Old Ivy Road Mixed-Use Development

A Technical Report submitted to the Department of Civil and Environmental Engineering

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

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In Partial Fulfillment of the Requirements for the Degree

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

Dr. T. Donna Chen, Department of Civil and Environmental Engineering

Acknowledgements
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Introduction

Design Problem Statement

Our group was tasked with designing and developing a mixed-use residential and commercial development for a 35.8 acre parcel along Old Ivy Road. The client requested 250 to 300 housing units divided into single family homes (10-15%), townhomes (20-30%), and apartment units (60-70%) with adequate parking. A minimum of two commercial buildings are required for the lot, as well as amenities for the housing developments. The goals include the development through the design phase and the pre and post construction phases.

Design Objectives

Our team prepared a site plan incorporating green infrastructure, traffic planning for construction, site grading for proper drainage, stormwater planning, and construction planning. We created six versions of our site plan to be completed throughout the length of the project to allow for redesigns and edits as other pieces of the site changed, such as the grading, road design, and stormwater management practices. In our site plan we have chosen to use essential urban planning techniques such as prioritizing walking, biking, and public transit. We did this through the addition of walking trails, sidewalks, and bus stops, as well as emphasizing connectivity of pedestrian access throughout the site.

A stormwater management plan as well as a grading plan were included as design goals for the site. The grading plan outlined the changes made to the grade of the post-development land, and the stormwater management plan covered the modification of the existing pond into a stormwater retention pond. The goal was to better suit the projected post-development stormwater volumes. A traffic plan was created to visualize and plan road closures, detours, and other construction related changes to traffic on surrounding roads. Additionally, we aimed to create construction related deliverables including a project schedule, scoping for a trade, and list of potential subcontractor partners.

Background

Affordable and sustainable housing is seen as a big issue within Albemarle County. The county website defines affordable housing as "when rent or mortgage, plus utilities, costs no more than 30% of a household's pre-tax income (Albemarle County, VA)." A family in the county making the median household income of $123,000 "- assuming a 30-year, 6.0% fixed rate mortgage, with a $25,000 down payment, and a monthly debt of $1,000" can afford to purchase a home for $393,000 but the median home sale price in the first quarter of 2023 is $458,798 - which is 16% higher than what is within their financial means. When considering the rental property market, which is also a concern of the County, it is estimated that "-today, a modest

2-bedroom apartment in Albemarle County rents for an average of $1,401 per month.” In order to afford this apartment at no more than 30% of their income, a full time worker in Albemarle County would have to make $26.94/hour or $56,040 annually. This is unrealistic as 62% of those in the county do not meet this income criteria. It is clear that housing needs to be more affordable within the county, which is most directly affected by the increase in its overall supply. This has to be within the sustainable criteria of being close to job centers, having community amenities, and access to public transit - all of which contribute to reducing the cost of living.

However, while the Old Ivy Road development adds housing units, it hasn’t been without controversy. One of the largest present concerns in the community involving this development is safety and traffic. The community opposition is worried that the increase in volume of traffic will further congest the roads, and decrease safety. Indeed, traffic conditions in the area are already poor, and this development will increase overall traffic. As such, a clear plan for accommodating increased traffic from the residents as well as the commercial property is needed. Further concerns stem from the beliefs that density will rise, taxes will go up, gentrification will increase, and infrastructure will become more problematic. However, academic institutions in Charlottesville believe that the units added by projects like ours will reduce overall prices and make Charlottesville more accessible to everybody. We will keep a conscious count on the number of units in the development and also will keep the public engaged on the project to build trust and knowledge.

Design

Site Design

Required Design Elements

The design of the site included all of the elements required by the client. This includes a mix of residential and commercial area, residential amenities, parking, relocating the Rivanna Trail, etc. (Dewberry Project Requirements, Appendix D). Figure 1 lays out all of the required components of the site plan in regards to Dewberry’s requirements.

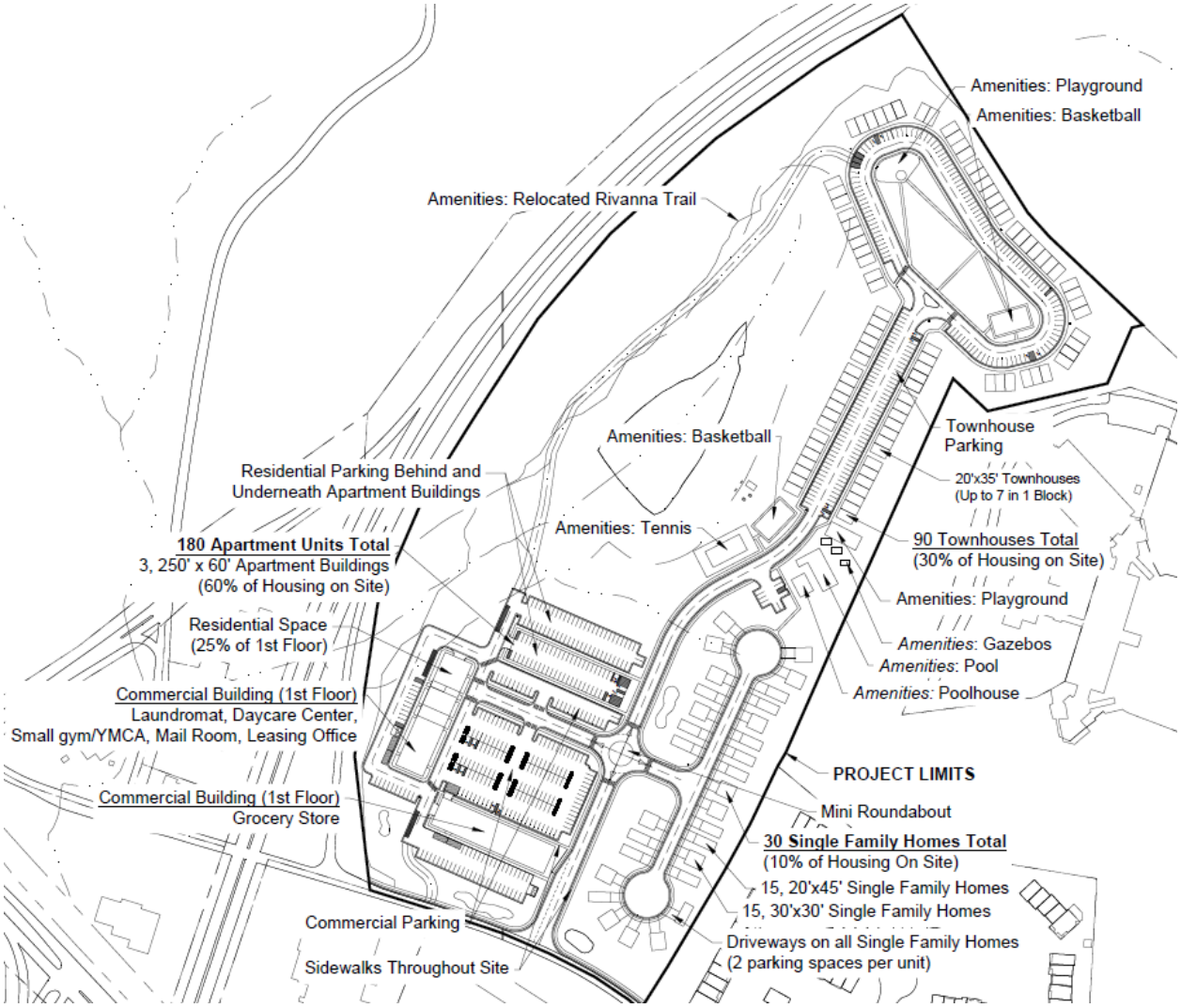

Figure 1. Dewberry Project Requirements Summarized on Site Plan

Residential/Commercial Design Areas

The design of the mixed use residential and commercial area followed all Project Requirements and relevant Albemarle County Code requirements (Project Requirements, Appendix D; Albemarle County Code of 1998). Our team aimed to create 300 housing units. The apartment units were planned to be constructed with the required two commercial buildings to create a mixed-use area that will foster community and allow for greater walkability. The ranges for each housing type were as follows:

- 30 Single Family Homes (10% of units)
- 90 Townhouse Units (30% of units)
- 180 Apartment Units (60% of units)

We centralized all commercial parking for the site between the southern and western apartment buildings which both had 1st floor commercial. We then put all residential parking behind each apartment building as well as 1 floor of underground parking underneath each

apartment building so that residents would not have to walk as far, and so there was a clear delineation between commercial and residential areas (allowing residents to tow if someone parks inside of their spot as there would be towing signs in front of all residential parking entrances). The parking layout also portrays 2 box truck/loading dock spaces behind the commercial floor apartment buildings that includes dumpster pad locations as well. The residential parking spaces are as follows:

- Single Family Homes
    - 20’ width x 26+’ varying length driveways, providing 2 spaces per house
- Townhouse Units
    - Total = 202 + 6 ADA
    - Required = 144
    - Visitor/Excess (for Park as well) = 58
    - ADA Car Accessible = 5
    - ADA Van Accessible = 1
- Apartment Unit 1 (All Residential) - 72 Dwelling Units
    - Total = 102 + 4 ADA
    - Required = 98
    - Visitor/Excess = 4
    - ADA Car Accessible = 3 (Underground Parking Area)
    - ADA Van Accessible = 1 (Underground Parking Area)
- Apartment Unit 2 (Grocery Store) - 60 Dwelling Units
    - Total = 89 + 4 ADA
    - Required = 81
    - Visitor/Excess = 8
    - ADA Car Accessible = 3 (Underground Parking Area)
    - ADA Van Accessible = 1 (Underground Parking Area)
- Apartment Unit 3 (Various Commercial) - 48 Dwelling Units
    - Total = 67 + 4 ADA
    - Required = 65
    - Visitor/Excess = 2
    - ADA Car Accessible = 3 (Underground Parking Area)
    - ADA Van Accessible = 1 (Underground Parking Area)

The commercial businesses that we decided would bring the most benefit to the community were a laundromat, a daycare center/YMCA (gym), and a grocery store. This would incentivize more families to move into the area as there are also abundant recreational areas that are safe for children. Living nearby a grocery store also saves on commute times for groceries and miscellaneous items. The proposed commercial layout can be seen in Figure 2.

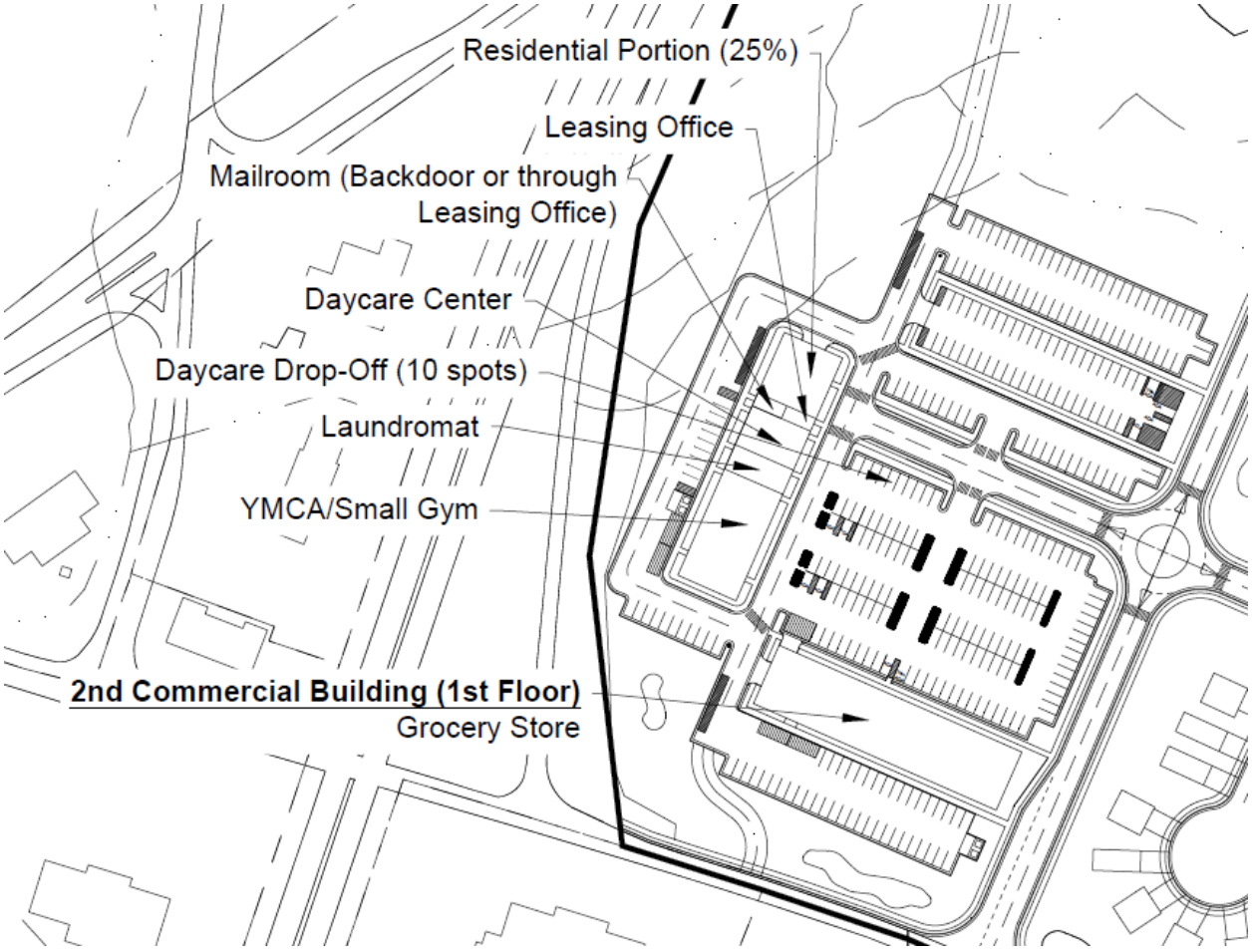

Figure 2. Commercial Floor Layouts

The commercial parking layout and spaces are as follows:

- Apartment Commercial Parking
    - Total = 159 + 6 ADA
    - Required = 152
        - Laundromat (3600 sq. ft.) = 13
        - Daycare (30 kids, 7 employees) = 10 + pickup/dropoff (10)
        - YMCA/Gym (7200 sq. ft.) = 58
        - Trader Joe's/Aldi/Small Grocery Store (11000 sq. ft.) = 61
    - Visitor/Excess = 7
    - ADA Car Accessible = 5
    - ADA Van Accessible = 1
- Apartment Commercial Loading
    - 4 Loading Spaces (12' x 30')
    - 2 Dumpster Pads with 2, 8 cubic yard dumpsters in each

The design of the other residential areas was also in accordance with project requirements and county code. Regarding single family housing, we decided to locate the single family homes around cul-de-sacs and varied the designs to have a mostly even split between houses that were 30’ x 30’ and those that were 20’ x 45’. We had to fit all single family homes into one parcel as that was the only parcel zoned for R1, while all others were zoned R-15 allowing us to put the townhouses and apartment buildings more optimally around the site. We decided to place the apartment buildings closest to the entrance so that the commercial areas could be accessed more readily by those coming into the site that are not residents. We placed the townhouses around the large park to maximize the viewshed area onto the park (helping with community safety for children playing, as well as residential views). We decided to place perpendicular parking in front of the townhouses to allow for easy access by residents who lived there as there was not enough space to design parking areas behind the townhouses without creating significant amounts of additional impervious cover.

Recreational Area Design

Within our design we have made it a priority to maximize the amount of green space and recreational areas available to residents. Despite the provision that states recreational areas do not need to be provided for single-family zoning, we decided to provide these areas with recreation regardless. Our recreational areas are centralized in two locations. The first are recreational areas within the larger park in the townhouse area, and the second is the community pool area centralized on the site itself. This allows almost all residents within the site area to be within 0.25 miles of a recreational area, making it extremely accessible and convenient to access as it is within walking distance.

The large park has future planned amenities within it in order to increase green/recreational space available to residents (Figure 3). We found it important to provide as much recreational space/green space as possible for the various health benefits associated with access to these areas. We also imagined that the large park would provide the future community with a large communal space for open air gatherings and/or a community garden if they so wished. The park would also allow for the site to be more aesthetically pleasing for the residents/families who lived in front of it.

As a part of recreation, a portion of the Rivanna trail has been moved. The Rivanna trail is a beloved part of the Charlottesville community and our team wanted to ensure that we respect its meaning to the community. The trail previously ran through a portion of our site which will be impacted by construction. We wanted to keep its element of winding through the greenery on site, so we have moved portions of the trail plan North to keep it away from the new homes in this community. All recreational areas for the site can be seen in Figure 3 below.

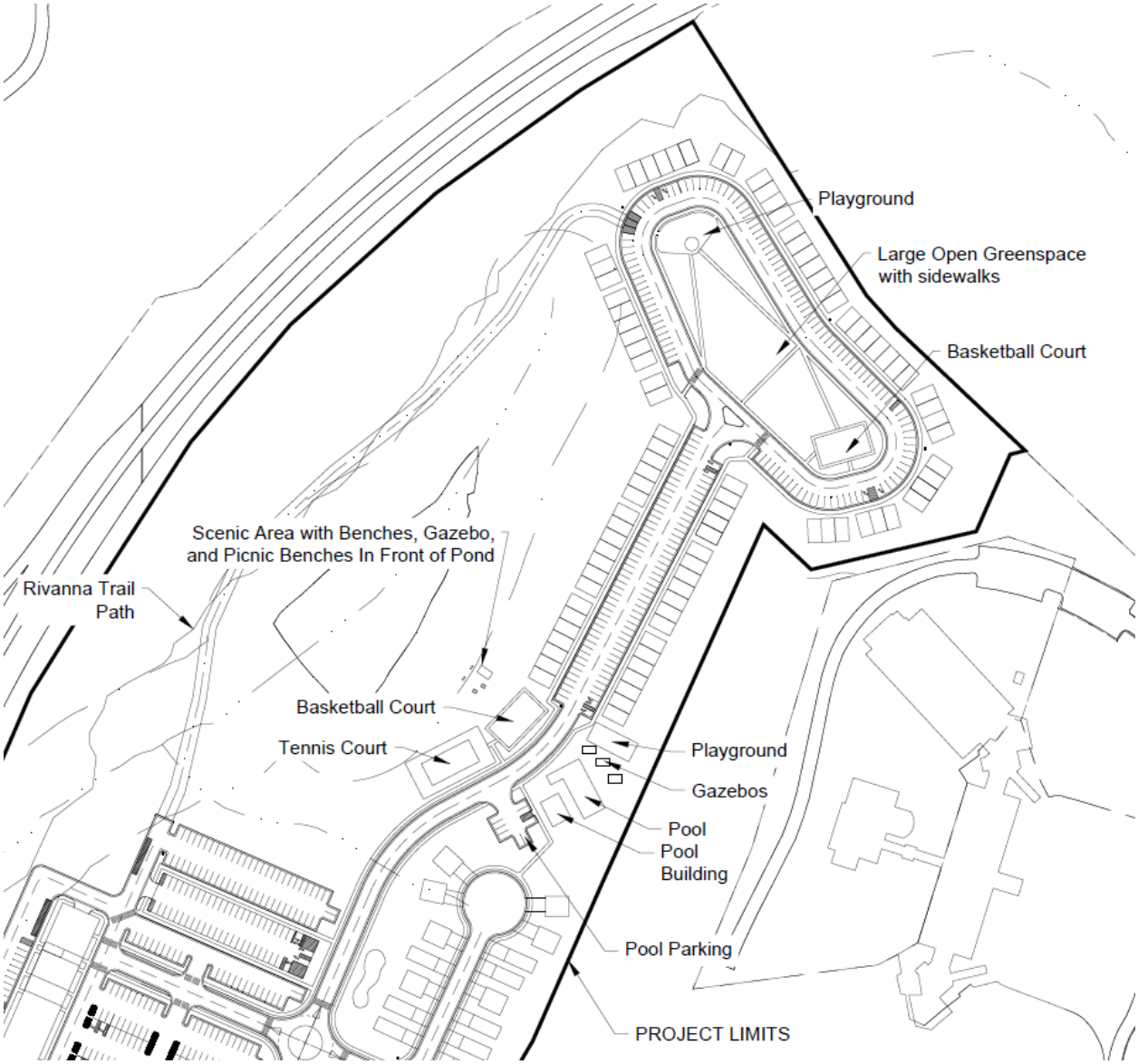

Figure 3. All Planned Recreational Areas on Site

Roadway Design

The design of roads and entrances followed County Code, fire access code, as well as various VDOT standards and design manuals. Since it is a majority residential development, we set the speed limit to be 25 mph throughout the site, except in parking lots and through the roundabout, which will be lower. In addition to that, we modified roads and their entrance radii to be able to accommodate school buses (radius = 45'). We also decided to move the initial site entrance to a different location (Figure 4). Space for an additional right turning lane was added onto the entrance of the site after further traffic analysis in order to relieve potential traffic congestion that might occur while entering the site.

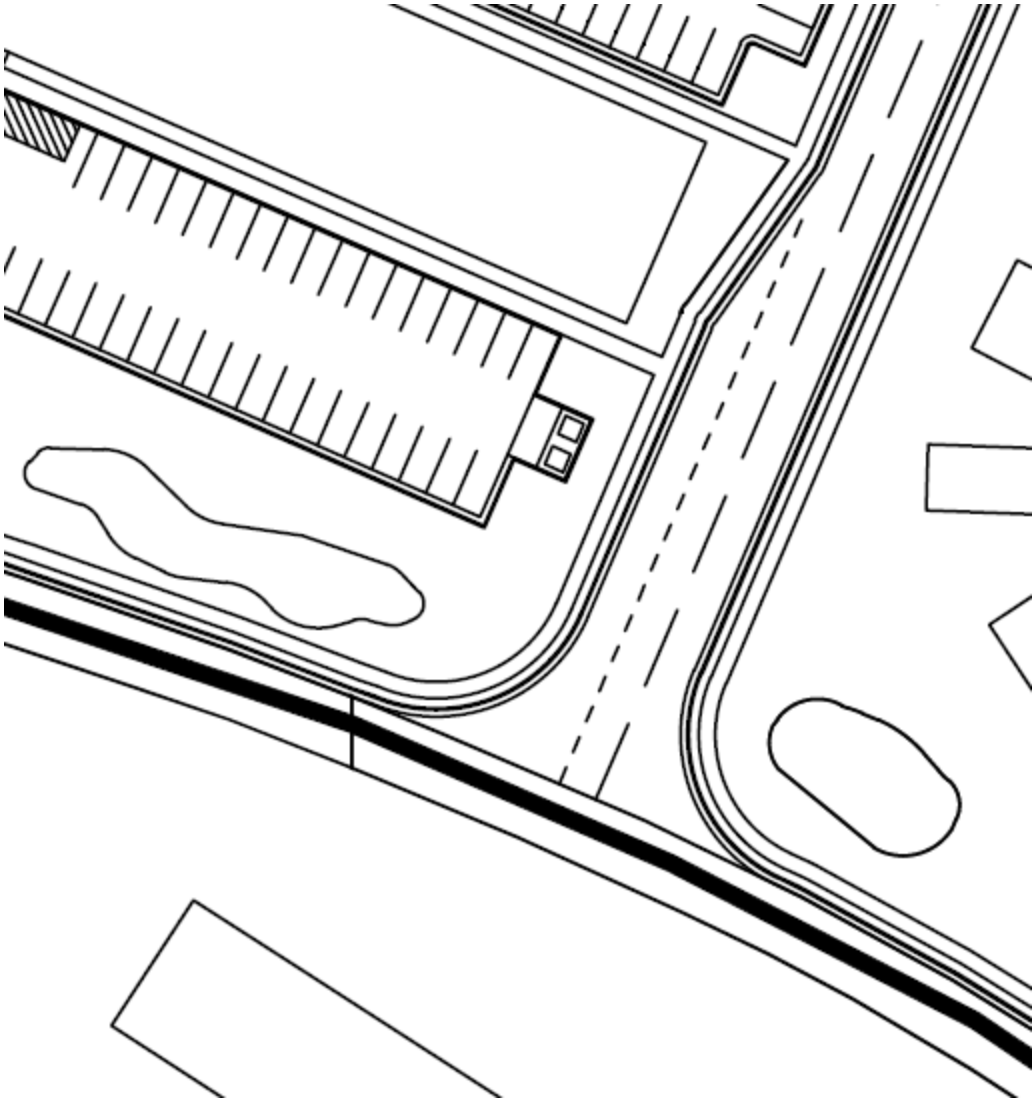

Figure 4. New Entrance and Right Turn Lane

In order to make the site more manageable and to not install traffic signals that must be maintained, we decided to install a single lane mini roundabout to handle traffic entering the commercial area as well as the site itself (Figure 5). This design was chosen since the site we have has a low daily traffic count. The traversable inner island makes the site accessible to larger vehicles, like school buses and commercial box trucks, while still keeping the overall sizing small.

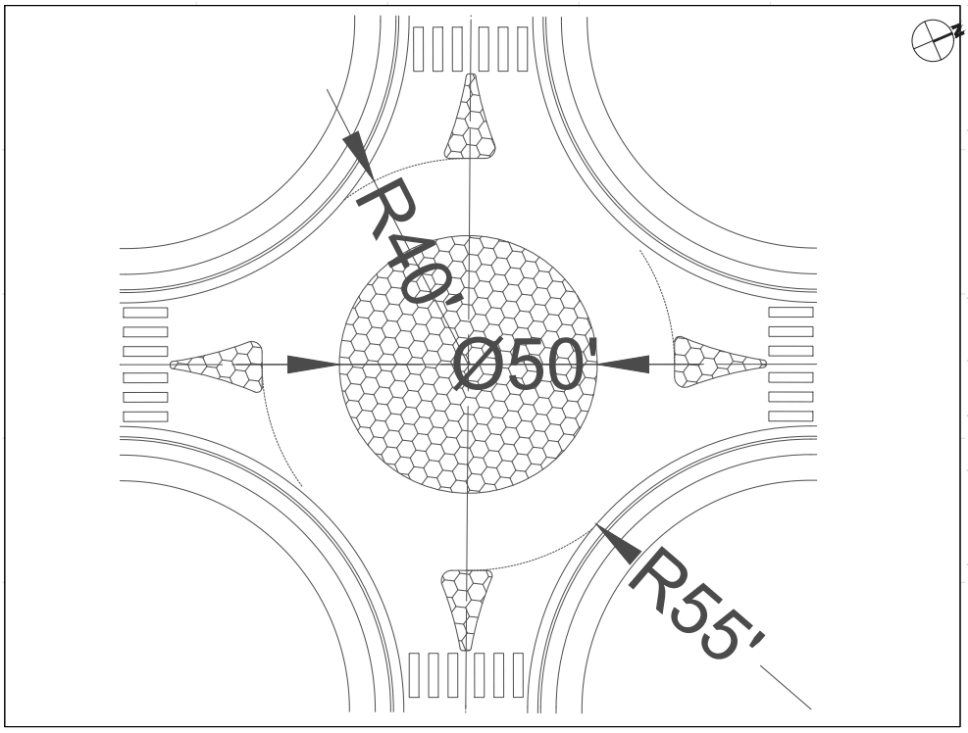

Figure 5. Roundabout Sizing and Radii

Stormwater Plan

We completed the stormwater management plan in tandem with the site plan. The preliminary stormwater plan, see Figure B10 in Appendix B, set out the initial drainage areas along with proposed areas for the locations of best management practices (BMPs). As the grading and site plans became more detailed, we went on to place the BMPs in their final locations. The areas that we had initially reserved for stormwater BMPs were larger than the necessary spaces needed to meet VRRM specifications. These conservative estimates that we made early in the design process gave us more flexibility later in the design. We ended up dividing the space into four drainage areas. Their sizes can be seen below in Table 1.

Table 1. Drainage Area Sizes

Drainage area	Size (acres)
A	2.62
B	2.77
C	5.20
D	25.21

BMP Selection

The final stormwater infrastructure design is shown below in Figure 6. Our best management practices (BMP) strategy consists of several measures. These locations chosen for these BMPs were at the low points within each area. Drainage area A, which is home to half of the single family homes, will have a level 2 bioretention BMP. Similarly, drainage area B will also have one bioretention. The design for drainage area C, which contains the apartment buildings and their associated parking lots, has more diverse infrastructure. The BMPs for this area include one level 2 bioretention basin along with two split filterra systems located on an island between parking spaces. Drainage area B, which is by far the largest area, uses a level 2 wet pond to treat drainage. The detention pond will be constructed on the site of an existing pond, which is already the natural low point on the site. Additionally, storm sewers will be placed periodically throughout the road system to allow for drainage from impervious surfaces. The exact placement of storm sewers is not within the scope of this project.

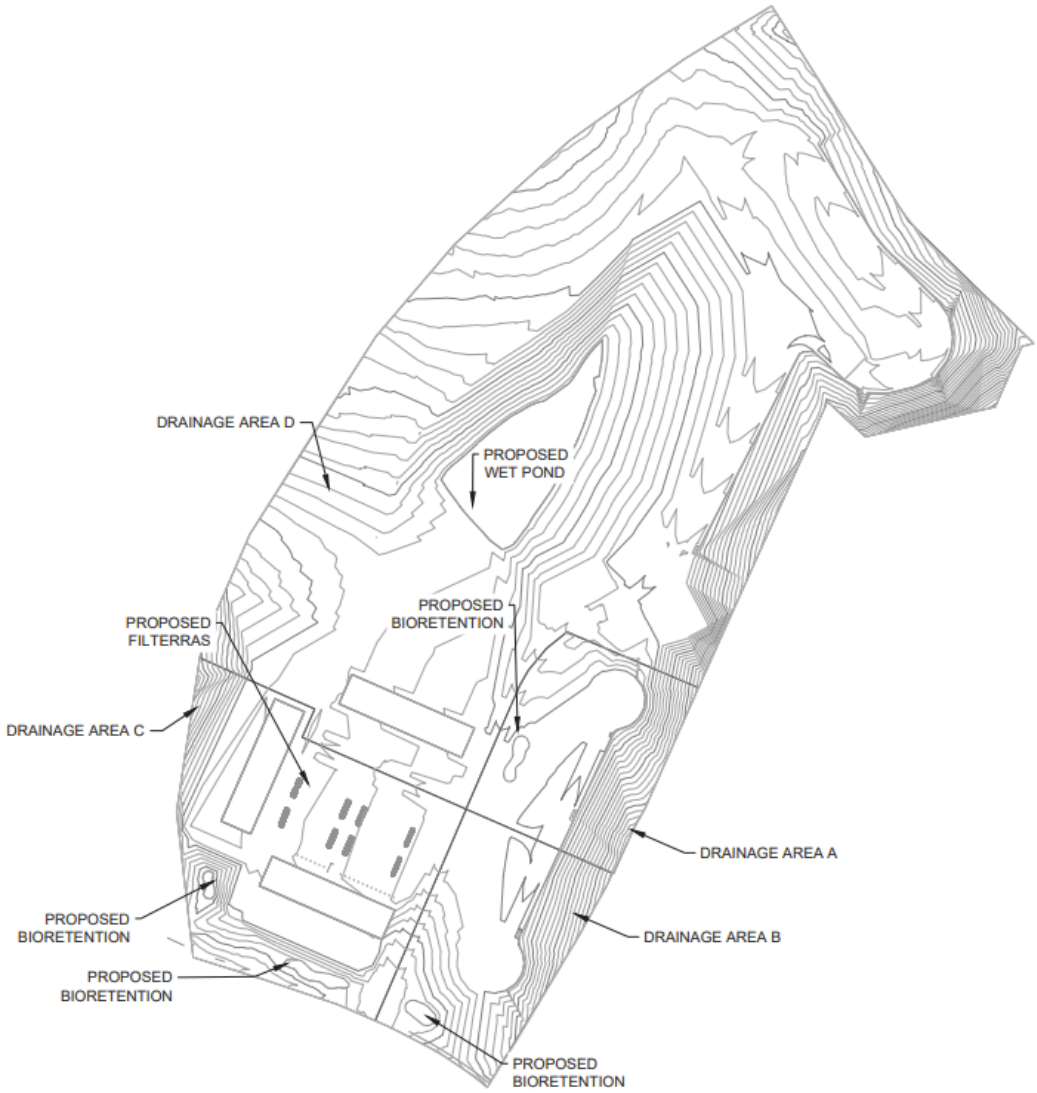

Figure 6. Proposed Stormwater Management Plan with New Grading

Phosphorus Removal

We used the Virginia Runoff Reduction Method (VRRM) to calculate the phosphorus removal of the BMPs on our site. A copy of the spreadsheet is located in Appendix D. The VRRM found that in order to meet Virginia stormwater regulations we needed to reduce the Total Phosphorus (TP) load by 20.28 lb/year. We inputted the final project conditions based on land cover and soil types. We then inputted all proposed BMPs along with the drainage areas in which they will be placed. We found that our proposed BMPs would treat 34.96 lb of TP per year, a removal rate greater than that required by law. Considering this, we determined that there is no need to purchase stormwater credits since our current plan meets local regulations.

Grading Plan

While the existing site is very hilly, the proposed surface is much more shallow. Design constraints, such as a maximum grade of 10% for most roads on the site and a max grade of 2% for parking lots and intersections, meant that roads were not able to follow existing contours very closely. This resulted in large sections of cut. However, the hills on the site also resulted in many voids that will need filling, offsetting the amount of cut volume that is produced. Additionally, minimum K-values, shown in Figure 7, that determine the sharpness of vertical curves restricted us from following the natural contours closely, resulting again in areas of unfavorable cut and fill as seen in Figure 8. Yards and green spaces require between a 3 and 10% grade for aesthetic and drainage purposes. However, a lack of pre-determined grading led to undesirable grades along the western side of the site, particularly west of the single family homes and west of the townhomes. To remedy the large grades, several five-foot retaining walls were placed along the roads, as seen in Figure 9. Even so, grades to the west of the single family homes reach up to 25%, and grades west of the townhomes reach up to 44%. The final volume report for the proposed surface can be seen in Table 2.

Private Street Standards for Albemarle County *										
Street	**Design Speed mph**	**Min. CL radius ft.**	**Max. Grade**	**Min. K-crest**	**Min. K-sag**	**Min. Stopping Sight Dist. Ft.**	**Min. travelway width ft.**	**Min. ROW or easement width**	**Min. shoulder width**	**Sources**
rural 2-lot	(no standard)							30	n/a	14-412A1
rural 3-5 lots	15	40	20%	5	15	100	14	30	3	14-412A2, 410, 415
6 lots or more	same as VDOT standards, see Detail 5									14-412A3, 415
multifamily, nonresidential	n/a	40	10%	5	15	100	20 (curb to curb) **	30	n/a	14-412B
Alleys	n/a	n/a	20%	n/a	n/a	100	12***	20	n/a	14-410

* where standards are not specified (for guardrail or drainage for example) standards are to be as required by VDOT
** or 24' next to perpendicular parking spaces (Zoning Ordinance parking lot requirements, 18-4.12.15)
*** with 14' wide stone base
1. Angle of intersection shall be 80 degrees minimum
2. Temporary turnaround shall be provided on phased streets more than 300ft in length. Cul-de-sacs must be provided for permanent street ends. See the graphic below.
3. Reserved or spite strips are prohibite
4. In the development areas, curb and gutter, sidewalks (5' min.), and planting strips (6' min) are required

Figure 7. Design Standards for Private Streets in Albemarle County

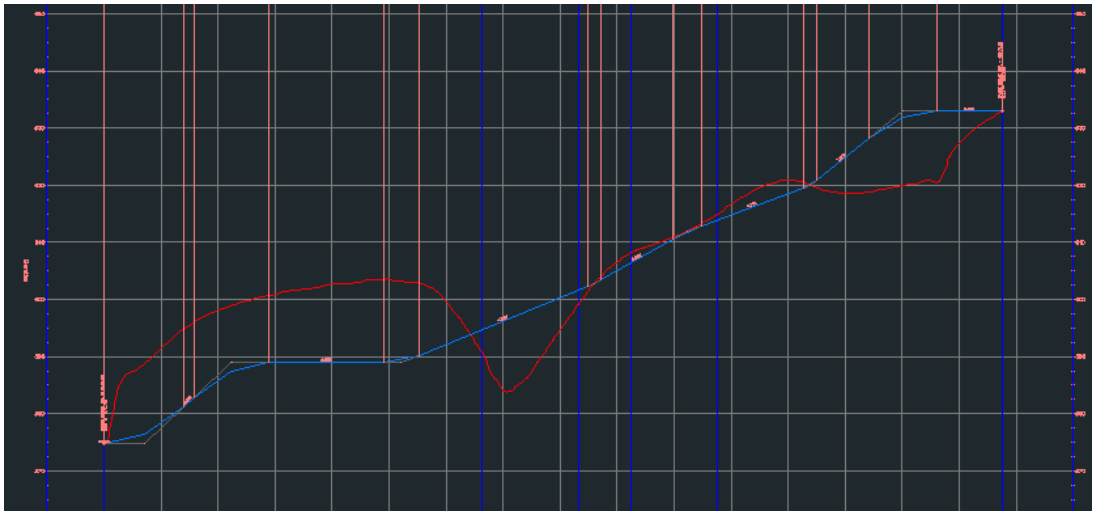

Figure 8. Profile of Main Road Alignment Showing Cut and Fill Areas

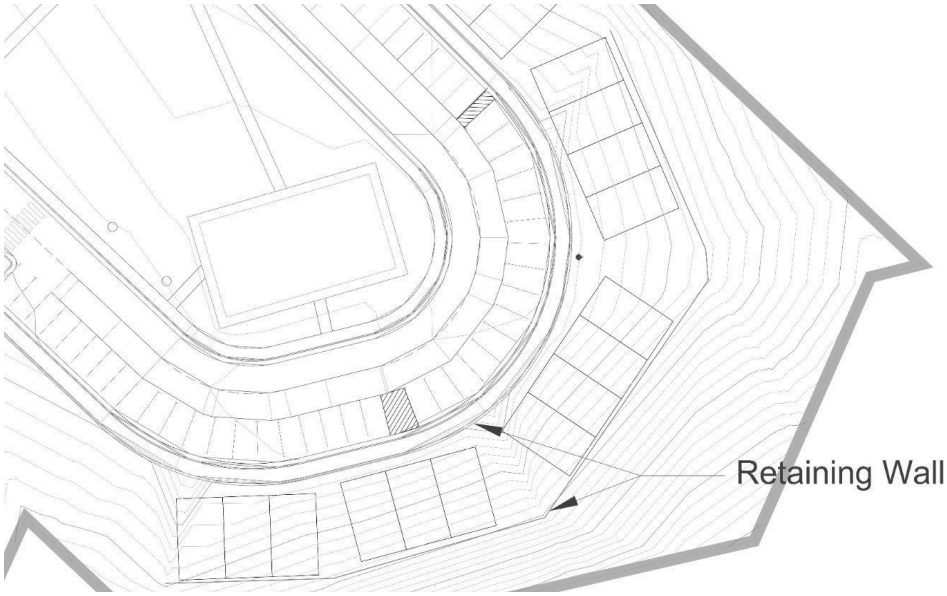

Figure 9. Retaining walls near townhomes

Table 2. Volume calculations for final surface

Total Cut (Cubic Yards)	443986.49
Total Fill (Cubic Yards)	96543.41
Net (Cubic Yards)	347443.07 (Cut)

The level 2 detention pond in the northern section of the site treats almost 60% of the total site's area, which was achieved through a combination of pre-existing grading and additional grading. Earthwork was done to ensure that those sections all drained towards the pond. The site was split into three other drainage areas as well, though smaller and draining into bioretention ponds, outlined in the stormwater plan. The finalized grading plan can be seen in Figure 10.

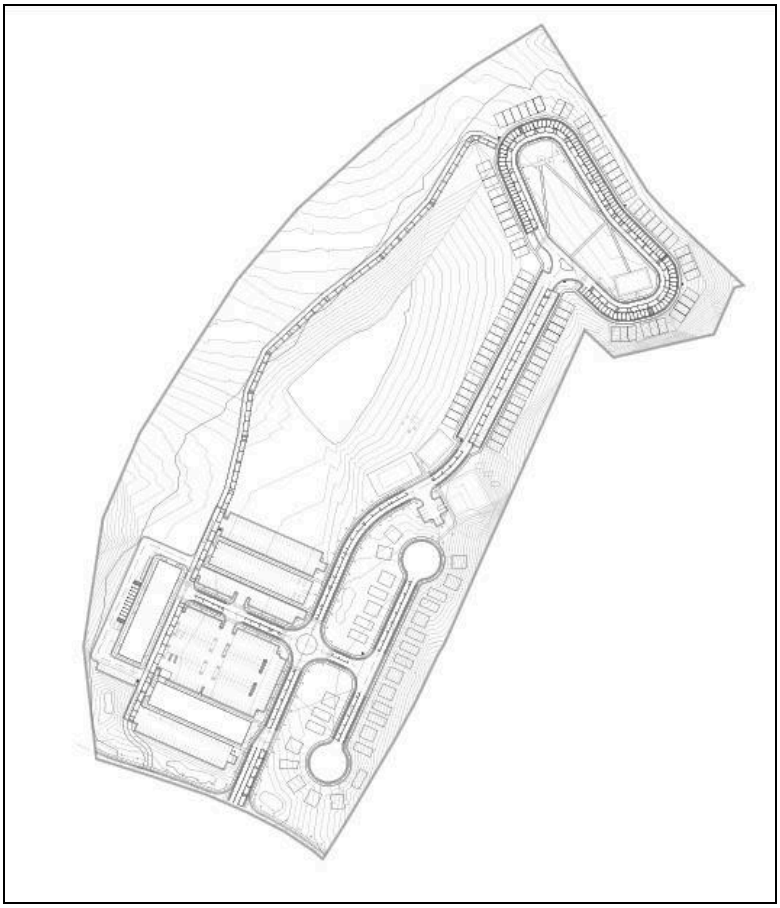

Figure 10. Finalized grading plan

Traffic plan

An iterative traffic plan was created to show how construction would take place with regular traffic flowing through the area and how the completion of the site would affect existing traffic conditions.

To do so, the background traffic conditions had to be analyzed from which conclusions could be drawn. Much of the data and information was drawn from a Traffic Impact Analysis document prepared by Timmons Group for the surrounding area including the site. The key things that were considered when looking into the background traffic conditions were the existing roadways, intersections and points of entrance/exit.

The major roadways which service the site are Old Ivy Rd, Ivy Rd and US 29. Old Ivy Rd is the most important as the site is right off of it. The table below shows what kind of road it is along with its speed limit and ADT.

Table 3. Existing Roadways Feeding into Development

Road Name	Type of Road	Speed Limit (MPH)	ADT (Average Daily Traffic)
Old Ivy Road	Two Lane - Undivided	35	8,300
Ivy Road	Two Lane - Undivided	35	58,000
US 29	Four Lane - Highway	55	58,000

We also analyzed the intersections in the area to see what type they are along with the delays in the AM peak times of 7-9 AM and PM peak times of 4-6 PM as seen in Table 4.

Table 4. Existing Intersections

Intersection	Type	Peak Delay AM (sec/veh)	Peak Delay PM (sec/veh)
Ivy Rd & Canterbury Dr	Signalized	48.2	45.9
Old Ivy Rd & Faulconer Dr	Unsignalized	349.1	20
Old Ivy Rd & Ivy Rd	Signalized	13.3	13.2
Old Ivy Rd & 29 Off Ramp	Unsignalized	87.3 (eastbound) 167.7 (westbound)	27.5 (eastbound) 47.1 (eastbound)

It was also important to see how Old Ivy Rd and subsequently the site is connected to the surrounding traffic network as seen in Figure 11.

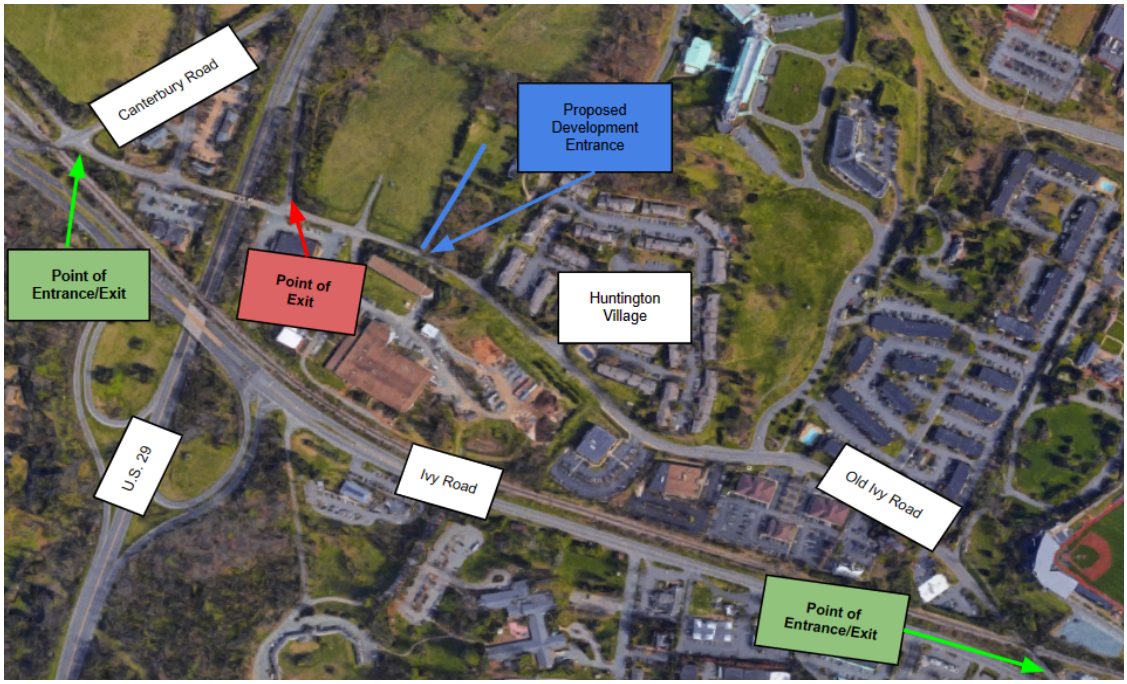

Figure 11. Map of Traffic Network with Roadways and Points of Entrance/Exit

Putting all of this information together, we can conclude that there is a high volume of traffic going through Ivy Rd to get either on or off US 29 during peak times as people commute to and from work. While this traffic doesn't directly go through Old Ivy Rd, passing through the west entrance can be difficult especially as highlighted in the traffic constraints of the eastern entrance.

After development, we believe the typical daily service volume of the development will increase by 2,253 average daily trips to a total of 10,553 veh/day. In order to service this additional load on Old Ivy Road, we're proposing that an additional right turn lane be added to it, leading into the development. Something to keep in mind is that not all of these added trips won't necessarily be impacting Old Ivy Road as some of them will be within the site as residents go to various amenities or commercial spaces throughout the site.

While construction is being worked on, we're proposing that a one way, two lane taper is instituted with a flagger on each side of the closed off section. One of the flaggers will be the lead flagger and communicate either verbally or electronically with the other flagger. This way, only one lane of the road will have to be closed and this will be during off peak hours such as noon and during the evening/night.

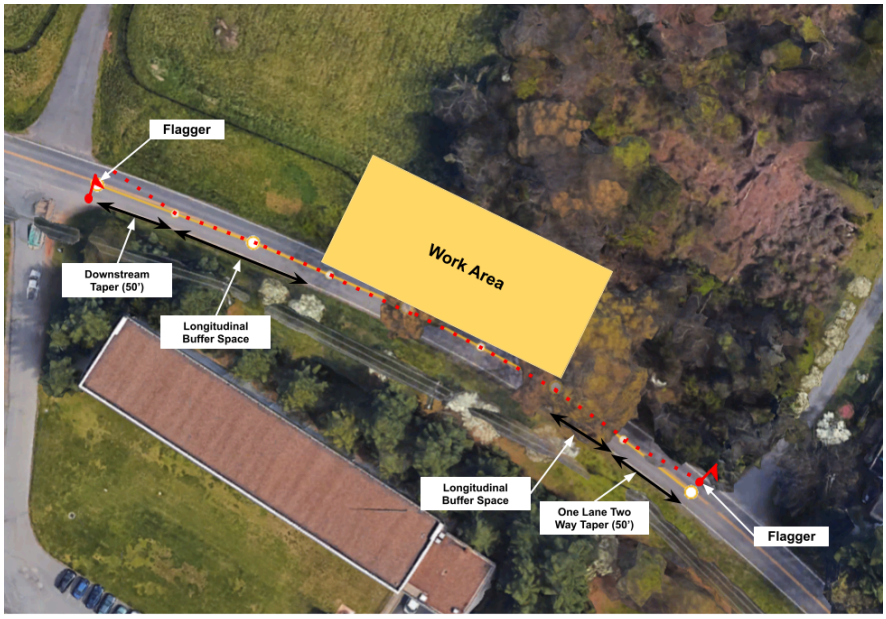

Figure 12. Traffic Plan During Construction

To manage some of the additional traffic load generated by the site, we're also proposing a new intersection as shown in Figure 15. There would be an additional left turn lane entering the site so that traffic isn't backed up on Old Ivy Road westbound. There are also both right and left turn lanes exiting the site to avoid backup in the site as well.

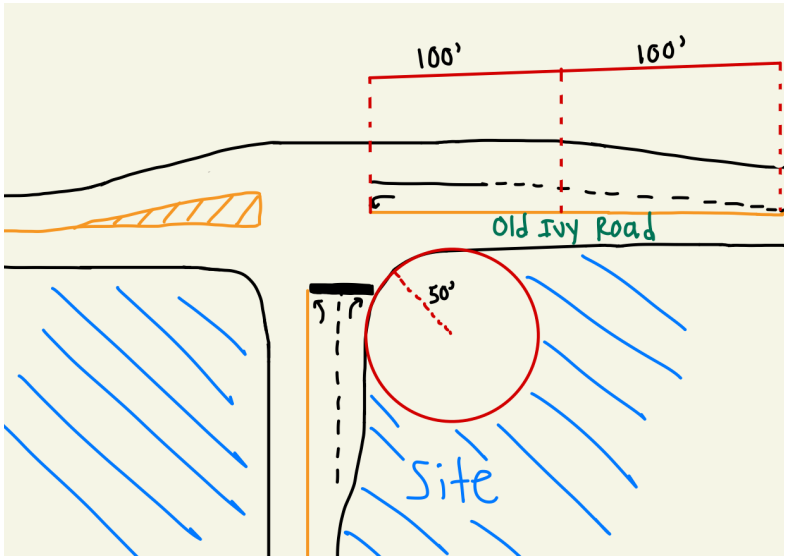

Figure 13. Proposed Intersection

Construction Plan

A construction plan for the site will help execution of building go more smoothly. To prepare for construction, our team developed a number of deliverables. These include a construction schedule Gantt chart, a list of subcontractors near Charlottesville that will be contracted to perform work, and a sample scoping document for landscaping.

To create the construction schedule, each labor step was divided into a category of preconstruction, sitework and structures, interiors, and inspection and closeout. From there, each division was structured to begin and end in a way that respected the necessary prerequisites of the construction process. For example, MEP work was scheduled to begin after completion of framing. Given the schematic nature of the design, exact timing and scheduling will fluctuate and a more detailed schedule will be able to be developed as the drawings progress. Figure 11 shows a simplified construction schedule, and a detailed schedule is available in Appendix D.

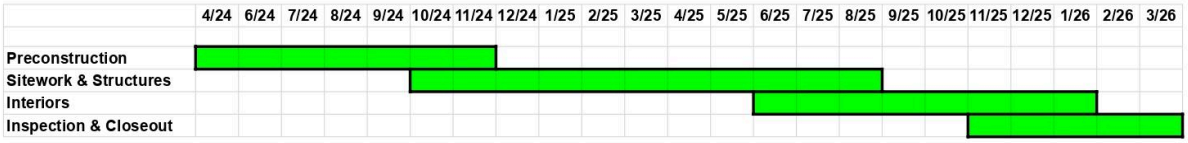

Figure 14. Simplified construction schedule

Selection of trade contractors is reliant on specialty, distance, pricing, and pre-existing relationships. Given the nature of this project, subcontractor specialization and proximity to the jobsite were the primary factors considered. Each trade has two options available as a shortlist in case one subcontractor is too busy to take the work or quotes a price that is unreasonable. In the selection process, companies based in Charlottesville were prioritized due to their knowledge of the community and their likelihood to bid on a local project. To find suitable contractors, a combination of internet searches and observational research was conducted. The divisions chosen follow MasterFormat CSI Division guidelines and are the most popular guidelines used on the construction of a neighborhood. Some divisions such as division 09 - finishes encompass different trades such as gypsum board, flooring, ceilings, and painting. In this case, multiple contractors were included in the list to cover these required parts of the building. A complete list of subcontractors can be found in Appendix D.

A detailed scoping document was created for the landscaping subcontractor. This was done using the format provided by Dewberry along with publicly available scoping documents on planting. The scoping document consists of three parts, a general overview section, information on the physical products, and the plan for executing for the subcontractor. While most projects only have a scorpion document for planting and a separate one for any other kind of hardscaping elements, both were combined into one for this project. Special considerations had to be taken in this scoping document for the plants as they are live organisms whose physical conditions are prone to change suddenly and drastically. These are also elements that require follow-up and constant maintenance post-project completion, further expanding the scope.

Design Constraints

Site Plan Constraints

The largest constraint facing the site plan was the learning curve regarding zoning, fire access requirements, specific Albemarle design requirements, and finding out new design manuals to base the design off of throughout the project. Due to how many design guidelines

that were followed to meet zoning and recommended design constraints, the site plan was changed multiple times in order to accommodate each new guideline added which caused subsequent changes throughout all other plans.

Grading Constraints

The largest design constraint facing the grading plan was the existing hilly conditions of the site combined with the generally low grades required for subdivision design roads. Additionally, the inclusion of street parking, while convenient for residents, meant that these particular roads were subject to an even lower grade of 2% to allow for ADA accessibility. These low grades lead to roads not being able to gain elevation at the same rate as the site, and resulting in large cut requirements. The overall favoring of low grades for development created challenges for grading the site while attempting to avoid large cut and fill sections.

Stormwater Constraints

Stormwater management planning was constrained by state stormwater code, outlined by the Virginia Stormwater Management Program (VSMP) Regulation. The BMPs that we selected needed to meet the total phosphorus removal requirements outlined in these standards. The potential BMPs available for use were those listed in the VRRM spreadsheet. Runoff coefficients that characterized land uses impacted the stormwater runoff quantity and quality. Managing these runoff coefficients constrained decisions regarding land use that were made during the design of the site plan.

Traffic constraints

Traffic constraints relate to the existing road infrastructure in place, particularly Old Ivy Road. There are only two points of entrance and exit on Old Ivy Road, with an extra exit point. This limits how both future residents and construction workers can access the site. In particular, the south entrance/exit point of Old Ivy Rd falls under an old railroad bridge which limits only one vehicle from entering/exiting at the same time and has a clearance of 11’1”, prohibiting larger vehicles like buses, or trucks from entering through there.

Construction Constraints

Construction related constraints relate to the reality of each job site being unique from the last. For sourcing subcontractors, qualified companies are limited to those physically nearby the Old Ivy Road site. In terms of scheduling, the unique variables associated with making a reliable schedule such as existing site conditions and material availability make defining success harder to accomplish. Lack of subcontractor critique and feedback on our scoping makes defining realistic scope more difficult.

Conclusion and discussion

There were a variety of complex decisions made throughout the design process. Some of these decisions were highly constrained by regulations and codes, while other aspects were

more flexible and allowed for creative problem-solving. As we progressed through the design process we had a number of iterations. Some changes were made after we received new information during weekly meetings with our industry mentors, while other changes were the result of new ideas from discussions held within the team. The various iterations can be found below in Appendix B: Site Plan Iterations.

One decision that we made early on was to have a roundabout near the entrance of the site versus a stoplight or a 4 way stop. A couple of factors went into this decision. The primary factor was safety. Compared to a signalized intersection or a 4 way stop, a roundabout has fewer points where crashes can happen. Another key factor was efficiency. Given the size of the neighborhood, we wanted to have the cars able to flow without causing backups. Since there's one main "artery" that connects all of the buildings, keeping it clear is important.

With the affordable housing shortage in not only Charlottesville but the greater Albemarle area, the most simple way to address it is through an increase in the supply of housing. Creating an additional 250-300 housing units not only takes a step towards that but shows that it can be a doable and sustainable way of building mixed-use residential developments within Charlottesville. The addition of community amenities such as parks, green spaces, and other recreational areas makes this a place that future residents will want to move into. Green ways of transportation, including walking, biking, and public transit through the additions of accessible sidewalks, walking trails, and bus stops to better connect the community with one another and the greater area.

Our project has met the needs of the developer by fulfilling the housing unit requirement with the requisite amenities and parking while going the extra step to thoughtfully address community concerns. While there will be an influx in traffic within the local area, carefully crafted road design, including innovative roundabouts, within the site regulates vehicular and foot traffic while the site entrance intersection was designed in a way that reduces queue times and car backup. These features ensure that traffic is efficiently regulated both within the site and throughout its connection to its surroundings. Careful coordination with local environmental groups has ensured that the Rivanna Trail's integrity is being kept and accessible to all. Town hall discussions with the local community and prospective residents have ensured that the commercial spaces on site are addressing their needs without being just a means of gentrifying the area through unwanted and expensive businesses. This project makes effective use of an unused parcel and is economically accessible to all socio-economic groups as it meets the Albemarle County requirement of a minimum of 20% of the total number of housing being provided as affordable housing due to its dense nature.

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cc10192023_PM.pdf

Appendix A - Detailed Schedule

GANTT CHART

* = an automatically calculated cell

TASK NAME	START DATE	END DATE	START ON DAY*	DURATION* (WORK DAYS)	TEAM MEMBER	PERCENT COMPLETE
Preliminary Site Plan						
Blocky Site Plan	9/22	9/29	0	7	Grey/Reese	100%
15% Site Plan	9/29	10/13	7	14	Grey/Matt	100%
30% Site Plan	10/13	11/10	21	28	Grey/Reese	100%
60% Site Plan	11/10	11/24	49	14	Grey/Reese	100%
90% Site Plan	11/24	12/1	63	7	Grey/Reese	100%
100% Site Plan	12/1	12/8	70	7	Grey/Reese	100%
Preliminary Traffic Plan						
Preliminary Traffic Plan V1	9/22	10/6	0	14	Subham/Matt	100%
30% Traffic Plan V2	10/13	11/17	21	35	Subham/Alex	100%
Preliminary Grading Plan						
Preliminary Grading V1	11/13	12/8	52	25	Matt/Reese	100%
Preliminary Rivanna Trail Plan						
Rivanna Trail Placement V1	10/6	10/13	14	7	Grey	100%
Preliminary Construction Timeline						
Preliminary Gantt Chart Framework	11/1	11/10	40	9	Subham/Alex	100%

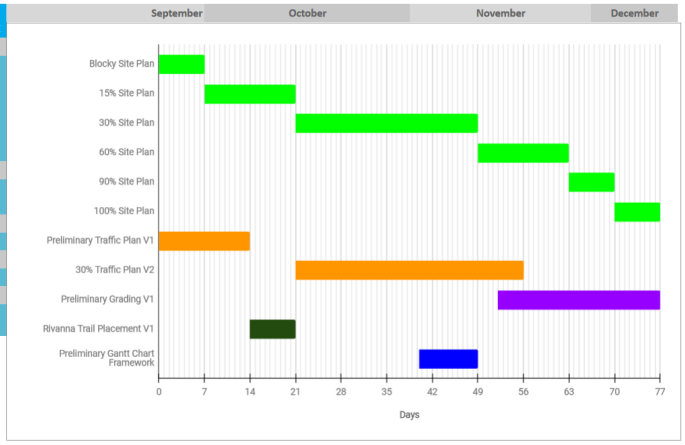


Figure A1. Fall 2023 Schedule

GANTT CHART

* = an automatically calculated cell

TASK NAME	START DATE	END DATE	START ON DAY*	DURATION* (WORK DAYS)	TEAM MEMBER	PERCENT COMPLETE
Traffic Plan						
60% Traffic Plan V3	1/17	1/26	0	9	Subham	100%
90% Traffic Plan V4	1/26	2/16	9	21	Subham	100%
100% Traffic Plan V5	2/16	3/8	30	21	Subham	25%
Grading Plan						
Grading V1	1/17	3/11	0	54	Matt/Reese	75%
Grading V2	3/11	4/1	54	21	Matt/Alex	0%
Stormwater Management						
Stormwater Plan V1	1/17	3/4	0	47	Matt	50%
Stormwater Plan V2	3/4	4/8	47	35	Matt	0%
Construction Information						
Construction timeline	1/22	3/18	5	56	Subham/Alex	50%
Trades Identified	2/2	2/19	16	17	Subham/Alex	100%
Subcontractors Identified	2/19	3/25	33	35	Subham/Alex	0%
Major Trade Estimate	3/4	3/25	47	21	Subham/Alex	0%
Sample Scoping Document	3/11	4/1	54	21	Subham/Alex	0%
Site Plan						
50% Site Plan	1/17	2/9	0	23	Grey/Reese	100%
70% Site Plan	2/9	2/26	23	17	Grey/Matt	100%
90% Site Plan	2/26	3/18	40	21	Grey/Reese	0%
Completed Site Plan	3/18	4/15	61	28	Grey/Reese	0%

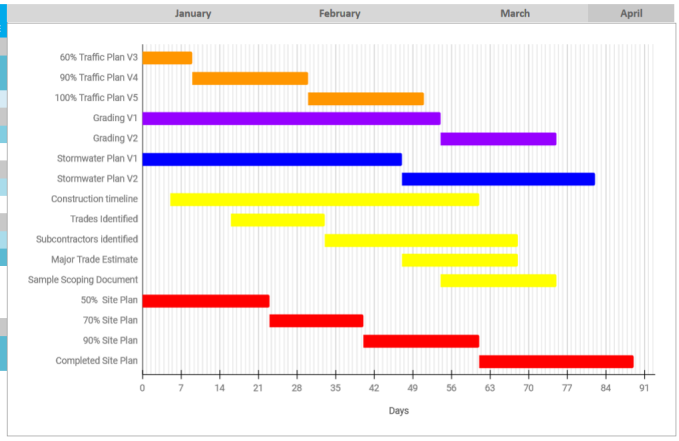


Figure A2. Spring 2024 Schedule

Appendix B - Design Evolution

Site Plan Evolution

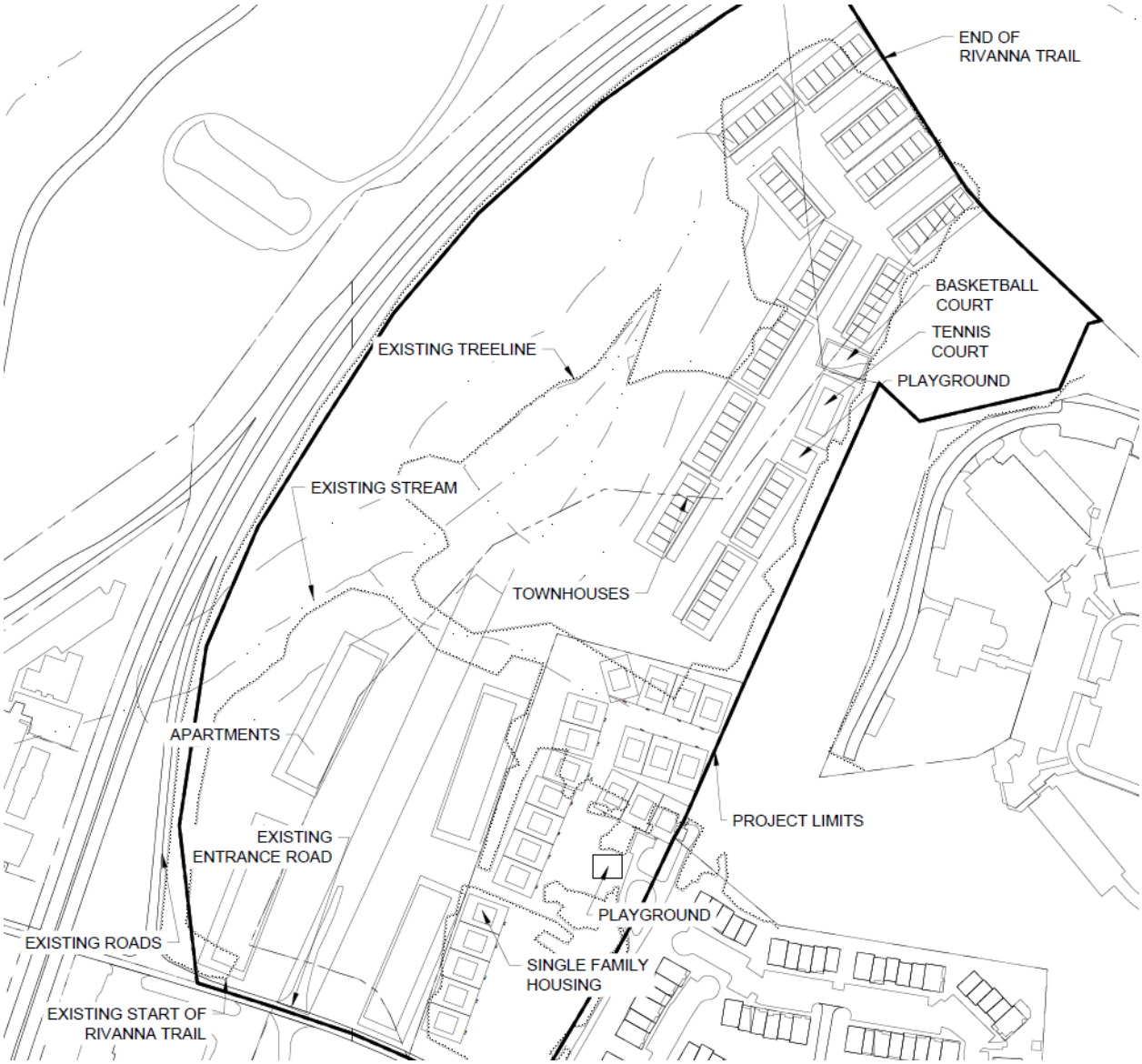


Figure B1. Preliminary Site Plan 10% Completion (October 5, 2023)

Key changes: Initial placement of residential units, recreational areas, and proposed main entrance.

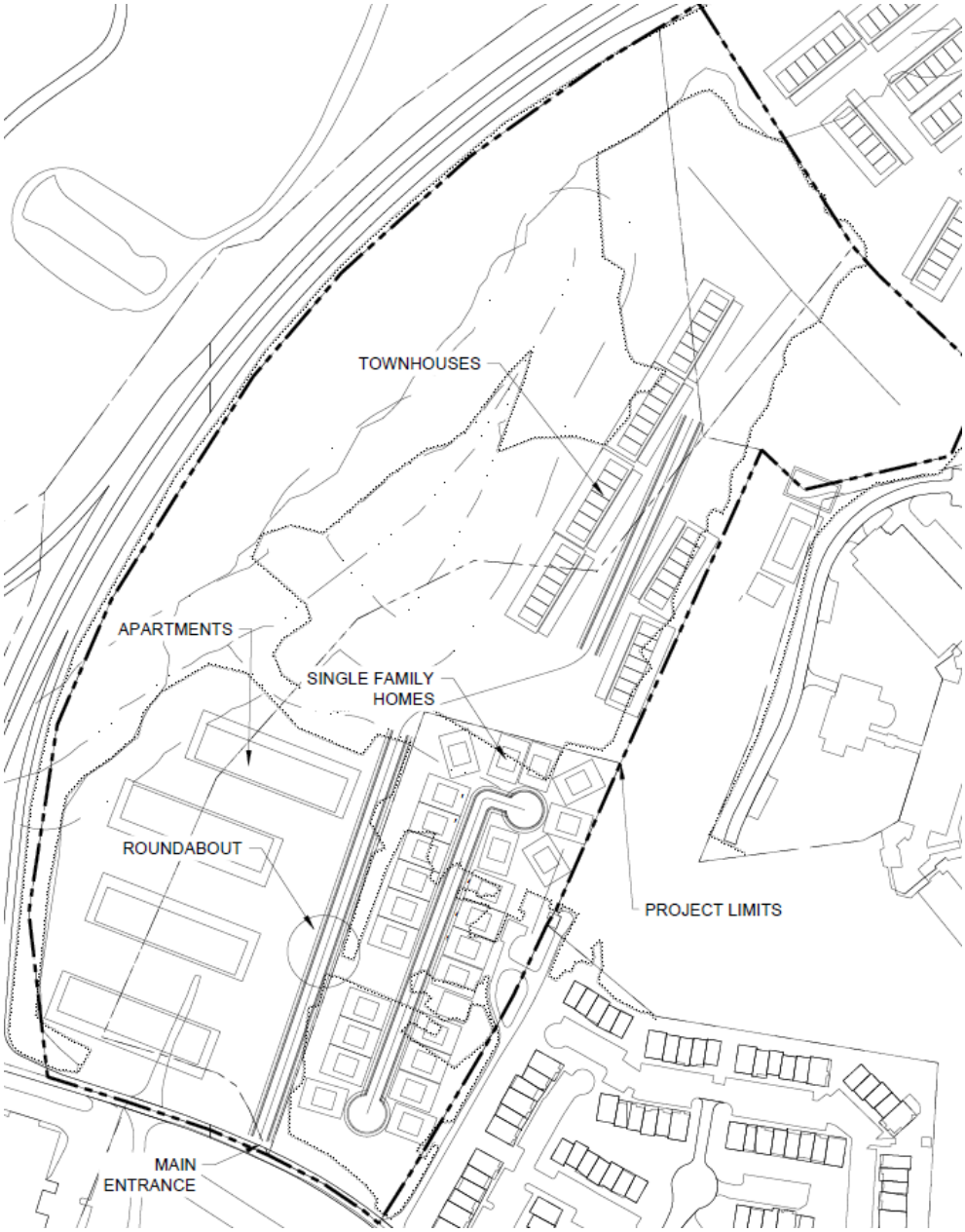


Figure B2. Preliminary Site Plan 25% Completion (October 11, 2023)

Key changes: More concrete layout of single family homes with cul-de-sac placement, placement of roundabout central to design, and placement of townhouses adjacent to Pond.

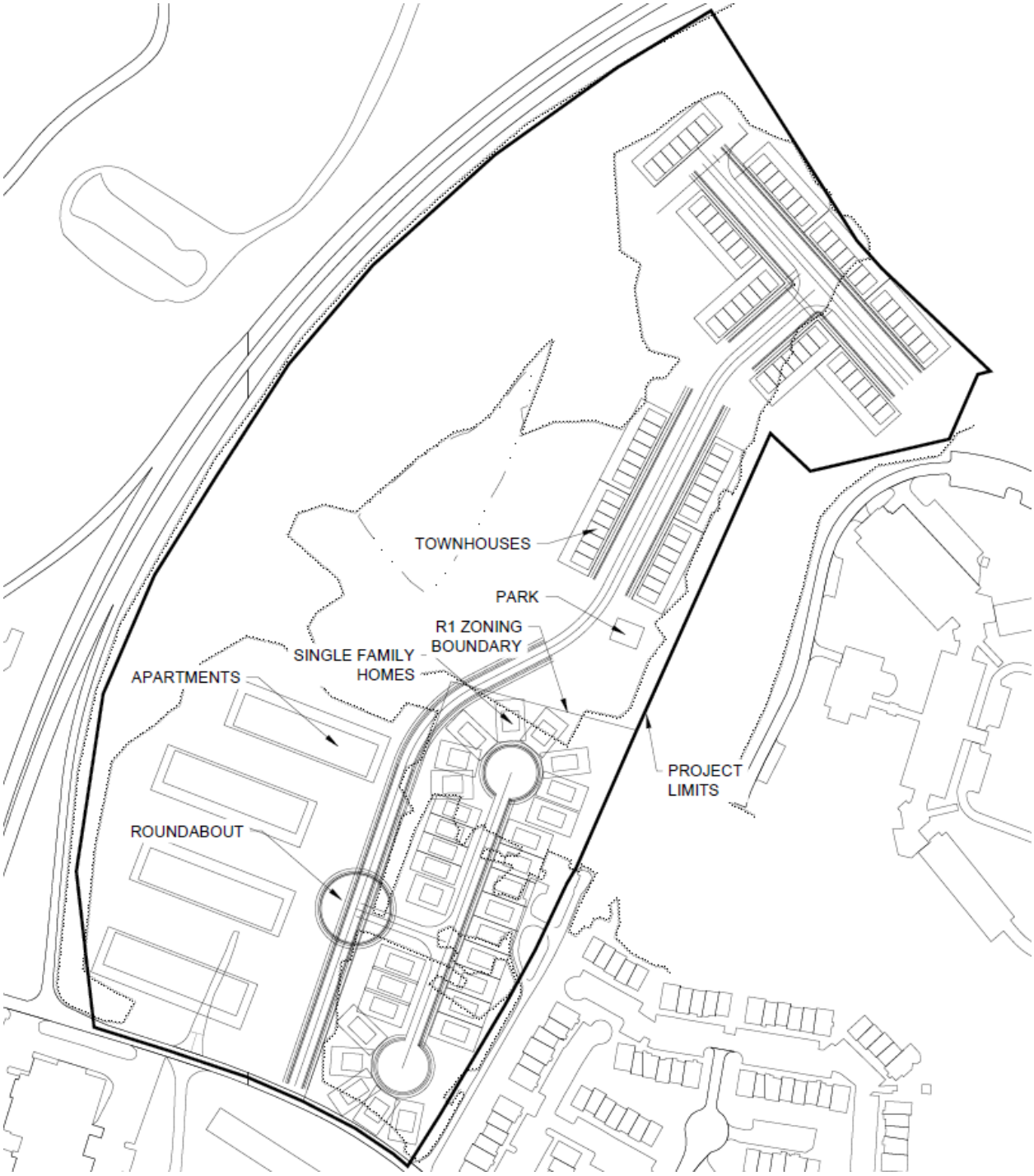


Figure B3. Preliminary Site Plan 35% Completion (October 16, 2023)

Key changes: More detail into single family home design and townhouse design.

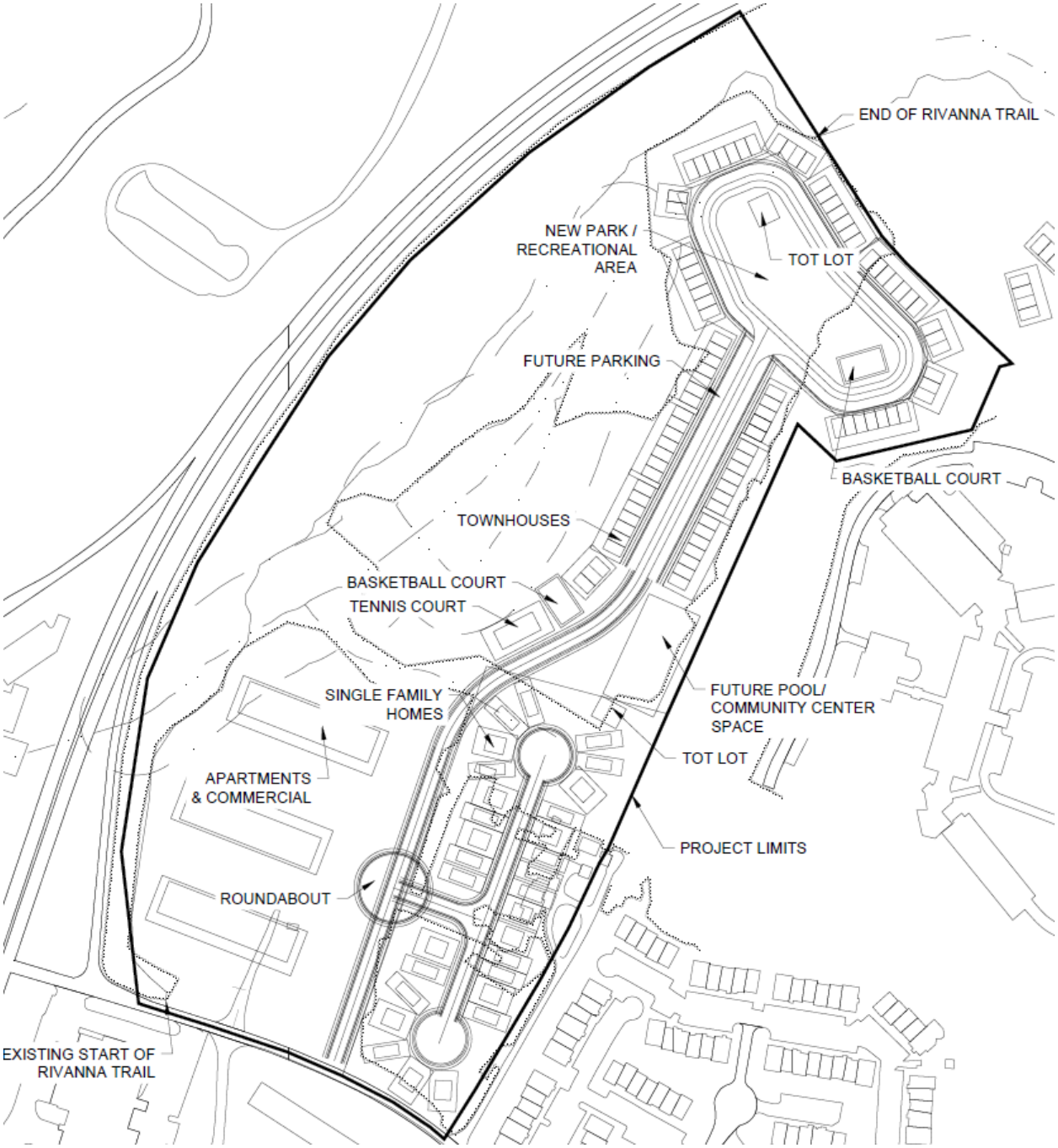


Figure B4. Preliminary Site Plan 50% Completion (October 27, 2023)

Key changes: New inclusion of large park area in townhouse development, recreational areas have moved around, and input of future pool area/community center. One apartment complex was removed.

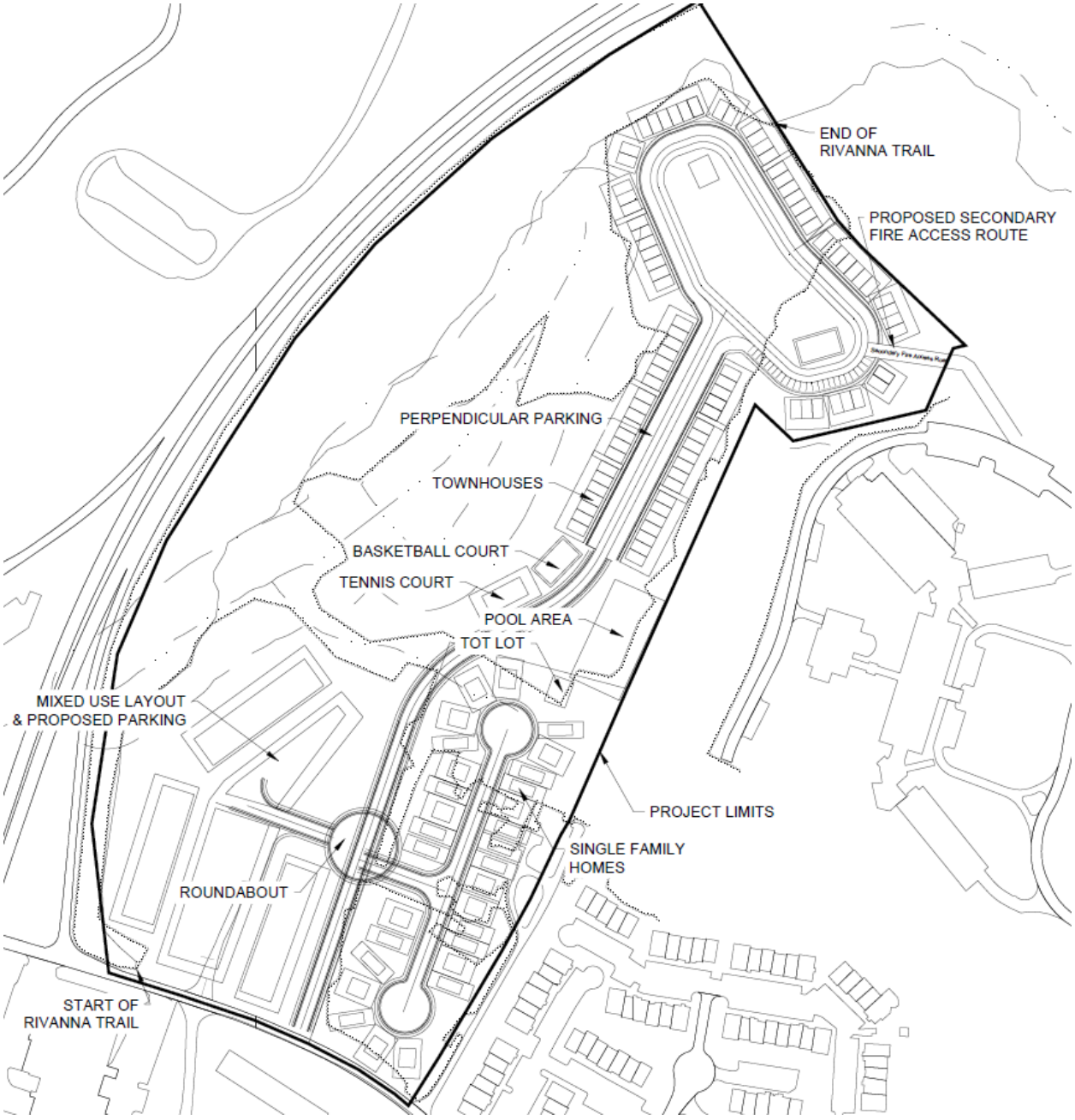


Figure B5. Preliminary Site Plan 55% (November 02, 2023)

Key changes: Proposed secondary fire access route from off-site was put in. Existing Rivanna trail placement into site, new mixed use parking layout off of Roundabout entrance.

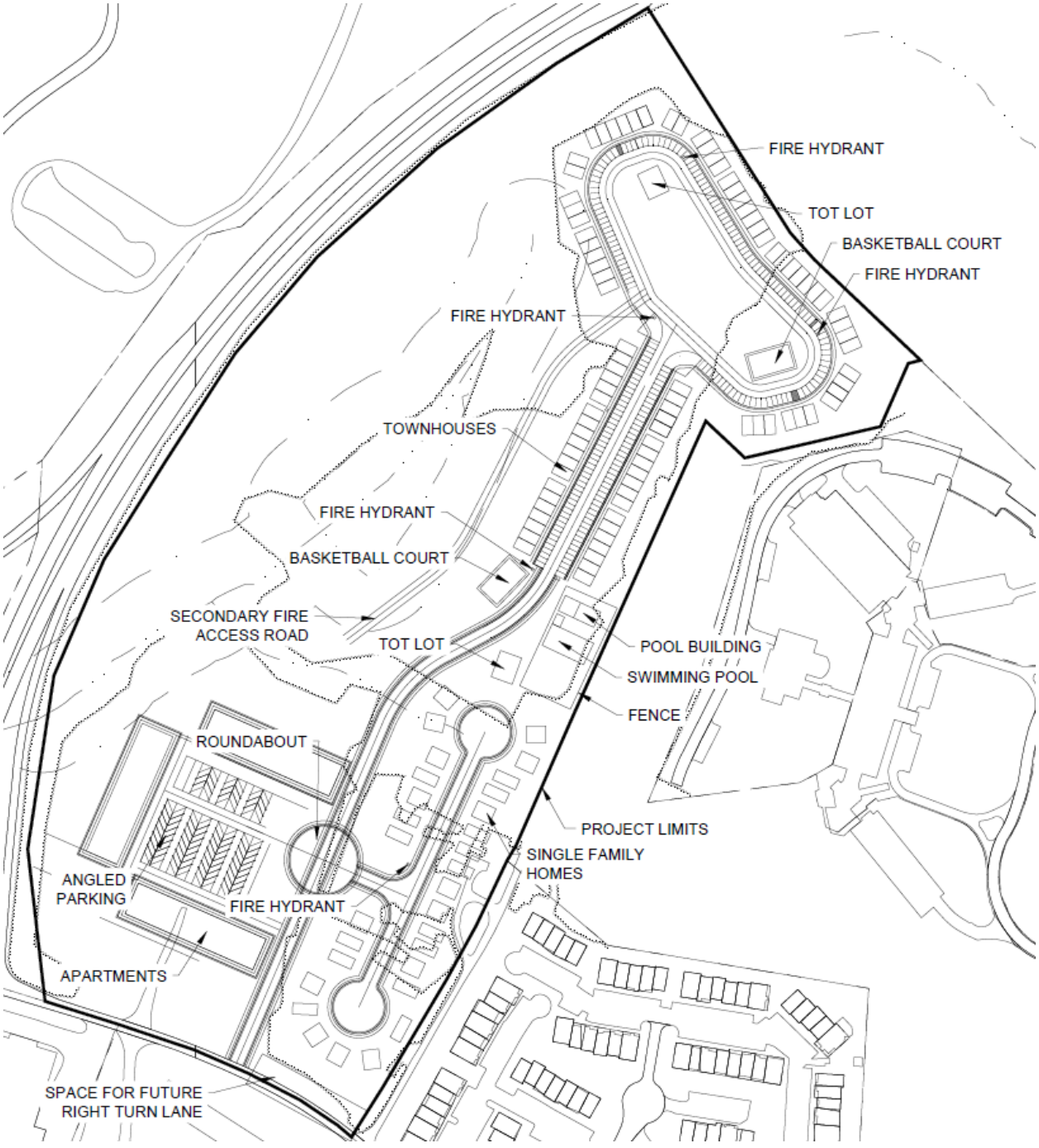


Figure B6. Preliminary Site Plan 75% (November 11, 2023)

Key changes: Space for a future right turn lane is put into site, new parking layout for the mixed use development apartment area is put in with angled parking. Parking along townhouses is put in as well. Secondary fire access route was moved so that route was not from off-site. Various fire hydrant placements were put in and the swimming pool area was designated with a fence.

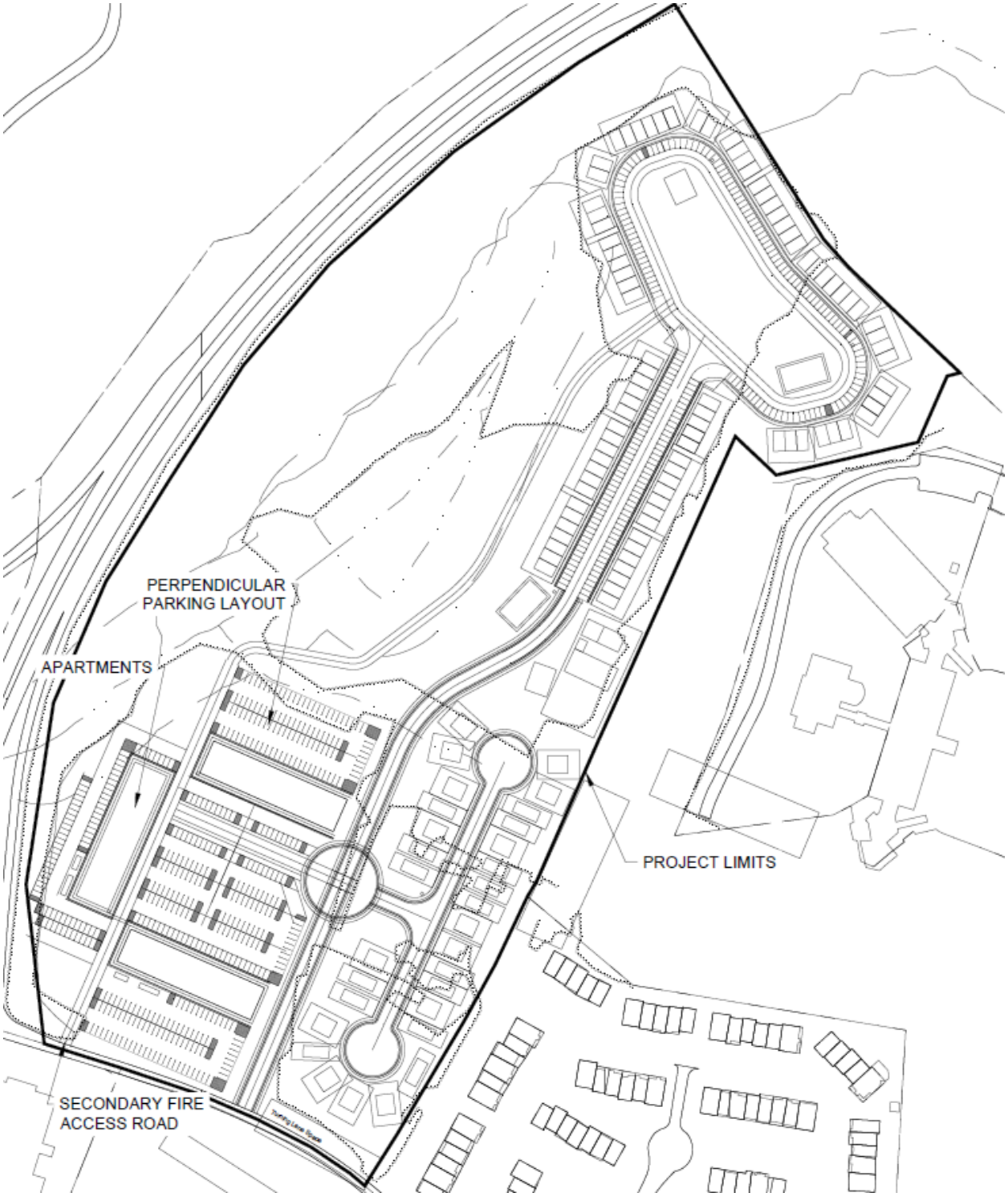


Figure B7. Preliminary Site Plan 95% (November 13, 2023)

Key changes: New perpendicular parking layout for mixed use residential/commercial area. Residential parking is put behind apartments while commercial parking is in front. Secondary fire access road is completely connected throughout the site.

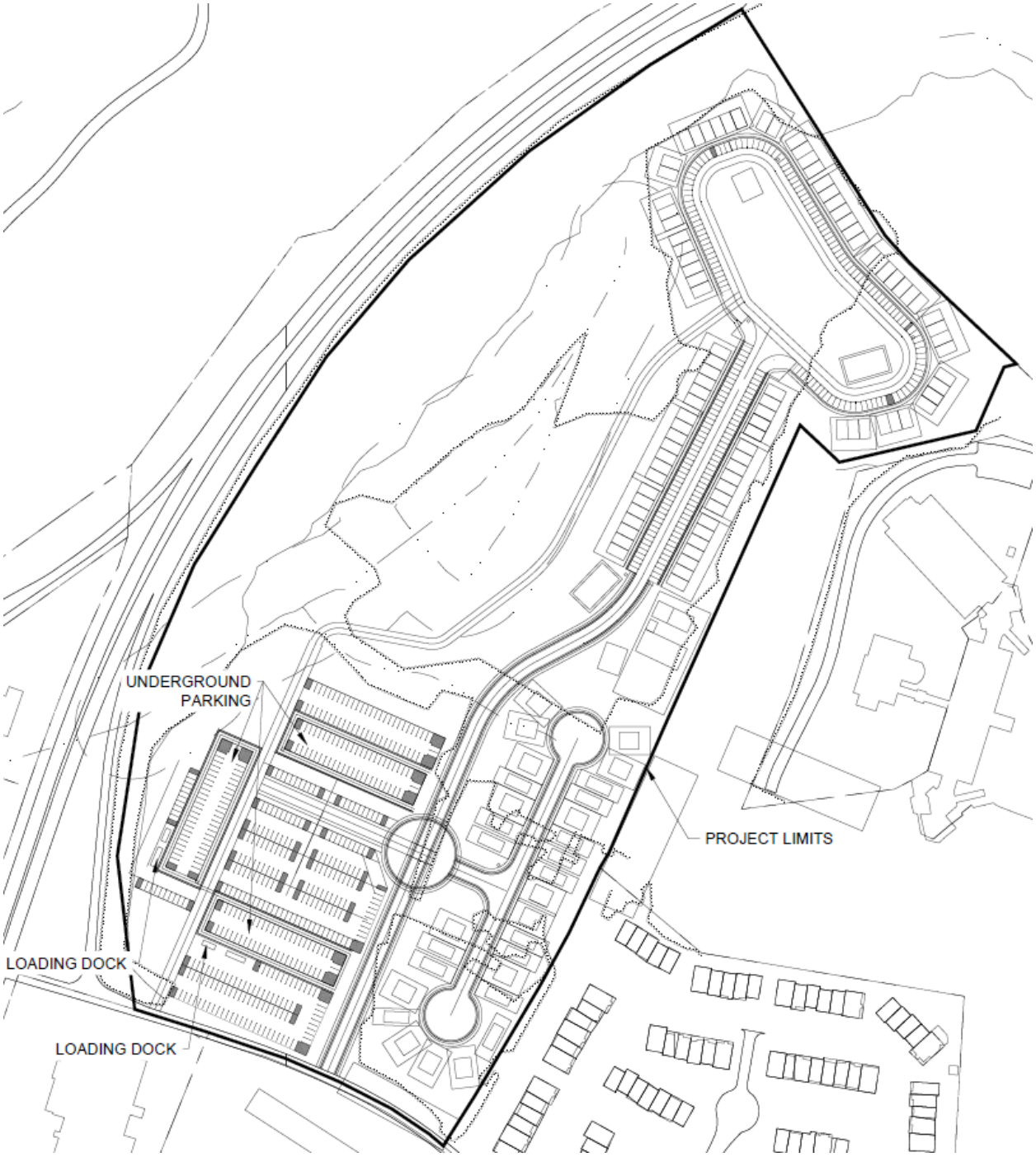


Figure B8. Preliminary Site Plan 100% (December 06, 2023)

Key changes: Residential Parking is separated between one layer of underground parking underneath the apartments and additional parking behind the building in order to conserve space. Loading docks that can accommodate the parking of 2-3 trucks are placed behind the 2 apartment buildings that have commercial areas on their first floors.

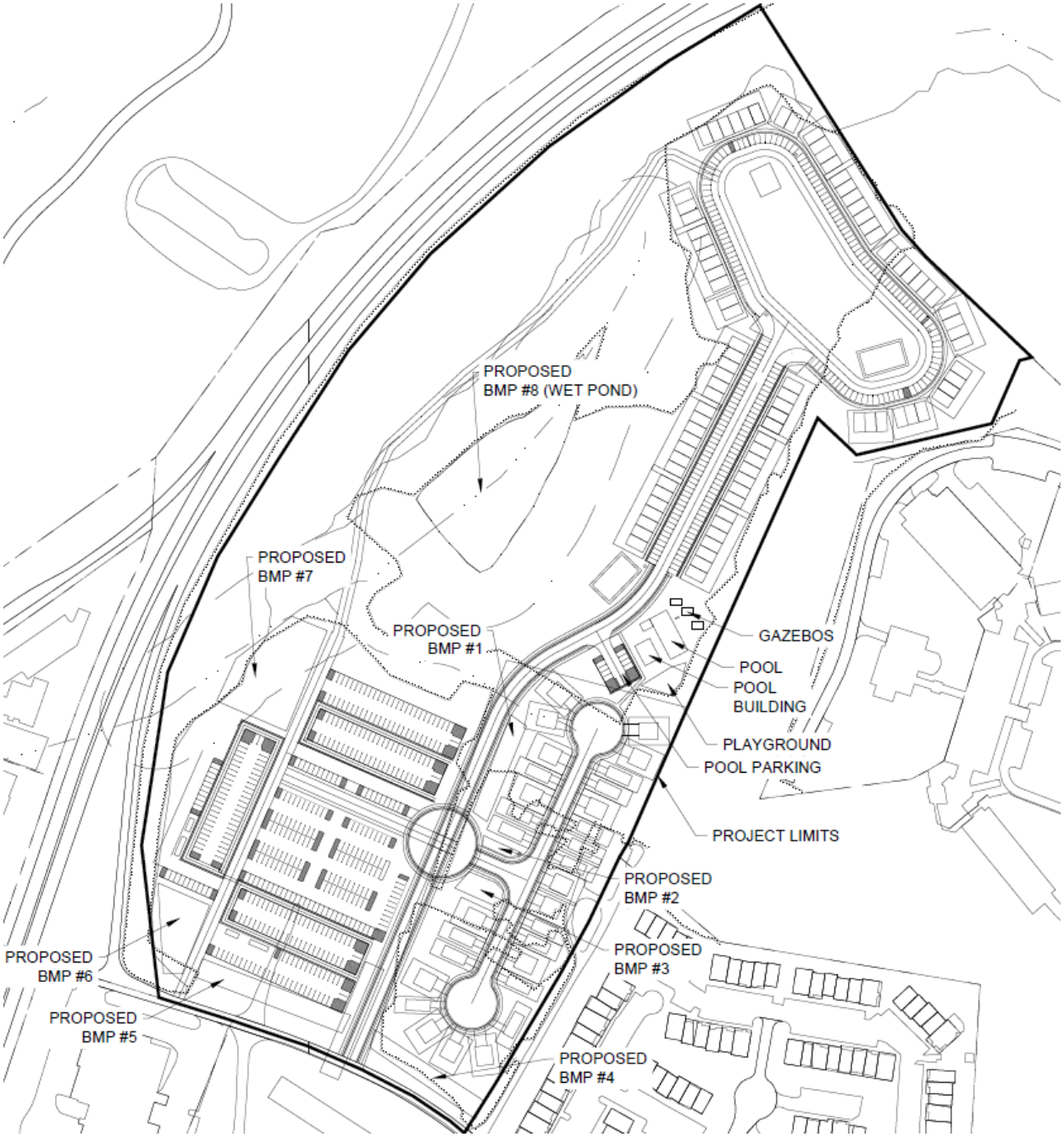


Figure B9. Final Site Plan 30% (February 26, 2024)

Key changes: Proposed BMPs (Bioretention areas and a wet pond) are put into the site plan for future proper sizing. More pool details and the pool parking lot were put in as well.

Stormwater Plan Evolution

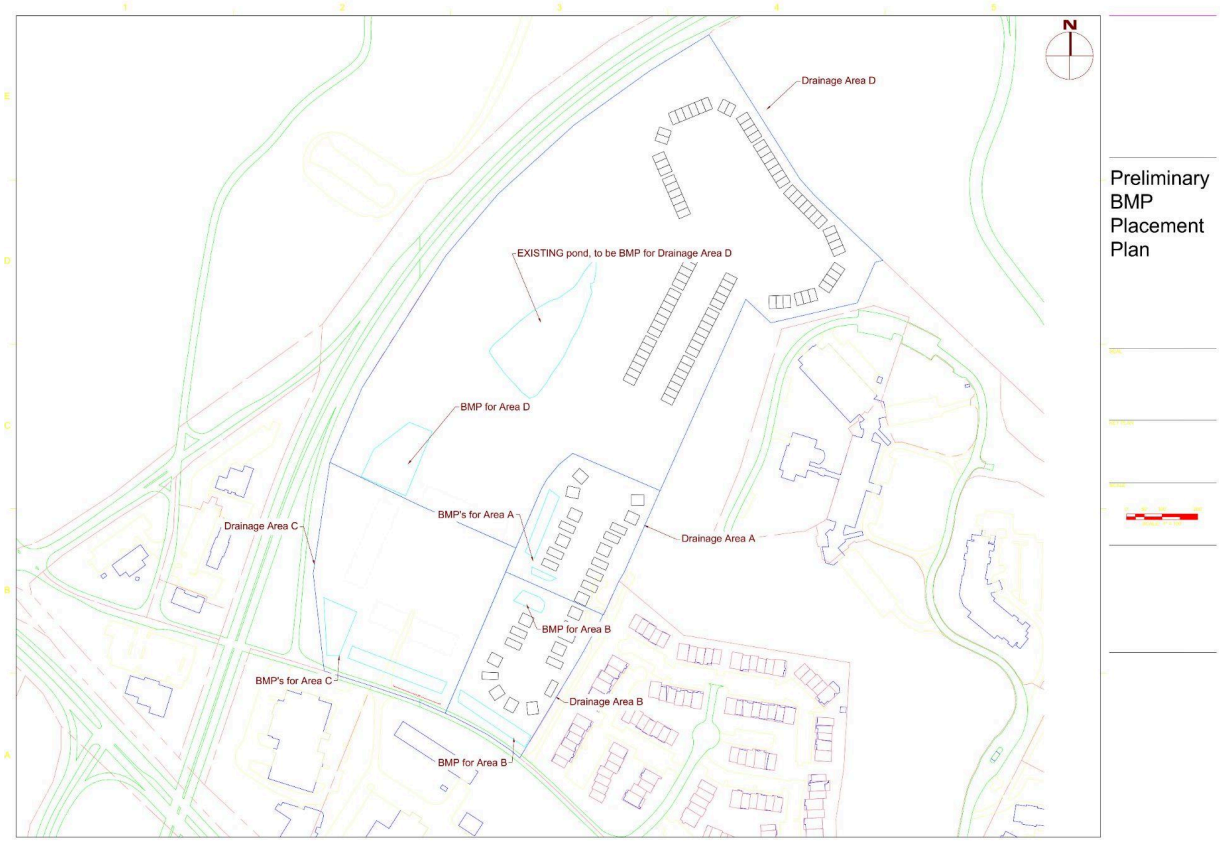


Figure B10. Preliminary Stormwater Plan

Process: The site was divided into drainage areas A through D which can be seen above in figure X. These boundaries were determined based on existing topography and Best Management Practices (BMP's) were placed at the lowest points within the drainage areas. The next steps will involve selecting specific BMPs and completing the VRRM spreadsheet.

Grading Plan Evolution

A preliminary grading plan was developed during the first semester of this project, but the physical CAD file contained many errors and issues. It was decided to start from scratch for the final semester of designing to ensure a clean and functioning file that will provide visually pleasing results. The previous flawed grading plan can be seen in Figure 20.

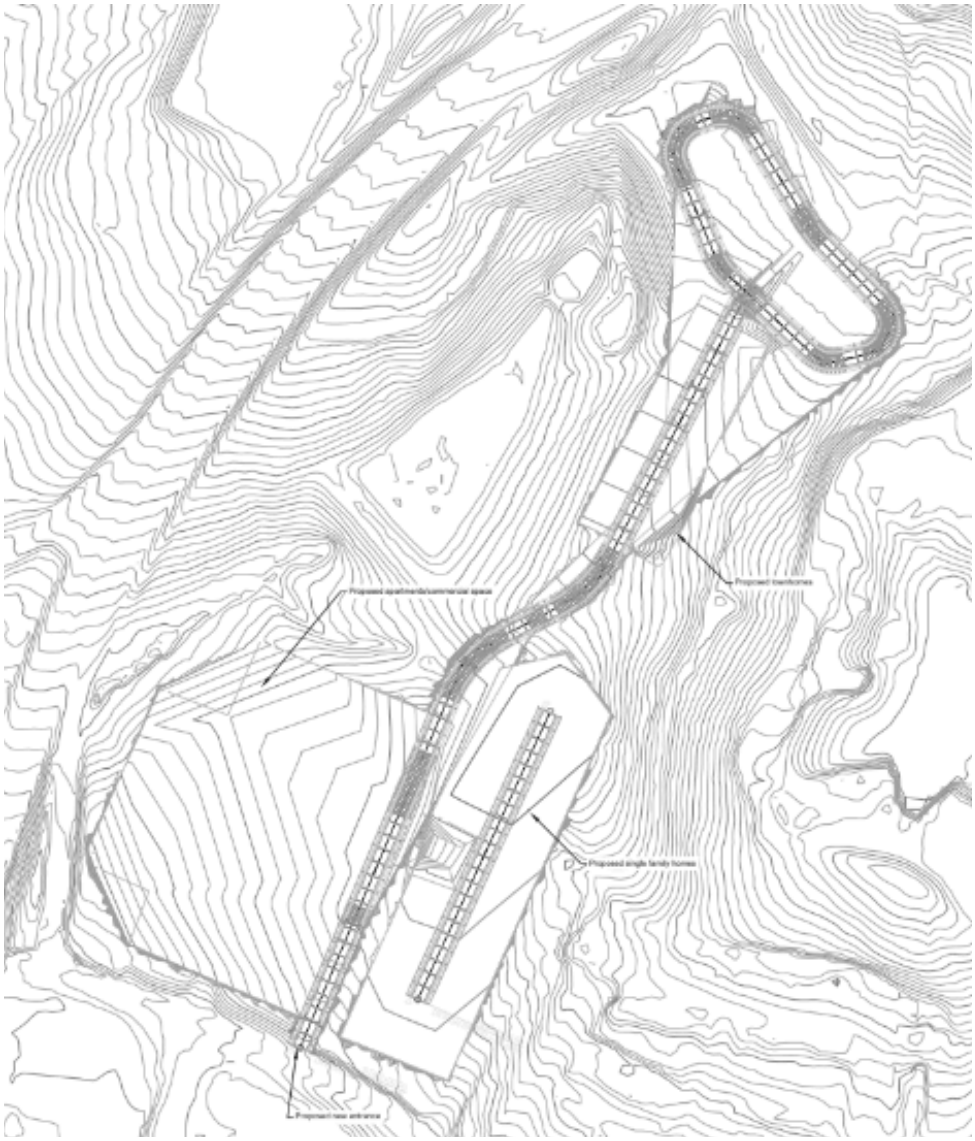


Figure B11. Version 1 grading plan

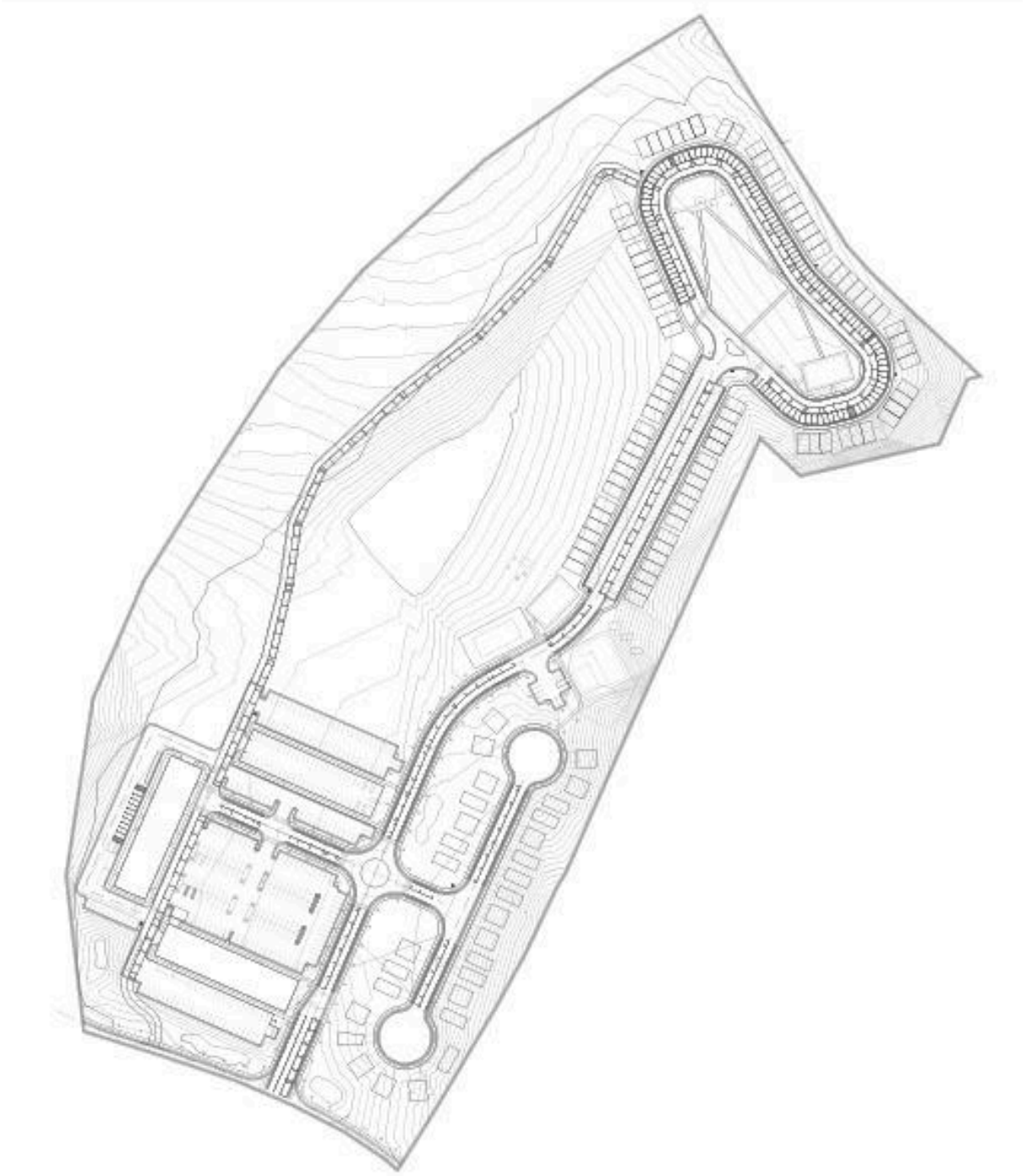


Figure B12. Grading Plan V2 overlaid on finalized site plan

Appendix C - Engineering Standards

Main Road and Entrances

1. Main Entrance Onto Site
   a. Entrance to site is more than 50’ away from other entrances allowing for proper spacing (no racing across to the other side).

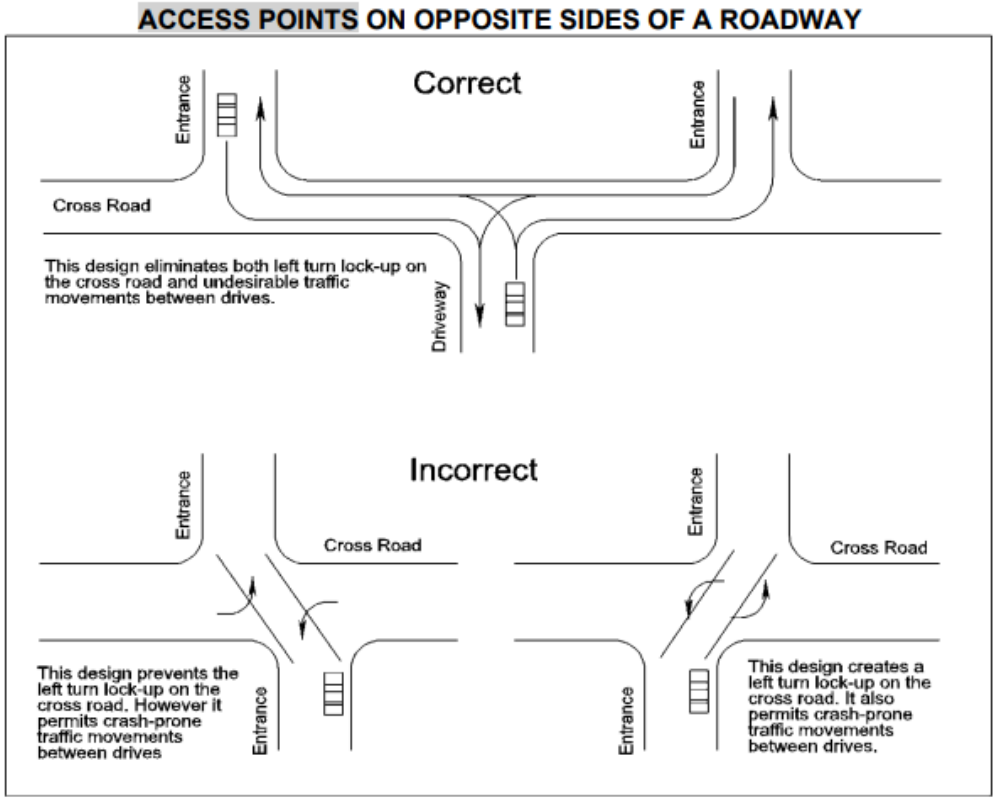


FIGURE 4-6 ACCESS POINTS ON OPPOSITE SIDES OF A ROADWAY

Source: Driveway Handbook, dated March 2005, Florida Dept. of Transportation.

Figure C1. (VDOT Appendix F, pg. F-112, Figure F 4-6)

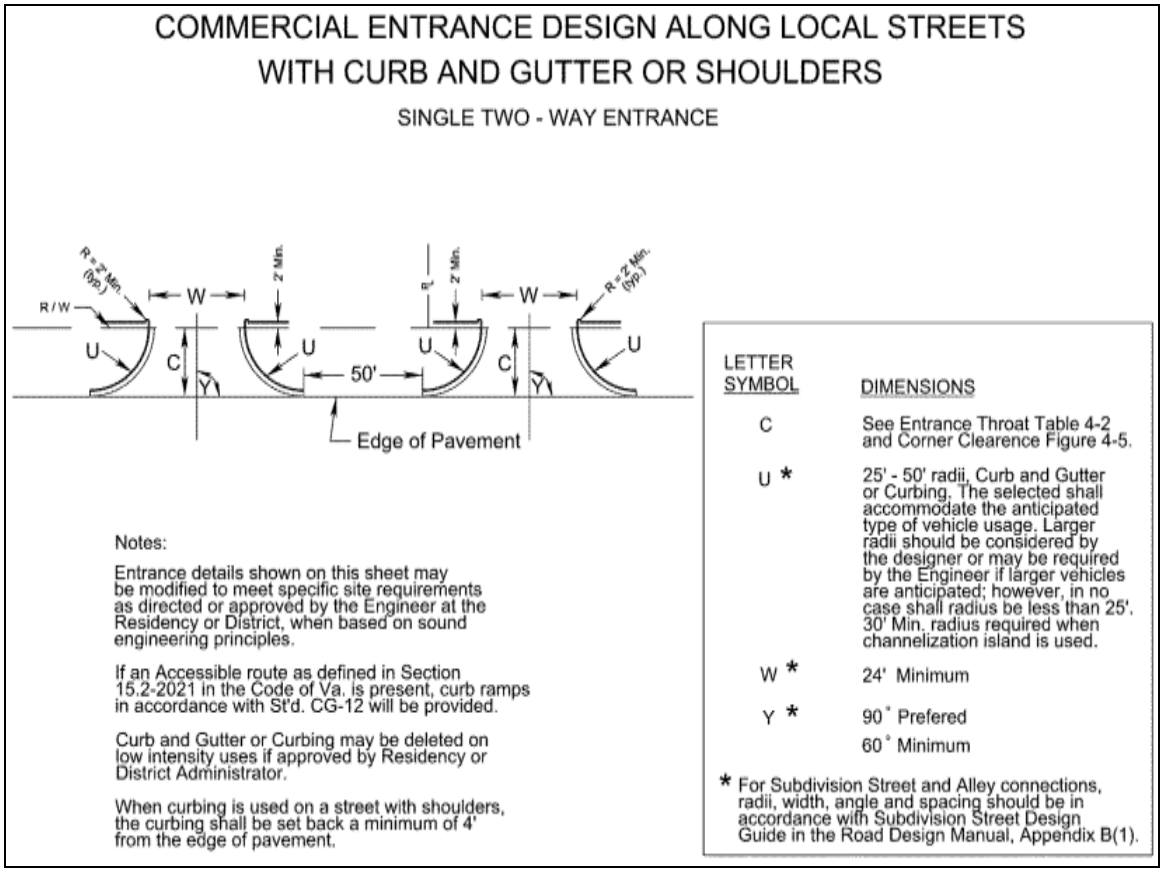


Figure C2. (VDOT Appendix F, Figure 4-11)

b. Main Entrance Specifications
   i. Turning Radius: 50' (For buses and trucks entering site)
   ii. Entrance Throat = 50'

Design Vehicle and Turning Radius by Land Use		
Land Use(s) Served by Access	**Design Vehicle**	**Radius (Minimum)**
Office with Separate Truck Access	Passenger Car/Pickup	25
Office without Truck Access	Single Unit Truck SU-30	45
Commercial / Retail with Separate Truck Access	Passenger Car/Pickup	25
Commercial / Retail without Separate Truck Access	WB-67 Truck	50
Industrial with Separate Truck Access	Passenger Car/Pickup	25
Industrial without Separate Truck Access	WB-67 Truck	50
Recreational without Watercraft Access or Camping	Passenger Car/Pickup	25
Recreational with Watercraft Access or Camping	Motor Home/Boat	50
Agricultural Field Access	Single Unit Truck SU-30	45
Municipal and County Roads	WB-67 Truck	50

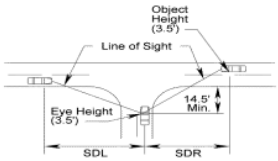
TABLE 4-3 DESIGN VEHICLE AND TURNING RADIUS BY LAND USE

Figure C3. (VDOT Appendix F, pg. F-104, Figure 4-3 Design Vehicle and Turning Radius by Land Use)

iii. Intersection Sight Distance: 390 ft, Sight Distance right and left

Intersection Sight Distance

The following table shows intersection sight distance requirements for various speeds along major roads:



SDR = Sight Distance Right (For a vehicle making a left turn)
SDL = Sight Distance Left (For a vehicle making a right or left turn)

Height of Eye 3.5'												**Height of Object 3.5'**
Design Speed (mph)**		**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**65**	**70**
SDL=SDR: 2 Lane Major Road	In Feet	225	280	335	390	445	500	555	610	665	720	775
SDR: 4 Lane Major Road (Undivided) or 3 Lane		250	315	375	440	500	565	625	690	750	815	875
SDL: 4 Lane Major Road (Undivided) or 3 Lane		240	295	355	415	475	530	590	650	710	765	825
SDR: 4 Lane Major Road (Divided – 18' Median)		275	340	410	480	545	615	680	750	820	885	955
SDL: 4 Lane Major Road (Divided – 18' Median)		240	295	355	415	475	530	590	650	710	765	825
SDR: 5 Lane Major Road (continuous two-way turn-lane)		265	335	400	465	530	600	665	730	800	860	930
SDL: 5 Lane Major Road (continuous two-way turn-lane)		250	315	375	440	500	565	625	690	750	815	875
SDR: 6 Lane Major Road (Divided – 18' Median)		290	360	430	505	575	645	720	790	860	935	1005
SDL: 6 Lane Major Road (Divided – 18' Median)		250	315	375	440	500	565	625	690	750	815	875
SDL: (Where left turns are physically restricted)		210	260	310	365	415	465	515	566	620	670	725

TABLE 2-5 INTERSECTION SIGHT DISTANCE

Source: 2018 AASHTO Green Book, Chapter 9, Section 9.5.3

Figure C4. (VDOT Appendix F, pg. F-50, Table 2-5 Intersection Sight Distance)

2. Single Family Residential Entrance
    a. Road Width = 24'
    b. Radius = 45' to accommodate school busses
3. Secondary Fire Access Route Entrance
    a. Entrance Dimensions: 24' width, R = 45' (dirt road, able to drive over sidewalk with lower curb)

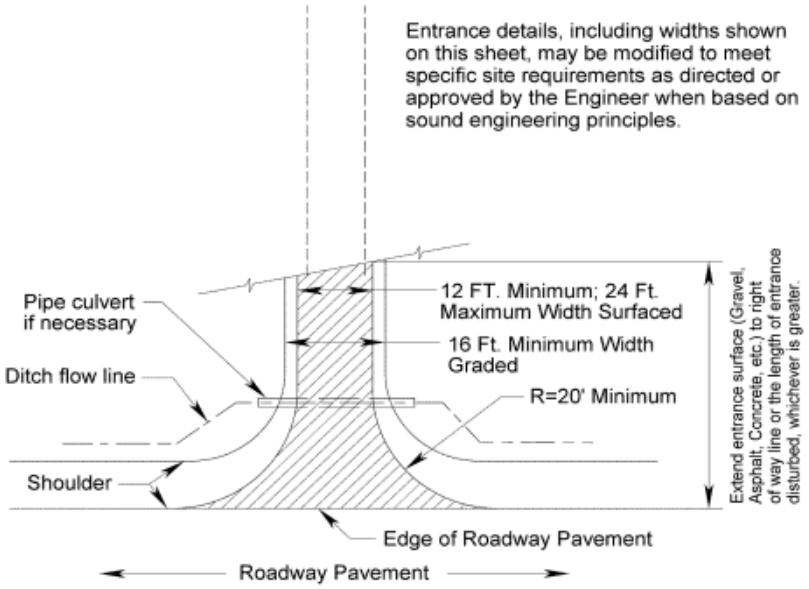


FIGURE 4-1 PRIVATE ENTRANCE AND LOW VOLUME COMMERCIAL ENTRANCE DETAIL

Figure C5. (VDOT Appendix F, Figure 4-1)

4. Townhouse Entrance
    a. Road Median Design (Manual on Uniform Traffic Control Devices MUTCD Sec. 3I.06)
    b. 18’ road widths maintained with median, 7’ median minimum side lengths maintained, R = 5’ on corners.

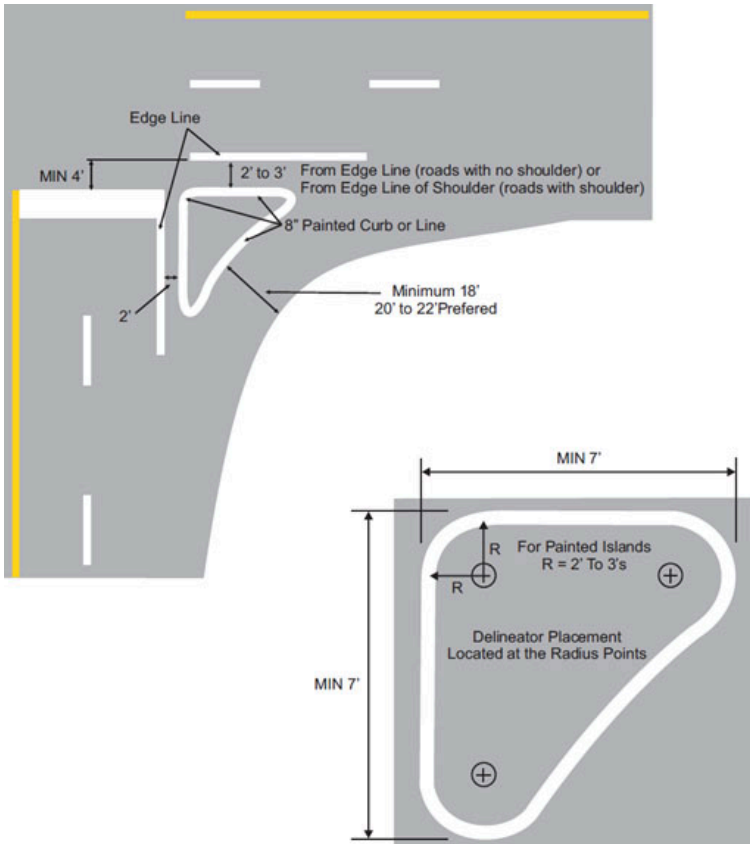


Figure C6. Median/Island Design Guidelines

5. Roundabout
    a. The Federal Highway Administration Roundabout Standards for a mini roundabout were followed.
    b. Our daily traffic volume to the site = 4,326 AADT
    c. Roundabout Center Island Radius = 25 feet
    d. Roundabout Design Radius = 80 feet
    e. Circular Roadway Width = 15 feet
    f. Design Speed (per FHWA manual) = 15 mph
    g. Priorities: accommodates pedestrians and semi trucks for commercial area
    h. Only necessary to have a single lane in the roundabout.
    i. Mini Roundabout Geometric Guidelines
        i. Central Island Diameter = 50 ft, fully mountable
        ii. Central island and splitter island curb height is less than 2 inches high and is flush (traversable) and painted when frequently used by buses
        iii. Central islands that are raised should be domed using 5-6% cross slope, max height of 5 inches
        iv. Circular roadway width = 15 ft
        v. Approach Lanes = 10 -11 ft to reduce speeds
    j. Mini Roundabouts are recommended for intersections where ADT is no more than 15,000 vehicles
    k. Mini Roundabout Specifications
        i. Entry path radius (Outer Turn Radius) = 55 ft
        ii. Stopping Sight Distance (FHWA 6.3.9) >= 100 ft

iii. Inscribed Circle Diameter = 80 ft
iv. Final roundabout design is seen in Figure 5

Design Element	Mini-Roundabout	Single-Lane Roundabout	Multi-lane Roundabout
Desirable maximum entry design speed	15 to 20 mph	20 to 25 mph	25 mph to 30 mph
Maximum number of entering lanes per approach	1	1	2+
Typical inscribed circle diameter	45 to 90 ft.	90 to 180 ft.	150 to 220 ft. (two-lanes)
Central island treatment	Fully traversable	Raised (w/ traversable apron)	Raised (w/ traversable apron)
Typical daily service volumes on 4-leg roundabout below which may be expected to operate without requiring a detailed capacity analysis (veh/day)*	Up to approximately 15,000	Up to Approximately 25,000	Up to Approximately 45,000 for two-lane roundabout

Figure C7. (VDOT Appendix A, pg. A-56 Roundabout Design Comparison Chart)

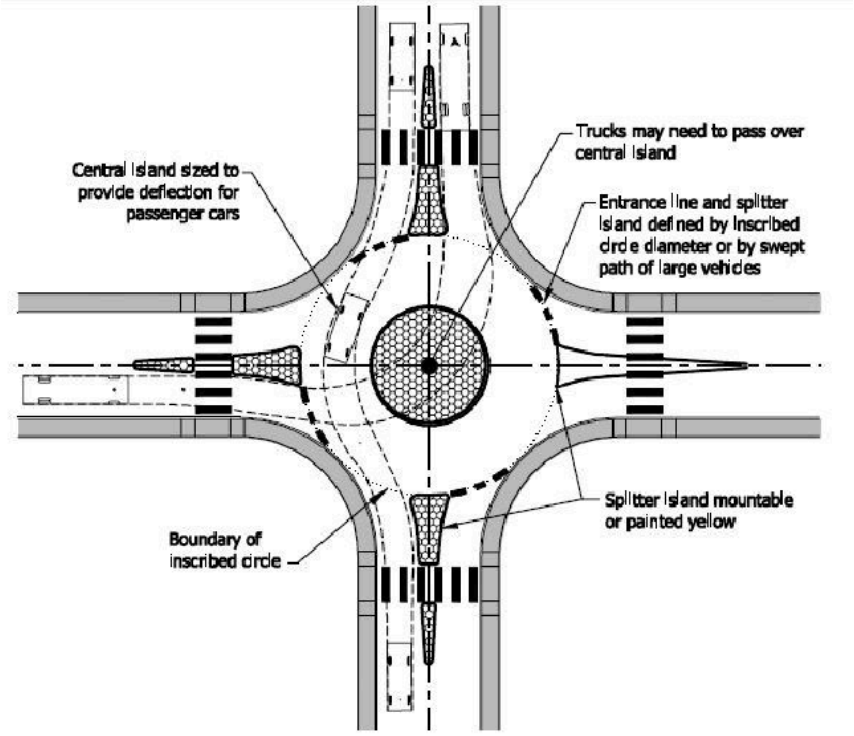


FIGURE A3-9 FEATURES OF TYPICAL MINI-ROUNDABOUT

Figure C8. (VDOT Appendix A, pg. A-51 Features of a Typical Mini Roundabout)

6. Main Road (VDOT Appendix B, Subdivision Street Design Guide)
   a. 24’ minimum road width
   b. 0.5’ curb and 2’ gutter (CG-6)

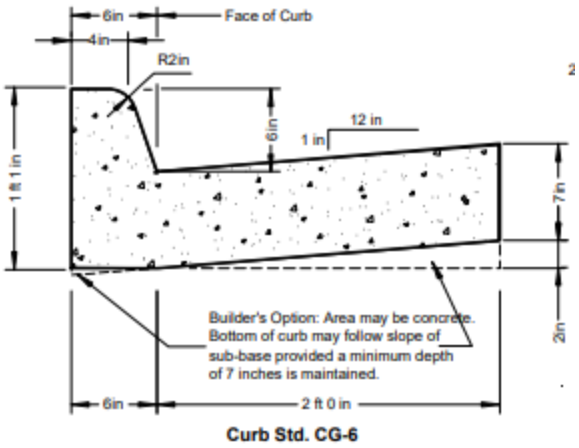
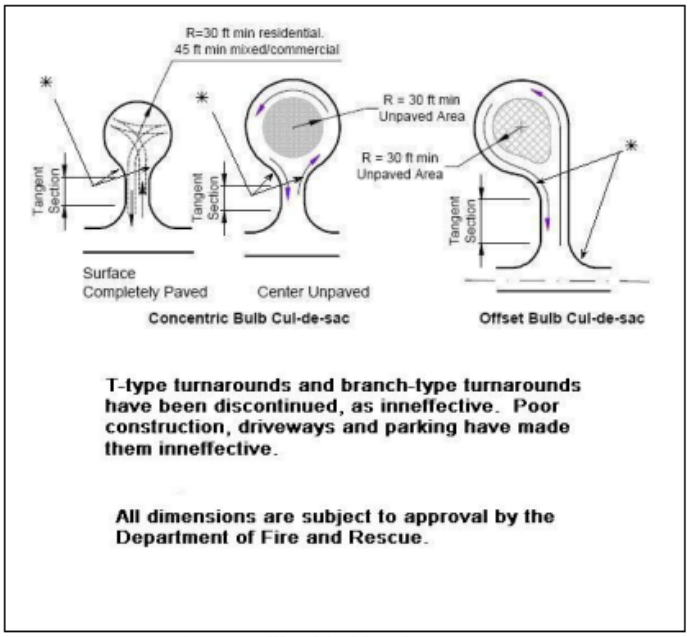


Figure C9. Standard Road Gutter Diagram

c. 3’ plant buffer strip
d. 5’ sidewalks
e. Radius going into single family home area is 45’ to accommodate school buses
f. Turn radius on main road is 251’ (VDOT Geometric Design Standards Appendix A1 page 2)
g. Cul-de-sac design will follow adapted Albemarle County Design Manual



* 25’ radii added by the County

Figure C10. Cul-de-Sac Design Standard

7. Fire Access
    a. Secondary Access Road
        i. Road Design
            1. Fire apparatus access roads do not exceed 10% in grade.
            2. Fire apparatus access roads are 24 feet in width

ii. Commercial areas will have 2 fire access routes (Fire Code D104.1)
    1. Buildings or facilities exceeding 30 feet or three stories in height shall have not fewer than two means of fire apparatus access for each structure.
    2. Where two fire apparatus access roads are required, they shall be placed a distance apart equal to not less than one half of the length of the maximum overall diagonal dimension of the lot or area to be served, measured in a straight line between accesses.
    3. Aerial fire apparatus access roads shall have a minimum unobstructed width of 26 feet, exclusive of shoulders, in the immediate vicinity of the building or portion thereof (our fire access lanes/roads are 26 feet with 2' curb)(Fire Code D105.2)
iii. Residential Townhouses will have 2 fire access routes (Fire Code D106.1)
    1. Multiple-family residential projects having more than 100 dwelling units shall be provided with two separate and approved fire apparatus access roads regardless of whether they are equipped with an approved automatic sprinkler system.
    2. Where two fire apparatus access roads are required, they shall be placed a distance apart equal to not less than one-half of the length of the maximum overall diagonal dimension of the property or area to be served, measured in a straight line between accesses.

b. Fire Hydrant Placement (VA Fire Code Appendix C)
    i. Spacing between each hydrant = 500 ft
    ii. Max distance from any point on street/road frontage to hydrant = 250 ft.
        1. Reduce by 50 feet for dead-end streets or roads
        2. Exception: The average spacing shall be permitted to be increased by 10 percent where existing fire hydrants provide all or a portion of the required number of fire hydrants.

Housing Standards

Apartment Buildings

Apartment Buildings (180 units total)

1. Design of Buildings
    a. Each building is a maximum of 250 x 60 ft (*Project Requirements, Appendix D*)
        i. 1st Building: 1st floor commercial + 4 additional stories with 15 units each [60 units total]
        ii. 2nd Building: 1st floor commercial (75%) + 1st floor units (25%, 3 units) + 4 additional stories with 15 units each [48 units total]
        iii. 3rd Building: 5 stories with 1st floor having 12, and each floor after having 15 units each [72 units total]
    b. Setback Requirements (*Albemarle County Code Sec. 4.19*)
        i. Front: 5'
        ii. Back: 20'
        iii. Side: 10'
2. Design of Parking Lots, Docks, and Dumpster Pads
    a. All apartments have underground parking
    b. Parking Minimums
        i. Residential = 1.35(180) = 243 spaces total (*Project Requirements, Appendix D*)

1. 1st Building = 81 spaces + 4 ADA (*2010 ADA Standards*)
2. 2nd Building = 65 spaces + 3 ADA (*2010 ADA Standards*)
3. 3rd Building = 98 spaces + 4 ADA (*2010 ADA Standards*)
4. 1 of every 6 ADA is van accessible (*2010 ADA Standards*)

ii. Commercial parking requirements were based off square footage of retail space. There is a total of 26,250 sq. ft. from 2 of the apartment buildings having commercial as their ground floor areas. Commercial parking spaces were calculated by using square footage for the use and using parking space minimum calculations from Albemarle's County Code Sec. 4.12.6.

1. Laundromat (3600 sq. ft.) = 13 spaces
2. Daycare (assumed 30 kids, 7 employees) = 10 spaces minimum
    a. Dropoff Area has no minimum, but we designed 10 spaces
3. YMCA/Gym (7200 sq. ft.) = 58 spaces
4. Smaller Grocery Store (Trader Joe's/Aldi) (11,000 sq. ft.) = 61
5. ADA requires 5 passenger vehicle accessible spots and 1 van accessible spot for the 159 space lot (2010 ADA Standards)

c. Perpendicular Parking Lot Space Design (Sec 4.12.16)
    i. Aisle widths are 24'
    ii. Parking dimensions are 9' x 18'
d. ADA Parking Lot Spaces Design (2010 ADA Standards) (Sec 4.12.16)
    i. ADA guidelines require accessible spaces with access aisles for every parking lot designed with the number of spaces required varying by the number of spaces inside the lot.
    ii. Van Accessible Parking Space dimensions: 11'W x 18'L with 5' wide accessible aisle on 1 side
    iii. Normal Accessible Parking Space dimensions: 9'W x 18'L with 5' wide accessible aisle on 1 side
e. Loading Dock Design (Sec. 4.12.13)
    i. Each commercial building will have 2 loading dock spaces each
    ii. Loading spaces are provided on the same lot and adjacent to the structure it serves.
    iii. Loading spaces are designed so as not to impede any required parking spaces, or any pedestrian or vehicular circulation.
    iv. Loading spaces are provided in addition to and exclusive of any parking requirement on the basis of: (1) one space for the first 8,000 square feet of retail gross leasable area, plus one space for each additional 20,000 square feet of retail gross leasable area
    v. Loading spaces shall be a minimum of 12 feet in width, 14½ feet in clearance height and a length sufficient to accommodate the largest delivery trucks serving the establishment, but in no case will such length be less than 25 feet.
    vi. Loading Pad dimensions are as follows: 12' x 30'
f. Dumpster Pads (Sec. 4.12.13)(Sec. 4.12.14)
    i. Each site plan that depicts a commercial or industrial building of 4,000 gross square feet or more shall provide a dumpster pad that does not impede any required parking or loading spaces, nor any pedestrian or vehicular circulation aisles (necessitating a dumpster pad location for each commercial building)

ii. The pad shall extend beyond the front of each dumpster and its length can't be less than eight feet beyond the front of the dumpster. The site shall be designed so that stormwater does not run through, and drains away from, areas where dumpsters are located in order to minimize the potential for contaminating stormwater runoff due to contact with solid waste

iii. Dumpster pad dimensions are as follows: 19' length, 22' wide enclosing 2, 8 cubic yard commercial dumpsters (which measure 6' x 6')(general standards are 14'W x 19'L)

Townhouses

Townhouses (90 units total)

1. Design of Buildings
    a. Blocks of townhomes are 7 maximum (*Project Requirements, Appendix D*)
    b. Setback Requirements (*Albemarle County Code Sec. 4.19*)
        i. Front: 5'
        ii. Back: 20'
        iii. Side: 10' from each 7 unit block (if it's in a block, can have shared walls)
2. Design of Curvilinear Parking
    a. 1.6(90) = 144 spaces total (*Project Requirements, Appendix D*)
    b. Curvilinear Parking Dimensions = 9' x 18'
    c. Width of the parking space measured at the narrowest point along the length of the space
    d. For curvilinear parking, a 100-foot sight distance must be maintained, and shall be measured as provided in Section 602.1 (Figure 6-5) of the Albemarle County Design Standards Manual.
        i. For parking on the inside of a curved travelway, a minimum centerline radius of 120' is required to maintain sight distance (*Albemarle County Design Standards Manual*)
        iv. Parking Graphically (current design along townhouse sidewalks)

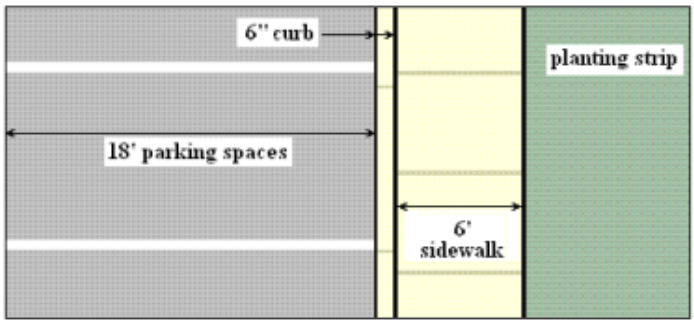


Figure C11. Parking Guidelines (*Albemarle County Design Standards Manual*)

Single Family Homes

Residential R1 Single Family Homes (30 units total)

1. Design of Buildings
    a. 30 homes that are either 30' x 30' or 25' x 45' (*Project Requirements, Appendix D*)
    b. Setback Requirements (*Sec. 4.19*)
        i. Front: 18' (garages)

        ii. Back: 20’
        iii. Side: 10’
2. Design of Parking
    a. 20’ width by 18’ length driveways on all homes (*Project Requirements, Appendix D*)

Recreational Area Design

1. Recreational Requirements (County Code Sec. 4.16)
    a. Minimum/Open Area (Sec 4.16.1)
        i. Developed recreational areas shall be provided for every development of 30 units or more equal to or exceeding 4 dwelling units per acre, except for single-family and two-family dwellings developed on conventional lots.
        ii. A minimum of 200 square feet per unit of recreational area shall be provided in common area or open space on the site, this requirement not to exceed five percent of the gross site area
        iii. The current park area is 59,900+ sq. ft. (3.84% of gross site area)
        iv. Total site area is 1,557,945 sq. ft.
    b. 2 Tot lot (Sec. 4.16.2.1)
        i. One tot lot shall be provided for the first 30 units and for each additional 50 units (5 tot lots required - 3 are being substituted)
        ii. 1 tot lot is in the Park Area
        iii. 1 tot lot is in the Pool Area
    c. 2 Basketball Courts (Sec 4.16.2.2)
        i. There is a minimum half court per 100 units
        ii. 3 half courts are required, providing 4 half courts (2 full courts)
        iii. 1 half court is substituting 1 tot lot
        iv. 1 basketball court is in the Park Area
        v. 1 basketball court is in the Pool Area
    d. 1 Swimming Pool Area
        i. Substituting for 2 tot lot
2. Parking for Recreational Areas (Sec. 4.12.6)
    a. The minimum number of parking spaces required for a residential recreational facility within a subdivision shall be reduced by the percentage of dwelling units within the subdivision within one-quarter mile of the facility (within 1,320 feet)
    b. Basketball = 2 per court, not necessary due to provision above
    c. Swimming pool = 1 per 125 sq. ft. water surface, 9 spots included
    d. Tot lots = none, due to above

Grading Standards

1. Grading of Roads and Sidewalks
    a. VDOT Subdivision Street Design Guide
        i. All roads are below a 10% grade (Section B-3)(Virginia Department of Transportation [VDOT], 2007)
        ii. All sidewalks are below a 5% grade and 5 feet wide (Section B-4 I.)
    b. Albemarle County Design Standards Manual – Engineering
        i. All K values of sag curves exceed 5 and all K values of crest curves exceed 15
        ii. All parking lots are below a 2% grade

Traffic Plan

Table 1-1: Trip Generation Comparison

LAND USE	ITE CODE	AMOUNT	UNITS	WEEKDAY ADT	AM PEAK HOUR IN	AM PEAK HOUR OUT	AM PEAK HOUR TOTAL	PM PEAK HOUR IN	PM PEAK HOUR OUT	PM PEAK HOUR TOTAL
Single-Family Detached Housing	210	80	Dwelling Units	847	15	47	62	52	30	82
Single-Family Detached Housing - Duets	210	60	Dwelling Units	650	12	35	47	39	23	62
Multi-Family Housing (Low-Rise) - Apartments	220	335	Dwelling Units	2,492	35	116	150	109	64	173
Multi-Family Housing (Low-Rise) - Townhomes	220	50	Dwelling Units	337	6	19	25	20	12	32
TOTAL		**525**	**Dwelling Units**	4,326	67	217	284	220	129	349

SOURCE: Institute of Transportation Engineers' *Trip Generation Manual* 10th Edition (2017)

Figure C12. Trip Generation Comparison

Timmons Group. (2022). *Old Ivy Residence: Traffic Impact Analysis*. https://lfweb.albemarle.org/WebLink/DocView.aspx?id=1423952&dbid=0&repo=CountyofAlbemarle&cr=1

Land Use	Average Trips Generated	Amount of Units	ADT
Single-Family Detached Housing	10.6	30	318
Apartments	7.4	180	1,332
Townhomes	6.7	90	603
Total			2,253

Figure C13. Trip Generation Calculations

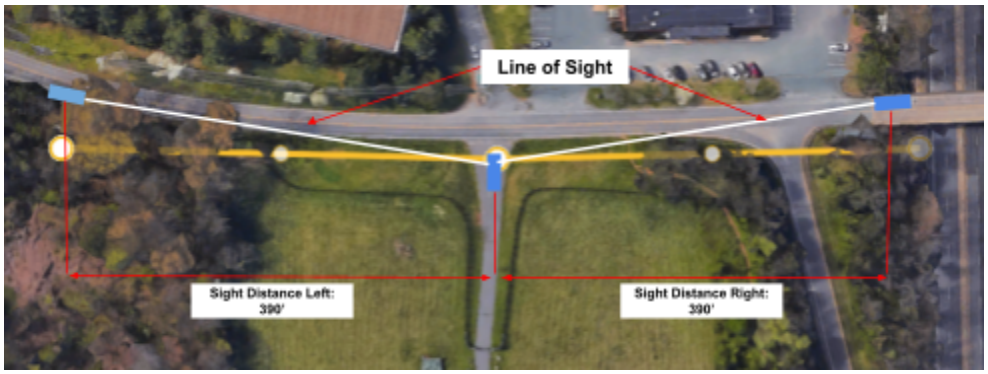


Figure C14. Intersection Line of Sight

Appendix D - Technical Deliverables

- Project Requirements
- Final Site

- Final Grade
- VRRM Stormwater Spreadsheet
- Construction Subcontractor Short List
- Landscaping Scoping Document
- Construction Phasing and Timeline