THE UNIVERSITY OF IOWA
IOWA INITIATIVE
FOR SUSTAINABLE COMMUNITIES

FINAL DELIVERABLE

Title	Waterloo Neighborhood Master Plan at Former Edison School Site
Completed By	Kyla DeShaney, Mal Weisbrodt, Tim Sullivan, Brandon Kakert
Date Completed	May 2021
UI Department	Department of Civil & Environmental Engineering
Course Name	CEE:4850:0001 Project Design & Management
Instructor	Richard Fosse
Community Partners	City of Waterloo

This project was supported by the Iowa Initiative for Sustainable Communities (IISC), a community engagement program at the University of Iowa. IISC partners with rural and urban communities across the state to develop projects that university students and IISC pursues a dual mission of enhancing quality of life in Iowa while transforming teaching and learning at the University of Iowa.

Iowa Initiative for Sustainable Communities
The University of Iowa
347 Jessup Hall
Iowa City, IA, 52241
Phone: 319.335.0032
Email: iisc@uiowa.edu
Website: http://iisc.uiowa.edu/

PROJECT REPORT

EDISON NEIGHBORHOOD REDEVELOPMENT

Prepared For:

City of Waterloo

Presented By:

Kyla DeShaney
Mal Weisbrodt
Tim Sullivan
Brandon Kakert

May 7, 2021

TABLE OF CONTENTS

Section I. Executive Summary

A University of Iowa engineering project team, in consultation with the City of Waterloo, was tasked with redeveloping the former Edison Elementary School site into a wonderful new neighborhood. The project team is comprised of civil and environmental engineering students in our final semester at the University of Iowa. After thoroughly reviewing the request for proposal, certain design criteria were identified, including a residential area with single-family homes and a 1.5-to-2-acre park, as well as a commercial area that will tie directly into the existing commercial zone immediately south of the site. Additional required design elements included street layouts, lot sizes, water lines, sanitary sewer and storm sewer lines, and stormwater management.

After submitting the proposal, the preliminary design phase began. Within Civil 3D, each team member created their own unique neighborhood design, with a total of four design alternatives. A comparison table listing the pros, cons and specifications of each alternative was compiled in Microsoft Excel, and the four alternatives were then presented to the client and faculty advisor along with this comparison table. At this point, it was determined that Alternative 1 would be the most desirable option, and therefore was moved forward with as the design to be worked on for the remainder of the final design process.

The goals of this project are as follows: 10 years from now, be unable to tell that the site used to be a school, and the infrastructure of the neighborhood must closely resemble that of the surrounding area, or in other words “blend in.” Additionally, our final design must maximize the overall return-on-investment. During the final design process, some recommendations were compiled, such as the inclusion of a stormwater detention basin between the residential and transitional zones. Another recommendation of ours is to potentially include duplexes instead of single-family homes in 12 of the 16 appropriately sized residential lots. This would allow for more units on these lots, and in return would help maximize the overall return-on-investment for the developer and property tax income for the City. Another recommendation is to implement underground parking in the commercial zone, especially if second-story apartments are included, but that is ultimately beyond our project scope and can be decided at a later point in time.

Seen below, in Figures 1 and 2, are aerial views of the site before and after the design.

Figure 1: Aerial View of Existing Site

Figure 2: Aerial View of Proposed Design

As far as what the neighborhood may look like once it is built, some concepts for buildings in the commercial zone, as well for the residential homes and park, can be seen below in Figure 3.

Figure 3: Concepts for Commercial Building, Residential Homes, and Park

As mentioned before, front-to-back duplexes (as seen in Figure 4 will be implemented on the transitional lots and could also be implemented on 12 of the 16 residential lots, if desired.

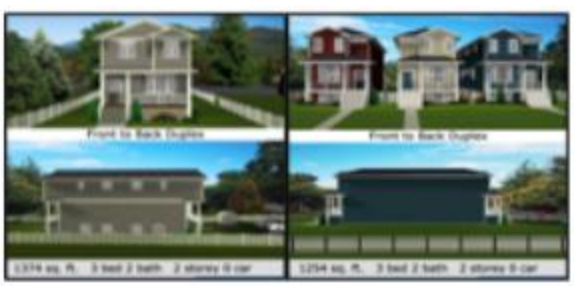


Figure 4: Concepts for Front-to-Back Duplexes

To improve the stormwater management within the site, the installation of a dry detention basin between the residential and transitional area is proposed. In addition, a sidewalk or trail is along the north side of the basin is recommended, to allow pedestrians to walk from Magnolia Pkwy to Evergreen Ave. The rational method was used to determine the maximum volume needed to hold enough water in the detention basin, which was found to be 0.48 acre-feet. The basin shape is a trapezoidal prism, and the dimensions of the basin are a depth of 2 feet, a bottom length of 214.5 feet, and a bottom width of 30 feet. The slope of the basin is 4:1. The basin outlet diameter is 12 inches and will connect to a 12-inch diameter concrete pipe that extends 60 feet to the existing storm sewer. The emergency spillway is located at the intersection of Magnolia Pkwy and Harwood Ave, and the water will spill out into the road and drain down Magnolia Pkwy. With help from the grading plan, any excess runoff from the commercial lots that does not make it to the alley that drains to the basin will drain into the existing storm sewer intakes.

With the location of the park at the north end of the site, the basin at the middle of the site, and existing storm sewer at the south end of the site, additional storm sewer was not needed. All storm runoff is forced to those three locations from the use of the grading plan mentioned later in the report.

The existing watermain can provide water to only half of the proposed residential and transitional lots. To compensate for this, two of the existing watermain segments will be extended. The first segment will extend South from the existing Evergreen Ave towards Harwood Ave and provide water for 11 of the residential lots. The next segment will extend South from the existing Magnolia Pkwy to Falls Ave and provide water for 2 of the transitional lots. Both segment extensions were comprised of 6-inch PVC pipe, and the total length of pipe was 875 feet. One 6-inch diameter fire hydrant was installed halfway along the first segment extension on Evergreen Ave, six 6-inch gate valves were installed at all bends, intersections, and at the fire hydrant, and four 6-inch tapping sleeves were installed at the connections of the existing watermain and the proposed watermain.

The existing sanitary sewer lines provide access to all the residential, transitional, and commercial lots apart from one residential and one transitional lot. To provide service to those lots, a small line is proposed to start at the edge of residential lot 16, which is located along Magnolia Pkwy and above the detention basin and connect South to the existing line along the proposed alley. The line is 8-inch PVC pipe, will be a minimum of 10 feet in depth and will run under the centerline of Magnolia Pkwy. Three manholes will be installed, and will be at the end of the line, at the bend of the Harwood Ave intersection, and at the connection to the existing sanitary line. The pipe network is gravity fed, and the slope is 0.40 feet per 100. The slope will start at the end of the proposed line and drain into the existing line. The total length of pipe is 229 feet. The existing system should be inspected before construction to assess any damages or adjustments to the line before construction.

The Evergreen Ave extension will be 505 feet long and constructed of hot mix asphalt (HMA) of ½ inch size mix. The right of way (ROW) of Evergreen Ave is 56 feet wide, which includes two 12-foot lanes at a 2% crown sloping toward the curb and gutter. The curb and gutter are a total of 30 inches wide and 1 foot high with 6-inches dedicated to curb.

Beyond that, there is 8 feet of green space, a 4-foot sidewalk, and another 1.5 feet of green space to tie into the lots. The 8 feet of green space allows enough room for trees to be planted along the street. The pavement thickness was determined following Iowa DOT standards, which resulted in an 8-inch granular subbase, 2.5 inches of HMA base course, and 2 inches of HMA intermediate and surface courses. The alley between the transitional and commercial zones will be 325 feet long with a ROW of 22 feet with a 2% inverted crown. The thickness of the alley will be the same as Evergreen Ave except with a 7-inch granular subbase. The trail in the park will consist of a 1/8th mile long, 8-foot-wide Portland Cement Concrete (PCC) path at a 1.5% slope outward. The thickness of the trail will be 5 inches of PCC and 6 inches of granular subbase.

The average annual daily traffic (AADT) for the roads surrounding the site were found from the Iowa DOT. Bismark Ave, to the north of the site, has approximately 1,000 daily trips, while Falls Ave to the south has about 2,000 daily trips. Given this information, traffic control measures were proposed. A stop sign should be implemented at the extension of Evergreen Ave where it intersects with Bismark Ave. There is an existing stop sign at the southbound leg of that intersection, so a stop sign at the northbound leg should be placed to match. A yield sign should be implemented on Harwood Ave at the three-way intersection meeting Evergreen Ave. This yield sign is not necessary but recommended for safety measures.

Total estimated construction cost for this project was estimated to be roughly $367,000. In order to keep the lots affordable, this project takes advantage of the existing sanitary sewer lines, as well as the existing watermain to a lesser extent, and allows for the ability to use several of the residential lots for duplexes. Additional major cost items include the detention basin and utility installation. A complete list of all cost estimates can be found in Appendix E.

Section II. Qualifications and Experience

1. Our Company

The project team is comprised of four civil engineering students in their senior year at the University of Iowa. Our team members specialize in transportation design, water resource management, environmental practices, and steel structures.

2. Organization and Design Team Description

Kyla DeShaney was Co-Project Manager and was the main point of contact between the client and faculty advisor. In this role, Kyla helped organize tasks and deliverables for all members of the design team, on a weekly basis. In addition, Kyla assisted with the design process, specifically the roadway design, and the cost estimate.

Mal Weisbrodt was Co-Project Manager for the project. Tasks completed within this role included organization of meeting agenda for both with the client and team and ensured all weekly assignments were completed properly. In addition, Mal was a point of contact with the faculty advisor and assisted Co-Project Manager Kyla with additional assignments.

Tim Sullivan filled the role of Technical Support for the project. The responsibilities within this role included filing and storing documents in an organized fashion within our Microsoft Teams group. Tim also reached out to the City of Waterloo's engineering department on multiple occasions to help retrieve data and relevant documents regarding the site, under the lead of both co-project managers. In addition to these individual responsibilities, Tim assisted the design process with a focus on stormwater management and road design.

Brandon Kakert was the Editor for the project. The responsibilities of this role consisted of overseeing the writing and editing, as well as preparing figures and tables for the reports and leading the development of the PowerPoint presentations. In addition, Brandon assisted with the design process, specifically with the horizontal and vertical alignments for the road(s) and trail, as well as the detention basin grading.

<u>Section III</u>. Design Services

1. Project Scope

The design project entailed the redevelopment of the former Edison Elementary School site in Waterloo into a new neighborhood consisting of a residential area with single-family homes, a park, a transitional area with duplexes, and a commercial area at the south end of the site. In particular, the single-family residential area includes 16 lots totaling 3.01 acres, as well as a park totaling 1.62 acres which includes an exercise trail. The transitional area includes four lots totaling 0.78 acres and the commercial area includes two lots totaling 0.8 acres. One of the main goals of this project was to be unable to tell that the site used to be a school 10 years from now, and with our final design we feel that this is certainly achievable. In addition, the design of the neighborhood should closely resemble that of the surrounding area, allowing itself to blend in with the neighboring infrastructure. With the use of AutoCAD Civil 3D, a master plan of the final proposed neighborhood design was completed, including access roads, sidewalks, utility locations, stormwater and sewer system locations, cut and fill, and elevations. Tasks completed within the duration of this project are as follows:

- Overall site design of neighborhood layout
- Design of stormwater management
- Design of trail within the park
- Design of Evergreen Ave extension
- Design of new water main
- Grading plan of entire site
- Construction cost estimate

2. Work Plan

The project was formatted to be completed in four major phases to ensure a smooth transition between processes. The four phases included design proposal, design development, design formation, and final design presentation. Phase One consisted of the design proposal and included the drafting of four general layouts of the site, with varying locations of the key components. Key components included residential lots, commercial lots, transitional lots, and a park. After the four layouts were presented to the client, one was selected to continue developing. Phase Two consisted of adding more features to the selected design, including stormwater management practices, park trails, access roads, road extensions, and underground utility networks. Phase Three focused on the final details of the design and produced working renderings, plan and profile sheets, and design report. Phase Four consists of presenting the final design to the class, as well as the client and public (if applicable). The progress timeline of the project was depicted in a continually updated Gantt Chart and can be found in Appendix F.

<u>Section IV</u>. Constraints, Challenges, and Impacts

1. Constraints

One major constraint of our design project was that we were unable to do a physical site visit due to COVID restrictions and bad weather. We would have only been able to send one person from our team to the site, but due to the extreme cold and amount of snow on the ground during the preliminary design phase of the project, it was not feasible. With that being said, our faculty advisor Rick Fosse was eventually able to make it up to Waterloo and take some pictures for us.

Another constraint was that the infrastructure of our proposed new neighborhood had to fit in with the existing infrastructure surrounding the perimeter of the site. For example, the shallow depth and limited availability of storm sewer surrounding the project site makes it difficult to provide a stormwater management basin.

Lastly, because we only had a few months to complete our design, the limited amount of time we had to complete this project was a notable constraint seeing that it was something we could not change.

2. Challenges

A notable challenge for this project was to come up with a design that will allow our client to have a positive return on investment. Some design measures considered that will allow for this were to increase the number of residential lots by adding a transitional zone, between the residential zone and commercial zone at the south end of the site. In addition, the design maximized the number of residential lots, while still meeting the required acreage of the park.

Another notable challenge for this project was the stormwater management. Due to the construction of new housing and road, the amount of impervious land cover increased. The slope of the existing site is relatively flat, but there are two low points. One of these low points is roughly in the intersection of Harwood Ave with the alley that runs parallel to the Evergreen Ave extension. The second low point is north of the transitional housing site, located directly between the two points where each side of Harwood Ave ends. With that in mind, the chosen method to mitigate stormwater was to install a detention basin at the location of the second low point. In addition, the grading of the site was adjusted to allow for impervious stormwater runoff to flow towards existing storm sewer entrances. The runoff between the residential lots, east of the Evergreen Ave extension, will flow south and drain into the detention basin. Also, the existing storm sewer infrastructure in the surrounding area was at a shallow depth. Creating intakes in the design that could tie into that infrastructure would not be feasible.

Yet another notable challenge of this project was to overcome the high point near the middle of the Evergreen Ave extension. Thankfully, the runoff will either go north into existing storm sewer intakes, or south into existing storm sewer intakes and/or the detention basin.

Additionally, to combat for the low spot in the alley, it may be deemed necessary to contact the private landowners of this area and request permission to regrade the gravel, to allow for the runoff to flow south towards existing storm sewer intakes.

One final challenge that should be noted, is that the location of the Evergreen Ave extension at the intersection of Bismark Ave will result in the removal of a large, healthy tree in the park. With that in mind, one theoretical option (if desired) would be to offset the intersection to allow for this large, healthy tree to stay, which may result in the loss of a residential lot.

3. Societal Impact within the Community and/or State of Iowa

The societal impact of our project within the community of Waterloo was considered, which consisted of "any activity that is directly performed by or related to the project and has a direct impact on the community's populace, economy, and public revenues." In particular, we focused on the societal impact of our project regarding Individual and Family Changes, as well as Sustainable Practices.

Individual and Family Changes consisted of factors that influence the daily life of individuals and families within the project area, such as how people live, work, play, and interact with one another daily. With that being said, we feel that our proposed design positively influences these changes within the immediate and nearby area. The proposed park could very well provide a sense of togetherness and community, not only for the habitants of the proposed residential and transitional zone, but also for habitants within the surrounding neighborhood(s). In addition, the commercial zone being within close walking distance of both the residential and transitional zones provides another way for residents to easily be able to interact with one another.

Sustainable Practices consisted of specific design elements intended to make the project environmentally and economically sustainable in the long term. Our design included sustainable design elements such as a stormwater detention basin, as well as a park in the residential area that was able to keep most of the existing trees intact. In addition, this project presents an opportunity to create more affordable housing in the area, without impacting any farmland or environmentally sensitive land.

Section V. Alternative Solutions Considered

Each member of our team put together a unique design alternative within AutoCAD Civil 3D during the concept development phase of this project. The pros and cons of each were compared by the team in a Microsoft Excel table before presenting to the client, at which point a final design alternative was selected based on feedback from the client. The four design alternatives, with details including pros and cons, are seen in the following figures.

Table 1: Comparison of New Infrastructure within Design Alternatives

New Infrastructure				
Design Alternative	Number of Streets	Total Length of Streets (foot)	Sanitary Sewer (foot)	Watermain (foot)
Alternative #1	3	1340	600	1380
Alternative #2	4	1374	880	1380
Alternative #3	3	1160	1200	1200
Alternative #4	3	1210	350	1080

As seen above in Table 1, a comparison table of various added infrastructure for each design alternative was evaluated, including number of streets, total length of streets, and sanitary sewer and water main length. Notably, these are only preliminary values that were determined early in the design process and were updated and corrected as necessary for the final proposed design.

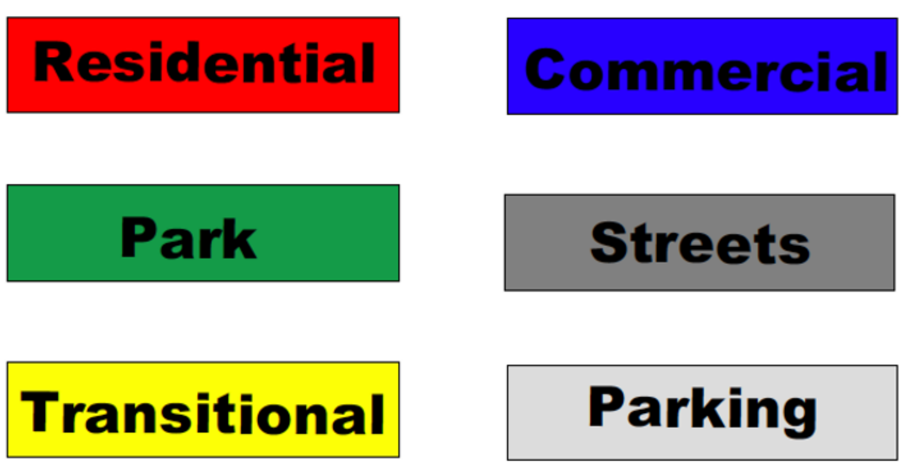


Figure 5: Color Key for Design Alternatives

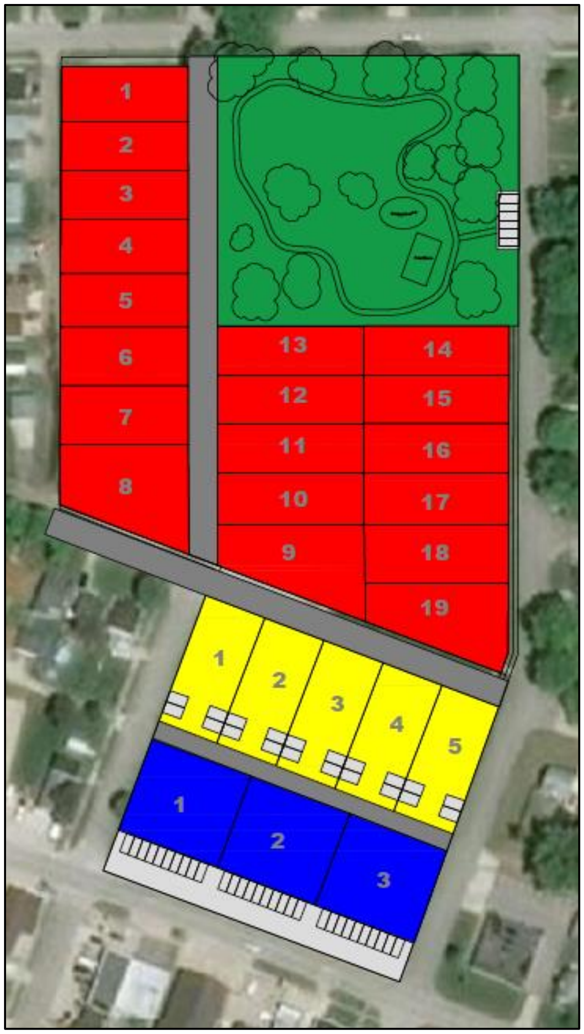


Figure 6: Alternative 1 by Kyla DeShaney

As seen above in Figure 6, the residential zone in Alternative 1 included varying lot sizes and allotted space to allow for potential sidewalks to be included. The total acreage of the residential zone was 3.5 with a total of 19 lots. The park area was chosen to utilize the existing trees and included amenities such as a trail, pavilion, playground, and open field space. The acreage of the park was 1.97 with a total of six parking spots.

For the transitional zone in Alternative 1, duplexes were to be included over a total of five lots with a total acreage of 1.13. In addition, a total of 20 parking spots were to be included. For the commercial zone, three lots were to be included over a total acreage of 1.06, along with 30 parking spots at the south end of the lots, directly off Falls Avenue. The delivery entrance for the proposed building(s) on these lots would be in the rear alley, between the commercial and transitional zone.

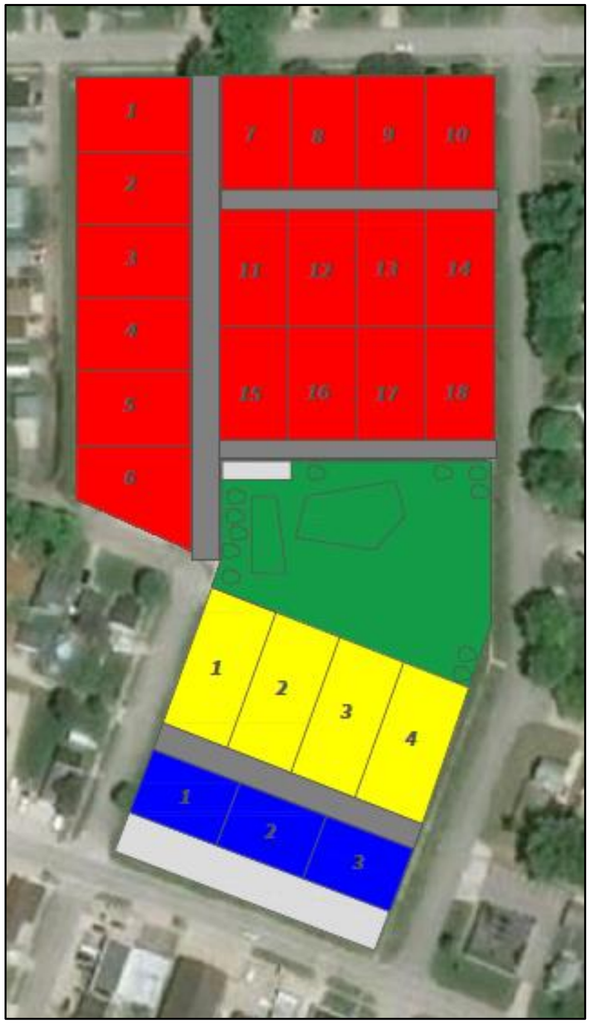


Figure 7: Alternative 2 by Mal Weisbrodt

As seen above in Figure 7, the residential zone in Alternative 2 included additional streets to allow for easier access to housing. The total acreage of the residential zone was 3.7 with a total of 18 lots. The park area was placed strategically to act as a buffer between the transitional and the residential zone, and included amenities such as a pavilion, open field space, and a playground. The acreage of the park area was found to be 1.3 with a total of nine parking spots.

For the transitional zone in Alternative 2, a total of eight townhouse units were to be included over four lots with a total acreage of 1.01. Notably, there were no parking spots included for the transitional area because the townhouses will have driveways. For the commercial zone, three lots were to be included with a total acreage of 0.93, along with 27 parking stalls at the south end of the lots, directly off Falls Avenue. The loading zone was to be included in the shared back roadway connecting to the transitional zone.

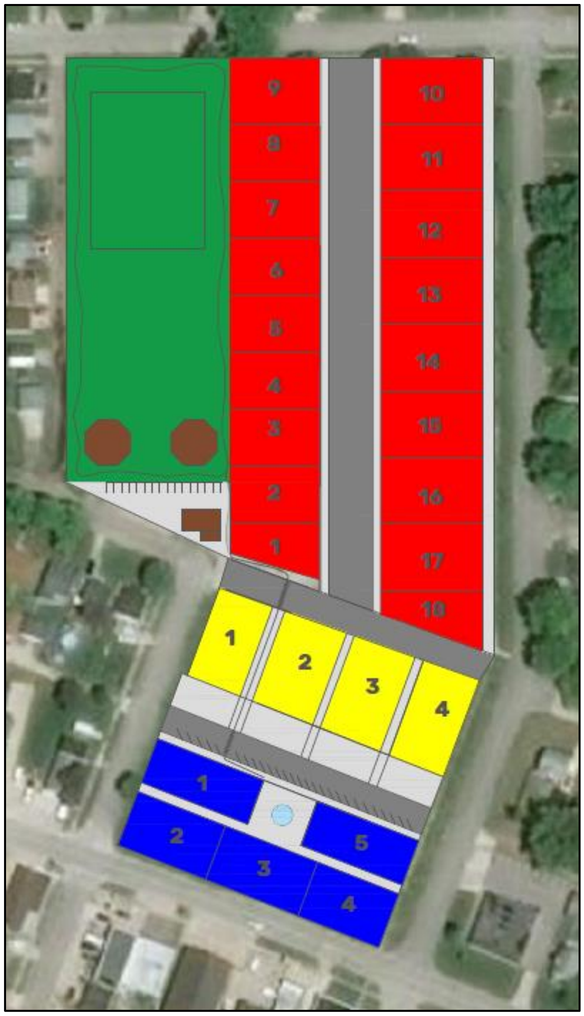


Figure 8: Alternative 3 by Tim Sullivan

As seen above in Figure 8, the residential zone in Alternative 3 provided at least 70-foot-wide lots to allow for larger garages, as well as sidewalks in the front of each lot. The total acreage of the residential zone was 2.8 with a total of 18 lots. The location of the park area was chosen to capture the largest runoff slope. The park was designed to include amenities such as pavilions, workout equipment, storage shed, workout equipment, and a trail - a trail that can be rated for utility work and runs south to the commercial zone. The acreage of the park was 2.0 with a total of 10 parking spots.

For the transitional zone in Alternative 3, 32 apartment units were to be included across four lots, leaving eight units for each lot. The total acreage was 0.9 with a total of 64 parking spots. For the commercial zone, five lots were to be included over a total acreage of 0.9, along with 25 parking spots at the north end of the commercial zone. Most notably, a commons area for pedestrians was included between Lot 1 and 5, with room for tables, public art, and a fountain.

<u>Figure 9</u>: Alternative 4 by Brandon Kakert

As seen above in Figure 9, the residential zone in Alternative 4 included trees separating each of the backyards on Lots 9-19 for privacy. The total acreage of the residential zone was 3.95 with a total of 19 lots. The location of the park area was chosen to be in the center of the residential zone, in order to provide the neighborhood a sense of community and togetherness. The park area included amenities such as a playground, pavilion, open field, and a track, and was 1.49 acres in sizes with a total of nine parking spots.

For the transitional zone in Alternative 4, 32 apartment units were to be included across four lots, leaving eight units for each lot. The total acreage was 1.13 with a total of 64 parking spots. For the commercial zone, three lots were to be included over a total acreage of 0.91, along with 24 diagonal parking spots at the south end of the lots, directly off Falls Avenue, which aimed to allow vehicles to pull directly from the street into a spot.

Section VI. Final Design Details

1. Final Design Alternative

After comparing the pros and cons of each alternative and presenting them to the client and faculty advisor, Alternative 1 was ultimately chosen to move forward with. Unlike any of the other alternatives, this alternative made use of the existing trees at the northeast corner of the site within the design of the park. Some modifications were made to Alternative 1 in the final design as seen in Figure 8 below.

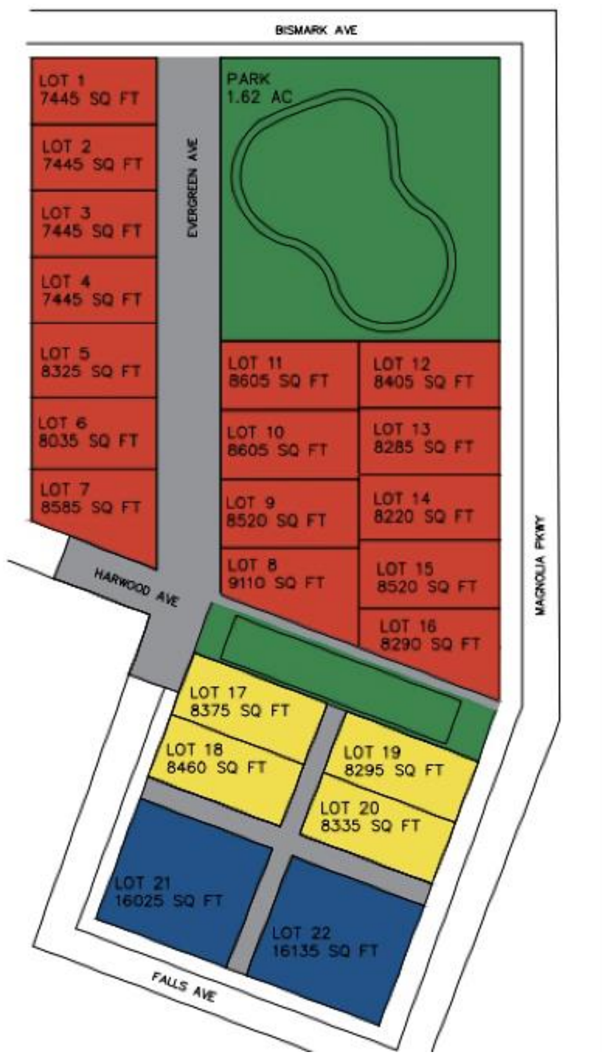


Figure 10: Final Design Layout

Compared to the original design, Alternative 1 from the preliminary design process, the final design saw some modifications. The number of residential lots was decreased from 19 to 16 but the sizes of the lots were increased. The number of commercial lots was reduced to two, as recommended by the client and faculty advisor. The originally proposed Harwood Ave extension between the residential and transitional zone was replaced with a stormwater detention basin. In collaboration with this basin, the transitional lots were rotated from their original vertical, upright positioning, to horizontal positioning. This was done to allow for a driveway to run between the lots and lead directly to the detention basin, which will allow for stormwater runoff to easily flow through.

2. Grading Plan

One of the most notable slopes of the existing site is located at the intersection of the alley (running parallel to the Evergreen Ave extension) and Harwood Ave. In addition, there is a high point near the middle of the Evergreen Ave extension that causes water to runoff to the north and particularly to the south end of the street. Thankfully, there are existing storm sewer intakes at the corner of Hardwood Ave and Evergreen Ave. With that being said, it was necessary to create a grading plan for the stormwater detention basin, located directly between the east and west ends of Harwood Ave where it disconnects.

The overall grading plan for the site was done to ensure that water runoff patterns will not have any detrimental effects on the neighborhood. As seen below in Figure 11 and 12, the arrows show the direction of flow on each lot after the proposed grading is completed. The idea here is for water to flow towards impervious surfaces (such as Evergreen Ave) to intakes or to the detention basin, or otherwise flow over pervious surfaces (such as between backyards) in the general direction of the detention basin.

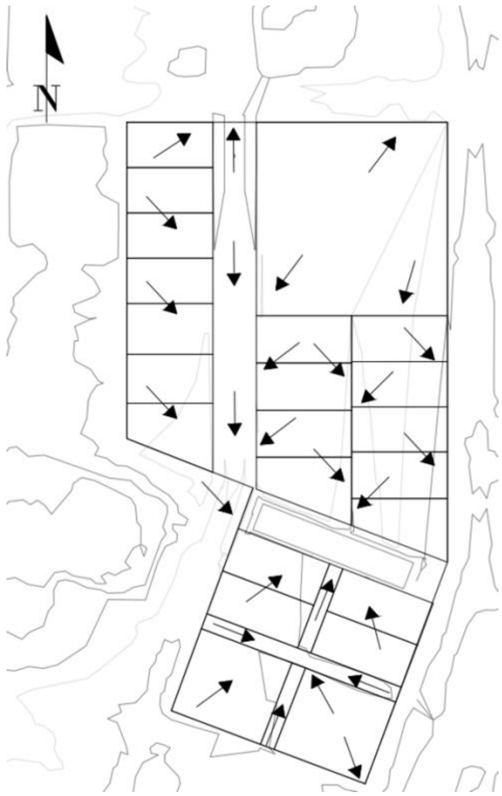


Figure 11: Proposed Grading Plan for the Edison Site

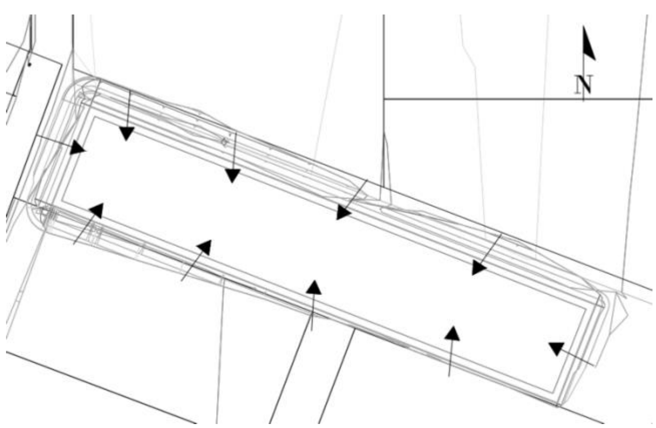


Figure 12: Proposed Grading Plan for the Basin

3. Park Design

The proposed park trail is 1/8th of a mile and designed to be used by pedestrians for walking and running. ADA guidelines were followed, including a minimum 41.5-foot radius for each curve resulting in a design speed of 15 mph. The total width of the trail is 8 feet with each lane being 4 feet and having a 1.5% cross slope. Pavement depth is 5 inches, using Portland Cement Concrete (PCC) with 6 inches of granular subbase. The design details can be found in Figures 13 – 15.

The decision to construct the park trail with concrete instead of asphalt was based on a few major factors in particular. The reliability and long-term structural resiliency of concrete far outweighs the initial increase in cost. A concrete trail will also better support utility vehicles. Asphalt paths have a tendency to obtain longitudinal cracks that require occasional repair. Concrete also remains at a lower temperature than asphalt in hot and sunny weather. Since this trail is designed for recreational use, including walking dogs and other pets, the lower heat absorption of concrete is preferred.

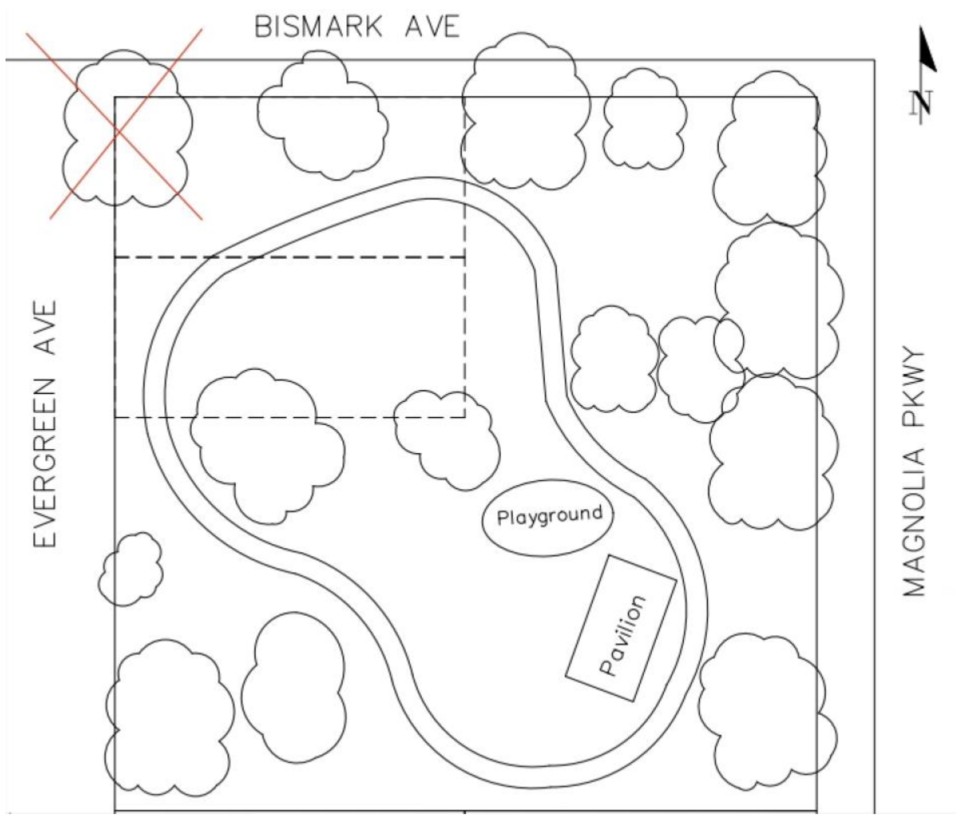
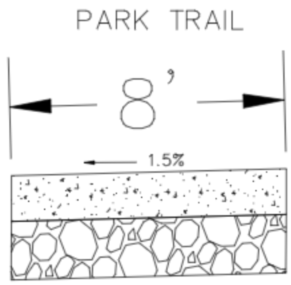
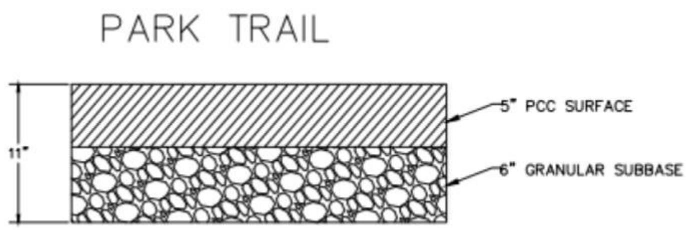


Figure 13: Aerial View of Park Trail Design



<u>Figure 14</u>: Proposed Park Trail Design



<u>Figure 15</u>: Proposed Park Trail Thickness Design

4. Residential Lot Design

The residential lot sizes had some slight variance, particularly in the southern-most three lots, with Lot 7 being 8585 square feet, Lot 8 being 9110 square feet, and Lot 16 being 8290 square feet. The total acreage of the residential area is 3.01 acres. Notably, 12 of the 16 lots meet the minimum lot area requirement for a duplex of 8000 square feet, so this could be an option for the developer, if desired, to include several duplexes in the residential area in addition to single-family homes. As mentioned previously in the grading section, water runoff in the residential area should flow towards impervious surfaces (such as Evergreen Ave) to intakes or towards the detention basin, or otherwise flow over pervious surfaces (such as between backyards) in the general direction of the detention basin.

5. Transitional Lot Design

The transitional area is a total of 0.77 acres and will be used for duplexes. As mentioned before, 12 of the 16 residential lots are large enough to be used for duplexes as well, if desired. As for the access road to the transitional lots, a small driveway from the alley between the transitional area and the commercial area will run between Lots 1-2 and Lots 3-4. This driveway was intentionally designed to run north and south to allow for impervious water runoff to drain into the detention basin immediately north of the transitional zone.

6. Commercial Lot Design

The two commercial lots combine for a total acreage of 0.74 and will be used at the discretion of the developer. Similar to the transitional zone, a small driveway runs north and south between the two commercial lots for parking access. The parking layout would consist of diagonal spots on each side of the driveway, with a one-way drive running north from Falls Ave to the alley. In addition to this, we would recommend underground parking to allow more space. This would be especially beneficial if apartments are included on the second (and possible third) story above the commercial businesses.

7. Storm Water Management

Detention Basin

To accommodate for the increase in surface flows, a dry detention basin was designed to collect the surface flows and discharge to the existing storm sewer network. The rational method was used to estimate the peak rate of runoff for both pre-developed and developed conditions for a 100-year flood. The rational method uses a runoff coefficient, rainfall intensity, and project area to calculate peak flows. The runoff coefficient is based on the land type, and because both conditions had various types of areas, a composite runoff coefficient was calculated as mentioned in Equation 4A-5_2 from Chapter 4 of the Iowa DOT Design Manual. Pre-developed conditions contained open lawn and a small gravel surface, and developed conditions contained residential lots, commercial areas, paved surfaces, and open park space. Runoff coefficient values were taken from Table 1 in Section 4A-5 of the Iowa DOT Design Manual. The composite runoff coefficient for the pre-developed and developed sites are 0.348 and 0.66, respectively. The overall site area is 7.326 acres.

Rainfall intensity values were taken from Table 2 Section 4A-5 of the Iowa DOT Design Manual. A design storm duration of 6 hours was selected. Time of concentration were calculated to determine the response of the area and develop intensities for those times. Intensity values of a 100-year storm for durations between 15 minutes to 6 hours and interpolated values to match the duration during the time of concentration were used. The peak runoff rate for the developed site during a 6 hour 100-year storm was established using the rational method. The peak runoff rate for the pre-developed site was calculated only during the time of concentration of 15 minutes to have the highest peak runoff rate for pre-existing conditions.

The release volume and required storage were calculated until the critical storage was found. The runoff volume was determined by multiplying the inflow of the developed site by the duration of the storm. The release volume was calculated by multiplying the peak runoff rate of the pre-developed site by the duration of the storm. By subtracting the runoff volume from the release volume, the required storage was found. As seen in Table 2, the maximum required storage for the basin is 20,965 cubic feet.

Table 2: Storage duration volumes for a 6-hour 100-year storm.

Duration (Hour)	Q100 Intensity (in/hr)	Q100 Inflow (cfs)	Q100 Volume (cubic ft)	Release Volume Q5 (cubic ft)	Storage (cubic ft)
0.25	7.03	33.99	30592.86	16223.061	14369.8
0.376	5.96	28.82	38995.67	18104.936	20890.73
0.406	5.72	27.66	40432.67	19467.673	20964.99
0.5	4.98	24.08	43343.51	32446.121	10897.39
1	3.39	16.39	59009.84	64892.243	0
2	2.15	10.4	74850.24	129784.486	0
3	1.64	7.93	85642.6	194676.728	0
6	0.99	4.79	103397.8	389353.457	0

The dimensions of the basin were determined to fit the maximum required storage volume. From Section 2G-1 of the Iowa DOT design manual, the slope on the embankments should be at least 4:1 or flatter, the bottom cross-slopes will be 2% minimum, and the embankment top should be at least 6 feet wide. With those constraints, the depth of the basin is 2 feet, the bottom length is 214.5 feet, and the bottom width is 30 feet. The basin will drain to the existing storm system at the intersection of Magnolia Pkwy and Harwood Ave. The basin outlet diameter is 12 inches and will connect to a 12-inch diameter concrete pipe that extends 60 feet to the existing storm sewer. The emergency spillway is located at the same intersection, and the water will spill out into the road and drain down Magnolia Pkwy.

Figure 16: Potential Design for Dry Detention Basin

The minimum depth of cover for the storm pipe connecting the basin to the existing storm system is 1 foot. The storm sewer constraints were referenced from the Iowa SUDAS manual. Besides from this connection, additional storm sewer was not needed because the park, basin and grading of the entire site accounts for all water runoffs.

It should also be noted that a sidewalk path along the north side of detention basin would be a desirable addition once the residential lots are built. This was not necessary to be included in the cost estimate but again should be noted.

8. Water Main Design

The existing water main on the current site does not reach the residential or transitional lots, while the existing 8-inch water main reaches the two commercial lots. The proposed 6-inch PVC (polyvinyl chloride) water main will tie in to the existing 6-inch pipe and create a loop network.

Towards the North-end of the site at the intersection of Evergreen Ave and Bismark Ave, there is existing watermain that dead ends. The proposed watermain will connect to the existing at that intersection and continue down along the extension of Evergreen Ave. It will then tie into the existing line at Harwood Ave. This connection will be 6-inch PVC pipe. The next proposed watermain is a segment between Magnolia Pkwy and Falls Ave, and it will be an extension of the existing watermain at Magnolia Pkwy. The existing watermain at Magnolia Ave is 6-inch PVC pipe, and the main at Falls Ave is 8-inch PVC pipe. The extension between the two will be 6-inch PVC pipe. For both segment extensions at each connection to the existing mains, a tapping sleeve and 6-inch gate valve are to be installed. The proposed watermain segments can be seen below in Figure 17.

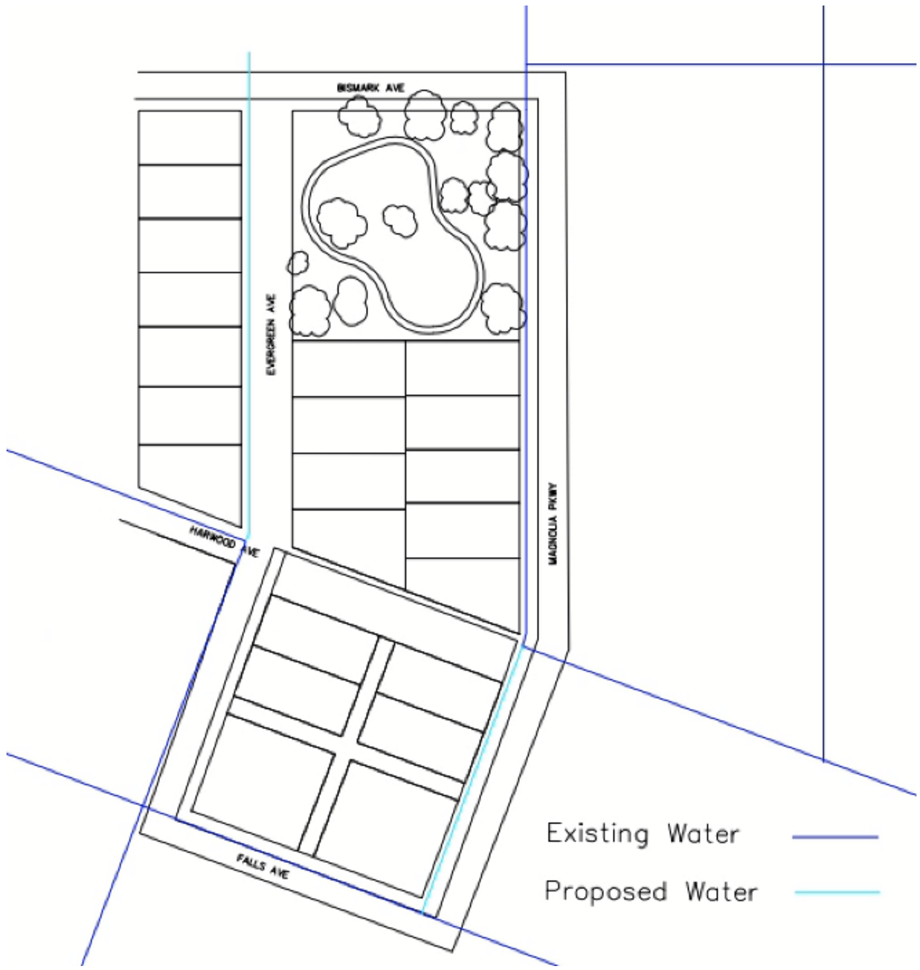


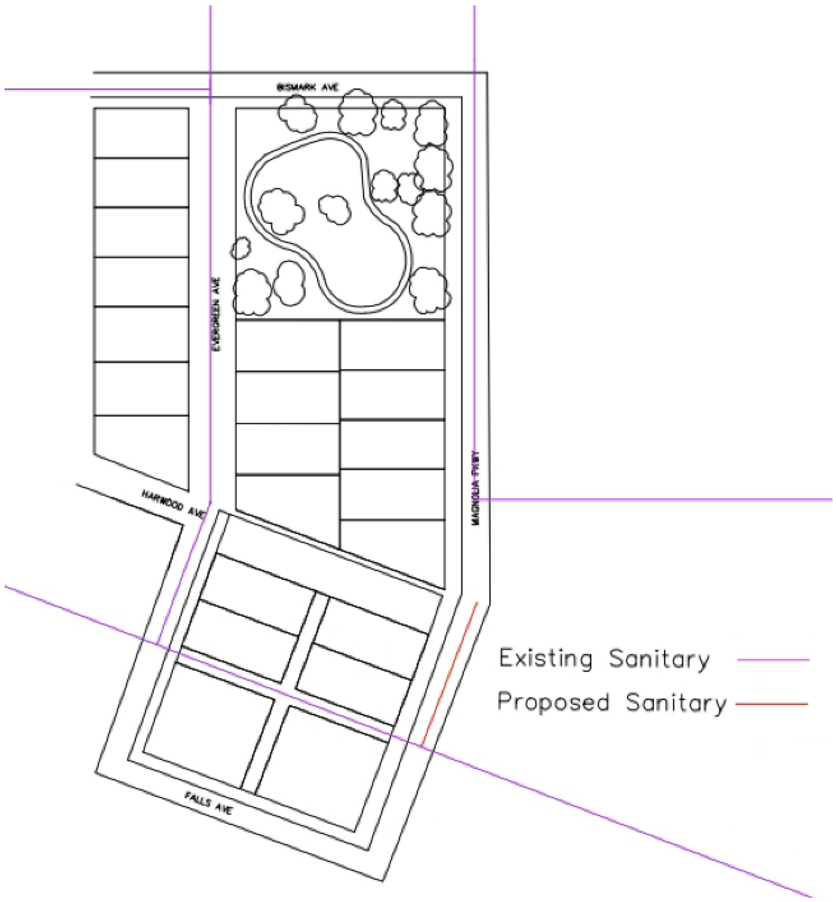
Figure 17: Proposed 6-inch PVC Watermain Segments

The depth of the watermain is determined in Section 4C-1 of Iowa SUDAS Design Manual. Black Hawk County falls within the minimum depth cover of 5 feet, and it is 4 feet behind the curb. All valves used were 6-inch gate valves, and all fire hydrants were independently valved. The total length of proposed watermain pipe to be installed in the final design is 875 feet.

9. Sanitary Design

The existing sanitary sewer lines run through the entire site, with an exception to one transitional lot and one residential lot. The proposed addition will stub out from the existing line that runs under the designed alley North of the commercial section up to residential lot 16. This line will run directly under the center of Magnolia Pkwy. Three 48-inch manholes will be installed, one at the connection between the existing and the proposed pipe, one at the bend in the line, and the other will be at the end of the line. The sanitary line will be 229 feet of 8-inch PVC pipe and will have a minimum cover of 8 feet. The minimum slope of the pipe is 0.40 feet per 100 feet. The service stub for both lots will be 4 inches in diameter. All design specifications were determined from Chapter 3 Section 3 of the Iowa SUDAS Design Manual.

With that being said, the existing hookups of the entire main should be inspected before construction to determine whether they need to be repaired and replaced. Additionally, it should be noted that due to the age of the existing sanitary sewer, the condition of it should be evaluated, and any necessary spot repairs should be included within the subdivision plans. The proposed location of the new sanitary line can be seen in Figure 18 below.



<u>Figure 18</u>: Location of Existing and Proposed Sanitary Sewer Lines

10. Road and Pavement Design

In the design, Evergreen Ave will be extended from Bismark Ave to Hardwood Ave, which is approximately 505 ft. The proposed segment contains two 12-foot asphalt lanes with 2.5 inches of concrete curb and gutter. Beyond that, there is 8 feet of grass, 4 feet of concrete sidewalk then 1.5 feet of grass, creating a right of way (ROW) of 56 feet. At the edge of the ROW is where the residential lots begin. The pavement thickness is a total of 14.5 inches, with an 8-inch granular subbase, 2.5-inch base course, 2-inch intermediate course, and a 2-inch surface course. The specific details of the road segments can be found in Figures 19 and 20. The back of curb and gutter is 1 foot thick, and the front is 6 inches thick. Details can be seen in Figure 21.

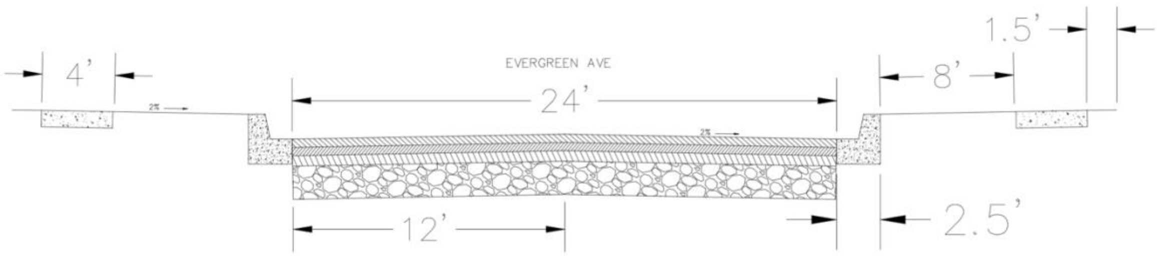


Figure 19: Proposed Evergreen Ave Road Design

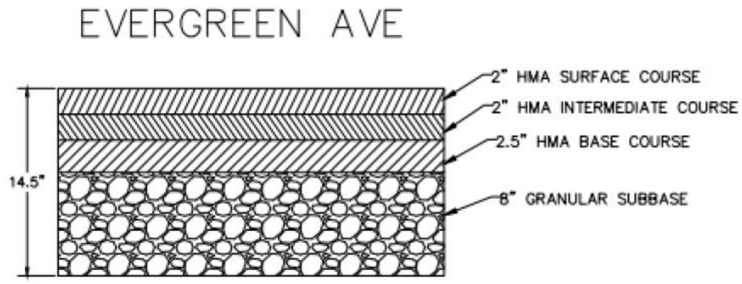


Figure 20: Proposed Evergreen Ave Thickness Design

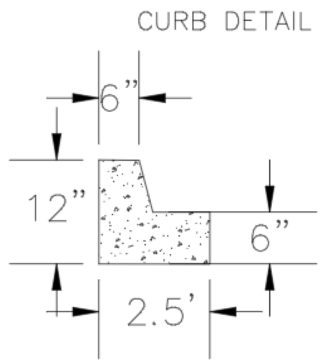
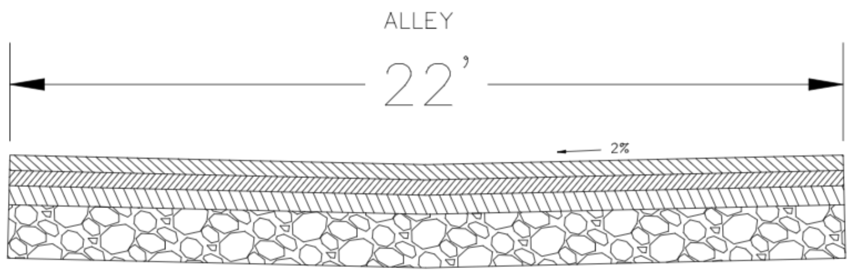
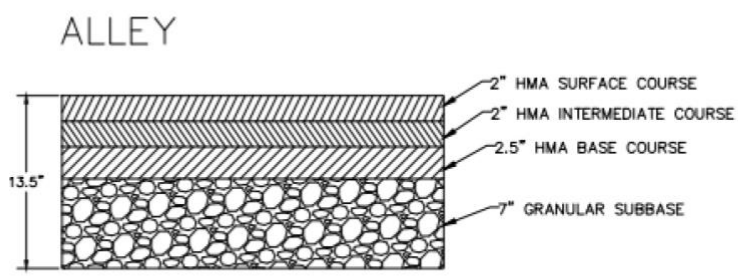


Figure 21: Proposed Curb and Gutter

The alley between the transitional zone and commercial zone will have two 11-foot asphalt lanes creating a ROW of 22 feet. It will have a granular subbase of 7”, base course of 2.5”, intermediate course of 2”, and a surface course of 2”, totaling a thickness of 13.5”. The details of the alley segments can be found in Figures 22 and 23.



<u>Figure 22</u>: Proposed Alley Road Design



<u>Figure 23</u>: Proposed Alley Thickness Design

11. Traffic Control

Using the Iowa DOT website for traffic data, the annual average daily traffic (AADT) volumes were found for the current site, with data as recent as 2017. As seen in Figures 24 and 25 below, the highest average volume of traffic occurs on Falls Ave (indicated in orange), ranging from 2000 to 4999 vehicles per day. Additionally, Bismarck Ave (indicated in green) sees an average of 1000 to 1999 vehicles per day.

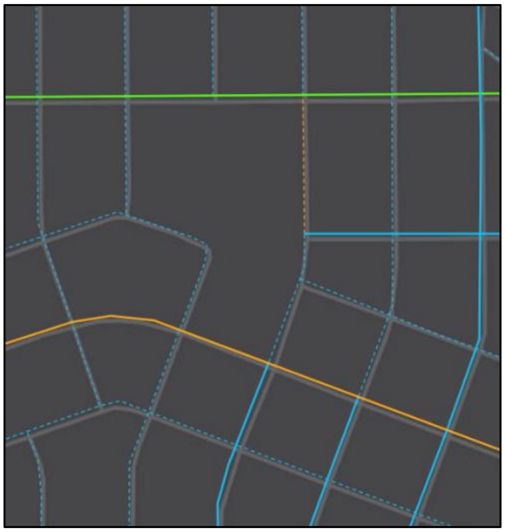


Figure 24: AADT Map for Site

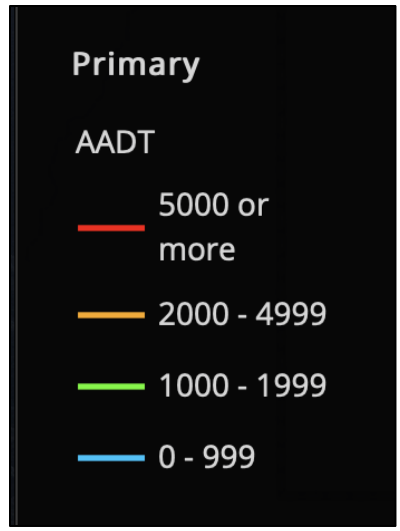


Figure 25: AADT Counts

The proposed neighborhood development should not have a significant impact on these volumes. Between the residential and transitional zones, there will likely only be an additional 50-100 trips per day, and most of the commercial zone traffic will be from Falls Ave. With that in mind, there will need to be a stop sign implemented at the north end of the Evergreen Ave extension (northbound) where it meets Bismark Ave. A yield sign will be implemented on Harwood Ave (eastbound) where it intersects with Evergreen Ave. This is a three-way intersection and for safety reasons a yield sign is proposed.

<u>Section VII</u>. Construction Cost Estimate

The construction cost estimate for this project was based on unit prices taken from the Iowa DOT Bid Express website. The unit prices were chosen from several different "lettings," or awarded contract bids, ranging from January 20, 2021, to April 20, 2021. The averages for each item of interest were calculated using the high and low values from the different bids. The total estimated construction cost for this project is roughly $367,000. A detailed cost estimate table can be found in Appendix E. Estimates were calculated for each pavement in both Hot Mix Asphalt and Portland Cement Concrete, although the total cost represents the prices of HMA for Evergreen Ave and the commercial alley, and PCC for the park trail. Other major factors to the cost were the detention basin and the installation of the utilities such as water main, storm sewer, and sanitary sewer. There is an existing sanitary sewer line that follows directly below the proposed Evergreen Ave, so the only additional cost is for service stubs to each lot.

Section VIII. Appendices

Appendix A – Stormwater Management
Section 1: Runoff Coefficients
Section 2: Rainfall Intensity
Section 3: Detention Basin

Appendix B – Water Mains
Section 1: Water Main Installation

Appendix C – Sanitary Sewer
Section 1: Design Specification

Appendix D – Soil Information
Section 1: Soil Survey

Appendix E – Pavement Design
Section 1: Mix Design

Appendix F – Construction Cost Estimate
Section 1: Cost Breakdown

Appendix G – Work Schedule
Section 1: Gantt Chart

Appendix A – Stormwater Management

Section 1: Runoff Coefficients

Iowa DOT. (2015, July 2). *Using the Rational Method to Determine Peak Flow.* Design Manual, Chapter 4 – Drainage, Section 4A-5.

Table A-1.1: Runoff Coefficients for the Rational Method

description of area	runoff coefficient (C)***			
	5 year	10 year	50 year	100 year
Paved Surfaces/Buildings	0.94	0.95	0.98	0.98
Gravel Surfaces, Compacted	0.45	0.50	0.55	0.60
Gravel Surfaces, Loose Graded or Not Compacted	0.35	0.40	0.45	0.50
Industrial Light, 60% Impervious	0.64	0.69	0.79	0.83
Industrial Heavy, 75% Impervious	0.76	0.79	0.86	0.89
Commercial/Business Areas, 85% Impervious	0.81	0.85	0.91	0.92
Residential Row houses/town houses, 65% Impervious	0.66	0.67	0.74	0.76
Residential 1/4 Acre lots, 40% Impervious*	0.48	0.49	0.58	0.62
Residential 1/2 Acre lots, 25% Impervious*	0.36	0.39	0.49	0.54
Residential 1 Acre lots, 20% Impervious*	0.32	0.34	0.46	0.51
Lawn, 0 to 2% slope (flat) **	0.22	0.22	0.30	0.36
Lawn, 2 to 7% slope (average) **	0.24	0.25	0.35	0.40
Lawn, 7% or greater (steep) **	0.26	0.30	0.38	0.45
Parks/Golf Courses/Cemeteries, 8% Impervious	0.21	0.21	0.28	0.34

* Based on Type B soils. Some regions in Iowa have predominant C and D type soils which require larger 'C' values. Appropriate experience is required in selecting appropriate 'C' values. Contact Office of Design Soils Section for further guidance.

** Based on heavy soils and lawn in fair condition. For situations involving sandy soils, contact the Methods Section

*** For higher percent of imperviousness than in the "description of area", developing land with no cover to poor cover, compacted soils, locations of high water table, and/or soils having a slow infiltration rate when thoroughly wetted, these values may be too low. Consult HEC-22, AASHTO Drainage Design Guidelines, or the Methods Section.

The Rational Equation

The Rational Method uses the Rational equation given below:

$$Q = CIA \quad \text{(Equation 4A-5\_1)}$$

where:

Q = Peak flow, ft^3/s.

C = Runoff coefficient (dimensionless).

I = Rainfall intensity, in/hr.

A = Drainage area, acres.

Figure A-1.1: The Rational Equation

$$C = \frac{C_1A_1 + C_2A_2 + C_3A_3 ... + ...C_nA_n}{A_1 + A_2 + A_3 ... + ...A_n} \quad \text{(Equation 4A-5\_2)}$$

where:

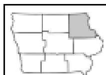
$A_1, A_2, A_3, \ldots A_n$ = areas of the distinct parts.

C_1 = C value for A_1, C_2 = C value for A_2, etc.

Figure A-1.2: Equation for Composite Coefficient

Section 2: Rainfall Intensity

Iowa SUDAS. (2015). *Rainfall and Runoff Periods.* Design Manual, Chapter 2 – Stormwater, Section 2B-2.

	**Return Period**															
	1 year		***2 year***		***5 year***		***10 year***		***25 year***		***50 year***		***100 year***		***500 year***	
Duration	***D***	***I***	***D***	***I***	***D***	***I***	***D***	***I***	***D***	***I***	***D***	***I***	***D***	***I***	***D***	***I***
5 min	0.38	4.66	0.45	5.47	0.56	6.76	0.65	7.86	0.78	9.42	0.88	10.5	0.98	11.8	1.22	14.7
10 min	0.56	3.40	0.66	4.00	0.82	4.94	0.96	5.76	1.14	6.89	1.29	7.75	1.44	8.64	1.79	10.7
15 min	0.69	2.77	0.81	3.24	1.00	4.02	1.17	4.68	1.40	5.60	1.57	6.31	1.75	7.03	2.19	8.77
30 min	0.96	1.93	1.14	2.28	1.41	2.83	1.65	3.31	1.98	3.96	2.23	4.47	2.49	4.98	3.10	6.20
1 hr	1.25	1.25	1.47	1.47	1.85	1.85	2.17	2.17	2.64	2.64	3.01	3.01	3.39	3.39	4.34	4.34
2 hr	1.53	0.76	1.81	0.90	2.28	1.14	2.70	1.35	3.30	1.65	3.79	1.89	4.30	2.15	5.58	2.79
3 hr	1.71	0.57	2.01	0.67	2.55	0.85	3.03	1.01	3.74	1.24	4.32	1.44	4.94	1.64	6.55	2.18
6 hr	2.01	0.33	2.36	0.39	2.98	0.49	3.56	0.59	4.43	0.73	5.17	0.86	5.97	0.99	8.07	1.34
12 hr	2.32	0.19	2.69	0.22	3.38	0.28	4.02	0.33	5.02	0.41	5.86	0.48	6.79	0.56	9.25	0.77
24 hr	2.63	0.10	3.04	0.12	3.78	0.15	4.48	0.18	5.56	0.23	6.48	0.27	7.48	0.31	10.1	0.42
48 hr	3.00	0.06	3.44	0.07	4.23	0.08	4.98	0.10	6.12	0.12	7.10	0.14	8.15	0.16	10.9	0.22
3 day	3.28	0.04	3.73	0.05	4.56	0.06	5.32	0.07	6.49	0.09	7.48	0.10	8.56	0.11	11.4	0.15
4 day	3.53	0.03	4.00	0.04	4.85	0.05	5.64	0.05	6.84	0.07	7.86	0.08	8.95	0.09	11.8	0.12
7 day	4.17	0.02	4.72	0.02	5.70	0.03	6.58	0.03	7.87	0.04	8.95	0.05	10.1	0.06	13.0	0.07
10 day	4.76	0.01	5.38	0.02	6.45	0.02	7.39	0.03	8.77	0.03	9.90	0.04	11.0	0.04	14.0	0.05

D = Total depth of rainfall for given storm duration (inches)
I = Rainfall intensity for given storm duration (inches/hour)

Table A-2.1: Return Period for Northeast Iowa (Waterloo)

Iowa SUDAS. (2015). *Time of Concentration.* Design Manual, Chapter 2 – Stormwater, Section 2B-3.

$$T_t = \frac{\ell}{3{,}600V}$$

where:

T_t = travel time, hours
ℓ = flow length, ft
V = average velocity, ft/s
3,600 = conversion factor, seconds to hours

<u>Figure A-2.1</u>: "Travel Time" Equation for Shallow Flow

$$T_t = \frac{0.007(n\ell)^{0.8}}{(P_2)^{0.5}S^{0.4}}$$

where:

T_t = travel time, h
n = Manning's roughness coefficient (Table 2B-3.01)
ℓ = sheet flow length, ft
P_2 = 2 year, 24 hour rainfall, in
S = slope of land surface, ft/ft

<u>Figure A-2.2</u>: "Travel Time" Equation for Sheet Flow

Section 3: Detention Basin

Iowa SUDAS. (2015). *General Information for Detention Practices.* Design Manual, Chapter 2 – Stormwater, Section 2G-1.

$$q_{pi} = CiA$$ **Equation 2G-1.01**

where:

q_{pi} = peak runoff from site (peak inflow into detention basin)
C = runoff coefficient
i = rainfall intensity, in/hr
A = drainage area, ac

Figure A-3.1: Modified Rational Method Equation for Critical Storage

$$S_d = q_{pi}t_d - \frac{Q_a(t_d + T_c)}{2}$$ **Equation 2G-1.02**

where:

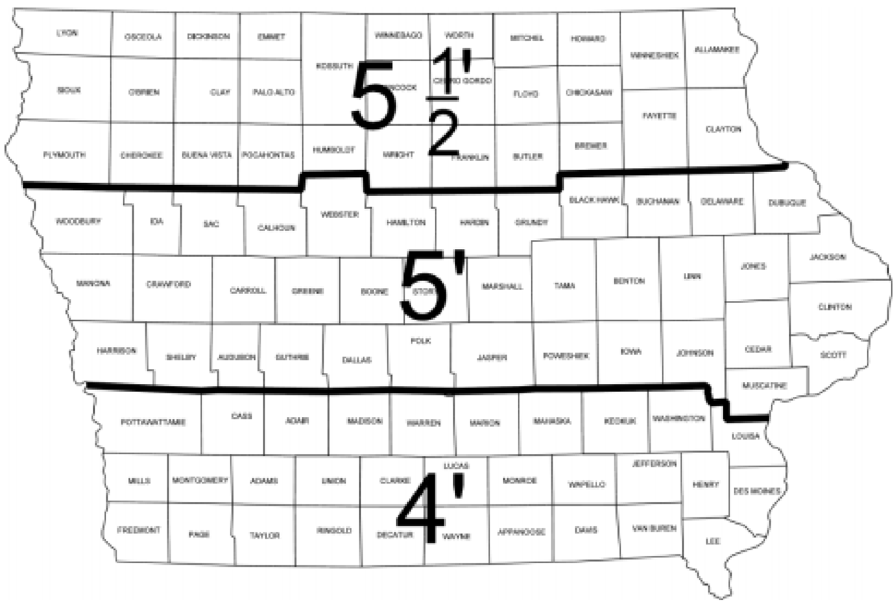
S_d = detention volume required, ft^3
Q_a = allowable peak outflow rate, cfs
t_d = design storm duration, sec
T_c = time of concentration for the watershed, sec

Figure A-3.2: Equation for Detention Basin Storage Volume

Appendix B – Water Mains

Section 1: Water Main Installation

Iowa SUDAS. (2015). *Facility Design.* Design Manual, Chapter 4 – Water Mains, Section 4C-1.



<u>Figure B-1.1</u>: Map of Minimum Depth of Cover for Water Main Installation (5' for Waterloo)

Appendix C – Sanitary Sewer

Section 1: Sanitary Sewer Pipe Specifications

Iowa SUDAS. (2013). *Facility Design*. Design Manual, Chapter 3 – Sanitary Sewers, Section 3C-1.

Table C-1.1: Minimum Slope Requirements for Sanitary Sewer Pipe Diameters

Pipe Size (inches)	Minimum Slope (ft/100 ft)
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12
21	0.10
24	0.08
27	0.067
30	0.058
36	0.046

Appendix D – Soil Information

Section 1: Soil Survey

Natural Resources Conservation Service. (2006). *Soil Survey of Black Hawk County, Iowa.* 4177B – Saude-Urban land complex, 2 to 5 percent slopes.

4177B—Saude-Urban land complex, 2 to 5 percent slopes

Component Description

Saude and similar soils

Extent: 35 to 55 percent of the mapped areas
Geomorphic setting: Stream terraces
Geomorphic component: Treads

<u>Figure D-1.1</u>: Description of Soil Survey (1 of 2)

Slope range: 2 to 5 percent
Depth to restrictive feature: Very deep (more than 60 inches)
Drainage class: Well drained
Parent material: Alluvium
Flooding: None
Depth to wet zone: More than 6.7 feet all year
Ponding: None
Available water capacity to a depth of 60 inches: 6.5 inches
Content of organic matter in the upper 10 inches: 3.4 percent

Urban land

General description: This component consists of areas that are covered by buildings, roads, streets, parking lots, mobile home parks, and other structures. The original soils can no longer be identified.
Extent: 35 to 55 percent of the mapped areas

Minor Dissimilar Components

Finchford and similar soils

Extent: 0 to 20 percent of the mapped areas

<u>Figure D-1.2</u>: Description of Soil Survey (2 of 2)

Appendix E – Pavement Design

Section 1: Mix Design

Table E-1.1: Roadway Thickness Requirement

A. For Asphalt Concrete Base Pavements

Design Criteria*			Thickness in Inches Asphalt Concrete		
Traffic Class (ADT)	Subgrade Class	Subgrade CBR	Base	Surface	Total
II (50-200 ADT)	Good	9	4.0	1.0	5.0
	Moderate	6	5.0	1.0	6.0
	Poor	3	5.5	1.5	7.0
III (201-700 ADT)	Good	9	4.0	1.5	5.5
	Moderate	6	5.0	1.5	6.5
	Poor	3	6.0	1.5	7.5
IV (1,501-4,500 ADT)	Good	9	5.5	2.0	7.5
	Moderate	6	6.5	2.0	8.5
	Poor	3	7.5	2.0	9.5

B. For Untreated Aggregate Base Pavements

Design Criteria*			Thickness in Inches			
Traffic Class (ADT)	Subgrade Class	Subgrade CBR	Untreated Aggregate Base	Asphalt Concrete Base	Asphalt Concrete Surface	Total
II (50-200 ADT)	Good	9	5.0	.0	3.0	8.0
	Moderate	6	8.0	.0	3.0	11.0
	Poor	3	8.0	2.0	2.0	12.0
III (201-700 ADT)	Good	9	7.0	.0	3.0	10.0
	Moderate	6	8.0	2.0	2.0	12.0
	Poor	3	8.0	3.0	2.0	13.0
IV (1,500-4,500 ADT)	Good	9	8.0	3.0	2.0	13.0
	Moderate	6	8.0	3.5	2.0	13.5
	Poor	3	8.0	4.5	2.0	14.5

Appendix F – Engineer's Cost Estimate

Section 1: Construction Cost Breakdown

Table F-1.1: Construction Cost Estimate Breakdown of Entire Project

ITEM NO	ITEM NAME	UNIT PRICE	UNIT	VALUE	PRICE
2102-2710070	CLASS 10 EXCAVATION	$11.14	CY	7515.15	$83,718.77
2105-8425015	TOP SOIL, STRIP, SALVAGE, SPREAD	$6.12	CY	3757.58	$22,996.36
2111-8174100	GRANULAR SUBBASE	$6.00	SY	1934.42	$11,606.52
2122-5500060	PAVED SHOULDER, HMA 6 IN	$24.60	SY	144.89	$3,564.27
2213-6745500	REMOVAL OF CURB	$370.28	STA	1.73	$640.58
2303-1031500	HMA BASE COURSE 1/2 IN	$41.75	TON	66.32	$2,768.86
2303-1032500	HMA INTERMEDIATE COURSE 1/2 IN	$40.25	TON	66.32	$2,669.38
2303-1033504	HMA SURFACE COURSE 1/2 IN	$38.50	TON	66.32	$2,553.32
2435-0130160	MAHOLE SANITARY SEWER 60 IN	$125.00	EACH	3.00	$375.00
2435-0250100	INTAKE, SW-501	$4,000.00	EACH	2.00	$8,000.00
2435-0600020	MANHOLE LID ADJUSTMENT	$2,485.85	EACH	3.00	$7,457.55
2435-0600120	INTAKE ADJUSTMENT	$950.00	EACH	4.00	$3,800.00
2435-0700020	CONNECTION TO EXISTING INTAKE	$500.00	EACH	5.00	$2,500.00
2502-8221006	SUBDRAIN RISER, 6 IN	$142.00	EACH	1.00	$142.00
2504-0114008	SANITARY SEWER TRENCHED, PVC PIPE 8 IN	$67.79	LF	229.00	$15,523.91
2504-0200404	SANITARY SEWER SERVICE STUB, PVC PIPE 4 IN	$60.70	LF	60.00	$3,642.00
2505-0112008	STORM SEWER PVC PIPE 8 IN	$92.56	LF	60.00	$5,553.60
2510-6745850	REMOVAL OF PAVEMENT	$10.93	SY	1192.00	$13,028.56
2511-0302500	REC TRAIL PCC 5 IN	$48.49	SY	590.42	$28,629.36
2512-1725256	CURB & GUTTER PCC 2.5 FT	$47.30	LF	1181.00	$55,861.30
2524-9275100	WOOD POSTS FOR TYPE A SIGN, 4 IN X 4 IN	$15.00	LF	14.00	$210.00
2524-9325150	INTSTALL TYPE A SIGN	$45.00	EACH	2.00	$90.00
2527-9263112	PAINTED PAVEMENT MARKINGS	$22.81	STA	504.00	$11,496.24
2554-0114006	WATER MAIN PVC PIPE 6 IN	$60.27	LF	887.00	$53,459.49
2554-0207006	GATE VALVE 6 IN	$950.00	EACH	6.00	$5,700.00
2554-0208006	TAPPING VALVE ASSEMBLY, 6 IN	$3,000.00	EACH	4.00	$12,000.00
2554-0210201	FIRE HYDRANT ASSEMBLY, WM-201	$3,500.00	EACH	1.00	$3,500.00
2554-0212030	VALVE ADJUSTMENT	$110.00	EACH	1.00	$110.00
2601-2636015	HEXPAVE GRASS PAVING SYSTEM	$199.00	EACH	1.00	$199.00
2601-2636041	SEEDING AND FERTILIZING	$3,500.00	ACRE	0.46	$1,610.00
2602-0010010	MOBILIZATION, EROSION CONTROL	$500.00	EACH	5.00	$2,500.00
2610-0000120	TREE REMOVAL	$1,050.00	EACH	1.00	$1,050.00
	20% CONTINGENCIES	$73,391.21	EACH	1.00	$73,391.21
				TOTAL	**$366,956**

Appendix G – Work Schedule

Section 1: Gantt Chart

TASK NAME	START DATE	END DATE	START ON DAY*	DURATION* (WORK DAYS)	PERCENT COMPLETE
Introduction					
Intial Client Contact	1/30	2/4	0	6	100%
First Client Meeting	2/5	2/7	6	3	100%
Project Proposal	2/8	2/12	9	5	100%
Scope of Services					
Initial Data Collection	2/5	2/12	6	8	100%
Preliminary Design	2/15	3/7	16	21	100%
Design Alternatives	2/15	3/7	16	21	100%
Comments From Client	2/19	3/7	20	17	100%
Design					
Overall Site Layout	2/22	3/12	23	19	100%
Site Utilities	3/3	3/15	32	13	100%
Road Design	3/8	3/17	37	10	100%
Alignment & Cross Sections	3/17	4/5	46	20	100%
Miscellaneous	3/19	4/5	48	18	100%
Proposal					
Draft Proposal/Presentation	3/5	4/9	34	36	100%
Drawing/Sheet Formatting	3/22	4/9	51	19	100%
Project Cost Estimate	3/24	4/9	53	17	100%
Final Proposal & Presentation	4/12	5/7	72	26	100%

Figure G-1.1: Work Schedule for Project as of May 7, 2021

Section IX. Design Drawings

Design drawings have been included electronically along with the submittal of this design report.