5.16 Water Quality

This section discusses the water quality in the study area and explains why water quality is important to the project. The impacts of the project alternatives on water quality also are evaluated and proposed mitigation measures are discussed to offset any potential adverse effects.

5.16.1 What is water quality and why is it important to this project?

Water quality refers to the physical, chemical, and biological characteristics of aquatic systems. It is important to protect water quality for the intended uses of a water body that may include support of aquatic habitats, domestic water supply, contact recreation (such as swimming or other water sports), or agricultural irrigation. Any increase in impervious cover will lead to an increase in the amount of runoff flows and associated pollutants and cause a drop in water quality. It is important to determine the potential effects of the project on the water quality of the receiving water bodies and to mitigate any adverse effects.

5.16.2 Have there been changes to water quality in the study area or to the analysis process since the release of the 2008 Draft EIS?

Based on amended Regulation Number 93, effective on March 30, 2012, impaired waters in the study area have changed. At the main stem of the South Platte River from the outlet of Chatfield Reservoir to the Burlington Ditch diversion, the parameter of concern is no longer *E. coli*, but arsenic. Also, the entire segment of the South Platte River from Burlington Ditch to below the confluence with Big Dry Creek is now considered impaired water.

The water quality study area also has changed because of the changes to the alternatives and the construction limits. In the 2008 Draft EIS, a partial Driscoll analysis (Driscoll, Shelley & Strecker, 1990) was performed to estimate the pollutant loads to provide a quantitative comparison between the alternatives. The same methodology is used in this Supplemental Draft EIS.

What does a partial Driscoll analysis entail?

The Driscoll model is used to determine highway runoff pollutant loading impacts to receiving waters. This modeling approach identifies and quantifies the elements in highway runoff, identifies the sources and migration paths of these pollutants from the highways to the receiving waters, analyzes the effects of these pollutants in the receiving waters, and then develops the necessary abatement/ treatment methodology for objectionable pollutants.

5.16.3 What study area and process was used to analyze water quality?

The study area for water quality matches the construction limits of the project alternatives. However, the impacts are applied to the overall watershed to determine if the impacts are significant (see Exhibit 5.16-1).

The partial Driscoll analysis was performed for all of the alternatives for both water bodies: the South Platte River and Sand Creek.

What is a watershed?

A watershed is the area where all of the water that is underneath the land or drains off of it goes.

Exhibit 5.16-1. Water quality study area

5.16.4 What are the areas of water quality interest that are being analyzed, what is the existing water quality condition in the study area, and how do the project alternatives impact it?

The partial Driscoll analysis involves the estimation of pollutant loads per mean storm event. The following list shows the polluting factors and the reason why they are analyzed:

- Lead, copper, and zinc are a concern because they dissolve in water and can have toxic effects when they build up in water plants and aquatic life.
- Total Suspended Solids (TSS) is a concern because it can increase the murkiness of water; as the floating particles in murky water settle, this can lead to loss of aquatic habitat and channel instability.
- Phosphorus is a concern because it can increase the production of algae in water, which can reduce oxygen levels in streams.

The existing loads of these factors in the South Platte River and Sand Creek were estimated using the partial Driscoll analysis and are presented in Exhibit 5.16-2 and Exhibit 5.16-3, respectively, along with the load estimations for the alternatives.

Exhibit 5.16-2. South Platte River water quality effect summary

Alternative/Option	Water Quality Factor (pounds per mean storm event)					
	Lead	Copper	Phosphorous	Zinc	TSS	Percentage TSS Increase
Existing Conditions	1.21	0.16	1.21	1.00	431	N/A
No-Action Alternative, North Option	1.40	0.19	1.40	1.15	496	15
No-Action Alternative, South Option	1.41	0.19	1.41	1.16	501	16
Revised Viaduct Alternative, North Option	1.73	0.23	1.73	1.43	615	43
Revised Viaduct Alternative, South Option	1.77	0.24	1.77	1.46	628	46
Partial Cover Lowered Alternative, Basic Option	1.95	0.26	1.95	1.60	691	60
Partial Cover Lowered Alternative, Modified Option	1.97	0.27	1.97	1.62	698	62

Exhibit 5.16-3. Sand Creek water quality effect summary

Alternative/Option	Water Quality Factor (pounds per mean storm event)					
	Lead	Copper	Phosphorous	Zinc	TSS	Percentage TSS Increase
Existing Conditions	5.31	0.72	5.31	4.37	1,886	N/A
Build Alternatives, General-Purpose Lanes Option	6.46	0.87	6.46	5.31	2,292	22
Build Alternatives, Managed Lanes Option	7.26	0.98	7.26	5.97	2,576	37

As shown in Exhibit 5.16-2, the No-Action Alternative will have slight adverse effects on water quality in the South Platte River. Results in Exhibit 5.16-2 and Exhibit 5.16-3 show an overall increase in pollutant and TSS loads, which generally includes heavy metals such as lead, copper, phosphorous, and zinc. The percentage increase in factor loads in runoff will require permanent BMPs to mitigate the effects of the proposed alternatives back to the existing conditions. For each alternative option, these BMPs will be implemented to comply with CDOT's Municipal Separate Storm Sewer Systems (MS4) permit, which will ultimately have a beneficial effect on water quality.

Exhibit 5.16-4 summarizes the comparison of the traffic volumes, total project impervious areas, and impervious area over streams. The analysis shows that traffic volumes can increase while minimal change will occur in impervious surface area. The exhibit also shows an increase in impervious area for the Build Alternatives ranging from 26 percent to 65 percent.

Note that the total impervious areas for the Build Alternatives are different from those in the 2008 Draft EIS. Also note that the No-Action Alternative has a smaller impervious area than the Build Alternatives.

Increased impervious area over streams also is shown in Exhibit 5.16-4 for each of the alternatives ranging from 0 acres to 2.28 acres. The amount of surface area at stream crossings is important due to difficulty in capturing constituents at the crossing. During snow events, plowing may push sand, gravel, and de-icing agents off the highway and outside the drainage system, making it inaccessible for treatment by the permanent BMPs before discharge into the receiving water bodies.

Exhibit 5.16-4. Water quality factor summary

Alternative/Option	Water Quality Factor				
	Total Impervious Surface (acres)	Percent Increase in Impervious Surface	Daily Traffic Volume (vehicles per day)	Number of Stream Crossings	New Impervious Surface Over Streams (acres)
South Platte River					
Existing Conditions	56.10	N/A	143,800	1	0
No-Action Alternative, North Option	65.89	17	191,700	1	0
No-Action Alternative, South Option	65.48	17	191,700	1	0
Revised Viaduct Alternative, North Option	81.17	45	214,600	1	0
Revised Viaduct Alternative, South Option	81.30	45	214,600	1	0
Partial Cover Lowered Alternative, Basic Option	91.49	63	214,600	1	0
Partial Cover Lowered Alternative, Modified Option	92.57	65	214,600	1	0
Sand Creek					
Existing Conditions	215.06	N/A	132,300	1	0
No-Action Alternative	215.06	N/A	174,300	1	0
Build Alternatives, General-Purpose Lanes Option	271.22	26	229,100	1	1.93
Build Alternatives, Managed Lanes Option	302.18	40	174,500	1	2.28

5.16.5 How are the negative effects from the project alternatives mitigated for water quality?

Mitigation measures to avoid and/or minimize adverse effects presented in the 2008 Draft EIS are still adequate for this project. Specific mitigation measures are discussed below. When the mitigation measures are implemented the impacts to water quality by this project will be minimal.

The runoff from I-70 will be captured and conveyed in a storm drain system that discharges to the South Platte River. Prior to discharging to the South Platte, the system will discharge to a water quality pond to provide water quality treatment. The outlet of the pond is smaller than the inlet of the pond, so runoff is temporarily stored in the pond and releases over a period of a few days. During this time (CDOT requires a minimum drain time of 40 hours), sediment settles out of the runoff and is stored in the pond and the runoff, with reduced sediments, discharges to the South Platte River.

Permitting

CDOT will take maintenance responsibility for any MS4 improvements constructed as part of this project and also will obtain the Colorado Discharge Permit System (CDPS) permit that covers stormwater discharges during construction. Additionally, CDOT requires that construction contractors secure dewatering permits for construction activities, if necessary.

Permanent BMPs

A variety of BMPs could be implemented at the site to remove the particulate pollutants from the stormwater with practical ranges from 10 percent to 90 percent. Removal of soluble pollutants and oil and grease by typical BMPs are less effective. Most notably and widely used in the Denver metropolitan area are extended detention basins with typical removal rates ranging from 50 percent to 80 percent for a well-designed basin. These basins increase retention times, allowing sediment and other suspended solid pollutants, such as metals that are carried with sediment, to settle to the bottom. Then, other pollutants, such as oils and greases, can partially volatilize before the stormwater runoff enters receiving waters.

The location of permanent water quality BMPs has not been determined, but will be required as the design of the improvements progress. Water quality mitigation will be provided as required by CDOT's MS4 permit and their New Development and Redevelopment Program. This can be accomplished by capturing and treating the direct runoff from the project site or by capturing and treating at an offsite area to ensure "equivalent water quality benefit to the receiving water." This project will treat highway runoff entering the South Platte River and Sand Creek and provide 100 percent water quality capture volume for the newly developed impervious surfaces or an equivalent offsite impervious area prior to entering those waterways.

Winter maintenance

CDOT implements "non-structural" BMPs into their winter maintenance practices, including policies and common sense practices that ensure the agency is meeting or exceeding the water quality standards in their MS4 permit. Based on CDOT standards obtained by personal interview, current non-structural practices include:

- Prevent over-treating by commencing liquid de-icer application at the beginning of snowfall and no longer pre-treating roads.
- Apply sand/salt mixtures (30/70 percent, respectively) at rates of 105 pounds to 115 pounds per lane mile, roughly 1/3 of the maximum allowable amount of 300 pounds per lane mile.
- Use liquid de-icer products, such as magnesium chloride and Caliber (a mixture of magnesium chloride, cornstarch, alcohol, and tree sap); apply these products at rates of 40 pounds to 80 pounds per lane mile.
- DRCOG and CDOT regulations require complete removal of sand/salt within the "core" sweeping area and only 35 percent removal outside the "core" areas, within four days of snow events. For the past two years, it has been CDOT practice to remove all remaining sand/salt from the study area even though it is not in the "core" sweeping area—and CDOT will continue to do so.
- Fleet upgrades include on-board computers to track the amount of mixture being applied, as well as rates of application of de-icing materials. This technology prevents over-treating; the majority of the CDOT Region 1 fleet is currently equipped with these computers.
- Use Ice Slicer, another solid mixture; this product is a sand/salt mixture with anti-corrosive additives and is applied at a rate of 100 pounds to 150 pounds per lane mile. This product is preferred over regular sand/salt mixtures because it produces less fugitive dust.
- Stockpile solid mixtures at the I-70/Havana Street maintenance facility; the mixtures are kept under domes to protect them from precipitation, which prevents water high in salts from running off into receiving waters.

- Perform quality assurance audits on de-icing mixtures several times per year to ensure elevated levels of harmful anti-caking compounds are not found in the mixtures.
- Train snowplow drivers annually, stressing the importance of meeting or exceeding water quality and air quality permit requirements.
- Use temperature gauges built into trucks and roadway surfaces to assist with making decisions related to de-icing application rates and mixes.
- Use vacuum sweepers, not side-cast sweepers, as part of ongoing fleet upgrades; trash within the right of way is picked up prior to each sweeping.
- Rely on cameras to determine problem areas during each storm event.

Construction BMPs

During construction, as soils are disturbed, storm runoff may create erosion and degradation of water quality if proper BMPs are not employed. Alternative implementation will be done in accordance with the programs established under CDOT's MS4 permit. Site-specific engineering design studies will be performed during final design, and care will be exercised during construction to prevent problems of stability and erosion during and after construction. To mitigate these effects, BMPs for erosion and sediment control, dust control, stormwater control, and expansive soils will be implemented during construction. BMPs for erosion and blowing dust during construction include the use of silt fences, erosion bales, erosion control blankets, sediment traps, sediment basins, soil stockpile management, temporary diversion structures, and spill prevention and control measures.

After construction, other BMPs will be followed for permanent erosion control. These include regrading as necessary, seeding and revegetating soils and slopes, mulch protection for new plantings, and stormwater control channels. These BMPs are described in numerous standard publications, including the *Erosion Control and Stormwater Quality Pocketbook* (CDOT, 2002b), *Best Management Practices for Erosion and Sediment Control* (U.S. Department of Transportation, 1995), and *Erosion and Sediment Control Handbook* (Goldman, Jackson & Bursztynsky, 1986).

Exhibit 5.16-5 lists the impacts and mitigations associated with water quality.

Exhibit 5.16-5. Summary of water quality impacts and mitigations

<table>
<tr><th>Alternative/ Option</th><th>Permanent Impacts and/or Benefits</th><th>Mitigation
Measures Applicable to All Alternatives</th></tr>
<tr><td>No-Action Alternative</td><td>Increase in runoff TSS loads of 15 percent to 16 percent to the South Platte River</td><td rowspan="4">• Construct water quality ponds as part of the project to treat stormwater runoff from the highway
• Treat runoff entering the South Platte River and Sand Creek and provide 100 percent water quality capture volume
• Prevent over-treating by using deicer/sand/salt products and technology in accordance with best management practices
• Stockpile solid mixtures per CDOT water quality requirements such as occur at the I-70/Havana Street maintenance facility; the mixtures are kept under domes to protect them from precipitation, which prevents water high in salts from running off into receiving waters</td></tr>
<tr><td>Revised Viaduct Alternative</td><td>• Increase in runoff TSS loads of 43 percent to 46 percent to the South Platte River
• Increase in runoff TSS loads of 22 percent to Sand Creek</td></tr>
<tr><td>Partial Cover Lowered Alternative</td><td>• Increase in runoff TSS loads of 60 percent to 62 percent to the South Platte River
• Increase in runoff TSS loads of 22 percent to Sand Creek</td></tr>
<tr><td>Managed Lanes Option (option to Build Alternatives)</td><td>Additional 15 percent increase in runoff TSS loads to Sand Creek</td></tr>
</table>

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