THE UNIVERSITY OF IOWA
IOWA INITIATIVE
FOR SUSTAINABLE COMMUNITIES

FINAL DELIVERABLE

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Completed By	Laura Zepeski, Maritza Jones, Margaret Trowbridge , Alex Mounivong
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Instructor	Paul Hanley and Richard Fosse
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December 9th, 2022

CLINTON STORMWATER UTILITY FEE

IOWA CIVIL & ENVIRONMENTAL ENGINEERING

PREPARED FOR

Jason Craft
City Engineer
Clinton, IA

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Section I – Executive Summary

Changes in federal and state regulations are reshaping the way cities manage their stormwater and wastewater. Across the nation, cities are moving away from combined sanitary and storm sewer utility systems. These separate systems provide significant improvements to the environment and community, but the cost of separating and operating the two systems can be a burden for any sized community. The city of Clinton has felt this financial burden in recent years and has worked to separate their storm and sanitary sewers. This process is about 85% complete and is expected to be finished within the next 15 years. However, the city is at a point where it can no longer sustainably fund these projects and operate these systems; they need to establish a separate stormwater utility fund. It is important to note that this is not an uncommon situation. Many communities are experiencing the same burdens due to aging infrastructure and additional regulatory costs. This study seeks to estimate a budget for the new stormwater utility and establish an equitable system to charge the fees to the customers.

Currently, the city of Clinton's stormwater management projects are funded primarily by sanitary sewer utilities. This has contributed to Clinton having one of the highest sanitary sewer rates in the state and a backlog of stormwater projects. A separate stormwater utility fee would allow for a better representation of a user's contribution to stormwater runoff. This will also lessen the burden on other municipal budgets such as the sanitary sewers, streets and transportation budgets. The user charge and the stormwater utility fee concept is the most dependable and equitable approach available to local governments for financing stormwater management *(Financing Stormwater Utilities, 2nd Edition).* Table 1 shows how Clinton's total utility fees with the proposed stormwater utility fee compares with similar communities in Iowa.

Table 1: Monthly utility costs for Iowa communities, sorted by total utility cost.

City	Population	Stormwater fee[1]	Sanitary sewer rate[2]	Water rate[2]	Credit (rate reduction)	Cost-share program	Total monthly utility cost
Waukee	23,940	$6.25	$49.94	$40.85	No	Yes	$97.04
North Liberty	20,875	$2.00	$48.08	$38.42	No	Yes	$88.50
Pleasant Hill	10,157	$4.00	$33.37	$39.32	No	Yes	$76.70
Norwalk	12,799	$7.50	$38.71	$28.77	No	Yes	$74.98
Clinton	**24,434**	**$4.63[3]**	**$38.52**	**$35.47**	**Yes[3]**	**Yes[3]**	**$73.98**
Cedar Rapids	132,000	$7.26	$36.47	$29.58	Yes	Yes	$73.30
Johnston	24,500	$7.05	$26.39	$35.05	No	Yes	$67.59
Dubuque	51,941	$9.00	$23.64	$33.08	Yes	Yes	$65.72
Marion	41,500	$3.50	$26.00	$34.50	Yes	Yes	$64.00
Coralville	24,222	$3.00	$31.35	$18.72	No	Yes	$53.07

[1]ERU rate, [2]Based on a use of 400 ft^3 of water per month, [3]Proposed

The estimated target revenue from the proposed stormwater utility fee structure was based on anticipated stormwater management operations and maintenance, such as personnel budget, repairs/maintenance, equipment, capital funds for new projects, and a cost-share program. Each of these was estimated at $350,000, $200,000, $100,000, $1,000,000, and $100,000, respectively.

The proposed rate structure uses the equivalent residential unit (ERU) method. This is the most common method for a stormwater utility fee structure and is the simplest to implement. The ERU is a base rate that is determined from the average impervious area of all single-family residential parcels. All single-family properties are charged the same ERU base rate, but multi-family, commercial and industrial properties are charged for their actual impervious area, measured in ERUs. For example, if a commercial property contains 100 times the impervious area of the calculated ERU, the property will be charged 100 times the ERU base rate.

Our team used geographic information systems (GIS) to perform machine learning techniques to measure the impervious area of each parcel within Clinton city limits. This required an aerial image, a parcel shapefile, and a zoning shapefile obtained from Iowa GeoData and the City Engineer. The median impervious area of single-family properties was used instead of the mean for the ERU to reduce the statistical impact of outlying properties.

The calculated ERU is 2,707 ft^2. This results in 6,847 ERUs in single-family residences, 3,496 ERUs in multi-family residences, 9,358 ERUs in commercial properties, and 14,323 ERUs in industrial properties. In total, this is 34,025 ERUs; for reference, that is 3.3 mi^2 of impervious area. Agricultural areas were not included in the utility fee because of their low impervious areas. Manufactured housing is also not included in the fee because it is outside of the storm sewer utility service area.

Credits can be offered to encourage landowners to participate in stormwater best management practices (BMPs), which reduces the burden on the public stormwater system from the property. We recommend that credits be approved by meeting or exceeding Iowa Stormwater Management Manual (ISWMM) standards based on three criteria; Type I: Volume Reduction, Type II: Peak Runoff Reduction, and Type III: Water Quality Improvement. Each criterion approved will grant the landowner up to 25% fee reduction, with a maximum reduction of 75%. The overall amount of credits that will be utilized by the community is impossible to predict. The more credits that are granted will require a higher base fee in order to achieve revenue goals. Our base rate calculation assumed an estimated 10% of parcels utilizing a maximum fee reduction of 75%. With this assumption, the base fee will need to be $4.63 to achieve the revenue goal of $1,750,000.

This ERU rate will generate $1,750,000 annually for the city of Clinton. This annual budget will be allocated for capital funds, a personnel budget, repairs and maintenance, equipment, and a cost-share program.

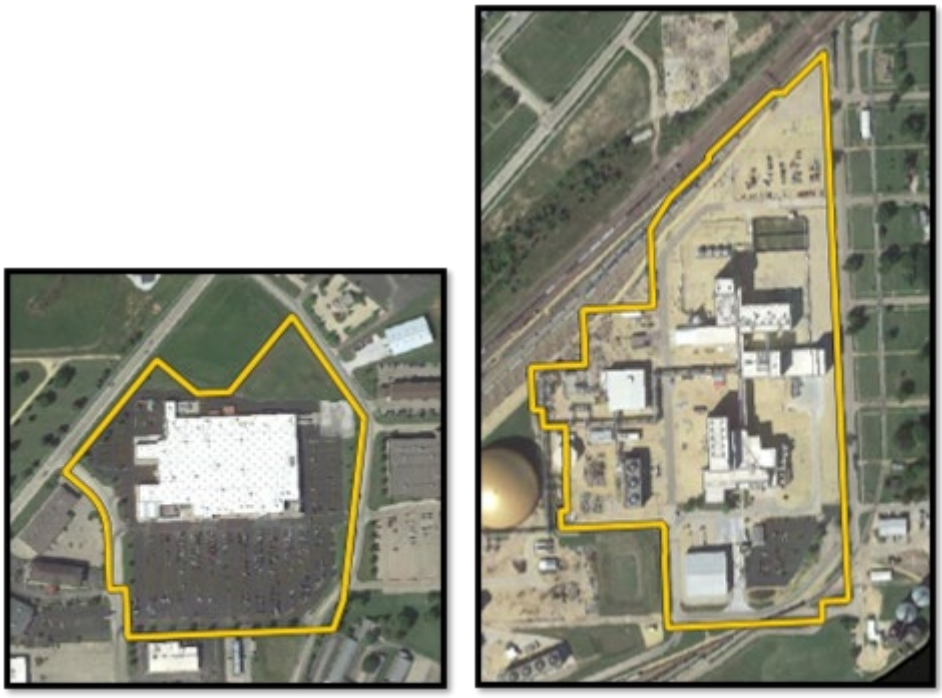

Figure 1: Wal-Mart, an average commercial property (left); Archer-Daniels-Midland, an average industrial property (right).

Figure 1 represents what properties can expect to pay with a base rate of $4.63. The selected average commercial property, Wal-Mart, contains 857,174 ft^2 of impervious area. This is equivalent to 317 ERUs with a $1,467.71 monthly fee. The selected average industrial property, ADM, contains 1,452,273 ft^2 of impervious area, equivalent to 536 ERUs with a $2,481.68 monthly fee.

The cost-share program is a common practice that involves the municipality reimbursing a portion of the expenses towards implementing BMPs. This program also encourages and educates the community about sustainable stormwater practices. With the nature of the cost-share program requiring an upfront cost from the municipality, the program can be implemented after the first year of revenue is generated from the stormwater utility fee. Clinton's cost-share program would offer to provide funding, or reimbursement, for up to 50% or a maximum of $2,000 per project. These funds will be offered on a first-come, first-served basis.

This ERU method is an equitable way to implement a stormwater utility fee which provides flexibility in community growth and changes in financial needs. A stormwater utility fee will provide funds to implement, operate, and maintain stormwater management practices. The main purpose of these practices is to reduce stormwater quantity and improve stormwater quality. This is beneficial to the community on both a small and large scale by diminishing negative effects of heavy rainfall, mitigating damage from flood events, preventing channel erosion These practices can improve the city's resilient infrastructure and overall effort towards sustainability.

Section II –Qualifications and Experience

Organization and Design Team Description

We are a team of students at the University of Iowa in a capstone design class. Our team of dedicated students have expertise in various areas relating to water resources. The project manager is Laura Zepeski, an environmental engineering student with a focus on water resources engineering. Maritza Jones is an environmental engineering student with a focus area in water resources engineering. Maritza led the research for the fee structure and the credit utilization. Margaret Trowbridge is a civil engineering student pursuing a minor in geographic information science. Margaret led the GIS calculations and CAD work. Alex Mounivong is an environmental engineering student with a focus on water resources engineering. Alex provided assistance with GIS procedures, credit utilization, and rate determination.

Section III – Design Services

Project Scope

A stormwater utility fee is a dependable and equitable approach for municipalities to finance stormwater management. This utility approach charges landowners a fee that is proportional to their stormwater runoff. Different rate structures were analyzed to determine the optimal structure for the client. Using GIS tools, impervious and pervious areas were calculated for each representative parcel. A scalable preliminary fee and rate structure was determined to meet the client's target annual revenue. The scalable fee offers flexibility for the client to adjust for future growth. The following tasks were conducted to help Clinton develop an equitable stormwater utility fee:

- Researched model stormwater fee ordinances. Models for use in Clinton were evaluated and a list of pros and cons for each prepared.
- Researched peer communities and compiled information about their stormwater fees, methods, and current rates.
- Developed a methodology to calculate stormwater fees for Clinton. Evaluated different methodologies for each zoning classification.
    - Impervious area calculations were performed using GIS methods for the ERU method.
- Evaluated potential credits for individual property owners which may reduce the stormwater fee based on quantifiable actions by the property owner to reduce stormwater impacts attributed to their property.
- Calculated a sample stormwater utility fee that met target annual revenue requirements with an estimated credit utilization.

Work Plan

A Gannt chart showing the project schedule is included as Appendix A.

Section IV – Constraints, Challenges, and Impacts

Constraints

Federal and state regulations relating to stormwater and wastewater management have continuously become more stringent over time. Clinton is constrained by these regulation changes, as they have made it necessary for the city to separate their storm sewer system from their sanitary sewer system. Doing so comes with many related expenses, previously all covered by sanitary sewer rates. Completing this separation without proper funding has not been ideal, but the city had no choice than to comply with new regulations.

The client wishes to implement a cost-share program to encourage all properties to implement their own BMPs. The city currently has no money allocated specifically toward stormwater management projects. The lack of funds does not allow for the cost-share program to be immediately operational. Therefore, the city must generate revenue from the first year of the stormwater utility fee before any funds are available for a cost-share program.

Challenges

The challenges of this project prioritize making the stormwater utility fee equitable for the Clinton community. Clinton's current sanitary sewer rates are among the highest in Iowa. While implementing a stormwater utility fee will generate funds and significantly improve stormwater management, it does not guarantee a prompt decrease in the sanitary sewer rate. An additional utility cost will not be favorable among property owners. However, rather than using other municipal utility budgets, funding stormwater infrastructure from a stormwater utility fee is more representative and proportionate to a property’s stormwater discharge.

In addition to this, quantifying the effectiveness of each BMP to a percent fee reduction was challenging. Research on Iowa ordinances identified that quantifying these BMPs is based on a case-to-case basis for each property by utilizing criteria that quantify stormwater runoff. It will require utilizing similar criteria to those established in other communities for Clinton's early stages of the credit structure. Challenges will continue to rise as more BMPs are eligible for credit in the future, which will need to be based on the identified criteria. A qualified representative from the city must inspect BMPs implemented by property owners to confirm their existence and effectiveness. The more BMPs eligible for credits will require more labor hours for inspection and an increased budget for the city to achieve their target revenue.

Additionally, the cost-share program provides property owner’s guidance both financially and educationally during the BMP implementation process. However, even with financial assistance from a cost-share program, some BMPs can be expensive to implement. It may be difficult for property owners to see a positive return on investment from implementing a BMP to receive a rate reduction. Therefore, expressing the importance of implementing BMPs and how they can decrease long-term costs will be necessary for the overall progression in stormwater management within Clinton. Lastly, the maintenance of the credit utilization and cost-share program will need to be reevaluated (as needed) with the expansion of BMP implementation. Accumulating revenue for this cost-share program became a challenge based on no current stormwater management revenue.

Societal Impact within the Community and/or State of Iowa

A dedicated stormwater management funding source will generate newer, more effective stormwater infrastructure and management practices for new and older developments. Anticipated stormwater projects can be constructed to improve the existing issues regarding flood events, erosion, creek instability, and stormwater quality. This stormwater utility fee will more equitably distribute the cost of these projects to members of the community. The city of Clinton has numerous pending projects that the stormwater utility fee can fund. The absence of these issues will improve the health, safety, and financial stability of affected residents. This may improve property values in some areas that currently deal with poor drainage and frequent flooding.

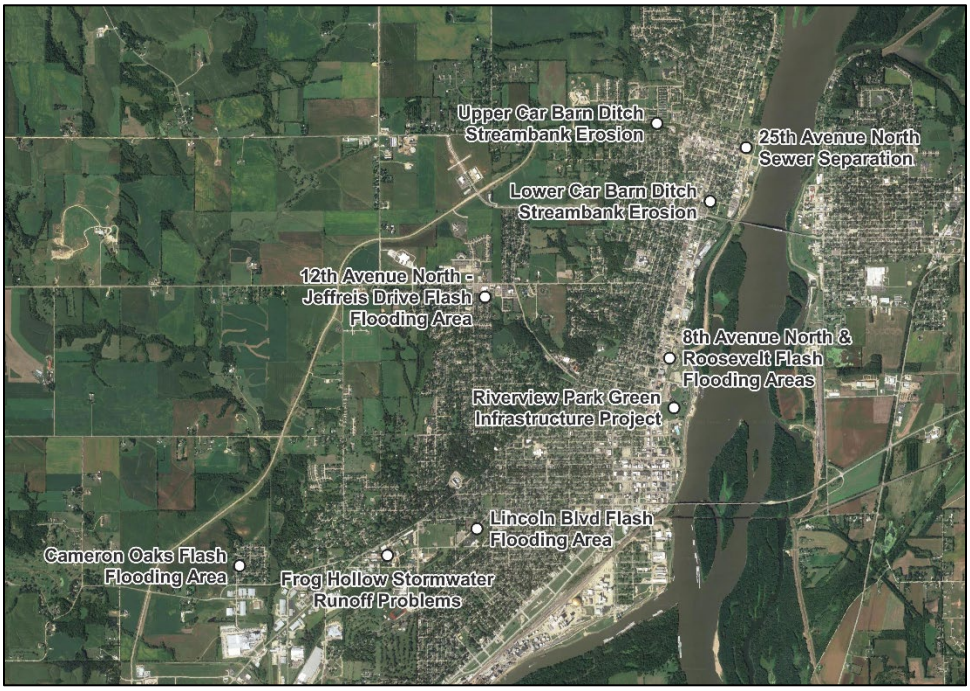

Figure 2: Potential stormwater project locations.

Figure 2 shows the locations of the following anticipated stormwater projects:

- Mill Creek master plan
  - Upper car barn ditch streambank erosion
  - Lower car barn ditch streambank erosion
- 25th Avenue North sewer separation
- 12th Avenue North - Jefferies Drive flash flooding hazard area
- 8th Avenue North and Roosevelt flash flooding hazard areas
- Riverview Park Green Infrastructure Project
- Lincoln Blvd flash flooding hazard area
- Frog Hollow stormwater runoff problems
- Cameron Oaks flash flooding hazard area

The current Clinton population is economically diverse. Recognizing the economic disparities within the community was considered in developing the base rate from single-family properties. Specifically, ensuring that the ERU rate was not targeting groups with smaller impervious area footprints was essential. At the same time, regardless of stricter stormwater management policies in new development areas, these properties are still charged the same ERU base rate as pre-existing developments.

A stormwater utility fee with the opportunity to receive credits will encourage stormwater education and awareness within the community. The implementation of BMPs can improve water quality and reduce runoff volume for the watershed, establishing a more natural or pre-development condition. Properly designed, constructed, and maintained BMPs effectively remove pollutants found in urban runoff. Removing these pollutants early in the cycle is environmentally conscious for infiltration and groundwater recharge and more financially responsible for drinking water treatment.

Section V – Alternative Solutions That Were Considered

We researched the stormwater ordinances and credit programs of many peer communities in Iowa to explore the possible methods for Clinton. This research can be found in Appendix B. Many stormwater utility fee structures are developed around impervious areas. The three most widely used structures are the equivalent residential unit (ERU) method, single-family unit (SFU) method, and the per square foot method. The pros and cons for all three methods are summarized below in Table 2.

ERU Method

The ERU method charges the same monthly base rate to all residential dwelling units. This rate is determined based on the average impervious area of residential properties. Due to this, the monthly fee does not represent each specific residential parcel's impervious area or contribution to stormwater runoff. This approach is the most common and simplest to implement.

SFU Method

The SFU method has a different rate for different sizes of residential properties, unlike ERU which treats all single-family residential parcels the same. This allows the rates to be more representative of a landowner's impervious area, thus, is often favored by politicians. However, this method is more intensive for implementation than ERUs. It will require additional evaluations for any new developments, as well as a statistical analysis of the residential property sizes. A tiered structure is developed that may make implementation more confusing for customers, as well as making it more difficult for the municipality to adjust user fees to meet target revenues.

Per Square Foot Method

The per square foot method charges landowners based on actual impervious area. This method involves calculating the impervious area of every parcel. Landowners are charged in direct proportion to the amount of impervious area on site, making it the fairest option; however, this requires extensive GIS data and aerial photography analysis, and the rate structure is more complicated than the other methods. This can lead to a very expensive and labor-intensive

implementation process. This method is incredibly complicated for municipalities to adjust to meet target revenues. Per square foot structures have also been difficult to defend in court.

Table 2: Pros and cons of three possible stormwater utility fee methods.

Model	Pros	Cons
Equivalent Residential Unit (ERU)	• Flat rate is easy to change to match desired revenue. • Cheaper to maintain • Does not require high resolution photos. • Requires less GIS analysis • Hard to contest.	• Owners of smaller single-family residential lots may feel their rate is unfair compared to larger lots.
Single-Family Unit (SFU)	• The rate better represents the on-site impervious area, increasing the equity. • Often favored by politicians	• It is more difficult to manipulate to meet desired revenue. • Requires higher resolution photos. • Expensive- requires statistical analysis of residential homes to determine tiers and will require another evaluation by a qualified professional with new developments/growth. • Multiple rate classes may confuse the public and allow more room for appeals • Difficult to implement.
Per Square Foot (PSF)	• Each fee is directly proportional to the amount of impervious area on the property.	• Complexity of method causes difficulty to meet desired revenue. • Requires extensive GIS data and aerial photography analysis. All properties will need measurements of the impervious area. • Expensive long-term maintenance of databases to analyze and calculate individual impervious areas and for new development areas. • Hard to demonstrate the method to customers

Multi-Criteria Decision Analysis

A multi-criteria decision analysis, included in Appendix C, was performed to determine which method would best suit the needs of Clinton, using revenue capacity, equity and fairness, data requirements, short-term and long-term financial considerations, ease of understanding, and stakeholder approval as the criteria. Equity, cost, and ease of understanding were the most important criteria. The ERU method outperformed the other options in all three of these categories and easily ranked the highest, thus, it is our proposed rate structure for Clinton, IA.

Credits

In the proposed credit structure, property owners have the opportunity for rate reductions in the form of credits by implementing their own best management practices, or BMPs. Each criterion that a BMP sufficiently improves, according to ISWMM standards, results in up to a 25% decrease in the property's stormwater utility rate; this is capped at a 75% rate reduction.

An alternative to this credit structure is to provide a predetermined list of BMPs that qualify for a rate reduction with a correlated rate reduction per BMP. These rate reductions would still be based on the criteria mentioned above, but their ability to improve existing conditions would be quantified to create an equitable set rate per BMP. The challenge of this alternative is that if a BMP has a set rate reduction, requirements or standards would need to be set for that rate reduction to reflect its effectiveness. Building requirements for specific BMPs vary with different property sizes, soil types, property types, etc. This alternative was not chosen because if a BMP were to qualify for the credit, these building requirements would need to be met, which would also be challenging to quantify.

In order to keep the proposed BMP credit structure accurate and equitable, each BMP submitted to receive credit will require evaluation by a city employee; this will ensure that each BMP effectively meets one or more stormwater improvement criteria. However, this also means the city of Clinton may need to evaluate over 500 BMP projects each year. While this is accounted for in the budget, these calculations and site visits could require a lot of time. An alternative to alleviate this time intensive process would be to limit the use of BMPs for credit reduction to commercial and industrial properties. This would result in evaluating fewer but also larger BMP projects, which would still allow for substantial improvement in stormwater management as the BMPs implemented by larger properties are expected to have a more significant effect than BMPs implemented by residential properties.

In the proposed design, only properties within the stormwater utility service area are charged a stormwater utility fee. An alternative to this would be to include all properties within the city limits. Including all properties within the city limits would increase the number of properties charged a user fee, consequently lowering the base ERU rate for residents. With a lower base rate, BMP credits on single-family residential property would have a small monetary effect on both the city and the property owner, resulting in minimal to no benefit of using a city employee to evaluate BMPs for residential credit. Therefore, removing a credit option for single-family residential properties would be insignificant, while saving the city time and money spent on evaluating these residential BMPs. These residential credit alternatives were not chosen because rate reductions for single-family residential properties were prioritized for Clinton.

Section VI – Final Design Details

ERU Method

The impervious area of each parcel was estimated using GIS tools, using data provided by the city of Clinton. Figure 2 shows the impervious areas. All the properties outside of the stormwater utility service area were removed from the dataset, as they will not be charged a utility fee; this was requested by the City Engineer. To determine the ERU, properties found in single-family zones were filtered through to remove any property that did not have an actual single-family house present.

The median impervious area of single-family home properties was used to determine the ERU area instead of the mean impervious area. This will help reduce any outliers incorporated into our data and is statistically more accurate. The median area is less than the mean area; this will lower the monthly base fee but will shift more of the revenue income to be collected from commercial and industrial properties. Minimizing the cost to residents will likely make the new utility more accepted by the public.

The median impervious area of the remaining properties was used as the ERU: 2,707ft^2. This resulted in a total of 34,025 ERUs. Details regarding impervious areas and the ERU calculations are in Appendix D.

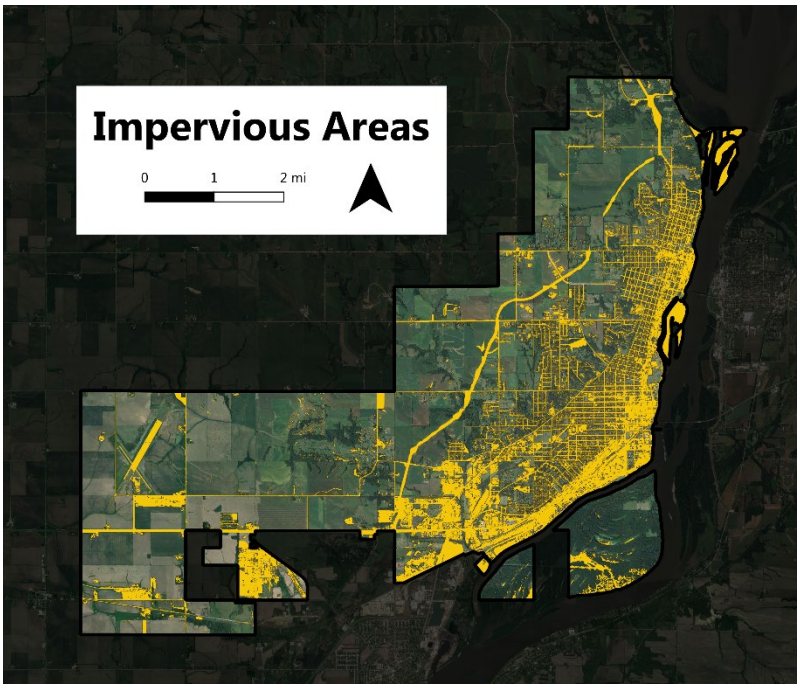

Figure 2: Map of calculated impervious areas in Clinton.

Credits

Landowners will be given the opportunity to receive credit to lower their ERU rate. Credits will be allotted based on the implementation of BMPs. Credits will be divided into three criteria: Type I, Type II, and Type III. The maximum credit allotted is 75%.

Type I: Volume Reduction – The parcel has BMPs in place that infiltrate a volume of runoff equal to or greater than the recharge volume as defined in the ISWMM. This credit would reduce the parcel's ERU rate by up to 25%.

Type II: Peak Runoff Reduction – The parcel has BMPs in place to temporarily store stormwater runoff, sufficient to reduce the peak discharge rate of flow released from the parcel. This credit would reduce the parcel's ERU rate by up to 25%.

Type III: Water Quality Improvement – The parcel has BMPs in place that reduces the total suspended solids (TSS) discharged in runoff as defined in the IWSMM. This credit would reduce the parcel's ERU rate by up to 25%.

Appendix D contains more information on the criteria for credits.

Residential customers are anticipated to utilize BMPs with smaller footprints based on their significantly smaller impervious areas. Based on the three criteria identified for BMP credit, residential BMPs will fall underneath Type I and Type II because of smaller stormwater runoff areas. It was determined that Type III is more complex for residential properties to get credit unless a combination of BMPs is utilized. That said, a rooftop disconnection is a BMP that affects both the quantity and quality of runoff. This is offered to residents to maintain an equitable opportunity for residential properties to receive maximum credit reduction. The ISWMM identifies a rooftop disconnection as an infiltration and water quality method, which directs the stormwater runoff from the rooftop to a rain garden or other pervious surfaces with higher infiltration rates which are based on soil composition.

Residential BMPs were determined to have more specific measuring criteria for anticipating stormwater runoff quantities taken from the ISWMM and ISWEP. Appendix E indicates the identified residential BMPs and their benefits to stormwater management for smaller scale projects. In addition, page 7 of the design drawings identifies specific cross-section areas to construct rain gardens, rain barrels, and rooftop disconnection for residential properties to follow based on the ISWEP and ISWMM. It was further recognized that larger projects by residential properties would be offered in the credit/cost-share program, such as pervious pavements, but may not be accessible until funding for a reimbursement program is in order.

Commercial, industrial, and multi-family residential properties were identified as large-scale zones with more substantial ERU rates, reflecting their need for more effective practices implemented in their impervious area. Based on the enormous magnitude of impervious areas on these properties, the selected BMPs were identified based on the ability to comply with the three types of credit criteria.

An additional way to quantify a BMP's effectiveness and assess its eligibility for credits for commercial, industrial, and multi-family residential properties that contain less than ½ acres of impervious area is available. BMPs for properties this size should be sized to be at least 10% of the impervious area on the site. The goal of this is to reduce the cost of assessing the effectiveness of BMPs for small properties. Properties with an impervious area larger than ½ acre may need to provide engineering studies to prove satisfaction with the credit requirements.

Refer to Appendix D for BMPs with correlated benefits. Pages 5 and 6 of the design drawings identify cross-sections for commercial, industrial, and multi-family residential properties BMPs eligible for credit. This represents the more expensive and complex BMPs that are directed towards larger properties. This resulted in an inequitable practice. Implementing a cost-share program was encouraged to allow for more equitable opportunities.

Cost-Share Program

A cost-share program would involve the municipality paying up to 50%, or a maximum of $2,000, towards the expenses regarding BMP implementation. The cost-share program requires an upfront funding source, therefore, can only be implemented until after the first year when

revenue has been generated. This program is designed to encourage property owners to participate in sustainable stormwater practices. The funds allocated for this program are available to all property types and will be on a first-come first-served basis.

Based on the three criteria, the BMPs indicated in Appendix E have been selected to be utilized for the cost-share program. Utilizing the ISWEP and ISWMM, these BMPs were selected for the cost-share program based on its ability to reduce the stormwater runoff quantity or enhance stormwater runoff quality. In addition, the cost-share program was recommended for Clinton based on recorded improvements of other ordinances of similar populations as Clinton. Finally, it was established that to make the stormwater utility fee equitable for all properties, educating the community would be necessary.

Revenue

The city of Clinton has provided an estimated target annual revenue based on a cost-of-service to fund sustainable stormwater practices. The target revenues are provided below.

- Operation and Maintenance
  - $350,000 – for personnel to provide catch basin cleaning, street sweeping, and general maintenance
  - $200,000 – for storm sewer/catch basin repairs and maintenance
  - $100,000 – for equipment or saved for larger purchases
- Capital Improvements
  - $1,000,000 – for storm sewer projects
- Cost-Share Program
  - $100,000 – for BMP expenses regarding the cost-share program

It is estimated that 10% of total parcels will utilize the maximum credit of a 75% fee reduction. More information on this estimate can be found in Appendix D. An **ERU base rate of $4.63** will generate sufficient funds to reach the target annual revenue of $1,750,000. This base rate generates $1,891,892 annually if no credits were applied. More information on these calculations can be found in Appendix F.

Section VII – Cost Estimate

Implementing the new utility fee will add new costs to the city of Clinton.

The city of is responsible for billing their property owners. The city likely already has the necessary infrastructure and systems in place for charging property owners for other utilities, so it should take the city very few hours to incorporate the stormwater utility bill and is considered negligible for the annual cost estimate.

A qualified city employee will need to evaluate BMPs to determine credit eligibility and approve cost-share applications. These tasks are expected to require intensive labor hours.

The impervious area cover data will need to be reevaluated and updated as the city develops and changes. These calculations can be done with the data the city already collects and can be

performed on free software, so the sole cost is staff hours. This task will not need to be completed every year, so it was excluded from the annual cost estimate.

The following table is an estimate of the annual cost of implementing the proposed stormwater utility fee:

Task	Estimated Hours	Estimated Wage	Annual Cost
Evaluating BMPs for credit eligibility	800	$25/hour	$20,000
Approving cost-share program applications	400	$25/hour	$10,000
Total:			**$30,000**

Appendices

Appendix A: Gantt Chart

Clinton Stormwater Utility Fee

Project Start: Mon, 9/12/2022

Display Week: 1

TASK	Team Member	START	END	14-Sep	21-Sep	28-Sep	5-Oct	12-Oct	19-Oct	26-Oct	2-Nov	9-Nov	16-Nov
Determine the average areas and impervious areas based on land use													
Aquire data and initial intersections/clips/filtering	Margaret, Alex	9/14/22	9/21/22										
Create impervious area layer	Alex, Margaret	9/28/22	10/19/22										
Clip impervious area layer by zones	Margaret	10/19/22	10/26/22										
Filter single family for ERU calculation	Margaret	10/26/22	11/2/22										
Determine optimal rate structure													
Research existing rate structures in the Midwest	Maritza, Laura	9/14/22	10/5/22										
Determine the best option for Clinton using Multi-Criteria Analysis	All	9/28/22	10/5/22										
Determine BMPs eligible for credit													
Research possible methods	Maritza, Laura	10/5/22	11/9/22										
Decide how much of a reduction should be offered	Maritza, Alex	11/9/22	11/16/22										
Develop a revenue calculator	Alex	11/2/22	11/16/22										

Appendix B: Iowa Ordinances Research and Credit Analysis

Cities in Iowa Ordinance Research and Analysis

*Total utility cost was found using 400 ft^3 per residence

City	Population	Total Stormwater Budget	ERU rate	ERU (ft^2)	Sanitary sewer Rate	Water Rate	Credit (reduce overall fee)	Cost share, rebate, grant program	Total utility cost*
Cedar Rapids	132,000	$13,500,000	$7.26	4,356	$12.19 / 1000 gal	$14.79 / 200 ft^3	Yes	Yes	$73.30
Coralville	24,222	$700,000 n/a CIP	$3.00	3,440	$4.40/ 100 ft^3	$1.92 / 100 ft^3	No	Yes	$53.07
Dubuque	51,941	$17,900,000	$9.00	2,917	$5.91/ 100 ft^2	$8.27 / 200 ft^3	Yes	Yes	$65.72
Johnston	24,500	$1,730,000	$7.05	4,000	$6.00 / 100 ft^3	$7.85/ 1,000 gal	No	Yes	$67.59
Marion	41,500	$30,632 n/a CIP	$3.50	No data	$6.00 / 100 ft^3	$15.25/ 200 ft^3	Yes	Yes	$64.00
Marshalltown	27,591	$165,000	$4.00	2,800	$3.11 / 100 ft^3	n/a	Yes	No	$40.43
North Liberty	20,875	No data	$2.00	No data	$5.63 / 1000 gal	$7.01 / 1000 gal	No	Yes	$88.5
Norwalk	12,799	$1,995,500	$7.50	No data	$10.43/ 1,000 gal	$7.61 / 1000 gal	No	Yes	$74.98
Pleasant Hill	10,157	$2,050,000	$4.00	3,500	$7.15 / 1000 gal	$9.80 / 1,000 gal	No	Yes	$76.70
Waukee	23,940	$1,050,000	$6.25	2,973	$11.57 / 1,000 gal	$9.15 / 1,000 gal	No	Yes	$97.04

Cedar Rapids, Iowa

Population	Annual Operating Stormwater Budget	Annual CIP Budget Stormwater Budget	ERU rate	ERU (ft^2)	Sanitary sewer Rate	Water Rate	Credit (reduce overall fee annually)	Cost share, rebate, grant program
132,000	$8,200,000	5,300,000	$7.26	4,356	$12.19 / 1000 gal	$14.79 / 200 ft^3	Yes	Yes

Credit:

Reducing overall fee annually

- ERU reduction for installation of stormwater infiltration practices in accordance with the ISWMM

% of lot impervious area runoff infiltrated in a 1.25" rain event.	ERU count reduction
10% to 25% by area	10%
25% to 49% by area	20%
50% to 74% by area	30%
75% to 100% by area	40%

Cost share program

- Reimburses 50% of qualifying expenses
- A maximum reimbursement for residential properties no for commercial
- Uses all BMPs for water quality and quantity credit

Other (Educational Credit)

- Education classes
- Service-learning project

Coralville, Iowa

Population	Annual Operating Stormwater Budget	Annual CIP Budget Stormwater Budget	ERU rate	ERU (ft^2)	Sanitary sewer Rate	Water Rate	Credit (reduce overall fee annually)	Cost share, rebate, grant program
24,222	$700,000	No data	$3.00	3,440	$4.40/ 100 ft^3	$1.92 / 100 ft^3	No	Yes

- ERU rate + $1.40 per ERU for commercial
- Sanitary Sewer (13.75 / 200 ft^3) + $4.40 for each additional 100 ft^3
- Water rate ($7.44 / 200 ft^3) + $1.92 for each additional 100 ft^3

Credit:

Grant Program (Stormwater Management Best Practices Grants)

- Rain gardens, soil quality restoration, cisterns, infiltration trenches, pervious paving, bioretention cells / swales
- Reimburse up to $2,000 or 50% of total project cost
- Uses an application program that the City of Coralville looks at

Dubuque, Iowa

Population	Annual Operating Stormwater Budget	Annual CIP Budget Stormwater Budget	ERU rate	ERU (ft^2)	Sanitary sewer Rate	Water Rate	Credit (reduce overall fee annually)	Cost share, rebate, grant program
51,941	$1,900,000	$16,000,000	$9.00	2,917	$5.91 / 100 ft^3	$8.27 / 200 ft^3	Yes	Yes

Credit:

Reducing overall fee annually

Private Detention Basin Credit		
Peak Flow Preservation	Credit may be available if the peak flow of runoff during 2, 10, and 100-year rains after development does not exceed the peak flow of runoff that occurred prior to development.	10%
Peak Flow Reduction	Credit may be available if a detention basin is shown to reduce the pre-development peak flow of runoff from the site by at least twenty percent during 2, 10, and 100-year rains following development.	12%
Private NPDES Credit		
An NPDES credit may be available is available for a customer who maintains an NPDES General Permit No. 1 or General Permit No. 2 for stormwater discharge associated with an industrial activity.		10%

Cost share program -("Stormwater Best Management Practices (BMP) Material Assistance Program")

- Reimburse up to $1000 or 50% of the total project cost
- Qualifying projects include
  - Rain Gardens, Bio-Retention Swales, Permeable Paving systems, Streambank Restoration

Johnston, Iowa

Population	Annual Operating Stormwater Budget	Annual CIP Budget Stormwater Budget	ERU rate	ERU (ft^2)	Sanitary sewer Rate	Water Rate	Credit (reduce overall fee annually)	Cost share, rebate, grant program
24,500	$980,000	$750,000	$7.05	4,000	$6.50 / 1000 gal	$7.85 / 1000 gal	No	Yes

- Sanitary rate ($7.04) + $6.50 for 1,000 gal
- Water rate ($10.56) + $7.85 for 1,000 gal

Credit:

Reducing overall fee annually

- Exist but not provided

Cost share program

- Exist but not provided

Marion, Iowa- Similar structure to Clinton, IA

Population	Annual Operating Stormwater Budget	Annual CIP Budget Stormwater Budget	ERU rate	ERU (ft^2)	Sanitary sewer Rate	Water Rate	Credit (reduce overall fee annually)	Cost share, rebate, grant program
41,500	$30,632	No data	$3.50	No data	$6.00 / 100 ft^3	$15.25 / 200 ft^3	Yes	Yes

- Sanitary sewer rate ($2.00) + $6.00 for each additional 100 ft^3
- Water rate ($4.00) + 15.25 for ¾ inch meter

Credit:

Reducing overall fee annually

1. Peak Flow Control – TYPE I. The parcel has facilities in place to temporarily store stormwater runoff from the property, sufficient to reduce the peak discharge rate of flow released from the site.

2. Runoff Volume Reduction Credit – TYPE II. The parcel has facilities or controls in place that infiltrate a volume of runoff equal to or greater than the 'Recharge Volume – Re v' as defined in the Iowa Stormwater Management Manual.

3. Water Quality – TYPE III. The parcel has facilities or controls in place that reduce the amount of total suspended solids (TSS) discharged in runoff, as compared to no controls.

Cost share program (Residential cost-sharing / rebate program)

- Qualifying BMPs
  - Rain gardens, Rain barrels, Lawn soil improvement

Marshalltown, Iowa

Population	Annual Operating Stormwater Budget	Annual CIP Budget Stormwater Budget	ERU rate	ERU (ft^2)	Sanitary sewer Rate	Water Rate	Credit (reduce overall fee annually)	Cost share, rebate, grant program
27,591	$150,000	$15,000	$4.00	2,800	$3.11 / 100 ft^3	n/a	Yes	No

- Sanitary sewer rate ($23.99) + $3.11 for each additional 100 ft^3
- The Water Works Board of the Marshalltown Water Works creates water rate

Credit:

- Exists but not provided

North liberty, Iowa

Population	Annual Operating Stormwater Budget	Annual CIP Budget Stormwater Budget	ERU rate	ERU (ft^2)	Sanitary sewer Rate	Water Rate	Credit (reduce overall fee annually)	Cost share, rebate, grant program
20,875	No data	No data	$2.00	No data	$5.63 / 1000 gal	$7.01 / 1000 gal	No	Yes

- Sanitary sewer rate ($31.24) + $5.63 for each additional 1,000 gallons
- Water rate ($17.44) + $7.01 for each additional 1,000 gallons

Credit:

Rebate Program

- BMPs
  - Rain gardens, Bioswales, Pervious paving and other infiltration practices, Bank stabilization, Soil quality restoration

Partnerships:

- Uses the "Your Best Lawn: Green Lawns Don't Have to Cost the Earth"

Norwalk, Iowa

Population	Annual Operating Stormwater Budget	Annual CIP Budget Stormwater Budget	ERU rate	ERU (ft^2)	Sanitary sewer Rate	Water Rate	Credit (reduce overall fee annually)	Cost share, rebate, grant program
12,799	$70,500	$1,425,000	$7.50		$10.43/ 1,000 gal	$7.61 / 1000 gal	No	Yes

- Sanitary sewer rate ($7.50) + $10.43 per 1,000 gallons
- Water rate ($6.00) + $7.61 for each 1,000 gallons

Credit:

Cost share program (Called Homeowner Grant Program)

- Reimbursement of up to 50% of a project cost to a maximum of $1,500
- Applications are reviewed by the Community Development Department and then recommended for funding by stormwater advisory committee

Pleasant Hill, Iowa

Population	Annual Operating Stormwater Budget	Annual CIP Budget Stormwater Budget	ERU rate	ERU (ft^2)	Sanitary sewer Rate	Water Rate	Credit (reduce overall fee annually)	Cost share, rebate, grant program
10,157	$650,000	$1,400,000	$4.00	3,500	$7.15 / 1000 gal	$9.80 / 1,000 gal	No	Yes

- Sanitary rate ($11.98) + $7.15 for each 1,000 gallons
- Water rate ($10.00) + $9.80 for each 1,000 gallons

Credit:

Cost share program (Use a BMP reimbursement)

- Reimburse for installation of most BMPs up to 50%
  - Ex: Rain barrels – 50% or $75

Partnerships:

- Apart of rain campaign & Best lawn program

Waukee, Iowa

Population	Annual Operating Stormwater Budget	Annual CIP Budget Stormwater Budget	Stormwater rate	ERU (ft^2)	Sanitary sewer Rate	Water Rate	Credit (reduce overall fee annually)	Cost share, rebate, grant program
23,940	$775,000	$275,000	$6.25	2,973	$11.57 / 1,000 gal	$9.15 / 1,000 gal	No	Yes

- Sanitary sewer rate ($15.32) + $11.57 for each additional 1,000 gallons
- Water rate (13.47) + $9.15 for each additional 1,000 gallons

Credit:

Stormwater Grant Program

- BMPs
  - Soil quality restoration, rain gardens, Bio-retention cells, native landscaping
- Standards and limits of Waukee grant program

Standard Grant Funding Maximum Limits:

- $1,000 for SQR, per property (see more details below)
- $1,000 per BMP
- $5,000 per individual single-family or townhome property, inclusive of any funds for SQR or other BMPs
- $20,000 per Homeowners' Association
- $5,000 for commercial properties paying up to 5 ERUs per month. An additional $1,000 would be allowed for each additional ERU, up to a maximum of $20,000 per project. For example, a property with 8 ERUs would be eligible for $8,000; 20 ERUs or greater would be eligible for $20,000, etc.

There is a $20,000 maximum for any project, regardless of the number of applicants or size of the property. Adjacent property owners could work together to create a larger project; for example, tiling several rear yards. In this case, the grant limit increases by $5,000 with each additional property owner to a maximum of $20,000 per project.

Appendix C: Multi-Criteria Decision Analysis

Decision Matrix

Multi-Criteria Decision Analysis

Objective: Select the best by-pass alternative

Criteria	Weights
Revenue capacity	10%
Equity/ fairness	30%
Data requirements	10%
Cost (short and long)	25%
Ease of understanding	20%
Stakeholder approval	5%
	100%

Rank/Adequacy		
ERU	SFU	Per-Square ft
3	2	1
1	2	3
3	1	1
3	1	1
3	1	2
2	3	1

Score		
ERU	SFU	Per-Square ft
0.3	0.2	0.1
0.3	0.6	0.9
0.3	0.1	0.1
0.75	0.25	0.25
0.6	0.2	0.4
0.1	0.15	0.05
2.35	1.5	1.8

Final Scores (best option has the highest score)

Appendix D: Design Calculations and Assumptions

Design Calculations and Assumptions

Impervious Area Calculations

The impervious area was estimated using GIS tools, using data provided by the city of Clinton. An aerial image raster of the city, obtained from Iowa Geospatial Data – Office of the Chief Information Officer, was inputted into the segmentation tool to estimate the shapes of objects in a newly generated shapefile. A few select features were used to train a machine learning tool to identify impervious and pervious surfaces. Additional data from OpenStreetMap was used to help increase the accuracy of the impervious cover. Building footprints and pavement shapefiles were erased and then intersected with the impervious cover shapefile to correct areas known to be impervious. The parcels and zoning shapefiles that were provided by the city were intersected together. Then the impervious cover shapefile was clipped by the parcels/zoning shapefile. The parcel data allowed us to determine how much impervious area was present in each individual property and zoning attribute allowed us to separate the parcels by land use classifications. A separate shapefile was made for each land use classification from the resulting shapefile. The value of the impervious area for each parcel was determined by running the area function in the field calculator on each shapefile.

To find the ERU, the properties found in the single-family zones were filtered through to remove any property that did not have an actual single family house present. Churches, hospitals, undeveloped land, and other types of property were removed through visual inspection of the aerial image and property ownership. The median impervious area of the remaining properties was used as the ERU.

Credit Participation Estimate

We are assuming that 10% of landowners will participate in the credit program. The Iowa Stormwater Education Partnership estimates 3% to 5% of landowners participate in stormwater credits programs nationwide. We chose 10% because underestimating incurs the risk of not generating enough revenue for the stormwater sewer system.

Appendix E: Credits for BMP Information

Credit/Cost-Share Program Criteria

Type	Purpose	Percent Reduction Maximum
Volume Reduction	The parcel has BMPs in place that infiltrate a volume of runoff equal to or greater than the recharge volume as defined in the ISWMM.	25%
Peak Runoff Reduction	The parcel has BMPs in place to temporarily store stormwater runoff, sufficient to reduce the peak discharge rate of flow released from the parcel.	25%
Water Quality	The parcel has BMPs or controls in place that reduces total suspended solids (TSS) discharged in runoff.	25%

The following BPM's have been identified for use in Clinton, Iowa. These BMPs are eligible for an overall stormwater utility fee reduction. ***Residential properties***

BMPs	Benefits for stormwater runoff	Resource
Rooftop and Pavement Disconnection	• Treats stormwater runoff through filtering and infiltration • Can reduce amount of downstream erosion caused by high volume runoff • Pollutant treatment for small driveways and rooftops	https://www.iowadnr.gov/Portals/idnr/uploads/water/stormwater/manual/iswmm_chapter05.pdf https://iowastormwater.org/green-infrastructure/tree-boxes-trenches/
Rain barrel	• Reduced stormwater entering existing drainage system	https://iowastormwater.org/campaigns/rainscaping/rainwater-harvesting/
Rain Gardens	• Improves groundwater discharge • Pollutant treatment for small driveways and rooftops	https://iowastormwater.org/campaigns/rainscaping/rain-gardens/
Soil quality management and restoration	• Increases the infiltration and groundwater recharge with healthier soils • Reduces pollution through infiltration	https://iowastormwater.org/campaigns/rainscaping/soil-quality-restoration/

Industrial/Commercial/Multi-Family properties

BMP's	Benefits to stormwater runoff	Resource
Porous or Permeable pavement	• Reduces runoff • Increases groundwater recharge through infiltration • Allows reduction for required infrastructure, such as catch basins and pipes	https://iowastormwater.org/green-infrastructure/permeable-pavers/
Bioretention	• Reduces runoff volume, flowrate, and temperature • Infiltration and groundwater recharge • Improves the quality of local surface waterways • Reduces soil erosion • Provides wildlife habitat	https://iowastormwater.org/green-infrastructure/bioretention-cells/
Bioswales	• Stormwater volumes can be reduced through infiltration • Increases groundwater recharge	https://iowastormwater.org/green-infrastructure/bioswales/
Bio-retention Planters	• Provides treatment through filtration before conveyance to stormwater drainage systems	https://iowastormwater.org/green-infrastructure/bioretention-cells/
Green roofs	• The vegetation will moderate interior building temperatures and provide insulation from heat and cold • Enhances wildlife habitat	https://iowastormwater.org/green-infrastructure/green-roofs/
Soil quality management and restoration	• Increases the infiltration and groundwater recharge with healthier soils • Reduces pollution through infiltration	https://iowastormwater.org/campaigns/rainscaping/soil-quality-restoration/
Native landscaping	• Increasing infiltration and groundwater recharge • Decreases stormwater runoff from parcel	https://iowastormwater.org/campaigns/rainscaping/native-landscaping/

Appendix F: Revenue Calculator

ERU Information (monthly)								
SFH		**MFH**		**Commercial**		**Industrial**	
Average Imp. Area (ft^2):	3010	Average Imp. Area (ft^2):	4368	Average Imp. Area (ft^2):	16956	Average Imp. Area (ft^2):	88929
Median Imp. Area (ft^2):	2707	Median Imp. Area (ft^2):	2524	Median Imp. Area (ft^2):	5560	Median Imp. Area (ft^2):	18448
Base Rate:	**$4.63**	Total Imp. Area (ft^2):	9464660	Total Imp. Area (ft^2):	25332185	Total Imp. Area (ft^2):	38772905
# of parcels:	6847	# of ERUs	3496	# of ERUs	9358	# of ERUs	14323
Revenue	$31,726.52	Revenue	$16,200.89	Revenue	$43,361.72	Revenue	$66,368.53

Target Annual Revenue Information:	
Personnel Budget:	$350,000
Repairs/Maintenance:	$200,000
Equipment:	$100,000
Capital Funds:	$1,000,000
Cost-Share Program	$100,000
Total:	$1,750,000

% of Parcels Utilizing Credits:	10.00%
Max. Credit	75%

Total # of ERUs:	34025
Total Annual Revenue (w/o credits):	**$1,891,891.89**
Total Annual Revenue (w/ credits):	**$1,750,000.00**

*Notes:
- 10% of parcels utilizing the maximum 75% fee reduction

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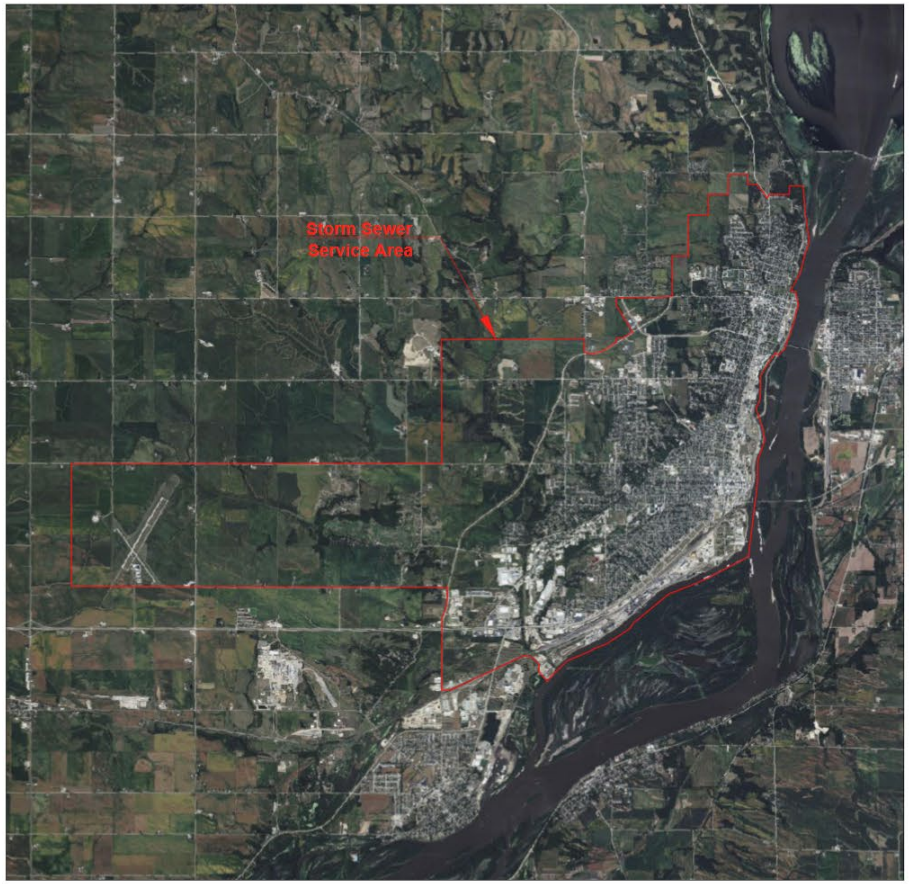
Design Drawings

CLINTON STORMWATER UTILITY FEE

University of Iowa



SHEET NO.	INDEX OF SHEETS
1	TITLE PAGE
2	STORMWATER UTILITY FEE LAND USE CLASSIFICATIONS
3	POTENTIAL STORMWATER PROJECT LOCATIONS
4	UTILITY FEE STRUCTURE
5-6	POTENTIAL BMPS FOR COMMERCIAL, INDUSTRIAL, AND MULTIFAMILY RESIDENTIAL PROPERTIES
7	POTENTIAL BMPS FOR SINGLE FAMILY RESIDENTIAL PROPERTIES

SHEET NO. 01

SHEET NAME: Title Sheet

Print Date:	12/9/2022
Drawing File Name:	Stormwater Utility Fee Plan Set
Scale:	As Shown

Sheet Revisions

Date:	Comments	Init.

Clinton Stormwater Utility Fee

Clinton, Iowa

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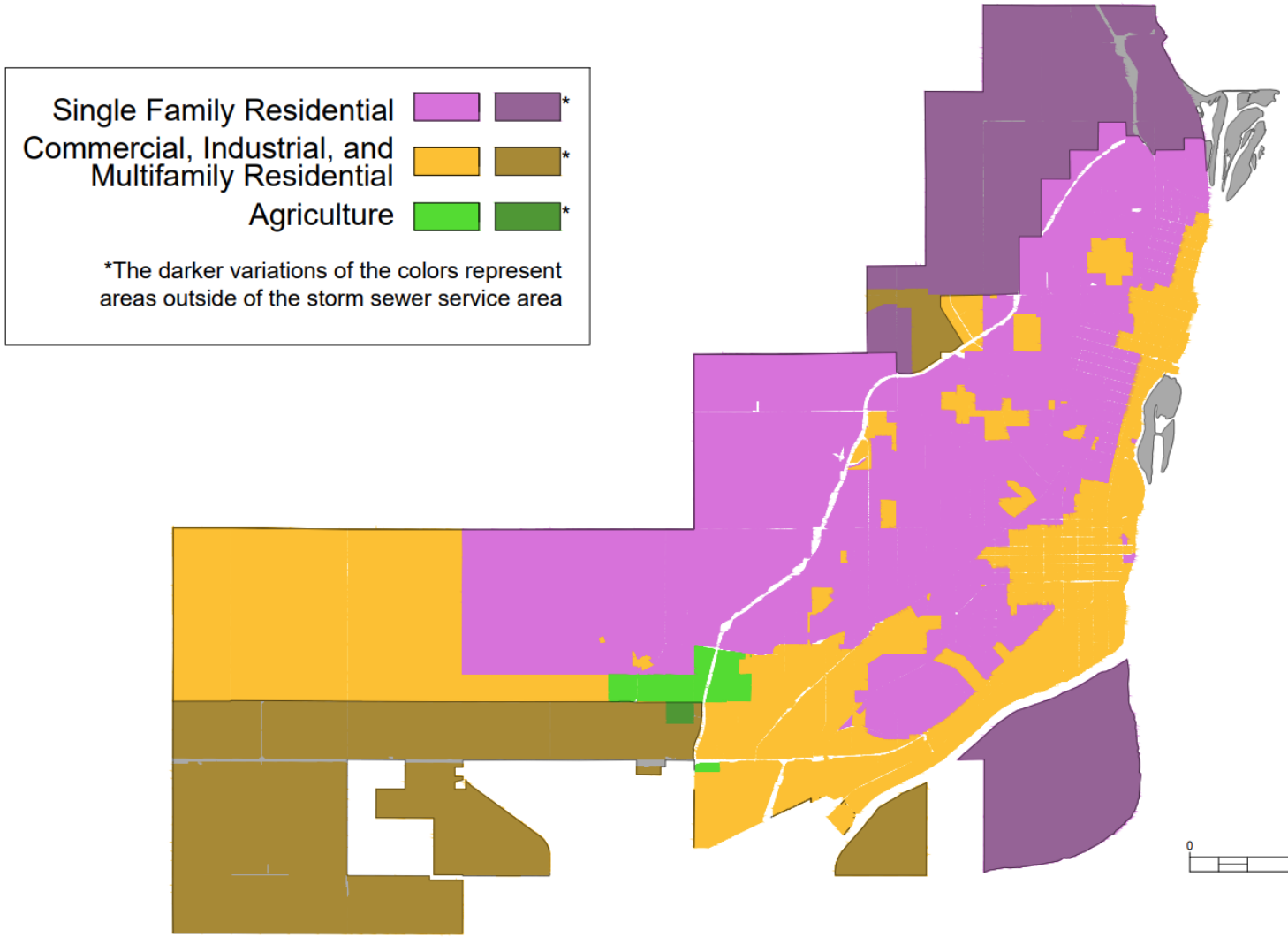
PROJECT:	CEE: 4164
DATE :	12/9/2022
DRAWN BY:	Margaret Trowbridge
REVISION:	



PROJECT: CEE-4164
DATE : 12/9/2022
DRAWN BY: Margaret Trowbridge
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Clinton Stormwater Utility Fee

Clinton, Iowa

SHEET NAME
Stormwater Utility Fee Land Use Classifications

SHEET NO.
02

PROJECT: CEE:4164
DATE : 12/9/2022
DRAWN BY: Margaret Trowbridge
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Clinton Stormwater Utility Fee

Clinton, Iowa

SHEET NAME
Potential Stormwater Project Locations

SHEET NO.
03

Utility Fee Rate Structure

Single family properties are charged at a uniform rate of $4.63. This is the equivalent residential unit (ERU).

Commercial, industrial, and multifamily properties are a single land use classification for the utility fee, charged by a multiplier of their impervious area proportional to the ERU.

Agriculture properties are not charged a stormwater utility fee because of their low impervious areas.

Only properties within the storm sewer service area are charged a stormwater utility fee.

Credits

Property owners can receive credits for participating in best management practices to reduce their annual stormwater utility fee. BMPs can help manage stormwater by controlling flooding, reducing erosion, and water quality improvement. The most important measurable criteria for BMPs are peak flow control, runoff volume reduction, and water quality. Each criteria which a BMP improves will result in a percent reduction of 25% of the annual stormwater utility fee.

Peak Flow Control

The parcel has BMPs in place to temporarily store stormwater runoff from the property, sufficient to reduce the peak discharge flow rate released from the site

Runoff Volume Reduction

The parcel has BMPs or controls in place that store the volume of runoff equal to or greater than the Recharge Volume – Re_V as refined in the Iowa Stormwater Management Manual.

Water Quality

The parcel has BMPs or controls in place that reduce the amount of total suspended solids (TSS) in discharged runoff, as compared to no controls.

Different BMPs will be eligible to receive credits for single family residential properties and for commercial, industrial, and multifamily residential properties.

For commercial, industrial, and multifamily residential properties that contain less than $\frac{1}{2}$ acres of impervious area, BMPs should be sized to be at least 10% of the impervious area on the site. Properties that have an impervious area that is larger than $\frac{1}{2}$ acre may need to provide engineering studies in order to prove satisfaction of the credit requirements.

Whether or not these criteria are met will be quantified by city staff members using resources such as the Iowa Stormwater Management Manual (ISWMM), Iowa Stormwater Education Partnership.

Cost-Share Program

After the first year of implementing the stormwater utility fee, a cost-share program will be introduced. All properties are eligible to participate. The city will reimburse property owners 50% for implementing BMPs.

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Clinton Stormwater Utility Fee

Clinton, Iowa

SHEET NAME

Utility Fee Structure

SHEET NO.

04

Potential BMPs for Commercial, Industrial, and Multifamily Residential Properties - 1/2

Bioretention Cells

Bioretention cells are landscaped depressions that retain stormwater runoff from impervious surfaces. They reduce runoff volumes and water pollution. Bioretention cells are required to have:

- Outlet connected to subdrain
- 18-30 inch deep modified soil layer (75-90% washed concrete sand, 0-10% organic material, 0-25% soil with a soil texture that includes A-horizon characteristics and meets specifications)

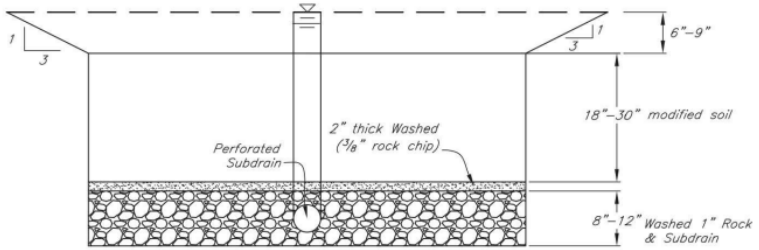

Image source: Iowa Stormwater Education Partnership

Bioswales

Bioswales are sloped drainageways designed to manage stormwater. They are populated with vegetation that provides erosion protection, increases infiltration, and reduces velocity rate. They should be located in sloped areas so stormwater will drain towards them.

- Modified soil
- Washed rock
- Perforated subdrain
- Berms
- Vegetated with plants that can withstand both heavy watering and drought
- Linear systems that are greater in length than width perform better

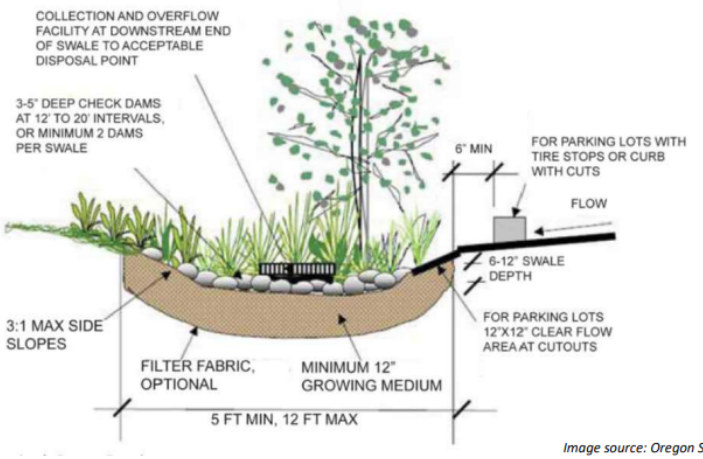

Image source: Oregon State University

Green Roofs

Green roofs are roofs that incorporate vegetation, soil or another growing medium, and a drainage layer over waterproof membranes. They can reduce 50% to 80% of roof runoff. Green roofs work best on flat or gently sloping roofs.

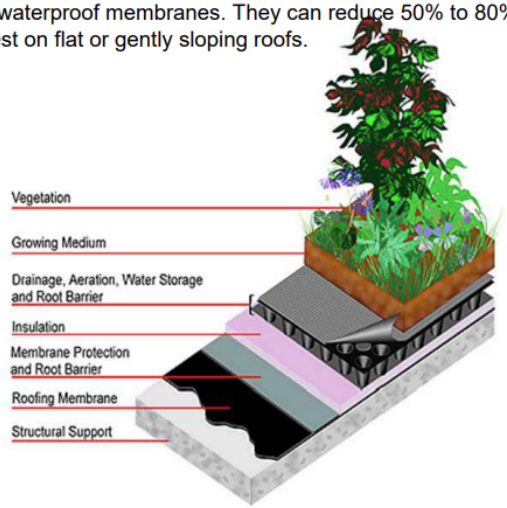

Image source: lid-stormwater.net

Soil Quality Management and Restoration

Soil quality restoration is the process of improving soil health on new or existing lawns. This can be done by reducing soil compaction through tillage or aeration and increasing organic matter content with the addition of high quality topsoil and/or compost. Good soil quality reduces the need for watering and organic matter increases infiltration. Soil quality management and restoration is comprised of:

- Soil aeration
- $\frac{1}{2}$ to $\frac{3}{4}$ inch of compost should be spread across the yard.

Image source: Tee Time Lawn Care (left), Home Depot (right)
Source: Iowa Stormwater Education Partnership

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Clinton Stormwater Utility Fee
Clinton, Iowa

SHEET NAME
Potential BMPs for Commercial, Industrial, and Multifamily Residential Properties - 1/2

SHEET NO.
05

Potential BMPs for Commercial, Industrial, and Multifamily Residential Properties - 2/2

Porous or Permeable Pavement

Porous or permeable pavement allows stormwater to infiltrate surfaces which would typically be impervious. These alternative pavements reduce stormwater runoff and filter out pollutants. These pavements must be comprised of:

- Permeable asphalt, permeable concrete, or permeable pavers
- A perforated drain tile installed in the rock chamber

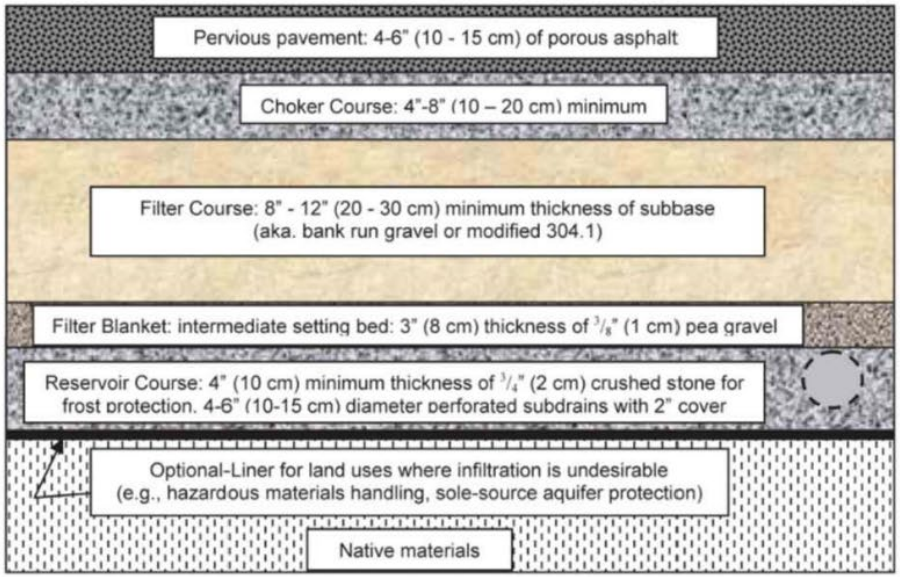

Image source: Minnesota Department of Transportation

Native Landscaping

Native landscaping can enhance the landscape's ability to infiltrate and manage stormwater because of the deep root systems. The following images show examples of plants native to Iowa; this is not a comprehensive list of all of the plants native to Iowa.

Image source: Iowa Stormwater Education Partnership
Source: Iowa Stormwater Education Partnership

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SHEET NAME
Potential BMPs for Commercial, Industrial, and Multifamily Residential Properties - 2/2

SHEET NO.
06

Potential BMPs for Single Family Residential Properties

Rain Barrel

Rain barrels can be purchased and connected to downspouts to store rainwater. This reduces the volume of stormwater entering the existing drainage system. Stored water can be used for watering yards and gardens. Rain barrels can be purchased at hardware stores. Rain barrels must:

- Be able to hold at least 40 gallons of water
- Be positioned to collect rainwater from roof

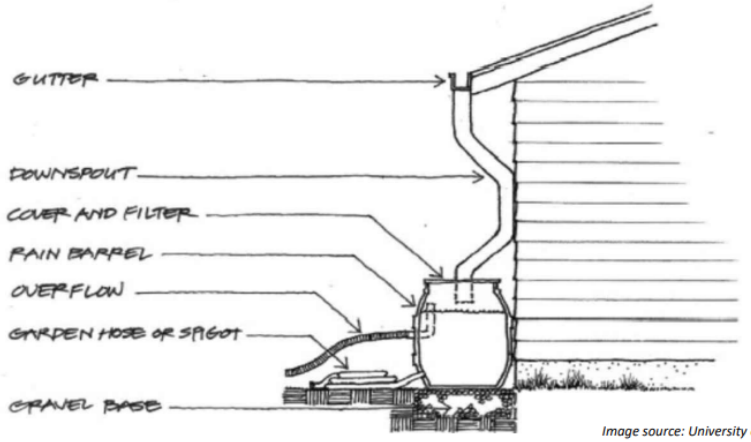

Image source: University of Flordia

Rain Gardens

Rain gardens are depressions or shallow bowls made in the landscape that is level from all directions. Runoff that travels to a rain garden temporarily ponds and eventually infiltrates into the soil. The garden can also trap pollutants for small driveways and rooftops. Rain gardens should be placed at a low point so water flows into it. Rain gardens must have:

- 50% of plants native to Iowa
- Amended soil (50% sand, 30% compost, 20% yard topsoil - low clay content)
- Edging (such as pavers, plastic, metal, or rocks)

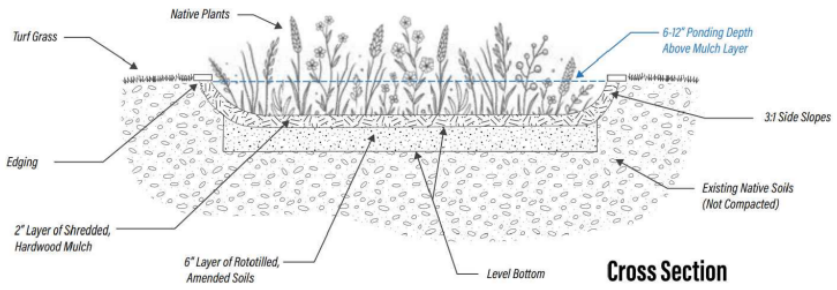

Image source: Iowa Stormwater Education Partnership

Rooftop and Pavement Disconnection

This can reduce the amount of downstream erosion caused by high volume runoff. It can reduce pollutants from small driveways and rooftops entering the sewer system. The impervious areas runoff should be routed directly to pervious surfaces.

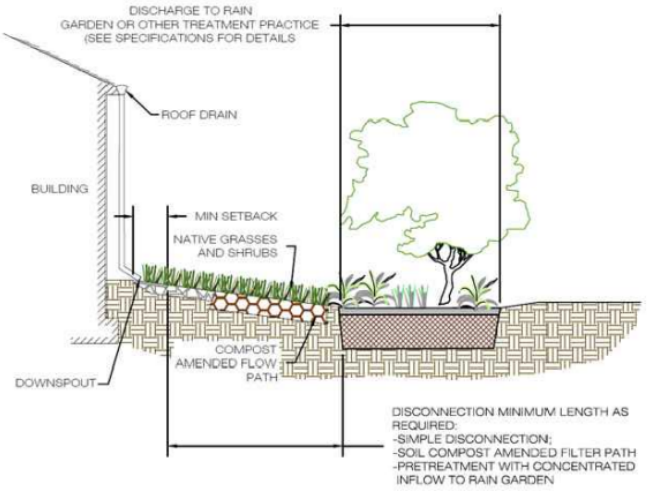

Image source: Virginia Stormwater BMP Clearinghouse

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SHEET NAME
Potential BMPs for Single Family Residential Properties

SHEET NO.
07