

The Ohio State University
Campus as a Living Laboratory

The Riverfront Recreation and Education Facility

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Executive Summary

The Ohio State University Framework Plan discusses the possibilities of the newly transformed river corridor. Sasaki and Ohio State master planners hope that the “river corridor will be an active research and learning corridor” and “a pastoral recreation zone” (The Ohio State University & Sasaki, 2010). The problem is that there is currently no draw to the river, nor is there a research and learning facility nearby that is also central to campus. The Riverfront Recreation and Education Facility (RREF) will go beyond just solving this problem. The building’s attractive design, innovative research equipment, and state-of-the-art sustainable features make it a very advantageous addition to the College of Food, Agriculture, and Environmental Sciences (CFAES). The RREF’s promotion of outdoor play and connectivity with the environment will also draw community members outside of CFAES.

The RREF will be located near the Sisson Hall Footbridge, just south of Woody Hayes Drive. The building will be constructed on stilts in the Olentangy River floodplain. It will have a one-floor layout with a restroom, rental station area, and classroom. There will be many windows to allow for natural light, as well as a deck outside of the classroom. Along with the construction of the building, a small fixed dock will be built into the river as an access point for water equipment. The RREF will also have a green roof and photovoltaic solar panels. These features will be aesthetically pleasing and will cut down on energy costs of the building. Students and faculty can use these resources to study the benefits and costs of the alternative energy source and green roof and determine what features could be used for future Ohio State construction.

The RREF will partner with Ohio State Recreational Sports to offer rental equipment such as footballs, Frisbees, kayaks, and canoes. With this equipment, students and other community members will be able to enjoy the green space and the newly transformed river free of cost; there is approximately 150 yards of green space surrounding the RREF. Any Ohio State student or faculty member will be able to rent the classroom for free, and others can rent the space for a small fee. The classroom will be especially beneficial to CFAES because of the live-feed monitor from the research equipment and cameras installed under the building and dock. Other possible equipment includes a stream gauge, underwater cameras, and nest boxes for native wildlife.

The RREF has many funding opportunities, including the fee assessed for renting the classroom space. This facility will promote sustainable energy, the environment, and well-being of the mind and body. It is a perfect addition to the framework plan that will help the river corridor become the next Oval.

Introduction

The One Ohio State Framework Plan focuses on making the entire campus a learning environment, delivering sustainable actions, and transforming the river area. Our proposal for the Riverfront Recreation and Education Facility, or RREF, combines all of these ideas. This facility will provide a classroom in a unique, outdoor setting and serve as a living laboratory. Students will have the opportunity to develop their skills through hands-on research and learn in a contemporary classroom setting while connecting with the outdoors. Additionally, spending time outdoors can increase personal well-being, and our facility will serve as a liaison for people to relieve stress and gain exercise. The RREF's sustainable features will promote zero waste and green energy through innovative architecture and eco-friendly materials. The design will also act as a framework for future construction at Ohio State. A new facility near the river will be a great way to attract students, faculty, and other Columbus community members to the newly renovated river corridor.

Design

The RREF is a seasonal facility, intended for use during the spring, summer, and fall that will promote outdoor learning and engagement. It will be located in the Olentangy River floodplain on the east side of the river, between the Sisson Hall footbridge and Woody Hayes Drive (Figure 1). The building will be stationed closest to the footbridge, making it central to campus and easily accessible for students. There will be parking available along Cannon Drive and at the Veterinary College. The size of the building will be approximately 600 square feet, with a maximum capacity of 40 people. It will be constructed out of natural wood, because of the materials' low impact on the environment, low cost, and durable structure. The design will consist of two main areas, a rental station and a classroom. It will be constructed in the shape of a backwards "L", with the rental station being the smaller projection of the "L" facing the stadium, and the classroom as the larger portion facing the river (Figure 2). People will access

the building through stairs and a ramp located on the east side leading up to the rental station; there will also be stairs leading from the classroom deck to the riverside dock.



Figure 1. Map of the RREF'S location

The classroom will overlook the river and have two sliding glass doors that open on the west wall. The doors will open to a small deck, which will allow for quick access via stairs to the dock located on the river. This feature creates an open environment, allowing the participants to better engage with nature without disturbing it. In addition, the doors will help alleviate some of the cost for heating and cooling by allowing outdoor ventilation. The small deck outside the classroom will serve as an observation station, equipped with binoculars and other instruments. The fixed dock on the river will provide an easier means of collecting water samples and a more efficient method of executing studies on the river. The dock will also serve as an access point for kayaks, canoes, and other water sports equipment.

The building is specifically located within the river's floodplain in order to maximize learning opportunities while minimizing its impact on the landscape and biodiversity. The building will be elevated on stilts to avoid the damages and risks associated with flooding while still being close enough to interact with the river. Stilt buildings and houses have been successfully used all over the world as a protection against flooding and unwanted vermin. The

stilts will be made of reinforced concrete deep within the bedrock and placed well above the base flood elevation (BFE) to ensure sustainability. Base flood elevation “refers to elevation of the flood having a one percent chance of being equaled or exceeded in any given year” (*Ohio Floodplain Management Handbook, 2005*). The Olentangy River has riverine flooding, which means that the river has a slow rate of rising but has the potential to last for a long time (*Ohio Floodplain Management Handbook, 2005*). This is ideal for the RREF because flooding can easily be predicted early on, so the building can be evacuated accordingly. The Olentangy River has a relatively mild flow speed, which will cause little damage to the building (The Lower Olentangy Watershed Action Plan in 2003). Additionally, this building will take up less space than a conventional structure, allowing for the space under it to be used, causing less of an impact on the environment.

Currently, there is a conservation easement placed on the Olentangy River corridor to protect the newly renovated area. This means that the Ohio State University restricts building development near the river, so the construction of the RREF must be in compliance with the conservation easement and must be approved by the City of Columbus, Ohio EPA, and the Ohio State Facilities Operations and Development Department. As previously discussed, the building will be elevated on stilts in the floodplain, which will cause little disruption to the river ecosystems. Additionally, the RREF will be used to monitor and improve the river systems, making a valid case for the building’s benefits.



Figure 2. Multiple angle image of the RREF

Sustainable Features

In addition to the RREF's practical design, it contains many unique and sustainable features. The main sustainable features of the RREF are the green roof and photovoltaic solar panels. In order to maximize their efficiency, the photovoltaic solar panels will be placed over the green roof. This design is more productive in reducing the heat flux of urban environments and will maintain the most efficient temperature for sunlight absorbance in the solar panels (Scherba et al, 2011). In other states, buildings that have implemented this design have been granted federal energy efficiency and solar incentives from the government for their environmental conscientiousness.

There are many benefits to supplying energy through photovoltaic solar panels. The natural energy absorbed by these panels emits no harmful greenhouse gases, unlike natural gas heating systems, and can produce direct electricity for the building (Green, 2012). The RREF's position towards the east will allow for optimal amounts of sunlight to pass through the solar panels and energize the building. Solar panels are designed to withstand adverse weather conditions, which is important because of the unpredictable seasons in Ohio. The average installation fee for a 600 square foot area of solar panels is about \$55,000, but beyond this one-time fee they require hardly any funds for upkeep. The average yearly payoff of a 600 square foot area of photovoltaic solar panels is \$1,034.55, along with about 1.8 tons of CO₂ saved. Since Ohio State plans on keeping these structures for an indefinite amount of time, it is reasonable to say that once the panels have exceeded their initial costs in savings they will prove to be a worthy investment.

Next, a green roof will help to remedy some of the negative impacts of installing a building in an urban setting near the river and provide a variety of sustainable functions for the facility. Since the RREF will be built in close proximity to the Olentangy River, the building plans must account for problems in pollution and storm water runoff. Rooftop vegetation can recover for lost green space and mitigate runoff. Research shows that vegetated roofs retain nearly 83% of rainfall and serve to filter the water safely back into the environment (Van Woert, 2005). This process is done naturally through a system of layers in the roof. Water is stored by the substrate underneath the vegetation, which then takes up the water and returns it to the atmosphere through evapotranspiration. These layers can also moderate the temperature of water re-entering the environment via runoff, keeping them from overheating or overcooling the river.

The green roof will be placed at a reduced slope of about 2-4 centimeters with a deeper media to balance and greatly reduce the amount of total runoff (Van Woert et al, 2005). Green roofs are able to extend the duration of time in which water is filtered beyond actual rain events, which allows for smooth re-entry to the river and minimal amounts of erosion. This process will not result in any backup and is mutually beneficial for both the rooftop vegetation and the surrounding ecosystem.

Furthermore, the top vegetative layer can improve air quality and reduce the Urban Heat Island Effect. The horizontal vegetation surface carries out a daily evaporation cycle, which helps to cool city air temperatures during hot summer months. Vegetation absorbs light that will otherwise be converted into heat energy and accumulate in the atmosphere. Additionally, green roofs reduce smog and filter noxious greenhouse gases while capturing airborne pollutants and atmospheric deposition. These temperature-moderating effects can result in less of a demand on power plants and function well in potentially higher temperatures during future summers (Kerth, 2013).

Green roofs also provide aesthetic benefits and educational opportunities. Ohio State's urban location can seem as though it is filled with concrete structures, and one of the main benefits of the new Olentangy Riverfront is the increase in green space. Building a green roof on top of the RREF will be a beautiful addition and will not take away from the green space on which we will be building near the Olentangy River. People passing through the footbridge and touring Ohio State's campus will notice the green roof and can view the biodiversity and gardening taking place. The roof is easily accessible for students of many disciplines to learn about biology, technology, and innovation through hands-on experiments and observations.

The University of Toronto has used green roofs on their campuses for over a decade now; their scientists having conducted extensive research displaying the costs and benefits of green roofs (Van Woert et al, 2005). This research indicates that the initial cost of green roofs, which stands around \$15 per square foot paired with a low yearly maintenance cost around \$0.75-\$1.50 per square foot, has a strong long term pay off in energy, environmental, aesthetic, and educational benefits. Economic reports state that green roofs save an average of \$19 per square foot on storm water and energy costs over a 50-year period. However, these reports do not include many of the additional aesthetic and environmental benefits, which have been estimated at \$30 per square foot for air quality, biodiversity, and reduced CO₂ emissions (VanWoert et al.,

2005). Figure 3 outlines these costs and benefits, comparing the one time installation fee to the 50-year payoff of each of the green roof's positive features. Furthermore, green roofs are beneficial during wintertime as well. The thick layers of material used in green roofs are useful for both insulation and heat retention. As the amount of urban areas increases, green roofs are a sensible and effective method for mitigating the effects of industrial pollution and storm water damage.

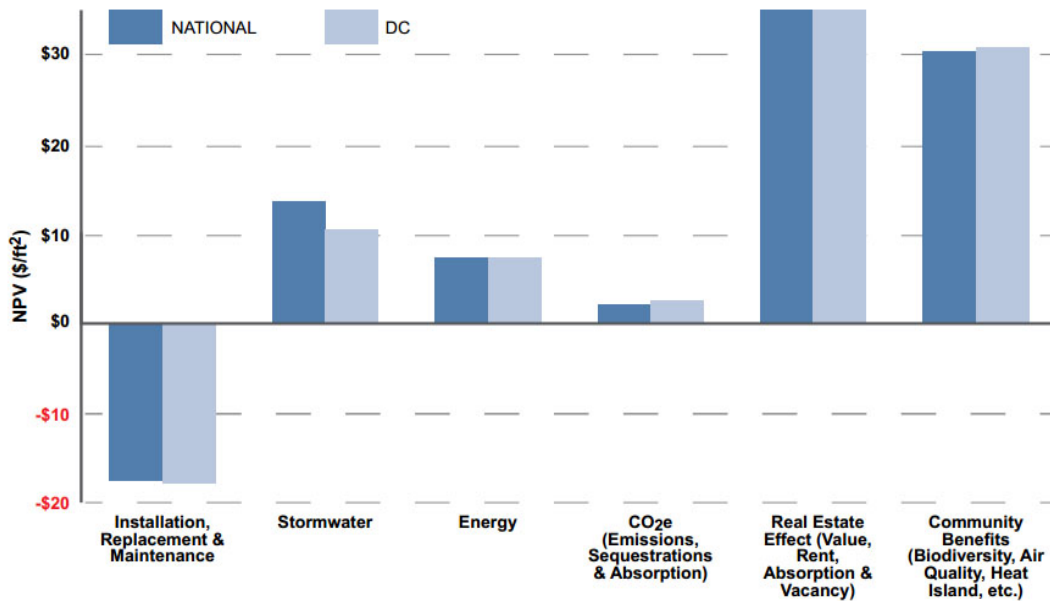


Figure 3. A graph representing the installation costs of a green roof and the average monetary benefits of its various functions over a fifty-year period in Net Present Value (NPV). Figure modified from N. VanWoert *et al.*, *J Environmental Quality*, 2005.

The cost for both of these installations has already fallen greatly since they were first marketed. Given the time span between now and the actual construction of the RREF, solar panels and green roofs will be relatively inexpensive compared to the current prices. The photovoltaic solar panels operation and maintenance is considered very low, if not completely negligible. Students or volunteers involved in green organizations who want to learn more about biodiversity and what it takes to keep a green area alive and functioning can maintain the green roofs.

Funding

The main concerns of constructing the RREF are the costs and funding involved with a brand new building. The RREF will cost approximately \$350,000 to construct, including the cost of green roof materials, photovoltaic solar panels, the dock, and the deck. This cost does not, however, include that of research equipment, other classroom materials, and bathroom utilities. The bathroom will cost approximately \$8,000. The research equipment and live-feed display in the classroom of the data from this equipment will cost approximately \$50,000.

Alumni from CFAES or other related organizations can support the building with donations. The fee assessed to community members for renting the classroom space or rental equipment can also fund the construction and building renewal costs. More sources for funding include grants from the Ohio Higher Education Funding Commission; The President's Club; the College of Food, Agriculture, and Environmental Sciences; the Recreational Sports Facilities Fund; and private donations.

Equipment and Classroom Rental

Similar to the Outdoor Adventure Center (OAC) - funded by the Recreational Sports Facilities Fund - the RREF will have rental equipment available to those with valid Buck-ID's or Rec Sports memberships. Other patrons will also be able to rent equipment for a small fee. There will be smaller items available, such as Frisbees, beach towels, soccer balls, camping chairs, corn hole, and footballs. The Oval currently does not offer any kind of sports equipment, so students and other community members will be more likely to use the green space surrounding the river when there is a cost-free, interactive way to do so. By signing a waiver, Ohio State community members and the general public can also rent larger equipment, such as canoes and kayaks. There will be a required 24-hour notice for customers to rent kayaks or canoes; that equipment will also have a 4-hour maximum rental time to prevent the RREF from running out of available equipment.

The OAC already has most of this larger equipment available, so a partnership with them will make liability issues and the renting process much simpler for the RREF. Unlike the adventure trips that the OAC currently offers, the RREF will allow people to enjoy adventure sports locally - without the expense or travel. The OAC stores their kayaks, canoes, and sailboats in a service yard, so RREF can use this space during the winter when the equipment is

not being used in the Olentangy River. A partnership with the OAC will also provide staffing for the RREF. This new facility will be owned by CFAES, but students will staff the rental station, which creates another on campus job opportunity. These employment opportunities will serve as another means of attracting all students to the RREF and river area.

A concern with renting this water equipment is the retrieval and returning of the kayaks and canoes once they are out on the Olentangy River. Most people will not be able to paddle to the access point by Patterson Road on the Olentangy River Trail, nor will they be able to paddle to the wetlands due to the southerly flow of the river. Fortunately, the Outdoor Adventure Center is purchasing large vans in the summer of 2014 specifically for transporting kayaks and canoes. The RREF will set up designated stopping points where the customers and RREF/OAC employees can load the kayaks and canoes into the van to be returned. The customers can then choose to either ride in the van or walk back to the RREF. Matt Hartman, the OAC Director, expressed great interest in this partnership. He already plans to establish a canoe and kayak rental station in the summer of 2014 near the French Field House along the Olentangy, which is located in close proximity to where the RREF will be built.

The classroom space in the RREF will be available to professors, researchers, Ohio State clubs and organizations, as well as the general public. When anyone wants to rent the classroom space, he or she will be required to call or email the RREF two weeks ahead of the desired date. The space will be free to all Ohio State students and faculty, and a \$20 per hour fee will be applied to those outside of the Ohio State community.

Discovery Themes

The RREF's rental equipment and mission will advocate Health and Wellness through physical activity, well-being of the mind and body, and connection with the outdoors. The facility will attract students to the green area and provide materials and equipment for them to make the most of their riverfront experience. Stress relief is extremely important for college students and spending time in fresh air and sunlight can improve both emotional and physical well-being. Being outdoors can mitigate stress, depression, and loneliness while improving leadership skills, participation, and overall mood. Outdoor play also increases fitness levels and builds active, healthy bodies; it also raises vitamin D levels, which helps protect against bone problems, heart disease, and other health problems. Exposure to natural settings has proven

effective in reducing ADHD and improves critical thinking skills (Harvard Medical School, 2010). Like the pre-existing health and wellness facilities on campus, the RREF will further engage the university community in physical and wellness activities.

The Energy and Environment theme focuses on Ohio State research solving the global need for energy. The RREF's innovative sustainability features will set a precedent for the future of Ohio State and serve as an example for future construction plans on Ohio State structures by indicating what sustainable energy resources are the most effective. The RREF's sustainable features will also allow students and faculty to conduct research on alternative energy sources directly on campus. The facility's take on these Discovery Themes makes it a great addition to the Ohio State University.

Connection with CFAES

The creation of the Riverfront Recreation and Education Facility will be especially beneficial the College of Food, Agriculture, and Environmental Sciences. The building's construction method will allow for innovative research equipment and provide wildlife habitats. The pier-style construction will leave room between both the floodplain and river and the underside of the building. In this space, CFAES faculty can utilize different monitoring and research equipment such as permanent YSI monitors (YSI Inc.), stream gauges, underwater cameras, nest boxes for native wildlife, and critter cameras near the nest boxes. While CFAES currently has research equipment available, the RREF will allow for expansions and improvements in areas not yet explored. It will also provide another outlet of research opportunities for students and faculty. Ohio State does not currently have a permanent stream gauge installed, which will be especially helpful after the river renovation is complete so that flow and discharge can be regularly monitored via a live feed in the classroom. A permanent YSI monitor will give live data on pH, turbidity, and other water quality components. Underwater cameras, which CFAES does not currently have, will give researchers the ability to view the interactions between species. A large monitor will be installed in the classroom to provide live feed data and footage from the research equipment. The RREF will also promote the CFAES to all visitors. The building will serve as a bulletin for all events, updates and research happening within the College and could serve as a venue for CFAES-hosted seminars.

The Heffner Wetland Research & Education Building and the RREF have potential to work together and be very complimentary resources. Both promote research and engagement, which is a top priority for Ohio State and the Framework Plan. There are several classes, such as Aquatic Methods and Stream Ecology, held at the Heffner Research and Education Building at the Schiermeier Wetlands Complex that can hold sessions at the RREF. The RREF can also serve as a way of exposing people to the wetlands and educating them about its research and volunteer opportunities. The creation of the RREF will also help the Heffner Building by promoting Ohio State's river ecosystem as a whole; the Schiermeier Wetlands Complex highlights the wetlands, and the RREF will highlight the river.

The One Ohio State Framework Plan

The Ohio State Framework Plan hopes to transform the river corridor into the symbol for "One University" by creating an appealing open space area surrounding the renovated river. The Plan describes the river area as the future Oval; the problem is, however, that very few students or community members currently visit this area. The RREF will draw people to the area and promote all of the desired ideas of active learning and research, recreation, connection with the community, and efficient energy. Not only will the RREF promote an ideal future for Ohio State, but it is also an ideal addition to the College of Food, Agriculture, and Environmental Sciences.

The Framework Plan discusses both open space and new infrastructure. The construction of the RREF will mean taking away space from the other CFAES buildings, but its construction has many advantages. The recreation and education components of the facility promote connection with the outdoors and the use of open space around the newly renovated river corridor. Students of all majors and interests will visit the RREF, just as they currently visit the OAC and Adventure Recreation Center (ARC). The RREF will promote similar ideas to these pre-existing health and wellness facilities, but this new facility will allow all community members to make the most of their time outdoors and take advantage of Ohio State's natural resources (i.e. the Olentangy River). The vision of Ohio State recreational sports is for the University to be a leader in living balanced lives of physical activity and well-being. The RREF will do exactly that, while also promoting research and education.

Discussion

The Riverfront Recreation and Education Facility is the ideal solution for making the riverfront area the new Oval for the next 100 years. Through its unique design, open classroom setting, and sustainable features, the RREF promotes an ideal learning environment for a living laboratory. When projecting the cost of the building at approximately \$350,000 and taking into account the monetary savings, environmental benefits, and additional benefits, one can see that it supports its own economic value. This added value is what makes this building so unique and remarkable; it provides students, faculty, and the community with an environmentally conscientious facility that is the first of its kind. This will be used as the framework for future sustainable building development and ingenuity on campus. The RREF's elevated structure will allow the building to be constructed in line with the conservation easement that is placed on the area. The stilts will cause minimal disruption to the river ecosystems, while allowing a one of a kind learning experience. As discussed, the RREF will be a great addition to CFAES and entire university. Through its promotion of the Discovery Themes of Energy and the Environment and Health and Wellness, the RREF is eligible to receive significant funding through the Discovery Themes opportunities. The building will also be funded by multiple other sources, such as alumni, outside donors, and other organizations. The RREF allows for many possible extensions, such as ice skating equipment in the winter months as well as a partnership with the OAC to create an outdoor rock-climbing wall. A recent survey was conducted concerning riverfront recreation at Ohio State; the results showed that there is a strong desire for a recreational facility along the area. This reiterates the RREF's future success in attracting people to the riverfront, all while doing so in an economically and environmentally compliant manner.

Conclusion

The Riverfront Recreation and Education Facility will provide an opportunity for the Ohio State and Franklin County community to connect with the environment on the new Olentangy Riverfront. Students can learn through hands-on classroom experiments and a living laboratory, while all residents can increase health and wellness through outdoor activities. The RREF facility will be made from sustainable materials and designed to minimize negative environmental impacts while improving overall environmental quality. A variety of colleges and organizations can benefit from using the RREF, connecting CFAES with the ARC and any other

interested subjects. The RREF will bring people to the new Olentangy Riverfront, emphasize active learning and growing, and serve as an example for future sustainable designs on Ohio State's campus.



Figure 4. An example of a building similar to what we envision for the RREF

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