IOWA

Design Report

Eagle Park and Bluejay Landing Park Greenway

Bondurant, IA

University of Iowa

Department of Civil and Environmental Engineering

Contents

Executive Summary

The City of Bondurant, Iowa consulted with a University of Iowa Senior Design team to design an innovative, nature conscious neighborhood park on a former farm field adjacent to an existing park, Eagle Park, in the city. The proposed park, named Bluejay Landing Park, will turn an unused portion of city property into a recreational destination for Bondurant families. The park will introduce young children to nature through educational and risk play, while offering adult visitors to the park a relaxing, scenic place to walk their dog or enjoy the outdoors. In the design of future park, the student team evaluated the best options for native replanting of the site, maintenance of the park through flood events, and opportunities for community involvement at Bluejay Landing.

The Senior Design team received three primary requests from the client. Bondurant wanted both a traditional play area and a nature playscape area of the park, the City wanted to incorporate Iowa's natural prairie and ecosystem, and the City wanted different cost estimates based on project scale and phase to help them assess their prioritization of available funding. The team carefully considered these criteria when designing Bluejay Landing.

The design of Bluejay Landing Park detailed in this report has several defining elements. A nature-themed traditional playground was placed on the front-facing portion of the park to welcome families and serve as a familiar introduction to the nature playscape. A walking trail winds throughout Bluejay Landing, starting at the traditional playground, curving through prairie planting and a butterfly garden, before entering the nature playscape. Most park property was dedicated to the nature playscape to give children room to run and roam. Play pieces found in the nature playscape, including tree stumps, boulders, and logs, require children to use their imagination and interact closely with nature. Throughout the park, native forbs, prairie grass, and sycamore trees were planted that will serve the park aesthetically while being able to withstand flood events.

The team estimated the cost of the Bluejay Landing Park to be $601,085.37 for the high-end design. Construction was split into three phases to be completed consecutively. The first phase was estimated at $205,706.22, the second phase at $41,726.24, and the final phase at $214,940.91. A low-end design budget was estimated to cost $422,882.24.

Qualifications and Experience

Team Contact Information

Project Manager: Anna Larson

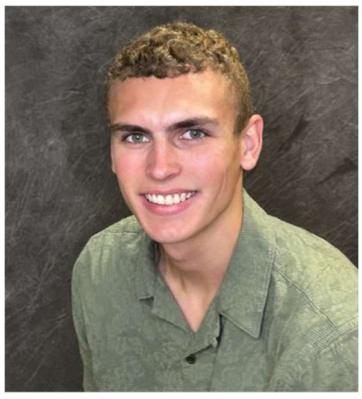
Eamonn Lally

Matthew Rosonke

Meet the Team

Eamonn Lally has developed grading plans for a variety of projects including small agricultural facilities, aggregate mining operations, power plant sites, residential subdivisions, and parking facilities throughout Illinois. His work involved surveying, evaluating site constraints, and producing grading designs. Through his works he gained proficiency in AutoCAD. He also performed detention pond analyses for agricultural sites in Burlington, Illinois, gaining experience with hydraulic modeling software, including HEC-RAS and HEC-HMS.

Anna Larson has worked on neighborhood and recreational development projects in small communities, including a new housing development in Boone, IA, and boat ramp installments in Shelby and Mitchell County. Anna Larson is familiar with ADA regulations for pedestrian walkways from improving public transportation access for DART in Des Moines, IA. She is competent in using AutoCAD software Civil3D and MicroStation. She has also worked in water resource engineering on a dam mitigation project in Alden, IA, and has experience with HEC-RAS and HEC-HMS.



Matthew Rosonke has experience developing site plans for a variety of projects throughout the Des Moines metropolitan area. Through his work, he developed a strong working knowledge of AutoCAD, easement acquisition, rezoning processes, municipal codes, ADA regulations, and evaluating site constraints. His time at the Neal Smith National Wildlife Refuge expanded his knowledge of native plant species, including plant identification, management and maintenance of native plant communities, and effective strategies for controlling invasive species. While at Neal Smith, he was responsible for tasks such as native seed collection, replanting efforts, and trail maintenance, providing valuable hands-on experience applicable to park and natural area design.

Project Design

Scope

This project focused on the planning and conceptual design of a nature-based playscape, traditional playground, incorporation of native plantings, and improved connectivity between Bluejay Landing Park and Eagle Ridge Park in Bondurant, Iowa. The primary objective was to increase public access, improve park usability, and strengthen the natural atmosphere of both parks while respecting floodplain constraints and long-term city plans.

The project emphasized natural exploration, flood-resilient design, and improved pedestrian connectivity. Bluejay Landing was prioritized, as it is currently the least developed for public use and serves as the primary access point to Eagle Ridge Park. Improvements were designed to increase access to Eagle Ridge following upgrades to Bluejay Landing.

The scope of work included reviewing existing planning documents, such as the Eagle Park Master Plan, along with available GIS and mapping data from Polk County and Iowa geographic data servers. The team conducted a site constraints assessment focused on floodplain limits, hydrology, existing vegetation, and long-term maintenance considerations. Conceptual design alternatives were developed for Bluejay Landing with an emphasis on natural play, exploration, and flood-resilient features constructed from natural materials. The project also included identifying and proposing a pedestrian connection across Mud Creek through the evaluation of potential crossing locations, development of ADA-accessible crossing recommendations, and consideration of lower-cost or temporary alternatives to a full bridge.

Additional tasks included developing concepts for trail alignments, benches, and gathering spaces located outside high-risk flood zones; proposing nature-based improvements such as prairie plantings, pollinator-friendly vegetation, and interpretive signage while maintaining clear sightlines; and providing recommendations for delineating public and private property, particularly around shared pond areas. The scope concluded with the preparation of renderings for community engagement and client review, as well as the delivery of a final conceptual site plan, supporting graphics, and a narrative describing design intent and implementation considerations.

Work Plan

The Senior Design team had a kickoff meeting with Katie Klus, the Communications and Events Coordinator for the City of Bondurant, on Thursday, January 29th, 2026. This meeting included an initial visit to Eagle Park and the site of the proposed Bluejay Landing Park. Eagle Park is the largest city park in the residential area of Bondurant, and is highly popular with residents for its long, relatively secluded walking path, two stocked fishing ponds, and views of the park's prairie. A disc golf course planned for the summer is expected to increase Eagle Park's visitor count further. Mud Creek runs along the western edge of Eagle Park. Bluejay Landing Park's property is located across Mud Creek on the northern portion of Eagle Park.

Bluejay Landing Park is 7.5 acres. Only the southwest portion of the property is visible from the neighborhood street of the park. The remainder of the park is tucked behind private property, and the client expressed at this meeting a desire for natural barriers to prevent park visitors from trespassing onto the adjacent private property. The existing condition of the land of the Bluejay Landing site was relatively flat, although remnants of corn stalks and fencing from its former use needed to be removed and smoothed over. A ditch on the property from the adjacent private pond to Mud Creek, shown in Figure 1, also posed an imperative problem as it divided the site into two segments.

Figure 1: Existing ditch at Bluejay Landing Park site, Jan. 29, 2026

The team returned to the project site on February 28, 2026, to conduct a field survey. The ditch was surveyed to inform design of the culvert that would need to be installed. The area designated for the traditional playground, shown in Figure 2, was surveyed to inform ADA grading of the concrete walking trail. An area to the southeast of Bluejay Landing was also surveyed as it was being considered for the location of the trail connection between Bluejay Landing and Eagle Park. However, based on data from this survey the connection was redesigned to a different location. Survey data of clearing items such as boulders, trees, and a fence were taken in the planned nature playscape area, shown in Figure 3.

Figure 2: Site of planned welcome area, facing west, Feb. 28, 2026

Figure 3: Site of planned nature playscape, facing north, Feb. 28, 2026

Two nature playscape companies were consulted to find play pieces for the nature playscape that fit the climate and budget of the site and to learn techniques for landscaping nature playscapes. These meetings provided details on what conditions and landscaping work best for each piece of play equipment, and instructed our design on placement, use, and quantity of play pieces. Local seeding companies were consulted to

find plantings for the park that were native to the project area and resilient to extensive water exposure.

The team participated in the City of Bondurant Parks and Recreation Board meeting on March 19th, 2026. The board provided constructive feedback on the initial concept design, including the addition of more limestone crossings and creating accessible play options for nature equipment. The board also requested an in-depth breakdown of cost and maintenance options for the nature playscape, which is detailed in this report.

Project Characteristics

Constraints

The project site presents several constraints that informed the final design of the park. Firstly, nearly all Bluejay Landing lies in the 100-year floodplain zone, with the remaining small portion on the edge of the site lying in the 500-year floodplain zone. This prevented the incorporation of materials and plants susceptible to water damage and raised estimated maintenance costs on design elements. For example, aggregate was chosen as the material for most of the trail throughout the park as it isn't damaged by water, although it can erode. Still, replacing eroded aggregate is more economical for the City than replacing concrete. Concrete trail was still used in portions of the park, including portions in the 100-year floodplain, at the request of the client. It is to be understood that the concrete trail may need to be replaced more frequently than the average lifespan of sidewalk within the city.

Another constraint was the existing grade of the site. As a former farm field, the site was relatively flat, which can make for a less exciting landscape for a children's playscape. However, this means the site will require little regrading to ensure proper drainage to the adjacent creek and ADA compliance of the park trail. The largest constraint posed by the existing grade of the site was identifying viable bridge placements for the connection to Eagle Park. The south side of Bluejay Landing is a retention wetland and holds water for much of the year. Furthermore, the Bluejay Landing side of the riverbank is several feet below the Eagle Park riverbank, making this a complicated area for the bridge crossing, although it appears preferable on paper due to its closer proximity to the Eagle Park trail. Due to the ditch in Bluejay Landing, the proposed bridge crossing moved north into the Nature Playscape area, which, while a bit out of the way, is a flat, calm portion of the creek that is ideal for a pedestrian bridge crossing.

The adjacent property boundaries and the layout of Bluejay Landing's neighborhood gives Bluejay Landing a unique shape. Most of Bluejay Landing Park is not visible from the

neighborhood street or sidewalk as it is tucked away behind homes. The traditional playground was placed on the plot of land visible to the street to clearly show the presence of a park to passerbys. The concrete trail then leads park visitors to the nature playscape deeper within the property. The northwest portion of the park is narrow and provides little space for park equipment. Instead, the prairie plants were planted, and an area was provided for picnicking.

Challenges

The project involved several key design challenges related to the site's physical condition and its function as an intended actively used public space. A primary challenge was designing within areas that experience periodic flooding. This required the use of features such as trails, nature-based play elements, and gathering spaces that can withstand temporary inundation while remaining safe and functional for all users. This challenge was addressed through careful material selection, strategic placement of features outside of the most vulnerable flood areas, and the use of design approaches that minimize long-term damage and maintenance.

Another significant challenge was maintaining effective connectivity throughout the site, particularly between Bluejay Landing and Eagle Ridge Park. The presence of a creek, along with an existing drainage ditch located between the proposed nature-based playscape and the traditional playground, created constraints on trail alignment and user movement. To address this, the trail system was intentionally routed to maintain continuity while minimizing environmental disturbance, and a low-impact bridge was incorporated to provide a safe and practical crossing over the drainage ditch as well as the adjacent Mud Creek.

Managing the transition between public parkland and adjacent private property also presented a design challenge. Portions of the site include shared or adjacent pond ownership, which required clear definition of boundaries while maintaining an open and welcoming park environment. This was addressed through the incorporation of landscape buffers and signage that provide clarity for users without creating a sense of restriction.

Overall, these challenges were resolved through an integrated design approach that balances site constraints, user experience, and long-term functionality. The final design reflects solutions that are practical, resilient, and appropriate for the site conditions while supporting the intended use of the park.

Impacts

This project is expected to enhance Bondurant's park system by creating inclusive, safe, and environmentally integrated public spaces that strengthen the community's quality of life. The incorporation of diverse native prairie species will improve the visual character of the park while also reflecting Iowa's history of prairie conservation. Native plantings provide opportunities for residents to learn about local ecosystems, participate in conservation efforts, and experience natural landscapes that are both aesthetically appealing and environmentally beneficial.

The project also strengthens public infrastructure by improving connectivity between parks, schools, neighborhoods, and other community amenities. Increased connectivity supports safer pedestrian movement, encourages outdoor recreation, and strengthens relationships among residents. By making public spaces more accessible and attractive, the project contributes to Bondurant's ability to attract and retain residents, support continued development, and maintain long-term economic stability.

A major focus of the project is the incorporation of a nature-based playscape that promotes physical activity, creativity, and social interaction. Unlike traditional playgrounds, nature-based play environments encourage children to engage with natural materials, use their imagination, and develop problem-solving skills through unstructured play. These spaces also help children build confidence and improve their ability to assess risk in a controlled environment. By allowing children to explore challenges at their own comfort level, the playscape supports cognitive development, decision-making, and personal growth while remaining safe and accessible for a wide range of users.

In addition to supporting recreation and education, the project prioritizes sustainable land use and environmental stewardship. Flood-resilient design measures, protection of environmentally sensitive areas, and the use of native vegetation help reduce long-term maintenance needs while improving ecological health. The project also respects surrounding property owners by considering public-private boundaries and minimizing negative impacts to nearby land uses. As a result, this project aligns with broader state goals related to sustainability, public safety, and long-term community development, while also serving as a model for future park projects throughout Iowa.

Design Details

Bluejay Landing Park was divided into three subsections referred to in this section. The first section is the welcome section, which is the first area visitors encounter and includes the traditional playground, butterfly garden, art installation, and future crossing to Eagle Park. The nature playscape is the second section, and the remaining land which features native plantings and a picnic area is called the northwest section.

Traditional Playground

The traditional playground is the public face of the park, easily visible from the neighborhood street. The City of Bondurant wanted a traditional playground incorporated in the welcome area of the park as an introduction for children new to the more imaginative play of the nature playscape. The traditional playground will be nature themed, so although the play will be structured, children will grow more comfortable with nature-inspired elements and eventually venture deeper into the park to discover and explore the larger, less structured nature playscape.

The traditional playground will be less accessible than the nature playscape, as elements like stairs, slides, ladders, and swings may be difficult or unattainable for individuals with disabilities. The Log benches will be placed along the edge of the traditional playground for parents to relax while watching their children. The log benches will match the natural furniture included in the nature playscape, helping to tie the two areas together for a cohesiveness across the park.

Nature Playscape

The nature playscape was designed to encourage children to exercise their imagination and sense of adventure. The layout was planned so the deeper into the park children venture, the more risk is factored into play. This allows children to “grow up” with the park, and attempt more difficult levels of play with age, experience, and self-confidence. The first play pieces along the nature playscape trail were intended for children aged two to five. The pieces include smooth, low to the ground logs, a swing, and musical play pieces. Next along the trail was the log mash, which is a log climbing structure that serves as a centerpiece of the nature playscape. The log mash offers various levels of play based on the boldness of the user, allowing different ages of children to play within their level of risk at once. The following section of the nature playscape featured tree stumps of varying heights and widths for children to jump between, run around, or whatever else their imagination finds use for. In the farthest corner of the nature playscape was a boulder climb, which ensures even older children encounter a challenging play piece.

Many sections of the nature playscape incorporated native plants along its edges as a soft border separating different spaces. Log tunnels were included within the native plantings to provide an exciting method for children to move between sections of the park. Carved log benches were placed throughout the park to provide options for children and parents to rest. Even with the planned sections of the nature playscape, adequate area was left as open space for children to run around, play with their pet dogs, fly a kite, etc. The remaining, undedicated spaces also gives the city opportunity for expansion of more play pieces in the future.

The nature playscape was graded to ensure runoff drains to Mud Creek and does not pool stagnantly anywhere in the playscape. While the play pieces were made of natural materials and made to withstand weather events, the play pieces were not built to sit in water for long periods of time. For the longest lifespan and quality, the play pieces need to be annually coated in a protective oil.

Grass and woodchip surfacing was used as the ground cover. The woodchips were placed primarily surrounding the play pieces to provide softer landing in case of falls. Grass was used everywhere else in the nature playscape. The City will need to regularly mow the grass as part of the park's upkeep.

Park Trails

A ten-foot trail was planned for the length of the park. The trail ties into the existing neighborhood sidewalk, then meanders through the welcome area, winds through the nature playscape, and finally leads to a picnic area in the northwest section of Bluejay Landing. The trail showcases the native plantings, butterfly garden, and art installation in the welcome area. Before entering the nature playscape, the trail forks, leading to the planned pedestrian bridge between Bluejay Landing and Eagle Park, which is discussed in the next section. The trail in the welcome section was built with Portland Cement Concrete, and the remainder of the park trail was constructed of aggregate like the trail in Eagle Park, including the forked part of the trail leading to the future pedestrian bridge.

The entirety of the trail is ADA compliant, with an average cross slope of 1.5% and a lower running slope. Where possible, the trail was designed to follow the existing grade as much as possible to lower regrading costs. Near the traditional playground, the trail drains to the street. In the nature playscape, the trail drains to Mud Creek. Elsewhere the trail was designed to drain to native planting areas on either side of the trail.

Both the PCC trail and the aggregate trail will require extra maintenance due to the park's location in a floodplain. Water exposure wears down concrete and leads to cracks and holes. This is typical of any PCC sidewalk, but Bluejay Landing's trail will need replacing more frequently than other city sidewalks. Similarly, while aggregate cannot crack or break from water exposure, it will erode as rain events wash trail fragments away. Like its counterpart in Eagle Park, the aggregate trail will need fresh layers of aggregate following major rain or flooding events.

Eagle Park Connection

The City of Bondurant wanted Bluejay Landing to act as an introduction for families and young children to the less play-based Eagle Park, which instead highlights a native prairie, fishing ponds, disc golf, and is overall a slower paced, more relaxed park than many

children are used to. As such, it is imperative that the two neighboring parks are accessible to one another. The two parks are currently divided by Mud Creek, and the nearest crossing by sidewalk is a roughly ten-minute walk from Bluejay Landing.

The City is awaiting a hydraulic analysis of Mud Creek that prevented the inclusion of a permanent pedestrian bridge crossing in this design. However, the crossing location and a temporary bridge crossing were included, ensuring the park is well prepared for a permanent bridge once the hydraulic analysis is completed. The bridge crossing was initially placed to the southeast of Bluejay Landing, but after surveying the area several issues were revealed. Firstly, the ground elevation was below the water height of Mud Creek, so the grass was marshy and acted like a wetland. This would require extensive fill or else the trail would be constantly flooded, therefore seeing little use and high maintenance. Second, the bank on the Bluejay Landing side of the creek was several feet below the bank on the Eagle Park, creating a structural challenge for the permanent bridge given the short width of Mud Creek. Lastly, a dam in Mud Creek near this area added depth to the water, making it a more dangerous area should anyone accidentally fall.

Instead, the bridge crossing was placed upstream within Bluejay Landing in between the welcome section and the nature playscape, directly upstream of the culvert from the private pond. The ground elevation was higher, the banks were nearly even elevations, and the water, although faster, was shallower. While a permanent bridge cannot be planned yet, a temporary bridge was placed over Mud Creek at this location until the hydraulic analysis is completed. A temporary bridge is an optional item for the City to include in the design that would allow accessible passage between Bluejay Landing Park and Eagle Park in the interim between park and permanent bridge construction. The temporary bridge could be shipped and installed on-site by the contracted company, and after the rental period the company would remove the bridge from site.

To tie in with Bluejay Landing's goal of adventure and risk-taking for children, groups limestone boulders were placed in various spots in Mud Creek along the length of the nature playscape as a method for able-bodied visitors to cross between Bluejay Landing and Eagle Park. It is recommended the limestone boulder crossings are installed one at a time to ensure the boulders do not create a dam.

Private Pond Overflow Culvert

The property boundaries of Bluejay Landing required the park trail to pass over an existing ditch the connects overflow of a private pond to Mud Creek. The existing ditch receives flow from underground stormwater pipe with an outlet structure at the beginning of the ditch. To allow the PCC trail to cross over, a culvert was installed to extend the underground stormwater drainage. The Double End Area Method was used to estimate

the volume of water held by the ditch at full capacity in the space allocated for the culvert. Based on the calculated volume and required length of the culvert necessary to build the trail, a diameter of 48 inches was determined to be appropriate. Calculations for this estimate can be found in Appendix D. It should be noted this is a rough estimate and further design work should be completed to verify culvert dimensions. Beyond the 37.5 feet of culvert needed for the trail, the rest of the ditch was left in existing conditions to transport water to Mud Creek.

Seeding and Native Plantings

Native seed mixes provided by Allendan Seed Company will be featured throughout Bluejay Landing to provide a natural prairie aesthetic. The mixes contain seed that is native to Iowa and consist of 75% forb seed. An emphasis was put on providing a healthy population of forbs that provide vibrant displays of color from spring through fall. Three seed mixes have been selected for this design, one for general planting areas, one that is specifically used for the butterfly garden, and another designed to delineate property boundaries.

The premade Iowa ecotype seed mixes that Allendan offers are not well-suited for the site due to the floodplain constraints. Some non-native seed mixes are offered that include plants that can withstand flood prone conditions; however, the non-native plantings take away from the parks character and community values on conservation. Our team then consulted Allendan for a custom seed mix that better aligns with the vision for the project, community values, and site constraints. This mix includes a heavy dose of forbs that were selected based on their ability to withstand flood prone conditions. A variety of colors and textures are offered in the mix that contribute to the natural aesthetic. A full report on the Allendan Custom 10/30 Mix is offered in Appendix A.

Viriginia Mountain Mint and Slender Mountain Mint are two of the more unique plants that are included in the custom mix. These plants provide a sensory element to the park, as they offer a distinct, minty smell. Visitors are then provided with opportunities to interact with these plants and gain experience in plant identification. Providing this sensory element into the landscaping further promotes curiosity and exploration. It also allows visitors to be hands on with the native vegetation, rather than just providing them with appealing visuals.

The butterfly garden mix includes two types of milkweeds, which are crucial for attracting butterfly species, specifically the monarch butterfly. These milkweeds provide the only food source for monarchs and their larvae. Monarchs lay their larvae on the bottom sides of these milkweeds, which provides opportunities for exploration and for visitors to track larvae growth. Complementary signage in the butterfly garden would educate visitors on the different stages of larvae growth and emphasize the importance of milkweeds to

monarch butterflies, and the other varieties of pollinators it attracts. This mix also includes other native pollinator species that complement the milkweeds and provide color from spring to fall, ensuring that the garden flourishes nearly year-round. A full report of the CP42 Leopold #1 Pollinator 10/30 Iowa Ecotype is also provided in Appendix A.

Figure 4 shows an example layout of plantings within the butterfly garden. The exact plantings in the rendering are not intended to represent specific plants but rather the placement and amount of variety of the seeding mix.

Figure 4: Example butterfly garden

The last mix includes only grasses, as it is designed for the delineation between public and private property, and to soften the culvert's appearance in Eagle Park. Native grasses can be expected to grow to a maximum of 12 feet tall at full maturity, which provides enough height to remove items from visitors' line of sight. A mix of 4 ounces of switchgrass, 1-ounce big bluestem, and 1-ounce of indiangrass is included to act as the tall vegetative fence. A quarter ounce of bluegrass is also included, but with its maximum height being 3 feet tall, its purpose is to not remove private property from one's line of sight, but rather to net the grass together to create a stronger vegetative fence. Overall, this mix is well-suited for discouraging visitors from entering private property and removing the view of the box culvert that takes away from the park's character.

Although the high-cost design was selected, Appendix B displays the low-cost alternatives for seeding. It's important to note that these seed mixes were not selected as the preferred alternative due to their low portion of forbs and non-native seeds. However, the reports for these mixes have been provided to give insight into low-cost alternatives for seeding.

Sycamore trees were planted throughout the nature-based playscape with the intention of providing shade once the trees are fully grown. Sycamore trees are native to Iowa and fast growing, adding three to six feet of height each year. Sycamore trees are found in floodplains and can help stabilize riverbanks in addition to providing shade for park goers.

Stabilizing the riverbanks is crucial in preventing erosion and reduces the effects of flooding on the site.

Additional Park Amenities

Near the bridge crossing, space has been allotted in the design for the City to add an art installation to Bluejay Landing that would serve as an icon of the park. The art installation is placed at the end of the welcome section opposite the butterfly garden and immediately before the nature playscape. It is intended for the sculpture or art piece to have enough height to be visible from the street and from Eagle Park's main trail, as a manner of drawing intrigue that encourages people to venture into Bluejay Landing. The City can use the selection or creation of an art piece as a means of garnering community involvement and interest in Bluejay Landing Park. The local high school could be involved in its design or construction, or a mural wall could be incorporated that art students could paint.

Another element critical to Bluejay Landing's success is signage throughout the park. Some signage will be educational, such as teaching park visitors about the native plantings, butterfly garden, and even the invasive species of reed canary found near Mud Creek. Other signage will offer guidance to children new to the unstructured play of the nature playscape. These signs will "dare" children to jump from one tree stump to another, for example, or invite children to try to play "Mary Had a Little Lamb" on the musical play pieces. There will also be signage dedicated to exploration. These signs will ask children to look for specific butterflies, bugs, and birds. These activities will teach children about Iowa's native ecosystem while giving children a fun scavenger hunt. Other ideas for this category of signage include asking children to count all the colors they can see in the art installation, or how many kinds of different plants they see in the native planting areas.

One of the challenges of developing Bluejay Landing was finding the best use for the northwest section of the property, as it is the furthest section of the park to access and adjacent properties pinch this section to be narrow. However, the park still lacked a designated rest area away from the excitement of play spaces for families to set up lunch or adults to enjoy the park in a more peaceful setting. The northwest section offered the perfect location to accommodate this. A picnic area featuring mown grass for comfortable seating and a gazebo for shade was carved out of the native plantings. A rendering of the intended gazebo is shown in Figure 5. The native plants surrounding the picnic area create a buffer from the adjacent properties so park users can still feel immersed in nature.

Figure 5: Example gazebo model

Alternatives

Low-Cost

The low-cost alternative focused on reducing overall project cost while maintaining the proposed layout and core functionality of the site. This design included the same trail network and stream crossing as the base concept but utilized more cost-effective nature-based and traditional playground equipment. Less expensive play features were selected, and opportunities for incorporating reused materials, such as existing boulders and repurposed pipes, were considered to further reduce costs.

One of the main advantages of this option was that it kept the overall design and connectivity between the parks while making the project more affordable. The use of reused materials also helped reduce material costs and supports sustainability. This option would be more realistic to construct within a typical park budget.

However, there were some drawbacks. Lower-cost equipment may not last as long and could require more maintenance over time. It may also result in a less polished appearance compared to higher-end designs. While the site would still function as intended, the overall user experience and long-term durability could be somewhat reduced.

There are also lower costing seed mixes that could be used to reduce the landscaping cost for the site. Allendan Seed Company offers several low-cost seed mixes; however, these mixes may not be suitable for the site based on the client's vision for the project. The low-cost mixes for general planting areas are made up of 75% grass seed and only

25% forb seed. These mixes are also not native to Iowa's ecotype, which removes some character from the park.

Although seed mixes that are heavier in forbs are desired, one benefit of the low-cost seed mixes is that they are specifically made up of grasses and forbs that can thrive in moist, wet, and flood prone conditions. This gives the low-cost mixes an advantage, as these plants wouldn't have their lifespan cut short due to unfavorable conditions, reducing the need for reseeding in the future. These mixes could also be planted in tandem with a high-cost seed mix or any combination of them. This offers a way of maintaining a healthy population of forbs without having to delegate a larger portion of the budget to seed.

Seed mixes specifically for the butterfly garden consist of either 75% or 80% forb seed, with mixes containing 75% forb seed being lower in cost, and mixes that are non-native to Iowa having the lowest cost. Although they are non-native seeds, they come with the same benefit of being able to withstand wet soil conditions, which would ensure they thrive in the FEMA floodplain area.

High-Cost

The high-cost alternative kept the same layout, including the PCC and aggregate trails and the stream crossing, but used higher-quality, larger, more specialized playground equipment. This included an upgraded nature-based and a larger, more expensive traditional playground. New materials and play features were prioritized instead of reused ones to improve consistency and long-term performance.

The main advantage of this option was improved durability and overall quality. It also provides a more diverse play experience for all ages. Higher-end equipment would likely last longer and provide better user experience. It would also create a more finished and visually appealing design.

The main disadvantage was the increased cost. Most of the additional cost came from the upgraded playground equipment rather than changes to the layout or infrastructure. This made the design less feasible depending on the available budget.

High-cost seeding options have also been implemented into this high-end design. One of these seed mixes is 100% native forb seed, which provides the park with brilliant bursts of color. To reduce costs, this seed mix could be planted in combination with another low- to medium-cost seed mix. This ensures that there is a larger forb population, but also a large enough grass population to allow the park to truly resemble a native prairie. Allendan also curated a custom seed mix that is suitable for the project constraints. It consists of 75% forb seed that displays a variety of colors from spring to fall. Since this is a custom mix heavy in forbs, it is by far the most expensive seed mix alternative

provided in this design. Additionally, the selected forbs are well suited for wet soil conditions, and the mix includes a decent dose of native grasses that would eliminate the need for the custom mix to be planted in tandem with a low-cost mix. However, Bondurant still has the option to do so based on budget constraints.

High-end seed mixes for the butterfly garden also consist of either 75% or 80% forb seed, with higher percent mixes being more costly. Given that there is only a 5% difference, a 75% forb seed mix would be best suited for the garden, as it will still provide a magnificent display of color with the added benefit of reducing landscaping costs. The park further benefits from these high-cost seed mixes as they are all seeds native to Iowa's ecotype.

Considering that Bondurant is expected to receive a seeding grant from the Neal Smith Wildlife Refuge, planting a high-cost seed mix is very feasible. They offer grasses and forbs that are native to Iowa, which provides bountiful learning opportunities and supports community values on conservation. These mixes also better align with the vision for the project, as they provide a larger population of forbs that offer a brilliant display of color from spring to fall. Using these in combination with a lower amount of low-cost seed mix can also provide opportunities to reduce landscaping costs and would ensure grasses are present to offer a variety of textures that help build the park's character. The custom seed mix further aligns with the project constraints as it was designed with forbs that withstand wet conditions, which ensures plant longevity and reduces the need for reseeding in the future. Although the most expensive option, the custom mix provides an adequate population of grasses to maintain a natural prairie appearance.

Selection of Preferred Alternative (High Vs. Low)

The final design decision was based on balancing cost with long-term performance and usability. Since both alternatives had the same layout and core features, along with the added benefit of seeding grants from the Neal Smith Wildlife Refuge, the decision came down to the cost of the playground equipment and expected user experience. The high-cost alternative offered better a more diverse play experience for all ages but required a higher budget, while the low-cost alternative was more affordable but came with tradeoffs for the play features.

The high-cost alternative was selected as the preferred option because it provides a more durable and long-lasting design. The use of higher-quality playground equipment is expected to reduce maintenance needs and replacement frequency over time. In addition, this option creates a more visually appealing and engaging environment for users, which better supports long-term community use.

Although the initial cost is higher, the improved performance and lifespan of the materials make it a more reliable long-term solution. The added investment is justified by the increased durability, improved user experience, and reduced need for future upgrades or replacements. Based on these factors, the high-cost alternative was determined to be the most effective option for meeting the overall goals of the project.

Cost Estimate

Quantities were estimated based on the site plan developed for the Bluejay Landing Park and Eagle Park area. The nature-based play equipment are the key features in this design and make up the largest portion of the total cost. Nature-based play equipment does not align with standard bid items, so prices were obtained directly from the vendor. Vendor pricing was also used for the traditional playground, seed mixes, signage, and some small ticket items. Other items were based on pricing found on Bid Express; an online database of unit pricings provided by contractors for similar items of work in Iowa.

Dimensional analysis was performed for the trail, park areas, and planting plots to inform us of the approximate areas of each component. Counts were taken of individual furnishing, tree, and play elements. Additionally, light grading is required, which demands the need for cut and fill of soil to accommodate the ADA-compliant trail. These CAD measured quantities served as the basis for estimating areas, volumes, lengths, and unit counts used to construct the price estimates.

General cost estimates for the Eagle Park and Bluejay Landing Park Integrated Design Project are available from Table 1 through Table 2. Table 1 provides the cost estimates for the high- and low-cost alternatives, respectively. Table 2 breaks down the cost by phase so that Bondurant is aware of the associated cost with each step of construction. Lastly, each cost estimate was calculated with a 10% contingency to account for unknown obstacles that may be experienced during construction. An additional 20% engineering and administration contingency was applied to the total cost in anticipation of consulting costs. A full itemized cost estimate can also be found in Appendix C.

Table 1: Cost estimate by section

Section	Cost ($)	
	High-Cost Alternative	Low-Cost Alternative
Nature Playscape	$225,355.63	$126,284.39
Northwest Bluejay Landing	$21,794.97	$21,476.60
Traditional Park & Welcome Area	$215,222.76	$177,533.03
10% Contingencies	$46,237.34	$32,529.40
20% Engineering and Administration	$92,474.67	$65,058.81
Total Project Cost	$601,085.37	$422,882.24

Table 2. Cost estimate by phase		
Phase	Cost ($)	
	High-Cost Alternative	Low-Cost Alternative
Phase 1	$205,706.22	$168,222.22
Phase 2	$41,726.24	$41,726.24
Phase 3	$214,940.91	$115,345.58
10% Contingencies	$46,237.34	$32,529.40
20% Engineering and Administration	$92,474.67	$65,058.81
Total Project Cost	$601,085.37	$422,882.24

Appendix A: High-Cost Alternative Seed Mix Summaries

Allendan Custom 10/30 Mix

Grasses	Scientific Name	Common Name	Seeds/Ft^2	PLS Lbs/Acre	PLS Lbs Total
1	*Muhlenbergia racemosa*	Marsh Muhly	3.000	0.102	0.31
2	*Carex scoparia*	Broom Sedge	0.500	0.016	0.049
3	*Carex vulpinoidea*	Fox Sedge	1.000	0.027	0.082
4	*Carex molesta*	Troublesome Sedge	1.000	0.109	0.33
5	*Carex hystericina*	Porcupine Sedge	0.500	0.045	0.14
6	*Carex lurida*	Lurid Sedge	0.050	0.011	0.034
7	*Carex bebbii*	Bebb's Sedge	0.050	0.004	0.012
8	*Carex stricta*	Upright Sedge	0.050	0.003	0.0077
9	*Elymus virginicus*	Virginia Wildrye	2.950	1.912	5.74
10	*Carex brevior*	Prairie Oval Sedge	0.500	0.047	0.14
11	*Scirpus cyperinus*	Woolgrass	0.400	0.001	0.0019
		SUBTOTAL GRASSES	**10.000**	**2.278**	**6.833**

Forbs/Legumes	Scientific Name	Common Name	Seeds/Ft^2	PLS Lbs/Acre	PLS Lbs Total
1	*Anemone canadensis*	Canada Anemone	0.100	0.034	0.10
2	*Mimulus ringens*	Square-stemmed Monkeyflower	3.000	0.004	0.011
3	*Rudbeckia hirta*	Black-eyed Susan	1.000	0.030	0.089
4	*Potentilla arguta*	Prairie Cinquefoil	0.500	0.006	0.018
5	*Pycnanthemum tenuifolium*	Slender Mountain Mint	1.000	0.007	0.022
6	*Lythrum alatum*	Winged Loosestrife	3.000	0.003	0.0082
7	*Ludwigia alternifolia*	Seedbox	3.000	0.006	0.019
8	*Lobelia siphilitica*	Great Blue Lobelia	4.000	0.022	0.065
9	*Artemisia ludoviciana*	White Sage	0.500	0.005	0.016
10	*Symphyotrichum pilosum*	Hairy Aster	0.500	0.010	0.029
11	*Pycnanthemum virginianum*	Virginia Mountain Mint	0.500	0.006	0.019
12	*Zizia aurea*	Golden Alexander's	0.500	0.124	0.37
13	*Oligoneuron riddellii*	Riddell's Goldenrod	0.300	0.009	0.026
14	*Echinacea pallida*	Pale Purple Coneflower	0.300	0.157	0.47
15	*Bidens cernua*	Nodding Bur Marigold	0.100	0.013	0.039
16	*Asclepias syriaca*	Common Milkweed	0.100	0.064	0.19
17	*Iris shrevei*	Blue Flag Iris	0.010	0.027	0.082
18	*Monarda fistulosa*	Wild Bergamot	1.000	0.039	0.12
19	*Oligoneuron rigidum*	Stiff Goldenrod	0.300	0.020	0.060
20	*Eupatorium perfoliatum*	Boneset	1.490	0.025	0.076
21	*Symphyotrichum laeve*	Smooth Blue Aster	0.500	0.025	0.074
22	*Lobelia cardinalis*	Cardinal Flower	0.500	0.003	0.010
23	*Euthamia graminifolia*	Grass-leaved Goldenrod	0.500	0.004	0.012
24	*Physostegia virginiana*	Obedient Plant	0.100	0.012	0.037
25	*Eryngium yuccifolium*	Rattlesnake Master	0.100	0.036	0.11
26	*Asclepias incarnata*	Swamp Milkweed	0.100	0.057	0.17
27	*Lespedeza capitata*	Round-headed Bush Clover	0.050	0.017	0.051
28	*Liatris pycnostachya*	Prairie Blazing Star	0.300	0.074	0.22
29	*Parthenium integrifolium*	Wild Quinine	0.050	0.019	0.058
30	*Veronicastrum virginicum*	Culver's Root	4.000	0.014	0.041

31	*Verbena hastata*	Blue Vervain	0.600	0.018	0.053
32	*Ratibida pinnata*	Gray-headed Coneflower	1.000	0.091	0.27
33	*Solidago speciosa*	Showy Goldenrod	0.500	0.014	0.043
34	*Rudbeckia subtomentosa*	Sweet Coneflower	0.100	0.006	0.019
35	*Heliopsis helianthoides*	Oxeye, False Sunflower	0.200	0.086	0.26
36	*Symphyotrichum novae-*	New England Aster	0.100	0.004	0.012
37	*Eutrochium maculatum*	Spotted Joe Pye Weed	0.100	0.003	0.0086
		SUBTOTAL FORBS	**30.000**	**1.094**	**3.282**

Woody	Scientific Name	Common Name	Seeds/Ft^2	PLS Lbs/Acre	PLS Lbs Total
		SUBTOTAL VINES/WOODY	**0.000**	**0.000**	**0.000**
		TOTAL	**40.000**	**3.372**	**10.115**

CP42 Leopold #1 Pollinator 10/30 Iowa Ecotype

Grasses	Scientific Name	Common Name	Seeds/Ft^2	PLS Lbs/Acre	PLS Lbs Total
1	*Andropogon gerardii*	Big Bluestem	0.500	0.136	0.14
2	*Sorghastrum nutans*	Indiangrass	0.500	0.113	0.11
3	*Bouteloua curtipendula*	Sideoats Grama	1.500	0.681	0.68
4	*Schizachyrium scoparium*	Little Bluestem	5.000	0.908	0.91
5	*Carex brevior*	Prairie Oval Sedge	0.200	0.019	0.019
6	*Elymus virginicus*	Virginia Wildrye	0.200	0.130	0.13
7	*Sporobolus compositus*	Rough Dropseed	1.590	0.144	0.14
8	*Sporobolus heterolepis*	Prairie Dropseed	0.010	0.002	0.0017
9	*Carex molesta*	Troublesome Sedge	0.500	0.054	0.054
		SUBTOTAL GRASSES	**10.000**	**2.187**	**2.187**

Forbs/Legumes	Scientific Name	Common Name	Seeds/Ft^2	PLS Lbs/Acre	PLS Lbs Total
1	*Allium stellatum*	Wild Prairie Onion	0.050	0.012	0.012
2	*Anemone cylindrica*	Thimbleweed	0.030	0.003	0.0031
3	*Allium canadense*	Wild Garlic	0.010	0.049	0.049
4	*Achillea millefolium*	Common Yarrow	0.200	0.003	0.0031
5	*Verbena stricta*	Hoary Vervain	0.500	0.049	0.049
6	*Baptisia alba*	White Wild Indigo	0.010	0.016	0.016
7	*Asclepias tuberosa*	Butterfly Weed	0.030	0.019	0.019
8	*Asclepias incarnata*	Swamp Milkweed	0.370	0.210	0.21
9	*Artemisia ludoviciana*	White Sage	0.200	0.002	0.0022
10	*Tradescantia ohiensis*	Ohio Spiderwort	0.010	0.003	0.0034
11	*Silphium laciniatum*	Compass Plant	0.005	0.021	0.021
12	*Silphium perfoliatum*	Cup Plant	0.005	0.010	0.0097
13	*Silphium terebinthinaceum*	Prairie Rosinweed	0.005	0.014	0.014
14	*Silphium integrifolium*	Rosinweed	0.005	0.011	0.011
15	*Symphyotrichum novae-angliae*	New England Aster	0.100	0.004	0.0041
16	*Symphyotrichum laeve*	Smooth Blue Aster	0.200	0.010	0.0099
17	*Symphyotrichum pilosum*	Hairy Aster	0.100	0.002	0.0019
18	*Oligoneuron album*	Upland White Aster	0.100	0.004	0.0043
19	*Rudbeckia hirta*	Black-eyed Susan	4.000	0.118	0.12
20	*Rudbeckia triloba*	Brown-eyed Susan	0.500	0.040	0.040
21	*Ratibida pinnata*	Gray-headed Coneflower	1.000	0.091	0.091
22	*Echinacea pallida*	Pale Purple Coneflower	0.200	0.105	0.10
23	*Eupatorium perfoliatum*	Boneset	0.030	0.001	0.00051
24	*Lythrum alatum*	Winged Loosestrife	1.000	0.001	0.00091
25	*Eupatorium altissimum*	Tall Boneset	0.030	0.002	0.0016
26	*Eutrochium maculatum*	Spotted Joe Pye Weed	0.030	0.001	0.00086
27	*Eupatorium purpureum*	Sweet Joe Pye Weed	0.030	0.002	0.0019
28	*Astragalus canadensis*	Canadian Milkvetch	0.500	0.080	0.080
29	*Chamaecrista fasciculata*	Partridge Pea	0.100	0.101	0.10
30	*Desmanthus illinoensis*	Illinois Bundle Flower	0.200	0.130	0.13
31	*Solidago speciosa*	Showy Goldenrod	0.300	0.009	0.0086
32	*Hypericum ascyron*	Great St. John's Wort	0.100	0.001	0.0014
33	*Mimulus ringens*	Square-stemmed Monkeyflower	1.000	0.001	0.0012
34	*Pycnanthemum virginianum*	Virginia Mountain Mint	1.000	0.012	0.012

35	*Penstemon grandiflorus*	Large-flowered	0.300	0.058	0.058
36	*Penstemon digitalis*	Foxglove Beardtongue	0.800	0.017	0.017
37	*Oligoneuron rigidum*	Stiff Goldenrod	1.000	0.066	0.066
38	*Solidago nemoralis*	Old Field Goldenrod	1.000	0.009	0.0091
39	*Liatris aspera*	Rough Blazing Star	0.050	0.009	0.0085
40	*Liatris pycnostachya*	Prairie Blazing Star	0.050	0.012	0.012
41	*Brickellia eupatorioides*	False Boneset	0.020	0.002	0.0017
42	*Helianthus pauciflorus*	Prairie Sunflower	0.020	0.010	0.010
43	*Desmodium illinoense*	Illinois Ticktrefoil	0.020	0.013	0.013
44	*Heliopsis helianthoides*	Oxeye, False Sunflower	0.250	0.108	0.11
45	*Parthenium integrifolium*	Wild Quinine	0.020	0.008	0.0078
46	*Rudbeckia subtomentosa*	Sweet Coneflower	0.200	0.013	0.013
47	*Zizia aurea*	Golden Alexander's	0.100	0.025	0.025
48	*Vernonia fasciculata*	Ironweed	0.050	0.006	0.0057
49	*Physostegia virginiana*	Obedient Plant	0.050	0.006	0.0062
50	*Lespedeza capitata*	Round-headed Bush	0.020	0.007	0.0068
51	*Desmodium canadense*	Showy Ticktrefoil	0.020	0.010	0.0099
52	*Dalea purpurea*	Purple Prairie Clover	4.000	0.605	0.61
53	*Dalea candida*	White Prairie Clover	0.840	0.120	0.12
54	*Lobelia siphilitica*	Great Blue Lobelia	1.300	0.007	0.0071
55	*Eryngium yuccifolium*	Rattlesnake Master	0.050	0.018	0.018
56	*Ludwigia alternifolia*	Seedbox	0.500	0.001	0.0010
57	*Oenothera biennis*	Common Evening	1.300	0.039	0.039
58	*Veronicastrum virginicum*	Culver's Root	1.300	0.004	0.0044
59	*Monarda fistulosa*	Wild Bergamot	0.500	0.019	0.019
60	*Zizia aptera*	Heartleaf Alexander	0.020	0.005	0.0045
61	*Ruellia humilis*	Wild Petunia	0.020	0.010	0.010
62	*Asclepias syriaca*	Common Milkweed	0.200	0.127	0.13
63	*Potentilla arguta*	Prairie Cinquefoil	4.000	0.047	0.047
		SUBTOTAL FORBS	**29.950**	**2.518**	**2.518**

Woody	Scientific Name	Common Name	Seeds/Ft^2	PLS Lbs/Acre	PLS Lbs Total
1	*Rosa arkansana*	Prairie Rose	0.020	0.022	0.022
2	*Amorpha canescens*	Lead Plant	0.030	0.005	0.0051
		SUBTOTAL VINES/WOODY	**0.050**	**0.027**	**0.027**
		TOTAL	**40.000**	**4.731**	**4.731**

Appendix B: Low-Cost Alternative Seed Mix Summaries

CP25 Wet Prairie 30/10

Grasses	Scientific Name	Common Name	Seeds/Ft^2	PLS Lbs/Acre	PLS Lbs Total
1	*Andropogon gerardii*	Big bluestem	8.000	2.178	2.18
2	*Elymus virginicus*	Virginia Wildrye	2.000	1.296	1.30
3	*Carex vulpinoidea*	Fox Sedge	3.000	0.082	0.082
4	*Glyceria striata*	Fowl Mannagrass	4.000	0.068	0.068
5	*Poa palustris*	Fowl Bluegrass	6.000	0.126	0.13
6	*Carex hystericina*	Porcupine Sedge	1.000	0.091	0.091
7	*Panicum virgatum*	Switchgrass	2.000	0.389	0.39
8	*Sorghastrum nutans*	Indiangrass	4.000	0.908	0.91
		SUBTOTAL GRASSES	**30.000**	**5.137**	**5.137**

Forbs/Legumes	Scientific Name	Common Name	Seeds/Ft^2	PLS Lbs/Acre	PLS Lbs Total
1	*Veronicastrum virginicum*	Culver's Root	1.230	0.004	0.0042
2	*Rudbeckia subtomentosa*	Sweet Coneflower	0.150	0.009	0.0095
3	*Asclepias incarnata*	Swamp Milkweed	0.050	0.028	0.028
4	*Silphium perfoliatum*	Cup Plant	0.010	0.019	0.019
5	*Physostegia virginiana*	Obedient Plant	0.010	0.001	0.0012
6	*Pycnanthemum virginianum*	Virginia Mountain Mint	0.250	0.003	0.0031
7	*Ludwigia alternifolia*	Seedbox	1.500	0.003	0.0031
8	*Mimulus ringens*	Square-stemmed Monkeyflower	1.500	0.002	0.0018
9	*Eutrochium maculatum*	Spotted Joe Pye Weed	0.050	0.001	0.0014
10	*Lythrum alatum*	Winged Loosestrife	1.500	0.001	0.0014
11	*Oligoneuron riddellii*	Riddell's Goldenrod	0.100	0.003	0.0029
12	*Symphyotrichum novae-angliae*	New England Aster	0.150	0.006	0.0062
13	*Lobelia siphilitica*	Great Blue Lobelia	1.500	0.008	0.0082
14	*Rudbeckia triloba*	Brown-eyed Susan	2.000	0.160	0.16
		SUBTOTAL FORBS	**10.000**	**0.251**	**0.251**

Woody	Scientific Name	Common Name	Seeds/Ft^2	PLS Lbs/Acre	PLS Lbs Total
		SUBTOTAL VINES/WOODY	**0.000**	**0.000**	**0.000**
		TOTAL	**40.000**	**5.388**	**5.388**

IOWA

Eagle Park and Bluejay Landing Park Greenway

CP42 Wet Pollinator 10/30

Grasses	Scientific Name	Common Name	Seeds/Ft^2	PLS Lbs/Acre	PLS Lbs Total
1	*Andropogon gerardii*	Big Bluestem	1.000	0.272	0.27
2	*Elymus virginicus*	Virginia Wildrye	1.500	0.972	0.97
3	*Carex vulpinoidea*	Fox Sedge	3.000	0.082	0.082
4	*Carex hystericina*	Porcupine Sedge	0.100	0.009	0.0091
5	*Carex brevior*	Prairie Oval Sedge	0.050	0.005	0.0047
6	*Poa palustris*	Fowl Bluegrass	1.450	0.030	0.030
7	*Glyceria striata*	Fowl Mannagrass	0.400	0.007	0.0068
8	*Scirpus atrovirens*	Dark Green Bulrush	1.000	0.006	0.0059
9	*Scirpus cyperinus*	Woolgrass	1.000	0.002	0.0016
10	*Muhlenbergia racemosa*	Marsh Muhly	0.500	0.017	0.017
		SUBTOTAL GRASSES	**10.000**	**1.402**	**1.402**

Forbs/Legumes	Scientific Name	Common Name	Seeds/Ft^2	PLS Lbs/Acre	PLS Lbs Total
1	*Hypericum ascyron*	Great St. John's Wort	0.500	0.007	0.0072
2	*Tradescantia ohiensis*	Ohio Spiderwort	0.010	0.003	0.0034
3	*Asclepias incarnata*	Swamp Milkweed	0.100	0.057	0.057
4	*Lythrum alatum*	Winged Loosestrife	4.000	0.004	0.0036
5	*Helianthus grosseserratus*	Saw-tooth Sunflower	0.050	0.009	0.0091
6	*Physostegia virginiana*	Obedient Plant	0.100	0.012	0.012
7	*Lobelia cardinalis*	Cardinal Flower	0.300	0.002	0.0020
8	*Lobelia siphilitica*	Great Blue Lobelia	4.000	0.022	0.022
9	*Eupatorium perfoliatum*	Boneset	0.100	0.002	0.0017
10	*Symphyotrichum novae-angliae*	New England Aster	0.300	0.012	0.012
11	*Euthamia graminifolia*	Grass-leaved Goldenrod	0.500	0.004	0.0039
12	*Oenothera biennis*	Common Evening Primrose	1.950	0.059	0.059
13	*Ludwigia alternifolia*	Seedbox	4.000	0.008	0.0084
14	*Eutrochium maculatum*	Spotted Joe Pye Weed	0.250	0.007	0.0072
15	*Mimulus ringens*	Square-stemmed Monkeyflower	4.000	0.005	0.0047
16	*Anemone canadensis*	Canada Anemone	0.010	0.003	0.0034
17	*Silphium terebinthinaceum*	Prairie Rosinweed	0.010	0.027	0.027
18	*Bidens cernua*	Nodding Bur Marigold	0.050	0.006	0.0065
19	*Zizia aurea*	Golden Alexander's	0.100	0.025	0.025
20	*Silphium perfoliatum*	Cup Plant	0.010	0.019	0.019
21	*Rudbeckia triloba*	Brown-eyed Susan	4.000	0.320	0.32
22	*Rudbeckia subtomentosa*	Sweet Coneflower	0.500	0.032	0.032
23	*Desmodium canadense*	Showy Ticktrefoil	0.100	0.050	0.050
24	*Thalictrum dasycarpum*	Purple Meadow-rue	0.050	0.012	0.012
25	*Pycnanthemum virginianum*	Virginia Mountain Mint	1.000	0.012	0.012
26	*Oligoneuron riddellii*	Riddell's Goldenrod	0.460	0.013	0.013
27	*Veronicastrum virginicum*	Culver's Root	3.550	0.012	0.012
		SUBTOTAL FORBS	**30.000**	**0.746**	**0.746**

Woody	Scientific Name	Common Name	Seeds/Ft^2	PLS Lbs/Acre	PLS Lbs Total
		SUBTOTAL VINES/WOODY	**0.000**	**0.000**	**0.000**
		TOTAL	**40.000**	**2.148**	**2.148**

Appendix C: In-Depth Cost Estimate

HIGH END COST ESTIMATE BY SECTION						
NATURE PLAYSCAPE						
ITEM	**DESCRIPTION**	**UNIT**	**QUANTITY**	**UNIT COST**	**TOTAL**	**Notes:**
	CLEARING AND GRUBBING					
			13.19			
3				$50.28		
	Tensar BX1100 (estimated)					*Paramount Materials
6	Public Use	EA	1	$29,483.00	$29,483.00	*Natures Instruments
7	Log Frame To-Fro Basket Swing (Single Bay)	EA	1	$27,868.00	$27,868.00	*Natures Instruments
8	Double Log Mash W/ One 8ft Rope	EA	1	$24,123.91	$24,123.91	*Natures Instruments
9	Public Log Tunnel	EA	2	$9,465.69	$18,931.38	*Natures Instruments
10	Picnic Table	EA	2	$1,300.00	$2,600.00	
11	Thunder Drums (Set of 3)	EA	1	$4,523.52	$4,523.52	*Natures Instruments
12	Standard Public 9 Piece Obstacle Course	EA	1	$3,844.12	$3,844.12	*Natures Instruments
13	Log Love Seat	EA	4	$3,801.55	$15,206.20	*Natures Instruments
14	Full Log Park Bench	EA	9	$3,486.86	$31,381.74	*Natures Instruments
15	Hanging Amadinda	EA	1	$2,837.39	$2,837.39	*Natures Instruments
16	Log Stepping Rounds 12"x18"Diameter	EA	5	$362.66	$1,813.30	*Natures Instruments
17	Log Stepping Rounds 18"x12" Diameter	EA	6	$309.71	$1,858.26	*Natures Instruments
18	Log Stepping Rounds 12"x12" Diameter	EA	11.00	$294.03	$3,234.33	*Natures Instruments
19	MULCH, WOOD CHIPS (Wood Chips/Surfacing) (3")	CY	204.83	$80.00	$16,386.40	*BidX
20	Trash Cans	EA	4	$750.00	$3,000.00	

	Signage	EA	4	$400.00	$1,600.00	
			10	$40.00	$400.00	Kelly Tree Farm LLC.
						*Angi Landscape
					$27.45	_____
						*Outside Pride
	Seed Installment					*BidX
	Subtotal				**$225,355.63**	
						*Allendan
	Seed Installment				$100.95	*BidX
	MODIFIED SUBBASE					
	Tensar BX1100 (estimated)	SY	230.79	$3.00	$692.37	*Paramount Materials

TRADITIONAL PARK & WELCOME AREA

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT COST		
1	CLEARING AND GRUBBING	AC	1	$3,702.57	$3,702.57	*BidX
2	RECREATIONAL TRAIL, PORTLAND CEMENT CONCRETE, 5 IN.	SY	507.46	$53.28	$27,037.47	*BidX
3	MODIFIED SUBBASE	CY	84.57	$50.28	$4,252.18	*BidX
4	Traditional Playground	EA	1	$124,406.00	$124,406.00	*Playground Boss

5	Allendan Custom 10/30 Mix	AC	0.5	$549.05	$274.53	*Allendan
6	CP42 Leopold #1 Pollinator 10/30 Iowa Ecotype	AC	0.08	$290.00	$23.20	
7	Seed Installment	AC	0.5	$124.63	$62.32	*BidX
8	Trash Cans	EA	2	$750.00	$1,500.00	*Belson Outdoors
9	CULVERT, CONCRETE ROADWAY PIPE, 48 IN. DIA.	LF	37.5	$223.48	$8,380.50	*BidX
10	Signage	EA	3	$400.00	$1,200.00	*Wood Product Signs
11	12' X 40' X 50-ton Steel Panel Bridge	EA	1	$39,080.00	$39,080.00	***Mustang Extreme Environmental Services**
12	MULCH, WOOD CHIPS (Wood Chips/Surfacing) (3")	CY	66.30	$80.00	$5,304.00	*BidX
	Total Bluejay Subtotal				**$462,373.36**	
	10% Engineering & Administration Fees				$46,237.34	
	20% Construction Contingency				$92,474.67	
	Total Cost Estimate				**$601,085.37**	

LOW END COST ESTIMATE

NATURE PLAYSCAPE

ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT COST	TOTAL	NOTES
1	CLEARING AND GRUBBING	AC	2.28	$3,702.57	$8,441.86	*BidX
2	SPECIAL COMPACTION OF SUBGRADE FOR RECREATIONAL TRAIL	STA	13.19	$277.41	$3,658.46	*BidX
3	MODIFIED SUBBASE	CY	40.39	$50.28	$2,030.81	*BidX
4	AGGREGATE, ROADWAY COVER, 3/8 IN.	TON	1.10	$30.08	$33.09	*BidX
5	Tensar BX1100 (estimated)	SY	727.11	$3.00	$2,181.33	*Paramount Materials
6	Log Mash Play Structure	EA	1	$10,768.67	$10,768.67	*Natures Instruments
7	Boulders	EA	2	$5,000.00	$10,000.00	*Natures Instruments
8	Log Tunnel	EA	2	$6,000.00	$12,000.00	*Natures Instruments
9	Picnic Table	EA	2	$1,300.00	$2,600.00	
10	Thunder Drums (Set of 3)	EA	1	$4,523.52	$4,523.52	*Natures Instruments
11	Standard Public 9 Piece Obstacle Course	EA	1	$3,844.12	$3,844.12	*Natures Instruments
12	20" Milled Log Bench	EA	13	$1,385.49	$18,011.37	*Natures Instruments
13	Log Stepping Rounds 12"x18"Diameter	EA	5	$362.66	$1,813.30	*Natures Instruments
14	Log Stepping Rounds 18"x12" Diameter	EA	6	$309.71	$1,858.26	*Natures Instruments
15	Log Stepping Rounds 12"x12" Diameter	EA	11.00	$294.03	$3,234.33	*Natures Instruments
16	MULCH, WOOD CHIPS (Wood Chips/Surfacing) (3")	CY	204.83	$80.00	$16,386.40	*Natures Instruments
17	Trash Cans	EA	4	$750.00	$3,000.00	
18	Signage	EA	4	$400.00	$1,600.00	
19	Sycamore Tree	EA	10	$40.00	$400.00	*Wood Product Signs
20	Limestone Boulders	EA	9	$2,000.00	$18,000.00	Kelly Tree Farm LLC.
21	CP25 Wet Prairie 30/10	AC	0.05	$156.00	$7.80	*Angi Landscape

22	Mix of Switchgrass, Big Bluestem, Indiangrass, and bluegrass	SF	1770.23	$0.35	$619.58	*Allendan
23	Seed Installment	AC	1.59	$124.63	$198.16	*Outside Pride
24	Seeding and Fertilizing	AC	1.5	$715.56		*BidX
						*BidX
		AC	0.81			
		STA	4.27			
		TON	0.35			

ITEM	DESCRIPTION	UNIT		COST	TOTAL	NOTES
			507.46	$53.28		
		CY			$4,252.18	*BidX
		EA	1	$86,922.00		*BidX
	CP25 Wet Prairie 30/10	AC	0.5	$156.00		*BidX
6		AC	0.08			
7			0.5			*Allendan
8	Trash Cans	EA	2	$750.00	$1,500.00	
9	CULVERT, CONCRETE ROADWAY PIPE, 48 IN. DIA.	LF	37.5	$223.48	$8,380.50	*BidX
10	Signage	EA	3	$400.00	$1,200.00	*Belson Outdoors

11	12' X 40' X 50-ton Steel Panel Bridge	EA	1	$39,080.00	$39,080.00	***Mustang Extreme Environmental Services**
12	MULCH, WOOD CHIPS (Wood Chips/Surfacing) (3")	CY	66.30	$80.00	$5,304.00	*Wood Product Signs
	Subtotal				**$177,533.03**	
	Total Bluejay Subtotal				**$325,294.03**	
	10% Engineering & Administration Fees				$32,529.40	
	20% Construction Contingency				$65,058.81	
	Total Cost Estimate				**$422,882.24**	

Appendix D: Storm Culvert Calculation

Double End Area Method:

Contour Elevation (ft)	Area (ft^2)	Contour Interval (ft)	Change in Storage (ft^3)	Storage (ft^3)
941	0			0
		1	102.69	
942	205.38			102.69
		1	363.52	
943	521.66			466.21

Maximum water volume of existing ditch in area to be covered by culvert: 466.21 ft^3

Length of culvert: 37.50 ft

Volume of culvert, circular: $V = L\pi r^2 = 37.5 \times \pi \times r^2 = 466.21$

Required radius: $r = \sqrt{\frac{466.21}{37.5\pi}} = 1.99\ ft$

Required diameter: $D = 2r = 2 \times 1.99 = 3.98\ ft\ \times 12\frac{in}{ft} = 47.76 \approx 48\ in$