IOWA STATE UNIVERSITY
Haber Road Pasture
Stormwater Demonstration Park Master Plan

“A Place to Celebrate and Investigate Stormwater”
on the Iowa State University Campus

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EXECUTIVE SUMMARY

Iowa State University Haber Road Pasture
Stormwater Management Demonstration Park Master Plan

Take acres of water, add 14 tons of dirt, 215 pounds of lead and zinc, and 1/3 ton of oil and gas, mix, and pour into Squaw Creek every year. This isn’t a recipe that fish, fowl or human would knowingly create, but one that has been cooking for many years. The University and the Ames community value Squaw Creek. Their joint concern and the involvement of Facilities Planning and Management, Civil Engineering, Landscape Architecture and the City of Ames led to the creation of this Master Plan to address clean water.

We propose a Haber Road Pasture Stormwater Management Demonstration Park that creates a new recipe. This new recipe removes 12 tons of dirt, 119 pounds of lead and zinc, and 1/4 ton of oil and gas yearly from the stormwater flow. It not only reduces the amount of pollutants entering Squaw Creek, it also drastically reduces the volume at which this cleaner stormwater enters the creek. An array of techniques, called “stormwater best management practices” are proposed in Frederiksen Court, and in the Haber Road Pasture. Runoff that used to rush to Squaw Creek through a 60” storm sewer will be re-routed into the pasture’s pond and wetland for filtering.

The cost of full implementation is estimated at $3.36 million. $1,839,911 is the estimated cost for the Haber Road Pasture Stormwater Demonstration Park. The balance of $1,522,161 creates the proposed changes to Frederickson Court. The Plan can be implemented in phases as required.

This Plan guides the development of a place to clean, celebrate, and investigate stormwater on the ISU campus. The proposed park:
- cleans stormwater from Frederiksen Court
- restores native vegetation and increases ecological and habitat diversity
- creates bicycle and pedestrian paths and walkways and additional car parking
- establishes education and interpretation features including outdoor classrooms
- identifies low-input maintenance goals and practices
- “extends” Brookside Park, providing recreation benefits for both the ISU community and the Ames community as a whole

It has been an honor to work on this Master Plan. We invite you to read this report and envision a new kind of “Water Park” for the region.

Thank You,

J. Peter Marsh

Director of Design and Science,
The Kestrel Design Group, Inc.
INTRODUCTION

Stormwater runoff from Frederiksen Court at Iowa State University runs directly into Squaw Creek. It carries with it most of the non-point source pollutants from the area. Runoff is primarily conveyed by a 60” storm sewer, resulting in large quantities, almost 1 acre foot of polluted water every four minutes, which is quickly discharged into Squaw Creek without any cleaning of the water or control of the amount or rate of stormwater discharged to the creek. Modeling indicates that this includes 14 tons of sediment, and 92 pounds of phosphorus, along with about 1/4 ton of nitrogen and 1/4 ton of hydrocarbons each year.

ISU recognizes the value of Squaw Creek to the university and Ames communities. Stormwater management has fast become an issue in the ISU and the City of Ames communities due to the history of flooding, concerns for water quality, mid-summer low water levels, the establishment of Squaw Creek Watershed Coalition, and National Pollution Discharge Elimination System (NPDES) Phase II requirements.

The university desires to address the negative impacts of stormwater from Frederiksen Court. The future relocation of horses from Haber Pasture creates an opportunity for ISU to use this open space to create a “stormwater management park” to manage stormwater from Frederiksen Court and capitalize on bioretention, nutrient management, water quality, and education opportunities afforded by Haber Pasture. This Master Plan guides these efforts.

The Master Plan, when implemented, will result in dramatic reductions in the amount of pollution entering Squaw Creek. Sediment entering the creek will be reduced from 14 tons to less than one ton, and phosphorus from 92 pounds to 24 pounds yearly.

Study Area and Context
The Haber Road Pasture area studied in this Master Plan comprises approximately 20 acres, located south of 13th Street, east of Haber Road, west of Squaw Creek and Brookside Park. West of Haber Road is ISU student housing in Frederiksen Court, and the ISU Firemanship Training, and Transportation Services facilities. Frederiksen Court is medium to high density residential area with a high amount of impervious surfaces; most stormwater runoff is piped directly into Squaw Creek. Runoff from the adjacent Firemanship Training, and Transportation Services facilities, small relative to the overall project area, is piped under Haber Road and then flows via sheet flow across Haber Pasture and ultimately to Squaw Creek.

Haber Road Pasture has been used for the pasturing of horses for decades, however, the horses will someday be relocated permanently from the pasture. The Pasture is mostly located within the floodplain and flood fringe of Squaw Creek, and is dominated by pasture grasses and a savanna like area with scattered mature trees in the northwest part of the Pasture. The Pasture contains undulating swales and oxbow channel remnants in its lower elevations.

Squaw Creek is a third order meandering stream that drains approximately 130,000 acres. The creek would be classified in the Rosgen method as a Class B Stream, one that is moderately entrenched, moderate in depth to width ratio, and has moderate sinuosity. The draft of Iowa’s integrated report for
2008, created by Iowa’s Department of Natural Resources (DNR), shows that no portion of Squaw Creek is considered “impaired” water.

The City of Ames’ Brookside Park is located east of Haber Pasture, between the Pasture and Squaw Creek. The park contains passive and active recreation areas, woodlands with woodland trails, and combined bicycle/pedestrian paths. One of these paths runs along the south edge of the pasture, connecting ISU with Brookside Park and areas beyond to the east. ISU owns the land where Brookside Park is located, and leases the land to the City of Ames.

South of the Pasture is ISU’s coal storage pile, a Fire Service firefighting practice area, a nursery, and a cell phone tower. These features are outside of the study area, but do influence the planning for Haber Road Pasture. There is some discharge of filtered coal pile leachate into a small portion of the old oxbow. For the foreseeable future the coal pile, firefighting practice area, nursery, and cell tower will remain in place.

Student projects in the ISU Department of Landscape Architecture have identified a number of goals and objectives that helped inform the University goals for Haber Road Pasture. Student identified goals and objectives include reducing the quantity and improving the quality of Frederiksen Court runoff, restoring native vegetation and increasing habitat diversity for wildlife, expanding the current bike path system, and incorporating educational elements throughout the site.

In addition to the above goals and objectives, ISU would like to:
- provide additional parking for Brookside Park or campus use
- educate the public about ecological restoration as horses are being retired from the pasture, flooding, and stream geomorphology
- create a stormwater system and landscape with low maintenance intensity
- create a wetland, prairie and savanna experience using landforms, native grasses and trees, wildflowers and mown short grass
- take advantage of but minimize impacts to Brookside Park
- plan for new High Voltage High Tension power lines to be constructed along the west edge of the Pasture
- plan for the future expansion of Haber Road to four lanes
- Create clear, achievable and measurable maintenance goals and guidelines to keep operations and maintenance actions and costs to a minimum
- identify funding opportunities for implementing the Plan

Together, these goals and objectives, along with the study area’s opportunities and constraints, form the basis of this Master Plan.
GOALS, OBJECTIVES, KEY ELEMENTS
The following summarizes the key goals and objectives in the Plan. A more detailed list of goals and objectives can be found in the Appendix.

Stormwater Management
- Manage stormwater from Frederiksen Court including parking lots and roofs, reduce the impact to Squaw Creek by reducing the quantity and improving the quality of runoff from the 60” pipe that outlets into Squaw Creek at the northeast corner of Haber Road Pasture
- Create a stormwater demonstration park
- Integrate ideas for on-site collection and management of runoff in Frederiksen Court using a suite of applicable Best Management Practices (BMP’s)
- Construct a wetland and other BMP’s to replace the 60” storm sewer pipe
- Target urban non-point source stormwater pollutants for water quality improvement
- Consider sensitive use of Brookside Park to achieve stormwater goals
- Consider ways to disconnect coal pile leachate discharge from the Pasture oxbow and provide for leachate suspended solids collection and PH treatment
- Avoid impacting the City of Ames sanitary sewer line that runs diagonally through the pasture
- Develop a stormwater system that will be minimally impacted by flooding from Squaw Creek
- Incorporate ideas on baseline and on-going data collection data, and how to measure/quantify water quantity and quality goals

Vegetation and Ecological Restoration
- Conserve existing healthy large oak, sycamore, and other trees
- Provide an increase in the diversity of habitat for wildlife
- Restore native vegetation and increase native vegetation communities within the Ames area
- Plan to minimize the impacts of flooding on vegetation restoration while being restored and post-restoration
- Consider restoration impacts on permanent wildlife populations (deer and geese) and resulting water quality and maintenance needs

Education and Interpretation
- Engage, inform, and educate the ISU and Ames communities about the importance of stormwater issues and restoration during planning, Plan implementation, and post-implementation phases
- Provide for an outdoor teaching area/teaching lab
- Incorporate educational and interpretive elements throughout the site, including signage along circulation systems

Circulation and Parking (including future Haber Rd, High Voltage Power Lines)
- Expand the existing bike path and walkway system to improve safety and circulation through and around the site
- Provide additional parking for Brookside Park or ISU campus use
- Plan for expanded bikeways and walkways and parking in conjunction with the preferred option (Option 4b) for reconstruction of Haber Road to 4 lanes
Operations and Maintenance
- Minimize the need for continuous site maintenance
- Provide clear, achievable and measurable goals that would allow ISU to maintain a successful project while holding operations and maintenance costs to a minimum
- Create a facility and landscape suited to ISU budget constraints and maintenance practices as this area is assigned to a new department to manage it

Security
- Plan for a safe and secure place for ISU and Ames users; remove existing fencing, add lights and emergency alert stations along paths and walkways, and possibly close the park at 10:00 pm
- Consider creation of shallow water basins to create less deeper water security risks
- Create openness along pasture perimeter so that deer crossing roads are visible

Funding
- Identify funding opportunities for Plan implementation
- Use Plan and its materials to pursue funding for implementation
- Market the water quality and quantity benefits to IADNR, USACE, EPA etc

ISU, AND STATE OF IOWA STORMWATER PLANNING AND DESIGN

The ISU MS4 Permit and General Permit #2
The National Pollution Discharge Elimination System (NPDES) Phase II program requires operators of small municipal separate storm sewer systems (MS4’s) in “urbanized areas” to obtain an NPDES permit and develop stormwater management programs or plans. The programs or plans must provide best management practices and address six minimum control measure under the MS4 program. Iowa State University is a MS4 jurisdiction that is required to obtain permits where soil is disturbed. Implementation of best management practices are required to prevent the migration of soil and other pollutants into the stormwater system.

Part II of the ISU MS4 Permit (Number 85-03-0-04) identifies best management practices, measurable goals, implementation dates and frequencies for stormwater pollution prevention and management. Section E. Post-construction Stormwater Management, has subsections addressing construction site runoff, site plan review procedures, and re-pavement and stormwater repair retrofit evaluation program. Section E. states that “the permittee (ISU) shall develop, implement, and enforce a program to address stormwater runoff from new construction and re-construction projects for which stormwater coverage is required.”

Section E.3. states that “the (ISU) Stormwater Management Team shall evaluate re-pavement and utility repair projects to determine if post-construction BMP’s to minimize and/or treat runoff are feasible and shall ensure they are implemented when possible. The team shall evaluate the feasibility of installing post-construction runoff controls to minimize or treat runoff from existing streets and parking lots and implement these practices when possible.
While not required, and not based on re-pavement and utility repair projects, this Master Plan does follow the spirit of the permit in that it guides the installation of post-construction runoff controls to minimize or treat runoff from existing streets and parking lots west of Haber Road Pasture and implement these practices when possible.

The ISU MS4 permit does not have specific information or criteria regarding quality, quantity, and rate of post-construction runoff controls.

**State of Iowa Stormwater Management Manual**

The State of Iowa’s Stormwater Management Manual (version 1; 2/19/07) is used in Iowa to present planning and design guidelines for the management of stormwater quality and quantity in the urban environment. The manual provides guidance on planning and implementation of BMP’s for water quality improvement, and contains most of the commonly-used stormwater management BMP’s, hydrologic design and implementation of stormwater quality BMP’s, and traditional analysis and design of stormwater conveyance for larger storm events to prevent flooding. Stormwater management programs and practices are designed to reduce the discharge of pollutants to the maximum extent practicable (MEP).

The manual encourages the use of non-structural BMP’s to provide for water quality as well as water quantity control in existing urbanized areas. The use of practices that can be incorporated on-site to reduce runoff from urbanized areas is encouraged, such as disconnecting downspouts from the storm drain system and collecting and storing this rain in rainbarrels or cisterns for re-use. Stormwater management should identify pollutants of concern, and BMP’s can be implemented to reduce the runoff that needs to be captured, infiltrated, or treated. Another option is to implement a series of treatment BMP’s to capture and treat polluted runoff.

The basic strategies identified for treating runoff are convey runoff slowly through vegetation, infiltrate into the soil; retain/detain runoff for later release with the detention providing treatment; and treat runoff on a flow-through basis using various treatment technologies.

For the rainfall frequency for Ames, the average annual rainfall for the period 1960-2006 was 31.58 inches, and the mean rainfall depth (P6) is 0.62 inches.

**Recommended Minimum Stormwater Management Requirements**

2A-4 Part B of the manual contains 10 guidelines that are recommended minimum stormwater management requirements for new development or redevelopment sites falling under applicability criteria. As such, the use of these guidelines for master plan level planning and determining stormwater management performance is appropriate for Haber Pasture given the Plan goals and objectives. Key guidelines include:

**Water quality volume (WQv).** The manual states that post-construction runoff should be managed to improve water quality, and that removal of at least 80% of total suspended solids (TSS) is a common goal. This can be quantified and expressed through specifying a water quality volume (WQv) that is treated to the 80% TSS removal goal, and is equal to the site runoff generated from the design rainfall event. It is presumed that a stormwater management system
complies with this guideline if it is sized to capture and treat the 1.25” rainfall depth, which is the rainfall depth recommended for determining the WQv for Iowa.

**Maximized Water Quality Capture Volume (WQCV).** The manual also includes a method for estimating the maximized water quality capture volume (WQCV) for sizing of extended detention storage for water quality improvement. The mean rainfall depth of 0.62 inches is used in estimating the water quality capture volume. This method obtains a first-order estimate of the needed capture volume using simplified (non-computer modeled) procedures that target the most typically occurring population of runoff events. The estimated capture volume includes 20% of additional volume to account for a loss of storage volume from sediment accumulation.

**Stream Channel Protection.** Extended detention of 1 yr/24 hour storm through the use of structural stormwater controls, including the use of velocity control techniques, and establishment and protection of riparian buffers is recommended to protect stream channels. This is intended to reduce the frequency, magnitude, and duration of post-development bank flow conditions. Given that Squaw Creek is an incised channel, stream channel protection contained in the Plan could help meet these channel protection goals.

**Overbank Flood Protection.** Overbank flood protection for downstream channels is provided by controlling the post-development 5-year, 24 hour storm peak discharge rate (Qp5) from exceeding the predevelopment discharge rate using structural stormwater controls. The use of non-structural site design practices that reduce the total amount of runoff (which could be implemented in the Frederiksen Court area) will also reduce Qp5 by a proportional amount. Meeting WQv and Stream Channel Protection guidelines would typically effectively meet this rate control.

**Extreme Flood Protection.** Extreme flood protection is provided by controlling and/or safely conveying the 100 yr/24 hour event (Qf). This is accomplished by either a) controlling Qf through structural stormwater controls to maintain the existing 100-year floodplain, or b) sizing on-site conveyance systems to safely pass Qf and allowing it to discharge into a receiving water whose protected floodplain is sufficiently sized to account for extreme flow increases without causing damage. Haber Pasture is within the floodway and the special hazard flood area of Squaw Creek, and experiences flooding about every three years, and will continue to experience such flooding.

**Infiltration/Groundwater Recharge.** Recharge to groundwater is implemented to the extent practicable through use of nonstructural better site design techniques that allow for recharge of stormwater runoff into soil. Given the low permeability soils, and assumed shallow depth to the seasonal high water table in Haber Pasture, potential for recharge to near surface groundwater is limited to some degree. Recharge to groundwater/soil is appropriate and is recommended by the use of BMP’s that recharge stormwater runoff into soil in the Frederiksen Court area.
SITE ANALYSIS

Haber Road Pasture and Frederiksen Court Area Site History
Existing Conditions and Planned Improvements

*Haber Road Pasture and Squaw Creek*

The Haber Road Pasture study area has been a horse pasture for many decades. It appears that the area has not been cultivated and has probably been used as pasture since at least the 1930’s, as 1939 air photos show the area as pasture with large (> 30” diameter/dbh) trees. Soil samples taken in the pasture show lenses of sands, silts and clay deposits; along with the meandering swales and old oxbow these are indicators of frequent flooding over decades.

*Hydrology and stormwater.* There are two FEMA flood designations mapped on the Haber Road site: Floodway Areas and Special Flood Hazard Area (SFHA), Zone AE. The northeast part of Haber pasture, and most of Brookside Park is shown within the floodway of Squaw Creek. The SFHA covers most of the remaining site area including the adjacent coal pile, nursery and cell tower areas. FEMA dictates general regulations for SFHA and Floodway areas, which is no fill and no encroachment; unless the developer can ensure that increases in water surface elevations will not occur. The City of Ames may enact greater restrictions on allowable actions within these areas and coordinates this on local, state, and federal levels for approval.

A Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood (the 100-year flood). Land within SFHA base flow boundaries requires flood insurance, and development within the SFHA is regulated.

Floodway Areas are the channel of the steam plus any adjacent floodplain areas. These areas must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Encroachments are activities or construction within the floodway including fill, new construction, substantial improvements, and other development. These activities are prohibited within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses that the proposed encroachment would not result in any increase in flood levels.

Squaw Creek has become an incised creek channel. It appears that over the last 15 years the pasture has flooded about 5 times, or about once every 3 years interval. A functioning full back interval is two times in 3 years, less often than this indicates channel incision. The implementation of quantity and rate controls to meet stream channel protection, overbank flooding, and extreme flood protection in the Master Plan could proportionally reduce the effects of current channel incision and the amount of future incision in this reach of the creek.
A City of Ames 36" sanitary sewer runs diagonally under the pasture. The buried depth of the sewer pipe varies from about 4.5 to 7 feet below the surface. Two small sanitary sewers connect to this line from the west. The manholes at the connection points are raised above the surface, possibly to an elevation above the 100 year flood elevation. The manholes are located within the special flood hazard area. Master Plan activities should minimize disturbances over this line, including excavation for stormwater conveyance and collection.

Stormwater runoff from the 65.5 acre Frederiksen Court area west of Haber Road produces substantial amounts of stormwater and related non-point source pollutants on an annual basis. Modeling based on general land use derived parameters indicates that for example, for the 10 year storm event, the average annual runoff is 16 acre feet, with related amounts of non-point pollution such as sediments (total suspended solids or TSS), heavy metals, etc being generated and transported from Frederiksen to the Pasture and directly to Squaw Creek by the runoff. The gross volume runoff rate (non-metered or not restricted by storm sewer pipes and outlets) is about 189 cubic feet per second, a rate which would fill a typical backyard swimming pool in about 10 seconds. See the map and tables as follows.
### Annual Pollutant Loads, Runoff Rates, and Runoff Volumes - Frederiksen Court Area, ISU Modeled based on an assumed high percentage (approx 82%) of impervious surface*. Dec 2008.

<table>
<thead>
<tr>
<th>Subwatershed</th>
<th>Sub2</th>
<th>Sub3</th>
<th>Sub4</th>
<th>Sub5</th>
<th>Sub6</th>
<th>Total Sub 2-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Area c)</td>
<td>0.26</td>
<td>2.2</td>
<td>1.6</td>
<td>3.9</td>
<td>57.5</td>
<td>65.5</td>
</tr>
<tr>
<td>Curve Number</td>
<td>98</td>
<td>92</td>
<td>92</td>
<td>63</td>
<td>92</td>
<td>NA</td>
</tr>
</tbody>
</table>

| Sediment TSS (lb/yr) | 203.6 | 1,469.4 | 1,068.7 | 208.7 | 38,404.9 | **41,355 (20 tons)** |
| Phosphorus TP (lb/yr) | 0.7 | 4.9 | 3.6 | 0.8 | 127.9 | **138** |
| Nitrogen TKN (lb/yr) | 3.1 | 22.3 | 16.2 | 3.7 | 583.2 | **629 (1/3rd ton)** |
| Copper CU (lb/yr) | 0.1 | 0.7 | 0.5 | 0.1 | 18.4 | **20** |
| Lead PB (lb/yr) | 0 | 0.3 | 0.2 | 0 | 7.7 | **8** |
| Zinc ZN (lb/yr) | 1.5 | 11.1 | 8.1 | 2.1 | 290.2 | **313** |
| Hydrocarbons HC (lb/yr) | 5.1 | 36.8 | 26.8 | 5.4 | 963.1 | **1,037 (1/2 ton)** |

| Volume (af/yr) | 24 hr rainfall depth | 0.8 | 5.5 | 4.0 | 1.1 | 145.0 | **156** |
| 2-yr (cfs) | 2.91" | 1 | 3.7 | 4.1 | 0.9 | 107.8 | **118** |
| 2-yr (af) | 0.054 | 0.35 | 0.26 | 0.11 | 9.2 | **10** |
| 10-yr (cfs) | 4.27" | 1.4 | 5.9 | 6.5 | 3.2 | 172.2 | **189** |
| 10-yr (af) | 0.08 | 0.58 | 0.42 | 0.31 | 15.1 | **16** |
| 50-yr (cfs) | 5.87" | 2 | 8.4 | 9.2 | 6.9 | 247.3 | **274** |
| 50-yr (af) | 0.11 | 0.84 | 0.62 | 0.61 | 22.1 | **24** |
| 100-yr (cfs) | 6.61" | 2.3 | 9.6 | 10.5 | 8.8 | 281.8 | **313** |
| 100-yr (af) | 0.13 | 0.97 | 0.71 | 0.77 | 25.3 | **28** |

*Final Master Plan modeling, February 2009, assumes a lower (62%) overall percentage of impervious surface.

The 60" storm sewer running along the north edge of the pasture conveys most of the Frederiksen Court area runoff and related pollutants. Based on a 10 year storm event, the 60" pipe’s full flowing volume is estimated at about 225 cubic feet per second, or a rate which could fill one acre one foot deep in a little over 3 minutes. This pipe could be daylighted (or runoff brought to the surface) at a couple of points in the pasture, preventing runoff and pollutants from directly discharging into Squaw Creek. Runoff could be outlet into the oxbows and meanders and a treatment train system of non-structural and structural BMP’s used to improve the runoff quality, reduce the runoff quantity through extended detention and evapo-transpiration, and reduce the rate of runoff to appropriate stream channel and overbank flood protection rates. The extreme flood (100 yr flood event or Qf) could be conveyed to the extent possible to safely pass the Qf and allowing it to safely discharge into Squaw Creek before the pasture is flooded and as Squaw Creek waters rise and the pasture becomes flooded.
### Frederiksen Court Area Estimated Runoff Volumes and Estimated Sizing Options

<table>
<thead>
<tr>
<th>CRITERIA / EVENT</th>
<th>Rainfall depth</th>
<th>% impervious and size in acres</th>
<th>Runoff produced</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water Quality Volume</strong> WQv</td>
<td>1.25” rainfall depth</td>
<td>60% ave impervious area, 65.5 acres</td>
<td>4.2 acre feet</td>
<td>Not oversized for sediment storage</td>
</tr>
<tr>
<td><strong>Water Quality Capture Volume</strong> WQCV</td>
<td>0.62” mean rainfall depth</td>
<td>60% ave impervious area, 65.5 acres</td>
<td>2.2 acre feet</td>
<td>Oversized 20% for sediment storage</td>
</tr>
<tr>
<td><strong>Stream Channel Protection Volume</strong> 1 yr/24 hr event</td>
<td>2.38” rainfall depth</td>
<td>60% ave impervious area, 65.5 acres</td>
<td>7.8 acre feet</td>
<td>Would usually provide Overbank Flow Protection Rate Control</td>
</tr>
<tr>
<td><strong>10 year / 24 hour event</strong></td>
<td>4.27” rainfall depth</td>
<td>60% ave impervious area, 65.5 acres</td>
<td>16 acre feet</td>
<td></td>
</tr>
</tbody>
</table>

WQv and WQCV methodologies use different base data, assumptions, and modeling methods.

*Overbank Flood Protection consisted of a combination of Stream Channel Protection detention, and control of 25 year peak discharge rate.

The oxbows and meanders in the pasture provide suitable locations for creating a treatment train of stormwater management BMP’s to control the quantity and rate of stormwater from Frederiksen Court area west of Haber Road. The existing system of oxbows and meanders, with slight modifications for creating defined extended detention basins and/or treatment wetlands, can capture and treat the Water Quality Volume (WQv), the maximized Water Quality Capture Volume, and the Stream Channel Protection Volume. Detaining the entire 16 acre feet (produced from a 10 year, 24 hour event) would require major grading to create basins and wetlands if this event was only managed in Haber Pasture with zero runoff – an extreme scenario.

**Soils.** There are six soil types in the pasture; proceeding from southwest to northeast in bands across the pasture they are: Biscay clay loam, and Clarion loam; Coland clay loam; Spillville-Coland complex and Spillville loam, and Hanlon-Spillville complex. See the soils map and table as follows.
108B Wadena loam, 2 to 5 percent slopes, >78" depth to water table

135 Coland clay loam, 0 to 2 percent slopes, 0" depth to water table

259 Biscay clay loam, 0 to 2 percent slopes, 0" depth to water table

108B Wadena loam, 2 to 5 percent slopes, >78" depth to water table

1314 Hanlon-Spillville complex, channeled, 0-2 percent slopes, 12" depth to water table

138C Clarion loam, 5-9 percent slopes, 48" depth to water table

485 Spillville loam, 0-2 percent slopes, 48" depth to water table

1585 Spillville-Coland complex, channeled, 0-2 percent slopes, 12" depth to water table
<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Slopes</th>
<th>Depth to Water Table</th>
<th>Drainage</th>
<th>Erosion</th>
<th>Flood Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biscay clay loam 259</td>
<td>0-2%</td>
<td>0”</td>
<td>Poor-Very Poor</td>
<td>Moderate</td>
<td>Rarely to frequently</td>
</tr>
<tr>
<td>Clarion loam</td>
<td>1-9%</td>
<td>48”</td>
<td>Moderately Well</td>
<td>Moderate</td>
<td>Rarely to frequently</td>
</tr>
<tr>
<td>Coland clay loam 135</td>
<td>0-2%</td>
<td>0”</td>
<td>Poor</td>
<td>Moderate</td>
<td>Frequent</td>
</tr>
<tr>
<td>Spillville (see 1585)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spillville-Coland complex 1585</td>
<td>0-2%</td>
<td>12”</td>
<td>Moderate-Poor</td>
<td>Moderate</td>
<td>Frequent - channeled</td>
</tr>
<tr>
<td>Hanlon-Spillville complex 1314</td>
<td>0-2”</td>
<td>48”</td>
<td>Moderately Well to Somewhat Poor</td>
<td>Moderate</td>
<td>Frequent - channeled</td>
</tr>
</tbody>
</table>

Except for the small area of Clarion soils, the soils on the west part of the site (Biscay and Coland) are located on 2 to 5% slopes, are poorly drained, have moderate erosion potential, and have shallow depths to the water table. The southwest entrance to the pasture is composed of Biscay clay loam soils, with poor to very poor drainage and moderate erosion potential. This soil type is frequently saturated at the soil surface during the wettest periods of normal years and this saturation is considered apparent. The soil in this location has been disturbed and compacted by horses and is eroding. Runoff from southwest of Haber Road is discharged by two stormwater pipes at this location, aiding erosion and transporting eroded soils into the pasture towards the low linear meander down slope on Coland soils.

There is a low linear meander area in the east-central part of the pasture where water tends to pond on the Coland clay loam soils, which are characterized by poor permeability. These soils are frequently saturated between the soil surface and a depth of 1 foot below the surface during the wettest portions of years. Because of the poor drainage and high water table/depth to saturated soils, stormwater management on this soil should take into account saturated soils and restrictions for infiltration.

The area immediately north of the coal pile, and the coal pile itself, is located on Spillville soils. The soil is somewhat poorly drained, has a frequently saturated zone at a depth of 1 foot during the wettest periods. Surface runoff potential is low, and the soils are frequently flooded for brief to long durations from rainfall and snowmelt. Any detention and treatment of coal pile leachate should avoid or minimize infiltration due to the shallow depth to saturated soils.

Soils of the Spillville-Coland complex, located in the north and northwest parts of the pasture, are dissected by meandering stream channels. Coland soils are in the slightly lower landscape positions, and are frequently saturated at the surface of the soil during the wettest periods of normal years. Because of the moderate to poor permeability and high water table/depth to saturated soils of about 1 foot,
Stormwater management in these areas should take into account saturated soils and restrictions for infiltration. Detention and/or stormwater wetlands would be appropriate on these soils.

Hanlon-Spillville complex soils are located in the floodplain at the northwest corner of Brookside Park, and south of 13th Street at the northeast part of the pasture. The soils are moderately well to somewhat poorly drained and are dissected by meandering stream channels. A frequently saturated zone occurs within depths of 1 to 6 feet during wettest periods, especially April to June in normal years. Flooding occurs occasionally for very brief periods during the months of February to November from precipitation events and snowmelt.

Vegetation. Haber Pasture largely consists of introduced cool-season pasture grasses, and a savanna like area in the northeast with large mature trees. Burdock and other weeds have invaded the grasses. Some smaller volunteer trees are growing under or near the large mature trees. Large trees consist of Silver Maple, Burr Oak, Box Elder, Sycamore, and possibly Green Ash (ISU report, 2003). Overall most trees appear to be healthy, however, a few of the trees have lost the upper parts of the main trunk or have dieback of major branching. Plans for stormwater management should avoid or minimize impacts to these large healthy mature trees and their roots.

A treeline of Box Elder, Mulberry, and Linden is located along the southeast boundary of the site. The woodland in Brookside Park contains Burr Oak, Hackberry, Ash, Black Walnut, Red Oak, Mulberry, and some Buckthorn and Honeysuckle. The understory contains stinging nettle (ISU report, 2003). Plans for routing stormwater management features through the woods should avoid or minimize impacts to large healthy trees and their roots while selectively clearing as needed to create features such as detention basins and wetlands, grassy swales, etc. Routing of stormwater features into the woods does provide the opportunity to create and restore woods edge ground-level and mid-story habitat with native species, which will increase the diversity of species and wildlife habitat.

Circulation and Parking. Existing Haber Road (a 2 lane road) forms the west edge of the study area, with 13th Street (a four lane road) crossing over Squaw Creek on the north edge. A bicycle/pedestrian path is located on the south side of 13th Street. To the east in Brookside Park are internal park roads and parking lots. A bicycle/pedestrian path runs along the south side of the park, going west into and through the nursery and Fire Service firefighting practice area before crossing Haber Road just north of the old clay block building at the northwest corner of the firefighting practice area. The path crossing at Haber Road is staggered, with the path continuing on the west side of Haber about 100’ to the north, creating unsafe conditions and potential traffic conflicts.

Coal trucks access the coal pile along the north edge of the practice area from Haber Road, crossing the bike/pedestrian path. This creates coal truck and bike/pedestrian conflicts. Informal general use parking does seem to occur near the old clay block building in the northwest corner of the practice area. To the south of the nursery and practice area are elevated railroad tracks. Haber Road narrows to one lane under the tracks and is signalized to control traffic (auto, bicycle, pedestrian) to alternating one-way flow under the tracks. This barrier creates conflicts and safety concerns, and reduces the level of service for autos, trucks, bikes and pedestrians.
The City of Ames has identified two possible options for upgrading Haber Road to four lanes and building a new railroad bridge at Haber Road. The preferred option, Option 4b, creates a new “T” intersection just north of the railroad tracks.

The bicycle/pedestrian path system should be improved to provide a path along Haber Road from 13th Street to University Avenue under the railroad tracks. The Haber Road path crossing should be reconfigured to align the crossing, regrade the path on the west side of Haber to acceptable grades, and improve crossing signage. The path/coal truck crossing location should be further evaluated to make sure that proper sight distances and clearances are provided, and measures taken to minimize the amount of coal residue deposited on the path. Alternative locations for bicycle and pedestrian paths should also be examined, such as creating a path that enters the pasture from Brookside Park at the northeast corner of the coal pile and proceeds to the west to the Frederiksen Court area.

There is a bicycle/pedestrian path in Brookside Park along the south side of Squaw Creek that crosses the creek downstream of 13th Street. This path could be extended along the south side of the creek through Haber Pasture and under 13th Street to the mini-disc golf area and beyond. A connecting path could be added along the north side of the pasture to connect Haber Road/13th St to this extended path.

Paved or non-paved walkways could also be created within the new stormwater park to connect and experience stormwater park features and provide access to and through the pasture.

*High Voltage/High Tension Power Lines.* The City of Ames and ISU are erecting high voltage/high tension power lines in 2009 along the west edge of Haber Pasture, and the south side of the firefighting practice area and nursery. The power line easement will be 100’ wide, and may restrict the ability to create vertical features, including vegetation/trees, of any appreciable height, and other actions, within the easement.

*Education and Interpretation.* The pasture is currently not used for education and interpretation. With the relocation of horses from the pasture, and the creation of a stormwater management park, an opportunity is created to develop education and interpretation elements to meet the project goals and objectives.

*Cultural/Historical.* The pasture and its horses are recognized and cherished cultural and historic features of this part of the ISU Campus and the City of Ames. The new stormwater park should preserve and incorporate design elements that highlight its significant past use as a horse pasture and significant pasture features such as the white post fences, red gates, pasture fences, the watering spigot, and other key elements. Key views into and within the pasture should be identified, integrated and connected with education and interpretive features and paths and walkways.

*Maintenance.* New stormwater management BMP’s such as detention basins and/or stormwater treatment wetlands, and structural elements such as pipes, pipe risers, outlets and control weirs will require regular inspection and maintenance depending on the BMP, including sediment removal and reuse about every 3 to 5 years. Re-vegetated areas will also require maintenance during and after establishment. Standard maintenance practices typically needed for prairie and woodland restoration should suffice, however, if maintenance personnel are not familiar and experienced with these practices.
the university may need to address this by training staff and/or obtaining maintenance services such as controlled burning from qualified specialists.

Another possible approach is to hire seasonal/student workers from departments such as Horticulture, Landscape Design and Landscape Architecture, Restoration Ecology, and Conservation Biology. These students would be assigned primarily to Haber Pasture Stormwater Park.

Some of the large mature trees have dieback of the main trunk or lateral branching. These trees should be monitored with trimming or felling of hazard trees done as appropriate. Leaving declining or dead trees in-place is desired and is appropriate for diversity of habitat, particularly for keystone species such as woodpeckers.

Stormwater management BMP’s, vegetation, and site elements should be designed to withstand flooding with little to no impacts. If flooding is imminent, for some of the stormwater BMP’s pre-flooding preventative action may need to be taken, such as opening/closing of flow-control valves. This will depend on the types of BMP selected and constructed.

During and after flooding, the study area should be inspected and appropriate maintenance actions taken.

**Frederiksen Court Area, including ISU Firemanship Training Building, and Transportation Services**

*Soils, hydrology and stormwater.* Soils in Frederiksen Court and the surrounding area mostly have good to moderate permeability in the upper elevations, and depths to water table from 48” to greater than 78”. These soils are rarely flooded. This makes the soils suitable for retrofitting bioretention and infiltration BMP’s in all but the lower elevations of the site. Existing fuel pumps, tanks, and trash receptacles should be addressed as the design for Haber Road Pasture proceeds.

<table>
<thead>
<tr>
<th>Frederiksen Court Area Soils</th>
<th>(Source: Story County Soil Survey)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Type</td>
<td>Slopes</td>
</tr>
<tr>
<td>Wadena loam 108B</td>
<td>2-5%</td>
</tr>
<tr>
<td>Biscay clay loam 259</td>
<td>0-2%</td>
</tr>
<tr>
<td>Clarion loam</td>
<td>1-9%</td>
</tr>
</tbody>
</table>
HABER PASTURE ALTERNATIVE CONCEPT PLANS

Three concept plans for managing stormwater and meeting the goals and objectives of the Master Plan have been developed. The concepts are similar in their planning for vegetation and ecological restoration, education and interpretation, circulation and parking, security, and operations and maintenance. The key differences are in the size and shape of basins created for managing stormwater runoff.

All concepts.

Vegetation and Restoration. The study area would be revegetated with native grasses and forbs, and shrubs and trees indigenous to the area, suited to the soil type and soil saturation characteristics, and their function in the stormwater treatment system. Hydric vegetation in detention basins and treatment wetlands and grassed swales should be tolerant of saturated soils and short to medium duration ponding, and have high evapo-transpiration rates. Vegetation found in drier xeric or more upland areas is best suited to dryer soils and droughty conditions.

Stormwater features in the savanna area of the site are designed to avoid or minimize impacts to the large healthy mature trees roots. Site features routed through the Brookside Park woodland should minimize impacts to large healthy trees and their roots while selective clearing is needed to create features such as detention basins and wetlands. Routing of stormwater features into the woods provides the opportunity to create and restore ground-level and mid-story habitat with native species. This will increase the diversity of species and wildlife habitat.

Education and Interpretation. Possible locations of primary education features and/or outdoor classrooms are:

- near Squaw Creek where the stormwater system would discharge to the creek
- where the 60” storm sewer is daylighted
- at an overlook where Frederiksen Court intersects Haber Road
- between primary and secondary detention basins/stormwater wetlands

Other locations for primary and secondary features such as education and interpretation kiosks and signage include: the existing clay block building, the coal pile leachate discharge area and its detention basin/wetland, and where walking paths and bridges run along or cross over detention basins/stormwater wetlands and grassed swales. These features provide an opportunity for Iowa State students to take part in the design of the public education programs and facilities.

Circulation and Parking. A bicycle/pedestrian path system would be located along Haber Road from 13th Street to University Avenue under the railroad tracks. The existing path crossing Haber Road should be reconfigured to align the crossing. The path on the west side of Haber should be regraded to acceptable grades and crossing signage should be improved. An alternative location for this path, entering the pasture from Brookside Park at the northeast corner of the coal pile and proceeding to the west to the Frederiksen Court area could be implemented.

The Brookside Park path along the south side of Squaw Creek should be extended along the creek and under 13th Street to the mini-disc golf area and beyond. A connecting path should be added along the north side of the pasture.
Additional paved or non-paved walkways can be created within the new stormwater park to connect to and allow the experience of stormwater park features and provide access to and through the pasture.

**Security.** Security should be addressed by additional lights and emergency alert stations along paths, walkways, and at education and interpretation locations. Closing the park after 10:00 pm could also help.

**Operations and Maintenance.** Revegetation to native grasses, forbs, shrubs and trees in the pasture and in Brookside Park requires establishment maintenance for 3 to 5 years after planting. This includes some reseeding and replanting of failed areas, mowing, controlled burning, and/or chemical spot control of weeds. Following establishment, vegetation will require mowing once a year to control weeds or the use of controlled burning every two to three years. Occasional spot spraying or pulling to control weeds and invasive species may also be needed.

**Concepts 1 through 3.**
The existing system of oxbows and meanders in Haber Pasture could detain and treat about 9 acre feet of runoff. Each concept is based on managing runoff produced from a 10 year / 24 hour storm event of approximately 16 acre feet. The concepts assume a high percentage of impervious surface (82%) in the Frederiksen Court area, and vary based on the amount of storage and/or reuse of stormwater in the Frederiksen and the resulting volumes conveyed to Haber Pasture. The concepts are intended to help guide ISU staff and decision makers in determining the appropriate level of stormwater management in Haber Pasture, from 1) doing almost nothing, to 2) some modifications while accommodating the WQv, WQCV, Stream Channel Protection volumes and providing rate control, and 3) making major changes, and detaining all 16 acre feet of runoff.

Storage and reuse of stormwater in Frederiksen can be accomplished using a suite of best management practices (BMP’s), including cisterns; see the appendix for a suite of applicable BMP “recipe cards”. All of the concepts daylight the 60” storm sewer pipe and route daylighted runoff into a treatment train of detention basins, stormwater wetlands and grassed swales to improve water quality, thereby reducing the amount and rate of runoff. Runoff conveyed under Haber Road from the west via the smaller stormwater pipes would sheet flow into the treatment train system.

A separate detention basin and wastewater treatment wetland should be constructed for capture and treatment of coal pile leachate, with no mixing of stormwater and leachate.

**Concept 1: Haber Oxbow and Meanders and Frederiksen Store and Re-use BMP’s**
This concept is based on 7.6 acre feet being stored and reused in Frederiksen Court, with the remaining 9 acre feet being discharged into Haber Pasture. Primary and secondary detention basins/stormwater wetlands are created to provide extended detention, using minor grading to modify the existing oxbows and meanders. This concept would accommodate the WQv, WQCV, the Stream Channel Protection volume and rate control in Haber Pasture with minimal modifications.
CONCEPT 1 - Haber Oxbow and Meanders and Frederiksen Court Store and Re-use BMPs

New Haber Road, greened roadway slopes with stormwater "level spreaders" or similar

Pretreatment Flume Pool - Daylight 60" pipe

Primary Detention Basin - 2.4 ac-ft

Secondary Discharge to Squaw Creek

Primary Discharge to Squaw Creek

Sheet Flow from #4

10 yr: 0.42 acre ft

10 yr: 0.08 acre ft

#3

#2

Sheet Flow from #2 & #3

Secondary Detention Basin - 2.0 ac-ft

Repair erosion at manholes

* Maintain existing flow through woods

Dams to separate coal pile discharge

Treatment Wetland separate for coal pile

Regrade to keep runoff in Haber Pasture

Realign trails to meet at road crossing. Regrade to reduce trail steepness.

New trail along Haber Road

New access to coal pile

Parallel parking along Haber Road

Parking Lot option

New trail under 13th Street and continues along Creek

Extension of trail along Creek

Coal pile discharge

#6

Concept 1

Frederiksen Court

• 7.6 acre-feet (10 year event)
• BMP’s for 1/2" and 3/4" events
• Repair erosion at inlets and outlets
• Subterranean rooftop collected and infiltrated using BMP’s and cisterns

Haber Pasture

• 8.2 acre-feet (10 year event)
• Keep healthy trees wherever possible
• Daylight 60" pipe at NE corner of pasture
• Extended detention of runoff in modified existing oxbows and meanders
• Retain existing topography with minor earthwork modifications
• Little to moderate use of Brookside Park

Haber Pasture

• 9.0 acre-feet (10 year event)
• Keep healthy trees where possible
• Daylight 60" pipe at NW corner of pasture
• Extended detention of runoff in modified existing oxbows and meanders
• Retain existing topography with minor earthwork modifications
• Little to moderate use of Brookside Park

ISU Haber Road
Stormwater Demonstration Park Master Plan
CONCEPT 1

Prepared for:
Iowa State University
Facilities Planning and Management
Planning Services
200 General Services Building
Ames, Iowa 50011-4012
Concept 2: Haber Modified Oxbow and Meanders and Frederiksen Bioretention BMP’s
This concept is based on 5.6 acre feet being stored and reused in Frederiksen Court, with the remaining 11 acre feet being discharged into Haber Pasture. Primary and secondary detention basins/stormwater wetlands are created to provide extended detention, using minor to moderate grading to modify the existing oxbows and meanders, including the shallow linear depression in the south central part of the study area in this system. This concept creates additional storage beyond Concept 1, and would accommodate the WQv, WQCV, the Stream Channel Protection volume and rate control in Haber Pasture with minimal to moderate modifications.
CONCEPT 2 - Haber Modified Oxbow and Meanders and Frederiksen Court Bioretention BMPs

- 5.6 acre-feet (10 year event)
- BMPs for 1/4" and 1/2" events
- Subwatershed 46 runoff collected and infiltrated using BMPs

**Haber Pasture**
- 15.0 acre-feet (10 year event)
- Keep healthy trees where possible
- Daylight 60" pipe at NW corner of pasture
- Extended detention of runoff in modified existing oxbows and meanders
- Repurpose existing topography for more storage with minor earthwork modifications
- Minimal use of Brookside Park

- 0.42 acre ft
- 0.08 acre ft
- 10 yr: 0.31 acre ft
- 10 yr: 0.08 acre ft

**Cambridge Subwatershed**
- 5.6 acre-feet (10 year event)
- BMP’s for 1/4" and 1/2" events
- Subwatershed #6 runoff collected and infiltrated using BMP’s

- 11.0 acre-feet (10 year event)
- Keep healthy trees where possible
- Daylight 60" pipe at NW corner of pasture
- Extended detention of runoff in modified existing oxbows and meanders
- Repurpose existing topography for more storage with minor earthwork modifications
- Minimal use of Brookside Park

**Proposed Trails**
- Primary education/outdoor teaching opportunities
- Secondary education/outdoor teaching opportunities

**Proposed Walkways**
- 10-20 ft
- Maintain existing flow through woods

**Roadway**
- Parallel parking along Haber Road
- Parking Lot option

**Parking Lot option**
- New parking along 13th Street
- Existing parking along 13th Street

**Coal Pile**
- Parking Lot option
- New access to coal pile

**New trail along Haber Road**
- New trail under 13th Street and continues along Creek

**Extension of trail along Creek**
- Coal pile discharge

**Approximate Site Boundary**
- Existing Utilities
- Existing Trail
- Proposed Trail
- Approximate Property Line

**ISU Haber Road Stormwater Master Plan Concept 2**

Prepared by:

Iowa State University Haber Road Pasture
Stormwater Demonstration Park Master Plan
April 20, 2009
**Concept 3: Haber “Creek Bend” Reshaping**

This concept is based on no storage and reuse in Frederiksen Court, with the entire 16 acre feet being discharged into Haber Pasture. This concept creates a distinctive combination of landform and bowed detention basins that reflect the southwest arcing bend of Squaw Creek and arcs that reflect the opposite movement of Frederiksen Court area water from the southwest to northeast. The daylighted 60" pipe would convey its runoff into a primary wet detention basin, which could be connected hydrologically to secondary basins as water moves through the bows towards the creek. Runoff from pipes in the Federiksen area would be changed in its routing to convey runoff into the arced basins nearer Haber Road. This concept creates a large amount of additional storage beyond Concept 1, and would accommodate the WQv, WQCV, the Stream Channel Protection volume and rate control of the entire 16 acre feet from a 10 year / 24 hour event in Haber Pasture with major modifications.
Concept 3 - Haber “Creek Bend” Reshaping

- Fredricksen Court
- 0.0 acre-feet

Haber Pasture
- 16.6 acre-feet (10 year event)
- Keep healthy trees where possible
- Daylight 60” pipe at NW corner of pasture
- Oxbows & ponds merged “Creek Band” detention area
- Major earthwork, topography totally reshaped

Concept 3

Frederiksen Court
• 0.0 acre-feet
Haber Pasture
• 16.6 acre-feet (10 year event)
• Keep healthy trees where possible
• Daylight 60” pipe at NW corner of pasture
• Oxbows & ponds merged “Creek Band” detention area
• Major earthwork, topography totally reshaped

Detention Area
16.0 ac-ft

Secondary Discharges to Squaw Creek and emergency overflow
Sheet Flow from #4
10 yr: 0.42 acre ft

Primary Discharge
Separate detention for coal pile
Regrade to keep runoff in Haber Pasture

New trail under 13th Street and continues along Creek

Proposed Walkways

Primary education/outdoor teaching opportunities
Secondary education/outdoor teaching opportunities

Proposed Trails

10 yr: 0.31 ac-ft
Volume in acre-feet

Vertical Site Elements

Approximate roadway, sidewalks, utilities, trails, landscape, trees, native vegetation

Approximate Site Boundary

Prepared by:
Kestrel Design Group

Iowa State University Haber Road Pasture
Stormwater Demonstration Park Master Plan
April 20, 2009
27
FINAL HABER ROAD PASTURE
STORMWATER DEMONSTRATION PARK MASTER PLAN

“A Place To Celebrate and Investigate Stormwater” on the ISU Campus

Based on feedback at the December 15, 2008 Charette, a revised version of Concept 2 has been developed as the Final Master Plan (see the December 15, 2008 meeting notes in the appendix for more related information).

The Master Plan guides the development of a stormwater demonstration park, which creates a place to celebrate and investigate stormwater on the ISU campus. The planned stormwater demonstration park manages stormwater from Frederiksen Court, restores native vegetation and increases ecological and habitat diversity, provides bicycle and pedestrian circulation and facilities, identifies locations for additional parking for pasture and recreational users, guides education and interpretation features including outdoor classrooms, identifies elements of a secure site, identifies low-input maintenance goals and practices, estimates costs to implement the plan, and identifies potential funding sources for plan implementation.

MASTER PLAN ELEMENTS

The Final Master Plan is based on Concept 2: Haber Modified Oxbow and Meanders and Frederiksen Bioretention BMP’s. Concept 2 assumed that some runoff would be stored and reused in Frederiksen Court, with remaining runoff being discharged into Haber Pasture. Primary and secondary detention basins/stormwater wetlands would provide extended detention, using minor to moderate grading to modify the existing oxbows and meanders, possibly including the shallow linear depression in the south central part of the study area.

In the Final Master Plan, storage and reuse of stormwater in Frederiksen Court area will be accomplished using a suite of BMP’s including cisterns. The Final Plan assumes that approximately 1.3 acre feet of runoff will be retained and managed in Frederiksen Court for the 5 year/24 hour storm event. Excess runoff from Frederiksen Court is directed to a wet pond/wetland system, as is drainage from areas 2 and 3 (See Frederiksen Court Subwatersheds Map, page 13). Estimated runoff managed in Haber Pasture is about 7.6 acre feet for this storm event.
A Place to Celebrate and Investigate Stormwater on the ISU Campus

- BMP's for 1/2" events, detain approximately 1.3 acre-feet
- Collect and infiltrate runoff

Haber Pasture
- 6.5 acre-feet (5 year event) live storage
- Keep healthy trees where possible
- Daylight 60" pipe at NW corner of pasture
- Extended detention of runoff in modified oxbows and meanders
- Reshape existing topography for more storage
- Minimal use of Brookside Park

- Minimal use of Brookside Park
- Existing stormwater outlet onto site

- Interpretive signage
- Directional signage

- Vertical artwork
- Based on water
- Kinetic artwork, sanitary sewer flow feature

- Steel grate bridge with red gate railing
- Monitoring/research dock

- White fence posts with bluebird boxes
- Red gate

- Pasture overseeded with native grasses and forbs
- Vertical artwork
- Based on water
- Kinetic artwork, sanitary sewer flow feature

- Steel grate bridge with red gate railing
- Monitoring/research dock

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- Pasture overseeded with native grasses and forbs
- Vertical artwork
- Based on water
- Kinetic artwork, sanitary sewer flow feature

- Steel grate bridge with red gate railing
- Monitoring/research dock

- White fence posts with bluebird boxes
- Red gate

- Pasture overseeded with native grasses and forbs
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- Monitoring/research dock
STORMWATER MANAGEMENT

Master Plan Stormwater Management Criteria and Approach

Pond/wetland treatment train system.

The stormwater system for the Master Plan in Haber Pasture consists of a pond/wetland treatment train system with two separate basins: a wet pond, and a shallower wet extended detention wetland. Runoff from drainage areas 4, 5, and 6, in the 60” storm sewer from the Frederiksen Court area is directed into the first basin, a wet pond, and then into the wet extended detention wetland. Runoff from drainage areas 2 and 3 is piped under Haber Road and then runs via overland flow into the wet extended detention wetland.

The two basin treatment train system will improve water quality, and reduce the quantity of discharge into Squaw Creek, as well as reduce the peak discharge rate. The wet pond traps sediments and reduces runoff velocities prior to entry into the extended detention wetland, where stormwater receives additional treatment. Pollutants are removed from stormwater runoff in the wet pond, and in the wetland, through uptake by vegetation and algae, vegetative filtering, and through gravitational settling of suspended sediments.

The existing 60” storm sewer pipe will be daylighted near Haber Road, with an outlet and apron added directing water into the first basin, a wet pond. Options include 1) remove a few pipe sections and add outlet/apron, plugging and leaving the remaining 60” pipe in place with a manhole added to capture overflow from storms greater than the 25 year event, or 2) remove the 60” pipe from the disconnection point to its current outlet, and reuse the outlet/apron at its new location. For the Master Plan we have assumed Option 1.

Separate coal pile leachate discharge.

A separate detention basin or wastewater treatment wetland will be constructed to capture and treat coal pile leachate discharge. This will be separated from the extended detention wetland by an earth berm that supports a bicycle/pedestrian trail. Coal pile discharge will be routed separately to the east towards Squaw Creek.

Stormwater Management Criteria addressed and assumed in the Final Master Plan:

1. Water Quality Volume (WQv); the treatment train system is designed to capture and treat the Water Quality Volume, based on a 1.25” rainfall depth.

2. Channel Protection (Cpv); based on a 1 year/24 hour event rainfall depth of 2.38”. The storage volume above the permanent pool/water surface level is used to provide control of the channel protection volume (Cpv). This is accomplished by releasing the 1-year, 24-hour storm runoff volume over 24 hours (extended detention). Vertical water level fluctuations are kept to a minimum to reduce fluctuation stress on vegetation. The total storage volume needed to manage the Channel Protection Volume (Cpv) includes the Water Quality Volume (WQv).

3. Overbank Flood Protection; is achieved by controlling the post-development 5 year / 24 hour storm peak discharge rate (Qp5) from exceeding the predevelopment discharge rate. Flows greater than the 25 year / 24 hour event will be directed to the creek via the concrete riser, and greater flows including the 100 year event will bypass the system via an emergency spillway as necessary. The rate and velocity control of discharge to Squaw Creek is controlled at the primary outlet location by the use of sized outlet pipes and a concrete riser.
4. *Groundwater Recharge*: while it is desired to estimate the recharge of stormwater runoff into the soil, this was not been done for the Final Master Plan. ISU will drill borings and add piezometers to some of the holes in 2009. We recommend recharge volume be determined as necessary in the future using data from the borings and piezometers.

The need for development of cross sections and hydraulic profiles to help determine backwatering and possible loss of storage volume has been discussed, but is not included as part of this Plan.

**Frederiksen Court Area (west of Haber Road) assumptions and criteria:**
1. Retains and manages on-site the first ½” in 24 hours of rainfall using a variety of BMP’s such as raingardens, infiltration basins, permeable paving, cisterns, greenroofs, greenwalls, and tree bioretention (Silva Cells) in parking lots. See the Recipe Cards in the Appendix.
2. Retains and manages on-site approximately 2 acre feet of runoff for the 2 year/24 hour event. This will reduce the amount of runoff needed to be managed in Haber Pasture.
3. Water quality will be improved on-site in the Frederiksen Court area. See the modeling results in this section.
4. BMP’s will become part of a stormwater demonstration and education program for Frederiksen Court residents, and include education elements for ISU staff training and outdoor teaching lab opportunities.

**Haber Road Pasture Stormwater Demonstration Park assumptions and criteria:**
*Haber Pasture, as a stormwater demonstration park, will be used to manage runoff to meet the WQv and Cpv criteria, and in doing so will:*
- Manages excess runoff from the Frederiksen Court area subwatershed 6, and runoff from subwatersheds 4 and 5
- Manages runoff from subwatersheds 2 and 3, and from Haber Pasture itself
- Runoff from Frederiksen via the 60” storm sewer will be directed into the first basin, a wet pond
- Runoff from Haber Pasture itself will surface flow into the extended detention wetland before discharge into Squaw Creek
- The seasonally high water table is assumed to be at an elevation 890 to 891 (1’ below existing ground surface in the old oxbow meanders of 891 to 892 [above sea level])
- The estimated 5 year event storage needed to meet peak discharge rate control is about 11 acre feet
- Permanent pools will be sized and shaped to minimize use by nuisance waterfowl such as Canada geese
- Runoff water quality will improve and the volume of runoff conveyed to Squaw Creek reduced (see the modeling results in this section)

Specific components of the stormwater system include:

**60” Storm Sewer Structure and Outlet**
- A section of the 60” storm sewer pipe will be removed, and an outlet inserted to route stormwater into the first basin / wet pond
- Outlet elevation to the first wet basin is approximately 890.25, this is a controlling elevation for the entire system (based on the inlet elevation of 891)

**First Basin / Wet Pond**
- Permanent pool/normal water level is approximately 892.0
- The pond will be excavated at its deepest point to an elevation of about 888 (about 3-4 feet below the assumed seasonally high water table)
- Basins will be slightly oversized (10%) to factor in the fluctuations in permanent pool elevations and potential groundwater recharge/surcharge, and some sediment storage

See the Haber Road Pasture Stormwater Demonstration Park Profile Schematic as follows.

**Permanent Pool Volume**
- 4.3 acre-feet

**Live Pool Volume**
- 11 acre-feet to 894
- 7.4 acre-feet to 895
Secondary Basin / Wet Extended Detention Wetland:
- Permanent pools are mostly of a low to high marsh depth, and about 20% at a 3 to 4 foot depth below the seasonal high water table

Connectivity between Basins
- An art piece using limestone rock and blocks would be inserted in the earth saddle between the first and second basins. This art piece would highlight differences in depths and the movement of water between basin one and two, possibly highlighting and helping to aerate the water. This would be a location for education and interpretation, as well as research and monitoring equipment. This and other art/interpretive pieces are envisioned for a nationwide design competition for students and/or invited environmental artists.

Wet Extended Detention Wetland Outlet and Outfall to Squaw Creek
- This main outlet consists of a buried pipe outletted into a channel to Squaw Creek, with the channel reinforced with limestone cross vanes and a splash pad as necessary at the outfall to Squaw Creek. The channel will include terraced limestone walls that act as a mini-amphitheatre and outdoor classroom. An emergency overflow will be included near this location.

<table>
<thead>
<tr>
<th>Runoff Rates and Runoff Volumes</th>
<th>ISU Haber Road Pasture Stormwater Demonstration Park Master Plan, with proposed normal water level at 892</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-settlement - Prairie, meadow conditions</strong></td>
<td><strong>Existing - Developed Conditions</strong></td>
</tr>
<tr>
<td>Design Storm Variable</td>
<td></td>
</tr>
<tr>
<td>0.5 inch (cfs)</td>
<td>0</td>
</tr>
<tr>
<td>0.5 inch (af)</td>
<td>0.00</td>
</tr>
<tr>
<td>1-yr (cfs)</td>
<td>1.1</td>
</tr>
<tr>
<td>1-yr (af)</td>
<td>0.6</td>
</tr>
<tr>
<td>5-yr (cfs)</td>
<td>15</td>
</tr>
<tr>
<td>5-yr (af)</td>
<td>2.8</td>
</tr>
<tr>
<td>100-yr (cfs)</td>
<td>93</td>
</tr>
<tr>
<td>100-yr (af)</td>
<td>12</td>
</tr>
<tr>
<td>Permanent Pool Volume (ac-ft)</td>
<td></td>
</tr>
<tr>
<td>Live Pool Volume (ac-ft)</td>
<td>892-896 / top of basin</td>
</tr>
<tr>
<td></td>
<td>892-895 / 25 yr event</td>
</tr>
</tbody>
</table>

Based on drainage area of 65.5 acres
Wenck Associates, Inc. 2/24/09
Pollutant Removal and Water Quality Modeling
The pond/wetland system with two separate cells improves the quality of water discharged to Squaw Creek, as well as reducing the total volume and peak discharge rate.

### Pollutant Loads and Pollutant Removal

<table>
<thead>
<tr>
<th>ISU Haber Road Pasture Stormwater Demonstration Park Master Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>With proposed normal water elevation at 892</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Existing - Developed Conditions</th>
<th>Proposed with Haber Wet Pond Bottom at 888</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pollutant Load in Frederiksen</td>
<td>Removed in Frederiksen</td>
</tr>
<tr>
<td>Variable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sediment TSS (lb/yr)</td>
<td>27365</td>
<td>21043</td>
</tr>
<tr>
<td>Phosphorus TP (lb/yr)</td>
<td>92</td>
<td>54</td>
</tr>
<tr>
<td>Nitrogen TKN (lb/yr)</td>
<td>418</td>
<td>238</td>
</tr>
<tr>
<td>Copper Cu (lb/yr)</td>
<td>13.2</td>
<td>8.8</td>
</tr>
<tr>
<td>Lead Pb (lb/yr)</td>
<td>5.5</td>
<td>4</td>
</tr>
<tr>
<td>Zinc Zn (lb/yr)</td>
<td>209</td>
<td>104</td>
</tr>
<tr>
<td>Hydrocarbons HC (lb/yr)</td>
<td>687</td>
<td>508</td>
</tr>
</tbody>
</table>

*Proposed Master Plan condition assumes runoff from 1/2 inch rainfall is infiltrated for Frederiksen Court impervious area at 62% impervious (drainage area 6). Excess runoff from Frederiksen Court is directed to wet pond and finally to extended detention wetland. Drainage areas 4 and 5 drain to wet pond while drainage areas 2 and 3 drain to extended detention wetland.
Discharge Rate Reduction by Wet Pond and ED Wetland

Runoff Volume
(Assumes Infiltration Basin(s) Implementation on Frederiksen Court)
Total Suspended Solids Load Reduction by Wet Pond and ED Wetland

1-year, 24-hour Hydrograph for ED Wetland with NWL = 892.0

Outflow begins at hour 12 and is less than 0.5 cfs by hour 36 (24 hour drawdown for Cpv).
VEGETATION AND ECOLOGICAL RESTORATION
The study area will be revegetated with native grasses and forbs, and shrubs and trees indigenous to the area, suited to the soil type and soil saturation characteristics, and their function in the stormwater treatment system.

Open areas of the site and open savanna areas will be seeded with a native grasses and forbs mix of species such as Little Bluestem, Purple Prairie Clover, and other mesic prairie species, with selective replanting of Burr Oak and other fire-resistant tree and shrub species.

Vegetation in wet basins and extended detention wetlands and grass swales should be tolerant of saturated soils and short to continual ponding, and be of types that produce high evapo-transpiration. Hydric vegetation in deep zones should include species such as Water Lilies, Floating Pondweed, and Bladderwort, while vegetation in emergent zones (partial submersion/1” to 3’ of water) would consist of species such as Bulrushes, Sedges, Sweet Flag, Arrowhead and Blue Iris. Xeric vegetation in drier or more upland transition areas should be suited to dryer soils and droughty conditions.

Stormwater features in the savanna like northeast part of the site are designed to avoid or minimize impacts to the large healthy mature trees and their roots. Features routed through the Brookside Park woods would minimize impacts to large healthy trees and their roots while selectively clearing to create detention wetlands, outlets channels, trails, and education and interpretive features.

Routing of stormwater features through the woods creates the opportunity to restore ground-level and mid-story habitat with native floodplain species such as Silver Maple, Hackberry, and native understory trees and shrubs to increase the diversity of habitat.

RESEARCH
ISU staff and students, along with City of Ames staff, community groups, and citizens, will use the stormwater demonstration park for research, teaching, and learning. The pasture should enable research focused on stormwater parameters, ecological restoration and vegetation and habitat quality, and related impacts to Squaw Creek. The impacts of seasonal water table fluctuations and of flooding on the pasture stormwater system and habitat can also be researched. The pasture will provide ample research opportunities for staff and students in Landscape Architecture, Civil Engineering, Restoration Ecology, Biology, Water Resources, and similar programs.

CIRCULATION AND PARKING
A 10’ wide bicycle/pedestrian path should be constructed with the future widening of Haber Road from 13th Street to University Avenue under the railroad tracks. The existing path crossing Haber Road should be reconfigured to directly align the crossing, and regrade the path if necessary to meet acceptable grades. Crossing signage should be improved. A path entering the pasture from Brookside Park at the northeast corner of the coal pile and proceeding to the west to the Frederiksen Court area is added as part of the plan.

The Brookside Park path along the south side of Squaw Creek should be extended along the creek and under 13th Street to the mini-disc golf area and beyond. A connecting path should be added along the north side of the pasture.
Additional paved or non-paved walkways can be created within the new stormwater park to connect and experience stormwater park features and provide access to and through the pasture.

Short bridges with steel grating decks and railings made of traditional red gate fences would be used to cross basins at key locations. The bridges would allow people to observe water through the steel grating deck.

Two optional locations are shown on the plan for an additional 20 car asphalt parking, 1) in the southwest part of the site near the clay block building, accessed from Haber Road, or 2) south of the coal pile accessed from Brookside Park. Option 1 is recommended.

See the path and walkway system and parking options shown on the Master Plan.

EDUCATION AND INTERPRETATION
Possible locations of primary education features and/or outdoor classrooms are:
- edge of Squaw Creek where the stormwater system would discharge to the creek
- where the 60” storm sewer is daylighted
- overlook (on the pasture side of Haber Road) where Frederiksen Court intersects Haber Road
- between the first and second stormwater basins

At these primary locations, features will include an art piece with vertical elements that express water movement, and education/interpretive signs and similar features. Some will include directional signage. The area next to extended detention outlet to Squaw Creek, and the area near the connection between the two basins, will include terrace stone seating walls that serve as mini-amphitheaters for outdoor teaching and research.

The existing clay block building in the southwest corner of the pasture will be rehabilitated as a teaching, research, and maintenance facility and storage building. If this building is not available for this use, we recommend that a smaller (<600 square foot) research and maintenance building be constructed near this building.

Short sections of floating dock or raised path/boardwalks are recommended for research and monitoring. Locations include near the daylighted pipe in the first basin, and in the second basin near the point where basins connect.

ISU will be drilling soil borings in the pasture and adjacent Brookside Park woods in 2009 and installing piezometers to help determine seasonal water table and saturated soil elevations. While not shown on this plan, the boring holes and piezometers should become permanent education, research and monitoring components of the pasture.

OPERATIONS AND MAINTENANCE
Goals and Objectives, and Practices
- Minimize the need for continuous site maintenance
- Provide clear, achievable and measurable goals that would allow ISU to maintain a successful project while holding operations and maintenance costs to a minimum
• Create a facility and landscape suited to ISU budget constraints and maintenance practices as this area is assigned to a new department to manage it
• Use students from related majors such as Landscape Architecture, Restoration Ecology, Water Resources

Within the context of the above goals, the following maintenance practices are anticipated:

Revegetation to native grasses, forbs, shrubs and trees in the pasture and in Brookside Park requires establishment maintenance for 3 to 5 years after planting. This includes some reseeding and replanting of failed areas, mowing, controlled burning, and chemical spot control of weeds. Following establishment, vegetation will require mowing once a year to control weeds or the use of controlled burning every two to three years. Occasional spot spraying or pulling to control weeds and invasive species may also be needed.

New stormwater management BMP’S such as detention basins or stormwater treatment wetlands, structural elements such as pipes, pipe risers and outlets, and control weirs will require regular inspection and maintenance depending on the BMP, including sediment removal and reuse about every 3 to 5 years.

The wet basin will accumulate sediment and can be accessed most easily from the south and east, and less easily from the west for removal of sediment. Sediment removal will be performed based on standard ISU maintenance practices, or typically every 5 to 7 years or as determined by monitoring.

<table>
<thead>
<tr>
<th>Typical Inspection and Maintenance Requirements for Stormwater Wetlands</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replace wetland vegetation to maintain at least 50% surface area coverage in wetland plants after the second growing season.</td>
<td>One-time activity</td>
</tr>
<tr>
<td>Clean and remove debris from inlet and outlet structure. Mow side slopes.</td>
<td>3-4 times a year, or every other year if meadow</td>
</tr>
<tr>
<td>Monitor wetland vegetation and perform replacement planting as necessary.</td>
<td>Semi-annual inspection (first 3 years)</td>
</tr>
<tr>
<td>Examine stability of the original depth zones and micro-topographic features. Inspect for invasive vegetation and remove where possible. Inspect for damage to embankment and inlet/outlet structures, repair as necessary. Note any signs of hydrocarbon build-up and remove accordingly. Monitor for sediment accumulation in facility and in forebay. Examine to ensure that inlet and outlet devices are free of debris and operational.</td>
<td>Annual Inspection</td>
</tr>
<tr>
<td>Repair undercut or eroded areas.</td>
<td>As needed</td>
</tr>
<tr>
<td>Harvest wetland plants that have been choked out by sediment accumulation.</td>
<td>Annually</td>
</tr>
<tr>
<td>Removal of sediment from forebay.</td>
<td>5 to 7 years or after 50% of total forebay capacity has been lost</td>
</tr>
<tr>
<td>Monitor sediment accumulations, remove sediment when pool volume has been reduce significantly (~25%), plants are choked with sediment, or wetland becomes eutrophic.</td>
<td>10 to 20 years or after 25% of wetland volume has been lost</td>
</tr>
</tbody>
</table>

SECURITY
Security will be addressed by removal of existing fencing, added lights and emergency alert stations along paths and walkways and at education and interpretation locations, and possibly by closing the park after 10:00 pm.

ART
Vertical Art Pieces, elements that highlight and celebrate water will be created, potentially by ISU students, to add vertical water based interest at key places in the pasture. Traditional white post fences will be added along trails and walkways at key locations to provide an edge or terminus; some posts will have blue bird boxes attached to them. Traditional red field gates will be added as railings to metal mesh bridge structures, and at entrances from Brookside Park to be closed for security purposes as necessary.

COST ESTIMATE
The estimated cost of full implementation of the Master Plan, including best management practices in the Frederiksen Court area is $3.36 million. About $1,522,161 is estimated to implement best management practices in the Frederiksen Court area, and $1,839,911 for the Haber Road Pasture Stormwater Demonstration Park. See below for more details.
## MASTER PLAN LEVEL COST ESTIMATE

**All costs based on 2009 construction dollars**

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost $</th>
<th>Estimated Costs</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Daylighting of 60° StormSewer and Trail Connection</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excavate and Remove 60° StormSewer (SS) 3 or 4 Sections</td>
<td>1</td>
<td>Lump Sum</td>
<td>5000</td>
<td>$5,000</td>
<td></td>
</tr>
<tr>
<td>Outlet Structure and Apron in 60° SS</td>
<td>1</td>
<td>Each</td>
<td>5000</td>
<td>$5,000</td>
<td></td>
</tr>
<tr>
<td>Manhole and Overflow Riser at upstream end of exist 60° SS</td>
<td>1</td>
<td>Lump Sum</td>
<td>8000</td>
<td>$8,000</td>
<td></td>
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<tr>
<td>Metal Mesh Deck with Red Gate Rail and Support Structure</td>
<td>140</td>
<td>Ln Ft</td>
<td>175</td>
<td>$24,500</td>
<td></td>
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<tr>
<td>Water-based Vertical Art Piece</td>
<td>1</td>
<td>Lump Sum</td>
<td>10,000</td>
<td>$10,000</td>
<td></td>
</tr>
<tr>
<td>Interpretive Sign</td>
<td>2</td>
<td>Each</td>
<td>5000</td>
<td>$10,000</td>
<td></td>
</tr>
<tr>
<td>Directional Sign / Map</td>
<td>1</td>
<td>Each</td>
<td>1500</td>
<td>$1,500</td>
<td></td>
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<tr>
<td>10° Asphalt Trail</td>
<td>450</td>
<td>Ln Ft</td>
<td>22</td>
<td>$9,900</td>
<td></td>
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<tr>
<td>Compacted Fill</td>
<td>100</td>
<td>Cu Yd</td>
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<td><strong>Subtotal</strong></td>
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<td>20% Contingency</td>
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<td><strong>Construction Total</strong></td>
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<td>$92,880</td>
<td></td>
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<tr>
<td>Project Fees</td>
<td></td>
<td></td>
<td></td>
<td>$37,152</td>
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<tr>
<td><strong>TOTAL ESTIMATED PROJECT COST</strong></td>
<td></td>
<td></td>
<td></td>
<td>$130,032</td>
<td></td>
</tr>
</tbody>
</table>
## MASTER PLAN LEVEL COST ESTIMATE

### Extended Detention Wetland Basin

- **Excavation (Dry and Wet) and Embankment - place excavated material, haul some material off-site**
  - 8000 Cu Yd
  - 1 Each
- **Monitoring Dock**
  - 12000
- **Tiered Limestone Block Mini-amphitheatre**
  - 100 Ln Ft
- **ED Wetland Basin Erosion Control**
  - 6800 Sq Yd
- **ED Wetland Basin Seeding**
  - 1.6 Acre
- **ED Wetland Basin Planting - Edge Plugs 10' wide edge**
  - 1900 Ln Ft

Subtotal: $300,800

20% Contingency: $60,160

Construction Total: $360,960

Project Fees: $144,384

TOTAL ESTIMATED PROJECT COST: **$505,344**

### Extended Detention Wetland Basin Outlet and Outfall

- **Clearing and Grubbing**
  - 20 Each
- **Select Tree Removal**
  - 20 Each
- **Excavation (Dry and Wet) and Embankment - place excavated material, haul some material off-site**
  - 300 Cu Yd
- **48” Concrete Riser and Outlet Structure**
  - 1 Lump Sum
- **21” Class V RCP Outlet Pipe to outlet channel**
  - 50 Ln Ft
- **Metal Mesh Deck Bridge with Red Gate Rail and Support Structure**
  - 35 Ln Ft
- **Water-based Art Piece - flow forms and cross vanes**
  - 1 Lump Sum
- **Tiered Limestone Block Mini-amphitheatre**
  - 100 Ln Ft
- **Interpretive Sign**
  - 2 Each
- **Directional Sign / Map**
  - 1 Each
- **Erosion Control**
  - 150 Sq Yd
- **Seeding**
  - 0.25 Acre
- **Planting - Edge Plugs 10' wide edge**
  - 150 Ln Ft
- **Select Tree and Shrub Installation**
  - 1 Acre
- **Red Field Gate**
  - 2 Each

Subtotal: $91,325

20% Contingency: $18,265

Construction Total: $109,590

Project Fees: $43,836

TOTAL ESTIMATED PROJECT COST: **$153,426**

### Central Trail Junction, ED Wetland Bridge, SanSewer Manhole Art Piece

- **Metal Mesh Deck Bridge with Red Gate Rail and Support Structure**
  - 90 Ln Ft
- **White Wood Post (every 6th with blue bird house)**
  - 12 Each
- **Blue Bird House**
  - 2 Each
- **Limestone Block Council Ring**
  - 100 Ln Ft
- **Interpretive Sign**
  - 2 Each
- **Sanitary Sewer Manhole Vertical Flow Art Piece**
  - 1 Lump Sum

Subtotal: $42,050

20% Contingency: $8,410

Construction Total: $50,460

Project Fees: $20,184

TOTAL ESTIMATED PROJECT COST: **$70,644**

### Brookside Park/Coal Pile Gateway

- **Compacted Fill Earth Berm**
  - 175 Cu Yd
- **White Wood Post (every 6th with bluebird house)**
  - 18 Each
- **Blue Bird House**
  - 3 Each
- **Interpretive Sign**
  - 1 Each
- **Directional Sign / Map**
  - 1 Each
- **Red Field Gate**
  - 2 Each

Subtotal: $15,575

20% Contingency: $3,115

Construction Total: $18,690

Project Fees: $7,476

TOTAL ESTIMATED PROJECT COST: **$26,166**
## MASTER PLAN LEVEL COST ESTIMATE

### Maintenance and Education Resources Building - Structure

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost ($)</th>
<th>Estimated Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lump Sum Rehabilitation of existing clay block building, or</td>
<td>$40,000</td>
<td></td>
<td></td>
<td></td>
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<td>2</td>
<td>Lump Sum New Maintenance Educational Resources Structure (not included)</td>
<td>$0</td>
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<td></td>
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</table>

Subtotal: $40,000
20% Contingency: $8,000
Total: $48,000
Project Fees: $19,200

TOTAL ESTIMATED PROJECT COST: $67,200

### 20 car Parking Lot (Option 1 or 2)

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
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<th>Unit Cost ($)</th>
<th>Estimated Costs</th>
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<tbody>
<tr>
<td>1</td>
<td>Lump Sum Asphalt Parking Lot with wheel stop for 20 spaces</td>
<td>$25,000</td>
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</table>

Subtotal: $25,000
20% Contingency: $5,000
Total: $30,000
Project Fees: $12,000

TOTAL ESTIMATED PROJECT COST: $42,000

### Miscellaneous Site Improvements

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
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<th>Unit</th>
<th>Unit Cost ($)</th>
<th>Estimated Costs</th>
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<tbody>
<tr>
<td>17</td>
<td>Acre Pasture Overseeding - native grasses and light native forbes seed mix</td>
<td>$119,000</td>
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<tr>
<td>1850</td>
<td>Lin Ft 10' Asphaltr Bicycle Pedestrian Trail</td>
<td>$40,700</td>
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<td></td>
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<tr>
<td>1200</td>
<td>Lin Ft 6' Crushed Compacted Limestone Walkway</td>
<td>$9,600</td>
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<tr>
<td>250</td>
<td>Lin Ft Demolished and Reconstruct 10' Bicycle Pedestrian Trail</td>
<td>$7,500</td>
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<td></td>
<td></td>
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<tr>
<td>1000</td>
<td>Lin Ft Tree Protection Fence</td>
<td>$3,500</td>
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Subtotal: $180,300
20% Contingency: $36,060
Total: $216,360
Project Fees: $86,544

TOTAL ESTIMATED PROJECT COST: $302,904

### Estimated Haber Road Pasture Master Plan Level Grand Total

Estimated Haber Road Pasture Master Plan Level Grand Total: $1,839,911

### Estimated Frederiksen Court Retrofit Total

* For Raingardens: Basin is 12" deep for above ground water storage. 12" media (80% sand, 20% compost) in basin for water storage and filtration below ground level. Pricing for raingardens are such that cubic feet and square feet are uninterchangeable units. Unit prices include excavation, media, and wetland plantings.

### Frederiksen Court Area Construction Allowance

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Quantity</th>
<th>Unit</th>
<th>Unit Cost ($)</th>
<th>Estimated Costs</th>
</tr>
</thead>
<tbody>
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<td>56628</td>
<td>Cu Ft To Retrofit for detaining the 1/2” in 24 hour storm event</td>
<td>$906,048</td>
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Subtotal: $906,048
20% Contingency: $181,210
Total: $1,087,258
Project Fees: $434,903

TOTAL ESTIMATED PROJECT COST: $1,522,161

Estimated Frederiksen Court Retrofit Total: $1,522,161
FUNDING SOURCES
Key State of Iowa sources for further planning, design, and implementation are identified below. Federal sources are mainly addressed through the information in Watershed Improvement Grants, Section 319.

Iowa DNR Watershed and Water Quality Improvement Grants and Loans
http://www.iowadnr.gov/water/watershed/grants.html
DNR Contact: Steve Hopkins, DNR Nonpoint Source Program Coordinator
(515) 281-6402, Stephen.Hopkins@dnr.iowa.gov

Watershed Planning Assistance Grants
http://www.iowadnr.gov/water/watershed/devgrants.html

Key Program Information:
To improve watershed projects and water quality in Iowa, a new planning assistance program has been developed. This program, the Watershed Planning Assistance Grants Program, allows Soil and Water Conservation Districts (SWCDs) and other local watershed groups to obtain assistance in evaluating watersheds and developing quality watershed projects.
Under the program, “watershed planners” with expertise in developing watershed projects will be made available to assist your SWCD or local watershed group develop a plan for your watershed. In addition, financial assistance may be offered to support public information activities and other planning efforts. Once the planning is complete, a draft watershed plan will be developed. This plan can then be used to develop funding applications and, once funded, guide implementation of your watershed project.
Contacts:
- Steve Hopkins, DNR Nonpoint Source Program Coordinator, (515) 281-6402 or Stephen.Hopkins@dnr.iowa.gov
- Jeff Tisl, DSC Coordinator for northeast Iowa, (563) 422-6201 or Jeff.Tisl@iowaagriculture.gov

Watershed Improvement Grants, Section 319

Key Program Information:
The DNR is able to provide these grants through funding from the U.S. Environmental Protection Agency. The grants, made possible through Section 319 of the federal Clean Water Act, are often called "Section 319 Grants." The DNR uses the EPA grant funds to support its watershed improvement program and to fund grants for watershed improvement projects throughout the state. The DNR often partners with the Iowa Department of Agriculture and Land Stewardship and the USDA Natural Resources Conservation Service on these projects.

2009 Funding Application Deadline:
The application deadline for FY 2009 Section 319 funding, Water Protection Funds (WPF) and/or Watershed Protection Program Funds (WSPF) is April 1, 2009.

Contacts:
- Kyle Ament, project officer, (515) 242-6196, Kyle.Ament@dnr.iowa.gov
Water Quality Loan Fund / General Non-Point Source Program

Eligible projects include but are not limited to:

- restoration of wildlife habitat;
- stream bank stabilization;
- urban stormwater management;
- remediation of storage tanks;
- water conservation and reuse; and
- wetland flood prevention areas.

Loans can also be made for the water quality components of other projects, such as municipal landfill closure, brownfield remediation, bird sanctuaries, and urban stormwater "good housekeeping" measures.

Applicants that are owners of record or have long-term control of the property where the project is to be implemented are eligible. Loan amount can be up to 100% of the project costs with a minimum loan of $10,000. Loan terms can be up to 10 years.

To apply or for more information, contact Patti Cale-Finnegan, Iowa Department of Natural Resources, (515) 725-0498 (patti.cale-finnegan@dnr.iowa.gov).

Additional Watershed Funding Information, see:
http://www.iowadnr.gov/water/nonpoint/nps5.html

Iowa Department of Agriculture Watershed Improvement Grants and Loans
Financial Assistance for Conservation Practices-Review of funding options highlighted below:
http://www.agriculture.state.ia.us/dept_C.asp

Iowa Watershed Protection
http://www.agriculture.state.ia.us/waterResources/watershedProtection.asp

Key Program Information:
The Watershed Protection Program was enacted in 1999 to provide technical and financial assistance for the development and implementation of local watershed initiatives. Watershed protection projects reduce soil erosion, protect or enhance water quality, provide flood control, and protect other natural resources. These projects accelerate watershed planning and implementation efforts with cooperation from local, state, and federal partners.

Planning Assistance:
Planning assistance may be provided to help accurately identify existing problems and issues critical to achieve desired resource management objectives. New technologies continue to improve the data collection and evaluation processes for multi-objective watershed projects. Watershed Development and Planning Assistance Grants are awarded to soil and water conservation districts and their conservation partners to help local leaders inventory, assess, and develop implementation strategies for watershed management. The result is more efficient use and productive expenditure of program funds.
Technical Assistance:
Regional Coordinators provide technical assistance and training to soil and water conservation district officials and other groups on watershed planning and implementation. The watershed approach continues to be the most comprehensive, efficient and effective method of resource management. New challenges are likely to emerge as watershed planning is continually refined, improved, and implemented long-term.

Implementation Assistance:
Implementation assistance is available through a competitive grant application process addressing identified environmental issues in a specific watershed. Watershed implementation projects typically leverage technical assistance and financial resources with local resources to improve the targeted watershed.

Contact:
Jeff Tisl, Northeast Iowa USDA Service Center
120 N Industrial Pkwy #4
West Union, IA 52175-1612
Phone: 563-422-6201
Fax: 563-422-3961
jeff.tisl@idals.state.ia.us

No-interest Loans
http://www.agriculture.state.ia.us/FieldServices/noInterestLoans.asp

Key Program Information:
The 1983 State Legislature established the conservation practices revolving loan fund to provide loans to eligible landowners at no interest for the construction of permanent soil conservation practices. Authorized in Iowa Code Section 161A.71, eligible landowners may borrow up to $10,000 for a 10-year period. Repayment is made in 10 annual payments equal to 10% of the initial loan amount. In the event of land ownership transfer, payment is due immediately.

The Revolving Loan Fund is an alternative to the traditional cost share programs. It allows a landowner to put a conservation practice on the ground today, with payments extended out over a ten year period. For some landowners, it also provides tax advantages.

Fund allocations are made to soil and water conservation districts, commissioners set priorities for their use, and field office staff assure the technical quality of practices built. These practices are also subject to maintenance agreements. Unlike the cost share program, management practices are not authorized.

Iowa Department of Agriculture and Land Stewardship, Field Service Bureau, Stormwater Best Management Practices Loans
http://www.agriculture.state.ia.us/FieldServices/stormwaterBMPloans.asp

Key Program Information:
Loans can be made to developers, cities, businesses and homeowners. The applicant must designate and have a commitment from the entity responsible for the long term maintenance of the stormwater quality BMP’s.

Funded Practices:
The Iowa Stormwater Management Manual identifies Stormwater BMP’s in Chapter 2. Practices identified in Chapter 2 D-L will be eligible. These include:
- Infiltration practices, soil quality restoration, native landscaping.
- Detention basins.
- Pond / wetland system.
- Grassed waterways.
- Pervious concrete or asphalt, modular paving systems.

Terms of the Loan:
- Loans from $5,000.
- Terms up to 20 years.
- Can fund up to 100% of BMP costs.
- Interest rate capped at 3% - fixed rate.
- Funding is available when you need it.
- Applications are accepted year-round.
- No penalty for pre-payment.
- Linked deposit loan structure through participating lenders.

How to Apply:
- The application process is coordinated through local Soil and Water Conservation District (SWCD) offices. If your project is eligible, complete the application form.
- A licensed engineer must sign the application confirming: 1) The project is designed according to the Iowa Stormwater Management Manual and 2) Only those practices directly related to the water quality improvements are listed in the cost estimate. Submit the application to the local SWCD.
- The SWCD will review the application for completeness. If approved by the SWCD, take a copy to your local lender and apply for a loan. Lenders can contact Lori Beary with the Iowa Finance Authority at (800) 432-7230 for more information.
- If approved, you and the local SWCD will receive written notice and construction can begin. Keep all records of costs and invoices.
- Once the project is complete, the engineer, contractor and SWCD will inspect the practice and verify the actual expenses.
- IFA will make a deposit with your lender based on the actual costs. The loan is repaid according to the loan terms established by the lender.

What is a linked deposit loan:
Under a linked deposit loan approach, the Iowa Finance Authority (IFA) works with local private lending institutions to provide assistance for water quality practices. The IFA agrees to accept a 0% rate of return on an investment (e.g., a certificate of deposit) and the lending institution agrees to provide a loan to eligible borrowers at 3% or less. It is up to your Soil and Water Conservation District to approve your project, and it’s up to your lender to qualify you for financing.
Water Quality Loan Fund
http://www.iowaagriculture.gov/FieldServices/waterQualityLoanFund.asp

Funded Practices:
- Virtually all practices eligible for State Cost Share, REAP and EQIP are eligible for loans. These practices may include but are not limited to:
- Terraces, grade stabilization structures, water & sediment control basins
- Pasture & hay land planting or prescribed grazing
- Grassed waterways and filter strips
- Field borders, windbreaks and buffers

Terms of the Loan:
- Loans from $5,000 to $50,000 (or more for improvements to animal feeding operations)
- Terms up to 10 years or up to 20 years for animal feeding operation loans
- Can fund up to 100% of actual costs
- Interest rate no more than 3% - fixed for the life of the loan
- Funding available when you need it, applications accepted year round
Use the lender of your choice or go to www.ifaprograms.com to view the list of current participating lenders

Application Process:
- Begin by talking to your local Soil and Water Conservation District (SWCD)
APPENDIX A.
Summary of October 24, 2008 Meeting, Site Visit, and Charette, including goals and objectives

Synopsis of the day’s activities:
In the morning, Kestrel consultants met ISU FPM and other staff to meet one-another, discuss goals and expectations for the day; review project goals, schedule, outcomes, and stormwater precedents from other universities. After the meeting we split into two groups; one group walked Frederiksen Court and discussed stormwater best management practice retrofit opportunities and constraints, and the other group visited Haber Pasture and discussed similar issues including the challenges and opportunities afforded by Squaw Creek.

After lunch a Charette was held that focused discussion of project goals and objectives, including stormwater requirements and desires; ISU Long Range Plans; uses of Haber Rd Pasture; coal storage and fire training areas; Brookside Park; existing conditions Haber Rd Pasture, Frederiksen Ct, Brookside Park, Squaw Creek; We reviewed preliminary hydrology and pollutant load modeling, and precedents of other university’s stormwater facilities. We identified site opportunities and constraints, funding opportunities, and next steps in the master planning.

Summaries of Key Stormwater Management Master Plan items and discussions:

Goals and Objectives
- Manage stormwater from Frederiksen Court: reduce the quantity and improve the quality of runoff from the 60” pipe that outlets into Squaw Creek at the northeast corner of Haber Road Pasture
- Create a stormwater demonstration “park:” demonstrate stormwater best management practices suited to the Pasture and enable education and interpretation by ISU students, and City of Ames residents especially the surrounding neighbors
- Collect Data: For both Frederiksen & Haber Pasture, collect data now for baseline information for typical/1” events & ongoing once Haber Master Plan is implemented
- Create a low maintenance facility and landscape, and operations and maintenance guidelines: suited to ISU budget and maintenance practices
- Integrate compatible uses into Haber Pasture: bike/pedestrian paths, paved and unpaved walkways/trails, parking for Pasture visitors and Brookside Park users
- Plan for a safe and secure place: for students and visitors
- Develop interpretive and education opportunities: outdoor teaching/classrooms, signs, and self-guided opportunities
- Create a landscape that is not energy intensive
- Identify funding opportunities and use master plan and its materials to pursue funding for implementation: from the State of Iowa/DNR/EPA/USACE/SWCD
- Create a place that is unique, aesthetically pleasing, and functional
- Market the water quantity and quality benefits to the DNR/EPA/Corps of Engineers etc of this demonstration project
  1. Help to pursue funding options
  2. Synergy and greater possibilities in working with the community
  3. Future Frederiksen Court Stormwater BMP Retrofits: positive changes for water quality
Site History, and Long Range Plans by ISU and the City of Ames

- Appears that Haber has never been cultivated, it was pasture in 1939 air photos, and there are large (> 30” dbh) mature trees on about 30% of the site
- Squaw Creek has become an incised creek channel; over the last 15 years the pasture has flooded around 5 times, about a once in every 3 years interval. A functioning bankfull interval is two times in 3 years, less often than this indicates channel incision.
- Old oxbow formations and depositions remain in Haber Pasture
- Firefighting/training areas, and the coal pile will remain
- There is some discharge of coal sediments (TSS) from the coal pile into the south end of the old oxbow. Keep coal discharges separate, but explore use of Haber to help manage TSS and PH further down the stormwater treatment train.
- The City of Ames sanitary sewer line that runs diagonally through the Pasture cannot be disturbed and will limit the location and depth of planned stormwater facilities.
- The planned high-voltage/high-tension overhead power lines along Haber Rd will encroach into Haber Pasture, the alignment and 100’ easement width needs to be identified and planned for, as it may be limited to mainly up the slope of current Haber Road. This will restrict stormwater facilities and other opportunities in Haber Pasture, including operations and maintenance activities
- Haber Rd reconstruction to 4 lanes is in the City’s 30 year plan (sometime after 2025?) This provides opportunities for improved bike/pedestrian facilities and crossings, and other improvements, facilitating a network of paths and trails. Rights-of-way needed for future construction will need to be identified and planned around for stormwater.
- An ISU Interpretative System with multi-phased signing plan is in progress

ISU MS4 Permit

- There are 6 BMP’s in the current permit, however, there are no specific quantity or quality requirements
- The next permit will deal with quantity but not quality
- The coal pile has its own NPDES permit

Water Quantity and Quality Goals, Opportunities, Constraints

- Manage the “P” stormwater event in Frederiksen;
  - Stormwater system, balance in Haber Pasture in Phase I
  - Manage first ½” in 24 hours in Frederiksen in Phase II
  - Manage first 1” in 24 hours in Frederiksen in Phase III
- Use Haber Stormwater “park” to manage runoff before implementation of hydrology changes in Frederiksen
- Data collection: For both Frederiksen & Haber Pasture, collect data now for baseline information for 1” events & ongoing once Haber Master Plan is implemented
- Monitor water quality and quantity, continue Squaw Creek macroinvertebrate counts, & teach ISU students and Ames citizens
- Failure is not acceptable, however, the system needs to work, it won’t be perfect, realistic expectations need to be set, adaptive management is a reality
- Understanding and setting expectations will require educating people, patience, good communication, and change

Iowa State University Haber Road Pasture
Stormwater Demonstration Park Master Plan
April 20, 2009

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**Key Opportunities**
- Moving of horses = opportunity for something else, and lower maintenance
- Scattered small site stormwater best management practices distributed in Frederiksen Court
- Haber parcel size enables slowing the runoff water and lengthening of flow paths
- Slowed water and lengthened flow paths help remove sediments before Squaw Creek discharge
- Phased implementation of Haber Pasture, and Frederiksen Court, along with adjacent Brookside Park and the under-construction Aquatic Center provides opportunities for partnering, path/trail connections, and making Haber Pasture more visible
- Enlarge public green space – Brookside Park & Haber Pasture as one “park” – remove as much as is feasible, such as fences and other barriers to universal access
- Reuse, respect, oxbows for SW treatment Oxbow- work with the land, include appropriate man-made elements especially as dynamic elements in the landscape
- Open grown sycamores, oaks are heritage trees, save them
- Ecological and wildlife enhancement in Haber Pasture (which is only 1/3 of catchment area)
- Education of ISU students and the general public
- Celebrate site uniqueness and integrate stormwater with iconic images and elements

**Key Constraints**
- Can’t fail, needs to look good immediately, not too “messy” for people passing by
- Shallow groundwater constraint, and poor infiltrating soils limit infiltration and filtration potential
- Planned Haber Road reconstruction and its rights-of-way width along with planned High-Voltage high-tension overhead power lines and its ROW, needs to be identified and planned for, will restrict stormwater management opportunities in Haber Pasture
- Coal runoff and oxbows – separate coal discharges from Haber; O&M can use adaptive management
- Flooding and its impact on the investment in new Haber Pasture vegetation and trails, floodwater sediments
- Education of general public

**Security**
- Water features
  - Shallow water means less risk
- Open area provides visibility, no shrubbery on perimeter where deer cross the roads
- Existing and new pathways should be lighted, add emergency alert stations, to enhance security
- Take down existing fencing
- Close Haber at 10 pm per Brookside Park

**Parking and Circulation**
- Address bike/pedestrian conflicts along Haber Rd and 13th St, and Coal truck/bike conflicts along south path; possible trail along north side of ballfields, and along both sides of Squaw Creek planned or possible
- Provide small parking lot for people exploring Haber and using Brookside Park, maybe 10 cars
Interpretation and Education
- Outdoor teaching, Outdoor learning lab, and classrooms, council rings, interpretive signs for students and community are appropriate elements in the Haber Pasture floodplain
- Add shed with tools for maintenance, monitoring, teaching. Keep out of floodway/floodplain.

Ecological Restoration and Habitat Enhancement
- Conserve existing significant oaks and sycamores, re-vegetate with native grasses and forbes
- Deer, geese already in pasture, permanent population of geese means wildlife management efforts and goose water quality concerns. Would like foxes in pasture to manage geese.
- Encourage birds, etc including wood duck houses

Operations and Maintenance
- Create a low maintenance facility and landscape suited to ISU budget and maintenance practices

Funding
- Identify federal to local opportunities, including DOT roadside management, State of Iowa and Iowa DNR/EPA/Corps of Engineers/watershed, Ames/community funding options
- KDG will revise its draft federal funds list

Next Steps
Kestrel needs information on:
- Haber Road reconstruction including Rights-of-Way width and location, operations and maintenance requirements and project schedule
- High Voltage Power Line construction including easement width and location, operations and maintenance requirements and project schedule
- Pipe sizes and the invert elevations of stormwater pipes from Frederiksen
- Pipe sizes, invert elevations of City of Ames sanitary sewer that crosses Haber diagonally
- Data for stormwater discharges from the coal pile into oxbow in Haber Pasture
- ISU will get more information regarding existing and need for future teaching activities and facilities in Haber Pasture.

Kestrel (KDG) will then refine the site analysis, hydrology and pollutant load modeling, and start preparing the draft stormwater management master plan. KDG will also revise and post federal and other funding opportunities for review and comment.

October 24, 2008 Meeting, Site Visit, and Afternoon Charette Attendees

<table>
<thead>
<tr>
<th>Name</th>
<th>Affiliation</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dave Bunker</td>
<td>Residence</td>
<td><a href="mailto:dbunker@iastate.edu">dbunker@iastate.edu</a></td>
</tr>
<tr>
<td>Steve Mayberry</td>
<td>EH&amp;S</td>
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</tr>
<tr>
<td>Les Lawson</td>
<td>Campus Services</td>
<td><a href="mailto:llawson@iastate.edu">llawson@iastate.edu</a></td>
</tr>
<tr>
<td>Angie Solberg</td>
<td>Planning Services</td>
<td><a href="mailto:asolberg@iastate.edu">asolberg@iastate.edu</a></td>
</tr>
<tr>
<td>Kayla Kaiser</td>
<td>Planning Services</td>
<td><a href="mailto:kaiserk@iastate.edu">kaiserk@iastate.edu</a></td>
</tr>
<tr>
<td>Barbara Steiner</td>
<td>Campus Services</td>
<td><a href="mailto:bsteiner@iastate.edu">bsteiner@iastate.edu</a></td>
</tr>
<tr>
<td>Tim Watson</td>
<td>Campus Services</td>
<td><a href="mailto:twatson@iastate.edu">twatson@iastate.edu</a></td>
</tr>
<tr>
<td>Mary Beth Golem</td>
<td>Residence – Fred Ct.</td>
<td><a href="mailto:mbgolem@iastate.edu">mbgolem@iastate.edu</a></td>
</tr>
<tr>
<td>Cathy Brown</td>
<td>Planning Services</td>
<td><a href="mailto:csbrown@iastate.edu">csbrown@iastate.edu</a></td>
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Iowa State University Haber Road Pasture
Stormwater Demonstration Park Master Plan
April 20, 2009
### Afternoon only

<table>
<thead>
<tr>
<th>Name</th>
<th>Department</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jeff Witt</td>
<td>FPM Utilities</td>
<td><a href="mailto:jwitt@iastate.edu">jwitt@iastate.edu</a></td>
</tr>
<tr>
<td>Rhonda Martin</td>
<td>FP&amp;M</td>
<td><a href="mailto:rhjmarti@iastate.edu">rhjmarti@iastate.edu</a></td>
</tr>
<tr>
<td>Mike Murray</td>
<td>FP&amp;M</td>
<td><a href="mailto:mimurray@iastate.edu">mimurray@iastate.edu</a></td>
</tr>
<tr>
<td>Corey Mellies</td>
<td>City of Ames</td>
<td><a href="mailto:cmellies@city.ames.ia.us">cmellies@city.ames.ia.us</a></td>
</tr>
<tr>
<td>Mimi Wagner</td>
<td>ISU-LA</td>
<td><a href="mailto:mimiw@iastate.edu">mimiw@iastate.edu</a></td>
</tr>
</tbody>
</table>
APPENDIX B.
Summary of key December 15, 2008 meeting and Charette items regarding management of stormwater runoff, vegetation restoration, and site features

The most important stormwater management criteria, and those to be addressed in final Plan are:
- Water Quality Volume WQv (based on 1.25” rainfall depth)
- Channel Protection Storage Volume Cpv (based on 1 yr/24 hour storm of 2.38”)

Management of the Overbank Flood Protection peak discharge rate for the 2 or 5 year storm event is desired.

The Channel Protection Storage Volume provides the necessary storage to meet Water Quality Volume criteria; thus the estimated 7.8 acre feet of runoff needed to meet Channel Protection Storage Volume criteria will meet both the WQv and the Cpv criteria.

Concept 2 is the preferred concept to move forward into the final Plan. With the final Plan we assume:
Frederiksen Court will:
- manage the ½” in 24 hours rainfall using a variety of BMP’s such as raingardens, infiltration basins, permeable paving, cisterns, greenroofs, greenwalls, and tree bioretention (Silva Cells)
- the approximate volume of runoff managed in Frederiksen will be 1.6 acre feet
- runoff water quality will improve and the volume of runoff conveyed to Haber Pasture reduced
- BMP’S will be part of a stormwater demonstration/education program, and ISU staff training

Haber Pasture, as a stormwater demonstration park, will be used to manage runoff to meet the WQv and Cpv criteria, and in doing so will:
- manage the 2.38” in 24 hours rainfall event using stormwater wetlands and structural elements to bring runoff from the 60” pipe to the surface, detain, and manage the release rate and volume
- the approximate volume of runoff managed in Haber will be 7.8 acre feet
- runoff will be detained and held for at least 24 hours
- ISU would like to use the best data available, and is gathering Haber Pasture area boring data, and is looking into doing additional borings to produce data on pasture soils, geomorphology and seasonal and average water table depths
- contacting folks doing the Aquatic Center may help understand the water level in their wetland, and its relation to water levels in Haber Pasture
- development of a cross section and hydraulic profile to help determine backwatering and possible loss of storage volume is desired
- storage volumes will be calculated above the permanent pool elevations, with cells slightly oversized to factor in the fluctuations in permanent pool elevations and potential groundwater recharge/surcharge, freeboard, and some sediment storage; calculation of recharge volumes is desirable
- permanent pools will be sized and shaped to minimize used by nuisance waterfowl eg Canada geese
- basins and surrounding uplands will be planted with tall native grasses, which will minimize the attractiveness of the area for such waterfowl.
- larger events (2 yr or 10 yr) will be detained and released in 24 hours as is feasible, and/or bypass the wetland cells; flows in excess of the 1 year/24 hour storm may be diverted directly to the creek
- the stormwater system will be multi-celled, the first cell may be dry as a safety precaution for spills, with remaining wetland cells having a permanent pool of a shallow depth
- connectivity between cells for hydraulic flexibility would be beneficial for research
- stormwater wetlands with permanent pools of water will be excavated to below the seasonal or average water
- 2’ of separation between the bottom of BMP’s (expect for stormwater wetlands) and the seasonal high water table is standard
- one primary outfall to the creek is preferred, with a secondary emergency outfall
- runoff water quality will improve and the volume of runoff conveyed to Squaw Creek reduced
- management of the Overbank Flood Protection peak discharge rate for the 2 or 5 year storm event is desired, and will be evaluated and included as feasible

Haber Pasture Site Circulation and Site Features, Habitat Restoration, and Education and Interpretation
- BMP’S will be part of a stormwater demonstration and education program in the pasture that will include monitoring equipment and outdoor research, education, and teaching elements
- trails/walkways will lead from the parking lot option located in the southwest corner of the site into, and connect with, the pasture trails and walkways
- existing paved trail through the ball field could be extended north along the dirt road east of the coal pile and enter the pasture near the northeast corner of the coal pile
- paths, lookout, and other site features, blended with existing mature trees, will provide passive recreation and wildlife viewing
APPENDIX C.
Best Management Practice Recipe Cards suitable for future stormwater bioretention, infiltration, collection and storage and re-use in Frederiksen Court. Many other BMP’s may be evaluated for use on these sites.
**DESIGN RECIPE**
The Kestrel Design Group, Inc.

A plant-filled depression in the landscape that collects and holds stormwater runoff temporarily while it infiltrates into the earth or evapotranspires back into the atmosphere.

**Ingredients:**
- 8-18” depression in landscape
- 30” minimum depth mixture of sand, topsoil and compost for optimal infiltration
- perforated underdrain or overflow structure to prevent flooding where applicable
- deep-rooted native plants to absorb and cleanse water

**Yield:**
- improved water quality
- enhanced wildlife habitat
- beautiful native plants
- reduced downstream flooding
- replenished groundwater
- reduced stormsewer system
- infiltrates immediately upon spring melt

**Serve with:**
- native plants, rainbarrels

**Costs:**
- low costs- approximately $16/sf to install
- a 300 sf rain garden can treat 1,200 square feet of impervious surface for only $4,800
A strategically placed gathering space, off the beaten path, with natural stone arcs to provide informal seating for individuals and small groups. Serves up to 12.

Ingredients:
- low seat-wall of boulders or stacked limestone
- 6-15’ inner diameter
- seating for 1-12
- stone, gravel, or mulch center
- enclosed and/or sheltered by vegetation
- quiet location

Yield:
- resting spot along trail
- encourages contemplation, reflection, and introspection
- promotes social interaction
- wildlife observation
- interpretive opportunities
- small group learning

Serve with:
- no-mow natural paths
- scenic vista

Costs:
- boulders $500 per dozen
- stacked limestone costs $1,000 per linear foot
- $1,500 per sign
Areas with dry, sunny, open conditions suitable for native wildflower and prairie grass plant communities.

Ingredients:
- remove invasive plants
- aerate compacted soils
- restore turf lawn and vacant areas to native plants
- overseed prairie edges
- maintain clean edge
- prescribed burn annually
- interpretive signs

Yield:
- discourages invasive plants
- filters air and water
- promotes infiltration
- reduces stormwater runoff
- prevents flooding
- provides habitat
- reduces urban heat island effect
- carbon sink for global warming
- provides attractive feature
- reduces costs with no mowing, weeding, or fertilizing

Serve with:
- butterfly identification book
- sun visor

Costs:
- $4,000-7,000 per acre
WOODLAND RESTORATION

DESIGN RECIPE
The Kestrel Design Group, Inc.

Areas with sunny, moist, rolling conditions suitable for native oak and maple forest, and spring ephemeral plant communities.

Ingredients:
- remove invasive plants
- aerate compacted soils
- restore turf lawn and vacant areas to native plants
- overplant woodland edges
- maintain clean edge
- interpretive signs

Yield:
- vegetation structure with ground layer, shrubs, understory and canopy
- discourages invasive plants
- filters air and water
- promotes infiltration
- reduces stormwater runoff
- prevents flooding
- provides habitat
- reduces urban heat island effect
- carbon sink for global warming
- provides attractive feature
- reduces costs with no mowing, weeding, or fertilizing

Serve with:
- babbling brook
- bird identification book

Costs:
- $5,000-7,000 per acre
DESIGN RECIPE
The Kestrel Design Group, Inc.

Low-lying areas with wet conditions where water collects either temporarily or permanently that are suitable for wetland plant communities.

Ingredients:
- remove invasive plants
- aerate compacted soils
- restore turf lawn and vacant areas to native plants
- overseed wetland edges
- maintain clean edge
- prescribed burn

Yield:
- discourages invasive plants
- stormwater runoff storage
- filters air and water
- promotes infiltration
- reduces stormwater runoff
- prevents flooding
- provides habitat
- reduces urban heat island effect
- carbon sink for global warming
- provides attractive feature
- reduces costs with no mowing, weeding, or fertilizing

Serve with:
- bird houses
- interpretive signage
- council ring
- boardwalk
- overlook
- water science station

Costs:
- $4,000-7,000 per acre
SAVANNA RESTORATION

DESIGN RECIPE
The Kestrel Design Group, Inc.

Areas with dry, sunny, open conditions suitable for native wildflower and prairie grass plant communities with scattered groves of oak trees.

Ingredients:
• remove invasive plants
• aerate compacted soils
• restore turf lawn and vacant areas to native plants
• overseed savanna edges
• maintain clean edge
• prescribed burn annually
• interpretive signs

Yield:
• vegetation structure with ground layer, shrubs, understory and canopy
• discourages invasive plants
• filters air and water
• promotes infiltration
• reduces stormwater runoff
• prevents flooding
• provides habitat
• reduces urban heat island effect
• carbon sink for global warming
• provides attractive feature
• reduces costs with no mowing, weeding, or fertilizing

Serve with:
• bird houses
• picnic lunch

Costs:
• $4,000–7,000 per acre
HABITAT GARDENS

DESIGN RECIPE
The Kestrel Design Group, Inc.

Distinct areas with a specific focus on restoring suitable habitat for a particular native wildlife species that is often a threatened or rare species.

Ingredients:
- remove invasive plants
- aerate compacted soils
- restore turf lawn and vacant areas to native plants
- buffer core habitat patch
- maintain clean edge
- prescribed burn annually
- interpretive signs

Yield:
- provides habitat
- discourages invasive plants
- filters air and water
- promotes infiltration
- reduces stormwater runoff
- prevents flooding
- reduces urban heat island effect
- carbon sink for global warming
- provides attractive feature
- reduces costs with no mowing, weeding, or fertilizing

Serve with:
- native plants
- bird feeders

Costs:
- $1-2 per square foot
Small device to make weather observations such as temperature, humidity, wind speed, precipitation, water quality, and more.

**Ingredients:**
- monitoring station
- research plot
- water access

**Yield:**
- greater understanding of the campus microclimate
- generates quantifiable data
- contributes to knowledge and understanding
- wildlife observation
- interpretive opportunities
- small group learning

**Serve With:**
- node
- a good location with easy access
Transform an existing retaining wall into an artful gathering space.

**Ingredients:**
- stone
- timbers
- recycled plastic timbers
- concrete

**Yield:**
- connecting students to the campus
- improve communication between students
- improved visitor comfort on campus
- meeting space

**Serve With:**
- sun and shade
- people needing seats

**Costs:**
- $1 per foot
A permanent marker that provokes curiosity and interest, reveals answers in a unique perspective, addresses the big picture of what is important and why the viewer needs to know this information.

Ingredients:
- interesting story
- frame and post
- colorful graphics
- weather resistant material

Yield:
- increased interest
- renewed appreciation

Serve with:
- noteworthy location or element

Costs:
- $1500 per sign and frame
**PARKING LOT INFILTRATION ISLANDS**

**DESIGN RECIPE**
The Kestrel Design Group, Inc.

Plant-filled depressions in a parking lot with curb cuts to collect and hold stormwater runoff temporarily while it infiltrates into the earth or evaporates back into the atmosphere.

**Ingredients:**
- 8-18” depression in landscape
- curb cuts to allow runoff into depressions
- 30” minimum depth mixture of sand, topsoil and compost for optimal infiltration
- perforated underdrain or overflow structure to prevent flooding where applicable
- colorful, deep-rooted native plants to absorb and cleanse water while improving parking lot aesthetics
- trees to provide cooling shade for cars in parking lot

**Yield:**
- improved water quality
- enhanced wildlife habitat
- beautiful native plants
- reduced downstream flooding
- replenished groundwater
- reduced storm sewer system

**Serve with:**
- native plants

**Costs:**
- low cost - approximately $16/sf
- a 300 sf island can treat 1,200 sf of parking lot for only $4,800