



US-6 over the BNSF Railway

Bridge Replacement

*Permanent Water Quality Report
(FIR)*



**WILSON
& COMPANY**

Prepared for CDOT Region 6
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Introduction

This report describes the permanent water quality approach for the proposed US-6 over BNSF Railway bridge replacement. The project is located in Region 6 of the Colorado Department of Transportation (CDOT) and the City and County of Denver (CCD). The project encompasses the US-6 bridge replacement and minor roadway work on US-6. The project disturbs approximately 2.57 acres. This report follows the outline described in the *Region 6 Permanent Water Quality Documentation*, dated April 19, 2011. The replacement of this bridge and any associated improvements discussed in this report will be included with a larger Design-Build project. As such, the Design-Build Contractor/Engineer may elect to change the recommendations within this report.

Discussion of CDOT MS4 / NDRD Requirements

Design Objectives

The objective is to treat all stormwater flows generated within the proposed improvements or areas disturbed by the project. Impervious areas within the disturbed area will require treatment which removes 80% of the Total Suspended Solids (TSS) or captures 100% of the Water Quality Capture Volume (WQCV). Areas within the project limits with no impervious surfaces (roadway embankments) will follow the current drainage patterns without additional treatment. Stormwater generated within the proposed impervious areas reconstructed by the project will be captured and treated prior to release to the existing storm drain.

Treatment Options

Several treatment options were explored during the preliminary design process. The options were reviewed by CDOT. Rain Gardens, extended detention basins, and underground stormwater quality vaults were all considered. The extended detention basin and rain garden options are generally the preferred options due to the ease of maintenance and the proven pollutant removal rates. However, the extended detention basin (EDB) and rain garden BMP's occupy a larger area, and are not always feasible in urban settings. To the east of the proposed bridge the existing site topography and the limited space available for BMP locations prevented the practical use of an extended detention basin or rain garden. Given these physical restraints, an underground stormwater quality vault was the only feasible remaining option. The vault will be maintained by CDOT. Maintenance requirements include a maximum vault depth of 16' and a BMP utilizing hydrodynamic separation is preferred. In order to best meet the removal requirement, a system certified by the New Jersey Corporation for Advanced Technology (NJCAT) is recommended for the project. The High Efficiency Continuous Deflective Separator (CDS) by Contech was recently certified by the NJCAT and is recommended for this project. An extended detention basin will be used to treat the project stormwater generated to the west of the proposed bridge. The extended detention basin will treat 100% of the WQCV.

Expected Pollutant Removal Rates

Approximately 2.6 acres of the project disturbance will require treatment. The area treated by the CDS vault is approximately .83 acres. The area treated by the EDB is approximately 1.74 acres.

The CDS systems are designed by the manufacturer to achieve an 80% annual solids load reduction based on lab generated performance curves for a specific particle size distribution. The vaults are designed to treat the “first flush” of runoff generated from the impervious surfaces within the project. The “first flush” is generally defined as the first 0.5 inch of runoff and is considered to contain the highest concentration of pollutants. A 0.5 inch one-hour point rainfall depth was used to determine the water quality treatment flow rate used. A 0.5 inch one-hour point rainfall is approximately one half of the 2-year point rainfall depth and corresponding rainfall intensity. The Rational Method was used with this rainfall intensity to determine the Permanent Water Quality flow rate using the City and County of Denver Rainfall Intensity-Duration Curve from the *City and County of Denver Storm Drainage Design and Technical Criteria Manual*.

The EDB is a sedimentation basin designed to detain stormwater for many hours after a storm. A small outlet is used to extend the emptying time of the smaller, more frequent storms, to facilitate pollutant removal. The basins are sometimes called “dry ponds” because they are designed not to have a significant permanent pool of water remaining between storm runoff events.

Existing Water Quality Features

There are no existing water quality features that will be abandoned, reconfigured, or incorporated into the proposed design.

Right of Way

There are no additional right of way needs resulting from the proposed water quality approach for the project. The underground water quality vaults will be located within existing CDOT right of way.

Recommended Design

A CDS Model CDS2025 (manufactured by Contech Construction Products, Inc.) is recommended to treat the 4.2 cfs design flow (east system) and a EDB with a volume of 0.087 ac-ft is recommended to treat the WQCV (west system).

Maintenance and Operation

Description of Facility

The CDS Model CDS2025 vault is a prefabricated underground water quality vault. The vault consists of multiple chambers designed to remove suspended solids and floatables. The hydrodynamic separator removes sediment, oil and grease, and floating and sinking debris.

The EDB is a surface BMP. The area is graded and seeded as described in the construction documents. A small outlet and debris screen allow the area to drain in the required time.

Facility Access and Maintenance

While entry to the vaults is through manhole covers, typical maintenance activities can be made without entering the vault. A Vac truck is typically used to remove the collected sediment and oils without requiring entrance into the vault. As requested by CDOT, the bottom of the vault shall not be more than 16 feet below grade. The vaults are located in areas that will allow access without lane closures.

Maintenance of the CDS water quality vault will be performed by CDOT. Maintenance requirements will include periodic removal of the accumulated sediment and floatables. Cleaning of the CDS system should be done during dry weather conditions when no flow is entering the system. Cleanout of the CDS system with a vacuum truck is generally the most effective and convenient method of excavating pollutants from the system and does not require entrance into the vault. Cleaning of a CDS system is typically done by inserting a vacuum hose into the chamber and evacuating the water and pollutants.

The EDB is graded with 4:1 slopes to allow maintenance access. EDBs have low to moderate maintenance requirements on a routine basis, but may require significant maintenance once every 15 to 25 years. Maintenance frequency depends on the amount of construction activity within the tributary watershed, the erosion control measures implemented, the size of the watershed, and the design of the facility. Inspection should occur at least twice a year, observing the sediment in the facility and checking for debris at the outlet structure. When starting from seed, mow native/drought tolerant grasses only when required to deter weeds during the first three years.

Following this period, mowing of native/drought tolerant grass may stop or be reduced to maintain a height of no less than 6 inches (higher mowing heights are associated with deeper roots and greater drought tolerance). In general, mowing should be done as needed to maintain appropriate height and control weeds. Mowing of manicured grasses may vary from as frequently as weekly during the summer, to no mowing during the winter.

Conclusion

The proposed CDS water quality vault and EDB will treat all stormwater generated from proposed impervious surfaces reconstructed within the project limits

Appendices

Exhibits

- Site Map

Hydrology Computations

- Water Quality Flow Calculations

Drainage Maps

- Water Quality Basin Map