ABSTRACT

Title of Thesis:	EXPERIENTIAL LANDSCAPE DESIGN FOR EDUCATION: OXON RUN PARK AS A REGIONAL EDUCATION RESOURCE
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This design-research thesis explores the educational benefits of outdoor experiential learning for children, particularly in urban areas, and proposes a redesign of a 100-acre urban park to serve as an educational resource. This thesis first develops a theoretical framework based on research that nature can have restorative effects on attention that improve learning and behavior (Berman, Jonides, & Kaplan, 2008; Kaplan, 1995; Matsuoka, 2010). The focus of this thesis is Oxon Run Park located in Southeast Washington, DC. The proposed redesign includes educational spaces that can be visited and experienced by the local community or school classes, while focus areas at targeted locations concentrate educational resources that can enhance classroom learning. The research and redesign of Oxon Run Park addresses the question of how public spaces can be designed to serve as educational resources.

EXPERIENTIAL LANDSCAPE DESIGN FOR EDUCATION: OXON RUN PARK AS A REGIONAL EDUCATION RESOURCE

by

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Chapter 1: Introduction

1.0 Introduction

This thesis investigates research and theories associated with experiential, informal, and outdoor learning and applies them to public space through landscape design. The process of learning varies widely for each student and within a range of settings. Classrooms are typically indoors where teachers lecture or present problems for students to solve, though other methods of education include experiences in or out of the classroom. Experiential learning is defined as a cycle which consists of concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb, 1984). By guiding students through this cycle, the knowledge gained through experiences becomes more internalized and can be retained in a more permanent and meaningful way. Experiencing this cycle by physically moving through spaces that facilitate its steps in nature may be even more beneficial.

Access to outdoor areas during the learning process provides numerous benefits to children. Research shows that children demonstrate improvement in both direct and indirect academic outcomes, such as test scores and social skills (Williams & Dixon, 2013). Some authors also make the connection to experiential learning that can be drawn between the use of outdoor educational activities and student outcomes (Waliczek, Logan, & Zajicek, 2003). Being outdoors in nature, or even seeing natural scenes or trees through a window, can improve attention and restore the ability to focus in classrooms later (Kaplan, 1995; Li & Sullivan, 2016;

Matsuoka, 2010). Outdoor nature experiences provide students with the chance to refresh their attention resources and have meaningful interactions with the world around them at the same time. Activities can be planned to supplement classroom learning in more formalized spaces such as outdoor classrooms, or free exploration can be encouraged.

The reported benefits of nature for the learning process discussed above show the need for spaces where children can learn and gain experience outside of the formal classroom. Creating a meaningful learning experience is a key part of designing an effective outdoor classroom that will provide the most benefits to its users. A landscape that is easily accessible, enjoyable, and feels natural will be used more frequently and provide the best experience.

Research on the principles of experiential education and outdoor learning led to the main research question- how can an urban park be redesigned as a local educational resource? In this project, Oxon Run Park in Washington, DC is designed to serve as a regional education resource for the schools and community surrounding it. Fifteen schools within one half mile of the park serve students in a wide range of ages, making it an ideal candidate to become a meaningful educational resource. The design investigation process (see Figure 1) was carried out beginning with a thorough inventory and analysis and an examination of the literature. This information led to the development of goals and design typologies, which were combined in a conceptual master plan for the 100 acre park. Finally, a full master plan and detailed site plans were produced for targeted areas.

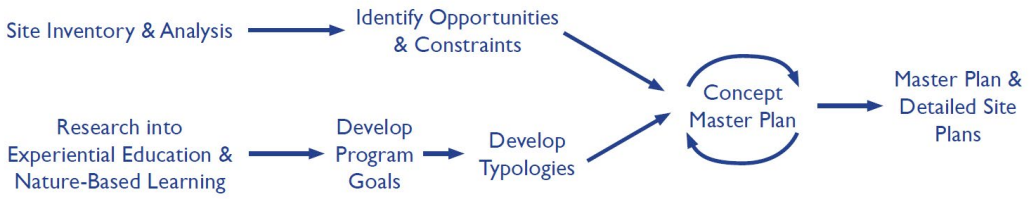

Figure 1. Design investigation process diagram (Ferguson)

1.1 Experiential Learning Landscapes

Existing literature that is relevant to this design study comes from two main areas of knowledge: outdoor learning environments and the benefits and applications of experiential learning. The purpose of this research is to develop principles of design that can be applied to a public outdoor space to offer meaningful educational and natural experiences to students and other visitors.

The model of experiential learning and benefits of nature for learning is explored first. Next, case studies of outdoor spaces that are used for learning and are associated with a variety of landscape typologies and institutions such as schools that support many age groups, camps, and museums are described. These case studies inform the typologies that are developed to provide a variety of spaces throughout the design for different uses and users.

Experiential Learning

Kolb defines learning as "the process whereby knowledge is created through the transformation of experience" (Kolb, 1984). He goes on to define the

four steps of experiential learning that allow for that transformation to take place: concrete experience, reflective observation, abstract conceptualization, and active experimentation (see Figure 2). These steps are best viewed as a cycle in which active experimentation leads to new concrete experiences, advancing learning for those who embark upon them. Concrete experiences sometimes need to take place outside of a classroom setting, but the connection to a lesson that has been learned previously or taught as a follow-up helps to advance the cycle of learning.

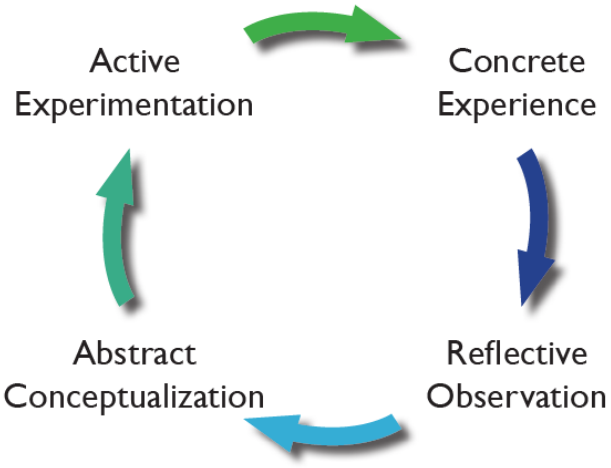

Figure 2. Kolb's cycle of experiential learning (Adapted by Ferguson)

The benefits of outdoor experiential education have been documented in primary and middle schools, particularly in field trips, which are often used to reinforce lessons learned in the classroom. In one study, students who attended a fieldtrip to a delta and students who did not were asked to draw the type of landform they were learning about before and after a series of lessons (Jose, Patrick, & Moseley, 2017). Students who visited the delta included more details in their drawings after visiting the fieldtrip site, especially details from "active learning experiences", which the authors compare to Kolb's concrete experiences. Students were given time to go through the four steps of experiential learning and retained more information because of this. Experiential and outdoor learning does not only

benefit environmental or earth science education, but science, math, and other programs as well. A study that found benefits to learning and understanding information in science and math taught in outdoor program also noted the use of words that indicated experiential education was occurring during interviews with students, teachers, and volunteers (Waliczek et al., 2003).

Experiential learning may also take place outside of and not associated with a school program. Play can be a tool for learning and in many ways will reinforce understanding in the same manner as experiential learning: children will watch others' behavior, make up their own games, and try out different ways of interacting with those around them. Studies suggest that inquiry-based children's museums are the ideal locations to support this kind of playful learning experience (Henderson & Atencio, 2007). Educators and other adults in these environments must encourage playful learning experiences and consider how they contribute to understanding, while not laying too much importance on how many facts or figures are acquired during a museum visit. Inquiry-based children's museums often encourage interaction with exhibits and playful behavior, so the inclusion of the whole family is suggested in order to help children learn from and with their parents to further the learning process.

Experiential learning about the environment can be informal and often comes from experiences with the world around a person in their day to day lives. Adults who were interviewed about their knowledge of the environment in Queensland, Australia, demonstrated that they often engaged in experiential learning by watching and interacting with older family members (Measham, 2007).

This type of learning about one's environment typically takes place informally and at an early age but shows the steps that are present in experiential learning which help to reinforce the knowledge. The people interviewed in this study also expressed the high degree to which they learned from older family members' actions or lessons.

Finally, experiential learning taking place outdoors can benefit children in more ways than just adding to their base of knowledge. Outdoor experiences that include action, reflection, examination, and application to other activities, the key parts of the experiential learning cycle, have been found to benefit children with learning difficulties (Farnham & Mutrie, 1997). Researchers observed a decrease in tension and anxiety and an increase in group cohesion among children from a special needs school during an outdoor program. The sense of group cohesion following a shared learning experience was present even after the outdoor development program when the students returned to their school. A follow up survey of teachers found that they believed that the experience was overall a positive one for all of the children who participated.

Learning in Nature

While experiential learning is a process that can engage students in a variety of settings, there are proven benefits to spending time in or viewing natural environments during any learning process. These benefits are largely based on Kaplan's Attention Restoration Theory (ART) that asserts that nature can help to restore directed attention which is used for problem solving and focusing on

activities (Kaplan, 1995). Nature provides the "soft fascination" that gently engages the mind and is necessary for the restoration of attention, and even images of nature scenes have benefits when compared to experiencing or viewing urban areas (Berman, Jonides, & Kaplan, 2008). The chance to take a break from school work or learn while outdoors takes advantage of these restorative benefits and can help students to focus on later tasks.

Green spaces near schools that are visible through the windows can benefit attention and performance as well. Views of green roofs for as little as 40 seconds (micro-breaks) were shown to improve performance more than views of concrete roofs (Lee, Williams, Sargent, Williams, & Johnson, 2015). Nature views during times when students have a break from learning, such as lunch or recess, also shown improve student performance in academic tasks (Matsuoka, 2010). Views of trees through a window have been demonstrated to improve performance during tasks that require attention and help recovery from stressful experiences in the classroom (Li & Sullivan, 2016).

Views and access to green spaces can benefit adults in schools as well as students. Workplace attitudes were improved and stress was reduced with increasing access to greenery around the place of work (Lottrup, Grahn, & Stigsdotter, 2013). Short breaks with views of nature could also benefit teachers' attention during the school day and access to outdoor spaces at a school reduces stress among teachers (Dennis Jr., Wells, & Bishop, 2014; Lee et al., 2015).

In addition to direct academic benefits of nature for student attention and performance, other health benefits can be realized that lead to higher classroom

achievement. Higher doses of nature experiences result in more benefits, with dosage defined by frequency, duration, and intensity of the time spent in nature (Shanahan et al., 2016). Visits to nature of longer duration or higher frequency resulted in lower prevalence of depression and more physical activity. Studies have shown in turn that increased aerobic physical activity among children can lead to improved cognition, mental health benefits, and enhanced performance (Lees & Hopkins, 2013). These benefits were realized even when time was reassigned from classroom activities for aerobic physical activity.

1.2 Outdoor Learning Spaces

The definition of outdoor learning spaces is not specific and will apply below to outdoor classrooms that are tied to specific schools, informal spaces that encourage learning through play, local sites or landmarks that are transformed into places of learning through programming or interpretation, and sites that are visited during school fieldtrips. Almost any outdoor space can be used for learning with some adaptation.

Overall, positive impacts on educational metrics have been found from programs in outdoor or "garden-based" learning. Many studies have established this and were compiled in a review that found an overwhelming report of positive direct and indirect academic outcomes (Williams & Dixon, 2013). Direct academic outcomes are those measurable in grades or other performance, while indirect academic outcomes include social learning and related skills that contribute to a student's ability to produce improved academic work. This review covered

approximately twenty years of research and suggested more research into the benefits for students at either end of the age spectrum as the majority of studies reviewed were focused on older elementary school students in grades 3 through 5. Recent movements such as Michelle Obama's work for healthy eating and gardening and the No Child Left Inside Coalition have encouraged the exploration of outdoor learning benefits and continued its growth from its roots in the 20th century.

While accepting the reported benefits of outdoor classrooms, other researchers have surveyed the users or administrators of these spaces to evaluate their opinions about them. When teachers and administrators of certified outdoor classrooms were interviewed, the resulting information gave some insight into how the benefits were influenced by certain design features (Dennis Jr. et al., 2014). A natural setting outdoors, performance of the designed spaces, maintenance and sustainability, and formal recognition of the space were identified as important themes through several outdoor classrooms. Furthermore, findings indicated that flexibility in the use or organization of spaces helped teachers to maintain the best uses of the classroom throughout the seasons and in complement to their lessons. The outdoor classrooms in this study were targeted towards very young children and have many features in common with a typical nature place space, though it is clear that learning was taking place. These outdoor classrooms demonstrated a high degree of engagement from teachers, children, and parents that valued the space. As maintenance was a frequent issue, involvement of the teachers and parents ensured their longevity and upkeep for students' benefit.

Four main recommendations to design and build a successful outdoor classroom are to provide thoughtfully-designed spaces that can be used daily, provide growth opportunities for staff, involve families, and look around the world for similar examples (Wirth & Rosenow, 2012). Being able to use a space daily increases the amount of time that students can be learning outdoors and promotes the importance of the space. The commitment from staff and families is key to ensuring the longevity of these outdoor spaces where maintenance is often an issue, especially if the space is subject to heavy, daily use. Many types of learning can be achieved in outdoor learning spaces and it is often suggested to focus on "whole child learning" that teaches students holistically so that they can gain skills at a higher level and supplement what they are taught in the classroom.

Outdoor classrooms and learning spaces are not exclusive to schools for young children; other facilities that provide educational experiences host them as well. The Fernbank Museum of Natural History in Atlanta, Georgia used a stand of old growth forest to create a unique outdoor space to support learning (Lerner, 2018). The new space, designed by local firm Sylvatica, features a canopy walk, wildlife sanctuary, meadow, and educational play spaces for children of various age groups. The museum believes that this new space allows it to literally reach out into the world and further its educational mission by giving visitors a more hands-on experience during their visit. The designers and museum officials were careful to retain the natural parts of the landscape in this old growth forest, while maintaining the naturalistic character of neighboring spaces. This provides just one example of

an outdoor learning space associated with a museum and open to more than just the children at a specific school, though it does still require a museum entry fee.

Other museums host outdoor spaces that support learning, which are often called "science playgrounds." Two such sites were examined in case studies at the New York Hall of Science and Exploration Park in Puerto Rico (Chermayeff, Blandford, & Losos, 2010). As the name implies, these spaces focus on learning through play in an informal manner which allows children the freedom to experiment and make discoveries. The science playground at the New York Hall of Science was designed, tested, and developed in ways that responded to how children used it. The play features have simple machines that children can operate and see the effects of. Museum staff were afforded the opportunity to include appropriate interpretive signage because the park initially lacked it; they added only what was necessary to help parents guide their children through the experience of the playground and answer their questions about how things work. The Exploration Park in Puerto Rico was also designed to support specific uses by children that were identified as important in the island setting. Paying attention to how children use a space is key to ensuring that any new design will be accepted and utilized as intended.

For schools that lack the space or funding to create their own outdoor learning spaces or the ability to visit a museum with a learning space or playground, local surroundings may offer some options for outdoor learning experiences. One case study discussed turning parks, nearby universities, and community centers into what they termed "outdoor learning centers" (Brown, 1998). These pop-up spaces

were set up by teachers or volunteers to mimic a city or state at a much smaller scale that students had to navigate their way through. Allowing students to walk through a model city and complete tasks like finding a doctor or cashing a check gave them valuable practice in real life skills and encouraged exploration. This temporary transformation of a space shows that flexibility in outdoor learning spaces is key and that in a pinch, a little creativity can be used to take advantage of whatever site is available. Using nearby publicly accessible spaces also allowed for larger scale learning landscapes to be created.

The case studies examined thus far have shown that outdoor learning spaces can support children at or away from schools and can cater to different age groups. Another important consideration is that children of all abilities may be using these outdoor spaces. Outdoor play in particular may be difficult for a child with special needs and may need to be adjusted to allow all children to play in an inclusive manner (Flynn & Kieff, 2002).

Many considerations to designing an outdoor space for children exist and more are needed to ensure that a play space is inclusive: including multisensory activities, promoting independence, and using learning groups are some of the most important adaptations. Multisensory activities ensure that a child with a loss of one sense can still experience something with their other senses. Small adaptations that are developed with the help of those close to the child can make most outdoor activities possible without a teacher or aid having to do things for the child. Learning groups allow other children to help the child with special needs to fully participate and gain learning experiences alongside them. These adaptations will

differ depending on the child's needs and examples of adaptations for all of these special needs are available and should be considered in the design of a space and its flexibility.

Guides for creating outdoor learning spaces exist, though mostly focus on outdoor classrooms that are associated with a single school. The design principles proposed by these guides are also applicable other outdoor learning environments, such as a shared space in a public park. Some of the many elements that are suggested for outdoor classrooms include a boundary to define the space, entry markers, artistic elements influenced by students, gathering spaces of various sizes, water features, a culinary garden, demonstration of natural and energy systems, and play spaces (Boston Schoolyard Initiative, 2013; Gamson Danks, 2010). These elements, when combined thoughtfully and applied to the local environment where appropriate, can create a space that allows exploration, gathering, teaching, and play as options for students and other visitors. No single example or case study is applicable to every school or public space, so input from the students and teachers who will use an outdoor learning space on a regular basis is crucial as well.

Almost any outdoor site has the potential to support learning experiences, especially with a teacher or guide who is determined to create a meaningful lesson there. Flexibility and adaptability of outdoor education spaces was a key theme throughout the examples that have been explored here. If a part of the space can serve multiple purposes as the calendar or school year progresses and can be changed easily by those using it, the site will be able to serve more people at more

times. Adaptations for all kinds of visitors and users is also key to ensuring that the outdoor learning space is accessible to all.

Experiential Learning in Nature

Many of the case studies of outdoor learning spaces included references to experiential learning, while experiential learning research discusses the resources available outdoors. In the final section of this literature review, direct connections between experiential learning and outdoor spaces are explored.

Community projects of many types have the opportunity to provide educational experiences to those who participate in them. The restoration of an urban stream in Berkeley, CA and the involvement of the local community is an example of this (Purcell, Corbin, & Hans, 2007). The goals of a restoration project on a stream near the UC Berkeley campus included removal of invasive species and an educational component for local high school and college students. Two areas were cleared by students and replanted with native species. The students who participated learned how to remove invasive species and plant native species in order to restore the stream's native plant population. Overall, the project was deemed a success as it reduced the proportion of invasive species compared to natives and students reported learning about how a restoration project works and how to plant native species. Many student participants also expressed a desire to join in future projects of this nature. This increased positive attitude towards restoration projects was a successful aspect of the project, hopefully encouraging more young people to lend a hand in taking care of their environment.

Fieldtrips are another prime candidate for educational nature experiences. One such fieldtrip and associated education program is The Nature Conservancy's wetlands education program, which explicitly shares conservation messages with its participants (Cachelin, Paisley, & Blanchard, 2008). Students whose curriculum included this program were exposed to lessons about wetlands in the classroom and had an opportunity to visit a wetland on a fieldtrip. Students who visited the wetland responded with some conservation-related topics while those who did not visit were the only ones to express no desire to see a wetland in the future. This study demonstrates that outdoor experiences gained on school fieldtrips can help children to retain more information about topics that they learn in the classroom and can additionally cause an increase in pro-conservation attitudes.

1.3 Research Conclusions

It is important for designers whose goal is to create a site for educational experiences to understand the steps of the process that students will be going through. A well-designed outdoor learning site will provide space for all parts of the experiential learning process and be adaptable for educators as they tailor a program for their particular topic and location.

The compiled literature of research and precedents shows that outdoor education has a number of benefits for children and older people alike, application of the experiential learning model can improve outcomes for all, and that outdoor education and experiential learning can be employed together. Students' behavior is often improved when they are allowed more freedom in the learning experience

outdoors. This and similar “indirect” academic improvements can lead to better performance in the classroom (Williams & Dixon, 2013). Measurable improvement to academic performance was reported in a number of cases as well, including learning and understanding information at a higher level (Waliczek et al., 2003). In addition, school faculty and staff often report less stress when they are able to go outdoors with their students and corresponding improvements to their own health and wellbeing (Dennis Jr. et al., 2014).

Many of the articles cited above reference the benefits of experiential education but often list various reasons why the specific experiences that were reported on were difficult to replicate. Cost can be a barrier to fieldtrips, whether to a natural site or a museum. Time constraints may also restrict the number of outdoor experiences that a student can be offered if travel is necessary. Camps can provide many benefits but occur infrequently and typically last for only a few days. Outdoor classrooms may be expensive for a school to build and maintain and tend to be exclusive to the school that creates them. In most cases, these difficulties could be solved with a smaller scale, more accessible outdoor learning landscape that students from many schools could visit more often for those crucial concrete experiences. A centrally-located, shared outdoor learning space, especially one set in a public park, can be this resource for nearby schools and the community.

Chapter 2: Site Inventory and Analysis

2.0 Site Selection

When choosing an urban park that could serve as a site for this design exploration, accessibility, need in the area, and size were key considerations. A larger green space could host a variety of educational experiences. The number of schools with easy access to the site was important to ensure that a large population of students was being served and could use this resource on a regular basis. Fieldtrips are shown to have a very positive influence on students' learning and environmental attitudes, but may not be available with great frequency (Cachelin et al., 2008). Having a location with outdoor amenities within walking distance of a school would allow more frequent short fieldtrips to provide outdoor learning experiences. This easy accessibility at little or no cost would be most beneficial to schools that serve students from lower-income families.

A number of sites in Washington, DC and Maryland were considered during this process. The possibility of working with a school on their grounds was explored and rejected in favor of focusing on public land that could instead serve multiple schools around it. A piece of land managed by the DC Department of Parks and Recreation in the Shaw neighborhood was considered. This land currently holds a community center, playgrounds, sports fields and courts, and a small natural area in the space of one square block (approximately 3.5 acres). Though many schools are located nearby, the size was ultimately deemed too small and restrictive for a

full design exploration. The site that was ultimately chosen was Oxon Run Park, an approximately 100 acre park located in Southeast Washington, DC.

2.1 Site Context

The site chosen for this project is Oxon Run Park, a district park in Washington, DC. It is located in Ward 8 of Washington, DC, an area in the Southeast quadrant of the city on the east bank of the Anacostia River (see Figure 3). When compared to the rest of the District of Columbia, the population of Ward 8 has a higher percentage of black residents, younger residents, and a lower median income. A greater percentage of residents are living below the poverty line and housing units have an average value that is less than half of that in the city as a whole. Residents in Ward 8 have a lower average educational attainment, with a majority achieving no more than a high school diploma, and an unemployment rate of 19% (DC Health Matters, 2018).

Figure 3. The location of Oxon Run Park in Washington, DC (Ferguson)

Oxon Run Park is linear and follows the route of Oxon Run, a stream that originates in District Heights, MD, for approximately 1.5 miles. The DC Department of Parks and Recreation manages Oxon Run Park, which is the largest park under that department's purview at approximately 100 acres. Oxon Run Park is a continuation of the National Park Service-managed greenway, Oxon Run Parkway, located directly to its northeast. The green corridor continues with Bald Eagle Hill to the south of Oxon Run Park.

The linear nature of Oxon Run Park means that is touches three well-defined neighborhoods in Ward 8, including Congress Heights, Washington Highlands, and Bellevue. There are a number of schools in these neighborhoods that serve a wide age range of children and could access Oxon Run Park for educational purposes. Within half a mile of Oxon Run Park 15 schools educate children between the grades of Pre-K 3 and high school. Approximately 6,700 students are enrolled at these schools and a large majority of students at each school are considered economically disadvantaged. Most of these schools have some amount of outdoor recreation space, but that is typically limited to a small playground or sports fields, which are not spaces that support educational nature experiences. The demographics of Ward 8 and the schools near Oxon Run Park indicate that there are a large number of children in the surrounding area who could benefit from an additional educational resource outdoors.

Table 1. Basic school data around Oxon Run Park

School	Public/Private	Grades	Enrollment (2016-2017)
Ballou High School	Public	9-12	930
Simon Elementary School	Public	PK3-5	276
Charles Hart Middle School	Public	6-8	349
Malcolm X Elementary School	Public	PK3-5	237
Hendley Elementary School	Public	PK3-5	445
W.B. Patterson Elementary School	Public	PK3-5	394
Leckie Education Campus	Public	PK3-8	553
Martin Luther King Jr. Elementary School	Public	PK3-5	346
Eagle Academy PCS	Public Charter	PK3-3	734
Achievement Preparatory Academy Elementary	Public Charter	PK3-3	464
Achievement Preparatory Academy Middle	Public Charter	4-8	468
Ingenuity Prep PCS	Public Charter	PK3-5	376
Somerset Preparatory Academy Middle/High School	Public Charter	6-12	324
Democracy Prep Congress Heights PCS	Public Charter	PK3-8	645
St Thomas More Catholic Academy	Private	PK-8	146-159
Paramount Child Development Prep School	Private	Age 2-5	

2.2 Social Factors

Demographics

As mentioned previously, the demographics of Ward 8 differ from those of Washington, DC when viewed as a whole. A very high percentage of Ward 8 residents are black when compared to the overall District which is more diverse (see Figure 4). On average, the residents of Ward 8 are younger than the city as a whole as well with a median age in Ward 8 of 29.6 compared to 33.8 in the whole District (see Figure 5). The percentage of renter-occupied housing is also much higher in Ward 8 at 74% when compared to Washington, DC overall at 52%. More households in Ward 8 have individuals under the age of 18 at home as well, with 40.8% compared to 20.7% in the whole District (U.S. Census Bureau, 2010).

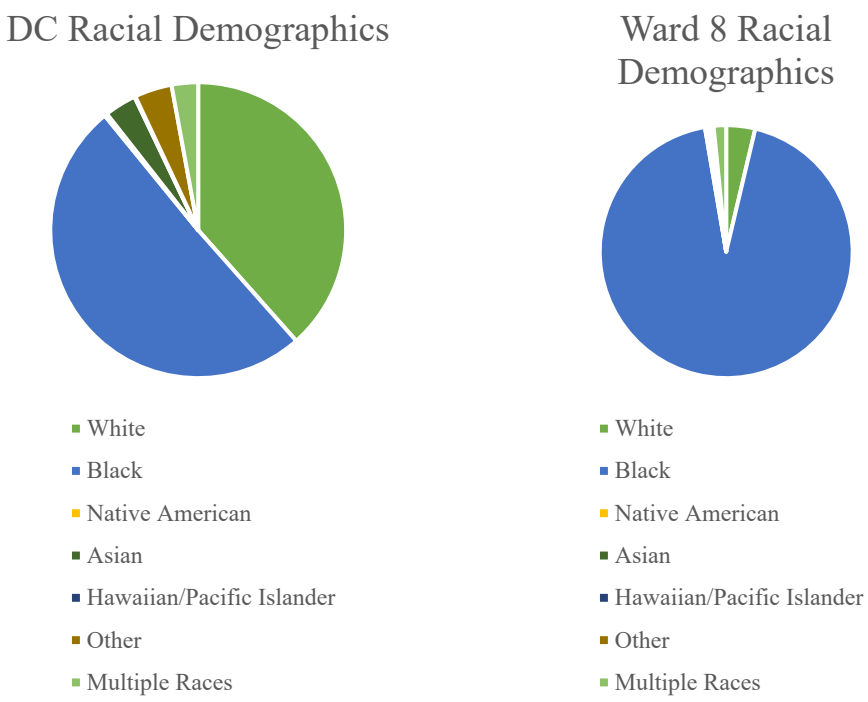

Figure 4. Racial demographics of Washington, DC (left) and Ward 8 (right) (US Census adapted by Ferguson).

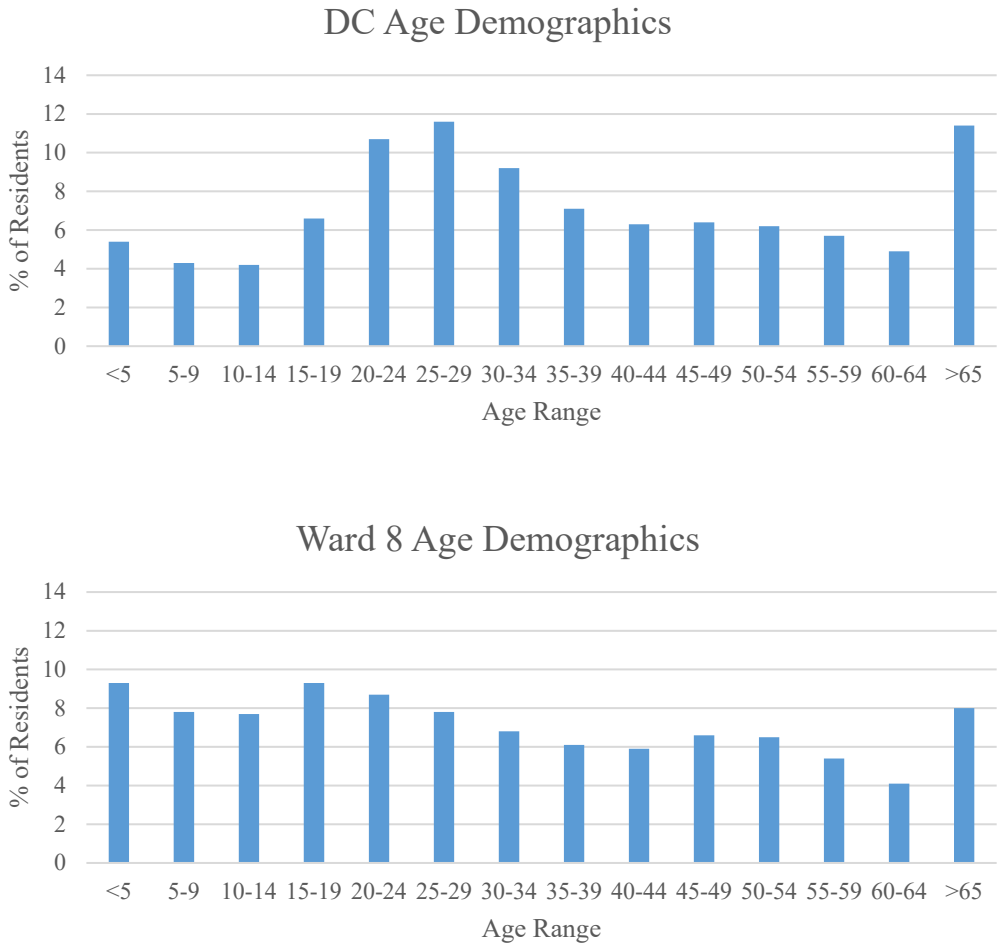

Figure 5. Age demographics of Washington, DC (top) and Ward 8 (bottom) (US Census adapted by Ferguson).

Circulation

Oxon Run Park is oriented northeast-southwest in its northern portion and north-south in its southern portion. It is bordered by four major roads along its length: Mississippi Avenue SE and Valley Avenue SE in the north; 1st Street SE and Livingston Road SE in the south. Three roads cross Oxon Run Park and divide it into four distinct areas as they pass over the stream and interrupt the open space.

These roads, from north to south, are Wheeler Road SE, 4th Street SE, and Atlantic Street SE.

Within the park paved asphalt pathways are present for pedestrians and bicycles. These paths are unmarked and follow Oxon Run on either side of the stream, typically at a distance of approximately 30 ft. Crossings of roadways are available on these paths at traffic lights. At locations within the park where these pathways intersect, circular paved areas with wayfinding signs indicate the direction and distance to points of interest. The paving reflects the directions that paths intersect. Pathways make connections out to some neighborhoods as well, connecting to streets that terminate at the edge of the park to provide access. Bridges cross Oxon Run at two locations in the northernmost section, one location in the next northern section, and at two locations in the southernmost section that are just outside of the park's boundaries. These bridges are narrow and lined with high chain link fences, some of which are overgrown in invasive species.

The main issue with circulation in the park currently is the use of pedestrian and bicycle pathways by cars and trucks that drive on them to reach areas of interest such as grills and picnic shelters. Vehicles were observed on the pathways and parked on nearby grass or dirt areas during visits to the park. Better marking of paths for their intended use, bollards to deter cars, and more available parking within the park could improve circulation for visitors using all means of transportation.

History

The area of Washington, DC east of the Anacostia River, and particularly that surrounding Oxon Run Park, has been recognized for its scenic character for many years. Some of the earliest evidence of this was the 1898 highway plan, which allowed streets through this part of the city to follow the natural topography rather than strictly adhering to the surrounding street grid that characterizes the rest of Washington, DC.

In the early 20th century Oxon Run Parkway, the area north of Oxon Run Park that is currently managed by the NPS, was used as a militia range for the District of Columbia National Guard. Throughout the 1920s and 1930s residents used the area for hiking and outdoor recreation, expressing an early desire for a park around Oxon Run. Flooding of Oxon Run was an issue around that time, prompting the installation of a sewer line in 1938. The park was identified as an area for recreation as need for outdoor spaces increased in the city (C. Shaheen, personal communication, October 17, 2018).

Schools and Public Lands

There is a total of 15 schools within one half mile of Oxon Run Park (see Figure 5). These include public, public charter, and private schools serving approximately 6,700 students from age 2 through high school. The children attending these schools are almost all students of color with an average of 97.1% of black students. An average of 79% of students at each school are considered

economically disadvantaged, and an average of 16.1% are enrolled in a special education program. See the school data table for additional details (Appendix 1).

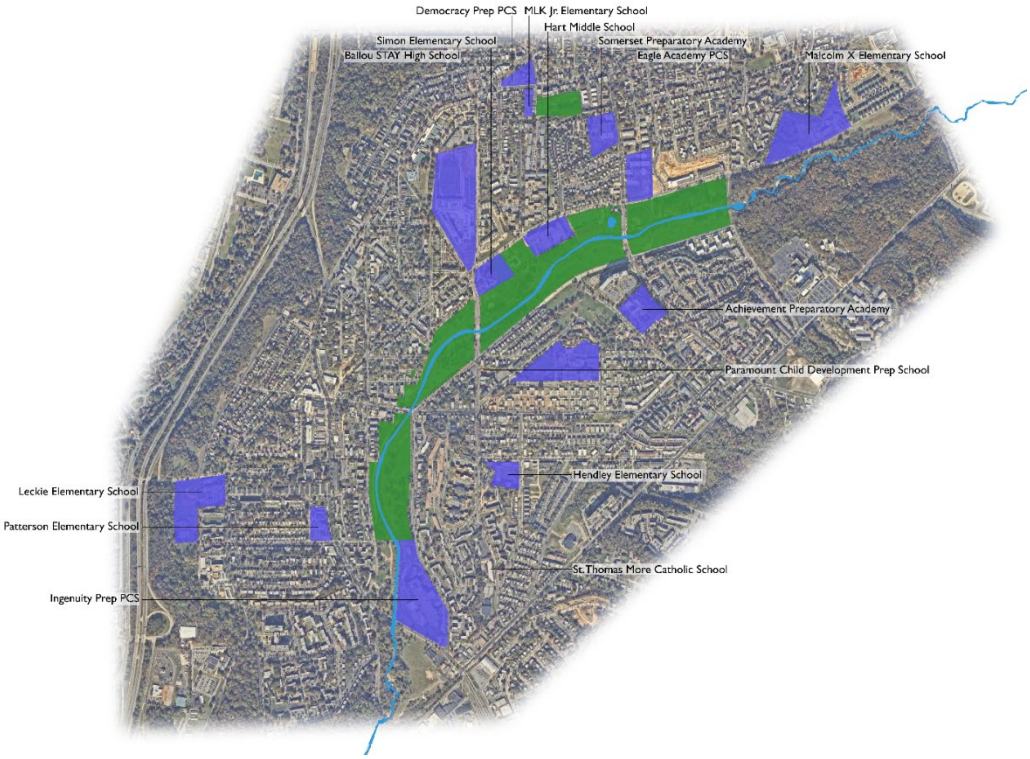

Figure 6. Schools surrounding Oxon Run Park

A number of other public outdoor spaces near Oxon Run Park that are managed by DC Department of Parks and Recreation or federal agencies. Oxon Run Parkway to the north is managed by the National Park Service and lacks any trails running through it. It is a densely wooded area between Mississippi Ave SE and Southern Ave SE into which several developments protrude, including a hospital and THEARC arts and recreation campus. Bald Eagle Hill is directly south of Oxon Run Park and is another densely wooded, NPS-managed piece of land. Further south across the border with MD, Oxon Cove Park and Oxon Hill Farm

mark the point where Oxon Run merges with the Potomac River. Trails and picnic areas are available in this NPS-managed park, along with a historic farm that allows visitor participation in farm activities. From Oxon Run Parkway to Oxon Cove Park there is therefore an approximately 4 mile long greenway with Oxon Run Park in the center.

Two recreation centers managed by the DC Department of Parks and Recreation (DPR) are present to the north and south of Oxon Run Park. Congress Heights Recreation Center is located north of Oxon Run Park and has a number of indoor and outdoor facilities. These include a baseball diamond, basketball and tennis courts, a playground, and multipurpose rooms. Ferebee Hope Recreation Center is located south and uphill from Oxon Run Park and has similar facilities in addition to an indoor pool and community gardens. DPR also manages the Oxon Run outdoor pool located in the central portion of Oxon Run Park itself.

2.2 Natural Factors

Park Features

Oxon Run Park has a number of public recreation amenities used by the surrounding communities. In the northernmost and southernmost sections of the park there are grill and picnic areas where gatherings were observed during weekend visits to the park. These areas saw high degrees of vehicle traffic on pathways approaching the gathering spaces. Athletic fields and courts can also be found within Oxon Run Park. Basketball courts are present in the same sections as the grilling and picnic areas and baseball diamonds are located in the two northern

sections. The northernmost section also contains an amphitheater in a wooded area near the main pathways.

The second northern section features the largest concentration of attractions. In addition to the baseball diamond, Oxon Run outdoor pool is located here between Simon Elementary School and Hart Middle School. The Southeast Tennis and Learning Center is also adjacent to Hart Middle School. A large play area is used by Simon Elementary School but open to the public in this section as well. Each section has at least one small, gated playground, but this location is the largest.

Drainage and Wetlands

Oxon Run forms the central spine of the greenway named after it. It originates in District Heights, MD and flows southwest along Pennsylvania Avenue, Cedar Hill Cemetery, Lincoln Hill Cemetery, Suitland Parkway, and Oxon Run Parkway in DC before entering Oxon Run Park. The 1.5 mile section of the waterway in Oxon Run Park has been channelized into a wide trapezoidal concrete structure. As it exits the park to the south, Oxon Run returns to a natural channel and eventually flows into the Potomac River at Oxon Cove, just south of the DC-Maryland border. The concrete edges of the stream in Oxon Run Park are often overgrown by vegetation, including many invasive species. The concrete bottom of the stream is cracked and broken in some areas and has silt deposits, dry spots, and occasionally trash or other debris.

Much of Oxon Run Park is designated as a regulatory floodway with a yearly 1% chance of flooding (100 year flood zone). Some areas just outside of the

park fall into a 500 year flood zone or have a 0.2% yearly chance of flooding. The low flooding risk is likely due to the highly channelized nature of Oxon Run through the park. Restoration of the natural channel would potentially result in more frequent flooding but would also allow the park itself to serve as a natural floodplain that could provide mitigation benefits.

No wetlands exist within the boundaries of Oxon Run Park, though damp areas were observed during visits to the park. This is likely due to the channelized streambed through which Oxon Run flows in this area. North of the park in Oxon Run Parkway and to the south in Bald Eagle Hill, delineated wetlands exist, both of which are located in areas where Oxon Run has a natural streambed. This suggests that any stream restoration of Oxon Run within the park would support the emergence of wetlands.

Soils, Geology, and Landforms

Oxon Run Park is located in the Atlantic Coastal Plain physiographic province. The underlying geology of Oxon Run Park is made up of alluvium originating from the Holocene, which is typical along a stream corridor. As distance from Oxon Run increases, there is clay-dominated bedrock that is part of older coastal plain deposits.

The soils in Oxon Run Park are mostly sandy loams or urban land complexes that exhibit frequent flooding. The majority of the soil types present are in hydrologic group B, which indicates good infiltration rates and would be suitable for stormwater management practices. These types of soils are typical of a stream corridor through an urban area.

Figure 7. Slopes in and around Oxon Run Park (Ferguson)

Oxon Run is the low point of the park and surrounding areas. The land rises up to the southeast and northwest as it increases in distance from the stream and the greenway. The elevation of Oxon Run Park ranges from approximately 80 ft above sea level at the northern end of the park adjacent to Oxon Run Parkway to approximately 30 ft above sea level at the far southern end. Steep slopes are present along the stream itself and in some locations along park edges. There is evidence of erosion in some areas with steep slopes at present. Design solutions should be sensitive to these slopes when considering access and vegetative cover.

2.3 Site Analysis

The site analysis reveals a number of opportunities and constraints that should be addressed by any successful design of this park, particularly one which focuses on educational experiences. The number of schools in the neighborhoods surrounding the park provide an opportunity to attract students of many ages who are studying a variety of subjects. Areas programmed specifically for education should be easily accessible from as many schools as possible. The current circulation within Oxon Run Park is functional but has room for improvement especially when it comes to a clear definition of the uses of various pathways. Clearly marked paths that are intended for pedestrians and cyclists should be made less accessible to larger vehicles to discourage their regular use. Since it is clear that the community does prefer to be able to drive into the park, appropriate driveways and parking areas should be provided to improve the circulation experience for all park users. Additional crossings of Oxon Run would also make areas on either side of the waterway more accessible for the whole community and reduce the need to walk up to a half mile around to the nearest roadway crossing. These crossings would benefit the local community as they use the park recreationally as well as any schools that visit.

2.4 Focus Area Selection Process

To select a focus site within Oxon Run Park that could serve as a central educational area, several factors were considered. In order to protect and improve

the ecological functioning of Oxon Run and the park as a whole, sensitive areas were defined after the site analysis process. These sensitive areas include:

1. A stream buffer of 100 ft
2. Steep slopes over 25%
3. Wetlands (none are present within the park boundaries).

Sensitive areas were mapped and overlaid onto the boundaries of Oxon Run Park. To ensure that the selected area is easily accessible from multiple schools, school locations were added to the map along with a one quarter mile radius from them, representing approximately a five minute walk. All of this information shown together allowed the identification of locations that fell outside of sensitive areas, within the park boundaries, and within one quarter mile of schools. Ten locations

were identified using this process and examined for potential conflicts such as current uses or space constraints.

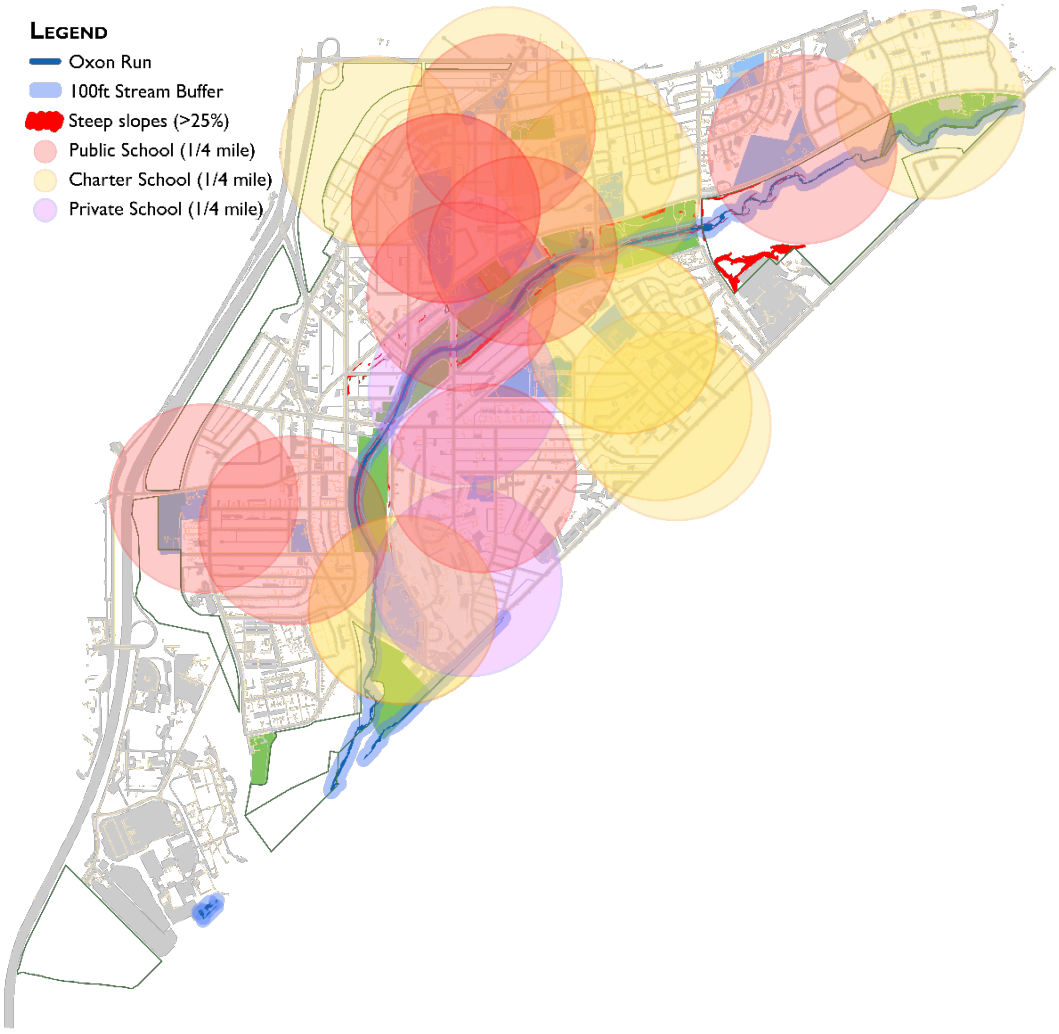

Figure 8. Focus area process- Oxon Run Park boundary, sensitive areas, and school radii (Ferguson)

Nearly every location that was identified had conflicts with current uses by the community. Table 2 shows the number of schools located within one quarter mile of each site and any disqualifying current uses. The locations identified as numbers 4, 5, and 6 were chosen for the focus area for design. They are all in close

proximity and near an existing bridge that crosses Oxon Run, making access easy from every direction, and within easy walking distance from at least three schools.

Table 2. Schools within 1/4 mile and current use of sites identified as potential focus areas

Potential Site	# schools within ~1/4 mile	Current Use
1	1	Amphitheater, grills, and playground
2	2	Open field, basketball courts
3	3	Baseball diamond
4	3	Open field
5	4	Open field
6	3	Proximity to pool, playground
7	3	Baseball diamond
8	2	Wooded and open field
9	3	Wooded and open field
10	2	Grills, picnic area, playground

Figure 9. Aerial view of the three sites selected as a focus area for design. (Ferguson)

Chapter 3: Design Process and Goals

3.0 Design Investigation Process

The design investigation process (see Figure 1) began with a thorough examination of the literature on educational experiences and an inventory and analysis of the site at Oxon Run Park, as described in the previous chapters. This information was used to develop the primary design goal and design typologies which guided the design process and placement of educational features in the park. Targeted areas that can serve a number of schools as educational resources were determined based on the site analysis as well. A master plan of all of Oxon Run Park was produced in addition to a more detailed site plan of the selected outdoor classroom and learning sites.

The design investigation process serves as experiential learning for the author as well, moving through the four steps detailed by Kolb. This connection is described through the example of a landscape design class at the University of Florida (Hansen, 2012). Planning and site inventory require concrete experience of the site as data is collected. Site analysis that determines what is relevant to design is reflective observation. The design phase is abstract conceptualization that involves testing ideas that respond to site opportunities and constraints. Active experimentation comes into the design phase as well and would be fully possible with construction.

Design Goal

The primary design goal for Oxon Run Park was influenced by the literature on experiential education and outdoor learning spaces and by the preceding site analysis. The main goal was supported by a few others, all of which are outlined below:

Primary Design Goal: Provide a variety of educational nature experiences along the length of Oxon Run Park.

Supporting Goals:

- Develop typologies of design interventions that provide different experiences.
- Locate educational resources where multiple schools can use them.
- Improve access throughout Oxon Run Park.
- Improve habitat and ecological functioning of Oxon Run Park by defining sensitive areas.

Design typologies that encompass a variety of experiences and can be applied to Oxon Run Park at multiple scales were developed to support the main goal. They are as follows:

1. Programmed spaces to supplement classroom learning and provide a restorative experience near schools.
    a. These include outdoor classrooms, gardens maintained by students, play, and art spaces.

2. Community gathering spaces to provide areas for the community to initially enter and use the park for flexible purposes.
    a. These include existing features such as picnic gathering areas and sports facilities.
    b. These spaces can be enhanced and concentrated to better define them and place them near main pathways.
3. Restored natural areas with interpretive signage for free exploration and informal learning by families and casual visitors.
    a. Restored forests, stream, and meadow can enhance the ecological functioning and habitat value of Oxon Run Park, which can in turn be educational.

In order to define sensitive areas and locate a concentration of educational resources in an area where multiple schools can use them, a careful process of site selection within the park was undertaken, as described below in the "Focus Area Selection" section above.

3.1 Design Approach

An approach to apply the principles developed from the research was needed when considering Oxon Run Park as a whole and the focus area that was selected to house the largest concentration of educational resources. The basis of much of the research was Kolb's cycle of experiential learning, made up of four steps. These steps of the cycle can be divided into two types of activities: interactive and passive. Concrete experiences and active experimentation are interactive

activities and require physically doing something or expending some energy to have an experience. Reflective observation and abstract conceptualization are more passive or introspective activities that often take place in the mind or during a discussion of the experiences (see Figure 6).

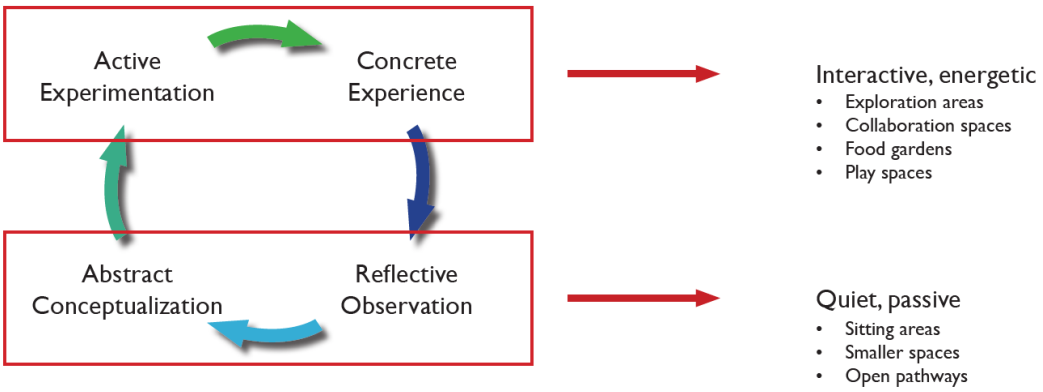

Figure 10. Design approach with two types of spaces based off of Kolb's cycle of experiential learning (Ferguson)

These two types of educational activities, interactive and passive, are words that also describe designed spaces, particularly in public parks. Interactive spaces include those where play, sports, or exploration happens and where the community gathers to create activity. Passive spaces host quieter sections of paths, seating, and perhaps small gathering areas.

Interactive and passive spaces that come from the steps in Kolb's cycle of experiential learning also connect to the design typologies defined above. Community gathering areas are interactive and energetic, hosting the sports facilities, large gathering spaces, and playgrounds already in use in the park. Restored natural areas provide the passive, quieter spaces that allow a more reflective experience within the park. The outdoor learning environments as a

typology are a mix of interactive and passive, as both are necessary in order to complete the cycle of experiential learning.

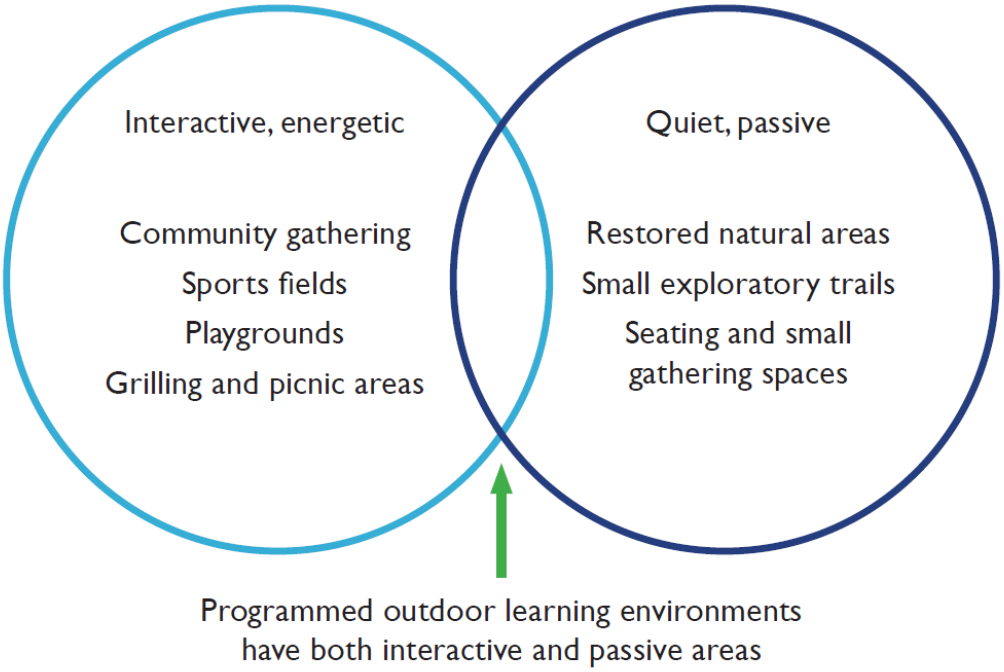

Figure 11. Diagram showing the translation of spaces based on Kolb's cycle of experiential learning to the design typologies defined earlier. (Ferguson)

Chapter 4: Oxon Run Park Experiential Landscapes

4.0 Master Plan

The master plan for Oxon Run Park was approached with the defined typologies and types of spaces from Kolb's cycle of experiential learning. At the master plan and focus area scales, interactive and passive spaces were included in proximity to one another to provide a variety of experiences. In the master plan, each of the four sections of Oxon Run Park divided by roadways has interactive community space and passive natural space available.

Throughout Oxon Run Park, the features that are heavily used by the community are maintained and enhanced. These include sports fields, basketball courts, grills, picnic areas, and playgrounds. The existing features are scattered through each section of the park, often with stretches of open fields between them. In the master plan the interactive spaces concentrate the community features to make available more space for restored natural areas and passive activities. More bridges and additional connecting trails are added to enhance accessibility within the park and allow this concentration of community resources. Parking is also added in the northernmost and southernmost sections where the most cars were observed driving over trails.

Passive restored natural spaces are present in each section of the park in expanded forested areas. There is particular attention paid to the 100 ft stream buffer to help protect the water quality in Oxon Run and concentrate educational

opportunities that connect to the stream. In many of the open areas that currently exist in the park meadows are proposed in order to enhance habitat and experiential diversity. Meadows also reduce the need for maintenance such as mowing in a large park like Oxon Run. In addition to the main shared use path within the park, the passive areas include some smaller trails for exploration that are accompanied by interpretive signs.

The community and restored natural spaces outlined above are most likely to be used by the community on a regular basis since they include areas that now see frequent use. They also have the potential to host classes from schools that are located towards the ends of the park and cannot easily make their way to the central, more highly programmed area on a regular basis. Table 3 shows the spaces that are present in the park now and the additional proposed spaces, and their uses.

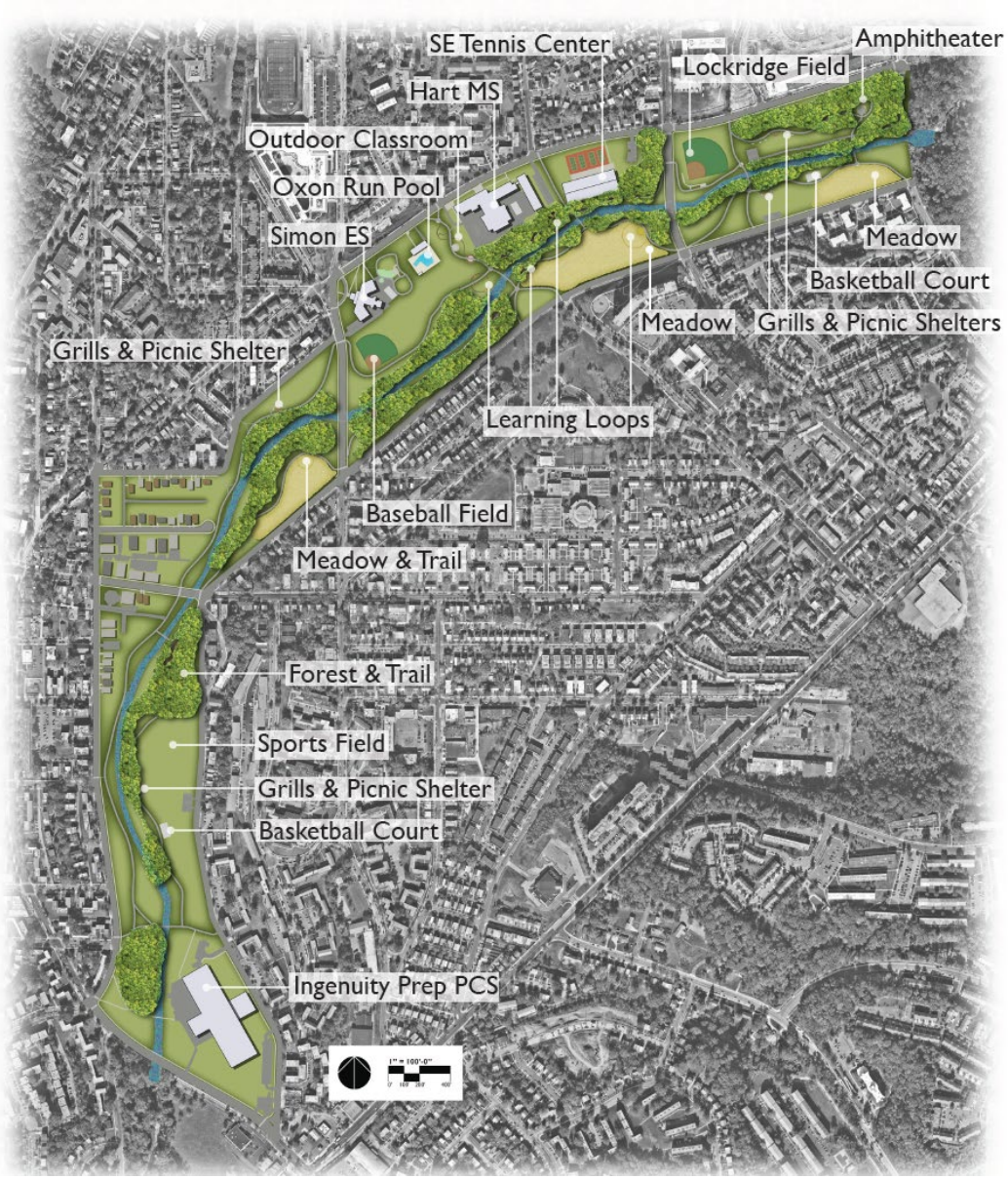

Figure 12. Master plan for Oxon Run Park (Ferguson)

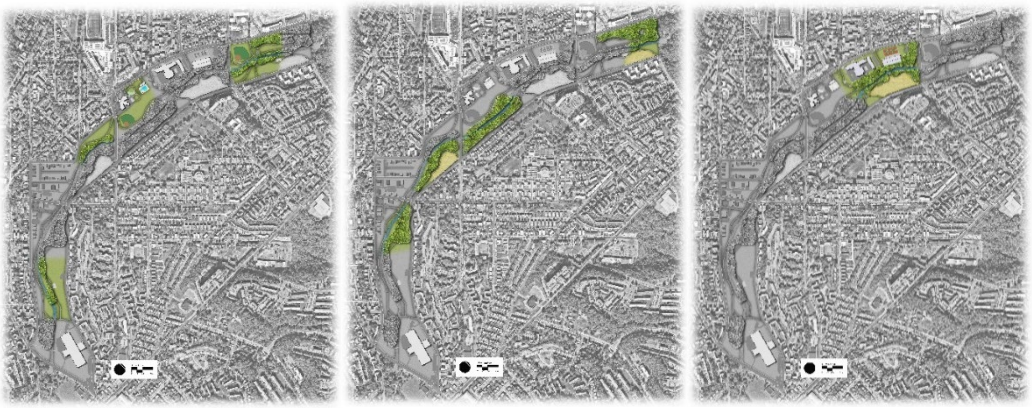

Figure 13. Master plans with types of areas highlighted left to right: interactive community spaces, passive natural spaces, and a central programmed area with educational resources. (Ferguson)

Table 3. Spaces present in Oxon Run Park before and after the proposed design.

Spaces Before	**Spaces After**	**Uses**
Amphitheater	Amphitheater	Gathering
Grills x1	Grills x3	Gathering
Horseshoe	Horseshoe	Gathering
Basketball courts	Basketball courts	Sports
Picnic shelters x1	Picnic shelters x3	Gathering
Picnic tables x2	Picnic tables x3	Gathering
Baseball diamond	Baseball diamond	Sports
Pool	Pool	Recreation
Playground (fenced) x2	Playground (fenced) x2	Recreation
Playground x2	Playground x3	Recreation
Trails	Trails	Exercise/recreation
	Seating along trails	Rest/reflection
	Parking	Access
	Learning loops	Learning/teaching
	Outdoor classroom	Learning/teaching
	Gardens	Learning/teaching

4.1 Focus Area

The focus area for the outdoor classroom amenities, as defined above, includes space on either side of Oxon Run near Oxon Run Pool, Hart Middle

School, and the Southeast Tennis and Learning Center (see Figure 12). An additional bridge is added in this area to maximize access to both sides of the stream and allow classes to walk through the site in loops instead of needing to back track. There are also smaller paths that create loops off of the main pathway, inspired by Kolb's cycle of experiential learning. These learning loops branch off into the various habitat types in this section of the park and explore the forest, meadow, stream, and field (see Figures 13-18). The loop of the main pathway and bridges, and these smaller learning loops allow classes to be guided through the site and experience the four steps of Kolb's cycle at multiple scales as they pass through interactive and passive spaces.

The focus area also includes an outdoor classroom located off of Mississippi Ave SE between Oxon Run Outdoor Pool and Hart Middle School (see Figure 19). The classroom is fenced in with defined, arched entries to create a welcoming and secure environment for free exploration (see Figure 20). The main shared use pathway entering the park moves through the outdoor classroom with smaller paths branching off into wooded areas. These wooded areas include a space for a piece of art or play feature, which would be designed or chosen by the students who use the space. In the center of the outdoor classroom is a large gathering space that could seat several classes of students with a capacity of 90 children (see Figure 21). The ground plane of this gathering space is a map of Washington, DC with the location of the park and its waterway marked. The southern end of the outdoor classroom has gardens surrounding a smaller gathering area. The gardens are used to grow food and other plants, which are chosen and cared for by students. These

plants provide a rich sensory experience of colors, scents, textures, and taste (see Figure 22). Tables in the gathering area allow for foods from the garden to be cleaned, prepared, and eaten. A water feature in this area provides irrigation for the gardens as well as an opportunity to teach or play. See Table 4 below for a list of the spaces that are included in the outdoor classroom and broader focus area and the activities that can take place there.

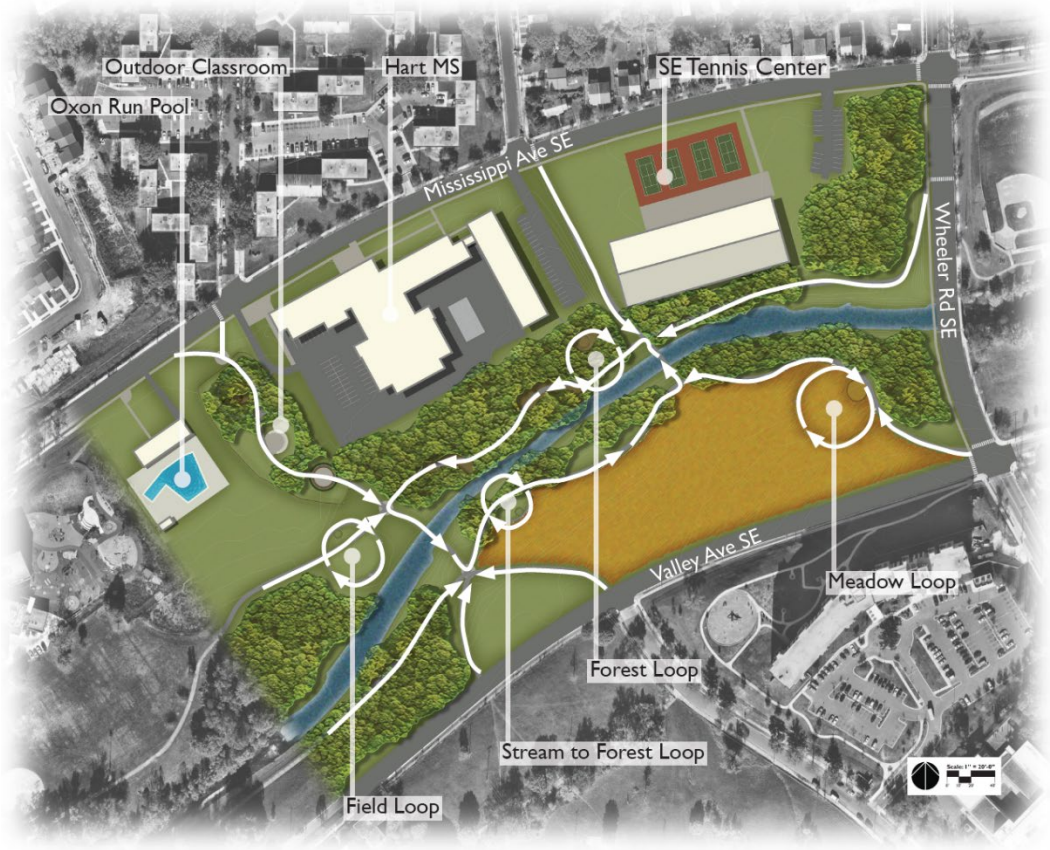

Figure 14. Focus area with paths and learning loops highlighted in white (Ferguson)

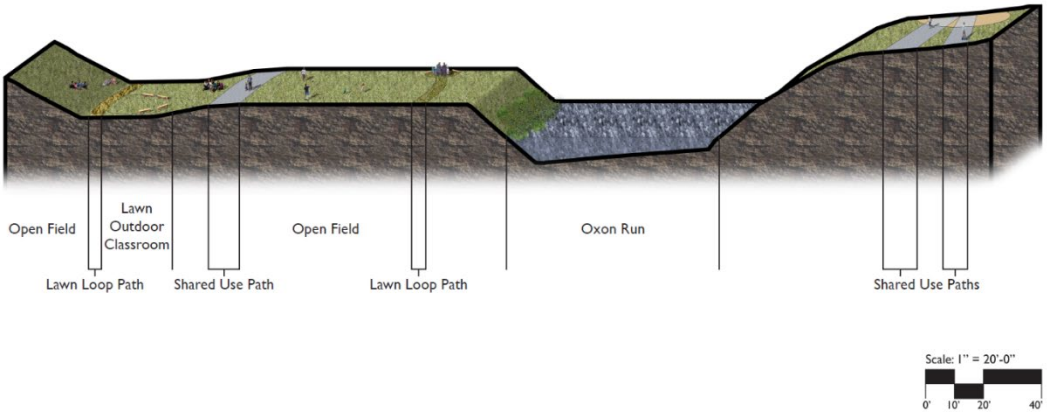

Figure 15. Field Learning Loop section showing the loop path, main shared use path, outdoor classroom, and Oxon Run. (Ferguson)

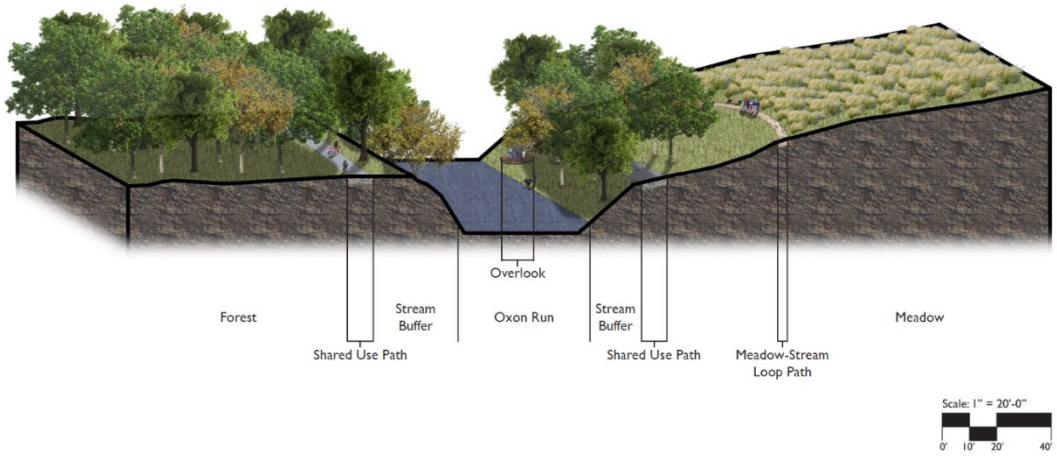

Figure 16. Stream to Forest Learning Loop section showing the main shared use path on either side of Oxon Run, the loop path, and the platform overlooking Oxon Run. (Ferguson)

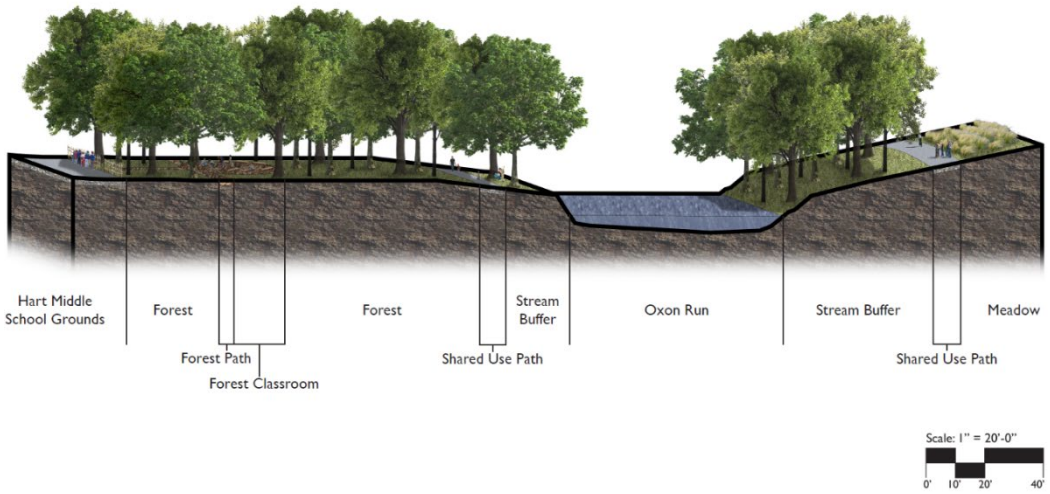

Figure 17. Forest Learning Loop section showing the main shared use path on either side of Oxon Run, the forest classroom, and the proximity to Hart Middle School. (Ferguson)

Figure 18. Overlook on Oxon Run on the Forest Learning Loop path, located near the main shared use path as it approaches Oxon Run. (Ferguson)

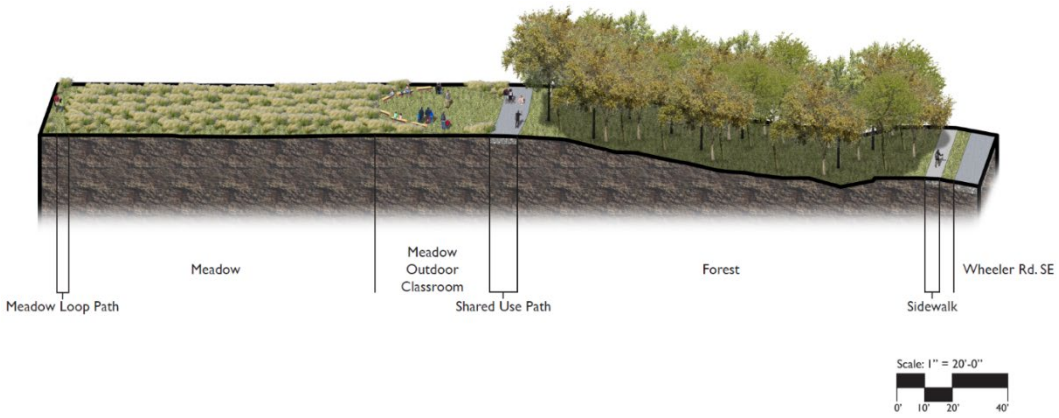

Figure 19. Meadow Learning Loop section showing the loop path, main shared use path, and outdoor classroom. (Ferguson)

Figure 20. Opening in the Meadow Learning Loop path to allow small gatherings and close observance of the meadow. (Ferguson)

Table 4. Focus area and outdoor classroom spaces and their uses.

Spaces	**Activities**
Field trail	Exploration
Field classroom	Lectures, class activities
Field seating	Resting, reflection
Field small gathering areas	Small group activities
Stream to forest trail	Exploration
Stream to forest seating	Resting, reflection
Stream to forest small gathering area	Small group activities
Stream to forest overlooks	Teaching, small group activities
Forest trail	Exploration
Forest seating	Resting, reflection
Forest classroom	Lectures, class activities
Forest overlooks	Teaching, small group activities
Meadow trail	Exploration
Meadow classroom	Lectures, class activities
Meadow small gathering areas	Small group activities
Meadow seating	Resting, reflection
Outdoor classroom entry plaza	Meeting place
Natural art/play feature	Play, artistic expression
Outdoor classroom small trail	Exploration
Natural play area	Play, collaboration
Large gathering area	Lectures, large activities, meeting place
Outdoor classroom seating	Resting, reflection
Food garden	Cultivation, teaching
Sensory garden	Cultivation, teaching
Food prep area	Collaboration, small group activities
Water feature	Play, small group activities

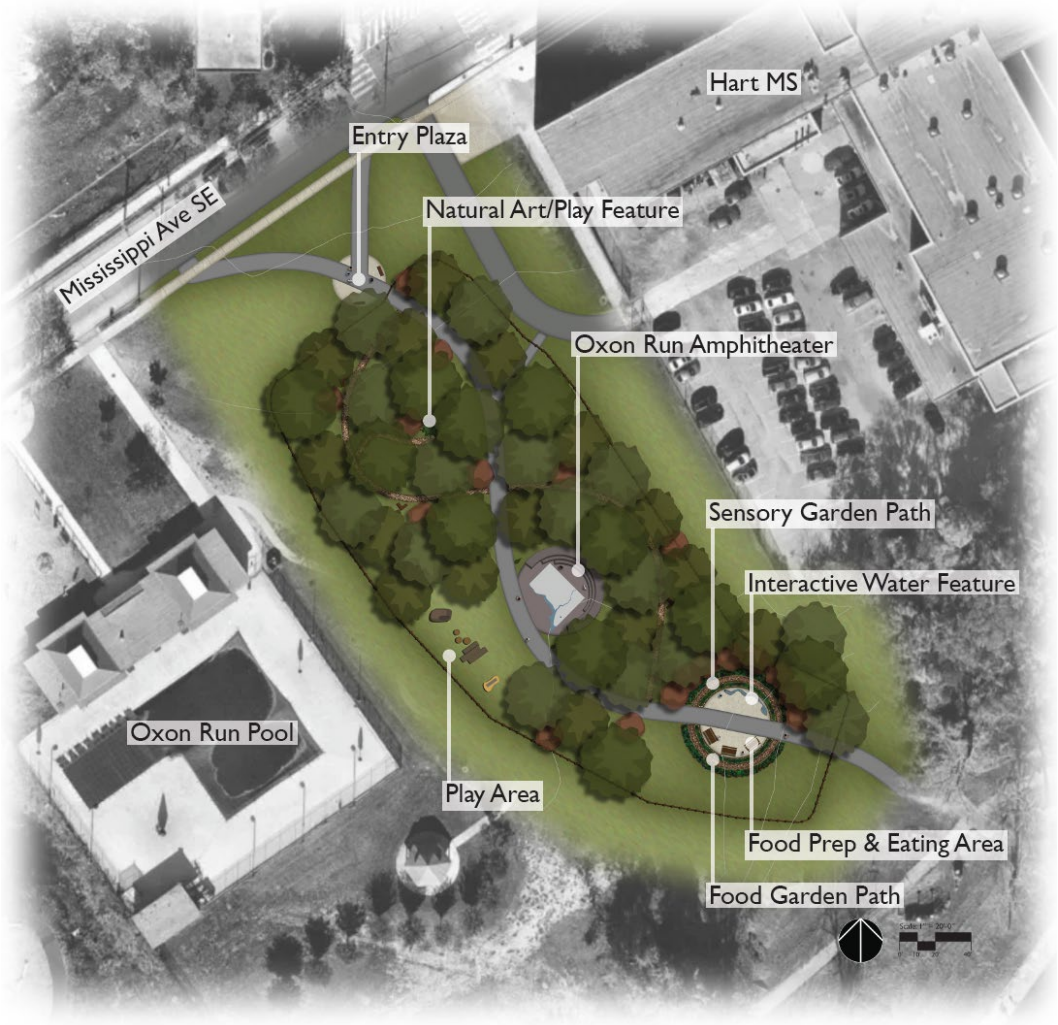

Figure 21. Outdoor classroom located within the focus area near Mississippi Ave SE between Oxon Run Outdoor Pool and Hart Middle School. (Ferguson)

Figure 22. The entrance to the outdoor classroom is marked by an archway and located adjacent to a plaza which can serve as a gathering space. (Ferguson)

Figure 23. The large central gathering space in the outdoor classroom can host several classes at once and is adjacent to play features. (Ferguson)

Figure 24. The small path branches off of the main pathway through the sensory garden with plants chosen and cared for by students.(Ferguson)

Chapter 5: Concluding Thoughts

5.0 Further Opportunities

The goal of this thesis project was to explore the design of public spaces with a focus on education, particularly by providing a variety of educational experiences. The final designs of Oxon Run Park achieved this goal by applying the design typologies through the principles of experiential education design developed from the research.

Future Directions

Many opportunities for further collaboration and restoration that could potentially be applied to Oxon Run Park exist. Oxon Run itself is a prime candidate for stream restoration given its highly channelized state. The concrete channel is cracked in many places, allowing openings for mostly invasive vegetation to grow and cause further deterioration. Oxon Run Park creates a wide enough buffer around the stream to form a floodplain, which would be enhanced by the proposed forest and stream buffer restoration. Research into urban stream restoration focused on Oxon Run as it moves through this city park is necessary to explore the prospect. If a stream restoration project were to be undertaken, involvement from the surrounding schools and community would provide more educational opportunities and create a sense of ownership of this local waterway.

Collaboration is crucial to Oxon Run Park even without considering the possible stream restoration. Community and school groups will be the targeted

users of the spaces that are proposed for this large city park and should be included early in any design process. While the proposed outdoor learning spaces are designed based on the research and best practices in experiential learning, the needs of the users should be the top priority in determining program for a site such as this. Nearby schools who may use an outdoor learning space and community groups such as the Friends of Oxon Run Park, which is facilitated by the DC Department of Transportation, should be consulted before moving forward.

Appendix 1: School Data

School	Address	Public/Private	Grades	Enrollment (2016-2017 if public)
Ballou High School	3401 4th St SE	Public	9-12	930
Simon Elementary School	401 Mississippi Ave SE	Public	PK3-5	276
Charles Hart Middle School	601 Mississippi Ave SE	Public	6-8	349
Eagle Academy PCS	3400 Wheeler Rd SE	Public Charter	PK3-3	734
Malcolm X Elementary School	1500 Mississippi Ave SE	Public	PK3-5	237
Achievement Preparatory Academy Elementary	908 Wahler Pl SE	Public Charter	PK3-3	464
Achievement Preparatory Academy Middle	908 Wahler Pl SE	Public Charter	4-8	468
Hendley Elementary School	425 Chesapeake St SE	Public	PK3-5	445
St Thomas More Catholic Academy	4265 4th St SE	Private	PK-8	146-159
Ingenuity Prep PCS	4600 Livingston Rd SE	Public Charter	PK3-5	376
W.B. Patterson Elementary School	4399 South Capitol Terr SW	Public	PK3-5	394
Leckie Education Campus	4201 M.L. King Ave SW	Public	PK3-8	553
Paramount Child Development Prep School	3924 4th St SE	Private	Age 2-5	
Somerset Preparatory Academy Middle/High School	3301 Wheeler Rd SE	Public Charter	6-12	324
Martin Luther King Jr. Elementary School	3200 6th St. SE	Public	PK3-5	346
Democracy Prep Congress Heights PCS	3100 Martin Luther King Jr. Ave SE	Public Charter	PK3-8	645

% Black	% Hispanic	% White	% Pacific/ Hawaiian	% Native American	% Multiple Races	Economically Disadvantaged	Special Education	Outdoor Rec Space	Distance to Oxon Run (miles)
98.0%	2.0%					100.0%	25.0%	Yes	0.30
98.0%	2.0%					100.0%	12.0%	Yes	0.00
99.0%	1.0%					100.0%	24.0%	Yes	0.00
99.6%						60.0%	18.1%	Yes	0.12
100.0%						100.0%	19.0%	Yes	0.31
96.8%	1.7%	1.1%			0.4%	60.0%	10.3%	Yes	0.27
96.8%	2.8%			0.4%		85.1%	17.3%	Yes	0.27
100.0%						100.0%	11.0%	Yes	0.38
99.0%						70-79%		Yes	0.51
96.8%	1.3%	1.9%				60.0%	20.7%	Yes	0.00
99.0%	1.0%					100.0%	22.0%	Yes	0.17
78.0%	7.0%	8.0%	1.0%		5.0%	100.0%	8.0%	Yes	0.40
									0.08
98.5%	0.3%				1.2%	60.0%	21.9%	Yes	0.18
99.0%	1.0%					100.0%	11.0%	Yes	0.33
97.5%	2.5%					60.0%	21.6%	Yes	0.42

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