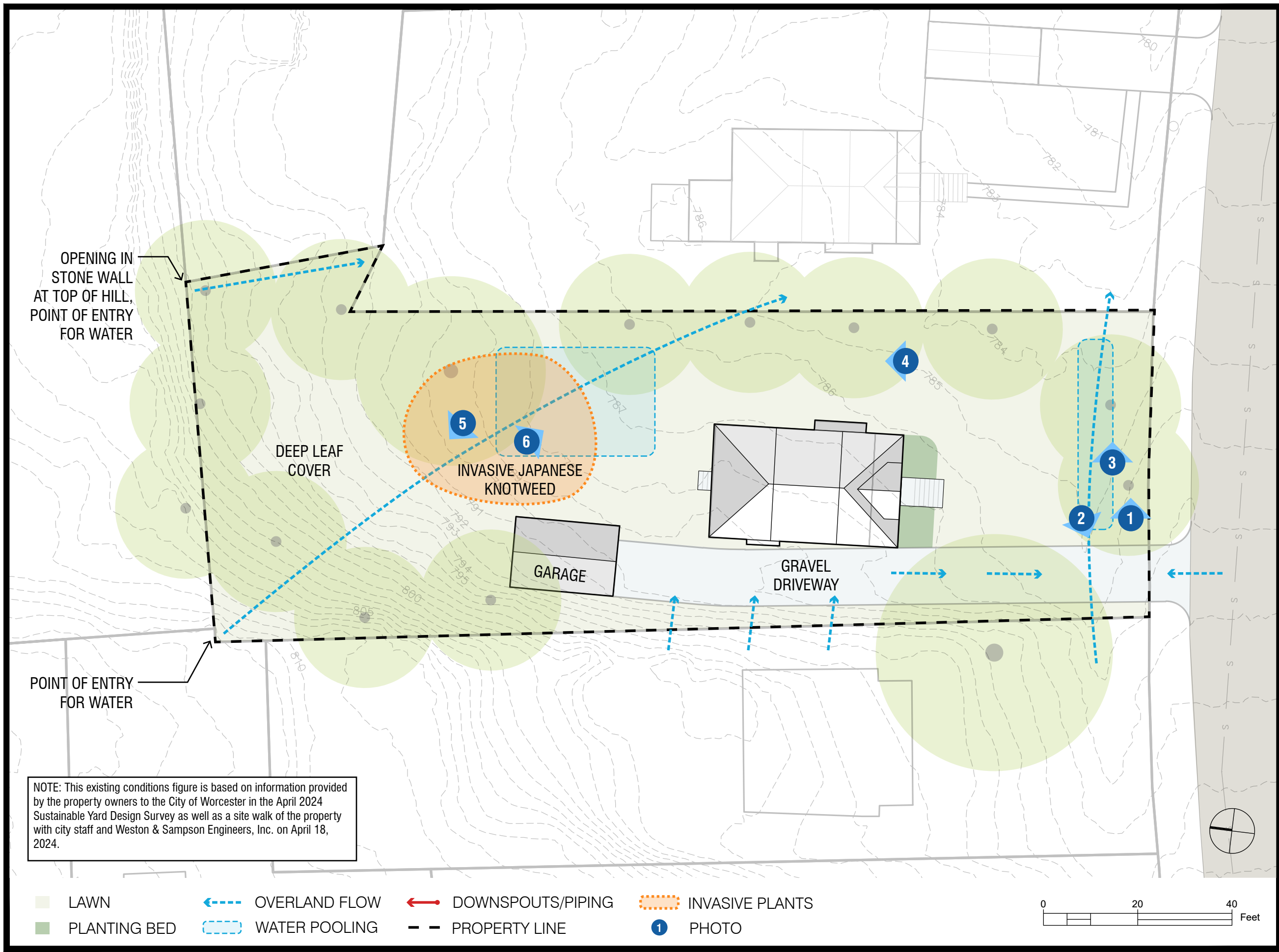


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Project:  
**SUSTAINABLE YARD DESIGN  
CASE STUDY 4  
WORCESTER, MA**

**Weston & Sampson**<sup>™</sup>  
Weston & Sampson Engineers, Inc.  
55 Walkers Brook Drive, Suite 100  
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Date: 05/09/24  
Drawn By: CD  
Reviewed By: AS  
Approved By: JM

W&S Project No.: ENG22 - 1048  
W&S File No.:

Drawing Title:  
**EXISTING CONDITIONS  
PLAN**

Sheet Number:  
**C101**



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1 WATER CHANNEL ALONG FRONT OF PROPERTY TOWARDS CATCH BASIN BEYOND



2 WATER SHEETING FROM ROAD AND DRIVEWAY TOWARDS CHANNEL



3 SIGNIFICANT WATER POOLING IN FRONT OF PROPERTY



4 PATH OF WATER ALONG SHADY EDGE OF PROPERTY



5 DEEP LEAF LITTER ALONG STEEP SLOPE AT BACK OF PROPERTY



6 INVASIVE JAPANESE KNOTWEED AND WATER POOLING IN BACK YARD

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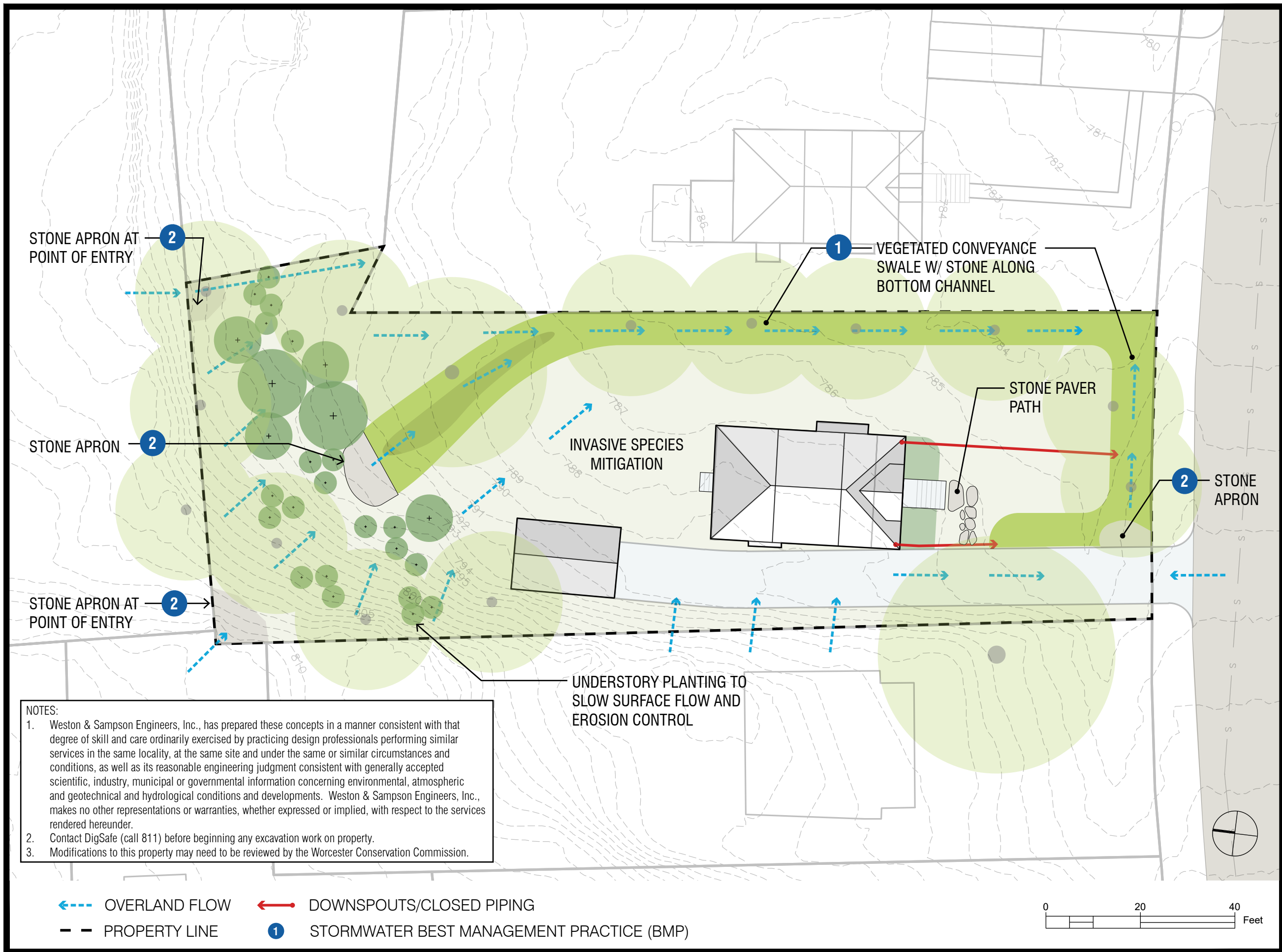
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W&S File No.:

Drawing Title:  
EXISTING CONDITIONS  
PHOTOS

Sheet Number:  
C102



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Reviewed By:	AS
Approved By:	JM
W&S Project No.: ENG22 - 1048	
W&S File No.:	

Drawing Title:
SITE PLAN
Sheet Number:
C201

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STORMWATER BEST MANAGEMENT PRACTICE (BMP)



Photo Credit: Massachusetts Office of Coastal Zone Management (CZM)

1 VEGETATED CONVEYANCE SWALE



Photo Credit: Alliance for the Bay, MD

2 STONE APRON

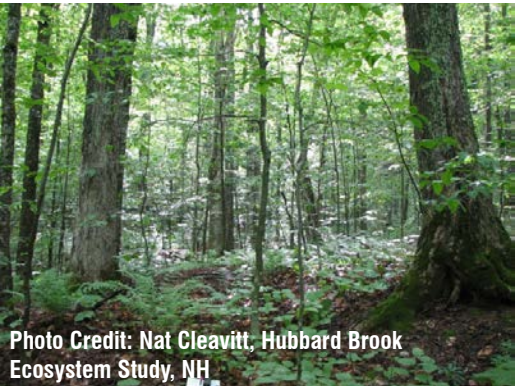


Photo Credit: Nat Cleavitt, Hubbard Brook Ecosystem Study, NH

3 UNDERSTORY PLANTING FOR EROSION CONTROL

NATURE-BASED SOLUTIONS RESOURCES

- [Easthampton Homeowner’s Guide to Do-It-Yourself Stormwater Management Solutions that Improve Community Resilience](http://easthamptonma.gov/DocumentCenter/View/3891/Residential-Guide-to-Stormwater-Management---English?bidId=) (easthamptonma.gov/DocumentCenter/View/3891/Residential-Guide-to-Stormwater-Management---English?bidId=)
- [National Fish and Wildlife](http://www.stormwaterguide.org/static/HomeownersGuide.pdf) (www.stormwaterguide.org/static/HomeownersGuide.pdf)

CONSIDERATIONS FOR PLANTING

Refer to the UMASS Extension Landscape, Nursery and Urban Forestry Program “[Plant Selection for Managed Landscapes: Right plant, right place](#)” guidelines below when selecting landscape plants.

Some site conditions to keep in mind when selecting landscape plants include:

- light availability, intensity and duration (full sun to deep shade)
- water availability, both quantity and quality
- exposure to wind and temperature extremes
- soil type, drainage, compaction
- hardiness zone
- competition from existing vegetation
- below ground conditions in urban sites
- above ground wires or obstructions

Aesthetic considerations for plant selection include:

- growth habit, i.e. pyramidal, columnar, spreading, etc.
- season and color of bloom
- foliage color, texture, and shape
- winter interest of bark, fruit, or structure
- benefits to wildlife
- fall color
- longevity

PLANT SELECTION BY FUNCTION

- [Pollinator Garden](http://massnrc.org/ppd/) (massnrc.org/ppd/)
- [Rain Garden](http://mass.gov/info-details/stormwater-solutions-for-homeowners) (mass.gov/info-details/stormwater-solutions-for-homeowners)
- [Understory Planting for Erosion Control](http://mass.gov/info-details/stormwater-solutions-for-homeowners) (mass.gov/info-details/stormwater-solutions-for-homeowners)
- [Vegetated Buffer](http://mass.gov/info-details/stormwater-solutions-for-homeowners) (mass.gov/info-details/stormwater-solutions-for-homeowners)
- [Vegetated Swale](http://mass.gov/info-details/stormwater-solutions-for-homeowners) (mass.gov/info-details/stormwater-solutions-for-homeowners)

WHERE TO PURCHASE NATIVE PLANTS

- [Grow Native Massachusetts](http://grownativemass.org/Great-Resources/nurseries-seed) (grownativemass.org/Great-Resources/nurseries-seed)
- [Native Plant Trust](http://nativeplanttrust.org) (nativeplanttrust.org)
- [Native Plant Initiative](http://apcc.org/our-work/education/native-plant-initiative/) (apcc.org/our-work/education/native-plant-initiative/)
- [Blue Stem Natives](http://bluestemnatives.com) (bluestemnatives.com)
- [New England Wetland Plants](http://newp.com) (newp.com)
- [Tree Talk Natives](http://treetalknatives.com) (treetalknatives.com)
- [American Beauties Native Plants](http://abnativeplants.com) (abnativeplants.com)
- Lady Bird Johnson Wildflower Center (wildflower.org)
- [National Nursery and Seed Directory](http://nnp.rngr.net/resources/directory) (nnp.rngr.net/resources/directory)
- [Arbor Day Foundation](http://arborday.org) (arborday.org)

SAMPLE PLANT LIST

VEGETATED CONVEYANCE SWALE

Grasses & Perennials

- Blue Flag Iris (Iris versicolor)
- Canada Bluejoint (Calamagrostis canadensis)
- Cardinal Flower (Lobelia cardinalis)
- Marsh Marigold (Caltha palustris)
- Swamp Milkweed (Asclepias incarnata)
- Sweet Joe-Pye Weed (Eutrochium purpureum)
- Tussock Sedge (Carex stricta)
- Little Bluestem (Schizachyrium scoparium)
- New England Aster (Aster novae-angliae)
- Pennsylvania Sedge (Carex pensylvanica)

Shrubs & Trees

- Sweet Gale (Myrica gale)
- Highbush Blueberry (Vaccinium corymbosum)
- American Witch Hazel (Hamamelis virginiana)

UNDERSTORY PLANTING

Grasses & Perennials

- Pennsylvania Sedge (Carex pensylvanica)
- Red Columbine (Aquilegia Canadensis)
- Little Bluestem (Schizachyrium scoparium)
- White Turtlehead (Chelone glabra)
- Foamflower (Tiarella cordifolia)

Shrubs & Trees

- American Witch Hazel (Hamamelis virginiana)
- Mountain Laurel (Kalmia latifolia)
- Highbush blueberry (Vaccinium corymbosum)
- Serviceberry (Amelanchier spp.)

JAPANESE KNOTWEED RESOURCES

- [PennState Extension](https://extension.psu.edu/japanese-knotweed) (https://extension.psu.edu/japanese-knotweed)
- [Ontario Invasive Plant Council](https://www.ontarioinvasiveplants.ca/wp-content/uploads/2016/06/OIPC_BMP_JapaneseKnotweed.pdf) (https://www.ontarioinvasiveplants.ca/wp-content/uploads/2016/06/OIPC\_BMP\_JapaneseKnotweed.pdf)

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W&S File No.:

Drawing Title:

SITE PLAN

Sheet Number:

C202

NOTE: Plant suitability is not limited to the sample plant list. A professional horticulturalist, landscape designer, or landscape architect can help in exploring additional species suitable for your site.





Prepared by Weston & Sampson, May 2024

Item Description	Quantity	Unit	Unit Price	Total Price	Notes	Reference Link
Gutters, Downspouts, and Downspout Extensions						
Aluminum Downspout	11	10 FT	\$16.50	\$181.50	Downspout piping typically sold in 10-ft segments. ~\$16.50 for 2"x3"x10' segment, per Home Depot. Larger size (3"x4"x10') is ~\$18. Assume 40 ft needed for vertical downspouts, 65 ft for horizontal extensions.	<a href="https://www.homedepot.com/p/Amerimax-Home-Products-2-in-x-3-in-x-10-ft-White-Aluminum-Downspout-2601000120/100016183">https://www.homedepot.com/p/Amerimax-Home-Products-2-in-x-3-in-x-10-ft-White-Aluminum-Downspout-2601000120/100016183</a>
Aluminum Downspout A-Elbow	2	EA	\$4.25	\$8.50	2"x3" ~\$4.25, 3"x4" ~\$5.25, per Home Depot.	<a href="https://www.homedepot.com/p/Amerimax-Home-Products-2-in-x-3-in-White-Aluminum-Downspout-A-Elbow-27064/100065489">https://www.homedepot.com/p/Amerimax-Home-Products-2-in-x-3-in-White-Aluminum-Downspout-A-Elbow-27064/100065489</a>
Aluminum Gutters	8	16 FT	\$26.00	\$208.00	Assume gutters installed on all four sides of roof; total ~128 ft. Typical sold in 16 ft segments.	<a href="https://www.homedepot.com/p/Amerimax-Home-Products-5-in-x-16-ft-White-Aluminum-K-Style-Gutter-2600200192/100013979">https://www.homedepot.com/p/Amerimax-Home-Products-5-in-x-16-ft-White-Aluminum-K-Style-Gutter-2600200192/100013979</a>
Aluminum Gutter End with Drop Outlet	2	EA	\$10.00	\$20.00	One needed for each downspout (2 total)	<a href="https://www.homedepot.com/p/Amerimax-Home-Products-5-in-White-Aluminum-K-Style-Gutter-End-with-2-in-x-3-in-Drop-Outlet-27010/100086452">https://www.homedepot.com/p/Amerimax-Home-Products-5-in-White-Aluminum-K-Style-Gutter-End-with-2-in-x-3-in-Drop-Outlet-27010/100086452</a>
River Stone Apron at Downspout Outlet	5	CF	\$10.00	\$50.00	Assume 10 sf x 3" deep per apron. 2 aprons needed. Per home depot, one 0.5-cf bag costs ~\$5.	<a href="https://www.homedepot.com/p/Vigoro-0-5-cu-ft-Bagged-River-Pebble-Landscape-Rock-54250V/100558618">https://www.homedepot.com/p/Vigoro-0-5-cu-ft-Bagged-River-Pebble-Landscape-Rock-54250V/100558618</a>
Contingency	20%	Subtotal		\$468.00		
				\$93.60		
		Total		\$561.60		
Conveyance Swale Segment 1 - Back and Side Yard						
Stone Apron	27	CF	\$10.00	\$270.00	~105 sf apron at start of swale. Assume 3" depth. Assume same river stone as the aprons for downspout outlets (\$5 per 0.5-cf bag)	
Stone Channel	170	CF	\$10.00	\$1,700.00	Assume 4 ft wide, 3" deep channel along bottom of segment 1 (~170 ft long). Assume same river stone as the stone aprons.	
Mulch - 3"	373	CF	\$2.00	\$746.00	3" depth over ~1490 sf conveyance swale segment.	<a href="https://www.homedepot.com/p/Vigoro-2-cu-ft-Bagged-Premium-Black-Wood-Mulch-52050197/205606445">https://www.homedepot.com/p/Vigoro-2-cu-ft-Bagged-Premium-Black-Wood-Mulch-52050197/205606445</a>
Bioretention Soil Mix - 18"	83	CY	\$30.00	\$2,490.00	18" depth over ~1490 sf conveyance swale segment.	Other projects
Coarse Sand - 1"	5	CY	\$55.00	\$275.00	1" depth over ~1490 sf conveyance swale segment.	Other projects
Pea Gravel - 3"	14	CY	\$86.00	\$1,204.00	3" depth over ~1490 sf conveyance swale segment.	Other projects
3/4" Crushed Stone - 8"	37	CY	\$50.00	\$1,850.00	8" depth over ~1490 sf conveyance swale segment.	<a href="https://www.aawillmaterials.com/store/3-4-Crushed-Stone-p281934456">https://www.aawillmaterials.com/store/3-4-Crushed-Stone-p281934456</a>
Geotextile Fabric	2340	SF	\$0.10	\$234.00	~1490 sf total area of conveyance swales, plus assume an additional 5 ft along the 170-ft length of swale segment to line the sides. Assume \$0.10 per sf based on multiple Home Depot options.	
Erosion Control/Restoration Mix for Moist Sites	3	LBS	\$39.00	\$117.00	1250 sf per lb, minimum order 3 lbs. ~1490 sf total.	<a href="https://newp.com/product/new-england-erosion-control-restoration-mix-for-detention-basins-and-moist-sites/">https://newp.com/product/new-england-erosion-control-restoration-mix-for-detention-basins-and-moist-sites/</a>
Contingency	20%	Subtotal		\$8,886.00		
				\$1,777.20		
		Total		\$10,663.20		
Conveyance Swale Segment 2 - Front Yard						
Stone Apron	12.5	CF	\$10.00	\$125.00	~50 sf apron at start of swale. Assume 3" depth. Assume same river stone as the aprons for downspout outlets (\$5 per 0.5-cf bag)	
Stone Channel	70	CF	\$10.00	\$700.00	Assume 4 ft wide, 3" deep channel along bottom of segment 1 (~70 ft long). Assume same river stone as the stone aprons.	
Mulch - 3"	129	CF	\$2.00	\$258.00	3" depth over ~515 sf conveyance swale segment.	<a href="https://www.homedepot.com/p/Vigoro-2-cu-ft-Bagged-Premium-Black-Wood-Mulch-52050197/205606445">https://www.homedepot.com/p/Vigoro-2-cu-ft-Bagged-Premium-Black-Wood-Mulch-52050197/205606445</a>
Bioretention Soil Mix - 18"	29	CY	\$30.00	\$870.00	18" depth over ~515 sf conveyance swale segment.	Other projects
Coarse Sand - 1"	2	CY	\$55.00	\$110.00	1" depth over ~515 sf conveyance swale segment.	Other projects
Pea Gravel - 3"	5	CY	\$86.00	\$430.00	3" depth over ~515 sf conveyance swale segment.	Other projects
3/4" Crushed Stone - 8"	13	CY	\$50.00	\$650.00	8" depth over ~515 sf conveyance swale segment.	<a href="https://www.aawillmaterials.com/store/3-4-Crushed-Stone-p281934456">https://www.aawillmaterials.com/store/3-4-Crushed-Stone-p281934456</a>
Geotextile Fabric	865	SF	\$0.10	\$86.50	~515 sf total area of conveyance swales, plus assume an additional 5 ft along the 70-ft length of swale segment to line the sides. Assume \$0.10 per sf based on multiple Home Depot options.	
Erosion Control/Restoration Mix for Moist Sites	3	LBS	\$39.00	\$117.00	1250 sf per lb, minimum order 3 lbs. ~515 sf total.	<a href="https://newp.com/product/new-england-erosion-control-restoration-mix-for-detention-basins-and-moist-sites/">https://newp.com/product/new-england-erosion-control-restoration-mix-for-detention-basins-and-moist-sites/</a>
Contingency	20%	Subtotal		\$3,346.50		
				\$669.30		
		Total		\$4,015.80		



Prepared by Weston & Sampson, May 2024

Item Description	Quantity	Unit	Unit Price	Total Price	Notes	Reference Link
Understory Plantings & Stone Aprons at Points of Entry - Backyard						
Tree Plantings	5	EA	\$350.00	\$1,750.00	Assume 2-2.5" caliper.	NEWP: <a href="https://newp.com/catalog/shrubs/">https://newp.com/catalog/shrubs/</a> NPT: <a href="https://newfs-society.s3.amazonaws.com/documents/2024-05-02_NPT_2024_Plants_Price_Availability_List.pdf">https://newfs-society.s3.amazonaws.com/documents/2024-05-02_NPT_2024_Plants_Price_Availability_List.pdf</a>
Shrub Plantings	21	EA	\$12.00	\$252.00	1 gal buckets ~\$12 per NEWP, other plant size options available, see links to right	
Stone Aprons	40	CF	\$10.00	\$400.00	~160 sf (two aprons) at points of entry. Assume 3" depth. Assume same river stone as the aprons for downspout outlets (\$5 per 0.5-cf bag)	
			Subtotal	\$2,402.00		
Contingency	20%			\$480.40		
			Total	\$2,882.40		
Front Walkway						
Stone Pavers	1	LS	\$900.00	\$900.00	Assume one 60 sf pallet of stone pavers needed for walkway.	<a href="https://www.homedepot.com/p/Southwest-Boulder-Stone-14-in-x-12-in-x-2-in-60-sq-ft-Storm-Mountain-Natural-Flagstone-for-Landscape-Gardens-and-Pathways-02-0221/312655103">https://www.homedepot.com/p/Southwest-Boulder-Stone-14-in-x-12-in-x-2-in-60-sq-ft-Storm-Mountain-Natural-Flagstone-for-Landscape-Gardens-and-Pathways-02-0221/312655103</a>
			Subtotal	\$900.00		
Contingency	20%			\$180.00		
			Total	\$1,080.00		
TOTAL COST				\$19,203.00		

Notes:

1. Costs are for materials only and exclude labor costs (contractor).

2. Costs are presented in 2024 US dollars and include a 20% contingency.

3. Costs are based on pricing from Home Depot, New England Wetland Plants, Inc., Native Plant Trust, and reference pricing from other projects

4. Weston & Sampson Engineers, Inc. makes cost estimates using its best judgement as an experienced and qualified professional engineer generally familiar with the construction industry. Weston & Sampson Engineers, Inc. has no control over the cost of labor, materials, equipment or services furnished by others, or any methods of determining prices, or competitive bidding or market conditions when the project will be constructed. Weston & Sampson Engineers, Inc. cannot and does not guarantee that a contractor’s bids or actual construction costs will not vary from cost estimates prepared. If property owner desires greater assurance as to probable construction cost, property owner should obtain a quote from a contractor.