

Design Considerations when Installing Native Vegetation for Stormwater Facilities

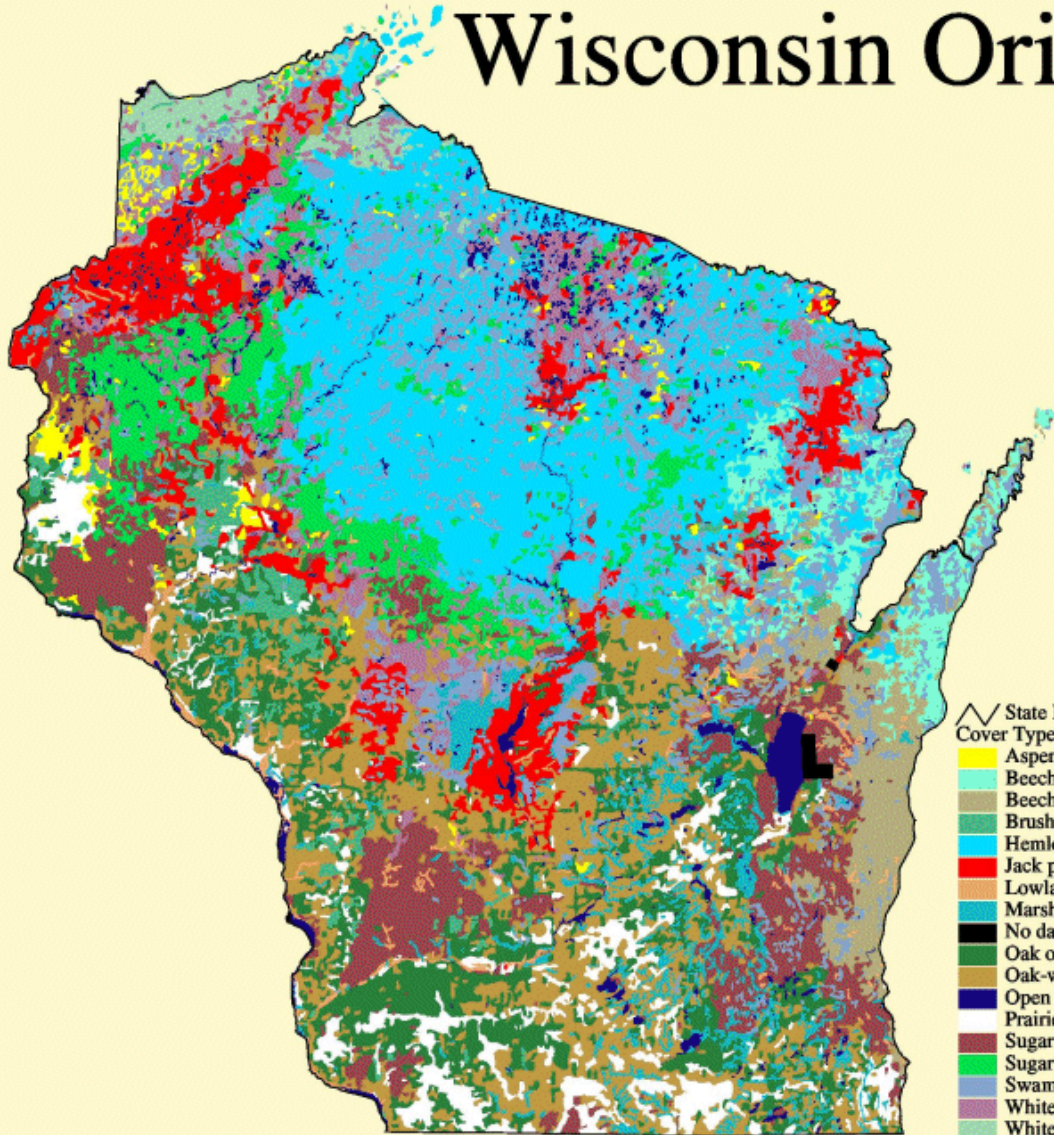
James Havel
Senior Ecologist



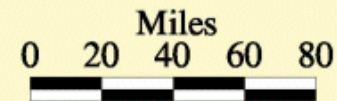
What is the definition of a Native Plant?

- Native plants are those that evolved naturally in a particular area before humans introduced plants from distant places. In Wisconsin, native plants typically grow in communities with species adapted to similar light, soil, moisture, and weather conditions.

Wisconsin Original Vegetation



Scale
1:3300000



∩ State Boundary
Cover Types

- Aspen, white birch, pine
- Beech, hemlock, sugar maple, yellow birch, white pine, red pine
- Beech, sugar maple, basswood, red oak, white oak, black oak
- Brush
- Hemlock, sugar maple, yellow birch, white pine, red pine
- Jack pine, scrub (hill's) oak forests and barrens
- Lowland hardwoods-willow, soft maple, box elder, ash, elm, cottonwood, river birch
- Marsh and sedge meadow, wet prairie, lowland shrubs
- No data or unknown
- Oak openings-bur oak, white oak, black oak
- Oak-white oak, black oak, bur oak
- Open water
- Prairie
- Sugar maple, basswood, red oak, white oak, black oak
- Sugar maple, yellow birch, white pine, red pine
- Swamp conifers-white cedar, black spruce, tamarack, hemlock
- White pine, red pine
- White spruce, balsam fir, tamarack, white cedar, white birch, aspen

Vegetative cover map derived from General Land Office notes and maps from the original land survey covered in Wisconsin (1832-1866). Map was digitized by the Wisconsin DNR



Why should native plants be considered in and around stormwater facilities?

Water Quality Protection



Erosion Control



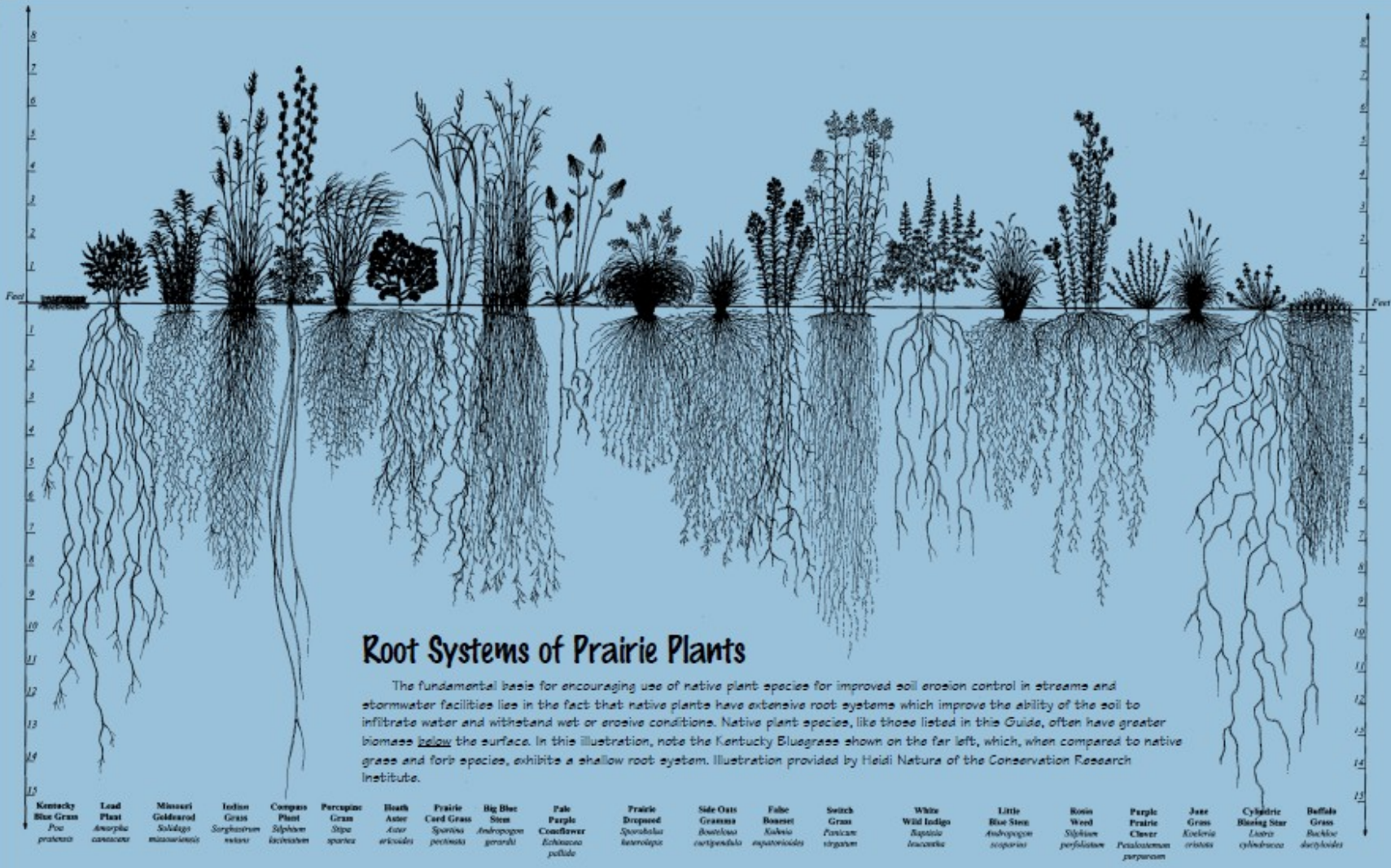


Diagram from USDA



Floral Diversity and Wildlife Habitat



Reduced Maintenance

- In time, native plants can create a self-sustaining community
- Maintenance is still required!!!

Developing a Successful Native Planting Plan Compatible with a Designed Stormwater Facility

- Assess the Current Site Conditions
 - Existing Vegetation
 - Soil Properties
 - Sun Exposure
 - Wildlife

Existing Vegetation



Maintained Lawn



Fallow Field



Site Preparation

- Eliminate Existing Vegetation

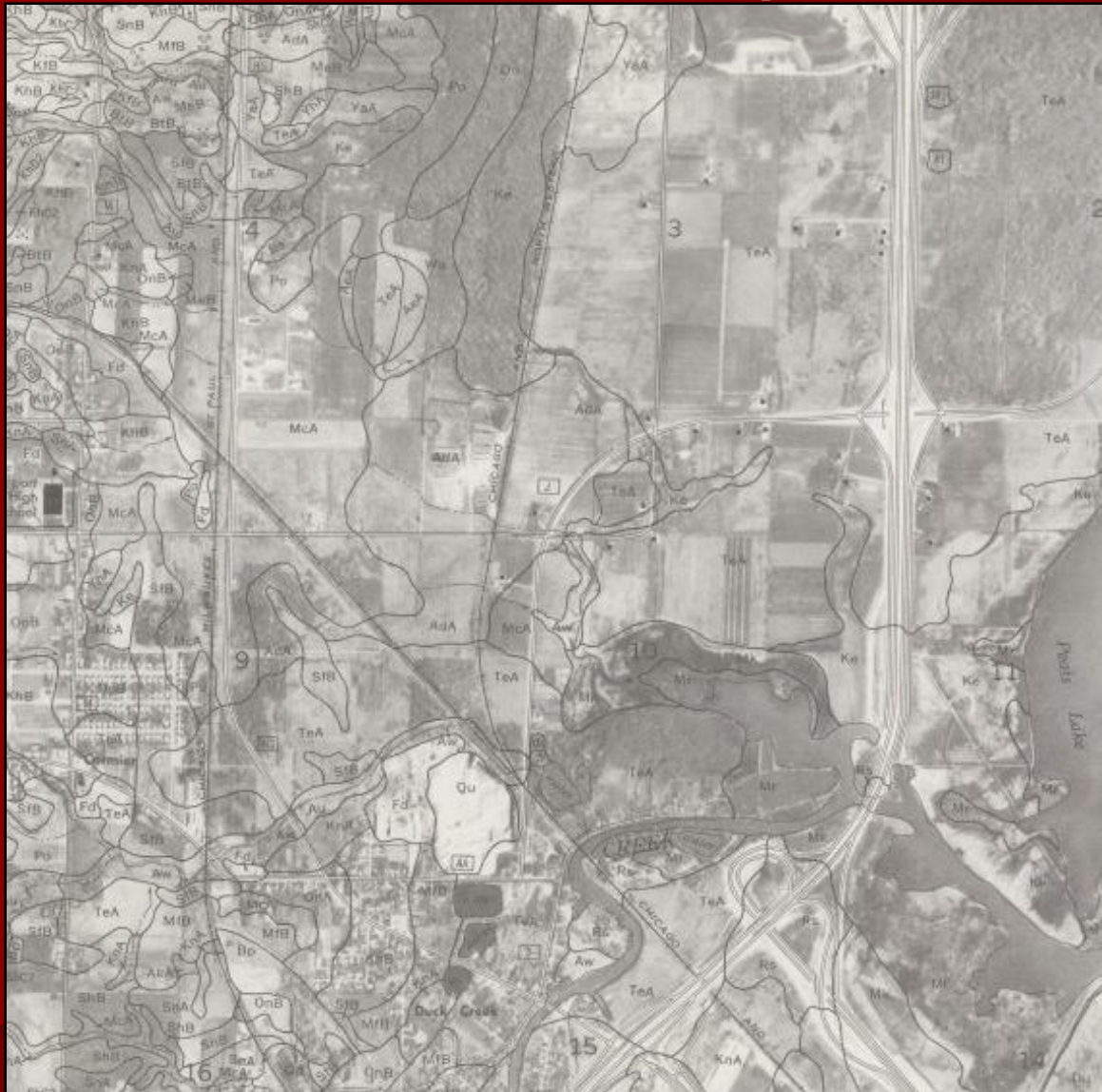
- Chemicals

- Chemical Free

- Repeated Tilling
 - Sod Removal



Soils Map

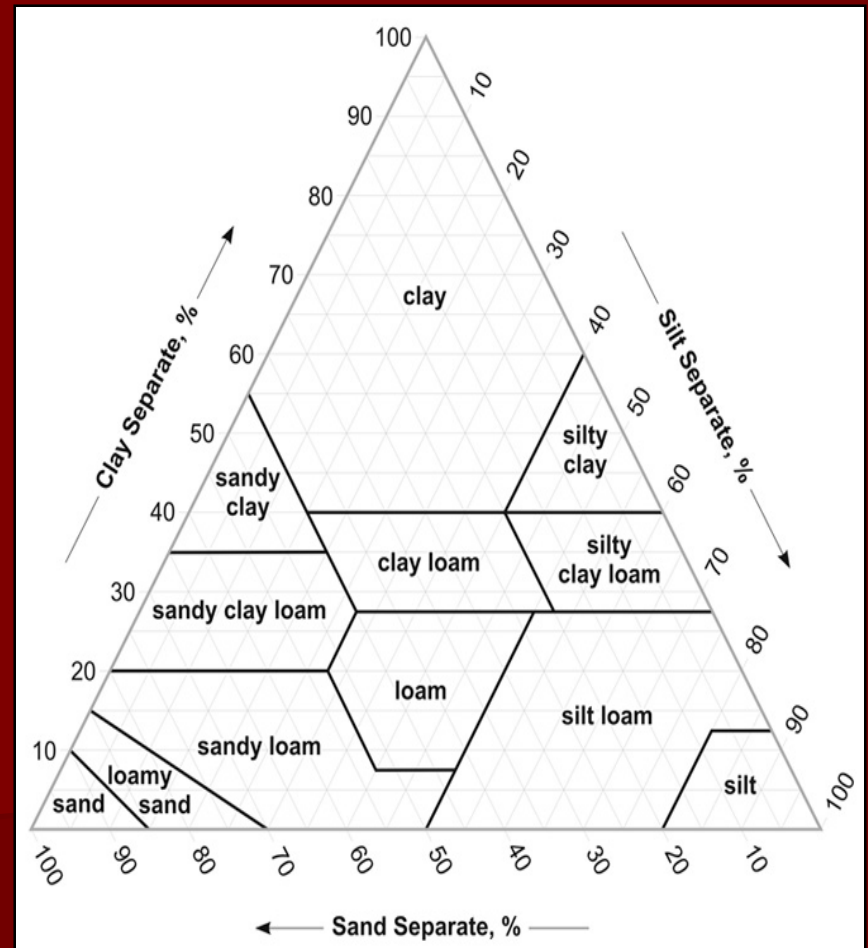
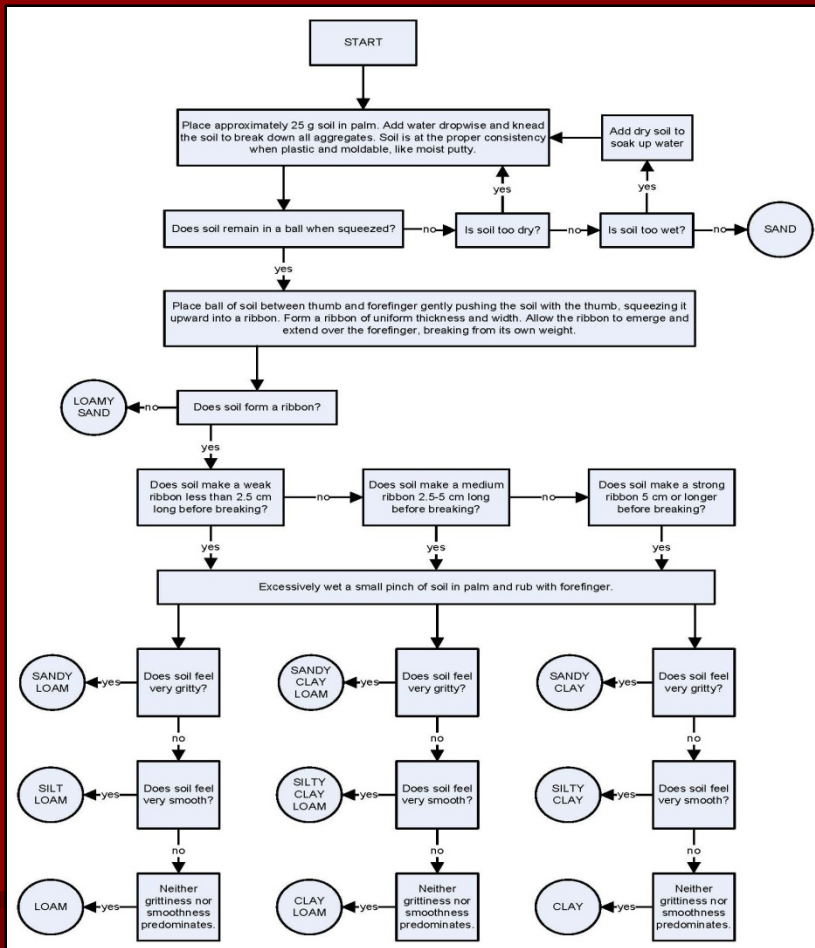


United States Department of Agriculture (USDA) - Natural Resource Conservation Service (NRCS)
Web Soil Survey site (<http://websoilsurvey.nrcs.usda.gov/app/>)

Soil Borings



USDA/NRCS Soil Texture Chart & Triangle



Additional Soil Consideration

■ pH



Topsoil Requirements

4-6" is Adequate

0-3" is Adequate



Sunlight



Wildlife

- Deer
- Muskrats
- Geese
- Carp
- Rabbits
- Meadow Voles





Muskrat Deterrents?













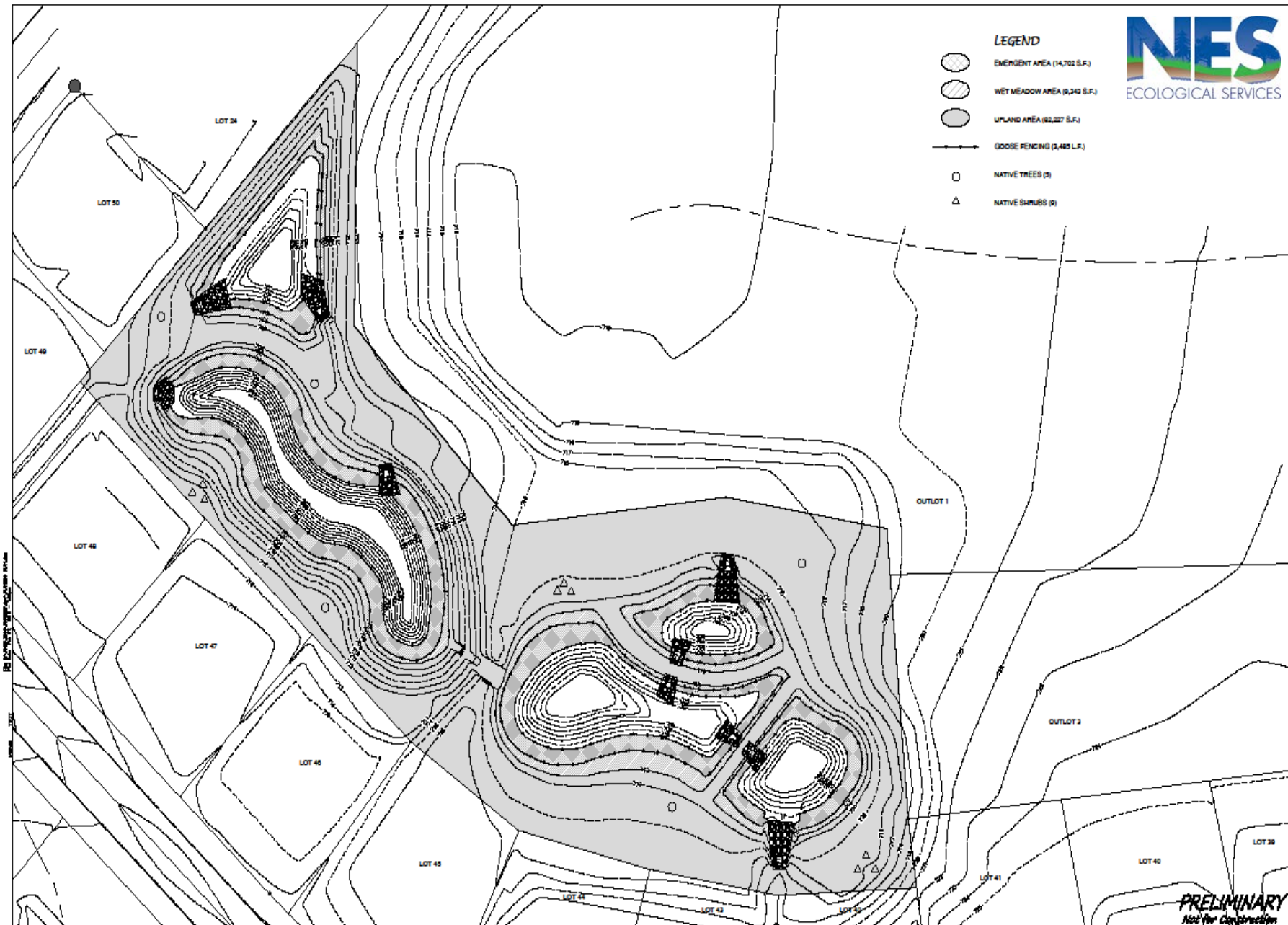
Typical Wet Pond Design

Planting Zones

- Open Water
- Emergent
- Wet Meadow
- Upland

LEGEND

-  EMERGENT AREA (14,702 S.F.)
-  WET MEADOW AREA (9,343 S.F.)
-  UPLAND AREA (82,027 S.F.)
-  GOOSE FENCING (2,485 L.F.)
-  NATIVE TREES (8)
-  NATIVE SHRUBS (9)



NO.	DATE	APPROVAL	REVISION	NO.	DATE	APPROVAL	REVISION	DRAWN
								CHECKED
								REVIEWED
								DATE

BEDFORD HEIGHTS POND
VILLAGE OF BELLEVUE
BROWN COUNTY, WISCONSIN

PLANTING PLAN

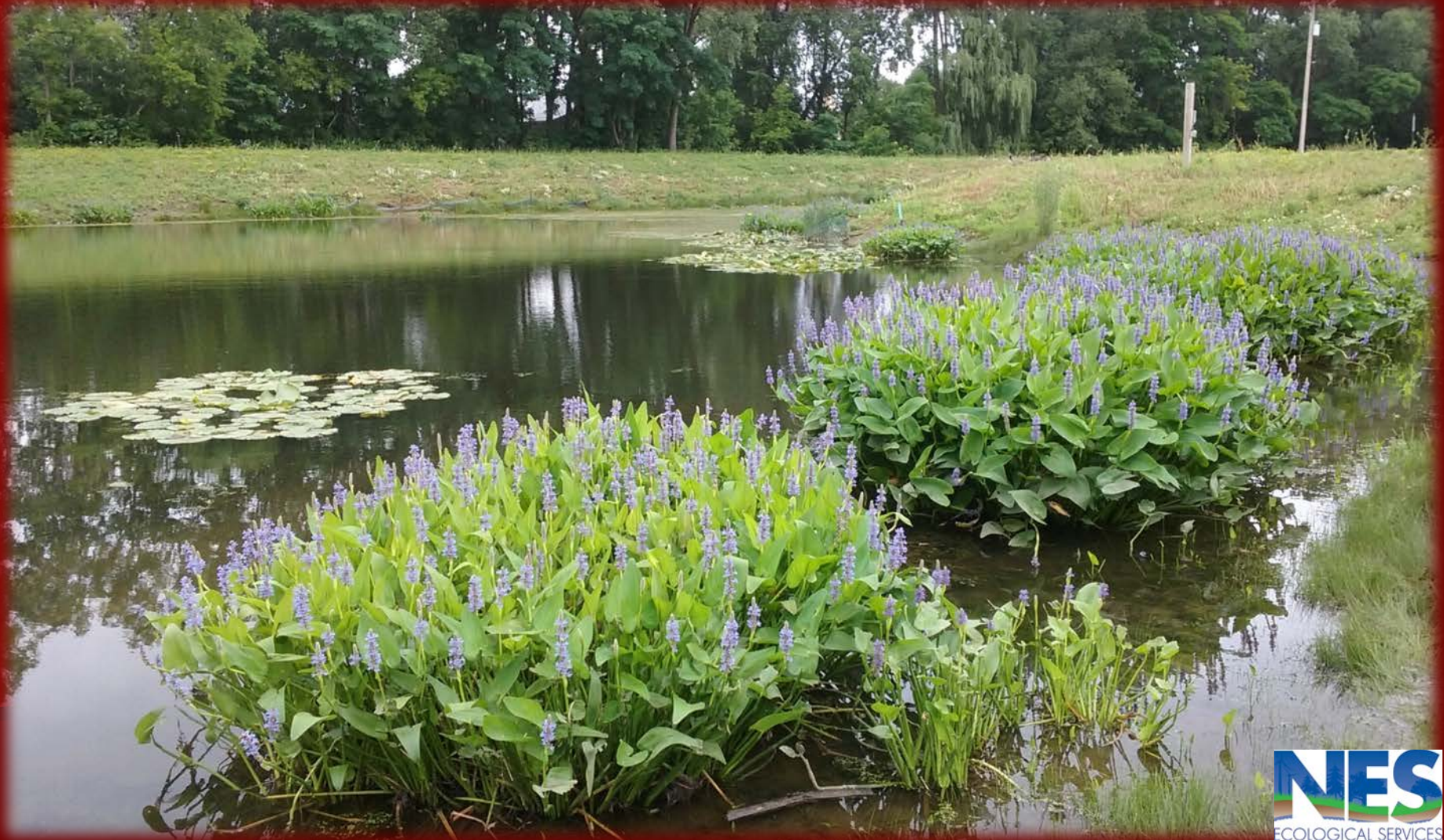
DATE	2010
FILE	
PLANTING PLAN	
DATE NO.	
SCALE	

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PRELIMINARY
Not for Construction

SHEET NO.
1

Water







Plant Selection

- A list of native species can be found by searching the following University of Wisconsin herbarium website:
 - UW Madison - <http://www.botany.wisc.edu/herb/Countysearch.html>

Native Plant Nurseries

- Natural Heritage Conservation Program –
WDNR compiled list of native plant
nurseries located at the following address:

<http://dnr.wi.gov/files/PDF/pubs/ER/ER0698.pdf>

Choosing the Appropriate Native Plants or Seed Mixture

- **Soil Texture:** Clay, Silt/Loam, Sand or Muck
- **Water Regime:** *Dry* – No Soil Saturation or Water Present
- *Moist* – Soils Saturated Below 6" and Water Table Present Below 12"
- *Wet* – Soils Saturated to the Soil Surface or Standing Water Present (Depth)
- **Sun Exposure:** *Shade* - < 4 Hours of Sunlight
- *Partial Shade/Sun* – 4 to 8 Hours of Sunlight
- *Sunny* - > 8 Hours of Sunlight

Water Zones

Open Water

Emergent

Additional Plant Characteristic Considerations

- Bloom Time
- Color
- Height
- Aggressive Spreaders
- Seed Generation/Wildlife Food
- Rush/Sedge:Forb Ratio
- Less Appealing to Herbivores

Open Water

- Submergent Plants
- Floating-leaved Plants



Water Celery
(*Vallisneria spiralis*)



Coontail
(*Ceratophyllum demersum*)



White Water Lily
(*Nymphaea alba*)



Emergent Zone



Common Bur-reed
(*Sparganium eurycarpum*)



Blue Flag Iris (*Iris versicolor*)



Common Arrowhead
(*Sagittaria latifolia*)



Fringed Sedge (*Carex crinita*)



Choosing the Appropriate Native Seed Mixture

- 1) Use Pre-Designed Nursery Seed Mix
- 2) Custom Design a Seed Mix

Tension Zone



<http://dnr.wi.gov/topic/ForestHealth/images/tensionzone.gif>

PROJECTED PLANTING AREA	
acres	square feet
1	43,560

DENSITY
Area: one acre (4046 square meters)
Rate: 1,000 seeds/square meter
Seed Density: 4,046,000 seeds/acre
Grass to forb ratio: 1,820,700 grass seeds (45%) and 2,225,300 forb seeds (55%)

TOTAL SEED	grasses	forbs
4,046,000	1,820,700	2,225,300

UPLAND MEADOW SEED MIX - Urban		frequency	no. of seeds per ounce	est. weight (ounces)	seeds required for planting	oz. required for planting	cost/oz or 1/2 lb	total cost
Nodding Pink Onion	<i>Allium cernuum</i>	0.020	7,600	5.86	44506	5.9	\$10.00	\$58.56
Butterfly Weed	<i>Asclepias tuberosa</i>	0.005	3,500	3.18	11127	3.2	\$50.00	\$158.95
Heath Aster	<i>Aster ericoides</i>	0.030	200,000	0.33	66759	0.3	\$50.00	\$16.69
Smooth Blue Aster	<i>Aster laevis</i>	0.060	55,000	2.43	133518	2.4	\$20.00	\$48.55
New England Aster	<i>Aster novae-angliae</i>	0.060	66,000	2.02	133518	2.0	\$25.00	\$50.58
Purple Prairie Clover	<i>Dalea purpurea</i>	0.030	15,000	4.45	66759	4.5	\$3.00	\$13.35
Showy Tick Trefoil	<i>Desmodium canadense</i>	0.015	5,500	6.07	33380	6.1	\$20.00	\$121.38
Pale Purple Coneflower	<i>Echinacea pallida</i>	0.030	5,200	12.84	66759	12.8	\$10.00	\$128.38
Purple Coneflower*	<i>Echinacea purpurea</i>	0.020	6,600	6.74	44506	6.7	\$2.00	\$13.49
Rattle Snake Master	<i>Eryngium yuccifolium</i>	0.040	7,500	11.87	89012	11.9	\$6.00	\$71.21
Round Headed Bush Clover	<i>Lespedeza capitata</i>	0.010	8,000	2.78	22253	2.8	\$20.00	\$55.83
Ox-eye	<i>Helianthus scaberrimus</i>	0.020	6,300	7.06	44506	7.1	\$3.00	\$21.19
Prairie Blazing Star	<i>Liatris pycnostachya</i>	0.020	11,000	4.05	44506	4.0	\$15.00	\$60.69
Wild Bergamot	<i>Monarda fistulosa</i>	0.180	70,000	5.72	400554	5.7	\$15.00	\$85.83
Wild Quinine	<i>Parthenium integrifolium</i>	0.012	7,000	3.81	26704	3.8	\$15.00	\$57.22
Smooth Penstemon*	<i>Penstemon digitalis</i>	0.050	130,000	0.86	111265	0.9	\$6.00	\$5.14
Yellow coneflower	<i>Ratibida pinnata</i>	0.070	30,000	5.19	155771	5.2	\$4.00	\$20.77
Black-eyed Susan	<i>Rudbeckia hirta</i>	0.080	92,000	1.94	178024	1.9	\$3.00	\$5.81
Brown-eyed Susan	<i>Rudbeckia triloba</i>	0.050	34,000	3.27	111265	3.3	\$6.00	\$19.64
Stiff Goldenrod	<i>Solidago rigida</i>	0.080	41,000	4.34	178024	4.3	\$6.00	\$26.05
Common Spiderwort	<i>Tradescantia ohiensis</i>	0.020	8,000	5.56	44506	5.6	\$15.00	\$83.45
Culver's Root	<i>Veronicastrum virginicum</i>	0.100	800,000	0.28	222530	0.3	\$50.00	\$13.91
Golden Alexanders	<i>Zizia aurea</i>	0.050	11,000	10.12	111265	10.1	\$6.00	\$60.69
Big Bluestem	<i>Andropogon gerardii</i>	0.250	10,000	45.52	455175	45.5	\$2.00	\$11.38
Side Oats Grama	<i>Bouteloua curtipendula</i>	0.150	6,000	45.52	273105	45.5	\$2.00	\$11.38
Prairie Sedge	<i>Carex bicknellii</i>	0.150	17,000	16.07	273105	16.1	\$8.00	\$16.07
Canada Wild Rye	<i>Elymus canadensis</i>	0.100	5,200	35.01	182070	35.0	\$2.00	\$8.75
Switch Grass	<i>Panicum virgatum</i>	0.150	14,000	19.51	273105	19.5	\$2.00	\$4.88
Little Bluestem	<i>Schizachyrium scoparium</i>	0.150	15,000	18.21	273105	18.2	\$2.00	\$4.55
Indian Grass	<i>Sorghastrum nutans</i>	0.200	12,000	30.35	364140	30.3	\$2.00	\$7.59
	Forbs	1.05	SUBTOTAL	110.77	2341016	110.77		\$1,261.74
	Grasses	1.15	SUBTOTAL	210.17	2093805	210.17		
			TOTAL	320.95	4434821	320.95	Tax	

PROJECTED PLANTING AREA		DENSITY
acres	square feet	Area: one acre (4046 square meters)
1	43,560	Rate: 1,000 seeds/square meter
		Seed Density: 8,092,000 seeds/acre
		Grass to forb ratio: 4,450,600 grass seeds (55%)
		and 3,641,400 forb seeds (45%)

TOTAL SEED	grasses	forbs
8,092,000	4,450,600	3641400

WETLAND MEADOW SEED MIX		frequency	no. of seeds per ounce	est. weight (ounces)	seeds required for planting	oz. required for planting	cost/oz or 1/2 lb	total cost
Canada Anemone	<i>Anemone canadensis</i>	0.010	8,000	4.55	36414	4.6	\$40.00	\$182.07
Marsh Milkweed	<i>Asclepias incarnata</i>	0.010	4,800	7.59	36414	7.6	\$15.00	\$113.79
Calico Aster	<i>Aster lateriflorus</i>	0.040	250,000	0.58	145656	0.6	\$50.00	\$29.13
New England Aster	<i>Aster novae-angliae</i>	0.060	66,000	3.31	218484	3.3	\$25.00	\$82.76
Common Beggars Tick	<i>Bidens frondosa</i>	0.006	5,000	4.37	21848	4.4	\$12.00	\$52.44
Joe Pye Weed	<i>Eupatorium maculatum</i>	0.120	95,000	4.60	436968	4.6	\$20.00	\$91.99
Boneset	<i>Eupatorium perfoliatum</i>	0.180	160,000	4.10	655452	4.1	\$30.00	\$122.90
Sneezeweed	<i>Helenium autumnale</i>	0.270	130,000	7.56	983178	7.6	\$15.00	\$113.44
Northern Blue Flag	<i>Iris versicolor</i>	0.002	1,300	5.60	7283	5.6	\$15.00	\$84.03
Marsh Blazingstar	<i>Liatrix spicata</i>	0.020	11,000	6.62	72828	6.6	\$12.00	\$79.45
Great Blue Lobelia	<i>Lobelia siphilitica</i>	0.150	500,000	1.09	546210	1.1	\$20.00	\$21.85
Obedient Plant	<i>Physotegia virginiana</i>	0.010	11,000	3.31	36414	3.3	\$50.00	\$165.52
Common Mountain Mint	<i>Pycnanthemum virginianum</i>	0.120	220,000	1.99	436968	2.0	\$40.00	\$79.45
Riddell's Goldenrod	<i>Solidago riddellii</i>	0.100	93,000	3.92	364140	3.9	\$10.00	\$39.15
Blue Vervain	<i>Verbena hastata</i>	0.018	93,000	0.70	65545	0.7	\$6.00	\$4.23
Ironweed	<i>Vernonia fasciculata</i>	0.020	24,000	3.03	72828	3.0	\$10.00	\$30.35
Culver's Root	<i>Veronicastrum virginicum</i>	0.100	800,000	0.46	364140	0.5	\$50.00	\$22.76
Golden Alexander	<i>Zizia aurea</i>	0.030	11,000	9.93	109242	9.9	\$6.00	\$59.59
Big Bluestem	<i>Andropogon gerardii</i>	0.080	10,000	35.60	356048	35.6	\$2.00	\$8.90
Canada Bluejoint	<i>Calamagrostis canadensis</i>	0.150	280,000	2.38	546210	2.0	\$50.00	\$97.54
Bebb's Sedge	<i>Carex bebbii</i>	0.080	34,000	10.47	356048	10.5	\$10.00	\$104.72
Crested Oval Sedge	<i>Carex cristatella</i>	0.030	58,000	2.30	133518	2.3	\$30.00	\$69.06
Awl-fruited Sedge	<i>Carex stipata</i>	0.050	34,000	6.55	222530	6.5	\$8.00	\$52.36
Brown Fox Sedge	<i>Carex vulpinoidea</i>	0.100	100,000	4.45	364140	3.6	\$8.00	\$29.13
Virginia Wild Rye	<i>Elymus virginicus</i>	0.030	4,200	31.79	133518	31.8	\$2.00	\$7.95
Fowl Manna Grass	<i>Glyceria striata</i>	0.200	90,000	9.89	728280	8.1	\$12.00	\$97.10
Rice Cut Grass	<i>Leersia oryzoides</i>	0.050	34,000	6.55	182070	5.4	\$12.00	\$64.26
Switch Grass	<i>Panicum virgatum</i>	0.100	14,000	31.79	445060	31.8	\$2.00	\$63.58
Green Bulrush	<i>Scirpus atrovirens</i>	0.120	460,000	1.16	534072	1.2	\$3.00	\$3.48
Wool Grass	<i>Scirpus cyperinus</i>	0.150	1,700,000	0.39	667590	0.4	\$8.00	\$3.14
	Forbs	1.27	SUBTOTAL	73.31	4610012	73.31		\$1,976.12
	Grasses	1.14	SUBTOTAL	143.33	4669084	139.10		
			TOTAL	216.64	9279096	212.41	Tax	

Additional Plant Characteristic Considerations

- Bloom Time
- Color
- Height
- Aggressive Spreaders
- Seed Generation
- Grass/Sedge:Forb Ratio
- More or Less Appealing to Wildlife/Pollinators



Common Milkweed
(*Asclepias syriaca*)

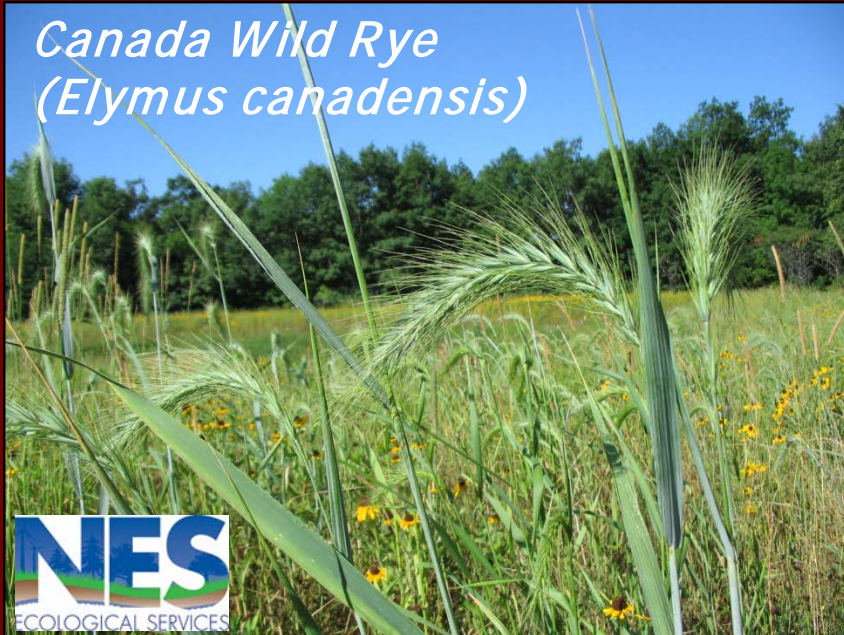


Butterfly Milkweed
(*Asclepias tuberosa*)

Purple Prairie Clover
(*Dalea purpurea*)



Canada Wild Rye
(*Elymus canadensis*)



Smooth Aster
(*Aster laevis*)



Rough Blazingstar
(*Liatris aspera*)

Wool Grass (*Scirpus cyperinus*)



Great Blue Lobelia
(*Lobelia siphilitica*)



Boneset
(*Eupatorium perfoliatum*)

Silphium & Helianthus spp.



Goldenrod (*Solidago spp.*)



Canada Bluejoint (*Calamagrostis canadensis*)



Rice Cut Grass (*Leersia oryzoides*)



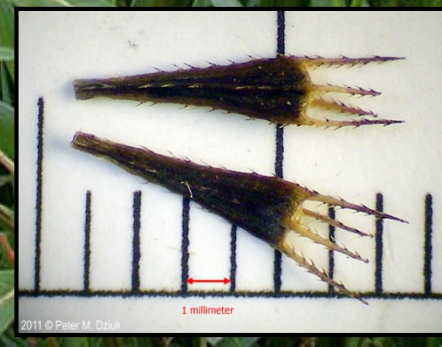
Saw-tooth Sunflower (*Helianthus grosseserratus*)



False Sunflower (*Heliopsis helianthoides*)

Nodding Bur-Marigold (*Bidens cernua*)

Showy Tick Trefoil (*Desmodium canadense*)







Wildlife Friendly?



Questions?

Thank You

Trees & Shrubs

- Community & Plant Diversity
- Wildlife Habitat
- Aesthetics

Bur Oak (*Quercus macrocarpa*)

American Hazelnut (*Corylus americana*)

Red-osier Dogwood (*Cornus sericea*)

Elderberry (*Sambucus canadensis*)

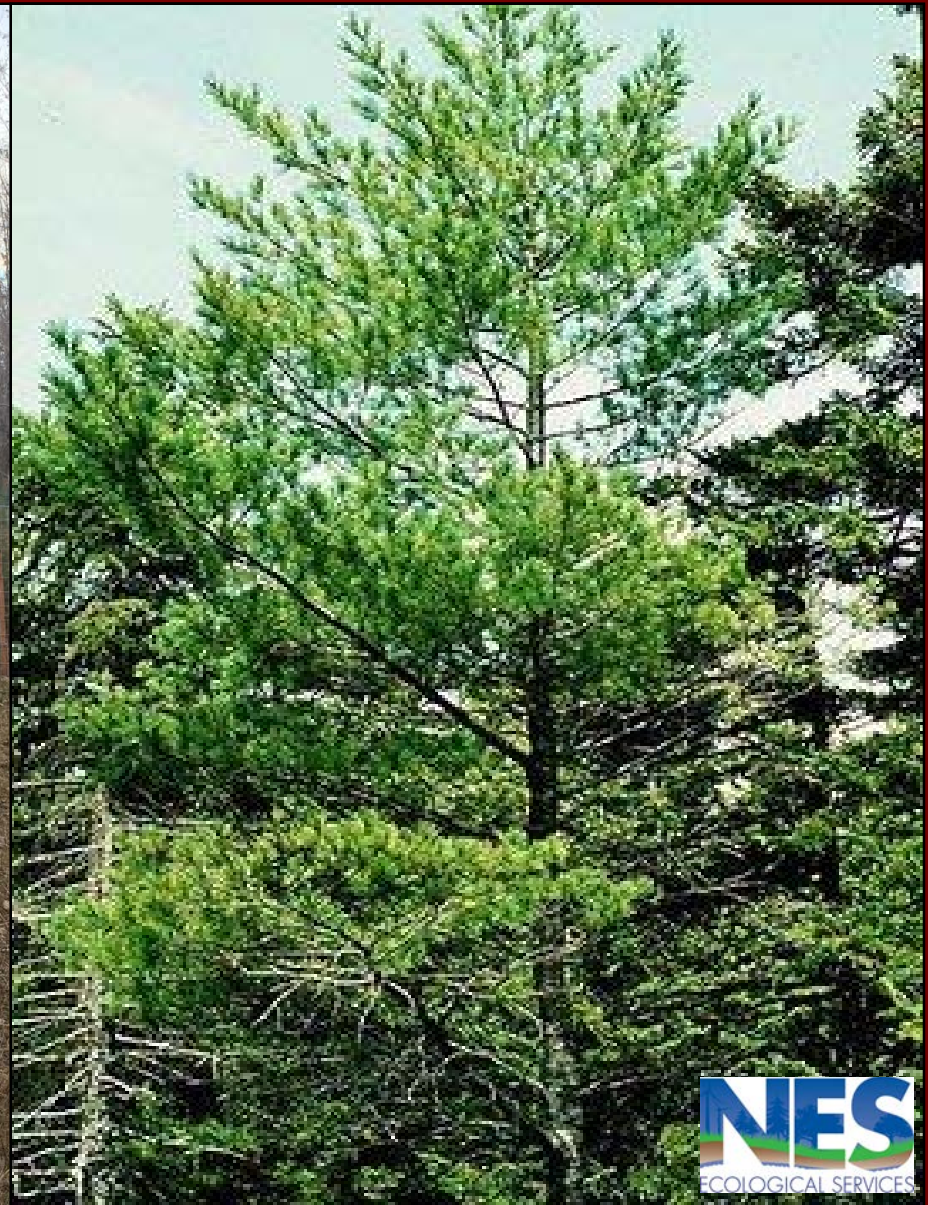
Nannyberry (*Viburnum lentago*)



Tamarack (*Larix laricina*)



Eastern White Pine (*Pinus strobus*)





Woodland Phlox
(Phlox divaricata)



Wild Geranium
(Geranium maculatum)



Bloodroot
(Sanguinaria canadensis)



Pennsylvania Sedge
(Carex pensylvanica)



Red Baneberry
(Actea rubra)



White Baneberry
(Actaea pachypoda)



NES
ECOLOGICAL SERVICES

Mayapple
(Podophyllum peltatum)

False Solomon's Seal
(Maianthemum racemosum)

Bottlebrush Grass
(Elymus hystrix)



Lady Fern
(Athyrium filix-femina)



Virginia Wild Rye
(Elymus virginicus)

Ostrich Fern
(Matteuccia struthiopteris)

Infiltration Basins & Rain Gardens



<i>Species</i>		
Common Name	Scientific Name	Plant Quantities
<i>Grasses/Sedges</i>		
Sweet Grass	<i>Anthoxanthum hirtum</i>	60
Bluejoint	<i>Calamagrostis canadensis</i>	95
Bebb's Sedge	<i>Carex bebbii</i>	45
Crested Oval Sedge	<i>Carex cristatella</i>	60
Brown Fox Sedge	<i>Carex vulpinoidea</i>	120
Virginia Wild Rye	<i>Elymus virginicus</i>	50
Prairie Cord Grass	<i>Spartina pectinata</i>	35
<i>Forbs</i>		
Canada Anemone	<i>Anemone canadensis</i>	50
Marsh Milkweed	<i>Asclepias incarnata</i>	25
Calico Aster	<i>Aster lateriflorus</i>	55
Flat-topped Aster	<i>Aster umbellatus</i>	25
Turtlehead	<i>Chelone glabra</i>	45
Spotted Joe-Pye Weed	<i>Eupatorium maculatum</i>	45
Boneset	<i>Eupatorium perfoliatum</i>	65
Wild Geranium	<i>Geranium maculatum</i>	55
Sneezeweed	<i>Helenium autumnale</i>	55
Northern Blue Flag Iris	<i>Iris versicolor</i>	60
Prairie Blazing Star	<i>Liatris pycnostachya</i>	45
Cardinal Flower	<i>Lobelia cardinalis</i>	25
Great Blue Lobelia	<i>Lobelia siphilitica</i>	45
Obedient Plant	<i>Physostegia virginiana</i>	20
Jacob's Ladder	<i>Polemonium reptans</i>	35
Common Mountain Mint	<i>Pycnanthemum virginianum</i>	60
Riddell's Goldenrod	<i>Solidago riddellii</i>	20
Blue Vervain	<i>Verbena hastata</i>	55
	Total	1,250

Additional Design Considerations

- Plant Availability
- 4:1 Side Slopes
- Natural E-mat

Plant & Seed Installation

- Site Preparation
- Cover crops
- Seed Mix/Plant Modifications
- Timing

Seeding Preference



Questions?

Thank You