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NCTCOG Blue-Green-Grey Micro-Detention Project for University Park

Summary Report

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Prepared for:



**North Central Texas
Council of Governments**



City of
University Park, TEXAS
Committed to Excellence

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1 Project Background

The City of University Park currently experiences nuisance flooding during relatively frequent storm events. Surface flooding occurs during events as frequent as the 2-year storm event, and some homes and roadways have experienced flooding due to the limited inflow capacity of the storm drain system. The City experiences frequent redevelopment that results in larger home footprints and an increase in the amount of impermeable cover. Detention can be expensive, impractical, and hard to implement on small sites, particularly in areas that are already built out. Cities often do not require detention for small infill projects due to these factors. However, the aggregate impact of multiple small infill projects can pose a significant problem when the existing storm drain systems do not have the capacity for the increased runoff.

Through the North Central Texas Council of Governments (NCTCOG) Blue-Green-Grey grant, an innovative solution to provide micro-detention for small infill projects was developed that decreases peak discharges and improves water quality. The solution is adaptable for various site conditions and space requirements, especially in areas of full build out. The proposed solution is a micro-detention storage system (MDSS) that could be located underneath public, residential, and small commercial building driveways, sidewalks, or parking areas. Runoff is diverted from driveways, roof drains, and sidewalks to permeable strips running parallel to the pavement, feeding into an underground gravel bed detention area. Runoff will be detained in the gravel bed and slowly released to the existing storm drain system. Water quality benefits will be obtained by the filtration and sedimentation aspects of the design as well as by removal of metals through ionic exchange with the material used in the permeable strips.

The MDSS system is to be adopted into University Park's city standards. The City's goal is to incorporate this system into their community to alleviate the flooding and provide water quality benefits.

2 Project Summary

2.1 Data Analysis and Literature Review

A data analysis and literature review report was created to discuss the different Best Management Practices (BMPs) implemented across the United States and describe the current conditions of University Park. The MDSS system was required to successfully detain the water and remove common pollutants and metals from roadway runoff. Since micro-detention systems are not a standard practice, most of the literature analyzed described different systems and methods to achieve water quality benefits. One important finding was the filtration media used by the state of Washington in their media filter drain BMP. The media filter drain is expected to have an effective life of 25 years, and the tested filtration media is considered to be low maintenance due to results of consistent removal efficiency after a minimum of 15 years. The filtration media has also been proven to remove roadway pollutants such as phosphorus, TSS, copper, and zinc. Due to the low maintenance and water quality success the material was adopted for the micro-detention storage system.

The micro-detention systems were designed to mitigate the increased runoff created from the impervious area added to properties by redevelopment. University Park lot ordinances and zoning requirements were analyzed to understand how much impervious area is allowed at the residential homes. Historical information was also analyzed to see if homes were typically redeveloping to the maximum impervious area. By calculating the potential increase in impervious area due to redevelopment per lot size, the average amount of stormwater runoff needing to be captured from the 10 year storm event was calculated. In the preliminary design phase, it was determined that driveways would provide enough storage for the micro-detention storage systems to detain increased runoff from redevelopment for the 10 year event.

2.2 Standard Details and Specifications

During the design phase a sizing tool as well as standard details and specifications were created for University Park. Because the size of the system will vary at every location, a spreadsheet was created to ensure that the desired amount of runoff will be captured for each site. The sizing tool allows home-owners to input the amount of area being added during redevelopment and driveway size. The spreadsheet then provides the dimensions needed for constructing the MDSS at that specific site.

Standard details and specifications were also created following the current standards of University Park and NCTCOG. The details created are for the construction of the micro-detention storage system at residential homes for straight and circular driveways. The specifications include all the information needed to construct and implement the system, including material requirements and construction methods.

The following details were created:

- Micro-detention Typical Driveway Plan View
- Micro-detention Typical Driveway Profile
- Micro-detention Circular Driveway Plan View
- Micro-detention Circular Driveway Profile
- Micro-detention Typical and Circular Driveway Cross Section
- Micro-detention Outlet Structure Detail
- Micro-detention Rood Drain Connection and Chamber Connection Detail
- General Notes for Micro-detention Storage System

The following specifications were created:

- Micro-detention Storage System
- Micro-detention Water Quality Filter Media
- Micro-detention Underdrain
- Micro-detention Inlet and Outlet Structures
- Micro-detention Roof Drain Extension

3 Moving Forward

The next step is for the City of University Park to adopt the details and specifications, and implement the system across the city as well as incorporate it into city ordinance to be used for redevelopment. Though the details created were predominantly related to driveways, there are other areas where the MDSS could be applied. For instance, sidewalks and parking areas are also potential locations. There have been multiple discussions with University Park about potential public locations across the city where this system could be implemented, all of which would be optimal pilot testing sites.

4 Lessons Learned

There were multiple design challenges faced during the development of the BMP. First, the BMPs are quite varied across the country. A benefit to learning about the different BMPs was that best practices could be implemented into the new MDSS design. It was discovered that variations in BMP design are predominantly due to geographical and environmental characteristics. For instance, the amount of filtration media used had to be altered from the Washington design because the amount of rainfall is significantly less in Washington than at University Park. Another necessity when trying to incorporate best practices from other BMPs is to confirm that the materials can be locally sourced. After deciding on the composition of the filtration media, the challenge was finding reasonably priced sources near University Park.

One of the most difficult challenges that one could learn from was making the system applicable regardless of existing infrastructure. The idea was that MDSS would be a discrete system that could be implemented anywhere. However, that means that every system installed will be unique dependent on the location. Therefore the design had to be flexible so that it would not negatively affect existing infrastructure while also serving the purpose of detaining the desired stormwater runoff. This was achieved by creating a sizing tool that allows those implementing the system to take into account their specific situation and available space.

5 Summary

The Blue-Green-Grey grant allowed for the design of a micro-detention system that positively impacts flooding conditions in University Park while also improving the stormwater quality entering the stormwater system. The system can be implemented all over the city in both residential and public scenarios. Due to the system's scalability and affordability, implementing the MDSS city-wide could counteract the runoff problems associated with the growth and redevelopment of the city. The City of University Park plans to incorporate the standard specifications and details created into their typical construction standards.

6 References

City of University Park Zoning Ordinance, Section 2.9.2-2.9.3

Media Filter Drain: Modified Design Evaluation, University of Washington, Seattle, Washington, September 15, 2014

Highway Runoff Manual, Washington State Department of Transportation, Engineering and Regional Operations, Development Division, Design Office, April 2019