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INTEGRATED REGULATION OF A SYSTEM OF RESERVOIRS FOR CONSERVATION PURPOSES

NATIONAL INSTITUTE OF HYDROLOGY
JALVIGYAN BHAWAN
ROORKEE - 247 667 (U.P.)
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PREFACE

Efficient utilization of the limited water resources requires that reservoirs must be operated in most judicious and scientific manner. The efficient regulation of the reservoirs can lead to increased benefits from the reservoir as well as significant reduction in damage due to floods. Further, if the operation policies of a system of reservoirs are evolved considering the operation of the system as a whole, then the benefits from the system can be improved significantly. There is, therefore, a strong need to apply the system engineering techniques for management of water resources systems of our country.

The present report deals with the development of operation policies for the conservation regulation of the Sabarmati system up to the Wasna barrage. In the present report, details of basin description, data used and the solution strategy adopted have been presented. A computer program has been developed for the simulation of a multi-purpose multi-reservoir system for conservation regulation. The program has been applied to the basin and optimum operation policies have been developed. Detailed operation tables using recommended policy have been presented in this report.

(S. M. Seth)
Director

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ABSTRACT

Reservoir operation is a very important aspect of the planning and management of water resources systems. Depending upon the magnitude of natural inflows and demands at a particular time, water is either stored in the reservoir or supplied from the storage. The reservoirs are commonly built in India for both conservation and flood control purposes.

A reservoir is operated according to a set of rules or guidelines for storing or releasing water depending upon the purposes it is required to serve. The decisions are made in different time periods in accordance with the demands and the state of the reservoir at that time.

The complexity of the problem of reservoir operation depends upon the extent to which the various purposes which a reservoir is supposed to serve are compatible and the number of reservoirs in the system for which integrated regulation is to be carried out.

The present report describes the results of a study carried out to develop operation policies for various dams located in the Sabarmati basin for conservation regulation. Since in a system of multiple reservoirs, the operation of one structure is dependent on the operation of other structure too, an integrated regulation of the Sabarmati system has been simulated. A generalized computer program for simulation of a multireservoir system for conservation regulation has been developed and applied to this system. The developed operation policy of these structures is explained in detail. Working tables of the reservoirs using recommended policy have also been presented.

1.0 INTRODUCTION

Among the various components of a water resources development project, reservoirs are the most important. A reservoir is created by constructing a dam across the stream. The principal function of a reservoir is to regulate and equalize the natural streamflow and thus, to change the temporal and spatial availability of water. Reservoir operation is a very important aspect related to planning and management of water resources systems. After a reservoir project comes into being, much of the benefits reaped, to a large extent, depend on how well it is operated. Detailed guidelines are to be given to the operator which enable him to take appropriate management decisions. A reservoir operation policy specifies the amount of water to be released from the storage at any time depending upon the state of the reservoir, level of demands and any information about the likely inflow in the reservoir.

The Irrigation department, Govt. of Gujarat, Gujarat has requested the National Institute of Hydrology, Roorkee, to prepare Reservoir Operation Manual for dams located in the Sabarmati basin, i.e., Dharoi dam, Harnav dam & Harnav weir, Guhai dam, Hathmati dam & Hathmati weir and Wasna Barrage. This work has been entrusted to NIH through an agreement signed between Irrigation deptt., Govt. of Gujarat and National Institute of Hydrology. This work has been taken up by N.I.H. as a consultancy project. The main objectives of the project are :

(a) To develop reservoir operation manual for Dharoi dam for flood control (i.e. flood forecasting and flood warning) as well as conservation purposes.

(b) To develop operation procedures for Harnav dam, Guhai dam, Hathmati dam, Hathmati weir, Harnav weir and Wasna barrage for irrigation purposes.

This work has been subdivided into two parts, first dealing with development of operation policies for nonmonsoon period and the other dealing with development of the policies for the monsoon period.

The aim of this report is to present the operation policies developed for various structures of the basin for conservation regulation. Since in a system of multiple reservoirs, the operation of one structure affects the regulation of water from the downstream structure also, integrated regulation of the Sabarmati system has been carried out. A computer program for integrated regulation of a multireservoir system for conservation regulation has been developed and applied to this system. The results of the program are satisfactory. The policy of operation and management of these structures is also explained. The data utilised to carry out the above mentioned studies is also described. Simulation tables of the reservoirs using recommended policy have also been presented in detail.

2.0 DESCRIPTION OF THE SABARMATI BASIN

2.1 General Description

The Sabarmati river is one of the four main rivers which traverse the alluvial plains of Gujarat. It rises in the Aravalli hills at north latitude 24° 40' and east longitude 73° 20' in the Rajasthan state at an elevation of 762 meters near the popular shrine of Amba Bhavani. After traversing a course of about 48 Km in Rajasthan, the river enters the Gujarat State. At the 51st Km of its run, the Wakal river joins it from the left near the village Ghonpankhari. Flowing in a generally south-west direction and winding among jungle covered hills over a bed strewn with shingles and boulders, at the 67th Km of its run, it receives the Sei river from the right near Mhauri and then the Harnav river from the left at about 103rd Km from the source, before it enters Dharoi reservoir. Emerging from the dam it passes through the plains and is joined on its left at about 170 Km from its source by the Hathmati river. Continuing to flow south-westwards, the river passes through Ahmedabad at about 165 Km downstream of Dharoi dam. Further 65 Km downstream, another tributary, the Watrak river joins it from the left. Flowing for a further distance of 68 Km, the river outfalls into the Gulf of Cambay in the Arabian sea.

The total length of the river from the head to its outfall into sea is 419 Km of which about 48 Km are in Rajasthan and the remaining 371 Km in Gujarat.

The river Sabarmati drains a total catchment area of 21085 sq. km. The river meets the following tributaries during its course of flow: (i) Sei (catchment area 883 sq. Km) (ii) Wakal (catchment area 1893 sq. Km) (iii) Harnav (catchment area 865 sq. Km) (iv) Hathmati (catchment area 1574 sq. Km) (v) Watrak (catchment area 8638 sq. Km). For the purpose of this study, the catchment area of 10619 sq. km up to Wasna Barrage is of interest.

The river Sabarmati runs in a valley with the ground rising on both sides. The drainage area assumes a shape of a fan lying within the east longitude 73° 48' to 71° 55' and north latitude 24° 54' to 22° 15' covering the part of Rajasthan state and parts of Sabarkantha, Ahmedabad, Banaskantha, Mehsana, Surendranagar and Kaira districts of Gujarat state. The topography of the Sabarmati basin can be considered to be hilly in the early reaches up to Dharoi after which the river flows mostly in plains. On an average the river empties 44775 million cubic meters (Mcm) of water in the Arabian sea annually. The studies carried out by the Govt. of Gujarat reveal the possibilities of utilizing 9692.2 Mcm of water for irrigating 132420.07 ha of land and for power generation to the extent of 2899 KW at 60 % load factor. At times, the Sabarmati river sends down very heavy floods and some of these have caused devastation in Ahmedabad and villages lower down, destroyed crops, carried away cattle, changed the course of the delta channels and filled up harbour with silt. The highest known floods have occurred in 1875, 1941, 1950 and 1973.

2.2 Sub-Basins of the Sabarmati Basin

A brief description of various sub-basins of the Sabarmati basin is given as follows:

Sei Sub-Basin

The river Sei rises from the south western spurs of the Aravalli hills and mostly flows in Rajasthan state. The river is formed by the confluence of several nallas originating from the western slopes of Aravalli hills. The Sei river meets Sabarmati after traversing a course of 102 kms. The catchment area of Sei is 883 sq.Km. The catchment area of the basin is hilly with steep slopes. The average annual rainfall in the catchment is 675 mm. The total catchment area of Sei dam is 331.66 Sq. Km (128.0 Sq. Miles) & normal expected yield at dam site is 52.032 Mcm. Most of the runoff occurs in the monsoon season. The winter rainfall is very small. However, in good rainfall years, some flow remains in the river up to March-April. A dam namely, Sei dam has been constructed on this river

Wakal Sub-Basin

The river Wakal rises from the south western spurs of the Aravalli hills at north latitude 24° 46' and east longitude 73° 23'. After traversing a course of 158 kms, it meets the river Sabarmati. The catchment area of Wakal is 1893 sq.Km. The basin is hilly, covered with forests. The basin covers the Sabarkantha district of Gujarat state and part of Udaipur district of Rajasthan state. A storage and diversion dam is also proposed on this river.

Harnav Sub-Basin

The river Harnav rises from Aravalli hills near village Ghadvas at north latitude 24° 12' and east longitude 73° 16'. After traversing 61 km, the Harnav river meets the river Sabarmati. The catchment area of Harnav river is 865 sq.km. The catchment area in the first 32 km is hilly and thereafter the basin is plain. The average rainfall in the catchment area is 80 cm. The main tributaries of Harnav river are Kaluri and Kusumba rivers draining an area of 311 and 124 sq. km respectively. The catchment area up to the dam site is hilly and remaining portion is generally in plains.

For gauge & discharge measurements, there are three gauging sites in the basin at Abhapur, Harnav-I and Khedbrahma. One storage reservoir with dual purpose of flood control and irrigation and three pickup weirs to cater for irrigation have been constructed across the river. All the three weirs are located downstream of Harnav dam and upstream of Khedbrahma.

Hathmati Sub-Basin

The river Hathmati rises from the Gujarat Malwa hills (South western foothills of the Rajasthan range) near Godad at north

latitude 23° 55' and east longitude 73° 29' in Sabarkantha district. After traversing a course of 98 Km, it meets the river Sabarmati near Ged, 20 Kms south west of Himatnagar in Sabarkantha distt. The catchment area of Hathmati river including its tributaries is 1574 sq.Km. The elongated catchment consists of 70 % hilly and thinly wooded jungles and about 30 % cultivated and inhabited lands. The two main tributaries of Hathmati are Bodoli and Guhai having catchment areas of 119 and 505 sq. km respectively. The catchment area up to the confluence of Guhai and Hathmati is a hilly region. The annual rainfall in the catchment is 86 cms.

On the Hathmati river, a dam namely, Hathmati dam and a pick up weir, namely Hathmati weir or Himatnagar weir have been constructed for getting the irrigation facilities from the tributary. The dam is located in district Sabarkantha and has the dual purpose of irrigation and flood control. The weir is located on the downstream of dam but upstream of confluence of river Hathmati with Sabarmati. The purpose of the weir is irrigation only. On the Guhai river, a storage dam has been constructed for irrigation and flood control. Gauge and discharge measurements are taken in the basin at Bhiloda, Balochpur, Kadiadra and Himatnagar weir.

A line diagram of the entire system is given in Fig. 1. The index map of Sabarmati basin up to Ahmedabad is given in Fig 2.

3.0 OPERATION OF THE SABARMATI SYSTEM FOR CONSERVATION REGULATION

3.1 OPERATION OF THE STRUCTURES IN DHAROI SUB-BASIN

3.1.1 General Description

The river Sabarmati rises in the Aravalli hills in the Rajasthan state and after traversing a distance of about 103 km, it enters the Dharoi reservoir. The total catchment area of the river at the dam site is 5540 sq.km. Upto the Dharoi reservoir, the main tributaries of the Sabarmati river are Sei and Siri from the right side and Wakal and Harnav from the left side.

On Sei river, a diversion dam has been constructed in Rajasthan state. On Harnav river, a storage dam namely, Harnav dam as well as a diversion weir namely, Harnav weir have been constructed for providing irrigation facilities in the command area. The weir is located downstream of the Harnav dam but upstream of the confluence of river Harnav with river Sabarmati. The most important structure on the river Sabarmati is the Dharoi dam which is located 165 km upstream of Ahmedabad. The gauge and discharge measurements are/have been made in the Dharoi catchment at Kheroj (1973 onwards), Abhapur(1967 onwards), Khedbrahma (1962 onwards) and at Dharoi dam site (1962 onwards).

The brief description of these hydraulic structures in this sub-basin is given in the following section.

The Sei dam

Sei dam has been constructed on Sei river in the Rajasthan state under a storage and diversion project which is located near village Teja Ka Bas situated in the north of village Wekaria in Kotra tehsil of distt. Udaipur. This project is also known as Jawai reservoir project. The latitude and longitude of the dam site are 24° 23' N and 73° 11' 8" E. The main objective of this project is to supply water for irrigation in Jawai command area. The water from the catchment upto this dam site is not available for the Dharoi reservoir command.

The Harnav Dam

In the head reaches of river Harnav, a gated dam, known as Harnav dam, has been constructed. Also known as Harnav-II dam or Vanaj dam, the dam is located near village Vanaj, in taluka Vijaynagar, distt. Sabarkantha and has dual purpose of irrigation and flood control. The catchment area at the dam site is 116 sq. km. The construction of the dam was completed in the year 1990. The FRL and HFL of the reservoir are at level 332.00 m and 336.85 m respectively. The dead storage and live storage capacity of the Harnav dam is 1.70 and 19.97 million cubic meter respectively. The crest level of the head regulator taking off water for irrigation from the dam is at 317.50 m. The salient features of the dam are presented in Tables section of this report.

Three weirs have been constructed between the dam site and

Khedbrahma: (i) Mamrechi weir situated 3 km downstream of Harnav dam near Abhapur (ii) Kenyatta weir situated 12 Km d/s of Harnav dam at Attarsumba Ashram and (iii) Chhapra weir or Harnav weir situated 25 Km d/s of Harnav dam. The Mamrechi and Kenyatta weirs were constructed by the former princely states. The third weir namely Chhapra weir was constructed in 1958 as Harnav-I. There are three gauging sites on Harnav river at Khedbrahma (downstream of Harnav weir), at Abhapur (downstream of Harnav dam), and at Harnav weir. Water requirement at the three weir sites are met from the Harnav dam and the flow from the intermediate catchment. Harnav dam is operated to meet the irrigation demands from these weirs. The river Harnav spills its water directly in the Dharoi reservoir. Since there is no raingauge station in the catchment area of the Harnav dam and no gauging site upstream of the Harnav dam, estimation of inflow in the reservoir is made on the basis of rate of rise or fall of water level in the reservoir.

The Harnav Weir

Also known as Harnav-I or Chhapra weir, the weir is located in district Sabarkantha downstream of Harnav dam and upstream of Khedbrahma. The weir was completed in the year 1959. The catchment area at the weir site is 427 sq.km. This single purpose project has been constructed to cater for irrigation. The weir has been completely filled up by sediment & debris. The spillway length of the weir is 191 m. For supplying the water in the command area of the Harnav weir, the water at the weir site is diverted in the Damavas and Patera tanks which are having combined live capacity of 2.067 million cubic meter. Thus, water in the Dharoi reservoir is spilled from the Harnav weir after filling the Damavas and Patera tanks to their full capacity.

The Dharoi Dam

The Dharoi dam is the most important structure of the Sabarmati basin. It is located on river Sabarmati near village Dharoi in Kheralu taluka of distt. Mehsana, 103 km from the source of the river. The latitude and longitude of the dam is 24°00' N and 72°52' E respectively. Its purpose are water supply to the cities of Ahmedabad and Gandhinagar, irrigation, flood control and power generation. The catchment area of the river at the dam site is 5540 sq. km. The dam has been completed in the year 1976. The FRL and HFL of the dam are at level 189.59 m and 175.87 m respectively. The dead storage and live storage capacity of the reservoir (as per revised capacity plan after 50 years) are 89.941 and 739.474 million cubic meter respectively. The salient features of this dam are also given in the Table section of this report.

3.1.2 Data Availability, Analysis and Processing

For deriving operation policies for conservation regulation of any system, monthly local inflow series at the dam sites, monthly target demands of the system, storage details of the reservoirs and the monthly evaporation depths prevalent in the region are required.

For the Harnav reservoir, the monthly inflow series has been obtained from the observations at Abhapur gauging site. The catchment area at the Abhapur gauging site is 125 sq. km. and discharge data from 1967 onwards are available at this site. For this study, data for the period 1967 to 1988 have been considered. The inflow at this site has been reduced proportionally to get the inflow at the dam site. Thus inflow series of 22 years have been utilised which is considered quite sufficient for deriving operating policies for this reservoir. This series is given in Table-HRD.1. The Elevation-Area-Capacity table for the reservoir is given in Table-HRD.2 and plotted in Figs-HRD.2 and HRD.3. The information about monthly water requirements from this reservoir (supplied by the Gujarat Irrigation Department) is given in Table-HRD.3.

For the Dharoi reservoir, the monthly inflow series has been provided by the Gujarat Irrigation Department for the period 1962 to 1991. From the inflow series provided by G.I.D, the local inflow at the Dharoi dam site has been calculated by subtracting the inflow at the Khedbrahma site (which is very near to Chhapra weir) from the observed inflow at Dharoi. This value of inflow at Dharoi will be the local flow at Dharoi, free from obstruction at any hydraulic structure. Since for integrated regulation, common period of observation is used, the simulation of the operation for this sub-basin has been carried out for the period 1967-88. The values of local inflow at the dam site which have been used in this study are given in Table-DHD.1. The Elevation-Area-Capacity table for the Dharoi dam has been taken from the revised capacity plan after 50 years. This is presented in Table-DHD.2 and Figs-DHD.2 and DHD.3. The water demands from the reservoir for irrigation in its command area and for water supply to the cities of Ahmedabad and Gandhinagar have been supplied by the Gujarat Irrigation Department and are given in Table-DHD.3. It needs to be mentioned here that it does not seem possible to meet the irrigation demands of Wasna barrage from this dam. Some reasons for this assumption are :

a) this is a water scarce reservoir and sometimes, it is difficult even to meet demands of the command area of this dam.

b) this dam lies 165 km upstream of Wasna barrage and the intermediate course of the Sabarmati river is sandy and absorption losses from the intermediate river bed is very high.

c) Gujarat irrigation department has specified that there are unaccounted illegal withdrawals from the intermediate reach of the river.

Thus it has been decided that spill from this reservoir will not be made till the level of water in the reservoir overtops the upper recommended rule level for the reservoir. It is also felt that the free catchment area at the Wasna barrage is sufficiently large and demands at the barrage should be met from the water collected from the free catchment area at the barrage. The normal evaporation depths considered are the same as in the operation of Harnav reservoir and is presented in Table-DHD.4.

3.1.3 The Solution Strategy Adopted

The methodology of simulation has been adopted for deriving the optimum rule levels for both the reservoirs. A number of rule levels for reservoir operation have been developed using various scenarios of reservoir inflows and level of demands. An exhaustive integrated monthly reservoir operation simulation study has been undertaken using these rule curves. The results of simulation have been intercompared. The operation policy which best meets the objectives of the conservation storage regulation has been finally recommended for adoption.

Rule Level Computations

Since more than 80% of the annual rainfall in India occurs in the four monsoon months from June to September, it is general tendency to fill up the reservoirs during the monsoon months and then to use this stored water for the remaining months of the water year.

The computations for deriving rule curves have been made using monthly inflow series for different probability levels along with average monthly demands. The monthly inflow series for the two reservoirs, as finalized above, has been analyzed using statistical approach. Power transformation approach has been used for this purpose. The monthly inflows for the Harnav reservoir and the Dharoi reservoir have been estimated for 50%, 60%, 70%, 75%, 80% and 90% probabilities using this approach. The results of this analysis for twelve months for Harnav reservoir and Dharoi reservoir are given in Table-HRD.4 and Table-DHD.5 respectively. It needs to be emphasized here that inflows corresponding to different probability levels are used in arriving at the rule levels to be tried in simulation. Rule levels are modified depending on the results of simulation. Those set of levels which give the best operation performance are finally adopted in the recommended policy.

Using monthly dependable inflow series, the water availability has been assumed as corresponding to particular monthly inflow series. Computations of end-of-month reservoir levels have been made for 12 months after allowing for water demands in full or partial and the evaporation losses from the reservoir surface. The elevation-area-capacity table has been used and the intermediate values have been linearly interpolated whenever required. The evaporation loss has been considered at normal monthly rate over the surface area of reservoir corresponding to a particular elevation.

Rule level Computation for Harnav Reservoir

Since Harnav reservoir is meant to serve only the irrigation demands (which include the demands at the three weir sites also), it is considered appropriate to set two rule levels for this reservoir. One, the upper rule level up to which the reservoir should be filled if there is sufficient inflow in the reservoir and all the irrigation demands are met in full. Second, the lower rule level, below which the supply is reduced to 75% of the irrigation demands.

For fixing the upper rule level, reservoir has been kept at FRL in the four monsoon months from June to September. In the months after the monsoon rule levels have been calculated using 50% probable inflow, meeting full irrigation demands and evaporation from the reservoir using forward computation by the following formula:

$$\text{Storage}_{end} = \text{Storage}_{begin} + \text{Inflow} - \text{Demand} - \text{Evaporation}$$

Thus using this rule level, effort is made to conserve water in the monsoon months such that all the demands of the water year can be satisfied in full and water can still be conserved for the next year. Unless this level is exceeded, water should not be spilled.

The lower rule level is calculated for the case when the reservoir level reaches at the dead storage level by the end of May. For computing this level, 90% reliable inflow, full irrigation demands and evaporation from the reservoir has been assumed. Backward calculations are carried out starting from the end of May using the following formula:

$$\text{Storage}_{begin} = \text{Storage}_{end} - \text{Inflow} + \text{Demand} + \text{Evaporation}$$

Using this formula, the calculations are made to find such a lower level for each month above which all the demands can be met in full. If the reservoir level goes below this level in a particular month, the demands will have to be suitably curtailed so that they can be met for a longer duration thus avoiding severe failure to the crops. Thus considering that 90% reliable inflow (negligible amount of inflow) is coming and satisfying all the demands in full will make us reach to dead storage level at the end of the water year, this level is decided. It is planned that below this level, only 75% of the irrigation demands will be met so that we can meet the demands for a longer duration thus avoiding severe failures.

Rule level Computation for Dharoi Reservoir

Dharoi reservoir is meant to serve the irrigation demands of its command area through the left and right bank canals and the water supply demands to the cities of Ahmedabad and Gandhinagar. The power plant at the dam site has not been installed yet and the demands from the Dharoi dam for power generation have not been supplied by G.I.D. Thus, this aspect has not been considered in this study. Three rule levels have been developed for this reservoir considering different combinations of reliable inflows, level of demands and the initial/end conditions of the reservoir level. One, the upper rule level to which, the reservoir should be filled before spilling the water in the river. Second, the middle rule level, below which only 75% of the irrigation demands are met so that we can meet the demands for longer duration. Third, the lower rule level, below which the demands for water supply only are met in full and no supply is made for meeting the irrigation demands.

The middle rule level is calculated for the case when the reservoir attains the dead storage level at the end of May. To

compute this level, 75% reliable inflow, full irrigation demands and normal evaporation from the reservoir has been assumed. Backward calculations are carried out from the end of May using the following formula:

$$\text{Storage}_{\text{begin}} = \text{Storage}_{\text{end}} - \text{Inflow} + \text{Demand} + \text{Evaporation}$$

Using this formula, the calculations are made to find such a lower reservoir level upto which all the target demands can be met in full and if reservoir level goes below this level, the demands will have to be curtailed. Thus, if the reservoir level is at this level in a given month, 75% reliable inflow enters in the subsequent months and all the demands in full are satisfied, reservoir will reach the dead storage level at the end of the water year. It is planned that below this level, only 75% of the irrigation demands will be met.

The lower rule level is calculated for the case when the reservoir reaches at the dead storage level at the end of May. For computing this level, 90% reliable inflow, full water supply demands and evaporation from the reservoir at the normal rate has been assumed. Backward calculations are carried out from the end of May using the following formula:

$$\text{Storage}_{\text{begin}} = \text{Storage}_{\text{end}} - \text{Inflow} + \text{Demand} + \text{Evaporation}$$

Using this rule level, effort is made to find such a lower level upto which all the water supply demands can be met in full. Thus, if the reservoir is kept at this level, 90% reliable inflows enter the reservoir in subsequent months and all the water supply demands in full are satisfied, the reservoir reach at dead storage level by the end of the water year. It is recommended that below this level, only demands for water supply should be met.

3.1.4 Simulation of the Multireservoir System

A computer program has been developed to simulate the monthly operation of a system of multiple reservoirs. The monthly local inflow data, monthly water demands and normal monthly evaporation are input to the program. The details of the reservoir storage and configuration of the system are also input to the program. The program takes into account the spills coming from any upstream structure and the demands at the downstream location which are to be met by operating the upstream structure. The program calculates the release (cumec), spill, evaporation losses etc. While doing this, it takes into account the flow coming from the upstream structures, diversion of the flow etc.

In the end, the program calculates the number of months when the supply is less than the demand and calculates the monthly time reliability of each structure for the trial policy. It also calculates the total volumetric demand and the volumetric supply from the reservoir and thus calculates the volumetric reliability of the reservoir. It also calculates the number of months of critical failure when the supply is less than 75% of the demand.

3.1.5 Discussion of Simulation Runs for the Dharoi System

A number of simulation runs have been taken by considering different demand levels at the various control locations. The results obtained in different cases are discussed below.

It has been decided to observe the simulation response of the system if the operation of each structure is carried out in accordance with the rule levels developed for that structure. Each structure has been assumed to meet its own demands only. The system was simulated from June 1967 to May 1989. The monthly time reliability of the Harnav reservoir came out to be 75.4 % and that of Dharoi reservoir has come out to be 76.9 %. The corresponding volume reliability obtained at these structures is 80.6 % and 88.8 % respectively. The monthly time reliability of the Dharoi reservoir for water supply demand is 96.2 %. The possibility of releasing water from the Harnav reservoir for meeting water supply demands at Dharoi reservoir was also investigated. It is generally observed that the capacity of the Harnav reservoir is very small in comparison to the demands at the Dharoi reservoir and further, in cases of scarcity at Dharoi reservoir, water is also scarce at the Harnav dam.

Based on these observations, it has been decided that Harnav dam must be operated to meet its own demands only and no release for Dharoi demands should be made from this dam. It has been tried to lower the upper rule levels in the four monsoon months such that the performance of the reservoir is not affected and some room can be kept in the reservoir during monsoon period for flood moderation. A number of simulation runs have been taken and the final recommended Rule Curves (Rule curve A and Rule curve B) are given in Table-HRD.5 and Fig-HRD.4. The operation table of the reservoir for 22 year period using recommended rule levels is presented in Table-HRD.6. The monthly time reliability of the reservoir is 75.4 % and the volume reliability is 80.6 %. From the table, it is clear that the recommended policy tries to meet the demands for as long the duration as possible by curtailing the releases if the reservoir level goes below the lower rule level. Most of the times, 75 % of the target demands have been met. In the span of 22 years, there are only 25 months when the release from the dam are less than 75 % of the demands.

For the Dharoi dam, simulation runs have been taken assuming that reservoir is being operated according to the developed rule levels. The levels in the four monsoon months have been reduced in such a way that the performance of the reservoir is not affected. The monthly time reliability of Dharoi dam has come out to be 76.9 % and volume reliability is 88.8 %. The final recommended rule levels (Rule curve A, Rule curve B and Rule curve C) are given in Table-DHD.6 and Fig-DHD.4. The operation table of the reservoir for the 22 year period using recommended policy is presented in Table-DHD.7. From the observation of the simulation table, it is clear that any unnecessary spill has not been made and efforts have been made to meet the demands for as long the duration as possible.

3.1.6 RECOMMENDED OPERATION PROCEDURE FOR CONSERVATION REGULATION OF HARNAV DAM

The recommended procedure for conservation regulation of the Harnav reservoir using two Rule Curves A and B is as follows:

For a particular month:

1. Try to maintain the reservoir at the Rule level A while meeting irrigation demands in full.

2. If it is not possible to maintain the reservoir level at A, meet all the irrigation demands as long as the reservoir is at or above level B.

3. If it is likely that reservoir will go below level B while satisfying full irrigation demands, curtail the supply for irrigation to 75 % of the demands.

4. If the level in the reservoir is below the level B and above the dead storage level, release water equal to 75 % of the irrigation demands.

5. It is advisable to review the situation periodically within a month and modify the previous decision for the remaining duration of that month and follow steps 1 to 4 to operate the reservoir.

3.1.7 RECOMMENDED OPERATION PROCEDURE FOR CONSERVATION REGULATION OF DHAROI DAM

The recommended procedure for conservation regulation of the Dharoi reservoir using three Rule Curves A and B and C is as follows:

For a particular month:

1. Try to fill the reservoir to upper rule level (Rule Level A) while meeting all the demands in full.

2. If it is not possible to maintain the reservoir level at rule level A, meet all the irrigation and water supply demands as long as the reservoir level is more than the level B.

3. If it is likely that reservoir level will go below the level B while meeting full irrigation and water supply demands, meet full water supply demands and curtail the supply for the irrigation to 75 % of the irrigation demands.

4. If it is likely that reservoir level will go below the level C while meeting full or curtailed irrigation demands and full water supply demands, stop the supply for irrigation demands and meet only the water supply demands in full.

5. If the reservoir level is below the level C and above the sill level of water supply canal, meet full water supply demands for as long the period as possible.

6. It is advisable to review the situation periodically within the month and modify the previous decision for the remaining duration of that month and follow steps 1 to 5 to operate the reservoir.

3.2 OPERATION OF THE STRUCTURES IN THE HATHMATI SYSTEM

3.2.1 General Description

The river Hathmati rises from the Gujarat Malwa hills in Sabarkantha district and after traversing a course of 98 km, it meets the river Sabarmati near Ged, 20 km south west of Himatnagar in Sabarkantha distt. The total catchment area of Hathmati river including its tributaries is 1574 sq. km. Two main tributaries of Hathmati are Bodoli and Guhai having catchment areas of 119 and 505 sq. km respectively.

On the Hathmati river, a dam namely, Hathmati dam and a pick up weir, namely Hathmati weir or Himatnagar weir have been constructed for providing the irrigation facilities. The weir is located downstream of the dam but upstream of confluence of river Hathmati with Sabarmati. On the Guhai river, a storage dam has been constructed for irrigation and flood control. The river Guhai meets the Hathmati river downstream of Hathmati dam but upstream of Hathmati weir. The Gauge and discharge measurements are made on the Guhai river at Kadiadra and Rampur and on Hathmati river at Bhiloda, Balochpur, and Hathmati weir.

The brief description of the three hydraulic structures of the basin and the method of supply of water in the system is given in the following section.

The Hathmati Dam

The Hathmati dam is located near village Fatehpur, in taluka Bhiloda, distt. Sabarkantha, and has dual purpose of irrigation and flood control. The catchment area at the dam site is 595 sq. km. The construction of the dam was completed in the year 1971-72. Along with the Hathmati dam, the Indrasi dam for providing necessary storage and the Navalpur waste weir for disposing off the flood water have also been constructed. The FRL and HFL of the reservoir are at level 180.74 m and 183.18 m respectively. The dead storage and live storage capacity of the Hathmati dam (as per revised fresh capacity plan, 1988) is 3.51 and 149.02 million cubic meter respectively. The crest level of the head regulator taking off water for irrigation from the dam is at 170.69 m. The salient features of the dam are presented in Tables section of this report.

The Indrasi dam has been built on the Indrasi river for providing necessary storage for the Hathmati dam. Above the level 178.76 m, the Hathmati reservoir and the Indrasi reservoir merge together. The dead storage and live storage capacity of this reservoir at level 178.76 m (as per revised fresh capacity plan, 1988) is 0.392 and 18.80 million cubic meter respectively. One head regulator has also been provided in this dam for releasing water for irrigation. The crest level of this head regulator is at level 172.21 m.

One Navalpur waste weir has also been constructed for disposing off the flood water from the Hathmati reservoir. The crest level of this ogee shaped weir is at level 180.74 m and it is ungated. The length of the spillway is 241 m and its

discharging capacity at HFL is 2943.2 cumec.

The Guhai Dam

The Guhai dam is located on river Guhai near village Khandial in Himatnagar taluka of distt. Sabarkantha; 39 km from the source of the river. The latitude and longitude of the dam is 23°42'00" N and 73°3'24" E respectively. Its purpose are irrigation and flood control. The catchment area of the Guhai river at the dam site is 422 sq. km. The dam has been completed in the year 1990. The FRL and HFL of the dam are at level 173.00 m and 173.77 m respectively. The dead storage and live storage capacity of the reservoir are 5.30 and 57.04 million cubic meter respectively. The salient features of this dam are also given in the Table section of this report.

The culturable command area of this project is 11465 ha and the annual water requirement from this reservoir for irrigation is 44.702 million cubic meter.

The Hathmati Weir

The Hathmati weir is located on the downstream of Hathmati dam and Guhai dam but upstream of confluence of river Hathmati with river Sabarmati. The ogee shaped weir was remodeled in 1972-73 and has the sill level at 134.078 m and an overflow section 306.367 m long. The total catchment area of the weir is 1357 sq. km. The design discharge of canal head regulator is 19.4 cumec. This weir is used to divert the flow of river Hathmati into the B, C and D zones of the command area of the Hathmati system for irrigation purposes. During floods, the excess flow of river Hathmati passes over the weir to join the river Sabarmati.

At the upstream of the Hathmati weir, two ancient storage structures, known as Limla dam and Karol dam exist for storing excess water at the Hathmati weir, to be released in the command areas of B, C and D zones. The storage capacity of the Limla dam is 10.28 million cubic meter and that of Karol dam is 7.504 million cubic meter. Thus, water in excess of the irrigation demands of the B, C and D zones at the Hathmati weir can be diverted to fill these two storage structures for use in case of scarcity before spilling the water in river Sabarmati.

Method of Supply of Water in Command area of Hathmati System

Hathmati canal system is one of the oldest irrigation system of Gujarat state. The command area of this project comprises of four zones:

i) Zone A: New area in Bhiloda & Himatnagar Taluka of Sabarkantha District under direct command of the reservoir.

ii) Zone B: Area of existing Hathmati canal system getting water through Himatnagar weir.

iii) Zone C: New area beyond Bokh between Sabarmati and Khari rivers in Sabarkantha, Gandhinagar and Ahmedabad districts.

iv) Zone D: Command area of existing Khari cut canal system.

The main canal of zone A takes off from the Hathmati dam. The capacity of the main canal in initial reach is 15.581 cumec. An escape has been provided at chainage 1425 of main canal to release water in the river Hathmati for B, C and D zones.

One head regulator of 4.816 cumec capacity has been provided in Indrasi dam for releasing water for B, C and D zones. The water released from Hathmati reservoir in the Hathmati river for B, C and D zones either through Indrasi head regulator or through escape of main canal of zone A is picked up at Himatnagar weir and is diverted in the main canal of B-zone.

During floods, water of river Hathmati is diverted in the main canal of zone B at Himatnagar weir and water is stored in Limla dam which is filled through Bokh feeder taking off from Hathmati canal (zone B) and Karol dams which is being fed through Hathmati main canal and Karol feeder. This stored water is released through H.R. in river Khari for Khari cut canal (zone D) and the same is picked up at Raipur weir.

The main canal of zone C takes off from Bokh feeder of Hathmati main canal of zone B. As such, water diverted in main canal of zone B at Himatnagar weir is utilized in zone B, zone C and zone D.

3.2.2 Data Availability, Analysis and Processing

For deriving operation policies for conservation regulation of any system, monthly local inflow series at the dam sites, monthly target demands of the system, storage details of the reservoirs and the monthly evaporation depths prevalent in the region are required.

For the Guhai reservoir, the monthly inflow series has been obtained from the observations at Khandial and Rampur gauging site. The catchment area at the Khandial gauging site is 471 sq. km. and discharge data for the period 1962-78 are available at this site. From 1980 onwards, the gauge and discharge data are available at Rampur, having catchment area of 477 sq. km. The inflow at these sites have been reduced proportionally to get the inflow at the dam site (Catchment area 422 sq. km.). The inflow for the year 1979 has been calculated by averaging the data of Khandial from 1962 to 1978. Thus inflow series of 24 years (1964-87) is available at the dam site which is considered quite sufficient for deriving operating policies for this reservoir. This series is given in Table-G1. The Elevation-Area-Capacity table for the reservoir is given in Table-G2 and plotted in Figs-G2 and G3. The information about monthly water requirements from this reservoir (supplied by the Gujarat Irrigation Department) is given in Table-G3. The normal values for monthly evaporation for the sub-basin are given in Table-G4.

For the Hathmati reservoir, the monthly local inflow series has been obtained from the observations at Hathmati weir (1964-67), at the dam site (1968-78) and at Bhiloda (1982-88). The observed data at Hathmati weir and Bhiloda have been modified in proportion to catchment area to get the inflow at the Hathmati dam site. A regression has been established between the monthly flows at Rampur with Bhiloda and based on the results, inflow at Hathmati dam for the period 1979-82 has been calculated from the observations at Khandial/Rampur. The inflow values at the dam site which have been used in this study are given in Table-HTD1. The Elevation-Area-Capacity table for the Hathmati dam has been taken from the revised fresh capacity plan, 1988. It needs to be mentioned here that above the level 172.21 m, only the live capacity of Indrasi dam has been added in the gross capacity of the Hathmati dam for getting the total capacity at any elevation. This is presented in Table-HTD2 and Figs-HTD2 and HTD3. The water demands from the reservoir for irrigation in different zones has been supplied by the Gujarat Irrigation Department and is given in Table-HTD3. The demands for A zone and BCD zone are given separately and priority has been given to the demands of the A zone. The normal evaporation depths considered are the same as in the operation of Guhai reservoir.

The monthly inflows from the free catchment area at the Hathmati weir (340 Sq.Km) have been calculated from the inflows at Hathmati dam after reducing the same in proportion to the catchment area. The weir has been operated for diverting the water for irrigation in the B, C and D zones and storing the excess water in the Limla and Karol dam, before spilling the water in the Sabarmati river.

3.2.3 Independency of the Hathmati System

A preliminary analysis of the data of the Hathmati sub-basin revealed that on an average, the annual flows available in this basin are less than the annual demand. Since conservation demands in this basin can be met with only through the Guhai dam, the Hathmati dam and the Hathmati weir, the system of Hathmati basin has been studied as an independent system as far as the conservation operation aspect is concerned. Thus it has been assumed that water from the Hathmati sub-basin can not be supplied to Wasna barrage for meeting conservation demands. However, integrated regulation of the Guhai dam, the Hathmati dam and the Hathmati weir has been carried out to get the best operation response.

3.2.4 The Solution Strategy Adopted

The same methodology of simulation that has been applied for observing the performance of a particular policy in Dharoi sub-basin has been adopted in this sub-basin also. A number of rule levels for reservoir operation have been developed and an integrated monthly reservoir operation simulation study has been undertaken using these rule curves. The operation policy which best meets the objectives of the conservation storage regulation has been finally recommended for adoption.

Rule level Computation for Guhai Reservoir

The monthly inflows for the Guhai reservoir have been estimated for 50%, 60%, 70%, 75%, 80% and 90% probabilities using power transformation approach. The results of this analysis for twelve months are given in Table-G5.

Since Guhai reservoir is meant to serve only the irrigation demands, it is considered appropriate to set two rule levels for this reservoir. One, the upper rule level up to which the reservoir should be filled if there is sufficient inflow in the reservoir and all the irrigation demands are met in full. Second, the lower rule level, below which the supply is reduced to 75% of the irrigation demands.

For fixing the upper rule level, reservoir has been kept at FRL in the four monsoon months from June to September. In the months after the monsoon rule levels have been calculated using 50% probable inflow, meeting full irrigation demands and evaporation from the reservoir using forward computation by the following formula:

$$\text{Storage}_{end} = \text{Storage}_{begin} + \text{Inflow} - \text{Demand} - \text{Evaporation}$$

The lower rule level is calculated for the case when the reservoir level reaches at the dead storage level by the end of May. For computing this level, 90% reliable inflow, full irrigation demands and evaporation from the reservoir has been assumed. Backward calculations are carried out starting from the end of May using the following formula:

$$\text{Storage}_{begin} = \text{Storage}_{end} - \text{Inflow} + \text{Demand} + \text{Evaporation}$$

The objectives of deriving these rule levels have already been explained in the previous section.

Rule level Computation for Hathmati Reservoir

The monthly inflows for the Hathmati reservoir have been estimated for 50%, 60%, 70%, 75%, 80% and 90% probabilities using power transformation approach. The results of this analysis for twelve months are given in Table-HTD4.

Hathmati reservoir is meant to serve the irrigation demands in the four zones of the Hathmati Canal system. A-zone directly gets water from the dam while water for B, C and D zones is diverted through the Hathmati weir. Looking at the capacity constraints of the Hathmati reservoir, it has been recommended that water may be released from this reservoir for meeting full demands of A-zone and 70% of the demands for the B, C and D zones. It is realised that remaining 30% demands of the B, C and D zones will be met by the local flow at the Hathmati weir coming from the area downstream of the Hathmati dam and the Guhai dam. Since the crest level of Navalpur waste weir is at FRL (180.74 m), water from this reservoir can not be spilled if the level is below FRL. Thus, it has been considered appropriate to set the upper rule level to FRL in all the months of the year. Two more rule levels have been proposed for this reservoir. First, the

middle rule level, below which the demands in the A-zone are met in full and demands in the B, C and D zones are reduced to 75% of the target demands to be satisfied from this reservoir for these three zones. Thus in this situation 0.75 x 70 = 52.5 % of the total demand of BCD zone will be satisfied by the reservoir. Second, the lower rule level, below which the demands in A-zone are met in full and no supply is made for meeting the demands in the B, C and D zone.

The middle rule level is calculated for the case when the reservoir attains the dead storage level at the end of May. To compute this level, 75% reliable inflow, 60% of the demands for B, C and D zones and normal evaporation from the reservoir has been assumed. Backward calculations are carried out from the end of May using the following formula:

$$\text{Storage}_{\text{begin}} = \text{Storage}_{\text{end}} - \text{Inflow} + \text{Demand} + \text{Evaporation}$$

The lower rule level is calculated for the case when the reservoir reaches at the dead storage level at the end of May. For computing this level, 90% reliable inflow, full irrigation demands of A-zone and evaporation from the reservoir at the normal rate has been assumed. Backward calculations are carried out from the end of May using the following formula:

$$\text{Storage}_{\text{begin}} = \text{Storage}_{\text{end}} - \text{Inflow} + \text{Demand} + \text{Evaporation}$$

Using this rule level, effort is made to find such a lower level upto which all the demands in the A-zone can be met in full. It is recommended that below this level, only demands for the A-zone will be met. Dead storage level in this case has been taken as the sill level in the Hathmati dam.

3.2.5 Discussion of Simulation Runs for the Hathmati System

A number of simulation runs have been taken by considering different demand levels at the various control locations. The results obtained in different cases are discussed below.

First, it was decided to meet 10% of the demands for B, C and D zones from the Guhai reservoir and 60% of the demands of this command from the Hathmati reservoir. The system was simulated from June 1964 to May 1988. The monthly time reliability of the Guhai reservoir came out to be 0.552 and that of Hathmati reservoir was 0.490. The reliability at the Hathmati weir came out to be 0.531. The corresponding volume reliability obtained at these structures was 0.69, 0.63 and 0.61 respectively. Then, it was decided to simulate the system for the situation when no demand of B, C and D zones is met from the Guhai reservoir and 70% demands of the above mentioned command are met from the Hathmati reservoir only. The monthly time reliability of the Guhai dam, Hathmati dam and the Hathmati weir came out to be 0.66, 0.46 and 0.52 respectively while the volume reliability came out to be 0.79, 0.59 and 0.59 respectively. Thus, it has been observed that by meeting the demands of the B, C and D zone from the Hathmati dam only, the reliability of Guhai reservoir has increased considerably while the decrease in the reliability of the Hathmati dam and weir is only marginal.

Based on these observations, it has been decided that Guhai dam must be operated to meet its own demands only and no release for the B, C and D zones should be made from this dam. It has been tried to lower the rule levels in the four monsoon months without affecting the performance of the reservoir, thus making some room in the reservoir during monsoon period for flood moderation. A number of simulation runs have been taken and the final recommended Rule Curves (Rule curve A and Rule curve B) are given in Table-G6 and Fig-G4. The operation table of the reservoir for 24 year period using recommended rule levels is presented in Table-G7. The monthly time reliability of the reservoir is 66% and the volume reliability is 79.3%. From the table, it is clear that the recommended policy tries to meet the demands for as long the duration as possible by curtailing the releases if the reservoir level goes below the lower rule level. Most of the times, 75 % of the target demands have been met. In the span of 24 years, there are only 31 months when the release from the dam are less than 75 % of the demands. It needs to be mentioned here that the years 1985, 1986 and 1987 were acute drought years and 21 of these 31 months fall within these three years period. The drought severity in these years can be judged from the fact that the total cumulative flow in these three years is less than one third of the demands from this reservoir in any single year.

For the Hathmati dam, simulation runs have been taken assuming different demand levels (60%, 70% and 75% of the demands for the B, C and D zones) and full demands of the A zone. For these demand levels, the monthly time reliability of Hathmati dam came out to be 49 %, 45.8 % and 43.7 % respectively. The same for the Hathmati weir came out to be 48.6 %, 52.1 % and 54.5 % respectively. It has been considered appropriate to meet 70 % of the irrigation demands of B, C and D zones from the reservoir. A number of simulation runs have been taken and the final recommended rule levels (Rule curve A, Rule curve B and Rule curve C) are given in Table-HTD5 and Fig-HTD4. The operation table of the reservoir for the 24 year period using recommended policy is presented in Table-HTD6. The monthly time reliability of the reservoir has come out to be 45.8 % and its volume reliability is 58.9 %. A-zone has been given priority for the supply of water and release for the B, C and D zones has been made from the head regulators of the Indrasi dam or the Hathmati dam. Efforts have been made to meet the demands for as long the duration as possible. In the Rel/Dem column of the table, the term "B" means failure in meeting full target demands of B, C and D zones from the reservoir while the term "A" means that in addition to demands in B, C and D zones, demands in A zone could also not be satisfied.

The release in excess of the demands of the A-zone from the Hathmati reservoir is discharged in the Hathmati river either through the Indrasi head regulator or through the escape in the main canal of Hathmati dam. This water is picked up at the Hathmati weir and is diverted in the main canal of B zone. Table-HTW1 gives the simulation of monthly operation of Hathmati weir. The capacity of Limla dam and Karol dam (total 17.783 million cubic meter) has been utilised in the weir operation. Thus, in case of any excess water at the weir site, the same is diverted to the Limla and Karol dam and spill from the weir in the river

Sabarmati is made only after filling the two storage reservoirs and after satisfying the demands of the B, C and D zones for that period.

From the analysis of this sub-basin, it is clear that there is scarcity of water in this region. During the discussions with the engineers at the field offices, it was revealed the available water is not sufficient to meet all the demands of this area. In view of the severe water shortage, it is recommended that the project authorities may consider providing lining of the channels if not already done so. Furthermore, they may also like to introduce improved practices of water management in this area. To make the both ends meet, adequate steps will have to be taken for supply as well as demand management.

3.2.6 RECOMMENDED OPERATION PROCEDURE FOR CONSERVATION REGULATION OF GUHAI DAM

The recommended procedure for conservation regulation of the Guhai reservoir using two Rule Curves A and B is as follows:

For a particular month:

1. Try to maintain the reservoir at the Rule level A while meeting irrigation demands in full.

2. If it is not possible to maintain the reservoir level at A, meet all the irrigation demands as long as the reservoir is at or above level B.

3. If it is likely that reservoir will go below level B while satisfying full irrigation demands, curtail the supply for irrigation to 75 % of the demands.

4. If the level in the reservoir is below the level B and above the dead storage level, release water equal to 75 % of the irrigation demands.

5. It is advisable to review the situation periodically within a month and modify the previous decision for the remaining duration of that month and follow steps 1 to 4 to operate the reservoir.

3.2.7 RECOMMENDED OPERATION PROCEDURE FOR CONSERVATION REGULATION OF HATHMATI DAM

The recommended procedure for conservation regulation of the Hathmati reservoir using three Rule Curves A and B and C is as follows:

For a particular month:

1. Try to fill the reservoir to the FRL (Rule Level A) while meeting target irrigation demands in full (70 % demands of the B, C and D zones and full demands of A zone).

2. If it is not possible to maintain the reservoir level at Rule Level A, meet all the target irrigation demands as long as the combined capacity of the Hathmati and Indrasi reservoirs is more than the capacity corresponding to level B.

3. If it is likely that combined reservoir capacity will go below the capacity corresponding to level B while meeting full irrigation target demands, meet full irrigation demands of the A zone and curtail the supply for B, C and D zones to 75 % of the target demands of these zones to be met from the Hathmati reservoir.

4. If it is likely that combined reservoir capacity will go below the capacity corresponding to level C while meeting full irrigation demands of A zone and 75 % of the target demands of B, C and D zones from the Hathmati reservoir, stop the supply to B, C and D zones and meet full demands of A zone only.

5. If the combined capacity of the Hathmati and Indrasi reservoirs is below the capacity corresponding to level C and above the sill level of Hathmati dam, meet full irrigation demands of the A zone only.

6. It is advisable to review the situation periodically within the month and modify the previous decision for the remaining duration of that month and follow steps 1 to 5 to operate the reservoir.

3.2.8 RECOMMENDED OPERATION PROCEDURE FOR CONSERVATION REGULATION OF HATHMATI WEIR

The recommended procedure for conservation regulation of the Hathmati Weir is as follows:

For a particular month:

1. Try to divert the flow in river Hathmati (released from Hathmati or Indrasi dam and the local flow of the weir) to meet the full irrigation demands of the B, C and D zones.

2. If the water available at the weir site is more than the demand of the B, C and D zone, divert the excess water to fill the two storage reservoirs, the Limla dam and the Karol dam.

3. If the water available at the weir site is still in excess, spill the water in the river Sabarmati.

3.3 OPERATION OF THE WASNA BARRAGE

Wasna barrage is located across river Sabarmati near village Wasna in Ahmedabad district. The total catchment area of the Wasna barrage is 10619 sq.km. The work of Wasna barrage was started in 1972 and completed in 1976. The Wasna barrage envisages the following benefits:

a) Irrigation of 72000 acres under existing Fatewadi Canal system is firmed up.

b) The underground aquifers in the Ahmedabad city is augmented and the tube wells in the city is recharged.

c) One major function of Wasna barrage is to store and hold the flow released from the Dharoi reservoir for the purpose of water supply to Ahmedabad city.

The barrage will be used to hold the water for drinking water supply to Ahmedabad city and to strengthen the existing irrigation system. Water supply demand of the Ahmedabad city has been met from the Dharoi reservoir and the same is delivered from the Dharoi dam through the canals meant for the purpose. The flow from the free catchment area can be diverted for irrigation in the canal system as and when it is possible. In case of scarcity, it does not seem advisable to release water either from the Dharoi reservoir or from the Hathmati weir to meet the demands at the barrage because of high absorption rate in the intermediate river bed and unaccounted unauthorized withdrawal whose magnitude can not be ascertained.

Thus, it has been realised that water from the upstream structures should not be released for meeting the irrigation demands of this barrage unless sufficient water is available in storage and water level is above the recommended upper rule level at any structure.

4.0 CONCLUSION

The efficient use of water resources requires not only judicious design but also proper management after construction. Reservoir operation is important part of planning and management of water resources systems. For the existing reservoirs, better management means higher reservoir yield through improved operation rather than future expansion.

The reservoirs are normally operated based on rule curves. A rule curve or rule level specifies the storage to be maintained in a reservoir during different times of the year. It is assumed that a reservoir can best satisfy its purposes if the storage levels specified by the rule curve are maintained in the reservoir at different times. The rule curve as such does not give the amount of water to be released from the reservoir.

In the present study, operation policies for conservation regulation of a system of multiple reservoirs have been developed. A computer program for conservation regulation of a multi-purpose multireservoir system has been developed and applied to the hydraulic structures located in the Sabarmati basin upto Ahmedabad. The program evaluates the performance of a trial policy for conservation operation of any system of reservoirs. From the observation of the simulation results, the trial policy can be updated till the best operation response is achieved.

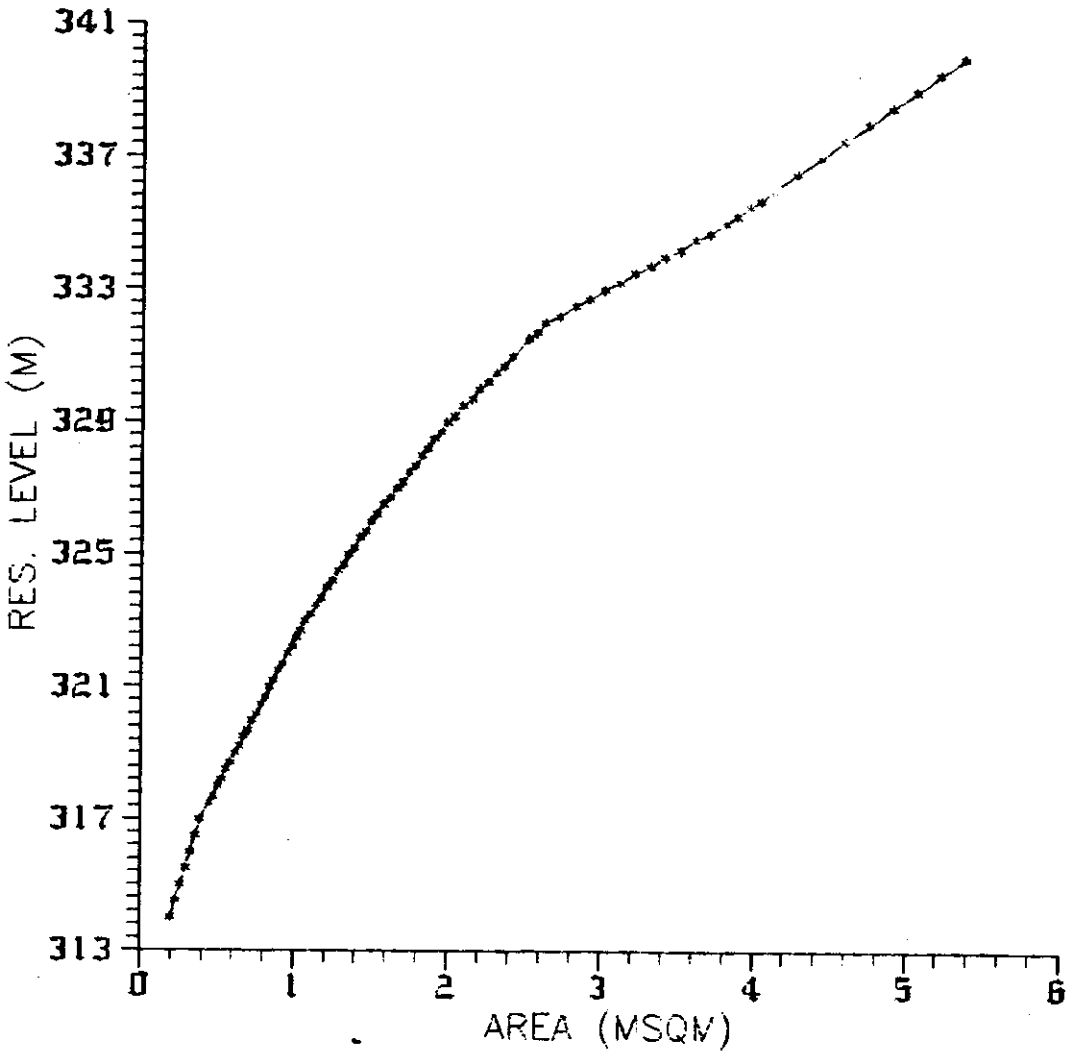
The basin considered for the present study is a water scarce area and based on the priority of demands and with a view to meet the irrigation demands, at least partly, for as long the duration as possible, a number of rule curves have been developed and guidelines for operation in different conditions have been prepared. The present study clearly proves the role of management in the optimum utilisation of water.

SALIENT FEATURES OF HARNAV DAM

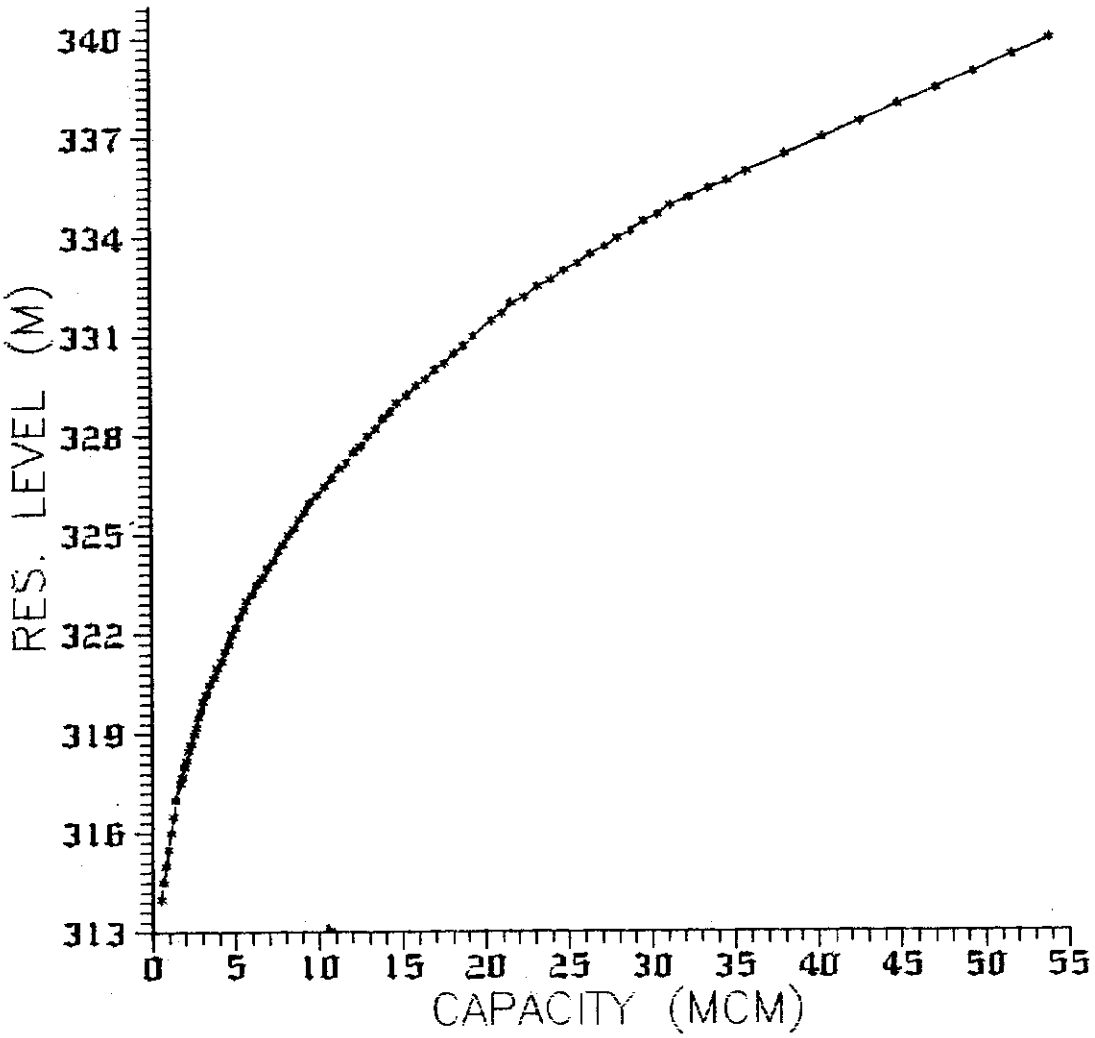
(1) General Details		
	a) Location	Vill: Vanaj, Ta: Vijaynagar Dist: Sabarkantha
	b) Co-ordinates	Latitude 23° 59' N Longitude 73° 18' E
	c) Year of Completion	1990
	d) Purpose	Irrigation & Flood Control
(2) Hydrology		
	a) Total catchment area at the dam site	116 Sq.Km
	b) Average annual rainfall	787 mm
	c) Average annual runoff	24.37 Mcm
	d) Maximum Probable Flood	5787 Cumec
(3) Dam		
	a) Type of dam	Composite Rolled Filled Type
	b) Length of dam at road level	406 m
	c) Maximum Height of Dam above lowest foundation pt	41.65 m
	d) R.L. of Top of Dam	336.85 m
(4) Reservoir		
	a) Full Reservoir Level	332.00 m
	b) High Flood Level	333.35 m
	c) Area at FRL	3.10 Sq.Km
	d) Gross Storage Capacity	21.67 Mcm
	e) Dead Storage Capacity	1.70 Mcm
	f) Live Storage Capacity	19.97 Mcm
(5) Flood Disposal		
	a) Type of Spillway	Ogee shaped with radial gates
	b) Length	43 m
	c) Discharge Capacity at HFL	1909 Cumec
	d) Number of Gates	3 Nos. (12.5 m x 8.23 m)

Contd.

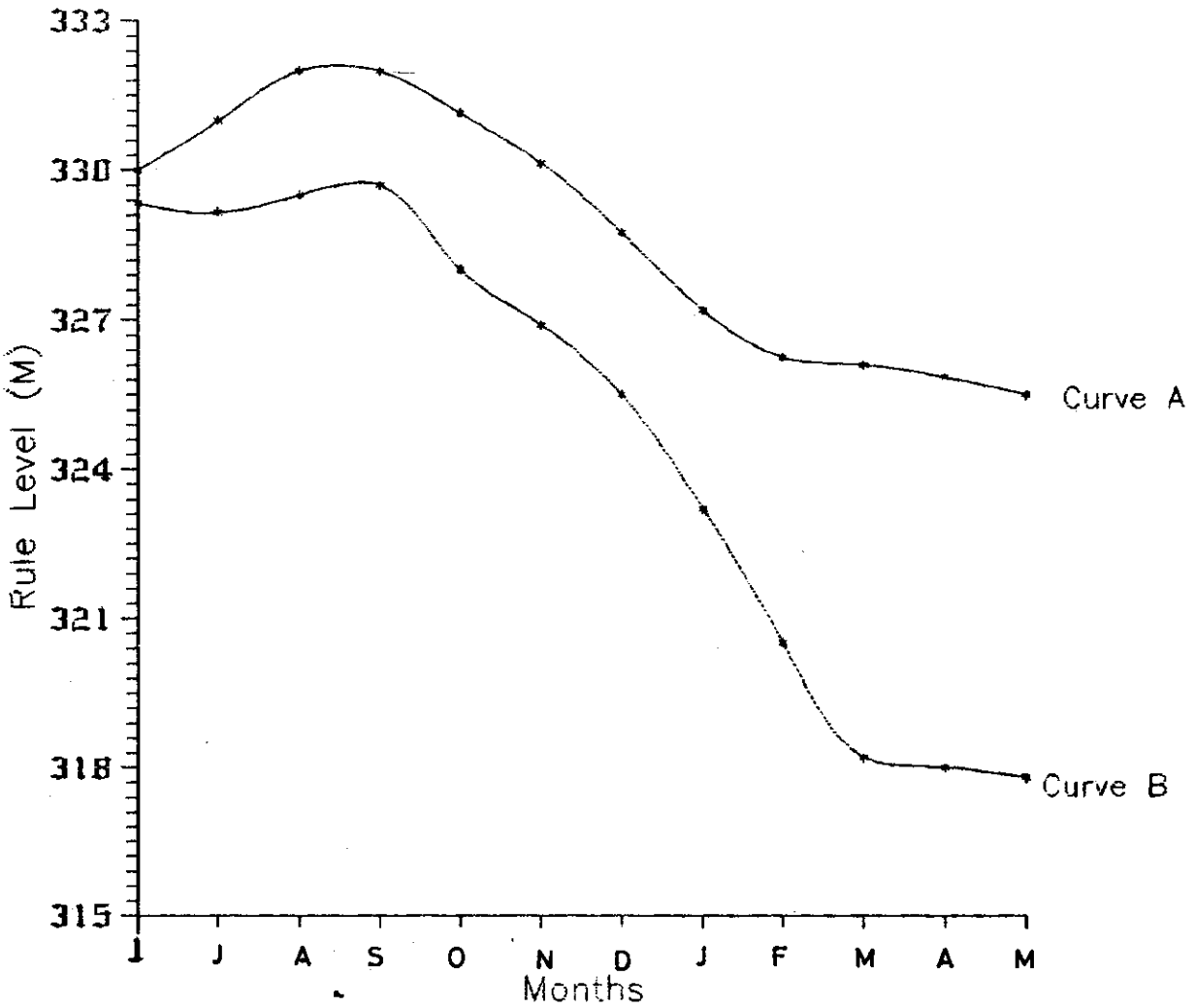
e) Crest Level	323.77 m
(6) Head Regulators	
a) Type of H.R	R.C.C barrels in both Piers of Spillway
b) Sill Level	317.50 m
c) Number & Size	2 Nos. (1.067 m x 1.067 m)
(7) Irrigation	
a) Gross Command Area	6058 Ha
b) Culturable Command Area	4040 Ha
c) Annual Irrigation	3440 Ha
(8) Financial Aspect	
a) Total Cost	544.58 Lacs
b) Benefit Cost Ratio	1.06



Fig–HRD2: Elevation–Area Curve for Harnav Rservoir



Fig–HRD3: Elevation–Capacity Curve for Harnav Reservoir



Fig– HRD4: Rule Curves for Harnav Reservoir

Table - HRD.1
Monthly Inflow Series for HARNAV DAM
in Million Cubic Meter

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1967						0.00	9.84	3.75	17.91	0.04	0.00	0.00
1968	0.00	0.00	0.00	0.00	0.00	0.00	27.13	45.59	0.01	0.00	0.00	0.00
1969	0.00	0.00	0.00	0.00	0.00	0.00	0.81	1.36	0.00	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	0.00	3.97	45.15	33.47	1.72	0.07	0.00
1971	0.00	0.00	0.00	0.00	0.00	2.75	5.18	5.08	0.97	0.17	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	0.04	7.96	1.84	0.23	0.00	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	0.01	3.80	22.80	5.22	1.74	0.46	0.00
1974	0.00	0.00	0.00	0.00	0.00	0.00	0.38	3.63	0.38	0.15	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	0.55	1.11	2.66	4.04	3.61	0.48	0.00
1976	0.00	0.00	0.00	0.00	0.00	0.00	5.85	19.70	14.78	1.81	0.52	0.00
1977	0.00	0.00	0.00	0.00	0.00	7.49	52.75	37.48	35.19	3.82	1.81	0.72
1978	0.00	0.00	0.00	0.00	0.00	0.00	16.95	17.80	10.79	3.20	1.02	0.40
1979	0.00	0.00	0.00	0.00	0.00	0.00	4.59	61.51	1.32	0.27	0.00	0.00
1980	0.00	0.00	0.00	0.00	0.00	0.00	11.06	10.67	2.13	0.48	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	3.43	9.28	1.76	0.19	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	10.39	2.23	0.37	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	3.57	8.54	14.20	3.16	2.34	0.04	0.00
1984	0.00	0.00	0.00	0.00	0.00	2.60	29.60	44.64	16.80	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00	1.95	3.80	0.06	0.73	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.64	4.36	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.06	13.43	0.45	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00							

Table - HRD.2
Elevation-Area-Capacity Table for HARNAV DAM

Elevation (m)	Area (M sq.m)	Capacity (M cu.m)
314.00	.2000	.526
314.50	.2315	.671
315.00	.2630	.816
315.50	.2945	.961
316.00	.3260	1.106
316.50	.3575	1.251
317.00	.3890	1.396
317.50	.4455	1.671
317.75	.4737	1.808
318.00	.5020	1.946
318.25	.5303	2.083
318.50	.5585	2.221
318.75	.5867	2.358
319.00	.6150	2.496
319.25	.6432	2.633
319.50	.6715	2.771
319.75	.6998	2.908
320.00	.7280	3.046
320.25	.7562	3.269
320.50	.7843	3.492
320.75	.8125	3.714
321.00	.8407	3.937
321.25	.8688	4.160
321.50	.8970	4.383
321.75	.9252	4.606
322.00	.9533	4.828
322.25	.9815	5.051
322.50	1.0097	5.274
322.75	1.0378	5.497
323.00	1.0660	5.720
323.25	1.1021	6.039
323.50	1.1382	6.358
323.75	1.1743	6.677
324.00	1.2103	6.996
324.25	1.2464	7.315
324.50	1.2825	7.635
324.75	1.3186	7.954
325.00	1.3547	8.273
325.25	1.3908	8.592
325.50	1.4268	8.911
325.75	1.4629	9.230
326,00	1.4990	9.550
326.25	1.5398	9.984
326.50	1.5807	10.419
326.75	1.6215	10.854
327.00	1.6623	11.289
327.25	1.7032	11.724
327.50	1.7440	12.159
327.75	1.7848	12.593
328.00	1.8257	13.028
328.25	1.8665	13.463
328.50	1.9073	13.898

Contd.

Elevation (m)	Area (M sq.m)	Capacity (M cu.m)
328.75	1.9482	14.333
329.00	1.9890	14.768
329.25	2.0421	15.343
329.50	2.0952	15.918
329.75	2.1483	16.493
330.00	2.2013	17.068
330.25	2.2544	17.643
330.50	2.3075	18.218
330.75	2.3606	18.793
331.00	2.4137	19.368
331.25	2.4667	19.943
331.50	2.5198	20.518
331.75	2.5729	21.093
332.00	2.6260	21.668
332.25	2.7240	22.467
332.50	2.8220	23.266
332.75	2.9200	24.065
333.00	3.0180	24.864
333.25	3.1160	25.663
333.50	3.2140	26.462
333.75	3.3120	27.261
334.00	3.4100	28.060
334.25	3.5080	28.859
334.50	3.6060	29.658
334.75	3.7040	30.457
335.00	3.8020	31.256
335.25	3.8802	32.395
335.50	3.9584	33.535
335.75	4.0366	34.675
336.00	4.1148	35.815
336.50	4.2712	38.094
337.00	4.4276	40.374
337.50	4.5840	42.654
338.00	4.7404	44.933
338.50	4.8968	47.213
339.00	5.0532	49.492
339.50	5.2096	51.772
340.00	5.3660	54.052

Table - HRD.3
Average Monthly Irrigation Demands from HARNAV DAM
in Million Cubic Meter

Month	Irrigation Demand
Jan	2.360
Feb	1.380
Mar	0.000
Apr	0.000
May	0.000
Jun	0.000
Jul	0.000
Aug	2.774
Sep	3.193
Oct	1.723
Nov	1.981
Dec	2.780

Table - HRD.4
Monthly Yield Estimation for HARNAV DAM

Month	Monthly Yield (Million Cubic Meter)					
	Probability Level for Value to be Equalled or Exceeded					
	50%	60%	70%	75%	80%	90%
Jan	0	0	0	0	0	0
Feb	0	0	0	0	0	0
Mar	0	0	0	0	0	0
Apr	0	0	0	0	0	0
May	0	0	0	0	0	0
Jun	0	0	0	0	0	0
Jul	4.363	2.769	1.589	1.113	0.722	0.166
Aug	9.524	6.729	4.515	3.546	2.687	1.187
Sep	1.620	0.796	0.321	0.174	0.080	0.004
Oct	0.167	0.068	0.020	0.008	0.002	0.000
Nov	0	0	0	0	0	0
Dec	0	0	0	0	0	0

Table - HRD.5
Recommended Rule Curve Levels for HARNAV DAM

Month	Rule Levels in Meter	
	Upper Rule Level Curve A	Lower Rule Level Curve B
Jan	327.20	323.20
Feb	326.25	320.50
Mar	326.10	318.20
Apr	325.85	318.00
May	325.50	317.80
Jun	330.00	329.35
Jul	331.00	329.15
Aug	332.00	329.50
Sep	332.00	329.70
Oct	331.15	328.00
Nov	330.15	326.90
Dec	328.75	325.50

Table - HRD.6

Monthly Operation Simulation of HARNAV DAM For Conservation Regulation Using Recommended Policy

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1967-06	11.000	326.83	.000	.350	.000	.000	.000	.000	.000	10.65	326.63	330.00
1967-07	10.650	326.63	9.840	.306	.000	.000	.000	.000	.816	19.37	331.00	331.00
1967-08	19.368	331.00	3.750	.372	2.774	.000	2.774	1.000	.000	19.97	331.26	332.00
1967-09	19.972	331.26	17.910	.388	3.193	.000	3.193	1.000	12.633	21.67	332.00	332.00
1967-10	21.667	332.00	.040	.386	1.723	.000	1.723	1.000	.000	19.60	331.10	331.15
1967-11	19.598	331.10	.000	.355	1.981	.000	1.981	1.000	.000	17.26	330.08	330.15
1967-12	17.263	330.08	.000	.316	2.780	.000	2.780	1.000	.000	14.17	328.65	328.75
1968-01	14.166	328.65	.000	.254	2.360	.000	2.360	1.000	.000	11.55	327.15	327.20
1968-02	11.553	327.15	.000	.226	1.380	.000	1.380	1.000	.000	9.95	326.23	326.25
1968-03	9.947	326.23	.000	.288	.000	.000	.000	.000	.000	9.66	326.06	326.10
1968-04	9.659	326.06	.000	.359	.000	.000	.000	.000	.000	9.30	325.80	325.85
1968-05	9.300	325.80	.000	.441	.000	.000	.000	.000	.000	8.86	325.46	325.50

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1968-06	8.859	325.46	.000	.304	.000	.000	.000	.000	.000	8.56	325.22	330.00
1968-07	8.556	325.22	27.130	.290	.000	.000	.000	.000	16.028	19.37	331.00	331.00
1968-08	19.368	331.00	45.590	.384	2.774	.000	2.774	1.000	40.133	21.67	332.00	332.00
1968-09	21.667	332.00	.010	.375	3.193	.000	3.193	1.000	.000	18.11	330.45	332.00
1968-10	18.109	330.45	.000	.336	1.723	.000	1.723	1.000	.000	16.05	329.56	331.15
1968-11	16.050	329.56	.000	.305	1.981	.000	1.981	1.000	.000	13.76	328.42	330.15
1968-12	13.764	328.42	.000	.267	2.780	.000	2.780	1.000	.000	10.72	326.67	328.75
1969-01	10.717	326.67	.000	.207	2.360	.000	2.360	1.000	.000	8.15	324.90	327.20
1969-02	8.151	324.90	.000	.176	1.380	.000	1.380	1.000	.000	6.59	323.69	326.25
1969-03	6.595	323.69	.000	.218	.000	.000	.000	.000	.000	6.38	323.51	326.10
1969-04	6.377	323.51	.000	.271	.000	.000	.000	.000	.000	6.11	323.30	325.85
1969-05	6.106	323.30	.000	.333	.000	.000	.000	.000	.000	5.77	323.04	325.50

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1969-06	5.774	323.04	.000	.229	.000	.000	.000	.000	.000	5.54	322.80	330.00
1969-07	5.545	322.80	.810	.165	.000	.000	.000	.000	.000	6.19	323.37	331.00
1969-08	6.190	323.37	1.360	.168	2.774	.000	2.080	.750F	.000	5.31	322.54	332.00
1969-09	5.307	322.54	.000	.129	3.193	.000	2.395	.750F	.000	2.78	319.52	332.00
1969-10	2.783	319.52	.000	.086	1.723	.000	.998	.579F	.000	1.70	317.55	331.15
1969-11	1.700	317.55	.000	.068	1.981	.000	.000	.000F	.000	1.63	317.43	330.15
1969-12	1.632	317.43	.000	.066	2.780	.000	.000	.000F	.000	1.57	317.31	328.75
1970-01	1.567	317.31	.000	.059	2.360	.000	.000	.000F	.000	1.51	317.20	327.20
1970-02	1.508	317.20	.000	.057	1.380	.000	.000	.000F	.000	1.45	317.10	326.25
1970-03	1.451	317.10	.000	.074	.000	.000	.000	.000	.000	1.38	316.93	326.10
1970-04	1.377	316.93	.000	.090	.000	.000	.000	.000	.000	1.29	316.62	325.85
1970-05	1.286	316.62	.000	.108	.000	.000	.000	.000	.000	1.18	316.25	325.50

Contd.

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1970-06	1.179	316.25	.000	.072	.000	.000	.000	.000	.000	1.11	316.00	330.00
1970-07	1.106	316.00	3.970	.099	.000	.000	.000	.000	.000	4.98	322.17	331.00
1970-08	4.978	322.17	45.150	.274	2.774	.000	2.774	1.000	25.412	21.67	332.00	332.00
1970-09	21.667	332.00	33.470	.400	3.193	.000	3.193	1.000	29.877	21.67	332.00	332.00
1970-10	21.667	332.00	1.720	.386	1.723	.000	1.723	1.000	1.565	19.71	331.15	331.15
1970-11	19.713	331.15	.070	.357	1.981	.000	1.981	1.000	.032	17.41	330.15	330.15
1970-12	17.413	330.15	.000	.318	2.780	.000	2.780	1.000	.000	14.31	328.74	328.75
1971-01	14.314	328.74	.000	.255	2.360	.000	2.360	1.000	.062	11.64	327.20	327.20
1971-02	11.637	327.20	.000	.227	1.380	.000	1.380	1.000	.046	9.98	326.25	326.25
1971-03	9.984	326.25	.000	.288	.000	.000	.000	.000	.000	9.70	326.08	326.10
1971-04	9.696	326.08	.000	.360	.000	.000	.000	.000	.000	9.34	325.83	325.85
1971-05	9.336	325.83	.000	.442	.000	.000	.000	.000	.000	8.89	325.49	325.50

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1971-06	8.894	325.49	2.750	.334	.000	.000	.000	.000	.000	11.31	327.01	330.00
1971-07	11.310	327.01	5.180	.288	.000	.000	.000	.000	.000	16.20	329.62	331.00
1971-08	16.202	329.62	5.080	.337	2.774	.000	2.774	1.000	.000	18.17	330.48	332.00
1971-09	18.170	330.48	.970	.339	3.193	.000	2.395	.750F	.000	16.41	329.71	332.00
1971-10	16.407	329.71	.170	.313	1.723	.000	1.723	1.000	.000	14.54	328.87	331.15
1971-11	14.541	328.87	.000	.284	1.981	.000	1.981	1.000	.000	12.28	327.57	330.15
1971-12	12.276	327.57	.000	.245	2.780	.000	2.780	1.000	.000	9.25	325.77	328.75
1972-01	9.251	325.77	.000	.185	2.360	.000	2.360	1.000	.000	6.71	323.77	327.20
1972-02	6.706	323.77	.000	.152	1.380	.000	1.380	1.000	.000	5.17	322.39	326.25
1972-03	5.173	322.39	.000	.186	.000	.000	.000	.000	.000	4.99	322.18	326.10
1972-04	4.987	322.18	.000	.231	.000	.000	.000	.000	.000	4.76	321.92	325.85
1972-05	4.756	321.92	.000	.282	.000	.000	.000	.000	.000	4.47	321.60	325.50

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1972-06	4.474	321.60	.040	.194	.000	.000	.000	.000	.000	4.32	321.43	330.00
1972-07	4.319	321.43	7.960	.200	.000	.000	.000	.000	.000	12.08	327.45	331.00
1972-08	12.079	327.45	1.840	.261	2.774	.000	2.080	.750F	.000	11.58	327.17	332.00
1972-09	11.578	327.17	.230	.240	3.193	.000	2.395	.750F	.000	9.17	325.71	332.00
1972-10	9.173	325.71	.000	.209	1.723	.000	1.292	.750F	.000	7.67	324.53	331.15
1972-11	7.672	324.53	.000	.182	1.981	.000	1.486	.750F	.000	6.00	323.22	330.15
1972-12	6.005	323.22	.000	.146	2.780	.000	2.085	.750F	.000	3.77	320.82	328.75
1973-01	3.773	320.82	.000	.092	2.360	.000	1.770	.750F	.000	1.91	317.94	327.20
1973-02	1.911	317.94	.000	.066	1.380	.000	.145	.105F	.000	1.70	317.55	326.25
1973-03	1.700	317.55	.000	.084	.000	.000	.000	.000	.000	1.62	317.40	326.10
1973-04	1.616	317.40	.000	.102	.000	.000	.000	.000	.000	1.51	317.22	325.85
1973-05	1.514	317.22	.000	.122	.000	.000	.000	.000	.000	1.39	316.99	325.50

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1973-06	1.392	316.99	.010	.082	.000	.000	.000	.000	.000	1.32	316.74	330.00
1973-07	1.320	316.74	3.800	.103	.000	.000	.000	.000	.000	5.02	322.21	331.00
1973-08	5.017	322.21	22.800	.275	2.774	.000	2.774	1.000	3.101	21.67	332.00	332.00
1973-09	21.667	332.00	5.220	.400	3.193	.000	3.193	1.000	1.627	21.67	332.00	332.00
1973-10	21.667	332.00	1.740	.386	1.723	.000	1.723	1.000	1.585	19.71	331.15	331.15
1973-11	19.713	331.15	.460	.357	1.981	.000	1.981	1.000	.422	17.41	330.15	330.15
1973-12	17.413	330.15	.000	.318	2.780	.000	2.780	1.000	.000	14.31	328.74	328.75
1974-01	14.314	328.74	.000	.255	2.360	.000	2.360	1.000	.062	11.64	327.20	327.20
1974-02	11.637	327.20	.000	.227	1.380	.000	1.380	1.000	.046	9.98	326.25	326.25
1974-03	9.984	326.25	.000	.288	.000	.000	.000	.000	.000	9.70	326.08	326.10
1974-04	9.696	326.08	.000	.360	.000	.000	.000	.000	.000	9.34	325.83	325.85
1974-05	9.336	325.83	.000	.442	.000	.000	.000	.000	.000	8.89	325.49	325.50

Contd.

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1974-06	8.894	325.49	.000	.305	.000	.000	.000	.000	.000	8.59	325.25	330.00
1974-07	8.590	325.25	.380	.213	.000	.000	.000	.000	.000	8.76	325.38	331.00
1974-08	8.756	325.38	3.630	.225	2.774	.000	2.080	.750F	.000	10.08	326.31	332.00
1974-09	10.080	326.31	.380	.218	3.193	.000	2.395	.750F	.000	7.85	324.67	332.00
1974-10	7.848	324.67	.150	.188	1.723	.000	1.292	.750F	.000	6.52	323.63	331.15
1974-11	6.518	323.63	.000	.161	1.981	.000	1.486	.750F	.000	4.87	322.05	330.15
1974-12	4.671	322.05	.000	.123	2.780	.000	2.085	.750F	.000	2.66	319.31	328.75
1975-01	2.664	319.31	.000	.077	2.360	.000	.887	.376F	.000	1.70	317.55	327.20
1975-02	1.700	317.55	.000	.062	1.380	.000	.000	.000F	.000	1.64	317.44	326.25
1975-03	1.638	317.44	.000	.081	.000	.000	.000	.000	.000	1.56	317.29	326.10
1975-04	1.556	317.29	.000	.099	.000	.000	.000	.000	.000	1.46	317.11	325.85
1975-05	1.457	317.11	.000	.119	.000	.000	.000	.000	.000	1.34	316.80	325.50

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1975-06	1.339	316.80	.550	.092	.000	.000	.000	.000	.000	1.80	317.73	330.00
1975-07	1.797	317.73	1.110	.088	.000	.000	.000	.000	.000	2.82	319.59	331.00
1975-08	2.819	319.59	2.660	.110	2.774	.000	2.080	.750F	.000	3.29	320.27	332.00
1975-09	3.289	320.27	4.040	.130	3.193	.000	2.395	.750F	.000	4.80	321.97	332.00
1975-10	4.804	321.97	3.610	.164	1.723	.000	1.292	.750F	.000	6.96	323.97	331.15
1975-11	6.957	323.97	.480	.174	1.981	.000	1.486	.750F	.000	5.78	323.05	330.15
1975-12	5.778	323.05	.000	.142	2.780	.000	2.085	.750F	.000	3.55	320.57	328.75
1976-01	3.551	320.57	.000	.087	2.360	.000	1.764	.747F	.000	1.70	317.55	327.20
1976-02	1.700	317.55	.000	.062	1.380	.000	.000	.000F	.000	1.64	317.44	326.25
1976-03	1.638	317.44	.000	.081	.000	.000	.000	.000	.000	1.56	317.29	326.10
1976-04	1.556	317.29	.000	.099	.000	.000	.000	.000	.000	1.46	317.11	325.85
1976-05	1.457	317.11	.000	.119	.000	.000	.000	.000	.000	1.34	316.80	325.50

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1976-06	1.339	316.80	.000	.080	.000	.000	.000	.000	.000	1.26	316.53	330.00
1976-07	1.259	316.53	5.850	.120	.000	.000	.000	.000	.000	6.99	323.99	331.00
1976-08	6.989	323.99	19.700	.292	2.774	.000	2.774	1.000	1.956	21.67	332.00	332.00
1976-09	21.667	332.00	14.780	.400	3.193	.000	3.193	1.000	11.187	21.67	332.00	332.00
1976-10	21.667	332.00	1.810	.386	1.723	.000	1.723	1.000	1.655	19.71	331.15	331.15
1976-11	19.713	331.15	.520	.357	1.981	.000	1.981	1.000	.482	17.41	330.15	330.15
1976-12	17.413	330.15	.000	.318	2.780	.000	2.780	1.000	.000	14.31	328.74	328.75
1977-01	14.314	328.74	.000	.255	2.360	.000	2.360	1.000	.062	11.64	327.20	327.20
1977-02	11.637	327.20	.000	.227	1.380	.000	1.380	1.000	.046	9.98	326.25	326.25
1977-03	9.984	326.25	.000	.288	.000	.000	.000	.000	.000	9.70	326.08	326.10
1977-04	9.696	326.08	.000	.360	.000	.000	.000	.000	.000	9.34	325.83	325.85
1977-05	9.336	325.83	.000	.442	.000	.000	.000	.000	.000	8.89	325.49	325.50

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1977-06	8.894	325.49	7.490	.382	.000	.000	.000	.000	.000	16.00	329.54	330.00
1977-07	16.003	329.54	52.750	.344	.000	.000	.000	.000	49.041	19.37	331.00	331.00
1977-08	19.368	331.00	37.480	.384	2.774	.000	2.774	1.000	32.023	21.67	332.00	332.00
1977-09	21.667	332.00	35.190	.400	3.193	.000	3.193	1.000	31.597	21.67	332.00	332.00
1977-10	21.667	332.00	3.820	.386	1.723	.000	1.723	1.000	3.665	19.71	331.15	331.15
1977-11	19.713	331.15	1.810	.357	1.981	.000	1.981	1.000	1.772	17.41	330.15	330.15
1977-12	17.413	330.15	.720	.319	2.780	.000	2.780	1.000	.701	14.33	328.75	328.75
1978-01	14.333	328.75	.000	.255	2.360	.000	2.360	1.000	.081	11.64	327.20	327.20
1978-02	11.637	327.20	.000	.227	1.380	.000	1.380	1.000	.046	9.98	326.25	326.25
1978-03	9.984	326.25	.000	.288	.000	.000	.000	.000	.000	9.70	326.08	326.10
1978-04	9.696	326.08	.000	.360	.000	.000	.000	.000	.000	9.34	325.83	325.85
1978-05	9.336	325.83	.000	.442	.000	.000	.000	.000	.000	8.89	325.49	325.50

Contd.

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1978-06	8.894	325.49	.000	.305	.000	.000	.000	.000	.000	8.59	325.25	330.00
1978-07	8.590	325.25	16.950	.290	.000	.000	.000	.000	5.882	19.37	331.00	331.00
1978-08	19.368	331.00	17.800	.384	2.774	.000	2.774	1.000	12.343	21.67	332.00	332.00
1978-09	21.667	332.00	10.790	.400	3.193	.000	3.193	1.000	7.197	21.67	332.00	332.00
1978-10	21.667	332.00	3.200	.386	1.723	.000	1.723	1.000	3.045	19.71	331.15	331.15
1978-11	19.713	331.15	1.020	.357	1.981	.000	1.981	1.000	.982	17.41	330.15	330.15
1978-12	17.413	330.15	.400	.319	2.780	.000	2.780	1.000	.381	14.33	328.75	328.75
1979-01	14.333	328.75	.000	.255	2.360	.000	2.360	1.000	.081	11.64	327.20	327.20
1979-02	11.637	327.20	.000	.227	1.380	.000	1.380	1.000	.046	9.98	326.25	326.25
1979-03	9.984	326.25	.000	.288	.000	.000	.000	.000	.000	9.70	326.08	326.10
1979-04	9.696	326.08	.000	.360	.000	.000	.000	.000	.000	9.34	325.83	325.85
1979-05	9.336	325.83	.000	.442	.000	.000	.000	.000	.000	8.89	325.49	325.50

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1979-06	8.894	325.49	.000	.305	.000	.000	.000	.000	.000	8.59	325.25	330.00
1979-07	8.590	325.25	4.590	.244	.000	.000	.000	.000	.000	12.94	327.95	331.00
1979-08	12.935	327.95	61.510	.339	2.774	.000	2.774	1.000	49.666	21.67	332.00	332.00
1979-09	21.667	332.00	1.320	.384	3.193	.000	3.193	1.000	.000	19.41	331.02	332.00
1979-10	19.410	331.02	.270	.356	1.723	.000	1.723	1.000	.000	17.60	330.23	331.15
1979-11	17.601	330.23	.000	.327	1.981	.000	1.981	1.000	.000	15.29	329.23	330.15
1979-12	15.293	329.23	.000	.289	2.780	.000	2.780	1.000	.000	12.22	327.54	328.75
1980-01	12.225	327.54	.000	.228	2.360	.000	2.360	1.000	.000	9.64	326.05	327.20
1980-02	9.636	326.05	.000	.199	1.380	.000	1.380	1.000	.000	8.06	324.83	326.25
1980-03	8.057	324.83	.000	.249	.000	.000	.000	.000	.000	7.81	324.64	326.10
1980-04	7.809	324.64	.000	.309	.000	.000	.000	.000	.000	7.50	324.39	325.85
1980-05	7.499	324.39	.000	.380	.000	.000	.000	.000	.000	7.12	324.10	325.50

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1980-06	7.120	324.10	.000	.262	.000	.000	.000	.000	.000	6.86	323.89	330.00
1980-07	6.858	323.89	11.060	.263	.000	.000	.000	.000	.000	17.65	330.26	331.00
1980-08	17.655	330.26	10.670	.372	2.774	.000	2.774	1.000	3.512	21.67	332.00	332.00
1980-09	21.667	332.00	2.130	.390	3.193	.000	3.193	1.000	.000	20.21	331.37	332.00
1980-10	20.214	331.37	.480	.368	1.723	.000	1.723	1.000	.000	18.60	330.67	331.15
1980-11	18.603	330.67	.000	.341	1.981	.000	1.981	1.000	.000	16.28	329.66	330.15
1980-12	16.281	329.66	.000	.303	2.780	.000	2.780	1.000	.000	13.20	328.10	328.75
1981-01	13.198	328.10	.000	.241	2.360	.000	2.360	1.000	.000	10.60	326.60	327.20
1981-02	10.597	326.60	.000	.213	1.380	.000	1.380	1.000	.000	9.00	325.57	326.25
1981-03	9.005	325.57	.000	.269	.000	.000	.000	.000	.000	8.74	325.36	326.10
1981-04	8.736	325.36	.000	.334	.000	.000	.000	.000	.000	8.40	325.10	325.85
1981-05	8.401	325.10	.000	.410	.000	.000	.000	.000	.000	7.99	324.78	325.50

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1981-06	7.991	324.78	.000	.283	.000	.000	.000	.000	.000	7.71	324.56	330.00
1981-07	7.708	324.56	3.430	.222	.000	.000	.000	.000	.000	10.92	326.79	331.00
1981-08	10.916	326.79	9.280	.292	2.774	.000	2.774	1.000	.000	17.13	330.03	332.00
1981-09	17.130	330.03	1.760	.330	3.193	.000	2.395	.750F	.000	16.17	329.61	332.00
1981-10	16.166	329.61	.190	.310	1.723	.000	1.723	1.000	.000	14.32	328.74	331.15
1981-11	14.323	328.74	.000	.281	1.981	.000	1.981	1.000	.000	12.06	327.44	330.15
1981-12	12.061	327.44	.000	.242	2.780	.000	2.780	1.000	.000	9.04	325.60	328.75
1982-01	9.039	325.60	.000	.182	2.360	.000	2.360	1.000	.000	6.50	323.61	327.20
1982-02	6.497	323.61	.000	.149	1.380	.000	1.380	1.000	.000	4.97	322.16	326.25
1982-03	4.968	322.16	.000	.181	.000	.000	.000	.000	.000	4.79	321.95	326.10
1982-04	4.787	321.95	.000	.225	.000	.000	.000	.000	.000	4.56	321.70	325.85
1982-05	4.562	321.70	.000	.275	.000	.000	000	.000	.000	4.29	321.39	325.50

Contd.

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1982-06	4.287	321.39	.000	.189	.000	.000	.000	.000	.000	4.10	321.18	330.00
1982-07	4.098	321.18	10.390	.214	.000	.000	.000	.000	.000	14.27	328.72	331.00
1982-08	14.274	328.72	2.230	.295	2.774	.000	2.080	.750F	.000	14.13	328.63	332.00
1982-09	14.129	328.63	.370	.278	3.193	.000	2.395	.750F	.000	11.83	327.31	332.00
1982-10	11.827	327.31	.000	.250	1.723	.000	1.292	.750F	.000	10.28	326.42	331.15
1982-11	10.284	326.42	.000	.225	1.981	.000	1.486	.750F	.000	8.57	325.24	330.15
1982-12	8.573	325.24	.000	.192	2.780	.000	2.085	.750F	.000	6.30	323.45	328.75
1983-01	6.296	323.45	.000	.142	2.360	.000	1.770	.750F	.000	4.38	321.50	327.20
1983-02	4.384	321.50	.000	.116	1.380	.000	1.035	.750F	.000	3.23	320.21	326.25
1983-03	3.234	320.21	.000	.140	.000	.000	.000	.000	.000	3.09	320.05	326.10
1983-04	3.093	320.05	.000	.173	.000	.000	.000	.000	.000	2.92	319.77	325.85
1983-05	2.920	319.77	.000	.208	.000	.000	.000	.000	.000	2.71	319.39	325.50

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1983-06	2.713	319.39	3.570	.191	.000	.000	.000	.000	.000	6.09	323.29	330.00
1983-07	6.092	323.29	8.540	.233	.000	.000	.000	.000	.000	14.40	328.79	331.00
1983-08	14.398	328.79	14.200	.349	2.774	.000	2.774	1.000	3.808	21.67	332.00	332.00
1983-09	21.667	332.00	3.160	.397	3.193	.000	3.193	1.000	.000	21.24	331.81	332.00
1983-10	21.237	331.81	2.340	.383	1.723	.000	1.723	1.000	1.758	19.71	331.15	331.15
1983-11	19.713	331.15	.040	.357	1.981	.000	1.981	1.000	.002	17.41	330.15	330.15
1983-12	17.413	330.15	.000	.318	2.780	.000	2.780	1.000	.000	14.31	328.74	328.75
1984-01	14.314	328.74	.000	.255	2.360	.000	2.360	1.000	.062	11.64	327.20	327.20
1984-02	11.637	327.20	.000	.227	1.380	.000	1.380	1.000	.046	9.98	326.25	326.25
1984-03	9.984	326.25	.000	.288	.000	.000	.000	.000	.000	9.70	326.08	326.10
1984-04	9.696	326.08	.000	.360	.000	.000	.000	.000	.000	9.34	325.83	325.85
1984-05	9.335	325.83	.000	.442	.000	.000	.000	.000	.000	8.89	325.49	325.50

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1984-06	8.894	325.49	2.600	.333	.000	.000	.000	.000	.000	11.16	326.93	330.00
1984-07	11.162	326.93	29.600	.310	.000	.000	.000	.000	21.084	19.37	331.00	331.00
1984-08	19.368	331.00	44.640	.384	2.774	.000	2.774	1.000	39.183	21.67	332.00	332.00
1984-09	21.667	332.00	16.800	.400	3.193	.000	3.193	1.000	13.207	21.67	332.00	332.00
1984-10	21.667	332.00	.000	.385	1.723	.000	1.723	1.000	.000	19.56	331.08	331.15
1984-11	19.559	331.08	.000	.354	1.981	.000	1.981	1.000	.000	17.22	330.07	330.15
1984-12	17.224	330.07	.000	.316	2.780	.000	2.780	1.000	.000	14.13	328.63	328.75
1985-01	14.128	328.63	.000	.253	2.360	.000	2.360	1.000	.000	11.51	327.13	327.20
1985-02	11.514	327.13	.000	.225	1.380	.000	1.380	1.000	.000	9.91	326.21	326.25
1985-03	9.909	326.21	.000	.287	.000	.000	.000	.000	.000	9.62	326.04	326.10
1985-04	9.622	326.04	.000	.358	.000	.000	.000	.000	.000	9.26	325.78	325.85
1985-05	9.264	325.78	.000	.439	.000	.000	.000	.000	.000	8.82	325.43	325.50

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1985-06	8.825	325.43	.000	.303	.000	.000	.000	.000	.000	8.52	325.19	330.00
1985-07	8.522	325.19	1.950	.225	.000	.000	.000	.000	.000	10.25	326.40	331.00
1985-08	10.247	326.40	3.800	.249	2.774	.000	2.080	.750F	.000	11.72	327.25	332.00
1985-09	11.718	327.25	.060	.240	3.193	.000	2.395	.750F	.000	9.14	325.68	332.00
1985-10	9.142	325.68	.730	.215	1.723	.000	1.292	.750F	.000	8.37	325.07	331.15
1985-11	8.365	325.07	.000	.194	1.981	.000	1.486	.750F	.000	6.69	323.76	330.15
1985-12	6.686	323.76	.000	.158	2.780	.000	2.085	.750F	.000	4.44	321.57	328.75
1986-01	4.443	321.57	.000	.108	2.360	.000	1.770	.750F	.000	2.57	319.13	327.20
1986-02	2.565	319.13	.000	.076	1.380	.000	.789	.572F	.000	1.70	317.55	326.25
1986-03	1.700	317.55	.000	.084	.000	.000	.000	.000	.000	1.62	317.40	326.10
1986-04	1.616	317.40	.000	.102	.000	.000	.000	.000	.000	1.51	317.22	325.85
1986-05	1.514	317.22	.000	.122	.000	.000	.000	.000	.000	1.39	316.99	325.50

Contd.

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1986-06	1.392	316.99	.000	.082	.000	.000	.000	.000	.000	1.31	316.70	330.00
1986-07	1.310	316.70	.640	.066	.000	.000	.000	.000	.000	1.88	317.89	331.00
1986-08	1.884	317.89	4.360	.103	2.774	.000	2.080	.750F	.000	4.06	321.14	332.00
1986-09	4.061	321.14	.000	.100	3.193	.000	2.262	.708F	.000	1.70	317.55	332.00
1986-10	1.700	317.55	.000	.068	1.723	.000	.000	.000F	.000	1.63	317.43	331.25
1986-11	1.632	317.43	.000	.066	1.981	.000	.000	.000F	.000	1.57	317.31	330.25
1986-12	1.567	317.31	.000	.064	2.780	.000	.000	.000F	.000	1.50	317.19	328.75
1987-01	1.503	317.19	.000	.057	2.360	.000	.000	.000F	.000	1.45	317.09	327.25
1987-02	1.446	317.09	.000	.055	1.380	.000	.000	.000F	.000	1.39	316.98	326.50
1987-03	1.391	316.98	.000	.072	.000	.000	.000	.000	.000	1.32	316.74	326.00
1987-04	1.319	316.74	.000	.087	.000	.000	.000	.000	.000	1.23	316.43	325.75
1987-05	1.232	316.43	.000	.104	.000	.000	.000	.000	.000	1.13	316.08	325.50

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1987-06	1.127	316.08	.000	.070	.000	.000	.000	.000	.000	1.06	315.83	330.00
1987-07	1.058	315.83	.000	.047	.000	.000	.000	.000	.000	1.01	315.67	331.00
1987-08	1.010	315.67	.130	.048	2.774	.000	.000	.000F	.000	1.09	315.95	332.00
1987-09	1.092	315.95	.000	.048	3.193	.000	.000	.000F	.000	1.04	315.79	332.00
1987-10	1.044	315.79	.000	.047	1.723	.000	.000	.000F	.000	1.00	315.63	331.25
1987-11	.997	315.63	.000	.045	1.981	.000	.000	.000F	.000	.95	315.47	330.25
1987-12	.952	315.47	.000	.044	2.780	.000	.000	.000F	.000	.91	315.32	328.75
1988-01	.908	315.32	.000	.039	2.360	.000	.000	.000F	.000	.87	315.18	327.25
1988-02	.869	315.18	.000	.038	1.380	.000	.000	.000F	.000	.83	315.05	326.50
1988-03	.831	315.05	.000	.049	.000	.000	.000	.000	.000	.78	314.88	326.00
1988-04	.782	314.88	.000	.060	.000	.000	.000	.000	.000	.72	314.68	325.75
1988-05	.722	314.68	.000	.072	.000	.000	.000	.000	.000	.65	314.43	325.50

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1988-06	.650	314.43	.000	.048	.000	.000	.000	.000	.000	.60	314.26	330.00
1988-07	.602	314.26	.060	.033	.000	.000	.000	.000	.000	.63	314.35	331.00
1988-08	.629	314.35	13.430	.147	2.774	.000	2.080	.750F	.000	11.83	327.31	332.00
1988-09	11.831	327.31	.450	.245	3.193	.000	2.395	.750F	.000	9.64	326.05	332.00
1988-10	9.640	326.05	.000	.217	1.723	.000	1.292	.750F	.000	8.13	324.89	331.25
1988-11	8.131	324.89	.000	.190	1.981	.000	1.486	.750F	.000	6.46	323.58	330.25
1988-12	6.456	323.58	.000	.154	2.780	.000	2.085	.750F	.000	4.22	321.31	328.75
1989-01	4.217	321.31	.000	.102	2.360	.000	1.770	.750F	.000	2.34	318.72	327.25
1989-02	2.344	318.72	.000	.073	1.380	.000	.572	.414F	.000	1.70	317.55	326.50
1989-03	1.700	317.55	.000	.084	.000	.000	.000	.000	.000	1.62	317.40	326.00
1989-04	1.616	317.40	.000	.102	.000	.000	.000	.000	.000	1.51	317.22	325.75
1989-05	1.514	317.22	.000	.122	.000	.000	.000	.000	.000	1.39	316.99	325.50

No. of failure months (When Release is less than Demand) = 65

No. of critical failure months (When Release is less than 75% of Demand) = 25

Monthly Time Reliability = 75.4 % ; Annual Time Reliability = 50.0 %

Volume Reliability = 80.6 %

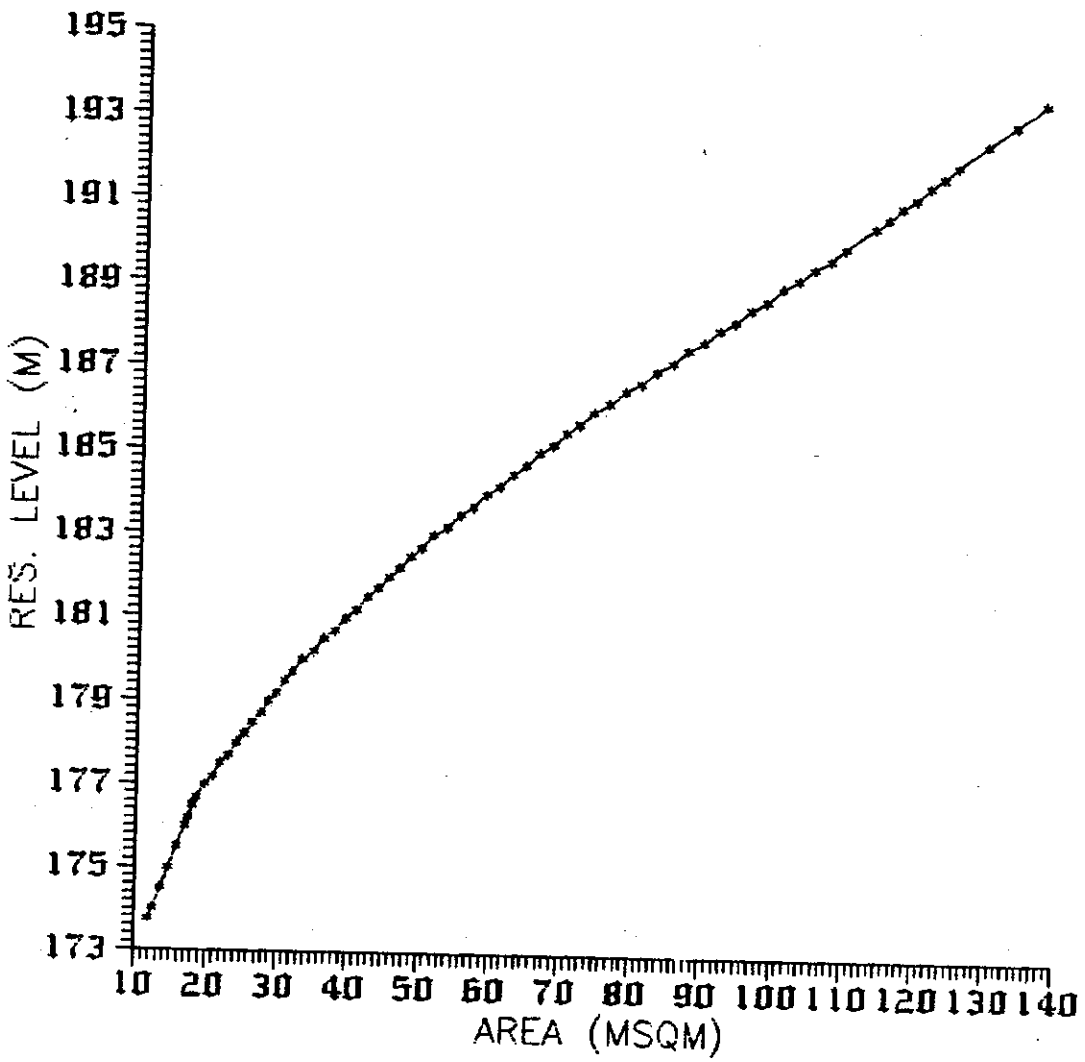
ANNEXURE-2.1

SALIENT FEATURES OF DHAROI DAM

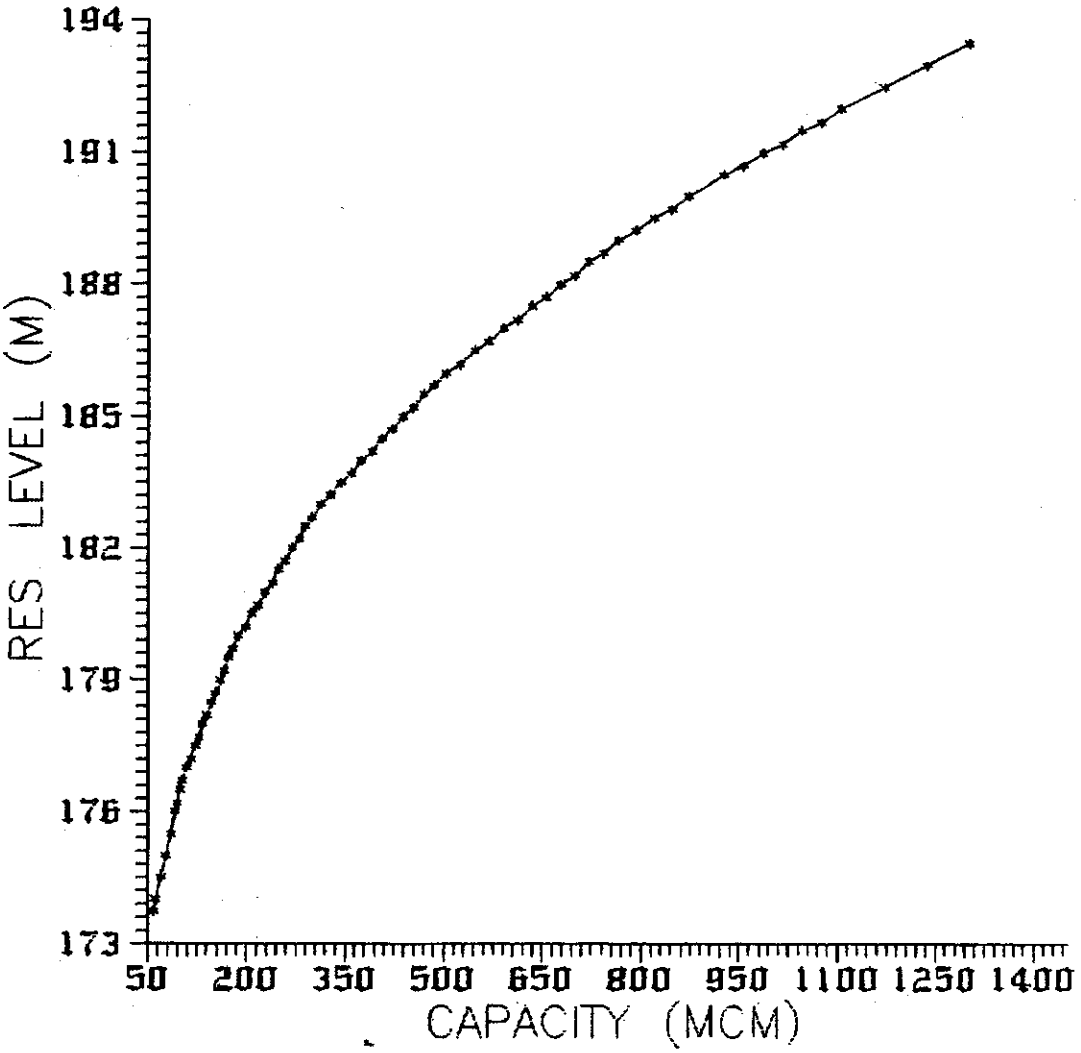
(1)	**General Details**	
	a) Location	Vill: Dharoi, Ta: Kheralu Dist: Mehsana
	b) Co-ordinates	Latitude 24° 00' N Longitude 72° 52' E
	c) Year of Completion	1976
	d) Purpose	Irrigation, Water Supply Flood Control & Power Generation
(2)	**Hydrology**	
	a) Total catchment area at the Dam site	5540 Sq.Km
	b) Net free catchment area at Dharoi for water planning	3217 Sq.Km
	c) Average annual rainfall in the catchment	633 mm
	d) 75 % reliable yield from net free catchment area	391.27 Mcm
	e) Maximum Probable Flood	27176 Cumec
(3)	**Dam**	
	a) Type of dam	Earthen & Masonary
	b) Length at Top of dam	1207 m
	c) Maximum Height above the lowest point of foundation	45.87 m
	d) R.L. of Top of Dam	195.07 m (Present) 196.29 m (Proposed)
(4)	**Reservoir**	
	a) Full Reservoir Level	189.59 m
	b) High Flood Level	193.60 m
	c) Dead Storage Level	175.87 m
	d) Area at FRL	107.45 Sq.Km
	e) Gross Storage Capacity at FRL	829.415 Mcm
	f) Dead Storage Capacity	89.941 Mcm
	g) Live Storage Capacity	739.474 Mcm

Contd.

(5) Flood Disposal		
a) Type of Spillway	Ogee shaped with radial gates
b) Length	219.46 m
c) Discharge Capacity at HFL	21982 Cumec
d) Number of Gates	12 (14.94 m x 11.28 m)
e) Crest Level	178.92 m
(6) Head Regulators		
a) Sill Levels	170.69 m (Water Supply Canal) 175.87 m (Irrigation Left Canal) 171.91 m (River Bed Penstock for Hydropower) 175.57 m (Canal Penstock for Hydropower)
c) Number & Size	2 Nos.; 1.22 m x 1.52 m (For Water Supply) 4 Nos.; 1.22 m x 1.52 m (Irrigation Right Canal) 2 Nos.; 1.22 m x 1.52 m (Irrigation Left Canal) 2 Nos.; 1.83 m x 1.83 m (River Bed Power House) 2 Nos.; 2.44 m x 1.83 m (Canal Bed Power House)
(7) Irrigation		
a) Gross Command Area	142321 Ha (Right Bank) 34791 Ha (Left Bank)
b) Culturable Command Area	76317 Ha (Right Bank) 18705 Ha (Left bank)



Fig–DHD2: Elevation–Area Curve for Dharoi Reservoir



Fig–DHD3: Elevation–Capacity Curve for Dharoi Reservoir

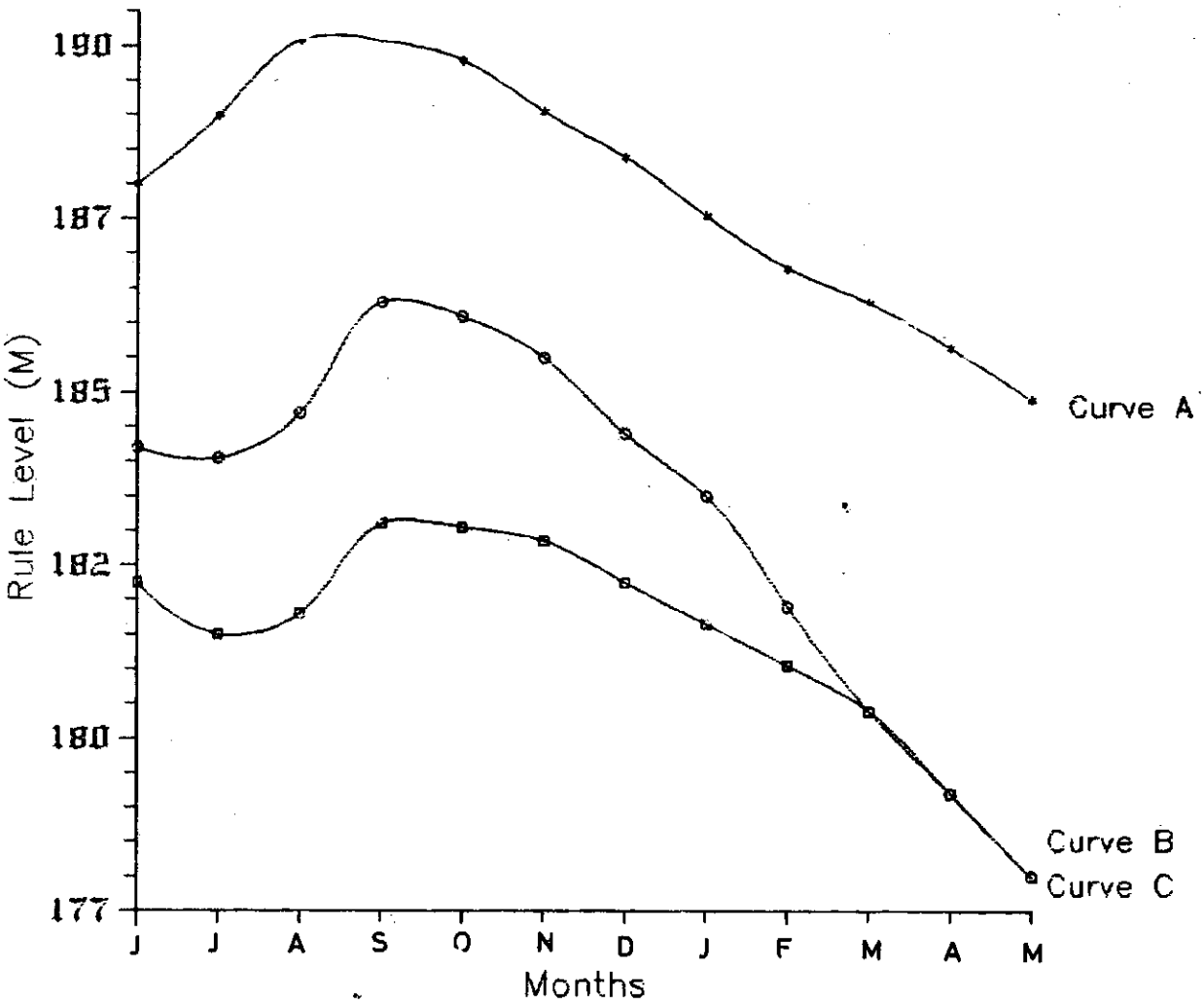


Fig-DHD4: Rule Curves for Dharoi Reservoir

Table - DHD.1
Monthly Inflow Series for DHAROI DAM
in Million Cubic Meter

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1967						14.98	336.82	164.21	245.93	47.47	12.43	14.25
1968	6.92	4.11	2.12	1.17	0.85	0.51	230.87	632.83	23.05	6.16	2.61	1.83
1969	0.52	0.83	0.90	0.53	0.30	5.25	84.35	56.70	34.68	2.21	0.16	0.00
1970	0.00	2.60	0.19	0.11	0.81	53.70	239.12	262.12	390.55	74.70	27.81	16.29
1971	3.44	1.67	0.52	0.16	0.00	58.24	176.42	73.71	32.72	8.53	1.92	1.35
1972	0.00	0.49	0.21	0.00	0.00	36.48	91.33	48.07	10.12	0.36	0.30	0.32
1973	0.27	0.00	0.33	0.25	0.16	13.50	117.30	704.73	2306.69	197.05	49.70	21.20
1974	11.16	6.98	3.88	2.06	5.89	2.10	48.04	70.33	13.05	11.47	1.96	0.60
1975	0.43	0.14	0.33	0.30	0.27	123.70	334.74	396.72	477.26	118.53	19.46	7.58
1976	4.89	4.45	1.31	0.62	0.12	12.29	147.38	831.53	508.61	86.50	25.55	5.46
1977	3.30	8.43	6.52	4.49	13.26	113.98	801.69	564.58	517.15	105.80	44.00	47.35
1978	14.54	22.93	7.51	11.47	44.52	13.21	120.37	221.70	91.63	16.96	23.02	3.73
1979	3.79	1.93	0.38	0.00	0.00	48.53	45.41	183.78	11.19	0.00	49.06	11.16
1980	9.19	6.69	1.25	2.99	0.46	559.54	308.70	406.22	50.86	1.46	3.22	18.21
1981	0.00	5.24	4.14	4.37	0.00	68.65	87.55	161.84	55.33	20.70	24.62	7.72
1982	7.70	3.50	3.04	0.00	3.53	6.53	118.54	129.93	12.04	0.00	24.00	8.91
1983	8.47	10.84	12.64	20.32	34.41	164.83	331.69	614.94	129.83	45.55	46.74	17.59
1984	0.95	1.44	16.82	14.73	3.10	6.66	71.84	471.17	137.68	29.52	2.92	8.61
1985	10.62	8.67	14.76	2.86	0.00	2.74	84.09	186.89	16.12	59.09	0.62	2.37
1986	11.04	4.73	3.13	0.00	8.89	16.96	46.97	73.54	2.59	0.70	0.00	0.00
1987	0.00	0.60	0.09	0.70	0.00	6.20	9.98	40.70	0.60	0.00	0.00	0.30
1988	0.21	0.40	0.00	0.30	0.00	8.70	163.86	437.72	45.04	10.84	0.21	0.00
1989	0.60	0.21	0.00	0.60	2.41							

Table - DHD.2
Elevation-Area-Capacity Table for DHAROI DAM

Elevation (m)	Area (M sq.m)	Capacity (M cu.m)
173.74	11.929	58.898
174.00	12.493	62.687
174.50	13.578	69.974
175.00	14.663	77.261
175.50	15.748	84.548
176.00	16.833	91.835
176.25	17.375	95.479
176.50	17.917	99.122
176.75	18.460	102.766
177.00	19.511	108.803
177.25	20.631	115.167
177.50	21.751	121.531
177.75	22.871	127.895
178.00	23.991	134.259
178.25	25.111	140.623
178.50	26.231	146.987
178.75	27.351	153.351
179.00	28.471	159.715
179.25	29.591	166.079
179.50	30.711	172.443
179.75	31.831	178.807
180.00	33.217	187.742
180.25	34.730	197.885
180.50	36.242	208.029
180.75	37.755	218.172
181.00	39.267	228.316
181.25	40.779	238.460
181.50	42.292	248.603
181.75	43.804	258.747
182.00	45.316	268.890
182.25	46.829	279.034
182.50	48.341	289.178
182.75	49.854	299.321
183.00	51.534	312.175
183.25	53.396	327.964
183.50	55.258	343.753
183.75	57.120	359.543
184.00	58.982	375.332
184.25	60.844	391.121
184.50	62.707	406.911
184.75	64.569	422.700
185.00	66.431	438.489
185.25	68.293	454.279
185.50	70.155	470.068
185.75	72.017	485.857
186.00	73.973	503.328
186.25	76.167	525.124
186.50	78.362	546.920
186.75	80.557	568.716
187.00	82.751	590.512
187.25	84.946	612.308
187.50	87.141	634.104

Contd.

Elevation (m)	Area (M sq.m)	Capacity (M cu.m)
187.75	89.335	655.900
188.00	91.530	677.695
188.25	93.725	699.491
188.50	95.919	721.287
188.75	98.114	743.083
189.00	100.313	765.309
189.25	102.562	792.472
189.50	104.811	819.636
189.75	106.974	846.546
190.00	109.087	873.313
190.25	111.201	900.080
190.50	113.314	926.847
190.75	115.244	956.665
191.00	117.174	986.484
191.25	119.103	1016.302
191.50	121.033	1046.121
191.75	122.963	1075.939
192.00	124.893	1105.758
192.50	129.008	1171.208
193.00	133.134	1236.901
193.50	137.260	1302.593

Table - DHD.3
Average Monthly Demands from DHAROI DAM
in Million Cubic Meter

Month	Irrigation Demand	Water Supply Demand	Total Demand
Jan	60.977	18.960	60.977
Feb	56.839	20.550	56.839
Mar	0.066	26.545	26.611
Apr	0.000	25.689	25.689
May	0.000	26.545	26.545
Jun	6.878	22.018	28.896
Jul	1.504	18.960	20.464
Aug	4.141	0.000	4.141
Sep	19.786	0.000	19.786
Oct	31.095	0.000	31.095
Nov	42.103	18.349	60.452
Dec	30.235	18.960	49.195

Table - DHD.4
Normal Monthly Evaporation Depths for Dharoi Sub-basin
in meter/month

Month	Evap_Depth	Month	Evap_Depth
Jan	0.1402	Jul	0.1524
Feb	0.1402	Aug	0.1524
Mar	0.1890	Sep	0.1524
Apr	0.2408	Oct	0.1524
May	0.3048	Nov	0.1524
Jun	0.2164	Dec	0.1524

Table - DHD.5
Monthly Yield Estimation for DHAROI DAM

Month	Monthly Yield (Million Cubic Meter)					
	Probability Level for Value to be Equalled or Exceeded					
	50%	60%	70%	75%	80%	90%
Jan	2.215	1.324	.654	.390	.189	.000
Feb	2.384	1.555	.908	.635	.406	.075
Mar	1.243	.687	.324	.196	.103	.009
Apr	.580	.262	.093	.046	.018	.000
May	.185	.051	.010	.003	.001	.000
Jun	18.722	10.963	5.816	3.920	2.462	.573
Jul	130.703	103.884	80.629	69.544	58.968	37.380
Aug	227.864	180.007	138.092	117.998	98.783	59.609
Sep	58.245	36.037	21.336	15.756	11.263	4.515
Oct	13.956	7.727	3.588	2.122	1.073	.054
Nov	5.506	2.363	.819	.408	.171	.007
Dec	4.092	2.433	1.225	.758	.400	.017

Table - DHD.6
Recommended Rule Curve Levels for DHAROI DAM

Month	Rule Levels in Meter		
	Upper Rule Lev Curve A	Middle Rule Lev Curve B	Lower Rule Lev Curve C
Jan	187.05	183.00	181.15
Feb	186.30	181.40	180.55
Mar	185.80	179.90	179.90
Apr	185.15	178.70	178.70
May	184.40	177.50	177.50
Jun	187.50	183.70	181.75
Jul	188.50	183.55	181.00
Aug	189.59	184.20	181.30
Sep	189.59	185.80	182.60
Oct	189.30	185.60	182.55
Nov	188.55	185.00	182.35
Dec	187.90	183.90	181.75

Table - DHD.7

Monthly Operation Simulation of DHAROI DAM For Conservation Regulation Using Recommended Policy

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	US_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1967-06	450.000	185.18	14.980	.000	14.309	28.896	22.018	28.896	1.000	.000	421.77	184.74	187.50
1967-07	421.775	184.74	336.820	.816	12.221	20.464	18.960	20.464	1.000	5.439	721.29	188.50	188.50
1967-08	721.287	188.50	164.210	.000	15.357	4.141	.000	4.141	1.000	36.584	829.41	189.59	189.59
1967-09	829.415	189.59	245.930	12.633	16.097	19.786	.000	19.786	1.000	222.681	829.41	189.59	189.59
1967-10	829.415	189.59	47.470	.000	15.898	31.095	.000	31.095	1.000	31.987	797.91	189.30	189.30
1967-11	797.906	189.30	12.430	.000	15.192	60.452	18.349	60.452	1.000	9.045	725.65	188.55	188.55
1967-12	725.647	188.55	14.250	.000	14.250	49.195	18.960	49.195	1.000	7.475	668.98	187.90	187.90
1968-01	668.977	187.90	6.920	.000	12.186	60.977	18.960	60.977	1.000	7.862	594.87	187.05	187.05
1968-02	594.871	187.05	4.110	.000	11.202	56.839	20.550	56.839	1.000	1.457	529.48	186.30	186.30
1968-03	529.484	186.30	2.120	.000	14.080	26.611	26.545	26.611	1.000	1.897	489.02	185.80	185.80
1968-04	489.015	185.80	1.170	.000	16.844	25.689	25.689	25.689	1.000	.000	447.65	185.15	185.15
1968-05	447.652	185.15	.850	.000	19.732	26.545	26.545	26.545	1.000	1.631	400.59	184.40	184.40

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	US_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1968-06	400.594	184.40	.510	.000	12.882	28.896	22.018	28.896	1.000	.000	359.33	183.75	187.50
1968-07	359.326	183.75	230.870	16.028	10.539	20.464	18.960	20.464	1.000	.000	575.22	186.82	188.50
1968-08	575.222	186.82	632.830	40.133	14.237	4.141	.000	4.141	1.000	400.392	829.41	189.59	189.59
1968-09	829.415	189.59	23.050	.000	16.016	19.786	.000	19.786	1.000	.000	816.66	189.47	189.59
1968-10	816.663	189.47	6.160	.000	15.679	31.095	.000	31.095	1.000	.000	776.05	189.10	189.30
1968-11	776.048	189.10	2.610	.000	14.883	60.452	18.349	60.452	1.000	.000	703.32	188.29	188.55
1968-12	703.323	188.29	1.830	.000	13.873	49.195	18.960	49.195	1.000	.000	642.09	187.59	187.90
1969-01	642.086	187.59	.520	.000	11.820	60.977	18.960	60.977	1.000	.000	569.81	186.76	187.05
1969-02	569.809	186.76	.830	.000	10.838	56.839	20.550	56.839	1.000	.000	502.96	186.00	186.30
1969-03	502.963	186.00	.900	.000	13.546	26.611	26.545	26.611	1.000	.000	463.71	185.40	185.80
1969-04	463.706	185.40	.530	.000	16.126	25.689	25.689	25.689	1.000	.000	422.42	184.75	185.15
1969-05	422.421	184.75	.300	.000	18.860	26.545	26.545	26.545	1.000	.000	377.32	184.03	184.40

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	US_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1969-06	377.316	184.03	5.250	.000	12.377	28.896	22.018	27.177	.940F	.000	343.01	183.49	187.50
1969-07	343.013	183.49	84.350	.000	8.902	20.464	18.960	20.464	1.000	.000	398.00	184.36	188.50
1969-08	397.996	184.36	56.700	.000	9.781	4.141	.000	4.141	1.000	.000	440.77	185.04	189.59
1969-09	440.775	185.04	34.680	.000	10.251	19.786	.000	14.840	.750F	.000	450.36	185.19	189.59
1969-10	450.364	185.19	2.210	.000	10.057	31.095	.000	23.321	.750F	.000	419.20	184.69	189.30
1969-11	419.195	184.69	.160	.000	9.247	60.452	18.349	49.926	.826F	.000	360.18	183.76	188.55
1969-12	360.182	183.76	.000	.000	8.268	49.195	18.960	41.636	.846F	.000	310.28	182.97	187.90
1970-01	310.278	182.97	.000	.000	6.609	60.977	18.960	50.473	.828F	.000	253.20	181.61	187.05
1970-02	253.195	181.61	2.600	.000	5.574	56.839	20.550	40.163	.707F	.000	210.06	180.55	186.30
1970-03	210.058	180.55	.190	.000	6.436	26.611	26.545	26.545	.998F	.000	177.27	179.69	185.80
1970-04	177.267	179.69	.110	.000	6.911	25.689	25.689	25.689	1.000	.000	144.78	178.41	185.15
1970-05	144.777	178.41	.810	.000	6.999	26.545	26.545	26.545	1.000	.000	112.04	177.13	184.40

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YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	US_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1970-06	112.043	177.13	53.700	.000	4.856	28.896	22.018	22.018	.762F	.000	138.87	178.18	187.50
1970-07	138.869	178.18	239.120	.000	6.169	20.464	18.960	20.464	1.000	.000	351.36	183.62	188.50
1970-08	351.356	183.62	262.120	25.412	10.841	4.141	.000	4.141	1.000	.000	623.91	187.38	189.59
1970-09	623.906	187.38	390.550	29.877	14.610	19.786	.000	19.786	1.000	180.522	829.41	189.59	189.59
1970-10	829.415	189.59	74.700	1.565	15.898	31.095	.000	31.095	1.000	60.781	797.91	189.30	189.30
1970-11	797.906	189.30	27.810	.032	15.192	60.452	18.349	60.452	1.000	24.457	725.65	188.55	188.55
1970-12	725.647	188.55	16.290	.000	14.250	49.195	18.960	49.195	1.000	9.515	668.98	187.90	187.90
1971-01	668.977	187.90	3.440	.062	12.186	60.977	18.960	60.977	1.000	4.444	594.87	187.05	187.05
1971-02	594.871	187.05	1.670	.046	11.195	56.839	20.550	56.839	1.000	.000	528.55	186.29	186.30
1971-03	528.553	186.29	.520	.000	14.064	26.611	26.545	26.611	1.000	.000	488.40	185.79	185.80
1971-04	488.398	185.79	.160	.000	16.813	25.689	25.689	25.689	1.000	.000	446.06	185.12	185.15
1971-05	446.056	185.12	.000	.000	19.689	26.545	26.545	26.545	1.000	.000	399.82	184.39	184.40

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	US_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1971-06	399.822	184.39	58.240	.000	13.590	28.896	22.018	28.896	1.000	.000	415.58	184.64	187.50
1971-07	415.576	184.64	176.420	.000	10.932	20.464	18.960	20.464	1.000	.000	560.60	186.66	188.50
1971-08	560.600	186.66	73.710	.000	12.589	4.141	.000	4.141	1.000	.000	617.58	187.31	189.59
1971-09	617.579	187.31	32.720	.000	13.026	19.786	.000	19.786	1.000	.000	617.49	187.31	189.59
1971-10	617.487	187.31	8.530	.000	12.754	31.095	.000	31.095	1.000	.000	582.17	186.90	189.30
1971-11	582.168	186.90	1.920	.000	11.943	60.452	18.349	60.452	1.000	.000	511.69	186.10	188.55
1971-12	511.694	186.10	1.350	.000	10.893	49.195	18.960	49.195	1.000	.000	452.96	185.23	187.90
1972-01	452.956	185.23	.000	.000	8.974	60.977	18.960	60.977	1.000	.000	383.00	184.12	187.05
1972-02	383.004	184.12	.490	.000	7.865	56.839	20.550	56.839	1.000	.000	318.79	183.10	186.30
1972-03	318.790	183.10	.210	.000	9.424	26.611	26.545	26.611	1.000	.000	282.96	182.35	185.80
1972-04	282.964	182.35	.000	.000	10.763	25.689	25.689	25.689	1.000	.000	246.51	181.45	185.15
1972-05	246.512	181.45	.000	.000	11.921	26.545	26.545	26.545	1.000	.000	208.05	180.50	184.40

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	US_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1972-06	208.046	180.50	36.480	.000	7.948	28.896	22.018	22.018	.762F	.000	214.56	180.66	187.50
1972-07	214.559	180.66	91.330	.000	6.408	20.464	18.960	20.088	.982F	.000	279.39	182.26	188.50
1972-08	279.393	182.26	48.070	.000	7.541	4.141	.000	3.106	.750F	.000	316.82	183.07	189.59
1972-09	316.816	183.07	10.120	.000	7.824	19.786	.000	14.840	.750F	.000	304.27	182.87	189.59
1972-10	304.273	182.87	.360	.000	7.562	31.095	.000	5.865	.189F	.000	291.21	182.55	189.30
1972-11	291.206	182.55	.300	.000	7.127	60.452	18.349	18.349	.304F	.000	266.03	181.93	188.55
1972-12	266.030	181.93	.320	.000	6.555	49.195	18.960	18.960	.385F	.000	240.84	181.31	187.90
1973-01	240.835	181.31	.270	.000	5.514	60.977	18.960	18.960	.311F	.000	216.63	180.71	187.05
1973-02	216.631	180.71	.000	.000	4.994	56.839	20.550	20.550	.362F	.000	191.09	180.08	186.30
1973-03	191.087	180.08	.330	.000	5.865	26.611	26.545	26.545	.998F	.000	159.01	178.97	185.80
1973-04	159.007	178.97	.250	.000	6.156	25.689	25.689	25.689	1.000	.000	127.41	177.73	185.15
1973-05	127.412	177.73	.160	.000	6.108	26.545	26.545	26.545	1.000	.000	94.92	176.21	184.40

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	US_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1973-06	94.919	176.21	13.500	.000	3.662	28.896	22.018	14.817	.513W	.000	89.94	175.87	187.50
1973-07	89.941	175.87	117.300	.000	3.756	20.464	18.960	18.960	.927F	.000	184.53	179.92	188.50
1973-08	184.525	179.92	704.730	3.101	10.543	4.141	.000	4.141	1.000	48.258	829.41	189.59	189.59
1973-09	829.415	189.59	2306.690	1.627	16.097	19.786	.000	19.786	1.000	2272.434	829.42	189.59	189.59
1973-10	829.415	189.59	197.050	1.585	15.898	31.095	.000	31.095	1.000	183.152	797.91	189.30	189.30
1973-11	797.906	189.30	49.700	.422	15.192	60.452	18.349	60.452	1.000	46.737	725.65	188.55	188.55
1973-12	725.647	188.55	21.200	.000	14.250	49.195	18.960	49.195	1.000	14.425	668.98	187.90	187.90
1974-01	668.977	187.90	11.160	.062	12.186	60.977	18.960	60.977	1.000	12.164	594.87	187.05	187.05
1974-02	594.871	187.05	6.980	.046	11.202	56.839	20.550	56.839	1.000	4.372	529.48	186.30	186.30
1974-03	529.484	186.30	3.880	.000	14.080	26.611	26.545	26.611	1.000	3.657	489.02	185.80	185.80
1974-04	489.015	185.80	2.060	.000	16.849	25.689	25.689	25.689	1.000	.575	447.96	185.15	185.15
1974-05	447.962	185.15	5.890	.000	19.737	26.545	26.545	26.545	1.000	6.976	400.59	184.40	184.40

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YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	US_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1974-06	400.594	184.40	2.100	.000	12.902	28.896	22.018	28.896	1.000	.000	360.90	183.77	187.50
1974-07	360.896	183.77	48.040	.000	8.897	20.464	18.960	20.464	1.000	.000	379.58	184.07	188.50
1974-08	379.575	184.07	70.330	.000	9.574	4.141	.000	4.141	1.000	.000	436.19	184.96	189.59
1974-09	436.190	184.96	13.050	.000	9.977	19.786	.000	14.840	.750F	.000	424.42	184.78	189.59
1974-10	424.424	184.78	11.470	.000	9.678	31.095	.000	23.321	.750F	.000	402.89	184.44	189.30
1974-11	402.895	184.44	1.960	.000	8.973	60.452	18.349	49.926	.826F	.000	345.96	183.53	188.55
1974-12	345.956	183.53	.600	.000	8.002	49.195	18.960	41.636	.846F	.000	296.92	182.69	187.90
1975-01	296.918	182.69	.430	.000	6.350	60.977	18.960	50.473	.828F	.000	240.53	181.30	187.05
1975-02	240.525	181.30	.140	.000	5.442	56.839	20.550	25.165	.443F	.000	210.06	180.55	186.30
1975-03	210.058	180.55	.330	.000	6.438	26.611	26.545	26.545	.998F	.000	177.40	179.69	185.80
1975-04	177.404	179.69	.300	.000	6.921	25.689	25.689	25.689	1.000	.000	145.09	178.43	185.15
1975-05	145.095	178.43	.270	.000	7.001	26.545	26.545	26.545	1.000	.000	111.82	177.12	184.40

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	US_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1975-06	111.819	177.12	123.700	.000	6.080	28.896	22.018	22.018	.762F	.000	207.42	180.49	187.50
1975-07	207.421	180.49	334.740	.000	8.467	20.464	18.960	20.464	1.000	.000	513.23	186.11	188.50
1975-08	513.229	186.11	396.720	.000	13.761	4.141	.000	4.141	1.000	62.632	829.41	189.59	189.59
1975-09	829.415	189.59	477.260	.000	16.097	19.786	.000	19.786	1.000	441.377	829.41	189.59	189.59
1975-10	829.415	189.59	118.530	.000	15.898	31.095	.000	31.095	1.000	103.047	797.91	189.30	189.30
1975-11	797.906	189.30	19.460	.000	15.192	60.452	18.349	60.452	1.000	16.075	725.65	188.55	188.55
1975-12	725.647	188.55	7.580	.000	14.250	49.195	18.960	49.195	1.000	.805	668.98	187.90	187.90
1976-01	668.977	187.90	4.890	.000	12.186	60.977	18.960	60.977	1.000	5.832	594.87	187.05	187.05
1976-02	594.871	187.05	4.450	.000	11.202	56.839	20.550	56.839	1.000	1.797	529.48	186.30	186.30
1976-03	529.484	186.30	1.310	.000	14.080	26.611	26.545	26.611	1.000	1.087	489.02	185.80	185.80
1976-04	489.015	185.80	.620	.000	16.836	25.689	25.689	25.689	1.000	.000	447.11	185.14	185.15
1976-05	447.110	185.14	.120	.000	19.722	26.545	26.545	26.545	1.000	.368	400.59	184.40	184.40

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	US_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1976-06	400.594	184.40	12.290	.000	13.030	28.896	22.018	28.896	1.000	.000	370.96	183.93	187.50
1976-07	370.958	183.93	147.380	.000	9.961	20.464	18.960	20.464	1.000	.000	487.91	185.78	188.50
1976-08	487.913	185.78	831.530	1.956	13.555	4.141	.000	4.141	1.000	474.288	829.41	189.59	189.59
1976-09	829.415	189.59	508.610	11.187	16.097	19.786	.000	19.786	1.000	483.914	829.41	189.59	189.59
1976-10	829.415	189.59	86.500	1.655	15.898	31.095	.000	31.095	1.000	72.671	797.91	189.30	189.30
1976-11	797.906	189.30	25.550	.482	15.192	60.452	18.349	60.452	1.000	22.647	725.65	188.55	188.55
1976-12	725.647	188.55	5.460	.000	14.240	49.195	18.960	49.195	1.000	.000	667.67	187.89	187.90
1977-01	667.672	187.88	3.300	.062	12.177	60.977	18.960	60.977	1.000	3.008	594.87	187.05	187.05
1977-02	594.871	187.05	8.430	.046	11.202	56.839	20.550	56.839	1.000	5.823	529.48	186.30	186.30
1977-03	529.484	186.30	6.520	.000	14.080	26.611	26.545	26.611	1.000	6.297	489.02	185.80	185.80
1977-04	489.015	185.80	4.490	.000	16.849	25.689	25.689	25.689	1.000	3.005	447.96	185.15	185.15
1977-05	447.962	185.15	13.260	.000	19.737	26.545	26.545	26.545	1.000	14.346	400.59	184.40	184.40

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	US_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1977-06	400.594	184.40	113.980	.000	14.312	28.896	22.018	28.896	1.000	.000	471.37	185.52	187.50
1977-07	471.367	185.52	801.690	49.041	12.667	20.464	18.960	20.464	1.000	567.680	721.29	188.50	188.50
1977-08	721.287	188.50	564.580	32.023	15.357	4.141	.000	4.141	1.000	468.976	829.41	189.59	189.59
1977-09	829.415	189.59	517.150	31.597	16.097	19.786	.000	19.786	1.000	512.864	829.41	189.59	189.59
1977-10	829.415	189.59	105.800	3.665	15.898	31.095	.000	31.095	1.000	93.981	797.91	189.30	189.30
1977-11	797.906	189.30	44.000	1.772	15.192	60.452	18.349	60.452	1.000	42.387	725.65	188.55	188.55
1977-12	725.647	188.55	47.350	.701	14.250	49.195	18.960	49.195	1.000	41.276	668.98	187.90	187.90
1978-01	668.977	187.90	14.540	.081	12.186	60.977	18.960	60.977	1.000	15.562	594.87	187.05	187.05
1978-02	594.871	187.05	22.930	.046	11.202	56.839	20.550	56.839	1.000	20.323	529.48	186.30	186.30
1978-03	529.484	186.30	7.510	.000	14.080	26.611	26.545	26.611	1.000	7.287	489.02	185.80	185.80
1978-04	489.015	185.80	11.470	.000	16.849	25.689	25.689	25.689	1.000	9.985	447.96	185.15	185.15
1978-05	447.962	185.15	44.520	.000	19.737	26.545	26.545	26.545	1.000	45.606	400.59	184.40	184.40

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	US_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1978-06	400.594	184.40	13.210	.000	13.042	28.896	22.018	28.896	1.000	.000	371.87	183.95	187.50
1978-07	371.866	183.95	120.370	5.882	9.789	20.464	18.960	20.464	1.000	.000	467.87	185.47	188.50
1978-08	467.865	185.47	221.700	12.343	12.360	4.141	.000	4.141	1.000	.000	685.41	188.09	189.59
1978-09	685.407	188.09	91.630	7.197	14.562	19.786	.000	19.786	1.000	.000	749.89	188.83	189.59
1978-10	749.886	188.83	16.960	3.045	14.858	31.095	.000	31.095	1.000	.000	723.94	188.53	189.30
1978-11	723.938	188.53	23.020	.982	14.270	60.452	18.349	60.452	1.000	.000	673.22	187.95	188.55
1978-12	673.219	187.95	3.730	.381	13.431	49.195	18.960	49.195	1.000	.000	614.70	187.28	187.90
1979-01	614.704	187.28	3.790	.081	11.459	60.977	18.960	60.977	1.000	.000	546.14	186.49	187.05
1979-02	546.138	186.49	1.930	.046	10.494	56.839	20.550	56.839	1.000	.000	480.78	185.67	186.30
1979-03	480.780	185.67	.380	.000	13.060	26.611	26.545	26.611	1.000	.000	441.49	185.05	185.80
1979-04	441.489	185.05	.000	.000	15.497	25.689	25.689	25.689	1.000	.000	400.30	184.40	185.15
1979-05	400.303	184.40	.000	.000	18.074	26.545	26.545	26.545	1.000	.000	355.68	183.69	184.40

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	US_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1979-06	355.685	183.69	48.530	.000	12.355	28.896	22.018	28.896	1.000	.000	362.96	183.80	187.50
1979-07	362.963	183.80	45.410	.000	8.911	20.464	18.960	20.464	1.000	.000	379.00	184.06	188.50
1979-08	378.999	184.06	183.780	49.666	10.886	4.141	.000	4.141	1.000	.000	597.42	187.08	189.59
1979-09	597.417	187.08	11.190	.000	12.555	19.786	.000	19.786	1.000	.000	576.27	186.84	189.59
1979-10	576.266	186.84	.000	.000	12.062	31.095	.000	31.095	1.000	.000	533.11	186.34	189.30
1979-11	533.110	186.34	49.060	.000	11.554	60.452	18.349	60.452	1.000	.000	510.16	186.08	188.55
1979-12	510.164	186.08	11.160	.000	10.955	49.195	18.960	49.195	1.000	.000	461.17	185.36	187.90
1980-01	461.174	185.36	9.190	.000	9.185	60.977	18.960	60.977	1.000	.000	400.20	184.39	187.05
1980-02	400.202	184.39	6.690	.000	8.198	56.839	20.550	56.839	1.000	.000	341.85	183.47	186.30
1980-03	341.855	183.47	1.250	.000	10.007	26.611	26.545	26.611	1.000	.000	306.49	182.91	185.80
1980-04	306.487	182.91	2.990	.000	11.638	25.689	25.689	25.689	1.000	.000	272.15	182.08	185.15
1980-05	272.149	182.08	.460	.000	13.071	26.545	26.545	26.545	1.000	.000	232.99	181.12	184.40

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	US_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1980-06	232.993	181.12	559.540	.000	13.753	28.896	22.018	28.896	1.000	115.781	634.10	187.50	187.50
1980-07	634.104	187.50	308.700	.000	13.949	20.464	18.960	20.464	1.000	187.103	721.29	188.50	188.50
1980-08	721.287	188.50	406.220	3.512	15.357	4.141	.000	4.141	1.000	282.106	829.41	189.59	189.59
1980-09	829.415	189.59	50.860	.000	16.097	19.786	.000	19.786	1.000	14.977	829.41	189.59	189.59
1980-10	829.415	189.59	1.460	.000	15.810	31.095	.000	31.095	1.000	.000	783.97	189.17	189.30
1980-11	783.970	189.17	3.220	.000	14.997	60.452	18.349	60.452	1.000	.000	711.74	188.39	188.55
1980-12	711.741	188.39	18.210	.000	14.125	49.195	18.960	49.195	1.000	.000	666.63	187.87	187.90
1981-01	666.630	187.87	.000	.000	12.160	60.977	18.960	60.977	1.000	.000	593.49	187.03	187.05
1981-02	593.493	187.03	5.240	.000	11.192	56.839	20.550	56.839	1.000	1.218	529.48	186.30	186.30
1981-03	529.484	186.30	4.140	.000	14.080	26.611	26.545	26.611	1.000	3.917	489.02	185.80	185.80
1981-04	489.015	185.80	4.370	.000	16.849	25.689	25.689	25.689	1.000	2.885	447.96	185.15	185.15
1981-05	447.962	185.15	.000	.000	19.737	26.545	26.545	26.545	1.000	1.086	400.59	184.40	184.40

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	US_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1981-06	400.594	184.40	68.650	.000	13.740	28.896	22.018	28.896	1.000	.000	426.61	184.81	187.50
1981-07	426.608	184.81	87.550	.000	10.420	20.464	18.960	20.464	1.000	.000	483.27	185.71	188.50
1981-08	483.274	185.71	161.840	.000	12.065	4.141	.000	4.141	1.000	.000	628.91	187.44	189.59
1981-09	628.908	187.44	55.330	.000	13.371	19.786	.000	19.786	1.000	.000	651.08	187.69	189.59
1981-10	651.082	187.69	20.700	.000	13.359	31.095	.000	31.095	1.000	.000	627.33	187.42	189.30
1981-11	627.328	187.42	24.620	.000	12.803	60.452	18.349	60.452	1.000	.000	578.69	186.86	188.55
1981-12	578.693	186.86	7.720	.000	12.019	49.195	18.960	49.195	1.000	.000	525.20	186.25	187.90
1982-01	525.199	186.25	7.700	.000	10.189	60.977	18.960	60.977	1.000	.000	461.73	185.37	187.05
1982-02	461.733	185.37	3.500	.000	9.181	56.839	20.550	56.839	1.000	.000	399.21	184.38	186.30
1982-03	399.213	184.38	3.040	.000	11.291	26.611	26.545	26.611	1.000	.000	364.35	183.83	185.80
1982-04	364.350	183.83	.000	.000	13.337	25.689	25.689	25.689	1.000	.000	325.32	183.21	185.15
1982-05	325.324	183.21	3.530	.000	15.406	26.545	26.545	26.545	1.000	.000	286.90	182.44	184.40

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YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	US_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1982-06	286.904	182.44	6.530	.000	9.933	28.896	22.018	24.754	.857F	.000	258.75	181.75	187.50
1982-07	258.747	181.75	118.540	.000	7.598	20.464	18.960	20.464	1.000	.000	349.23	183.59	188.50
1982-08	349.225	183.59	129.930	.000	9.564	4.141	.000	4.141	1.000	.000	465.45	185.43	189.59
1982-09	465.450	185.43	12.040	.000	10.489	19.786	.000	14.840	.750F	.000	452.16	185.22	189.59
1982-10	452.161	185.22	.000	.000	10.070	31.095	.000	23.321	.750F	.000	418.77	184.69	189.30
1982-11	418.770	184.69	24.000	.000	9.452	60.452	18.349	49.926	.826F	.000	383.39	184.13	188.55
1982-12	383.392	184.13	8.910	.000	8.761	49.195	18.960	41.636	.848F	.000	341.91	183.47	187.90
1983-01	341.905	183.47	8.470	.000	7.283	60.977	18.960	50.473	.828F	.000	292.62	182.58	187.05
1983-02	292.619	182.58	10.840	.000	6.397	56.839	20.550	47.767	.840F	.000	249.30	181.52	186.30
1983-03	249.296	181.52	12.640	.000	7.707	26.611	26.545	26.611	1.000	.000	227.62	180.98	185.80
1983-04	227.618	180.98	20.320	.000	9.169	25.689	25.689	25.689	1.000	.000	213.08	180.62	185.15
1983-05	213.079	180.62	34.410	.000	11.200	26.545	26.545	26.545	1.000	.000	209.74	180.54	184.40

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	US_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1983-06	209.744	180.54	164.830	.000	9.849	28.896	22.018	27.177	.940F	.000	337.55	183.40	187.50
1983-07	337.549	183.40	331.690	.000	10.825	20.464	18.960	20.464	1.000	.000	637.95	187.54	188.50
1983-08	637.950	187.54	614.940	3.808	14.718	4.141	.000	4.141	1.000	408.424	829.41	189.59	189.59
1983-09	829.415	189.59	129.830	.000	16.097	19.786	.000	19.786	1.000	93.947	829.41	189.59	189.59
1983-10	829.415	189.59	45.550	1.758	15.898	31.095	.000	31.095	1.000	31.824	797.91	189.30	189.30
1983-11	797.906	189.30	46.740	.002	15.192	60.452	18.349	60.452	1.000	43.357	725.65	188.55	188.55
1983-12	725.647	188.55	17.590	.000	14.250	49.195	18.960	49.195	1.000	10.815	668.98	187.90	187.90
1984-01	668.977	187.90	.950	.062	12.186	60.977	18.960	60.977	1.000	1.954	594.87	187.05	187.05
1984-02	594.871	187.05	1.440	.046	11.194	56.839	20.550	56.839	1.000	.000	528.32	186.29	186.30
1984-03	528.325	186.29	16.820	.000	14.069	26.611	26.545	26.611	1.000	15.449	489.02	185.80	185.80
1984-04	489.015	185.80	14.730	.000	16.849	25.689	25.689	25.689	1.000	13.245	447.96	185.15	185.15
1984-05	447.962	185.15	3.100	.000	19.737	26.545	26.545	26.545	1.000	4.186	400.59	184.40	184.40

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	US_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1984-06	400.594	184.40	6.660	.000	12.959	28.896	22.018	28.896	1.000	.000	365.40	183.84	187.50
1984-07	365.399	183.84	71.840	21.084	9.377	20.464	18.960	20.464	1.000	.000	428.48	184.84	188.50
1984-08	428.482	184.84	471.170	39.183	13.020	4.141	.000	4.141	1.000	92.258	829.41	189.59	189.59
1984-09	829.415	189.59	137.680	13.207	16.097	19.786	.000	19.786	1.000	115.004	829.41	189.59	189.59
1984-10	829.415	189.59	29.520	.000	15.898	31.095	.000	31.095	1.000	14.037	797.91	189.30	189.30
1984-11	797.906	189.30	2.920	.000	15.188	60.452	18.349	60.452	1.000	.000	725.19	188.54	188.55
1984-12	725.185	188.54	8.610	.000	14.247	49.195	18.960	49.195	1.000	1.377	668.98	187.90	187.90
1985-01	668.977	187.90	10.620	.000	12.186	60.977	18.960	60.977	1.000	11.562	594.87	187.05	187.05
1985-02	594.871	187.05	8.670	.000	11.202	56.839	20.550	56.839	1.000	6.017	529.48	186.30	186.30
1985-03	529.484	186.30	14.760	.000	14.080	26.611	26.545	26.611	1.000	14.538	489.02	185.80	185.80
1985-04	489.015	185.80	2.860	.000	16.849	25.689	25.689	25.689	1.000	1.375	447.96	185.15	185.15
1985-05	447.962	185.15	.000	.000	19.737	26.545	26.545	26.545	1.000	1.086	400.59	184.40	184.40

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	US_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1985-06	400.594	184.40	2.740	.000	12.959	28.896	22.018	28.896	1.000	.000	361.53	183.78	187.50
1985-07	361.528	183.78	84.090	.000	9.239	20.464	18.960	20.464	1.000	.000	415.92	184.64	188.50
1985-08	415.925	184.64	186.890	.000	11.142	4.141	.000	4.141	1.000	.000	587.53	186.97	189.59
1985-09	587.532	186.97	16.120	.000	12.442	19.786	.000	19.786	1.000	.000	571.42	186.78	189.59
1985-10	571.424	186.78	59.090	.000	12.438	31.095	.000	31.095	1.000	.000	586.98	186.96	189.30
1985-11	586.981	186.96	.620	.000	12.006	60.452	18.349	60.452	1.000	.000	515.14	186.14	188.55
1985-12	515.142	186.14	2.370	.000	10.959	49.195	18.960	49.195	1.000	.000	457.36	185.30	187.90
1986-01	457.359	185.30	11.040	.000	9.137	60.977	18.960	60.977	1.000	.000	398.28	184.36	187.05
1986-02	398.285	184.36	4.730	.000	8.151	56.839	20.550	56.839	1.000	.000	338.03	183.41	186.30
1986-03	338.025	183.41	3.130	.000	9.944	26.511	26.545	26.611	1.000	.000	304.60	182.88	185.80
1986-04	304.601	182.88	.000	.000	11.526	25.689	25.689	25.689	1.000	.000	267.39	181.96	185.15
1986-05	267.385	181.96	8.890	.000	13.046	26.545	26.545	26.545	1.000	.000	236.68	181.21	184.40

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YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	US_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1986-06	236.684	181.21	16.960	.000	8.548	28.896	22.018	22.018	.762F	.000	223.08	180.87	187.50
1986-07	223.078	180.87	46.970	.000	6.101	20.464	18.960	20.088	.982F	.000	243.86	181.38	188.50
1986-08	243.859	181.38	73.540	.000	7.051	4.141	.000	3.108	.750F	.000	307.24	182.92	189.59
1986-09	307.242	182.92	2.590	.000	7.612	19.786	.000	8.984	.454F	.000	293.24	182.60	189.59
1986-10	293.235	182.60	.700	.000	7.383	31.095	.000	.000	.000F	.000	286.55	182.44	189.30
1986-11	286.552	182.44	.000	.000	7.019	60.452	18.349	18.349	.304F	.000	261.18	181.81	188.55
1986-12	261.183	181.81	.000	.000	6.443	49.195	18.960	18.960	.385F	.000	235.78	181.18	187.90
1987-01	235.781	181.18	.000	.000	5.407	60.977	18.960	18.960	.311F	.000	211.41	180.58	187.05
1987-02	211.414	180.58	.600	.000	4.892	56.839	20.550	20.550	.362F	.000	186.57	179.97	186.30
1987-03	186.572	179.97	.090	.000	5.725	26.611	26.545	26.545	.998F	.000	154.39	178.79	185.80
1987-04	154.393	178.79	.700	.000	5.974	25.689	25.689	25.689	1.000	.000	123.43	177.57	185.15
1987-05	123.430	177.57	.000	.000	5.911	26.545	26.545	26.545	1.000	.000	90.97	175.94	184.40

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	US_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1987-06	90.973	175.94	6.200	.000	3.598	28.896	22.018	3.634	.126W	.000	89.94	175.87	187.50
1987-07	89.941	175.87	9.980	.000	2.522	20.464	18.960	7.458	.364W	.000	89.94	175.87	188.50
1987-08	89.941	175.87	40.700	.000	3.000	4.141	.000	.000	.000F	.000	127.64	177.74	189.59
1987-09	127.641	177.74	.600	.000	3.441	19.786	.000	.000	.000F	.000	124.80	177.63	189.59
1987-10	124.800	177.63	.000	.000	3.357	31.095	.000	.000	.000F	.000	121.44	177.50	189.30
1987-11	121.443	177.50	.000	.000	3.032	60.452	18.349	18.349	.304F	.000	100.06	176.56	188.55
1987-12	100.061	176.56	.300	.000	2.637	49.195	18.960	7.783	.158W	.000	89.94	175.87	187.90
1988-01	89.941	175.87	.210	.000	2.299	60.977	18.960	.000	.000W	.000	87.85	175.73	187.05
1988-02	87.852	175.73	.400	.000	2.257	56.839	20.550	.000	.000W	.000	85.99	175.60	186.30
1988-03	85.995	175.60	.000	.000	2.975	26.611	26.545	.000	.000W	.000	83.02	175.40	185.80
1988-04	83.020	175.40	.300	.000	3.677	25.689	25.689	.000	.000W	.000	79.64	175.16	185.15
1988-05	79.643	175.16	.000	.000	4.478	26.545	26.545	.000	.000W	.000	75.17	174.86	184.40

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	US_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1988-06	75.167	174.86	8.700	.000	3.194	28.896	22.018	.000	.000W	.000	80.67	175.23	187.50
1988-07	80.673	175.23	163.860	.000	4.071	20.464	18.960	18.960	.927F	.000	221.50	180.83	188.50
1988-08	221.502	180.83	437.720	.000	9.642	4.141	.000	4.141	1.000	.000	645.44	187.63	189.59
1988-09	645.440	187.63	45.040	.000	13.544	19.786	.000	19.786	1.000	.000	657.15	187.76	189.59
1988-10	657.149	187.76	10.840	.000	13.378	31.095	.000	31.095	1.000	.000	623.52	187.38	189.30
1988-11	623.519	187.38	.210	.000	12.559	60.452	18.349	60.452	1.000	.000	550.72	186.54	188.55
1988-12	550.717	186.54	.000	.000	11.525	49.195	18.960	49.195	1.000	.000	490.00	185.82	187.90
1989-01	489.997	185.82	.600	.000	9.587	60.977	18.960	60.977	1.000	.000	420.03	184.71	187.05
1989-02	420.033	184.71	.210	.000	8.470	56.839	20.550	56.839	1.000	.000	354.93	183.68	186.30
1989-03	354.934	183.68	.000	.000	10.282	26.611	26.545	26.611	1.000	.000	318.04	183.09	185.80
1989-04	318.041	183.09	.600	.000	11.961	25.689	25.689	25.689	1.000	.000	280.99	182.30	185.15
1989-05	280.991	182.30	2.410	.000	13.507	26.545	26.545	26.545	1.000	.000	243.35	181.37	184.40

No. of failure months (When Release is less than Demand) = 61

No. of failure months for Water Supply (When Release is less than WS Demand) = 10

No. of critical failure months (When Release is less than 75% of total Demand) = 27

Monthly Time Reliability = 76.9 % ; Annual Time Reliability = 66.66%

Volume Reliability = 88.8 %

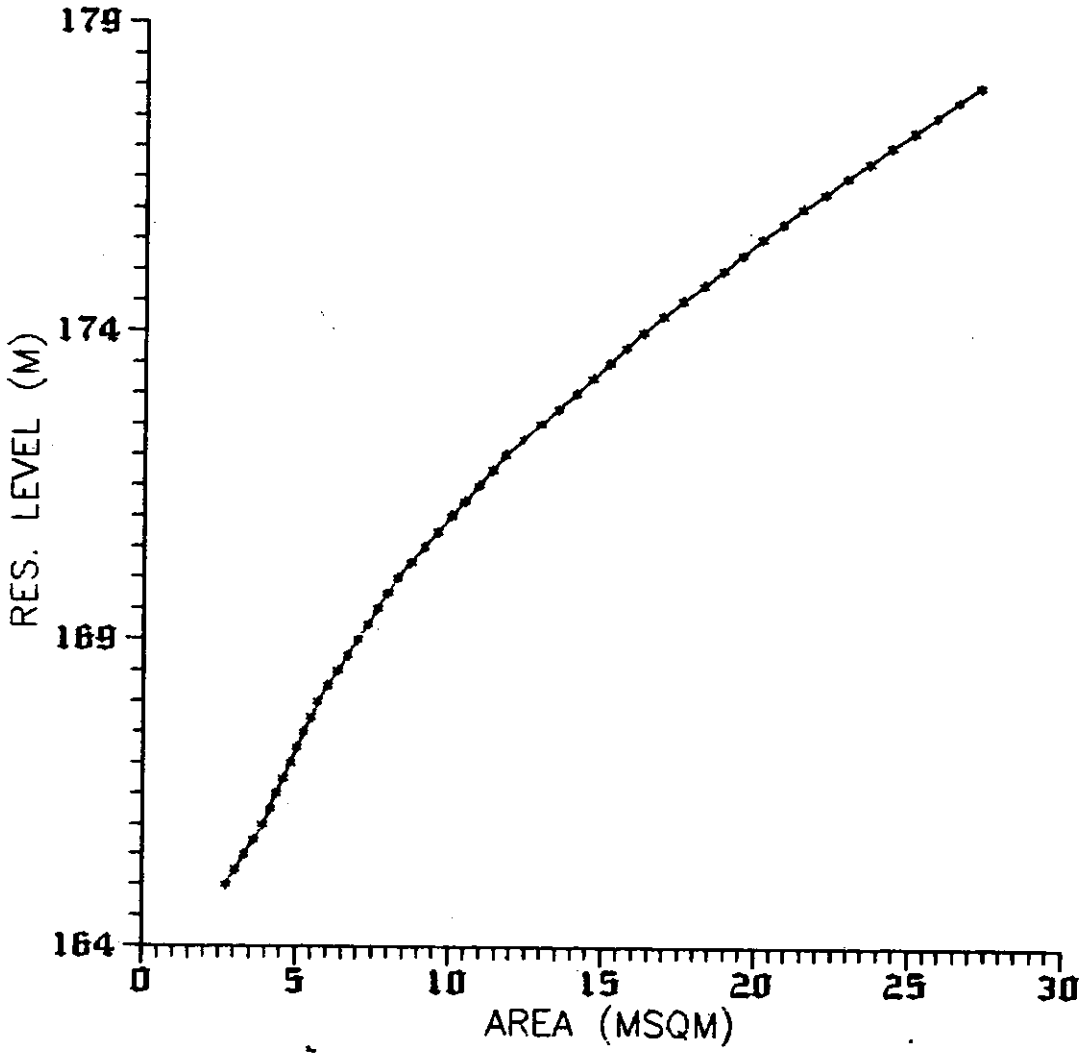
Monthly time Reliability for Water Supply = 96.2 %

SALIENT FEATURES FOR GUHAI DAM

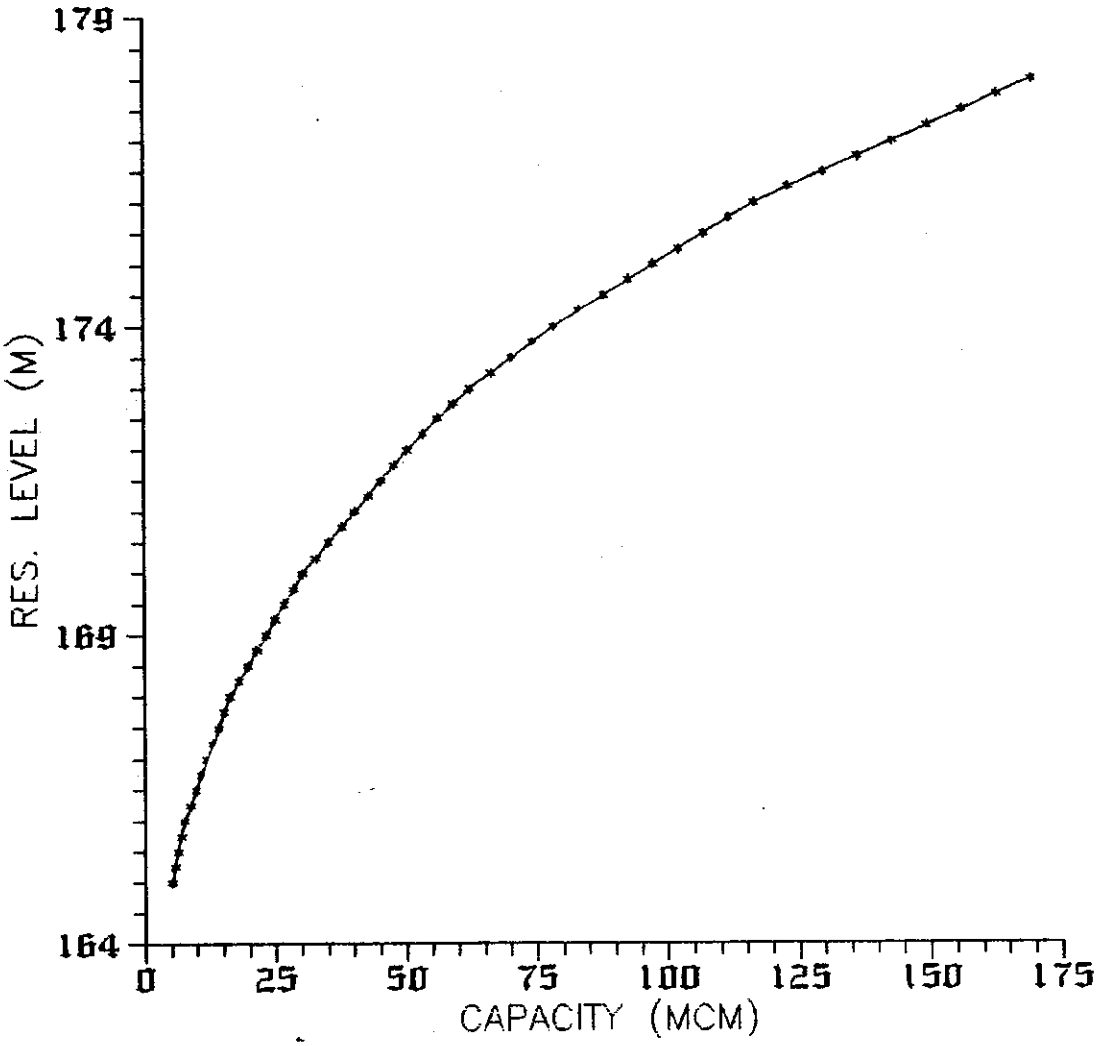
(1) General Details	
a) Location	Vill: Khandial, Ta: Himatnagar Dist: Sabarkantha
b) Co-ordinates	Latitude 23° 00' 42'' N Longitude 73° 03' 24'' E
c) Year of Completion	1990
d) Purpose	Irrigation & Flood Control
(2) Hydrology	
a) Total catchment area at the dam site	422.17 Sq.Km
b) Total Free catchment area the dam site	415.15 Sq.Km
c) Length of river upto confluence with Hathmati	48 Km
d) Length of river upto dam site	39 Km
e) Weighted Mean rainfall at 75% reliability	650.7 mm
f) Runoff corresponding to 75% reliability	56.449 Mcm
g) Maximum Probable Flood	5787 Cumec
(3) Dam	
a) Type of dam	Composite dam
b) Length at the top of dam	3970 m
c) Maximum Height of dam from River Bed	23.85 m
d) R.L. at Top of Dam	178.05 m
(4) Reservoir	
a) Gross Storage Capacity	62.34 Mcm
b) Dead Storage Capacity	5.30 Mcm
c) Live Storage Capacity	57.04 Mcm
d) Full Reservoir Level	173.00 m
e) High Flood Level	173.77 m
f) Dead Storage Level	165.05 m

Contd.

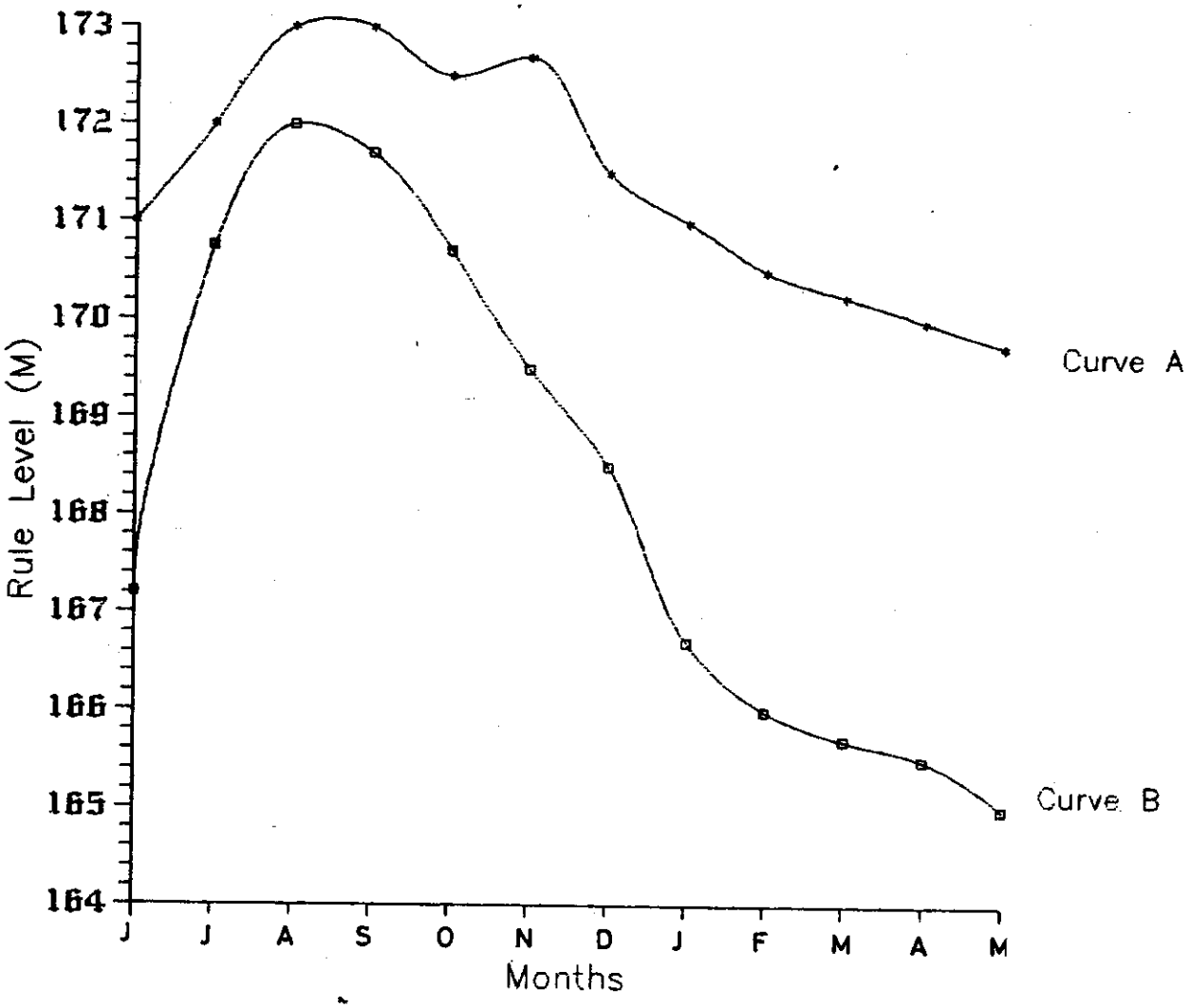
(5) Flood Disposal		
	a) Type of Spillway	Ogee Shaped
	b) Length	88.72 m
	c) Number & Size of Gates	6 Nos. (12.493 m x 8.23 m)
	d) Discharge Capacity at HFL	4138 Cumec
	e) Crest R.L.	164.77 m
(6) Head Regulators		
	a) Type & Size	R.C.C.Conduit (1.50 m x 1.80 m)
	b) Sill Level	164.75 m
	c) Discharging Capacity	5 Cumec
(7) Irrigation		
	a) Gross Command Area	14494 Ha
	b) Culturable Command Area	11465 Ha



Fig–G2: Elevation–Area Curve for Guhai Reservoir



Fig–G3: Elevation–Capacity Curve for Guhai Reservoir



Fig–G4: Rule Curves for Guhai Reservoir

Table - G1
Monthly Inflow Series for Guhai Reservoir
in Million Cubic Meter

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1964						1.65	5.30	12.44	9.73	7.53	4.78	2.46
1965	1.61	.85	.00	.00	.00	.00	35.62	9.01	1.90	.99	.00	.00
1966	.00	.00	.00	.00	.00	9.38	7.13	6.43	19.15	.39	.00	.00
1967	00	.00	.00	.00	.00	26.14	28.66	53.33	67.25	.72	.00	.00
1968	.00	.00	.00	.00	.00	.00	46.62	56.46	1.18	.68	.00	.00
1969	.00	.00	.00	.00	.00	.00	29.73	5.59	.60	.05	.00	.00
1970	.00	.00	.00	.00	.00	.13	28.40	26.31	40.18	3.12	1.02	.00
1971	.00	.00	.00	.00	.00	8.81	9.90	7.32	6.67	1.85	.52	.00
1972	.00	.00	.00	.00	.00	.38	5.78	31.05	1.91	.27	.00	.00
1973	.00	.00	.00	.00	.00	.07	4.10	77.86	127.78	9.80	3.06	4.41
1974	1.24	.26	.00	.00	.00	.00	1.34	3.02	.34	.06	.00	.00
1975	.00	.00	.00	.00	.00	11.84	.69	18.34	43.78	6.67	2.10	.76
1976	.00	.00	.00	.00	.00	.00	36.69	101.86	34.85	7.00	4.14	2.58
1977	1.16	.37	.00	.00	.00	7.76	88.33	59.66	48.13	9.92	3.94	2.52
1978	.00	.00	.00	.00	.00	.00	11.62	24.80	10.59	3.26	1.32	.92
1979	0.60	0.42	0.11	0.09	0.10	4.47	23.09	33.98	28.92	4.83	2.03	1.43
1980	.00	.00	.00	.00	.00	6.32	2.64	16.33	1.43	.26	.00	.00
1981	.00	.00	.00	.00	.00	16.92	123.78	167.15	24.28	.00	.39	.12
1982	.00	.00	.00	.00	.00	.00	29.31	15.73	.52	.01	.00	.00
1983	.00	.00	.00	.00	.00	8.13	6.43	21.02	4.32	6.50	.42	.19
1984	.88	.00	.00	.00	.00	.00	3.18	52.72	8.21	1.45	.10	.00
1985	.00	.00	.00	.00	.00	.00	.56	.05	.00	12.36	.00	.00
1986	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
1987	.00	.00	.00	.00	.00	.30	.00	.01	.00	.00	.00	.00
1988	.00	.00	.00	.00	.00							

Table - G2

Elevation-Area-Capacity Table for Guhai Reservoir

Elevation (m)	Area (M sq.m)	Capacity (M cu.m)
165.00	2.7532	5.185
165.25	3.0443	5.771
165.50	3.3354	6.357
165.75	3.6265	6.944
166.00	3.9176	7.530
166.25	4.1398	8.629
166.50	4.3621	9.728
166.75	4.5843	10.827
167.00	4.8065	11.926
167.25	5.0287	13.025
167.50	5.2509	14.124
167.75	5.4732	15.223
168.00	5.6954	16.322
168.25	6.0208	18.063
168.50	6.3461	19.805
168.75	6.6715	21.546
169.00	6.9969	23.287
169.25	7.3223	25.028
169.50	7.6476	26.770
169.75	7.9730	28.511
170.00	8.2984	30.252
170.25	8.7370	32.760
170.50	9.1756	35.267
170.75	9.6142	37.775
171.00	10.0528	40.282
171.25	10.4914	42.790
171.50	10.9300	45.297
171.75	11.3686	47.805
172.00	11.8072	50.312
172.25	12.3804	53.321
172.50	12.9536	56.329
172.75	13.5268	59.338
173.00	14.1000	62.346
173.25	14.6455	66.374
173.50	15.1910	70.402
173.75	15.7365	74.429
174.00	16.2820	78.457
174.25	16.9293	83.232
174.50	17.5767	88.008
174.75	18.2241	92.783
175.00	18.8714	97.559
175.25	19.5187	102.334
175.50	20.1661	107.109
175.75	20.8134	111.885
176.00	21.4608	116.660
176.25	22.1863	123.278
176.50	22.9118	129.895
176.75	23.6372	136.512
177.00	24.3627	143.130
177.25	25.0882	149.747
177.50	25.8137	156.365
177.75	26.5391	162.982
178.00	27.2646	169.600

Table - G3
Average Monthly Irrigation Demands from GUHAI Reservoir in Million Cubic Meter

Month	Irrigation Demand
Jan	7.910
Feb	2.564
Mar	0.000
Apr	0.000
May	0.000
Jun	0.047
Jul	0.965
Aug	1.036
Sep	7.866
Oct	9.582
Nov	8.479
Dec	6.253

Table - G4
Normal Monthly Evaporation Depths for Hathmati Sub-basin in meter/month

Month	Evap_Depth	Month	Evap_Depth
Jan	0.113	Jul	0.195
Feb	0.125	Aug	0.100
Mar	0.200	Sep	0.163
Apr	0.275	Oct	0.150
May	0.300	Nov	0.113
Jun	0.275	Dec	0.118

Table-G7

Monthly Operation Simulation of GUHAI DAM For Conservation Regulation Using Recommended Policy

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1964-06	30.000	169.96	1.650	2.252	.047	.000	.047	1.000	.000	29.35	169.87	171.00
1964-07	29.351	169.87	5.300	1.637	.965	.000	.724	.750F	.000	32.29	170.20	172.00
1964-08	32.290	170.20	12.440	1.789	1.036	.000	.777	.750F	.000	42.16	171.19	173.00
1964-09	42.164	171.19	9.730	1.722	7.866	.000	5.899	.750F	.000	44.27	171.40	173.00
1964-10	44.272	171.40	7.530	1.565	9.582	.000	9.582	1.000	.000	40.65	171.04	172.50
1964-11	40.655	171.04	4.780	1.096	8.479	.000	8.479	1.000	.000	35.86	170.56	172.00
1964-12	35.860	170.56	2.460	1.045	6.253	.000	6.253	1.000	.000	31.02	170.08	171.50
1965-01	31.022	170.08	1.610	.878	7.910	.000	7.910	1.000	.000	23.84	169.08	171.00
1965-02	23.844	169.08	.850	.858	2.564	.000	2.564	1.000	.000	21.27	168.71	170.50
1965-03	21.273	168.71	.000	1.300	.000	.000	.000	.000	.000	19.97	168.52	170.25
1965-04	19.973	168.52	.000	1.710	.000	.000	.000	.000	.000	18.26	168.28	170.00
1965-05	18.263	168.28	.000	1.768	.000	.000	.000	.000	.000	16.50	168.02	169.75

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1965-06	16.495	168.02	.000	1.532	.047	.000	.047	1.000	.000	14.92	167.68	171.00
1965-07	14.916	167.68	35.620	1.638	.965	.000	.965	1.000	.000	47.93	171.76	172.00
1965-08	47.933	171.76	9.010	2.241	1.036	.000	1.036	1.000	.000	53.67	172.28	173.00
1965-09	53.667	172.28	1.900	1.940	7.866	.000	5.899	.750F	.000	47.73	171.74	173.00
1965-10	47.727	171.74	.990	1.601	9.582	.000	7.187	.750F	.000	39.93	170.96	172.50
1965-11	39.930	170.96	.000	1.035	8.479	.000	8.479	1.000	.000	30.42	170.02	172.00
1965-12	30.416	170.02	.000	.904	6.253	.000	6.253	1.000	.000	23.26	169.00	171.50
1966-01	23.259	169.00	.000	.698	7.910	.000	7.910	1.000	.000	14.65	167.62	171.00
1966-02	14.651	167.62	.000	.629	2.564	.000	2.564	1.000	.000	11.46	166.89	170.50
1966-03	11.458	166.89	.000	.924	.000	.000	.000	.000	.000	10.53	166.68	170.25
1966-04	10.534	166.68	.000	1.211	.000	.000	.000	.000	.000	9.32	166.41	170.00
1966-05	9.323	166.41	.000	1.246	.000	.000	.000	.000	.000	8.08	166.12	169.75

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1966-06	8.077	166.12	9.380	1.330	.047	.000	.047	1.000	.000	16.08	167.94	171.00
1966-07	16.080	167.94	7.130	1.196	.965	.000	.724	.750F	.000	21.29	168.71	172.00
1966-08	21.290	168.71	6.430	1.321	1.036	.000	.777	.750F	.000	25.62	169.34	173.00
1966-09	25.622	169.34	19.150	1.385	7.866	.000	5.899	.750F	.000	37.49	170.72	173.00
1966-10	37.487	170.72	.390	1.327	9.582	.000	7.187	.750F	.000	29.36	169.87	172.50
1966-11	29.363	169.87	.000	.843	8.479	.000	6.359	.750F	.000	22.16	168.84	172.00
1966-12	22.161	168.84	.000	.741	6.253	.000	4.690	.750F	.000	16.73	168.06	171.50
1967-01	16.730	168.06	.000	.578	7.910	.000	5.932	.750F	.000	10.22	166.61	171.00
1967-02	10.220	166.61	.000	.527	2.564	.000	1.923	.750F	.000	7.77	166.05	170.50
1967-03	7.770	166.05	.000	.762	.000	.000	.000	.000	.000	7.01	165.78	170.25
1967-04	7.007	165.78	.000	.942	.000	.000	.000	.000	.000	6.07	165.38	170.00
1967-05	6.066	165.38	.000	.891	.000	.000	.000	.000	.000	5.17	165.00	169.75

Contd.

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1967-06	5.175	165.00	26.140	1.506	.047	.000	.047	1.000	.000	29.76	169.93	171.00
1967-07	29.762	169.93	28.660	1.951	.965	.000	.965	1.000	5.193	50.31	172.00	172.00
1967-08	50.312	172.00	53.330	2.435	1.036	.000	1.036	1.000	37.831	62.34	173.00	173.00
1967-09	62.340	173.00	67.250	2.298	7.866	.000	7.866	1.000	57.086	62.34	173.00	173.00
1967-10	62.340	173.00	.720	1.960	9.582	.000	9.582	1.000	.000	51.52	172.10	172.50
1967-11	51.518	172.10	.000	1.263	8.479	.000	8.479	1.000	.000	41.78	171.15	172.00
1967-12	41.776	171.15	.000	1.141	6.253	.000	6.253	1.000	.000	34.38	170.41	171.50
1968-01	34.382	170.41	.000	.929	7.910	.000	7.910	1.000	.000	25.54	169.32	171.00
1968-02	25.543	169.32	.000	.887	2.564	.000	2.564	1.000	.000	22.09	168.83	170.50
1968-03	22.092	168.83	.000	1.330	.000	.000	.000	.000	.000	20.76	168.64	170.25
1968-04	20.763	168.64	.000	1.749	.000	.000	.000	.000	.000	19.01	168.39	170.00
1968-05	19.013	168.39	.000	1.809	.000	.000	.000	.000	.000	17.20	168.13	169.75

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1968-06	17.204	168.13	.000	1.569	.047	.000	.047	1.000	.000	15.59	167.83	171.00
1968-07	15.589	167.83	46.620	1.692	.965	.000	.965	1.000	9.240	50.31	172.00	172.00
1968-08	50.312	172.00	56.460	2.435	1.036	.000	1.036	1.000	40.961	62.34	173.00	173.00
1968-09	62.340	173.00	1.180	2.161	7.866	.000	7.866	1.000	.000	53.49	172.26	173.00
1968-10	53.493	172.26	.680	1.719	9.582	.000	9.582	1.000	.000	42.87	171.26	172.50
1968-11	42.872	171.26	.000	1.093	8.479	.000	8.479	1.000	.000	33.30	170.30	172.00
1968-12	33.301	170.30	.000	.965	6.253	.000	6.253	1.000	.000	26.08	169.40	171.50
1969-01	26.083	169.40	.000	.758	7.910	.000	7.910	1.000	.000	17.41	168.16	171.00
1969-02	17.415	168.16	.000	.697	2.564	.000	2.564	1.000	.000	14.15	167.51	170.50
1969-03	14.154	167.51	.000	1.031	.000	.000	.000	.000	.000	13.12	167.27	170.25
1969-04	13.123	167.27	.000	1.351	.000	.000	.000	.000	.000	11.77	166.96	170.00
1969-05	11.772	166.96	.000	1.390	.000	.000	.000	.000	.000	10.38	166.65	169.75

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1969-06	10.382	166.65	.000	1.202	.047	.000	.035	.750F	.000	9.15	166.37	171.00
1969-07	9.145	166.37	29.730	1.335	.965	.000	.724	.750F	.000	36.82	170.65	172.00
1969-08	36.816	170.65	5.590	1.825	1.036	.000	.777	.750F	.000	39.80	170.95	173.00
1969-09	39.804	170.95	.600	1.528	7.866	.000	5.899	.750F	.000	32.98	170.27	173.00
1969-10	32.977	170.27	.050	1.202	9.582	.000	7.187	.750F	.000	24.64	169.19	172.50
1969-11	24.639	169.19	.000	.744	8.479	.000	6.359	.750F	.000	17.54	168.17	172.00
1969-12	17.535	168.17	.000	.636	6.253	.000	4.690	.750F	.000	12.21	167.06	171.50
1970-01	12.209	167.06	.000	.448	7.910	.000	5.932	.750F	.000	5.83	165.27	171.00
1970-02	5.828	165.27	.000	.368	2.564	.000	.159	.062F	.000	5.30	165.05	170.50
1970-03	5.302	165.05	.000	.536	.000	.000	.000	.000	.000	4.77	164.82	170.25
1970-04	4.766	164.82	.000	.655	.000	.000	.000	.000	.000	4.11	164.54	170.00
1970-05	4.111	164.54	.000	.620	.000	.000	.000	.000	.000	3.49	164.28	169.75

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1970-06	3.491	164.28	.130	.501	.047	.000	.000	.000F	.000	3.12	164.12	171.00
1970-07	3.120	164.12	28.400	.970	.965	.000	.724	.750F	.000	29.83	169.94	172.00
1970-08	29.827	169.94	26.310	1.934	1.036	.000	1.036	1.000	.000	53.17	172.24	173.00
1970-09	53.167	172.24	40.180	2.156	7.866	.000	7.866	1.000	20.985	62.34	173.00	173.00
1970-10	62.340	173.00	3.120	1.994	9.582	.000	9.582	1.000	.000	53.88	172.30	172.50
1970-11	53.884	172.30	1.020	1.321	8.479	.000	8.479	1.000	.000	45.10	171.48	172.00
1970-12	45.104	171.48	.000	1.209	6.253	.000	6.253	1.000	.000	37.64	170.74	171.50
1971-01	37.642	170.74	.000	.995	7.910	.000	7.910	1.000	.000	28.74	169.78	171.00
1971-02	28.737	169.78	.000	.961	2.564	.000	2.564	1.000	.000	25.21	169.28	170.50
1971-03	25.213	169.28	.000	1.444	.000	.000	.000	.000	.000	23.77	169.07	170.25
1971-04	23.768	169.07	.000	1.900	.000	.000	.000	.000	.000	21.87	168.80	170.00
1971-05	21.868	168.80	.000	1.964	.000	.000	.000	.000	.000	19.90	168.51	169.75

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YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1971-06	19.904	168.51	8.810	1.926	.047	.000	.047	.000	.000	26.74	169.50	171.00
1971-07	26.741	169.50	9.900	1.623	.965	.000	.724	.750F	.000	34.29	170.40	172.00
1971-08	34.294	170.40	7.320	1.771	1.036	.000	.777	.750F	.000	39.07	170.88	173.00
1971-09	39.065	170.88	6.670	1.592	7.866	.000	5.899	.750F	.000	38.24	170.80	173.00
1971-10	38.244	170.80	1.850	1.367	9.582	.000	7.187	.750F	.000	31.54	170.13	172.50
1971-11	31.541	170.13	.520	.893	8.479	.000	6.359	.750F	.000	24.81	169.22	172.00
1971-12	24.808	169.22	.000	.799	6.253	.000	4.690	.750F	.000	19.32	168.43	171.50
1972-01	19.320	168.43	.000	.634	7.910	.000	5.932	.750F	.000	12.75	167.19	171.00
1972-02	12.753	167.19	.000	.582	2.564	.000	2.564	1.000	.000	9.61	166.47	170.50
1972-03	9.607	166.47	.000	.850	.000	.000	.000	.000	.000	8.76	166.28	170.25
1972-04	8.757	166.28	.000	1.115	.000	.000	.000	.000	.000	7.64	166.03	170.00
1972-05	7.642	166.03	.000	1.105	.000	.000	.000	.000	.000	6.54	165.58	169.75

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1972-06	6.537	165.58	.380	.904	.047	.000	.035	.750F	.000	5.98	165.34	171.00
1972-07	5.979	165.34	5.780	.743	.965	.000	.724	.750F	.000	10.29	166.63	172.00
1972-08	10.292	166.63	31.050	1.348	1.036	.000	.777	.750F	.000	39.22	170.89	173.00
1972-09	39.216	170.89	1.910	1.530	7.866	.000	5.899	.750F	.000	33.70	170.34	173.00
1972-10	33.697	170.34	.270	1.224	9.582	.000	7.187	.750F	.000	25.56	169.33	172.50
1972-11	25.557	169.33	.000	.763	8.479	.000	6.359	.750F	.000	18.43	168.30	172.00
1972-12	18.434	168.30	.000	.657	6.253	.000	4.690	.750F	.000	13.09	167.26	171.50
1973-01	13.088	167.26	.000	.482	7.910	.000	5.932	.750F	.000	6.67	165.63	171.00
1973-02	6.673	165.63	.000	.394	2.564	.000	.977	.381F	.000	5.30	165.05	170.50
1973-03	5.302	165.05	.000	.536	.000	.000	.000	.000	.000	4.77	164.82	170.25
1973-04	4.766	164.82	.000	.655	.000	.000	.000	.000	.000	4.11	164.54	170.00
1973-05	4.111	164.54	.000	.620	.000	.000	.000	.000	.000	3.49	164.28	169.75

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1973-06	3.491	164.28	.070	.497	.047	.000	.000	.000F	.000	3.06	164.10	171.00
1973-07	3.064	164.10	4.100	.472	.965	.000	.724	.750F	.000	5.97	165.33	172.00
1973-08	5.968	165.33	77.860	1.621	1.036	.000	1.036	1.000	18.832	62.34	173.00	173.00
1973-09	62.340	173.00	127.780	2.298	7.866	.000	7.866	1.000	117.616	62.34	173.00	173.00
1973-10	62.340	173.00	9.800	2.029	9.582	.000	9.582	1.000	4.200	56.33	172.50	172.50
1973-11	56.329	172.50	3.060	1.391	8.479	.000	8.479	1.000	.000	49.52	171.92	172.00
1973-12	49.519	171.92	4.410	1.333	6.253	.000	6.253	1.000	1.045	45.30	171.50	171.50
1974-01	45.297	171.50	1.240	1.158	7.910	.000	7.910	1.000	.000	37.47	170.72	171.00
1974-02	37.469	170.72	.260	1.157	2.564	.000	2.564	1.000	.000	34.01	170.37	170.50
1974-03	34.008	170.37	.000	1.760	.000	.000	.000	.000	.000	32.25	170.20	170.25
1974-04	32.248	170.20	.000	2.322	.000	.000	.000	.000	.000	29.93	169.95	170.00
1974-05	29.926	169.95	.000	2.404	.000	.000	.000	.000	.000	27.52	169.61	169.75

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1974-06	27.522	169.61	.000	2.087	.047	.000	.047	1.000	.000	25.39	169.30	171.00
1974-07	25.388	169.30	1.340	1.426	.965	.000	.724	.750F	.000	24.58	169.19	172.00
1974-08	24.578	169.19	3.020	1.376	1.036	.000	.777	.750F	.000	25.45	169.31	173.00
1974-09	25.445	169.31	.340	1.105	7.866	.000	5.899	.750F	.000	18.78	168.35	173.00
1974-10	18.781	168.35	.060	.806	9.582	.000	7.187	.750F	.000	10.85	166.75	172.50
1974-11	10.849	166.75	.000	.418	8.479	.000	5.129	.605F	.000	5.30	165.05	172.00
1974-12	5.302	165.05	.000	.322	6.253	.000	.000	.000F	.000	4.98	164.91	171.50
1975-01	4.980	164.91	.000	.291	7.910	.000	.000	.000F	.000	4.69	164.79	171.00
1975-02	4.688	164.79	.000	.304	2.564	.000	.000	.000F	.000	4.38	164.66	170.50
1975-03	4.384	164.66	.000	.449	.000	.000	.000	.000	.000	3.94	164.47	170.25
1975-04	3.935	164.47	.000	.549	.000	.000	.000	.000	.000	3.39	164.23	170.00
1975-05	3.386	164.23	.000	.519	.000	.000	.000	.000	.000	2.87	164.01	169.75

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YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1975-06	2.867	164.01	11.840	.931	.047	.000	.047	1.000	.000	13.73	167.41	171.00
1975-07	13.728	167.41	.690	.988	.965	.000	.724	.750F	.000	12.71	167.18	172.00
1975-08	12.706	167.18	18.340	1.225	1.036	.000	.777	.750F	.000	29.04	169.83	173.00
1975-09	29.044	169.83	43.780	1.807	7.866	.000	7.866	1.000	.811	62.34	173.00	173.00
1975-10	62.340	173.00	6.670	2.029	9.582	.000	9.582	1.000	1.070	56.33	172.50	172.50
1975-11	56.329	172.50	2.100	1.382	8.479	.000	8.479	1.000	.000	48.57	171.83	172.00
1975-12	48.568	171.83	.760	1.287	6.253	.000	6.253	1.000	.000	41.79	171.15	171.50
1976-01	41.788	171.15	.000	1.077	7.910	.000	7.910	1.000	.000	32.80	170.25	171.00
1976-02	32.801	170.25	.000	1.053	2.564	.000	2.564	1.000	.000	29.18	169.85	170.50
1976-03	29.184	169.85	.000	1.590	.000	.000	.000	.000	.000	27.59	169.62	170.25
1976-04	27.594	169.62	.000	2.092	.000	.000	.000	.000	.000	25.50	169.32	170.00
1976-05	25.503	169.32	.000	2.163	.000	.000	.000	.000	.000	23.34	169.01	169.75

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1976-06	23.340	169.01	.000	1.877	.047	.000	.047	1.000	.000	21.42	168.73	171.00
1976-07	21.416	168.73	36.690	1.799	.965	.000	.965	1.000	5.029	50.31	172.00	172.00
1976-08	50.312	172.00	101.860	2.435	1.036	.000	1.036	1.000	86.361	62.34	173.00	173.00
1976-09	62.340	173.00	34.850	2.298	7.866	.000	7.866	1.000	24.686	62.34	173.00	173.00
1976-10	62.340	173.00	7.000	2.029	9.582	.000	9.582	1.000	1.400	56.33	172.50	172.50
1976-11	56.329	172.50	4.140	1.399	8.479	.000	8.479	1.000	.279	50.31	172.00	172.00
1976-12	50.312	172.00	2.580	1.341	6.253	.000	6.253	1.000	.001	45.30	171.50	171.50
1977-01	45.297	171.50	1.160	1.157	7.910	.000	7.910	1.000	.000	37.39	170.71	171.00
1977-02	37.390	170.71	.370	1.157	2.564	.000	2.564	1.000	.000	34.04	170.38	170.50
1977-03	34.039	170.38	.000	1.761	.000	.000	.000	.000	.000	32.28	170.20	170.25
1977-04	32.278	170.20	.000	2.323	.000	.000	.000	.000	.000	29.95	169.96	170.00
1977-05	29.955	169.96	.000	2.405	.000	.000	.000	.000	.000	27.55	169.61	169.75

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1977-06	27.549	169.61	7.760	2.278	.047	.000	.047	1.000	.000	32.98	170.27	171.00
1977-07	32.984	170.27	88.330	2.007	.965	.000	.965	1.000	68.030	50.31	172.00	172.00
1977-08	50.312	172.00	59.660	2.435	1.036	.000	1.036	1.000	44.161	62.34	173.00	173.00
1977-09	62.340	173.00	48.130	2.298	7.866	.000	7.866	1.000	37.966	62.34	173.00	173.00
1977-10	62.340	173.00	9.920	2.029	9.582	.000	9.582	1.000	4.320	56.33	172.50	172.50
1977-11	56.329	172.50	3.940	1.399	8.479	.000	8.479	1.000	.079	50.31	172.00	172.00
1977-12	50.312	172.00	2.520	1.341	6.253	.000	6.253	1.000	.000	45.24	171.49	171.50
1978-01	45.238	171.49	.000	1.144	7.910	.000	7.910	1.000	.000	36.18	170.59	171.00
1978-02	36.184	170.59	.000	1.127	2.564	.000	2.564	1.000	.000	32.49	170.22	170.50
1978-03	32.493	170.22	.000	1.708	.000	.000	.000	.000	.000	30.78	170.05	170.25
1978-04	30.785	170.05	.000	2.251	.000	.000	.000	.000	.000	28.53	169.75	170.00
1978-05	28.534	169.75	.000	2.328	.000	.000	.000	.000	.000	26.21	169.42	169.75

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1978-06	26.206	169.42	.000	2.021	.047	.000	.047	1.000	.000	24.14	169.12	171.00
1978-07	24.138	169.12	11.620	1.562	.965	.000	.724	.750F	.000	33.47	170.32	172.00
1978-08	33.473	170.32	24.800	2.031	1.036	.000	1.036	1.000	.000	55.21	172.41	173.00
1978-09	55.206	172.41	10.590	2.086	7.866	.000	7.866	1.000	.000	55.84	172.46	173.00
1978-10	55.844	172.46	3.260	1.816	9.582	.000	9.582	1.000	.000	47.71	171.74	172.50
1978-11	47.706	171.74	1.320	1.200	8.479	.000	8.479	1.000	.000	39.35	170.91	172.00
1978-12	39.347	170.91	.920	1.101	6.253	.000	6.253	1.000	.000	32.91	170.27	171.50
1979-01	32.913	170.27	.600	.905	7.910	.000	7.910	1.000	.000	24.70	169.20	171.00
1979-02	24.698	169.20	.420	.872	2.564	.000	2.564	1.000	.000	21.68	168.77	170.50
1979-03	21.681	168.77	.110	1.317	.000	.000	.000	.000	.000	20.47	168.60	170.25
1979-04	20.475	168.60	.090	1.737	.000	.000	.000	.000	.000	18.83	168.36	170.00
1979-05	18.827	168.36	.100	1.801	.000	.000	.000	.000	.000	17.13	168.12	169.75

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YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1979-06	17.126	168.12	4.470	1.678	.047	.000	.047	1.000	.000	19.87	168.51	171.00
1979-07	19.871	168.51	23.090	1.602	.965	.000	.965	1.000	.000	40.39	171.01	172.00
1979-08	40.394	171.01	33.980	2.272	1.036	.000	1.036	1.000	8.726	62.34	173.00	173.00
1979-09	62.340	173.00	28.920	2.298	7.866	.000	7.866	1.000	18.756	62.34	173.00	173.00
1979-10	62.340	173.00	4.830	2.018	9.582	.000	9.582	1.000	.000	55.57	172.44	172.50
1979-11	55.570	172.44	2.030	1.366	8.479	.000	8.479	1.000	.000	47.76	171.75	172.00
1979-12	47.755	171.75	1.430	1.278	6.253	.000	6.253	1.000	.000	41.65	171.14	171.50
1980-01	41.655	171.14	.000	1.074	7.910	.000	7.910	1.000	.000	32.67	170.24	171.00
1980-02	32.671	170.24	.000	1.050	2.564	.000	2.564	1.000	.000	29.06	169.83	170.50
1980-03	29.057	169.83	.000	1.585	.000	.000	.000	.000	.000	27.47	169.60	170.25
1980-04	27.471	169.60	.000	2.086	.000	.000	.000	.000	.000	25.39	169.30	170.00
1980-05	25.386	169.30	.000	2.156	.000	.000	.000	.000	.000	23.23	168.99	169.75

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1980-06	23.230	168.99	6.320	2.030	.047	.000	.047	1.000	.000	27.47	169.60	171.00
1980-07	27.472	169.60	2.640	1.524	.965	.000	.724	.750F	.000	27.86	169.66	172.00
1980-08	27.865	169.66	16.330	1.707	1.036	.000	.777	.750F	.000	41.71	171.14	173.00
1980-09	41.711	171.14	1.430	1.593	7.866	.000	5.899	.750F	.000	35.65	170.54	173.00
1980-10	35.649	170.54	.260	1.276	9.582	.000	7.187	.750F	.000	27.45	169.60	172.50
1980-11	27.446	169.60	.000	.803	8.479	.000	6.359	.750F	.000	20.28	168.57	172.00
1980-12	20.284	168.57	.000	.699	6.253	.000	4.690	.750F	.000	14.90	167.68	171.50
1981-01	14.895	167.68	.000	.537	7.910	.000	5.932	.750F	.000	8.43	166.20	171.00
1981-02	8.426	166.20	.000	.455	2.564	.000	1.923	.750F	.000	6.05	165.37	170.50
1981-03	6.048	165.37	.000	.606	.000	.000	.000	.000	.000	5.44	165.11	170.25
1981-04	5.441	165.11	.000	.742	.000	.000	.000	.000	.000	4.70	164.79	170.00
1981-05	4.700	164.79	.000	.702	.000	.000	.000	.000	.000	4.00	164.49	169.75

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1981-06	3.998	164.49	16.920	1.168	.047	.000	.047	1.000	.000	19.70	168.49	171.00
1981-07	19.704	168.49	123.780	1.768	.965	.000	.965	1.000	90.438	50.31	172.00	172.00
1981-08	50.312	172.00	167.150	2.435	1.036	.000	1.036	1.000	151.651	62.34	173.00	173.00
1981-09	62.340	173.00	24.280	2.298	7.866	.000	7.866	1.000	14.116	62.34	173.00	173.00
1981-10	62.340	173.00	.000	1.950	9.582	.000	9.582	1.000	.000	50.81	172.04	172.50
1981-11	50.808	172.04	.390	1.252	8.479	.000	8.479	1.000	.000	41.47	171.12	172.00
1981-12	41.467	171.12	.120	1.136	6.253	.000	6.253	1.000	.000	34.20	170.39	171.50
1982-01	34.198	170.39	.000	.925	7.910	.000	7.910	1.000	.000	25.36	169.30	171.00
1982-02	25.363	169.30	.000	.883	2.564	.000	2.564	1.000	.000	21.92	168.80	170.50
1982-03	21.916	168.80	.000	1.323	.000	.000	.000	.000	.000	20.59	168.61	170.25
1982-04	20.593	168.61	.000	1.741	.000	.000	.000	.000	.000	18.85	168.36	170.00
1982-05	18.852	168.36	.000	1.800	.000	.000	.000	.000	.000	17.05	168.10	169.75

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1982-06	17.052	168.10	.000	1.561	.047	.000	.047	1.000	.000	15.44	167.80	171.00
1982-07	15.444	167.80	29.310	1.551	.965	.000	.965	1.000	.000	42.24	171.19	172.00
1982-08	42.238	171.19	15.730	2.167	1.036	.000	1.036	1.000	.000	54.77	172.37	173.00
1982-09	54.765	172.37	.520	1.953	7.866	.000	5.899	.750F	.000	47.43	171.71	173.00
1982-10	47.433	171.71	.010	1.581	9.582	.000	7.187	.750F	.000	38.68	170.84	172.50
1982-11	38.676	170.84	.000	1.010	8.479	.000	8.479	1.000	.000	29.19	169.85	172.00
1982-12	29.187	169.85	.000	.877	6.253	.000	6.253	1.000	.000	22.06	168.82	171.50
1983-01	22.057	168.82	.000	.672	7.910	.000	7.910	1.000	.000	13.48	167.35	171.00
1983-02	13.475	167.35	.000	.600	2.564	.000	2.564	1.000	.000	10.31	166.63	170.50
1983-03	10.311	166.63	.000	.878	.000	.000	.000	.000	.000	9.43	166.43	170.25
1983-04	9.433	166.43	.000	1.151	.000	.000	.000	.000	.000	8.28	166.17	170.00
1983-05	8.282	166.17	.000	1.187	.000	.00	.000	.000	.000	7.11	165.82	169.75

Contd.

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1983-06	7.115	165.82	8.130	1.228	.047	.000	.047	1.000	000	13.97	167.46	171.00
1983-07	13.970	167.46	6.430	1.105	.965	.000	.724	.750F	.000	18.57	168.32	172.00
1983-08	18.571	168.32	21.020	1.471	1.036	.000	.777	.750F	.000	37.34	170.71	173.00
1983-09	37.342	170.71	4.320	1.511	7.866	.000	5.899	.750F	.000	34.25	170.40	173.00
1983-10	34.252	170.40	6.500	1.323	9.582	.000	7.187	.750F	.000	32.24	170.20	172.50
1983-11	32.242	170.20	.420	.906	8.479	.000	6.359	.750F	.000	25.40	169.30	172.00
1983-12	25.397	169.30	.190	.814	6.253	.000	4.690	.750F	.000	20.08	168.54	171.50
1984-01	20.083	168.54	880	.639	7.910	.000	7.910	1.000	.000	12.41	167.11	171.00
1984-02	12.415	167.11	.000	.574	2.564	.000	2.564	1.000	.000	9.28	166.40	170.50
1984-03	9.277	166.40	.000	.837	.000	.000	.000	.000	.000	8.44	166.21	170.25
1984-04	8.440	166.21	.000	1.090	.000	.000	.000	.000	.000	7.35	165.92	170.00
1984-05	7.350	165.92	.000	1.069	.000	.000	.000	.000	.000	6.28	165.47	169.75

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1984-06	6.281	165.47	.000	.847	.047	.000	.035	.750F	000	5.40	165.09	171.00
1984-07	5.399	165.09	3.180	.645	.965	.000	.724	.750F	.000	7.21	165.86	172.00
1984-08	7.210	165.86	52.720	1.588	1.036	.000	1.036	1.000	.000	57.31	172.58	173.00
1984-09	57.306	172.58	8.210	2.114	7.866	.000	7.866	1.000	.000	55.54	172.43	173.00
1984-10	55.535	172.43	1.450	1.784	9.582	.000	9.582	1.000	.000	45.62	171.53	172.50
1984-11	45.619	171.53	.100	1.147	8.479	.000	8.479	1.000	.000	36.09	170.58	172.00
1984-12	36.093	170.58	.000	1.024	6.253	.000	6.253	1.000	.000	28.82	169.79	171.50
1985-01	28.816	169.79	.000	.815	7.910	.000	7.910	1.000	.000	20.09	168.54	171.00
1985-02	20.091	168.54	.000	.761	2.564	.000	2.564	1.000	.000	16.77	168.06	170.50
1985-03	16.766	168.06	.000	1.133	.000	.000	.000	.000	.000	15.63	167.84	170.25
1985-04	15.632	167.84	.000	1.487	.000	.000	.000	.000	.000	14.15	167.50	170.00
1985-05	14.146	167.50	.000	1.530	.000	.000	.000	.000	.000	12.62	167.16	169.75

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1985-06	12.616	167.16	.000	1.322	.047	.000	.035	750F	.000	11.26	166.85	171.00
1985-07	11.258	166.85	.560	.890	.965	.000	.724	.750F	.000	10.20	166.61	172.00
1985-08	10.204	166.61	.050	.809	1.036	.000	.777	.750F	.000	8.67	166.26	173.00
1985-09	8.668	166.26	.000	.567	7.866	.000	2.799	.356F	.000	5.30	165.05	173.00
1985-10	5.302	165.05	12.360	.541	9.582	.000	7.187	.750F	.000	9.93	166.55	172.50
1985-11	9.934	166.55	.000	.408	8.479	.000	4.225	.498F	.000	5.30	165.05	172.00
1985-12	5.302	165.05	.000	.322	6.253	.000	.000	.000F	.000	4.98	164.91	171.50
1986-01	4.980	164.91	.000	.291	7.910	.000	.000	.000F	.000	4.69	164.79	171.00
1986-02	4.688	164.79	.000	.304	2.564	.000	.000	.000F	.000	4.38	164.66	170.50
1986-03	4.384	164.66	.000	.449	.000	.000	.000	.000	000	3.94	164.47	170.25
1986-04	3.935	164.47	.000	.549	.000	.000	.000	.000	000	3.39	164.23	170.00
1986-05	3.386	164.23	.000	.519	.000	.000	.000	.000	.000	2.87	164.01	169.75

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	WS_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1986-06	2.867	164.01	.000	.411	.047	.000	.000	.000F	.000	2.46	163.62	171.00
1986-07	2.456	163.62	.000	.257	.965	.000	.000	.000F	.000	2.20	163.37	172.00
1986-08	2.198	163.37	.000	.224	1.036	.000	.000	.000F	.000	1.97	163.15	173.00
1986-09	1.974	163.15	.000	.177	7.866	.000	.000	.000F	.000	1.80	162.98	173.00
1986-10	1.796	162.98	.000	.150	9.582	.000	.000	.000F	.000	1.65	162.83	172.50
1986-11	1.646	162.83	.000	.106	8.479	.000	.000	.000F	.000	1.54	162.73	172.00
1986-12	1.540	162.73	.000	.104	6.253	.000	.000	.000F	.000	1.44	162.62	171.50
1987-01	1.436	162.62	.000	.094	7.910	.000	.000	.000F	.000	1.34	162.53	171.00
1987-02	1.343	162.53	.000	.097	2.564	.000	.000	.000F	.000	1.25	162.44	170.50
1987-03	1.246	162.44	.000	.143	.000	.000	.000	.000	.000	1.10	162.30	170.25
1987-04	1.102	162.30	.000	.174	.000	.000	.000	.000	.000	.93	162.13	170.00
1987-05	.929	162.13	.000	.163	.000	.000	.000	.000	.000	.77	161.89	169.75

Contd.

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	WS_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1987-06	.766	161.89	.300	.148	.047	.000	.000	.000F	.000	.92	162.12	171.00
1987-07	.918	162.12	.000	.108	.965	.000	.000	.000F	.000	.81	162.01	172.00
1987-08	.810	162.01	.010	.094	1.036	.000	.000	.000F	.000	.73	161.76	173.00
1987-09	.726	161.76	.000	.073	7.866	.000	.000	.000F	.000	.65	161.53	173.00
1987-10	.653	161.53	.000	.061	9.582	.000	.000	.000F	.000	.59	161.33	172.50
1987-11	.592	161.33	.000	.042	8.479	.000	.000	.000F	.000	.55	161.20	172.00
1987-12	.549	161.20	.000	.041	6.253	.000	.000	.000F	.000	.51	161.06	171.50
1988-01	.508	161.06	.000	.037	7.910	.000	.000	.000F	.000	.47	160.95	171.00
1988-02	.472	160.95	.000	.038	2.564	.000	.000	.000F	.000	.43	160.83	170.50
1988-03	.434	160.83	.000	.054	.000	.000	.000	.000	.000	.38	160.65	170.25
1988-04	.380	160.65	.000	.065	.000	.000	.000	.000	.000	.32	160.45	170.00
1988-05	.315	160.45	.000	.059	.000	.000	.000	.000	.000	.26	160.26	169.75

No. of failure months (When Release is less than Demand) = 98

No. of critical failure months (When release is less than 0.75 x Demand) = 31

Monthly Time Reliability = 66.0 % ; Annual Time Reliability = 41.66%

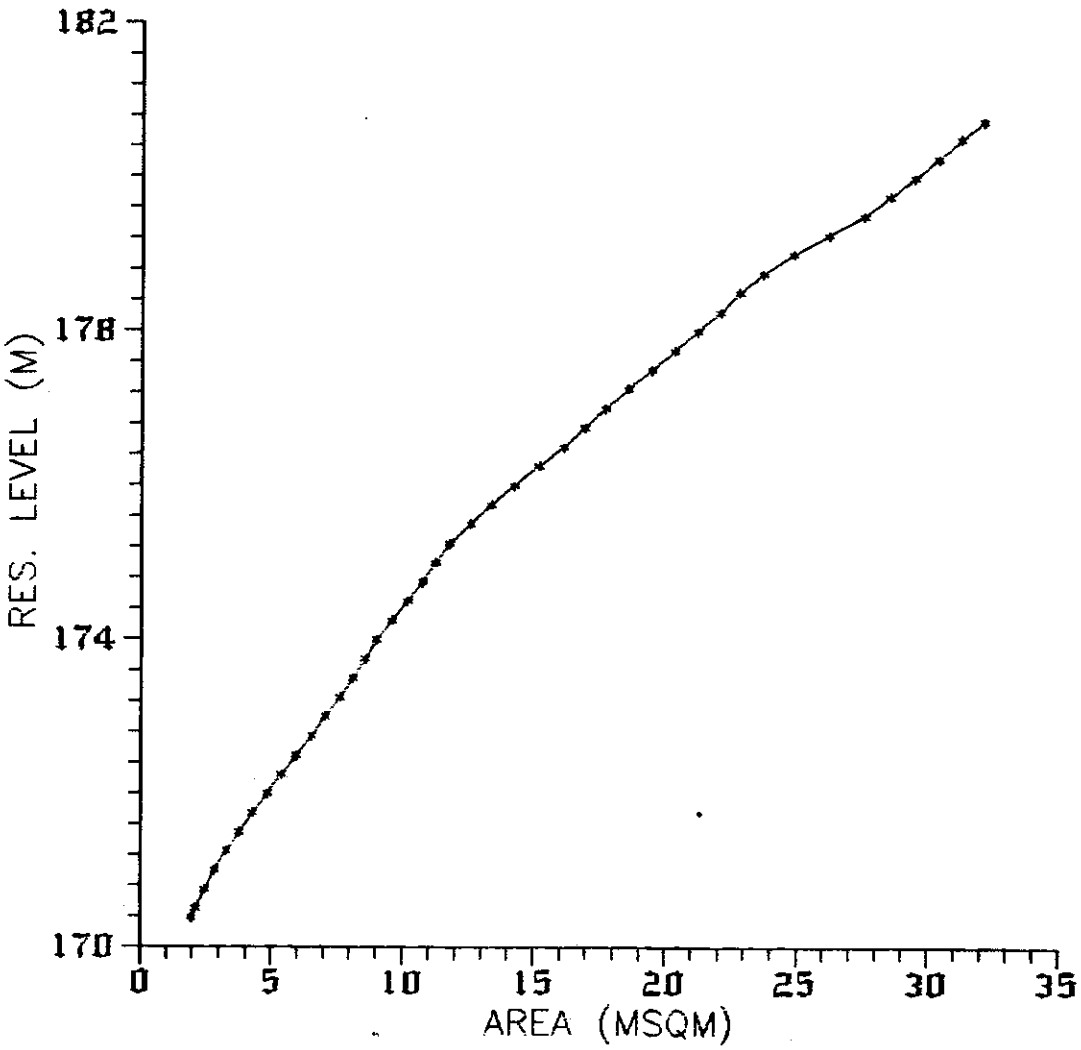
Volume Reliability = 79.3 %

SALIENT FEATURES FOR HATHMATI DAM

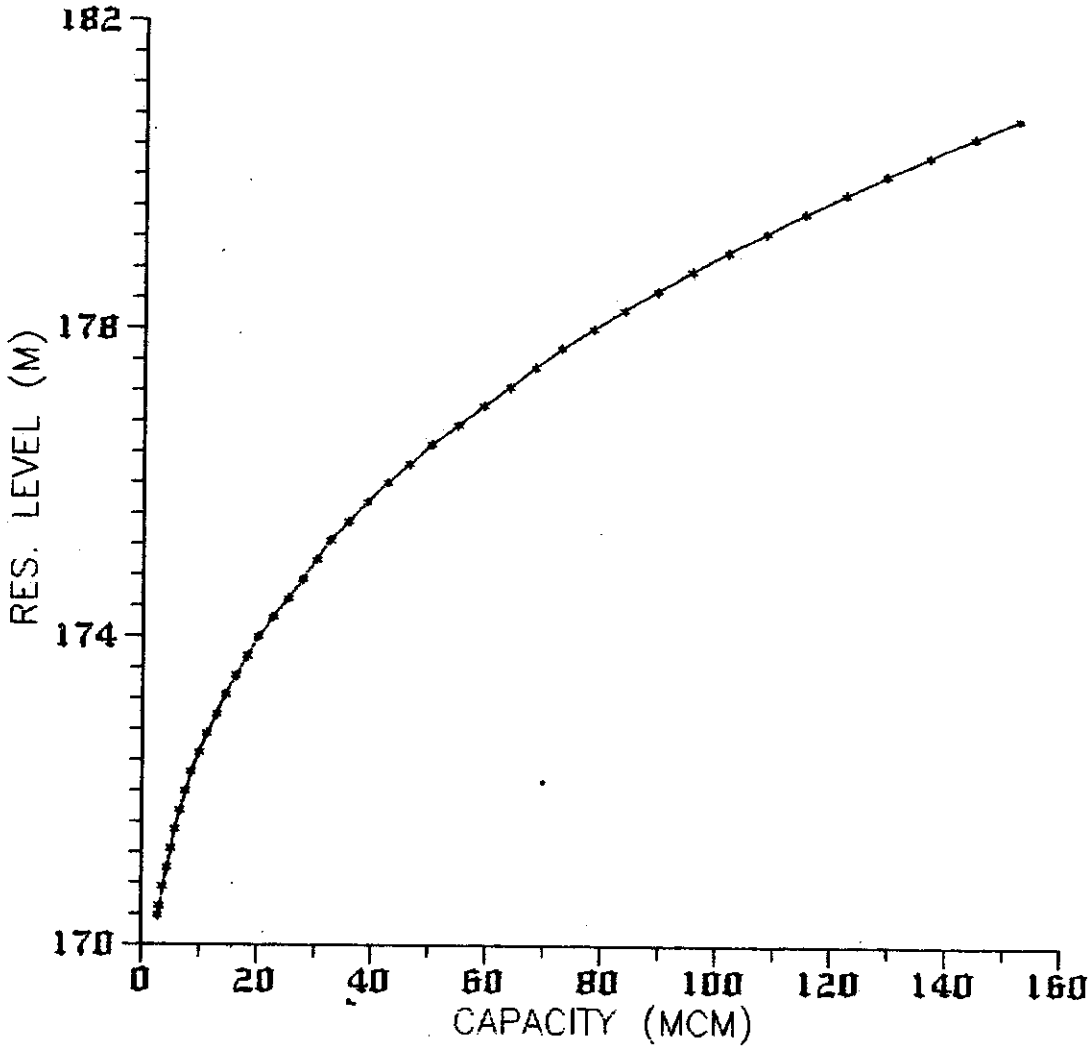
(1) General Details		
	a) Location	Vill: Fatehpur, Ta: Bhiloda Dist: Sabarkantha
	b) Co-ordinates	Latitude 23° 42' Longitude 73° 13'
	c) Year of Completion	1971
	d) Purpose	Irrigation & Flood Control
(2) Hydrology		
	a) Total catchment area of the river basin	1575 Sq Km
	b) Total catchment area at the dam site	595 Sq Km
	c) Length of river upto confluence with Sabarmati	98 Km
	d) Average annual rainfall	864 mm
	e) Average annual runoff	123 Mcm
	f) Design Flood	2944 Cumec
(3) Dam		
	a) Type of dam	Earthen
	b) Length of Hathmati dam	933 m
	c) Length of Indrasi dam	476 m
	d) Maximum Height of Hathmati dam	23.62 m
	e) Maximum Height of Indrasi dam	20.58 m
	f) R.L. of Top of Dam	185.31 m
(4) Reservoir		
	a) Gross Storage Capacity	152.5 Mcm
	b) Dead Storage Capacity	3.5 Mcm
	c) Live Storage Capacity	149 M cm
	d) Full Reservoir Level	180.74 m
	e) High Flood Level	183.18 m

Contd.

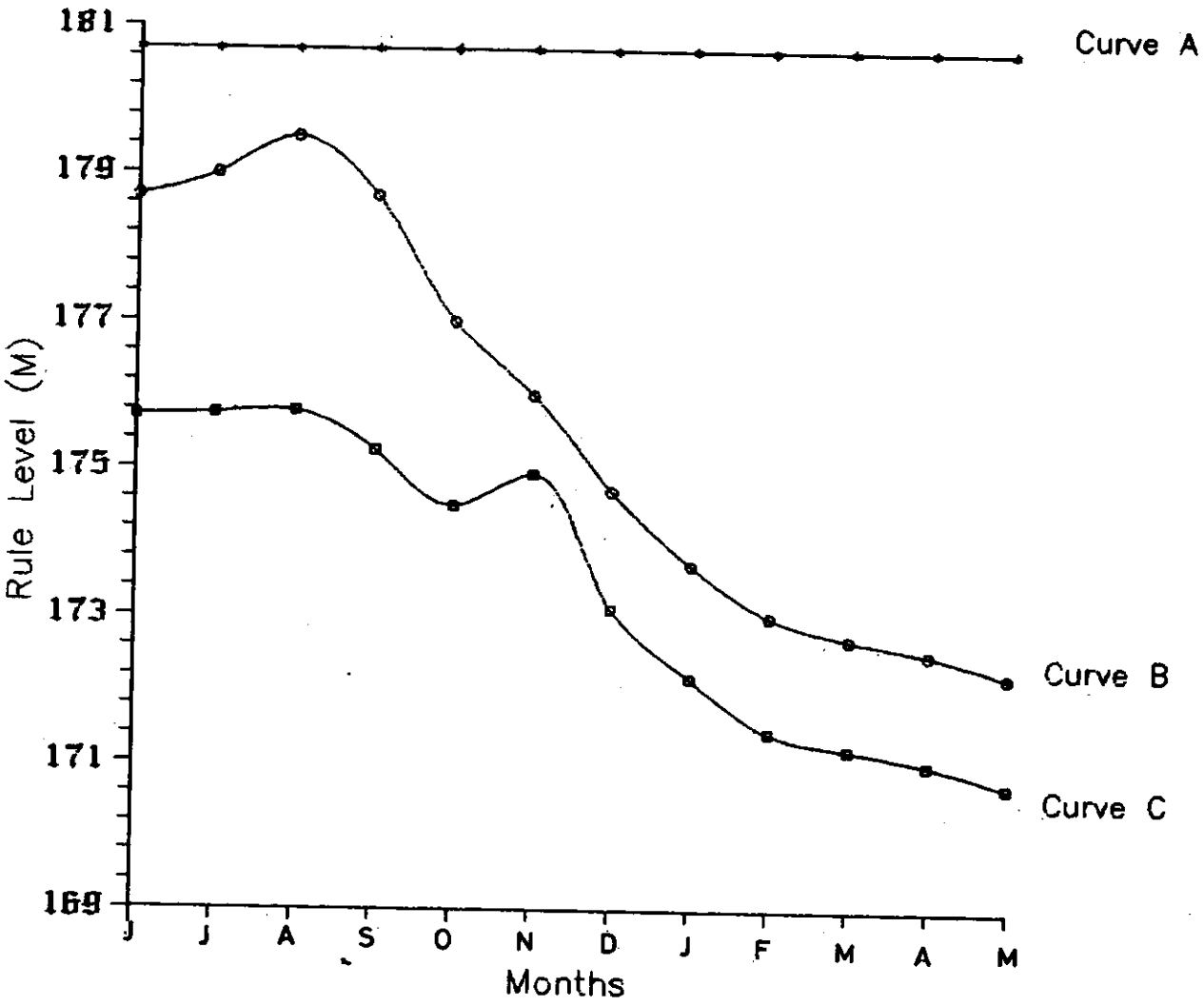
(5)	Flood Disposal	
	a) Type & Shape of Spillway	Waste Weir, Ogee shaped
	b) Length	241 m
	c) Discharge Capacity at HFL	2944 Cumec
	d) Number of Gates	Ungated
	e) Crest Level	180.74 m
(6)	Head Regulators	
	a) Type of H.R	Head Wall Type with Box Type Conduit
	b) Sill Level	170.69 m in Hathmati dam 172.21 m in Indrasi dam
	c) Number & Size	2 Nos. (1.83m x 1.21 m) in Hathmati dam 2 Nos. (1.52m x 1.21 m) in Indrasi dam
(7)	Irrigation	
	a) Gross Command Area	73817 Ha
	b) Culturable Command Area	51667 Ha
	c) Irrigated Command Area	27195 Ha
(8)	Financial Aspect	
	a) Total Cost	544.58 Lacs
	b) Benefit Cost Ratio	1.06



Fig–HTD2: Elevation–Area Curve for Hathmati Reservoir



Fig–HTD3: Elevation–Capacity Curve for Hathmati Reservoir



Fig–HTD4: Rule Curves for Hathmati Reservoir

Table - HTD1
Monthly Inflow Series for Hathmati Reservoir
in Million Cubic Meter

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1964						0.00	9.64	21.37	12.42	6.51	0.00	0.00
1965	0.00	0.00	0.00	0.00	0.00	0.00	3.96	8.57	3.99	2.12	0.00	0.00
1966	0.00	0.00	0.00	0.00	0.00	1.97	3.29	1.87	11.98	1.21	0.00	0.00
1967	0.00	0.00	0.00	0.00	0.00	6.48	4.26	3.80	12.83	4.82	0.00	0.00
1968	0.00	0.00	0.00	0.00	0.00	0.00	145.33	50.68	5.29	3.11	0.00	0.00
1969	0.00	0.00	0.00	0.00	0.00	0.00	12.43	1.82	4.92	0.00	0.00	0.00
1970	0.00	0.00	0.00	0.00	0.00	10.65	35.03	19.26	99.22	5.84	1.40	.91
1971	.37	3.85	0.00	0.00	0.00	38.23	25.63	25.42	8.66	5.09	0.00	0.00
1972	0.00	0.00	0.00	0.00	0.00	6.09	14.33	25.79	7.78	.37	0.00	0.00
1973	0.00	0.00	0.00	0.00	0.00	6.09	16.23	44.30	259.46	13.50	0.00	0.00
1974	0.00	0.00	0.00	0.00	0.00	.60	4.02	15.03	0.00	0.00	0.00	0.00
1975	0.00	0.00	0.00	0.00	0.00	17.63	11.46	40.50	61.35	10.69	0.00	0.00
1976	0.00	0.00	0.00	0.00	0.00	4.17	66.96	138.88	108.35	10.69	5.37	5.46
1977	.16	14.93	0.00	0.00	0.00	21.95	162.53	82.15	56.95	8.87	4.61	3.56
1978	5.62	7.74	0.00	0.00	0.00	1.61	5.22	38.09	38.10	10.47	5.13	0.00
1979	0.76	0.53	0.14	0.11	0.13	5.65	29.17	42.93	36.53	6.10	2.56	1.80
1980	0.00	0.00	0.00	0.00	0.00	8.91	3.72	23.03	2.02	.36	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	23.85	174.52	235.67	34.23	0.00	.55	.16
1982	0.00	0.00	0.00	0.00	0.00	0.00	56.99	19.23	3.90	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.24	27.74	55.84	15.73	13.63	1.75	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.00	2.23	80.49	36.59	12.72	3.45	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00	5.95	10.36	0.00	5.19	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00	3.66	4.61	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	14.30	46.69	135.79	1.13	0.04	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00							

Table - HTD2

Elevation-Area-Capacity Table for Hathmati Reservoir

Elevation (m)	Area (M sq.m)	Capacity (M cu.m)
170.38	1.9500	2.812
170.50	2.1157	3.083
170.75	2.4598	3.684
171.00	2.8061	4.403
171.25	3.2827	5.123
171.50	3.7593	5.844
171.75	4.2807	6.658
172.00	4.8320	7.536
172.25	5.3864	8.491
172.50	5.9577	9.854
172.75	6.5290	11.217
173.00	7.0726	12.816
173.25	7.6054	14.506
173.50	8.1170	16.267
173.75	8.5739	18.208
174.00	9.0309	20.149
174.25	9.5998	22.670
174.50	10.1899	25.300
174.75	10.7498	27.842
175.00	11.2641	30.253
175.25	11.7784	32.664
175.50	12.5666	35.857
175.75	13.3662	39.083
176.00	14.2449	42.619
176.25	15.1965	46.441
176.50	16.1360	50.322
176.75	16.9356	54.872
177.00	17.7352	59.422
177.25	18.5835	63.916
177.50	19.4594	68.380
177.75	20.3352	73.020
178.00	21.2110	78.371
178.25	22.0868	83.722
178.50	22.8265	89.585
178.75	23.7206	95.601
179.00	24.8665	101.818
179.25	26.2182	108.475
179.50	27.5698	115.132
179.75	28.5694	122.216
180.00	29.5211	129.358
180.25	30.4309	136.811
180.50	31.2874	144.662
180.74	32.1440	152.513

Table - HTD3
Average Monthly Irrigation Demands from HATHMATI Reservoir and HATHMATI WEIR in Million Cubic Meter

Month	Irrigation Demand	
	A-zone	BCD-zone
Jan	4.71	8.46
Feb	2.02	3.55
Mar	0.00	0.00
Apr	0.00	0.00
May	0.00	0.00
Jun	1.36	8.66
Jul	0.53	5.31
Aug	1.64	16.08
Sep	5.21	37.65
Oct	5.59	45.09
Nov	4.76	23.47
Dec	5.38	9.82

Table - HTD4
Monthly Yield Estimation for HATHMATI Reservoir

Month	Monthly Yield (Million Cubic Meter) Probability Level for Value to be Equalled or Exceeded					
	50%	60%	70%	75%	80%	90%
Jan	0	0	0	0	0	0
Feb	0	0	0	0	0	0
Mar	0	0	0	0	0	0
Apr	0	0	0	0	0	0
May	0	0	0	0	0	0
Jun	2.262	1.106	0.414	0.201	0.073	0.000
Jul	12.704	9.420	7.000	5.968	5.049	3.342
Aug	29.419	21.462	15.008	12.118	9.500	4.710
Sep	12.405	7.111	3.543	2.240	1.265	0.154
Oct	3.660	2.527	1.518	1.043	0.612	0.002
Nov	0	0	0	0	0	0
Dec	0	0	0	0	0	0

Table - HTD5
Recommended Rule Curve Levels for Hathmati Reservoir

MONTH	Rule Levels in Meter		
	Upper Rule Level Curve A	Middle Rule Level Curve B	Lower Rule Level Curve C
Jan	180.74	173.75	172.16
Feb	180.74	173.00	171.42
Mar	180.74	172.75	171.20
Apr	180.74	172.50	171.00
May	180.74	172.25	170.70
Jun	180.74	178.75	175.72
Jul	180.74	179.00	175.75
Aug	180.74	179.50	175.78
Sep	180.74	178.75	175.25
Oct	180.74	177.00	174.50
Nov	180.74	176.00	174.93
Dec	180.74	174.75	173.10

Table - HTD.6

Monthly Operation Simulation of HATHMATI DAM For Conservation Regulation Using Recommended Policy

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	AZ_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1964-06	75.000	177.84	.000	5.390	7.422	1.360	5.906	.796B	.000	63.70	177.24	180.74
1964-07	63.703	177.24	9.640	3.666	4.247	.530	3.318	.781B	.000	66.36	177.39	180.74
1964-08	66.359	177.39	21.370	3.717	12.896	1.640	10.082	.782B	.000	73.93	177.79	180.74
1964-09	73.930	177.79	12.420	3.098	31.565	5.210	24.976	.791B	.000	58.28	176.94	180.74
1964-10	58.275	176.94	6.510	2.210	37.153	5.590	29.262	.788B	.000	33.31	175.30	180.74
1964-11	33.313	175.30	.000	1.275	21.189	4.760	4.760	.225B	.000	27.28	174.69	180.74
1964-12	27.278	174.69	.000	1.097	12.254	5.380	10.535	.860B	.000	15.65	173.42	180.74
1965-01	15.645	173.42	.000	.743	10.632	4.710	6.805	.640B	.000	8.10	172.16	180.74
1965-02	8.097	172.16	.000	.546	4.505	2.020	2.020	.448B	.000	5.53	171.39	180.74
1965-03	5.531	171.39	.000	.666	.000	.000	.000	.000	.000	4.86	171.16	180.74
1965-04	4.865	171.16	.000	.791	.000	.000	.000	.000	.000	4.07	170.89	180.74
1965-05	4.073	170.89	.000	.737	.000	.000	.000	.000	.000	3.34	170.61	180.74

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	AZ_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1965-06	3.336	170.61	.000	.576	7.422	1.360	.000	.000A	.000	2.76	170.35	180.74
1965-07	2.760	170.35	3.960	.541	4.247	.530	.530	.125B	.000	5.65	171.43	180.74
1965-08	5.649	171.43	8.570	.970	12.896	1.640	1.640	.127B	.000	11.61	172.82	180.74
1965-09	11.609	172.82	3.990	1.015	31.565	5.210	5.210	.165B	.000	9.37	172.41	180.74
1965-10	9.374	172.41	2.120	.683	37.153	5.590	5.590	.150B	.000	5.22	171.28	180.74
1965-11	5.221	171.28	.000	.323	21.189	4.760	1.386	.065A	.000	3.51	170.69	180.74
1965-12	3.512	170.69	.000	.271	12.254	5.380	.000	.000A	.000	3.24	170.57	180.74
1966-01	3.241	170.57	.000	.242	10.632	4.710	.000	.000A	.000	3.00	170.46	180.74
1966-02	3.000	170.46	.000	.249	4.505	2.020	.000	.000A	.000	2.75	170.34	180.74
1966-03	2.751	170.34	.000	.363	.000	.000	.000	.000	.000	2.39	170.10	180.74
1966-04	2.387	170.10	.000	.439	.000	.000	.000	.000	.000	1.95	169.81	180.74
1966-05	1.948	169.81	.000	.412	.000	.000	.000	.000	.000	1.54	169.45	180.74

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	AZ_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1966-06	1.537	169.45	1.970	.462	7.422	1.360	.000	.000A	.000	3.04	170.48	180.74
1966-07	3.045	170.48	3.290	.534	4.247	.530	.530	.125B	.000	5.27	171.30	180.74
1966-08	5.271	171.30	1.870	.612	12.896	1.640	1.640	.127B	.000	4.89	171.17	180.74
1966-09	4.889	171.17	11.980	.776	31.565	5.210	5.210	.165B	.000	10.88	172.69	180.74
1966-10	10.884	172.69	1.210	.756	37.153	5.590	5.590	.150B	.000	5.75	171.47	180.74
1966-11	5.747	171.47	.000	.343	21.189	4.760	1.892	.089A	.000	3.51	170.69	180.74
1966-12	3.512	170.69	.000	.271	12.254	5.380	.000	.000A	.000	3.24	170.57	180.74
1967-01	3.241	170.57	.000	.242	10.632	4.710	.000	.000A	.000	3.00	170.46	180.74
1967-02	3.000	170.46	.000	.249	4.505	2.020	.000	.000A	.000	2.75	170.34	180.74
1967-03	2.751	170.34	.000	.363	.000	.000	.000	.000	.000	2.39	170.10	180.74
1967-04	2.387	170.10	.000	.439	.000	.000	.000	.000	.000	1.95	169.81	180.74
1967-05	1.948	169.81	.000	.412	.000	.000	.000	.000	.000	1.54	169.45	180.74

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YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	AZ_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1967-06	1.537	169.45	6.480	.701	7.422	1.360	1.360	.183B	.000	5.96	171.54	180.74
1967-07	5.955	171.54	4.260	.910	4.247	.530	.530	.125B	.000	8.77	172.30	180.74
1967-08	8.775	172.30	3.800	1.078	12.896	1.640	1.640	.127B	.000	9.86	172.50	180.74
1967-09	9.357	172.50	12.830	1.148	31.565	5.210	5.210	.165B	.000	16.33	173.51	180.74
1967-10	16.329	173.51	4.820	1.177	37.153	5.590	5.590	.150B	.000	14.38	173.23	180.74
1967-11	14.381	173.23	.000	.741	21.189	4.760	4.760	.225B	.000	8.88	172.32	180.74
1967-12	8.880	172.32	.000	.468	12.254	5.380	4.901	.400A	.000	3.51	170.69	180.74
1968-01	3.512	170.69	.000	.260	10.632	4.710	.000	.000A	.000	3.25	170.57	180.74
1968-02	3.252	170.57	.000	.267	4.505	2.020	.000	.000A	.000	2.99	170.46	180.74
1968-03	2.985	170.46	.000	.389	.000	.000	.000	.000	.000	2.60	170.24	180.74
1968-04	2.596	170.24	.000	.468	.000	.000	.000	.000	.000	2.13	169.93	180.74
1968-05	2.128	169.93	.000	.438	.000	.000	.000	.000	.000	1.69	169.59	180.74

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	AZ_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1968-06	1.690	169.59	.000	.346	7.422	1.360	.000	.000A	.000	1.34	169.28	180.74
1968-07	1.344	169.28	145.330	3.108	4.247	.530	4.247	1.000	.000	139.32	180.33	180.74
1968-08	139.319	180.33	50.680	5.905	12.896	1.640	12.896	1.000	18.998	152.20	180.74	180.74
1968-09	152.199	180.74	5.290	4.932	31.565	5.210	31.565	1.000	.000	120.98	179.71	180.74
1968-10	120.992	179.71	3.110	3.780	37.153	5.590	37.153	1.000	.000	83.17	178.22	180.74
1968-11	83.169	178.22	.000	2.248	21.189	4.760	21.189	1.000	.000	59.73	177.02	180.74
1968-12	59.732	177.02	.000	1.933	12.254	5.380	12.254	1.000	.000	45.54	176.19	180.74
1969-01	45.545	176.19	.000	1.521	10.632	4.710	10.632	1.000	.000	33.39	175.31	180.74
1969-02	33.391	175.31	.000	1.414	4.505	2.020	4.505	1.000	.000	27.47	174.71	180.74
1969-03	27.472	174.71	.000	2.088	.000	.000	.000	.000	.000	25.38	174.51	180.74
1969-04	25.384	174.51	.000	2.723	.000	.000	.000	.000	.000	22.66	174.25	180.74
1969-05	22.661	174.25	.000	2.785	.000	.000	.000	.000	.000	19.88	173.96	180.74

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	AZ_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1969-06	19.876	173.96	.000	2.346	7.422	1.360	1.360	.183B	.000	16.17	173.49	180.74
1969-07	16.170	173.49	12.430	1.804	4.247	.530	.530	.125B	.000	26.27	174.59	180.74
1969-08	26.267	174.59	1.820	1.920	12.896	1.640	1.640	.127B	.000	24.53	174.43	180.74
1969-09	24.527	174.43	4.920	1.598	31.565	5.210	5.210	.165B	.000	22.64	174.25	180.74
1969-10	22.639	174.25	.000	1.319	37.153	5.590	5.590	.150B	.000	15.73	173.43	180.74
1969-11	15.730	173.43	.000	.796	21.189	4.760	4.760	.225B	.000	10.17	172.56	180.74
1969-12	10.174	172.56	.000	.521	12.254	5.380	5.380	.439B	.000	4.27	170.95	180.74
1970-01	4.273	170.95	.000	.289	10.632	4.710	.472	.044A	.000	3.51	170.69	180.74
1970-02	3.512	170.69	.000	.286	4.505	2.020	.000	.000A	.000	3.23	170.56	180.74
1970-03	3.226	170.56	.000	.415	.000	.000	.000	.000	.000	2.81	170.38	180.74
1970-04	2.810	170.38	.000	.498	.000	.000	.000	.000	.000	2.31	170.05	180.74
1970-05	2.312	170.05	.000	.465	.000	.000	.000	.000	.000	1.85	169.74	180.74

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	AZ_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1970-06	1.847	169.74	10.650	1.029	7.422	1.360	1.360	.183B	.000	10.11	172.55	180.74
1970-07	10.108	172.55	35.030	1.914	4.247	.530	3.318	.781B	.000	39.91	175.81	180.74
1970-08	39.906	175.81	19.260	2.703	12.896	1.640	10.082	.782B	.000	46.38	176.25	180.74
1970-09	46.381	176.25	99.220	3.410	31.565	5.210	31.565	1.000	.000	110.63	179.33	180.74
1970-10	110.627	179.33	5.840	3.558	37.153	5.590	37.153	1.000	.000	75.76	177.88	180.74
1970-11	75.756	177.88	1.400	2.121	21.189	4.760	21.189	1.000	.000	53.85	176.69	180.74
1970-12	53.846	176.69	.910	1.801	12.254	5.380	12.254	1.000	.000	40.70	175.87	180.74
1971-01	40.701	175.87	.370	1.400	10.632	4.710	10.632	1.000	.000	29.04	174.87	180.74
1971-02	29.039	174.87	3.850	1.349	4.505	2.020	4.505	1.000	.000	27.04	174.67	180.74
1971-03	27.035	174.67	.000	2.069	.000	.000	.000	.000	.000	24.97	174.47	180.74
1971-04	24.966	174.47	.000	2.698	.000	.000	.000	.000	.000	22.27	174.21	180.74
1971-05	22.268	174.21	.000	2.758	.000	.000	.000	.000	.000	19.51	173.92	180.74

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YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	AZ_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1971-06	19.509	173.92	38.230	3.379	7.422	1.360	5.906	.796B	.000	48.45	176.38	180.74
1971-07	48.453	176.38	25.630	3.408	4.247	.530	3.318	.781B	.000	67.36	177.44	180.74
1971-08	67.357	177.44	25.420	3.812	12.896	1.640	10.082	.782B	.000	78.88	178.02	180.74
1971-09	78.883	178.02	8.660	3.180	31.565	5.210	24.976	.791B	.000	59.39	177.00	180.74
1971-10	59.387	177.00	5.090	2.219	37.153	5.590	29.262	.788B	.000	33.00	175.28	180.74
1971-11	32.995	175.28	.000	1.267	21.189	4.760	4.760	.225B	.000	26.97	174.66	180.74
1971-12	26.969	174.66	.000	1.088	12.254	5.380	10.535	.860B	.000	15.35	173.37	180.74
1972-01	15.346	173.37	.000	.738	10.632	4.710	6.511	.612B	.000	8.10	172.16	180.74
1972-02	8.097	172.16	.000	.546	4.505	2.020	2.020	.448B	.000	5.53	171.39	180.74
1972-03	5.531	171.39	.000	.666	.000	.000	.000	.000	.000	4.86	171.16	180.74
1972-04	4.865	171.16	.000	.791	.000	.000	.000	.000	.000	4.07	170.89	180.74
1972-05	4.073	170.89	.000	.737	.000	.000	.000	.000	.000	3.34	170.61	180.74

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	AZ_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1972-06	3.336	170.61	6.090	.941	7.422	1.360	1.360	.183B	.000	7.13	171.88	180.74
1972-07	7.125	171.88	14.330	1.314	4.247	.530	.530	.125B	.000	19.61	173.93	180.74
1972-08	19.611	173.93	25.790	2.102	12.896	1.640	3.829	.297B	.000	39.47	175.78	180.74
1972-09	39.470	175.78	7.780	2.057	31.565	5.210	12.529	.397B	.000	32.66	175.25	180.74
1972-10	32.664	175.25	.370	1.648	37.153	5.590	6.086	.164B	.000	25.30	174.50	180.74
1972-11	25.300	174.50	.000	1.077	21.189	4.760	4.760	.225B	.000	19.46	173.91	180.74
1972-12	19.463	173.91	.000	.947	12.254	5.380	5.380	.439B	.000	13.14	173.05	180.74
1973-01	13.136	173.05	.000	.686	10.632	4.710	4.710	.443B	.000	7.74	172.06	180.74
1973-02	7.741	172.06	.000	.518	4.505	2.020	2.020	.448B	.000	5.20	171.28	180.74
1973-03	5.202	171.28	.000	.626	.000	.000	.000	.000	.000	4.58	171.06	180.74
1973-04	4.577	171.06	.000	.749	.000	.000	.000	.000	.000	3.83	170.80	180.74
1973-05	3.828	170.80	.000	.701	.000	.000	.000	.000	.000	3.13	170.52	180.74

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	AZ_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1973-06	3.127	170.52	6.090	.908	7.422	1.360	1.360	.183B	.000	6.95	171.83	180.74
1973-07	6.949	171.83	16.230	1.341	4.247	.530	.530	.125B	.000	21.31	174.12	180.74
1973-08	21.307	174.12	44.300	2.436	12.896	1.640	10.082	.782B	.000	53.09	176.65	180.74
1973-09	53.089	176.65	259.460	3.972	31.565	5.210	31.565	1.000	124.813	152.20	180.74	180.74
1973-10	152.199	180.74	13.500	4.569	37.153	5.590	37.153	1.000	.000	123.98	179.81	180.74
1973-11	123.978	179.81	.000	3.009	21.189	4.760	21.189	1.000	.000	99.78	178.92	180.74
1973-12	99.780	178.92	.000	2.756	12.254	5.380	12.254	1.000	.000	84.77	178.30	180.74
1974-01	84.770	178.30	.000	2.394	10.632	4.710	10.632	1.000	.000	71.74	177.69	180.74
1974-02	71.743	177.69	.000	2.430	4.505	2.020	4.505	1.000	.000	64.81	177.30	180.74
1974-03	64.808	177.30	.000	3.680	.000	.000	.000	.000	.000	61.13	177.09	180.74
1974-04	61.129	177.09	.000	4.843	.000	.000	.000	.000	.000	56.29	176.83	180.74
1974-05	56.286	176.83	.000	5.023	.000	.000	.000	.000	.000	51.26	176.55	180.74

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	AZ_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1974-06	51.263	176.55	.600	4.172	7.422	1.360	5.906	.796B	.000	41.79	175.95	180.74
1974-07	41.785	175.95	4.020	2.689	4.247	.530	3.318	.781B	.000	39.80	175.81	180.74
1974-08	39.798	175.81	15.030	2.601	12.896	1.640	10.082	.782B	.000	42.15	175.97	180.74
1974-09	42.145	175.97	.000	2.111	31.565	5.210	7.370	.233B	.000	32.66	175.25	180.74
1974-10	32.664	175.25	.000	1.648	37.153	5.590	5.716	.154B	.000	25.30	174.50	180.74
1974-11	25.300	174.50	.000	1.077	21.189	4.760	4.760	.225B	.000	19.46	173.91	180.74
1974-12	19.463	173.91	.000	.947	12.254	5.380	5.380	.439B	.000	13.14	173.05	180.74
1975-01	13.136	173.05	.000	.686	10.632	4.710	4.710	.443B	.000	7.74	172.06	180.74
1975-02	7.741	172.06	.000	.518	4.505	2.020	2.020	.448B	.000	5.20	171.28	180.74
1975-03	5.202	171.28	.000	.626	.000	.000	.000	.000	.000	4.58	171.06	180.74
1975-04	4.577	171.06	.000	.749	.000	.000	.000	.000	.000	3.83	170.80	180.74
1975-05	3.828	170.80	.000	.701	.000	.000	.000	.000	.000	3.13	170.52	180.74

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YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	AZ_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1975-06	3.127	170.52	17.630	1.465	7.422	1.360	1.360	.1838	.000	17.93	173.71	180.74
1975-07	17.932	173.71	11.460	1.860	4.247	.530	.530	.1258	.000	27.00	174.66	180.74
1975-08	27.002	174.66	40.500	2.585	12.896	1.640	10.082	.7828	.000	54.84	176.75	180.74
1975-09	54.835	176.75	61.350	3.225	31.565	5.210	24.976	.7918	.000	87.98	178.43	180.74
1975-10	87.984	178.43	10.690	3.127	37.153	5.590	29.262	.7888	.000	66.28	177.38	180.74
1975-11	66.285	177.38	.000	1.889	21.189	4.760	21.189	1.000	.000	43.21	176.04	180.74
1975-12	43.207	176.04	.000	1.504	12.254	5.380	12.254	1.000	.000	29.45	174.92	180.74
1976-01	29.449	174.92	.000	1.124	10.632	4.710	9.151	.8618	.000	19.17	173.87	180.74
1976-02	19.174	173.87	.000	1.009	4.505	2.020	4.505	1.000	.000	13.66	173.12	180.74
1976-03	13.660	173.12	.000	1.423	.000	.000	.000	.000	.000	12.24	172.91	180.74
1976-04	12.237	172.91	.000	1.800	.000	.000	.000	.000	.000	10.44	172.61	180.74
1976-05	10.437	172.61	.000	1.751	.000	.000	.000	.000	.000	8.69	172.29	180.74

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	AZ_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1976-06	8.686	172.29	4.170	1.575	7.422	1.360	1.360	.1838	.000	9.92	172.51	180.74
1976-07	9.921	172.51	66.960	2.532	4.247	.530	3.318	.7818	.000	71.03	177.65	180.74
1976-08	71.032	177.65	138.880	4.896	12.896	1.640	12.896	1.000	39.920	152.20	180.74	180.74
1976-09	152.199	180.74	108.350	5.234	31.565	5.210	31.565	1.000	71.551	152.20	180.74	180.74
1976-10	152.199	180.74	10.690	4.541	37.153	5.590	37.153	1.000	.000	121.20	179.71	180.74
1976-11	121.195	179.71	5.370	3.018	21.189	4.760	21.189	1.000	.000	102.36	179.02	180.74
1976-12	102.359	179.02	5.460	2.843	12.254	5.380	12.254	1.000	.000	92.72	178.63	180.74
1977-01	92.721	178.63	.160	2.523	10.632	4.710	10.632	1.000	.000	79.73	178.06	180.74
1977-02	79.727	178.06	14.930	2.750	4.505	2.020	4.505	1.000	.000	87.40	178.41	180.74
1977-03	87.401	178.41	.000	4.453	.000	.000	.000	.000	.000	82.95	178.21	180.74
1977-04	82.948	178.21	.000	5.906	.000	.000	.000	.000	.000	77.04	177.94	180.74
1977-05	77.042	177.94	.000	6.142	.000	.000	.000	.000	.000	70.90	177.64	180.74

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	AZ_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1977-06	70.900	177.64	21.950	5.724	7.422	1.360	5.906	.7968	.000	81.22	178.13	180.74
1977-07	81.219	178.13	162.530	5.244	4.247	.530	4.247	1.000	82.058	152.20	180.74	180.74
1977-08	152.199	180.74	82.150	6.037	12.896	1.640	12.896	1.000	63.217	152.20	180.74	180.74
1977-09	152.199	180.74	56.950	5.234	31.565	5.210	31.565	1.000	20.151	152.20	180.74	180.74
1977-10	152.199	180.74	8.870	4.523	37.153	5.590	37.153	1.000	.000	119.39	179.65	180.74
1977-11	119.393	179.65	4.610	2.975	21.189	4.760	21.189	1.000	.000	99.84	178.93	180.74
1977-12	99.839	178.93	3.560	2.782	12.254	5.380	12.254	1.000	.000	88.36	178.45	180.74
1978-01	88.363	178.45	5.620	2.503	10.632	4.710	10.632	1.000	.000	80.85	178.12	180.74
1978-02	80.848	178.12	7.740	2.707	4.505	2.020	4.505	1.000	.000	81.38	178.14	180.74
1978-03	81.376	178.14	.000	4.271	.000	.000	.000	.000	.000	77.11	177.94	180.74
1978-04	77.105	177.94	.000	5.647	.000	.000	.000	.000	.000	71.46	177.67	180.74
1978-05	71.458	177.67	.000	5.847	.000	.000	.000	.000	.000	65.61	177.34	180.74

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	AZ_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1978-06	65.611	177.34	1.610	4.965	7.422	1.360	5.906	.7968	.000	56.35	176.83	180.74
1978-07	56.350	176.83	5.220	3.329	4.247	.530	3.318	.7818	.000	54.92	176.75	180.74
1978-08	54.923	176.75	38.090	3.601	12.896	1.640	10.082	.7828	.000	79.33	178.04	180.74
1978-09	79.330	178.04	38.100	3.595	31.565	5.210	24.976	.7918	.000	88.86	178.47	180.74
1978-10	88.859	178.47	10.470	3.144	37.153	5.590	29.262	.7888	.000	66.92	177.42	180.74
1978-11	66.923	177.42	5.130	1.976	21.189	4.760	21.189	1.000	.000	48.89	176.41	180.74
1978-12	48.887	176.41	.000	1.661	12.254	5.380	12.254	1.000	.000	34.97	175.43	180.74
1979-01	34.972	175.43	.760	1.255	10.632	4.710	10.632	1.000	.000	23.85	174.36	180.74
1979-02	23.845	174.36	.530	1.160	4.505	2.020	4.505	1.000	.000	18.71	173.81	180.74
1979-03	18.711	173.81	.140	1.702	.000	.000	.000	.000	.000	17.15	173.61	180.74
1979-04	17.149	173.61	.110	2.214	.000	.000	.000	.000	.000	15.05	173.33	180.74
1979-05	15.045	173.33	.130	2.233	.000	.000	.000	.000	.000	12.94	173.02	180.74

Contd.

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	AZ_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	M m3	M	M m3	M m3	M m3	M m3	M m3		M m3	M m3	M	M
1979-06	12.942	173.02	5.650	2.053	7.422	1.360	1.360	.183B	.000	15.18	173.35	180.74
1979-07	15.179	173.35	29.170	2.065	4.247	.530	3.201	.754B	.000	39.08	175.75	180.74
1979-08	39.083	175.75	42.930	3.094	12.896	1.640	10.082	.782B	.000	68.84	177.53	180.74
1979-09	68.637	177.53	36.530	3.305	31.565	5.210	24.976	.791B	.000	77.09	177.94	180.74
1979-10	77.086	177.94	6.100	2.796	37.153	5.590	29.262	.788B	.000	51.13	176.54	180.74
1979-11	51.127	176.54	2.560	1.618	21.189	4.760	17.082	.806B	.000	34.99	175.43	180.74
1979-12	34.988	175.43	1.800	1.325	12.254	5.380	10.535	.860B	.000	24.93	174.46	180.74
1980-01	24.928	174.46	.000	1.005	10.632	4.710	9.151	.861B	.000	14.77	173.29	180.74
1980-02	14.771	173.29	.000	.858	4.505	2.020	3.884	.862B	.000	10.03	172.53	180.74
1980-03	10.030	172.53	.000	1.158	.000	.000	.000	.000	.000	8.87	172.32	180.74
1980-04	8.872	172.32	.000	1.420	.000	.000	.000	.000	.000	7.45	171.98	180.74
1980-05	7.452	171.98	.000	1.310	.000	.000	.000	.000	.000	6.14	171.60	180.74

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	AZ_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	M m3	M	M m3	M m3	M m3	M m3	M m3		M m3	M m3	M	M
1980-06	6.142	171.60	8.910	1.490	7.422	1.360	1.360	.183B	.000	12.20	172.91	180.74
1980-07	12.202	172.91	3.720	1.397	4.247	.530	.530	.125B	.000	14.00	173.17	180.74
1980-08	13.995	173.17	23.030	1.827	12.896	1.640	1.640	.127B	.000	33.56	175.32	180.74
1980-09	33.558	175.32	2.020	1.865	31.565	5.210	5.210	.165B	.000	28.50	174.82	180.74
1980-10	28.503	174.82	.360	1.521	37.153	5.590	5.590	.150B	.000	21.75	174.16	180.74
1980-11	21.751	174.16	.000	.986	21.189	4.760	4.760	.225B	.000	16.01	173.47	180.74
1980-12	16.005	173.47	.000	.825	12.254	5.380	5.380	.439B	.000	9.80	172.49	180.74
1981-01	9.800	172.49	.000	.501	10.632	4.710	4.710	.443B	.000	4.59	171.06	180.74
1981-02	4.589	171.06	.000	.332	4.505	2.020	.745	.165A	.000	3.51	170.69	180.74
1981-03	3.512	170.69	.000	.448	.000	.000	.000	.000	.000	3.06	170.49	180.74
1981-04	3.064	170.49	.000	.536	.000	.000	.000	.000	.000	2.53	170.19	180.74
1981-05	2.528	170.19	.000	.497	.000	.000	.000	.000	.000	2.03	169.87	180.74

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	AZ_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	M m3	M	M m3	M m3	M m3	M m3	M m3		M m3	M m3	M	M
1981-06	2.031	169.87	23.850	1.539	7.422	1.360	1.360	.183B	.000	22.96	174.28	180.74
1981-07	22.982	174.28	174.520	4.074	4.247	.530	4.247	1.000	36.982	152.20	180.74	180.74
1981-08	152.199	180.74	235.670	6.087	12.896	1.640	12.896	1.000	216.737	152.20	180.74	180.74
1981-09	152.199	180.74	34.230	5.211	31.565	5.210	31.565	1.000	.000	149.65	180.66	180.74
1981-10	149.653	180.66	.000	4.349	37.153	5.590	37.153	1.000	.000	108.15	179.24	180.74
1981-11	108.151	179.24	.550	2.735	21.189	4.760	21.189	1.000	.000	84.78	178.30	180.74
1981-12	84.777	178.30	.160	2.482	12.254	5.380	12.254	1.000	.000	70.20	177.60	180.74
1982-01	70.200	177.60	.000	2.102	10.632	4.710	10.632	1.000	.000	57.47	176.89	180.74
1982-02	57.466	176.89	.000	2.101	4.505	2.020	4.505	1.000	.000	50.86	176.53	180.74
1982-03	50.860	176.53	.000	3.174	.000	.000	.000	.000	.000	47.69	176.33	180.74
1982-04	47.686	176.33	.000	4.123	.000	.000	.000	.000	.000	43.56	176.06	180.74
1982-05	43.563	176.06	.000	4.188	.000	.000	.000	.000	.000	39.38	175.77	180.74

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	AZ_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	M m3	M	M m3	M m3	M m3	M m3	M m3		M m3	M m3	M	M
1982-06	38.375	175.77	.000	3.529	7.422	1.360	1.360	.183B	.000	34.49	175.39	180.74
1982-07	34.486	175.39	56.990	3.363	4.247	.530	3.318	.781B	.000	84.80	178.30	180.74
1982-08	84.796	178.30	19.230	4.240	12.896	1.640	10.082	.782B	.000	89.70	178.50	180.74
1982-09	89.704	178.50	3.900	3.397	31.565	5.210	24.976	.791B	.000	65.23	177.32	180.74
1982-10	65.231	177.32	.000	2.315	37.153	5.590	29.262	.788B	.000	33.65	175.33	180.74
1982-11	33.654	175.33	.000	1.284	21.189	4.760	4.760	.225B	.000	27.61	174.73	180.74
1982-12	27.610	174.73	.000	1.106	12.254	5.380	10.535	.860B	.000	15.97	173.46	180.74
1983-01	15.968	173.46	.000	.748	10.632	4.710	7.123	.670B	.000	8.10	172.16	180.74
1983-02	8.097	172.16	.000	.546	4.505	2.020	2.020	.448B	.000	5.53	171.39	180.74
1983-03	5.531	171.39	.000	.666	.000	.000	.000	.000	.000	4.86	171.16	180.74
1983-04	4.865	171.16	.000	.791	.000	.000	.000	.000	.000	4.07	170.89	180.74
1983-05	4.073	170.89	.000	.737	.000	.000	.000	.000	.000	3.34	170.61	180.74

Contd.

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	AZ_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1983-06	3.336	170.61	.240	.595	7.422	1.360	.000	.000A	.000	2.98	170.46	180.74
1983-07	2.982	170.46	27.740	1.271	4.247	.530	.530	.125B	.000	28.92	174.86	180.74
1983-08	28.921	174.86	55.840	2.924	12.896	1.640	10.082	.782B	.000	71.76	177.69	180.74
1983-09	71.755	177.69	15.730	3.085	31.565	5.210	24.976	.791B	.000	59.42	177.00	180.74
1983-10	59.424	177.00	13.630	2.376	37.153	5.590	29.262	.788B	.000	41.42	175.92	180.74
1983-11	41.415	175.92	1.750	1.416	21.189	4.760	12.171	.574B	.000	29.58	174.93	180.74
1983-12	29.578	174.93	.000	1.157	12.254	5.380	10.535	.860B	.000	17.88	173.71	180.74
1984-01	17.885	173.71	.000	.773	10.632	4.710	9.014	.848B	.000	8.10	172.16	180.74
1984-02	8.097	172.16	.000	.546	4.505	2.020	2.020	.448B	.000	5.53	171.39	180.74
1984-03	5.531	171.39	.000	.666	.000	.000	.000	.000	.000	4.86	171.16	180.74
1984-04	4.865	171.16	.000	.791	.000	.000	.000	.000	.000	4.07	170.89	180.74
1984-05	4.073	170.89	.000	.737	.000	.000	.000	.000	.000	3.34	170.61	180.74

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	AZ_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1984-06	3.336	170.61	.000	.576	7.422	1.360	.000	.000A	.000	2.76	170.35	180.74
1984-07	2.760	170.35	2.230	.443	4.247	.530	.530	.125B	.000	4.02	170.87	180.74
1984-08	4.017	170.87	80.490	2.146	12.896	1.640	10.082	.782B	.000	72.28	177.72	180.74
1984-09	72.279	177.72	36.590	3.404	31.565	5.210	24.976	.791B	.000	80.49	178.10	180.74
1984-10	80.488	178.10	12.720	2.967	37.153	5.590	29.262	.788B	.000	60.98	177.09	180.74
1984-11	60.979	177.09	3.450	1.863	21.189	4.760	17.082	.806B	.000	45.48	176.19	180.74
1984-12	45.484	176.19	.000	1.565	12.254	5.380	12.254	1.000	.000	31.67	175.15	180.74
1985-01	31.665	175.15	.000	1.160	10.632	4.710	10.632	1.000	.000	19.87	173.96	180.74
1985-02	19.873	173.96	.000	1.032	4.505	2.020	4.505	1.000	.000	14.34	173.22	180.74
1985-03	14.336	173.22	.000	1.464	.000	.000	.000	.000	.000	12.87	173.01	180.74
1985-04	12.872	173.01	.000	1.861	.000	.000	.000	.000	.000	11.01	172.71	180.74
1985-05	11.011	172.71	.000	1.818	.000	.000	.000	.000	.000	9.19	172.38	180.74

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	AZ_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1985-06	9.193	172.38	.000	1.354	7.422	1.360	1.360	.183B	.000	6.48	171.70	180.74
1985-07	6.479	171.70	5.950	1.029	4.247	.530	.530	.125B	.000	10.87	172.69	180.74
1985-08	10.870	172.69	10.360	1.405	12.896	1.640	1.640	.127B	.000	18.18	173.75	180.74
1985-09	18.184	173.75	.000	1.247	31.565	5.210	5.210	.165B	.000	11.73	172.84	180.74
1985-10	11.728	172.84	5.190	.967	37.153	5.590	5.590	.150B	.000	10.36	172.59	180.74
1985-11	10.360	172.59	.000	.532	21.189	4.760	4.760	.225B	.000	5.07	171.23	180.74
1985-12	5.068	171.23	.000	.332	12.254	5.380	1.224	.100A	.000	3.51	170.69	180.74
1986-01	3.512	170.69	.000	.260	10.632	4.710	.000	.000A	.000	3.25	170.57	180.74
1986-02	3.252	170.57	.000	.267	4.505	2.020	.000	.000A	.000	2.99	170.46	180.74
1986-03	2.985	170.46	.000	.389	.000	.000	.000	.000	.000	2.60	170.24	180.74
1986-04	2.596	170.24	.000	.468	.000	.000	.000	.000	.000	2.13	169.93	180.74
1986-05	2.128	169.93	.000	.438	.000	.000	.000	.000	.000	1.69	169.59	180.74

YYYY-Mn	Ini_sto m m3	Ini_lev m	Loc_Flo m m3	Evapr m m3	Tot_Dem m m3	AZ_Dem m m3	Releas m m3	Rel/Dem	Spill m m3	End_st m m3	End_Lev m	Rul_Lev m
1986-06	1.690	169.59	.000	.346	7.422	1.360	.000	.000A	.000	1.34	169.28	180.74
1986-07	1.344	169.28	3.660	.373	4.247	.530	.530	.125B	.000	4.10	170.89	180.74
1986-08	4.100	170.89	4.610	.639	12.896	1.640	1.640	.127B	.000	6.43	171.69	180.74
1986-09	6.432	171.69	.000	.531	31.565	5.210	2.389	.076A	.000	3.51	170.69	180.74
1986-10	3.512	170.69	.000	.341	37.153	5.590	.000	.000A	.000	3.17	170.54	180.74
1986-11	3.171	170.54	.000	.237	21.189	4.760	.000	.000A	.000	2.93	170.43	180.74
1986-12	2.934	170.43	.000	.231	12.254	5.380	.000	.000A	.000	2.70	170.31	180.74
1987-01	2.703	170.31	.000	.207	10.632	4.710	.000	.000A	.000	2.50	170.17	180.74
1987-02	2.496	170.17	.000	.215	4.505	2.020	.000	.000A	.000	2.28	170.03	180.74
1987-03	2.281	170.03	.000	.314	.000	.000	.000	.000	.000	1.97	169.82	180.74
1987-04	1.967	169.82	.000	.382	.000	.000	.000	.000	.000	1.58	169.50	180.74
1987-05	1.585	169.50	.000	.361	.000	.000	.000	.000	.000	1.22	169.17	180.74

Contd.

YYYY-Mn	Ini_sto	Ini_lev	Loc_Flo	Evapr	Tot_Dem	AZ_Dem	Releas	Rel/Dem	Spill	End_st	End_Lev	Rul_Lev
	m m3	m	m m3	m m3	m m3	m m3	m m3		m m3	m m3	m	m
1987-06	1.224	169.17	14.300	1.135	7.422	1.360	1.360	.183B	.000	13.03	173.03	180.74
1987-07	13.029	173.03	46.690	2.334	4.247	.530	3.318	.781B	.000	54.07	176.71	180.74
1987-08	54.068	176.71	135.790	4.597	12.896	1.640	12.896	1.000	20.165	152.20	180.74	180.74
1987-09	152.199	180.74	1.130	4.887	31.565	5.210	31.565	1.000	.000	116.88	179.56	180.74
1987-10	116.877	179.56	.040	3.652	37.153	5.590	37.153	1.000	.000	76.11	177.89	180.74
1987-11	76.111	177.89	.000	2.114	21.189	4.760	21.189	1.000	.000	52.81	176.64	180.74
1987-12	52.808	176.64	.000	1.762	12.254	5.380	12.254	1.000	.000	38.79	175.73	180.74
1988-01	38.792	175.73	.000	1.346	10.632	4.710	10.632	1.000	.000	26.81	174.64	180.74
1988-02	26.814	174.64	.000	1.236	4.505	2.020	4.505	1.000	.000	21.07	174.10	180.74
1988-03	21.074	174.10	.000	1.806	.000	.000	.000	.000	.000	19.27	173.89	180.74
1988-04	19.267	173.89	.000	2.350	.000	.000	.000	.000	.000	16.92	173.58	180.74
1988-05	16.917	173.58	.000	2.383	.000	.000	.000	.000	.000	14.53	173.25	180.74

No. of failure months (When Release is less than Demand) = 156

No. of failure months for A-zone = 29; Monthly Time Reliability for A-zone = 89.9 %

Monthly Time Reliability = 45.8 % ; Annual Time Reliability = 20.83 %

Volume Reliability = 58.9 %

Table - HTW1
Monthly Operation Simulation of HATHMATI WEIR For Conservation Regulation Using Recommended Policy

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1964-06	.00	4.547	8.660	4.547	1.000	.000	5.886
1964-07	5.51	2.788	5.310	8.296	1.000	.000	8.873
1964-08	12.21	8.442	16.080	20.653	1.000	.000	13.446
1964-09	7.10	19.766	37.650	26.863	1.000	.000	2.660
1964-10	3.72	23.672	45.090	30.052	.666B	.000	.000
1964-11	.00	.000	23.470	.000	.000B	.000	.000
1964-12	.00	5.155	9.820	5.155	.525B	.000	.000
1965-01	.00	2.095	8.460	2.095	.248B	.000	.000
1965-02	.00	.000	3.550	.000	.000B	.000	.000
1965-03	.00	.000	.000	.000	.000	.000	.000
1965-04	.00	.000	.000	.000	.000	.000	.000
1965-05	.00	.000	.000	.000	.000	.000	.000

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1965-06	.00	.000	8.660	.000	.000B	.000	.000
1965-07	2.26	.000	5.310	2.263	.426B	.000	.000
1965-08	4.90	.000	16.080	4.897	.305B	.000	.000
1965-09	2.28	.000	37.650	2.280	.061B	.000	.000
1965-10	1.21	.000	45.090	1.211	.027B	.000	.000
1965-11	.00	.000	23.470	.000	.000B	.000	.000
1965-12	.00	.000	9.820	.000	.000B	.000	.000
1966-01	.00	.000	8.460	.000	.000B	.000	.000
1966-02	.00	.000	3.550	.000	.000B	.000	.000
1966-03	.00	.000	.000	.000	.000	.000	.000
1966-04	.00	.000	.000	.000	.000	.000	.000
1966-05	.00	.000	.000	.000	.000	.000	.000

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1966-06	1.13	.000	8.660	1.126	.130B	.000	.000
1966-07	1.88	.000	5.310	1.880	.354B	.000	.000
1966-08	1.07	.000	16.080	1.069	.066B	.000	.000
1966-09	6.85	.000	37.650	6.846	.182B	.000	.000
1966-10	.69	.000	45.090	.691	.015B	.000	.000
1966-11	.00	.000	23.470	.000	.000B	.000	.000
1966-12	.00	.000	9.820	.000	.000B	.000	.000
1967-01	.00	.000	8.460	.000	.000B	.000	.000
1967-02	.00	.000	3.550	.000	.000B	.000	.000
1967-03	.00	.000	.000	.000	.000	.000	.000
1967-04	.00	.000	.000	.000	.000	.000	.000
1967-05	.00	.000	.000	.000	.000	.000	.000

Contd.

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1967-06	3.70	.000	8.660	3.703	.428B	.000	.000
1967-07	2.43	.000	5.310	2.434	.458B	.000	.000
1967-08	2.17	42.838	16.080	33.863	1.000	11.146	17.783
1967-09	7.33	57.086	37.650	37.650	1.000	26.767	17.783
1967-10	2.75	.000	45.090	20.537	.455B	.000	.000
1967-11	.00	.000	23.470	.000	.000B	.000	.000
1967-12	.00	.000	9.820	.000	.000B	.000	.000
1968-01	.00	.000	8.460	.000	.000B	.000	.000
1968-02	.00	.000	3.550	.000	.000B	.000	.000
1968-03	.00	.000	.000	.000	.000	.000	.000
1968-04	.00	.000	.000	.000	.000	.000	.000
1968-05	.00	.000	.000	.000	.000	.000	.000

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1968-06	.00	.000	8.660	.000	.000B	.000	.000
1968-07	83.05	3.717	5.310	23.093	1.000	63.670	17.783
1968-08	28.96	80.125	16.080	16.080	1.000	93.005	17.783
1968-09	3.02	26.355	37.650	29.378	1.000	.000	9.511
1968-10	1.78	31.563	45.090	42.851	.950B	.000	.000
1968-11	.00	16.429	23.470	16.429	.700B	.000	.000
1968-12	.00	6.874	9.820	6.874	.700B	.000	.000
1969-01	.00	5.922	8.460	5.922	.700B	.000	.000
1969-02	.00	2.485	3.550	2.485	.700B	.000	.000
1969-03	.00	.000	.000	.000	.000	.000	.000
1969-04	.00	.000	.000	.000	.000	.000	.000
1969-05	.00	.000	.000	.000	.000	.000	.000

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1969-06	.00	.000	8.660	.000	.000B	.000	.000
1969-07	7.10	.000	5.310	7.103	1.000	.000	1.793
1969-08	1.04	.000	16.080	2.833	.176B	.000	.000
1969-09	2.81	.000	37.650	2.811	.075B	.000	.000
1969-10	.00	.000	45.090	.000	.000B	.000	.000
1969-11	.00	.000	23.470	.000	.000B	.000	.000
1969-12	.00	.000	9.820	.000	.000B	.000	.000
1970-01	.00	.000	8.460	.000	.000B	.000	.000
1970-02	.00	.000	3.550	.000	.000B	.000	.000
1970-03	.00	.000	.000	.000	.000	.000	.000
1970-04	.00	.000	.000	.000	.000	.000	.000
1970-05	.00	.000	.000	.000	.000	.000	.000

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1970-06	6.09	.000	8.660	6.086	.703B	.000	.000
1970-07	20.02	2.788	5.310	22.805	1.000	.000	17.495
1970-08	11.01	8.442	16.080	16.368	1.000	3.080	17.783
1970-09	56.70	47.340	37.650	37.650	1.000	66.388	17.783
1970-10	3.34	31.563	45.090	34.900	1.000	.000	7.593
1970-11	.80	16.429	23.470	17.229	1.000	.000	1.352
1970-12	.52	6.874	9.820	8.746	.891B	.000	.000
1971-01	.21	5.922	8.460	6.133	.725B	.000	.000
1971-02	2.20	2.485	3.550	4.685	1.000	.000	1.135
1971-03	.00	.000	.000	.000	.000	.000	1.135
1971-04	.00	.000	.000	.000	.000	.000	1.135
1971-05	.00	.000	.000	.000	.000	.000	1.135

Contd.

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1971-06	21.85	4.547	8.660	25.308	1.000	1.084	17.783
1971-07	14.65	2.788	5.310	5.310	1.000	12.123	17.783
1971-08	14.53	8.442	16.080	16.080	1.000	6.888	17.783
1971-09	4.95	19.766	37.650	24.715	1.000	.000	4.848
1971-10	2.91	23.672	45.090	31.429	.697B	.000	.000
1971-11	.00	.000	23.470	.000	.000B	.000	.000
1971-12	.00	5.155	9.820	5.155	.525B	.000	.000
1972-01	.00	1.801	8.460	1.801	.213B	.000	.000
1972-02	.00	.000	3.550	.000	.000B	.000	.000
1972-03	.00	.000	.000	.000	.000	.000	.000
1972-04	.00	.000	.000	.000	.000	.000	.000
1972-05	.00	.000	.000	.000	.000	.000	.000

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1972-06	3.48	.000	8.660	3.480	.402B	.000	.000
1972-07	8.19	.000	5.310	8.189	1.000	.000	2.879
1972-08	14.74	2.189	16.080	16.926	1.000	.000	3.725
1972-09	4.45	7.319	37.650	15.489	.411B	.000	.000
1972-10	.21	.496	45.090	.708	.016B	.000	.000
1972-11	.00	.000	23.470	.000	.000B	.000	.000
1972-12	.00	.000	9.820	.000	.000B	.000	.000
1973-01	.00	.000	8.460	.000	.000B	.000	.000
1973-02	.00	.000	3.550	.000	.000B	.000	.000
1973-03	.00	.000	.000	.000	.000	.000	.000
1973-04	.00	.000	.000	.000	.000	.000	.000
1973-05	.00	.000	.000	.000	.000	.000	.000

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1973-06	3.48	.000	8.660	3.480	.402B	.000	.000
1973-07	9.27	.000	5.310	9.274	1.000	.000	3.964
1973-08	25.31	27.274	16.080	29.899	1.000	22.689	17.783
1973-09	148.26	268.784	37.650	37.650	1.000	379.397	17.783
1973-10	7.71	35.763	45.090	43.477	1.000	.000	16.170
1973-11	.00	16.429	23.470	16.429	1.000	.000	9.129
1973-12	.00	7.919	9.820	7.919	1.000	.000	7.229
1974-01	.00	5.922	8.460	5.922	1.000	.000	4.691
1974-02	.00	2.485	3.550	2.485	1.000	.000	3.626
1974-03	.00	.000	.000	.000	.000	.000	3.626
1974-04	.00	.000	.000	.000	.000	.000	3.626
1974-05	.00	.000	.000	.000	.000	.000	3.626

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1974-06	.34	4.847	8.660	8.515	.983B	.000	.000
1974-07	2.30	2.788	5.310	5.085	.958B	.000	.000
1974-08	8.59	8.442	16.080	17.031	1.000	.000	.951
1974-09	.00	2.160	37.650	3.111	.083B	.000	.000
1974-10	.00	.126	45.090	.126	.003B	.000	.000
1974-11	.00	.000	23.470	.000	.000B	.000	.000
1974-12	.00	.000	9.820	.000	.000B	.000	.000
1975-01	.00	.000	8.460	.000	.000B	.000	.000
1975-02	.00	.000	3.550	.000	.000B	.000	.000
1975-03	.00	.000	.000	.000	.000	.000	.000
1975-04	.00	.000	.000	.000	.000	.000	.000
1975-05	.00	.000	.000	.000	.000	.000	.000

Contd.

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1975-06	10.07	.000	8.660	10.074	1.000	.000	1.414
1975-07	6.55	.000	5.310	6.549	1.000	.000	2.653
1975-08	23.14	8.442	16.080	31.210	1.000	.375	17.783
1975-09	35.06	20.577	37.650	37.650	1.000	17.984	17.783
1975-10	6.11	24.742	45.090	30.851	1.000	.000	3.544
1975-11	.00	16.429	23.470	19.973	.851B	.000	.000
1975-12	.00	6.874	9.820	6.874	.700B	.000	.000
1976-01	.00	4.442	8.460	4.442	.525B	.000	.000
1976-02	.00	2.485	3.550	2.485	.700B	.000	.000
1976-03	.00	.000	.000	.000	.000	.000	.000
1976-04	.00	.000	.000	.000	.000	.000	.000
1976-05	.00	.000	.000	.000	.000	.000	.000

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1976-06	2.38	.000	8.660	2.383	.275B	.000	.000
1976-07	38.26	2.788	5.310	23.093	1.000	17.958	17.783
1976-08	79.36	142.386	16.080	16.080	1.000	205.666	17.783
1976-09	61.91	122.592	37.650	37.650	1.000	146.856	17.783
1976-10	6.11	32.963	45.090	39.072	1.000	.000	11.765
1976-11	3.07	16.708	23.470	19.777	1.000	.000	8.071
1976-12	3.12	6.875	9.820	9.995	1.000	.000	8.246
1977-01	.09	5.922	8.460	6.013	1.000	.000	5.799
1977-02	8.53	2.485	3.550	11.016	1.000	.000	13.265
1977-03	.00	.000	.000	.000	.000	.000	13.265
1977-04	.00	.000	.000	.000	.000	.000	13.265
1977-05	.00	.000	.000	.000	.000	.000	13.265

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1977-06	12.54	4.547	8.660	13.178	1.000	3.912	17.783
1977-07	92.87	141.554	5.310	5.310	1.000	229.118	17.783
1977-08	46.94	130.447	16.080	16.080	1.000	161.310	17.783
1977-09	32.54	84.472	37.650	37.650	1.000	79.365	17.783
1977-10	5.07	35.883	45.090	40.952	1.000	.000	13.645
1977-11	2.63	16.508	23.470	19.142	1.000	.000	9.317
1977-12	2.03	6.874	9.820	8.908	1.000	.000	8.405
1978-01	3.21	5.922	8.460	9.133	1.000	.000	9.079
1978-02	4.42	2.485	3.550	6.908	1.000	.000	12.436
1978-03	.00	.000	.000	.000	.000	.000	12.436
1978-04	.00	.000	.000	.000	.000	.000	12.436
1978-05	.00	.000	.000	.000	.000	.000	12.436

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1978-06	.92	4.547	8.660	5.466	1.000	.000	9.243
1978-07	2.98	2.788	5.310	5.771	1.000	.000	9.703
1978-08	21.77	8.442	16.080	24.160	1.000	6.048	17.783
1978-09	21.77	19.766	37.650	37.650	1.000	3.888	17.783
1978-10	5.98	23.672	45.090	29.655	1.000	.000	2.348
1978-11	2.93	16.429	23.470	21.709	.925B	.000	.000
1978-12	.00	6.874	9.820	6.874	.700B	.000	.000
1979-01	.43	5.922	8.460	6.356	.751B	.000	.000
1979-02	.30	2.485	3.550	2.788	.785B	.000	.000
1979-03	.08	.000	.000	.080	.000	.000	.080
1979-04	.06	.000	.000	.063	.000	.000	.143
1979-05	.07	.000	.000	.074	.000	.000	.217

Contd.

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1979-06	3.23	.000	8.660	3.446	.398B	.000	.000
1979-07	16.67	2.671	5.310	19.340	1.000	.000	14.030
1979-08	24.53	17.168	16.080	19.833	1.000	21.866	17.783
1979-09	20.87	38.522	37.650	37.650	1.000	21.746	17.783
1979-10	3.49	23.672	45.090	44.941	.997B	.000	.000
1979-11	1.46	12.322	23.470	13.785	.587B	.000	.000
1979-12	1.03	5.155	9.820	6.184	.630B	.000	.000
1980-01	.00	4.442	8.460	4.442	.525B	.000	.000
1980-02	.00	1.864	3.550	1.864	.525B	.000	.000
1980-03	.00	.000	.000	.000	.000	.000	.000
1980-04	.00	.000	.000	.000	.000	.000	.000
1980-05	.00	.000	.000	.000	.000	.000	.000

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1980-06	5.09	.000	8.660	5.091	.588B	.000	.000
1980-07	2.13	.000	5.310	2.126	.400B	.000	.000
1980-08	13.16	.000	16.080	13.160	.818B	.000	.000
1980-09	1.15	.000	37.650	1.154	.031B	.000	.000
1980-10	.21	.000	45.090	.206	.005B	.000	.000
1980-11	.00	.000	23.470	.000	.000B	.000	.000
1980-12	.00	.000	9.820	.000	.000B	.000	.000
1981-01	.00	.000	8.460	.000	.000B	.000	.000
1981-02	.00	.000	3.550	.000	.000B	.000	.000
1981-03	.00	.000	.000	.000	.000	.000	.000
1981-04	.00	.000	.000	.000	.000	.000	.000
1981-05	.00	.000	.000	.000	.000	.000	.000

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1981-06	13.63	.000	8.660	13.629	1.000	.000	4.969
1981-07	99.73	118.886	5.310	18.124	1.000	200.488	17.783
1981-08	134.67	391.457	16.080	16.080	1.000	510.045	17.783
1981-09	19.56	40.471	37.650	37.650	1.000	22.381	17.783
1981-10	.00	31.563	45.090	31.563	1.000	.000	4.256
1981-11	.31	16.429	23.470	20.999	.895B	.000	.000
1981-12	.09	6.874	9.820	6.965	.709B	.000	.000
1982-01	.00	5.922	8.460	5.922	.700B	.000	.000
1982-02	.00	2.485	3.550	2.485	.700B	.000	.000
1982-03	.00	.000	.000	.000	.000	.000	.000
1982-04	.00	.000	.000	.000	.000	.000	.000
1982-05	.00	.000	.000	.000	.000	.000	.000

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1982-06	.00	.000	8.660	.000	.000B	.000	.000
1982-07	32.57	2.788	5.310	23.093	1.000	12.260	17.783
1982-08	10.99	8.442	16.080	16.080	1.000	3.351	17.783
1982-09	2.23	19.766	37.650	21.995	1.000	.000	2.128
1982-10	.00	23.672	45.090	25.800	.572B	.000	.000
1982-11	.00	.000	23.470	.000	.000B	.000	.000
1982-12	.00	5.155	9.820	5.155	.525B	.000	.000
1983-01	.00	2.413	8.460	2.413	.285B	.000	.000
1983-02	.00	.000	3.550	.000	.000B	.000	.000
1983-03	.00	.000	.000	.000	.000	.000	.000
1983-04	.00	.000	.000	.000	.000	.000	.000
1983-05	.00	.000	.000	.000	.000	.000	.000

Contd.

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1983-06	.14	.000	8.660	.137	.016B	.000	.000
1983-07	15.85	.000	5.310	15.851	1.000	.000	10.541
1983-08	31.91	8.442	16.080	23.322	1.000	17.029	17.783
1983-09	8.99	19.766	37.650	28.755	1.000	.000	8.888
1983-10	7.79	23.672	45.090	40.349	.895B	.000	.000
1983-11	1.00	7.411	23.470	8.411	.358B	.000	.000
1983-12	.00	5.155	9.820	5.155	.525B	.000	.000
1984-01	.00	4.304	8.460	4.304	.509B	.000	.000
1984-02	.00	.000	3.550	.000	.000B	.000	.000
1984-03	.00	.000	.000	.000	.000	.000	.000
1984-04	.00	.000	.000	.000	.000	.000	.000
1984-05	.00	.000	.000	.000	.000	.000	.000

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1984-06	.00	.000	8.660	.000	.000B	.000	.000
1984-07	1.27	.000	5.310	1.274	.240B	.000	.000
1984-08	45.99	8.442	16.080	33.863	1.000	20.573	17.783
1984-09	20.91	19.766	37.650	37.650	1.000	3.025	17.783
1984-10	7.27	23.672	45.090	30.941	1.000	.000	3.634
1984-11	1.97	12.322	23.470	17.927	.764B	.000	.000
1984-12	.00	6.874	9.820	6.874	.700B	.000	.000
1985-01	.00	5.922	8.460	5.922	.700B	.000	.000
1985-02	.00	2.485	3.550	2.485	.700B	.000	.000
1985-03	.00	.000	.000	.000	.000	.000	.000
1985-04	.00	.000	.000	.000	.000	.000	.000
1985-05	.00	.000	.000	.000	.000	.000	.000

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1985-06	.00	.000	8.660	.000	.000B	.000	.000
1985-07	3.40	.000	5.310	3.400	.640B	.000	.000
1985-08	5.92	.000	16.080	5.920	.368B	.000	.000
1985-09	.00	.000	37.650	.000	.000B	.000	.000
1985-10	2.97	.000	45.090	2.966	.066B	.000	.000
1985-11	.00	.000	23.470	.000	.000B	.000	.000
1985-12	.00	.000	9.820	.000	.000B	.000	.000
1986-01	.00	.000	8.460	.000	.000B	.000	.000
1986-02	.00	.000	3.550	.000	.000B	.000	.000
1986-03	.00	.000	.000	.000	.000	.000	.000
1986-04	.00	.000	.000	.000	.000	.000	.000
1986-05	.00	.000	.000	.000	.000	.000	.000

YYYY-Mn	Loc_Flo m m3	US_Flo m m3	Tot_Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1986-06	.00	.000	8.660	.000	.000B	.000	.000
1986-07	2.09	.000	5.310	2.091	.394B	.000	.000
1986-08	2.63	.000	16.080	2.634	.164B	.000	.000
1986-09	.00	.000	37.650	.000	.000B	.000	.000
1986-10	.00	.000	45.090	.000	.000B	.000	.000
1986-11	.00	.000	23.470	.000	.000B	.000	.000
1986-12	.00	.000	9.820	.000	.000B	.000	.000
1987-01	.00	.000	8.460	.000	.000B	.000	.000
1987-02	.00	.000	3.550	.000	.000B	.000	.000
1987-03	.00	.000	.000	.000	.000	.000	.000
1987-04	.00	.000	.000	.000	.000	.000	.000
1987-05	.00	.000	.000	.000	.000	.000	.000

Contd.

YYYY-Mn	Loc Flo m m3	US Flo m m3	Tot Dem m m3	Diversion m m3	Rel/Dem	Spill m m3	Storage m m3
1987-06	8.17	.000	8.660	8.171	.944B	.000	.000
1987-07	26.68	2.788	5.310	23.093	1.000	6.375	17.783
1987-08	77.59	31.421	16.080	16.080	1.000	92.936	17.783
1987-09	.65	26.355	37.650	27.001	1.000	.000	7.134
1987-10	.02	31.563	45.090	38.720	.859B	.000	.000
1987-11	.00	16.429	23.470	16.429	.700B	.000	.000
1987-12	.00	6.874	9.820	6.874	.700B	.000	.000
1988-01	.00	5.922	8.460	5.922	.700B	.000	.000
1988-02	.00	2.485	3.550	2.485	.700B	.000	.000
1988-03	.00	.000	.000	.000	.000	.000	.000
1988-04	.00	.000	.000	.000	.000	.000	.000
1988-05	.00	.000	.000	.000	.000	.000	.000

No. of failure months = 138

Monthly Time Reliability = 52.1 % ; Annual Time Reliability = 12.5%

Volume Reliability = 59.2%

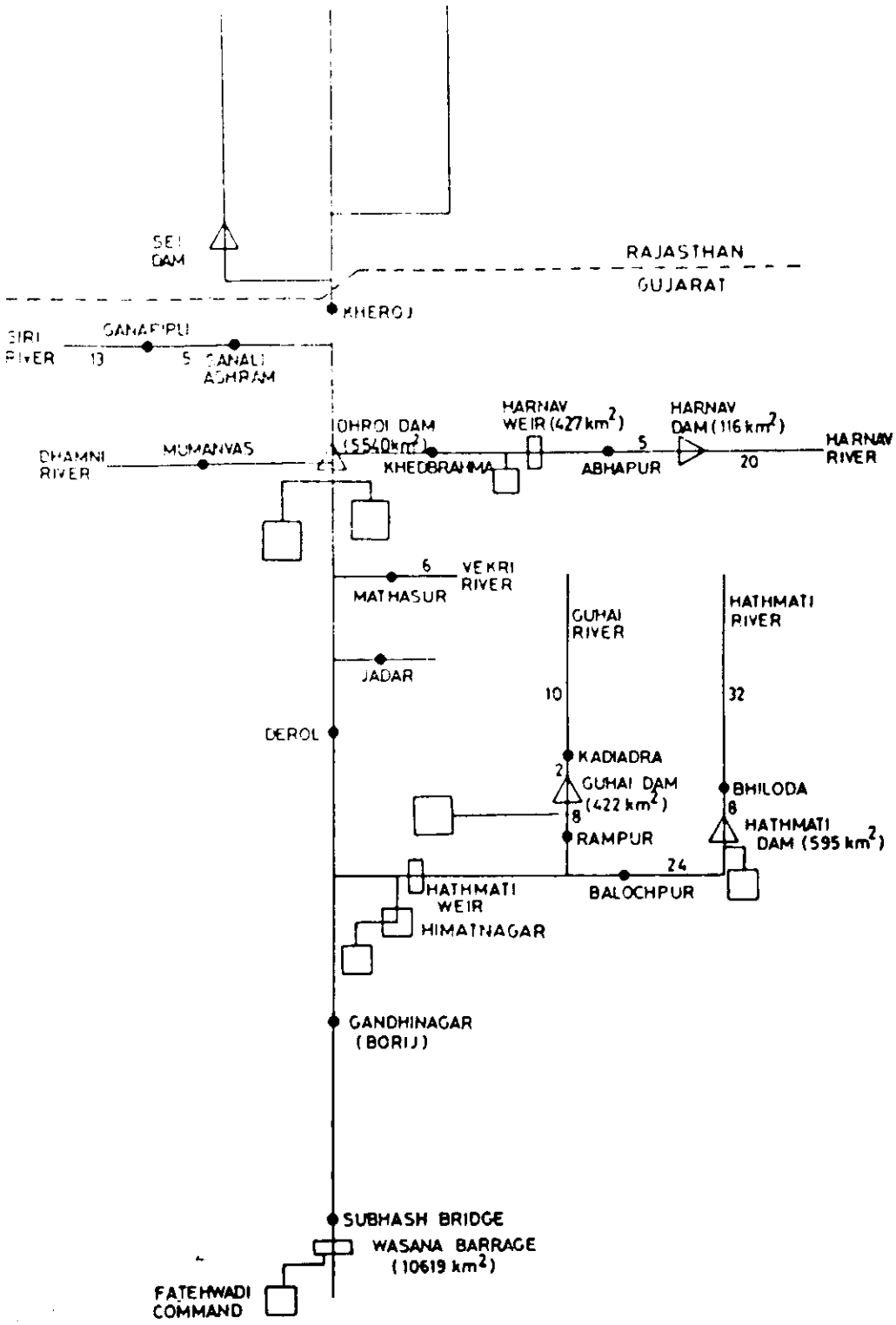
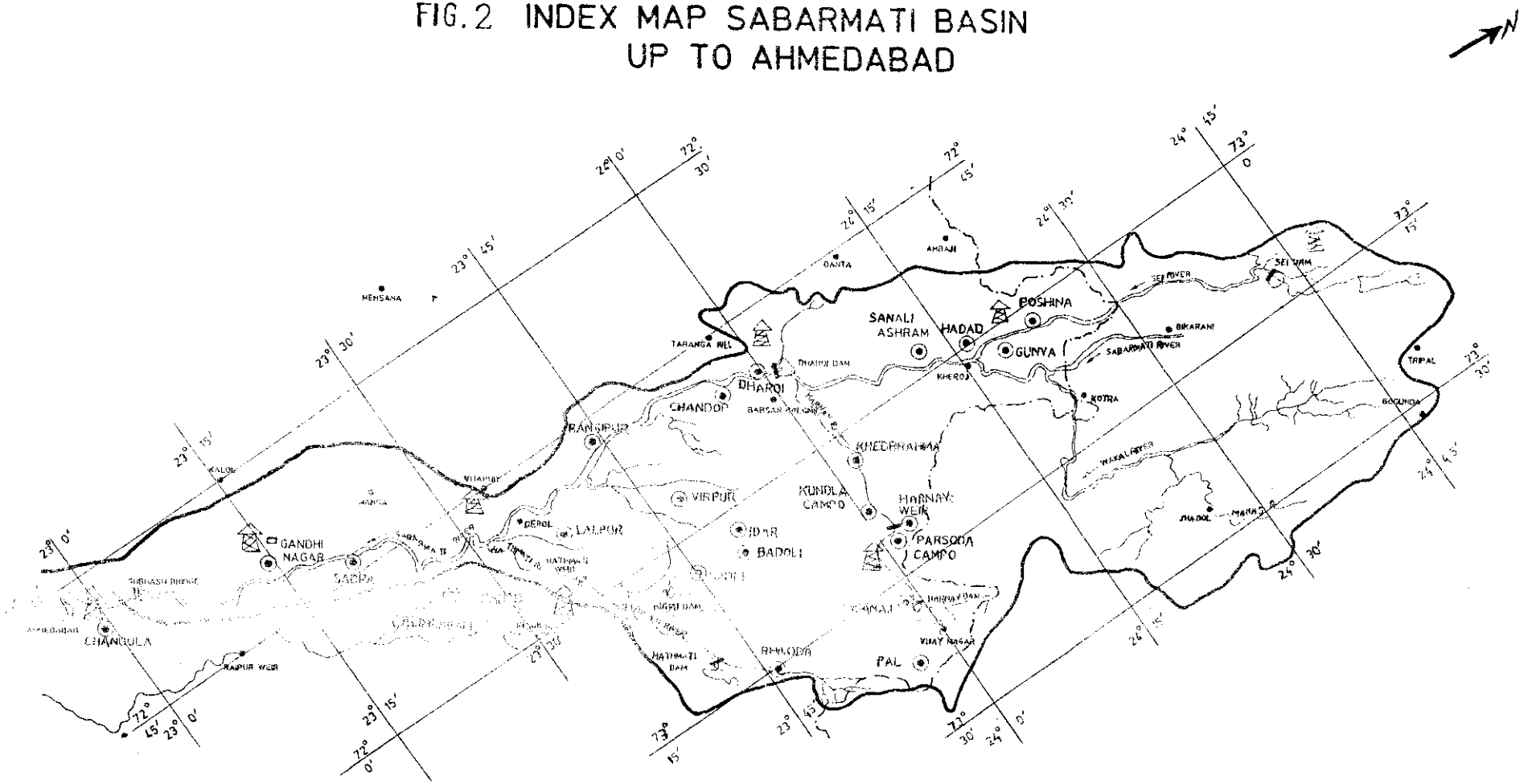


FIG. 1 LINE DIAGRAM – SABARMATI BASIN UPTO WASNA BARRAGE (AHMEDABAD)

FIG. 2 INDEX MAP SABARMATI BASIN UP TO AHMEDABAD



LEGEND

1. RIVERS WITH TRIBUTARIES, DAM & WEIR
2. STATE BOUNDARY
3. WIRELESS STATIONS
4. RAINGAUGE STATIONS (ORDINARY)
5. RAINGAUGE STATIONS (SELF RECORDING)

F

DIRECTOR : DR. S.M. SETH

STUDY GROUP

SCIENTISTS : SHRI M.K. GOEL

: SHRI S.K. JAIN

SCIENTIFIC STAFF : SHRI P.K. AGRAWAL