Piedmont Virginia Community College Site Design

A Technical Report submitted to the Department of Civil Engineering

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Partial Fulfillment of the Requirements for the Degree of Civil Engineering

Bachelor of Science, School of Engineering

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Piedmont Virginia Community College Site Design

Piedmont Virginia Community College (PVCC) is a comprehensive, public institution of higher education that awards associate degrees and certificates, and that "seeks to be a leader and innovator in post-secondary education" (*Mission and Goals | Piedmont Virginia Community College*, 2018). PVCC is looking to expand their campus with a new building and parking lot that will be developed on their empty land off of College Drive, shown in green in Figure 1.

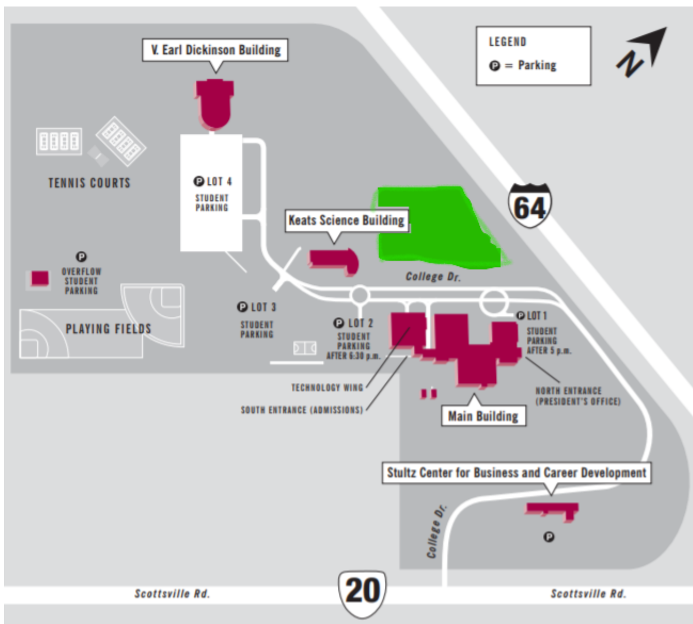

Figure 1: Campus Map (*Main Campus Map*, 2018).

This building will serve as the welcoming hub of the campus, as it houses many administrative offices and will be one of the first things that people see upon arrival. The addition of a welcome building will benefit new students by serving as an informational hub as they get oriented on campus and will be the first point of contact for any visitors. This building will also serve as part of the technology center for PVCC and will house both labs and collaborative work spaces. In addition to indoor spaces, the design will allow outdoor, undeveloped spaces to be utilized as outdoor classrooms, recreational spaces, and connections to other parts of campus.

One challenge with the design is that the site has a large slope of about 41% from College Drive down to the undeveloped site. Developing a building on a site that has steep grades means it must be properly graded to meet regulations for maximum slopes and accessibility, mandated by design codes and the Americans with Disabilities Act (ADA) respectively.

As the campus is currently laid out, there is no main welcoming building for PVCC. The main building that exists now is large and consists of a variety of classrooms, auditoriums, labs, libraries, lounges, etc. It is mostly an academic building and has little space for administrative and welcoming services (About PVCC | Piedmont Virginia Community College, 2018). The parking lots next to this building are only available to students after the standard work day is over (*Main Campus Map*, 2018). This means that the building is harder for students to access during normal working hours because there is no readily available parking close to the building. The new building that is being developed will include an accompanying parking lot with 100 parking spaces. This will make it easier for students, visitors, faculty, and staff to access and use the resources provided by this new building.

In the as-built condition, there is no welcoming area for students, administration, or prospective students. There is no defined and easily-accessible area for students to inquire about resources available to them and more general information about the school. By creating a new building at the entrance of the PVCC campus, everyone entering the site will be guided directly to the information they need. Adding a new building on this undeveloped land also allows students to use new spaces on campus, especially as this new building has collaborative spaces, labs, and new academic resources for students.

In order to solve this problem the team developed a site design to be presented in a plan set with details including the site layout, grading, erosion and sediment control, stormwater management, utility connections, and a traffic control plan. This process is representative of a typical project for civil engineering firms. Because of this, the team worked closely with engineers from Draper Aden and Associates (DAA), a civil engineering firm located in Charlottesville, Virginia, who guided the team and provided necessary information to create this deliverable.

Site Layout Decision Making

First the team began with the design of the site. The first step was to decide where the 20,000 sq ft building should be oriented in regards to College Drive and the rest of campus, and then determine the best place and shape of the parking lot that contains 100 parking spaces. The team developed several preliminary concept designs and met with DAA and architecture firm VMDO to discuss the viability of each design. Initial criteria we set for ourselves and what we wanted based on meetings with DAA were visibility, variety, connectability, and uniqueness. We wanted visibility of the building from I-64, connectability to the rest of campus, wanted to approach it with unique methods, and allow for room for future development or use for the extra green space if possible. The three initial concepts we developed are shown below in figure 2 with the designs label as 1,2, or 3. As you can see designs 2 and 3 have the building positioned perpendicular to College Dr. where design 1 has it parallel. Each offers different things. Designs 2 and 3 have more room for future development on plan right side of the site where design 3 is the unique site and offers the most room for future development because it proposes a 2 story parking garage instead of a surface lot. This is obviously the most expensive option but we wanted to include it to have variety and propose a unique solution. We ended up ruling out design 3 due to this high cost the garage would cause. When comparing designs 1 and 2 we looked mostly at the visibility and connectability of each layout. Design 1 is more visible to interstate-64 and design 2 is more visible for the vehicles entering PVCC campus so we had to decide which of these factors we valued more. Design 1 has more connectability to the rest of the campus with a lot of the surface area of the building facing College Dr. and the main building across the street. Weighing all these reasons we chose design 1 to be the main concept layout for this site. It had the best visibility to interstate-64, had the most room for connection to the rest of the campus, the building felt less isolated, and it seemed more cost effective.

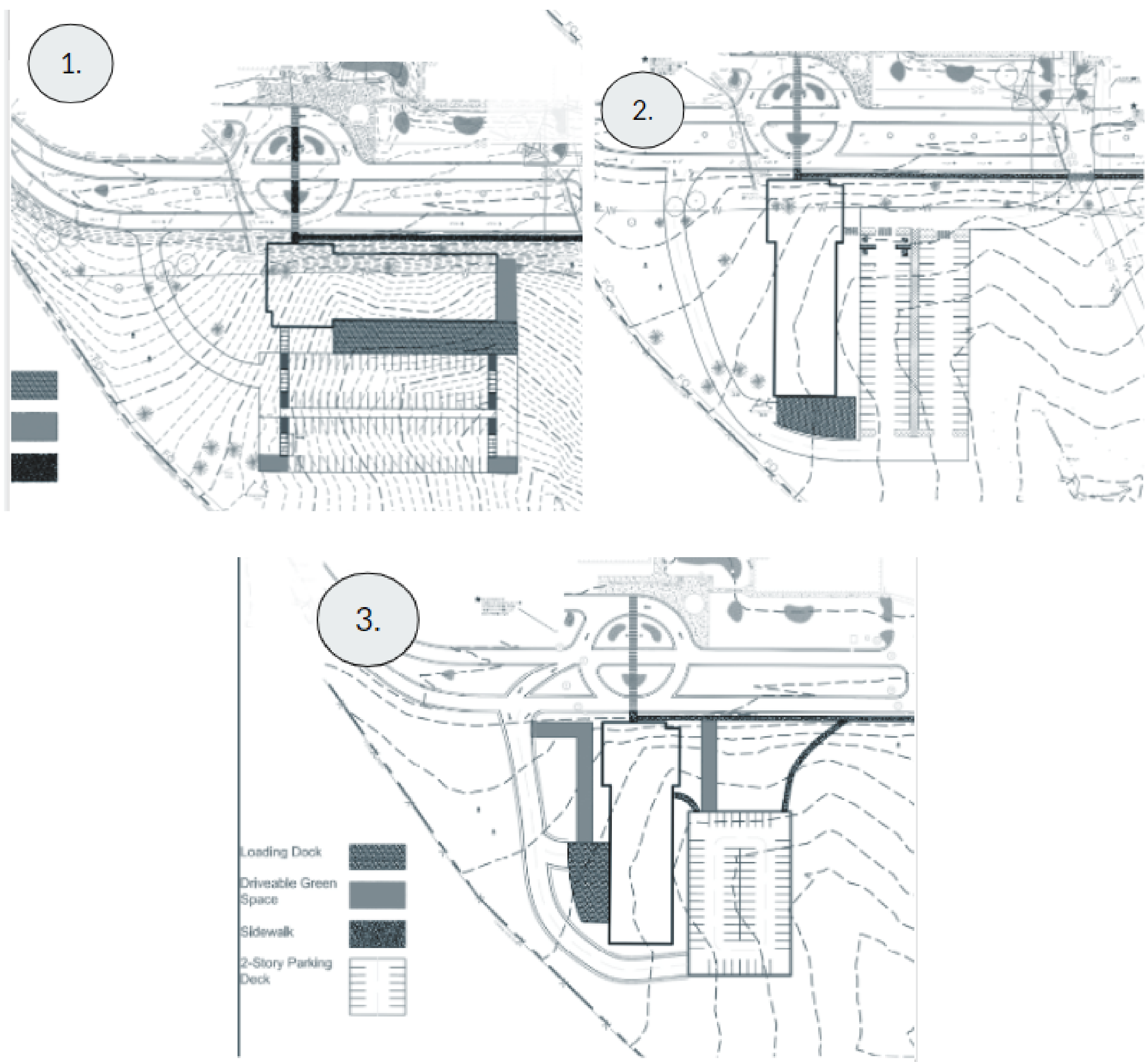

Figure 2 : Concept Designs

In the world of engineering and design, no layout or concept stays true to its initial design. After the initial grading was created and other ideas floated around we determined that it would be best to eliminate the left drive aisle and have one on the right side of the parking lot instead. The reason we decided to go with the right drive aisle instead of the left is because we initially had concerns with driver confusion upon entering the site and making a decision of turning into this building right away. We also expressed concerns with the access points of the drive aisle, the left one would most likely be a right-in-right-out access point and that meant vehicles exiting the site had to go right and travel down College Dr. and turn around before exiting PVCC. Because of this we introduced a right drive aisle and entertained the idea of having both drive aisles, but although the one on the right has steeper grades, the road on the left would require more asphalt and require a retaining wall to be constructed above the loading dock which is really expensive. Deciding to proceed with just the drive aisle on the right of the building seems the most desirable as it is the most cost effective, it decreases the amount of disturbed and impervious area, and is all an all access driveway which is more efficient for drivers. The final concept design we created is shown below in figure 3.

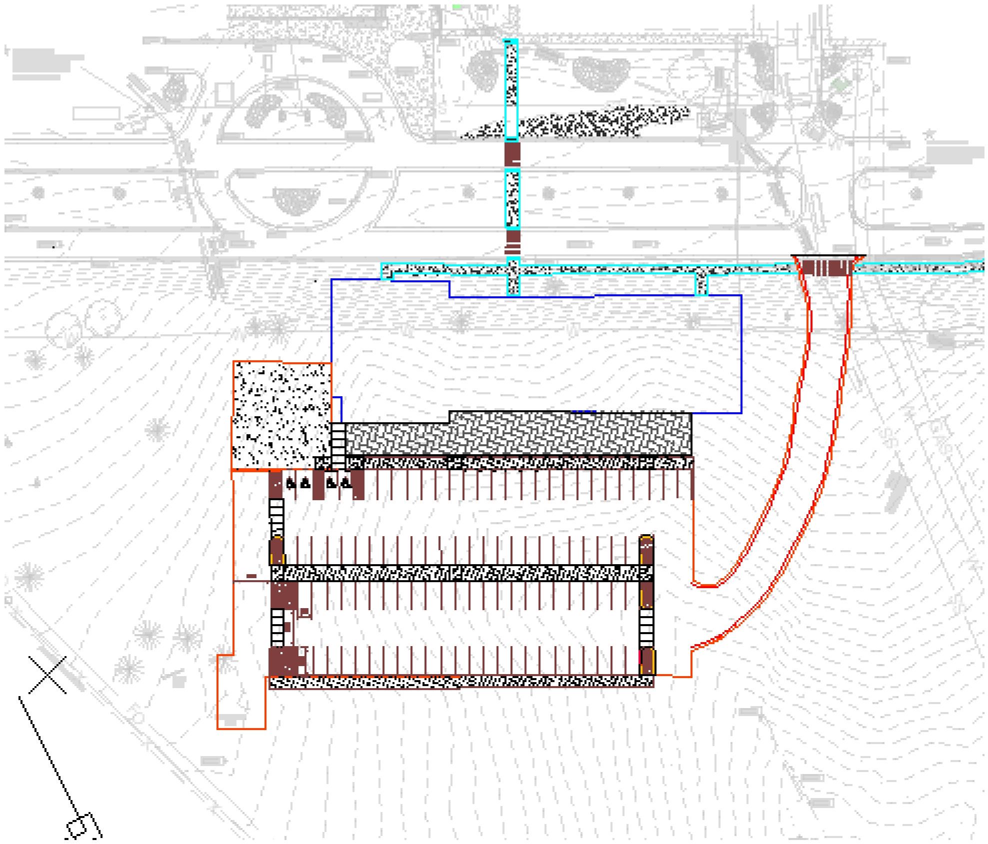

Figure 3: Final Concept Design for Building and Parking Lot Placement

Grading

Grading was the first step in the project. In order to begin this process, the team began with known points of elevation from a survey provided by DAA and modified the existing contours to fit the conditions needed for the design. As the first starting point, the team used College Drive, which sits at an elevation of 480’. Knowing the height of the first floor of the building to be 20’ (given to the team by DAA) and planning for the entrance off of College Drive to be on the second floor with a 1/4 foot elevation increase to allow water to drain down the entrance ramp away from the building, the finished floor elevation of the building was established at 460.25’. Grading work then continued by grading the plan right access road at a maximum of a 10% slope with 3:1 sloping or less off the sides of the road. Preliminary grading involved only the use of 5’ contours to allow the most flexibility in quickly shifting the design after receiving feedback. In general, the reconnection to existing contours from the base survey was prioritized in order to minimize costs associated with earthwork throughout the project. The area where this was not feasible was the grading of the parking lot which required a 2% maximum slope across the ADA accessible spaces and a 5% maximum slope elsewhere. The first design of the parking lot had grading with less than a 1% slope for the majority of the lot followed by a 5% slope. The rapid change in grade was raised as a concern during a meeting with the team from Draper Aden and was modified to allow water to drain from the lot better and vehicle traffic to navigate smoother. This decision also resulted in great savings for the amount of fill soil that will need to be used to construct the parking lot.

Filling in 1’ contours between the designed 5’ contours allowed the grading to be finalized and greater detail to be expressed in areas such as the increasing slope from College Drive to the second floor building entrance and the exact elevations tying into the building, loading dock, and parking lot. Throughout the addition of the 1’ contours, other contours were constantly shifting to maintain a maximum of a 3:1 slope across all landscaped areas, 10% on roadways, 5% in the parking lot, and 2% across ADA spaces, sidewalks, and patios. Working in collaboration with the team members working on stormwater, which will be discussed later, the location of the retention pond was selected at a low point in the site and represented the last element to be graded into the site. Following the full site grading, a roadway profile was made along the centerline of the driveway to show the vertical geometry of the roadway. By modifying the curves in the profile to meet standards, some changes were made to the horizontal geometry to match the vertical elevations. Finally, contours were further pulled in to meet existing contours as quickly as possible to save some fill soil from being needed. A plan view of the grading is shown in Figure 4.

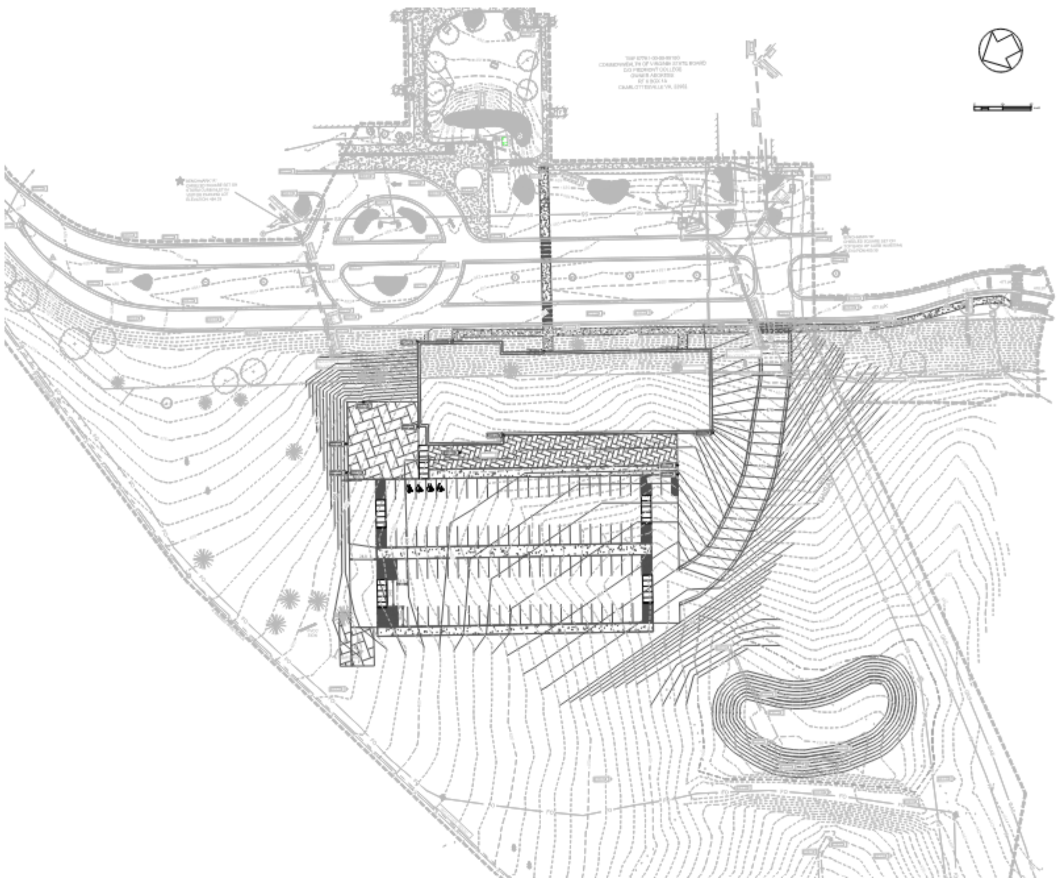

Figure 4: Plan View of the Grading (Proposed Contour Lines) of the Site

Parking Lot

First, in order to comply with ADA standards, a certain number of handicap spaces are required. In a parking lot with 100 total spaces, 4 of them must be ADA accessible with one of the four being van accessible. Figure 5 shows the location of these ADA spaces. The team chose to locate those spaces closest to the entrance of the building to the parking lot. Another requirement of ADA spaces is that they must be next to a striped space for accessible means. These striped spaces are also shown below in the figure.

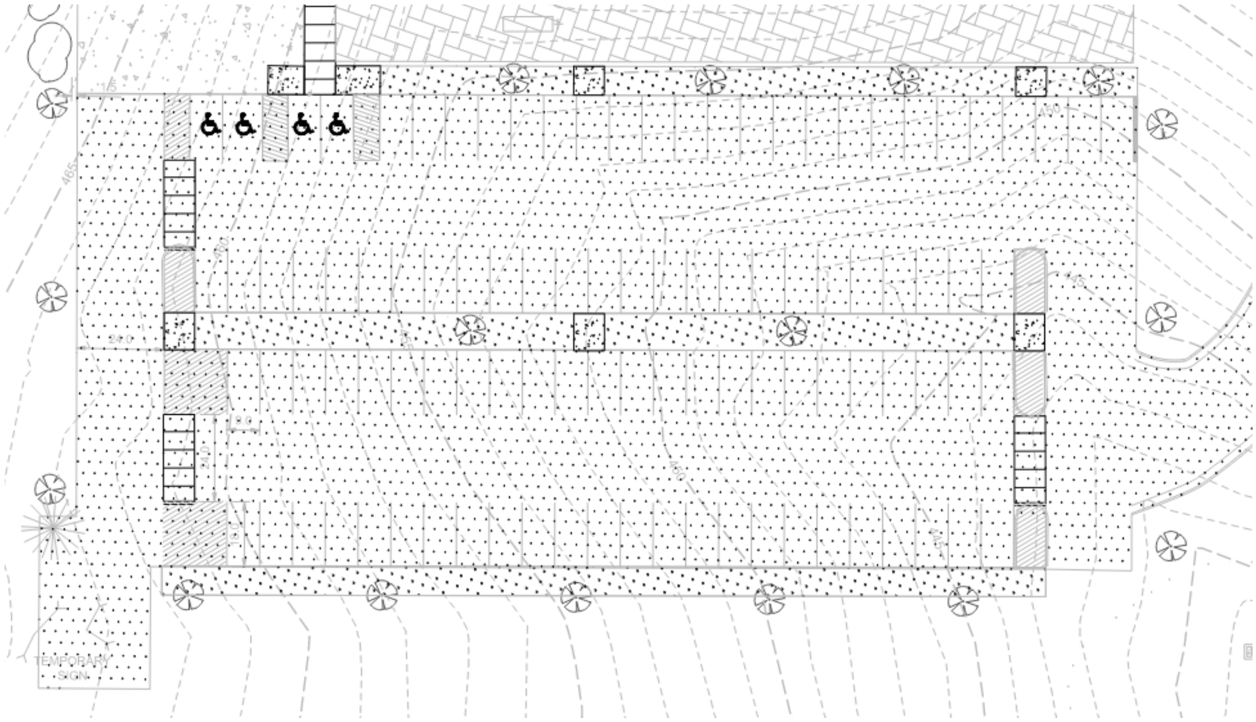

Figure 5: Location of Handicap Spaces in the Parking Lot

While designing this project, the team had to ensure that the parking lot was suitable for all types of vehicles that would be accessing the site. Design vehicles obviously include standard passenger cars but also less obvious vehicles such as the delivery and dumpster trucks that will be coming to the site and need access to the building. These vehicles are accessing the site to pick up waste and to make deliveries of equipment and supplies to both the first floor labs and food and supplies to the cafe housed inside of the building. This meant that a loading dock must be included for these larger, tractor trailer type trucks to load and unload deliveries. In order to make sure that these trucks and passenger cars were able to navigate the turns of the parking lot, the team utilized a software in Civil 3D called Vehicle Tracking which allowed certain sized vehicles to be maneuvered through the parking lot to test if there was adequate clearance for them to complete the movements required of them. After running this software several times, and making adjustments, the team was able to drive a WB-40 into the site, out of the site, and reverse it into the loading dock as well as being able to navigate passenger cars through each entrance and exit scenario successfully. Fire trucks also had to be able to safely navigate throughout the entire parking lot in a loop and exit the site so their design vehicle was also run through the software to ensure it was viable.

Utilities

Another main design aspect of this project is the routing of the utilities. The main utilities located within the site are natural gas, water, sanitary/sewer, fiber optic, and telecommunications. In the current state of the site, it seems the natural gas line will not be disrupted with project construction and can remain as is. The other utilities require some sort of rerouting. The main water line only involves moving the horizontal portion of the line, parallel to College Drive, further down the site so it is not underneath the new building. It can connect with the existing lines plan left of the site and plan right of the site flowing down to the outfall point. The sanitary/sewer line is controlled by gravity and the line is deep enough that it does not need to be relocated during the project. The only adjustment that needs to be made is extending the manhole coverage up to meet the new grade of the constructed road. Lastly, the communication lines must be relocated as both the fiber optic and the telecommunications line will be not affected by the construction and grading of the new proposed drive aisle. After rerouting the current utilities for construction purposes, they must also be tied into the new building. The connections for these utilities will occur plan right of the building and will connect back with the existing lines and they all flow plan south of the site. The rerouting of utilities can be seen in Figure 6.

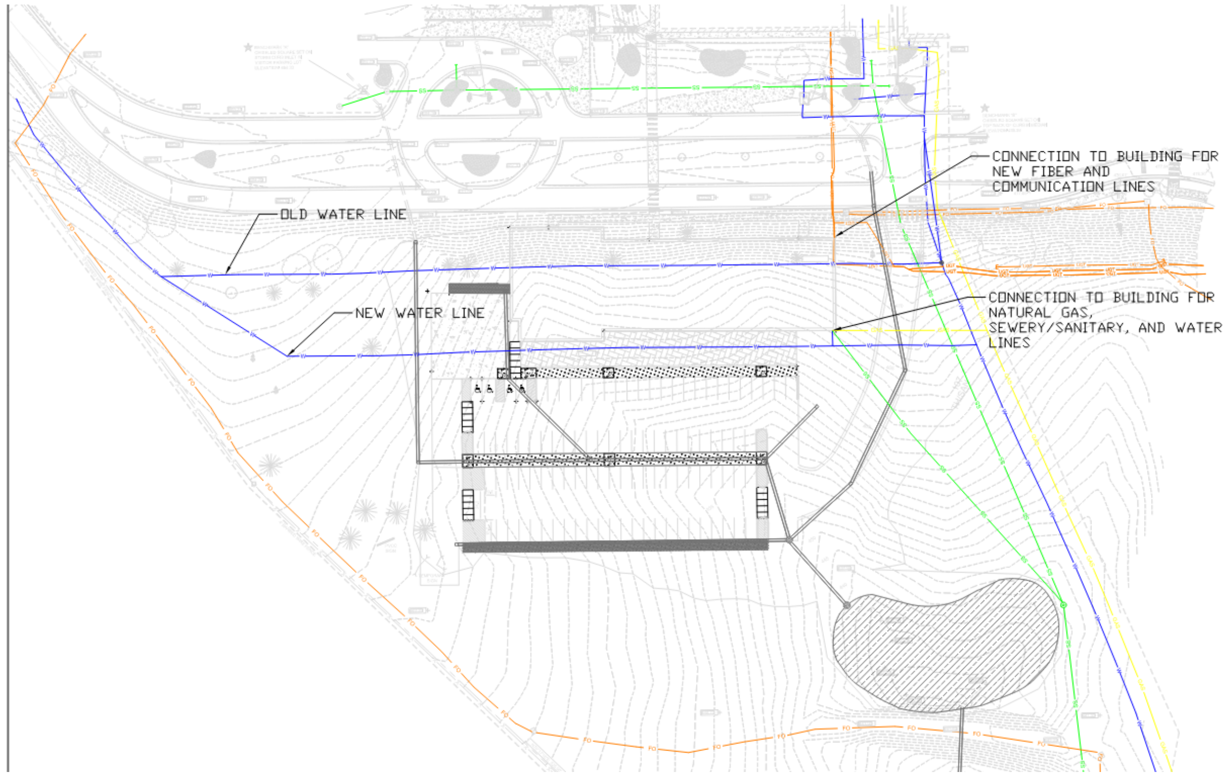

Figure 6: Utility Routing

Stormwater

The stormwater design component included both water quantity calculations and stormwater pipe layouts. The first step of stormwater calculations was determining the total area of runoff, which included the entirety of the site and the already existing site to the plan view north of the project site. Once the drainage area was determined, the team calculated the peak discharge from the site for both pre and post conditions. Additionally, using the entire drainage area, the team was able to to estimate the surface area of the wet pond. The wet pond was chosen as detention for stormwater runoff reduction for the ability to help improve both quantity and quality control. There is also a natural low point on the site that the water flows to, so the team wanted to take advantage of that. Additionally, multiple Best Management Practices, or BMPs. were proposed on the site, including a bioretention in the parking lot and another bioretention plan north of the loading dock. These were put in place for runoff mitigation purposes as well as to promote education opportunities and align with Virginia Energy Conservation and Environmental Standards (VEES). The proposed stormwater pipes were put in place to collect a large portion of stormwater runoff from the existing site plan view north of the design site. Additional pipes were also included for the proposed site to collect water from the impervious areas and bioretention in the parking lot. The pond design and proposed pipes can be seen in Figure 7. The pipe network was laid out to tie into the existing pipe network by demolishing two existing headwalls just plan south of College Drive. The pond covers 2% of the surface area of the contributing drainage area which, per Virginia guidelines, is within the acceptable range.

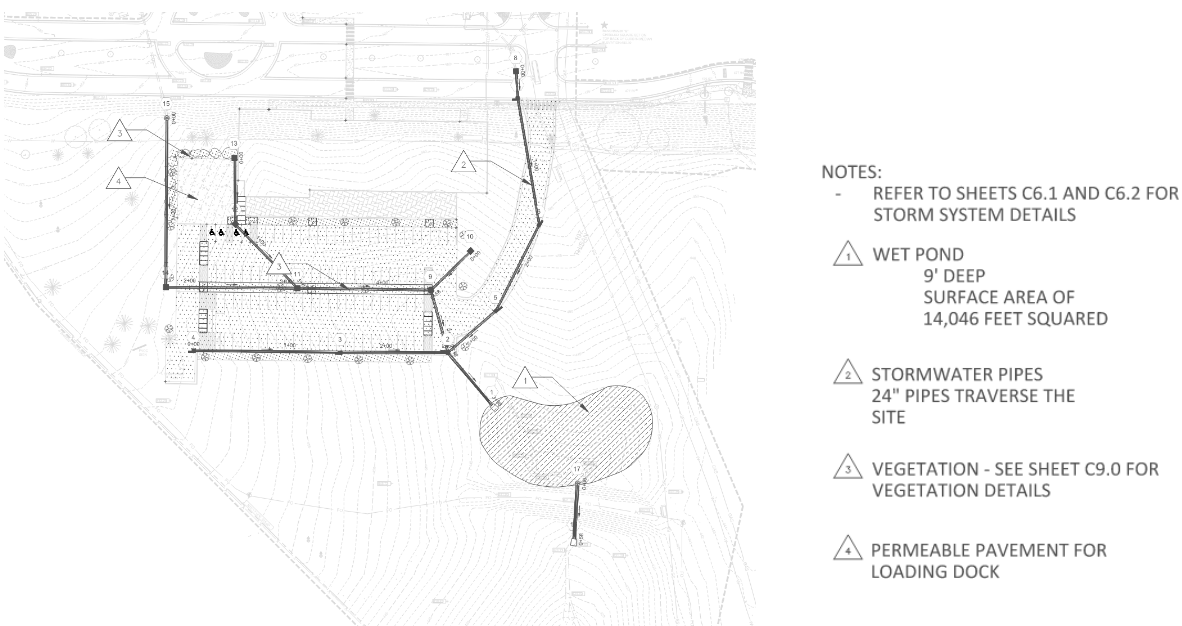

Figure 7: Stormwater BMPs and Pipe Network and Notes

The stormwater section of the project was very in depth and required a lot of work. There was a lot of CAD troubleshooting and working with DAA to determine the right pipe sizes and calculations. Although CAD was accessible through the University's computer's, student access had limitations on the specifics within CAD. For that reason, the group was not able to change pipe sizes within CAD themselves. The group determined the needed pipe sizes, and DAA swapped out pipe sizes within CAD. The group, with the help of DAA, utilized the Hydraflo program within Civil 3D to ensure pipe sizes and drainage areas were accurate and effective. The modeled system created in Hydraflo is shown in Figure 8. This system aligned with the system the group created in Civil 3D and from this model the stormwater patterns of the site were able to be analyzed. The Storm Sewer Summary Report is included below in Figure 9, this report shows how the group implemented the delineated drainage areas and calculated runoff coefficients to determine how much runoff goes into each inlet. Pipe sizes had to be consistent with the existing pipes that come into the site since we tied our network into an existing network.

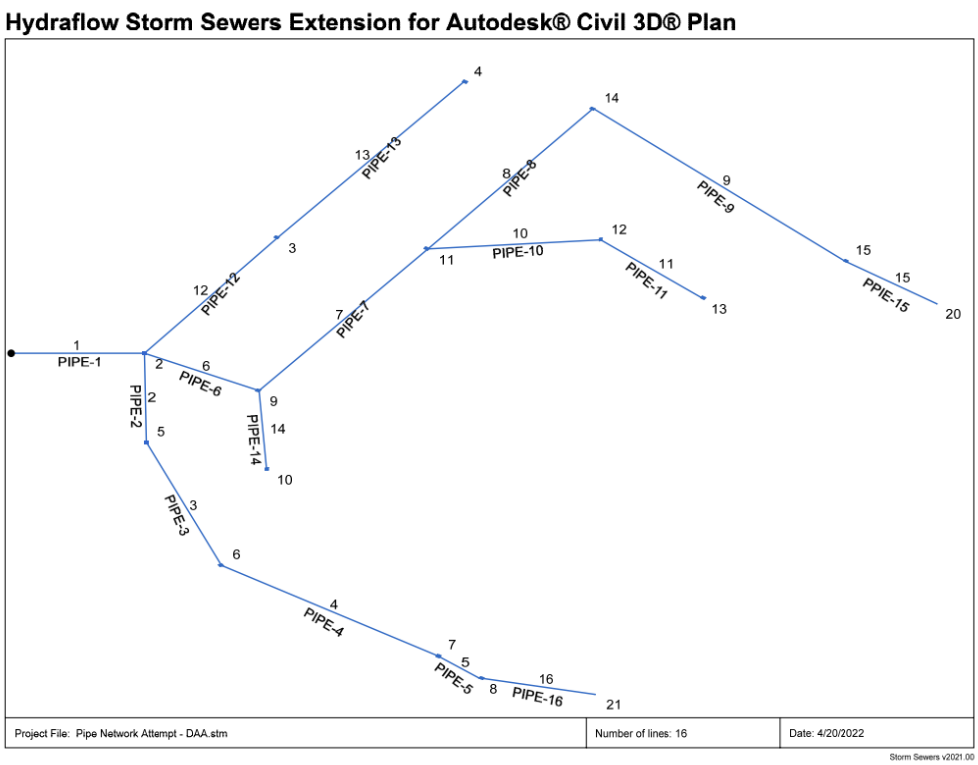

Figure 8: Storm Sewer Layout Hydraflo

Storm Sewer Summary Report

Page 1

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	PIPE-1	24.00	24	Cir	71.166	432.92	439.92	9.836	434.92	441.65	n/a	441.65 j	End	Curb-
2	PIPE-2	15.91	18	Cir	65.828	444.00	450.00	9.115	444.72	451.42	n/a	451.42	1	Combination
3	PIPE-3	15.84	18	Cir	99.908	450.00	460.00	10.009	451.42	461.42	n/a	461.42 j	2	Combination
4	PIPE-4	14.96	18	Cir	133.146	460.00	470.00	7.511	461.42	471.40	n/a	471.40 j	3	Combination
5	PIPE-5	14.67	18	Cir	28.000	470.00	472.00	7.143	471.40	473.40	n/a	473.40 j	4	DropGrate
6	PIPE-6	8.94	24	Cir	67.000	445.00	450.00	7.463	445.49	451.07	n/a	451.07	1	DropGrate
7	PIPE-7	7.87	24	Cir	138.593	450.00	454.00	2.886	451.07	455.00	n/a	455.00 j	6	Combination
8	PIPE-8	6.35	24	Cir	136.537	454.00	457.00	2.197	455.00	457.89	n/a	457.89 j	7	DropGrate
9	PIPE-9	6.20	24	Cir	175.417	457.00	459.84	1.619	457.89	460.72	n/a	460.72 j	8	DropGrate
10	PIPE-10	0.89	15	Cir	92.696	454.00	455.00	1.079	455.00	455.37	n/a	455.37 j	7	Combination
11	PIPE-11	0.13	15	Cir	68.628	455.00	456.00	1.457	455.37	456.14	n/a	456.14 j	10	DropGrate
12	PIPE-12	1.58	15	Cir	111.763	445.00	450.00	4.474	445.28	450.50	0.09	450.50	1	Combination
13	PIPE-13	0.50	15	Cir	152.374	450.00	455.00	3.281	450.50	455.27	n/a	455.27 j	12	DropGrate
14	PIPE-14	0.20	15	Cir	57.803	450.00	454.00	6.920	451.07	454.17	n/a	454.17 j	6	DropGrate
15	PPIE-15	6.20	21	Cir	58.000	461.34	461.92	1.000	462.07	462.84	n/a	462.84	9	None
16	PIPE-16	14.60	18	Cir	63.000	473.00	474.63	2.587	474.01	476.03	1.13	476.03	5	None

Project File: Pipe Network Attempt - DAA.stm | Number of lines: 16 | Run Date: 4/20/2022

NOTES: Return period = 10 Yrs. ; j - Line contains hyd. jump.

Storm Sewers v2021.00

Figure 9: Storm Sewer Summary Report Hydraflo

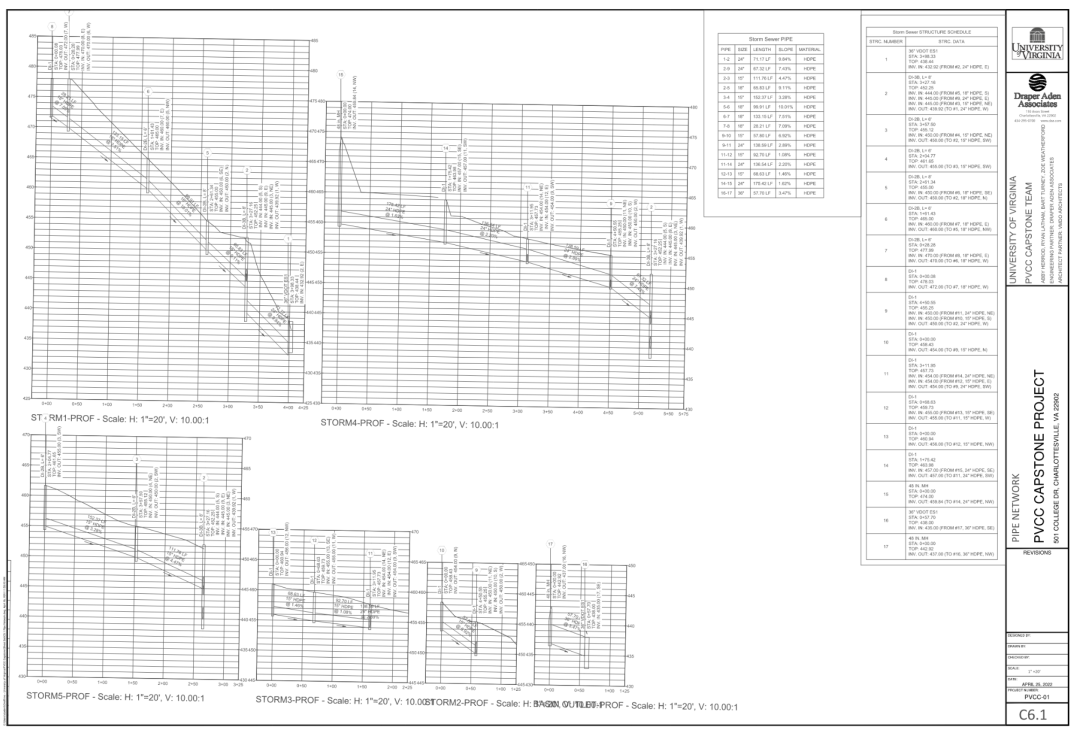

Figure 10: Pipe Profiles

The group used both drop-grate inlets and curb inlets in their modeling of the system. Both were used multiple times and represent the placement of the inlets as shown in Figure 10: Drainage Areas. If the inlet was in a grassy portion of the site, the drop-grate inlets were used. If the inlets were located along a roadway, the curb inlets were used. Various openings and lengths were used for curb inlets as necessary. This process required constant communication with DAA to figure out the program and how to best analyze the data that the program spewed out. The delineated drainage areas represent the area of the site that drains all of its stormwater to the specified inlet. This process also included two off-site drainage areas from the plan-north of the site. These drainage areas are included in figure 10 and accounted for a large amount of impervious area to be added into the stormwater calculations

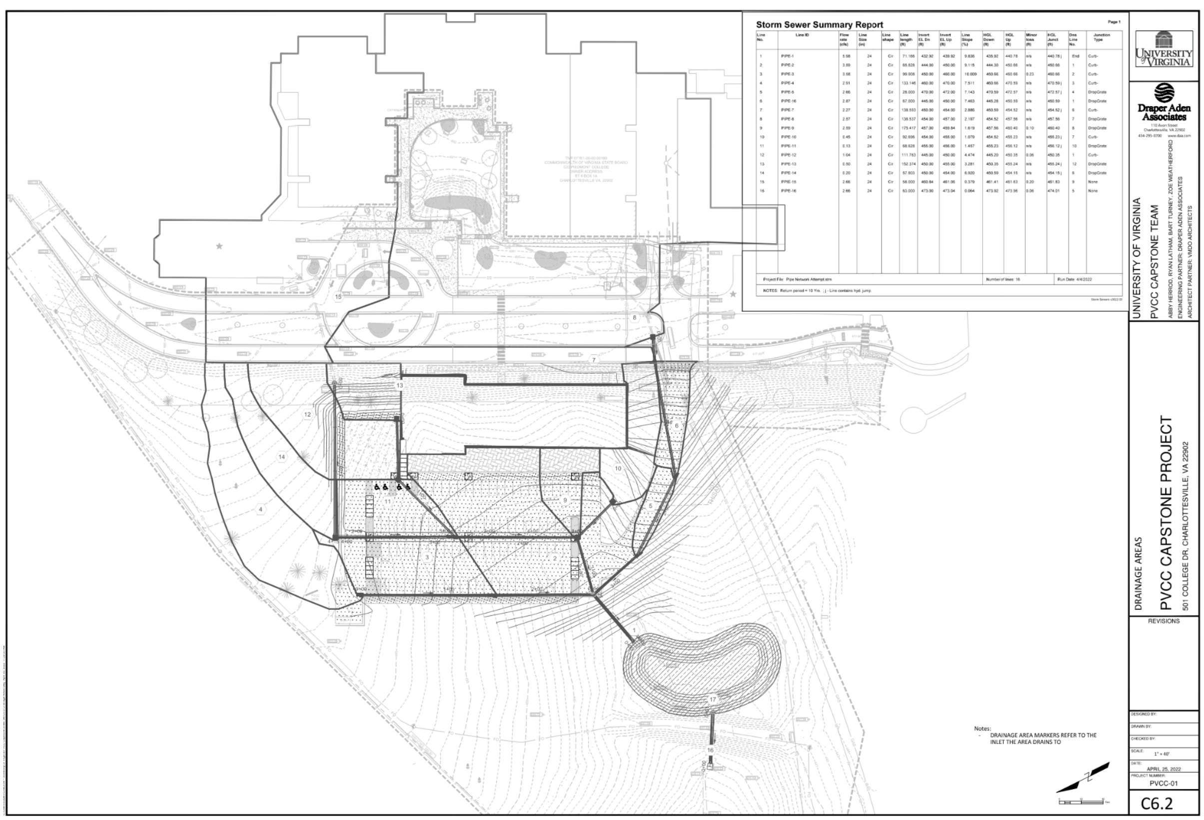

Figure 11: Delineated Drainage Areas with Corresponding Inlets

Erosion and Sediment Control

The next process that was done for this project was erosion and sediment control (ESC). Typically for construction projects of this nature, ESC is done in two phases. The first phase occurs before any construction begins and the second phase happens during the construction process. It is important to have erosion and sediment control in a construction project because during construction, the soil is highly vulnerable to erosion by wind and water. Eroded soil endangers water resources by reducing water quality and causing the siltation of aquatic habitats of fish and other important species. Eroded soil also necessitates repair of sewers and ditches and the dredging of lakes. In addition, clearing and grading during construction cause the loss of native vegetation necessary for terrestrial and aquatic habitats. These ESC measures are put into place to ensure the disturbed earth stays within the limits of disturbance for the site and does not cause any excess damage to the nearby ecosystem. The measures needed for the site pre-construction include a construction entrance designated for construction vehicle use only, silt fences to keep soil in, tree protection, inlet protection to protect the existing storm drain inlets on the site, outlet protection, mulching and seeding, and a sediment basin for where the proposed pond will be introduced. These measures for phase 1 of ESC can be seen in Figure 8 and a legend for the various measures used can be seen in Figure 9.

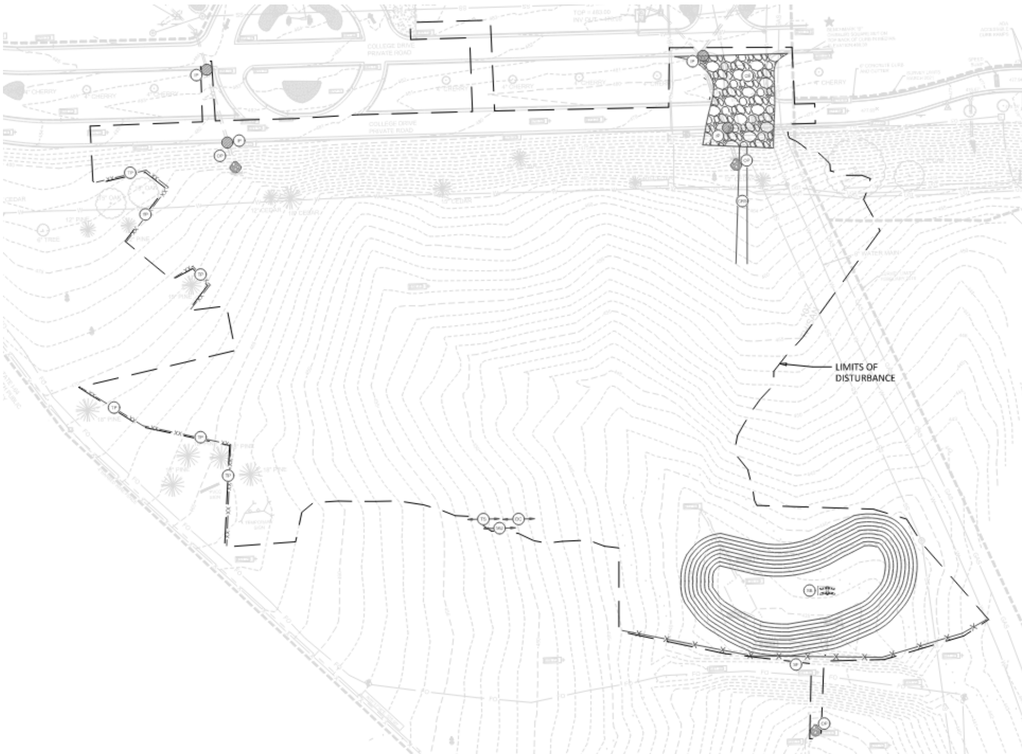

Figure 8: Erosion and Sediment Control Plan Phase 1

EROSION AND SEDIMENT CONTROL LEGEND			
No.	TITLE	KEY	SYMBOL
3.02	TEMPORARY STONE CONSTRUCTION ENTRANCE	CE	
3.03	CONSTRUCTION ROAD STABILIZATION	CRS	CRS
3.05	SILT FENCE	SF	X
3.07	STORM DRAIN INLET PROTECTION	IP	
3.14	TEMPORARY SEDIMENT BASIN	SB	
3.18	OUTLET PROTECTION	OP	
3.31	TEMPORARY SEEDING	TS	TS
3.35	MULCHING	MU	MU
3.38	TREE PRESERVATION AND PROTECTION	TP	— XX —
3.39	DUST CONTROL	DC	DC

Figure 9: ESC Legend for Phase 1

Phase 2 for ESC occurs during construction and will keep all the same initial measurements but will include more inlet and outlet protection due to the addition of the BMP and stormwater management pipe system. Phase 2 will also include blanket mulching in areas of the site where the slope is steeper than 3:1. The measures for ESC phase 2 can be seen in Figure 10. A legend for the various ESC measures can be found in Figure 11.

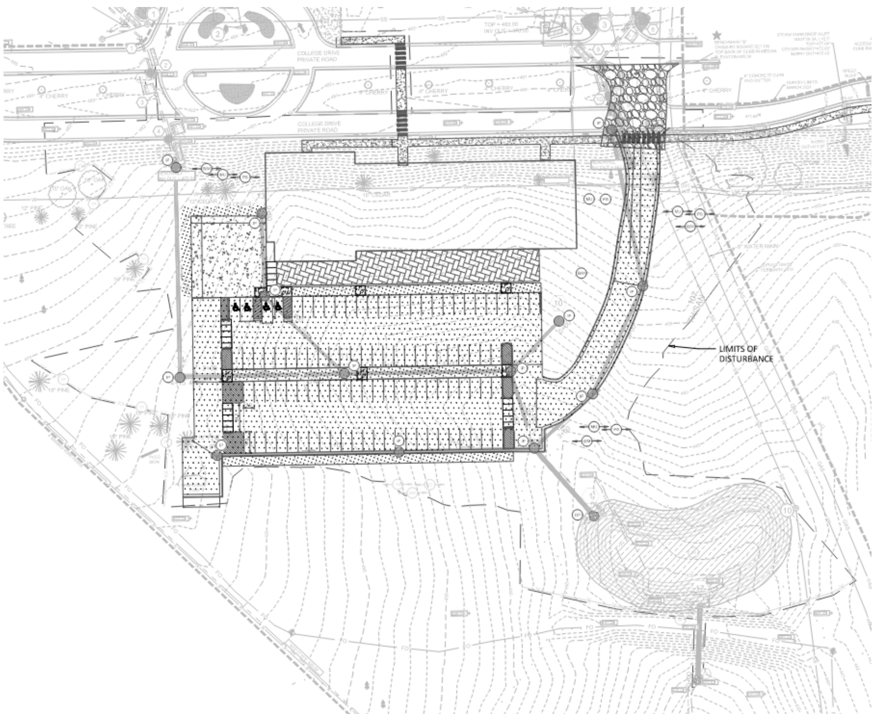

Figure 10: ESC Measures for Phase 2

EROSION AND SEDIMENT CONTROL LEGEND			
No.	TITLE	KEY	SYMBOL
3.02	TEMPORARY STONE CONSTRUCTION ENTRANCE	CE	
3.02	CONSTRUCTION ROAD STABILIZATION	CRS	CRS
3.05	SILT FENCE	SF	—X—
3.07	STORM DRAIN INLET PROTECTION	IP	
3.14	TEMPORARY SEDIMENT BASIN	SB	
3.18	OUTLET PROTECTION	OP	
3.32	PERMANENT SEEDING	PS	←PS→
3.35	MULCHING	MU	←MU→
3.36	SOIL STABILIZATION BLANKETS MATTING	B/M	←B/M→
3.38	TREE PRESERVATION AND PROTECTION	TP	— XX —

Figure 11: ESC Measures Legend

Traffic Control Plan

For any site that requires demolition or use of an existing road, a traffic control plan must be created. This is a plan that will relay information about road closures, detours, and other pertinent information to the drivers or travelers that would be needing to access the area. For this project, the plan south lane of College Drive will need to be closed off to normal vehicular traffic. This is due to the grading that will need to be done to the site for the building placement requiring a maintainable slope which necessitates the cut into the roadway. Part of that road may need to be demolished to allow for proper cutting and grading of the land. This will be up to the contractor for the best way to alter the existing land to obtain the required grading and layout for the building. Because of the road closure, signage must be available on site to inform drivers to merge to the plan north road of College Drive. What was previously a one lane road will temporarily be converted to two lanes of opposing traffic for the duration of construction. The necessary measures must be taken to make this happen such as adding temporary striping to the road to show that it is two lanes and reducing the speed limit of the existing road to account for the construction site. There will also need to be signage alerting drivers of the construction entrance that will be on the site and to watch for turning construction vehicles and not enter the site. A snapshot of the traffic control plan for this site can be found in Figure 12 with the accompanying notes in Figure 13.

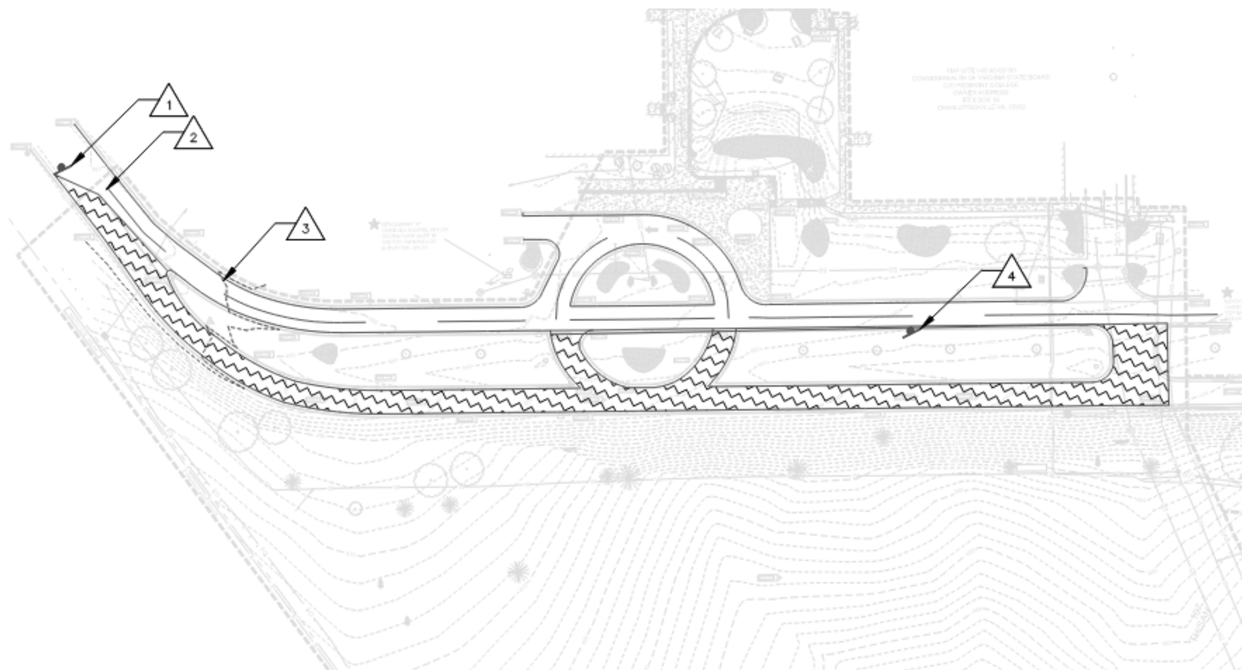

Figure 12: Traffic Control Plan

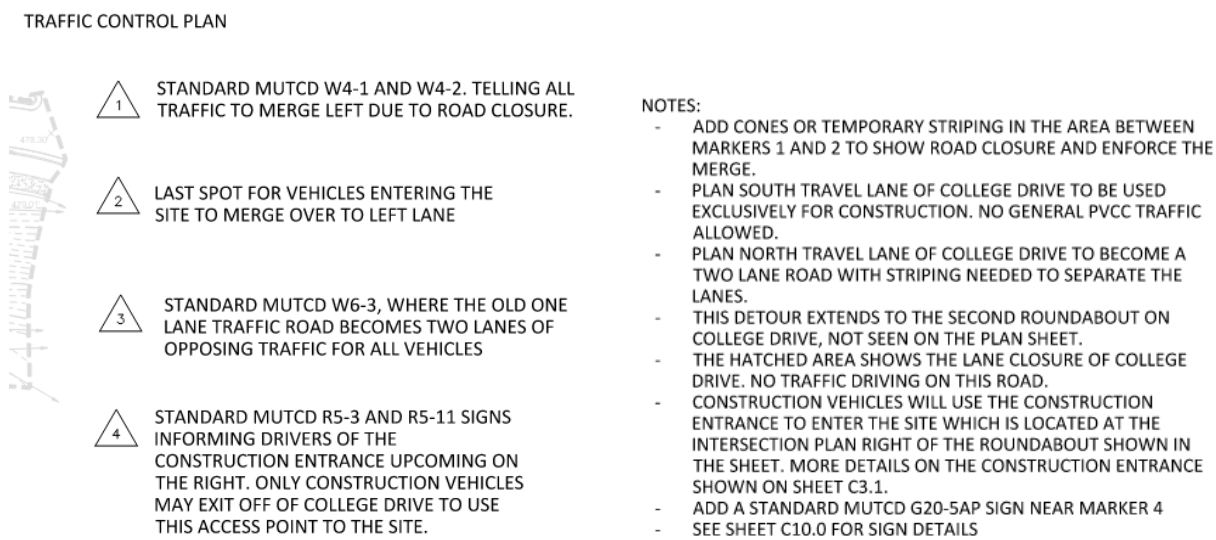

Figure 13: Traffic Control Plan Notes

Landscaping

Landscaping is a key part of any construction project of a new building. Most customers require a standard for aesthetics and an element of cleanliness around the design. For engineers sake, the landscaping portion of the project is normally delegated to outside contractors or other people in the company. In this case, for our project, the team dabbled a little into the landscaping side of things by looking at the guidelines for Albemarle County. Based on the municipal code and our project standards trees must be planted surrounding the perimeter or the parking lot every 40 feet and also plant trees in the interior of the parking lot evenly spaced, one tree for every 10 spaces (*Municode Library*, n.d.). The team also decided to plant shrubbery and other vegetation around the loading dock to make it more aesthetically pleasing for those driving into the site. A better impression is created by the vegetation than the industrial look of semi-trucks unloading deliveries. The plan set for landscaping this site is shown in Figure 14 and the notes for the types of vegetation needed for the site are shown in Figure 15. If there was more time allotted for this project, the team would have looked into lighting of the parking lot and drive aisle and the use of the outdoor space between the building and the parking lot. Ideally the space is intended to be utilized by PVCC members as a collaborative outdoor space to study, eat, use as an outdoor classroom , etc. This would involve other aesthetically pleasing vegetation, like a garden in the area and benches or tables for collaborative use.

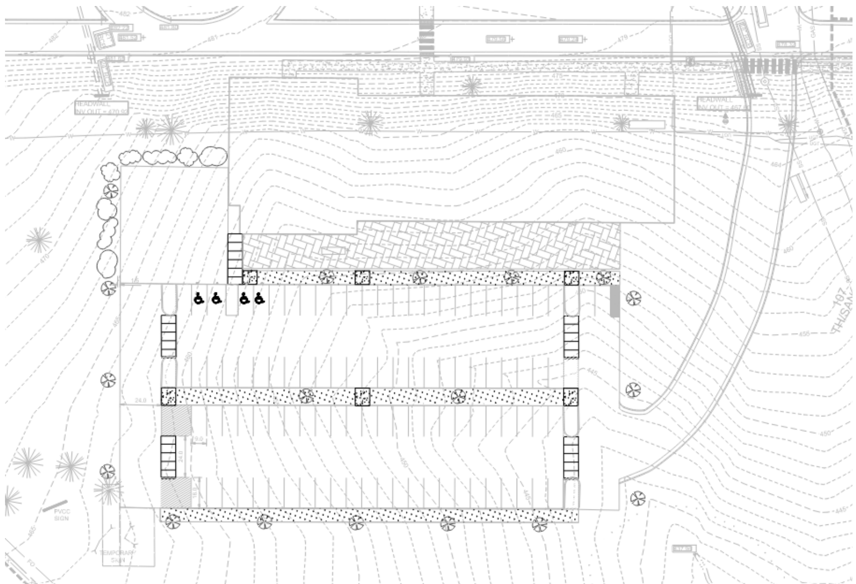

Figure 14: Landscaping Plan Sheet

NOTES:

1. FROM THE ALBEMARLE COUNTY GUIDELINES AROUND LANDSCAPING PARKING AREAS:
   - 1.1. "LARGE TREES SHOULD ALIGN THE PERIMETER OF PARKING AREAS, LOCATED 40 FEET ON CENTER. TREES SHOULD BE PLANTED IN THE INTERIOR OF PARKING AREAS AT THE RATE OF ONE TREE FOR EVERY 10 PARKING SPACES AND SHOULD BE EVENLY DISTRIBUTED THROUGHOUT THE INTERIOR OF THE PARKING AREA."
   - 1.2. TREES REQUIRED BY THE PRECEDING PARAGRAPH SHOULD MEASURE 2 $\frac{1}{2}$ INCHES CALIPER (MEASURED SIX INCHES ABOUT THE GROUND); SHOULD BE EVENLY SPACED; AND SHOULD BE OF A SPECIES COMMON TO THE AREA. SUCH TREES SHOULD BE PLANTED IN PLANTERS OR MEDIANS SUFFICIENTLY LARGE TO MAINTAIN THE HEALTH OF THE TREE AND SHALL BE PROTECTED BY CURBING.
2. PLANT SPECIES REQUIRED SHOULD BE BASED UPON THE GENERIC LANDSCAPE PLAN RECOMMENDED SPECIES LIST AND NATIVE PLANTS FOR VIRGINIA
   - 2.1. A TOTAL OF 16 TREES SHOULD SURROUND THE PERIMETER OF THE PARKING LOT AND LOADING DOCK.
   - 2.2. THE TREES BEING PLANTED AS DESCRIBED ABOVE SHALL BE A MIX BETWEEN WILLOW OAK TREES, RED MAPLE TREES, AND SUGAR MAPLE TREES.
   - 2.3. A TOTAL OF TWO TREES SHOULD BE PLANTED IN THE INTERIOR MEDIAN OF THE PARKING LOT. THESE TREES ARE RECOMMENDED TO BE AMERICAN HORNBEAM TREES.
   - 2.4. ORDER AND NUMBER OF EACH TYPE OF TREE PLANTED DETERMINED BY CONTRACTOR
3. SHRUBS WILL BE PLANTED ALONG THE LOADING DOCK AS SHOWN IN THE PLAN SHEET TO PROVIDE AESTHETIC COVERING OF THE LOADING DOCK. THEY SHOULD HAVE A HEIGHT OF 24"
   - 3.1. THE TOTAL NUMBER OF SHRUBS RANGE FROM 5 TO 10 BASED ON THE SHRUBS NEEDED TO SURROUND THE PERIMETER OF THE LOADING DOCK.
   - 3.2. THE TYPE OF SHRUBS NEEDED ARE A MIX BETWEEN WITH HAZEL, SILKY WILLOW, AND AMERICAN CHOKEBERRY.
   - 3.3. ORDER AND NUMBER OF EACH TYPE OF SHRUB PLANTED DETERMINED BY CONTRACTOR
4. THE HATCHING IN THE MEDIAN OF THE PARKING LOT AND THE AREA ABOVE AND BELOW THE PARKING LOT REPRESENTS MULCHING AND GRASSY MEDIANS WITH NATIVE VEGETATION SUCH AS DEER TONGUE GRASS OR AUTUMN BENTGRASS.

Figure 15: Landscaping Notes

Plan Set Details

Traditionally for any civil engineering firm the deliverable for any project is a complete plan set. A plan set is composed of civil drawings, usually done in a AutoCAD software program. Civil construction drawings are a set of plans that a contractor will use to build a project, and they are what engineers will use to convey the information of what they have designed (Roper, 2020). In this project, the team used Civil 3D to create a plan set of civil drawings intended for the contractor to complete this project of adequately preparing the site for the construction and building of a new 20,000 sq.ft. building and a parking lot to hold 100 parking spaces.

Conclusion

To conclude, this project was a great learning experience for the entire team. Expansive knowledge of Civil 3D was gained and it was a wonderful time getting to learn from actual engineering professionals at Draper Aden and Associates. The team put in the work for the 7-8 months to fully understand what goes into site design and all the complications it involves. This was a tricky site to deal with because of the steep grading, but this is a type of problem that happens everyday in real civil projects. Fortunately, we were able to look at the plan sets that DAA created to present to PVCC for this exact project. We were able to analyze the professional plan set and compare and contrast the design to the one we created. Luckily there were not many major design differences. The biggest differences being that DAA had the driveway entrance to the site on the left side of the building instead of the right and the locations of the retention ponds varied slightly. Regardless of the outcome and whether our design is the best design to choose for implementation, the amount of experience and knowledge gained by completing this project is unmeasurable and the team is proud of the work and results created.

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