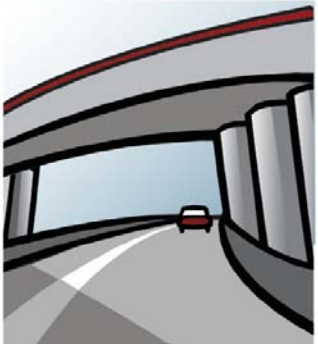
US 6/Wadsworth



Environmental Assessment

# Water Quality Technical Memorandum

CDOT Project STU #0062-019 (15215)
CH2M HILL Project No. 358660

February 2009

CH2MHILL

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# Acronyms and Abbreviations

| | |
|---|---|
| µg/L | micrograms per liter |
| AASHTO | American Association of State Highway and Transportation Officials |
| ADT | average daily traffic |
| BMP | best management practice |
| BOD | biological oxygen demand |
| CDOT | Colorado Department of Transportation |
| CDOW | Colorado Division of Wildlife |
| CDPHE | Colorado Department of Public Health and Environment |
| CDPS | Colorado Discharge Permit System |
| cfu | colony forming units |
| COD | chemical oxygen demand |
| CWA | Clean Water Act |
| CWQCA | Colorado Water Quality Control Act |
| *E. coli* | *Escherichia coli* |
| EA | environmental assessment |
| ECSQG | *Erosion Control and Stormwater Quality Guide* |
| EMC | event mean concentration |
| FHWA | Federal Highway Administration |
| kg | kilogram |
| mg | milligram |
| mg/L | milligrams per liter |
| ml | millimeter |
| MS4 | municipal separate storm sewer system |
| NEPA | National Environmental Policy Act |
| NPDES | National Pollutant Discharge Elimination System |
| NURP | Nationwide Urban Runoff Program |
| PAH | polyaromatic hydrocarbons |

| | |
|---|---|
| SB | Senate Bill |
| SDWA | Safe Drinking Water Act |
| SEO | State Engineer's Office |
| SWAP | Source Water Assessment and Protection |
| SWMP | Stormwater Management Plan |
| TM | Technical Memorandum |
| TMDL | total maximum daily load |
| TVS | table value standards |
| UDFCD | Urban Drainage and Flood Control District |
| USEPA | U.S. Environmental Protection Agency |
| USGS | U.S. Geological Survey |
| WQCC | Water Quality Control Commission |
| WQCD | Water Quality Control Division |
| WQCV | water quality capture volume |
| WS | water supply |

# Project Description

The Colorado Department of Transportation (CDOT) proposes to reconstruct the interchange of US 6 and Wadsworth Boulevard (Wadsworth) and widen Wadsworth between 4th and 14th Avenues in Jefferson County, Colorado. The purpose of the project is to improve traffic flow and safety for motorists, pedestrians, and bicyclists; accommodate high traffic volumes; and increase multi-modal travel options and connections at the US 6 and Wadsworth interchange and along Wadsworth between 4th Avenue and 14th Avenue. The existing design and configuration of the interchange and roadway have not kept pace with traffic and multi-modal travel demands. CDOT, the Federal Highway Administration (FHWA), City of Lakewood, area residents, businesses, and commuters have prioritized improvements to US 6 and Wadsworth through previous planning efforts.

In accordance with the National Environmental Policy Act of 1969 (NEPA) and its implementing regulations, CDOT is preparing an Environmental Assessment (EA) to assess the potential impacts to environmental resources as a result of the project. The study area for this analysis is defined as the area following US 6 (also designated as 6th Avenue) and Wadsworth (also designated as State Highway 121). The east-west limits along US 6 are from the eastern interchange ramps with Wadsworth west to Garrison Street. On Wadsworth, the project limits are 4th Avenue to 14th Avenue (see Figure 1).

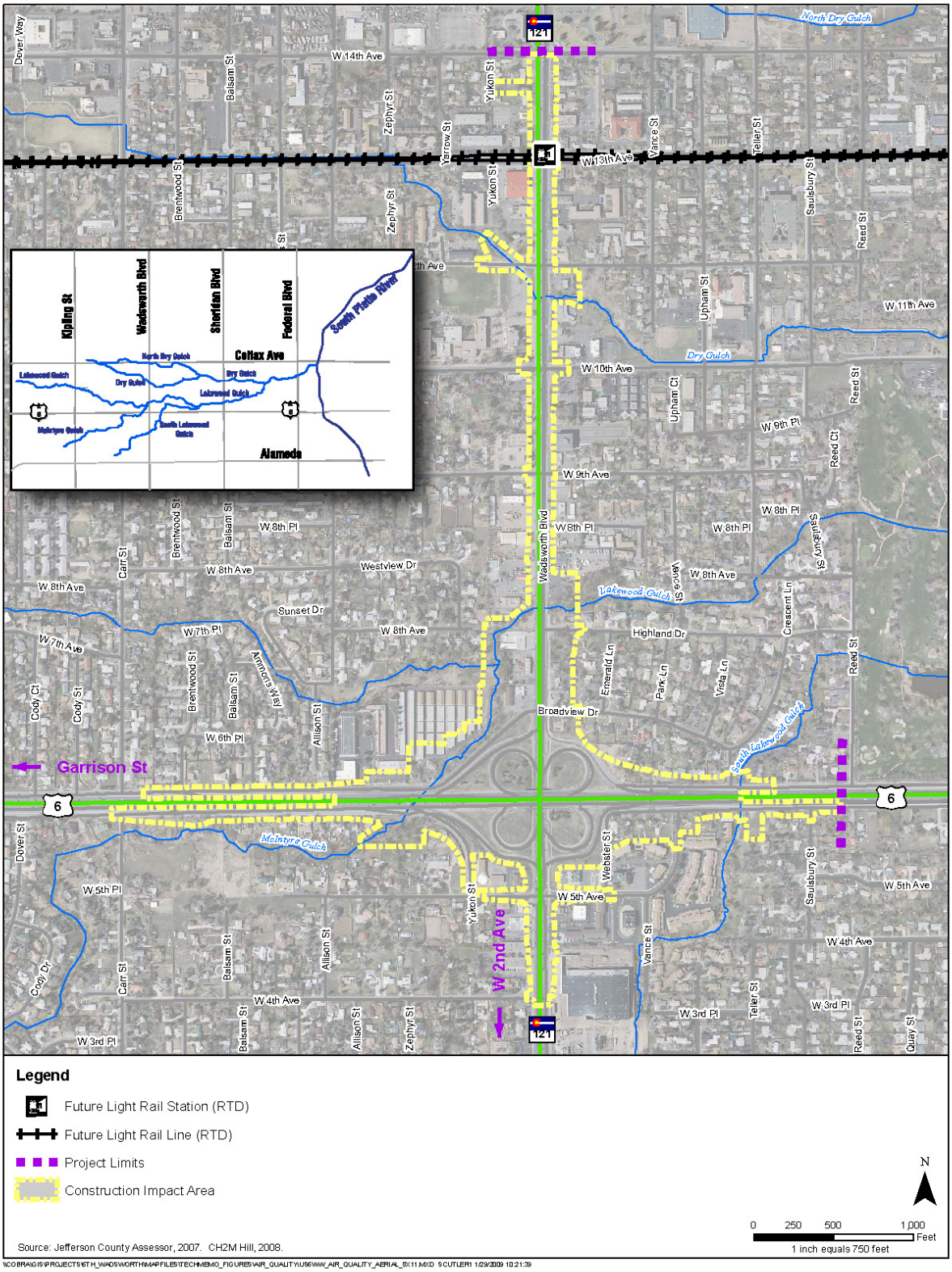
The study area is located in the Upper South Platte River Basin. The main stem of the South Platte River, the primary drainage near the project boundaries, is located 4.6 miles east of the study area. As shown in Figure 1, there are several smaller creeks and drainages in or adjacent to the study area that are tributaries to the South Platte River, including South Lakewood Gulch, Lakewood Gulch, McIntyre Gulch, and Dry Gulch.

# Methodology and Assumptions

This Technical Memorandum (TM) assesses the potential for impacts to water quality as a result of the proposed project. Four interchange design concepts were studied in the selection of a preferred alternative for the US 6 and Wadsworth interchange. After a detailed evaluation, the Tight–Diamond-with-Loop Alternative was determined as the best choice to balance transportation needs with environment and community impacts. The final four alternatives were not distinguishable from each other for the purpose of evaluating water quality impacts. Therefore, only the Build Alternative was evaluated in this TM.

The objective of this assessment is to estimate general water quality effects on the receiving watercourses adjacent to the US 6 and Wadsworth corridor that are expected from highway runoff associated with the Build Alternative. The water quality assessment utilized guidance developed by the FHWA to determine the impacts of highway improvement projects in accordance with NEPA guidelines. The initial analysis included determination of existing conditions, or "baseline conditions." Predicted conditions that would result from the Build Alternative were determined based on the preliminary design. The existing and predicted conditions were compared either qualitatively or quantitatively to determine impacts from the project. Supplemental literature data were incorporated into the analysis to qualitatively and quantitatively estimate the highway runoff impacts from the study area.

FIGURE 1
Project Study Area



# Governing Regulations

The primary federal regulatory drivers for the Water Quality Program are the Phase I and Phase II Stormwater Regulations under the Clean Water Act (CWA). Among other requirements, the regulations require regulated entities to acquire a National Pollutant Discharge Elimination System (NPDES) Permit for their stormwater discharges. The U.S. Environmental Protection Agency's (USEPA) stormwater NPDES regulations specify that entities required to have municipal permits must comply with the requirement to control the discharge of pollutants to the maximum extent practicable. The Colorado Department of Public Health and Environment (CDPHE) has jurisdiction over the NPDES permit program in Colorado.

## Clean Water Act (40 CFR 401 and 402)

The CWA establishes the basic structure for regulating discharges of pollutants to waters of the United States and provides the statutory basis for the NPDES permit program.

The NPDES permit program is authorized by Section 402 of the CWA. In 1987, the NPDES program was expanded to cover stormwater discharges from municipal separate storm sewer system (MS4) and industrial sources. The MS4 NPDES permits require regulated municipalities to use best management practices (BMPs) to reduce pollutants to the maximum extent practicable.

## Safe Drinking Water Act (40 CFR 141-143)

The Safe Drinking Water Act (SDWA) protects public health by regulating the nation's public drinking water supply and protecting drinking water and its sources. The 1996 amendments to the SDWA directed that each state develop a Source Water Assessment and Protection (SWAP) Program outlining how the state will conduct an assessment of all its public water supplies. CDOT is a stakeholder in the Colorado SWAP Program mandated by the SDWA.

## Erosion and Sediment Control (23 CFR 650, Subpart B)

It is the policy of the FHWA that all highways funded in whole or in part under Title 23, United States Code, must be located, designed, constructed, and operated according to standards that will minimize erosion and sediment damage to the highway and adjacent properties, and abate pollution of surface and groundwater resources. The FHWA adopts the American Association of State Highway and Transportation Officials (AASHTO) *Highway Drainage Guidelines*, Volume III, "Erosion and Sediment Control in Highway Construction" (1992) as guidelines to be followed on all construction projects funded under Title 23. These guidelines are not intended to preempt any requirements made by or under state law if such requirements are more stringent.

The *CDOT Drainage Design Manual* was developed to provide guidance and establish criteria for engineers performing hydrologic and hydraulic analysis and design (CDOT, 2004b). *CDOT's Erosion Control and Stormwater Quality Guide* provides direction, criteria, and procedures to ensure that a stormwater management plan will be developed and detailed BMPs used for construction (CDOT, 2002). Additionally, CDOT's *Standard Specifications for*

*Road and Bridge Construction* details practices that should be used on CDOT projects to minimize water pollution during construction (CDOT, 2005).

## Colorado Water Quality Control Act

USEPA has delegated authority for implementation of the CWA and SDWA in Colorado to the CDPHE. The Colorado Water Quality Control Act (CWQCA), the state version of the CWA, was passed in 1973 to protect and maximize the beneficial uses of state waters and regulate water quality of the state's water bodies. The CWQCA established CDPHE's Water Quality Control Commission (WQCC) as the rulemaking body for regulations that protect Colorado water bodies. The WQCC adopts water quality classifications and standards for surface and groundwaters of the state, as well as various regulations aimed at protection of streams and the implementation of the CWQCA and CWA programs. Information such as surface water classifications and standards, groundwater classifications and standards, point source discharge regulations, watershed protection regulations, drinking water regulations, and CWA Section 303(d) requirements will be used in the evaluation of water quality baseline conditions and impacts.

In 1981, the WQCC adopted Regulation No. 61 (5 CCR 1002-61), "Colorado Discharge Permit System Regulations," to implement the CWQCA (CDPHE, 1981). In particular, Sections 25-8-501 through 25-8-505 are designed to be in conformity with the CWQCA, CWA, and their respective regulations. Pursuant to Regulation No. 61, CDOT fell under Phase I and Phase II of the municipal separate storm sewer system program and was required to obtain a permit as a regulated MS4. An MS4 is made up of ditches, gutters, storm sewers, and similar means of collecting and conveying runoff that do not connect with a wastewater collection system or treatment plant. CDOT has a combination Phase 1/Phase II MS4 Permit (COS-000005) that was issued February 1, 2007.

## Colorado Discharge Permit System (CDPS)

The primary federal regulatory drivers for the current stormwater quality program are the Phase I and Phase II Stormwater Regulations under the CWA, which require regulated entities to acquire a NPDES Permit for their stormwater discharges. In Colorado, and in most states, the USEPA has granted the state the authority to issue and enforce NPDES permits. EPA has oversight of this authority. Pursuant to this authority, the State of Colorado has adopted its own regulations regarding implementation of this program. Regulation No. 61 outlines the requirements for the Colorado Discharge Permit System (CDPS), Colorado's version of the NPDES, and the requirements for stormwater discharges for which permits are required (CDPHE, 1981). CDPHE issues these permits through its Water Quality Control Division (WQCD).

CDOT was a Phase I MS4 entity and obtained its CDPS Permit for MS4 (Permit No. COS-000005) on January 15, 2001. CDOT's permit covers "state and interstate highways and their right-of-ways within the jurisdictional boundary of CDOT served by, or otherwise contributing to discharges to the state waters from the municipal separate storm sewer system owned or operated by CDOT." The Permit requires CDOT to "develop and implement a program that ensures that new highway projects and significant highway modifications are reviewed for the need to include permanent water quality best management practices." Based on the "sensitive" water criteria for the New Development Redevelopment Program established by CDOT, the US 6 and Wadsworth project would

need to be evaluated in order to determine if it is a significant highway modification requiring permanent BMPs (CDOT, 2004a).

The US 6 and Wadsworth project traverses the City of Lakewood, which is also a Phase I MS4 entity and obtained its CDPS Permit for MS4 (No. COS-000002) in 1996. One of the requirements of Lakewood's CDPS Permit was to develop a program to reduce stormwater impacts associated with development and redevelopment projects. Guidelines for stormwater management, the reduction of flows from development sites, and pollution control measures are outlined in the City of Lakewood's *Storm Drainage Criteria Manual* (City of Lakewood, 1982).

### Senate Bill 40 Wildlife Certification

Senate Bill 40 (SB 40) (33-5-101, et seq., C.R.S., 1973) requires any state agency to obtain certification from the Colorado Division of Wildlife (CDOW) when the state agency plans construction in any stream, its banks, or tributaries. Emphasis in this legislation is on the protection of fishing waters in the state, but it also recognizes the importance of protecting the entire stream ecosystem, including wetlands and riparian areas.

In 1990, CDOT and CDOW signed an agreement intended to streamline the SB 40 certification process for transportation projects. The agreement established a series of thresholds, below which CDOT could proceed with the projects without going through the formal certification process. This is based on the assumption that most CDOT projects involve only minimal disturbance to streams, especially if CDOT adheres to a set of BMPs during construction. Projects with impacts in excess of the thresholds require formal certification from CDOW.

## Affected Environment

### Watershed

The proposed US 6 and Wadsworth project is located in the Upper South Platte River Basin and the South Platte River is the primary drainage near the study area. Smaller creeks and drainages on or adjacent to the study area include South Lakewood Gulch, Lakewood Gulch, McIntyre Gulch, and Dry Gulch. Dry Gulch, Lakewood Gulch, and McIntyre Gulch cross under Wadsworth in the northern portion of study area. South Lakewood Gulch crosses under US 6 east of Wadsworth. Land use in the study area is primarily highway and commercial surrounded by residential development.

For much of the year, South Lakewood Gulch, Lakewood Gulch, McIntyre Gulch, and Dry Gulch are dry and experience periodic high flows. Lakewood Gulch, a west-bank tributary to the South Platte River in the central metropolitan area, occasionally experiences higher than normal flows and flooding conditions in some reaches. The Lakewood Gulch watershed has a drainage area of approximately 16.0 square miles, the majority of which is in the urban area of the City of Lakewood. McIntyre Gulch flows from the Denver Federal Center into Lakewood Gulch east of Wadsworth, and has a narrow and deep channel with eroded banks near the vicinity of the study area.

## WQCC Stream Classifications

The WQCC has divided all water bodies in Colorado into various segments as defined in Regulation No. 31 (5 CCR 1002-31), "The Basic Standards and Methodologies for Surface Water," dated May 31, 2008 (CDPHE, 2008a). Segment 16c of the Upper South Platte River Basin is defined in Table 1. This segment traverses the study area and includes South Lakewood Gulch, Lakewood Gulch, McIntyre Gulch, and Dry Gulch. As shown in Figure 1, these water bodies drain into the South Platte River, approximately 4.6 miles east of the study area, in what is defined as Segment 14 of the Upper South Platter River Basin[1].

The WQCC has classified streams in the study area for various uses as described in Regulation No. 38 (5 CCR 1002-38), "Classifications and Numeric Standards for the Upper South Platte River Basin, Laramie River Basin, Republican River Basin, Smoky Hill River Basin," dated March 1, 2008 (CDPHE, 2008b). The uses associated with water bodies in the study area are defined as follows:

1. **Use Protected:** These are waters that the WQCC has determined do not warrant special protection provided by the outstanding waters designation or the anti-degradation review process.
2. **Water Aquatic Life, Class 2**: These are waters that are not capable of sustaining a wide variety of cold or warm water aquatic life, including sensitive species, due to physical habitat, water flows or levels, or uncorrectable water quality conditions that result in substantial impairment of the abundance and diversity of species. "Aquatic life" includes fish species as well as invertebrates.
3. **Agricultural**: These surface waters are suitable or intended to become suitable for irrigation of crops usually grown in Colorado and are not hazardous as drinking water for livestock.
4. **Recreation Class 1a:** These are surface waters in which primary contact uses have been documented or are presumed to be present. These uses include recreational activities in or on the water when the ingestion of small quantities of water is likely to occur, such as swimming, rafting, kayaking, tubing, windsurfing, and water-skiing.

TABLE 1
Water Quality Segments in the Study Area

| Stream | Segment | Segment Description | Designated Uses[1] |
|---|---|---|---|
| South Platte River | 16c, Upper South Platte River Basin | All tributaries to the South Platte River, including all lakes, reservoirs, and wetlands, from the outlet of Chatfield Reservoir to a point immediately below the confluence with Big Dry Creek, except for specific listings in the subbasins of the South Platte River, and in Segments 16a, 16b, 16d, 16e, 16f, 16g, 17a, 17b, and 17c. | Use Protected<br>Warm Water Aquatic Life, Class 2<br>Recreation, Class 1a<br>Agriculture |

[1]The designated uses are defined in Regulation No. 31, "The Basic Standards and Methodologies for Surface Water," dated May 31, 2008 (CDPHE, 2008a).

[1] Segment 14 is defined as the South Platter River from Bowles Avenue in Arapahoe County north to the Burlington Ditch.

The WQCC has set water quality standards that are protective of the designated uses for Segment 16c of the Upper South Platte River Basin. The standards for this segment are found in WQCC Regulation No. 38 (CDPHE, 2008b) and are listed in Table 2. The exception to this are any irrigation ditches. The WQCC does not have the authority to establish water quality standards for ditches, although discharges into ditches require a NPDES permit, and limitations are established based on best available technology.

TABLE 2
Water Quality Standards for Classified Streams

| Stream Segment | Physical and Biological Standards | Inorganic (mg/L) | Metals (µg/L) | | Temporary Modifications and Qualifiers |
|---|---|---|---|---|---|
| South Platte River, 16c | D.O.=5.0 mg/L<br>pH=6.5-9.0<br>F.Coli=200/100mL<br>E.Coli=126/100mL | $NH_3$(ac/ch)=TVS<br>$Cl_2$(ac)=0.019<br>$Cl_2$(ch)=0.011<br>CN=0.005<br>S=0.002<br>B=0.75<br>$NO_2$=0.5 | As(ac)=100(Trec)<br>Cd(ac/ch)=TVS<br>CrIII(ac/ch)=TVS<br>CrVI(ac/ch)=TVS<br>Cu(ac/ch)=TVS<br>Fe(ch)=1000(dis)<br>Pb(ac/ch)=TVS | Mn(ac/ch)=TVS<br>Hg(ch)=0.01(Tot)<br>Ni(ac/ch)=TVS<br>Se(ac/ch)=TVS<br>Ag(ac/ch)=TVS<br>Zn(ac/ch)=TVS | Fish ingestion organics<br>Temporary modifications: East and West Toll Gate Creeks, Toll Gate Creek<br>Se(ch)=18µg/l(dis), Se(ac)=no acute standard. (Type iii) Expiration date of 2/28/2010.<br>NH3(ac/ch)=TVS(old)(Type i). Expiration date of 12/31/2011. |

Notes:

All standards are chronic unless otherwise stated.

mg/L = milligrams per liter

µg/L = micrograms per liter

TVS = Table value standards. It refers to equations found in Table III of Regulation No. 31, "The Basic Standards and Methodologies for Surface Water" (CDPHE, 2008a).

WS = Water supply. This means that the standard for these parameters is based on either the secondary drinking water standard for that parameter or the ambient water quality, whichever is higher.

Chronic means the level not to be exceeded by the concentration for either a single representative sample or calculated as an average of all samples collected during a 30-day period.

Acute means the level not to be exceeded by the concentration in a single sample or calculated as an average of all samples collected during a 1-day period.

CDPHE's WQCD is required through Section 303(d) of the CWA to develop a list of water bodies within the state that are not meeting the water quality standards. The WQCD is then required to further evaluate the stream and develop a total maximum daily load (TMDL). The TMDL generally will lay out the amount of pollutants that each source, point and nonpoint, can discharge into the stream. Portions of stream Segment 16c are included on WQCD's 2008 303d List (East Toll Gate Creek, West Toll Gate Creek, and Toll Gate Creek), but none of these receive flow from the study area (CDPHE, 2008c). Included on the Division's 2008 303d List are several TMDLs that have been developed for Segment 14, which does receive flow from the study area. Segment 14 has been identified as water quality-limited for nitrate, fecal coliform, and/or *Escherichia coli (E. coli)* (CDPHE, 2004 and 2008d).

Wastewater treatment facilities were noted as the primary point-source dischargers of nitrate to Segment 14. Although stormwater runoff from nonpoint sources was noted not to be a significant contributor to the nitrate impairment, a nitrate waste load allocation of 20 kilograms (kg) per day was set for ungaged surface waters in Segment 14. The nitrate TMDL recommends that stormwater outfalls that have nitrate concentrations exceeding 20 milligrams (mg) per day should be analyzed to ensure that there are no illegal connections to a sanitary sewer or industrial source (CDPHE, 2004). Typical highway runoff is known to

be a potential source of nitrate pollutants (FHWA, 1996). Pollutant sources may include atmosphere, roadside fertilizer use, and sediments. Left untreated, surface runoff into South Lakewood Gulch, Lakewood Gulch, McIntyre Gulch, and Dry Gulch would potentially affect Segment 14.

Segment 14 periodically exceeds current pathogen standards (CDPHE, 2008d). Significant contributions of *E. coli* are conveyed to Segment 14 through urban stormwater collection systems during storm events and dry weather conditions. CDPHE has developed a draft TMDL for *E. coli* in which the WQCD is proposing a density-based allocation approach that will encompass nonpoint and point sources of *E. coli*. Any point along Segment 14 would have to meet the *E. coli* standard of 126 bacteria colony forming units (cfu) per 100 millimeters (ml) of water (CDPHE, 2008d). Attainment of the numeric target will be determined by the calculation of a 30-day geometric mean for end-of-pipe dry weather discharges, which could potentially impact discharges to South Lakewood Gulch, Lakewood Gulch, McIntyre Gulch, and Dry Gulch. Additionally, untreated highway runoff is known to be a potential source of total and fecal coliforms (FHWA, 1996). Pollutant sources may include soil litter, bird droppings, and trucks hauling livestock/stockyard waste.

### Groundwater Quality

Limited groundwater monitoring data were available for the study area. The State Engineer's Office (SEO) does not collect or monitor wells near the US 6 and Wadsworth interchange, and the location of other wells in the general area is too far beyond the project boundaries for any available data to be relevant.

### Water Quality Sampling Sites

Several federal and state agencies as well as the City of Lakewood were contacted in an effort to obtain water quality data that were site-specific for the study area. The U.S. Geological Survey (USGS) and CDPHE both have water quality monitoring networks throughout the South Platte River watershed, but all of the water quality monitoring sites along the South Platte River are located too far from the study area to provide any meaningful data. Moreover, the City of Lakewood has no ongoing water quality monitoring on either Lakewood Gulch or McIntyre Gulch (City of Lakewood, 2008). As a result, no existing water quality monitoring data was available that could be readily used in the baseline water quality assessment of the study area.

### Point-Source Discharges and Water Supplies

Local available data were evaluated to determine the direct discharges that were in the study area and that could be potentially affected by interchange expansion. No CDPS permitted point-source discharges were found in the study area. Additionally, there are no public water supply intake points near the study area that will be impacted. No attempt was made to determine the location of any private wells or water intakes.

# Impact Evaluation Methodology

The water quality assessment utilized guidance developed by the FHWA to determine the impacts of highway improvement projects in accordance with NEPA guidelines. Specifically, annual pollutant mass loadings from highway runoff were evaluated for existing and proposed conditions. This method of estimating mass loading due to highway runoff is the Driscoll method, and it is a component of the FHWA probabilistic dilution model developed with Driscoll. The full Driscoll model was not applied to this water quality impact assessment because site-specific parameters for the study area were not available for model input. Supplemental literature data from the FHWA were incorporated into the analysis to qualitatively and quantitatively estimate the highway runoff impacts from the study area.

## Driscoll Method for Estimating Pollutant Loading

FHWA has developed a method to estimate the pollutant loading due to highway runoff. Site characteristics used directly in equations determine discharge from flow rate, runoff volume, and pollutant mass loading rate. Data tables based on the site location provide required parameters. Alternatively, these parameters may be calculated using local data if more precise calculations are desired. The method focuses on pollutants contributed by highway segments within a watershed. Typical water quality pollutants of concern from highways are shown in Table 3. The steps required to determine the annual and event pollutant mass load include calculation of the runoff quantity at the site and identification of the average pollutant concentration in the runoff.

TABLE 3
Typical Water Quality Pollutants of Concern

| Constituent | Source | Basis for Inclusion |
|---|---|---|
| Suspended Solids | Pavement wear, vehicles, atmosphere, maintenance, snow/ice abrasives, sediment disturbance | Excessive sediment can be detrimental to aquatic life (primary producers, benthic invertebrates, and fish) by interfering with photosynthesis, respiration, growth, and reproduction. |
| Zinc | Tire wear, motor oil, and grease | Toxic to aquatic organisms, can bioaccumulate, and has the potential to contaminate drinking water supplies. |
| Cadmium | Tire wear, insecticide application | Toxic to aquatic organisms, can bioaccumulate, and has the potential to contaminate drinking water supplies. |
| Arsenic | Lead slag waste when smelter slag is used as the abrasive blast material for removal of surface coatings; this slag is likely to contain arsenic and mercury in hazardous quantities | Toxic to aquatic organisms, can bioaccumulate, and has the potential to contaminate drinking water supplies. |
| Nickel | Diesel fuel and gasoline, lubricating oil, metal plating, brake-lining wear, asphalt paving | Toxic to aquatic organisms, can bioaccumulate, and has the potential to contaminate drinking water supplies. |
| Copper | Metal plating, bearing wear, engine parts, brake-lining wear, fungicides, and insecticides | Toxic to aquatic organisms, can bioaccumulate, and has the potential to contaminate drinking water supplies. |
| Iron | Auto body rust, steel highway structures, engine parts | Toxic to aquatic organisms, can bioaccumulate, and has the potential to contaminate drinking water supplies. |
| Lead | Leaded gasoline, tire wear, lubricating oil and grease, bearing wear, atmospheric fallout | Toxic to aquatic organisms, can bioaccumulate, and has the potential to contaminate drinking water supplies. |
| Manganese | Engine parts | Toxic to aquatic organisms, can bioaccumulate, and has the potential to contaminate drinking water supplies. |
| Chromium | Metal plating, engine parts, brake-lining wear | Toxic to aquatic organisms, can bioaccumulate, and has the potential to contaminate drinking water supplies. |
| Nitrite and Nitrate Nitrogen | Atmosphere, roadside fertilizer use, sediments | Can lead to accelerated growth of vegetation or algae, resulting in impaired use of water; un-ionized ammonia can be toxic to freshwater fish. |
| Total Phosphorus | Atmosphere, roadside fertilizer use, sediment | Can lead to accelerated growth of vegetation or algae, resulting in impaired use of water. |
| Total Coliforms/ Fecal Coliforms | Soil litter, bird droppings, trucks hauling livestock/stockyard waste | Common bacteria found in stormwater that can lead to the closure of adjacent swimming areas, and may increase the cost of treating drinking water at water supply reservoirs. |
| Polyaromatic Hydrocarbons (PAHs) | Fuels | Toxic to aquatic organisms. Toxicity of PAHs is additive where, even though no single PAH concentration exceeds a water quality standard, the sum of the PAHs can, under certain circumstances, be toxic. |

| | | |
|---|---|---|
| Magnesium | Engine parts | Toxic to aquatic organisms, can bioaccumulate, and has the potential to contaminate drinking water supplies. |
| Sodium/ Chloride | Deicing salts | Potentially can be detrimental to plants and animals. Can increase salinity that could impact groundwater, streams, and lakes. |
| Sulfates | Roadway beds, fuel, deicing salts | Lowers pH (increases acidity) in streams, which stresses aquatic life and leaches toxic metals out of sediment and rocks. High acidity and concentrations of heavy metals can be fatal to aquatic organisms, and may eliminate entire aquatic communities. |
| Chemical Oxygen Demand (COD) | Oxygen-demanding substances include plant debris, street litter, animal waste, and organic matter commonly found in stormwater | An important water quality determinate because it estimates the level of oxygen demand in polluted waters, and is also indicative of the sustainable level of aquatic life. |
| Biochemical Oxygen Demand (BOD) | Oxygen-demanding substances include plant debris, street litter, animal waste, and organic matter commonly found in stormwater | Often used to determine the amount of organic pollution in surface waters. |
| Oil and Grease | Spills, leaks, motor lubricants, antifreeze, hydraulic fluids, asphalt surface leachate | Contain a wide array of hydrocarbon compounds, some of which are toxic to aquatic organisms at low concentrations. |

## Pollutant Loading Analysis

In the absence of site-specific loading data for the study area, a mass loading calculation was used to determine annual mass loadings for the proposed roadway improvements on Wadsworth from 4th to 14th Avenues and along US 6 from approximately Broadview Drive on the east to Allison Street on the west. Mass loadings for urban stormwater runoff were estimated using methodology from the *Federal Highway Administration Evaluation and Management of Highway Runoff* (FHWA, 1996).

Pollutant loading rates were determined from the site median concentrations of pollutants for urban highways based on an average daily traffic (ADT) volume of more than 30,000 vehicles, the coefficient of variation of the pollutant event mean concentration, drainage area and pervious area, and rainfall characteristics available for the Denver area (FHWA, 1996). Complete statistical information was obtained from FHWA. Site data were adapted primarily from the I-25 Denver site from the Nationwide Urban Runoff Program (NURP) study because the site had a complete statistical data set. Extensive statistical data for rainfall (intensity, duration, interval, and various coefficient of variations) and pollutant concentrations (site median event mean concentrations [EMCs] of pollutants, coefficient of variations) are not available to be applied in the loading analysis to achieve site-specific results for the City of Lakewood. However, the estimated results provide an adequate characterization of potential water quality effects that can be expected within the study area.

Due to limited project drainage information, the study area was divided into six watershed segments with existing and proposed areas as shown in Table 4. Figures 2 and 3 show the study area watershed segments used to analyze the contributing area and impervious area treated for each segment.

TABLE 4
US 6 and Wadsworth Impervious Area

| Study area Watershed Segments | Outfall Location | Total Contributing Area[1] (acres) | Impervious Area Treated (acres) | |
|---|---|---|---|---|
| | | | Existing | Proposed Build Alternative |
| 1 (WQ-MG1 and MG2) | McIntyre Gulch | 32.21 | 19.09 | 20.02 |
| 2 (WQ-LG1) | Lakewood Gulch (South Location) | 6.71 | 3.91 | 4.69 |
| 3 (WQ-LG2) | Lakewood Gulch (North Location) | 13.72 | 4.22 | 4.46 |
| 4 (WQ-DG1) | Dry Gulch | 9.32 | 3.73 | 3.75 |
| 5 (WQ-14th-1) | 14th Ave. Storm Drain | 11.03 | 2.11 | 2.07 |
| 6 (WQ-SLG1) | South Lakewood Gulch | 5.17 | 3.68 | 4.66 |
| **Total** | | **78** | **37** | **40** |

[1]Includes contributing offsite basins.

Table 5 shows the analysis conducted to determine the increase in annual mass loading rates from the study area for each project watershed segment and the Build Alternative. Site characteristics and values for some parameters from FHWA were used directly in equations to determine discharge flow rate, runoff volume, and pollutant mass loading rate.

FIGURE 2
Watershed Segments and Potential Water Quality Treatment Ponds, Northern Portion of the Study Area

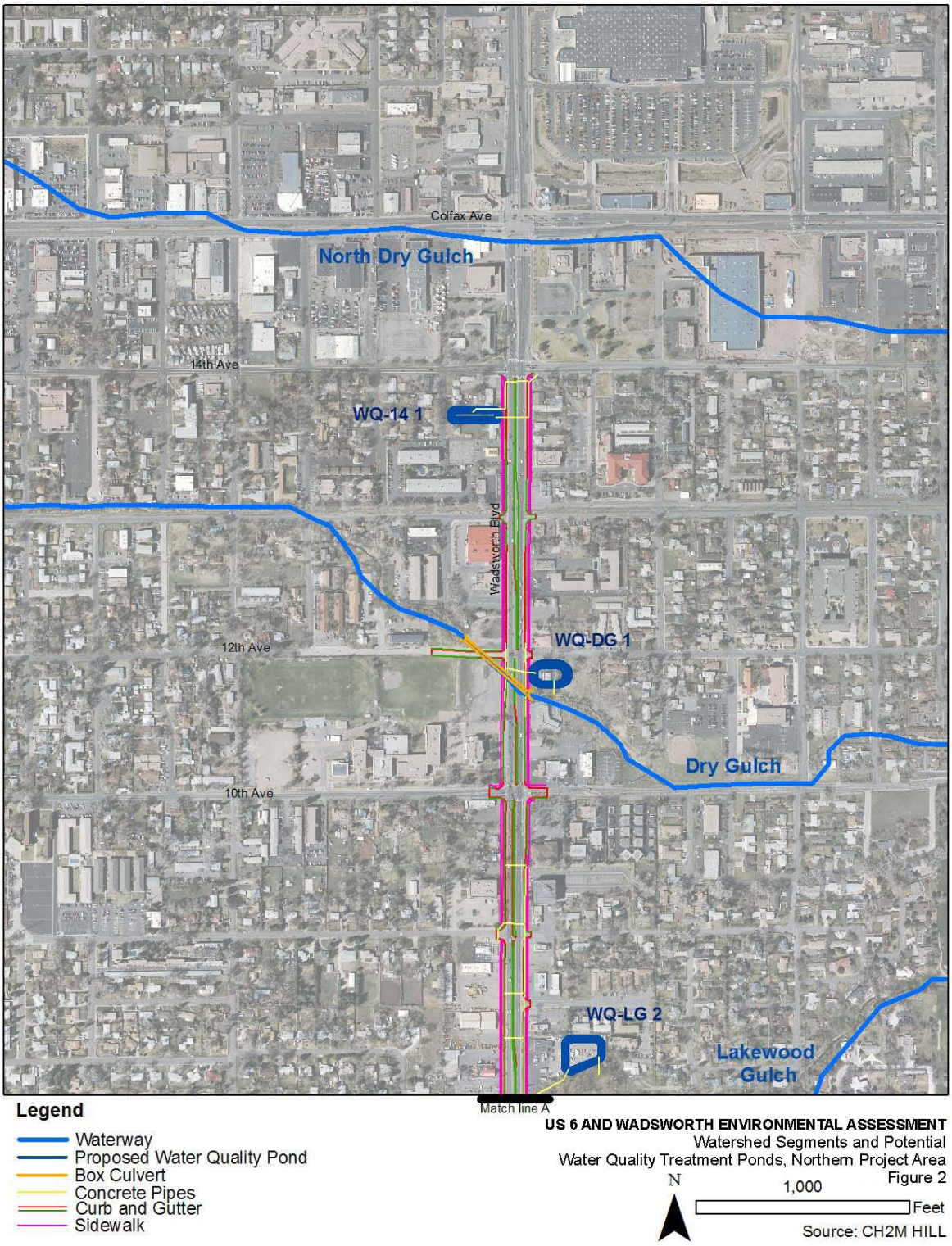


FIGURE 3
Watershed Segments and Potential Water Quality Treatment Ponds, Southern Portion of the Study Area

TABLE 5
Expected Annual Mass Loading of Pollutants from Highway Runoff for US 6 and Wadsworth Existing Alignment and Proposed Build Alternative

| | Parameters Analyzed | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Pollutants** | **Total Suspended Solids** | **Total Organic Carbon** | **Chemical Oxygen Demand** | **Nitrate + Nitrite** | **Phosphorus (as PO4)** | **Total Copper** | **Total Lead** | **Total Zinc** |
| Average Event Mean Conc[1] (mg/L) | 174 | 31 | 140 | 0.93 | 0.49 | 0.066 | 0.49 | 0.40 |
| **Annual Mass Loading of Existing Highway (kg/yr)** | | | | | | | | |
| 1 (WQ-MG1 and MG2) | 4,493 | 800 | 3,615 | 24.01 | 12.65 | 1.70 | 12.65 | 10.33 |
| 2 (WQ-LG1) | 920 | 164 | 740 | 4.92 | 2.59 | 0.35 | 2.59 | 2.12 |
| 3 (WQ-LG2) | 993 | 177 | 799 | 5.31 | 2.80 | 0.38 | 2.80 | 2.28 |
| 4 (WQ-DG1) | 878 | 156 | 706 | 4.69 | 2.47 | 0.33 | 2.47 | 2.02 |
| 5 (WQ-14th-1) | 497 | 88 | 400 | 2.65 | 1.40 | 0.19 | 1.40 | 1.14 |
| 6 (WQ-SLG1) | 866 | 154 | 697 | 4.63 | 2.44 | 0.33 | 2.44 | 1.99 |
| **Annual Mass Loading of Highway with Build Alternative (kg/yr)** | | | | | | | | |
| 1 (WQ-MG1 and MG2) | 4,712 | 839 | 3,791 | 25.18 | 13.27 | 1.79 | 13.27 | 10.83 |
| 2 (WQ-LG1) | 1,104 | 197 | 888 | 5.90 | 3.11 | 0.42 | 3.11 | 2.54 |
| 3 (WQ-LG2) | 1,050 | 187 | 845 | 5.61 | 2.96 | 0.40 | 2.96 | 2.41 |
| 4 (WQ-DG1) | 883 | 157 | 710 | 4.72 | 2.49 | 0.33 | 2.49 | 2.03 |
| 5 (WQ-14th-1) | 487 | 87 | 392 | 2.60 | 1.37 | 0.18 | 1.37 | 1.12 |
| 6 (WQ-SLG1) | 1,097 | 195 | 882 | 5.86 | 3.09 | 0.42 | 3.09 | 2.52 |
| **Percent Increase of Annual Load (%)** | | | | | | | | |
| 1 (WQ-MG1 and MG2) | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 2 (WQ-LG1) | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| 3 (WQ-LG2) | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| 4 (WQ-DG1) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5 (WQ-14th-1) | -2 | -2 | -2 | -2 | -2 | -2 | -2 | -2 |
| 6 (WQ-SLG1) | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |

[1]Source: FHWA, 1996.
mg/L = milligrams per liter
kg/yr = kilograms per year

In general, pollutants in stormwater runoff from the highway are expected to increase approximately 1 to 27 percent over existing levels with the additional impervious area added to the existing highway. The largest increase in pollutants, 27 percent, is expected in the project watershed segment that will discharge to South Lakewood Gulch. Additionally, the impervious area for watershed segment WQ-14th-1 has slightly decreased for the Build Alternative, potentially resulting in a decrease in annual pollutant loads from that segment. The expected percent increase in annual load from the highway is only an estimate and should not be viewed as an exact value. Actual site-specific stormwater monitoring data and well-defined highway drainage basin calculations would be necessary to determine site-specific loading information.

Left untreated, the predicted increase in pollutant loadings in the study area would potentially increase contributions of nitrate and *E. coli* to the nearby tributaries to Segment

14, such as Lakewood Gulch and South Lakewood Gulch. TMDLs for Segment 14 of the South Platte River will need to be carefully considered during the stormwater BMP for the project. Furthermore, consideration should be given in selecting BMPs that will provide treatment for nitrate and *E. coli* to reduce stormwater runoff pollutant loads to comply with South Platte River Segment 14 TMDLs.

Because the annual mass loading estimation is based on various parameters, such as the mean annual rainfall volume and the average number of storm events per year, the expected annual mass loading calculations have limitations. If larger values for the average mean annual rainfall volume and the average number of storm events per year were applied to the analysis, the mean event mass loads and annual mass loadings would increase. However, because the comparison of mass loads is driven primarily by the increase in drainage area for the project, the percent increase from the existing annual mass loading to proposed annual mass loading would remain within the range of approximately 1 to 27 percent.

A significant limitation of the expected annual pollutant loading analysis for the study area is that it does not take into account the how much stormwater runoff is being treated for the existing conditions and the effectiveness of the limited stormwater BMPs in place for the existing conditions. Because existing conditions for the study area are highly impervious with stormwater BMPs in place, some form of treatment is being provided for the existing pollutant loads. However, this treatment is most likely below guidelines specified in CDOT's New Development and Redevelopment Program because the interchange has not undergone any recent improvements after CDOT's MS4 Permit was issued. Existing site-specific BMP design and monitoring data would need to be collected in order to determine the effectiveness of the limited existing water quality treatment facilities.

## Impacts

### No Build Alternative

Because the No Build Alternative would not involve new highway construction in the study area, the construction effects of the build packages would be avoided.

The No Build Alternative would result in other impacts, such as increased highway and interchange congestion, and cause contaminant concentrations in the highway runoff to increase due to high ADT values. Because there are limited BMPs (grass swales and depression areas) currently in place to address existing and increasing future pollutant loadings from US 6 and Wadsworth, further water quality degradation would be anticipated to the receiving waters, as well as the surrounding wetlands.

### Build Alternative

Implementation of the Build Alternative would require widening US 6 and Wadsworth near the interchange and potentially replacing structures in the study area. These improvements would present erosion and sediment control issues related to the construction activities. Much of the erosion and sediment issues are related to earthwork, which would result in the presence of unprotected, open areas while construction of the new paved surfaces and structures progresses. These bare surfaces are highly susceptible to erosion from rain and wind because they lack the protection that established vegetation normally provides.

The Build Alternative would replace and lengthen structures conveying Lakewood Gulch and Dry Gulch under Wadsworth and McIntyre Gulch and South Lakewood Gulch under US 6. This would involve realignment of McIntrye Gulch and the construction of a concrete box culvert to convey flows under US 6 and Wadsworth. Construction of the new interchange would require the placement of piers to a depth that could reach groundwater. All of these actions would involve work regulated under Section 404 of the Clean Water Act, requiring one or more permits from the U.S. Army Corps of Engineers.

Construction from the existing structures or from the stream banks is preferred in order to minimize activities within the stream channels. All attempts should be made to keep equipment out of the channel and limit the time that the activity occurs in the channel. Temporary stream diversions can be both an impact and mitigation. The construction of the diversion would likely have short-lived, immediate turbidity effects, but could effectively isolate the flowing stream from the instream construction disturbance. Construction activities are anticipated to last for 48 to 60 months. Application of BMPs, described below under mitigation, will prevent erosion and mitigate sedimentation to the maximum extent practicable.

Alignment of the proposed US 6 and Wadsworth toe-of-slope may encroach into wetland boundaries. The construction has the potential to result in temporary erosion, sedimentation, and destruction of riparian vegetation in the immediate area.

After construction is complete and the roadway is in operation, the widened transportation corridor would have a larger impervious or paved area. The majority of pollutants are generated by vehicle traffic, with some additional particulate matter settling out of the air. The larger impervious area generates more runoff, because rainfall has less pervious area to infiltrate into the ground. The combined roadway pollutants and potential erosion sediment are the primary pollutant constituents in the post-construction stormwater runoff. Table 5 presents a summary of quantitative analyses showing the expected additional pollutant loadings from the Build Alternative to the receiving streams in the study area. It is estimated that the Build Alternative would create 40 acres of impervious highway area versus 37 acres for the existing alignment. Pollutant loading analysis has shown that there is a potential for various highway pollutant concentrations to be elevated for the Build Alternative if BMPs are not put in place. BMPs are necessary to achieve removal of these common highway pollutants as specified in CDOT's New Development and Redevelopment Program.

## Cumulative Impacts

Cumulatively, impacts on water quality would be expected to further degrade this urban watershed due to the continuous increase in impervious area unless measures are taken to address these impacts and/or the water quality. Development densities are anticipated to increase within the study area. This increase in density is anticipated to increase urban runoff and, if unmitigated, would have a degrading effect on water quality of receiving streams. If permanent BMPs are not implemented at central discharge points to the receiving water to collect existing and additional runoff from the new improvements, the water quality of the receiving streams will continue to degrade substantially. Consequently, the water quality degradation could negatively impact sensitive habitat areas as well as the project corridor.

## Mitigation

Every effort will be made to minimize both temporary and permanent impacts to water quality to ensure the Build Alternative will not affect fish and other water-dependent wildlife and vegetation. Disturbances during construction can produce areas of erodible surfaces; therefore, it is important to control sediment flows and minimize impacts during construction. The following permanent BMPs will be employed to mitigate both short-term and permanent impacts to water bodies as a result of construction:

- CDPS regulations for stormwater quality, including obtaining a stormwater construction permit, will be adhered to during construction of the Build Alternative.
- All work performed on the project will conform to Section 107.25 (Water Quality) and Section 208 (Erosion Control) of the CDOT *Standard Specifications for Road and Bridge Construction*.
- A Stormwater Management Plan (SWMP) will be developed that will detail the BMPs to be used for construction. Practices from the *Erosion Control and Stormwater Quality Guide* (ECSQG) (CDOT, 2002) are outlined below:
  - Adjacent disturbed slopes will be revegetated with native plant species to protect exposed soils from erosion (see BMP EC 1, ECSQG).
  - Where temporary or permanent seeding operations are not feasible due to seasonal constraints, mulch or other CDOT-approved methods of stabilization will be applied to protect soils from erosion (see BMP EC 2, ECSQG).
  - Erosion control blankets will be used as appropriate on newly seeded slopes to control erosion and promote the establishment of vegetation (see BMP EC 5, ECSQG).
  - Temporary berms will be given priority consideration for protecting the sensitive areas in the study area (see BMP EC 8, ECSQG). Additional erosion control measures such as silt fences and erosion bales can be implemented at the construction site, but with care and not as the sole erosion control system. Erosion bales will be free of noxious weeds.
  - Erosion bales can be used as sediment barriers and filters along the toe-of-fills adjacent to water surface waterways and drainages, and at the cross-drain inlets, where appropriate, with additional reinforcement and in conjunction with other erosion control measures such as temporary berms (see BMP EC 1, ECSQG).
  - Where appropriate, silt fences can be used to intercept sediment-laden runoff before it enters a water body, such as a wetland, only when they are used in conjunction with other erosion control measures such as temporary berms (see BMP EC 3, ECSQG).
  - Where appropriate, slope drains will be used to convey concentrated runoff from the top to the bottom of disturbed slopes (see BMP EC 7, ECSQG). Slope and cross drain outlets will be constructed to trap sediment.

  - Check dams will be used where appropriate to slow the velocity of water through roadside ditches and swales (see BMP EC 9, ECSQG).

- Construction access at the site, for items such as haul roads, crane paths, and concrete washout areas, will be planned carefully in order to leave any sensitive habitats undisturbed.

- A concrete washout area will be constructed at the improvement site with the following specifications:

  - Suitable locations within the CDOT right-of-way will be set aside for a concrete truck washout area. A pit with sufficient capacity to hold all anticipated wastewater will be constructed at least 50 feet away from any State waters and the bottom of the pit will be at least 5 feet higher than groundwater. The area will be signed as a concrete wash water cleanout area and the access road leading to a paved road or highway should have a stabilized construction entrance as detailed in the ECSQG. No fertilizer, hydrofertilizer, or hydromulching will be allowed adjacent to any stream or wetland.

- If required, a construction dewatering discharge permit will be obtained for groundwater dewatering activities.

- As appropriate, permanent BMPs will be constructed for use during the construction phase to improve water quality control at the site. A concept-level evaluation of possible water quality BMPs and their locations was performed. This study evaluated impacts on right-of-way requirements including detention basins, conveyance network, outfall locations, and facilities that serve as BMPs for water quality. The evaluation took into consideration drainage and BMP criteria for both the City of Lakewood and CDOT. The City of Lakewood and CDOT have adopted similar Urban Drainage and Flood Control District (UDFCD) criteria for drainage and BMP design.

  A preliminary, conservative hydrologic and hydraulic analysis of onsite and offsite areas was performed for the Build Alternative using drainage criteria outlined in UDFCD's *Urban Storm Drainage Criteria Manual*, Volume 2. Drainage criteria for both the City of Lakewood and CDOT were taken into consideration in the development of the conceptual water quality pond design. However, pond volumes were based on required water quality treatment volumes within the study area including onsite basins, side streets, and offsite basin. Stormwater runoff from offsite basins will be conveyed through the proposed drainage system with stormwater quality treatment. Ponds were only sized for water quality volume pursuant to CDOT direction due to direct outfalls to existing streams. When the project enters the design phase, analysis of the allowable pre-development release rates may result in larger pond sizes, if detention is required. Based on the drainage analysis, the proposed conceptual drainage design for the Build Alternative determined that six water quality facilities were needed to provide the necessary water quality capture volume (WQCV). In general, water quality ponds 1 (WQ-MG1 and MG2), 2 (WQ-LG1), 3 (WQ-LG2), 4 (WQ-DG1), 5 (WQ-14th-1), and 6 (WQ-SLG1) will outfall directly into a receiving water body or an existing MS4 system[2].

[2] Because Pond 1 is divided into two separate facilities (WQ-MG1 and WQ-MG2) there are actually seven distinct ponds as reported in the EA document. For the purposes of this analysis, WQ-MG1 and WQ-MG2 are reported as one facility.

Flows from pond 1 will outfall to McIntyre Gulch. Flows from ponds 2 and 3 will outfall to Lakewood Gulch, while flows from pond 4 will outfall to Dry Gulch. Flows from pond 5 will connect to the existing City of Lakewood stormwater system where a potential stormwater detention opportunity is available. Finally, flows from pond 6 will outfall to South Lakewood Gulch. These water quality ponds were designed into roadway interchanges and medians wherever possible. In areas where pond surface area converged on right-of-way limits, ponds were shaped to minimize additional land acquisition.

In addition, the study area is near sensitive State waters and requires compliance with the CDOT New Development and Redevelopment Program under CDOT's stormwater discharges associated with the MS4 Permit. In order to comply with CDOT's New Development and Redevelopment Program, the preliminary project design is taking a conservative approach and is complying with the program's more stringent Tier 1 project classification and design criteria. Tier 1 projects require 100 percent treatment of the WQCV, which is defined as the first 0.50 inch of runoff. For the Build Alternative, 100 percent treatment of the WQCV was included in the preliminary stormwater water quality facility design. Table 6 shows a summary of the WQCV requirements for the six water quality facilities for the Build Alternative. Figures 2 and 3 show the potential locations of the water quality treatment ponds.

TABLE 6
Water Quality Facility Design

| | Build Alternative | | | | | |
|---|---|---|---|---|---|---|
| Pond | Project Impervious Area (acres) | Off Site Impervious Area (acres) | Total Impervious Area Treated (acres) | Project Required WQCV[1] (acre-feet) | Additional Offsite WQCV[1] (acre-feet) | Planned WQCV[1] Treatment (acre-feet) |
| 1 (WQ-MG1 and MG2) | 20.02 | 3.25 | 23.27 | 0.79 | 0.15 | 1.01 |
| 2 (WQ-LG1) | 4.69 | 0 | 4.69 | 0.18 | 0 | 0.21 |
| 3 (WQ-LG2) | 4.46 | 7.89 | 12.35 | 0.20 | 0.35 | 0.55 |
| 4 (WQ-DG1) | 3.75 | 3.61 | 7.35 | 0.17 | 0.14 | 0.33 |
| 5 (WQ-14th-1) | 2.07 | 6.11 | 8.18 | 0.09 | 0.24 | 0.34 |
| 6 (WQ-SLG1) | 4.66 | 0 | 4.66 | 0.21 | 0 | 0.22 |
| **Total** | **39.65** | **20.86** | **60.5** | **1.64** | **0.88** | **2.66** |

[1]Water quality capture volume (WQCV) shall be released in 40 hours.

- Non-structural BMPs, such as pesticide and fertilizer application guidelines and anti-icing and de-icing guidelines, will be employed to improve water quality in conjunction with BMP implementation. Other non-structural BMPs, such as water quality signage adjacent to the receiving streams and irrigation ditches, are examples of additional tools that should be considered for implementation.

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