

## Chapter 5 Alignment Identification

An important component of this corridor study is the identification of the process used to develop potential alternate alignments to US 93 for potential forwarding into the screening process. The identification of potential alignments was based on analysis results of the Quantm Alignment Planning System (i.e., Quantm) route optimization software, as well as the assessment of potential alignments contained in the 1996 US 93-Evaro to Polson FEIS. General corridors were identified based on input from local government, the community, and resource agencies.

The identification of alternate alignments is necessary to determine which alignments are most relevant to carry forward into the screening process and determine whether a single, feasible alternate alignment is possible. Although a No Build option was not considered in the screening process, during a NEPA/MEPA environmental review, a No Build option is carried forward in order to provide a baseline by which the other alternatives are evaluated. Since an EIS was previously prepared for US 93 in the Polson area with no conclusion on this section of US 93, it was necessary to evaluate the EIS alignments in this identification process. Additionally, because the Quantm route optimization software was available to the study team, it was decided that any new routes generated by Quantm should also be explored.

### 5.1 Design Criteria

In order to generate new alignments, minimum geometric design criteria for the roadway must be known. Since the corridor study area incorporates both urban and rural land, MDT's Road Design Manual criteria for rural principal arterials and urban principal arterials were utilized. The minimum geometric design criteria listed in Table 2.2 were used for alignment identification. Portions of the roadway (whether existing or proposed) falling within the Polson city limits were categorized as "urban", while portions outside of the Polson city limits were categorized as "rural".

In some cases, minimum design criteria cannot be achieved. In these circumstances, design exceptions need to be sought and accepted by MDT's roadway design staff. For alignment identification purposes, the need for design exceptions is not explicitly addressed in this corridor study. The existing US 93 does have vertical roadway grade design exceptions on Polson Hill, as the vertical grades in both directions are over the MDT design criteria of 4 percent for a rural principal arterial.

### 5.2 Data Gathering

The primary objective in gathering data was to identify potential constraints within the study area that could inhibit the development of an alignment. If information was not available within MDT's internal repositories, other GIS data repositories such as NRIS were searched. Additional information was gathered from public sources, interviews with local governments, and staff input. Specific Tribal sensitive area data was provided by CSKT. Information contained within the Environmental Scan Report (Appendix B) for the study area was also included.

In order to determine the preliminary alignments for the study, the TOC reviewed the identified constraints and prioritized the information. The TOC determined which features should be avoided, which data should be considered sensitive, which should be considered an additional cost to the project,

and which should be shown on the mapping for reference only. The TOC’s conclusions are listed in Table 5.1.

**Table 5.1 Feature Identification and Prioritization**

<b>Linear Features</b>		Roads, railroad, irrigation canals, streams, drainages
<b>Special Zones</b>	<b>Avoid Areas</b>	4(f) / 6(f) resources (schools, parks, etc.), cemeteries, public water supply, abandoned mines, landfills, sewage lagoons
	<b>Sensitive Areas</b>	Wildlife habitat & crossings, Fairgrounds, native grasslands, specific lands of tribal importance
	<b>Additional Costs</b>	Hazardous areas (underground storage tanks), wetlands*
<b>Additional Data</b>		Study area boundary, Polson city limits, topography, land ownership, vegetation

\*Note: For wetlands, the Clean Water Act requires avoidance and minimization measures to be implemented first before any impacts/mitigation is allowed.

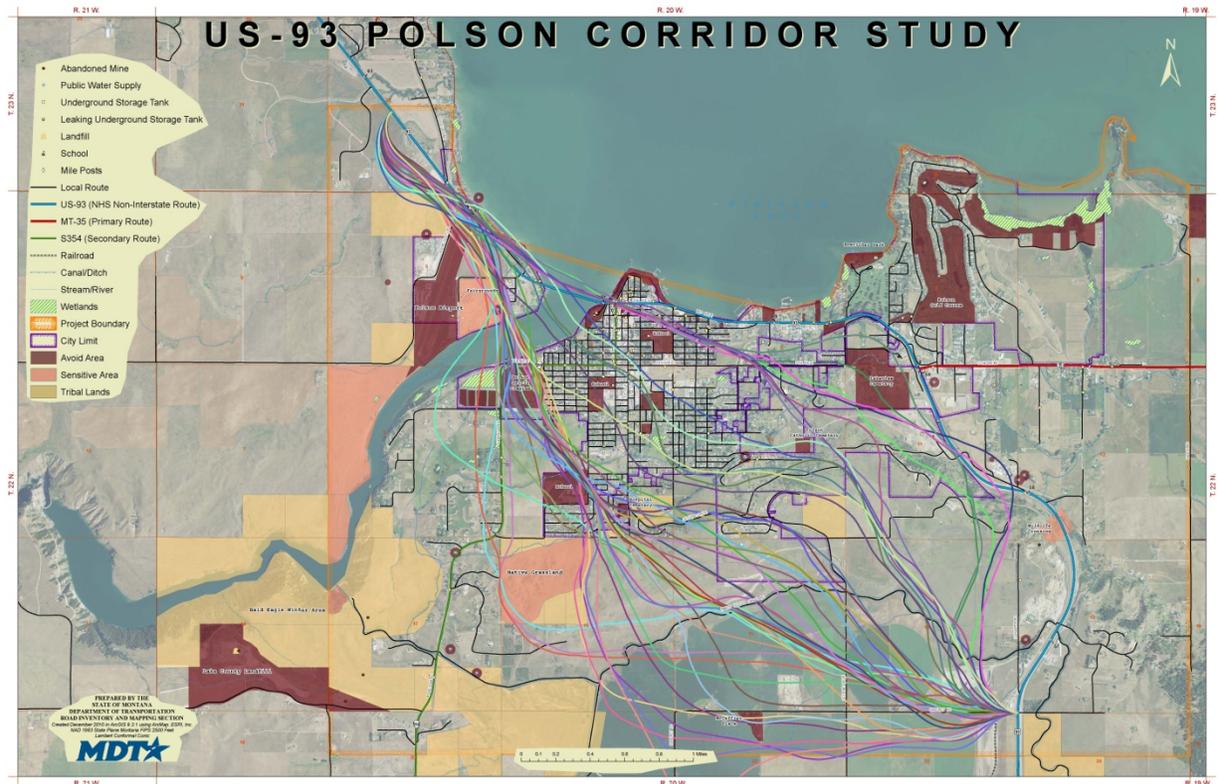
The identification of “avoid” areas and “sensitive” areas was important in the process because Quantm recognizes the importance of certain features based on these two definitions and attempts to route alignments that stay clear of these areas whenever possible. Accordingly, very few of the Quantm generated alignments were found to traverse through an “avoid” area. This process allows the community to identify and prioritize certain features within the community, and results in efforts to stay clear of these areas during the development of potential alternate alignments.

### 5.3 Quantm Background

The Trimble Quantm Alignment Planning System (i.e., Quantm) is a planning tool that uses route optimization software to generate multiple cost-based alignments that balance social, environmental, and terrain constraints and scenarios. This unique software generated hundreds of potential alignments for review by local stakeholders. As the study progressed, different scenarios were created, and revised alignments were produced for further consideration and refinement. This approach to alignment identification allowed for multiple iterations to fulfill local stakeholders’ needs (Trimble 2009).

To begin the Quantm process, all data including linear features, special zones, geometric standards, structure sizes, and Digital Terrain Model was synthesized into a GIS format. Once start and end points were determined, the Quantm system generated multiple potential alignments as presented in the discussion herein.

Figure 5-1 is reflective of a totally “unconstrained” model run in that Quantm alignments generated primarily cut through the existing city proper, without sensitivity to established routes and/or land uses. The purpose of this first model run was to identify what Quantm would generate in an unconstrained condition. The type of information shown in Figure 5-1 is commonly referred to as a “spaghetti” map, in that it portrays a series of fine lines representing potential alignments within the study area.

**Figure 5-1 First Run of Potential Alignments**

## 5.4 Quantm Alignment Trends

A starting point was determined to be the intersection of Caffrey Road and US 93. The end point was determined to be near RP 63, approximately 0.75 miles northwest of the intersection of Irvine Flats Road with US 93. All of the Quantm alignments use the existing two-mile segment of Caffrey Road from the westerly termini of Caffrey Road back to the US 93/Caffrey Road intersection. The estimated range of costs for the Caffrey Road segment is \$4.3 to \$5.1 million dollars. These costs are generated by the Quantm route optimization tool and are reflective of construction costs (i.e., do not include detailed right-of-way cost, project development costs, utility relocation costs, inflation, etc.) This planning level cost does not include preliminary engineering, construction engineering, and/or indirect costs (IDCs). Note that this is the case for all planning level costs presented in this chapter.

The five alignment trends produced by Quantm are described below, and are shown graphically on Figure 5-3.

### **Northern Bridge – 1**

This alignment is shown in purple on Figure 5-3. North Bridge – 1 follows Caffrey Road to the westerly termini as described previously, traverses in a northwest direction, clips the tribal native grassland sensitive area, follows Kerr Dam Road to the north, and cuts through the Fairgrounds property. It then intersects US 93 between the airport and the west end of the Flathead River Bridge. The bridge length

crossing the Flathead River as computed by Quantm is 1,350 feet. The total length of this alignment, including the Caffrey Road segment, is 5.14 miles. The estimated range of costs for this alignment, which includes the Caffrey Road segment, is \$31.0 to \$37.0 million dollars.

### **Northern Bridge – 2**

This alignment is shown in orange on Figure 5-3 and follows Caffrey Road, similar to Northern Bridge – 1 described above, and then traverses in a northwest direction. The alignment skirts around the southwest corner of the tribal native grassland sensitive area. As with Northern Bridge – 1, this alignment follows Kerr Dam Road, bisecting the Fairgrounds property prior to intersecting with US 93 between the airport and the west end of the Flathead River Bridge. The bridge length crossing the Flathead River as computed by Quantm is 1,450 feet. The total length of this alignment, including the Caffrey Road segment, is 5.43 miles. The estimated range of costs for this alignment, which includes the Caffrey Road segment, is \$33.0 to \$39.1 million dollars.

### **Central Bridge**

This alignment is shown in pink on Figure 5-3. The Central Bridge alignment follows Caffrey Road, skirts around the tribal native grassland sensitive area, travels north/northwest and crosses the Flathead River at the southern edge of the airport property. Then, the alignment skirts the western edge of a tribal land parcel (southwest of the existing US 93) and connects with US 93 north of the airport and south of Stone Horse Drive.

The bridge length crossing the Flathead River as computed by Quantm is 1,100 feet. The total length of this alignment, including the Caffrey Road segment, is 6.06 miles. The estimated range of costs for this alignment, which includes the Caffrey Road segment, is \$36.0 to \$43.5 million dollars.

### **Southern Bridge – 1**

The South Bridge – 1 alignment is shown in green on Figure 5-3 and follows Caffrey Road, clips the tribal native grassland sensitive area, and travels just north of the Bald Eagle winter area where it crosses the Flathead River. This alignment connects with US 93 near RP 63.

The bridge length crossing the Flathead River as computed by Quantm is 1,150 feet. This bridge crossing is almost 100 feet above the river surface (at its highest point). The total length of this alignment, including the Caffrey Road segment, is 7.16 miles. This results in the longest alignment of the five generated by Quantm. The estimated range of costs for this alignment, which includes the Caffrey Road segment, is \$34.0 to \$44.0 million dollars.

### **South Bridge – 2**

This alignment is shown in yellow on Figure 5-3. The South Bridge – 2 alignment follows Caffrey Road, cuts through the tribal native grassland sensitive area, clips the Bald Eagle winter area, travels along the western side of the study area boundary, and connects to US 93 near RP 63.

The bridge length crossing the Flathead River as computed by Quantm is 1,800 feet. This bridge crossing is the longest bridge crossing length of the five Quantm alignments, and is due to the alignment skew and crossing at a wide spot of the river. Additionally, the elevation of the bridge is the highest and is

almost 160 feet above the river surface (at its highest point). The total length of this alignment, including the Caffrey Road segment, is 6.65 miles. The estimated range of costs for this alignment, which includes the Caffrey Road segment, is \$37.0 to \$47.2 million dollars.

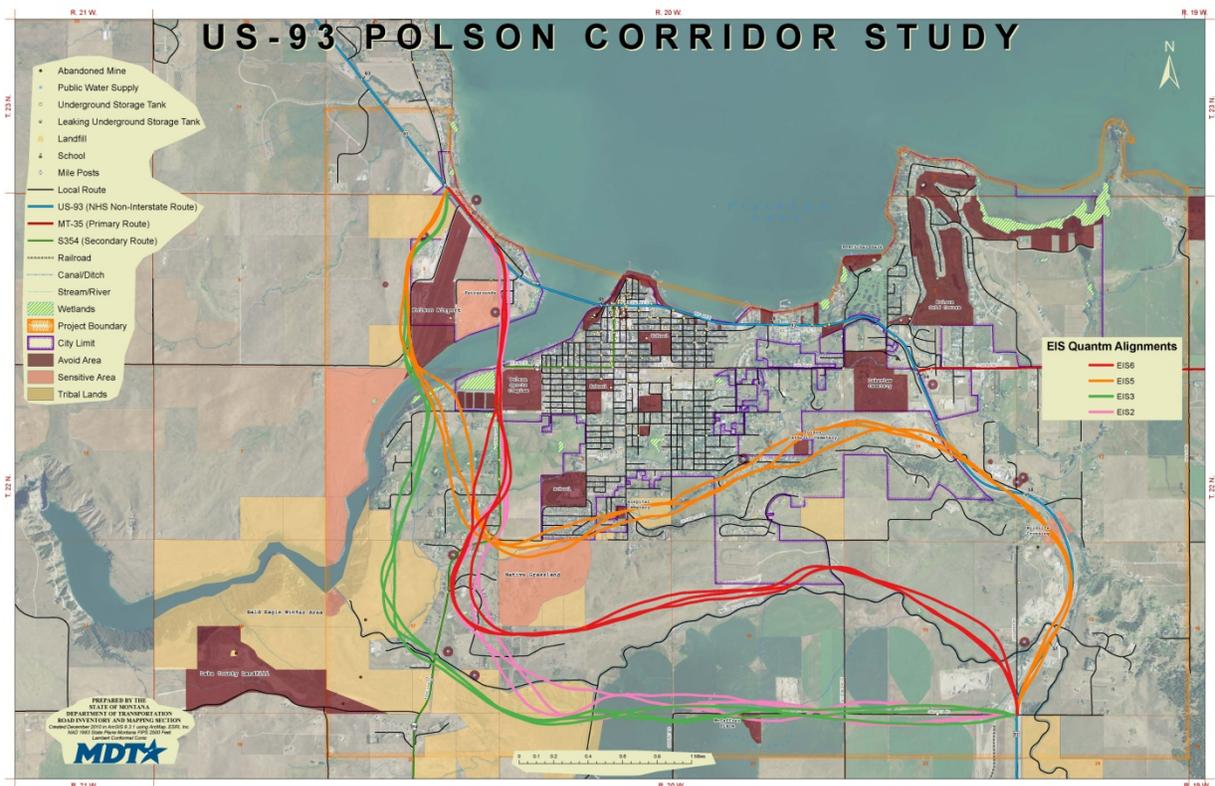
### 5.5 EIS Alignments

The TOC reviewed and analyzed the eight alternate alignments developed during the preparation of the US 93-Evaro to Polson FEIS (see Figure 5-3). Quantm was used to analyze four of the EIS alignments (EIS Alignment 2, 3, 5, and 6) which were manually entered into the software (see Figure 5-2). Because the remaining four alignments (EIS Alignment 1, 4, 7, and 8) traverse through the City of Polson proper and are more “urban”, it was decided that Quantm would not be the appropriate tool for analysis of these alignments. Each of the alignments is defined below and shown on Figure 5-3. Costs generated for each alignment are reflective of construction costs (i.e., do not include detailed right-of-way cost, project development costs, utility relocation costs, inflation, etc.). Planning level costs do not include preliminary engineering, construction engineering, and/or IDCs. Note that this is the case for all planning level costs presented in this chapter.

#### 5.5.1 EIS Alignments Modeled in Quantm

Figure 5-2 shows the EIS alignments that were modeled in Quantm. Each alignment is described in the text that follows.

**Figure 5-2 EIS Alignments Modeled in Quantm**



**EIS Alignment 2**

The Quantm alignments generated for EIS Alignment 2 are shown as pink lines in Figure 5-2. This alignment follows Caffrey Road, then curves northwest with no impacts to the tribal native grasslands, before proceeding north along Kerr Dam Road and crossing the river just east of the Fairgrounds property. A new bridge across the Flathead River would be constructed to continue the general Kerr Dam Road alignment straight north over the river.

The bridge length crossing the Flathead River as computed by Quantm is 1,520 feet. The total length of this alignment is 5.74 miles. The estimated range of costs for this alignment is \$34.7 to \$41.6 million dollars.

**EIS Alignment 3**

The Quantm alignments generated for EIS Alignment 3 are shown as green lines in Figure 5-2. This alignment follows Caffrey Road and extends approximately one mile west of the end of the road (at the 90-degree bend) before curving to the northwest. The alignment travels north through tribal lands, and then crosses the river just south of the airport. The alignment continues northbound, west of the airport, and ties into US 93 at Rocky Point Road. A new bridge across the Flathead River would be constructed.

The bridge length crossing the Flathead River as computed by Quantm is 1,100 feet. The total length of this alignment is 6.48 miles. The estimated range of costs for this alignment is \$30.4 to \$36.4 million dollars.

**EIS Alignment 5**

The Quantm alignments generated for EIS Alignment 5 are shown as orange lines in Figure 5-2. This alignment begins near Saw Mill Road, heads west, then southwest, where it bisects the tribal land located east of the Hospital Cemetery and the tribal native grasslands before heading north toward the southwest corner of the airport. EIS Alignment 5 then continues northbound, west of the airport property, until it connects to US 93.

The bridge length crossing the Flathead River as computed by Quantm is 1,200 feet. The total length of this alignment is 5.17 miles. The estimated range of costs for this alignment is \$41.0 to \$44.1 million dollars.

**EIS Alignment 6**

The Quantm alignments generated for EIS Alignment 6 are shown as red lines in Figure 5-2. EIS Alignment 6 starts just north of the intersection of US 93 and Caffrey Road and crosses the Pablo Feeder Canal. This alignment continues to travel west in the general vicinity of the Pablo Feeder Canal, then curves northward (with no impacts to the tribal native grasslands and tribal lands). This alignment proceeds along Kerr Dam Road and crosses the river just east of the Fairgrounds property. A new bridge across the Flathead River would be constructed to continue the general Kerr Dam Road alignment straight north over the river.

The bridge length crossing the Flathead River as computed by Quantm is 1,650 feet. The total length of this alignment is 6.64 miles. The estimated range of costs for this alignment is \$45.0 to \$48.8 million dollars.

### **5.5.2 EIS Alignments Not Modeled in Quantm**

As discussed previously, due to the urban nature of the remaining four alignments from the US 93-Evaro to Polson FEIS (EIS 1, 4, 7, and 8), it was decided that Quantm would not be the appropriate tool for analysis of these alignments. These four alignments are shown in Figure 5-3 and described below.

#### **EIS Alignment 1**

This alignment follows the current US 93 alignment and consisted of reconstructing the roadway in its existing corridor with adjustments to allow for future widening to a consistent 3-lane geometry, improving horizontal curves, reconstructing substandard intersections, improving vertical alignment (includes removing the road surface from the floodplain), and avoiding any important feature adjacent to the roadway. The bridge over the Flathead River would be replaced. The bridge length crossing the Flathead River is 1,560 feet. The total length of this alignment is 5.65 miles; however, the segment from the intersection of Caffrey Road to MT 35 has already been improved. Accordingly, the true length of the alignment that would be in need of reconstruction is 3.11 miles. The estimated range of costs for this alignment is \$23.7 to \$28.4 million dollars.

#### **EIS Alignment 4**

Alignment 4 starts near Saw Mill Road and travels west/northwest until it intersects 7<sup>th</sup> Street East. At this point EIS Alignment 4 continues due west until it reaches 1<sup>st</sup> Street East, there it turns south and follows 1<sup>st</sup> Street East until it reaches 10<sup>th</sup> Avenue East. At this intersection it travels due west until it reaches the Sports Complex. EIS Alignment 4 then traverses north, crossing the Flathead River and joining US 93 just west of the current bridge. A new bridge crossing the Flathead River would be constructed. The bridge length crossing the Flathead River is 1,400 feet. The total length of this alignment is 3.25 miles. The estimated range of costs for this alignment is \$27.8 to \$33.4 million dollars.

#### **EIS Alignment 7**

This alignment consists of a couplet utilizing the existing US 93 for the westbound direction, and 3<sup>rd</sup> Avenue and 4<sup>th</sup> Avenue, in their entirety, for the eastbound direction (i.e., this alignment start where 3<sup>rd</sup> Avenue and 4<sup>th</sup> Avenue connect to US 93 and follow each street until the street ends). As a couplet, this alignment would require a total of three bridge crossings. Two of these bridge crossings would be new (e.g., for the eastbound direction). The couplet alignments would tie into US 93 east of Regatta Road. The total length of this alignment is 2.60 miles. The estimated range of costs for this alignment is \$22.1 to \$26.5 million dollars.

#### **EIS Alignment 8**

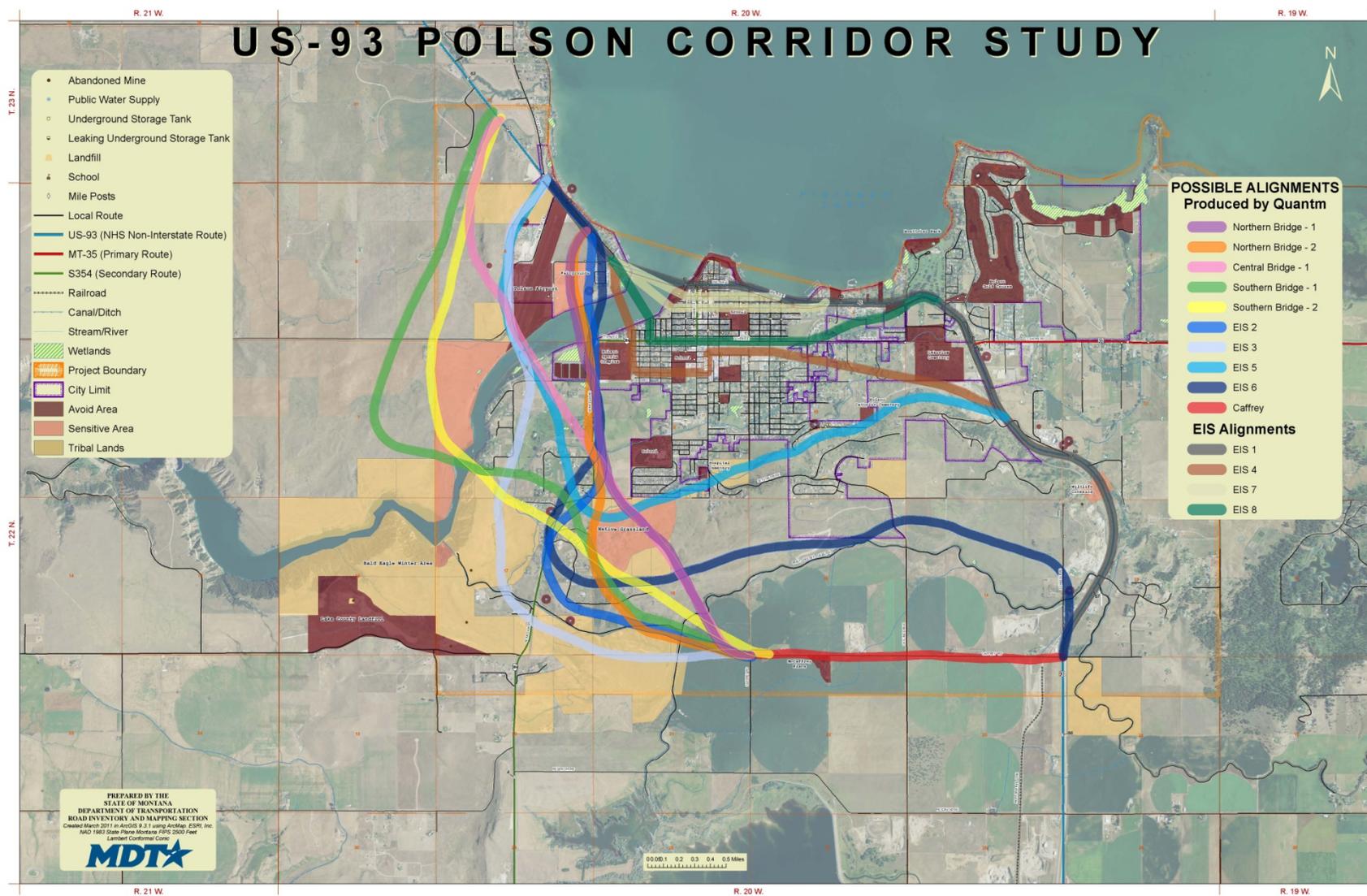
This alignment starts at the intersection of 7<sup>th</sup> Avenue East / Hillcrest Road and US 93. This alignment follows 7<sup>th</sup> Avenue for approximately the first ¼ mile, then veers off 7<sup>th</sup> Avenue to form a relatively tangent alignment to the intersection of 11<sup>th</sup> Street East. This alignment then follows 7<sup>th</sup> Avenue until the intersection of 4<sup>th</sup> Street West, at which point it follows 4<sup>th</sup> Street West northward, crosses the river

and unites US 93 just west of the current bridge. A new bridge crossing the Flathead River would be constructed. The bridge length crossing the Flathead River is 1,750 feet. The total length of this alignment is 2.49 miles. The estimated range of costs for this alignment is \$26.9 to \$32.3 million dollars.

**Figure 5-3** shows the alignments produced by Quantm as well as the EIS alignments previously identified in the 1996 FEIS.



Figure 5-3 Potential EIS Alignments and Alignments Produced by Quantm



## 5.6 Overall Trends

The Quantm analysis identified five trend areas resulting in three distinct bridge crossing locations over the Flathead River. These three bridge crossing locations are shown on Figure 5-4 and are as follows:

- Northern Bridge Crossing - Two northern bridge trends (near the Fairgrounds) were found within the Quantm analysis. A detailed review of these two trends led to the creation of a single alignment “swath” to carry forward into the screening process. The Northern Bridge Crossing alignment resulted in a total length of 5.43 miles, and a planning level cost range of \$33.0 to \$39.1 million dollars.
- Central Bridge Crossing - One central bridge trend (just southwest of the airport runway) was observed in the Quantm analysis. The Central Bridge Crossing alignment resulted in a total length of 6.06 miles, and a planning level cost of \$36.0 to \$43.5 million dollars. Note that there are two possible variations to the “Central Bridge Crossing” alignment – one traversing west of the ridge near the Polson airport, and one going east of the ridge near the Polson airport.
- Southern Bridge Crossing - Two southern bridge trends were observed in Quantm. The two observed trends were combined into a single Southern Bridge Crossing alignment “swath” with a total length of 6.65 miles and a planning level cost range of \$37.0 to \$47.2 million dollars.

The Quantm generated alignment “swaths” described above are shown in blue on Figure 5-4. These three general alignments were carried forward into the screening process. In addition, the EIS alignments described herein, and shown in yellow on Figure 5-4, were carried forward into screening. This resulted in 11 alignments being screened in the screening process. Table 5.2 shows the alignments and their respective total length, bridge length and planning level cost range.

**Table 5.2 Alignment Length and Planning Cost Comparison**

Criteria	Northern Bridge	Central Bridge	Southern Bridge	EIS 1	EIS 2	EIS 3	EIS 4	EIS 5	EIS 6	EIS 7	EIS 8
Total Length	5.43 miles	6.06 miles	6.65 miles	5.65 miles (3.11)	5.74 miles	6.48 miles	3.25 miles	5.17 miles	6.64 miles	2.60 miles	2.49 miles
Bridge Length	1,450 feet	1,100 feet	1,800 feet	1,560 feet	1,520 feet	1,100 feet	1,400 feet	1,200 feet	1,650 feet	1,650 feet	1,750 feet
Planning Level Range of Costs	\$33.0 – 39.1M	\$36.0 – 43.5M	\$37.0 - 47.2M	\$23.7 – 28.4M	\$34.7 – 41.6M	\$30.4 – 36.4M	\$27.8 – 33.4M	\$41.0 – 44.1M	\$45.0 – 48.8M	\$22.1 – 26.5M	\$26.9 – 32.3M

