

APPENDIX A23

ENERGY ANALYSIS TECHNICAL MEMORANDUM

FOR THE State Highway 9 Iron Springs Alignment Environmental Assessment

Prepared for

COLORADO DEPARTMENT OF TRANSPORTATION

FEDERAL HIGHWAY ADMINISTRATION

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ACRONYMS

CDOT	Colorado Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
FHWA	Federal Highway Administration
mph	miles per hour
ROD	Record of Decision
SH 9	State Highway 9
VMT	Vehicle Miles Traveled

1 INTRODUCTION

2 This technical memorandum has been prepared in support of the State Highway (SH) 9 Iron
3 Springs Alignment Environmental Assessment (EA). This memorandum evaluates the effects of
4 the Iron Springs Alignment (Proposed Action) and the No Action Alternative (widening on the
5 existing alignment) with respect to energy consumption.

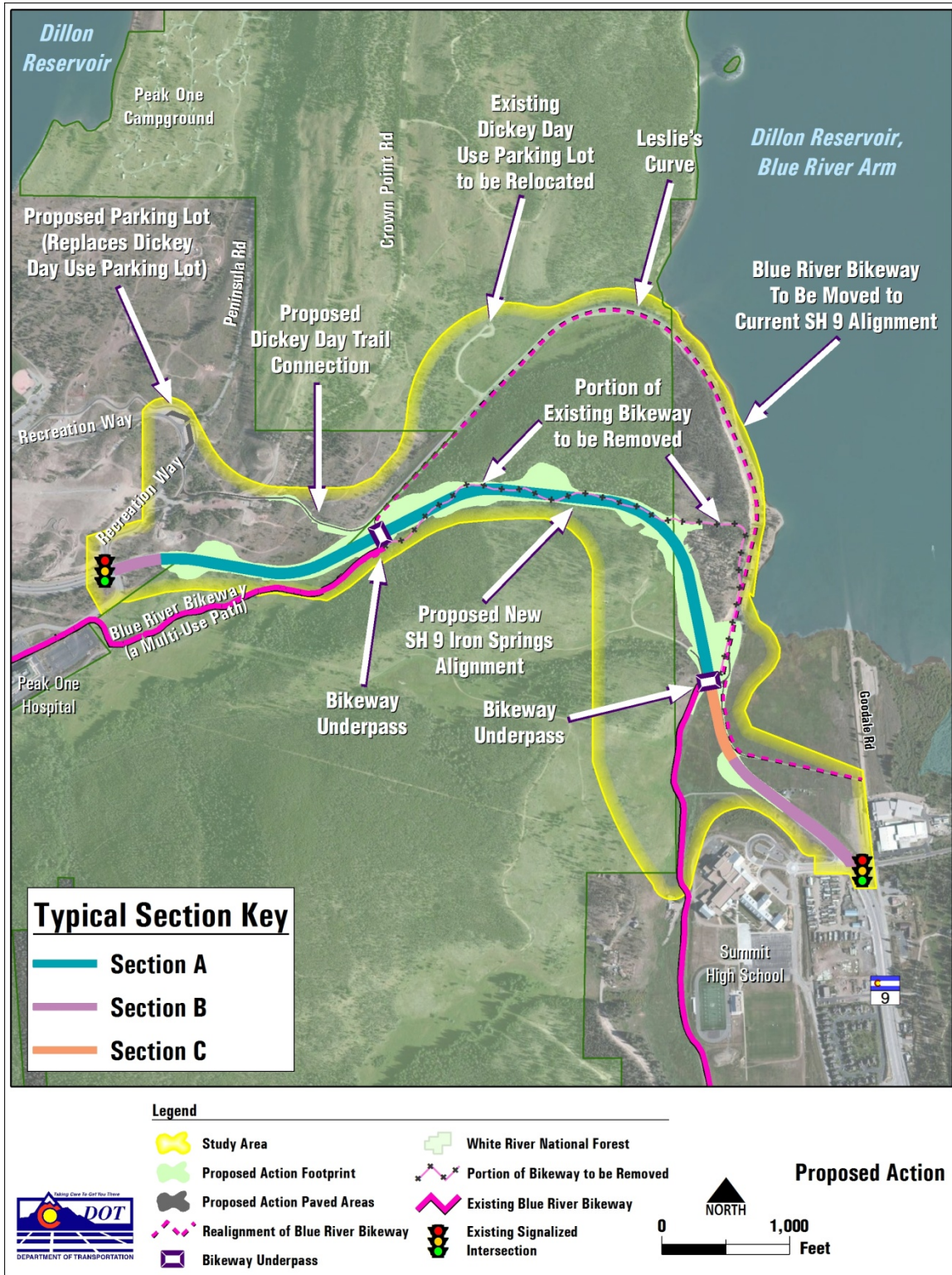
6 *Proposed Action*

7 As part of implementation of the SH 9 improvements between Frisco and Breckenridge, the
8 Colorado Department of Transportation (CDOT) and Federal Highway Administration (FHWA)
9 are proposing to realign approximately 1.3 miles of existing SH 9 just south of the Town of
10 Frisco, Colorado (see **Figure 1**). This stretch of SH 9, which falls between mileposts 93 and 95,
11 would be realigned to provide a four-lane reduced section roadway away from Dillon Reservoir.
12 This Proposed Action, also referred to as the Iron Springs Alignment, would shorten SH 9 by
13 approximately 0.4 mile. The Proposed Action would provide roadway safety benefits, as well as
14 water quality and drinking water protection benefits, as a result of straightening the highway to
15 remove a tight, compound curve (known as Leslie’s Curve), which is in close proximity to Dillon
16 Reservoir. The existing condition on Leslie’s Curve is considered substandard and contributes to
17 accidents in the area.

18 The Proposed Action would include realignment of a portion of the existing Frisco-Farmer’s
19 Korner-Blue River Bikeway (also referred to herein for brevity as the Blue River Bikeway or
20 bikeway). This portion of the bikeway would be moved to the alignment currently occupied by
21 SH 9, would be approximately 0.4 mile longer than the existing bikeway, and would be at a
22 gentler grade than the current alignment. In addition, the Dickey Day Use Parking Lot would be
23 moved west to a new parking lot to be constructed as part of the project, with access provided
24 via Recreation Way using the existing signalized intersection at SH 9 and Recreation Way. A new
25 trail connection would be provided to link the proposed parking lot with the realigned bikeway
26 and existing trail, which currently begins at the old Dickey Day Use Parking Lot.

27 Additional detail regarding the Proposed Action, including typical sections, is provided in the EA
28 main text and the project drawings provided in Appendix A1 of the EA.

1 **Figure 1 Proposed Action**



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1 *No Action Alternative*

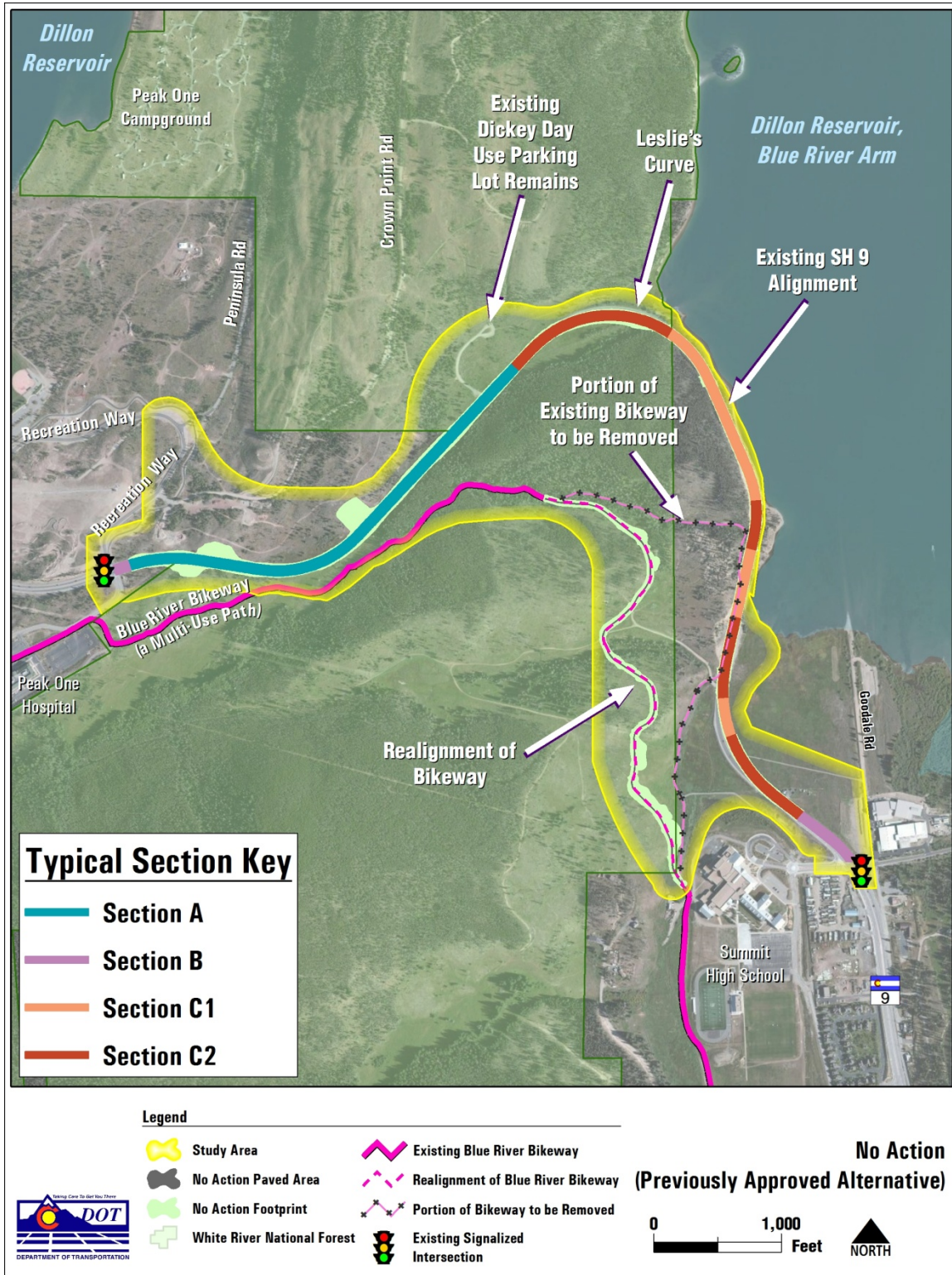
2 If the Proposed Action is not selected for implementation, SH 9 would be widened to provide a
3 four-lane reduced section roadway along the existing alignment as previously approved in the
4 SH 9 Frisco to Breckenridge Environmental Impact Statement (EIS) and Record of Decision (ROD)
5 (CDOT and FHWA, 2004a; 2004b) (**Figure 2**). The 2004 Preferred Alternative is considered the
6 “No Action Alternative” for this EA and is used as a baseline for comparison with the Proposed
7 Action. These improvements would be implemented if the Proposed Action is not selected.

8 Widening along the existing alignment would require large rock cuts and retaining walls
9 (problematic to design and construct), and the highway would remain in close proximity to
10 Dillon Reservoir. The length of SH 9 would remain the same as that of the existing highway. The
11 tight Leslie’s Curve would not be eliminated; however, safety features such as a barrier between
12 opposing lanes would be installed to improve safety.

13 With this alternative, approximately 0.8 mile of the existing Blue River Bikeway would be
14 realigned to allow space for the highway widening. The length of bikeway would not change
15 appreciably and the current relatively steep grades on the path would remain.

16 Additional detail regarding the No Action Alternative, including typical sections, is provided in
17 the EA main text and the project drawings provided in Appendix A1 of the EA.

1 Figure 2 No Action Alternative (Previously Approved)



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1 ANALYSIS

2 This analysis evaluates and compares energy consumption for the construction (short term) and
3 operation (long term) of the transportation systems for the Proposed Action and the No Action
4 Alternative. This analysis is for SH 9 between mileposts 95 and 93. This 2-mile-long segment of
5 SH 9 in the No Action Alternative would be shortened through realignment by approximately
6 2,400 feet to approximately 1.5-mile long in the Proposed Action.

7 *Direct Impacts*

8 The construction envisioned for either the No Action Alternative or the Proposed Action would
9 consume energy. In general, because the energy requirements of various road construction
10 techniques are similar, both the No Action Alternative and the Proposed Action are expected to
11 have similar construction energy requirements. The No Action Alternative would involve
12 construction of a longer road but would be widening an established road corridor. The Proposed
13 Action would involve a shorter road construction corridor but would involve construction on a
14 new alignment. Because the Proposed Action would be on a new alignment, traffic conflicts and
15 delays and resulting fuel consumption during construction may be lower. The corridor bikeway
16 would require relatively little reconstruction under the No Action Alternative but would require
17 more construction on the old SH 9 alignment under the Proposed Action. Overall, the
18 differences are expected to be minor and are relevant only during the relatively brief
19 construction period.

20 The main energy consumption for the corridor in ongoing operations will be to power vehicles.
21 Energy will also be consumed through maintenance of SH 9, such as winter snow plowing or
22 pavement repairs, although this is expected to be much less energy than used by vehicles. Other
23 operational items, such as street lights or traffic signals, are not a major consideration for this
24 project and so have been excluded.

25 The vast majority of vehicles, now and into the foreseeable future, are expected to be powered
26 by petroleum-based fossil fuels. Other vehicle fuels can include natural gas or electricity, but
27 their usage rate is relatively low and would not be affected by this project so they were deemed
28 to be inconsequential for this analysis.

29 The most substantive difference between the No Action Alternative and the Proposed Action in
30 operational energy consumption terms will be in the amount of fuel burned by SH 9 traffic. The
31 primary difference between the alternatives lies in the final overall length of SH 9 in the project
32 corridor and the resulting vehicle miles traveled (VMT) associated with each alternative.
33 Assuming traffic characteristics remain the same for each alternative (vehicle types, volumes,
34 etc.), the shorter route would result in less fuel consumption. Therefore, VMT is a gauge of the
35 relative energy consumption among the alternatives.

36 **Table 1** presents the predicted 2035 VMT for the alternatives within the study corridor. The
37 Proposed Action would shorten SH 9 by nearly 25 percent in the project corridor. Consequently,
38 the Proposed Action would provide a benefit through less operational energy consumption by
39 vehicles than would the No Action Alternative.

Table 1 Comparison of Alternatives' Daily Vehicle Miles Traveled and Fuel Use in the Project Corridor

Alternative	Predicted 2035 Daily VMT (miles)	Daily VMT Change from 2035 No Action (miles)	Estimated Change in Daily VMT and Fuel Consumption Versus No Action (percent)
No Action Alternative	62,800	0	0
Proposed Action	48,500	-14,300	-23

A number of factors will affect fuel consumption by the various vehicle types under the two alternatives other than just VMT, but these are smaller considerations for energy usage. For example, fuel consumption tends to be lowest under steady cruise-type driving conditions at speeds of 35 to 45 miles per hour (mph); fuel consumption will typically increase with higher speeds. The No Action Alternative may have speed limits of 40 to 45 mph through the Leslie's Curve section, while the Proposed Action may have a speed limit of 50 mph, which may result in slightly more fuel consumption for the Proposed Action. A higher engine load, for example, traveling uphill, can reduce fuel efficiency while traveling downhill can increase it. The No Action Alternative would be relatively flat through this segment while a slight uphill/downhill may be introduced through the new alignment of the Proposed Action, which may result in slightly more fuel consumption. Congested traffic conditions (and lower fuel efficiency) would be similar for the two alternatives.

Engine friction, rolling resistance, and accessories (for example, air conditioning) can reduce fuel efficiency at lower speeds. Adding cold engine starts or stop-and-go driving conditions can also increase fuel consumption. Overall, because the two alternatives are not expected to differ substantively in these traffic characteristics in the project corridor, these characteristics will not materially distinguish energy usage.

Indirect Impacts

New development, re-development, and general population increases in the project vicinity, including construction of new homes or commercial buildings, would increase demand for energy. The transportation system can indirectly affect these actions.

The Proposed Action is not expected to have any other effect different from that of the No Action Alternative on such topics as land development patterns, land development pace, travel mode choices, etc.; therefore, no differences in indirect impacts are expected between them.

Energy Conservation Measures

Several opportunities for energy conservation would be available through the Proposed Action. First and most important because SH 9 would be shorter, less fuel would be burned by vehicles. Long-term road maintenance costs may be reduced due to the shorter highway distance. Recycled materials, such as asphalt, should be used to the maximum extent possible.

The construction contractor should conduct disruptive activities during periods of lower traffic volumes to reduce the number of idling vehicles. The contractor should keep equipment well-maintained, minimize equipment idling, and encourage carpooling to and from the work site. Staging areas should be located as close to the construction as possible.

1 **SUMMARY**

2 The short-term and long-term energy requirements of two corridor alternatives—No Action
3 Alternative and Proposed Action—were evaluated and compared. For the
4 short-term/construction energy usage, the differences between the No Action Alternative and
5 Proposed Action would be minor and inconsequential.

6 The traffic characteristics that affect long-term/operational energy usage are similar between
7 the two alternatives. The primary distinction among these characteristics would be the length of
8 SH 9 and the resulting VMT for each alternative. The Proposed Action would result in a 0.5-mile
9 shorter highway and, consequently, would result in lower future VMT and energy
10 consumption—approximately 6 percent in annual fuel savings for the 9-mile-long corridor
11 between Frisco and Breckenridge over the No Action Alternative.

12 **REFERENCES**

13 Colorado Department of Transportation (CDOT) and Federal Highway Administration (FHWA).
14 2004a. *State Highway 9 Frisco to Breckenridge Final Environmental Impact Statement and 4(f)*
15 *Evaluation*. February. [Note: This document is an abbreviated Final EIS which incorporates the
16 Draft EIS, constituting the complete Final EIS.]

17 Colorado Department of Transportation (CDOT) and Federal Highway Administration (FHWA).
18 2004b. *State Highway 9 Frisco to Breckenridge Record of Decision*. May.