DEPARTMENT OF TRANSPORTATION

Colorado Rail Relocation Implementation Study

Final Report

R2C2 RAIL RELOCATION for COLORADO COMMUNITIES

January 2009

Final Report

Colorado Rail Relocation Implementation Study

Prepared for:

Colorado Department of Transportation

Prepared by:

Parsons Brinckerhoff, Inc.

In association with:

Felsburg Holt & Ullevig, Inc.
CRL Associates, Inc.
RMC Consultants, Inc.
H.C. Peck & Associates Inc.
Xcelente Marketing Group, LLC
Doc.1 Solutions, LLC

January 2009

TABLE OF CONTENTS

List of Tables

List of Figures

1. Background

R2C2
RAIL RELOCATION *for* COLORADO COMMUNITIES

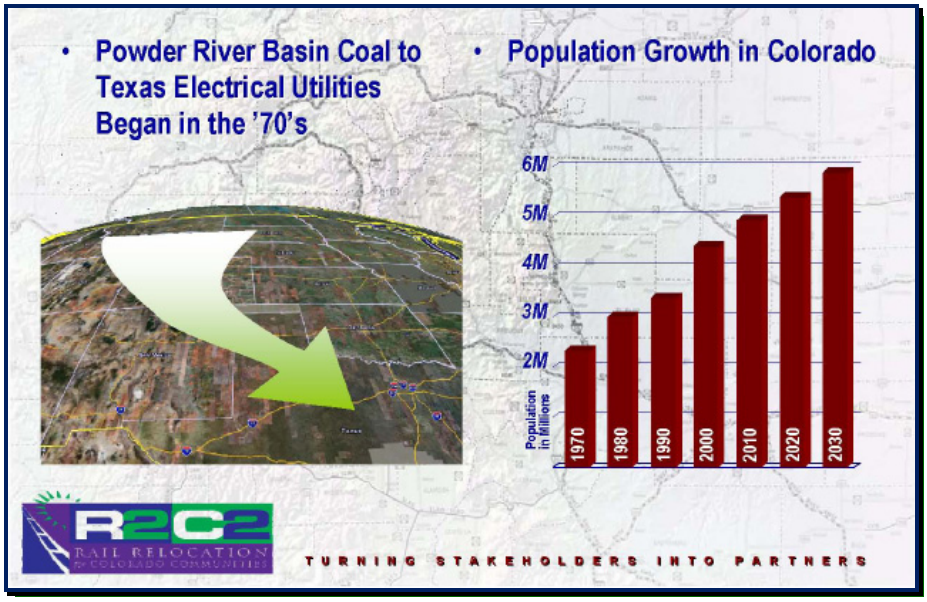
1.0 BACKGROUND

1.1 Previous Studies

The Colorado Department of Transportation (CDOT) and the two Class I Railroads operating in Colorado, the BNSF Railway (BNSF) and the Union Pacific Railroad (UP) (hereinafter jointly referred to as the Railroads), have completed several reviews and studies since 1979 investigating the potential for public-private partnerships that would culminate in the relocation of a significant portion of through freight rail traffic away from the congested Front Range onto a bypass route on the Eastern Plains of Colorado.

CDOT, at that time known as the Colorado Department of Highways, originally evaluated such a rail relocation concept in 1979. The *Colorado State Rail Plan – Rail Bypass Feasibility Study*, was conducted in order to evaluate the feasibility of re-routing existing Front Range through freight rail traffic. In the late 1970s, increasing unit coal train traffic carrying Powder River Basin coal from northeast Wyoming to the coal fired electric utilities in Texas was already impacting the Front Range communities between the Denver metropolitan area and Pueblo (see Figure 1-1). Several alternative bypass alignments in eastern Colorado were evaluated in that 1979 study.

Figure 1-1 Rail and Traffic Growth



When the original study was conducted, there were seven Class I railroad companies operating in Colorado (see Figure 1-2). Today, following a series of railroad mergers over the past 20 years, only two Class I railroads remain in the Western US: the BNSF and the UP. The institutional constraints involved in dealing with seven railroad companies created a much more difficult environment than what exists today working with two railroad companies to resolve the numerous issues in a major rail relocation.

Colorado's railroads were originally built late in the 19th century and cities and towns grew up around the railroads. The need for railroads to be an integral part of the communities was due to the transport of both freight and passengers since automobiles and trucks did not exist. Even in the early 1900s, the State's road system was rudimentary. The Interstate Highway System and other highway improvements in the 1950's changed the environment for passenger mobility and freight transport within Colorado and throughout the US. It has now become practical to consider the potential benefits and costs to the public, as well as to the railroads, of re-locating railroad through freight movements away from population centers along the Front Range.

In 2002, the two Railroads proposed a long-term plan to ease traffic congestion and improve passenger and freight mobility along the Front Range. The proposed project would consolidate certain freight lines and operations, relocate freight terminals and yards, construct a freight bypass route through eastern Colorado and remove through-freight trains from the congested Front Range, while still maintaining local freight service and competitive options to Colorado rail customers. As a major public partner in this proposed transportation partnership, CDOT agreed to conduct a study of the public benefits of the proposed rail relocation project to determine whether there would be sufficient benefits accruing to the citizens of Colorado to warrant the investment of public dollars in the project. Under a public-private partnership basis, in 2003, CDOT, in cooperation with BNSF and UP, initiated the Public Benefits and Costs Study (Public Benefits Study).

Figure 1-2 Railroad Consolidations

CDOT released the findings of the Public Benefits Study in 2005. The results of that study, which can be found at http://www.dot.state.co.us/railroadstudy/ , indicated that the public would receive a number of measurable benefits should the railroad relocation project move forward. These included:

- improved air quality from the relocation as well as from reduced traffic congestion;
- overall reduction in noise and vibration, resulting in increased property values and improved quality of life along the Front Range;
- overall reduction in train-vehicle accidents and travel delays due to time spent at busy railroad-highway at-grade crossings along the Front Range; and
- potential to operate intercity rail passenger trains along the former freight right of way that supported high numbers of through freight trains

The Public Benefits Study measured the benefits and economic impacts of the proposed project, estimated construction costs, and assessed broad funding and financing options. As part of the Public Benefits Study, CDOT conducted a survey of a limited number of public and private sector stakeholders to determine opinions of the proposed project's impacts. Among those surveyed were local elected officials, legislators and chambers of commerce in the impacted areas. The survey found strong support from both public and private sector stakeholders. The overall response to the proposed project was positive, with 89% of respondents believing the net effect of the project would be positive. The most frequently cited benefits were economic development, reduced traffic congestion, and the ability to more easily implement passenger rail services along the Front Range. The most cited concern was grade crossing safety on the Eastern Plains. No formal public outreach was conducted in this study.

The Public Benefits Study identified public and private benefits related to the redevelopment and relocation of railroad yards and construction of rail-related facilities east of the Front Range, such as the creation of new jobs, economic development opportunities, reduced energy usage, and the ability to move Colorado coal to out-of-state markets more efficiently.

The Public Benefits Study compared the costs associated with building the proposed project as well as the costs of not building the project. The comparison of costs and benefits reflected the long-term conditions, as data were based on estimates from 2004 to 2030. Three possible scenarios were evaluated, and the costs and benefits of the project were estimated at different levels. The evaluations and recommendations in the Public Benefits Study were based on a mid-range cost scenario. Under this scenario, the estimated cost to construct the project was $1.2 billion, while the direct and indirect public and private benefits of the project were estimated at $4.2 billion, both in 2004 dollars.

1.2 Colorado Rail Relocation Implementation Study

The Public Benefits Study concluded that the citizens of Colorado would accrue more than sufficient benefits to warrant the investment of public dollars in the proposed relocation project. As a result, CDOT, in 2006 determined that a next phase of work should move forward and in 2007, initiated the Colorado Rail Relocation Implementation Study. This study was designed to:

- determine the steps to be carried out to form a public/private partnership;
- begin a public involvement process which would conduct a series of meetings with public stakeholders to identify issues and to explore options;
- establish the Base Case of the existing rail network;
- analyze existing and proposed rail operations;
- revise the cost and benefit estimates based on any changes in assumptions or revisions to the Project;
- determine how costs could be shared based on benefits and related factors;
- establish a matrix of funding alternatives and investigate potential sources of funding;
- identify options to finance a project; and
- develop strategies for carrying out the necessary environmental clearances.

In the original scope of work for the Rail Relocation Implementation Study, CDOT and the Railroads jointly agreed to review the rail infrastructure improvements examined in the Public Benefits Study and determine which improvements could be undertaken in a public/private partnership between CDOT and the Railroads that would yield benefits similar to those set forth in the Public Benefits Study. Those improvements were to become the "Revised Railroad Project," and would have consisted of a wide variety of state-wide infrastructure improvements, some of which may or may not have been different than those set forth in the Public Benefits Study.

However, at the initial meeting of the Executive Oversight Team (see **Chapter 2 – Project Coordination** for a discussion related to this "policy committee" for the Rail Relocation Implementation Study), it was agreed to revise the scope of the Colorado Rail Relocation Implementation Study to focus only on the north/south rail bypass which would relocate through freight rail traffic off of the Front Range rail corridor between Denver and Pueblo (known as the "Joint Line" since portions of the line are owned by both UP and BNSF and are used by both Railroads) onto a new rail corridor to be built on the Eastern Plains of Colorado. This change in scope removed the "other rail infrastructure improvements", such as relocation of rail yards and facilities of the Railroads and rail infrastructure improvements on the western slope of Colorado, from further consideration in

the Rail Relocation Implementation Study. The sole focus of the Colorado Rail Relocation Implementation Study was now to analyze the potential to move a majority of the current through freight rail traffic away from the Front Range corridor (Pueblo to Denver) onto a new rail bypass in the Eastern Plains of Colorado.

In order to analyze the possible rail bypass project costs and also to determine the railroad operations savings and costs associated with such potential bypass routes, two "Study Alignments" were identified for analysis in the Rail Relocation Implementation Study. These two hypothetical alignments were identified for three purposes: 1) to determine order of magnitude construction costs of a potential "bypass route", 2) compare order of magnitude railroad operational savings operating on a new bypass route as opposed to operating on the existing Joint Line, and 3) identify environmental resources that may be encountered in eastern Colorado if a rail bypass project were to be constructed. More detail regarding these two "Study Alignments" is included in Chapter 3 – Bypass Alternatives. (The Bypass route evaluated in the Public Benefits Study is similar to the Study Alignment A discussed in this study.)

One of the key areas of emphasis of the Rail Relocation Implementation Study was to conduct extensive Public Involvement (see Chapter 8 – Public Outreach Program). As part of this effort, and in order to implement a successful public involvement and community outreach program, the Project Team created the R2C2 (Rail Relocation for Colorado Communities) logo for the study to distinguish the Rail Relocation Implementation Study (hereinafter referred to as R2C2) from other projects such as the Rocky Mountain Rail Authority Study and the Prairie Falcon Parkway Express or "Super Slab". R2C2 was used in all communications with identified stakeholders. The logo was introduced in a news release announcing R2C2 on November 9, 2007. It was also used on subsequent news releases, letterhead, the project website and all other project communications, including this final report.

As was mentioned earlier in this chapter, as part of the Public Benefits Study, CDOT conducted a limited survey of major public and private sector stakeholders to determine opinions of the proposed project's impacts. Among those surveyed were local elected officials, legislators and chambers of commerce in the impacted areas. In hindsight, it now appears that survey should have been cast over a broader element of the State including eastern Colorado. At the Open Houses conducted during R2C2, there was opposition to the proposed rail bypass from eastern Colorado landowners, farmers and ranchers. Such responses were not received as part of the survey conducted during the 2005 Public Benefits Study. The Public Benefits Study cited grade crossing safety on the Eastern Plains as the most significant concern. The list of concerns shown in Appendix 8 includes this issue but also highlights other concerns of residents of eastern Colorado.

1.3 Study Purpose

The purpose of R2C2, as stated in the scope of work, was to:

- determine what steps will have to be carried out to form a public/private partnership;
- better define and finalize the scope and costs of any potential project;
- determine how costs could be shared based on both public and private benefits and related factors;
- investigate what sources of funding are available;
- determine how to finance a project;
- develop strategies for carrying out the necessary environmental requirements; and
- make recommendations for 'Next Steps'.

2. Project Coordination

R2C2
RAIL RELOCATION for COLORADO COMMUNITIES

2.0 PROJECT COORDINATION

2.1 Executive Oversight Team (EOT)

The Executive Oversight Team was created to provide policy guidance to and serve as a forum for making recommendations to the CDOT Project Manager. In addition, the EOT reviewed and approved relevant deliverables created throughout the course of R2C2. The EOT was involved in the decisions made during the course of the R2C2 Study that changed the original scope of work. The primary change to the scope of work was to focus the R2C2 efforts only on the north-south railroad bypass and not evaluate other potential rail infrastructure improvements around the state.

The EOT consisted of representatives from CDOT, the Railroads and the Regional Transportation District (RTD). As was anticipated in the original scope of work, the EOT met six times during the course of the 21 month-long project: November 2007, March-June-August–November 2008 and January 2009. Minutes of these EOT meetings are included in **Appendix 2**.

2.2 Technical Advisory Committee (TAC)

The Technical Advisory Committee was formed to provide CDOT and the Consultant Project Team with technical guidance and support in the review of technical aspects of the work. The TAC made recommendations to the EOT regarding R2C2 deliverables.

The TAC membership organizations are shown in **Table 2-1**. The TAC met six times during the course of R2C2: October 2007and February-May-June-September-November 2008. Minutes of the TAC meetings are included in **Appendix 2**.

Table 2-1 Technical Advisory Committee

Railroads
✦ BNSF Railway
✦ Union Pacific Railroad
✦ Victoria and Southern Railroad
Industry/Other
✦ Coal Industry – Rio Tinto Energy
✦ Smith Railway Consulting
Colorado Department of Transportation
✦ Regions 1, 2, 4, and 6
✦ Intermodal Programs Unit
✦ Mobility Analysis Unit
State Departments
✦ Colorado Department of Agriculture
✦ Colorado Department of Local Affairs
✦ Colorado Public Utilities Commission
Regional Agencies
✦ Regional Transportation District
✦ Denver Regional Council of Governments
✦ Action 22
✦ Statewide Transportation Advisory Committee
Local Governments
✦ Town of Limon/ Ports to Plains
✦ City and County of Denver
✦ Rocky Mountain Rail Authority/City of Castle Rock

2.3 Railroad Coordination

CDOT's Project Manager, along with members of the Consultant Project Team began the railroad coordination process by holding meetings with management of each of the Railroads at their headquarters, BNSF in Fort Worth and UP in Omaha, in June and July of 2007. These meetings were held to identify the objectives of the Railroads, to obtain information on the Railroads' view of future freight markets and to discuss elements of R2C2 which would allow the Railroads to achieve their objectives within their identified corporate constraints. At the Fort Worth and Omaha meetings, the Railroads both agreed to

participate on the TAC and EOT and to provide the necessary data and analysis to conduct and complete the study. Letters from the Project Team to the Railroads following these meetings outlined the data required by the consultants from the Railroads for R2C2.

Confidentiality / Non-Disclosure Agreements were signed with both the BNSF and UP by CDOT and consultant Project Team members to use railroad operations data during the course of R2C2. Also, in developing the Rail Traffic Controller (RTC) modeling simulation of the rail operations, the Project Team's modelers met on two different occasions in Fort Worth and Omaha with the Railroads' modeling staff.

2.4 Project Management Team

At key points in R2C2, the Project Management Team (PMT) met to coordinate key activities. The PMT consisted of the CDOT's Project Manager, consultant Project Manager, Implementation Lead, Environmental Lead and Specialists, Rail Alignments Lead, Public Outreach Lead, Financial Analysis Lead, Economic Analysis Lead, Right of Way Analysis Specialist, Graphics Specialist, and CDOT Government Relations staff.

A kick-off meeting of the PMT was held in June of 2007 to discuss the scope of work and proposed project timelines. In addition, meetings of the PMT were held prior to the first and second rounds of Open Houses in 2008 to get overall consensus on strategies for accomplishing the public involvement effort for the spring and autumn Open Houses. This included reviewing and providing comments on the slide presentations, boards and handouts used at the Open Houses.

The primary project responsibilities of the consulting firms and vendors making up the R2C2 Project Team are shown in Table 2-2.

Table 2-2 R2C2 Project Team Responsibilities

Firm	Role
Parsons Brinckerhoff – Prime Consultant	Project Management, Environmental Analysis, Rail Traffic Controller Modeling, Financial Analysis, Economic Analysis
Felsburg Holt & Ullevig	Rail Operations/Coordination, Study Alignment Design, Project Cost Estimates
CRL Associates, Inc.	Public Outreach/Involvement
RMC Consultants, Inc.	Historical, Cultural and Hazardous Materials
H. C. Peck & Associates, Inc.	Right of Way
Doc. 1 Solutions	Printing
Xcelente Marketing & Advertising	Bilingual Communication

3. Bypass Study Alignments

R2C2
RAIL RELOCATION for COLORADO COMMUNITIES

3.0 Bypass Study Alignments

3.1 Introduction

The Public Benefits Study, as previously mentioned, examined an array of improvements across the state of Colorado that comprised the "Railroad Project". The Railroad Project consisted of:

- double track connection between UP Moffat Subdivision and Belt Line at Utah Junction - Grade Separation at Pecos Street;
- grade separate BNSF Front Range Subdivision and switching lead from UP North Yard to Belt Junction Main Line;
- double track with Centralized Traffic Control (CTC) UP's Utah Junction to Belt Junction Line - Grade separate or close all road crossings;
- rebuild and double track with CTC Denver Rock Island (DRI)/COE line between Belt Junction and Sandown Junction and grade separate or close all road crossings
- remove BNSF-UP crossing at Sand Creek; replace with power operated crossovers, including double track on UP's Greeley Subdivision M.P. 4.0 to M.P. 7.0.;
- construct new track connection in the northeast quadrant between UP's Greeley Subdivision (M.P. 4.3) and the current DRI line;
- add sidings or sections of double track with CTC on UP's Limon Subdivision between Sandown Junction (M.P. 634.2) and Watkins (M.P. 612), including necessary grade separation of road crossings;
- construct new 35-mile line with CTC between Omar (BNSF Brush Subdivision) and Peoria (UP Limon Subdivision);
- add 9300 ft. sidings or sections of double track with CTC on UP's Limon Subdivision between M.P. 612 and Aroya;
- construct new 60-mile line with CTC between Aroya and BNSF Boise City Subdivision at Las Animas;
- add 9300 ft. sidings or sections of double track on BNSF Brush Subdivision between Union and Omar;
- add a second track with CTC on UP Moffat Subdivision between Utah Jct. and Prospect Jct.;
- add CTC and additional sidings as necessary on the UP-BNSF freight line between South Denver and Palmer Lake;
- construct additional capacity improvements (sidings, double track, CTC) as needed on UP-BNSF joint line between Palmer Lake and Pueblo and accommodate both freight and commuter passenger operations on a common line; and
- develop potential freight terminal facilities at Hudson, the Rocky Mountain Arsenal, and/or Watkins to replace facilities in the Denver center city area

With the above improvements as a starting point for this study, the Consultant Project Team's initial goal was to meet with the Railroads to discuss what this study should accomplish and what participation could be expected of the BNSF and UP throughout the R2C2 Study.

After discussions with the Railroads, it was clear that each railroad had significantly different views on the level of private railroad benefits of the route previously studied in the Public Benefits Study. Therefore, the Project

Team determined that an independent modeling analysis would be done comparing the previously studied route[1] along with a new route against the existing Base Case or No Build alternative. The Railroads were also clear that from a timing, workload and cost-affordability basis, the focus of this study should be the route or "Bypass" from Brush to Las Animas and not the other ancillary improvements that were a part of the Public Benefits Study "Railroad Project". The items listed above, from the Public Benefits Study, would now be limited to new railroad construction from Omar to Peoria and from Aroya to Las Animas with siding extensions along the existing UP between Peoria and Aroya.

It should be noted that these alignments, developed with the established design criteria, were prepared to identify a general location of the alignments and to estimate their associated "ballpark" costs for feasibility and modeling purposes only. They were not intended to represent an exact, final alignment and, as such, one must be careful in reviewing these alignments. For example, in laying out the general alignments, consideration was given to minimizing impact on existing buildings and other features. However, sufficient detailed engineering was not conducted to ensure that all impacts would be avoided. Further review has subsequently been completed which suggests that many of these potential impacts could, in fact, be avoided. The realignment review would be available for consideration in the future steps, where these Study Alignments would be refined.

3.2 Design Criteria

Design Criteria were developed prior to conceptual alignment design to determine allowable speeds, maximum horizontal and vertical curvature, and typical section details. Using each railroad's standards, criteria were developed and then presented to the TAC and EOT for comment and approval. Table 3-1 and Figure 3-1 detail the results of the discussions and the criteria used to develop the alignments.

Table 3-1 Design Criteria

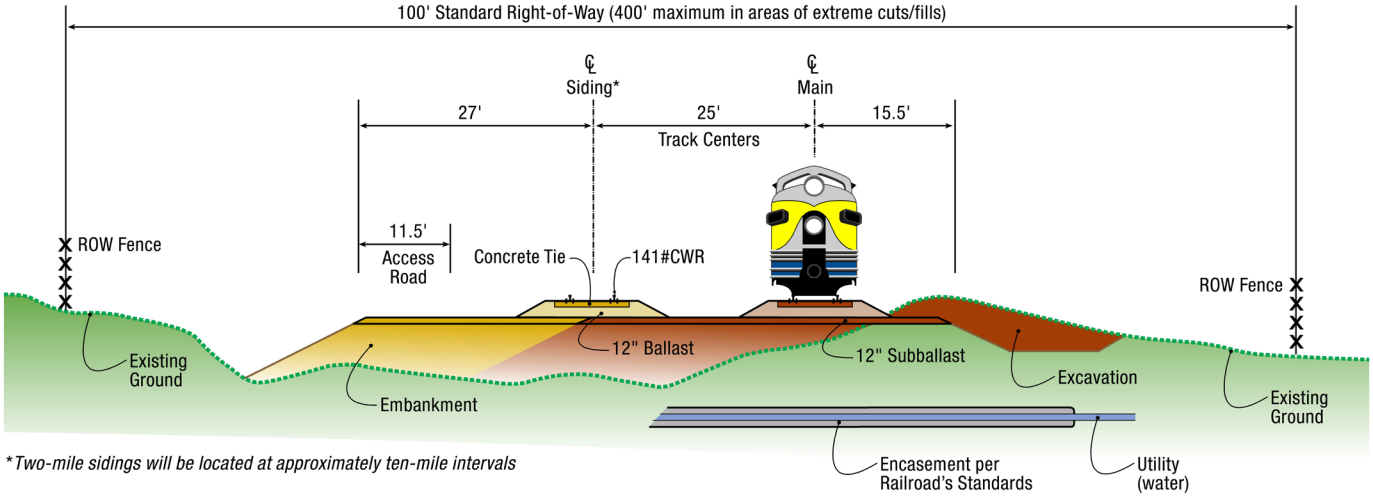
Item	Criteria
Typical Section	
Rail (Continuously Welded Rail (CWR))	141# CWR (New Head Hardened)
Ties	Concrete
Ballast	12 in.
Subballast	12 in.
Shoulder	15.5 ft.
Subgrade Slope	2%
Ditch	
Depth	3 ft.
Width	10 ft.
Cut/Fill Slopes	2H:1V
Access Road	11.5 ft.

[1] The Public Benefits Study relied on modeling data and costs from the BNSF and UP for the Railroad Project.

Item	Criteria
Horizontal Alignment	
Max Curve	3 degrees
Min Tangent	300 ft.
Speed Limit	60 MPH
Vertical Alignment	
Max Grade	0.8%
Vertical Curve (rate of change)	
Sag	0.05
Summit	0.10
Vertical Clearance	23.5 ft.
Right of Way	
Minimum	100 ft.
Other	20 ft. Outside Toe of Slope
Track Centers	25 ft.
Additional Tracks	
Double Track	None
Sidings (2 miles in length)	Every 10 Miles
Set Outs	@ Failed Equipment Detectors (FED)*
Turnouts	
Connections to Existing Tracks	#24
Second Main Tracks	#24
Sidings	#15
Set-outs (For cars detected in FEDs)	#11
Hot Bearing (HBD) & Dragging Equip. Detectors (DED)	Every 20 miles
At-Grade Crossings (Material)	Concrete
Signals	Centralized Traffic Control
Communications (Microwave Towers & Base Stations)	Every 20 miles

*Failed Equipment Detectors (FED) consist of Hot Bearing and Dragging Equipment Detectors (HBD/DED)

Figure 3-1 Typical Section



3.3 Data Sources and Software

Alignment details from the Public Benefits Study or previously studied corridors were not available to serve as a base for R2C2. Therefore, new mapping and routes were required. See **Appendix 3** for details on the Geographic Information System (GIS) data used for the conceptual alignment development.

MicroStation and Inroads software packages were used for design purposes. MicroStation is the drafting package used for presentation purposes, while Inroads is the design software that incorporates the existing topography, from the GIS terrain, and proposed horizontal and vertical design to represent the proposed ground with the new rail infrastructure built. Impacts associated with this grading envelope can then be estimated.

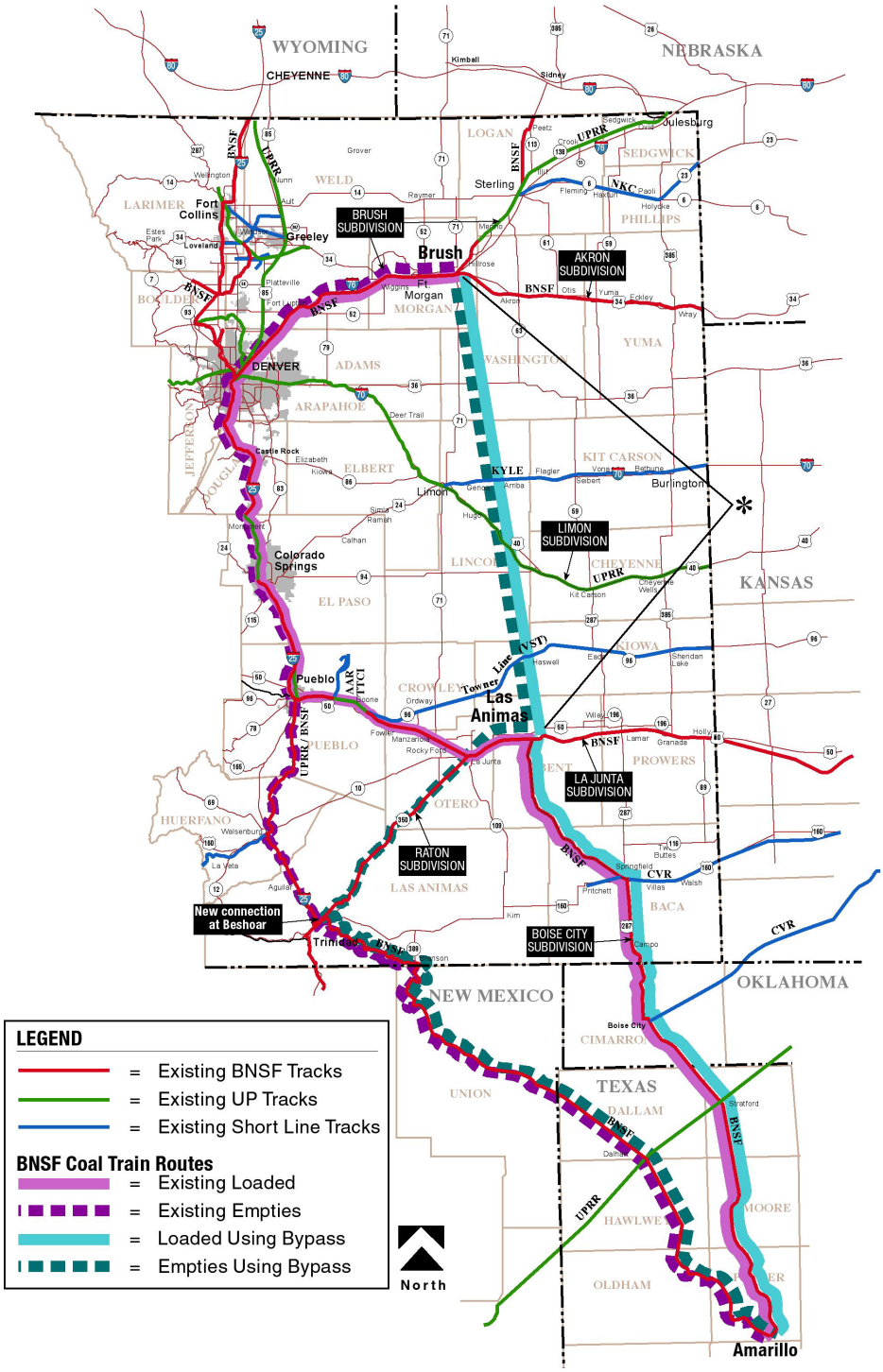
3.4 Study Alignment Development

3.4.1 Definition of Study Alignments

With the focus of this study changing from a statewide view to just the north/south bypass from Brush to Las Animas, alternative conceptual routes were developed for consideration. Study Alignment A consists of new track construction from Omar to Peoria and from Aroya to Las Animas with siding extensions from Peoria to Aroya along the existing UP, as defined in the Public Benefits Study. Study Alignment B was roughly defined by communications with the Railroads which resulted in the new route being defined simply by cities through which the route should pass. Brush and Las Animas are starting and ending points that were chosen by the Railroads as their initial opinion of the shortest route.

The traffic on the new bypass route would consist of existing BNSF and UP trains that currently do not serve customers along the existing route from Denver to Pueblo. The majority of rerouted trains to the bypass would consist of BNSF coal trains. Currently the loaded BNSF coal trains that originate in the Powder River Basin in Wyoming travel from Brush through Denver towards Pueblo, then to Las Animas. From Las Animas, the trains travel south to Texas through Boise City, Oklahoma. The empty trains have a different return route from Texas. They travel back to Pueblo through Trinidad. See **Figure 3-2**. If a bypass alignment is built, the coal trains,

Figure 3-2 Coal Traffic Routes



* The possible bypass route is demonstrated as a straight line from Brush to Las Animas for demonstration purposes only. The conceptual routes studied are more defined in Figure 3-3.

and any other through freight traffic, would travel over the bypass routes which connect into the existing rail network near Las Animas. Instead of the empties traveling north from Trinidad to Pueblo, they would travel along BNSF's existing track from Trinidad to Las Animas on their Raton Subdivision. Currently, trains that come into Trinidad from Texas have to make multiple train movements in order to travel northeast along the Raton Subdivision to Las Animas. A new connection was included to allow continuous movement through Trinidad. This connection is considered part of the Study Alignments and has been designed and included in the alignment costs and modeling analysis for both the alignment alternatives. This new connection will be referred to as the Beshoar Connection.

3.4.1.1 No Build Alternative

The No Build Alternative, or Base Case, consists of the existing routes that UP and BNSF use from Brush to Denver south through Pueblo and then into Texas. A more detailed discussion of existing use of these routes can be found in **Chapter 4 - Railroad Operations Analysis** of the report.

3.4.1.2 Study Alignment A

Study Alignment A, similar to the alignment that was previously studied in the Public Benefits Study, traverses from Brush along BNSF's Brush Subdivision to Omar, then along a new route south to the existing UP Limon Subdivision between Byers and Peoria. From this point the route uses the existing UP Limon Subdivision for approximately 87 miles to Aroya, where it then traverses on a new route south until it ties into BNSF's La Junta Subdivision just east of Las Animas.

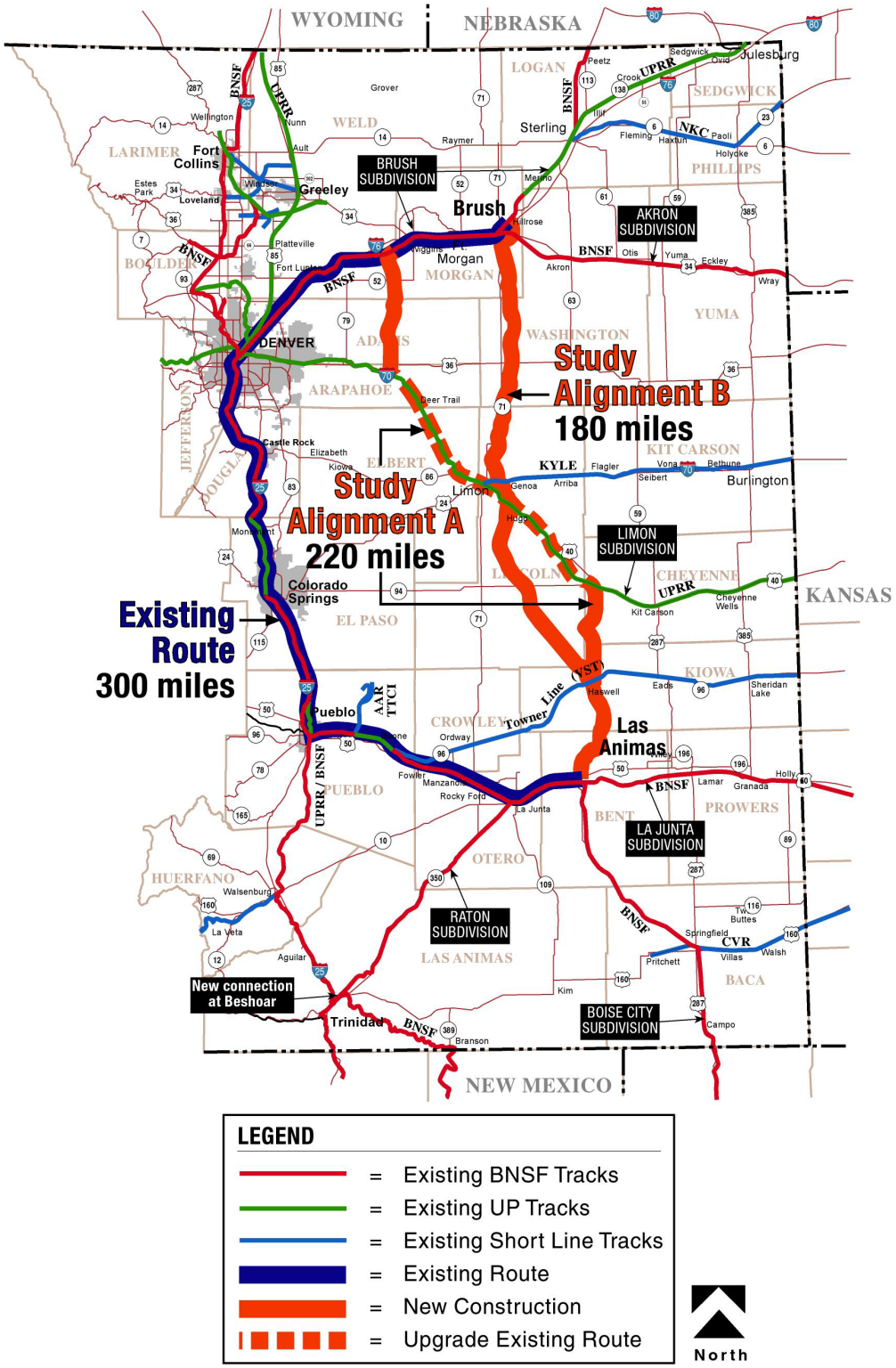
3.4.1.3 Study Alignment B

The new route, or Study Alignment B, was developed based upon discussions with the BNSF on ideal operating grades and track curvature. This route is all new construction from Brush to Las Animas, starting just east of Brush along the BNSF's Akron Subdivision, then traversing south near Limon; it then ties into existing BNSF's La Junta Subdivision in Las Animas, prior to the Boise City Subdivision connection at the same location as Study Alignment A.

During the public involvement process, an alternative version of Study Alignment B was consistently discussed. The public requested that Study Alignment B be constructed adjacent to existing State Highway 71 (SH-71). The Consultant Project Team developed this alignment and created a rough design to determine that the overall grading cost would be approximately $1.2 billion, which is the total estimated cost of Study Alignment B developed based on the design criteria. This higher cost is attributed to SH-71 grades that are greater then 0.8 percent, which resulted in higher fills and deeper cuts. Other impacts of the SH-71 adjacent alignment would be more right of way required to accommodate the larger grading footprint and direct impacts to 42 homes or farms that are currently adjacent to SH-71. Based on these findings, this variation was not progressed in this study.

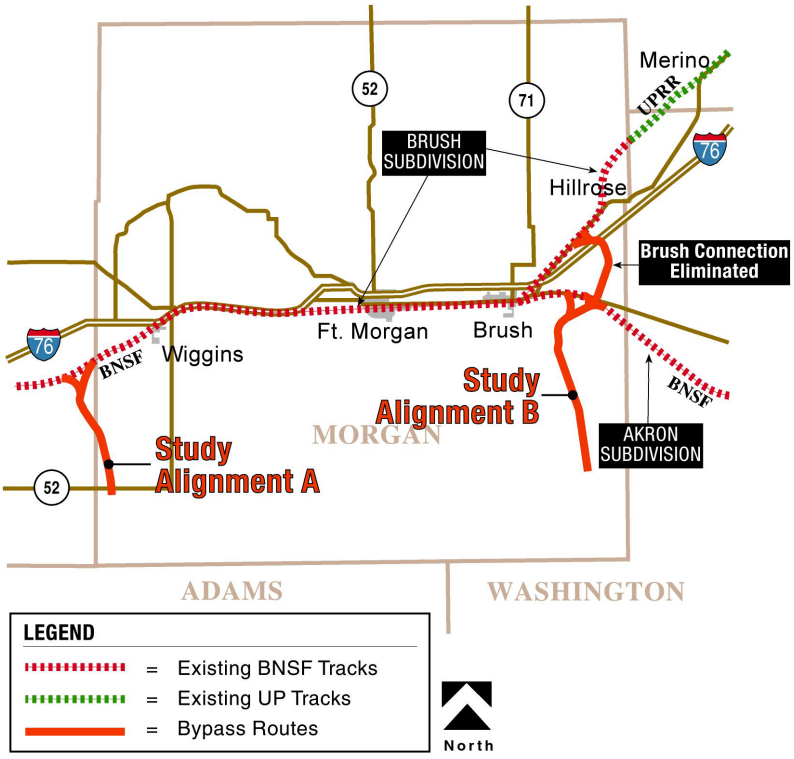
Figure 3-3 shows the conceptual study alignments that were developed for this study.

Figure 3-3 Conceptual Study Alignments



Initially, two different connections near Brush for Study Alignment B were considered. Figure 3-4 below shows the different connections. The connection that was carried forward ties into the BNSF's Akron Subdivision, which is just east of the town of Brush. UP does not currently have trackage rights on this section of BNSF's track east of Brush. Therefore, an alternative connection to BNSF's Brush Subdivision was designed, where UP has trackage rights. The alternative Brush Subdivision connection would require four additional road and railroad grade separations compared to the Akron Subdivision connection. The TAC and EOT members agreed that the additional cost was not warranted and that a possible solution would be to allow UP trackage rights along the section of BNSF track to access the new route. Trackage rights between the Railroads were not fully discussed nor were agreements made between the parties at this point in time.

Figure 3-4 Brush Area Connections



3.4.2 Capacity

The conceptual alignments from Brush to Las Animas were conceived to be single track with two-mile long sidings at approximately ten-mile intervals based on input from BNSF and UP. Siding locations were situated to avoid locating the new track within road crossings, railroad curves or where bridges currently exist. For Study Alignment A the sidings along the existing UP portion, between Peoria and Aroya, were extended to allow for similar operations as the newly built segments.

The design speed for the new alignments would be a maximum speed of 60 MPH, maintaining a maximum grade of 0.8 percent and maximum horizontal curvature of 3 degrees. These standards are based on the predominant traffic being unit coal trains of up to 120 cars, 286,000 pounds each. This would result in the most efficient use of locomotives, fuel, manpower and facilities.

Where the study alignments connect to Railroads, east and west rail connections were included to accommodate any future moves. Study Alignment A connections includes Omar, Peoria, Aroya and Las Animas. On Study Alignment B these connections are at Brush, Limon and Las Animas.

Where the new routes intersect with the existing Kyle and Towner Line short line railroads, the routes would be grade separated and wye connections would be made to accommodate certain movements. Full movement connections are provided on the Towner Line for both alignments. Only the northern connections are accommodated on the Kyle for Study Alignment B because I-70 is adjacent to the Kyle on the south, and it is acknowledged that such a new interchange between BNSF and Kyle would impact the existing competitive balance between UP and BNSF. No adjustments were made to the existing connections of the Kyle with UP for

Study Alignment A. It is unlikely that all these connections would be required, but to be conservative, the costs were included for these movements.

3.5 Cost Estimates

3.5.1 Quantities

The cost estimates only include construction necessary from Omar to Las Animas for Study Alignment A, from Brush to Las Animas for Study Alignment B and the Beshoar Connection for both alignments.

The quantities that were estimated consist of the items detailed in the design criteria as well as other civil items. Track lengths, earthwork, subballast, clearing and grubbing, topsoil, seeding and right of way requirements were developed using design software. Other items, such as culverts, private crossings, utility relocations/protections, stormwater management, and signage were estimated at a cost per route mile basis. Drainages and road crossing locations were developed using aerial photographs and GIS data.

These estimates do not include any costs associated with adjustments that the Railroads would need to make to accommodate the rerouted traffic on their system relative to rail yard or other facility improvements, such as fueling platforms, locomotive or car repair shops.

There are nine categories of quantities and each is detailed below.

3.5.1.1 Right of Way

The right of way quantities were developed from the typical section shown in **Figure 3-1**. When the typical section is applied to the proposed horizontal and vertical alignments, the area of earthwork impact can be estimated. The proposed right of way is then located a minimum of 20 feet beyond the area required for earthwork to allow for a fire break. A fire break is a section of ground within the railroad's right of way that does not have any vegetation in case a fire is started within the right of way. This will limit the possibility of the fire spreading past the fire break onto adjacent land.

The right of way required for Study Alignments A and B is a minimum of 100 feet in width, with a maximum of 400 feet in areas of extreme cuts and/or fills. The portion of either alignment that requires 400 feet of right of way is less than three percent of the project length.

3.5.1.2 Grading

Grading quantities consist of clearing and grubbing, earthwork, topsoil, seeding, subballast and stormwater management. All the quantities above, except for stormwater management, were developed from the results of the conceptual design based on the design criteria. The stormwater management is based on a cost per route mile basis.

3.5.1.3 Utilities/Grade Separations

Utilities are also estimated on a cost per route mile basis at this stage. Utility costs consist of encasement of water, gas, fiber optic, telephone or other underground utilities. Encasements are required to protect the utility against railroad train loading. BNSF and UP have specific design standards that would be followed at all underground utility locations. This cost also covers relocation or adjustments of overhead power lines.

Road crossings are an important issue with the public. Road crossings were assumed to be installed where roads currently exist. There are two roadway improvement types where the railroad crosses an existing roadway: grade separated and at-grade. See **Appendix 3** for photos of various crossing types.

Where the road is currently functionally classified as a collector, state highway, or interstate, the roadway was assumed to be grade separated. Table 3-2 lists the roadways that were assumed grade separated for each alignment. If the roadway does not fall into the above category it was assumed to be constructed as an at-grade crossing. At-grade crossings are discussed below in Section 3.5.1.8.

3.5.1.4 Rail Crossings/Drainage Structures

Where the new portions of the alignments cross existing rail lines, they were assumed to be grade separated. These crossings were estimated using the proposed alignment profiles to determine the length of bridge required.

Drainage structures consist of bridges or culverts. Bridges were assumed over the major drainage crossings, while the smaller drainages were assumed to be culverts. The bridge quantity was developed using the profiles created to establish the length of bridge required. Table 3-3 lists the major drainages that would require bridges for the two alignments. The culverts were estimated on a cost per route mile basis.

Table 3-2 Grade Separated Roadways

Study Alignment A	Study Alignment B
US-50	US-50
Bent CR-14	Bent CR-14
3 ea. @ CO-96	3 ea. @ CO-96
CO-94	CO-94
3rd Ave/Barron	Lincoln CR-2W
CO-71/Indiana	US-40/US-287
2 ea. @ CO-40	I-70
2 ea. @ I-70	Lincoln CR-3T
US-36	US-36
88th/Irondale	Morgan CR-K
CO-52	
15 Total	**12 Total**

Table 3-3 Major Water Crossings

Study Alignment A	Study Alignment B
Purgatoire River	Purgatoire River
Leitensdorfer Arroyo	Leitensdorfer Arroyo
Hoehne Ditch	Hoehne Ditch
South Side Ditch	South Side Ditch
Arkansas River	Arkansas River
Ft. Lyon Canal	Ft. Lyon Canal
Stacy Lakes Draw	South Rush Creek
Rush Creek	North Rush Creek
Big Sandy Creek	Long Branch Creek
Aroya Gulch	Big Sandy Creek
West Bijou Creek	Arikaree River
Antelope Creek	Vega Creek
Rock Creek	Sand Creek
Kiowa Creek	Buck Creek
-	Shears Draw
-	North Fork/Arikaree River

3.5.1.5 Trackwork

The trackwork consists of the track and turnouts. As detailed above in the design criteria, different weights of rail and type of turnouts are used per track type. The track is estimated on a per track foot basis and includes ballast, rail, ties, pads, insulators, clips and installation. Turnouts are estimated per turnout size and type.

3.5.1.6 Fences and Signs

Fences would be installed on both sides of the track and were estimated on a per foot basis, which includes gates, braces, corners and cattle guards. Railroad signs, which include whistle posts, speed, station, and other operationally required signs, are estimated on a per route mile basis.

3.5.1.7 Signals and Communications

It is proposed that the signal system be Centralized Traffic Control (CTC). In a CTC system a centralized train dispatcher's office controls the railroad turnouts and the signals that railroad engineers must obey in order to keep the traffic moving across the railroad. For instance, where BNSF has CTC along their railroad, they

operate the signal system from Fort Worth, Texas and in a like manner, UP dispatches their CTC network from Omaha, Nebraska. This allows for safe and efficient rail operations. The CTC components (signals, control points, failed equipment detectors, electric locks, at-grade active warning devices and switch heaters) are each estimated based on the number necessary to meet the established design criteria. The improvements to the dispatching center are estimated on a route mile basis to upgrade the operating railroad's existing system to accommodate the new route.

The communications system consists of microwave towers, repeaters and radios to allow for continuous communications between trains, dispatching center, facilities, and railroad workers. Improvements to this system are also estimated on a per route mile basis.

3.5.1.8 At-grade Crossings

If the existing roadway is not functionally classified as a collector, state highway or interstate, the crossing was assumed to be at-grade. All public at-grade crossings are assumed to be 32 feet wide and constructed with concrete crossing material. At-grade crossings will require adequate warning based on the existing use. Active warning devices were assumed to be installed on roadways that are currently paved or at a skew that compromises adequate sight distance. Active warning costs are covered under the CTC costs above. Railroad crossing signs will be used on the remaining public at-grade crossings.

Some of the skewed gravel roadways were assumed to be realigned to provide adequate sight distance to eliminate the need for active warning devices. A lump sum cost was developed for a typical roadway realignment and applied to each of these locations.

Since it would be complex at this level of analysis to estimate the number of private crossings required to travel from field to field, with at-grade crossings or livestock underpasses, an estimate of one per route mile was assumed. This is a conservative estimate considering the existing UP portion of Study Alignment A has a private crossing approximately every three miles.

3.5.1.9 Other Cost Items

Mobilization and Engineering costs were estimated by applying industry excepted percentages to the above defined items. Five percent was used for Mobilization and 12 percent for engineering, which consists of design, construction management and the National Environmental Policy Act (NEPA) process. The NEPA process is discussed later in Chapter 6 - Environmental Issues Scan.

Based on the level of design, a 30 percent contingency was added to all costs. This percentage covers unforeseen items and costs of possible alignment adjustments as no detailed survey or field work was done with this study.

3.5.2 Unit Costs

The unit costs used were initially developed based on the Consultant Project Team's experience and were then validated with CDOT unit bid prices where applicable. The TAC and EOT provided comments and further validated the 2008 costs that were used. Table 3-4 lists the unit costs.

Table 3-4 Unit Costs

Item	Description of Work	Unit	Unit Cost
1.	**Land for Transportation**		
	A. Acquire Right of Way	AC	$2,500
2.	**Grading**		
	A. Clearing & Grubbing	AC	$4,000
	B. Excavation	CY	$3
	C. Embankment	CY	$4
	D. Borrow	CY	$4
	E. Soil Stabilization	CY	$5
	F. Water for Compaction	KGal	$20
	G. Topsoil Placement	CY	$10
	H. Seeding & Mulching	AC	$2,000
	I. Subballast	CY	$40
	J. Stormwater Management	RM	$10,000
3.	**Other Right of Way Expenditures**		
	A. Relocate/Protect Utilities	RM	$15,000
	B. Grade Separation, Hwy over RR:		
	1. Straight Grade Separation	EA	$3,353,700
	2. Skewed Grade Separation	EA	$4,405,400
4.	**Bridges, Trestles and Culverts**		
	A. Grade Separation, Railroad over Railroad	SF	$210
	B. Bridges over Drainage Ways	SF	$210
	C. Culverts	RM	$20,000
5.	**Trackwork, (including Ballast & Ties)**		
	A. Mainline:		
	1. Furnish Track, 141# CWR, Conc.	TF	$180
	2. Furnish Turnouts, No. 24 (Swing Nose Frog)	EA	$350,000
	B. 2 Mile Sidings @ 10 Mile Intervals:		
	1. Furnish Track, 141# CWR, Conc.	TF	$180
	2. Furnish Turnouts, No. 15	EA	$225,000
	C. Setout Tracks @ 600 TF (2@ 2000TF):		
	1. Furnish Track, 136# CWR, Conc.	TF	$160
	2. Furnish Turnouts, No. 11	EA	$190,000
6.	**Fences, Snowsheds and Signs**		
	A. Construct Right of Way Fence	LF	$5
	B. Signage	RM	$1,000

Item	Description of Work	Unit	Unit Cost
7.	**Signals and Communications**		
	A. Signals, CTC (including Detectors and Power):		
	1. Control Points	EA	$750,000
	2. Intermediate Signals	EA	$300,000
	3. HBD/DED (Every 20 miles)	EA	$300,000
	4. Set-Outs (Electric Locks, Manual Switch Machines)	EA	$200,000
	5. At-grade Active Warning Devices	EA	$500,000
	6. Switch Heaters, Propane Tanks, Generators	EA	$100,000
	7. CTC - Dispatch Center	RM	$200,000
	B. CTC Upgrade of UP Limon Subdivision	RM	$500,000
	C. Communications	RM	$40,000
8.	**Public Improvements (Including Signs)**		
	A. Public Grade Crossings 32 TF	EA	$14,000
	B. Private Crossings	RM	$3,000

AC = Acre, CY = Cubic Yard, KGal = 1,000 Gallons, RM = Route Mile, EA = Each, TF = Track Foot, LF = Linear Foot

3.5.3 Summary of Costs of Alternative Study Alignments

The overall costs of the conceptual alignments developed in this study are detailed below in **Table 3-5**.

Table 3-5 Conceptual Study Alignment Costs

Cost Category	Study Alignment A* ($Millions)	Study Alignment B* ($Millions)
1. Right of Way	$7	$12
2. Grading	$142	$317
3. Utilities/Grade Separations	$74	$60
4. Rail Crossings/Drainage Structures	$22	$31
5. Trackwork	$145	$232
6. Fences and Signs	$6	$10
7. Signal and Communications	$131	$123
8. At-grade Crossings	$3	$7
9. Other Cost Items	$267	$396
Total	**$797**	**$1,188**

*Beshoar Connection costs included.

4. Rail Options Analysis

R2C2
RAIL RELOCATION *for* COLORADO COMMUNITIES

4.0 Rail Operations Analysis

4.1 Introduction

As part of the R2C2 scope, a detailed analysis of existing railroad operations and potential operations on alternative routes was performed. To determine the impacts of diverting BNSF and UP trains from the current Front Range "Joint Line" between Denver and Pueblo, the entire operation, both current and proposed, was coded into the Berkeley Simulation Rail Traffic Controller (RTC) simulation model. Many of the Class I railroads, including UP and BNSF use the RTC model to simulate operating impacts of changes to their track, signals and network. This combined network includes both alternative routes: Study Alignment A and Alignment B. Operating and engineering data, provided by planning personnel from both BNSF and UP, detailing railroad infrastructure, train operations, operating practices and constraints were collected and entered into the model. Conceptual engineering and operational data for Study Alignments A and B were added to complete the evaluation network. Operating divertible trains over each alternative alignment in turn provided the means to develop a detailed simulation of operating parameters from running trains over both study alignments, including estimates of train runtimes and fuel consumption for trains from both Railroads. The results of these simulations were incorporated into the economic analysis that is part of Chapter 5 – Benefits Analysis.

Validation meetings were held on several occasions with representatives of both BNSF and UP. Valuable review and input was provided to ensure that the Base Case simulation properly represented the typical train performance and impact of all trains operating anywhere on the defined network, including active local trains switching the dense industrial trackage around Denver. The recommendations of planners and operations personnel of the Railroads were used to refine the inputs to the model to ensure a fair and accurate representation of their respective operations in the completed Base Case model. This process provided both Railroads confidence that the Base Case represents an accurate snapshot of operations that took place during the two-week test period in summer 2007, and to validate the assumptions used to generate the model's simulations from the two study alignments.

These reviews also provided the Railroads the opportunity to verify details of Study Alignments A and B and the trains being diverted to them on the expanded network. These evaluations by both Railroads were essential to provide each carrier the background of how the model's simulation results were generated as a basis for the benefits analysis. Their input has been incorporated into the final runs of the RTC model and the final output results are presented herewith. Each railroad has been provided the final model for their review, validation, and approval.

The complete network model includes significant amounts of operating and engineering data:

- track data with grade, curvature, and speed limits;
- physical plant detailing single, double, or multiple track, sidings, yards, and spurs;
- signal systems;
- junctions and interchanges;
- grade crossings; and
- county lines

These input data include 1782 miles of track, 1053 trains, and 1160 train signals. The simulation period was for seven days with an additional two days each for 'warm up" and "cool down" based on actual operations over a four week period in June and July 2007. These additional days at the beginning and end of the simulation ensure that the data captured are for trains that are operating in a normal full train count

operational environment and have made complete trips from beginning to end. These data were obtained from both UP and BNSF. The train data were downloaded from the railroad's train dispatching databases and are representative of train consists (number of locomotives and cars) and routes of actual trains taken from the predetermined sample period. These input data were verified by the Railroads through their respective Base Case validations.

4.2 Base Case

The Base Case simulation is intended to provide the benchmark against which the two alternative alignments have been compared. The development of the Base Case has provided a clear picture of the current railroad operation and several significant observations are worth noting.

- BNSF's Brush Subdivision east of Denver is a busy single track line with passing sidings. Trains on this subdivision underperform in terms of average system velocity because of the need for trains to make frequent stops in sidings to meet opposing trains.
- The Joint Line south of Denver is made up of single, double and triple track segments; however, it is still constrained due to the long southbound grade between Castle Rock and Palmer Lake. This grade slows loaded coal trains in the model to 11 to 13 mph, confirming actual operations.
- The Denver Belt Line has a low speed limit which constrains the regional network by causing delay to following trains.
- The number and spacing of at-grade crossings of rail lines in the Denver Metropolitan area hampers train velocity on both UP and BNSF.
- Yard facilities and auxiliary tracks in and around Denver are operating close to capacity with current train volumes; further growth in coal train volumes through Denver would further exacerbate this situation.

The current rail operations in the analysis area have several high operating cost components:

- Coal trains from the Powder River Basin (PRB) require 3 crews in each direction between Sterling, CO and Amarillo, TX, a distance of approximately 448 miles.
- All trains operating on the Joint Line consume fuel at much higher rates than on level routes. This higher burn rate also produces added emissions.
- BNSF is maintaining and operating over two single track, unsignaled routes between Pueblo and Amarillo with the loaded coal trains utilizing a relatively level route and empty trains returning over a separate route with steeper grades.

4.3 Study Alignments A and B

Two conceptual alternatives were modeled. Study Alignment A would use existing BNSF tracks from Brush to Omar, new trackage from Omar to Byers, existing UP tracks between Byers and Aroya, and then new trackage from Aroya to Las Animas. Study Alignment B would use entirely new trackage between the BNSF east of Brush to Las Animas. Both alignments would provide significant operational benefits in the RTC model. In comparison to the existing traffic using the Joint Line (30 to 31 trains per day), approximately 13 trains would remain on the Joint Line serving local industries and shippers.

- If either Study Alignment A or B were constructed, UP traffic remaining on the Joint Line would be limited to:
  - local train service;
  - unit coal trains to Colorado Springs (the Drake and Nixon plants);

- Denver-Pueblo merchandise trains (existing volume of 2 to 3 trains per day); and
- merchandise and military movements to and from Fort Carson; i.e., Kelker (railroad control point near Fort Carson).

- If either A or B were constructed, BNSF traffic left on the Joint Line would be limited to:
  - local freights;
  - Denver-Pueblo, Denver to La Junta, and Trinidad to Denver merchandise trains; and
  - merchandise and military movements to and from Fort Carson.

Under either alternative, the UP and BNSF trains remaining on the Joint Line would operate with fewer conflicts due to delays following the heavily loaded unit coal trains and delays in sidings waiting for meets. Diversion of the through trains to either of the bypass alignments would also reduce conflicts in the Denver yard facilities for both UP and BNSF operations.

4.3.1 Study Alignment A Model Findings

- Capital improvements modeled in RTC for Study Alignment A were not limited to the new sections between Omar and Byers and Aroya and Las Animas. The UP Limon Subdivision between Byers and Hugo was upgraded in the model to include two mile long passing sidings and CTC (Centralized Traffic Control) along this existing route. These improvements enhance the capacity of the existing UP segment of Study Alignment A so that there will be operating uniformity and compatibility with the new segments and to assure the route will be able to accommodate the new traffic without affecting the UP's existing east-west traffic.
- The need for installation of CTC on the Limon Subdivision is primarily driven by the addition of the diverted BNSF trains using this route. The CTC will also minimize impacts to operations for existing UP traffic.
- UP operations staff estimated that their Greeley Subdivision is blocked about seven hours out of every 24 hour period by BNSF trains crossing at grade at Sand Creek Junction. Most of those train delays would be eliminated if BNSF through traffic were routed onto either the A or B alignments.
- The limited amount of traffic currently on the Raton Subdivision between Trinidad and La Junta (three trains per day) makes the use of this line a feasible alternative for northbound empties returning to Study Alignment A.
- Study Alignment A reduces one way route miles between Brush and Las Animas by 77 miles (or 26%) compared to the Base Case.

4.3.2 Study Alignment B Model Findings

- Rerouting of trains to Study Alignment B will provide similar reduction in conflicts with BNSF trains for the UP at Sand Creek on the Greeley subdivision
- The absence of local freight traffic on the new Las Animas-Brush line segment makes both trip time and crew assignments/hours more predictable. RTC model results confirmed that the spacing of two-mile long passing sidings at ten-mile intervals provides sufficient infrastructure to minimize delays from meeting opposing trains.
- All sidings were used multiple times during the one week simulation period indicating that their spacing is appropriate.
- The limited amount of traffic on the Raton Subdivision makes the use of this line ideal for routing empties returning to the Wyoming mines.

- Study Alignment B reduces one way route miles between Brush and Las Animas by 116 miles (or 39%) compared to the Base Case.

4.4 Performance Results and Comparison

The RTC simulations were used to model potential operational benefits that would result from the rerouting of the through rail traffic to either Study Alignment A or B and could provide the opportunity for:

- shorter, more direct routes for rail traffic between Wyoming and Texas;
- reduced train activity in the urban areas of Denver, Colorado Springs and Pueblo which could reduce:
  - noise;
  - rail crossing delays for the remaining rail operations; and
  - emissions – both locomotive and vehicular
- reduced operating costs;
- reduced crew and fuel expense;
- improved equipment utilization;
- increased velocity; and
- greater rail capacity in and out of Denver available for future traffic growth and possible rail passenger use

Of interest to each railroad is the impact on their respective operations as a consequence of these two Study Alignments. Following are two figures, one for each railroad, contrasting and comparing performance results by grouped classes of trains.

The three simulations in this analysis (Base Case, Study Alignment A, and Study Alignment B) were repeated five times each with different random number seeds to slightly alter train departure times. This is done to model variability in operations. Results from all five simulations were averaged to provide the results shown in the two following figures.

The BNSF results shown in **Table 4-1** include all trains operating in the RTC modeled Denver region. The UP results are as shown in **Table 4-2.**

Estimated BNSF operational savings are driven almost entirely by more favorable routing of unit coal trains off the Joint Line and onto either of the two Study Alignment bypasses. Improvements are achieved in both runtime and fuel consumption for either Study Alignment A or B compared to the Base Case of existing operations.

UP model results are almost unchanged for all trains. This result reflects that there are not a significant number of UP reroutes. Beneficial results for UP are primarily due to RTC estimating reduced congestion on the Joint Line and in the Denver terminal area.

The following **Table 4-3** details the changes in train counts on each of the network component links for the Base Case and the two Study Alignments. The 'Trains per Day' information is also shown on **Figure 4-1**.

Table 4-1 BNSF Operations – Summary of RTC Model Results

Base Case Miles	Train Count	Runtime (Hours)	Velocity	Fuel	Class of Service
2,997.70	28	69.90	42.89	15,011.38	Amtrak
29,572.74	66	1,247.14	23.71	534,770.26	Coal BNSF
36,128.76	77	804.56	27.02	272,082.76	Coal Mtys BNSF
4,471.08	37	161.83	27.63	23,111.60	Premium BNSF
22,179.02	131	875.30	25.34	173,911.80	Merchandise BNSF
1,525.50	60	249.21	6.12	6,883.66	Other BN
				1,010,760.08	Fuel Ex AMT

Alternate A Miles	Train Count	Runtime (Hours)	Velocity	Fuel	Class of Service
2,997.70	28	71.89	41.70	14,634.30	Amtrak
25,920.74	66	965.37	26.85	430,520.12	Coal BNSF
36,538.70	77	643.70	35.23	280,614.50	Coal Mtys BNSF
4,470.14	37	142.24	31.43	22,939.70	Premium BNSF
22,331.62	131	770.37	28.99	171,619.54	Merchandise BNSF
1,526.24	60	235.73	6.47	6,773.66	Other BN
				912,467.52	Fuel Ex AMT

Δ Miles	Δ Trn Cnt	Δ Runtime	Δ Velocity	Δ Fuel		% Miles	% Runtime	% Velocity	% Fuel
0.00	0	-2.00	-1.19	377.08	Amtrak	0.00%	-2.86%	-2.78%	2.51%
3,652.00	0	281.76	3.14	104,250.14	Coal BNSF	12.35%	22.59%	13.23%	19.49%
-409.94	0	160.86	8.20	-8,531.74	Coal Mtys BNSF	-1.13%	19.99%	30.36%	-3.14%
0.94	0	19.59	3.80	171.90	Premium BNSF	0.02%	12.11%	13.75%	0.74%
-152.60	0	104.93	3.65	2,292.26	Merchandise BNSF	-0.69%	11.99%	14.40%	1.32%
-0.74	0	13.48	0.35	110.00	Other BNSF	-0.05%	5.41%	5.77%	1.60%
				98,292.56	Fuel Ex AMT				9.72%

Alternate B Miles	Train Count	Runtime (Hours)	Velocity	Fuel	Class of Service
2,997.70	28	71.86	41.71	14,616.84	Amtrak
23,861.98	66	881.59	27.07	416,817.80	Coal BNSF
34,040.30	77	553.19	36.48	265,654.74	Coal Mtys BNSF
4,470.36	37	142.18	31.44	22,875.50	Premium BNSF
22,373.58	131	759.60	29.45	171,832.60	Merchandise BNSF
1,526.30	60	233.58	6.53	6,753.16	Other BN
				883,933.80	Fuel Ex AMT

Δ Miles	Δ Trn Cnt	Δ Runtime	Δ Velocity	Δ Fuel		% Miles	% Runtime	% Velocity	% Fuel
0.00	0	-1.97	-1.17	394.54	Amtrak	0.00%	-2.81%	-2.74%	2.63%
5,710.76	0	365.55	3.35	117,952.46	Coal BNSF	19.31%	29.31%	14.15%	22.06%
2,088.46	0	251.38	9.45	6,428.02	Coal Mtys BNSF	5.78%	31.24%	34.98%	2.36%
0.72	0	19.65	3.81	236.10	Premium BNSF	0.02%	12.14%	13.80%	1.02%
-194.56	0	115.70	4.12	2,079.20	Merchandise BNSF	-0.88%	13.22%	16.24%	1.20%
-0.80	0	15.64	0.41	130.50	Other BNSF	-0.05%	6.27%	6.75%	1.90%
				126,826.28	Fuel Ex AMT				12.55%

Negative values (-) are inceasing (unfavorable) for miles, runtime and fuel. For velocity, negative values indicate a decrease in velocity.

Table 4-2 UP Operations – Summary of RTC Model Results

Base Case Miles	Train Count	Runtime (Hours)	Velocity	Fuel	Class of Service
2,997.70	28	69.90	42.89	15,011.38	Amtrak
5,590.28	46	266.93	20.94	82,792.88	Coal UP
5,130.14	48	234.81	21.85	37,784.00	Coal Mtys UP
1,037.70	36	113.31	9.16	5,021.08	Premium UP
3,232.66	61	183.16	17.65	34,966.34	Merchandise UP
771.40	28	224.56	3.44	5,254.06	Other UP
				165,818.36	Fuel Ex AMT

Alternate A Miles	Train Count	Runtime (Hours)	Velocity	Fuel	Class of Service
2,997.70	28	71.89	41.70	14,634.30	Amtrak
5,573.64	46	255.68	21.80	80,788.14	Coal UP
5,216.12	48	237.80	21.94	38,417.84	Coal Mtys UP
861.70	36	101.32	8.50	4,107.20	Premium UP
3,232.20	61	171.34	18.86	35,020.68	Merchandise UP
771.40	28	224.75	3.43	5,249.42	Other UP
				163,583.28	Fuel Ex AMT

Δ Miles	Δ Trn Cnt	Δ Runtime	Δ Velocity	Δ Fuel		% Miles	% Runtime	% Velocity	% Fuel
0.00	0	-2.00	-1.19	377.08	Amtrak	0.00%	-2.86%	-2.78%	2.51%
16.64	0	11.25	0.86	2,004.74	Coal UP	0.30%	4.22%	4.09%	2.42%
-85.98	0	-2.98	0.09	-633.84	Coal Mtys UP	-1.68%	-1.27%	0.40%	-1.68%
176.00	0	11.99	-0.65	913.88	Premium UP	16.96%	10.58%	-7.14%	18.20%
0.46	0	11.81	1.21	-54.34	Merchandise UP	0.01%	6.45%	6.88%	-0.16%
0.00	0	-0.19	0.00	4.64	Other UP	0.00%	-0.08%	-0.08%	0.09%
				2,235.08	Fuel Ex AMT				1.35%

Alternate B Miles	Train Count	Runtime (Hours)	Velocity	Fuel	Class of Service
2,997.70	28	71.86	41.71	14,616.84	Amtrak
5,564.26	46	251.78	22.10	80,571.06	Coal UP
5,216.46	48	232.56	22.43	38,526.00	Coal Mtys UP
861.70	36	99.65	8.65	4,087.14	Premium UP
3,232.20	61	163.38	19.78	34,932.38	Merchandise UP
771.40	28	223.91	3.45	5,237.62	Other UP
				163,354.20	Fuel Ex AMT

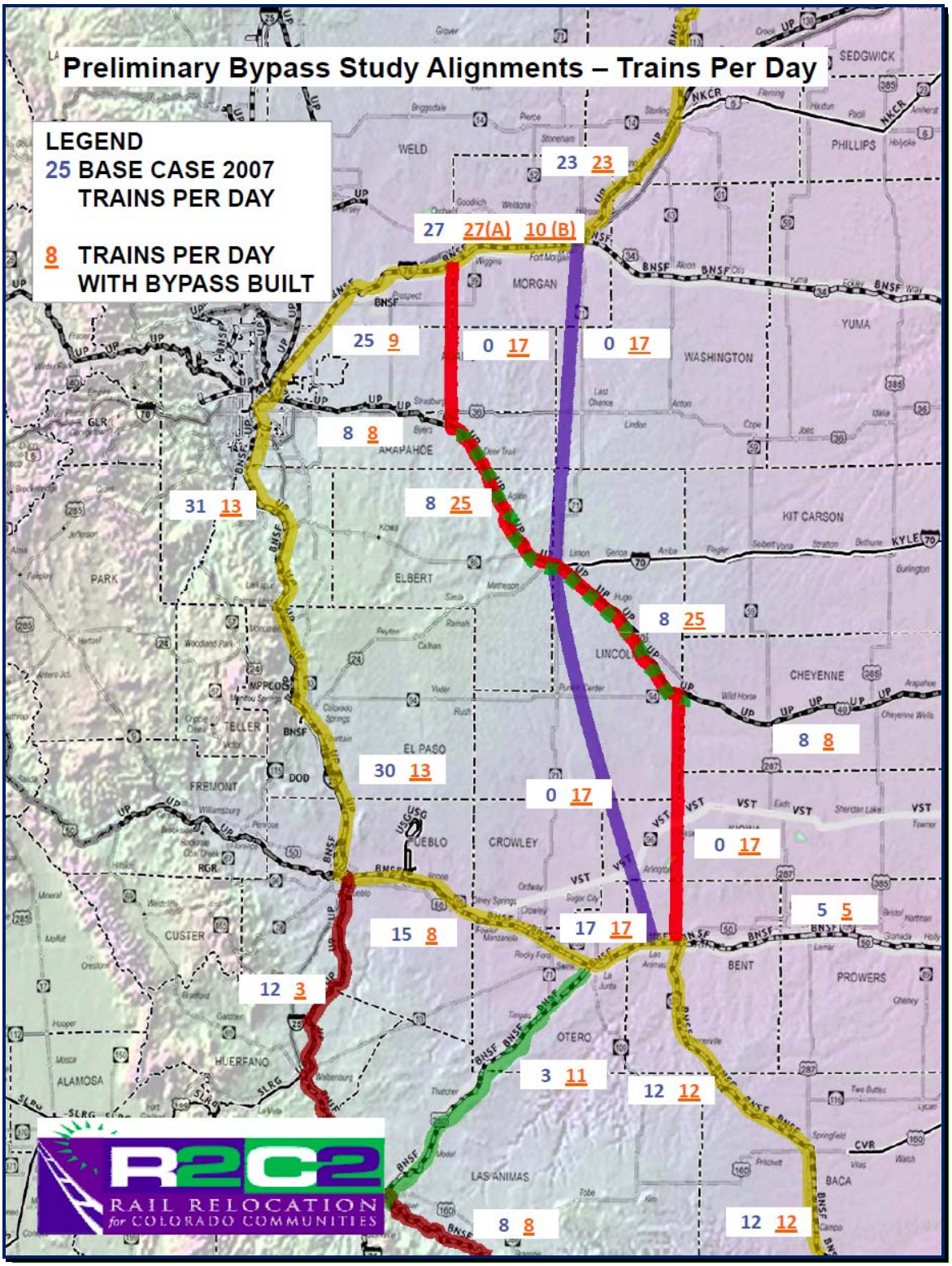
Δ Miles	Δ Trn Cnt	Δ Runtime	Δ Velocity	Δ Fuel		% Miles	% Runtime	% Velocity	% Fuel
0.00	0	-1.97	-1.17	394.54	Amtrak	0.00%	-2.81%	-2.74%	2.63%
26.02	0	15.15	1.16	2,221.82	Coal UP	0.47%	5.68%	5.52%	2.68%
-86.32	0	2.25	0.58	-742.00	Coal Mtys UP	-1.68%	0.96%	2.67%	-1.96%
176.00	0	13.66	-0.51	933.94	Premium UP	16.96%	12.05%	-5.58%	18.60%
0.46	0	19.78	2.13	33.96	Merchandise UP	0.01%	10.80%	12.09%	0.10%
0.00	0	0.65	0.01	16.44	Other UP	0.00%	0.29%	0.29%	0.31%
				2,464.16	Fuel Ex AMT				1.49%

Negative values (-) are inceasing (unfavorable) for miles, runtime and fuel. For velocity, negative values indicate a decrease in velocity.

Table 4-3 Train Operations by Line Existing Segment

Trains Per Day 2007	RR	Daily			Seven Days		
Links		**Base Case**	**Align. A**	**Align. B**	**Base Case**	**Align. A**	**Align. B**
Brush to Sterling	UPRR	23	23	23	162	162	162
Brush to Fort Morgan	BNSF	27	27	10	190	186	73
Brush East to Akron Junction	BNSF	11	11	28	78	78	197
Fort Morgan to Denver	BNSF	25	25	9	178	174	61
Akron Junction to Akron	BNSF	11	11	28	78	78	197
East leg of wye at Brush Junction	BNSF	3	3	20	23	23	139
South leg of wye at Brush Junction	BNSF	8	8	8	55	55	58
Denver to South of Colorado Springs	Joint Line	31	13	13	214	93	93
South of Colorado Springs to Pueblo	Joint Line	30	13	13	209	89	89
Pueblo to Trinidad	BNSF	12	3	3	85	24	24
Trinidad to Amarillo	BNSF	8	8	8	58	58	58
Trinidad to La Junta	BNSF	3	11	11	19	75	75
Pueblo to La Junta	BNSF	15	8	8	107	57	57
La Junta to Las Animas	BNSF	17	17	17	118	122	122
Las Animas to Amarillo	BNSF	12	12	12	82	82	82
Las Animas East	BNSF	5	5	5	36	36	36
Denver to Greeley	UPRR	14	14	14	100	100	100
Denver to Boulder	BNSF	3	3	3	22	23	23
Denver to Byers	UPRR	8	9	9	56	60	60
Byers to Limon	UPRR	8	25	8	55	178	59
Limon to Aroya (east of Aroya to Kansas)	UPRR	8	8	8	55	56	56

Figure 4-1 Trains Per Day



5. Benefits Analysis

R2C2
RAIL RELOCATION for COLORADO COMMUNITIES

5.0 BENEFITS ANALYSIS

5.1 Introduction

This chapter presents the data, methods, and assumptions used to update the benefit calculations for the R2C2 Study. These items were originally calculated in May 2005[i], and related to the alignment that was defined at that time. For this update, two Study Alignments (A and B), are now considered. Many of the potential rail projects in the Public Benefits Study are no longer included as they are not in the vicinity of the bypass project. To facilitate comparisons with the earlier study, framework assumptions have been maintained, including the categories of benefits, time periods of analysis, and whether benefits are treated quantitatively or qualitatively.

The calculations presented in the Public Benefits Study have been revised according to new methodologies, assumptions, and/or data sources which more accurately estimate the current state of costs and benefits in 2008.

Benefit categories included in this chapter are:

- transportation benefits;
- economic development and land use benefits;
- environmental benefits;
- safety and security benefits; and
- quality of life benefits

Passenger rail benefits are not included in the R2C2 Study. A comprehensive assessment of both the costs and benefits associated with possible passenger rail service on the existing freight rail right of way is currently being conducted as part of the Rocky Mountain Rail Authority Passenger Feasibility Study. All benefits and costs estimated in that study may be added to the findings of the R2C2 Study at a later date.

In this chapter, the benefit categories listed above are refined into sub-categories of related items which serve to further explain the impacts of the rail relocation. Depending on data availability and relevance to the analysis, items are investigated individually in either a quantitative or qualitative manner. Benefits are presented as potential variations from the existing rail network configuration (benefits accruing from train traffic moving to either of the Study Alignments are calculated in light of operations remaining on the Joint Line). Based on the most recent RTC modeling results, the calculations presented in this chapter assume that an average of 17 trains per day are re-routed from the Joint Line to the study alignments, outlined in Chapter 4 - Railroad Operations Analysis.

In the Public Benefits Study, the package of projects was assumed to be constructed over a four-year period from 2006 through 2009, with operations beginning in 2010. The benefit-analysis horizon encompassed the years 2010 through 2030 – a twenty year timeframe. In the R2C2 Study, the assumption of a four-year construction period (2008-2011) was maintained, and it was assumed that operations would begin in 2012. This assumption is only used for the purposes of this benefits analysis. An actual implementation schedule has not been estimated. The benefit-analysis horizon would encompass the period of 20 years, from 2012 through 2031. Previous monetary values have been updated to reflect 2008 values, and are presented in constant 2008 US dollar terms. The 2008 dollar terms presentation is acceptable for comparing proportional net benefits, though absolute dollar savings, costs, or net present values of these cash flows are likely lower than would actually be calculated if an inflation escalation factor were included. The average annual Consumer

[i] The primary reference document from the previous "Public Benefits" study is Technical Memorandum No. 5, May 18, 2005.

Price Index (CPI) increase for all urban wage earners in the West geography for the 10-year period 1998 to 2008, as reported by the Bureau of Labor Statistics, was 2.94%.

The following tables (**Tables 5-1 through 5-6**) present a summary of each benefit category analyzed. Items are presented as the present value of total benefits for the time period from 2012 through 2031, as well as average annual figures over the same period. Discount rates used for these calculations are 2.15% and 11.33% respectively for public and railroad-related benefits. The final page of this chapter contains an expanded version of the table with additional values indicated for all benefit sub-categories.

Table 5-1 Summary Categories

Benefit items	Study Alignment A (millions $'s, Discounted present value)	Study Alignment B (millions $'s, Discounted present value)
Transportation benefits	244	384
Economic Development benefits	561	839
Environmental benefits	166	266
Total	**971**	**1,489**

(1) Items in the table indicate the discounted present value of benefits

(2) Passenger rail benefits are not included, nor are unquantifiable safety, security or quality of life benefits discussed later

5.2 Summary of Benefit Items Included in Study

The following tables present the detailed benefit items included in the R2C2 Study, note the overall approaches to estimation, and where necessary, compare the approach used in this study with that of the Public Benefits Study. Some items have been moved into new categories, calculated in a different manner, or eliminated from consideration completely because of changes in project definitions. Please see the explanation column in the tables for more information.

*Items marked with an asterisk in **Tables 5-2 – Table 5-5** below have either been moved into different sections as described by the explanation section, or have been analyzed using only qualitative methods.

Table 5-2 Transportation Benefits

Items	R2C2	Explanation
Railroad Operating Efficiency Gains	Yes	Item uses inputs from the RTC Model.
Avoided Capital Costs for Grade Crossing Separation	Yes	Item adjusted based on updated estimates of the cost of the alternative bypass study alignments, and the cost for new grade-separated crossings.
Reductions in Travel Delay	Yes	Item adjusted based on updated estimates of train movements with the bypass study alignments and updated traffic flows.
Reductions in Train-Vehicle Incidents	Yes	Item adjusted based on historical incident statistics as well as updated estimates of rail and highway traffic for the alternate bypass study alignments.
Emergency Vehicle Delays	Yes*	Reflects updated rail and highway traffic.
Impacts to Truck Operations	Yes*	Reflects updated rail and highway traffic.

Transportation Benefit Note: The transportation benefit section includes an additional item titled "Savings in Vehicle Operating Costs" (VOC), which indicates cost savings in gasoline and diesel usage. This item was included in the "Environmental Benefit" section of the Public Benefits Study, because it more directly relates to transportation.

Table 5-3 Economic Development and Land Use Benefits

Items	R2C2	Explanation
Western Colorado: Coal industry	No	Western Colorado coal producers may benefit due to certain related rail system upgrades that could result from the Project. This benefit is excluded in the revised study because east-west rail connections were not included in the scope of this project.
Eastern Plains: New economic growth from better rail facilities	Yes	This benefit uses current BEA Regional Input-Output Modeling System (RIMS II)[ii] data to estimate overall economic growth caused by new railroad routes (increases in industrial earnings).
Front Range: Redevelopment of urban rail yards	No	Unlike the earlier study, the R2C2 Study assumes that the existing railroad and associated rail yards would not be removed. Therefore, redevelopment of those sites is not projected in this assessment.
Land use benefits	No	Unlike the earlier study, the R2C2 Study assumes that the existing railroad and associated rail yards would not be removed. It is recognized, however, that train counts will be significantly reduced. Moreover, commuter/intercity rail services may be established in or in close proximity to the existing joint line railroad. While the introduction of commuter rail service may enhance land values and increase development to some degree around the stations, benefiting the public and private developer interests, estimating these impacts will entail a more extensive market assessment, which is beyond the scope of the R2C2 Study. It is recommended that this analysis be included as part of the ongoing study of commuter rail service feasibility in the corridor, which is being conducted by the Rocky Mountain Rail Authority. All benefits and costs associated with commuter rail service will be evaluated and estimated as part of that study and may be added to the findings of the R2C2 Study at a later date.
Eastern Colorado: Economic growth from better rail access	Yes*	The previous assumptions of employment improvements resulting from the project were maintained. A revised approach is applied, using RIMS II[iii] input-output data for Colorado and estimating total benefits associated with new railroad routes. Since economic development would occur statewide (considering the linkages among different industrial sectors and geographical extensions of the railroad), economic development is not classified into Front Range or eastern Colorado as in the Public Benefits Study, but instead a statewide calculation is conducted.
Eastern Colorado – Benefits to grain producers / highway maintenance costs	Yes	The shipping cost via trains and trucks, and estimates of the shipping-cost savings for grain producers in eastern Colorado were updated. Reductions in highway maintenance costs related to this category are also analyzed
Construction jobs and earnings	Yes	The R2C2 Study applies more current RIMS II input-output data. Benefits include increases in employment and associated wages as well as increased state, and local taxes.

[ii] http://www.bea.gov/regional/rims/
[iii] http://www.bea.gov/regional/rims/

Table 5-4 Environmental Benefits

Items	R2C2	Explanation
Air quality benefits	Yes	The unit value of each pollutant, including CO, PM_{10}, $PM_{2.5}$, NO_X, VOC, CO_2 and SO_2 was updated. This item includes emissions reductions for trains, idle time emissions reductions for vehicles, and reduced truck emissions resulting from reduced truck movements for grain transport in eastern Colorado.
Natural environmental impacts	Yes*	Qualitative
Visual benefits	No	Unlike the earlier study, the R2C2 Study assumes that the existing railroad and associated rail yards would not be removed. Therefore, visual benefits were not assumed in this assessment.
Property value benefits due to noise reduction	No	In the Public Benefits Study, the effects of noise and vibration were indicated as impacts on property value affected by distance to the railroad. Because the existing tracks would not be removed and some freight traffic, and possibly also passenger rail trains, will be operated over the existing right of way, the impacts of noise reductions may be considered marginal relative to the current operation, and are not included in this Chapter.
Energy reductions for autos	Yes*	Item maintained, but moved to the Transportation Benefit section as "Savings in VOC". This benefit accrues as a result of reduced idle times of automobiles at at-grade crossings. For diesel-fuel savings in railroad operations, the R2C2 Study has included costs in the transportation efficiency gains section. These savings are not included in the VOC savings to avoid double-counting issues.

Table 5-5 Safety and Security Benefits

Items	R2C2	Explanation
Vehicle-Train incidents	Yes*	The R2C2 Study has included this item in the Transportation Benefits section. The item is excluded here to avoid double counting.
HAZMAT	Yes*	Qualitative
Terrorism, disaster response ability	Yes*	Qualitative
Pedestrian-Train incidents	Yes*	Qualitative

Table 5-6 Capital Cost Savings to Future Passenger Rail

Items	R2C2	Explanation
Capital Cost Savings to Future Passenger Rail	No	Not included in the R2C2 Study. All benefits and costs associated with commuter rail service will be evaluated and estimated as part of the Rocky Mountain Rail Authority Feasibility Study.

5.2.1 Transportation Benefits

5.2.1.1 Railroad Operating Efficiency Gains

Efficiency gains in the operation of the BNSF are expected as a result of fewer train miles traveled and faster train speeds along the alternative routes due to shorter distances traveled, decreased curves and grades and a route with operations in less congested yard areas. The calculation of this item has been revised using the configurations of Study Alignments A and B as defined in **Chapter 3 - Bypass Alignments**. Detailed estimates from the RTC model results, including savings relative to the baseline in train hours, train miles, and diesel fuel consumption, are included. Because only BNSF trains experience significant efficiency gains, there are no UP results shown in the following sections or tables. The RTC model was based on the trains operating on the existing rail network.

Methodology

Train operations simulation: As indicated, the RTC model has been used to estimate railroad operational savings. Variables estimated include train miles, train hours, and gallons of diesel fuel consumed. The costs of new right of way and construction are included in the capital cost estimates noted in **Chapter 3 - Bypass Alignments**.

Variable costs of train operations: Variable costs of operation and maintenance per train hour have been estimated based on BNSF's and UP's 2007 Railroad Annual Reports (R1 reports) using Railway Operating Expenses (Schedule 410) and Railroad Operating Statistics (Schedule 755). Cost items have been restricted to those that are directly variable with train operations; semi variable costs, and fixed costs are not included. **Tables 5-7a and 5-7b** summarize these analyses. 2007 unit costs have been escalated to 2008 dollars using the Surface Transportation Board (STB) Railroad Cost Adjustment Factor all inclusive index.

Table 5-7a Derivation of BNSF Train Variable Costs (reported line items in millions 2007$)

Crew Costs Benefit Calculation		Car Cost Benefit Calculation			Locomotive Cost Benefit Calculation		
Schedule 410 - Crew Costs		*Schedule 410 - Car Costs*			*Schedule 410 - Locomotive Costs*		
Line 402:	$655.4		**Ownership Costs**			**Ownership Costs**	
Line 403:	$642.2	**Line 232:**	Depreciation	$44.4	**Line 213:**	Depreciation	$229.8
Line 414:	$476.2	**Line 226:**	Lease rentals - debits	$322.7	**Line 207:**	Lease rentals - debits	$306.4
	$1,774	**Line 227:**	Lease rentals - credits	-$4.7	**Line 208:**	Lease rentals - credits	-$0.5
Schedule 755 - Total Train Miles		**Line 230:**	Other rents - debit	$400.6	**Line 214:**	Joint facility - debit	$3.9
Line 7:	170.9	**Line 231:**	Other rents - credit	$122.4	**Line 215:**	Joint facility - credit	$0.0
				$885.4			$539.7
Rate: Crew Cost/Train Mile	$10.38		**Repair Costs**			**Repair Costs**	
		Line 221:	Repair & Maint	$453.3	**Line 202:**	Repair & Maint	$664.4
		Line 222:	Machinery Repair	$2.0	**Line 203:**	Machinery Repair	$3.5
		Line 223:	Equipment Damaged	$30.0	**Line 204:**	Equipment Damaged	$0.1
		Line 224:	Fringe Benefits	$51.0	**Line 205:**	Fringe Benefits	$73.8
		Line 225:	Other Cas. & Insur.	$8.0	**Line 206:**	Other Cas. & Insur.	$12.3
		Line 235:	Repairs billed to others	-$155.5	**Line 216:**	Repairs billed to others	-$90.8
				$388.9			$663.4
		Schedule 755			*Schedule 755*		
		Line 88:	Total Car Miles	11,218.7	**Line 7:**	Total Train Miles	$170.9
		Line 7:	Total Train Miles	170.9	**Line 115-117:**	Total Train Hours	$12.2
		Line 115-117:	Total Train Hours	12.2			
		Rate:	Ownership Cost/Hr	$72.86	**Rate:**	Ownership Cost/Train Hr	$44.41
			Repair Cost/Car Mile	$2.28		Repair Cost/Train Mile	$3.88

Source: BNSF R-1 Report for 2007.

Table 5-7b Derivation of UP Train Variable Costs (reported line items in millions 2007$)

Crew Costs Benefit Calculation		Car Cost Benefit Calculation		Locomotive Cost Benefit Calculation	
Schedule 410 - Crew Costs		*Schedule 410 - Car Costs*		*Schedule 410 - Locomotive Costs*	
Line 402:	$875.8	**Ownership Costs**		**Ownership Costs**	
Line 403:	$615.8	**Line 232:** Depreciation	$84.9	**Line 213:** Depreciation	$231.0
Line 414:	$591.5	**Line 226:** Lease rentals - debits	$230.3	**Line 207:** Lease rentals - debits	$396.5
	$2,083	**Line 227:** Lease rentals - credits	-$1.9	**Line 208:** Lease rentals - credits	-$0.8
Schedule 755 - Total Train Miles		**Line 230:** Other rents - debit	$803.6	**Line 214:** Joint facility - debit	$0.3
Line 7:	165.2	**Line 231:** Other rents - credit	-$191.2	**Line 215:** Joint facility - credit	$0.0
			$925.7		**$627.0**
Rate: Crew Cost/Train Mile	**$12.61**	**Repair Costs**		**Repair Costs**	
		Line 221: Repair & Maint	$505.9	**Line 202:** Repair & Maint	$669.5
		Line 222: Machinery Repair	$5.3	**Line 203:** Machinery Repair	$5.0
		Line 223: Equipment Damaged	$0.0	**Line 204:** Equipment Damaged	$0.5
		Line 224: Fringe Benefits	$62.0	**Line 205:** Fringe Benefits	$73.6
		Line 225: Other Cas. & Insur.	$43.5	**Line 206:** Other Cas. & Insur.	$13.0
		Line 235: Repairs billed to others	-$211.8	**Line 216:** Repairs billed to others	$0.0
			$405.0		**$761.5**
		Schedule 755		*Schedule 755*	
		Line 88: Total Car Miles	**14,254.6**	**Line 7:** Total Train Miles	**$165.2**
		Line 7: Total Train Miles	**165.2**	**Line 115-117:** Total Train Hours	**$12.8**
		Line 115-117: Total Train Hours	**12.8**		
		Rate: Ownership Cost/Hr	**$72.32**	**Rate:** Ownership Cost/Train Hr	**$48.98**
		Repair Cost/Car Mile	**$2.45**	Repair Cost/Train Mile	**$4.61**

Source: UP R-1 Report for 2007.

Growth rate in train traffic: According to projections by the US Energy Information Agency from 'Annual Energy Outlook 2008'[iv], the growth rate in demand for Western coal (mainly Powder River Basin coal) from 2006 to 2030 is expected to be 0.93% annually. As a result, a growth rate of 0.93% train volume for future years was used in this analysis.

Discount rate: To derive the discounted present value of the benefits, a discount rate reflecting current real costs of capital within the railroad industry has been used. The STB has determined that the industry cost of capital (after tax) is 11.33%.[v]

Results

Table 5-8 presents yearly estimates for railroad operating efficiency gains from 2012 to 2031 for Study Alignments A and B associated with the reduced cost of locomotive and car maintenance and crews. The train crew cost savings are projected based on system-wide crew costs per train mile as reported by both railroads. Actual crew reductions must consider operational constraints and conditions in the rail labor agreements. Because of the relatively short savings in round trip miles for Study Alignment A, crew cost savings may be limited to reductions in payments for overtime and "overmiles".

[iv] http://www.eia.doe.gov/oiaf/aeo/pdf/0383(2008).pdf The Annual Energy Outlook Report, 2008 states that western coal production will grow by 20% between 2006 and 2030 from its 2006 level of 24.5 quadrillion Btu, equating to 0.93% annual growth.
[v] Surface Transportation Board Decision, STB Ex Parte No. 558 (Sub-No. 10), "Railroad Cost of Capital, 2006", decided April 14, 2008.

Table 5-8 Railroad Operating Efficiency Gains – Operational Savings

Year	BNSF Annual Train Hour Savings		BNSF Annual Train Mile Savings		UP Annual Train Hour Savings		UP Annual Train Mile Savings	
	A	B	A	B	A	B	A	B
2012	31,600	41,800	168,300	414,200	520	1,680	(14,700)	(19,300)
2013	31,900	42,200	169,800	418,000	530	1,690	(14,800)	(19,400)
2014	32,200	42,600	171,400	421,900	530	1,710	(15,000)	(19,600)
2015	32,500	43,000	173,000	425,800	540	1,720	(15,100)	(19,800)
2016	32,800	43,400	174,600	429,800	540	1,740	(15,200)	(20,000)
2017	33,100	43,800	176,200	433,800	550	1,760	(15,400)	(20,200)
2018	33,400	44,200	177,900	437,800	550	1,770	(15,500)	(20,400)
2019	33,700	44,600	179,500	441,900	560	1,790	(15,700)	(20,500)
2020	34,100	45,000	181,200	446,000	560	1,800	(15,800)	(20,700)
2021	34,400	45,500	182,900	450,200	570	1,820	(16,000)	(20,900)
2022	34,700	45,900	184,600	454,300	570	1,840	(16,100)	(21,100)
2023	35,000	46,300	186,300	458,600	580	1,860	(16,300)	(21,300)
2024	35,300	46,700	188,000	462,800	580	1,870	(16,400)	(21,500)
2025	35,700	47,200	189,800	467,100	590	1,890	(16,600)	(21,700)
2026	36,000	47,600	191,600	471,500	590	1,910	(16,700)	(21,900)
2027	36,300	48,100	193,300	475,900	600	1,930	(16,900)	(22,100)
2028	36,700	48,500	195,100	480,300	600	1,940	(17,000)	(22,300)
2029	37,000	49,000	197,000	484,800	610	1,960	(17,200)	(22,500)
2030	37,400	49,400	198,800	489,300	610	1,980	(17,400)	(22,800)
2031	37,700	49,900	200,600	493,800	620	2,000	(17,500)	(23,000)
Total	691,500	914,700	3,679,900	9,057,800	11,400	36,660	(321,300)	(421,000)

Tables 5-9a and 5-9b present annual dollar amount impacts to BNSF and UP and to coal shippers, respectively, as a result of operational changes in the categories presented in **Tables 5-8.** According to BNSF, 78% of the cars used to ship coal on the Joint Line are owned by the shippers. As such, coal car maintenance costs have been allocated between shippers and BNSF at a ratio of 78 to 22. Associated net present value calculations are also shown in **Table 5-10**. The same discount rate applicable to BNSF has been applied to the shipper savings to calculate the present value.

A portion of non-fuel - per mile savings is derived from potential reductions in crew costs, which were calculated using crew cost factors noted in **Tables 5-7a and 5-7b**, above. This simplified calculation does not take into account potential limitations or benefits from adjusting crew districts, or changes in overmile costs incurred by the railroads for reduced crew service lengths. Particularly for Study Alignment A, additional research would need to be completed to accurately reflect the potential changes in crew costs.

Table 5-9a Non-Fuel Operational Cost of BNSF and UP

Year	Non-Fuel Annual benefit (thousands)		Discounted Present Value of Annual Benefit (thousands)		Non-Fuel Annual benefit (thousands)		Discounted Present Value of Annual Benefit (thousands)	
	A	B	A	B	A	B	A	B
	BNSF	BNSF	BNSF	BNSF	UP	UP	UP	UP
2012	$ 4,600	$ 9,000	$ 2,994	$ 5,859	$ (240)	$ (240)	$ (156)	$ (156)
2013	$ 4,600	$ 9,100	$ 2,690	$ 5,321	$ (240)	$ (250)	$ (140)	$ (146)
2014	$ 4,700	$ 9,200	$ 2,468	$ 4,832	$ (240)	$ (250)	$ (126)	$ (131)
2015	$ 4,700	$ 9,200	$ 2,217	$ 4,340	$ (240)	$ (250)	$ (113)	$ (118)
2016	$ 4,700	$ 9,300	$ 1,992	$ 3,941	$ (250)	$ (250)	$ (106)	$ (106)
2017	$ 4,800	$ 9,400	$ 1,827	$ 3,578	$ (250)	$ (250)	$ (95)	$ (95)
2018	$ 4,800	$ 9,500	$ 1,641	$ 3,248	$ (250)	$ (260)	$ (85)	$ (89)
2019	$ 4,900	$ 9,600	$ 1,505	$ 2,948	$ (250)	$ (260)	$ (77)	$ (80)
2020	$ 4,900	$ 9,700	$ 1,352	$ 2,676	$ (250)	$ (260)	$ (69)	$ (72)
2021	$ 5,000	$ 9,800	$ 1,239	$ 2,428	$ (260)	$ (260)	$ (64)	$ (64)
2022	$ 5,000	$ 9,900	$ 1,113	$ 2,203	$ (260)	$ (270)	$ (58)	$ (60)
2023	$ 5,100	$ 10,000	$ 1,019	$ 1,999	$ (260)	$ (270)	$ (52)	$ (54)
2024	$ 5,100	$ 10,000	$ 916	$ 1,796	$ (260)	$ (270)	$ (47)	$ (48)
2025	$ 5,200	$ 10,100	$ 839	$ 1,629	$ (270)	$ (270)	$ (44)	$ (44)
2026	$ 5,200	$ 10,200	$ 753	$ 1,478	$ (270)	$ (280)	$ (39)	$ (41)
2027	$ 5,300	$ 10,300	$ 690	$ 1,340	$ (270)	$ (280)	$ (35)	$ (36)
2028	$ 5,300	$ 10,400	$ 619	$ 1,216	$ (270)	$ (280)	$ (32)	$ (33)
2029	$ 5,400	$ 10,500	$ 567	$ 1,102	$ (280)	$ (280)	$ (29)	$ (29)
2030	$ 5,400	$ 10,600	$ 509	$ 1,000	$ (280)	$ (290)	$ (26)	$ (27)
2031	$ 5,500	$ 10,700	$ 466	$ 906	$ (280)	$ (290)	$ (24)	$ (25)
Total	$ 100,200	$ 196,500	$ 27,416	$ 53,839	$ (5,170)	$ (5,310)	$ (1,418)	$ (1,455)

Table 5-9b Non-Fuel Operational Cost Savings of Coal Shippers

Year	Non-Fuel Annual benefit (thousands)		Discounted Present Value of Annual Benefit (thousands)	
	A	B	A	B
	Shipper	Shipper	Shipper	Shipper
2012	$ 2,180	$ 3,237	$ 1,419	$ 2,107
2013	$ 2,200	$ 3,267	$ 1,287	$ 1,910
2014	$ 2,221	$ 3,298	$ 1,166	$ 1,732
2015	$ 2,242	$ 3,328	$ 1,057	$ 1,570
2016	$ 2,262	$ 3,359	$ 959	$ 1,424
2017	$ 2,284	$ 3,391	$ 869	$ 1,291
2018	$ 2,305	$ 3,422	$ 788	$ 1,170
2019	$ 2,326	$ 3,454	$ 714	$ 1,061
2020	$ 2,348	$ 3,486	$ 648	$ 962
2021	$ 2,370	$ 3,518	$ 587	$ 872
2022	$ 2,392	$ 3,551	$ 532	$ 790
2023	$ 2,414	$ 3,584	$ 483	$ 716
2024	$ 2,436	$ 3,618	$ 437	$ 650
2025	$ 2,459	$ 3,651	$ 397	$ 589
2026	$ 2,482	$ 3,685	$ 360	$ 534
2027	$ 2,505	$ 3,719	$ 326	$ 484
2028	$ 2,528	$ 3,754	$ 296	$ 439
2029	$ 2,552	$ 3,789	$ 268	$ 398
2030	$ 2,576	$ 3,824	$ 243	$ 361
2031	$ 2,599	$ 3,860	$ 220	$ 327
Total	$ 47,681	$ 70,797	$ 13,056	$ 19,385

5.2.1.2 Diesel Fuel Savings

An average diesel fuel cost of $3.17per gallon was calculated, representing the average cost paid for diesel by BNSF and UP between the 4th quarter of 2007 and the third quarter of 2008 according to Quarterly Fuel Surcharge Reports. This unit cost was increased by 10% to $3.49 per gallon to account for hedging performed by BNSF that effectively lowered the price of fuel paid in 2008.[vi]

BNSF and other railroads participate in a fuel surcharge program overseen by the STB to spread a portion of the cost of fuel over a threshold unit cost per gallon to the shippers buying the coal. Based on current fuel cost sharing arrangements with shippers, fuel savings would accrue to BNSF on the first $0.86 of fuel costs and to the shippers on fuel costs over $0.86.[vii] Therefore, it is appropriate to assume that BNSF's long-term effective cost of fuel is the equivalent of $0.86. It is also appropriate to assume that the remainder of BNSF's fuel cost savings would accrue to shippers in the form of reduced fuel surcharge costs. This equates to $2.63 per gallon based on the $3.49 cost per gallon assumption stated above. **Table 5-10a** shows the total gallons saved for each alignment over the 2012 to 2031 time period. **Table 5-10b** shows the dollar-term savings associated with the fuel quantities shown in **Table 5-10a**.

[vi] 10% hedge assumption from BNSF 2007 Q3 10-Q Report. The same hedging assumption was applied to the UP fuel price.
[vii] BNSF charges a fuel surcharge when the price of highway diesel fuel as published by the Energy Information Administration (EIA) is above $1.25. The actual cost of BNSF fuel is about 40% lower than the EIA indexed fuel price due to the different fuel grade and certain tax exemptions.

Table 5-10a Diesel Fuel Operational Savings (gallons)

Year	BNSF		UP		Shippers	
	A	B	A	B	A	B
2012	1,447	1,867	(253)	(392)	3,906	5,040
2013	1,461	1,885	(256)	(395)	3,942	5,087
2014	1,474	1,902	(258)	(399)	3,979	5,134
2015	1,488	1,920	(260)	(403)	4,016	5,182
2016	1,502	1,938	(263)	(406)	4,053	5,230
2017	1,516	1,956	(265)	(410)	4,091	5,279
2018	1,530	1,974	(268)	(414)	4,129	5,328
2019	1,544	1,992	(270)	(418)	4,168	5,377
2020	1,559	2,011	(273)	(422)	4,206	5,427
2021	1,573	2,030	(275)	(426)	4,245	5,478
2022	1,588	2,049	(278)	(429)	4,285	5,529
2023	1,602	2,068	(280)	(433)	4,325	5,580
2024	1,617	2,087	(283)	(438)	4,365	5,632
2025	1,632	2,106	(286)	(442)	4,406	5,685
2026	1,648	2,126	(288)	(446)	4,447	5,737
2027	1,663	2,146	(291)	(450)	4,488	5,791
2028	1,678	2,166	(294)	(454)	4,530	5,845
2029	1,694	2,186	(296)	(458)	4,572	5,899
2030	1,710	2,206	(299)	(462)	4,614	5,954
2031	1,726	2,226	(302)	(467)	4,657	6,009
Total	31,651	40,839	$ (5,538)	$ (8,562)	$ 85,425	$ 110,223

Table 5-10b Diesel Fuel Operational Savings (thousands $)

Year	BNSF		UP		Shippers	
	A	B	A	B	A	B
2012	$ 5,047	$ 6,512	$ (883)	$ (1,365)	$ 13,621	$ 17,574
2013	$ 5,094	$ 6,572	$ (891)	$ (1,378)	$ 13,747	$ 17,738
2014	$ 5,141	$ 6,633	$ (899)	$ (1,391)	$ 13,875	$ 17,903
2015	$ 5,189	$ 6,695	$ (908)	$ (1,404)	$ 14,004	$ 18,069
2016	$ 5,237	$ 6,757	$ (916)	$ (1,417)	$ 14,134	$ 18,237
2017	$ 5,286	$ 6,820	$ (925)	$ (1,430)	$ 14,266	$ 18,407
2018	$ 5,335	$ 6,883	$ (933)	$ (1,443)	$ 14,398	$ 18,578
2019	$ 5,384	$ 6,948	$ (942)	$ (1,457)	$ 14,532	$ 18,751
2020	$ 5,435	$ 7,012	$ (951)	$ (1,470)	$ 14,667	$ 18,925
2021	$ 5,485	$ 7,077	$ (960)	$ (1,484)	$ 14,804	$ 19,101
2022	$ 5,536	$ 7,143	$ (969)	$ (1,498)	$ 14,942	$ 19,279
2023	$ 5,588	$ 7,210	$ (978)	$ (1,512)	$ 15,081	$ 19,458
2024	$ 5,640	$ 7,277	$ (987)	$ (1,526)	$ 15,221	$ 19,639
2025	$ 5,692	$ 7,344	$ (996)	$ (1,540)	$ 15,362	$ 19,822
2026	$ 5,745	$ 7,413	$ (1,005)	$ (1,554)	$ 15,505	$ 20,006
2027	$ 5,798	$ 7,482	$ (1,014)	$ (1,569)	$ 15,649	$ 20,192
2028	$ 5,852	$ 7,551	$ (1,024)	$ (1,583)	$ 15,795	$ 20,380
2029	$ 5,907	$ 7,621	$ (1,033)	$ (1,598)	$ 15,942	$ 20,570
2030	$ 5,962	$ 7,692	$ (1,043)	$ (1,613)	$ 16,090	$ 20,761
2031	$ 6,017	$ 7,764	$ (1,053)	$ (1,628)	$ 16,240	$ 20,954
Total	$ 110,367	$ 142,406	$ (19,310)	$ (29,857)	$ 297,876	$ 384,347

The net present values of these savings are shown in Table 5-11. The same discount rate (11.33%) is used for the shippers' portion of the cost savings as is used for the railroads share. While it is very likely that the applicable discount rate for the shippers' is different than the railroads, the 11.33% rate was deemed reasonable for this study. If shippers are included in future discussions regarding operational efficiency and cost sharing, an accounting of various coal-fired electric power plants weighted average cost of capital would need to be performed.

Table 5-11 Net Present Value of Diesel Fuel Operational Savings (thousands $)

Year	BNSF		UP		Shippers	
	A	B	A	B	A	B
2012	3,285	4,239	(575)	(889)	8,866	11,440
2013	2,978	3,843	(521)	(806)	8,038	10,371
2014	2,700	3,484	(472)	(730)	7,287	9,403
2015	2,448	3,158	(428)	(662)	6,606	8,524
2016	2,219	2,863	(388)	(600)	5,989	7,728
2017	2,012	2,596	(352)	(544)	5,430	7,006
2018	1,824	2,353	(319)	(493)	4,923	6,352
2019	1,654	2,134	(289)	(447)	4,463	5,758
2020	1,499	1,934	(262)	(406)	4,046	5,220
2021	1,359	1,754	(238)	(368)	3,668	4,733
2022	1,232	1,590	(216)	(333)	3,325	4,291
2023	1,117	1,441	(195)	(302)	3,015	3,890
2024	1,013	1,307	(177)	(274)	2,733	3,526
2025	918	1,185	(161)	(248)	2,478	3,197
2026	832	1,074	(146)	(225)	2,246	2,898
2027	755	974	(132)	(204)	2,036	2,628
2028	684	883	(120)	(185)	1,846	2,382
2029	620	800	(108)	(168)	1,674	2,160
2030	562	725	(98)	(152)	1,517	1,958
2031	510	658	(89)	(138)	1,376	1,775
Total	30,220	38,993	$ (5,287)	$ (8,175)	$ 81,562	$ 105,240

5.2.1.3 Trackage Rights Payment on Study Alignment A

As noted in **Chapter 3 – Bypass Alignments**, an 87 mile segment of Study Alignment A is trackage currently owned and operated by UP. Should Study Alignment A be constructed, BNSF would be required to pay trackage rights to UP for use of this segment. No discussions have occurred between UP and BNSF regarding the actual terms of this agreement, but it would represent a significant annual payment from BNSF, estimated between $10 and $20 million, depending on agreement terms, traffic volumes, and traffic mix. This would allow BNSF to avoid some of the costs of operations and maintenance on its own track, which are already quantified in the maintenance savings section of this Study. Similarly, the additional BNSF traffic on this segment of UP track would result in increased maintenance of way costs incurred by UP that would be expected to offset payments received from BNSF for the track use.

Due to the complexity and uncertainty of negotiated trackage rights terms that would need to be addressed in the future if Study Alignment A were implemented, the trackage rights issues were not included as part of this Study and were not taken into account as part of the net benefit calculations. Thus, for Study Alignment A, it is assumed that trackage rights compensation due to UP for operating rights between Byers and Aroya, net of avoidable costs of operating on BNSF's trackage, would be deducted from BNSF's benefits from Study Alignment A.

5.2.1.4 Maintenance of Way (MOW)

The cost of track and structure maintenance (MOW) is a component of train operations that would potentially change if train traffic was moved to one of the bypass routes. The 2007 R-1 reports from BNSF and UP were used to help estimate the decreased costs on the Joint Line and additional costs associated with the bypass

routes. A general assumption was made that the repair and maintenance costs in Schedule 410 of the R-1 reports and the capital maintenance costs in Schedule 330 were 75% variable and 25% fixed in determining the total maintenance costs that should be included in the MOW cost estimate.

Because maintenance costs would continue to be incurred on the Joint Line even under one of the bypass scenarios, MOW costs were calculated and netted with any cost or savings related to the bypass alignments. Table 5-12 shows these costs and savings components and the net costs to BNSF and UP under each of the bypass scenarios. For Study Alignment A, BNSF would have a reduction in cost of $6.8 million per year while UP would incur an additional cost of $7.7 million per year. For Study Alignment B, BNSF would have a reduction in annual MOW cost of $4.7 million while UP's cost would not be impacted, all in 2008 dollar terms. The annual costs and discounted present values of these annual costs between 2012 and 2031 are shown in Table 5-13.

Table 5-12 MOW Annual Cost Estimates (2008 $ millions)

Variable MOW Costs			
Existing			$ 29.0
Study Alignment A (BNSF) (Including Joint Line)			$ 18.9
Study Alignment A (UP)			$ 7.7
Study Alignment B (BNSF) (Including Joint Line)			$ 20.1
Study Alignment A variable savings to BNSF			$ 10.1
Study Alignment A variable costs to UP			$ 7.7
Study Alignment B variable savings to BNSF			$ 8.9
Fixed MOW Costs (Fixed costs assumed constant on Joint Line and UP's KP Line)			
		Fixed cost	
Existing $0 (no change in route miles)	Miles	Per Mile	
Study Alignment A - 135 added BNSF miles	135	$24,470	$ 3.3
Study Alignment B - 178 added BNSF miles	175	$24,470	$ 4.3
Total Annual MOW Costs (net variable + fixed)			
Study Alignment A - BNSF- reduced MOW costs			$ (6.8)
Study Alignment A - UP - added MOW costs			$ 7.7
Study Alignment B - BNSF - reduced MOW costs			$ (4.7)

Table 5-13 MOW Annual Cost Estimates

Year	Alignment A UP Costs		Alignment A BNSF Costs		Alignment B BNSF Costs	
	Annual Cost	Discounted Present Value	Annual Cost	Discounted Present Value	Annual Cost	Discounted Present Value
2012	$7.70	$5.01	$ (6.79)	$ (4.42)	$ (4.66)	$ (3.04)
2013	$7.77	$4.54	$ (6.85)	$ (4.01)	$ (4.71)	$ (2.75)
2014	$7.84	$4.12	$ (6.91)	$ (3.63)	$ (4.75)	$ (2.50)
2015	$7.92	$3.73	$ (6.98)	$ (3.29)	$ (4.80)	$ (2.26)
2016	$7.99	$3.39	$ (7.04)	$ (2.98)	$ (4.84)	$ (2.05)
2017	$8.06	$3.07	$ (7.11)	$ (2.71)	$ (4.89)	$ (1.86)
2018	$8.14	$2.78	$ (7.18)	$ (2.45)	$ (4.93)	$ (1.69)
2019	$8.21	$2.52	$ (7.24)	$ (2.22)	$ (4.98)	$ (1.53)
2020	$8.29	$2.29	$ (7.31)	$ (2.02)	$ (5.02)	$ (1.39)
2021	$8.37	$2.07	$ (7.38)	$ (1.83)	$ (5.07)	$ (1.26)
2022	$8.44	$1.88	$ (7.45)	$ (1.66)	$ (5.12)	$ (1.14)
2023	$8.52	$1.70	$ (7.52)	$ (1.50)	$ (5.16)	$ (1.03)
2024	$8.60	$1.54	$ (7.58)	$ (1.36)	$ (5.21)	$ (0.94)
2025	$8.68	$1.40	$ (7.66)	$ (1.23)	$ (5.26)	$ (0.85)
2026	$8.76	$1.27	$ (7.73)	$ (1.12)	$ (5.31)	$ (0.77)
2027	$8.84	$1.15	$ (7.80)	$ (1.01)	$ (5.36)	$ (0.70)
2028	$8.93	$1.04	$ (7.87)	$ (0.92)	$ (5.41)	$ (0.63)
2029	$9.01	$0.95	$ (7.94)	$ (0.83)	$ (5.46)	$ (0.57)
2030	$9.09	$0.86	$ (8.02)	$ (0.76)	$ (5.51)	$ (0.52)
2031	$9.18	$0.78	$ (8.09)	$ (0.69)	$ (5.56)	$ (0.47)
Total	**$168.4**	**$46.1**	**$ (148.44)**	**$ (40.64)**	**$ (102.01)**	**$ (27.93)**

5.2.1.5 Avoided Capital Costs for New Grade Separated Crossings

This benefit item is derived from foregone building costs for new grade separated crossings on the existing route. These new grade separated crossings represent those which are currently most desired on the Joint Line if the bypass study alignment was not constructed. The cost of constructing a new grade separated crossing on the Eastern Plains will be less than construction of a crossing closer to the more urban areas of Denver. Though there would be more crossings constructed on the new route in absolute terms, their lower construction cost would yield a net benefit when comparing the two scenarios.

Methodology

In the Public Benefits Study, the construction/maintenance cost per new grade separated crossing was assumed to be $20 million (2004 Dollars). The estimated grade separated crossings on the Joint Line are assigned the same cost as in the Public Benefits Study ($20 million) as a result of their proximity to urban areas and likely complex designs. The formula for this benefit calculation is:

# of Grade Separated Crossings for each Route X Capital Cost of Construction for each Grade Separated Crossing

The cumulative cost of grade separated crossings on each of the study alignments has been calculated by the R2C2 Team and is shown in **Table 5-14** as $104.6 million and $81.3 million for Study Alignments A and B, respectively. The Total Benefit is calculated by subtracting the estimated total cost of grade separations required on the new bypass routes from the estimated cost of the grade separations that would need to be built on the existing route if no bypass were built. It is important to note that some existing grade crossings would be part of Study Alignment A.

Table 5-14 Grade Separated Crossing Estimates ($ millions)

Estimated Grade Sep. Costs on Existing Route				Grade Sep. Costs Required for Bypasses		
#	Location	Route		Location	Route	
1	BNSF 72nd	A	B	US-50	A	B
2	BNSF 80th	A	B	CR-14	A	B
3	BNSF 96th	A	B	CO-96 (x3)	A	B
4	BNSF (Fountain)	A	B	CO-94	A	B
5	BNSF Sherman		B	3rd Avenue / Barron	A	
6	UP (Widefield)	A	B	CO-71 / Indiana	A	
7	UP (Power Plant)	A	B	CO-40 (x2)	A	
8	BNSF 56th	A	B	I-70 (x2 on Alt A)	A	B
				US-36	A	B
				88th / Irondale	A	
				CO-52	A	
				CR-2W		B
				US-40 / US-287		B
				CR-3T		B
				CR-K		B
	Cost Per GSC	20.0	20.0	*N/A*	*N/A*	*N/A*
	Total Cost	**$140.0**	**$160.0**	**Total Cost**	**$104.6**	**$81.3**
	Total Benefit				**$35.4**	**$78.7**

5.2.1.6 Reductions in Travel Delay at Railroad Crossings

With the re-routing of much of the existing freight operations from the Joint Line to Study Alignment A or B, a significant decrease in vehicle delays for automobiles and trucks would be expected as a result of faster train speeds, and fewer train miles traveled through congested areas.

Methodology

As part of this analysis, updated assumptions of the train routes and traffic volumes for at-grade crossings were incorporated. Using these data, the delay on the existing route due to the 17 trains that would be re-routed was calculated, monetized and compared to the delay these same trains would cause on each of the alternative study alignments. The net benefit of reduced travel delay was calculated using the following formula:

Highway volume x Delay per blocked vehicle X
Probability of being blocked x Time value of automobiles and trucks

Highway volume data for crossings, in terms of average annual daily traffic (AADT), is provided by publicly accessible FRA safety databasesviii as well as traffic counts from CDOT and local jurisdictions. An average of 350 vehicles per day is estimated on the new public at-grade crossings for Study Alignments A and B that will not be recommended for grade separation. In calculating this assumption, AADT data from local roads on the existing route were isolated and an average of the AADT for these local routes was used. All highways and high volume roads, which do not accurately characterize the traffic on roads intersecting the new study alignments, were excluded from the traffic volume calculation. All AADT estimates were converted to 2008 traffic counts based on the percentage growth rate of population in each county which contained the road in question.

The time that a train blocks the roadway is estimated at between four and seven minutes, and therefore five minutes was used as the average. This estimate is based on the average length of a train car being 60 feet, and the average train containing 120 cars. An average train speed of 15 to 17 miles per hour for the entire route is assumed. This 'block time' factor is used in calculating the probability of being blocked by one of the 17 BNSF trains using the existing route compared to the alternatives. The probability of vehicle blockage is therefore defined as:

Daily train volume x block time per train/24 hours =5.90%

The time values for automobile users and commercial vehicles are estimated based on the average hourly wages of workers and truck drivers, respectively. For automobiles, time value is assumed to be 60% of the average wage rate in peak hours (three hours per day), and 50% of the average wage rate in non-peak hours (21 hours per day). In addition, it is assumed that each automobile would be occupied by 1.31 passengers.

Commercial trips tend to have a higher time value than personal travel by automobile drivers. The value of time saved from regional commercial travel is assumed to be 120% of the average hourly wage rate for heavy truck and tractor trailer drivers. This estimate takes into account the total compensation of the driver, which equals the driver's wage plus 20% for the fringe costs incurred by the business owner. According to the Colorado Department of Labor and Employmentix, the statewide average wage is $19.93/hour. The average wage for a truck driver, citing the same source, is $17.92/hour. Therefore, the time value of vehicles would be equal to:

($19.93*60%*3/24 + $19.93*50%*21/24)*1.31 = $13.38/hour (Automobiles)

$17.92*1.2 = $21.5/hour (Trucks)

The annual growth rate of this benefit is dependent on the growth rate of train and highway volume (AADT). As indicated in **Section 5.2.1.1**, Railroad Operating Efficiency Gains, the growth rate of train volume is estimated at 0.93%. According to the Colorado 2030 Statewide Transportation Plan[x], vehicle miles traveled in Colorado will grow from 25.1 billion in 2000 to 41.9 billion in 2030. The corresponding average annual growth rate of traffic is equal to 1.72%.

Results

As indicated in **Table 5-15**, the total present value benefits of travel-delay reduction for railroad crossings in both Study Alternatives A and B (2012-2031) would be $29.1 million.

[viii] http://safetydata.fra.dot.gov/officeofsafety/

[ix] http://lmigateway.coworkforce.com/lmigateway/admin/gsipub/htmlarea/uploads/Pub200602byArea.xls

[x] http://www.dot.state.co.us/StatewidePlanning/PlansStudies/files_final2030update_jdc/2030%20Statewide%20Transportation%20Plan.pdf

Table 5-15 Vehicle Delay Reduction Benefits - Railroad Crossings

Year	Study Alignment A		Study Alignment B	
	Annual Benefit	Discounted present value	Annual Benefit	Discounted present value
2012	$1,385,800	$1,385,800	$1,384,400	$1,384,400
2013	$1,422,700	$1,392,800	$1,421,300	$1,391,300
2014	$1,460,700	$1,399,800	$1,459,100	$1,398,400
2015	$1,499,600	$1,406,900	$1,498,100	$1,405,400
2016	$1,539,600	$1,414,000	$1,538,000	$1,412,500
2017	$1,580,600	$1,421,100	$1,579,000	$1,419,700
2018	$1,622,800	$1,428,300	$1,621,100	$1,426,800
2019	$1,666,000	$1,435,500	$1,664,300	$1,434,000
2020	$1,710,400	$1,442,800	$1,708,700	$1,441,300
2021	$1,756,000	$1,450,100	$1,754,200	$1,448,600
2022	$1,802,900	$1,457,400	$1,801,000	$1,455,900
2023	$1,850,900	$1,464,800	$1,849,000	$1,463,200
2024	$1,900,300	$1,472,200	$1,898,300	$1,470,600
2025	$1,950,900	$1,479,600	$1,948,900	$1,478,100
2026	$2,002,900	$1,487,100	$2,000,900	$1,485,500
2027	$2,056,300	$1,494,600	$2,054,200	$1,493,000
2028	$2,111,200	$1,502,100	$2,109,000	$1,500,600
2029	$2,167,400	$1,509,700	$2,165,200	$1,508,200
2030	$2,225,200	$1,517,300	$2,222,900	$1,515,800
2031	$2,284,600	$1,525,000	$2,282,200	$1,523,400
Total	---	$29,086,900	---	$29,056,700

5.2.1.7 Reductions in Vehicle Operating Costs

Total vehicle operating costs are comprised of costs from fuel consumption, automotive parts replacement and maintenance, and insurance. Because new routes will pass through low volume crossings as well as areas of reduced population density, vehicle operating costs for drivers statewide are expected to be reduced. Benefits expected for automobile drivers include reduced costs of vehicle operation in terms of time and fuel savings. Because the cost of fueling is disproportionately large compared with other vehicle operating costs, this factor was used along with idle time savings for the basis of the benefits calculation.

Methodology

Citing the 2005 Transportation Research Board (TRB) study, 'Estimating the Benefits and Costs of Public Transit Projects ' [xi], automobile gasoline usage was assumed at 0.005 gallons per idling minute. The idle-time savings of 5 minutes at crossings in the study alignments in comparison with the existing route are provided in the Public Benefits section; 'Reductions in Travel Delay at Railroad Crossings'.

[xi] http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp78/guidebook/tcrp78.pdf

According to Denver's gasoline-price index[xii] (at the time of this study), the current gasoline price is $3.50 per gallon, and it is assumed that the gasoline price in the study period would remain at $3.50 per gallon in 2008 constant dollars. The benefit of vehicle operating cost reductions is given by:

Gasoline usage at idle time x delay-time savings x gasoline price
= 0.005 gallon/idle minute x Delay-time savings x $3.50/gallon (2008)
= $0.0151/idle minute (2008) x Delay-time saving of all grade crossings

Results

Based on the time savings for all grade crossings in the two study alignments compared with the existing route, it is estimated that the average annual benefits from vehicle operating cost reductions for Study Alignments A and B would be $1.13 million and $1.17 million, respectively, in 2008. Therefore, the total benefits accruing between 2012 and 2031 would be $28.6 and $29.6 million, respectively. The present value of these benefits would be $21.4 and $22.1million, respectively.

5.2.1.8 Reductions in Train-Vehicle Incidents

A decline in the frequency of train-vehicle incidents is expected following a reduction in train-vehicle exposure at the at-grade crossings along the alternative routes as compared to the existing route. The train-vehicle incident rate is calculated as a function of historical incident rates at major volume crossings in the State of Colorado, and the number of crossings projected on a given alternative.

Methodology

Two alternative routes have been assessed in the R2C2 Study (Study Alignments A and B), and the number of new crossings has been estimated for each alternative. In addition, a cost per incident type was specified - an input that was not included in the Public Benefits Study. Based on the 2004 National Safety Council report 'Estimating the Costs of Unintentional Injuries'[xiii], the value of fatality, injury, and property-damage only incidents were estimated at $3.92, $0.14, and $0.09 million, respectively (Table 5-16).

Based on historical incident data provided by the FRA, a distributional weight (frequency of incident outcomes) for each incident category is estimated. These weights are based on historical outcomes in train-vehicle incidents at rail-highway crossings from the FRA safety databases cited earlier. Based on these data, the average train-vehicle incident cost is calculated at $0.56 million (Table 5-16).

Table 5-16 Cost Per Incident Analysis

Incident Type	Frequency of Incident Types	Cost	Total Cost
Fatality Incident	0.118	$3,920,000	$462,600
Injury Incident	0.405	$140,000	$56,700
Property Damage Only Incident	0.477	$90,000	$42,930
Average Incident Cost			$562,240

An incident probability was estimated using the 10-year incident rate for local road at-grade crossings in the State of Colorado, which averaged 18.1 incidents per year at public rail highway crossings statewide[xiv]. This translates into a 0.71% probability of an incident on any one of the State's 2,535 public crossings. In a given

[xii] http://www.denvergasprices.com
[xiii] http://www.nsc.org/lrs/statinfo/estcost.htm#COST
[xiv] http://safetydata.fra.dot.gov/officeofsafety/ , query 1.07 (State of Colorado)

year, the 0.71% State average probability was then adjusted for the existing and alternative routes based on auto traffic / train exposure factors. As shown in Table 5-17, the incident probability per year (after adjusting for exposure) along the existing route (2.02%) is ten times higher than the alternative routes due to the higher auto traffic volumes at crossings.

Table 5-17 Cost Savings in Train-Vehicle Incidents

Item	Joint Line	Alignment A	Alignment B
Number of At-Grade Crossings on Route	101	64	65
Crossing Incident Probability / Year	2.02%	0.201%	0.201%
Average Incident Cost	$562,240	$562,240	$562,240
Annual Cost for Each Alignment	$1,147,100	$72,400	$73,600
2008 Difference between Joint Line and Alternative	-	$1,074,700	$1,073,500
Total Cost Savings (2012-2031)	-	**$27,916,200**	**$27,885,100**

AADT for the alternative routes is estimated using the same methodology as in the "Reductions in Travel Delay" section (based on low-traffic roads with similar characteristics to the Eastern Plains). It is estimated, in the lack of representative data, that all new Eastern Plains crossings would have the same daily traffic, and therefore their incident rates would be similar. It is also assumed that 17 trains are diverted from the existing route to a new bypass route. Average cost per incident on the existing route is calculated, along with the savings in incidents for Study Alignments A and B based on the number of public crossings in each alternative and traffic / train exposure, expressed in the adjusted crossing incident probability per year.

Results

Based on this approach, total cost savings in train-vehicle incidents for Study Alignment A and B (2012-2031) would be $20.7 million in both scenarios (Table 5-18).

Table 5-18 Cost Savings in Train-Vehicle Incidents

Year	Study Alignment A		Study Alignment B	
	Annual Benefit	Discounted present value	Annual Benefit	Discounted present value
2012	$1,074,700	$987,000	$1,073,500	$985,900
2013	$1,103,351	$992,000	$1,102,119	$990,900
2014	$1,132,767	$997,000	$1,131,502	$995,900
2015	$1,162,966	$1,002,100	$1,161,668	$1,001,000
2016	$1,193,971	$1,007,100	$1,192,638	$1,006,000
2017	$1,225,802	$1,012,200	$1,224,433	$1,011,100
2018	$1,258,482	$1,017,300	$1,257,077	$1,016,200
2019	$1,292,033	$1,022,500	$1,290,590	$1,021,300
2020	$1,326,479	$1,027,600	$1,324,997	$1,026,500
2021	$1,361,842	$1,032,800	$1,360,322	$1,031,700
2022	$1,398,149	$1,038,000	$1,396,588	$1,036,900
2023	$1,435,424	$1,043,300	$1,433,821	$1,042,100
2024	$1,473,692	$1,048,600	$1,472,047	$1,047,400
2025	$1,512,981	$1,053,900	$1,511,291	$1,052,700
2026	$1,553,317	$1,059,200	$1,551,582	$1,058,000
2027	$1,594,728	$1,064,500	$1,592,947	$1,063,300
2028	$1,637,243	$1,069,900	$1,635,415	$1,068,700
2029	$1,680,892	$1,075,300	$1,679,015	$1,074,100
2030	$1,725,705	$1,080,700	$1,723,778	$1,079,500
2031	$1,771,712	$1,086,200	$1,769,734	$1,085,000
Total	---	$20,717,200	---	$20,694,200

5.2.1.9 Emergency Vehicle Delays

It is assumed, as in the Public Benefits Study, that decreased train volume through congested areas will result in a reduction in the blockage of emergency vehicles by trains at rail-highway crossings. The diversion of trains to either Study Alignment A or B will shift some emergency vehicle delays to eastern Colorado; however, these delays are less probable in areas with lower highway and train volumes. New configurations will also contain fewer at-grade crossings, serving to further reduce emergency vehicle delays. A change from the existing route to Study Alignment A or B should therefore result in a net reduction in emergency vehicle delays at rail-highway crossings.

5.2.1.10 Impact to Truck Operations

As in the Public Benefits Study, the impacts to truck operations are not determined using quantitative analysis. There are many elements of the project which could potentially affect the trucking industry, though attempting to quantify these accurately would be difficult. However, it is possible to make some assumptions about the general impacts of this project on the trucking industry. One assumption is that traffic patterns will shift toward eastern Colorado as distribution and logistics facilities move into proximity with the new study alignment. A shift in rail traffic to eastern Colorado will also bring increased economic activity to the area, causing an

increased demand for trucks and freight-hauling in the eastern portion of the state. On the other hand, some freight movement previously handled by trucks may shift to rail transport due to the lower cost rail alternative. Finally, increased trucking traffic in eastern Colorado will cause faster wear of pavement in the area. It is uncertain how much of a cost this will incur in terms of increased road maintenance in the region, and whether this cost will be offset somewhat by increased economic benefit brought by changing traffic patterns in the area.

5.2.2 Economic Development Benefits

This section seeks to explain the economic development impacts to the public and private sectors in the event of a switch from the existing railroad configuration to Study Alignment A or B. The calculation of this benefit item has been approached using a revised method from the earlier Public Benefits Study, while keeping with the assumptions of increased employment associated with construction of the alternative routes. An approach based on the RIMS II input-output data for the State of Colorado is utilized. RIMS II multipliers are used to show impacts on industrial output, household earnings, and employment brought about by activity in any industry. The specific industry factors are multiplied by the industry activity (such as capital spending or job growth) to more accurately reflect ripple effects in the local economy from the industry activity. Multipliers are produced by the Bureau of Economic Analysis[xv], and are based on regional data for Colorado.

It is believed that economic development would occur statewide considering the linkages among industrial sectors and geographical extensions of the railroad. As a result, the R2C2 Study does not categorize economic development into Front Range or eastern Colorado development as in the Public Benefits Study.

5.2.2.1 Private Sector Economic Development Impacts

In the Public Benefits Study, in addition to the shipping cost savings for grain producers in eastern Colorado, private sector benefits originated from the following sources: 1) An increase in coal-output in Western Colorado, 2) New economic growth along the Front Range due to redevelopment of urban rail yards in Denver and developments associated with improved rail facilities, and 3) New economic growth in eastern Colorado due to improved rail access and development of intermodal facilities.

In the current benefit analysis scope, improvements to east-west rail connections have been eliminated from consideration. In addition, it is assumed that the existing rail alignment would not be removed since it will continue to serve Front Range freight customers, as well as a potential future passenger rail service. Finally, no major new intermodal facilities are assumed in the vicinity of the new study alignments.

As a result of these assumptions, potential coal-output increases in Western Colorado, and development and property-value increases in the Denver area are not included in the R2C2 Study. Moreover, a substantial share of the economic development benefits associated with a major new intermodal facility has also been eliminated from consideration.

The result of this narrowing assumption results in a substantial reduction in the economic development benefits compared with the Public Benefits Study.

Methodology

Private sector economic development benefits would accrue as a result of expansions or enhancements to domestic industries in Colorado. As in the Public Benefits Study, it is assumed that these benefits would take five years to fully develop, and would grow by 2.0% annually from 2017 onward. Consistent with the midrange scenario in the Public Benefits Study, it is believed that the new alternatives would create 75

[xv] http://www.bea.gov/bea/regional/rims/

additional jobs in Colorado, and that these jobs would be distributed among the 69 various industries according to current industrial employment patterns (Table 5-19).

Table 5-19 Impacts to Colorado Economic Development

Category		Value ($M)
Assumptions		
	Number of new permanent non-construction jobs created (Jobs are assumed phased-in over a five-year period from 2012 to 2016)	75
	Increase in annual final demand for statewide goods and services (millions)	$11.3
	Benefit to Industry	$1.1
Employment and earnings impacts		
Statewide impacts		
	Direct jobs	75
	Indirect and induced jobs	110
	Total job creation	185
	Wage earnings associated with job creation	$7.6
Tax impacts (million/year)		
Federal taxes		
	Personal tax	$0.3
	Social security tax	$0.2
	Corporate profit tax	$0.1
	Indirect business tax	$0.1
	Subtotal increase in federal taxes	$0.7
State and local taxes		
	Personal tax	$0.1
	Social security tax	$0.1
	Indirect business tax	$0.3
	Subtotal increase in Colorado tax revenues	$0.5

Note: Monetary units are in Millions of USD

Results

As indicated in Table 5-19, Impacts to Colorado Economic Development, based on RIMS II multipliers, the 75 direct permanent jobs created would lead to 110 indirect and induced jobs, for a total of 185 jobs. This corresponds to an increase of approximately $7.6 million in total wage earnings. Based on RIMS II multipliers, the total additional employment would yield an increase in final demand (purchases of goods and services by their final users) of approximately $11.3 million, which is assumed to be phased in over a five-year period from 2012 to 2016.

Assuming that about one-tenth of this increase in final demand would represent additional value added (i.e., an addition to Gross State Product), the annual benefit in 2012 would be approximately $1.1 million. As indicated in Table 5-20, the total discounted private benefits in Colorado would be $19.9 million.

Table 5-20 Private Benefits in Colorado from 2012 to 2031

Year	Benefits by year	Discounted benefits
2012	$1.10	$1.01
2013	$1.12	$1.01
2014	$1.14	$1.01
2015	$1.17	$1.01
2016	$1.19	$1.00
2017	$1.21	$1.00
2018	$1.24	$1.00
2019	$1.26	$1.00
2020	$1.29	$1.00
2021	$1.31	$1.00
2022	$1.34	$1.00
2023	$1.37	$0.99
2024	$1.40	$0.99
2025	$1.42	$0.99
2026	$1.45	$0.99
2027	$1.48	$0.99
2028	$1.51	$0.99
2029	$1.54	$0.99
2030	$1.57	$0.98
2031	$1.60	$0.98
Total discounted benefits		**$19.90**

5.2.2.2 Public Sector Economic Development Impacts

The Public Benefits Study calculated Public Sector economic impacts based on increases in employment brought by better rail access, savings from transporting grain products with rail rather than trucking, construction benefits, and highway maintenance cost savings with decreased truck traffic.

Methodology

The method used in this study forecasts public-sector benefits in terms of tax-revenue increases by applying the input/output tax multipliers in Colorado associated with increases in earnings from new employment.

Results

As indicated in **Table 5-19**, from 2012 to 2031, the annual increase in federal tax revenues would be $0.7 million, and the annual increase in Colorado tax revenues would be $0.5 million. Total increases in tax revenues from 2012 to 2031 would be $24.0 million.

5.2.2.3 Benefits to Grain Producers in Eastern Colorado

Considering that northeastern Colorado is a major center of wheat production, there are considerable economic advantages to grain producers and grain shippers in adding a north-south train route to eastern Colorado. Benefits will accrue to grain producers and shippers in the form of greater access to direct north-south train routes. Another factor that will benefit grain producers is the new option of moving an increased

amount of grain by rail, the low-cost shipping option for grain when compared to truck transport. Either new route will also reduce train mileage traveled, as well as miles traveled through congested areas in proximity to Denver and the Front Range. Study Alignment B, however, would appear to provide service closer to the grain producing areas.

Methodology

The calculation of this benefit item has been approached using a revised cost for shipping by rail and truck, and a re-estimation of the shipping-cost savings for grain producers in eastern Colorado. Approximately one additional train every two weeks is estimated along the bypass routes (22 trains per year) transporting wheat and possibly other grains. This equates into a 57% increase in eastern Colorado rail grain, and 17% of total production being moved by rail compared to the Public Benefits Study. It was assumed that annual grain production will remain at a constant level until 2031. $1.20 was a standard shipping rate for grain freight per ton in 2004; this rate was escalated to $1.39 in 2008 dollars. Average transport rates were calculated using wheat rates from various origins to various destinations as published in the USDA's Grain Transportation Report 2003; adjusted, to 2008 dollars. A fuel efficiency was assumed for shipping trucks having a loaded capacity of 28.5 tons based on data from the 'Indiana Rail Plan' study in 2002[xvi]. A weighted average cost to minor and principle arterials for combo 5-axle semis[xvii] was used.[xviii] Refer to **Table 5-21** for calculations.

Results

It is believed that, the annual shipping-cost savings for grain producers in eastern Colorado is $1.2 million. Total discounted grain producer shipping-cost savings for the period from 2012 to 2031 would be about $18.3 million. It was assumed that the federal and state tax rate in Colorado would stay constant until 2031, and therefore the associated increases in tax revenue would be $2.06 million from 2012 to 2031.

5.2.2.4 Highway Maintenance

Converting from truck transportation to rail transportation would result in changes in the number of grain truck traffic on highways, which may result in the reduction of highway maintenance costs and savings in taxes. In addition, fewer grain trucks on roads would lead to a reduction in the collection of diesel fuel taxes from grain hauling activities. Reductions in highway maintenance costs are projected to counterbalance the reduction in tax revenues from truck transportation of grain, and result in positive savings for the public.

[xvi] http://www.in.gov/indot/3654.htm
[xvii] Personal communication with Denver Tolliver, Upper Great Plains Transportation Institute, February 21, 2004
[xviii] Personal communication with Denver Tolliver, Upper Great Plains Transportation Institute, February 21, 2004

Table 5-21 Benefits to Grain Producers

Item	Existing Route	Alternative Routes
Average annual production (bushels)[xix]	66,146,800	66,146,800
Colorado commodity flow by truck	89%	83%
Colorado commodity flow by rail	11%	17%
Average bushels by truck	58,870,652	54,703,404
Average bushels by rail	7,276,148	11,443,396
Bushels per truck	850	850
Number of trucks	69,260	64,357
Truck rates per loaded ton-mile	0.055	0.055
Distance from Brush to Las Animas (miles)	175	175
Cost of truck Brush to Las Animas (per bu.)	$0.29	$0.29
Cost per truck	$247.35	$247.35
Bushels per unit train (52 cars/4750 cubes)	171,600	171,600
Number of unit trains	37	59
Rail rates per loaded (Ton-Mile)	0.026904	0.026904
Distance from Brush to Las Animas (miles)	175	175
Cost of rail Brush to Las Animas (per bu.)	$0.14	$0.14
Cost per unit train	$24,195.60	$24,195.60
Total Cost of Unit Trains	**$4,234,230**	**$4,234,230**
Total Cost of Trucks	**$17,131,360**	**$15,918,690**
Total Cost of Grain Shipment	**$21,365,590**	**$20,152,920**
Average Annual Savings		**$1,212,670**
Highway Maintenance		
Cost of highway maintenance[xx]	$0.51/mile	$0.51/mile
Colorado diesel tax[xxi]	$0.449/g	$0.449/g
Diesel efficiency (miles per gallon)[13]	5.6	5.6
Total highway maintenance costs	$5,391,815	$5,010,108
Total diesel tax revenues	$853,460	$793,047
Net costs (maintenance cost minus tax revenue)	$4,538,360	$4,217,060
Average Annual Savings		**$321,300**

As indicated in **Table 5-21**, the total savings in highway maintenance by switching from the existing route to the study alternatives is about $321,300 per year. Over the period from 2012 to 2031, the discounted highway maintenance savings amount to $4.9 million.

5.2.2.5 Construction Benefits

New investment in railroad construction, like any major construction expenditure, will increase construction industry employment and produce more jobs in the supporting labor force in eastern Colorado. Increases in

[xix] Average annual Colorado production 1998 to 2007. http://www.nass.usda.gov/Statistics_by_State/Colorado/index.asp#.html
[xx] HDR report, based on communication with Denver Tolliver, Upper Great Plains Transportation Institute, February 2004. Updated to 2008 USD
[xxi] http://www.coloradogasprices.com/tax_info.aspx

regional earnings will stimulate the consumption of goods and services in the region, which will in turn generate tax revenue through income taxes, sales tax, as well as other taxes paid commensurate with additional earnings. As a result, railroad construction on either study alignment would have a beneficial impact on local economies in the state of Colorado.

Methodology

Estimates of construction related employment, earnings, and associated tax revenues have been based on the construction cost estimates for each study alignment alternative. Total rail construction costs have been estimated at $0.797 and $1.188 billion dollars for Study Alignments A and B respectively. These estimates include the Beshoar Junction for both A and B, and the extension of existing sidings, which applies only to Study Alignment A. Unlike the Public Benefits Study, these estimates no longer include east-west rail segments and intermodal facilities, which are now no longer part of the project definition.

For purposes of this analysis, total (direct, indirect, and induced) impacts on employment and earnings have been estimated. These have been classified as public benefits (i.e., benefits accruing to the general public) although the earnings are private sector wages. Resulting increases in state and local tax revenues for the major sources of tax revenue affected by increased earnings and expenditures have also been estimated.

As noted, the estimated construction costs for each alternative provide the basis for the construction economic impact assessment. However, land acquisition costs have been excluded, as these will not generate significant employment effects. To estimate the impacts as they occur over the construction period, it was assumed that the construction cost would be distributed evenly over the 4-year construction period from the end of 2008 to 2012. (This "construction period" of 2009 – 2012 is assumed only for the purposes of the analysis in this Chapter. As the Next Steps Figure 9-1 in Chapter 9 – Recommendations and Next Steps indicates, there are many steps to be accomplished that would require a significant amount of time before any construction of a bypass could occur.)

As indicated by the RIMS II Colorado multipliers provided by the BEA, the total employment multiplier for the construction sector is 19.5 – therefore, a $1 million increase in final demand in the Colorado construction sector would lead to an additional 19.5 jobs. The average hourly salary for construction laborers was $12.9/hour or $28,000/year in 2006. The average annual construction salary has been adjusted to $29,700 in 2008 terms.

Results

The total earnings multiplier for the construction sector is 0.7755. Therefore, a $1 million investment in Colorado's railroad construction industry would lead to an increase of $775,500 in total household income. It is assumed that the rates of income tax, sales tax, and other taxes associated with the additional wages would stay constant until the year 2031. The employment and earnings impacts of the two study alternatives are indicated in Table 5-22. Because construction related employment, earnings, and tax revenues are non-recurring, employment is reported in person years. In addition, earnings and tax revenues are reported as cumulative at the completion of the first year of construction (2009), after the second year (2010) and after assumed project completion in 2012. After 2012, construction related impacts no longer occur as a result of this project.

Table 5-22 Construction Impacts on the State and Local Economy

Year	Through 2009		Through 2010		Through 2012 (project completion – full build)	
Alternative	A	B	A	B	A	B
Employment and earnings impacts						
Total Job Creation (person years, cumulative through year of construction)	2,820	4,390	5,650	8,780	11,300	17,560
Total Wage Earnings (millions $s, cumulative)	$112.5	$174.8	$225.0	$349.5	**$450.0**	**$699.0**
Tax Impacts (millions $s, cumulative)						
State/Local Taxes						
Personal Income Tax (4.63%)	$5.2	$8.1	$10.4	$16.2	$20.8	$32.4
State and local sales taxes on earnings (state sales @ 2.9% plus variable county and local taxes, assumed = 5%)	$4.5	$7.0	$9.0	$14.0	$18.0	$28.0
State and local sales tax on construction materials and supplies	$3.9	$5.8	$7.8	$11.6	$15.7	$23.3
Total state and local (major) taxes (cumulative through year of construction)	$13.6	$20.9	$27.2	$41.8	**$54.5**	**$83.7**

5.2.3 Environmental Benefits

5.2.3.1 Natural Environment Impacts

In the Public Benefits Study, environmental impacts are classified into the following categories: the effects on the natural and built environment, noise and vibration, air quality, energy usage reduction, and visual benefits to the Front Range. Recognizing that the existing railroad would not be removed if either of the alternatives is implemented, the effects on the natural and built environment, as well as visual benefits to inhabitants of the Front Range, are not included in this environmental benefit analysis. The effects of noise and vibration as well as proximity to the railroad and corresponding impacts on property value would also be removed following the same assumption. This report updates the unit value of each pollutant, and includes additional pollutants such as PM_{10} and SO_X. Finally, energy usage savings given by a decrease in fuel consumption are included in the transportation benefits section of this report, not in the environmental section as in the Public Benefits Study.

Environmental benefits are closely linked to air quality benefits. Pollutants of principal concern to transportation projects include carbon monoxide (CO), carbon dioxide ($CO_{2)}$, and particulate matter under 10 microns in diameter (PM_{10}) emitted from vehicle exhaust. Nitrogen oxides (NOx), and volatile organic compounds (VOCs) are additional pollutants released by vehicles, and are sources of concern being that they are precursors in the formation of ozone (O_3) in the atmosphere. Furthermore, diesel-fueled vehicles (buses and trains) emit sulfur oxides (SO_X). These pollutants are also emitted by the facilities which generate electricity used in powering light and heavy-rail vehicles. These emissions are a known factor in elevated ozone levels, respiratory problems, reduced visibility in the atmosphere, and plant, tree, and crop damage. Carbon Monoxide impairs the flow of oxygen in humans. High levels can result in death, while low levels are known to lead to breathing difficulties and dizziness. PM_{10} is a known factor in respiratory problems and premature

death. It is the primary source of haze reducing visibility. NO_X and SO_X can cause lung damage and respiratory illness, as well as contribute to acidic deposition causing harm to water bodies, vegetation, and buildings.

The emissions savings calculations in the following three sections (5.2.3.2 - 5.2.3.4) are a result of formal air quality modeling outputs by the PB Environmental Group. Emissions benefits are calculated using unit values of pollutants for each benefit, and are in terms of the public health savings that occur from a reduction in emissions for each pollutant category.

As seen in the detailed estimates of each category of emissions reductions (train related, grade crossing related, and truck related), by far the overwhelming emissions reductions occur as a result of reduced train miles and locomotive diesel emissions.

5.2.3.2 Emissions-Reduction Benefit of Trains

Emissions reductions will take place in the Front Range as a shift of train traffic to eastern Colorado occurs. In addition, overall emissions reductions are assumed to take place in either of the two study alignments as trains are traveling fewer miles along shorter routes. Emissions increases in eastern Colorado are expected as train traffic is re-routed to one of the alternatives, though a train vehicle emission reduction is expected for the State of Colorado as a whole. By avoiding the steep grades of the existing route, fewer locomotives will be required and higher average speed will result in fewer hours of locomotive operations.

Methodology

As noted earlier, travel time savings estimates were obtained from the RTC modeling effort. This benefit item is calculated using the following formula:

= Reduction in train hours traveled x Emissions of pollutants per train hour x (unit cost of each pollutant)

Pollutant values were obtained from a Victoria Transport Policy Institute (VTPI) data set[xxii], and an EPA report[xxiii] for Sulfur Dioxide. These reports are used for pollutant values in the following two benefit calculation sections as well. Values used for individual pollutants represent the mean of VTPI high and low values, and are shown in Table 5-23.

Table 5-23 Emissions Values Per Ton

Pollutant	Value
CO	$370
NOx	$9,560
VOC	$7,650
PM_{10}	$6,300
CO2	$15
SO2[xxiv]	$100

Results

Total emissions-reduction benefits (2012-2031) given by train operating efficiency gains in Study Alignment A would be $164.9 million, and $265.0 million in Study Alignment B (Table 5-24).

[xxii] www.vtpi.org/airpollution.xls
[xxiii] http://yosemite.epa.gov/ee/epalib/nwlet.nsf/434d5673ac53b154852564cd007a8a0d/913052d2b67dbe4d852564e0007e61bf!OpenDocument

Table 5-24 Emissions-Reduction Savings of Trains

Year	Study Alignment A		Study Alignment B	
	Annual Benefit	Discounted Annual Benefit	Annual Benefit	Discounted Annual Benefit
2012	$ 9,240,800	$ 8,487,000	$14,846,300	$13,635,300
2013	$ 9,410,800	$ 8,461,300	$15,119,500	$13,593,900
2014	$ 9,584,000	$ 8,435,600	$15,397,700	$13,552,700
2015	$ 9,760,300	$ 8,410,000	$15,681,000	$13,511,500
2016	$ 9,939,900	$ 8,384,500	$15,969,500	$13,470,500
2017	$10,122,800	$ 8,359,000	$16,263,400	$13,429,700
2018	$10,309,100	$ 8,333,700	$16,562,600	$13,388,900
2019	$10,498,800	$ 8,308,400	$16,867,400	$13,348,300
2020	$10,691,900	$ 8,283,100	$17,177,700	$13,307,700
2021	$10,888,700	$ 8,258,000	$17,493,800	$13,267,400
2022	$11,089,000	$ 8,232,900	$17,815,700	$13,227,100
2023	$11,293,100	$ 8,208,000	$18,143,500	$13,187,000
2024	$11,500,900	$ 8,183,100	$18,477,300	$13,146,900
2025	$11,712,500	$ 8,158,300	$18,817,300	$13,107,100
2026	$11,928,000	$ 8,133,500	$19,163,500	$13,067,200
2027	$12,147,500	$ 8,108,800	$19,516,100	$13,027,600
2028	$12,371,000	$ 8,084,200	$19,875,200	$12,988,100
2029	$12,598,600	$ 8,059,700	$20,241,000	$12,948,700
2030	$12,830,400	$ 8,035,200	$20,613,400	$12,909,400
2031	$13,066,500	$ 8,010,800	$20,992,700	$12,870,200
Total	$220,984,600	$164,935,100	$355,034,600	$264,985,200

5.2.3.3 Truck Travel Time Emissions Benefits

This benefit is a result of the decrease in vehicle idle-times at rail-highway crossings. With fewer delays and less car idling time at crossings, considerable benefits accrue in the form of automobile emissions reduction. Benefits are stated in terms of cost-savings brought by reductions in the emissions of selected air pollutants. Reductions in the emission of CO, NO_X, VOC, PM_{10}, and CO_2 are stated in terms of monetary damage costs to public health.

Methodology

This benefit item is calculated using the following formula:

= Total idle time in minutes for each crossing x Number of crossings x
Emissions of pollutants per idling minute x (unit cost of each pollutant)

Pollutant unit values are provided in the VTPI document referenced in section 5.2.3.2. The benefits of vehicle idle time reduction are estimated as indicated in **Table 5-25** below.

Table 5-25 Vehicle Idle-Time Emissions Benefits

Year	Study Alignment A		Study Alignment B	
	Annual Benefit	Discounted Annual Benefit	Annual Benefit	Discounted Annual Benefit
2012	$ 16,600	$ 15,200	$ 16,300	$ 15,000
2013	$ 15,600	$ 14,000	$ 15,300	$ 13,800
2014	$ 14,700	$ 12,900	$ 14,500	$ 12,800
2015	$ 14,100	$ 12,100	$ 13,900	$ 12,000
2016	$ 13,700	$ 11,600	$ 13,400	$ 11,300
2017	$ 13,300	$ 11,000	$ 13,100	$ 10,800
2018	$ 13,000	$ 10,500	$ 12,800	$ 10,300
2019	$ 12,800	$ 10,100	$ 12,500	$ 9,900
2020	$ 11,700	$ 9,100	$ 11,500	$ 8,900
2021	$ 11,600	$ 8,800	$ 11,300	$ 8,600
2022	$ 11,300	$ 8,400	$ 11,100	$ 8,200
2023	$ 11,300	$ 8,200	$ 11,100	$ 8,100
2024	$ 11,400	$ 8,100	$ 11,100	$ 7,900
2025	$ 11,400	$ 7,900	$ 11,200	$ 7,800
2026	$ 11,500	$ 7,800	$ 11,200	$ 7,600
2027	$ 11,600	$ 7,700	$ 11,300	$ 7,500
2028	$ 11,600	$ 7,600	$ 11,400	$ 7,400
2029	$ 11,700	$ 7,500	$ 11,500	$ 7,400
2030	$ 11,900	$ 7,500	$ 11,700	$ 7,300
2031	$ 12,000	$ 7,400	$ 11,800	$ 7,200
Total	$ 252,800	$ 193,400	$ 248,000	$ 189,800

Results

Total emissions-reduction benefits (2012-2031) given by vehicle idle-time reduction in Study Alignment A would be $193,400, and $189,800 in Study Alignment B.

5.2.3.4 Emissions-Reduction Benefit of Reduced Truck Transport

As transport by truck is diverted to rail, it can be expected that air pollution on the Front Range and the Eastern Plains will be reduced. This benefit category calculates the air quality benefits that arise from the diversion of truck transport of goods to rail transport. Benefits, as in the previous section, are stated in terms of cost-savings brought by reductions in the emissions of selected air pollutants. Again, as in Section 5.2.3.2, reductions in the emission of CO, NO_X, VOC, PM, and CO_2 are stated in terms of their monetary damage costs to public health.

Methodology

This benefit item is calculated using the following formula:

= Total truck transport miles per trip x Number of truck trips x
Emissions of pollutants per mile of travel x (unit cost of each pollutant)

Pollutant unit values are provided in the VTPI document referenced in section 5.2.3.2. The benefits of truck travel time emissions benefits are estimated as indicated in Table 5-26.

Table 5-26 Truck Travel-Time Emissions Benefits

Year	Study Alignment A		Study Alignment B	
	Annual Benefit	Discounted Annual Benefit	Annual Benefit	Discounted Annual Benefit
2012	$ 112,300	$ 103,100	$ 112,300	$ 103,100
2013	$ 101,900	$ 91,600	$ 101,900	$ 91,600
2014	$ 92,100	$ 81,100	$ 92,100	$ 81,100
2015	$ 84,300	$ 72,600	$ 84,300	$ 72,600
2016	$ 76,300	$ 64,400	$ 76,300	$ 64,400
2017	$ 69,300	$ 57,200	$ 69,300	$ 57,200
2018	$ 63,000	$ 50,900	$ 63,000	$ 50,900
2019	$ 65,300	$ 51,700	$ 65,300	$ 51,700
2020	$ 53,700	$ 41,600	$ 53,700	$ 41,600
2021	$ 49,400	$ 37,500	$ 49,400	$ 37,500
2022	$ 45,500	$ 33,800	$ 45,500	$ 33,800
2023	$ 41,800	$ 30,400	$ 41,800	$ 30,400
2024	$ 40,100	$ 28,500	$ 40,100	$ 28,500
2025	$ 36,900	$ 25,700	$ 36,900	$ 25,700
2026	$ 34,600	$ 23,600	$ 34,600	$ 23,600
2027	$ 32,600	$ 21,800	$ 32,600	$ 21,800
2028	$ 31,400	$ 20,500	$ 31,400	$ 20,500
2029	$ 30,200	$ 19,300	$ 30,200	$ 19,300
2030	$ 29,900	$ 18,700	$ 29,900	$ 18,700
2031	$ 28,700	$ 17,600	$ 28,700	$ 17,600
Total	$ 1,119,300	$ 891,600	$ 1,119,300	$ 891,600

Results

Total discounted emissions-reduction benefits (2012-2031) given by truck travel reduction in Study Alignment A would be $891,600. In Study Alignment B the emissions reductions values would be the same, since the reduction in truck-miles traveled is the same along both routes.

5.2.4 Safety and Security Benefits

5.2.4.1 Hazardous Material Transport

This item is derived from reduced exposure to hazardous materials experienced by routing of such materials along the Study Alignments A or B. Because the geographical regions through which the study alignments pass have lower population densities, lower highway traffic volumes, and fewer at-grade crossings than the existing route, a reduced risk to hazmat exposure as a result of train incidents is estimated. In the case that a train

carrying hazardous material is involved in an incident, the health risks would likely be quite serious. Using the same assumption as the Public Benefits Study, it is projected that between 75 and 90 percent of highly radioactive waste will be transported by rail in the coming years. Although the risk of an incident is present, the probability of occurrence for this type of incident is minuscule. As a result, this benefit item is discussed only in a qualitative manner, as in the Public Benefits Study. The absence of comparable cases to garner data from is a further reason no attempt is made to quantify the risks related to potential hazardous material incidents at rail-highway crossings.

5.2.4.2 Terrorism Risk

As in the Public Benefits Study, this category is discussed only qualitatively. The small probability of a terrorist attack on a through freight train in Colorado, as well as the absence of past cases to refer for comparative data, make a quantitative assessment of terrorism risk ineffectual. However, a reduction in any risk of a terrorist attack that exists today is estimated. One reason for this estimate is that moving the train farther from the Front Range area will make the alternative routes a less attractive target for terrorist groups as fewer major population centers would be affected by an attack. Another reason for the estimate of terrorist risk reduction is that having multiple route choices by which to transport goods through the state would make it considerably more difficult for terrorist groups to track redundancy in train travel patterns.

5.2.4.3 Pedestrian-Train Incidents

The R2C2 Study, like the Public Benefits Study, includes only a qualitative assessment of impacts of the project on pedestrian-train incidents. The probability of a freight train incident involving a pedestrian is already minute, and it is believed that a shift in train traffic to even less populated areas of Colorado will serve to further reduce this probability. Because of the improbable nature of these incidents, a quantitative assessment of this item was not performed.

5.2.5 Quality of Life Benefits

The subjective analysis of "Quality of Life Benefits" varies in this analysis depending on the particular geography that is being evaluated. The quality of life along the Front Range would be expected to improve. Those citizens of the Eastern Plains region immediately adjacent to any new rail bypass will undoubtedly experience a negative impact because of train noise, impacts to their farming and ranching operations, etc.

For inhabitants of the Front Range, a decrease in train traffic will benefit those affected in categories analyzed previously, including reduced delays, reduction in train traffic, emissions reductions etc. Noise due to train traffic and air pollution is expected to decline as well. In the Front Range, the redistribution of through freight train operations will also increase the feasibility of potential future passenger rail services for areas of the State expected to grow in both jobs and population. A Rail Passenger Feasibility Study being conducted by the Rocky Mountain Rail Authority is expected to provide detailed costs and benefits to the State from such possible rail passenger service.

In eastern Colorado, some new jobs and economic development benefits may offset some of the negative quality of life factors such as increases in air pollution, rail traffic, noise, impacts to farms and ranches in the vicinity of any new rail alignment, etc. Depending on funding, CDOT is proposing an additional detailed study of the impacts and benefits of a possible new rail bypass to the eastern Colorado counties, communities and landowners affected by any future new rail relocation effort.

5.3 Summary Results

Table 5-27 summarizes the benefits as they have thus far been estimated. Because a potentially major source of public benefit associated with introduction of passenger rail service in the existing corridor has not been fully assessed, these results remain preliminary and only partially complete. For comparison purposes, the estimated costs of Study Alignments A and B as shown in Chapter 3 – Bypass Alignments are $797 million for Study Alignment A and $1.188 billion for Study Alignment B.

Table 5-27 Benefit Summary ($ millions)

Benefit items	Study Alignment		Sector Classification
	A	B	
Transportation Benefit	**244.3**	**383.9**	
Railroad operating efficiency savings (including fuel savings)	50.9	83.2	Private business (railroads)
Railroad MOW costs	-5.5	27.9	Private business (railroads)
Trackage Right Payment (paid by BNSF)	-103.1	0.0	Private business (railroads)
Trackage Right Payment (received by UP)	103.1	0.0	Private business (railroads)
Shipper operating efficiency savings (including fuel savings)	94.6	124.6	Private business (shippers)
Avoided capital costs for new grade-separated crossings	35.4	78.7	Public sector (local and state government)
Reduction in roadway vehicle delay at railroad crossings	26.7	26.7	Public
Reduction in roadway vehicle operating costs	21.4	22.1	Public
Reduction in the number train-vehicle incidents	20.7	20.7	Public
Economic Development Benefits (total excludes tax revenues to eliminate double counting)	**560.8**	**839.0**	
Additional business sector earnings	7.1	7.1	Private business
Tax revenues associated with increases in sector earnings	24.0	24.0	Public sector (local and state government)
Shipping cost savings for grain producers in eastern Colorado	18.3	18.3	Private business
Tax revenues associated with cost savings and increased net earnings for grain producers	2.1	2.1	Public sector (local and state government)
Highway Maintenance Cost Savings	4.9	4.9	Public sector (local and state government)
Construction related earnings - additional wage earnings (cumulative, entire construction period, including multiplier effects)	450.0	699.0	Public (resident labor force)
Construction related benefits – additional state and local tax revenues (cumulative, entire construction period, including multiplier effects)	54.5	83.7	Public sector (local & state government)

Table continued on following page

Table 5-27 Benefit Summary ($ millions) (continued)

Benefit items (Continued)	Study Alignment		Sector Classification
	A	B	
Environmental Benefits	166.0	266.1	
Air quality benefits – emission reduction benefit of trains	164.9	265.0	Public
Air quality benefits - emission reduction benefit of vehicle idle-time reduction	0.2	0.2	Public
Air quality benefits – diversion of freight from truck to rail in eastern Colorado	0.9	0.9	Public
TOTAL	971.2	1489.1	
Summary – Distribution of Benefits by Beneficiary Group			
Private business benefits	165.5	261.1	
Public benefits[xxv]	684.9	1034.5	
Public sector benefits (reduced government expenditures and increased government tax revenues)[xxvi]	120.9	193.4	

Note: Values in this table are presented as discounted present values of un-escalated future benefits

[xxv] includes employment and earnings benefits from construction; excludes tax revenue impacts where double counting would occur
[xxvi] excludes tax revenue impacts where double counting would occur

6. Environmental Issues Scan

R2C2
RAIL RELOCATION *for* COLORADO COMMUNITIES

6.0 Environmental Issues Scan

6.1 Environmental Analysis

An environmental issues scan was conducted in order to understand the presence or absence of key resources that occur along Study Alignments A and B. The analysis accomplished for this study is not intended to predetermine any outcome of any environmental process that would be required at some future time to fulfill federal, state and/or local responsibilities under the National Environmental Policy Act (NEPA), the Federal Endangered Species Act, the National Historic Preservation Act, the Clean Water Act, the Clean Air Act, or other regulatory requirements. Additionally, the limited scope pursued under R2C2 did not include efforts to address the rich heritage of the families who have worked the lands of eastern Colorado. The involvement of a future Citizen's Advisory Board and results of public and agency scoping would help to capture the important community resources that would need to be evaluated in any future NEPA analysis. See **Section 6.13** about NEPA activities that would take place if a bypass project were to go forward.

Only existing data from readily available resources has been utilized, and no data already reported in the Public Benefits Study has been recapped in this Study.

6.2 Study Area

Generally, a study area of 1000 feet to either side of the centerline of Study Alignments A and B was used to determine the presence of most environmental resources. One-half mile to either side of the centerlines was used in the cultural resources file search, and one mile to either side of the centerlines was utilized for hazardous material sites (e.g., landfills). In addition, a 2.5 mile radius around each of the urban areas of Las Animas, Limon and Brush was used. Spatial data files were imported in GIS and a 1000-foot buffer was added to the study alignments. ArcGIS was utilized to determine the presence or absence of potential environmental resources along both study alignments. **Figures 6-1 – 6-4** recap the data.

These two potential study alignments were selected only to identify alternative costs, railroad operational savings, and environmental resources that may be encountered in eastern Colorado if a rail bypass project were to be pursued at some point in the future.

6.3 Resources

To aid the reader's comparison of what was accomplished under the Public Benefits Study and R2C2, **Table 6-1** is provided:

Table 6-1 Study Elements

Study Element from Public Benefit Study	Update Status for R2C2
Study Area	The Public Benefit Study evaluated a swath which was generally 20-30 miles in width. The swath evaluated for R2C2 is generally 2,000 feet plus a 2.5 mile radius around Las Animas, Limon and Brush. For exceptions to this study area, see the individual resource discussion.
Archeological/Historic	Archeological and Historical resources are updated based upon a file search of the Colorado Office of Archaeology and Historic Preservation database for all known previously recorded cultural resources. In keeping with the earlier study, resources are categorized by county.
Special Status Plants and Animals	Special Status species are updated based upon the most current data. In keeping with the earlier study, species are categorized by county.
Major Creeks and Rivers, Wetlands and Other Surface Water Resources	Major creeks and rivers to the study area are included in the R2C2's GIS mapping. No new information has been recorded regarding Wetlands and Other Surface Water Resources.
Hazardous and Contaminated Materials Sites	Hazardous and contaminated material sites are updated from the earlier study based upon searches of the most-commonly used databases.
Water Wells and Oil and Gas Well Fields	Data regarding the proximity of permitted water, oil and gas wells to the study alignments are included in R2C2's GIS mapping.
Demographics	The 2000 Census is the most current information for demographics, the same year that was complied for the Public Benefit Study. No newer information is available, and therefore demographic information is not compiled in this Study.
Noise and Vibration	A comparison is provided in R2C2 by study alignment segment which could potentially experience a change in the number of freight trains traveling through or near those segments. A discussion of train horn noise is also provided. No noise or vibration analysis has been conducted for R2C2.
Air Quality	Air quality emissions for key pollutants are estimated for Study Alignments A and B to compare against the No Build alignment emissions.
State Parks/Conservation Lands	The state parks have been mapped to determine if either of the study alignments intersect or are adjacent to state parks. In addition, a GIS layer was obtained from the Colorado Natural Heritage Program that indicates potential conservation areas. Any areas that are near were documented. The Colorado Division of Wildlife (CDOW) has data available through the Natural Diversity Information Source FTP Server. The CDOW-owned lands layer was also added to the map and analyzed to determine if any CDOW lands are located near the proposed study alignments.
Prime Farmland	Due to the project being located in eastern Colorado which is replete with pasture and farm lands, the Colorado Natural Resource Conservation Service website was consulted for the presence of prime and unique farmland. Data has been categorized by county.
Land Use	This resource was studied in the Public Benefit Study. No new analysis has been developed for R2C2.
Acquisition	The right of way acquisition processes for either a CDOT-led or a Railroad-led effort is summarized for R2C2.

Figure 6-1 Environmental Resources Map 1

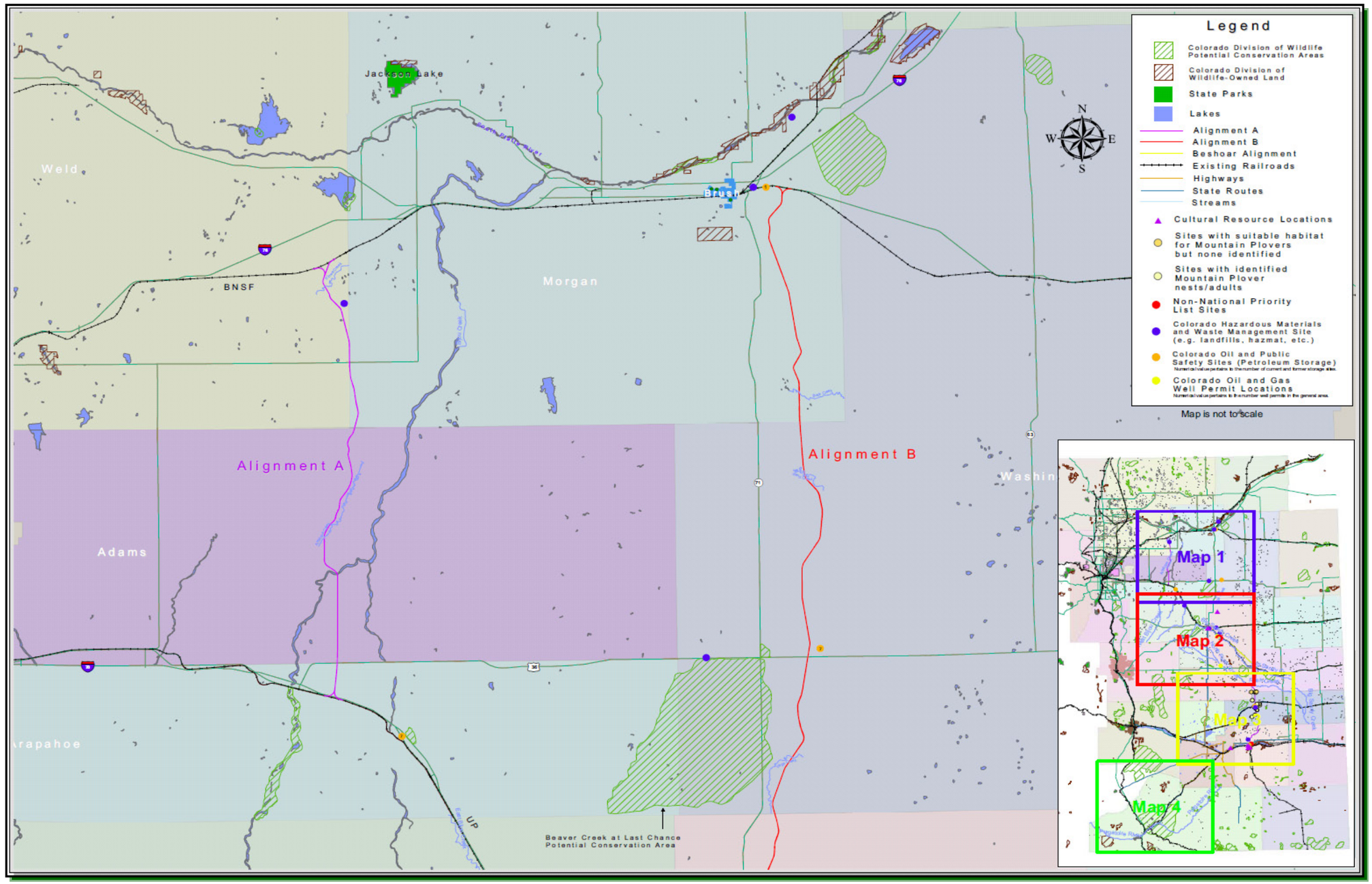


Figure 6-2 Environmental Resources Map 2

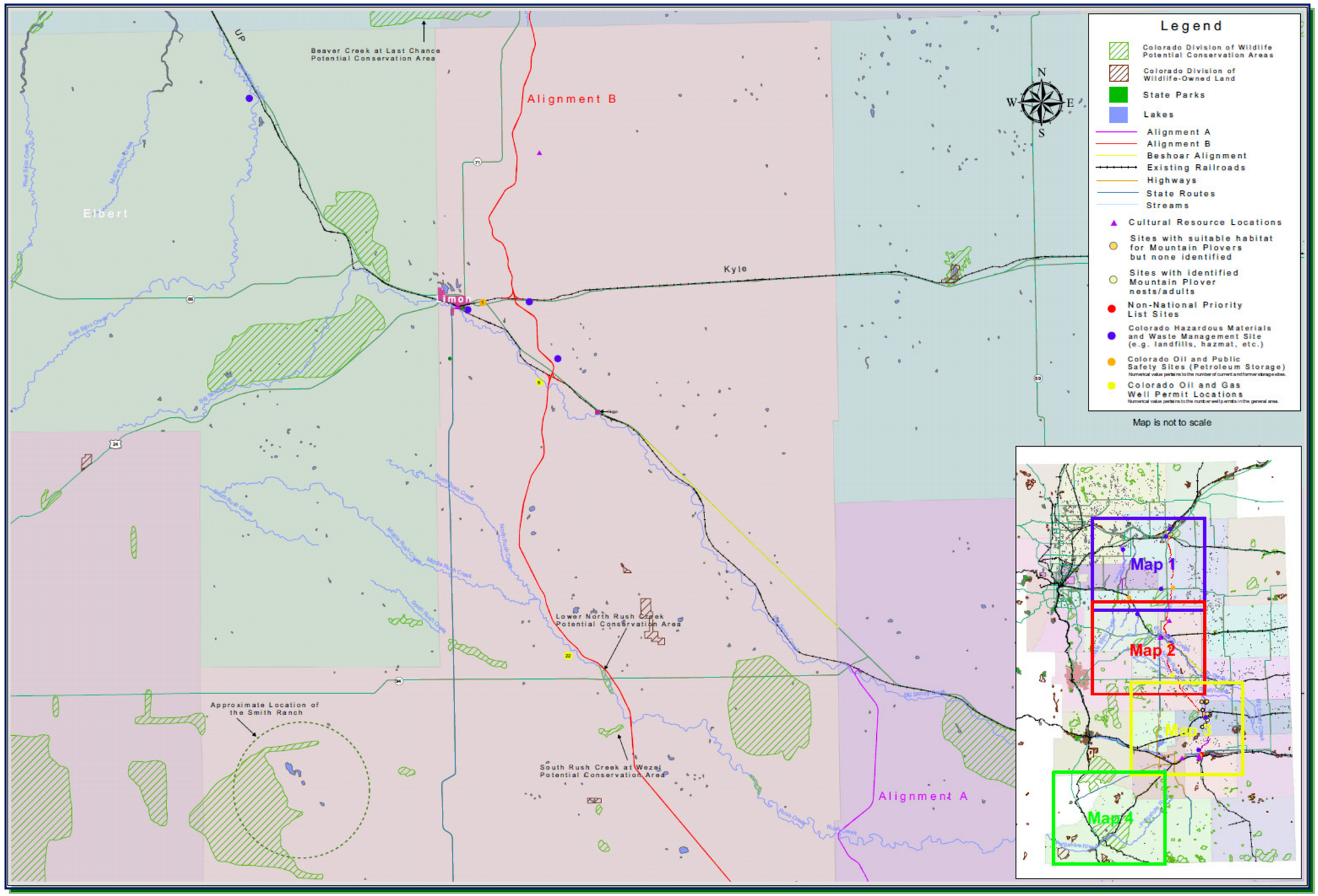


Figure 6-3 Environmental Resources Map 3

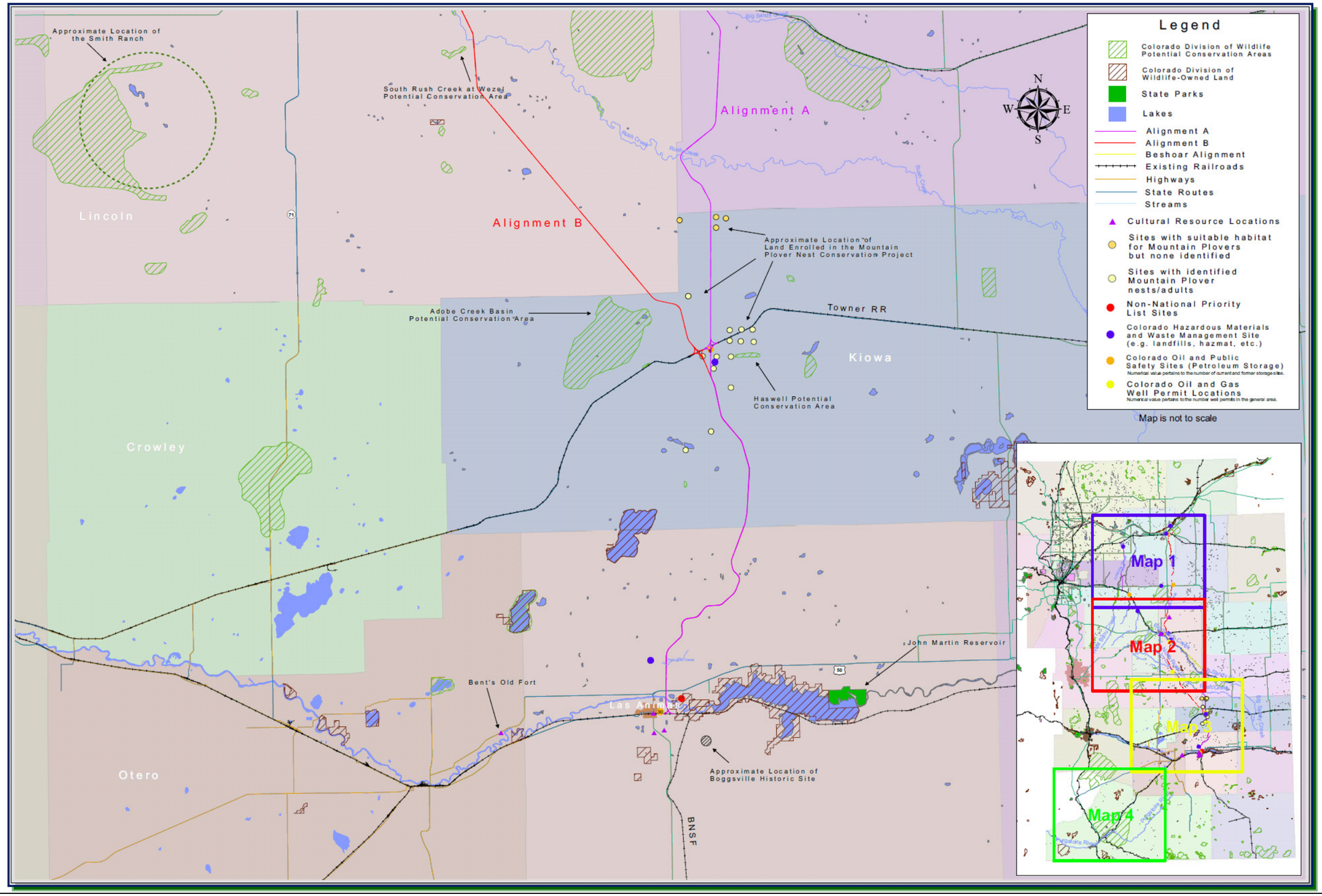
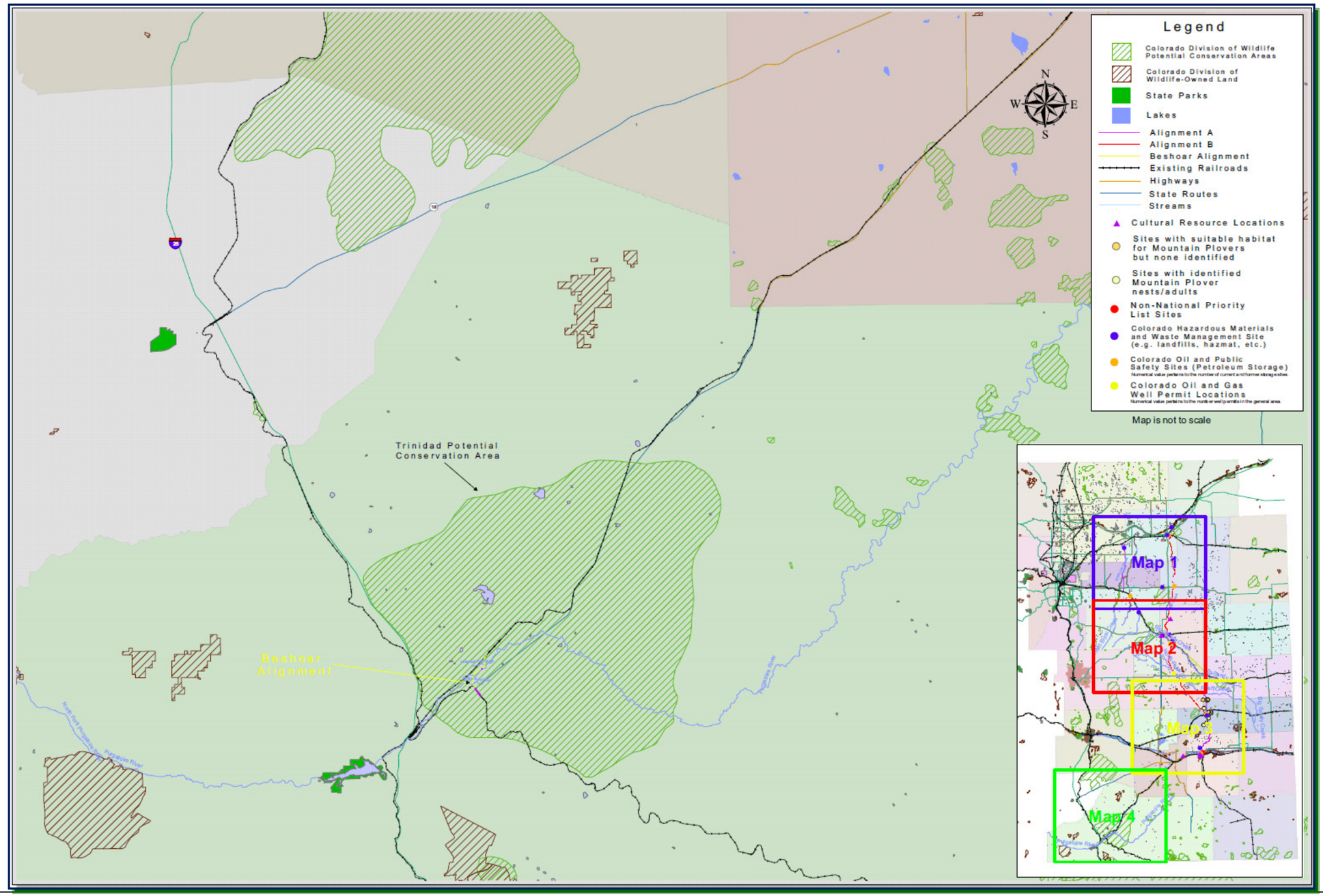


Figure 6-4 Environmental Resources Map 4



6.4 Archaeological/Historic

A total of 46 known resources are within or intersect the Cultural Resources Study Area or fall outside of the study area but reside within an area of interest raised by the public during the public meetings (see **Table 6-2**). Three sites have been listed in the State Register of Historic Places: the Haswell Women's Booster Club-Booster Hall, located in Haswell; the Walks Camp Park, located north of Limon; and the Hugo Union Pacific Railroad Roundhouse in Hugo. Four resources are listed in the National Register of Historic Places (NRHP): the Bent County Courthouse and Jail, in Las Animas; Boggsville National Historic Site, south of Las Animas; the Limon Depot, in Limon; and Bent's Old Fort National Historic Landmark, west of Las Animas.

View looking east of historic Missouri Pacific rail line Located in Haswell, Colorado.

Two sites have been officially determined eligible for the NRHP:

- Missouri Pacific Railroad (Towner to North Avondale Junction) National Register Eligible Historic District; and
- Denver Texas and Fort Worth Railroad, Beshoar Junction, Beshoar Siding

The Victoria and Southern (V&S Railway), formerly known as the Missouri Pacific Railroad, intersects the study area north of Las Animas, and the Denver Texas Railroad (when it existed) intersected the study area at the Beshoar Junction.

Two other resources have been recommended as (field) eligible (i.e., the results of professional investigation but prior to an official determination), but no official determinations have been made at this time:

- Segments of the Santa Fe Trail; and
- U.S. 6 – Brush to Sterling.

Segments of the Santa Fe Trail would likely be officially determined eligible for the NRHP, assuming they still retain sufficient physical integrity. U.S. 6 between Brush and Sterling may also be determined eligible for the NRHP due to its contributions to the broad patterns of farm-to-market history and due to the historic nature of some of its bridges, ditches and individual design of culverts. However, no new segments of Study Alignment B cross U.S. 6.

William Bent's Gravesite, located south of Las Animas, has been recommended not eligible but no official determination has been made.

Two resources, both prehistoric archaeological sites, have no NRHP status or recommendations; both resources were recorded in the 1930s, and locations and other data have never been verified. All other known documented resources are either recommended or officially determined not eligible for the NRHP.

Table 6-2 Archaeological / Historic Resources

County	Site Name	Study Alignment		Proximity To One Mile Study Area		Site Type	NRHP Status	Sensitivity
		A	B	Within	Outside			
Arapahoe		√		√		Archaeological	None	Unknown
Adams		√		√		Archaeological	Field not eligible	Low
Bent	Fort Lyon Canal	√	√	√		Historical archaeology	Field not eligible	Low
	Bent County Courthouse/ Jail				√	Historic building	NRHP	High
	Boggsville				√	Historic district	NRHP	High
	William Bent's Grave				√	Historic grave	Field not eligible	Low
	Santa Fe Trail segments	√	√	√		Historical archaeology	Field eligible	High
Cheyenne		√		√		4 various archaeological sites	Officially or field not eligible	Low
Kiowa		√	√	√		2 historic buildings	Field not eligible	Low
	Haswell Women's Booster Club	√	√	√		Historic building	SRHP	High
	Missouri Pacific Railroad	√	√	√		Historic railroad district	Officially eligible	High
Las Animas	Elson Bridge	√	√	√		Historic structure location	Structure originally listed in the NRHP but has since been removed and delisted	Low
	Denver Texas and Fort Worth RR, Beshoar Jct., Beshoar Siding	√	√	√		Historic railroad	Officially eligible	High
	Southside Ditch	√	√	√		Historic ditch	Not Eligible for the NRHP	Low

County	Site Name	Study Alignment		Proximity To One Mile Study Area		Site Type	NRHP Status	Sensitivity
		A	B	Within	Outside			
Lincoln		√	√	√		14 various archaeological sites	Officially or field not eligible	Low
	Walks Camp Park				√	Historic building	SRHP	High
	Limon Depot*	√		√		Historic building	NRHP	High
	Beaver Creek to Big Sandy Transmission Line			√		Historical archaeology/ historic transmission line	Field not eligible	Low
	Hugo Round House*	√		√		Historic building	SRHP	High
Morgan	Various Transmission Lines	√	√	√		Historical archaeology/ historic transmission line	Officially or field not eligible	Low
			√	√		3 historical archaeological sites	Field or officially not eligible	Low
	U.S. Highway 6 segment				√	Historical archaeology/ historic highway	Field eligible	High
Otero	Bent's Old Fort				√	Historic district	National Historic Landmark	High
Washington			√	√		Archaeological	Officially not eligible	Low

No previously recorded resources were located within the study area in Elbert or Weld Counties.
SRHP - State Register of Historic Places
NRHP - National Register of Historic Places
*With the exception of the Hugo Round house and the Limon Depot, no file search was conducted for those segments of Alignment A that would utilize existing track.

The study methodology included consideration of several resources of interest to the general public in the vicinity of the project area including Bent's Old Fort National Historic Site, Boggsville National Register Site, the Bent County Courthouse and Jail, William Bent's Grave, and Walks Camp Park. These sites are currently outside of the study area corridor, but should be considered in any final alternative selection. The Limon Depot and the Union Pacific Roundhouse in Hugo are resources along the existing rail line that is a part of Study Alignment A.

A number of surface drainages cross the study alignments, with a higher number crossing Study Alignment B than Study Alignment A. This generally reflects a greater possibility for prehistoric resources to occur in Study Alignment B.

6.5 Special Status Plants and Animals

In order to determine the types of threatened and endangered species and species of concern in the study area, CDOT provided a list of all potential threatened and endangered species, species of concern and other species where favorable conditions increase the likelihood of presence in the study area. In addition to the list of species, CDOT also provided the habitat types where these species occur. **Table 6-3** lists the species and their associated habitats.

Table 6-3 Listed Wildlife and Plant Species by County

Species	Status	Habitat	Adams	Arapahoe	Bent	Cheyenne	Elbert	Kiowa	Las Animas	Lincoln	Morgan	Washington	Weld
Massasauga rattlesnake	SC	Grassland			√			√	√	√			
Mountain plover	SC		√	√	√	√	√	√	√	√	√	√	√
Texas horned lizard	SC				√			√	√	√			
Ferruginous hawk	SC		√	√	√	√	√	√	√	√		√	√
Greater prairie chicken	SE											√	
Long-billed curlew	SC					√	√	√	√		√	√	√
Common kingsnake	SC				√				√				
Northern pocket gopher	SC			√			√			√			√
Lesser prairie chicken	ST,FC				√	√		√		√			
Black-footed ferret	FE, SE		√	√	√	√	√	√	√	√	√	√	√
Swift fox	SC			√	√	√	√	√	√	√	√	√	√
Western burrowing owl	ST		√	√	√	√	√	√	√	√	√	√	√
Black-tailed prairie dog	SC		√	√	√	√	√	√	√	√	√	√	√
Gunnison prairie dog	FC								√				
Plains sharp-tailed grouse	SE						√						√
Northern leopard frog	SC	Riparian	√	√	√	√	√	√	√	√	√	√	√
Bald eagle	ST		√	√	√	√	√	√	√	√	√	√	√
Preble's jumping mouse	FT, ST		√	√			√				√		√
Cylindrical papershell	SC										√		√
New Mexico jumping mouse	FC								√				
Arkansas darter	FC				√	√	√	√	√	√			
Common kingsnake	SC		See designation under Grassland										

Species	Status	Habitat	Adams	Arapahoe	Bent	Cheyenne	Elbert	Kiowa	Las Animas	Lincoln	Morgan	Washington	Weld
Northern redbelly dace	SE												√
Piping plover	FT, ST		√	√	√		√	√		√	√	√	√
Plains leopard frog	SC				√	√	√	√	√	√			
Least tern (interior pop)	FE		√	√	√		√	√		√	√	√	√
Pallid sturgeon	FE		√	√			√			√	√	√	√
Western snowy plover	SC				√			√					
Whooping crane	FE		√	√			√			√	√	√	√
Yellow mud turtle	SC				√								
Ute ladies'- tresses orchid	FT		√	√							√		√
Colo butterfly plant	FT												√
Mountain plover	SC	Cropland	See designations under 'Grassland'										
Common kingsnake	SC												
Northern Pocket Gopher	SC												
Whooping Crane	FE		See designation under "Riparian'										

Federal – Candidate FC
Federal – Endangered FE
Federal – Threatened FT
State – Special Concern SC
State – Endangered SE
State - Threatened ST

6.6 Habitat Types

Three primary habitats form the land uses in eastern Colorado. The most prevalent are the grassland of eastern Colorado. This habitat consists mainly of shortgrass prairies, which have been an important component in agricultural productivity and are ecologically diverse, containing such grass species as: buffalo grass, blue grama, and occasionally taller grasses such as little bluestem and western wheatgrass. Productive grasslands that were once primarily used for raising livestock have largely been converted to agricultural croplands.


Mountain Plover
Source: Coalition for Otero Mesa

The second most prevalent type of habitat for special status species is riparian areas. Riparian zones are found in eastern Colorado along the banks of many of its creeks and rivers. These areas are ecologically diverse and contribute to the health of other aquatic ecosystems by filtering out pollutants and preventing erosion.

The most prevalent area is cropland, which is a common land use throughout most of eastern Colorado. As mentioned above, these areas were once shortgrass prairies that were since converted to cropland or serve as

pasturelands. Today, some of these agricultural lands are rated as 'prime farmlands' due to their sustained high yield crops. See Section 6-12 for more information.

Mountain Plover Conservation Project - During a public meeting in Limon, it was brought to the attention of the Consultant Project Team that several plots of land are currently enrolled in the *Mountain Plover Conservation Project* through the Rocky Mountain Bird Observatory (RMBO). The Consultant Project Team received permission to identify the sites where mountain plover adults or nests have been spotted as well as those sites with suitable habitat. This data was not available in electronic format, so the approximate locations were manually added to the GIS map. The sites that were provided by the RMBO are all located in Kiowa County and the majority of them appear to fall in proximity to the study area for Study Alignment A and to the portion of overlap between Study Alignments A and B at the south end of the study corridors. See Figure 6-3 for these locations.

6.7 Major Creeks and Rivers

The attributes of the river files obtained from CDOT do not indicate if the rivers shown are permanent, intermittent, ephemeral, etc., but it was assumed that the majority of what are shown as rivers in the GIS files are either intermittent or ephemeral streams. The only assumed perennial streams that intersect the study alignments are the Arkansas River, which is located near Las Animas at the southern end of the project and the Purgatoire River, which is located near Trinidad.

Since these water bodies are considered waters of the U.S., the U.S. Army Corps of Engineers (Corps) has jurisdiction over the rivers. This means that a federal permit would be required to conduct any work inside the ordinary high water mark of these waters, including building a bridge over them. West Bijou Creek, the Big Sandy, and Rush Creek may also be jurisdictional and should be investigated during the future detailed study. West Bijou Creek may also be jurisdictional and should be investigated during any future detailed study. Table 6-4 lists the potential creek and river crossings for Study Alignment A, Study Alignment B, and Beshoar Junction.

Table 6-4 Potential Creek and River Crossings

Study Alignment A	Study Alignment B
✦ Kiowa Creek/Jack Rabbit Creek ✦ Rock Creek ✦ Antelope Creek ✦ West Bijou Creek ✦ Big Sandy Creek ✦ Aroya Gulch ✦ Rush Creek ✦ Stacy Lakes Draw ✦ Fort Lyons Canal ✦ Arkansas River	✦ Shears Draw ✦ Buck Creek ✦ Sand Creek – affected in numerous locations ✦ Vega Creek – affected in numerous locations ✦ North Fork Arikaree River ✦ Arikaree River – numerous crossings ✦ Big Sandy Creek ✦ Long Branch ✦ Rush Creek – Numerous Crossings ✦ Fort Lyon Canal ✦ Arkansas River
✦ Beshoar Junction: ❑ Purgatorie River ❑ Leitensdorfer Arroya ❑ Hoehne Ditch ❑ South Side Ditch	

6.8 Hazardous and Contaminated Materials Sites

View of Lincoln County Landfill (large mound on horizon) from approximately ¾ mile east of Study Alignment B.

Study Alignments A and B were also assessed with regard to the presence of regulated environmental sites. Assessment included Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund), Resource Conservation and Recovery Act (RCRA), and petroleum storage sites. Water well and oil and gas well locations within a distance of approximately one mile to either side of each alignment were also assessed. Federal and state databases available online were utilized to identify such sites. Research results for CERCLA, RCRA, and petroleum storage sites were assessed with regard to their proximity to the proposed bypass study alignments according to industry-standard search-distance criteria (i.e., one-mile or less) for each type of record, as described in American Society for Testing and Materials (ASTM) standard E1527-05. **Table 6-5** shows the findings from the database searches.

*Table 6-5 Hazardous Material, Water Well, and Oil and Gas Well Sites**

Site Type	Sensitivity	Adams	Arapahoe	Bent	Cheyenne	Elbert	Kiowa	Las Animas	Lincoln	Morgan	Washington	Weld	Notes
CERCLA Sites (i.e., Superfund)	Very Low												No current or listed NPL sites were identified.
Colorado Hazardous Material and Waste Management Sites	Low			√		√	√		√	√			Five solid waste disposal facilities were identified within 1 mile of Study Alignment A, and two solid waste disposal facilities within 1 mile of Study Alignment B.
Colorado Petroleum Storage Tank Sites	Low		√	√			√		√	√	√		UST and AST sites located predominantly within towns and cities along the two study alignments.
Colorado Division of Water Resources Well Permit Sites	Low	√	√	√	√	√	√	√	√	√	√	√	Water wells located predominantly near towns and cities along each study alignment.
Colorado Oil and Gas Well Permit Sites	Low								√				Oil and gas sites appear to occur only in Lincoln County.

Research indicated that there are no National Priority List (NPL) or Superfund sites located within one mile of either proposed R2C2 study alignments. Investigation of the Colorado Hazardous Materials and Waste

Management Division (HMWM) database revealed five solid waste disposal facilities within 1 mile of Study Alignment A, and two solid waste disposal facilities within 1 mile of Study Alignment B. Although these locations are within the search distance criteria, the locations can be avoided, thereby minimizing potential impacts.

Review of the Colorado Division of Oil and Public Safety (OPS) database of registered petroleum storage tank sites (COSTIS) identified underground storage tank (UST) and above ground storage tank (AST) sites are predominantly located within towns and cities along the two study alignments. Construction of a future alignment likely will avoid such locations and impacts are expected to be minor. The Colorado Division of Water Resources water well permit database indicates that water wells occur predominantly near towns and cities along each study alignment. As such, minor impacts are expected from or to water wells as a result of constructing either railroad alignment. Review of the Colorado Oil and Gas Conservation Commission database indicates the study alignment corridors contain very few oil or gas wells, and therefore potential impacts will likely be avoided and are expected to be low.

6.9 Noise

Typically, train activities can produce noise impacts from a variety of sources, including operations, ground vibration, and noise from wheels and horns. Train horns can be the most annoying of these sources, as federal law requires that locomotive horns be sounded upon approaching every "unsealed" public grade crossing (e.g., a train and rail crossing without grade separation).

This law also requires each lead locomotive to have an audible warning device that produces a sound level of at least 96 decibels (dBA) at least 100 feet ahead of the locomotive. The minimum noise level of 96 dBA (with averages between 100 and 110) assures that the train can be clearly heard and recognized over ambient background noise in a variety of environments, such as inside an enclosed automobile or truck cab. In addition, all major railroads have operating rules that require their engineers to blow train horns at highway-rail grade crossings as a warning to motorists and pedestrians.

Figure 6-5 Example Noise Levels

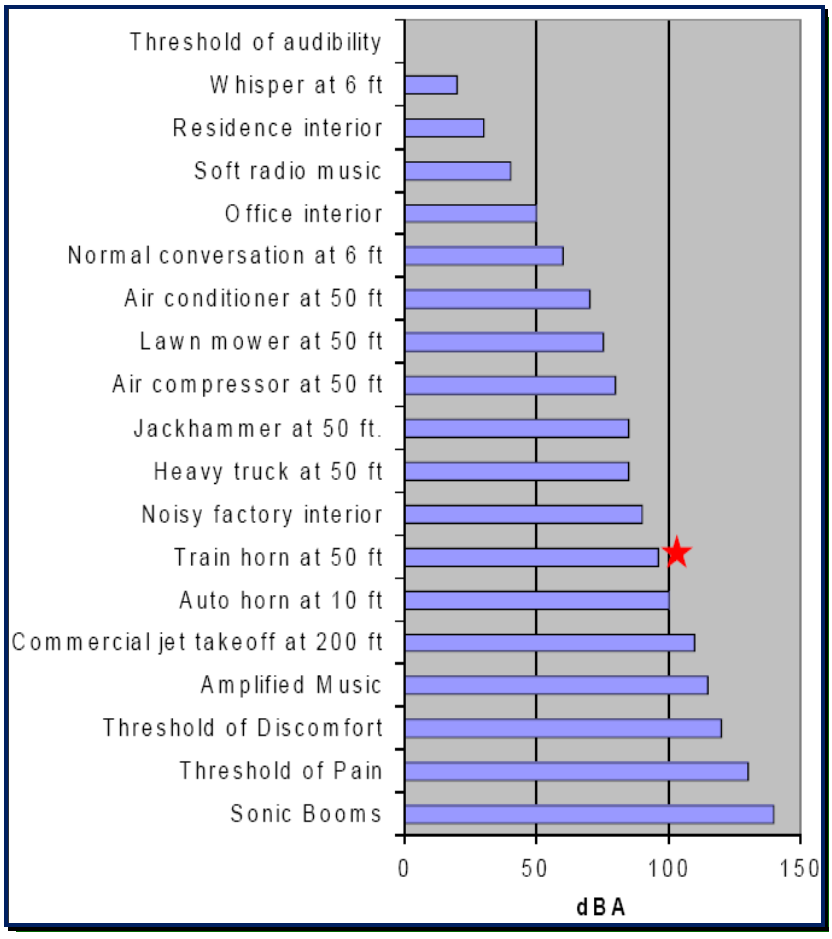


Figure 6-5 shows examples of noise levels for various day-to-day activities compared with noise from a train horn. This chart demonstrates that train horn noise at 50 feet (which can range from 96 and 110 dBA on average) can be as loud as a noisy factory or an automotive horn at 10 feet. This range of noise is considered

"very loud" on its lower end to "deafening" at the highest level. Jackhammers and air compressors are quieter than train horns, by approximately 10 dBA. This would mean that jackhammers are half as noisy as train horns, since every 10 dBA increase in noise level is perceived as a subjective doubling in loudness.

Train horns are currently blown (and impacts to existing residents and businesses occur) every day along the existing portions of Study Alignment A and in Las Animas. (See **Table 6-6**.)

Table 6-6 Potential Increases and/or Decreases of Trains along Route Segments

Route	New Route	Existing Route	Presence of Trains		
			No Change	Additional Trains	Fewer Trains
Study Alignment A – Full Trains					
Brush to Wiggins		√	√		
Wiggins to Las Animas		√			√
Wiggins to Peoria	√			√	
Peoria to Aroya		√		√	
Aroya to Las Animas	√			√	
Las Animas to Campo		√	√		
Study Alignment A – Empty Trains					
Las Animas to Trinidad		√		√	
Trinidad to Pueblo		√			√
Pueblo to La Junta		√			√
Pueblo to Denver		√			√
Denver to Wiggins		√			√
Study Alignment B – Full Trains					
Brush to Las Animas	√			√	
Brush to Las Animas	√			√	√
Las Animas to Campo		√	√		
Study Alignment B – Empty Trains					
Las Animas to Trinidad		√		√	
Pueblo to La Junta		√		√	
Trinidad to Pueblo		√			√
Pueblo to Denver		√			√
Denver to Wiggins		√			√

There is a potential for projected train horn noise to interfere with the relatively quiet solitude that describes much of the land uses along the Study Alignments A and B.

The sounding of locomotive horns or whistles in advance of highway-rail grade crossings has been used as a universal safety precaution by railroads since the late 1800s. The manner in which horns have been sounded (two longs, one short and one long) was standardized in 1938. Since that time, in some locations across the

U.S., "Whistle Bans" have been established by local ordinance or through agreements with particular railroads. Unfortunately, the silencing of locomotive horns, without improving the safety design of the crossings, subsequently increased the number of vehicle/train accidents at crossings by 85%. The Federal Railroad Administration (FRA) will therefore no longer allow communities to ban trains from sounding horns at road crossings unless they put other safety measures in place to protect drivers.

It has been a long-held policy that safety considerations necessitating sounding of train horns take precedence over the nuisance effects of such noise. FRA is very aware that train horns, whistles, and bells can disturb those living near railroad tracks; however, these warning devices have significantly reduced grade-crossing collisions by providing motorists with audible alerts of an approaching train. In response, the FRA issued regulations that specify when trains must sound a locomotive horn while approaching and entering upon public crossings, and provides exceptions to that requirement. This enables communities to create Quiet Zones, in which locomotive horns are not routinely sounded at grade crossings, thereby improving the quality of life by permitting the silencing of locomotive horns at grade crossings while still ensuring that safety is maintained.

6.10 Air Quality

The proposed relocation of the freight rail from the Front Range to the Eastern Plains is expected to cut state-wide emissions of criteria pollutants. This will result from the improved rail routes, faster train speeds and less vehicle idling at the rail crossings. The study looked at the twenty year horizon from 2012 to 2032. The annual savings of train travel under Study Alignments A and B against the No Build alignment were from 29,500 to 68,000 hours. The savings in idle time compared with the No Build were from 59,500 to 85,000 hours. (See **Table 6-7**.) CO, NO_x, PM, SO_2 and VOC emissions analyzed in this study decreased compared to emissions under the No Build alignment by tens to thousands of metric tons annually. (See **Table 6-8**.) Reductions under Study Alignment A were smaller than under Study Alignment B due to greater reductions in annual operational time.

Table 6-7 Time Reductions

Factor	Analysis Years	Study Alignment A (hours)	Study Alignment B (hours)
Annual Rail Time Reductions	2012 – 2032	29,500 – 42,500	47,500 – 68,000
Annual Rail Crossing Idle Time Reductions		60,500 – 85,000	59,500 – 83,500

The air quality in the Front Range corridor will improve with the proposed relocation, while local concentrations in eastern Colorado may increase but are likely to remain well below the appropriate National Ambient Air Quality Standards (NAAQS) due to the following reasons:

- The air quality levels in eastern Colorado are currently well below the standards;
- EPA only monitors for PM_{10} in Prowers County because it is a maintenance area for PM_{10}, but PM levels did not exceed the standard there since 1992; and
- Air quality levels at the Front Range monitors close to the freight rail corridor currently do not exceed NAAQS for the pollutants of concern considered in this study.

Table 6-8 Pollutant Saving over the No-Build

Factor		Study Alignment A (in metric tons)						Study Alignment B (in metric tons)					
		VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2
Annual Train Emissions Decrease	Analysis Years 2012 - 2032	46 – 66	219 – 316	804 – 1158	20 – 30	20 – 29	66 – 95	74 – 107	352 – 507	1292 – 1860	33 – 47	32 – 46	106 – 153
Annual Rail Crossing Idle Emissions Decrease		1	5	0.3	0.1	0.1		1	5	.3	1	0.1	
Annual Total Emissions Decrease		**47 – 67**	**224 – 321**	**804 – 1159**	**20 – 30**	**20 – 29**	**669 – 959**	**759 – 108**	**357 – 512**	**1292 – 1860**	**33 – 48**	**32 – 46**	**106 – 153**

Note: Numbers rounded.

6.11 State Parks/Conservation Lands

A GIS file was obtained from the Colorado State Land Board that displays the state-owned lands. There are numerous small plots of land that are owned by the State Land Board as potential sites for schools.


North Rush Creek

'State parks' were isolated and mapped to determine if either of the study alignments intersected or are adjacent to these resources. While there are no state parks located within the study area for either corridor, there are state parks located near the study alignments. (See **Section 6-4** for a discussion about the Walks Camp Park north of Limon.) Jackson Lake State Park is located more than 10 miles northeast of the northern end of the Study Alignment A and nearly 30 miles northwest of the northern end of Study Alignment B. John Martin Reservoir State Park is located on the northeastern end of John Martin Reservoir, east of the city of Las Animas. While this state park is more than 10 miles east of the southern end of Study Alignments A and B, a parcel of land reserved for John Martin Reservoir is within 500 feet of the study alignments. It is unlikely that a proposed study alignment would impact either of these state parks.

6.11.1 Potential Conservation Areas

Information was obtained from the Colorado Natural Heritage Program's (CNHP) website that indicates potential conservation areas. According to the metadata for the GIS datasets, "The CNHP collects data on rare and imperiled species and natural communities in Colorado. Potential conservation areas (PCAs) are derived from these data. A potential conservation area represents CNHP's best estimate of the primary area supporting the long-term survival of targeted species and natural communities."

While not designated conservation areas, PCAs have been identified as having the greatest potential for conservation. In order for these areas to become "official" conservation areas, it would require cooperation or dedication of the land from the property owner.

These are areas that have been identified as having either general biodiversity interest, moderate significance, high significance, very high significance, or outstanding significance. There is only one PCA, Lower North Rush Creek that falls within the study area of either corridor. It is rated "moderate" and is located in the corridor for Study Alignment B. There are five other sites that are located within one to three miles from the study alignments: Study Alignment A- Haswell, high significance; Study Alignment B- Beaver Creek at Last Chance, high significance; South Rush Creek at Wezel, very high significance; and Adobe Creek Basin, moderate significance. The Trinidad Potential Conservation Site is rated "very high significance" and is located in the Beshoar Junction corridor.

During future studies, these areas should be considered for their ecological significance, even though they aren't official conservation areas.

6.12 Prime Farmland

Prime farmland, according to the Natural Resources Conservation Service (NRCS) is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses. It has the combination of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if it is treated and managed according to acceptable farming methods. . . . ".

Some prime farmlands are of national significance (e.g., those found along the South Platte River basin in Weld County), and others are of state significance (i.e., land other than prime farmland which has a good combination of physical and chemical characteristics for the production of crops). Irrigation is the key differentiator between these lands and others which hold the potential of becoming prime, if irrigated. For example, Kiowa County has "high potential dry cropland of statewide importance" that could move to the prime category if irrigated.

Prime farmland and high potential dry croplands have been identified for the following counties in which the proposed study alignments are located:

- Adams
- Arapahoe
- Elbert
- Kiowa
- Bent
- Weld
- Morgan

6.13 Future NEPA Documentation Requirements

Before a bypass route could be built, certain environmental regulatory requirements would need to be met. The primary requirement would be compliance with the National Environmental Policy Act (NEPA). Compliance with NEPA would occur irrespective of the project participants (i.e., whether or not CDOT concluded its participation in the bypass effort).

NEPA serves to ensure that federal agencies use a systematic and interdisciplinary approach to decision making when its actions may affect the quality of the human environment. In order to achieve this objective, NEPA regulations require that certain processes occur, including agency and public participation. While the ultimate decision regarding the NEPA action rests with the lead federal agency, other agencies and the public are to be engaged at key milestones. The primary milestones include project scoping, the development of the project's

purpose and need, the identification of reasonable alternatives, the assessment of alternatives including the resources to be examined and the criteria to be used in that assessment, the determination of significance of impacts, the identification of possible mitigation measures, the identification of the preferred alternative, and an opportunity to comment on official draft and final documents.

6.13.1 The Route Selection Process

Route selection ultimately occurs during the NEPA study in the selection of a preferred alternative. The results of planning studies may or may not be used as a starting point for NEPA. In the instance of R2C2, one plausible scenario would be for Study Alignments A and B to be among those alternatives considered for further evaluation. These alternatives, along with any other reasonable alternatives that move through the assessment process described above, would be evaluated for consistency with the project's purpose and need and would be assessed against the resources determined to be germane to the decision at hand. If the NEPA study takes the form of an Environmental Impact Statement (EIS) (as opposed to an Environmental Assessment), the federal agency is to disclose its preference of the preferred alternative when it publishes the Draft EIS, if known. Otherwise, the preferred alternative is identified in the Final EIS. The public is afforded an opportunity to officially comment on both of these documents, and the agency has a responsibility to respond to all substantive comments offered by the public. Prior to these official opportunities, the public will have other opportunities to provide input on the key process steps that lead to the conclusion of a preferred alternative.

6.13.2 Surface Transportation Board (STB) Jurisdiction

The construction and/or operation of a new rail line that will be part of the interstate rail network requires Surface Transportation Board (STB) approval. STB is a federal agency, decisionally independent while administratively affiliated with the U.S. Department of Transportation (U.S. DOT). STB's Section of Environmental Analysis (SEA) is responsible for undertaking environmental reviews of proposed STB actions in accordance with NEPA and other environmental laws and making environmental recommendations to the STB. Like the U.S. DOT's Federal Highway Administration (FHWA) that CDOT collaborates with on many capital improvement projects, the STB has its own regulations governing the implementation of NEPA for STB-led actions (see 49 CFR 1105).

If the bypass project were to move forward, the entity(s) that would construct and operate the new rail line would approach the STB for approval. Prior to its decision, the STB would consider the transportation issues and environmental effects of the proposed changes. Under 49 U.S.C. 10901(c), the STB must approve a proposal to construct or operate a rail line unless the STB finds that such activities are inconsistent with the "public convenience and necessity" (a broad public interest standard under which the STB weighs the transportation need or benefits against any kind of harm likely to result). Historically, the agency has evaluated whether there is a public demand or need for the proposed service; whether the applicant is financially able to undertake the construction and provide rail service; and whether the proposal is in the public interest and will not unduly harm existing services. The interests of shippers are accorded substantial importance in assessing the public interest. Safety and environmental concerns are also considered and weighed against transportation concerns in evaluating the public interest.

Identical to the process followed by CDOT, the STB's environmental review process must meet the requirements of the President's Council on Environmental Quality (CEQ), (40 CFR 1500). NEPA is a procedural law whose objective is to ensure an informed decision that considered the environmental effects of the action and the avoidance, minimization, and/or mitigation of negative environmental impacts. For actions like the bypass project, the CEQ requires that the steps outlined below be followed, whether the implementing agency is the FHWA or STB:

- notification of the project published in the Federal Register;
- identification of any Cooperating Agencies;

- the implementation of a public involvement plan that ensures early and continuous opportunities for public participation;
- public and agency scoping;
- development of a project Purpose and Need;
- identification of a reasonable range of alternatives;
- alternatives analysis;
- impact assessment of the salient resources of the cultural, social, natural and physical environments for those reasonable alternatives to be evaluated;
- assessment of direct, indirect and cumulative impacts;
- identification of possible avoidance, minimization and mitigation measures;
- identification of a Preferred Alternative in the Draft EIS, if known;
- selection of a Preferred Alternative;
- opportunities for public review, comment and a public hearing;
- agency response to public comment;
- documentation of findings (e.g., Draft and Final EIS, Record of Decision (ROD)); and
- compliance with other federal, state and local laws including (not an inclusive list):
  - Farmland Protection Policy Act;
  - National Historic Preservation Act;
  - Endangered Species Act;
  - DOT Act of 1966 (Section 4(f));
  - Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970;
  - Clean Water Act;
  - Clean Air Act; and
  - Executive Orders (e.g., Environmental Justice, Floodplain Management, Protection of Wetlands)

6.13.3 CDOT as a Co-Lead Agency

Under the jurisdiction of the STB, CDOT may be able to participate as a co-lead agency. The entity(s) that would construct and operate the new rail line would first approach the STB regarding their desire for CDOT's active involvement. All parties, including any third party contractor hired to fulfill the NEPA process, would enter into a Memorandum of Understanding (MOU) to identify roles and responsibilities. There are examples of a state DOT being co-lead with the STB. While the STB is an active party and ultimate decision maker to the process, some look to a state agency's involvement for local oversight. In lieu of the co-lead arrangement, state agencies like CDOT would still participate in the process, especially for matters involving the crossing of any state highway. Likewise, other federal and state agencies would also be involved to varying degrees. The U.S. Army Corp of Engineers and the State Historic Preservation Officer (SHPO) are two examples of other agency involvement (regarding the Clean Water Act and the National Historic Preservation Act, respectively). FHWA would be involved regarding the crossing of any federal-aid highway facility.

6.13.4 Differences in Approach

Because STB and CDOT (through FHWA) follow CEQ requirements for NEPA, the regulations governing each are very similar. Additionally, CDOT has an *Environmental Stewardship Guide* whereby any state-only action would follow the spirit of federal requirements. However, there are additional requirements

placed on highway agencies that are not required of the STB or FRA. The most obvious are those required by the August 10, 2005 Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) with a focus on environmental stewardship and streamlining which are summarized below.

The primary differences include:

- document formatting and style guides;
- noise analysis for highway-generated noise vs. rail-generated noise;
- FHWA requires projects to follow CDOT's latest procedures for public involvement;
- CDOT may be required to follow the procedures for environmental streamlining and public and agency participation as outlined in SAFETEA-LU (for a good summary of SAFETEA-LU see http://environment.transportation.org/environmental_issues/safetea_lu/#bookmarkBackground);
- CDOT would follow the principles of *Context Sensitive Solutions* as outlined in the Chief Engineer's Policy Memo 26;
- local presence; FHWA maintains a Colorado office and CDOT has regional and headquarter offices. STB is in Washington, D.C.; and
- decision arm; The three-member STB board approves all STB NEPA documents. The Division Administrator of the Colorado Division of the FHWA and/or the Chief Engineer and the Region Transportation Director from CDOT approve CDOT's NEPA documents (depending upon the presence of federal action). CDOT's Transportation Commission approves project funding.

6.13.5 Purpose and Need Statement

In addition to the resources examined for R2C2, the Technical Advisory Committee (TAC) and the Executive Oversight Team (EOT) developed an initial *Purpose and Need Statement* as a starting point for any future NEPA study. A *Purpose and Need Statement* is integral to a NEPA evaluation. It is to provide the details about the transportation-related needs and is to describe the "what and why" of the project. The *Purpose and Need Statement* is also used to derive reasonable alternatives and to define the criteria under which the transportation alternatives are initially evaluated. The initial *Purpose and Need Statement* drafted by this Study can be found in **Appendix 6.** It would serve as a starting point for the public and agency public participation efforts as part of any future NEPA study.

6.14 The Right of Way Acquisition Process

In order to construct a freight bypass rail line, property would have to be acquired from private landowners. Acquisition of property is normally one of the very last processes to occur prior to actual construction. Prior to the decision to build a new bypass rail line, a determination would be required as to which agency or railroad is to become the new owner of all or part of the bypass rail line.

In the typical case involving new rail lines, a railroad entity is the owner of the right of way required for the new rail line. A railroad entity is to comply with Colorado statutes when acquiring real property. In the case of R2C2, the future owner has not been determined and because of CDOT's involvement in the study thus far, CDOT as the owner of the real property is considered to be a feasible assumption. If CDOT were to be the owner, its processes would be governed by Colorado statutes and the *Uniform Relocation Assistance and Real Property Acquisition Policies of 1970, as amended*, if federal funds were to be involved.

Generally, the acquisition of private property by the railroad entity or CDOT would not occur until a preferred alternative has been selected in compliance with the National Environmental Policy Act (or NEPA). The key steps for each process are as follows:

6.14.1 Private Property Acquisition Process by a Railroad

- Request for property acquisition received from internal Department.
- Real Estate Acquisition Manager meets with requesting Department to understand the project.
- Research / determine title and ownership.
- Personally meet with each property owner or owner's designated representative to explain the railroad project.
- Appraise each property and determine fair market value.
- Present owner with an offer.
- Give property owner an adequate opportunity to consider offer.
- Conduct good faith negotiations.
- Negotiate an option or purchase and sale agreement with property owner.
- Pay the agreed upon price and close sale prior to taking possession of property.

6.14.2 Private Property Acquisition Process by CDOT

- Personally contact each real property owner or the owner's designated representative to explain the acquisition process to the property owner, including the right to accompany the appraiser during inspection of the property, and the right of an additional appraisal.
- Appraise each property utilizing an experienced Colorado licensed certified general appraiser.
- Provide the owner with a written offer of the approved estimate of just compensation for the real property to be acquired and a summary statement of the basis for the offer.
- Give the property owner an opportunity to consider the offer.
- Conduct negotiations without any attempt to coerce the property owner into reaching an agreement.
- Pay the agreed purchase price before requiring the property owner to surrender possession of the property being acquired.

6.14.3 Condemnation of Private Property

A railroad entity and CDOT both have the authority to exercise eminent domain (i.e., condemn property) for uses that conform to Colorado Statutes. The need to exercise this authority is very rare as most often terms of purchase are negotiated which meet the needs of the property owner.

6.15 Data Sources

Internet searches and consultation with agencies were conducted in order to determine if there was data available for analysis related to the information found in this chapter. GIS datasets were obtained from the following entities:

- CDOT's GIS website for county, city, roadway, railroad, rivers, and lakes;
- Colorado Natural Heritage Program's (CNHP) website for potential conservation areas;
- Colorado State Land Board for state-owned lands;
- County websites for local parks and major features;

- Natural Resources Conservation Service (NRCS) for prime farmland;
- Colorado Office of Archaeology and Historic Preservation (OAHP) for cultural resources;
- U.S. Environmental Protection Agency (USEPA) database of potential hazardous substance release sites;
- the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) for listed National Priority List (NPL) or Superfund-type sites;
- review of the Colorado Hazardous Materials and Waste Management Division (HMWM) database of regulated sites; and
- Colorado Division of Oil and Public Safety (OPS) database of registered petroleum storage tank sites (COSTIS)

6.16 Summary of Key Findings

A summary of the key resource findings are found on the next several pages in **Table 6-9**.

Table 6-9 Summary of Key Environmental Findings

Resource	Study Alignment A	Study Alignment B
Water Resources		
Creeks/waterways would be crossed and/or reside within 1000'	• Kiowa Creek/Jack Rabbit Creek • Rock Creek • Antelope Creek • West Bijou Creek • Big Sandy Creek • Aroya Gulch • Rush Creek • Stacy Lakes Draw • Fort Lyons Canal • Arkansas River	• Lower Platte and Beaver Ditch • Buck Creek • Sand Creek – affected in numerous locations • Vega Creek – affected in numerous locations • North Fork Arikaree River • Arikaree River – numerous crossings • Big Sandy Creek • Long Branch • Rush Creek – Numerous Crossings • Fort Lyon Canal • Arkansas River • Shears Draw

	• Beshoar Alignment:
	  ❑ Purgatorie River
	  ❑ Leitensdorfer Arroya
	  ❑ Hoehne Ditch
	  ❑ South Side Ditch	

Unnamed Streams	Crossed about one dozen times	Crossed about 3 dozen times
Summary: More drainages and waterways would be affected under Study Alignment B. The only assumed perennial streams that intersect the study alignments are the Arkansas River, which is located near Las Animas at the southern end of the project and the Purgatoire River, which is located near Trinidad. Since they are considered waters of the U.S., the Army Corps of Engineers (Corps) has jurisdiction over the rivers. This means that a federal permit would be required to conduct any work inside the ordinary high water mark of these waters, including building a bridge over them. West Bijou Creek, the Big Sandy, and Rush Creek may also be jurisdictional and should be investigated during the future detailed study. Coordination with the Corps will need to be completed on all drainage crossings in order to determine if they are considered jurisdictional waters and would be regulated under Section 404 of the Clean Water Act by the Corps.		

Resource	Study Alignment A	Study Alignment B
Wells and Mines		
Water, irrigation, crop, livestock and/or natural gas wells within 100′	Approximately nine	Approximately nine wells within 100′ – including The town of Haswell's water well
Mines	One mine is within 500′	None
Summary: Similar impact – except that Study Alignment B would affect the town of Haswell's water well		
Energy Resources (not including biofuels)		
Pipelines (natural gas, propane, crude oil), Transmission and/or Optical Lines	Less than one dozen instances (including approximately six miles of parallel route within 50′)	Approximately one dozen instances (some crossed multiple times)
Windmills	None	Three within 500 – 1500′
Summary: Similar impacts between the two study alignments.		
Land		
Homes, businesses (within 15′ – 1000′)	Roughly 24 homes and/or businesses fall within approximately 1000′ to either side of the study alignment centerline – closest impacted is ~ 125′. The majority of these are within the town of Las Animas.	Roughly 26 homes and/or businesses fall within approximately 1000′ – the minimum distance to closest impacted is approximately 15′. About half of these are in the town of Las Animas.
	Beshoar Alignment: Roughly 6 homes/businesses fall within 1000′ to either side of study alignment centerline. The minimum distance to closest impacted home/business is approximately 200′ from centerline.	
State Lands	Approximately 6 parcels of state land crossed	Approximately 14 parcels of state land crossed
Interchanges/ intersections with other RR lines, additional land is required for interchanges.	5 Interchanges - South of Peoria with the UP line; west of Wiggins with the BNSF line; west of Aroya with the UP line, east of Haswell with the Towner line; and in Las Animas with the BNSF line	5 Interchanges – East of Brush and the BNSF near U.S. 34; east of Limon with the Kyle line and UP line, east of Limon with the UP line, east of Haswell with the Towner line; and in Las Animas with the BNSF line
State Parks	While there are no state parks located within the study area limits for either corridor, there are some state parks outside of the study limits that are of interest for any future studies. Walks Camp Park is located north of Limon outside of the study area. Jackson Lake State Park is located more than 10 miles northeast of the northern end of the Study Alignment A and nearly 30 miles northwest of the northern end of Study Alignment B. John Martin Reservoir State Park is more than 10 miles east of the southern end of Study Alignments A and B. There is one parcel of land reserved for John Martin that resides within 500′ of either study alignment near Las Animas.	

Resource	Study Alignment A	Study Alignment B
Prime Farmland	Prime farmland of national and state significance and high potential dry cropland of statewide importance has been identified in the following counties within or in close proximity to the study area: Adams; Arapahoe; Elbert; Crowley; Kiowa; Otero; and Bent. Irrigation is the key differentiator between these lands and others with the potential of becoming prime with irrigation.	
Summary: More undeveloped and developed lands would be impacted by Study Alignment B. There is greater potential for impacts near Haswell (size of interchange) and in Las Animas (proximity to homes/businesses). If the bypass project were to proceed in the future, alignment options are feasible to significantly avoid impacts to homes/businesses.		
Biological Resources		
Potential Conservation Areas	West Bijou Creek, moderate significance; Haswell, high significance	Lower North Rush Creek, moderate; Beaver Creek at Last Chance, high significance; South Rush Creek at Wezel, very high significance; Adobe Creek Basin, moderate significance
	Trinidad Potential Conservation Site is rated "very high significance" and is located in the Beshoar Junction corridor.	
Mountain Plover Conservation Project	Several plots of land are currently enrolled in the Mountain Plover Conservation Project through the Rocky Mountain Bird Observatory (RMBO). Approximate nests locations were mapped near Haswell.	
Special Status Species	Special Status Species exist in all counties within the study area.	
Summary: Based on the designation of potential conservation areas, the preservation of land known to contain Mountain Plovers, and the extensive list of potentially present threatened and endangered and special concern species, it is assumed that biological resources exist in all counties within the study area.		
Cultural Resources		
Historic	The resources with a high sensitivity that fall within the both study areas of Study Alignments A and B are: ❑ the Haswell Women's Booster Club-Booster Hall; ❑ Santa Fe Trail segments; ❑ Missouri Pacific Railroad (Towner to North Avondale Junction) National Register Eligible Historic District; and ❑ Denver Texas and Fort Worth Railroad, Beshoar Junction, Beshoar Siding U.S. 6 (Study Alignment B only)	
Archeological		
Summary: Five historic resources of high significance are within the study area of one mile to either side of the proposed study alignments. The U.S. 6 resources are along a portion of the No-Build Alternative. No archeological sites of high significance were found within the study corridor.		
Hazardous Materials		
Solid waste facilities	Five facilities	Two facilities
National Priority List (NPL) or Superfund sites	None present within study area	
Summary: Although these locations are within the search distance criteria, the locations can be avoided and potential impacts from either proposed study alignment are expected to be minimal.		

Resource	Study Alignment A	Study Alignment B
Noise		
Rail versus Highway Noise	✦ Rail noise is more intermittent than highway noise. ✦ Rail noise is relatively brief, whereas highway noise is continuous. Federal highway projects have noise abatement criteria (67 dBA) whereas freight rail projects have none.	
Moving Locomotives	✦ A diesel electric locomotive would have a maximum wayside noise level of 88 dBA from a distance of 50' at a pass-by speed of 45 to 50 mph. ✦ At this speed, the freight cars that follow the locomotive would create noise levels of 80 dBA from a distance of 50'. At 200' the locomotive and rail cars would be 6 to 8 dBA lower, depending upon terrain.	
FRA Horn Rule (2005)	✦ Trains must sound horns at public crossings ✦ Horn must be sounded 20 seconds or ¼ mile before crossing ✦ Horn pattern: 2 long, 1 short, 1 long ✦ Minimum 96 dBA @ 100' Maximum 110 dBA @ 100'	
Summary: Both study alignments would relocate freight rail traffic to areas that today enjoy the relative peace and quiet of rural living. Train activities that produce noise impacts include operations, ground vibration, and noise from wheels and horns. Train horns can be the most annoying of these sources.		
Air Quality		
Travel Time Reductions	29,500 – 42,500 hours	47,500 – 68,000 hours
Idle Time Reductions	60,500 – 85,000 hours	59,500 – 83,500 hours
Summary: The proposed relocation of the freight rail from the Front Range to the Eastern Plains is expected to cut state-wide emissions of criteria pollutants. This will result from the improved rail routes, faster train speeds and less vehicle idling at the rail crossings. The study looked at the twenty year horizon from 2012 to 2032. CO, NO_x, PM, SO_2 and VOC emissions analyzed in this study decreased compared to emissions under the No Build alignment by tens to thousands of metric tons annually. Reductions under Study Alignment A were smaller than under Alignment B due to greater reductions in annual operational time with Study Alignment B. The air quality in the Front Range corridor will improve with the proposed relocation, while local concentrations in eastern Colorado may increase but are likely to remain well below the appropriate national ambient air quality standards (NAAQS) due to the following reasons: The air quality levels in eastern Colorado are currently well below the standards; EPA only monitors for PM_{10} in Prowers County because it is a maintenance area for PM_{10}, but PM levels have not exceeded the standard there since 1998; and air quality levels at the Front Range monitors close to the freight rail corridor currently do not exceed NAAQS for the pollutants of concern considered in this study.		
Prior to a decision to build a new bypass rail line, certain environmental regulatory requirements would need to be met. The primary requirement would be compliance with the National Environmental Policy Act (NEPA). Compliance with NEPA would occur irrespective of the project participants (i.e., whether or not CDOT concluded its participation in the bypass effort). NEPA is a procedural law whose objective is to ensure an informed decision that considered the environmental effects of the action and the avoidance, minimization, and/or mitigation of negative environmental impacts. See **Section 6.13** for details.		

Resource	Study Alignment A	Study Alignment B
Preliminary Purpose and Need Statement		
Project Purpose: The purpose for undertaking the relocation of through freight rail lines is to: ✦ minimize through-freight movements in the major population centers along the Front Range; ✦ minimize rail/vehicle conflicts; ✦ acquire capacity for commuter rail options within existing freight rail corridors; and ✦ create economic development opportunities in the eastern portions of Colorado. Project Need: The need for the relocation of through freight rail lines results from the combined effects of: ✦ significance of the growth in Front Range communities and the growth in through freight rail traffic; ✦ chronic vehicular congestion in the major metro areas along the Front Range combined with the existing and projected growth in through freight rail traffic whose flow is slowed by additional factors such as steep rail grades; ✦ desire of the Front Range communities to be positioned for future passenger rail along the Front Range in order to maintain mobility; ✦ opportunity to foster economic growth in the Eastern Plains communities		
Right of Way Acquisition		
Generally, the acquisition of private property would not occur until one of the last processes, following the selection of the preferred alternative as part of the National Environmental Policy Act (NEPA). The acquiring agency (i.e., railroad entity or governmental agency like CDOT) would need to be determined in order to know the type of right of way acquisition process to be followed. Generally, both types of processes are similar (e.g., fair market value appraisal of property value, written basis of an offer provided to owner(s) with time to consider offer, good faith negotiations, and payment of the agreed upon price prior to transfer of property). While both entities have the right of condemnation (i.e., eminent domain), rarely does this right need to be exercised, as negotiations almost always result in just compensation.		

7. Funding and Financing

R2C2
RAIL RELOCATION for COLORADO COMMUNITIES

7.0 FUNDING AND FINANCING

7.1 Introduction

If the decision is ultimately made to proceed with a rail bypass project, sponsorship and a reliable funding and financing plan will need to be established prior to implementation. Benefits received from the project and to some extent shares of project funding, have been discussed throughout the duration of the R2C2 Study, but due to circumstances outlined in this chapter, a firm funding and financing plan has yet to be established. While much work remains to identify viable funding for the project, the Technical Advisory Committee and Executive Oversight Team have raised issues regarding the project's funding and financing options and have educated stakeholders, thereby setting the stage for partnerships to form so that the project could be moved forward under a structure that leverages the strengths of both the private and public participants. This chapter outlines the research performed to date on the potential partners to this project as well as the funding and financing mechanisms they may qualify for to help implement the Project.

Funding and financing both refer to the general activity of providing the money needed to pay for a project's planning, design, construction, and operation, but are different concepts which are commonly mistaken for one another. Funding refers to the ultimate source of payment for a project's capital costs and expenses, whether it is through a lump sum or cash flow over time (pay as you go). If the funding cash flow does not match the timing needs for the project, financing is used to secure money through borrowing and lending to match project needs. If a project is financed, the debt (principal and interest) must be paid back (or funded) over time with some revenue source, or combination of sources, such as user fees or taxes.

7.2 Public Funding

The federal government, through the US Department of Transportation (USDOT), provides numerous grants (funding) and financing programs to help make large infrastructure projects possible. Grant programs are available to achieve a range of project goals across all transportation modes, including programs through the Federal Railroad Administration (FRA) and Federal Highway Administration (FHWA). Federal funding is generally passed through state departments of transportation. In urban areas, metropolitan planning organizations (MPOs) specify how federal funds will be programmed.

Federal funding sources for highway transportation generally comes from federal gasoline taxes. There are two primary ways in which the amount of this funding from this pool is determined and allocated to the states. One method involves a formula, which looks at local factors such as population, air quality attainment status, highway traffic, geographic equity, or other comparable criteria in order to determine the funding each state receives. There is generally competition among projects for federal dollars, as funding is limited, and there is rarely enough money available to allocate for all projects planned in a region.

A second method for distributing federal funds is through federal earmarking of specific projects. This process assigns a certain amount of money to a project at the federal level, which is then passed through the states for the express purpose of funding that specific project.

Federal funding involves specific terminology that it is important to clarify prior to the discussion of the various programs. The following sections outline pertinent terminology which may be used in later sections of this chapter.

7.2.1 Authorization and Appropriation

The process by which a federal funding program is created or continued is called Authorization. The Authorization process outlines a funding bill, and describes such factors as how long the program will exist, the upper limit to spending under the program, and who is qualified to receive the funds. Once a program has passed through the Authorization stage, the next step is for funding to be appropriated. Appropriations bills set aside the actual amount of funding to be distributed annually for each program.

Funds can also be Allocated and Apportioned. Allocation is the process by which funding is provided by Congress to the USDOT for a specific project or for a competitive application process. Apportionment refers to funding that is distributed to each state on a formulaic basis.

7.2.2 Matching Funds

Under most federal programs, a state (or other non-federal entity) is required to provide matching funds in order to receive federal funding for a project. This matching component is expressed in terms of a percentage share of total project cost. The default match for federal programs is currently 80/20, where the federal government provides 80% of a project's total costs, and a state or local source will provide the remaining 20%. States often fund their portion of the match with sources such as state fuel tax revenue or state general fund revenue. Local governments and other public or private entities can also match federal funds. MPOs and States sometimes give priority to projects which provide an overmatch, or a larger local share.

7.2.3 Eligibility

Eligibility for federal funding is determined based on the guidelines of the specific grant or program being applied for; however there are some general rules governing the types of projects eligible for funding. For capital improvements, generally a project improves an existing transportation network, or provides a way to improve surface transportation in a region by way of new system routes. Improvements can mean better access to transit facilities, system or regional integration efforts, or transportation operating efficiency gains. As such, project eligibility refers to whether the project fits within the parameters set out in the federal program authorization. There may also be restrictions on the type of organization that is eligible to receive funds under a program (such as public vs. private entity eligibility). While these general rules apply to formula funds and grant programs, federal earmarks are much less structured in terms of their eligibility requirements. Generally an earmark is awarded through political lobbying, or similar activity, used to gain congressional support for funding a particular project.

7.2.4 SAFETEA-LU

The federal surface transportation program is established in multi-year authorization acts that provide funding and policy guidance for highway, transit, and other transportation modes. Authorization acts are normally in place for periods of four to six years, but may also be extended until work on the next authorization act has been completed.

The current authorization act – the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA–LU) was signed into law by President Bush on August 10, 2005 and will expire on September 30, 2009. It authorized close to $250 billion in funding over that period. Work on the next authorization bill has also begun but due to the expected funding challenges it is not clear if the new bill will be in place prior to expiration of SAFETEA-LU. If the process leading up to the passage of a new authorization is not complete prior to the lapse of the current bill, Congress usually votes to extend the current act until the details of a new act can be finalized.

Chairman Oberstar (Chairman of the House Transportation & Infrastructure Committee) wants to get a House bill out quickly and finish by October 1, 2009. His stated approach is to use the SAFETEA-LU Policy and Revenue Commission report as a general template as it relates to performance standards, accountability, streamlining the number of programs and the concept of a Metropolitan Mobility program. It is unclear what approach will be used in the Senate.

The Policy and Revenue Commission (now expired – originally created to preserve and enhance the United States surface transportation system) report that provides recommendations for the next authorization cycle puts forward the concept of completely restructuring the existing federal surface transportation program to become "performance-driven, outcome-based, generally mode-neutral and refocused to pursue objectives of genuine national interest." In replacement of the existing programs would be 10 functional programs; one of those entitled "Global Competitiveness" would focus on ensuring the efficient movement of freight. To achieve the Commission's investment goals, the report proposes significantly increasing the federal motor fuels user fee annually by five to eight cents per gallon over the next five years. The motor fuels user fee would then be indexed to inflation following this ramp-up period. The Commission also endorses other financing alternatives, including congestion pricing, tolling, public-private partnerships and freight-based user fees.

Of particular interest to this project is the level of discussion surrounding freight traffic. In addition to the Commission report, the American Association of Road and Transportation Builders (ARTBA - a major transportation industry group) and the American Association of State Highway Transportation Officials (AASHTO) have both supported inclusion of a new freight component in the next transportation authorization.

ARTBA has put forward its concept of creating a new federally-led, performance-driven program, the Critical Commerce Corridors (3C) Program, to build the transportation system capacity necessary to ensure the safe, secure and efficient movement of freight throughout the U.S. ARTBA's 3C program calls for financing these investments through new freight-related user fees and creating new budget "firewalls" to ensure these revenues are dedicated to freight improvement projects.

The AASHTO proposal includes a significant new freight infrastructure spending program to be financed outside the Highway Trust Fund with a new investment fund for freight related projects to total $42 Billion over six years, half apportioned to states and half allocated to fund projects of national significance on national freight corridors.

While these are some of the recommendations that will inform the discussion and formation of the reauthorization proposal, it is not certain how much, if any, will actually be included in a final bill and how much the emphasis on freight movement might actually extend to federal funding sources for freight rail projects. Also, given the heavy demand for freight improvements throughout the U.S., it is not clear how effective the R2C2 project would be in competing for any such funds.

7.2.5 Federal Funding Programs

This section contains descriptions of several federal funding programs that the project could qualify for, though given the current national economic contraction and related funding shortfalls, the competition for these funds is high and the availability of is low. None of these funding programs are expected to contribute a significant percentage of the overall project cost, though they are still worth mentioning given the large project cost and expected need for multiple funding sources.

7.2.5.1 Rail Line Relocation and Improvement Capital Grant Program

The Rail Line Relocation and Improvement Capital Grant Program, Section 9002 of SAFETEA-LU, administered by Federal Railroad Administration (FRA), provides financial assistance for local rail line relocation and

improvement projects. Only states and political subdivisions of states are eligible for grants under this program. A state is eligible for a grant from FRA for any construction project that improves the route or structure of a rail line and:

- Involves a lateral or vertical relocation of any portion of the rail line
- Is carried out for the purpose of mitigating adverse effects of rail traffic on safety, motor vehicle traffic flow, community quality of life, or economic development
- Meets the Costs-Benefits Requirement -A grant may be awarded under this section for a project for the relocation of a rail line only if the benefits of the project for the period of the estimated economic life of the relocated rail line exceed the costs of the project for the same time period.

Though the grant rules state that construction projects are eligible for funding, pre-construction activities, such as preliminary engineering/design work and environmental compliance, are considered part of the overall construction project. Funds could feasibly be used to cover expenses under all categories of a proposed bypass alignment, including engineering and right of way expenditures.

Congress authorized $350 million per year for each of the fiscal years (FY) 2006 through 2009 for this program. However, Congress did not appropriate any funding for this program until FY 2008. A notice of funding availability and solicitation of applications was published in the Federal Register on September 5, 2008. For FY 2008, Congress appropriated $20 million in federal funds for the Rail Line Relocation and Improvement program, with around $5 million directed to nine earmarked projects.

To apply (all applications must be submitted through the FRA website), an applicant must submit a description of the anticipated public and private benefits associated with each proposed project. The determination of the benefits must be developed in concert with the owner and user of the rail line, and any private entity involved in the project. The portion of federal shared costs will not exceed 80% under this program.

7.2.5.2 At-Grade Rail Crossings

SAFETEA-LU made a number of significant changes in the available matching ratios and the funding environment for highway-rail grade crossing projects. SAFETEA-LU continued the authorization of Federal-aid highway funds through FY 2009. The designation of a safety set-aside in Surface Transportation Program (STP) funding for each state for categorical safety programs, including the highway-rail grade crossing program, which began in 1973, was shifted to the new Highway Safety Improvement Program (HSIP) starting in FY 2006.

From FY 2006 through 2009, $220 million has been authorized each year in SAFETEA-LU under HSIP as a set-aside for the *Highway-Rail Grade Crossing Program* to reduce the number of fatalities and injuries at public railway-highway crossings. This is done through the elimination of hazards and/or the installation/upgrade of protective devices at crossings.

- The set-aside for Highway-Rail Grade Crossing funds under HSIP may be used for (but are not limited to) the following types of railroad grade crossing safety improvement projects:
- Crossing elimination by new grade separations, relocation of highways, relocation of railroads, and crossing closure without other construction
- Reconstruction of existing grade separations
- Crossing improvement by:
  - installation of standard signs and pavement markings;
  - installation of STOP signs;

- installation or replacement of active traffic control devices, including track circuit improvements and interconnection with highway intersection traffic signals;
- crossing illumination;
- crossing surface improvements; and
- general site improvements

Using this grant program, costs incurred by crossing signal work projects, as well as signage and public improvements (grade crossings and roadway realignment) could be partially funded.

States are apportioned funds based on a Federal Highway Administration (FHWA) formula, and the states decide how they obligate their funds among local projects. As of June 30th 2008, Colorado had about $9.3 million of funding available through FY 2009 under this program, with a significant portion already obligated to projects.

This funding is authorized under SAFETEA-LU Section 1401 (d). $220 million is set-aside for the *Railway-Highway Crossing Program* under 23 USC 130 for years 2006-2009. R2C2 Project has approximately $92 to $112 million in rail crossing costs associated with it (for Study Alignments B and A respectively), a portion of which may qualify for this funding source. The federal share of at-grade rail crossing projects is 90%.

7.2.5.3 Congestion Mitigation and Air Quality (CMAQ) Improvement Program

The CMAQ program authorizes over $8.6 billion dollars in funds to state DOTs, MPOs, and transit agencies to invest in projects that reduce criteria air pollutants from transportation-related sources over a period of five years (FY 2005-2009). Funding is available for areas that do not meet the National Ambient Air Quality Standards (non-attainment areas) as well as former non-attainment areas that are now in compliance (maintenance areas). Funds are distributed based on a formula considering an area's population by county and the severity of its ozone and carbon monoxide problems.

The SAFETEA-LU requires states and MPOs to give priority in distributing CMAQ funds to diesel engine retrofits, and other cost-effective emission reduction and congestion mitigation activities. SAFETEA-LU also requires the Secretary of Transportation to evaluate and assess the effectiveness of a representative sample of CMAQ projects to determine the direct and indirect impact of the projects on air quality and congestion levels, as well as ensure the effective implementation of the program.

Freight initiatives may be eligible under the CMAQ guidance. Although freight is not mentioned specifically, the provision for public-private partnerships, strengthened considerably with the previous federal transportation authorization act (TEA-21), allows public (CMAQ) funds to be used for privately owned and operated services, which could include the bypass project. Emissions reductions can be generated directly by projects focusing on the vehicles themselves, through treatment of tailpipe exhaust or application of advanced engine technologies and may thus qualify for CMAQ funding (assuming all other requirements are met).

CMAQ funding is applied for in a similar fashion to Surface Transportation Program (STP) funding. Funds are applied for through state DOTs and local MPOs which are apportioned funding by the FHWA based on a federal formula. While the Denver metro area is an 8-hour ozone non-attainment area, both proposed study alignments for the R2C2 project area are located outside the non-attainment area to the east. However, relocation of most of the through rail freight operations from the Denver metro area to a bypass would reduce emissions in the non-attainment area. CMAQ rules allow the use of funds nearby the non-attainment area, though this use of funds would be at the discretion of the Denver Regional Council of Governments (DRCOG) or other MPOs that receive CMAQ funding.

The DRCOG area received approximately $20M each year for FY08 & FY09 in CMAQ funding, as initially estimated by CDOT's Resource Allocation process. The Resource Allocation process estimates that CMAQ funding for FY 2010 will fall to around $14 million as a result of the economic downturn and current Federal Aid situation. This amount relates only to the gross sum of money that DRCOG receives, however around 25-50% of funding is preprogrammed for funding "pools" formed for Intelligent Transportation Systems, Signal Systems, and other related projects. A significant portion of CMAQ funding is also directed into a long term commitment to the FasTracks program. Remaining funds are available through a competitive project submission process that ranks eligible projects by local selection criteria. The typical split between federal and project sponsor is 70-75% federal, and 25-30% state and/or local match.

7.2.5.4 Surface Transportation Program (STP)

The Surface Transportation Program is administered by the FHWA, and is meant to provide flexible funding that may be used by States and local jurisdictions for projects on any Federal-aid highway. Funding however, is not limited to highway projects. Eligible applications include highways, bridge projects on any public road, transit capital projects, and intracity and intercity bus terminals and facilities. Other eligible projects include:

- advanced truck stop electrification systems;
- intersections that: have disproportionately high accident rates; have high congestion; and are located on a Federal-aid highway;
- environmental restoration and pollution abatement; and
- control of terrestrial and aquatic noxious weeds and establishment of native species

The FY 2008 authorization for the STP program was $6.5 billion, with $6.6 billion authorized for FY 2009. Apportioned funds are distributed based on the following factors:

- 25% based on total lane miles of Federal-aid highways in each state;
- 40% based on vehicle miles traveled on Federal-aid highways in each state ; and
- 35% based on estimated tax payments attributable to highway users in the States into the Highway Account of the Highway Trust Fund

STP funding could be used for the rail relocation effort in such categories as plant / weed control, public grade crossings, grade separations, and other accident-reducing intersection improvements. The federal share of STP projects is generally 80%. Legislation for STP funding is outlined in SAFETEA-LU Section(s): 1101(a)(4), 1103(f), 1113, 1603, 1960, and 6006, as well as in 23 USC 133, 104(b)(3), and 140.

7.2.5.5 National Highway System (NHS) Program

The National Highway System program provides funding for improvements to rural and urban roads that are part of the NHS, such as the Interstate System and connections to major intermodal terminals. Under certain circumstances, NHS funds may be used to fund transit improvements in National Highway System corridors.

Apportioned funds are distributed to state DOTs and MPOs based on the following factors:

- 25% based on total lane miles of principal arterials in each state;
- 35% based on total vehicle miles of travel on principal arterials in each state;
- 30% based on diesel fuel used on all highways in each state; and
- 10% based on total lane miles of principal arterials per capita in each state

$6.2 and $6.3 billion are authorized for the program in FY 2008 and 2009 respectively. NHS funds are transferable between other United State Code (USC) Title 23 programs including CMAQ and STP. 50% of

funding may be transferred to these two programs, and 100% may be transferred to STP if approved by the Secretary of Transportation. While NHS program funds could not be used for the rail relocation effort, if excess NHS funds were transferred to the Colorado STP and CMAQ programs, they could be diverted for use at the discretion of CDOT.

The federal share of NHS program funding is typically 80%. Funding is applied for through a state DOT or MPO. NHS funding is made possible by SAFETEA-LU Section(s): 1101(a)(2), 1103, 6006, and 23 USC 103, 104(b)(1)

7.2.5.6 Transportation, Community, and System Preservation (TCSP) Program

The Transportation, Community, and System Preservation Program (TCSP) provides funding for initiatives including planning and implementing grants; performing research to investigate and address the relationships between transportation, community, and system preservation; and identifying private sector-based initiatives.

Eligible activities authorized for TCSP funding include projects that:

- improve the efficiency of the transportation system;
- reduce environmental impacts of transportation;
- reduce the need for costly future public infrastructure investments;
- ensure efficient access to jobs, services and centers of trade; and
- examine development patterns and identify strategies to encourage compatible private sector development patterns

Funds are available to States, MPOs, local governments, and tribal governments. The law requires equitable distribution of funds to a diversity of populations and geographic locations. Funding eligibility under this program is defined somewhat loosely and is at the discretion of the Secretary of Transportation, so it is difficult to predict the specific project cost categories for which funding could be available.

SAFETEA-LU authorized TCSP funding in the amount of $61.25 million per year for FYs 2006 through 2009. Actual TCSP Program funding levels can vary based on Congress' annual appropriations.

For discretionary grants, an interagency team evaluates applications for the competitive TCSP Program. The team includes representatives from the following agencies: FHWA, Federal Transit Administration (FTA), U.S. Department of Transportation (USDOT) Office of the Secretary of Transportation, FRA, Research and Special Programs Administration (RSPA), and the Environmental Protection Agency (EPA). TCSP Program grants can also be designated by Congress.

In order to receive funding currently, a project should be earmarked by a local congressional member. Contacting a local representative who will lobby for project funding is usually necessary in order to receive any funding under this program, since such a large amount of available money is usually earmarked prior to distribution. This process usually happens around the spring of each year. The federal share of any project or activity is 80%.

7.2.5.7 Rail and Fixed Guideway Modernization

The transit capital investment program (49 U.S.C. 5309) provides capital assistance for three primary activities, including the modernization of existing rail systems, new and replacement buses and facilities, and new fixed guideway systems.

Funding can be used for transit capital projects to modernize or improve existing fixed guideway systems, including purchase and rehabilitation of rolling stock, track, line equipment, structures, signals and communications, power equipment and substations, passenger stations and terminals, security equipment and

systems, maintenance facilities and equipment, operational support equipment including computer hardware and software, system extensions, and preventive maintenance. Since R2C2 would be primarily a new construction project for rail freight, there is little likelihood that any of its elements could be eligible under the Section 5309 program. Engineering, environmental, and other non-capital costs would not be eligible under this program.

Eligible recipients for funding are public entities and agencies including states, municipalities, other political subdivisions of states; public agencies and instrumentalities of one or more states. Transit modes eligible for funding are heavy rail, commuter rail, light rail, monorail, trolleybus, aerial tramway, inclined plane, cable car, automated guideway transit, ferryboats, that portion of motor bus service operated on exclusive or controlled rights of way, and high-occupancy-vehicle (HOV) lanes.

Funds are allocated by formula to urbanized areas with rail systems that have been in operation for at least seven years. $6.07 billion has been authorized by SAFETEA-LU for FY 2005 through 2009 under this program. A Metropolitan or Regional FTA office should be contacted in order to apply for funding. The federal funding share of this program is 80%, with 20% provided by local sources.

7.2.5.8 Earmarks in SAFETEA-LU Reauthorization

SAFETEA-LU will expire on September 30, 2009. It is likely that reauthorization will not occur before the expiration date. When the new authorization occurs, there may be opportunities for members of Congress to propose transportation projects for federal funding "earmarks", or funds authorized for specific projects by the Federal government. Those states with members in the leadership of Congress should be better poised to receive funding that is available as long as they have projects eligible to receive funding in the program that is earmarked. If the CDOT, in conjunction with other states impacted by this project, decides to seek an earmark, it should begin to "make the case" for the earmark with its Congressional delegation well in advance of SAFETEA-LU reauthorization. CDOT also would need to identify a member of Congress to sponsor the earmark and to protect it from being stripped as the bill moves through the legislative process.

It now appears that there will be strict limits placed on the number of earmarks permitted. As discussed above, it is possible that a new authorization bill may have a greater emphasis on freight rail, there is also a strong recommendation from AASHTO that "to the maximum extend practicable, Congress should eliminate earmarking. Funding levels for earmarks should be no more than 5% of the total program."

7.2.5.9 Flexible Match

Flexible match allows a wide variety of public and private contributions to be counted toward the non-federal match of federal-aid projects.

TEA-21 introduced new flexibility to matching requirements for the federal-aid program. Newer guidelines allow certain public donations of cash, land, materials, and services to satisfy the non-federal matching requirement. These matching options include:

- the value of private and certain state and local contributions, including publicly-owned property;
- funds from other federal agencies may count toward the non-federal share of recreational trails and transportation enhancement projects;
- funds from the Federal Lands Highway Program may be applied as non-federal match for projects within or providing access to Federal or Indian lands; and
- funds from federal land management agencies may be used as the match for most federal-aid highway projects

States may also seek program-wide approval for STP projects. The matching requirement would then apply to the program instead of individual projects. The ability of CDOT to provide a larger than normal match to federal funding programs is of concern, as the state is presently low on funding to complete additional projects.

Flexible match provisions increase a state's ability to fund its transportation programs by:

- accelerating certain projects that receive donated resources;
- allowing states to reallocate funds that otherwise would have been used to meet federal-aid matching requirements; and
- promoting public-private partnerships by providing incentives to seek private donations

7.2.6 CDOT Funding Capacity

Like many states, the federal funding received by CDOT for transportation projects is not meeting its needs, such that new capital investment is expected to be very limited in the near term, especially given rapidly escalating costs to maintain existing infrastructure. These issues are being exacerbated by the current economic environment, which has indirectly caused traditional revenue sources for transportation projects to diminish. The difficulty and added expense of obtaining debt financing is another recent development with implications for the financing of CDOT projects. An evaluation of the current Statewide Transportation Improvement Program (STIP) for Colorado provides a snapshot of CDOT funding from State and federal sources and a forward look through FY 2013, however these numbers are projected and will probably be affected by the current economic environment. Funding capacity and revenue receipts, for Colorado and other states, are in a period of great uncertainty. The recessionary forces mentioned above are a downside factor, however there are talks of an infrastructure stimulus plan which could be an upside to the funding situation for infrastructure projects and DOTs.

Federal regulations require state DOTs to develop and maintain their STIP, which contains capital and non-capital transportation projects proposed for funding under Title 23 (highways) and Title 49 (transit) of the U.S. Code as well as all regionally significant transportation projects requiring an action by FHWA or the FTA.

The current STIP was adopted on March 20, 2008. The STIP includes FY 2008-2013 Transportation Improvement Programs (TIPs) from Colorado's five MPOs who were closely involved in the development of the document.

To be included in the STIP, an MPO or CDOT Transportation Region must propose a project. The project list for an MPO is developed through board meetings, as well as MPO technical and policy committee meetings. In regions that do not have a representative MPO, projects are proposed for inclusion by the CDOT Transportation Region. Transportation Regions develop their project lists through continuous contact with local transportation officials as a way of identifying project needs and priorities. All projects proposed must be consistent with the CDOT's 2035 plan in order to receive funding in the STIP. This progression of a project from the County level, to the State Transportation Commission for approval, is referred to as 4P (project priority programming process) by CDOT.

Though most funds have been programmed for FY 2008, some unprogrammed funding is available in later years, mainly FY 2012 and FY 2013. While some funding is currently unprogrammed, CDOT does not expect to have any funds from current programs available to play a major role in paying for a bypass project. In fact, major downward revisions to funding availability in future STIP documents are expected. Table 7-1 shows a summary of annual CDOT revenues, programmed, and unprogrammed funding from the FY 2008 STIP.

Table 7-1 CDOT STIP Summary (FY 2008)

Category	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013
Revenue	1,044,316	1,042,478	955,312	882,427	1,197,686	1,234,718
Deductions	(105,953)	(115,125)	(117,794)	(110,526)	(119,452)	(121,473)
Additions	2,014,646	970,337	606,341	651,408	945,170	449,832
Unprogrammed	0	(7,036)	(44,734)	(20,937)	(246,351)	(271,458)
Programmed	(2,953,009)	(1,890,654)	(1,399,125)	(1,402,372)	(1,777,053)	(1,291,619)
Remaining	0	0	0	0	0	0
All Numbers in $000's - Numbers subject to change						

7.3 Project Financing

It is likely that some portion of the Project will be financed, though a specific structure has yet to be established. When choosing a financing structure for the R2C2 project, it is important to first distinguish whether financing will be provided by public or private sources. Tax exempt public financing vehicles, such as municipal bonds and federal loan programs, can make capital investment for infrastructure projects significantly cheaper than they would otherwise be if obtained using private financing. Private sources would primarily include construction loans and taxable bonds issued by private corporations or equity/bank debt structures used through public-private partnerships. Federal programs such as TIFIA and RRIF (described below) make it possible for certain private entities to gain access to tax exempt debt, giving them similar advantages to public agencies for accessing the capital markets for project financing.

7.3.1 Financing Programs

7.3.1.1 The Transportation Infrastructure Finance and Innovation Act (TIFIA)

The Transportation Infrastructure Finance and Innovation Act of 1998 (TIFIA), administered by the USDOT, makes three forms of credit assistance available for surface transportation projects:

- secured (direct) loans – provide flexible repayment terms, as well as the option of combined construction and permanent financing of capital costs;
- loan guarantees – provide full faith and credit guarantees by the federal government to institutional investors who make loans for projects; and
- standby lines of credit – secondary sources of funding in the form of contingent federal loans that may supplement project revenues during the first 10 years of project operation

Candidates for TIFIA funding include highway, transit, passenger rail, freight facilities, and certain port projects, and can be public or private entities. Any project that is eligible for federal assistance through existing surface transportation programs is also eligible for TIFIA. Since R2C2 involves freight rail it would be eligible for financing under TIFIA. Since TIFIA eligibility extends from planning to construction phases, all categories of the rail relocation effort could be eligible for TIFIA.

Projects must cost at least $50 million, or equal 33.3% of the State's apportionment of federal aid funds (whichever is less), and be supported at least partly from user charges or other non-federal dedicated funding sources. The project must be included in the State Transportation Plan. Each project must receive an investment grade rating on its senior debt before federal credit assistance is provided. TIFIA loans take the

form of subordinate debt but are provided at a relatively low interest rate, equal to the treasury rate plus a small premium.

The TIFIA program has fees attached to the financing received. The fee structure for TIFIA is as follows:

- Each applicant is required to pay a non-refundable Application Fee of $30,000.
- Each borrower will be required to pay a Transaction Fee equal to the costs incurred in negotiating the credit agreement. This credit processing fee will typically range from $200,000-$300,000.
- Borrowers will be required to pay an $11,000 Servicing Fee annually, due by November 15.
- Borrowers also will be required to pay a Monitoring Fee as defined in the credit agreement.

Projects are evaluated by the Secretary of Transportation on the basis of economic benefits generated, extent of private capital leveraged, and promotion of innovative technologies. In order to apply for TIFIA, an applicant must submit a letter of interest describing the project and the proposed financial plan, including the requested credit assistance. If it is determined by the USDOT that the basic project eligibility criteria are met, a formal application may be submitted. TIFIA is made possible by U.S. Code Tile 23 Chapter 6 – TIFIA Statute.

While in the past there have been significant funds available to projects under the TIFIA program, the current financial market issues have increased the attractiveness of TIFIA funds. The most recent information indicates that the applications currently in hand by USDOT exceed the remaining funds available under SAFETEA-LU. As a result, there may be further modifications in their approach to allocations and fees including the possibility of assessing risk-based fees.

7.3.1.2 Railroad Rehabilitation and Improvement Financing (RRIF) Program

The RRIF program was established by TEA-21 and amended by SAFETEA-LU. This program authorizes the FRA Administrator to provide direct loans and loan guarantees up to $35 billion. Up to $7 billion is reserved for projects benefiting freight railroads other than Class I carriers.

RRIF funding may be used to:

- Acquire, improve, or rehabilitate intermodal or rail equipment or facilities, including track, components of track, bridges, yards, buildings and shops;
- Refinance outstanding debt incurred (for purposes listed above);
- Develop or establish new intermodal or railroad facilities; and
- Direct loans can fund up to 100% of a railroad project, with repayment periods of up to 25 years. Interest rates are equal to the cost of borrowing for the government. This is a substantial advantage over TIFIA, which as noted above, allows a maximum of 33% of a project's costs to be borrowed.

A disadvantage of RRIF is that a risk-based application cost must be paid by the applicant, which is not the case with TIFIA. These tradeoffs must be weighed in choosing which federal programs are the best fit for the project.

Eligible borrowers of RIFF funds include railroads, state and local governments, government sponsored authorities and corporations, and joint ventures including at least one railroad.

Only the capital portion of the project would be eligible for financing under this program. Environmental clearances need to be completed before financing is secured, so it is unlikely that planning or other 'soft' costs could be financed with RRIF program money.

Since RRIF does not currently have an appropriation, the cost to the government of providing financial assistance must be paid by the applicant (through payment of the Credit Risk Premium). The Administrator will calculate the amount of the Credit Risk Premium that must be paid for each loan before it can be disbursed.

In addition to the Credit Risk Premium, which is paid only if a loan is approved, each applicant must pay an Investigation Fee regardless of whether the loan is approved. The Investigation Fee may not exceed one half of one percent of the requested loan amount, but is often substantially less.

Applications for funding are submitted to the FRA, and are approved or disapproved within 90 days of receipt. A complete application package includes an environmental assessment as well as an initial review by the FRA. RRIF funding is made possible by 45 U.S.C. Section 822.

7.3.1.3 Private Activity Bonds (PAB)

Section 11143 of Title XI of SAFETEA-LU amends Section 142 of the Internal Revenue Service Code to add highway and freight transfer facilities to the types of privately developed and operated projects for which private activity bonds may be issued. This allows private activity to occur on these types of projects, while the tax-exempt status of the bonds is maintained.

Providing private developers and operators with access to tax-exempt interest rates lowers the cost of capital significantly, thus enhancing investment prospects. Increasing the involvement of private investors in highway and freight projects generates new sources of money, ideas, and efficiency.

Qualified Highway or Surface Freight Transfer Facilities include:

- any surface transportation project which receives federal assistance under Title 23, United States Code;
- any project for an international bridge or tunnel for which an international entity authorized under Federal or State law is responsible and which receives federal assistance under Title 23, United States Code (as so in effect); and
- any facility for the transfer of freight from truck to rail or rail to truck (including any temporary storage facilities directly related to such transfers) which receives federal assistance under Title 23 or Title 49 United States Code

Examples of facilities for the transfer of freight from truck to rail or rail to truck include cranes, loading docks and computer-controlled equipment that are integral to such freight transfers.

The law limits the total amount of PABs issued for transportation purposes to $15 billion and directs the Secretary of Transportation to allocate this amount among qualified facilities. The $15 billion in exempt facility bonds is not subject to the state volume caps. States receive separate PAB allocations through a formula: Colorado, in 2008, had around $413 million available to them in PAB funds but these are not all eligible for direct transportation purposes. Some of this allocation is already used by other agencies that provide housing and other services in Colorado.

The U.S. DOT accepts applications from sponsors interested in receiving authority to use a portion of the $15 billion in exempt facility bonds. Though there is no fixed application procedure, basic information on the project must be provided including project description, schedule, amount requested, etc.

As of July 2008, USDOT has approved a total of $7.4 billion in PAB allocations for a total of 8 projects, as shown in **Table 7-2**.

Table 7-2 USDOT Approved Private Activity Bonds

Project	PAB Allocation (millions)
Approved Allocations *(July 2008)*	
Port of Miami Tunnel, Florida	$980.0
Safe & Sound Bridge Improvement Program, Missouri	$700.0
Knik Arm Crossing, Alaska	$600.0
Capital Beltway HOT Lanes, Virginia (*issued 6-12-08*)	$589.0
IH-635 (LBJ Freeway), Texas	$288.0
Pennsylvania Turnpike Capital Improvements	$2,000.0
Ambassador Bridge Gateway Project – Phase I	$212.6
I-595, Florida	$2,000.0
Total Approved Allocations	**$7,369.6**

Some of these Approved Allocations may not be used if the project financing is completed on a public basis such as the Safe & Sound Bridge Improvements Program in Missouri. One of the previously approved large allocations (SH-121 in Texas) was removed when it was determined that project would be delivered by the North Texas Turnpike Authority.

7.4 Partnering Opportunities

This section provides an overview of research performed to identify potential partners that could financially participate in the R2C2 project. The findings from **Chapter 5 - Net Benefits Analysis** informed this research, though the primary focus of **Chapter 5** was to estimate the net benefits of the project, not to allocate specific project costs to individual public agencies or private sector entities. As such, this section lists the potential partners that could participate in a bypass project, and is not directly tied to a net benefit calculation that might be realized by those parties.

Included as part of the discussion is the possibility of a second project that is separate from a bypass project – the potential conversion of the Joint Line to commuter rail (Joint Line Commuter Rail). While the Joint Line Commuter Rail project was not explicitly listed as part of the Public Benefits Study, CDOT has indicated that obtaining right of way in the I-25 corridor to operate commuter or intercity passenger rail is a priority, and that the Joint Line is a logical location for such passenger rail to be located. Such intercity passenger rail service is the subject of a separate, parallel study being conducted with CDOT funding assistance (SB-1 Funds) by the Rocky Mountain Rail Authority.

The potential partners encompass both public and private entities including utilities, the coal mining industry, Class I and Short Line railroads, railroad investors, local transportation authorities, and federal, State and local governments. These stakeholders are defined and discussed in the context of a public-private partnership (Partnership) for a bypass project with varying levels of participation. It is envisioned that participation in the Partnership will be based on the level of financial contribution, which, in turn, hinges on the alignment selected and the value of the investment in that alignment to the potential stakeholders.

The findings contained in this section are the result of several months of discussions with various parties via both public meetings and interviews. The views expressed are provided to foster further discussion and are expected to evolve over time as a bypass project concept is developed and prioritized by stakeholders.

7.4.1 Review and Analysis of Organizations

Public and private entities will be impacted in a variety of ways by this project as outlined in **Chapter 5 - Net Benefits Analysis**. Due to the geographic scale of the project area, over 50 cities and towns in 17 counties, and innumerable businesses and residents could be impacted by a bypass project.

The Consultant Project Team conducted public meetings and forums for stakeholders between April and October of 2008 to inform the public of the project concepts being developed, answer questions, and collect feedback. Also, Technical Advisory Committee meetings held in October of 2007 and February, May, June, September and November of 2008 attracted attention from rail industry interests and infrastructure investors. These parties recognize the potential savings the project could provide to the Class I railroads and asked for the opportunity to examine the project from an investment perspective, regarding both the building and operation of a bypass facility, either jointly or individually. Due to proprietary and confidentiality concerns, the following overview explains the types of organizations that approached the Project Team without naming specific companies or consortiums of investors.

7.4.1.1 Railroads

Class I Railroads - The BNSF has high stakes in a bypass project primarily due to the potential savings that could be realized by BNSF on its coal operations. Class I railroads have the capacity and ability to develop this project independently if it is found to be financially feasible. Typically, under a railroad project public-private partnership, private railroad project funding shall be commensurate with benefits derived in comparison with other freight transportation projects competing for the railroad's capital dollars. Similarly, the public sector match should be commensurate with public benefits.

Class I railroads can apply for and receive some of the federal funding and financing that is available to public entities, such as CDOT, for rail projects such as a bypass. As there are very few grant programs for rail, the value is primarily using low-cost financing mechanisms that could greatly reduce the Railroads' cost of capital for the project, making it a more attractive investment.

The UP and BNSF railroads are the owners of the Joint Line rights of way that CDOT has interest in for future commuter rail operations. As such, the involvement of CDOT in a bypass project could also be used to strike a mutually beneficial deal to purchase Joint Line right of way or operating rights from the UP and BNSF, potentially using mechanisms such as a long-term option contract.

Short Line Railroads - Generally, Short Line railroads either transport natural resources or commodities short distances to processing or manufacturing plants or provide transfer service between their customers and Class I railroads. Short Lines will continue to be an integral part of the state's transportation network; especially as Class I railroads have indicated that their new business models require very strong Short Line partners. Short Line railroads are better positioned to provide customer service to lower density lines and Class I railroads are generally more focused on the long-haul movement of goods. Short Line's feeder networks may also be better candidates for the location of new businesses rather than congested Class I mainlines.

Larger Short Line railroads have similar capital plans to Class I railroads and commonly evaluate expansion projects based on their return on investment. Because Short Line railroads qualify for most of the same federal loan and grant programs as Class I railroads, the R2C2 project may be within Short Lines' investment capabilities depending upon private match levels, despite its relatively high capital cost.

In order for a Short Line railroad (or any investor) to achieve a reasonable return on investment, they would have to reduce their operating risk by establishing long-term minimum usage agreements and associated fees with the Class I railroad. With this revenue floor-creating agreement in place, the Short Line has only costs to manage and would have greater ease to cover recurring financing or equity return costs.

While the R2C2 project would (at least at first) have one primary user, the BNSF Railway, there are opportunities for Short Lines to partner with the BNSF to increase efficiency and reduce the cost of operation. If a potential Short Line investor expects other freight operators in addition to BNSF to use a bypass, they may be more inclined to move forward with the investment, though close coordination with BNSF would be necessary.

7.4.1.2 State and Other Government Entities

As noted above, under typical rail public-private partnerships for a project of this size and scope, public sector funding is commensurate with public benefits. The identification of public sector partners and possible public funding sources are important to identify in order to assess the feasibility of R2C2 to reach implementation.

Colorado Department of Transportation - The State will realize transportation and quality of life benefits by having the through coal train operations withdrawn from the congested I-25 corridor. Noting these outcomes and understanding that the exact quantification of the net benefits may not be agreed on by all project stakeholders, CDOT's level of participation in the R2C2 project would be expected to be limited by its capital project funding levels anticipated in the years to come.

The State's transportation funding needs are vast, and in recent years, all major capital projects have been primarily funded by either large bond issues pledging future fuel tax revenues or new local tax revenues levied in impacted areas though voter referendums. The R2C2 project would likely require a voter referendum to raise construction funds through increased taxes.

As the interests of CDOT are primarily focused on improving overall transportation outcomes and a new line will probably be owned and operated by the private sector, it is not the appropriate role of CDOT to promote one R2C2 Study Alignment over another. The primary focus of CDOT involvement in the R2C2 project implementation is to facilitate meeting future passenger rail needs in the I-25 corridor. CDOT envisions the need for passenger rail service in the I-25 corridor between Fort Collins, Denver, Colorado Springs and Pueblo at some point in the future. One approach to constructing passenger rail would be to use the right of way and possibly the existing infrastructure of the Joint Line. This approach could only be feasible if the majority of the through freight rail operations were relocated off of the Joint Line.

Given CDOT's limited ability to participate financially in the R2C2 project, it could focus its support of the project in areas where it could effectively leverage its limited resources for maximum value, such as:

- Environmental and planning studies – CDOT could sponsor up-front work such as studies required to achieve necessary clearances to qualify for federal funding and financing assistance. The most productive timing for entering into such studies is after the appropriate private sector entity(ies) has determined the project concept they are willing to fund and construct.
- Public sponsorship – CDOT could co-sponsor the project as a means to assist in obtaining funding and financing through State or federal programs. Any State or federal funding programs would relate specifically to future additional funds available for freight railroad projects; not existing State/federal highway funding.
- Right of way acquisition – Though the Class I railroads have similar powers to CDOT regarding the acquisition of right of way, CDOT has more experience working with local jurisdictions and property owners in Colorado and might be able to assist in or to negotiate fair terms for the land required for a bypass project.

Since a primary goal of CDOT is to obtain the right of way, operating "slots" or trackage rights on the Joint Line for future passenger rail use, any participation by CDOT in these or other activities is recommended to be conducted as part of an agreement for the acquisition of such rights. CDOT's services could be on an in-kind basis in return for credit towards obtaining rights on the Joint Line. CDOT should not expend resources for the

implementation of a bypass without having first negotiated terms for obtaining the desired rights for passenger rail services in the I-25 corridor, be that on the Joint Line or in other areas of the corridor.

Regional Transit District (RTD) - RTD is currently developing one of the largest light and commuter rail programs in the United States using sales tax proceeds dedicated for FasTracks as well as federal funds. As part of their program RTD is exploring options for project delivery and operation under long-term concession agreements to maximize their ability to deliver the program in a timely manner. Commuter rail service from Denver to points south along the Front Range is not in the current plan because much of that route is outside the RTD district and the parts within RTD are currently served or proposed to be served in FasTracks by light rail. RTD may be a potential partner in developing such service only to a limited extent.

Rocky Mountain Rail Authority (RMRA) - The RMRA is a multi-jurisdictional government body created under an intergovernmental agreement to study high speed passenger rail service in the I-70 and I-25 corridors. Using grant funding from CDOT, it is conducting a one year study to evaluate the feasibility of regional rail connecting major Colorado cities in the I-25 and I-70 corridors. The findings of this study will not be available until mid-2009. The RMRA does not currently have ongoing funding or jurisdiction to build capital projects, though in the future that organization or a successor could play a role in developing regional rail options for the I-25 corridor south of Denver on the Joint Line.

7.4.1.3 Local Governments

Since the predominance of rail traffic expected to move off of the Joint Line to the Eastern Plains is through unit coal train traffic, many of the public entities along the R2C2 Study Alignments will not realize economic development benefits or other positive and quantifiable impacts. In fact, the local jurisdictions along the R2C2 Study Alignments may not favor the R2C2 project due to potential loss of land by local farmers and ranchers, pollution, and other impacts from the new freight operations. Local jurisdictions along the existing Joint Line likely favor moving the unit coal trains to a bypass route as this could reduce pollution and traffic congestion in their areas. Economic impacts to various public and private entities, including changes in jobs and spending, could also impact the potential bypass project's support. These benefits are explored in more detail in **Chapter 5 - Net Benefits Analysis**.

City of Limon/Transload Facility - A potential rail transload facility for trains interchanging with the Kyle Short Line, with coal destined for the Goodland Power Station in Goodland, Kansas is currently being considered, though its development does not hinge on the R2C2 project. If the transfer facility is built, it could have limited impact on the local economy through the attraction of some limited amount of industry or jobs. As such the potential transload facility should be noted as a related project but it is not of the scale to impact a bypass route or be considered for partnering arrangements.

Local Governments along the Existing Joint Line - If the through coal train operations are relocated to the Eastern Plains and passenger rail is implemented on the existing Joint Line route, there could be significant opportunity for new development near station areas in cities and counties along the commuter rail line. Quality commuter rail access from the outer suburbs not served by RTD Light Rail Service to the urban job centers of Denver and Colorado Springs could substantially increase the value of land in these communities. If this occurs, cities, counties and developers of the station areas could become partners with CDOT or a yet to be named "Rail Passenger Authority", assisting with rights of way acquisition, station development, or outright capital contributions towards commuter rail development.

7.4.1.4 Third Party Investors

Transportation infrastructure investment in the United States has entered a new era in the past decade, with more third party involvement in the financial aspects of project development and operation. Transportation

infrastructure investments are often considered relatively safe due to their tangible nature and steady long-term return profiles (given the right operating agreements and a healthy economic outlook). The main negative aspect of these investments is their relative illiquidity due to their complexity and high cost.

Institutional investors, large banks, or consortiums thereof (both domestic and international) are the most common third party investors in transportation infrastructure. Such groups generally hire outside companies with specific expertise to operate and maintain the assets. The assets themselves typically become part of a portfolio or fund that is sometimes traded similar to a stock or mutual fund.

Participation in the project by a third party investor would require the same operating guarantees from BNSF and UP as would be needed for a Short Line railroad, as discussed above. The third party investor may only play a financial role in the project, outsourcing operations to another entity or the Class I railroad itself. Either way, the third party investor would evaluate its involvement based solely on cash flow, returns, and perceived project risks over time. Therefore, a third party investor would not be considered a viable partner except to the extent they might reduce the overall costs to deliver and finance the project.

7.4.1.5 Utilities

The projects listed in Table 7-3 are utility expansion projects currently underway or proposed in eastern Colorado and surrounding states. Most of these projects could not be considered for partnering because they are not in the vicinities of either bypass alignment or have been advanced past the point where a bypass project could be easily incorporated into their design. The three projects highlighted in yellow have some potential for future right of way sharing or other participation due to their location, especially the High Plains Express and Eastern Plains transmission projects. Each of the three highlighted projects is described in more detail below (Table 7.3). Any co-location of utility transmission lines would require the approval of the host railroad. Due to safety and engineering considerations, many railroads prohibit the installation of above-ground high-voltage transmission lines along their rights of way.

Table 7-3 Utility Projects in Colorado and Surrounding Areas

Project Name	Affected Area	Purpose	Expected Completion
High Plains Express Transmission Project	WY / CO / NM / AZ	Multiple improvements to expand power grid	2017
Eastern Plains Transmission Project	Eastern CO / Southwest KS	Develop joint transmission facilities	2011
Wyoming-Colorado Intertie Project	Wyoming / Morgan County, CO	Transmission line from WY to Pawnee Substation, CO	2012 - 2013
Cascade Hydroelectric Facility	Colorado Springs, CO	Hydroelectric station improvements	2008
East Montrose Electric System Improvement Project	Montrose, CO	New transmission line to east of Montrose, CO	In planning stage
Poudre Valley REA Power Reliability Improvement	Poudre Valley, CO	Power line to connect Waverly and Richard Lake Substations	In planning stage
San Luis Valley Electric System Improvement Project	San Luis Valley, CO	Power line between Walsenburg and San Luis Valley Substations	2011
Goodland Energy Center	City of Limon, CO to Goodland, KS	New industrial complex including an electricity generation plant	2009
Southern Delivery System	Colorado Springs, Pueblo, Fountain, CO	Bring water to residents in the affected area	In planning stage
Clear Spring Reclamation Facility	Colorado Springs, CO	Regional wastewater treatment facility	2012

High Plains Express Transmission Project (HPX) - The Xcel Energy HPX project is a plan to expand the power grid in Wyoming, Colorado, New Mexico, and Arizona. It could be considered as a potential partner for acquiring or sharing right of way as one section of the project falls in close proximity to the study Study Alignment B between the Cities of Limon and Fort Morgan. It should be noted that HPX is considering a partnership with the Eastern Plains Transmission Project. If the HPX partners with the Eastern Plains Project, the section relevant to a bypass would not be built, thus eliminating HPX as a potential partner. Permitting is scheduled to be complete in 2009 with operations to begin in 2017.

The Eastern Plains Transmission Project - This project is a joint effort of Tri-State G&T and Western Area Power Administration to develop joint transmission facilities in eastern Colorado and southwest Kansas. One of the transmission routes falls in close proximity to the Study Alignment B roughly between Limon and Fort Morgan (similar to the HPX). The project had been scheduled to begin construction in 2008 with completion by 2011. However, the environmental studies have been expanded to consider alternate routings.

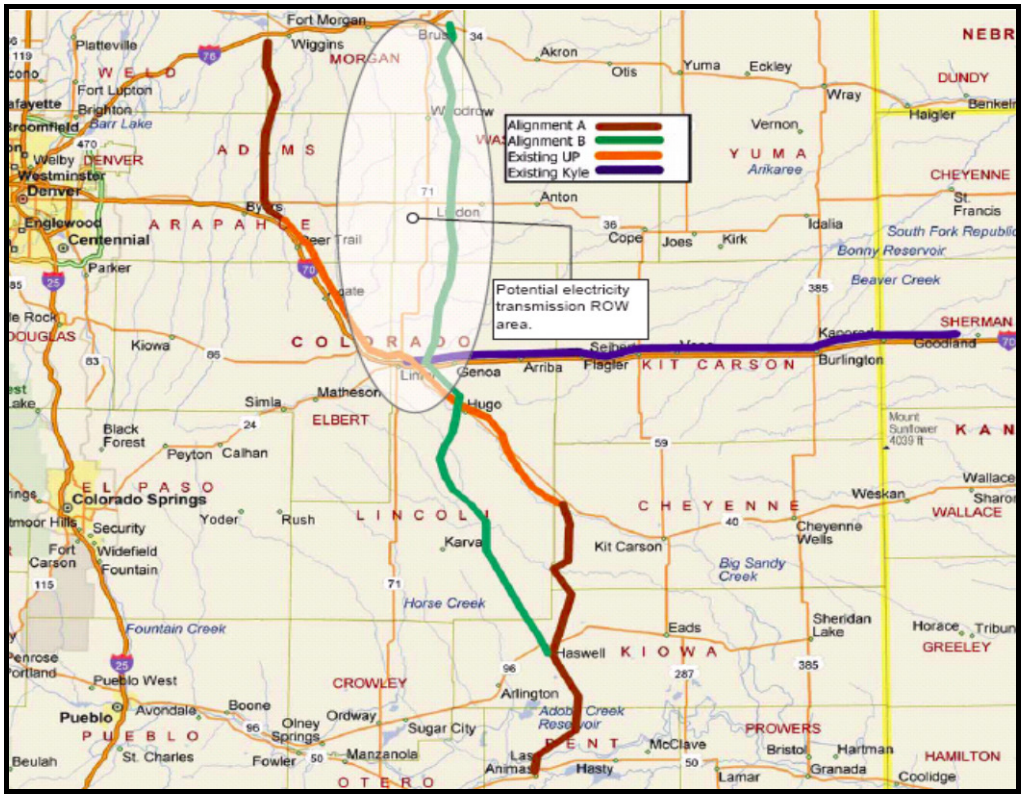
Goodland Energy Center (GEC) – The GEC is a mid-size, industrial complex currently under construction with a power plant, water treatment and distribution system, and a wastewater treatment system located in Goodland, Kansas. The power plant will be a coal and bio-mass fueled electric generation facility capable of generating 22 megawatts of electricity with coal envisioned as their main power source. The GEC does not have a coal source at this time, but is considering an agreement with UP and the Kyle Short Line Railroad to provide Wyoming coal via the connection between Goodland, Kansas and Limon, Colorado.

A future bypass along Study Alignment B would route BNSF coal trains near the Limon transfer location potentially providing the GEC with additional coal supply options and potential price competition between suppliers. The Goodland Power Station is currently proposed to be served by the UP only through the Kyle

connection. This potential benefit to GEC would be any savings provided by such price competition. However, it is acknowledged that such a new interchange would impact the existing competitive balance between the UP and BNSF.

Figure 7-1 is a map showing these three utility projects within the R2C2 project area. The area shaded white shows the potential location of either the Eastern Plains or High Plains Express transmission projects. The location of the Kyle Short Line Railroad is shown in dark blue, running east along I-70 from Limon.

Figure 7-1 Map of R2C2 Project Area and Utility Projects
(Alignments approximate, map not to scale)



In addition to utility projects in a bypass area, partnering opportunities with the coal's end users were evaluated. Texas utility companies (coal-fired electricity production facilities) are the primary recipients of coal transported by BNSF via the Joint Line. These end users are a logical group to consider for partnering on the project, since they could reap benefits from a bypass project in the form of lower transportation costs of the coal they purchase.

There is a conceivable scenario where the electricity producers could provide an up-front capital contribution to the project in return for a discount from the BNSF on coal they purchase. This would be a very complex transaction to accurately value because of the variability in shipping and electricity costs, which would need to be forecast over the long-term. Additionally, the railroads' cost of capital, due to their potential ability to qualify for future low interest financing though the federal government (currently under consideration in Congress), is probably lower than that of the power plants, rendering such an arrangement more expensive for the project overall. Based on these findings, the Texas utilities do not appear to be likely financial participants in a bypass at this time. Despite shorter, faster coal transportation, they are unlikely to see easily quantifiable, direct and immediate monetary benefits from the new route.

Emission Reduction Credit - Emission Reduction Credit (ERC) trading is infrequently discussed in relation to transportation projects, but the relocation of BNSF and UP freight operations from the Joint Line to the Eastern Plains could create enough emissions savings within the Denver and Colorado Springs non-attainment areas to attract capital from emitters of air pollutants who are not in conformance with federal standards.

Chapter 5 - Net Benefits Analysis of this report states that moving the freight operations off of the Joint Line would potentially remove significant amounts of air pollutants from the I-25 corridor each year though the efficiency gains of the rail operations and the reduction in idling traffic at at-grade crossings waiting for trains to pass.

The value of these ERCs is difficult to determine due to the shallow market for such credits in the Denver area. This said, the US Environmental Protection Agency Office of Air and Radiation has stated in its National Program and Grant Guidance (2008) that it would continue to assist states with the implementation of monitoring and trading programs related to emissions allowances. With several power plants in the Denver and Colorado Springs non-attainment areas, it is possible that a buyer for these credits could be found. It is unlikely that the price paid for such credits would cover a substantial portion of a bypass capital cost.

Texas Utilities (Shippers) - As noted in Chapter 5 - Net Benefits Analysis some savings could accrue to the buyers of the coal, which are Texas electricity producers, as they own some of the train cars and pay significant fuel surcharges to BNSF. The specific cost or savings sharing arrangements are not known but it is possible that the shippers could play a part in the project as they stand to benefit from either of the bypass alignments.

7.4.1.6 Coal Mining Industry

The predominance of the freight movements anticipated to be relocated from the Joint Line to a bypass route are unit coal trains originating in Wyoming's Powder River Basin (PRB), destined for Amarillo, Texas and points south. This analysis does not consider any impacts to western Colorado coal producers or other potential users of the proposed bypass.

Demand for coal mined from the PRB area is projected to grow at a rate of 0.9% per year between 2008 and 2030[i]. The PRB accounts for 40% of the total coal production in the U.S. and is used as far west as Oregon and as far south as Florida[ii]. A majority of the coal mined (92%) is used in electricity generation across much of the contiguous United States except for the Mid-Atlantic and Northeast Regions and California[iii]. The remaining 8% is used in other industrial plants (5%), coke plants (2%), and for commercial and residential uses (1%)[iv]. A vast majority (96%) of coal mined at the PRB is transported via train from the mine mouth to its final destination[v]. Coal transported from the PRB to Texas is a small percentage of total coal mined in the PRB, and therefore the improved route through Colorado has a small effect on the overall business of the mines in that area.

PRB coal has a relatively low BTU content, which, in combination with the efficient extraction techniques used there, makes PRB coal less expensive than coal mined in other parts of the United States. Coal mines sell their coal at the mine mouth to utilities, and do not see any profit from the transportation charges. Transportation charges average 75% of the total cost for PRB coal for end consumers[vi]. An improved transportation route could benefit the mines of the PRB if the lower roundtrip transport times result in higher annual coal consumption, though this impact would be difficult to substantiate. As such, coal mining companies are not considered to be target partners in a bypass project at this time.

[i] 'Annual Energy Outlook 2008' from the US Energy Information Agency
[ii] 'Deliveries of Coal from the Powder River Basin: Events and Trends 2005 – 2007' from the US Dept. of Energy
[iii] 'Deliveries of Coal from the Powder River Basin: Events and Trends 2005 – 2007' from the US Dept. of Energy
[iv] 'Annual Coal Report 2007' from the US Energy Information Agency
[v] 'Deliveries of Coal from the Powder River Basin: Events and Trends 2005 – 2007' from the US Dept. of Energy
[vi] 'Deliveries of Coal from the Powder River Basin: Events and Trends 2005 – 2007' from the US Dept. of Energy

8. Public Outreach Program

R2C2
RAIL RELOCATION for COLORADO COMMUNITIES

8.0 Public Outreach Program

8.1 Project Logo

In order to implement a successful public involvement and community outreach program, the Consultant Project Team created the R2C2 logo for the study to distinguish this Study from other unrelated endeavors such as the Rocky Mountain Rail Authority Study and the Prairie Falcon Parkway Express or "Super Slab". R2C2 (Rail Relocation for Colorado Communities) was used in all communications with identified stakeholders. The logo was introduced in a news release announcing R2C2 on November 9, 2007. It was also used on subsequent news releases, letterhead, the project website and all other project communications, including this final report.

8.2 Open Houses & Other Meetings

The Consultant Project Team held several Open Houses throughout the study to introduce the R2C2 study to the public. Five public Open Houses geographically dispersed throughout the study area were held in the spring of 2008. The Open Houses were advertised through a mass email to over 400 stakeholders, including elected and appointed officials, rail groups and others in the study area. The team also issued a news release one week in advance of the Open Houses to local media outlets including Spanish media outlets. The Spring Open Houses, held in Brush, Pueblo, Limon, Castle Rock, and Las Animas focused primarily on introducing the hundreds of attendees to the Public Benefits Study results and the scope and purpose of R2C2. (Table 8.1 identifies the date, location and numbers of attendees at the Spring and Autumn R2C2 Open Houses.) Issues and concerns raised during these Open Houses were identified and addressed in cooperation with CDOT's Public Relations office, the CDOT Government Relations team and the Technical Advisory Committee. Further responses were then communicated via letters, phone calls, and a set of a Frequently Asked Questions (FAQs) which were posted on the website as well as distributed at Open Houses to allow public access.

In order to expand notification and study information to a broader audience, CDOT also met with various elected and appointed officials, public interest groups and community leaders in the study area to discuss more effective ways to communicate information including the dates and locations of the second round of public Open Houses. The seven Autumn Open Houses were held throughout October in Limon, Colorado Springs, Las Animas, Brush, Denver, Pueblo and Strasburg. These Open Houses presented study updates based on comments and concerns heard during the first round of Open Houses and also discussed the anticipated study conclusions and next steps in the process.

In addition to the formal Open Houses and elected officials briefings, the Consultant Project Team met with various other stakeholders throughout the study area including representatives from transportation planning regions, agricultural, business and transit groups. The team also met with the Board of Directors of a citizens group that was formed in response to R2C2 known as C.A.R.R. – Citizens Against Rail Relocation, to better understand and address their concerns.

Table 8-1 Spring and Autumn R2C2 Open Houses

	Date	Location	# of Attendees*
Spring	4/29/08	Brush	20
	5/1/08	Pueblo	16
	5/5/08	Limon	82
	5/6/08	Castle Rock	27
	6/17/08	Las Animas	68
Total			213
Autumn	10/7/08	Limon	45
	10/8/08	Colo. Springs	35
	10/9/08	Las Animas	37
	10/14/08	Brush	73
	10/15/08	Denver	26
	10/28/08	Strasburg	17
Total			233
Grand Total			446*
*Number reflects only those individuals who chose to sign in			

8.3 Website Development & Other Information Tools

The Consultant Project Team maintained a website devoted to providing information on R2C2. The website, www.dot.state.co.us/railroadstudy/default.asp included the results of the Public Benefits Study, a list of Consultant Project Team members, study maps, the public involvement program including dates of Open Houses, comment cards, and Open House presentations, FAQs and answers, news releases and articles, and a summary of comments and questions received during the Spring and Autumn Open Houses. The public was also invited to comment through a P.O. Box specifically designated for R2C2.

8.4 Other Project Communications

The Consultant Project Team in cooperation with CDOT Government Relations staff created several informational handouts including comment cards, frequently asked questions and a 'Next Steps' flow chart. In order to get this information to a broad and diverse audience, the Consultant Project Team provided key materials in both English and Spanish. At the conclusion of the study, the Consultant Project Team will contact any interested stakeholder who provided contact information to let them know the Final R2C2 Study is available for review.

Copies of bi-lingual news releases, media lists, a comprehensive stakeholder list, the FAQs document, bi-lingual comment cards, a summary of comment cards received and a comprehensive summary of comments and questions from the Spring and Autumn Open Houses are included in Appendix 8.

9. Recommendations and Next Steps

R2C2
RAIL RELOCATION *for* COLORADO COMMUNITIES

9.0 Recommendations and Next Steps

9.1 Introduction

The Colorado Rail Relocation Implementation Study (R2C2) was initiated by CDOT in 2007 to further develop the concept of a new rail bypass to divert through rail freight traffic from the existing "Joint Line" of the BNSF and UP to the Eastern Plains of Colorado. The existing Joint Line follows the I-25 Front Range corridor between Denver and Pueblo. (It is known as the "Joint Line" since portions of the line between Denver and Pueblo are owned by both UP and BNSF and is used by both Railroads.) The "Bypass" concept was previously evaluated in CDOT's Public Benefits Study which was concluded in 2005 and showed that significant public and private benefits including congestion relief and environmental benefits could result from a freight rail bypass of the Front Range metro area.

The R2C2 Study has updated the benefits of the 2005 study and analyzed the costs of such a rail bypass by examining potential alternate alignments and modeling the diversion of rail traffic to possible new routings.

Funding and financing options were explored.

An extensive public outreach program which was not included in the Public Benefits Study was conducted as part of R2C2, with dozens of meetings in communities both in the Eastern Plains as well as in the Front Range. While the R2C2 Study developed more comprehensive capital and operating costs information, and updated potential benefits, it has also identified public concerns of residents in the farming and ranching communities of eastern Colorado.

R2C2 is one of the many planning and design efforts that will be required before any rail bypass moves forward to implementation.

9.2 Project Findings

While the Public Benefits Study examined a broad range of potential rail-related projects in the state, early on in the R2C2 process the Project Team was directed to focus on the potential for a north-south oriented rail bypass. The bypass would be designed to accommodate the heavy unit coal through train traffic to follow a more direct route outside the densely populated Front Range communities. R2C2 has determined that either of the two Study Alignments evaluated would have a positive benefit to cost ratio. Either of the alignments studied could result in diversion of a majority of the freight traffic that currently uses the Joint Line. The Joint Line would still be required to serve rail freight customers in Front Range communities including major power plants.

The existing routing for unit coal trains between Wyoming and Texas passes through Denver, Colorado Springs and Pueblo and is approximately 300 miles long between Brush and Las Animas. Study Alignment A which is similar to the bypass route studied in the 2005 Public Benefits Study would be about 220 miles long between the same two common points. Study Alignment A would have a lower capital cost ($800M in 2008 dollars) than Study Alignment B and by utilizing a portion of the existing UP Limon Subdivision would require acquisition of fewer miles of new right of way. Study Alignment B however would have a shorter overall routing (178 miles) and thus greater reductions in fuel consumed, diesel emissions, and rail operating costs. Study Alignment B would be more costly in terms of capital investment ($1.2B in 2008 dollars) and would require purchase of more acres of land for the new right of way. Study Alignment B would primarily serve the north-south coal traffic of BNSF in addition to some unit grain trains and the increasing ethanol unit train market. By avoiding the use of UP trackage, Study Alignment B has the advantages of fewer train conflicts, and single

dispatching control, thus higher potential operating efficiency. Study Alignment B, however, would not provide an attractive routing for much of UP's traffic.

The R2C2 Study did not evaluate the potential benefits and costs of utilizing the existing Joint Line between Denver, Colorado Springs and Pueblo for intercity rail passenger service. That is one of the alternatives being addressed in the parallel Rocky Mountain Rail Authority (RMRA) study which will be concluded in summer 2009. At that time it would be possible to combine the results of R2C2 and the I-25 Corridor option of RMRA to determine the consolidated benefits and costs of both freight and passenger operations.

9.3 Recommendations

The potential for diverting the majority of heavy freight traffic from the Front Range communities and thereby possibly opening up the Joint Line for intercity passenger rail service results in a strong recommendation for further study. With valuable input from the proposed Citizens Advisory Group composed of members from both Front Range and eastern Colorado communities, further study is needed to combine the findings of R2C2 and the I-25 portions of the RMRA study. More detailed engineering of alignments is needed to define and minimize potential community impacts. Additional environmental analyses are also needed to progress the initial environmental scan done in R2C2.

In the event that "Next Steps" lead to further study and analysis of a proposed north-south railroad bypass, all key variables such as trains per day using the bypass, diesel fuel and gasoline costs, cost of capital, wages, current construction related unit costs, trackage rights assumptions, etc. will need to be updated in the models and templates utilized in this study. The various chapters of the Final Report list the numerous assumptions and methodologies that were used in the R2C2 Study and those would necessarily need to be reviewed and updated to provide a current and accurate analysis at the time future steps are taken.

The following is a list of recommendations for CDOT's further consideration:

- Create a Citizens Advisory Group that will provide a basis for the involvement of citizens with CDOT in future efforts relating to a potential relocation of through rail freight to eastern Colorado.
- Provide a detailed evaluation of the benefits and impacts of a potential new eastern Colorado rail bypass line to the agriculture industry and communities of eastern Colorado.
- At the completion of both studies, combine the results of R2C2 and portions of the RMRA's I-25 corridor passenger rail feasibility study to determine the consolidated benefits and costs to the State of both freight and passenger operations. Continue to identify funding sources to combine the findings of the R2C2 and RMRA studies.
- Continue conversations with both Railroads and the public to explore possible options that may lead to the implementation of a bypass under a public-private partnership. Utilizing the results of the cost and rail operations analysis of the Study Alignments A and B, pursue with both Railroads possible options that may lead to the future implementation of a bypass. Such options could include either of the Study Alignments A or B, combinations of those two alignments, or different alignments that may emerge in ongoing discussions.
- Continue to support federal and state initiatives that could provide potential funding and financing programs that could be utilized in the implementation of a new rail bypass. Take steps necessary to keep possible partners in a public-private partnership well positioned to take advantage of future funding sources.

- Provide R2C2 study results to other private parties that have expressed interest in participating in a partnership that might lead to the potential implementation of a through rail freight bypass in eastern Colorado.

9.4 Next Steps

Figure 9-1 shows the numerous additional studies and the multiple decision points which must be navigated in going forward. These steps flow from the recommendations stated above. As the Figure shows, at any point during the process, CDOT's involvement and participation in the process could be concluded. And, while the private sector could continue the process, similar steps as shown on the figure would be required.

One of the first steps would be the establishment of a Citizens Advisory Group to work with CDOT as the process continues. CDOT is currently evaluating potential organizational structures for such a group.

The public outreach of R2C2 also revealed the need for a more detailed evaluation of the benefits and impacts of a new rail line to the agriculture industry and communities of eastern Colorado. These benefits and impacts were not addressed in the Public Benefits Study or the R2C2 Study and CDOT has made a commitment to perform such a detailed analysis.

Combining the findings of the R2C2 Study with the I-25 corridor elements of the separate RMRA study will assist CDOT in determining if it would be feasible for the State or another entity to obtain ownership of all or portions of the Joint Line right of way, or operating rights in the I-25 corridor in order to facilitate commuter or intercity passenger rail.

Subsequently, a next key step would be creating the detailed agreements related to forming possible public-private partnerships, identifying potential funding sources, and developing a financial plan. Additionally, it would be important to determine whether intergovernmental agreements would be necessary and develop a plan for their creation.

Following completion of that key step, the environmental documentation, (i.e., Environmental Impact Statement or Environmental Assessment) would take place. By law, it is after this step that a final route selection process would occur as federal statutes mandate alternatives be assessed for environmental impact prior to environmental clearance of a final route.

Only after all of these steps have been completed would design, right of way acquisition, mitigation of various issues, and bypass construction be able to occur.

Figure 9-1 Next Steps