Appendix A-5: Preliminary Engineering Water Resources Design Report

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Preliminary Engineering Water Resources Design Report

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Introduction

Project Background

The METRO Blue Line Extension (BLE) project will extend light rail transit (LRT) passenger service from Target Field Station in Minneapolis to Oak Grove Parkway Station in Brooklyn Park. The project corridor is approximately 13.4 miles in length and runs through the cities of Minneapolis, Robbinsdale, Crystal, and Brooklyn Park, all located in Hennepin County (County). A large portion of the alignment is within the County Road (CR) 81 corridor, which is also known as West Broadway Avenue within Minneapolis. Within this report, West Broadway will refer to the Minneapolis segment and CR 81 will refer to the Robbinsdale, Crystal and Brooklyn Park segments. The project has been divided into four major segments corresponding to the major municipalities impacted by the project. See Figure 1 for the proposed project alignment.

- Minneapolis – The LRT guideway will start at Target Field Station and go west/northwest along 6th Avenue N, 7th Street N, Oak Lake Avenue to 10th Avenue N, 10th Avenue N to Washington Avenue N (CR 152), and Washington Avenue N to 21st Avenue N. A new bridge for LRT, vehicular traffic, bikes, and pedestrians will extend across I-94 to connect 21st Avenue N on the east and west sides of I-94. The guideway will continue to run along 21st Avenue N to Irving Avenue N, where it will turn southwest to connect to West Broadway near James Avenue N. 21st Avenue N will no longer carry vehicular traffic between 4th Street N and Irving Avenue N and will be converted to guideway for the LRT and bikeway, with sidewalks for pedestrians on both sides of the street. From James Avenue N, the guideway will run down the center of West Broadway to the Minneapolis city limit near North Memorial Medical Center. Stations will be located at Target Field (existing), Plymouth Avenue N and Washington Avenue N, Lyndale Avenue N and 21st Avenue N, James Avenue N, Penn Avenue N and West Broadway, and Lowry Avenue N and West Broadway. West Broadway will also be improved and reconstructed between James Avenue N to Lyndale Avenue N, even though LRT does not travel along this portion.
- Robbinsdale – The LRT guideway transitions to CR 81 through the City of Robbinsdale. The stations will be located at Lowry Avenue N and West Broadway and 40th Avenue N, and there will be a new park-and-ride structure at the existing US Bank site.
- Crystal – The LRT guideway remains on CR 81 through the City of Crystal. The project will replace the existing at-grade intersection of CR 81 and Bass Lake Road with a grade-separated interchange. A station and park-and-ride lot will be located at-grade at Bass Lake Road.
- Brooklyn Park – The LRT guideway will continue to run within the median on CR 81 in Brooklyn Park from 63rd Avenue to 73rd Avenue, then transitions from CR 81 to CR 103 via an elevated structure. The LRT guideway runs along the center of CR 103 from 73rd Avenue to the end point at Oak Grove Station. Stations will be located at 63rd Avenue, Brooklyn Boulevard, 85th Avenue, 93rd Avenue, and Oak Grove Parkway. A new park-and-ride structure will be constructed adjacent to the Oak Grove Parkway station. The Operations and Maintenance Facility (OMF) is also located in Brooklyn Park.

In concurrence with the preliminary design, the BLE project is also working on a Supplemental Draft Environmental Impact Statement (SDEIS). In 2016, the Metropolitan Council had published a Final Environmental Impact Statement and Determination of Adequacy, based on the preferred project route at

that time. Since then, the project has pivoted away from portions of the original route, requiring the Supplemental Draft and Final EIS, which is focused on changes to the project based on the LRT's revised alignment. The project's environmental consultant team that is preparing the SDEIS is reviewing impacts to environmental resources, including wetlands and floodplains. The project is also conducting a contaminated material study to understand risks during construction. This study includes Phase I and Phase II Environmental Site Assessments (ESA) along the project corridor to identify locations of contaminated materials and provide mitigation strategies for project impacts to areas of concern. The stormwater management design team is working closely with the environmental consultants to understand the constraints associated with implementation of stormwater best management practices (BMPs) within or adjacent to areas of concern for contamination.

Figure 1. BLE Project Alignment

Purpose

The purpose of this report is to document the regulatory requirements for the project, discuss the approach to stormwater management, provide a summary of the preliminary design, provide a summary of outstanding questions and issues, and identify next steps. The report is focused on stormwater management for the preliminary design, which is based on the municipal consent layouts provided to stakeholders for review at the end of February 2024. Floodplain and wetland delineations and impacts are documented in a separate 'Water Resources Technical Report' that was prepared for the SDEIS. Permitting and mitigation for wetland and floodplain impacts will be documented in the final design plans, report, and permits.

Data Collection and References

The preliminary water resources design is based on a variety of sources. In general, these include:

- SSURGO soil data (via *Web Soil Survey*) for soil types
- Geotechnical investigations, including soil borings, conducted for previous projects along the project corridor
- Phase I and Phase II Environmental Site Assessments
- Minnesota Department of Health Source Water Protection Web Map Viewer for drinking water supply management areas
- Municipal water resource management plans
- Watershed management organization (WMO) plans and rules
- Record drawings and construction plans of existing infrastructure aggregated by the municipalities
- Hydraulic models from WMOs, municipalities, and previous projects
- Floodplain elevations and boundaries as provided by the Federal Emergency Management Agency (FEMA), municipalities or WMOs

Regulatory Environment

Regulatory Agencies

Regulatory and permitting authority for stormwater management falls to the Minnesota Pollution Control Agency (MPCA), WMOs, Hennepin County, and municipalities. The Minnesota Department of Transportation (MnDOT) has a review and approval process that will occur with connections to their drainage system. The requirements change periodically to reflect the current issues affecting water resources in their jurisdictions and rule changes at the State or Federal level. The project will be subject to the regulations in effect when the design is submitted for approval by permitting agencies. Appendix A contains a matrix summarizing the stormwater management requirements of the various agencies along the corridor. The regulatory agencies responsible for stormwater management include:

- MPCA National Pollutant Discharge Elimination System (NPDES) Construction Stormwater Permit
- Mississippi Watershed Management Organization (MWMO)
- Bassett Creek Watershed Management Commission (BCWMC)

- Shingle Creek and West Mississippi Watershed Management Commission (SCWMC or WMWMC, or SCWM WMC when referred to in reference to their joint watershed management plan)
- City of Minneapolis
- City of Robbinsdale
- City of Crystal
- City of Brooklyn Park
- Hennepin County
- Minnesota Department of Transportation

As shown in the regulatory matrix, Brooklyn Park, Crystal and Robbinsdale have ordinances or standards that require projects to be designed in accordance with the relevant watershed organization's rules. The City of Minneapolis has its own stormwater ordinance and permitting process that is separate from the WMOs. Hennepin County follows the Municipal Separate Storm Sewer System (MS4) requirements for volume retention and rate control for projects in their right-of-way (ROW). Appendix G shows the expected roadway jurisdictions throughout the corridor, that will be confirmed with the project stakeholders in the preliminary report review process, and changes will be incorporated at the 60% design level. Some stormwater requirements will vary depending on whose jurisdiction applies to the given roadway. The design for each segment will follow the most restrictive requirements for the given segment. Although the BLE project has been divided into segments and sub-segments for the preliminary design, the stormwater management plan takes a watershed-wide approach where possible. For areas of the corridor that connect to MnDOT systems, the project will look at individual connection points to ensure existing capacity issues are not worsened.

The expectation is that the guideway, stations, and roadway will be considered as "linear" projects, which typically have less stringent treatment requirements due to the limited ROW and ability to capture drainage within narrow corridors. Park-and-rides and the OMF will be considered "non-linear" or "site" projects, with higher expectations for stormwater management. Furthermore, the proposed park-and-ride structures in Robbinsdale and Brooklyn Park and the OMF will need to meet the Minnesota Sustainable Building Guidelines known as B3.

In addition to the agencies listed above, it is expected that the project will need to submit requests to revise floodplain mapping to include proposed floodplain mitigation areas. These will be submitted to FEMA for approval. Furthermore, the project will need to receive permits from the United States Army Corps of Engineers (USACE) and the Minnesota Department of Natural Resources (MnDNR) for impacts to wetlands and the proposed mitigation plan.

Impaired Waters and TMDLs

Section 303(d) of the Clean Water Act (CWA) requires states to assess all waters to determine if they meet water quality standards and to conduct total maximum daily load (TMDL) studies to set pollutant reduction goals. The MPCA maintains and updates biennially the list of Minnesota's impaired waters. Project areas that outlet within one mile of MPCA-designated impaired or special waters may be required to incorporate additional BMPs, including stricter stormwater treatment requirements.

Table 1 lists the impaired waters and includes the types of impairments and their respective TMDL status.

Table 1: Impaired Waters Receiving Runoff from the BLE Corridor (2024 Inventory)

Name	Impairments	EPA-Approved TMDL Plan
Mississippi River	• Fecal coliform • Mercury in fish tissue • Nutrients • PCBs in fish tissue	TMDL plan for mercury and nutrients
Bassett Creek	• Benthic macroinvertebrates bioassessments • Chloride • Fecal coliform • Fish bioassessments	TMDL plan for chloride and fecal coliform
Crystal Lake	• Nutrients • Perfluorooctane sulfonate (PFOS) in fish tissue	Crystal Lake Nutrient TMDL Implementation Plan (2009)
Twin Lakes: Lower, Middle, Upper	• Mercury in fish tissue • Nutrients • PCBs in fish tissue • PFOS in fish tissue • Fish bioassessments	Twin and Ryan Lakes Nutrient TMDL (2007) TMDL plan for mercury in fish tissue (2007)
Shingle Creek	• Benthic macroinvertebrates bioassessments • Chloride • Dissolved oxygen • E. coli • Fish bioassessments	Shingle and Bass Creeks Biota and Dissolved Oxygen TMDL Implementation Plan (2012) Shingle Creek Chloride TMDL Implementation Plan (2007)

Drinking Water Supply Management Areas

There are several drinking water supply management areas (DWSMA) that encompass the corridor north of Lowry Avenue N. The DWSMAs have vulnerability classification, from very low to very high, based on

the soil and bedrock profile of the area influenced by the pumping of groundwater. There are areas of low, moderate and high vulnerability in Robbinsdale and Brooklyn Park. In addition to the vulnerability classifications, portions of the project corridor fall within the emergency response areas (ERAs) of Robbinsdale and Brooklyn Park Central DWSMAs, which is defined as the area within the one-year groundwater flow path of a well. The Modeling Area Summaries in Appendix E include information on whether the existing or proposed BMP is within the DWSMAs.

The low, medium and high classifications have implications for the types of BMPs that may be implemented. The owner of the drinking water supply well and the WMO, in addition to the Minnesota Department of Health, may have restrictions against infiltration BMPs. Discussions with staff from SCWM WMC and the cities of Robbinsdale and Brooklyn Park are ongoing and will define the restrictions for the BLE design.

Environmental Site Assessment Results

The ESA consultant provided the project team with results from the Phase I ESA and preliminary results of the Phase II ESA. The Phase I ESA identified parcels along the project corridor that are at low, medium, and high risk for contaminated materials. As part of the Phase II ESA, which is in progress, soil borings and test pits are continually being conducted to better understand the amount and type of contamination at specific locations. The Modeling Summaries in Appendix E note whether the BMP is in an area that has potential of low, medium or high contamination. It is possible that areas suitable for infiltration BMPs will be limited to filtration BMPs because they are found to contain contaminated material or groundwater that could be impacted by infiltration.

Drainage Design Approach

Proposed Project

The proposed project includes the following basic components:

- Construction of a BLE guideway and northbound and southbound track. The guideway will be a mix of ballasted, embedded, and direct fixation track. In some areas, the guideways will replace existing vegetated surfaces. Where the guideway will be ballasted, perforated pipe track drains will be located below the subballast.
- Reconstruction of 7th Street N, Oak Lake Avenue, 10th Avenue N, Washington Avenue N, 21st Avenue N, West Broadway Avenue (CR 81), Bottineau Boulevard (CR 81), West Broadway Avenue (CR 130), and Oak Grove Parkway, and additional side streets within the project limits.
- Replacement or modification of 20 bridges. Construction of two new bridges crossing I-94 at 21st Avenue N in Minneapolis, one for LRT and one for the roadway.
- Construction of grade-separated interchanges at Lowry Avenue North and Bass Lake Road.
- Construction of new roadways as needed to support the OMF and park-and-ride in the Brooklyn Park segment.
- Construction of LRT stations and platforms.
- Construction of park-and-ride facilities (surface lot and ramp structures).
- Construction of OMF.

As noted previously, the project has been divided into 4 segments: Minneapolis, Robbinsdale, Crystal, and Brooklyn Park. The following sections will describe the overall drainage design approach and the types of BMPs being considered, and details of the proposed changes in each segment and the specific stormwater strategies recommended. More details on the types of BMPs and how regulatory requirements will be met for the project will be provided in the 60% design report and construction plans.

Design Methodology

In general, a proposed stormwater plan needs to analyze three items, which are discussed in more detail in the sub-sections below:

1. Existing drainage patterns and the regulatory environment, which was described in the previous section.
2. Changes to hydrology due to an increase in impervious surface
3. Changes to hydraulics due to a conversion from one conveyance system to another (surface flow in ditches versus pipe flow) and due to the reduction in storage available

The stormwater management plan needs to include the design of BMPs in accordance with the regulatory agencies' rules and ordinances to manage these three items. The sequencing approach to locating BMPs was as follows:

1. Locate BMPs within the currently available ROW to the greatest extent practicable
2. Locate BMPs within other public ROW or remnants of parcels that are anticipated to be acquired due to other project requirements
3. Locate BMPs within currently undeveloped land outside of the ROW

See Appendix B for a summary of the design criteria used for preliminary design.

Drainage Patterns

The intent of the proposed drainage system for the BLE project is to mimic the existing drainage patterns to the greatest extent possible while also meeting the requirements of the regulatory agencies. There are some instances where small diversions in drainage patterns are proposed to route project runoff to a BMP. These diversions are limited in size to below the subwatershed level, such that significant amounts of stormwater will not be diverted between jurisdictional watershed agencies and typically will not be diverted between different water bodies within a watershed. Where water is diverted between watershed boundaries, rates will be mitigated to not create any undesirable downstream conditions. When diversions are proposed for treatment purposes, the BMPs will be designed to ensure that there is no increase in discharge rates to existing storm sewer facilities or to the receiving water.

Hydrology

Runoff coefficients for the project and adjacent land uses have been established using published values for Natural Resource Conservation (NRCS) Curve Numbers and for Rational Method hydrology considering soil types, land cover type, and topography. NRCS Curve Numbers are used to determine the runoff rates for pond modeling and the design of minor culverts (less than 54 inches in diameter). Rational method coefficients are used to design trunk storm sewer pipes. Composite Curve Numbers and Rational Coefficients are calculated using standard methods as described in the MnDOT *Drainage Manual* or

industry-standard models. The following assumptions for runoff coefficients were made during preliminary design:

- The portions of the BLE guideway that will be constructed on ballast rock are considered to be impervious surfaces for the water quality calculations due to the compacted Class 5 aggregate underneath the ballast.

Time of concentration (Tc) values were calculated using Manning's Kinematic Solution for initial overland flow and Manning's Equation for the remainder of the flow path as described in the MnDOT *Drainage Manual*. The design assumes the following:

- Minimum Tc for paved surfaces is 7 minutes
- Typical Tc for roadway sections with a grassed median or boulevard is 10 minutes
- Typical Tc for areas that encompass some offsite drainage, but the majority of the area is the project corridor, is 12 minutes
- Calculate the Tc all other areas

Rainfall Intensity-Duration-Frequency (IDF) data used for pipe calculations was taken from the Atlas 14 regionalized IDF values developed by MnDOT for use with the Rational Method. The Atlas 14 runoff depths for the location along the project corridor were used in hydraulic modeling of BMPs along with the rainfall distribution derived from the Atlas 14 data.

Hydraulics

The hydraulic analysis is based on the methods described in the MnDOT *Drainage Manual* and industry-standard models. Design storms events are listed in the Preliminary Water Resources Design Criteria in Appendix B. Specific design methods are listed below for the various components.

- Trunk storm sewer design: Manning's Formula will be used to calculate the pipe size needed to convey the flows generated for the given hydrology and design storm.
    - Pipe slope and diameter will be designed such that the flow velocity was 3 feet per second or greater for the design storm.

Storage Design:

- Existing ponds and other storage BMPs were modeled using the XP-SWMM hydrology and hydraulics software to determine high water level (HWL) and discharge rates. Proposed pond modeling and designed will be described in the 60% drainage design report.
- Floodplain/bridge hydraulics: This design will be described in the 60% drainage design report.

Water Quality

Water quality performance for BMPs will be quantified given the generally assumed performance of a BMP type as approved by the regulatory agency in the 60% water resources design report. When applicable, P8 and/or MIDS water quality modeling software will be used to calculate BMP performance.

Proposed BMPs

The proposed stormwater management plan includes a variety of BMPs that can provide water quality treatment, rate control, and volume retention to offset impacts due to the impervious surface added or reconstructed because of the BLE project. Specific BMP types and locations will continue to be refined as the design progresses. Further coordination with staff from the cities, WMOs, Hennepin County, and MnDOT may also affect the ultimate stormwater management plan. The roadway jurisdiction map in Appendix G will be reviewed in detail with stakeholders to confirm design standards and operation and maintenance agreements.

The types of BMPS listed below are currently included in the proposed stormwater management plan. BMPs have been limited to existing right-of-way to the extent possible. See the BMP Toolbox in Appendix C for more detailed information on the design, expected maintenance and visual examples of the following types of BMPs.

- Bioretention Basin, Raingarden, or Vegetated Swale: Shallow, landscaped basins that provided storage volume for stormwater runoff from adjacent impervious areas. The basin includes a layer of a sand and compost mixture that provides water quality treatment. Runoff volume reduction is achieved through evapotranspiration and infiltration into underlying soils. Basins can also be designed to provide water quality treatment through filtration.
- Infiltration/Filtration Basin: Constructed basin that captures, temporarily stores and filtrates or infiltrates design volume of water within 48 hours or less. Drawdown of stored runoff occurs through infiltration into surrounding naturally permeable soil for infiltration basins. For filtration basins, the runoff drains through filtration media and into underdrains. Infiltration basins contain flat, densely vegetated bottom that is situated in naturally permeable soils. Filtration basins have engineered soil media with underdrains in areas without naturally permeable soils or areas of contamination.
- Tree or Planter Box and Tree Trenches: These consist of a prepared soil mixture, a mulch layer, an underdrain system, and a shrub, tree, or plants. Stormwater runoff drains directly from impervious surfaces via curb openings, storm sewer piping, or as an overland flow where it infiltrates into a filter media. They are typically used in the boulevard areas adjacent to roadways. These may extend under adjacent sidewalks and trails if needed to achieve the necessary volume for stormwater or vegetation needs.
- Wet Stormwater Detention Ponds: Constructed basins that capture and store stormwater runoff temporarily or for an extended period of time, in order to prevent or mitigate downstream water quantity or quality impacts. Typically installed as an end-of-pipe BMP at downstream end of stormwater system. Wet stormwater detention ponds (also called NURP ponds) include a permanent pool volume that is always wet and is sized to remove pollutants by gravitational settling of particulates. The live storage is the amount the water can ‘bounce’ in the pond during a storm event and is used to provide rate control for stormwater runoff.
- Pond Retrofit: Wet stormwater ponds can be retrofitted by adding iron enhanced sand, infiltration components, modifying outfalls or inlets to adjust the storage volume, or incorporating water reuse. Retrofit options enable these existing BMPs to do a better job of removing soluble phosphorus, smaller particulates, and to provide more attenuation for Atlas 14 storm events.
- Underground Storage or Infiltration: Underground detention devices are used to store stormwater runoff temporarily or are used for rate control. These facilities can act solely to store water for

graduated release, or the water can be pumped out for reuse. Large pipe galleries, open-bottom concrete vaults, and other systems temporarily store runoff until it can infiltrate into the ground. A weir or outlet pipe controls the volume of water to be infiltrated. Additional storage volume above the outlet attenuates peak discharges. Water quality benefits are achieved through infiltration or filtration.

- Structural Pollutant Control Devices (SPCD): Hydrodynamic oil and grit separators are underground structures that remove larger particles and the pollutants that may be attached to them, as well as floating debris and oils. Also known as a stormwater treatment manhole, these are primarily placed where pretreatment is required upstream of other BMPs and ROW is constrained. They may also be used upstream of wetlands or connections to existing storm sewer systems where other water quality BMPs are not feasible due to elevation, topography, or ROW constraints. These are typically designed to treat the first flush of runoff.

Soil types along the BLE corridor were initially determined using the web-based soil surveys available from the U.S. Department of Agriculture and have been corroborated with the soils investigation being completed for the project. In general, the soil type listed in the soil surveys was used as the starting point to determine which hydrologic soil group (HSG) was associated with that soil type. The HSG classifications provide an understanding of how permeable the existing soils are, with HSG A soils having the highest infiltration capacity and HSG D soils having the lowest. In most locations south of Trunk Highway (TH) 610, the land was developed prior to the original soil survey work, and the soils were often classified as “urban land”. In these cases, available soil boring logs were used to better define the capacity of the soil for infiltration.

Stormwater Management Plan

The preliminary design stormwater management plan for the BLE project includes hundreds of BMPs and several miles of new and reconstructed storm sewer to convey and treat the stormwater runoff from the new and reconstructed impervious surfaces. The project’s overall stormwater management plan includes BMPs that provide volume retention, water quality treatment, and rate control. Each segment of the project has unique characteristics that require a specialized approach. The stormwater management design in the areas of the project that were in the previous alignment, mainly Brooklyn Park, are more complete than the areas that have been added with the realignment. CR 81 was reconstructed in the late 2000s and included improvements to the storm sewer systems and added stormwater management BMPs to meet the regulatory requirements at that time. The Robbinsdale, Crystal, and part of the Brooklyn Park segments of the LRT project are in these reconstructed corridors and have less drainage issues due to the improvements completed. The storm sewer systems in the Minneapolis segment of the project were constructed decades ago, and many are undersized and do not meet current design standards. The Minneapolis system will require more detailed design and analysis to bring the systems up to meet current design standards. The project is still in the process of collecting data that will inform the final design, including survey, geotechnical borings, and environmental investigations.

This section provides a summary of the existing and proposed drainage systems and level of design completed within each city. The Drainage Overview Maps in Appendix D and the Modeling Summaries in Appendix E provide additional details on the existing and proposed conditions along the project corridor. Appendix F includes a summary of ***potential*** water quality volume that can be provided within each resource area. The potential BMP locations are shown on the Drainage Overview Maps (Appendix D) for

each city, which are a snapshot of the municipal consent phase of the project. As we continue to receive information on the existing conditions and constraints (soils, contamination, utilities, transit-oriented development (TOD) locations, etc.), we anticipate the amount of space available for BMPs will decrease and therefore the estimated water quality volume will also decrease. The project team is continually refining the design of the stormwater management system for the project with the intent to meet all regulatory requirements, while acknowledging that this may be difficult in some areas of this highly urban corridor that has little available above or below ground space for stormwater management.

Minneapolis

The Minneapolis segment extends from Target Field Station to the city limit with Robbinsdale at Lowry Avenue N. The guideway runs along several roadways through the North Loop and goes north on Washington Avenue N to 21st Avenue N, where two new bridges will be constructed to carry LRT and traffic across I-94. The guideway continues on 21st Avenue N for several blocks then shifts to West Broadway. The project also includes reconstruction of West Broadway from Lyndale Avenue N to James Avenue N to address pavement condition and improve safety and access.

The existing stormwater management system is a mix of storm sewer pipes, tunnels and ditches that convey the stormwater runoff from north Minneapolis to the Mississippi River via the New and Old Bassett Creek Tunnels, 12th Street interceptor, and direct storm sewer outfalls on 14th Avenue North, West Broadway Avenue, and 21st Avenue North. Most of the corridor, from Logan/Oliver Avenue N to Target Field, is within the MWMO. The portion between Logan/Oliver Avenue N and Lowry Avenue N is within BCWMC. Most of the stormwater runoff from the project corridor is untreated by stormwater BMPs in the existing condition.

Much of the segment through Minneapolis is modeled within the South Model Area of the City of Minneapolis' North Minneapolis Region Hydrologic and Hydraulic (H&H) model. The project team is using this model to understand the existing conditions and flood extents within the segments of the project within the City. As part of the H&H modeling conducted by the City, inundation areas were mapped for the 2-year, 10-year and 100-year storm events. These are areas where water surcharges out of the stormwater system and inundates the ground surface for a period of time. The modeling and maps show there are inundation areas on portions of 21st Avenue N, West Broadway, and 10th Avenue N. The LRT design criteria requires 1.5 feet of freeboard from the 100-year high water elevation to the top of the rail for embedded track. Therefore, pipe capacity and flood storage will be required in the Minneapolis segment to mitigate the existing street flooding and decrease the high water level to be 1.5 feet below the top of rail where the LRT will be located, which requires up to an approximately 4.5' reduction in high water elevation. There are two existing inverted siphons in the storm sewer system that carry stormwater runoff from the Minneapolis system beneath I-94 and connect to downstream storm sewer systems on 21st Avenue N and West Broadway. The existing siphons at 21st Avenue N will be impacted by the new bridge structures and will be relocated to the south of the proposed bridge. The West Broadway siphon will remain in place, but the downstream connection to the existing storm sewer at the intersection of Washington Avenue N and West Broadway may need to be reconfigured to avoid being beneath the LRT.

The proposed stormwater management plan for the Minneapolis segment identifies several locations for proposed green stormwater infrastructure (bioretention basins or tree trenches) and filtration basins. The final design will likely include underground infiltration and detention BMPs to meet the water quality requirements and provide flood storage.

Robbinsdale

The Robbinsdale segment extends from Victory Memorial Drive to 47th Avenue N along CR 81. The stormwater management system is mainly storm sewer with a few wet stormwater ponds that were constructed with CR 81 improvements in the late 2000s timeframe. Stormwater runoff from the Robbinsdale segment discharges to Crystal Lake and Lower Twin Lake. Most of the corridor is within the SCWMC, with the portion in the southwest quadrant of CR 81 and Lowry Avenue North in BCWMC.

The proposed stormwater management plan for the Robbinsdale segment identifies several locations for proposed filtration basins, filtration bench retrofits to existing wet stormwater ponds, and infiltration basins.

Crystal

The Crystal segment extends from 47th Avenue N to 62nd Avenue N along CR 81. The stormwater management system is mainly storm sewer with a few wet stormwater ponds and infiltration basins that were constructed with the CR 81 improvements in the late 2000s timeframe. Stormwater runoff from the Crystal segment discharges to Twin Creek, Lower, Middle and Upper Twin Lakes. The portion of the corridor north of Lombard Lane discharges to storm sewer that drains to the City of Brooklyn Park's system.

The proposed stormwater management plan for the Crystal segment identifies several locations for proposed infiltration basins, underground infiltration, and infiltration or filtration bench retrofits to existing stormwater ponds.

Brooklyn Park

The Brooklyn Park segment extends from 62nd Avenue N to 73rd Avenue N along CR 81. Then the guideway shifts over to CR 103 via a new elevated structure, and continues along CR 103 to Oak Grove Parkway, and along Oak Grove Parkway to its termination at the OMF site at Xylon Avenue. Starting at CR 103, the alignment in Brooklyn Park has not changed from the previous version of the project, and therefore the project design is furthest along in this segment. The typical section has changed, and the width of the gutter pan is 24" instead of 18", which will result in some redesign of the storm sewer system along CR 103.

The existing stormwater management system is a combination of storm sewer and ditches that discharge to some existing stormwater BMPs, but much of this portion of the corridor is untreated. Stormwater runoff from the Brooklyn Park segment discharges to Twin Creek, Shingle Creek, Century Channel and to the Mississippi River through other unnamed drainageways.

During the previous project, a draft Subarea Stormwater Master Plan was developed for about 400 acres of undeveloped land that includes the LRT corridor, reconstruction of Oak Grove Parkway, a park-and-ride, and the OMF facility. This area is adjacent to the Target North Campus, and much of the land is owned by Target Corporation. The Subarea Stormwater Master Plan analyzed the existing conditions and proposed a shared stormwater management system between Metro Transit, Brooklyn Park and County ROW, Target Corporation, and future development areas. Most of this area drains south across TH 610 through an existing storm sewer system and will be required to meet stormwater management

requirements in the developed condition. There is very little stormwater runoff in the existing condition as there is very little impervious surface and the soil is sandy and well-drained. The future development will result in a significant increase in impervious surface and will need to provide water quality treatment and a large amount of rate control to meet the existing peak discharge rates at TH 610. The draft Subarea Stormwater Master Plan will need to be revisited during the final design of the BLE project and will either need to be carried forward through WMO approval, or redesign may need to occur for the BLE project to meet current requirements.

The proposed stormwater management plan for the Brooklyn Park segment identifies several locations for proposed infiltration basins, wet stormwater ponds, underground detention, bioretention basins, tree trenches and pond retrofits.

Conclusion and Next Steps

Construction of the proposed BLE project will result in a large amount of reconstructed impervious surface, and the project will need to meet volume retention, water quality, and rate control requirements for the WMOs, Cities, County, and MPCA. The preliminary stormwater management plan proposes several mitigation measures, including the expansion or enhancement of existing facilities, and construction of new BMPs at key locations.

As the project progresses to a 60% design level, additional information is being collected and more detailed analysis and design is being conducted by the project team. The following is a list of outstanding design issues affecting the overall corridor:

- Additional soil borings in the locations of proposed BMPs to verify assumptions about infiltration, potential groundwater elevations, and environmental contamination. Determine if piezometers are also needed to estimate groundwater elevations.
- Hydrologic and hydraulic modeling of proposed BMPs to verify the design meets rate control requirements
- Water quality modeling of proposed BMPs to verify the design meets performance criteria
- Coordination with WMOs, Cities, Counties, and MPCA on the proposed design and permitting requirements.
- Operations and maintenance plans and ownership delineation

Appendices

Appendix A – Regulatory Matrix

Appendix B – Drainage Design Criteria

Appendix C – BMP Toolbox

Appendix D – Drainage Overview Maps

Appendix E – Modeling Summaries

Appendix F – Water Quality Summary Table

Appendix G – Roadway Jurisdiction Map