Final Progress Report

for Biscuit Run Park Phase 2 Development

Capstone Project ❖ CE 4991
December 13, 2024

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I. Problem Statement

As the population of Albemarle County has increased, particularly surrounding the City of Charlottesville, the southern region has been left with a growing disparity in access to public green space and recreational facilities. Because of this, the construction of a brand new county park – Biscuit Run – has been set in motion by local officials in order to create such recreational facilities and improve quality of life while also preserving natural and historical resources in a developing area. The new park will include walking and cycling trails, athletic fields, pavilions, play areas, and scenic views of Carter Mountain. Spanning 1,190 acres, the park will be situated between Route 20 (Scottsville Road) and Old Lynchburg Road, stretching south from I-64 to just north of Black Branch. Phase 1 of construction for this park concluded in October 2024, which included a new paved entrance to the park by VDOT and the first part of an entrance road to a trailhead parking lot. Phase 2 construction is currently proposed to include extensions of the entrance roads, larger parking lots, terraced sports fields, and a trail system.

The goal of this project is to evaluate the progress of Phase 1, evaluate site conditions, and redesign the park as necessary to better fit the theme of "living with nature", while still meeting the needs of the local community for more recreational space. CAD design deliverables for Phase 2 will be created using Civil 3D for a designated portion of the park.

II. Scope

Working on the second phase of the park's development and construction, our team contributed by designing a portion of the park featuring paved trails, two athletic fields, and a stormwater detention basin in accordance with the 'living with nature' theme. The designated extents of this work within the park's Phase 2 Master Plan Map is included below in Figure 1. Following the development of a phasing plan, Emmy and Grace focused on stormwater management (SWM) design and environmental protection, Joe and Bailey focused on trail design, and Mark and Jordan focused on field design, construction scheduling, and budgeting. Additionally, relevant stakeholders whose perspectives and insight from the Virginia Department of Environmental Quality (VDEQ), the Virginia Department of Transportation (VDOT), the Americans with Disabilities Act (ADA), multiple Albemarle County departments, and the residents of Charlottesville and Albemarle County informed key aspects and details of our final design. In particular, the needs and desires of the Avon Street, Mill Creek Village, Lake Reynovia, Southwood Mobile Home Park, and other communities in close proximity to the park were prioritized. Through our designs, we aimed to better connect these residents to the natural and athletic recreational facilities available at the Design Area of Interest at Biscuit Run Park.

We delivered CAD drawings and associated phasing plans depicting placement of facilities, grading, stormwater management, safety accommodations, ADA compliance, environmental protection, and general implementation with respect to the park's trails and athletic fields, as well as the stormwater detention basin for Phase 2 of construction. In pursuit of these deliverables, we first conducted preliminary research on the park's master plan and sustainable park design, narrowing our focus to the park's trails and athletic fields.

Subsequently, we completed a visit to the project site, and spoke with the communities and organizations involved in the park's construction, so as to best inform our own proposals for the park. Following the physical and social exploration of the project, a preliminary design, detailed below, was developed. Environmental concerns (SWM, stream crossings), accessibility (grading, ADA compliance), and safety (CPTED) were addressed during the design process. This initial proposal will subsequently be examined for all manner of risks that could arise with its implementation, with each concern being quantified into both time and money. Risks will be addressed through a change in either our proposal's design or phasing plan. Ultimately, a set of

CAD drawings, phasing plans, and a presentation detailing both will be delivered to UVA and the project team at AMT Engineering in the spring of 2025.

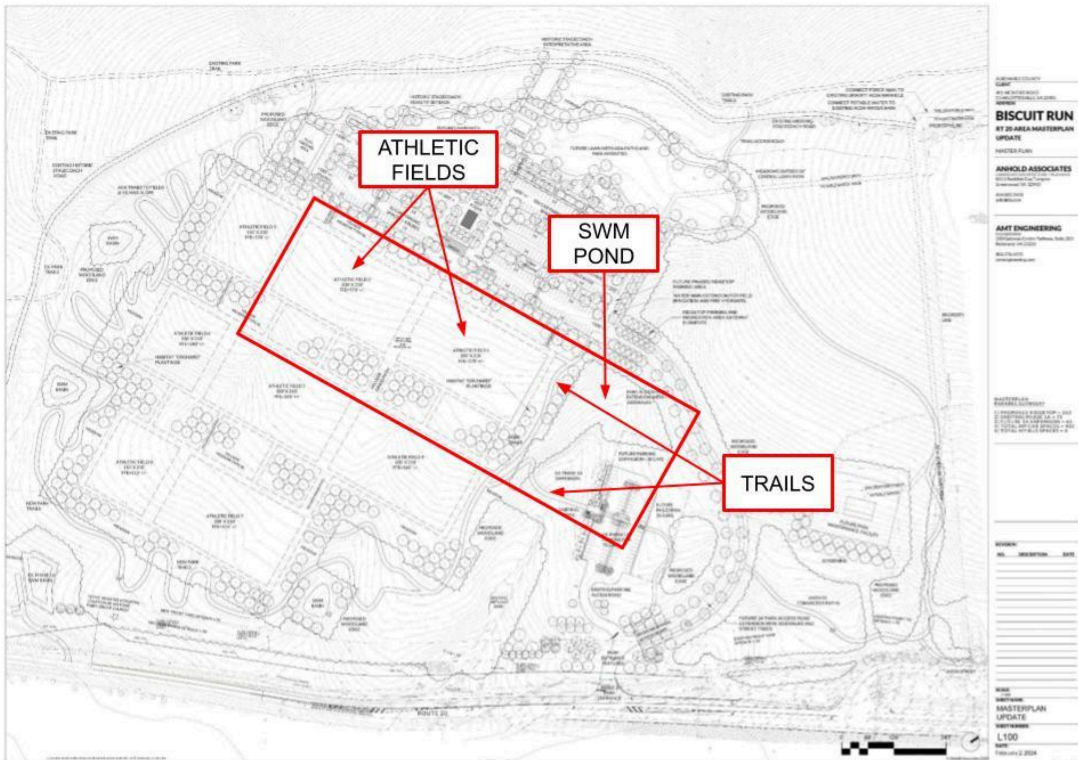

Figure 1: Phase 2 Master Plan for Park with Design Area of Interest

III. Schedule

Our group schedule is set up chronologically based on what we felt was the most intuitive order for design. Tasks are organized under activity group headers and include estimated start and finish dates, along with what group members will be responsible for completing this particular task and what prior tasks, if any, are required for completion. The first activity group was “Initial Planning and Research”, which was conducted from 9/9/2024 through 9/30/2024. During this phase, we familiarized ourselves with the park’s master plan, Phase I construction status, and sustainable park design principles in order to uncover our role and develop our scope. One of the tasks in this subheading is “Stakeholder Meetings”, which will last the entire duration of the project, since we feel it is important to continue conversations with our advisors, local residents, and future users of the park. After all, the stakeholders' wants and needs are at the core of all design decisions. Next, the “Site Visits & Data Collection” stage stretched from 10/1/2024 until 10/14/2024 and included research into environmental needs and the community, culture, and history of the area.

We have recently completed the “Preliminary Design” phase, during which we completed trail layout and grading, stormwater and VRRM analysis, BMP design, and other Phase 2 improvements outlined in our scope. The progress went according to the planned schedule, with no significant setbacks encountered. After winter break, we will resume work, beginning with an evaluation of our design’s environmental and community impacts as well as a review by the project’s stakeholders. February will see the development of a phasing plan, followed by research into all necessary to the project and the finalization of all CAD drawings during March. After compiling all of our finalized drawings into a complete set, our final design and implementation plans will be presented to UVA Engineering faculty, AMT Engineering associates, and representatives of Albemarle County. The full schedule created for this design process can be found in Appendix A.

IV. Current Progress

Due to the nature of our project, we were encouraged by our advisors to spend a significant amount of time in the fall researching and understanding Biscuit Run Park, as well as sustainable park design as a whole. This research included looking into the history of the park and understanding how the property has changed hands over the years, wrapping our heads around the timeline that has brought us to the construction of Phase 1 that is currently underway (land exchange articles: 1, 2). We also grew familiar with the current master plan shared by Don, as well as all county reports and news articles. We investigated the Albemarle GIS database and Google Maps to get a better understanding of the roads, amenities, and neighborhoods around the site. The Virginia Department of Environmental Quality has an Environmental Justice Screen website, which confirms to us that the neighborhoods to the north and west of the park are low income communities (~75-90% of the population) and ~80% of the residents are people of color. Research into existing environmental conditions was also conducted. The land is mostly forested, and the entire site consists of Type B soils. Through our designs, we will convert land use into impervious (roads), (fields, vegetation along roadways, planted areas, etc), and mixed areas (water main). Some general research into sustainable park design that could be applied to Biscuit Run is included in Appendix B.

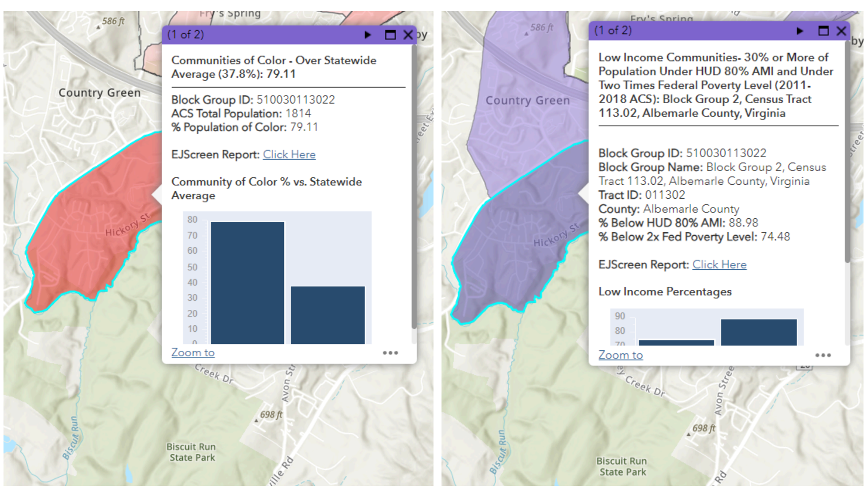

Figure 2: Virginia DEQ Environmental Justice Screen Website Data

Directly across Route 20 sits Brookhill Farm, an equestrian center. Because previous master plans for the site included equestrian trails and parking, Grace reached out to the owners of Brookhill to see if anyone had previously discussed with them the possibility of a partnership, to which they responded that they had not been contacted, but that they would be happy to assist us if we did decide to go the equestrian route. They pointed out that trails with horses, bikes, and pedestrians could be dangerous, but one solution could be for trails to be assigned different uses on different days.

Grace has arranged to meet with Peter Krebs, who works as an advocate for the Piedmont Environmental Council. In 2023, Peter wrote an article titled "Making Biscuit Run Park Available to Everyone", in which he detailed the importance of walkability and neighborhood connections so that all people, regardless of their income level or race, will be able to enjoy the park. Our conversation about access, equity, and community were extremely informative and will allow us to design for a more inclusive Biscuit Run.

Grace also made a visit to the Albemarle County Historical Society to see what information could be found about the old stagecoach road that bisects the park, which we envision being a valuable learning opportunity and could serve as an attraction for school field trips and history buffs. Don has heard that Thomas Jefferson once used the road, and according to the Anhold Associates website (the landscape architecture firm for the project), the road was originally constructed in the 1730s to connect Charlottesville and Scottsville. Because of Scottsville's location on the James River, it was a major trading and transportation hub at the time. Historical Collections Librarian Miranda Burnett compiled maps, old newspaper clippings, and Pawlett's series of abstracted Road Order Books. The following clippings in Figure 3 include mention of "Bisckett Run" or the nearby Mill Quarter, which gives us some names, dates, and jumping off points for further research into the roads history we can use for interpretation.

Emmy also served as the go-between for our team and Xavier, a CAD specialist at AMT Engineering who works with Don. In addition, she set up the necessary CAD files, troubleshooted XREFs and data shortcuts, and set up meetings with Xavier for CAD related questions. This allowed other group members to begin exploring the files and thinking about how the design can best be improved. Since Civil 3D is fairly new to most of us, we expected a bit of a learning curve with the CAD portion of the design, particularly when grading. Our regular meetings with Don and Xavier served as a sounding board for any questions that arose throughout the semester.

activity along the western side of Carter's Mountain around the late Secretary's Foard, Secretary's Mill and Secretary's Mill Quarter near the later site of Carter's Bridge. The first road order that day called only for an alteration by Charles Lynch and Edwin Hickman "Gent[n]" of the road to the "Secretarys foard on North River" and probably referred to a rerouting of the road from Key's Mill down the east side of the Rivanna River to the Secretary's Ford. The next local order was for maintenance of the "Road from David Lewis Road to the late Secretary's Mill" and referred to the road leaving the Three Notch'd Road and following roughly the line of Avon Street ➤ Route 742 ➤ Route 20 or else Route 20 from Moore's Creek to the Mill just above the present Carter's Bridge. Thomas Sowell was appointed overseer with his hands, "the Inhabitants on Biskett Run" and "the Secretarys hands that live above the Mountain" (those at the Mill Quarter) to help him keep the road in order.

Beyond this it was now ordered that a road be cleared from "the late Secretarys Mill to the Court House". Although this road may have continued down the Hardware River to cross at the ford near the later plantation Belle Aire, it is more likely that it followed the more direct line along the present Route 20 south to intersect the River Road near the Court House. The Secretary's Road to his Tye River Quarter left the Mill also but, unfortunately for those going to court, it tended in a more southwesterly direction, diverging from the most direct line to Albemarle Court House.

Besides the work on this predecessor of Route 20 from Charlottesville to Scottsville, work continued on roads which joined it, leading east and west. David Lewis was now ordered to maintain Three Notch'd Road to the Secretary's Ford. Martin King's Road, running eastward from the Secretary's Mill to cross the Rivanna River (Route 708 east from Carter's Bridge) received a new feeder opened by James Taylor. This may have been along Route 795 from the Hardware River (James Taylor's Ford) or may have been the road through the Mount Pleasant plantation to join 708 to the east of the present state road.

In October (10 October 1746 O.S.) the ferry at Albemarle Court House was relocated slightly to run from the land of William Battersby across the James River to the mouth of Totier Creek, and this necessitated the removal of the road on the south side of the river to a new route running through Battersby's land. This would appear to be the same location it occupied in 1754 when a plat of the horseshoe bend in the James River shows a road descending to it. That this new ferry site also required some work on the north side of the river is evident from an order the next spring (13 March 1746 O.S.) for a road from the mouth of Totier up to the Court House.

During the winter road orders continued to be issued for work in the outlying portions of greater Albemarle, but little was being done within the present confines of the county. With the coming of spring, activity resumed with the appointment (12 March 1746 O.S.) of a surveyor for a portion of the Three Notch'd Road from "Number Twelve to the County Line". Here, interestingly enough, the road is called "the Mount Road" for its old name, Mountain Road, which seems to have generally passed out of use in the road orders after about 1743. Although orders were issued in April for the maintenance of the River Road and the road from the Court House to Martin King's Road, actual road building during the summer occurred only in those areas later to be within

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opened, it had to be maintained and improved by the same named surveyor and labor gang. No one was paid for this work. It was hard labor for all - axe, pick, and shovel, grubbing hoe, horse and plow. Simple log and rock bridges had to be built across numerous small streams. Often the work was performed in the winter months in miserable weather - rain and cold. If one failed or refused to serve, the justices ordered the county Sheriff to investigate the circumstances of one's negligence of duty. The shirker could appeal to the court. If found negligent the court could levy a fine.

There were many early, notable roads in the Piedmont region. One of the first roads was the **Mountain Road**, better known as the **Three Notch'D** or **Three Chopt** road. Its path was from present day Richmond northeast through present day Charlottesville and over Woods Gap in the Blue Ridge into the Valley. Its name derived from axe marks on trees blazing the way. Originally it was a series of Indian and animal trails connected by settlers slowly improving the way as they moved west into the wilderness. Three Chopt road was not really planned - it just simply came about. Us Highway 250 closely follows the path of Three Chopt road.

Some of the first segments of Three Chopt appear in the Goochland County Court records of 1733 when the court ordered the improvement of part of the road "also known as the Mountain road." In 1734, the Goochland court appointed Peter Jefferson as "surveyor of road from mountains to Licking Hole Creek in the room of Henry Runnalls." Later, the name "Three Notch'D Road" appeared in the court records. Another important road was the SECRETARY'S ROAD named for John Carter, Secretary of the Colony (1690-1743). Carter patented 9350 acres just south of present day Charlottesville and established two quarters - Clearmont and Mill Quarter. The Mill Quarter was located at HWY 20 and Hardware River east of the Crossroads on US 29.

In 1740 Carter's employees began opening a road from the mill southwest and eventually to the Tye River and then on to Carter's 10,000 acre patent on the Piney River (just above Roses Mills). There was another of Carter's roads extending from the Fluvanna to his mill quarter. Finally there was the "Secretary's Ford" at the Rivana River (I-64 crossing) where later a bridge was built- and rebuilt after floods. John Carter never lived at his quarters in Albemarle or Amherst Counties.

The early court records of Goochland, Albemarle, and Amherst Counties are replete with road orders and other entries dealing with roads. What we take for granted (and pay with our taxes) today was very serious, important, and local to the citizens and their government in the early days of the colony. Following are examples extracted from the early court order books.

GOOCHLAND ORDER BOOK 1730-1731

Court- TUESDAY 21 JULY 1730

Survey of the roads on a motion of Edward Scott - ordered that a road be cleared from the fork of the James River to the mouth of Rockland River. My Chamberlain, Coches and DIGGES titheables. John Phelps Surveyor.

ALBERMARLE Co ORDER BOOK - 1745

23 May 1745 O.S., p. 13
Road.
On the motion of Robert Rose Clerk, leave is granted to him to clear a road from his plantations on Tye River to Leak's Plantation.

23 May 1745 O.S., p. 13
Road.
On the motion of John Harvie leave is granted him to clear a road from the Mouth of Tye River to the Branches of Harris's Creek.

27 June 1745 O.S., P. 23
Road.
William Cabell. Gent is appointed Surveyor of the High Way from the foard of Tye River to the Court House, the Male Tithables betwixt the said road and the river; and **??????**

27 June 1745 O.S., P. 23
Diret. N & C.
The Surveyors of several high ways within this county are ordered to setup posts with direction at the several forks of roads with in their respective districts; according to law, and that the said directions be set up at least ten feet from the ground.

25 July 1745 O.S., Horse P. 23
Scotts. ferry.
On the motion of Daniel Scott leave is given to him to keep a ferry from the court house landing to the opposite side he giving cond. and security as the law requires.

26 Sept. 1745 O.S., P. 64
Road.
Ordered that John Graves be overseer of the road from the mouth of the Tye River to the Branches of Harris's Creek and that all the Male Tithables between Buffaloe River and the Fluvanna (Charles Lavinder only excepted) do assist the said Graves in clearing the same.

26 Sept. 1745 O.S., P. 65
Road.
Ordered that Moses Higginbottom be overseer of a road from the said Higginbottom's Mill a Cross Buffaloe to Mr. Harvey's Road and that the Male Tithables Between Buffaloe and the Secretarys Mountains do clear the same and that the said Gang do join Jon Graves's to the mouth of the Tye River.

16 Aug. 1746 O.S., p. 164
Road.
Ordered the Road from Jones foard on Tye River be Continued to Swans Creek Mountain and from thence to the Mouth of Swans Creek and that the Secretarys Road be Continued from the Meadows to join John Harveys Road, and that the Widow Johnsons hands and the Inhabitanta of Buffaloe and Tye River be Aded to the hands formerly Appointed for Clearing the same, and that William Cabell Gent. be Overseer thereof,--

End of Part 1

Figure 3: Scans from Albemarle County Road Orders (Pawlett)

Trail Design

Led by Joe and Bailey, this facet of the site design began with the development of a trail layout in and around the athletic fields, connecting to the existing sidewalk and trail network outside of the Design Area of Interest (DAI). A preliminary layout was drawn by Joe in Civil 3D, as shown in yellow in Figure 4. This was subsequently revised based on comments from Don and Xavier by Bailey, as shown in pink in Figure 5. It was from this drawing that data concerning the square footage of impervious surface area was factored into the runoff volume calculations handled by Emmy and Grace. The results of these calculations were conveyed to the design of the bioretention pond, dictating its volume and surface area.

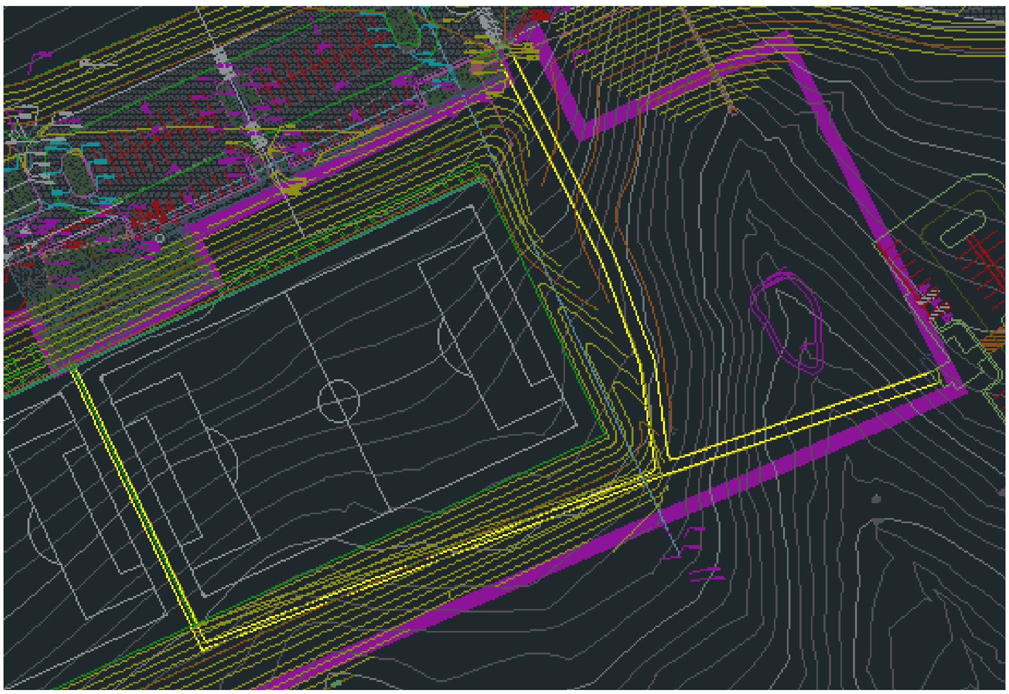


Figure 4: Preliminary Trail Layout in Civil 3D

In order to integrate the paths into the complete site grading plan, Bailey created an alignment along the path trajectory. The elevation points of the alignment were carefully set to match with other features, such as the end connection points and the field crossing, as well as to ensure ADA compliance in both slopes and widths. A profile was generated, with which the alignment was converted into a corridor. Finally, it was converted into a surface. This surface was then merged with the base surface from AMT along with the surfaces from the other features of the project. The merge was facilitated by Joe, Bailey, and Emmy, with consultation from

Xavier. The pathway ring around the bioretention pond required additional grading work to ensure the flow of runoff between the fields and the pond, as certain artifacts from the grading combinations required alterations or smoothing. Thus, Bailey modified the grading around the pond into a bowl-like shape that was wholly conducive to the flow of stormwater into the bioretention pond. This culminating adjustment completed the final site grading plan we have at present.

The main portion of the trail (following the southern edge of the DAI before turning to run between the two fields) is fully wheelchair-accessible. The ‘shortcut’ segment of the trail (located between the east field and retention pond), however, had too steep of an elevation change to be wheelchair accessible without significant alterations. Since the main portion of the trail already provides access to all features of the site (including both parking lots and both fields), we made the cost-saving decision to leave the ‘shortcut’ segment non-accessible. Instead, stairs were implemented to bridge the elevation gap most efficiently. Rather than a single set in the middle, however, the stairs were divided into two sets, one at the upper parking lot connection and one at the lower trail intersection. This provides users with an implicit understanding of which route is accessible.

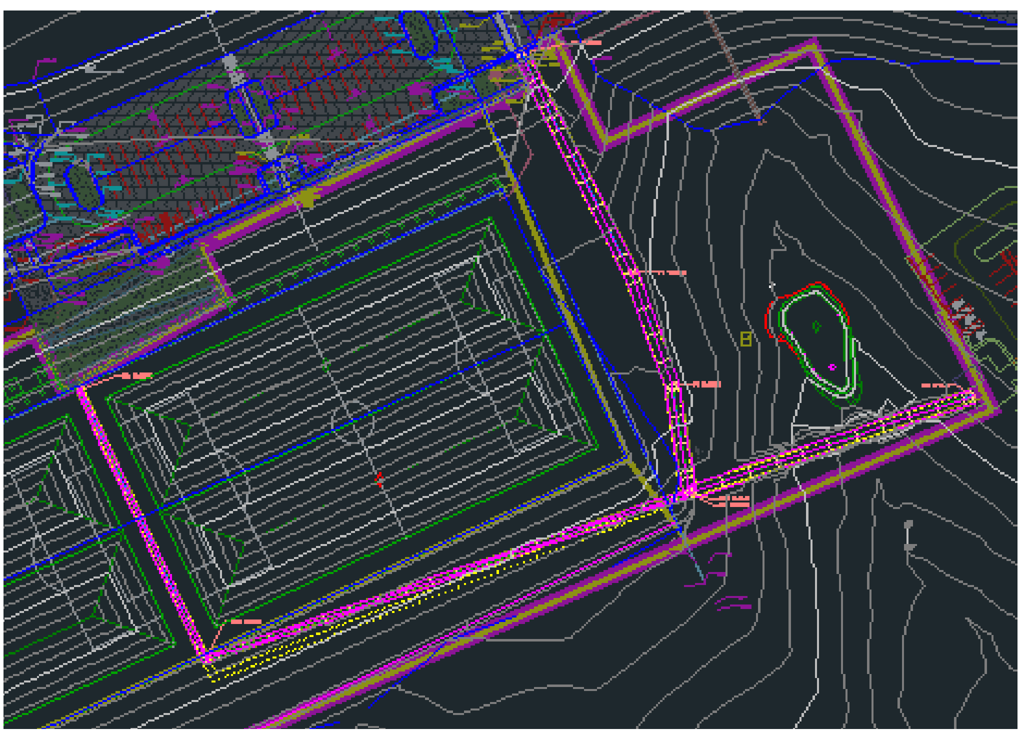


Figure 5: Final Trail Design in Civil 3D

Stormwater Management

Emmy began conducting research into the stormwater management, erosion and sediment control, and BMP sizing based on VRRM, VA BMP Clearinghouse, and VA DEQ SWM Handbook standards. Based on rough estimates of post-development land use, Emmy began calculating preliminary VRRM calculations for our area of interest (or AOI, see Appendix B). Through this analysis, a better understanding of which BMPs are appropriate for the site and its runoff removal requirements was gained.

Emmy and Grace worked together to design the site's stormwater management system. For our formal VRRM analysis, uncovering the nutrient removal requirements for our site depended on our trail and athletic field design, which were being designed simultaneously. As a result, our VRRM spreadsheet underwent multiple iterations as the trails and fields were developed and our AOI was adjusted (see Appendix B). Currently, our AOI is divided into three drainage areas (DAs), as outlined in Figure 6. Drainage area A includes the upstream hills, which will be the location of a tree planting BMP, and the athletic fields, which will include an underground rainwater collection system (approximated as infiltration in VRRM). Drainage area B includes the valley where our bioretention BMP will be located, around which our trail system will connect the parking lots to the fields. Lastly, drainage area C includes the downstream hills, which will be counted as mixed open land, with the exception of the trail (impervious). While permeable pavement was considered for our trail system, we ultimately decided against this BMP because, according to the DEQ handbook, permeable pavement would require 0% lateral slope and max 5% longitudinal slope, which would be very difficult to achieve with our site's geography. Also, most of the site's soils are clay and silt, which have low infiltration rates and would require an underdrain system.

Mark and Jordan worked on designing a rainwater collection system underneath the athletic field. They decided to choose natural grass turf for cost purposes. Infiltration was selected as the best approximation for this in VRRM, with the grass being used as a pretreatment method. While we are not actually using an infiltration BMP, its nutrient removal rates should be similar. The rain collection system will consist of grass on top, engineered soil media, and an underdrain to collect and move water, similar to a green roof, but underground.

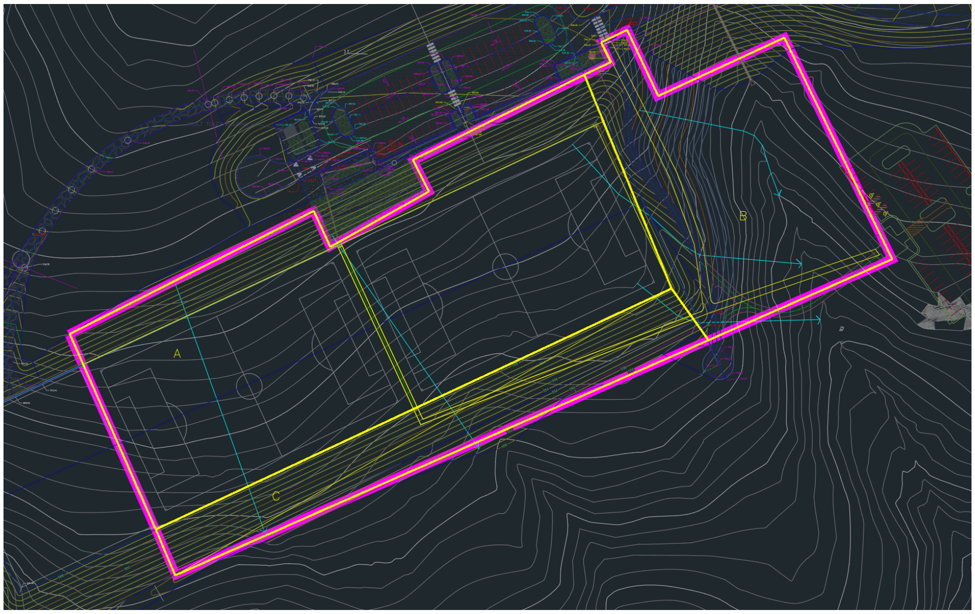


Figure 6: AOI and Labelled Drainage Areas

The tree planting BMP on the upstream hills will have a total of 55 trees, according to the design criteria outlined in the DEQ handbook. The steeper slopes of the hillsides, sunlight availablity, soil types, drainage, and spacial needs were all taken into consideration for species selection, and recommended trees are detailed on the Tree Planting BMP Design Criteria & Schedule Document (see Appendix B). The bioretention BMP will be a type 1 with no underdrain. Based on our calculations, 0.02 acres of surface area are currently required, but our design rounds this area up to 0.06 acres as a form of climate resilience, since rainfall intensities are expected to increase in the coming years.

Our bioretention design uses the minimum depths for all media layers. There was discussion about whether our bioretention should be online or offline, and we ultimately decided that offline made the most sense for our site. Therefore, our bioretention includes an overflow structure pipe, sized to handle 100-year storm flows, that will connect to an underground pipe that serves as a diversion structure and discharges water offsite (out of our scope, will not be detailed in our drawings). Flow that exceeds our bioretention's design capacity will be captured by the overflow pipe, and brought offsite via the diversion pipe. The overflow pipe was sized using the sharp-crested weir formula, where flow rate was calculated using TR-55 for a 100-year storm and weir length equaled pipe circumference (see Appendix B). Our bioretention was graded in Civil 3D with 3:1 side slopes, strategically choosing top and bottom elevations to ensure the net fill value is very small. Slopes of 2:1 were used outside of the bioretention basin to reconnect to existing grade without running into the trail design. Because our bioretention is larger than required, it will be capable of handling the runoff from these steeper incoming slopes. The trails are graded towards bioretention, tree planting, and field BMPs so that all runoff rainwater will be sustainable managed. With the addition of these BMPs, our site currently exceeds its total phosphorus load reduction requirements by 0.04 lb/year. The excess removal of nutrients should contribute to the site's resilience towards climate change.

The final stormwater management task of the fall semester was to begin sizing the temporary sediment basin, a requirement during Phase 2 construction. The calculations for the sediment basin can be found in Appendix B. These calculations were done according to the process described in Virginia DEQ's Stormwater Management Handbook, with the assistance of a spreadsheet provided to us by our advisors at AMT Engineering. The basin design will not be finalized or implemented into CAD until the Spring Semester, when erosion and sediment control plans are finalized.

Field Design and Cost Estimation

Mark and Jordan's cost estimations for the athletic fields are focused on field size, surface type, soil preparation, and drainage systems. Using historical data, they have found that the estimated cost to implement these drainage systems per field of the Underground Stormwater Retention System and the Permavoid Capillary System were $270,000 and $648,000, respectively. Cost estimates were developed for performance turf and natural grass. Performance turf construction costs range from $11 to $18 per square foot, leading to total costs of $594,000–$972,000 per field. For natural grass, costs are significantly lower at $4 to $9 per square foot, equating to $216,000–$486,000 per field. Native soil and engineered soil were considered for field bases. Using native soil aligns with performance turf costs ($11–$18/sq. ft.), resulting in total expenses of $594,000–$972,000 per field. Engineered soil is more expensive, ranging from $15 to $23 per square foot, with total costs between $965,250 and $1,242,000. Using comparative cost analysis tables, Mark and Jordan recommend using natural grass due to its cost-effectiveness compared to performance turf. Additionally, implementing an underground stormwater retention system aligns with both budgetary constraints and functional requirements for effective drainage. The final cost estimation using our chosen parameters of natural grass, underground retention system, native soil, and a 54,000 sqft field totaled to be around $500,000 per field.

V. Design Standards

Different aspects of the project necessitate adherence to different sets of standards.

While the expansive trail systems within the park may adhere to different guidelines pertaining to their functions and intended accessibility level, the scope of this project focuses specifically on the area of integrated sports facilities. As per the ADA Accessibility Guidelines supplement regarding recreational facilities, such areas must comply with 2010 ADA standards in the process of making an accessible route to each field in the complex. The most important requirements for such walkways are the maximum running slope (5%), maximum cross slope (2%), and minimum width (3 feet). Implementation of additional features such as handrails, if necessary, will be determined by these guidelines as well. Specifically for curb ramps at parking lot connections, VDOT standards will take precedence regarding their construction elements.

The athletic fields themselves have been selected to be soccer fields. The local market is primarily geared toward middle- and high school-aged sports; because of this, NFHS (National Federation of State High School Associations) minimum standards will be used for the field design. These standards pertain to field slope and size elements. The recommended size for the playing pitch is 65 by 110 yards. The planned surface medium is natural grass with a subsurface drainage system, in alignment with the park's overall emphasis on natural elements; the minimum slope for such designs is 1%.

With regards to stormwater management over the project area, best management practices (BMP) will be designed using the requirements and equations in the Virginia DEQ's Stormwater Management Handbook version 1.1 (June 2024). Water quality through these systems will be maintained in accordance with the VRRM (Virginia Runoff Reduction Method) version 4.1 (July 2024) spreadsheet and requirements. The TR-55 method (Technical Release 55, as defined by the USDA) was also used to calculate some relevant flow rate and time of concentration values.

Further design considerations include adequate lighting for both the walkways and fields, a necessity for safety along the paths and functionality of the pitch after dark. In addition, the implementation of bike racks and benches is planned throughout for user enhancement. Because the project area is situated at the main entrance to the park, aesthetic landscaping, including the re-inclusion of native trees and vegetation post-construction, is planned. Finally, close alignment and coordination with the construction of the surrounding recreational area and throughout the rest of the park is central to the integration and success of this project segment.

VI. Future Plans

This project spans over the course of two semesters, split into stages A and B.

Stage A consisted of preliminary research (including the establishment of the scope and scheduling plan), initial site inspection and data collection, as well as creation of a preliminary technical design and grading plan. In December of 2024, stage A was successfully completed, with its findings and deliverables consolidated within this end-of-semester report.

Following the winter break, stage B – encompassing the project evaluation and final design – will commence, with an estimated completion of April 2025. In the spring semester, Grace and Emmy will revise the VRRM analysis and BMP design for Biscuit Run that was developed during the fall semester, implementing any changes that may arise due to evolving trail and field design or stakeholder comments. Temporary sediment basin design will also be revised and finalized upon completion of the phasing plan and erosion and sediment control plan. This basin will then be added to our CAD drawings. The potential environmental and community impacts of the project will be evaluated and mitigated, and a detailed phasing plan will be developed so that all three scope elements (trails, fields, and SWM) can be constructed without conflict. The Civil 3D drawings will then need to be stylized and converted into plan sheets for our final presentation in April.

Further breakdowns of the current and future progression through these stages can be found in Appendix A.

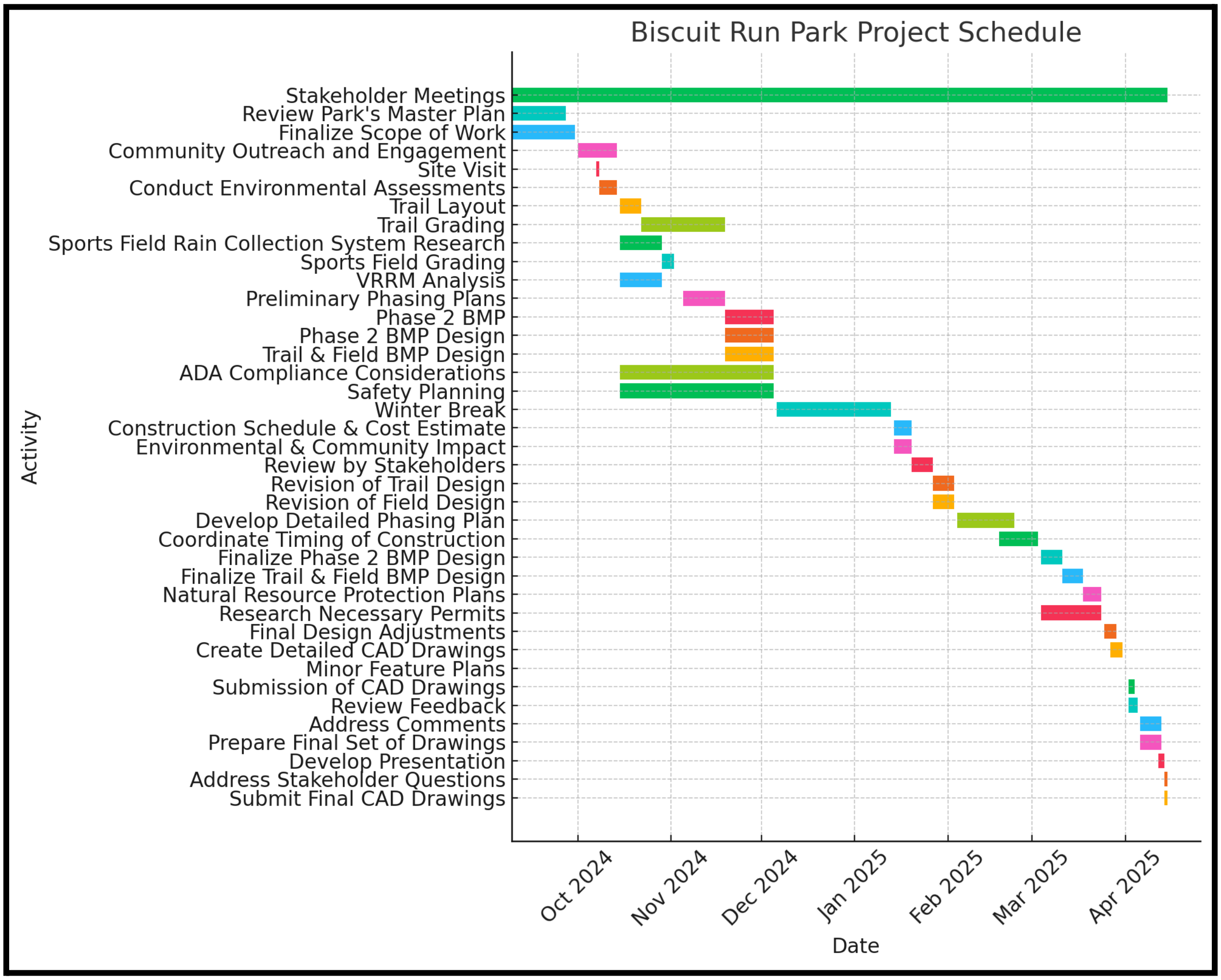
VII. Appendix A

Detailed Schedule

1. Excel Chart

Activity ID	Activity	Duration (days)	Start	Finish	Group Members	Predecessors
Initial Planning & Research			**9/9/2024**	**9/30/2024**		
A	Stakeholder Meetings	218	9/9/2024	4/15/2025	All	none
B	Review Park's Master Plan and Sustainable Park Design Principles	18	9/9/2024	9/27/2024	All	A (SS)
C	Finalize Scope of Work & Objectives	21	9/9/2024	9/30/2024	All	A (SS)
Site Visits & Data Collection			**10/1/2024**	**10/14/2024**		
D	Community Outreach and Engagement	13	10/1/2024	10/14/2024	Grace	C
E	Site Visit for Physical Exploration	1	10/7/2024	10/8/2024	All	none
F	Conduct Environmental Assessments (SWM, stream crossings)	6	10/8/2024	10/14/2024	Grace & Emmy	E
Preliminary Design Phase			**10/15/2024**	**12/5/2024**		
G	Trail Layout	7	10/15/2024	10/22/2024	Bailey & Joe	E
H	Trail Grading	28	10/22/2024	11/19/2024	Bailey & Joe	G
I	Sports Field Rain Collection System Research and Estimating	14	10/15/2024	10/29/2024	Jordan & Mark	E
J	Sports Field Grading and Design Improvement	17	10/29/2024	11/15/2024	Jordan & Mark	I
K	VRRM Analysis for Site	14	10/15/2024	10/29/2024	Grace & Emmy	E
L	Permanent BMP Design	23	10/30/2024	11/22/2024	Grace & Emmy	H, J, K
M	Trail & Field BMP Design	23	10/30/2024	11/22/2024	Grace & Emmy	H, J, K
N	Preliminary Phasing and ESC Plan	23	11/12/2024	12/5/2024	Jordan & Mark	L,M
O	Preliminary Phase 2 Construction Detention Pond Design (calculations)	17	11/19/2024	12/5/2024	Grace & Emmy	N
P	ADA Compliance and Accessibility Considerations	51	10/15/2024	12/5/2024	All	M,N,O (FF)
Q	Safety Planning (Crime Prevention Through Environmental Design)	51	10/15/2024	12/5/2024	All	M,N,O (FF)
Project Lull			**12/6/2024**	**1/13/2025**		
R	Winter Break	38	12/6/2024	1/13/2024	All	Q
Review & Risk Assesment			**1/14/2025**	**2/3/2025**		
S	Construction Schedule & Cost Estimate	6	1/14/2025	1/20/2025	Jordan & Mark	Q
T	Environmental & Community Impact	6	1/14/2025	1/20/2025	Grace & Emmy	S (SS)
U	Review by Stakeholders	7	1/20/2025	1/27/2025	All	T
V	Revision of Trail Design	7	1/27/2025	2/3/2025	Bailey & Joe	U
W	Revision of Field Design	7	1/27/2025	2/3/2025	Jordan & Mark	V (FF)
Phasing Plan Development			**2/4/2025**	**3/3/2025**		
X	Develop Detailed Phasing + ESC Plan for Trails, Fields, and SWM	19	2/4/2025	2/23/2025	Jordan & Mark	none
Y	Coordinate Timing of Construction Phases with Environmental & Community Factors	13	2/18/2025	3/3/2025	Jordan & Mark	none
Environmental Impact Mitigation			**3/4/2025**	**3/24/2025**		
Z	Finalize Phase 2 Construction Detention Pond Design (check calcs, add in CAD)	7	3/4/2025	3/11/2025	Grace & Emmy	Y
AA	Finalize Trail & Field BMP Deisgn	7	3/11/2025	3/18/2025	Grace & Emmy	Z
BB	Natural Resource Protection Plans	6	3/18/2025	3/24/2025	All	AA
CC	Research Necessary Permits	20	3/4/2025	3/24/2025	All	Z (SS)
CAD Drawing Finalization			**3/25/2025**	**3/31/2025**		
DD	Final Design Adjustments Based on Risk Assesments & Feedback	4	3/25/2025	3/29/2025	All	CC
EE	Create Detailed CAD Drawings for Trails, Fields, and Infrastructure Elements	6	3/25/2025	3/31/2025	All	DD
FF	Minor Feature Plans	4	3/27/2025	3/31/2025	All	EE
Review & Approval by UVA and AMT Engineering			**4/1/2025**	**4/5/2025**		
GG	Submission of Preliminary CAD Drawings & Phasing Plan	0	4/1/2025	4/1/2025	All	FF
HH	Review Feedback from UVA & AMT Engineering	2	4/2/2025	4/4/2025	All	HH
II	Address Comments and Make Necessary Revisions	3	4/2/2025	4/5/2025	All	GG
Final Presentation Preperation			**4/6/2025**	**4/14/2025**		
JJ	Prepare Final Set of Drawings, Reports, and Documentation	7	4/6/2025	4/13/2025	All	II
KK	Develop Presentation for UVA & AMT Engineering	7	4/6/2025	4/13/2025	All	JJ
LL	Address Any Final Questions or Concerns From Stakeholders	2	4/12/2025	4/14/2025	All	KK
Final Delivery			**4/14/2025**	**4/15/2025**		
MM	Submit Finalized CAD Drawings & Phasing Plans	1	4/14/2025	4/15/2025	All	LL
NN	Present Findings & Design to UVA and AMT Engineering	1	4/14/2025	4/15/2025	All	LL
OO	Final Presentation	1	4/14/2025	4/15/2025	All	LL

2. Gantt Chart



VIII. Appendix B

Deliverables, Previous Designs, & Document Links

1. **Advisor Meeting Agendas & Notes (by date)**
    - September 6, 2024
    - September 16, 2024
    - September 30, 2024
    - October 9, 2024
    - October 21, 2024
    - October 28, 2024
    - November 4, 2024
    - November 11, 2024
    - November 18, 2024
    - November 25, 2024
    - December 2, 2024

2. **General Research & Resources Document**

3. **Stagecoach Road Research Document**

4. **Iterative Research & Calculations for Stormwater Management**
    - October 4, 2024: Preliminary VRRM (From Interim Report)
    - October 23, 2024: Updated VRRM & Bioretention Sizing
    - October 24, 2024: Updated VRRM w/ New AOI
    - October 28, 2024: Trying Out Different Bioretention Sizes
    - October 31, 2024: Erosion & Sediment Control Notes
    - November 4, 2024: VRRM & BMP Sizing General Notes
    - November 4, 2024: BMP Design & Cost Estimates
    - November 11, 2024: BMP Design & Grading
    - November 14, 2024: Bioretention & Overflow Sizing Calculations & Diagrams

5. **TR-55 Spreadsheet**

6. **Current VRRM Spreadsheet**

Post-Development Project (Treatment Volume and Loads)

Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals
Forest (acres) -- undisturbed, protected forest or reforested land		0.06			0.06 *
Mixed Open (acres) -- undisturbed/infrequently maintained grass or shrub land		2.47			2.47
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed		3.76			3.76
Impervious Cover (acres)		0.19			0.19
					6.48

** Forest and Mixed Open areas must be protected in accordance with the Virginia Runoff Reduction Method*

Post-Development Requirement for Site Area

TP Load Reduction Required (lb/yr)	1.87

LAND COVER SUMMARY -- POST DEVELOPMENT

Land Cover Summary	
Forest Cover (acres)	0.06
Weighted Rv (forest)	0.03
% Forest	1%
Mixed Open (acres)	2.47

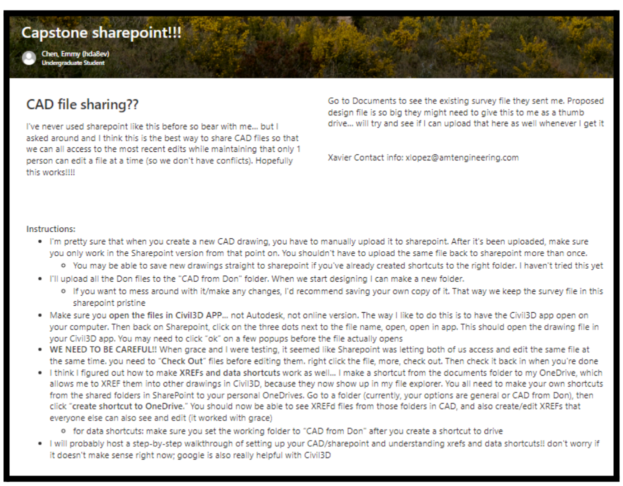
Treatment Volume and Nutrient Loads	
Treatment Volume (acre-ft)	0.1005
Treatment Volume (cubic feet)	4,378
TP Load (lb/yr)	3.55
TN Load (lb/yr)	33.36

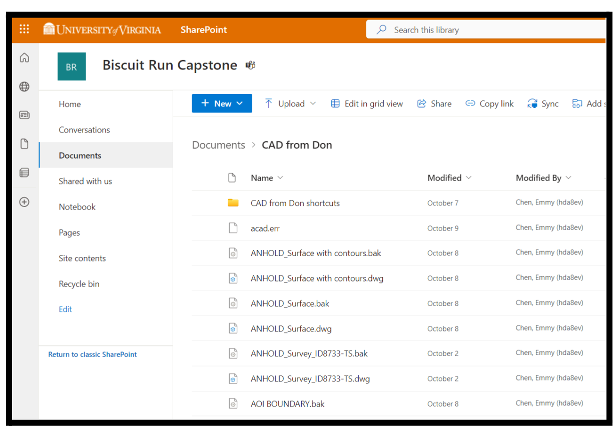
7. **Tree Planting BMP Design Criteria & Schedule Document**

8. **Bioretention BMP Design Criteria & Schedule Document**

9. **Temporary Sediment Basin Design Spreadsheet**
   - December 2, 2024: Preliminary Temporary Sediment Basin Calculations
   - December 4, 2024: Updated Calculations (Better Retrofit)

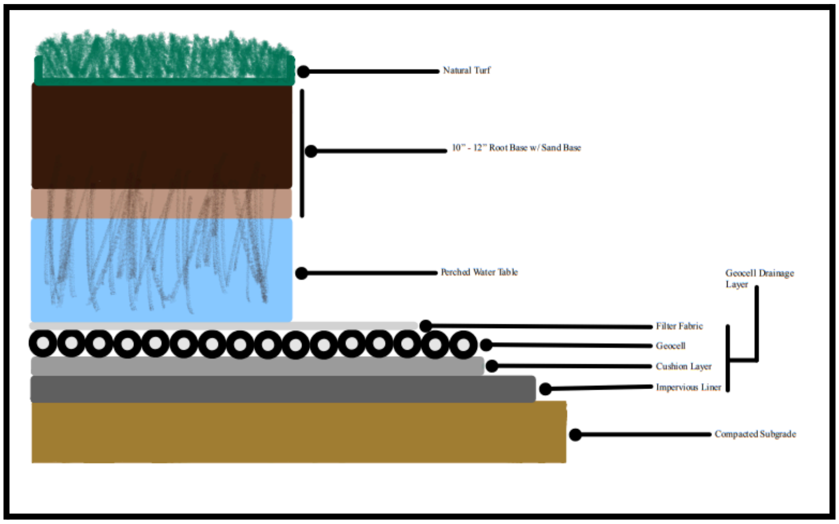
10. **CAD Files & Instructions on Sharepoint**





11. [Phasing Plan]

12. [Field Drainage Layers]



13. [Cost Estimate for Athletic Fields]

14. [Erosion and Sediment Control Plan]

15. **Temporary Construction Infrastructure Feature Map**