Prince George's County Planning Department

Parking Lot Redesign
Final Report

Eco Lots Consulting
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PALS
An initiative of the National Center for Smart Growth
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ABOUT PALS

The Partnership for Action Learning in Sustainability (PALS) is administered by the National Center for Smart Growth at the University of Maryland, College Park (UMD). It is a campus-wide initiative that harnesses the expertise of UMD faculty and the energy and ingenuity of UMD students to help Maryland communities become more environmentally, economically, and socially sustainable. PALS is designed to provide innovative, low-cost assistance to local governments while creating real-world problem-solving experiences for University of Maryland graduate and undergraduate students.

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Eco Lots Consulting

Eco Lots Consulting™ is committed to delivering innovative and sustainable solutions for parking lot redesign. We are leaders in urban ecological transformations, specializing in creating dynamic, functional, and environmentally friendly spaces. Our work includes urban farms, community spaces, and stormwater runoff solutions.

Our team includes environmental planners, Nuelle Johnson and Jillian Wimbush, landscape architect Alejandro Flores-Chevere, and project manager Kat Boutselis. With a combined 13 years of environmental science studies at the University of Maryland, and six months of consulting experience, Eco Lots Consulting is a growing company that can bring the best sustainable solutions for parking lots across Maryland.

Prince George's County Planning Department

The gatekeeper for this proposal to redesign the parking lot at M-NCPPC's Largo Headquarters, is the Prince George's County Planning Board, which will approve the new parking lot design. The proposal is specifically addressed to Lakisha Hull, Director of the Prince George's County Planning Department. With the board members, Ms. Hull will review the suggested layout and direct the planning and design team who will sketch out and implement the rain garden. The primary contact for this proposal is Theodore Levy of the County Planning Department, overseeing the planning and architectural team.

Another audience for this proposal is horticulturalists, plant ecologists, landscapers, garden designers, and construction contractors. The horticulturalists bring knowledge of plant materials native to Largo that would thrive in the rain garden. Landscapers can suggest best designs for feasibility and maintenance. The contractors will be responsible for the building the new layout. All these individuals will advise the design team and provide insight on the best way to implement the new layout.

A final audience are the employees who work at the Largo Headquarters and community members who live in the area. The parking lot is mainly used by employees who can give insight into the most useful features of the parking lot that should be kept. As well, community members can provide insight into what they would like to see in their community and what they would use.

Introduction

Eutrophication is an increasingly concerning issue impacting the health of bodies of water such as the Chesapeake Bay. Eutrophication occurs when an overabundance of nitrates and phosphates in water results in an overgrowth of algae. When the algae produced by eutrophication die, heterotrophic bacteria consume it. As the population of heterotrophic bacteria expands, they deplete oxygen levels in the water, as well as the ecosystem's marine life. This results in "dead zones."

According to the Chesapeake Bay Program website, 286 million pounds of nitrogen and 19.9 million pounds of phosphorus entered the Bay in 2021 (Nutrient Runoff, 2015). While these numbers are below the mean nitrogen and phosphorus loads entering the Bay from 1985 to 2021, there was a 16 percent increase in nitrogen loads and a 38 percent increase in phosphorus loads in the Bay from 2020 to 2021 (Nutrient Runoff, 2015).

A significant contributor to nitrogen and phosphorus pollution is runoff from point sources such as sewage treatment plants, agricultural lands, and construction sites. According to data collected by the University of Maryland, the largest percentage of nutrient pollution due to runoff can be tracked to atmospheric deposition, mobile utilities and industries (19 percent), municipal and industrial wastewater (19 percent), and agricultural manure (17 percent) (Maryland Sea Grant, 2012).

The Chesapeake Bay is roughly 200 miles long; however, its watershed spans 64,000 square miles—encompassing areas in Virginia, DC, Maryland, West Virginia, Delaware, Pennsylvania, and as far north as New York (Frequent Questions about the Chesapeake Bay TMDL | US EPA, 2015). Watersheds draining into the Chesapeake Bay could be carrying phosphorus, nitrogen, and sediment pollution from point sources all over the Northeast and Mid-Atlantic. Runoff from these areas is exacerbated by impervious surfaces. To reduce nutrient pollution in major bodies of water, impervious surface areas near Chesapeake Bay watersheds must be reduced.

In the past, the Maryland Department of Natural Resources has addressed eutrophication in the Bay by implementing algal turf scrubbers (ATS), which clean excess nutrients from the water (Mulbry et al., 2010). Scrubbers run a rapid stream of water over a highly illuminated and sloped surface, allowing for algae to grow on the surface and thus consume the excess nitrate and phosphate. While effectively removing nutrients from the water, this technique does nothing to prevent the issue from occurring in the first place. As such, implementing stormwater management near watersheds that drain into the Bay could capture the nutrients before they can enter the watershed.

Rain gardens and grass swales are stormwater management methods that mimic naturally occurring hydrological processes at low costs. Additionally, rain gardens support the biodiversity of native plants and pollinators. Permeable pavement is another form of

stormwater management that can function both as a walking or driving surface while also filtering pollutants out of stormwater.

Nutrient Reduction

These stormwater management strategies have been implemented in other parts of Maryland where they've proven effective. In one project, UMD-College Park scientists tested nutrient and phosphorus total maximum density loads (TMDLs) after the installation of two rain gardens. On average, they found that rain gardens removed about 75 percent of phosphorus and up to 80 percent of nitrogen (Strain, 2004).

In another project, Frederick County implemented various best management practices (BMPs) for reducing loads from stormwater, septic systems, agriculture, and wastewater as part of their initiative to reduce their TMDL in the Chesapeake Bay: "Maryland Phase II WIP Strategies: Frederick," (TMDL Analysis for Frederick County, Maryland). Rain gardens and grass buffers and swales were installed in various community spaces, including elementary schools, middle schools, high schools, community centers, churches, parks, and more. The rain gardens reduced TMDLs of nitrogen, phosphorus, and total suspended sediment (TSS) by 7.145 pounds, 1.534 pounds, and 349.95 pounds per year respectively for 4.66 acres of impervious area (TMDL Analysis for Frederick County, Maryland). The grass buffers reduced TMDLs of nitrogen, phosphorus, and TSS by 176.85 pounds, 10.36 pounds, and 4,222.56 pounds per year respectively for 36.19 acres of impervious area (TMDL Analysis for Frederick County, Maryland). The project incorporated permeable pavement at only one site, but its ability to remove pollutants was comparable to that of a rain garden treating 0.5 acres of impervious area– removing 0.58 pounds/year of nitrogen, 0.07 pounds/year of phosphorus, and 56.26 pounds/year of TSS (TMDL Analysis for Frederick County, Maryland).

Based on this data, TMDL reductions of nitrogen, phosphorus, and TSS are expected after installing a rain garden, grass swales, and permeable pavement in the smaller M-NCPPC parking lot. If about half of the 2.26-acre parking lot (1.13 acres) is transformed into a rain garden, TMDLs of nitrogen, phosphorus, and TSS will be reduced by 1.73 pounds/year, 0.37 pounds/year, and 84.86 pounds/year respectively. If the remaining half of the parking lot was repaved with permeable pavement, the nitrogen, phosphorus, and TSS TMDLs would be reduced by 1.31 pounds/year, 0.16 pounds/year, and 127.15 pounds/year respectively. Finally, if one-meter-wide step-pools were built along the parking lot's edge where it meets the creek (approximately 0.05 acres), TMDLs of nitrogen, phosphorus, and TSS would be reduced by 0.24 pounds/year, 0.014 pounds/year, and 5.83 pounds/year respectively.

Addressing the parking lot as a point source would transform the smaller lot on the side of the building into a rain garden that would filter pollutants in runoff and create an aesthetic space for M-NCPPC employees and members of the community to enjoy. This project will not only minimize the environmental impact of the M-NCPPC parking lot and provide a fun and functional space for community members but also to serve as a framework for future runoff reduction projects, a model of incorporating best management practices.

Implementing these stormwater management methods aligns with the goals of the Green New Deal by repairing and upgrading old infrastructure to reduce environmental pollutants and reduce greenhouse gas emissions by increasing carbon sequestration via vegetation.

Methods

The initial assessment for redesigning the parking lot included researching and assessing the site virtually using Google Earth Pro. First, we noted that the parking lot is in two sections: a larger lot directly across from the rear of the building, and a smaller lot to the east of the larger lot. Examining the images on various dates showed that the smaller lot was at less than 25 percent capacity most of the time and the large parking lot was only at approximately 50 percent capacity. This use pattern focused the design on converting the smaller parking lot into a rain garden that would significantly increase infiltration and reduce runoff into the creak at the end of the parking lot.

At a meeting with the M-NCPPC clients to discuss ideas and gain design feedback we learned that design should implement stormwater BMPs to reduce runoff and create an enjoyable community space, possibly suitable for hosting events. Accordingly, the team researched ways to make outdoor spaces more interactive, including a community garden, an outdoor jungle gym for both adults and children, and an outdoor workspace for employees. The clients also mentioned designing the space to incorporate the shed at the edge of the parking lot.

The next step of the design process was a meeting with Theodore Levy and several colleagues for site visit. The focus of the visit was the area of the parking lot slated for redesign and an adjacent area dedicated to a walking path. The parking lot slopes to a creek—likely a tributary of the Chesapeake. A grass swale along the south edge of the parking lot could keep runoff out of the creek. The site visit was also an opportunity to learn how the group would like to see the space designed for their own use.

The existing walking path was a point of interest. The group agreed that while the path was good for exercise and to appreciate nature, its small loop became monotonous. The desire for more extensive and varied walking paths suggests that expanding this feature would be well-received. The group also reported that water pools on the walking trail adjacent to the parking lot. To meet the goal of a longer path that can drain water, trail would connect to the permeable pathway that would line the perimeter of the rain garden. As a best management practice, permeable pavers would be used.

The idea of adding space to eat was brought up by several employees, including an area for food trucks during lunch hours, picnic benches and tables shaded with solar panels that could accommodate charging devices. This feature could be open to community members, creating a more inclusive space. A space for community members to gather and eat requires proper disposal methods so the space would include several trash cans, recycling bins, and compost bins with directions for what materials go in which bin. This would make it easier for waste to be put in the right place and keep the area as clean as possible.

The space should also appeal to members of the surrounding community, and it could include a multipurpose court or field and installations for games like ping pong, which would provide recreational opportunities for employees and community members. The path is already lined with some are installations on the lawn, which could be expanded, giving the area more color, and interest. The older pieces, 2-D metal structures along the walking trail are old and rusted; their material could be repurposed to create new, more modern and inviting artwork.

This location is near the Beltway (I-495), separated by the creek. The roadway noise should be buffered by natural sound barriers. The line of trees along the edge of the property provides very little insulation from sound from the highway. The addition of Yew trees

along the riparian zone would help block some of the Beltway noise and create a better environment for activities outside of the building.

Designs were presented at the second client meeting along with a walkthrough of the project's progress. The design options in the slide presentation with a visualization of the revitalized parking lot incorporated client feedback, and comments from a passerby, who was walking around the parking lot for exercise.

Based on the collected data, the design expands the walking path, and makes it more sinuous, as a result longer and less monotonous. The design also incorporates a connection to the building entrance for easier accessibility for employees who will be the primary users. Additional feedback led us to minimize the area of the gym and playground, since these features may not garner much use from staff since they lack a wash station to freshen up after physical activity.

Levy and the team showed interest, however, in the basketball court, as well as the picnic tables and outdoor workspace, which we were advised to enlarge and move closer to the building. We also were asked to be mindful of using vegetation with high pollen near the workspaces and picnic tables. One of the finals comments was to include dimensions for the BMPs and functional features, as well as the number of available parking spaces after the redesign of the lot.

In the final design, half of the 2.26-acre lot is designated for stormwater infiltration via rain gardens, while the other half is designed as an outdoor space for community members and employees. This space would include shaded benches with solar-powered outlets for employees to enjoy fresh air while they work, shaded picnic benches for lunch breaks and community events. Permeable pavers are used in this community space and the walking path that would connect with the older path to form an infinity-shaped route. This path could possibly branch to connect to the shed in the corner of the lot, as well as with the "Largo Loop," a larger project meant to extend walking and hiking trails.

Layout Details

Figure 1 is the first design for the layout of the parking lot, meant to serve the community. The gym/playground area and the basketball court are closer to the main road, where they are visible and accessible.

Through iterations with clients, Figures 2 and 3 are more oriented to employee use. The outdoor workspace is closer to the building entrance so that employees can easily walk to and from the

building during breaks, or to work outside. The rain gardens were consolidated and placed in a more centralized area for easier maintenance.

At the client's request, specific dimensions for the features are estimated using Google Earth Pro. The length of the original trail, about 313 meters, is more than doubled to 728 meters (about half a mile). The playground/gym area about 0.2 acres and the workspace is slightly larger at 0.25 acres. The porous court measured roughly 0.02 acres. The total size of the step pools (located along the perimeter of the lot near the creak) and the picnic area would both be about 0.05 acres. Finally, the food truck lot would be about 0.4 acres (50 10x20-foot parking spaces.)

Figure 1. First draft of the layout of the new lot

Figure 2. A first redesign of the M-NCPPC parking lot

Figure 3. A second redesign of the M-NCPPC parking lot

Estimated Budget and Justification

Estimated Cost of Main Components

Rain Garden: at $4 - $35 per square foot (Chesapeake Bay Trust), between $196,892 - $1,722,805

- Multiplying $4 and $35 by 1.13 acres converted to square feet
- Cost varies based on the complexity of the rain garden system, the plant materials, the installation process, etc.

Pavement: $384,891.40 - $855,391 (Chesapeake Bay Trust - Permeable Pavement Fact Sheet and The Baltimore Sun)

- Multiplying acres converted to square feet by the price and adding the components for a range of the lowest and highest price points
- Permeable pavement costs are from the Chesapeake Bay Trust - Permeable Pavement Fact Sheet, the porous pavement costs from The Baltimore Sun
- Finals costs depend on the amount of pavement and the chosen layout
- Final estimates should note the pavement types by the use (permeable paving for the basketball court, pathways, food trucks, outdoor gym area, workspace, and current walking path)

Walkway Lights: $688.25 for 25 lights (Bellevue-Build with Ferguson)

- Multiplying $27.53 by 25

Bioretention Step Pool: $48,406 - $185281 (based on bioretention values, King and Hagan, 2011)

- Cost from MD Stormwater BMP Cost Worksheets
- Price variations due to complexity of the bioretention system

Outdoor Equipment: $7,360 (Outdoor-Fitness)

- Ski Walker (two people) - $1,375
- Push Up Bars - $350
- Pull Up Bars - $776
- Floating Balance System - $2,145
- Horizontal Ladder - $1,491
- Swing Set - $1,223

Benches: $291,372 - $302,172 (EnerFusion Inc. and Belson Outdoors)

- Calculated in three different categories: shaded solar benches, shaded solar tables with charging stations, and shaded benches.

- 8 solar benches with shade at $12,495 each
- 6 solar tables with charging stations and shade at $11,985 and $13,785
- 18 shaded benches at $6,639

Installation: general contractor and landscapers

- Not included in the total since the cost is based on an hourly rate and installation time hasn't been estimated
- General Contractor: $19.67 per hour (Houzeo, 2024)
- Landscaper: $18.85 per hour (Houzeo, 2024)
- Costs are based on average Maryland prices (Houzeo, 2024)
- Contractors' fees would be added (Houzeo, 2024)

Total: $929,609.65 - $3,073,697.25

Budget Justification

The budget components cover construction of the rain garden, bioretention step pools, permeable pavement for walkways and other areas used, shaded benches with solar panels, shaded benches in the picnic area, modern workout equipment, and porous basketball court. The rain garden and bioretention step pools address the runoff from the parking lot into the stream and areas of standing water.

To capture sediment before it reaches the creek, the rain garden and bioretention step pools would hold runoff from the parking lot and filter the water before it flows into the stream. The bioretention step pools slows the water into the creek, which reduces the chances of flooding.

Permeable pavement allows rainwater to flow through the pavement and into the soil or into catchment system, depending on the design (Selbig, 2019). Permeable pavement not only allows water to be filtered, it cools the surface so it's not as hot in the summer (Selbig, 2019). The average summer temperature is 72.6 degrees with higher humidity in southern and eastern regions (Maryland Manual). The pavement would mitigate summer climate and keep runoff from the stream.

The client seeks to create areas for sitting outside where employees could have a lunch break or work. More benches with shading would protect from sunlight, rain, snow, etc. Solar panels on top of the shade structure can provide power. Staff to charge their devices and work outside at a better capacity.

A picnic area with benches is another place where employees can eat. M-NCPPC has some workout equipment on the walking path, but the equipment is out-of-date and old. New equipment would bring the space together and should be chosen to benefit M-NCPPC employees and community members.

The basketball court's porous pavement would be a proper surface for basketball and provide another way for employees to participate in recreational activities. An area for food trucks serves events or daily lunch. The walkway lights will be helpful in the winter when the sun sets earlier, and people want to walk on the path at night.

Reducing the Budget

M-NCPPC projects are included in the Prince George's County's Capital Improvement Program and Budget. The 2022 approved budget was $196,993 and for 2022-2027 is $485,475 (Prince Georges County Government). Even though the estimated cost is larger than this budget, there are grants that would help fund the project.

The Chesapeake Bay Trust's Stormwater Stewardship Grant Program would help fund the project. Although the deadline has passed, an application can be submitted when the program opens.

The Maryland Sea Grant is another funding source. Their grant funding for 2022 was over $4 million without State funding and over $6 million with State funding (Arc GIS StoryMaps; Sea Grant Maryland, 2013). The program focuses on aquaculture and fisheries, but this project relates to the health of the Chesapeake and is worth exploring.

Other applicable grants from the Chesapeake Bay Trust include Rain Check Rebate; Prince George's County Stormwater Stewardship; Green Streets, Green Jobs, Green Towns; and Watershed Assistance Grant Program; and the Chesapeake and Atlantic Coastal Bays Trust Fund. These grants range in their funding amounts.

Another option would be to use vegetation from local nurseries such as Patuxent Nursery, Green Landing Nursery, Bona Terra, etc. This would lower the costs of the rain garden. Determining the type of rain gardens and bioretention step pools will give a better idea of the price and potential for cost reductions.

Conclusion

This parking lot redesign has significant benefits including reduced TMDLs of nutrients and sediment into the creek, reduced heat island effect, and the creation of a community-centered space for employees and community members.

Based on calculations, the combination of rain gardens, permeable pavement, and step pools would reduce runoff of nitrogen, phosphorus, and TSS into the Bay by 3.28 lbs./yr, 0.54 lbs./yr, and 217.84 lbs./yr respectively.

This space will also provide employees with the option to take a break from the inside office space and get fresh air and creates a visible and accessible community space.

This proposal provides stormwater runoff prevention into the Chesapeake Bay while serving the needs of the clients by installing rain gardens, which originated in Prince George's County in 1990. It will inspire other organizations to renovate their parking areas with stormwater BMPs and set a precedent for including stormwater BMPs when building new establishments.

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