

Vegetation Conditions and Recommendations for Stormwater Ponds and Channels Draining to and from Dunn's Marsh

The following sections document the condition of the vegetation communities for stormwater ponds and drainage channels draining to and from Dunn's Marsh, as well as a few other locations of interest. Each area's name is followed by its Best Management Practice (BMP) identification number from the stormwater SLAMM model. The vegetation communities were surveyed in 2012 and 2013 using meander surveys to identify dominant native and invasive plant species. The vegetation communities at Dunn's Marsh and Lacy Heights were mapped using GPS with sub-meter accuracy.

Recommendations for the vegetation management in each area are provided, taking into account current and future proposed uses. In general, management objectives for the stormwater facilities should include invasive species control, and maintenance of native or benign non-native plant communities. Invasive species control Best Management Practices, such as the following suggestions, should be followed. See also the [Wisconsin's Urban Forestry Best Management Practices for Preventing the Introduction and Spread of Invasive Species](#), from Wisconsin Council on Forestry (8/11/09).

Suggested Invasive Species Control Best Management Practices for Stormwater Facility Maintenance

- Train City staff to identify invasive species. Provide copies of "A Field Guide to Terrestrial Invasive Plants in Wisconsin" (pocket-size flip book) from Wisconsin Department of Natural Resources.
- Develop a yearly management plan for each location, including approximate timing of mowing, invasive species control, and brush trimming needs.
- Time mowing to prevent flowering and seed development of invasive species.
- Prevent the movement of invasive species propagules on equipment and clothing. Clean mower tires and cutting assembly after mowing sites with invasive species. Clean the mower on-site after mowing. Clean footwear and clothing after site work and before entering different sites.
- Prevent the movement of invasive species propagules in material. Use soil, aggregate and plant material that are free of invasive species. Keep material that may contain invasive species on-site if possible (reuse/recycle), or destroy in a manner that will prevent spread.
- Minimize soil disturbance. Plant cover crops as soon as possible after soil disturbance to minimize invasive species germination.
- Use native and non-invasive seed and plant materials for temporary cover crops, permanent revegetation and landscaping. Rely on natural revegetation ONLY in areas where native species dominate and will aggressively recolonize the disturbed area.
- Mark edges of native plantings with permanent signs, including "Do Not Mow" and "Do Not Dump" statements.
- In aquatic situations, inspect and remove aquatic plants, animals and mud from all equipment. Drain all water from all equipment and gear, including tracked vehicles, barges, silt or turbidity

curtains, hoses, sheet pile and pumps. Dispose of unwanted aquatic plants and animals in an appropriate way. If invasive aquatic animals are present, disinfect equipment and gear.

1. Arrowhead Ponds (East - 1710 and West – 1720-1)

a. Current Conditions

The water from Arrowhead Ponds and ThermoFisher Pond currently flow together into a rip-rapped swale that drains to Dunn's Marsh. The City conducted forestry mowing and clearing around the Arrowhead Ponds in 2009/2010. The dominant tree species removed during the clearing was black locust (*Robinia pseudoacacia*). A broadleaf-specific herbicide was applied via boom sprayer over the site in 2010 to control black locust resprouts, burdock, thistle, and other invasive plants. The City currently maintains the area around the ponds as parkland and mows the vegetation, primarily reed canary grass, on a regular basis.

b. Management Recommendations

This area appears to be used by the local community for passive recreation and pet exercise. Unless the City wants to restrict this type of access to the trails and the playground, Stantec recommends continuing current management activities, which include:

- regular mowing
- annual or biennial broadleaf-specific herbicide applications around the ponds for broadleaf weed control.

Should the City wish to limit access and reestablish native species, an area south of the Military Ridge Trail may be an appropriate location for this because it does not receive foot traffic, but is highly visible from the two recreational trails. A combination of native plant plugs and native seed would be recommended for this area, following one to three herbicide applications to remove existing vegetation. Wet meadow species should be installed near the swale bottom and mesic prairie species should be installed along the upper slopes and flat areas.

2. Nicolet / ThermoFisher Pond (1700)

a. Current Conditions

The Nicolet and ThermoFisher Ponds were originally designed as dry ponds and were built in 1986. Stormwater discharges to ThermoFisher Pond through a culvert at its west end, and any water that does not infiltrate into the ground (overland flow) flows over a concrete release structure (restrictor plate) and enters a release pond. The dry pond is dominated by a monoculture of cattail (*Typha angustifolia*). The release pond is dominated by cattail with some open water. The pond exterior is dominated by honeysuckle (*Lonicera x bella*), buckthorn (*Rhamnus cathartica*), and red-osier dogwood (*Cornus stolonifera*) with some black willow (*Salix nigra*) and cottonwood (*Populus deltoides*) trees. Its eastern boundary has a sandbar willow (*Salix exigua*) fringe. The

southern upland boundary has scattered bur oak (*Quercus macrocarpa*), black walnut (*Juglans nigra*), and shrubs. The northern upland boundary is dominated by honeysuckle and buckthorn. Garbage and graffiti is present near the release structure. The pond is currently providing muskrat habitat. The City is considering its options for removing excess sediment and retrofitting the control structure to retain more water.

b. Management Recommendations

Cut and apply herbicide to stumps (cut stump treatment) to control buckthorn and honeysuckle around the dry pond and the release pond to allow for more desirable wildlife habitat shrubs such as red-osier dogwood and sandbar willow to continue to establish. Reducing density of the shrub layer may also deter use of the area by the public and may minimize future graffiti and littering. Allow for further growth of bur oak within the uplands to the south and east of the dry pond.

3. **Summit Storm Discharge**

a. Current Conditions

The channel is deeply incised and eroded. There is also a severe trash problem within the channel resulting from garbage from the storm sewer washing into the channel through a culvert south of Crescent Road. Disturbed woodland lies on both sides of the channel, which have been built up to act as berms. The dominant tree species in the woodland are box-elder (*Acer negundo*) and green ash (*Fraxinus pennsylvanica*). The shrub layer is dense with buckthorn and honeysuckle, causing shading of the understory and minimizing cover in the herbaceous layer. The herbaceous layer is sparse and is dominated by violets (*Viola* spp.) and garlic mustard (*Alliaria petiolata*). An additional drainageway that enters the channel via a small culvert between the Nature's Retreat Apartments has significant build-up of silt.

b. Management Recommendations

The trash issue could be addressed with a trash collection structure and community outreach designed to educate residents on the impacts of trash entering the storm sewers. The City is exploring options that include removing the berm along the north side of the creek to allow for overbank flow to enter the wet meadow basin south of the apartments. Stormwater inputs to the channel need to be addressed prior to channel alterations.

The City is also interested in regrading the reed canary grass-dominated (*Phalaris arundinacea*) wet meadow north of the Cannonball Trail and south of the drainage way to allow for more secondary storage. This is a very narrow area and is delineated as wetland. It will be very challenging to restore native vegetation within this area due to the existing reed canary grass seed bank and the stormwater inputs.

If any additional berms or trails are created near the newly installed Red Arrow Pond, areas dominated by bur reed (*Sparganium eurycarpum*) and sedge meadow communities should be avoided and additional outflow should be directed towards degraded plant communities dominated by reed canary grass and cattail.

There are meanders in the stream east of Red Arrow Pond which should be maintained if possible.

Recommended measures for addressing other existing conditions include:

- Remove the buckthorn and honeysuckle using the cut and stump treat herbicide method.
- Thin the box-elder.
- Remove the woody debris from site. Install native grasses appropriate for partial shade to reduce erosion along the channel banks.

4. Red Arrow Pond (1655)

a. Current Conditions

Red Arrow Pond was constructed in spring of 2013. Woody vegetation control occurred in winter of 2011 to prepare the area for pond construction and the area is now primarily bare ground with chipped wood. The north edge along Crescent Road is largely bare ground and is steeply sloped, but it was seeded in early summer of 2013 and covered with erosion control blanket. The area between the Red Arrow Pond and Apache Pond has dense areas of emergent marsh dominated by bur-reed, especially towards the north. Further south of this area there are patches of reed canary grass and emergent marsh areas. The marsh is dominated by cattail with lesser amounts of native emergent plant species and scattered willow shrubs. The area southwest of Red Arrow Pond is primarily disturbed wooded wetland dominated by cottonwood, green ash, and box elder in the canopy; honeysuckle and red-osier dogwood in the shrub layer; and reed canary grass in the understory.

b. Management Recommendations

Recommended measures for addressing the conditions noted above include:

- Ensure that vegetative cover establishes along the steep slope of Crescent Road.
- Promote a native wet meadow / shrub-carr plant community within the cleared area following pond construction in 2013.
- Continue to remove and control box elder, honeysuckle, and buckthorn with the cut stump method to the area south of the pond.
- Control reed canary grass, cattail, and purple loosestrife (*Lythrum salicaria*) with spot-herbicide treatments to allow native wet meadow vegetation to re-establish from the seed bank.

- Interseed a wet meadow seed mix if the native herbaceous plant community does not reestablish after two or three years of continued invasive species control.

5. Apache Pond (1650)

a. Current Conditions

Apache Pond was constructed in 2011 following extensive woody vegetation clearing to remove honeysuckle, buckthorn, box elder, and all trees within the pond footprint. Invasive species control has been ongoing to reduce populations of reed canary grass, cattail, purple loosestrife and thistles (*Cirsium* spp.). Native seed mixes were installed in fall of 2011 which included a short grass prairie mix around the upper pond margins, a wet-mesic woodland seed mix to the east of the pond, and a wet meadow seed mix to supplement the existing wet meadow plant community south of the pond.

The wet meadow community to the south of the pond has responded well to woody vegetation control and herbaceous invasive species removal, with the emergence of many native species from the seed bank. This community is dominated by blue vervain (*Verbena hastata*), dark-green bulrush (*Scirpus atrovirens*), cinnamon willow herb (*Epilobium coloratum*), pinkweed (*Polygonum pensylvanicum*), and sedges (*Carex* spp.). A large emergent marsh area dominated by bur-reed exists southwest of pond. South of the wet meadow community is an emergent marsh community dominated by cattail with some jewelweed (*Impatiens capensis*), water plantain (*Alisma plantago-aquatica*), mint (*Mentha arvensis*), and clumps of sandbar willow.

The pond basin is still lacking in native cover, primarily due to extreme fluctuations in water levels in 2012. The pond margin is dominated by barnyard grass (*Echinochloa* spp.) and annuals with some reed canary grass. Muskrat holes were found in the pond basin in 2012. North of the pond and south of the sidewalk along Crescent Road, where native prairie species were planted, side-oats grama (*Bouteloua curtipendula*) and some native forbs are establishing. Invasive species of concern in this area include crown vetch (*Coronilla varia*), sweet clover (*Melilotus* spp.), bird's foot trefoil (*Lotus corniculata*), and thistle.

The woodland east of the pond and west of the condos has establishing populations of bottlebrush (*Elymus hystrix*), rye grasses (*Elymus* spp.), false sunflower (*Heliopsis helianthoides*), asters, and ironweed (*Vernonia fasciculata*). The dominant tree within the woodland is cottonwood. The rain garden southeast of the pond appears to be functioning and is dominated by native species. The understory within the wooded wetland south of the pond is being established by native rye grass species including Virginia wild rye (*Elymus virginicus*) and silky rye (*Elymus villosus*). Populations of reed canary grass and thistles have been reduced in abundance but are still present.

b. Management Recommendations

Recommended measures for addressing the conditions noted above include:

- Conduct spot mowing on an as-needed basis around the pond margin and areas seeded to native prairie to target biennial weeds such as sweet clover and to allow light to reach the ground level to promote native seed germination.
- Continue to control invasive woody vegetation such as honeysuckle, sandbar willow, buckthorn, and cottonwood saplings with cut stump treatment or with foliar herbicide treatments for small saplings and resprouts.
- Continue to control purple loosestrife, reed canary grass, and push back the cattail clone with spot herbicide treatments, to support native plant diversity.

6. **The Preserve** (apartment complex along Crescent Rd. that abuts Dunn's Marsh)

a. Current Conditions

This is a City-owned upland area behind the apartment complex. The open area is primarily old field vegetation with clumps of the invasive Japanese silver grass (*Miscanthus sacchariflorus*) present. A row of honeysuckle and buckthorn located along the southern property extent blocks the viewshed from the condos and Crescent Road users. Scattered black walnuts also occur in this area.

b. Management Recommendations

Recommended measures for addressing the conditions noted above include:

- Cut and remove honeysuckle and buckthorn from the tree line in order to open the viewshed to the marsh.
- Apply herbicide to the cut stumps.
- Protect and retain black walnut and any other desirable native trees.
- Following clearing, seed the understory with appropriate native grasses to reduce erosion.

The old field area is a prime location for a showy prairie restoration and is visible from the sidewalk and from the condos. In order to restore the area to prairie, the existing vegetation needs to be removed with the application of a non-specific herbicide. Two to three applications may be necessary to kill existing vegetation and deplete the weed seed bank. Installation of a mesic tall grass (or short grass) prairie seed mix, including showy forbs, would attract butterflies and other insects and provide an aesthetically pleasing landscape.

7. **Dunn's Marsh – High Priority Area (1600/1640)**

a. Current Conditions

The southern portion of Dunn's Marsh, south of Cannonball Trail, is significantly degraded by stormwater inputs, which has encouraged the establishment of invasive species populations. The area contains several different plant communities, including emergent marsh, sedge meadow, wet meadow, wet shrubs, and wet-mesic woodland, as shown on the Dunn's Marsh Plant Community Map. There was very little evidence of submerged aquatic vegetation in June, 2013, when the plant survey was completed.

The emergent marsh zone is composed of two different plant communities. The first, and most prevalent, emergent marsh community is dominated by the invasive narrow-leaf cattail (*Typha angustifolia*) and hybrid cattail (*T. x glauca*). In many areas along the shoreline of Dunn's Marsh, narrow-leaf cattail forms a near-monoculture with very low diversity. This monoculture appears near the stormwater discharge outfall in the northeast part of the marsh, all along the northern shore, and in large stands on the western and eastern shores. Along the southern shore, the narrow-leaf cattail stand contains more diversity, including stinging nettle (*Urtica dioica*), jewelweed, arrow-leaved tearthumb (*Polygonum sagittatum*), river bulrush (*Bolboschoenus fluviatilis*), and giant bur-reed (*Sparganium eurycarpum*).

The second emergent marsh plant community type is diverse, dominated by native species – typically a combination of river bulrush and giant bur-reed. Other native species found in this community include water smartweed (*Polygonum amphibium*), jewelweed, stinging nettle, clearweed (*Pilea pumila*), small spike false-nettle (*Boehmeria cylindrica*), water horehound (*Lycopus americanus*), arrow-leaved tearthumb, pinkweed, spike-rush (*Eleocharis palustris*), soft-stem bulrush (*Schoenoplectus tabernaemontani*), marsh skullcap (*Scutellaria galericulata*), elderberry (*Sambucus canadensis*), arrowhead (*Sagittaria latifolia*), and broad-leaved cattail (*Typha latifolia*). In one area on the west side of the marsh, the emergent marsh community grades up into a shallow marsh/sedge meadow community dominated by lake sedge (*Carex lacustris*), broad-leaved cattail, and meadowsweet (*Spiraea alba*). The native emergent marsh community is found in small patches along the western and eastern shorelines. The native emergent marsh community is in danger of being overtaken by invasive cattails.

Wet meadow communities at Dunn's Marsh are similarly divided into native and non-native dominated communities. In the southeast quadrant, there is a small wet meadow with bluejoint grass (*Calamagrostis canadensis*), iris (*Iris virginica*), broad-leaved cattail, meadowsweet, tussock sedge (*Carex stricta*), lake sedge, and reed canary grass. Similar small patches of native wet meadow are found on the northwest and west side of the marsh. The native wet meadows are at risk of being converted to reed canary grass-dominated communities.

The large wet meadows on the west and east sides of the marsh are dominated by reed canary grass. Reed canary grass covers ninety percent of these communities, with sparse occurrences of meadowsweet, Canada thistle (*Cirsium arvensis*), jewelweed, iris, stinging nettle, and red-osier dogwood. The wet meadow along the southern shore is dominated by reed canary grass and Canada thistle, but also contains a slightly higher diversity of native species, including stinging nettle, jewelweed, iris, bluejoint, and lake sedge. There are many large downed trees lying in the southern wet meadow area.

The south side of the marsh transitions to upland in a shrub-dominated community. Common shrubs include sandbar willow, pussy willow (*Salix discolor*), eastern black currant (*Ribes americanum*), red-osier dogwood, grey dogwood (*Cornus racemosa*), and elderberry. Beyond the shrubs, the uplands are cool-season grass dominated meadows. South of the Capital City Bike Trail, the slope has been restored to prairie, in bloom with tall white beardtongue (*Penstemon digitalis*) and wild white indigo (*Baptisia alba*) at the time of survey.

The eastern side of the marsh is bordered by a wet-mesic woodland with an open understory. The canopy includes bur oak, swamp white oak (*Quercus bicolor*), and silver maple (*Acer saccharinum*). There is a significant amount of downed wood. The understory is dominated by reed canary grass, associated with Canada thistle, jewelweed, awl-fruited sedge (*Carex stipata*), elderberry, riverbank grape (*Vitis riparia*), and high-bush cranberry (*Viburnum opulus*).

The western side of the marsh is also bordered by a wet-mesic woodland. Large areas of the woodland adjacent to the wet meadow areas contain dead and dying standing trees, many of which are black ash (*Fraxinus nigra*). The understory is dominated by rice cut grass (*Leersia oryzoides*), associated with awl-fruited sedge, jewelweed, and great blue lobelia (*Lobelia siphilitica*). This area is very popular with the neighborhood children, who use the downed branches from the dead trees to construct “forts”.

The northern part of the marsh, north of Cannonball Trail, has undergone a number of changes over the years. Apache Pond (see description above) was excavated in an old field area between the wetland and Crescent Road. The wetland communities in this northern part are similar to those in the southern part: native emergent marsh, non-native emergent marsh, native sedge and wet meadow, reed canary grass dominated wet meadow, and a wooded wetland.

Based on plant community mapping efforts from 1972-3 (Bedford et al, 1974) and 1994 (R.A. Smith, and Hey & Associates), the current marsh complex continues to be impacted by invasive species spread and high water levels. In 1972-3, deep marsh, mostly broad-leaved cattail, was found all along the shoreline. In 2013, narrow-leaved

cattail, which can tolerate deeper water than the native broad-leaved cattail, is spreading along the shoreline into the native emergent community. The broad-leaved cattail is now found in only a few locations, at least 20 feet back from the current water's edge. Plant species diversity within the narrow-leaved cattail stands is poor. Sedge meadow, wet meadow, and wet prairie mapped in 1972-73 and 1994 has been replaced in many locations with wet meadow dominated by reed canary grass, where the diversity is very poor. Old field communities at the margins of the marsh in 1972-3 have now succeeded to woodland.

b. Management Recommendations

Management of Dunn's Marsh vegetation should concentrate on three goals: 1) reduce the hydrological and biological impacts of stormwater inputs; 2) reduce populations of invasive species, which will persist as a legacy of past urbanization activity despite improvements in incoming water quality and quantity; and 3) rebuild emergent vegetation stands in the current open water zone. Recommended measures for addressing these goals include:

- Continue to provide and/or improve upstream volume, peak flow, and sediment control for stormwater runoff inputs.
- Control sediment inputs into the marsh from the channel through the west woodland using check dams, sediment traps, vegetated filter strips, diversion swales, or similar.
- Reduce the population of narrow-leaved cattail using herbicides designed for use in aquatic settings. Alternatively, cut or crush the cattail stems at ground level or below the estimated maximum flood levels.
- Remove the dead biomass. Standing dead biomass may be removed using prescribed burns. After adequate control is achieved, seed treated areas with a cover crop (*Bidens* spp. and *Polygonum* spp.) and install native emergent seeds or plants.
- Continue to manage native vegetation establishment through follow-up spot herbicide treatments and burning.
- Reduce the population of reed canary grass using herbicide treatments. Use mowing and/or burning to reduce the biomass and vigor of the reed canary grass. After adequate control is achieved, seed the treated areas with a cover crop and native wet meadow species.
- Continue to manage native vegetation establishment through follow-up herbicide treatments, mowing and burning.

If adequate control of narrow-leaved cattail is achieved, consider using drawdowns to rebuild emergent vegetation areas in the open water zone. Supply native seed for emergent species that will compete with cattail seedlings. Alternatively, consider using

floating wetlands (ex. Biohaven) for nutrient removal, plant species diversity, avian habitat, and increased structural diversity.

8. Pine Ridge Pond (N of McKee Rd, west and south of Dawley Conservancy, 1610)

a. Current Conditions

This area is currently a small, deep dry pond with significant storage capacity. At the end of a dead-end residential street, the pond is adjacent to two houses and the wooded Dawley Conservancy. The slopes of this pond are very steep, and are dominated by crown vetch, musk thistle (*Carduus nutans*), stinging nettle, and saplings of box elder. The bottom of the basin is dominated by reed canary grass, however there is a small patch of wet meadow vegetation there, including rice cut grass), sedges (*Carex stipata*, *C. bebbii*), and great blue lobelia.

The City periodically mows the top and side of the banks. The City is interested in converting this dry pond to a bioretention basin with engineered soil.

b. Vegetation Recommendations

Recommended measures for addressing the conditions noted above include:

- Manage the area to control/eradicate weedy and invasive species. Plant and maintain native shrubs on the outer pond banks adjacent to the Conservancy, and plant and maintain deep-rooted native herbaceous species on the inner pond banks and the basin floor to support infiltration and bioretention functions.
 - Apply an appropriate herbicide to the pond banks during the growing season at least 2 to 3 weeks prior to construction disturbance to weaken and/or kill invasive species.
 - Erosion control measures (use of erosion control blanket, polymer, or mulch depending on the design) along with a non-invasive cover crop should be applied to stabilize the soil after construction.
 - Continue herbicide treatments to weedy and invasive species that regrow following construction disturbance.
 - Plant native shrubs, such as dogwoods (*Cornus stolonifera*, *C. racemosa*), ninebark (*Physostegia opulifolius*), and nannyberry (*Viburnum lentago*) on the outer pond banks to provide a buffer and transition to the Conservancy.
 - Plant a native seed mix suitable for bioretention basins on the basin bottom and sideslopes. Coordinate with the stormwater engineer to determine which native species should be planted to accommodate the intended hydroperiod of the bioretention pond. Plant a high rate of native species, as well as a cover crop.
 - Maintain the native seeding by mowing 2-3 times to a height of 8-12 inches periodically for the first two to three years, and spot-spraying persistent invasive species. Ongoing annual vegetation management will be required

to maintain the native plant communities and minimize invasion by undesirable species.

9. Seminole Village Pond (1621)

a. Current Conditions

The City had scattered native seed around the ponds in the past. The area surrounding the pond, specifically to the east, is being mown by an adjacent landowner. The mowing is so low to the ground that it appears as though it is causing bare spots in the lawn and is only promoting turf grass. The dominant tree species around the pond, especially on the south and west, is black locust. The City has removed some black locust trees along Seminole Highway, but neighbors to the east have complained that there is a lack of screening from the Highway. The City has been interested in continuing removal of the black locust trees and then building a berm along Seminole Highway, constructed from spoils, to provide a barrier to road-related noise and activity. However, the berm would have to be quite high to serve these purposes, unless it were to be topped with screening vegetative plantings.

b. Management Recommendations

Recommended measures for addressing the conditions noted above, include:

- Remove all black locust trees from the site if plans are in place to create a berm or plant mature native trees.
- Apply an appropriate herbicide to the cut black locust stumps to minimize resprouts.
- If a berm will be installed along Seminole Highway:
 - It should be constructed all at once – not by the slow addition of available spoils.
 - The berm should be constructed by City staff or a contractor that has experience designing berms so that berm failure does not occur.
 - Erosion control measures (use of erosion control blanket, polymer, or mulch depending on the design) along with a non-invasive cover crop should be applied to stabilize the soil.
 - Shrubs or small trees can be installed along the top of the berm to create a visual barrier. Depending on the size of the berm, evergreen trees / shrubs should be considered for one of the rows to provide cover throughout the winter.
 - The herbaceous layer should be seeded with a no mow fescue that does not require much maintenance following the first few growing seasons. (Alternatively, native prairie species could be installed along the front and back of the berm for native cover.)
 - Woodchip mulch should be placed around the installed shrubs and trees.

- If a berm does not appear feasible:
 - More mature native trees appropriate to the area could be installed between the west side of the pond and Seminole Highway. Recommended species that are present in the area include red oak (*Quercus rubra*), white oak (*Quercus alba*), black walnut, shagbark hickory (*Carya ovata*), and black cherry (*Prunus serotina*). River birch (*Betula nigra*) is an appropriate and showy tree that can be placed near the pond margin.
 - Appropriate native shrubs near the pond margin include American elderberry, nanny berry viburnum (*Viburnum lentago*), and red-osier dogwood.
 - Suitable native shrub species for the upland area include black chokeberry (*Aronia melanocarpa*), hazelnut (*Corylus americana*), and ninebark.

10. **Seminole Village Pond Release** (adjacent to Seminole Highway)

a. Current Conditions

The channel leading from Seminole Village Pond, under Seminole Highway, and through the Dawley Conservancy Greenway is eroded and shows evidence of silt movement. This is likely due to flashy movement of water through the channel. The channel from PD to Seminole Pond is ripped but has some evidence of erosion. Dominant vegetation in this area is black locust, scattered black walnut, box elder, garlic mustard, and reed canary grass.

A potential wet meadow wetland exists east of Seminole Highway, south of the Seminole Village Pond. Investigations into soils and hydrologic conditions would be needed during the early part of the growing season to make a definitive wetland determination. This area is characterized by a moderately depressional basin dominated by reed canary grass and beggar's ticks. The depression is likely too small to function as detention; although, overflow from the channel could be directed to this area to infiltrate (it may already do so).

b. Management Recommendations

Recommended measures for addressing the conditions noted above include:

- A suitable cover crop, permanent native seed mix, and erosion control should be installed at locations where bare soils exist, following any alterations to the channel.
- The wet meadow could be restored to native vegetation; however, this would likely be a costly effort that would require continual maintenance due to the

continual influx of reed canary grass, stormwater, and nutrients from the channel.

11. Dawley Conservancy Greenway (from Seminole Village Pond to Dunn's Marsh)

a. Current Conditions

The north part of this area is a mesic prairie area that grades down to the south into a wetland abutting Dunn's Marsh to the west. The City conducts regular prescribed burns to the prairie, which is heavily forb dominated and infested with non-native cool season grasses.

The dry-mesic woodland south of the prairie is dominated by red and white oak and shagbark hickory trees. The understory of the woodland is dominated by brambles (*Rubus* spp.) and old field vegetation, with scattered honeysuckle and common buckthorn.

This Greenway provides important upland buffer habitat for Dunn's Marsh and allows for connectivity of wildlife habitat.

b. Management Recommendations

Recommended measures for addressing the conditions noted above include:

- Within the mesic prairie, interseed native warm season grasses following the next prescribed burns to improve native cover and diversity, and to improve structure, and fuel density for future prescribed burns.
- Within the woodland, control honeysuckle and common buckthorn (especially important since densities are manageable at this point).
- Treat cut stumps with an appropriate herbicide to prevent resprouts.
- Burn the woodland every 5 years, as feasible, to continue to promote the relatively open nature of the woodland and reduce encroachment by non-native shrubs and shade tolerant tree species.

12. Harlan Hill's West Pond (S of Arboretum, drains into online pond, adjacent to rain gardens, 1220)

a. Current Conditions

The pond is primarily dominated by reed canary grass with some scattered native wetland species such as arrowhead. A culvert was recently removed from the west end of the pond. The City has interest in potentially replacing the culvert or removing fill from around the pond to increase storage capacity. Increasing storage could minimize some of the flooding that occurs within Greene Prairie.

b. Vegetation Recommendations

There is the potential for a native prairie restoration in the upland triangle south of Cannonball Trail and east of Seminole Highway and wet meadow restoration within the wetland areas adjacent to and south of the ponds. This is a highly visible area due to the Cannonball Trail and adjacency to Seminole Highway. There will be continual reed canary grass invasion/support pressure from the stormwater inputs to this area, so any wet meadow restoration will require long-term maintenance.

13. Renaissance Pond (1657)

a. Current Conditions

The vegetation around the three ponds comprising the Renaissance Pond area consists primarily of maintained turf. The dominant species observed are Kentucky bluegrass (*Poa pratensis*), reed canary grass, and dandelion (*Taraxacum officinale*). Trash is a problem here. The functionality of one of the basins may be improved by retrofitting it as a bioretention area.

b. Management Recommendations

Mesic prairie restoration is recommended in the areas around the ponds. This location is visible from the road and visible to nearby residents. Prairie restoration may reduce long-term mowing efforts, provide bird and butterfly habitat, and would promote a more aesthetically pleasing landscape. Prairie restoration will require killing off existing vegetation with a series of non-selective herbicide treatments. When the existing vegetation has been removed, a native mesic prairie seed mix should be installed during the spring or late fall. The restored prairie should be mown 2-3 times during the first few growing seasons to a height of 8-12 inches and selective herbicide treatments may be necessary to reduce persistent invasive species such as reed canary grass. Interpretive signs and "Do Not Mow/Do Not Dump" signs should be posted around the prairie area.

If one of the basins is converted to a bioretention pond, the area needs to be kept in a solid cover of native species to assist with the maintenance of long-term infiltration function. To manage for this outcome:

- Prior to construction, treat all of the invasive species on the basin side slopes and bottom with herbicide.
- Maintain the area in temporary cover crops during periods of construction inactivity.
- Coordinate with the stormwater engineer to determine which native species should be planted to accommodate the intended hydroperiod of the bioretention pond.
- Plant a high rate of native species, as well as a cover crop.

- Maintain the native seeding by mowing 2-3 times to a height of 8-12 inches periodically for the first two to three years, and spot-spraying persistent invasive species.

14. Southern boundary of Greene Prairie (Dunn's Branch of Nine Springs Creek) – High Priority Area

a. Current Conditions

Stormwater from south of the Cannonball Path enters the Arboretum Property through two culverts under the berm of the Cannonball Path. Water frequently ponds at the southern boundary of Greene Prairie, leading to dominance of reed canary grass and destruction of the historic wet prairie community initially restored by Henry Greene in the 1940s and 50s.

b. Vegetation Recommendations

Vegetation cannot be improved until stormwater inputs are improved. This is a high priority area for improvement due to the continued impairment of the wet prairie community within Greene Prairie. Efforts should be undertaken to keep as much stormwater as possible on the south side of the Cannonball Trail.

Regular mowing of the ditch to the north of the Cannonball Trail could assist with reducing vegetation density (reed canary grass dominated) to allow for faster flow of water within the channel, which may help reduce the amount of overflow that escapes into Greene Prairie. Coordination with the Arboretum to include these areas within prescribed burn units could also assist with removing the thatch layer to improve water flow. Additionally, the ditch would be easily distinguishable following a prescribed burn that would facilitate an inspection to reveal any areas of silt build up that could be restricting flow in the channel. Following improvements to stormwater inputs, coordination with the Arboretum is recommended to control the reed canary grass and reintroduce native wet prairie species.

15. Tower Hill/Mckee Farms Park

a. Current Conditions

McKee Farms Park contains a large open retention pond split in two by a paved recreational trail. Turfgrass is maintained between the trail and the banks of the pond. The pond slopes are dominated by non-native species, specifically reed canary grass, crown vetch, leafy spurge, and wild parsnip. Scattered native wetland species are present, primarily along the water's edge. Native species include spike-rushes, soft-stem bulrush, water-horehound, and sedges. A few patches of shrubs exist along the pond margins; including willow shrubs, box elder saplings, and red-osier dogwood.

b. Management Recommendations

Due to the dominance of persistent invasive species along the pond margins, restoration of native plant communities will require complete removal of existing vegetation through herbicide applications. It is recommended that the mowed area around the pond be reduced to make a wider vegetative band available for restoration. Having a wider swath of unmowed vegetation around the ponds may also discourage the presence of geese because they disfavor open water areas surrounded by tall vegetation that can hide predators.

Native plant restoration will be challenging due to steep slopes and persistent invasive species. Erosion control measures may be required prior to and during herbicide applications so that the potentially resulting bare soils do not contribute to sediment entering the ponds. Examples of appropriate erosion control measures would include installing silt fence or other filtration devices along the water's edge, and establishing a temporary cover crop of oats or annual rye following herbicide applications. A native wet meadow seed mix with a relatively broad moisture tolerance to compensate for water level fluctuations should be installed along the pond slopes. Native emergent plant plugs such as bulrushes and arrowhead can be installed near the water's edge.

Follow-up management for the restored areas includes spot mowing (with a string trimmer) and spot herbicide treatments to target persistent invasive species. Ongoing annual vegetation management will be required to maintain the native plant communities and minimize invasion by undesirable species.

16. Triverton Greenway

a. Current Conditions

This Greenway consists of mown turf that gently slopes to a small ditch that conveys stormwater from the adjacent roads and business park. This area may be modified to increase stormwater retention.

b. Management Recommendations

This area presents a high potential for a showy native planting due to the presence of gentle slopes and maintained turf with few persistent invasive species. Additionally, this is a highly visible area due to adjacency to a busy road and a business park. A native mesic prairie mix with showy wildflowers is appropriate for the higher areas along the slopes and a wet meadow mix is appropriate for the base of the slope where water is present during the spring and after rainfall events, and/or in any new stormwater facilities planned here.

To manage the area to meet its potential, existing vegetation should be killed off with a series of herbicide applications and native seed should be installed in the spring or late fall following site preparation. Mowing to a height of 8-12 inches should occur 2-3 times

during the first two or three growing seasons to reduce weed species and encourage the establishment of the installed native species. Vegetation management should occur on an as-needed basis following native plant establishment.

17. Lacy Heights – Priority Area

a. Current Conditions

Lacy Heights Pond is a dry detention basin with steep side slopes. Two stormwater outlets discharge to the site on opposite ends, and the stormwater flows overland through broad swales to the pond outlet. This area is under consideration for conversion to a bioretention pond with infiltration.

On one slope, there is a mature bur oak, a red oak, and a black walnut tree. The understory of this area includes small common buckthorn and bush honeysuckle shrubs, riverbank grape, and Virginia creeper (*Parthenocissus quinquefolia*). Downslope of the tree, a narrow-leaved cattail stand persists in a wetter area near a stormwater discharge outfall. A small fringe of fox sedge (*Carex vulpinoidea*) and other wet meadow species encircles the cattail stand. Another patch of wet meadow is found near the stormwater pond outlet. Reed canary grass is found throughout the basin bottom and side slopes. Several large clones of Canada thistle are located in the basin bottom and on the side slopes. A patch of thistle (*Carduus nutans*) is located upslope of the outlet. A small patch of spotted knapweed (*Centaurea biebersteinii*) is located in a dry area of the basin bottom. The dry areas of the basin bottom are dominated by Kentucky bluegrass (*Poa pratensis*) and ruderal vegetation (dandelions, clovers), while the slopes are dominated by quackgrass (*Elytrigia repens*).

The plant community survey was completed in June 2013 after a very intense 4-inch rainfall event. There were deposits of sediment by each stormwater outlet, approximately 5 inches deep and at least 5 feet long, of dark brown, gritty material.

b. Management Recommendations

If the area is maintained as a dry pond, the vegetation should be managed to control the widespread, persistent invasive species. Invasive species control efforts will need to consist of several rounds of herbicide treatment over much of the basin and side slopes. The Kentucky bluegrass area should also be eradicated, but the narrow-leaved cattails may be retained. Erosion control measures, such as temporary cover crops of oats or annual rye, or applications of polymer, may be required in between and after herbicide applications so that bare soils do not contribute to sediment entering the basin.

Once control of invasive plant populations is achieved:

- Install a wet mesic prairie seeding at a high rate of application.

- Plant clusters of very aggressive, robust native plants near the stormwater outfalls, such as cup plant (*Silphium terebinthinaceum*), New England aster (*Aster novae-angliae*), and prairie cordgrass (*Spartina pectinata*). These plants will provide a high density of standing and dead/down biomass to slow the rate of flow into the pond.
- On the upland slope under the oak trees, cut and stump treat the invasive shrubs, and selectively treat invasive species with herbicide.
- Install native woodland species under the oak trees. Install native shrubs under the oak tree, such as hazelnut and ninebark.
- Maintain the native seeding by mowing 2-3 times to a height of 8-12 inches periodically for the first two to three years, and spot-spraying persistent invasive species.
- Coordinate with the neighbors immediately adjacent to the side slopes to ensure that they are using appropriate (i.e. minimal) amounts of lawn fertilizer.

If the basin is converted to a bioretention pond, the area needs to be kept in a solid cover of native species to assist with the maintenance of long-term infiltration function.

To manage for this outcome:

- Prior to construction, treat all of the invasive species on the basin side slopes and bottom, including the narrow-leaved cattail, with herbicide.
- Maintain the area in temporary cover crops during periods of construction inactivity.
- Coordinate with the stormwater engineer to determine which native species should be planted to accommodate the intended hydroperiod of the bioretention pond.
- Plant a high rate of native species, as well as a cover crop.
- On the upland slope under the oak trees, cut and stump treat the invasive shrubs, and selectively treat invasive species with herbicide.
- Install native woodland species under the oak trees.
- Install native shrubs under the oak tree, such as hazelnut and ninebark.
- Maintain the native seeding by mowing 2-3 times to a height of 8-12 inches periodically for the first two to three years, and spot-spraying persistent invasive species.
- Coordinate with the neighbors immediately adjacent to the side slopes to ensure that they are using appropriate (i.e. minimal) amounts of lawn fertilizer.