

DEVELOPING THE KIWANIS ENVIRONMENTAL EDUCATION PRESERVE PHASE II FINAL REPORT

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A Project that Reclaim and Restore
the Natural Habitat of a Small Abandoned Land,
Create Restorative Landscapes,
and Support Environmental Education Opportunities
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ABSTRACT

In 2017, the Kiwanis Club of Ann Arbor Foundation purchased a 17-acre property to the west of Ann Arbor at 100 N. Staebler Road, Scio Township. This property has 7.6-acre vegetated area that includes a small pocket of wetlands including two ponds. It was historically used for agriculture followed by a book manufacturing facility, and was poorly managed. Upon acquiring the property, the Kiwanis sponsors, Margaret Krasnoff and Dan Devers visioned this parcel as an opportunity to pursue and practice Environmental Education. Ever since, they have been pushing their vision to bring the Kiwanis Environmental Education Preserve (KEEP) into existence.

During Phase I (2019 – 2020), a SEAS Masters Project conducted a census and inventory of vegetation and wildlife, a baseline characterization of existing ecosystem types, and modelled stormwater runoff from the Kiwanis warehouse and parking lot. Phase II continued the vision and expanded the project by completing the site inventory, refining preliminary designs for the KEEP parcel, developed educational materials and displays, and initiated the restoration and educational process. It resulted in a package of landscape design that will be built mostly by volunteers in the future and will help visitors from all ages to better experience the KEEP. Management options and education module suggestions were also provided as reference to initiate the next phase of work.

ACKNOWLEDGEMENTS

Foremost, I'd like to express my gratitude to my advisor, Professor Allen Burton, for his guidance through the practicum, and his support and patience. His immense knowledge helped me learn so much in the practicum. He always responded to my emails as fast as possible, and gave me advice on the decision-making process, my presentation and the final report.

I am very grateful for my client: Margaret Krasnoff and Dan Dever from the Kiwanis Club of Ann Arbor Foundation, INC. They have guided me through multiple field trips, their vision, passion, and love for environmental education is what motivated me to join in and complete the practicum.

My sincere thanks also goes to Professor Joan Nassauer for the insightful comments on part of my practicum, and helped me to realize that there is a lot for me to improve.

I would also want to thank the faculty and peers at the School For Environment and Sustainability, especially the MLA group, for their support and help throughout the practicum. Getting to know each of their projects and practicums made me realize how important our work is.

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INTRODUCTION

Nowadays, Environmental Education is playing a core role in shaping people's behavior and decisions to be environmentally responsible and take actions in environmental issues (Pedro & Pedro, 2010). It is also a topic that evokes discussions among most landscape planners and designers. Urban and suburban sprawl has degraded natural resources including habitat, biodiversity and species abundance, creating urgent environmental issues that demand prompt solutions (Benedict, McMahon, & A., 2012). The Kiwanis Environmental Education Preserve (KEEP) parcel, owned by Kiwanis Club of Ann Arbor, is located near Ann Arbor and has been negatively affected by human activities.

Founded in Detroit, Michigan in 1915, the Kiwanis Club is a non-profit organization dedicated to "Serving the Children of the World", providing all sorts of meaningful help such as opening nursery schools for underprivileged children. Not long after it was founded, it branched out and opened the Ann Arbor chapter in 1921 (Hapgood, 1989) which is well known for its Kiwanis Thrift Shop. Today, the Kiwanis club has grown to be a strong international organization with 7,332 clubs and 592,820 members worldwide.

In 2017, the Kiwanis Thrift Shop purchased and moved to a 17-acre property to the west of Ann Arbor at 100 N. Staebler Road, Scio Township. This property has a large building, a parking lot, a small pocket of wetlands including two ponds, and woods covered with dense vegetation. Historically, it was used for agriculture followed by a book manufacturing facility.

The Kiwanis sponsors wish to reclaim much of their property and encourage native plant and wildlife habitats, characterizing and document the environmental condition, along with creating educational opportunities for students, local organizations, and the public. These educational opportunities would include interpretive materials, and displays to describe beneficial land stewardship, sound environmental practice, natural and impacted ecosystems, and stormwater management in human-dominated land-uses.

The goals for the practicum were: Completing the documentation of site inventory; Refining and completing the preliminary landscape designs; Creating a regional environmental education preserve; Producing a management plan to conserve and restore natural resources; and Proposing ideas to design educational activities and interpretive materials for KEEP.

Challenges in the practicum were mostly brought by the pandemic. For example, limited travel and collaboration opportunities; lacking detailed landform information, so some design and suggestions remain on a theoretical level, and I was unable to start their implementation.

METHODS

SITE INVENTORY

I reached out to the SEAS Phase I student team to learn about their survey results and completed the site inventory (Brannon et al., 2020). The maps and data they provided were: aerial photos; land cover data of 1800, 1960, 1984, 1990 and 2005; vegetation cover data and quantitative data that described vegetation quality; photos and survey results of wildlife presents; hydrology map and water quality analysis results.

Field surveys were conducted in different seasons: June 4th, 2020, September 4th, 2020, November 21st, 2020 and January 29th, 2021, using cameras to record the experience on the site. A survey was conducted using a laser surveying instrument to measure the slope of an existing swale to the south of the parking lot on March 6th, 2021. The USDA Web Soil Survey was reviewed to research the soil condition of the KEEP Parcel.

LANDSCAPE DESIGN

The results of Phase I characterized the current ecological condition of the site. A site inventory was developed of other potential ecosystem services, such as aesthetic values and sensory learning opportunities. During and after the site visits, experiential analysis was conducted using the photos, video recordings and audio recordings, in order to maintain and create the restorative potential in the design process.

I had meetings and field trips with the client to discuss the design elements, and created solutions to the design problems with preliminary sketches. The design process weaved in interdisciplinary considerations, following a sequence to identify the attributes and physical traits that were carefully measured and developed to contribute to restoration (Hunter & Askarnejad, 2015) and learning. Theories used in the process were: Prospect-Refuge Theory (Appleton, 1975), Environmental Information Processing Theory (Kaplan, 1987), Attention Restoration Theory (Kaplan and Kaplan, 1989; Kaplan, 1995), Scenic and Landscape Aesthetics Theories (USDA-FS, 1995), etc.

PLANTING DESIGN

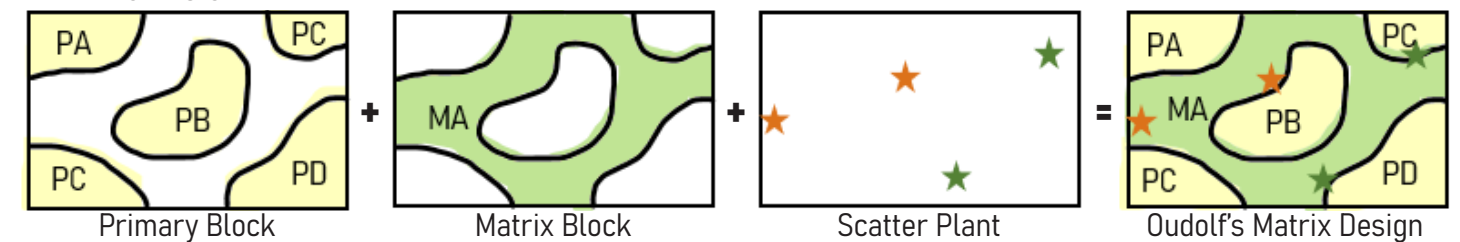


Figure 1-4 : Demonstration of Primary Block, Matrix Block, Scatter Plant and the complete Oudolf's Matrix Design

Piet Oudolf is a Dutch garden designer. His planting style is naturalistic and requires a deep understanding of the plant's developmental phenology, its microhabitat needs, and how its aesthetic presence changes over time during the process of plant selection. The planting design consists of three layers, primary block layer, matrix block layer and scatter plant layer. On top of these three layers, wood plants are defining the structure of the design, because they are larger and more visually present, they will also cast shade around them, so it needs to be decided before designing the primary blocks, matrix block and scatter plants. Primary blocks, which are the primary interest holding species that bring structural presence for 9 - 12 months. Matrix blocks holding species that act as a backdrop for primary blocks. They add visual cohesion to the design. Relative to primary blocks, they have lower focal impact for much to all the year. Scatter plants are species that have a short period of impact but are relatively inconspicuous before and after this moment, like spring ephemerals. (Oudolf & Kingsbury, 2014)

ENVIRONMENTAL EDUCATION MODULE

I conducted background reviews of relevant existing environmental educational outdoor centers through literature researches and online searches. A summary of possible educational elements was developed that are appropriate for a wide range of ages (K-12 and adults). Finally, ideas were provided for environmental education modules, interpretive materials and activities.

CASE STUDIES

LOUISIANA CHILDREN'S MUSEUM



Figure 5-9: Birdseye view and landscape of Louisiana Children's Museum

Location: 15 Henry Thomas Dr, New Orleans, LA 70124

Size: 8 acres

Project Type: Museum, Landscape Architecture/Architecture/Interior Design

Designer: Mithun

Opening Date: 2019

Introduction

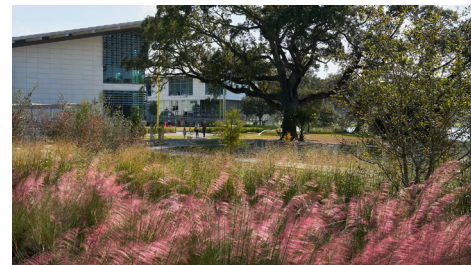
Following Hurricane Katrina, the Louisiana Children's Museum (LCM) adapted its mission to respond to the changing needs of its recovering community. The museum's new home is distributed into two linked buildings, carefully sited to protect existing live oaks while enhancing the lagoon and open space for environmental education. The choreography of the visitor experience connects people and nature – moving through groves of live oaks, across water, and into a courtyard and sensory gardens.

Connection to the KEEP

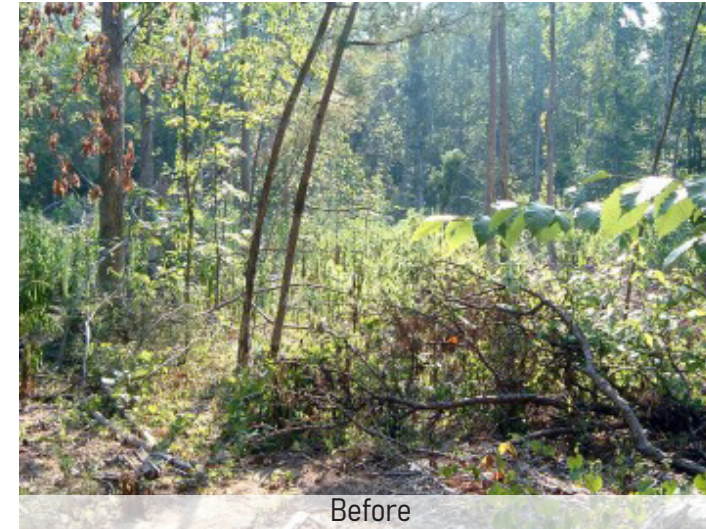
Similar in size, but the LCM is mostly a water body, It strengthens the linkage between human and environment by "Takes the learning outside", which is also going to be achieved in the design of KEEP.

Lessons Learned

This project adopted the Reggio Emilia child development philosophy—a child-centered approach that emphasizes multi-sensory nature play—guided the integrated site and building design. By creating environments that empower children to make their own choices, provide multi-sensory experiences, and enable and reflect children's work and ideas, the museum encourages children and families to engage more deeply. The design provides diverse child-scaled spaces, so that children are invited to engage with each other and the natural world through play and multi-sensory expression, such as listening to the bird song, hide and seek, building things together.



NORTH CAROLINA BOTANICAL GARDEN EDUCATION CENTER



Before



After

Figure 10-12: North Carolina Botanical Garden Education Center

Location: 100 Old Mason Farm Rd. Chapel Hill, North Carolina 27517

Size: 7.5 acres

Project Type: Garden/Arboretum

Designer: Swanson + Associates, P.A

Opening Date: 2009

Introduction

The North Carolina Botanical Garden (NCBG), a unit of the University of North Carolina-Chapel Hill, was founded in 1966 and is nationally known for its conservation programs, collections, and diverse educational offerings. The mission of the NCBG is to inspire understanding, appreciation, and conservation of plants in gardens and natural areas and to advance a sustainable relationship between people and nature.

Connection to the KEEP

Similar in size, similar in design challenge of to develop a low-impact, high-performance cultural venue capable of integrating indoor and outdoor educational exhibits while preserving and enhancing both natural and cultivated landscapes.



Lessons Learned

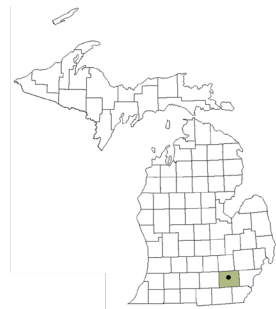
In this project, 8 aluminum above-ground cisterns are used with a capacity of 54,400 gallons to collect building roof runoff for dedicated irrigation reuse. Bioretention basins treat excess runoff from parking surfaces. Carefully-sited paths provide universal accessibility without the need for steps or ramps. In addition, this reduces summer parking lot surface temperature by using high-albedo pavers as compared to nearby asphalt. It also attracts thousands of participants annually with carefully designed programs, classes, and events and provides opportunities for volunteers.

SITE INVENTORY & ANALYSIS

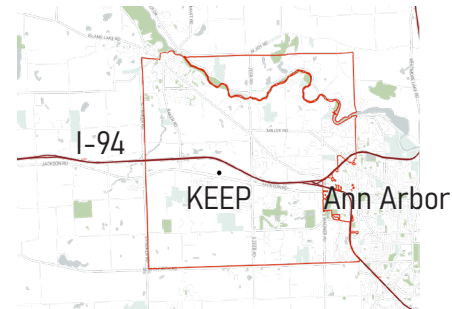
LOCATION & SITE CONTEXT



Figure 13-15: Site Location
US - Michigan



Washtenaw County



Scio Township

The KEEP Property



Figure 16: Aerial Map of KEEP, By Sarah Brannon, Katherine Ferran, Joy Yaki

The KEEP is located to the west of Ann Arbor at 100 N. Staebler Road, Scio Township. It is a 7.6-acre densely vegetated area within the 17-acre parcel purchased by the Kiwanis Club of Ann Arbor foundation. It has a small pocket of wetlands including two ponds, next to the Kiwanis Thrift Shop building, the warehouse of Lindenmeyr Munroe Paper and a parking lot.



Figure 17: Existing Visitor Pathway Circulation Map of KEEP

VISITOR PATHWAY CIRCULATION

The KEEP can be accessed by Jackson Road and North Staebler Road, through the parking lot of the Kiwanis Thrift Shop. There are currently two main entry point to the KEEP, one is from the concrete walkway, and the other one is near the truck loading dock, underneath the arch of Buckthorn. Most part of the existing trail goes along the water area, but it is not a complete trail pathway with two dead-ends.

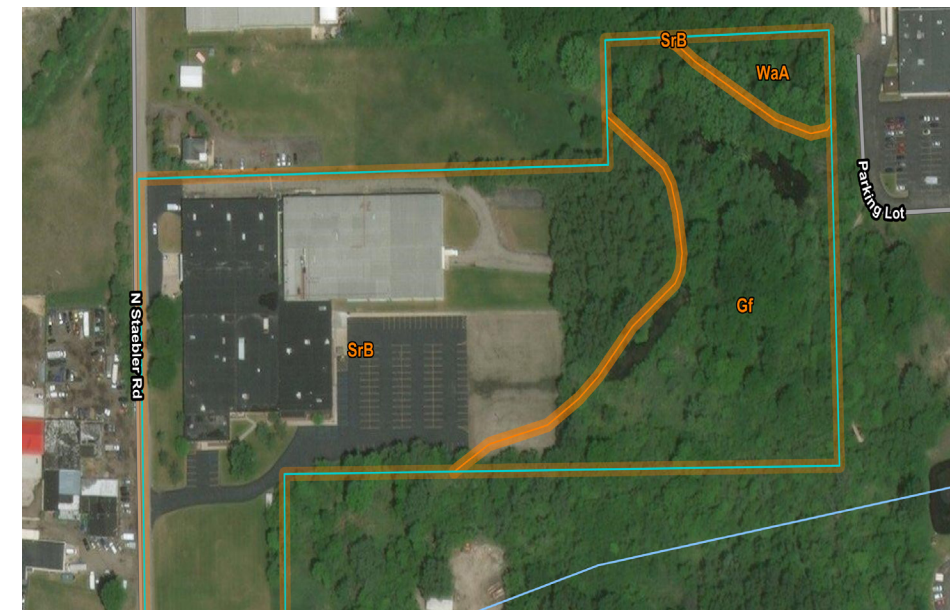


Figure 18: Soil Map of KEEP from USDA Web Soil Survey <https://websoilsurvey.nrcs.usda.gov/app/>

SOIL

The KEEP is mostly covered by Spinks-Oshtemo loamy sands and Gilford sandy loam. Spinks-Oshtemo loamy sands is well drained and more than 80 inches deep to the water table. This promotes vegetation growth and seed germination. The Gilford sandy loam is poorly drained, and about 0 inches depth to the water table, which increasing the risk of water inundation.

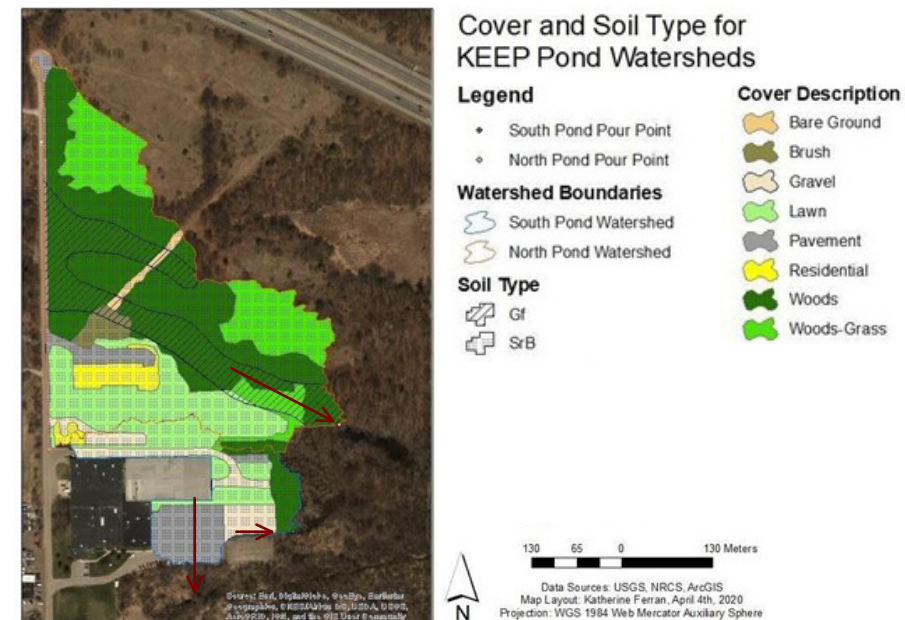


Figure 19: Watershed Map of KEEP, By Sarah Brannon, Katherine Ferran, Joy Yaki

HYDROLOGY

The two ponds in the KEEP resulted from historical agricultural activities, being created for irrigation. There is no continuous inflow to the ponds, which are primarily fed by storm-water runoff. Currently, stormwater from the Kiwanis building roofs are collected with pipes and directed to the County drainage ditch to Honey Creek. Suffering from low and flashy flows, water pollutants like oils, greases, polycyclic aromatic hydrocarbons, and zinc likely degrade the quality of the aquatic habitat in the KEEP.

VEGETATION

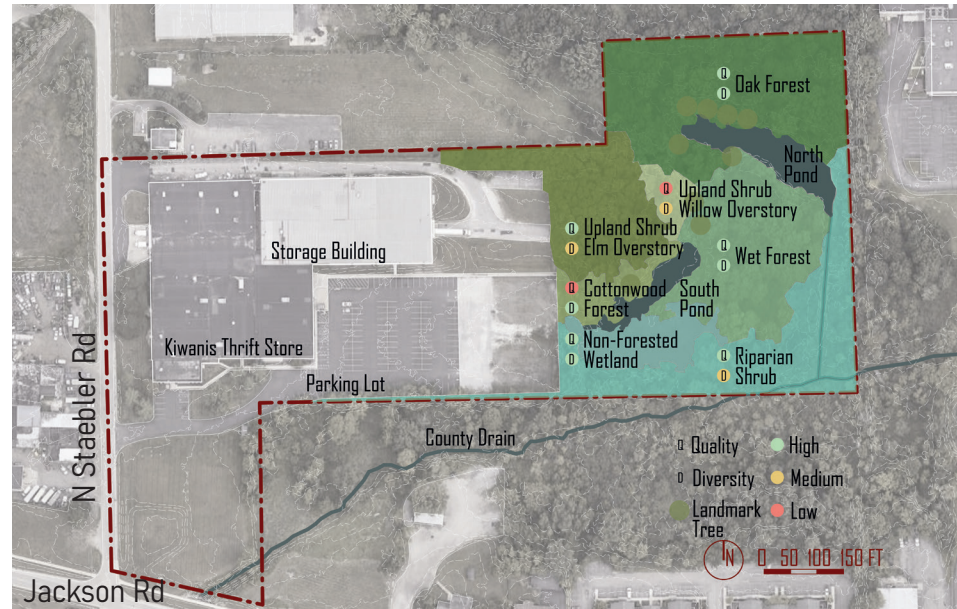


Figure 20: Vegetation Cover Types & Quality Map of KEEP

Based on the survey done in Phase I, the vegetated area is characterized into seven cover types with different quality and plant diversity. The dominance of Buckthorn in the understory in cover types like Cottonwood Forest and Upland Shrub Elm Overstory leads to lower quality during succession, when the overstory trees are dying out and not being replaced. However, the vegetation community still shows a sign of productivity and ecological complexity, even though it has gone through decades of

disturbance. Areas with higher quality and diversity like the Oak forest seems to be a remnant of the signature forest in Michigan, Oak-Hickory forest. The Wet Forest has inherited the native seed bank from the original dominance of wetland before other types of land use. With careful design and proper management, the health of the KEEP vegetation community can be restored and improved for educational purposes.

WILDLIFE



Figure 21: Wildlife Photos of KEEP By Sarah Brannon, Katherine Ferran, Joy Yakie, Yanning Gao

During Phase I, on-site field visits were conducted, and on-site cameras were used to record wildlife presents. In Phase II, I also recorded footprints and manure left behind by wildlife. Mammals, birds and amphibians are spotted on site, which demonstrates the current ecosystem can support a wide diversity of wildlife in the rural-urban setting. Ecological functions of this semi-natural ecosystem have not been too adversely. Species like the opossum have a positive influence on the KEEP because its tick-dependent diet helps control Lyme dis-

ease. Squirrels and chipmunks help increase the germination rate of oak acorns. Birds spread seeds. Nevertheless, the site lacks iconic Michigan species like Kirtland warblers, Eastern Box Turtles, and Massasauga rattlesnakes. The large population of white-tail deer, typical of the Ann Arbor area, are causing overbrowsing. Water dependent biota are also rare due to the low quality of the two ponds, with birds mostly perching or foraging. The design needs to support greater diversity to be both ecological functioning and attractive to visitors.

EXPERIENTIAL ANALYSIS

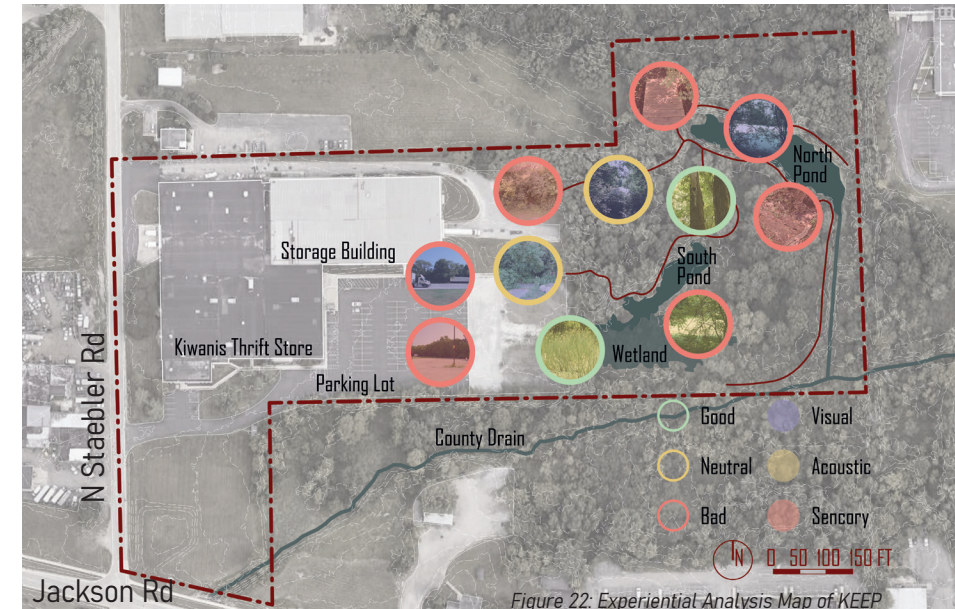


Figure 22: Experiential Analysis Map of KEEP



Figure 23-24: Demonstration of Experiential Analysis

Preference is a kind of universal caring resulting from human information processing. Kaplan et al. suggested people's preference of a natural environment is based on an Environmental Preference Matrix. The Environmental Preference Matrix includes two elements that are helping people with understanding the environment; coherence and legibility, and two elements that guarantee involvement and exploration: complexity and mystery. The coherence and complexity define how a person can mentally function in the present, and the legibility and mystery are the promise to continue the information processing in the future. The preferred landscapes have a balanced combination of all of these four elements. How-

ever, as I recorded my experience on the site, there was too much complexity and mystery, with low to no coherence and legibility.

As the example shows, dense vegetation presents high complexity and low coherence, which impedes information processing, and the site is lacking a clear trail which is essential to wayfinding. The current trail wanders and disappears into the deep forest, increasing the amount of mystery in the KEEP; the excess amount of mystery makes it hard for visitors to interpret the experience in the next moment.

STRATEGIES

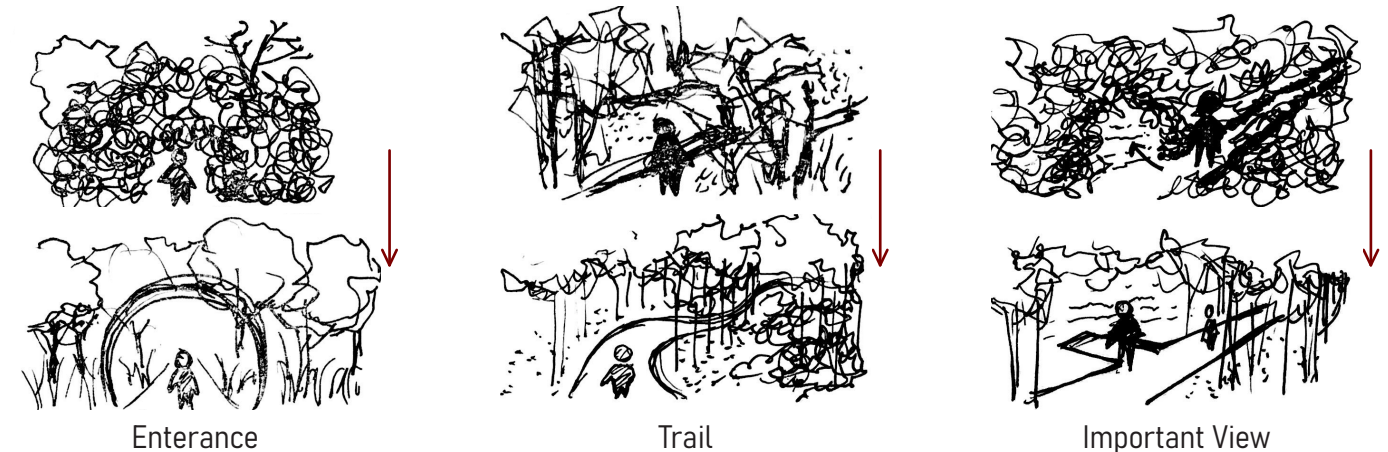


Figure 25-30: Strategy Sketches of Creating Preferred Environment

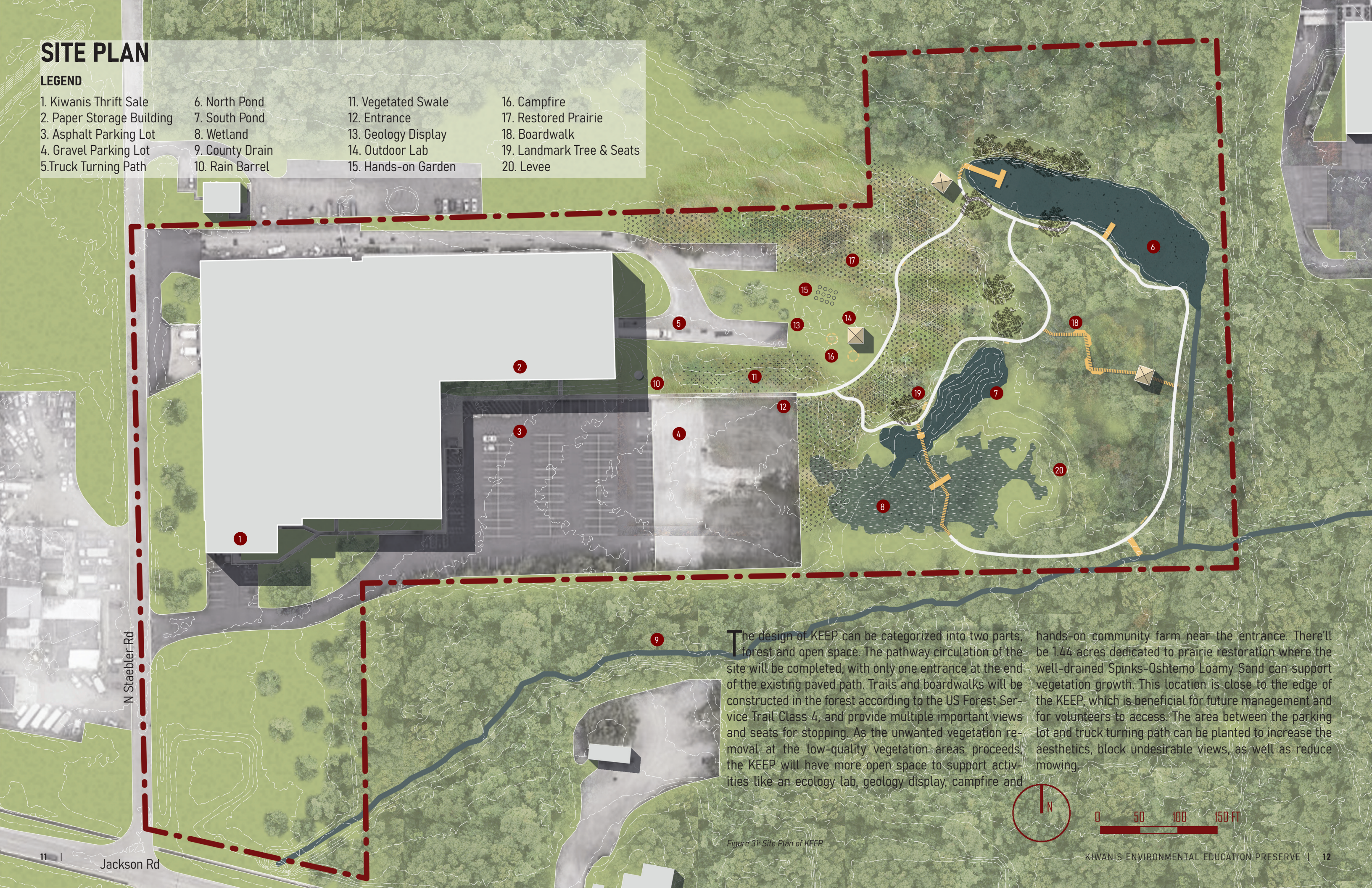
To make the KEEP a preferred environment for visitors, unwanted vegetation removal should be conducted, which will make the space larger and more breathable. Reducing the excess amount of information on the site will help visitors perceive the site better. Strategies like

making the entrance more defined and clearer, widening the trail and installing maps and signages, giving enough space to allow both walking and sightseeing, will help create a balanced landscape, reduce the complexity and mystery, and increase the coherence and legibility.

SITE PLAN

LEGEND

- | | | | |
|---------------------------|-----------------|---------------------|---------------------------|
| 1. Kiwanis Thrift Sale | 6. North Pond | 11. Vegetated Swale | 16. Campfire |
| 2. Paper Storage Building | 7. South Pond | 12. Entrance | 17. Restored Prairie |
| 3. Asphalt Parking Lot | 8. Wetland | 13. Geology Display | 18. Boardwalk |
| 4. Gravel Parking Lot | 9. County Drain | 14. Outdoor Lab | 19. Landmark Tree & Seats |
| 5. Truck Turning Path | 10. Rain Barrel | 15. Hands-on Garden | 20. Levee |



The design of KEEP can be categorized into two parts, forest and open space. The pathway circulation of the site will be completed, with only one entrance at the end of the existing paved path. Trails and boardwalks will be constructed in the forest according to the US Forest Service Trail Class 4, and provide multiple important views and seats for stopping. As the unwanted vegetation removal at the low-quality vegetation areas proceeds, the KEEP will have more open space to support activities like an ecology lab, geology display, campfire and

hands-on community farm near the entrance. There'll be 1.44 acres dedicated to prairie restoration where the well-drained Spinks-Oshtemo Loamy Sand can support vegetation growth. This location is close to the edge of the KEEP, which is beneficial for future management and for volunteers to access. The area between the parking lot and truck turning path can be planted to increase the aesthetics, block undesirable views, as well as reduce mowing.



Figure 31: Site Plan of KEEP

DETAILED DESIGN

PLANTING DESIGN

1. Paper Storage Building
2. Asphalt Parking Lot
3. Gravel Parking Lot
4. Truck Turning Path
5. Compacted Gravel Path
6. Vegetated Swale
7. Overflow Inlet
8. Entrance
9. Geology Display
10. Outdoor Lab

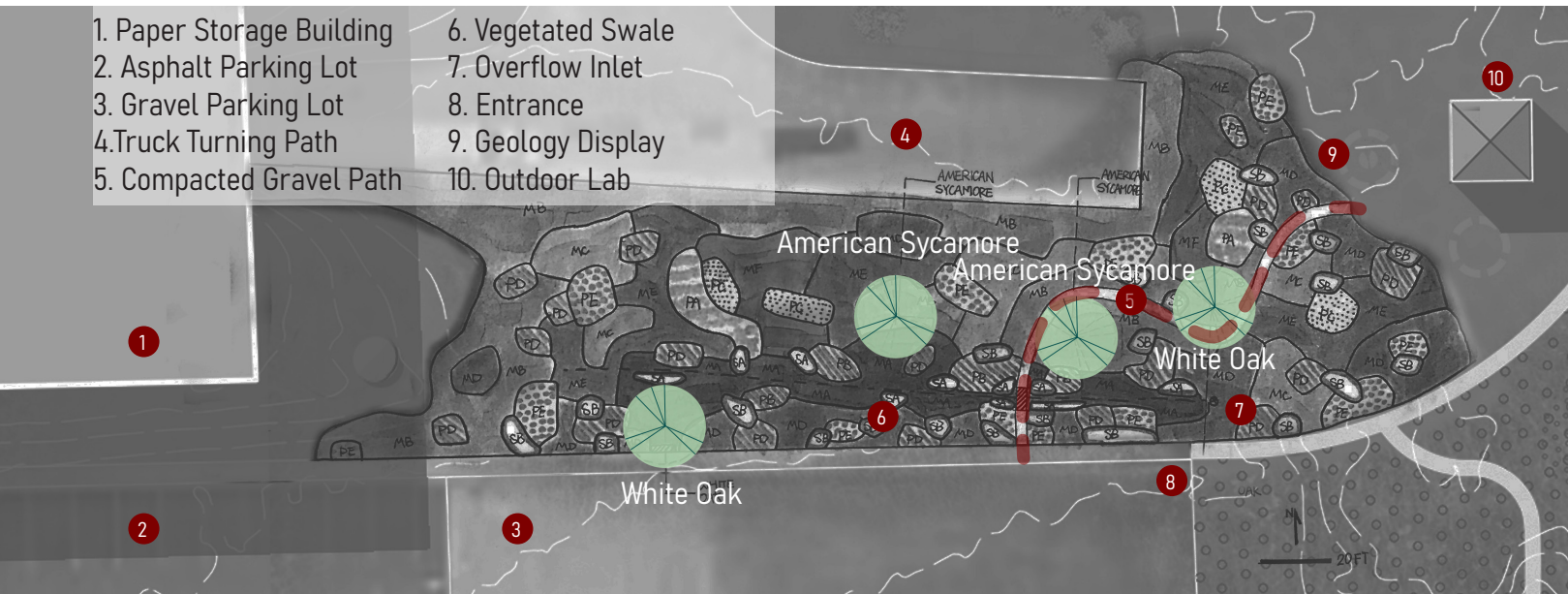


Figure 32: Woody Plant Layer of KEEP Planting Design

The goal for the planting design is to increase the aesthetics near the entrance of the KEEP, blocking the unwanted view and leading the visitors to the entrance of the KEEP. It can reduce mowing with lower maintenance, provide food and habitat for pollinators, and become a part of the environmental education modules at the same time.

The design includes removing current lawn, installing a vegetated swale at the lowest part of the planting area, but still leaving a small portion of lawn where the rain barrel will be installed, for easy access and maintenance. A 5 ft wide trail will be added, paved with compacted crushed gravel, that wanders through the planting area to let visitors fully enjoy the beauty of native herbaceous plants.

As the perennials and ornamental grasses will attract the visitors' eyes; a 15+ ft area by the truck dock will not be planted with woody or herbaceous plants taller than 5 ft. This will provide open viewing for safe vehicular traffic in the dock area.

For the structural layer, which is the woody plants layer, I chose White Oak (*Quercus alba*) and American Sycamore (*Platanus occidentalis*) for their nativity and erect shape and pyramidal canopy. They all provide beautiful foliage color in fall. In addition, the older American Sycamore (*Platanus occidentalis*) has scaled bark of camouflage color, which can also be a visual interest. These trees will also provide shade for the trail and the seats on the side of the trail.

For the other three planting layers, the matrix layer serves as the canvas of the painting, consisting of mainly ornamental grasses. Primary blocks with more attractive color, structure and texture are painted with broad strokes on the canvas, which are the focal points that spread out on the planting area. The scatter plants in the design are spring ephemerals that flower early before other perennials come out and disappear later in the season. It will occupy part of the space for the primary and matrix blocks to make the canvas less blank; but, will return it back after the species in primary and matrix blocks begin to grow. The planting design will not remain the same as when first planted; it will change as the plants grow and fill-in, or even die out, until it reaches a dynamic equilibrium.

The recommended species in the planting design are mostly Michigan native species, and all of have ecological value. Only the two perennials, Threadleaf Bluestar (*Amsonia hubrichtii*) and Tall Verbena (*Verbena bonariensis*) in the primary block PA are not Michigan natives. They are chosen because the Threadleaf Bluestar is an early flowering species and it provides smooth texture and unique yellowish color throughout the year, and it makes great aesthetic contrast in texture and color with the coarse Tall Verbena. Both can provide ecological benefit by attracting pollinators. In primary block PB, the Marsh Blazing Star (*Liatris spicata*) and Great Blue Lobelia (*Lonelia siphilitica*) provide a mysterious purplish-blue color and contrasting texture, both work well together and can resist wetness. They are planted by the vegetated swale. Primary block PC consists of Joe-pye Weed (*Eupatorium purpureum*); it is tall, with coarse texture, large dark green leaves, large clumps of flower that can help filtering out the view from the truck turning path. Primary block PD consists of Butterfly weed (*Ascepias tuberosa*) and Purple Coneflower (*Echinacea purpurea*); while primary block PE consists of Black-eyed Susan (*Rudbeckia hirta*) and Eastern Beebalm (*Monarda bradburiana*). These two combinations of primary block are used most in the design. They are hearty and provide a contrast of different shades of orange and different shades of purple. A large part of PD and PE are along the existing paved path. With contrast like this, these blocks are the most attractive to visitors and are defining the entrance of the KEEP.

Matrix block MA is Tussock Sedge (*Carex stricta*) is short and resistant to inundation, which is a great ground cover in the vegetated swale. Matrix block MB is Bottlebrush Grass (*Elymus hystrix*), chosen because of its color similarity to the lawn with a longer leaf blade, its playfulness when it shoots out bottlebrush-like flowerheads during flowering season, and the seed head remains for later interest. It helps blending the edge of the planting area into the outdoor lab area and rain barrel area, where the lawn is needed. Matrix block MC consists of Purple Lovegrass (*Eragrostis spectabilis*) and Prairie Blazing Star (*Liatris pycnostachya*) have soft purple mist-like grass that will light up when sun comes from the west, with stronger purple vertical lines adding some soft color in the backdrop. Matrix block MD, Prairie Dropseed (*Sporobolus heterolepis*) is a clumping grass that can soften the hard edges and has seed heads that will light up with back light from the west. Matrix block ME, Little Bluestem (*Schizachyrium scoparium*) is the most common prairie grass and can provide color and many important ecological functions, including erosion control. Matrix block MF, Indian Grass (*Sorghastrum nutans*) is a tall grass that works perfectly with primary block PA. Their tall structure can filter out unwanted views and the combination is an important focal point when visitors walk from the parking lot towards the KEEP.

Scatter plants SA, Blue Flag Iris (*Iris versicolor*) can resist inundation, so it is also planted in the vegetated swale. It flowers early in spring with purplish-blue flowers. After the flowering season it will leave upright green leaves behind. Scatter plants SB, Red Columbine (*Aquilegia canadensis*) only flowers in spring, bringing some red sparkle to the KEEP throughout the planting area.

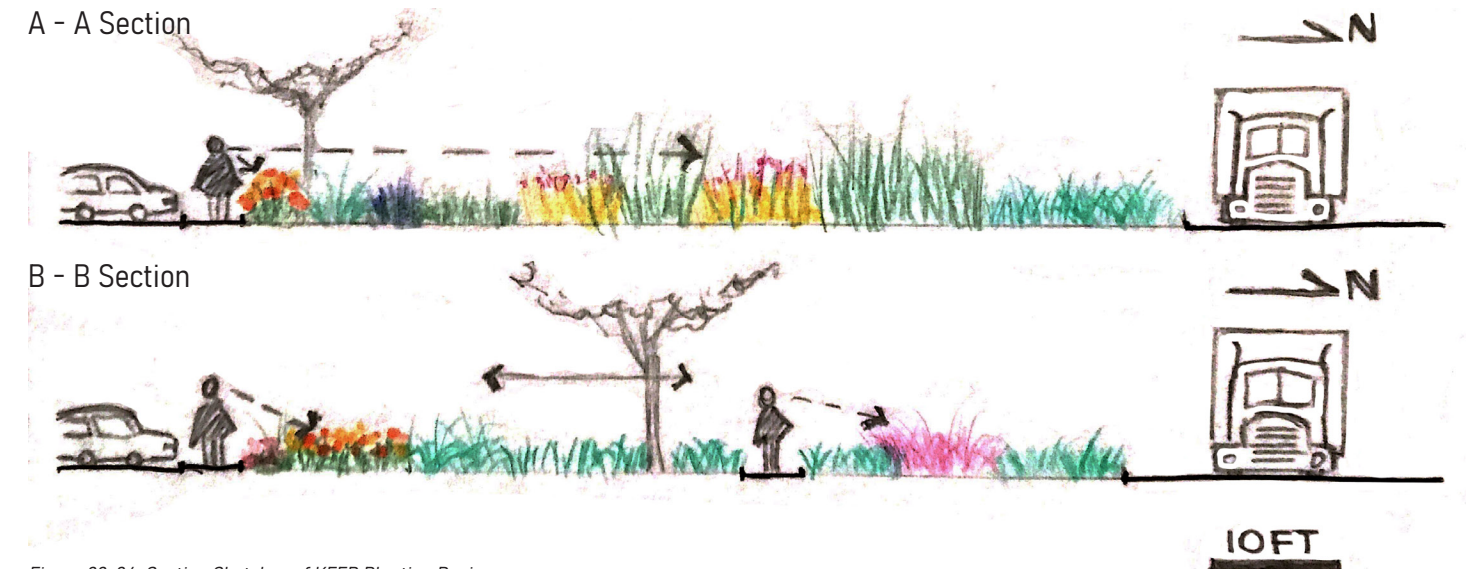


Figure 33-34: Section Sketches of KEEP Planting Design

PLANTING PLAN

- 1. Paper Storage Building
- 2. Asphalt Parking Lot
- 3. Gravel Parking Lot
- 4. Truck Turning Path
- 5. Compacted Gravel Path
- 6. Vegetated Swale
- 7. Overflow Inlet
- 8. Entrance
- 9. Geology Display
- 10. Outdoor Lab

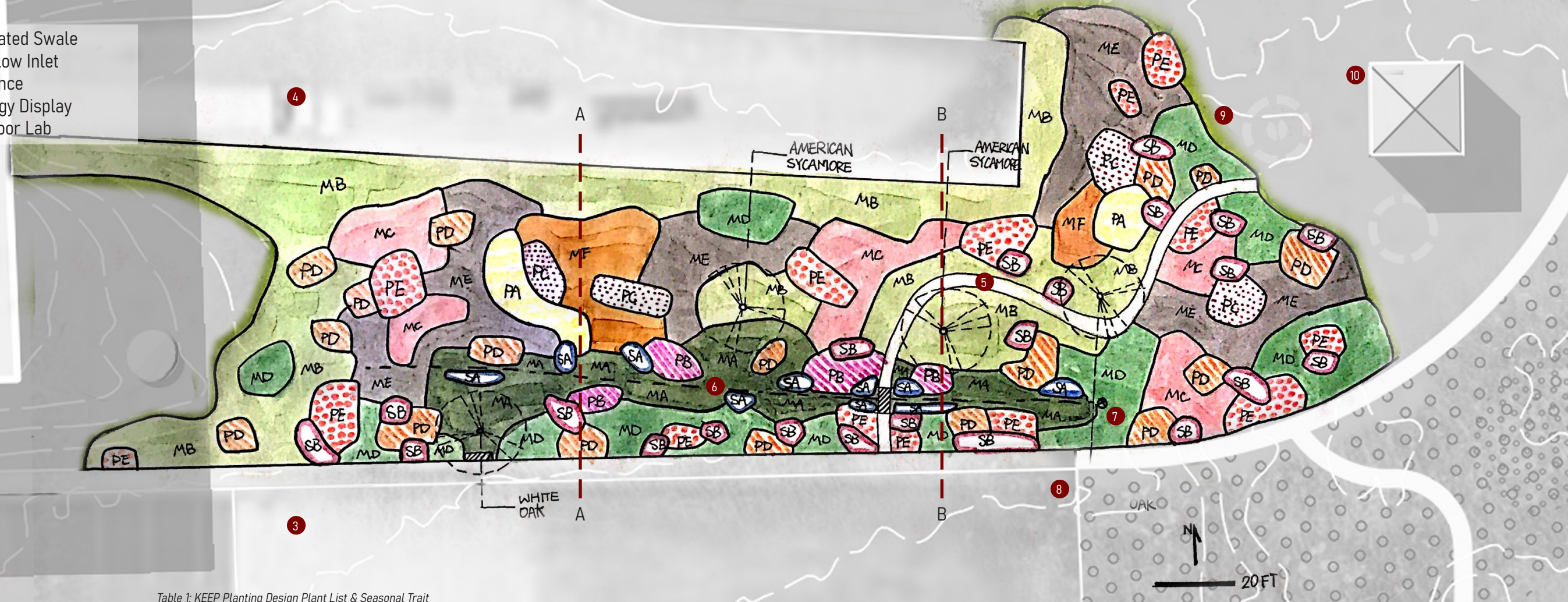


Figure 35: KEEP Planting Design Plan

Table 1: KEEP Planting Design Plant List & Seasonal Trait

Role	Type	Abbreviation	Botanical Name	Common Name	Percentage	Early Spring	Mid Spring	Late Spring	Early Summer	Mid Summer	Late Summer	Early Autumn	Mid Autumn	Late Autumn	Winter	Ecological Value			
Primary Block	Perennial	PA	<i>Amsonia hubrichtii</i>	Threadleaf Bluestar	60%											Butterfly			
			<i>Verbena bonariensis</i>	Tall Verbena	40%												Butterfly		
		PB	<i>Liatris spicata</i>	Marsh Blazing Star	50%												Birds	Butterfly	
			<i>Lonelia siphilitica</i>	Great Blue Lobelia	50%												Birds	Butterfly	
		PD	<i>Ascepias tuberosa</i>	Butterflyweed	50%													Birds	Butterfly
			<i>Echinacea purpurea</i>	Purple Coneflower	50%													Birds	Butterfly
PE	<i>Rudbeckia hirta</i>	Black-eyed Susan	70%													Birds	Butterfly		
	<i>Monarda bradburiana</i>	Eastern Beebalm	30%													Birds	Butterfly		
Matrix Block	Ornamental Grass	MA	<i>Carex stricta</i>	Tussock Sedge												Birds	Butterfly		
		MB	<i>Elymus hystrix</i>	Bottlebrush Grass												Birds	Butterfly		
	Perennial	MC	<i>Eragrostis spectabilis</i>	Purple Lovegrass	60%												Birds	Butterfly	
			<i>Liatris pycnostachya</i>	Prairie Blazing Star	40%												Birds	Butterfly	
	Ornamental Grass	MD	<i>Sporobolus heterolepis</i>	Prairie Dropseed													Birds	Butterfly	
ME		<i>Schizachyrium scoparium</i>	Little Bluestem													Birds	Butterfly		
Scatter Plant	Perennial	SA	<i>Iris versicolor</i>	Blue Flag Iris												Birds	Butterfly		
		SB	<i>Aquilegia canadensis</i>	Red Columbine												Birds	Butterfly		
Woody Plant	Tree	QA	<i>Quercus alba</i>	White Oak												Birds	Butterfly		
		PO	<i>Platanus occidentalis</i>	American Sycamore												Birds	Butterfly		

- Seedhead
- Birds
- Bees & Other Insects
- Butterfly
- Small Mammal
- Erosion Control

TRAIL & BOARDWALK



Figure 36: USFS Trail Class 4 Reference Photos

US FOREST SERVICE TRAIL CLASS 4

Referencing the USFS Trail Class 4, which has relatively wide, smooth tread, infrequent obstacles meet ADA accessibility requirements. Informational signage and trail side amenities available will provide guidance and resting spots. The modified recreational environment will help visitors better experience the KEEP.



Before



After

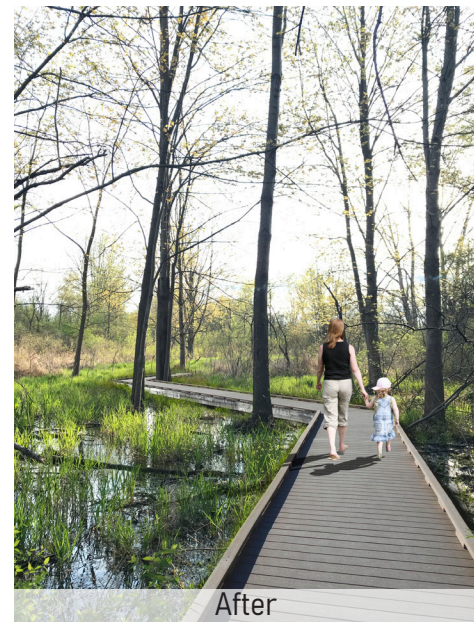
Figure 37-38: KEEP Trail: Before & After

TRAILS

The trails will be modified from narrow paths with many obstacles to a 5 ft wide trail with compacted soil and vegetation cleared on the trail side. Benches can be made with fallen wood to provide a natural style. Maps and signages should be placed at the trail side as needed.



Before



After

Figure 39-40: KEEP Boardwalk: Before & After

BOARDWALKS

There will be 5 ft wide, zig-zag shaped boardwalks added across the existing wet forest and wetlands. The final walkway angles and their placement will be decided according to site conditions. Composite Decking, a mixture of wood fiber and plastic, is recommended as the boardwalk material for its durability and eco-friendliness. It's usually more expensive than lumber, but the price difference may be less now that lumber prices are increasing dramatically. The actual budget will be decided before the construction. It will need maintenance to prevent mold and algae.



Figure 41: Geology Display

GEOLOGY DISPLAY

A custom-made pavilion will include a vertical planting of Lake Michigan, and glass boxes containing stone specimens from different parts of Michigan. This display along with the planting behind it will help block the truck loading area, while providing interpretive study features.



Figure 42: Boardwalk Outlook on Wetland

BOARDWALK OUTLOOKS

Located on the pond and wetland, they will provide a wider viewshed and the feeling of escaping from busy life while immersing oneself in nature. This could become a useful place for meditation and mental restoration.

LONG-TERM MANAGEMENT & CONSERVATION

MANAGEMENT TIMELINE EXAMPLE

YEAR	PHASE	ITEM	DETAIL
Year 1	Phase 1: Management	Install rain barrel	Possibly install a 1,500-gallon barrel by the east side of the building to collect roof runoff, with a near-surface buried pipe connecting to the South Pond. A pump may or may not be necessary.
		Unwanted vegetation removal in low-quality area, keeping large trees	In autumn, clear-cut the low-quality area, except for cottonwoods and other large trees to prepare for prairie restoration. In autumn and winter, hand-pull or use weed wrench to remove Buckthorn under 5 cm, cut Buckthorn over 5 cm in diameter using chainsaw and burn the stumps to prevent resprouting. Remove unwanted vegetation to the south of the parking lot.
		Seed collection	While removing unwanted vegetation, collect native seeds, especially acorns and other overstory species. Ship the seeds to nursery for storage or to grow tree seedlings.
		Construct trails and boardwalk	Create class 4 trails and boardwalks based on US Forest Service Trail Design Parameters.
	Phase 2: Restoration	Reseeding site	Reseed areas where Buckthorn removed using direct seeding method in fall and following spring.
		Remove unwanted vegetation on south side of the South Pond and wetland	Cut down trees and shrubs that have not reached mature size on the south side to allow more sunlight.
		Grading, excavation and fill	Dig a large hole near the inflow of the South Pond for fish overwintering. Depth 3 - 6 ft depths. Install a solar powered aerator to increase oxygen content in water in the hole. Install culverts in the berm between the North Pond and Wet Forest to drain the water in the Wet Forest and reduce forest flooding; thereby improving ecological quality while reducing mosquito breeding areas. Use the excavated soil to create berm around the wetland area to prevent water from entering the current Wet Forest.
		Prescribed burn	In autumn, after the clear cutting in the designated prairie restoration area, conduct prescribed burn to remove litter, kill off invasive species and prepare the seedbed.
		Prairie seeding	Broadcast seeding the prairie seed mix by hand after the prescribed burn.
		Mowing & weeding	Keep removing the newly germinated or resprouted buckthorns. During prairie plant establishment, weeds may appear. In spring, mow to 4 - 8 inches height for 2 to 3 times on a 30-days interval to slow down the establishment of weed.
Year 2	South Pond and wetland planting and management	Use native wet prairie to replant the South pond and wetland surrounding areas, see species detail in Appendix.	
		Use Black-margined Loosestrife Beetle (<i>Galerucella californiensis</i>) to control Purple Loosestrife. To control the Reed Canary Grass, plant live Sandbar Willow stakes, harvested on site, spaced 2 or 3 feet apart.	
		To reduce the mosquito population in the South Pond and wetland area, introduce native fish species like the Fathead Minnow (<i>Pimephales promelas</i>).	
	Phase 3: Education	Birdhouse building and placement	Place out the birdhouses into the site according to the standardized birdhouse dimensions and placement map.
		Pavilion and signage placement	Construct and place according to the maps.
		Outdoor furniture placement	Outdoor furniture include a fireplace, wood log as seats, benches, and display board.
		Planting installation	In autumn, plant the area between the parking lot and the truck loading area according to the planting plan, leaving space for rain barrel maintenance. Water thoroughly after planting using the water in the rain barrel.
Year 3 - Future	Phase 4: Maintain Ponds & Prairie	Site review	Continue yearly site assessment. Projects include plant establishment in the prairie and forest to decide the detailed future management method; species monitoring using on-site cameras linking to habitat quality; increase content of environmental education; hydrological evaluation and monitoring both ponds; document inflow and outflow volumes to update Phase 1 model and create long-term documentation and analysis.
	Phase 5: Long-term Management	Prescribed Burn	Continue with the prescribed burn every autumn for the restored prairie and the oak forest to keep the prairie open and increase nutrients in the soil, decrease the number of competitors and increase oak regeneration.
		Deer fencing and weeding	Mechanically remove Buckthorn resprouts before fruiting season using hand-pulling, weed wrench and chainsaw. Use deer fences to protect the newly germinated or planted oak seedlings. For non-forested wetland area, monitor the beetle population and purple loosestrife herbivory every spring.
		Sediment clean-up	Clean sediment from the rain garden and the wetland area close to the parking lot four times a year.
		Devices and structures	Check for rust, rot, mold, and algae on the outdoor furniture yearly, repair and replace as needed. Check and clean the entire system of the rain barrel every month, clean litter or debris filters.

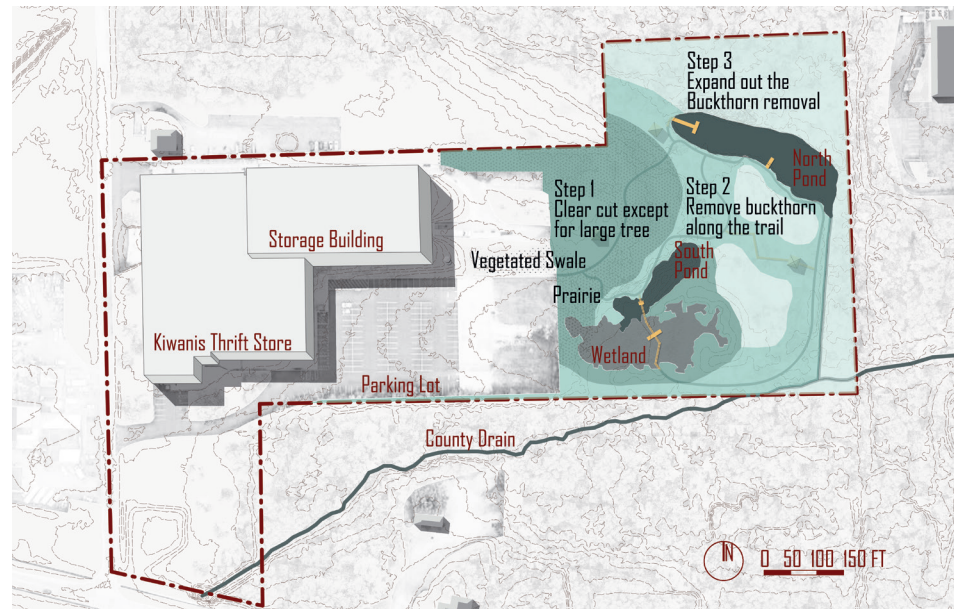


Figure 43: Vegetation Removal Plan

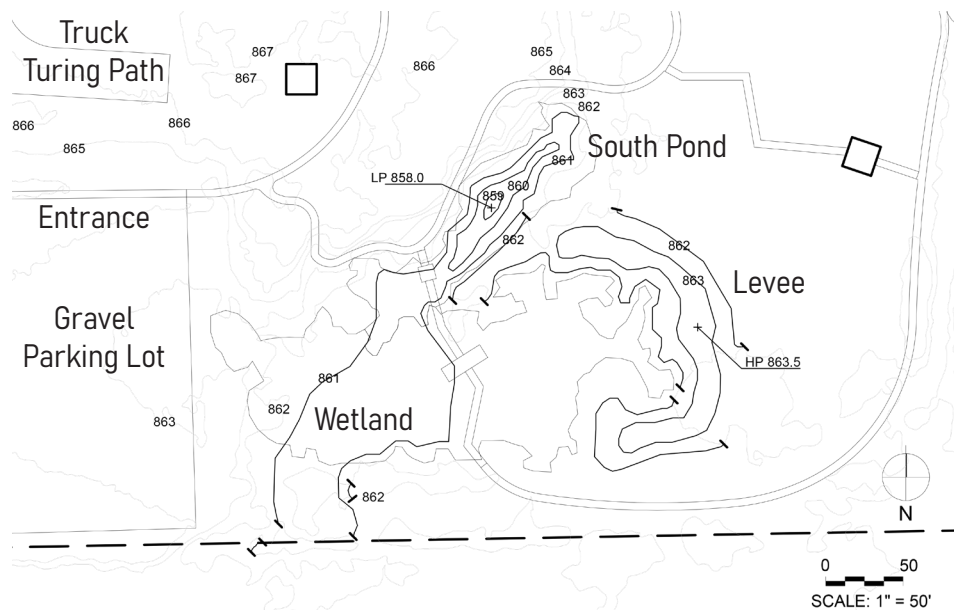


Figure 44: Grading Plan

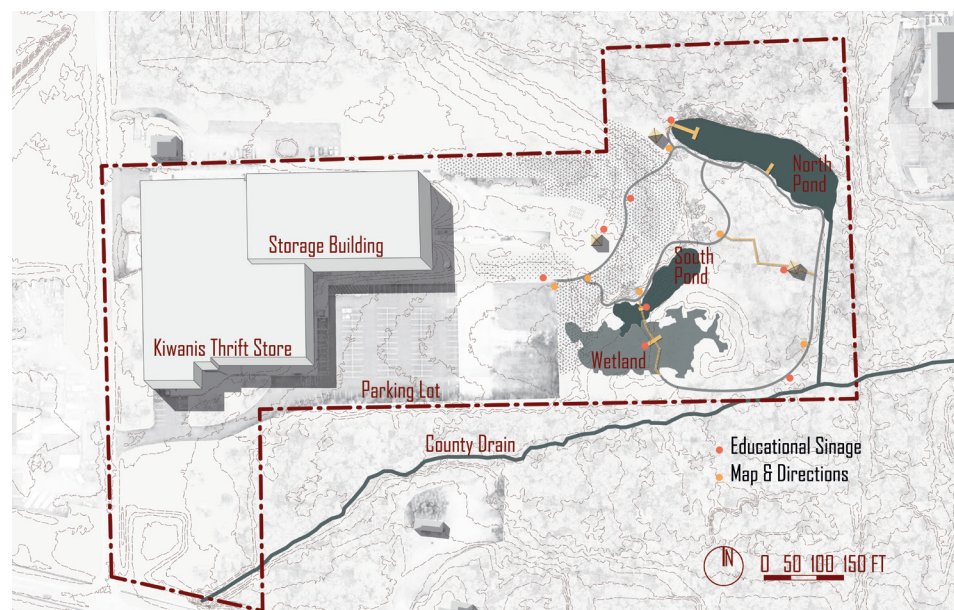


Figure 45: Maps & Signages Placement Plan

VEGETATION REMOVAL

As the trails are being constructed, unwanted vegetation is also being removed. Spread out the unwanted vegetation removal from the trail as you progress and prioritize clear cutting the low-quality area in Step 1.

GRADING

According to the grading plan, there will be 539.2 cubic yards of cut and 524.1 cubic yards of fill. The cut is slightly larger than fill, so approximately equal. The final grading will be decided on site according to the site condition. The excavator will access the South Pond from the gravel parking lot to the north side of the South Pond as the vegetation removal continues, and dump excavated soil to the proposed levee.

MAPS & SIGNAGES

Maps and signage will be placed alongside the trail and boardwalk; including directional signs, interpretive and interactive signage for educational purposes. They are 2.5 ft high so children and people with disabilities can easily read.

STORMWATER MANAGEMENT

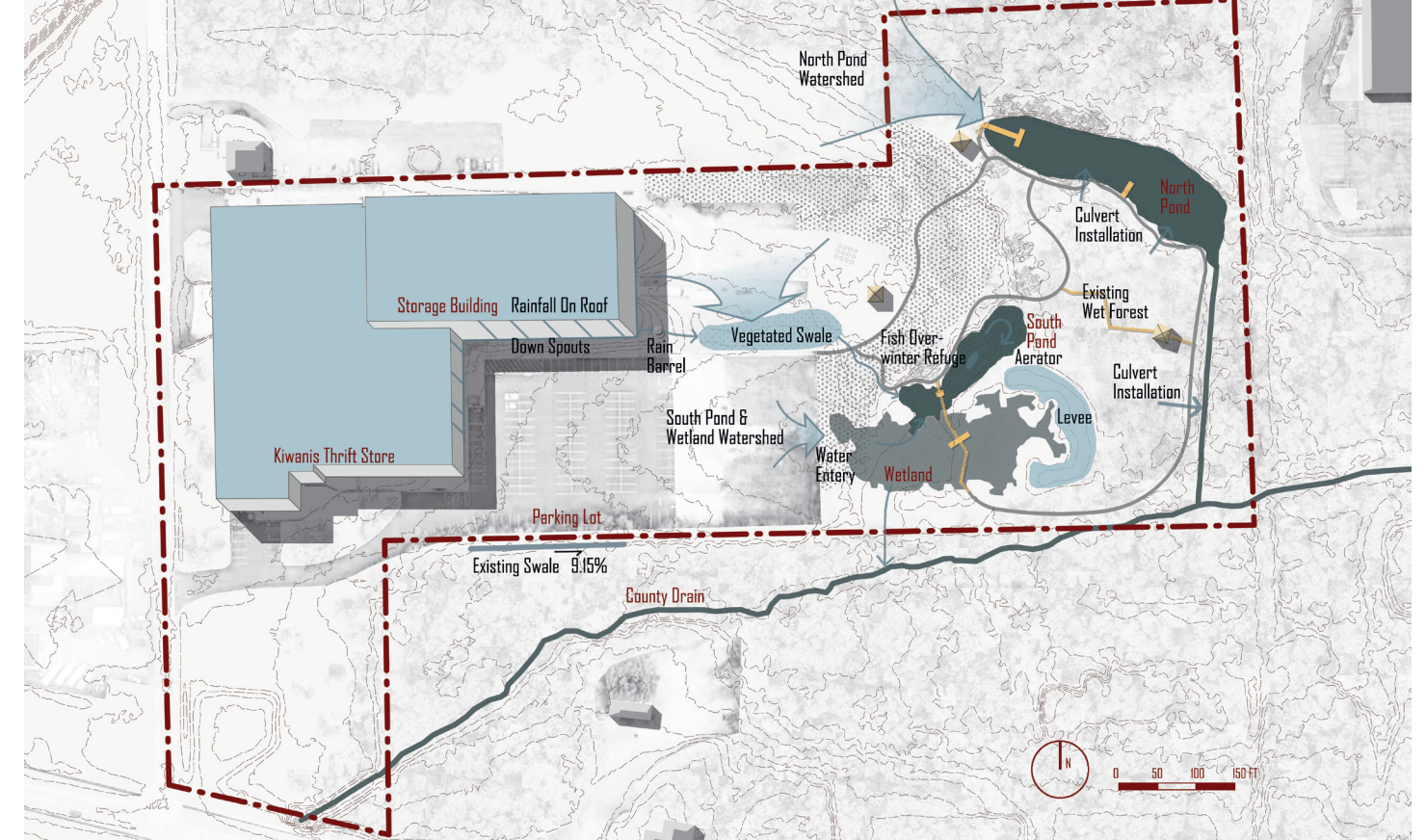


Figure 46: Stormwater Management Plan

Stormwater management mostly focuses on increasing circulation in the South Pond. The North pond will remain “dead” due to a lack of oxygen and provide a useful comparison for educational purposes; but may need future management.

Place a large deep hole in the South Pond (4–6 ft depth) for fish over-winter refuge. Add an aerator to increase circulation and oxygen levels during the other 3 seasons. The stormwater falls on the roof collected by a 5100-gallon rain barrel, such as the RainFlo CGS-5100. Stormwater will be programmed and released with gravity or pumped from the rain barrel to the South pond to replenish the water source and maintain better water quality. The new planting design between the parking lot and the truck loading area also includes a vegetated swale, which will help receiving and infiltrating the water that comes from the north, the overflow will also be sent to the South Pond.

Stormwater from the parking lot largely drains to the south swale, which has a slope gradient of 9.15% sloping to the east. This is adequate to convey water to the wetland area. This water will be filtered by the wetland, improving its quality. Install culverts in the berm between the North Pond and the existing wet forest to decrease the accumulation of water in the forest.

Build up levee to the east of wetland to prevent overflow entering the existing wet forest.



Figure 47: Rain Barrel Photo from Rainharvest.com

Rain Barrel Example:
RainFlo CGS-5100
 Tank Gallons: 5,100
 Tank Diameter: 8' -11'
 Overall Height: 13' - 10'
 Price: \$14,895.95

BIRDHOUSES

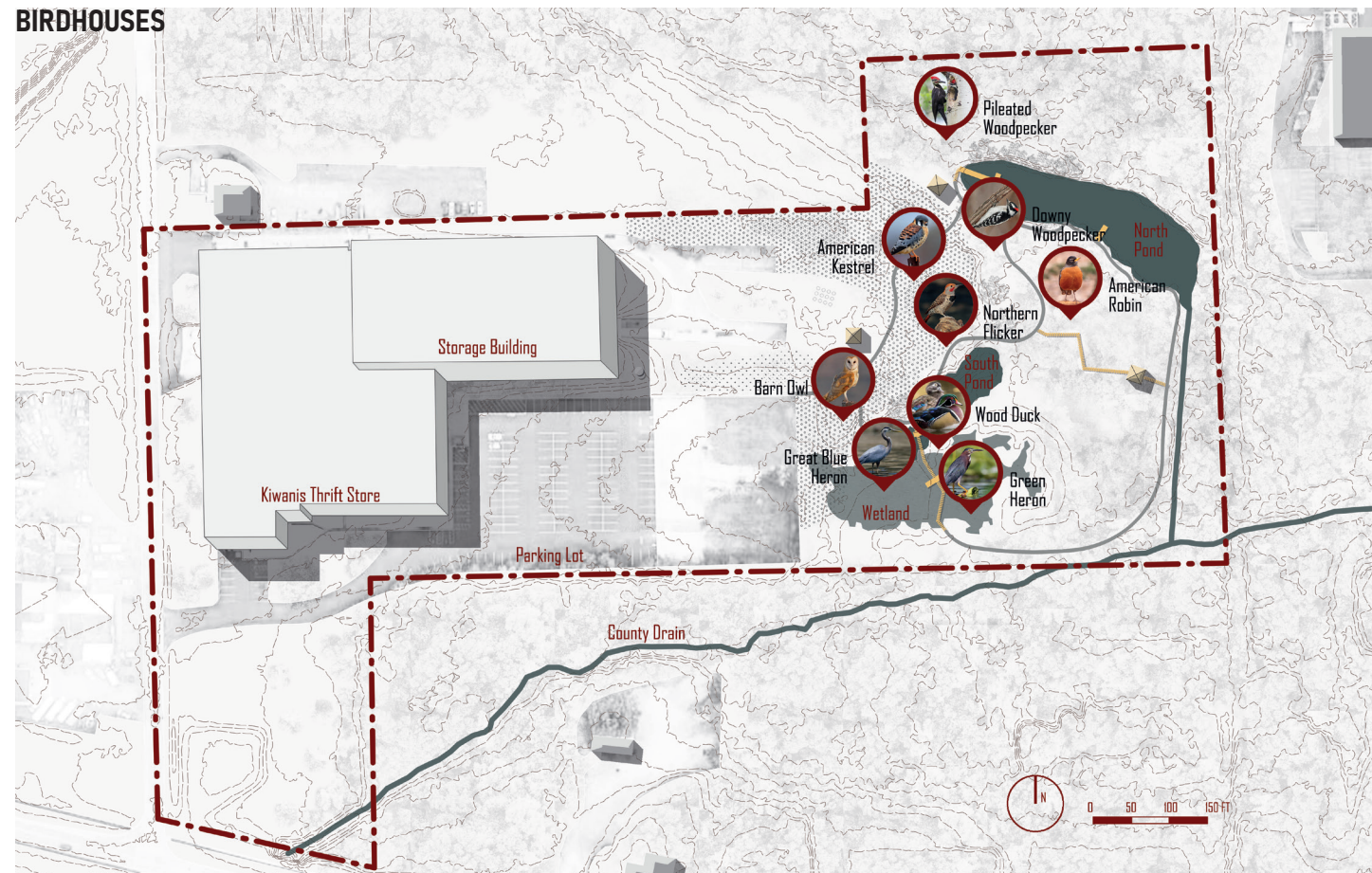


Figure 48: Birdhouse Location Map

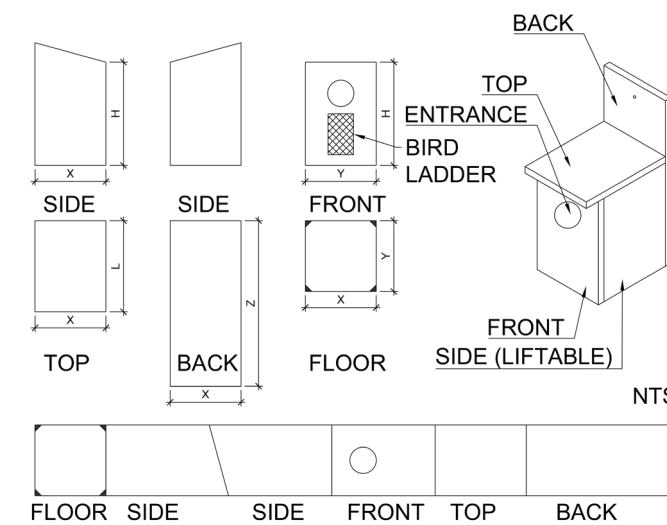


Figure 49: Birdhouse Construction Plan

Adding numerous types of birdhouses and the improved habitat should greatly increase bird diversity and abundance. Instructions are provided for volunteer construction of birdhouses and recommended areas of placement. Birds like the Great Blue Heron are not cavity (birdhouse) birds, but nesting platforms can be built to support them building their own nest on top.

A commonly used birdhouse plan is used as reference to create the construction plan for multiple birdhouses. It is made with thick wood board that can be easily bought in stores. It includes a floor with corner trimmed to allow drainage; two sloping sides with one of the side that is liftable for maintenance; a front with entry hole built based on different size of the bird and a wire mesh on the inside of the front to serve as bird ladder; a top to provide shade and cover; and a back to be screwed on live tree or dead tree or post. The birdhouses will require regular maintenance after the nesting season is over, lift up the side to clear out the residuals for future nesting.

BIRD SPECIES	SCIENTIFIC NAME	NESTING PERIOD	PRIMARY HABITAT	ENTRANCE SIZE	FLOOR SIZE (X * Y)	HOUSE HEIGHT (H)	PLACEMENT	NOTE
Barn Owl	<i>Tyto alba</i>	Feb - Jul	Grassland, Marsh	3 3/4" h * 4 1/2" w	12 3/8" * 22 3/4"	16"	Prefers open habitats, 8' - 25' over the ground	
Wood Duck	<i>Aix sponsa</i>	Mar - Jul	Forest, Lake, Marsh	3"h * 4"w	8" * 9 1/4"	24"	6' - 30' above ground on the pole, facing toward water	
Downy Woodpecker	<i>Dryobates pubescens</i>	Apr - Jul	Forest, Grassland	1 1/4" diameter 7" above floor (top hole)	4" * 4"	9"	6' - 20' above ground	
Pileated Woodpecker	<i>Dryocopus pileatus</i>	Apr - Jul	Forest, Grassland	4" diameter 21" above floor (top hole)	10" * 10"	24"	20' or higher on a tree in a forest, forest edge, or grove, facing south or east	
Northern Flicker	<i>Colaptes auratus</i>	May - June	Grassland, Open Woodland	2 1/2"	7 1/4" * 7 1/4"	24"	6' - 12' above ground on dead or live tree	
American Kestrel	<i>Falco sparverius</i>	Apr - Jul	Grassland, Open Woodland	3"	10"	14"	10' - 30' above ground on live tree or post	
Warblers		May - June	Forest, Marsh	1 1/4" - 1 1/2"	4" * 4" - 5" * 5"	9"-12"	On live tree or pole	
American Robin	<i>Turdus migratorius</i>	Apr - Jul	Forest, Open Woodland		7" * 8"	13"	5' - 25' high on live tree or on a wall, shade the box during the day, or face north to east and make sure clear entrance	Nesting Platform
Blue Jay	<i>Cyanocitta cristata</i>	Mar - Jul	Forest		8" * 8"	8"	Usually in pine trees up to 20' high deep in forests	Nesting Platform
Green Heron	<i>Butorides virescens</i>	Mar - Jul	Marsh				Oaks, willows, box elder, cedar, honey locust, hickory, sassafras, and mangroves. The nest is usually on or over the water, from ground level to 30' off the ground	
Great Blue Heron	<i>Ardea herodias</i>	Mar - Jul	Lake, Marsh				20' -30' high pole above water with nesting platforms and perch pole	Nesting Platform

Table 3: Standardized Birdhouse Dimension

Note: Z = H + 2" , The length of the top cap (L) should be a little longer, hanging from the front

PRESCRIBED BURN

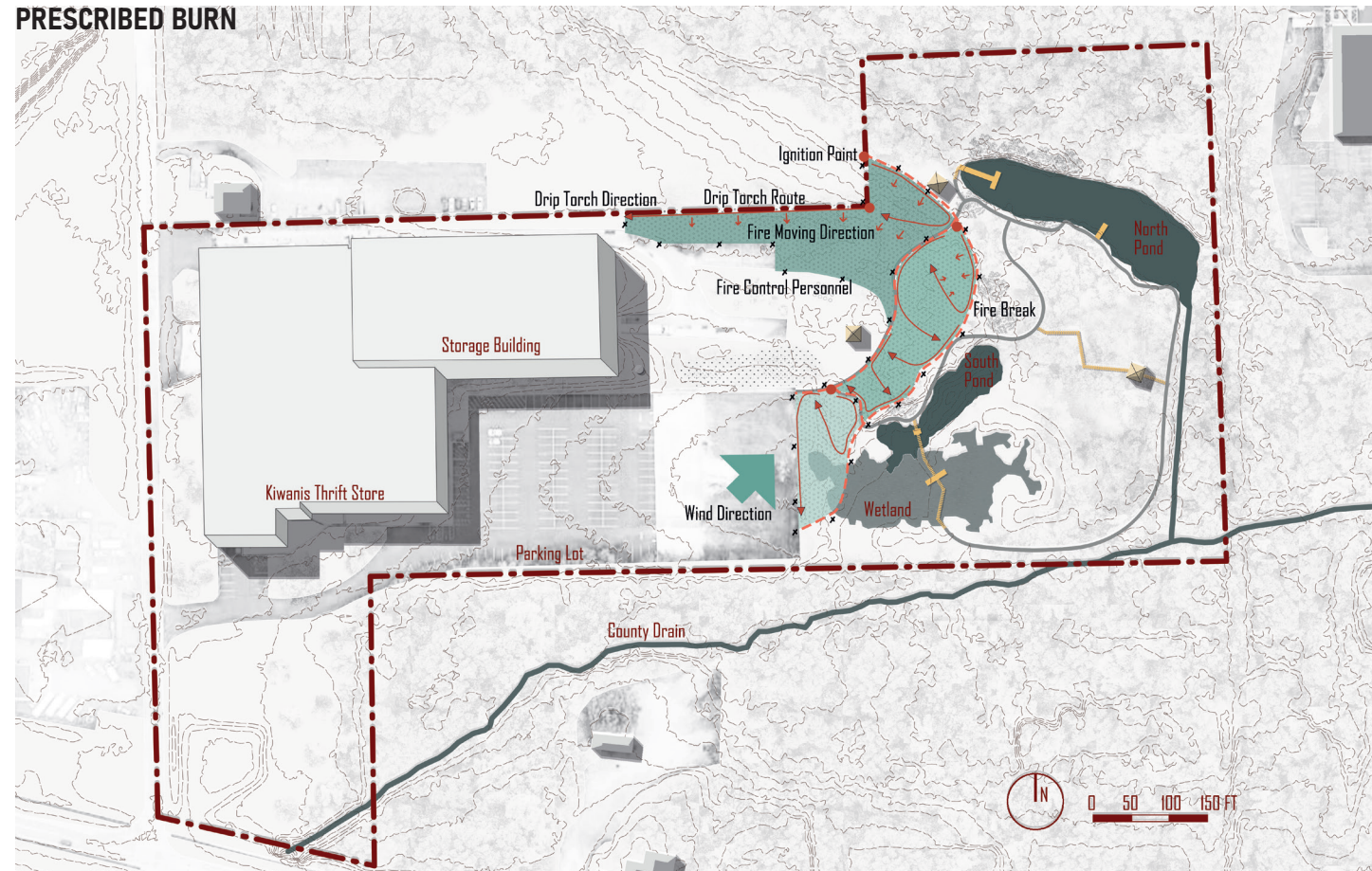


Figure 50: Prescribed Burn Plan

Conduct prescribed burning to reduce unwanted species, rejuvenating, and improving habitat for wildlife in autumn, both before and after prairie planting. Additional field surveys will be needed to study the result of prescribed burn, and adjusting the prescribed burning plan. It can also be included in the environmental education modules. Detailed information on the prescribed burn plan is below:

- * Section out the prairie into three parts.
- * Use trails as fire breaks, create 2' wide fire breaks at the edge of the prairie.
- * Temperature (°F) 40 - 70°F
- * Relative Humidity (%) 30 - 50%
- * Wind Speed (mph) 3 - 15 mph
- * Wind Direction 180° - 210°
- * Fire behavior: Cool fire with 1 - 3" flames, medium intensity.
- * Use strip head fire throughout the site and backfire at the north edge.

ENVIRONMENTAL EDUCATION MODULES

The purpose of Environmental Education for Sustainability is to use the environmental knowledge to improve the attitude to the environment, and ultimately foster pro-environmental behaviors (Kollmuss & Agyeman, 2002) and help people be more responsible to the environment that nurtures us. The Environmental Education for Sustainability is a three-fold approach that includes education about the environment, education in the environment and education for the environment (Tilbury, 1995). Education about the environment is developing awareness, knowledge and understanding between human and environment, the approach is mostly research, environmental studies and lectures; education in the environment emphasizes activity-based learning, creates deeper emotional connection other than just "knowing", and further develops the awareness through experience. This approach is very good for the children's learning experience. Education for the environment is the ultimate goal for environmental education, which goes beyond knowledge and builds up environmental stewardship and actively involves issue-based environmental problems, and continuously seeking solutions. The three-fold education approach needs a holistic view on not just ecology and environmental quality, but also needs to have an understanding in the socio-economic and politics, environmental psychology, etc.

To demonstrate this approach in the physical environment of KEEP, and help fostering the pro-environmental behaviors, the practicum is dedicating itself to the place making, used environmental psychology knowledge to create the sense of place in the KEEP. It is connecting a bond between the people and the KEEP, and making the KEEP have special meaning for people, which will encourage people to protect the KEEP environment and beyond (Kudryavtsev et al., 2012). One of the approaches for creating the sense of place is to support positive experience through design. For example, the boardwalk outlook on a restored wetland can create a soothing environment for the visitors, and the outdoor lab is a great place for learning. The other approach is to include instructional features in the KEEP, like interactive signage that are specifically designed for all groups of people and ensure engagement.

Other than making a place that is helpful for the environmental education process, the completed site inventory, the suggested design and management plan are all good materials for environmental education for sustainability. Such as, the land history and management, the process of stormwater management, native floral and edible gardening. These education modules can also reflect on larger topics like the positive influence of the environment on people's physical and mental wellbeing, and climate change. People from all ages can engage in hands-on activities like water quality research, planting installation, and volunteering in site maintenance. Other activities and interpretive features can also be added to the environmental education modules. Such as, animal storybooks, educational tree tags, bug hotels, plant and bird identification using maps and ID cards, and scavenger hunt for plants, wildlife trace, and ecosystem cycles. All of the education modules will foster the landscape stewardship in people.



Figure 51: Plant Specimens Showcase
<https://www.nanmuxuan.com/leisure/ppgosrvhyi.html>



Figure 52: Tree Tag with QR Code
<https://www.bates.edu/canopy/tree-tags/>



Figure 53: Interactive Signage
<https://visi.co.za/making-more-and-more/>



Figure 54: Bug Hotel
University of Michigan-Dearborn Environmental Interpretive Center

CONCLUSION & SIGNIFICANCE

The practicum takes on the challenge of reclaiming natural habitats situated in a light industrial and agricultural area that is no longer used for manufacturing or farming purposes. The KEEP parcel is one of the many places where the natural environment has been adversely affected by development without awareness of or sensitivity to environmental impacts. This practicum, continued from Phase I, can serve as a model that can be replicated or imitated in areas of similar conditions.

The overall goals of completing the documentation of site inventory; refining and completing the preliminary landscape designs; producing a management plan to conserve and restore natural resources; and making proposals to design educational activities and interpretive materials for KEEP have been met. The complete documentation of site inventory can be a source of reference for future projects and environmental education. If the package of landscape design and management plan is approved by the client, it can move on to making construction documents and being physically implemented. The reclaimed landscape will have a positive effect on physical and mental health that is becoming recognizable and appears in a lot of research. Nowadays more and more physicians are prescribing nature, Nature Rx, to their patient with chronic diseases to improve their wellbeing. Sustainable landscape design of the KEEP will become an accessible “nature pill” for the nearby residence, the restorative landscape will lead visitors to embrace nature and promote a healthier life (Collado, et al, 2017).

FUTURE PROJECTS

Future volunteer and UM Master Project Teams can keep refine the site inventory, landscape design, management plan and educational components. The new version of site inventory can be used to compare with the first version done by students in Phase I and continue documenting chronological data. The vegetation removal can start in the low-quality area. Construction documents can be made for the boardwalks and site furniture as the landscape design is being refined. I recommend collaborating with construction professionals to ensure the feasibility of the construction proposal. I recommend expanding the Environmental Education Modules via collaborations with educators, ecologists, and artists. Finally, it will be useful to engage with community groups to develop strategies for use and engagement by the public.

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