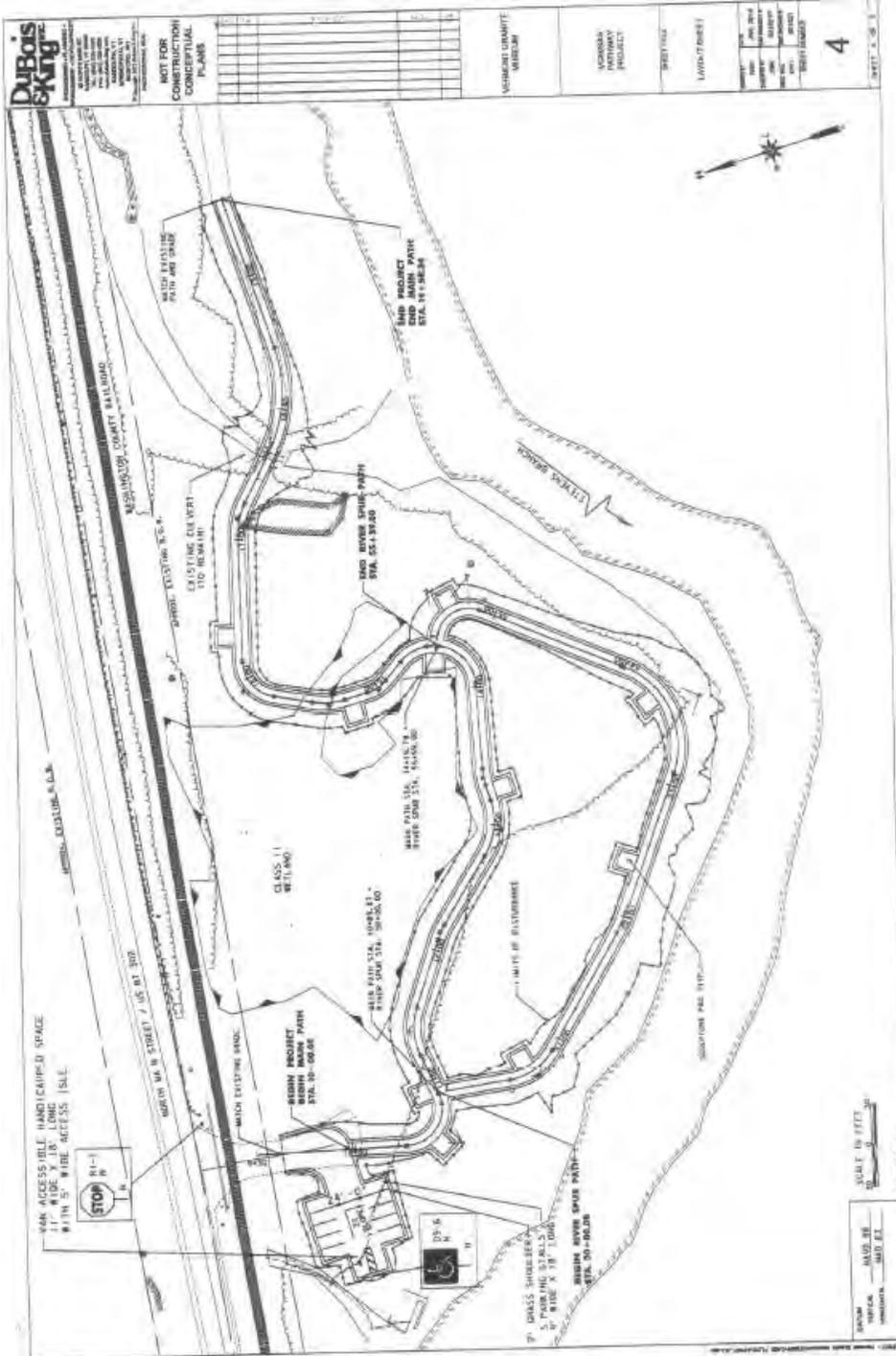


Figure 5. Bike path plans – January 2014





Charlotte Brodie <cbrodie@dubois-king.com>

Vermont Granite Museum, Barre; fish survey results

Ladago, Bret <Bret.Ladago@state.vt.us>

Thu, Sep 11, 2014 at 9:50 AM

To: Charlotte Brodie <cbrodie@dubois-king.com>

Cc: "Appleton, Tim" <Tim.Appleton@state.vt.us>, "Kim, Rich" <Rich.Kim@state.vt.us>

Hi Charlotte,

This section of the Stevens Branch contains a diversity of fish species including healthy populations of wild (naturally reproducing) brown trout, rainbow trout, and brook trout. Blacknose dace, longnose dace, longnose sucker, pumpkinseed, white sucker, creek chub, and common shiner have also been found. These species, along with other aquatic communities would benefit by restoring a riparian buffer along the property of the museum. Buffers provide a host of essential functions and values including shading, shelter, filtration, streambank stability, and recruitment of natural wood and organic materials. For a stream the size and nature of the Stevens Branch, we would normally recommend a 100ft undisturbed buffer measured from the top of the bank. I realize this may not be practical for the entirety of the property due to already established development, but it looks like there is a lot of space to work with downstream of the museum. Perhaps some tree and shrub planting? I would be happy to meet with you on site and go over options. Let me know if you have any additional questions.

Cheers,

Bret Ladago

Fisheries Biologist

Vermont Department of Fish and Wildlife

3902 Roxbury Road

Roxbury, VT 05669

(802) 485-7566





Charlotte Brodie <cbrodie@dubois-king.com>

Vermont Granite Museum

Austin, John M <JohnM.Austin@state.vt.us>
To: Charlotte Brodie <cbrodie@dubois-king.com>

Fri, Sep 12, 2014 at 9:03 AM

Hi Charlotte,

I'm familiar with the site your investigating and in my view, the best restoration would be to restore as much of the site to a forested or shrub habitat condition as possible. The best values it will provide, given the context of development around it and the Stevens Branch, is for building flood resilience and mitigating impacts from soil disturbance that effects erosion of the stream bank. I'm no expert in how to do that, so I'll leave that for others to figure out, but for an overall restoration concept, I suggest focusing on just getting native trees and shrubs re-established on the site to the greatest extent possible. Willows, alders, box elders, and silver maple would be a good start.

Best,

John

John M. Austin, CWB

Lands & Habitat Program Manager

Vermont Fish & Wildlife Department

5 Perry Street, Suite 40

Barre, VT 05641

[802-476-0197](tel:802-476-0197)

From: Charlotte Brodie [<mailto:cbrodie@dubois-king.com>]

Sent: Wednesday, September 10, 2014 10:20 AM

To: Austin, John M

Subject: Fwd: Vermont Granite Museum

Hello John and John,

[Quoted text hidden]



Charlotte Brodie <cbrodie@dubois-king.com>

Vermont Granite Museum

Popp, Bob <Bob.Popp@state.vt.us>
To: Charlotte Brodie <cbrodie@dubois-king.com>

Tue, Sep 16, 2014 at 11:26 AM

Hi Charlotte, just some general guidelines to offer. Try to figure out what community(s) would naturally have occurred there and attempt to recreate it using native species that would be components of that natural community(s). Also if possible it is always best to use locally sourced plants.

I'm not sure what portion of the property to which you refer, but it would be best from a wildlife habitat, movement corridor, and water quality perspective to restore the riparian area along the river.

Bob

Bob Popp

Department Botanist

VT. Dept of Fish and Wildlife

Natural Heritage Inventory

[\(802\) 476-0127](tel:8024760127)

From: Charlotte Brodie [<mailto:cbrodie@dubois-king.com>]

Sent: Wednesday, September 10, 2014 9:47 AM

To: Popp, Bob

Subject: Vermont Granite Museum

[Quoted text hidden]



Charlotte Brodie <cbrodie@dubois-king.com>

Ninebark/ invasive species status?

Popp, Bob <Bob.Popp@state.vt.us>

Mon, Aug 18, 2014 at 12:49 PM

To: Charlotte Brodie <cbrodie@dubois-king.com>

Hi Charlotte, yes I recall seeing it there when I visited the site a few years ago with Russ Baret, former Wash Co forester. It is native in NYS in some of the counties that abut Vermont. I found it some years ago along the Mettawee river in Pawlet, a few miles from the NY border so who knows whether it is actually native here. In any case it is certainly not native outside the Champ V. Art Gilman considers it to be probably adv. from farther south and west. Found mostly on riverbanks, or sometimes in dry fields, widely distributed; occasional. Increasing. Specimens seen from Caledonia, Chittenden, Washington, Windsor, Rutland, and Windham counties.

I don't consider it to be invasive although it clearly can and does spread from cultivation. I don't recall seeing it on any lists. I believe it is a fairly widely used ornamental shrub.

Bob

Bob Popp

Department Botanist

VT. Dept of Fish and Wildlife

Natural Heritage Inventory

(802) 476-0127

From: Charlotte Brodie [<mailto:cbrodie@dubois-king.com>]

Sent: Monday, August 18, 2014 11:28 AM

To: Popp, Bob

Subject: Ninebark/ invasive species status?

Hi Bob,

[Quoted text hidden]



Charlotte Brodie <cbrodie@dubois-king.com>

Vermont Granite Museum

Ferguson, Mark <mark.ferguson@state.vt.us>
To: Charlotte Brodie <cbrodie@dubois-king.com>

Wed, Sep 10, 2014 at 3:19 PM

There is an uncommon fish, the Alleghany pearl dace, reported from farther upstream in Stevens Branch. It could inhabit this reach or, if not, restoration to improve habitat might encourage it to reestablish here. No other Natural Heritage records for the area that I'm aware of. You may also want to contact Eric Sorenson for information and ideas, as well as one of the district Wildlife staff (John Buck or Tim Appleton) at the Barre office. I think Rich Kim is the Fisheries biologist for that area.

Also, The DEC Biomonitoring Lab may be able to provide you with a list of fishes that have been found in Stevens Branch, if they have sampled it; Rich Langdon or Steve Fiske.

Mark Ferguson
Natural Heritage Inventory
Vermont Fish & Wildlife Department
[802-279-3422](tel:802-279-3422)

From: Charlotte Brodie [cbrodie@dubois-king.com]
Sent: Wednesday, September 10, 2014 9:57 AM
To: Ferguson, Mark
Subject: Fwd: Vermont Granite Museum

[Quoted text hidden]



Charlotte Brodie <cbrodie@dubois-king.com>

Vermont Granite Museum, updated mapping

Morrison, Shannon <Shannon.Morrison@state.vt.us>

Mon, Dec 15, 2014 at 5:24 PM

To: Charlotte Brodie <cbrodie@dubois-king.com>

Its been a while since I looked at this site – the project is likely permissible as you describe. On the project plans you should clearly mark where the existing path is, the wooded area, the area of phragmites, what will be cut and how often etc. The cutting regime should 1) allow for the function of the wetland to persist - so allowing for dense vegetation overall maintained at certain height – the area should not be turned into lawn; and 2) management needs to be at a time of year that will help suppress the phragmites, rather than spread the seed. You need to do some research on this, as it will be a condition of the permit.

From: Charlotte Brodie [<mailto:cbrodie@dubois-king.com>]

Sent: Monday, December 08, 2014 3:05 PM

To: Morrison, Shannon

Subject: Vermont Granite Museum, updated mapping

[Quoted text hidden]



Charlotte Brodie <cbrodie@dubois-king.com>

Vermont Granite Museum

Ferguson, Mark <mark.ferguson@state.vt.us>
To: Charlotte Brodie <cbrodie@dubois-king.com>

Wed, Sep 10, 2014 at 3:55 PM

Was just a remark about aquatic restoration in general, since I don't know anything about the site. Actions which reduce streambank erosion, improve riparian vegetation, and improve instream habitat generally benefit fish species.

Mark

From: Charlotte Brodie [cbrodie@dubois-king.com]
Sent: Wednesday, September 10, 2014 3:39 PM
To: Ferguson, Mark
Subject: Re: Vermont Granite Museum

[Quoted text hidden]



Charlotte Brodie <cbrodie@dubois-king.com>

Vermont Granite Museum, proposed plan

Morrison, Shannon <Shannon.Morrison@state.vt.us>

Thu, Jun 13, 2013 at 12:33 PM

To: Charlotte Brodie <cbrodie@dubois-king.com>

Cc: Evan Detrick <edetrick@dubois-king.com>

Charlotte, I think if the buffer zone impacts do not include clearing through an intact wooded situation this could be something we permit. I get the sense the buffer is somewhat disturbed – I would like to see the parcel in person before I sound too encouraging. Thanks

Shannon Morrison

District Wetlands Ecologist

Department of Environmental Conservation

Watershed Management Division

1 National Life Drive, Main-2

Montpelier, VT 05620-3522

Phone:802-490-6178

<http://www.vtwaterquality.org/wetlands.htm>

From: Charlotte Brodie [<mailto:cbrodie@dubois-king.com>]

Sent: Tuesday, June 11, 2013 12:14 PM

To: Morrison, Shannon

Cc: Evan Detrick

Subject: Vermont Granite Museum, proposed plan

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