AGENDA
CITY OF CEDAR FALLS, IOWA
PLANNING AND ZONING COMMISSION MEETING
WEDNESDAY, SEPTEMBER 25, 2019
5:30 PM AT CITY HALL

Call to Order and Roll Call

Approval of Minutes

1. Planning and Zoning Commission Minutes of September 11, 2019.

Public Comments

Old Business

2. Panther West Preliminary Plat (DEFERRED)
Location: 40 acre property north of Aldrich Elementary School
Applicant: Panther Farms, LLC
Previous discussion: August 28, 2019
Recommendation: *Applicant requests deferral to the next meeting*
P&Z Action: *None*

3. Creekside Technology Center Master Plan
Location: North of Highway 20 and Hudson Road Interchange
Previous Discussion: Presentation on September 11, 2019
Recommendation: *Recommend approval*
P&Z Action: *Review and make a recommendation to City Council*

New Business

4. Central Business District Façade Review - 202 Main Street
Location: The Horny Toad, 202 Main Street
Applicant: Ivan Weiland
Previous discussion: None
Recommendation: *Recommend approval*
P&Z Action: *Review and make a recommendation to City Council*

5. Central Business District Façade Review – 100 E. 2nd Street, Suite 105
Location: Andy's Bike Shop, 100 E. 2nd Street, Suite 105
Applicant: Eagle View Partners
Previous discussion: None
Recommendation: *Recommend approval*
P&Z Action: *Review and make a recommendation to City Council*

6. Central Business District Façade and Site Plan Review - 203/205 Main Street
Location: 203/205 Main Street
Applicant: Brad Leeper
Previous discussion: None
Recommendation: *Recommend approval*
P&Z Action: *Review and make a recommendation to City Council*

Commission Updates

7. ***Imagine Downtown!* Vision Plan – Public Review Draft**
Presentation and Open House tonight at 6:30 PM (following the regular meeting)

Adjournment

Reminders:

* October 9th and 23rd Planning & Zoning Commission Meetings
* October 7th and 17th City Council Meetings

Cedar Falls Planning and Zoning Commission
Regular Meeting
September 11, 2019
City Hall Council Chambers
220 Clay Street, Cedar Falls, Iowa

MINUTES

The Cedar Falls Planning and Zoning Commission met in regular session on Wednesday, September 11, 2019 at 5:30 p.m. in the City Hall Council Chambers, 220 Clay Street, Cedar Falls, Iowa. The following Commission members were present: Hartley, Holst, Larson, Leeper, Prideaux, Saul and Wingert. Adkins was absent. Karen Howard, Community Services Manager, Shane Graham, Economic Development Coordinator, and David Sturch, Planner III, were also present.

1.) Chair Holst noted the Minutes from the August 28, 2019 regular meeting are presented. Ms. Prideaux made a motion to approve the Minutes as presented. Mr. Hartley seconded the motion. The motion was approved unanimously with 7 ayes (Hartley, Holst, Larson, Leeper, Prideaux, Saul and Wingert), and 0 nays.

2.) The first item of business was the Panther West Preliminary Plat. This item was deferred.

3.) The next item for consideration by the Commission was the preliminary and final plats for The Pointe at Henry Farms. Chair Holst introduced the item and Mr. Graham provided background information. He explained that it is a 50 acre development at the southwest corner of West Ridgeway Avenue and Highway 58. The property was rezoned from A-1, Agriculture to HWY-1 in 2018 and a new Fleet Farm store and convenience store were approved. The current plat will split the lots for current and future projects. He displayed a rendering of the preliminary plat showing existing and proposed contours, utilities, easements, lot lines, zoning and right-of-way previously dedicated to the City for West Ridgeway Avenue Reconstruction. He also discussed the final plat and explained the cross-access easements. Mr. Graham displayed the lots and tracts that are included and discussed their intended uses. He discussed the conditions that were in place with regard to the Zoning Agreement and the updates that have taken place and noted that all conditions have been satisfied. Staff recommends approval of the plats subject to conformance with all City staff recommendations and comments from the Planning and Zoning Commission.

Mr. Holst stated that he feels it is in order and consistent with the rezoning.

Mr. Leeper made a motion to approve the item. Mr. Hartley seconded the motion. The motion was approved unanimously with 7 ayes (Hartley, Holst, Larson, Leeper, Prideaux, Saul and Wingert), and 0 nays.

4.) The Commission then considered a College Hill Neighborhood Commercial District Façade Review for 2211 College Street. Chair Holst introduced the item and Mr. Sturch provided background information. He explained that this item is for improvements for the building at the above mentioned address, including removal of

the shingled portion of the roof structure and repurpose the awning structure to implement into the new façade plan. Everything behind the shingled portion will be rebuilt and covered with new materials. The idea is to develop a new façade maintaining the window and door openings and re-cover it with multi-color granite tile material and the letters from the sign will be over the tile. The steel frame currently holding the roof will be refurbished and will project from the building to provide cover and shade relief. The top of the façade will be extended to match the existing wall extension. New cornice will installed with LED lights that will downcast over the sign. Staff recommends approval of the project with conformance to any staff recommendations and Commission comments. Mr. Sturch also noted that correspondence was received from the College Hill Partnership.

The owner, Shahid Chatha, stated that they are just trying to clean up the look of the front of the building to make it look nicer.

Kathryn Sogard, 330 Columbia Circle, Waterloo, (Executive Director of the College Hill Partnership) stated that the Partnership did get clarification about the coloring as requested. She also noted that there are concerns with parking, but they do understand that this request only addresses the façade.

Mr. Leeper noted that he didn't see any red flags with the project. Mr. Hartley stated that he would like to see a better representation, but he does feel that it is an improvement.

Ms. Saul made a motion to approve the item. Mr. Leeper seconded the motion. The motion was approved unanimously with 7 ayes (Hartley, Holst, Larson, Leeper, Prideaux, Saul and Wingert), and 0 nays.

5.) The next item of business was a PO-1 District site plan amendment for All Smiles Family Dentistry signage. Chair Holst introduced the item and Mr. Sturch provided background information. He explained that the signage amendment includes a proposed 8' tall, 40 square foot area sign, which conforms to the PO-1 district sign standards. The sign will be in alignment with the parking lot. Staff recommends approval with conformance to staff recommendations and Commission comments.

Ms. Prideaux stated that she feels it is a nice looking sign. Mr. Leeper asked if this is something that really needs to come through the Commission or could it be changed in the Ordinance to streamline things. Ms. Howard stated it is one item currently being considered.

Mr. Wingert asked about getting a left turn lane on Hudson Road into the development. Mr. Sturch stated that a traffic study would need to be done to determine right-of-way. Currently a trail is being designed.

Ms. Prideaux made a motion to approve the item. Mr. Leeper seconded the motion. The motion was approved unanimously with 7 ayes (Hartley, Holst, Larson, Leeper, Prideaux, Saul and Wingert), and 0 nays.

6.) The next item for consideration by the Commission was a College Hill Neighborhood Commercial District façade review for a temporary mural. Chair Holst introduced the

item and noted that Ms. Prideaux would be abstaining from the vote. Ms. Howard provided background information stating that this item was added last minute as it is proposed for Homecoming weekend. Because it is in the College Hill Overlay District, it needs to be reviewed by Commission to approve the locations and content.

Bettina Fabos, professor at UNI, gave a presentation about Fortepan Iowa and proposed wheat pasted murals. She displayed archived scanned images from 1860 – 2000 that represent life in Iowa and that are the kinds of photos that Fortepan Iowa have been compiling on the public archive. She explained that they have been partnering with public libraries to share resources and make them available to the public. They have been writing grants to make the program better and Cedar Falls is one the target cities for their grant writing. Fortepan is working with the Iowa Arts Council to create wheat pasting of images for photo exhibitions. They have received funding to create five wheat pasted images in Cedar Falls. She explained that wheat pasting is a form of using water and flour to create a paste to create and add images to surfaces. She explained that they are seeking permission to put images up in Cedar Falls and showed potential sites that they may like to use. They intend to present images to City Council at the next meeting if the Commission passes the item.

Mr. Holst asked how long the image lasts. Ms. Fabos explained that it can be power washed and does not damage the buildings. It can come down at any time.

Ms. Saul asked how the Commission is to approve the item when they don't know what image or building is being proposed. Ms. Howard stated that this is a unique project and when looking at the zoning ordinance, it addresses more permanent murals. This is not permanent and it is time sensitive so staff was hoping to get the Commission's blessing to send it to City Council.

Ms. Saul made a motion to approve the item. Mr. Hartley seconded the motion. The motion was approved unanimously with 7 ayes (Hartley, Holst, Larson, Leeper, Prideaux, Saul and Wingert), and 0 nays.

7.) The Commission then considered a presentation from Confluence, Inc. regarding the Creekside Technology Center Master Plan. Chair Holst introduced the item and Mr. Graham provided background information. He explained that in 2018 the City was looking for consultants to develop a master plan for property owned by the City along the south side of West Ridgway Avenue, east and west of Hudson Road.

Chris Shires and Brenda Nelson of Confluence gave the presentation of the proposed master plan. Mr. Shires provided background information in his introduction noting that this is an important gateway into the community. Ms. Nelson discussed the site analysis and displayed a rendering of the intersection. Mr. Shires discussed their guiding principles, explaining that the goal is to control and enhance the southern Cedar Falls gateway, develop high end technology, office or industrial park and explore other potential markets for complementary land use, and to utilize existing natural features to provide stormwater amenities. They are also looking to provide connections and improve pedestrian, bicycle and vehicular circulation both within the project and to the rest of the community.

Ms. Nelson explained that their first step was as site analysis and identified noise [illegible] a barrier on the south, and they have Ridgeway Avenue, a main roadway on the north, bordering the site. One of the primary features is the creek that runs through the west parcel and they would like to take advantage of that. She also noted that there are a number of different places that provide an opportunity to view the parcel. Early on they identified that they wanted to make this minimum grading and as sustainable as possible. They looked at loop roads through the center to access the parcels from either side and provide drainage opportunities from east to west. There was also an opportunity for a nice greenspace on the east side. She displayed renderings of the different sides of the parcels and a utilities diagram.

Mr. Shires summarized the market study, noting that the site is highly visible and near commercial and business uses. It is also favorable for general office, a business and technology park, as well as a light industrial campus. It can support a small amount of retail, but residential is not recommended. He discussed the 10-year demand as well as the time frame, and noted that the City should be patient with the site as parcels with interchange frontage and visibility are rare.

Ms. Nelson discussed circulation and trail connections, noting that the low impact master plan development is designed to require minimal grading and promote straight forward stormwater flow. It is a simple design with a primary loop road connecting the parcel to Ridgeway Avenue in two places, and the roadway corridors are designed to increase aesthetics, soften the impact of infrastructure and elevate the design. Sidewalks are placed along both sides of the street, with tree-lined streets and landscaped parking lots to enhance the pedestrian experience. The loop trail will connect to the greater Cedar Falls trail system. Ms. Nelson also spoke to the utilities and the ability to easily extend them, as well as the stormwater strategy. She explained that public space is provided in a stormwater plaza and open lawn, and provided a graphic to depict the possible look of the plaza. She discussed the lots and how they are configured.

Mr. Holst asked if they anticipate the lots being subdivided as things are developed. Mr. Shires stated that it could happen. This is just a general overview that could change over time as development takes place. Ms. Nelson showed the entire master plan, noting that parking is generally buffered with buildings and landscaping. She discussed potential building heights and types and showed 3-D aerial images of how it could look in the future. She also discussed gateway signage and their general proposed standards.

Mr. Shires discussed design guidelines, speaking to the design intent and concepts, as well as intended land uses. Some uses included corporate and professional office type uses, laboratories, testing facilities, hotels and recreational clubs. Undesirable, prohibited uses include residential, warehouses, or truck stops. He also talked about bulk regulations such as minimum lot size and width, setbacks, building heights and open space, as well as parking regulations and landscaping. Building design standards, such as primary materials and secondary materials, were discussed. Mr. Shires also discussed lighting and signage.

Ms. Nelson addressed phasing of the project, discussing what would take place in each of the five phases and provided a summary of the timing for them. Mr. Shires

talked about information regarding the cost for the phases. Mr. Leeper commended the City on taking initiative on the project. He commented that the development seems to be largely inward and would like to think about what the drive by character would be as people come in to the City. He also suggested screening the parking lots from the view on Highway 20.

Mr. Leeper stated that he felt that the design guidelines may be a little too specific as this is a long term project. He also asked about maximum setbacks in order to ensure buildings are closer to sidewalks and streets.

Ms. Saul stated she is excited about the property and the plan. Mr. Wingert asked about the City's plans for developing the properties and what it will look like to a potential tenant, and what costs would the City incur.

Mr. Leeper stated that he would like to see the City be selective and try not to stretch development too far. Mr. Wingert asked if the name of the development is set in stone, as there is another development with that name. Mr. Graham noted that there have been other suggestions and they could be considered. At this time, the item is just for discussion only.

8.) Ms. Howard provided some updates regarding Commission binders. She also discussed the draft Downtown Vision Plan and noted that it will be presented at the September 25th Planning and Zoning Commission meeting, following the regular agenda items.

9.) As there were no further comments, Mr. Wingert made a motion to adjourn. Mr. Leeper seconded the motion. The motion was approved unanimously with 7 ayes (Hartley, Holst, Larson, Leeper, Prideaux, Saul and Wingert), and 0 nays.

The meeting adjourned at 7:05 p.m.

Respectfully submitted,

Karen Howard
Community Services Manager

Joanne Goodrich
Administrative Clerk

DEPARTMENT OF COMMUNITY DEVELOPMENT

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MEMORANDUM

Planning & Community Services Division

TO: Planning & Zoning Commission

FROM: Shane Graham, Economic Development Coordinator

DATE: September 19, 2019

SUBJECT: Creekside Technology Center Master Plan

In 2010 and 2015 the City of Cedar Falls acquired approximately 157 acres of farm ground along the south side of W. Ridgeway Avenue, located to the east and west of Hudson Road (see image below). The purpose of the acquisition of these properties was to control the future anticipated uses on the property, as this is a main entryway into Cedar Falls.

Earlier this year, the City issued a Request for Proposals (RFP) for master planning services for the property. Master planning services included the creation of a master development plan for the property, a market analysis to determine the anticipated land uses, a utilities analysis, a marketing brochure, and a 3D flyover video. The project was awarded to Confluence, Inc. from Des Moines/Cedar Rapids, who have been working on the project for the past several months.

Confluence, Inc. has recently submitted the final draft of the master plan, titled “Creekside Technology Center” to the City for review. Part of the scope of services provided by the consultant is to give a presentation to the Planning & Zoning Commission and City Council to present the draft of the master plan. The presentation of the draft master plan occurred at the September 11, 2019 Planning & Zoning Commission meeting, and at the September 25, 2019 P&Z Commission meeting, staff is recommending that the Commission approve the master plan, which will then be forwarded to City Council.

If you have any questions regarding this project, please feel free to let me know.

CREEKSIDE TECHNOLOGY CENTER MASTER PLAN

Cedar Falls, Iowa
September 2019

Phase 2 Booklet: Master Plan

HRGreen

LELAND CONSULTING GROUP

CONFLUENCE

Previous Planning Efforts and Documents

- Existing Future Land Use Master Plan
- Existing Traffic Impact Study: Proposed Open Door Hospitality Development
- Existing 2035 Long Range Transportation Plan
- Existing Trails Master Plan

Cedar Falls Advisory Committee

Karen Howard	Chase Schrage
Ron Gaines	Stephanie Sheetz
Shane Graham	David Sturch
Cory Hines	

City of Cedar Falls

Jim Brown	Mayor
Mark Miller	1st Ward
Susan deBuhr	2nd Ward
Daryl Kruse	3rd Ward
Tom Blanford	4th Ward
Frank Darrah	5th Ward
Rob Green	At Large
David Wieland	At Large

Design Team and Contact Information

Confluence
900 2nd St SE, Suite 104
Cedar Rapids, Iowa 52401
P: 319.409.5401

Leland Consulting Group
610 SW Alder Street, Suite 1008
Portland, Oregon 97205
P: 503.222.1600

HR Green Inc.
8710 Earhart Lane SW
Cedar Rapids, Iowa 52404
P: 319.841.4000

Introduction + Analysis

Introduction + Analysis

Introduction

In 2018, the City of Cedar Falls hired Confluence, HR Green and Leland Consulting Group to prepare a market study and master plan for two agricultural parcels on the north side of Highway 20, south of Ridgeway Avenue at the intersection of Hudson Road. The 81-acre parcel on the west side of Hudson Road at the edge of city limits is bisected by Dry Run Creek with significant flood plain area. Rural farm ground lies to the west. The 76-acre parcel east of Hudson Road contains gently sloping ground and is bordered on the east by an existing mobile home park.

As one of the primary gateways into Cedar Falls and the University of Northern Iowa, this development will provide a first impression of Cedar Falls and the City is proactively developing a master plan to ensure the highest and best use of the property.

At the onset of this project, the City worked with the Design Team developing guiding principles they believed represented the vision and direction desired for the development of the property and to use as a measuring stick during the master plan design process. They are as follows:

Guiding Principles

1. Control and enhance this southern Cedar Falls Gateway.
2. Develop a high-end technology, office or industrial park and explore other potential markets for complementary land use.
3. Utilize existing natural features to provide stormwater amenities.
4. Provide connections and improve pedestrian, bicycle and vehicular circulation both within the project and to the rest of the community.

Study Phases

Phase One - Project Initiation

1. Kick-off meeting to review priorities and goals, clarify roles, gather information and visit the site.
2. Collect and analyze various site data and Land Use information
3. Transportation and Utilities Analysis
4. Market Analysis, Forecasting and Strategic Planning
5. Analysis Review Meeting with Advisory Committee

Phase Two - Master Planning

1. Land Use and Transportation Master Plan
2. Natural Resources and Stormwater Management Recommendations
3. Preliminary Cost Opinion for infrastructure improvements.
4. Community Gateway Recommendations
5. Absorption/Development Build-Out Projections and Targeted Industries and Retail Types
6. Draft Plan Advisory Committee Meeting Review Session

Phase Three – Final Draft Master Plan Hearings + Adoption

1. Final Draft Report and Executive Summary
2. Marketing and Promotional Information Material
3. Final Draft Report Review with the Advisory Committee
4. Planning and Zoning Presentation - overview of final masterplan
5. City Council Presentation - overview of final master plan

Project Aerial

Background and Context

The city's thoughtful master plan for Creekside Technology Center will provide a useful tool to successfully manage the growth, function and aesthetics of this important city entrance as development progresses southward. Several infrastructure improvements are anticipated for this gateway including traffic signals at the intersection of Hudson Road and Ridgeway Avenue.

A successful and growing business and technology park lies to the north, as well as additional important development ground on both sides of Hudson Road, one of the influencing reasons for the City's decision to focus expansion on commercial and high-end business and office uses for this master plan.

Farmland, residential homes and a landscaping company, currently exist north of the western parcel in an area identified as future development land. A new Holiday Inn and Convention Center is under construction at the northeast corner of the Hudson Road, Ridgeway Avenue intersection and is the only developed portion of the 16 acre Gateway Business Park flanking Ridgeway Avenue east of Hudson Rd. North of that land is the aforementioned technology park, where numerous companies have developed, including Mudd Advertising, Principal Financial Group, Scientific Games and CBE Group.

Prairie Lakes Park is also located to the north of the technology park and includes over 170 acres of parkland. Prairie Lakes, the Cedar Falls Visitor Center, and Cedar Falls Tourism and Visitors Bureau, over 2 miles of trail, art installations, pavilions, an outdoor fitness trail, boat launch and floating docks are located there. The park doubles as an important stormwater amenity and is connected to both parcels as the end of the Dry Run Creek watershed.

One of the largest and most prominent companies nearby is the Target Distribution Center, west of Prairie Lakes Park and Hudson Road, along Technology Parkway. The Distribution Center campus, similar in size to Prairie Lakes Park, contains two large and very active facilities.

Environmental Opportunities and Constraints

Hudson Road bisects the property splitting the ground into two relatively equal parcels. The western parcel is 81 acres and the east parcel is 76 acres. Highway 20 to the south of both parcels creates a physical and sensory barrier, requiring all vehicular, bicycle and pedestrian traffic connecting the site to come from the north, east, or west. Currently the only access to either site is from Ridgeway Avenue. Most vehicular and pedestrian traffic entering either parcel will likely pass through the intersection of Ridgeway Avenue and Hudson Road. The design of this intersection will have a significant impact on the development patterns in both parcels.

Critical views into the site occur at two key intersections, Hudson Road and Ridgeway Avenue and the Hudson Road overpass at Highway 20. Views into both parcels are limited by topography, especially throughout the eastern half of the site where hills rise above Ridgeway Avenue. The viewshed at the overpass has the potential to provide a unique vantage point across both parcels and presents an opportunity to define a sense of entry to the new Creekside Technology Center as well as the City of Cedar Falls.

Western Parcel

Private farm ground borders the western parcel to the west and Hudson Road forms the Eastern border. The most significant natural feature of the western parcel is Dry Run Creek. The parcel is bisected by the creek, with topography generally sloping toward the creek from the east and west edges of the parcel. While the creek reduces the amount of developable land, this natural feature provides interest and an additional opportunity to enhance development that occurs there. Dry Run Creek flows north to Prairie Lakes Park, under a bridge along Ridgeway Avenue that is slated for improvements when the unimproved Ridgeway Avenue west of Hudson Road is upgraded.

Eastern Parcel

Hudson Road forms the western boundary and County Terrace Mobile Home Park currently sits along the eastern property line. Topography within this parcel is also typical of rolling agricultural hills and generally drains from the east to the west. A central drainageway running southeast to northwest through the middle of the parcel will have an impact on development patterns and site circulation. Views into this parcel are limited from Ridgeway Avenue due to a hill running along the eastern half of the site. The parcel is most visible from Hudson Road at the overpass, the intersection with Ridgeway Avenue and from the northeast corner of the parcel.

Site Inventory and Analysis Diagram

Site Inventory and Analysis

1. Hudson Road Intersection Improvement
2. Gateway Opportunitiy
3. Floodplain + Creek Enhancements
4. Critical Viewsheds
5. Drainageways
6. Vehicular Noise

SCALE 1":700'

0' 350' 700' 1050'

Development Approach

Natural features, surrounding land uses, and existing circulation provide a framework for opportunities that meet the city development goals for the property. The intent of the graphic on the facing page is to illustrate general development opportunities, constraints, drainage patterns, key intersections, and primary vehicular and pedestrian circulation. The result is the first step toward defining the shape, size, and land use of developable parcels.

On the facing page, developable areas are illustrated in brown, and potential green infrastructure opportunities shown in light green. Stormwater conveyance under Hudson Road provides an opportunity to create a water feature and associated public open space within the east parcel, enhancing the pedestrian experience there. Pedestrian trails on the property's west side are focused in the natural areas and like the other side, connect into the greater Cedar Falls trail system. Stream restoration strategies will also be explored to improve the quality and function of Dry Run Creek.

Screening and Buffering

The adjacency of Highway 20 has numerous impacts on development. It carries high volumes of traffic adjacent to the site which is desirable for most development options; however, the speed and quantity of vehicles also creates challenges when considering the pedestrian's experience. The elevated highway creates a physical and visual barrier along the southern edge of both parcels as well as negative sensory impacts like traffic noise and a sense of danger. A buffer zone, shown in dark gray on the facing page buffers the parcels from the negative environmental effects associated with highway traffic. Options for buffering include a setback, architectural screening, vegetative screening, and buildings.

Gateway Opportunities

Primary views into both parcels exist at two key locations: the intersection of Hudson Road and Ridgeway Avenue and from the Overpass of Hudson Road over Highway 20. Gateways can be created using many features including signage, architecture and vegetation to frame and brand views. The design and development of buildings, vehicular and pedestrian infrastructure within these viewsheds should be designed in a way to celebrate and brand the development in each parcel and larger City of Cedar Falls.

Site Circulation

Vehicular

The graphic on the facing page identifies primary vehicular and pedestrian circulation within both parcels that minimizes earth moving, provides access to potential property parcels, and aligns with the planned future intersections along Ridgeway Avenue. Cross access easements are identified for potential future connections to the east and west.

It should be noted that in order to maximize the development of the western parcel, it will be necessary to construct a crossing of Dry Run Creek. Due to the existing grades and size of the creek's drainage basin, costs for the road crossing without a combined pedestrian trail could range between $1,800,000 - $2,000,000. A combined vehicular and pedestrian trail could range between $2,400,000 to $2,700,000.

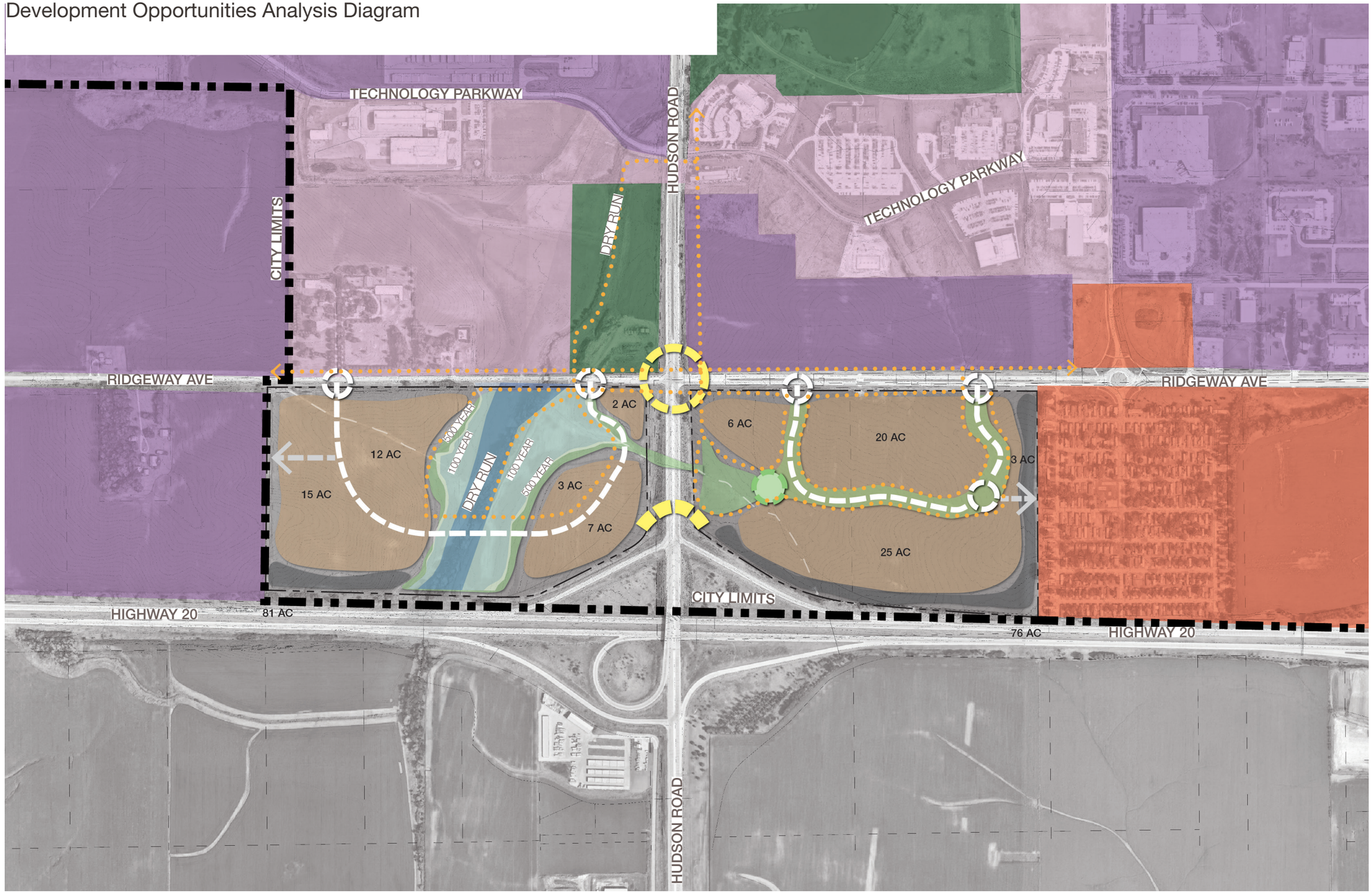
Pedestrian

Pedestrian circulation within the west parcel should be centered around Dry Run Creek for its scenic qualities and floodplain to either side. Walks outside the Dry Run Creek corridor should be located adjacent to the roadway network to minimize conflict with development. A separate pedestrian crossing of Dry Run Creek could range from $800,000 to $1,000,000.

Drainageways and roadway networks are key organizing elements for a trail system throughout the eastern parcel. An opportunity to incorporate green infrastructure exists at the western edge of the parcel where the roadway and drainageway meet at Hudson Road. Features that could be located in this location include a park, stormwater management practice and art installations.

Prairie Lakes Park is a major pedestrian amenity that deserves a well-designed trail connection to and from surrounding developments. Future development to the north of these parcels should consider utilizing the Dry Run Creek floodplain to create a pedestrian corridor connecting the Creekside Technology Center to the park.

Development Opportunities Analysis Diagram



Legend

- Gateway Opportunity
- Primary Intersection
- Secondary Intersection
- Primary Green Infrastructure Opportunity
- Vehicular Traffic
- Future Vehicular Traffic
- Pesdestrian Traffic
- Approximate Development Area
- Green Infrastructure Opportunity
- Buffer Zone
- Flood-way

Future Land Use on Adjacent Land

- Commercial Corridor
- Industrial
- Office and Business Park
- Greenways and Floodplain

SCALE 1":700'

0' 350' 700' 1050'

Transportation and Utilities Analysis

Transportation

The existing or planned roadway and trail network are readily accessible to provide multimodal access to the eastern parcel of the Creekside Technology Center property. Ridgeway Avenue has appropriate capacity for additional traffic and proposed internal collector roads can meet the road at planned intersections based on the development on the north side. This same planned development includes a regional trail connection on the north side of Ridgeway Avenue. The proposed master plan for the subject property will include at-grade crossings at the proposed intersections to connect to this trail.

These favorable conditions are not present adjacent to the western parcel of the property, however. Ridgeway Avenue west of Hudson Road is a rural, 2-lane road that has not been improved in years. Additionally, there are no published plans indicating that the regional trail system will get extended along Ridgeway Avenue.

Utilities

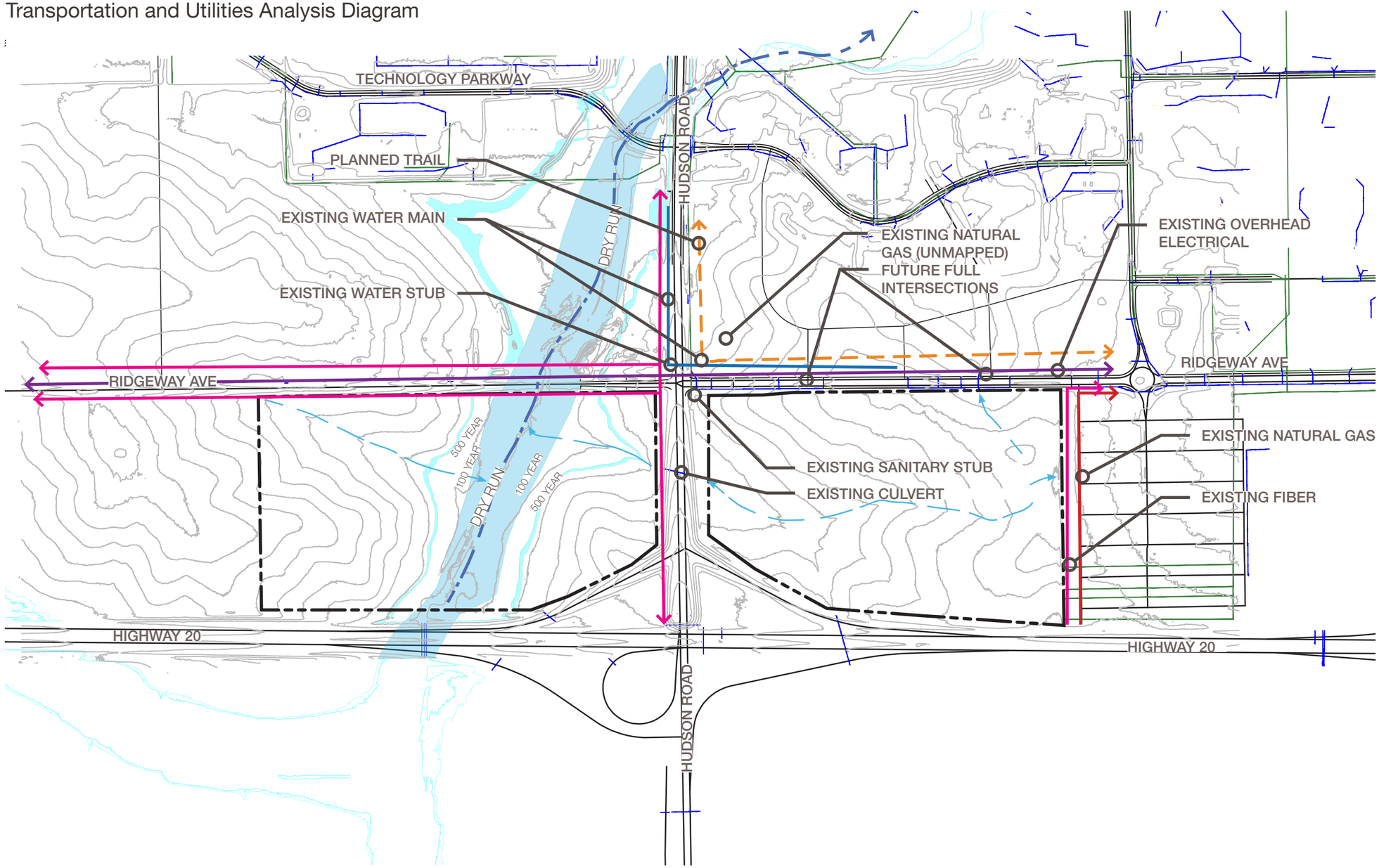
All utilities are in reasonably close proximity to both of the Creekside Technology Center property parcels, though they are much closer to the eastern parcel. The City of Cedar Falls owns and maintains sanitary sewers, and has stubbed out a 15 inch pipe to the SE quadrant of Ridgeway Avenue and Hudson Road. This should be sufficient to serve the entire eastern parcel assuming southwestern-most buildings are located near the primary loop road. The western parcel is lower, with Dry Run Creek running through it, and is unlikely to be able to connect to the aforementioned stub. It is more reasonable to assume that a separate trunk sewer will need to be extended along the Dry Run Creek alignment from the existing sewer just south of Technology Parkway.

Cedar Falls Utilities (CFU) already has significant infrastructure for their various offerings in close proximity to the parcels. Water service is just across Ridgeway Avenue, starting at the NW quadrant of the intersection with Hudson Rd. From this location, distribution mains should be able to serve the western parcel, but a trenchless crossing of Ridgeway Avenue will be needed at some point. Distribution mains to serve the eastern parcel can connect just about anywhere along the main that parallels Ridgeway Avenue on the north side. Other utility services provided by CFU include electrical distribution and natural gas. Electrical is near both of the Creekside Technology Center parcels, with a distribution line along the north side of Ridgeway Avenue for the length of both frontages. Natural gas is currently stubbed at the NE corner of the eastern parcel and is also extended to the new hotel north of Ridgeway Drive and west of Cyber Lane. Communications services include video, internet, and telephone through CFUs award-winning, high-bandwidth, fiber optic network. Fiber optic cable is present along the west side of Hudson Road and along the eastern boundary of the eastern parcel. In summary, all potential utility and communication needs for development are feasibly obtainable.

Storm Water Management

Based on review of the existing contours and assuming that proposed development will not significantly change the runoff patterns, it appears that most of the runoff generated within the two parcels stay within them, eventually concentrating in swales that lead to Dry Run Creek. The majority of the eastern parcel drains in a swale to the west and crosses under Hudson Road through a 66-inch diameter culvert to the western parcel. A small subcatchment in the northeast corner of the eastern parcel drains north to a culvert and storm sewer network along Ridgeway Avenue. Any proposed development will be subject to strict storm water ordinances that ensure the existing infrastructure will be adequate to convey any runoff released from the two parcels.

Transportation and Utilities Analysis Diagram



Key Elements

Key Elements

Land Uses and Market Study

The market study, which can be found in greater detail in the Appendix, confirmed that this highly visible site, near current commercial and business uses, favored development for general office, business and technology park, light industrial, and possibly as a site for a major corporate campus. A small amount of retail would likely be viable, primarily the type that would be supported by the workers of the surrounding commercial areas, commuters and nearby hotels (such as a restaurant). Residential uses were explored but because of the lack of proximity and connectivity to other residential areas, would feel fragmented if developed as part of this effort. Furthermore, residential uses would not be the highest and best use of this highly visible and valuable land located at a major highway interchange.

Market Analysis, Buildout Projections and Strategy

Office, industrial and support retail uses remain the most valuable and desirable uses for this study area. The market analysis projects the total combined 10-year demand for these uses on the subject property to be 255,000 to 440,000 sq. ft.

Based on these demand rates, the subject property as master planned is projected to take 30 to over 60 years to be fully developed. As this property and the area around it continues to develop, the rate of development may increase. Furthermore, factors such as landing a major corporate campus or other significant single user can significantly shorten this timeline.

However, even with full build-out not projected to occur for many years, patience should be employed with the development process, as parcels with highway interchange frontage and visibility as well as municipal services and public utilities are limited and not easily acquired. Having these parcels available and in-stock for office, industrial, flex and research and development space will keep the City of Cedar Falls at the front-of-the-line when competing with the region for new business development and corporate campuses.

Estimating Demand

The subject property will draw demand support for office and industrial development from employment growth occurring across Black Hawk County and four much smaller adjacent counties (Iowa Workforce Region 7). Region-wide demand square footage, per decade, is summarized in the tables below.

Regional 10-year Office Demand Projections

	2018 Jobs	Pct. In Office Space	Est. S.F. per Office Job	Current Office Space (sf)	10-yr Growth Rate	10-yr Office Space Growth
Healthcare	14,620	*25%*	*250*	913,750	1.5%	144,043
Finance/Insurance	4,150	*80%*	*250*	830,000	1.5%	134,760
Prof/Tech Svcs	3,323	*80%*	*250*	664,500	1.6%	113,150
Admin/Support	3,725	*50%*	*250*	465,625	1.7%	83,450
Management	935	*85%*	*250*	198,688	2.1%	45,007
Real Estate	998	*50%*	*250*	124,688	1.0%	12,595
Education	13,083	*5%*	*250*	163,531	0.7%	11,086
All Other	59,045	mixed	*250*	703,594	mixed	15,682
Total*	**99,878**			**4,064,375**		**559,771**
				Subject Capture		
				low	20%	112,000
				high	30%	168,000

Source: Labor Market Information Division, Iowa Workforce Development (Long-term industry forecasts from the for 2016 to 2026 were converted to 2018-2018, based in part on Short-term forecasts for 2017-2019); and Leland Consulting Group

Regional 10-year Industrial Demand Projections

	2018 Jobs	Pct. In Industrial/Flex Space	Est. S.F. per Industrial Job	Est. Current Industrial Space (sf)	10-yr Projected Growth Rate	10-yr Industrial/Flex Growth (s.f.)
Manufacturing	17,788	*25%*	*500*	8,449,063	0.4%	312,319
Transport & Warehousing	3,875	*80%*	*1,500*	5,231,250	1.1%	583,486
Wholesale Trade	3,510	*80%*	*1,000*	3,334,500	0.2%	67,774
All Other	74,705	*mixed*	*250*	1,244,381		126,794
Total*	**99,878**			**18,259,194**		**1,090,373**

Source: Labor Market Information Division, Iowa Workforce Development (Long-term industry forecasts from the for 2016 to 2026 were converted to 2018-2018, based in part on Short-term forecasts for 2017-2019); and Leland Consulting Group

As outlined in greater detail in the full market analysis appendix, the subject property is well-suited to capture a significant share of both industrial (including flex and R&D space) and office development projected for the region, including approximately:

- 110,000 to 220,000 square feet of flex/R&D space per decade
- 110,000 to 168,000 square feet of office space per decade

In addition, drawing on a smaller market area comprised of southern Cedar Falls, Hudson, and a small portion of Waterloo, the site has the potential to capture retail demand of approximately 30,000 to 55,000 square feet per decade – focused primarily on food service/dining, personal services, storefront medical and financial office services, and convenience retail serving the growing daytime employment population and underserved south Cedar Falls neighborhoods.

Market Analysis Conclusions: Why Cedar Falls? Why This Site?

- The mid-sized “twin cities” market of Waterloo-Cedar Falls is distant enough from any competing urban area to have its own market identity and regional influence, but not large enough to avoid some level of dependence, especially with metropolitan Des Moines, its primary regional neighbor.

- While the city of Cedar Falls has a number of major highway entry points, its southern gateway is particularly important to the city’s image and economic role, both because of this relationship to Des Moines and because of the presence of the University of Northern Iowa just to the north.

- This favorable location within the metro has already begun to yield positive market effects, capturing a significant share of the Waterloo-Cedar Falls new commercial development over the past decade –
- primarily in the form of office, flex/R&D, light industrial, and lodging development in and around the Cedar Falls Technology Park.

- The subject property is well-situated to capitalize on this momentum, taking advantage of potentially excellent visibility and access, along with natural drainage features that can serve as a centerpiece to a superior site design.

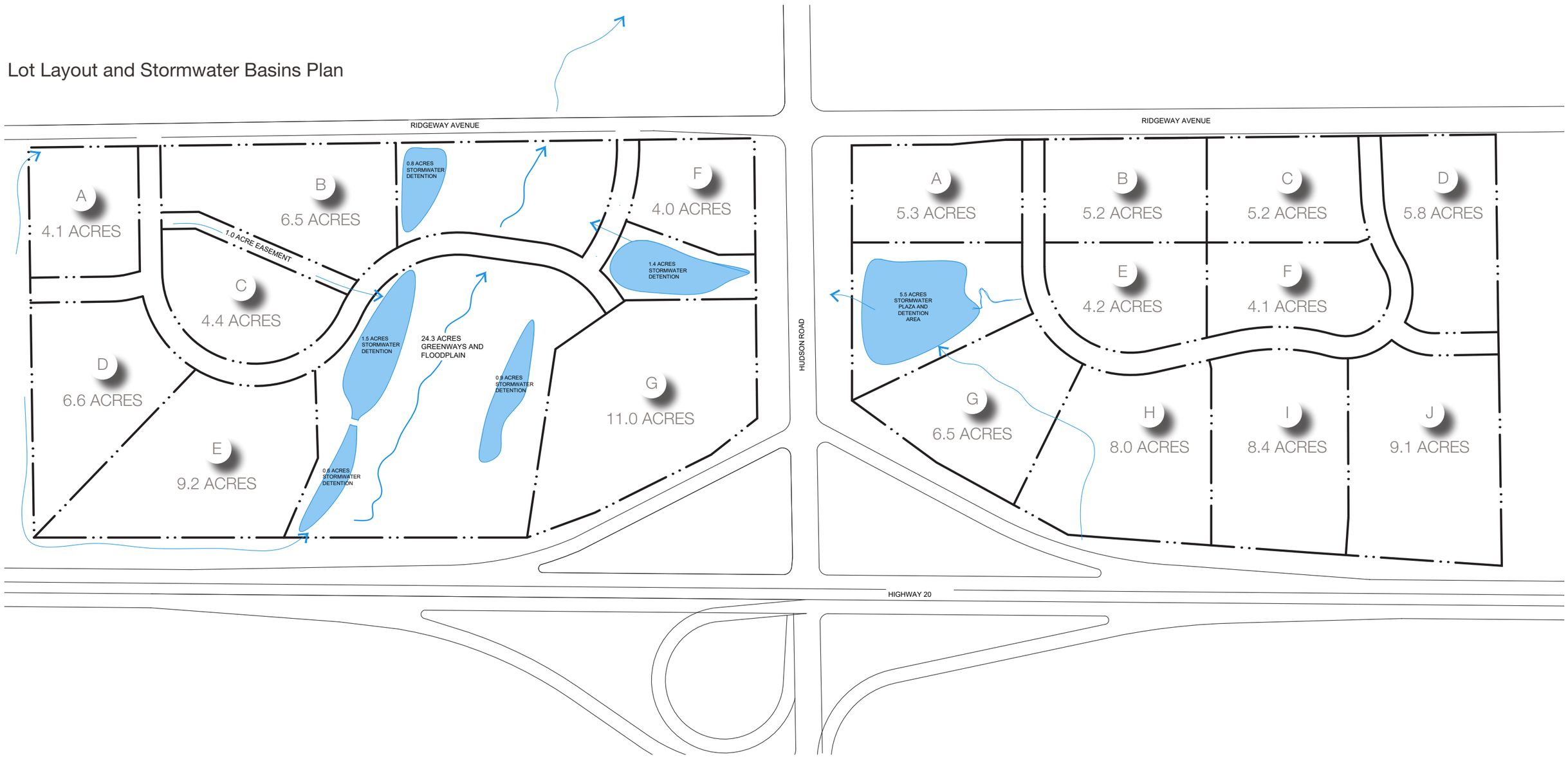
- While central Waterloo does pose some new competitive threat with recent investments in their Technology Works project (an adaptive re-use of older John Deere facilities into incubator and related tech space), the subject property is sufficiently differentiated from that competition – with more of a focus on commercial users that are “going concerns,” less reliant on subsidized start-up amenities.

- The subject property also has strong potential to develop as a purpose-built hub for dining and service retail targeted to the growing southwest metro employment concentration. Existing competition is thus far somewhat scattershot and lacking in the kind of shared site amenities and walk/bike-friendly connectivity that the subject property could offer.

- Finally, the site in question represents an opportunity to shore up the aesthetics of what appears to be a permanent gateway location (given that the municipality of Hudson, to the south is already allowing warehouse/light industrial development up to the Cedar Falls border).

Phasing Plan

Lot Layout and Stormwater Basins Plan



Absorption and Phasing

The preferred site plan vision shown here is ambitious – appropriately so for a key remaining assembly of highway-fronting commercial land in Cedar Falls. While the aggressiveness of the plan is warranted given the prime site and the strong momentum currently enjoyed by the city, it translates into an absorption horizon that could consume several decades under reasonable market assumptions. As such, the phasing for the site's development needs to be flexible yet strategic.

Because the western parcel has potential value as a high amenity, high design campus-styled site that would be suitable for a major corporate user, it makes sense to preserve that site until such a user can be identified and successfully recruited. The eastern parcel lacks the full upside potential of the west side, due to its largely featureless topography, but shares important site attributes such as visibility, access, traffic volume and proximity to fast-growing commercial land uses.

Thus, we recommend making infrastructure improvements and marketing development parcels into five phases starting with the west half of the east parcel. It is assumed for phases 2, 4 and 5 that the road stub outs will be installed only as periphery development pressure requires. Also, water service may need to be fully constructed for along each proposed road loop, prior to the roadway pavement, if required pressure can't be achieved with dead-end transmission mains. However, all loop roadway pavement will be installed per phase.

Phase 1:
Sanitary service will be provided at the northwest corner of this parcel and utilities will be extended to accommodate the 1st phase starting with the roundabout at Cyber Lane. This allows development of east side Lots A, B, E,G, and H as well as the stormwater plaza and associated wet basin.

Phase 2:
This phase extends the east parcel's loop road, finishing at the roundabout on Ridgeway and Waterway Avenues. A portion of Phase 2 drains north to a culvert that crosses under Ridgeway Avenue. Per the proposed storm water management plan, the city would need to construct the off-site regional detention basin, north of Ridgeway Avenue before that portion of Phase 2 is developed. With the completion of this phase, the Creekside Technology Center's east parcel would be complete adding lots C, D, F, I and J.

Phase 3:
West side project development will begin starting at east end of that parcel. The implementation of this phase should occur only after other major city infrastructure improvements are made such as signalizing the intersection of Ridgeway Avenue and Hudson Road, and the bridge improvements over Dry Run Creek. Two dry stormwater detention basins will be constructed as part of this phase along with other improvements such as creek restoration, soft trails, low water crossings, prairie and trees to the flood plain area east of Dry Run Creek. This phase allows for the development of highly visible west side lots F and G.

Phase 4:
This phase requires the least infrastructure development by installing a short road spur off Ridgeway Avenue on the northwest corner of the site and allows development of west side lots A and B. One dry stormwater detention basin is associated with this phase.

Phase 5:
This phase requires the largest infrastructure investment and includes not only significant roadway length, but the bridge over Dry Run Creek, as well as dry stormwater detention basins. This completes the Technology Center by allowing development of west side lots D and E.

Phases 3, 4, or 5 could concurrently occur with phases 1 and/or 2 depending on market conditions and if a prospective flagship user for the west parcel can be secured. The approximate maximum square footage at full build out along with an estimated build-out time frame is listed below.

- Phase 1: maximum approx. 430,000 SF - 20 yrs. estimated build-out
- Phase 2: maximum approx. 405,000 SF – 20 yrs. estimated build-out
- Phase 3: maximum approx. 160,000 SF – 8 yrs. estimated build-out
- Phase 4: maximum approx. 165,000 SF – 8 yrs. estimated build-out
- Phase 5: maximum approx. 235,000 SF – 10 yrs. estimated build-out

Circulation and Trail Connections

This low impact master plan development contains vehicular circulation and lot layout designed to require minimal grading and promote straightforward stormwater flow. Vehicular circulation on both parcels is simple, with each containing a primary loop road connecting to Ridgeway Avenue in two locations. The east parcel contains a dead-end spur to the east for future development and the west parcel contains a dead-end spur to the west for future development as well as a cul-de-sac spur terminating at an office complex on the south east portion of that parcel.

Both roadway corridors contain central boulevards and entry landscaping to increase aesthetics, soften the impact of infrastructure and elevate the design desired for this southern gateway to Cedar Falls. Boulevards should be predominately planted as lawn to limit maintenance costs.

Access points to parking areas from the roadway are aligned to minimize the number of conflict points along the primary corridors.

Throughout the development, walks are provided along both sides of the streets to encourage safe pedestrian movement. Tree-lined streets, and parking lot landscape screening enhance the pedestrian experience. East side trails run through the north-central portion of the site and around the stormwater plaza and wetland basin area. The west parcel design includes a trail along along the drainage easement and also capitalizes on the natural flood plain areas by providing mulch chip/mown trails that meander in a loop, traversing Dry Run Creek Creek at two low water crossings. This loop trail provides a nature-oriented experience for those working or living nearby who wish to take advantage of it. Trails within this project connect to the greater Cedar Falls trail system, and the trails proposed along Dry Run Creek are intended to continue north along the creek to Prairie Lakes Park in the future.

Utilities

All utilities are in reasonably close proximity to both east and west project parcels, though they are significantly closer to the eastern parcel. The City owns and maintains sanitary sewers and has stubbed a pipe to the SE quadrant of Ridgeway Avenue and Hudson Road capable of serving the entirety of the east property parcel. A proposed sewer along Dry Run Creek will serve the west side. Further study may be needed to determine if upsizing of the sanitary sewer is needed to serve future development to the west of this parcel or if existing service in the area should be extended since extension of existing services in the region could potentially result in extreme sewer depths.

Other utilities such as electrical, natural gas and communications services can be feasibly obtained for the project. See the Phase One document for a description of available services and utilities diagram.

Stormwater Strategy

The current trend in storm water management is to implement Best Management Practices (BMP) as much as possible at the upper reaches of basins. This approach involves implementing practices on individual lots that reduce the amount of, and improves the quality of, stormwater runoff to receiving waters. In many cases, this approach reduces or eliminates the need for detention of runoff before it leaves the site. While this approach is still possible for the subject properties, the City directed us to take a more traditional approach, which includes regional detention basins that outlet into Dry Run Creek.

Conceptual design of these regional detention basins was based on City's stormwater ordinance and processes described in the Iowa Storm Water Management Manual. At this early stage of planning, several assumptions were needed, including that the existing runoff basin boundaries and flow paths would not change significantly when the sites are developed. Of course, significant changes to the runoff regime, such as changes in land use and conveyance elements, were included in the hydrologic model for the proposed development.

As might be expected, a comparison of the runoff hydrographs of the natural condition, assumed to be undisturbed prairie, and the developed condition, reveals glaring increases is both peak discharge and volume. This requires detention basins with a significant amount of available storage volume. The individual basins are shown in the Appendix and the summary of the required storage volumes are shown in the following table.

Basin ID	Pond ID	Natural 2-Year Peak Flow (CFS)	Developed 100-Year Peak Flow (CFS)	Required Storage Volume (AC/FT)	Notes
W1	PW1	16.1	134.8	6.0	Also receives flow from PE1
W2	PW2	23.5	338.8	12.5	
W3	PW3	10.8	101.9	4.2	
W4	PW4	17.8	129.2	4.6	
E1	PE1	34.9	431.8	22.5	
E2	N/A	14.8	64.9	1.5	No room for on-site detention. City should provide at planned regional facility, north of Ridgeway Avenue.

It should be noted that the proposed detention basins can be aesthetically appealing as shown in the ISWEP brochure included in the Appendix. This brochure refers to stormwater wetlands but they function as detention basin above any permanent pool elevation.

Dry Run Creek Assessment and Recommendations

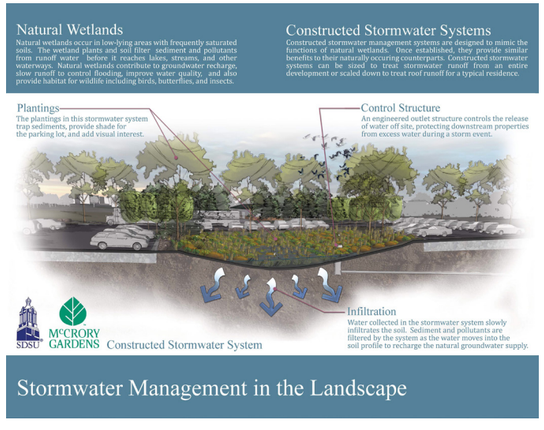
The stretch of Dry Run Creek from US 20 to Ridgeway Avenue was inspected in late spring to identify opportunities to stabilize and enhance this natural topographic feature. A technical memo describing the site visit and recommended improvements is provided in the Appendix.

Public Space

An enhanced wet stormwater basin, stormwater plaza and open lawn are proposed to serve those in the eastern half of the development and provide a visual focal point from the Hudson Road gateway. The plaza presents numerous opportunities to feature stormwater elements such as artful rainwater design to highlight the collection and treatment of water. The goal is to bring the plaza area to life during rain events and provide interpretive stormwater signage as an educational resource. This signage should feature the stormwater plaza and wetland detention basin and all other stormwater practices in use throughout the development. Green space near the plaza provides a space for the public to sit, play, and use the trail loop around the basin. Wayfinding lighting such as illuminated bollards or light columns are proposed at the stormwater plaza to provide a low-maintenance sense of security and ambience to the space.

Additional green space is located throughout the development and should be used to enhance the areas further away from the plaza district through plantings, small seating nodes and pedestrian transition zones as illustrated on the plan.

McCrory Gardens in Sioux Falls, SD
Source: Confluence



Manassas Park Elementary School Landscape in Manassas Park, VA
Source: https://www.asla.org/2011awards/456.html

Master Plan

Master Plan Concepts

East Parcel

The east parcel is planned primarily for office and light industrial uses on 4 to 9-acre lots, typically desired by single-tenants. Some parcels can be combined to accommodate either a larger single-tenant or multi-tenant business park with flex-space. Buildings are 2 to 3 stories and parked at 3 stalls per 1,000 square feet of gross floor area (GFA).

The high visibility lot at the northwest corner of the site has been identified as a potential hotel and/or retail center to provide support for out-of-town clients and employees of businesses within the technology center. Limited retail can also be included within the other parcels that front Ridgway Avenue to provide additional support services and capitalize on high visibility lots.

Landscape buffers are designed to screen parking fields from views outside and within the technology center. Building locations and form are designed to frame the streetscape, minimize parking lot visibility from the interior loop road, and provide a sense of security for pedestrians.

OFFICE AND LIGHT INDUSTRIAL: 660,000 SF GFA
56.5 AC

RETAIL/HOTEL: UP TO 100,000 SF GFA
UP TO 5.3 AC

A HOTEL + RETAIL BUILDING - 3 TO 4 STORIES
5.3 AC PARCEL / 75,000 - 100,000 SF GFA

B OFFICE BUILDING - 2 STORIES
5.2 AC PARCEL / 75,000 SF GFA

C OFFICE BUILDING - 2 STORIES
5.2 AC PARCEL / 75,000 SF GFA

D OFFICE BUILDING - 2 STORIES
5.8 AC PARCEL / 80,000 SF GFA

E OFFICE BUILDING - 2 STORIES
4.2 AC PARCEL / 40,000 SF GFA

F OFFICE BUILDING - 2 TO 3 STORIES
4.1 AC PARCEL / 40,000 - 60,00 SF GFA

G OFFICE BUILDING - 3 STORIES
6.5 AC PARCEL / 85,000 SF GFA

H OFFICE BUILDING - 2 TO 3 STORIES
8.0 AC PARCEL / 85,000 - 130,000 SF GFA

I OFFICE BUILDING - 2 TO 3 STORIES
8.4 AC PARCEL / 90,000 - 140,000 SF GFA

J OFFICE BUILDING - 2 TO 3 STORIES
9.1 AC PARCEL / 90,000 - 140,000SF GFA

K BOULEVARD WITH GREEN INFRASTRUCUTRE

L PUBLIC PLAZA

M STORMWATER WETLAND
5.5 AC PARCEL

N CULVERT CONNECTING TO WEST PARCEL

O 1/4 MILE TRAIL

P NATIVE LANDSCAPE SCREENING

Q CULVERT CONNECTING TO RIDGEWAY STORM SEWER

R GATEWAY SIGNAGE

S ROADWAY STUB OUT TO EAST

View from northwest corner of east site towards the southeast

West Parcel

The master plan for the west parcel provides for office and light industrial lots that range from 4 to 11-acres with a large central open area along existing floodplain and creek. Buildings are 2 to 3 stories and parked at 3 stalls per 1,000 square feet gross floor area (GFA).

The lot at the northeast corner of the site may include a small amount of retail to support area business development. The largest lot at the southeast of the parcel includes many desirable features including visibility from the highway, an entry drive and views overlooking Dry Run Creek. This parcel is particularly well suited for a corporate campus or flagship business location.

A vehicular and pedestrian bridge allows traffic to flow seamlessly across Dry Run Creek and provides an opportunity for further branding of the technology center. Strategic landscape buffers along the edges of parking throughout the technology center screen views into the site and minimize the visual impact of larger parking fields.

OFFICE AND LIGHT INDUSTRIAL: 450,000 SF TO 560,000 SF GFA
41.8-45.8 AC

RETAIL: UP TO 40,000 SF GFA
UP TO 4 AC

A OFFICE BUILDING - 2 TO 3 STORIES
4.1 AC PARCEL / 45,000 - 65,000 SF GFA

B OFFICE BUILDING - 2 TO 3 STORIES
6.5 AC PARCEL / 70,000 - 100,000 SF GFA

C OFFICE BUILDING - 2 STORIES
4.4 AC PARCEL / 45,000 SF GFA TOTAL

D OFFICE BUILDING - 2 STORIES
6.6 AC PARCEL / 70,000 SF GFA

E OFFICE BUILDING - 2 TO 3 STORIES
9.2 AC PARCEL / 100,000 - 120,000SF GFA

F OFFICE + RETAIL - 2 STORIES
4.0 AC PARCEL / 40,000 SF GFA

G OFFICE BUILDING - 3 STORIES
11.0 AC PARCEL / 120,000 SF GFA

H DRY CREEK RUN / GREENWAYS AND FLOODPLAIN - 24.3 AC

I DRY STORMWATER DETENTION
5.2 AC COMBINED

J NATIVE LANDSCAPE SCREENING

K BOULEVARD WITH GREEN INFRASTRUCUTRE

L PEDESTRIAN + VEHICULAR BRIDGE

M ROADWAY STUB OUT TO WEST

N NATIVE LANDSCAPE SCREENING

O STORMWATER EASEMENT AND PEDESTRIAN TRAIL - 1 AC

P EXISTING BRIDGE REPAIR WITH STORMWATER IMPROVEMENTS AT RIDGEWAY AVE + DRY RUN CREEK

Q NATURAL SURFACE PEDESTRIAN PATH WITH LOW WATER CROSSINGS

R GATEWAY SIGNAGE

Vliew from southeast corner of west site towards the northwest

View from northwest corner of east site towards the southeast


SCALE 1”:300’

Community Gateway Recommendations

Hudson Road is a major roadway and one of the primary entrances to Cedar Falls from Highway 20 — especially for those traveling to the University of Northern Iowa campus. The intersection of Hudson Road and Ridgeway Avenue is an opportunity to brand not only the Creekside Technology Center, but the City as a whole. The focus of this section is to define design concepts of gateway signage and entry signage within the project area.

Gateway Signage

Hudson Road and Ridgeway Avenue are generally elevated above the landscape to connect to Highway 20 and drain stormwater. In order to achieve appropriate prominence and scale, gateway signage should be located on an elevated ground plane that raises the sign above the adjacent roadways. The speed of traffic, size of the intersection and clear zone at the intersection of Hudson Road and Ridgeway Avenue also requires that the sign be sized large enough to be legible from a significant distance. University Avenue includes a similar gateway sign that includes a limestone veneer, horizontal orientation and an illuminated lantern with the city logo cutout, but at a smaller intersection. Gateway signage in this location should be based on the University Avenue signage, but be increased in size.

Symmetrical signs on the east and west sides of Hudson Road will enhance the sense of arrival for those traveling from the north and south. Rotating the signs 45 degrees will allow for a double-sided sign that is legible from both Hudson Road and Ridgeway Avenue. The inclusion of accessory features such as limestone columns, also included as part of the signage at University Avenue, will help to increase the prominance of the gateway signage at this busy intersection.

Development Entry Signage

Existing development entry signage precedents at the technology center to the north of this project should inform the development entry signage at this location in materiality and form to maintain aesthetic continuity across similar developments. Development entry signage should be located in a visible location parallel to Ridgeway Avenue at all intersections within Creekside Technology Center

View north from Hudson Road

View from Hudson Road to northeast

Design Guidelines

Design Guidelines

Design Intent

In order to ensure the Creekside Technology Center reaches its full potential and is developed in a uniform and manner consistent with the Master Plan, a minimum level of design guidelines should be established for the property. Doing so will help ensure that it is developed as a quality business park that will become a long-term asset for the community. The following is a set of general design guidelines for consideration as a supplement to the standards contained within the Business/Research Park District (BR) and the Highway 20 Commercial Corridor Overlay District (HWY-20). These guidelines may be incorporated via an ordinance revision.

Conceptual Master Plan

The conceptual Master Plan developed for the study area is intended to serve as an example for how the property can be developed with a variety of parcel and building sizes and shapes over multiple phases. The specific roadway layouts and lot sizes will be determined as the property is developed.

The overall intent is that this property will be platted into individual lots - each served by public streets and utilities. Stormwater will be managed with a combination of on-site and shared facilities to address water volume and quality. As depicted in the Master Plan, buildings should be generally 2 to 3-stories in height and oriented to the adjoining streets. Parking lots should be well landscaped and interconnected between adjoining lots when possible. All areas not essential for circulation, parking, building or service shall function as open space. Open space should be generous and include amenities such as trails, water features, and natural areas. Buildings should be designed following good architectural principals and surfaced with a variety of high-quality, durable materials.

Intended Land Uses

The following are the desired uses within the Master Plan area in order to fully maximize the potential as a professional business park development. Further included are uses that should be prohibited.

Permitted Uses:

- Corporate and professional office type uses including medical service providers and banks.
- Laboratories, testing facilities, research offices,and light manufacturing or assembly where all activities occur entirely within the principal structure, there is no outdoor storage, and there is no semi-truck traffic utilized to transport goods manufactured or sold.
- Civic, educational, vocational facilities and governmental type uses.
- Limited retail uses and personal services businesses intended to support the business park including restaurants, coffee shops, office supply stores and retail shopping businesses, childcare centers, dry cleaners, fitness centers, and gyms.
- Hotels.
- Recreational clubs

Prohibited Uses:

- Single-family and multi-family residential dwellings.
- Adult entertainment businesses.
- Delayed deposit service business including check cashing, payday lending, car title loan businesses.
- Pawnshops.
- Auto, truck, construction and farm equipment-oriented businesses including dealers, service centers, repair shops, car or truck washes, gas stations, and new and used sales lots.
- Warehouses, including mini- and self-storage facilities, shipping and distributions centers.
- Manufacturing or assembly uses and other industrial uses that include outdoor storage and/or utilize semi-trucks for delivery of products to and from the business.
- Other uses prohibited by the underlying zoning.

Bulk Regulations

- Min. Lot Size: 2-acres.
- Min. Lot Width: 100-feet, measured at the front yard setback line.
- Front Yard Setback: 15-feet from all public street rights-of-way including highway frontage.
- Side and Rear Yard Setback: 20-feet from all internal lot lines, 30-feet from boundary of Master Planned area.
- Min. Separation Between Buildings Not Attached: 20-feet.
- Min. Building Height: 20’
- Min. Open Space: 30% defined as any area not encumbered by a building or paved area and may include credit for shared open space and stormwater management areas.

Parking Standards

All off-street parking spaces, driveways, drive aisles, and loading areas shall be paved per City standards. Parking required shall also be as determined by City Code. Shared parking between off-peak uses within the Master Plan area is encouraged. Parking should not be located between a building and any adjoining street.

Landscaping

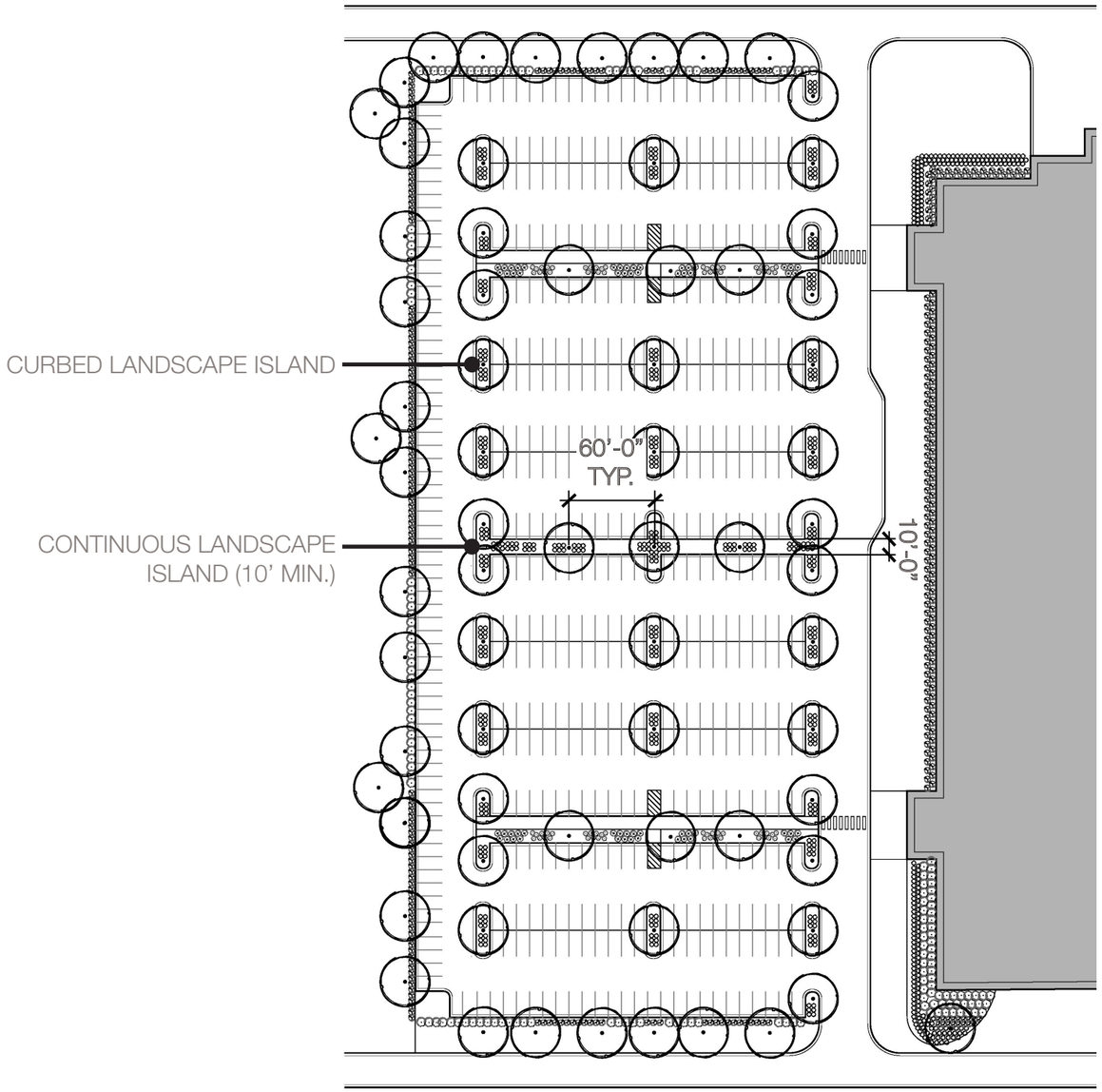
All areas not encumbered by buildings, structures, or paving should be landscaped with a combination of turf grass, ornamental grasses, plant beds, shrubs, and trees. Wood-based mulch should be used around all plantings and in all plant beds. Inorganic ground cover material, including rock, chip brick, and synthetic turf, is discouraged except in limited application along building foundations and around drainage structures. Landscaping should at a minimum, meet the standards required for the Business/Research Park District (BR), plus the following:

Parking Lot Landscaping:

- Parking Lot Design Standards - All rows of parking should be terminated with a curbed landscaped island. No off-street parking or loading area should be more than 100 feet from a deciduous shade tree located within a landscaped open space area. Sidewalks that abut the front edge of any parking stall should be no less than seven (7) feet wide to accommodate a two (2) feet vehicle overhang. A minimum of every third parking lot bay shall contain a continuous landscape island for the length of the bay excluding the area immediately adjacent to any handicap parking areas. These continuous landscaped islands shall be a minimum of ten foot (10') contiguous planting area and provide an average of one (1) overstory tree for every sixty linear feet (60') of landscaped bed. Green infrastructure such as landscaped biocell islands may double for the landscape island requirements as long as the overstory tree requirements are still met. In lieu of placing the trees within the continuous biocell island, they may be placed in islands along the adjacent row of parking.

- Parking Lot Landscaping Requirements - All parking lot islands should be landscaped with a combination of turf grass, prairie grass plantings, plant beds, shrubs, and trees. Rock, chip brick, pavers, pavement and similar hard surfacing should not be permitted within a parking lot island except sidewalks or pavers may be placed within a parking lot island as necessary to accommodate pedestrian circulation. No less than one (1) deciduous shade tree should be planted within each required landscaped island.

- Parking Lot Screening Requirements - Whenever an off-street parking area fronts a public street, a minimum three (3) foot tall vehicle headlight screen should be installed between the parking lot and the adjoining street. This screen can be constructed with a combination of prairie plantings, dense deciduous and evergreen shrubs, ornamental grasses, earth berming, and low masonry walls.



Continuous Island Illustration

Stormwater Management: Each individual lot shall be designed at a minimum, to provide controls for the Water Quality storm, defined as a rainfall event of 1.25 inches in depth. These minor and relatively low-cost improvements are very effective at capturing and filtering the higher level of contaminates associated with these frequent storms and can be attractive enhancements adjacent to impervious areas such as building roofs and paved parking area. Impervious areas providing stormwater detention or retention should be landscaped. Areas closer to buildings and street rights-of-ways should be detailed with a higher level of finish. Treatment of the retention pond edge should take into consideration erosion control and aesthetics.

Building Foundation: Building foundation plantings should be installed and maintained next to and along no less than fifty percent (50%) of the frontage of all building foundation lines that face or front a public street. Building foundation plantings should consist of a combination of low height plant materials such as shrubs, ornamental grasses, and perennials, and may be installed at grade, in raised planters, or within decorative plant containers. The minimum depth of all foundation plant beds, planters, and containers should be three (3) feet.

Streetscape: One (1) deciduous shade tree (minimum 8-feet tall) at planting should be planted for every 50 feet of street frontage, not including driveways. Periodic clusters of ornamental grasses and/or shrubs should be repeated along the streetscape at an average interval of one (1) cluster or grouping for every 50 feet of frontage.

The trees and grasses/shrub clusters should be located within the street right-of-way, between the public street and any sidewalk or trail. These plantings may be grouped or spaced at varying intervals as needed to address placement limitations and restrictions.

Buffers: A fifty foot wide landscaped buffer should be installed along Hudson Road and the Highway 20 frontage to help soften and enhance the highway corridor and entryway. Furthermore, a 30 foot wide landscaped buffer should be installed along the east boundary of the east site to buffer the neighboring properties. Each buffer park should generally have two (2) deciduous shade trees, three (3) coniferous trees, and six (6) shrubs planted for every 25 linear feet of buffer.

Building Design Standards

All buildings constructed within the Master Plan area should comply with the following standards.

Massing, Proportions, Trim, and Pedestrian Scale: All buildings should employ recognized architectural styles and design principals on all sides (four-sided architecture) and be proportional, with elements in scale, and designed with a top, middle, and bottom. For example, buildings with three (3) or more stories in height should have masonry or stone (heavy) bases and generally have low-slope roofs with heavy cornices versus pitched, residential style roofs that may be out-of-scale with the building. Building exterior materials should be applied in an authentic and honest manner reflecting the materials purpose, weight, and typical use in order to convey a sense of strength and durability.

Except where architecturally unsuitable, appropriately scaled trim should be included around all window and door openings, building corners, roof lines, and façade material transitions located on primary facades. All building soffits, overhangs, and cornices should be appropriately scaled and based on the architectural style. If used, shutters should be in scale with the adjoining opening and be operational or have the appearance of being operational and functional as a true shade or shutter.

Awnings, overhangs, and projections over walkways and building entries should be of an appropriate pedestrian scale and height. Clear fenestrations should be located along all street facing facades and along pedestrian walkways to add visual interest for the motoring and walking public.

Buildings or building elements that do not follow a recognizable architectural style, are not proportional in scale, do not employ four-sided (applied to all building facades), do not follow recognized architectural design principals, or do not have pedestrian scale elements are the street level and entryways should not be considered as meeting the intent and requirements of this section.

Exterior Materials: All exterior building materials should be utilized in the application as intended by the manufacturer and follow proper installation requirements and standards, including management of water migration and installation of appropriate substrate material.

Primary and Secondary Façades: For the purposes of this section, “primary façade” means all street-facing and highway-facing façades and facades with a building’s main entrance. Buildings may have more than one primary façade. All other facades are “secondary” facades.

Exterior Material Classes: For the purposes of these guidelines, all exterior building materials are to be divided into three classes as further defined herein: Primary, Secondary, and Limited. Primary materials should be utilized along all Primary Facades. Secondary materials should be limited to use in Secondary Facades. Limited materials should only be used in limited amounts as trim elements.

- Primary Materials: Include the following and other comparable or superior materials.
  - Fired clay brick, full-veneer masonry wall system
  - Fired clay thin brick, adhered to a wall with the appearance of full brick
  - Natural and synthetic stone, veneer and paneling
  - Glass, curtain wall and/or glass cladding system (clear glass)
  - Spandrel glass
  - Burnished/ground-faced concrete block (color integral)
  - Architectural quality precast concrete panels (color integral)
  - Architectural quality composite metal wall panel systems (concealed fasteners)
  - Other comparable or superior materials

- Secondary Materials: Include the Primary Materials and the following:
  - Split-faced concrete block
  - Brick, stone, or burnished block that is painted
  - Cast-in-place or precast concrete panels that are not architectural quality or that are painted
  - Architectural quality metal wall panel systems with exposed fasteners
  - Wood or Cement fiber board siding and panels
  - Genuine Portland cement-based stucco traditionally applied
  - Exterior Insulation and Finish System (EIFS) water-managed and exterior rated
  - Other comparable or superior materials

- Limited Materials: Include the following:
  - Smooth concrete block
  - Translucent wall panel system, such as Kalwall
  - Ceramic Glass block
  - Vinyl and PVC siding, panels, and trim
  - Metal siding, panels, and trim
  - Wood composite siding, panels, and trim
  - Opaque, mirrored, or tinted glass
  - Fabric
  - Other comparable materials

Other Limitations:

- EIFS when used, should not be installed within ten (10) feet of the finished floor elevation of the façade on which it is located.

- Thin brick and stone veneer, when utilized, should comply with the following:
  - Thin brick and stone veneer should only be used in applications where the actual brick or stone thickness will not be distinguishable or is otherwise addressed by adjustments in the wall plane to provide the appearance of full depth brick or real stone.
  - 'L' shaped brick corner pieces and full-depth brick caps should be utilized at all corners and edges to maintain the appearance of full-depth brick.
  - Thin brick and stone veneer should be continued (returned) a minimum of 12-inches around wall corners to further maintain the appearance of full-depth brick or real stone.
- The first floor of all primary facades should be no less than 20% clear glass (fenestrations), with little to no decernable tint, color or mirroring.

Screening

All building and site elements should be screened.

Building Mounted and Rooftop Equipment: All exterior-mounted and all roof-top building HVAC and mechanical equipment, vents, piping, roof access ladder, and utility meters should be located out of view or otherwise screened from view from all adjacent public or private streets and residential developed or zoned properties. Screening should be accomplished via landscaping, walls, and building elements, parapets, or screen walls, or a combination of these methods.

Trash and Recycling Containers and Ground Mounted Equipment: All trash containers, trash compactors, grease collection containers, and recycling containers and all ground mounted HVAC equipment, power generators and other exposed mechanical equipment should be screened from public view on all sides. Screening should be accomplished via landscaping, walls, fences, and building projections or a combination of these methods.

Lighting

The following standards should apply to all exterior lighting.

- All building mounted and site lighting should be LED type (light produced via light emitting diodes) of a soft-white or bright-white light color and quality.

- All light fixtures should be down-cast in nature and possess sharp, cut-off qualities to limit off-site glare. Light cast onto a building or sign should not shine past the wall plane. Wall-pack type light fixtures are prohibited except for decorative wall sconce type light fixtures.

- Buildings and signage may be up-cast or down-cast illuminated provided said lighting does not shine or glare off or past the sign or building wall.

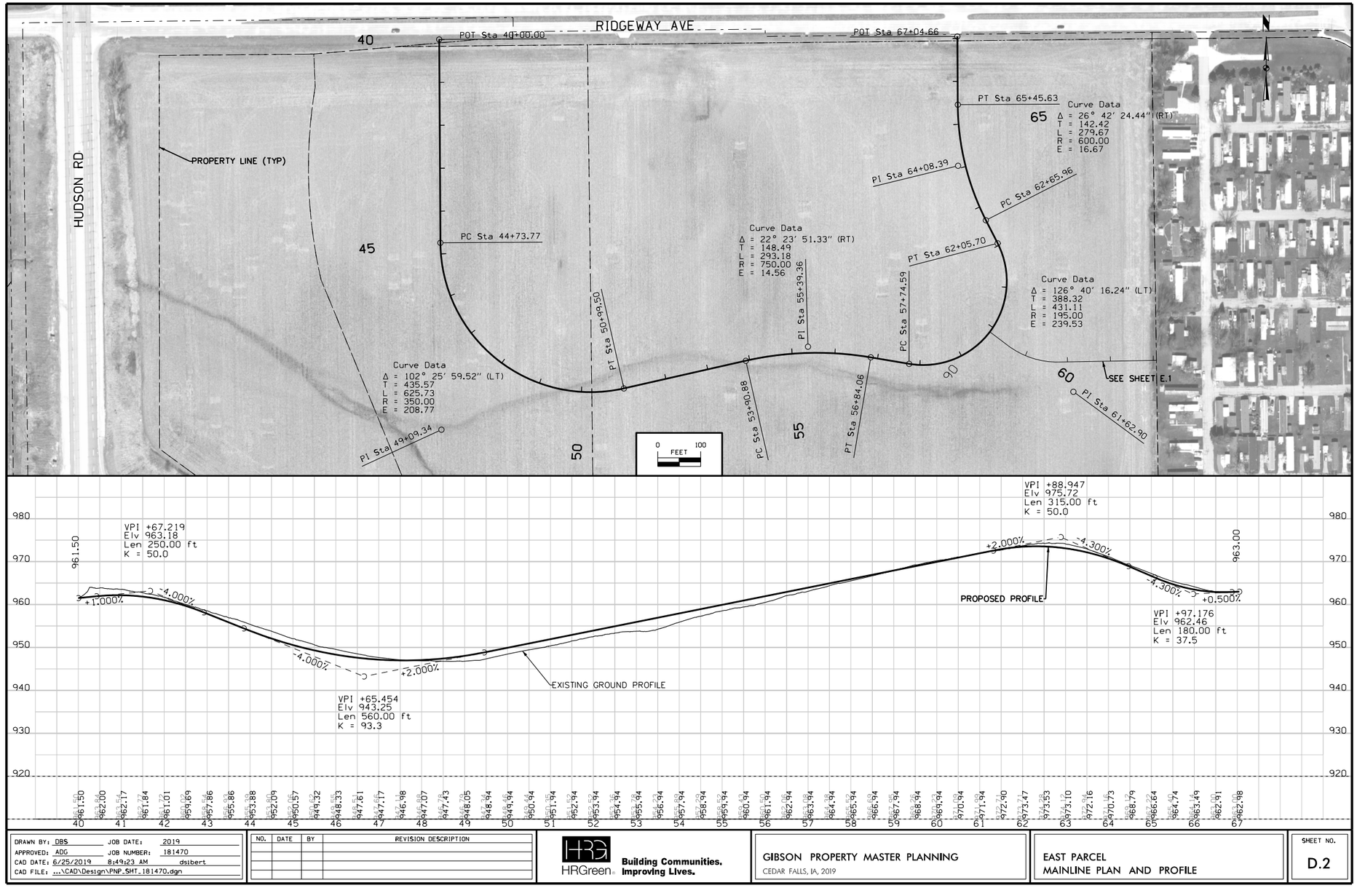
- Buildings may include illuminated banding, illuminated translucent panels, and permanent string lights.

Signage

All signage shall comply with the City's sign code regulations for the underlying zoning.

Appendix

Roadway Section, Plans and Profiles



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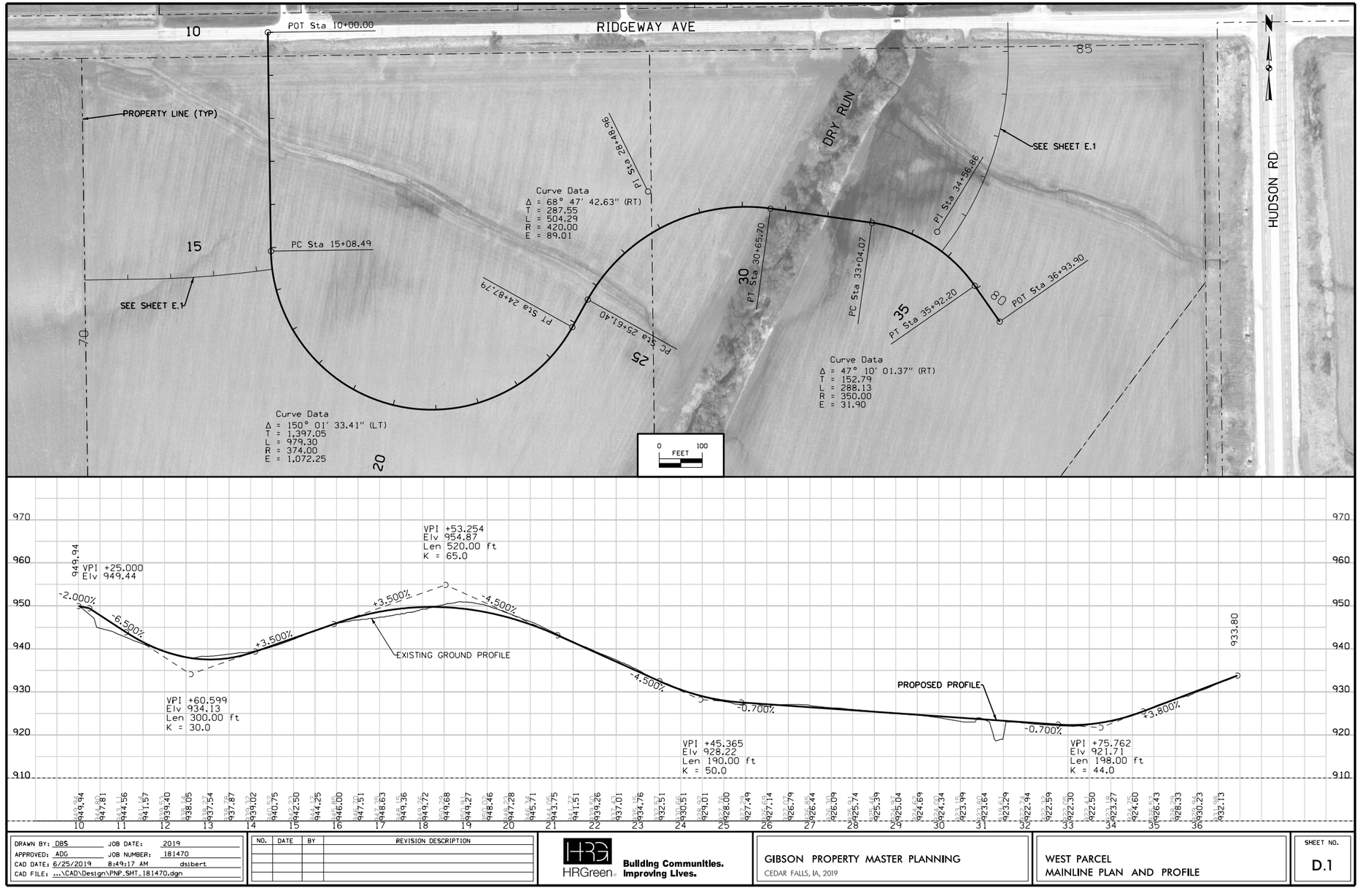
GIBSON PROPERTY MASTER PLANNING
CEDAR FALLS, IA, 2019

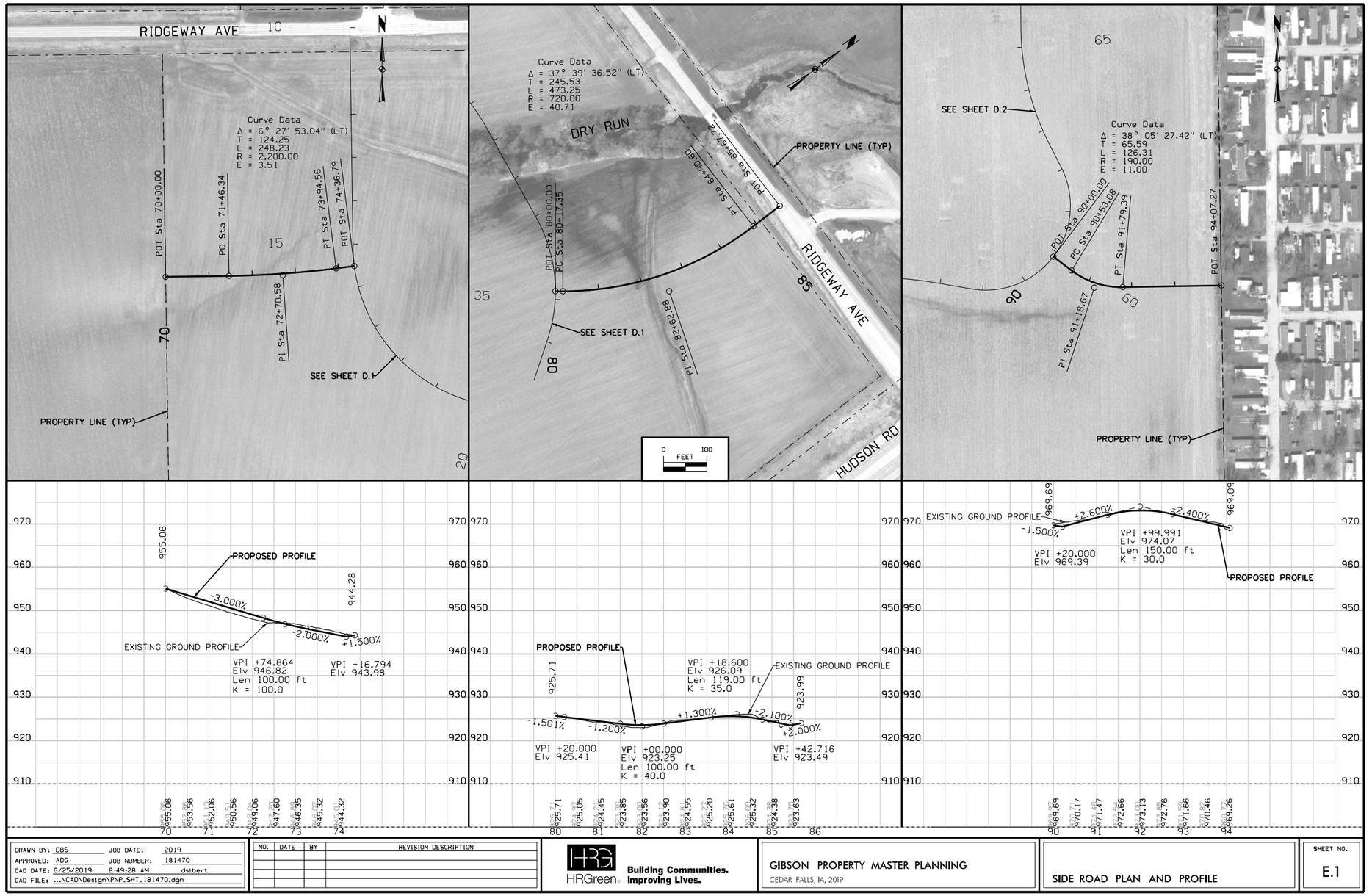
EAST PARCEL
MAINLINE PLAN AND PROFILE

SHEET NO. D.2

Roadway Section, Plans and Profiles



Roadway Section, Plans and Profiles



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GIBSON PROPERTY MASTER PLANNING
CEDAR FALLS, IA, 2019

SIDE ROAD PLAN AND PROFILE

SHEET NO. E.1

Roadway Section, Plans and Profiles

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June 4, 2019

Confluence
900 2nd St. SE, Suite 104
Cedar Rapids, IA 52401

Re: Creekside Technology Center Master Plan
West Parcel – Dry Run Reach Assessment

Overview

Dry Run is a relatively narrow, sand-bottom stream in Blackhawk County, IA that runs from rural headwaters through urban areas in Cedar Falls to the Cedar River. The reach of Dry Run assessed for this project runs through the West Parcel of the Gibson Property between US Highway 20 and Ridgeway Road south of Cedar Falls, IA (Figure 1). The stream flows across the property roughly northeast from a 3-bay concrete structure under US Hwy 20 to where it exits the property under a bridge at Ridgeway Avenue to the north. This reach of Dry Run drains approximately 4.66 square miles of rural Black Hawk county upstream from Ridgeway Avenue (Figure 2).

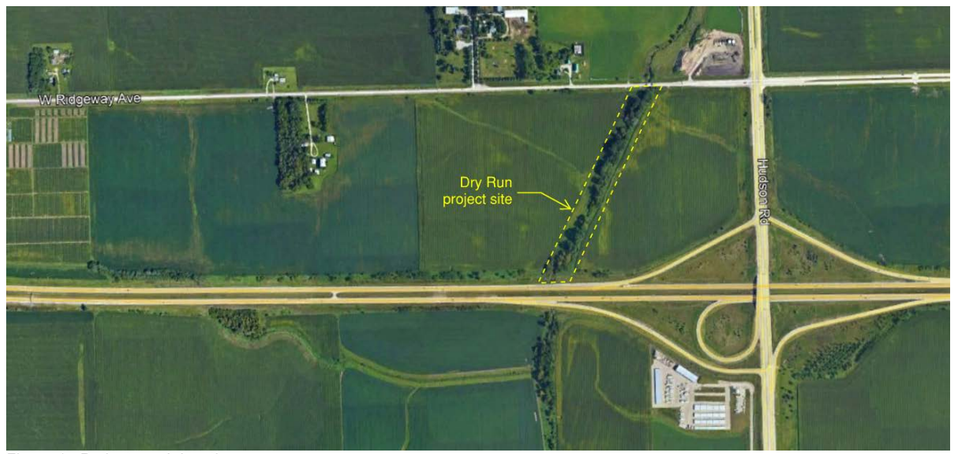

Figure 1. Project reach location.

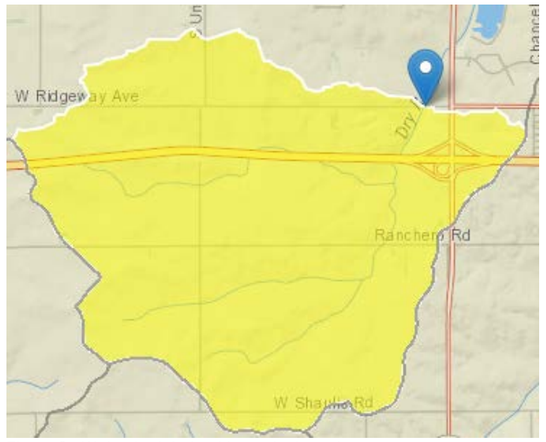

Figure 2. Watershed drained by project reach.

Stream Reach Information

The project reach is roughly 1750 feet long and has a slope of about 0.0015 from south to north. The stream channel is roughly 15 – 25 feet wide with banks mostly incised between 4 to 8 feet, vegetated overbanks, and row cropped fields on both sides (Figure 3). The riparian zone along the reach ranges in width from about 4 feet to about 25 feet. The riparian canopy covers >75% of the stream length, and >90% of the riparian overbanks are vegetated. Row crops immediately border the riparian zone on both banks (Figure 4). Small fish, a frog, birds, and tracks of multiple animals were observed during the site visit.

Dry Run Creek Assessment

Figure 3. Typical cross section of Dry Run within the project reach.

Figure 4. Riparian buffer and row crop on (a) the left bank and (b) the right bank.

The stream is constrained by its own incision for the entirety of its length along the channel, though some low floodplain bench areas do appear where banks have slumped and widened. Vertical grade controls are primarily associated with large wood or gravel riffles. At the time of the survey, water levels in the stream were generally 14” or less, though several pools and unconsolidated sandy deposits were over 24” deep. The majority of the stream substrate on the property is sandy material with additional small areas of cobble and coarse gravel in the upper 1/3 of the stream length and finer gravels in the middle and lower thirds. The lower third has significant silt deposition as well. Soils in both banks appear to have well defined layers of top soil, sandy soils, and clay (Figure 5).

Dry Run Creek Assessment

Figure 5. Typical bank soil profile showing top soil, sandy soil, and clay with gravel at the toe in this case.

There is limited riffle-run-pool structure with minor planform variation. There are two gravel associated riffles and several semi-permanent riffles formed by large woody debris in the channel bed. Large wood appears to be the main source of structure within the reach (Figure 6). Pools are primarily associated with plunge features from entering tile drains (Figure 7) and scour occurring in bends and at the downstream bridge abutments.

Figure 6. Typical large wood providing in-channel structure within project reach.

Dry Run Creek Assessment

Figure 7. Pool below tile drain outfall.

There are currently four tile drains discharging directly within the reach, with 3 on the left bank and 1 on the right bank (By convention, left and right are determined by facing downstream). The flow and structures (pipes, inlets, etc.) associated with these tile drains will need to be accounted for in drainage design for any new development.

Problem Areas and Potential Restoration Opportunities

Four major issues were observed within the project reach:

- significant incision along both banks
- limited riparian buffer
- diversion of the stream by the Ridgeway Avenue bridge abutment
- gully erosion at tile drains and field drainage locations

There are many techniques available for stream restoration. The Iowa Department of Natural Resources has recently developed a reference set of best management practices for stream restoration in Iowa. This resource, called the Iowa River Restoration Toolbox (IRRT) (https://www.iowadnr.gov/Environmental-Protection/Water-Quality/River-Restoration/River-Restoration-Toolbox), represents the state of the art in stream restoration science and practice and is available to the public. Many projects under IADNR or other state jurisdiction are now being evaluated according to this framework. Therefore, recommendations and relevant details to address the issues identified within the project reach will be pulled from this resource.

Incised Banks

Much of the stream length has at least one bank that is incised 4 – 6 feet (Figure 8) often undercutting existing vegetation (Figure 9). Additional areas show signs of slumping (Figure 10). Incision threatens integrity of the banks, constrains the stream from its floodplain, and can lead to increased flashiness and velocities at high flows. In general, bank reshaping and stabilization provide a shallower slope and protect the bank soils from additional erosion.

Figure 8. Typical four- to eight- foot stream bank incision within project reach.

Figure 9. Exposed tree roots from incision and undercutting.

Dry Run Creek Assessment

Figure 10. Example slumping of banks within project reach.

Examples of relevant streambank reshaping and stabilization techniques for this reach include streambank toe protection with toe wood (IRRT 7.2.1), with stone (IRRT 7.2.2), or with fabric encapsulated soil lifts (IRRT 7.2.3); vegetative restoration of reshaped stream banks using live staking / joint planting (IRRT 2.2.1), live fascines (IRRT 2.2.2), brush layering (IRRT 2.2.3), seeding (IRRT 2.2.6), and nursery stock / bare root/ plug planting or transplanting (IRRT 2.2.7). Vegetative restoration is carried out after reshaping, and can either be combined with fabric encapsulated soil lifts or with erosion control matting (IRRT 2.2.4).

Limited Riparian Buffer

The vegetated boundary along both sides of a stream is called the riparian zone. The IRRT recommends a riparian buffer of at least 50ft on each side of the stream that is vegetated with regionally appropriate native vegetation in more than half of the buffer area (IRRT 3). Since the existing vegetated boundary of the stream is approximately 4-25 ft wide on either side of Dry Run (Figure 11), it is recommended that removal of undesirable vegetation and establishment of new vegetation is performed along the entire reach length once the final channel morphology is constructed.

Figure 11. Limited riparian buffer typical within project reach.

Diversion of Dry Run by the Ridgeway Avenue Bridge Abutment

Dry Run currently flows at a skewed angle to Ridgeway Avenue, the bridge span opening does not line up with the stream channel. The location of the existing Ridgeway Avenue bridge abutments causes diversion of streamflow and resultant scour at the downstream end of the reach (Figure 12). Abutment scour can lead to increased erosion and instability and in worst case scenarios failure of infrastructure. Whether the channel diversion is due to natural migration and meandering of the stream channel away from the span opening, or whether the bridge was constructed with the stream in the existing alignment, the existing abutments are not located wide enough to fully span the stream channel. This causes stream flow to alter direction at the west abutment, which in turn causes the stream to swirl and form a scour pool immediately upstream of the bridge.

Figure 12. Stream diversion and scour pool upstream of the Ridgeway Avenue bridge.

It is recommended that the new alignment of the Ridgeway Avenue bridge and any new bridges associated with future development limit restriction of the stream channel. This will require spacing of the abutments and sufficient span length such that the toe of the abutment banks does not restrict the bankfull channel width.

Gully Erosion at Tile Drains and Field Drainage Locations

There are existing tile drains and field drainage ditches that are eroding and head cutting within the reach (Figure 13, Figure 14). Gully erosion and head cutting are major concerns, because they undermine the stability of the banks, potentially alter the geometry and alignment of the channel, and lead to recurring failure of drainage systems.

It is recommended that erosion at these locations is dealt with in two ways. First, the flows that are discharging at these locations should be handled by new drainage designs, thereby eliminating or mitigating flow. Second, the banks at these locations should be stabilized and vegetation restored in conjunction with restoration of incised banks.

Dry Run Creek Assessment

Figure 13. Tile drain outfall (center picture at water line) and associate gully erosion.

Figure 14. Gully erosion where edge of field drains into Dry Run.

Dry Run Creek Assessment

Conclusions

Dry Run is a naturally occurring stream feature of the Gibson Property with intrinsic natural and aesthetic value. The existing condition of the project reach has incised banks, a limited riparian buffer, diversion of stream alignment by the Ridgeway Avenue bridge, and some gully erosion at several locations. Recommendations include bank reshaping and stabilization of incised and gully areas, followed by restoration and establishment of a riparian buffer on both sides of the stream consistent with practices described in the Iowa River Restoration Toolbox. In addition, future bridge alignments should consider placement and sufficient spans such that the bankfull width is not restricted by the toe of the abutment banks.

Sincerely,

HR GREEN, INC

Robert C. Everhart, PhD, EIT
Staff Engineer

Attachments:

Iowa River Restoration Toolbox Practice Guide 2: Vegetative Restoration
Iowa River Restoration Toolbox Practice Guide 3: Riparian Buffering
Iowa River Restoration Toolbox Practice Guide 7: Streambank Toe Protection/Stabilization

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Main 319.841.4000 + **Fax** 319.841.4012
HRGREEN.COM

June 4, 2019

Confluence
900 2nd St. SE, Suite 104
Cedar Rapids, IA 52401

Re: Creekside Technology Center Master Plan
West Parcel – Dry Run Reach Assessment

Overview

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Figure 1. Project reach location.

ISWEP Wetland Brochure

STORMWATER WETLANDS

Stormwater Quality and Quantity Management

WHAT ARE STORMWATER WETLANDS?

A stormwater wetland is a man made management practice that provides a natural way to treat and remove pollutants from stormwater runoff before it enters a stream, river, or lake. As stormwater is captured in the wetland, pollutant removal is achieved through various mechanisms. Vegetation aids in this process helping to slow, settle and uptake nutrients through biochemical reactions.

WHY INSTALL STORMWATER WETLANDS?

Urbanized landscapes generate large quantities of stormwater runoff during rain storms. As stormwater flows off buildings and homes, into streets, down storm drains, and into local water bodies, it picks up pollutants that negatively affect water quality. Stormwater wetlands provide an opportunity to manage the quantity and quality of stormwater runoff from a large area of urban development. Without the use of stormwater wetlands or other stormwater management practices, polluted water would flow directly into water bodies.

STORMWATER WETLANDS OF IOWA

1 Spencer - Partnership with Walmart
2 Webster City - Riverside Park
3 Ankeny - 36th St. and Fourmile Creek
4 Cedar Falls - University of Northern Iowa
5 Des Moines - Northeast Corner of Easter Lake
6 Storm Lake - Abner Bell Wetland

cleanwater IOWA CLEANWATERIOWA.ORG · NRCS · ISWEP · Polk Soil & Water CONSERVATION DISTRICT · SRF STATE REVOLVING FUND · IOWA DEPARTMENT OF AGRICULTURE & LAND STEWARDSHIP www.iowaagriculture.gov

MARCH 2019

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STORMWATER WETLAND COMPONENTS

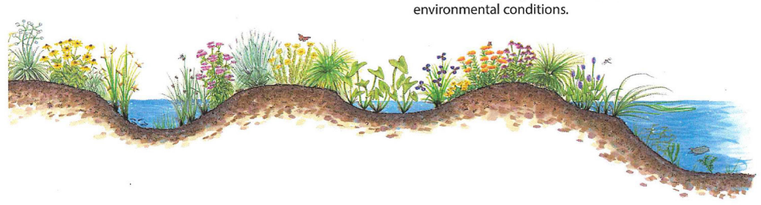
1 **Forebay:** Eroded soil is captured from incoming runoff before entering the wetland. Over time, buildup of eroded soils can be removed from the forebay allowing for easier maintenance. This prevents damage to the wetland and plants and increases overall longevity of the wetland.

2 **Microtopography:** A series of small berms and depressions designed to increase the distance water has to travel. This "stormwater maze" forces water to weave slowly through the wetland promoting pollutant removal.

3 **Areas of Shallow Water:** Varying depths of water promote plant growth allowing for biological uptake which helps remove pollutants.

4 **Pools:** Deep pools reduce the suspension of sediment, reduce thermal pollution, and increase habitat.

5 **Outlet:** A primary function of a stormwater wetland is to help slow down stormwater. Aligning with this goal, the outlet of the wetland is intentionally designed to release water slowly to improve downstream environmental conditions.



WETLANDS **IN ACTION**

Removes Pollutants through Settling

Eroded soil is a major pollutant prevalent in Iowa waters. When stormwater is slowed down in the stormwater wetland, eroded soil settles out and improves water clarity.

Slows Down Stormwater

Instead of rapidly flowing directly into a water resource, the stormwater from a contributing water course now slowly flows through the wetland providing temporary water storage and other benefits.

Removes Pollutants through Biological Uptake

Plants present in wetlands have special chemical and biological functions that can help remove pollutants through biological uptake. These biological processes remove nutrients such as phosphorus and nitrates, and common pollutants in Iowa waterways.

Supports Wildlife and Habitat

Wetlands support a wide variety of plant and animal life. Typical wetland species have sturdy stems, leaves, and flowers that provide a great habitat for birds, animals, and invertebrates.

FEATURED **STORMWATER WETLANDS**

Ankeny is a leader in utilizing wetlands across their city to manage and treat stormwater runoff. Several wetlands were installed in the Prairie Trail Development as part of a stormwater treatment train. The wetlands slow down the runoff and remove pollutants before moving to the next stormwater structure. A wetland constructed adjacent to Fourmile Creek and north of 36th Street was built to address sediment and nutrients in the runoff from 55 acres which would have flowed untreated directly into the creek. These wetlands also provide habitat for a variety of wildlife species as well as educational opportunities for the public.

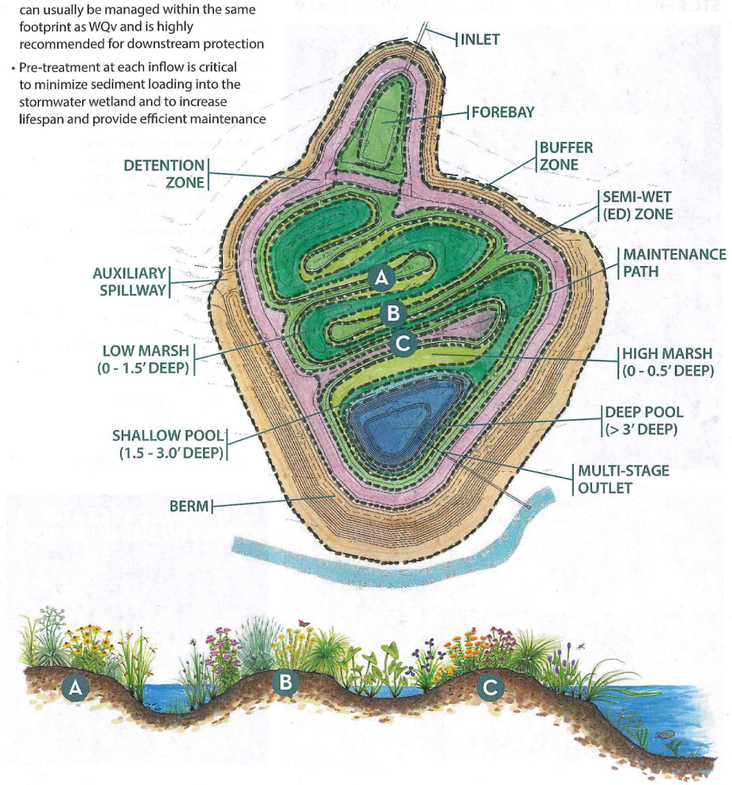
Prairie Trail Development

DESIGN **ELEMENTS**

Stormwater wetlands can be designed to address both stormwater quality and quantity using the unified sizing criteria. Refer to the Iowa Stormwater Management Manual for complete design guidelines and calculation worksheets.

DESIGN HIGHLIGHTS

- Be able to pass or manage all the storm events safely through the wetland
- Minimum treatment is for water quality volume storage in the permanent pool (1.25" 24 hour rain)
- Channel protection volume (1 year storm) can usually be managed within the same footprint as WQv and is highly recommended for downstream protection
- Pre-treatment at each inflow is critical to minimize sediment loading into the stormwater wetland and to increase lifespan and provide efficient maintenance

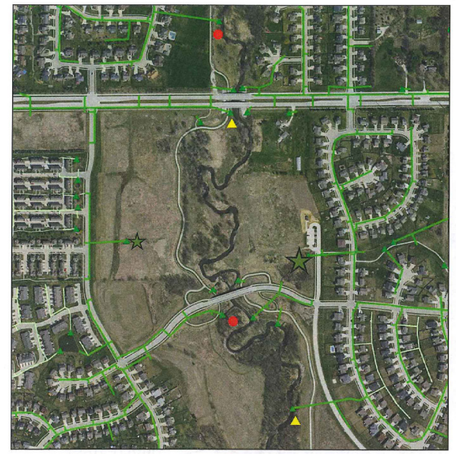


STORMWATER WETLAND **SITE SELECTION**

Stormwater wetlands are able to treat flow at the end of a drainage swale or stormwater pipe. Many urban areas have limited space to install retrofit practices. Stormwater wetlands often can be located in parks or open space areas at the outlet of stormwater pipes or drainage swales. Unlike other options, they can be used to treat runoff from large drainage areas with a single end of pipe practice. That creates efficiencies by treating a larger area with only one stormwater practice to inspect and maintain.

A public area allows the community to control the installation, maintenance and use of the wetland and buffer area. They are perfect for greenways and park space and provide additional community benefits such as recreation, habitat and education.

STORMWATER PIPE AND SURFACE DRAINAGE MAP



These maps are a good source of reference to determine potential wetland sites.

- Look for pipe outlets and drainage swales that flow to open space or public areas near a stream.
- Check the sites to be sure there is enough elevation change to bring the stormdrain water to the surface and into the wetland and to a wetland outlet.
- Avoid existing wetlands and sensitive areas.

● UNSUITABLE WETLAND SITE
  - too close to stream
  - not enough space

▲ POTENTIAL WETLAND SITE WITH PIPE REDIRECT
  - utilize nearby area
  - move pipe outlet

★ SUITABLE WETLAND SITE
  - adequate space
  - elevation considerations

→ STORMDRAIN PIPES AND OUTLETS

DRAINAGE AREA AND WETLAND SIZE GUIDANCE

10 acres minimum drainage area

3-5% of drainage area needed to treat water quality volume

6-12% of drainage area needed to manage large flood events

Once a potential wetland site is identified:

- Determine the drainage area to check if wetland site is adequate.
- An engineer can further study the site feasibility.

IDNR River Restoration Toolbox - Practice Guide 2

River Restoration Toolbox
Practice Guide 2

Vegetative Restoration

IOWA DEPARTMENT OF NATURAL RESOURCES

Iowa Department of Natural Resources

April, 2018

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LIST OF PHOTOGRAPHS

RIVER RESTORATION TOOLBOX PRACTICE GUIDE 2

Executive Summary

Vegetative restoration provides stream bank stability while improving the ecological function of both the stream and riparian area. Vegetative restoration is preferred over hard armoring and other engineered, flexible revetment techniques such as riprap and sheet pilling because of the aesthetics, energy dissipation, and natural function of the vegetation. Vegetative restoration methods are often used in conjunction with other forms of restoration, such as channel bank grading, and are selected based on site conditions, constraints, and specific project objectives. The following techniques are detailed in this report:

1. Live Staking/Joint Planting
2. Live Fascines
3. Brush Layering
4. Erosion Control Matting
5. Sod Matting
6. Seeding
7. Nursery Stock, Bare Root, Vegetative Plug, and Transplanting

The *River Restoration Toolbox Practice Guide 2: Vegetative Restoration* (Practice Guide) has been developed to assist with the presentation of design and construction information for stream restoration in Iowa. It is intended to provide guidance to:

- Those responsible for reviewing and implementing stream restoration,
- Professionals responsible for the design of stream restoration projects,
- Others involved in stream restoration at various levels who may find the information useful as a technical reference to define and illustrate vegetative restoration techniques.

The Practice Guide includes a written assessment of the vegetative restoration practice and describes a variety of vegetative restoration techniques. Each technique includes design guidelines, a specifications list, photographs, and, when applicable, drawings.

The information in the Practice Guide is intended to inform practitioners and others, and define typical information required by the State of Iowa to be included with the use of vegetative restoration techniques. The information and drawings are not meant to represent a standard design method for any type of technique and shall not be used as such. The Practice Guide neither replaces the need for site-specific engineering and/or landscape designs, nor precludes the use of information not included herein.

The Practice Guide may be updated and revised to reflect up-to-date engineering, science, and other information applicable to Iowa streams and rivers.

1.0 INTRODUCTION

Vegetative restoration refers here to the use of vegetation and natural materials to stabilize stream banks and riparian areas (e.g., buffers, etc.). Vegetative restoration provides a natural-looking stream bank while also reducing erosion, improving water quality, and enhancing wildlife habitat. Vegetative restoration provides an alternative to hard armoring and engineered, flexible revetment techniques that deflect energy; the presence of vegetation dissipates energy. Stream bank vegetation provides long-term stability; as the root systems grow they increase the strength and structure of the stream bank by creating a dense system of roots that resist erosion. A specific type of vegetative restoration called soil bioengineering involves the application of live plant material in a variety of arrangements, generally on a sloped surface, to provide engineered-stability function. The NRCS, National Engineering Handbook (NEH), Technical Supplement 14I, Streambank Soil Bioengineering, issued in August 2007 (NRCS 2007a), is an exhaustive resource for soil bioengineering techniques common in river restoration.

Vegetative restoration techniques can be relatively inexpensive and some techniques require little to no training to implement; this makes some types of vegetative restoration a good option for landowners. The State of Iowa recommends that property owners only consider undertaking the restoration of a stream bank themselves for heights of less than four feet and with slopes flatter than 6H:1V (IDNR 2006). Channel banks with a height of greater than four feet and steeper than 6H:1V are still candidates for vegetative restoration practices but require consultation with a professional.

Vegetative restoration success is largely affected by the plant species selection, timing of planting, handling, storage, installation procedure of the plant material, and their placement in the proper location relative to the stream (NRCS). The guidelines and specifications provided in this document are general and not a comprehensive design manual. It is the responsibility of the designer to understand the design approach and the feasibility of using these techniques on a case-by-case basis. The following criteria in no way replaces design discretion, experience, and training, and cannot incorporate every scenario. They are intended to flag common errors, promote empirically stable design ranges, assist designers and reviewers in communication, and adapt tested designs to Iowa conditions.

1.1 PLANT SELECTION

The use of plant species native to Iowa is required. Native plant species are adapted to the specific conditions found along Iowa rivers and their associated riparian areas; with the exception of annual crop covers, they offer the best chance for long-term growth, and correspondingly the stability and function of the riverine ecosystem. Non-native species can become invasive and threaten the diversity of species and vigor of native plants; their use can ultimately threaten stream bank stability and other riverine ecosystem functions. *The Iowa Riverside Plant Selection (rev. 12/15/2016)* guide should be consulted, along with other national

guides (NRCS, others, see References), to aid in plant species selection. Seedings will not include any species identified by the most up to date "Iowa Noxious Weeds" list (Iowa Code §317.1A, 2017) and/or those listed on the Corps "Excluded Species Plant List" found on the Rock Island District's regulatory branch homepage.

Each native riparian plant species has different characteristics that may make them better suited for a specific project, or elevation along a given channel bank, and plant selection and installation (planting) method should be determined to address the issues and goals present at a site. For example, willows with a deep, spreading root system may be better suited for a bank stabilization project when compared to a species with a shallow root system. When shade and reduced in-stream temperatures are a desired goal, a native riparian tree species may be more appropriate than native shrubs, grasses, and forbs. However, intermixing the stand with diversity that includes matting root species between deeper rooting plants can also reduce soil mobilization. All plants used on stream banks should be selected with attention to how much inundation (depth under water) they can withstand and for how long (duration) they can stand inundation (IDNR 2016). Local expertise and guidelines should be consulted when selecting the appropriate plant material.

When implementing vegetative restoration, success is dependent on vegetation survival and growth. Harvesting vegetation in areas near the project site where soil and hydrology are similar, or otherwise procuring vegetation adapted for the conditions at the project site, will improve chances of success. Specific species selection is dependent on the hydrology and soil of the project site and should be selected for each planting zone and condition (e.g., proximity to flow, slope, sun, shade, presence of trails, resistance to scouring flow, etc.) present (Iowa DNR 2016).

1.2 SITE PREPARATION

Site preparation is an important component of revegetation. Hard soil should be tilled to a depth of 4-6" and then be smoothed so there are no abrupt breaks in slope. The tops of slopes should be level and rounded over to avoid low spots where surface water runoff can concentrate and cause gullies to form. There should be no clumps of soil present on the surface.

Prior to planting the soil should be tested and evaluated to determine the need for amendment. Fertilizers containing phosphorus and nitrogen should be avoided in riparian areas. High nutrients concentration in streams and rivers are a threat to aquatic organisms. Soil amendments can include topsoil, lime to adjust soil pH, compost, and mycorrhizal spores. The use of any soil amendments should follow the manufacturer's recommendations.

1.3 VEGETATION CARE

Following the installation of vegetation, the site should be cared for until the plants are fully established.

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- Mulch – Most vegetation will require mulch to protect the plants from the weather and to retain moisture. Weed free straw mulch is the most common mulch for large, seeded areas. Individual plants may be mulched with wood chips, pine straw, etc.

- Water – Vegetation should be watered immediately after planting and at any time lack of rainfall threatens plant survival.

- Other protection – Vegetation should be protected against threats present at the site, such as animals browsing, ATV and vehicle traffic, foot traffic (human and animal), and weather (wind, flooding, temperature), etc.

- Inspection and maintenance – Vegetation should be inspected regularly for adequate growth, disease, pests, and other damage (e.g. – predation, vandalism, etc.). Maintenance consists of spraying for insects and diseases, weeding, watering, and installing covers, barriers, and/or supports.

1.4 PLANTING SCHEDULE

Scheduling a time to plant vegetation is dependent on a variety of local conditions. Per the NRCS (NRCS, 1998), planting should be geared for periods during which the plants will have adequate moisture for establishment, yet will not be subject to high flow events. If local conditions have created high runoff, then the planting window may be pushed back to the early summer. However, summer plantings should generally be avoided because of hot temperatures and dry conditions, leading to high desiccation rates and limited chances of success. Conversely, fall plantings are susceptible to frost heave and ice flows in winter which may rip out roots that are not yet established. Even when planting occurs at a proper time, a flash flood event may damage vegetation before it is fully established. Consequently, flexibility in planting schedule, inspection, and maintenance of vegetation is critical to successful revegetation.

1.5 SOIL BIOENGINEERING

Several techniques in this Practice Guide are soil bioengineering that require the use live cuttings. The choice of species, harvesting, storage, and preparation of these cuttings is critical to the success of these techniques.

1.5.1 Soil Bioengineering Plant Species

Most stream bank soil bioengineering techniques involve cuttings taken from woody plant species adapted to the riparian environment. These cuttings root easily when inserted into the soil, especially if the cuttings are taken and installed (planted) when the plant is dormant. When stems are placed in contact with soil, they sprout roots; when they are in contact with air, they sprout stems and leaves. Many of these species are hardy pioneer species, making them ideal for rapid establishment on a restoration site. Generally, willows (*Salix spp.*), dogwoods (*Cornus*

spp.), silver maple *(Acer sacc.)* and cottonwoods and poplars (*Populus spp.*) are suitable for soil bioengineering. Care should be exercised in selecting specific varieties of these plants; some root from cuttings more easily than others, and some do not root from cuttings at all.

Some of the benefits of using cuttings versus rooted stock include lower cost, ease of planting, shallower depth of planting, and a wide range of local ecotype availability.

1.5.2 Harvesting

Cuttings can be harvested (collected) any time during the dormant season, from "leaf-off" in autumn to just before the emergence of the buds in early spring. Iowa Department of Transportation (Iowa DOT) requires material may be harvested between November 15 and January 1 (Iowa DOT 2014). Some sources advise that cuttings can be collected during the growing season, but caution that all leaves must be removed from the stem prior to planting, and establishment and success will be lower (NRCS 1998).

Material to be harvested should be healthy and free of splits, rot, and insect infestation and should generally vary between 5 to 8 feet in length. The equipment should be sharp enough to make clean cuts. When harvesting in a dry area, collect material at least two years old; younger plants do not have enough stored energy for thorough root establishment. Cuttings from live material should leave at least one third of the parent plant intact, and be made from an appropriate part of the plant so that it is not damaged. For example, cutting the top off (coppicing) of certain trees will cause them to become more shrub-like than tree-like, and should be avoided.

Cuttings, and even prepared stakes, fascines, etc., can be obtained commercially. Care should be taken to ensure the procured plant species is appropriate for the site.

1.5.3 Storage and Handling

Typically, harvested live cuttings must be bundled, transported, and stored before use. After cutting, the materials are bundled and loosely bound with twine for transportation. If the materials require transportation in a motor vehicle, the material should be sheltered in a closed compartment or under a secured cover or tarp so it will not dry out.

Live cuttings should ideally be soaked in water before use; an optimal soaking duration is 14 days (NRCS 2007a). Alternatively, material can be planted the same day they are harvested if they are watered.

If cuttings are not installed at the time of harvest they should be stored at a dry location. Iowa DOT specifies cuttings be stored below 41° F and above 90% humidity and requires the use of a thermometer and hygrometer to verify these conditions. If stored outside in these conditions or refrigerated, live hardwood cuttings can last up to four months. The cuttings must be soaked and rehydrated before use.

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If storage conditions are damp or wet, it is important to monitor the cuttings for root development. The root process may start after 10 days; it can be difficult to use cuttings with these initial roots because they are typically very tender and difficult to handle and install without damaging them.

1.5.4 Preparation

Preparation of the dormant live cuttings is generally the same, regardless of method of installation. The side branches of the cuttings are removed with a minimum of two undamaged bud tips left intact (Iowa DOT 2014). Cuttings of the specified diameter are cut to length. Some methods require blunt cuts, others require angled cuts, and some techniques leave the growing tip uncut. These specifications are presented with each technique in this Practice Guide. All cuts should be smooth, leaving no splits or cracks.

1.5.5 Installation

Once prepared the plant materials should be protected from drying and overheating until it is installed. The prepared materials can be stored in water or moist soil (healed in) for a maximum of 2 days. Outside storage locations should be continually shaded and protected from the wind. If the ambient temperature is 50°F or greater, the dormant plant material shall not be stored on site, but installed the day it is removed from refrigeration and prepared. If the plant material is harvested on-site in warmer than 50-degree conditions, the plant material shall be installed the same day.

2.0 VEGETATIVE RESTORATION TECHNIQUES

2.1 LIVE STAKING/JOINT PLANTING

2.1.1 Narrative Description

Live staking and joint planting involves the insertion of prepared cuttings (live stakes) from dormant woody plants (trees and/or shrubs) into the ground so they root and grow. Joint planting is a common variation of live staking; the live stakes are inserted through openings of revetments (e.g., rip rap) and then into the soil underneath them.

Live stakes do not provide much initial reinforcement of the soil because they do not normally extend beyond a slope failure plane. Over time however, the stakes take root and the roots help bind the soil together. The above-ground growth provides surface protection which can prevent surface erosion (e.g., rills, gullies). The growth also adds roughness to the stream bank, reducing the velocity of stream flow. Live stakes, alone or as joint plantings, are useful on wet slopes because they absorb water from the soil, control internal seepage, and allow the slope to dry out and stabilize. Live stakes and joint plantings assist in quickly reestablishing riparian vegetation (NRCS 2007a). Joint planting provides a more natural appearance to stream banks stabilized with rip rap and other flexible and hard revetments.

Installing live stakes on an existing slope, as well as joint planting through existing rip rap, can be undertaken by landowners. Often however, a lack of vegetation on stream banks is due to unstable conditions; analysis and design by a professional may be required to stabilize the stream bank and reestablish vegetation.

2.1.2 Technique Information

- **Use:** Live staking and joint planting is used to quickly establish roots (below ground) and plant growth (above ground) along a stream bank. This helps reduce surface erosion, slow flow velocity by adding surface roughness, reinforce the soil, and reduce soil moisture and seepage.

- **Other uses:** The growth of the stake can improve aesthetics, riparian habitat, and water quality. The roots of woody plants provide a means of uptake of excess nutrients (especially nitrogen) in storm water runoff. The above-ground growth can shade the stream and reduce water temperatures. During high flows, the vegetation can provide refuge for fish and other aquatic living organisms. Live stakes can also be used to repair shallow soil slips, slumps, and gullies.

- **Best applications:**

    - Sites with adequate supply of woody plant species suitable for cuttings

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    - Bare areas on existing stable slopes and stream banks, or slopes and banks recently graded to a stable angle (e.g., as part of a stream restoration project)

- **Variations:**

    - Combining live staking with other measures capable of providing initial stability (e.g., cover crop, erosion control matting, rip rap, other revetments). Joint planting is a common variation of live staking.

    - Using large (length and diameter cuttings). Live posts, dormant post planting, willow posts, etc. all generally refer to live staking and/or joint planting with a large (3-8" diameter, 3-20' long) dormant live cutting (NRCS 2007a). Bigger diameters and longer lengths are best suited for heavily eroded areas and varying water levels. They can provide more initial stabilization than live stakes if they extend beyond a slope failure plane.

- **Computations:** Computations are generally not necessary for landowners using live staking and/or joint planting to revegetate bare areas on otherwise stable stream banks. For stream restoration projects, live staking and joint planting require design by a professional.

  Hydrologic and hydraulic computations aid in verifying that the appropriate conditions exist for use of live staking or joint planting. Geometric calculations are required to properly size and situate the vegetative structure within the context of its individual location. Hydraulic analysis is required to determine where to place live stakes on the slope, how the above-ground growth will distribute energy at various flow stages, and to verify that the velocities and shear stresses generated by streamflow do not exceed the permissible velocity and tensile strength of the vegetative structure.

  Live stake properties: Depending on length of prepared cuttings and soil condition, live staking is cited in NRCS 2007a as having an initial permissible velocity of 1-2.5 ft/s; permissible velocity increases to 3-10 ft/s once vegetation is established. NRCS also cites initial permissible shear stress of 0.5-2 lbs/ft^2; permissible shear stress increases to 2 lbs/ft^2 to over 5 lbs/ft^2 once vegetation is established.

  Joint planting properties: Joint planting is cited in NRCS 2007a as having an initial permissible velocity of 5 ft/s to over 10 ft/s; permissible velocity increases to over 12 ft/s once vegetation is established. NRCS also cites initial permissible shear stress of over 3 lbs/ft^2; permissible shear stress increases to over 8 lbs/ft^2 once vegetation is established.

- **Key Feature:** Live staking and joint planting require the use of woody riparian plant species that root easily from dormant live cuttings.

- **Cautions:**
  - Planting vegetation adjacent to streams can adversely impact the local hydraulics, sometimes deflecting currents, catching debris and causing blockages, or increasing roughness and causing increases in flood stage.
  - Vegetation alone will likely be unsuccessful on steep bank slopes without sufficient shaping. No more than 50% Sycamore, river birch and dogwood in any single area.

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2.1.3 Detail Drawings and Data Table

The following drawings and data table depict information that should be included in construction plans for live staking and joint planting. The data table includes design guidelines and sources, where applicable.

Table 1. Required Design Data for Live Staking/Joint Planting[1]

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
A	Live stake spacing	Feet	2-4' (NRCS 2007a)	Spacing between individually installed live stakes. Stakes can be placed in a triangular grid (NRCS 2007a) or randomly (NRCS 2007a, Iowa DNR 2006). Recommend species diversity throughout project area.
B	Live stake – top of slope placement	Feet	N/A	Position of live stake relative to the top of a slope
C	Live stake – toe of slope placement	Feet	N/A	Position of live stake relative to the toe of a slope
D	Live stake – base flow relationship	Feet	N/A	Placement of lower row of live stakes relative to the approximate base flow water level with consideration given to duration of inundation during bankfull and other high flow events.
E	Live stake length	Feet	3' (Iowa DNR 2006); 3-10' (NRCS 2007a)	Length of prepared dormant live cutting from woody plant to be used

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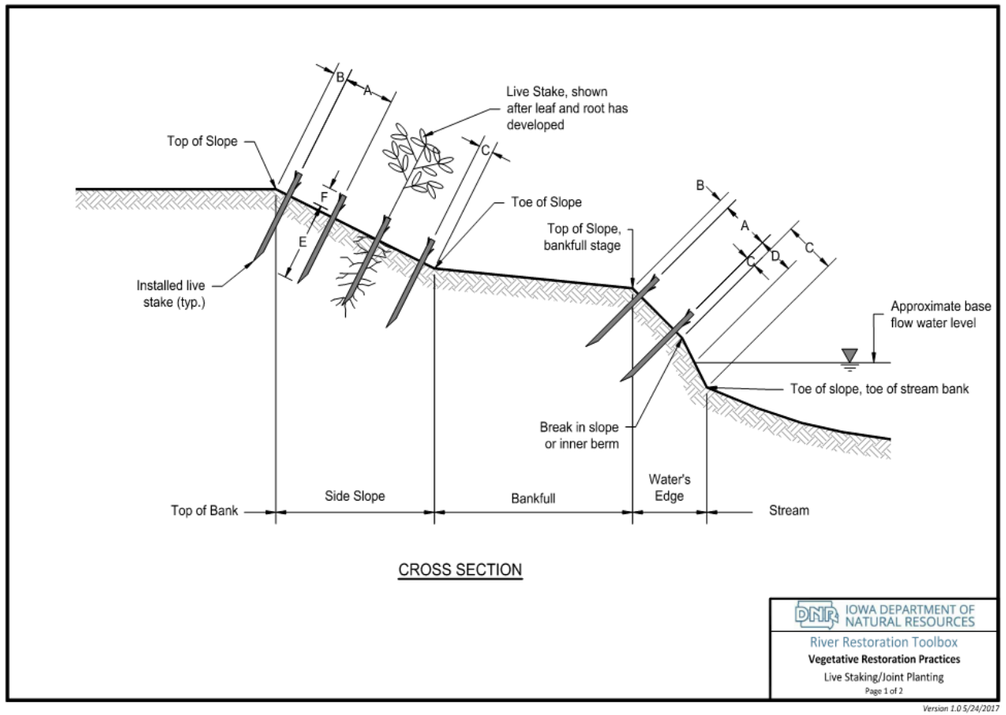
Table 1. Required Design Data for Live Staking/Joint Planting[1]

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
				as live stake. Length should be sufficient to reach low-flow water table elevation.
F	Live stake protrusion	Feet	1/5 x live stake length (Iowa DNR 2006); taller than surrounding vegetation (NRCS 2007a)	Distance installed live stake should protrude about 20% from the ground. At least two buds or bud scars should be present above the ground in the final installation, depending on the surrounding vegetation height.
G	Live stake diameter	Inches	1/2 – 2" (Iowa DNR 2006); ¾-3" (NRCS 2007a)	Diameter of prepared dormant live cutting from woody plant to be used as live stake – typically cite a permissible minimum and maximum diameter.

Notes:

1. Data are for live staking in bare soil, in soil covered with erosion control matting, and/or in soil covered with rip rap or other revetment (joint planting).
2. Dimension labels are referenced in the detail drawings.
3. Common guidance, values, or ranges are given unless they require computation using site-specific input.

Drawing 1. Live Staking/Joint Planting



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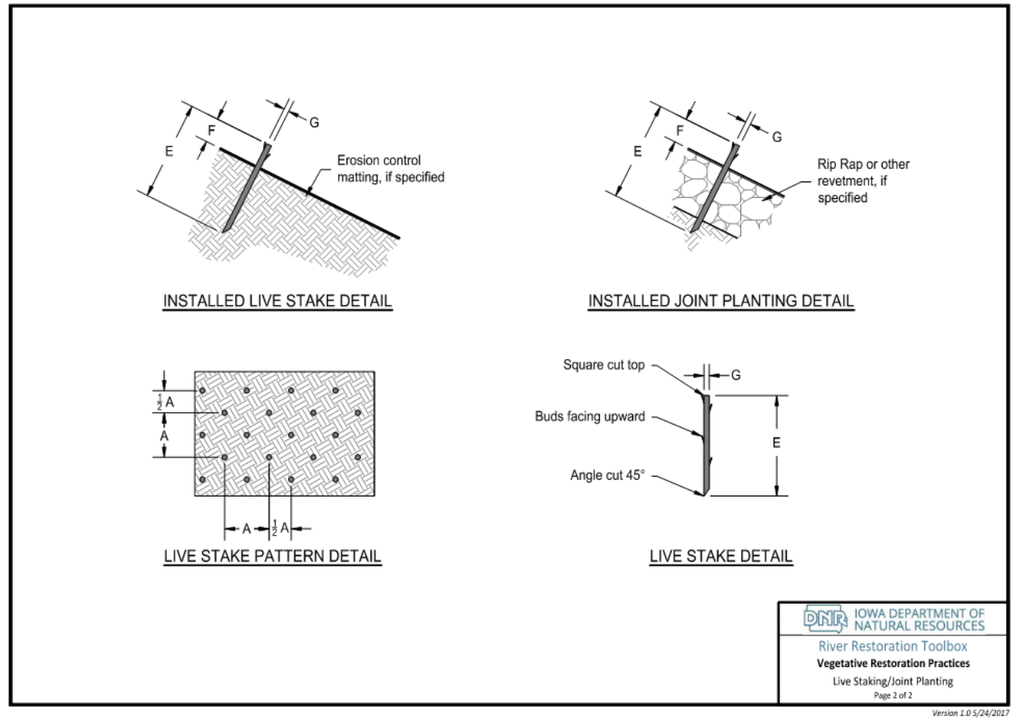

2.1.4 Specifications

In addition to the information presented in Section 1.0 Introduction, the following information should be developed into specifications to accompany the use of live staking and joint planting:

- Materials:
    - Prepared live stakes of acceptable species and size.
    - Fertilizers and/or other soil amendments as required based on site conditions.
- Equipment/Tools:
    - Rubber mallet or dead blow hammer
    - Hand pruners, loppers, hand saw, and/or chain saw
    - Punch bar or hand auger used to create pilot holes
    - Stinger (hydraulic injector to create pilot hole)
    - Metal cap (if using the post planting variation these can be used to push in the larger diameter cuttings)
    - Excavator (if using the post planting variation these can be used to push in the larger diameter cuttings)
- Sequence:
    - Cleanly remove all side branches and the top growth, and fashion the cuttings into live stakes as depicted in the detail drawing. An option during preparation is to paint and seal the top of the live stake by dipping the top 1-2 inches into a 50-50 mix of light colored latex paint and water. Sealing the top of stake will reduce the possibility of desiccation, assure the stakes are planted with the top up, and makes the stakes more visible for subsequent planting evaluations.
    - Use a punch bar or hand auger to create a narrow pilot hole, perpendicular to the slope, through any erosion control matting, rip rap, or other revetment, filter fabric, etc., if present, and deep enough to intercept the water table. The hole should be only as large as necessary to install the live stake without damage while ensuring the highest amount of stake-soil contact.
    - Insert the pointed end of the live stake into the pilot hole. Tamp into the ground with a dead blow hammer taking care not to split or otherwise damage the live

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stake. Use water, soil backfill, tamping, etc. to achieve good soil-to-stem contact and remove air pockets.

- Workmanship:
    - All cuts should be clean and smooth.
    - No cracked or split live stakes should be used. If they split during tamping, they should be replaced.
    - The specified number of live stakes should be installed into the soil and protrude above the soil and any erosion control matting, rip rap, or other revetment.
    - The live stake should not move after installation; ensuring it is in firm contact with the soil.
    - It is important to ensure that the upstream and downstream ends of the live staking and joint planting merge smoothly into the undisturbed bank beyond the project area. The rate of installing live stakes and joint plantings should taper off gradually to blend in with the existing vegetation.
- Maintenance: Cuttings may require initial protection from beaver, deer, cattle, or other predators. Various types of deer-proof fencing or fine wire screen or mesh can be secured around the cuttings to offer protection. If the area is grazed, restrict livestock from the project site.

2.1.5 Photographs

Photo 1. Dormant live cuttings prepared as live stakes. Source: Bio Draw-a product of Salix Applied Earth Care

Photo 2. Installed live stakes prior to trimming. Source: Bio Draw-a product of Salix Applied Earth Care, 1996

Photo 3. Live stake test plots. Source: Charlotte-Mecklenburg Storm Water Services

Photo 4. On-site live cutting refrigeration. Source: Charlotte-Mecklenburg Storm Water Services

Photo 5. Hydraulic stinger live stake installation. Source: Lake Superior Tree Farm

Photo 6. Live stakes in bankfull flow. Source: Charlotte-Mecklenburg Storm Water Services

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Photo 7. Joint planting. Source: Charlotte-Mecklenburg Storm Water Services

Photo 8. Joint planting with new growth. Source: Charlotte-Mecklenburg Storm Water Services

Photo 9. Joint planted rip rap. Source: Charlotte-Mecklenburg Storm Water Services

Photo 10. Prepared live stakes. Source: Lake Superior Tree Farm

Photo 11. Live stakes in erosion control matting. Source: Collins & Baker Engineering

Photo 12. Live stakes installed in late autumn on Dead River, MI. Source: Collins & Baker Engineering

2.2 LIVE FASCINES

2.2.1 Narrative Description

A live fascine is a long bundle of live cuttings tied together and then installed into a shallow trench on the stream bank to reduce erosion and stabilize the soil. They can be placed along the toe of the stream bank, as toe protection, or elsewhere on the bank along the contours or at angles.

Live fascines provide immediate protection against surface erosion of the stream toe or bank. Their placement along the stream bank contour can break a long slope into a series of shorter slopes, thus slowing overland flow. Fascine placement on an angle can capture and direct drainage advantageously down a slope. Fascines may even provide immediate protection against shallow slope failures if the stakes fastening them into the trench extend past a failure plane.

Over the long-term, the cuttings comprising the fascine root and grow. The above-ground growth provides surface protection which continues to prevent surface erosion (e.g., rills, gullies). The growth also adds roughness to the stream bank, reducing the velocity of stream flow. The roots bind soil particles together and reinforce the soil mantle (NRCS 2007a).

Installing live fascines on an existing slope can be undertaken by landowners. Often however, a lack of vegetation on stream banks is due to unstable conditions; analysis and design by a professional may be required to stabilize the stream bank and reestablish vegetation.

2.2.2 Technique Information

- **Use:** Live fascines protect the stream bank toe and stream bank slopes from shallow slides, seepage, and surface erosion, and re-establishes native vegetation.

- **Other uses:** In addition to short- and long-term erosion control and slope stability, live fascines will mature into streamside vegetation and provide numerous other benefits including improved aesthetics, riparian habitat, and water quality. For example, fascine growth increases the amount and quality of riparian habitat for birds, mammals, and other terrestrial animals by providing food and cover, and improves in-stream habitat and water quality for fish and other aquatic organisms through reducing water temperatures by providing shade. During high flows, the vegetation also provides refuge to fish and other aquatic organism from high velocities.

- **Best applications:**

    - Sites with a large supply of long live cuttings

    - Recently graded slopes (e.g., as part of a stream restoration project)

    - The toe of a stream bank requiring protection from high velocity and/or shear stress.

    - To control overland flow by breaking up long banks into a series of shorter banks

- **Variations:**

    - Substituting live stakes for one or both dead stout stakes fastening the fascine into the trench

    - Combining a live fascine with another type of toe protection such as rip rap

    - Lining the trench and slope with erosion control matting and staking the fascine into the trench on top of the matting.

    - Orienting fascines vertically, up the stream bank. Called the vertical bundle method, the fascines are assembled with the basal ends of the cutting all on one end and placed in the water.

- **Computations:** Computations are generally not necessary for landowners using live fascines to revegetate bare areas on otherwise stable stream banks. However, planting vegetation adjacent to streams can adversely impact the local hydraulics, sometimes deflecting currents adversely, catching debris and causing blockages, or increasing roughness and causing increases in flood stage.

For stream restoration projects, live fascines require design by a professional.

Hydrologic and hydraulic computations aid in verifying that the appropriate conditions exist for use of live fascines. Geometric calculations are required to properly size and situate the vegetative structure within the context of its individual location. Hydraulic analysis is required to determine where to place live fascines on the slope, how the above-ground growth will distribute energy at various flow stages, and to verify that the velocities and shear stresses generated by streamflow do not exceed the permissible velocity and tensile strength of the vegetative structure.

Live fascine properties: Depending on adequate anchoring, live fascine is cited in NRCS 2007a as having an initial permissible velocity of 5-8 ft/s; permissible velocity increases to 8 ft/s to over 10 ft/s once vegetation is established. NRCS also cites initial permissible shear stress of 1.2 – 3.1 lbs/ft^2; permissible shear stress increases to 1.4 lbs/ft^2 to over 3 lbs/ft^2 once vegetation is established.

- **Key Features:**
    - Live fascines require the use of woody riparian plant species that root easily from dormant live cuttings.
    - Dormant live cuttings are assembled into bundles and bound together with biodegradable twine
    - Fascines are placed along contours (horizontally), on angles, and in a variation vertically.
- **Cautions:**
    - Planting vegetation adjacent to streams can adversely impact the local hydraulics, sometimes deflecting currents, catching debris and causing blockages, or increasing roughness and causing increases in flood stage.
    - Vegetation alone will likely be unsuccessful on steep bank slopes without sufficient shaping.

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2.2.3 Detail Drawings and Data Table

The following drawings and data table depict information that should be included in construction plans for live fascine. The data table includes design guidelines and sources, where applicable.

Table 2. Required Design Data for Live Fascine[1]

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
A	Fascine spacing	Feet	3-10' depending on slope (NRCS 2007a)	Spacing between installed live fascines. Spacing varies based on slope (NRCS 2007a). Recommend species diversity throughout project area.
B	Upper fascine - slope limit	Feet	N/A	Placement of upper installed live fascine relative to the top of a slope.
C	Lower fascine - slope limit	Feet	N/A	Placement of lower installed fascine relative to the toe of a slope.
D	Lower fascine – base flow limit	Feet	N/A	Placement of lower installed fascine relative to the approximate base flow water level with consideration given to duration of inundation during bankfull and other high flow events.
E	Fascine length	Feet	8' – 10' (NRCS 2007a)	Length of assembled fascine.
F	Live cutting length	Feet	5' – 15' (NRCS 2007a)	Length of dormant live cutting from woody plant to be assembled into a

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Table 2. Required Design Data for Live Fascine[1]

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
				fascine. Length should be sufficient to reach low-flow water table elevation.
G	Live cutting diameter	Inches	3/4" – 2" (NRCS 2007a)	Diameter of dormant live cutting from woody plant to be assembled into a fascine – typically cite a permissible minimum and maximum diameter
H	Fascine twine fastening spacing	Feet	2' (NRCS 2007a)	Spacing between twine fastening used to hold the assembled fascine together
I	Fascine diameter	Feet	0.5' – 2' (NRCS 2007a)	Diameter of assembled fascine
J1	Trench depth	Feet	½ fascine diameter – ¾ diameter (NRCS 2007a)	Depth of trench into which the assembled fascine is installed. Trenches should be excavated as deep as practicable to facilitate the maximum amount of soil/live cutting contact.
J2	Trench width	Feet	Fascine diameter	Width of trench into which the fascine is installed should be approximately equal to the diameter of the fascine to facilitate good soil/cutting contact

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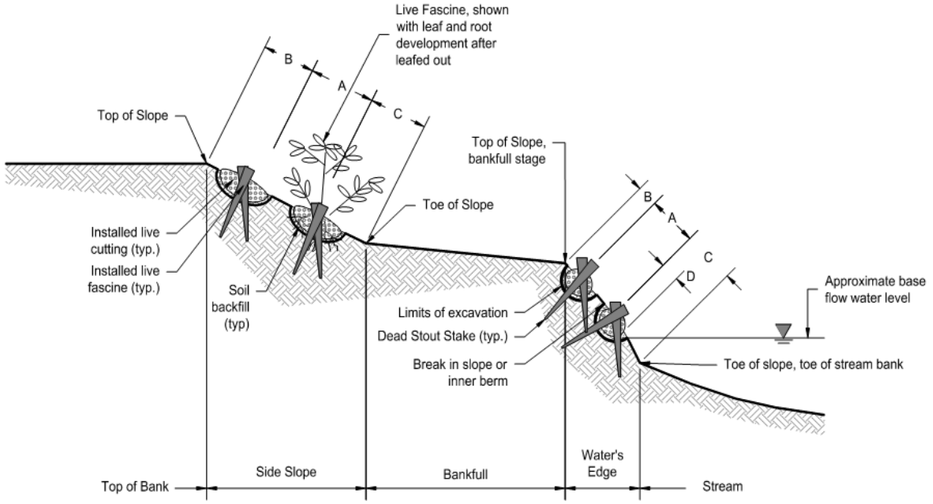
Table 2. Required Design Data for Live Fascine[1]

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
K	Dead stout stake spacing	Feet	3' (NRCS 2007a)	Spacing of wooden, wedge-shaped stakes used to fasten the assembled fascine into the trench
L	Dead stout stake length	Feet	2' – 3' (NRCS 2007a)	Length of wooden, wedge-shaped stakes used to fasten the assembled fascine into the trench
M	Fascine angle (optional)	Degrees	30° - 60° (NRCS 2007a)	Angle of assembled fascine installation. On upper banks adjacent to a stream and along outside meanders, it may be useful to align the fascines at an angle to reduce the likelihood of scour and rill erosion around installed bundles.

Notes:

1. Data are for live fascines in bare soil and in soil covered with erosion control matting.
2. Dimension labels are referenced in the detail drawings.
3. Common guidance, values, or ranges are given unless they require computation using site-specific input.

Drawing 2. Live Fascine



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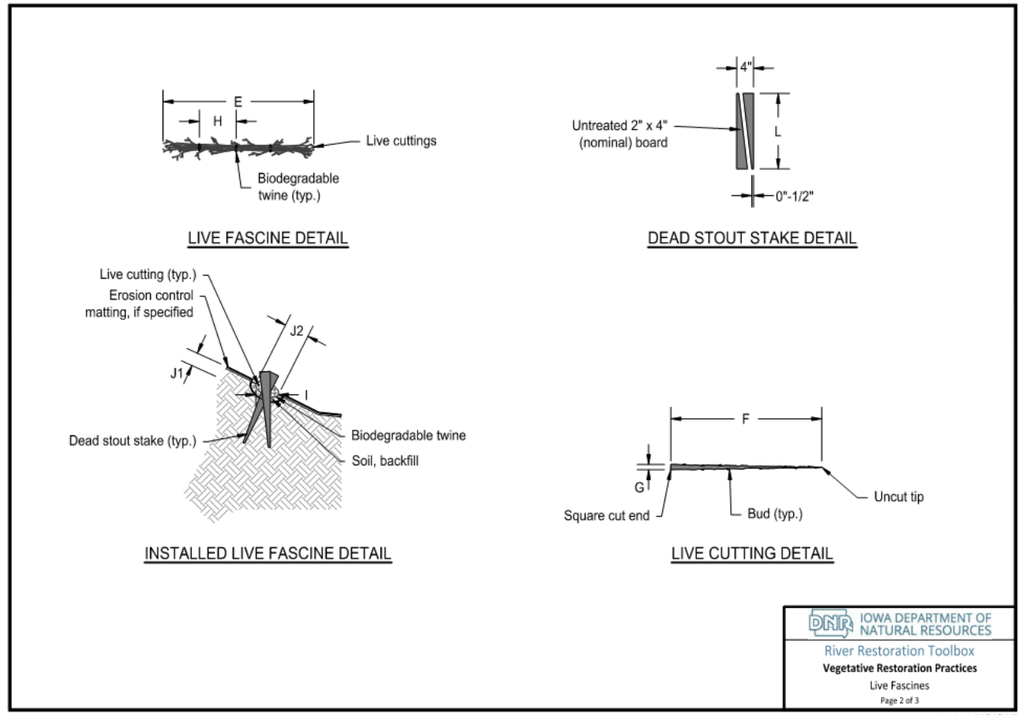

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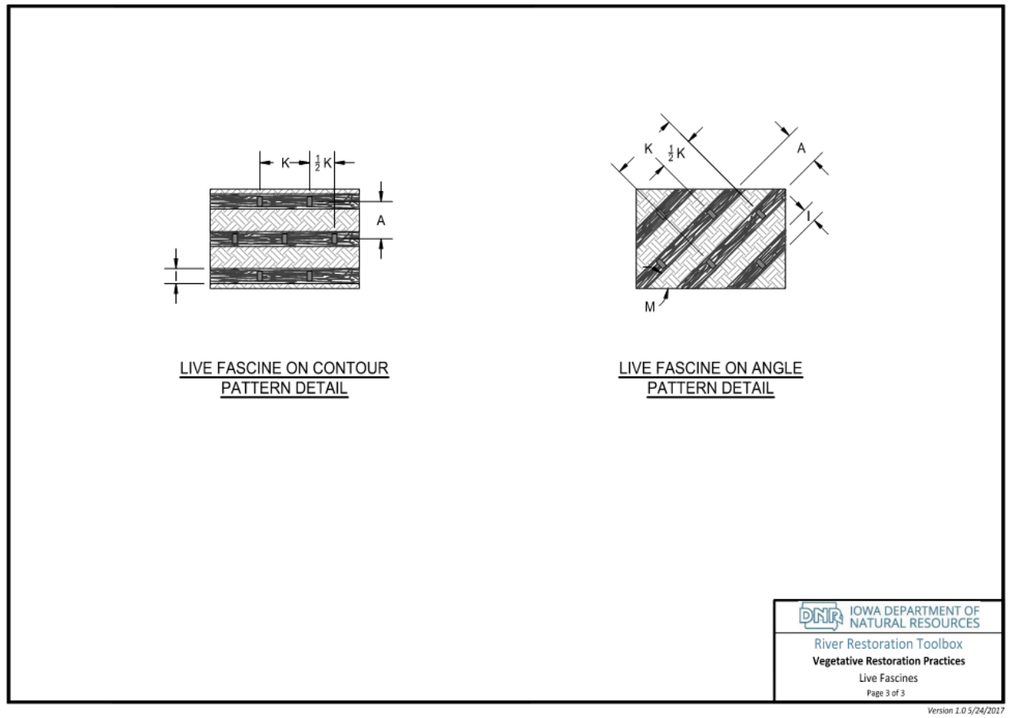

2.2.4 Specifications

In addition to the information presented in Section 1.0 Introduction, the following information should be developed into specifications to accompany the use of live fascines:

- Materials:
    - Dormant live cuttings of acceptable species and size. Cuttings should be straight, long, and slender branches. Dead branches may be combined into the bundle if they are not brittle.
    - Dead stout stakes - Wooden 2" x 4" boards, cut on a diagonal, to firmly anchor the bundle into the trench. As a variation, live stakes can be used in combination with dead stout stakes to help secure the live fascines
    - Biodegradable twine
    - Fertilizers and/or other soil amendments as required based on site conditions.
- Equipment/Tools:
    - While the installation of live fascines is typically accomplished by handwork, a small backhoe may be used to dig the required trenches, depending upon the size and scale of the project and the required dimeter of the live fascine.
    - Scissors, machete, hand pruners, loppers, hand saw, or other cutting tools
    - Round tip shovel
    - Hammer and/or sledge hammer
- Sequence:
    - Prepare fascines:
        - Leave side branches intact. Stagger the live cuttings in a uniform bundle built to a diameter specified. Vary the orientation of the cuttings. 8- to 10-foot-long bundles can be prepared for ease of moving from the preparation area to the installation site. They can be spliced together to create a fascine long enough to fit the project site.
        - In the vertical bundle variation of a live fascine the cuttings are oriented in one direction so the cut ends can be placed in the water.
        - Tie bundles with twine at specified intervals.

- Toe protection installation:
  - For toe protection on contour:
    - Start installation from a stable point at the upstream end of the unstable stream bank toe.
    - Excavate a trench at the toe of bank.
    - Align the fascine along the toe of the bank and place it into the trench.
    - Fasten the fascine into the trench with dead stout stakes pushed directly through the bundle at the spacing specified. Allow the stake to protrude 2 inches above the top of the bundle. A variation to improve depth of reinforcement and rooting, involves installing live stakes just below (downslope) and in between the previously installed dead stout stakes, leaving approximately 3 feet protruding from the finished ground.
    - Cover the fascine with soil, ensuring good soil-to-stem contact. Wash it with water to get soil around the inner stems of the bundle. Some of the bundle should remain exposed to sunlight to promote sprouting.
    - When using erosion control matting between the fascine bundles, the matting is first placed in the bottom of the trench, an inch of soil is placed on top and up the sides of the trench and erosion control matting, and the fascine bundle is then placed in the trench and staked down (NRCS 2007a).
  - For toe protection with vertical bundles: Fascines can be oriented perpendicular to the stream bank contours with the cut ends in the water. This practice is often called the "vertical bundle method."
- Slope protection installation:
    - Start installation at the toe of the bank and proceeds towards the top of bank.
    - Remove loose, failed, or failing soil from surface of the bank and smooth.

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- Align the fascine along the contour for dry banks. Place the fascine bundle at angle specified along wet slopes to facilitate (capture and direct) drainage.
- Excavate a trench to the width and depth specified.
- Place the bundle in the trench and fasten with dead stout stakes. Install dead stout stakes directly through the bundle at the specified spacing. The top of the stakes should protrude 2 inches above the top of the bundle. A variation to improve depth of reinforcement and rooting involves installing live stakes just below (downslope) and in between the previously installed dead stout stakes, leaving approximately 3 feet protruding from the finished ground.
- Cover the fascine with soil, ensuring good soil-to-stem contact. Wash it with water to get soil around the inner stems of the bundle. Some of the bundle should remain exposed to sunlight to promote sprouting.
- When using erosion control matting between the fascine bundles, the matting is first placed in the bottom of the trench, an inch of soil is placed on top and up the sides of the trench and erosion control matting, and the fascine bundle is then placed in the trench and staked down (NRCS 2007a).

- Workmanship:
  - All cuts should be clean and smooth.
  - No cracked or split live stakes should be used.
  - The fascines and/or dead stout stakes should not protrude from the banks to a degree such that they reduce the cross-sectional area of the stream.
  - Some of the fascine should be exposed to sunlight to promote sprouting.
  - It is important to ensure that the upstream and downstream ends of the live fascine installed tie-in smoothly into the undisturbed bank outside of the project area.
- Equipment:
  - Sledge hammer or a rubber mallet or dead blow hammer if lives stakes are used as anchors.

- Hand pruners, loppers, hand saw, and/or chain saw
- Shovel

- Maintenance: Fascine growth may require protection from beaver, deer, cattle, or other predators. Various types of deer-proof fencing or fine wire screen or mesh can be secured around the cuttings to offer protection. If the area is grazed, restrict livestock from the project site.

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2.2.5 Photographs

Photo 13. Prepared fascines. Source: Unknown

Photo 14. Prepared fascine. Source: Unknown

Photo 15. Cuttings stored in water before made into fascines. Source: Charlotte-Mecklenburg Storm Water Services

Photo 16. Fascines placed at angles and on contours. Source: Charlotte-Mecklenburg Storm Water Services

Photo 17. Fascines with new growth. Source: Charlotte-Mecklenburg Storm Water Services

Photo 18. Installed fascine. Source: Stantec

2.3 BRUSH LAYERING

2.3.1 Narrative Description

Brush layering is a soil bioengineering technique that consists of alternating layers of dormant live cuttings (brush) and soil, and can be used to rebuild or to stabilize a stream bank. The brush provides internal slope stabilization to counter shallow soil slides and frictional resistance to shear stress generated by water flowing against the slope like conventional geotextile slope reinforcement products and erosion control matting. Brush layering provides short-term protection against surface erosion and slope failure; in the long-term, roots grow along the stems of the material and help bind the soil together. In addition, the protruding cuttings reduce the lengths of long slopes, helping to reduce erosion due to surface runoff. Furthermore, the brush layers act as horizontal slope drains, helping to stabilize saturated slopes.

Brush layering on an existing slope can be undertaken by landowners. Often however, a lack of vegetation on stream banks is due to unstable conditions; analysis and design by a professional may be required to stabilize the stream bank and reestablish vegetation.

2.3.2 Technique Information

- **Use:** Brush layering protects slopes from shallow slides and surface erosion, and re-establishes native vegetation.
- **Other uses:** In addition to short- and long-term erosion control and slope stability, brush layering will mature into streamside vegetation and provides numerous other benefits. For example, the vegetative growth from brush layering increases the amount and quality of riparian habitat for birds, mammals, and other terrestrial animals by providing food and cover, and improves in-stream habitat and water quality for fish and other aquatic organisms through reducing water temperatures by providing shade. The roots of woody plants also aid with the uptake of excess nutrients in storm water runoff, especially nitrogen. During high flows, the vegetation also provides fish and other aquatic organisms with refuge from high velocities.
- **Best applications:**
    - Brush layering requires large amounts of live cuttings and is best undertaken at sites with an adequate supply of suitable species for on-site harvesting.
    - Brush layering is limited to shallow bank slope excavations and should be constructed on a stable foundation (NRCS 2007a); toe protection may be required at a brush layering site.
    - Bare areas on stable slopes.

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- **Variations:**
    - A variation of brush layering is branch packing. Branch packing adds a matrix of vertical posts in the brush layers. Branch packing is typically used to repair small, scoured-out stream banks and slope failures only.
    - Brush layers separated by geotextile-wrapped soil lifts is called vegetated geogrid. Vegetated geogrids are suitable in high shear stress, outside bend, steep stream banks.
- **Computations:** Computations are generally not necessary for landowners using brush layering to revegetate bare areas on otherwise stable stream banks. However, planting vegetation adjacent to streams can adversely impact the local hydraulics, sometimes deflecting currents adversely, catching debris and causing blockages, or increasing roughness and causing increases in flood stage.

  For stream restoration projects, brush layering requires design by a professional.

  Hydrologic and hydraulic computations aid in verifying that the appropriate conditions exist for use of brush layering. Geometric calculations are required to properly size and situate the vegetative structure within the context of its individual location. Hydraulic analysis is required to determine where to place brush layering on the slope, how the above-ground growth will distribute energy at various flow stages, and to verify that the velocities and shear stresses generated by streamflow do not exceed the permissible velocity and tensile strength of the vegetative structure.

  Brush layering properties: Depending on adequate anchoring, brush layering is cited in NRCS 2007a as having an initial permissible velocity of 2-4 ft/s; permissible velocity increases to over 10 ft/s once vegetation is established. NRCS also cites initial permissible shear stress of 0.2 – 1 lbs/ft^2; permissible shear stress increases to 2.6 lbs/ft^2 to over 6 lbs/ft^2 once vegetation is established.
- **Key Features:**
    - Brush layering requires the use of woody riparian plant species that root easily from dormant live cuttings.
    - Dormant live cuttings are layered in a crisscross pattern in three courses on one or more benches excavated in the stream bank.
- **Cautions:**
    - Planting vegetation adjacent to streams can adversely impact the local hydraulics, sometimes deflecting currents, catching debris and causing blockages, or increasing roughness and causing increases in flood stage.

- Vegetation alone will likely be unsuccessful on steep bank slopes without sufficient shaping.

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2.3.3 Detail Drawings and Data Table

The following drawings and data table depict information that should be included in construction plans for brush layering. The data table includes design guidelines and sources, where applicable.

Table 3. Required Design Data for Brush Layering[1]

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
A	Brush layer course spacing	Inches	3-5" (NRCS 2007a)	Amount of soil between each of three courses of brush and live cuttings that form the brush layer
B	Brush layer – top of slope placement	Feet, inches	--	Position of brush layer bench relative to the top of a slope.
C	Brush layer – toe of slope placement	Feet, inches	--	Placement of brush layer bench relative to the toe of a slope.
D	Brush layer – base flow relationship	Feet, inches	--	Position of brush layer bench relative to the approximate base flow water level with consideration given to duration of inundation during bankfull and other high flow events.
E	Bench excavation width	Feet	2-3' (NRCS 2007a)	Width of excavation of bench onto which the layers of brush and live cuttings and soil will be layered. Square-cut end (not the uncut growing tip) of the live cuttings should touch the back of the excavation.

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Table 3. Required Design Data for Brush Layering[1]

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
F	Brush and live cutting diameter	Inches	3/4" – 3" (NRCS 2007a)	Diameter of brush and live cutting from woody plant to be used in brush layer – typically cite a permissible minimum and maximum diameter
G	Brush and live cutting length	Feet	3' – 6' (NRCS 2007a)	Length of brush and live cutting from woody plant to be used in brush layering
H	Brush and live cutting protrusion	Inches	6" – 18" (NRCS 2007a)	Distance installed brush and live cuttings should protrude from the slope.
I	Brush and live cutting density	Branches per linear foot	15-45 branches per foot (NRCS 2007a)	Install the brush layer in three courses with the first layer oriented to the right, the second layer oriented to the left, and the third layer pointing straight out of the slope. The finished brush layer has 15-45 branches per linear foot; 5-15 should be live cuttings.
J	Bench excavation slope	Degrees	15-25° (NRCS 2007a)	Slope of bench excavation down from the front outer edge to the back of the excavation.

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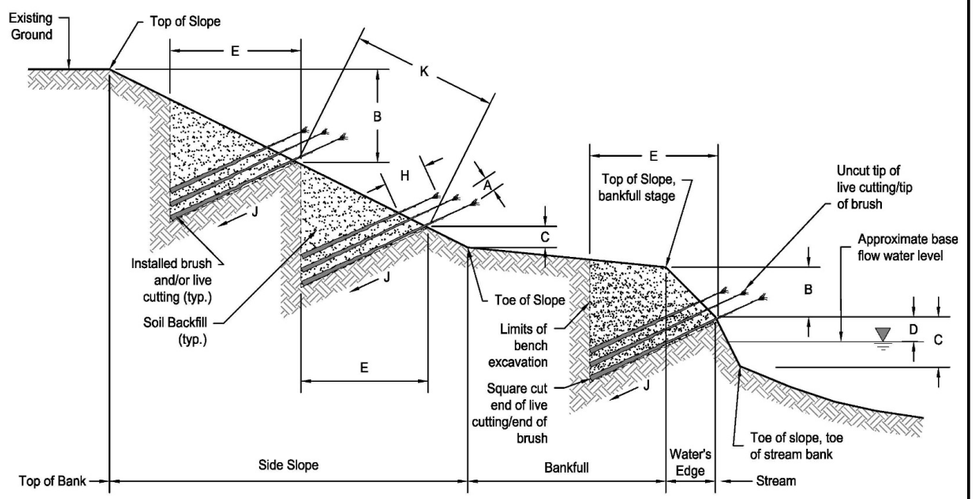
Table 3. Required Design Data for Brush Layering[1]

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
K	Bench spacing	Feet	3-5' (NRCS 2007a)	Bench spacing is the distance between benches on which the brush is layered. Bench spacing varies based on slope and whether soil conditions are wet or dry.

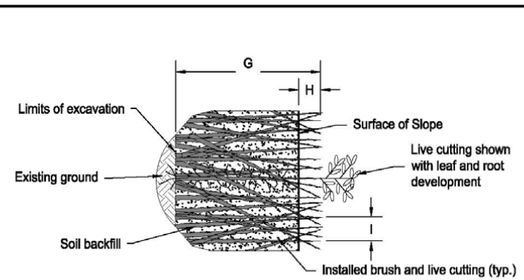
Notes:

1. Data are for brush layering in bare soil.
2. Dimension labels are referenced in the detail drawings.
3. Common guidance, values, or ranges are given unless they require computation using site-specific input.

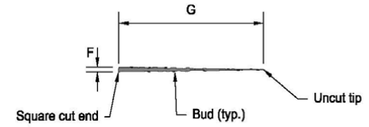
Drawing 3. Brush Layering



CROSS SECTION



PLAN VIEW DETAIL



LIVE CUTTING DETAIL

2.3.4 Specifications

In addition to the information presented in Section 1.0 Introduction, the following information should be developed into specifications to accompany the use of brush layering:

- Materials:
    - Brush
    - Dormant live cuttings from acceptable species and cut to size
- Equipment/Tools:
    - Machete, clippers, saw, hammers, chainsaw, and/or loppers
    - Shovel and/or machinery to excavate and level benches
- Sequence:
    - Prepare live cuttings to the size specified.
    - Remove loose soil from face of the slope.
    - Start installation from the toe of the slope while working upslope along the bank.
    - Excavate benches.
    - Place branches in overlapping and crisscross configuration in three courses, separated by soil. Repeat until desired thickness is reached. Compact backfill to remove air pockets.
    - Orient the stems such that the basal ends touch the back of the undisturbed slope. Approximately ¼ of the branch stem should extend beyond outside of each brush layer.
    - Trim the terminal bud so that stem energy will be routed to the lateral buds for more rapid root and stem sprouting.
- Workmanship:
    - All cuts should be clean and smooth.
    - No cracked or split live stakes should be used.
    - The finished surface of the brush layering should be generally in accordance with the lines, grades, cross sections, and elevations of the design.

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    - It is important to ensure that the upstream and downstream ends of the brush layering tie-in smoothly into the undisturbed bank outside of the project area.
- Maintenance: Brush layering growth may require protection from beaver, deer, cattle, or other predators. Various types of deer-proof fencing or fine wire screen or mesh can be secured around the cuttings to offer protection. If the area is grazed, restrict livestock from the project site.

2.3.5 Photographs

Photo 19. Brush Layering with soil warp used to stabilize a stream bank. Source: Salix Applied Earth Care

Photo 20. Brush layering, including soil wrap, Whiskeytown Lake, CA. Source: Salix Applied Earth Care

Photo 21. Brush layering, including soil wrap, Whiskeytown Lake, CA. Source: Salix Applied Earth Care

Photo 22. Brush layering, including soil wrap, Whiskeytown Lake, CA. Source: Salix Applied Earth Care

Photo 23. Bench excavation for brush layering. Source: Stantec

Photo 24. Brush layering with soil wrap, Raleigh, NC. Source: KCI

2.4 EROSION CONTROL MATTING

2.4.1 Narrative Description

Erosion control matting is used to temporarily stabilize and protect disturbed soil from erosion due to surface water runoff, to improve moisture retention, and protect newly planted seed from washing away and being consumed by animals. The mattings are manufactured from a variety of biodegradable and/or non-biodegradable materials, including coconut fiber (coir), jute, hemp, wood excelsior (shavings), and/or straw mulch. Natural, biodegradable materials are preferred in stream restoration applications.

Erosion control matting is typically placed on the surface of soil slopes and fastened with biodegradable stakes, preferably wood. Woody cuttings and herbaceous plants can be planted through the matting; seed and topsoil can be placed underneath. Erosion control matting stabilizes stream banks and other slopes until vegetation takes root.

Lack of vegetation on stream banks is often due to unstable conditions; analysis and design by a professional may be required to stabilize the stream bank and select and design appropriate erosion control matting.

2.4.2 Technique Information

- **Use:** Intended to temporarily stabilize and protect disturbed soil from erosion due to surface water runoff until vegetation can be established.

- **Other uses:** Creates advantageous microclimate and protects newly planted seeds from washing away and being consumed by animals. In addition, covering seeded areas with erosion control matting can increase the germination rates for grasses and legumes, and assist vegetation establishment. Erosion control matting can also reduce desiccation and evaporation by insulating the soil.

- **Best applications:** Erosion control matting should be used in areas where the risk of soil loss exists due to earth-disturbing activities. Application should adhere to the slope and shear stress constraints published by the product manufacturer. Erosion control blankets are not intended for use in low-flow channels.

- **Computations:** Hydrologic and hydraulic computations aid in verifying that the appropriate conditions exist for use of erosion control matting. Geometric calculations are required to properly size and situate the matting within the context of its individual location. Hydraulic analysis is required to determine where to place erosion control matting on the slope, how the matting and the intended vegetative growth will distribute energy at various flow stages, and to verify that the velocities and shear stresses generated by streamflow do not exceed the permissible velocity and tensile strength of

the product used. Erosion control matting manufacturers provide permissible velocity and allowable shear stress information for their products.

- **Key Features:**
  - A manufactured matting (e.g., a spun or woven fabric typically supplied in rolls) is used to cover soil.
  - Erosion control matting is fastened into trenches at the top and bottom of slopes and is also fastened throughout with stakes.
  - Erosion control matting can be placed over seeded and mulched soil. Live stakes can be installed through erosion control matting.

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2.4.3 Detail Drawings and Data Table

The following drawings and data table depict information that should be included in construction plans for erosion control matting. The data table includes design guidelines and sources, where applicable.

Table 4. Required Design Data for Erosion Control Matting[1]

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
A	Matting stake spacing	Feet, inches	Varies; typically, 6-12", maximum spacing of 18"; based on manufacturer's specification for site conditions (SUDAS 2017).	Spacing between erosion control matting stakes used to fasten the matting to the soil
B	Matting overlap	Feet, inches	Varies; typically, 3-8", based on manufacturer's specification for site conditions (SUDAS 2017)	Amount of erosion control matting overlap if multiple pieces and/or rolls of matting are used. Overlap varies depending on the location of the overlap with respect to position on the slope, location of the matting (edge or end), and product specifications.
C	Matting anchor trench depth	Feet, inches	Varies; 4" minimum, based on manufacturer's specification for site conditions (SUDAS 2017)	Depth of trench into which edge of erosion control matting is anchored at the top and/or toe of a slope.
D	Matting anchor trench width	Feet, inches	Varies; 4" minimum, based on manufacturer's specification for site conditions (SUDAS 2017)	Width of trench into which edge of erosion control matting is anchored at the top and/or toe of a slope.

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Table 4. Required Design Data for Erosion Control Matting[1]

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
E	Top of slope anchor trench setback	Feet, inches	--	Top of slope anchor trench distance from the top of slope. Top of slope refers to top of side slope, bank slope, terrace slope, bankfull, etc.
F	Matting stake length	Inches	Varies; typically, a minimum of 6", based on manufacturer's specification for site conditions (SUDAS 2017)	Length of erosion control matting stakes or staples used to fasten the matting to the soil

Notes:

1. Data are for erosion control matting applied to stream bank slopes.
2. Dimension labels are referenced in the detail drawings.
3. Erosion control manufacturer's guidelines should be followed, based on type of matting used and conditions at the site.

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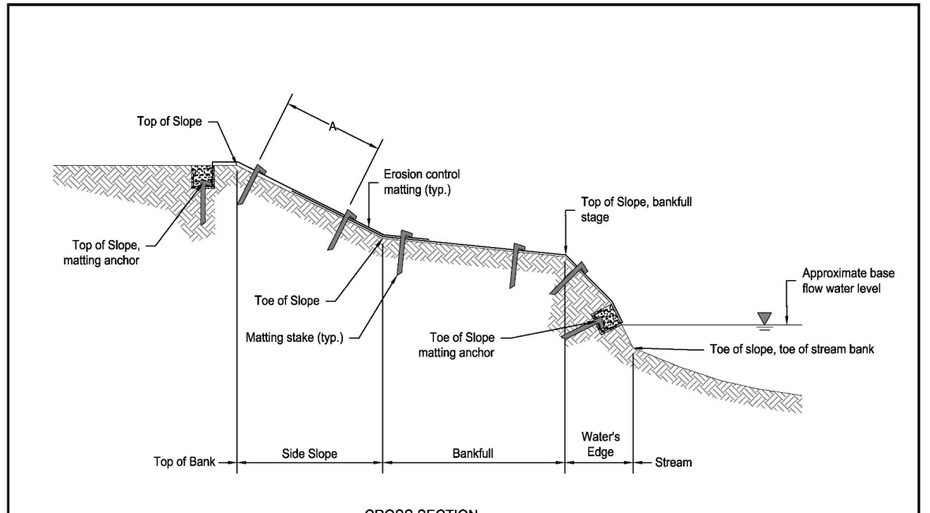
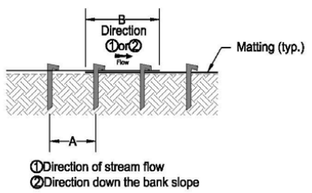
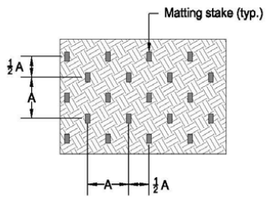
Drawing 4. Erosion Control Matting





MATTING OVERLAP DETAIL



MATTING STAKE PATTERN DETAIL

MATTING STAKE DETAIL

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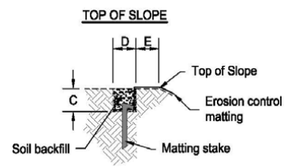

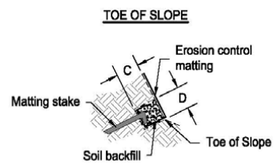

MATTING ANCHOR DETAIL

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2.4.4 Specifications

In addition to the information presented in Section 1.0 Introduction, the following information should be developed into specifications to accompany the use of erosion control matting:

- Materials:
    - Erosion control matting
    - Wedge-shaped wooden stakes and/or metal or biodegradable staples, depending on the manufacturer's specifications
- Equipment/Tools:
    - Heavy equipment is typically unnecessary when installing erosion control matting.
    - Shovel
    - Rubber mallet or hammer
    - Scissors, boxcutter, or other cutting tool
- Sequence:
    - Grade the exposed earthen surface and remove all debris.
    - Compact the exposed earthen surface to the desired amount.
    - Amend soils as necessary.
    - Seed the exposed surface with native herbaceous seed and rake to ensure good seed-soil contact.
    - Excavate a trench along the toe of the slope and along the top of the bank.
    - Excavate a trench at the upstream end that is perpendicular to the flow (key trench) and connect to the ends of the other trenches.
    - Place the ends of the matting on the stream bank with the ends of the matting in the trench so that the matting is touching the three sides of the trench. Secure the matting to the bottom of the trench by using a wedge-shaped wooden stake.
    - Cover the rest of the stream bank with the matting, making sure that the edges of each mat overlap and are shingled away from the direction of flow. Each overlap should be secured with wedge-shaped wooden stakes or staples, depending upon the manufacturer's specifications. In addition, secure the blanket to the slope according to the manufacturer's specifications. It is important to secure the upstream end of the mat by keying it into the final trench.
    - Backfill the trenches with excavated soil or small cobble and compact it.
- Workmanship:
    - The finished surface of the erosion control matting should not have any voids, or matting that has not been properly anchored into the stream bank.
    - All trenches need to be compacted, especially the trenches that are perpendicular to the flows along the upstream and downstream edges of the project site.
    - There should be no loose ends of erosion control matting.
    - It is important to ensure that the upstream and downstream ends of the erosion control matting are keyed into the bank to prevent the matting from becoming unraveled during high flows.
    - It is critical that the matting maintain contact with the soil during a high flow event. If the matting separates from the soil by more than an inch under a reasonable tug additional staking is necessary.
    - If possible, avoid disturbing installed erosion control matting.

2.4.5 Photographs

Photo 25. Top of slope trench for erosion control matting anchor. Source: Collins & Baker Engineering

Photo 26. Erosion control matting installed on a slope. Source: Salix Applied Earthcare

Photo 28. Erosion control matting. Source: Salix Applied Earthcare

Photo 29. Erosion control matting installed on slope. Source: Iowa DNR

Photo 27. Erosion control matting with seed growing through. Source: Charlotte-Mecklenburg Storm Water Services

Photo 30. Erosion control matting being rolled onto a stream bank. Source: Collins & Baker Engineering

2.5 SOD MATTING

2.5.1 Narrative Description

Sod matting consists of large pieces of intact wetland soil and vegetation that has been removed from a donor site. Pieces of sod matting can be harvested from areas scheduled for demolition or other areas where material is available. Sod matting is used to provide channel bank stabilization where rock and/or logs are either not available or within context of the existing watershed conditions. The sod mats themselves provide initial channel bank stabilization, and the stabilization benefit is increased as the root systems grow deeper and denser. Sod matting is typically used in low-gradient stream systems where cohesive soils are present.

Installing sod mats on an existing slope can be undertaken by landowners. Often however, a lack of vegetation on stream banks is due to unstable conditions; analysis and design by a professional may be required to stabilize the stream bank and reestablish vegetation.

2.5.2 Technique Information

- **Use:** Sod matting can be used for both immediate and long-term bank stabilization. Immediate stabilization is provided by the mass of the harvested sod mats and the vegetation growth already present. Long-term stability is increased when rooting depth increases and becomes denser.

- **Other uses:** Sod matting can be used in combination with other bank protection measures such as toe wood, root wads; stacking sod mats on top of these and other types of toe protection provides a natural transition between the toe protection structure and the stream bank slope. Vegetative cover can improve wildlife habitat along the stream corridor while also improving the aesthetics of a project site. Sod mats prevent erosion from storm water runoff and reduce sheet and rill erosion.

- **Best applications:**

    - Sites with an adequate supply of sod with suitable species for sod mats

    - Transitions between in-stream and/or toe protection structures and stream banks.

    - Bare areas on existing stable slopes and stream banks or slopes and banks recently graded to a stable angle (e.g. - as part of a stream restoration project)

    - Areas on the floodplain where restoration activities are proposed

- **Computations:** Computations are generally not necessary for using sod mats to revegetate bare areas on otherwise stable stream banks. However, hydrologic and hydraulic computations can aid in verifying that the appropriate conditions exist for use

of sod mats and whether a combination of other bank protection methods may be necessary.

- **Key Feature:** Sod mats are harvested at a site, usually in a proximity to the work, and placed on stream banks providing immediate vegetative cover of bare soils.

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2.5.3 Detail Drawings and Data Table

The following drawings and data table depict information that should be included in construction plans for sod matting. The data table includes design guidelines and sources, where applicable.

Table 5. Required Design Data for Sod Matting[1]

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
A	Sod mat width	Feet	Sod mats should generally be about 8 sq. ft and 6-8" thick, depending on the type of equipment used to excavate them (NRCS 2008).	Width of individual sod mat.
B	Sod mat length	Feet	Sod mats should generally be about 8 sq. ft and 6-8" thick, depending on the type of equipment used to excavate them (NRCS 2008).	Length of individual sod mat.
C	Sod mat thickness	Inches	6" – 8" (NRCS 2008)	Thickness of individual sod mat.
D	Stacked sod mat setback	Feet, inches	--	The distance between the edges of sod mats stacked to form a slope
E	Width of stacked sod mats	Feet, inches	--	Width of a bank created by stacked sod mats

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Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
F	Height of stacked sod mats	Feet, inches	Harvested sod mats should be placed in a matching hydrological zone similar to the donor site.	Height of a slope created by stacked sod mats
G	Width of surface-applied sod mats	Feet, inches	--	Width of a slope stabilized with surface-applied sod mats
H	Top of bank sod matting distance	Feet	Harvested sod mats should be placed in a matching hydrological zone similar to the donor site.	Distance sod matting is installed on the top of bank

Notes:

1. Data are for sod matting that is stacked to form a slope or surface-applied to a slope.
2. Dimension labels are referenced in the detail drawings.
3. Common guidance, values, or ranges are given unless they require computation using site-specific input.

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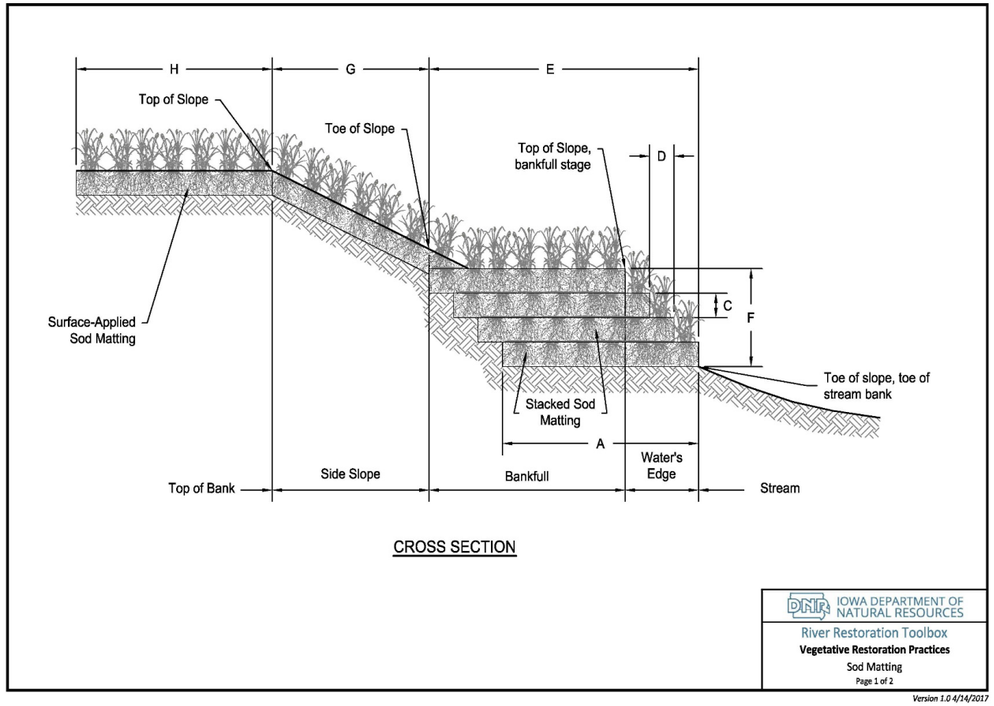
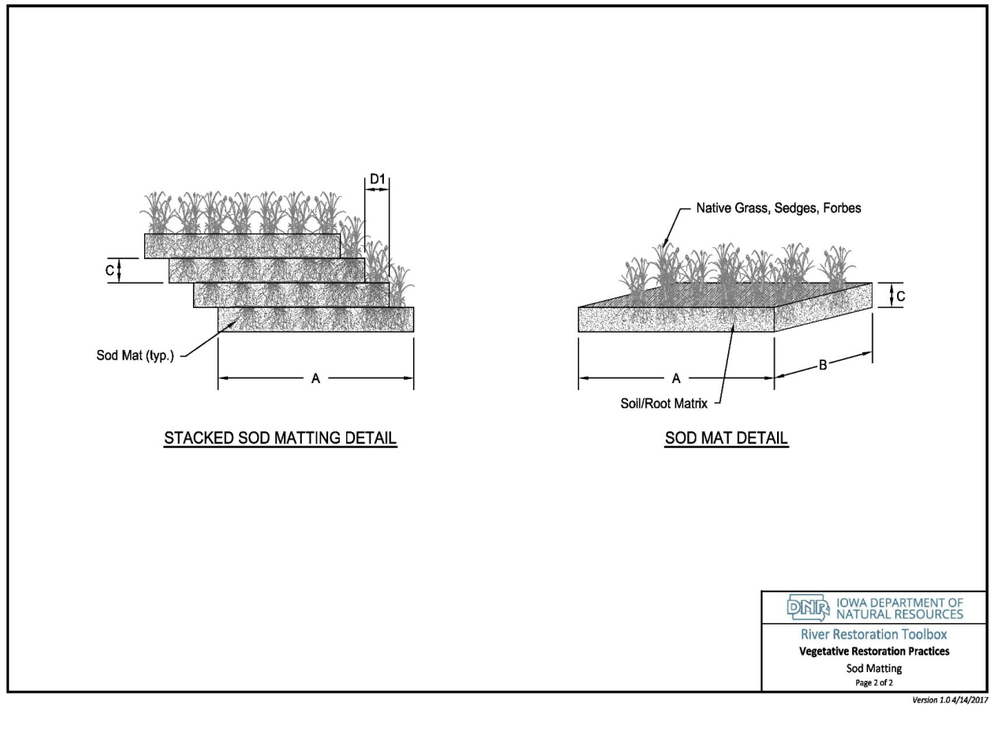
Drawing 5. Sod Matting





2.5.4 Specifications

In addition to the information presented in Section 1.0 Introduction, the following information should be developed into specifications to accompany the use of sod matting:

- Materials
    - Donor site that contains an adequate supply of sod mats
    - Backhoe or front-end loader, wheel barrow, flatbed truck or trailer
    - Round and/or square tipped shovels
    - Wooden stakes
- Equipment:
    - A backhoe or front-end loader with a sharp-edged steel plate. A front-end loader can harvest uniform sod squares. The backhoe can harvest quickly, but yields uneven-edged mats.
- Sequence:
    - Identify location of sod mats to be harvested
    - Harvest sod mats from donor site with shovels, backhoe, or a modified front-end loader that contains a sharp-edged steel plate that undercuts the sod for safe and effective removal.
    - Depending upon the project size, load sod mats into a wheel barrow or onto a flatbed truck, or trailer and transport them to the work site.
    - Place the sod mat within the proper hydrologic zone, fitting them tightly against one another.
    - The top mat and/or other mats can be anchored with a live and/or dead stout stake to ensure that it does not mobilize during a flood event before the roots have established.
- Workmanship:
    - It is easiest to harvest sod mats when the soils are moist, yet well drained at the time of the cutting.
    - Sod mats can be stored on site if they are kept moist.

- When transporting sod mats long distances, maintain moisture levels so that they do not become dried out.
- The sod mat should be placed into the same hydrologic zone as where it was harvested.
- When placing sod mats, do not leave large gaps between each sod mat as non-native vegetation will quickly attempt to colonize these voids.
- Sod mats can be transplanted during any season if there is sufficient moisture in the soil where they will be placed.

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2.5.5 Photographs

Photo 31. Sod mat harvest with a front-end loader. Source: Buck Engineering

Photo 32. Sod mat placed to form stream bank. Source: Buck Engineering

Photo 33. Sod mat stacked over toe wood. Source: Stantec

Photo 34. Sod matting on outside of a meander bend. Source: Stantec

Photo 35. Sod matting on stream banks. Source: Stantec

Photo 36. Excavator placing sod matting. Source: Bluegrass Streams, LLC

2.6 SEEDING

2.6.1 Narrative Description

Seeding is a low cost, low labor method to stabilize soils that involves the establishment of permanent, perennial vegetative cover consisting of grass or forb seed mixes. Seeding can be used as a single approach to stabilize stream banks where erosion is minor, or used in combination with other erosion control techniques such as erosion control matting and soil bioengineering where erosion is moderate to severe. The use of native, indigenous grasses and forbs is required as these species have evolved in a manner that will allow the recruitment of naturally-occurring woody vegetation.

Seeding provides rapid stabilization of stream banks by producing a mass of fibrous roots in the upper soil layer; this mass of roots bind the soil together and serve as a barrier, protecting the soil surface from wind and water erosion. In addition, grass roots help to improve soil structure by increasing soil porosity and increasing organic material that helps bind soil particles.

Seeding on an existing slope can be undertaken by landowners. Often however, a lack of vegetation on stream banks is due to unstable conditions; analysis and design by a professional may be required to stabilize the stream bank and reestablish vegetation.

2.6.2 Technique Information

- **Use:** Seeding is used to quickly establish plant growth along a stream bank. This helps reduce surface erosion, slow flow velocities, and reinforce the soil. Seeding may be used as both temporary and permanent vegetative cover during a stream restoration.

- **Other uses:** Vegetative cover will improve wildlife habitat along the stream corridor, as well as the aesthetics of the project site. Seeding will also prevent erosion from storm flow and reduce sheet and rill erosion. Seeding can be used to increase organic matter on a site and improve existing soil conditions.

- **Best applications:**

    - Bare areas on existing stable slopes and stream banks or slopes and banks recently graded to a stable angle (e.g. - as part of a stream restoration project)

    - Seeding is best used when rich topsoil is readily available and the seedbed has been properly prepared. Restoration projects should include seeding to reduce construction and post-construction erosion rates.

    - While seeding should be used along areas typically experiencing low to moderate stream bank erosion rates, it can be used along the entire riparian corridor.

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- Computations: Computations are generally not necessary for using seeding to revegetate bare areas on otherwise stable stream banks. However, hydrologic and hydraulic computations can aid in verifying that the appropriate conditions exist for use of seeding and whether a combination of other bank protection methods may be necessary.

- **Key Features:**

    - Seeding can be used alone in cases of low flows, or in combination with other vegetative practices in cases of moderate to severe flows.

    - Native forb and/or grass seed mixes should be used.

2.6.3 Design Guidelines

- Proper seed selection can play a vital role in determining the success of this type of erosion control method. Choose local and climatically adapted perennial species that are long-lived, hearty, and require low inputs of fertilizer, irrigation, and mowing. Seed blends or mixtures should always be considered as they are more adaptable (Iowa DNR 2016).

- Use seeds that are appropriate to the season (i.e., warm-season plantings or cool-season plantings) and site conditions (Iowa Riverside Plant Selection 2016).

- Topsoil may be needed if the soil on the bank is not adequate.

- Use of mulch to cover seeds will prevent seeds from being blown or washed away and keep the soil surface moist.

- Native seed can be sown in the autumn directly into a cover crop of an annual grass. The annual grass provides a "living mulch" and will not out-compete the new growth of native grasses and forbs the following growing season.

- When deployed as a single technique, seeding alone will not stabilize the toe of a stream bank and it may not be an adequate approach to reduce existing stream bank erosion rates.

2.6.4 Specifications

In addition to the information presented in Section 1.0 Introduction, the following information should be developed into specifications to accompany the use of seeding:

- Materials:

    - Seed mix

- Organic fertilizer, inoculant, and/or nitrogen, if needed.
- Hydraulic mulch, tackifier, dye, if needed.

- Equipment/Tools:
  - Heavy equipment used to prepare the seedbed include chisel plows, discs, and rototillers. Application of seed mixes can be accomplished using seed drills or hydroseeders, if compatible with site conditions.
  - Rakes and shovels can be used to prepare the seed bed of smaller sites.
  - Broadcast spreader
  - Buckets for hand seeding

- Sequence:
  - Examine the site's soil conditions to determine whether the soil fertility and pH levels needs to be amended to satisfy the needs of the specific plant species that was selected.
  - Select proper seed mix, depending upon the conditions of the project site and time of year the site will be planted. Factors may include shade vs. sunlight, habitat values, rooting depths, etc. (Iowa DNR 2016).
    - Any Time of Year: Ready-sprouting mix (Iowa DNR)
      - ½ Virginia Wild Rye
      - ½ Annual Rye Grass if planted between March – September
      - ½ Oat Grain or Winter Wheat if planted between October – February
  - Fall/Spring Planting: Incorporate Diversity Mix (Iowa DNR) into above application guidelines.
  - Determine seeding rates and density
  - Depending upon the site's soil conditions, till existing site, apply topsoil, inoculant, compost, etc.
  - Apply the seeding mix to the project site by applying a liquid seed mix that can mechanically be blown (hydroseeded) onto the site, or by hand-broadcasting the seed mix. Till or rake seeds to the depth required for each seed species.

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  - Apply a thin layer of mulch or install an erosion control mat over the newly seeded area, if possible. Erosion mats should form well to the banks to prevent loosening and floatation, consist of biodegradable woven material, and consist of a material opening to allow for sprouts to emerge.

- Workmanship:
  - Seeding should be done during low flow conditions.
  - Vegetation must have enough time to adequately root and grow before high flows occur on the project site.

2.6.5 Photographs

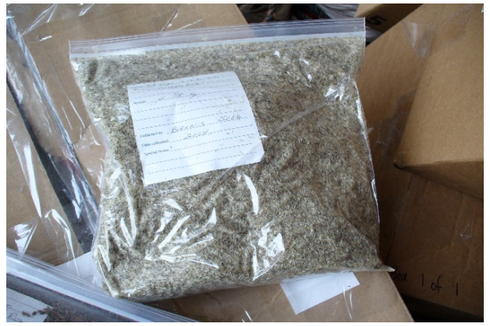

Photo 37. Native seed. Source: Lake Superior Tree Farm

Photo 38. New growth of native grass stream buffer. Source: Charlotte-Mecklenburg Storm Water Services

Photo 39. Testing soil pH and moisture. Source: Collins & Baker Engineering

Photo 40. Apply mulch to seeded stream banks. Source: Buck Engineering

Photo 41. Cover crop on the Dead River, MI. Source: Collins & Baker Engineering

Photo 42. Native forb seed. Source: Lake Superior Tree Farm

2.7 NURSERY STOCK, BARE ROOT, VEGETATIVE PLUG, AND TRANSPLANTING

2.7.1 Narrative Description

Nursery stock, bare roots, vegetative plugs, and the transplanting of carefully selected native plant material can provide immediate stream bank protection to an area of concern. The above-ground growth provides surface protection which continues to prevent surface erosion (e.g., rills, gullies). The growth also adds roughness to the stream bank, reducing the velocity of stream flow. The roots bind soil particles together and reinforce the soil mantle (NRCS 2007a). To assist with specific species selection for a project site, an Iowa Riverside Plant Selection guidance can be found online on the DNR website at http://www.iowadnr.gov/Environmental-Protection/Water-Quality/River-Restoration.

Nursery stock, bare root seedlings and vegetative plugs of varying native species can be obtained from local and regional nurseries (NRCS 2007b, 2011). Existing native vegetation can be can typically be found on-site of the stream restoration project and marked for excavation so they can be salvaged and stored until they can be transplanted.

Installing nursery stock, bare roots, vegetative plugs, or the transplanting of carefully selected native plant material on a project site can be undertaken by landowners. Often however, a lack of vegetation on stream banks is due to unstable conditions; analysis and design by a professional may be required to stabilize the stream bank and reestablish vegetation.

2.7.2 Technique Information

- **Use:** Nursery stock, bare roots, vegetative plugs, and the transplanting of carefully selected native plant material protects the stream bank toe and slope from shallow slides, seepage and surface erosion, and re-established native vegetation.

- **Other uses:** In addition to short- and long-term erosion control and slope stability, nursery stock, bare roots, vegetative plugs, and the transplanting of carefully selected native plant material provides numerous other benefits including improved aesthetics, riparian habitat, and water quality. For example, vegetation growth increases the amount and quality of riparian habitat for birds, mammals, and other terrestrial animals by providing food and cover and improves in-stream habitat and water quality for fish and other aquatic organisms by reducing water temperatures by providing shade.

- **Best applications:**

    - This form of vegetative reestablishment is best used when combined with other erosion control methods, depending upon the site and the project's goals and objectives.

- On its own, native riparian vegetation is typically installed along areas experiencing low to moderate stream bank erosion rates. When combined with other erosion control techniques, native riparian vegetation can be installed along the entire riparian corridor.

- **Computations:** Hydrologic and hydraulic computations aid in verifying that the appropriate conditions exist for installation of native riparian plants. Special consideration needs to be given to the frequency and duration of flows along the stream for proper plant selection.

  Computations are generally not necessary for landowners using nursery stock, bare roots, vegetative plugs, and the transplanting of carefully selected native plant material to revegetate bare areas on otherwise stable stream banks. However, planting vegetation adjacent to streams can adversely impact the local hydraulics, sometimes deflecting currents adversely, catching debris and causing blockages, or increasing roughness and causing increases in flood stage.

  As part of a stream restoration project, the design of a planting plan for nursery stock, bare roots, vegetative plugs, or the transplanting of native plant material requires design by a professional.

- **Key Feature:** The most important consideration when choosing where to plant a specific species is where to place it within the stream's cross-section, including along the water's edge, near the bankfull elevation, along the side slope, or on the top of bank, per the Iowa Riverside Plant Selection guidance (Iowa DNR 2016).

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2.7.3 Detail Drawings and Data Table

The following drawings and data table depict information that should be included in construction plans for planting nursery stock, bare roots, and vegetative plugs, and transplanting. The data table includes design guidelines and sources, where applicable.

Table 6. Required Design Data for Transplanting[1]

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
A	Planting depth	Varies	Depth as required based on dimension of excavated soil and roots. Transplant should be planted at the same depth prior to harvest.	Planting depth of the transplant.
B	Height of mounded soil backfill	Inches	--	Height of mounded loose soil placed into over-excavated planting pit.
C	Depth of planting pit	Varies	Depth as required based on dimension of excavated soil and roots.	Depth of the planting pit; accommodates dimension of soil and excavated roots as well as mounded loose soil at bottom of pit.
D	Width of planting pit	Varies	1 ½ to 2 times the width of the excavated soil and roots	Over-excavated width of the planting pit; accommodates the width of the excavated soil and roots.
E	Height of mounded soil perimeter	Inches	3"	Height of soil berm constructed along the perimeter of the planting pit; helps retain water.

Table 6. Required Design Data for Transplanting[1]

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
F	Width of mounded soil perimeter	Inches	8"	Width of soil berm constructed along the perimeter of the planting pit; helps retain water.
G	Width of weed barrier fabric (optional)	Inches	--	Width of fabric placed on surface to control weeds within the mounded soil perimeter; transplants typically have grasses, leaf matter, etc. attached and do not require weed barrier fabric.
H	Fabric stake length (optional)	Inches	4"-6"	Length of staples/spikes used to secure weed barrier fabric
I	Thickness of mulch (optional)	Inches	3"	Thickness of mulch, if necessary. Transplants typically have grasses, leaf matter, etc. attached and do not require mulch.
J	Gap between mulch and plant stem/trunk (optional)	Inches	2"	Room between plant stem/trunk and mulch. Transplants typically have grasses, leaf matter, etc. attached and do not require mulch.

Notes:
1. Data are for transplanted vegetation.
2. Dimension labels are referenced in the detail drawings.
3. Common guidance, values, or ranges are given unless they require computation using site-specific input.

Drawing 6. Transplanting

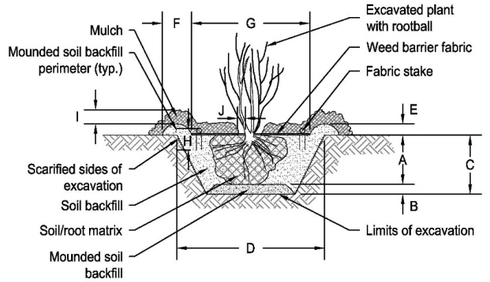

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Table 7. Required Design Data for Bare Root Plants[1]

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
A	Planting depth	Varies	Depth as required based on dimension of rootstock (SUDAS 2011). Root flare should be at or slightly above finished grade.	Planting depth of the bare root plant.
B	Height of mounded soil backfill	Inches	6" (SUDAS 2011)	Height of mounded loose soil placed into over-excavated planting pit.
C	Depth of planting pit	Varies	Depth as required based on dimension of rootstock (SUDAS 2011)	Depth of the planting pit; accommodates dimension of rootstock as well as mounded loose soil at bottom of pit.
D	Width of planting pit	Varies	1 ½ to 2 times the width of the rootstock (SUDAS 2011)	Over-excavated width of the planting pit; accommodates the width of the rootstock.
E	Height of mounded soil perimeter	Inches	3" (SUDAS 2011)	Height of berm constructed along the perimeter of the planting hole using soil backfill material; helps retain water.
F	Width of mounded soil perimeter	Inches	8" (ISA 2014)	Width of berm constructed along the perimeter of the planting hole using soil backfill material; helps retain water.

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Table 7. Required Design Data for Bare Root Plants[1]

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
G	Width of weed barrier fabric	Varies	--	Width of fabric placed on surface to control weeds within the mounded soil backfill perimeter
H	Fabric stake length	Inches	4"-6"	Length of steel staples or degradable resin spikes used to secure weed barrier fabric
I	Thickness of mulch	Inches	3" (SUDAS 2011)	Thickness of mulch
J	Gap between mulch and plant stem/trunk	Inches	2"	Room between plant stem/trunk and mulch.

Notes:

1. Data are for bare root plants.
2. Dimension labels are referenced in the detail drawings.
3. Common guidance, values, or ranges are given unless they require computation using site-specific input.

Item 3.

Drawing 7. Bare Root Plants

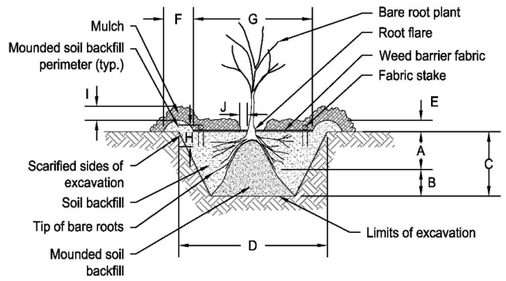

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Table 8. Required Design Data for Container Grown Nursery Stock[1]

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
A	Planting depth	Varies	Plant at same depth as in container (SUDAS 2011)	Planting depth of the container plant.
B	Height of mounded soil backfill	Inches	6“ (SUDAS 2011)	Height of mounded loose soil placed into over-excavated planting pit.
C	Depth of planting pit	Varies	Plant at same depth as in container (SUDAS 2011)	Depth of the planting pit; accommodates dimension of container as well as mounded loose soil at bottom of pit.
D	Width of planting pit	Varies	1 ½ to 2 times the width of the container (SUDAS 2011)	Over-excavated width of the planting pit; accommodates the width of the container.
E	Height of mounded soil perimeter	Inches	3” (SUDAS 2011)	Height of berm constructed along the perimeter of the planting hole using soil backfill material; helps retain water.
F	Width of mounded soil perimeter	Inches	8” (ISA 2014)	Width of berm constructed along the perimeter of the planting hole using soil backfill material; helps retain water.

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Table 8. Required Design Data for Container Grown Nursery Stock[1]

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
G	Width of weed barrier fabric	Inches		Width of fabric placed on surface to control weeds within the mounded soil backfill perimeter
H	Fabric stake length	Inches	4”-6”	Length of steel staples or degradable resin spikes used to secure weed barrier fabric
I	Thickness of mulch	Inches	3” (SUDAS 2011)	Thickness of mulch
J	Gap between mulch and plant stem/trunk			Room between plant stem/trunk and mulch.

Notes:

1. Data are for container-grown nursery stock.
2. Dimension labels are referenced in the detail drawings.
3. Common guidance, values, or ranges are given unless they require computation using site-specific input.

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Drawing 8. Container-Grown Nursery Stock

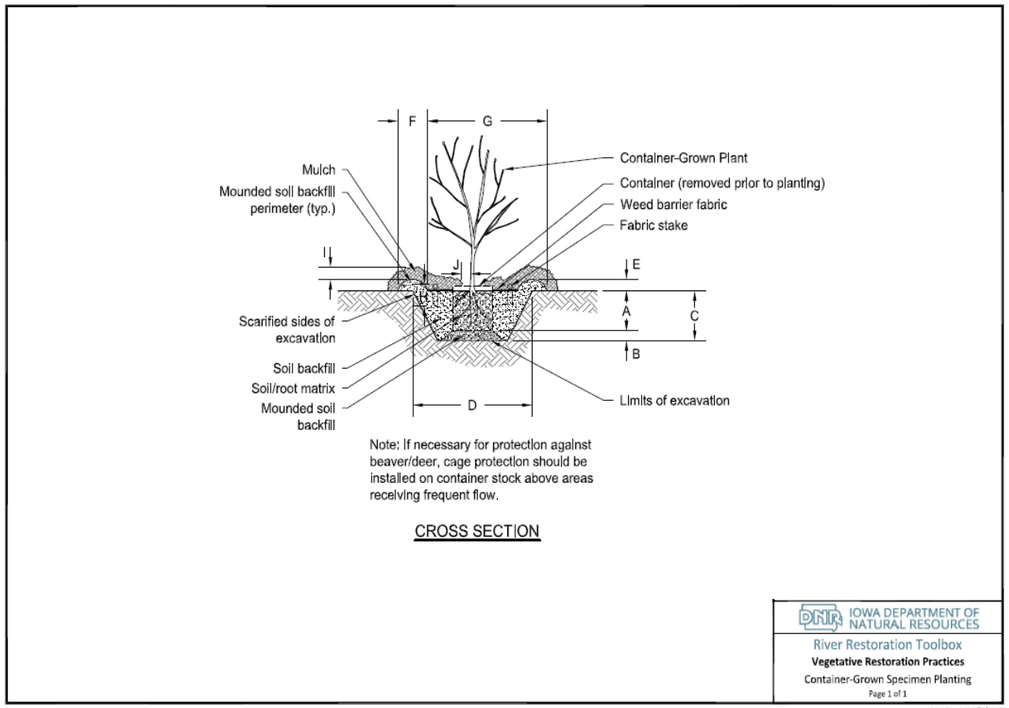

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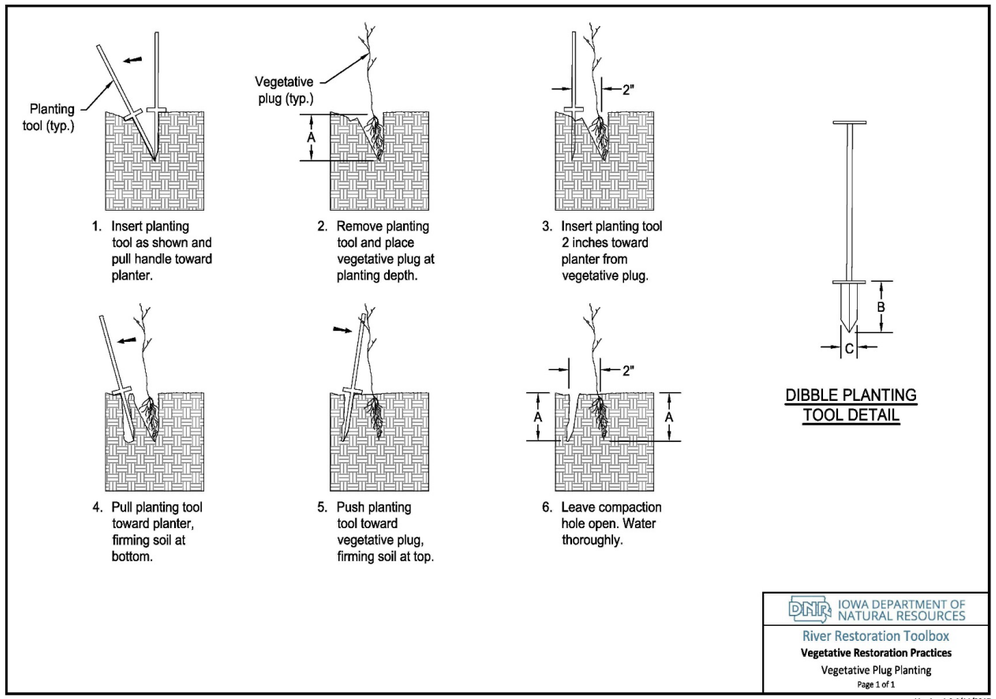
Table 9. Required Design Data for Vegetative Plugs[1]

Dimension[2]	Name	Typical Unit	Guidelines[3]	Description
A	Planting depth	Inches	Plug should be easily placed into soil opening and not crushed or pressed.	Depth of planting to accommodate plug
B	Planting tool blade length	Inches	At least equal to planting depth	Length of planting tool blade
C	Planting tool blade width	Inches	Wide enough to accommodate plug	Width of planting tool blade

Notes:

1. Data are for vegetative plugs.
2. Dimension labels are referenced in the detail drawings.
3. Common guidance, values, or ranges are given unless they require computation using site-specific input.

Drawing 9. Vegetative Plugs



2.7.4 Specifications

In addition to the information presented in Section 1.0 Introduction, the following information should be developed into specifications to accompany the use of nursery stock, bare roots, vegetative plugs, or the transplanting of native plant material:

- Materials:
    - Chosen nursery stock, vegetative plugs, and transplants
- Equipment/Tools:
    - When safe and feasible, a back hoe should be used when placing very large plants.
    - Round tip shovels
    - Soil tamping hand tool
    - Vertical support stakes, if required
    - Sledge hammer
    - Anti-predation fencing, if required
- Sequence:
    - Provide storage of plants on site or have only as many plants delivered as can be planted in a day.
    - Layout plants along the project per the project's specifications. Protect plants from direct sun, drying of the root stock, and freezing prior to planting.
    - Except for vegetative plugs, holes for individual plantings should be excavated to produce nearly vertical sides and flat bottoms. Planting pits should be excavated by-hand, using a mattock, pick, iron bar, etc. The planting pits should be excavated to a depth and diameter suitable for the form of plant (e.g., transplant, bare root, or containerized). All planting holes should have roughed, scarified sides and bottoms.
    - Determine whether soil amendment is required and apply, if needed.
    - Remove any container and score root ball before planting.
    - Backfill all plants with soil excavated from the planting pit and tamp lightly to remove any voids. Plug openings are closed by inserting planting tools next to the

planted opening and pressing adjacent soil toward plug and closing the gap around the plug.

- Water all vegetation immediately following planting.
- Apply vertical support stakes or anti-predation fencing if needed.

- Workmanship:
  - All plant material needs to be fresh, free from transplant shock or visible wilt.
  - All container plants need to have been propagated in a container long enough for the root system to have developed sufficiently to hold its soil.
  - Prior to installation, inspect the plant material to make sure there is a vigorous root system, and the plants are healthy, free from defects, decay, diseases, insect pest eggs, and all other forms of infestation.
  - If stored on site, plants need to be protected and from the wind, sun, and freezing. If practical, the roots can be covered with moist sawdust, wet burlap, wood chips, shredded bark, peat moss, or other similar material.
  - Do not plant when the soil is frozen.
  - Plants are ideally installed during their dormancy period.
  - Planting hole should be sufficient as not to cramp the roots.
- Maintenance: Plants may require initial protection from beaver, deer, cattle, or other predators. Various types of deer-proof fencing or fine wire screen or mesh can be secured around the plants and beds of plants, etc., to offer protection. If the area is grazed, restrict livestock from the planting site.

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2.7.5 Photographs

Photo 43. Bare root trees. Source: Lake Superior Tree Farm

Photo 44. Vegetative plugs. Source: Collins & Baker Engineering

Photo 45. Bare root trees. Source: Lake Superior Tree Farm

Photo 46. Planting vegetative plugs. Source: Iowa DNR

Photo 47. Trees planted on Edwards Branch. Source: Charlotte-Mecklenburg Storm Water Services

Photo 48. Vegetative plugs at Edwards Branch, NC. Source: Charlotte-Mecklenburg Storm Water Services

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Riparian Buffering

IOWA DEPARTMENT OF NATURAL RESOURCES

Iowa Department of Natural Resources

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Executive Summary

Riparian buffers provide a link between terrestrial and aquatic ecosystems. They provide numerous benefits including bank stability, improved aquatic and terrestrial habitat, improved biodiversity, and improved water quality. Riparian buffers are important to native stream fish because they provide cover, reduce sediment and nutrient delivery, and provide channel roughness during flood events. Generally, wider riparian buffers provide more benefits; buffers should be at least 100 ft. wider than the stream's belt width (50 ft. on each side of belt width). The information provided in this practice focuses on the functions of bank stability and erosion resistance provided by riparian buffers. Riparian buffers provide several functions in addition to bank stability related to chemical and biological functions; those functions are not covered in depth in this guide. A general graphical overview of riparian buffering is provided in Drawing 1 and Drawing 2.

The *River Restoration Toolbox Practice Guide 3: Riparian Buffers* (Practice Guide) has been developed to assist with the presentation of design and construction information for stream restoration in Iowa. It is intended to provide guidance to:

- Those responsible for reviewing and implementing stream restoration,
- Professionals responsible for the design of stream restoration projects,
- Others involved in stream restoration at various levels who may find the information useful as a technical reference to define and illustrate riparian buffers.

The information in the Practice Guide is intended to inform practitioners and others, and define typical information required by the State of Iowa to be included with the use of riparian buffers. The information and drawings are not meant to represent a standard design method for any type of technique and shall not be used as such. The Practice Guide neither replaces the need for site-specific engineering and/or landscape designs, nor precludes the use of information not included herein.

The Practice Guide may be updated and revised to reflect up-to-date engineering, science, and other information applicable to Iowa streams and rivers.

Introduction
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1.0 INTRODUCTION

Riparian buffers are strips of vegetated land adjacent to a body of water (e.g., stream, lake, wetland, etc.). They serve important stream functions including sediment trapping, nutrient cycling, stream shading, energy dissipation, natural moderation of floods, bank stability, natural wetland development, and delivery of organic matter to aquatic systems (Iowa DNR 2015).

Stream buffers can slow flood flows, eliminating surface erosion and allowing water to infiltrate the soil and recharge ground water supplies (NRCS and Wildlife Habitat Council 2007). The slowing of surface water also allows for nutrient uptake by riparian vegetation and degradation of pesticides (Bongard and Wyatt 2010), keeping these pollutants out of sensitive aquatic ecosystems. Vegetation also reduces sediment inputs to the stream both by filtering sediment from overland flow and catching sediment during flood events that would otherwise end up in the channel downstream (NRCS and Wildlife Habitat Council 2007). A forested stream buffer provides shade which contributes toward cooler water temperatures critical for fish and other aquatic species, particularly trout. Trees also provide woody habitat for aquatic species and shade reduces primary productivity thereby diminishing nuisance overgrowth of algae (Morgan et al. 2006).

The benefits of stream buffers include not only ecological benefits but community benefits as well. Stable streams surrounded by intact riparian buffers enhance aesthetics and recreational activity opportunities such as swimming, boating, and angling; local communities can benefit economically from these opportunities.

Riparian buffering techniques include preservation as well as implementing physical augmentation (e.g., restoration/establishment and enhancement) of the buffer to improve water quality and/or ecosystem function. All techniques should strive to mimic the native composition, density, and structure of fully functional stream buffers situated within the same watershed. When developing a riparian buffer plan, resource professionals should consider stream size, stream slope, drainage area, need for filtering runoff, stability of the stream, life history requirements of resident species, potential for stream bank erosion, longitudinal and horizontal migration, and floodplain interaction frequency.

In most cases, stream buffer projects are not intended to stand alone as a restoration project; rather they should be included as a ***component*** of a comprehensive stream restoration plan designed by a professional. Streams that are recognizably unstable, entrenched, incised, or otherwise disconnected from their floodplains, and which require extensive stream bed and/or bank restoration necessitate a restoration plan including techniques that address the processes causing instability. Under some circumstances, if stream restoration is not possible, it may be appropriate to establish a buffer to accommodate anticipated adjustments in the stream's dimension, pattern, and profile caused by continued stream instability and other watershed changes.

However, riparian buffering can be as simple as implementing relatively inexpensive revegetation activities and in these cases, requires little to no training to implement. Such activities are a good option for landowners.

The guidelines and specifications provided in this document are general and not a comprehensive design manual. It is the responsibility of the designer to understand the design approach and the feasibility of using riparian buffering techniques on a case-by-case basis. The following criteria in no way replaces design discretion, experience, and training, and cannot incorporate every scenario. They are intended to flag common errors, promote empirically stable design ranges, assist designers and reviewers in communication, and adapt tested designs to Iowa conditions.

2.0 BUFFER WIDTH

There is not a one-size-fits-all riparian buffer width; local conditions such stream size, geomorphology, local land use, native riparian plants and animals, and landowners' expectations must be examined. A buffer width intended to meet the objectives of the stream restoration project (e.g., stream bank stability, water quality, habitat, etc.) should be a minimum starting point; buffer width may require expansion to provide other benefits provided by riparian ecosystems. In Iowa, riparian buffers should be wide enough to encompass the stream's belt width with a minimum of 50 additional feet on each side of the belt width to provide buffering of the outsides of meander bends at the edges of the belt width. Smaller buffer widths may be appropriate on a case-by-case basis for small streams; consideration of reduced buffer width should be based on issues related to construction constraints, land ownership, and land use activities.

2.1 BUFFER WIDTH RELATIONSHIP TO GEOMORPHOLOGY

Encroachment on channels (e.g., from soil fill, buildings, farm fields, clearing vegetation, etc.) can cause instability, affect a stream's lateral containment (confinement), and result in channel enlargement, lateral accretion, stream bank erosion, and sediment transport problems (Rosgen 2006). The presence of a vegetated buffer adjacent to a stream reduces the potential for encroachments, thus reducing the potential for instability. Stable streams exist in a state of dynamic equilibrium and may naturally adjust their lateral and vertical positions over time; riparian buffers should be wide enough to accommodate these movements to ensure protection of the stream.

Lateral containment, also called confinement, is quantified by the Meander Width Ratio (MWR), which is defined as the belt width of the channel divided by the bankfull width of the channel (see Drawing 1). Some aspects of stream stability can be predicted by examining MWR. For example, the EPA's Stream Function Pyramid (Harman et al. 2012) – Geomorphology Performance Standard for a Rosgen C or E stream type is "Functioning" if MWR ≥ 3.5. This ratio is

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Buffer Width
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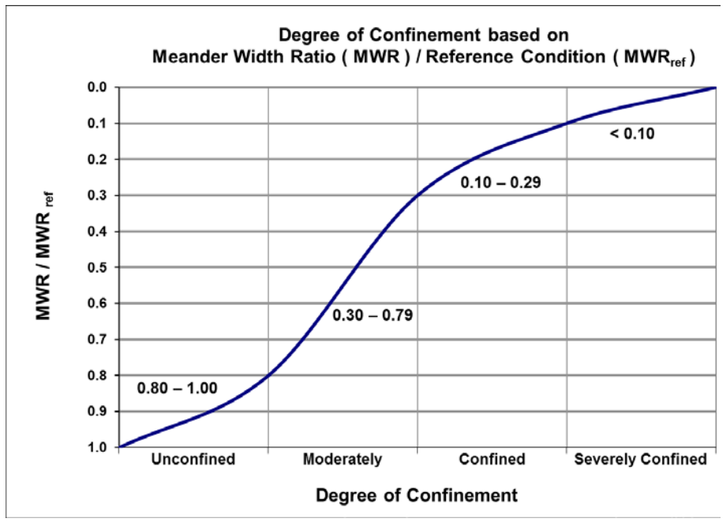
an absolute minimum however, and in certain settings a MWR between 4 and 40 is required to maintain geomorphic stability. Table 1 presents MWR for all Rosgen stream types.

Table 1. MWR by Stream Type (Rosgen 1996)

Rosgen Stream Type	Average MWR	MWR Range
A	1.5	1-3
D	1.1	1-2
B and G	3.7	2-8
F	5.3	2-10
C	11.4	4-20
E	24.2	20-40

The potential for instability resulting from the stream being too confined can often be prevented when the stream can meander freely in a riparian buffer at least as wide as the stream's average belt width (i.e., average MWR x bankfull width). This guidance is not applicable in every scenario and the minimum required MWR may need to differ from the average MWR; thus, each stream should be examined against the characteristics of stable reference conditions. In Watershed Assessment of River Stability and Sediment Supply (WARSSS, Rosgen 2006) degree of lateral confinement is expressed as the stream's MWR divided by the MWR of a reference reach/condition (see Figure 1); streams are considered confined when the degree of confinement is less than 0.30 (i.e., $MWR/MWR_{ref} < 0.3$).

Figure 1. Degree of Confinement as Function of MWR



2.2 OTHER BUFFER WIDTH RELATIONSHIPS

Studies addressing the effectiveness of buffers of various widths show, in general, wider buffers provide more water quality improvements and habitat value (NCIRT 2010). The relationship is not linear however; the increased benefits of wider buffers tend to increase at a slower rate once the buffer width exceeds 50 feet (NC Division of Water Quality 2007).

The USDA's Conservation Buffers website (www.bufferguidelines.net) offers resources for planning and designing buffers in rural and urban landscapes, including *Conservation Buffers: Design Guidelines for Buffers, Corridors, and Greenways* which provides illustrated design guidelines developed from extensive literature review. A variety of goals are considered as they relate to the characteristics of vegetated stream buffers, including buffer width. Goals include soil protection, air and water quality improvement, fish and other wildlife habitat, economic product production, recreation, and beautification.

3.0 BUFFER ZONES

Riparian buffers will function best when they include multiple zones relating to the hydrology and hydraulics of the stream, vegetation, and valley topography. Riparian buffers equaling at least the stable belt width of the stream plus an additional 50 feet on each side are likely to provide the greatest physical, hydrological, biological, and chemical benefits to the stream. Additional efforts to protect land and establish regionally-appropriate native vegetation within the broad floodplain and even on steeper valley sides can provide additional benefits to the stream. When possible, buffer vegetation should be perennial in order to optimize the bank stabilizing and erosion-resistance functions. See below drawings for the illustrated representation of these zones.

- **Near-Stream Zone (Belt Width):** The near-stream zone is located adjacent to the stream. This zone is the belt width, the corridor where the stream flows measured between the outsides of opposing meander bends. This zone may be shifted to one side of the stream when a valley side restricts the stream corridor.

- **Broad Floodplain Zone:** The broad floodplain zone is located between the near-stream zone and the valley sides; it is a low terrace that is sometimes flooded. If floodplain data are available, the area below the 500-year flood elevation may be considered part of this zone.

- **Valley Side Zone:** The valley walls are located outside of the floodplain as determined by a distinct break in slope in the valley profile. The valley side zone is characterized by steeper slopes than in the other zones.

4.0 BUFFER VEGETATION

A mixture of woody and herbaceous vegetation that incorporates a variety of native perennial species is ideal for a riparian buffer to provide streambank stability and other riparian functions. Vegetation can provide both mechanical stability through soil reinforcement and hydrologic stability through the reduction of soil moisture content. Riparian systems in Iowa are divided into four plant zones corresponding to elevations along the stream bank profile - water's edge, bankfull, side slope, and top of bank (Iowa DNR 2015). All four planting zones may occur in the near-stream buffer zone or they may be spread throughout the near-stream, broad floodplain, and valley side buffer zones. The Iowa Riverside Plant Selection (rev. 12/15/2016) should be consulted, along with River Restoration Toolbox Practice Guide 2: Vegetative Restoration, to aid in selecting plants and planting methods for use in riparian buffers.

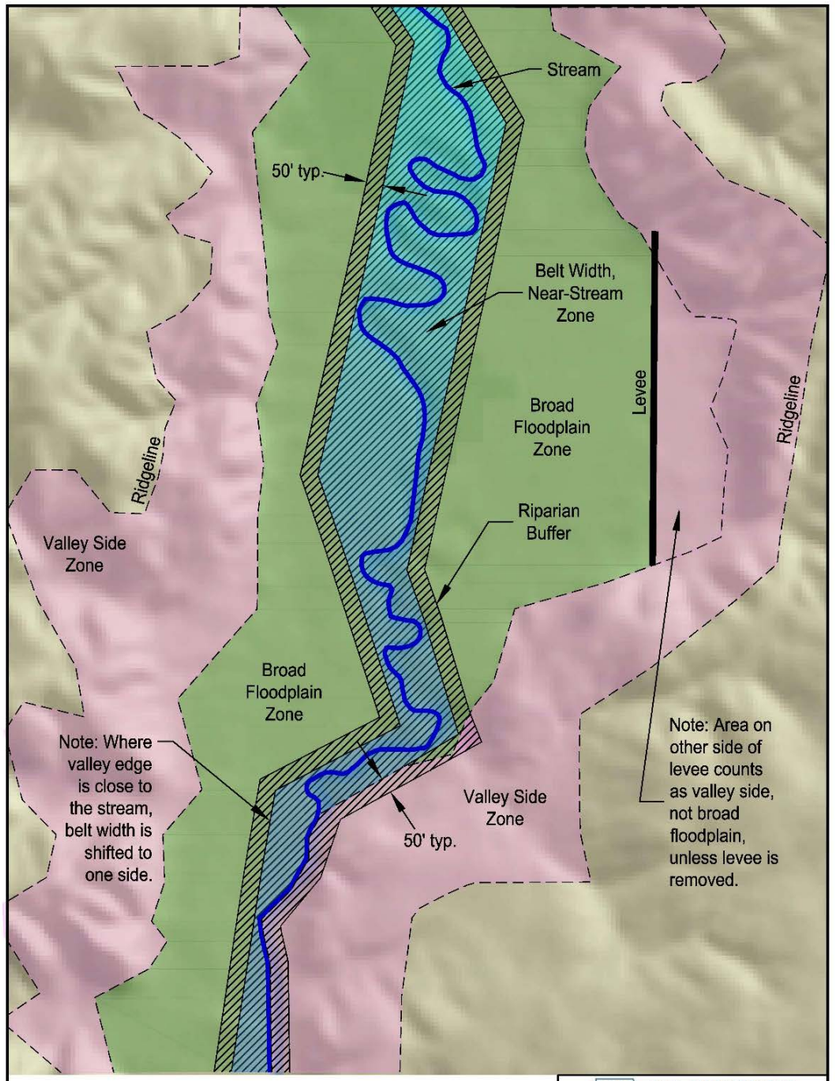
Riparian buffer vegetation should be adapted to the specific hydrologic conditions in both the buffer zone(s) and planting zones and be designed to perform specific ecological functions. The streambanks typically consist of the water's edge and bankfull zones; often the side slope planting zone is also considered part of the stream bank. Stream bank vegetation should consist of water tolerant species and is primarily responsible for streambank stability. Ideally, riparian vegetation will mostly consist of native perennial, deep-rooted plants, such as trees. Trees can provide important shade, recruitment of woody habitat into streams, leaf litter and large roots to stabilize the bank. In prairie ecosystems, however, trees may not be part of the natural riparian system. In these systems, native riparian prairie grass and forb species, especially species with dense, vertically-distributed root systems, will be better suited. However, it is still common in these systems to find occasional riparian trees and shrubs such as willow and cottonwood. Vegetation on the stream banks functions best at maturity and should not be disturbed.

Vegetation in the top of bank planting zone is adjacent to and up-gradient from the stream banks. Top of bank vegetation can consist of trees, shrubs, vines, forbs, rushes, sedges, or grasses, designed to catch surface runoff and increase infiltration (NRCS 2007). Vegetated stream buffers provide a wealth of habitat for wildlife; the larger the riparian area the more wildlife species expected to benefit (Bongard and Wyatt 2010).

5.0 BUFFER SHAPES

Riparian buffers are not required to be uniformly wide and run parallel to the stream bank. Buffer width can be measured perpendicular to flow, usually from the top of bank on each side of the stream. Strict adherence to this method of establishing buffer width can result in an irregularly-shaped buffer that meanders with the stream across the valley. Irregular buffers can be difficult to survey and manage; as the channel meanders the buffer boundary changes direction (bearing) as well.

Drawing 1. Riparian Buffering



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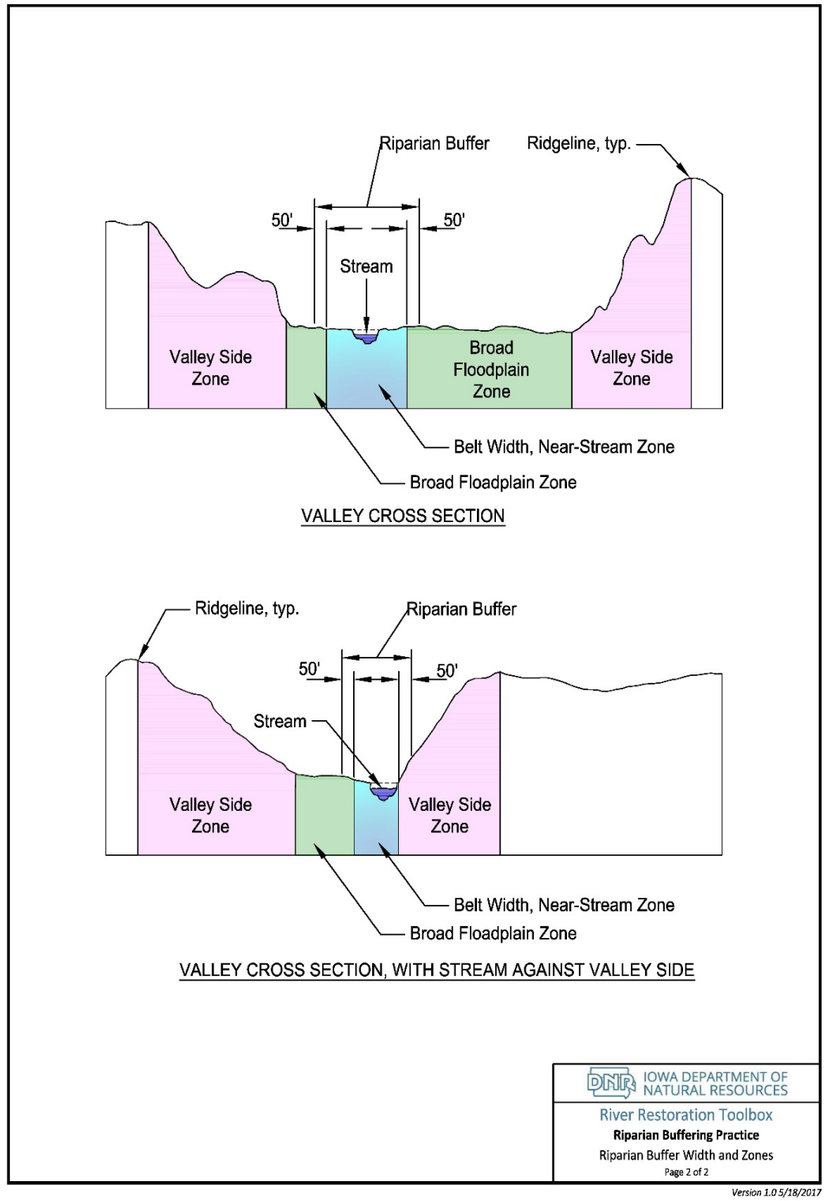
Drawing 2. Riparian Buffering (continued)



Version 1.0 5/18/2017

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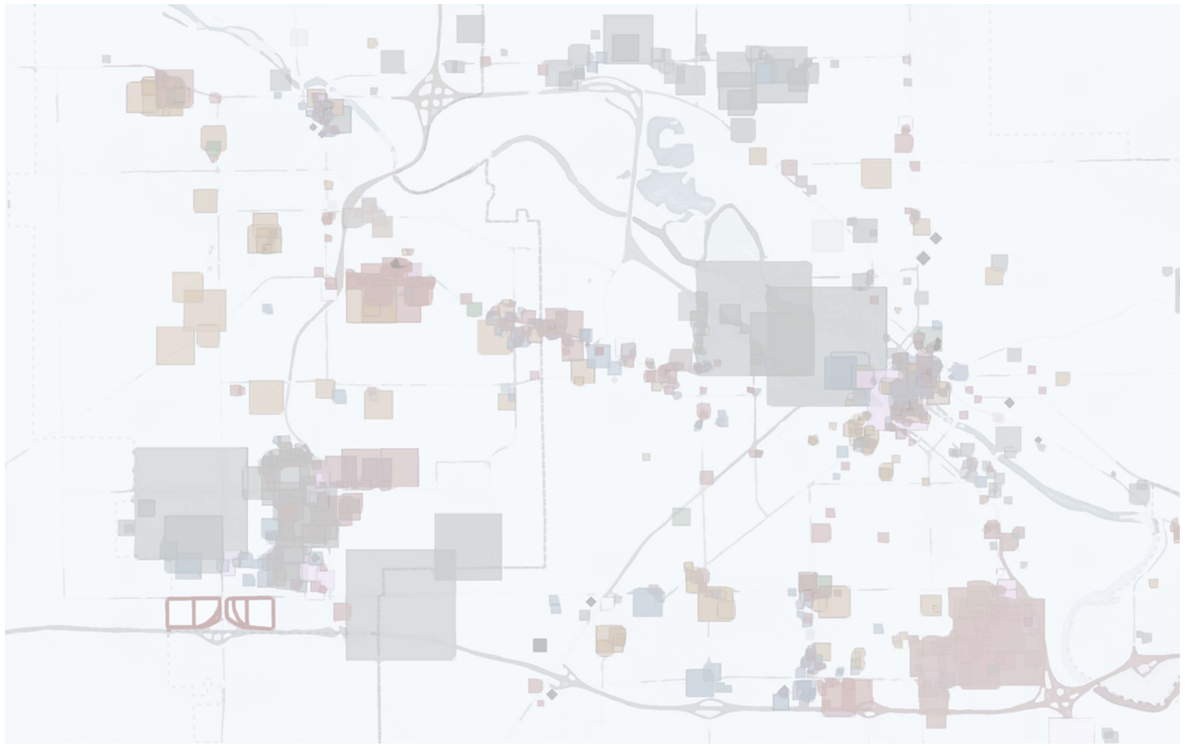
Market Analysis



Cedar Falls Gibson Property | Market Analysis

August, 2019

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Prepared For:

CEDAR FALLS Iowa

Prepared By:

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CONFLUENCE

General Limiting Conditions

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Background

This memo summarizes a preliminary determination of market support for private sector development on the 157-acre former Gibson Property, consisting of two assembled City-owned parcels straddling Hudson Road, north of U.S. Highway 20, at the southern border of Cedar Falls, Iowa. This analysis is in support of an on-going master planning effort for the property and focuses primarily on opportunities for commercial land uses, including light industrial, office, retail. This analysis also outlines possible industry targeting approaches, based on a review of economic and employment trends in the nation, state & local region.

Approach

The analysis begins with an overview of demographic and economic conditions shaping demand for potential subject property land uses. For each commercial land use under consideration, we define a market area for the subject and then summarize local and regional demographic and economic factors likely to affect the current and future market for each use in the market area. These factors include specific competitive supply conditions such as occupancy, rents, construction activity and absorption as well as demand drivers – primarily projected employment growth in certain industries as well as projected household growth. The present analysis concludes with a discussion of the context locale and the subject site itself, evaluated in terms of a variety of locational factors influencing commercial development suitability

A market the size of the Cedar Falls-Waterloo metropolitan area (essentially Black Hawk County) presents certain challenges in terms of data collection and data quality. Most analysis of market supply and demand factors relies heavily on commercial property data collected by subscription services such as Costar, Inc. or other national brokerages such as Colliers or Cushman & Wakefield. For smaller markets, local brokers tend to have superior knowledge of market conditions and trends but incomplete or infrequent data collection and reporting practices. National brokers, on the other hand, have detailed and well-organized data, but tend to give small markets insufficient attention in terms of updates and thoroughness – requiring significant quality control and "cleaning" to prepare inputs for demand modeling. Federal and state data on employment and other economic factors – also critical to forecasting demand – tends to be limited to the county (as opposed to city) level, and often has suppressed data in key categories due to confidentiality concerns.

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Economic and Market Conditions

Demographic Conditions & Trends

Population and Household Basics

	Cedar Falls	Waterloo	Black Hawk Co.	State of Iowa	USA
Population - 2018 est.	41,656	69,525	135,103	3,219,046	330,088,686
Households - 2000	12,879	28,189	49,683	1,149,276	105,480,101
Households - 2010	14,608	28,607	52,470	1,221,576	116,716,292
Households - 2018 est.	15,681	28,975	54,071	1,285,531	124,110,001
2000 to 2010	1.3%	0.1%	0.5%	0.6%	1.0%
2010 to 2018	1.0%	0.2%	0.4%	0.7%	0.9%
Average Household Size (2018)	2.39	2.36	2.40	2.43	2.59
Family Households (2 or more related)	55%	60%	61%	65%	66%
Single-person Households	28%	32%	29%	28%	27%
Renter Households (2018)	33%	31%	30%	27%	33%

Source: ESRI and Leland Consulting Group

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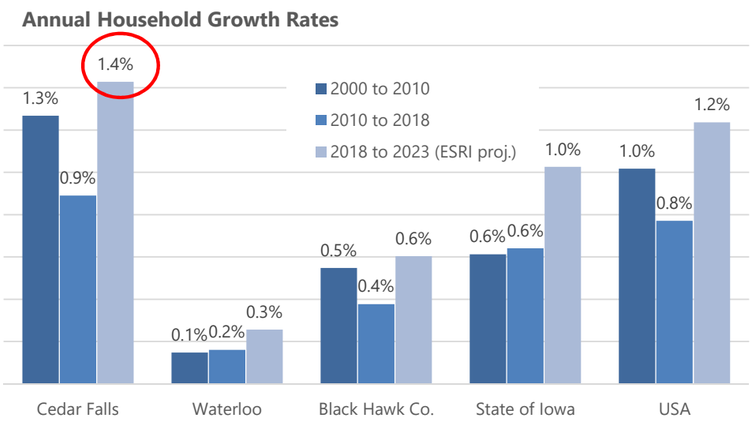

Source: ESRI and Leland Consulting Group

Household growth in Cedar Falls has outpaced that in Waterloo since 2000 and is projected to continue in that fashion, with 1.4 percent annual growth expected through the coming five years, faster than both state and national overall rates.

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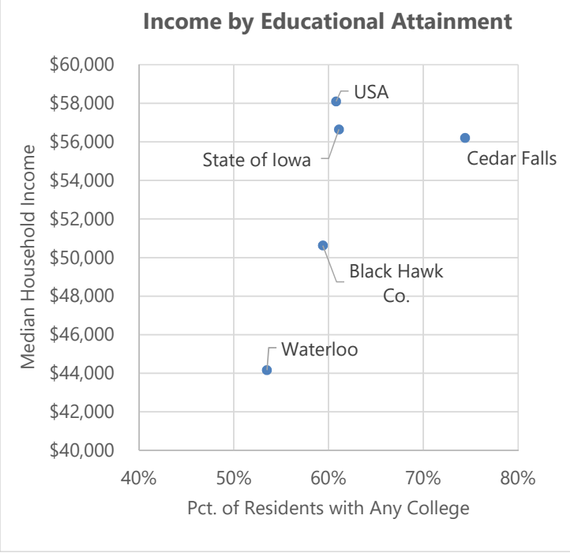

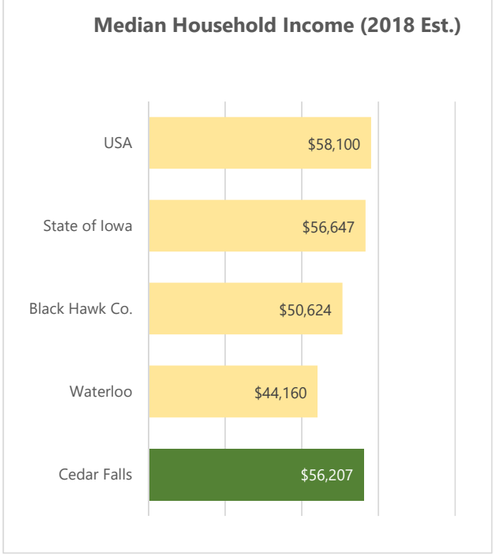

Source: ESRI and Leland Consulting Group

Income is strongly related to education levels. Almost three-quarters of Cedar Falls residents age 20 and up have attended at least some college, thanks in part to the NIU presence, considerably higher than relevant state and regional comparisons. Incomes in Cedar falls are considerably higher than in Waterloo – almost on par with both the state and nation. Because of the low incomes associated with current college students, this figure probably understates the relative affluence and spending power of the city's residents.

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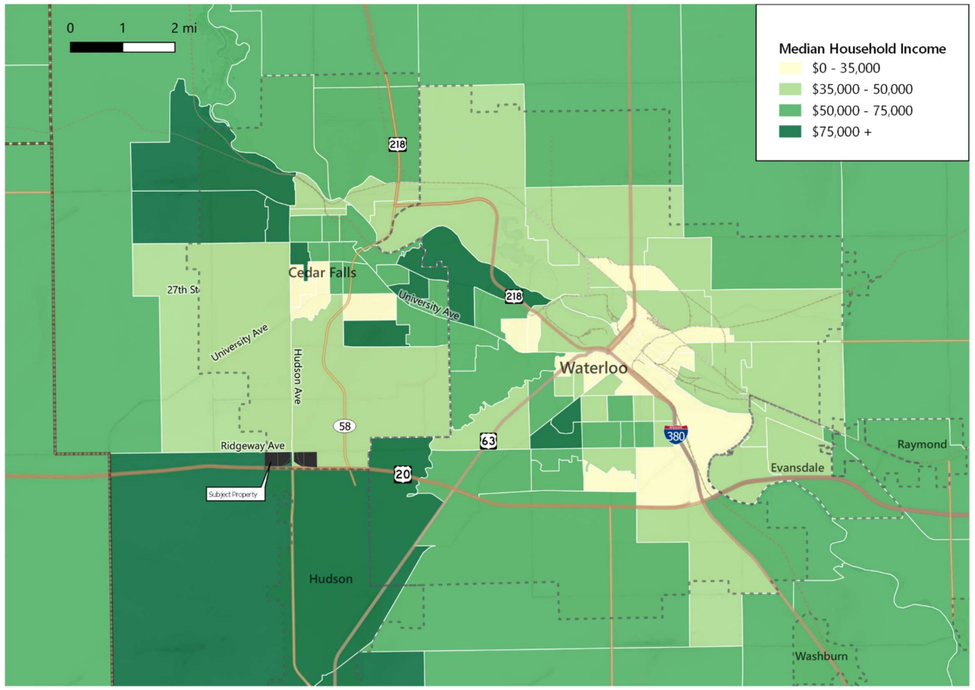
Figure 1: Median Household Income (2018 est.)



Source: ESRI and Leland Consulting Group

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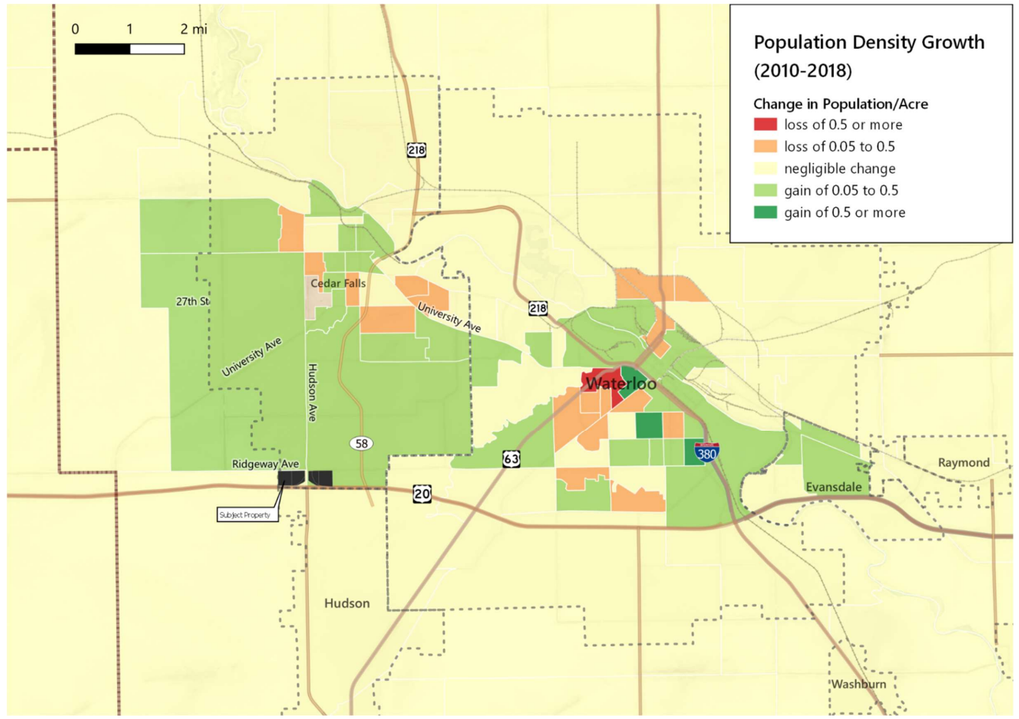
Figure 2: Metro Area Population Growth Shifts Since 2010



Source: ESRI and Leland Consulting Group

Although the shifts are somewhat subtle, the above map illustrates the trends in population density change across the Waterloo-Cedar Falls metro area. Notable for this project is the movement since 2010 of Cedar Falls population density gradually southward (in addition to some north-central pockets of growth). Waterloo is experiencing more volatility, with population loss in some downtown-adjacent neighborhoods but growth in others.

Employment Conditions

Overall Employment Growth Trends

The nation (and much of the world) saw a prolonged economic slowdown beginning in 2008, without substantial improvement until 2011. This recession was evident across all sectors of the economy, but perhaps best understood through its impact on total employment levels. The dotted blue line in shows nationwide job growth, indexed to a base of 2001, and illustrates the general nationwide business cycle since that time.

Since the trough of the recession, in 2010/2011, there has been positive annual employment growth nationally, as well as in both the State of Iowa and Black Hawk County. Since 2001, Iowa's cumulative job growth has lagged below the national rate. Because of this, the nation has 20-percent more jobs currently (as of 2017) than in 2001, while Iowa has seen growth of 8.8-percent.

Statewide job growth has in fact been quite uneven across urban and rural areas, with its largest cities (especially the Des Moines metropolitan area) experiencing very robust growth, while most rural counties remained stagnant or in decline. As a smaller urban market with some rural characteristic, Black Hawk County's overall employment growth trend has generally followed the ups and downs of the national and state economy.

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Figure 3: Percent Employment Growth Since 2001, Black Hawk County vs. Iowa & U.S.

Source: BLS and Leland Consulting Group

Manufacturing Employment Growth Trends

Despite overall job growth lagging behind the nation (nearly on par with the state) the good news for Black Hawk County can be found by looking at its historical economic life-blood, manufacturing. Comparing county manufacturing job growth to the statewide and national trends, again indexed to a 2001 base year, Figure 4 shows that although the local metro area experienced a 4.1-percent decrease for the decade ending in 2015, both the state and nation saw significantly steeper declines (-8.8 percent and -21.6 percent, respectively).

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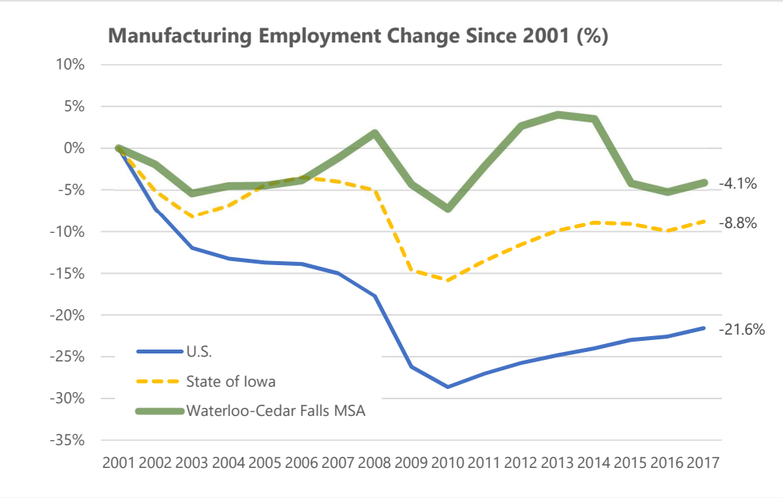
So, even though there was no net post-recession increase in Black Hawk County manufacturing, this remarkable comparison of manufacturing sector health *relative* to the state and nation, especially since 2001, highlights a central reason for Cedar Falls' ability to stave off the more serious population losses experienced by many rural Iowa communities.

Figure 4: Manufacturing Employment Growth Since 2001, Black Hawk County vs. Iowa & U.S



Source: BLS and Leland Consulting Group

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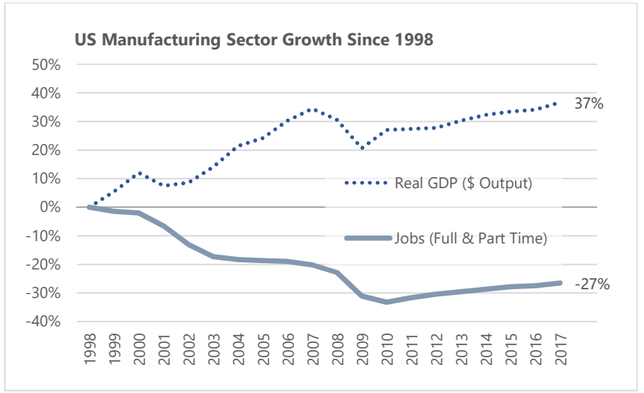
Figure 5: Manufacturing Output (GDP) Growth vs. Job Growth Since 1998



Source: U.S. BEA and Leland Consulting Group

Despite a significant drop-off in manufacturing *employment* levels, the manufacturing sector is, in fact, performing quite well in terms of total output. As Figure 5 shows, over the past two decades, nationwide manufacturing employment has declined by 27-percent at the same time that total output (inflation-adjusted manufacturing sector GDP) has increased a robust 37-percent.

This imbalance results almost entirely from production gains due to automation. In other words, because of technological advances, manufacturing firms have gone from generating $79,000 in total output per human employee in 1998 to $147,000 in 2017 (in inflation-adjusted dollars). This statistic is very relevant to urban planning and local economic development. Landing a new manufacturing facility through local industry recruitment efforts is today likely to translate into far fewer local jobs than a similar facility investment two decades ago. Major industrial developments are still coveted, of course, but increasingly the local benefits have more to do with growth in property taxes and somewhat less with employment growth.

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Cedar Falls Employment Profile

Figure 6 shows employment by industry, specific to the city of Cedar Falls – both in terms of jobs held by Cedar Falls residents and jobs taking place within Cedar Falls workplaces. With nearly 4,200 full and part-time jobs, the education sector provides the largest number of jobs taking place in Cedar Falls, followed by retail and lodging/dining ("food service and accommodations"). Employment concentrations in these sectors are consistent with a residential-oriented city.

These are followed closely by several sectors that tend to be higher-paying, and, as we show later, upwardly trending in Cedar Falls relative to Waterloo: healthcare, manufacturing, logistics (transportation and warehousing) and professional/technical services. healthcare, with nearly 2,700 jobs. Three other sectors have more than 1,000 employees both living in Cedar Falls or working in Cedar Falls: healthcare, retail and educational services. The accommodation and food services (lodging/dining) sector rounds out the top five industry sectors, with nearly 1,000 resident workers and 1,200 jobs in Cedar Falls workplaces. Growth in these sectors is evidence of Cedar Falls' gradual transformation into a more regionally-oriented economic hub, increasingly sharing a role that has been historically skewed towards Waterloo.

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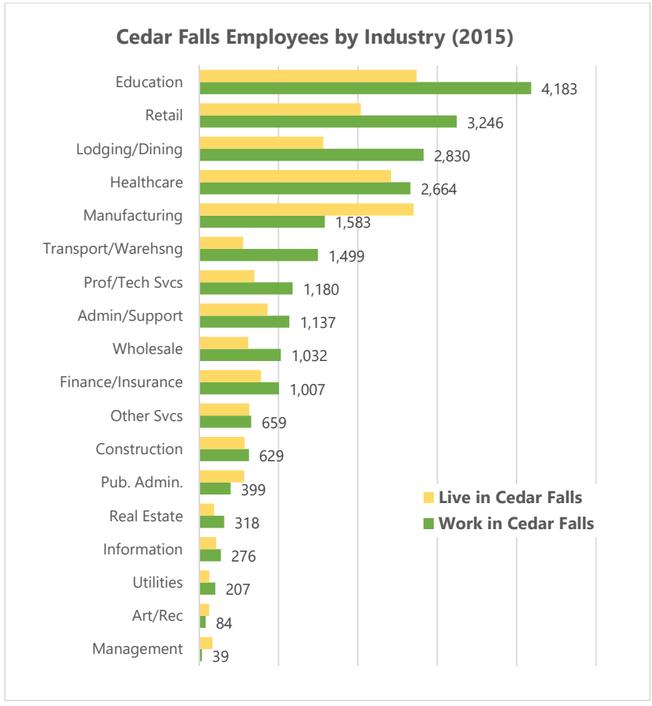
Figure 6: Cedar Falls Employment by Industry, 2015



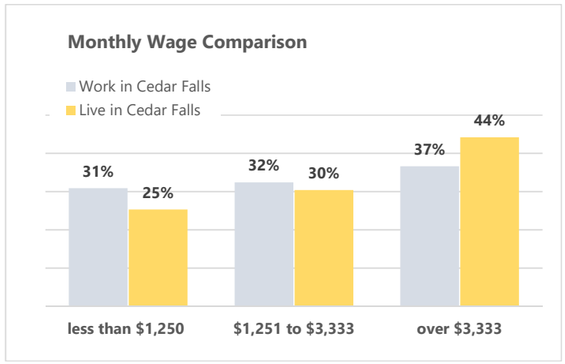
Source: US Census Longitudinal Employment and Household Dynamics (LEHD) dataset and Leland Consulting Group

Note: Figure excludes Natural Resources and Mining sectors, with minimal employment

Of those top five industries, retail and dining/lodging stand out as having relatively low wages, while manufacturing, healthcare and education are generally much better-paying, both nationally and in the local economy.

Comparing wages earned by Cedar Falls resident workers with wages paid by Cedar Falls businesses, Figure 7 shows that in-town jobs are somewhat lower-paying on average than out-of-town jobs filled by out-commuting Cedar Falls residents – although the differences are not extreme.

Figure 7: Cedar Falls Wage Comparison, 2015



Source: US Census Longitudinal Employment and Household Dynamics (LEHD) dataset and Leland Consulting Group

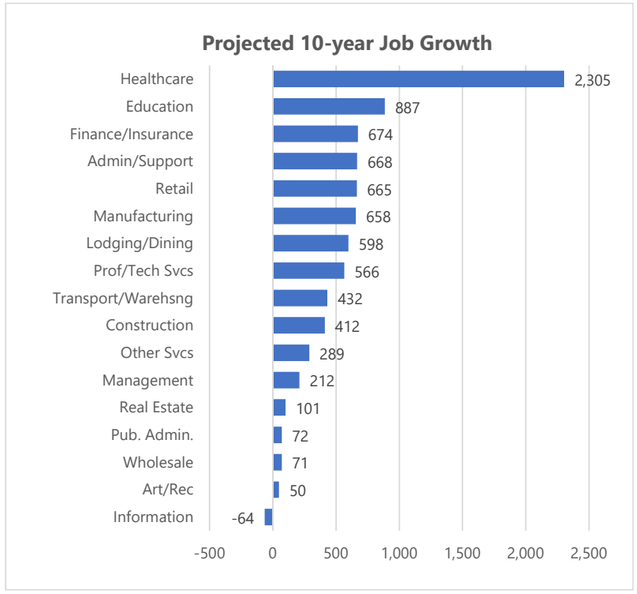
Employment Forecasts

Through its Workforce Development department, the State of Iowa periodically produces "long-term" forecasts of future employment growth across the many industry sectors and sub-sectors. These 10-year forecasts are made for each of the state's 16 workforce development regions shown in the map. Black Hawk County is the primary economic hub for Region 7.

The most recent available set of employment forecasts covers the period from 2016 to 2026. Iowa Workforce Development projects at least some growth across (almost) all industries for Region 7. Total employment growth for the 10-year forecast period is 8,595 jobs, added to its current base of just over 100,000 jobs. The overall projected addition of 8,600 jobs would represent an average annual employment growth rate of 0.83-percent for the counties in Region 7.

The leading single growth sector is projected to be healthcare, with an expected 2,305 new jobs over the decade. Medical industry growth is driven (both here and across most national markets) largely by the aging Baby Boomer population bulge. As that segments enters their senior years, demand for medical and related social services are likely to rise across the board.

Figure 8: Long-Term Employment Growth Projections by Industry (2018-28), Iowa Region 7



Source: Labor Market Information Division, Iowa Workforce Development (Long-term industry forecasts from the for 2016 to 2026 were converted to 2018-2018, based in part on Short-term forecasts for 2017-2019); and Leland Consulting Group. Note: Figure excludes Utilities, Mining and Natural Resources industry sectors, which have minimal regional employment

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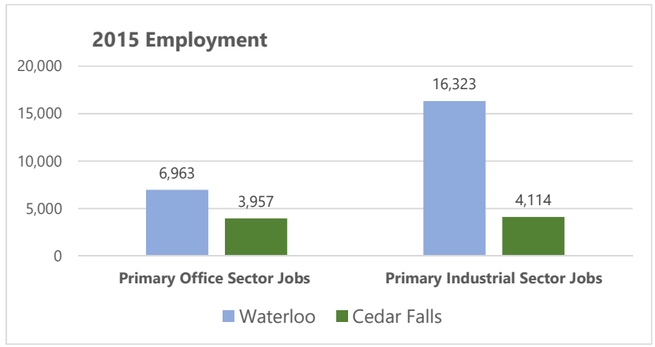
Shifts Within the Waterloo-Cedar Falls Economy

Waterloo is still the dominant employer in the metro, with nearly double the primary office sector jobs and almost four times the primary industrial sector jobs as Cedar Falls, as of 2015 (the latest date allowing for direct comparisons within the metro area.

Figure 9: Primary Office vs. Industrial Jobs Comparison (2015)



Source: US Census Longitudinal Employment and Household Dynamics (LEHD) dataset and Leland Consulting Group

Note: Primary Office includes jobs in information, finance, real estate, management of companies, professional/tech services, and administrative support services. Primary Industrial includes jobs in manufacturing, logistics (transportation and warehousing), and wholesale trade.

However, as the figures below illustrate, the last decade has seen a relative trend favoring growth in Cedar Falls versus Waterloo across office sector and industrial sector jobs. In fact, much of the recent growth in both office and industrial employment has occurred in the business parks just north of the subject property. This ongoing shift is an important indicator of broadening employment activity of the type likely to support demand for space on the subject property.

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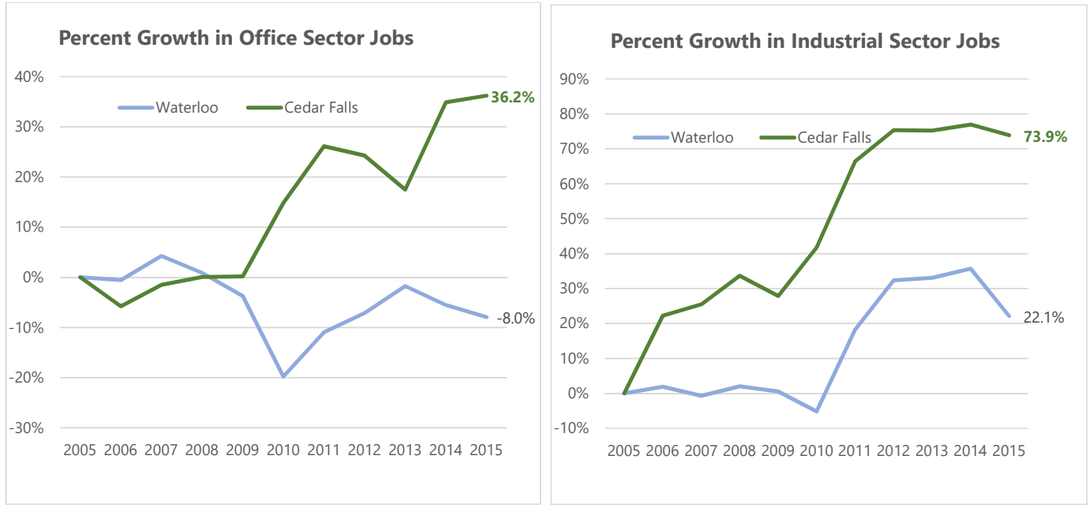
Figure 10: Growth Comparisons Between Waterloo and Cedar Falls in Office and Industrial Employment, 2005 to 2015



Source: US Census Longitudinal Employment and Household Dynamics (LEHD) dataset and Leland Consulting Group

Worker Flows

In 2005, Cedar Falls had estimated daily flows of approximately 12,400 people commuting *into* the city from outside for work, with just over 10,000 Cedar Falls residents commuting *out* for work. Another 5,640 residents were able to both live *and* work in the city.

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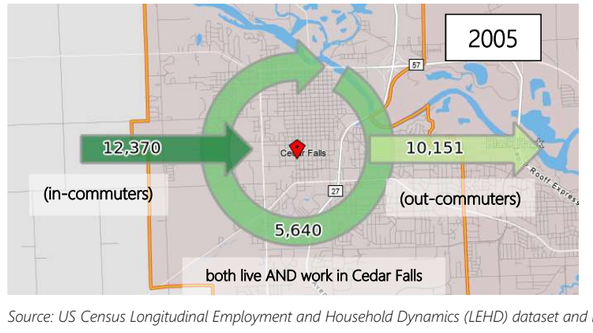
The count of those able to both live and work in a city is a good alternative indicator of jobs-housing balance, as it reflects how well a place meets the residential needs and wants of those who are actually employed there. While there is no "optimal" ratio for how many in-town employees manage to also live in town, that indicator can be tracked in a relative sense as a barometer of civic well-roundedness.

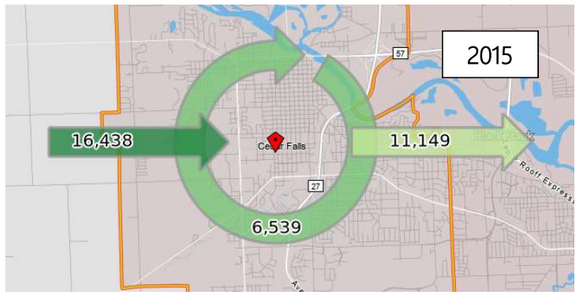
In the case of Cedar Falls, the fact that the "live and work" group grew by nearly 1,000 over the decade ending in 2015 is a positive indicator of increased civic maturity as both workplace and bedroom. The evidence of shift from Waterloo towards Cedar Falls as a workplace option is further evidenced by addition of over 4,000 new in-commuters over the same period.

Figure 11: In-Commuting and Out-Commuting Patterns for Cedar Falls, 2005 vs. 2015



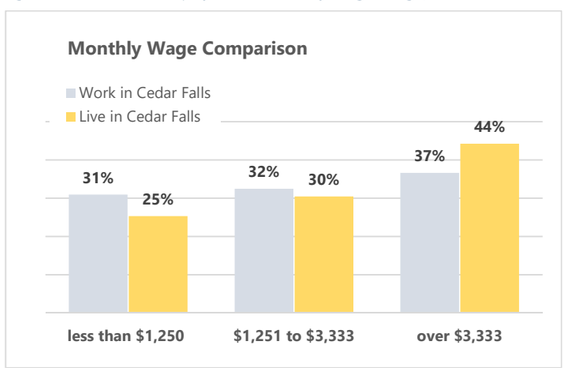
Source: US Census Longitudinal Employment and Household Dynamics (LEHD) dataset and Leland Consulting Group

Because this evolution of Cedar Falls' regional role is heavily driven by "traded sector" industries (essentially "importers of regional dollars") such as finance, logistics and manufacturing. As such, these changes are likely to be accompanied by strong multiplier effects—as the influx of jobs and resulting household income growth recirculates through the local economy in the form of retail, dining, and business-to-business spending.



Source: US Census Longitudinal Employment and Household Dynamics (LEHD) dataset and Leland Consulting Group

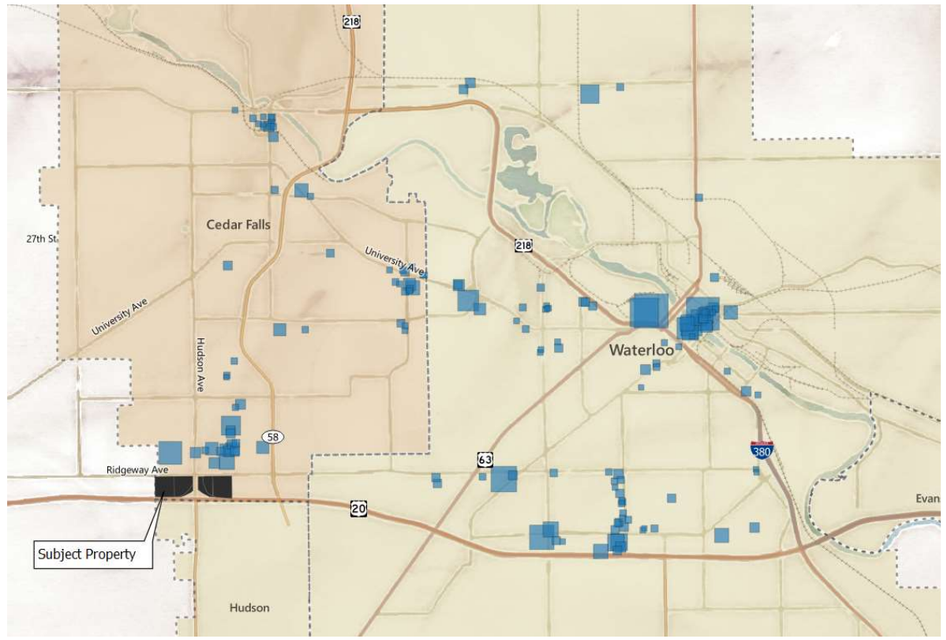
Figure 12: Cedar Falls Employment Growth by Wage Range, 2005 vs 2015



Source: US Census Longitudinal Employment and Household Dynamics (LEHD) dataset and Leland Consulting Group

Office Market

Figure 13: Existing Office Supply



Source: Costar and Leland Consulting Group

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Fundamental demand for office space on a given property is seen as a function of the level of employment across a broader surrounding market area. Certain industry sectors, such as finance, professional services and information will need nearly all employees to be working in offices, while firms in other industries may require relatively little office real estate. Projected job growth in office-intensive sectors is the primary predictor of future office demand. In areas where demand for office space is already higher than can be accommodated by standing office inventories (as evidenced by low vacancy rates and rising rents) there may also be "pent-up" demand for immediate construction.

Regional 10-year Office Demand Projections

	2018 Jobs	Pct. In Office Space	Est. S.F. per Office Job	Current Office Space (sf)	10-yr Growth Rate	10-yr Office Space Growth
Healthcare	14,620	*25%*	*250*	913,750	1.5%	144,043
Finance/Insurance	4,150	*80%*	*250*	830,000	1.5%	134,760
Prof/Tech Svcs	3,323	*80%*	*250*	664,500	1.6%	113,150
Admin/Support	3,725	*50%*	*250*	465,625	1.7%	83,450
Management	935	*85%*	*250*	198,688	2.1%	45,007
Real Estate	998	*50%*	*250*	124,688	1.0%	12,595
Education	13,083	*5%*	*250*	163,531	0.7%	11,086
All Other	59,045	mixed	*250*	703,594	mixed	15,682
Total*	**99,878**			**4,064,375**		**559,771**
				Subject Capture		
				low	20%	112,000
				high	30%	168,000

Source: Labor Market Information Division, Iowa Workforce Development (Long-term industry forecasts from the for 2016 to 2026 were converted to 2018-2018, based in part on Short-term forecasts for 2017-2019); and Leland Consulting Group

The potential for significant office demand in Iowa's workforce Region 7 (Black Hawk, Bremer, Buchanan, Butler, and Grundy) is bolstered by strong recent and projected growth in industry sectors that typically require office space, namely: financial activities, real estate, professional/technical/scientific services, management of companies, and administrative support activities. These sectors typically need new office space for at least 50 percent of new employees (80 percent or above for finance and professional/tech services). With the exception of information (a sector still dominated by the struggling newspaper

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publishing industry) all are expected to grow faster than 1.0 percent annually – above the overall jobs growth projected rate of 0.8 percent and more than double the expected household growth rate (0.7 percent) for all but information and real estate.

Healthcare employment is more difficult to reliably translate into future office space demand (as opposed to hospital or clinic demand). The proportion of new healthcare jobs requiring office space tends to range from 20 percent to 50 percent, depending on the market and local providers. The table above assumes a 25-percent office penetration rate. With over 2,300 projected new jobs over the coming decade, healthcare could support demand for 144,000 square feet of new medical office space – more than any individual traditional "office sector".

Capture Potential

In all, new demand for office space across the 5-county Region 7 should approach 560,000 square feet over ten years. Given that Region 7 office development of any scale is almost entirely limited to Black Hawk county and given that Cedar Falls appears to be increasing its county share of office-sector employment recently, we estimate that attainable subject property capture of new regional office space could range from 20 to 30 percent, equating to approximately 112,000 to 168,000 square feet of supported development. Given that likely new competition for higher-end office space in the market is currently limited (with space in Waterloo's Tech Works complex standing out as a notable exception), even high capture rates may be possible with fortunate timing. While capturing above 30 percent of regional office growth is not out of the question, but would require a particularly aggressive marketing approach, a standout design, and a strong recruiting preference on behalf of the City towards this particular site.

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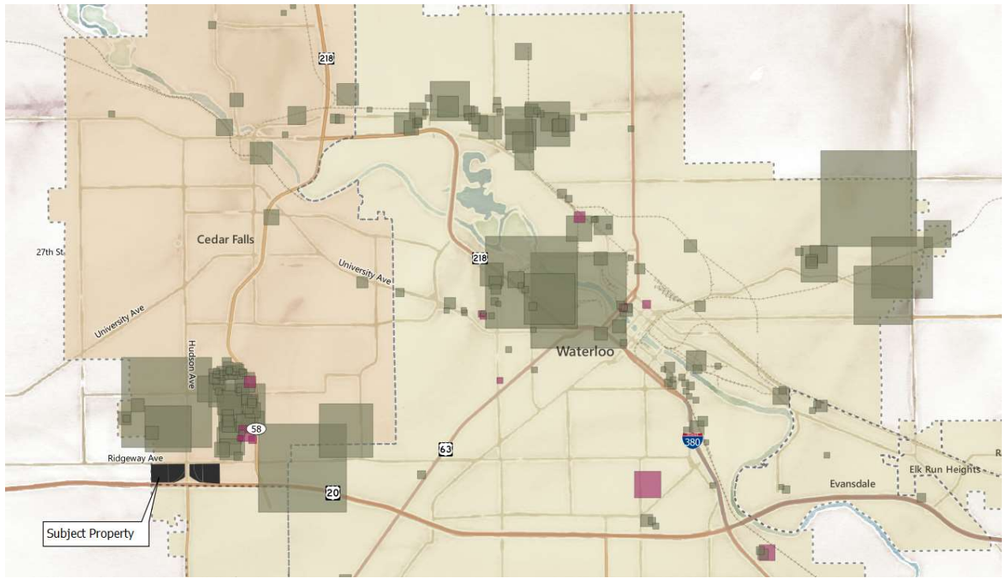
Industrial Market

Figure 14: Existing Industrial and Flex Supply



Source: Costar and Leland Consulting Group

Industrial/flex demand is estimated in a similar fashion to office, although some of the inputs are prone to higher margins-of-error, since the percentage of employees requiring office/flex ranges considerably even within a single industry group. Likewise, the average square footage required per employee is highly variable, depending heavily on the degree of automation and nature of activities occurring within a given facility Two final uncertainty factors are

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that 1) large-scale expansions of existing industrial firms are typically closely-held company secrets until close to the time of construction (often coming as a surprise to employment-forecasters) and 2) attracting a relocating or expanding firm from outside the market to develop a facility locally is usually the product of aggressive outreach, recruitment efforts and incentives together with corporate decision-making criteria that can be obscure. While recruitment often ends with logical additions to a city's existing industry clusters, the result can also result in introducing brand new industries to a market.

Given those caveats, the following demand calculations represent reasonable assumptions about prevailing local and national industry trends, resulting in development projections that are more likely to be close in terms of aggregate square footage than in terms of exact breakdowns by industry.

Regional 10-year Industrial Demand Projections

	2018 Jobs	Pct. In Industrial Space	Est. S.F. per Industrial Job	Est. Current Industrial Space (sf)	10-yr Projected Growth Rate	10-yr Industrial Growth (s.f.)
Manufacturing	17,788	*25%*	*500*	8,449,063	0.4%	312,319
Transport & Warehousing	3,875	*80%*	*1500*	5,231,250	1.1%	583,486
Wholesale Trade	3,510	*80%*	*1000*	3,334,500	0.2%	67,774
All Other	74,705	*mixed*	*250*	1,244,381		126,794
Total*	**99,878**			**18,259,194**		**1,090,373**

Source: Labor Market Information Division, Iowa Workforce Development (Long-term industry forecasts from the for 2016 to 2026 were converted to 2018-2018, based in part on Short-term forecasts for 2017-2019); and Leland Consulting Group

Capture Potential

Led by strong projected growth in logistics (transportation and warehousing sectors) and moderate but positive anticipated manufacturing growth, Region 7 could add another 1.1 million square feet of industrial/flex space to its approximately 18-20 million square foot existing inventory. While this level of growth is modest, it comes in the context of decades of dwindling national manufacturing demand. As noted in a previous section, manufacturing and logistics are particularly affected by trends in facility automation, effectively reducing the employment impact of new plants, even when the development value (and resulting construction impacts and property tax revenues) can be quite high.

Compared to office development, Black Hawk county is likely somewhat less dominant in terms of its share of industrial space (though this is difficult to quantify with available data). As a result. a 10- to 20-percent capture rate of region-wide demand for the subject property may be somewhat more aggressive – but still attainable, given the potential special focus on a larger corporate user. With that target, the subject property could develop approximately 110,000 to 220,000 square feet of space over ten years. The focus of development, in terms of best fit with the site, would be towards the more office-like R&D/flex range of the industrial development continuum.

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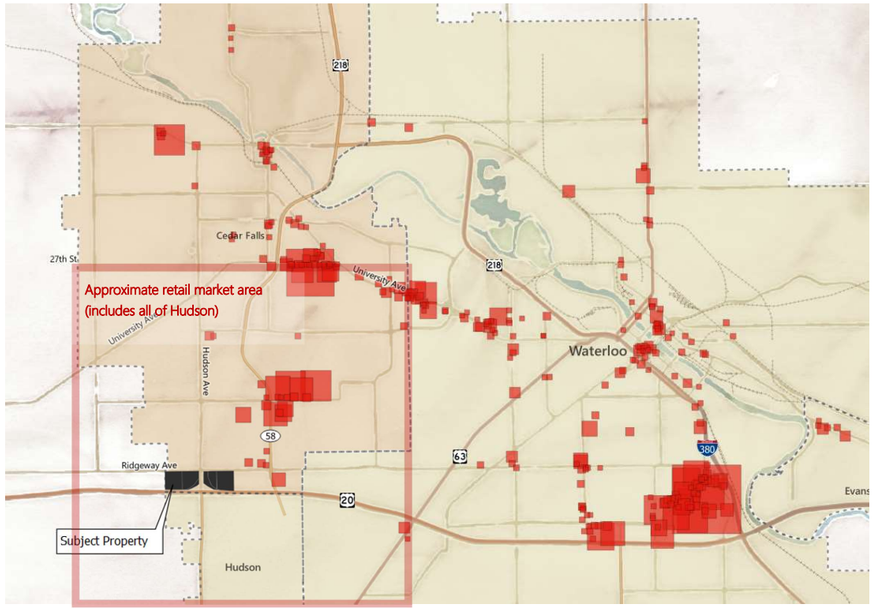
Retail Market

Figure 15: Existing Retail Supply and Retail Market Area



Source: Costar and Leland Consulting Group

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Demand for new retail space is determined by future retail spending potential of projected new households as well as by some recapturing of retail spending that is currently lost to nearby communities or areas (referred to as "leakage" or "retail void"). An additional adjustment is made to allow for demand from space turnover and replacement of existing obsolete retail space.

Additional demand is derived from the daytime spending potential of office workers (and some industrial employees, although they are more likely to eat lunch on-site) and overnight visitors staying in nearby lodging.

This retail analysis assumes that customers for the subject property would be drawn from a market area including all of Cedar Falls south of University Ave. plus a portion of southwestern Waterloo and the town of Hudson (where few competing retail and dining options exist).

Retail Market Area 10-year Demand Projections

	10-yr New Demand from HH Growth (s.f.)	Plus Recapture-able Existing Leakage (s.f.)	Plus Est. Obsolete s.f. Replaced (1% in 10 yr)	Total New 10-yr Demand (s.f.)
Furniture & Home Furnishings	2,212	281	372	2,865
Electronics & Appliance	1,887	2,510	34	4,431
Building Material, Garden Equip	3,582	0	1,558	5,139
Food & Beverage (grocery)	7,918	48,436	673	57,027
Health & Personal Care	3,240	2,558	420	6,217
Clothing & Accessories	2,351	0	1,971	4,322
Sporting Gds, Hobby, Book, Music	1,769	0	2,658	4,427
General Merchandise	10,586	0	5,996	16,583
Misc. Store Retailers	3,572	4,937	41	8,549
Foodservice & Drinking Places	6,752	0	1,903	8,655
Other (incl. cinema, prof./med. office, banks, fitness, etc.)	10,645	0	3,524	14,169
Total*	**54,513**	**58,722**	**19,149**	**132,384**

Source: Leland Consulting Group, with inputs from Costar (on retail supply), ESRI (demographics and spending potential)

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Because of the market area constraints posed by the boundary with Hudson, discussed in the Site Analysis below, retail demand for the subject property is likely limited to dining and service retail targeted to daytime populations in the project vicinity, with secondary support from surrounding neighborhoods. Ten-year demand is estimated at approximately 35,000 to 50,000 square feet.

Site Analysis for Potential Commercial Development

Category	Subject Evaluation ★ *weak* ★★ *fair* ★★★ *adequate* ★★★★ *strong* ★★★★★ *very strong*
Labor Market Proximity Convenience to residential options for management is one of the most important drivers of office site selection. Proximity to well-educated labor pool aids hiring and workforce quality of life. Industrial users are less dependent on a workforce of college graduates but do require proximity to strong training options.	★★★ Proximity to well-educated labor pool due to presence of NIU. Competitive with northern Iowa sites, but lags larger urban Iowa markets. Higher-end residential options for ownership & management are better in Cedar Falls than Waterloo, but also limited relative to larger Iowa markets.
Customer Proximity Being near end customers *per se*, is concern mainly for retailers (and some professional and medical offices). Office and industrial space can benefit from proximity to B-to-B clients and customers through simple ease of access,	★★★ (mixed) The site is very well-located relative to prospective retail dining and service customers originating from area workplaces and hotels. For retail drawing from household spending power, however, the site is less well located. It is further from both single family and multifamily households (including university housing) than current

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Category	Subject Evaluation ★ *weak* ★ ★ *fair* ★ ★ ★ *adequate* ★ ★ ★ ★ *strong* ★ ★ ★ ★ ★ *very strong*
although this benefit varies across industries and supply-chain practices of specific companies.	competing sites and not really on the way to other significant destinations. More importantly, the site's location at the border of the City's boundary with Hudson adds considerable uncertainty as to the scale and timing of residential rooftop growth on the southern half of what would be its traditional trade area "ring". From the perspective of either industrial or office tenants, proximity to other businesses is potentially very good (with the Technology and Industrial Center firms).
Visibility Visibility from major roads & highways can add continual advertising value for retail and office properties, boosting prestige, name recognition, wayfinding. (Distinctive signage & architecture is an important complement). Industrial users derive some similar benefits, but to a lesser degree.	★★★★★ Visibility is excellent for the subject property for east-west traffic on U.S. Hwy. 20 and for motorists entering Cedar Falls from the south.
Access Ease of access (mainly auto, but also transit & ped) is critical for retailers and very desirable for office customers, management and employees. Industrial users demand good access for employees, but are generally more concerned with ease of truck movement.	★★★★ Access is also potentially excellent for both automobile and truck traffic. The potential for strong trail connectivity and crossings should boost pedestrian and bicycle access as well.

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Category	Subject Evaluation ★ *weak* ★ ★ *fair* ★ ★ ★ *adequate* ★ ★ ★ ★ *strong* ★ ★ ★ ★ ★ *very strong*
Traffic Volume Office properties are not dependent on traffic in the same way as retail, but high volume helps to reap visibility benefits. Traffic volume, if too high, can become a detriment for industrial users.	★★★ Hudson Road is one of the primary entry pathways from Des Moines and other southern population centers into the NIU campus area. Traffic volumes on Ridgeway, US 20 and Hudson Rd. are modest relative to some other metro area commuting corridors, but growing.
Neighboring Land Uses Office real estate gets shared prestige from clustering near other offices similar in class or function. Other nearby land uses should not detract from overall desired image.	★★★1/2 Proximity to office, lodging and light industrial customers north of Ridgeway is a strong plus for potential dining and service retail uses and potentially consistent with either flex/employment or corporate use on the subject property. The new self-storage business in the southwest quadrant of U.S. 20 and Hudson Rd. (in Hudson) is moderately detrimental to prestige/image potential for the subject property, but mitigated somewhat by the physical separation of the interchange. The existing mobile home park adjacent to the subject on the east is also unfortunate from an image standpoint. While it can be buffered through design elements, it may remain a limiting factor to the value potential on the east subject parcel. Over time, the trailer park use may move as land values increase enough to make selling outweigh what likely is currently a "cash cow" for the owner.
Site Aesthetics	★★★ (potentially higher) The subject is aesthetically comparable to likely competing sites in northeast Iowa. That said, the Dry Run water feature, if integrated well with the site design, has the potential to add significantly to the site's

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Category	Subject Evaluation ★ *weak* ★ ★ *fair* ★ ★ ★ *adequate* ★ ★ ★ ★ *strong* ★ ★ ★ ★ ★ *very strong*
Aesthetic aspects such as natural landscape, views to and from the site, as well as streetscape and other urban or architectural amenities can boost office value.	natural appeal. This may be especially beneficial for a corporate campus user looking for a strong image-oriented site location.

SWOT Analysis

To organize the preliminary strategic findings arising from the market analysis thus far, we employ SWOT analysis, listing out the internal Strengths, Weaknesses of the subject property, alongside the external Opportunities and Threats in the potential project environment that may impact its chances for success.

- ***S****trengths*: characteristics of the site/project that give it an advantage over others.
- ***W****eaknesses*: characteristics of the site/project that place the business or project at a disadvantage relative to others.
- ***O****pportunities*: elements in the environment that the project could exploit to its advantage.
- ***T****hreats*: elements in the environment that could cause trouble for the project.

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•

	potentially ***helpful***	*potentially* ***harmful***
*(**internal** to, or part of the site)*	**Strengths** • Excellent site access and visibility • Topographic/natural amenity potential of Dry Run • Current City ownership preserving timing & use options • Adjacent to fast-growing Technology Park • Major gateway location for northbound (primarily metro Des Moines-originating) traffic • Proximity to UNI (activity generator, source of dining/service demand, training • Fiber-to-the-door connectivity (Gigabit City – moving towards 10Gb)	**Weaknesses** • Challenge with undevelopable flood plain land on western parcel Mobile home park adjacency – detrimental to aesthetics, prestige upside • Storage facility adjacency (across US 20 in Hudson) • Edge location – currently somewhat disconnected from existing development clusters (except for Technology Park)
*(**external** to the site)*	**Opportunities** • Steady metro population & overall job growth • Job growth strongest in sectors important to office and flex/R&D demand • Shifts in metro office and industrial jobs towards Cedar Falls (outpacing Waterloo growth) • Fast growth in nearby daytime population (potential restaurant & service customers) • Technology Works in Waterloo (see Threats) may make Black Hawk county more desirable to relocating corporations – who may then choose Cedar Falls as final site	**Threats** • Waterloo still dominant in metro (larger population, larger employer base) • Rooftop (population) density limited in nearby (1-mile) area, constraining potential retail development scale • Uncertainty & lack of control regarding future development immediately south in Hudson • Potential competition with Technology Works (400K + square foot redevelopment project in central Waterloo (strong John Deere ties, hotel, office space, training facilities, maker space, incubator space)

Absorption and Phasing

The preferred site plan vision is quite ambitious –appropriately so for a key remaining assembly of highway-fronting commercial land in Cedar Falls. While the aggressiveness of the plan is warranted given the prime site and the strong momentum currently enjoyed by the city, it translates into an absorption horizon that could consume several decades under reasonable market assumptions. As such, the phasing for the site's development needs to be flexible yet strategic.

Because the western parcel has potential value as a high-amenity, high-design site that would be suitable for a major corporate campus user, it makes sense to preserve that site until such a user can be identified and successfully recruited. The eastern parcel lacks the full upside potential of the west side,

due to its largely featureless topography, but shares important site attributes such as visibility, access, traffic volume and proximity to fast-growing commercial land uses.

Thus, we recommend making infrastructure improvements necessarily to market development parcels on the east side to small and medium users as an initial phase. Once the east side approaches capacity, then a second phase of infrastructure improvement and development can begin on the west. *However, if and when a prospective flagship user for the larger west. parcel can be secured, the City (or other owner/developer) should consider parallel development of both east and west parcels*

Market Analysis Conclusions: Why Cedar Falls? Why This Site?

- The mid-sized "twin cities" market of Waterloo-Cedar Falls is distant enough from any competing urban area to have its own market identity and regional influence, but not large enough to avoid some level of dependence, especially with metropolitan Des Moines, its primary regional neighbor.
- While the city of Cedar Falls has a number of major highway entry points, its southern gateway is particularly important to the city's image and economic role, both because of this relationship to Des Moines and because of the presence of Northern Iowa University just to the north.
- This favorable location within the metro has already begun yield positive market effects, capturing a significant share of the Waterloo-Cedar Falls new commercial development over the past decade – primarily in the form of office, flex/R&D, light industrial, and lodging development in and around the Cedar Falls Technology Park.
- The subject property is well-situated to capitalize on this momentum, taking advantage of potentially excellent visibility and access, along with natural drainage features that can serve as a centerpiece to a superior site design.
- While central Waterloo does pose some new competitive threat with recent investments in their Technology Works project (an adaptive re-use of older John Deere facilities into incubator and related tech space), the Gibson subject property is sufficiently differentiated from that competition – with more of a focus on commercial users that are "going concerns," less reliant on subsidized start-up amenities.
- The subject property also has strong potential to develop as a purpose-built hub for dining and service retail targeted to the growing southwest metro employment concentration. Existing competition is thus far somewhat scattershot and lacking in the kind of shared site amenities and walk/bike-friendly connectivity that the subject property could offer.
- Finally, the site in question represents an opportunity to shore up the aesthetics of what appears to be a permanent gateway location (given that the municipality of Hudson, to the south is already allowing warehouse/light industrial development up to the Cedar Falls border).

Photo Inventory - West Parcel

View East from Ridgeway Ave at Dry Run Creek

View Northwest Towards the West Parcel

Photo Inventory - West Parcel

View Southeast from Ridgeway Ave

Ridgeview Ave Bridge crossing at Dry Run Creek

Dry Run Creek

View of Dry Run Creek from Ridgeway Ave

Photo Inventory - East Parcel

Existing Roadway Sign

Existing Industrial Park Monument Sign

Existing Monument Sign

View along Ridgeway Ave facing West

View of Ridgeway Ave facing West

View of Ridgeway Ave / Chacellor Drive Intersection

Photo Inventory - East Parcel

View towards East Parcel from Highway 20 Exit Ramp

View towards East Parcel from Hudson Road Overpass

DEPARTMENT OF COMMUNITY DEVELOPMENT

City of Cedar Falls
220 Clay Street
Cedar Falls, Iowa 50613
Phone: 319-273-8600
Fax: 319-273-8610
www.cedarfalls.com

MEMORANDUM

Planning & Community Services Division

TO: Planning and Zoning Commission

FROM: Iris Lehmann, AICP, Planner II

DATE: September 19, 2019

SUBJECT: Sign review of property in the Central Business District Overlay

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REQUEST: New signage on façade

PETITIONER: Ivan Weiland, Horny Toad American Bar & Grill; Contractor: Nagle Signs

LOCATION: 202 Main Street

PROPOSAL

The property owner of 202 Main Street, Horny Toad American Bar & Grill, is requesting a site plan review for a new wall sign and projecting sign at 202 Main Street in the Central Business District Overlay Zoning District.

BACKGROUND

The petitioner proposes to install one new wall sign and one new projecting sign on the E 2nd Street facade of 202 Main Street. The signage would mark the side entrance into the building. The property is located directly east of the 200 block of Main Street on the south side of E 2nd Street, see image to the right.

This item requires review by the Planning and Zoning Commission and the City Council due to the fact that this property is located within the Central Business District (Section 26-189). The downtown district requires a building site plan review (i.e. design review) for any “substantial improvement” to an exterior façade, including new signs and awnings. A substantial improvement to properties in the Central Business District Overlay is defined in Section 26-189 (f) and reads as follows:

> "Substantial improvement" includes any new building construction within the overlay district or any renovation of an existing structure that involves any modification of the

exterior appearance of the structure by virtue of adding or removing exterior windows or doors or altering the color or exterior materials of existing walls. All facade improvements, changes, alterations, modifications or replacement of existing facade materials will be considered a substantial improvement. Included in this definition are any new, modified or replacement awning structures or similar material extensions over the public sidewalk area. A substantial improvement also includes any increase or decrease in existing building height and/or alteration of the existing roof pitch or appearance."

Typically signage is not part of the review process unless the review is mandated by the Ordinance. In this case, when a new projecting sign is installed that overhangs the public right-of-way the Planning and Zoning Commission and City Council must review and approve the request. Not all signs are reviewed in this manner. If a sign or projecting sign is simply replaced, review of this level is not triggered and a permit can be issued with only staff level review.

ANALYSIS

The applicant is proposing to install a new aluminum projecting sign and wall sign above the north side entrance of 202 Main Street advertising the current tenant, Horny Toad American Bar & Grill. The projecting sign is an approximately 2'9'' wide by 7' tall. The wall sign is approximately five and a half feet wide and half a foot tall. Projecting signs within the Central Business District cannot exceed 40 square feet per sign face and wall signs cannot exceed ten percent of the total storefront area (Section 26-189 (j)). The districts signage size requirements have been met. Both proposed signs will be placed on the north elevation facing E 2nd Street. Both signs will be lighted. All projecting signs within the Central Business District are required to be at least 10 feet above the sidewalk and cannot project further than half the width of the sidewalk that the storefront is located on or five feet, whichever is less (Section 26-189 (j)(2)). The proposed projecting sign projects about 2'9'' feet into the right-of-way and has an approximate 12 foot clearance above the sidewalk. The sidewalk at this location is approximately 10 feet wide. The proposed placement of the signs meet city code. If approved by the Planning and Zoning Commission, this item will be placed on the next regularly scheduled City Council meeting. If the City Council approves this request, a sign permit will be issued for the new signs.

TECHNICAL COMMENTS

No comments.

STAFF RECOMMENDATION

The Community Development Department recommends approval of the submitted facade plan for 202 Main Street.

PLANNING & ZONING COMMISSION

Discussion/Vote
9/25/2019

September 5, 2019

City of Cedar Falls
Dept. of Community Development
Cedar Falls, IA 50613

Re: Ivan Weiland
(Landlord and owner)
Horny Toad American Bar & Grill
202 Main St.

To whom it may concern:

Nagle Signs Inc., in conjunction with Ivan Weiland, Horny Toad's owner, are asking the Department approval for the following modifications to the above address.

Furnish and install 7' tall, aluminum structure double-sided projection mounted, LED internally lighted wall sign, (copy and logo will light). Face is routed aluminum and backed with polycarbonate. Projecting approximately 2'9" from building and approximately 12' clearance above sidewalk.

Furnish and install 9"H x 5'5"W x 5"D cabinet with 1" face retainers "TRUE LOCAL LIVES HERE" white LED lit cabinet with trim capped acrylic face and applied 3M graphics.

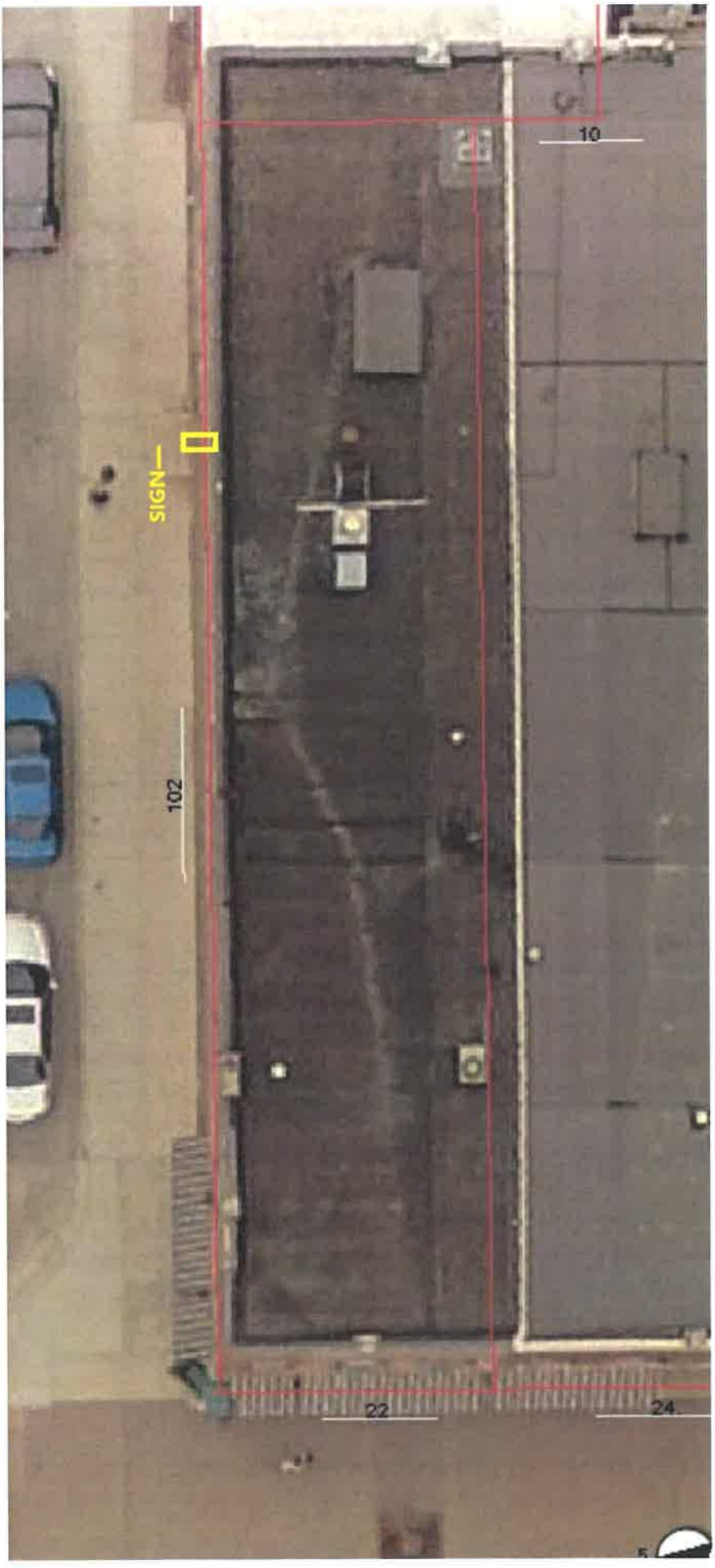
Sincerely,
Nagle Signs Representative

Brian Buss

Horny Toad American Bar & Grill

Owner/Landlord

Ivan Weiland _____


10
SIGN
102
22
24

Nagle signs inc.
WATERLOO
1020 Wilbur Ave, PO BOX 2098
Waterloo, IA 50704
319-233-4604 • 800-728-4604
Fax: 319-233-7514
MARSHALLTOWN
605 Iowa Ave. West
Marshalltown, IA 50158
641-752-6608 • 888-656-7446
Fax: 641-752-6968

PROJECT
HORNY TOAD

LOCATION
CEDAR FALLS, IA

REPRESENTATIVE
BRIAN BUSS

DESIGNER
HMF

SKETCH #
7-26-19A2

SCALE

FILE NAME
HORNY TOAD/
7-26-19A.PDF

PRINT FILE(S)

REVISION(S)
1 -
2
3
4
5

WORK ORDER #

WSA · International Sign Association

CLIENT APPROVAL
SIGNATURE/DATE

naglesigns.com

True LOCAL LIVES HERE

1" = 1'0"

DEPARTMENT OF COMMUNITY DEVELOPMENT

City of Cedar Falls
220 Clay Street
Cedar Falls, Iowa 50613
Phone: 319-273-8600
Fax: 319-273-8610
www.cedarfalls.com

MEMORANDUM

Planning & Community Services Division

TO: Planning and Zoning Commission

FROM: Iris Lehmann, AICP, Planner II

DATE: September 19, 2019

SUBJECT: Sign review of property in the Central Business District Overlay

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REQUEST: New signage on façade

PETITIONER: Eagle View Partners, Andy's Bike Shop; Contractor: Signs by Tomorrow

LOCATION: 100 E 2nd Street, Suite 105

PROPOSAL

A new tenant, Andy's Bike Shop, and the property owner of 100 E 2nd Street are requesting a site plan review for a new projecting sign at 100 E 2nd Street, Suite 105 in the Central Business District Overlay Zoning District.

BACKGROUND

The petitioner proposes to install one new projecting sign on the facade of 100 E 2nd Street for a new business, Andy's Bike Shop, locating in Suite 105. The property is located directly east of the 200 block of Main Street on the north side of E 2nd Street, see image to the right.

This item requires review by the Planning and Zoning Commission and the City Council due to the fact that this property is located within the Central Business District (Section 26-189). The downtown district requires a building site plan review (i.e. design review) for any "substantial improvement" to an exterior façade, including new signs and awnings. A substantial improvement to properties in the Central Business District Overlay is defined in Section 26-189 (f) and reads as follows:

> "Substantial improvement" includes any new building construction within the overlay district or any renovation of an existing structure that involves any modification of the exterior appearance of the structure by virtue of adding or removing exterior windows or

doors or altering the color or exterior materials of existing walls. All facade improvements, changes, alterations, modifications or replacement of existing facade materials will be considered a substantial improvement. Included in this definition are any new, modified or replacement awning structures or similar material extensions over the public sidewalk area. A substantial improvement also includes any increase or decrease in existing building height and/or alteration of the existing roof pitch or appearance."

Typically signage is not part of the review process unless the review is mandated by the Ordinance. In this case, when a new projecting sign is installed that overhangs the public right-of-way the Planning and Zoning Commission and City Council must review and approve the request. Not all signs are reviewed in this manner. If a sign or projecting sign is simply replaced, review of this level is not triggered and a permit can be issued with only staff level review.

ANALYSIS

The applicant is proposing to install a new aluminum projecting sign on suite 105 of 100 E 2nd Street to advertise the new tenant, Andy's Bike Shop. The projecting sign is approximately 3' wide by 1' tall. Projecting signs within the Central Business District cannot exceed 40 square feet per sign face (Section 26-189 (j)). The districts signage size requirements have been met. The projecting sign will be placed on the south elevation facing E 2nd Street above the store entrance. The sign will be lighted. All projecting signs within the Central Business District are required to be at least 10 feet above the sidewalk and cannot project further than half the width of the sidewalk that the storefront is located on or five feet, whichever is less (Section 26-189 (j)(2)). The proposed projecting sign projects about 3' feet into the right-of-way and has an approximate 10 foot clearance above the sidewalk. The sidewalk at this location is approximately 10 feet wide. The proposed placement of the sign meets city code. If approved by the Planning and Zoning Commission, this item will be placed on the next regularly scheduled City Council meeting. If the City Council approves this request, a sign permit will be issued for the new signs.

TECHNICAL COMMENTS

No comments.

STAFF RECOMMENDATION

The Community Development Department recommends approval of the submitted facade plan for 100 E 2nd Street, Suite 105.

PLANNING & ZONING COMMISSION

Discussion/Vote
9/25/2019

SIGNS BY TOMORROW
SIGNS & GRAPHICS NATIONWIDE
2915 McClain Drive
Cedar Falls, Iowa 50613
Ph: 319-268-0001
Fax: 319-268-0002
E-mail: cedarfalls@signsbytomorrow.com

CUSTOMER Andy's Mobile Bike Shop
105 2nd St.
Cedar Falls, IA 50613

CONTACT Andy Tetmeyer
(515) 447-0491
andysmobilebikeshop@gmail.com

DESIGNER Brian
PROOF DATE 7-31-19
FILE NAME Andy's Bike Shop / "Andys-2
REVISION # Rev 4

DEPARTMENT OF COMMUNITY DEVELOPMENT

City of Cedar Falls
220 Clay Street
Cedar Falls, Iowa 50613
Phone: 319-273-8600
Fax: 319-273-8610
www.cedarfalls.com

MEMORANDUM

Planning & Community Services Division

TO: Planning and Zoning Commission

FROM: Iris Lehmann, AICP, Planner II

DATE: September 19, 2019

SUBJECT: Façade review of property in the Central Business District Overlay

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REQUEST: Request to approve a Central Business District Overlay Site Plan for new facade treatments and use change at 203/205 Main Street

PETITIONER: Owner: Brad Leeper

LOCATION: 203/205 Main Street

PROJECT #: DR19-009

PROPOSAL

The new owner of 203/205 Main Street is requesting a site plan review to redevelop the façade of the building and convert what was the rehearsal space and museum for the CF Municipal Band into two residential apartments. The property is located in the Central Business District Overlay. See current and proposed facade images below. The proposed floor plans of the building are attached.

Current

Proposed

BACKGROUND

203-205 Main Street was originally constructed in the1880's. During the historic inventory of the downtown conducted in 2015 it was found that this building is noncontributing to the Cedar Falls Downtown Historic District due to the significant modifications that have been made to the façade.

This property is located within the C-3, Commercial District Zone (Section 26-172) and is also subject to the Central Business District Overlay regulations (Section 26-189). In this zone, any "substantial improvement" to an exterior façade, including removing exterior windows and the addition of new awnings, requires design review by the Planning and Zoning Commission and City Council. A substantial improvement to properties in the Central Business District Overlay is defined in Section 26-189 (f) and reads as follows:

> "Substantial improvement" includes any new building construction within the overlay district or any renovation of an existing structure that involves any modification of the exterior appearance of the structure by virtue of adding or removing exterior windows or doors or altering the color or exterior materials of existing walls. All facade improvements, changes, alterations, modifications or replacement of existing facade materials will be considered a substantial improvement. Included in this definition are any new, modified or replacement awning structures or similar material extensions over the public sidewalk area. A substantial improvement also includes any increase or decrease in existing building height and/or alteration of the existing roof pitch or appearance."

In addition, the Central Business District requires that any new residential uses within the district are only allowable subject to planning and zoning commission and city council review and approval (Section 26-172 (c)(2)). Although residential uses are encouraged to be established in upper levels of downtown commercial buildings and this particular building has seen a number of uses in its upper floor over the years, the change from what was the rehearsal space and museum into two residential apartments needs to be reviewed under current code requirements.

ANALYSIS

Following is an evaluation of the proposed changes according to the review standards in the Central Business District Overlay Zone:

1. Proportion: This criterion takes into account the relationship of the proposed horizontal elements (such as cornice lines, awnings and canopies) and vertical elements (such as windows and doors) with the elements of adjacent buildings. The applicant is proposing to demo a portion of the existing façade to make room for large storefront windows, install the original window openings on the second level, add new trim, and a masonry veneer, see image to the right. These changes are consistent with the historic storefront design elements present on other buildings on Main Street and with best practice. The proportions of the proposed windows and doors are consistent

with those in the district and neighboring buildings. The placement of the proposed sign band, above the storefront windows, and trim align with the horizontal elements of the neighboring buildings. **Criterion is met.**

2. Roof shape, pitch and direction: The building's roof is not being altered. However, the applicant is proposing to finish the top of the wall with a decorative cornice, which is consistent with many of the other intact historic buildings along Main Street. **This criterion is met.**

3. Pattern: The pattern of solid surfaces and openings needs to be considered in the alteration of a building. The applicant is proposing to demo a portion of the existing façade to make room for large storefront windows and to install the original window openings on the second level. This pattern is consistent with the character of the storefronts along Main Street and brings the building closer to its historical design. Large windows with transom windows above are desirable for storefronts, as they maximize light and views into the interior of the store. **Criterion is met.**

4. Building Composition: The proposed design must provide visual interest and visually break up long building walls. Buildings with a width of 50 or more feet are required to provide additional details such as breaks in the building wall plane. This structure is 44 feet wide; the requirement to provide breaks in the wall plane is not required. The mullions proposed in the storefront windows and the spacing of the proposed upstairs windows creates proportional visual breaks in the façade. **Criterion is met.**

5. Windows and transparencies: The CBD requires that new construction have a minimum of 70 percent of the storefront area, between two and ten feet in height above the ground level, consist of clear and transparent storefront windows. Modifications to existing storefronts can maintain or expand their transparency percentage but cannot decrease. The proposed change would open up the storefront of the building to at least 70% transparency, meeting the requirement for new construction. Installing windows on the second floor adds additional transparency. The proposed windows will be clear and non-reflective. **Criterion is met.**

6. Materials and textures: For new construction certain amounts of high quality materials must be used. This includes the requirement that 50% of the façade be brick, stone, or terra cotta on street-facing facades. The proposed redesign of 203 Main Street would add a thin brick veneer over the top half of the façade with glass, smooth- faced painted cement board, and aluminum comprising the bottom half. The applicant has indicated that full wythe brick is not possible in this instance given the existing condition of the building wall. The proposed materials are in keeping with buildings in the district and meet the material requirements of this section. **Criterion is met.**

7. Color: The proposed design utilizes a brown-red brick veneer that is complementary and consistent with the red earth-toned brick on other buildings in the vicinity. The painted cement board and aluminum will be a grey/black. The proposed colors are neutral and compatible with the existing colors of the district. **Criterion is met.**

8. Architectural features: Architectural features including but not limited to cornices, entablatures, doors, windows, shutters, fanlights and other elements prevailing in the area shall be considered in the construction or alteration of a building. The proposed new windows, sign band, trim (including the installation of a cornice), are all elements that are

consistent with the district and add interest to the building. **Criterion is met.**

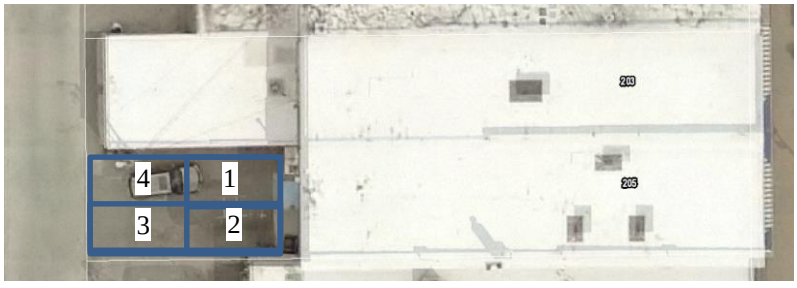
9. Building entries: The entries into this building are not changing; **this criterion does not apply for this review.**

10. Exterior mural wall drawings, painted artwork, exterior painting: No mural is being proposed; **this criterion does not apply for this review.**

11. Signage: As a tenant for the storefront has not yet been found, the applicant is proposing a wall and projecting sign that will act as a placeholder for a future tenant. The proposed wall sign will be placed within the proposed building sign band located above the transom windows and the projecting sign is elevated above the store entrance and will be designed to meet code size and clearance standards. Wall signs within the CBD cannot exceed ten percent of the total storefront area and all projecting signs shall not exceed 40 square feet per sign face (Section 26-189 (j)). The dimensions of these signs meet the code size requirements. In addition, all projecting signs within the CBD are required to be at least 10 feet above the sidewalk and cannot project further than half the width of the sidewalk that the storefront is located on or five feet, whichever is less (Section 26-189 (j)(2)). The shown projecting sign meets these requirements. When a tenant is found, and as long as what they propose follows what is shown, only a staff level review would be required. However, if future tenant signage differs greatly from what is shown here review and approval by both the Planning and Zoning Commission and City Council would be required. **Criterion is met.**

12. Use: The second phase of this proposed project will entail converting what was the rehearsal space and museum for the CF Municipal Band into two residential apartments. Both proposed apartments will have two bedrooms, see attached floor plan. The change of use from non-residential to residential requires review and approval by the Planning and Zoning Commission and City Council. Residential uses are permitted and encouraged to be established on upper levels of downtown commercial buildings. This proposed change in use would be in keeping with the intent of the code and appropriate for a Main Street building.

A change in use triggers review of parking requirements. Apartments require: “two parking spaces per dwelling unit, plus one additional parking space for each bedroom in each dwelling unit in excess of two bedrooms” (Sec. 26-220 (b)(12)(ii)). A building with two, two bedroom apartments requires four parking spaces. The building currently has four parking spaces off the alley along the back of the property (two stacked spaces). These four spaces will remain. **Criterion is met.**



TECHNICAL COMMENTS
Staff has no technical comments.

STAFF RECOMMENDATION
The Community Development Department recommends approval of the submitted proposal to redevelop the façade of 203/205 Main Street and convert what was the rehearsal space and museum for the CF Municipal Band into two, two bedroom residential apartments.

PLANNING & ZONING COMMISSION
Discussion/Vote
9/25/2019

CENTRAL BUSINESS DISTRICT DESIGN REVIEW APPLICATION

Project: 203/205 Main Street Facade Redevelopment.

Owner: Prestige WW

Contact information: 1304 Washington St. C.F. 319.239.5496

Applicant: Brad Leeper

SUMMARY

1. Overview
   A. The intent of the work is to redevelop the façade of the property to mend an important piece of Main Street. Work involves demolition of the original metal siding which has been completed. New work includes partial wall demolition, restoration of original openings, new trim and masonry veneer.
   B. Future work includes redevelopment of the upper level for two apartments. The upper level has contained apartments and professional offices in the past, Its last use was rehearsal space and museum for the CF Municipal Band. Given the back and forth nature we don't consider this a fundamental change in use but have included plans for this if that is the interpretation.
      i. Parking – It has been indicated that parking is required for the upper apartments. We do have 4 spaces in back if required. It is worth noting however that the recent changes for the College Hill Overlay district exempted parking requirements for rehabbed second floor residential spaces exactly like this. Section 26-181 states, "*Dwelling units within mixed-use buildings in the C-3 District: One parking stall per bedroom, but not less than one stall per dwelling unit, except as follows. For mixed-use buildings constructed prior to January 1, 2019, parking is not required for existing dwelling units. In addition, for mixed-use and commercial buildings constructed prior to January 1, 2019, parking is not required for upper floor space that is converted to residential use.*" While this is the section for CHN it does specifically reference a C-3 District which this is. It is also worth noting that over the last 20 years there have been many residential units on the upper floor of Main Street Retail establishments. It is likely most of those happened without additional parking requirements.
   C. See attached drawings.
   D. Signage is unknown at this time since a retail tenant is not secured at this time.
2. Main Street Review
   A. Main Street review occurred Friday 8/16. No changes were requested at that meeting and no formal comments have been received.
3. Processing fee in the amount of $50. I will drop this off.
4. Overlay district requirements met
   A. 70% of the storefront area between 2 and 10 feet is clear transparent glass.
   B. Storefront windows begin 2' above the adjacent ground plane
   C. Street facing façade is composed of more than 51% brick
   D. Painted cement board and aluminum amounts to 30% of the façade.
5. Complete façade improvement grant program application and attach.
   A. See attached form.
   B. See attached cost estimate.

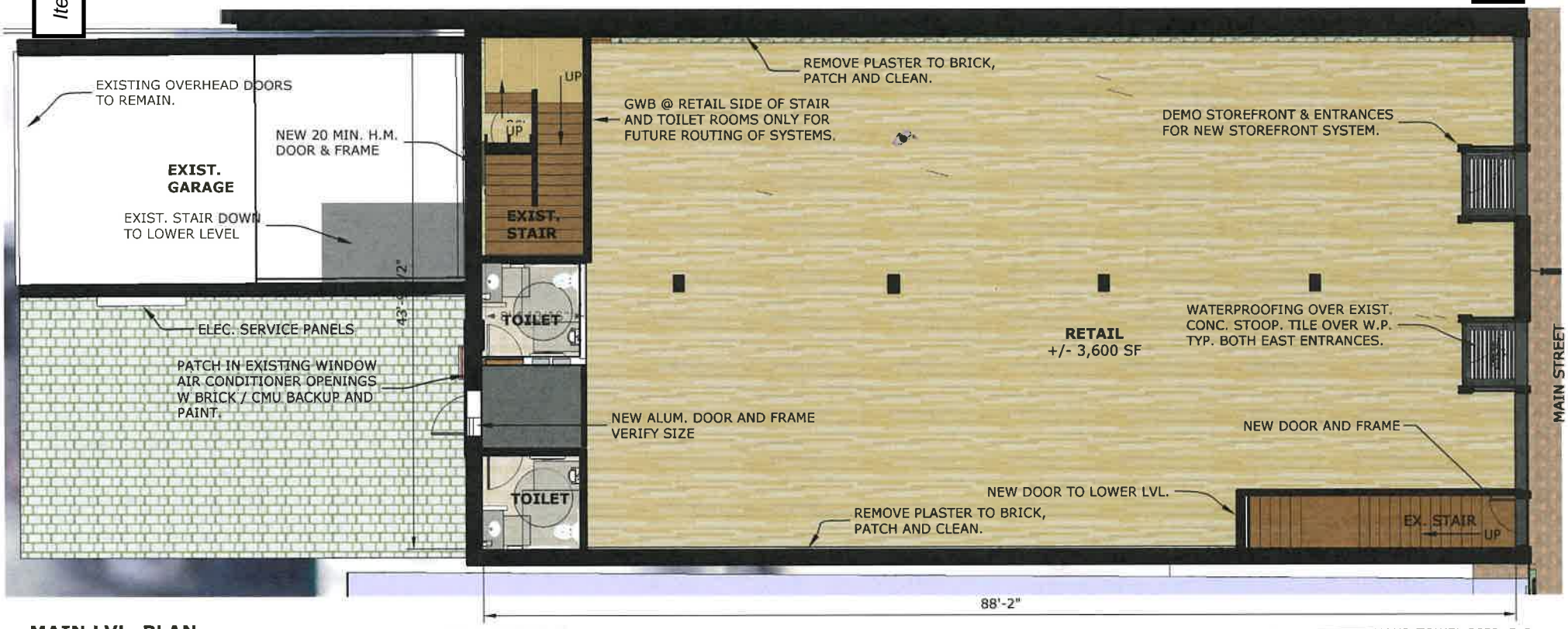
EXISTING CONDITION

203 MAIN STREET

203 MAIN STREET

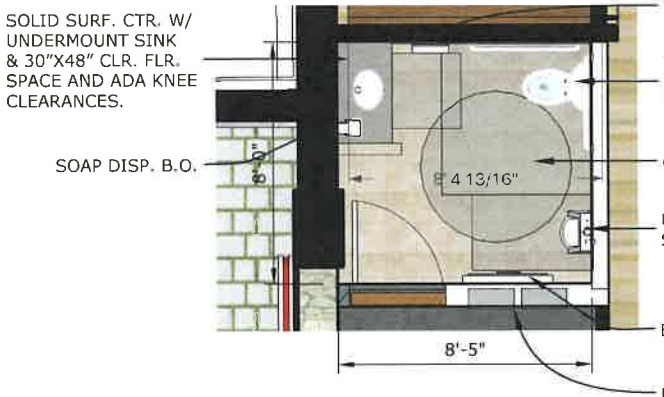
203 MAIN STREET

203 MAIN STREET



MAIN LVL. PLAN

SCALE: 1/8"=1'-0"



TYP. TOILET PLAN SCALE: 1/4"=1'-0"

GENERAL NOTES:
- UPPER PLAN IS IN PROCESS AND IS MEANT AT THIS TIME TO PRESENT THE POTENTIAL SCOPE OF WORK FOR ROUGH IN.
- UPPER LEVEL DEVELOPMENT IS PART OF FUTURE PHASE.
- WALLS TO BE LAYED OUT ON FLOOR BEFORE ROUGH-IN TO VERIFY WITH EXISTING CONDITIONS.

UPPER LVL. PLAN

SCALE: 1/8"=1'-0"

DEPARTMENT OF COMMUNITY DEVELOPMENT

City of Cedar Falls
220 Clay Street
Cedar Falls, Iowa 50613
Phone: 319-273-8600
Fax: 319-273-8610
www.cedarfalls.com

MEMORANDUM
Planning & Community Services Division

TO: Planning & Zoning Commission

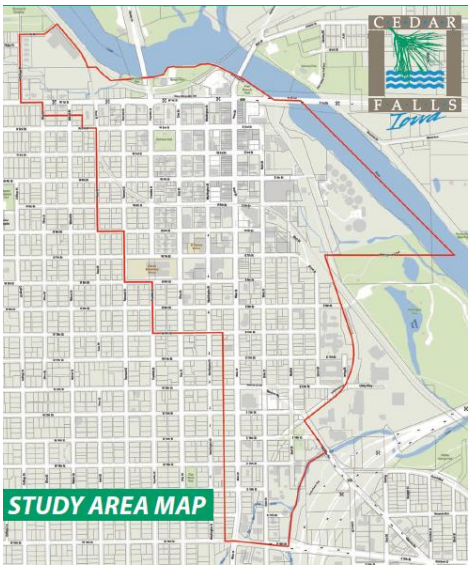
FROM: Karen Howard, AICP, Planning & Community Services Manager
Iris Lehmann, AICP, Planner II

DATE: September 19, 2019

SUBJECT: Presentation of the Public Review Draft of the *Imagine Downtown!* – Vision Plan

On Wednesday, September 25 at 6:30 PM, immediately following the regularly scheduled Planning & Zoning Commission meeting, there will be a presentation of the public review draft of the *Imagine Downtown!* Vision Plan, followed by Q&A and a public open house. The public has been invited and encouraged to attend.

Project Background



Cedar Falls has a thriving 24-hour downtown. This success creates momentum for additional investment in Downtown. However, the City has been operating under development standards and processes, some of which were originally established 50 years ago. These regulations have been refined over time, including the recently amended CBD overlay district, created to preserve and protect the character of the historic Downtown core. However, there was a recognition that more needed to be done to guide future growth in the Downtown District and the surrounding neighborhoods to meet the current and future needs of the community. Therefore, the City initiated the *Imagine Downtown!* Visioning Project. The project has two phases, an extensive community visioning effort, followed by development of zoning tools to implement the vision. The study area includes the central business district (CBD) and areas surrounding the CBD that transition into the traditional residential neighborhoods to the west. It also includes the extended Main Street corridor and neighborhood areas immediately south and northwest of the downtown along the south side of the Cedar River (see map above).

Project Summary

The *Imagine Downtown!* Vision Plan is the result of an extensive public engagement process that kicked off last April with a priority-setting session with the City Council, followed by a public workshop, stakeholder interviews, focused group sessions, and a study of the existing character of the study area, the market, and transportation network. This initial work provided the basis for an intensive 6-day Community Design Charrette, which included a hands-on workshop where

the public was invited to share their aspirations for the future, technical meetings to ensure that the plan would be grounded in reality, an open design studio where the public was invited to drop in throughout the week to view the plan in progress and provide additional feedback, a lunch and learn session on downtown mobility, and a report-out presentation on the last day of the charrette to present the plan-in-progress based on the big ideas gathered during the week. Over the last several months, the consultant team, led by Ferrell Madden, has refined and fleshed out the plan and it is now ready for public review.

The *Imagine Downtown!* Vision Plan will provide a road map for growth and development in and around Downtown Cedar Falls. It will establish a general framework for public policy decisions and investment, in tandem with clear aspirations for the scale and character of future development downtown, which will be reflected in new zoning standards that will be developed in phase two of the project.

Next Steps

Following the presentation of the public review draft of the plan on September 25, there will be an open house where the public can view the plan, ask questions, and provide feedback. The draft of the plan, along with the opportunity for the public to provide comments, will be posted on the project webpage for viewing and download at: www.ourcedarfalls.com. Copies of the draft plan will also be available for viewing at City Hall and the Public Library. There will be a public hearing at the October 9 Planning & Zoning Commission meeting to gather any additional feedback. It is anticipated that the Planning & Zoning will make their recommendation to the City Council at their October 23 meeting with consideration and adoption at City Council meetings in November.

If you have any questions, please contact Karen Howard or Iris Lehmann.