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1. INTRODUCTION

The purpose of this document is to summarize the information necessary to meet the intent of the January 2006 Memorandum of Agreement (MOA) between the Federal Transit Administration (FTA) and the United States Army Corps of Engineers (USACE) as related to National Environmental Policy Act of 1969 (NEPA) requirements and Section 404 mandates. This document includes relevant documentation from the North Metro Corridor Environmental Impact Statement (EIS) and associated technical reports including the project purpose and need chapter and information from the alternative screening and analysis process. This document tracks progress of coordination between FTA and USACE towards developing the project purpose and need, alternative screening, selection of a preferred alternative in the North Metro Corridor EIS, and the definition of compensatory mitigation measures, as required. It will be used for submittals to the USACE for coordination purposes and will be updated as additional information is developed.

In November 2004, voters in metropolitan Denver’s Regional Transportation District (RTD) approved the FasTracks initiative, which is to expand and improve public transit service to metro Denver communities over a 12-year period. The FasTracks Plan (RTD 2004) calls for the construction and operation of rail lines and improved bus service and park-n-Rides throughout the region.

The RTD’s North Metro Corridor EIS is part of the RTD FasTracks Program. The EIS examined a range of alternatives that would provide fixed-guideway transit service within the North Metro Corridor between Denver Union Station (DUS) in downtown Denver, Colorado and the 162nd Avenue area in Thornton. This project’s Notice of Intent (NOI) was published in the Federal Register (FR) on 12 September 2006.

Cooperation with the USACE was conducted under the December 2004 NEPA/404 Merger Process and Agreement. Both the purpose and need, development of the alternatives, and the alternatives screening process were coordinated with the USACE through this process.

The North Metro corridor study area (Figure 1-1) links the Denver Central Business District (CBD) to northeast Denver and the cities of Commerce City, Thornton, and Northglenn in Adams County. The North Metro corridor study area is in the northern portion of the Denver metropolitan region, extending from approximately DUS north to the 162nd Avenue area. The wedge-shaped study area includes lower downtown Denver, which comprises the southern boundary, and the RTD boundary at the county line between Adams and Weld counties, which comprises the northern boundary. The eastern boundary follows the South Platte River Valley south from the RTD boundary to 104th Avenue and continues along Quebec Street to the Interstate 70 (I-70)/Union Pacific (UP) Alignment. The North Metro corridor study area is bounded to the west by Interstate 25 (I-25).

There are numerous rail corridors within the study area as shown in Figure 1-1. These rail lines include:

- UP Railroad Greeley Subdivision
- UP Railroad Limon line (parallels the south side of I-70)
- UP Railroad Boulder Industrial Lead (also referred to as the UP Dent line or the UP Boulder Branch)
- BNSF Railway Brush Subdivision (also referred to as the Chicago line or mainline)

The BNSF Railway Brush Subdivision travels from DUS through Sand Creek Junction and continues northeast along United States Highway 2 (US 2). The UP Railroad Greeley Subdivision rail line travels from DUS through Sand Creek Junction and continues northeast along Interstate 76 (I-76) and then United States Highway 85 (US 85). The UP Railroad Limon line connects to the UP Railroad Greeley Subdivision at approximately 40th Avenue and travels east along an alignment south of I-70. The UP Railroad Boulder Industrial Lead, which starts north of Sand Creek Junction and travels directly north, is commonly referred to as the UP Dent Line or UP Boulder Branch (Figure 1-1). Historically, the UP Boulder Branch provided a UP Railroad connection between Sand Creek Junction and St. Vrain Creek. At St. Vrain Creek, the UP Boulder Branch extended west to the Valmont Power Plant near Boulder, which allowed the UP Railroad to have connections north to Fort Collins, west to Boulder, and east to La Salle.

Terrain within the North Metro corridor study area has been highly modified due to urbanization. For example, in much of the project area, streams have been channelized. The channelization of these streams (i.e., removal of stream meanders) has created drier conditions in many of the floodplains along the streams. Whereas historically these floodplains would have received overbank flows during spring runoff and storm events, they either no longer flood or only flood infrequently during very high-flow events. Conversely, in some areas stormwater detention ponds and roadside drainageways have been constructed to prevent flooding of important infrastructure. This has resulted in the re-routing of surface water flows, creating wetland conditions in some areas that were historically dry. Elements of the affected environment related to waters of the United States (US) that are discussed further in the following subsections include linear water bodies and wetlands. Figures 1-2A through 1-2L depict the locations of these features, as well as locations of detention ponds.

The project study area is a smaller subset of the North Metro corridor study area and included land 300 feet either side of the centerline of alignments and 300 feet beyond station boundaries for wetlands and other water features.
1.1 LINEAR WATER BODIES

The Preferred Alternative passes by and crosses 15 different named streams, rivers, and ditches (some more than once) (Figures 1-2A through 1-2L). These include from south to north:

- South Platte River (first and second crossing)
- O'Brian Canal (first and second crossing)
- Sand Creek
- O-Brian Canal (third crossing)
- South Platte River (third crossing)
- Lower Clear Creek Canal
- Riverdale Tributary to Grange Hall Creek
- Grange Hall Creek
- North Fork Grange Hall Creek
- Northeast Fork Grange Hall Creek
- Union Ditch
- Signal Ditch
- Wadley Creek South
- Wadley Creek North
- German Ditch
- Short Run
- Big Dry Creek
FIGURE 1-2A. NORTH METRO CORRIDOR WETLAND AND OTHER WATERS MAP
FIGURE 1-2B. NORTH METRO CORRIDOR WETLAND AND OTHER WATERS MAP
FIGURE 1-2F. NORTH METRO CORRIDOR WETLAND AND OTHER WATERS MAP

North Metro Corridor

January 2011

H-10
FIGURE 1-2I. NORTH METRO CORRIDOR WETLAND AND OTHER WATERS MAP

North Metro Corridor

H-13
January 2011
1.2 WETLANDS

Forty-eight palustrine emergent (PEM) wetlands and 28 palustrine emergent/palustrine scrub-shrub (PEM/PSS) wetlands were identified and mapped within the project study area of the Preferred Alternative. These wetlands are illustrated on Figures 1-2A through 1-2L. (See Section 6, Conceptual Compensatory Mitigation for Specific Sites.) Emergent wetlands are dominated by herbaceous vegetation (non-woody plants). Palustrine scrub-shrub (PSS) wetlands are those that support small trees and bushes that are less than 20 feet in height (Cowardin et al., 1979). The majority of wetlands within the project study area are found in drainages and adjacent to streams, where they may occupy the entire channel bottom or alternate with areas of open water or channel bottom. Others may exist in narrow margins along one or both banks. While the characteristics of the individual wetlands may vary, dominant species typically include cattails (*Typha* sp.), bulrushes (*Schoenoplectus* spp.), sedges (*Carex* sp.), spikerushes (*Eleocharis* spp.), and smartweeds (*Polygonum* spp.). Wetland hydrology is typically sustained by precipitation, groundwater, surface water runoff, and/or irrigation runoff.

Wetlands perform a variety of functions and functions important to humans and wildlife. The level of functionality at which a wetland performs a specific function, or suite of functions, is dependent on its topographic position in the landscape, size, and vegetative composition, among other factors. Wetland functions that are frequently evaluated include:

- General wildlife and fish/aquatic habitat
- Flood flow attenuation (reducing the flow and/or velocity of flood waters)
- Surface water storage
- Sediment/toxicant/nutrient removal (water quality improvement)
- Sediment/shoreline stabilization
- Production export/food chain support
- Uniqueness (ability to recreate it, if it is impacted)
- Recreation/education potential

Two wetland complexes within the Southern Section ranked high or moderate for relevant functions assessed. The two wetlands are associated with natural hydrologic sources. These wetlands are discussed below.
Sand Creek Complex. Wetlands associated with Sand Creek total approximately 1.9 acres within the Southern Section of the project study area and flow through a heavily industrialized section of Denver. Even so, this area has been restored and re-engineered, supporting a variety of wildlife, including beaver (*Castor canadensis*), barn swallows (*Hirundo rustica*), and some warm-water fish species.

The wetlands associated with Sand Creek in the project study area are classified as PEM/PSS and are comprised predominantly of sandbar willow, reed canarygrass, and Emory's sedge (*Carex emoryi*), with some diversity of other sedges and rushes.

The wetlands along Sand Creek provide wildlife habitat, including habitat for sensitive species, flood attenuation, sediment/nutrient/toxicant removal, sediment/shoreline stabilization, groundwater discharge/recharge, and recreation/education potential.

South Platte River Complex. Within the project study area, the South Platte River complex occurs along the corridor in three places: near Park Avenue, and again near 45th Avenue in downtown Denver, and within a complex of wetlands and ponds adjacent to Steele Street Park in Adams County. In the Park Avenue area, the river encompasses approximately 2.6 acres. The river is somewhat entrenched, with no associated wetlands. In the Steele Street Park area, the complex is comprised of the river, its associated wetlands, Siegrist Pond, Tani Reservoir, and West Gravel Lake No. 3, for a total of 10.7 acres. The South Platte River forms a wide meander through this area, and much of the bank substrate is alluvial deposition. Abutting the river are small, fringe PEM/PSS wetlands (WL 14-3) of approximately 0.5 acre, dominated by sandbar willow and reed canarygrass with a mature, woody, riparian overstory. Niver Creek (WL 14-1 and OW 14-1) is a small tributary to the South Platte River contributing to the higher functional assessment of the entire area.

Adjacent to the river, the three gravel ponds are connected by a trail system. West Gravel Lake No. 3 is maintained as a public fishing area. A small wetland restoration site is located along Siegrist Pond, outside of the project study area. These ponds provide habitat for shorebirds and fish and are part of a general wildlife corridor through the area.

The wetlands and associated gravel ponds provide water quality improvement, bank stabilization, wildlife habitat (including state-listed threatened and endangered species), flood flow attenuation, short- and long-term water storage, and recreation/education potential.

Two wetland complexes with natural hydrological sources received high ratings for some functions within the Northern Section. Two other complexes received moderate ratings. These areas are briefly discussed below.

Grange Hall Creek Complex. Located in Northglenn in an area bordered on the west by light industry and the east by residential development, the Grange Hall Creek complex includes the North Fork of the Grange Hall Creek and Grange Hall Creek, and total 1.4 acres. These features form a confluence east of the project study area. Several hydrologic inputs to the system occur west of the rail right-of-way (ROW) and include the perennial Grange Hall Creek and the North Fork of Grange Hall Creek. The steep railroad ROW separates the east and west sides of the complex. The North Fork of Grange Hall Creek is impounded east of the ROW, and the high groundwater table supports a substantial wetland.
The wetlands associated with the North Fork of the Grange Hall Creek appear to be hydrologically impounded due to the railroad ROW and are predominantly cattails and spike rush (*Eleocharis* spp.). Most of the riparian area is grassland, but a multi-strata overstory abuts the creek on the west side of the rail ROW and sandbar willow borders the retention pond within the North Fork.

Grange Hall Creek itself has been substantially modified east of the railroad ROW but retains a multi-strata wetland fringe. The entire area is criss-crossed by walking and bicycle paths. The Grange Hall Creek complex provides wildlife habitat for riparian and wetland dependent species.

**Big Dry Creek Wetlands Complex.** The Big Dry Creek complex north of E-470 in Thornton occurs in an area of rangeland. The complex is comprised of Big Dry Creek, its abutting wetlands, and wetlands and other water features that lie in its floodplain, including Morris Creek. These areas combined total approximately 4.7 acres. The complex is classified as predominantly PEM, with herbaceous wetland plants dominating the wetland areas.

Hydrology for the area comes primarily from Big Dry Creek and is supplemented by laminar flow from storm events, as evidenced by rills that occur throughout the adjacent pastureland.

The Dry Creek complex provides sediment/nutrient/toxicant removal, short-term and long-term water storage, groundwater discharge/recharge, production export/food chain support, and flood attenuation.

Two other wetland complexes within the project study area received moderate ratings for several functions and are discussed briefly below.

**4100 Drainageway.** Comprising approximately 2.1 acres within the South Platte River watershed, the 4100 Drainageway straddles both sides of a steep railroad ROW south of East 96th Avenue in Thornton. The hydrology in this area is driven by a tributary of the South Platte River originating west of the project study area. This tributary loses definition within a large PEM wetland and detention pond to the west and a multi-strata wetland to the east of the ROW.

The Colorado Agriculture Canal is well defined to the east of the alignment. The 4100 Drainageway does not appear to be intercepted by the canal, and historical map records provide no evidence that this may have been part of the Colorado Agriculture Canal. Therefore, the Colorado Agriculture Canal was not considered as part of the wetland complex. Additionally, the 4100 Drainageway is not within the project study area but does add to the high functions of this wetland complex.

Other high functions of this wetland include wildlife habitat. Numerous bird species use the west wetland and retention pond, and the east wetland provides habitat for red fox (*Vulpes vulpes*) and other small mammals.

The 4100 Drainageway received moderate ratings for short- and long-term water storage, flood flow attenuation, and general wildlife habitat, and high ratings for sediment/nutrient/toxicant removal.
**Riverdale Tributary, Grange Hall Creek Watershed.** The Riverdale Tributary (1.8 acres) is also divided by a steep railroad ROW and is hydrologically connected through culverts under the track. Although highly disturbed, the area to the west has multiple inputs and is densely populated with sedges and rushes. The retention pond to the east has a dense PEM/PSS wetland fringe. The area provides habitat for numerous birds.

The Riverdale Tributary received moderate ratings for general wildlife habitat, sediment/nutrient/toxicant removal, long- and short-term water storage, and flood flow attenuation.
2. PURPOSE AND NEED FOR THE ACTION

2.1 PROJECT PURPOSE

The Purpose of the North Metro Corridor Project is to implement high-capacity, fixed-guideway transit within the North Metro corridor between DUS and the 162nd Avenue area.

2.2 TRANSPORTATION NEED

This study addresses several transportation-related issues in the North Metro corridor study area that were identified through public scoping and agency involvement. Details about these issues (described in greater depth below) have been captured in succinct Need statements that helped formulate reasonable alternatives. In summary, the North Metro Corridor Project would help meet the following needs:

- Need for mobility improvements
- Need for regional connectivity
- Need to serve traditional and new transit users
- Need to support community and regional plans, including the voter-approved FasTracks Plan (RTD 2004)
- Need to qualify for federal funding programs

2.2.1 Need for Mobility Improvements

Future population and employment growth in the North Metro corridor study area is expected to increase travel demand and to lead to an increase in travel time, congestion, and delay for travelers within the region. The North Metro Corridor Project would meet this increased travel demand by providing reliable alternative modes of travel.

According to the Metro Vision 2035 Regional Transportation Plan (Metro Vision 2035 Plan) (Denver Regional Council of Governments (DRCOG) 2010), the population of the Denver region is expected to grow by 59 percent (%), and new employment is forecast to increase by 64% between the years 2005 and 2035. The North Metro corridor study area is projected to experience growth that exceeds that of the Denver region in the same timeframe. According to the DRCOG regional travel demand model (DRCOG 2009), population in the North Metro corridor study area is expected to increase by over 74%, and employment is expected to grow by 76% between 2005 and 2035. Facilities such as Denver International Airport (DIA) and the E-470 Tollway have contributed to new development and increased trip generation throughout the North Metro corridor study area. In addition, the Northern Front Range region (which includes the communities to the north of the Denver metropolitan area) continues to demonstrate strong growth, with a projected increase of nearly 300,000 residents by 2035, according to the North Front Range Metropolitan Planning Organization's 2035 Economic and Demographic Forecast Report (2006). This anticipated growth could impact the North Metro corridor study area as more people in these communities travel to and from Denver (DRCOG 2005). Figure 2-1 and Figure 2-2 show 2007 and projected year 2035 population densities for the North Metro corridor study area.

As a result of this expected growth, the Metro Vision 2035 Plan estimated that the average vehicle miles traveled (VMT) in the Denver region would increase by 74% between 2005 and
2035, and the number of congested lane miles would triple (DRCOG 2010). More recent calculations conducted with the DRCOG/RTD 2007 and 2035 regional travel demand models indicate that VMT would actually increase by 68% in the Denver region. According to the *Metro Vision 2035 Plan*, major highways within the North Metro corridor study area that are expected to experience severe periods of congestion by 2035 include segments of I-25 between downtown Denver and State Highway 7 (SH 7), I-76 from I-25 to east of Quebec Street, I-270 from I-25 to east of Quebec Street, and I-70 from I-25 to east of Quebec Street. Other highways and arterials within the North Metro corridor study area that are expected to experience severe congestion include SH 7, US 85, Washington Street, Colorado Boulevard, Quebec Street, Vasquez Boulevard, 84th Avenue, 104th Avenue, 120th Avenue, and 144th Avenue.

Delay, considered to be the extra time spent traveling due to traffic congestion, was also forecast in the *Metro Vision 2035 Plan* to grow by more than 325% from 2005 to 2035 for the Denver region (DRCOG 2010). The *North Metro Transportation Study* (RTD 2001) estimated that travelers would experience a total Denver metropolitan area daily delay of approximately 580,000 person-hours, and 192 lane-miles of roadway would be severely congested for year 2020 (RTD 2001). RTD’s models now predict that delay in the Denver region would increase fivefold between 2005 and 2035, increasing by 401% from 253,705 vehicle hours of delay (VHD) to 1,271,135.

Within the North Metro corridor study area, from the Weld County line to downtown Denver, morning (a.m.) peak period VMT is expected to increase 50%, and afternoon VMT is expected to increase 55% between 2007 and 2035. The total daily VMT is expected to increase 41%, which indicates more people driving outside of peak travel times. The daily vehicle hours traveled (VHT) in the North Metro corridor are expected to increase 80% by 2035, which indicates more time spent traveling because this rate is higher than the number of miles traveled. In other words, people would travel more miles, but the hours spent in vehicles to drive those additional miles would increase disproportionately due to congestion and lower average speeds.
FIGURE 2-1. YEAR 2007 NORTH METRO CORRIDOR STUDY AREA POPULATION DENSITIES

LEGEND
2007 Population Density (Households per Acre)
- Up to 3
- 3.1 to 5
- 5.1 to 10
- More than 10.1

- Denver Union Station
- North Metro Corridor Study Area
- Existing Railroad
- County Line

Source: Roads, Highways (CDOT, 2005 and RTD/Dynascan, 2006)
Railroads, Lakes, Streams (CDOT, 2005)
Population Density (DRCOG, 2010)
Parks and Open Space (DRCOG, 2004)
Table 2-1 presents current (2007) traffic counts and projected (2035) traffic volumes for specific street locations in the North Metro corridor study area. Total growth and annual growth percentages are also provided. Figure 2-3 and Figure 2-4 show current and projected congestion for specific roadway segments in the North Metro corridor study area.

### TABLE 2-1. CURRENT AND PROJECTED AVERAGE DAILY TRAFFIC VOLUMES AND GROWTH

<table>
<thead>
<tr>
<th>Segment</th>
<th>Location</th>
<th>2007 Average Daily Volume</th>
<th>2035 Average Daily Volume</th>
<th>Total Growth 2007 to 2035</th>
<th>Average Annual Growth 2007 to 2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>York Street</td>
<td>North of 47th Avenue</td>
<td>5,650</td>
<td>9,510</td>
<td>68%</td>
<td>1.9%</td>
</tr>
<tr>
<td>56th Avenue</td>
<td>East of Brighton Boulevard</td>
<td>4,340</td>
<td>12,310</td>
<td>184%</td>
<td>3.8%</td>
</tr>
<tr>
<td>I-25</td>
<td>North of US 36</td>
<td>171,600</td>
<td>251,140</td>
<td>46%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Steele Street</td>
<td>North of 78th Avenue</td>
<td>1,580</td>
<td>4,500</td>
<td>185%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Washington Street</td>
<td>South of 88th Avenue</td>
<td>27,500</td>
<td>36,270</td>
<td>32%</td>
<td>1.0%</td>
</tr>
<tr>
<td>88th Avenue</td>
<td>East of Devonshire Boulevard</td>
<td>22,560</td>
<td>38,560</td>
<td>71%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Welby Road</td>
<td>North of 88th Avenue</td>
<td>6,000</td>
<td>8,200</td>
<td>37%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Thornton Parkway</td>
<td>East of Steele Street (west of railroad)</td>
<td>12,510</td>
<td>19,630</td>
<td>57%</td>
<td>1.6%</td>
</tr>
<tr>
<td>100th Avenue</td>
<td>West of Colorado Boulevard (west of railroad)</td>
<td>5,540</td>
<td>7,740</td>
<td>40%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Colorado Boulevard</td>
<td>North of Arroyhead Pass Road (south of 104th Ave)</td>
<td>24,190</td>
<td>33,580</td>
<td>39%</td>
<td>1.2%</td>
</tr>
<tr>
<td>104th Avenue</td>
<td>East of Steele Street (west of railroad)</td>
<td>29,800</td>
<td>47,350</td>
<td>59%</td>
<td>1.7%</td>
</tr>
<tr>
<td>112th Avenue</td>
<td>East of Irma Drive (west of railroad)</td>
<td>16,240</td>
<td>17,430</td>
<td>7%</td>
<td>0.3%</td>
</tr>
<tr>
<td>120th Avenue</td>
<td>East of Claude Court (west of railroad)</td>
<td>37,340</td>
<td>49,800</td>
<td>33%</td>
<td>1.0%</td>
</tr>
<tr>
<td>124th Avenue</td>
<td>East of 1st Street</td>
<td>4,790</td>
<td>7,790</td>
<td>63%</td>
<td>1.8%</td>
</tr>
<tr>
<td>128th Avenue</td>
<td>West of Eastlake Drive/Northlake Drive (east of railroad)</td>
<td>13,990</td>
<td>20,980</td>
<td>50%</td>
<td>1.5%</td>
</tr>
<tr>
<td>York Street</td>
<td>South of 136th Avenue and railroad (north of 134th Way)</td>
<td>3,410</td>
<td>4,500</td>
<td>32%</td>
<td>1.0%</td>
</tr>
<tr>
<td>136th Avenue</td>
<td>East of York Street and railroad (west of Clayton Street)</td>
<td>20,740</td>
<td>41,800</td>
<td>102%</td>
<td>2.5%</td>
</tr>
<tr>
<td>I-25</td>
<td>North of 136th Avenue</td>
<td>87,200</td>
<td>157,630</td>
<td>81%</td>
<td>2.1%</td>
</tr>
<tr>
<td>144th Avenue</td>
<td>East of York Street (west of railroad)</td>
<td>3,950</td>
<td>24,940</td>
<td>531%</td>
<td>6.8%</td>
</tr>
<tr>
<td>SH 7/160th Avenue</td>
<td>West of Colorado Boulevard</td>
<td>14,760</td>
<td>40,260</td>
<td>173%</td>
<td>3.6%</td>
</tr>
</tbody>
</table>


Notes:
The 2007 volumes along I-25 and Washington Street were estimated based on volumes from 2005 and 2008.
I-# = Interstate #
SH = State Highway
US 36 = United States Highway 36
FIGURE 2-3. CONGESTED ROADWAY SEGMENTS AND CONGESTION FORECASTS — 2007

LEGEND

- Existing Congested Roadway Segments

Note: Roadways are considered severely congested when links have a volume-to-capacity ratio greater than 0.95 for 3 or more hours during the day.

- North Metro Corridor Study Area
- County Line
- Existing Railroad
- Secondary Highway
- Primary Highway
- Local Road
- Park/Open Space
- Stream
- Waterbody

Source: Roads, Highways (CDOT, 2006 and RTD/Dynmap, 2006)
Railroads, Lakes, Streams (CDOT, 2006)
Congestion Data (CDOT, 2011)
Paths and Open Space (CDOT, 2004)
FIGURE 2-4. CONGESTED ROADWAY SEGMENTS AND CONGESTION FORECASTS — 2035
Currently, limited transit service is available to meet growing travel demand in the North Metro corridor study area. Limited bus transit service exists on roadways east of I-25, and only four north to south routes provide regional connectivity with stops in downtown Denver and other locations within the corridor: one on Washington Street (the Route 7), two on I-25 (the 120X and 122X), and one on Colorado Boulevard and I-25 (the Route 40X). Other routes use short segments of these roadways but they either lack stops in the corridor or are Local east-west crosstown services without connections to the regional system in downtown Denver. Washington Street is currently congested along select segments south of 88th Avenue. The roadway is projected to be congested throughout its length within the North Metro corridor study area by 2035. I-25 is currently or projected to be congested throughout its length within the North Metro corridor study area. Colorado Boulevard provides some north to south connectivity and also has areas of current and future congestion. A call-n-Ride provides service north of 112th Avenue. Call-n-Ride service using smaller transit vehicles provides additional transit service to riders with limited access or proximity to transit.

Increases in travel demand, congestion, and delay are best met through alternative modes of transportation, specifically high-capacity, fixed-guideway service. The North Metro Transportation Study (RTD 2001) found that the travel time benefits of a high-capacity, fixed-guideway system are greater than any other mode of transportation. Based on estimated travel times from the vicinity of 120th Avenue and I-25 to DUS, the study estimated that travel times in year 2020 for high-capacity, fixed-guideway are more than 50% less than the same general connection by automobile. The current 2035 travel demand model estimates a.m. peak period automobile travel times from 120th Avenue and I-25 to DUS to be over 49 minutes. Based on current model estimates, from SH 7 in Thornton to DUS, the 2035 automobile travel time is projected to be 61 minutes. The transit travel time in the I-25 bus/high-occupancy vehicle (HOV) lanes is 52 minutes in 2035. A fixed-guideway vehicle travel time is estimated to be 32 minutes in 2035, a nearly 48% improvement in travel time over the automobile, and a 38% improvement over bus transit.

### 2.2.2 Need for Regional Connectivity

Based on the North Metro Transportation Study (RTD 2001), future North Metro corridor travelers are expected to make daily commutes to major activity centers throughout the Denver region, primarily to and from Denver’s CBD and Central Denver, to and from DIA and Aurora, and to and from Boulder and Broomfield counties. Current transit service does not offer a wide range of options for travelers who need to make these long distance regional trips. As the North Metro corridor study area increases in population and employment, more residents and employees would need reliable transit service to connect the North Metro corridor with the rest of the Denver region.

Because high-capacity, fixed-guideway transit service is separated from the roadway and not impacted by motor vehicle congestion or accidents, it can offer efficient interregional connections. Enhanced park-n-Ride and feeder bus access can increase connectivity and encourage local economic opportunities. Completion of the entire FasTracks Plan (RTD 2004) would provide regional connections to origins and destinations across the Denver region (see Figure 2-5). North Denver metropolitan residents and employees would have access to the rest of the FasTracks system, including direct access to other major fixed-guideway transit lines at the southern end of the corridor at DUS. The North Metro corridor transit options must be compatible with other high-capacity regional transportation corridors and the planned FasTracks corridors.
A potential future regional transit connection to the Northern Front Range region may also be desired as those communities north of the North Metro corridor study area continue to grow. The compatibility of the North Metro corridor transit alternatives with related Northern Front Range transit projects needs to be considered as well. The North Front Range 2035 Regional Transportation Plan (RTP) (North Front Range Metropolitan Planning Organization 2007) identifies several regionally significant corridors north of the North Metro corridor. A series of measures were used to place eleven corridors into three tiers, Tier 1 being the top priority and Tier 3 the lowest priority. In Larimer and Weld Counties, United States Highway 287 (US 287) and I-25 are prioritized as Tier 1 corridors and US 85 is prioritized as a Tier 2 corridor. One transportation study that connects the two regions is the North I-25 Draft Environmental Impact Statement (DEIS), released by Colorado Department of Transportation (CDOT) in October 2008 (CDOT 2008). This DEIS evaluates multi-modal transportation improvements along the 61-mile I-25 transportation corridor between the Fort Collins/Wellington area to Denver. Based on public comments on the DEIS alternatives, a Preferred Alternative has been identified. The multi-modal Preferred Alternative includes a commuter rail option that would connect to the northern terminus of the North Metro corridor Preferred Alternative and interface with corridor operations by extending service into downtown Denver. The proposed alignment from Fort Collins would use the BNSF Railway to Longmont and then connect Longmont to North Metro. From Longmont, the alignment is south on the BNSF Railway and Great Western Railroad, then east along the south side of State Highway 119 (SH 119) to County Road 7 (CR 7), and along CR 7 to the UP Railroad, and then connects to North Metro by crossing I-25 following the UP Railroad east, and then southeast to the North Metro corridor end-of-line at the SH 7/162nd Avenue Station (CDOT 2008). The operating concept presented in the North I-25 DEIS considers the potential for sharing commuter rail fleet and employing alternating trains (those that extend to Fort Collins and those that stay within the North Metro corridor). However, related infrastructure, vehicle requirements and other operational factors will require further analysis prior to implementation of the North I-25 corridor, which is estimated to be in the 2055-2075 timeframe. The North Metro corridor is the initial element of this regional transit connection between the North Front Range region and downtown Denver (see Figure 2-5).

2.2.3 Need to Serve Traditional and New Transit Users

The current limitations of transit service in the North Metro corridor study area prevent both traditional and new transit users from efficiently traveling within the North Metro corridor study area and throughout the Denver region. Traditional transit users are defined as users who already use some form of transit (e.g., a bus). New transit users are defined as users who do not currently use transit. Population groups that traditionally use transit include the elderly, disabled, school-age children, and low-income families. Traditional users in the Denver area also include “choice riders” who find the convenience and fuel/parking savings to be attractive. School-age children are generally too young to drive or have limited access to vehicles and are, therefore, dependent on transit. There are many school-age children in the corridor, as evidenced by the more than one dozen schools in the corridor representing all age levels. According to the Metro Vision 2035 Plan (DRCOG 2010), both the elderly and disabled populations are growing at faster rates than the general population. The number of residents aged 60 and older in the Denver area is expected to increase by 634,000 people, from 13% to 22% of the population by 2035. Many of the elderly and disabled do not operate a vehicle (approximately 67,000 based on the 2000 Census) and need mobility options in order to travel to work, health facilities, schools, and other destinations. The highest concentrations of elderly persons in the North Metro corridor study area are between 104th Avenue and 112th Avenue. In addition to this area with a concentration of elderly, much of the area south of 84th Avenue is
also below the median household income, where low-income families are more likely to rely on
transit options. With this proportion of traditional transit-dependent users in the North Metro
corridor study area, new transit options would further serve their needs.

New transit users can benefit equally from the improved mobility and enhanced regional
connectivity that reliable transit service would offer the North Metro corridor study area. New
users or “choice riders” are likely to be attracted to high-capacity, fixed-guideway transit service
as vehicle travel times, congestion, delay, and air quality continue to worsen in the area.
Efficient high-capacity transit service can provide travelers an alternative to modes of travel that
rely on the roadway system.

2.2.4 Need to Support Community and Regional Plans, Including the Voter-Approved FasTracks Plan

The implementation of high-capacity, fixed-guideway transit in the North Metro corridor is
consistent with the plans of area communities and follows the voter-approved FasTracks Plan
(RTD 2004). Figure 2-5 shows the locations of all the FasTracks fixed-guideway transit routes.
Long-range planning conducted by Adams County, local municipalities, and DRCOG all
incorporate a transit element to increase mobility and regional connectivity. The FasTracks
Plan (RTD 2004) represents a comprehensive 12-year plan for high-quality transit services and
facilities throughout the Denver region. The FasTracks Plan (RTD 2004) includes construction
or extension of eight major regional, high-capacity, fixed-guideway transit lines, a Commuter
Rail Maintenance Facility (CRMF), and an improved bus network, as well as the transformation
of DUS into the region’s primary multi-modal transportation hub. The regional nature of
FasTracks is crucial to effectively enable travelers to reach destinations across the region. In
addition, projects in cities north of the Denver metropolitan area along the Northern Front Range
have developed transit alternatives that would connect to the FasTracks system via the North
Metro corridor. The North Metro corridor is an important regional transportation component
because it would connect the area’s residents and employees to their destinations by transit,
thereby reducing automobile travel and the associated negative impacts (such as increased
congestion and delay and decreased air quality) for local and long-distance trips. By voting to
increase the sales tax to fund the plan, citizens within RTD indicated their support and
preference of investment in the transit components embodied in the FasTracks Plan (RTD
2004) (see Figure 2-5).

2.2.5 Need to Qualify for Federal Funding Programs

Should federal funding be sought for the North Metro Corridor Project, certain criteria would
need to be met to qualify. There are several potential federal funding sources, which are
presented below.

New Starts Funding Program
FTA’s discretionary New Start Program is the primary financial resource for new transit
“guideway” capital investments. Safe, Accountable, Flexible, Efficient Transportation Equity Act:
A Legacy for Users (SAFETEA-LU) directs FTA to evaluate and rate candidate projects. The
specific New Starts criteria include alternatives analysis, project justification, and local financial
commitment. Currently, some of the project justification criteria include mobility improvements,
environmental benefits, operating efficiencies, cost effectiveness, and transit supportive land
use policies and future patterns. Recent policy changes propose new funding guidelines based
on livability, in addition to cost and time saved. New guidelines will be forthcoming in a rulemaking process (FTA 2010).

Transportation Infrastructure Finance and Innovation Act of 1998
The North Metro corridor may be funded through a federal loan program known as the Transportation Infrastructure Finance and Innovation Act of 1998 (TIFIA). This program provides federal credit assistance for major transportation investments of critical national importance. The TIFIA credit program consists of secured loans, loan guarantees, and standby lines of credit designed to address projects’ varying requirements throughout their life cycles. Transit capital projects are eligible for the TIFIA credit program. Like FTA’s New Starts Funding Program, projects must meet specific criteria to qualify, including demonstration of regional significance, use of new technology, and maintenance or protection of the environment.
Railroad Rehabilitation and Improvement Financing Program
The Railroad Rehabilitation and Improvement Financing (RRIF) Program was established in 1998 by the Transportation Equity Act for the 21st Century and amended by the 2005 SAFETEA-LU. Under the RRIF Program, the Administrator of the Federal Railroad Administration (FRA) of the United States Department of Transportation (USDOT) is authorized to provide direct loans and loan guarantees up to $35.0 billion, of which up to $7.0 billion is reserved for projects benefiting freight railroads other than Class I railroads, in other words, “Short Line” railroads. Class I railroads are considered the larger, long-distance railroad companies based on operating revenue, and include companies such as the UP Railroad and BNSF Railway. Short Line railroads are smaller, independent companies that usually operate over a relatively short distance, providing links between rail freight industries, connections to larger railroads, or tourist passenger train service. Direct loans may fund up to 100% of a railroad project with repayment periods of up to 25 years, and interest rates equal to the cost of borrowing to the government.

RRIF Program funding may be used to:

1. Acquire, improve, or rehabilitate inter-modal or rail equipment or facilities, including track, components of track, bridges, yards, building and shops;

2. Refinance outstanding debt incurred for these same purposes; or

3. Develop or establish new inter-modal or railroad facilities.

Eligible borrowers include railroads, state and local governments, government-sponsored authorities and corporations, joint ventures that include at least one railroad, and “captive” shippers that intend to construct a new rail connection. Such shippers may seek funding for improvements in existing railroads only as part of a joint venture with a railroad.

2.3 PROPOSED ACTION AND NEPA
NEPA requires federal agencies to prepare an EIS for any major action involving the use of federal funds that may significantly affect the quality of the environment. The North Metro Corridor EIS evaluates alternatives for transit improvements between downtown Denver and Thornton to identify transportation benefits, environmental impacts, and consistency with community plans. The North Metro Corridor EIS analyzes alternatives that are intended to meet the project purpose and need; details the process that was followed to determine the Preferred Alternative; discloses foreseeable social, environmental, and economic impacts resulting from the project; outlines mitigation measures to minimize impacts; and provides findings for public and agency review.

2.4 RELATIONSHIP TO THE PLANNING PROCESS
The transportation planning process in the Denver region is guided by DRCOG, which represents a nine-county area including municipalities and county governments, CDOT, RTD, and other local jurisdictions. Through this process DRCOG develops both short-term and long-term transportation plans for the state, region, and cities/counties. DRCOG also manages and distributes some transportation funding to member agencies. In addition to the documents developed by DRCOG, RTD has adopted a transit plan for the Denver region called the FasTracks Plan (RTD 2004).
The *Metro Vision 2035 Plan* (DRCOG 2010) is the long-range plan for the Denver region. It provides a vision for the future growth and development of the metropolitan area based on the expectations and desired plans of local governments, RTD, CDOT, and the views of the public. The plan identifies all needs regardless of available revenues. The plan also outlines the transportation system envisioned for the year 2035 while its companion document, the *Metro Vision 2035 Plan*, provides a vision of the transportation system that is specific to corridors through the region.

The *Metro Vision 2035 Plan* includes a federally required component, the *Fiscally Constrained 2035 Regional Transportation Plan*. This component is a fiscally-constrained plan and includes a comprehensive list of transportation programs and projects that are capable of being financed under reasonable revenue projections within the next twenty years. All FasTracks corridors, including the North Metro corridor, are included in the *Fiscally Constrained 2035 Regional Transportation Plan*. The plan identifies the North Metro corridor as a part of the regional rapid transit system that includes light rail, commuter rail, and bus rapid transit (BRT) corridors.

FasTracks is a 12-year comprehensive financial plan developed by RTD to increase transit service and facilities in the Denver metropolitan area. The *FasTracks Plan* (RTD 2004) was adopted by the RTD Board in April 2004 and approved for funding by voters, known as Referendum 4A, in November 2004. The plan identifies the North Metro corridor for commuter rail transit service between downtown Denver and Thornton, with eight station locations generally located in Denver's Globeville/Elyria/Swansea area; Commerce City; 88th Avenue; Thornton Parkway to 104th Avenue; 112th Avenue; 124th Avenue; 144th Avenue; and 162nd Avenue neighborhoods. While FasTracks provides a funding mechanism for transit improvements in the region, the North Metro Corridor EIS will determine the Preferred Alternative that best meets the project's purpose, need, goals, and objectives while minimizing social, environmental, and economic impacts.
3. ALTERNATIVE DEVELOPMENT

Each alternative developed for the North Metro Corridor Project contains a set of elements organized to achieve the project goals. The supporting elements include the alignment locations, required infrastructure (including stations), and particular vehicle technologies that support the North Metro service concept to provide high-capacity fixed-guideway transit. North Metro’s alternatives also considered how to access RTD’s proposed CRMF site.

Using the previous studies and plans as a baseline, and input from the scoping process, the following assumptions were applied to develop alternatives:

- All North Metro Transportation Study (RTD 2001) alternatives are reconsidered, except those that do not meet Purpose and Need.
- The alternatives must provide high-capacity line-haul service (back and forth between common terminus points) within the North Metro corridor study area.
- The alternatives need to provide local access and station stops within the North Metro corridor study area.
- Alternative alignments should limit property acquisition.
- Alternative alignments and stations should serve as many activity centers as possible.
- Alternative alignments must connect to DUS and the end-of-line near 162nd Avenue in Thornton.
- For consistency in evaluation, all alternatives included eight station target areas in addition to DUS, generally located in Denver’s Globeville/Elyria/Swansea area, Commerce City, 88th Avenue, Thornton Parkway to 104th Avenue, 112th Avenue, 124th Avenue, 144th Avenue, and 162nd Avenue neighborhoods.
- Similar to the fixed-guideway transit component of the North Metro Transportation Study (RTD 2001) locally preferred alternative (LPA), a minimum all-day service frequency of 30 minutes was assumed along the entire corridor, with additional service during the peak period.

Alternatives development is detailed in this section according to alignments, technology, stations, and transit service strategies. The North Metro corridor study area was organized into two sections to simplify the alternatives analysis process and related descriptions in this document. The Southern Section begins at the DUS access point near 20th Street and ends at 84th Avenue. The Northern Section is between 84th Avenue and the 162nd Avenue area, just north of State Highway (SH) 7.

3.1 TRANSIT ALIGNMENT ALTERNATIVES

The previous studies noted earlier identified the UP Railroad Alignment consisting of the Greeley Subdivision south of Sand Creek Junction, and the BNSF Railway Alignment consisting of the Brush Subdivision south of Sand Creek Junction, as the two most reasonable North Metro railway corridors to consider for connecting Denver to Commerce City and all points north. These two UP Railroad and BNSF Railway mainlines cross at-grade at Sand Creek Junction. The UP Boulder Branch north of Sand Creek Junction was determined to be the most appropriate alignment for connecting communities to the north. While the UP Railroad Greeley Subdivision (both north and south of Sand Creek Junction) was considered, the UP Boulder
Branch appeared to be more reasonable for the connections in the north, since the UP Railroad Greeley Subdivision corridor does not provide access to the communities of Northglenn and Thornton. Additionally, 10 to 15 freight trains pass through the Greeley Subdivision each day carrying automobiles, grain, and general merchandise, while the UP Boulder Branch serves one customer with as few as 20 three-car trains per year.

In the summer of 2009, RTD agreed to purchase the UP Boulder Branch ROW. Although the UP Railroad no longer owns this rail alignment, for the purposes of this document, it will continue to be referred to as the UP Boulder Branch.

Alternatives to the BNSF Railway and UP Railroad alignments were introduced during public scoping. These included an I-25 alignment and a Washington Street alignment. In addition, the previously described UP Railroad Greeley Subdivision corridor from DUS to Brighton was suggested. These are illustrated on Figure 3-1. As a result of the scoping process, the following conceptual alignment alternatives were investigated:

- UP Railroad Alignment (which consists of the UP Railroad Greeley Subdivision to the UP Boulder Branch)
- BNSF Railway/UP Boulder Branch Railroad Alignment (which consists of the BNSF Railway Brush Subdivision to the UP Boulder Branch)
- I-25 corridor
- Washington Street corridor (two options)
- UP Railroad Greeley Subdivision from DUS to Brighton

Additional Alignments in Southern Section (DUS Access to 84th Avenue)

Early in the project, RTD recognized a need to bypass a heavily congested railroad junction in the Southern Section of the corridor. The BNSF Railway Brush Subdivision and UP Railroad Greeley Subdivision cross each other at-grade while crossing over Sand Creek and under Interstate 270 (I-270) at a constrained area known as Sand Creek Junction (see Figure 3-2 for an illustration of Sand Creek Junction and the bypass alternatives). Alternatives were developed that considered either going through or over Sand Creek Junction or bypassing it to the west or east. The early numbering convention for these alignment options depended on whether the alignment began in the UP Railroad corridor (using “1” as a prefix with the lettered alignment, such as 1-A or 1-B), or the BNSF Railway corridor (using “2” as a prefix, such as 2-A or 2-B). The alignment options included A, going through, over, or directly adjacent to the junction; B, C, and D, bypassing on the west side of Sand Creek Junction; and E and F, bypassing on the east side of Sand Creek Junction. Alignments B, C, and D are referred to as the “cross-country” alignments in this study. During additional refinements, multiple variations of alignment options A and B were developed.

Since the project began, a number of events occurred where RTD needed to consider new alignments or reevaluate alignments previously set aside. In January 2008, RTD and the UP Railroad Company could not reach terms over the purchase of several critical pieces of UP Railroad property south of Commerce City. Key property included the UP Railroad line into DUS and UP Railroad’s 36th Street Railyard, which RTD would have used for its CRMF location. Due to the high cost of this section, two other alternatives outside but adjacent to the UP Railroad Alignment, and two alternatives in the BNSF Railway corridor were reconsidered. The BNSF Railway corridor alternatives included either using the BNSF Railway ROW, or paralleling outside of the BNSF Railway ROW, on the east side.
The two modified UP Railroad Alignment alternatives are referred to as West of the Railyard and Over the Railyard (Figure 3-3). The UP Railroad West of the Railyard Alignment alternative uses the proposed East corridor rail line (outside the UP Railroad ROW) from DUS to 31st Street, and then swings to the east slightly and then to the west to cross over the proposed East corridor and UP Railroad rail lines to run along the west side of the UP Railroad Railyard. From the Railyard, it crosses over I-70 and York Street, and then to avoid Sand Creek Junction, curves west under the BNSF Railway before it connects to the cross-country alignments B, C, or D. The UP Railroad Over the Railyard Alignment alternative is similar, but at 31st Street, stays within the proposed East corridor ROW until it crosses on structure over the UP Railroad Railyard, I-70, and York Street, and then follows the same alignment as described for the UP Railroad West of the Railyard alternative.
FIGURE 3-2. SOUTHERN SECTION ALIGNMENTS TO COMMERCE CITY

LEGEND

SOUTHERN SECTION ALIGNMENTS

- Bridge Structure
- Wall Structure
- Existing Tress
- Optional Station Site

Source: North Metro Corridor Project Team, 2009.
FIGURE 3-3. MODIFIED UP RAILROAD ALIGNMENT ALTERNATIVES

Source: North Metro Corridor Project Team, 2010.
Subsets of the A alignment were also developed for the BNSF Railway Brush Subdivision when other alternative costs increased, and the vehicle technology improved and could handle steeper grades. The previous A alignment had to go over I-270 and/or Sand Creek Junction due to grades. With the steeper grade allowance, two versions of a modified BNSF Railway Brush Subdivision’s A alignment were developed to go under I-270 and west of Sand Creek Junction. The 2-A-2 alignment (at-grade) was defined to extend along a portion of Brighton Boulevard south of I-270 at grade, and the 2-A-3 alignment (on-structure) was defined to be elevated along the same segment of Brighton Boulevard to avoid select street and rail crossings.

The 2-A-2 alignment continues along the BNSF Railway Brush Subdivision and at Riverside Cemetery crosses over to the east side of the BNSF Railway, then goes on the east side of Brighton Boulevard/State Highway 265 (SH 265) up to approximately 56th Avenue where it crosses over 56th Avenue and to the west side of BNSF Railway on bridge structure. It then runs at-grade on the east side of Brighton Boulevard and west of the BNSF Railway through the Suncor Energy (U.S.A.) Inc. (Suncor) refinery area. It ties into the UP Boulder Branch north of Sand Creek Junction.

The 2-A-3 alignment, generally at-grade on the east side of the BNSF Railway Brush Subdivision from DUS, becomes elevated when it splits off from the B alignments at Riverside Cemetery. It follows the same alignment as 2-A-2 except it would remain elevated along Brighton Boulevard/SH 265 (on the east side of the road) above the railroad spurs into the Suncor refinery, touching down and crossing under I-270, then running at-grade just west of Sand Creek Junction before tying into the UP Boulder Branch Alignment south of 64th Avenue.

The 2-A-2 and 2-A-3 alignment names were later shortened to A-2 and A-3, and are described that way hereafter.

Additional General Alignments
During scoping, some of the public suggested improving the east to west connectivity within the North Metro corridor study area. These options included roadway improvements and a fixed-guideway commuter rail circumferential connection with RTD’s Northwest Rail, Gold Line, North Metro, and East corridors somewhere north of DUS. Citizens recommended that a segment of Quebec Street be used from an unspecified location north of I-70 to 72nd Avenue, where North Metro would turn west to return to the UP Boulder Branch corridor. This alternative was suggested as a way to address the difficulties of connecting Denver and Commerce City, and to serve several key activity centers in Commerce City. The citizens who suggested this route believed the Quebec Street corridor would better serve the residents of Commerce City and would showcase recent redevelopment that has occurred over the past 10 years including the Rocky Mountain Arsenal National Wildlife Refuge, a new soccer stadium, a new city municipal building, and the new Adams City High School.
3.2 STATION LOCATION ALTERNATIVES

The North Metro corridor has eight station target areas. Multiple station options were developed and evaluated for the target areas. For the final Preferred Alternative, only one option was selected at each target area, for a total of eight stations.

The process for selecting a station site and developing options for it is briefly described here. The general public and representatives of the cities and counties that would benefit from the stations were included in the process through a series of station planning meetings.

Stations are generally sited within a community that can provide sufficient ridership, provide property that can be acquired for the station, and possibly support future transit oriented development (TOD) around the station. It is desirable for commuter rail stations to be approximately 2 miles apart.

Criteria for station site selection include mobility and engineering feasibility. For example, the station should improve overall mobility and depending on the type of station, be convenient to a major roadway with a nearby signalized intersection. Engineering criteria require that platforms are placed on a straight and level segment of track, provide level passenger boarding, and should be a minimum of 300 feet from where the tracks cross a road. Site selection also considers if the station should be a local, neighborhood walk-up style, or a regional commuter park-n-Ride. In siting the station and developing the station footprint, the presence of environmental resources at the site were considered to minimize impacts.

3.3 TRANSIT TECHNOLOGY AND TRAVEL DEMAND MANAGEMENT/ TRANSPORTATION SYSTEM MANAGEMENT (TDM/TSM) ALTERNATIVES

The UP Railroad has formally documented that, if passenger rail vehicles do not meet FRA compliance standards for vehicle safety, they will not be allowed to operate alongside freight rail vehicles within UP Railroad ROW. The BNSF Railway Company has provided no formal statement but has implied a similar policy.

Light rail transit (LRT) technology does not comply with FRA vehicle safety standards, and with the position of each of the railroad companies, LRT cannot be implemented within the active freight railroad ROWs. The FRA-compliant commuter rail technologies that would be considered for the BNSF Railway or UP Railroad alignments are FRA-compliant diesel multiple unit (DMU) and electric multiple unit (EMU). In addition to LRT technology and commuter rail technology (EMU and DMU), locomotive hauled coaches (LHC), BRT, subway, monorail, third rail (an electrified rail along the tracks to power the trains), double-decker DMU or EMU, and streetcar were suggested technologies. Roadway and fixed-guideway commuter rail improvements to provide east to west connectivity were also suggested by the public.

During the conceptual alternatives development process of the North Metro Corridor Project, appropriate rail technology alternatives were matched with the alignments. LRT was considered for all the alignments outside the railroad ROW, but DMU and EMU were only considered applicable to the UP Railroad Alignment, the BNSF Railway/UP Boulder Branch Alignment, and the UP Railroad Greeley Subdivision railroad corridors. The DMU and EMU vehicle technologies were not considered along the I-25 corridor due to limitations on their operation on the existing grades along the highway, nor along Washington Street, because introducing an
interface of heavier rail technology with automobile traffic would be unsafe and not compatible with traffic when LRT is the standard application.

The transportation system management (TSM) and travel demand management (TDM) alternative features relatively low-cost improvements that could be made in the corridor. It focuses on an enhanced bus system. All alternatives are shown in Table 3-1.

<table>
<thead>
<tr>
<th>TABLE 3-1. ALIGNMENT AND TECHNOLOGY ALTERNATIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alignment and Technology Alternatives</strong></td>
</tr>
<tr>
<td><strong>No Action Alternative</strong></td>
</tr>
<tr>
<td><strong>Transportation System Management/Travel Demand Management (TSM/TDM)</strong></td>
</tr>
<tr>
<td>LRT Technology</td>
</tr>
<tr>
<td>- Paralleling UP Railroad (UP Railroad Greeley/UP Boulder Branch) on West</td>
</tr>
<tr>
<td>- Paralleling BNSF Railway/UP Boulder Branch on West</td>
</tr>
<tr>
<td>- Paralleling UP Railroad Greeley Subdivision on East or West</td>
</tr>
<tr>
<td>- Paralleling Interstate 25 on West</td>
</tr>
<tr>
<td>- On Washington Street in Median</td>
</tr>
<tr>
<td>- On Washington Street in Median with Traffic Lane Reduction</td>
</tr>
<tr>
<td>DMU Technology</td>
</tr>
<tr>
<td>- UP Railroad Alignment (UP Railroad Greeley/UP Boulder Branch)</td>
</tr>
<tr>
<td>- BNSF Railway/UP Railroad Boulder Branch</td>
</tr>
<tr>
<td>- UP Railroad Greeley</td>
</tr>
<tr>
<td>EMU Technology</td>
</tr>
<tr>
<td>- UP Railroad Alignment (UP Railroad Greeley/UP Boulder Branch)</td>
</tr>
<tr>
<td>- BNSF Railway/UP Railroad Boulder Branch</td>
</tr>
<tr>
<td>- UP Railroad Greeley</td>
</tr>
<tr>
<td>Other Alternatives</td>
</tr>
<tr>
<td>- Locomotive Hauled Coaches</td>
</tr>
<tr>
<td>- Bus Rapid Transit</td>
</tr>
<tr>
<td>- Streetcar</td>
</tr>
<tr>
<td>- Monorail</td>
</tr>
<tr>
<td>- Subway</td>
</tr>
<tr>
<td>- Third Rail</td>
</tr>
<tr>
<td>- Double-decker DMU or EMU</td>
</tr>
<tr>
<td>- East to West Connections Roadway</td>
</tr>
<tr>
<td>- East to West Circumferential Commuter Rail</td>
</tr>
<tr>
<td>- Quebec Street</td>
</tr>
</tbody>
</table>

Source: North Metro Corridor Project Team, 2008.

Note:

UP = Union Pacific
3.4 TRANSIT SERVICE STRATEGIES

The transit service strategy for all potential North Metro corridor study area alternatives is based on maintaining and enhancing the current transit networks, improving travel time, accommodating long-term demand, expanding coverage and access, and ensuring regional service integration. Elements and actions associated with each of these broad guidelines are described in the following paragraphs.

In the Southern Section of the North Metro corridor study area, the street network is primarily a grid, facilitating the existing transit service of local and limited-stop buses. The North Metro corridor study area is served by downtown Denver-focused and north-south crosstown local and limited-stop buses. This service provides connectivity to northeast Denver. Northern suburbs within the North Metro corridor study area have a less well-connected, curvilinear street network. This area is served by express service buses at park-n-Rides and a less-dense network of local buses, and demand responsive service (call-n-Ride).

The existing transit network configuration, as described, would be maintained and enhanced by all alternatives. Additional parking and transit transfer locations would be established with any North Metro fixed-guideway transit technology alternative so that access to and between transit facilities would be direct and logical.

With the exception of the north-south crosstown buses, downtown Denver would be the primary travel destination and the southern terminus for the majority of transit service from the North Metro corridor study area. In any alternative, this connectivity provides access to regional rail and other local and regional transit services. Within the North Metro corridor study area, local buses would connect activity centers, and additional local services would be added to feed transit users from northern suburban areas to park-n-Rides.

3.5 COMMUTER RAIL MAINTENANCE FACILITY (CRMF)

The Preferred Alternative must also access RTD’s CRMF site. The North Metro corridor, Gold Line, East Corridor, and Northwest Rail trains would use the same maintenance facility. The North Metro trains would need to travel to the CRMF for storage and maintenance. Several locations were proposed for the CRMF before the Fox North Site was selected. The Fox North Site is adjacent to railroad ROW that would serve the future Gold Line and Northwest Rail commuter rail corridors. The UP Railroad north yard and the BNSF Railway trailer-on-flatcar (TOFC) yard are west of the proposed CRMF site, and an Owens Corning manufacturing facility is on the east. The CRMF site was evaluated in the Commuter Rail Maintenance Facility Supplemental Environmental Assessment to FasTracks Commuter Rail Corridors (FTA and RTD 2009) which serves as a supplement for the Gold Line DEIS (FTA 2008) and East Corridor DEIS (FTA 2009).

The CRMF was subsequently included in the Gold Line Corridor Final Environmental Impact Statement (FEIS) (FTA 2009) and East Corridor FEIS and Section 4(f) Evaluation (FTA 2009). In November 2009, a Record of Decision (ROD) was issued for both these projects which included the CRMF.
4. ALTERNATIVE ANALYSIS PROCESS

The screening process initially included three levels of screening, with the intent to select the most feasible alignment(s), vehicle technology, and station options for further analysis in the DEIS. Two advanced screening steps (Level 4 and Level 5) were added for the Southern Section to address issues that surfaced during the study process. These issues were partly due to the complexity of the Southern Section but also due to the higher than anticipated costs for ROW for some alternatives. Station options and vehicle technology were also addressed in more detail during the final screening steps. A detailed evaluation of the alignment, station, and vehicle technology options was performed for the DEIS and input from agencies, stakeholders, and the public on the analysis presented in the DEIS was considered before selecting the Preferred Alternative. This section describes the initial screening levels for the entire corridor, the advanced screening levels that were further required for the Southern Section alignments, and the DEIS evaluation to identify the Preferred Alternative. The overall screening process is illustrated in Figure 4-1.
FIGURE 4-1. ALTERNATIVES SCREENING PROCESS

Source: North Metro Corridor Project Team, 2009.
4.1 ALIGNMENT AND TECHNOLOGY SCREENING LEVELS

Full details for the first screening efforts for alignments and technology are available in the Level 1 and Level 2 Alternatives Evaluation Report (RTD 2007), and the Level 3 Alternatives Evaluation and Screening Report/RTD Annual Program Evaluation (RTD 2008). The later screening evaluations are documented in Levels 4 and 5 Alternatives Evaluation Report (RTD 2010). The evaluation criteria that were used are summarized in Table 4-1.

<table>
<thead>
<tr>
<th>TABLE 4-1. SUMMARY OF ALTERNATIVES EVALUATION CRITERIA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level 1 Criteria</strong></td>
</tr>
<tr>
<td>• Does the alternative concept meet project Purpose?</td>
</tr>
<tr>
<td>• Does the alternative meet project Need?</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
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<td></td>
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<td></td>
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<tr>
<td></td>
</tr>
</tbody>
</table>

**Focus:** Screen initial list of alignment alternatives and vehicle technologies. Evaluate station target areas.

**Focus:** Screen refined list of alignment alternatives and technologies.

**Focus:** Evaluate UP Railroad and BNSF Railway alignments from DUS to 84th Avenue; evaluate cross-country alignments; and evaluate all station options. Evaluate DMU and EMU vehicle technologies.

**Focus:** Further evaluate cross-country alignments; further evaluate station options. Evaluate DMU and EMU vehicle technologies.

**Focus:** Re-evaluate modified UP Railroad and BNSF Railway alignments from DUS to Commerce City; evaluate BNSF Railway station options; evaluate modified/ refined station options in remainder of corridor. Evaluate DMU and EMU vehicle technologies.

Source: North Metro Corridor Project Team, 2008.

Notes:
- DMU = diesel multiple unit
- DUS = Denver Union Station
- EMU = electric multiple unit
- ROW = right-of-way
- UP = Union Pacific

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At each screening level, RTD and the project team considered and addressed project concerns and opportunities that the public and government agencies had brought to attention during a series of public and local government/agency meetings. At the conclusion of each level of screening, the results were shared at follow-up milestone meetings for the public, the Local Governments Team (LGT), and the Agency Working Group (AWG). The AWG included the joint lead agencies of RTD and FTA, cooperating and participating agencies, and the railroads. Table 4-2 provides a summary of the alternatives and screening results. A summary of the screening process and how it relates to the Least Environmentally Damaging Practicable Alternative (LEDPA) is presented in the sections that follow (Sections 4.2 - 4.7).

### Table 4-2. Summary of Screening Results

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Level Eliminated</th>
<th>Reason for Retention/Elimination</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Baseline Alternatives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Action Alternative</td>
<td>Level 1 eliminated</td>
<td>Carry forward.</td>
</tr>
<tr>
<td></td>
<td>Level 2 eliminated</td>
<td>• Does not meet Purpose and Need but provides basis for comparison with other alternatives.</td>
</tr>
<tr>
<td><strong>TSM Alternative</strong></td>
<td>Level 3 eliminated</td>
<td>Eliminated at Level 3.</td>
</tr>
<tr>
<td></td>
<td>Level 4 eliminated</td>
<td>• Does not fulfill project’s Purpose and Need to provide high-capacity transit.</td>
</tr>
<tr>
<td></td>
<td>Level 5 eliminated</td>
<td>• Does not provide travel time benefit or reliability benefit.</td>
</tr>
<tr>
<td></td>
<td>DEIS</td>
<td>• Does not serve middle of corridor well, nor TOD.</td>
</tr>
<tr>
<td><strong>Build Alternatives – LRT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LRT – All Alignments</td>
<td>Level 1 eliminated</td>
<td>LRT in rail corridors eliminated at Level 1.</td>
</tr>
<tr>
<td>• All rail corridors</td>
<td>Level 2 eliminated</td>
<td>LRT technology does not comply with FRA vehicle safety standards, and with the position of the UP Railroad and BNSF Railway companies, LRT cannot be implemented within these ROWs.</td>
</tr>
<tr>
<td>• I-25</td>
<td>Level 3 eliminated</td>
<td>LRT in roadway corridors eliminated at Level 2.</td>
</tr>
<tr>
<td>• Washington Street (Two Options)</td>
<td>Level 4 eliminated</td>
<td>• Requires extensive ROW and property acquisition.</td>
</tr>
<tr>
<td></td>
<td>Level 5 eliminated</td>
<td>• Higher cost due to grade separations (structures).</td>
</tr>
<tr>
<td></td>
<td>DEIS</td>
<td>• High adverse traffic impacts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Low transit speed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Low ridership levels.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The Washington Street or I-25 alignments would not serve Commerce City.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Not compatible with DUS redevelopment or FasTracks’ East, Northwest Rail, or Gold Line rail corridors, or CDOT’s north I-25 corridor.</td>
</tr>
<tr>
<td>LRT outside rail corridors</td>
<td>Level 2 and 5</td>
<td>LRT outside rail corridors eliminated at Levels 2 and 5.</td>
</tr>
<tr>
<td>eliminated at Levels 2 and 5</td>
<td></td>
<td>• Higher cost and greater property impacts due to additional ROW requirements to 128th Avenue.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Access to DUS not feasible due to physical constraints for an additional track.</td>
</tr>
</tbody>
</table>
### TABLE 4-2. SUMMARY OF SCREENING RESULTS

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Level Eliminated</th>
<th>Reason for Retention/Elimination</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Build Alternatives – Commuter Rail Transit (DMU or EMU)</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| UP Railroad Greeley Alignment (DUS to Brighton) | ✓ | Eliminated at Level 1.  
- Does not meet Purpose and Need for North Metro to provide a north to south connection between the 162nd Avenue area and DUS. Greeley is out of direction. |
| UP Boulder Branch portion of the UP Railway Alignment (north of Sand Creek Junction) | Evaluated in FEIS | Carry forward.  
- The UP Boulder Branch portion of the UP Railroad Alignment meets Purpose and Need to provide high-capacity fixed-guideway service and the north-south connection between the 162nd Avenue area and DUS. (It begins at the Sand Creek Junction of railroad crossings in Commerce City.)  
- Lower cost and fewer impacts because in existing railroad ROW.  
- Compatible with FasTracks’ East, Northwest Rail, and Gold Line corridors. Also compatible with CDOT’s North I-25 corridor. |
| **Build Alternatives Commuter Rail (DMU or EMU) — Southern Section** | | |
| UP Railroad Alignment in UP ROW (Original Alternative south of Sand Creek Junction) | ✓ | Eliminated at Level 5.  
- The original UP Alignment (within UP Railroad ROW) was re-evaluated and eliminated due to significantly higher costs (for UP Railroad ROW acquisition). |
| UP Railroad Alignment West of UP Railyard outside UP ROW (south of Sand Creek Junction) | ✓ | Eliminated at Level 5.  
- Greater number of residential acquisitions than the modified BNSF Railway Alignment Alternative East of BNSF Railway ROW. |
| UP Railroad Alignment Over UP Railyard outside UP ROW (south of Sand Creek Junction) | ✓ | Eliminated at Level 5.  
- Greater number of residential acquisitions than the modified BNSF Railway Alignment Alternative East of BNSF Railway ROW.  
- Difficult to site piers in UP Railyard and opposed by UP Railroad. |
| BNSF Railway Alignment within BNSF Railway ROW (Original Alternative) | ✓ ✓ | Eliminated at Level 3.  
- At Level 3 Screening in 2007, the BNSF Railway Alignment was eliminated due to costs, compared to costs of UP Railroad alignments expected at that time. Eliminated at Level 5.  
- Re-evaluated at Level 5 and eliminated because it would require costly purchase of BNSF Railway ROW. |
## TABLE 4-2. SUMMARY OF SCREENING RESULTS

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Level Eliminated</th>
<th>Reason for Retention/Elimination</th>
</tr>
</thead>
</table>
| BNSF Railway Alignment East of BNSF Railway ROW (This alignment would include the B-2 alignment) | Evaluated in FEIS | Carry forward.  
- Fulfills project’s Purpose and Need to provide high-capacity fixed-guideway transit.  
- Lower costs than original UP Railroad Alignment. In UP Railroad ROW alternative and original BNSF Railway in BNSF Railway ROW alternative.  
- Overall fewer residential and business acquisitions than modified UP Railroad alternatives (West of UP Railyard and Over UP Railyard alternatives) evaluated in Level 5 Screening.  
- Compatible with DUS redevelopment and FasTracks’ East, Northwest Rail, or Gold Line corridors. |
| Build Alternatives Commuter Rail (DMU or EMU) — Southern Section Alignments |                  |                                                                                                                     |
| A (through or over Sand Creek Junction)                                     | ✓                | Eliminated at Level 4.  
- Cannot go through Sand Creek Junction at-grade because it is not compatible with railroad operations.  
- Grade-separated structure over Sand Creek Junction and I-270 results in higher costs than other alignments. |
| A-2 (from BNSF Railway at-grade)                                            | ✓                | Eliminated at Level 5.  
- Would impact roadway safety (some left-turn lanes would need to be removed) along Brighton Boulevard/SH 265.  
- Would interfere with Suncor’s railroad service (also a safety concern). |
| A-3 (from BNSF Railway elevated)                                            | ✓                | Eliminated subsequent to the DEIS.  
- Safety concerns associated with the blast zone of Suncor.  
- Conflicts with existing railroad operations that could result in disruptions to commuter rail service. |
| B-1 (west of Sand Creek Junction)                                           | ✓                | Eliminated at Level 5.  
- Conflicts heavily with Metro Wastewater and Denver Water.  
- Refinements became B-2.  
- Required piers in Denver Water Reservoir. |
| B-2 (Cross-country alignment west of Sand Creek Junction)                   | Evaluated in FEIS| Carry forward.  
- Fulfills Purpose and Need.  
- Compatible with DUS redevelopment and FasTracks’ East, Northwest Rail, and Gold Line corridors.  
- Fewer environmental and community impacts than B-3 and B-4.  
- Provides a safer route past the Suncor refinery than A-3.  
- No identified conflicts with railroad operations. |
### TABLE 4-2. SUMMARY OF SCREENING RESULTS

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Level Eliminated</th>
<th>Reason for Retention/Elimination</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-3, and B-4 (Cross-country alignments west of Sand Creek Junction)</td>
<td>Level 1</td>
<td>Eliminated subsequent to DEIS • Would have more environmental, private property and business impacts than A-3 and B-2.</td>
</tr>
<tr>
<td></td>
<td>Level 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level 4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Level 5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DEIS</td>
<td>✔</td>
</tr>
<tr>
<td>C (west of Sand Creek Junction)</td>
<td>✔</td>
<td>Eliminated at Level 4. • Hazardous material site impacts.</td>
</tr>
<tr>
<td>D (west of Sand Creek Junction)</td>
<td>✔</td>
<td>Eliminated at Level 4. • Hazardous material site impacts. There is another similar alignment (B-4) that has less impact. • Less favorable geometry.</td>
</tr>
<tr>
<td>E and F (east of Sand Creek Junction)</td>
<td>✔</td>
<td>Eliminated at Level 3. • Interference with BNSF Railway freight operations. • Impacts to Suncor. • More expensive than other alignments.</td>
</tr>
</tbody>
</table>

#### Comma Rail Technology

<table>
<thead>
<tr>
<th>Diesel Multiple Unit (DMU) Technology – All Alignments</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Eliminated subsequent to DEIS. • Not as cost effective as EMU for this corridor • More adverse community impacts than EMU (air quality and noise) • Less support among the community and participating agencies than EMU</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electric Multiple Unit (EMU) Technology – All Alignments</th>
<th>Evaluated in FEIS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Carry forward. • Fulfills Purpose and Need. • Compatible with DUS redevelopment. • Compatible with other FasTracks commuter rail corridors. • Compatible with CDOT North I-25 corridor.</td>
</tr>
</tbody>
</table>
### TABLE 4-2. SUMMARY OF SCREENING RESULTS

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Level Eliminated</th>
<th>Reason for Retention/Elimination</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Other Alternatives</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other Technology</strong> (LHC, BRT, Monorail, Subway and/or Third Rail, Streetcar, Double-Decker DMU or EMU)</td>
<td>✓</td>
<td>Eliminated at Level 1.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• LHC is not optimal for the North Metro station spacing and grades. LHC requires high construction costs for bridges. LHC travel times offer less efficient performance and would require larger fleet compared to DMU and EMU technology.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• BRT requires HOV/HOT lane extensions along I-25 and concurrent implementation with highway improvements (currently not programmed). Bus/HOV options along I-25 are not precluded from future consideration.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Monorail requires full grade separations in corridor at very high costs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Subway is prohibitively expensive.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Third Rail is not suitable for at-grade operations due to safety concerns.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Streetcar is not suitable high-capacity line-haul mode. It is slower because it operates in traffic.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Double-decker DMU or EMU would require higher overpass clearances, adding costs to bridge reconstruction.</td>
</tr>
<tr>
<td><strong>Other East to West Connections</strong> (Includes Roadway, as well as a Fixed Guideway Circumferential Connection)</td>
<td>✓</td>
<td>Eliminated at Level 1.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Does not meet Purpose and Need for North Metro to provide a north to south high-capacity connection between the 162nd Avenue area and DUS.</td>
</tr>
<tr>
<td><strong>Quebec Street Alternative</strong></td>
<td>✓</td>
<td>Eliminated at Level 1.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• The proposed Quebec Street alternative would be applicable for incorporation into future studies for future connection to FasTracks corridors or the Northeast Area Transit Evaluation (NATE).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• This alternative would rely on the UP Alignment west of the UP Railyard alternative or over the UP Railyard alternatives which were eliminated.</td>
</tr>
</tbody>
</table>

Source: North Metro Corridor Project Team, 2009.
4.2 LEDPA ANALYSIS - INITIAL SCREENING (LEVEL ONE)

Level 1 screened a broad range of alignment alternatives according to whether they met Purpose and Need. Using Purpose and Need as the evaluation criteria, this level focused on evaluating roadway (I-25 and Washington Street) and rail corridor alignments and a broad spectrum of vehicle technologies, including EMU, DMU, LRT, LHC, BRT, monorail, third rail, streetcar, and subway. Station target areas were also reviewed. Commuter rail technology (EMU and DMU) within or along the UP Railroad and BNSF Railway/UP Boulder Branch Alignment alternatives, LRT within or adjacent to the railroad alignment alternatives, and LRT along I-25 and Washington Street corridors were advanced to the next screening level because they met the project Purpose and Need. The TSM Alternative, and the UP Railroad and BNSF Railway alignments out of DUS were also advanced. For information on the alternatives eliminated in Screening Level 1, refer to Table 4-2. Alternatives that do not meet Purpose and need would not be implemented and therefore are not practicable.

4.3 LEDPA ANALYSIS - COMPARATIVE SCREENING (LEVEL TWO)

Screening Level 2 continued the evaluation of vehicle technology and rail corridor alignments, as well as the TSM Alternative, to determine degrees of effectiveness for achieving project goals. Through criteria that evaluated affordability, mobility improvements, basic environmental impacts, community impacts and benefits, and compatibility with related projects, it identified key trade-offs and advanced the most promising alignments and vehicle technologies, which were the BNSF Railway/UP Boulder Branch Alignment and the UP Railroad Alignment. Commuter rail technology was selected over LRT and all other technologies during this level of screening. These recommendations were primarily due to the availability of ROW and conceptual level costs. Station target areas were further reviewed.

Environmental factors considered for Level 2 screening included stream crossings, floodplains, aquatic resources including wetlands, and publicly-owned parks, open space and trails. Each alternative contains a similar number of stream crossings (Table 4-3). The LRT alternatives have the lowest impact on wetlands due to their location within a built environment. The alternatives that are located within or along railroad ROW have the potential to impact a greater area of wetlands.
TABLE 4-3. STREAM CROSSINGS AND POTENTIAL WETLANDS BY ALTERNATIVE – SCREENING LEVEL 2 RESULTS

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Stream Crossings</th>
<th>Potential (acres) Wetlands within 100 feet</th>
<th>Screening Results and Justification for Elimination</th>
</tr>
</thead>
<tbody>
<tr>
<td>LRT – Parallel UPRR</td>
<td>3</td>
<td>8.8</td>
<td>Eliminated Not practicable due to unreasonable cost and property impacts</td>
</tr>
<tr>
<td>LRT – I-25</td>
<td>3</td>
<td>7.7</td>
<td>Eliminated Not practicable due to unreasonable cost and property impacts</td>
</tr>
<tr>
<td>LRT – Washington Street</td>
<td>3</td>
<td>8.0</td>
<td>Eliminated Not practicable due to unreasonable cost, property impacts, and adverse traffic impacts</td>
</tr>
<tr>
<td>LRT – Washington Street with Lane Reduction</td>
<td>3</td>
<td>8.0</td>
<td>Eliminated Not practicable due to unreasonable cost, property impacts, and adverse traffic impacts</td>
</tr>
<tr>
<td>DMU – UPRR</td>
<td>3</td>
<td>10.0</td>
<td>Carried Forward</td>
</tr>
<tr>
<td>DMU – BNSF/UPRR</td>
<td>5</td>
<td>10.0</td>
<td>Carried Forward</td>
</tr>
<tr>
<td>EMU – UPRR</td>
<td>3</td>
<td>10.0</td>
<td>Carried Forward</td>
</tr>
<tr>
<td>EMU – BNSF/UPRR</td>
<td>5</td>
<td>10.0</td>
<td>Carried Forward</td>
</tr>
</tbody>
</table>

Note: TSM and No Action Alternatives carried forward to next screening level as well.

As reviewed with the USACE, the LRT alternatives in the Level 2 Evaluation were not practicable due to high cost and ROW (property) impacts. The cost of the LRT alternatives were more than double the FasTracks budget, and consequently would not be implementable, and therefore not a practicable alternative. Since the LRT alternatives were not within railroad ROW they impacted hundreds more parcels than the EMU/DMU alternatives and therefore were not a practicable alternative. In addition, with the high adverse traffic impacts for the LRT - Washington Street alternatives, the project need “to improve mobility” would not be met and therefore this is another reason these alternatives were not practicable.

The USACE concurred with the purpose and need and the screening results from Levels 1 and 2 in a letter on 16 January 2007 and concurred that the LEDPA had not been eliminated in a letter on 14 November 2007. (Appendix 3).

4.4 LEDPA FOR SOUTHERN SECTION ALIGNMENTS

For the Northern Section, the UP Boulder Branch was identified as the Preferred Alternative as discussed in the previous section. The Southern Section alternatives required several assessment steps due to changes in the CRMF location, changes in vehicle technology that resulted in reevaluating alternatives, and multiple options to avoid the Sand Creek Junction area. The chronological events for developing and assessing these alternatives were referred to as Screening Levels 3, 4, and 5 and are described below. However due to the reiterative process and multiple suboptions, all Southern Section alternatives were grouped together and evaluated at the same time for the LEDPA analysis as shown in Table 4-4.
4.4.1 Southern Section Detailed Screening (Level Three)

This screening level concentrated on the Southern Section alignments, including the UP Railroad and BNSF Railway, as well as the Alignment “A” and cross-country alignment options B-1, B-2, B-3, B-4, C, D, E, and F to avoid the congested Sand Creek railroad junction. (See Figure 3-2 for the alignments.) The quantitative (measure-based) analysis in Level 3 included conceptual cost estimates, mobility benefits, and environmental impacts such as wetlands. By Level 3, multiple station options had been introduced for each station target area. At the conclusion of Level 3 screening, the UP Railroad Alignment from DUS was recommended to connect to the UP Boulder Branch in Commerce City, and alignments A, B-1, B-2, B-3, B-4, C, and D were advanced to Screening Level 4. Later, as described in Level 5, the BNSF Railway alignment in the Southern Section was reevaluated. Therefore the potential impact to wetlands and other waters for the screening analysis of Levels 3, 4, and 5 are combined and shown in Table 4-4.

4.4.2 Southern Section Alternative Refinement (Level Four)

Level 4 screening focused on the alignment options designed to bypass the Sand Creek Junction crossing in the Southern Section (A, B-1, B-2, B-3, B-4, C, and D). The Level 4 evaluation process used criteria similar to Level 3 primary criteria, and developed more detail on residential and business impacts. The B alignment options were advanced for further consideration because they had less community impact. The results of the Level 4 screening are detailed in the Level 4 Evaluation and Screening Report (RTD 2008b). As noted earlier, the screening process for the Southern Alignment alternatives had multiple steps and required revisiting some alternatives. Therefore the potential impact to wetlands and other waters for the screening analysis of Levels 3, 4, and 5 are combined and shown in Table 4-4.
4.4.3 Southern Section Alternative Refinement (Level Five)

In January 2008, RTD and the UP Railroad Company could not reach terms over the purchase of several critical pieces of UP Railroad property south of Commerce City. Subsequently, RTD determined it should re-evaluate the use of either the UP Railroad or BNSF Railway alignments between DUS and the Denver County/Adams County line. The cost to acquire UP Railroad property was much higher than anticipated, especially the area RTD desired for its CRMF. This greatly increased the cost of the UP Railroad Alignment alternative and the CRMF location, and resulted in RTD’s reconsideration of previous facility locations, and evaluation of modified alternatives. A new CRMF location was proposed (the CRMF location is evaluated in a separate study, the Commuter Rail Maintenance Facility Supplemental Environmental Assessment to FasTracks Commuter Rail Corridors, [FTA and RTD 2009]) and subsequently was included in the Gold Line FEIS (2009a) and ROD (2009b), and the East Corridor FEIS (2009d) and ROD (2009e). The modified BNSF Railway Alignment alternative in the Southern Section placed the commuter rail alignment outside but paralleling adjacent to the BNSF Railway ROW. The modified UP Railroad Alignment alternatives in the Southern Section used the proposed East Corridor ROW (outside the UP Railroad ROW) and then avoided UP Railroad’s 36th Street railyard by either going west of or over the railyard. A Level 5 screening step was undertaken to re-evaluate the modified UP Railroad Alignment versus the BNSF Railway Alignment in the Southern Section, out of DUS. Level 5 incorporated some primary Level 3 criteria, but focused on ROW and property impacts and costs, as listed in Table 4-1. A modified version of the BNSF Alignment was recommended, paralleling the east side of the BNSF Railway ROW, because it had fewer property impacts. New station options within Denver were also introduced along the BNSF Railway corridor and were evaluated using Level 5 screening criteria. The results are detailed in the Level 5 UP Railroad and BNSF Alignment Reevaluation Report (RTD 2008c), and the Level 5 BNSF Station Options Screening Report (RTD 2008d). In May 2009, RTD decided to re-evaluate the practicality of the previously screened-out BNSF Railway corridor A alignments, because vehicle technology had improved, allowing steeper grades; therefore, alignments that were previously not feasible (such as under I-270) could now be considered. The 2009 iterations of the BNSF Railway Corridor A alignments were named A-2 and A-3 (previously 2-A-2 and 2-A-3). (See Figure 4-2 for the A alignment.) The potential impact to wetlands and other waters for the screening analysis of Levels 3, 4, and 5 are combined and shown in Table 4-4 in the following section.
FIGURE 4-2. ALIGNMENTS A-3, B-2, B-3, AND B-4 TO COMMERCE CITY
4.4.4 LEDPA Analysis for Southern Section

A comparison of the impacts to wetlands and other waters as well as the justification that the LEDPA has not been eliminated is presented in Table 4-4.

In the Southern Section (DUS to 84th Avenue) there are several alternatives on or along the BNSF or UP railroad corridors. The BNSF Railway Alignment east of the BNSF Railway ROW is recommended as the preferred alternative in the Southern Section. Although the preferred alternative has higher estimated wetland and other waters impacts, it is the least environmentally damaging practicable alternative because the other alternatives are not practicable. The two alternatives within railroad ROW (the UP Railroad Alignment in UP ROW and the BNSF Railroad Alignment in BNSF ROW) had very high costs because they would require ROW property acquisition from the railroads that would exceed the FasTracks budget. In fact, the costs for the UP Railroad ROW were so high that RTD moved the proposed CRMF from this corridor to another location. Based on this greater magnitude of cost for ROW, these alternatives would not be implementable for the FasTracks program. Since these alternatives would not be implemented, they would not be practicable and therefore, are not the LEDPA.

The two other Southern Section alignment alternatives outside the UP Railroad ROW (the UP Railroad Alignment west of the UP Railyard Alternative and the UP Railroad Alignment over the UP Railyard Alternative) were not practicable due to property, business, and residential impacts. Compared to the Preferred Alternative, these alternatives impacted 8-30 more private properties, including 8-20 more active businesses and 5-16 more properties with residences. The west of the UP Railyard Alternative had the greatest impacts. Since the alternatives provide similar mobility benefits, it is not reasonable or practicable to impact these additional businesses and residences, therefore eliminating these alternatives did not eliminate the LEDPA.

In addition to evaluating alternatives within the Southern Section from DUS to 84th Street, there were several alternatives and sub-options for avoiding the Sand Creek Junction area, which is within the Southern Section. The Preferred Alternative for this area is the B-2 alignment. Alternatives with greater wetland and other waters impacts that were eliminated included the other B options (B-1, B-3, B-4). Alternatives with less wetland and other waters impacts included the A, C, D, E, and F alternatives and their sub-options. These alternatives were not practicable for the following reasons.

Within the Southern Section, the A Alternative which went through Sand Creek Railroad junction was not practicable because it was not compatible with railroad operations and therefore was not implementable. The A-2 and A-3 Alternatives along Brighton Boulevard had the same alignments, but the A-3 Alternative has an elevated bridge structure whereas the A-2 alignment is at-grade along Brighton Boulevard. These alternatives were not as safe as the Preferred Alternative (B-2) because the Suncor Refinery is on both sides of the alignment. At the DEIS public hearing and in written comments, Suncor representatives stated their concerns because the A-2/A-3 alignment runs between the Refinery’s main processing units. This is the severe area of the potential blast zone, where there is concern due to potential toxic emissions or explosions. This concern is compounded because it is close to the plant’s main flare which periodically goes off occasionally requiring closure of Brighton Boulevard. With these public safety concerns disclosed by Suncor, neither alternative A-2 nor A-3 is practicable and therefore are not the LEDPA.
<table>
<thead>
<tr>
<th>Alternative</th>
<th>Wetlands (acres)</th>
<th>Other Waters (acres)</th>
<th>LEDPA Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Alternatives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Action</td>
<td>-</td>
<td>-</td>
<td>• Eliminated – Not practicable because it does not meet the basic purpose of the project (purpose and need).</td>
</tr>
<tr>
<td>Transportation System Management (TSM)</td>
<td>-</td>
<td>-</td>
<td>• Eliminated – Not practicable because it does not meet the basic purpose of the project (purpose and need).</td>
</tr>
</tbody>
</table>

**Commuter Rail Alignment**

**Commuter Rail Alignment – Northern Section**

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Wetlands (acres)</th>
<th>Other Waters (acres)</th>
<th>LEDPA Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>UP Boulder Branch portion of the UP Railroad Alignment (north of Sand Creek Junction)</td>
<td>Included in Alternatives below</td>
<td>Included in Alternatives below</td>
<td>• Preferred Alternative for Northern Section – has concurrence from USACOE that the LEDPA has not been eliminated.</td>
</tr>
</tbody>
</table>

**Commuter Rail Alignment – Southern Section Options (with UP Boulder Branch in the North)**

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Wetlands (acres)</th>
<th>Other Waters (acres)</th>
<th>LEDPA Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>UP Railroad Alignment in UP Railroad ROW (Original Alternative south of Sand Creek Junction)</td>
<td>10.0</td>
<td>5.5</td>
<td>• Eliminated – Not practicable due to higher costs (for UP Railroad ROW acquisition).</td>
</tr>
<tr>
<td>UP Railroad Alignment west of UP Railyard outside UP Railroad ROW (south of Sand Creek Junction)</td>
<td>10.0</td>
<td>5.5</td>
<td>• Eliminated – Not practicable because greater environmental impacts than the BNSF Railway Alignment east of BNSF Railway ROW Alternative due to residential and business relocations.</td>
</tr>
<tr>
<td>UP Railroad Alignment over UP Railyard outside UP Railroad ROW (south of Sand Creek Junction)</td>
<td>10.0</td>
<td>5.5</td>
<td>• Eliminated – Not practicable because greater environmental impacts than BNSF Railway Alignment east of BNSF Railway ROW Alternative due to residential and business relocations.</td>
</tr>
<tr>
<td>BNSF Railway Alignment within BNSF Railway ROW (Original Alternative)</td>
<td>10.0</td>
<td>6.7</td>
<td>• Eliminated – Not practicable because costly purchase of BNSF Railway ROW required.</td>
</tr>
<tr>
<td>BNSF Railway Alignment east of BNSF Railway ROW (This alignment would feature one of the alignment options described below)</td>
<td>10.0</td>
<td>6.7</td>
<td>• Preferred – This alignment is further refined to include an option for avoiding the Sand Creek Junction area including the cross-country alignment options.</td>
</tr>
</tbody>
</table>

**Commuter Rail Southern Section Alignment Options for Avoiding Sand Creek Junction**

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Wetlands (acres)</th>
<th>Other Waters (acres)</th>
<th>LEDPA Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option A (through or over Sand Creek Junction)</td>
<td>0.1</td>
<td>0.6</td>
<td>• Eliminated – Not practicable because cannot go through Sand Creek Junction at-grade as it is not compatible with railroad operations. Grade-separated structure over Sand Creek Junction results in highest costs of all the cross-country alignments.</td>
</tr>
</tbody>
</table>
### TABLE 4-4. POTENTIAL WETLANDS AND OTHER WATERS BY ALTERNATIVE AND LEDPA ANALYSIS SUMMARY

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Wetlands (acres)</th>
<th>Other Waters (acres)</th>
<th>LEDPA Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option A-2 (at-grade along Brighton Boulevard west of Sand Creek Junction)</td>
<td>0.1</td>
<td>1.2</td>
<td>• Eliminated - Not practicable due to safety concerns associated with Suncor Refinery.</td>
</tr>
<tr>
<td>Option A-3 (elevated along Brighton Boulevard west of Sand Creek Junction)</td>
<td>0.1</td>
<td>1.2</td>
<td>• Eliminated – Not practicable due to safety concerns associated with Suncor Refinery; and conflicts with existing railroad operations.</td>
</tr>
<tr>
<td>Option B-1 (west of Sand Creek Junction)</td>
<td>0.3</td>
<td>1.6</td>
<td>• Eliminated – Greater impact to wetlands and other waters than the Preferred Alternative (B-2) due to greater impact to nearby canal and reservoir. (Option B-2 is a refinement of this alternative.)</td>
</tr>
<tr>
<td>Option B-2</td>
<td>0.3</td>
<td>1.3</td>
<td>• Preferred Alignment for Southern Section</td>
</tr>
<tr>
<td>Option B-3</td>
<td>0.5</td>
<td>2.5</td>
<td>• Eliminated – Greater impacts to wetland and other waters than Preferred Alternative (B-2).</td>
</tr>
<tr>
<td>Option B-4</td>
<td>0.3</td>
<td>2.2</td>
<td>• Eliminated – Greater impact to wetlands and other waters than Preferred Alternative (B-2).</td>
</tr>
<tr>
<td>Option C (west of Sand Creek Junction)</td>
<td>0.3</td>
<td>0.7</td>
<td>• Eliminated – Not practicable because there are greater hazardous material risks and landfills.</td>
</tr>
<tr>
<td>Option D (west of Sand Creek Junction)</td>
<td>0.3</td>
<td>0.8</td>
<td>• Eliminated – Not practicable because there are greater hazardous material risks and landfills.</td>
</tr>
<tr>
<td>Options E and F (east of Sand Creek Junction)</td>
<td>0.0</td>
<td>1.1</td>
<td>• Eliminated – Not practicable due to potential interference with BNSF Railway freight railroad operations east of Sand Creek Junction and costs are approximately $6 to $10 million (24% to 35%) higher than Options B, C, and D for basic alignment and structures necessary to cross the UP Railroad and BNSF Railway alignments north of Sand Creek</td>
</tr>
</tbody>
</table>

Source: North Metro Corridor Project Team, 2010.

Notes:
- LEDPA = Least Environmentally Damaging Practicable Alternative
- ROW = right-of-way
- USACOE = United States Army Corps of Engineers

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Alignment Alternatives C and D had the greatest potential hazardous materials impacts of all alternatives and had the highest number of landfills near the alignment. For alternatives C and D, the alignment was within 300 feet of five more landfills than the Preferred B-2 alignment. In addition, Alternatives C and D had the potential to interfere with the groundwater barrier along the north side of the Suncor Refinery. With these hazardous materials and potential landfill impacts there were cost and safety implications and therefore these were not practicable alternatives.

Alignments such as Alternatives E and F were not practicable because their costs were approximately 25% - 35% higher than other alternatives and it was unlikely that they could be implemented due to potential interference with BNSF Railway freight rail operations east of Sand Creek Junction.

Also as shown in Table 4-4, the No Action Alternative does not meet the project purpose. The TSM Alternative (enhanced bus service) does not meet the project purpose and need for a reliable fixed guideway system. Therefore these alternatives were not practicable and the LEDPA was not eliminated.

4.5 LEDPA ANALYSIS - VEHICLE TECHNOLOGY

The results of the evaluation in the DEIS identified EMU as the preferred vehicle technology. Generally, it is the alignment and stations that have a physical impact and not the vehicle technology. Therefore the impacts to wetlands and other waters are not affected by the vehicle technology.

4.6 LEDPA ANALYSIS - STATIONS

4.6.1 Station Development and Refinement

At the beginning of the North Metro station planning effort, more than four dozen station options were suggested for the eight station target areas in the corridor. As with the screening criteria used for the alignments and technology, similar detailed criteria were incorporated into the Level 1 station screening criteria, within these six categories:

1. Mobility (ridership, parking demand, and access needs)
2. Operational (track alignment compatibility)
3. Site Configuration (accommodation of parking/facility needs)
4. Community (demographics, interests, and compatibility)
5. Economic (existing businesses and future development)
6. Environmental (sensitivity of resources)

Subsequent screenings included determining public and local government support for the station options, and involved conducting special station planning meetings.
During the station screening, certain key discriminators became apparent from the list of detailed criteria. These discriminators aided the project team’s decisions to set aside or advance station options ultimately to the DEIS for detailed analysis. These key discriminators included:

- **Ridership**: future population and employment within 0.5 mile of the station
- **Parking**: initial and future demand; and ability to provide supply to meet demand
- **Access**: by roadway and pedestrian/bicycle trail system
- **ROW**: property acquisition, economic and business impacts
- **Community Acceptance**: agency and public
- **Environmental Concerns**: hazardous material impacts, other environmental impacts, and whether the station option would be the LEDPA.

See the evaluation and screening reports for levels 3, 4, and 5 for details on the station options and screening process. The stations were also dependent on the alignment alternative and 15 station options were advanced to the DEIS for further evaluation. These options were often a refinement of previous options including refining the station footprint to avoid wetlands or minimize impacts. The refined options evaluated in the DEIS are listed in Table 4-5. No recommendation was made at the Denver Station Target Area in the DEIS, but subsequent to the publication of the DEIS, the Coliseum/Stock Show North was preferred. Also, subsequent to the DEIS, the recommendation for the 88th Avenue Station option changed to preference for the option that includes a relocated Welby Road. The final results are also shown in Table 4-5.

### 4.6.2 LEDPA Analysis for Stations

As shown in Table 4-5, most of the Preferred Station options either had no impact or less impact than the other options for that particular station target area. There are three Preferred Stations that impact wetlands and/or other waters: 72nd Avenue, 104th Avenue, 162nd Avenue.

At the Commerce City station target area, although the 68th Avenue Station had less wetland impact than the preferred 72nd Avenue Station option, the LEDPA was not eliminated. The Preferred Station at Commerce City (72nd Avenue Station) would impact one parcel and result in no relocations; whereas the 68th Avenue Station option would impact seven parcels resulting in three residential relocations and one business relocation. It was not practicable to incur these additional relocations for a similar alternative and therefore the LEDPA was not eliminated.

At the 104th Avenue general station target area, no other station options were feasible because the land was already developed or there was no straight section of track on which to site a station platform. Tangent track at the station platform allows for level boarding, meaning patrons do not have to step up or down into the vehicle, meeting ADA guidelines.

Although there are impacts to Other Waters at the Preferred 162nd Avenue East Station, these impacts are less than the other alternative the 162nd Avenue West Station. Based on this information, the LEDPA has not been eliminated.
<table>
<thead>
<tr>
<th>Station Target Area</th>
<th>Station Options Evaluated in the DEIS</th>
<th>Wetlands</th>
<th>Other Waters</th>
<th>Results Subsequent to DEIS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Southern Section</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Denver</td>
<td>• Coliseum/Stock Show South (No recommendation)</td>
<td>0.0</td>
<td>0.0</td>
<td>Eliminated</td>
</tr>
<tr>
<td></td>
<td>• Coliseum/Stock Show North (No recommendation)</td>
<td>0.0</td>
<td>0.0</td>
<td>Preferred</td>
</tr>
<tr>
<td>Commerce City</td>
<td>• 68th Avenue</td>
<td>0.0</td>
<td>0.0</td>
<td>Eliminated</td>
</tr>
<tr>
<td></td>
<td>• 72nd Avenue South</td>
<td>0.2</td>
<td>(0.0 Jurisdictional)</td>
<td>Preferred</td>
</tr>
<tr>
<td><strong>Northern Section</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>88th Avenue (Thornton)</td>
<td>• 88th Avenue</td>
<td>0.0</td>
<td>0.0</td>
<td>Eliminated</td>
</tr>
<tr>
<td></td>
<td>• 88th Avenue with Welby Road Relocation</td>
<td>0.0</td>
<td>0.0</td>
<td>Preferred</td>
</tr>
<tr>
<td>104th Avenue (Thornton)</td>
<td>• 104th Avenue</td>
<td>0.3</td>
<td>0.1</td>
<td>Preferred</td>
</tr>
<tr>
<td>Northglenn/Thornton</td>
<td>• 112th Avenue Parking West of York Street</td>
<td>0.0</td>
<td>0.0</td>
<td>Preferred</td>
</tr>
<tr>
<td></td>
<td>• 112th Avenue Parking East of York Street</td>
<td>0.0</td>
<td>0.0</td>
<td>Eliminated</td>
</tr>
<tr>
<td>124th Avenue (Thornton)</td>
<td>• 124th Avenue</td>
<td>0.0</td>
<td>0.0</td>
<td>Preferred</td>
</tr>
<tr>
<td>144th Avenue (Thornton/Adams County)</td>
<td>• 144th Avenue West</td>
<td>0.0</td>
<td>0.0</td>
<td>Eliminated</td>
</tr>
<tr>
<td></td>
<td>• 144th Avenue East</td>
<td>0.0</td>
<td>0.0</td>
<td>Preferred</td>
</tr>
<tr>
<td></td>
<td>• 144th Avenue Split</td>
<td>0.0</td>
<td>0.0</td>
<td>Eliminated</td>
</tr>
<tr>
<td>162nd Avenue (Thornton)</td>
<td>• 162nd Avenue West</td>
<td>0.0</td>
<td>0.3</td>
<td>Eliminated</td>
</tr>
<tr>
<td></td>
<td>• 162nd Avenue East</td>
<td>0.0</td>
<td>0.1</td>
<td>Preferred</td>
</tr>
</tbody>
</table>

Source: North Metro Corridor Project Team, 2009.
4.7 AVOIDANCE AND MINIMIZATION OF IMPACTS

In general, the station alternatives were refined to avoid or minimize impacts to wetlands. For example:

- The 104th Avenue Station was refined to locate the station platform on bridge structure to allow parking underneath the track and mostly within RTD ROW. This minimized impacts to the existing detention pond and wetlands at the station site, the impacts to wetlands to 0.29 acres, a reduction of 0.7 acres.
- The 112th Avenue Station was refined and located further north to avoid wetlands, and expansion parking will be provided on the same site in the form of a parking structure, avoiding wetlands.
- The 124th Avenue/Eastlake Station was located north of East 124th Avenue to avoid wetlands to the south of East 124th Avenue.
- The SH 7/162nd Avenue Station platforms and the passing track were located as far south as possible to avoid impacts to Big Dry Creek and its associated wetlands.

In addition, several measures were taken during design to minimize impacts along the alignment, including:

1. Redesigning from double track to single track in various locations
2. Spanning other water crossings and utilized existing structures when applicable. New piers were strategically placed outside the ordinary high water mark (OHWM) whenever possible.
3. Adding retaining walls to the design where applicable to reduce impacts. At 162nd Avenue, for example, a retaining wall was added just east of the tracks to avoid other which avoided water 35-3 completely.
4. Identifying construction methodology and staging areas to avoid waters and wetlands.

With the selection of the Preferred Alternative including alignment, station, and mitigation measures, a more detailed level of design was undertaken. The wetland and other waters impacts associated with the refined Preferred Alternative are presented in the next section.
5. FEIS PREFERRED ALTERNATIVE

This section outlines the Preferred Alternative’s Southern and Northern sections, stations, vehicle technology, and operations.

5.1 ALIGNMENT

The Preferred Alternative alignment generally follows the BNSF Railway Brush Subdivision to UP Boulder Branch between DUS to 162nd Avenue area, a distance of approximately 18 miles (Figure 5-1). This is referred to as the BNSF Railway/UP Boulder Branch Alternative. For a detailed depiction of this alignment see Figures 1-2A through 1-2L in the Introduction Section. The southern terminus is at the DUS access point (at approximately 20th Street), and its northern terminus is in the 162nd Avenue area in Thornton. The Preferred Alternative is located adjacent to and just east of the BNSF Railway mainline (Brush Subdivision) in Denver. In Commerce City, the Preferred Alternative crosses over the BNSF Railway mainline and is generally adjacent to the O’Brien Canal through private commercial and industrial parcels in what is referred to as the “Cross-Country Area.” (The Preferred Alternative follows what had been described in the DEIS as alignment option B-2 in the southern section.) The alignment connects with the UP Boulder Branch ROW near West 70th Avenue. North of Commerce City, the Preferred Alternative remains within the UP Boulder Branch ROW, which was purchased by RTD in 2009.

The majority of the alignment is single-track, except for five areas with a passing track: from DUS to 38th Street; from south of 72nd Avenue to just north of I-76; from north of Thornton Parkway to just north of 104th Avenue; from south of 124th Avenue to south of York Street; and from SH 7 to the end of line—approximately 162nd Avenue. The second track in these locations allows trains in two directions to pass without delay, thus maintaining the peak period service plan for 15 minute headways between DUS and the SH 7/162nd Avenue station.

The corridor is divided into two sections. The Southern Section covers the area from the DUS access to 84th Avenue. The total direct, permanent impacts to wetlands in this section for the Preferred Alternative would be 0.1 acre (0.1 acre jurisdictional) and 2.0 acres (1.3 acre jurisdictional) to other water features.

The Northern Section continues from 84th Avenue to the terminus at the 162nd Avenue area. The total direct, permanent impact to wetlands in this section for the Preferred Alternative would be 1.4 acres (0.6 acre jurisdictional) and 0.8 acre (0.3 acre jurisdictional) to other water features.

These acreages represent impacts from construction of the proposed alignment only. Impacts resulting from construction of the stations are discussed in the next section.