

Black River Beautification & Restoration Design Plan

Toonerville Rail-Trail, Springfield, Vermont

By Jason Kokkinos & Holly Greenleaf



University of Vermont

Plant and Soil Science Department

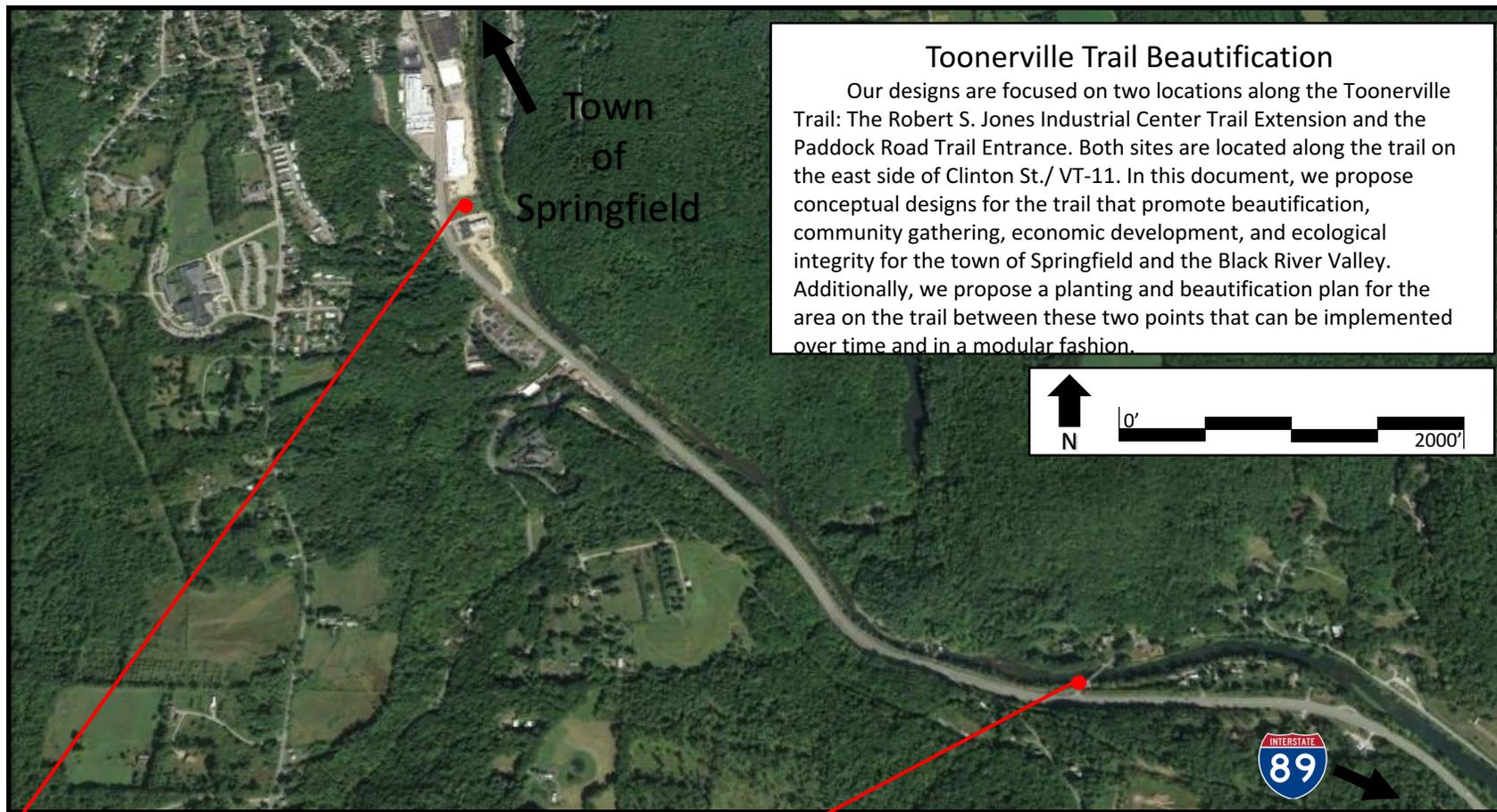
Graduate Landscape Design & Drawing (1 credit)

Dr. Stephanie Hurley, Professor/Advisor

December 2016



Site Context

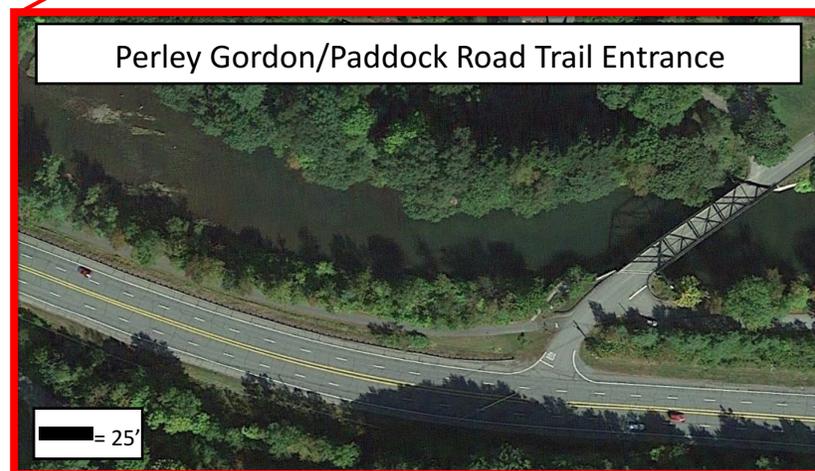


Toonerville Trail Beautification

Our designs are focused on two locations along the Toonerville Trail: The Robert S. Jones Industrial Center Trail Extension and the Paddock Road Trail Entrance. Both sites are located along the trail on the east side of Clinton St./ VT-11. In this document, we propose conceptual designs for the trail that promote beautification, community gathering, economic development, and ecological integrity for the town of Springfield and the Black River Valley. Additionally, we propose a planting and beautification plan for the area on the trail between these two points that can be implemented over time and in a modular fashion.



Robert S. Jones Industrial Center Trail Extension



Perley Gordon/Paddock Road Trail Entrance

Site Information: Springfield, VT

- Hardiness Zone: 5a (-20 to 15 degrees F)
- Soils:
 - Northern Site: 32B Urban land—Windsor—Agawam complex
 - Loamy sand, fine sandy loam, loamy fine sand
 - 0-8% slope, well-drained—excessively drained
 - Southern Site: 80F Macomber-Taconic Complex (silt loam)
 - 25-70% slope, very rocky, well-drained
- Existing Vegetation
 - Trees: maple, sycamore, oak, hemlock, birch, beech, pine, sumac
 - Invasives: poison ivy, Japanese knotweed, black swallowwort, glossy buckthorn, honeysuckle, bittersweet, barberry

Paddock Road Entrance:



Industrial Center Entrance:



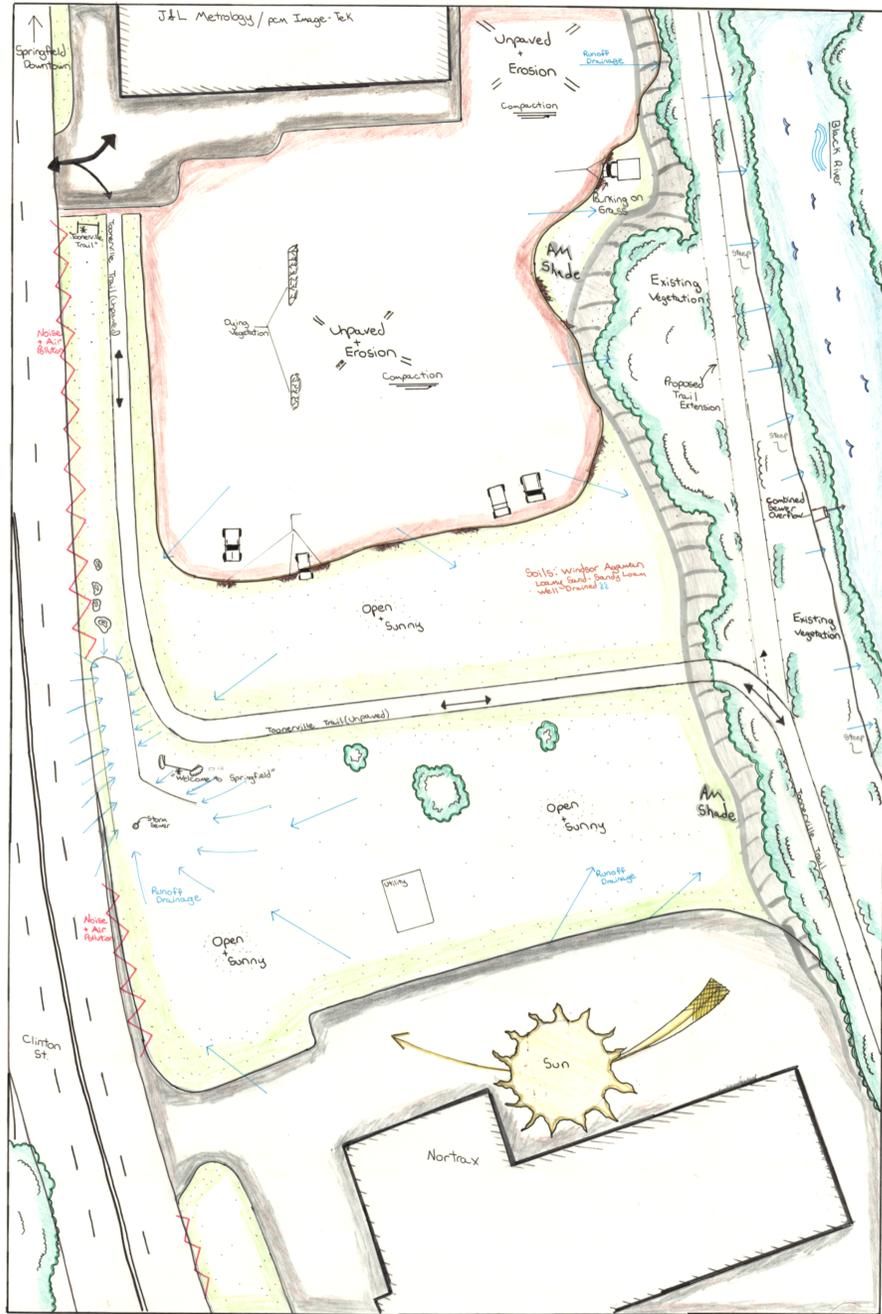
Site Analysis: Robert S. Jones Industrial Center Trail Entrance

Opportunities

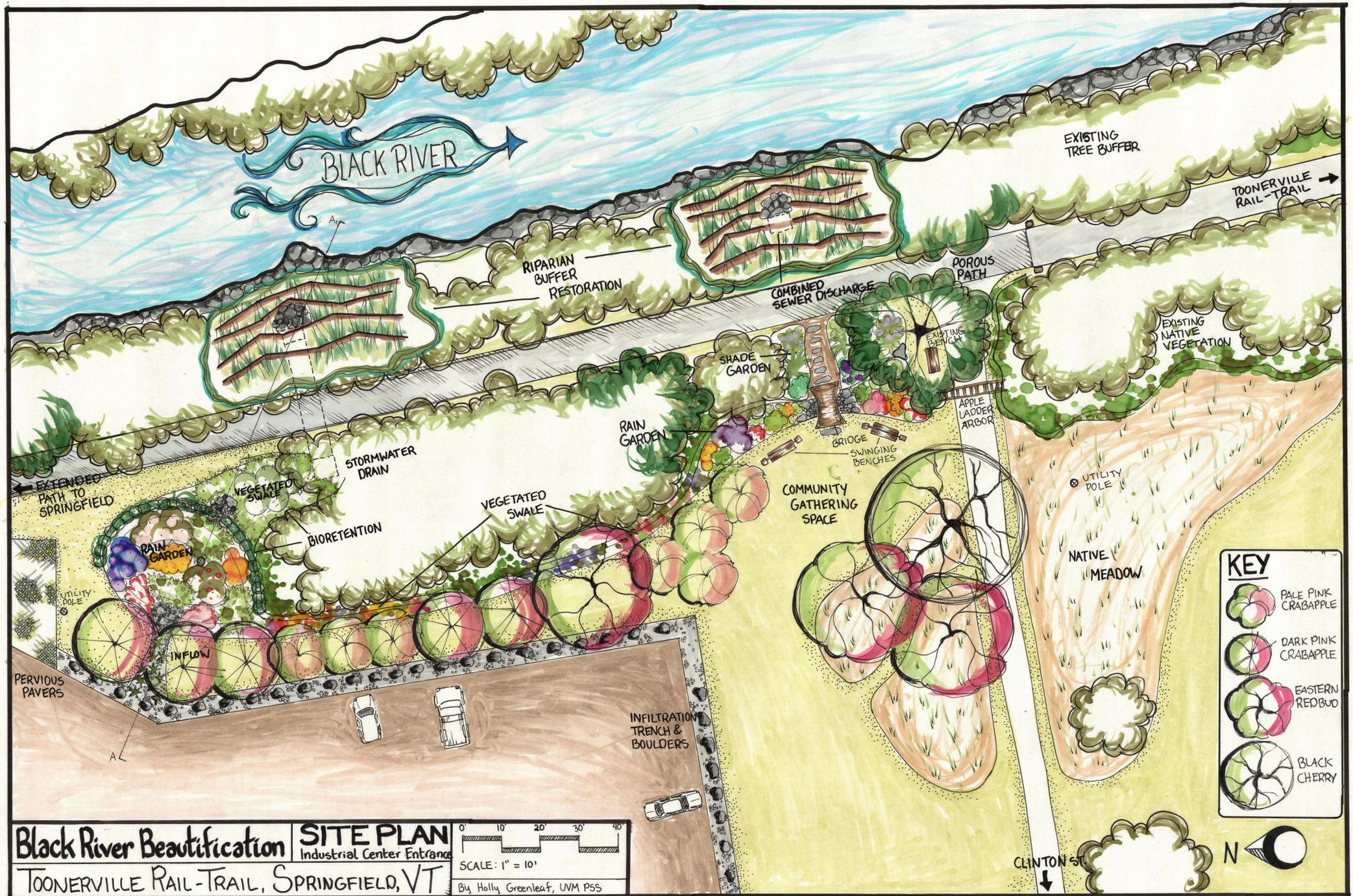
- Excessive stormwater runoff and erosion
- Eroding and expanding parking lot
- Open and sunny, shade near trail
- Good visibility from road
- Available parking
- Access to trail entrance and extension
- Near downtown
- Well-drained soils

Constraints

- Traffic and noise
- Industrial buildings, “eye sore”
- Parcel ownership
- Combined Sewage/Stormwater Outflow (CSO)
- Steep riparian banks



Site Plan: Industrial Center Entrance



Black River Beautification
SITE PLAN
 Industrial Center Entrance
 TOONERVILLE RAIL-TRAIL, SPRINGFIELD, VT

0' 10' 20' 30' 40'
 SCALE: 1" = 10'
 By Holly Greenleaf, UVM PSS

KEY

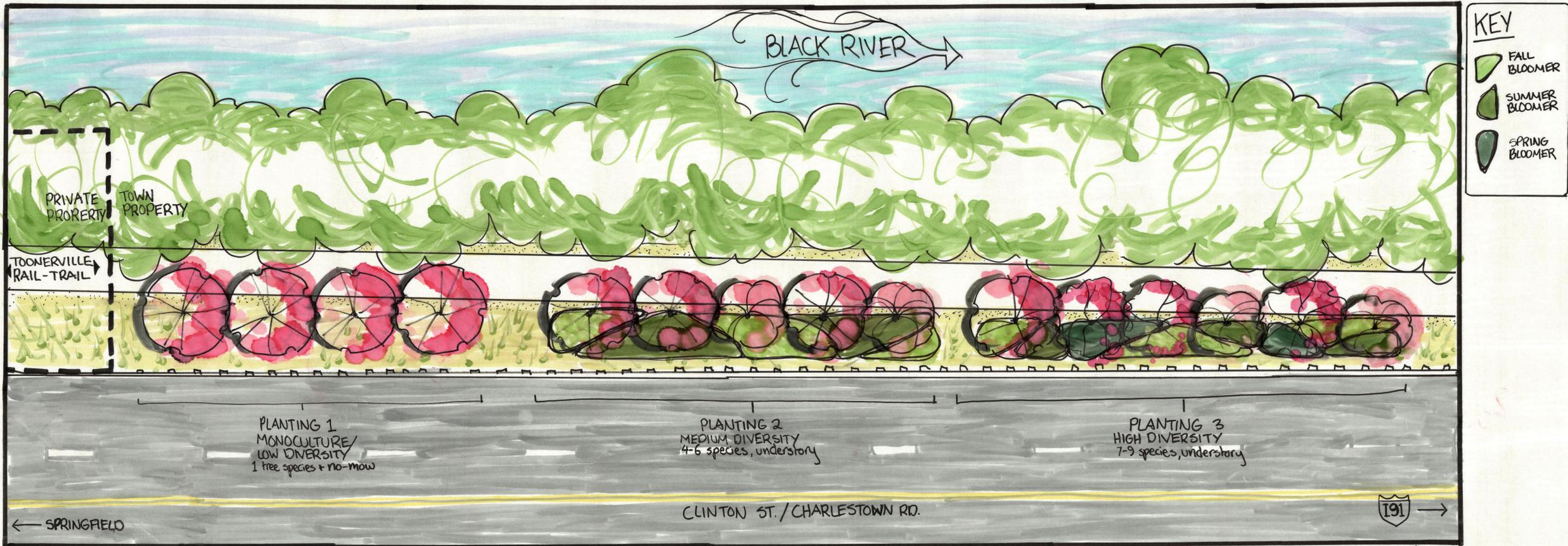
	PALE PINK CRABAPPLE
	DARK PINK CRABAPPLE
	EASTERN REDBUD
	BLACK CHERRY



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Planting Plan: "River of Blooms"

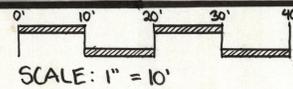


KEY

-  FALL BLOOMER
-  SUMMER BLOOMER
-  SPRING BLOOMER

Black River Beautification "River of Blooms" PLANTING PLAN CONCEPT

TOONERVILLE RAIL-TRAIL, SPRINGFIELD, VT By Holly Greenleaf, UVM PSS





Eastern Redbud, VT native

Toonerville Rail-Trail Plant Selection

Design Considerations:

- Beautiful springtime blooms for cultural, economic, and ecological benefit
- Native VT species wherever possible
- Ecosystem restoration: Increase vegetation for stormwater infiltration and wildlife habitat
- Small areas along trail (5-10')
- Salt-tolerant plants
- Hardy, low-maintenance
- Provide season-long blooms to support key wildlife
- Provide vegetated corridor for people and wildlife alike!

Eastern Redbud, *Cercis canadensis*



Common Name: eastern redbud

Type: Tree

Family: Fabaceae

Native Range: North and Central America

Zone: 4 to 8

Height: 20.00 to 30.00 feet

Spread: 25.00 to 35.00 feet

Bloom Time: April

Bloom Description: Pink

Sun: Full sun to part shade

Water: Medium

Maintenance: Low

Suggested Use: Street Tree, Flowering Tree, Naturalize

Flower: Showy

Leaf: Good Fall

Attracts: Butterflies

Tolerate: Deer, Clay Soil, Black Walnut

Native



Crabapple, *Malus ssp.* 'Louisa'

Common Name: flowering crabapple

Type: Tree

Family: Rosaceae

Zone: 4 to 8

Height: 12.00 to 15.00 feet

Spread: 12.00 to 15.00 feet

Bloom Time: April

Bloom Description: Pink

Sun: Full sun

Water: Medium

Maintenance: Low

Suggested Use: Flowering Tree

Flower: Showy

Attracts: Birds, Butterflies

Fruit: Showy, Edible

Other: Winter Interest

Tolerate: Air Pollution

Garden locations



Non-Native

- *Malus* 'Louisa'
Gorgeous, true pink flowers enhance the classical weeping form of this crabapple in spring. It's one of the best weepers, with arching, graceful branches that are upswept at the tips. Scattered lemon-gold fruits are noticeable from late July to mid-November. They darken to gold-orange with a tan-brown blush.

http://www.bbg.org/gardening/article/marvelous_malus

<http://www.missouribotanicalgarden.org/plantfinder/plantfindersearch.aspx>

<http://www.affordabletrees.com/wp-content/uploads/2013/01/Cherry-Weeping1.jpg>, <http://www.cjfiore.com/assets/catalog/maluslsa.jpg>



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Crabapple, *Malus* 'Prairifire'

Common Name: flowering crabapple

Type: Tree

Family: Rosaceae

Zone: 4 to 8

Height: 15.00 to 20.00 feet

Spread: 15.00 to 20.00 feet

Bloom Time: April to May

Bloom Description: Deep pinkish red

Sun: Full sun

Water: Medium

Maintenance: Low

Suggested Use: Flowering Tree

Flower: Showy, Fragrant

Leaf: Good Fall

Attracts: Birds, Butterflies

Fruit: Showy

Tolerate: Air Pollution

Garden locations



Non-Native

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Crabapple, *Malus ssp.* 'Cardinal'

- Common Name: crabapple
- Type: Tree
- Family: Rosaceae
- Zone: 5 to 8
- Height: 10.00 to 15.00 feet
- Spread: 15.00 to 25.00 feet
- Bloom Time: April
- Bloom Description: Red
- Sun: Full sun
- Water: Medium
- Maintenance: Low
- Suggested Use: Flowering Tree
- Flower: Showy
- Leaf: Colorful, Good Fall
- Attracts: Birds, Butterflies
- Fruit: Showy, Edible
- Tolerate: Air Pollution

Garden locations



Non-Native

<https://s-media-cache-ak0.pinimg.com/originals/ec/13/13/ec131382343f9ac7457ad772b7bf978e.jpg>,
<http://i61.tinypic.com/x0oiub.jpg> <http://www.missouriherbarium.org/plantfinder/plantfindersearch.aspx>

Black Cherry, *Prunus Serotina*

Common Name: black cherry

Type: Tree

Family: Rosaceae

Native Range: North America

Zone: 3 to 9

Height: 50.00 to 80.00 feet

Spread: 30.00 to 60.00 feet

Bloom Time: April to May

Bloom Description: White

Sun: Full sun to part shade

Water: Medium

Maintenance: Low

Suggested Use: Shade Tree, Flowering Tree

Flower: Showy, Fragrant

Leaf: Good Fall

Attracts: Birds

Fruit: Showy



Native



2003 © Peter M. Dziuk

http://www.lostinspaceandtime.net/health/wp-content/uploads/2014/09/wild_black_cherry1.jpg,

<https://www.minnesotawildflowers.info/udata/r9ndp23q/pd3/prunus-serotina-008.jpg>,

https://img1.etsystatic.com/026/0/6879804/il_570xN.632833003_hmlr.jpg <http://www.missouribotanicalgarden.org/plantfinder/plantfindersearch.aspx>

Other potential flowering trees (natives):

- Serviceberry/Juneberry, *Amelanchier canadensis/laevis*
- Flowering Dogwood, *Cornus florida*
- Hawthorns, *Crataegus ssp.*
- American Plum, *Prunus americana*
- Chokecherry, *Prunus virginiana*
- American Basswood/Linden, *Tilia americana*



Flowering Dogwood



Serviceberry



Plum



Chokecherry



Hawthorn



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Other potential flowering trees (non-natives):

- Sargent Cherry, *Prunus sargentii*
- Winter-flowering Higan Cherry, *Prunus subhirtella*
- Manchurian Cherry/Amur Chokecherry, *Prunus maackii*
- Beach Plum, *Prunus maritima* (native to Northeast)



Sargent Cherry



Winter-flowering Higan Cherry



Manchurian Cherry



Beach Plum

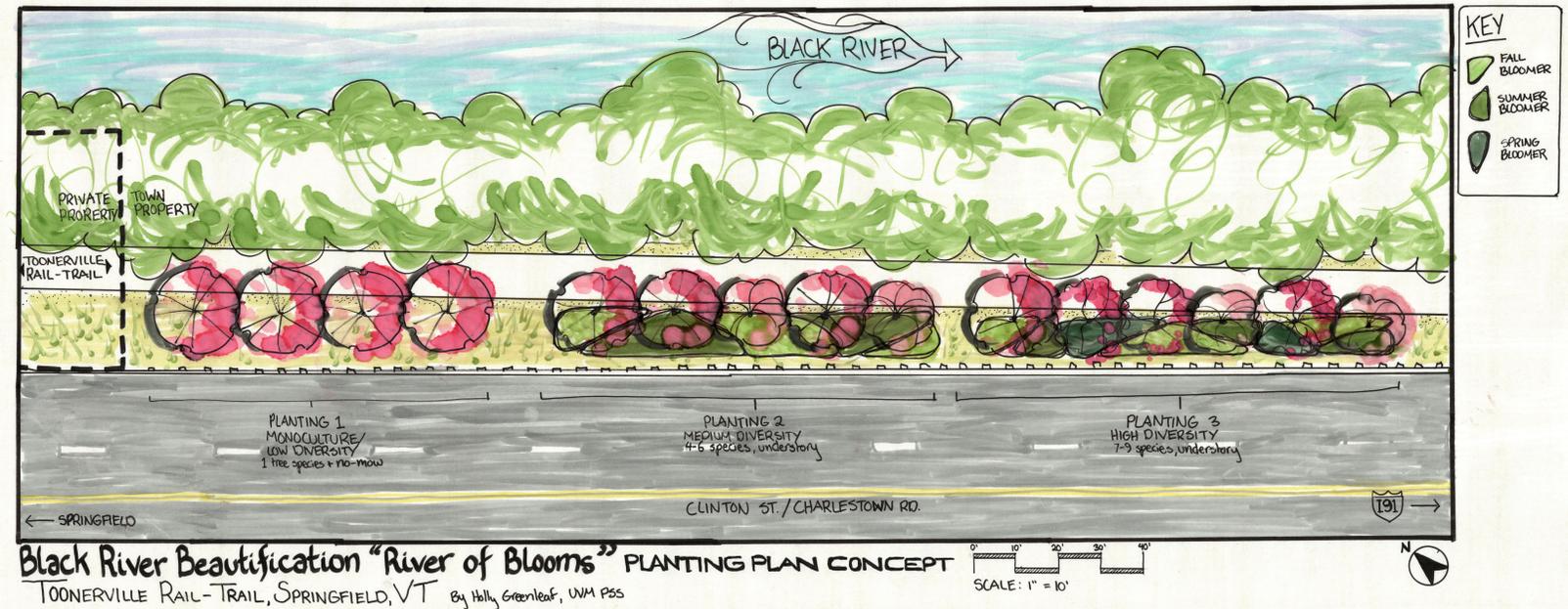


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Planting Plan: “River of Blooms”



1. Low-diversity: Pick 1 Crabapple and establish no-mow zone/wildflower meadow as understory
2. Medium Diversity: Pick 2 Crabapples and 1-2 summer bloomers & 1-2 fall bloomers
3. High Diversity: Pick 3+ trees and 1-3 spring bloomers, 1-3 summer bloomers, 1-3 fall bloomers

Pathway Plant List “River of Blooms” • Vine

- Honeysuckle, *Lonicera sempervirens* (to grow up fence)

• Trees

- Crabapples, *Malus spp.*, 10'-20' spread
- Eastern Redbud, *Cercis canadensis*, 25'-35' spread (in wider areas where canopy can fit without impeding on ROW)

• Flowering

• Spring Blooming:

- Blue Flag Iris, *Iris versicolor*
- Wild Geranium, *Geranium maculatum*
- Windflower, *Anemone canadensis*
- Blue False Indigo, *Baptisia australis*

• Summer Blooming:

- Daylilies, *Hemerocallis ssp.*
- Purple Coneflower, *Echinacea purpurea*
- Beebalm, *Monarda didyma*
- Black-eyed Susan, *Rudbeckia hirta*

• Late Summer/Fall Blooming:

- New England Aster, *Symphotrichum novae-angliae*
- Goldenrod, *Solidago canadensis*
- Swamp Milkweed, *Asclepias incarnata*
- Boneset, *Eupatorium perfoliatum*

• Grasses

- Purple Threeawn, *Aristida purpurea*
- Little Bluestem, *Schizachyrium scoparium*



Boneset



Windflower



Purple Threeawn



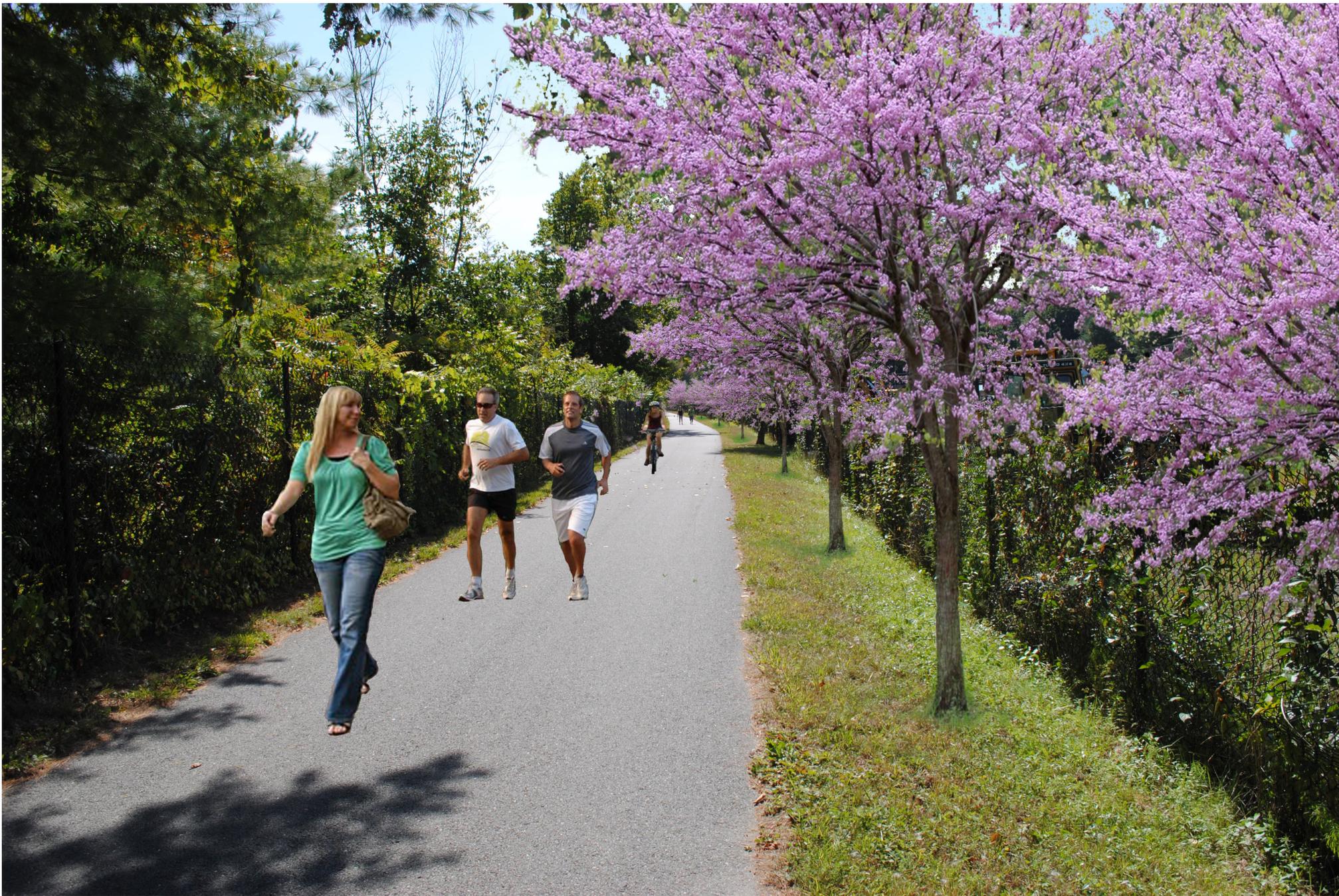
Black-eyed Susan

<http://plants.gardensupplyco.com/Content/Images/Photos/A087-15.jpg>, https://c1.staticflickr.com/8/7315/9704303264_b5e8db6e48_b.jpg,
<https://plants.ces.ncsu.edu/media/images/Rudbeckia-fulgida-var-sullivantii-Goldsturm--F-D-Richards--cc-by-sa-2-0.jpg>,
<http://www.pfaf.org/Admin/PlantImages/AnemoneCanadensis2.jpg>, http://www.plantsystematics.org/users/meredith/1_2_07_s/eupatorium_perfoliatum

Photo-simulations: “River of Blooms”



Before
Existing Northern
Entrance



After
Existing Northern
Entrance: Low
Diversity



After
Existing Northern
Entrance:
Medium Diversity



After
Existing Northern
Entrance: High
Diversity

Riparian Buffer Restoration

Purpose:

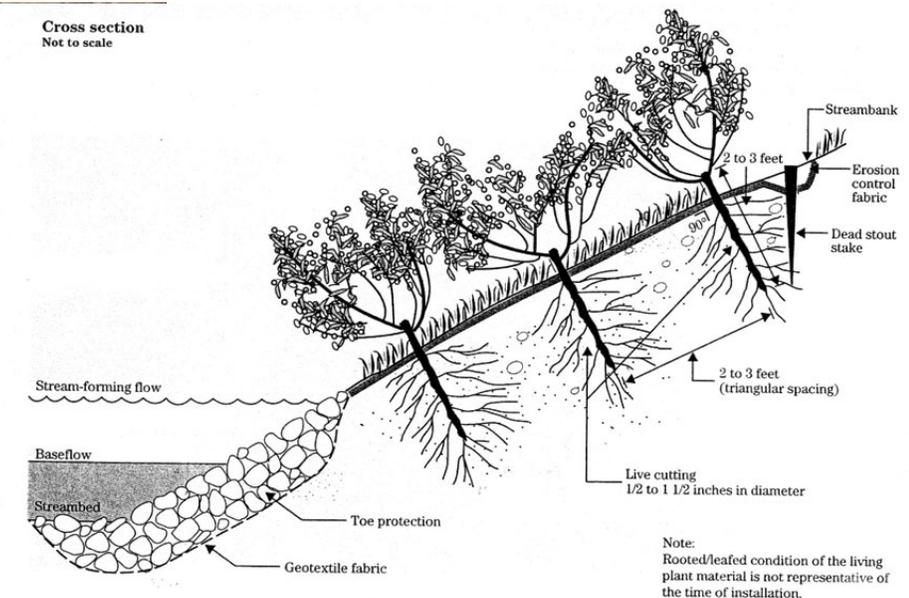
- Water quality—capture and filter stormwater runoff (sediment & nutrients)
- Stabilize bank—prevent erosion and mitigate flooding
- Provide key habitat—shallow water ecosystem and riparian corridor



Coir rolls for bank stabilization



Live stakes (Willow, Dogwood, Alder)
Fascines (live stake bundles), Shrubs,
Sapling replacement trees

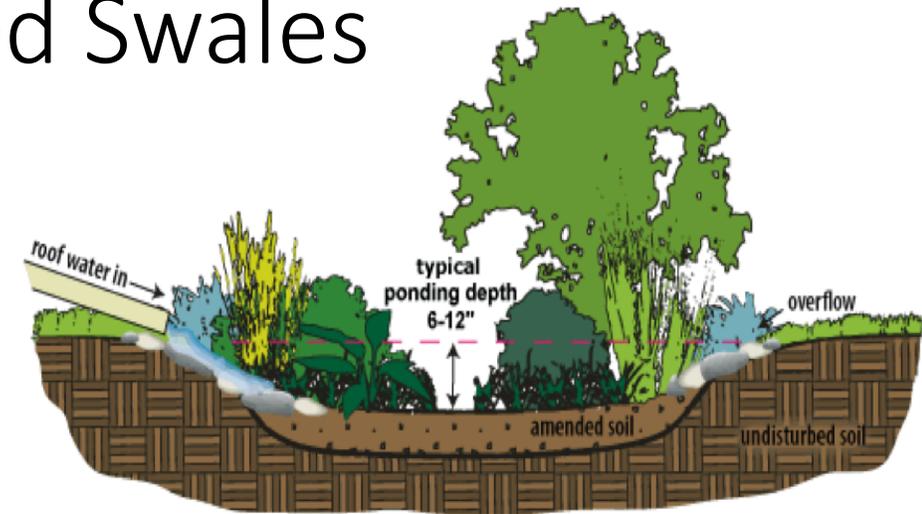


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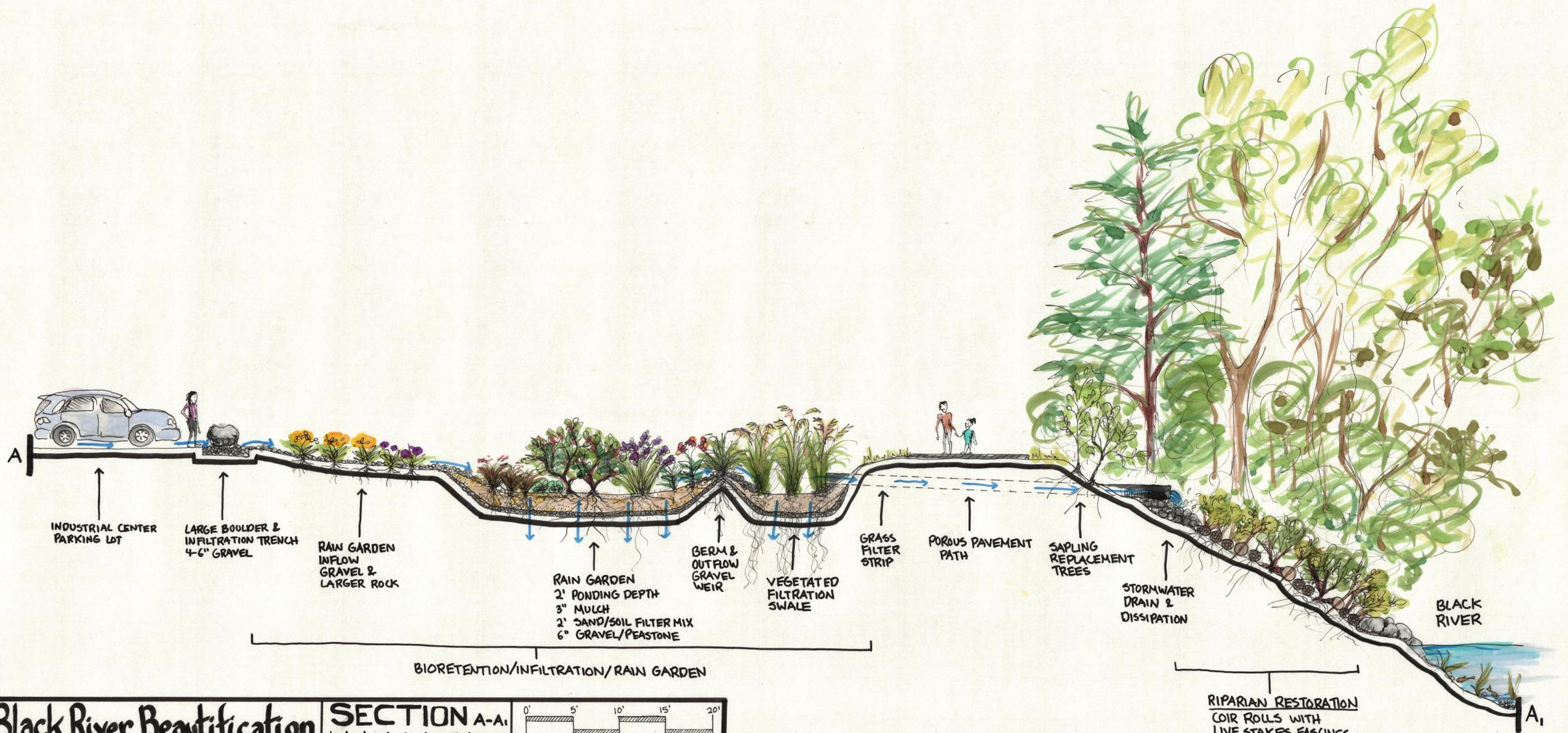
Bioretention/Rain Garden/Vegetated Swales

Purpose:

- A bowl-shaped garden designed to capture and absorb stormwater
- Stormwater is the leading non-point source of pollution in lakes in the United States (Winston et. al. 2011)
- Capture & filter sediments and pollutants (physical settling of suspended solids, biological plant uptake of pollutants and evapotranspiration, and physiochemical adsorption of phosphorus)
- Recharge groundwater
- Slows water, reducing peak hydrologic flow and preventing erosion downstream
- Reverse compaction and improve drainage

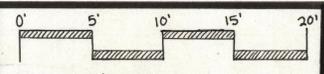


Section: Bioretention and Riparian Buffer Restoration



Black River Beautification SECTION A-A:
Industrial Center Entrance

TOONERVILLE RAIL-TRAIL, SPRINGFIELD, VT



By Holly Greenleaf, UVM PSS

→ STORMWATER PATH

RIPARIAN RESTORATION
COIR ROLLS WITH
LIVE STAKES, FASCINES
NATIVE PLANTS

Rain Garden Plant List

Plant Selection: Pick one plant from each group for the corresponding plant group on the plan. Be sure to pick at least 1 spring bloomer, 1 summer bloomer, and 1 fall bloomer

Gravel Inflow

- Blue Flag, *Iris versicolor*
 - Hardy to zone 3, 2-3' height, 2-3' spread, full sun/part shade, medium/wet soils, violet blue flowers may-june, clump forming, salt tolerant
- Daylilies, *Hemerocallis ssp.*
 - Hardy to zone 3, 2-3' height, full sun/part shade, yellow-orange blooms july-aug, salt tolerant

Berm

- Bearberry/Kinnikinnick, *Arctostaphylos uva-ursi*
 - Hardy to zone 2, .5-1' height, 3-6' spread, light pink blooms april-may, full sun/part shade, dry/medium soils, erosion control, attracts birds
- Little Bluestem, *Schizachyrium scoparium*
 - Hardy to zone 3, 2-4' height, full sun, dry/medium soil, purple/bronze flowers late summer, upright clumps, bluish near base, great bronze/orange fall color, salt-tolerant



1. Inflow Area

Characteristics: sturdy, multi-stemmed to dissipate water flow

- Gray Sedge, *Carex grayi*
 - Hardy to Zone 5, 2-3' height, full sun/part shade, medium/wet soil, green blooms may-oct, pale green spiked seedheads, evergreen, salt tolerant, erosion control
- Fox Sedge, *Carex vulpinoidea*
 - Hardy to Zone 3, 1-3' height, full sun/part shade, medium/wet soil, green blooms may-july, clump forming, salt tolerant, erosion control, attracts birds
- Little Bluestem, *Schizachyrium scoparium*
 - Hardy to zone 3, 2-4' height, full sun, dry/medium soil, purple/bronze flowers late summer, upright clumps, bluish near base, great bronze/orange fall color, salt-tolerant



2. Bottom level south

Characteristics: Woody, water-loving, winter interest

- Meadowsweet, *Spiraea alba*
 - Hardy to zone 3, 4-6' height, full sun/part shade, medium/wet soils, white blooms june-aug, salt tolerant
- Red Osier Dogwood, *Cornus sericea*
 - Hardy to zone 2, 6-9' height, 8-12' spread, full sun/part shade, medium/wet soils, white blooms on may-june, red stems in winter, good fall color, erosion control, attracts birds and butterflies
- Winterberry, *Ilex verticillata*
 - Hardy to zone 3, 8-10' height, 8-10' spread, full sun/part shade, medium/wet soils, greenish-white blooms june-july, persistent red berries on female (need male also), erosion control, nesting site for birds



3. Bottom Level north

Characteristics: herbaceous, water-loving, late blooming

- Sneezeweed, *Helenium autumnale*
 - Hardy to zone 3, 3-5' height, 2-3' spread, full sun, medium/wet soils, yellow blooms aug-oct, attracts butterflies
- Goldenrod, *Solidago canadensis*
 - Hardy to zone 3, 4-5' height, 4-5' spread, full sun/part shade, medium soils, yellow blooms aug-oct, salt tolerant, attracts butterflies
- Joe Pye Weed, *Eupatorium/Eutrochium maculatum*
 - Hardy to zone 4, 3-6' height, full sun/part shade, medium/wet soils, dark pink blooms july-oct, larval host, attracts butterflies



4/5. Upslope front north & south

Characteristics: small-medium height, herbaceous, bright colors

- Purple Cone-flower, *Echinacea purpurea*
 - Hardy to zone 3, 1-2' height, 1-2' spread, full sun/part shade, dry/medium soils, purplish pink blooms june-aug, drought tolerant, attracts birds and butterflies
- Butterfly Milkweed, *Asclepias tuberosa*
 - Hardy to zone 3, 1-3' height, 1-2' spread, full sun/part shade, dry/medium soils, yellow-orange blooms june-aug, drought tolerant, attracts butterflies
- Great Blue Lobelia, *Lobelia siphilitica*
 - Hardy to zone 4, 2-3' height, 1-2' spread, full sun/part shade, medium/wet soils, blue blooms july-sept, salt tolerant
- Red Cardinal Flower, *Lobelia cardinalis*
 - Hardy to zone 3, 2-4' height, 1-2' spread, full sun/part shade, medium/wet soils, scarlet red blooms july-sept, salt tolerant
- Turtlehead, *Chelone glabra*
 - Hardy to zone 3, 2-3' height, full sun/part shade, medium/wet soils, white blooms aug-oct,
- Windflower, *Anemone canadensis*
 - Hardy to zone 4, 1-3' height, full sun/part shade, medium soils, white flowers april-june, salt tolerant



6/7. Upslope side south and north

Characteristics: medium height, herbaceous, purple/blue

- Blue False Indigo, *Baptisia australis*
 - Hardy to zone 4, 4-5' height, 3-4' spread, full sun/part shade, dry/medium soils, indigo-blue blooms may-june, pods persist, nitrogen-fixing, drought tolerant, salt tolerant
- Swamp Milkweed, *Asclepias incarnata*
 - Hardy to zone 3, 4-5' height, 2-3' spread, full sun, medium/wet soils, pink/mauve blooms july-aug, attracts butterflies
- Blazing Star, *Liatris spicata*
 - Hardy to zone 3, 2-4' height, red-purple blooms july-august, full sun, medium soils, salt tolerant
- Spotted Beebalm, *Monarda punctata*
 - Hardy to zone 3, 1.5-2' height, 1' spread, Yellow with purple spots June-July, full sun/part shade, dry/medium soils



8. Upslope back south

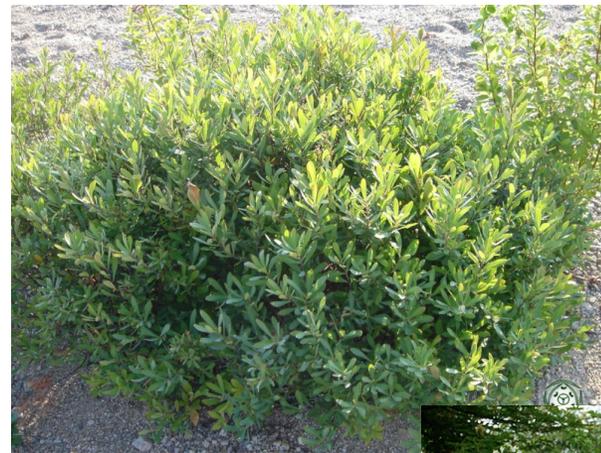
Characteristics: medium-high height, herbaceous

- Smooth Oxeye, *Heliopsis helianthoides*
 - Hardy to zone 3, 3-6' height, 2-4' spread, full sun, dry/medium soils, yellow blooms june-aug, drought tolerant, erosion control, salt tolerant, attracts butterflies
- Culver's Root, *Veronicastrum virginicum*
 - Hardy to zone 3, 4-7' height, 2-4' spread, full sun, medium/wet soils, white-pale blue blooms may-aug, attracts butterflies
- New England Aster, *Symphotrichum novae-angliae*
 - Hardy to zone 4, 3-6' height, 2-3' spread, full sun/part shade, medium soils, purple blooms aug-sept, attracts butterflies, salt tolerant
- Beebalm, *Monarda didyma*
 - Hardy to zone 4, 2-4' height, 2'3' spread, full sun/part shade, red blooms July-aug, medium/wet soils, fragrant



9. Upslope back north

Characteristics: small-medium height, woody



- Sweetgale, *Myrica gale*
 - Hardy to zone 2, 4-6' height, 4-6' spread, full sun/part shade, medium/wet soils, yellow-green blooms july-sept, lustrous glossy green leaves
- Black Chokeberry, *Aronia melanocarpa*
 - Hardy to zone 3, 3-6' height, 3-6' spread, full sun/part shade, medium soils, white blooms in may, persistent black fruits, good red fall color, salt tolerant
- Mountain Laurel, *Kalmia latifolia*
 - Hardy to zone 3, 5-6' height, 3-5' spread, full sun/part shade, medium/wet soils, rose pink blooms, evergreen foliage,



10. Upslope back center/outflow

Characteristics: tall grasses, multi-stemmed to dissipate flow

- Switchgrass, *Panicum virgatum*
 - Hardy to zone 4, 3-6' height, 2-3' spread, full sun/part shade, dry/medium/wet soils, pink-tinged blooms july-feb, clump forming, bright red/yellow fall color, salt tolerant
- Big Bluestem, *Andropogon gerardii*
 - Hardy to zone 4, 4-6' height, 2-3' spread, full sun, dry/medium soils, tolerates erosion & drought, purplish-red blooms sept-feb, good fall color



Plant List: Vegetated Swale Overflow Garden

1. Woody Shrubs (Pick 5-6 of 1 or 2 species)
 - Red Osier Dogwood, *Cornus Sericea*
 - Buttonbush, *Cephalanthus occidentalis*
 - Black Chokeberry, *Aronia melanocarpa*
 - Sweetgale, *Myrica gale*
 - Elderberry, *Sambucus canadensis*
 - Summersweet, *Clethra alnifolia*
 - Witherod Viburnum, *Viburnum cassinoides*
2. Perennial Grasses (20)
 - Switchgrass, *Panicum virgatum*



Buttonbush



Elderberry



Summersweet



Witherod Viburnum

Vegetated Swale: Native Wildflower Meadow Plants

- Native Wildflower and Grass Mix: Ernst Conservation Seed Mixes

Riparian Buffer Mix

ERNMX #	ERNMX-178
Cost Per Pound	\$30.45
Seeding Rate	20 lb per acre with a cover crop at 30 lb per acre (dry sites - grain oats, Jan 1-Aug 1; or, grain r
Mix Type	Riparian Sites
Species List (click for details)	<ul style="list-style-type: none"> 20% Virginia Wildrye, PA Ecotype (Elymus virginicus, PA Ecotype) 16% Indiangrass, PA Ecotype (Sorghastrum nutans, PA Ecotype) 15% Deertongue, 'Tioga' (Panicum clandestinum (Dichanthelium c.), 'Tioga') 12.5% Big Bluestem, 'Niagara' (Andropogon gerardii, 'Niagara') 8% Switchgrass, 'Carthage', NC Ecotype (Panicum virgatum, 'Carthage', NC Ecotype) 5% Partridge Pea, PA Ecotype (Chamaecrista fasciculata (Cassia f.), PA Ecotype) 4% Autumn Bentgrass, PA Ecotype (Agrostis perennans, PA Ecotype) 4% Blue Vervain, PA Ecotype (Verbena hastata, PA Ecotype) 3% Blackeyed Susan, Coastal Plain NC Ecotype (Rudbeckia hirta, Coastal Plain NC Ecotype) 3% Oxeye Sunflower, PA Ecotype (Heliopsis helianthoides, PA Ecotype) 2.3% New England Aster, PA Ecotype (Aster novae-angliae (Symphyotrichum n.), PA Ecotype) 2% Soft Rush (Juncus effusus) 1% Boneset, PA Ecotype (Eupatorium perfoliatum, PA Ecotype) 1% Joe Pye Weed, PA Ecotype (Eupatorium fistulosum, PA Ecotype) 1% Blue False Indigo, Southern WV Ecotype (Baptisia australis, Southern WV Ecotype) 1% New York Ironweed, PA Ecotype (Vernonia noveboracensis, PA Ecotype) 0.5% Great Blue Lobelia, PA Ecotype (Lobelia siphilitica, PA Ecotype) 0.5% Wild Bergamot, PA Ecotype (Monarda fistulosa, PA Ecotype) 0.2% Grassleaf Goldenrod, PA Ecotype (Euthamia graminifolia (Solidago g.), PA Ecotype) <p>Total: 100%</p>

Partially Shaded Area Roadside Mix

ERNMX #	ERNMX-140
Cost Per Pound	\$41.61
Seeding Rate	20 lb per acre, or 1/2 lb per 1,000 sq ft
Mix Type	Woodland Openings, Partially Shaded Sites & Shrubby Sites Associated with Bioengineering
Species List (click for details)	<ul style="list-style-type: none"> 32% Little Bluestem, Fort Indiantown Gap-PA Ecotype (Schizachyrium scoparium, Fort Indiantown Gap-PA Ecotype) 20% Virginia Wildrye, PA Ecotype (Elymus virginicus, PA Ecotype) 20% Autumn Bentgrass, PA Ecotype (Agrostis perennans, PA Ecotype) 5% Purple Coneflower (Echinacea purpurea) 4% Partridge Pea, PA Ecotype (Chamaecrista fasciculata (Cassia f.), PA Ecotype) 3% Tall White Beardtongue, PA Ecotype (Penstemon digitalis, PA Ecotype) 3% Marsh (Dense) Blazing Star (Spiked Gayfeather), PA Ecotype (Liatris spicata, PA Ecotype) 2% Blackeyed Susan, Coastal Plain NC Ecotype (Rudbeckia hirta, Coastal Plain NC Ecotype) 2% Oxeye Sunflower, PA Ecotype (Heliopsis helianthoides, PA Ecotype) 1.5% Slender Bushclover, VA Ecotype (Lespedeza virginica, VA Ecotype) 1% Ohio Spiderwort, PA Ecotype (Tradescantia ohioensis, PA Ecotype) 1% White Wood Aster, PA Ecotype (Aster divaricatus (Eurybia divaricata), PA Ecotype) 1% Eastern Columbine (Aquilegia canadensis) 1% Thimbleweed, PA Ecotype (Anemone virginiana, PA Ecotype) 1% Browneyed Susan, WV Ecotype (Rudbeckia triloba, WV Ecotype) 0.8% Blue False Indigo, Southern WV Ecotype (Baptisia australis, Southern WV Ecotype) 0.5% White (Silver Rod) Goldenrod, PA Ecotype (Solidago bicolor, PA Ecotype) 0.5% Wild Bergamot, Fort Indiantown Gap-PA Ecotype (Monarda fistulosa, Fort Indiantown Gap-PA Ecotype) 0.5% Zigzag Goldenrod (Solidago flexicaulis) 0.2% Hoary Mountainmint, MD Ecotype (Pycnanthemum incanum, MD Ecotype) <p>Total: 100%</p>

Retention Basin Floor Mix - Low Maintenance

ERNMX #	ERNMX-126
Cost Per Pound	\$13.86
Seeding Rate	20-40 lb per acre, or 1 lb per 1,000 sq ft
Mix Type	Storm Water Management Facility Sites
Species List (click for details)	<ul style="list-style-type: none"> 20% Virginia Wildrye, PA Ecotype (Elymus virginicus, PA Ecotype) 20% Alkaligrass, 'Fults' (Puccinellia distans, 'Fults') 17% Deertongue, 'Tioga' (Panicum clandestinum (Dichanthelium c.), 'Tioga') 17% Fox Sedge, PA Ecotype (Carex vulpinoidea, PA Ecotype) 14% Creeping Bentgrass (Agrostis stolonifera) 4% Ticklegrass (Rough Bentgrass), PA Ecotype (Agrostis scabra, PA Ecotype) 4% Autumn Bentgrass, PA Ecotype (Agrostis perennans, PA Ecotype) 3% Soft Rush (Juncus effusus) 1% Path Rush, PA Ecotype (Juncus tenuis, PA Ecotype) <p>Total: 100%</p>

<http://www.ernstseed.com/seed-mixes/>



Plant List: Shade Garden Plants

- Hosta/Plantain Lilies, *Hosta ssp.*
- Ferns: Sensitive Fern, Christmas Fern, New York Fern, Ostrich Fern
- Wild Ginger, *Asarum canadense*
- Wild Geranium, *Geranium maculatum*
 - Hardy to zone 3, 1-2' height, full sun/full shade, medium/dry soils, acidic, white blooms may-july, attracts butterflies/birds
- Virginia Spiderwort, *Tradescantia virginiana*
 - Hardy to zone 4, 2-3' height, part shade/full shade, medium/wet soils, acidic, purple blooms june-july, attracts butterflies



Hostas



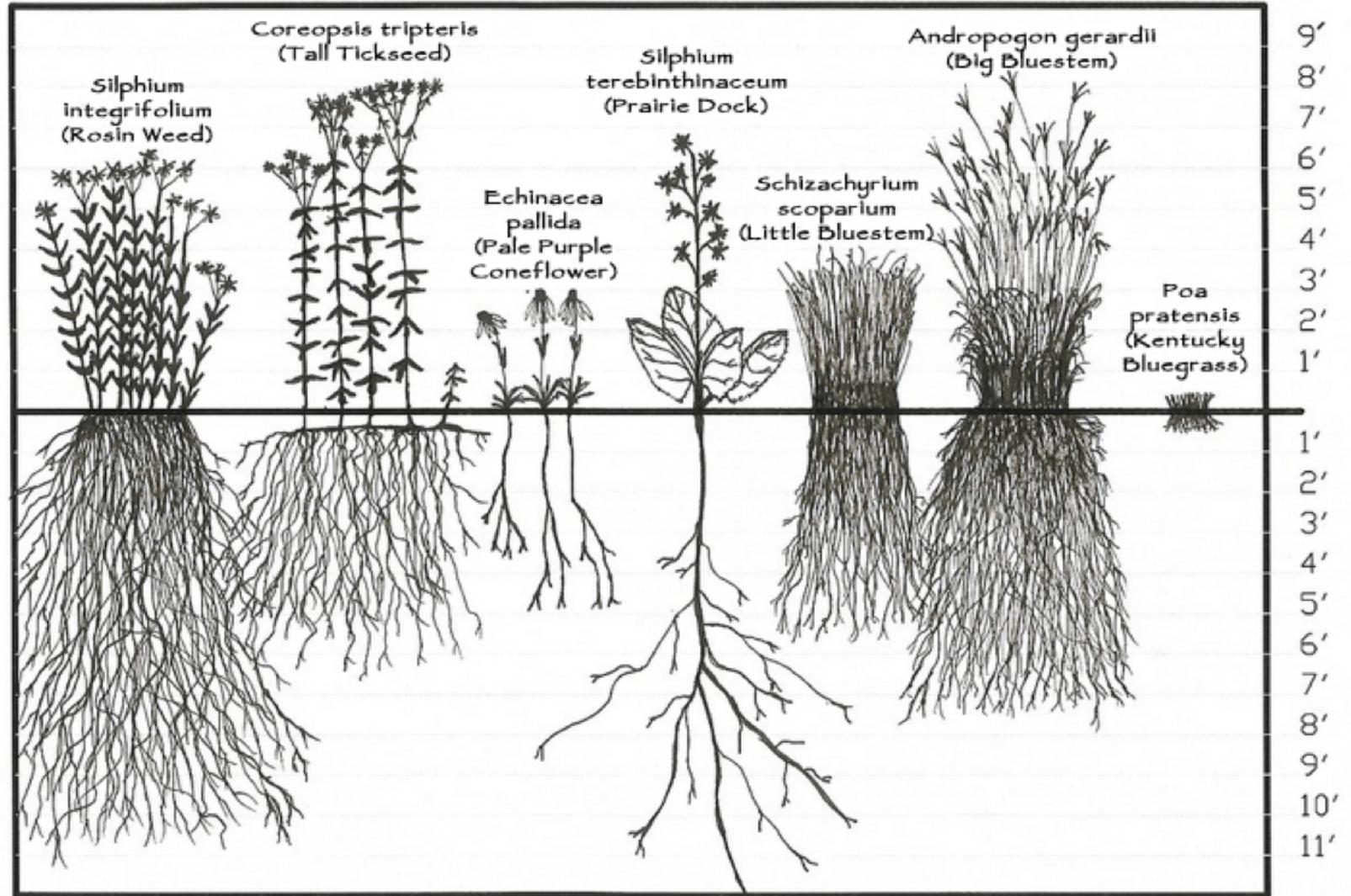
Spiderwort



Wild Ginger

No-Mow Zone/Native Wildflower Meadow

ROOT DEPTH COMPARISON



HEARTLAND RESTORATION SERVICES, Inc.



Native Wildflower Meadow Process (Adopted from Linden LAND Group)



- Tear up sod
- Till compost into soil
- Hydro seed eco-seed mix slurry (ie. Wildflower Mixes from NE Wetland Plants, Inc. or Wildflower Mixes from Ernst Conservation Seeds)
- Plant plugs of perennial flowers and grasses
- May have to cut weeds (not pull) for first couple years until planted species fill out
- Control burn or mow once a year in fall
- Allow 3 years to start getting desired results, will only get better and more beautiful from there!!!

- OR fence off no-mow zone and let nature do her magic! It will take longer for native wildflowers to get established, but over time, it will look like a natural Vermont meadow

Materials & Costs



Parking Lot Perimeter Infiltration Trench

- Crushed stone strip—2-6” crushed stone
- Large boulders from local suppliers

Purpose:

- Contain parking lot to prevent unnecessary compaction & stormwater runoff
- Capture and infiltrate stormwater runoff around parking lot edge
- Provide seating and play features
- Allow grass to grow



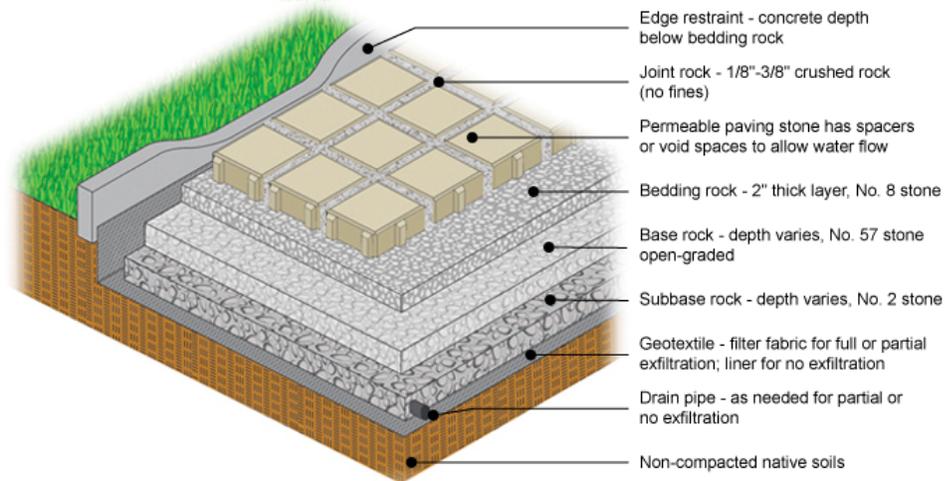


Pervious Pavers

- Porous pavement made out of recycled tires for trail extension
- Permeable pavers for delivery truck parking

Purpose:

- Allow water infiltration and reduce runoff and erosion, protecting valuable riparian buffers
- Any development within 250' of a water body should be minimal and low-impact as possible
- To reduce impact, allow for infiltration, and use recycled materials



<http://www.porouspaveinc.com/projects/benefits/>,
 <http://www.ecolandscaping.org/event/john-hancock-charles-river-walking-path/>,
http://www.ecolandscaping.org/wp-content/uploads/2016/08/IMG_3281.jpg,
<http://macaulay.cuny.edu/eportfolios/greenparking/files/2012/10/Grass-Paver.jpeg>,
 <http://www.angeluspavingstones.com/wp-content/uploads/2012/10/permeable-pavers-diagram.png>

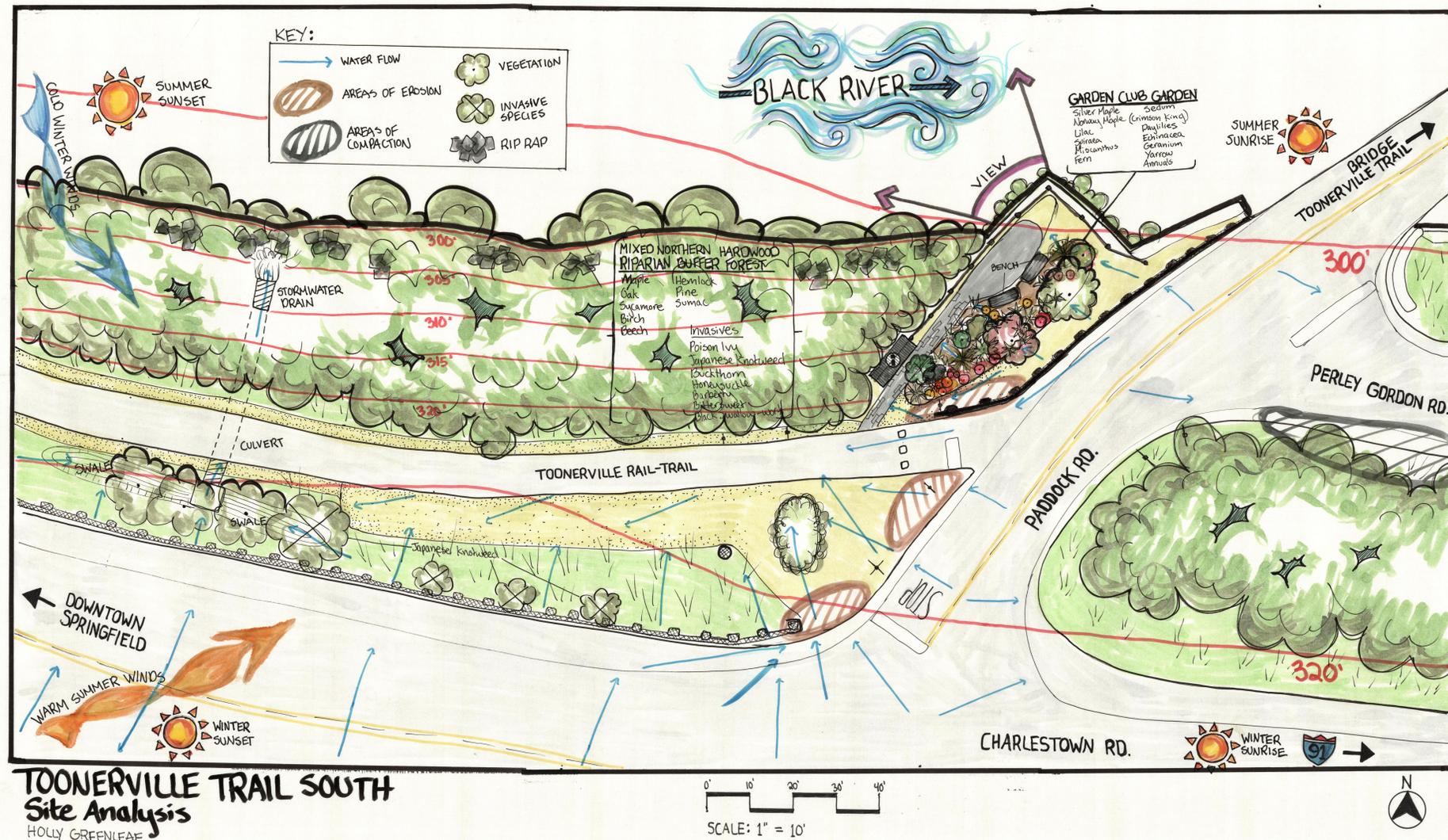
Site Analysis: Paddock Road Trail Entrance

Opportunities

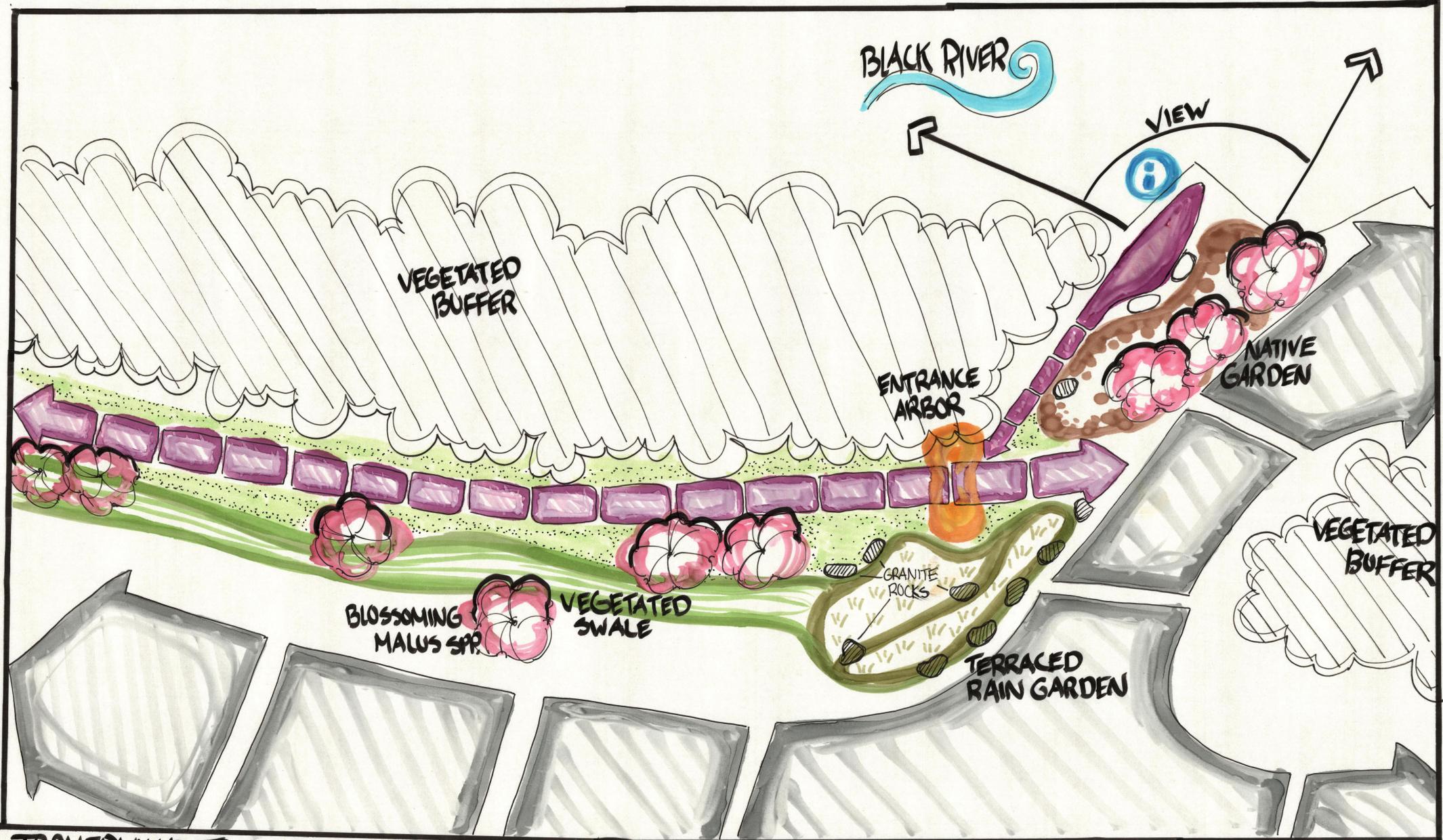
- Stormwater runoff from roads running into greenspace
- Sunny area
- Existing viewing deck and view of waterfall
- Parking available
- Well-drained soils

Constraints

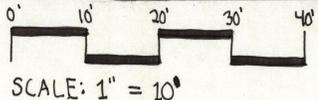
- Steep riparian bank
- Limited parking
- Invasive species present



Concept:
Paddock
Road
Entrance



TOONERVILLE TRAIL SOUTH
Conceptual diagram
HOLLY GREENLEAF



Site Plan: Paddock Road Entrance

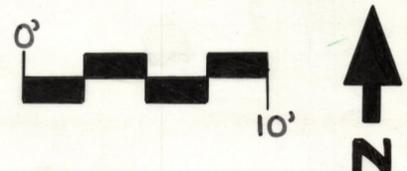


Photo-simulation: Bioretention & “River of Blooms”

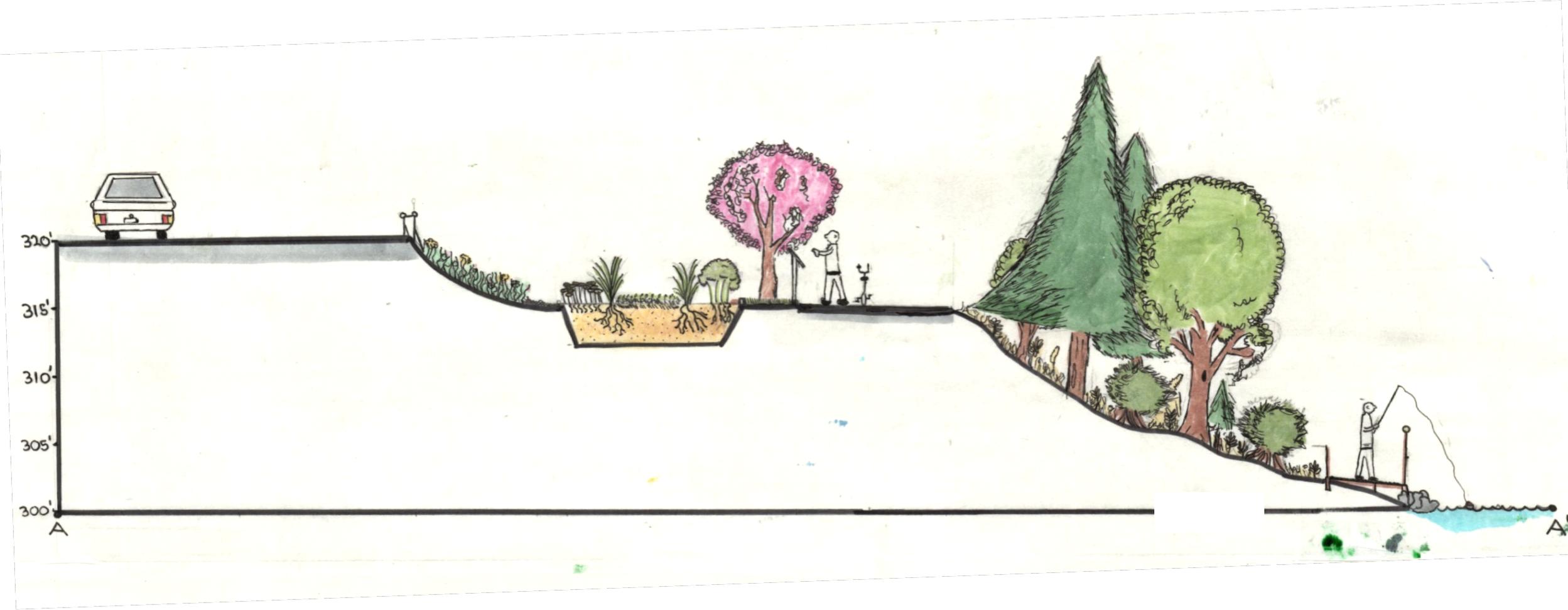


Before
Paddock Entrance



After
Paddock Entrance
with bioretention
and blossoming
trees

Section: Bioretention and Riparian Buffer Restoration



Plant List

Forest Understory Restoration: Herbaceous Species

Heart-Leaf Aster (*Aster cordifolius*)

Hardiness Zone: 3-8

Bloom: Sept-Oct.

Height: 2-3 feet

Spread: 2-3 feet

Light: Partial Shade

Soil Wetness: Average Dry-Moist



Image: [1,2]

Forest Understory Restoration: Herbaceous Species

Canada Goldenrod (*Solidago canadensis*)

Hardiness Zone: 4-9

Bloom Time: Sept.-Oct.

Height: 3-6 feet

Spread: 2-3 feet

Light: Full Sun to Partial Shade

Soil Wetness: Average Dry-Moist



Image: [3,4]

Forest Understory Restoration: Herbaceous Species

Orange Jewelweed (*Impatiens capensis*)

Hardiness Zone: 2-11

Bloom Time: July.-Oct.

Height: 2-5 feet

Spread: 0.5-1 feet, Bunch growing

Light: Partial Shade (Sun required for bloom)

Soil Wetness: Moist



Image: [5,6]

Forest Understory Restoration: Herbaceous Species

White Snake Root (*Ageratina altissima*)

Hardiness Zone: 2-11

Bloom Time: Sept.-Nov.

Height: 1-4 feet

Spread: 2-3 feet

Light: Partial Shade

Soil Wetness: Average Moist

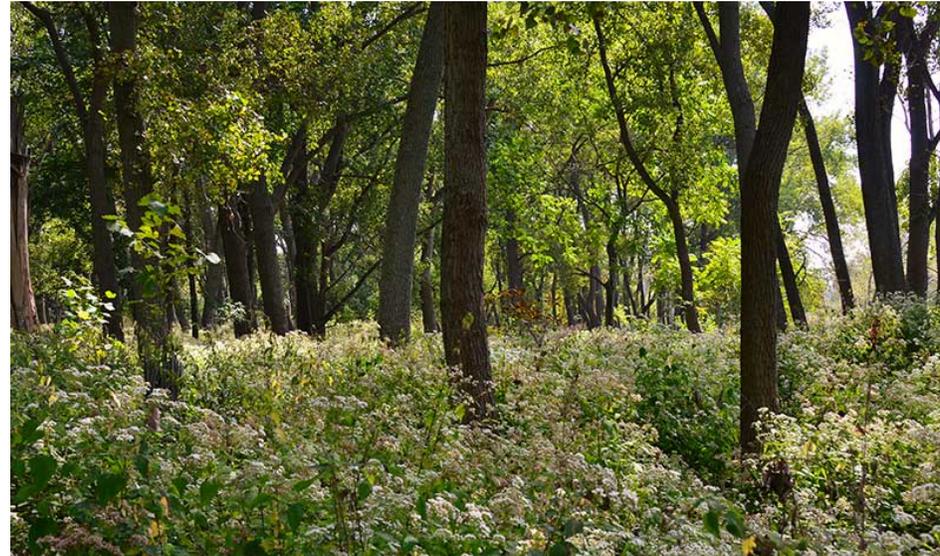


Image: [7,8]

Forest Understory Restoration: Herbaceous Species

Wild Geranium (*Geranium maculatum*)

Hardiness Zone: 3-8

Bloom Time: April-May.

Height: 1-4 feet

Spread: 2-3 feet, Bunch Growing

Light: Partial Shade

Soil Wetness: Average Moist



Image: [9,10]

Forest Understory Restoration: Woody Species

Virginia Creeper (*Parthenocissus quinquefolia*)

Hardiness Zone: 3-9

Bloom Time: May-August.

Length: 12-36 feet

Spread: 1-2 feet, Vine

Light: Partial Shade

Soil Wetness: Average Moist



Image: [11,12]

Forest Understory Restoration: Woody Species

Sassafras (*Sassafras albidum*)

Hardiness Zone: 4-9

Bloom Time: April-May

Height: 30-60 feet

Spread: 25-40 feet

Light: Partial Shade

Soil Wetness: Wet, but Well Drained



Image: [13,14]

Forest Understory Restoration: Woody Species

Winterberry (*Ilex verticillata*)

Hardiness Zone: 3-9

Bloom Time: June-July

Height: 3-12 feet

Spread: 3-12 feet

Light: Partial Shade, Sun needed for Bloom and Fruiting

Soil Wetness: Medium to Wet



Image: [15,16]

Forest Understory Restoration: Woody Species

Grey Dogwood(*Cornus racemosa*)

Hardiness Zone: 4-8

Bloom Time: May-June

Height: 10-15 feet

Spread: 10-15 feet

Light: Partial to Full Shade

Soil Wetness: Medium to Wet



Image: [17,18]

Forest Understory Restoration: Woody Species

Northern Leatherwood (*Dirca palustris*)

Hardiness Zone: 3-9

Bloom Time: March-April

Height: 4-6 feet

Spread: 4-6 feet

Light: Partial to Heavy Shade

Soil Wetness: Medium



Image: [19,20]

Invasive Species Management

Common Invasive Species: Japanese Knotweed, Buckthorn, Honeysuckle, Japanese Barberry, Oriental Bittersweet, Black Swallowwort

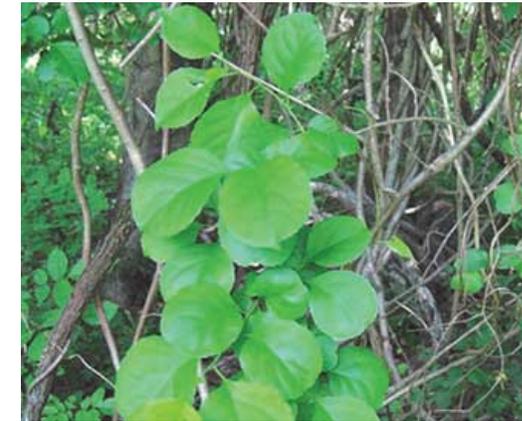


Image: [21,22,23,24,25,26]

Invasive Species Management

Mechanical Removal: While often labor intensive and slow, this method is the most environmentally sound, especially in sensitive areas or close to water sources. Target and remove invasive species when they are flowering to prevent seeding.

Herbicide Application: If herbicide application is permitted within the buffer area of the river, only use water safe alternatives of Glyphosate (i.e. AquaNeat, Rodeo). Broad leaf spraying is not suggested in this landscape. Instead, either cut the species down to a 1-3" stump and apply herbicide along the bark ring with a sponge or use a hypodermic needle to inject 5 mL of concentrated herbicide into the stem or root nodules.



Image: [27,28]

Invasive Species Management

Alternative Methods:

- Solarization – 1.5 mm black plastic or tarp stretched to smother and degrade invasive species. Works best in open sunny areas w/ herbaceous weeds.
- “Benign” Chemicals – weak acids such as vinegar and dilute oils or soaps can have an affect on the foliar health of a weedy plant, but have little ability for translocation to roots. Apply directly and repeatedly to leaf over the course of the growing season, while avoiding contact with desired native species.
- Targeted Browsing/Biological Control – Targeted grazing/browsing or selective arthropod release are promising ecological controls for invasive species, but are still in experimental stages of testing. Contact local DNR agent before attempting or introducing any species into a wild area.



Image: [29,30]

Invasive Species Management – Helpful Resources

Private Herbicide Applicator Certification – Required for the restricted use and purchase of commercial herbicides. Exam is free, and certification lasts 5 years.

- http://agriculture.vermont.gov/pesticide_regulation/applicator_dealer_resources/private_applicators

Vermont Invasives – Local action group focused on identifying, mapping, and removing invasive species from Vermont ecosystems. Helpful for organizing field days and education events.

- <http://www.vtinvasives.org/>

• **USDA Noxious Weeds List** – Specific to Vermont. Includes distribution maps, species information, and identifying characteristics.

- <https://plants.usda.gov/java/noxious?rptType=State&statefips=50>

• **Natural Lands Trust “Controlling Invasive Species”** – Pocket guide to invasive species management and removal. Great for introducing new stewards to the practice.

- <https://natlands.org/wp-content/uploads/downloads/2013/01/Invasives2009-07Page.pdf>

• **iMAP Invasives** – Geolocation tool for mapping and communicating on the location of invasive patches.

- <http://www.imapinvasives.org/>

“Soft Armoring” Coir Roll Bank Stabilization

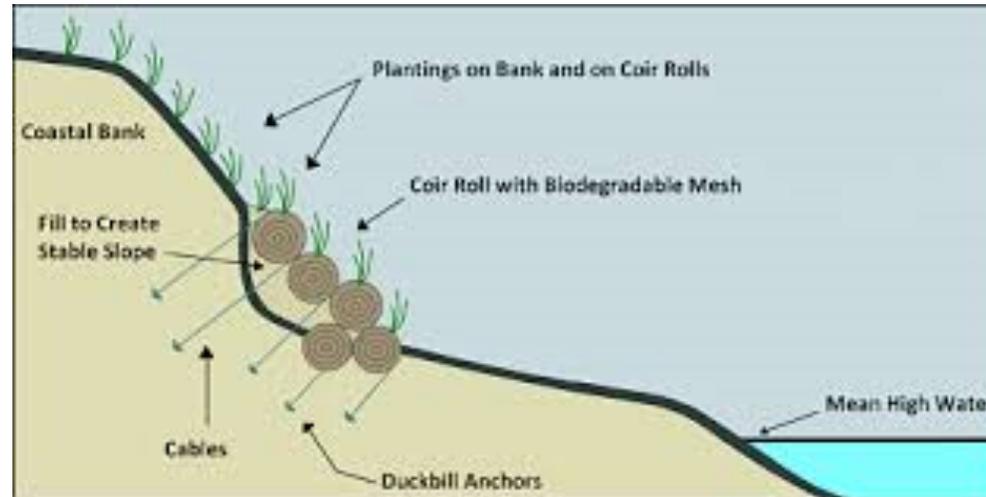


Image: [31,32,33]

Thank you!



Questions or Comments?

Picture Citations

- [1] www.outbacknursery.com/catalog/astercordifolius.htm
- [2] www.restoringthelandscape.com/2012_01_01_archive.html
- [3] <http://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?kempercode=f620>
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- [6] <https://seasonsflow.wordpress.com/2014/09/13/flowers-of-late-summer-jewelweed/>
- [7] <http://nyc.books.plantsofsuburbia.com/eupatorium-rugosum-ageratina-altissimawhite-snakerootasteraceae/>
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- [10] http://minnesotaseasons.com/Plants/wild_geranium.html
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- [12] <http://www.dailylocal.com/article/DL/20140613/LIFE/140619874>
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- [16] http://www.wildflower.org/plants/result.php?id_plant=ILVE
- [17] <https://www.arborday.org/trees/treeguide/TreeDetail.cfm?ItemID=829>
- [18] <http://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?kempercode=j930>
- [19] <https://www.uwgb.edu/biodiversity/herbarium/shrubs/dirpal01.htm>
- [20] <https://jardinage.ooreka.fr/plante/voir/1127/dirca-palustris>
- [21] <https://www.invasivespeciesinfo.gov/plants/knotweed.shtml>
- [22] <http://plants.usda.gov/core/profile?symbol=FRAL4>
- [23] <http://news.cornell.edu/stories/2014/04/invasive-vines-swallow-new-yorks-natural-areas>
- [24] <http://www.missouribotanicalgarden.org/PlantFinder/PlantFinderDetails.aspx?kempercode=d727>
- [25] <http://lakeshoreparkknoxville.org/new-conservation-easement-for-lakeshore-park/>
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- [27] <http://dnr.wi.gov/topic/invasives/control.html>
- [28] <http://pt.slideshare.net/johnlampe/how-to-kill-i>
- [29] <http://ipm.ucanr.edu/PMG/PESTNOTES/pn74145.html>
- [30] <http://nahantmarsh.org/wp-content/uploads/2014/01/>
- [31] <http://www.mishorelinepartnership.org/shoreline-erosion-control.html>
- [32] <https://www.devronltd.com/product/coir-mats-logs/>
- http://library.water-resources.us/docs/MMDL/ECO/MM_Description.cfm?ID=8

Narrative (Jason Kokkinos)

Primary design goals of the entrance to the Toonerville Rail-Trail at Perley-Gordon/Paddock Road are beautification, environmental stewardship, and community gathering. As a main entrance point into the trail and the location of an existing Springfield Garden Club feature, this area is already under regular use. We suggest an installation of two permeable paver parking areas along Perley-Gordon Road to increase overall use of the area and provide an environmental benefit by allowing infiltration of stormwater runoff before it reaches the Black River.

At the trail head, we suggest installation and upkeep of a rain garden to enhance the local beauty and provide additional stormwater treatment from the surrounding roadways. This garden is sized (12'x 20') to treat 3,200 square feet of impervious area from 1" of rain over 24 hours. We suggest 1-2" diameter stones on the east and south side of the garden to help dissipate incoming flow. Depending on aesthetics or cost, these may either be coarse cut or polished riverstones. Planted with native species with bloom times that span the growing season, this rain garden will also act as a benefit to pollinators and wildlife. The rain garden should be approximately 33" deep of sand-based soil topped with a 3" layer of low-phosphorus compost. As an overflow from the rain garden during extreme storm events, and to treat incoming stormwater runoff from further down the road of Clinton Street, we suggest maintaining the existing swale in a "no-mow" wildflower state. This will provide an aesthetic and ecological benefit to the trail, while minimizing management. The trail and swale should be separated by 2-4 feet of mown, Kentucky bluegrass, providing a feeling of managed, yet still accessible, nature. Along the trail, planted in circular mulch beds every 15 feet, we suggest installing moderately sized crab apple trees (*Malus sp.*). Apples are part of the cultural heritage of Springfield, and their vibrant pink bloom will invite local and tourists alike.

On the river-side of the trail, we suggest a structural wooden addition to the current viewing platform adjacent to the existing garden. A railed wooden deck that bends back to the shoreline and down in elevation will foster a feeling of closeness to the river and forest. With the upstream view of the waterfalls and the humility provided by being in proximity to nature, one can envision this as a place of deep contemplation and introspection. Part of this wooden deck should also include a limited-access gate to the riparian buffer forest corridor, which sanctioned environmental stewards (Black River Action Team) may use. This gate will provide access for riparian forest restoration efforts which should include a health assessment and inventory of the existing established native tree species, a removal of the noxious and invasive understory or shrub plants, and active installation and seeding of native species (both herbaceous and woody). This can act as both a visible demonstration area for ecological restoration and starting point for efforts to be continued upstream. Finally, as both an item of demonstration and environmentally sound practice, we suggest the installation of "soft-armoring" along the river bank in this area. Coconut coir rolls or other organically based material can be used to stabilize shore banks and dissipate incoming river flow, preventing further erosion.

Narrative (Holly Greenleaf)

The Toonerville Rail-Trail is a unique feature of Springfield, Vermont, providing access to the natural beauty of the Black River and opportunities for recreation and community gathering. Our landscape design project aims to improve restoration and beautification along the Toonerville Rail-Trail to provide cultural, economic, and ecological benefits. The upcoming extension to Rail-Trail and the proposed changes, outlined below, will attract many new visitors and community members alike to the beauty of blooming trees and gardens, connecting the downtown to the banks of the Black River. It will also provide ecological restoration practices to conserve soil and water quality, benefitting wildlife as well as the community and helping to inspire a sense of place in Springfield.

The first design phase proposed is a “River of Blooms”, with rows of springtime blooming trees and gardens along the trail to provide an annual sight to see after the long winter. We suggest starting at the Paddock Rd. entrance and the Robert S. Jones Industrial Center entrance, and work inward. Design considerations include pink blooms in early spring (Crabapple, Eastern Redbud, Cherry trees), a narrow area between the trail and Charlestown Rd./Clinton St. (about 10’ wide), and salt-tolerant, hardy, and low-maintenance native species. We provide 3 different options for the understory depending on stakeholder preferences: low-diversity consisting of Crabapples and a wildflower meadow understory (mow once a year in fall); medium diversity with 1-2 tree species and a planted understory of 1-2 summer blooming species and 1-2 late summer/fall blooming species; and high diversity mix with 3+ trees species including at least 2 natives, an understory consisting of 1-3 spring bloomers, 1-3 summer bloomers, and 1-3 late summer/fall bloomers. The understory for both planting options 2 and 3 will be massings of each species (6+) to benefit native pollinators and provide a naturalistic cottage garden aesthetic. The tree canopy paired with a low flowering understory provides a protected feel while on the path, but does not obstruct views from the road for safety and for vehicle traffic to view the trail as well.

We propose functional and beautiful green stormwater infrastructure (GSI) near the existing northern terminal of the trail (Robert S. Jones Industrial Center) to manage stormwater runoff, improve water quality of the Black River, and provide beautiful and educational spaces for people. We propose a 3-5’ wide infiltration trench filled with 6” of crushed stone or gravel (4-6” in size) surrounding the parking lot to contain parking and reduce compaction and further erosion, while also capturing stormwater runoff and reducing erosion. Large boulders are placed on top of the trench, spaced apart to prevent cars from parking on the trench and compacting it, while also providing places to sit.

We propose a bioretention system to capture the stormwater runoff coming off the parking lot, filter out sediment, nutrients, and pollutants, and recharge groundwater. Runoff will go into the inflow area, a slightly sloped swale filled with gravel, boulders, and water-loving species like Iris and Daylilies. Then, it flows through a gravel inlet, dissipating the water as it enters the rain garden, a bowl-shaped garden filled with drought-tolerant, flood-tolerant, and salt-tolerant species. Each plant grouping has a specific function and a corresponding list of species to choose from. The rain garden is surrounded by a planted berm that holds the water in, allowing for infiltration, until it overflows over a

gravel weir into a vegetated swale that directs water toward the stormwater drain. There is an overflow pipe in the main rain garden in preparation for high precipitation events, allowing a second exit route connected directly to the stormwater drain.

Two riparian restoration areas are proposed near the outlets of the stormwater drain and the combined sewer outlet (CSO) drain to treat polluted runoff from reaching the river. The goal of these areas is to establish a dense native understory on naturalized terracing to slow down the flow of water and prevent further erosion of the bank and plant material. Coir rolls (made of coconut fiber) are staked into the bank on-contour with live stakes of willow, dogwood, or alder. Then, fascines (bundles of live stakes placed horizontally on-contour) are placed above and below the coir rolls to establish dense native vegetation and water catchment. These features will capture any sediment in water runoff and create mini berms/terraces to allow for regeneration along the bank. These ecological engineering solutions will protect the bank from flooding, prevent erosion, and capture runoff, reducing peak hydrologic flows and erosion downstream, and improving water quality.

Finally, a community gathering space is proposed near the existing entrance, with a row of flowering trees to provide a welcoming entrance. The trees stand in front of the vegetated swale, seeded with native wildflower mixes, that lead into both bioretention/rain gardens. The southern rain garden near is more for educational and aesthetic purposes, with a wooden foot bridge crossing the garden to stepping stones leading through a shade garden. There are swinging benches and an arbor made from old apple ladders with Honeysuckle. We propose establishing no-mow zones to evolve into wildflower meadows (mow once a year in fall) on either side of the trail entrance with a meandering path mown through to reduce the size of the lawn and provide fun for kids and more ecological benefits.

The vegetated swales, bioretention/rain gardens, no-mow zones, and riparian buffer restoration areas can be replicated along the proposed extension of the trail as well as the blooming planting plans. We propose a porous material for the new path, such as Porous Pavers made from recycled tires than can withstand the freezing and thawing inherent in Vermont winters. This type of surface allows water to percolate through the pathway and into the ground, reducing stormwater runoff and erosion. Along the new path, we propose to continue the tree corridor plantings. If there is not enough space due to industrial parking areas, we propose pervious pavers for the trucks that still allows grass to grow through.

The design features proposed can be implemented piece-meal, allowing for flexibility and budget requirements. Each design feature was developed with ecology, community, and economics in mind. We hope these designs aid the town of Springfield to gather support, raise money, and provide community members and visitors alike with beautiful places to explore the blooming banks of the Black River in springtime, a warm welcoming entrance to the town, improved water quality of the Black River, and places to gather and celebrate the history, present, and future.