

UNITED STATES GOVERNMENT
MEMORANDUM

Bureau of Reclamation
Region 3
Boulder City, Nevada

To: Regional Director
From: Regional Supervisor of Power
Subject: Electric plant investment suballocated to irrigation--
Parker-Davis Project

December 7, 1961

Memorandum of August 24, 1954 to the Regional Director from the Regional Power Engineer (copy attached) contains the derivation of subject sub-allocation percentages on a capacity-use basis. In the past, the percentage for Davis Dam and Reservoir was applied to the total cost of these features. Because, according to the 1960 Audit Report of the Comptroller General, the Mexican Treaty allocation is unrelated to the irrigation allocation, costs allocated to irrigation should be based on apportionment of the costs allocated to the generation and transmission of power only.

No change has been made in the basis for allocating transmission costs to irrigation. However, the estimate of ultimate pump capacity on the Gila Project (formerly 27,040 kw) has been revised to 34,000 kw in the light of drainage pumping estimates. This capacity requirement results in the following revised irrigation suballocation factors:

- (1) Davis Dam power allocation, 230-kv switchyard, 230-kv line from powerplant to switchyard, control cable tunnel to 230-kv switchyard and general plant less contributions

$$34,000/0.9 (225,000) = 0.168$$

- (2) Parker-Davis 230-kv line and Parker 230-kv switchyard

$$37,777/180,000 = 0.21$$

- (3) Parker 161-kv switchyard with connected transformer capacity of 300,000 kva, 0.9 power factor - 2% losses assumed between Davis and Parker

$$37,777 (0.98)/300,000 (0.9) = 0.137$$

- (4) Parker-Gila 161-kv lines

$$37,777 (0.98)/(2) 80,000 = 0.231$$

- (5) Gila Substation - two 30,000 kva transformers banks. One bank is an APA customer benefit feature and the other a system benefit feature - 4,000 kw peak pumping demand at 4-kv

$$4,000/30,000 = 0.133 \text{ excluding } 7.5\% \text{ features}$$

- (6) Gila Wellton-Mohawk 161-kv line - 7% losses assumed from Parker Dam to Gila Substation

$$37,777 (0.93)/80,000 - 4,000/80,000 = 0.388$$

- (7) Wellton-Mohawk features - 1.00

In the following tabulation, the above factors have been applied to appropriate costs to arrive at the total suballocation of power costs to irrigation:

<u>Feature</u>	<u>Factor</u>	<u>Cost</u>	<u>Power Suballocation to Irrigation</u>
Davis Dam power allocation	0.168	\$48,620,000	\$8,168,000
Davis 230-kv Switchyard	0.168	3,679,509	618,158
Control Cable Tunnel to 230-kv Swyd	0.168	517,022	86,860
Davis PP to 230-kv Switchyard line	0.168	92,795	15,590
Davis-Parker 230-kv line and Parker 230-kv Switchyard	0.21	5,112,174	1,073,557
Parker 161-kv Switchyard	0.137	1,436,740	196,833
Parker-Gila 161-kv lines Nos. 1 & 2	0.231	2,545,711	588,059
Gila Sub (Excluding APA Wheeling)	0.133	1,224,646	162,878
Gila W-m 161-kv line	0.388	244,341	94,804
W-M Sub No. 2	1.0	657,553	657,553
W-M PP's Nos. 1, 2, & 3 and lines	1.0	6,746	6,746
W-M Subs Nos. 1 & 3 and lines	1.0	183,326	183,326
W-M PP No. 3 Switchyard to Wellton Turnout Pump	1.0	1,000	1,000
			<u>\$11,853,364</u>

/s/ R. S. Welsh

Attachment

Noted: A. B. West Date 12-8-61
Regional Director

OFFICE MEMORANDUM UNITED STATES GOVERNMENT

To: Regional Director
 From: Regional Power Engineer
 Subject: Electric plant investment allocated to irrigation--Parker-Davis Project

Boulder City, Nevada
 August 24, 1954

The purpose of this memorandum is to explain the factors used in making subject allocation in past years for the annual average rate and repayment study; and to propose for consideration of all concerned revised factors based on new developments. Close examination of subject allocation has been prompted in part by the fact that beginning with the FY 1954 average rate and repayment study, the Commissioner has requested that we indicate how the allocation is made and that support thereof be filed at the project for review and verification on call.

Original Allocation

The original allocation was made for the "Report on engineering feasibility -- of the combined Parker-Davis Projects - November 1947" and was based on an estimated ultimate irrigation pumping energy requirement of 136,700,000 kWhrs in 1975. During the peak irrigation month, it was assumed that 12% of the annual energy requirement would be used at 100% load factor creating a peak pumping load of 22,800 kw. Irrigation allocation of investment in features used to supply this load was then made on a "capacity use" basis as follows allowing 10% for losses.

1. Davis Dam, powerplant, terminal facilities and general plant.	22,800 <u>225,000(0.9)</u>	= 11.25%
2. Davis-Parker 230-kv transmission line and Parker 230-kv switchyard	22,800 <u>180,000(0.9)</u>	= 14.06%
3. Parker-Gila 161-kv line.	22,800 <u>160,000(0.9)</u>	= 15.85%
4. Gila Substation.	22,800 <u>30,000</u>	= 75.94%
5. Wellton-Mohawk additions		100.0%

1949 Revision of Original Allocation

In 1949 the original allocation was revised and used in the FY 1950 and subsequent repayment studies. The revised factors as follows were based on a peak pumping load of 28,137 kw derived in the same manner as the 22,800 kw figure in the original allocation but using revised energy and load factor estimates. In items 2 and 3 surge impedance line capacities were used in lieu of design capacities.

1. Davis Dam, powerplant, terminal facilities and general plant.	$\frac{28,137}{225,000(0.9)}$	= 13.895%
2. Davis Parker 230-kv transmission line and Parker 230-kv switchyard	$\frac{28,137}{132,250(0.9)}$	= 23.64%
3. Parker-Gila 161-kv lines	$\frac{28,137}{2(64,803)0.9}$	= 24.122%
4. Gila Substation.		66.67% (assumed)
5. Wellton-Mohawk additions		100.%

Proposed Allocation

Review of the above allocations indicates that certain of the capacity figures should be revised in the light of present and anticipated future developments. The ultimate installed capacity in pumps at W-M Pumping Plants will be 29,000 H.P. or 22,773 kw based on motor efficiency of 95% as indicated by the test data. Present and ultimate capacity at the Yuma Mesa Pumping Plant is 4900 H.P. or approximately 4,000 kw. Capacity required in relift pumps is estimated at 1452 kva (230 kva in Dome Area as per report entitled, "Study of Power Supply for relift pumps in the Dome Area - W-M Division, Gila Project" dated 7/12/54 and transmitted to Chief Engineer with letter of same subject and date and 1222 kva in the Wellton-Mohawk as shown in report entitled, "Study of reconductoring of Wellton-Mohawk Irrigation and Drainage District 34.5-kv lines" dated May 24, 1953) at 75% P. F. or 1089 kw making a total ultimate rating in pumps of 27,862 kw. Allowing 10% for average losses, 30,958 kw would be required at Davis Powerplant to supply the total pump capacity. The capacity shown does not allow for possible future addition required by virtue of drainage pumping requirements. While this possible future demand is recognized there is no current basis to estimate what these future requirements might be,

if any, and is therefore not considered at this time. This capacity requirement results in the following proposed irrigation allocation percentages:

(1) Davis Dam and Powerplant, 230-kv switchyard, and general plant - $30,958/225,000$ or 13.8% of the total investment at Davis Dam excluding 69-kv terminal facilities. The 225,000 kw is the total nameplate or rated capacity of the five units at Davis Dam although under favorable conditions the net plant capability as reported to the F.P.C. is 272,000 kw.

(2) Parker-Davis 230-kv line including the 230-kv switchyards at Parker Dam - $30,958/180,000$ or 17.2%. The capacity of transmission lines is not clearly defined as in the case of generating units. The capacity of 230-kv lines is given in the PO&M-125 statistics on power facilities as 180 mw. This is generally considered to be the design capacity and in most cases is conservative. Bulletin No. PSD-405, Parker-Davis Project Power System Dispatchers' Instructions gives the nominal load limit for the Davis-Parker 230-kv line as 240 mva with a third-zone impedance relaying limit of 285 mva. The 180 mw figure for the line appears to be consistent with the use of generator nameplate ratings.

(3) Parker 161-kv switchyard with connected transformer capacity of 300,000 kva, 0.9 power factor

$$\frac{30,958(0.98)}{300,000(0.9)} = 11.2\%$$

(4) Parker-Gila 161-kv lines - $30,958(0.98)/2 \times 80,000$ or 19%. The PO&M-125 listings give the capacity of 161-kv lines as 80 mw. Two percent is allowed for line losses between Davis and Parker Dams.

(5) Gila Substation - $\frac{4,000}{30,000}$ or 13.3% excluding 7.5% features.

Ultimately Gila Substation will have two new 30,000 kva transformer banks. One of these banks will be a system feature and the other an APA Steam Wheeling customer benefit feature. A peak of 4,000 kw is required from the system bank to supply the Yuma-Mesa Pumping Plant.

(6) Gila-Wellton-Mohawk 161-kv line - $\frac{30,958(0.93) - 4000}{80,000} = 31.3\%$. It is planned to convert the

Gila W-M 34.5-kv line to the 161-kv and to move the existing 30,000 kva Gila transformer to W-M. The figure of 0.93 allows 7% for losses from Parker Dam to Gila Substation.

(7) Wellton-Mohawk Substation - $\frac{30,958(0.92) - 4,000}{30,000}$
 or 81.6%.

The old 30,000 kva Gila Substation transformer bank will be installed at W-M Substation. Eight percent losses assumed between the Wellton-Mohawk Substation and Parker Dam.

(8) Wellton-Mohawk Substations No. 1 and 3 and 34.5-kv lines between W-M Sub Nos. 1, 2 and 3 - 100%.

In the following tabulation, the above percentages have been applied to the appropriate total estimated costs as indicated on the current PF-2a for Parker-Davis Project plus Parker Project costs to June 30, 1954, where applicable in determining the total costs allocable to irrigation.

<u>Feature</u>	<u>Total Est. Cost</u>	<u>Factor</u>	<u>Allocation</u>
1. Davis Dam, powerplant 230-kv switchyard and general plant	\$67,129,405	0.138	\$9,263,858
2. Davis-Parker 230-kv line and Parker 230-kv Switchyard	5,160,471	0.172	887,601
3. Parker 161-kv Switchyard	1,352,983	0.112	151,534
4. Parker-Gila 161-kv lines	2,440,145	0.19	463,628
5. Gila Substation	1,697,340	0.133	225,746
6. Gila-Wellton-Mohawk 161-kv line	278,995	0.313	87,325
7. Wellton-Mohawk Sub	695,000	0.816	567,120
8. Wellton-Mohawk additions	<u>179,098</u>	<u>1.000</u>	<u>179,098</u>
Total	\$78,933,437		\$11,825,910

Interim irrigation allocation percentages for Gila and W-M #2 Substations before the Gila transformer bank is moved would be $\frac{30,958}{30,000}(0.93) = 96\%$ and 100% respectively. The other percentages would remain unchanged.

With your concurrence, the tabulation will be sent to the project so that it will be available for review and verification on call per instructions contained in the Commissioner's letter of April 15, 1954, subject, "Reconciliation of Accounting Records and Average Rate and Repayment Studies for Power Systems."

/s/ R. S. Welsh