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STATE OF MONTANA
DEPARTMENT OF HIGHWAYS

BASIN — BOULDER

I 15 - 3 (13) 157

DESIGN PLANNING REPORT

STATION 1240 TO 1530

REVISED

MARCH , 1976 ,

PREPARED BY

MORRISON — MAIERLE INC.

Consulting Engineers

Helena, Montana

TABLE OF CONTENTS

	<u>Page</u>
I. INTRODUCTION -----	1
II. CRITERIAL GUIDELINES-----	1
III. GENERAL -----	2
IV. HORIZONTAL ALIGNMENT & TRAFFIC VOLUMES -----	2
V. MEDIAN DESIGN -----	3
VI. PROFILE GRADES -----	4
VII. TRAFFIC LANES, SHOULDERS & DITCH WIDTHS -----	4
VIII. BACKSLOPES -----	4
IX. STRUCTURES -----	6
X. INTERCHANGE -----	6
XI. FRONTAGE AND ACCESS ROADS -----	7
XII. DRAINAGE -----	8
XIII. UTILITIES, RAILROAD, AND RIGHT-OF-WAY -----	10
XIV. MAINTENANCE OF TRAFFIC -----	10
XV. FENCING -----	11
XVI. COST SUMMARY -----	11
XVII. ALTERNATE PLANS AND COSTS -----	13

FIGURES & TABLES

Figure 1 - Shoulder Treatment - Minimum Conditions -----	5
Figure 2 - River Encroachment - Special Details -----	9
Table 1 - Cost Estimate -----	12
Table 2 - Summary of Design Features-----	14
Table 3 - Estimated Cost of Alternate Plans -----	16
Table 4 - Estimated Cost of Selected Plan Plus Alternates-----	17

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BASIN-BOULDER INTERSTATE

PROJECT NO. I 15-3(13)

DESIGN PLANNING REPORT

REVISED MARCH 1976

STATION 1240 to 1530

Prepared by Morrison-Maierle, Inc. for Montana Department of Highways

I. INTRODUCTION:

In October 1975 the Final Design Planning Report for the project was submitted. It contained costs, maps and descriptions of a number of plans and it was more of an alternate study than a Planning Report. This was done to present all reasonable solutions to the reviewing agencies and because many of the individual problems had not been resolved.

Now, general agreement has been reached by members of the Impact Evaluation Group in all areas except between Stations 1270 and 1330 and this report will present the design features which are proposed. The plan between Stations 1270 and 1330 has not been resolved but the solutions being considered are presented in Chapter XVII, ALTERNATE PLANS AND COSTS.

The Selected Plan is the one now proposed for detailed design and eventual construction. It is so named because it is the combination of alternates selected by the Impact Evaluation Group and it is shown on the two attached Plan-Profile sheets.

II. CRITERIAL GUIDELINES:

Design plans and specifications will conform to Montana Department of Highways standards and to the guidelines of Federal Aid Highway Program Manual, Volume 6, Chapter 2, Section 1.

III. GENERAL:

The total project is a 4-lane facility, 5.5 miles long. It begins at Station 1240 near the silica quarry east of Basin and ends at Station 1530 near Boulder, where it ties into the existing 4-lane Boulder Hill South Project.

IV. HORIZONTAL ALIGNMENT & TRAFFIC VOLUMES:

Between Stations 1240 and 1270 the alignment consists of reversing $7^{\circ} 30'$ curves. The roadway lies above and to the north of the PTW and leaves the PTW in its existing location for use as a maintenance of traffic road and for later use as a low grade access road. Some of the spiral lengths have been reduced from the standard 350 ft. to 300 ft. to provide the needed tangent lengths for the reversing curvature.

The alignment between Stations 1270 and 1330 has not yet been decided but the most favorable appears to be the alignment shown on the plan-profile sheet. This consists of an $8^{\circ} 30'$ curve located across the river from the PTW and reversing into a $7^{\circ} 30'$ curve. Following the $7^{\circ} 30'$ curve to the left is a $3^{\circ} 30'$ curve to the right followed by a $6^{\circ} 30'$ curve to the left. The other alternates being considered in this area will be discussed in Chapter XVII, "ALTERNATE PLANS AND COSTS".

At Station 1330 the alignment continues on the $6^{\circ} 30'$ curve to the left, enters a tangent section and then near Station 1350 enters a compound curve to the right consisting of a 3° , $2^{\circ} 30'$ and a 1° curve.

The remainder of the project to Station 1530 consists of curvi-linear alignment in which the sharpest curvature is $3^{\circ} 30'$. Some of the spiral lengths in this area have been reduced from the standard 350 ft. to 300 ft. to provide the needed latitude for adjustment to avoid stream encroachment.

The following design speeds are provided.

<u>Sta.</u>	<u>Design Speed</u>
1240 - 1270	50 MPH
1270 - 1295	48+ MPH If $8^{\circ}30'$ line is used
1295 - 1340	50 MPH
1340 - 1530	70 MPH

Estimated current and design year traffic was furnished by MDH Planning and Research Bureau, and is as follows:

<u>1972 ADT</u>	<u>1996 ADT</u>	<u>DHV</u>	<u>D(Distribution)</u>	<u>Trucks</u>	<u>Pickups</u>
1100	2350	350	55%-45%	15%	18.8%

The 1995 traffic flow diagram for the interchange is shown on the enclosed plan-profile sheets.

V. MEDIAN DESIGN:

The MDH standard 14 foot narrow median section with New Jersey type (concrete wall) median barrier will be used from Sta. 1240 to Sta. 1435. From Sta. 1435 to 1530 each set of lanes are on independent alignment. The river will be between the two sets of lanes from Sta. 1470 to the project end at Sta. 1530. At Sta. 1530, one mile west of Boulder, the project ties into the existing 4-lane Interstate.

VI. PROFILE GRADES:

The grades shown on the attached plan-profile sheets will probably require only minor final adjustments. Some changes may be required for bridge clearance and earthwork balance purposes. The maximum grade used is 3.0%. Grades will be less than the maximum steepness allowed for the design speeds shown in the table in Section IV and as determined by the degree of curvature of the horizontal alignment.

VII. TRAFFIC LANES, SHOULDERS & DITCH WIDTHS:

Each of the four traffic lanes will be the standard width of 12 feet. Standard shoulder widths of 10-foot outside and 4-foot inside are proposed throughout. The treatment of subgrade shoulder is shown on Figure 1-A. Wherever guardrail is required or where river encroachment would occur using a normal subgrade shoulder, the 5-foot width from the outside of shoulder to subgrade shoulder will be used.

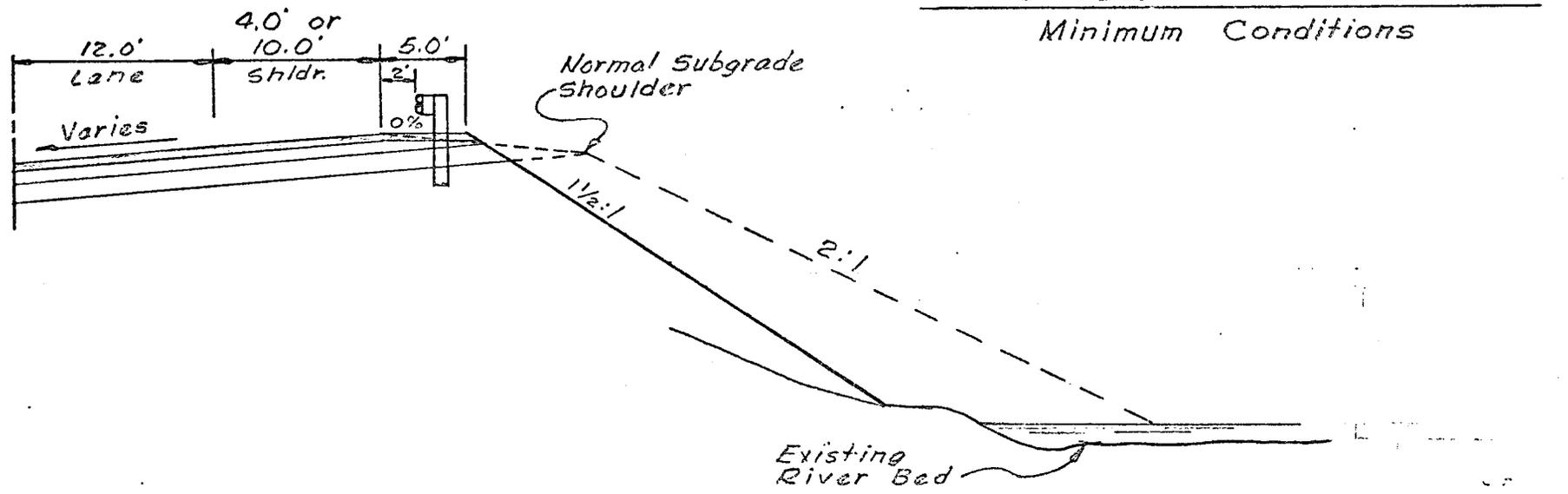
The 10-foot 20:1 ditch in cut may be narrowed for short distances to reduce excavation and in some areas it may be widened to 24-feet to accommodate the low grade access road. This is shown on Figure 1-B.

VIII. BACKSLOPES:

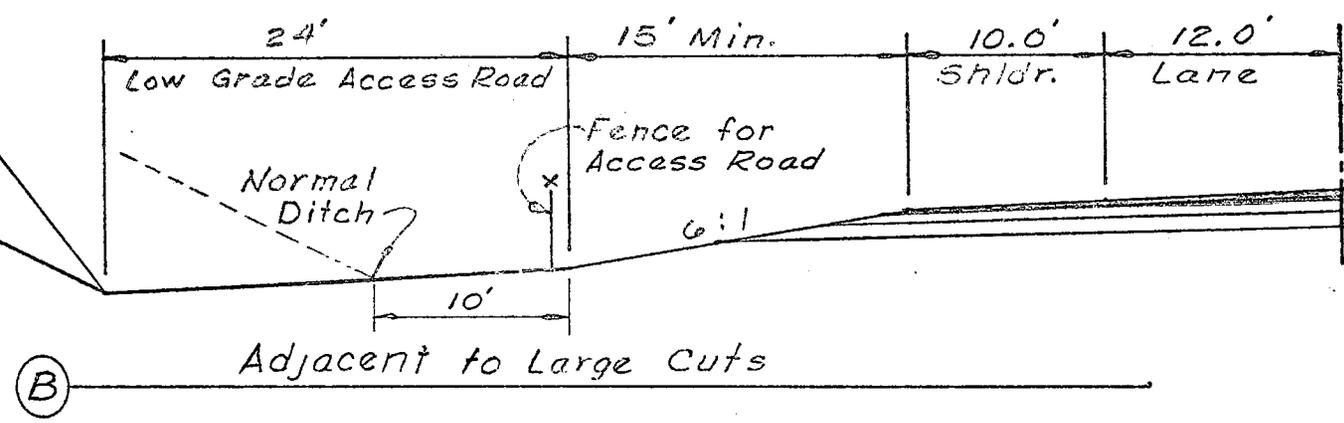
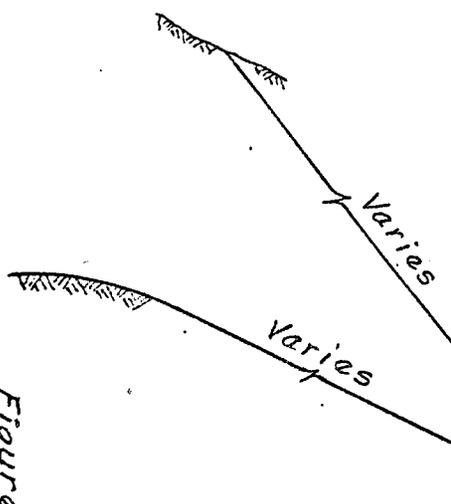
Deviation from standard fill slopes was made in several locations to avoid encroachment into the river channel or to provide additional channel width or avoid other obstructions. Rock embankment slopes steeper than 1½:1 in special cases would be obtained through special large rock placement.

Shoulder Treatment

Minimum Conditions



(A) ———— Adjacent to Boulder River



5

Figure 1

DATE: MAR 1976
BY: GAG
CHK:

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CONSULTING ENGINEERS
HELENA, MONTANA

PROJ. NO:
PAGE:

Cut backslopes reach a steepness of $\frac{1}{2}$:1 but are more commonly $\frac{1}{4}$:1 or flatter. These are as recommended by the MDH Materials Section in several of their soils investigation reports.

IX. STRUCTURES:

There are 13 bridges planned within the limits of the project between Sta. 1240 and 1530, excluding the section between Stations 1270 and 1330. They are located at eight sites, five of which require dual structures. Eight of the bridges carry the Interstate over the river, two are interchange structures, and two are grade separation structures at Galena Gulch. One frontage road bridge over the river is required at the High Ore Creek road.

Preliminary studies indicate that the bridges will probably be prestress beam type structures for greater economy. Where single span structures can be used, reinforced earth abutments are being considered.

In the area between Stations 1270 and 1330 other bridges could be required depending on which alignment is selected.

X. HIGH ORE INTERCHANGE:

Access to Galena Gulch and High Ore Creek require that an interchange be placed in the area. A minimum width diamond-type interchange near Station 1385 is planned with the Interstate over the local road.

Placing the interchange at this location instead of at Galena Gulch as proposed in the Environmental Statement reduces the amount of channel change at Galena Gulch but makes it necessary to place a grade separation structure at the Galena Gulch road. The road user benefits are better with the interchange located near High Ore Creek and the Galena area is left undisturbed for future defacto or for planned recreation use.

XI. FRONTAGE AND ACCESS ROADS:

Access to High Ore Creek will be provided by a new frontage road and a new bridge over the Boulder River at High Ore Creek road as shown on the Plan sheets. Traffic to Galena Gulch will be carried from the interchange on the Present Traveled Way (PTW) using the existing PTW bridge. The existing Galena Gulch road will be connected to the PTW via a grade separation near Sta. 1425.

A 20-foot wide low grade access road for the purpose of driving cattle from Boulder to the summer pastures of the upper Boulder River Valley, will be provided throughout the project. From Sta. 1240 to 1270 the PTW will serve for this access. From Station 1270 to Station 1300 the access road location will be dependent upon which Interstate alignment is selected. At Station 1300 and continuing to Station 1360 it is planned to place the access road north of the river on an existing unsurfaced one lane road. The road will be widened and a gravel surface will be provided. At Station 1360 the access road will cross High Ore Creek over a culvert and connect to the existing High Ore Creek road. It then follows the existing road and crosses the river. A new bridge is proposed at this site to replace the existing dilapidated timber bridge.

The access road is planned to run parallel to the Interstate and south of the river from the High Ore Gulch road to the interchange at Sta. 1385 where it will join the PTW and be carried to the grade separation at the Galena Gulch road (Sta. 1425). Here, it will cross under the Interstate and over the river on an existing bridge and be carried adjacent to and south of the Interstate to Sta. 1530 where it leaves the Interstate alignment and remains south of the river and ends when it intersects the State Highway, FAS 281, on the south edge of the Town of Boulder.

Figure 1-B shows how the low grade access road will be carried in the roadway prism in restricted cut areas. Where there is room, the access road will be separated from the Interstate.

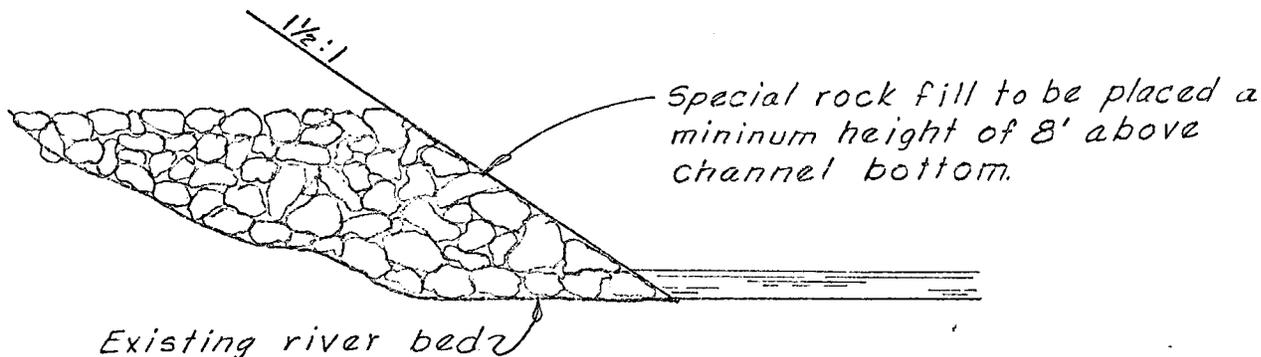
Although the low grade access road is being provided primarily as a stock drive lane, it will also provide vehicular access to the river for fishing and recreation throughout the project except from Sta. 1450 to Sta. 1530 where the river is carried between the lanes. In this section pedestrian access can be gained at the two bridges at Sta. 1455 and Sta. 1530.

XII. DRAINAGE:

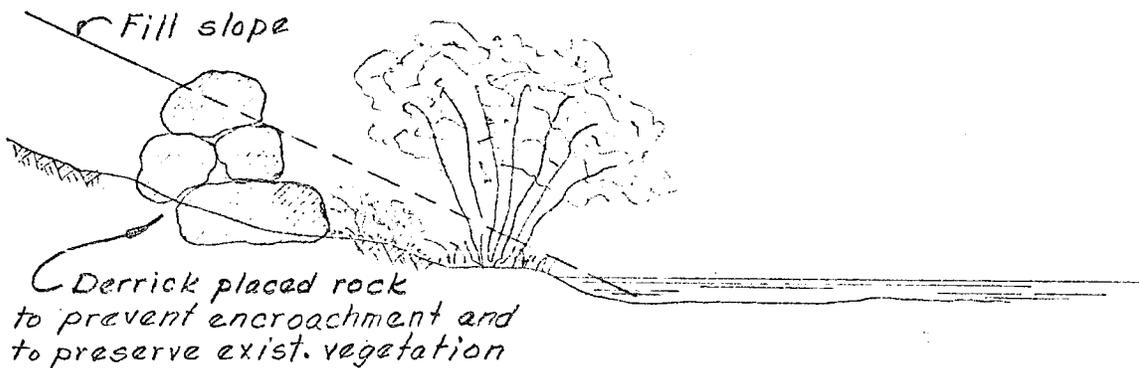
The primary drainage consideration is the Boulder River which parallels the proposed alignment throughout the project. Special channel realignment design considerations will be used to minimize environmental damage to the river where realignment is necessary. Figure 2 shows how bank protection can be provided on fills which extend into the river. It also shows how minor river encroachments can be avoided in some areas by using derrick-placed rock.

Side drainages which cross the proposed alignment will be treated according to the standard design practices. Hydrologic studies, as well as flow and channel design studies, will be used to determine the drainage system needs. Fifty-year design flow for the Boulder River is in the 3000 to 4000 cfs range in this area.

RIVER ENCROACHMENT
SPECIAL DETAILS



Fills into River



Dry Rock Walls

XIII. UTILITIES, RAILROAD, AND RIGHT-OF-WAY:

No detailed assessment of the extent of utilities relocation has been made, but it is known that there will be a considerable amount. There is a power line and some telephone lines that will require some relocating to get them out of the construction areas involved.

The single Burlington Northern Railroad track extends west from Boulder and ends at Basin. This track line is expected to remain in-place indefinitely and no alignment relocation of the track is proposed. A new at-grade crossing is proposed on the low grade access road near Sta. 1385, which would replace the existing crossing now being used near Sta. 1362.

Right-of-way will have to be acquired from both public and private lands along the route. The amount needed has not been determined. Between Station 1493NB (1496SB) and Station 1530 (end of project), right-of-way was purchased at the time the Boulder Hill South R/W was being acquired because a single ownership extended into this project.

XIV. MAINTENANCE OF TRAFFIC:

Between Stations 1240 and 1270 traffic can remain on the PTW throughout construction. The method of handling traffic between Stations 1270 and 1330 is dependent on which plan is selected. From Station 1330 to 1370 traffic will have to be carried through construction. The PTW can be used while a portion of the right side of the roadway is constructed. Traffic will then have to be carried on the roadway embankment. At Station 1370 traffic can be routed onto the PTW and can remain there throughout the rest of the project.

In the independent alignment section (Sta. 1435 to 1530) the northbound lanes can be built first while traffic uses the PTW. Then traffic can be routed over the northbound lanes while the southbound lanes are constructed.

XV. FENCING:

Interstate fence is planned throughout the project on both sides of the roadway. The Montana Fish and Game Department has indicated that fence should be provided as needed to keep stock out of the stream along the proposed stock lane.

From Sta. 1470 to 1530, where the river will be carried between the lanes, additional fence will be required on both sides of the river in the median since it is planned to provide pedestrian fishing access to this area. On the steep slopes adjacent to the river, it will be necessary to provide a bench for the fencing which will likely add to the encroachment on the stream in these areas.

XVI. COST SUMMARY:

The costs in Table 1 are for the Selected Alignment shown on the two Plan-Profile sheets. This is the alignment that resolves the concerns indicated by the Impact Evaluation Group better than the others that were considered.

Although the plan between Stations 1270 and 1330 has not yet been determined, costs for what seems to be the best plan available are included. This is the alignment across the river from the PTW, an 8° 30' curve and a steel span arch river crossing. This is designated Plan F in Chapter XVII, ALTERNATE PLANS AND COSTS.

BASIN-BOULDER I 15-3(13)157
 ESTIMATED COST OF SELECTED PLAN
 (Excluding R/W & Utilities)

Item	Station Limits				Total
	1240-1270	1270-1330 (Plan F)	1330-1440	1440-1530	
1. Similar Features*	\$231,500	\$438,900	\$967,700	\$755,500	\$2,393,600
2. Excavation	835,800	798,200	840,300	115,700	2,590,000
3. Bridges	-	484,000	1,504,000	1,034,000	3,022,000
4. Arch Culvert @ Sta. 1276	-	325,000	-	-	325,000
5. Maint. of Traffic	17,000	20,000	25,000	5,000	67,000
6. Special Channel Treatment	24,000	71,000	45,000	60,000	200,000
7. Waste Excess Material	-	204,000	-	-	204,000
TOTAL	\$1,108,300	\$2,341,100	\$3,382,000	\$1,970,200	\$8,801,600

* Similar features include: Clear & Grub, Surfacing, Small Drainage Culverts, Fencing, Signing, Guardrail, Concrete Median Barrier, Topsoil & Seed.

TABLE 1

XVII. ALTERNATE PLANS AND COSTS: (STA. 1270 to 1330)

This section of the project has been subject to a great deal of study in an effort to preserve the loop in the Boulder River near Sta. 1280 because of concerns expressed by the F&G Dept. The alignment shown on Plan-Profile Sheet #1 is the alternate which seems to be the most desirable in consideration of environmental, engineering and related features involved except that the $8^{\circ} 30'$ curve is outside the standards commonly used for Interstate routes. FHWA approval is required before an $8^{\circ} 30'$ curve can be further considered. This has been requested and a determination is expected in the near future.

The plans considered for this section relate to two general alignments. The first, called the Basic Alignment, generally follows the PTW and there are two variations of this Plan. The second, called the Selected Alignment, is located across the river from the PTW and there are six variations to this plan.

The alternates are as follows and they are so listed in Table 2 with a summary of features and costs. They are illustrated on the enclosed photo plans.

PLAN A - Basic Alignment with no bridge at Station 1278.

PLAN B - Basic Alignment with bridge at Station 1278.

PLAN C - Selected Alignment with $7^{\circ} 30'$ curve and culvert at Station 1276.

PLAN D - Selected Alignment with $7^{\circ} 30'$ curve and Bridge at Station 1276.

BASIN-BOULDER I 15-3(13)157
SUMMARY OF DESIGN FEATURES AND COSTS - STATION 1270 to STATION 1330

	BASIC ALIGNMENT		SELECTED ALIGNMENT					
	Plan (A) EMB - No Bridge	Plan (B) With Bridge	With 7° 30' Curve @ Sta. 1280			With 8° 30' Curve @ Sta. 1280		
			Plan (C) With Culvert	Plan (D) With Bridge	Plan (E) Reinf. Earth Br.	Plan (F) With Culvert	Plan (G) With Bridge	Plan (H) Reinf. Earth Br.
General Description	Essentially follows PTW alignment North of River. Crosses under R/R.	Essentially follows PTW alignment North of River. Crosses under R/R.	Line over point across river from PTW. Crosses over R/R.	Line over point across river from PTW. Crosses over R/R.	Line over Point across river from PTW. Crosses over R/R.	Line over point across river from PTW. Crosses over R/R.	Line over point across river from PTW. Crosses over R/R.	Line over Point across river from PTW. Crosses R/R.
Frontage Road Location	Adjacent and right of Interstate.	Across river from PTW and I-15.	Rt. of I-15 to river crossing. Crosses under I-15 in veh. U-pass. Follows PTW.	Rt. of I-15 to river crossing. Crosses under I-15 bridge. Follows PTW.	Rt. of I-15 to river crossing. Crosses under Re-earth Bridge. Then follows PTW.	Rt. of I-15 to river crossing. Crosses under I-15 in veh. U-pass. Then follows PTW.	Rt. of I-15 to river crossing. Crosses under I-15 bridge. Then follows PTW.	Rt. of I-15 to river crossing. Crosses under Re-earth Bridge. Then follows PTW.
Affect on River Loop @ Sta. 1280	Covers most of loop.	Leaves loop undisturbed except for bridge pier on island.	Leaves loop undisturbed - eliminates use of existing overflow channel.	Leaves loop undisturbed.	Leaves loop undisturbed.	Leaves loop undisturbed.	Leaves loop undisturbed.	Leaves loop undisturbed.
Safety Aspects	Good	Poor - Bridge on 7°30' curve - Fr. Rd. crosses R/R at grade	Good	Poor - Bridge on 7°30' curve.	Good - Re-earth Bridge has soil cover to retard freezing.	Safety reduced due to substandard curvature.	Very poor - Bridge on 8°30' curve.	Good - Re-earth Bridge has soil cover to retard freezing.
Geometric Standards	Has max. curvature by design stds. of 7°30'	Has max. curvature by design stds. of 7°30'	Has max. curvature by design stds. of 7°30'	Has max. curvature by design stds. of 7°30'	Has max. curvature by design stds. of 7° 30'.	8°30' curve exceeds max. std. of 7°30'	8°30' curve exceeds max. std. of 7°30'	8° 30' curve exceeds min. std. of 7° 30'.
Open Cut Areas	388,000 sq. ft. or 8.90 acres	388,000 sq. ft. or 8.90 acres	492,000 sq. ft. or 11.29 acres	492,000 sq. ft. or 11.29 acres	492,000 sq. ft. or 11.29 acres	360,000 sq. ft. or 8.26 acres	360,000 sq. ft. or 8.26 acres	360,000 sq. ft. or 8.26 acres.
Earthwork Balance	Earthwork balanced throughout project	Earthwork balanced throughout project	550,000 CY excess material to be wasted. Heavy cut at Sta. 1270	600,000 CY excess material to be wasted. Heavy cut at Sta. 1270	550,000 CY excess material to be wasted. Heavy cut at Station 1270.	130,000 CY excess material to be wasted.	170,000 CY excess material to be wasted.	130,000 CY excess material to be wasted.
Affect on R/R Operation	Temporary interruption during constr. of Shoo fly and R/R bridge	Same as Basic Line	Virtually none	Virtually none	Virtually none	Virtually none	Virtually none	Virtually none
Maintenance of Traffic Problems	Relatively difficult - traffic carried on Fr. Rd. adjacent to I-15.	Traffic carried on Fr. Rd. across river away from constr. Detour Rd. low std.	Moderate - Traffic carried on PTW - Crosses I-15 at 1275. On PTW to 1305 - thru construction to 1330	Moderate - Same as (C)	Moderate - same as (C)	Moderate - Same as (C)	Moderate - Same as (C)	Moderate - same as (C)
Extent of River Disturbance	2500 ft.	1200 ft. - reduction partly due to location of Fr. Rd.	750 ft.	500 ft.	500 ft.	750 ft.	500 ft.	500 ft.
Design Acceptability	Unacceptable to F&G - too much river disturbance	Acceptable to F&G but costs \$2,793,000 more than (A)	F&G does not like culvert due to possible fish passage problems.	Acceptable to F&G. Costs \$980,000 more than (C)	Believed to be acceptable to F&G	F&G does not like culvert due to possible fish passage problems.	Acceptable to F&G. Costs \$980,000 more than (E)	Believed to be acceptable to F&G
CONSTR. COSTS	\$2,043,100	\$4,836,000	\$3,654,100	\$4,759,100	\$3,931,200	\$2,341,100	\$3,446,100	\$2,618,200

TABLE 2

- PLAN E - Selected Alignment with 7° 30' curve and Reinforced Earth Bridge at Station 1276.
- PLAN F - Selected Alignment with 8° 30' curve and culvert at Station 1276.
- PLAN G - Selected Alignment with 8° 30' curve and Bridge at Station 1276.
- PLAN H - Selected Alignment with 8° 30' curve and Reinforced Earth Bridge at Station 1276.

Table 3 also lists each alternate plan and shows a cost breakdown for each. These are total construction costs between Stations 1270 and 1330, but they do not include R/W or utilities.

Plans A and B include costs for a culvert river crossing at Station 1308 with a vehicular underpass for the access road. If a bridge were built at this location as the Fish and Game requests, the cost of both plans would be increased by \$779,000.

The bar chart, Table 4, shows the total construction cost of all eight alternate plans added to the costs of the remainder of the project. Notice that the stationing is out of sequence. The cost of the alternate plans was placed at the top of the chart since they are the only ones with a cost difference. The dashed portion at the top of Plans A and B indicates the total cost of these alternates if a bridge were used at Station 1308 instead of a culvert.

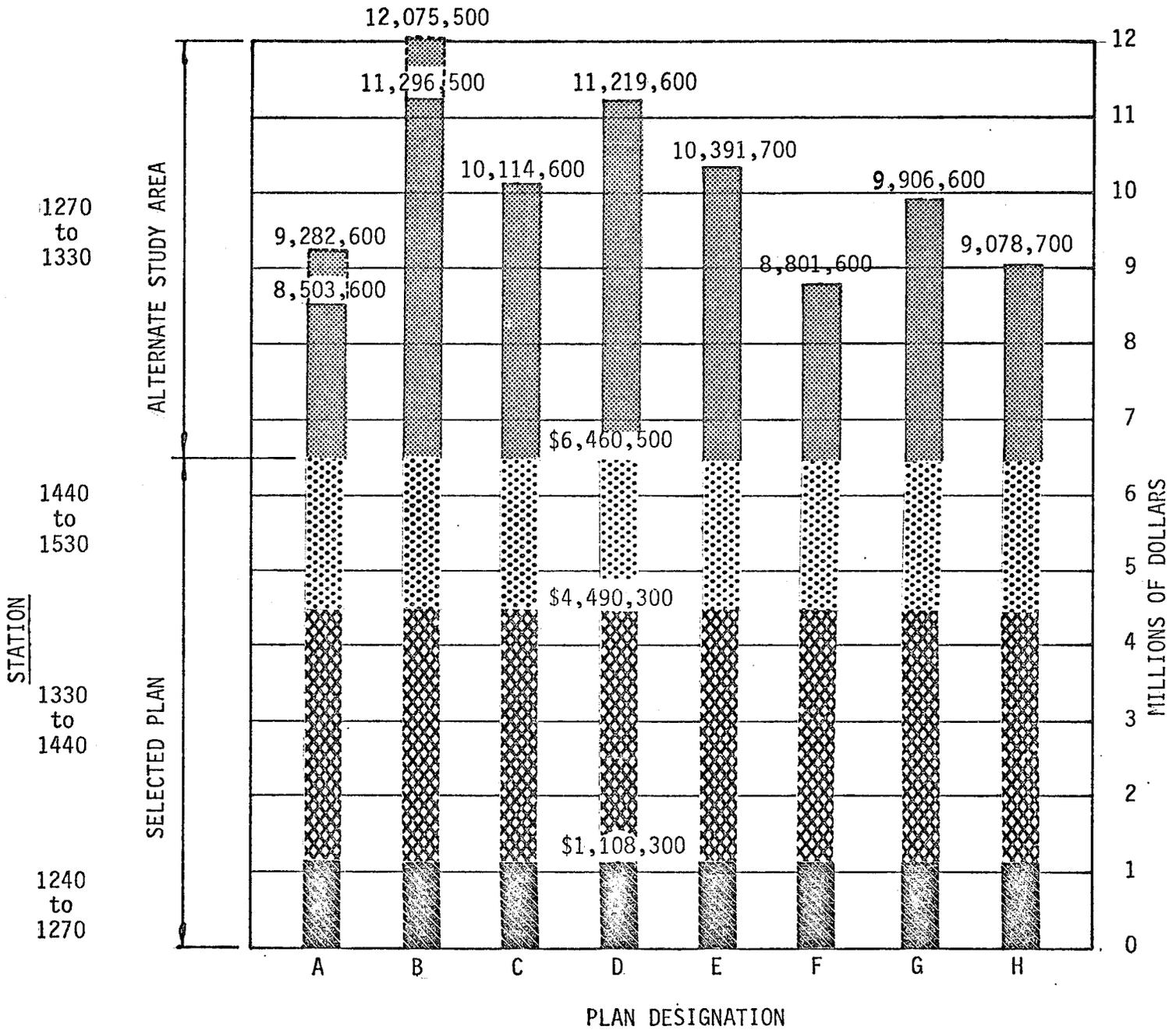
BASIN-BOULDER I 15-3(13)157
ESTIMATED COST OF ALTERNATE PLANS
BETWEEN STATIONS 1270 & 1330

ITEM	PLAN A Basic Line No. Br. 7°30' Curve	PLAN B Basic Line With Br. 7°30' Curve	PLAN C Selected Line With Culv. 7°30' Curve	PLAN D Selected Line With Br. 7°30' Curve	PLAN E Selected Line Re-Earth Br. 7°30' Curve	PLAN F Selected Line With Culv. 8°30' Curve	PLAN G Selected Line With Br. 8°30' Curve	PLAN H Selected Line Re-Earth Br. 8°30' Curve
*1. Similar Features	\$ 438,900	\$ 438,900	\$ 438,900	\$ 438,900	\$ 438,900	\$ 438,900	\$ 438,900	\$ 438,900
2. Excavation	353,200	353,200	1,594,200	1,594,200	1,594,200	798,200	798,200	798,200
3. Bridges	752,000	3,608,000	484,000	1,914,000	1,086,100	484,000	1,914,000	1,086,100
4. Arch Culverts	331,000	331,000	325,000	-	-	325,000	-	-
5. Maint. of Traffic	33,000	15,000	20,000	20,000	20,000	20,000	20,000	20,000
6. Special Chan. Treatment	135,000	89,900	71,000	71,000	71,000	71,000	71,000	71,000
7. Waste Excess Material	-	-	721,000	721,000	721,000	204,000	204,000	204,000
TOTAL	\$2,043,100	\$4,836,000	\$3,654,100	\$4,759,100	\$3,931,200	\$2,341,100	\$3,446,100	\$2,618,200
With Bridge instead of Culvert @ Sta. 1308	779,000 \$2,822,100	779,000 \$5,615,000						

*Similar Features include: Clear and Grub, Surfacing, Minor Drainage Culverts, Fencing, Signing, Guardrail, Concrete Median Barrier, Topsoil & Seed.

TABLE 3

BASIN-BOULDER I 15-3(13)157
ESTIMATED COST OF SELECTED PLAN
PLUS EACH ALTERNATE



NOTE 1. R/W and Utilities Costs not included.

2. Dashed portion of Plan A & B is for Bridge instead of culvert at Sta. 1308

TABLE 4

Discussion of Alternates (Sta. 1270-1330)

The Basic Plan was the first to be developed during this series of studies and was based on a balance of a minimum of channel encroachment and a minimum of heavy cut sections. The Fish & Game Department objected to the river encroachment and a number of alternate plans were developed in an effort to reduce these encroachments.

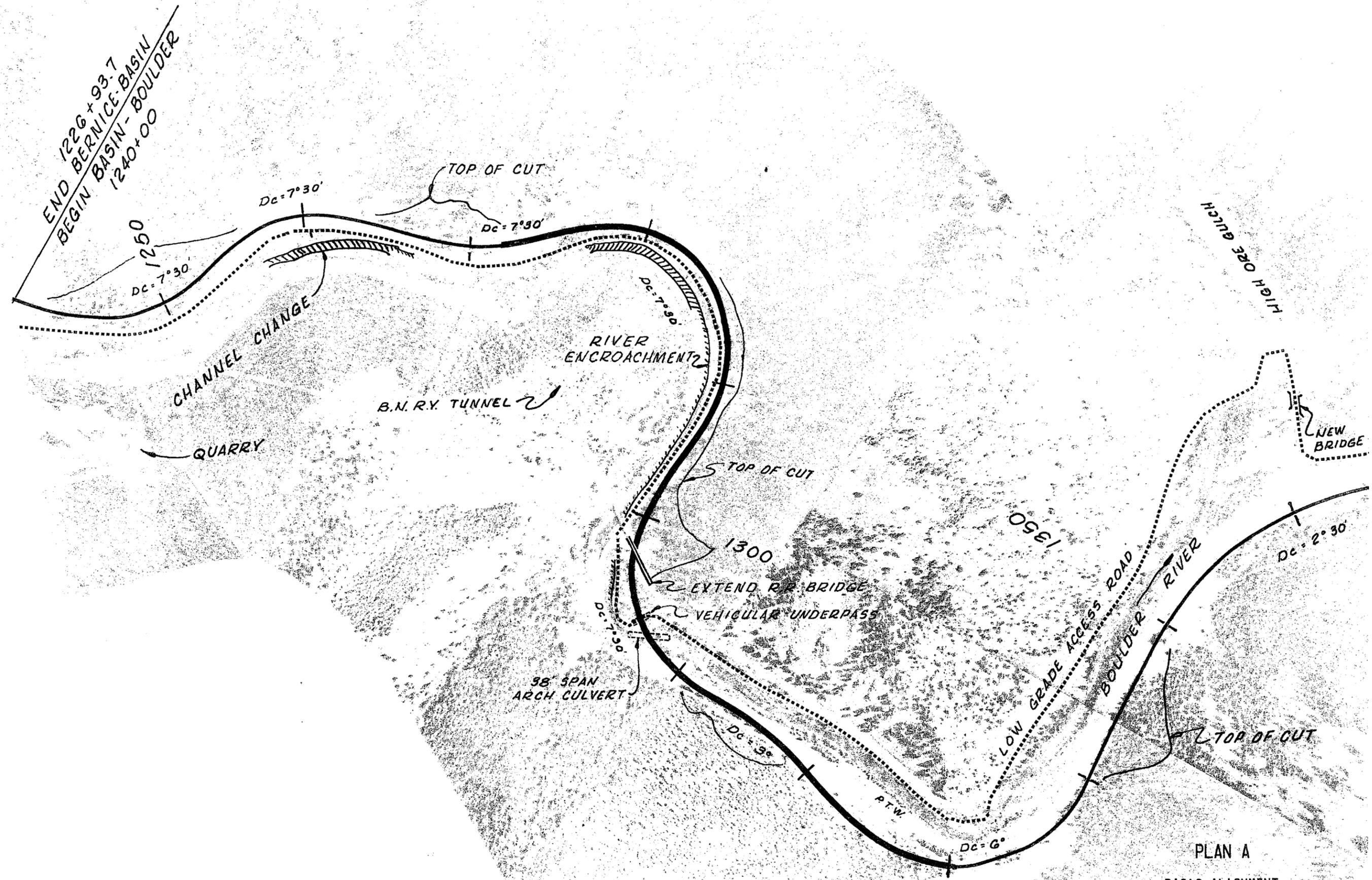
Plans A and B follow the Basic Alignment which generally follows the PTW. Plan A required a channel change at the river loop near Station 1280. Plan B crosses this loop on a $7^{\circ} 30'$ curve with a bridge costing about \$2.7 million.

Plans C, D and E follow the general selected alignment which is across the river from the PTW. Plan C, with a $7^{\circ} 30'$ curve, incorporates a steel plate arch for the river crossing which the Fish & Game objected to because they are uncertain whether or not fish will pass freely through this type of structure. Plan D spans the river with a bridge and Plan E uses the new concept of Reinforced Earth approach abutments and a single span bridge.

Plans F, G and H are similar to Plans C, D and E except that an $8^{\circ} 30'$ curve is used, which exceeds the $7^{\circ} 30'$ minimum Interstate curve standards.

The consultant recommends a steel plate arch pipe with a natural stream bottom for the river crossing at this location. If this is objectionable to the Impact Group and if the Group feels the additional cost is justified, the consultant would suggest the use of the Reinforced Earth approach abutments

and a single span bridge. Standard Reinforced Earth construction methods could be used with vertical walls and textured concrete facing elements could also be specified. A clear opening of up to about 60 feet could be left for the river although 45 feet would be adequate. The access road structure could be built in the same way. An innovative feature which could be considered is to place about five feet of select embankment on top of the bridge deck. This should virtually eliminate the problem of the bridge deck freezing before the adjacent roadway. This is of particular advantage since the bridge would be on a sharp curve.



1226+93.7
 END BERNICE BASIN
 BEGIN BASIN - BOULDER
 1240+00

1250
 $D_c = 7^\circ 30'$

TOP OF CUT
 $D_c = 7^\circ 30'$

CHANNEL CHANGE

B.N.R.Y. TUNNEL

RIVER ENCROACHMENT

QUARRY

TOP OF CUT

1300

EXTEND RR BRIDGE
 VEHICULAR UNDERPASS

38' SPAN
 ARCH CULVERT

$D_c = 6^\circ$
 P.T.W.

1350
 LOW GRADE ACCESS ROAD

BOULDER RIVER

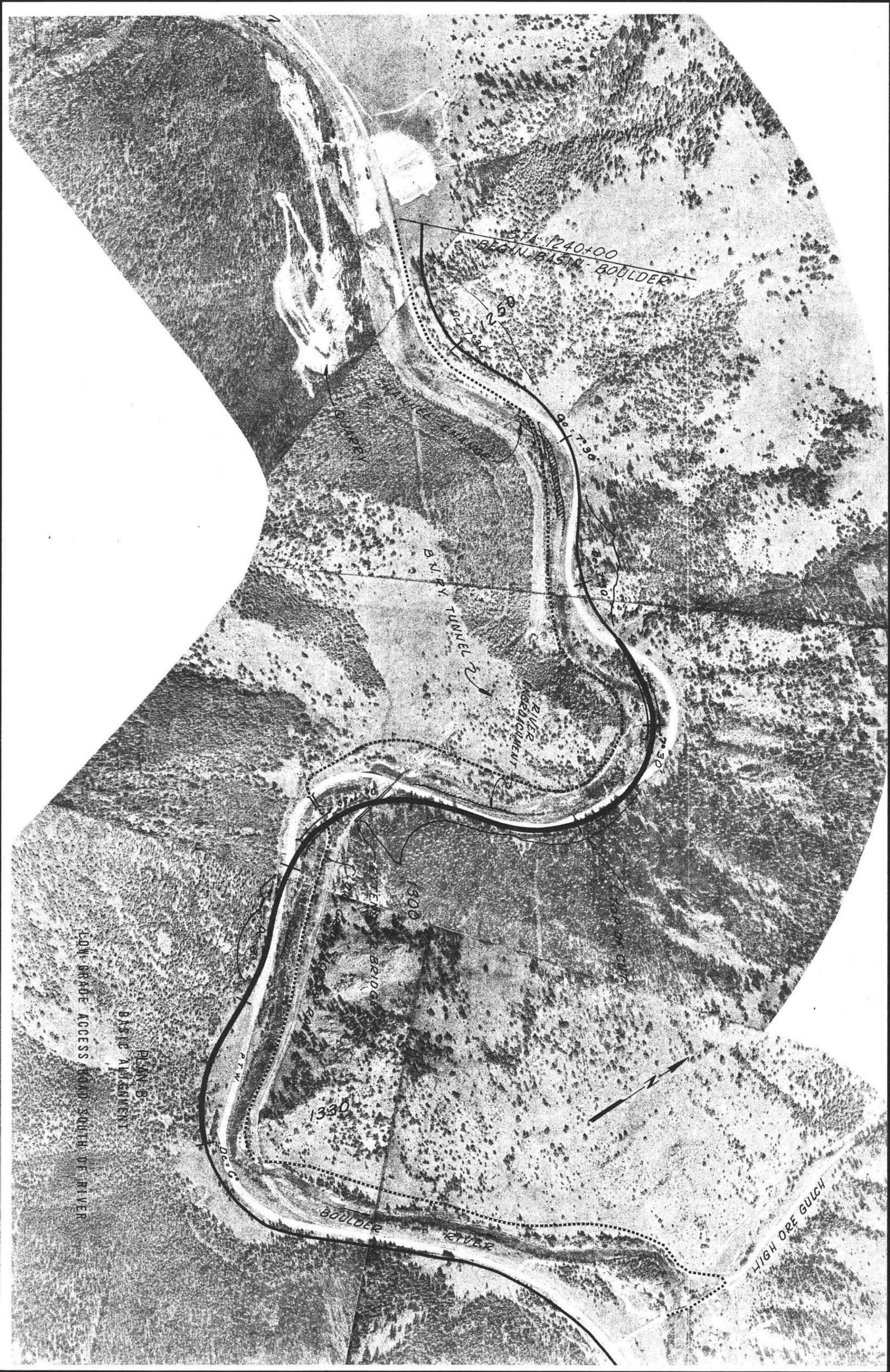
$D_c = 2^\circ 30'$

TOP OF CUT

HIGH GUE GULCH

NEW BRIDGE

PLAN A
 BASIC ALIGNMENT
 7° 30' CURVE



STA. 1240+00
BEGIN BASIN BOULDER

BURY TUNNEL

RIVER REACHMENT

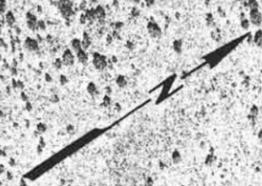
BRIDGE

BOULDER RIVER

HIGH ORE GULCH

PLAN B
BASIC ALIGNMENT

LOW GRADE ACCESS ROAD SOUTH OF RIVER



P.T.W.

De S G

1300

1330

1300 CURV

RIVER

De S G

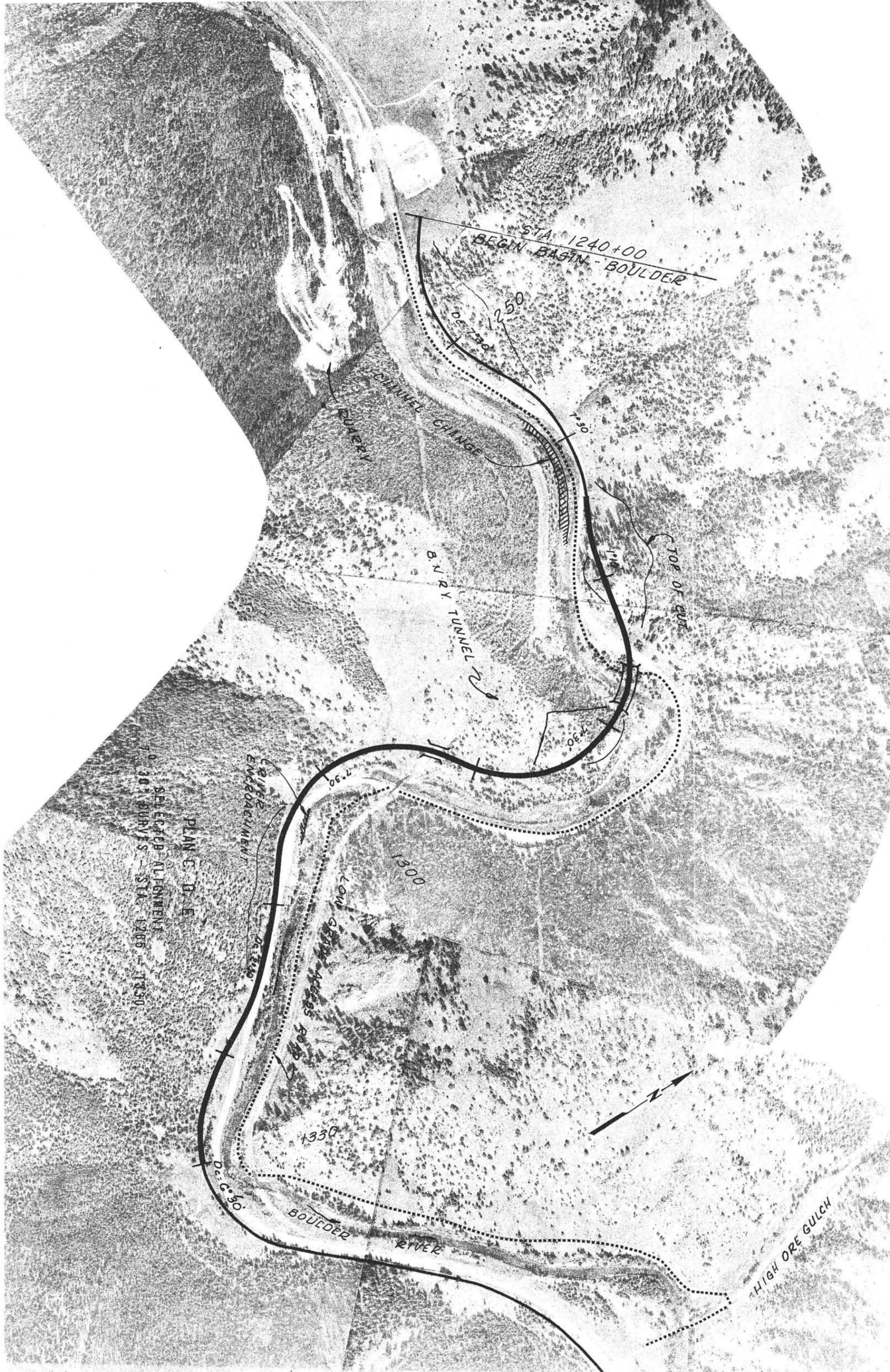
De S G

7+30

2+50

De S G

CHANNEL CENTERLINE



STA. 1240+00
BEGIN BASIN - BOULDER

CHANNEL CHANGE

QUARRY

B.N.R. TUNNEL

TOP OF CUT

7 0 30 SURVEYS - STA. 1205 - 1330

PLAN C. D. E.

SELECTED ALIGNMENT

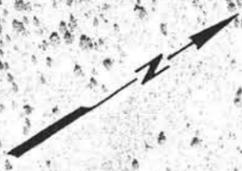
RAILROAD ENROADMENT

LOW GRADE ACCESS ROAD

HIGH ORE GULCH

BOULDER

CRACK



PLAN F. G. H.
SELECTED ALIGNMENT
80.30' CURVE - STA. 1280



STA. 1240+00
BEGIN BASIN BOULDER

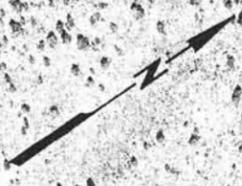
CHANNEL CHANGE

B.N.R. TUNNEL

RIVER
EMBANKMENT

BOULDER
RIVER

HIGH ORE GULCH



INTER-DEPARTMENTAL MEMORANDUM

DEPARTMENT OF HIGHWAYS

To Impact Evaluation Group Members
Homer G. Wheeler, P. E.
From Impact Evaluation Coordinator

Date November 20, 1975

Subject I 15-3 (13)
Basin-Boulder
Ref: 07 - HGW

Attached is information on the above subject to aid you in preparing discussion for the Impact Evaluation Group meeting on November 24, 1975.

HGW:lp

Attachment

Distribution: R. Byron Roberts - DCA
Bill Furois - DCA/Highway Traffic Safety
Dr. Loren Bahls - EOC
Mike Roadh - Air Quality/DHES
Don Willems - Water Quality/DHES
Tom Ellerhoff - Environ. Sciences/DHES
Gerhard M. Knudsen - Nat. Resources
Brian Cockhill - Mont. Historical Society
Ralph Boland - Fish & Game
FHWA



Avoid Verbal Instructions

Page Two
Mont. Dept. of Highways
re: I15-3(13) Basin-Boulder
November 17, 1975

Meeting Notes

Sta. 1240-1260

The group considered the effects of all alternates presented in the Design Planning Report and it appeared that the consensus of opinion favored Alternate 5, alignment over point (Sta. 1245-1265). The additional cost would be about \$213,000 and approximately 1,700 feet of river disturbance would be avoided as compared to the Basic Plan. The area of exposed cut would be increased 4.2 acres.

Sta. 1260-1330

In this section the group appeared to favor Alternate 9a, alignment over point south of river with a culvert at Station 1277 and an 8°30' curve around the point. The Fish & Game prefers a bridge at Sta. 1277. This alternate preserves the river loop near Sta. 1278 which is of prime concern to the Fish & Game Department and would simplify maintenance of traffic through construction by leaving the PTW open. It would cost about \$391,000 more than the Basic Plan and would reduce the length of river disturbance by 1,750 feet. The area of exposed cut would be reduced 0.6 acre.

Sta. 1330-1440

The group appeared to favor the consultant's recommendation of placing the Interchange at Sta. 1385 with a grade separation at Galena Gulch and with river bridges at Stations 1412 and 1440. This alternate would cost about \$902,000 more than the Basic Plan and would reduce the length of river disturbance by 1,750 feet. The area of exposed cut would be about the same as the Basic Plan. Right of Station 1460 the low grade access road will have to pass between the river the the steep hillside to the south. A small amount of river encroachment will occur at this location but the width should be minimal and no channel excavation would be necessary.

Sta. 1440-1530

The group appeared to agree with the consultant's recommendation in this area which was to reduce spiral curve lengths 300 feet where necessary to improve alignment and reduce stream encroachment. Length of river disturbance would be reduced by 600 feet at no additional cost; only a reduction of design standards.

Page Three
Mont. Dept. of Highways
re: I 15-3(13) Basin-Boulder
November 17, 1975

Summary

Mr. Kologi indicated that the Impact Evaluation Group would meet again within the next few days to determine their final recommendations and allow design of the project to commence.

Cost Revisions

Attached are Pages 26, 27 and 30 of the Final Design Planning Report on which revised costs are shown. These pages will replace the pages in your Planning Report which is dated October 23, 1975. Please distribute these to Planning Report holders as you see fit.

Sincerely,

MORRISON-MAIERLE, INC.

J. Walter Scott, P.E.

JWS:el

Attachments

- B. Length of River Disturbance:
- (1) Sta. 1243 to 1249 - 800 ft. Channel Ch.
 - (2) Sta. 1251 to 1267 - 1600 ft. Channel Ch.
 - (3) Sta. 1276 to 1277 - 100 ft. Encroachment, Br.
 - (4) Sta. 1302 to 1304 - 200 ft. Encroachment
 - (5) Sta. 1312 to 1314 - 200 ft. Encroachment
 - Total 2900 ft.
 - (6) 2,000 ft. less than Basic Plan.
- C. Area of Exposed Cut: (sq.ft.)
- (1) Sta. 1240 to 1260 - 0
 - (2) Sta. 1260 to 1275 - 327,000
 - (3) Sta. 1275 to 1305 - 140,000
 - (4) Sta. 1305 to 1330 - 25,000
 - Total 492,000
 - (5) 104,000 more than Basic Plan.
- D. Cost Increase Over Basic Plan:
- | | | |
|--|--------------------|---------------------|
| (1) Increased excavation, 827,300 CY @ \$1.50 = | \$1,241,000 | |
| (2) River bridge @ Sta. 1278 = | 1,430,000 | |
| (3) Bridge over R/R @ Sta. 1295 = | 484,000 | Less R/R |
| (4) Less vehic. underpass & culv. @ Sta. 1308 = | (331,000) | Br. |
| (5) Waste 601,000 CY excess excav. @ \$1.20 = | 721,000 | (752,000) |
| (6) Maintenance of traffic (reduced) = | (13,000) | |
| (7) Special channel treatment (reduced) = | (96,000) | |
| Total | <u>\$3,436,000</u> | |
| (8) Cost per foot of channel disturbance reduced over Basic Plan - \$2,684,000 | | |
| <u>2,000 ft.</u> | = \$1340/ft. | |
| | | = \$134,000/100 ft. |

8a. Alignment Over Point South of River - Sta. 1275 to 1310 -
7030' Curves. with Arch Culvert @ Sta. 1278 (Shown on Plan 7)

- A. Features:
- (1) Same as Alternate 8, except 38 ft. span metal arch replaces bridge at Sta. 1278.
- B. Length of River Disturbance:
- (1) Increased 250 ft. over Alt. 8 - Total = 3150 ft.
 - (2) 1750 ft. less than Basic Plan.
- C. Area of Exposed Cut: (sq.ft.)
- (1) Same as Alt. 8 - 492,000.
- D. Cost Increase Over Basic Plan:
- | | | |
|--|--------------------|--------------------|
| (1) Total, Alt. 8 = | \$3,436,000 | |
| (2) Less cost of Bridge @ Sta. 1278 = | (1,430,000) | |
| (3) Plus cost of 38' arch = | 405,000 | (752,000) |
| (4) Plus cost of veh. underpass = | 45,000 | |
| Total | <u>\$2,456,000</u> | |
| (5) Cost per foot of channel disturbance reduced over Basic Plan = \$1,704,000 | | |
| <u>1750 ft.</u> | = \$970/ft. | |
| | | = \$97,000/100 ft. |

Costs Revised 11/17/75

9. Alignment Over Point South of River - Sta. 1275-1310 -
8°30' Curve. (Shown on Plan 8)

A. Features:

- (1) Substandard 8°30' curve at Sta. 1280.
- (2) Other features same as Item 8 above.

B. Length of River Disturbance:

- (1) Same as No. 8 above - 2900 ft.
- (2) 2000 ft. less than Basic Plan.

C. Area of Exposed Cut: (sq.ft.)

- (1) Sta. 1240 to 1260 - 0
- (2) Sta. 1260 to 1275 - 208,000
- (3) Sta. 1275 to 1305 - 127,000
- (4) Sta. 1305 to 1330 - 25,000
- Total 360,000
- (5) 28,000 less than Basic Plan.

D. Cost Increase Over Basic Plan:

- | | |
|---|-----------------------|
| (1) Increased excavation, 296,500 CY @ \$1.50 = | \$ 445,000 |
| (2) River bridge @ Sta. 1278 = | 1,430,000 |
| (3) Bridge over R/R @ Sta. 1295 = | 484,000 |
| (4) Less vehic. underpass & culv. @ Sta. 1308 = | (331,000) |
| (5) Waste 170,000 CY excess excav. @ \$1.20 = | 204,000 (752,000) |
| (6) Maintenance of traffic (reduced) = | (13,000) |
| (7) Special channel treatment = | (96,000) |
| Total | <u>\$2,123,000</u> |
| (8) Cost per foot of channel disturbance | \$1,371,000 |
| reduced over Basic Plan = | <u>\$1,371,000</u> |
| | 2,000 ft. = \$690/ft. |
| | = \$69,000/100 ft. |

9a. Alignment Over Point South of River - Sta. 1275-1310 -
8°30' Curves. (Shown on Plan 8)

A. Features:

- (1) Same as Alternate 9, except 38 ft. span metal arch replaces bridge at Sta. 1278.

B. Length of River Disturbance:

- (1) Increased 250 ft. over Alt. 9 above - Total = 3150 ft.
- (2) 1750 ft. less than Basic Plan.

C. Area of Exposed Cut: (sq.ft.)

- (1) Same as Alt. 9 - 360,000.

D. Cost Increase Over Basic Plan:

- | | |
|--|-----------------------|
| (1) Total, Alt. 9 = | \$2,123,000 |
| (2) Less cost of Bridge @ Sta. 1278 = | (1,430,000) |
| (3) Plus cost of 38 ft. arch = | 405,000 (752,000) |
| (4) Plus cost of veh. underpass = | 45,000 |
| Total | <u>\$1,143,000</u> |
| (5) Cost per foot of channel disturbance | \$ 391,000 |
| reduced over Basic Plan = | <u>\$ 391,000</u> |
| | 1,750 ft. = \$220/ft. |
| | = \$22,000/100 ft. |

Costs Revised 11/17/75

7.	Low Grade Access Road South of River (Shown on Plan 6) -Cost per foot of river disturbance reduced over Basic Plan - \$53/ft. or \$5,300/100 ft. -River disturbance reduced 900 ft.	\$ 48,000
8.	Alignment over Point South of River - Sta. 1275-1300 - 7°30' Curves (Shown on Plan 7) -Cost per foot of river disturbance reduced over Basic Plan - \$1340/ft. or \$134,000/100 ft. -River disturbance reduced 2,000 ft.	\$3,436,000 \$2,684,000
8a.	Alignment over Point South of River - Sta. 1275 to 1310 - 7°30' Curves (Shown on Plan 7) With Arch Culvert at Sta. 1278 -Cost per foot of river disturbance reduced over Basic Plan = \$970/ft. = \$97,000/100 ft. -River disturbance reduced 1750 ft.	\$2,456,000 \$1,704,000
9.	Alignment Over Point South of River - Sta. 1275-1300 - 8°30' Curves (Shown on Plan 8) -Cost per foot of river disturbance reduced over Basic Plan - \$690/ft. or \$69,000/100 ft. -River disturbance reduced 2,000 ft.	\$2,123,000 \$1,371,000
9a.	Alignment over Point south of River - Sta. 1275 to 1310 - 8°30' Curves (Shown on Plan 8) - -Cost per foot of river disturbance reduced over Basic Plan = \$220/ft. = \$22,000/100 ft. -River disturbance reduced 1750 ft.	\$1,143,000 \$ 391,000
		<u>Costs Revised 11/17/75</u>

XVIII. RECOMMENDATIONS:

PART 1 - STATION 1330 to 1530.

The accompanying PLAN 2, Recommended Plan shows the recommended alternate alignment and profile. It consists of the Basic Plan between Stations 1330 and 1530 with the addition of Alternates 3 and 4, shown in Sections XVI and XVII. These items include moving the interchange to Sta. 1385 near High Ore Creek, the use of bridges at Stas. 1412 and 1440, and the lowering of design standards of some curves between Stas. 1435 and 1530 by reducing spiral length from 350 ft. to 300 ft. This

See original for maps