

San Juan  
Animas La Plata  
File # 10

OSE-2214

1962 OCT 16 PM 1:16  
STATE ENGINEER OFFICE  
SANTA FE, N. M.

October 15, 1962

Mr. John H. Bliss  
Upper Colorado River Commissioner  
125 North Castillo  
Santa Fe, New Mexico

Dear John:

In a news release dated today the Department of the Interior announced that the report on the proposed Animas-La Plata project in Colorado and New Mexico has been forwarded to the seven States of the Colorado River Basin and to other interested parties for their comments under the Flood Control Act of 1944.

According to the news release, the report shows:

"The proposed plan of development would provide a full irrigation supply for 58,900 acres of dry land and a supplemental supply for 25,600 acres that are now inadequately irrigated. Of this total, 64,300 acres are in Colorado and 20,200 are in New Mexico. A substantial portion of the dry lands are Indian-owned, while the supplemental service lands are non-Indian. Most of the project water will originate in the Las Animas River, which has an average annual runoff of 408,200 acre-feet at the point of diversion as against an average runoff of 34,200 acre-feet for the La Plata River.

"Development of a new municipal and industrial water source for Durango would increase that city's supply by an average of 9,200 acre-feet annually. By exchange, an additional 3,700 acre-feet of water annually would then become available to the Florida Project. This water would supplement the irrigation supply to 1,170 acres and would bring an additional 1,110 acres under irrigation.

Mr. John H. Bliss  
October 15, 1962  
Page Two

"Total construction cost of the Animas-La Plata Project is estimated at \$102,281,900. Tentative allocations, excluding \$890,000 investigation funds derived from the Colorado River Development Fund and contributed funds, are: irrigation, \$95,878,000; municipal and industrial water, \$2,388,000; fish and wildlife, \$2,744,000; recreation, \$381,900.

"The costs allocated to irrigation would be repaid partly by the water users over a 50-year period, partly by the Conservancy Districts from ad valorem taxes, and the remainder from Colorado's and New Mexico's apportioned revenues in the Upper Colorado River Basin Fund. The city of Durango would repay with interest the costs allocated to municipal and industrial water. The recreation and fish and wildlife costs are considered to be in the broad public interest and would be borne by the United States."

Sincerely yours,



Ival V. Goslin  
Executive Director

IVG:htw

cc: Stephen E. Reynolds  
✓ David P. Hale  
Claud S. Mann  
Dudley Cornell



ST  
Animas-La Plata

M E M O R A N D U M

September 26, 1962

TO: David P. Hale, Interstate Stream Engineer  
FROM: Philip B. Mutz and J. L. Whiteman  
SUBJECT: Diversion Requirements for the New Mexico Portion of the Animas-La Plata.

At a conference with Bureau of Reclamation personnel of the Durango Office on the 13th and 14th of December 1961 the method used in determining consumptive use for the New Mexico area of the Animas-La Plata Project was discussed. At that time the Bureau people indicated that the Blaney-Criddle method was used to estimate consumptive use. They further indicated that farm delivery was determined by dividing consumptive use by farm efficiency. The following is quoted from a memo dated January 24, 1962 in reference to the discussion: ". . . . In effect the Bureau procedure is to allow for incidental consumptive use requirements for water in the estimate of farm losses and conveyance losses. The procedure used requires that the estimate of both farm losses and canal losses be sufficiently high to allow for incidental water requirements . . . . ."

Since the aforementioned meeting a question has been raised as to the adequacy of the farm delivery requirement

for leaching, necessitated by the possible quality of the water available for irrigation and the salt tolerance of the crops to be produced in the project area. Since the adequacy of the farm delivery requirement is dependent on several judgement factors, studies were made to show the conditions that may prevail assuming that the soils and land are maintained so that leaching will be effective.

Basic Data:

- (1) Derivation of consumptive use of irrigation water page 66 Appendix B. Water Supply U.S.B.R.
- (2) Project water requirements pages 70, 71, 72 Appendix B, Water Supply
- (3) Quality of water analysis, La Plata River at State Line, pages 60, 61 Appendix B, Water Supply
- (4) Sensitivity of crops to Salt, page 14, Circular 969, "Classification and Use of Irrigation Waters," U. S. Department of Agriculture
- (5) Leaching Requirement formulae pages 37 and 38 "Diagnosis and Improvement of Saline and Alkali Soils" Agriculture Handbook No. 60 U. S. Department of Agriculture

First the quality of La Plata River water at the New Mexico-Colorado State Line was reviewed to estimate the

probable quality under project conditions in terms of conductance. Historically, the worst condition was on July 12, 1955 when the flow was 1.4 cfs and the conductance 1,920 micromhos. The best condition existed June 7, 1957 when the flow was 615 cfs and the conductance 95 micromhos. The average of fifty samples taken during the period July 1955 to November 1960 indicated an average conductance of 1026 micromhos. It is difficult to estimate what the water quality will be with project conditions, therefore three quality conditions were considered:

- (1) Approximate present average conductance-1,000 micromhos
- (2) Approximate present maximum observed-2,000 micromhos
- (3) Mean of average and maximum-1,500 micromhos.

The Circular listed in Item 4 of the basic data indicates that most of the crops have a drainage water\* salt tolerance ranging from a conductance of 4,000 - 8,000 micromhos. Two drain water conditions were selected for study:

- (1) 6,000 micromhos
- (2) 8,000 micromhos

The studies are summarized on Table 1.

Columns (8) and (9) of Table No. 1 indicate that a larger

\* Drainage water refers to that water occurring at the base of the plant root zone.

quantity of water is needed for farm delivery than provided for in the Animas-La Plata Report only under the quality conditions of an input of 2,000 micromhos with the drain water limited to 6,000 micromhos.

It is possible that the values shown in Column (9) of Table 1, Blaney-Criddle recommendation, should be increased 5% for the Meadows area to provide for surface wastes that may be encountered in irrigating the deep, finely textured soils of that area. In this case the U.S.B.R. farm delivery requirement would provide just enough water for the conditions of input of 2,000 and 1,500 micromhos and drain water of 8,000 and 6,000 micromhos respectively, ~~and in addition~~ <sup>but</sup> would not provide enough water for conditions of input of 2,000 micromhos and drainwater of 6,000 micromhos.

However, there is a quantity of water available in addition to the U.S.B.R. diversion requirement which could be used for leaching purposes during the period April to October each year. This quantity was estimated from the Bureau of Reclamations' operational study and is shown in Table No. 2.

Table No. 2 shows that for the period of study there is an average of 7,100 acre feet of water in excess of the diversion requirement at the State line during the irrigation season, (April-October). It is apparent that 5,900 acre feet of this total (Column 5 and 6 Table 2) is a fairly reliable source



and could be diverted for leaching water. Assuming that the works can divert the water, conveyance losses do not exceed 20%, farm losses other than deep percolation do not exceed 20% and using the U. S. Bureau of Reclamation total acreage for the area then the 5,900 acre feet noted above could provide the following additional quantities of leaching water to the New Mexico areas:

La Plata	5,900 acres	0.60 AF/acre
Meadows	6,900 acres	0.51 AF/acre
La Plata and Meadows	12,800 acres	0.28 AF/acre

This would extend the U.S.B.R. supply for farm delivery requirement by:

La Plata	21%
Meadows	16%
La Plata and Meadows	9%

If the water available for leaching can be applied to the land, it appears ~~as if~~ <sup>that</sup> this water would make up for any leaching deficit indicated by the assumed conditions in Table No. 1.

The U.S.B.R. computation of total diversion requirement includes a reuse of return flow in meeting the farm delivery requirement. The amount of reuse is 0.35 acre feet for the La Plata, New Mexico area, 12% of the farm delivery requirement and 0.20 acre feet for the Meadows area, 6% of the farm delivery requirement. The origin of this return flow will probably be from

wastes and deep percolation losses from the first application in New Mexico. ~~The use of this return,~~ <sup>that return</sup> whether it constitutes a partial or entire supply for some areas for a portion of the season is not known. That portion of the return flow derived from deep percolation losses may be of poor quality. If the quality of the total return flow for reuse has a conductance higher than 2,000 micromhos the use of such return flows could reduce yields if additional leaching water is not provided.

The diversion requirement computed by the Bureau for the Animas-La Plata Project does not provide, as discussed in previous reviews by this office, a conservative estimate of that requirement. The Bureau may argue, as they have previously, that they feel the report is adequate. Further discussion with the Durango office might provide additional information.

TABLE NO. 1

COMPUTED ALLOWANCE FOR FARM LOSS OTHER THAN DEEP PERCOLATION  
FOR  
VARIOUS WATER QUALITY CONDITIONS

Area	(1) C.U. per Irrigable Acres, Inches	(2) Effective Precipitation Inches	(3) Electrical Conductance Irrigation Water Micromhos	(4) Drain Water Micromhos	(5) U.S.B.R. Total Req'd Farm Delivery Af/Ac	(6) Total Water Delivered to land (2) + (5) Af/Ac $\frac{2}{1}$	(7) Req'd Delivery to land for C.U. and Leaching Af/Ac	(8) Computed Allowance for Farm loss (7) ÷ (6) % $\frac{3}{1}$	(9) Recommended Allowance by Blaney and Criddle and $\frac{4}{1}$
La Plata	23.43	3.99	1000	8000	2.91	3.24	2.12	35	20
	23.43	3.99	1500	8000	2.91	3.24	2.28	30	20
	23.43	3.99	2000	8000	2.91	3.24	2.47	24	20
	23.43	3.99	1000	6000	2.91	3.24	2.23	31	20
Meadows	23.43	3.99	1500	6000	2.91	3.24	2.47	24	20
	23.43	3.99	2000	6000	2.91	3.24	2.78	14	20
	24.70	3.35	1000	8000	3.19	3.47	2.23	36	20
	24.70	3.35	1500	8000	3.19	3.47	2.41	31	20
	24.70	3.35	2000	8000	3.19	3.47	2.61	25	20
	24.70	3.35	1000	6000	3.19	3.47	2.35	32	20
	24.70	3.35	1500	6000	3.19	3.47	2.61	25	20
	24.70	3.35	2000	6000	3.19	3.47	2.93	16	20

- 1/ Water at the bottom of the plant root zone.
- 2/ Precipitation is converted to feet.
- 3/ % of Farm delivery requirement, excluding deep percolation. Expressed as 100% minus percentage resulting from Col. (7) ÷ Col. (6)
- 4/ Blaney-Criddle recommended farm losses have been reduced 5% to account for deep percolation losses from farm laterals. Assumed available for leaching

TABLE NO. 2  
WATER AVAILABLE AT MEADOWS DIVERSION DAM  
IRRIGATION SEASON  
(April - October)

(1)	(2)	(3)	(4)	(5) (6) (7) A Portion of the Water at State Line in Excess of Requirement			(8)
Year	Residual La Plata River Water	Delivery from Animas Canal	Total Water Available at State Line	Spills from Meadows Diversion Dam	La Plata Water Excess of Req'm	Spills from Meadows Reservoir	Total Excess for Leaching Col. 5 + 6 + 7
1928	39.6	6.1	45.7	0	5.5	0	5.5
29	49.3	4.7	54.0	1.9	7.7	0.4	10.0
1930	42.8	4.5	47.3	0.6	4.9	0.4	5.9
31	35.7	2.9	38.6	0	1.4	0.4	1.8
32	47.8	2.9	50.7	0	6.9	1.4	8.3
33	40.0	3.0	43.0	0	2.3	0.2	2.5
34	23.8	3.0	26.8	0.3	1.8	0	2.1
1935	41.4	7.3	48.7	0	7.1	0	7.1
36	38.3	5.3	43.6	0.7	5.3	0.2	6.2
37	54.2	3.8	58.0	5.5	5.6	5.8	16.9
38	43.9	4.1	48.0	0	6.9	0.8	7.7
39	37.6	5.1	42.7	0	3.1	0	3.1
1940	32.8	2.4	35.2	0	4.1	0	4.1
41	74.7	0.4	75.1	15.4	4.8	7.3	27.5
42	54.8	2.4	57.2	4.4	6.3	6.3	17.0
43	42.3	5.3	47.6	0	7.4	0	7.4
44	42.6	4.7	47.3	0	6.3	1.0	7.3
1945	44.2	3.3	47.5	0	5.2	2.0	7.2
46	41.3	5.0	46.3	0.1	3.4	0	3.5
47	39.8	4.6	44.4	0.2	3.0	0.6	3.8
48	41.3	6.5	47.8	0	6.3	1.2	7.5
49	46.5	2.5	49.0	0	4.9	3.6	8.5
1950	40.1	6.1	46.2	0.7	5.5	0	6.2
51	27.3	2.7	30.0	0	1.8	0.2	2.0
52	50.9	3.5	54.4	1.2	7.8	2.4	11.4
53	38.7	5.3	44.0	0	4.1	0	4.1
54	34.8	5.6	40.4	0	2.3	0	2.3
1955	32.8	5.0	37.8	0.2	2.9	0	3.1
56	27.1	4.3	31.4	0	3.8	0	3.8
57	49.9	4.7	54.6	2.0	7.0	0	9.0
Total	1256.3	127.0	1383.3	33.2	145.4	34.2	212.8
Avg.	41.9	4.2	46.1	1.1	4.8	1.1	7.1



DEPARTMENT OF  
HEALTH, EDUCATION, AND WELFARE  
REGIONAL OFFICE

PUBLIC HEALTH SERVICE  
Colorado River Basin Water Quality Control Project  
Building 22, Room 414, Denver Federal Center  
Denver 25, Colorado

55  
Animas  
1962 SEP 17 AM 8:13  
STATE ENGINEER OFFICE  
SANTA FE, N. M.

September 14, 1962

Mr. S. E. Reynolds  
State Engineer  
State Capitol  
Santa Fe, New Mexico

Attention: Mr. David P. Hale  
Interstate Stream Engineer

Dear Sir:

This is in reply to your letter of August 21, 1962, indicating your interest in receiving two copies of our report A Preliminary Economic Base Study of the Animas-La Plata Project Watersheds in the Four Corners Area of the Colorado River Basin. At present this report is undergoing internal Public Health Service review. Upon release I will be glad to provide you with the copies which you have requested.

Sincerely yours,



Charles E. Sponagle  
Project Director



~~Water Quality Project~~  
35  
Animas-La Plata

August 31, 1982

Mr. Charles E. Sponagle  
Project Director  
Colorado River Basin Water  
Quality Control Project  
Public Health Service, DHEW  
Denver Federal Center, Building 22  
Denver 25, Colorado

Dear Mr. Sponagle:

When it becomes available, it would be appreciated if you would supply this office with two copies of your report, "A Preliminary Economic Base Study of the Animas-La Plata Project Watersheds in the Four Corners Area of the Colorado River Basin."

Thank you.

Very truly yours,

David P. Hale  
Interstate Stream Engineer

DPH:rs





37  
2/20/62

August 16, 1962

Miss Helene C. Monberg  
Correspondent  
1618 - 17th Street, N.W.  
Washington 9, D.C.

Dear Helene:

In reply to your letter of August 13 there has not been a change in New Mexico's position on the Animas-La Plata project.

Best regards.

Sincerely,

SER:c

S. E. Reynolds  
State Engineer



Dear Steve,

Thank you very much for your careful answers to my letter of inquiry of July 21 about the amount of water that New Mexico has left for planning purposes.

Has there been any change in New Mexico's decision to go ahead with the Animas-LaPlata project which, I understand from the Bureau, is going to have a favorable benefit-cost ratio and therefore can be justified?

The Fryingpan bill is supposed to be signed by the President either today or tomorrow, and he goes to Pueblo on Friday. Isn't that great?

73's,

*Helene Monberg  
New Mexico  
Newspapers, Inc.*

1962 AUG 15 PM 1:45  
STATE ENGINEER OFFICE  
SANTA FE, N. M.

STATE ENGINEER OF E  
MEMO

DATE

*8/15*

TO:

*Plint*

- ( ) For Your Information ( ) Note & Return
- ( ) For Your Files ( ) Circulate
- ( ) For Your Handling ( )

REMARKS:

*Are you studying possible power quality water for N.M. portion of Animas-La Plata*

*To → FP*

*Have not made detailed study. Discussion demand does not provide a margin for quality control should it be needed. The permit area could be*





IN REPLY  
REFER TO: 4-700

UNITED STATES  
DEPARTMENT OF THE INTERIOR

BUREAU OF RECLAMATION

REGIONAL OFFICE - REGION 4

P. O. BOX 360

SALT LAKE CITY 10, UTAH

ST  
Animas La Plata  
1962 APR -2 AM 8:28

STATE ENGINEER OFFICE  
SANTA FE, N. M.

MAR 30 1962

Mr. S. E. Reynolds  
State Engineer  
State Capitol  
Santa Fe, New Mexico

Attention: Mr. David P. Hale

Dear Sir:

We are returning to you a set of five amended appendices for our feasibility report of February 1962 on the Animas-La Plata Project as requested by Mr. Hale's letter of January 22, 1962. The same Hydrology Appendix (No. 15) that you formerly had is returned so that your previous entries on some of the pages will be accessible to you.

The appendices must continue to be regarded as tentative until the project report is approved by the Secretary of the Interior. When so approved a copy of the report will be sent to you by the Commissioner of Reclamation.

Very truly yours,

*G. S. Rippon*

Acting

Regional Director

Enclosure No. 24367



5,1, 2/10/62

M E M O R A N D U M

January 24, 1962

TO: Files

FROM: Philip B. Mutz

SUBJECT: Proposed Feasibility Report dated May 1961 -  
Animas-La Plata Project - Bureau of Reclamation

Under date of August 14, 1961 New Mexico's preliminary field-level comments on the subject report were submitted to the Regional Director of the Bureau of Reclamation, Salt Lake City, Utah. Under date of October 24, 1961 the Regional Director addressed a letter to the State Engineer discussing the comments. On reviewing the Bureau's letter it was decided to meet with representatives of the Bureau of Reclamation's Durango office and attempt to clarify certain questions regarding the proposed feasibility report. The writer spent December 13 and 14 in Durango discussing various aspects of the report with Bureau of Reclamation personnel. As a result of that conference and the letter of October 24, 1961 containing comments supplemental to those of the letter of August 14, 1961. This memorandum is prepared to set forth an explanation of some of the comments and



to point out areas where additional study may be required when the report is next presented to the State for review.

The Bureau has suggested that the existing works diverting and distributing water from the La Plata River in New Mexico could continue to operate under the proposed project without extensive rehabilitation. We have concluded from brief inspection of these works made in 1961 that considerable rehabilitation will be necessary in order for the lands served to receive all the benefits of the project water supply. The existing diversion dams are generally in a very bad state of repair and most require considerable work each year so that they can continue to divert water into the ditches. Flash floods during the summer often render the structures inoperable. Headgate and wasteway structures are either in a bad state of repair or nonexistent.

The Durango office pointed out that should the Bureau investigate a rehabilitation of the system they would probably require an expensive permanent type structure at each heading or suggest a consolidation of several ditches into one heading. A permanent diversion structure at each heading would probably cost several hundred thousand dollars each. The possibility of using the structure contemplated in the plan of the report at the Hillside Diversion to serve

most of the lands between the Stateline and the town of La Plata, New Mexico should be given consideration. The plan of the report would construct a siphon across the La Plata River to serve lands on the east side of the river. A further enlargement of the works leading from the diversion dam and construction of connecting laterals to serve existing ditches might well provide facilities to serve some existing lands.

There could possibly be opposition from the local interests to the combining of diversions at one point. Past history of operations in this area records many controversies among the local interests regarding the distribution of water to the various ditches under their respective water rights. If a plan were contemplated to consolidate certain of the diversions, it would probably be desirable to retain, at or near their present locations, the diversion dams for the Jackson, Helton and McDermott Ditches in order to provide for diversion of return flows from diversions made above the town of La Plata, New Mexico. Possible combining of the Left Hand and Helton diversions should be investigated.

Bureau personnel suggested that an investigation of the rehabilitation of the existing structures could be accomplished in the definite planning stage of the project

development. This procedure seems logical. It would appear that the local people in the La Plata, New Mexico area should be contacted regarding the proposed project especially to understand their position on the alternatives of rehabilitation of the existing works.

In the letter of October 24, 1961 the Bureau stated that the Indian lands included in the proposed project would no doubt demand early priority consideration. It was learned at the conference in Durango that the boundaries of the Southern Ute Indian Reservation include a considerable reach of both the Animas and La Plata Rivers in Colorado.

The letter of October 24 suggested that the relationship of the various priorities of water rights be worked out by the two states. At the conference at Durango it was understood that such a relationship was not necessary to the water supply studies required for the subject report.

In the October 24 letter the Bureau replied to our comment that the historical quantity of water diverted under the La Plata River Compact was allowed before the quantity of project water necessary to meet the demands was computed. In the operation studies it had been noted that a correction had been made to the historical quantity of water diverted under the La Plata River Compact. At the conference in Durango it was determined that the historical quantities of water available under the La Plata River Compact

were adjusted, in a minor amount, to a theoretical operation of that Compact. In other words the Bureau had assumed in their studies a perfect operation under the compact which in actual practice had not been effected.

At the conference in Durango it was determined that the water supply studies computed by the Bureau had used return flows that were too large by an average of 6400 acre feet annually from the proposed Animas-La Plata Project. The error resulted because the estimates had been based on the acreage of the original land classification data which was reduced by the detailed land classification thus reducing the requirement for water and the amount of the return flow. It was also determined that the Bureau had not accounted for return flows from the increased uses assumed in the studies by the Town of Farmington. Such return flows, estimated to be one half of the monthly diversions, would amount to an average of about 8500 acre feet per year. The two differences in return flows, from the Animas-La Plata Project a negative quantity, from Farmington a positive quantity, both enter the river in the reach Farmington to Hogback and almost offset each other. Correction of the return flows do not make a material difference in the water supply analyses.

The Bureau personnel in Durango stated that subsequent studies would be corrected for the above noted discrepancies.

The Bureau had computed the increased depletion that would be occasioned by furnishing water to the City of Durango and the exchange of water with the Florida Project as contemplated in the feasibility report. We had not been able to check the stated depletion that would occasioned by the inclusion of these two areas in the project. At the conference in Durango, Bureau personnel were not able to reconcile the depletions computed in the report. They were able to balance within an average of about of 600 acre feet annually which should not materially affect any of our comments or conclusions on the study.

The Bureau's letter of October 24 stated that incidental consumptive uses along canals and laterals and in areas adjacent to the irrigated lands exist because of conveyance and farm losses. We had commented that incidental consumptive uses apparently had not been considered in computing the diversion requirement. The report states that the Blaney-Criddle method was used to estimate consumptive use. At the conference in Durango the computation of the diversion requirement was reviewed. It was determined that the Bureau had computed the crop irrigation requirement using the Blaney-Criddle method and deducting effective precipitation.

The farm irrigation requirement was determined by dividing the crop irrigation requirement by the estimated farm efficiency. The farm irrigation requirement was divided by the estimated conveyance losses to determine the diversion requirement at the head of the project. In effect the Bureau procedure is to allow for incidental consumptive use requirements for water in the estimate of farm losses and conveyance losses. The procedure used requires that the estimate of both farm losses and canal losses be sufficiently high to allow for incidental water requirements. I do not know whether the Bureau's assumed farm efficiency and canal conveyance losses are adequate to include sufficient water for incidental uses. Mr. Blaney, in his discussion of the consumptive use and irrigation water requirement of crops, presents a procedure for estimating the water requirement as follows:

"The irrigation water required to satisfy consumptive use by each crop growing or to be grown on a farm is obtained by subtracting the effective rainfall from consumptive water requirements during the growing or irrigation season as shown in table. . . . This net consumptive requirement (consumptive use minus precipitation) of the crop when divided by the farm irrigation efficiency, gives the seasonal amount of water required at the farm headgate for each acre of the crop. The summation of the headgate requirements for each crop, times its acreage, gives the total amount of water that must be delivered to the farm headgate for satisfactory crop production. To this total must be added the amount of water needed for incidental farm operations."

The above has been the procedure used by the writer to compute farm irrigation requirements. Diversion requirements have been computed by correcting the farm irrigation requirement for the estimated canal losses. The estimate of canal losses included evaporation from the water surface, transpiration losses from plants growing along the canal and receiving water from the canal and seepage losses.

The Bureau's letter of October 24 stated that in the water supply studies a minimum flow of 50 cfs was maintained in the Animas River from Durango to Farmington. Our analysis of the water supply studies indicated that it was not a criteria of the water supply studies to maintain a minimum flow of 50 cfs at Farmington, rather in most instances, an average monthly flow of 50 cfs or more was maintained in the Animas River to the headgate of the Farmer's Mutual ditch due to the requirements of irrigation rights, fishery by-passes at Teft and operational wastes and spills. In only seven months of the study period was an average monthly flow of less than 50 cfs maintained in the Animas River at the Farmington gage.

The Bureau's letter of October 24 stated that the language of the report describing the criteria to determine the minimum surplus flow available for Animas River project

development would be changed to be consistent with the operation studies outlined in the Water Supply Appendix. The method used in the water supply analysis to determine the amount of water available for Animas River development was as follows: The recorded flow of the Animas River at Farmington was adjusted monthly by an estimated ideal diversion to the Farmer's Mutual Ditch, the result would be the computed historic flow of the Animas River at its mouth. This computed flow was compared to the recorded flow of the San Juan River at Farmington on a percentage basis and the result labeled the historic contribution of the Animas River to the flow of the San Juan River at Farmington. Below Farmington and above the Hogback, 1) estimated channel losses were deducted, 2) estimated ideal diversion requirements of the Fruitland Indian project, Jewett Valley Ditch and Hogback Indian Project including its extension were deducted, 3) added were estimated new return flows from the Animas-La Plata Project and the Navajo Irrigation Project, and 4) added were returns from the diversion to the Farmer's Mutual, Fruitland Indian and Jewett Valley ditches. The algebraic difference of the above quantities was applied to the recorded flow of the San Juan River at Farmington. The corrected flow was multiplied by the computed percentage contribution of the Animas River and the result was used as the minimum surplus available for Animas River development



at the point. The reach below Farmington was only one of five control points used to determine surplus flows for the Animas River, the other control points being located on the Animas River.

The Bureau's study did not present a computed residual flow at the mouth of the Animas River as a result of the proposed operation of the Animas-La Plata Project. We have made such a study, the results of which are discussed later in this memorandum.

The Bureau's letter of October 24 stated that, even though permits issued by the State Engineer of New Mexico had not been recognized in the water supply analyses, preliminary water supply studies indicate the inclusion of Utah Construction Company's right supplied as a present downstream use would reduce the average project water supply to the Animas-La Plata Project as presently planned by less than one percent. We have made a study to determine the effect of the M & I rights on the water supply available to the Animas-La Plata Project using the Bureau of Reclamation's criteria and correcting for the two above noted discrepancies in return flows. The requirements below Farmington were adjusted upwards in the amount of 60,000 acre feet per year to account for permits for municipal and industrial water by the State Engineer. The results of our study indicate that the adjustment for return flows and the inclusion of

60,000 acre feet of M & I demand below Farmington would reduce the total flow at the head of the Animas Diversion Canal, as defined in the Bureau of Reclamation feasibility report, by an average of 1,000 acre feet per year over the 1928-57 period. The total average diversion under the U.S.B.R. report would be 201,600 acre feet per year and under the adjustments used in our analysis the diversion would be 200,600 acre feet per year. It can be concluded, therefore, that the inclusion of Utah Construction Company right as a present use would reduce the water supply at the Animas-La Plata Project by less than 1 percent using the criteria of the Bureau of Reclamation Report.

We have also made a study to determine the residual demand of the uses below Farmington not supplied by return flows and by the flows remaining in the Animas River after deducting water for the proposed Animas-La Plata Project. This residual demand as computed in our study would be a demand on the river at Navajo Dam. The criteria of our study assumed, 1) a channel loss of 20,000 acre feet between Blanco and Hogback each year and that such channel loss would be offset by return flows from a 40,000 acre foot per year M & I demand on Navajo Dam such demand to be located on the river above Farmington, 2) the Navajo Indian Irrigation Project operating with return flows averaging 28,800

acre feet per year returning to the river above Farmington and 31,900 acre feet per year returning above Fruitland, 3) return flows from the Hammond Project as computed by the Bureau of Reclamation, 4) return flows from existing uses between Navajo Dam and Farmington averaging 17,000 acre feet per year, 5) the residual flows of the Animas River after depletions made by the operation studies in the Bureau of Reclamation's proposed report on the Animas-La Plata Project, 6) return of one-half of the diversion by the extended Town of Farmington uses assumed by the Bureau, 7) the demand of the Fruitland Indian Ditch at its present location which is above the mouth of the La Plata River, 8) returns from the Animas-La Plata Project via the La Plata River, 9) demand of the Jewett Valley Ditch and 60,000 acre feet per year M & I demand both located at Kirtland, 10) returns from the Meadow's Area of the Animas-La Plata Project returning below Kirtland and above Hogback together with the above mentioned, returns from the Navajo Project in this reach, 11) returns from the Farmer's Mutual, Fruitland Indian and Jewett Valley ditches and, 12) demand of the Hogback Project including its proposed extension. The flow remaining in the Animas River after depletion by the proposed Animas-La Plata and Florida Projects was further reduced, by a curve which tends to discount the large erratic flows. No use of natural flows of the La Plata

at its mouth were made. Such flows would likely be in large erratic quantities under project operation. The results of this study indicate that there would be an average demand of 1800 acre feet per year remaining to fill the requirements below Farmington, the maximum would be 15,000 acre feet in 1934. The study does not consider any diminution of return flow due to shortages to the diversion requirements. With no more demand on Navajo Reservoir the 110,000 acre foot Navajo Project plus the Hammond Project and a 40,000 acre foot per year M & I demand there would be no shortage to these demands in the study period. There would, however, be shortages to the Animas-La Plata Project demands but they would not be large and probably would not have a material effect on the estimated return flows.

No attempt was made to operate Utah Construction Company's storage. The effect of their storage if operated correctly would be reduce their demand during the months of peak requirement (late summer months) and increase their demand during the periods of higher stream flow (spring and early summer months).

The demand of the uses below Farmington not supplied by return flows would average 30,200 acre feet per year during the period. Of this amount 28,400 acre feet would be supplied from the remaining flows of the Animas River

at Farmington. It should be pointed out that the usable flows of the Animas River at Farmington as computed from the Bureau of Reclamation's study have incorporated into them the effects of the extended uses by Farmington, the proposed Florida Project, and the City of Durango and Florida portions of the Animas-La Plata Project all reflected as a right prior to all demands below Farmington. This procedure was adopted by the Bureau of Reclamation in their study, probably to facilitate the computations.