Utility Company	Easement Width	Easement Location
Public Utility Easement	10’	Meridian Road Station 361+64 to Station 374+58 on east side
Public Utility and Drainage Easement	10’	North side of Up River Road to south side of Murphy Road on east side
Public Utility and Drainage Easement	10’	North side of Murphy Road to south side of Woodlake Road on east side
Public Utility and Drainage Easement	10’	North side of Woodlake Road to Meridian Station 447+36 on east side
Public Utility and Drainage Easement	10’	Meridian Road Station 451+59 to south side of Softwood Road on east side
Public Utility and Drainage Easement	10’	North side of Softwood Road to south side of Northcliff Road on east side
Public Utility and Drainage Easement	10’	North side of Northcliff Road to Meridian Road Station 506+06 on east side
Public Utility and Drainage Easement	10’	Meridian Road Station 517+75 to south side of Hodgen Road on east side
Public Utility and Drainage Easement	20’	Meridian Road Station 414+03 to Station 421+03 on west side

4.3 Coordination of Future Needs

The utility company is responsible for relocating their existing utility lines that are located within the right-of-way. If existing utilities are located outside the right-of-way, the utility company and the County should coordinate efforts to relocate the utility lines.

Any necessary utility relocations are preferred within a joint utility corridor or co-location within the right-of-way. Purchasing new individual or exclusive easements is not recommended. Utility company needs and existing easement agreements will be considered for all relocation recommendations and the placement of new lines. The location and width of the consolidated utility easement corridor must be coordinated with the utility providers and facilitated by the County. More detailed utility relocation recommendations will follow design phases.

4.4 Utility Relocation Cost Estimate

The proposed roadway improvements to Meridian Road will create potential conflicts with existing utilities. The conflicts occur due to a change in the vertical alignment and/or a change in the horizontal alignment and the location of cut and fill slopes throughout the corridor. Table 13 shows the utilites relocations costs by station and utility company. Table 14 summarizes the potential utility conflicts, the location and length of utility conflict, and estimated costs for relocation by utility company.

The relocation cost per ft was based on the following unit costs:

- CSU Gas $20/ft
- Black Hills Gas $30/ft
- Mountain View Buried Electric $80/ft
- Mountain View Overhead Electric $40/ft
- Qwest Fiber Optic $15/ft
- Qwest Telephone $10/ft
- Comcast $15/ft
- Sanitary $65/ft

Table 13. Estimated Utility Relocation Costs by Station

Relocations for utilities currently outside of existing right-of-way are a direct cost to the project (highlighted in gold).

Relocations for utilities currently in the existing right-of-way are the financial responsibility of the utility provider and not a direct project cost.

Meridian Road from US 24 to Hodgen Road		CSU Gas	Black Hills Gas	Water	Mountain View Electric		Sanitary Sewer	Qwest	Comcast	Utility Total		TOTAL PROJECT COSTS
					Overhead Electric	Underground Electric						
FROM STA	TO STA	INT $	INT $	INT $	INT $	INT $	INT $	INT $	INT $	INT $	ULT $	
0+00	10+00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
10+00	20+00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
20+00	30+00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
30+00	40+00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
40+00	50+00	$0	$0	$0	$40,000	$0	$0	$0	$0	$40,000	$40,000	$40,000
50+00	60+00	$0	$0	$0	$40,000	$0	$0	$4,500	$0	$44,500	$44,500	$44,500
60+00	70+00	$0	$0	$0	$40,000	$0	$0	$0	$0	$40,000	$40,000	$40,000.00
70+00	80+00	$0	$0	$0	$40,000	$0	$0	$0	$0	$40,000	$40,000	$40,000.00
80+00	90+00	$0	$0	$0	$40,000	$0	$0	$10,500	$0	$50,500	$50,500	$40,000.00
90+00	100+00	$0	$0	$0	$40,000	$0	$0	$1,500	$0	$41,500	$41,500	$41,500
100+00	110+00	$0	$0	$0	$40,000	$0	$0	$15,000	$0	$55,000	$55,000	$55,000
110+00	120+00	$0	$0	$0	$40,000	$0	$0	$15,000	$15,000	$70,000	$70,000	$70,000
120+00	130+00	$0	$0	$0	$40,000	$0	$0	$15,000	$15,000	$70,000	$70,000	$70,000
130+00	140+00	$0	$0	$0	$40,000	$0	$0	$15,000	$15,000	$70,000	$70,000	$70,000
140+00	150+00	$0	$0	$0	$40,000	$0	$0	$0	$4,500	$44,500	$44,500	$44,500
150+00	160+00	$0	$0	$0	$40,000	$0	$0	$0	$0	$40,000	$40,000	$40,000.00
160+00	170+00	$0	$0	$0	$40,000	$0	$0	$0	$0	$40,000	$40,000	$40,000.00
170+00	180+00	$0	$0	$0	$40,000	$0	$0	$0	$0	$40,000	$40,000	$40,000.00
180+00	190+00	$0	$0	$0	$40,000	$0	$0	$0	$0	$40,000	$40,000	$40,000.00

Meridian Road from US 24 to Hodgen Road		CSU Gas	Black Hills Gas	Water	Mountain View Electric		Sanitary Sewer	Qwest	Comcast	Utility Total		TOTAL PROJECT COSTS
					Overhead Electric	Underground Electric						
FROM STA	TO STA	INT $	INT $	INT $	INT $	INT $	INT $	INT $	INT $	INT $	ULT $	
190+00	200+00	$0	$0	$0	$40,000	$0	$0	$0	$0	$40,000	$40,000	$40,000.00
200+00	210+00	$0	$0	$0	$40,000	$0	$0	$0	$0	$40,000	$40,000	$40,000.00
210+00	220+00	$0	$0	$0	$40,000	$0	$0	$0	$0	$40,000	$40,000	$40,000.00
220+00	230+00	$0	$12,000	$0	$40,000	$24,000	$0	$300	$0	$76,300	$76,300	$64,300
230+00	240+00	$0	$15,000	$0	$40,000	$0	$0	$0	$0	$55,000	$55,000	$40,000.00
240+00	250+00	$0	$0	$0	$40,000	$0	$0	$0	$0	$40,000	$40,000	$40,000.00
250+00	260+00	$0	$12,000	$0	$40,000	$0	$0	$0	$0	$52,000	$52,000	$52,000
260+00	270+00	$0	$15,000	$0	$40,000	$0	$0	$0	$0	$55,000	$55,000	$40,000
270+00	280+00	$0	$12,000	$0	$40,000	$0	$0	$0	$0	$52,000	$52,000	$40,000
280+00	290+00	$0	$30,000	$0	$40,000	$0	$0	$0	$0	$70,000	$70,000	$40,000
290+00	300+00	$0	$30,000	$0	$40,000	$0	$0	$0	$0	$70,000	$70,000	$40,000
300+00	310+00	$0	$30,000	$0	$40,000	$0	$0	$0	$0	$70,000	$70,000	$40,000
310+00	320+00	$0	$12,000	$0	$40,000	$0	$0	$0	$0	$52,000	$52,000	$40,000
320+00	330+00	$0	$0	$0	$40,000	$0	$0	$7,500	$0	$47,500	$47,500	$40,000
330+00	340+00	$0	$0	$0	$40,000	$0	$0	$4,500	$0	$44,500	$44,500	$40,000
340+00	350+00	$0	$0	$0	$40,000	$0	$0	$0	$0	$40,000	$40,000	$40,000
350+00	360+00	$0	$0	$0	$40,000	$0	$0	$4,500	$0	$44,500	$44,500	$44,500
360+00	370+00	$0	$0	$0	$0	$0	$0	$3,000	$0	$3,000	$3,000	$3,000
370+00	380+00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	0
380+00	390+00	$0	$0	$0	$0	$0	$0	$12,000	$0	$12,000	$12,000	$12,000
390+00	400+00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	0
400+00	410+00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	0
410+00	420+00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	0
420+00	430+00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	0
430+00	440+00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	0
440+00	450+00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	0
450+00	460+00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	0
460+00	470+00	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	0
470+00	480+00	$0	$0	$0	$0	$0	$0	$10,500	$0	$10,500	$10,500	10500
480+00	490+00	$0	$6,000	$0	$0	$0	$0	$3,000	$0	$9,000	$9,000	3000
490+00	500+00	$0	$9,000	$0	$0	$0	$0	$0	$0	$9,000	$9,000	0
500+00	510+00	$0	$15,000	$0	$0	$0	$0	$0	$0	$15,000	$15,000	0
510+00	520+00	$0	$9,000	$0	$0	$0	$0	$0	$0	$9,000	$9,000	0
520+00	530+00	$0	$30,000	$0	$0	$0	$0	$0	$0	$30,000	$30,000	0
Subtotal		$0	$237,000	$0	$1,280,000	$24,000	$0	$121,800		$1,712,300	$1,712,300	$1,464,800
											Force Account:	$250,000
											Project Total Utility Cost:	**$1,714,800**

Table 14. Estimated Utility Relocation Cost by Utility Company

Utility Company	Potential Utility Line Conflict	Location/Station		Relocation Length (Ft)	Estimated Cost
		From	To		
Black Hills	Natural Gas	250+00	260+00	400	$12,000
Black Hills Subtotal					*$12,000*
Comcast	Television and/or Fiber Optic	110+00	120+00	1000	$15,000
		120+00	130+00	1000	$15,000
		130+00	140+00	1000	$15,000
		140+00	150+00	300	$4,500
Comcast Subtotal					*$49,500*
Mountain View Electric	Electric (Overhead & Underground)	40+00	50+00	1000 OHE	$40,000
		50+00	60+00	1000 OHE	$40,000
		60+00	70+00	1000 OHE	$40,000
		70+00	80+00	1000 OHE	$40,000
		80+00	90+00	1000 OHE	$40,000
		90+00	100+00	1000 OHE	$40,000
		100+00	110+00	1000 OHE	$40,000
		110+00	120+00	1000 OHE	$40,000
		120+00	130+00	1000 OHE	$40,000
		130+00	140+00	1000 OHE	$40,000
		140+00	150+00	1000 OHE	$40,000
		150+00	160+00	1000 OHE	$40,000
		160+00	170+00	1000 OHE	$40,000
		170+00	180+00	1000 OHE	$40,000
		180+00	190+00	1000 OHE	$40,000
		190+00	200+00	1000 OHE	$40,000
		200+00	210+00	1000 OHE	$40,000
		210+00	220+00	1000 OHE	$40,000
		220+00	230+00	1000 OHE + 300 U	$64,000
		230+00	240+00	1000 OHE	$40,000
		240+00	250+00	1000 OHE	$40,000
		250+00	260+00	1000 OHE	$40,000
		260+00	270+00	1000 OHE	$40,000
		270+00	280+00	1000 OHE	$40,000
		280+00	290+00	1000 OHE	$40,000
		290+00	300+00	1000 OHE	$40,000
		300+00	310+00	1000 OHE	$40,000
		310+00	320+00	1000 OHE	$40,000
		320+00	330+00	1000 OHE	$40,000
		330+00	340+00	1000 OHE	$40,000
		340+00	350+00	1000 OHE	$40,000
		350+00	360+00	1000 OHE	$40,000
Mountain View Electric Subtotal					*$1,304,000*
Qwest	Telephone / Fiber Optic	50+00	60+00	300	$4,500
		90+00	100+00	100	$1,500
		100+00	110+00	1000	$15,000
		110+00	120+00	1000	$15,000
		120+00	130+00	1000	$15,000
		130+00	140+00	1000	$15,000
		220+00	230+00	20	$300
		350+00	360+00	300	$4,500
		360+00	370+00	200	$3,000
		380+00	390+00	800	$12,000
		470+00	480+00	700	$10,500
		480+00	490+00	200	$3,000
Qwest Subtotal					*$99,300*
				Force Account:	$250,000
				Total Cost to Project:	**$1,714,800**

[1] *Relocation costs for utilities currently outside existing right of way are a direct cost to the project*

5.0 Drainage

The purpose of the conceptual drainage analysis is to identify and analyze order of magnitude stormwater flows and stream crossing locations along the Meridian Road Corridor from US 24 to Hodgen Road. Analysis consists of the following:

- Identify existing drainage structure locations, sizes, and material types.
- Develop conceptual basin delineation using USGS mapping.
- Review existing drainage planning documents and FEMA information.
- Evaluation of existing drainage structures and their adequacy.
- Evaluate proposed urban roadway section between US 24 and Rex Road for location of possible closed storm sewer system.
- Identify possible water quality locations and features.
- Conceptual sizing of new drainage facilities.
- Develop cost estimate for drainage, water quality, and erosion control features along the corridor.

The following Meridian Road conceptual drainage analysis is divided into the Major Drainage Basins through which the road passes. For each major drainage basin, the existing and proposed conditions are discussed along with water quality management for the Meridian Road corridor.

5.1 Methodology

5.1.1. Hydrology

The analysis and design of the Meridian Road drainage improvements is based upon the requirements of the El Paso County Drainage Criteria Manual (DCM). Conceptual basin delineation was developed using a combination of project specific field survey, USGS mapping, and existing drainage reports. The Falcon Drainage Basin Planning Study (Falcon DBPS), Bennett Ranch Drainage Basin Planning Study (Bennett Ranch DBPS), and Black Forest Reserve Master Plan (Black Forest Reserve MDDP) were used in conjunction with new basin delineation along the corridor to determine conceptual flow paths for water crossings. Key roadside channels and ditches were located and conceptual sizing of closed storm sewer systems were estimated using this data. New basins were delineated in areas not covered by drainage plans and in cases where existing basins were in question. Basin flows were calculated assuming no detention when no other information was available.

Conceptual flows were determined by using a flow per area ratio developed from existing representative basins within the project with known published flow rates. Representative basins were taken from the Black Forest Reserve MDDP and the Bennett Ranch DBPS. Flow per area ratios were determined for three basin areas sizes: 0 to 25 acres, 25 to 100 acres, and 100+ acres. Table 14 lists the flow per acre estimates used for the project. Published flow rates from existing drainage reports were used to size their respective drainage structures.

Table 14. Flow Class Estimate

Basin Area Size	Flow (Q) per Acre (cfs /ac)
0 to 25 acres	1.25
25 to 100 acres	0.98
100+ acres	0.81

Culverts were conceptually sized to meet the DCM requirement of headwater to depth ratio no higher than 1.2. Structures were located and sized based on the ultimate conceptual design for cost estimating purposes. During preliminary design, the structure sizes will be reviewed further to assure proper clearance is provided under the roadway.

Storm sewer systems were conceptually designed to estimate the approximate size of the trunk lines, the location of the trunk lines, system flow directions and the outfall locations. Inlets were not hydraulically located but were located at approximately 500 ft intervals for cost estimating purposes. Rough calculations show that inlets may work with 800 ft spacing, but this spacing will change during preliminary design to accommodate roadway and access point locations.

Table 15 lists the estimated 100-yr flows for basins crossing Meridian Road. Flow rates taken from reports reference the report name and indicate if detention upstream from Meridian Road is included. The 'Flow Used In Design' is shown to verify the flow rate used to size the proposed infrastructure improvements. Flow rates were also calculated for basins that had published flow rates in drainage basin reports. These flow rates were used to validate the 'Flow Class' estimated in Table 14.

Flow rates used for sizing crossings and channels within the Falcon Drainage Basin were taken from the Falcon DBPS. Hydrology was not recalculated for this basin, but flow rates were compared against project flow estimates and found to be comparable.

5.1.2. Design

Improvements to Meridian Road are anticipated to ultimately meet the recommendations outlined in Section 8 of this plan. The first phase of improvements is anticipated to be 4-lanes from Woodmen Road to Rex Road based on funding limitations. In the future, this stretch of road is planned to be a 6-lane, principal arterial. The drainage design will accommodate each phase while limiting the amount of re-work or "throw away" of drainage structures. This may lead to using non-standard structures in the initial phases of construction to accommodate future improvements.

Table 15. Crossings, Basin Areas and Estimated Flows

Crossing Station	Basin Area (ac)	Flow Class (cfs/ac)	Estimated cfs	Report Flows (cfs)	Flow Used In Design	Comments
150+00	See Falcon DBPS	Taken From Falcon DBPS	Taken From Falcon DBPS	167	167	From Falcon Drainage Basin - Stapleton Road.
182+16	114	0.98	111		111	
186+90	897	0.81	727	780	780	From Bennett Ranch DBPS – Londonderry Drive
228+25	141	0.98	138		138	
224+69	10	1.25	13		13	
209+00	5	1.25	6		6	
234+57	138	0.98	135		135	
262+17	30	0.98	30		30	
302+37	4,080	0.5	2,040		2,040	
314+90	65	0.98	64		64	
333+44	33	0.98	32		32	
341+59	22	1.25	28		28	
344+77	15	1.25	19		19	
349+82	468	0.81	379		379	
380+37	21	1.25	27		27	
447+33	741	0.81	600	323	323	Black Forest Reserve - with detention (560 w/o)
462+21	13	1.25	16	10	10	Black Forest Reserve
470+39	204	0.81	165	143	143	Black Forest Reserve - with Detention (169 w/o)
485+48	19	1.25	24	32	32	Black Forest Reserve

[1] *Newly Delineated Basins for Bennett Ranch, Upper Black Squirrel Creek, East Kiowa Creek, and West Kiowa Creek*
[2] *SCS calculation performed for very large area*

5.2 Meridian Road Major Drainage Basins

Meridian Road runs north and south through five major drainage basins within the study area: Falcon Basin, Bennett Ranch Basin, Upper Black Squirrel Creek Basin, East Kiowa Creek Basin, and the West Kiowa Creek Basin. Flow from these basins crosses Meridian Road flowing primarily west to east. The existing conditions, proposed conditions, and water quality will be discussed for each of the five basins.

5.2.1. Falcon Basin (Sta. 0+00 to 177+00)

5.2.1.1. Existing Conditions

The Falcon Basin incorporates a total of 10.3 square miles on the south end of Meridian Road and is located between US 24 and approximately Stapleton Drive. The Falcon Basin lies primarily west of Meridian Road with flows moving to the south and southeast. Much of the basin flows south of Stapleton Drive are captured by an existing shallow ditch on the west side of Meridian Road. This ditch carries water south to the Woodmen and Meridian Road intersection where three 48 in RCP pass flows under Woodmen Road.

The Falcon Basin consists primarily of SCS hydrologic group A soils (sand, loamy sand, and sandy loam) near Meridian Road and has significant amounts of group B soils (silt loam or loam) with very little group D soils (clay loam, silty clay loam, sandy clay, silty clay, or clay). Five acre residential lots make up most of the land use along with minor amounts of commercial properties and undeveloped areas.

Existing development appears to have incorporated some of the recommendations from the Falcon DBPS, but those improvements are in different locations than the proposed DBPS location. This includes a detention pond shown south of Woodmen Road with two 7ft by 4 ft RCB culverts planned to collect the Meridian Road west ditch that conveys the Middle Tributary. This pond has been located south of Woodmen Road and east of Meridian Road. The existing storm system that conveys water to this location is smaller than what was proposed in the DBPS. These changes to the DBPS improvement locations have been reviewed as a part of this study and incorporated in the proposed drainage features.

Since much of the basin flow is collected by the existing shallow roadside ditch running parallel to Meridian Road on the west side and carried south to Woodmen Road, there are not many crossings under Meridian Road. One major crossing occurs at the Stapleton Drive intersection and flow is conveyed by two 6 ft by 2.5 ft RCB culverts that discharge to the east along Stapleton Drive. Culverts allow the roadside ditch to cross access points and intersections. Table 16 lists existing drainage structures in the basin and their performance.

Crossing locations with a 'status' listed as inadequate in Table 16 have potential for roadway overtopping. Potential flooding occurs on Meridian Road and to homes below or close to roadway grade elevation in existing conditions. The existing ditch on the east side of Meridian is shallow and in poor condition in some areas, particularly near stations 60+00 and 67+00. Homes in this area are at high risk for flooding. Road overtopping also occurs on Woodmen Road at the Meridian Road intersection in the 100 year storm.

5.2.1.2. Proposed Conditions

Flow from the basin was analyzed in the Falcon DBPS using the SCS method and HEC-1 software. Recommendations from the Falcon DBPS that have yet to be constructed were reviewed and incorporated into the Meridian Road project plan where applicable.

There are no proposed drainage improvements from US 24 to Woodmen Rd. Proposed roadway improvements will have minimal effect on current roadway drainage.

Ultimately, curb and gutter is proposed for the roadway from Woodmen Road to Rex Road. As discussed in the Existing Conditions section, flow from the basin is primarily caught by an existing roadside ditch paralleling Meridian Road and running south to Woodmen Road. It is proposed in the Falcon DBPS that this ditch be replaced with a trapezoidal, 15 ft bottom channel that runs from Stapleton Drive to Woodmen

Road. Conceptual analysis confirms the need for the ditch upgrade. This channel will collect roadway and off-site flows and direct them to existing drainage structures at Woodmen Road.

The west portion of Meridian Road adjacent to the proposed channel will utilize curb opening inlets to catch the roadway drainage and discharge to the channel. Grade control structures will be located along the channel to control the channel slope and create a grass lined water quality feature.

The access roads crossing the proposed 15 ft bottom channel will require upgrades to pass the proposed flow. See Table 16 for a list of the existing structure performance and proposed replacements.

Woodmen Road has been recently widened near the Meridian Road intersection. The three existing 48 in RCP pipes were extended at Woodmen Road and do not match the two DBPS proposed 7 ft by 4ft RCBC.

The Final Drainage Report for Woodmen Road, Powers to US 24, shows a flow of 341 cfs to the three 48 in RCP without the Meridian Road improvements. This flow is estimated to increase to 430 cfs after Meridian Road is improved. The Woodmen Road report shows a capacity of 262 cfs for the facility as constructed. Either the existing structures will need to be upsized to convey the proposed flow or a proposed detention pond will be needed to meter the channel flows to match the capacity of the existing Woodmen Road drainage structures. Considering the three 48 in RCP do not simply discharge under Woodmen Road, but instead are connected to a pipe system that may further limit the capacity of this crossing, it is recommended that a detention pond be constructed rather than upsizing the facility.

It is proposed that the pond be located at the northwest quadrant of the Meridian Road and Woodmen Road intersection. An alternate location for the pond is also proposed on the west side of Meridian just north of Owl Place. The alternate pond location will require further analysis to ensure the location is suitable. This alternate location does provide cost benefits for possible downsizing of the channel downstream and culvert crossings; however, it will allow for less contributing area to be treated for water quality in the pond.

5.2.1.3. Water Quality

Water quality needs can be met through the use of proper erosion control techniques in roadside ditches, the channel, and proposed detention pond to help establish vegetation. Runoff from the roadway will discharge into the proposed 15 ft wide channel and a water quality structure in the pond will act as the primary source of treatment before its discharge into the system under Woodmen Road. Roadside ditches should be used as water quality features, to the extent possible. Extended life biodegradable erosion control blankets should be chosen for placement in ditches. Fabricators recommend a blanket with a two to three year lifespan to ensure time for seed to take hold. Roadside ditches will need further analysis to determine the fabric needed to withstand shear stresses associated with water velocities resulting from grades and flow rates.

Table 16. Proposed Channel Crossings

Station	Diameter	Quantity	Material	Description	Estimated 100 year Peak Flows (cfs)	Status	Proposed
63+80	48"	1	CMP	flows south across Owl Place	302	inadequate	replace with (2) 6'x4' RCBC
70+70	12"	1	CMP	flows south across access	302	inadequate	install (2) 6'x4' RCBC
83+50	36"	1	CMP	flows south across access	280	inadequate	install (2) 6'x4' RCBC
87+00	24"	3	CMP	flows south across access	280	inadequate	replace with (2) 6'x4' RCBC
96+85	87"x63"	2	Arch CMP	flows south across Woodmen Hills Drive	197	adequate	relocate, replace with (2) 6'x3' RCBC
99+80	24"	2	CMP	flows south across access	197	inadequate	replace with (2) 6'x3' RCBC
150+60	2.5'x6'	2	RCBC	flows west to east under Meridian @ Stapleton	167	adequate	no change required

5.2.2. Bennett Ranch Basin (Sta. 177+00 to 268+50)

5.2.2.1. Existing Conditions

The Bennett Ranch Basin lies north of the Falcon Basin and south of the Upper Black Squirrel Creek Basin. Meridian Road crosses the basin from approximately Stapleton Drive to just south of Ayer Road.

The Bennett Ranch Basin consists primarily of SCS group B (clay loam, silty clay loam, sandy clay, silty clay, or clay) soils near Meridian Road and has small amounts of group A soils (silt loam or loam). The basin consists primarily of rural and suburban residential development with flow moving primarily east and southeast.

Using USGS mapping and the Bennett Ranch DBPS, five major crossings at Meridian Road were found. These crossings are a series of tributaries that generally flow north to south and west to east to their confluence with the West Fork of Squirrel Creek. The largest of these crossings is located at station 186+89 where there are three 48 in RCP pipes. Table 17 lists existing drainage structures in the Bennett Ranch Basin and their performance.

The possibility of road overtopping occurs at station 209+00. The existing contours appear to drain water to this location where a low point forms at the edge of pavement. This overtopping can be removed with

proper grading. The potential for roadway overtopping also occurs where structures were found to be inadequate. Refer to Table 17 for inadequate culvert locations.

An existing pond is located near station 162+00 on the west side of Meridian Road. This pond appears to outlet into the west Meridian Road ditch and flow towards the existing box culverts under the Meridian Road and Stapleton Drive intersection.

5.2.2.2. Proposed Conditions

Ultimately, curb and gutter is proposed on Meridian Road from Woodmen Road to Rex Road. Proposed storm sewers are designed to collect and drain roadway flows. One system drains the roadway between station 177+50 and Stapleton Drive. This system discharges into an existing open channel on the southeast side of Stapleton Drive.

At stations 187+00 and 192+00, inlets are proposed on both sides of Meridian Road. These inlets will collect runoff from Meridian Road between station 187+00 and the high point located at station 217+00. The runoff collected by these inlets will discharge at the proposed 12 ft by 12 ft box culvert at station 187+00.

An inlet located on either side of Meridian Road at station 225+00 collects water from the highpoint at station 217+00 north to the end of curb and gutter at Rex Road. This water is discharged to a natural channel at station 225+00.

A ditch is proposed between station 160+50 and Stapleton Drive to carry flow from the existing pond along the west side of the road. This ditch is planned to collect off-site drainage and the existing pond discharge and direct the flow to a proposed detention and water quality pond in the northwest corner of Stapleton Drive and Meridian Road.

The Bennett Ranch DBPS proposes a pond located in the northwest corner of the Stapleton Drive and Meridian Road intersection. This pond is labeled as the Paint Brush Hill Metropolitan District pond and has not been constructed, it is proposed that this pond be constructed during the construction of Meridian Road to detain the increase in flows due to the additional impervious area of the roadway. During construction of Meridian Road this pond would not need to be sized as large as is proposed in the Bennett Ranch DBPS as Paint Brush Hills has not been developed yet. It is proposed that the pond be designed to capture flows from Meridian Road and discharge at historic levels, and be designed so it can easily be enlarged during construction of Paint Brush Hills. This would mainly require the outlet structure to be designed in such a way that it will release the historic flows from the Paint Brush Hills site, and once the property is developed the pond will need to be enlarged to provide detention capacity for the developed flow.

See Table 17 for the proposed upgrades to drainage structures within the project limits in the Bennett Ranch Basin. It is proposed that the existing structure at station 186+89 be replaced with one 12 ft by 12 ft RCBC which will have a secondary use as a trail crossing. In order to fit the proposed box culvert under the roadway, it will be necessary to lower the invert of the upstream channel bottom. A 4 ft boulder drop structure is proposed to be installed upstream to accommodate the channel invert adjustment and fit the 12 ft by 12 ft RCBC under the road.

5.2.2.3. Water Quality

Water quality may be improved with vegetated roadside ditches where possible, the proposed detention pond, and using proper erosion control techniques and materials to allow vegetation to grow and minimize erosion.

Table 17. Bennett Ranch Basin Crossings

Station	Diameter	Quantity	Material	Description	Estimated 100 year Peak Flows (cfs)	Status	Proposed
182+16	48"	1	RCP	Flows East	111	adequate	Lengthening required
186+89	48"	3	RCP	Flows East	780	inadequate	12'x12' RCBC as proposed for trail crossing
224+69	buried	N/A	N/A	Flows East	13	inadequate	Replace with 24" RCP
228+25	48"	1	RCP	Flows East	138	inadequate	Replace with 54" RCP
234+57	36"	1	RCP	Flows East	135	inadequate	Replace with 7'x3' RCBC
253+50	18"	1	CSP	Flows North to South	30	inadequate	Replace with 30" RCP
262+17	30"	1	CSP	Flows East	30	relocate	Replace with 30" RCP

5.2.3. Upper Black Squirrel Creek Basin (Sta. 268+50 to 406+50)

5.2.3.1. Existing Conditions

The Upper Black Squirrel Creek Basin lies between the north border of the Bennett Ranch Basin and the south border of the East Kiowa Creek Basin. Meridian Road intersects the Upper Black Squirrel Creek Basin from just south of Ayer Road to Murphy Road. The majority of storm flows feed the Snipe Creek, Black Squirrel Creek, or Cantrell Creek. Flows shown in Table 18 below were estimated using the flow per area ratio method described in Section 5.1, Methodology.

The Basin consists primarily of SCS group B soils (silt loam or loam) with very little group D soils (clay loam, salty clay loam, sandy clay, salty clay, or clay). The basin consists primarily of rural and undeveloped areas. Flow from the basin runs east and southeast, channeling before passing under Meridian Road via culverts.

Seven crossings occur on Meridian Road within the Upper Black Squirrel Creek Basin. The largest of these crossings is the Upper Black Squirrel Creek as it passes from west to east. Currently, an 84 in CMP is located at station 302+37 and is considered hydraulically deficient. The Creek is designated as a Zone A FEMA Floodplain. Table 18 lists existing drainage structures in the Upper Black Squirrel Creek Basin and their performance. There is the potential for road overtopping where structures are currently categorized as inadequate.

5.2.3.2. Proposed Conditions

Roadside ditches are proposed along both the northbound and southbound sides of Meridian Road. These ditches will primarily collect roadside flows and be graded to discharge into existing discharge points.

As described in the Existing Conditions section, Black Squirrel Creek carries a large amount of flow and the current structure used to pass flows under Meridian Road is undersized. The Creek is designated as a Zone A FEMA Floodplain, which means the new structure cannot increase the upstream water surface by more than one ft above existing conditions and cannot impact any upstream structures. Two 12 ft by 12 ft RCBC are proposed at this location. A detailed analysis will need to be conducted at this location during the design phase.

Table 18 lists the proposed upgrades to inadequate structures on the project.

5.2.3.3. Water Quality

It is proposed that improved water quality be obtained through the use of grass lined roadside ditches. Ditches are proposed along both the northbound and southbound sides of Meridian Road.

Table 18. Upper Black Squirrel Creek Basin Crossings

Station	Diameter	Quantity	Material	Description	Estimated 100 year Peak Flows (cfs)	Status	Proposed
301+40	none	N/A	N/A	flows north to south	60	inadequate	install 42" RCP
302+37	84"	1	CMP	flows east	2000	inadequate	replace with (2) 12'x12' RCBC
308+10	12"	1	CMP	flows north to south	25	inadequate	replace with 24" RCP
312+10	none	1	CMP	flows north to south	25	inadequate	replace with 24" RCP
314+75	24"	1	RCP	flows north to south	25	relocate	replace with 24"RCP
314+90	buried	N/A	N/A	flows east	64	inadequate	replace with 5'x3' RCBC
333+44	24"	1	CMP	flows east	32	inadequate	replace with 30" RCP
341+59	24"	1	CMP	flows east	28	inadequate	replace with 30" RCP
344+77	18"	1	CMP	flows east	19	inadequate	replace with 24" RCP
349+82	24"	1	CMP	flows east	379	inadequate	replace with 10'x5' RCBC
380+37	30"	1	CMP	flows west	30	adequate	extend pipe
387+90	none	N/A	N/A	flows north to south	30	inadequate	install 30" RCP
401+00	none	N/A	N/A	flows north to south	15	inadequate	install 24" RCP

5.2.4. East Kiowa Creek Basin (Sta. 406+50 to Sta. 498+00)

5.2.4.1. Existing Conditions

The East Kiowa Creek Basin lies between the north border of the Upper Black Squirrel Creek Basin and the south border of the West Kiowa Creek Basin. Meridian Road crosses the East Kiowa Creek Basin from Murphy Road to just north of Northcliff Road. Flow within the basin was taken from the analysis performed in the Black Forest Reserve Final Drainage Plan.

The Basin consists primarily of SCS group B soils (silt loam or loam). The basin is mostly undeveloped. Flow from the basin generally moves east, converging into channels that cross under Meridian Road via culverts.

Roadway flow primarily runs offsite. There are some roadside ditches, but much of the land slopes away from the roadside without well defined ditches.

Table 19 lists existing drainage structures in the basin and their performance. There is the potential for road overtopping where structures are currently categorized as inadequate.

5.2.4.2. Proposed Conditions

Flow from Meridian Road is generally proposed to follow existing flow paths. Road grades are designed to match existing grading. Much of the flow runs away from the roadway and follows existing flow paths. Ditches are designed where ditches exist today and in locations found to be necessary with new grading.

Four crossings occur at Meridian Road within the basin. The largest crossing, East Kiowa Creek, currently passes through a 72 in CMP at station 447+33. A 12 ft by 12 ft RCBC is proposed at this crossing and will have a secondary use as a trail crossing. Table 19 lists the proposed upgrades to inadequate structures on the project.

5.2.4.3. Water Quality

Water quality can be achieved through vegetated banks, ditches, and swales. Proper erosion control will help establish vegetation and minimize erosion.

Table 19. East Kiowa Creek Basin Crossings

Station	Diameter	Quantity	Material	Description	Estimated 100 year Peak Flows (cfs)	Status	Proposed
407+15	24"	1	CMP	flows north to south	25	relocate	install 24" RCP
408+30	18"	1	CMP	flows north to south	20	inadequate	install 24" RCP
415+00	none	N/A	N/A	flows north to South	20	inadequate	install 24" RCP
418+80	none	N/A	N/A	flows north to south	25	inadequate	install 24" RCP
436+40	18"	1	CMP	flows north to south	25	inadequate	install 24" RCP
447+33	72"	1	CMP	flows east to west	323	inadequate	install 12'x12' RCBC
450+00	none	N/A	N/A	flows east to west	20	inadequate	install 24" RCP
457+50	none	N/A	N/A	flows east to west	25	inadequate	install 24" RCP
462+21	30"	1	CMP	flows east to west	16	adequate	extend pipe
470+39	18"	1	CMP	flows east to west	143	inadequate	replace with 6'x4' RCBC
485+48	24"	1	CMP	flows east to west	32	inadequate	replace with 30" RCP
488+30	none	N/A	N/A	flows north to south	25	inadequate	replace with 24" RCP

5.2.5. West Kiowa Creek Basin (Sta. 498+00 to Sta. 524+56)

5.2.5.1. Existing Conditions

The West Kiowa Creek Basin lies on the northern border of the East Kiowa Creek Basin and extends to north of Hodgen Road and the project limit. Meridian Road crosses the basin in only a small section from Northcliff Road to Hodgen Road. The Basin consists primarily of SCS group B soils (silt loam or loam). The basin is primarily undeveloped.

There does not appear to be any road overtopping that occurs in this section of the corridor. The road is at a highpoint and the land slopes away.

5.2.5.2. Proposed Conditions

Generally, the land slopes away from the roadway on the southbound side of Meridian Road through the West Kiowa Creek Basin. The proposed roadway drainage has flow moving away from Meridian Road on the west side and moving north and south along Meridian Road on the east side. At the high point near station 504+50, runoff on the east side of Meridian Road will be split flowing to the north and south. Runoff flowing to the south will end up in the East Kiowa Creek Basin. Flow to the north will end up at the intersection of Meridian Road and Hodgen Road requiring a culvert to pass this flow to the west. This will be the one required crossing of Meridian Road in the West Kiowa Creek Basin. This crossing will be at the intersection of Meridian Road and Hodgen Road at station 524+00. The estimated 100-year flow rate is approximately 10 cfs. The estimated pipe to handle this flow is a single 30 in RCP.

5.2.5.3. Water Quality

Water quality can be achieved through vegetated banks, ditches, and swales. Proper erosion control will help establish vegetation and minimize erosion.

5.3 Drainage Conclusions

The southern portion of Meridian Road, from US 24 to Rex Road, will ultimately be an urban road section. While runoff from this area is expected to increase due to the Meridian Road expansion, resources are available to mitigate the effects of this increased runoff while providing water quality.

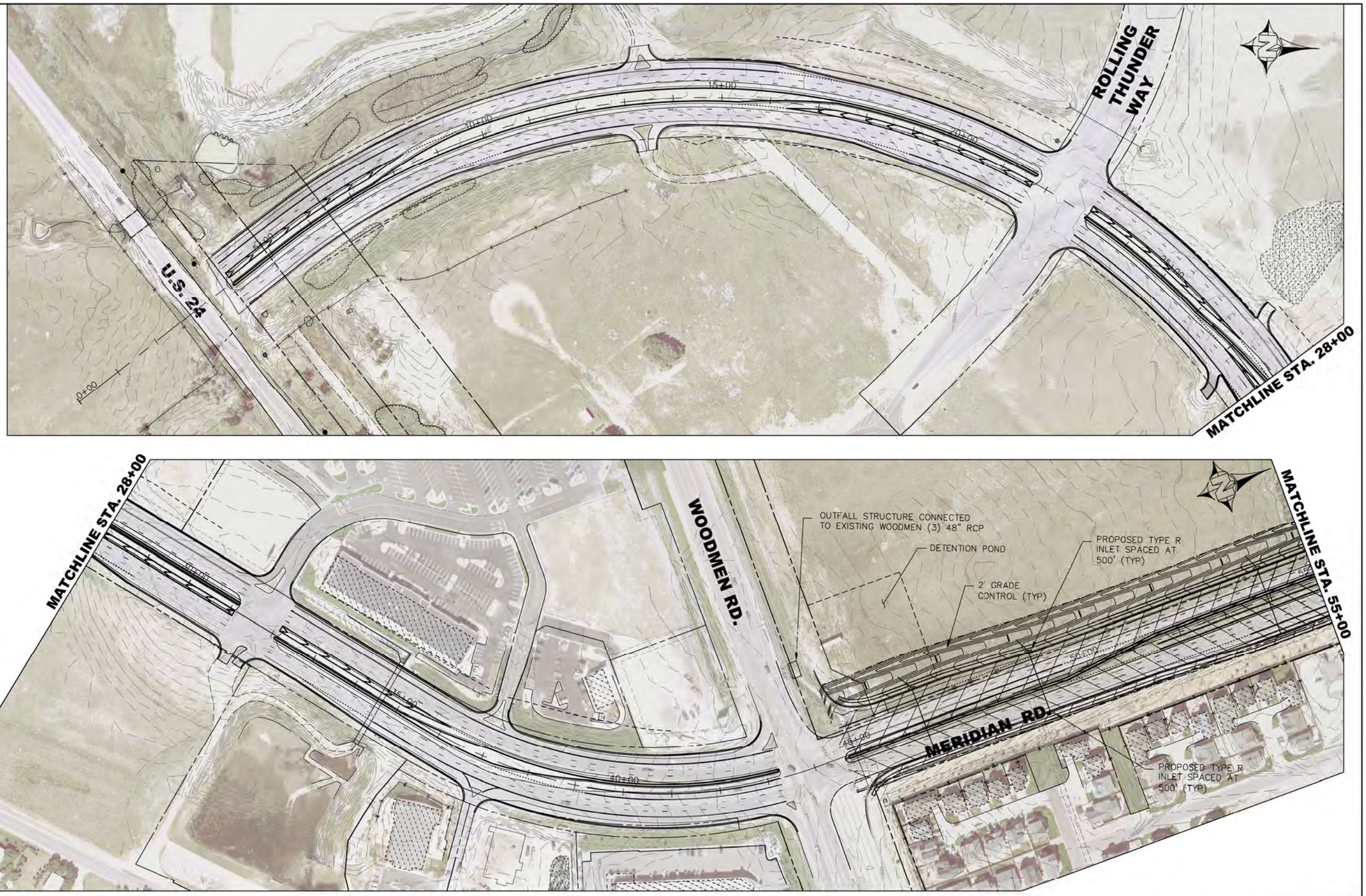
The proposed detention pond at the corner of Meridian Road and Woodmen Road can provide detention and water quality for most of the urban portion of Meridian Road. The alternative pond location just upstream of Owl Place can also provide water quality and detention, but its location is not ideal. The benefit of this location is a reduced channel section downstream of the pond; however, less contributing area will receive water quality treatment from this facility. Some water quality can also be obtained in the proposed channel that will parallel Meridian Road between Stapleton Drive and Woodmen Road.

The proposed detention pond at the corner of Meridian Road and Stapleton Drive can provide detention and water quality for the portion of Meridian Road from Stapleton Drive to just south of the proposed 12 ft by 12 ft RCBC at station 186+89. Construction of this pond would also ensure that downstream facilities are not compromised since the released flows would match historic levels. Additional water quality can also be obtained in the proposed roadside ditch on the west side of Meridian Road north of Stapleton Drive.

The rural sections of Meridian Road, north of Rex Road, would have runoff conveyed by roadside ditches and culverts where required. Water quality can be achieved through the use of vegetated ditches and swales. Detention is not proposed for the rural section as the increase in runoff due to the new road section will be minor when compared to existing conditions.

The drainage design of Meridian Road is anticipated to be able to meet the requirements of the DCM.

Figures 7-1 through 7-10. Drainage



EL PASO COUNTY
DEPARTMENT OF TRANSPORTATION

MERIDIAN ROAD (NORTH) IMPROVEMENTS

URS

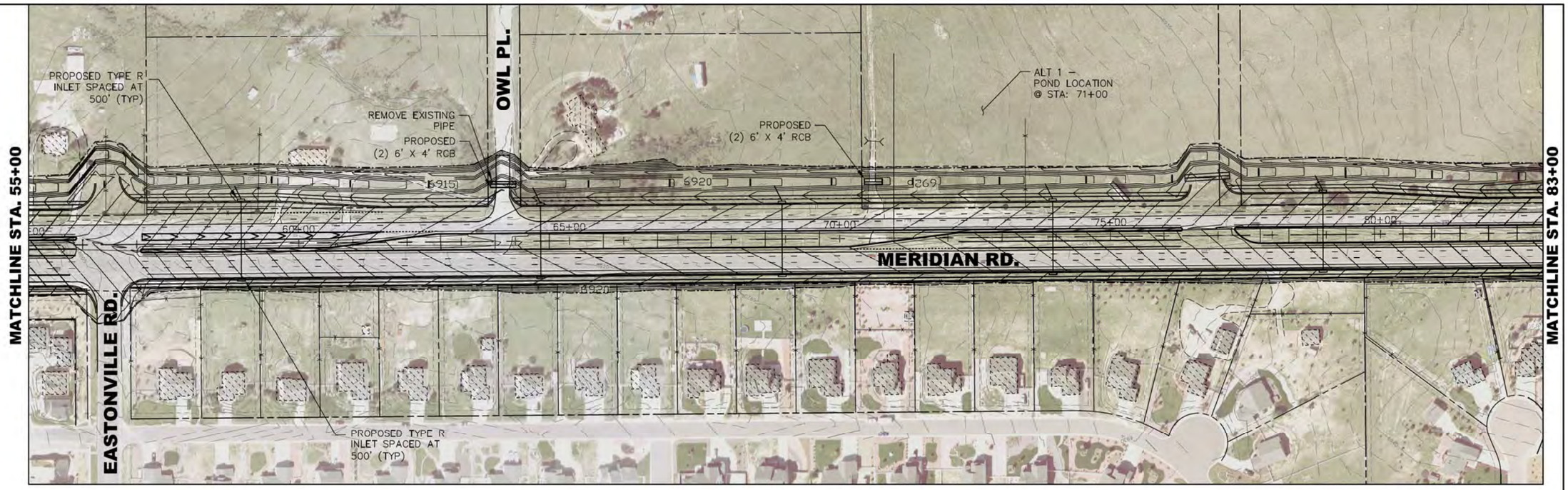
ORIGINAL SCALE
0 50 100 200 400

MERIDIAN ROAD (NORTH) DRAINAGE

LEGEND

- CENTERLINE
- TOP OF CUT
- TOE OF FILL
- EXISTING R.O.W.
- PROPOSED CONTOUR
- EXISTING EASEMENT
- PROPOSED EASEMENT
- EX MAJOR CONTOUR
- EX MINOR CONTOUR

FIGURE 7-1



EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

MERIDIAN ROAD (NORTH) IMPROVEMENTS

URS

ORIGINAL SCALE

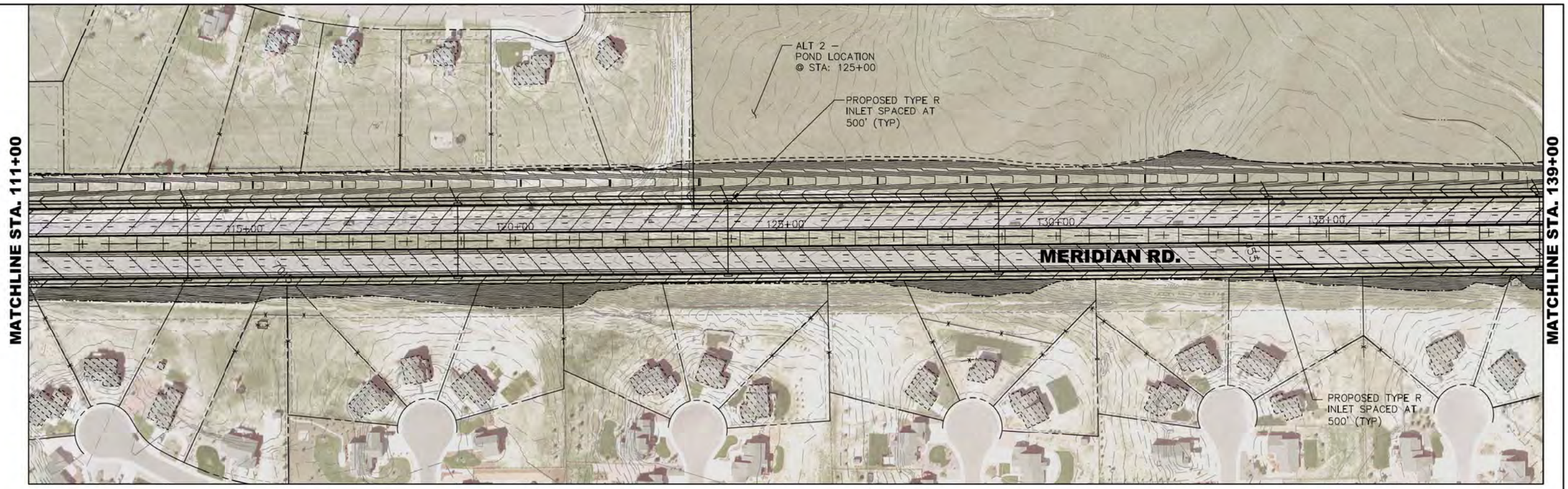
0 50 100 200 400

MERIDIAN ROAD (NORTH) DRAINAGE

LEGEND

- CENTERLINE
- TOP OF CUT
- TOE OF FILL
- EXISTING R.O.W.
- PROPOSED CONTOUR
- EXISTING EASEMENT
- PROPOSED EASEMENT
- EX MAJOR CONTOUR
- EX MINOR CONTOUR

FIGURE 7-2



EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

MERIDIAN ROAD (NORTH) IMPROVEMENTS

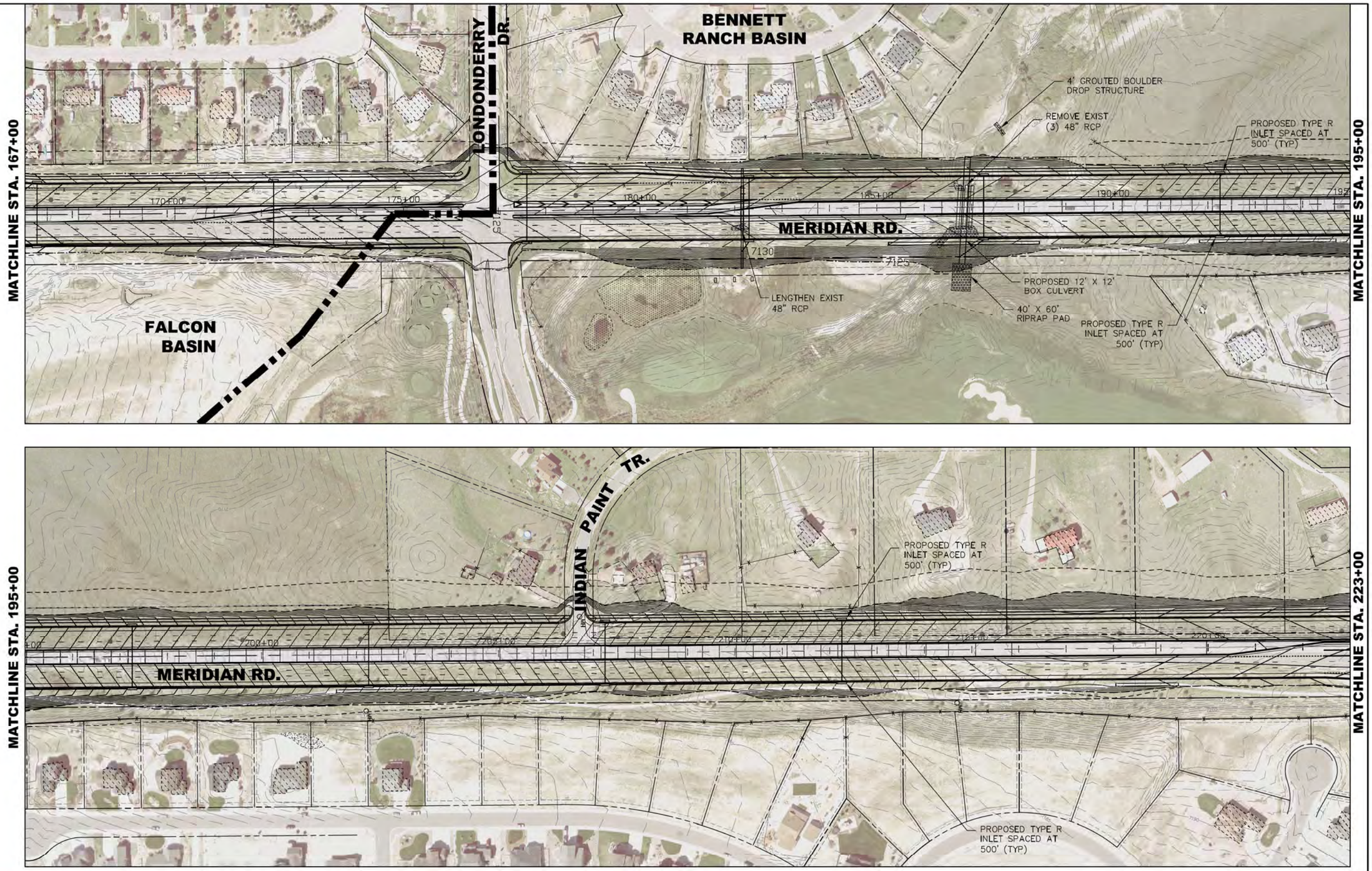
URS

ORIGINAL SCALE

0 50 100 200 400

MERIDIAN ROAD (NORTH) DRAINAGE

FIGURE 7-3



EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

MERIDIAN ROAD (NORTH) IMPROVEMENTS

URS

ORIGINAL SCALE

0 50 100 200 400

MERIDIAN ROAD (NORTH) DRAINAGE

LEGEND

- CENTERLINE
- TOP OF CUT
- TOE OF FILL
- EXISTING R.O.W.
- PROPOSED CONTOUR
- EXISTING EASEMENT
- PROPOSED EASEMENT
- EX MAJOR CONTOUR
- EX MINOR CONTOUR

FIGURE 7-4

MATCHLINE STA. 223+00

MATCHLINE STA. 251+00

PROPOSED TYPE R INLET SPACED AT 500' (TYP)

PROPOSED 24" RCP

REMOVE 36" CSP

PROPOSED 7' X 3' RCB

PROPOSED 6' X 3' RCB

REMOVE EXISTING PIPE

MERIDIAN RD.

7205

PROPOSED TYPE R INLET SPACED AT 500' (TYP)

15' X 15' RIPRAP PAD

40' X 20' RIPRAP PAD

REX RD.

GRADED CONTROL STRUCTURE

LENGTHEN EXISTING 48" RCP

15' X25' RIRPRAP PAD

MATCHLINE STA. 251+00

MATCHLINE STA. 279+00

PROPOSED 24" RCP

REMOVE 18" CSP

PROPOSED 30" RCP

LENGTHEN EXIST 30" CSP

PROPOSED 30" RCP

MERIDIAN RD.

7305

PROPOSED 30" RCP

9' X 15' RIPRAP PAD

ANTLER RIDGE DR.

BENNETT RANCH BASIN

UPPER BLACK SQUIRREL CREEK BASIN

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

MERIDIAN ROAD (NORTH) IMPROVEMENTS

URS

ORIGINAL SCALE

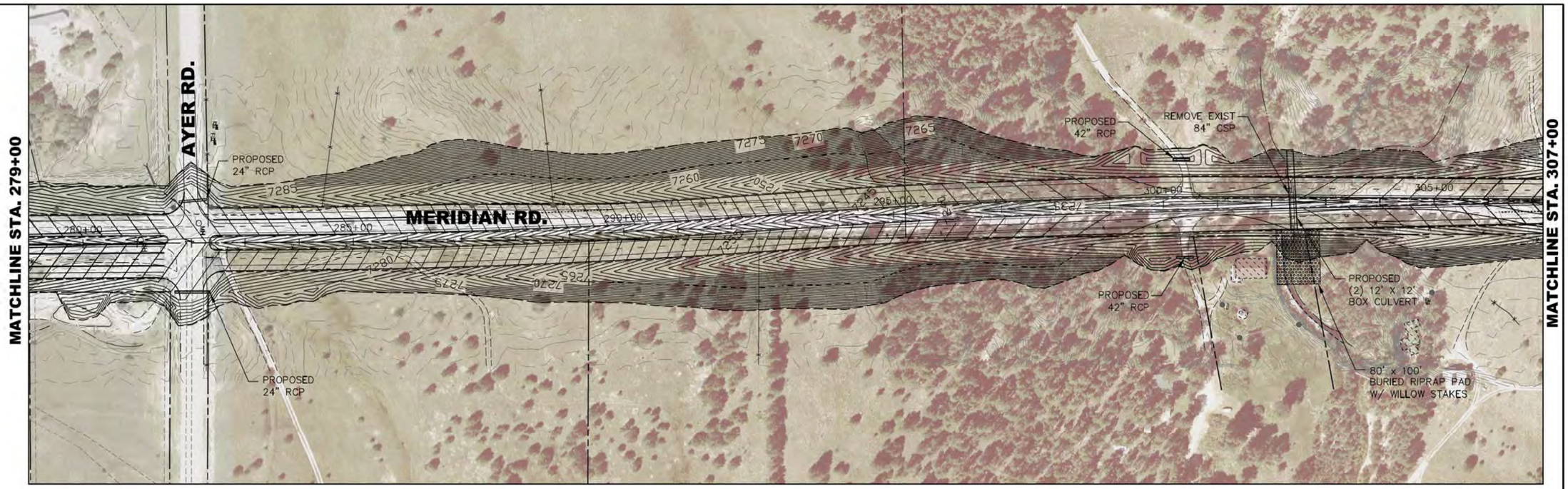
0 50 100 200 400

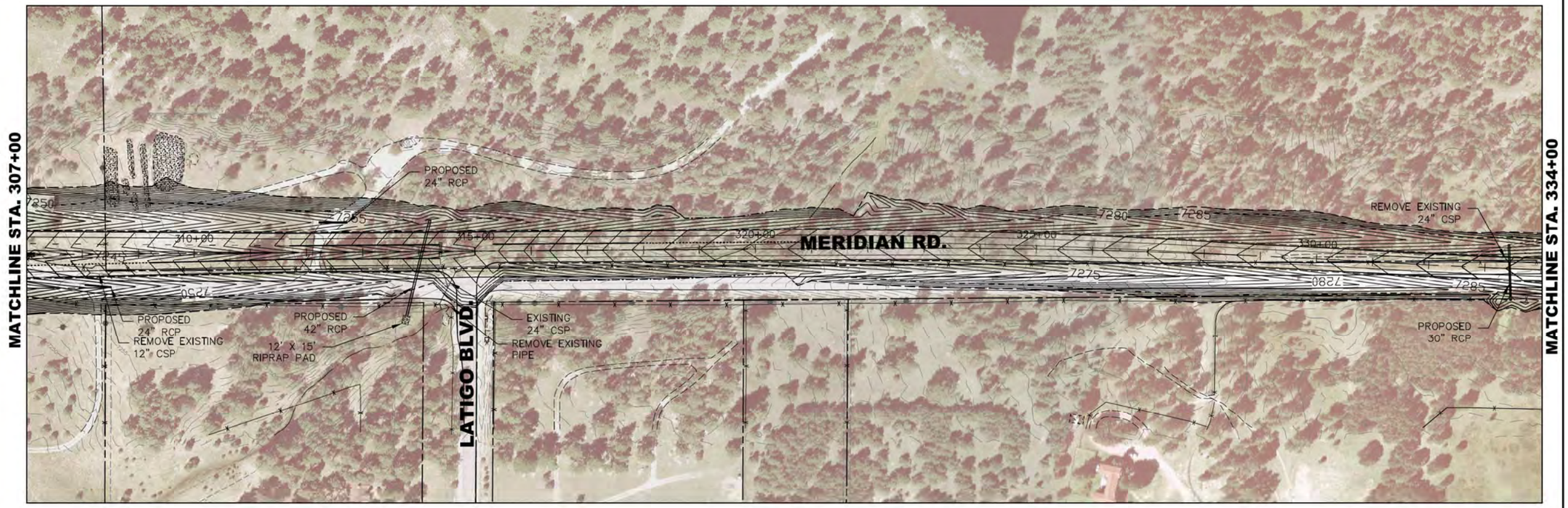
MERIDIAN ROAD (NORTH) DRAINAGE

LEGEND

- CENTERLINE
- TOP OF CUT
- TOE OF FILL
- EXISTING R.O.W.
- PROPOSED CONTOUR
- EXISTING EASEMENT
- PROPOSED EASEMENT
- EX MAJOR CONTOUR
- EX MINOR CONTOUR

FIGURE 7-5





EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

MERIDIAN ROAD (NORTH) IMPROVEMENTS

URS

ORIGINAL SCALE

0 50 100 200 400

MERIDIAN ROAD (NORTH) DRAINAGE

LEGEND

- CENTERLINE
- TOP OF CUT
- TOE OF FILL
- EXISTING R.O.W.
- PROPOSED CONTOUR
- EXISTING EASEMENT
- PROPOSED EASEMENT
- EX MAJOR CONTOUR
- EX MINOR CONTOUR

FIGURE 7-6

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

MERIDIAN ROAD (NORTH) IMPROVEMENTS

URS

ORIGINAL SCALE

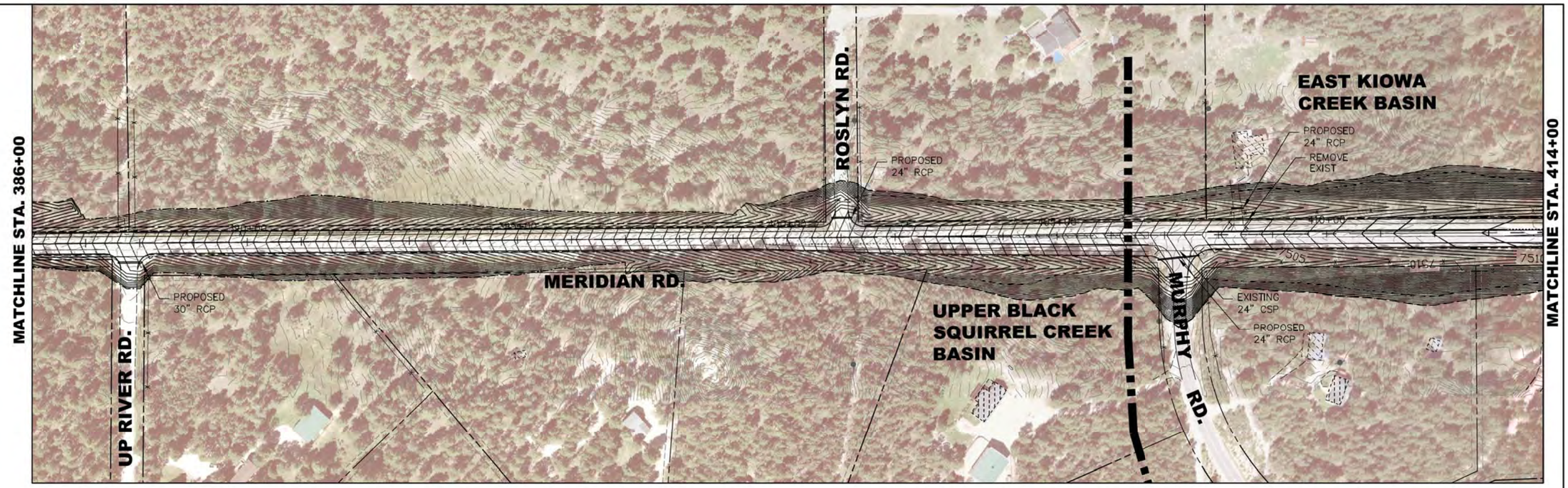
0 50 100 200 400

MERIDIAN ROAD (NORTH) DRAINAGE

LEGEND

- CENTERLINE
- TOP OF CUT
- TOE OF FILL
- EXISTING R.O.W.
- PROPOSED CONTOUR
- EXISTING EASEMENT
- PROPOSED EASEMENT
- EX MAJOR CONTOUR
- EX MINOR CONTOUR

FIGURE 7-7



EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

MERIDIAN ROAD (NORTH) IMPROVEMENTS

URS

ORIGINAL SCALE

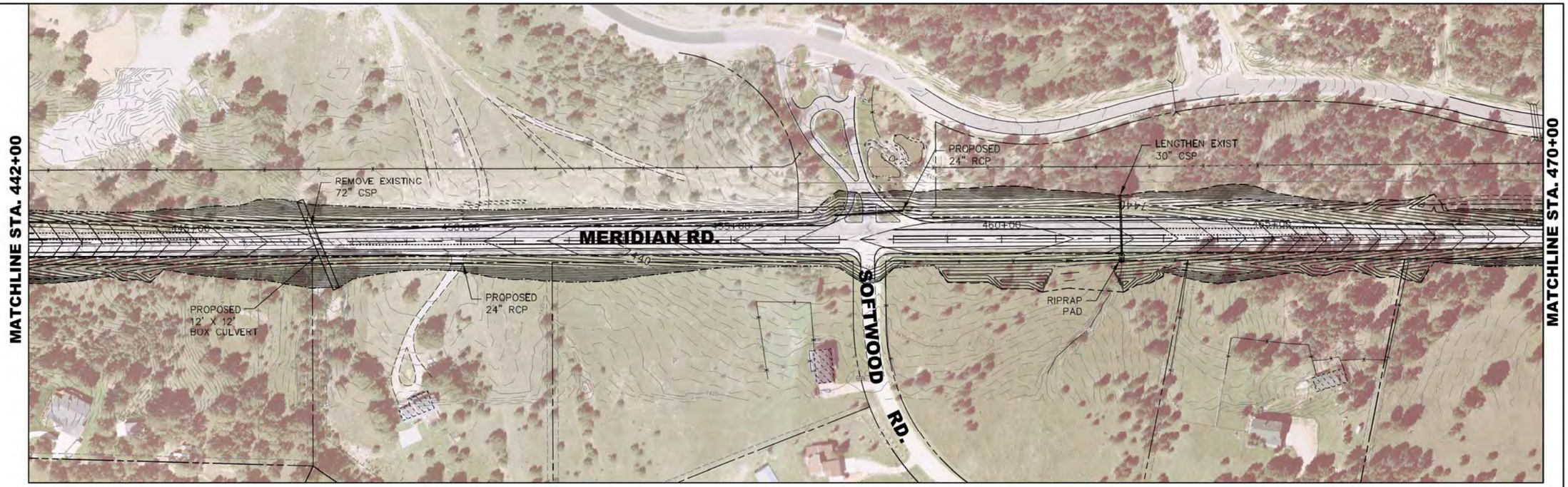
0 50 100 200 400

MERIDIAN ROAD (NORTH) DRAINAGE

LEGEND

- CENTERLINE
- TOP OF CUT
- TOE OF FILL
- EXISTING R.O.W.
- PROPOSED CONTOUR
- EXISTING EASEMENT
- PROPOSED EASEMENT
- EX MAJOR CONTOUR
- EX MINOR CONTOUR

FIGURE 7-8



EL PASO COUNTY
DEPARTMENT OF TRANSPORTATION

MERIDIAN ROAD
(NORTH) IMPROVEMENTS

URS

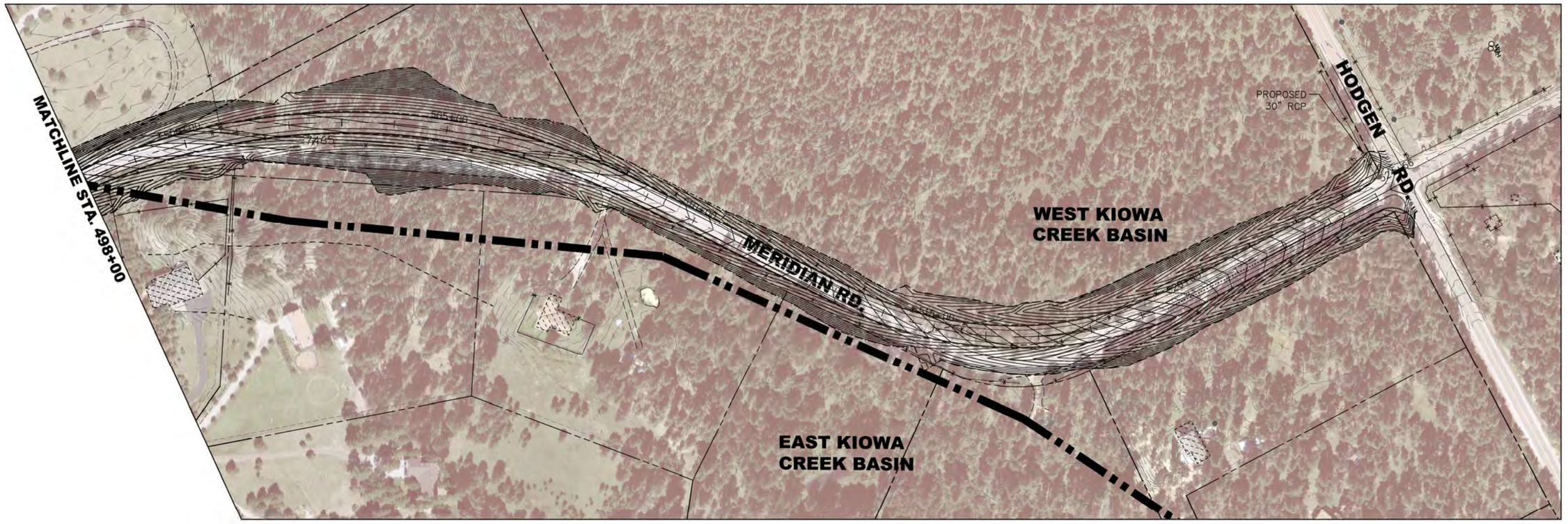
ORIGINAL SCALE
0 50 100 200 400

MERIDIAN ROAD (NORTH) DRAINAGE

LEGEND

- CENTERLINE
- TOP OF CUT
- TOE OF FILL
- EXISTING R.O.W.
- PROPOSED CONTOUR
- EXISTING EASEMENT
- PROPOSED EASEMENT
- EX MAJOR CONTOUR
- EX MINOR CONTOUR

FIGURE 7-9



EL PASO COUNTY
DEPARTMENT OF TRANSPORTATION

MERIDIAN ROAD
(NORTH) IMPROVEMENTS

URS

ORIGINAL SCALE
0 50 100 200 400

MERIDIAN ROAD (NORTH) DRAINAGE

LEGEND

- CENTERLINE
- TOP OF CUT
- TOE OF FILL
- EXISTING R.O.W.
- PROPOSED CONTOUR
- EXISTING EASEMENT
- PROPOSED EASEMENT
- EX MAJOR CONTOUR
- EX MINOR CONTOUR

FIGURE 7-10

6.0 Geotechnical & Subsurface Investigation

A geotechnical engineering investigation for the Meridian Road Corridor was conducted in April 2008 to provide recommendations for grading, preliminary recommendations for new pavement sections, and preliminary foundation recommendations for proposed concrete box culverts. The focus of the study includes Meridian Road between Woodmen Road and Hodgen Road. A geotechnical engineering study was previously prepared by Entech Engineering between US 24 and Woodmen Road. The pavement recommendations between US 24 and Woodmen Road are included in this plan.

This section summarizes the data obtained during the investigation and provides preliminary conclusions and recommendations based on the proposed construction and the subsurface conditions encountered. Design parameters and a discussion of geotechnical engineering considerations related to the proposed roadway improvements are also included.

6.1 Proposed Construction

The Meridian Road Corridor plan proposes interim and ultimate improvements to approximately 10 miles of Meridian Road, from US 24 north to Hodgen Road. Portions of the northbound segment between Woodmen Road and Stapleton Drive may be overlaid with hot mix asphalt (HMA). Proposed improvements will generally follow the existing Meridian Road alignment. Roadway profiles indicate the grading will consist of maximum cuts and fills that range to approximately 23 ft and 10 ft, respectively. A majority of the significant cuts and fills will occur in the northern portion of the alignment. Concrete box culverts (CBC) are being considered in two areas where the roadway will cross existing drainage channels. These structures are anticipated near station 187+00, north of Londonderry Drive, and near station 302+25, north of Ayer Road.

6.2 Existing Site Conditions

In general, the Meridian Road Corridor is bound by urban and rural residential developments. From Woodmen Road north to approximately Stapleton Drive, the roadway consists of a divided 4-lane road that slopes gently towards the south. North of Stapleton Drive, the roadway transitions to a 2-lane road, undulating topography, and an overall regional slope to the south. A small drainage channel is located near the proposed CBC crossing at approximately station 187+00 and crosses under the roadway via a concrete pipe. Near the other proposed CBC location (approximately station 302+25), Meridian Road spans over Black Squirrel Creek via a CMP. A small amount of flowing water was observed at each of these locations at the time of the field investigation. Other smaller ephemeral drainages cross the roadway via small diameter culverts at other locations along the corridor. Vegetation along the corridor primarily consists of grasses and weeds, with coniferous trees beginning near Antlers Ridge Drive and extending north to Hodgen Road.

6.3 Subsurface Conditions

Information on the subsurface conditions was obtained by drilling 19 exploratory borings. Logs of the borings and locations are presented on Figures 8.2 and 8.3, with the corresponding legend and notes presented on Figure 8.1. Laboratory testing on selected soil samples was conducted in general accordance with applicable American Association of State Highway Transportation Officials (AASHTO) and American Society for Testing and Materials (ASTM) standards. The following subsurface descriptions are of a generalized nature to highlight the major stratification features encountered in the borings. The boring logs should be referenced for more detailed information.

6.3.1. Pavement Sections

Borings P1 through P5, P9 and P12 were drilled through the existing roadway pavement. Measurements of the asphalt thicknesses were recorded the nearest ¼ in and are summarized in the table below. Aggregate base course was not encountered in the exploratory borings.

Table 21. Pavement Boring Locations

Boring No.	Location	Existing Asphalt Thickness (in)
P1	59+00, southbound	6
P2	94+00, northbound	12
P3	119+00, southbound	6
P4	148+00 northbound	12
P5	181+80, northbound	12
P9	296+00, southbound	8
P12	410+00, southbound	6

LEGEND

(6) ASPHALT. NUMBER IN PARENTHESES INDICATES APPROXIMATE THICKNESS IN INCHES.

FILL: SILTY TO CLAYEY SAND AND WELL-GRADED SAND WITH SILT, WITH OCCASIONAL GRAVEL, MOIST, BROWN TO DARK BROWN.

SILTY SAND (SM), OCCASIONALLY CLAYEY, LOOSE TO VERY DENSE, SLIGHTLY MOIST TO MOIST, LIGHT BROWN.

CLAYEY SAND (SC), STIFF TO HARD, SLIGHTLY MOIST TO WET, BROWN TO OLIVE-BROWN.

POORLY-GRADED SAND (SP), MEDIUM DENSE, MOIST TO WET, LIGHT BROWN.

SANDSTONE BEDROCK, CLAYEY, WITH OCCASIONAL LAYERS OF SANDY CLAYSTONE, MEDIUM HARD TO VERY HARD, MOIST TO WET, BROWN TO OLIVE-BROWN.

DRIVE SAMPLE, 2-INCH I.D. CALIFORNIA LINER SAMPLER.

47/12 DRIVE SAMPLE BLOW COUNT. INDICATES THAT 47 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

DISTURBED BULK SAMPLE.

gd@+2 INDICATES PROPOSED GRADE IS APPROXIMATELY 2 FEET ABOVE BORING ELEVATION.

8 DEPTH TO WATER LEVEL AND NUMBER OF DAYS AFTER DRILLING MEASUREMENT WAS MADE.

LABORATORY TEST RESULTS

WC = WATER CONTENT (%) (AASHTO T 265);
DD = DRY DENSITY (pcf) (AASHTO T 265);
+10 = PERCENTAGE RETAINED ON NO. 10 SIEVE (AASHTO T 27);
-200 = PERCENTAGE PASSING NO. 200 SIEVE (AASHTO T 11);
LL = LIQUID LIMIT (AASHTO T 89);
PI = PLASTICITY INDEX (AASHTO T 90);
NP = NONPLASTIC (AASHTO T 90);
R = HVEEM R-VALUE (AASHTO T 190);
MDD = MAXIMUM DRY DENSITY (psf) (AASHTO T 99);
OMC = OPTIMUM MOISTURE CONTENT (%) (AASHTO T 99).
A-2-6(0)= AASHTO CLASSIFICATION (GROUP INDEX).

NOTES

1. THE EXPLORATORY BORINGS WERE DRILLED ON MAY 8 AND 9, 2008, WITH A 4-INCH DIAMETER CONTINUOUS FLIGHT POWER AUGER.
2. THE LOCATIONS OF THE EXPLORATORY BORINGS WERE MEASURED APPROXIMATELY BY TAPING FROM FEATURES SHOWN ON THE SITE PLAN PROVIDED.
3. THE ELEVATIONS OF THE EXPLORATORY BORINGS WERE OBTAINED FROM THE ROADWAY PROFILE DRAWINGS PROVIDED.
4. THE EXPLORATORY BORING LOCATIONS AND ELEVATIONS SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.
5. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
6. GROUND-WATER LEVELS SHOWN ON THE LOGS WERE MEASURED AT THE TIME AND UNDER CONDITIONS INDICATED. WE DID NOT PERFORM FOLLOW-UP MEASUREMENTS IN BORINGS P1 THROUGH P5 AND P9. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.

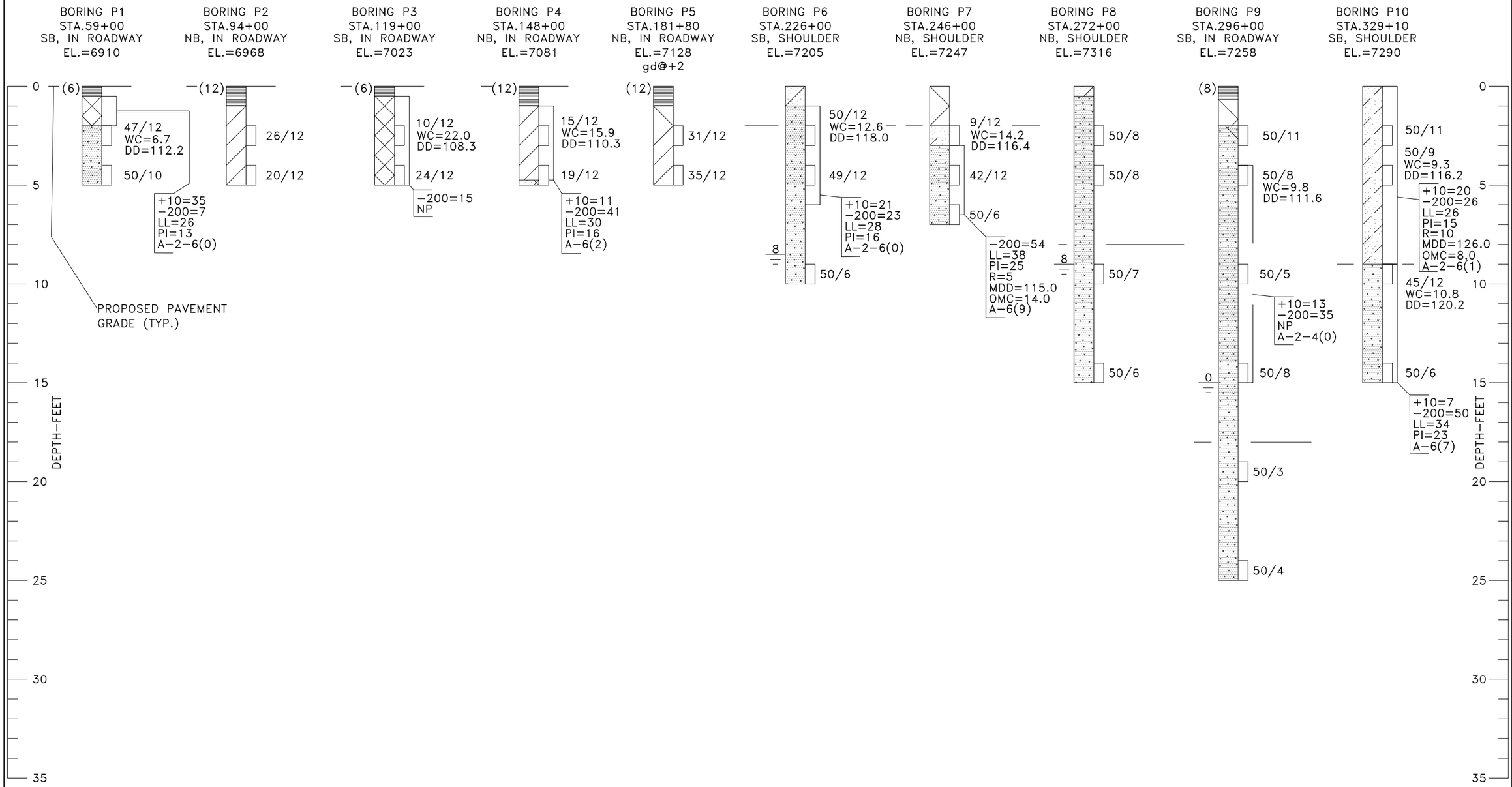
EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

URS

MERIDIAN ROAD (NORTH) IMPROVEMENTS

MERIDIAN ROAD (NORTH) EXPLORATORY BORING LOGS

FIGURE 8-1



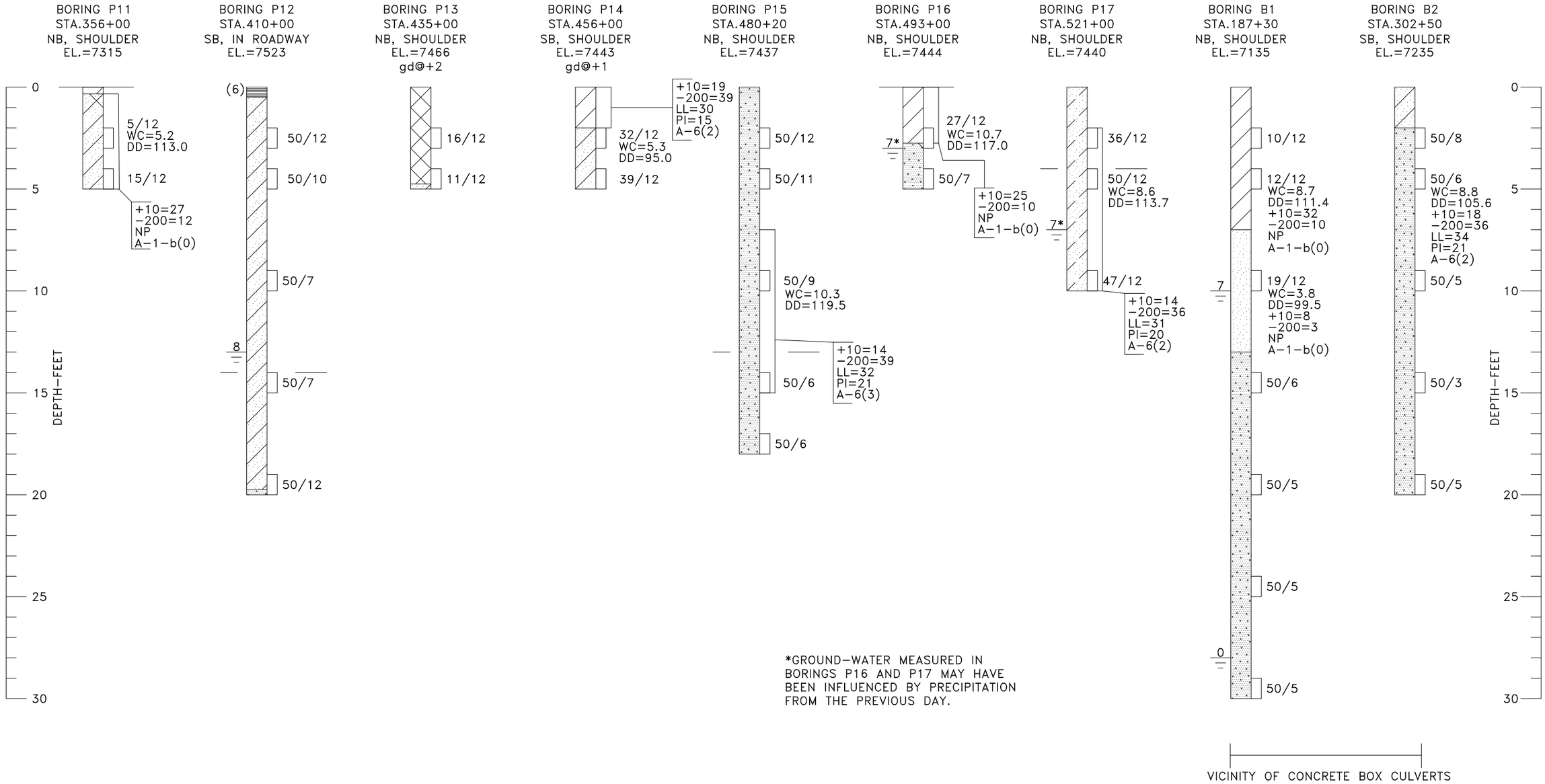
EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

MERIDIAN ROAD (NORTH) IMPROVEMENTS

URS

MERIDIAN ROAD (NORTH) EXPLORATORY BORING LOGS

FIGURE 8-2



*GROUND-WATER MEASURED IN BORINGS P16 AND P17 MAY HAVE BEEN INFLUENCED BY PRECIPITATION FROM THE PREVIOUS DAY.

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

URS

MERIDIAN ROAD (NORTH) IMPROVEMENTS

MERIDIAN ROAD (NORTH) EXPLORATORY BORING LOGS

FIGURE 8-3

6.3.2. Subgrade Conditions

Fill consisting of silty sand, clayey sand, and well-graded sand with silt was encountered in 11 of the borings. The fill was encountered to depths ranging from approximately 0.5 to 7 ft in eight of the borings and to the maximum 5 ft depth explored in the remaining three borings. A majority of the fill appeared to be relatively compact; however, the lateral or vertical extent of the fill was not determined.

The native soils encountered generally consist of silty sand and clayey sand. The exception was in Boring B1 where poorly-graded sand was encountered. The native soils were encountered in 12 of the borings and extended to depths ranging from approximately 0.5 to 19.5 ft in seven of the borings and to the maximum 5 to 10 ft depths explored in the remaining five borings. Sampler penetration blow counts indicate the silty sand is loose to very dense, the clayey sand is stiff to hard, and the poorly-graded sand is medium dense. Swell-consolidation test results indicate the tested sample of clayey sand swelled 1.3% when wetted under a constant 150 psf surcharge pressure.

Clayey sandstone bedrock with occasional layers of sandy claystone was encountered either at the surface or below the overburden soils in eleven of the borings, and extended to the maximum 5 to 30 ft depths explored. Sampler penetration blow counts suggest the bedrock is medium hard to very hard.

Swell-consolidation tests were conducted on remolded samples of sandy claystone and clayey. The samples were compacted to approximately 95% of the maximum standard Proctor dry density (ASTM D 698) at a moisture content near optimum. The test results indicate that after wetting the samples under a constant 150 psf surcharge pressure, the sandy claystone swelled approximately 1.9% and the clayey sand was nonexpansive.

Ground water was encountered in seven of the borings (P6, P8, P9, P12, P16, P17, and B1) either at the time of drilling or when measurements were made 7 to 8 days after drilling. The depth to ground water ranged from approximately 3 to 15 ft. No follow-up measurement were performed in Borings P1 though P5, and P9, as these borings were drilled within the mainline roadway and were backfilled and patched the day of drilling. It was noted that the ground water encountered in Borings P16 and P17 during follow-up measurements may have been influenced by precipitation from the previous day. It is possible for ground water to be present at different elevations during other times of the year.

6.4 Site Grading

Fill placed for support of pavements should consist of a relatively non-expansive granular material. The on-site materials encountered will be suitable for reuse as fill; however, the top 2 ft of subgrade will be required to have the minimum R-value specified in the design or greater. Proposed imported materials should be approved by the geotechnical engineer. All pavement subgrade fill should be compacted to the criteria presented in Appendix K of the ECM.

No signs of major slope instability were observed during the field investigation. Native hillsides in the area appear to have a stable geologic history. Major stability problems are not anticipated if site grading is carefully planned and cuts and fills do not exceed approximately 25 ft in height. Permanent unretained cuts and fills less than 25 ft in height may be 3 horizontal to 1 vertical. The risk of slope instability will be significantly increased if seepage is encountered in the cuts. Ground water measurements in Borings P9 and P12 suggest some seepage may occur in the cut slopes in these areas. The ground water level was also slightly below the proposed grade in Borings P8, P16 and P17. An investigation is recommended to determine the stability of the slopes after actual slope profiles are developed.

Formal stability analyses were not performed to evaluate the recommended slopes. The recommendation is based on published literature and project experience with similar cuts and fills that indicate the recommended slopes should have adequate factors of safety.

Good surface drainage should be provided around all permanent cuts and fills to direct surface runoff away from the slope faces. Fill slopes, cut slopes and other stripped areas should be protected against erosion by revegetation or other methods.

6.5 Pavement Design

6.5.1. Subgrade Materials

The materials encountered at the site primarily classify as A-2-4, A-2-6 and A-6 with group indices ranging from 0 to 9 in accordance with the AASHTO soil classification system. Less frequently occurring A-1-a and A-1-b soils with a group index of 0 were also encountered in some of the borings. The A-2-6 and A-6 soils are generally considered to have fair to poor support characteristics for pavements and the A-1 and A-2-4 soil types are considered be good to excellent. Hveem stabilometer test results indicate an R-value of 5 for the tested sample of A-6 material (sandy claystone), and an R-value of 10 for the tested sample of A-2-6 material (clayey sand).

6.5.2. Design Traffic

The 20-year, 18-kip equivalent single axle loads (ESAL) for design of flexible pavements in Meridian Road are shown in Table 22.

Table 22. 20-Year Equivalent Single Axle Loads

20-Year Equivalent Single Axle Loads	
Segment	**ESAL**
Woodmen Road to Rex Road	2,360,308
Rex Road to Latigo Boulevard	1,103,613
Latigo Boulevard to Hodgen Road	1,165,940

If it is determined that actual traffic is significantly different, then the pavement thickness design should be re-evaluated.

6.5.3. Pavement Sections

Recommended preliminary pavement sections were determined using the ECM and the DARWin 3.01 pavement design software based on the 1993 AASHTO pavement design procedures.

Based on the subsurface conditions encountered in the widely spaced borings, several preliminary pavement section options were developed. Assuming the subgrade will consist of the on-site soils that have a minimum R-value of 10, sections were calculated assuming full-depth HMA, a composite section consisting of HMA over base course section, and HMA over a chemically treated subgrade. In addition,

two full-depth HMA alternatives were developed assuming the pavements are constructed on a minimum 2 ft depth of select import subgrade that has minimum R-values of 40 or 60.

Table 23. Preliminary Pavement Sections – Woodmen Road to Hodgen Road *

Roadway Segment	Subgrade R-value[1]	Preliminary Pavement Alternatives Thickness (in)		
		Full Depth HMA	Composite HMA over Base Course	HMA over 12 in Chemically Treated Subgrade [2]
Woodmen Road to Rex Road	10	11.75	8.5/12	8.75
	40	8.25	-	-
	60	6.5	-	-
Rex Road to Latigo Boulevard	10	10.5	7.25/12	7.5
	40	7.5	-	-
	60	5.75	-	-
Latigo Boulevard to Hodgen Road	10	10.5	7.25/12	7.5
	40	7.5	-	-
	60	6	-	-

[1] Assumes the upper 2 ft of the pavement subgrade will have the specified R-valued or greater.
[2] Assumes the upper 12 in of the pavement subgrade will be treated with cement, flyash or lime, with a minimum 7 day strength of 160 psi. Determination of the appropriate stabilization material(s) should be determined during the final study.
** Geothechnical Engineering Study, Proposed Meridian Road Improvements, Woodmen Road to Hodgen Road; El Paso County, Colorado; Kumar and Associates, Inc.; June 12, 2008.*

Pavement thickness recommendations were extracted from the ENTECH Engineering report on Meridian Road between US 24 and Woodmen Road. Recommendations based on soil type appear in Table 22.

Table 24. Pavement Sections – US 24 to Woodmen Road *

Soil Type	CBR	Pavement Alternatives Thickness (in)	
		Full Depth HMA	Composite HMA over Base Course
1	4.9	6.0	13.0
		9.5	--
4	35.0	6.5	16.0
		11.0	--
5	34.7	5.0	8.0
		8.0	--

** Pavement Recommendations, Falcon Highlands Marketplace; ENTECH Engineering, Inc.; June 1, 2006*

Some on-site materials are anticipated to have an R-value less than 10. These materials (presumably clay and claystone materials), where encountered within 2 ft below the proposed pavement grade, should be overexcavated and replaced with materials that meet the minimum R-value assumed for the design. The limits of overexcavation can be further defined during final pavement design; however, depending on the spacing of additional borings, the limits may need to be determined at the time of construction. If it is determined that large areas require overexcavation and it is preferred to use the on-site soils in the upper subgrade, it may be appropriate to determine additional pavement alternatives that assume a lower R-value during the final study.

Using a select import subgrade for the upper 2 ft eliminates the need to delineate overexcavation limits, and has a higher subgrade R-value, resulting in a smaller pavement section. Import materials will require frequent monitoring of the material properties during construction (particularly the R60 material) to assure the R-value requirements are met. The surface of the subgrade should be sloped to drain towards the edge(s) of the roadway prior to placement of the import R40 or R60 material, if applicable. To the extent practical, the base of the import granular layer should daylight above the adjacent drainage ditch invert elevation.

Preliminary pavement sections have been provided that assume HMA placed on a layer of chemically treated subgrade. Additional investigation must be performed to determine the appropriate chemical additive for the project. Given the soil types encountered, additives most commonly used include flyash or cement. Lime is commonly used for expansive clay subgrades; however, a majority of the site is anticipated to be nonexpansive and granular. Preliminary planning estimates indicate that between 3% and 6% cement would be required and between 10% and 14% fly ash would be required based on the dry weight of the soil. A laboratory soil-cement mix design should be performed prior to construction to determine the required blend of cement that will produce the specified strength. Disadvantages to chemically treated subgrade include construction difficulties during winter months, and the required cure time before construction traffic can be permitted on the treated subgrade. A specialty contractor will be required to complete the process correctly.

6.5.4. Expansive Soil Considerations

The ECM requires mitigation of expansive soils when the measured swell is greater than 2% with a 150 psf surcharge pressure. Based on the subsurface conditions encountered in the widely spaced borings and the measured in-situ and remolded swell testing performed, the swell potential within the project area is estimated to be low. Therefore, special mitigation of expansive soils will not be required.

6.5.5. Pavement Overlay

The condition of the existing northbound pavement between Woodmen Road and Stapleton Drive was visually evaluated in order to assign a strength coefficient of the existing pavement materials. In general, the northbound pavements were in excellent condition. The northbound lanes appeared to have been paved within the past five years, and only had very occasional low severity transverse cracks.

The recommended HBP overlay section was determined using the CDOT component analysis procedure. Based on the results of the pavement condition and section encountered, a minimum HBP overlay section of less than 1 in was calculated. As a standard practice and to improve performance characteristics, a minimum overlay of 2 in is recommended. Considering the age of the roadway, the thickness of HMA, and the condition of the pavement, it appears the roadway was adequately designed for the anticipated ESALs. The calculated overlay amount is relatively minor, and would bring the current section back to a 20-year design life. Without an overlay, the existing pavement life is anticipated to be 20 years, minus the number of years that it has been in service.

6.5.6. Subgrade Preparation

Topsoil and excessive organic matter present below the proposed pavement grade should be removed in its entirety prior to placement of fill or pavement materials. The suitability of existing fill materials should be evaluated prior to placement of new fill and/or pavement materials.

Prior to placing the pavement section, the entire subgrade area should be scarified to a depth of 8 in, adjusted to a moisture content near optimum and compacted to the minimum criteria presented in the “Site Grading” section. The pavement subgrade should be proof rolled with a heavily loaded pneumatic-tired vehicle. Pavement design procedures assume a stable subgrade. Areas which deform under heavy wheel loads are not stable and should be removed and replaced to achieve a stable subgrade prior to paving.

6.5.7. Subgrade Stabilization

Unstable subgrade soils may be encountered during construction, particularly in the low lying fill areas and in areas where relatively shallow ground water is encountered. If encountered, these areas may be stabilized by use of geogrid reinforcement (Tensar BX1100 or equivalent) in combination with aggregate base course. Geogrid reinforcement should only be necessary if the placement of new fill material does not adequately stabilize the unstable subgrade base. Specific stabilization requirements should be evaluated at the time of construction.

6.5.7.1. Drainage

The collection and diversion of surface drainage away from paved areas is extremely important to the satisfactory performance of the pavement. Drainage design should provide for the removal of water from paved areas and prevent wetting of the subgrade soils. Landscape vegetation that requires heavy irrigation should be avoided adjacent to pavements.

6.5.8. Pavement Materials

The HMA should conform to the requirements of Pikes Peak Region Asphalt Paving Specifications. Aggregate base course should be a Class 6 material conforming to the requirements presented in Appendix D of the ECM.

6.6 Subsurface Drains

It appears cuts for portions of the roadway may extend below or near the ground-water level in the vicinity of Borings P8, P9 and P12. Therefore, it is recommended that permanent subsurface-drain systems be used in these areas. The drains should consist of a trench drain, located below the ditch invert, combined with a blanket drain extending up the side of the adjacent cut slope. A recommended detail for the drain as well as the limits of the drain should be developed during the final geotechnical engineering study. Adjustment of the drain detail and length of the drains may be required during construction to compensate for conditions encountered at the time of construction.

6.7 Concrete Box Culvert Foundations

The native granular soils will be suitable for direct support of a spread footing or mat foundation system. Recommended bearing pressures are expected to be on the order of 1,500 to 3,000 psf for shallow foundations bearing on the native granular soils and/or nonexpansive structural fill.

Any fill or areas of loose material encountered within the foundation excavations should be removed and the footings extended to adequate native bearing material. As an alternate, the fill and/or loose material may be removed and replaced with properly compacted nonexpansive fill material. The native soils may pump or deform excessively under construction traffic due to the potentially close proximity of the ground water and the high moisture content of the soils. Construction equipment should be selected to avoid this difficulty. The use of track-mounted construction equipment is normally recommended since tracks will exert lower contact pressures than pneumatic tires. The movement of vehicles over proposed foundation areas should be restricted. A layer of crushed rock may be placed in the bottom of foundation excavations prior to steel and concrete placement. If properly installed, the crushed rock will reduce disturbance of the native soils caused by construction operations. Disturbing the native soils will potentially increase foundation settlements.

6.8 Excavation Considerations

Excavation of the near surface bedrock and overburden soils should be possible with heavy-duty conventional excavation equipment with rippers.

In Borings P8, P9, P12, P16 and P17 ground water was measured near or above the proposed pavement grade. The base of excavations that extend to or near the ground-water level may soften due to construction traffic. As a result, subgrade stabilization may be required prior to placement of fill or pavement materials in these areas. Methods of stabilization are discussed above in the Subgrade Stabilization section.

Dewatering of cut excavations, if necessary, can be accomplished by grading to perimeter trenches and/or using temporary sump pits. The pits should be constructed well below the base of the excavation to avoid loss of supporting capacity of the soils.

7.0 Environmental

This section describes the environmental survey completed for the Meridian Road Corridor and includes a summary of the methodology, key findings, and potential impacts. The intent was to determine if any the following areas would impact or be impacted by the proposed roadway improvements.

- Hazardous Materials (HazMat)
- Cultural/Historic Resources
- Section 4f (Parks and Recreation)
- Waters of US and Wetlands
- Wildlife
- Threatened & Endangered Species

7.1 Methodology

The environmental survey included a review of information applicable to the Meridian Road corridor, interactions with government agencies, and a corridor field visit. Key pieces of information included the following:

- A regulatory database search report, completed by Environmental Data Resources, Inc. (EDR), that identifies known regulated operations, reported incidents, and other items that may suggest further environmental inquiry is needed.
- Historic topographic maps that provide information regarding site history.
- US Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Soil Survey that identifies the soil types along the corridor.
- Agency records obtained via correspondence.

Requests sent to various federal, state, and local agencies sought information pertinent to the project area, such as records of leaking underground storage tanks (LUST) or endangered species habitat. Agencies contacted include the following:

- US Fish and Wildlife Service (USFWS)
- Colorado Department of Labor and Employment, Division of Oil and Public Safety (OPS)
- Colorado Department of Public Health and Environment (CDPHE), Hazardous Materials & Waste Management Division
- Colorado Division of Wildlife (CDOW)
- Colorado Historical Society
- Colorado Natural Heritage Program (CNHP)
- Falcon Fire Department

In addition to the documents review, a site reconnaissance provided the opportunity to make general observations of existing conditions.

7.2 Hazardous Materials

Environmental records pertaining to the subject corridor and surrounding areas could identify conditions indicative of releases or threatened releases of hazardous substances, pollutants and contaminants, petroleum or petroleum products, and controlled substances.

7.2.1. Database Search

EDR prepared a Corridor Study report that presents search results of 36 federal and 16 state/local databases, including a list of site addresses where potential contamination sources exist or have existed. Such sources include but are not limited to UST; landfills; hazardous waste generation or treatment, storage and disposal facilities; and subsurface contamination in the surrounding area. The report identifies facilities with known and documented environmental conditions that may negatively affect the project area. A facility may be a potential concern if any of the following apply:

- The facility is listed on one of the following databases of reported hazardous materials releases:
  - Federal: National Priority List, CORRACTS, CERCLIS, RCRA TSD
  - Colorado: Leaking UST, VCP list

  and is located within, adjacent to, or potentially up-gradient of the project corridor.
- The facility is listed as a solid waste disposal and site landfill and located within, adjacent to, or up gradient of the project corridor (does not include transfer stations).
- The facility is located within or adjacent to the project corridor and listed as a RCRA large-quantity or small-quantity hazardous waste generator (LQG or SQG, respectively), a CERCLIS NFRAP site, an ERNS site, a State SPILLS site, or an UST/AST operator.

The EDR report did not identify facilities of concern along Meridian Road. Table 25 shows the sites within one mile of the corridor that appeared on the search report. Mountain View Electric's Latigo Facility and Falcon School District 49 are located west of Meridian Road. The Latigo Facility was on the LUST list; that site was remediated and closed in 1990. Two additional tanks were also closed. Records indicate there are no registered, active tanks currently on site. The school district facility is a RCRA-SQG with no reported violations, a remediated and closed LUST site (1990), and an active UST site (three registered tanks). Two USTs were permanently closed in-place and one UST was removed. The Safeway Fuel Center, located east of Meridian Road, has two registered USTs and there were no violations on record as of the time of this survey.

Table 25. Hazmat Sites

Facility	Proximity to Meridian Road	Federal/State Record
Falcon School District 49	0.8 mile west	RCRA-SQG FINDS LUST
Mountain View Electric Latigo Facility	0.6 mile west	LUST UST
Safeway Fuel Center	0.2 mile east	UST

7.2.2. Regulatory Agencies

Written requests submitted to the CDPHE and the Falcon Fire Department sought to retrieve state and local records pertaining to the project area. CDPHE responded that they need specific addresses. Since the EDR report indicated no sites of concern along the corridor, specific addresses were not submitted. Should the design phase identify impacts to specific properties, the CDPHE can search for records pertaining to those addresses. The Falcon Fire Department has not yet responded at the time of this survey.

7.2.3. Conclusion

Hazardous materials are not expected to impact environmental conditions within the project area. Previously remediated releases (e.g., LUST) that received a "no further action" or "closure" status by the regulating agency are historically recognized environmental conditions (REC). A historical REC generally creates a potential environmental concern due to the potential for remaining low levels of contamination. The sites are either located too far away from the anticipated construction or the sites are hydro-geologically down gradient from the project.

Based on the results of the environmental survey, the following measures will help avoid negative environmental impacts:

- Monitor the use of right-of-way
- Implement management practices that help prevent releases of potentially hazardous substances

7.3 Cultural Resources

A letter to the State Historic Preservation Office (SHPO) requested information regarding historical and archaeological resources of concern along the Meridian Road corridor, and concurrence that the project will not adversely impact these resources. A review of the on-line cultural resource database administered by the SHPO, Office of Archaeology and Historic Preservation revealed that there have not been many surveys in the area and that no cultural resources are listed. The SHPO public on-line database also showed that there are no identified resources along the corridor.

Neither the EDR report nor the Colorado State Historic Register lists the Eastonville Cemetery, established in 1865 at the northeast corner of Meridian Road and Latigo Boulevard. However, the site may be eligible for listing and it is recommended impacts to the site be avoided or mitigated.

Although there were no historical sites listed in the EDR report, there are several historic sites in El Paso County that are not mapped for security and preservation reasons. A review confirmed that those sites do not fall within the limits of the Meridian Road Corridor Plan.

7.4 Section 4f (Parks and Recreation)

Two trails, the Rock Island Trail and the America the Beautiful Trail, cross near Woodmen Road. Impacts to these trails have not yet been determined. Negative impacts are not anticipated.

7.5 Waters of the US

7.5.1. Wetlands

EDR's NEPA Check document included a 3-mile buffer around the corridor. The report did not reveal any jurisdictional wetlands within the search boundaries. However, a site visit indicated wetlands on the golf course property near the intersection of Meridian Road and Stapleton Drive. During later phases of the project, delineation in accordance with the Routine Wetland Determination procedures outlined in the 1987 US Army Corps of Engineers (USACE) Wetlands Delineation Manual (Environmental Laboratory 1987) will verify the presence of wetlands.

Delineation involves a detailed examination to determine the presence of plants, soils and hydrologic indicators. Field examinations will include the following tasks:

- Identify and list all plants considered dominant in wetlands.
- Identify the presence of hydric soil indicators.
- Identify the extent of hydric soils.

For each potential wetland area, a comparison of the dominant plant list to the *National List of Plant Species That Occur in Wetlands: Intermountain (Region 4) (Reed 1988)* will determine the "wetland indicator status" of each species. Generally, if at least 50% of those species have an indicator status of facultative or wetter, the potential wetland area would satisfy the COE criteria for wetland vegetation. Evidence and potential sources of wetland hydrology also indicates the presence of wetlands. This evidence is not limited to the presence of water, but includes other primary and secondary wetland hydrology indicators. If indicators are found, multiple pits will be dug in an up gradient pattern to attempt to identify the extent of hydric soils. After determining the approximate extent of the wetlands based on the presence of hydric soils, hydrophytic vegetation, and wetland hydrology, the wetland boundary will be mapped.

7.5.2. Other Waters of the U.S.

Streams in the study area include Kiowa Creek, Snipe Creek, Cantrell Creek, and Black Squirrel Creek. Kiowa Creek is located on the northern end of the corridor. Snipe Creek and Cantrell Creek form confluences with Black Squirrel Creek. Black Squirrel Creek flows along the southern boundary of the corridor.

7.6 Flora and Fauna

7.6.1. Threatened and Endangered Species Habitat & Species of Concern

CNHP's Biodiversity Tracking and Conservation System (BIOTICS) database tracks known occurrences of significant natural communities and rare, threatened or endangered plants and animals. For this project, the search criteria specified a 200 ft buffer for any direct hits, a 3-mile buffer for plants, and a 5-mile buffer for wildlife. The BIOTICS database search did not identify any tracked species within 200 ft of the corridor.

The report describes resources known in this area and gives the location and the last observed date. The report also includes elements known to occur within the specified project site, as well as elements known from similar landscapes near the site. The status of the known elements is also noted with both the Natural Heritage Program methodology and legal status under state and federal statutes. The Natural Heritage Program ranks are standardized across the program network and are assigned global and state levels of

rarity, with one (1) being critically imperiled or extremely rare to five (5) being demonstrably secure. Some species are protected from potential harm by omitting the section information.

While this data can be utilized to anticipate possible impacts or identify areas of interest, and the search has identified certain elemental occurrences within the search boundaries (3 miles for plant species, and 5 miles for raptors and wildlife), undocumented elements may also exist. The absence of data for a particular area, species, or habitat does not necessarily mean that these natural resources do not occur on or adjacent to the project site; rather the files do not currently contain information to document their presence. The information contained in this search is not intended to replace field studies necessary for more localized planning efforts, especially if impacts to wildlife habitat are possible.

The review of known occurrences indicated multiple CNHP designated Potential Conservation Areas (PCAs) within the general vicinity of the project area. Specifically, the northern 3,000 ft of the Meridian Road corridor is located entirely within an area of Moderate Biodiversity Significance. PCAs are designated to successfully protect occurrences by capturing the ecological processes necessary to support the continued existence of a particular element of natural heritage significance. Conservation areas may include a single occurrence of a rare element or a suite of rare elements or significant features. Conservation areas are defined by determining the species' life history in conjunction with topographic, geomorphic and hydrologic features, vegetative cover, and potential land uses. Although the proposed boundary does not automatically exclude all activity, it is hypothesized that some activities could compromise the element or the process on which they depend. Consideration of certain activities or land use changes should be carefully considered and evaluated for their consequences.

The Colorado Division of Wildlife (CDOW) has legal authority over wildlife in the state and is therefore responsible for the evaluation of and final decision regarding any potential effects a proposed project may have on wildlife. The CDOW response letter suggested contacting the USFWS regarding Preble's Meadow Jumping Mouse (PMJM) and the Northern Leopard Frog range. The USFWS responded that the proposed project "is not likely to adversely affect" biological resources.

Tables 26 and 27 show the potential species known to occur within El Paso County, Colorado as reported in the EDR NEPA Check document.

Table 26. Threatened & Endangered Fauna

Wildlife (Fauna)		
Common Name	**Latin Name**	**Status**
Mammals		
Preble's Meadow Jumping Mouse	*Zapus hudsonius preblei*	State Threatened, Federally Threatened
Black-tailed Prairie Dog	*Cynomys ludovicianus*	State Threatened
Swift Fox	*Vulpes velox*	State Threatened
Fishes		
Greenback Cutthroat Trout	*Oncorhynchus clarki stomias*	State Threatened, Federally Threatened
Arkansas Darter	*Etheostoma cragini*	State Threatened
Southern Redbelly Dace	*Phoxinus erythrogaster*	State Endangered
Birds		
Bald Eagle	*Haliaeetus leucocephalus*	State Threatened
Mexican Spotted Owl	*Strix occiddentalis lucida*	State Threatened, Federally Threatened
American Peregrine Falcon	*Falco pergrinus anatum*	State Special Concern
Borrowing Owl	*Athene cunicularia*	State Threatened
Ferruginous Hawk	*Bueo regalis*	State Special Concern
Mountain Plover	*Charadrius montanus*	State Special Concern
Amphibians		
Northern Leopard Frog	*Rana pipiens*	State Special Concern
Plains Leopard Frog	*Rana blairi*	State Special Concern
New Mexico Spadefoot	*Spea multiplicata*	State Special Concern
Reptiles		
Massasauga	*sistrurus catenatus*	State Special Concern

Table 27. Known Species

Flora/Fauna	Common Name	Scientific Name
Fauna	Tiger beetle	*Cicindela nebraskana*
Flora	Small headed rush	*Juncus brachycephalus*
	Foothills ponderosa pine savannas	*Pinus ponderosa/Carex inops*
	Richardson alum-root	*Heuchera richardsonii*
	Prairie violet	*Viola pedatifida*
	Crawe sedge	*Carex crawei*
	Selkirk violet	*Viola selkirkii*
	Xeric tallgrass prairie	*Andropogon gerardii-sporobolus heterolepis*

7.7 Environmental Conclusions

Substantial research into the presence of hazardous materials, cultural resources, parks & trails, waters of the US, and flora and fauna leads to the conclusion that few, if any, resources are at risk from the proposed roadway improvements. The following tasks are necessary after design of the roadway alignment and prior to the construction phase:

- Wetlands – conduct field examination of plants, soils and hydrologic indicators to delineate wetland boundaries
- Flora and Fauna – conduct field surveys to verify the presence (or lack thereof) of potential species

8.0 Analysis & Implementation Plan

8.1 Concept

The Analysis considers a range of improvements to Meridian Road to provide recommendations for the long-term, ultimate condition along with interim phases as warranted by technical findings. The upper limit is referred to as the "ultimate" condition or road section and is based primarily on the MTCP classification and associated ECM standards. While the existing MTCP classification is based on 2030 projected traffic volumes, the ultimate road section presented in this corridor plan is based on recent 2035 traffic projections, resulting in a road classification change between Ayer Road and Latigo Boulevard from 2-lane minor arterial to 4-lane principal arterial.

The minimum recommended road section is based on existing traffic volumes and presented in this section as the "best case" interim solution. Other interim or independent projects are most likely necessitated by funding limitations. Interim phases are presented in a prioritized Implementation Plan for construction improvements later in this section.

The range of improvements was evaluated based on technical data presented in previous sections of this corridor plan such as master plan conformance, traffic volumes and crash analysis, utility impacts, drainage, geotechnical considerations, environmental concerns, existing ROW, and existing and proposed access points. The range also includes recommendations from the Falcon Basin Drainage Planning Study. This section also includes the design criteria and typical sections, the specifics for the ultimate and interim road sections, corridor constraints and deficiencies, and projected construction costs. Each element is critical to evaluating the corridor and is the basis for the recommendations presented herein.

8.2 Constraints and Existing Deficiencies

Constraints within the Meridian Road Corridor are characterized as areas with horizontal and vertical alignments deficiencies, questionable pavement conditions, Falcon Drainage Basin impacts to the roadway, right-of-way limitations, and the potential for utility conflicts. The horizontal and vertical alignment between Ayer Road and Latigo Boulevard does not meet current criteria and presents a potential safety hazard. Although the Eastonville Cemetery is not listed as a historical and archaeological resource, it poses a possible roadway constraint near the Latigo Boulevard intersection. The cemetery has graves in proximity to the existing right-of-way. The proposed roadway alignment from Ayer Road to north of Latigo Boulevard was adjusted to bring the road into compliance with design standards and to eliminate the possibility of impacting the cemetery.

The existing horizontal and vertical curves between Northcliff Road and Hodgen Road do not meet design criteria. The deficiencies result in sight distance limitations and hazardous driving conditions. The proposed roadway improvements between Northcliff Road and Hodgen Road are a partial realignment to correct horizontal curve deficiencies along with vertical corrections. The design speed in this segment is stepped down from 70 mph to 45 mph to reduce impacts to adjacent property owners and bring the road into compliance with design standards. This segment ends with a stop condition at Hodgen Road so reducing the design speed is not anticipated to create driver expectations problems.

The existing pavement in the southbound lanes between Woodmen Road and Londonderry Drive is in a poor condition. This pavement was the original Meridian Road, complete with a crown, and now carries two lanes of southbound traffic. North of Londonderry Drive, Meridian Road transitions to the original 2-lane section up to Hodgen Road. The existing pavement condition between Londonderry Drive and Hodgen Road varies and is discussed in detail in Chapter 6.

The middle tributary of the Falcon Drainage Basin parallels the west side of Meridian Road from approximately Stapleton Drive to Woodmen Road. The Falcon DBPS calls for an open channel along this stretch of road. The constraints associated with the channel are the right-of-way impact and the undersized facilities downstream. A 15 ft wide open channel bottom is required on the west side of the road section. The drainage facilities under Woodmen Road for both the west and middle tributaries combine in an underground drainage system that does not currently have flow capacity as recommended in the Falcon DBPS. The result of these undersized structures is the need to detain runoff upstream of the Woodmen Road crossings. The discharge of the proposed detention pond would be limited to the available capacity of the underground drainage system south of Woodmen Road. The most likely location for the detention pond is the northwest corner of the Woodmen Road and Meridian Road intersection. Other pond locations in proximity to Owl Place will be considered during design, but may be to far upstream to provide the needed detention or discharge restraint.

Right-of-way for the proposed ultimate improvements is presented in Chapter 9, Corridor Preservation. The right-of-way between US 24 and Woodmen Road is essentially in place. Between Woodmen Road and Rex Road, right-of-way has been dedicated through the development process on the east side of the road. Several pending developments on the west side are anticipated to result in right-of-way dedication. Obtaining right-of-way from several parcels on the west side of Meridian Road is also anticipated to complete necessary roadway and drainage improvements. In general, between Rex Road and Hodgen Road, right-of-way is needed on both sides of Meridian Road in the areas that have current horizontal and vertical deficiencies as previously described.

Multiple underground and aboveground utilities exist along the corridor, particularly between Woodmen Road and Stapleton Drive. Several of these utilities require either relocation or special design consideration to mitigate the potential for conflicts. These utility conflicts will be addressed in detail during design phases. Relocations are anticipated for the ultimate road section regardless of the possible interim construction projects in order to minimize the cost of these relocations.

8.3 Design Criteria

The Meridian Road Corridor consists of following three roadway classifications based on the MTCP:

Table 28. MTCP Road Classification (Based on 2030 Projected Traffic)

Meridian Road Segment	Classification
US 24 to Rex Road	6-lane Principal Arterial
Rex Road to Ayer Road	4-lane Principal Arterial
Ayer Road to Hodgen Road	Minor Arterial (Corridor Preservation for 4-lane Principal Arterial)

As previously discussed, the road classification between Ayer Road and Latigo Boulevard is recommended to change to a 4-lane Principal Arterial based on 2035 projected traffic volumes. The road classifications used for this Analysis are based on this change and are presented below.

Table 29. Design Road Classification Based on 2035 Projected Traffic

Meridian Road Segment	Classification
US 24 to Rex Road	6-lane Principal Arterial
Rex Road to Latigo Boulevard	4-lane Principal Arterial
Latigo Boulevard to Hodgen Road	Minor Arterial (Corridor Preservation for 4-lane Principal Arterial)

The proposed roadway design for these roadway classifications is based on ECM criteria and associated design speed. The design speed between Northcliff Road and Hodgen Road is stepped down from 70 mph to 55 mph to 45 mph to accommodate horizontal curves and to minimize property owner impacts in this area. The design criteria for the 55 mph and 45 mph design speeds are per the ECM requirements. The key design criteria presented in the table below are used for both the ultimate and interim road sections.

Table 30. Key Design Criteria

Criteria	6-lane Principal Arterial (Urban)	4-lane Principal Arterial (Rural)	2-lane Minor Arterial (Rural)
Design Speed/ Posted Speed	50/45	70/65 mph	70/65mph
Minimum Centerline Curve Radius	930	2510 ft (2050 ft) [1]	1505 ft (2050 ft) [1]
Number of Through Lanes	6	4	2
Lane Width	12 ft	12 ft	12 ft
Right-of-way	160 ft (210 ft) [2]	180 ft	100 ft (180 ft) [3]
Paved Width	48 ft [4]	38 ft [4]	40 ft
Median Width (including curb and gutter)	31 ft	24 ft	n/a
Outside Shoulder Width (paved/gravel)	8 ft	12 ft (10 ft/2 ft)	10 ft (8 ft/2 ft)
Centerline Grade (Min. – Max.)	0.5 – 6.0%	1.0 – 5.0%	1.0 – 6.0%
Design Vehicle	WB 67	WB 67	WB 67

[1] *Based on 70 mph design speed*
[2] *210 ft right-of-way is either already preserved or needed between Woodmen Road and Rex Road*
[3] *Preserve 180 ft right-of-way to Hodgen Road*
[4] *Pavement width in each direction*

8.4 Typical Section

The typical sections and notable standards for each roadway classification are discussed below. The proposed ultimate roadway typical section meets the ECM criteria and standards. A secondary typical section was also developed for interim construction projects until traffic volumes reach the forecasted levels to warrant improvements.

8.4.1. Typical Section - Urban Principal Arterial (6-lane)

The segment from US 24 to Rex Road is divided into two sections: US 24 to Woodmen Road and Woodmen Road to Rex Road. Both will follow the ECM design standard for a 6-lane Principal Arterial (Urban) with one exception. The right-of-way from US 24 to Woodmen Road is 180 ft and from Woodmen Road to Rex Road is 210 ft. The Falcon Drainage Basin open channel planned between Woodmen Road and Stapleton Drive is the reason for the additional right-of-way width. Reducing the right-of-way between Stapleton Drive and Rex Road to the typical 180 ft is possible and will be considered during design phases. In general, both typical sections consist of 96 ft of pavement including 8 ft outside and 4 ft inside paved shoulders. Figures 9-1 through 9-3 show the typical section, along with proposed interim construction based on current traffic volumes.

Further improvements between US 24 and Woodmen Road are not anticipated at this time. The future condition anticipates widening to the inside to create six lanes as shown in Figure 9-1. An interim section is not recommended between Woodmen Road and Woodmen Hills Drive due to existing traffic volumes and pending development adjacent to Meridian Road. The proposed typical section is presented in Figure 9-2.

Interim improvements between Woodmen Hills Drive and Rex Road are anticipated to be the outer two lanes as shown in Figure 9-3. Improvements to the northbound lanes between Woodmen Hills Drive and Stapleton Drive may be limited to an overlay section due to existing condition of the pavement in this area.

8.4.2. Rural Principal Arterial (4-lane)

Figure 9-4 presents the segment from Rex Road to Latigo Boulevard that will follow the ECM design standard for a 4-lane Principal Arterial (Rural): 180 ft right-of-way width consisting of 76 ft of pavement including 10 ft outside paved shoulders, plus 2 ft gravel shoulders, and 4 ft paved inside paved shoulder, plus 2 ft gravel shoulders. Interim improvements are anticipated to be construction of the ultimate two northbound lanes with grading provided for the future southbound lanes. Two-way traffic would travel on the future northbound lanes with 7 ft balanced shoulders on the ultimate pavement width.

8.4.3. Rural Minor Arterial (2-lane)

From Latigo Boulevard to Hodgen Road, the typical section will follow the ECM design standard for a 2-lane Minor Arterial (Rural) as presented in Figure 9-5 with 40 ft of pavement including 8 ft paved shoulders, plus 2 ft gravel shoulders. The design speed between Northcliff Road and Hodgen Road is stepped down from 70 mph to 55 mph to 45 mph to accommodate horizontal curves and to minimize property owner impacts in this area. The MTCP indicates corridor preservation for a 4-lane Principal Arterial (180 ft right-of-way) on this segment of Meridian Road, thereby allowing for additional development beyond the year 2030. Interim improvements are not anticipated through this section of Meridian Road.

8.4.4. Interim Road Sections

The interim road sections described above are based on the ECM criteria to include the horizontal and vertical alignments. The alignments are consistent for both the interim and ultimate road section recommendations. One minor exception to the ECM is non-standard shoulder widths in the interim condition from Rex Road to Latigo Boulevard. The exception will maximize the use of pavement proposed for the ultimate condition without creating significant construction waste.

Drainage improvements and utility relocations necessary to construct the ultimate road section will be included as part of interim construction projects in order to reduce or eliminate future rehabilitation costs.

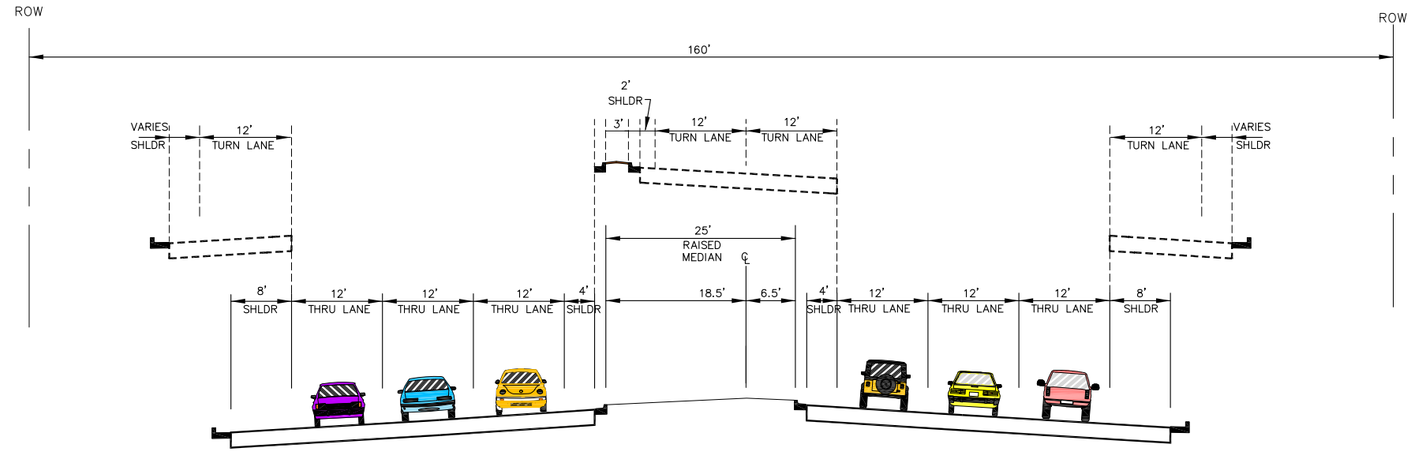
The interim road section recommendations are based on evaluation of the corridor technical data with particular emphasis on the traffic and crash analyses. The analysis looked at both the existing and 2035 projected traffic volumes. The interim road sections are recommended to meet existing traffic volumes with safety improvement considerations to mitigate crashes. These interim recommendations may also assist with construction funding shortfalls.

8.4.5. Ultimate Road Sections

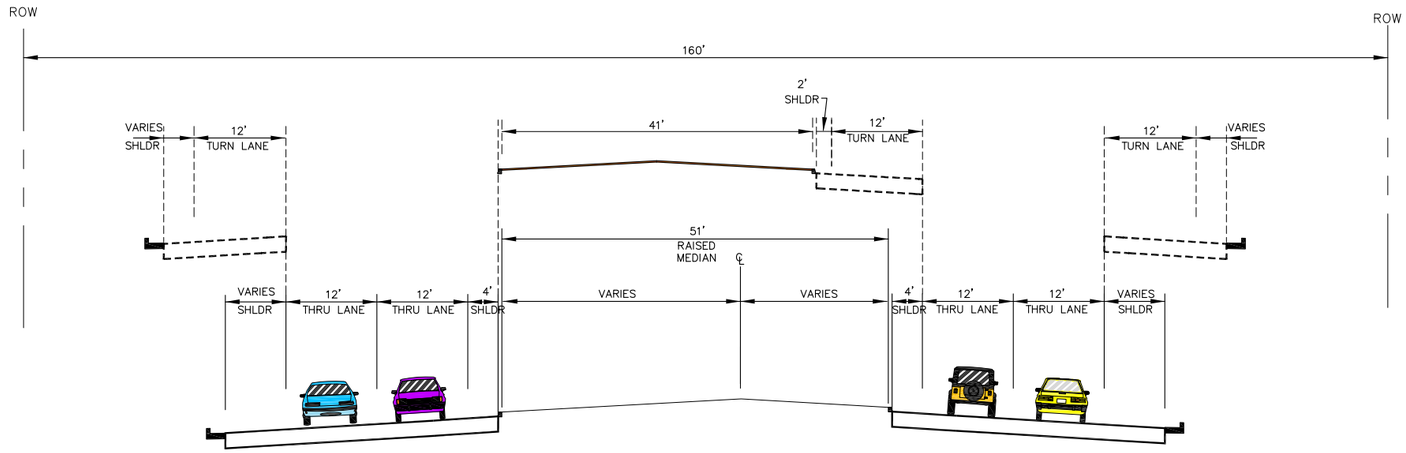
The proposed recommended ultimate road sections are based on the ECM criteria to include the horizontal and vertical alignments and 2035 projected traffic volumes. The description of the ultimate road sections is included in typical section descriptions in Section 8.4. Drainage improvements are planned for the ultimate condition to include the Falcon DBPS open channel on the west side of Meridian Road. Utility conflict mitigation and relocations are planned as part of the ultimate improvements.

8.5 Analysis

The Analysis of the technical data for both the proposed interim and ultimate road sections concluded with similar impacts since most interim improvements are to the outside of the proposed ultimate section. When improvements to the outside were not recommended for the interim case, grading for the ultimate condition was recommended to both preserve the right-of-way and to facilitate proper intersection configuration. With similar impacts for both the proposed interim and ultimate road sections, the differences are traffic volumes and associated lane configuration, and construction cost. Traffic volumes are discussed in detail in Chapter 3. The existing and projected traffic volumes are the basis of the proposed typical sections. Construction cost estimates were completed for both the proposed interim and ultimate road sections.



ULTIMATE TYPICAL SECTION
(WIDEN TO INSIDE)
US 24 TO WOODMEN ROAD



INTERIM TYPICAL SECTION
(NO ACTION)
US 24 TO WOODMEN ROAD

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

MERIDIAN ROAD (NORTH) IMPROVEMENTS

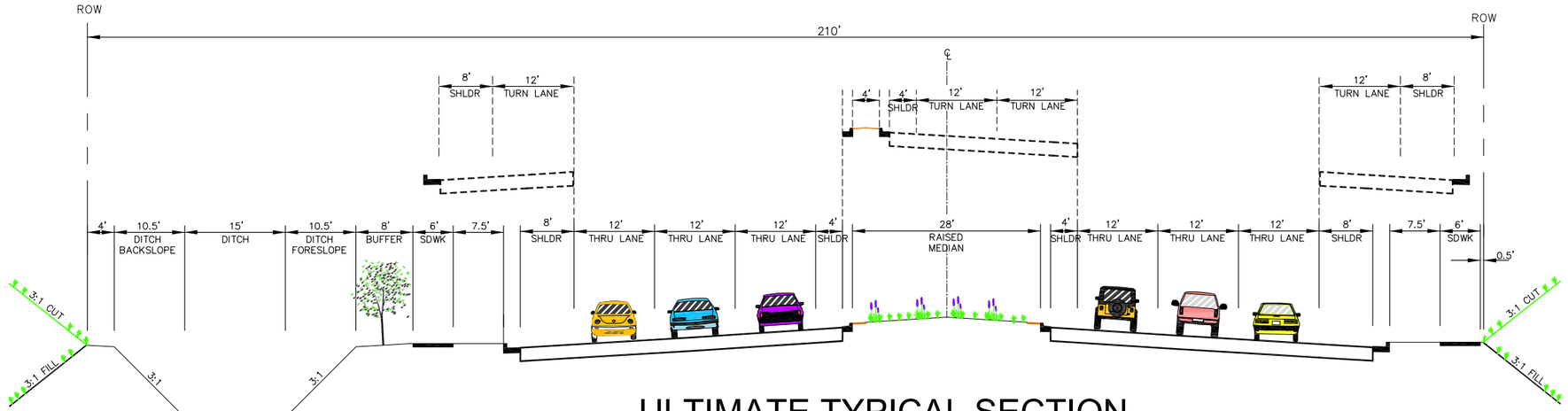
URS

ORIGINAL SCALE

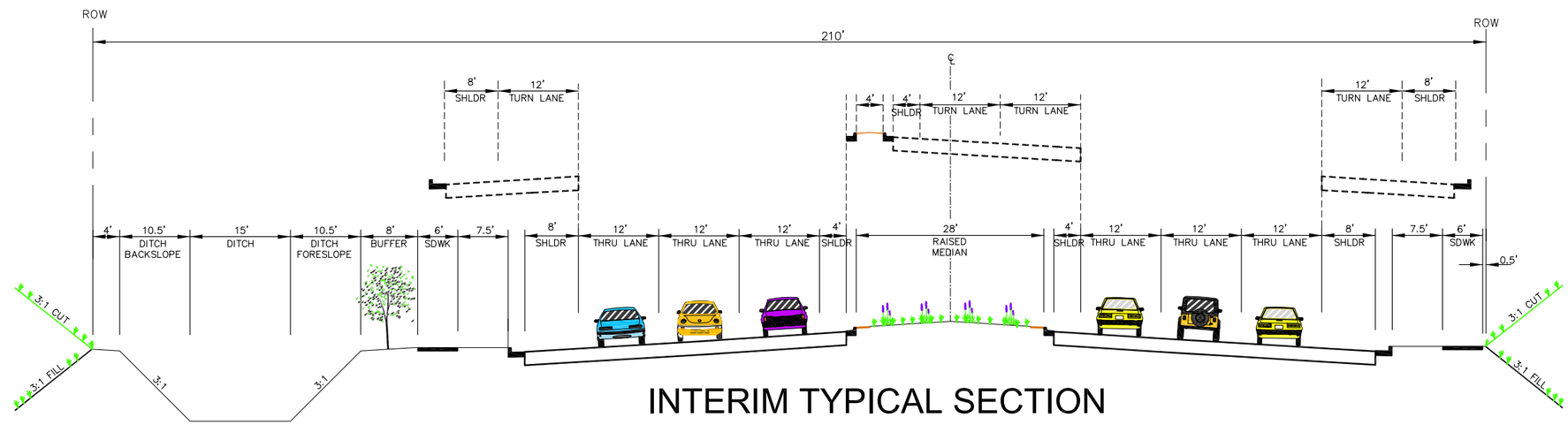
0 5 10 20 40

MERIDIAN ROAD (NORTH) TYPICAL SECTIONS

FIGURE 9-1



ULTIMATE TYPICAL SECTION
(BUILD 6-LANE URBAN SECTION, OVERLAY NB)
WOODMEN ROAD TO WOODMEN HILLS DRIVE



INTERIM TYPICAL SECTION
(BUILD FULL ULTIMATE SECTION)
WOODMEN ROAD TO WOODMEN HILLS DRIVE

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

MERIDIAN ROAD (NORTH) IMPROVEMENTS

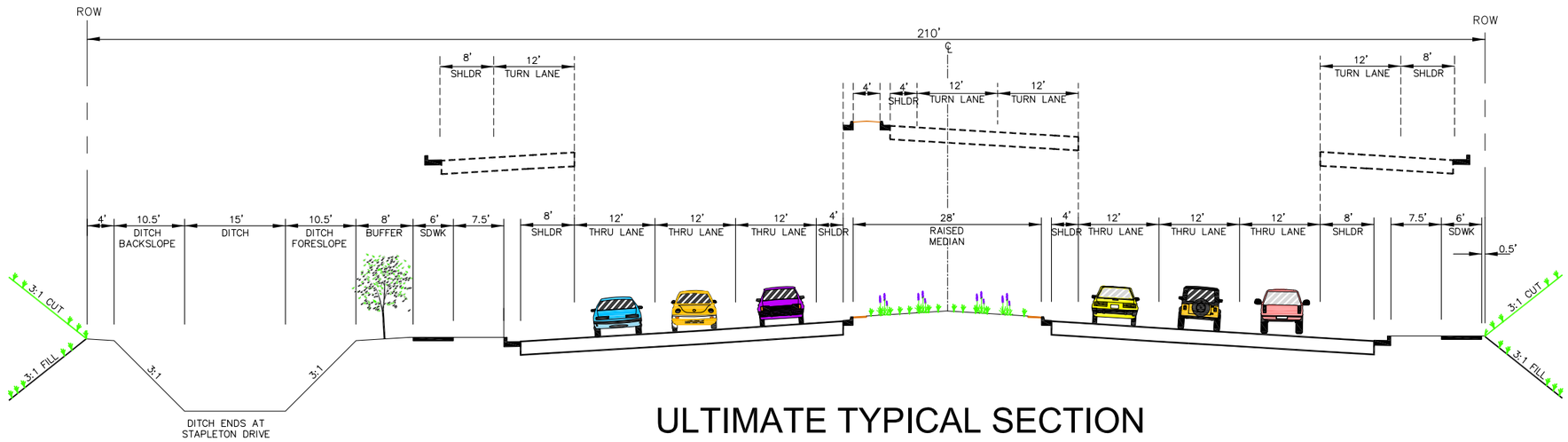
URS

ORIGINAL SCALE

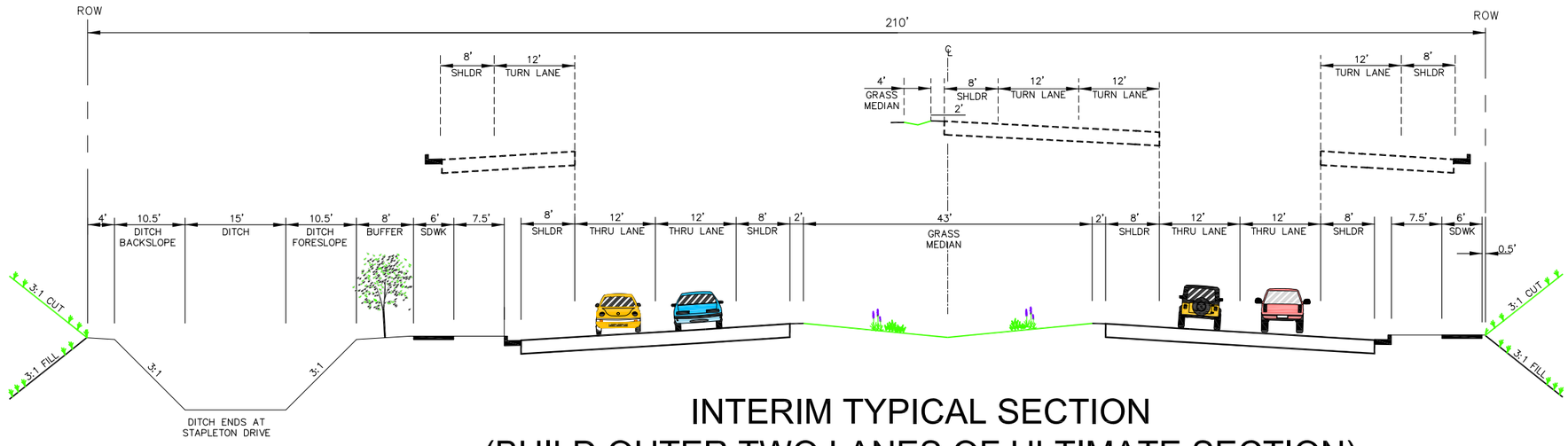
0 5 10 20 40

MERIDIAN ROAD (NORTH)
TYPICAL SECTIONS

FIGURE 9-2



ULTIMATE TYPICAL SECTION
(BUILD 6-LANE URBAN SECTION, OVERLAY NB TO STAPLETON DRIVE)
WOODMEN HILLS DRIVE TO REX ROAD



INTERIM TYPICAL SECTION
(BUILD OUTER TWO LANES OF ULTIMATE SECTION)
WOODMEN HILLS DRIVE TO REX ROAD

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

MERIDIAN ROAD (NORTH) IMPROVEMENTS

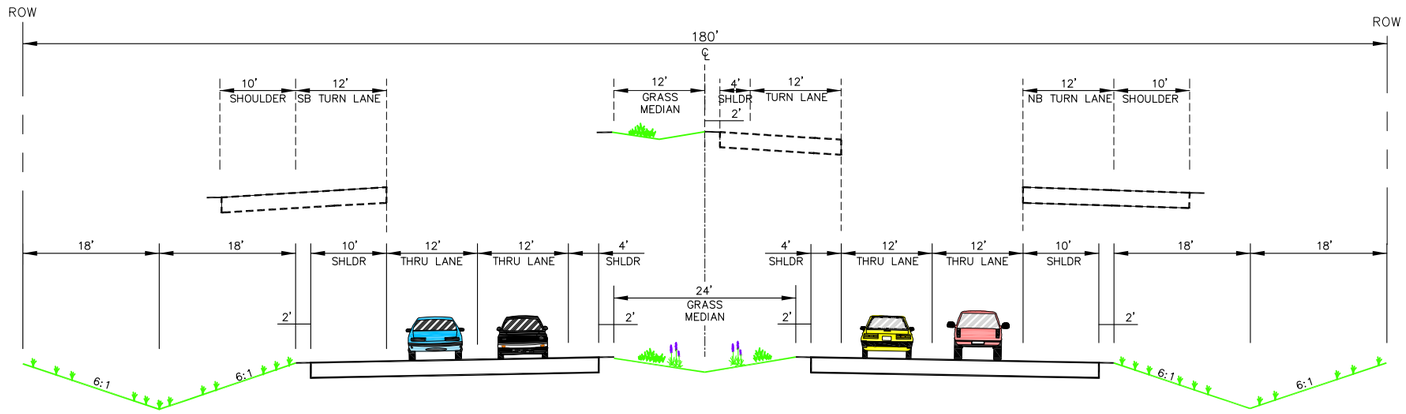
URS

ORIGINAL SCALE

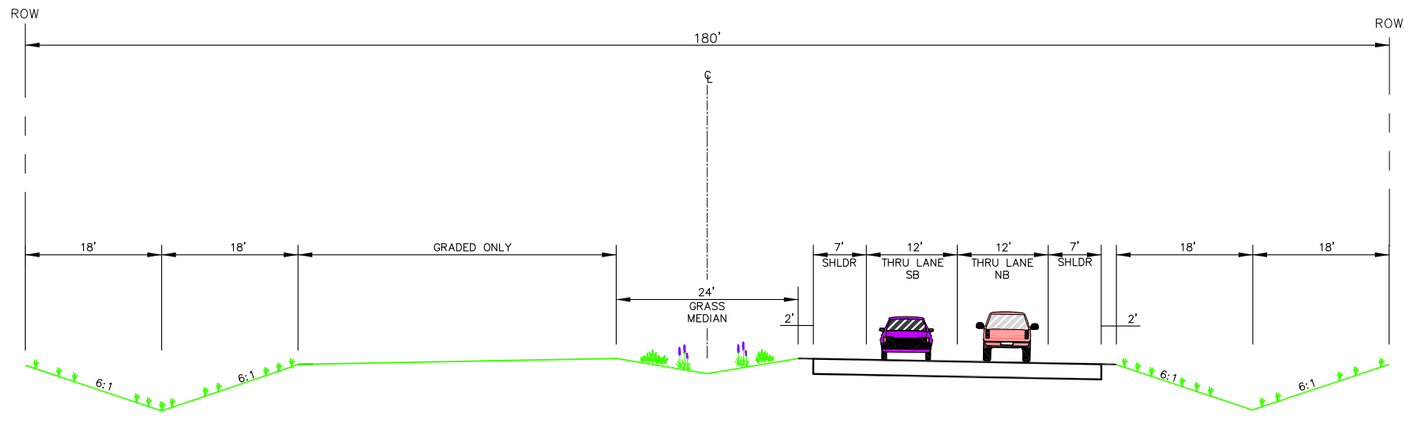
0 5 10 20 40

MERIDIAN ROAD (NORTH) TYPICAL SECTIONS

FIGURE 9-3



ULTIMATE TYPICAL SECTION
(BUILD 4-LANE RURAL SECTION)
REX ROAD LATIGO ROAD



INTERIM TYPICAL SECTION
(GRADE ULTIMATE SECTION, PAVE NB ONLY)
REX ROAD TO LATIGO ROAD

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

MERIDIAN ROAD (NORTH) IMPROVEMENTS

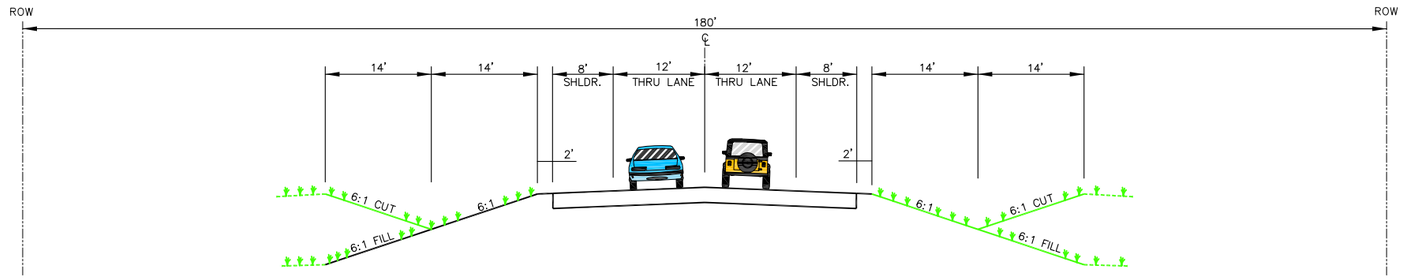
URS

ORIGINAL SCALE

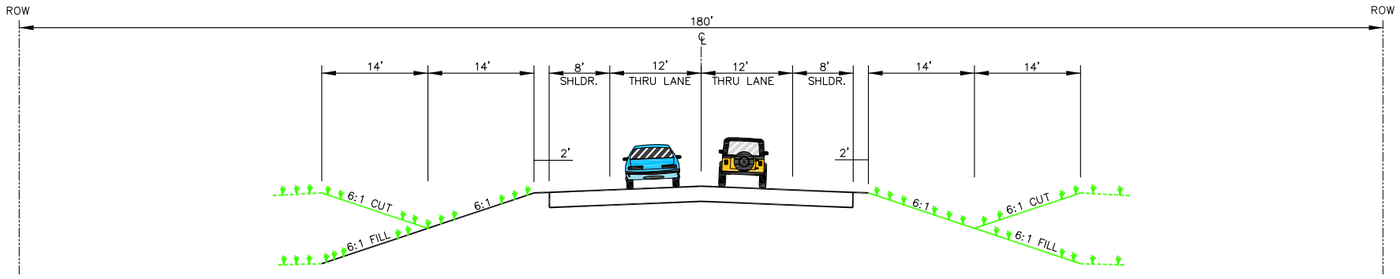
0 5 10 20 40

MERIDIAN ROAD (NORTH) TYPICAL SECTIONS

FIGURE 9-4



ULTIMATE TYPICAL SECTION
(BUILD 2-LANE RURAL SECTION)
LATIGO ROAD TO HODGEN ROAD



INTERIM TYPICAL SECTION
(BUILD FULL ULTIMATE SECTION)
LATIGO ROAD TO HODGEN ROAD

EL PASO COUNTY DEPARTMENT OF TRANSPORTATION

MERIDIAN ROAD
(NORTH) IMPROVEMENTS

URS

ORIGINAL SCALE
0 5 10 20 40

MERIDIAN ROAD (NORTH)
TYPICAL SECTIONS

FIGURE 9-5

8.6 Cost Estimates

Estimated costs for improvements to Meridian Road were calculated in 1,000 ft increments and totaled for the entire corridor length. Subcategories included pavement, earthwork, drainage, right-of-way and easements, and utility costs. A 15% contingency was added to each category to cover incidental costs such as striping, signage, temporary erosion control, and access relocations. Due to the significant possibility of utility conflicts, the cost estimate includes a $250,000 utility force account to address additional mitigation. Costs are detailed for the interim and ultimate recommended typical sections, though they may be equal for a subcategory in some segments. As shown in Figure 10, the total project cost for the interim road section is estimated at $57.2 million. The estimated total project cost for the ultimate condition is $63 million.

Figure 11 shows the estimated project cost for the interim road section by 1,000 ft segments along the entire corridor. Figure 12 presents the same information for the ultimate road section.