Final Borrow Haul Study
Alternatives Analysis

Gross Reservoir Dam

December 14, 2012

Prepared for:

DENVER WATER

Prepared by:

HDR

Table of Contents

Page No.

List of Tables

Page No.

List of Appendices

Executive Summary

HDR Engineering, Inc. (HDR) was initially hired by Denver Water in 2008 to evaluate two conceptual alternatives: to transport material needed to raise the Gross Dam site either via railroad or by truck (*Borrow Haul Study*, HDR, 2009 [2009 Report]). Based upon this report, it was determined that the costs associated with the rail alternative were prohibitively high. The existing mainline track at that time (2008) was functioning near maximum capacity, therefore, it was deemed impractical to construct an additional unloading track (adjacent to Union Pacific Railroad's [UPRR] existing mainline track), which would require adding or changing existing operations to accommodate the rail alternative. The 2009 Report determined that truck hauling material to the site to be the most economically feasible. The truck hauling alternative could include enhancing existing pullouts and/or adding pullouts and widening the shoulder of State Highway 72 (SH 72) to provide passing opportunities for traffic (particularly in areas with steep grades). Additionally, HDR recommended that construction traffic be restricted to off-peak times as another possible method to reduce congestion. The highest traffic volume on westbound SH 72 occurs from 3:00 p.m. to 5:00 p.m. The 2009 Report estimated that the truck hauling alternative would result in an increase of 88 truck trips per day (round-trip) using 44 smaller end dumps during construction along SH 72 (anticipated to take four construction seasons).

As part of Denver Water's FERC license amendment application, Boulder County residents were given the opportunity to review the 2009 Report and provide feedback and comments on these alternatives. The comments received from Boulder County residents expressed their opposition to additional truck traffic along SH 72 because of the additional noise, air pollution, and traffic constraints that would result. This feedback was used to further refine the alternatives and assumptions within the 2009 Report; the results of which are contained in this report.

Specifically, the following report includes a detailed analysis of three possible sources of material used to raise Gross Dam and increase capacity (aggregate, fly ash, and cement) and the costs and environmental impacts of three alternative means of delivering material to the site (see Appendix A for the general transportation routes and Appendix B for detailed cost estimates).

The components for hauling material for each alternative are as follows:

Truck hauling (Alternative 1)

- Truck hauling fine aggregate, cement, and fly ash from source to Gross Dam using large tractor trailer trucks.
- Truck hauling timber and ash/slash from Gross Dam to disposal site.
- Construction of five turn-outs for trucks on SH 72.
- Gross Dam Road improvements of approximately 35 curves and construction roadway maintenance.
- Three-inch overlay of SH 72.

Truck and rail hauling (Alternative 2)

- Truck and rail hauling fine aggregate, cement, and fly ash from source to 88th Avenue rail staging area using large tractor trailer trucks.
- Rail hauling fine aggregate, cement, and fly ash from 88th Avenue rail staging area to Crescent rail siding.
- Truck hauling fine aggregate, cement, and fly ash from Crescent rail siding to Gross Dam.
- Truck hauling timber and ash/slash from Gross Dam to Crescent rail siding and rail hauling to disposal site.

Rail hauling and conveying material (Alternative 3)

- Truck and rail hauling fine aggregate, cement, and fly ash from source to 88th Avenue rail staging area using large tractor trailer trucks.
- Rail hauling fine aggregate, cement, and fly ash from 88th Avenue rail staging area to Crescent rail siding.
- Transporting fine aggregate, cement, and fly ash via conveyor from Crescent rail siding to Gross Dam staging area.
- Truck hauling timber and ash/slash from Gross Dam to Crescent rail siding and rail hauling to disposal site.

With the reassessment of the 2009 study, it is anticipated the hauling of material would last 3 construction seasons using larger tractor trailer trucks in lieu of smaller end dumps. This would introduce approximately 49 trucks per day to the road system during construction.

The primary concerns expressed by Boulder County residents were the traffic constraints and increased environmental impacts that could result from this project, particularly increased air pollution and increased noise. In order to quantify and compare the various alternatives, two analyses were conducted:

1. An assessment of five criteria air contaminants (PM_{10}, $PM_{2.5,}$ SO_2, CO and NO_x), carbon dioxide (CO_2), and Volatile Organic Compounds (VOCs).
2. An analysis of greenhouse gas emissions.

The results of these analyses show that from an air quality perspective, there is not a significant difference in emissions between the alternatives. Because emissions for all alternatives are below *de minimis* thresholds, General Conformity requirements under 40 CFR 93.153(c)(1) do not apply for this action and no further air quality analysis or conformity determination would be required for this project. See Appendix C for a complete description of the air analyses, methodology used and results.

A greenhouse gas (GHG) inventory was conducted for this project, which is a comprehensive accounting of GHG emissions attributed to the project's activities. The results indicated that GHG emissions are decreased by slightly more than 50% from a truck hauling with rail (Alternative 2) compared to truck hauling only (Alternative 1). However, the GHG emissions in either case are not significant enough to use as a basis for making a business decision. The GHG emissions resulting from this project do not meet the threshold requirements of any current legislation for reporting or reducing GHG emissions. See Appendix C for a complete description of the GHG inventory, methodology used and results.

To assess project-related noise, a conservative approach was used that over-estimated the noise impacts from the project. In other words, the existing noise levels were estimated to be conservatively low and the project-related noise was estimated at the higher end of the range. Even with these assumptions, the results indicated that the addition of the project-related noise sources would have a negligible effect on the existing noise levels. (See Appendix C for a complete description of the noise analysis, methodology used, and results.) There are no significant noise impacts, therefore, there are no relevant differences among the alternatives to use as a basis for comparison. Therefore, the primary considerations for selecting an alternative for hauling material are cost, and public perception. (See Table ES-1 for comparison of alternative costs.)

Table ES-1. Comparison of Alternative Costs

Alternative	Description	Cost
Alternative 1	Truck hauling	$18,640,000
Alternative 2	Rail and truck hauling	$35,430,000
Alternative 3	Rail hauling and conveyor	$44,920,000

Chapter 1. Alternatives

1.1 Alternative 1

Alternative 1 consists of truck hauling fine aggregate, cement, and fly ash from various material source locations to the Gross Dam material staging area and truck hauling timber materials from Gross Dam to various sites for disposal. (Refer to Sheet A-1 in Appendix A for the haul routes.) The details for hauling materials for Alternative 1 are provided in Table 1-1.

Table 1-1. Alternative 1–Truck Hauling

Type of Material	Starting Point	Ending Point	Distance One-Way
Fine aggregate	Fort Lupton, CO	Gross Dam Material Staging Area	52.4 miles
Cement	Portland, CO	Gross Dam Material Staging Area	144.9 miles
Fly ash	Jim Bridger Power Plant, WY	Gross Dam Material Staging Area	346.9 miles
Timber	Winiger Ridge at Gross Dam	Denver-Metro Area	46.7 miles
Ash/slash	Winiger Ridge at Gross Dam	Foothills Landfill, Golden, CO	24.5 miles

Note: These sources were used for the conceptual and comparison purposes only. Actual locations may vary and will be identified by the contractor during construction.

1.2 Alternative 2

Alternative 2 consists of rail hauling fine aggregate, cement, and fly ash from various material source locations to the Crescent rail siding, then truck hauling the material to the Gross Dam material staging area. Timber materials would be truck hauled from Gross Dam to Crescent rail siding, loaded onto railcars and rail hauled to various sites for disposal. The details for hauling materials for Alternative 2 are provided in Table 1-2.

Table 1-2. Alternative 2–Rail and Truck Hauling

Transportation Mode	Type of Material	Starting Point	Ending Point	Distance One-Way
Truck	Fine aggregate	Fort Lupton, CO	88th Avenue Rail Staging	17.8 miles
Rail	Fine aggregate	88th Avenue Rail Staging	Crescent Railroad Siding	30.6 miles
Conveyor	Fine aggregate	Crescent Railroad Siding	Stockpile near the Crescent Railroad Siding	1,000 feet
Truck	Fine aggregate	Stockpile near the Crescent Railroad Siding	Gross Dam Material Staging Area	4.0 miles
Rail	Cement	Portland, CO	88th Avenue Rail Staging	126 miles
Rail	Cement	88th Avenue Rail Staging	Crescent Railroad Siding	30.6 miles
Conveyor	Cement	Crescent Railroad Siding	Silos	1,000 feet

Table 1-2. Alternative 2–Rail and Truck Hauling

Transportation Mode	Type of Material	Starting Point	Ending Point	Distance One-Way
Truck	Cement	Silos	Gross Dam Material Staging Area	4.0 miles
Rail	Fly ash	Jim Bridger Power Plant, WY	88th Avenue Rail Staging	329 miles
Rail	Fly ash	88th Avenue Rail Staging	Crescent Railroad Siding	30.6 miles
Conveyor	Fly ash	Crescent Railroad Siding	Silos	1,000 feet
Truck	Fly ash	Silos	Gross Dam Material Staging Area	4.0 miles
Truck	Timber	Winiger Ridge at Gross Dam	Crescent Railroad Siding	16.8 miles
Rail	Timber	Crescent Railroad Siding	Denver-Metro Area	34.3 miles
Truck	Ash/slash	Winiger Ridge at Gross Dam	Foothills Landfill, Golden, CO	24.5 miles

1.3 Alternative 3

Alternative 3 consists of rail hauling fine aggregate, cement, and fly ash from various material source locations to the Crescent rail siding then using a conveyor system to transport material to the Gross Dam material staging area. Timber materials would be truck hauled from Gross Dam to Crescent rail siding and loaded onto railcars and rail hauled to various sites for disposal. The details for hauling materials for Alternative 3 are provided in Table 1-3.

Table 1-3. Alternative 3–Rail Hauling with Conveyor

Transportation Mode	Type of Material	Starting Point	Ending Point	Distance One-Way
Truck	Fine aggregate	Fort Lupton, CO	88th Avenue Rail Staging	17.8 miles
Rail	Fine aggregate	88th Avenue Rail Staging	Crescent Railroad Siding	30.6 miles
Conveyor	Fine aggregate	Crescent Railroad Siding	Gross Dam Material Staging Area	2.3 miles
Rail	Cement	Portland, CO	88th Avenue Rail Staging	126 miles
Rail	Cement	88th Avenue Rail Staging	Crescent Railroad Siding	30.6 miles
Conveyor	Cement	Crescent Railroad Siding	Gross Dam Material Staging Area	2.3 miles
Rail	Fly ash	Jim Bridger Power Plant, WY	88th Avenue Rail Staging	329 miles
Rail	Fly ash	88th Avenue Rail Staging	Crescent Railroad Siding	30.6 miles

Table 1-3. Alternative 3–Rail Hauling with Conveyor

Transportation Mode	Type of Material	Starting Point	Ending Point	Distance One-Way
Conveyor	Fly ash	Crescent Railroad Siding	Gross Dam Material Staging Area	2.3 miles
Truck	Timber	Winiger Ridge at Gross Dam	Crescent Railroad Siding	16.8 miles
Rail	Timber	Crescent Railroad Siding	Denver-Metro Area	34.3 miles
Truck	Ash/slash	Winiger Ridge at Gross Dam	Foothills Landfill, Golden, CO	24.5 miles

1.4 Truck Hauling

In the 2009 Moffat Collection System Project Draft Environmental Impact Statement (DEIS) completed by the U.S. Army Corps of Engineers, a non-specific site in Longmont was identified as a source for the fine aggregate material to construct the dam. For the purposes of this Alternatives Analysis and Final Study, an actual material source location meeting the material specifications was identified near Fort Lupton. Identifying an actual material source was necessary to develop detailed cost estimates for comparison purposes only; actual material source(s) will be identified by the contractor during construction. The Fort Lupton aggregate source was deemed feasible because of the proximity of the UPRR 88th Avenue rail staging location. Hauling material by truck from a source near the 88th Avenue rail staging area was determined more cost effective when compared to implementing a load-out track and conveyor system directly at the source.

Trucks per day are based on a 3-year construction period (8 months per year for 3 years) for purposes of comparing truck hauling and rail hauling. The Corps EIS assumed a 4-year construction period for its planning purposes. The actual quantities of material hauled, associated truck trips, and hauling times may vary based on final dam design.

The truck hauling portion of the project was reevaluated to verify the assumptions made in the 2009 Report. All material transported by truck to the project site (regardless of origin), would use SH 72 for the final leg of the journey to gain access to the site (see Figure A-1 in Appendix A). The 2009 Report concluded that truck hauling (the most economically feasible alternative) could include enhancing the existing pullouts and widening shoulders to minimize disruptions to traffic along SH 72 as a result of increased truck traffic. This would allow trucks to pull off to allow traffic to flow freely during high traffic volume (particularly in areas with steep grades). In addition to enhancing the pullouts and shoulders, haul time restrictions could reduce congestion during peak travel hours for the residents using SH 72.

The costs associated with providing/enhancing pullouts (which include mobilization and traffic control costs) have been updated and are provided in Table 1-4. Refer to Appendix B, Tables B-1 through B-5 for details.

Table 1-4. Estimated Cost to Improve SH 72 Pullouts

Alternative	Description	Proposed Area (feet)	Estimated Cost
MP 14.0 pullout	Existing pullout	200' × 12'	$31,600
MP 15.0 pullout	East of existing bus stop	250' × 12'	$36,200
MP 15.1 pullout	Existing pullout	300' × 12'	$40,800
MP 16.1 pullout	Existing shoulder widening	850' × 12'	$93,100
MP 17.2 pullout	Existing pullout	350' × 12'	$44,200

Note: 12 inches of aggregate base course and 6 inches of asphalt were used to compute cost (quantities taken from HDR's 2009 Borrow Haul Study).

Additional alternatives explored in minimizing disruptions to traffic along SH 72 were the addition of climbing lanes or widening of shoulders. The steep portion of SH 72 from SH 93 to Gross Dam Road is approximately five miles in length. By adding two individual half-mile climbing lanes in this stretch, it would allow multiple opportunities for slow moving truck traffic to move over from the main through lane and allow following vehicles to pass. These climbing lanes would consist of 12 foot drive lanes with eight foot shoulders. Widening of existing shoulders was another alternative explored for the steep five mile portion of SH 72. This improvement would consist of adding 8 foot shoulders on both sides of the existing roadway to provide a wider roadway for safer passing opportunities and increase the safety of bicycle traffic in the corridor.

Although adding these types of improvements presents more opportunities to minimize impact on daily traffic, they present many challenges within themselves. To implement two individual half-mile climbing lanes, it is estimated that the time to design and construct these improvements would take over a year. For the construction of two eight foot shoulders for five miles, the anticipated construction timeframe would double to two construction seasons. The impacts to the existing traffic would be substantial as there would be periodic lane/shoulder closures for rock blasting and excavation on the uphill side, the introduction of truck traffic to the corridor to construct the improvements and the potential of detours for the duration of construction. In addition to the process of constructing the improvements, other factors could impact the implementation and prolong the schedule such as obtaining environmental clearances and permits as necessary, obtaining the required right of way or easements (which could last up to 12-18 months) and potential utility relocations if required.

Cost is another factor that would have to be considered in implementing the two types of alternatives. An estimated conceptual opinion of costs for two ½ mile climbing lanes on State Highway 72 (12 feet wide with an 8-foot shoulder), for a length of 1 mile, or the widening of both shoulders for a length of 5 miles is shown in Table 1-5.

Table 1-5. Estimated Conceptual Cost to Improve SH 72 Drive Lanes

Alternative	Description	Cost
Addition of climbing lanes	Two – ½ mile climbing lanes 12 foot wide with 8 foot shoulders	$4.0 to $5.0 million
Widened shoulders	Addition of 8 foot shoulders on both sides of SH 72	$22.5 to $25.0 million

Whether trucks haul material the entire distance (from the material source location) or whether material is transported by truck from the rail siding to the Gross Dam material staging area, it will be necessary to utilize Gross Dam Road (County Road 77S). Boulder County maintains Gross Dam Road from SH 72 to the railroad tracks. Denver Water currently maintains Gross Dam Road from the railroad track crossing to Flagstaff Road. During dam construction, Denver Water or its contractor could be responsible for maintaining all of Gross Dam Road. Many of the curves along Gross Dam Road are not designed to convey passing truck traffic, therefore, it could be necessary to upgrade portions of Gross Dam Road. Because truck hauling is a component of Alternatives 1 and 2 only, the costs to upgrade Gross Dam Road are only provided for these two alternatives. The need for these improvements will be further investigated during the design phase of the Moffat Project.

Based upon data obtained during site visits and models simulating truck turning movements, it is anticipated that Gross Dam Road could require 35 curves to be widened between 7 to 14 feet for approximately 1 mile (combined total). Widening would be necessary (particularly around tight curves) to accommodate the turning radius required by haul trucks and potential two way truck traffic. The cost to upgrade Gross Dam Road is included in both Alternatives 1 and 2 because the use of this road is assumed to be a component of both alternatives.

1.5 Rail Hauling

Centerline of proposed track looking west

During discussions with UPRR as part of the 2009 *Borrow Haul Study*, the railroad did not support a rail hauling alternative for the project. At that time (2008), the rail economy was strong and the Moffat rail line was functioning near maximum capacity. In the intervening years, the demand for coal decreased and there was a slight decline in rail traffic. As part of this reevaluation and Final Study, HDR contacted UPRR staff to assess whether UPRR's position on the proposed rail hauling alternative for this project had changed. HDR used this opportunity to discuss with UPRR the feasibility of this project, and to propose developing an operation plan that would gain UPRR's approval. As a result, UPRR agreed to reexamine the possibility of changing the operations in this location to accommodate the rail hauling alternative associated with the Gross Dam enlargement and, for the purposes of this study, it was assumed that the Moffat rail line would be functioning below maximum capacity when Denver Water needs to transport materials to Gross Reservoir.

In order to properly develop a rail operation plan that allows UPRR to visualize both train movements and the proposed unloading operations, HDR developed an exhibit of a feasible alternative. This exhibit is similar to drawings produced and evaluated at a 10% conceptual review level by UPRR (see Sheet A-2 in Appendix A).

HDR conducted a site visit on July 11, 2012, at the Crescent rail siding location to provide more detailed information regarding the feasibility of a rail hauling alternative, and to identify ways to minimize both construction and operational costs, and to reduce conflicts with existing UPRR operations. Data obtained in 2009 on existing rail layout and material necessary to construct an unloading track was reassessed and updated, if necessary.

During the site evaluation, it was determined that the optimal alternative must allow UPRR to clear the mainline/passing track and "spot" loaded cars into the site without impeding mainline through-traffic. Once the loads are spotted on the loaded track, only one move is made to the empty track and the empty cars can prepare to depart.

Typical unloading pit with conveyor integrated within a track

Material must be efficiently unloaded from the railcars to reduce product losses, which could reduce the number of railcar loads. A more detailed evaluation of the use of a car topper, (described in the 2009 *Borrow Haul Study*) revealed that although feasible, use of a car topper is not optimal because all of the material cannot be removed from the railcars with this equipment. In addition, the distance from the mainline to the existing house track (the portion of track where the loaded cars are stored) is less than 25 feet, therefore, a railroad flagman would be needed which would interfere with UPRR operating procedures and add additional costs. UPRR stated to HDR that unloading or stockpiling material along the right-of-way (ROW) would not be allowed. However, unloading material into a pit via a conveyor integrated in the track (and located within the ROW), and developing an operating plan approved by UPRR would be acceptable. This process would allow cars to be unloaded quickly and would ensure that excess material is not lost and there is no fouling the track along the mainline (within 25 feet).

Material staging area north of Crescent Siding

It is assumed that all railcars would be unloaded within one working day after arriving on-site. Therefore, it will be necessary to stockpile material near the unloading pit to ensure that material is available to meet the production demands during construction. A large, open meadow just east of the siding was identified as a possible stockpile location and is assumed to be associated with the Eldorado Canyon State Park, Crescent Meadows open space. This location could be ideal given the large open area, and close proximity to the Crescent rail siding. Approximately 3 acres would be disturbed for the facility (see Figure A-2 in Appendix A). Approximately 1,000 linear feet of conveyor would be necessary to transport material from the rail pit to the stockpile area. The stockpile area would most likely consist of two 1,000-ton capacity storage silos for fly ash and cement. Fine aggregate material could be stockpiled in open areas. A covered conveyor, powered by electric services adjacent to the site, would be necessary to protect the material from wind and rain. Following construction, the stockpile area and conveyor alignment would need to be restored to its original condition prior to demobilization. In Alternative 3 a conveyor is used in lieu of truck hauling, which is analyzed and discussed in Section 1.6.

The goal for Alternatives 2 and 3 is to identify an alignment and operation plan that would deliver construction materials to Gross Dam by rail that is economical, feasible and would be accepted by UPRR. In order to assess the feasibility of a rail alternative, HDR identified possible economical or engineering constraints to rail hauling. Constructing a track west of Gross Dam Road was identified as a constraint, because of the additional costs ($1 million or more) and the political hurdles associated with temporarily parking a train on the existing road, which would block access for emergency vehicle and other traffic. The addition of railroad signals and gates and flashers would be necessary to connect to the existing siding track and to protect movements across Gross Dam Road. In addition to the prohibitively high additional cost, it is also operationally not feasible for train traffic to cross Gross Dam Road to support the proposed project. The current track layout at this location does not allow Denver Water to utilize the Crescent house track to circumvent the loaded cars upon delivery by UPRR without impeding the mainline traffic, therefore, keeping the existing and proposed alignment to the east of Gross Dam Road is operationally feasible and would be preferred by UPRR from an operations standpoint (see Sheet A-2 in Appendix A).

Track Mobile moving cars

A rock face wall to the east was also identified as a constraint because of the high removal costs, the possibility that ROW acquisition would be required, and the unknown environmental concerns involved. A conceptual siding and unloading plan was developed based upon the aforementioned constraints and desired railroad applications (see Sheet A-2 in Appendix A). The cost estimate to construct this new siding is approximately $2.1 million (see Table B-6 in Appendix B). The proposed layout would have the capacity to accommodate 14 loaded cars and 14 empty cars. Arriving railcars (loaded) would enter the facility via the existing Crescent house track (which is referred to as the proposed loaded track). Once the loads are spotted, UPRR would then circumvent the loaded cars via the siding track and reenter the facility on the newly constructed track (or empty track). UPRR would then connect to the empty cars (unloaded the previous day), and depart to Denver. Denver Water would process the material by transferring two railcars over to the empty track at a time, and unload using a track mobile. Based on a conveyor capacity of 175 tons per hour, all 14 cars (totaling 1,400 tons per delivery) could be unloaded in eight hours. All cars would then sit on the empty track to await pick-up from UPRR.

1.6 Rail Hauling with Conveyor

Typical Covered Ground line Conveyor

Alternative 3 utilizes a ground line conveyor system in conjunction with rail hauling, which would extend from the Crescent rail siding unloading pit to the stockpile location near the dam identified in the DEIS. Truck hauling material is not part of Alternative 3; however, trucks would be necessary for hauling trees that have been removed during construction to the rail siding. Although the majority of trucking would be eliminated with Alternative 3, additional infrastructure would be necessary for storing material such as fly ash and cement at the identified stockpile location.

Construction of the conveyor system would require clearing existing vegetation up to 100 feet in width for a length of 2.3 miles to the stockpile area (see Figure A-3 in Appendix A). For the purposes of this high-level conceptual analysis, a ROW width of 100 feet was used for the conveyor, road maintenance, and switchbacks. The actual width needed would be determined during final design. Access points would also need to be constructed from Gross Dam Road to the conveyor for routine maintenance activities. There is an approximate 700-foot vertical grade difference between the Crescent siding area and the dam, which would result in possible conveyor inefficiencies. Further, switchback alignments would be necessary in areas with steep grades. The conveyor ROW could not follow Gross Dam Road and would require new disturbance of approximately 26 acres. Refer to Sheet A-3 in Appendix A for a conceptual conveyor alignment. Following construction, the conveyor ROW would be restored to its approximate original conditions. Costs to replant trees, if required, are provided under “land restoration” in Table B-10 in Appendix B. There were two power sources identified by Denver Water at Gross Dam and near the Crescent rail siding. It is assumed the contractor will be required to obtain permits and to add additional power poles or suspend electric wire from the conveyor. In addition to these identified constraints, additional engineering and studies would need to be conducted to further refine Alternative 3 and variables such as elevation, right-of-way, and property ownership would need to be considered in greater detail.

1.7 Tree, Ash and Slash Loading and Hauling

Removal of trees and their remnants (such as ash/slash) around the reservoir rim would be required by Denver Water as part of the proposed reservoir expansion. For the purposes of this analysis, it is assumed that trees would be removed, burned and stockpiled into piles of timber and piles of ash/slash at Winiger Ridge. Trees would be loaded and hauled away via either truck or rail, depending on the alternative selected. Trees loaded and hauled away by truck from Winiger Ridge would exit the site via an improved 4-wheel drive road to Forest Road 359, then take County Road 68 to County Road 132, and finally take SH 72 to the final disposal location within the Denver Metro Area. Trees removed by rail would be loaded onto a truck at Winiger Ridge and hauled to the Crescent rail siding track, and loaded onto railcars and transported via rail to the final disposal location within the Denver Metro Area.

The cost of hauling the removed trees and ash/slash has been included in each alternative as a separate line item so that it can be removed from the final alternative selected, if necessary (see Tables B-7 through B-9 in Appendix B).

1.8 Cost Comparison of Alternatives

Tables and figures were developed for different components for each alternative to effectively compare and evaluate alternative costs. These components include roadway turnouts, road upgrades, track construction, stockpile equipment, conveyors, and material disposal (timber and ash/slash) as separate line items and include additional details not limited to haul miles, materials costs, and labor. These items are presented in Tables B-7 through B-10 in Appendix B with enough detail to facilitate a comparison of both alternatives and components within each alternative based on cost. All information is based on data provided by Denver Water, the DEIS, industry standards, and CDOT.

This Final Study concludes that from a cost perspective, Alternative 1 (truck hauling) is the most feasible. However, there are public concerns associated with Alternative 1 such as additional traffic and an increase in activity in and around SH 72, and Crescent Village up to the Gross Dam Reservoir. Alternative 2 (truck and rail hauling) is almost double the cost of Alternative 1; however, it would be less intrusive to the general public. Although additional traffic on SH72 and around Crescent Village would be minimized under Alternative 2 and Alternative 3, surrounding neighbors within the proposed stockpile location near the rail siding would experience greater impacts such as increased construction activity and road realignments. Alternative 3 costs are driven higher than the other alternatives due to the introduction of the construction and operations of a 2.3 mile covered conveyor to the Gross Dam staging area. See Table 1-6 for comparison of alternative costs.

Table 1-6. Comparison of Alternative Costs

Alternative	Description	Cost
Alternative 1	Truck hauling	$18,640,000
Alternative 2	Rail and truck hauling	$35,430,000
Alternative 3	Rail hauling and conveyor	$44,920,000

Chapter 2. Environmental Impacts

2.1 Air Quality

Air quality is determined by comparing concentrations of monitored pollutants with prescribed standards. The standards of maximum acceptable levels of criteria pollutants are specified by the U.S. Environmental Protection Agency (USEPA). The Clean Air Act (CAA) established two types of National Ambient Air Quality Standards (NAAQS): primary standards designed to protect public health, and secondary standards which protect public welfare (42 U.S.C. 7409). The USEPA Office of Air Quality Planning and Standards has set NAAQS for the following six criteria pollutants:

- Ozone (O_3)
- Nitrogen dioxide (NO_2)
- Carbon monoxide (CO)
- Sulfur dioxide (SO_2)
- Respirable particulate matter (PM_{10} and $PM_{2.5}$)
- Lead (Pb)

2.1.1 Existing Conditions

To determine air quality, the project study area includes counties or areas where the emissions occur, including the locations where the material originates, is delivered to, and is disposed of (and the roads and railroad track used to link them). These include: Arapahoe County, Boulder County, Denver County, Jefferson County, Larimer County, and Weld County. As of July 20, 2012:

1. The Denver-Boulder-Greeley-Ft. Collins-Loveland, Colorado area (which includes all or part of each county in the study area) is designated as nonattainment for ozone.
2. All or part of each county in the study area is designated as maintenance for carbon monoxide.
3. All or part of Arapahoe, Boulder, Denver, and Jefferson counties are designated as maintenance areas for PM_{10}.
4. All counties in the study area are designated as attainment or unclassifiable (to be treated as attainment) for all other criteria pollutants.

Attainment areas are designated based upon pollutant standards set by the USEPA. An attainment area is a geographic area in which the level of a criteria air pollutant meets the primary standard (designed to protect human health), or NAAQS, for that pollutant. A nonattainment area is a geographic area in which the level of a criteria air pollutant is higher than the level allowed by the NAAQS. A single geographic area may have acceptable levels of one criteria air pollutant but unacceptable levels of one or many other criteria air pollutants. Thus, an area could be both attainment and nonattainment for different criteria air pollutants at the same time.

Attainment is generally designated for each county, but frequently a metropolitan area is grouped together when designating attainment status. A maintenance area, as discussed above, is defined as a county or region that previously had been designated as nonattainment for a given pollutant, but is currently within attainment. An area is designated as a maintenance area for a period of 20 years from the time the county was no longer designated as nonattainment.

2.1.2 Impacts to Air Quality by Alternative

The net difference in fuel usage between Alternative 1 (truck hauling only) and Alternative 2 (truck and rail hauling) is a difference of approximately 197,300 gallons used during the three-year project period for the scenario with aggregate originating in Fort Lupton and the fly ash originating in Bridger (see Table 2-1 and the detailed emissions analysis in Appendix C). Under Alternative 3 (rail hauling plus conveying), fuel usage decreased by 213,800 gallons when compared to Alternative 1 during the three-year period. The net emissions change for NO_x, $PM_{2.5}$, PM_{10}, CO, and VOCs show a slight increase in emissions under Alternative 2, compared to Alternative 1; whereas the net emissions for SO_2 and CO_2 decrease slightly as a result of lower fuel usage.

Table 2-1. Emissions by Alternative

Summary	Total Fuel Used (gal/yr)	PM_{10} (ton/yr)	$PM_{2.5}$ (ton/yr)	SO_2 (ton/yr)	CO (ton/yr)	CO_2 (ton/yr)	NO_x (ton/yr)	VOC (ton/yr)
Alternative 1–Truck Hauling	377,600	0.39	0.28	0.04	2.22	4,247	14.78	0.67
Alternative 2–Rail and Truck Hauling	180,300	0.48	0.44	0.02	3.42	2,029	18.00	0.85
Alternative 3–Rail Hauling and Conveyor	163,800	0.46	0.43	0.02	3.32	1,844	17.35	0.82

General Conformity requirements (established under the Clean Air Act) ensure that activities by federal agencies in nonattainment and maintenance areas do not result in impacts to air quality. General Conformity requirements are in effect only for actions with federal funding or approvals (e.g. Finding of No Significant Impact, Record of Decision) taken at least one year after an area is formally designated as nonattainment. Because there are current nonattainment and maintenance counties in the project study area, General Conformity would apply to this action because of the federal action associated with it (i.e., because of the EIS being completed by the U.S. Army Corps of Engineers). However, as shown in Table 2-1, the emissions of potentially affected pollutants would be well below General Conformity *de minimis*[1] thresholds provided in 40 CFR 93.153 (see Appendix C for detailed information related to air quality, emissions, methodology and results).

From an air quality perspective, there is not a significant difference in emissions between alternatives. As a result of having emissions below *de minimis* thresholds, under 40 CFR 93.153(c)(1), General Conformity requirements do not apply for this action and no further air quality analysis or conformity determination would be required for this project.

In order to address the concerns expressed about the project by Boulder County residents, greenhouse gas (GHG) inventory (or a carbon footprint) was calculated in addition to an air emissions analysis. A GHG inventory provides a comprehensive accounting of GHG emissions attributed to a project's activities (see Appendix C for the regulatory drivers and details of the methodology used).

This particular study shows that GHG emissions are decreased by slightly more than 50% from a truck with rail option compared to a truck only option. However, the GHG emissions in either case are not significant enough for which to base a business decision. In addition, the GHG emissions resulting from this project do not meet the threshold requirements of any current legislation for reporting or reducing GHG emissions. See Appendix C for a complete description of the GHG inventory.

[1] The definition of *de minimis* is "the minimum threshold for which a conformity determination must be performed" (source: U.S. EPA http://www.epa.gov/airquality/genconform/deminimis.htm)

Results

Alternative 1 (truck hauling) would require the greatest amount of fuel used and would result in the most tons of CO_2 emitted—377,600 gallons of fuel and 4,247 tons of CO_2 over a 3-year period (see Table C-2 in Appendix C). The net difference between Alternative 1 (truck hauling) versus Alternative 2 (truck with rail hauling) is a decrease in fuel use of approximately 197,300 gallons during the 3-year project period for the scenario with aggregate originating in Fort Lupton and the fly ash originating in Bridger. Under Alternative 3 (rail hauling plus conveyor), fuel usage decreased by 213,800 gallons from Alternative 1 during the 3-year period.

Approximately 4,247 tons of CO_2 would be emitted over 3 years under Alternative 1. The amount of CO_2 emitted under Alternative 2 is less than half the amount under Alternative 1, with 2,029 tons CO_2 over the 3-year period. Alternative 3 would result in a further decrease, with 1,844 tons of CO_2 emitted (see Table 2-1). The net difference is a decrease of 2,218 tons CO_2 between Alternative 1 and Alternative 2, and a further decrease of 2,403 between Alternative 1 and Alternative 3. The difference in CO_2 emissions between Alternatives 2 and 3 is insignificant.

To put this decrease in perspective, 2,218 tons of CO_2 is equivalent to:[2]

- Annual GHG emissions from 395 passenger vehicles
- CO_2 emissions from the electricity use of 251 homes for one year
- Annual CO_2 emissions of 0.0005 coal-fired power plants.

According to the American Association of Railroads (AAR), trains are four times more fuel efficient than trucks.[3]

Since GHGs are directly related to fuel consumption, moving freight by rail instead of truck generally lowers GHG emissions. Total fuel use for this analysis decreased from 377,600 gallons of fuel used from a truck only alternative to 180,300 gallons of fuel used under a truck with rail alternative, and decreased further to 163,800 gallons of fuel used under a rail with conveyor alternative.

This particular study shows that GHG emissions are decreased by slightly more than 50% from a truck with rail option compared to a truck only option. However, the GHG emissions in either case are not significant enough for which to base a business decision. In addition, the GHG emissions resulting from this project do not meet the threshold requirements of any current legislation for reporting or reducing GHG emissions.

Boulder County is investigating the possibility of requiring the use of biodiesel on certain fleets. Regardless of the difficulties of enforcing such a requirement on a fleet with trips that originate outside of the County, a qualitative comparison of emission differences between diesel and biodiesel fuels was completed. On average, emissions for most pollutants decrease when combusting biodiesel compared to petroleum-based diesel, including for hydrocarbons, CO, particulate matter[4],[5], as well as emissions of CO_2[6]. This decrease in emissions is greater for a fuel made up of 100% biodiesel when compared to a blended fuel consisting of, for example, 20% biodiesel and 80% petroleum diesel, (which is a common blend when using biodiesel[6]). However, emissions for NO_x increase when using biodiesel[4,5], and the increase in emissions is greater for a fuel made up of 100% biodiesel compared to a 20% blended biodiesel fuel.

2 http://www.epa.gov/cleanenergy/energy-resources/calculator.html

3 http://www.aar.org/~/media/aar/Background-Papers/The-Environmental-Benefits-of-Rail.ashx

4 http://www.epa.gov/oms/models/biodsl.htm

5 www.nrel.gov/vehiclesandfuels/npbf/pdfs/33794.pdf

6 http://www.r3biofuels.com/images/BiofuelBasics.pdf

This increase in NO_x is particularly important for areas which have attainment issues with ozone (such as the Boulder area, see Section 2.1.1 Existing Conditions) because NO_x emissions are a precursor to ozone. It is possible that the decrease in HC (also referred to as VOCs, and which are also precursors to ozone) would partially offset the increase in ozone created by the increase in NO_x under a biodiesel-use scenario, especially in the area very close to the source of emissions, as NO_x "consumes" ozone in the near field, but increases ozone farther downwind. Equivalent calculations made for all alternatives under a biodiesel scenario would show decreases in the criteria pollutants which are already lower emitting (PM_{10} and $PM_{2.5}$, SO_2, CO, and VOC), and increases to the criteria pollutant (NO_x), which is the highest emitting of the criteria pollutants.

Emissions of CO_2 (i.e., GHGs) would also decrease with the use of biodiesel fuel, if one considers that biofuel combustion emits only "biogenic" CO_2 that is a 100% renewable fuel. However, one problematic issue is the indirect GHG emission potential of biodiesel, including fuel and fertilizer to produce crops, plus potential deforestation-related CO_2 emissions. When considering these emissions in a global market, it is not clear that biodiesel use decreases total life-cycle CO_2 emissions when compared to petroleum-based diesel fuel.

The total fuel used would increase under a biodiesel scenario, as the use of biodiesel generally reduces fuel economy in diesel engines by about 10%. For example, assuming a 100% biodiesel fuel, approximately 1.1 gallons of biodiesel would be used compared to 1 gallon of equivalent use of conventional diesel fuel[6].

From an air quality perspective, there is not a significant difference in emissions between alternatives. As a result of having emissions below *de minimis* thresholds, under 40 CFR 93.153(c)(1), General Conformity requirements do not apply for this action and no further air quality analysis or conformity determination would be required for this action.

2.2 Noise

2.2.1 Existing Conditions

HDR performed an assessment of noise associated with Alternative 1 (truck hauling only) and Alternative 2 (truck and rail hauling). A discussion of basic acoustical concepts used in the assessment, and the methodology used can be found in Appendix C.

2.2.2 Environmental Consequences

Truck Hauling (Alternative 1 and Truck Hauling Portion of Alternative 2)

Under Alternative 1, trucks would be used to remove vegetation and other debris prior to construction, and trucks would also be used to deliver materials to the site needed to raise Gross Dam. In support of this traffic noise analysis, HDR traffic engineers developed an estimated vehicle mix for the roadways within the study area, based on methods in "Vehicle Volume Distributions by Classification", prepared by the Washington State Transportation Center and Chaparral Systems Corporation in July 1997. Following are the assumptions used in the truck noise analysis:

1. Existing roadway traffic on SH 72 has an annual average daily traffic volume (AADT) between 4,900 vehicles per day (vpd) (east of Gross Dam Road) and 1,400 vpd (west of Gross Dam Road), according to available 2010 Colorado Department of Transportation data. An AADT of 1,400 vpd was used to under-estimate existing noise levels so the incremental noise increase associated with the proposed project would be maximized. This results in a conservative approach that over-states the potential incremental noise increase due to the project.

2. The existing traffic on SH 72 is assumed to be 94% autos, 3% medium trucks (i.e. panel trucks), and 3% heavy trucks, based upon data of typical vehicle mixes for roads with similar functional classes as well as available county-level road class data from CDOT. This results in an average of 55 autos, 2 medium trucks, and 2 heavy trucks per hour traveling at an average of 40 mph on SH 72 (representative of overall traffic on SH 72 traveling in both directions).
3. Existing road traffic on Gross Dam Road is assumed to be negligible.
4. Under Alternative 1, project-related traffic is estimated to be 49 heavy trucks (98 round-trips) on SH 72 and on Gross Dam Road, operating for 10 hours during the daytime (10 average trucks per hour). Trucks are estimated to travel an average of 40 mph on SH 72 and 20 mph on Gross Dam Road. These values are averages based on a three year construction period. Actual number of trucks on the road will vary by season and construction year.

For the truck hauling component of Alternatives 1 and 2, the estimated noise levels during construction (which is calculated as the existing noise level plus noise levels associated with the project) along SH 72 was compared to the existing noise levels for SH 72 (see Appendix C).

The increased noise level during construction is greatest for the truck hauling alternative, as there is an expected increase from an average of 2 heavy trucks per hour to approximately 11 heavy trucks per hour on SH 72 (for travel in both directions). This increase in noise level would occur primarily during the daytime working hours (although it may be necessary at times to transport material at night). Therefore, the traffic increase affects the hourly average noise level (L_{eq}) during the hours that project-related trucks are active, but has very little effect on the 24-hour day-night noise level (L_{dn}) which is dominated by the 10-dBA penalty added to nighttime L_{eq} values. In other words, although noise levels will increase mostly during the day (when louder noise levels are less offensive), nighttime noise levels will not be significantly affected by project-related truck traffic.

Rail Hauling (Rail Portion of Alternatives 2 and 3)

Transporting materials to the site via rail would require the addition of one train every other day to a new siding in the project area. Once at the project site, a track mobile vehicle would move two railcars at a time to the unloading hopper, where the contents are deposited. Following are the assumptions used in the train noise assessment.

1. The existing volume of rail traffic on the UPRR main line is between 39 to 49 trains per day. To conservatively estimate existing train noise levels in the project area (and to use the upper range as an estimate of project-related noise) this assessment assumed an average of 1.67 trains per hour (based on an average of 40 trains per day evenly distributed throughout a 24-hour time period).
2. Existing trains are conservatively estimated to be composed of 30 railcars and 1 locomotive, and are assumed to be traveling at an average speed of 40 mph. In reality, the existing trains are probably longer; however, these assumptions use the upper range of project-related noise impacts.
3. The additional project-related rail traffic on UPRR’s main line is estimated to be 1 train (composed of 1 locomotive and 14 cars), arriving every other day, traveling an average speed of 40 mph.
4. Project-related siding activity includes a track mobile vehicle moving two cars at a time to hoppers that transfer material to conveyer belts. This analysis assumes an average of 3.5 movements over 10 daytime hours in one work day. Operating time is expected to take less than 20 minutes per movement. Conveyer belts are enclosed, therefore, noise impacts are assumed to be negligible.
5. Project-related truck traffic associated with the rail option will be 49 heavy trucks (98 round-trips) on Gross Dam Road from the Crescent rail siding to the dam site, operating for 10 hours

during the daytime (10 trucks per hour). Trucks are assumed to travel 20 mph on Gross Dam Road.

For the rail component of Alternatives 2 and 3, the estimated project-related noise levels for both the UPRR main line and the Crescent rail siding were compared to the existing noise levels from the existing UPRR main line train traffic to determine noise-related impacts during construction (see Appendix C).

Results

The greatest project-related noise impact to the UPRR main line is a single hour every other day when the train containing material increases the average number of trains per hour from 1.7 to 2.7. There is a corresponding increase in noise level during that hour; however, this slight increase has a negligible (zero) effect on the day-night average level because it is only one hour during a 48-hour period. The greatest project-related noise impact to the Crescent rail siding is a single hour every other day when the track mobile moves full railcars to the material conveyers and transfers the empty cars to another position on the siding. Because these activities are confined to the siding, noise emissions from this activity are a point-source (or localized) source of noise. The noise levels resulting from these activities diminish with distance at a greater rate than the main line traffic (point-source propagation versus line-source propagation). Therefore, at 100 feet the increase is 3 decibels, but beyond 1,000 feet the increase has a negligible (zero) effect on the noise level, even during the single hour when noise-related impacts are greatest. Due to the forecasted train arrivals, at most, seven railcar movements during a 48-hour period (one “movement” is a pair of railcars moved from the conveyer position and then another pair of railcars to the hopper position, and there are 14 railcars cycled through the siding every-other day), it has a negligible (zero) effect on the day-night average level at any distance.

As noted previously, the estimated existing noise levels are conservatively low. During periods when existing noise levels are higher than estimated for this analysis, the addition of the project-related noise sources would have a negligible effect on the existing noise levels. Because there are no significant noise impacts, there are no relevant differences among the alternatives and there are no relevant differences among the alternatives to use as a basis for comparison.

References

U.S. Environmental Protection Agency (USEPA), EPA420-R-00-023 December 2000, Technical Supporting Document: Control of Emissions of Hazardous Materials, Air Pollutants from Motor Vehicles and Motor Vehicle Fuels. *Assessment and Standards Division, Office of Transportation and Air Quality, U.S. Environmental Protection Agency*

USEPA, *Control of Hazardous Air Pollutants from Mobile Sources, Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007.*

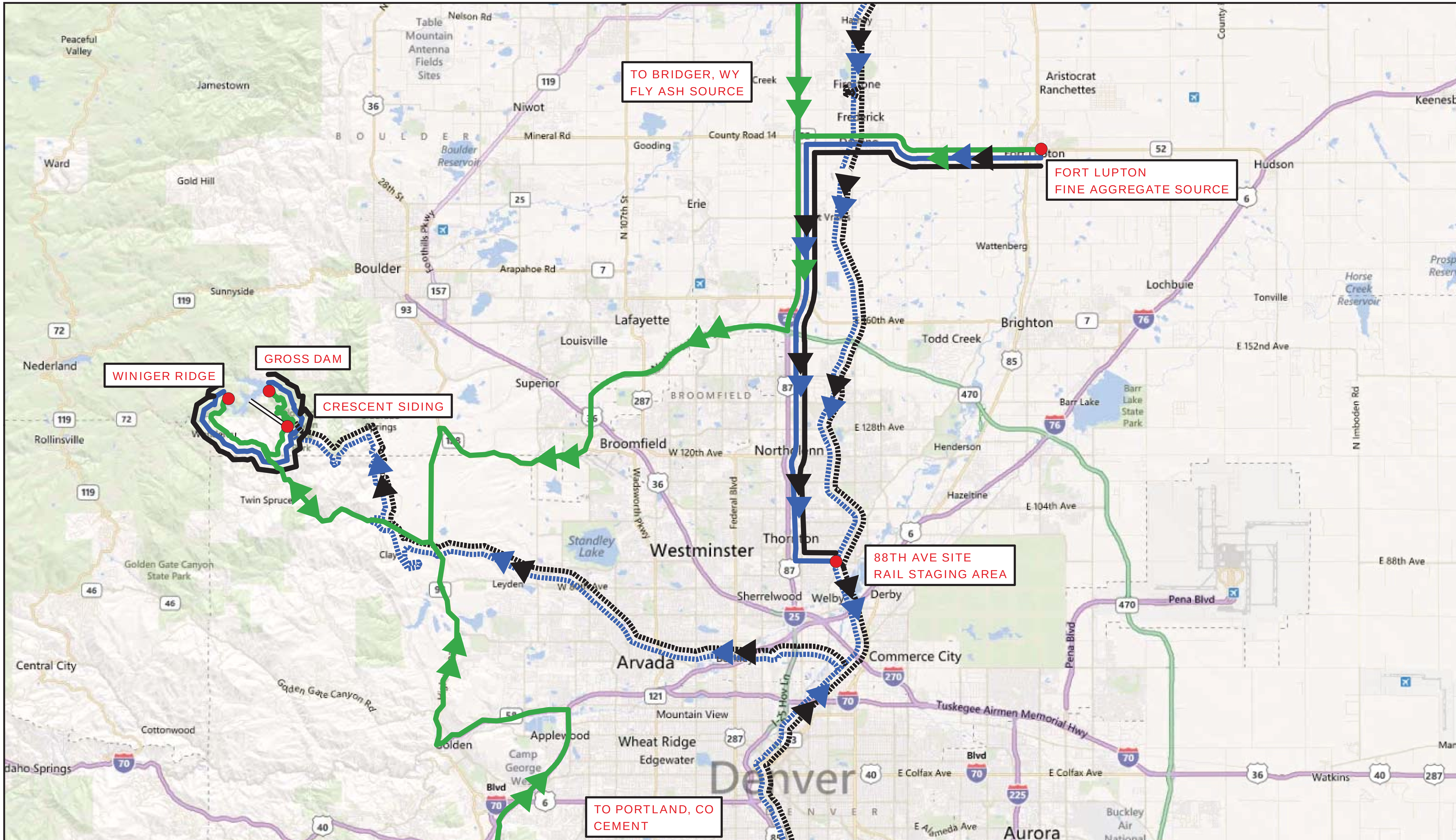
USEPA, *Integrated Risk Information System (IRIS)* (http://www.epa.gov/ncea/iris/index.html) USEPA, *1999 National Air Toxics Assessment (NATA),* (http://www.epa.gov/ttn/atw/nata1999/)

USEPA, Emission Factors for Locomotives, EPA-420-F-09-025, April 2009, (http://www.epa.gov/nonroad/locomotv/420f09025.pdf)

USEPA, *Mobile 6.2 Emission Factor Model, September 24, 2003.* Model used to create truck calculations for fuel usage based on speed, mileages and estimated number of trips carrying "Ash Slash" material required for the project provided by Denver Water.

U.S. Department of Transportation, *Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA, September 30, 2009.*

Appendix A—Exhibits



NORTH

Alternative 1
- Truck

Alternative 2
- Truck
- Railroad

Alternative 3
- Truck
- Railroad
- Conveyor

DENVER WATER

HDR engineering, Inc.

DRAWN BY:	TAH
CHECKED BY:	LDS
DATE:	09/18/12
SHEET NUMBER	A-1
LOCATION & DESCRIPTION:	Colorado General Transportation Routes
SHEET TITLE:	Alternative Haul Diagram

OPERATION PLAN:

1. UPRR TO ARRIVE EXISTING TRACK INBOUND (ZTS# 118).
2. UPRR TO SPOT LOADED CARS (14 EA.) ON INBOUND TRACK.
3. UPRR TO USE EXISTING SIDING TRACK (ZTS # 117) TO RUNAROUND LOADED CARS.
4. UPRR TO PULL EMPTY CARS FROM PROPOSED TRACK A HEAD EASTBOUND TO DENVER.
5. INDUSTRY TO PROCESS (UNLOAD) 2 EA. CARS AT A TIME OVER PROPOSED PIT, AND SPOT EMPTIES ON PROPOSED TRACK A.
6. DERAIL AND WEST TURNOUT (M.P. 31.20) TO REMAIN LOCKED WHILE INDUSTRY IS PROCESSING CARS.

CAPACITIES:

TRACK A = 14 CARS @ 55' FROM 13' CL PT TO 13' CL PT.
ZTS TRACK 118 = 14 CARS @ 55' FROM 13' CL PT TO 13' CL PT.

14 CARS @ 100 TONS = 1,400 TONS PER UNIT DELIVERY

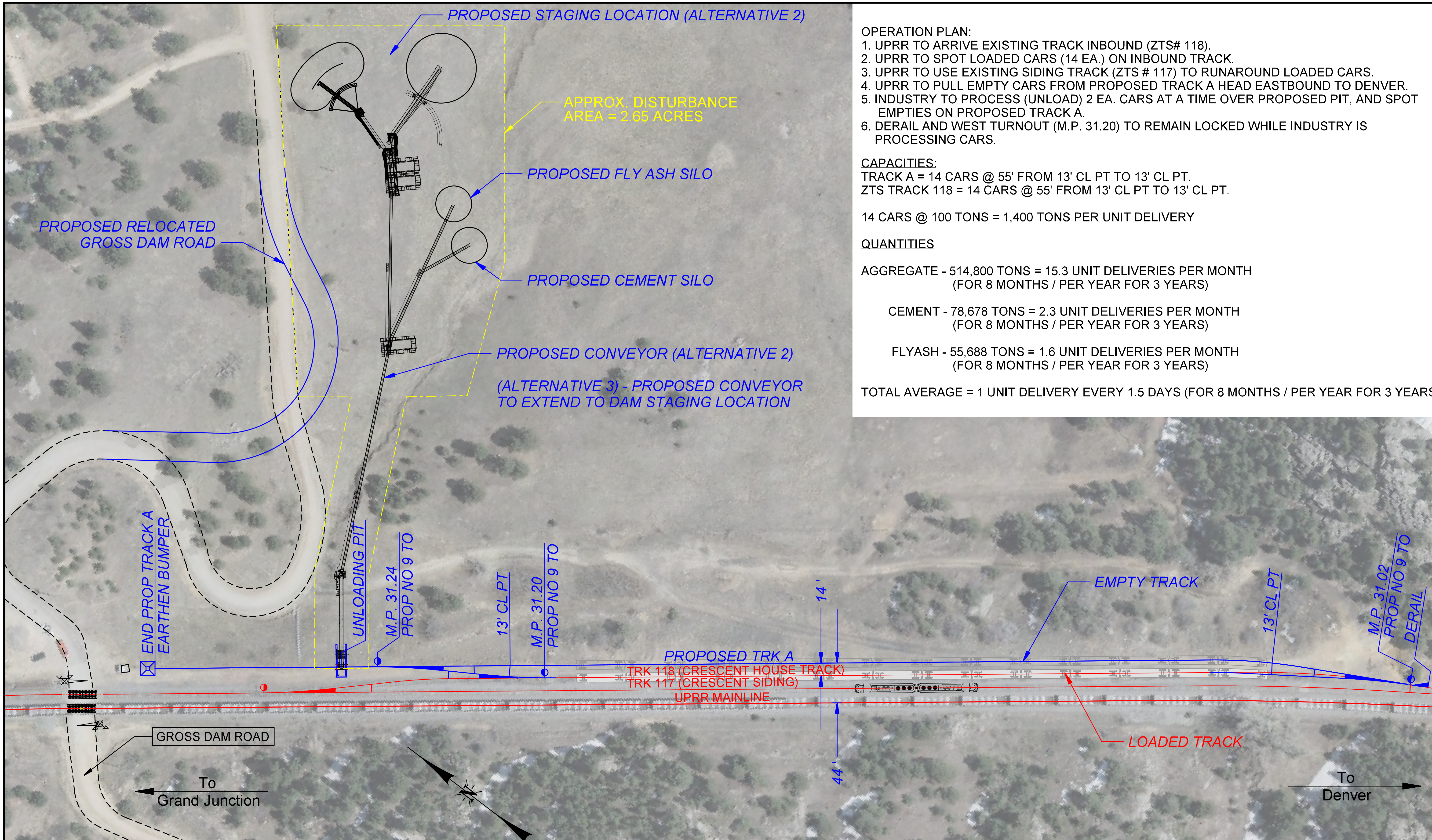
QUANTITIES

AGGREGATE - 514,800 TONS = 15.3 UNIT DELIVERIES PER MONTH (FOR 8 MONTHS / PER YEAR FOR 3 YEARS)

CEMENT - 78,678 TONS = 2.3 UNIT DELIVERIES PER MONTH (FOR 8 MONTHS / PER YEAR FOR 3 YEARS)

FLYASH - 55,688 TONS = 1.6 UNIT DELIVERIES PER MONTH (FOR 8 MONTHS / PER YEAR FOR 3 YEARS)

TOTAL AVERAGE = 1 UNIT DELIVERY EVERY 1.5 DAYS (FOR 8 MONTHS / PER YEAR FOR 3 YEARS)



- CONCEPTUAL -

FOR REVIEW/DISCUSSION

Legend	
EXIST. MAIN TRACK	red line
PROPOSED TRACK	blue line
EXIST. ROAD	dashed line
PROPOSED ROAD	blue line

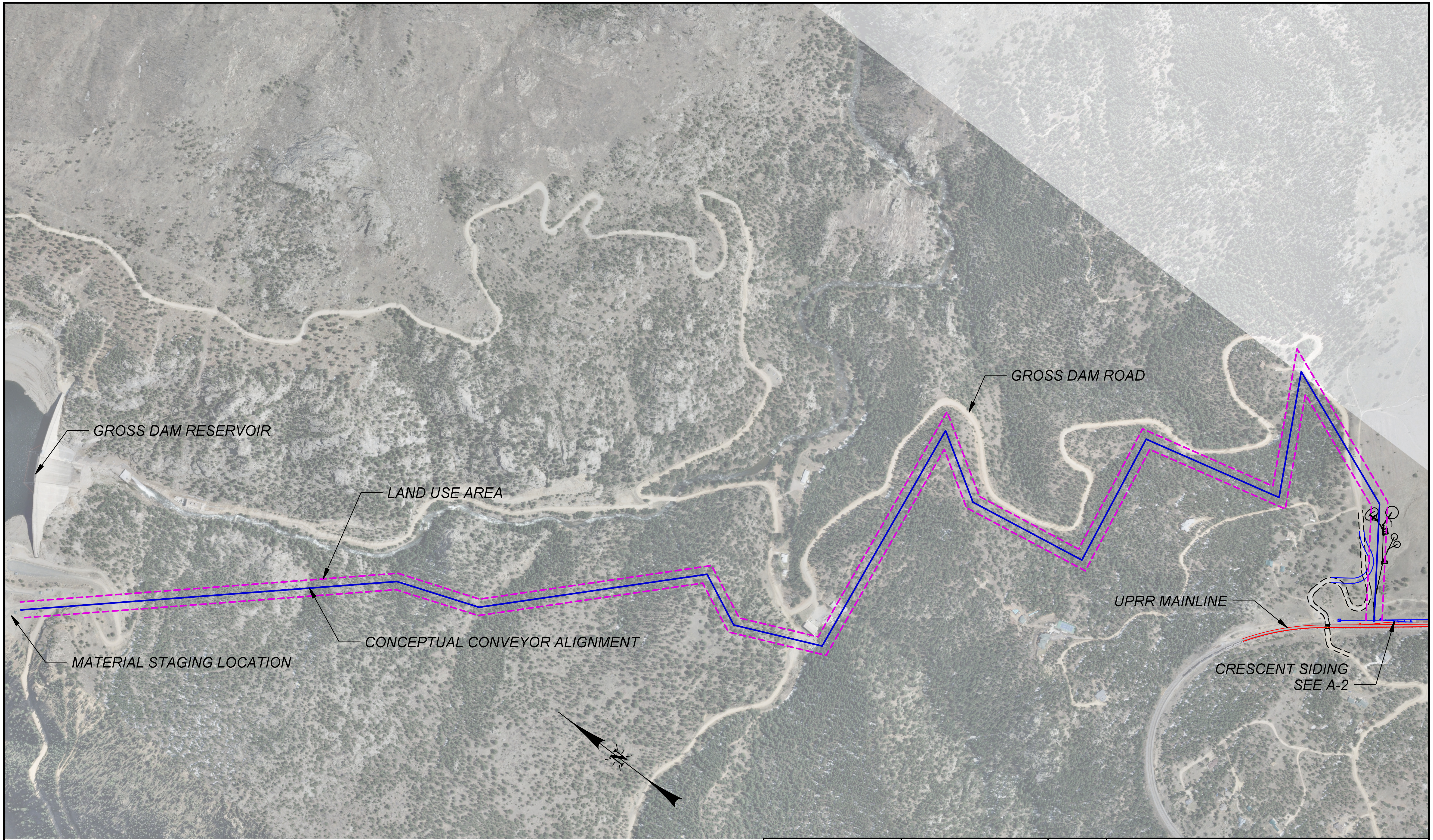
DENVER WATER

HDR Engineering, Inc.

DRAWN BY: LDS	LOCATION & DESCRIPTION: DENVER DIVISION / MOFFAT TUNNEL SUBDIVISION M.P. 30.58 / CPDS030 CRESCENT
CHECKED BY: LDS	
DATE: 12/13/2012	SHEET TITLE: GROSS DAM RESERVOIR EXPANSION PROPOSED RAIL UNLOADING SPUR A-2
SHEET NUMBER 001 of 001	

UPRR.tbl HDR_Denver_Rail.tbl RailSiding_exhibit.dgn $$model$$ 12/13/2012

RailSiding_exhibit.dgn



- CONCEPTUAL -

FOR REVIEW/DISCUSSION

NOTE: 100' WIDE LAND USE AREA = 26.0 ACRES

DENVER WATER

HDR Engineering, Inc.

DRAWN BY: LDS	LOCATION & DESCRIPTION: DENVER WATER GROSS DAM RESERVOIR
CHECKED BY: JDW	
DATE: 12/13/2012	SHEET TITLE: ALTERNATIVE CONVEYOR ALIGNMENT A-3
SHEET NUMBER 001 of 001	

UPRR.tbl
HDR_Denver_Rail.tbl
Conveyor_exhibit.dgn
$$model$$
12/13/2012

Conveyor_exhibit.dgn

Appendix B – Updated Cost Estimates

Table B-1

Conceptual Estimate

MP 14.0 Turnout (200' x 12')

CREATED BY: JASON WENGER
CHECKED BY: DOUG EMMONS
UPDATED BY: WAYNE FOX

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
304-06000	Aggregate Base Course (Class 6)	TON	160	$ 34.00	$ 5,440
403-33751	Hot Mix Asphalt (Grading S) (75) (PG 64-28)	TON	88	$ 100.00	$ 8,800
626-00000	Mobilization	L S	1	$ 6,800.00	$ 6,800
630-10005	Traffic Control	L S	1	$ 1,700.00	$ 1,700
630-00000	Flagging	HOUR	60	$ 26.00	$ 1,560
	TOTAL OF BID ITEMS				**$ 24,300**
				SUBTOTAL	**$ 24,300**
	Contingency		30%		$7,290
				PROJECT TOTAL	**$ 31,600**

9/5/2012

HDR | ONE COMPANY *Many Solutions*

Table B-2

Conceptual Estimate

MP 15.0 Turnout (250' x 12')

CREATED BY: JASON WENGER

CHECKED BY: DOUG EMMONS

UPDATED BY: WAYNE FOX

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
304-06000	Aggregate Base Course (Class 6)	TON	200	$ 34.00	$ 6,800
403-33751	Hot Mix Asphalt (Grading S) (75) (PG 64-28)	TON	110	$ 100.00	$ 11,000
626-00000	Mobilization	L S	1	$ 6,800.00	$ 6,800
630-10005	Traffic Control	L S	1	$ 1,700.00	$ 1,700
630-00000	Flagging	HOUR	60	$ 26.00	$ 1,560
	TOTAL OF BID ITEMS				**$ 27,860**
				SUBTOTAL	**$ 27,860**
	Contingency		30%		$8,358
				PROJECT TOTAL	**$ 36,200**

9/5/2012

Table B-3

Conceptual Estimate
MP 15.1 Turnout (300' x 12')

CREATED BY: JASON WENGER
CHECKED BY: DOUG EMMONS
UPDATED BY: WAYNE FOX

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
304-06000	Aggregate Base Course (Class 6)	TON	240	$ 34.00	$ 8,160
403-33751	Hot Mix Asphalt (Grading S) (75) (PG 64-28)	TON	132	$ 100.00	$ 13,200
626-00000	Mobilization	L S	1	$ 6,800.00	$ 6,800
630-10005	Traffic Control	L S	1	$ 1,700.00	$ 1,700
630-00000	Flagging	HOUR	60	$ 26.00	$ 1,560
	TOTAL OF BID ITEMS				**$ 31,420**
				SUBTOTAL	**$ 31,420**
	Contingency		30%		$9,426
				PROJECT TOTAL	**$ 40,800**

9/5/2012

Table B-4

Conceptual Estimate

MP 16.1 Turnout (850' x 12')

CREATED BY: JASON WENGER
CHECKED BY: DOUG EMMONS
UPDATED BY: WAYNE FOX

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
304-06000	Aggregate Base Course (Class 6)	TON	680	$ 34.00	$ 23,120
403-33751	Hot Mix Asphalt (Grading S) (75) (PG 64-28)	TON	374	$ 100.00	$ 37,400
626-00000	Mobilization	L S	1	$ 6,800.00	$ 6,800
630-10005	Traffic Control	L S	1	$ 1,700.00	$ 1,700
630-00000	Flagging	HOUR	100	$ 26.00	$ 2,600
	TOTAL OF BID ITEMS				**$ 71,620**
				SUBTOTAL	**$ 71,620**
	Contingency		30%		$21,486
				PROJECT TOTAL	**$ 93,100**

9/5/2012

Table B-5

Conceptual Estimate

MP 17.2 Turnout (350' x 12')

CREATED BY: JASON WENGER
CHECKED BY: DOUG EMMONS
UPDATED BY: WAYNE FOX

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
304-06000	Aggregate Base Course (Class 6)	TON	280	$ 34.00	$ 9,520
403-33751	Hot Mix Asphalt (Grading S) (75) (PG 64-28)	TON	144	$ 100.00	$ 14,400
626-00000	Mobilization	L S	1	$ 6,800.00	$ 6,800
630-10005	Traffic Control	L S	1	$ 1,700.00	$ 1,700
630-00000	Flagging	HOUR	60	$ 26.00	$ 1,560
	TOTAL OF BID ITEMS				**$ 33,980**
				SUBTOTAL	**$ 33,980**
	Contingency		30%		$10,194
				PROJECT TOTAL	**$ 44,200**

10/18/2012

HDR | ONE COMPANY *Many Solutions*

Table B-6
Conceptual Estimate
MP 31.35 Cost to construct new siding

CREATED BY: WAYNE FOX
CHECKED BY: LARRY STOCKTON

ITEM NO.	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE	COST
203-00060	Embankment Material (Complete In Place) (RR Fill)	CY	50,000	$ 12.00	$ 600,000
203-00060	Embankment Material (Complete In Place) (By Truck)	CY	35,000	$ 8.00	$ 280,000
	(For Gross Dam Road Curve Re-alignment @ Crescent)				
626-00000	Mobilization	L S	1	$ 100,000.00	$ 100,000
	Construct Track (Complete in place)	FT	1,174	$ 180.00	$ 211,320
	Construct Turnouts	EACH	2	$ 95,500.00	$ 191,000
	Construct Derail	EACH	1	$ 53,000.00	$ 53,000
	Unloading Pit	EACH	1	$ 240,000.00	$ 240,000
	TOTAL OF BID ITEMS				**$ 1,675,320**
				SUBTOTAL	**$ 1,675,320**
	Contingency		30%		$502,596
				PROJECT TOTAL	**$ 2,177,900**

Information:

Right of way costs for stockpile and road realignment are not included.

Table B-7

COSTS FOR HAULING (ALTERNATIVES 1-3)

12/14/2012

FROM	TO	MATERIAL	MILES 1-WAY	TRUCK COSTS 1	RAIL COSTS 1	CONVEYOR COSTS 2	OTHER COSTS	TOTAL COST PER OPTION
ALTERNATIVE 1 - TRUCKING HAUL FROM SOURCE TO GROSS DAM:								
Ft. Lupton, Colorado	Gross Dam Staging Area	Fine Aggregate	52.4	$ 8,854,560				
Portland, Colorado	Gross Dam Staging Area	Cement	144.9	$ 2,254,125				
Bridger Plant, WY	Gross Dam Staging Area	Fly Ash	346.9	$ 3,828,516				
Winiger Ridge (W/Loading Logs)	Denver-Metro	Timber	46.7	$ 222,750				
Winiger Ridge (W/Load-Ash/Slash)	Foothills Landfill	Ash/Slash	24.5	$ 8,575				
ASSOCIATED COSTS								
SH 72 Five-Turnouts			0.4				$ 245,900	
Gross Dam Curve Improvements & Maintenance			6.00				$ 1,429,477	
SH 72 Overlay			8.7				$ 1,793,296	
				$ 15,168,526			$ 3,468,673	**$ 18,640,000**
ALTERNATIVE 2 - RAILING AND TRUCKING HAUL FROM SOURCE TO GROSS DAM:								
Ft. Lupton, Colorado (Truck)	88 Ave RR Siding	Fine Aggregate	17.8	$ 5,148,000				
88 Ave RR Siding (Rail)	Crescent RR Siding	Fine Aggregate	30.6		$ 16,550,000			
Crescent RR Siding (Truck)	Gross Dam Staging Area	Fine Aggregate	4.0	$ 2,522,520				
Portland, Colorado (Rail)	Crescent RR Siding	Cement	140.9		$ 2,530,000			
Crescent RR Siding (Truck)	Gross Dam Staging Area	Cement	4.0	$ 287,175				
Bridger Plant, WY (Rail)	Crescent RR Siding	Fly Ash	342.9		$ 1,790,000			
Crescent RR Siding (Truck)	Gross Dam Staging Area	Fly Ash	4.0	$ 203,259				
Winiger Ridge (W/Loading Logs)	Crescent RR Siding	Timber	16.8	$ 198,900				
Winiger Ridge (W/Load-Ash/Slash)	Crescent RR Siding	Ash/Slash	16.8	$ 5,880				
Crescent RR Siding (Rail)	Denver-Metro	Timber	34.3		*			
Crescent RR Siding (Rail)	Disposal in Golden, CO	Ash/Slash	12.1		*			
ASSOCIATED COSTS								
Gross Dam Curve Improvements & Maintenance			6.00				$ 1,429,477	
Railroad Siding Improvements at Crescent (See Table 6)							$ 2,178,000	
Covered Conveyor System Costs (Rail to Crescent Stockpile)			0.2			$ 1,167,000		
Cement and Fly Ash Silos (Assume 2 Cement & 2 Fly Ash)							$ 1,200,000	
Railroad Siding Operating Costs at Crescent					$ 216,000			
				$ 8,365,734	$ 21,086,000	$ 1,167,000	$ 4,807,477	**$ 35,430,000**
ALTERNATIVE 3 - RAILING HAUL AND CONVEYING FROM SOURCE TO GROSS DAM:								
Ft. Lupton, Colorado (Truck)	88 Ave RR Siding	Fine Aggregate	17.8	$ 5,148,000				
88 Ave RR Siding (Rail)	Crescent RR Siding	Fine Aggregate	30.6		$ 16,550,000			
Crescent RR Siding (Conveyor)	Gross Dam Staging Area	Fine Aggregate	2.3					
(Costs shown in total conveyor costs below)								
Portland, Colorado (Rail)	Crescent RR Siding	Cement	140.9		$ 2,530,000			
Crescent RR Siding (Conveyor)	Gross Dam Staging Area	Cement	2.3					
(Costs shown in total conveyor costs below)								
Bridger Plant, WY (Rail)	Crescent RR Siding	Fly Ash	342.9		$ 1,790,000			
Crescent RR Siding (Conveyor)	Gross Dam Staging Area	Fly Ash	2.3					
(Costs shown in total conveyor costs below)								
Winiger Ridge (W/Loading Logs)	Crescent RR Siding	Timber	16.8	$ 198,900				
Winiger Ridge (W/Load-Ash/Slash)	Crescent RR Siding	Ash/Slash	16.8	$ 5,880				
Crescent RR Siding (Rail)	Denver-Metro	Timber	34.3		*			
Crescent RR Siding (Rail)	Disposal in Golden, CO	Ash/Slash	12.1		*			
ASSOCIATED COSTS								
Covered Conveyor System Costs (RR Crescent/Crescent-Dam)			2.3			$ 16,300,000		
Railroad Siding Improvements at Crescent (See Table 6)							$ 2,178,000	
Railroad Siding Operating Costs at Crescent					$ 216,000			
				$ 5,352,780	$ 21,086,000	$ 16,300,000	$ 2,178,000	**$ 44,920,000**

*** Rail haul costs for return trip are in the initial haul costs.**

1 -See Table B-9 for truck and rail costs.

2 -See Table B-10 for truck and rail costs.

Table B-8

TRUCKS PER DAY

11/12/2012

HDR ONE COMPANY *Many Solutions*℠

ALTERNATIVE 1

	Truck Loads	Calculations	Trucks/Day	Days
State Highway 72 & Gross Dam Road:				
Fine Aggregate	20,592	24 Construction Months X 22 work days/ mo.= 528 days		**528**
Cement	3,147			
Fly Ash	2,228			
	25,967		**49.18**	
Winiger Ridge to Front Range:		First 8 Construction Months X 22 work days/ mo.= 176 days		**176**
Timber	1,000			
Slash/Ash	50			
	1,050		**5.97**	

ALTERNATIVE 2

	Truck Loads	Calculations	Trucks/Day	Days
Gross Dam Road:				
Fine Aggregate	20,592	24 Construction Months X 22 work days/ mo.= 528 days		**528**
Cement	3,147			
Fly Ash	2,228			
	25,967		**49.18**	
Fine Aggregate from Ft. Lupton to 88th RR Siding:	**20,592**		**39.00**	
Winiger Ridge on SH 72 to Crescent RR Siding:		First 8 Construction Months X 22 work days/ mo.= 176 days		**176**
Timber	1,000			
Slash/Ash	50			
	1,050		**5.97**	

ALTERNATIVE 3

	Truck Loads	Calculations	Trucks/Day	Days
Fine Aggregate from Ft. Lupton to 88th RR Siding:	**20,592**	24 Construction Months X 22 work days/ mo.= 528 days	**39.00**	**528**
Winiger Ridge on SH 72 to Crescent RR Siding:		First 8 Construction Months X 22 work days/ mo.= 176 days		**176**
Timber	1,000			
Slash/Ash	50			
	1,050		**5.97**	

The assumed load of the trucks are based on the legal load limit of 25 tons.
Provided the information at the time, the 2009 Borrow Haul Study assumed 44 truck per day (88 truck trips).
Since the 2009 Borrow Haul report, quantities of cement, fly ash, timber and slash/ash have been added;
therefore generating more trucks per day.
22 workdays is the standard number of workdays for the construction industry and assumed for this report.

Table B-9

TRUCK AND RAIL HAUL SUMMARY

11/12/2012

HDR | ONE COMPANY *Many Solutions*℠

TRUCK HAUL SUMMARY

SUPPLIER	HAULER	TRUCK/RAIL OPTION	FROM	TO	ITEM HAULED	CUBIC YARDS	TONS	LOADS	LOAD SIZE CUBIC YARD	LOAD SIZE TONS	ONE WAY MILES	COST/ TON/MILE	RR SIDING TRANSLOAD	COST/ TON	TOTAL COST
L. G. Everest	L. G. Everest	TRUCK	Ft. Lupton	Gross Dam Staging Area	Fine Aggregates	360,000	514,800	20,592	17.48	25.00	52.40	$0.33		$17.20	$8,854,560
L. G. Everest	L. G. Everest	TRUCK W/RAIL	Ft. Lupton	88th Ave RR Siding	Fine Aggregates	360,000	514,800	20,592	17.48	25.00	17.80	$0.56		$10.00	$5,148,000
L. G. Everest	L. G. Everest	TRUCK W/RAIL	Cresent (RR Siding)	Gross Dam Staging Area	Fine Aggregates	360,000	514,800	20,592	17.48	25.00	4.00	$1.23		$4.90	$2,522,520
Holcim	U. S. Transport	TRUCK	Portland, CO Plant	Gross Dam Staging Area	Cement	62,000	78,678	3,147	19.70	25.00	144.90	$0.20		$28.65	$2,254,125
Holcim	U. S. Transport	TRUCK W/RAIL	Cresent (RR Siding)	Gross Dam Staging Area	Cement	62,000	78,678	3,147	19.70	25.00	4.00	$0.91	$6.50	$3.65	$287,175
Bridger Power Plant	U. S. Transport	TRUCK	Jim Bridger Plant	Gross Dam Staging Area	Fly Ash	55,000	55,688	2,228	24.69	25.00	346.90	$0.20		$68.75	$3,828,516
Boral or Bridger	U. S. Transport	TRUCK W/RAIL	Cresent (RR Siding)	Gross Dam Staging Area	Fly Ash	55,000	55,688	2,228	24.69	25.00	4.00	$0.91	$6.50	$3.65	$203,259
Denver Water	Forest Products	TRUCK	Winiger Ridge	Foothills Landfill	Salvaged Timber		25,000	1,000		25.00	24.50				$222,750
Denver Water	Forest Products	TRUCK W/RAIL	Winiger Ridge	Cresent (RR Siding)	Salvaged Timber		25,000	1,000		25.00	16.80				$198,900
Denver Water	Forest Products	TRUCK W/RAIL	Winiger Ridge	Cresent (RR Siding)	Ash/Slash		1,250	50		25.00	16.80				$6,705
Denver Water	Forest Products	TRUCK	Winiger Ridge	Foothills Landfill	Ash/Slash		1,250	50		25.00	24.50				$7,898

RAIL HAUL SUMMARY

FROM	TO	ITEM HAULED	CUBIC YARDS	TONS	CAR LOADS	TRAINS (14 CARS)	LOAD SIZE CAR/ CY	LOAD SIZE TRAIN/C Y	CAR LOAD SIZE TONS	ONE-WAY MILES	COST PER TON	COST PER TON MILE	COST PER TRAIN	COST PER CAR	TOTAL COST
88TH Ave., Hendersor	Cresent (RR Siding)	Fine Aggregates	360,000	514,800	5,148	368	70	980	100	30.6	$32.14	$1.05	$45,000	$3,214	**$16,547,143**
Portland, CO	Cresent (RR Siding)	Cement	62,000	78,678	787	56	70	980	100	140.9	$32.14	$0.23	$45,000	$3,214	**$2,528,936**
Bridger Power Plant	Cresent (RR Siding)	Fly Ash	55,000	55,688	557	40	70	980	100	342.9	$32.14	$0.09	$45,000	$3,214	**$1,789,955**
Cresent (RR Siding)	Disposal in Golden, CO	Ash/Slash		1,250	13	1	70	980	100	16.8					*
Cresent (RR Siding)	Denver-Metro Area	Salvaged Lumber		25,000	250	18	70	980	100	34.3					*

Assumptions:

Cement = 94 lbs/CF or 2538 lbs/CY
Fly Ash =75 lbs/CF or 2025 lbs/CY
(Info from David Neel-Craig Power Plant)

Fine Aggregate 1.43 Tons/CY
(Info from L.G. Everest - Tim Cheever)

*** These Items will be loaded and hauled on the return trip at no additional haul cost.**

Fine Aggregate Quote from Aggregate Industries at Longmont = $6.00 Ton
Fine Aggregate Quote from L G Everest Pit at Ft. Lupton = $5.00 Ton

Transloading costs not included, because of using silos.
Costs for Timber includes loading trucks with log loader (1 hr per truck).
Costs for Slash/Ash includes loading trucks with front end loader.

Notes:

1. The volume of truck loads are based on the state legal load limit of 25 tons.
2. Assumed belly dump trucks 70 feet long.
3. Quantities and costs are estimated for purposes of comparison; actual quantities may vary.

Table B-10
CONVEYOR SYSTEM COST SUMMARY

11/12/2012

HDR | ONE COMPANY *Many Solutions*℠

Alternate 3 - Portable Conveyor Type	Belt Width	Belt Length	Estimated Number Required	Cost F.O.B. Factory *	Freight	Cover	Install Cover	Remote Control and Control Panels	Cost for each Conveyor	Cost Per LF	Total LF Conveyor
Jump	30	70	79	$28,074	$76,806	$1,080	$1,080	$10,000	$9,246,125	$1,672	5530
Groundline	30	900	7	$365,090	$87,500	$37,775	$37,775	$10,000	$3,766,980	$598	6300
Groundline	36	3300	0	$1,852,595	$0	$45,027	$45,027	$10,000	$0		0
Telestacker	30	150	2	$211,320	$4,167	$3,720	$3,720	$10,000	$465,853	$1,553	300
					$168,472	**$87,602**	**$87,602**	**$40,000**			**12130**
								Total Cost	**$13,478,958**		
	Cost Per Unit	**Unit**	**Quantity**	**Sub-Totals**							
Conveyor Power Lines	$3	LF	10560	$31,680							
Conveyor Erection	$30	LF	10560	$316,800							
Conveyor Maintenance Cost	3%	L S	1	$404,369							
Conveyor Operations Cost		L S	1	$517,440							
Conveyor Removal and Demobilize	$20	LF	10560	$211,200							
Cutting, Tree Removal & Disposal	$60,000	Acre	26	$1,560,000							
Landscape Restoration	$50,000	Acre	26	$1,300,000							
Design and Construction Engineering	$50,000	L S	1	$50,000							
			Sub-total	**$4,391,489**							
Overhead and Profit	15%			$2,680,567							
Contingencies	30%			$5,361,134							
			Sub-total	**$8,041,701**							
		Sub-totals:		**$25,912,148**							
Recoverable Salvage Value(Groundline)	50%			$1,883,490							
Recoverable Salvage Value(Jumps & Telestacker)	80%			$7,769,583							
			Sub-total	**$9,653,073**							
			Total:	**$16,259,076**							

Conveyor Operations Cost for Alternate 3:	**No.**	**Cost/Hr**	**Hours**	**Total Cost**
Foreman	1	$25	5280	$132,000
Telestacker Operators	2	$20	5280	$105,600
Mobile Groundline Operators	2	$20	5280	$105,600
Labors	2	$15	5280	$79,200
Pickups	3	$18	5280	$95,040
			Total	**$517,440**

Table B-10

CONVEYOR SYSTEM COST SUMMARY (PAGE 2)

11/12/2012

Crescent Siding RR Stockpile Conveyor Only:

Alternate 2 - Portable Conveyor Type	Belt Width	Belt Length	Number Required	Cost F.O.B. Factory *	Freight	Cover	Install Cover	Remote Control and Control Panels	Cost for each Conveyor	Cost Per LF	Total LF Conveyor
Groundline	30	900	1	$365,090	$12,500	$37,775	$37,775	$10,000	$463,140	$515	900
Jump	30	100	3	$40,105	$4,167	$1,543	$1,543	$10,000	$172,073	$574	300
Telestacker	30	150	1	$211,320	$2,083	$3,720	$3,720	$10,000	$230,843	$1,539	150
Misc. Conveyor Costs									$164,881		
				$616,515	**$18,750**	**$43,038**	**$43,038**	**$30,000**			**1350**
								Total Cost	**$1,030,938**		
Conveyor Power Lines	$3	LF	1000	$3,000							
Design and Construction Engineering	$10,000	L S	1	$10,000							
Landscape Restoration	$25,000	Acre	3	$75,000							
Overhead and Profit	15%			$154,641							
Contingencies	30%			$309,281							
			Sub-total	**$551,922**							
		Sub-totals:		**$1,582,860**							
Recoverable Salvage Value(Groundline)	50%			$231,570							
Recoverable Salvage Value (Telestacker)	80%			$184,675							
			Sub-total	**$416,245**							
			Total:	**$1,166,615**							

Hours = 8 Months (22 Days/ Month) X 3 Year X 10 hr/day= 5,280 Hrs

1) Recoverable salvage value for the conveyor is 50% for groundline conveyors and 5% year for telestacker conveyor.
2) The total conveyor length is based on a conceptual alignment using the manufacturer's recommended incline of 16 degrees for groundline and jump conveyors.
3) For Alternate 3, the length of the conveyor was increased by 10% to account for steep vertical terrain variations in the proposed conveyor alignment.
(500 LF down and 500 LF up in elevation)
4) Conveyor Operations Cost for Alternate 2 is considered negligible when compared to Alternate 3 and covered by the assigned contingencies
5) Information from Superior Industries assumes 30 Inch conveyor belt width which produces 175 TPH - 500 TPH
*** F. O. B. is the initial for freight on bearing or point of delivery**

Appendix C—Basis and Assumptions for Air Quality and Noise Analyses

Air Quality

Criteria Air Pollutants and Air Toxics

Air quality is determined by comparing concentrations of monitored pollutants with prescribed standards. The standards of maximum acceptable levels of criteria pollutants are specified by the U.S. Environmental Protection Agency (USEPA). The Clean Air Act (CAA) established two types of National Ambient Air Quality Standards (NAAQS): primary standards designed to protect public health, and secondary standards which protect public welfare (42 U.S.C. 7409). The USEPA Office of Air Quality Planning and Standards has set NAAQS for the following six criteria pollutants shown in Table C-1.

Table C-1. National Ambient Air Quality Standards

Pollutant [final rule cite]		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide [76 FR 54294, Aug 31, 2011]		primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead [73 FR 66964, Nov 12, 2008]		primary and secondary	Rolling 3 month average	0.15 μg/m^3 (1)	Not to be exceeded
Nitrogen Dioxide [75 FR 6474, Feb 9, 2010] [61 FR 52852, Oct 8, 1996]		primary	1-hour	100 ppb	98th percentile, averaged over 3 years
		primary and secondary	Annual	53 ppb (2)	Annual Mean
Ozone [73 FR 16436, Mar 27, 2008]		primary and secondary	8-hour	0.075 ppm (3)	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particle Pollution [71 FR 61144, Oct 17, 2006]	$PM_{2.5}$	primary and secondary	Annual	15 μg/m^3	annual mean, averaged over 3 years
			24-hour	35 μg/m^3	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24-hour	150 μg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide [75 FR 35520, Jun 22, 2010] [38 FR 25678, Sept 14, 1973]		primary	1-hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

(1) *Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.*

(2) *The official level of the annual NO2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.*

(3) *Final rule signed March 12, 2008. The 1997 ozone standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years) and related implementation rules remain in place. In 1997, EPA revoked the 1-hour ozone standard (0.12 ppm, not to be exceeded more than once per year) in all areas, although some areas have continued obligations under that standard ("anti-backsliding"). The 1-hour ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1.*

(4) *Final rule signed June 2, 2010. The 1971 annual and 24-hour SO2 standards were revoked in that same rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.*

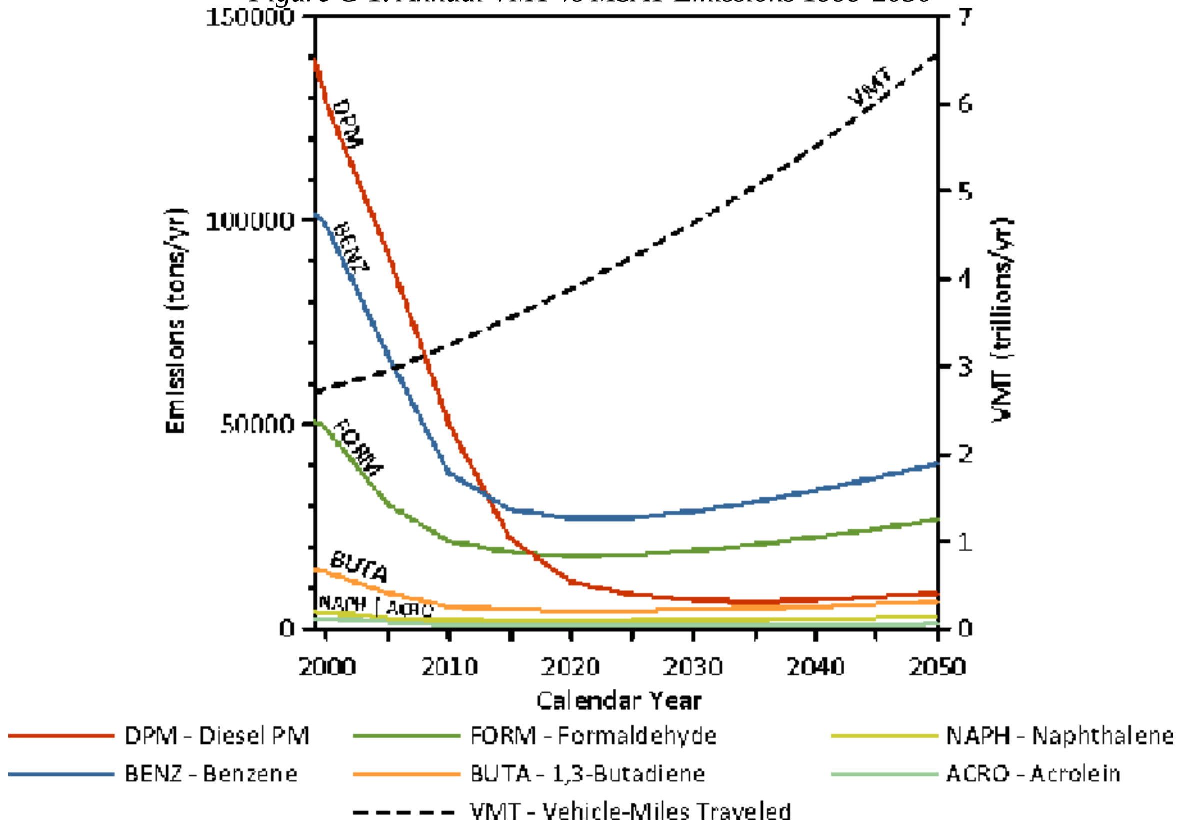
In addition to the criteria air pollutants for which there are NAAQS, USEPA also regulates emissions of air toxics, some of which are also classified as hazardous air pollutants (HAP) under the Clean Air Act (CAA). Most air toxics originate from human-made sources, including: on-road mobile sources, non-road mobile sources, area sources (such as dry cleaners), and stationary sources (such as factories or refineries). The Federal Highway Administration (FHWA) has prepared guidance on the analysis of mobile source air toxics (MSAT) for highway projects (FHWA 2009). In this guidance, FHWA recommends no analysis, qualitative analysis, or quantitative analysis, depending on the magnitude of project-related traffic. MSATs are a subset of the 187 HAPs identified under the CAA, plus diesel particulate matter (DPM). MSATs are compounds emitted from highway vehicles and non-road equipment. Some toxic compounds are present in fuel and are emitted into the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline (see Document No. EPA420-R-00-023, December 2000). The principal air toxics emitted from mobile sources are acetaldehyde, acrolein, benzene, 1,3-butadiene, formaldehyde, and DPM.

USEPA is the lead federal agency for administering the Clean Air Act and has certain responsibilities regarding the health effects of MSATs. The USEPA issued a major rule on the Control of Hazardous Air Pollutants from Mobile Sources (Federal Register, Vol. 72, No. 37, page 8430, February 26, 2007) and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System (IRIS) (http://www.epa.gov/ncea/iris/index.html). In addition, USEPA identified seven compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers from their 1999 National Air Toxics Assessment (NATA) (http://www.epa.gov/ttn/atw/nata1999/). These are acrolein, benzene, 1,3-butadiene, diesel particulate matter plus diesel exhaust organic gases (diesel PM), formaldehyde, naphthalene, and polycyclic organic matter. While FHWA considers these the priority MSATs, the list is subject to change and may be adjusted in consideration of future USEPA rules.

The 2007 EPA rule mentioned above requires controls that will dramatically decrease MSAT emissions through cleaner fuels and cleaner engines. Between 1999 and 2050, Federal Highway Administration (FHWA) projects that even with a 145 percent increase in Vehicle Miles Traveled (VMT), these controls will reduce the total annual emission rate for the priority MSATs by 72 percent (see Figure C-1). Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the USEPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the project area are likely to be lower in the future than they are currently.

According to USEPA estimates, the lifetime cancer risk from all sources of air pollution ranges from one to 25 cases per million people in rural areas, and from 25 to 50 cases per million people in urban areas. These risks compare with an overall lifetime cancer risk from all causes of 333,000 cases per million people. Although little is known about the existing levels of MSATs in the study area, it is apparent, based on the nationwide reductions forecast by USEPA, that MSAT concentrations and associated risks generally should decline in coming decades, even with substantial growth in mobile and stationary source activity.

Figure C-1. Annual VMT vs MSAT Emissions 1999-2050



Source: http://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/100109guidmem.cfm

Emissions Analysis Methodology

The analysis includes an assessment of five criteria air contaminants (PM_{10}, $PM_{2.5}$, SO_2, CO and NO_x), carbon dioxide (CO_2), and Volatile Organic Compounds (VOCs). The EPA model, MOBILE 6.2 was used for the truck haul analysis. MOBILE 6.2 is an emission factor model for predicting gram per mile emissions of Hydrocarbons (HC – expressed as VOC), Carbon Monoxide (CO), Nitrogen Oxides (NOx), Carbon Dioxide (CO_2), Particulate Matter (PM), and toxics from cars, trucks, and motorcycles under various conditions.

The rail analysis used average gallons of diesel fuel per freight-ton hauled per mile efficiency factor combined with established USEPA emission standards for nitrogen oxides (NO_x), hydrocarbons (HC), carbon monoxide (CO), particulate matter (PM) and smoke for newly manufactured and remanufactured large line-haul locomotives[7]. These standards, which are codified at 40 CFR Part 1033, include several sets of emission standards with applicability dependent on the date a locomotive is first manufactured. Table C-2 provides a summary of the three proposed alternatives of hauls by truck and rail, including the material hauled and the associated fuel usage. The analysis considered the weight of each material in tons for each leg of the haul, the distance of the route, and the fuel used in gallons.

[7] http://www.epa.gov/nonroad/locomotv/420f09025.pdf

Table C-2. Fuel Usage by Option

Item Hauled	Alternative	Mode	Subtotal Fuel Used (gal/yr)	Total Fuel Used (gal/yr)
Aggregate	1	*Truck*		**171,300**
	2	*Truck* *Rail* **Total**	*71,300* *33,600*	**104,900**
	3	*Truck* *Rail* **Total**	*58,200* *33,600*	**91,800**
Cement	1	*Truck*		**72,400**
	2	*Truck* *Rail* **Total**	*2,000* *23,600*	**25,600**
	3	*Truck* *Rail* **Total**	*0* *23,600*	**23,600**
Fly Ash	1	*Truck*		**122,700**
	2	*Truck* *Rail* **Total**	*1,400* *40,700*	**42,100**
	3	*Truck* *Rail*	*0* *40,700*	
Timber	1	*Truck*		**7,400**
	2	*Truck* *Rail* **Total**	*2,700* *1,800*	**4,500**
	3	*Truck* *Rail* **Total**	*2,700* *1,800*	**4,500**
Ash Slash	1	*Truck*		**3,800**
	2	*Truck* *Rail* **Total**	*2,600* *600*	**3,200**
	3	*Truck* *Rail* **Total**	*2,600* *600*	**3,200**

To estimate a net change in emissions for the three year period (2013-2015) of the project, it was assumed that an equivalent amount of material would be handled either by trucks or by a "truck with rail" option. Emissions estimates were made for nitrogen oxides (NO_x), particulate matter less than 10 microns in diameter (PM_{10}), particulate matter less than 2.5 microns in diameter $_{(PM2.5),}$ volatile organic compounds (VOCs), carbon dioxide (CO_2), sulfur dioxide (SO_2), carbon monoxide (CO), as shown in Table C-3.

Estimates of the number of railcars moved by rail along the proposed routes were provided by Denver Water and supplemented with estimates of total gross-tons moved (including weights of freight and railcars) made by HDR. An estimate of a system-wide fuel efficiency (on a gallons/gross ton mile basis) derived from a rough locomotive fuel use estimate based on using the AAR’s average fuel efficiency value of 469 revenue tons-miles per gallon (this would be applied just to the material carried, and implies the railcar weights and empty movements are embedded in the value), and EPA grams per gallon emission factors by pollutant to estimate total annual emissions for 2013-2015.

It is also assumed there is 100 tons of freight carried per railcar. The fuel calculation depends only on the total quantity of material carried over each distance (to get total ton-miles). The “Ash Slash” 7.7-mile haul is too short and too small a material amount to justify a haul by rail. However, since it is a very small component of the comparison, it is assumed to be a rail haul for the sake of doing a complete truck versus complete rail haul comparison.

For truck calculations, estimates of the number of round-trip truck trips required to haul an equivalent amount of freight was provided by Denver Water, along with estimates of county-specific vehicle speed and mileages. Fuel efficiency and emission factors for the HDDV8B vehicles at 40 mph were determined using EPA’s MOBILE6.2 emission factor model, dated September 24, 2003. Trucks were assumed to carry 25 tons per load, except for the “ash slash” material, which assumed a specific number of truckloads required for the project.

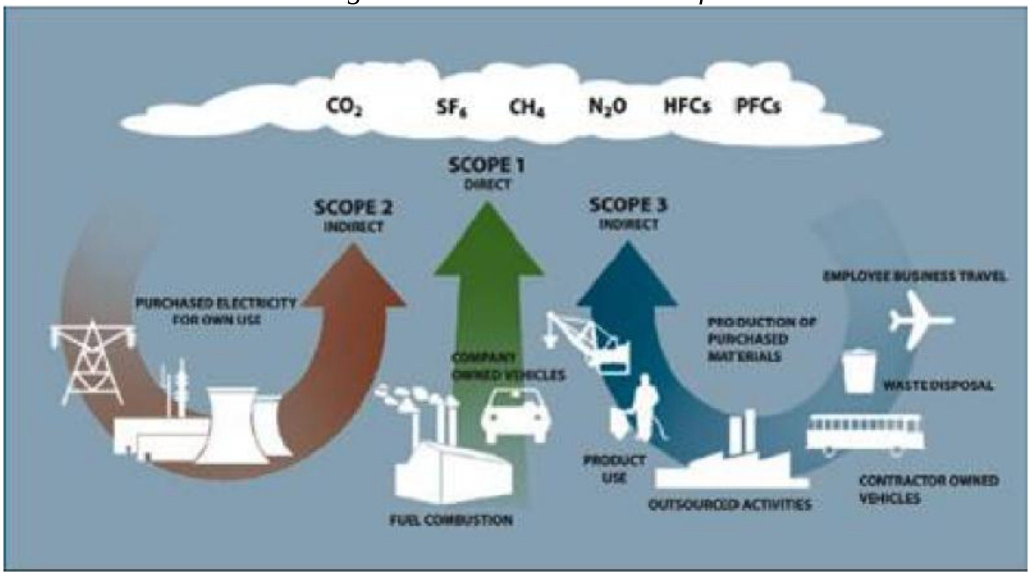
Greenhouse Gas Inventory (Carbon Footprint Analysis)

A “carbon footprint" is defined as the amount of greenhouse gases (GHGs) that are emitted into the atmosphere each year by a person, household, building, project or company. It relates to the amount of GHGs produced through such activities as the burning of fossil fuels for electricity, heating and transportation, and generally is measured in tons of carbon dioxide equivalent. Carbon dioxide equivalents (CO_{2e}) are a useful metric because they provide a common standard to describe emissions across industries and regardless of source. A carbon footprint is calculated by performing a GHG inventory which is a comprehensive accounting of GHG emissions attributed to a project’s activities. The GHG inventory process identifies, documents, and accounts for GHG emissions through a data collection and analysis process that calculates carbon dioxide equivalents.

There are six GHGs that form the basis of GHG inventories. As shown in Figure C-2, these GHGs and common sources of emissions are:

1. Carbon dioxide (CO_2): Generated by burning fossil fuels, solid waste, trees and wood products.
2. Methane (CH_4): Generated by producing and transporting fossil fuels.
3. Nitrous oxide (N_2O): Generated by fertilizer applications, sewage treatment, industrial processes, and by burning fossil fuels and solid waste.
4. Hydrofluorocarbons (HFCs): Commonly found in refrigerants, fire suppressants, and manufacturing processes.
5. Perflurorcarbons (PFCs): Commonly found in refrigerants, electrical equipment, and manufacturing processes.
6. Sulfur hexafluoride (SF_6): Commonly found in electrical equipment and manufacturing processes

Figure C-2. Common Sources of GHGs



Source: GHG Protocol

The GHG Protocol, the most widely used GHG accounting tool in the world, defines direct and indirect emissions as follows:

- Direct GHG emissions are emissions from sources that are owned or controlled by the reporting entity.
- Indirect GHG emissions are emissions that are a consequence of the activities of the reporting entity, but occur at sources owned or controlled by another entity.

The GHG Protocol further categorizes these direct and indirect emissions into three broad scopes:

- Scope 1: All direct GHG emissions.
- Scope 2: Indirect GHG emissions from consumption of purchased electricity, heat or steam.
- Scope 3: Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities (e.g. T&D losses) not covered in Scope 2, outsourced activities, waste disposal, etc.

Only direct emissions from mobile combustion sources (truck and rail) are analyzed in this study.

Federal Rules and Guidance on GHG Emissions

A number of legal findings and events over the past several years have led to regulatory actions by the USEPA and the Council on Environmental Quality (CEQ) regarding climate change and GHG emissions.

Massachusetts vs USEPA

In a 2007, the Supreme Court found that CO_2 and other GHG emissions meet the definition of air pollutants under the Clean Air Act[8]. The lawsuit was in regard to tailpipe emissions from cars and trucks, which account for about one-third of the country's total GHG emissions[9]. The Supreme Court required the EPA to determine whether or not GHG emissions from new motor vehicles (the specific sector cited in the law suit) cause or contribute to air pollution, which may reasonably be anticipated to endanger public health or welfare.

[8] http://www.epa.gov/climatechange/endangerment/
[9] http://www.eia.gov/oiaf/1605/ggrpt/carbon.html

Endangerment Finding

As a next step, on December 7, 2009, the EPA made the determination that the current and projected concentrations of the six key GHG emissions endanger public health and welfare[10]. This was a required step in the process leading to the regulation of GHG emissions under the Clean Air Act. The EPA also found that new motor vehicles and new motor engines cause or contribute to GHG pollution which was determined to threaten public health and welfare.

EPA Mandatory GHG Reporting Rule

In April 2009, the USEPA issued a rule for mandatory GHG reporting from large U.S. GHG emission sources. The goal of the rule is to collect accurate and comprehensive emissions data to inform policy makers, and potentially to assist in developing a cap and trade system. The Rule became effective on December 29, 2009 and applies to any facility or supplier whose greenhouse gas emissions exceed 25,000 metric tons of CO_{2e}. Beginning in calendar year 2010, if a facility's emissions are greater than this threshold, the facility was required to begin monitoring, recording and reporting the GHG emissions annually, effective January 1, 2011. The Rule covers 85- 90% of national US emissions and covers around 13,000 facilities[11].

CEQ Draft NEPA Guidance on Consideration of the Effects of Climate Change and Green House Gas Emissions

On February 18, 2010, the Council on Environmental Quality (CEQ) released, for public review and comment, a draft "Guidance Memorandum" on the consideration of GHG emissions and climate change impacts as part of compliance with NEPA. The Guidance Memorandum addresses two related issues:

- The treatment of GHG emissions that may directly or indirectly result from the proposed federal action.
- The analysis of potential climate change impacts upon the proposed federal action.

Increasingly, the consideration of GHG emissions and the potential effects of climate change have been incorporated into NEPA reviews of proposed federal actions. However, the federal agencies have limited guidance and policies regarding when and how such analyses should take place. This draft Guidance Memorandum provides formal guidance from CEQ to the federal agencies on the treatment of GHG emissions and climate change impact issues within the NEPA process. Specifically, the threshold of 25,000 metric tons of CO_2-equivalent GHG emissions annually is suggested as a "useful, presumptive, threshold for discussion and disclosure ... because it has been used and proposed in rule-makings under the Clean Air Act[12]." All federal agency actions requiring NEPA review, except federal land and resource management activities, are covered by this guidance.

International Agreements: Kyoto Protocol and a Post-2012 Framework

Given that climate change is a global issue, a number of steps have been taken at the international level to promote coordination and collaboration. The Kyoto Protocol, an international environmental treaty and protocol to the United Nations Framework Convention on Climate Change is generally seen as an important first step towards a truly global emission reduction regime, and it provides the essential framework for a future international agreement on climate change. It was adopted in Kyoto, Japan, in December 1997 and entered into force in February 2005.The ultimate objective of the Kyoto Protocol is to stabilize GHG concentrations at a level that would prevent dangerous anthropogenic interference with the climate system. The U.S. signed the Kyoto Protocol in November 1998, but did not ratify the treaty and,

[10] http://www.epa.gov/climatechange/endangerment/
[11] http://www.epa.gov/ghgreporting/
[12] http://ceq.hss.doe.gov/nepa/regs/Consideration of Effects of GHG Draft NEPA Guidance FINAL 02182010.pdf

therefore, is not committed to the binding targets. However, the first commitment period of the Kyoto Protocol ends in 2012, and a new international framework is currently under negotiation for a Post-2012 framework.

Methodology

The EPA model MOBILE 6.2 was used for the truck haul analysis and produces emission factors for CO_2 to be used in the carbon footprint component of the analysis. The rail analysis was derived from gallons of diesel fuel per freight hauled per mile. The rail portion of the "truck with rail" analysis are based only on fuel efficiency (gross tons of freight hauled per mile). See Table C-3.

Table C-3
One-Way Fuel Use and Emissions per Year by Pollutant and Item Hauled for Alternatives 1, 2 and 3 (2013-2015)

Item Hauled	Alternative	Mode	Subtotal Fuel Used (gal/yr)	Total Fuel Used (gal/yr)	PM_{10} (ton/yr)	$PM_{2.5}$ (ton/yr)	SO_2 (ton/yr)	CO (ton/yr)	CO_2 (ton/yr)	NO_x (ton/yr)	VOC (ton/yr)
Aggregate	1	*Truck*		171,300	0.18	0.13	0.02	1.01	1927	6.71	0.30
	2	*Truck*	*71,300*								
		Rail	*33,600*								
		Total		104,900	0.21	0.18	0.01	1.40	1180	7.76	0.36
	3	*Truck*	*58,200*								
		Rail	*33,600*								
		Total		91,800	0.19	0.17	0.01	1.33	1032	7.25	0.34
Cement	1	*Truck*		72,400	0.07	0.05	0.01	0.43	814	2.83	0.13
	2	*Truck*	*2,000*								
		Rail	*23,600*								
		Total		25,600	0.10	0.09	0.00	0.71	288	3.58	0.17
	3	*Truck*	*0*								
		Rail	*23,600*								
		Total		23,600	0.09	0.09	0.00	0.69	266	3.50	0.17
Fly Ash	1	*Truck*		122,700	0.13	0.09	0.01	0.72	1380	4.80	0.22
	2	*Truck*	*1,400*								
		Rail	*40,700*								
		Total		42,100	0.16	0.16	0.00	1.20	474	6.08	0.29
	3	*Truck*	*0*								
		Rail	*40,700*								
		Total		40,700	0.16	0.16	0.00	1.19	458	6.03	0.29
Timber	1	*Truck*		7,400	0.01	0.01	0.00	0.04	83	0.29	0.01
	2	*Truck*	*2,700*								
		Rail	*1,800*								
		Total		4,500	0.01	0.01	0.00	0.07	51	0.38	0.02
	3	*Truck*	*2,700*								
		Rail	*1,800*								
		Total		4,500	0.01	0.01	0.00	0.07	51	0.38	0.02
Ash Slash	1	*Truck*		3,800	0.00	0.00	0.00	0.02	43	0.15	0.01
	2	*Truck*	*2,600*								
		Rail	*600*								
		Total		3,200	0.01	0.00	0.00	0.03	36	0.20	0.01
	3	*Truck*	*2,600*								
		Rail	*600*								
		Total		3,200	0.01	0.00	0.00	0.03	36	0.20	0.01

SUMMARY

ALTERNATIVE 1 - TRUCK HAUL	377,600	0.39	0.28	0.04	2.22	4,247	14.78	0.67
ALTERNATIVE 2 - RAILROAD AND TRUCK HAUL	180,300	0.48	0.44	0.02	3.42	2,029	18.00	0.85
ALTERNATIVE 3 - RAILROAD HAUL AND CONVEYOR	163,800	0.46	0.43	0.02	3.32	1,844	17.35	0.82

Noise

HDR performed an assessment of noise associated with two alternative methods of transporting materials to and from the reservoir project site (rail-based transport and truck-based transport). Following are a discussion of basic acoustical concepts used in the assessment, a discussion of the noise assessment methodologies, and the results.

Acoustical Concepts

Noise is defined as unwanted sound. Sound is made up of tiny fluctuations in air pressure. Sound, within the range of human hearing, can vary in intensity by over one million units. Therefore, a logarithmic scale, known as the decibel (dB) scale, is used to quantify sound intensity and to compress the scale to a more manageable range.

Sound is characterized by both its amplitude (how loud it is) and frequency (or pitch). The human ear does not hear all frequencies equally. In fact the human hearing organs of the inner ear deemphasize very low and very high frequencies. The A-weighted decibel (dBA) is used to reflect this selective sensitivity of human hearing. This scale puts more weight on the range of frequencies where the average human ear is most sensitive, and less weight on those frequencies we do not hear as well. The human range of hearing extends from approximately 3 dBA to around 140 dBA. Table C-4 shows a range of typical noise levels from common noise sources.

Table C-4. Common Noise Sources and Noise Levels

Sound Pressure Level (dBA)	*Typical Sources*
120	Jet aircraft takeoff at 100 feet
110	Same aircraft at 400 feet
90	Motorcycle at 25 feet Gas lawn mower at 3 feet
80	Garbage disposal
70	City street corner
60	Conversational speech
50	Typical office
40	Living room (without TV)
30	Quiet bedroom at night

SOURCE: Rau and Wooten, eds. 1980. *Environmental Impact Analysis Handbook.* McGraw-Hill.

Using the decibel scale, noise levels from two or more noise sources cannot be arithmetically added together to determine the overall noise level. Rather, the combination of two sounds at the same level yields an increase of 3 dB. On average, a 3-dB change in the A-weighted noise level is generally considered a noticeable change in loudness, whereas a 5-dB increase is clearly noticeable. A 10-dB change is perceived by most people as a doubling or halving of the perceived loudness.

The sounds that we hear are a combination of many sounds of different pitches. It is possible to use a frequency analyzer, and separate sound into its different frequency components (i.e. from the low frequencies to the high frequencies). Frequency is measured in Hertz (Hz), or cycles per second, and the frequency ranges are called octave bands. Data that have been sorted into octave bands is called spectral data. Data that have not been sorted into octave bands is called overall or broadband data.

Sound pressure waves travel (propagate) away from the noise source. Atmospheric and meteorological conditions affect the way sound propagates. Wind speed and direction can affect sound propagation by inhibiting or enhancing sound propagation if the wind is blowing towards or away from the noise source, respectively. The ground surface can also affect the way sound propagates: frozen or smooth, hard surfaces, including calm water in lakes and rivers, can reflect sound while porous surfaces can reduce sound that travels over it. In the wintertime, frozen snow and smooth ice are two surface types that could reflect sound, and cause it to travel farther (propagate more efficiently). In the summer soft grass is more acoustically porous (absorptive) and, therefore, results in less efficient sound propagation (as sound moves away from the noise source more of the acoustical energy is absorbed by the ground cover).

Environmental noise is often expressed as a sound level occurring over a stated period of time, typically one hour. When the acoustic energy is averaged over a stated period of time, the resulting equivalent noise level represents the energy-based average noise level for that that period. This is called the equivalent continuous noise level (L_{eq}) and it represents an energy-based average (or mean) noise level occurring over a stated time period (most commonly a 1-hour period). The $L_{eq(1\ hr)}$ represents a constant sound that, over the specified period, has the same acoustic energy as the time-varying sound. This metric is used as a baseline by which to compare project related noise levels (noise modeling results, which are also expressed as a $L_{eq(1\ hr)}$) and to assess the potential project-related noise increase over existing conditions. The day-night noise level (L_{dn}) is calculated using 24 consecutive hourly L_{eq} values. The L_{dn} also applies a ten decibel penalty to $L_{eq(1\ hr)}$ values during the hours of 10:00 pm and 7:00 am. This is done to account for the additional annoyance associated with nighttime noise events. In this manner it is considered useful for evaluating community response to noise.

Assessment Methodology

Affected Environment

The Federal Transit Administration (FTA) published methods to estimate existing noise levels in areas that are close to major transportation (rail and roadway) corridors (FTA 2006). Existing noise levels were estimated using these methods. Results are tabulated in terms of the distance from existing transportation routes, specifically the distance from SH 72 the route for Alternative 1 (truck-haul), and the distance from the UPRR main line the route for Alternative 2 (rail hauling). Table C-5 shows estimated existing noise levels in terms of both a $L_{eq(1\ hr)}$ as well as the $L_{dn.}$ The typical daytime hour represents the expected noise with an average traffic volume during the hour.

Table C-5. Estimated Existing Noise Levels from Transportation Routes

	Typical daytime hour ($L_{eq(1\ hr)}$), dBA				Day-night average level (L_{dn}), dBA			
Distance from tracks/road	**100 ft**	**200 ft**	**500 ft**	**1000 ft**	**100 ft**	**200 ft**	**500 ft**	**1000 ft**
UPRR Main Line	67	62	55	50	73	68	62	57
SH 72	48	42	35	30	55	50	43	37

As a conservative measure, the estimated existing noise levels are very low. This is due to lower values for traffic volumes (the number of vehicles or trains per day) from the expected range of traffic volumes. It is also due to the assumption of an atypically short train length. The low existing noise level estimate is conservative because it will provide a greater potential difference to compare against the additional project-related noise sources. During periods when non-project-related (existing) noise levels are higher than estimated here, the addition of the project-related noise sources will have less of an effect on the existing noise levels.

As would be expected, the existing noise levels shown in Table C-6 are greater locations close to the noise source.

Table C-6. Typical Expected Environmental Noise Levels According to General Land Use Descriptions

Land Use Category	L_{dn} Range	Typical L_{dn}	Daytime $L_{eq(15\ hr)}$	Nighttime $L_{eq(9\ hr)}$
Very noise urban	67 and up	70	69	61
Noisy urban residential	62 to 67	65	64	57
Urban and noisy suburban residential	57 to 62	60	58	52
Quiet urban and normal suburban residential	52 to 57	55	53	47
Quiet suburban residential	47 to 52	50	48	42
Very quiet suburban and rural residential	Below 47	45	43	37

Source: ANSI Standard S12.9/Part 3-1993

The land uses in the areas around the transportation routes range from "Quiet urban and normal suburban residential" to "Very quiet suburban and rural residential". The estimated noise levels due to existing traffic on transportation routes are sometimes already higher than the typical expected noise levels. In areas which could be described as "Quiet suburban residential" these transportation routes will exceed the expected noise levels within 200 feet of SH 72 and within 1000 feet of the UPRR main line.

Methodology-Estimating Noise Levels

HDR assumed that existing freight traffic is evenly distributed throughout a 24-hour period and over the three year period, and calculated an average number of freight trains per hour. Using methods published by the FTA, HDR calculated noise emissions from existing freight trains—expressed as $L_{eq(1\ hr)}$ and also as a L_{dn}. HDR also used FTA methods to calculate project-related train noise, and logarithmically added project-related noise to the existing freight train noise to assess the potential project-related increase in train noise. The estimated levels of project-related noise sources were calculated and combined with the existing noise levels to determine the overall potential noise levels. Table C-7 shows overall estimated noise levels in terms of the distance from the affected transportation routes: for Truck alternative, the distance from SH 72; and for the Train alternative, the distances from the UPRR main line as well as the distances from the Crescent rail siding. The results are shown in as both a $L_{eq(1\ hr)}$ and an L_{dn}.

Table C-7. Estimated Existing Plus Project-Related Noise Levels

	Average hourly level ($L_{eq(1\ hr)}$), dBA				Day-night average level (L_{dn}), dBA			
Distance from tracks/road	100 ft	200 ft	500 ft	1000 ft	100 ft	200 ft	500 ft	1000 ft
Truck alternative								
SH 72	52	47	41	35	55	50	43	37
Train alternative								
UPRR Main Line	67	62	56	51	73	68	62	57
Crescent Siding	68	62	56	50	73	68	62	57

Source: HDR Engineering, Inc.