Harvest Ridge Residential Subdivision

New Sharon, IA

Keagen Head, Ben Hughes, and Baylor Verbrugge

May 9th, 2025

Table of Contents

Section I Executive Summary

The University of Iowa Civil & Environmental Engineering Project Team is honored to have the opportunity to work on this rural subdivision design in New Sharon, IA as a part of our senior design capstone project. This project has aimed to transform a greenfield site into a well-planned residential community. It integrates essential infrastructure and housing diversity to address the town's growing residential needs while complying with local zoning regulations. The Project Team includes three final-year civil engineering students: Keagen Head, Ben Hughes, and Baylor Verbrugge. Each team member brings extensive experience in transportation, water resources, and urban planning through internships and coursework.

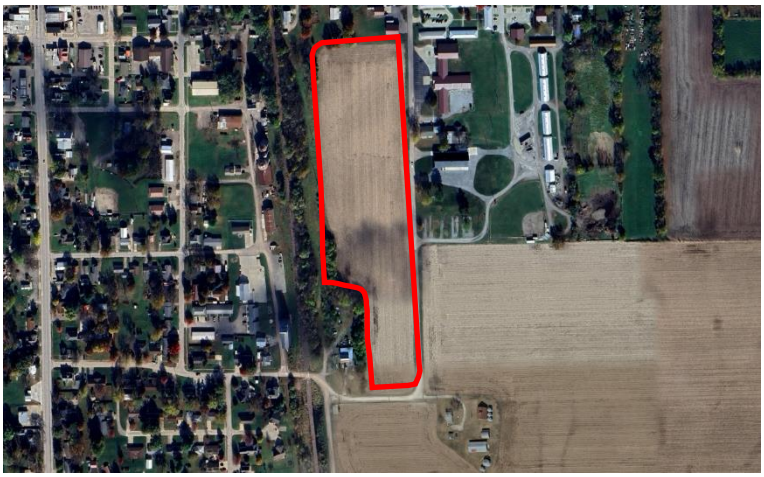

Figure 1.1 The existing site in city of New Sharon.

The project scope includes designing a mixed-housing subdivision that balances single-family and multi-family residences while ensuring efficient land use and accessibility. The design incorporates vital infrastructure elements, including sanitary and storm sewer systems, a reliable water supply network, and a well-structured roadway system. Additional features such as sidewalks, green spaces, and proper stormwater drainage will enhance sustainability and accessibility.

To optimize the subdivision layout, multiple design alternatives were evaluated. Two primary street layout configurations were considered: a cul-de-sac design and a grid layout. Housing alternatives were also examined, including a single-family housing model, a multi-family model, and a mixed-housing approach that balances density and diversity. We recommended the cul-de-sac alternative, as it's the best way to handle the long and narrow shape of the site by minimizing the street surface area and maximizing the available space for lots. This alternative

also offers freedom for the developer to be flexible with the south portion of the site. The alternative chosen can be seen in Figures 1.2 and 1.3.

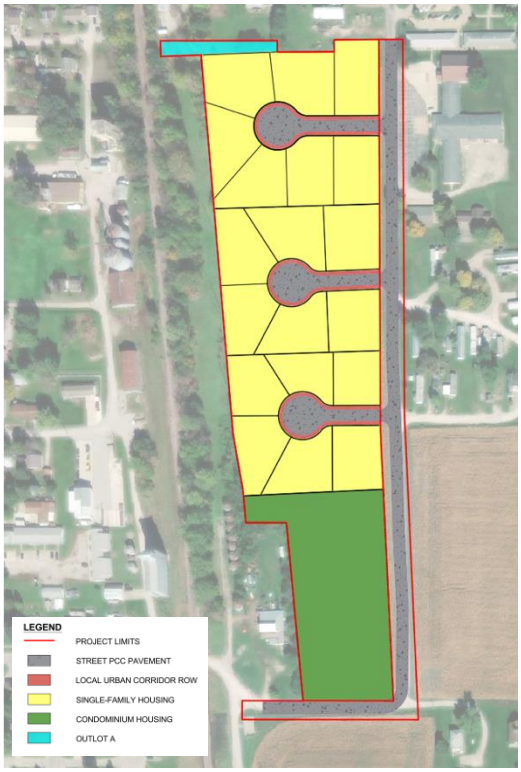

Figure 1.2 The lot design.

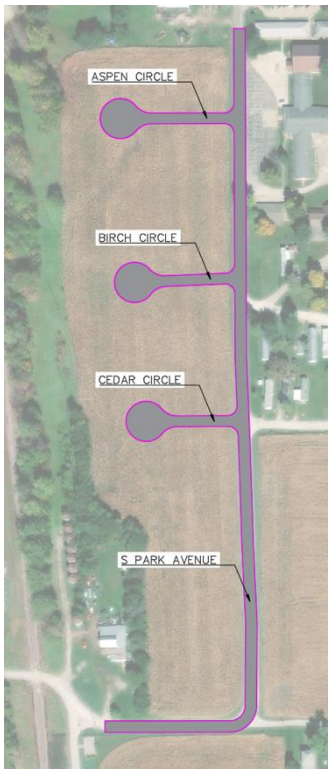

Figure 1.3 The street design.

The yellow lots located in the center of the property in Figure 1.2 are designed for single-family housing. There are 19 lots ranging from 0.35-0.55 acres in size and are designed for ranch-style building footprints. The blue lot located in the northwest corner of the property in Figure 1.2 is an outlot not intended for development with buildings or structures. Its use will be determined by the developer. The green lot located in the south portion of the property in Figure 1.2 offers flexibility to the site's design, for it can be utilized in a variety of different ways, but our design proposes it be used for condominium housing. It contains 1 lot about approximately 3 acres in size and would serve 16 units serviced by a private drive prepared for an expansion west. See Figure 1.4 for the condominium housing lot design.

Figure 1.4 The condominium lot design.

To ensure efficient execution, a phased construction plan was developed, minimizing disruption while optimizing resource allocation. It would be most ideal to reconstruct Park Avenue prior to selling lots and moving homeowners into the cul-de-sacs. In this case, the lots adjacent to S Park Avenue could be utilized for temporary access during reconstruction. If the developer prefers not to construct each development simultaneously, we recommend starting with Aspen Circle, then building Cedar Circle, and finishing with Birch Circle. This order will limit the impacts of construction site runoff. See the comparative analysis of S Park Avenue reconstruction in the phasing plan in Appendix B.

Several challenges and constraints shaped the project's execution. The site presents limitations such as adjacent residential developments and a nearby railroad, which influence design options. The shape of the track of land was also a major challenge. It's relatively narrow, making it difficult to provide proper depth in each lot. The removal of an existing tile drainage system and the acquisition of stormwater easements along the railroad will be necessary. Additionally, due to lack of survey information on the elevation of the existing sanitary sewer system to establish the slope of the pipes, HCS has not done an analysis on the capacity of the existing adjacent sanitary sewer system. We recommend that slope data on the existing sanitary sewer be obtained so that its capacity can be calculated to determine if it is sufficient to serve this site.

The societal impact of the project is significant, as it aligns with New Sharon's objective to expand housing availability and attract residents. The subdivision supports local workforce expansion, as many New Sharon residents work in neighboring towns in agriculture, manufacturing, and service industries. By increasing housing supply, the project contributes to

economic stability and community growth while enhancing local resources and infrastructure. Additionally, the project supports the town's comprehensive plan, which emphasizes sustainable land use and community development.

The total cost of the project is around $2.96 million. This cost was split into two major categories, subdivision costs ($1.39 million) and the improvements to S Park Avenue ($1.57 million). These categories leave the project with three options for lot infrastructure costs. The first option would include the subdivision costs and 100% of the S Park Ave improvements, resulting in a lot infrastructure cost of $117,000. The second option would include the subdivision costs and 50% of the S Park Ave improvements, resulting in a lot infrastructure cost of $86,000. Option three would only include the subdivision costs, resulting in a lot infrastructure cost of $55,000. If options 2 or 3 are chosen, the City of New Sharon would need to explore alternate funding options for the improvements to S Park Avenue.

In conclusion, deliverables include conceptual engineering drawings, a comprehensive design report, a poster of the design, and a project presentation summarizing key findings and recommendations. We are committed to delivering a high-quality, sustainable, and functional housing subdivision in New Sharon. By integrating thoughtful urban planning and civil engineering solutions, this project will provide a much-needed residential development that meets community needs while fostering long-term economic and environmental resilience. The project's emphasis on infrastructure efficiency, accessibility, and sustainability will ensure a lasting positive impact on the town and its residents.

Section II Organization, Qualifications, and Experience

Organization and Design Team Description

This team consisted of three individuals in their final semester of civil engineering school at the University of Iowa. Keagen Head, the project manager, specializes in water resources and transportation design but also minors in military science as part of his Army ROTC curriculum. Ben Hughes has an area of expertise in urban studies and has recently been hired by Shive Hattery in the Des Moines area as a Civil Designer on the Site Development team. Baylor Verbrugge has an area of expertise in transportation engineering and has also recently been hired by Snyder and Associates in Ankeny as a Civil Engineer.

Although we'd been assigned job titles within this project, we worked as a fluid team regularly sharing and distributing the workload whenever capable. With that being said, Keagen has served as the main point of contact maintaining a positive relationship with the client as well as being ultimately responsible for the water resources delivered in the design. Ben has supported all the technical systems required to produce the design as well as taken primary responsibility of design zoning considerations, urban planning, and project layout. Baylor has overseen the delegation of tasks, editing our final products, and the layout of the transportation systems within the site.

Section III Design Services

Project Scope

Our team has designed a housing subdivision in New Sharon, IA, transforming a greenfield site into a well-planned residential community. The subdivision includes a mix of single-family and multi-family housing while ensuring compliance with local zoning regulations and integrating essential infrastructure. The project involves subdividing the site according to zoning requirements and developing a layout that balances housing diversity with efficient land use. Infrastructure development was a key component of the project, including the design of sanitary and storm sewer systems, a reliable water supply network, and a well-structured roadway layout.

A phased construction plan was developed to minimize disruptions while optimizing resource allocation and limiting capital expenditures and risk, ensuring that construction will not out pace demand. A comprehensive cost estimate was also prepared, covering all project phases and infrastructure components. The final deliverables include engineering design drawings, a detailed design report outlining methodologies and recommendations, a project poster providing key information regarding the housing development, and a project presentation summarizing key findings. By integrating thoughtful planning and engineering solutions, this project created a functional and attractive housing subdivision that meets New Sharon's growing residential needs.

Work Plan

The project was divided into a structured, phased approach guided by incremental submittals to ensure timely, thorough planning, design, and delivery of all project work products. Below is the

chronological work plan, detailing the order of tasks, associated objectives, key deliverables, and associated point of completion.

Phase 1: Project Initiation and Data Collection

The project began with internal team meetings to develop a shared understanding of the project scope and to identify necessary background data such as aerial maps, existing infrastructure layouts, and relevant municipal studies. Prior to the initial client meeting, the team prepared a written project summary and compiled supporting references. A formal kickoff meeting with the client was conducted to review the project scope and exchange critical data, followed by documentation and distribution of meeting minutes. This phase was completed upon formal introductions and the kickoff meeting on January 27th, 2025.

Phase 2: Site Assessment and Concept Development

Next, the team coordinated a site visit with the client. A comprehensive walk-through helped assess on-the-ground conditions and constraints, which was documented with notes and photographs. This visit informed the preliminary development of multiple design concepts that would help guide further development of formal design alternatives. The team held several internal sessions along to generate these concepts, taking into account data collected and client input. This phase was completed upon determination of the key components that were to be varied across the future design alternatives.

Phase 3: Design Concept Development

Building upon site assessments and client feedback, the team analyzed site conditions and refined the conceptual alternatives. These were then illustrated through sketches or diagrams and evaluated based on constructability, utility integration, environmental and community impact, and cost-effectiveness. This process was iterative and required several weeks of drafting and internal review. This phase was completed upon the preferred design concept being selected by the client at the New Sharon City Council meeting on March 24th, 2025.

Phase 4: Final Design and Documentation

Once an alternative was selected, the team proceeded with the full project design, including engineering drawings, cross-sections, and details rendered on Civil3D software. Additionally, a

construction phasing plan, detailed design report, poster, presentation, and cost estimate were prepared. After rigorous internal review and revisions, the final deliverables were submitted to both instructors and the client on May 16th, 2025

Project Management and Coordination

Throughout all phases, consistent project management was maintained. This included administrative oversight, weekly updates to instructors, bi-weekly client communication, documentation of team member contributions and hours, and regular examination of progress and milestones.

Section IV Constraints, Challenges, and Impacts

Constraints

The design of the Harvest Ridge Housing Subdivision was shaped by several key constraints that significantly influenced the overall layout and development strategy. Among these was the fact that the project was an infill development, meaning it had to be integrated into an already established area rather than developed on a vacant, undeveloped tract of land. As an infill project, Harvest Ridge required careful consideration of the surrounding land uses, infrastructure, and community character. This constrained the design flexibility, as the new subdivision had to seamlessly connect with existing roadways, utility networks, and adjacent neighborhoods, while minimizing disruption and maintaining cohesion with the existing urban fabric.

Another major constraint was the presence of an existing infrastructure system on the site. Elements such as drainage lines, utility corridors, and existing road alignments needed to be preserved, rerouted, or upgraded in a way that aligned with the new development. This existing system limits where roads could be placed and where homes could be sited, often requiring adjustments to the ideal layout of lots and public spaces. The design team had to work around these systems to avoid costly relocations or service interruptions, which required detailed coordination and flexible planning.

The presence of an existing residential property located at the southwest corner of the site posed a unique constraint. Because this property was not part of the subdivision, it created an interruption in what might otherwise have been a unified development. The design had to accommodate this parcel, respecting privacy, and providing clear boundaries between the new subdivision and the existing property. There was also discussion of a potential purchasing of this property, which added an additional level of consideration when designing the subdivision. This condition also influenced road connectivity and lot arrangements near the southwest edge, requiring thoughtful transitions and changing how the site was designed near the southwest corner.

A final constraint is related to the academic nature of this project. As stated previously, we did not have access to survey information specific to the site and the existing utilities nearby. This paired with the short duration of this semester only allowed us to complete a conceptual design of the utilities on the site. We do believe that the proposed utility design is feasible, but we recommend that survey information be gathered before a final decision is made on the feasibility of the project.

Challenges

In addition to the constraints of the site, the Harvest Ridge Housing Subdivision also presented several key challenges that influenced the planning and engineering approach. One of the most significant was the lack of existing elevation data for underground utilities, including the water main, sanitary sewer, and storm sewer systems. Without this information, it was difficult to assess connection points, determine feasible slopes for gravity-based systems, and evaluate potential conflicts with proposed infrastructure. This gap in data required conservative design assumptions, which introduced uncertainty and limited the ability to finalize utility layouts.

Compounding these issues was the site's flat topography. While a flat site can simplify some aspects of construction, it also poses difficulties for stormwater management and gravity-fed sewer systems. Without natural slope to assist in drainage, the design had to rely on precise grading and stormwater strategies to manage runoff and ensure positive drainage away from homes and to the proper locations. The flat grade also made it more challenging to establish

efficient utility routes with adequate cover and slope, particularly in the absence of existing elevation data.

Another notable challenge was the presence of an existing road, Park Avenue, that runs adjacent to the site on the East and South sides. This existing roadway caused challenges within the cost of the project. Repaving Park Avenue would significantly increase the overall cost of the project which would, in turn, increase the future cost of the lots to be purchased. The budgeting of a project can be very significant and ensuring that there are alternate solutions for the cost of improving Park Avenue is vital to this project.

Societal Impact Within the Community

The Harvest Ridge Housing Subdivision is expected to have a meaningful and positive societal impact on the City of New Sharon. With a current population of approximately 1,200 residents, the addition of a new subdivision represents a significant step toward meeting the town's growing housing demand. The subdivision will introduce 19 new single-family lots and approximately 16 condominium units, creating opportunities for both seniors and families to find modern, accessible housing within the community.

One of the primary goals of the subdivision is to support aging-in-place by offering ranch-style homes that are more accessible for senior residents. This type of housing is in increasing demand as aging adults look for homes that minimize physical barriers and allow them to remain independent longer. At the same time, the inclusion of family-oriented homes helps attract and retain younger households, supporting a more balanced and sustainable population structure. This dual-purpose approach ensures that the subdivision will serve a broad range of residents, contributing to the long-term vitality and diversity of the community.

In a broader regional context, many citizens of New Sharon are employed in neighboring towns, making the availability of quality, affordable housing within commuting distance an essential need. By expanding the town's housing stock, the Harvest Ridge project helps New Sharon better accommodate this working population. It also positions the town as a more attractive

residential option for those who work outside the city limits but seek a quieter, small-town lifestyle. Overall, the Harvest Ridge Housing Subdivision represents a strategic investment in the future of New Sharon, addressing pressing housing needs while supporting population growth and community development in a way that aligns with the town's values.

Section V Alternative Solutions That Were Considered

When considering the design of the new housing development in New Sharon, multiple alternatives for **street configuration and housing types** were evaluated. Each option presented unique benefits and challenges, influencing connectivity, affordability, infrastructure efficiency, and overall community character. Three exhibits, as seen below, were created to be presented to the City of New Sharon with different combinations of the varying components listed below for their determination of the preferred alternative.

Street Configuration Considerations

Two primary street layout options were considered: a **cul-de-sac design** and a **grid layout**.

A **cul-de-sac configuration** offers significant benefits in terms of traffic safety, privacy, and community cohesion. These streets foster a quieter, close-knit neighborhood atmosphere while maximizing land use without excessive road infrastructure. However, this design comes with drawbacks, including poor connectivity, longer travel distances, complex construction phasing, to ensure unobstructed access and minimal disruption, and inefficient infrastructure services. Snow removal, garbage collection, and bus routes can be more challenging due to the dead-end layout.

Conversely, a **grid street layout** provides high connectivity and accessibility, making the neighborhood more walkable and ensuring efficient infrastructure by eliminating dead ends. This layout simplifies utility services and improves emergency response times. However, the trade-offs include increased through-traffic, which may lead to higher noise levels and safety concerns, as well as a lack of privacy and rigid lot configurations that limit flexibility in home placement.

Site specifically, the combination of the long, narrow site and trying to superimpose a grid street layout would result in irregular shapes and sizes of the subdivided lots resulting in a lack of depth, therefore minimal backyards.

Housing Type Considerations

To address New Sharon's demographic needs and development goals, different housing types and combinations were considered, including **single-family homes, multi-family duplexes, condominium housing, and mixed-housing developments.**

Single-family homes would primarily feature larger lots, ranging from 1/3 acre to 1/2 acre, with ranch-style homes, as requested by the community. This housing type is desirable for families, offering increased privacy, more personal space, and a strong homeownership investment potential. The community's preference for single-family homes with larger lots supports a living environment with lower population density, which is seen as an ideal setting for families. However, single-family housing developments consume more land, resulting in higher infrastructure and service costs. The larger lot sizes typically associated with single-family homes may also reduce overall housing affordability due to the lower density of units.

Duplexes, which have already proven popular in New Sharon, offer a more efficient use of land compared to single-family homes. They allow for higher density while maintaining a degree of privacy and separate living spaces for residents. Duplexes are particularly appealing to the aging population, as they require less maintenance than single-family homes, making them more suitable for seniors or individuals with limited mobility. The demand for duplexes reflects a preference for affordable housing options that provide a balance between space, cost, and ease of upkeep. However, the potential for higher population density can lead to increased traffic, infrastructure strain, and concerns about privacy between units. Additionally, duplexes may face challenges in meeting the preferences of those who prioritize larger, more private lots.

Condominiums, particularly for retirees, offer low-maintenance living, which is a key preference for aging populations. Additionally, condominiums can provide a strong sense of community for retirees and require little to no maintenance, with upkeep handled by a homeowners' association (HOA). This feature is especially attractive to older adults looking to

downsize while remaining in the area. Condominiums also provide a significant number of housing units for retired and aging residents who wish to return to the community, addressing the need for affordable and accessible housing options. However, condominiums may face challenges in terms of reduced privacy, limited outdoor space, and high density. Additionally, the reliance on an HOA for maintenance can lead to concerns about fees and governance.

A **mixed housing development** could effectively integrate the benefits of each housing type, offering a variety of options that appeal to different demographic groups. Single-family homes would provide privacy and space for families, while duplexes offer affordable, low-maintenance housing for aging citizens. Condominiums would cater to retirees, offering a sense of community and minimal upkeep. This diverse mix supports efficient land use and fosters a vibrant, integrated community. However, managing balanced density, cohesive aesthetics, and the differing maintenance responsibilities between property types could present challenges. Addressing infrastructure strain and zoning regulations will be essential to ensuring the success of this mixed development approach.

Alternative Designs

With the considerations listed above, three alternatives were created, combining several variations of both street configurations and housing types to allow the City of New Sharon to identify which aspects align with their vision and determine a preferred alternative.

Alternative 1, as seen in Figure 5.1, presented the proposed design of a cul-de-sac centric neighborhood consisting of a mix of primarily single-family homes and some condominium housing. Due to the reduced street area offered by cul-de-sacs, the single-family lots are the biggest relative to the other designs, ranging from 0.40 to 0.60 acres, providing 19 total lots. Additionally, the homes are clustered along each corridor providing similar lot size and shapes with an additional isolated 3.3-acre plot providing opportunity for a condominium complex for the retired-age community with 16 projected units (See “Potential Condominium Housing Complex Site Design”).

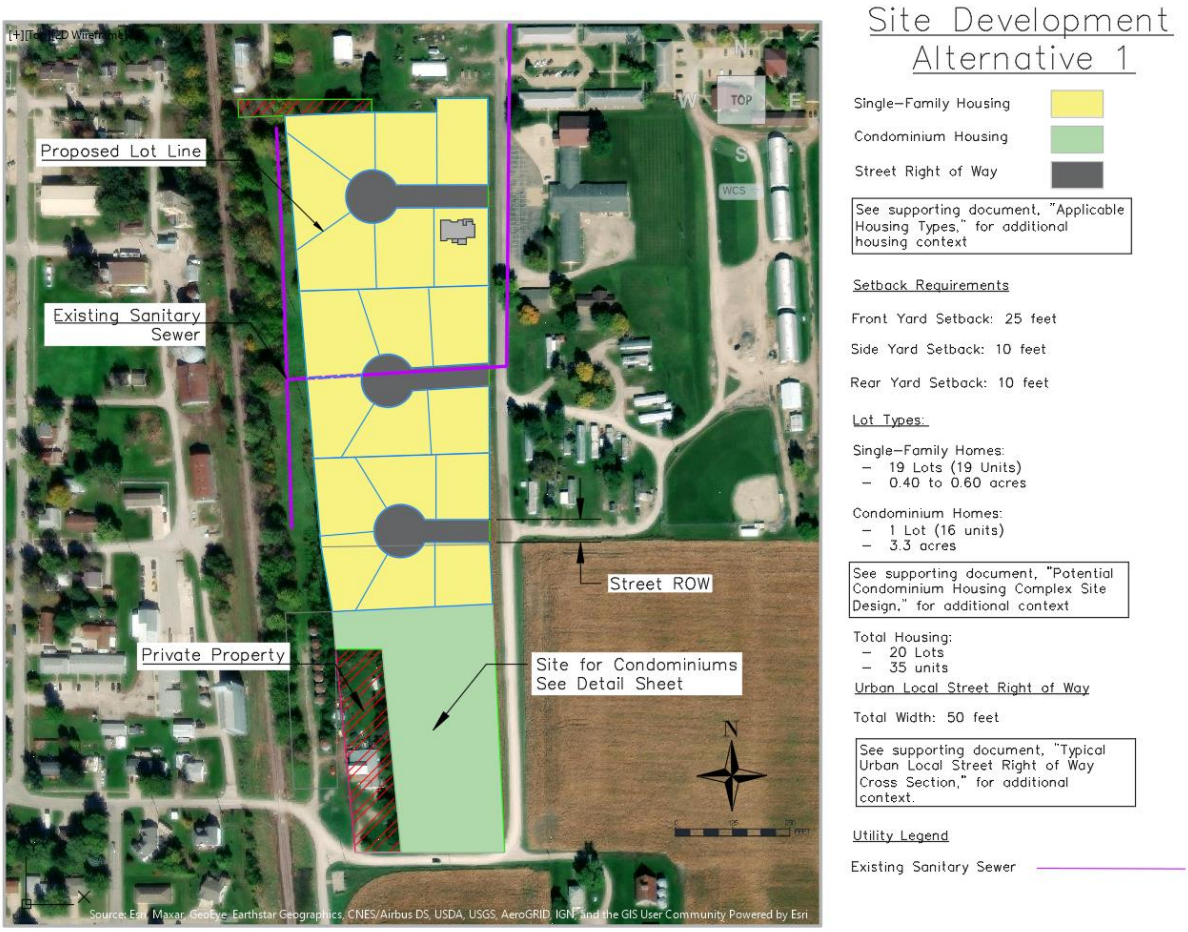

Figure 5.1. Site Development Alternative 1 Exhibit

Alternative 2, as presented in Figure 5.2, outlines a proposed grid-configured neighborhood featuring mostly single-family homes while providing some duplex lots. The design includes a main corridor running parallel to the existing S Park Ave, with the key consideration of avoiding parcels bordered by streets on both sides. Additionally, to maintain visual cohesion within the community, the housing types were clustered together. These considerations influenced the location, orientation, and size of the lots. As a result, the single-family lots are smaller compared to other designs, ranging from 0.35 to 0.43 acres, providing a total of 20 lots. The duplex section consists of 10 lots (20 units), with lot sizes ranging from 0.28 to 0.33 acres.

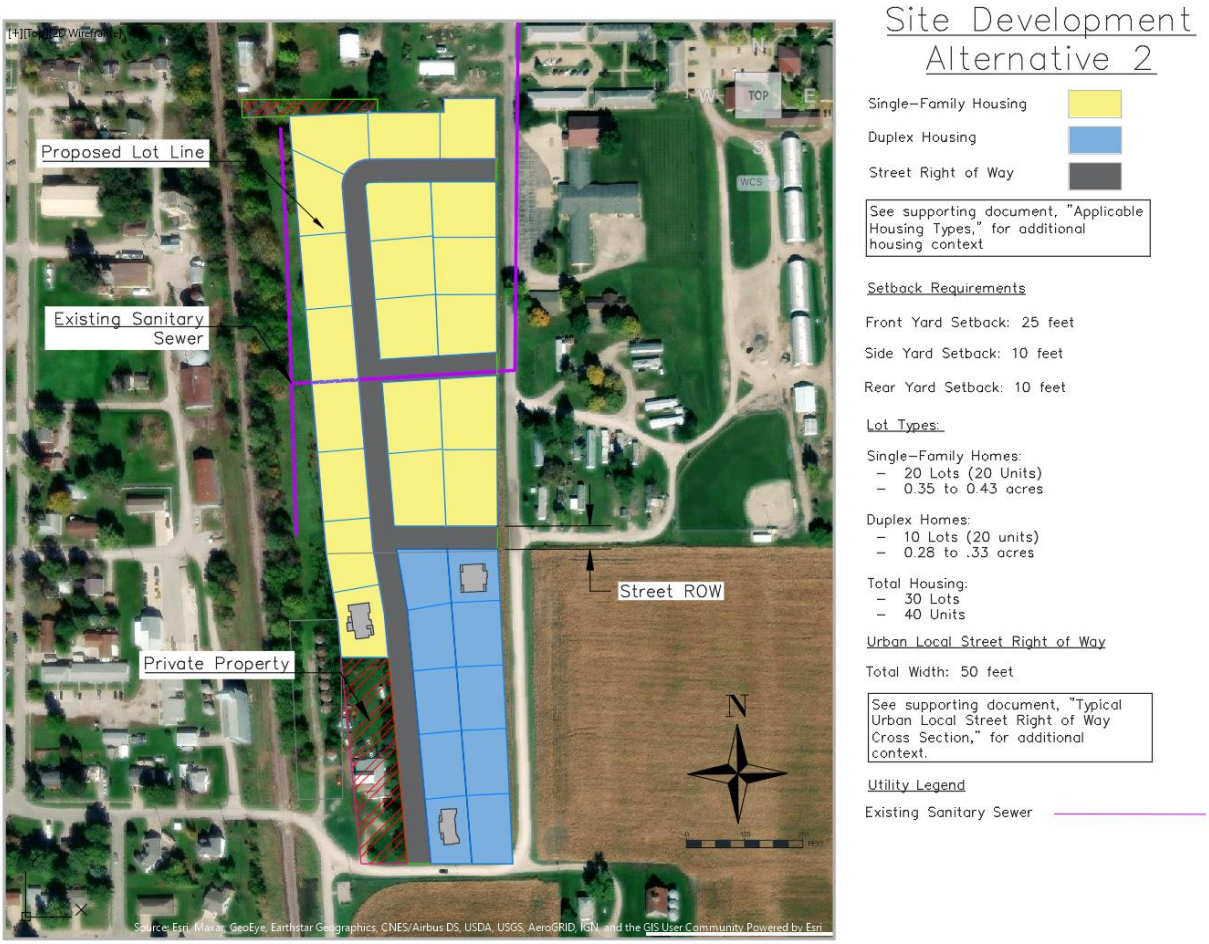

Figure 5.2. Site Development Alternative 2 Exhibit

Alternative 3, as seen in Figure 5.3, combines elements of both street configurations and housing types. The layout is primarily grid-based, with one cul-de-sac located on the north side of the site. The main corridor is again aligned parallel to S Park Ave, with attention to avoiding parcels bordered by streets on both sides and maintaining visual cohesion of housing types. With those considerations and a focus on housing variety, the site offers a mix of single-family homes, duplexes, and condominiums with a total of 32 lots and 61 units, with lot sizes ranging from 0.28 to 0.48 acres across all housing types.

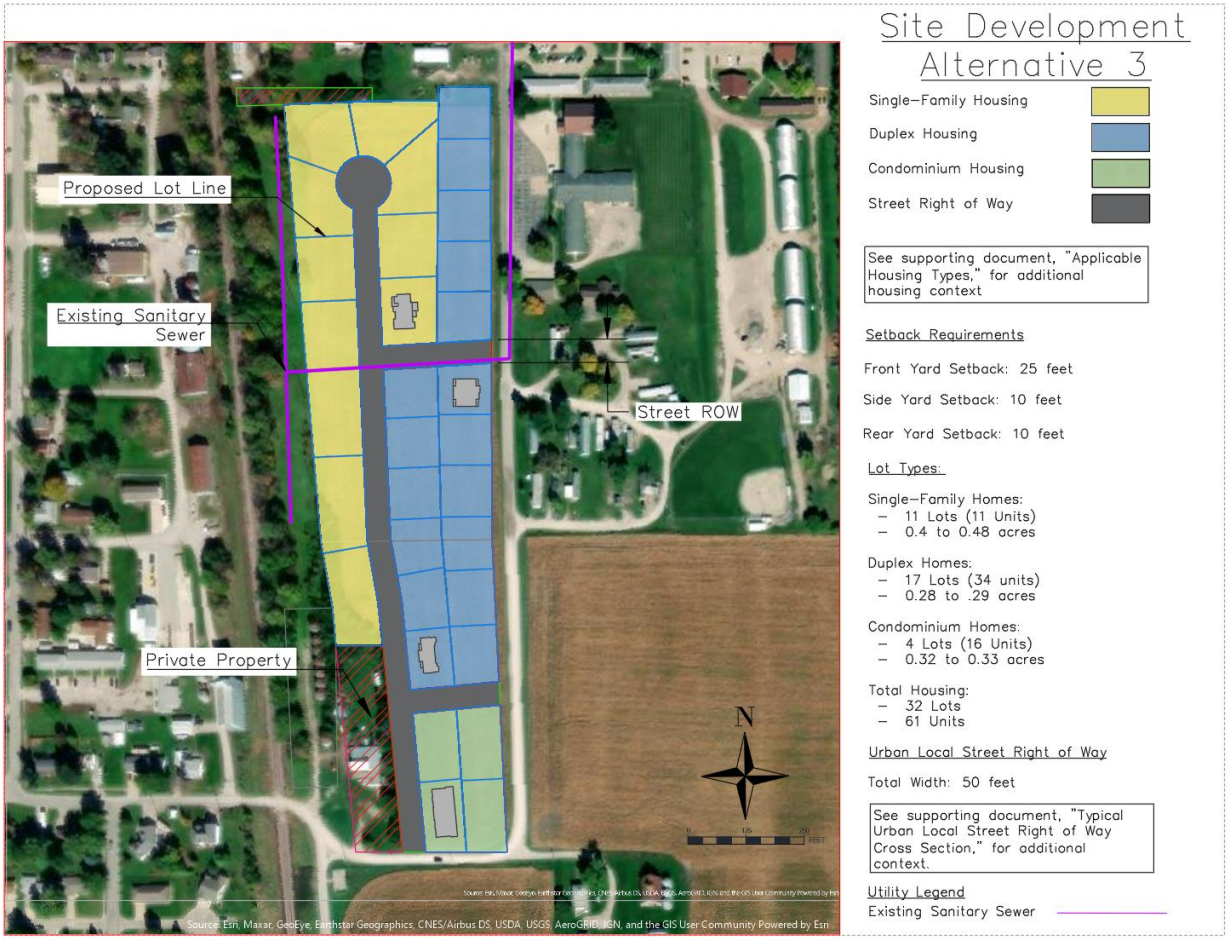

Figure 5.3. Site Development Alternative 3 Exhibit

After evaluating all of the proposed alternatives for the housing development in New Sharon, **we recommended Alternative 1**. This alternative was the best fit for the unique constraints of the long and narrow parcel of land available for development. Its cul-de-sac design maximized the use of the land by minimizing the street surface area, thereby allowing for more space dedicated to residential lots. Furthermore, this layout provided an opportunity for creativity in utilizing the southern portion of the site, which could accommodate specific needs, such as senior living condominiums. The cul-de-sac configuration fosters a close-knit community atmosphere, creating an ideal setting for families. This sense of community, combined with the efficient land use, made Alternative 1 the most suitable option for New Sharon. The City Council considered all options at a work session and concurred, ultimately selecting Alternative 1 as its preferred solution, recognizing its potential to meet the town's development goals while ensuring a vibrant and connected neighborhood.

Section VI Final Design Details

Street Design and Layout

The overall proposed street layout was a combination of a redesign of the existing road, S Park Avenue, and three new cul-de-sacs that were positioned based on the existing topography and sanitary sewer on the site. The cul-de-sac design was determined by the City of New Sharon to ensure an appropriate mix of single and multi-family lots. The street network consists of two road classifications: collector and local. S Park Avenue is the only collector street in the network and was proposed to be improved from a rural cross section to an urban cross section, while still maintaining its 60’ right-of-way. This right-of-way can be seen below in Figure 6.1. The three cul-de-sacs were determined to be local roads and given an urban 50’ right-of-way, seen below in Figure 6.2.

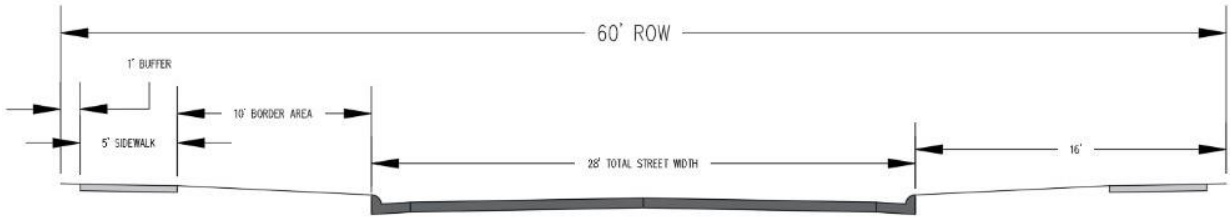

Figure 6.1. Collector street urban right-of-way.

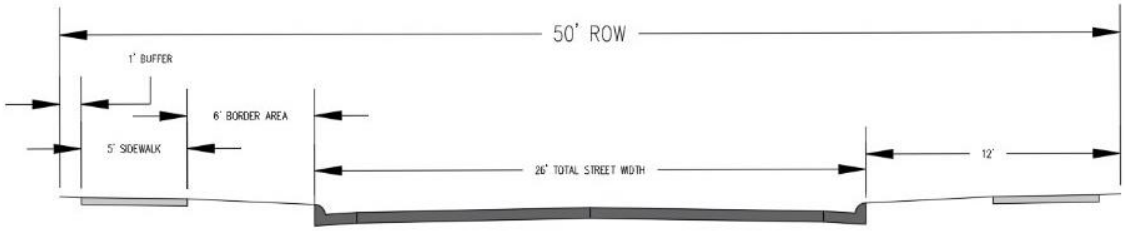

Figure 6.2. Local street urban right-of-way.

The width of each right-of-way was determined using SUDAS Chapter 5C-1 and Chapter 5C-2. The widths of the segments in each right-of-way were found in Table 5C-1.01 in SUDAS Chapter 5C-1 and can be found in Appendix C as Table B.1. We recommend that the 60’ right-of-way consists of a 28’ total street width, 10’ utility border areas, 5’ sidewalks, and 1’ right-of-

way buffers. We recommend that the 50’ right-of-way consists of a 26’ total street width, 2’ curb and gutters, 6’ utility border areas, 5’ sidewalks, and 1’ right-of-way buffers.

S Park Avenue is used to access all three cul-de-sacs. The Northern cul-de-sac was named Aspen Circle, the middle cul-de-sac was named Birch Circle, and the Southern cul-de-sac was named Cedar Circle due to the common trend within New Sharon to have tree-named streets. The overall street layout can be seen below in Figure 6.3.

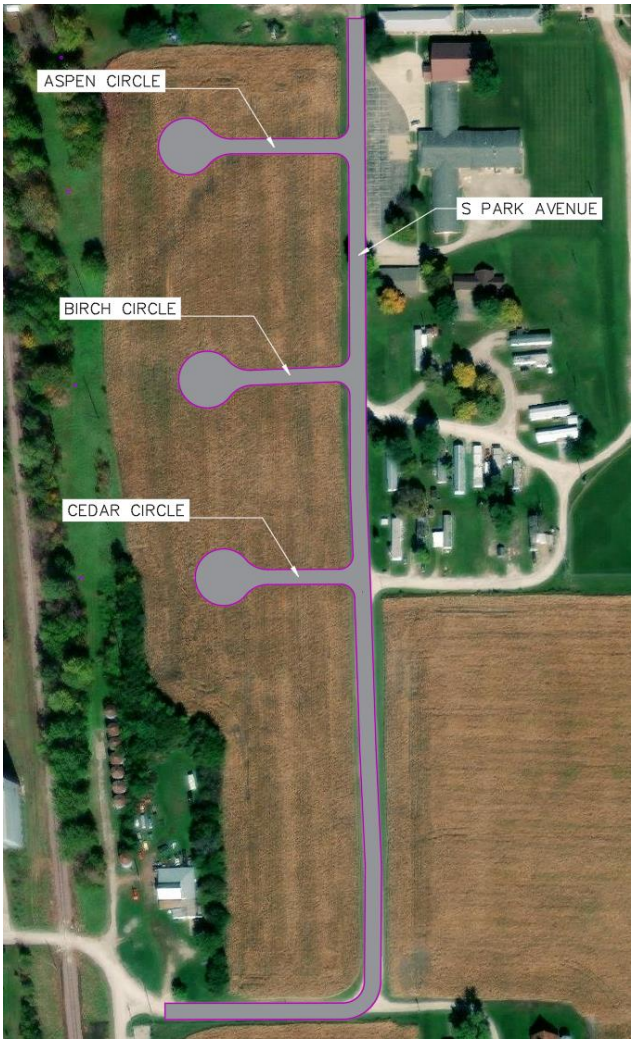

Figure 6.3. Road Layout

The cul-de-sac design was found using SUDAS Chapter 5C-2, Section P. The cul-de-sac radius was found to be 48’ to abide by the 2018 International Fire Code, and the transition radius was found to be 50’. Throughout the entire roadway network, there were around 2,700 linear feet of

roadway resulting in around 3,500 square yards of pavement. The location of the cul-de-sacs was determined based on the location of the existing sanitary sewer that was on the site. Birch Circle is directly aligned with said sanitary sewer. Cedar Circle and Aspen Circle were both aligned in locations that allowed a proposed sanitary sewer to be located below the roadway.

Land Use and Site Development

The City of New Sharon asked that the housing subdivision be designed with a mix of single-family housing and multi-family condominiums. The single-family homes were requested to be between 0.33 and 0.5 acres and suitable for the construction of ranch-style homes. As well as condominiums to be designated to the southern portion of the site, accounting for the narrowing property limits.

According to the City of New Sharon's Zoning Ordinance (Section 158.08), outlined in Appendix D, High-Density Residential developments must adhere to minimum setback requirements of 25 feet for the front yard, and 10 feet for both side and rear yards. Additionally, lots must maintain a minimum frontage of 60 feet and a minimum area of 10,890 square feet (¼ acre). Structures are also restricted to a maximum height of 45 feet.

Parcel layouts were developed to optimize key zoning constraints—setbacks, frontage, and lot area—while meeting the city's development objectives and aligning with the proposed local urban street network. This process involved the use of Civil3D software, as seen in Figure 6.5 and research into typical building footprints for ranch-style homes and condominiums.

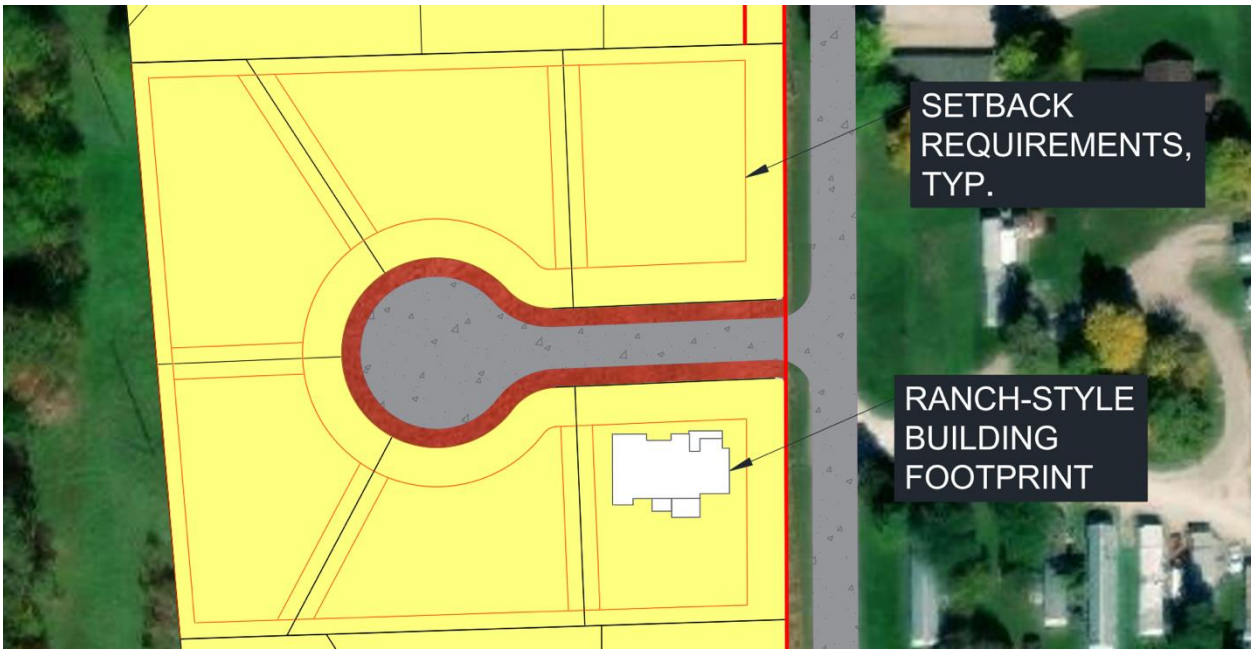

Figure 6.5. Civil3D lot layout with setback offsets and representative building footprint

Additionally, the New Sharon Comprehensive Plan Future Land Use Map, as seen in Appendix D, was used to best orient the corridors and proposed infrastructure to align both with the existing infrastructure and projected residential expansion.

Utilities

The proposed utilities on site include sanitary sewer system, storm sewer system, and watermain system. HCS solutions has collaborated with the city of New Sharon as well as Mahaska County Water to obtain information on existing conditions as well as applicable design standards in New Sharon and Mahaska County. However, we did not have access to survey information specific to the site or existing utilities. This coupled with the short duration of the semester only allowed us to complete a conceptual design of the sanitary, storm, and watermain systems. The primary design standards used throughout the design process were Iowa SUDAS and Iowa DOT standards. See Figure 6.6 for existing utility systems and see Figure 6.7 for proposed utility systems.

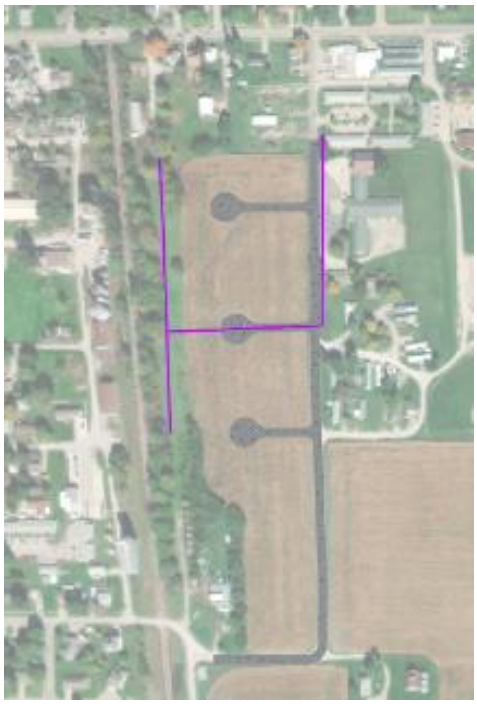

Figure 6.6. The existing utilities of site.

Figure 6.7. The proposed utilities of site.

The proposed sanitary sewer consists of 8” sanitary sewer pipe, which matches the surrounding sanitary sewer system and provides sufficient capacity to serve Harvest Ridge. Each lot on the site has a 4” sanitary sewer service stub feeding the property, and the system has several SW-301 48” sanitary sewer manholes. According to Iowa SUDAS, 8” sanitary sewer has a minimum fall of 0.40%, and a minimum cover (from the top of pipe to ground elevation) of 4 feet, and this sanitary sewer system shall exceed those minimums. Due to lack of existing survey data, elevations of the existing sanitary sewer system are unknown, therefore the profile sheets are not included in the construction drawings. The sanitary sewer system is designed so that it can serve the development of surrounding properties that naturally drain to this sewer.

The proposed storm sewer system consists of 15” storm sewer pipe. S Park Ave, Aspin Circle, Birch Circle, and Cedar Circle have the proper number of storm sewer SW-501 intakes, which are strategically placed at low points and within the required spacing according to Iowa SUDAS and the Iowa DOT guidelines. The storm sewer system also has several storm sewer SW-401 48” manholes placed appropriately throughout the system. In addition to the curb and gutter storm sewer system, the grading of the site includes serval overland flow routes for increased capacity in extreme precipitation events.

The proposed watermain system consists of 6” watermain pipe, which matches the surrounding watermain system. Due to lack of existing survey data, the existing watermain system elevation adjacent to the site is unknown, therefore the watermain should have 5.5’ of cover and tie into the existing system at its elevation. The proposed watermain system ties into the existing watermain system in two locations. One location is approximately 5’ south of Cedar Circle across S Park Avenue on its east side, and another location is at the intersection of East Market Street and S Park Avenue, approximately 350’ north of Harvest Ridge. Several 6” watermain valves are strategically placed throughout the system in accordance with Iowa SUDAS and in locations that provide redundance to the system to minimize potential impacts on property owners in the event of a water main break. Several fire hydrant assemblies are placed in accordance with Iowa SUDAS, less than 500’ apart, and at low and high points along S Park Ave to allow maintenance crews to leverage the water pressure and release air in emergencies.

The standard according to Iowa SUDAS for horizontal spacing between sanitary sewer and watermain as well as between storm sewer and watermain are both 10’. The standard according to Iowa SUDAS for vertical spacing between sanitary sewer and watermain as well as between storm sewer and watermain are both 18”. A horizontal spacing of 10’ is maintained between all utility systems discussed in this section at all times except for utility crossings, in which case, the vertical spacing requirement of 18” is met.

Section VII Engineer’s Cost Estimate

The cost of the Harvest Ridge Subdivision was split into two categories: subdivision costs and Park Avenue improvement costs. Within those categories, the cost was found by combining the construction costs, 7% engineering costs, and a 15% contingency. The cost of the subdivision was estimated to be around $1.39 million, and the cost of the improvements to Park Avenue was estimated to be around $1.57 million. The full breakdown of the cost analysis can be found in Appendix A. It is important to note that these cost estimates do not include the cost of the land or necessary off-site easements.

The total cost of the project, combining Park Avenue and subdivision costs, was found to be around $2.96 million. If this cost were to be split evenly between the proposed lots on the site,

the average infrastructure costs for each lot would be relatively high. Because of this, we have created three pricing options. Option 1 consists of including 100% of the Park Avenue costs and 100% of the subdivision costs in the lot pricing, resulting in an average infrastructure cost per lot to be around $117,000. Option 2 consists of including 50% of the Park Avenue costs and 100% of the subdivision costs in the lot pricing, resulting in an average infrastructure cost per lot to be around $86,000. Option 3 consists of including only the subdivision costs in the lot pricing, resulting in an average infrastructure cost per lot to be around $55,000. We recommend that the City of New Sharon exercises the 3rd option and would, in turn, need to explore other funding options for the improvements to Park Avenue.

Section VIII Appendices

Appendix A – Cost Analysis

Bid Item Code	Item	Unit	Unit Cost	Quantity	Cost
2101-0850001	Clearing and Grubbing	acre	$6,480.24	0.0	$0.00
2102-2710070	Excavation, Class 10, Roadway and Borrow	cy	$5.18	10553.8	$54,668.89
2102-0425046	Selected Backfill	cy	$6.28	27.5	$172.89
2113-0001000	Subgrade Stabilization Material	sy	$4.80	6222.2	$29,866.67
2111-8174100	Granular Subbase	sy	$9.54	6222.2	$59,360.00
2301-1033070	7" PCC Pavement	sy	$63.66	5333.3	$339,520.00
2512-1725206	Curb and Gutter	lf	$55.48	2000.0	$110,960.00
2105-8425015	Topsoil Strip, Salvage, and Spread	cy	$4.15	4444.4	$18,444.44
2601-2636041	Seeding & Fertilizing	acre	$1,766.13	1.5	$2,594.87
2554-0112004	4" Watermain Pipe (DIP)	lf	$105.00	1542.0	$161,910.00
2554-0207004	4" Watermain Valve	ea	$3,300.00	3.0	$9,900.00
2504-0110008	8" Sanitary Sewer Pipe	lf	$128.41	1083.0	$139,068.03
2435-0250100	Storm Intake SW-501	ea	$4,465.64	21.0	$93,778.44
2504-0200404	Sanitary Sewer Service Stub 4"	lf	$72.78	0.0	$0.00
2554-0210201	Fire Hydrant Assembly	ea	$8,541.28	4.0	$34,165.12
2435-0140148	Storm Manhole SW-401 48"	ea	$4,721.66	4.0	$18,886.64
2507-6800011	Class A Revetment	sy	$35.00	4.5	$157.50
2503-0110015	15" Storm Sewer Pipe	lf	$78.39	1924.0	$150,822.36
2435-0130148	Sanitary Manhole SW-301 48"	ea	$7,752.09	5.0	$38,760.45
2109-8225100	Special Compaction of Subgrade	STA	$484.23	20.0	$9,684.60
				Total	$1,272,720.90

Figure A.1. S Park Ave Construction Cost Analysis

Bid Item Code	Item	Unit	Unit Cost	Quantity	Cost
2101-0850001	Clearing and Grubbing	acre	$6,480.24	0.2	$1,101.64
2102-2710070	Excavation, Class 10, Roadway and Borrow	cy	$5.18	1501.9	$7,780.00
2102-0425046	Selected Backfill	cy	$6.28	2.9	$17.90
2113-0001000	Subgrade Stabilization Material	sy	$4.80	4222.2	$20,266.67
2111-8174100	Granular Subbase	sy	$9.54	4222.2	$40,280.00
2301-1033070	7" PCC Pavement	sy	$63.66	4000.0	$254,640.00
2512-1725206	Curb and Gutter	lf	$55.48	500.0	$27,740.00
2105-8425015	Topsoil Strip, Salvage, and Spread	cy	$4.15	26072.1	$108,199.41
2601-2636041	Seeding & Fertilizing	acre	$1,766.13	12.4	$21,900.01
2554-0112004	4" Watermain Pipe (DIP)	lf	$105.00	1457.0	$152,985.00
2554-0207004	4" Watermain Valve	ea	$3,300.00	3.0	$9,900.00
2504-0110008	8" Sanitary Sewer Pipe	lf	$128.41	981.0	$125,970.21
2435-0250100	Storm Intake SW-501	ea	$4,465.64	19.0	$84,847.16
2504-0200404	Sanitary Sewer Service Stub 4"	lf	$72.78	1085.0	$78,966.30
2554-0210201	Fire Hydrant Assembly	ea	$8,541.28	3.0	$25,623.84
2435-0140148	Storm Manhole SW-401 48"	ea	$4,721.66	0.0	$0.00
2507-6800011	Class A Revetment	sy	$35.00	13.5	$472.50
2503-0110015	15" Storm Sewer Pipe	lf	$78.39	2031.0	$159,210.09
2435-0130148	Sanitary Manhole SW-301 48"	ea	$7,752.09	1.0	$7,752.09
2109-8225100	Special Compaction of Subgrade	STA	$484.23	5.0	$2,421.15
				Total	$1,130,073.97

Figure A.2. Subdivision Construction Cost Analysis

Bid Item Code	Item	Unit	Unit Cost	Quantity	Cost
2101-0850001	Clearing and Grubbing	acre	$6,480.24	0.2	$1,101.64
2102-2710070	Excavation, Class 10, Roadway and Borrow	cy	$5.18	12055.8	$62,448.89
2102-0425046	Selected Backfill	cy	$6.28	30.4	$190.79
2113-0001000	Subgrade Stabilization Material	sy	$4.80	10444.4	$50,133.33
2111-8174100	Granular Subbase	sy	$9.54	10444.4	$99,640.00
2301-1033070	7" PCC Pavement	sy	$63.66	9333.3	$594,160.00
2512-1725206	Curb and Gutter	lf	$55.48	2500.0	$138,700.00
2105-8425015	Topsoil Strip, Salvage, and Spread	cy	$4.15	30516.6	$126,643.86
2601-2636041	Seeding & Fertilizing	acre	$1,766.13	13.9	$24,494.88
2554-0112004	4" Watermain Pipe (DIP)	lf	$105.00	2999.0	$314,895.00
2554-0207004	4" Watermain Valve	ea	$3,300.00	6.0	$19,800.00
2504-0110008	8" Sanitary Sewer Pipe	lf	$128.41	2064.0	$265,038.24
2435-0250100	Storm Intake SW-501	ea	$4,465.64	40.0	$178,625.60
2504-0200404	Sanitary Sewer Service Stub 4"	lf	$72.78	1085.0	$78,966.30
2554-0210201	Fire Hydrant Assembly	ea	$8,541.28	7.0	$59,788.96
2435-0140148	Storm Manhole SW-401 48"	ea	$4,721.66	4.0	$18,886.64
2507-6800011	Class A Revetment	sy	$35.00	18.0	$630.00
2503-0110015	15" Storm Sewer Pipe	lf	$78.39	3955.0	$310,032.45
2435-0130148	Sanitary Manhole SW-301 48"	ea	$7,752.09	6.0	$46,512.54
2109-8225100	Special Compaction of Subgrade	STA	$484.23	27.5	$13,316.33
				Total	$2,404,005.44

Figure A.3. Total Construction Cost Analysis

Subdivision Cost	$ Amount
Construction Cost	$1,130,073.97
7% Engineering Cost	$79,105.18
15% Contingency	$181,376.87
Total	$1,390,556.02

Figure A.4. Subdivision Total Cost Analysis

Park Ave Improvements	$ Amount
Construction Cost	$1,272,720.90
7% Engineering Cost	$89,090.46
15% Contingency	$204,271.70
Total	$1,566,083.06

Figure A.5. S Park Ave Total Cost Analysis

*Note: These cost estimates do not include the cost of the land or necessary off-site easements.

Appendix B – Phasing Plan

Table B.1 Proposed Phases

Phase	Task(s)	Description
Phase 1: S Park Ave	- Full-depth removal of chip seal on S Park Ave (E Market St to site boundary) - Install 8” sanitary sewer, water main, and storm sewer trunk lines - Apply stabilized aggregate surface for temporary access during development	All underground utilities connecting to E Market St must be installed before any site development. Since this work requires full-depth excavation of S Park Ave, the chip seal must be removed first. Installing utilities in this phase prevents future pavement damage and supports an efficient buildout.
Phase 2: Northern Cul-de-sac and Infrastructure	- Clearing, grading, erosion control - Surveying and staking - Street, curb, and gutter construction - Lot grading and prep	Ideal starting point due to proximity to existing utilities and minimal disturbance to neighboring areas. Topography ensures drainage away from new development, minimizing impact on adjacent properties.
Phase 3: Southern Cul-de-sac and Infrastructure	- Clearing, grading, erosion control - Surveying and staking - Street, curb, and gutter construction - Lot grading and prep	Follows Phase 1 to maintain construction flow and limit disruption. Runoff naturally flows northwest, protecting previously developed lots.
Phase 4: Middle Cul-de-sac and Infrastructure	- Clearing, grading, erosion control - Surveying and staking - Street, curb, and gutter construction - Lot grading and prep	Scheduled after northern and southern areas to preserve construction access and avoid disruptions. Sanitary sewer capacity and internal utility routing simplify construction.
Phase 5: Condominium Community (South-most portion)	- Clearing, grading, erosion control - Surveying and staking - Street, curb, and gutter construction - Lot grading and prep	Final phase due to major disruption required along S Park Ave. Allows more time for design and possible expansion westward, supporting a more cohesive site layout and improved construction efficiency.

Table B.2 S Park Ave Reconstruction - Comparative Analysis

Category	**Option 1:** Restore Chip Seal Surface	**Option 2:** Upgrade to Urban Cross Section (Curb & Gutter)
Description	Reconstruct S Park Ave using the same chip seal surface currently in place.	Reconstruct S Park Ave with curb and gutter, stormwater intakes, and optional sidewalks.
Pros	- Lowest upfront cost - Matches existing rural context - Quick and simple to install	- Improved stormwater management - Increased durability and lifespan - Pedestrian-friendly design
Cons	- Shorter lifespan - Higher long-term maintenance - Poor drainage and no pedestrian features	- Higher initial cost - May require ROW acquisition - Longer construction timeline
Drainage	Limited — runoff drains onto adjacent ditches or surfaces	Controlled via curb, gutter, and inlets — designed for urban stormwater management
Traffic Suitability	Best for low-volume, low-speed residential streets	Supports higher traffic volumes and long-term growth
Maintenance	Requires periodic resealing and grading	Low maintenance if properly installed — designed for long-term use
Walkability	Not walkable — lacks curbs or sidewalks	Supports sidewalks, pedestrian crossings, and ADA accessibility
Long-Term Viability	Lower — may require rework if neighborhood grows	High — consistent with subdivision-style growth and infrastructure standards

Appendix C – Transportation Standards

Table C.1. SUDAS Preferred Roadway Elements

Design Element	Local		Collector		Arterial	
	R	*C/I*	*R*	*C/I*	*R*	*C/I*
General						
Design level of service[1]	D	D	C/D	C/D	C/D	C/D
Lane width (single lane) (ft)[2]	10.5	12	12	12	12	12
Two-way left-turn lanes (TWLTL) (ft)	N/A	N/A	14	14	14	14
Width of new bridges (ft)[3]	See Footnote 3					
Width of bridges to remain in place (ft)[4]	----------	----------	----------	----------	----------	----------
Vertical clearance (ft)[5]	14.5	14.5	14.5	14.5	16.5	16.5
Object setback (ft)[6]	3	3	3	3	3	3
Clear zone (ft)	Refer to Table 5C-1.03, Table 5C-1.04, and 5C-1, C, 1					
Urban						
Curb offset (ft)[7]	2	2	2	3	3	3
Parking lane width (ft)	8	8	8	10	N/A	N/A
Roadway width with parking on one side[8]	26/27/31[9]	34	34	37	N/A	N/A
Roadway width without parking[10]	26	31	31	31	31	31
Raised median with left-turn lane (ft)[11]	N/A	N/A	19.5	20.5	20.5	20.5
Cul-de-sac radius (ft)	45/48[12]	45/48[12]	N/A	N/A	N/A	N/A
Rural Sections in Urban Areas						
Shoulder width (ft)						
ADT: under 400	4	4	6	6	10	10
ADT: 400 to 1,500	6	6	6	6	10	10
ADT: 1,500 to 2000	8	8	8	8	10	10
ADT: above 2,000	8	8	8	8	10	10
Foreslope (H:V)	4:1	4:1	4:1	4:1	6:1	6:1
Backslope (H:V)	4:1	4:1	4:1	4:1	4:1	4:1

R = Residential, C/I = Commercial/Industrial

Elements Related to Design Speed

Design Element	Design Speed, mph[13]							
	25	*30*	*35*	*40*	*45*	*50*	*55*	*60*
Stopping sight distance (ft)	155	200	250	305	360	425	495	570
Passing sight distance (ft)	900	1090	1,280	1,470	1,625	1,835	1,985	2,135
Min. horizontal curve radius (ft)[14]	198	333	510	762	1,039	926	1,190	1,500
Min. vertical curve length (ft)	50	75	105	120	135	150	165	180
Min. rate of vertical curvature, Crest (K)[15]	18	30	47	71	98	136	185	245
Min. rate of vertical curvature, Sag (K)	26	37	49	64	79	96	115	136
Minimum gradient (percent)	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Maximum gradient (percent)	5	5	5	5	5	5	5	5

Appendix D – Land Use Regulations

158.08 **HIGH DENSITY RESIDENTIAL.** The R-2 district is a high-density residential district. The principal use of land is for multi-family designed housing opportunities, consisting of individually owned horizontally attached single family dwellings, single family cluster detached dwellings, and multi-family attached dwellings. The R-2 district is appropriately located near primary and secondary collectors or arterials.

(1) *Principal uses permitted.* Property and buildings in an R-2 district shall be used only for the following purposes:

(a) Single-family dwellings;

(b) Two, Three, and Four family dwelling units attached horizontally;

(c) One family detached dwellings in a cluster development of two or more;

(d) Five or more unit apartments;

(e) Public Parks, open spaces and recreational facilities;

(f) In-home day care;

(g) Group care facilities, family care facilities with over ten residents;

(h) Accessory uses which are customarily incidental to any of the above stated uses, but not involving the conduct of business. Accessory uses shall include private garages and carports, private swimming pools and private greenhouses not operated for commercial purposes.

(2) *Use exceptions.* The following use exceptions are deemed appropriate on review by the board of adjustment in accordance with the provisions contained in this title:

(a) Hospitals, sanitariums, nursing homes and convalescent homes on sites of one acre or more, with the same off-street parking and yards as those required for other institutional uses under this title;

(b) Public utilities;

(c) Swimming pools, golf courses and country clubs, except miniature courses or driving ranges operated for a profit;

(d) The taking of boarders or the leasing of rooms by a resident family, providing total number does not exceed two per building;

(e) Home occupations;

(f) A bed and breakfast inn, provided off-street parking is available for a total of five spaces.

(3) *Bulk regulations.*

(a) Building Requirements

(1) Maximum height is 45 ft or 3 stories

(2) Minimum Lot area is 10,890 square feet

(3) Minimum Frontage is 60 feet

(b) Yard Requirements

(1) Minimum Front Yard Setback is 25 feet

(2) Minimum Rear Yard Setback is 10 feet

(3) Minimum Side Yard Setback is 10 feet

Figure D.1. New Sharon Zoning Ordinance: Section 158.08 High-Density Residential

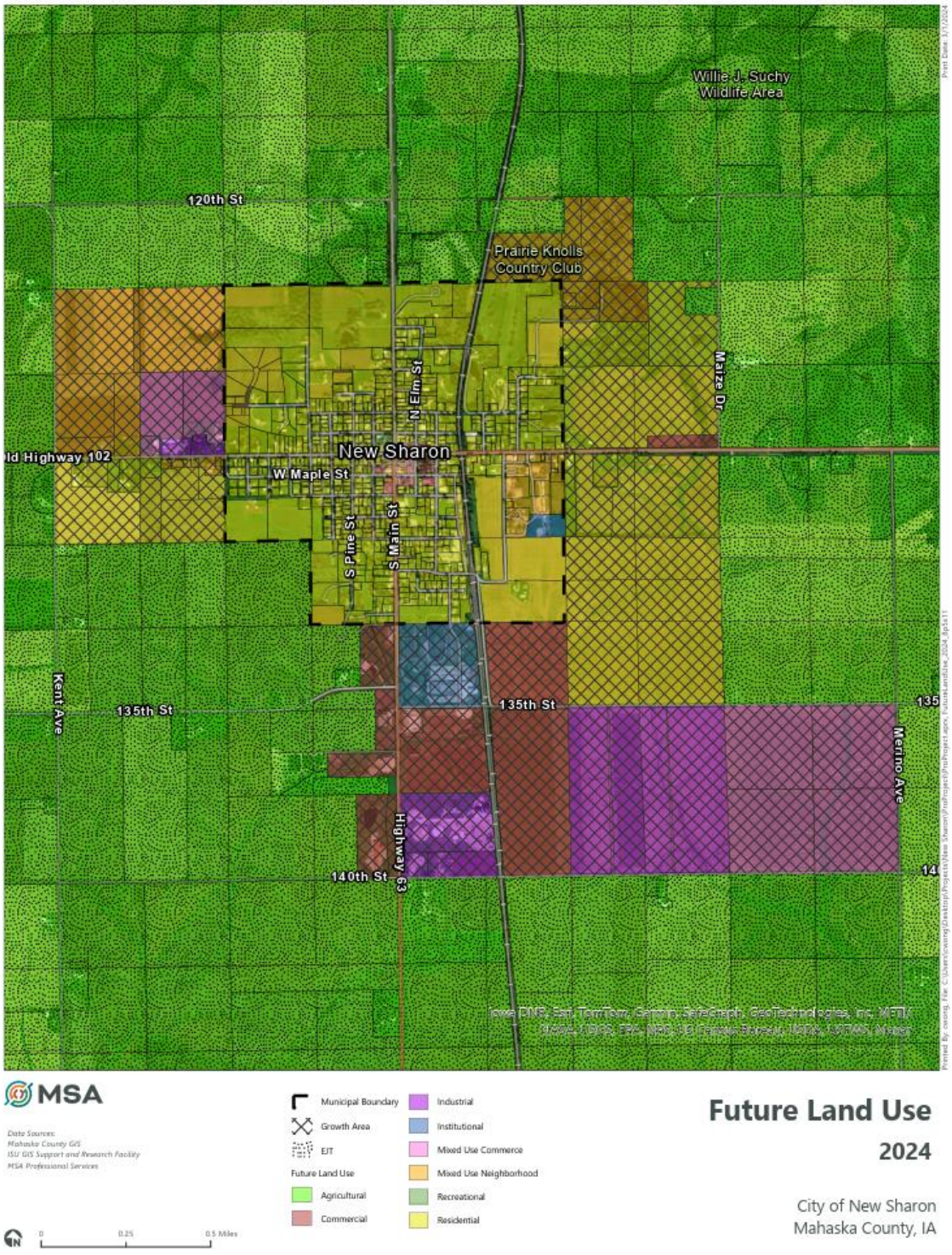

Figure D.2. New Sharon Comprehensive Plan: Future Land Use Map