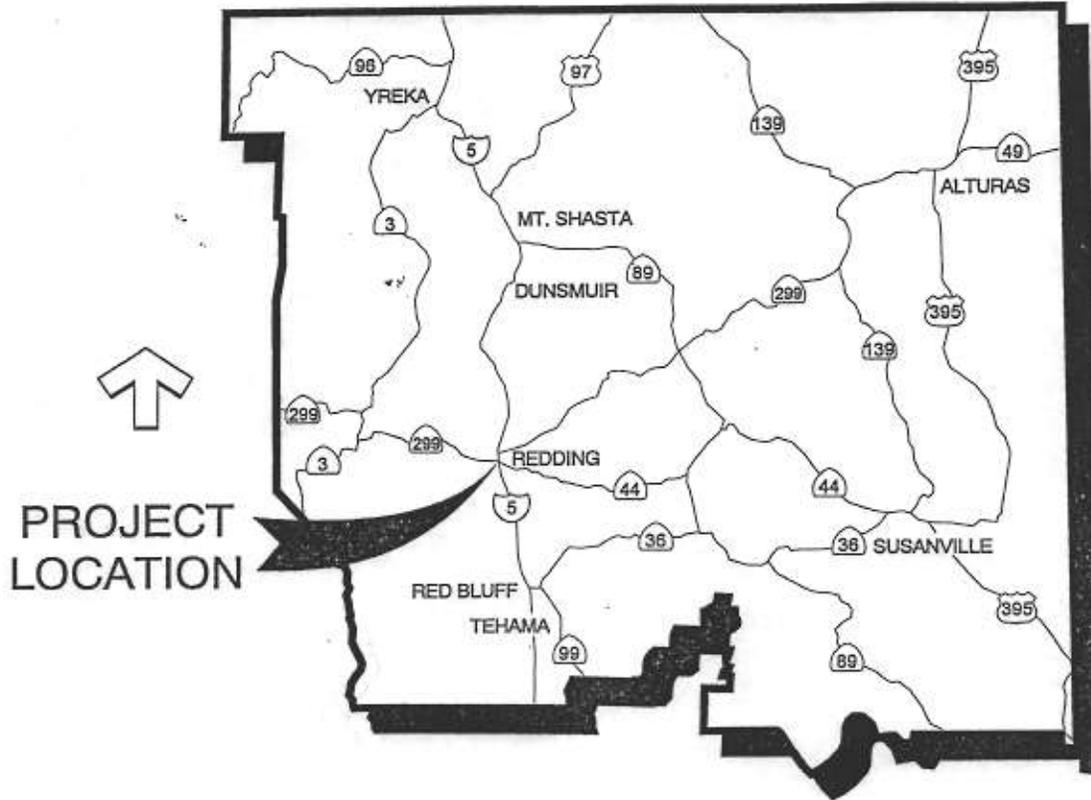


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**Project Study Report (PSR) – Interstate 5 Knighton Road Interchange**

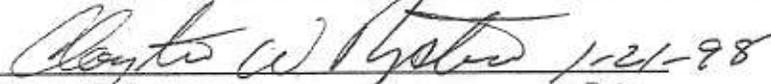
# PROJECT STUDY REPORT

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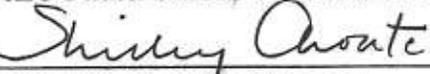


## On Route 5 In Shasta County, Knighton Road Interchange Modification and Extension of Knighton Road from Churn Creek Road/Pacheco Road East to Airport Road

I have reviewed the right of way information contained in this Project Report and the R/W Data Sheet attached hereto, and find the data to be complete, current, and accurate:

  
Clayton W. Nystrom  
North Region Division Chief  
Right of Way  
Date 1-21-98

### RECOMMENDED FOR APPROVAL BY:

  
Shirley Choate, Project Manager  
Date 1-27-98

### APPROVED BY:

  
Roy Bushey, District Director  
District 2  
Date 1-28-98

**REPORT SIGNATURE SHEET**

**PREPARED BY:**

This Project Study Report has been prepared under the direction of the following Registered Engineer. The registered Civil Engineer attests to the technical information contained herein and has judged the qualifications of any technical specialists providing engineering data upon which recommendations, conclusions, and decisions are based.

Joseph W. Weiland  
Joseph W. Weiland, P.E. (OMNI-MEANS)  
Registered Civil Engineer

12/18/97  
Date

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12-19-97  
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## 1. INTRODUCTION

This Project Study Report (PSR) was prepared to evaluate both operational and capacity improvements for the Knighton Road/Interstate 5 interchange located at KP 15.76 (PM 9.77) and the extension of Knighton Road from Churn Creek Road east approximately 2.63 kilometers (1.63 miles) to Airport Road in Shasta County. **Attachment 1** shows the project location. The proposed improvements will be required to meet increased traffic demands from future development and the proposed extension of Knighton Road east to Airport Road. Eight (8) interchange improvement alternatives have been developed which range from widening the existing structure and signalizing the ramps to realignment of Knighton Road with a new partial clover-leaf interchange. One alignment alternative was developed for the extension of Knighton Road as a four lane divided arterial east to Airport Road. Buildout costs for constructions and right of way for the interchange alternatives range from \$5.07 million (Alternative A) to \$16.00 million (Alternative C-3). Buildout construction and right of way costs for the extension of Knighton Road was estimated to cost \$10.44 million. Copies of all cost estimates are included in **Attachment 2**.

Three (3) project development phases have been identified with buildout of the interchange improvements and buildout of the Knighton Road extension representing Phase 3 and with Phase 3 representing post-2020 improvements. Phase 2 represents improvements to the Knighton Road/Interstate 5 interchange needed through the year 2020 at an estimated cost of \$4.58 million for construction and right of way. Phase 1 represents improvements needed through the year 2010 and include the extension of Knighton Road east to Airport Road as a two-lane divided arterial plus improvements to the existing section of Knighton Road between the northbound Interstate 5 off-ramp intersection east to Churn Creek Road. The "Project Component Costs" for Phase 1 are as follows:

Environmental	\$100,000
Design Engineering	\$603,000
R/W Engineering/Support	\$25,000
Right of Way	\$402,000
Construction	\$6,654,000
Construction Engineering	\$407,000
<b>TOTAL</b>	<b>\$8,191,000</b>

The County of Shasta and the City of Redding are the Lead Agency. Funding is anticipated through Local Agencies using traffic mitigation fees and State Transportation Improvement Plan (STIP) funds.

## 2. BACKGROUND

Knighton Road at the interchange is a two-lane arterial road, 9.8 meters (32 feet) wide, in a sparsely populated area. Adjacent land use is predominately agricultural and light commercial, which includes a commercial truck stop in the southeast quadrant. Knighton Road extends 1.3 km west of Interstate 5 and

0.3 km to the east where it converges with Churn Creek Road. The Knighton Road interchange is a compact diamond interchange (Type L-1) constructed in 1963. **Attachment 3** shows the existing interchange facility. There is a distance of 305 meters between the northbound and southbound ramp termini. This section of Interstate 5 is a 4 lane divided freeway with a 25.6-meter median. Key features of this interchange include:

- No left-turn lanes on the overcrossing to Interstate 5 off-ramps.
- Stop sign controls at ramp intersections, Riverland Drive/Knighton Road intersection, and Churn Creek/Knighton Road intersection.
- Riverland Drive/Knighton Road intersection is located approximately 30 meters west of the Interstate 5 southbound ramp intersection.
- Knighton Road/Churn Creek Road intersection is located approximately 245 meters east of the Interstate 5 northbound ramp intersection.
- Existing approach profile grade to the overpass is eight percent, with a vertical alignment of 50 kph design speed.
- The width on Knighton Road between the northbound ramp intersection and Churn Creek Road is inadequate for turning movements into the truck stop's first driveway.
- A pedestrian sidewalk is located on the south side of the Knighton Road overcrossing.

The Knighton Road interchange has a high volume of trucks due to a truck stop facility located just east of the interchange and south of Knighton Road. A rehabilitation project in 1985 replaced the AC pavement with PCC pavement on the ramps, approaches to the overcrossing, and Knighton Road in front of the truck stop. This project corrected severe wheel rutting in the AC pavement generated by the heavy truck traffic.

In April, 1991 the City of Redding requested Caltrans to initiate a Project Study Report. At that time, the City of Redding identified the Knighton Road interchange as the third highest priority of interchanges in the County. All of the interchange alternatives with the exception of Alternative A-1 was prepared by Caltrans in response to the City's request and was presented in a "Design Study Report (DSR)" which is used extensively in this PSR. This DSR was included in the "Shasta County Interchange Improvement Study" (SCIIS) which evaluated 17 interchanges in Shasta County.

The proposed Knighton Road extension has been identified in the "Shasta County General Plan Circulation Element" and in the "Redding Municipal Airport Specific Plan" adopted by the County, City of Anderson and City of Redding as a necessary improvement. The proposed Knighton Road extension alignment was identified in the "Knighton Road Extension Plan Line Alignment Study" (Draft, August 1991) prepared for the County in cooperation with the City of Redding. A copy of this study is included in **Attachment 4**. The alignment extends for approximately 2.63 kilometers (1.63 miles) from Churn Creek/Pacheco Road to a point of intersection with Airport Road - Airport Road essentially parallels Interstate 5. The proposed

alignment is through currently undeveloped land that has traditionally been used for agricultural uses. The alignment also crosses both Churn Creek and Clover Creek.

### 3. NEED AND PURPOSE

**Traffic Data:** Caltrans 1996 Traffic Volumes publication indicates that the Average Annual Daily Traffic (AADT) for Interstate 5 south of Knighton Road was 41,000 and 41,500 AADT to the north. Based on an Operational Study of the interchange and adjacent intersections prepared for Shasta County and Caltrans in 1992, the Knighton Road interchange operated satisfactory with Level of Service (LOS) "C". The adjacent intersections also operated well with LOS A. Existing traffic volume data was also provided in the "Knighton Road Extension Traffic Analysis" (March, 1991) prepared in support of the Plan Line Alignment Study (**Attachment 4**). This study indicated that Knighton Road just east of the interchange had 5,000 AADT, Churn Creek Road just to the east of Pacheco Road had 4,200 AADT, Meadow View Drive just to the east of Churn Creek Road had 2,540 AADT, Rancho Road had an AADT of 3,800 vehicles, and Airport Road had an AADT that varied from 8,300 vehicles just south of Rancho Road to 7,100 vehicles just north of Meadow View Drive. **Attachment 5**, Figure 2 illustrates the existing traffic volumes. This study also indicated that the existing peak hour intersection Levels of Service along Airport Road at Rancho Road, Knighton Road and Meadow View Drive were at LOS A.

Year 2020 traffic projections with the existing Knighton Road Interchange and without the extension of Knighton Road east to Airport Road were obtained from the current Shasta County Travel Demand Model. This condition was assumed to represent the base condition. The model shows that Interstate 5 is projected to have 69,100 AADT south of Knighton Road and 72,500 AADT to the north. These projections represent a 69% to 75% increase respectively in freeway traffic over current traffic levels. The model also shows that Knighton Road just east of the interchange has 16,500 AADT (230% increase), Churn Creek Road just to the east of Pacheco Road has 7,250 AADT (73% increase), Meadow View Drive just to the east of Churn Creek Road has 4,400 AADT (4% increase), Rancho Road has an AADT of 17,700 vehicles (366% increase), and Airport Road had an AADT that varied from 23,500 vehicles (183% increase) just south of Rancho Road to 19,400 vehicles (173% increase) just north of Meadow View Drive. **Attachment 5**, Figure 3 illustrates these daily traffic projections.

Year 2020 PM peak hour intersection turning movement volumes were also obtained from the model and are shown in **Attachment 5**, Figure 3. The following table presents projected year 2020 PM peak intersection Levels of Service based on these volumes. Intersection geometrics and control assumed in the Knighton Road Extension Plan Line Alignment Study, "No Project Buildout" conditions were assumed for this scenario. As shown in the table, Level of Service "F" operations are projected at the two unsignalized ramp intersections based on the current intersection geometrics and control. Level of Service "D" operations would be projected at the Rancho Road intersection with Airport Road under this scenario. This intersection is within the City of Redding which recognizes LOS "C" or better as their Level of Service standard.

YEAR 2020 BASE  
PM PEAK HOUR  
LEVELS OF SERVICE (LOS)

Intersection	Control	LOS	Delay
Knighton Rd/I-5 SB Ramps	stop sign	F	743.1 sec. total intersection delay
Knighton Rd/I-5 NB Ramps	stop sign	F	76.7 sec. total intersection delay
Knighton Rd/Churn Cr Rd/Pacheco Rd	traffic signal	C	18.3 sec/veh
Meadow View Dr/Airport Rd	traffic signal	C	17.0 sec/veh
Knighton Rd/Airport Rd	traffic signal	B	9.0 sec/veh
Rancho Rd/Airport Rd	traffic signal	D	27.2 sec/veh

**Accident Data:** The following accident data was presented in a TASAS Table B report for the three year period between September 1, 1994 through August 31, 1997 for the segment of Interstate 5 between KP R14.68 and R16.29. The accident data shown in TASAS Table B follows:

INTERSTATE 5		ACCIDENT RATE - ACCS PER MV					
		ACTUAL			AVERAGE		
K I L O M E T E R	TOTAL ACCIDENT	FAT	F+I	TOTAL	FAT	F+I	TOTAL
POST (KP)							
R14.68-R16.29	10	.000	.09	.22	.006	.24	.59

As shown in the table, the actual accident rates on mainline Interstate 5 were lower than the average rates.

**Area Plans:** In the development of the "Redding Municipal Airport Master Plan", specific airport access and emergency response requirements were based on surrounding land use and facilities. This master plan recognized the regional importance of the Redding Municipal Airport as the primary air transportation center for passengers and freight not only for Shasta County and the City of Redding, but also for adjacent counties and cities in Northern California. The primary surface transportation corridor to access the airport is Interstate 5. The current routes to the airport from Interstate 5 are either via Knighton Road to Churn Creek Road to Meadow View Drive to Airport Road, or Churn Creek Road to Rancho Road to Airport Road. As an alternative route, the master plan states that a direct relationship between primary air and surface systems can be attained by maximizing the existing Knighton Road Interchange at Interstate 5, and by extending Knighton Road to the entrance to the airport.

## 4. ALTERNATIVES

**Interchange Alternatives:** Five design concepts which included seven alternatives were presented in the DSR for Interstate 5/Knighton Road interchange. These alternatives included Alternatives A, B, C-1, C-2, C-3, D and E and are included in this report. One additional alternative which builds on the Alternative A concept (Alternative A-1) has been developed and is also included in this report. The concepts include:

- Improve the existing facilities.
- Construct a new overcrossing on the existing alignment.
- Construct a new interchange with a partial clover leaf configuration (Type L-9) north of the existing overcrossing.
- Construct a new trumpet interchange (Type L-11).
- Utilize existing overcrossing and construct an additional overcrossing to the north.

The alternatives presented in the following discussion represent concepts developed in their respective studies to facilitate buildout traffic conditions. The alternatives are as follows:

### NO BUILD ALTERNATIVE

This alternative does not include any capacity improvements to the interchange. Eventually the ramp intersections would be converted into three-way stops initially, and then signalized intersections when justified by traffic volumes.

### ALTERNATIVE A

This alternative proposes improving the existing interchange by widening the overcrossing and ramps to include additional lanes (the northbound off-ramp would be realigned to the west to align with the entrance to the northbound on-ramp) and signalizing the ramps and frontage roads (**Attachment 6, Attachment 6a**).

### ALTERNATIVE A-1

Alternative A-1 (**Attachment 6, Attachment 6b**) proposes improving the existing interchange by widening the overcrossing and the northbound ramps to include additional lanes. The existing southbound ramps would be realigned to the west and a loop on-ramp is included in the northwest quadrant. Riverland Drive would be realigned to intersect Knighton Road 150 meters west of the existing intersection. Both ramp intersections would be signalized.

## **ALTERNATIVE B**

Alternative B replaces the existing overcrossing with a partial cloverleaf interchange. The alignment of Knighton Road would remain in the same location with the new overcrossing providing a 75 kph design speed. The existing northbound off-ramp and southbound off-ramp would be realigned. A loop on-ramp is included in the northwest quadrant. Riverland Drive would be realigned to intersect Knighton Road 150 meters west of the existing intersection (**Attachment 6, Attachment 6c**).

## **ALTERNATIVE C-1**

Alternative C-1 proposes a new overcrossing with a 75 kph design speed on the existing Knighton Road alignment. Each of the existing ramps would be relocated, and loop on-ramps constructed in the northwest and southwest quadrants. Riverland Drive would be realigned to intersect Knighton Road about 150 meters west of the existing intersection (**Attachment 6, Attachment 6d**).

## **ALTERNATIVE C-2**

This alternative includes realigning Knighton Road to the north and constructing a new overcrossing with a 75 kph design speed, realigning all existing ramps and place loop on-ramps in northwest and southeast quadrants, and realigning Riverland Drive to intersect Knighton Road 150 meters west of the existing intersection (**Attachment 6, Attachment 6e**).

## **ALTERNATIVE C-3**

Alternative C-3 proposes realigning Knighton Road to the north intersecting Churn Creek Road 55 meters north of the existing intersection, constructing a new overcrossing with a 75 kph design speed, realigning all existing ramps, placing loop on-ramps in northwest and southeast quadrants, and realigning Riverland Drive to intersect Knighton Road about 150 meters west of the existing intersection (**Attachment 6, Attachment 6f**).

## **ALTERNATIVE D**

This alternative proposes a modified trumpet configuration similar to a Type L-9 interchange. This alignment provides unrestricted access from southbound Interstate 5 to eastbound Knighton Road. A new overcrossing would be constructed north of the existing overcrossing. This configuration would require all new ramps. The northeast and southwest quadrants would include diamond ramps and the northwest and southeast quadrants would include loop and diamond ramps. The west end of Knighton Road would need to be realigned to the north intersecting the southbound off-ramp at a T-intersection. Riverland Drive would be realigned to intersect Knighton Road to the west (**Attachment 6, Attachment 6g**).

## **ALTERNATIVE E**

This alternative proposes utilizing the existing overcrossing for eastbound traffic and constructing a parallel structure to the north for westbound traffic. All of the existing ramps would be relocated. The vertical

alignment for the approaches to the existing overcrossing would be realigned. Riverland Drive would be realigned to intersect Knighton Road 150 meters west of the existing intersection (Attachment 6, Attachment 6h).

The following table was prepared to present both the advantages and disadvantages associated with each interchange alternative:

**INTERCHANGE ALTERNATIVES  
COMPARISONS**

ALT	ADVANTAGES	DISADVANTAGES
NO BLD	<ol style="list-style-type: none"> <li>1. Low cost.</li> <li>2. No Right of Way required.</li> </ol>	<ol style="list-style-type: none"> <li>1. Restricted capacity in future.</li> <li>2. Does not address turning problem into truck stop.</li> <li>3. Does not address deficient design speed.</li> </ol>
A	<ol style="list-style-type: none"> <li>1. Minimal new right of way required.</li> <li>2. Insignificant affects to truck stop infrastructure.</li> </ol>	<ol style="list-style-type: none"> <li>1. Does not address turning problem into truck stop.</li> <li>2. Perpetuates deficient design speed on overcrossing.</li> <li>3. Does not allow for future loop on-ramps in northwest and southeast quadrants.</li> </ol>
A-1	<ol style="list-style-type: none"> <li>1. New right of way required only in the northwest and southwest quadrants.</li> <li>2. Insignificant affects to truck stop infrastructure and proposed tourist complex.</li> <li>3. Improves westbound to southbound traffic.</li> </ol>	<ol style="list-style-type: none"> <li>1. Does not address turning problem into truck stop.</li> <li>2. Perpetuates deficient design speed on overcrossing.</li> <li>3. Does not allow for future loop on-ramp in southeast quadrant.</li> <li>4. Requires acquisition of 5 houses in northwest quadrant.</li> </ol>
B	<ol style="list-style-type: none"> <li>1. New right of way required only in northwest quadrant.</li> <li>2. No significant effects on truck stop.</li> <li>3. Improves westbound to southbound traffic.</li> <li>4. Improves vertical profile.</li> </ol>	<ol style="list-style-type: none"> <li>1. Steep driveway grades into truck stop inhibits turn movements of trucks.</li> <li>2. Requires acquisition of 5 houses in northwest quadrant.</li> <li>3. The weave section between the northbound off-bound and truck stop is undesirably short at buildout.</li> <li>4. Does not allow for future loop on-ramp in southeast quadrant.</li> </ol>
C-1	<ol style="list-style-type: none"> <li>1. Excellent high capacity interchange.</li> <li>2. Adaptable to future development of Knighton Road.</li> </ol>	<ol style="list-style-type: none"> <li>1. Severely encroaches on truck stop and requires acquisition of 5 houses in northwest quadrant.</li> <li>2. Removal of the truck stop would eliminate much of the need for interchange improvements.</li> </ol>
C-2	<ol style="list-style-type: none"> <li>1. High capacity interchange without impacting the truck stop.</li> <li>2. Addresses turning movement problems into the truck stop.</li> <li>3. Four-lane OC in build-out.</li> <li>4. Flexibility allows for future additional lanes.</li> </ol>	<ol style="list-style-type: none"> <li>1. Requires substantial R/W (6.3 ha) and requires acquisition of 5 houses in northwest quadrant.</li> </ol>
C-3	<ol style="list-style-type: none"> <li>1. High capacity interchange requiring four-lane OC in buildout.</li> <li>2. In provides the best service along Knighton Road with the reconfigured truck stop driveway. Solves truck turning movement problem.</li> <li>3. Flexibility allows for future additional lanes.</li> </ol>	<ol style="list-style-type: none"> <li>1. Requires substantial R/W (6.8 ha) and acquisition of 5 houses in northwest quadrant.</li> </ol>

ALT	ADVANTAGES	DISADVANTAGES
D	<ol style="list-style-type: none"> <li>1. High capacity interchange.</li> <li>2. Flexibility allows for future additional lanes.</li> <li>3. Provides best LOS for southbound to eastbound traffic.</li> </ol>	<ol style="list-style-type: none"> <li>1. Requires substantial R/W (5.2 ha) and requires acquisition of 5 houses in northwest quadrant.</li> <li>2. Low LOS for east/west traffic if Knighton Road is extended east to Route 273.</li> <li>3. Increased accident potential.</li> </ol>
E	<ol style="list-style-type: none"> <li>1. Retains existing overcrossing and provides good capacity.</li> <li>2. Allows for addition of future lanes.</li> <li>3. Improves vertical profile for approaches to existing overcrossing.</li> <li>4. Provides room for future loop on-ramp in the southeast quadrant of the interchange.</li> </ol>	<ol style="list-style-type: none"> <li>1. Requires substantial R/W (4.7 ha) and requires acquisition of 5 houses in northwest quadrant.</li> <li>2. Undesirably short tangent which requires a design exception.</li> <li>3. Non-conventional interchange does not meet drivers expectations, especially tourists.</li> <li>4. Multiple horizontal curves on Knighton Road.</li> <li>5. Undesirable horizontal curves through ramp intersection.</li> </ol>

***Knighon Road Extension Alternative:*** The "Knighon Road Extension Plan Line Alignment Study" (Attachment 4) evaluated and identified an alignment for the extension of Knighton Road as an ultimate four lane divided arterial facility from the existing Knighton Road intersection with Churn Creek Road/Pacheco Road east to Airport Road. Attachment 8, Attachment 8a to 8g illustrates the proposed roadway alignment and improvements. Modifications to Knighton Road between the northbound ramps and the Churn Creek Road/Pacheco Road intersection would be required. Churn Creek Road would also be realigned to intersect the new roadway approximately 0.86 Kilometers (0.53 miles) feet to the east of the current Churn Creek Road/Pacheco Road intersection. Traffic signals would be provided at the Knighton Road intersections with Churn Creek Road/Pacheco Road, Churn Creek Road and Airport Road.

Construction of the proposed Knighton Road extension will require providing new bridge structures over both Churn Creek and Clover Creek. Channel enhancements may be required both upstream and downstream of both the new Churn Creek bridge and the new Clover Creek bridge. An Advance Planning Study (APS) has been prepared for both creek crossings and is included in Attachment 9. The APS determined that a structure approximately 93 meters long by 23.6 meters wide (305 feet long by 77.5 feet wide) would be required over Churn Creek and a structure approximately 61 meters long by 26.8 meters wide (200 feet long by 88 feet wide) would be required over Clover Creek. Two lateral structures will also be provided to cross ACID canal laterals and is included in the APS.

The proposed extension of Knighton Road from Churn Creek/Pacheco Road east to Airport Road will require acquiring approximately 7.3 ha (17.9 acres) of new right of way. A right of way data sheet is included in Attachment 10. There are no structures involved in the required right of way. The estimated cost for construction and right of way is \$10,440,000.

#### ANALYSIS OF PROPOSAL

*The following interchange alternatives were considered to be the most viable:*

*Alternative A* - This alternative proposes utilizing the existing Knighton Road alignment and the existing Knighton Road overcrossing. The ultimate concept would include a five-lane overcrossing, two lanes on each ramp, signalization of the ramps and adjacent intersections, and relocation of Riverland Drive to the west. This alternative would need to be constructed in a single phase. Alternative A would require the acquisition of 0.2 ha (0.5 acres) of right of way. A right of way data sheet is included in **Attachment 10**. This alternative is estimated to cost \$5,070,000 for construction and right of way.

Alternative A would require a mandatory design exception for the design speed due to the vertical alignment of the existing overcrossing. The current design speed is 50 kph while the required design speed is 70 kph. A Fact Sheet has been prepared to address this mandatory design exception and submitted to Caltrans.

Alternative A also does not provide room for future loop-on ramps in either the northwest or southeast quadrants.

*Alternative A-1* - This alternative proposes utilizing the existing Knighton Road alignment and the existing Knighton Road overcrossing. The ultimate concept would include a five-lane overcrossing, construction of a loop on-ramp in the northwest quadrant, realignment of the southbound and northbound off-ramps to the west, two lanes on the northbound on and off ramps, two lanes on the southbound off-ramp, signalization of the ramps, and relocation of Riverland Drive to the west. Alternative A-1 would require the acquisition of 1.13 ha (2.80 acres) of right of way. A right of way data sheet is included in **Attachment 10**. At buildout, this alternative is estimated to cost \$6,881,000 for construction and right of way.

This alternative could be constructed in two stages. Stage 1 construction would consist of relocation of the northbound and southbound off-ramps to the west, construction of two lanes on the northbound on and off ramps and on the southbound off-ramp, construction of the loop on-ramp in the northwest quadrant, signalization of the ramp intersections and relocation of Riverland Drive. This stage would require acquiring 1.13ha (2.80 acres) and five residences. Stage 1 is estimated to cost \$4,576,000 for construction and right of way. Stage 2 represents buildout of the Alternative A-1 interchange improvements.

Similar to Alternative A, Alternative A-1 would require a mandatory design exception for the design speed due to the vertical alignment of the existing overcrossing. The current design speed is 50 kph while the required design speed is 70 kph. The Fact Sheet prepared to address this mandatory design exception for Alternative A addresses this issue.

Alternative A-1 also does not provide room for future loop-on ramps in southeast quadrant.

*Alternative C-2* - This alternative proposes a high capacity partial cloverleaf interchange (Type 1-9 configuration) north of the existing overcrossing. Constructing the new overcrossing north of the existing structure and extending the northbound off-ramp will allow the northbound loop on-ramp to be constructed with minimal right of way from the truck stop. The ultimate interchange is anticipated to include a four-lane overcrossing with 75 kph design speed, northbound and southbound loop on-ramps, realigned spread diamond ramps in each quadrant, signalization of the ramps, and relocation of Riverland Drive to the west.

The preferred design of Knighton Road would include a raised median barrier to restrict left turn movements into the Truck Stop and proposed tourist center. The main access to these facilities would be from Churn Creek/Pacheco Road. The proposed Alternative C-2 improvements would require acquiring 6.3 ha (15.6 acres) of additional right of way which includes six residences and one sheriff's substation. A copy of the right of way data sheet is included in **Attachment 10**. Buildout of this alternative is estimated to cost \$15,300,000 for construction and right of way.

Stage 1 construction would consist of a new four-lane overcrossing structure, a loop on-ramp in the northwest quadrant, realignment of the on-ramp and off-ramp, and removal of the existing overcrossing structure. All new right of way would be acquired during this stage. Stage 1 is estimated to cost \$14,500,000 for construction and right of way.

Stage 2 includes additional lanes for the overcrossing and ramps, a loop on-ramp in the southeast quadrant, and signalizing Knighton Road ramps and Riverland Drive intersections. Stage 2 is estimated to cost \$800,000 for construction.

*Alternative C-3* - This alternative is similar to Alternative C-2 except that Knighton Road is tangent between Interstate 5 and Churn Creek Road. This proposed alignment is parallel to the existing alignment 55 meters to the north. The proposed Alternative C-3 improvements would require acquiring 6.8 ha (16.9 acres) of additional right of way which includes six residences and one sheriff's substation. A copy of the right of way data sheet is included in **Attachment 10**. Buildout of this alternative is estimated to cost \$16,000,000 for construction and right of way with \$15,200,000 estimated for Stage 1 and \$800,000 estimated for Stage 2.

The following table presents a summary of the project costs for each viable alternative. The table includes not only the construction costs and right of costs but also gives an estimate of for engineering (design, right of way and construction) costs.

**ESTIMATED COSTS FOR VIABLE INTERCHANGE ALTERNATIVES**

ALTERNATIVE: STAGE	ENGINEERING COST (\$10 <sup>6</sup> )	CONSTRUCTION COST (\$10 <sup>6</sup> )	RIGHT OF WAY COST (\$10 <sup>6</sup> )	TOTAL COST (\$10 <sup>6</sup> )
A: Complete	1.60	4.70	0.37	6.67
A-1: Stage 1	0.95	2.63	1.95	5.53
Stage 2	0.85	2.31	0.00	3.16
C-2: Stage 1	1.80	7.30	7.20	16.30
Stage 2	0.28	0.80	0.00	1.08
C-3: Stage 1	1.80	7.30	7.90	17.00
Stage 2	0.28	0.80	0.00	1.08

The DSR which evaluated Alternatives A, C-2 and C-3 used year 2020 traffic projections available from the then current City of Redding traffic model. The new Shasta County Travel Demand Model was used for the Knighton Road extension evaluations and for determining the needed interchange improvements through the year 2020. A comparison of the interchange volumes between the previous year 2020 traffic projections and the projections from the current traffic model indicated that the previous model consistently projected higher volumes. During the PM peak hour for example, interchange ramp volumes from the previous traffic model were 2% higher on the northbound on-ramp, 9% higher on the southbound off-ramp, 69% higher on the northbound off-ramp and 124% higher on the southbound on-ramp. Because these alternatives were designed for the higher traffic projections, the buildout phase for these alternatives represent improvements that would serve a post-2020 traffic condition. In addition, because the Alternative A-1 improvements are similar in scope, buildout of this alternative would also represent improvements that would serve a post-2020 traffic condition.

The following table presents projected Levels of Service consistent with service levels and based on the traffic projections presented in the DSR. As such, the indicated service levels would represent post-2020 operations.

BUILDOUT (POST-2020) LEVELS OF SERVICE			
ALTERNATIVE	STAGE	LOCATION	LOS
No Build		Southbound Off-Ramp	F
No Build		Northbound Off-Ramp	F
A		Southbound Off-Ramp	E
A		Northbound Off-Ramp	C
A-1	1	Southbound Off-Ramp	A
A-1	1	Northbound Off-Ramp	F
A-1	2	Southbound Off-Ramp	A
A-1	2	Northbound Off-Ramp	C
C-2/C-3	1	Southbound Off-Ramp	F
C-2/C-3	1	Northbound Off-Ramp	F
C-2/C-3	2	Southbound Off-Ramp	C
C-2/C-3	2	Northbound Off-Ramp	C

*The following interchange alternatives were considered to be less viable:*

**Alternative B** - This alternative does not substantially improve the LOS of the interchange over Alternative A or A-1.

**Alternative C-1** - This alternative severely encroaches on the truck stop, which would eliminate the need for interchange improvements.

**Alternative D** - The trumpet configuration would be incompatible if Knighton Road was extended west across the Sacramento River to Route 273.

**Alternative E** - The construction of a parallel overcrossing 30 meters north of the existing structure produces a non-conventional interchange, which does not meet driver's expectations. The reversing curves near the ramp intersections are undesirable.

**Knighon Road Extension Alternative:** Only one alignment alternative was evaluated for the extension of Knighton Road from Churn Creek Road/Pacheco Road east to Airport Road. This roadway extension is considered an important element in improving access between the Redding Municipal Airport and the adjacent office/industrial areas to Interstate 5 which serves as the primary regional north/south transportation corridor for the movement of people and goods. The current routes to the airport from Interstate 5 are either via (1) Knighton Road to Churn Creek Road to Meadow View Drive to Airport Road (a distance of approximately 4.5 kilometers, 2.8 miles), or (2) Churn Creek Road to Rancho Road to Airport Road (a distance of approximately 7.5 kilometers, 4.7 miles). As an alternative route, the airport's master plan states that a direct relationship between primary air and surface systems can be attained by maximizing the existing Knighton Road Interchange at Interstate 5, and by extending Knighton Road to the entrance to the airport (a distance of approximately 3.0 kilometers, 1.8 miles). The proposed Knighton Road route represents a reduction in travel distance between Interstate 5 and the airport area of between 1.5 to 4.5 kilometers (1.0 to 2.9 miles).

The proposed roadway extension also would have the benefit of reducing traffic on the two alternative travel routes (1 and 2 above) by providing both a shorter travel route and by providing a facility designed to higher standards than the facilities provided on the two existing routes. The proposed roadway extension will be designed as a high speed (73 kph, 45 mph or greater) divided arterial facility with 1.8 to 2.4 meter wide shoulders (6 to 8 feet). Year 2020 traffic projections are provided both without the proposed roadway extension (**Attachment 5**, Figure 3) and with the proposed roadway extension (**Attachment 5**, Figure 5). The following table provides a summary of the projected reduction in daily traffic on the two alternative routes.

Roadway Segment	2020 W/O Knighton Road Extension - AADT	2020 With Knighton Road Extension - AADT	Net Change in AADT
Rancho Road E. of Churn Creek Road	17,700	15,200	- 2,500
Meadow View Drive E. of Churn Creek Road	4,400	1,200	- 3,200

As shown in the table, Rancho Road east of Churn Creek Road is projected to experience a reduction in AADT of 2,500 vehicles and Meadow View Drive east of Churn Creek Road is projected to experience a reduction in AADT of 3,200 vehicles with the proposed Knighton Road extension.

The shorter travel route would be expected to result in lower fuel consumptions and a decrease in vehicle kilometers of travel (VKT) (vehicle miles of travel - VMT) through the corridor due the reduction in AADT on the two alternative routes. The following table illustrates the potential reduction in year 2020 VKT (VMT) for each route over a year (365 day) period.

Roadway Segment	Net Change in AADT	Net Change in Travel Distance km (miles)	Net Reduction in Yearly VKT (VMT)
Rancho Road E. of Churn Creek Road	- 2,500	1.5 (1.0)	- 1,368,750 (- 912,500)
Meadow View Drive E. of Churn Creek Road	-3,200	4.5 (2.9)	- 5,256,000 (- 3,387,200)

As shown in the table, a reduction of approximately 1.37 million VKT (0.91 million VMT) would be projected on the Rancho Road route and 5.26 million VKT (3.39 million VMT) would be projected on the Meadow View Drive route with the proposed project implemented.

The project would also provide an alternative route for traffic to/from the south towards Interstate 5 via Airport Road and Riverside Drive in the City of Anderson (a distance of approximately 5.5 kilometers, 3.4 miles) and for traffic to/from the north towards Interstate 5 via Airport Road (a distance of approximately 5.6 kilometers, 3.5 miles) and freeway Route 44 (a distance of approximately 5.8 kilometers, 3.6 miles). The proposed Knighton Road extension would provide a shorter travel route on the local surface streets of from 2.5 kilometers (1.6 miles) on the Airport Road/Riverside Drive route to the south, and from 2.6 kilometers (1.7 miles) on the Airport Road to freeway Route 44 to the north.

#### PROJECT PHASING

The potential to phase both needed interchange improvements and the extension of Knighton Road was evaluated under both year 2010 and year 2020 traffic conditions. Year 2020 daily and PM peak hour traffic projections with the Knighton Road extension (**Attachment 5**, Figure 4) were obtained by using the current Shasta County Travel Demand Model. The model's street network was modified to include the proposed roadway extension to obtain the traffic forecasts. Year 2010 traffic projections with the Knighton Road extension (**Attachment 5**, Figure 5) were then derived by determining the exponential growth in traffic between existing traffic conditions (**Attachment 5**, Figure 2) and the year 2020 volumes forecasted by the traffic model.

**PHASE 1 - (YEAR 2010):**

Phase 1 (Year 2010) improvements include the Stage 1 construction of the Knighton Road Extension as a two lane divided (with median) arterial from the current Churn Creek Road/Pacheco Road intersection east to Airport Road. During this phase, the east leg of Churn Creek Road at the Knighton Road/Churn Creek Road/Pacheco Road intersection is closed off. Traffic is redirected to a new Churn Creek Road intersection with Knighton Road located approximately 0.86 kilometers (0.53 miles) further to the east. The Knighton Road Extension intersections with the realigned Churn Creek Road and with Mohegan Court include single through lanes on Knighton Road with turn channelization provided at the two intersections. Intersection geometrics at the Knighton Road intersection with Churn Creek Road/Pacheco Road include single/separate left turn lanes, through lanes, and right turn lanes on the two Knighton Road approaches and on the southbound Churn Creek Road approach, and a separate left turn lane and a shared through plus right turn lane on the northbound Pacheco Road approach. Establishing the Knighton Road Extension alignment at this intersection also requires modification to existing Knighton Road between the northbound ramps intersection and the Churn Creek Road/Pacheco Road intersection. Traffic signals are provided at the Knighton Road/Churn Creek Road/Pacheco Road, the new Churn Creek Road and at the Knighton Road/Airport Road intersections. **Attachment 8, Attachments 8h to 8n** illustrates the proposed Phase 1 improvements.

The following table presents the projected PM peak hour Levels of Service for Phase 1 (Year 2010) traffic with Knighton Road extended to Airport Road. As shown in the table, intersection operations at these intersections are projected to be at LOS "C" or better. Traffic operations at the Knighton Road intersection with the Interstate 5 northbound ramps was also evaluated assuming no change in existing intersection geometrics and control. The northbound ramps would remain in their current location and control would still be by stop sign on the northbound off-ramp approach. As shown in the table, overall unsignalized Levels of Service would be within the LOS "A" range with LOS "D" projected for the northbound off-ramp approach to the intersection.

**PHASE 1 (YEAR 2010)  
PM PEAK HOUR  
LEVELS OF SERVICE (LOS)**

Intersection	Control	LOS	Delay
Knighton Rd/I-5 NB Ramps	stop sign	A	4.3 tot/int/del
		D	22.9 worst case
Knighton Rd/Churn Cr Rd/Pacheco Rd	traffic signal	C	17.8 sec/veh
Knighton Rd/Mohegan Ct	stop sign	A	0.8 tot/int/del
		B	8.6 worst case
Knighton Rd/Churn Creek Rd	traffic signal	B	6.9 sec/veh
Meadow View Dr/Airport Rd	traffic signal	C	17.2 sec/veh
Knighton Rd/Airport Rd	traffic signal	C	16.9 sec/veh
Rancho Rd/Airport Rd	traffic signal	C	19.3 sec/veh

The Phase 1 (Year 2010) analysis concluded that Stage 1 of the Knighton Road Extension project would provide the needed capacity at least through the year 2010. Stage 1 includes construction of a two lane with median roadway from the Churn Creek Road/Pacheco Road intersection east to Airport Road. Stage 1 would also include construction of the two ACID lateral structures and a 93 meters long by 13.3 meters wide (305 feet long by 43.5 feet wide) bridge over Churn Creek and a structure approximately 61 meters long by 13.3 meters wide (200 feet long by 43.5 feet wide) over Clover Creek. Channel enhancements may be required both upstream and downstream of both the new Churn Creek bridge and the new Clover Creek bridge. Traffic signals would be required at the Knighton Road intersections with Churn Creek Road/Pacheco Road and Airport Road. Approximately 7.19 ha (17.76 acres) of new right of way would be acquired with this phase.

The estimated Phase 1 (Year 2010) construction and right of way cost is \$7,065,000.

#### **PHASE 2 - (YEAR 2020):**

The following table presents the projected PM peak hour Levels of Service for Phase 2 (Year 2020) traffic conditions with the Stage 1 Knighton Road extension improvements identified for Phase 1 in place. As shown in the table, traffic operations along the Knighton Road extension with the Stage 1 improvements are projected to operate at LOS "C" or better. The only additional improvement is the signalization of the Knighton Road/Churn Creek Road intersection.

The Year 2020 Base Levels of Service at the two Knighton Road intersections with the Interstate 5 northbound and southbound ramps indicated that these ramps were projected to operate at LOS "F" with the current geometrics and control. The Alternative A-1, Stage 1 interchange improvements were evaluated under year 2020 traffic conditions. Stage 1 construction would consist of relocation of the northbound and southbound off-ramps to the west, construction of two lanes on the northbound on and off ramps and on the southbound off-ramp, construction of the loop on-ramp in the northwest quadrant, signalization of the ramp intersections and relocation of Riverland Drive. **Attachment 6**, Attachment 6i illustrates the proposed Alternative A-1, Stage 1 improvements. This alternative was chosen because it both utilized the existing overcrossing and it provided for the loop on-ramp in the northwest quadrant.

The projected intersection Levels of Service at the two ramp intersections with the Alternative A-1, Stage 1 improvements are shown in the table. As shown, the projected Levels of Service with these geometrics and the indicated control is LOS "B" at the southbound ramps intersection and LOS "C" at the northbound ramps intersection.

**PHASE 2 (YEAR 2020)  
PM PEAK HOUR  
LEVELS OF SERVICE (LOS)**

<b>Intersection</b>	<b>Control</b>	<b>LOS</b>	<b>Delay</b>
Knighton Road/I-5 SB Ramps	traffic signal	B	10.9 sec/veh
Knighton Road/I-5 NB Ramps	traffic signal	C	21.0 sec/veh
Knighton Rd/Churn Cr Rd/Pacheco Rd	traffic signal	C	21.0 sec/veh
Knighton Rd/Mohegan Ct	stop sign	A B	0.8 tot/int/del 9.7 worst case
Knighton Rd/Churn Creek Rd	traffic signal	B	7.0 sec/veh
Meadow View Dr/Airport Rd	traffic signal	C	18.9 sec/veh
Knighton Rd/Airport Rd	traffic signal	C	19.3 sec/veh
Rancho Rd/Airport Rd	traffic signal	C	24.4 sec/veh

Alternative A-1, Stage 1 would require acquiring the right of way needed for buildout of the interchange. Alternative A-1, Stage 1 is estimated to cost \$4,576,000 for construction and right of way.

The estimated Phase 2 (Year 2020) construction and right of way cost is \$4,576,000.

**PHASE 3 - (POST-2020):**

Phase 3 (Post-2020) would be represented by buildout of the interchange and construction of the Stage 2 Knighton Road extension improvements.

**5. SYSTEM PLANNING**

According to the "Route Concept Report Route I-5", Interstate 5 through the Knighton Road interchange is included in the Anderson to South Redding urbanized section. The Route Concept and Rationale through this section is an Urban LOS D-40, 4-6 lane freeway.

The Knighton Road Interchange concepts and alternatives (except Alternative A-1) were prepared by Caltrans and presented in a "Design Study Report" which was included in the "Shasta County Interchange Study, Final Report (July, 1996). This report was prepared for the Shasta County Regional Transportation Planning Agency (RTPA). Alternative A-1 is consistent with these concepts in that this alternative is a combination of Alternatives A and B.

The proposed Knighton Road extension has been identified in the "Shasta County General Plan Circulation Element" and in the "Redding Municipal Airport Specific Plan" adopted by the County of Shasta, City of Anderson and City of Redding as a necessary improvement.

## 6. HAZARDOUS MATERIAL/WASTE

Within the influence of the Knighton Road interchange, Caltrans noted in the DSR that the southeast quadrant has the greatest potential for hazardous wastes. The truck stop in this quadrant completed an upgrade of their facilities in 1990. Sub-surface sampling may be necessary. There is no evidence of hazardous waste in any of the other quadrants.

Brown & Mills has completed a Phase 1 Initial Site Assessment (ISA) for the proposed Knighton Road extension alignment. A copy of the ISA is included in **Attachment 11**. The study concluded that the assessment has identified no significant indications of hazardous substance storage, use, spills, or disposal along the planned roadway alignment or within adjoining areas which would pose a significant risk to either public health or the environment. However, a few minor concerns were identified and include:

- Several small debris piles consisting of automobile parts, tires and other rubbish were observed immediately south of the east-central portion of the planned alignment. Though no visible evidence of significant quantities of hazardous or toxic substances were observed, isolated areas of contamination could exist within or immediately beneath this debris. The ISA concluded that further studies should be conducted regarding near-site debris only if hazardous and/or toxic substances, stained soils, foul odors, or other obvious indications of contamination are detected prior to or during construction.
- Several off-site underground storage tanks (located within ½ mile of the project area) have leaked gasoline, diesel fuel, and/or waste oil. In general, these tanks are located within the nearby Redding Municipal Airport area or at the Knighton Road interchange area. Based on a review of Regional Water Quality Control Board (RWQCB) files, the RWQCB has closed a majority of these cases (files regarding one leaking underground storage within ½ mile of the project area still needs to be reviewed).

## 7. TRAFFIC MANAGEMENT PLAN

A Traffic Management Plan will be required. No significant delays are anticipated, but development of work-hour restrictions, detours, and lane closures will be required.

## 8. ENVIRONMENTAL CLEARANCE

A preliminary survey by the Caltrans Environmental Branch has indicated that existing areas within the proposed interchange alternatives may contain hazardous wastes and/or archaeological sites. A Mitigated

Negative Declaration for California Environmental Quality Act (CEQA) clearance and an Environmental Assessment resulting in a Finding of No Significant Impact (FONSI) for National Environmental Policy Act (NEPA) clearance (if federal funds are utilized for construction of the road extension) are anticipated to be prepared for the interchange work because no significant resources appear to be impacted. However, detailed studies may change this conclusion.

Diaz Associates completed an Environmental Evaluation (EE) for the proposed Knighton Road Extension alignment. A copy of the EE is included in **Attachment 12**. The EE concluded that, based on review of the "Shasta County General Plan", "Redding Municipal Airport Specific Plan", "California Natural Diversity Data Base", studies performed for the Knighton Road plan line and the interchange, studies performed for the proposed "Eagle Crest Estates Subdivision", site reconnaissance, and a general knowledge of the area, primary issues of environmental concern that need to be addressed include:

- Conversion of Prime Agricultural Soils
- Impacts on Biological Resources
- Air Quality Impacts
- Noise Impacts on Existing and Future Residents
- Impacts on Archeological Resources

**Conversion of Prime Agricultural Land:** The proposed project would result in the permanent removal of 4.3 ha (10.5 acres) of Class I and II Prime Agricultural Soil from potential future agricultural production.

**Impacts on Biological Resources:** It is known that "waters of the United States" or jurisdictional wetlands are present within the project boundary. Based on preliminary evaluation, less than 1/3 acre of wetlands are associated with Churn Creek and Clover Creek. It is not known if any endangered, threatened, proposed, or candidate species, or their critical habitat exist within these creek areas. The EE recommended that surveys should be undertaken to first determine if the potential habitat exists. If it does, surveys will need to be undertaken in the spring for plant species and when necessary for wildlife and fisheries species. A wetlands delineation including determining the presence of Fairy Shrimp in Clover Creek can be undertaken throughout the year. Aside from on-site mitigation which is not feasible, participation in a wetlands mitigation bank would cost an estimated \$20,000 to \$25,000 assuming impacts are slightly greater than 1/3 acre. Since the impact may be less than 1/3 acre no mitigation may be required.

Coordination of these efforts with the State Department of Fish and Game (DFG), U.S. Army Corps of Engineers (COE), U.S. National Marine Fisheries Service and the U.S. Fish and Wildlife Service (FWS) should commence as soon as possible.

**Air Quality Impacts:** The EE determined that an air quality analysis will need to be undertaken to determine construction related air quality impacts and long term impacts resulting from the proposed Knighton Road Extension.

**Noise Impacts on Existing and Future Residents:** The EE noted that due to existing and future projected Interstate 5 and Airport Road traffic, it was highly unlikely that the proposed Knighton Road Extension

would result in a significant increase in area noise levels close to these major transportation corridors. However, land uses away from these noise sources may need to be evaluated to determine future impacts and necessary mitigations.

**Impacts on Archeological Resources:** The EE noted that it is unknown if any cultural resources exist within the project site area even though the majority of the proposed alignment has been disturbed by past and present agricultural practices. The EE identified that an archeological reconnaissance of the alignment should occur. Due to the crossings of Churn and Clover Creeks, the COE may require archeological clearance from the State Office of Historical Preservation to satisfy FWS requirements.

Based on current evaluations, the EE concluded that the necessary state and federal environmental documents that would have to be prepared are a Mitigated Negative Declaration for California Environmental Quality Act (CEQA) clearance and an Environmental Assessment resulting in a Finding of No Significant Impact (FONSI) for National Environmental Policy Act (NEPA) clearance (if federal funds are utilized for construction of the road extension). Shasta County would be the Lead Agency for CEQA clearance, whereas FHWA would be the lead agency for NEPA clearance.

## 9. FUNDING AND SCHEDULING

Funding for the Phase 1 (Year 2010) improvements is proposed to be obtained through 1998 State Transportation Improvement Plan (STIP) funds. Phase 2 (Year 2020) and Phase 3 (Post-2020) improvements are anticipated to be paid through the Local Agencies with funds from traffic impact fees and/or from future STIP funding cycles.

The "Project Component Costs" for Phase 1 are as follows:

Environmental	\$100,000
Design Engineering	\$603,000
R/W Engineering/Support	\$25,000
Right of Way	\$402,000
Construction	\$6,654,000
Construction Engineering	\$407,000
<b>TOTAL</b>	<b>\$8,191,000</b>

The following is the anticipated project schedule through to preparation of PS&E for the Phase 1 improvements.

<b>Milestone</b>	<b>Schedule</b>
Obtain PSR Approval	December, 1997
Obtain Environmental Clearance	June, 1999
Start PS&E	June, 1999
Right of Way Certification	December, 1999

## 10. CONTACTS

Questions or comments regarding this Project Study Report may be directed to:

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## 11. LIST OF ATTACHMENTS

Attachment 1	Vicinity Map
Attachment 2	Cost Estimates
Attachment 3	Existing Facilities
Attachment 4	Draft - Knighton Road Extension Plan Line Alignment Study
Attachment 5	Traffic Forecasts/Traffic Operations Evaluation Update
Attachment 6	Interchange Alternatives Plan and Profile

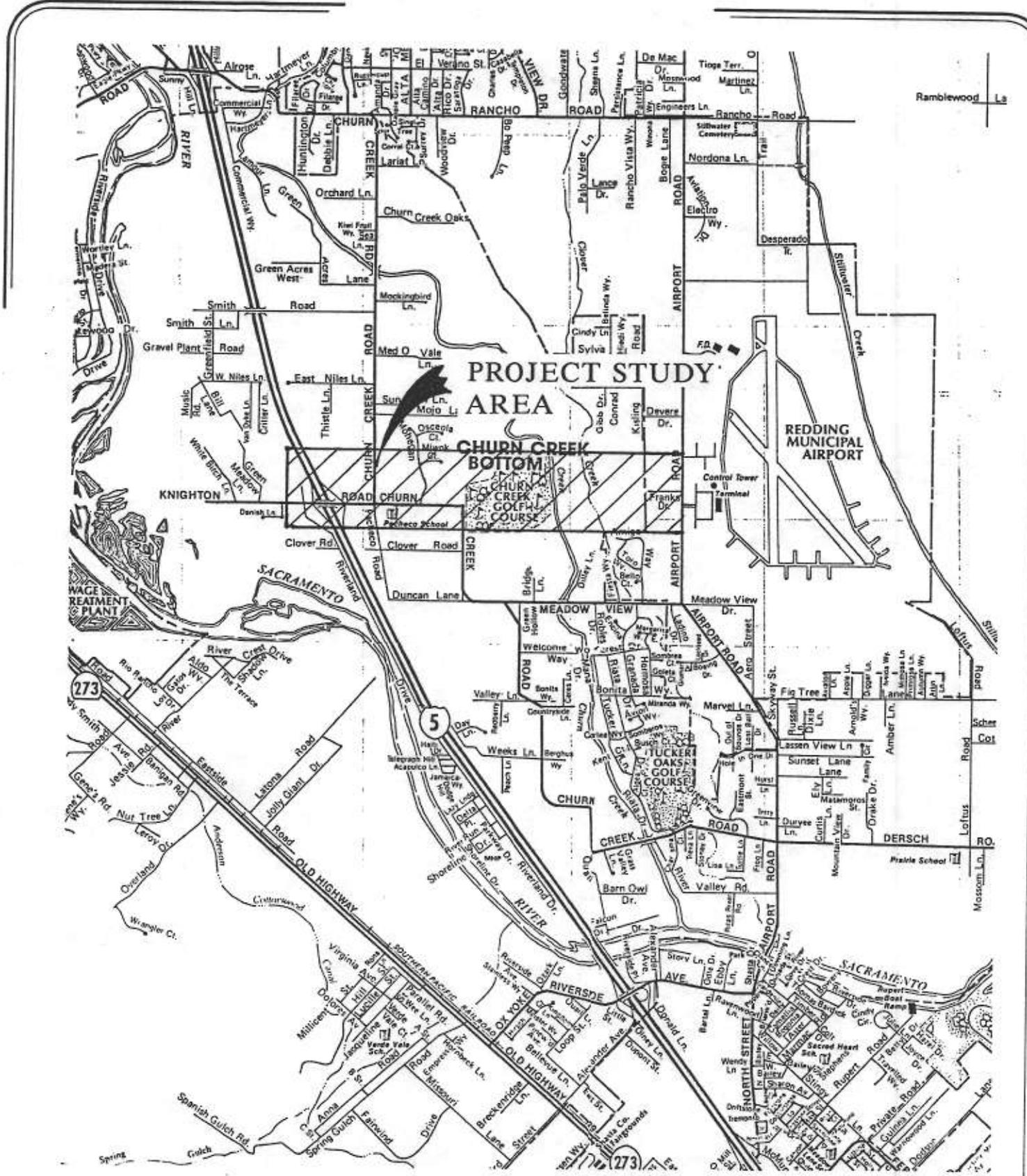
## 11. LIST OF ATTACHMENTS (Cont'd)

Attachment 7	Interchange Alternatives Typical Sections
Attachment 8	Knighton Road Extension Plan, Profile and Typical Sections
Attachment 9	Knighton Road Extension Advance Planning Studies
Attachment 10	Right of Way Data Sheets
Attachment 11	Phase I - Initial Site Assessment (ISA)
Attachment 12	Environmental Evaluation (EE)

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**ATTACHMENT 1 .**

**VICINITY MAP**



**KNIGHTON ROAD PSR**

**ATTACHMENT 1**

**VICINITY MAP**

