HYDRO POWER PLANNING IN THE BASIN OF RIVER PRA IN GHANA

A DISSERTATION

Submitted in partial fulfillment of the requirements for the award of the degree

of

MASTER OF TECHNOLOGY

in

WATER RESOURCES DEVELOPMENT

By

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CANDIDATE'S DECLARATION

I hereby declare that the work which is being presented in the dissertation entitled **"HYDROPOWER PLANNING IN THE BASIN OF RIVER PRA IN GHANA"** in partial fulfillment of the requirements for the award of **MASTER OF TECHNOLOGY** in **WATER RESOURCES DEVELOPMENT** and submitted to the Department of Water Resources Development and Management, Indian Institute of Technology, Roorkee is a record of my own work. This work was carried out from July 2005 to June 2006 under the supervision of **Dr. B. N. Asthana,** Ex Visiting Professor, Department of Water Resources Development and Management and **Prof. Gopal Chauhan**, Professor, Department of Water Resources Development and Management.

The matter embodied in this dissertation has not been submitted by me for the award of any other degree or diploma.

Dated 27th June 2006

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This to certify that the statements above, made by the candidate are true to the best of my knowledge.

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SYNOPSIS

Electricity supply in Ghana has for most parts been sourced from the Volta hydroelectric power station in the south eastern town of Akosombo since late 1960s. It is being supplemented by thermal generation when the levels of water fall. Thermal power generation started from the early 1980s. Though many rivers exist in Ghana, their potential has not been explored.

In this study, the flow and slope of the Pra river basin of South Western Ghana has been examined for hydropower generation. Literature review on principles of planning and design hydropower generation has also been made. The study has revealed that four run-of-the-river schemes totaling 120MW of installed capacity can be planned to provide 702 Gwh of electric energy in an average year. This energy equals about 15% of firm energy requirement of the country.

This has been achieved by creating three small ponds in cascade each for a head of 15.34m and laying one water carrier from the third power house to a fore bay for a fourth powerhouse by means of a 7.4km long conduit.

The preliminary dimensioning of a typical powerhouse, the barrage structure and energy dissipator and the forebay has also been done.

The creation of a hydropower scheme in the south west of the country it is hoped would significantly reduce transmission losses from Akosombo. It also hoped to save expenditure on cost in thermal generation as the cost of hydroelectric generation is generally low.

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CHAPTER ONE

INTRODUCTION

1.1 Ghana and its energy scenario

A higher population and higher economic growth rate has made demand for energy outstrip supply in the West African nation of Ghana. Additionally, since the 1980's, governments have pursued a policy of extending electricity to rural communities. The objective being to encourage the use of electricity for productive use for cottage industries and eventually the growth of such industries into bigger consumers. This, it is hoped, will create employment and economic growth for the rural communities. Consequently, therefore, the modest 45 to 47% of Ghana's population currently with access to electric power is expected to grow.

Electricity consumption in Ghana has grown at 10 to 15 % per annum for the last two decades. It is projected that the average demand growth in the near future will be about 6% per year as a result of which consumption of electricity will reach 9,300 GWh by 2010. This projected electricity growth has profound economic, financial, social and environmental implications. The aspirations of developing countries for higher living standards can only be satisfied through sustained development of their electric power generation as part of their basic infrastructure.

Urbanization in Ghana is expected to increase to 55% in 2012 from the 2000 value of 40%. Eventually it is expected to reach 60 % by 2020. Currently a little more than 33% of Ghana's urban population lives in the capital region of Greater Accra and is expected to reach 40% by 2020. Since a considerable percentage of household expenditure goes into energy and that energy sources in urban areas are more diversified than in rural areas, due to a bigger variety of commercial fuels and appliances in the urban areas than in the rural areas and that the cost of alternatives is higher in the rural areas than it is in the urban where incomes are higher, urban populations will consume more electricity as the Ghanaian economy grows. Electricity demand will thus grow much faster than the overall economic growth of 4-5 % per year.[16]

Also as the Ghana government continues its rural electrification policy, electricity demand would certainly rise since more than half of the population is currently without access to grid-based electricity. It is very expensive to build long-distance transmission lines to serve small communities, especially when these communities are relatively poor and cannot afford to pay rates high enough to cover the cost of these services. Even though smaller scale and locally installed generation systems using solar panels, batteries and the like can be more affordable, connection to the national grid remains both a matter of prestige and politics.

Domestic electric energy consumption in Ghana was 6,004 in GWh 2004. An additional 660 GWh was supplied to Ghana's neighbours. The projected average local load growth of about 6% implies that local consumption will be about 9,300 GWh by 2010. Not only are electricity exports also expected to increase but supply to the defunct Volta Aluminum Company which is expected to resume operation will also aggravate the shortfall eventually.

The firm capacity of Ghana's hydro system of about 4,800 GWh represents about half of the projected domestic consumption for 2010. This implies that at least 50 percent of

Ghana's electricity requirement will be provided from thermal sources by the year 2010 if further sources of hydropower are not harnessed.

In the medium to long term, up to 600 MW of additional generating capacity will be required by 2012. Obviously the amount of energy hydropower can give is limited and hence thermal will always remain a reality as consumption of energy grows. However, the full hydropower potential of Ghana's rivers must be exploited to bring down the cost of hydropower to consumers.

Cost of thermal generation is however expected to come down significantly when the proposed West African Gas Pipeline (WAGP) Project for power generation is completed. The WAGP Project involves the construction of a natural gas pipeline of about 600km to supply natural gas from Nigeria to meet the energy requirements of Ghana and other West African countries. The countries presently involved in the project are Ghana, Nigeria, Benin and Togo. The project will provide clean fuel for thermal generation and is expected to deliver natural gas at relatively lower costs than light crude oil.

It is expected that the gas will be delivered by the beginning of 2007. In addition, Ghana is involved in the development of the West African Power Pool (WAPP), aimed at establishing a regional market for electricity. The WAPP is expected to allow the sharing of available energy resources and increase the reliability of electricity supply in West Africa.

1.2 The need for new sources of locally generated hydropower

Despite the proposed gas power plant, however, locally generation of hydropower holds a lot of promise for many reasons. First is the cheaper cost. Second is vulnerability of such international schemes to manipulation and international disputes. Third is the benefit one gains from use of Clean Development Energy (CDM), fourth is the prevalence of market forces in determining the price of gas which may go higher as prices appreciate. Obviously, the fact is that with the West African pool, consuming nations must pay to supplying nations, hence the more energy a country can produce on its own the better. It goes without saying therefore that external sources of fuel have a toll on the foreign exchange reserves of a nation.

In view of this, studies have recently started on harnessing small hydropower potentials on small rivers to meet local demand. The government has also given approval for the construction of new dams for storage schemes in some areas in the north of the country which has profound environmental consequences since they are close to national parks where rare plant and endangered animal species exist.

Without doubt, to provide affordable electricity to rural consumers, cheaper and environmentally friendly electricity is needed. For that hydropower holds a lot of promise because of the non renewable nature of petroleum products and its negative environmental impacts as well.

Ghana has many large rivers including Ofin, Pra, Ankobra, Volta, Afram, Ayensu, Densu, Birim, Oti. However the hydropower potential of many of these rivers however has not been exploited. This is because their potential is looked at in respect to storage type schemes. Run of the river schemes have not been pursued to any meaningful extent. The only scheme so far referred to, as a 'run of the river scheme' in the country is the hydropower scheme from the Kpong dam, which stores and utilizes the tail water from the Akosombo hydropower scheme downstream at Kpong. The reason for the lack of interest in run of the river schemes may be because of the relatively flat nature of the rivers in Ghana. It may also be because of the environmental and social problems associated with the previous experiences with storage hydropower schemes.

The need to exploit hydropower, especially run of the river on most of these rivers is however very important because of the advantage of hydropower over other forms of energy since it is cheaper and presents less environmental problems. It can be easily started and stopped as against thermal for example which takes a long time to heat up or cool down. Since run of the river schemes use existing flows in the river, if the flow is not harnessed, it will go waste. It goes without saying therefore that, at the time of low demand, the use of run of the river generated electricity allows regulation of flow out of storage reservoirs to save water in such storage schemes for use in time of higher demand. Run of the river submerges less areas than storage schemes and thus as the population grows and people encroach on river basins, run of the river type of hydropower schemes have to be looked into.

1.3 Cost of Electricity

The generating source has a reflection in the cost of electricity. Until thermal sources were added, the cost of generation was a pretty low 2-2.5 US cents/ kWh. The introduction of thermal sources raised the costs to 4.5-8 US cents/kWh and higher depending on the cost of imported fuel such as light crude oil. As a result, the average cost of generation increased from 2 US cents/kWh in the mid-1990s to about 6 US cents in 2002. However, tariffs to end-users have not always reflected these due to government's subsidized tariff policy.

1.4 Transmission losses and need for hydropower sources in South-western Ghana

Currently a substantial amount of the electricity produced is lost before it gets to consumers owing to losses during transmission and distribution. The two existing major hydropower schemes in the country are situated in the southeast. Thermal schemes exist in the southwest. The north has no power source currently even though new schemes have been planned. Power therefore has to be transported over very long distances to consumers in most parts of the country. This has resulted in a high rate of losses during transmission. Such losses were about 14% in 2001 (11% during distribution and 3% during transmission). The need for hydropower schemes in the southwest of the country where rainfall is usually the highest is thus very important since it will help in increasing the diversification of locations of hydropower sources and thus help in reducing transmission losses. It will also help in supplying cheap energy to consumers in the rural southwest of the country.

The electric power transmission system of Ghana is connected to its neighbours, La Côte d'Ivoire on the west by a 226-kV transmission line and Togo and Benin on the east by a 161- kV transmission line. Ghana also supplies electric power to Burkina Faso in the north through a low voltage distribution network. A high voltage transmission system between Ghana and Burkina Faso is being developed. In 2002, La Côte d'Ivoire exported 1,563 GWh of electricity (worth about $77 million), of which 111 GWh went to Burkina Faso and another 233 GWh was transmitted across Ghana to Togo and Benin. Also in 2002, Ghana exported an additional 170 GWh of electricity to Togo and Benin.

In this dissertation, studies have been done to explore the possibilities for run-of-the-river hydropower schemes in one of Ghana's rivers, River Pra, (Fig 1.1) which is in the South West of the country.

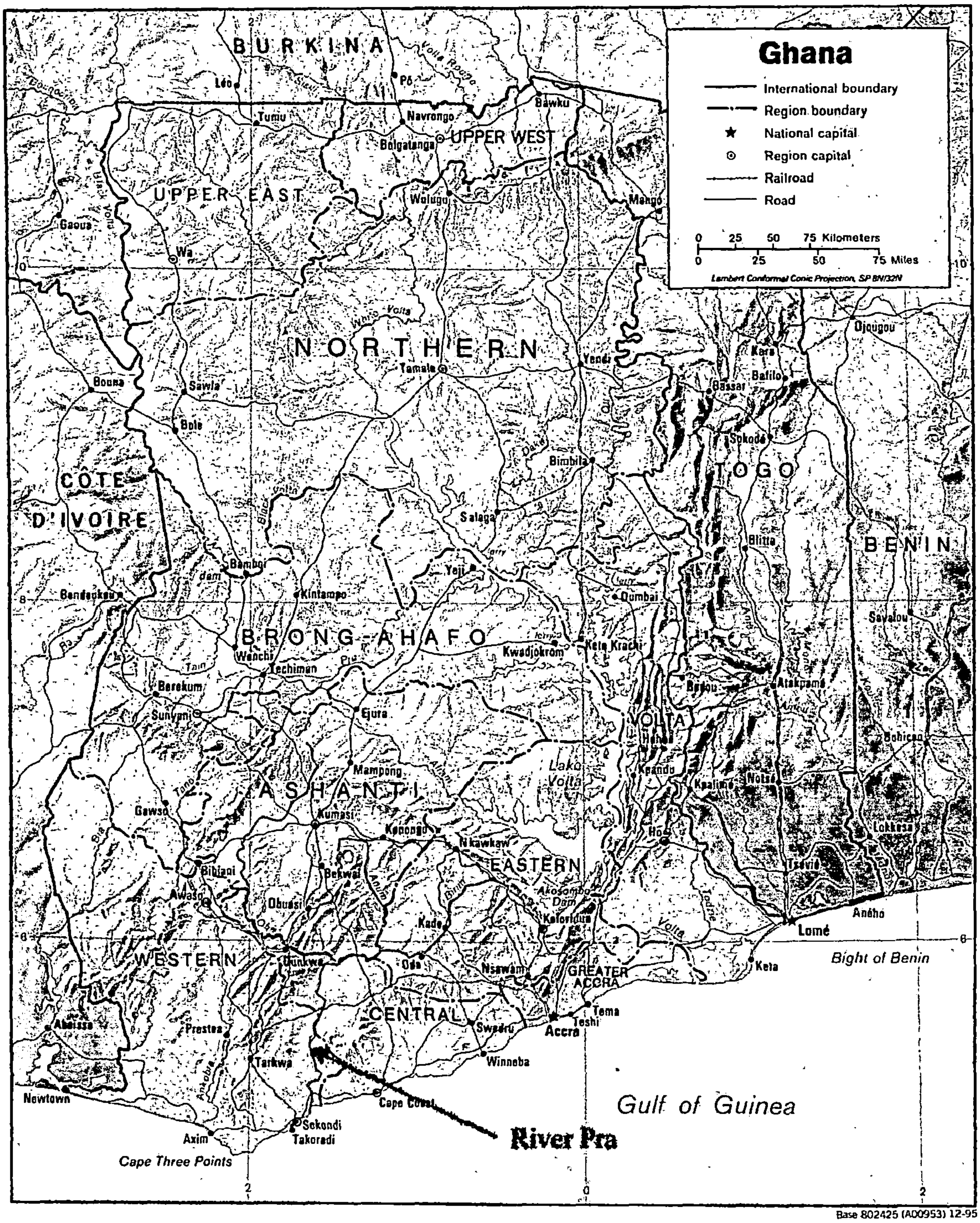


Fig. 1.1 Map of Ghana showing rivers and its neighbours

1.5 <u>Historical Development Of Electricity In Ghana</u>

The history of electricity in Ghana can be divided into three distinct periods

a) Before the construction the first Hydro power station at the Akosombo dam.

b) The years when hydro energy was the primary source of energy

c) The years when thermal energy was used to supplement hydro generation

The different stages of hydropower development in Ghana so far showing the type of source and the consumption patterns as explained in the paragraphs below can be seen in figures 1.2 to 1.4 and in table 1.1

Before Akosombo

The total electricity demand during this period is estimated to have been about 70 MW. It was provided through stand alone generators for private individuals and companies.

The Hydro Years

Akosombo Hydroelectric Project and Kpong Hydroelectric Project

The need to develop Ghana's huge bauxite reserves for an aluminum industry resulted in construction of a dam in 1962 with a total installed capacity of 588 MW each completed in 1965. In 1972, two additional generating units were installed bringing the total installed capacity to 912 MW.

The Volta Lake, created by the dam, submerged an area of about 8,500 km^2 and created the world's largest man made lake with a capacity of 150,000 million m^3 of water at Full Supply Level (FSL) of 278 feet NLD. The lake has a shoreline length of about 7,250 km. The Lake is about 400 km long and covers about 3% of Ghana. The drainage area of the

Lake comprises a land area of approximately 398,000 km^2, of which about 40 % is within Ghana's borders. Other portions lie in Togo, Benin, Mali and la Côte d'Ivoire. The average annual inflow to Lake Volta from this catchment area is about 37,600 million m^3.

Demand for Electricity during the Volta Development Period

Initially the major customers of generated power were an American aluminum smelter through whom loans were sourced for the dam construction, and the national electricity distribution company. Total domestic load (excluding the smelter) supplied from the grid in 1967 was approximately 540 GWh with an associated peak demand of about 100 MW. Domestic consumption was therefore less than 20% of the installed capacity at the Akosombo Station.

Between 1967 and 1976, domestic consumption grew from 540 GWh to 1,300 GWh. The average annual growth rate was about 10%. This was followed by a period of relatively stagnant domestic consumption from 1977 to 1980, when it stayed at about 1,350 GWh. From 1981, it declined to about 1,000 GWh in 1984.

The decline in power consumption in the early eighties was compounded by the severest drought in the recorded history of the Volta Basin from 1982 to 1984. Total inflow into the reservoir over this three-year period was less than 15 percent of the long-term expected total. Electricity supply during this period was consequently rationed. Supply to VALCO, the aluminum smelter was completely curtailed and export supplies to Togo and Benin were reduced.

Thermal Complementation – The Takoradi Thermal Power Plant

The drought of 1983 brought to the fore the vulnerability of hydropower to climatic conditions. Studies were thus conducted on the use of thermal energy to augment hydro generation. In times of insufficient rainfall resulting in low inflows into the Volta Lake, the thermal plants could be used to meet the shortfall in demand resulting from reduced hydro generation.

A 30-MW Diesel Station was also rehabilitated as an immediate and short term measure to support the operation of the hydro plants and consequently reduce the risk of another exposure to poor rainfall and reduced power generation. Because of, the cost of generation, the Diesel plant has been used intermittently and is currently not in commercial operation.

Between 1985 and 1992, a number of studies were carried out to confirm the technical, economic and financial feasibility of introducing thermal plants within the generation mix.

In addition, the late 1980s saw the beginning of significant increases in the demand for power in Ghana.

With the continued increase in demand for power, further studies, recommended construction of a 600-MW plant, with an initial 300-MW combined cycle plant and a 100-MW Combustion Turbine unit to be commissioned by 1995.

The first 330- MW tranche of the thermal Plant was commissioned in 1999. It is noted however that the first 110-MW combustion turbine unit went into commercial operation in December 1997 and the second in January 1998.

In 1998, the power system in Ghana experienced another crisis resulting in the rationing of power to consumers.

The crisis was brought on largely by poor rainfall and consequently low inflows into the Volta Lake affecting power generation, and also the inability to obtain sufficient back up power from La Côte d'Ivoire.

In order to deal with the power shortage, the Government contracted two private emergency power producers, both of the UK to produce and sell into the distribution grid in Tema up to 30 MW each. This arrangement was ended in 2000 when the crisis was over and normal power generation had been restored. The power crises set the basis for the addition of power plants to the generation system in Ghana through the private sector for the expansion of the Thermal Power Plant. In 1994, the Government launched a new policy framework for the development of the power sector. The policy envisaged the introduction of private sector participation in infrastructural development for the sector to meet growing demand.

In 1999, the Government decided to expand the Thermal Power Plant Station to 550 MW with the addition of 2x110 MW Combustion Turbine plants. With the expansion of the Thermal Power Plant, thermal generation increasingly started playing a major role within the power generation mix of Ghana. The two combustion turbine units were put into commercial operation in March and September 2000 respectively.

The Ghana National Petroleum Corporation also developed a power barge in order to utilize available natural gas reserves in the south west of the country. The barge has not yet gone into commercial production. Arrangements are ongoing to establish viable fuel sources for it.

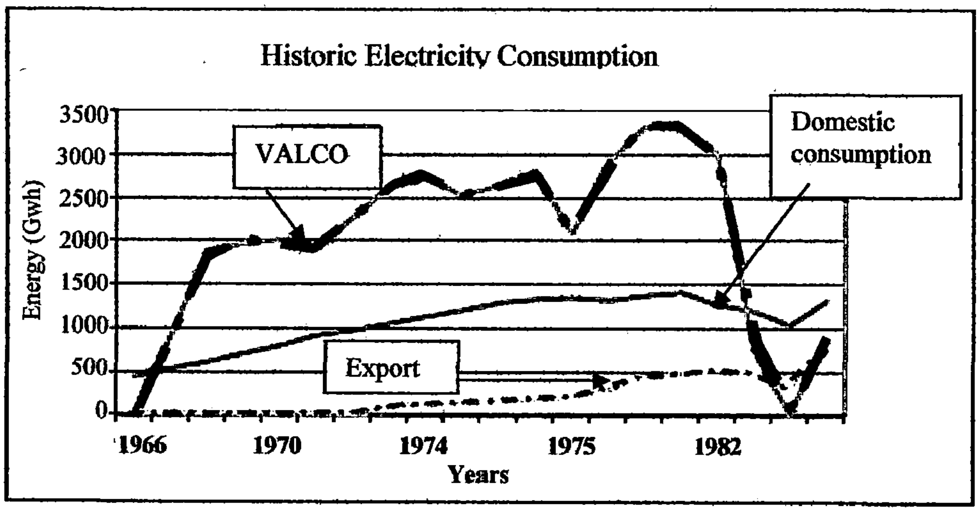


Fig. 1.2 Consumption of electrical energy from 1967 to 1985

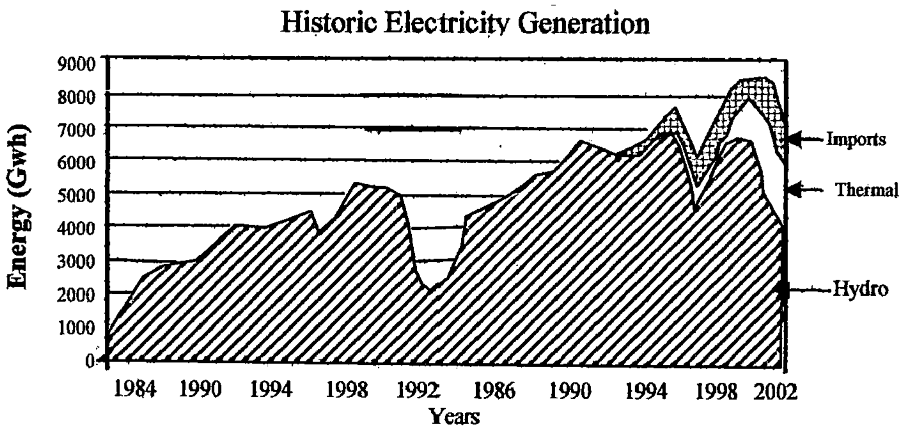


Fig. 1.3 Electricity generation in Ghana, 1966-2003

Current Power System Facilities

The total installed generation capacity is 1,778 MW. This comprises:

1. Akosombo Hydroelectric Power Plant	-installed capacity	-1,038 MW
2. Kpong Hydroelectric Power Plant	-installed capacity	- 160MW
3. Takoradi Thermal Power Station	-installed capacity	- 550MW
4. Tema Diesel Power Plant	-installed capacity	- 30 MW
5. Osagyefo Power Barge(not operational)	-installed capacity	- 125 MW

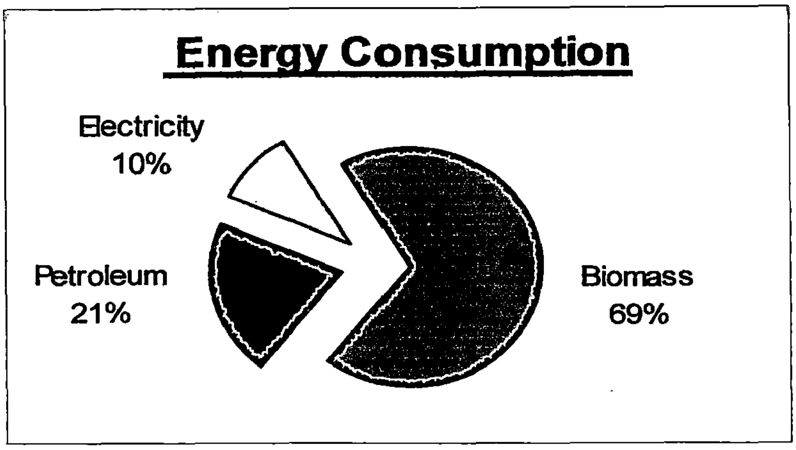


Fig. 1.4 Energy Consumption Patterns In Ghana

Table 1.1 ENERGY SOURCES IN GHANA

ELECTRICITY (Source Year 2000)		
Generation	**GWh**	**% of total energy**
Hydro Generation	6,609.00	81.7%
Thermal Generation	613.14	7.6%
Import (Thermal)	863.86	10.7%
Renewable (Solar)	0.69	0.01%
Total Energy	8,086.69	100%

1.6 Overview of Hydropower plan in the River Pra Basin

River Pra is one of Ghana's major rivers with a total length of 445km and total catchment area of 14324.80km^2. It is situated in the South Western half of the country and empties into the sea through marshlands. The river has many tributaries, the largest of which is the river Ofin. The river basin is relatively flat; hence construction of a storage scheme will cause submergence of a large area for a small height. The slope of the river is quite irregular. For the purposes of this dissertation, the southern most part of this river for which topographical sheets are available has been selected.

SLOPE ALONG RIVER PRA (Slope of river as you go southwards towards the ocean)

LENGTH (KM)	**SLOPE**
30	0.000508
27	0.00054 (1/1772)
35	0.00039 (1/2585)
26	0.00058 (1/1706)
13.9	0.00130 (1/912)

Final portion is irregular and very flat as it passes through marshes before entering the sea.

1.7 Scope Of Works

A history of electricity production and usage in Ghana to the present date and the need for more sources of hydroelectric energy has been discussed above. This dissertation work however, focuses on the general planning of hydropower schemes in the Pra River Basin. Geographical Information Systems (GIS) programs have been used on the topographic sheets of the river basin to study the most appropriate layout for the works, the area of submergence, the choice between a storage and a run of the river scheme and the suitability of a run of the river scheme in a river basin which is as flat as Pra's.

The layout of structures such as penstocks, intake structures energy dissipaters, forebay, water conduits has been developed.

The preliminary dimensioning of the barrage structure of one of the schemes has been done along with the preliminary dimensioning of one Power House.

The total amount of energy that could be harnessed from the river basin to augment the already existing power scenario has also been done.

The possible environmental impacts of the projects have also been discussed.

1.8 Organization of the Dissertation

The report consist of the following chapters

Chapter One

This chapter gives an introduction to the current and historical energy scenario in Ghana and the need to develop new hydropower sources especially in the south west of the country. The general overview of the river Pra Basin in the south west is also discussed.

Chapter Two

This chapter deals with the hydrological studies done for the Pra basin including the generation of missing data and the estimation of the design flood.

Chapter Three

In this chapter, hydropower studies are done. Literature survey is done and the different methods suggested by different experts for selecting the installed capacity and choosing the most appropriate turbine are discussed.

Chapter Four

The General layout of the project is discussed in this chapter. Relevant analysis based on the recommendations given by the different experts is used to select an appropriate design discharge, installed capacity and number of units.

Chapter Five

Typical structures that are required to for the proper functioning of the scheme including the power house, the barrage, the intakes and energy dissipators are discussed in this chapter.

Chapter 6

In this chapter the possible environmental impacts of the planned scheme are discussed and the possible remedies are proposed.

Chapter 7

The conclusions arrived at in the study are discussed and the scope for future studies are proposed.

CHAPTER TWO

HYDROLOGICAL STUDIES

2.1 Discharge data.

Daily flow data is available for two stations on the river which are Assin Praso and Daboase, the location of which can be seen in Fig 4.1 of the general layout of the project. Data for Assin Praso is available from 1957 to February 1984 and is attached in the appendix as Appendix A. The flow from Daboase consists of monthly flow from 1965 to 1978 attached as Appendix C and daily flow from 1991 to 2003 attached as appendix B. The available daily data was reorganized into 10 daily flows. This has been shown as Appendix D and E respectively. Unfortunately a lot of data is missing and has to be revaluated or recalculated before any meaningful analysis can be made.

2.2 Generation of Missing Data

Two methods have been used to fill in the missing data and to extend the data. Langbien's log deviation method was used to ascertain missing data between the existing data and the Thomas Fiering model for extension of flow data missing for long periods. The reorganized 10 daily data with the generated missing data has been attached as appendix E

2.2.1 The Thomas Fiering Model for extension of stream flow.

The Thomas Fiering Model for streamflow generation is used for extension of a group of data.

It is a based on first order Markov model. The Thomas Fiering model allows for nonstationarity in both mean and standard deviation due to annual cycle. It also allows for non-stationarity in the month to month correlation structure. For applying the Thomas Fiering Model at least 12 year data should be available.[5]

The Thomas Fiering Model is of the form

$$Q_n = \bar{Q}_n + (\sigma Q_n)/(\sigma Q_{n-1}) * R_{(n\sim n-1)} (Q_{n-1} - \bar{Q}_n) + t\,(\sigma Q_n) * \sqrt{(1-(R_{(n\sim n-1)})^2)}$$

Where

'Q_n' is the flow for the particular period being sought

'$\bar{Q}_n$' is the average for that period that has being taken over a long period

'σ' denotes standard deviation

'R' denotes correlation

't' a random number from a normally distributed population with 0 mean and unit standard deviation

It is one method of Markovian scheme for stream flow generation.

In using the Thomas fiering model the random component keeps varying. What happens therefore is that using different random numbers different data can be generated. If there is known data therefore it may be important to keep using different sets of random numbers till a result close to reality can be arrived at.

In this particular work, the ratio of the flow between the known values at Daboase and Assin Praso was calculated. To extend the, the missing data Daboase therefore, various sets of random numbers were used until a result was obtained where the ratio between the extended data at Daboase and the existing Data at Assin Praso was close enough to what was calculated for the known data. The results have been attached as Appendix F.

2.2.2 Langbien's Log Deviation Method

Langbien's Log Deviation Method (recommend by the Central Water Commission of India) uses the correlation between two sets of data to estimate the missing data in one of the data series. In Langbien's log deviation method, the relationship between the logs of the data rather than the data itself is used. This is to remove the skewness inherent in streamflow data. The correlation between two sets of data must be high before the method can be used in estimating the missing data.[12]

Langien's Log deviation Method is of the form shown below

$$Y = a + bX$$

Where Y and X are deviations of from the mean of the X and Y data.

$$\Sigma Y = aN + b\,\Sigma X$$

$$\Sigma XY = a\,\Sigma X + b\,\Sigma X^2$$

But $\Sigma X = \Sigma Y = 0$ since both X and Y are deviations from the mean

Therefore $a = 0$

And $b = (\Sigma XY)/(\Sigma X^2)$

The correlation coefficient r between the two sets of data is given by

$$R = (\Sigma XY)/(\Sigma X^2 \Sigma Y^2)^{0.5}$$

The steps in using this technique are as follows

1. Take the logarithms of the set of discharges for which some are missing.
2. Compute the mean of these discharges
3. Deduct the mean computed under step 2 from the logarithms of discharges under step 1 to give *Y*.
4. Repeat steps 1 to 3 for the concurrent data of the index data to give *X*
5. Compute A and R. If the correlation is two low, discontinue. If it is high enough go to step 6. (In the computations for missing data for this dissertation, all correlations below 8 were discarded.
6. Estimate the log-deviation for the set of discharges for which some is missing by multiplying the log deviation *X* of the index data by *b*.
7. Estimate the logarithms of the discharges at the station with the missing data by adding the mean of logarithms of station S to the log deviations computed under step 6.
8. Take the antilogarithms of the logarithms of discharges computed under step 7.

The flow available data at Daboase at is too scanty to be used for extension of data, however, the average of the ratios of the data at the two sites was found this was used as a guide for the available discharge for Power generation at Daboase.

2.3 <u>Discharge At The Four Selected Sites For Hydropower Studies</u>

Based on the data that was determined for these two sites, the discharges at the four selected sites for hydropower studies was determined by distributing the discharges between the four sites. This was done taking cognizance of the number of tributaries contributing flows to the river at the various locations.

The average ratio of the flow between the two locations is 2.57.

The discharge at the first site was therefore taken as twice that at Assin Praso

The discharge at the second site was taken as 2.2 times that at Assin Praso

The discharge at the third site was taken as 2.4 times that at Assin Praso.

The flow through the third power house is diverted into the third power house.

The discharges in the three cases are not significantly different. Therefore the discharges that will be used to harness hydropower will not cause any appreciable difference between the three sites hence the discharge at location one which is less than the other two has been used to plan all three power houses.

All preliminary studies that have been done in this dissertation work are for location 1.

The discharges for the three locations have been attached as Appendix G.

2.3 Estimation of Design Flood

Another important aspect of hydrologic studies is the estimation of design flood for designing hydraulic structures. The accuracy in estimating the design flood is important so as not to make the cost too high and also not to cause damage either to the structure or to downstream areas. The design flood is therefore fixed depending on the importance of the structure and the amount of damage its failure may cause. Guidelines of the Central Water Commission of the Government of India states that for barrages and minor dams, the standard Project flood (SPF) or a 100 year flood whichever is higher must be adopted. The standard project flood is defined as the discharge generated by the highest storm which is considered reasonably characteristic of the region in which the project basin lies.

It may be taken generally as the biggest storm which has occurred in the region of the basin during the period of available rainfall records.

For designing a spillway for a dam, the initial reservoir level before the impact of the design flood has to be taken as at full reservoir level.[15,17]

There are various methods available for estimation of the flood peak. These include:

- The Rational Method
- The Empirical Method
- Unit-hydrograph technique
- Flood frequency studies.

However for the purposes of this dissertation work, only runoff data and the size of catchment is available. Neither Rainfall data for the catchment nor catchment characteristics is available. Hence the only method that is possible for use is the Flood frequency method. The 'flood frequency method' is a statistical method of frequency analysis. The values of annual maximum floods from a given catchment constitute a hydrological series called the annual flood series. This set of maximum discharge data is arranged in decreasing order of magnitude and the probability of each event or exceeded (plotting position) is calculated by the plotting position given by formula[17]

$$P = m/(N + 1)$$

Where

m	=	order number of the event
N	=	total number of events in the data

T = recurrence interval, frequency or return period

= $1/P$

Among the methods usually used for frequency analysis are the following:

- Gumbel's extreme value distribution
- Log-Pearson Type III distribution.
- Log normal distribution.

The method adopted for this dissertation work is Gumbel's method.

Under this method, a flood is defined as the largest of 365 daily flows and the annual series of flood flows constitute a series of largest values of flows. Using the series of maximum flows, the design discharges is estimated as shown below. The design flood was calculated for the flow data available at Daboase.

Using Gumbel's method, the design is chosen as has been shown below

Table 2.1 Computation of Design Discharge

Order Number *m*	Flood discharge *x* (m^3/s)	T_p (years)
1	2160.84	28.00
2	2001.56	14.00
3	1643.72	9.33
4	1621.54	7.00
5	1223.32	5.60
6	1222.97	4.67
7	1216.21	4.00
8	1161.88	3.50
9	1139.69	3.11
10	1081.51	2.80
11	1043.42	2.55
12	1005.14	2.33
13	986.96	2.15
14	957.87	2.00
15	922.96	1.87
16	909.14	1.75
17	826.66	1.65
18	821.77	1.56
19	766.51	1.47
20	740.04	1.40
21	694.43	1.33
22	656.32	1.27
23	656.32	1.22
24	621.78	1.17
25	498.21	1.12
26	415.80	1.08
27	380.46	1.04

Average = 1013.96

Standard Deviation = 438.37

From Tables of reduced mean and standard deviation in Gumbel's extreme value distribution with sample size N=27

y_n = 0.5332

S_n = 1.1004

Choosing T= 10 years

$$y_T = -(\text{Ln.Ln}(T/(T-1))$$
$$= -(\text{Ln.Ln}(10/(9))$$
$$= 2.5037$$

$$K = (2.5307-0.5332)/(1.1004)$$
$$= 1.56$$

$$X_T = 1697.817$$

Choosing T= 5 years

$$y_T = -(\text{Ln.Ln}(5/(4))$$
$$= 1.49994$$

$$K = (1.49994-0.5332)/(1.1004)$$
$$= 0.878535$$

$$X_T = 1399.085$$

Choosing T= 20 years

$$y_T = -(\text{Ln.Ln}(20/19))$$
$$= 2.9702$$

$$K = (2.9702-0.5332)/(1.1004)$$
$$= 2.214649$$

$$X_T = 1984.793$$

A plot of these figures on a semi log scale shows that the distribution follows Gumbel's distribution.

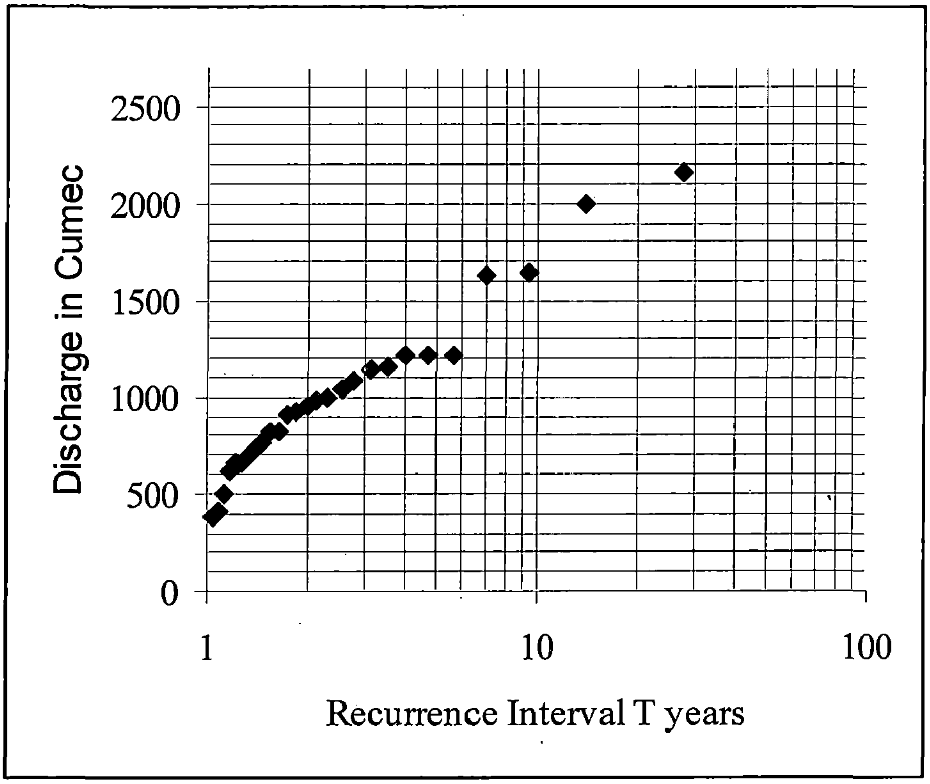


Fig 2.1 Flood probability analysis by Gumbel's distribution

Therefore at a Return Period of 100 years

$$y_T = -(\text{Ln.Ln}(100/99))$$
$$= 4.600149$$

$$K = (2.9702-0.5332)/(1.1004)$$
$$= 3.695883$$

$$X_T = 2634.117 m^3/s \text{ for Daboase}$$

<u>Confidence Interval</u>

Checking the confidence limit boundaries with a 90% probability

For a confidence Probability c, the confidence interval of the variate X_T is bounded by the values X_1 and X_2 given by

$X_T = X_T \pm f(c)\, S_e$

Probable error, $S_e = b\,(\sigma_{n-1})/(\sqrt{N})$

$b = \sqrt{(1 + 1.3K + 1.1K^2)}$

$b = 4.56$

$S_e = 385.04$

From the table of normal variates the value of the confidence probability function for a confidence probability of 90%= 1.645

Therefore for a confidence interval of 90%, the selected design flood falls between 3267.502 m^3/s and 2000.732 m^3/s.

CHAPTER THREE

POWER STUDIES

3.1 GENERAL

Estimation for hydropower generation involves three parameters: the discharge available, the head available and the efficiency of the turbine used to convert the waterpower to Electric Energy. The relationship between Discharge (m^3/s), Head (m) and Power (KW) in terms of efficiency of turbine (η) and acceleration due to gravity (g) is of the form

$$P = \eta \, x \, g \, x \, Q \, x \, H$$

There are generally two ways of harnessing water for generation of Hydropower: namely the storage scheme and run-of-the-river scheme. In storage schemes the water is stored, head is increased and power generated with a modified river discharge. In run of the river schemes, the natural discharge in the river, which varies vastly with time, is used to generate power.

Since the topography of the river does not permit storage projects, run-of-the-river projects are proposed. Hence the method used to estimate power potential of a run-of-the-river scheme is discussed in this chapter.

3.2 Flow Duration curves

The first step in harnessing the run of a river potential of a river is drawing a flow duration curve. This curve shows the relationship between the magnitude and frequency of daily, weekly or monthly discharge for a particular river basin. It shows the percentage of time that particular flows are equaled or exceeded over a historical period. The Flow Duration Curve provides a simple yet comprehensive graphical view of overall historical variability associated with stream flow in a river.

Flow duration curves are used to estimate power potential and thus the amount of energy that can be harnessed from a run of the river project. The discharges are arranged in descending order with rank (m) from 1 to N. where N is the total number of data available. The exceedence probability is got by Weibull's method (m/(n+1). Usually for power projects the planning is based on 90 % dependability. The flow duration curve is a complement of the cumulative distribution function of particular duration stream flows. Each value of discharge Q has a corresponding exceedence probability, p. A flow duration curve is thus a plot of Qp, the P^{th} percentile or percentile of daily stream flow versus exceedence probability p, where p is defined by[1]

$$p = 1 - P\{Q \leq q\}$$

$$p = 1 - F_Q(q)$$

The quantile Qp is a function of the observed stream flows, and since this function depends upon empirical observations, it is often termed the empirical quartile function.

For run of the river schemes, 10 daily discharges of any different dependability found by arranging the discharges of particular periods in descending order and ranked as previously stated using Weibull's method are used. A synthetic flow year can thus be formed having particular dependable runoffs in each 10 daily period. Such flow series, though does not correspond to any particular year, help in estimating power potentials. This approach was recommended Nigam.[15]

Brown[2] gave another method. According to Brown, a design discharge from streams with wide and erratic flow conditions can be chosen on the basis of economic consideration. The average discharge is calculated first. This average is usually far less than the maximum discharge which can be intercepted depending on the shape of the flow duration curve. Some amount of storage can lessen the difference between the two. Economics of Power generation shall be calculated considering the multiples of mean flow. The design discharge and installed capacity is usually chosen for the one that gives the minimum cost of unit generation.

According to Mosonyi[11], however, estimation of the total energy of a stream using the flow duration curve of 30 to 40 years hydrological data is the first step. This will be the total energy under the average year flow duration curve and will be the gross energy potential of the river assuming no significant change in head. Harnessing of this energy will not be techno economically feasible. Hence a reduction factor is applied. This reduction factor varies and is usually a percentage of the gross energy. The flatter the flow duration curve, the bigger the reduction factor. This reduction factor has been between 75 to 89% of the gross energy in many situations.

Like Brown, Mosonyi also suggested economic considerations as a basis of for the choice of technically utilizable power. Previously the practice was to use discharge that is available for 85 to 90 percent of the time. However, presently, in order to make greater use of available water, and therefore to generate more energy, the trend has been to shift towards shorter durations. Today, with better transmission facilities and grid connections, it has become economically feasible to go for the use of water available for about 34% if the time. Some projects in Europe are even making use of water that is available as low as 10% of the time. In Mosonyi's opinion therefore, based on economic consideration, the discharge chosen for installed capacity can be that which is available between 34 to 50 % of the time. Depending on the availability of a good grid connection and the energy needs of the consumers, this discharge can be chosen for as low as that available even 10% of the time.

3.2.1 Annual and Mean Flow Duration Curves

According to Vogel and Fennessey[22] drawing flow duration curves on an annual basis gives better results than flow duration curves that involves the entire period of flow. This is because the lower tail of flow duration curves that are used for energy estimates is highly sensitive to the particular period of the record. However mean annual flow duration curves that represent the exceedence probability in typical and hypothetical years are not influenced by the occurrence of extreme records which may be either extreme low flows or high floods which are not typical of the normal flow in the river. They however give a good enough estimate of the exceedence probabilities of the various flows in the river or stream. Vogel and Fennessey[22] suggested that flow duration curves can be drawn finding the mean or average of stream flow data of a particular period in the year for all the years under consideration. This mean flow data for the different periods can be used in drawing the Flow Duration Curve of a hypothetical year.

3.3 Energy Duration Curves

The amount of energy that can be generated by a particular project varies on a timely basis in the same way in which the head or discharge varies. For run of the river schemes where head is practically constant, the Flow Duration Curve follows the same shape as the energy duration curve. The energy duration curve is a curve that shows variability energy capable of being generated in terms of magnitude and frequency on daily, weekly or monthly basis. The relationship between the energy duration curve and the flow duration curve can be seen in the power equation

$$P = \eta \, x \, g \, x \, Q \, x \, H$$

Where the different symbols hold the same meaning and units as already stated.

Unlike the flow duration curve, the energy duration curve is affected by the varying efficiency as the discharge flowing through the turbine changes. Hence the efficiency should not be assumed to be constant but must be related to the flow and its bearing on the efficiency for the particular turbine. The efficiency also includes that of the generator and other operation characteristics.

Another difference between the flow duration curve and the energy duration curve is that whereas the flow duration curve has only a lower boundary of zero flow, the energy duration curve has both an upper and lower boundary depending on the operating range of the generating capacities for that particular design.

3.2.1 Flow And Energy Duration Curves Using Class Intervals

For purposes of calculating risks, it is important to draw flow and energy duration curves, using different confident intervals to show which of these intervals give the best estimate of energy that can be generated.

Annual Energy Duration Curves are developed using the concept of class intervals and their frequency for each individual year. To develop the mean annual Energy Duration

Curve, the mean percentage exceedence of each class interval (Cj) is calculated as show below:

$$\bar{C}j = \sum_{i=1}^{n} Cj$$

where

n = number of years of available records

Cj = Percent exceedence value of class interval j

j = Class interval number

With the class intervals on the vertical axis and the corresponding exceedence probabilities on the horizontal axis, the mean annual energy duration or flow duration curve as the case may be is drawn.

Once the appropriate annual Energy Duration Curve has been drawn, confidence limits about the mean annual Energy Duration Curves are determined. For this, the standard deviation of the annual exceedence probability for each class interval is found as shown below using expressions by Armstrong and Rossmiller[1]

$$Sj = [\sum_{i=1}^{n} (Cj - \bar{C}j)^2 / (n-1)]^{0.5}$$

Where

Sj = Standard deviation the J^{th} Class interval

The various confidence intervals are then calculated as was done for the design flood as shown above.

The introduction of class intervals is very helpful in cases where the amount of available data is very large such as in a situation with daily discharges of a large number of years.

In such cases the energy values can be separated into 20 to 30 well distributed class intervals. However when dealing with 10 daily flows, we have 36 data per year whilst class intervals concept leads to sixty classes for close approximation. In dealing with 10 daily discharges therefore the class interval concept leads to extended calculations without a very significant effect on the results. It has thus not been adopted in this study.

3.4 Design Discharge and Installed Capacity.

Installed Capacity is the power that can be generated by the design discharge at maximum efficiency.

The Design Discharge is however the maximum discharge capable of being utilized for energy generation at any site. In most run of the river schemes, the design discharge will not be the maximum flow available in the river. The choice of installed capacity and therefore design discharge is an economic consideration as discussed above. Choosing too high a design discharge could mean that for a greater part of the life of the project, many of the units will be idle leading to loss of revenue. Choosing too low a design discharge, however, could mean that discharge above the design discharge will go waste leading to loss of potential revenue. The choice of design discharge therefore is a balance between these two parameters as has already been pointed out by Mosonyi[11], Brown[2] and Nigam[15].

Firm Energy

This is the amount of energy available most of the time usually 90% of the time in hydropower projects and the energy produced above the firm energy for smaller periods is called the **Secondary Energy**. The graph of the firm energy with pondage is as shown below [5,7]

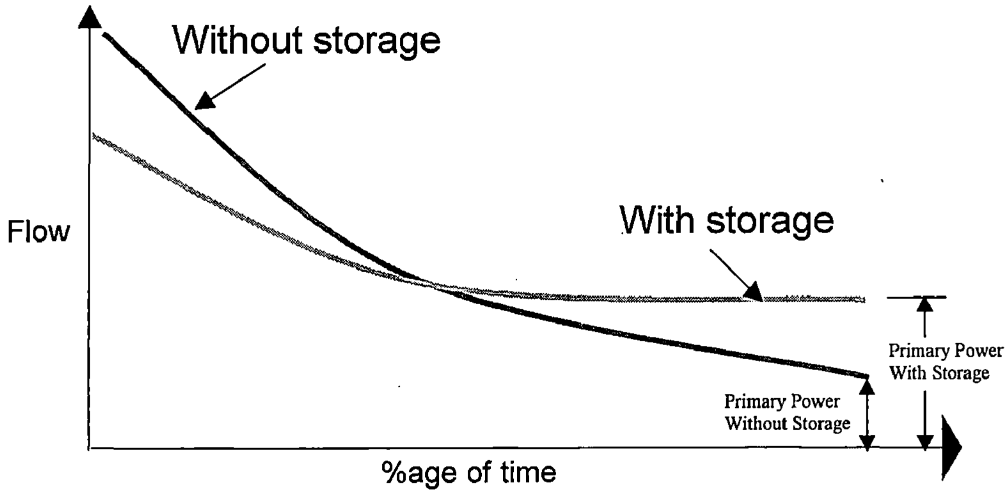


Fig. 3.1 Graph of flow duration curve with storage and without storage

Plant Load Factor

This is the ratio of the average load to the Peak load. If the Peak load is the installed capacity then the Plant load factor becomes the average load divided by the installed capacity. It is an indication of the percentage of time that the plant is made use of. The plant load factor is also called the Plant Use Factor.

Utilization Factor

The utilization factor is the ratio of the quantity of water actually utilized for power production to that available in the river. If the head is assumed to be constant, then the utilization factor will be equivalent to the ratio of power utilized to that available. The value of the utilization factor usually varies with from 0.4 to 0.9 for a hydel plant depending on the plant capacity, the load factor and the storage. Storage increases the utilization factor. If the load factor is very high and there is full pondage available at the plant, the utilization factor may go as high as unity.[7]

Storage raises the dry weather portion of the curve and lower the high flow portions. Thus it tends to equalize the flow at different times of the year.

3.5 Choice Of Turbine

Water turbines are the machines that convert hydraulic energy into mechanical energy. They are of two main types; the reaction turbines and the impulse turbine.

The impulse turbine generally uses the velocity of the water to move the runner and discharges to atmospheric pressure. The water stream hits each bucket on the runner. There is no suction on the down side of the turbine, and the water flows out the bottom of the turbine housing after hitting the runner. An impulse turbine is generally suitable for high head, low flow applications.

A reaction turbine however develops power from the combined action of pressure and moving water. The runner is placed directly in the water stream flowing over the blades rather than striking each individually. Reaction turbines are generally used for sites with lower head and higher flows than compared with the impulse turbines. The choice of which turbine to use for a particular site, depends generally on the hydraulic head available.

Different turbines have different operation ranges. Different turbines also have different efficiency characteristics. The efficiency also depends on the percentage of the design discharge that is flowing through it at a particular time. The efficiency is maximum at design discharge.

The choice of size of turbine or the number of such turbines necessary to harness the potential available in a run of the river project is a balance between the economic consideration and the minimum power generation in the year.

Bigger unit turbines are cheaper than many smaller units that can perform the same function. Also bigger turbines have a much better efficiency than a smaller one. However, there is a limit to the lower limit of discharge that particular turbines can work with. The Kaplan turbine for example can work up to even 40% of its design discharge as shown in the curve[2] below.

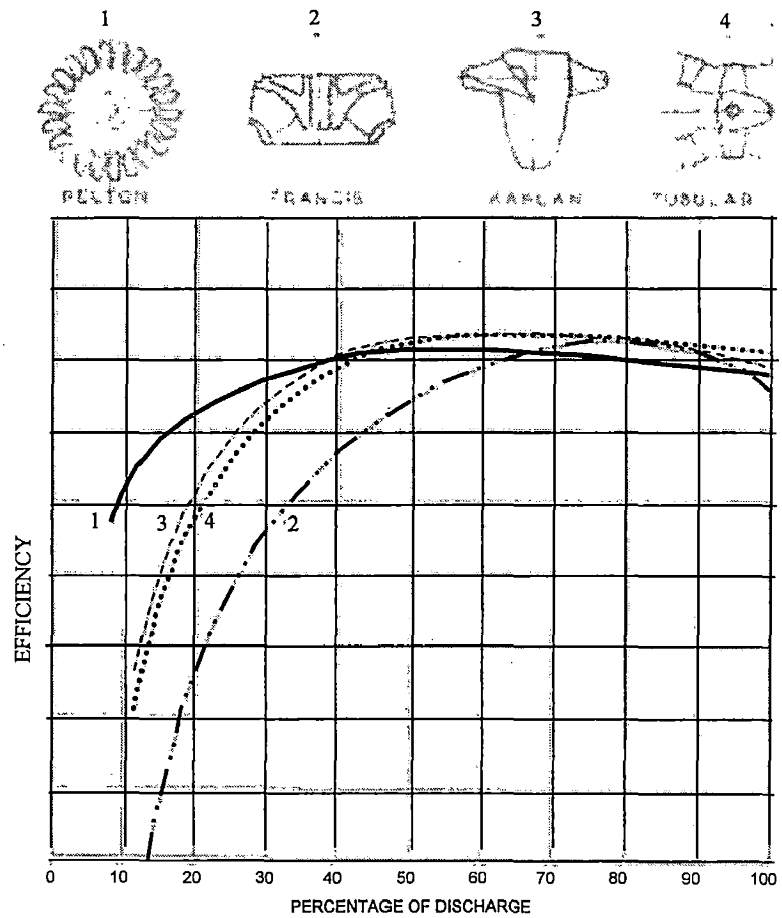


Fig. 3.2 Graph of Efficiency against percentage of Design discharge for various turbines

For this study, Kaplan turbine, a reaction turbine in which the blades are adjustable, allowing for a wider range of operation has been selected for the available head of around 15m. The efficiency of a Kaplan turbine is about 0.93

3.6 Choice Of Installed Capacity

As discussed above different methods of choosing installed capacity have been suggested by Mosonyi, Brown and. Nigam.

One method is to use the flow available in the 50% dependable year by arranging the flows for each 10-daily period and taking the year corresponding to the 50 percent dependable year. Based on these flows, unrestricted energy that can be generated is calculated. The amount of energy that can be generated in the entire year is calculated. A curve of power generated on the horizontal axis is drawn against a vertical axis of amount of energy that can be generated.

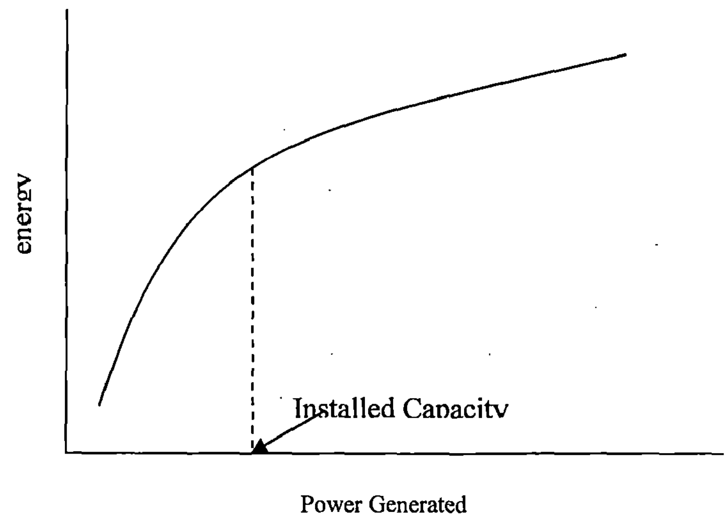


Fig 3.3 Graph of power generated with energy generation

The installed capacity is chosen as the point when the curve starts to assume a straight line. Alternatively a graph of incremental energy that can be gained with a unit increase in power generated is drawn against power generated. The installed capacity is chosen at a point where the graph sees a sharp change.

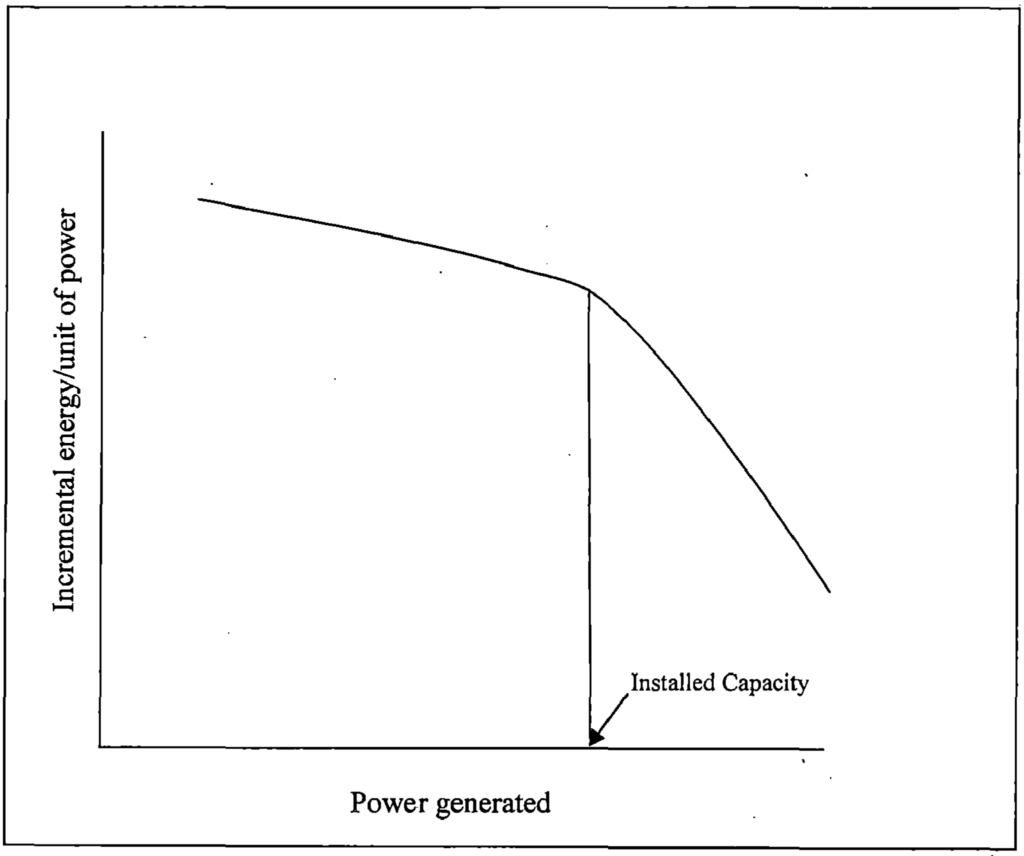


Fig. 3.4 Graph of incremental energy against installed capacity

Installed capacity may also be chosen on the basis of the minimum cost of generation. The ideal practice is to plot a graph of the cost of unit generation against different installed capacities and the capacity which gives the minimum cost of generation per unit is chosen as the installed capacity. This is depicted in the graph below.

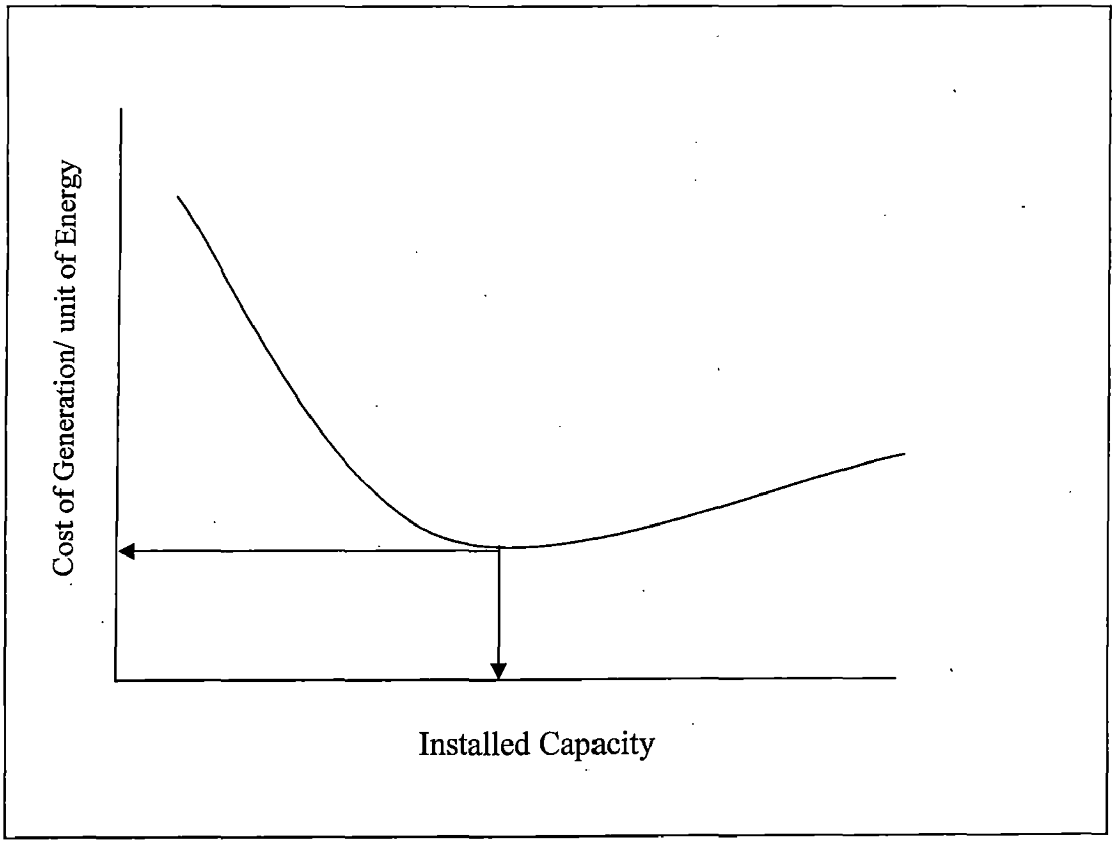


Fig 3.5 Graph showing choice of installed capacity on the basis of minimum generation cost

CHAPTER FOUR

LAYOUT OF SCHEMES AND THEIR SALIENT FEATURES

4.1 Factors Affecting The Layout Of The Project

Numerous factors determine the layout of a hydroelectric scheme among which are economic, environmental, geological, public safety and the structural safety of the hydropower structures. Usually, extensive topographical and geological surveys have to be conducted before choosing the proper layout that should satisfy all these factors that have been stated above. These have been followed to a large extent in planning the layout of this hydropower plan. However, this has been done based solely on data information gathered from the topographic maps of the river basin and not from actual ground surveys. Ground surveys have to be conducted therefore to augment the information gathered from these topographic maps.

4.1.1 Location of Barrage

The general lay out of the project can be seen from fig 4.1 below. The main deciding factor for the location of the barrage was the dual consideration for creating a head while minimizing possible submergence of the outlying areas. This is very important because submergence has social, economic and environmental factors. The proximity of natural forest and animal reserves to the project area significantly played a factor. Additionally, many communities live in the vicinity of the project area and will have to be resettled at high cost. The less the level of submergence therefore, the less will be the cost incurred in compensating and resettling inhabitants.

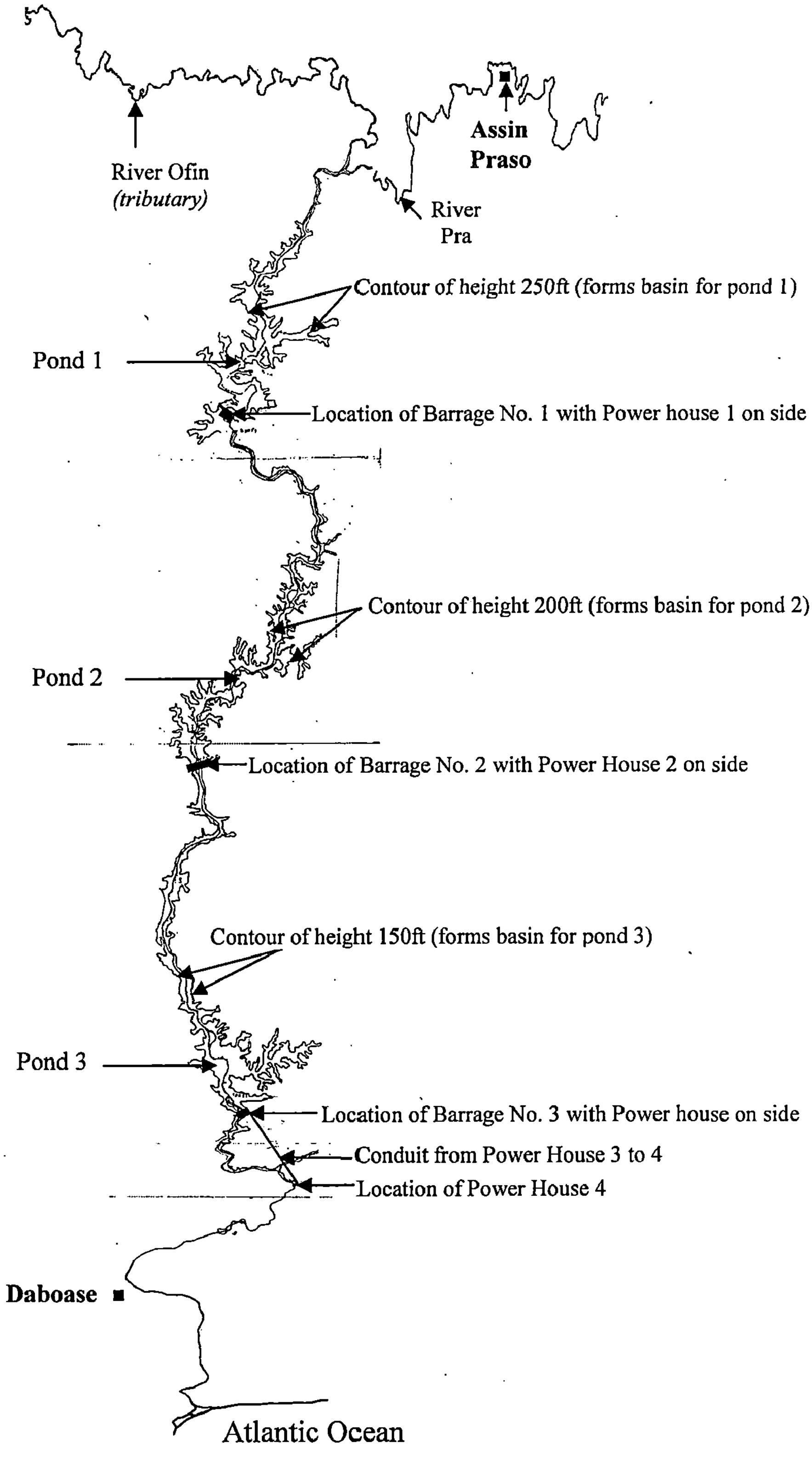
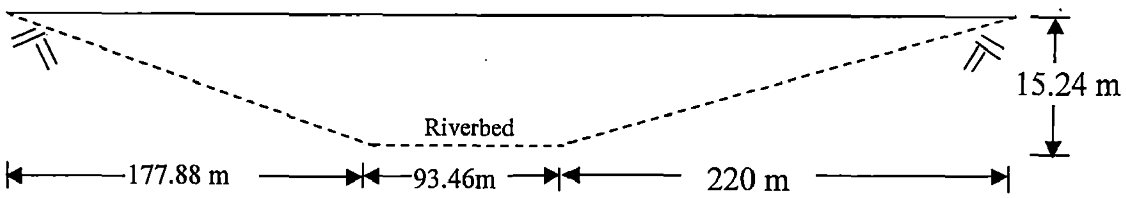


Fig 4.1 General Layout of Project

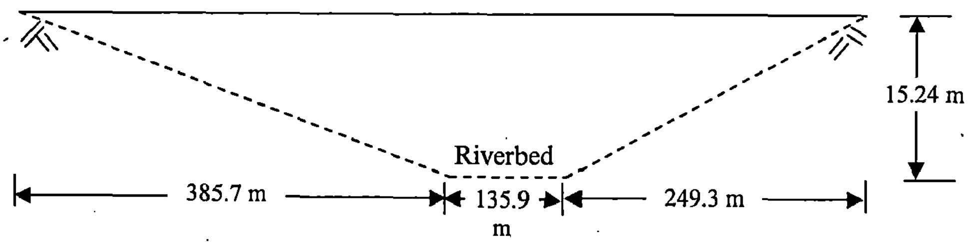
Another factor in deciding the location for a barrage is the length of the barrage axis which also has a cost component. Therefore the choice of the location of the barrage was taken as the location where the natural ground profile allowed for the minimum barrage length while creating the desired head and storage needed.

4.2 Layout Of Project

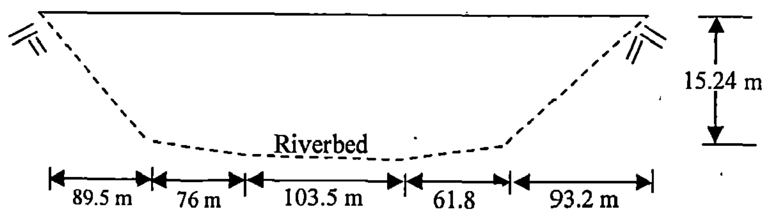
It is quite evident from the lengths and the slopes along the river that a standard run of the river scheme with a long head race channel cannot be adopted since a length of 30km for a head of 15m implies that the total head will be lost by the time the water reaches the power houses.



A Location of Barrage 1



B Location of Barrage 2



C Location of Barrage 3

Fig 4.2 Ground Cross sections at three barrage locations

However, even though the river basin is generally flat, the banks of the river are relatively steep and see a sharp rise a few kilometers from the riverbed. Therefore as can be seen from fig 4.2 there exists an adequate basin in the immediate vicinity of the river to allow for storage. It is therefore feasible to construct three barrages with about 15.34m ponding with a concrete intake block for the power house and earthen embankment after this concrete structure and another earthen embankment on the other side of each barrage across river Pra to hold water within the basin created by three respective contours (contours of elevation 100ft, 150ft and 200ft) across which the river flows to store water for a head of 15.24m for a run of the river scheme without submerging large areas. Power will be generated by diverting water into three respective powerhouses located at the toe of each of the barrage-dam combination. These three generation systems will be in cascade; hence the tail water of the upstream scheme will be released into the ponds of the downstream barrage. Additionally, water from the tail water of the last of these three powerhouses will be diverted through a 7.4km open channel having a slope of 1 in 7000 into a forebay for power generation in a fourth powerhouse. Further downstream, the release of the fourth powerhouse water will be channeled back into the river.

The storage provided in each of the three ponds is on an average adequate to store water for a day. Hence such storage systems though is classified as a run of the river scheme[7] is feasible to meet peak loads for a few hours in a day These will be run of the river schemes with pondage to run as peaking stations.

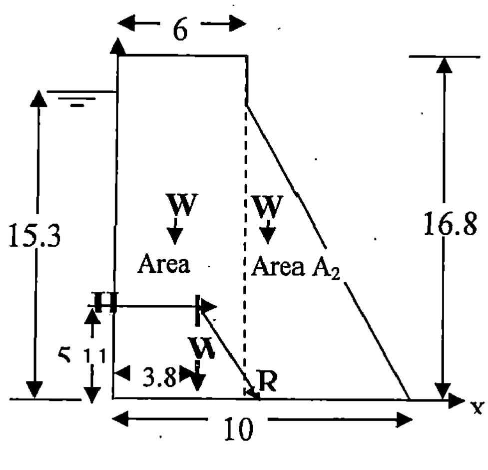
The choice of a barrage with the arrangement mentioned instead of a weir or small dam or a barrage is because of the problems of siltation and cost. With the relatively small height of the dam, there is a danger of siltation rendering the reservoir unusable in a relatively short time. The need for frequent flushing therefore necessitates a barrage. However, the long length required makes a barrage uneconomical. Hence the choice is made of a barrage in the main river section with a concrete dam on one side for power house block.

A concrete dam was chosen for the intake block instead of an earthen one because despite the relatively cheaper cost of an earth dam, it would require a long base which would lead to significant head loss in the penstocks that will pass through it. It is also not advisable to place a penstock through an earthen dam from safety considerations.

Dimensions of the small Concrete dam

The maximum height along any section of the concrete dam will be about 16.34m which would allow for a free board of about 1m. The top of the dam will be of width about 5m. The base width has been decided on stability basis such that the resultant of the hydrostatic pressure and the weight of the concrete will pass through the middle third of he base of the dam. Other stability analysis however can be done only after extensive investigation.

The computations to verify the stability of the structure based on the middle third rule is as shown below



The centroid of the dam shown above through which the resultant **R** of the weight of the dam **W** and the hydrostatic force **H** can be found as shown below.

If A is the total cross sectional area of the dam structure and A_1 and A_2 are the areas of the rectangular and triangular portions respectively, then the centroid of the dam along the horizontal axis can be.

Let x_i be the distance of the centroid of a particular portion along the horizontal.

Then $A*X = \sum Ai * Xi$

$X = [(6 * 16.84) * 3 + ½ (4 * 15.34) * (6 + 4/3)]/[(6*16.84+½(15.34*4]$

$= 4.01m$

Horizontal hydrostatic force **H** acting a third from the bottom $= ½ \gamma_w h_w^2$

$= 117.66m$

Weight of the self weight of the concrete acting through the centroid = 2.4 * A

$= 316.128$

The resultant $= \sqrt{(316.13^2 + 117.66^2)}$

$= 337.31$

Orientation of the resultant to the vertical $= \tan^{-1}(117.66/316.13)$

$= 20.41^o$

Distance along the base from point of action of resultant to point action of dam weight.

$= 5.11 * \tan 20.55$

$= 1.90m$

= 5.61m from vertical face of dam

This falls within the middle third the upper limit of which is 6.67m from vertical face of the dam.

The salient features of the envisaged scheme are as given below.

Table 4.1

Salient Features of Scheme		
Number of Barrages planned	3	
Number of Ponds envisaged	3	
Number of Head race tunnel	1	
Number of Power Houses	4	
Characteristics of Ponds		
Pond 1		
Area	30.9	km^2
Volume	157	Million m^3
Length of barrage with concrete intake block and earthen embankment	491.13	m
Width of river at barrage axis	93.46	m
Pond 2		
Area	25.3	km^2
Volume	129	Million m^3
Length of barrage with concrete intake block and earthen embankment	770	m
Length of portion of portion across the river	135.85	m
Pond 3		
Area	27.3	km^2
Volume	139	Million m^3
Length of barrage with concrete intake block and earthen embankment	423	m
Width of river at barrage axis	103.45	m
Length of head race tunnel from power house 3 to forebay of power house 4	7.4	km

4.3 Mode of Operation

4.3.1 Frequency of Sediment Flushing

Sediment has to be frequently flushed out of the pond. Flushing will be done during floods when the flood is released by opening the gates fully maintaining a minimum drawdown below which the intakes will be located. Frequent fortnightly flushing would be arranged such that the sediment deposition in front of intake does not come above the intake invert level.

Advantage of limited storage of water in a run of the river scheme.

The layout chosen for this project is primarily to create a head for power generation in this flat basin. However, it has the added advantage of providing storage for running power house as peaking stations during low flow periods.

4.4 Design Discharge and Installed Capacity

4.4.1 Choice Of Installed Capacity Based On 50% Dependable Synthetic Year

The various methods suggested by various experts for fixing installed capacity, have been discussed in chapter 2. The computations made for installed capacity in this method are given below.

The ten daily flow data at Assin Praso taken for the years 1965 to 1983 for which it was possible to determine the missing data comprehensively has been arranged in a descending order and the flow corresponding to the 50 % year has been taken. The ten daily flows in this synthetic year have been used with the net head (15m) and the operating efficiencies of the selected turbines to calculate the amount of energy that can be generated for different installed capacities. The tabulations has been attached in the appendix as Appendix H.

The annual energy that could be generated for each of the installed capacities has been determined by adding up the energy generated during each ten daily period. The computation for this has been added in the Appendix as Appendix 1

Table 4.2 Energy generation in 50% Dependable year with different installed capacities

Installed capacity (MW)	Energy (Million Units)	Incremental energy (MU)	Energy Generated/MW Inst. Cap. ($x10^6$)	Energy Increase/MW increase in Inst Cap	Plant Load Factor
10	79.00		7.90		0.91
15	108.30	29.30	6.79	5.15	0.84
20	132.64	24.34	6.63	6.15	0.77
25	154.82	22.19	6.19	4.44	0.72
30	175.54	20.72	5.85	4.14	0.68
35	192.75	17.21	5.51	3.44	0.64
40	207.50	14.75	5.19	2.95	0.60
45	219.81	12.31	4.88	2.46	0.57
50	229.01	9.21	4.58	1.84	0.53
55	234.98	5.97	4.27	1.19	0.49
60	237.30	2.32	3.96	0.46	0.46

The plant load factor was determined by dividing the energy generated for the entire year at the particular installed capacity by the amount of energy that could have been generated if the plant is run fully and continually at that installed capacity.

For example at an installed capacity of 10MW, the power generated is 76.15 million units.

If the plant is run at an installed capacity of 10MW continuously however the energy generated will be 87.6 million units.

Therefore the plant load factor = 76.15 / 87.6

The computations for this has been attached in the appendix as Appendix I

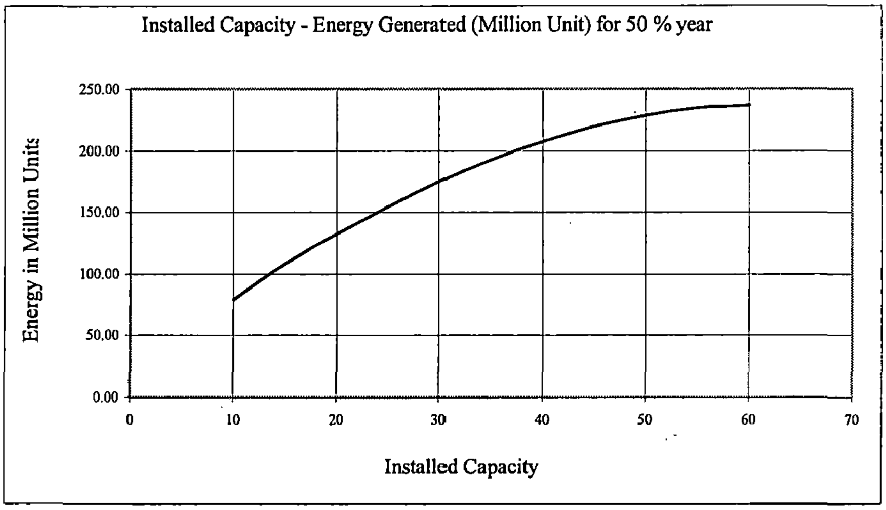


Fig 4.3 Installed Capacity and energy generated in 50% dependable year

Choice of installed capacity based on 10 years continues data

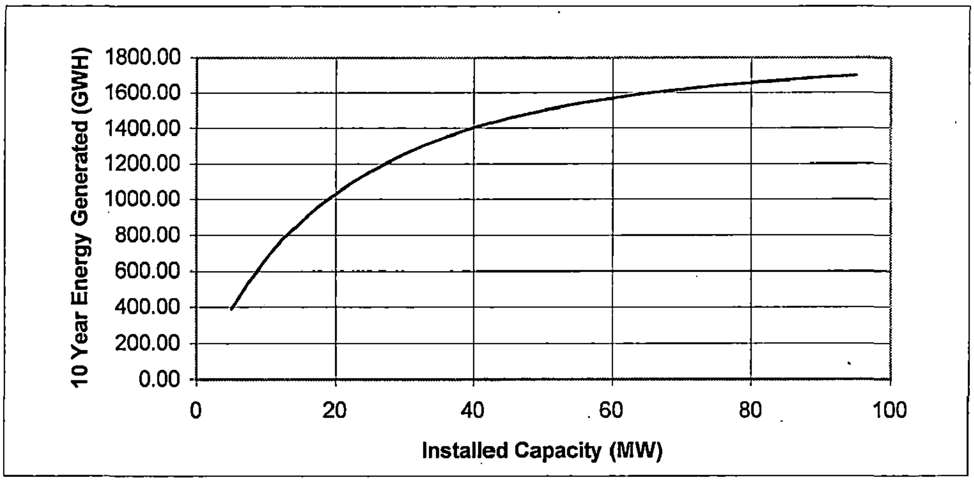


Fig 4.4 Different Installed Capacities and Energy Generated in a 10 year period 1978 to 1977

For this scheme, energy that could be generated from a 10-year continuous flow from 1968 to 1977 was also used. This was done by use of the 10 daily discharges available for each 10 daily period for each of the years from 1968 to 1977. The total amount of energy that could be harnessed over the 10-year period was calculated for different installed capacities and a graph of installed capacity against energy was drawn as shown below.

Table 4.3 Calculation of energy generation for 10 continuous years

Installed Capacity (MW)		5	10	15	20	25	30	35	40	45	50	55	60	Unrestrict
1968		39.77	70.38	98.25	125.48	151.88	177.93	202.94	226.94	249.88	270.28	290.32	308.98	54
1969		43.20	86.25	126.12	156.74	177.62	193.04	205.36	217.36	228.78	239.58	248.98	254.63	27
1970		43.20	78.98	102.74	118.88	131.46	142.41	151.12	158.39	164.87	168.21	170.11	171.18	17
1971		42.91	78.23	102.23	119.04	133.87	143.64	149.64	153.86	156.99	158.19	159.13	159.13	15
1972		41.17	71.58	93.97	111.37	122.59	128.11	131.31	133.71	136.11	138.51	140.91	143.31	14
1973	Energy	36.69	57.96	71.95	83.44	93.72	102.74	110.67	114.55	115.75	115.88	115.88	115.88	11
1974		36.39	57.73	71.72	83.21	93.49	102.51	110.44	114.32	115.52	115.65	115.65	115.65	11
1975		38.56	65.12	81.49	93.59	102.95	108.36	112.35	114.75	117.15	118.97	120.17	121.37	12
1976		38.68	59.43	73.51	83.82	90.17	94.97	99.77	104.21	106.61	107.84	109.04	110.24	11
1977		31.16	43.02	49.32	54.44	58.04	61.64	63.67	64.87	66.07	67.27	68.47	69.22	6
Total		391.73	668.67	871.29	1030.02	1155.78	1255.34	1337.27	1402.96	1457.73	1500.38	1538.66	1569.59	183
Extra Energy with 5MW increase			276.94	202.62	158.73	125.76	99.56	81.93	65.69	54.77	42.66	38.27	30.93	
Percentage increase in energy			70.70	30.30	18.22	12.21	8.61	6.53	4.91	3.90	2.93	2.55	2.01	

The computations for this are attached in the Appendix as Appendix J

Also Percent increase in energy that could be generated with an increase in installed capacity was calculated and the graph was drawn.

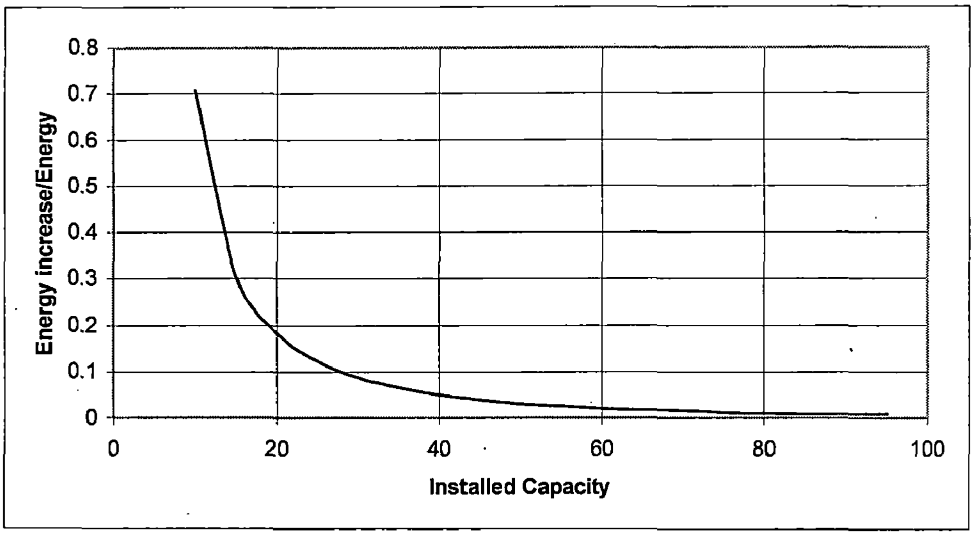


Fig 4.5 Graph showing Percent increase in Energy per 5MW increase in installed capacity

A graph of the plant load factor for different choice of installed Capacities was also drawn to ascertain the economic viability of the chosen installed capacity.

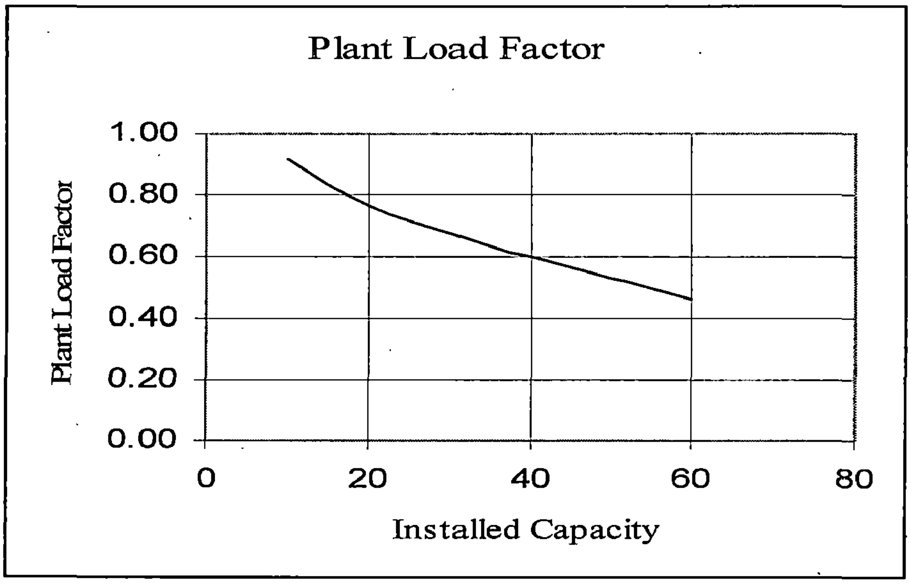


Fig 4.6 Graph of Plant Load Factor

An installed capacity of 30MW was chosen corresponding to an energy generation of 1255GWh over a 10 year period.

This installed capacity corresponds to a design discharge of 215 cumec, which subsequently corresponds to an exceedence probability of 30 and a plant load factor of 68% which is desirable.

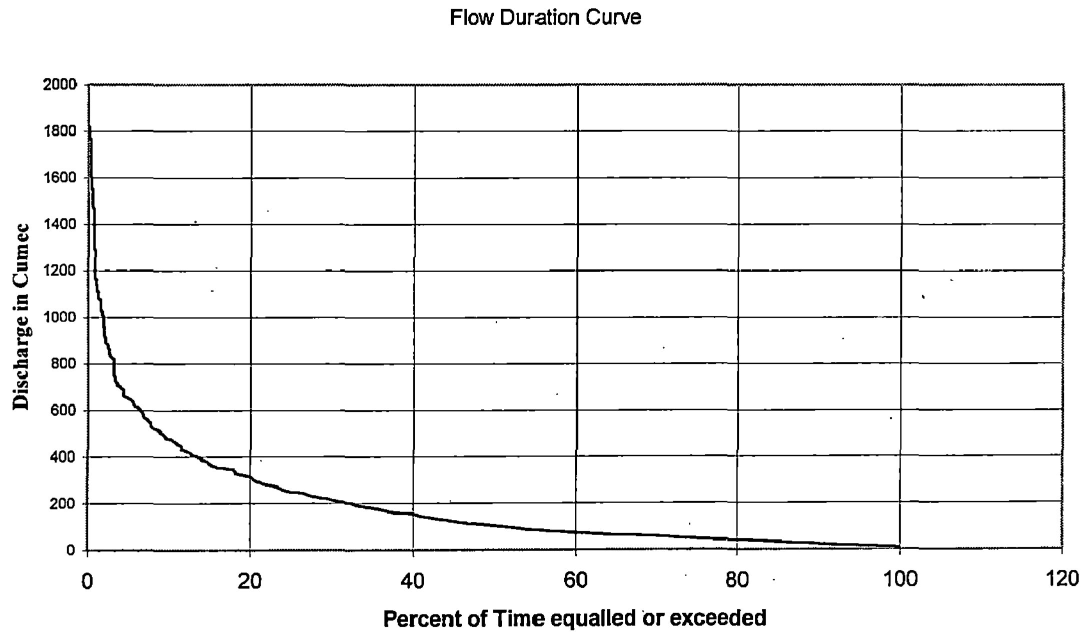


Fig 4.7 Flow Duration Curve

As can be seen from Appendix I, the chosen installed capacity implies that a total of 175.54 million units representing about 3.66% of the current firm energy 4800Gwh produced in the country can be produced by each of the power houses. The four power houses together can therefore produce 702.16 Gwh of electrical energy per year. This represents 14.63% of the total firm energy required in the country.

Energy higher than the modest 175.54 Gwh can be harnessed by choosing a higher installed capacity. However, that will come at a lower plant load factor which may imply that many generating units will lie ideal during the greater part of the year implying a higher production cost. Hence a conservative plant load factor of 68% was selected.

4.5 Number of Units in power house.

As already stated, the number of units should be a balance between the amount of energy that can be generated and the cost involved. The choice should ideally be chosen for that which gives the minimum generating cost. However, this analysis could not be carried out due to lack of information. The minimum size of unit was therefore decided such that one unit should be able to produce firm power and all units should be of equal size.

Flow for 90% exceedence probability (Firm Power)	=	35 m^3/s
Power available for 90% of the time	=	0.93 x 9.81 x 35 x 15.24
	=	4866.36822kw
	=	4.9MW
Number of Units	=	30/4.9
	=	6.12 =6units (approx)

CHAPTER FIVE

DIMENSIONING OF TYPICAL STRUCTURES OF THE SCHEME

5.1 Introduction

In this chapter, the preliminary dimensioning of some typical structures of the scheme have been worked out. This would help in the whole scheme when required. These structures are as below.

1. Barrage
2. Intake
3. Water Carrying Conduit
4. Forebay
5. Power House

5.2 Preliminary Dimensioning Of Barrage

Need for a barrage

Even though, silt or sediment data for the river was not available during the process of planning this scheme, there is a likelihood of siltation which will render the pond unusable in a relatively short time. There is therefore the need for frequent flushing.

A barrage has therefore been provided with a concrete intake block and earthen bunds on both sides of the two. The function of this barrage will be to impound water to create the needed head and also to allow for flushing of sediments. Hence, it will have radial gates placed between piers on a horizontal floor with crest at river bed. It will be designed to resist uplift, seepage and sliding. The flood discharge will be released by lifting the gates and allowing the flow to go downstream.

The general layout of the scheme at the location of the barrage is shown for barrage 1

Preliminary dimensioning of barrage at Pond 1.

The length of barrage span is usually calculated by the Lacey waterway criteria

$$= 4.83 \sqrt{Q}$$

However this gave a waterway of 247m. However from studies it is evident that the Lacey[21] water way is has even been kept to 0.25 times the Lacey water way for discharge intensities of even up to 65cumec/m

The length (L) of barrage opening for a flood of 2634.11 cumec

$$Q = 1.7\,LH^{3/2}$$

$$L = 25.79 \text{ m}$$

But for a broad crested barrage with flow concentration considered, the Length of the Barrage waterway is calculated by

$$Q = 1.705\,(L - 0.1n\,H)H^{3/2}$$

Where n is the number of end contractions

However this water way was seen to give a sheet pile depth of 28m below river bed which is not desired. Hence a sheet pile depth of 13 m was chosen and the water way provided accordingly.

With an overall water way L of 70m

Choosing five piers of thickness 2m

Select 3 bays.

Length of each bay = (80-8)/6

= 12 m

Sheet pile depth calculation

Average Discharge intensity of barrage (q) = Total Discharge/ Overall waterway.

=2634.11/80

=32.93 cumec

Assuming lacey's silt factor for alluvial soil = 1

Depth of scour (R) = $1.35\ (q^2/f)^{1/3}$

= 13.87m

Depth of upstream sheet pile = 1.2 x R

= 16.64m below HFL of 4m above riverbed level

= 12.64m below river bed level

Depth of downstream sheet pile = 1.3 x R

= 18.03m below HFL of 4m above riverbed level

= 14.03 below riverbed level

Length of barrage floor

Maintaining a safe exit gradient is very important for the stability of the structure from seepage considerations and also for piping. To safeguard against piping, the exit gradient must not be allowed to exceed a certain safe limit for the respective soils

Exit gradient is given by (1-n) (G-1)

Where

G is the specific gravity of the soil and

n is the porosity

It has been determined that for a standard floor of floor length b, with a vertical cut-off depth d, the exit gradient at its downstream end is given by the equation

$G_E = H/d \times 1/(\pi\sqrt{\lambda})$

Where $\lambda = [1 + \sqrt{(1+\alpha)}]/2$ and $\alpha = b/d$

Selecting a safe exit gradient of 1/6 for alluvial soils

$G_E = 15.34/28.5/3.14/\lambda$

$\lambda = 2.089$

$= [1 + \sqrt{(1+\alpha)}]/2$

$\alpha = \sqrt{[(2\lambda-1)^2 - 1]}$

$= 3.017$

$= b/d$

$b = 3.017 \times 14.03$

$= 42.32$ m

5.2.1 Energy Dissipators

When the gates are opened during floods and discharge is released, the energy in the flow has to be dissipated in order to prevent scour and havoc in the downstream reaches of the river.

The most appropriate type of energy dissipator for this type of structure is the stilling basin type[3]. The energy dissipator planned will make use of the hydraulic jump created to kill the energy in the water.

Hydraulic Jump (Standing Wave)

The hydraulic jump is defined as a phenomenon that is a distinct rise or jump of water accompanied by a great deal of turbulence. This phenomenon may occur when a shallow stream of water moving with a high velocity strikes a stream of water moving with a low velocity.[17]

The hydraulic jump can be used to destroy the kinetic energy and head in a fast moving stream to prevent scouring in downstream areas.

If H is the head in a moving head of water that has to be killed

D_1 the depth of a stream entering the standing wave.

D_2 the depth of the stream leaving the standing wave.

q the flow intensity

Then by use of the momentum equation which has not been gone into in this dissertation work since it is beyond the scope, we get

$$D_1 + D_2 = 2q^2 / (g \times D_1 \times D_2)$$

Similarly the Head loss can be found to be

$$H_L = (D_1 - D_2)^3 / (4 \times D_1 \times D_2)$$

Hence knowing the desired head loss and the flow concentration and assuming D_1, D_2 can be calculated. Using the values of D_1 and D_2 thus obtained the Head can be calculated. This goes on by trial and error until the appropriate head loss is obtained. This was carried out and the results shown below was obtained.

Table 4.1 Calculation of D_1 and D_2 of energy dissipater from Head loss

D_1	D_2	H_L
1.6	10.98191	11.74940705
1.5	11.41337	14.22651116
1.445	11.66769	15.84100603
1.446	11.66295	15.80981892
1.449	11.64875	15.71668449
1.461	11.59236	15.35045493
1.4615	11.59002	15.33541123

Hence a prejump depth of 1.4615m and post jump depth of 11.59m.

The Froude Number of this flow is $F = q/(g \times D_1^3)^{0.5}$

$= 5.95$

The type of stilling basin necessary for this type Froude Number is the Saint Anthony Falls (S.A.F.) stilling basin.

Length of Stilling Basin (L) $= 4.5 \times D_2/F^{0.6}$

$= 17.88$m

Height of Chute and Floor blocks $= D_1$

$= 1.46$ m

Width and Spacing of chute blocks $= 0.75\ D_1$

$= 1.1$m

Distance from upstream end of stilling basin to floor blocks $= L/3$

$= 5.96$ m

Minimum spacing of Floor blocks from side wall $= 3\ D_1/8$

$=0.578$m

Height of end sill $= 0.07\ D_2$

$= 0.8$

Depth of tail water above stilling basin floor $= (1.10 - F^2/120)D_2$

$= 9.33$ m

Height of sidewall of basin above maximum tail water depth $= D_2/3$

$= 3.86$m

The floor of the stilling basin will be depressed below the ground level by the depth of stilling basin below high flood depth minus the high flood depth.

$= 9.33 - 4$

$= 5.33$m

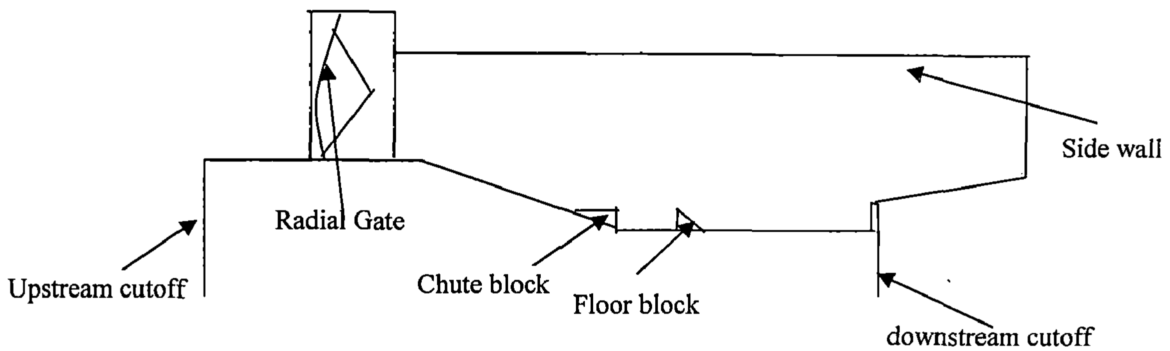
The glacis will be sloped 3 in 1 and will start 3 m from the end of the barrage pier.

Horizontal length of floor = 3 x 5.33

= 15.99m

The upstream length of the barrage floor will be kept at a nominal 7 m

The sidewalls of this depression will be protected against scouring. An un scaled sketch of the barrage and Stilling basing is shown below.



5.1 Sketch of Barrage floor and stilling basin

5.3 Intake Structure

To draw water from the pond created by the barrage and supply it to the hydropower turbines through the water conductor system, in the required quantity and quality, an intake structure is needed.

The choice of location of the intake structure depends upon:

5.3.1 Conditions For Location And Layout Of Intake Structure[20]

a) Type of development, that is, run-of-the river or storage dam project.

b) Location of power house with respect to the dam.

c) Type of water conductor system, that is, tunnel, canal or penstock.

d) Topographical features of area.

e) In cases where there is a considerable movement of boulders, stones and sand in the down stream direction, the intake should be arranged so that the effect of such movement will not lead to a partial restriction or blockage of the intake; in respect of storage reservoir intakes the sill level of the intake should be aimed to be kept above the sedimentation level at or near the dam face arrived at.

f) The intake can often be located so as to enable it to be constructed before the level of the reservoir is raised.

5.3.2 COMPONENTS OF THE INTAKE

Bell Mouth

This is provided to minimize head loss by ensuring a smooth flow of water into the conductor system.

Regulating Gate

This is to regulate the flow into the water conductor. It is also fitted with a stop logs or bulkhead or emergency gate.

Trash Rack

This is to prevent the entry of trash and floating debris

Sediment Exclusion Devices

In addition to choosing the optimum position for the intake to ensure the maximum removal of sediments, sediment exclusion devices are placed in the intake.

Design Requirements of Intake

The intake structure has to be designed for structural stability like any other gravity structure. It should be stable under worst combination of loads and forces including seismic forces while operating

I. Fully open

II. Partially open

III. Fully closed

It also has to be designed to meet operational requirements. The arrangement of the structures and the equipment should be such as to ensure reliable and reasonable quick operation. All the structures and equipments shall be easily approachable for inspection and repairs. There should be arrangement and space for storage and replacement of any equipment.

The intake structure should also be designed to meet hydraulic requirements such that the velocities through the trash rack, gates and other passages should be within economic and practical limits ensuring minimum losses.

Selection of Intake type for this scheme

The intake for the first three powerhouses upstream of the project shall be low head since the head is up to 15m. The intake structure shall be in the body of the dam and the gates of the intake shall be controlled from the top of the dam through a gate groove that runs vertically down though the dam.

Preliminary Dimensioning of Intake structure

To prevent vortices, the centre line of intake should be so located as to ensure submergence requirements

For small size intakes (i.e. $Fr = v/\sqrt{(gD)} > 1/3$)

$$Fr = 4/\sqrt{(9.81 \times 3.34)}$$

$$= 0.699$$

submergence depth, h can be found by $h/D = 0.5 + 2 \times Fr$

$$= 1.898$$

$$h = 6.34m$$

$$\text{Entrance opening height } (h_e) = h_1 + h_2$$

The penstock runs horizontally from the pond and then slopes Hence it is at an angle (Θ) of 0° to the horizontal as it exists the intake structure.

D is diameter of penstock equal 3.34

h_1 = [√(1.21 x tan2 ϴ + 0.0847) + 1/(2 x cos ϴ) – 1.10 x tan ϴ] x D.

= 2.64m

h_2 = [0.791/ cos ϴ + 0.077 x tan ϴ) x D

= 2.64m

h_e = 2.64 + 2.64

=5.28m

Intake opening area = Penstock area/(Cc x cos ϴ)

Where Cc is the coefficient of contraction for low dams = 0.7.

Opening area of intake = π x 3.34^2/(4 x 0.7 x cos 0)

= 12.52m

The opening area of the intake is generally taken to be rectangular to facilitate design and operation of gate.

Width of intake opening (b_e) = Area/ height

= 12.52/ 5.28

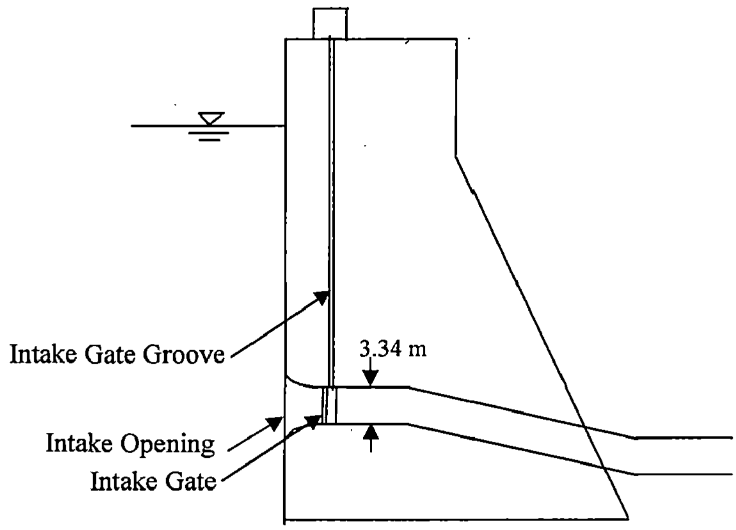
= 2.37m

The inlet should be streamlined to minimize the losses. The profile of the roof and floor should approximate to that of a jet from the horizontal slot. The profile is generally an ellipse given by the following equation:

$$x^2/(1.1 \times D)^2 + y^2/(0.291 \times D)^2 = 1$$

Profile of the sides should also follow the following equation

$$x^2/(0.55 \times b_e)^2 + y^2/(0.2143 \times b_e)^2 = 1$$



5.2 Intake Structure

Trashracks

Trash racks are very important since the entry of trash and floating debris into the generating units significantly lowers the amount of energy that can be generated by as much as 15%. The used of trash racks coupled with frequent raking is thus very important.

The head for which to design the trash rack is significant because designing for too high a head increases the cost of the intake structure whilst designing for a small head makes the structure unsafe. According to Creager and Justin[6,19] for low head developments in warm climates a maximum head of 1.5 to 1.8m of water can be used. Mosonyi has also suggested a head of 1 to 2m. A head of 2m will be adopted in designing the trash rack for this project.

The type of trash rack selected owing to the submergence is trash rack type 1

Permissible Velocities

To eliminate eddies and vortices, Mosonyi has recommended an entrance velocity into trash rack of[1]

$V = 0.075 \times \sqrt{(2 \times g \times H)}$ Where H is the head from centreline of gate to normal water surface.

Choosing an intake level at 6.34m below water surface the permissible velocity is 0.74m/s.

By USBR standards a permissible velocity of 0.6 to 1.5 cumec can be chosen.

A permissible velocity of 0.74 cumec through trash racks will thus be adopted.

$V = 0.74 m/s$

Clear spacing between trash rack bars will be taken as 1/30 of runner diameter, which comes to about 90mm. The screens will have a spacing of 90mm.

Screen spacing = 90mm

Distance of the trash rack from the intake gate.

$= 0.8 \times h_e$

$= 0.8 \times 5.28$

$= 4.22m$

From curves given by Davis[8,19] with a choice of bar thickness of 12mm for type 1 trash rack, unsupported length of bar has been taken as 80cm.

For the fourth Powerhouse downstream, water for power generation will be taken from the forebay into which the tail water from the third powerhouse will be discharged. It will therefore have the forebay type of intake.

This type of intake is located in the forebay. The penstocks then take water from the forebay into the powerhouse located below at a lower level. The general layout of this type of intake is shown in section 5.5

5.4 Water Conveying Structure From Third Powerhouse To Forebay Of Fourth Power House

As previously discussed, the fourth Powerhouse downstream will draw water from a forebay into which water will be conveyed from the tail water of the third powerhouse. This water will be conveyed through an open channel. The level of water in the channel will rise or fall depending on the number of units running in power house Number 3.

In other to get the maximum head for power generation down stream, this pipe will run at a very low slope of 1 in 7000.

The dimensions of the trapezoidal channel will be adopted as shown below.

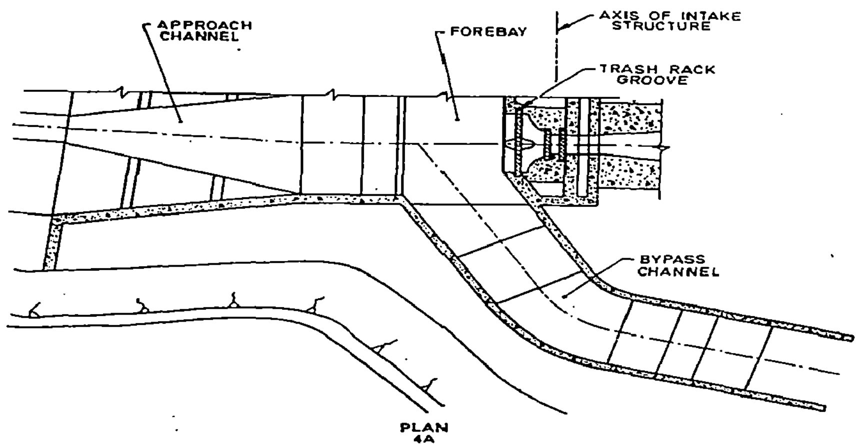
Initial velocity in the channel will adopted as 5m/s.

Cross sectional area required	=	43 sq m
Depth	=	5 m
Top Width	=	11
Bottom width	=	6.2

Hence a trapezoidal line channel of depth 5m, top width 11m and bottom width 6.2m shall be adopted for the 7.4 km channel

5.5 Forebay Type Of Intake

PLAN



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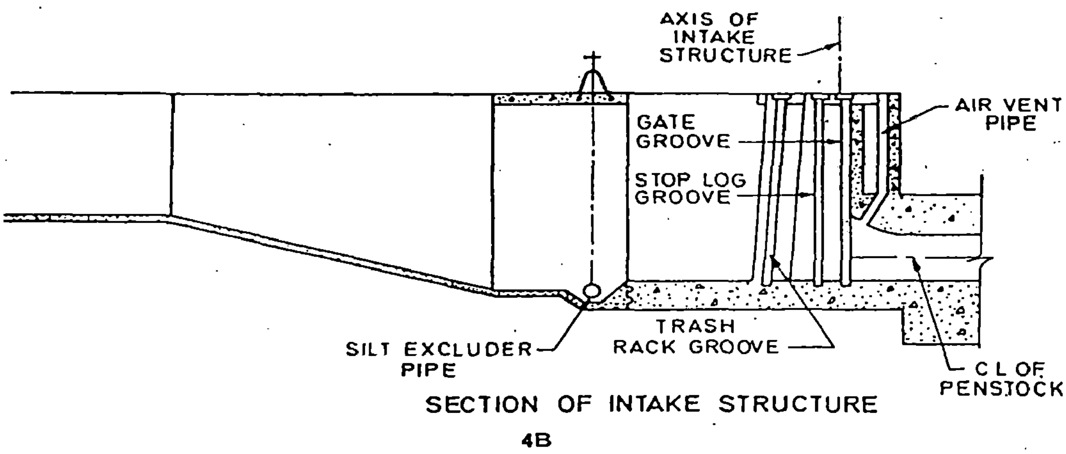

Fig 5.3 Forebay type of Intake

The slope of the penstocks for the fourth power house shall be the same as that of the first three. This is so as to maintain the same depth of intake centre line below water level and thus maintain the same permissible velocity from the formula given by Mosonyi. The distance of the intake from the power house shall also be the same owing to the need to maintain stability for the concrete embankment of the forebay.

Intake opening shall be as for the three previous forebays.

Height of intake opening (h_e) =5.28m

Width of intake opening (b_e) = 2.71m

The trash racks shall also be adopted as what was adopted for the first three schemes

Preliminary Dimensioning Of The Forebay For Powerhouse Number 4

Forebays act as a balancing reservoir and take water through penstocks for power generation in a powerhouse. The forebay also acts as a temporary storage for water in the event of load rejection by the turbine and as an immediate source when load is increased Owing to the long length of pipe from the reservoir to powerhouse Number 4, a forebay will be provided at the tail end of the water conveying structure. One penstock will exit the forebay and branch into six before entering the powerhouse. The intake for this penstock shall be the forebay intake as has already been stated. The storage needed in the forebay will therefore be for a 2-minute duration.

There are various ways of creating a forebay that includes:

- Widening the tail end of the water conveying structure into a small basin.
- Erection of a small dam across a natural channel along the water conveying structure.
- Excavation of the tail end of the channel to create the basin.

The type chosen for this forebay considering the ground profile seen through the topographic maps is the third option, which is the excavation to create the basin. The inside of the excavated forebay will be lined with concrete.

The installations in the forebay include

1. Entrance bay or basin
2. Spillway
3. Flushing sluice
4. Screens
5. Valve Chamber or gate chamber
6. Conduit or penstock inlet.

Discharge	=	215 cumec
Storage	=	2 minutes
Volume	=	215 x 60 x 2
	=	25800 m^3
Depth	=	13 m
Length	=	65m
Width	=	30.5m
Freeboard	=	0.5m

The forebay depth was chosen to account for a height of 8m above intake opening centre line, the height h_2 = 3.21m discussed in section 5.3.2 and the minimum clearance of $0.3h_e$ = 1.605m required for the approach apron.

The length of the forebay is in cognisance with the distance between the two furthermost units in the power house.

Since there are 6 units in the power house, there shall be 6 intakes in the forebay. The downstream end of the forebay shall have the same dimensions as the concrete dam of the first three power houses

5.6 Preliminary Dimensioning of Power House Number 1

5.6.1 Net Head

To determine the net head on a turbine, head loss through penstock has to be worked out and deducted from gross head. Head loss in Penstock is given by the Darcy Weisbach equation[15,20,23]

$$h_f = (f L V^2)/(2gD)$$

Where f is the friction coefficient

L is the length of Penstock

V is the velocity of flow in the pipe or conduit

g is acceleration due to gravity

D diameter of pipe

V is maintained at 4m/s, L is maintained at 10m and D is 3.34m and f for a still pipe is determined to be 0.092

The head loss was calculated to be 0.22m

Since the length of penstock is small in the three powerhouses, the losses are neglected and the total head is taken as the net head

5.6.2 Turbine and Generator Parameters

For the head of 15.34m, Kaplan turbine is selected

(i) Ns = $(1475)/H^{1/3}$ for Kaplan turbines[20]

= 598.1 rpm

(ii) Turbine Speed = Ns $(H)^{5/4}/\sqrt{P}$ where P is power in horsepower

= 220 rpm

According to Doland[15,20] if the head is expected to vary less than 10%, the number of poles is taken as lower multiples of four.

Number of poles selected = 28

Synchronous Speed (N) = 120 x Frequency/No of poles

= 120 x 50/28

= 214 rpm

Hence turbine speed will be = 214 rpm

Ns = $N \times \sqrt{P}/(H)^{5/4}$ = $214 \times \sqrt{6423.14}/(15)^{5/4}$

= 581 rpm (corrected specific speed)

(iii) Runner Discharge Diameter

The peripheral coefficient

To determine the runner discharge diameter, determination of the peripheral coefficient (Ø) is required. The peripheral coefficient is the ratio of the peripheral speed at a nominal inlet diameter to the theoretical sprouting velocity of water under the head acting on the turbine.

According to P.C. Nag and Madhvan[13,20]

Ø	=	$0.0252\ Ns^{2/3}$	for adjustable blade Kaplan turbine
	=	1.755	
Diameter of runner	=	$84.6 \times Ø \times \sqrt{H}/N$	Mosonyi[11]
	=	$84.6 \times 1.755 \times \sqrt{15}/214$	
	=	2.69m	

Spiral Case Dimensions

The dimensions of the Spiral case have been given by Curves[15,20]. It can be determined as per the curves shown below. And has been calculated as shown on the next page.

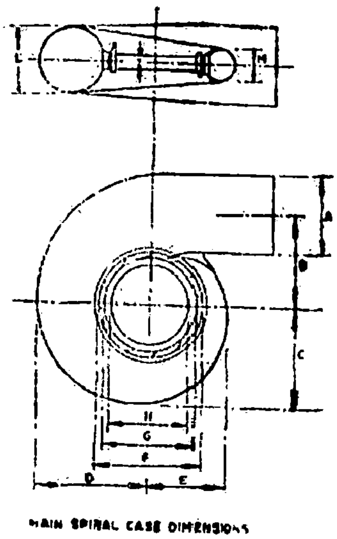

Fig 5.4 a Curve for selecting draft tube dimensions

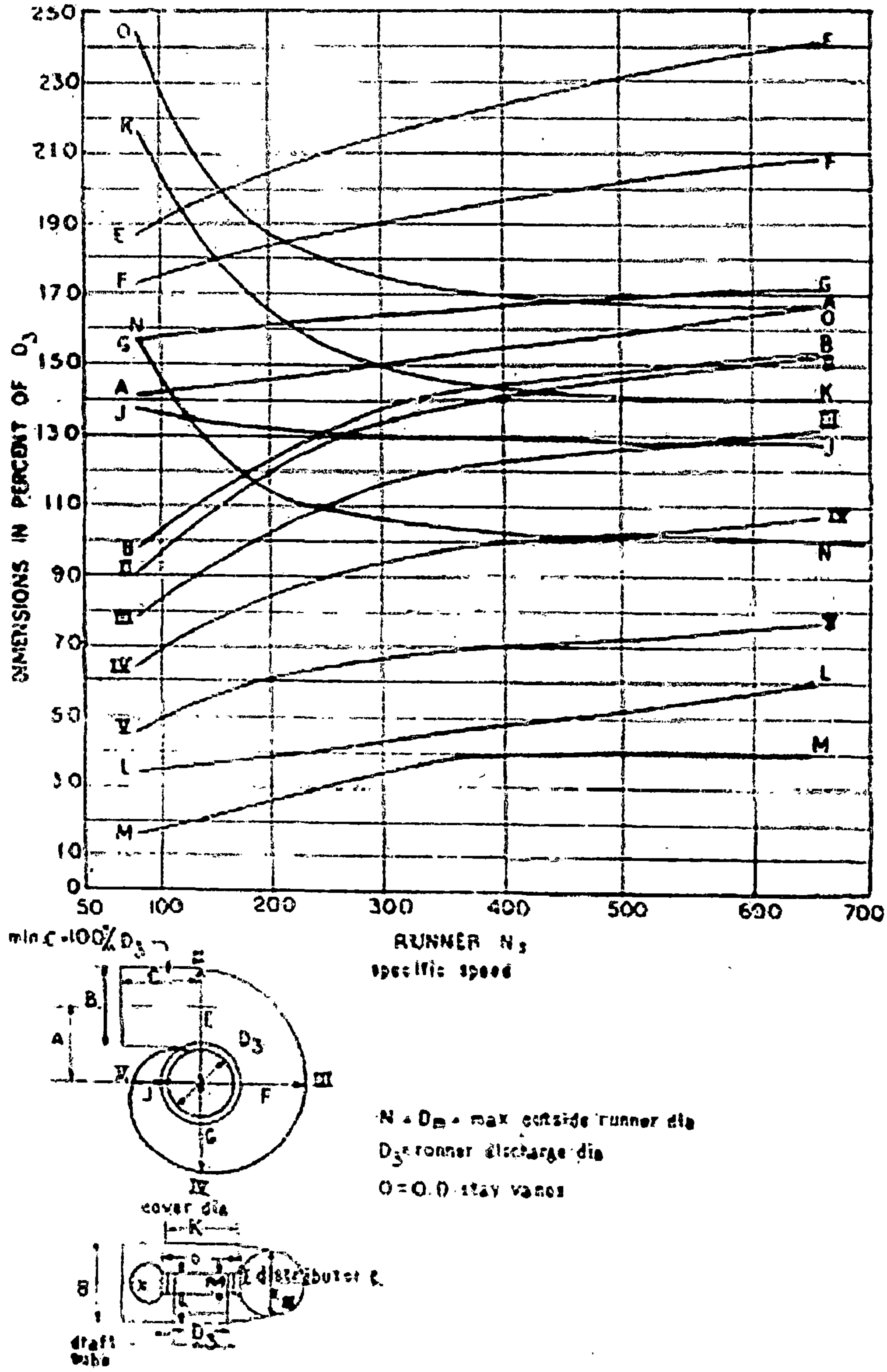

Fig 5.4 b Curve for selecting Draft Tube Dimensions

Dimensions of Spiral Case

A	=	D_3 (1.20 - 19.56/Ns)	=	3.07 m
B	=	D_3 (1.10 + 54.80/Ns)	=	3.16m
C	=	D_3 (1.32 + 49.25/Ns)	=	3.69 m
D	=	D_3 (1.50 + 48.80/Ns)	=	4.26 m
E	=	D_3 (0.98 + 63.60/Ns)	=	2.93 m
F	=	D_3 (1.00 + 131.4/Ns)	=	3.29 m
G	=	D_3 (0.89 + 96.50/Ns)	=	2.84 m
H	=	D_3 (0.79 + 81.75/Ns)	=	2.50 m
I	=	D_3 (0.10 + 0.00065Ns)	=	1.28 m
L	=	D_3 (0.88 + 0.00049Ns)	=	3.13 m
M	=	D_3 (0.60 + 0.000015Ns)	=	1.64m

(v) Draft tube Dimensions

Since the discharge Diameter of runner is greater than 2m, the draft tube should have two splitter walls and three openings. However in this case only one splitter wall has been provided since the runner diameter is not significantly more than 2m .

Total width of exit of draft tube	=	3.724 x D_3	=	10m
Provide two piers each of thickness	=	0.58 x D_3	=	1.6m
Width of each opening	=	1.572 x D_3	=	4.3m
Centre of runner to start of pier	=	1.35 x D_3	=	3.55m
Centre of runner to end of draft tube	=	3.80 x D_3	=	10m
Height of Draft tube opening	=	1.005 x D_3	=	2.88 m

Inner height of Draft tube at bottom	=	$0.0674 \times D_3$	=	1.81 m
Runner exit to bottom	=	$2.5 \times D_3$	=	6.73 m

(vi) Generator Diameter[16]

Generator Diameter (m) = $0.119 \times P_N^{0.466} \times K^{0.233}$

Generator Diameter (in) = $4.68 \times P_N^{0.466} \times K^{0.233}$

Where Pn = Number of poles

K = capacity of generator in KVA

The conversion from Kilowatts to Kilovolt Amperes involves the power factor that is the ratio of the active to the reactive power in the circuit. Power factor equals unity (1) when the voltage and current are in phase, and is zero when the current leads or lags the voltage by 90 degrees.

Selecting a power factor of 0.95

K = Power in KW /0.95 = 5041.8

Generator Diameter = 4.1m

According to B.H.E.L. practice[15] the main dimensions of the generator depends on the air-gap diameter D_i and the active length of the core. By referring curves of speed and output MVA (Megavolt amperes), the outer core diameter can is taken from curves. That has been selected as 3m for a synchronous speed of 214 and a 5MVA

Outer length of the core D_a $= D_i (1 + \pi / P_N)$

$= 3(1 + 3.14/28)$

$= 3.3m$

Stator frame diameter (D_f) $= D_a + 1.2$

$= 4.5$

Inner diameter of Generator Barrel $= D_f + 2$

$= 6.5m$

The outer core of the generator barrel is got by adding for 1m of concrete

Outer Core $= 6.5 + 1$

$= 7.5m$

Generator Height (Hg)[20] = K(Dg/Np) + 2.3 where this K varies from 5.5 to 12.5

Choosing a value of 5.5

= 3.3m

The Generator has a diameter of 4.1 and a height of 3.3m.

The outer diameter of the generator barrel is 7.5m

The bottom of Generator shall be 1.5m above the top of scroll case.

5.6.3 Unit Spacing

The Unit Spacing was adopted by plotting all the relevant structures including draft tube, scroll case and generator barrel. Using this, the total unit spacing was calculated.

Unit Spacing $= 1.5 + 10.025$

$= 11.525$

This falls in line with the overall spacing given by P.C Nag and K. Madhavan in Hydropower structures by R. S. Varshney[13,20]

Erection bay

An erection bay of Length	= Length of Unit Bay has been chosen.
Length of Erection bay	= 11.525m
Overall Length of Power House	= 11.525 x 7
	= 80.67 m say 81m

Crane Span

Similarly the Crane Span has been taken as 12m after adding all structures and leaving allowances for panels.

Gantry Column and Valve Chamber

Gantry Columns of size 0.5m by 0.5m has been planned. A valve chamber of 3.07m by 1.0 m has also been provided at the junction of the penstock and spiral case entry.

Control Room

The Control room of width 5m and height 3m has been selected. It has been placed upstream of the powerhouse above the penstocks entering the Powerhouse.[20]

Transformer Bay

A transformer bay of width 2m has been provided downstream of powerhouse above the extended portion of the draft tube.

5.6.4 Height of Powerhouse from roof to Generator floor level

(i) Turbine Setting

Cavitation is a big problem in the operation of hydropower turbines especially high head turbines. Finding a proper setting for the turbine allows for a minimum water seal above the discharge opening of the draft tube in order that they may be no aeration inside that may impair the efficiency of the draft tube. The centre line of the distributor is thus fixed at an elevation to prevent this aeration problem and thus cavitation. There is the possibility of the formation of negative pressures and the formation of bubbles if the velocity of the jet is very high and the turbine is too high.

The setting of the turbine is to solve these problems and is of the form.

$Hs = ha - H\sigma - Hv$

Where Hs is the section Head

Ha is the atmospheric pressure taken as 10m

σ is the Thomas cavitation coefficient.

Hv is the velocity head.

H is the Head of water available

$\sigma = [1.1(0.28 + (1/7.5)(Ns/445)^3]$ for Kaplan turbine[20]

$= 0.605$

Neglecting velocity head

Hs = 0.925

Therefore the exit of runner shall be 0.925m above the tail water.

Height of Generator floor level above the tail water level

= Turbine setting height + Half diameter of scroll case + Clearance between scroll case and bottom of Generator + Height of Generator

= 0.925 + 3.13/2 + 1.5 + 3.3

= 7.29m

(ii) Turbine Shaft

Having a single shaft for both the rotor and the runner and using the umbrella type of arrangement in which the thrust bearing is below the generator barrel has the advantage of lowering the height of the powerhouse considerably. This arrangement will be adopted in this powerhouse. This will make it possible to save cost and design a more stable structure.

Height of shaft of runner = Generator Height + clearance between top of scroll case and bottom of generator flame + ½ max height of scroll case

= 3.3 + 1.5 + 3.13/2

= 6.37m

Total Height of Powerhouse = Crane Cabin Height + 0.5m clearance + hook height

+ 1m + height of runner shaft + 1/2m clearance

= 2 + 0.5 + 1 +1 +6.37 + 0.5

= 11.37m

Crane height above Generator floor

The height of crane above generator floor level has therefore been taken as 8.87m

The General layout of the scheme are given in the figures below

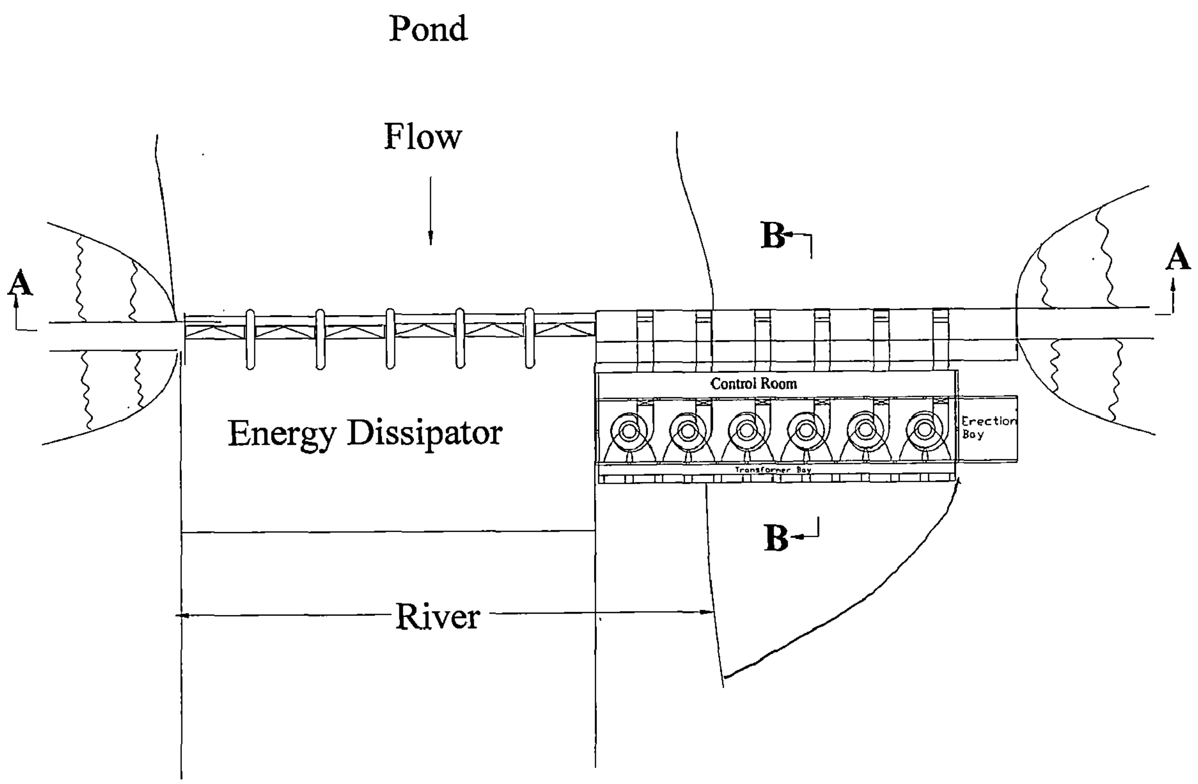

Fig 5.5 General Layout of Scheme 1

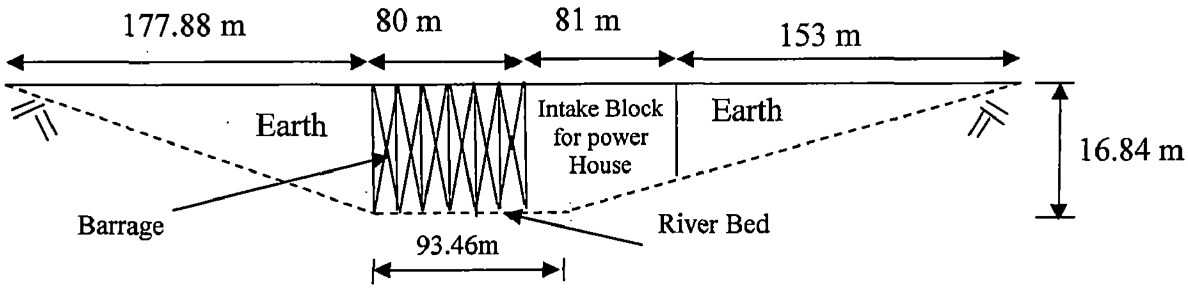

Fig 5.6 Section A-A Ground Profile and relative position of the different structures along the axis of Barrage 1

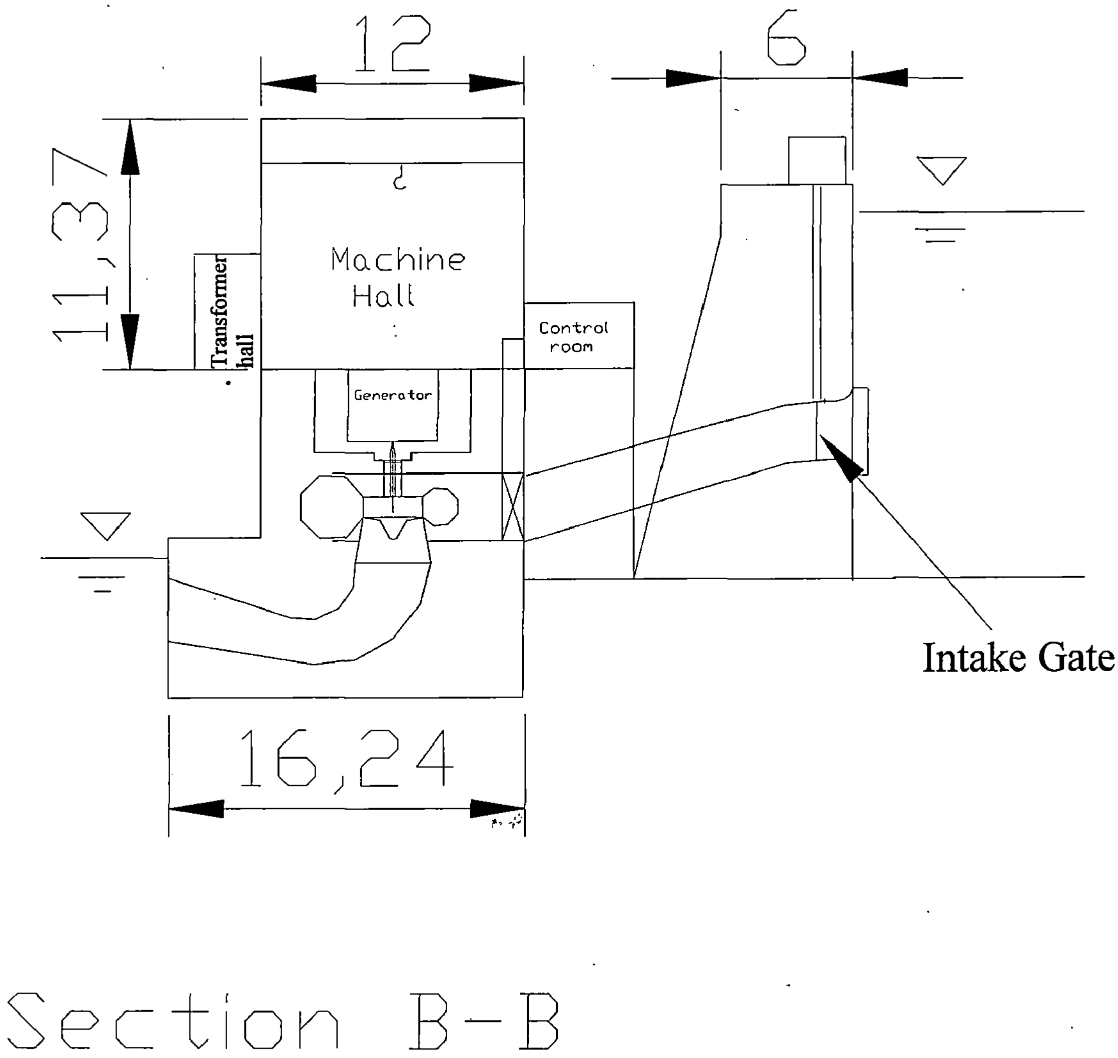

Fig 5.7 Section showing intake block and Power house elevation

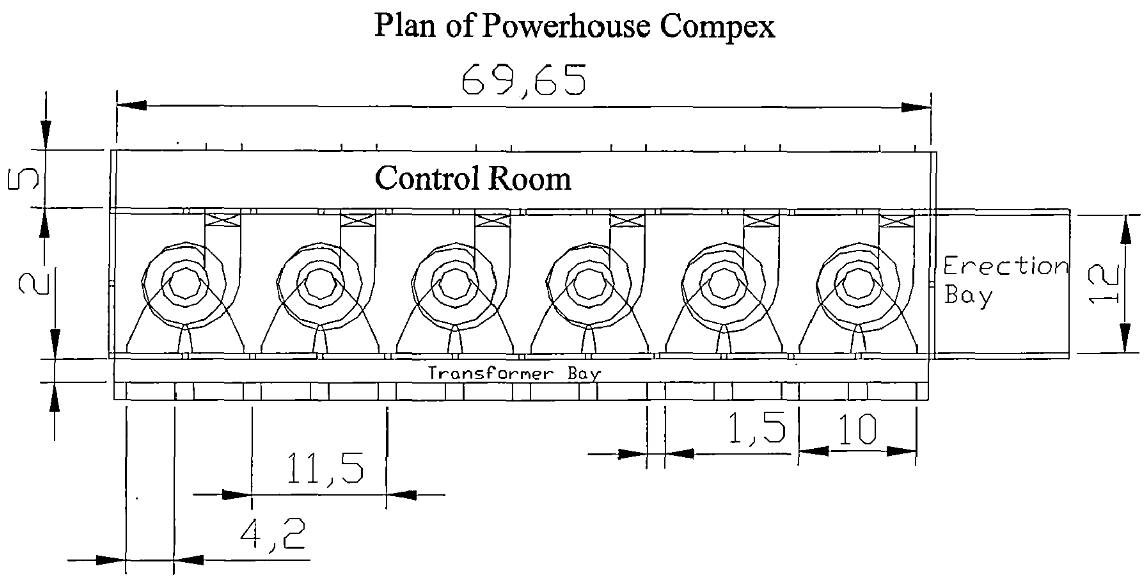

Fig 5.8 Plan of Power House Complex

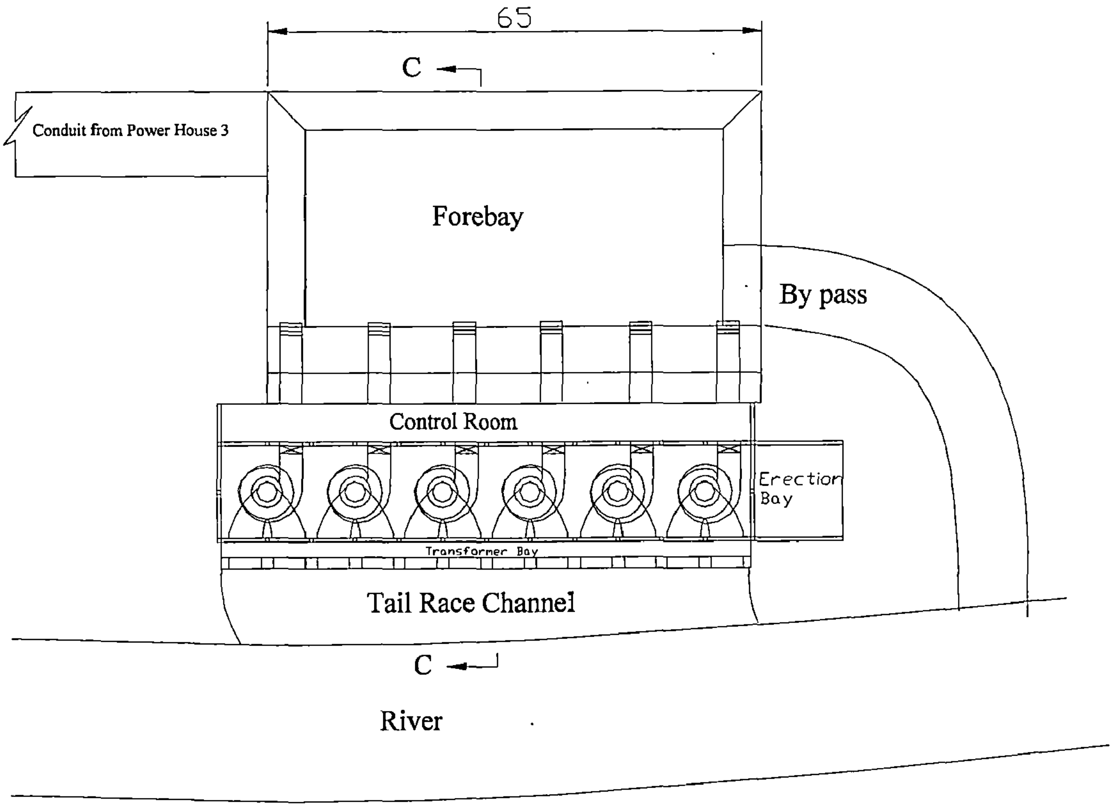

Fig. 5.9 Plan of General layout of Powerhouse and Forebay

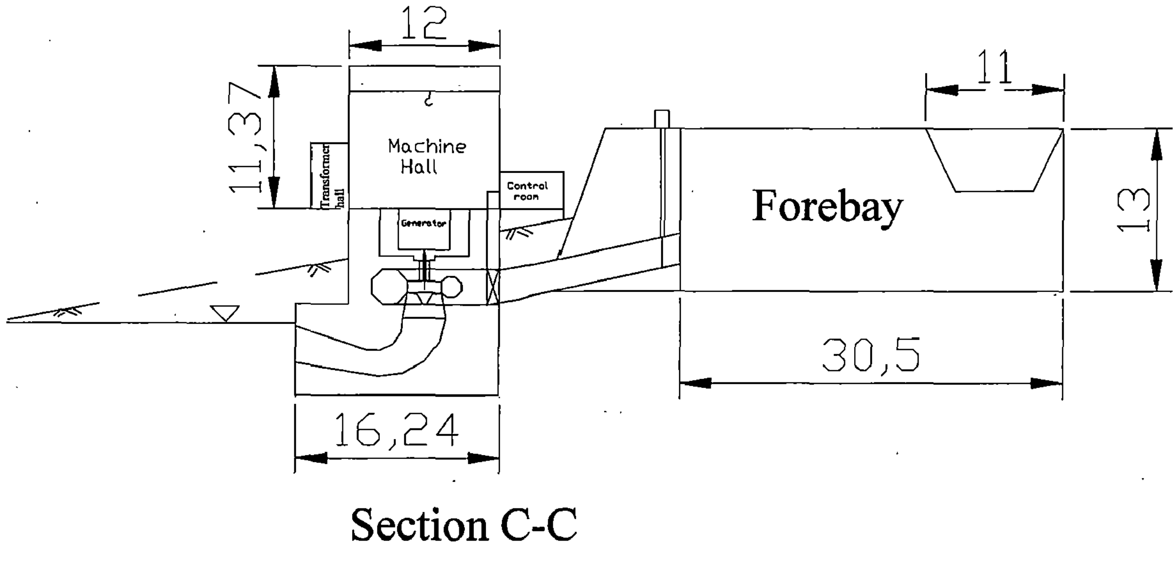

Fig 5.10 Section Through Power house 4 and Forebay

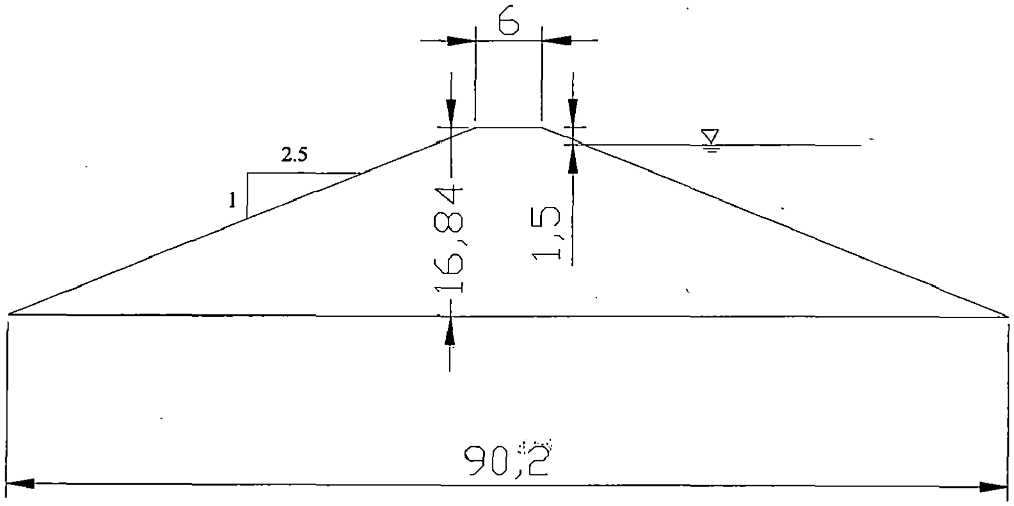

Fig 5.11 Section of the earth portion of the structure barrage-dam and earth combination

CHAPTER 6

ENVIRONMENTAL STUDIES

6.1 Need for Environmental Impact Assessment

The work planned so far is based on studies made from topographic maps of the river basin, from river flow data and other available reports.

A study of the topographic maps available shows the existence of forest reserves in various portions. Additionally, marshlands exist in the lower reaches of the river and within portions of the areas that will be submerged. Many communities live along the river. These situations and the possible environmental impacts are some of the determining factors for the choice of location of barrages and powerhouses and possible areas of submergence. Additionally it determined the amount of water that has to be released into the river as river maintenance flow when water is diverted into the tunnel for power generation in the fourth powerhouse.

The environmental impacts of the planned project on the community have to be looked at in the impacts it will create during construction and the possible impacts during operation.

6.2 Environmental Impacts of the Project

(i) During construction

- The effect of the planned development on the panoramic and visual aesthetic nature of the basin.

- The effect of extensive construction activities in the area on subsoil water regime and recharging capacity.
- Effect of runoff from the unprotected excavated burrow pits and muck disposal sites on soil erosion and sediment concentration in the river.
- The effect of increased sediment levels in the river on light penetration and thus, the photosynthetic activity and productivity of flora and fauna.

(ii) During operation

- Effect of either storage or diversion on the diversity of flora and fauna in the river basin.
- The effect of the proposed plan on the established livelihood and lifestyles of communities living in the river basin and the possible remedies.

6.3 Environmental Flows

Environmental flow is the water regime provided within a river to maintain ecosystems and their benefits where there are competing water uses and where flows are regulated. Failure to maintain such flows may lead to decline in the health of water dependent ecosystem.

Environmental flows provide critical contributions to river health, economic development and poverty alleviation.

Environmental flows are required to meet human and animal needs and to protect some valued features like aquatic animals, riparian vegetation, aesthetics, recreational and cultural features.

6.3.1 Methodology For Assessment Of Environmental Flows

The assessment of environmental flows involves hydrological studies, ecological studies and an integration of both.

The hydrologic studies involves

- Identification of the critical reaches, usually these are in the initial downstream reach of the diversion structure.
- Characterization of the river bed and bank features at sample locations (hydrologic and biotic terms
- Estimation of the average discharges and temperatures on ten daily basis during lean season at sample locations and the corresponding wetted perimeter, depth, velocity of flow, X-sectional area, and river bed slope.
- Assessment of the water quality (increased temperature, oxygen depletion, chemical contaminants)

The ecologic studies on the other hand involves

- Identification of the major species (flora and fauna) in the affected river reach and their habitat preferences in terms of water depth, flow velocity, water temperature etc.
- Assessment of the change in water depth, water velocity and riverbed features change with changing flow and thus their changing suitability for the chosen species i.e. linkage between survival of aquatic species and the flow in the river at different times

- Quantification of the degradation of habitat structure: sedimentation, lack of deep pools, altered distribution of constrained and unconstrained channel reach
- Quantification of degradation of food source (energy), altered supply of organic material in terms of lack of woody debris in river bed due to destruction of riparian vegetation and damage to river banks

There is also an Integration of Hydrological and Ecological Study which include

- Ascertaining the adequacy of existing flow regime at each section in different lean season months to meet habitat requirement of chosen species
- Specification of critical reaches and quantification of degradation in water quality, habitat structure, flow regime and food source (energy)
- Ascertaining the flow requirements to conserve habitats in critical reaches
- Ascertaining the flow requirements for flushing of silt deposits in critical reaches.
- Trade off analysis between modifications in flow regime required to help in restoration of channel and loss of benefits due to reduced power generation

The above aspects have to be required to be examined in detail when the field data and other relevant information is available.

CHAPTER SEVEN

7.1 CONCLUSIONS

- Though the basin of River Pra is relatively very flat, it is possible to generate adequate electrical energy by planning small ponds along the river by constructing high head barrages.
- The amount of energy that can be generated at a plant load factor of 68% will meet about 15% of Ghana's current firm energy. And about the 58% of the projected energy shortfall that will occur in 2010.
- The 702 Gwh of energy that can be produced in an average year in the Pra Basin is higher than the 613.14Gwh currently thermally generated in the country.
- Energy that is currently lost in transmitting energy over long distances can be saved by the provision of a hydropower source in the Pra Basin of South West Ghana.

7.2 Suggestions for Further Work

The development of the Pra River for hydropower generation is feasible and should be studied in detail with required field data and information.

The feasibility of the scheme should also be examined in respect of environmental aspects.

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APPENDIX A

Daily flow data of River Pra Taken at Assin Praso

Date	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
01-Jan		12.65	m	21.37	0	21.37	m	m	26.83	21.96	31.36	31.36	87.76	33.99	39.51	30.06	19.07	15.76	15.76	17.94	19.07	8.83	19.64	23.77	27.48	31.36	39.51	m
02-Jan		12.65	m	11.66	0	21.37	m	m	37.41	24.37	30.06	30.06	82.47	23.77	35.35	30.06	16.84	15.76	15.76	16.84	15.76	7.952	22.56	23.77	27.48	30.06	38.12	m
03-Jan		12.65	m	11.66	9.622	21.37	m	m	37.41	33.99	30.06	30.06	84.22	22.56	45.25	30.06	14.69	15.76	15.76	15.76	14.69	7.103	24.4	23.77	27.48	28.75	38.12	m
04-Jan		12.65	m	20.21	8.83	19.07	m	m	30.06	29.4	26.21	26.21	96.81	22.56	77.26	30.06	14.69	15.76	15.76	14.69	14.69	7.103	16.84	22.56	27.48	28.75	38.12	m
05-Jan		12.65	m	20.21	14.69	16.84	m	m	34.67	29.4	26.21	26.21	123.6	26.21	68.8	21.37	14.69	15.76	15.76	14.69	14.18	7.103	14.69	21.37	27.48	27.48	36.73	m
06-Jan		12.65	m	20.21	33.99	15.23	m	m	43.61	32.66	23.77	23.77	131.6	30.06	43.78	30.06	13.67	14.69	14.69	13.67	15.76	6.283	13.67	26.21	26.21	24.99	36.73	m
07-Jan		12.65	m	19.07	40.92	14.18	m	m	54.34	25.58	21.37	21.37	121.5	30.06	33.99	21.37	13.67	13.67	13.67	13.67	16.84	6.283	11.66	21.96	26.21	23.77	36.73	m
08-Jan		12.65	m	19.07	46.72	11.18	m	m	70.47	23.77	21.37	21.37	91.35	30.06	31.36	17.94	13.67	13.67	13.67	12.65	16.84	6.283	10.7	26.21	26.21	22.56	33.99	m
09-Jan		11.91	m	19.07	48.11	9.424	m	m	59.06	12.14	21.37	21.37	96.81	28.75	28.75	16.84	12.65	14.69	14.69	12.65	15.76	6.283	9.764	26.21	26.21	22.56	32.66	m
10-Jan		11.66	m	17.94	54.34	7.952	m	m	40.21	21.96	21.37	21.37	100.6	27.48	26.21	16.84	10.7	14.69	14.69	12.65	15.76	6.283	9.764	24.99	26.21	19.07	32.66	m
11-Jan		10.7	m	17.94	62.23	7.952	m	m	51.99	21.37	19.07	19.07	108.1	27.48	26.21	16.84	10.7	13.67	13.67	12.65	14.69	6.283	9.764	23.77	26.21	19.07	31.36	m
12-Jan		10.7	m	16.84	49.72	6.283	m	m	71.29	17.94	19.07	19.07	98.65	27.48	25.58	16.84	9.764	13.67	13.67	12.65	12.65	6.283	8.83	23.77	24.99	19.07	31.36	m
13-Jan		8.83	m	16.84	63.85	5.462	m	m	63.17	16.81	19.07	19.07	98.65	33.99	26.21	16.84	9.764	13.67	13.67	10.7	12.17	6.283	8.83	22.56	24.99	19.07	31.36	m
14-Jan		4.698	m	15.76	63.85	4.698	m	m	51.22	13.53	19.07	20.21	57.48	38.12	24.99	15.76	8.83	13.67	13.67	10.7	10.7	6.283	9.764	22.56	24.99	17.94	28.75	m
15-Jan		2.038	m	14.69	54.34	3.962	m	m	40.92	13.53	19.07	21.37	57.48	40.92	31.36	15.76	8.83	12.65	12.65	10.7	10.7	5.462	9.764	22.56	24.99	16.84	28.75	m
16-Jan		1.472	m	14.69	48.11	3.283	m	m	21.96	13.16	20.21	26.21	55.89	33.99	23.77	15.76	8.83	11.66	11.66	10.7	9.764	5.462	9.764	20.21	23.77	16.84	28.75	m
17-Jan		1.472	m	13.67	40.92	3.283	m	m	29.32	15.23	21.37	26.21	54.34	31.36	22.56	16.84	8.83	10.7	10.7	10.7	9.764	5.462	10.7	20.21	23.77	15.76	27.48	m
18-Jan		0.538	m	13.67	31.36	3.283	m	m	40.92	18.51	27.48	21.37	52.78	31.36	22.56	16.84	8.83	10.7	10.7	10.27	9.764	5.462	10.7	19.07	23.77	15.76	27.48	m
19-Jan		0.198	m	11.66	11.66	3.283	m	m	54.34	19.07	26.49	20.21	52.78	30.06	21.37	16.84	7.952	9.764	9.764	9.764	8.83	5.462	10.7	17.94	21.37	14.69	28.75	m
20-Jan		4.698	m	10.7	17.94	3.283	m	m	63.02	19.07	21.37	17.94	54.34	28.75	20.21	14.69	7.952	9.764	9.764	8.83	8.83	5.462	10.7	17.94	21.37	14.69	31.36	m
21-Jan		21.37	m	9.764	16.84	3.283	m	m	46.72	14.69	20.21	15.76	55.89	27.48	20.21	13.67	7.103	9.764	9.764	8.83	8.83	5.462	10.7	16.84	26.21	13.67	31.36	m
22-Jan		23.77	m	3.283	12.65	3.283	m	m	26.21	15.76	17.94	12.65	55.89	27.48	19.07	12.65	7.103	8.83	8.83	8.83	8.83	5.462	10.7	16.84	26.21	13.67	31.36	m
23-Jan		35.35	m	11.66	5.462	3.283	m	m	10.22	18.51	15.76	11.83	55.89	26.21	19.07	12.65	6.283	8.83	8.83	7.952	7.952	5.462	9.764	15.76	26.21	13.67	30.06	m
24-Jan		40.92	m	13.67	5.462	3.283	m	m	5.858	21.37	14.69	10.7	49.72	26.21	20.21	12.65	6.283	7.952	7.952	7.103	7.952	4.698	8.83	16.84	19.07	12.65	30.06	m
25-Jan		21.37	m	15.76	1.472	3.283	m	m	3.622	21.37	14.69	10.7	55.89	24.99	20.21	12.65	6.283	7.952	7.952	7.103	7.952	4.698	8.83	16.84	19.07	12.65	m	7.103
26-Jan		10.7	m	15.76	1.472	3.283	m	m	4.67	21.37	13.67	11.66	55.89	24.99	26.21	12.65	6.283	7.103	7.103	7.103	7.952	4.698	8.83	16.84	19.07	12.65	m	7.103
27-Jan		1.472	m	17.94	2.038	3.283	m	m	5.858	17.94	13.67	11.66	51.22	24.99	27.48	12.14	6.283	7.103	7.103	7.103	7.952	3.962	8.83	15.76	16.84	12.65	m	7.103
28-Jan		0.198	m	17.94	0.538	3.283	m	m	7.528	23.77	12.65	9.764	59.06	26.21	26.21	11.66	6.283	6.283	6.283	6.283	7.952	3.962	7.952	15.76	16.84	12.65	m	6.283
29-Jan		0.198	m	17.94	5.462	3.283	m	m	9.282	24.99	11.66	6.283	78.99	30.06	23.15	11.66	5.462	6.283	6.283	6.283	7.952	3.962	7.103	15.76	15.76	11.66	m	6.283

30-Jan	0	m	20.21	5.462	3.283	m	m	5.858	19.07	11.66	4.754	75.53	26.21	21.37	11.66	5.462	6.283	6.283	5.462	7.952	3.962	6.283	15.76	15.76	10.7	m	6.283
31-Jan	0	m	11.66	15.76	3.283	m	m	3.962	21.37	11.66	3.962	65.49	26.21	21.37	11.66	5.462	5.462	5.462	5.462	7.952	3.962	6.283	15.76	15.76	9.764	m	6.283
01-Feb	0	m	11.66	14.69	7.103	m	m	2.632	20.21	12.65	9.764	59.06	26.21	19.07	11.66	5.462	5.462	5.462	5.462	7.952	3.962	6.283	14.69	15.76	8.83	m	6.283
02-Feb	m	m	21.37	13.67	7.103	m	m	m	19.07	12.65	10.7	46.72	26.21	17.94	11.66	5.462	5.462	5.462	5.462	7.103	3.283	5.462	14.69	15.76	8.83	m	6.283
03-Feb	m	m	21.37	12.65	7.103	m	m	m	24.37	12.65	10.7	43.78	27.48	16.84	11.66	5.462	5.462	5.462	5.462	6.283	3.283	5.462	13.67	15.76	7.952	m	6.283
04-Feb	m	m	11.66	11.66	6.679	m	m	m	27.48	12.65	10.7	42.34	24.99	16.84	11.66	5.462	4.528	4.528	5.462	6.283	3.283	5.462	13.67	15.76	7.952	m	6.283
05-Feb	m	m	11.66	10.7	6.283	m	m	m	31.36	12.65	10.7	42.34	22.56	15.76	8.83	5.462	4.528	4.528	5.462	6.283	3.283	5.462	13.67	15.76	7.952	m	6.283
06-Feb	m	m	11.66	10.7	6.283	m	m	m	27.48	12.65	10.7	43.78	21.37	15.76	8.83	7.103	4.528	4.528	6.283	6.283	3.283	5.462	13.67	15.76	7.952	m	6.283
07-Feb	m	m	11.66	15.76	6.283	m	m	m	20.21	12.65	12.65	43.78	17.94	14.69	8.83	7.952	4.528	4.528	5.462	6.283	3.283	5.462	13.67	15.76	7.952	m	6.283
08-Feb	m	m	20.21	13.67	5.858	m	m	m	20.21	12.65	13.67	40.92	17.94	14.69	8.83	7.103	4.528	4.528	5.462	6.283	3.283	6.283	13.67	14.69	7.952	m	6.283
09-Feb	m	m	20.21	8.83	5.434	m	m	m	17.38	13.5	13.67	39.51	12.65	15.76	8.83	6.283	4.528	4.528	6.283	5.462	3.283	6.283	14.69	14.69	7.952	m	6.283
10-Feb	m	m	20.21	5.462	5.434	m	m	m	12.14	13.67	13.67	40.92	20.21	15.76	8.83	6.283	4.528	4.528	9.764	4.698	3.283	5.462	14.69	14.69	7.952	m	6.283
11-Feb	m	m	19.07	5.462	5.434	m	m	m	10.22	13.67	13.67	42.34	21.37	15.76	9.764	6.283	4.528	4.528	12.65	4.698	3.283	5.462	13.67	14.69	7.952	m	6.283
12-Feb	m	m	19.07	5.462	5.434	m	m	m	7.952	13.67	13.67	42.34	21.37	14.69	9.764	7.103	4.528	4.528	14.69	4.698	3.283	5.462	13.67	14.69	7.952	m	6.283
13-Feb	m	m	19.07	4.698	5.434	m	m	m	3.283	14.69	13.67	40.92	22.56	14.69	8.83	7.103	4.528	4.528	14.69	4.698	2.632	5.462	13.67	15.76	7.952	m	6.283
14-Feb	m	m	19.07	4.698	4.698	m	m	m	3.622	14.69	14.69	75.53	22.56	14.69	8.83	6.283	4.528	4.528	15.76	4.698	2.632	5.462	13.67	16.84	7.103	m	6.283
15-Feb	m	m	17.94	1.472	4.698	m	m	m	5.462	15.76	15.76	72	24.99	15.76	12.65	8.83	4.528	4.528	15.76	3.962	2.632	4.698	12.65	17.94	7.103	m	6.283
16-Feb	m	m	16.84	1.472	4.698	m	m	m	6.283	14.69	14.69	57.19	24.99	14.69	11.66	13.67	5.462	5.462	14.69	3.962	2.632	5.462	12.65	17.94	7.103	m	6.283
17-Feb	m	m	16.84	0.991	4.698	m	m	m	3.962	14.69	14.69	54.34	26.21	15.76	10.7	13.67	5.462	5.462	13.67	3.283	2.632	6.283	12.65	15.76	7.103	m	6.283
18-Feb	m	m	15.76	0.991	4.698	m	m	m	3.622	13.67	13.67	52.78	26.21	15.76	9.764	10.61	4.528	4.528	11.66	3.283	3.283	6.283	12.65	15.76	7.103	m	6.283
19-Feb	m	m	14.69	0.538	4.698	m	m	m	3.283	10.7	11.66	51.22	24.99	15.76	9.764	10.61	4.528	4.528	8.83	3.283	3.283	5.462	12.65	15.76	7.103	m	6.283
20-Feb	m	m	13.67	0.538	4.698	m	m	m	5.858	8.83	7.103	51.22	23.77	15.76	9.764	8.83	4.528	4.528	7.952	3.283	3.283	5.462	12.65	14.69	7.103	m	5.462
21-Feb	m	m	12.65	0.538	3.962	m	m	m	5.462	7.952	7.103	77.26	22.56	16.84	9.764	7.952	4.528	4.528	7.952	3.283	3.283	5.462	11.66	14.69	7.952	m	5.462
22-Feb	m	m	12.65	0.198	3.962	m	m	m	2.632	7.952	7.103	80.71	23.77	16.84	9.764	6.537	3.962	3.962	7.952	3.283	3.962	3.283	11.66	14.69	7.952	m	m
23-Feb	m	m	11.66	0.198	3.962	m	m	m	4.981	7.103	7.103	78.99	23.77	16.84	10.7	7.952	3.962	3.962	7.952	3.283	3.962	3.283	11.66	14.69	7.952	m	m
24-Feb	m	m	11.66	0	3.962	m	m	m	7.528	7.103	7.103	73.81	22.56	16.84	12.65	6.934	3.962	3.962	8.405	3.283	4.698	3.283	11.66	14.69	8.83	m	m
25-Feb	m	m	11.66	0	3.962	m	m	m	13.16	7.103	7.103	63.85	21.37	20.77	15.76	5.688	3.962	3.962	7.952	3.283	5.462	3.283	11.66	15.76	12.65	m	m
26-Feb	m	m	2.632	0	3.962	m	m	m	17.38	7.103	7.103	82.58	19.07	21.37	16.84	6.537	3.962	3.962	7.103	3.962	7.103	3.283	11.66	15.76	12.65	m	m
27-Feb	m	m	m	0	3.962	m	m	m	11.18	7.103	7.103	78.99	21.37	21.37	16.3	8.547	3.962	3.962	10.27	3.962	6.537	3.962	11.66	15.76	14.69	m	m
28-Feb	m	m	m	0	3.962	m	m	m	8.83	6.283	7.103	73.81	21.57	21.37	15.76	7.245	3.962	3.962	10.7	3.283	6.934	3.962	11.66	15.76	14.69	m	m
29-Feb			m				m				7.103				15.76				10.7				m				m
01-Mar m	m	m	3.283	0	3.962	m	m	56.69	8.83	7.103	7.103	65.49	59.06	67.13	14.69	6.283	6.283	15.76	9.311	3.283	8.83	3.962	11.66	16.84	14.69	30.06	
02-Mar m	m	m	3.962	0	3.962	m	m	65.49	7.103	7.103	6.283	62.23	45.25	65.49	14.69	6.283	6.283	15.76	8.83	3.283	10.7	3.962	12.65	16.84	16.84	30.06	
03-Mar m	m	m	3.962	0	3.962	m	m	47.46	11.66	7.103	6.283	57.48	49.72	51.22	15.76	5.462	5.462	15.23	7.952	3.283	11.66	3.962	12.65	17.94	20.21	28.75	

04-Mar	m	m	m	3.962	0	8.83	m	m	33.99	13.67	8.83	4.698	55.89	39.51	52.78	14.69	5.462	5.462	14.69	7.103	3.283	11.66	4.698	8.83	19.64	23.77	28.75
05-Mar	m	m	m	4.698	0	8.83	m	m	16.3	16.84	14.69	2.038	54.34	35.35	49.72	22.56	5.462	5.462	13.16	7.103	3.283	12.65	5.094	8.83	23.77	26.21	27.48
06-Mar	m	m	m	5.462	0	12.14	m	m	15.76	7.217	14.69	3.962	46.72	48.22	38.12	22.56	5.462	5.462	12.65	7.103	3.283	12.65	5.886	9.764	23.77	26.21	27.48
07-Mar	m	m	m	5.462	0	17.94	m	m	10.7	21.37	8.83	7.103	42.31	68.8	35.35	12.25	5.462	5.462	11.66	7.103	3.283	13.67	6.283	11.66	23.77	22.61	27.48
08-Mar	m	m	m	6.283	0	16.84	m	m	9.764	21.37	7.103	5.462	40.92	67.13	31.36	17.94	5.462	5.462	11.66	7.952	3.283	14.69	7.952	12.65	23.77	16.84	27.48
09-Mar	m	m	m	6.283	0	28.1	m	m	10.7	16.84	7.103	3.962	39.51	54.34	30.06	20.21	5.462	5.462	10.7	7.103	3.283	14.69	7.103	13.67	23.77	14.69	28.64
10-Mar	m	m	m	0.623	0	28.75	m	m	11.66	13.67	8.83	3.962	48.22	43.78	24.99	20.21	4.528	4.528	9.764	6.283	3.283	13.67	7.103	13.67	24.99	14.69	35.35
11-Mar	m	m	m	7.103	0	31.36	m	m	12.14	10.7	9.764	5.462	51.22	54.34	22.56	15.76	4.528	4.528	8.83	6.283	2.632	11.66	7.952	14.69	24.99	14.69	40.92
12-Mar	m	m	m	7.952	0	31.36	m	m	21.96	10.7	10.7	13.67	68.8	72.14	21.37	13.67	3.962	3.962	10.25	9.764	2.632	10.7	7.952	14.69	32.66	13.67	45.25
13-Mar	m	m	m	7.952	0	22.56	m	m	30.71	11.66	14.69	13.67	57.48	60.65	21.37	14.69	3.962	3.962	9.764	13.67	2.632	11.66	7.103	14.69	42.34	13.67	48.22
14-Mar	m	m	m	8.83	0	26.21	m	m	63.02	10.7	14.69	16.1	55.89	60.65	21.37	16.84	3.962	3.962	11.18	22.47	2.632	13.67	7.103	15.76	46.72	13.67	54.34
15-Mar	m	m	m	9.764	0	33.99	m	m	98.65	11.66	12.65	12.65	54.34	59.06	23.77	16.84	3.962	3.962	11.18	24.99	2.038	13.36	6.283	16.84	49.72	12.65	55.89
16-Mar	m	m	m	9.764	0	33.99	m	m	77.26	13.67	10.7	12.45	43.78	45.25	23.77	14.69	2.943	2.943	10.7	30.68	2.038	10.7	6.283	17.94	54.34	12.65	49.72
17-Mar	m	m	m	10.7	0	35.35	m	m	45.99	15.76	10.7	14.69	43.78	48.22	24.99	13.67	2.632	2.632	12.65	28.75	2.038	10.7	6.283	17.94	54.34	11.66	41.21
18-Mar	m	m	m	10.7	0	35.35	m	m	45.99	13.67	10.7	21.37	52.78	55.89	21.37	16.84	2.632	2.632	16.84	32.66	2.038	9.764	6.283	21.37	50.49	9.764	41.23
19-Mar	m	m	m	10.7	0	35.35	m	m	38.8	11.66	11.66	27.48	52.78	48.96	17.94	19.07	2.632	2.632	20.21	30.06	2.632	9.764	6.283	27.48	46.72	9.764	40.92
20-Mar	m	m	m	11.66	0	38.12	m	m	38.12	9.282	14.69	19.07	54.34	36.73	17.94	22.56	2.632	2.632	22.56	29.4	2.632	8.83	6.283	30.06	43.78	8.83	36.73
21-Mar	m	m	m	12.65	0	39.51	m	m	52.78	11.66	14.69	7.103	55.89	33.99	16.84	26.21	3.283	3.283	25.61	26.21	2.632	6.283	6.283	35.35	39.51	9.764	31.36
22-Mar	m	m	m	13.67	0	40.92	m	m	48.96	10.7	9.764	12.65	59.06	33.31	17.94	31.27	3.962	3.962	20.21	23.77	2.632	4.698	6.283	36.73	32.66	9.311	31.36
23-Mar	m	m	m	13.67	0	40.92	m	m	50.46	12.65	8.83	16.84	60.65	49.72	30.06	32.66	3.962	3.962	20.21	27.48	2.632	4.698	6.283	33.99	27.48	14.69	31.36
24-Mar	m	m	m	14.69	3.283	40.92	m	m	53.54	16.84	9.764	15.76	60.65	82.47	30.06	30.06	3.962	3.962	21.96	26.21	2.632	5.462	5.462	30.06	24.99	16.84	31.36
25-Mar	m	m	m	14.69	3.283	40.92	m	m	58.27	19.07	12.65	15.76	57.48	104.1	28.75	26.21	3.962	3.962	23.77	22.56	4.698	5.462	5.462	26.21	23.77	19.07	31.36
26-Mar	m	m	m	14.69	3.283	40.92	m	m	33.31	21.37	20.21	16.84	57.48	106.2	30.06	23.77	7.103	7.103	21.37	21.37	7.103	6.707	5.462	19.07	23.77	19.07	30.06
27-Mar	m	m	m	15.76	4.33	48.22	m	m	25.58	14.69	27.48	20.21	63.85	67.13	27.48	20.21	13.67	13.67	21.37	21.37	8.83	9.764	6.283	15.76	30.06	17.94	28.75
28-Mar	m	m	m	14.69	6.283	48.22	m	m	13.67	12.65	33.99	19.07	78.99	48.96	29.4	22.56	15.76	15.76	27.48	21.37	9.764	17.94	6.283	12.65	46.72	16.84	28.75
29-Mar	m	m	m	13.67	7.952	48.22	m	m	36.03	10.7	27.48	26.21	93.16	41.63	30.06	27.48	14.69	14.69	27.48	27.48	8.83	16.84	6.283	10.7	61.44	15.76	30.06
30-Mar	m	m	m	12.65	6.679	48.22	m	m	52.78	11.66	26.21	21.37	104.3	39.51	30.06	32.66	16.84	16.84	23.77	36.73	7.103	16.84	6.283	11.66	71.32	13.67	30.06
31-Mar	m	m	m	12.65	7.103	48.22	m	m	51.51	10.7	30.06	23.77	104.3	39.51	39.51	31.27	26.21	26.21	20.21	32.66	7.103	20.8	6.283	13.67	96.81	13.67	m
01-Apr	m	m	m	11.66	5.462	m	36.73	m	43.61	11.66	60.65	13.67	98.65	33.99	48.22	39.51	36.73	36.73	19.07	30.06	7.103	27.48	6.283	14.69	89.54	m	m
02-Apr	m	m	m	11.66	10.7	m	43.04	m	47.46	12.65	39.51	9.764	91.35	32.66	40.92	51.22	27.48	27.48	20.8	27.48	6.283	31.36	7.103	20.21	84.22	m	m
03-Apr	m	m	m	27.48	22.56	m	40.21	m	62.23	12.65	23.77	11.66	82.47	31.36	38.12	49.72	17.94	17.94	23.77	26.83	5.462	49.72	14.18	27.48	80.71	m	m
04-Apr	m	m	m	36.73	21.96	m	37.41	m	44.52	12.65	16.84	11.66	78.99	28.75	36.73	46.72	15.76	15.76	24.4	24.99	4.698	52.02	16.84	54.34	73.81	m	m
05-Apr	m	m	m	43.78	17.94	m	34.67	m	19.64	17.94	11.66	13.67	77.26	27.48	38.12	59.06	21.37	21.37	19.07	22.56	4.698	46.72	16.84	64.67	67.13	13.67	m
06-Apr	m	m	m	67.13	16.84	m	35.35	m	15.23	14.69	12.65	15.76	75.53	23.77	51.22	54.34	20.21	26.21	16.84	20.8	4.698	29.4	15.76	59.06	59.06	14.69	m

07-Apr	m	m	m	31.36	22.75	m	37.41	m	20.21	19.07	11.66	15.76	75.53	22.56	51.99	72.14	20.21	26.21	16.84	20.21	4.698	26.21	14.69	54.34	51.22	15.76	m
08-Apr	m	m	m	148	16.84	m	37.41	m	14.69	23.77	10.7	11.66	67.13	26.21	46.72	80.71	24.99	24.99	15.76	17.41	4.698	24.99	13.67	51.22	40.92	17.94	m
09-Apr	m	m	m	207.6	13.16	m	62.23	m	12.14	31.36	8.83	7.103	62.23	26.21	49.72	113.9	28.75	28.75	15.76	14.69	4.698	24.99	10.7	46.72	38.12	19.07	m
10-Apr	m	m	m	223.9	12.65	m	64.67	m	38.12	33.99	7.952	7.103	59.06	28.75	54.34	169.4	30.06	30.06	15.76	12.65	4.698	22.56	9.764	40.92	36.73	20.21	m
11-Apr	m	m	m	240.7	13.67	m	48.96	m	34.67	27.48	10.7	4.698	68.8	38.12	63.85	182.6	30.06	30.06	15.76	11.66	3.962	20.21	9.764	33.99	32.66	20.21	m
12-Apr	m	m	m	248	13.16	m	45.25	m	29.4	20.21	13.67	23.18	85.98	68.8	68.8	106.2	33.99	33.99	15.76	11.66	3.283	22.56	9.764	26.86	30.06	23.77	m
13-Apr	m	m	m	260.3	24.99	m	41.63	m	12.14	15.76	17.94	28.75	89.54	96.81	70.47	92.26	27.48	27.48	14.18	11.66	5.462	27.48	8.83	23.77	28.75	24.99	m
14-Apr	m	m	m	252.9	40.21	m	38.8	m	17.38	10.7	19.07	30.06	98.65	90.45	65.49	93.16	24.99	24.99	13.67	11.66	9.764	35.35	8.83	36.73	24.99	26.21	m
15-Apr	m	m	m	191.6	61.44	m	38.8	m	26.83	12.65	15.76	19.07	110	111.9	55.89	78.99	24.99	24.99	11.66	19.07	8.83	41.63	8.83	40.92	22.56	28.13	m
16-Apr	m	m	m	178.2	74.66	m	37.41	m	36	14.69	10.7	15.76	129.6	110	45.25	59.06	24.99	24.99	10.7	30.06	5.462	46.72	9.764	48.22	19.07	28.75	m
17-Apr	m	m	m	154.3	58.27	m	37.41	m	32.01	19.07	7.952	17.94	139.7	92.26	39.51	43.78	24.99	24.99	12.65	39.51	3.962	70.47	10.7	60.31	16.84	30.06	m
18-Apr	m	m	m	143.8	39.51	m	35.29	m	54.34	23.77	10.7	22.56	106.2	99.59	42.34	38.12	24.99	24.99	21.37	65.49	3.962	68.8	12.65	48.99	15.76	33.99	m
19-Apr	m	m	m	127.6	35.35	m	38.8	m	36	27.48	11.66	24.99	75.53	115.8	46.72	46.72	20.21	20.21	30.06	62.23	3.962	91.35	12.17	39.51	17.94	40.21	m
20-Apr	m	m	m	115.8	22.56	m	46.72	m	29.4	21.37	10.7	19.07	91.35	117.7	38.8	63.85	16.84	16.84	32.66	46.72	5.462	121.6	9.764	27.48	20.21	42.34	m
21-Apr	m	m	m	106.2	29.4	m	43.78	m	21.06	19.07	11.66	27.48	127.6	31.36	40.92	68.8	16.84	16.84	39.51	36.73	6.283	108.1	7.103	23.77	23.77	40.92	m
22-Apr	m	m	m	98.65	29.4	m	38.8	m	47.46	10.7	15.76	35.35	135.7	60.65	36.73	78.99	19.07	19.07	31.36	27.48	6.283	82.47	7.103	23.77	31.72	36.73	m
23-Apr	m	m	m	89.54	33.99	m	34.67	m	76.38	10.7	21.37	48.22	119.7	51.22	38.12	77.26	27.48	27.48	24.99	22.56	6.283	60.65	7.952	22.56	42.34	32.66	m
24-Apr	m	m	m	84.22	45.99	m	31.36	m	235.8	12.65	33.99	32.66	78.99	45.25	35.35	m	38.8	38.8	23.77	21.37	5.462	55.89	7.952	21.37	42.34	30.06	m
25-Apr	m	m	m	65.49	43.78	m	24.99	m	140.8	11.26	46.72	17.94	67.13	43.78	28.75	m	39.51	39.51	24.99	21.37	7.103	57.48	8.83	19.07	39.51	26.21	m
26-Apr	m	m	m	72.14	36.59	m	21.96	m	119.7	11.66	48.22	16.84	60.65	51.22	31.36	m	36.73	36.73	28.75	21.37	10.7	58.27	9.764	17.94	35.35	26.21	m
27-Apr	m	m	m	67.13	21.37	m	23.15	m	180.4	14.69	62.23	26.21	70.47	54.34	36.73	30.06	32.66	32.66	33.99	23.77	13.67	60.65	20.8	15.76	28.75	17.94	m
28-Apr	m	m	m	60.65	14.69	m	20.21	m	200.7	15.76	169.4	31.36	75.53	45.25	39.51	39.51	31.36	31.36	32.01	16.84	17.94	60.65	33.99	17.94	26.21	16.84	m
29-Apr	m	m	m	49.72	11.66	m	23.15	m	154.3	12.65	232.9	33.99	82.47	42.34	33.99	40.92	29.4	29.4	35.35	16.84	22.56	61.44	27.48	19.07	24.99	16.84	m
30-Apr	m	m	m	65.49	14.18	m	21.96	m	125.6	13.67	212.2	51.22	82.47	40.21	28.75	39.51	26.21	26.21	31.36	15.76	22.56	63.85	15.76	19.07	22.56	14.69	m
01-May	m	m	m	67.13	16.3	m	21.96	m	119.7	19.07	156.5	45.25	52.78	38.12	28.75	27.48	24.99	24.99	26.21	15.76	17.94	57.48	14.18	19.07	22.56	14.69	m
02-May	28.75	17.94	m	68.8	11.66	m	23.15	m	119.7	16.84	106.2	48.22	38.12	32.66	29.4	23.77	24.37	24.37	30.06	15.76	14.69	49.72	20.21	21.37	28.75	14.69	m
03-May	28.75	49.72	m	67.13	11.66	m	20.77	m	119.7	11.66	82.47	38.12	23.77	36.73	28.75	27.48	23.15	23.15	33.34	13.67	11.18	43.78	27.48	25.61	39.51	14.69	m
04-May	27.48	80.71	m	92.15	8.83	m	17.38	m	134.7	10.7	73.81	28.75	27.48	45.48	24.99	46.72	23.77	23.77	30.06	15.23	9.764	48.22	26.21	28.75	51.22	15.76	m
05-May	40.92	87.76	m	92.15	6.283	m	19.64	m	142.8	14.69	77.26	30.06	29.77	45.25	22.56	98.65	21.37	21.37	29.4	15.76	8.83	45.25	16.84	28.75	73.81	m	m
06-May	33.99	52.53	m	62.23	7.528	m	21.37	m	137.7	24.99	68.8	51.22	26.21	39.51	21.37	129.6	20.21	20.21	42.34	15.76	7.952	40.92	15.76	30.06	89.54	m	28.75
07-May	21.37	110	m	59.06	5.066	m	24.37	m	103.4	33.99	85.98	55.89	33.99	33.99	21.37	125.6	21.96	21.96	48.22	15.76	7.952	39.51	15.76	32.66	106.2	m	28.75
08-May	21.37	173.8	m	54.34	10.7	m	26.83	m	84.22	39.51	93.16	51.22	36.73	38.12	21.37	111.9	19.07	19.07	52.78	15.76	7.528	36.73	14.69	35.35	131.6	m	28.75
09-May	21.37	178.2	m	51.22	14.69	m	26.21	m	67.95	40.92	54.48	32.66	36.73	49.72	26.21	113.7	16.84	16.84	58.02	15.76	7.952	38.12	14.69	35.35	139.7	m	28.75
10-May	19.07	226.3	m	45.25	15.23	m	24.99	m	66.31	38.12	48.22	17.94	31.36	49.72	67.13	100.9	14.69	14.69	65.49	15.23	9.764	45.25	14.69	32.66	145.9	m	30.06

11-May	15.76	240.7	m	38.12	13.67	m	23.15	m	47.46	45.25	40.92	20.21	35.35	43.78	68.8	82.47	12.65	12.65	72.14	15.23	9.764	82.47	13.67	29.29	162.9	m	30.06
12-May	20.21	248	m	33.99	10.7	m	24.37	m	47.46	43.78	32.66	51.22	39.51	40.92	57.48	78.99	10.7	10.7	125.6	15.76	9.764	127.6	13.67	26.21	226.3	m	30.06
13-May	21.37	219.2	m	30.06	3.283	m	25.58	m	40.21	36.73	31.36	62.23	38.12	45.25	36.73	78.99	10.7	10.7	96.81	14.69	11.66	125.6	11.66	28.75	245.6	m	31.36
14-May	14.69	219.2	m	23.77	8.83	m	32.01	m	40.21	38.12	33.99	110	48.22	39.51	40.92	78.99	9.764	9.764	72.14	14.69	12.65	81.16	11.18	30.06	257.8	m	32.66
15-May	12.65	214.5	m	19.07	7.952	m	60.65	m	47.46	43.78	40.92	98.65	98.65	33.99	57.48	84.22	8.83	8.83	62.23	15.23	13.67	55.89	14.69	36.73	267.7	m	36.73
16-May	12.65	212.2	m	7.952	3.283	m	58.27	m	36	49.72	43.78	60.31	173.8	30.06	49.72	93.16	8.83	8.83	45.25	15.23	14.69	49.72	19.07	39.51	221.6	m	36.73
17-May	11.66	182.6	m	3.283	14.18	m	60.65	m	28.75	60.65	39.51	49.72	248	35.35	52.53	73.81	7.103	7.103	40.21	15.23	13.67	54.34	27.48	42.34	111.9	m	38.12
18-May	21.37	119.7	m	m	15.76	m	67.13	m	40.21	68.8	35.35	84.22	262.8	46.72	55.1	77.26	10.7	10.7	36.73	14.69	17.94	62.09	32.66	46.72	93.16	m	39.51
19-May	31.36	52.78	m	m	15.76	m	67.95	m	33.99	87.76	80.71	70.47	272.7	113.9	43.04	96.81	20.21	20.21	43.07	14.69	29.4	63.85	39.51	60.31	67.13	m	43.07
20-May	38.12	46.72	m	m	13.67	m	55.89	m	29.4	104.3	184.8	57.48	313.8	202.1	42.34	111.9	30.06	30.06	54.34	14.69	45.25	55.89	42.34	67.13	52.67	m	45.25
21-May	48.22	40.92	m	m	12.65	m	37.41	m	28.1	125.4	187.7	62.23	319.1	165	58.27	167.2	40.92	40.92	44.52	14.69	46.72	49.72	37.44	73.81	46.72	m	45.25
22-May	60.65	46.72	m	m	5.066	m	60.65	m	34.67	129.6	143.8	65.49	311.2	148	59.06	257.8	36.73	36.73	36.08	14.69	52.78	43.78	21.96	78.99	51.22	m	49.72
23-May	63.85	137.4	198.4	m	10.7	m	53.54	m	36	117.7	77.26	60.65	280.3	127.6	28.75	329.6	29.4	29.4	30.06	14.69	55.13	49.44	19.07	89.54	57.48	m	54.34
24-May	102.4	133.6	193.9	m	14.69	m	54.34	m	40.21	106.2	49.72	89.54	228.7	135.7	57.48	359.1	26.21	26.21	24.99	20.21	38.12	63.85	19.64	123.6	67.13	m	57.48
25-May	93.16	119.7	191.6	m	23.77	m	55.16	m	63.85	100.5	38.12	106.5	187.1	111.9	51.22	348.4	26.21	26.21	21.96	65.49	28.75	70.47	21.37	165	72.14	m	62.23
26-May	98.65	111.9	184.8	m	36.73	m	44.52	m	88.64	98.65	39.51	121.5	205.3	173.8	39.51	262.8	23.77	23.77	27.48	93.16	24.99	85.98	23.77	173.8	84.22	m	67.13
27-May	93.16	100.5	173.8	m	19.75	m	44.52	m	112.9	89.54	33.99	143.8	238.3	145.9	35.35	221.6	23.77	23.77	33.99	93.16	19.07	102.4	26.21	169.4	106.3	m	67.13
28-May	75.53	84.22	158.6	m	12.14	m	43.04	m	102.4	80.71	32.66	145.9	266	138.7	33.99	214.5	23.77	23.77	36.73	94.98	15.76	84.31	24.99	160.7	119.7	m	59.06
29-May	60.65	137.7	239.2	m	30.06	m	38.8	m	69.62	63.85	32.66	143.8	277.8	198.4	33.99	191.6	24.99	24.99	33.34	80.71	15.23	83.34	28.75	162.9	143.8	m	52.78
30-May	46.72	119.7	135.7	m	30.06	m	33.99	m	63.02	70.47	40.92	150.1	300.8	265.2	31.36	143.8	20.21	20.21	28.75	61.44	14.69	93.16	32.66	125.6	180.4	m	45.25
31-May	43.78	87.76	98.65	m	28.75	m	27.48	m	66.31	102.4	60.65	145.9	343	231.1	39.51	137.7	17.94	17.94	28.13	57.48	22.56	145.9	36.73	113.9	191.7	m	43.78
01-Jun	55.89	72.14	75.53	13.67	28.75	m	36.73	m	116.7	113.9	110	160.7	334.9	267.7	40.92	180.4	17.94	17.94	28.13	91.35	32.66	162.9	31.36	137.7	141.8	m	48.22
02-Jun	73.81	108.1	62.23	13.67	30.71	m	52.78	m	154.3	117.7	131.6	173.8	290.5	235.9	40.92	260.3	17.94	17.94	33.34	107.2	30.06	117.7	28.75	145.9	119.7	m	56.69
03-Jun	72.14	117.7	77.26	17.94	40.92	m	58.27	m	121.6	89.54	111.9	173.8	265.2	154.3	42.34	316.5	16.84	16.84	30.71	113.9	24.99	165	32.66	133.6	78.99	m	64.67
04-Jun	67.13	125.6	72.14	32.66	70.47	80.71	73.81	m	72.14	70.47	100.5	156.5	223.9	145.9	46.72	353.8	15.76	15.76	30.06	89.54	28.75	300.8	47.49	105.1	65.49	m	77.26
05-Jun	78.99	145.9	84.22	38.12	77.26	127.6	82.47	m	48.22	60.65	98.65	153	162.9	154.3	67.13	356.4	15.76	15.76	31.36	70.47	46.72	372.7	94.98	91.35	59.06	m	80.71
06-Jun	72.14	158.6	97.81	48.22	63.02	190.5	95.88	m	33.99	55.89	94.98	143.8	141.8	228.7	67.13	311.2	16.84	13.67	23.77	67.13	54.34	369.9	123.6	99.59	52.78	m	m
07-Jun	80.74	182.6	111.9	54.34	52.78	214.5	100.5	m	32.01	62.23	96.81	145.9	176	123.4	68.8	257.8	14.69	14.69	26.21	65.49	45.25	326.9	125.6	119.7	51.22	m	m
08-Jun	67.13	267.7	158.6	55.89	59.06	207.6	81.82	m	55.1	54.34	182.6	165	250.5	113.9	65.49	233.5	17.94	17.94	32.01	65.49	36.73	313.8	169.4	200.2	49.72	m	m
09-Jun	51.22	228.7	169.4	52.53	54.34	139.6	46.95	m	78.99	48.22	252.9	173.8	337.6	80.71	54.34	205.3	19.07	19.07	39.51	63.85	32.77	321.7	228.7	191.6	48.22	m	m

10-Jun	48.22	119.7	156.5	49.72	63.02	120.6	43.04 m	112.9	43.78	275.2	169.4	418	77.26	46.72	165	28.75	28.75	52.78	63.85	31.36	337.6	243.2	181.5	45.25 m	m
11-Jun	72.14	135.7	148	40.92	63.02 m		92.26 m	121.6	52.78	272.7	152.2	475.9	74.66	54.34	131.6	40.92	40.92	73.81	60.65	33.99	326.9	219.2	176	60.65	23.77 m
12-Jun	115.8	160.7	137.7	30.06	77.26	124.5	193.9 m	137.7	65.49	260.3	167.2	469.9	72.14	54.34	115.8	38.12	38.12	94.98	65.49	35.35	308.6	213.4	193.9	46.72	31.36 m
13-Jun	200.7	216.9	131.6	23.77	89.54	117.7	190.5 m	127.6	80.71	221.6	171.6	455.1	63.85	59.06	100.7	32.66	32.66	91.35	94.07	40.92	298.3	223	193.9	49.72	38.83 m
14-Jun	226.3	252.9	155.2	31.36	91.15	158.6	157.5 m	147	121.5	148	171.6	442	60.65	89.54	87.76	30.71	30.71	104.3	148	72.14	289.3	181.7	180.4	52.78	44.52 m
15-Jun	288	275.2	162.9	63.85	85.98	207.6	98.65 m	203	257.8	129.6	171.6	378.4	62.23	96.81	87.76	32.01	32.01	122.6	171.6	221.6	298.3	150.1	176	54.34	41.63 m
16-Jun	308.6	343	180.4	67.13	82.47	238.3	89.54 m	244.4	250.7	178.2	200.7	345.7	73.81	91.35	75.53	28.75	28.75	139.7	187.1	223.9	289.3	117.7	205.3	48.22	32.66 m
17-Jun	324.3	343	205.3	77.26	82.47	267.7	67.13 m	249.2	245.6	207.6	290.5	290.5	75.53	91.35	115.8	26.21	26.21	111.9	191.6	196.1	276.5	110	193.9	57.48	36.05 m
18-Jun	332.2	353.8	200.7	82.47	102.4 m		97.72 m	264	226.3	240.7	325.1	169.4	65.49	113.7	165	23.77	23.77	85.98	205.3	176	203	108.1	171.6	62.23	42.34 m
19-Jun	340.3	319.1	193.9	89.54	150.1	357.8	118.7 m	264	221.3	280.3	340.3	145.9	55.89	102.4	137.7	21.37	21.37	81.59	228.7	100.5	167.2	156.5	162.9	62.23	48.22 m
20-Jun	329.7	295.5	193.9	110	237.1	353.8	180.4 m	267.7	198.4	303.4	351.1	127.6	48.22	75.53	121.6	20.21	20.21	75.53	270.2	73.81	143.8	257.8	169.4	73.81	57.48 m
21-Jun	260.3	282.9	187.1	187.1	316.5	311.2	238.3 m	288	198.4	313.8	321.7	121.6	60.65	73.81	108.1	21.37	21.37	65.49	285.4	63.85	121.6	294.4	228.7	89.54	59.06 m
22-Jun	129.6	157.9	180.4	290.5	326.9	333.6	260.3 m	311.2	189.3	319.1	293.1	113.9	71.29	56.69	85.98	27.48	27.48	59.06	279	57.48	111.9	303.4	319.1	137.7	60.65 m
23-Jun	135.7	238.3	171.6	473.2	326.9	343	232.3 m	347	193.9	311.2	288	113.9	78.99	48.22	77.26	33.99	33.99	82.47	255.4	48.22	127.6	293.1	340.3	169.4	59.06 m
24-Jun	212.2	238.3	165	326.9	303.4	341.6	216.9 m	355.1	198.4	311.2	257.8	189.3	78.99	57.48	68.8	36.73	36.73	162.9	240.7	48.22	150.1	257.8	313.8	191.6	55.89 m
25-Jun	226.3	238.3	158.6	353.8	299.5	386.9	227.5 m	363.1	200.7	272.7	243.2	282.9	73.81	98.65	67.13	42.39	42.39	186	252.9	55.89	173.8	182.6	260.3	226.3	52.78 m
26-Jun	160.9	228.7	154.3	386.9	297	420.8	43.78 m	359.1	209.9	267.7	240.7	319.1	70.47	101.7	73.81	46.72	46.72	149.1	275.2	67.21	208.7	126.6	205.3	262.8	48.22 m
27-Jun	108.1	226.3	165	401	304.7	429.3	264 m	359.1	231.1	316.5	277.8	319.1	71.29	93.16	85.95	44.52	44.52	99.59	288	63.85	173.8	98.65	145.9	270.2	42.34 m
28-Jun	80.71	226.3	173.8	401	333.6	416.6	283.4 m	364.5	235.9	384	280.3	285.4	89.54	98.65	106.2	45.25	45.25	95.91	267.7	68.8	123.6	87.76	135.7	252.9	38.12 m
29-Jun	63.85	226.3	160.7	401	264.2	443.5	288 m	341.6	228.7	415.2	285.4	198.4	106.2	139.7	80.71	36.73	36.73	127.6	226.3	75.53	102.4 m		131.6	203	36.73 m
30-Jun	82.47	226.3	176	401	124.6	486.3	303.2 m	352.2	216.9	420.8	285.4	139.7	104.3	178.2	67.13	33.99	33.99	176	191.6	75.53	72.14 m		131.6	162.9	38.12 m
01-Jul	141.8	226.3	169.4 m		123.6	531.6	442 m	401	203	401	384	162.9	100.5	169.4	59.06	36.03	36.03	165	186	68.8	63.85 m		131.6	143.8	39.42 m
02-Jul	137.7 m		162.9 m		235.9	539.4	442 m	423.7	193.9	395.4	395.4	212.2	78.11	119.7	54.34	51.22	51.22	145.9	182.6	61.44	59.06 m		131.6	131.6	39.42 m
03-Jul	117.7 m		158.6 m		197.3	564.3	437.8 m	423.7	182.6	386.9	403.8	223.9	68.8	87.76	51.22	70.47	70.47	117.7	167.2	51.22	57.48 m		113.9	115.8	42.34 m
04-Jul	92.15 m		154.3 m		158.6	583	385.4 m	399.6	171.6	367.2	432.1	221.3	63.85	89.68	48.22	89.54	89.54	94.98	141.8	40.92	54.34 m		98.65	107.8	43.78 m
05-Jul	77.26 m		150.1 m		155.4	606.5	368.5 m	425.1	165	316.5	437.8	214.5	60.65	85.98	55.89	89.54	89.54	129.6	125.6	38.12	49.72 m		89.54	93.16	44.52 m
06-Jul	72.14 m		156.5 m		214.5	622.8	291.8 m	420.8	165	240.7	455.1	203	56.69	66.31	85.89	75.53	75.53	169.4	106.2	31.36	43.78 m		85.98	85.1	38.83 m
07-Jul	63.85 m		156.5 m		232.3	630.9	246.8 m	409.5	184.8	173.8	469.9	169.4	55.89	72.14	117.7	55.89	55.89	199.6	72.99	31.36	40.92 m		67.13	104.3	42.34 m

08-Jul	108.1	m	165	m	239.5	630.9	200.7	m	409.5	196.1	162.9	343.3	143.8	54.34	63.85	154.3	40.92	40.92	214.5	m	27.48	36.73	m	76.41	165	43.78	m
09-Jul	250.5	m	169.4	m	240.7	606.5	220.4	m	396.8	207.6	167.1	496.7	145.9	53.54	55.89	145.9	35.35	35.35	231.1	m	25.61	32.66	m	73.81	226.3	46.72	m
10-Jul	326.9	m	176	m	245.6	597	232.3	m	393.9	203	184.8	517.6	158.6	52.78	60.65	160.7	31.36	31.36	241.9	m	23.77	27.48	m	70.47	280.3	51.22	m
11-Jul	334.9	m	160.7	m	225.1	558.1	246.8	m	409.5	193.9	209.9	548.7	187.1	52.78	51.22	184.8	27.48	27.48	240.7	m	21.37	27.48	m	65.49	306	m	75.53
12-Jul	353.8	m	187.1	m	122.3	471.4	264	m	420.8	203	191.6	583	171.6	49.72	52.78	158.6	31.36	31.36	231.1	m	21.37	27.48	m	63.85	321.7	m	148
13-Jul	367.2	m	196.1	m	107.1	347	266.5	m	436.4	250.5	139.7	630.9	171.6	62.23	49.72	139.7	52.78	52.78	235.9	m	22.56	27.48	m	60.65	m	m	49.72
14-Jul	401	m	231.1	m	154.3	267.7	255.4	m	461	282.9	108.1	630.9	245.6	65.49	52.78	100.9	85.1	85.1	240.7	m	20.21	26.21	m	54.34	m	m	43.78
15-Jul	m	m	168	m	213.4	219.2	232.3	m	483.3	306	94.98	630.9	245.6	77.26	52.78	84.22	86.85	86.85	228.1	m	19.07	26.21	m	46.72	m	m	43.78
16-Jul	m	m	284.6	m	244.4	212.2	381.2	m	492.2	337.6	87.76	630.9	223.9	85.98	53.54	104.1	57.48	57.48	196.1	m	19.07	26.21	m	45.25	277.8	m	49.72
17-Jul	m	m	378.4	m	280.3	250.5	401	m	520.7	415.2	82.47	630.9	154.3	68.8	70.47	113.9	39.51	39.51	196.1	m	16.84	24.99	m	42.34	255.4	m	52.53
18-Jul	m	m	m	m	275.2	293.1	416.6	m	545.7	452.1	73.81	630.9	173.8	54.34	100.5	94.98	32.94	32.94	238.3	m	15.76	23.77	m	40.92	216.9	m	52.78
19-Jul	m	m	m	m	266.5	326.9	430.7	m	569	437.8	59.06	760.1	182.6	48.22	129.6	84.22	29.4	29.4	231.1	m	15.76	23.77	m	39.51	193.9	m	54.34
20-Jul	m	m	m	m	201.8	345.7	486.3	m	840.8	420.8	55.89	748.3	182.6	45.25	129.6	73.81	26.21	26.21	209.9	m	15.76	22.56	m	35.35	174.9	m	57.48
21-Jul	475.9	m	m	m	179.3	350	474.4	m	589.2	420.8	52.78	724.5	160.7	41.6	129.6	62.23	23.15	23.15	176	m	15.76	22.56	m	34.67	145.9	m	57.48
22-Jul	423.7	m	m	m	313.8	332.2	450.6	m	589.2	395.4	48.22	695.2	129.6	36.73	127.6	59.06	20.21	20.21	150.1	m	15.76	21.37	m	35.35	130.6	m	54.34
23-Jul	403.8	m	m	m	359.1	291.8	393.9	m	586.1	381.2	46.72	650.3	113.9	38.8	127.6	55.89	17.94	17.94	133.6	m	14.69	21.37	m	36.73	115.8	m	54.34
24-Jul	386.9	m	m	m	391.1	279	381.2	m	570.5	361.8	42.34	604.9	113.9	39.51	127.6	57.48	15.76	15.76	113.9	m	14.18	20.21	m	48.22	110	m	52.78
25-Jul	378.4	m	m	m	389.7	260.3	364.5	m	559.6	313.8	38.12	545.6	113.9	35.35	127.6	73.81	15.76	15.76	89.54	m	14.69	20.21	m	94.98	108.1	m	52.78
26-Jul	367.2	m	m	m	381.2	213.4	334.9	m	525.4	340.3	35.29	464	107.1	33.99	113.9	108.1	14.18	14.18	73.81	m	15.76	20.21	m	119.7	106.2	m	52.78
27-Jul	340.3	m	m	m	374.1	183.7	357.8	m	472.9	351.1	33.99	367.2	102.4	32.66	93.16	108.1	13.67	13.67	63.85	m	15.76	19.07	m	191.6	106.2	m	51.22
28-Jul	203	m	m	m	343	166.1	340.3	m	420.8	375.5	35.35	290.5	81	31.36	80.71	111.9	13.67	13.67	55.89	26.21	17.94	20.21	m	234.7	108.1	m	45.25
29-Jul	169.4	m	337.6	m	228.7	106.2	338.9	m	367.2	409.5	42.34	235.9	65.49	28.75	65.49	127.6	13.67	13.67	49.72	27.48	26.21	21.37	m	250.5	111.9	m	45.25
30-Jul	191.6	m	267.7	m	167	96.81	340.3	m	293.1	435	46.72	180.4	54.34	28.75	54.34	115.8	12.65	12.65	43.78	35.35	31.36	23.77	m	285.4	110	m	41.63
31-Jul	203	m	156.5	m	119.7	95.91	360.5	m	163.9	452.1	49.72	131.6	48.22	28.75	49.64	100.7	11.66	11.66	40.21	45.25	30.71	24.99	m	311.2	109.2	m	36.73
01-Aug	180.4	m	133.6	m	124.6	98.65	386.9	m	102.4	321.7	46.72	262.8	46.72	26.21	70.47	85.98	12.14	12.14	38.12	28.75	27.48	24.99	m	332.2	113.9	m	32.66
02-Aug	131.6	m	131.6	m	133.6	212.2	386.9	m	104.1	169.4	42.34	311.2	38.12	27.48	113.9	77.26	11.66	11.66	38.12	39.51	27.71	24.99	m	340.3	108.1	m	30.06
03-Aug	110	m	127.6	m	129.6	330.9	386.9	m	117.7	150.1	39.51	324.3	33.99	30.06	129.6	70.47	11.66	11.66	40.92	33.99	19.64	27.48	m	343	102.4	m	27.48
04-Aug	127.6	m	119.7	m	124.6	430.7	384	m	117.7	145.9	36.73	313.8	38.12	28.75	129.6	48.22	13.67	13.67	51.22	30.06	17.94	24.99	m	337.6	99.59	m	26.21
05-Aug	67.13	m	113.9	m	124.6	455.1	371.3	m	114.8	125.6	35.35	275.2	60.65	28.75	98.65	60.65	15.76	15.76	59.06	27.48	17.94	22.41	m	313.8	89.54	m	23.77
06-Aug	63.85	m	106.2	m	83.34	469.9	359.1	m	113.9	108.1	36.73	248	63.85	28.75	84.22	57.48	18.51	18.51	55.89	27.48	16.84	20.8	m	248	87.76	m	23.77

07-Aug	55.89 m	104.3 m	36.05	505.6	357.8 m		111.9	98.65	40.92	226.3	65.49	28.75	80.71	57.48	21.96	21.96	54.34	24.99	15.76	19.07 m		180.4	78.99 m	31.36
08-Aug	60.65 m	91.35 m	63.85	526.9	349.7 m		111.9	89.54	43.78	228.7	85.98	30.06	110	54.34	28.75	28.75	62.23	23.77	15.76	19.07 m		139.7	73.81 m	17.94
09-Aug	80.71 m	82.47 m	54.34	547.2	365.8 m		106.2	80.71	42.34	298.3	108.1	30.06	129.6	49.72	43.44	43.44	70.47	21.37	15.76	17.94 m		102.4	72.14 m	17.94
10-Aug	72.14 m	77.26 m	59.86	561.2	382.6 m		104.3	72.14	39.51	337.6	91.15	28.75	129.6	40.92	68.8	68.8	66.31	21.37	14.69	16.84 m		89.54	68.8 m	m
11-Aug	78.99 m	48.22 m	60.65	575.2	396.8 m		102.4	70.47	39.51	369.9	67.13	28.75	129.6	39.51	119.7	119.7	59.06	20.21	10.7	15.76 m		84.22	67.98 m	m
12-Aug	84.22 m	45.25 m	58.27	573.6	396.8 m		101.5	70.47	35.35	401	65.49	27.48	129.6	36.73	171.6	171.6	55.89	19.07	9.764	15.76 m		84.22	67.13 m	m
13-Aug	87.76 m	42.34 m	55.89	558.1	329.6 m		80.71	70.47	33.99	432.1	70.47	27.48	108.1	36.73	153.3	153.3	52.78	17.94	9.764	15.76 m		91.35	80.71 m	m
14-Aug	80.71 m	21.37 m	57.48	481.8	275.2 m		80.71	70.47	33.99	469.9	73.81	26.21	89.54	35.35	108.1	108.1	45.99	17.94	9.764	15.76 m		110	106.2 m	m
15-Aug	80.71 m	21.37 m	55.1	332.2	127.7 m		80.71	72.14	33.99	493.7	73.81	26.21	78.11	33.99	72.96	72.96	42.34	16.84	8.83	15.76 m		129.6	119.7	54.34 m
16-Aug	80.71 m	11.66 m	38.8	166.1	240.7 m		84.22	89.54	33.99	499.6	67.13	27.48	113.9	32.66	53.54	53.54	42.34	15.76	8.83	15.76 m		139.7	129.6	57.48 m
17-Aug	63.85 m	20.21 m	36.03	98.65	226.3 m		210.6	100.5	33.99	505.6	65.49	27.48	129.6	32.66	43.04	43.04	52.78	15.76	8.83	14.69 m		143.8	160.7	61.44 m
18-Aug	72.14 m	19.07 m	34.67	81.59	213.4 m		235.9	119.7	33.99	502.6	102.4	27.48	129.6	32.66	36.73	36.73	48.22	14.69	8.83	13.67 m		119.7	219.2	67.98 m
19-Aug	60.65 m	17.94 m	26.21	84.22	203 m		226.3	127.6	35.35	478.8	102.4	23.77	191.6	32.66	32.66	32.66	41.63	14.69	7.952	14.69 m		108.1	280.3	73.81 m
20-Aug	40.92 m	16.84 m	24.37	82.47	189.3 m		208.7	127.6	35.35	420.8	68.8	23.77	191.6	36.73	28.75	28.75	38.12	16.84	7.952	14.69 m		106.2	306	87.76 m
21-Aug	31.36 m	15.76 m	21.96	82.47	179.3 m		212.2	127.6	33.99	348.4	52.78	23.77	191.6	54.34	26.21	26.21	33.99	17.94	7.952	15.76 m		100.6	280.3	85.98 m
22-Aug	34.07 m	13.67 m	17.38	82.47	155.4 m		246.8	108.1	31.36	326.9	65.49	23.77	167.2	65.49	30.71	30.71	31.36	19.07	7.952	16.84 m		94.98	238.3	75.53 m
23-Aug	32.66 m	12.65 m	17.38	82.47	144.9 m		276.5	108.1	30.06	351.1	104.3	22.56	145.9	57.48	60.65	60.65	29.4	20.21	7.952	16.84 m		91.35	178.2	68.8 m
24-Aug	48.17 m	10.7 m	16.3	69.62	134.7 m		280.3	133.6	31.36	389.7	104.3	22.56	129.6	48.22	182.6	182.6	27.48	23.77	7.952	14.69 m		88.66	156.5	73.81 m
25-Aug	63.85 m	8.83 m	26.21	61.44	125.6 m		261.5	133.6	31.36	423.7	127.6	22.56	117.7	43.78	255.4	255.4	28.75	26.8	7.103	14.69 m		85.98	82.47	75.53 m
26-Aug	65.49 m	7.952 m	26.21	55.1	116.7 m		211	133.6	28.75	446.3	150.5	21.37	110	40.92	255.4	255.4	30.06	28.75	7.103	14.69 m		85.98	84.22	137.7 m
27-Aug	63.85 m	10.7 m	26.21	48.22	108.1 m		159.6	131.6	27.48	467	178.2	22.56	104.3	36.73	226.3	226.3	30.06	27.48	8.83	15.76 m		104.3	99.59	171.6 m
28-Aug	62.23 m	11.94 m	26.21	45.99	113.9 m		187.1	139.7	27.48	478.8	167.2	24.99	98.65	38.12	167.2	167.2	28.75	27.48	10.7	15.76	59.06	111.9	108.1	127.6 m
29-Aug	68.8 m	36.73 m	26.21	45.25	121.6 m		185.9	169.4	28.75	490.7	121.6	30.71	193.9	33.99	125.6	125.6	27.48	27.48	11.66	15.76	56.69	108.1	102.4	110 m
30-Aug	63.85 m	40.92 m	24.37	43.78	129.6 m		228.7	184.8	30.06	502.6	82.47	30.71	96.81	43.78	108.1	108.1	26.21	26.21	12.65	15.76	55.89	106.2	100.5	102.4 m
31-Aug	80.71 m	38.12 m	25.58	48.22	139.7 m		256.6	200.7	30.06	545.6	84.22	31.36	94.98	43.78	102.4	102.4	24.99	23.77 m		15.76	58.27	104.3	96.81	94.07 m
01-Sep	85.98 m	33.99 m	22.56	48.22	145.9 m		269	176	27.48	574.5	82.47	33.99	93.16	49.72	93.16	93.16	24.99	22.56 m		15.76	67.13	102.4	94.98	85.98 m
02-Sep	93.16 m	32.66 m	22.56	62.23	163.9 m		226.3	133.6	27.48	598.5	82.47	33.99	95.88	46.72	80.12	80.12	23.77	22.56 m		16.84	70.47	98.65	84.22	73.81 m
03-Sep	98.65 m	36.73 m	22.56	62.23	159.6	138.7	225.1	125.6	26.21	608.2	78.99	31.36	94.98	40.92	70.47	70.47	23.77	26.21 m		19.07	75.53	87.76	73.81	62.23 m

04-Sep	89.54 m	39.51 m	21.37	62.23	201.8	136.7	218.1	106.2	24.99	611.4	65.49	27.48	91.35	40.92	70.47	70.47	23.77	27.48 m		20.8	80.71	87.76	72.14	57.48 m	
05-Sep	77.26 m	43.78 m	11.66	43.04	214.5	132.6	201.8	113.9	23.77	608.2	65.49	24.99	92.26	38.12	74.66	74.66	24.99	26.21 m		21.96	88.66	87.76	70.47	54.34 m	
06-Sep	54.34 m	48.22 m	20.21	42.34	199.5	126.6	153.3	133.6	24.99	604.9	70.47	21.96	96.81	35.35	128.6	128.6	26.21	22.56 m		22.56	94.98	91.35	65.49	55.89 m	
07-Sep	35.35 m	52.78 m	19.07	42.34	203	121.6	114.8	169.4	39.51	592.3	65.49	22.56	106.2	32.66	167.2	167.2	30.06	20.21 m		21.37	107.2	98.65	76.41	67.13 m	
08-Sep	30.06 m	67.13 m	35.35	45.25	203	118.7	97.72	145.9	57.48	583	65.49	22.56	110	33.99	193.9	193.9	31.36	21.37 m		19.07	128.6	106.2	103.4	67.13 m	
09-Sep	33.99 m	87.76 m	48.22	45.25	215.4	119.7	90.45	152.2	46.72	561.2	63.85	36.03	104.3	32.66	178.2	178.2	36.73	26.21 m		17.94	167.2	116.8	160.7	94.98 m	
10-Sep	48.22 m	91.35 m	41.63	48.22	214.5	120.6	101.5	162.9	33.99	545.6	55.89	40.21	104.3	35.35	131.6	131.6	40.92	24.99 m		17.94	184.8	135.7	198.4	120.7 m	
11-Sep	63.85 m	93.16 m	30.06	48.96	219.2	112.9	108.1	158.6	28.75	542.5	51.22	36.73	102.4	43.78	115.8	115.8	42.34	22.56 m		19.07	191.6	158.6	228.7	133.6 m	
12-Sep	84.22 m	94.98 m	26.21	52.78	209.9	100.5	108.1	113.9	27.48	548.7	48.22	32.66	100.5	46.72	165	165	46.72	21.37 m		19.07	191.6	177.2	238.3	148 m	
13-Sep	89.54 m	82.47 m	21.37	60.65	213.4	89.54	105.2	98.65	31.36	566.8	49.72	35.35	119.7	48.22	177.9	177.9	49.72	20.21 m		16.84	182.6	190.5	250.5	192.7 m	
14-Sep	94.98 m	98.65 m	35.29	70.47	226.3	152.7	125.6	87.76	46.72	592.3	48.22	35.35	189.3	57.48	154.3	154.3	48.22	19.07 m		17.94	169.4	243.1	240.7 m	m	
15-Sep	80.71 m	106.2 m	45.99	63.85	237.1	143.8	172.7	85.98	59.06	592.3	45.25	36.73	193.9	57.48	208.7	208.7	39.51	17.94 m		19.07	150.1	257.8	206.4 m		19.07
16-Sep	78.99 m	113.9 m	61.44	52.44	246.8	161.8	180.4	84.22	62.23	666.7	43.78	38.12	178.2	78.99	212.2	212.2	35.35	16.84 m		20.21	145.9	269	196.1 m		19.07
17-Sep	117.7 m	115.8 m	148	46.72	243.2	137.7	265.8	80.71	55.89	666.7	45.25	38.12	145.9	104.1	139.7	139.7	32.66	20.21 m		21.37	137.7	272.7	207.6 m		19.07
18-Sep	123.6 m	121.6 m	182.6	39.51	256.6	129.6	279	72.14	63.85	683.7	46.72	39.51	145.9	104.3	150.1	150.1	30.06	20.21 m		24.99	142.8	275.2	198.4 m		19.07
19-Sep	137.7 m	160.7 m	221.6	39.51	267.7	45.14	307.3	68.8	123.6	683.7	49.72	39.51	187.1	80.71	156.5	156.5	26.21	32.66 m		32.66	212.2	285.4	182.6 m		19.07
20-Sep	117.7 m	187.1 m	223.9	38.8	269	98.65	343	70.47	145.9	672.4	59.06	43.78	193.9	63.85	158.6	158.6	24.99	24.99 m		40.92	309.9	290.5	162.9 m		17.94
21-Sep	117.7 m	196.1 m	m	40.5	291.8	93.16	356.4	80.71	169.4	672.4	63.85	65.49	193.9	54.34	160.7	160.7	23.77	28.75 m		55.13	361.8	270.2	173.8 m		17.94
22-Sep	117.7 m	198.4 m	82.47	40.21	300.8	63.02	365.8	94.98	169.4	678.1	57.48	64.67	193.9	48.22	174.9	174.9	24.99	28.75 m		59.06	381.2	266.5	219.2 m		16.84
23-Sep	143.8 m	198.4 m	72.96	40.92	300.8	48.96	363.1	113.9	148	689.4	63.85	57.48	193.9	45.25	171.6	171.6	24.99	28.75 m		60.65 m		260.3	221.6 m		16.84
24-Sep	180.4 m	182.6 m	89.54	39.51	341.6	42.34	351.1	133.6	127.6	683.7	72.14	57.48	193.9	43.78	135.7	135.7	24.99	28.75 m		60.65 m		245.6	228.7 m		16.84
25-Sep	184.8 m	209.9 m	85.98	36.73	369.9	35.35	303.4	158.6	110	689.4	80.15	73.81	193.9	40.92	150.1	150.1	22.56	27.48 m		62.23 m		240.7	214.5 m		16.84
26-Sep	180.4 m	214.5 m	108.1	35.35	402.4	38.8	284	226.2	89.54	701	87.76	235.9	193.9	38.12	129.6	129.6	28.75	12.65 m		62.23 m		250.5	189.3 m		16.84
27-Sep	158.6 m	216.9 m	101.1	35.35	377	48.22	252.9	284	72.14	712.6	84.22	262.8	193.9	35.35	121.6	121.6	54.34	20.21 m		66.68	306	280.3	176 m		15.76
28-Sep	108.1 m	221.6 m	88.64	35.35	364.5	44.52	252.9	311.2	78.99	736.4	77.26	293.1	193.9	36.73	124	124	55.89	32.01 m		68.8	443.5	337.6	160.7 m		15.76
29-Sep	84.22 m	231.1 m	83.34	32.66	363.1	37.41	226.3	332.2	104.3	742.3	70.47	298.3	193.9	38.12	73.81	73.81	65.49	24.99 m		73.81	356.4	384	148 m		15.76
30-Sep	89.54 m	245.6 m	m	29.4	345.7	33.31	228.7	343	114	760.1	68.8	270.2	193.9	36.73	77.26	77.26	85.1	32.66	62.23	78.99	353.8	384	137.7 m		14.69
01-Oct	102.9 m	255.4 m	167.2	30.96	343.1	33.99	307.3	334.9	84.22	772.6	70.47	191.6	193.9	33.99	142	142	106.2	54.34	64.67	82.47	337.6 m		133.6 m		14.69

02-Oct	115.8 m	257.8 m	199.5	38.12	392.5	37.41	317.8	257.8	72.14	772.6	80.71	169.4	193.9	33.99	150.1	150.1	110	62.23	62.23	84.22	326.9 m		111.9 m	14.69
03-Oct	80.71 m	267.7 m	238.3	46.72	429.3	48.96	282.9	180.4	78.99	772.6	77.26	167.2	176	48.22	147	147	94.98	72.14	67.13	82.47	316.5 m		93.16 m	14.69
04-Oct	98.65 m	250.5 m	238.3	59.06	477.3	43.78	323	182.6	77.26	772.6	73.81	145.9	193.9	54.34	125.6	125.6	82.47	67.16	70.47	77.26	285.4 m		87.76 m	15.76
05-Oct	117.7 m	245.6 m	200.7	63.85	507.1	47.46	33.45	205.3	73.81	778.8	77.26	148	171.6	62.23	118.7	118.7	68.8	57.48	72.14	65.49	260.3 m		121.6 m	16.84
06-Oct	180.4 m	243.2 m	174.9	59.86	510	52.78	300.8	226.3	68.8	766.4	70.47	158.6	160.7	65.49	138.7	138.7	57.48	51.22	72.14	55.89	235.9 m		167.2 m	16.84
07-Oct	191.6 m	245.6 m	m	54.34	584.5	49.72	320.4	245.6	91.35	730.4	70.47	167.2	123.9	72.14	137.7	137.7	55.89	48.22	70.47	54.34	219.2 m		212.2 m	14.69
08-Oct	233.5 m	238.3 m	125.6	53.54	616.3	41.63	321.7	228.7	62.23	695.2	94.98	162.9	141.8	82.47	111.9	111.9	64.67	28.75	68.8	52.53	212.2 m		227.5 m	14.69
09-Oct	214.5 m	226.3 m	111.9	49.64	639.6	34.67	332.2	182.6	57.48	634.2	106.2	119.7	131.6	100.7	96.81	96.81	84.22	36.73	68.8	54.05	209.9 m		231.1 m	16.5
10-Oct	200.7 m	221.6 m	119.7	48.22	630.9	30.71	359.1	158.6	62.23	592.3	108.1	116.7	122.5	108.1	91.35	91.35	106.2	33.99	65.49	48.22	219.2 m		229.9 m	12.65
11-Oct	219.2 m	212.2 m	155.4	80.71	632.6	21.96	393.9	154.3	68.8	545.6	111.9	113.9	113.9	121.6	135.7	135.7	123.6	30.06	87.76	46.72	216.9 m		221.6 m	11.66
12-Oct	233.5 m	200.7 m	172.7	120.6	614.7	36.03	381.2	135.7	78.99	487.8	92.06	102.4	104.3	135.7	162.9	162.9	117.7	27.48	143.8	45.25	214.5 m		190.5 m	12.65
13-Oct	250.5 m	187.1 m	168.3	123.4	609.8	40.21	381.2	137.7	87.76	426.5	98.65	104.6	134.7	141.8	180.4	180.4	117.7	30.06	171.6	43.78	212.2	300.8	173.8 m	9.764
14-Oct	240.7 m	173.8 m	m	101.5	609.8	48.22	368.5	180.4	94.98	335.9	80.71	78.99	134.7	125.6	193.9	193.9	133.6	30.06	200.7	60.65	212.2	265.2	158.6 m	8.83
15-Oct	171.6 m	141.8 m	150.1	70.47	587.7	61.44	325.6	205.3	111.9	369.9	68.8	93.16	125.6	104.1	180.4	180.4	143.8	30.06	233.5	45.25	238.3	252.9	154.3 m	8.83
16-Oct	137.7 m	127.6 m	182.6	96.81	541	69.62	360.5	212.2	127.6	361.8	63.85	100.5	106.2	72.14	148	148	129.6	30.06	248	45.25	255.4	231.1	119.7 m	m
17-Oct	203 m	98.65 m	211	139.7	572.1	81.59	360.5	221.6	135.7	364.5	63.85	117.7	91.35	67.13	112.9	112.9	113.9	31.36	270.2	45.25	267.7	238.3	106.2 m	m
18-Oct	137.7 m	102.4 m	218.1	163.9	498.1	92.6	328.2	203	131.6	369.9	98.65	140.8	85.98	67.13	102.4	102.4	106.2	46.72	270.2	46.72	279	243.2	93.16 m	m
19-Oct	165 m	104.3 m	233.5	152.2	477.3	100.5	315.1	169.4	113.9	378.4	113.9	138.7	78.11	68.8	96.81	96.81	100.5	67.98	235.9	51.22	285.4	243.2	89.54 m	m
20-Oct	171.6 m	104.3 m	262.8	75.02	453.6	112.9	329.6	169.4	121.6	384	131.6	133.6	75.53	68.8	87.76	87.76	106.2	68.8	228.7	55.89	290.5	228.7	86.88	243.2 m
21-Oct	180.4 m	108.1 m	m	81.59	418	92.26	363.4	205.3	125.6	378.4	135.7	137.7	106.2	82.47	77.26	77.26	106.2	59.06	198.4	59.06	295.7	221.6	70.47	260.3 m
22-Oct	158.6 m	110 m	267.7	63.85	317.8	74.66	266.5	205.3	117.7	375.5	152.2	150.1	137.7	93.16	67.95	67.95	111.9	52.78	158.6	67.13	262.8	216.9	79.86	251.7 m
23-Oct	117.7 m	100.5 m	211	52.78	312.5	105.2	220.4	158.6	110	386.9	173.8	171.6	129.6	96.81	66.31	66.31	123.6	51.22	122.6	73.81	243.2	221.6	91.35	248 m
24-Oct	94.98 m	121.6 m	134.7	52.78	334.1	134.7	178.2	141.8	102.4	386.9	184.8	137.7	91.35	82.47	66.31	66.31	105.3	49.72	106.2	86.88	235.9	238.3	98.68	289.3 m
25-Oct	80.71 m	127.6 m	115.8	121.6	357.8	132.6	141.8	127.6	82.52	375.5	212.2	149.1	63.85	65.49	70.47	70.47	96.81	49.72	102.4	104.3	220.4	257.8	114.8	316.5 m
26-Oct	78.99 m	123.6 m	100.5	206.4	360.5	117.7	170.5	102.4	70.47	361.8	,223.9 38	209.9	73.81	52.78	72.14	72.14	101.5	48.22	102.4	104.3	209.9	271.5	141.8 m	m
27-Oct	117.7 m	100.5 m	100.5	241.9	357.8	88.64	208.7	113.9	70.47	343	200.7	288	73.81	45.25	84.22	84.22	93.16	45.25	106.2	102.4	200.7	280.3	152.2 m	m
28-Oct	137.7 m	113.9 m	108.1	241.8	329.6	63.85	250.5	127.6	67.13	316.5	171.6	288	70.47	43.78	96.81	96.81	77.26	40.92	100.5	109.1	193.9	275.2	154.3 m	m

29-Oct	214.5	m	127.6	m	108.1	214.5	336.3	62.23	266.5	154.3	68.8	277.8	238.3	280.3	65.49	42.34	135.7	135.7	65.49	43.78	89.54	106.2	209.8	262.8	162.9	311.2	m
30-Oct	226.3	m	184.8	m	108.1	188.2	313.8	67.13	283.4	167.2	78.99	260.3	275.2	272.7	60.65	54.34	173.8	173.8	57.48	45.25	72.14	85.98	216.9	238.3	171.6	280.3	m
31-Oct	243.2	m	182.6	m	112.9	172.7	336.3	74.66	282.9	284	80.71	245.6	184.8	267.7	72.14	65.49	180.4	180.4	58.27	48.99	59.06	67.98	219.2	238.3	187.1	219.2	m
01-Nov	233.5	m	219.2	m	108.1	162.9	m	63.85	248	288	84.22	228.7	262.8	240.7	78.99	68.8	185.9	185.9	65.49	60.65	49.72	67.13	226.3	198.4	196.1	200.7	m
02-Nov	203	m	221.6	m	106.2	154.3	m	51.99	214.5	285.4	87.76	216.9	250.5	282.9	67.13	65.49	184.8	184.8	70.47	72.14	28.75	68.8	234.7	190.9	208.7	180.4	m
03-Nov	203	m	226.3	m	92.26	167.2	m	47.46	197.3	270.2	73.81	207.6	262.8	270.2	60.65	60.65	162.9	162.9	82.47	80.71	40.21	68.8	231.1	184.8	205.3	165	m
04-Nov	180.4	m	226.3	m	78.11	179.7	m	40.92	204.1	167.2	85.98	203	275.2	238.3	49.72	55.89	138.7	138.7	77.26	82.47	38.12	60.65	219.2	176	186	154.3	m
05-Nov	158.6	m	219.2	406.7	77.26	191.6	m	40.21	188.2	148	96.81	209.8	270.2	227.5	48.93	57.48	131.6	131.6	59.86	78.99	36.73	57.48	207.6	171.6	174.9	155.2	m
06-Nov	123.5	m	214.5	359.1	63.85	191.6	m	29.4	177.1	143.8	110	212.2	272.7	191.6	48.22	36.73	108.1	108.1	54.34	75.53	33.99	57.48	191.6	157.5	163.7	133.6	m
07-Nov	137.7	m	207.6	334.9	63.85	188.2	m	28.75	132.6	139.7	91.35	200.7	275.2	148	43.78	33.99	96.81	96.81	54.34	72.14	32.66	57.48	158.6	173.8	154.3	129.6	m
08-Nov	158.6	m	182.6	303.4	78.99	167.2	m	39.51	107.1	145.9	70.47	200.7	248	106.2	40.92	33.99	106.2	106.2	60.65	72.14	26.86	55.89	152.2	209.9	150.6	167.2	m
09-Nov	158.6	m	196.1	255.4	75.53	165	m	53.54	100.5	117.7	70.47	200.7	231.1	98.65	38.09	33.99	99.59	99.59	54.34	72.14	24.99	55.13	154.3	226.3	145.9	60.65	m
10-Nov	158.6	m	191.6	219.2	75.53	m	m	58.27	102.4	96.81	54.34	196.1	245.6	97.72	38.09	28.75	98.65	98.65	45.25	73.81	23.77	52.02	144.9	207.6	134.7	111.9	m
11-Nov	156.5	m	187.1	182.6	75.53	m	m	50.46	119.7	96.81	55.89	198.4	267.7	135.2	45.25	31.36	102.4	102.4	40.21	84.22	27.48	48.22	133.6	187.1	124.6	111.9	m
12-Nov	137.7	m	180.4	173.8	75.53	m	m	58.27	105.2	102.4	55.89	212.2	280.3	84.22	40.92	39.51	92.26	92.26	42.34	84.22	31.36	47.49	133.6	158.6	109.1	104.3	m
13-Nov	115.8	m	171.6	139.7	98.65	m	m	67.95	89.54	100.8	42.34	219.2	282.9	73.81	39.51	42.34	81.59	81.59	45.25	84.22	30.06	51.22	150.1	108.1	94.92	94.98	m
14-Nov	98.65	m	141.8	150.1	132.6	m	m	63.85	94.98	102.4	40.92	203	250.5	70.47	39.51	36.73	72.14	72.14	43.78	89.54	28.75	44.69	176	94.64	78.14	87.76	m
15-Nov	109.1	m	139.7	119.7	130.6	m	m	66.31	78.11	96.81	40.92	198.4	214.5	77.26	38.12	30.06	55.89	55.89	45.25	78.99	26.21	42.34	149.1	111.9	70.47	78.99	m
16-Nov	80.71	m	137.7	131.6	120.6	m	m	55.89	70.47	96.81	36.73	193.9	189.3	143.8	38.12	27.48	46.72	46.72	48.22	70.47	22.56	42.34	141.8	135.7	67.13	75.53	m
17-Nov	75.53	m	135.7	123.6	101.5	m	m	42.34	80.71	94.98	32.66	184.8	165	143.8	36.73	27.48	41.63	41.63	40.92	66.31	19.07	40.92	129.6	176	66.31	67.98	m
18-Nov	63.85	m	131.6	98.65	75.53	m	m	33.31	85.1	80.71	31.36	176	133.6	123.4	36.73	26.21	36.73	36.73	38.12	57.48	15.76	40.92	113.9	180.4	59.86	62.23	m
19-Nov	60.65	m	127.6	100.5	54.34	m	m	24.99	110	75.53	35.35	171.6	110	106.2	40.92	26.21	36.73	36.73	36.73	50.49	15.76	40.92	100.5	171.6	59.06	119.7	m
20-Nov	51.22	m	125.6	80.71	51.22	m	m	25.58	122.5	100.5	36.73	167.2	106.2	100.9	48.22	26.21	40.21	40.21	33.99	52.78	15.76	38.12	91.35	162.9	56.69	m	8.83
21-Nov	33.99	m	117.7	91.35	60.65	m	m	33.99	128.6	102.4	36.73	167.2	104.6	102.2	42.34	27.48	40.92	40.92	30.06	39.51	15.76	31.36	84.22	152.2	54.34	m	8.83
22-Nov	98.65	m	127.6	78.99	57.48	m	m	44.52	118.7	106.2	36.73	219.2	85.98	104.1	42.34	33.99	40.92	40.92	28.75	72.14	15.76	28.75	77.26	135.7	52.02	m	8.83
23-Nov	137.4	m	133.6	49.72	53.54	m	m	53.54	109	139.7	38.12	265.2	72.14	108.1	40.21	36.73	39.51	39.51	28.75	44.69	16.84	27.48	73.81	117.3	48.22	m	8.83
24-Nov	137.7	m	119.7	49.72	45.99	m	m	64.67	100.5	137.7	38.12	311.2	70.47	113.9	39.51	35.35	33.99	33.99	26.21	67.13	15.76	26.21	67.95	111.9	45.99	m	8.83
25-Nov	102.4	m	145.9	55.89	45.25	m	m	70.47	98.65	108.1	36.73	345.7	65.49	128.6	39.51	35.35	34.67	34.67	26.21	65.49	14.69	22.56	65.49	108.1	39.51	m	8.83

26-Nov	80.71	m	152.2	55.89	45.99	m	m	67.13	94.07	91.35	31.36	334.9	62.23	162.9	36.73	35.35	35.35	35.35	27.48	59.06	13.67	21.37	59.06	96.81	38.12	m	7.952
27-Nov	98.65	m	156.5	52.78	45.99	m	m	56.69	89.54	70.47	28.75	280.3	57.48	162.9	38.12	32.66	38.12	38.12	32.66	54.34	13.67	19.07	59.06	85.98	37.44	m	7.952
28-Nov	98.65	m	160.7	48.22	45.99	m	m	47.46	83.34	63.85	21.37	226.3	51.22	154.3	36.73	28.75	33.99	33.99	33.99	48.87	14.69	17.94	57.48	72.99	36.73	m	7.952
29-Nov	96.81	m	169.4	43.78	45.25	m	m	71.29	86.85	72.14	19.07	191.6	49.72	143.8	36.73	27.48	30.06	30.06	43.78	45.25	14.69	16.84	55.89	70.24	36.73	m	7.952
30-Nov	89.54	m	162.9	49.72	45.25	m	m	111.9	101.5	80.74	17.94	169.4	49.72	88.64	43.78	28.75	26.21	26.21	57.48	42.34	15.76	16.84	55.89	65.49	36.73	m	7.952
01-Dec	89.54	m	158.6	51.22	43.04	m	m	122.5	107.1	94.98	m	167.2	52.78	68.8	55.89	30.06	24.99	24.99	m	36.73	15.76	15.76	54.34	m	36.05	m	7.952
02-Dec	82.47	m	156.5	52.78	42.34	m	m	109	106.2	80.71	m	162.9	55.89	63.85	60.65	30.06	23.77	23.77	m	32.66	15.76	14.69	52.78	m	32.66	m	7.952
03-Dec	98.65	m	152.2	48.22	38.12	m	m	77.26	95.88	68.8	m	165	54.34	124.5	51.22	28.75	22.56	22.56	80.71	28.75	15.76	14.69	51.22	m	31.36	m	7.952
04-Dec	117.7	m	145.9	21.37	37.41	m	m	93.16	74.66	60.65	m	160.5	55.89	48.22	42.34	27.48	21.37	21.37	87.76	23.77	15.76	14.69	46.72	m	31.36	m	7.952
05-Dec	137.7	m	139.7	21.37	32.66	m	m	147	68.8	54.34	m	160.7	52.78	45.25	40.92	27.48	20.21	20.21	84.22	22.56	15.76	16.3	43.78	m	36.05	m	7.952
06-Dec	167.7	m	119.7	11.66	32.66	m	m	147	78.99	48.22	m	152.4	51.22	40.92	33.99	26.21	20.21	20.21	85.98	21.37	15.76	16.84	42.34	m	30.06	m	7.952
07-Dec	193.9	m	127.6	19.07	30.06	m	m	133.6	87.76	48.22	m	148	52.78	40.92	33.99	23.77	20.21	20.21	78.14	19.64	16.84	15.76	42.34	m	30.06	m	7.103
08-Dec	191.6	m	125.6	17.94	30.06	m	m	117.7	97.72	60.65	m	143.8	52.78	39.51	33.99	21.37	21.37	21.37	68.8	19.07	25.61	15.76	42.34	m	29.4	m	2.632
09-Dec	158.6	m	119.7	15.76	36.73	m	m	87.76	85.98	68.8	m	133.6	54.34	38.12	32.66	20.21	23.77	23.77	63.85	17.94	27.48	17.94	39.51	94.98	28.75	m	7.103
10-Dec	156.5	m	115.8	13.67	46.72	m	m	67.13	82.47	66.68	m	113.9	59.06	38.12	31.36	20.21	22.56	22.56	51.22	17.94	27.48	45.25	39.51	94.98	27.48	m	7.103
11-Dec	84.22	m	115.8	12.65	51.22	m	m	56.69	79.83	91.35	m	102.4	87.36	38.12	31.36	19.07	21.37	21.37	39.51	16.84	27.48	40.92	36.73	77.26	27.48	m	7.103
12-Dec	117.7	m	110	10.7	53.43	m	m	48.22	74.66	77.26	m	102.4	55.89	36.73	31.36	17.94	21.37	21.37	33.99	16.84	27.48	36.73	33.99	72.14	26.86	m	7.103
13-Dec	98.65	m	108.1	3.283	54.34	m	m	66.31	65.49	63.85	m	84.22	54.34	36.73	31.36	16.84	23.77	23.77	30.06	15.76	27.48	28.75	32.66	70.47	26.21	m	7.103
14-Dec	94.98	m	104.3	7.952	52.78	m	m	46.72	67.95	54.34	m	84.22	52.78	35.35	31.36	16.84	24.99	24.99	27.48	15.76	25.61	21.37	32.66	70.47	25.61	m	7.103
15-Dec	80.71	m	101.4	8.83	47.4	m	m	44.52	78.11	48.22	m	110	51.22	33.99	33.39	16.84	28.75	28.75	26.21	15.76	24.99	19.07	32.66	63.85	24.99	m	7.103
16-Dec	75.53	m	94.98	13.67	39.51	m	m	52.78	64.67	45.25	m	189.3	49.72	32.66	31.36	15.76	33.99	33.99	24.99	14.69	23.77	19.07	31.36	52.78	24.99	m	7.103
17-Dec	63.85	m	82.47	15.76	32.01	m	m	69.62	61.44	45.25	m	214.5	52.78	31.36	31.36	15.76	33.99	33.99	22.56	13.67	21.37	17.94	30.06	49.72	26.86	m	7.103
18-Dec	60.65	m	100.5	16.84	27.48	m	m	84.22	55.1	42.34	m	235.9	55.89	23.77	31.36	14.69	31.36	31.36	22.56	13.67	18.51	17.94	30.06	48.22	27.48	m	7.103
19-Dec	51.22	m	98.65	15.76	26.21	m	m	93.16	44.52	39.51	m	233.5	57.48	30.06	30.71	16.84	27.48	27.48	21.37	12.65	16.84	16.84	28.75	45.25	27.48	m	7.103
20-Dec	32.66	m	93.16	10.7	24.99	m	m	65.81	36.03	39.51	m	214.5	62.23	30.06	30.71	19.07	24.99	24.99	20.21	12.65	15.76	16.84	28.75	42.34	27.48	m	7.103
21-Dec	32.66	m	89.54	3.283	24.2	m	m	49.72	33.99	38.12	m	193.9	57.48	30.06	30.71	21.37	21.96	21.96	19.07	12.65	15.76	15.76	28.75	39.51	29.4	m	m
22-Dec	30.06	m	82.47	8.83	m	m	m	41.63	28.75	36.59	m	171.6	57.48	28.75	30.71	27.48	21.37	21.37	19.07	13.67	15.76	15.76	28.75	36.73	30.71	m	m
23-Dec	27.48	m	65.49	8.83	m	m	m	28.1	28.1	35.35	m	152.2	54.34	28.75	30.06	27.48	20.21	20.21	19.07	14.69	15.76	15.76	28.75	35.35	36.05	m	m

24-Dec	24.99	m	75.53	7.952	m	m	m	31.36	23.77	33.99	m	119.7	9.723	27.48	30.71	38.12	19.07	19.07	17.94	17.94	15.76	15.76	28.75	35.35	40.21	m	m
25-Dec	15.76	m	68.8	6.283	m	m	m	43.04	27.48	33.99	m	82.47	35.35	27.48	30.06	38.12	19.07	19.07	17.41	21.37	15.76	15.76	27.48	31.36	40.21	59.06	m
26-Dec	14.69	m	67.13	3.962	m	m	m	53.54	30.71	32.66	m	73.81	38.12	26.21	30.06	31.36	19.07	19.07	19.07	20.8	15.76	14.69	27.48	30.06	36.73	57.48	m
27-Dec	13.67	m	49.72	2.632	m	m	m	m	38.12	32.66	m	62.23	39.51	42.34	30.06	27.48	19.07	19.07	19.07	27.56	13.67	14.69	26.21	30.06	37.44	55.89	m
28-Dec	12.65	m	59.06	2.038	m	m	m	m	36.03	31.36	m	48.22	38.12	44.52	30.06	27.48	19.07	19.07	20.21	18.45	11.66	13.67	26.21	28.75	32.66	54.34	m
29-Dec	12.65	m	51.22	0.538	m	m	m	59.86	29.4	31.36	m	60.65	36.73	38.12	30.06	23.77	17.94	17.94	20.8	27.48	9.764	16.84	26.21	28.75	32.01	52.78	m
30-Dec	12.65	m	35.35	0	m	m	m	41.63	24.37	32.66	m	68.8	35.35	36.73	30.06	21.37	17.94	17.94	20.21	26.21	6.934	21.37	26.21	27.48	31.36	49.72	m
31-Dec	12.65	m	42.34	0	21.37	m	m	37.41	21.37	32.66	m	94.98	36.73	32.01	30.06	20.21	16.84	16.84	20.21	22.56	8.83	21.37	26.21	27.48	31.36	42.34	m

APPENDIX B

Daily flow of Pra river taken at Daboase

Date	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2003
01-Jan	181.37	99.22	104.07	m	m	144	126.2	m	m	m	m	130.27
02-Jan	151.26	96.46	100.44	m	m	131.2	121.1	m	m	m	m	130.54
03-Jan	160.83	97.35	100.19	m	m	126.3	104.5	m	m	m	m	127.84
04-Jan	152.96	98.65	99.95	m	m	123.5	92.71	m	m	m	m	126.22
05-Jan	144.11	97.27	96.54	m	m	121.9	85.43	m	m	m	m	123.82
06-Jan	139.34	96.3	96.3	m	m	119.2	84.97	m	m	m	m	124.36
07-Jan	134.91	96.3	96.3	m	m	117.8	84.97	m	m	m	m	119.33
08-Jan	130.27	96.46	96.3	m	m	117.6	84.97	m	m	m	m	117.75
09-Jan	122.23	96.46	96.54	m	m	115	85.2	m	m	m	m	117.75
10-Jan	117.67	91.52	100.11	m	m	113	88.69	m	m	m	m	118.63
11-Jan	112.58	85.23	102.5	m	m	121.4	91.75	m	m	m	m	118.54
12-Jan	111.98	77.75	99.87	m	m	121.4	85.36	m	m	m	m	121.7
13-Jan	108.17	70.4	92.47	m	m	112.8	83.82	m	m	m	m	120.38
14-Jan	104.32	62.14	85.2	m	m	112	83.74	m	m	m	m	116.72
15-Jan	102.74	61.8	81.32	m	m	108.4	83.74	m	m	m	m	116.98
16-Jan	100.11	62.83	77.95	m	m	108.4	83.74	m	m	m	m	123.29
17-Jan	96.54	75.68	77.72	m	m	111.7	83.74	m	m	m	m	124.62
18-Jan	96.3	92.25	77.72	m	m	108.6	83.74	m	m	m	m	120.12
19-Jan	96.3	96.3	77.72	m	m	112.2	83.59	m	m	m	m	117.84
20-Jan	96.3	96.3	77.72	m	m	132.6	81.47	m	m	m	m	117.41
21-Jan	96.3	96.3	77.72	m	m	122.2	81.31	m	m	m	m	112.58
22-Jan	97.03	96.3	77.87	m	m	112.8	81.31	m	m	m	m	112.24
23-Jan	108.01	96.3	80.26	m	m	112	81.31	m	m	m	m	112.24
24-Jan	117.15	95.58	84.9	m	m	107.9	81.31	m	m	m	m	112.24
25-Jan	118.02	82.78	88.45	m	m	100.6	81.54	m	m	m	m	112.24
26-Jan	122.77	77.65	88.45	m	m	98.81	84.74	m	m	m	m	112.24
27-Jan	137.69	74.35	84.29	m	m	96.46	84.74	m	m	m	m	112.24
28-Jan	130.82	63.79	71.04	m	m	96.06	81.54	m	m	m	m	111.98
29-Jan	126.76	61.46	62.08	m	m	92.7	81.31	m	m	m	m	108.17
30-Jan	130.82	60.78	57.77	m	m	92.46	81.31	m	m	m	m	104.15
31-Jan	139.07	60.85	59.16	m	m	92.38	81.31	m	m	m	m	100.44
01-Feb	142.98	58.11	83.19	m	m	91.35	81.31	m	m	m	m	m
02-Feb	135.47	57.18	85.12	m	m	92.38	81.31	m	m	m	m	m
03-Feb	134.37	58.5	87.36	m	m	92.46	81.31	m	m	m	m	m
04-Feb	126.58	59.19	89.24	m	m	92.46	81.31	m	m	m	m	m
05-Feb	123.73	55.94	98.08	m	m	92.7	81.54	m	m	m	m	m
06-Feb	125.16	55.67	96.46	m	m	95.82	84.97	m	m	m	m	m
07-Feb	112.84	55.02	96.3	m	m	92.7	89.16	m	m	m	m	m
08-Feb	108.17	54.43	96.3	m	m	92.46	99.22	m	m	m	m	m
09-Feb	103.91	54.43	96.3	m	m	92.62	95.82	m	m	m	m	m
10-Feb	96.54	54.76	96.3	m	m	94.69	85.9	m	m	m	m	m
11-Feb	92.94	52.12	96.06	m	m	93.1	87.91	m	m	m	m	m
12-Feb	96.3	52	92.7	m	m	99.71	80.72	m	m	m	m	m
13-Feb	99.95	50.61	92.38	m	m	100.2	81.24	m	m	m	m	m

14-Feb	100.44	50.74	91.12	m	m	99.95	81.47	m	m	m	m	m
15-Feb	103.9	52.26	88.84	m	m	96.54	83.59	m	m	m	m	m
16-Feb	104.07	52.91	88.45	m	m	96.95	83.59	m	m	m	m	m
17-Feb	102.74	62.7	84.97	m	m	107.6	81.47	m	m	m	m	m
18-Feb	100.36	61.94	81.32	m	m	130.1	81.31	m	m	m	m	m
19-Feb	99.95	60.85	77.95	m	m	147.1	82.24	m	m	m	m	m
20-Feb	96.54	63.37	77.28	m	m	145.1	95.59	m	m	m	m	m
21-Feb	96.3	62.21	70.52	m	m	139.2	98.51	m	m	m	m	m
22-Feb	96.54	60.78	61.13	m	m	130.3	79.09	m	m	m	m	m
23-Feb	100.2	58.71	57.71	m	m	117.9	77.72	m	m	m	m	m
24-Feb	103.65	58.71	57.38	m	m	108.3	77.28	m	m	m	m	m
25-Feb	100.69	53.73	55.28	m	m	100.2	71.16	m	m	m	m	m
26-Feb	104.15	53.28	51.18	m	m	92.94	70.73	m	m	m	m	m
27-Feb	108.17	50.99	45.61	m	m	92.46	70.51	m	m	m	m	m
28-Feb	111.47	45.69	43.51	m	m	92.38	67.54	m	m	m	m	m
29-Feb	*	44.42	*	*	*	91.27	*	*	*	m	*	*
01-Mar	123.66	42.86	42.74	m	m	91.27	m	m	m	m	m	126.76
02-Mar	114.56	49.08	45.37	146.68	m	97.55	m	m	m	m	m	130.27
03-Mar	106.87	66.1	48.49	122.36	m	100.1	m	m	m	m	m	132.18
04-Mar	108.56	67.11	55.82	103.59	m	111.2	m	m	m	m	m	136.02
05-Mar	105.9	64.26	83.44	96.7	m	132.3	m	m	m	m	m	136.02
06-Mar	100.8	64.95	92.47	96.3	m	137	m	m	m	m	m	137.68
07-Mar	115.77	63.65	99.63	96.3	m	119	m	m	m	m	m	137.68
08-Mar	117.5	57.52	99.46	96.3	m	107.2	m	m	m	m	m	134.64
09-Mar	118.63	51.12	106.15	96.79	m	115.2	m	m	m	m	m	131.63
10-Mar	123.57	43.05	104.07	103.91	m	128.3	m	m	m	m	m	127.3
11-Mar	123.65	42.27	100.2	107.91	m	132.4	m	m	m	m	m	123.29
12-Mar	120.03	39.03	96.06	107.91	m	169.1	m	m	m	m	m	123.03
13-Mar	131.51	39.38	89.16	104.4	m	169.5	m	m	m	m	m	123.03
14-Mar	157.53	47.94	88.68	103.9	m	160.6	m	m	m	m	m	122.76
15-Mar	151.16	52.38	88.68	100.2	m	194.9	m	m	m	m	m	119.07
16-Mar	138.35	57.78	88.68	97.03	m	198	m	m	m	m	m	118.81
17-Mar	135.83	66.7	88.45	103.66	m	206.5	m	m	m	m	m	118.81
18-Mar	131.49	67.32	85.43	104.4	m	206.7	m	m	m	m	m	115.69
19-Mar	138.93	67.32	88.45	107.66	m	202	m	m	m	m	m	113.62
20-Mar	150.09	67.32	88.92	104.15	m	194.9	m	m	m	m	m	112.24
21-Mar	136.59	66.91	92.46	100.44	m	190.9	m	m	m	m	m	111.98
22-Mar	123.83	60.52	96.06	100.69	m	217.4	m	m	m	m	m	
23-Mar	117.67	51.69	96.3	108.26	m	222.2	m	m	m	m	m	
24-Mar	112.15	48.48	96.3	117.41	m	220.5	m	m	m	m	m	
25-Mar	119.31	48.11	96.3	121.7	m	234.8	m	m	m	m	m	
26-Mar	129.47	45.73	96.54	m	m	229.2	m	m	m	m	m	
27-Mar	129.02	48.3	99.71	m	m	209.8	m	m	m	m	m	
28-Mar	132.47	51.3	96.54	m	m	192.7	m	m	m	m	m	
29-Mar	145.65	54.18	96.3	m	m	182.3	m	m	m	m	m	
30-Mar	155.29	54.56	96.3	m	m	180	m	m	m	m	m	
31-Mar	155.87	57.71	96.54	m	m	174.9	m	m	m	m	m	
01-Apr	153.63	63.99	100.2	m	m	161.6	m	m	m	m	m	
02-Apr	161.42	70.73	106.57	m	m	153.3	m	m	m	m	m	
03-Apr	157.6	77.06	147.54	m	m	138.4	m	m	m	m	m	

04-Apr	151.04	74.19	179.19	m	m	142.4	m	m	m	m	m
05-Apr	152.1	70.94	177.32	m	m	147	m	m	m	m	m
06-Apr	156.92	70.73	181	m	m	142.4	m	m	m	m	m
07-Apr	154.89	70.73	177.83	m	m	125.6	m	m	m	m	m
08-Apr	155.08	70.73	188.25	m	m	114.8	m	m	m	m	m
09-Apr	152.95	70.73		m	m	110.7	m	m	m	m	m
10-Apr	154.12	70.73	162.31	m	m	115.1	m	m	m	m	m
11-Apr	187.43	70.73	149.8	m	m	122.1	m	m	m	m	m
12-Apr	185.89	70.73	158.5	m	m	155.2	m	m	m	m	m
13-Apr	168.46	81.33	180.61	m	m	195.9	m	m	m	m	m
14-Apr	161.43	91.76	189.18	m	m	178.1	m	m	m	m	m
15-Apr	162.76	92.46	185.85	m	m	187.8	m	m	m	m	m
16-Apr	189.29	92.46	172.16	m	m	186.3	m	m	m	m	m
17-Apr	207.46	92.46	162.3	m	m	171.3	m	m	m	m	m
18-Apr	198.03	92.7	152.77	m	m	170.6	m	m	m	m	m
19-Apr	188.46	96.54	141.49	m	m	216.4	m	m	m	m	m
20-Apr	180.08	103.66	139.43	m	m	226.1	m	m	m	m	m
21-Apr	176.4	103.41	140.47	m	m	209.3	m	m	m	m	m
22-Apr	170.85	92.71	157.03	m	m	201.4	m	m	m	m	m
23-Apr	162.3	85.2	165.86	m	m	185.6	m	m	m	m	m
24-Apr	157.02	81.54	157.9	m	m	173.2	m	m	m	m	m
25-Apr	159.78	81.31	153.24	m	m	167.1	m	m	m	m	m
26-Apr	158.58	81.09	156.23	m	m	161	m	m	m	m	m
27-Apr	150.28	77.95	202.48	m	m	151.3	m	m	m	m	m
28-Apr	147.87	78.17	191.6	m	m	144.2	m	m	m	m	m
29-Apr	173.39	85.69	177.02	m	m	146.9	m	m	m	m	m
30-Apr	190.65	103.77	169.47	m	m	144.7	m	m	m	m	m
01-May	198.46	117.24	194.45	194.11	m	140.9	m	m	m	m	m
02-May	202.2	122.76	190.96	182.13	m	137.8	m	m	m	m	m
03-May	198.14	118.98	176.72	177.63	m	139.3	m	m	m	m	m
04-May	193.92	113.01	162.31	186.58	m	139.9	m	m	m	m	m
05-May	235.68	117.06	149.23	198.06	m	148.6	m	m	m	m	m
06-May	231.24	112.32	148.65	228.54	m	137.4	m	m	m	m	m
07-May	232.91	108.42	152.96	243.41	m	148.7	m	m	m	m	m
08-May	233.47	108.42	156.73	269.36	m	183.4	m	m	m	m	m
09-May	221.51	112.58	148.65	302.99	m	198.8	m	m	m	m	m
10-May	196.14	121.08	143.55	317.9	m	190.1	m	m	m	m	m
11-May	192.53	118.02	134.65	272.37	m	188	m	m	m	m	m
12-May	183.69	117.75	122.15	247.44	m	209.5	m	m	m	m	m
13-May	172.25	118.28	113.53	241.44	m	205.1	m	m	m	m	m
14-May	255.85	125.69	123.66	250.19	m	195	m	m	m	m	m
15-May	338.74	126.76	138.89	309.34	m	186.9	m	m	m	m	m
16-May	299.24	134.64	148.08	279.82	m	182.9	m	m	m	m	m
17-May	312.4	140.19	152.47	263.37	m	172.8	m	m	m	m	m
18-May	296.27	157.03	149.41	250.82	m	177.1	m	m	m	m	m
19-May	310.53	166.65	140.28	225.4	m	168.5	m	m	m	m	m
20-May	302.22	170.14	142.98	212.9	m	150.4	m	m	m	m	m
21-May	330.07	172.66	135.47	212.13	m	139.4	m	m	m	m	m
22-May	327.34	191.28	134.73	212.68	m	133.3	m	m	m	m	m
23-May	311.68	280.45	132.36	219.49	m	141	m	m	m	m	m

24-May	385.54	376.37	135.28	207.14	m	131.7	m	m	m	m	m
25-May	385.54	400.55	143.55	197.6	m	140.8	m	m	m	m	m
26-May	385.54	405.85	147.51	202.95	m	161.1	m	m	m	m	m
27-May	385.54	408.79	139.62	224.61	m	161.5	m	m	m	m	m
28-May	385.54	417.25	135.28	225.26	m	162.3	m	m	m	m	m
29-May	385.54	393.51	136.48	239.16	m	228.9	m	m	m	m	m
30-May	385.54	348.94	138.6	306.84	m	228.9	m	m	m	m	m
31-May	385.54	298.79	130.64	333.16	m	265.2	m	m	m	m	m
01-Jun	385.54	260.91	123.73	m	246.97	354.3	m	m	m	m	m
02-Jun	385.54	246.74	122.31	362.7	257.82	342	m	m	m	m	m
03-Jun	385.54	240.41	125.69	370.91	274.12	327.3	m	m	m	m	m
04-Jun	385.54	229.86	121.79	381.37	284.54	306.3	m	m	m	m	m
05-Jun	385.54	218.4	115.59	382.83	296.85	255.6	m	m	m	m	m
06-Jun	385.54	197.4	119	313.39	292.15	232.1	m	m	m	m	m
07-Jun	385.54	187.51	140.69	285.2	286.99	262.3	m	m	m	m	m
08-Jun	385.54	192.22	161.53	247.7	291.78	367.4	m	m	m	m	m
09-Jun	385.54	205.31	178.39	227.15	288.88	380	m	m	m	m	m
10-Jun	385.54	200.65	279.91	175.07	241.43	386.8	m	m	m	m	m
11-Jun	385.54	251.4	224.91	167.65	201.63	364.6	m	m	m	m	m
12-Jun	385.54	297.52	173.5	172.46	160.65	436.9	m	m	m	m	m
13-Jun	385.54	282.84	217.51	187.97	103.09	493.5	m	m	m	m	m
14-Jun	385.54	297.35	297.1	223.76	89.25	409.3	m	m	m	m	m
15-Jun	385.54	302.96	364.52	252.12	106.03	386.5	m	m	m	m	m
16-Jun	385.54	291.06	372.68	286.23	152.15	632	m	m	m	m	m
17-Jun	385.54	263.51	344.14	348.05	190.82	789.5	m	m	m	m	m
18-Jun	385.54	242.48	333.21	393.65	218.75	583	m	m	m	m	m
19-Jun	385.54	245.93	389.28	419.66	243.26	504.5	m	m	m	m	m
20-Jun	385.54	248.38	431.37	414.29	300.41	493.4	m	m	m	m	m
21-Jun	385.54	276.79	412.92	397.22	310.5	465.8	m	m	m	m	m
22-Jun	385.54	257.48	363.29	381.38	323.24	427.4	m	m	m	m	m
23-Jun	385.54	235.19	336.27	362.57	347.68	395.9	m	m	m	m	m
24-Jun	385.54	212.59	412.45	349.79	349.39	383.6	m	m	m	m	m
25-Jun	385.54	197.18	368.96	345.05	349.78	375.7	m	m	m	m	m
26-Jun	385.54	191.06	324.79	370.28	354.29	374.3	m	m	m	m	m
27-Jun	385.54	210.83	318.25	418.42	340.58	360.2	m	m	m	m	m
28-Jun	385.54	210.83	344.16	421.78	348.73	338.5	m	m	m	m	m
29-Jun	385.54	201.76	384.55	421.78	349.39	339	m	m	m	m	m
30-Jun	385.54	192.22	377.15	421.78	350.58	339.2	m	m	m	m	m
01-Jul	484.17	191.9	394.45	417.59	367.81	384.6	m	m	m	m	m
02-Jul	577.92	196.33	408.66	355.76	376.34	375.7	m	m	m	m	m
03-Jul	751.71	196.54	426.91	292.42	399.86	373.1	m	m	m	m	m

04-Jul	759.13	194.74	420.09	236.97	397.81	381.7	m	m	m	m	m
05-Jul	798.31	190.96	388.67	208.02	346.14	388.9	m	m	m	m	m
06-Jul	933.82	201.33	362.58	196.97	336.54	404.5	m	m	m	m	m
07-Jul	981.73	206.92	346.24	191.58	354.83	417.8	m	m	m	m	m
08-Jul	957.56	211.47	375.56	186.57	362.16	420.9	m	m	m	m	m
09-Jul	893.13	206.28	409.95	181.62	369.84	397.1	m	m	m	m	m
10-Jul	839.19	191.91	375.29	176.71	394.87	347.4	m	m	m	m	m
11-Jul	807.04	181.93	338.92	171.85	419.1	295.8	m	m	m	m	m
12-Jul	799.76	177.32	304.37	168.25	405.03	315.4	m	m	m	m	m
13-Jul	844.09	181.62	274.98	184.62	375.94	346.1	m	m	m	m	m
14-Jul	927.68	185.95	251.87	241.08	358.82	354.7	m	m	m	m	m
15-Jul	974.53	182.54	230.66	229.65	355.88	328.7	m	m	m	m	m
16-Jul	997.54	191.59	221.48	210.41	354.9	340	m	m	m	m	m
17-Jul	1012.4	201.76	220.92	192.43	343.86	359.7	m	m	m	m	m
18-Jul	881.89	211.48	220.81	186.89	343.46	297.1	m	m	m	m	m
19-Jul	757.91	213.23	218.82	186.57	349.39	244.2	m	m	m	m	m
20-Jul	675.7	229.08	212.24	186.47	356.15	263.2	m	m	m	m	m
21-Jul	612.94	234.94	206.6	184.81	369.43	292.1	m	m	m	m	m
22-Jul	577.24	236.65	196.86	181.51	392.79	317.8	m	m	m	m	m
23-Jul	506.88	257.13	189.81	177.32	387.41	339.8	m	m	m	m	m
24-Jul	463.5	273.16	181.52	181.62	368.62	355	m	m	m	m	m
25-Jul	424.85	268.13	172.16	185.95	349.66	394.2	m	m	m	m	m
26-Jul	389.27	251.86	167.05	181.31	333.31	400.4	m	m	m	m	m
27-Jul	356.54	235.29	162.3	172.46	299.24	335.4	m	m	m	m	m
28-Jul	326.44	219.39	157.6	171.55	280.77	297.4	m	m	m	m	m
29-Jul	298.75	207.03	154.12	167.05	268.84	274.6	m	m	m	m	m
30-Jul	273.28	196.65	167.98	162.59	257.82	261.4	m	m	m	m	m
31-Jul	249.87	186.79	196.16	162.3	251.5	252.8	m	m	m	m	m
01-Aug	233.57	179.87	217.29	m	241.44	253.3	m	m	m	m	m
02-Aug	224.93	172.06	211.91	m	240.75	266.8	m	m	m	m	m
03-Aug	224.93	167.05	202.08	m	240.75	273.5	m	m	m	m	m
04-Aug	256.31	162.01	196.65	m	240.75	258.5	m	m	m	m	m
05-Aug	327.91	153.25	191.58	m	240.75	259	m	m	m	m	m
06-Aug	394.38	148.46	186.57	m	240.75	271.4	m	m	m	m	m
07-Aug	424.66	145.43	181.62	m	240.75	290.2	m	m	m	m	m
08-Aug	460.98	143.64	176.71	m	240.75	308	m	m	m	m	m
09-Aug	493.12	139.34	172.97	m	240.41	301.2	m	m	m	m	m
10-Aug	471.89	135.01	185.77	m	235.62	288	m	m	m	m	m
11-Aug	432.96	132.08	212.17	m	235.28	274.7	m	m	m	m	m
12-Aug	391.57	130.36	239.4	m	235.96	264.6	m	m	m	m	m
13-Aug	365.55	126.22	248.24	m	245.24	254	m	m	m	m	m
14-Aug	330.97	121.96	256.17	m	240.41	244.8	m	m	m	m	m
15-Aug	330.3	118.02	245.26	m	229.97	235.4	m	m	m	m	m

16-Aug	27.6	117.75	219.08	m	221.37	229.9	m	m	m	m	m
17-Aug	311.9	117.15	192.66	m	220.6	222.5	m	m	m	m	m
18-Aug	292.77	108.76	182.23	m	240.08	219	m	m	m	m	m
19-Aug	283.93	108.16	181.92	m	250.8	215.9	m	m	m	m	m
20-Aug	300	108.16	186.57	m	248.73	228.6	m	m	m	m	m
21-Aug	345.39	108.08	191.27	m	280.08	236.3	m	m	m	m	m
22-Aug	394.48	106.74	191.27	m	310.67	246.8	m	m	m	m	m
23-Aug	406.83	104.23	186.57	m	350.12	272.7	m	m	m	m	m
24-Aug	398.74	102.74	181.31	m	403.48	282.2	m	m	m	m	m
25-Aug	410.77	100.52	172.16	m	485.88	289.8	m	m	m	m	m
26-Aug	396.25	102.74	167.35	m	554.31	386.6	m	m	m	m	m
27-Aug	369.7	104.32	m	m	627.12	404.5	m	m	m	m	m
28-Aug	357.49	108.17	m	m	640.02	394.4	m	m	m	m	m
29-Aug	340.59	112.58	m	m	620.31	379.2	m	m	m	m	m
30-Aug	318.76	121.61	m	m	592.4	356.1	m	m	m	m	m
31-Aug	304.09	126.49	m	m	568.48	315.5	m	m	m	m	m
01-Sep	289.94	134.09	m	m	540.08	286.6	m	m	m	m	m
02-Sep	273.4	130.27	m	m	529.35	267.4	m	m	m	m	m
03-Sep	267.16	122.23	m	m	495.24	257.5	m	m	m	m	m
04-Sep	265.38	117.67	m	m	468.07	252.2	m	m	m	m	m
05-Sep	270.16	112.32	m	m	410.4	252.2	m	m	m	m	m
06-Sep	293.65	108.17	m	m	382.48	261	m	m	m	m	m
07-Sep	310.25	104.4	m	m	369.02	261.6	m	m	m	m	m
08-Sep	301.33	104.4	m	m	362.16	252.3	m	m	m	m	m
09-Sep	308.48	107.66	m	m	356.15	251.6	m	m	m	m	m
10-Sep	323.24	104.4	m	m	355.88	249.8	m	m	m	m	m
11-Sep	350.6	104.99	m	m	356.82	251.8	m	m	m	m	m
12-Sep	365.38	116.55	m	m	342.69	251.5	m	m	m	m	m
13-Sep	364.44	112.75	m	m	322.72	244.2	m	m	m	m	m
14-Sep	366.34	114.98	m	m	308.36	240.9	m	m	m	m	m
15-Sep	397.25	117.84	m	m	300.6	240.4	m	m	m	m	m
16-Sep	427.38	121.7	m	m	328.27	233.3	m	m	m	m	m
17-Sep	378.3	123.46	m	m	354.43	226.3	m	m	m	m	m
18-Sep	339.44	128.24	m	m	360.96	217.1	m	m	m	m	m
19-Sep	310.4	161.79	m	m	348.09	212.4	m	m	m	m	m
20-Sep	286.39	191.42	m	m	316.36	212.6	m	m	m	m	m
21-Sep	265.39	219.42	m	m	287.01	218.8	m	m	m	m	m
22-Sep	250.34	250.12	m	m	269.92	220.3	m	m	m	m	m
23-Sep	240.76	258.89	m	m	269.92	210.4	m	m	m	m	m
24-Sep	231.44	286.66	m	m	287.01	203.3	m	m	m	m	m
25-Sep	220.49	321.33	m	m	314.69	194.4	m	m	m	m	m

26-Sep	227.16	342.55	m	m	321.56	191.9	m	m	m	m	m
27-Sep	222.81	354.96	m	m	317.34	196	m	m	m	m	m
28-Sep	219.37	354.96	m	m	328.11	192.2	m	m	m	m	m
29-Sep	219.15	342.55	m	m	334.19	197.7	m	m	m	m	m
30-Sep	219.26	321.96	m	m	334.59	201.3	m	m	m	m	m
01-Oct	221.03	296.38	m	m	362.73	193.7	m	m	m	m	m
02-Oct	224.03	274.49	m	m	399.46	190.8	m	m	m	m	m
03-Oct	221.15	253.02	m	m	407.39	203.3	m	m	m	m	m
04-Oct	221.26	248.59	m	m	400.28	276.9	m	m	m	m	m
05-Oct	226.38	251.96	m	m	375.93	322.1	m	m	m	m	m
06-Oct	233.47	257.82	m	m	362.56	287.4	m	m	m	m	m
07-Oct	241.45	268.24	m	m	356.15	272.8	m	m	m	m	m
08-Oct	260.56	270.15	m	m	355.35	271.5	m	m	m	m	m
09-Oct	295.64	262.89	m	m	348.86	275	m	m	m	m	m
10-Oct	301.63	252.54	m	m	334.08	285.3	m	m	m	m	m
11-Oct	351.56	250.92	m	m	310.14	296.1	m	m	m	m	m
12-Oct	347.15	239.28	m	m	286.63	304	m	m	m	m	m
13-Oct	336.67	258.68	m	m	269.2	305	m	m	m	m	m
14-Oct	324	298.67	m	m	258.17	289.6	m	m	m	m	m
15-Oct	305.61	348.54	m	m	258.88	264.2	m	m	m	m	m
16-Oct	280.78	387.86	m	m	280.79	260.3	m	m	m	m	m
17-Oct	261.95	418.82	m	m	308.24	274.9	m	m	m	m	m
18-Oct	254.18	406.99	m	m	307.87	283	m	m	m	m	m
19-Oct	253.36	376.35	m	m	278.61	291.9	m	m	m	m	m
20-Oct	247.9	362.7	m	m	302.47	303.6	m	m	m	m	m
21-Oct	240.07	359.63	m	m	308.35	307.9	m	m	m	m	m
22-Oct	247.9	381.8	m	m	317.49	304.8	m	m	m	m	m
23-Oct	253.01	403.37	m	m	343.21	293.3	m	m	m	m	m
24-Oct	247.67	359.14	m	m	342.28	298.1	m	m	m	m	m
25-Oct	235.63	329.8	m	m	328.89	303.7	m	m	m	m	m
26-Oct	228.4	319.39	m	m	320.53	303.7	m	m	m	m	m
27-Oct	226.27	298.36	m	m	316.45	295.1	m	m	m	m	m
28-Oct	225.49	281.13	m	m	315.69	271.9	m	m	m	m	m
29-Oct	238.93	274.24	m	m	309.11	256.3	m	m	m	m	m
30-Oct	251.97	263.13	m	m	315.69	246.4	m	m	m	m	m
31-Oct	241.44	251.27	m	m	315.82	240.8	m	m	m	m	m
01-Nov	239.04	232.57	m	m	310.87	233.3	m	m	m	m	m
02-Nov	238.81	226.16	m	m	317.87	224.8	m	m	m	m	m
03-Nov	237.1	218.83	m	m	347.29	216	m	m	m	m	m
04-Nov	235.05	207.03	m	m	348.47	m	m	m	m	m	m
05-Nov	229.97	198.24	m	m	335.23	200.6	m	m	m	m	m

06-Nov	226.71	212.59	m	m	328.5	191.8	m	m	m	m	m
07-Nov	229.07	234.85	m	m	321.56	185.8	m	m	m	m	m
08-Nov	221.7	249.41	m	m	305.21	176.9	m	m	m	m	m
09-Nov	223.7	230.55	m	m	304.84	171.9	m	m	m	m	m
10-Nov	215.6	220.15	m	m	315.06	166.6	m	m	m	m	m
11-Nov	207.35	224.82	m	m	308.99	162.2	m	m	m	m	m
12-Nov	204.98	235.98	m	m	286.39	156.6	m	m	m	m	m
13-Nov	199.94	257.84	m	m	265.51	153.1	m	m	m	m	m
14-Nov	194	285.17	m	m	252.31	151.2	m	m	m	m	m
15-Nov	197.81	297.35	m	m	245.59	148.4	m	m	m	m	m
16-Nov	194.85	298.09	m	m	229.76	148.4	m	m	m	m	m
17-Nov	190.01	299.22	m	m	212.58	146.7	m	m	m	m	m
18-Nov	186.89	315.31	m	m	202.08	143.8	m	m	m	m	m
19-Nov	187.61	319.38	m	m	196.65	143.8	m	m	m	m	m
20-Nov	180.38	309.25	m	m	191.27	143.8	m	m	m	m	m
21-Nov	178.64	286.63	m	m	182.23	143.8	m	m	m	m	m
22-Nov	181.31	268.97	m	m	181.31	143.8	m	m	m	m	m
23-Nov	179.57	253.6	m	m	176.41	142.7	m	m	m	m	m
24-Nov	172.06	237.34	m	m	167.15	140.8	m	m	m	m	m
25-Nov	165.88	224.49	m	m	159.55	140.1	m	m	m	m	m
26-Nov	144.42	212.24	m	m	157.7	136.6	m	m	m	m	m
27-Nov	133.31	201.76	m	m	157.31	136.4	m	m	m	m	m
28-Nov	162.89	191.9	m	m	152.96	136.4	m	m	m	m	m
29-Nov	202.99	186.27	m	m	148.74	136.4	m	m	m	m	m
30-Nov	213.33	175.52	m	m	149.41	136.3	m	m	m	m	m
01-Dec	213.44	150.1	m	m	143.92	135.3	m	m	m	m	m
02-Dec	206.92	148.36	m	m	139.34	144.5	m	m	m	m	m
03-Dec	200.15	148.36	m	m	134.91	146.5	m	m	m	m	m
04-Dec	194.85	148.08	m	m	130.81	161.5	m	m	m	m	m
05-Dec	188.24	143.92	m	m	130.27	173.3	m	m	m	m	m
06-Dec	181.52	140.92	m	m	126.22	214.5	m	m	m	m	m
07-Dec	173.77	139.16	m	m	122.23	219.3	m	m	m	m	m
08-Dec	170.25	134.64	m	m	121.96	209.8	m	m	m	m	m
09-Dec	167.15	127.3	m	m	121.96	191.4	m	m	m	m	m
10-Dec	165.26	134.92	m	m	121.7	180.9	m	m	m	m	m
11-Dec	160.73	143.83	m	m	118.02	174.8	m	m	m	m	m
12-Dec	156.05	151.81	m	m	117.75	166.9	m	m	m	m	m
13-Dec	151.23	144.11	m	m	118.02	158.4	m	m	m	m	m
14-Dec	144.3	139.34	m	m	121.96	150.1	m	m	m	m	m
15-Dec	143.83	135.19	m	m	125.95	140.3	m	m	m	m	m
16-Dec	143.26	135.19	m	m	126.22	137.4	m	m	m	m	m

17-Dec	135.28	139.06	m	m	126.22	134.9	m	m	m	m	m
18-Dec	132.08	139.34	m	m	126.49	133.3	m	m	m	m	m
19-Dec	130.63	139.34	m	m	130.54	130.5	m	m	m	m	m
20-Dec	127.84	139.9	m	m	134.36	130.5	m	m	m	m	m
21-Dec	128.22	147.23	m	m	131.08	130.5	m	m	m	m	m
22-Dec	128.14	139.62	m	m	135.19	130.5	m	m	m	m	m
23-Dec	124.36	134.64	m	m	143.26	130.5	m	m	m	m	m
24-Dec	120.76	126.49	m	m	m	130.5	m	m	m	m	m
25-Dec	112.76	122.23	m	m	m	130.5	m	m	m	m	m
26-Dec	107.33	121.7	m	m	152.95	130.5	m	m	m	m	m
27-Dec	105.24	118.02	m	m	152.95	130.5	m	m	m	m	m
28-Dec	118.11	117.15	m	m	152.67	130.5	m	m	m	m	m
29-Dec	115.08	108.76	m	m	148.36	130.5	m	m	m	m	m
30-Dec	111.9	108.08	m	m	143.83	133.3	m	m	m	m	m
31-Dec	106.66	106.74	m	m	139.99	131.9	m	m	m	m	m

APPENDIX C

Monthly Flow data of River Pra at Daboase

monthly (Daboase)	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Jan	50	70	73	43	157	86	62	36	41.7	26.7	43.4	30.5	29	12
Feb	67	42	49	27	113	58	44	20	17.6	9.3	68.1	28	13	5
Mar	99	53	59	51	136	154	69	30	17.7	37.2	52.6	52.5	11.5	24
Apr	128	129	101	83	178	158	49	184	66.4	85.4	92.5	85.5	18	19
May	151	143	169	144	295	229	45	216	56.2	218.4	159.4	156	42	216
Jun	435	352	308	520	542	235	230	48	162.1	294	249.3	415	277	525
Jul	849	678	291	1124	461	151	235	289	138.4	331.5	519.9	193	64	107
Aug	331	407	95	1388	249	82	233	195	176.9	250.1	140.2	86.5	22	59
Sep	448	298	178	1401	185	179	204	127	345.7	417.5	89.5	58	45.5	124
Oct	615	459	213	937	301	371	286	199	279.8	337.1	226	127	282	209
Nov	272	337	129	425	457	311	131	136	188.5	229.2	134.3	212	80.5	151
Dec	126	148	70	255	129	101	110	72	64.4	80.2	100	63	58	57.5
Avg Annual	297.6	259.7	144.6	533.2	266.9	176.3	141.5	129.3	129.6	193.1	156.3	125.6	78.54	125.7

APPENDIX D

Reorganized data of Dabaose into 10 daily flows

Daboase	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Jan	143.50	96.60	98.67	m	m	122.95	95.88	m	m	m	m	m	123.65
	102.53	78.07	85.02	m	m	114.94	84.47	m	m	m	m	m	119.76
	120.40	78.74	75.64	m	m	102.22	81.98	m	m	m	m	m	110.07
Feb	120.98	56.32	92.47	m	m	92.96	86.19	m	m	m	m	m	m
	99.72	55.95	87.11	m	m	111.64	83.91	m	m	m	m	m	m
	102.65	54.28	55.29	m	m	107.21	76.57	m	m	m	m	m	m
Mar	113.58	56.97	77.76	106.55	m	113.92	m	m	m	m	m	m	133.02
	137.86	54.74	90.27	104.12	m	183.45	m	m	m	m	m	m	119.04
	132.48	53.41	96.30	109.70	m	204.96	m	m	m	m	m	m	
Apr	154.98	71.06	157.80	m	m	135.13	m	m	m	m	m	m	
	182.93	88.48	163.21	m	m	180.96	m	m	m	m	m	m	
	164.71	87.08	167.13	m	m	168.47	m	m	m	m	m	m	
May	214.37	115.19	162.42	230.07	m	156.49	m	m	m	m	m	m	
	266.37	137.52	136.61	255.31	m	183.61	m	m	m	m	m	m	
	377.33	370.06	137.70	239.58	m	180.15	m	m	m	m	m	m	
Jun	385.54	217.94	148.86	305.15	276.15	321.42	m	m	m	m	m	m	
	385.54	272.34	314.82	286.58	176.60	509.32	m	m	m	m	m	m	
	385.54	218.59	364.28	389.01	342.42	379.95	m	m	m	m	m	m	
Jul	797.67	198.84	390.84	244.42	370.62	389.15	m	m	m	m	m	m	
	867.86	195.65	249.51	195.82	366.25	314.47	m	m	m	m	m	m	
	407.23	233.37	177.47	175.32	323.58	320.06	m	m	m	m	m	m	
Aug	351.27	154.61	192.32	m	240.27	276.99	m	m	m	m	m	m	
	306.76	118.86	216.37	m	236.84	238.93	m	m	m	m	m	m	
	367.55	108.93	181.66	m	493.90	324.01	m	m	m	m	m	m	
Sep	290.30	114.56	m	m	426.88	259.22	m	m	m	m	m	m	
	358.59	129.37	m	m	333.93	233.03	m	m	m	m	m	m	
	231.62	305.34	m	m	306.43	202.63	m	m	m	m	m	m	
Oct	244.66	263.61	m	m	370.28	257.87	m	m	m	m	m	m	
	296.32	334.88	m	m	286.10	287.25	m	m	m	m	m	m	
	239.71	320.11	m	m	321.23	283.81	m	m	m	m	m	m	
Nov	229.68	223.04	m	m	323.49	196.39	m	m	m	m	m	m	
	194.38	284.24	m	m	239.11	149.80	m	m	m	m	m	m	
	173.44	223.87	m	m	163.28	139.33	m	m	m	m	m	m	
Dec	186.16	141.58	m	m	129.33	177.69	m	m	m	m	m	m	
	142.52	140.71	m	m	124.55	145.71	m	m	m	m	m	m	
	116.23	122.79	m	m	144.48	130.91	m	m	m	m	m	m	

APPENDIX E

10 DAILY DISCHARGES OF PRA AT ASSIN PRASO WITH MISSING DATA GENERATED

Assin Praso	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	198
Jan		12.5	m	18.0	25.7	15.8	m	m	43.4	25.5	25.3	25.3	101.7	27.5	43.0	24.5	14.4	15.0	15.0	14.5	15.9	7.0	15.4	24.1	26.8	25.9	36.3	7.
		4.5	m	14.6	44.4	4.5	m	m	48.8	16.8	21.2	21.1	69.0	32.3	24.5	16.3	9.0	12.0	12.0	10.8	10.8	5.8	10.0	21.1	24.0	17.0	29.5	7.
		14.1	m	14.1	6.6	3.3	m	m	11.8	20.0	14.4	10.0	60.0	26.5	22.2	12.3	6.2	7.4	7.4	7.0	8.1	4.6	8.6	16.3	19.7	12.4	18.7	6.
Feb		m	m	16.2	11.8	6.4	m	m	12.4	22.0	12.8	11.7	44.3	21.8	16.3	10.0	6.2	4.8	4.8	6.1	6.3	3.4	5.7	14.1	15.4	8.1	15.2	6
		m	m	17.2	2.6	4.9	m	m	12.6	5.4	13.5	13.3	54.0	23.9	15.3	10.1	9.3	4.7	4.7	13.0	4.0	3.0	5.5	13.1	16.0	7.4	16.3	6.
		m	m	8.0	0.1	0.0	m	m	13.5	8.9	7.2	7.1	76.2	22.0	19.0	13.7	7.2	4.0	4.0	8.8	3.5	5.2	3.7	11.7	15.2	10.9	15.0	m
Mar		m	m	4.4	0.0	13.3	m	m	27.9	13.9	9.1	5.1	51.3	51.1	44.6	17.6	5.5	5.5	13.1	7.6	3.3	12.5	5.6	11.6	21.5	19.7	29.2	
		m	m	9.5	0.0	32.4	m	m	47.3	11.9	12.1	15.7	53.5	54.2	21.6	16.5	3.4	3.4	13.4	22.9	2.4	11.1	6.8	19.1	44.6	12.1	45.4	
		m	m	14.1	3.8	44.1	m	m	43.4	13.9	20.1	17.8	72.3	58.8	28.2	27.7	10.3	10.3	23.0	26.1	5.8	10.5	6.1	22.3	43.5	15.1	30.4	
Apr		m	m	80.9	16.1	m	42.9	m	31.8	19.0	20.4	11.8	76.8	28.2	45.6	73.7	24.3	25.5	18.8	21.8	5.2	33.5	12.6	43.4	62.1	16.9	28.4	
		m	m	191.3	38.4	m	40.9	m	30.8	19.3	12.9	20.6	99.5	94.1	53.7	80.5	25.4	25.4	17.8	31.0	5.4	54.6	10.1	38.7	22.9	29.9	28.8	
		m	m	75.9	28.1	m	28.4	m	130.2	13.3	85.4	32.1	90.1	46.6	35.0	53.6	29.8	29.8	30.6	22.4	11.9	66.9	14.7	20.0	31.8	25.9	32.2	
May	27.0	108.6	m	65.9	10.8	m	22.7	m	109.6	25.0	84.7	39.9	33.7	40.9	29.2	80.6	21.0	21.0	41.6	15.4	10.4	44.5	18.0	29.0	82.9	17.9	29.6	
	20.0	175.6	m	22.3	10.7	m	47.6	m	39.1	57.9	56.4	66.5	153.1	63.2	50.4	85.7	13.0	13.0	64.9	15.0	17.8	75.9	22.6	40.7	170.7	31.2	36.4	
	71.5	101.8	175.0	m	23.0	m	43.9	m	71.4	92.2	45.1	123.1	258.6	169.8	39.0	245.5	24.0	24.0	29.5	64.6	26.0	86.5	25.9	142.7	113.7	60.0	56.6	
Jun	66.7	152.7	106.6	37.7	54.0	154.4	67.2	m	82.6	71.7	145.5	161.6	260.1	158.2	54.1	264.0	18.2	17.8	32.8	79.8	36.4	278.9	112.6	140.6	71.2	77.8	75.5	
	253.8	269.6	171.0	61.6	106.2	228.2	128.6	m	202.6	172.1	224.2	234.2	330.0	65.2	82.8	113.9	29.5	29.5	98.2	162.3	117.4	260.1	173.8	182.3	56.8	39.7	110.5	
	146.0	229.0	169.3	362.2	289.7	391.3	235.8	m	344.1	210.3	333.2	277.3	208.3	80.6	94.6	82.1	36.9	36.9	120.4	256.2	62.5	136.6	205.6	221.2	196.6	49.1	126.1	
Jul	138.8	m	161.9	m	204.3	591.3	326.8	m	410.4	187.3	279.6	433.6	185.6	64.5	87.1	93.3	57.6	57.6	171.0	140.3	40.0	46.6	44.2	93.9	145.3	43.2	103.7	
	416.4	m	280.1	m	209.0	329.2	338.1	m	517.9	330.0	110.3	642.6	193.9	61.0	74.3	113.9	46.9	46.9	224.8	142.0	18.8	25.6	23.5	49.4	249.5	30.8	62.8	
	322.1	m	354.3	m	295.2	216.0	376.1	m	467.1	385.1	42.9	444.6	99.1	34.2	99.7	89.2	15.7	15.7	90.0	85.2	19.3	21.4	76.8	149.4	114.7	28.8	49.5	
Aug	95.0	m	108.8	m	93.4	413.8	373.1	m	110.5	136.2	40.4	282.6	63.2	28.8	107.6	60.3	24.6	24.6	53.7	27.9	19.0	21.9	127.7	242.7	89.5	31.8	25.7	
	73.1	m	26.4	m	44.7	303.4	259.9	m	141.2	91.9	34.9	457.4	75.7	26.6	129.1	35.0	82.0	82.0	47.9	17.0	9.1	15.2	90.2	111.7	153.8	67.1	33.4	
	55.9	m	18.9	m	23.1	60.5	133.6	m	227.8	142.8	30.1	433.7	112.6	25.2	131.9	46.1	140.1	140.1	29.0	24.5	9.0	15.7	114.6	98.4	138.9	102.1	77.1	
Sep	64.7	m	53.4	m	26.5	50.1	192.1	126.9	169.8	141.9	33.3	588.8	69.6	29.5	98.9	38.6	118.8	118.8	28.7	24.0	9.0	19.3	106.5	101.3	100.0	74.0	16.0	
	98.9	m	117.5	m	99.7	51.4	238.9	117.2	199.5	92.1	64.5	621.6	48.7	37.6	155.7	68.6	163.9	163.9	37.6	21.6	13.0	23.2	183.4	242.0	211.2	99.2	18.9	
	136.5	m	211.5	m	89.0	36.6	345.8	48.5	298.5	207.8	118.3	706.5	72.6	167.9	193.9	41.8	131.9	131.9	41.1	26.5	31.6	64.8	367.1	292.0	187.0	142.1	16.4	
Oct	153.6	m	245.2	m	175.1	50.4	513.1	42.1	289.9	220.3	72.8	728.8	83.0	154.7	161.0	66.2	126.0	126.0	83.1	51.2	68.2	65.7	262.3	353.3	161.6	139.9	15.2	
	193.0	m	145.3	m	194.9	112.4	559.7	66.5	354.4	178.9	107.3	402.4	92.4	112.4	105.0	97.3	140.1	140.1	119.3	39.3	209.0	48.6	247.2	262.8	139.4	147.9	9.6	
	150.1	m	127.4	m	136.7	148.9	343.1	92.1	239.3	162.5	88.6	337.1	192.9	213.9	85.9	65.9	99.2	99.2	90.6	48.6	110.7	87.9	228.0	247.5	129.5	283.2	8.8	
Nov	171.5	m	210.5	313.1	82.0	174.2	m	45.4	167.2	180.3	82.5	207.6	259.4	190.2	51.5	47.6	131.3	131.3	62.4	74.1	33.6	60.1	192.1	189.7	172.0	145.9	8.8	
	95.0	m	147.9	130.1	91.6	m	m	48.9	95.6	94.8	40.9	192.5	200.0	105.9	40.4	31.4	60.6	60.6	41.5	71.9	23.3	43.7	132.0	148.7	78.6	89.3	8.8	
	97.5	m	144.6	57.6	49.1	m	m	62.2	101.1	97.3	30.5	251.1	66.9	126.9	39.6	32.2	35.4	35.4	33.5	53.9	15.1	22.8	65.6	101.7	42.6	66.5	8.4	
Dec	139.4	m	136.1	27.3	37.0	m	m	110.2	88.6	65.2	44.9	150.8	54.2	54.8	41.7	25.6	22.1	22.1	75.1	24.0	19.2	18.8	45.5	75.8	31.3	50.7	7.2	
	76.0	m	100.9	11.6	40.9	m	m	62.8	62.8	54.7	37.4	157.1	58.0	32.9	31.4	17.0	27.2	27.2	26.9	14.8	22.9	23.5	31.8	59.2	26.5	34.9	7.1	
	19.1	m	62.4	4.0	22.3	m	m	42.9	29.3	33.8	30.4	102.6	39.9	32.9	30.2	27.7	19.2	19.2	19.3	20.3	13.2	16.5	27.4	31.9	34.4	44.4	7.1	

APPENDIX F

Extended Data At Assin Praso

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Jan	7.10	42.78	43.16	38.14	56.63	59.21	37.54	41.16	59.23	43.64	44.46	33.11	57.56	56.65	26.91	29.21	46.20	40.63	53.96	41.21	32.37	33.63
	7.10	41.59	45.37	39.71	49.56	68.71	41.70	41.72	62.29	37.77	43.32	31.58	56.42	54.55	26.56	27.89	48.01	41.85	52.19	41.04	33.33	33.81
	6.80	36.50	36.97	35.87	53.09	59.12	30.99	43.86	47.03	33.58	44.57	26.78	50.90	46.12	24.34	22.65	37.96	33.52	42.80	36.30	29.85	27.95
Feb	6.28	37.18	38.80	37.52	58.45	59.14	30.67	51.58	52.30	34.56	40.29	26.57	51.67	49.06	24.95	24.05	38.31	36.01	43.94	38.55	31.86	28.43
	6.20	35.39	33.11	36.11	64.63	62.23	27.01	54.72	44.50	34.57	35.81	23.76	40.06	40.80	25.90	23.29	38.83	31.53	37.28	38.08	26.11	25.24
	7.56	36.28	33.90	36.39	58.58	62.10	25.05	60.80	44.03	35.12	31.49	25.79	35.62	45.39	27.55	25.39	37.71	38.52	42.87	39.35	33.11	27.92
Mar	7.93	34.37	37.79	37.67	57.15	43.13	26.81	57.43	47.57	26.81	36.83	33.00	38.78	43.64	27.26	29.95	36.24	31.30	38.87	42.31	30.83	32.26
	12.40	31.80	40.37	38.90	78.17	60.13	25.04	69.02	66.31	41.78	43.28	48.38	45.47	48.34	26.37	29.63	38.12	40.39	38.11	38.79	36.96	36.39
	18.03	27.43	38.48	31.56	57.44	47.11	26.16	50.30	47.17	31.48	40.37	34.08	33.02	40.27	28.45	25.84	34.14	33.18	32.91	34.48	29.01	31.76
Apr	20.82	25.00	31.85	26.73	63.51	35.79	26.92	40.38	42.54	30.80	38.96	38.86	30.78	34.43	36.26	34.22	43.57	31.10	32.52	32.39	25.42	33.49
	28.69	27.17	32.24	25.13	57.66	46.57	32.85	46.76	46.26	29.49	37.39	45.73	39.55	42.91	48.62	33.35	48.00	33.38	37.19	41.75	24.36	37.78
	40.45	33.03	32.76	29.70	39.14	44.63	37.57	53.87	46.40	37.72	31.92	43.22	47.53	47.48	40.91	38.81	64.82	49.15	39.14	44.91	31.90	54.41
May	48.92	28.36	33.71	36.16	38.69	49.25	42.22	68.10	46.16	32.15	41.34	43.39	53.95	52.19	38.69	51.62	45.13	53.62	44.03	43.40	36.08	64.26
	71.96	36.81	50.31	39.43	36.95	50.44	51.59	96.10	61.66	38.47	52.53	50.93	56.19	60.75	47.24	47.50	52.77	69.67	50.11	63.91	38.34	70.07
	72.53	38.70	85.89	44.18	43.27	59.51	61.15	99.41	69.79	44.63	59.81	79.68	56.91	83.77	76.22	58.54	57.98	71.86	55.08	86.01	50.87	64.85
Jun	100.09	56.75	91.87	56.14	55.14	71.38	67.70	105.02	87.10	59.70	66.38	86.96	79.21	90.47	87.54	75.85	78.73	71.19	85.80	89.10	54.29	73.09
	96.03	74.52	83.32	68.51	72.24	108.88	99.06	118.39	116.82	76.77	93.10	88.08	113.28	100.31	93.41	125.99	107.36	107.66	102.07	99.61	67.51	125.92
	138.54	103.95	96.57	83.85	101.65	135.66	114.90	122.37	152.42	101.60	100.29	110.78	100.00	130.87	118.50	147.91	130.78	95.33	96.80	118.21	97.90	180.64
Jul	148.48	98.93	108.90	114.85	122.65	131.96	158.88	130.60	160.59	108.46	100.27	150.24	126.63	143.80	127.26	139.17	145.41	97.90	150.63	111.85	97.87	177.79
	147.26	128.63	137.64	167.07	163.18	160.52	249.51	189.93	182.62	142.15	112.62	219.50	160.83	142.05	174.48	198.30	198.49	120.15	223.95	123.55	108.46	214.46
	140.30	106.51	170.83	169.81	163.42	183.66	299.82	181.88	187.45	125.81	133.48	311.10	141.96	140.18	205.56	207.32	176.76	162.71	209.97	130.10	127.16	177.18
Aug	103.18	92.45	126.99	159.30	135.09	114.00	182.20	141.18	168.29	99.92	103.85	209.95	121.88	114.41	139.21	152.75	131.03	119.20	166.31	123.05	99.69	155.77
	135.00	93.83	131.86	207.75	162.72	100.42	210.48	121.94	209.61	123.01	134.05	253.98	136.99	130.77	151.98	176.48	126.52	158.21	181.40	169.22	111.66	229.45
	165.06	99.09	151.15	198.89	171.50	103.40	222.85	145.53	244.65	143.18	137.84	233.42	169.52	137.74	145.14	215.01	151.55	200.94	169.89	154.09	118.64	302.58
Sep	197.35	103.13	162.59	219.47	176.53	99.10	210.93	154.63	246.10	125.11	138.58	228.41	179.79	130.31	162.78	196.92	150.29	180.06	162.99	170.41	127.23	294.48
	194.48	119.37	183.76	249.94	191.44	93.15	236.45	170.84	263.68	140.03	144.62	214.00	174.24	130.00	166.44	222.74	170.97	177.17	201.35	203.31	136.19	343.14
	208.23	130.14	194.28	326.78	203.57	120.36	266.41	206.33	304.42	171.47	134.77	195.56	177.28	145.79	145.69	194.39	157.86	156.50	174.70	276.70	167.45	291.89
Oct	213.10	128.52	190.26	266.44	196.44	135.36	210.71	183.49	264.55	171.71	127.91	205.85	161.00	155.04	150.75	209.19	164.55	169.58	179.93	221.28	172.35	254.39
	209.38	148.79	223.57	285.70	197.25	146.97	214.61	179.27	238.03	167.20	149.55	242.96	206.58	177.03	160.22	229.66	162.68	182.79	194.72	226.27	190.18	235.11
	188.96	160.63	243.72	297.32	186.83	159.96	205.48	165.61	208.83	163.89	168.25	233.71	238.79	200.24	148.89	256.27	168.97	178.03	191.02	207.35	166.48	278.67
Nov	177.86	173.18	254.25	264.20	220.21	163.34	220.33	179.07	201.00	194.49	170.45	280.95	224.84	192.17	152.90	249.43	153.54	216.91	223.67	210.53	173.29	244.53
	148.31	151.11	231.01	234.18	192.62	154.47	209.95	172.81	180.44	190.82	172.62	249.53	209.18	174.36	135.36	244.88	140.83	215.86	211.31	205.18	167.08	199.07
	154.78	159.54	213.06	203.11	189.29	154.71	214.89	190.49	164.09	227.71	147.98	229.15	225.41	175.07	143.21	217.15	125.01	220.51	172.62	227.67	159.48	181.89
Dec	120.27	105.19	141.68	141.41	141.83	113.68	149.42	133.45	107.99	129.53	119.42	176.42	164.45	131.28	131.08	155.89	103.34	149.60	115.06	145.42	112.57	142.21
	112.78	89.93	118.78	121.56	120.14	98.83	103.84	108.12	83.72	123.03	90.14	146.96	116.30	112.31	105.39	117.54	92.55	114.20	103.63	112.65	84.63	118.23
	78.40	65.93	81.89	86.61	89.56	69.29	76.45	78.17	62.53	87.43	62.65	85.33	80.64	79.54	80.59	91.47	64.94	90.76	67.84	68.21	65.26	88.41

APPENDIX G

DISCHARGES AT THE THREE LOCATIONS FOR HYDROPOWER STRUCTURES.

LOCATION 1

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Jan I	86.81	51.05	50.62	50.62	203.34	55.09	86.05	48.93	28.87	30.04	30.04	29.04	31.87	13.90	30.73	48.16	53.69	51.87	72.67
Jan II	97.63	33.64	42.46	42.14	138.10	64.70	48.96	32.60	18.06	23.98	23.98	21.53	21.57	11.58	19.90	42.12	48.04	33.95	59.08
Jan III	23.60	40.04	28.77	19.95	119.90	52.91	44.46	24.67	12.42	14.88	14.88	14.09	16.22	9.14	17.11	32.50	39.42	24.80	37.44
Feb I	25.44	43.98	25.67	23.38	88.63	43.51	32.62	19.92	12.41	9.62	9.62	12.11	12.58	6.70	11.42	28.15	30.88	16.26	30.48
Feb II	25.83	10.71	27.01	26.65	107.98	47.80	30.67	20.30	18.60	9.43	9.43	26.07	7.97	5.92	11.10	26.12	31.97	14.72	32.61
Feb III	27.05	17.79	14.43	14.21	152.49	44.01	38.06	27.40	14.35	8.07	8.07	17.55	6.91	10.49	7.45	23.32	30.45	21.84	30.07
Mar I	55.70	27.71	18.28	10.17	102.62	102.23	89.24	35.11	11.07	11.07	26.21	15.17	6.57	24.97	11.20	23.21	43.02	39.35	58.30
Mar II	94.53	23.89	24.19	31.32	107.04	108.38	43.29	32.92	6.77	6.77	26.83	45.74	4.79	22.16	13.56	38.29	89.22	24.20	90.89
Mar III	86.71	27.76	40.20	35.56	144.70	117.55	56.40	55.33	20.62	20.62	46.08	52.22	11.63	21.00	12.12	44.70	87.00	30.30	60.89
Apr I	63.57	38.09	40.84	23.56	153.64	56.35	91.22	147.33	48.70	51.10	37.62	43.53	10.35	67.09	25.16	86.73	124.29	33.78	56.81
Apr II	61.63	38.64	25.77	41.22	199.08	188.29	107.42	160.95	50.70	50.70	35.69	61.94	10.82	109.24	20.21	77.36	45.77	59.73	57.54
Apr III	260.43	26.56	170.89	64.25	180.13	93.12	70.04	107.15	59.61	59.61	61.21	44.82	23.77	133.89	29.35	40.07	63.51	51.82	64.48
May I	219.21	50.10	169.37	79.87	67.39	81.86	58.38	161.19	42.08	42.08	83.18	30.89	20.71	89.00	36.10	57.92	165.78	35.85	59.18
May II	78.23	115.78	112.80	132.90	306.19	126.31	100.83	171.32	25.91	25.91	129.70	30.02	35.69	151.72	45.18	81.41	341.36	62.32	72.71
May III	142.88	184.47	90.11	246.20	517.17	339.64	78.03	490.91	48.06	48.06	58.98	129.18	52.07	173.09	51.82	285.41	227.31	119.99	113.15
Jun I	165.21	143.34	291.05	323.16	520.27	316.45	108.10	528.04	36.31	35.68	65.57	159.63	72.73	557.80	225.14	281.26	142.44	155.61	151.07
Jun II	405.24	344.13	448.50	468.38	660.08	130.49	165.70	227.85	58.94	58.94	196.37	324.53	234.87	520.22	347.52	364.62	113.64	79.37	220.94
Jun III	688.21	420.62	666.45	554.66	416.64	161.11	189.27	164.21	73.83	73.83	240.80	512.45	124.92	273.16	411.11	442.47	393.26	98.20	252.23
Jul I	820.70	374.52	559.23	867.14	371.12	129.03	174.26	186.67	115.17	115.17	341.96	280.67	80.02	93.20	88.47	187.82	290.66	86.47	207.48
Jul II	1035.88	659.94	220.66	1285.15	387.74	122.01	148.61	227.86	93.82	93.82	449.60	283.97	37.55	51.23	47.07	98.88	498.99	61.62	125.54
Jul III	934.18	770.27	85.74	889.12	198.25	68.41	199.49	178.30	31.33	31.33	180.08	170.30	38.69	42.78	153.53	298.73	229.48	57.60	99.01
Aug I	221.00	272.37	80.79	565.25	126.43	57.52	215.27	120.50	49.27	49.27	107.34	55.75	37.91	43.72	255.41	485.43	179.00	63.50	51.37
Aug II	282.34	183.79	69.90	914.83	151.39	53.22	258.25	69.93	164.07	164.07	95.83	33.95	18.24	30.46	180.47	223.40	307.53	134.26	66.85
Aug III	455.69	285.63	60.12	867.40	225.23	50.34	263.76	92.11	280.10	280.10	57.91	48.90	17.97	31.33	229.23	196.79	277.71	204.19	154.21
Sep I	339.60	283.87	66.52	1177.56	139.21	59.02	197.86	77.28	237.67	237.67	57.31	48.06	18.00	38.66	213.06	202.60	200.00	147.92	32.03
Sep II	399.06	184.23	128.98	1243.22	97.44	75.17	311.36	137.13	327.78	327.78	75.15	43.21	26.06	46.43	366.79	484.00	422.44	198.48	37.77
Sep III	596.95	415.68	236.67	1413.08	145.19	335.82	387.71	83.51	263.85	263.85	82.17	53.00	63.11	129.64	734.23	583.95	373.93	284.16	32.82
Oct I	579.71	440.58	145.70	1457.54	165.95	309.44	321.95	132.33	251.99	251.99	166.18	102.45	136.46	131.39	524.61	706.60	323.19	279.77	30.41
Oct II	708.85	357.79	214.56	804.85	184.79	224.88	210.05	194.56	280.23	280.23	238.59	78.52	418.08	97.20	494.43	525.67	278.85	295.84	19.18
Oct III	478.67	325.08	177.24	674.20	385.86	427.77	171.83	131.70	198.42	198.42	181.27	97.26	221.48	175.86	456.06	495.00	259.10	566.36	17.66
Nov I	334.39	360.58	165.04	415.29	518.80	380.35	102.90	95.15	262.67	262.67	124.89	148.14	67.16	120.17	384.11	379.36	344.05	291.74	17.66
Nov II	191.27	189.55	81.76	384.94	400.02	211.85	80.81	62.71	121.27	121.27	82.96	143.74	46.55	87.44	263.92	297.37	157.25	178.53	17.66
Nov III	202.15	194.55	60.99	502.22	133.81	253.88	79.20	64.38	70.74	70.74	67.07	107.76	30.26	45.68	131.22	203.35	85.17	133.09	16.78
Dec I	177.11	130.41	89.86	301.61	108.37	109.65	83.40	51.12	44.20	44.20	150.17	48.09	38.40	37.54	90.97	151.69	62.64	101.43	14.33
Dec II	125.56	109.37	74.82	314.21	115.94	65.76	62.86	33.93	54.41	54.41	53.78	29.66	45.86	47.10	63.53	118.50	53.09	69.87	14.21
Dec III	58.56	67.52	60.78	205.18	79.80	65.90	60.47	55.31	38.48	38.48	38.57	40.61	26.44	32.99	54.73	63.79	68.75	88.81	14.21

LOCATION 2

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Jan I	95.49	56.15	55.69	55.69	223.67	60.60	94.65	53.82	31.75	33.05	33.05	31.95	35.06	15.29	33.81	52.98	59.05	57.06	79.94
Jan II	107.39	37.01	46.70	46.36	151.91	71.17	53.85	35.86	19.86	26.38	26.38	23.68	23.73	12.74	21.89	46.33	52.85	37.34	64.99
Jan III	25.96	44.04	31.65	21.94	131.90	58.20	48.91	27.14	13.66	16.37	16.37	15.50	17.85	10.06	18.82	35.75	43.36	27.28	41.19
Feb I	27.99	48.38	28.24	25.72	97.49	47.86	35.89	21.92	13.65	10.58	10.58	13.32	13.84	7.37	12.56	30.97	33.97	17.88	33.53
Feb II	28.42	11.78	29.71	29.32	118.77	52.58	33.73	22.33	20.46	10.37	10.37	28.68	8.77	6.51	12.21	28.73	35.16	16.19	35.87
Feb III	29.76	19.57	15.87	15.63	167.74	48.41	41.86	30.14	15.78	8.87	8.87	19.31	7.60	11.53	8.20	25.65	33.50	24.02	33.07
Mar I	61.27	30.48	20.10	11.19	112.88	112.45	98.17	38.62	12.17	12.17	28.83	16.69	7.22	27.47	12.32	25.53	47.32	43.28	64.13
Mar II	103.98	26.28	26.60	34.45	117.74	119.22	47.62	36.22	7.45	7.45	29.51	50.32	5.27	24.38	14.92	42.12	98.14	26.62	99.98
Mar III	95.38	30.54	44.22	39.12	159.17	129.31	62.04	60.87	22.68	22.68	50.69	57.44	12.79	23.10	13.33	49.17	95.70	33.33	66.98
Apr I	69.92	41.89	44.93	25.92	169.00	61.98	100.34	162.06	53.57	56.21	41.38	47.88	11.38	73.80	27.68	95.40	136.72	37.16	62.49
Apr II	67.80	42.50	28.35	45.34	218.99	207.12	118.16	177.05	55.77	55.77	39.26	68.14	11.90	120.16	22.23	85.09	50.34	65.70	63.30
Apr III	286.48	29.22	187.98	70.68	198.14	102.44	77.05	117.87	65.57	65.57	67.33	49.30	26.14	147.28	32.28	44.07	69.86	57.00	70.93
May I	241.13	55.11	186.31	87.86	74.13	90.05	64.22	177.30	46.29	46.29	91.50	33.98	22.78	97.90	39.71	63.72	182.36	39.44	65.10
May II	86.06	127.36	124.08	146.19	336.81	138.94	110.91	188.45	28.50	28.50	142.68	33.02	39.26	166.89	49.70	89.55	375.50	68.55	79.98
May III	157.17	202.91	99.12	270.82	568.88	373.60	85.84	540.00	52.87	52.87	64.88	142.10	57.27	190.40	57.00	313.96	250.04	131.99	124.47
Jun I	181.73	157.67	320.16	355.47	572.29	348.10	118.91	580.85	39.94	39.24	72.13	175.60	80.00	613.58	247.65	309.39	156.68	171.17	166.18
Jun II	445.77	378.55	493.35	515.21	726.09	143.54	182.27	250.63	64.84	64.84	216.00	356.99	258.36	572.24	382.27	401.08	125.00	87.31	243.03
Jun III	757.03	462.69	733.10	610.13	458.30	177.22	208.20	180.63	81.22	81.22	264.89	563.70	137.41	300.47	452.22	486.72	432.58	108.01	277.45
Jul I	902.77	411.97	615.15	953.85	408.23	141.93	191.69	205.34	126.69	126.69	376.16	308.74	88.02	102.52	97.32	206.60	319.72	95.12	228.23
Jul II	1139.47	725.93	242.72	1413.67	426.52	134.21	163.47	250.65	103.20	103.20	494.56	312.37	41.31	56.35	51.78	108.77	548.89	67.78	138.09
Jul III	1027.60	847.30	94.32	978.03	218.08	75.25	219.44	196.13	34.46	34.46	198.08	187.33	42.56	47.06	168.88	328.60	252.43	63.36	108.92
Aug I	243.10	299.61	88.86	621.77	139.08	63.28	236.80	132.55	54.20	54.20	118.07	61.33	41.70	48.09	280.96	533.97	196.90	69.85	56.51
Aug II	310.57	202.17	76.88	1006.31	166.53	58.54	284.07	76.93	180.47	180.47	105.41	37.34	20.07	33.51	198.51	245.74	338.28	147.69	73.53
Aug III	501.26	314.20	66.14	954.13	247.75	55.38	290.14	101.33	308.11	308.11	63.70	53.79	19.77	34.46	252.15	216.47	305.48	224.61	169.63
Sep I	373.56	312.25	73.17	1295.32	153.13	64.92	217.64	85.01	261.44	261.44	63.04	52.87	19.80	42.53	234.37	222.86	220.00	162.72	35.24
Sep II	438.97	202.66	141.88	1367.54	107.18	82.69	342.50	150.84	360.56	360.56	82.67	47.53	28.66	51.07	403.46	532.40	464.68	218.32	41.55
Sep III	656.64	457.25	260.34	1554.38	159.71	369.41	426.48	91.86	290.24	290.24	90.39	58.30	69.42	142.61	807.66	642.34	411.32	312.58	36.11
Oct I	637.69	484.64	160.27	1603.29	182.54	340.39	354.14	145.56	277.19	277.19	182.80	112.70	150.11	144.52	577.08	777.26	355.51	307.75	33.45
Oct II	779.73	393.57	236.02	885.34	203.27	247.37	231.05	214.01	308.25	308.25	262.45	86.37	459.88	106.92	543.88	578.23	306.74	325.42	21.09
Oct III	526.54	357.59	194.96	741.62	424.45	470.54	189.02	144.87	218.27	218.27	199.40	106.99	243.63	193.44	501.66	544.50	285.01	622.99	19.43
Nov I	367.83	396.63	181.54	456.81	570.68	418.39	113.20	104.67	288.94	288.94	137.38	162.95	73.88	132.18	422.52	417.30	378.46	320.91	19.43
Nov II	210.40	208.51	89.93	423.43	440.02	233.04	88.89	68.98	133.39	133.39	91.26	158.12	51.21	96.18	290.31	327.11	172.97	196.38	19.43
Nov III	222.37	214.00	67.08	552.45	147.19	279.27	87.12	70.81	77.82	77.82	73.78	118.54	33.28	50.25	144.34	223.68	93.68	146.40	18.46
Dec I	194.82	143.45	98.85	331.77	119.21	120.61	91.74	56.23	48.62	48.62	165.18	52.90	42.24	41.29	100.07	166.86	68.91	111.57	15.76
Dec II	138.11	120.31	82.30	345.63	127.53	72.34	69.15	37.33	59.85	59.85	59.16	32.62	50.44	51.81	69.89	130.35	58.39	76.86	15.63
Dec III	64.42	74.28	66.86	225.70	87.78	72.49	66.51	60.84	42.33	42.33	42.43	44.67	29.09	36.29	60.20	70.17	75.63	97.69	15.63

LOCATION 3

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Jan I	104.18	61.26	60.75	60.75	244.01	66.11	103.26	58.71	34.64	36.05	36.05	34.85	38.25	16.68	36.88	57.79	64.42	62.24	87.21
Jan II	117.16	40.37	50.95	50.57	165.72	77.64	58.75	39.12	21.67	28.78	28.78	25.84	25.88	13.90	23.88	50.54	57.65	40.74	70.89
Jan III	28.32	48.04	34.53	23.94	143.89	63.49	53.35	29.61	14.90	17.86	17.86	16.91	19.47	10.97	20.53	39.01	47.30	29.76	44.93
Feb I	30.53	52.77	30.81	28.06	106.36	52.21	39.15	23.91	14.89	11.54	11.54	14.54	15.10	8.04	13.70	33.78	37.06	19.51	36.57
Feb II	31.00	12.85	32.41	31.98	129.57	57.36	36.80	24.36	22.32	11.32	11.32	31.28	9.56	7.10	13.32	31.34	38.36	17.66	39.13
Feb III	32.46	21.34	17.31	17.05	182.99	52.81	45.67	32.88	17.22	9.68	9.68	21.06	8.29	12.58	8.94	27.98	36.54	26.21	36.08
Mar I	66.84	33.25	21.93	12.21	123.15	122.68	107.09	42.13	13.28	13.28	31.45	18.20	7.88	29.97	13.44	27.85	51.63	47.22	69.96
Mar II	113.43	28.67	29.02	37.59	128.44	130.05	51.95	39.51	8.12	8.12	32.19	54.89	5.75	26.59	16.27	45.95	107.06	29.04	109.07
Mar III	104.05	33.31	48.24	42.67	173.63	141.06	67.68	66.40	24.74	24.74	55.29	62.66	13.95	25.20	14.54	53.64	104.41	36.36	73.07
Apr I	76.28	45.70	49.01	28.28	184.37	67.61	109.47	176.80	58.44	61.32	45.14	52.24	12.42	80.51	30.20	104.07	149.15	40.54	68.17
Apr II	73.96	46.36	30.92	49.46	238.90	225.95	128.91	193.14	60.84	60.84	42.83	74.33	12.99	131.09	24.25	92.83	54.92	71.68	69.05
Apr III	312.52	31.87	205.06	77.10	216.16	111.75	84.05	128.58	71.53	71.53	73.46	53.78	28.52	160.66	35.22	48.08	76.21	62.18	77.38
May I	263.05	60.12	203.24	95.84	80.87	98.23	70.05	193.42	50.50	50.50	99.82	37.07	24.85	106.80	43.32	69.51	198.94	43.03	71.01
May II	93.88	138.94	135.36	159.48	367.43	151.57	120.99	205.59	31.09	31.09	155.65	36.02	42.83	182.07	54.22	97.69	409.63	74.78	87.25
May III	171.45	221.36	108.13	295.44	620.60	407.57	93.64	589.09	57.67	57.67	70.78	155.02	62.48	207.71	62.18	342.50	272.77	143.98	135.78
Jun I	198.25	172.01	349.27	387.79	624.32	379.74	129.72	633.65	43.57	42.81	78.69	191.56	87.27	669.37	270.17	337.52	170.93	186.73	181.29
Jun II	486.29	412.96	538.20	562.05	792.10	156.59	198.84	273.42	70.73	70.73	235.64	389.44	281.85	624.26	417.02	437.54	136.36	95.24	265.13
Jun III	825.85	504.75	799.74	665.60	499.97	193.33	227.12	197.06	88.60	88.60	288.97	614.94	149.90	327.79	493.33	530.96	471.91	117.83	302.67
Jul I	984.84	449.43	671.07	1040.57	445.34	154.84	209.11	224.01	138.20	138.20	410.35	336.81	96.02	111.84	106.16	225.38	348.79	103.77	248.98
Jul II	1243.06	791.93	264.79	1542.18	465.29	146.42	178.33	273.43	112.58	112.58	539.52	340.77	45.07	61.47	56.49	118.66	598.79	73.95	150.65
Jul III	1121.02	924.33	102.89	1066.94	237.91	82.09	239.39	213.96	37.60	37.60	216.09	204.36	46.43	51.34	184.23	358.48	275.38	69.13	118.82
Aug I	265.20	326.84	96.94	678.30	151.72	69.03	258.33	144.60	59.12	59.12	128.80	66.90	45.49	52.46	306.50	582.52	214.80	76.20	61.65
Aug II	338.81	220.55	83.87	1097.79	181.67	63.86	309.90	83.92	196.88	196.88	115.00	40.74	21.89	36.55	216.56	268.08	369.03	161.12	80.21
Aug III	546.82	342.76	72.15	1040.87	270.27	60.41	316.51	110.54	336.12	336.12	69.49	58.68	21.56	37.60	275.08	236.15	333.25	245.02	185.05
Sep I	407.52	340.64	79.83	1413.08	167.06	70.83	237.43	92.74	285.20	285.20	68.78	57.68	21.60	46.40	255.67	243.12	240.00	177.51	38.44
Sep II	478.88	221.08	154.78	1491.86	116.92	90.20	373.63	164.56	393.34	393.34	90.18	51.85	31.27	55.71	440.14	580.80	506.93	238.17	45.32
Sep III	716.34	498.82	284.01	1695.69	174.23	402.99	465.25	100.22	316.62	316.62	98.61	63.60	75.73	155.57	881.08	700.74	448.71	341.00	39.39
Oct I	695.66	528.70	174.84	1749.04	199.13	371.33	386.34	158.79	302.39	302.39	199.42	122.94	163.76	157.66	629.54	847.92	387.83	335.72	36.49
Oct II	850.62	429.35	257.48	965.82	221.75	269.85	252.06	233.47	336.27	336.27	286.31	94.23	501.69	116.64	593.32	630.80	334.62	355.00	23.01
Oct III	574.41	390.10	212.69	809.04	463.04	513.32	206.20	158.04	238.11	238.11	217.52	116.71	265.78	211.03	547.27	594.00	310.92	679.63	21.19
Nov I	401.26	432.69	198.05	498.34	622.56	456.42	123.49	114.18	315.20	315.20	149.87	177.77	80.59	144.20	460.93	455.23	412.87	350.09	21.19
Nov II	229.53	227.46	98.11	461.92	480.02	254.22	96.97	75.26	145.52	145.52	99.56	172.49	55.86	104.92	316.70	356.85	188.70	214.24	21.19
Nov III	242.58	233.45	73.18	602.67	160.57	304.66	95.04	77.25	84.89	84.89	80.49	129.31	36.31	54.82	157.47	244.02	102.20	159.71	20.14
Dec I	212.53	156.49	107.83	361.93	130.05	131.57	100.08	61.34	53.04	53.04	180.20	57.70	46.08	45.04	109.17	182.03	75.17	121.71	17.20
Dec II	150.67	131.25	89.78	377.05	139.13	78.92	75.43	40.72	65.29	65.29	64.54	35.59	55.03	56.52	76.24	142.20	63.70	83.85	17.05
Dec III	70.27	81.03	72.94	246.22	95.76	79.08	72.56	66.38	46.17	46.17	46.28	48.74	31.73	39.59	65.67	76.55	82.50	106.57	17.05

APPENDIX H

DISCHARGE AT ASSIN PRASO ARRANGED IN DESCENDING ORDER FOR 50% DEPENDABLE YEAR SELECTION

Sl No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	50% yr
Exceed Prob	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5	Q(m^3/s)
Jan I	17.38	36.08	36.30	37.55	37.55	38.42	39.84	60.20	61.16	63.28	63.28	63.81	64.84	67.11	68.87	90.84	107.56	108.52	254.18	63.28
Jan II	14.48	22.57	24.88	26.91	26.96	29.98	29.98	40.75	42.05	42.44	52.64	52.68	53.07	60.05	61.20	73.85	80.87	122.04	172.62	42.44
Jan III	11.43	15.52	17.62	18.60	18.60	20.28	21.39	24.94	29.50	30.84	31.00	35.97	40.63	46.80	49.27	50.05	55.58	66.14	149.88	30.84
Feb I	8.38	12.02	12.02	14.27	15.14	15.51	15.73	20.32	24.91	29.23	31.80	32.09	35.19	38.10	38.60	40.78	54.39	54.97	110.79	29.23
Feb II	7.39	9.96	11.79	11.79	13.39	13.87	18.39	23.25	25.37	32.29	32.59	32.64	33.32	33.76	38.33	39.96	40.76	59.75	134.97	32.29
Feb III	8.63	9.31	10.08	10.08	13.11	17.76	17.94	18.03	21.94	22.23	27.30	29.15	33.81	34.25	37.58	38.06	47.57	55.01	190.62	22.23
Mar I	8.21	12.71	13.83	13.83	14.00	18.96	22.85	29.01	31.22	32.76	34.64	43.89	49.19	53.78	69.63	72.88	111.55	127.79	128.28	32.76
Mar II	5.99	8.46	8.46	16.95	27.70	29.86	30.23	30.25	33.54	39.15	41.16	47.86	54.11	57.18	111.52	113.61	118.16	133.80	135.47	39.15
Mar III	14.54	15.15	25.77	25.77	26.25	34.70	37.87	44.45	50.25	55.87	57.60	65.27	69.17	70.50	76.11	108.38	108.76	146.94	180.87	55.87
Apr I	12.93	29.45	31.46	42.23	47.02	47.61	51.05	54.41	60.87	63.87	70.43	71.01	79.46	83.86	108.41	114.03	155.37	184.16	192.05	63.87
Apr II	13.53	25.27	32.21	44.62	48.29	51.52	57.21	63.38	63.38	71.93	74.66	77.04	77.43	96.69	134.28	136.55	201.19	235.36	248.86	71.93
Apr III	29.71	33.20	36.68	50.08	56.02	64.77	74.51	74.51	76.52	79.38	80.32	80.60	87.55	116.41	133.94	167.36	213.61	225.16	325.54	79.38
May I	25.89	38.62	44.82	45.12	52.60	52.60	62.62	72.41	72.97	73.97	84.23	99.84	102.33	103.97	111.25	201.48	207.23	211.71	274.01	73.97
May II	32.38	32.38	37.53	44.62	56.48	77.90	90.89	97.79	101.76	126.03	141.00	144.73	157.89	162.13	166.13	189.65	214.15	382.74	426.70	126.03
May III	60.07	60.07	64.78	65.08	73.73	97.54	112.63	141.44	149.98	161.48	178.60	216.36	230.58	284.14	307.75	356.77	424.55	613.64	646.46	161.48
Jun I	44.59	45.39	81.96	90.91	135.13	178.05	179.17	188.84	194.51	199.54	206.51	281.42	351.58	363.82	395.56	403.95	650.33	660.06	697.26	199.54
Jun II	73.68	73.68	99.21	142.04	163.11	207.12	245.46	276.17	284.81	293.59	405.67	430.17	434.40	455.77	506.56	560.62	585.47	650.27	825.10	293.59
Jun III	92.29	92.29	122.74	156.15	201.38	205.27	236.59	301.01	315.28	341.45	491.57	513.88	520.80	525.78	553.09	640.56	693.33	833.07	860.26	341.45
Jul I	100.02	108.09	110.59	116.50	143.96	143.96	161.29	217.83	233.34	234.77	259.35	350.84	363.32	427.45	463.90	468.15	699.03	1025.88	1083.93	234.77
Jul II	46.94	58.84	64.04	77.03	117.28	117.28	123.60	152.52	156.92	185.76	275.82	284.83	354.97	484.68	562.00	623.74	824.92	1294.85	1606.44	185.76
Jul III	39.16	39.16	48.37	53.48	72.01	85.51	107.18	123.77	191.91	212.88	222.88	225.09	247.82	249.37	286.85	373.41	962.84	1111.40	1167.73	212.88
Aug I	47.38	54.65	61.59	61.59	64.22	69.69	71.90	79.38	100.98	134.17	150.63	158.04	223.75	269.09	276.25	319.27	340.46	606.79	706.56	134.17
Aug II	22.80	38.08	42.44	66.53	83.56	87.37	87.42	119.79	167.83	189.24	205.08	205.08	225.58	229.74	279.25	322.81	352.92	384.41	1143.53	189.24
Aug III	22.46	39.16	61.13	62.93	72.39	75.16	115.14	192.76	245.99	255.23	281.53	286.54	329.70	347.14	350.13	350.13	357.04	569.61	1084.24	255.23
Sep I	22.50	40.04	48.33	60.08	71.64	73.78	83.15	96.60	174.02	184.91	247.32	250.00	253.25	266.32	297.09	297.09	354.83	424.50	1471.95	184.91
Sep II	32.57	47.21	54.01	58.04	93.94	93.96	121.80	161.23	171.41	230.29	248.10	389.20	409.73	409.73	458.48	498.83	528.05	605.00	1554.02	230.29
Sep III	41.03	66.25	78.89	102.72	104.39	162.05	181.49	295.84	329.82	329.82	355.20	419.78	467.41	484.64	519.60	729.93	746.19	917.79	1766.34	329.82
Oct I	38.01	128.06	164.23	165.41	170.58	182.12	207.43	207.73	314.99	314.99	349.71	386.80	402.43	403.99	550.73	655.77	724.64	883.25	1821.92	314.99
Oct II	23.97	98.15	121.50	230.99	243.20	262.56	268.21	281.10	298.24	348.56	350.28	350.28	369.79	447.24	522.59	618.04	657.08	886.06	1006.07	348.56
Oct III	22.08	121.57	164.63	214.79	219.82	221.55	226.59	248.03	248.03	276.85	323.87	406.36	482.33	534.71	570.07	598.34	618.75	707.95	842.75	276.85
Nov I	22.08	83.95	118.94	128.63	150.21	156.11	185.17	206.30	328.34	328.34	364.67	417.98	430.07	450.72	474.20	475.44	480.14	519.11	648.50	328.34
Nov II	22.08	58.19	78.39	101.01	102.20	103.71	109.29	151.58	151.58	179.68	196.56	223.16	236.94	239.09	264.82	329.90	371.71	481.17	500.02	179.68
Nov III	20.98	37.82	57.10	76.23	80.47	83.84	88.43	88.43	99.00	106.46	134.70	164.03	166.36	167.26	243.18	252.69	254.18	317.35	627.78	106.46
Dec I	17.91	46.92	48.00	55.25	55.25	60.11	63.89	78.31	104.25	112.33	113.72	126.78	135.47	137.06	163.01	187.71	189.61	221.39	377.01	112.33
Dec II	17.76	37.07	42.42	57.32	58.87	66.36	67.23	68.01	68.01	78.57	79.42	82.20	87.34	93.52	136.72	144.92	148.12	156.94	392.76	78.57
Dec III	17.76	33.05	41.23	48.10	48.10	48.21	50.77	68.41	69.14	73.20	75.58	75.98	79.74	82.37	84.40	85.94	99.75	111.01	256.48	73.20

APPENDIX I

CALCULATIONS FOR CHOICE OF INSTALLED CAPACITY

Assumed Installed Capacity (KW)	10000
Head (m)	15.24
Turbine	Kaplan
Efficency	93%
Discharge Max	71.922

	Q (m^3/s)	Power (KW)	Energy(kwh)
Jan I	63.28	8798.32	2,111,597.81
Jan II	42.44	5900.26	1,416,063.10
Jan III	30.84	4288.09	1,029,142.08
Feb I	29.23	4063.63	975,270.25
Feb II	32.29	4490.06	1,077,614.71
Feb III	22.23	3091.36	741,926.50
Mar I	32.76	4554.57	1,093,097.53
Mar II	39.15	5443.83	1,306,519.76
Mar III	55.87	7768.56	1,864,453.55
Apr I	63.87	8880.88	2,131,410.88
Apr II	71.93	10000.00	2,400,000.00
Apr III	79.38	10000.00	2,400,000.00
May I	73.97	10000.00	2,400,000.00
May II	126.03	10000.00	2,400,000.00
May III	161.48	10000.00	2,400,000.00
Jun I	199.54	10000.00	2,400,000.00
Jun II	293.59	10000.00	2,400,000.00
Jun III	341.45	10000.00	2,400,000.00
Jul I	234.77	10000.00	2,400,000.00
Jul II	185.76	10000.00	2,400,000.00
Jul III	212.88	10000.00	2,400,000.00
Aug I	134.17	10000.00	2,400,000.00
Aug II	189.24	10000.00	2,400,000.00
Aug III	255.23	10000.00	2,400,000.00
Sep I	184.91	10000.00	2,400,000.00
Sep II	230.29	10000.00	2,400,000.00
Sep III	329.82	10000.00	2,400,000.00
Oct I	314.99	10000.00	2,400,000.00
Oct II	348.56	10000.00	2,400,000.00
Oct III	276.85	10000.00	2,400,000.00
Nov I	328.34	10000.00	2,400,000.00
Nov II	179.68	10000.00	2,400,000.00
Nov III	106.46	10000.00	2,400,000.00
Dec I	112.33	10000.00	2,400,000.00
Dec II	78.57	10000.00	2,400,000.00
Dec III	73.20	10000.00	2,400,000.00
			76,147,096.17

Assumed Installed Capacity (kw)	15000
Head (m)	15.24
Turbine	Kaplan
Efficency	93%
Discharge Max	107.883

	Q (m^3/s)	Power (KW)	Energy(kwh)
Jan I	63.28	8798.32	2,111,597.81
Jan II	42.44	5900.26	1,416,063.10
Jan III	30.84	4288.09	1,029,142.08
Feb I	29.23	4063.63	975,270.25
Feb II	32.29	4490.06	1,077,614.71
Feb III	22.23	3091.36	741,926.50
Mar I	32.76	4554.57	1,093,097.53
Mar II	39.15	5443.83	1,306,519.76
Mar III	55.87	7768.56	1,864,453.55
Apr I	63.87	8880.88	2,131,410.88
Apr II	71.93	10001.22	2,400,292.75
Apr III	79.38	11037.17	2,648,919.95
May I	73.97	10285.12	2,468,429.94
May II	126.03	15000.00	3,600,000.00
May III	161.48	15000.00	3,600,000.00
Jun I	199.54	15000.00	3,600,000.00
Jun II	293.59	15000.00	3,600,000.00
Jun III	341.45	15000.00	3,600,000.00
Jul I	234.77	15000.00	3,600,000.00
Jul II	185.76	15000.00	3,600,000.00
Jul III	212.88	15000.00	3,600,000.00
Aug I	134.17	15000.00	3,600,000.00
Aug II	189.24	15000.00	3,600,000.00
Aug III	255.23	15000.00	3,600,000.00
Sep I	184.91	15000.00	3,600,000.00
Sep II	230.29	15000.00	3,600,000.00
Sep III	329.82	15000.00	3,600,000.00
Oct I	314.99	15000.00	3,600,000.00
Oct II	348.56	15000.00	3,600,000.00
Oct III	276.85	15000.00	3,600,000.00
Nov I	328.34	15000.00	3,600,000.00
Nov II	179.68	15000.00	3,600,000.00
Nov III	106.46	14801.72	3,552,412.65
Dec I	112.33	15000.00	3,600,000.00
Dec II	78.57	10924.93	2,621,982.51
Dec III	73.20	10177.76	2,442,661.52
			101,881,795.49

Assumed Installed Capacity		20 MW
Head		15.24
Turbine	Kaplan	
Efficency		0.93
Discharg Max		143.84

	Q (m3/s)	Power (KW	Energy(kwh)
Jan I	63.28	9,635.85	2,312,603.99
Jan II	42.44	7,537.55	1,809,013.04
Jan III	30.84	5,371.45	1,289,149.05
Feb I	29.23	4,421.65	1,061,194.89
Feb II	32.29	4,490.06	1,077,614.71
Feb III	22.23	4,701.54	1,128,368.80
Mar I	32.76	6,505.46	1,561,309.92
Mar II	39.15	7,635.94	1,832,625.83
Mar III	55.87	8,885.48	2,132,515.91
Apr I	63.87	10,974.53	2,633,886.84
Apr II	71.93	12,831.04	3,079,449.94
Apr III	79.38	14,678.74	3,522,897.39
May I	73.97	14,179.57	3,403,096.44
May II	126.03	19,632.89	4,711,892.81
May III	161.48	20,000.00	4,800,000.00
Jun I	199.54	20,000.00	4,800,000.00
Jun II	293.59	20,000.00	4,800,000.00
Jun III	341.45	20,000.00	4,800,000.00
Jul I	234.77	20,000.00	4,800,000.00
Jul II	185.76	20,000.00	4,800,000.00
Jul III	212.88	20,000.00	4,800,000.00
Aug I	134.17	20,000.00	4,800,000.00
Aug II	189.24	20,000.00	4,800,000.00
Aug III	255.23	20,000.00	4,800,000.00
Sep I	184.91	20,000.00	4,800,000.00
Sep II	230.29	20,000.00	4,800,000.00
Sep III	329.82	20,000.00	4,800,000.00
Oct I	314.99	20,000.00	4,800,000.00
Oct II	348.56	20,000.00	4,800,000.00
Oct III	276.85	20,000.00	4,800,000.00
Nov I	328.34	20,000.00	4,800,000.00
Nov II	179.68	20,000.00	4,800,000.00
Nov III	106.46	20,000.00	4,800,000.00
Dec I	112.33	16,786.94	4,028,865.51
Dec II	78.57	13,783.75	3,308,100.06
Dec III	73.20	10,605.25	2,545,260.26
			132,637,845.38

Assumed Installed Capacity		25 MW
Head		15.24
Turbine	Kaplan	
Efficency		0.93
Discharg Max		179.81

	Q (m3/s)	Power (KW	Energy(kwh)
Jan I	63.28	9,635.85	2,312,603.99
Jan II	42.44	7,537.55	1,809,013.04
Jan III	30.84	5,371.45	1,289,149.05
Feb I	29.23	4,421.65	1,061,194.89
Feb II	32.29	4,490.06	1,077,614.71
Feb III	22.23	4,701.54	1,128,368.80
Mar I	32.76	6,505.46	1,561,309.92
Mar II	39.15	7,635.94	1,832,625.83
Mar III	55.87	8,885.48	2,132,515.91
Apr I	63.87	10,974.53	2,633,886.84
Apr II	71.93	12,831.04	3,079,449.94
Apr III	79.38	14,678.74	3,522,897.39
May I	73.97	14,179.57	3,403,096.44
May II	126.03	19,632.89	4,711,892.81
May III	161.48	25,000.00	6,000,000.00
Jun I	199.54	25,000.00	6,000,000.00
Jun II	293.59	25,000.00	6,000,000.00
Jun III	341.45	25,000.00	6,000,000.00
Jul I	234.77	25,000.00	6,000,000.00
Jul II	185.76	25,000.00	6,000,000.00
Jul III	212.88	25,000.00	6,000,000.00
Aug I	134.17	25,000.00	6,000,000.00
Aug II	189.24	25,000.00	6,000,000.00
Aug III	255.23	25,000.00	6,000,000.00
Sep I	184.91	25,000.00	6,000,000.00
Sep II	230.29	25,000.00	6,000,000.00
Sep III	329.82	25,000.00	6,000,000.00
Oct I	314.99	25,000.00	6,000,000.00
Oct II	348.56	25,000.00	6,000,000.00
Oct III	276.85	25,000.00	6,000,000.00
Nov I	328.34	25,000.00	6,000,000.00
Nov II	179.68	25,000.00	6,000,000.00
Nov III	106.46	22,438.72	5,385,293.26
Dec I	112.33	16,786.94	4,028,865.51
Dec II	78.57	13,783.75	3,308,100.06
Dec III	73.20	10,605.25	2,545,260.26
			154,823,138.64

Assumed Installed Capacity		30 MW
Head		15.24
Turbine	Kaplan	
Efficency		0.93
Discharge Max		215.77

	Q (m3/s)	Power (KW)	Energy(kwh)
Jan I	63.28	9,635.85	2,312,603.99
Jan II	42.44	7,537.55	1,809,013.04
Jan III	30.84	5,371.45	1,289,149.05
Feb I	29.23	4,421.65	1,061,194.89
Feb II	32.29	4,490.06	1,077,614.71
Feb III	22.23	4,701.54	1,128,368.80
Mar I	32.76	6,505.46	1,561,309.92
Mar II	39.15	7,635.94	1,832,625.83
Mar III	55.87	8,885.48	2,132,515.91
Apr I	63.87	10,974.53	2,633,886.84
Apr II	71.93	12,831.04	3,079,449.94
Apr III	79.38	14,678.74	3,522,897.39
May I	73.97	14,179.57	3,403,096.44
May II	126.03	19,632.89	4,711,892.81
May III	161.48	30,000.00	7,200,000.00
Jun I	199.54	30,000.00	7,200,000.00
Jun II	293.59	30,000.00	7,200,000.00
Jun III	341.45	30,000.00	7,200,000.00
Jul I	234.77	30,000.00	7,200,000.00
Jul II	185.76	30,000.00	7,200,000.00
Jul III	212.88	30,000.00	7,200,000.00
Aug I	134.17	27,781.33	6,667,518.88
Aug II	189.24	30,000.00	7,200,000.00
Aug III	255.23	30,000.00	7,200,000.00
Sep I	184.91	30,000.00	7,200,000.00
Sep II	230.29	30,000.00	7,200,000.00
Sep III	329.82	30,000.00	7,200,000.00
Oct I	314.99	30,000.00	7,200,000.00
Oct II	348.56	30,000.00	7,200,000.00
Oct III	276.85	30,000.00	7,200,000.00
Nov I	328.34	30,000.00	7,200,000.00
Nov II	179.68	28,547.51	6,851,403.14
Nov III	106.46	22,438.72	5,385,293.26
Dec I	112.33	16,786.94	4,028,865.51
Dec II	78.57	13,783.75	3,308,100.06
Dec III	73.20	10,605.25	2,545,260.26
			175,542,060.66

Assumed Installed Capacity		35 MW
Head		15.24
Turbine	Kaplan	
Efficency		0.93
Discharge Max		251.73

	Q (m3/s)	Power (KW)	Energy(kwh)
Jan I	63.28	9,635.85	2,312,603.99
Jan II	42.44	7,537.55	1,809,013.04
Jan III	30.84	5,371.45	1,289,149.05
Feb I	29.23	4,421.65	1,061,194.89
Feb II	32.29	4,490.06	1,077,614.71
Feb III	22.23	4,701.54	1,128,368.80
Mar I	32.76	6,505.46	1,561,309.92
Mar II	39.15	7,635.94	1,832,625.83
Mar III	55.87	8,885.48	2,132,515.91
Apr I	63.87	10,974.53	2,633,886.84
Apr II	71.93	12,831.04	3,079,449.94
Apr III	79.38	14,678.74	3,522,897.39
May I	73.97	14,179.57	3,403,096.44
May II	126.03	19,632.89	4,711,892.81
May III	161.48	31,069.01	7,456,561.56
Jun I	199.54	35,000.00	8,400,000.00
Jun II	293.59	35,000.00	8,400,000.00
Jun III	341.45	35,000.00	8,400,000.00
Jul I	234.77	35,000.00	8,400,000.00
Jul II	185.76	35,000.00	8,400,000.00
Jul III	212.88	35,000.00	8,400,000.00
Aug I	134.17	27,781.33	6,667,518.88
Aug II	189.24	31,126.10	7,470,264.33
Aug III	255.23	35,000.00	8,400,000.00
Sep I	184.91	34,521.19	8,285,085.25
Sep II	230.29	35,000.00	8,400,000.00
Sep III	329.82	35,000.00	8,400,000.00
Oct I	314.99	35,000.00	8,400,000.00
Oct II	348.56	35,000.00	8,400,000.00
Oct III	276.85	35,000.00	8,400,000.00
Nov I	328.34	35,000.00	8,400,000.00
Nov II	179.68	28,547.51	6,851,403.14
Nov III	106.46	22,438.72	5,385,293.26
Dec I	112.33	16,786.94	4,028,865.51
Dec II	78.57	13,783.75	3,308,100.06
Dec III	73.20	10,605.25	2,545,260.26
			192,753,971.80

Assumed Installed Capacity			40 MW
Head			15.24
Turbine		Kaplan	
Efficency			0.93
Discharge Max			287.69

	Q (m3/s)	Power (KW	Energy(kwh)
Jan I	63.28	9,635.85	2,312,603.99
Jan II	42.44	7,537.55	1,809,013.04
Jan III	30.84	5,371.45	1,289,149.05
Feb I	29.23	4,421.65	1,061,194.89
Feb II	32.29	4,490.06	1,077,614.71
Feb III	22.23	4,701.54	1,128,368.80
Mar I	32.76	6,505.46	1,561,309.92
Mar II	39.15	7,635.94	1,832,625.83
Mar III	55.87	8,885.48	2,132,515.91
Apr I	63.87	10,974.53	2,633,886.84
Apr II	71.93	12,831.04	3,079,449.94
Apr III	79.38	14,678.74	3,522,897.39
May I	73.97	14,179.57	3,403,096.44
May II	126.03	19,632.89	4,711,892.81
May III	161.48	31,069.01	7,456,561.56
Jun I	199.54	39,140.07	9,393,617.88
Jun II	293.59	40,000.00	9,600,000.00
Jun III	341.45	40,000.00	9,600,000.00
Jul I	234.77	40,000.00	9,600,000.00
Jul II	185.76	40,000.00	9,600,000.00
Jul III	212.88	40,000.00	9,600,000.00
Aug I	134.17	27,781.33	6,667,518.88
Aug II	189.24	31,126.10	7,470,264.33
Aug III	255.23	37,309.47	8,954,272.90
Sep I	184.91	34,521.19	8,285,085.25
Sep II	230.29	40,000.00	9,600,000.00
Sep III	329.82	40,000.00	9,600,000.00
Oct I	314.99	40,000.00	9,600,000.00
Oct II	348.56	40,000.00	9,600,000.00
Oct III	276.85	40,000.00	9,600,000.00
Nov I	328.34	40,000.00	9,600,000.00
Nov II	179.68	28,547.51	6,851,403.14
Nov III	106.46	22,438.72	5,385,293.26
Dec I	112.33	16,786.94	4,028,865.51
Dec II	78.57	13,783.75	3,308,100.06
Dec III	73.20	10,605.25	2,545,260.26
			207,501,862.59

Assumed Installed Capacity			45 MW
Head			15.24
Turbine		Kaplan	
Efficency			0.93
Discharge Max			323.65

	Q (m3/s)	Power (KW	Energy(kwh)
Jan I	63.28	9,635.85	2,312,603.99
Jan II	42.44	7,537.55	1,809,013.04
Jan III	30.84	5,371.45	1,289,149.05
Feb I	29.23	4,421.65	1,061,194.89
Feb II	32.29	4,490.06	1,077,614.71
Feb III	22.23	4,701.54	1,128,368.80
Mar I	32.76	6,505.46	1,561,309.92
Mar II	39.15	7,635.94	1,832,625.83
Mar III	55.87	8,885.48	2,132,515.91
Apr I	63.87	10,974.53	2,633,886.84
Apr II	71.93	12,831.04	3,079,449.94
Apr III	79.38	14,678.74	3,522,897.39
May I	73.97	14,179.57	3,403,096.44
May II	126.03	19,632.89	4,711,892.81
May III	161.48	31,069.01	7,456,561.56
Jun I	199.54	39,140.07	9,393,617.88
Jun II	293.59	45,000.00	10,800,000.00
Jun III	341.45	45,000.00	10,800,000.00
Jul I	234.77	45,000.00	10,800,000.00
Jul II	185.76	45,000.00	10,800,000.00
Jul III	212.88	42,595.84	10,223,002.02
Aug I	134.17	27,781.33	6,667,518.88
Aug II	189.24	31,126.10	7,470,264.33
Aug III	255.23	37,309.47	8,954,272.90
Sep I	184.91	34,521.19	8,285,085.25
Sep II	230.29	45,000.00	10,800,000.00
Sep III	329.82	45,000.00	10,800,000.00
Oct I	314.99	45,000.00	10,800,000.00
Oct II	348.56	45,000.00	10,800,000.00
Oct III	276.85	45,000.00	10,800,000.00
Nov I	328.34	43,679.47	10,483,073.49
Nov II	179.68	28,547.51	6,851,403.14
Nov III	106.46	22,438.72	5,385,293.26
Dec I	112.33	16,786.94	4,028,865.51
Dec II	78.57	13,783.75	3,308,100.06
Dec III	73.20	10,605.25	2,545,260.26
			219,807,938.09

Assumed Installed Capacity	50 MW
Head	15.24
Turbine	Kaplan
Efficency	0.93
Discharge Max	359.61

	Q (m3/s)	Power (KW	Energy(kwh)
Jan I	63.28	9,635.85	2,312,603.99
Jan II	42.44	7,537.55	1,809,013.04
Jan III	30.84	5,371.45	1,289,149.05
Feb I	29.23	4,421.65	1,061,194.89
Feb II	32.29	4,490.06	1,077,614.71
Feb III	22.23	4,701.54	1,128,368.80
Mar I	32.76	6,505.46	1,561,309.92
Mar II	39.15	7,635.94	1,832,625.83
Mar III	55.87	8,885.48	2,132,515.91
Apr I	63.87	10,974.53	2,633,886.84
Apr II	71.93	12,831.04	3,079,449.94
Apr III	79.38	14,678.74	3,522,897.39
May I	73.97	14,179.57	3,403,096.44
May II	126.03	19,632.89	4,711,892.81
May III	161.48	31,069.01	7,456,561.56
Jun I	199.54	39,140.07	9,393,617.88
Jun II	293.59	49,124.05	11,789,771.64
Jun III	341.45	50,000.00	12,000,000.00
Jul I	234.77	49,118.87	11,788,528.50
Jul II	185.76	50,000.00	12,000,000.00
Jul III	212.88	42,595.84	10,223,002.02
Aug I	134.17	27,781.33	6,667,518.88
Aug II	189.24	31,126.10	7,470,264.33
Aug III	255.23	37,309.47	8,954,272.90
Sep I	184.91	34,521.19	8,285,085.25
Sep II	230.29	45,118.91	10,828,538.88
Sep III	329.82	50,000.00	12,000,000.00
Oct I	314.99	50,000.00	12,000,000.00
Oct II	348.56	50,000.00	12,000,000.00
Oct III	276.85	50,000.00	12,000,000.00
Nov I	328.34	43,679.47	10,483,073.49
Nov II	179.68	28,547.51	6,851,403.14
Nov III	106.46	22,438.72	5,385,293.26
Dec I	112.33	16,786.94	4,028,865.51
Dec II	78.57	13,783.75	3,308,100.06
Dec III	73.20	10,605.25	2,545,260.26
			229,014,777.11

Assumed Installed Capacity	55 MW
Head	15.24
Turbine	Kaplan
Efficency	0.93
Discharge Max	395.57

Q (m3/s)	Power (KW	Energy(kwh)
63.28	9,635.85	2,312,603.99
42.44	7,537.55	1,809,013.04
30.84	5,371.45	1,289,149.05
29.23	4,421.65	1,061,194.89
32.29	4,490.06	1,077,614.71
22.23	4,701.54	1,128,368.80
32.76	6,505.46	1,561,309.92
39.15	7,635.94	1,832,625.83
55.87	8,885.48	2,132,515.91
63.87	10,974.53	2,633,886.84
71.93	12,831.04	3,079,449.94
79.38	14,678.74	3,522,897.39
73.97	14,179.57	3,403,096.44
126.03	19,632.89	4,711,892.81
161.48	31,069.01	7,456,561.56
199.54	39,140.07	9,393,617.88
293.59	49,124.05	11,789,771.64
341.45	55,000.00	13,200,000.00
234.77	49,118.87	11,788,528.50
185.76	54,243.13	13,018,350.60
212.88	42,595.84	10,223,002.02
134.17	27,781.33	6,667,518.88
189.24	31,126.10	7,470,264.33
255.23	37,309.47	8,954,272.90
184.91	34,521.19	8,285,085.25
230.29	45,118.91	10,828,538.88
329.82	55,000.00	13,200,000.00
314.99	55,000.00	13,200,000.00
348.56	54,034.42	12,968,260.47
276.85	51,584.02	12,380,165.08
328.34	43,679.47	10,483,073.49
179.68	28,547.51	6,851,403.14
106.46	22,438.72	5,385,293.26
112.33	16,786.94	4,028,865.51
78.57	13,783.75	3,308,100.06
73.20	10,605.25	2,545,260.26
		234,981,553.27

Assumed Installed Capacity	60,000.00
Head	15.24
Turbine	Kaplan
Efficency	0.93
Discharge Max	431.53

	Q (m3/s)	Power (KW	Energy(kwh)
Jan I	63.28	9,635.85	2,312,603.99
Jan II	42.44	7,537.55	1,809,013.04
Jan III	30.84	5,371.45	1,289,149.05
Feb I	29.23	4,421.65	1,061,194.89
Feb II	32.29	4,490.06	1,077,614.71
Feb III	22.23	4,701.54	1,128,368.80
Mar I	32.76	6,505.46	1,561,309.92
Mar II	39.15	7,635.94	1,832,625.83
Mar III	55.87	8,885.48	2,132,515.91
Apr I	63.87	10,974.53	2,633,886.84
Apr II	71.93	12,831.04	3,079,449.94
Apr III	79.38	14,678.74	3,522,897.39
May I	73.97	14,179.57	3,403,096.44
May II	126.03	19,632.89	4,711,892.81
May III	161.48	31,069.01	7,456,561.56
Jun I	199.54	39,140.07	9,393,617.88
Jun II	293.59	49,124.05	11,789,771.64
Jun III	341.45	56,323.90	13,517,735.03
Jul I	234.77	49,118.87	11,788,528.50
Jul II	185.76	54,243.13	13,018,350.60
Jul III	212.88	42,595.84	10,223,002.02
Aug I	134.17	27,781.33	6,667,518.88
Aug II	189.24	31,126.10	7,470,264.33
Aug III	255.23	37,309.47	8,954,272.90
Sep I	184.91	34,521.19	8,285,085.25
Sep II	230.29	45,118.91	10,828,538.88
Sep III	329.82	59,268.56	14,224,455.38
Oct I	314.99	59,075.56	14,178,134.62
Oct II	348.56	54,034.42	12,968,260.47
Oct III	276.85	51,584.02	12,380,165.08
Nov I	328.34	43,679.47	10,483,073.49
Nov II	179.68	28,547.51	6,851,403.14
Nov III	106.46	22,438.72	5,385,293.26
Dec I	112.33	16,786.94	4,028,865.51
Dec II	78.57	13,783.75	3,308,100.06
Dec III	73.20	10,605.25	2,545,260.26
			237,301,878.29

APPENDIX J

ENERGY ESTIMATION AT POWER HOUSE 1 BASED ON 10 YEARS CONTINUOUS FLOW DATA FROM 1968 TO 1977

Unrestricted Power Generated

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Jan I	7.04	28.27	7.66	11.96	6.80	4.01	4.18	4.18	4.04	4.43
Jan II	5.86	19.20	9.00	6.81	4.53	2.51	3.33	3.33	2.99	3.00
Jan III	2.77	16.67	7.36	6.18	3.43	1.73	2.07	2.07	1.96	2.26
Feb I	3.25	12.32	6.05	4.54	2.77	1.73	1.34	1.34	1.68	1.75
Feb II	3.71	15.01	6.65	4.26	2.82	2.59	1.31	1.31	3.62	1.11
Feb III	1.98	21.20	6.12	5.29	3.81	1.99	1.12	1.12	2.44	0.96
Mar I	1.41	14.27	14.21	12.41	4.88	1.54	1.54	3.64	2.11	0.91
Mar II	4.36	14.88	15.07	6.02	4.58	0.94	0.94	3.73	6.36	0.67
Mar III	4.94	20.12	16.34	7.84	7.69	2.87	2.87	6.41	7.26	1.62
Apr I	3.28	21.36	7.83	12.68	20.48	6.77	7.10	5.23	6.05	1.44
Apr II	5.73	27.68	26.18	14.94	22.38	7.05	7.05	4.96	8.61	1.50
Apr III	8.93	25.05	12.95	9.74	14.90	8.29	8.29	8.51	6.23	3.30
May I	11.10	9.37	11.38	8.12	22.41	5.85	5.85	11.57	4.30	2.88
May II	18.48	42.57	17.56	14.02	23.82	3.60	3.60	18.03	4.17	4.96
May III	34.23	71.91	47.22	10.85	68.26	6.68	6.68	8.20	17.96	7.24
Jun I	44.93	72.34	44.00	15.03	73.42	5.05	4.96	9.12	22.20	10.11
Jun II	65.12	91.78	18.14	23.04	31.68	8.20	8.20	27.30	45.12	32.66
Jun III	77.12	57.93	22.40	26.32	22.83	10.27	10.27	33.48	71.25	17.37
Jul I	120.57	51.60	17.94	24.23	25.95	16.01	16.01	47.55	39.02	11.13
Jul II	178.69	53.91	16.96	20.66	31.68	13.04	13.04	62.51	39.48	5.22
Jul III	123.62	27.57	9.51	27.74	24.79	4.36	4.36	25.04	23.68	5.38
Aug I	78.59	17.58	8.00	29.93	16.75	6.85	6.85	14.92	7.75	5.27
Aug II	127.20	21.05	7.40	35.91	9.72	22.81	22.81	13.32	4.72	2.54
Aug III	120.60	31.32	7.00	36.67	12.81	38.95	38.95	8.05	6.80	2.50
Sep I	163.73	19.36	8.21	27.51	10.75	33.05	33.05	7.97	6.68	2.50
Sep II	172.86	13.55	10.45	43.29	19.07	45.57	45.57	10.45	6.01	3.62
Sep III	196.47	20.19	46.69	53.91	11.61	36.69	36.69	11.43	7.37	8.78
Oct I	202.65	23.07	43.02	44.76	18.40	35.04	35.04	23.11	14.24	18.97
Oct II	111.91	25.69	31.27	29.20	27.05	38.96	38.96	33.17	10.92	58.13
Oct III	93.74	53.65	59.48	23.89	18.31	27.59	27.59	25.20	13.52	30.79
Nov I	57.74	72.13	52.88	14.31	13.23	36.52	36.52	17.36	20.60	9.34
Nov II	53.52	55.62	29.46	11.24	8.72	16.86	16.86	11.54	19.99	6.47
Nov III	69.83	18.60	35.30	11.01	8.95	9.84	9.84	9.33	14.98	4.21
Dec I	41.94	15.07	15.25	11.60	7.11	6.15	6.15	20.88	6.69	5.34
Dec II	43.69	16.12	9.14	8.74	4.72	7.57	7.57	7.48	4.12	6.38
Dec III	28.53	11.10	9.16	8.41	7.69	5.35	5.35	5.36	5.65	3.68

Power Generated at 5MW installed Capacity

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Jan I	5.00	5.00	5.00	5.00	5.00	4.01	4.18	4.18	4.04	4.43
Jan II	5.00	5.00	5.00	5.00	4.53	2.51	3.33	3.33	2.99	3.00
Jan III	2.77	5.00	5.00	5.00	3.43	1.73	2.07	2.07	1.96	2.26
Feb I	3.25	5.00	5.00	4.54	2.77	1.73	1.34	1.34	1.68	1.75
Feb II	3.71	5.00	5.00	4.26	2.82	2.59	1.31	1.31	3.62	1.11
Feb III	1.98	5.00	5.00	5.00	3.81	1.99	1.12	1.12	2.44	0.96
Mar I	1.41	5.00	5.00	5.00	4.88	1.54	1.54	3.64	2.11	0.91
Mar II	4.36	5.00	5.00	5.00	4.58	0.94	0.94	3.73	5.00	0.67
Mar III	4.94	5.00	5.00	5.00	5.00	2.87	2.87	5.00	5.00	1.62
Apr I	3.28	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	1.44
Apr II	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.96	5.00	1.50
Apr III	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	3.30
May I	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.30	2.88
May II	5.00	5.00	5.00	5.00	5.00	3.60	3.60	5.00	4.17	4.96
May III	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Jun I	5.00	5.00	5.00	5.00	5.00	5.00	4.96	5.00	5.00	5.00
Jun II	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Jun III	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Jul I	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Jul II	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Jul III	5.00	5.00	5.00	5.00	5.00	4.36	4.36	5.00	5.00	5.00
Aug I	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Aug II	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.72	2.54
Aug III	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	2.50
Sep I	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	2.50
Sep II	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	3.62
Sep III	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Oct I	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Oct II	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Oct III	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Nov I	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Nov II	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Nov III	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.21
Dec I	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Dec II	5.00	5.00	5.00	5.00	4.72	5.00	5.00	5.00	4.12	5.00
Dec III	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	3.68

Power generated at 10MW from 1968 to 1977

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Jan I	7.04	10.00	7.66	10.00	6.80	4.01	4.18	4.18	4.04	4.43
Jan II	5.86	10.00	9.00	6.81	4.53	2.51	3.33	3.33	2.99	3.00
Jan III	2.77	10.00	7.36	6.18	3.43	1.73	2.07	2.07	1.96	2.26
Feb I	3.25	10.00	6.05	4.54	2.77	1.73	1.34	1.34	1.68	1.75
Feb II	3.71	10.00	6.65	4.26	2.82	2.59	1.31	1.31	3.62	1.11
Feb III	1.98	10.00	6.12	5.29	3.81	1.99	1.12	1.12	2.44	0.96
Mar I	1.41	10.00	10.00	10.00	4.88	1.54	1.54	3.64	2.11	0.91
Mar II	4.36	10.00	10.00	6.02	4.58	0.94	0.94	3.73	6.36	0.67
Mar III	4.94	10.00	10.00	7.84	7.69	2.87	2.87	6.41	7.26	1.62
Apr I	3.28	10.00	7.83	10.00	10.00	6.77	7.10	5.23	6.05	1.44
Apr II	5.73	10.00	10.00	10.00	10.00	7.05	7.05	4.96	8.61	1.50
Apr III	8.93	10.00	10.00	9.74	10.00	8.29	8.29	8.51	6.23	3.30
May I	10.00	9.37	10.00	8.12	10.00	5.85	5.85	10.00	4.30	2.88
May II	10.00	10.00	10.00	10.00	10.00	3.60	3.60	10.00	4.17	4.96
May III	10.00	10.00	10.00	10.00	10.00	6.68	6.68	8.20	10.00	7.24
Jun I	10.00	10.00	10.00	10.00	10.00	5.05	4.96	9.12	10.00	10.00
Jun II	10.00	10.00	10.00	10.00	10.00	8.20	8.20	10.00	10.00	10.00
Jun III	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Jul I	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Jul II	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	5.22
Jul III	10.00	10.00	9.51	10.00	10.00	4.36	4.36	10.00	10.00	5.38
Aug I	10.00	10.00	8.00	10.00	10.00	6.85	6.85	10.00	7.75	5.27
Aug II	10.00	10.00	7.40	10.00	9.72	10.00	10.00	10.00	4.72	2.54
Aug III	10.00	10.00	7.00	10.00	10.00	10.00	10.00	8.05	6.80	2.50
Sep I	10.00	10.00	8.21	10.00	10.00	10.00	10.00	7.97	6.68	2.50
Sep II	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	6.01	3.62
Sep III	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	7.37	8.78
Oct I	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Oct II	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Oct III	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Nov I	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	9.34
Nov II	10.00	10.00	10.00	10.00	8.72	10.00	10.00	10.00	10.00	6.47
Nov III	10.00	10.00	10.00	10.00	8.95	9.84	9.84	9.33	10.00	4.21
Dec I	10.00	10.00	10.00	10.00	7.11	6.15	6.15	10.00	6.69	5.34
Dec II	10.00	10.00	9.14	8.74	4.72	7.57	7.57	7.48	4.12	6.38
Dec III	10.00	10.00	9.16	8.41	7.69	5.35	5.35	5.36	5.65	3.68

Power Generated at 15 MW from 1968 to 1977

1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
7.04	15.00	7.66	11.96	6.80	4.01	4.18	4.18	4.04	4.43
5.86	15.00	9.00	6.81	4.53	2.51	3.33	3.33	2.99	3.00
2.77	15.00	7.36	6.18	3.43	1.73	2.07	2.07	1.96	2.26
3.25	12.32	6.05	4.54	2.77	1.73	1.34	1.34	1.68	1.75
3.71	15.00	6.65	4.26	2.82	2.59	1.31	1.31	3.62	1.11
1.98	15.00	6.12	5.29	3.81	1.99	1.12	1.12	2.44	0.96
1.41	14.27	14.21	12.41	4.88	1.54	1.54	3.64	2.11	0.91
4.36	14.88	15.00	6.02	4.58	0.94	0.94	3.73	6.36	0.67
4.94	15.00	15.00	7.84	7.69	2.87	2.87	6.41	7.26	1.62
3.28	15.00	7.83	12.68	15.00	6.77	7.10	5.23	6.05	1.44
5.73	15.00	15.00	14.94	15.00	7.05	7.05	4.96	8.61	1.50
8.93	15.00	12.95	9.74	14.90	8.29	8.29	8.51	6.23	3.30
11.10	9.37	11.38	8.12	15.00	5.85	5.85	11.57	4.30	2.88
15.00	15.00	15.00	14.02	15.00	3.60	3.60	15.00	4.17	4.96
15.00	15.00	15.00	10.85	15.00	6.68	6.68	8.20	15.00	7.24
15.00	15.00	15.00	15.00	15.00	5.05	4.96	9.12	15.00	10.11
15.00	15.00	15.00	15.00	15.00	8.20	8.20	15.00	15.00	15.00
15.00	15.00	15.00	15.00	15.00	10.27	10.27	15.00	15.00	15.00
15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	11.13
15.00	15.00	15.00	15.00	15.00	13.04	13.04	15.00	15.00	5.22
15.00	15.00	9.51	15.00	15.00	4.36	4.36	15.00	15.00	5.38
15.00	15.00	8.00	15.00	15.00	6.85	6.85	14.92	7.75	5.27
15.00	15.00	7.40	15.00	9.72	15.00	15.00	13.32	4.72	2.54
15.00	15.00	7.00	15.00	12.81	15.00	15.00	8.05	6.80	2.50
15.00	15.00	8.21	15.00	10.75	15.00	15.00	7.97	6.68	2.50
15.00	13.55	10.45	15.00	15.00	15.00	15.00	10.45	6.01	3.62
15.00	15.00	15.00	15.00	11.61	15.00	15.00	11.43	7.37	8.78
15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	14.24	15.00
15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	10.92	15.00
15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	13.52	15.00
15.00	15.00	15.00	14.31	13.23	15.00	15.00	15.00	15.00	9.34
15.00	15.00	15.00	11.24	8.72	15.00	15.00	11.54	15.00	6.47
15.00	15.00	15.00	11.01	8.95	9.84	9.84	9.33	14.98	4.21
15.00	15.00	15.00	11.60	7.11	6.15	6.15	15.00	6.69	5.34
15.00	15.00	9.14	8.74	4.72	7.57	7.57	7.48	4.12	6.38
15.00	11.10	9.16	8.41	7.69	5.35	5.35	5.36	5.65	3.68

Potential Power Generated at 20MW

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Jan I	7.04	20.00	7.66	11.96	6.80	4.01	4.18	4.18	4.04	4.43
Jan II	5.86	19.20	9.00	6.81	4.53	2.51	3.33	3.33	2.99	3.00
Jan III	2.77	16.67	7.36	6.18	3.43	1.73	2.07	2.07	1.96	2.26
Feb I	3.25	12.32	6.05	4.54	2.77	1.73	1.34	1.34	1.68	1.75
Feb II	3.71	15.01	6.65	4.26	2.82	2.59	1.31	1.31	3.62	1.11
Feb III	1.98	20.00	6.12	5.29	3.81	1.99	1.12	1.12	2.44	0.96
Mar I	1.41	14.27	14.21	12.41	4.88	1.54	1.54	3.64	2.11	0.91
Mar II	4.36	14.88	15.07	6.02	4.58	0.94	0.94	3.73	6.36	0.67
Mar III	4.94	20.00	16.34	7.84	7.69	2.87	2.87	6.41	7.26	1.62
Apr I	3.28	20.00	7.83	12.68	20.00	6.77	7.10	5.23	6.05	1.44
Apr II	5.73	20.00	20.00	14.94	20.00	7.05	7.05	4.96	8.61	1.50
Apr III	8.93	20.00	12.95	9.74	14.90	8.29	8.29	8.51	6.23	3.30
May I	11.10	9.37	11.38	8.12	20.00	5.85	5.85	11.57	4.30	2.88
May II	18.48	20.00	17.56	14.02	20.00	3.60	3.60	18.03	4.17	4.96
May III	20.00	20.00	20.00	10.85	20.00	6.68	6.68	8.20	17.96	7.24
Jun I	20.00	20.00	20.00	15.03	20.00	5.05	4.96	9.12	20.00	10.11
Jun II	20.00	20.00	18.14	20.00	20.00	8.20	8.20	20.00	20.00	20.00
Jun III	20.00	20.00	20.00	20.00	20.00	10.27	10.27	20.00	20.00	17.37
Jul I	20.00	20.00	17.94	20.00	20.00	16.01	16.01	20.00	20.00	11.13
Jul II	20.00	20.00	16.96	20.00	20.00	13.04	13.04	20.00	20.00	5.22
Jul III	20.00	20.00	9.51	20.00	20.00	4.36	4.36	20.00	20.00	5.38
Aug I	20.00	17.58	8.00	20.00	16.75	6.85	6.85	14.92	7.75	5.27
Aug II	20.00	20.00	7.40	20.00	9.72	20.00	20.00	13.32	4.72	2.54
Aug III	20.00	20.00	7.00	20.00	12.81	20.00	20.00	8.05	6.80	2.50
Sep I	20.00	19.36	8.21	20.00	10.75	20.00	20.00	7.97	6.68	2.50
Sep II	20.00	13.55	10.45	20.00	19.07	20.00	20.00	10.45	6.01	3.62
Sep III	20.00	20.00	20.00	20.00	11.61	20.00	20.00	11.43	7.37	8.78
Oct I	20.00	20.00	20.00	20.00	18.40	20.00	20.00	20.00	14.24	18.97
Oct II	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	10.92	20.00
Oct III	20.00	20.00	20.00	20.00	18.31	20.00	20.00	20.00	13.52	20.00
Nov I	20.00	20.00	20.00	14.31	13.23	20.00	20.00	17.36	20.00	9.34
Nov II	20.00	20.00	20.00	11.24	8.72	16.86	16.86	11.54	19.99	6.47
Nov III	20.00	18.60	20.00	11.01	8.95	9.84	9.84	9.33	14.98	4.21
Dec I	20.00	15.07	15.25	11.60	7.11	6.15	6.15	20.00	6.69	5.34
Dec II	20.00	16.12	9.14	8.74	4.72	7.57	7.57	7.48	4.12	6.38
Dec III	20.00	11.10	9.16	8.41	7.69	5.35	5.35	5.36	5.65	3.68

Potential Power Generated at 25MW

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Jan I	7.04	25.00	7.66	11.96	6.80	4.01	4.18	4.18	4.04	4.43
Jan II	5.86	19.20	9.00	6.81	4.53	2.51	3.33	3.33	2.99	3.00
Jan III	2.77	16.67	7.36	6.18	3.43	1.73	2.07	2.07	1.96	2.26
Feb I	3.25	12.32	6.05	4.54	2.77	1.73	1.34	1.34	1.68	1.75
Feb II	3.71	15.01	6.65	4.26	2.82	2.59	1.31	1.31	3.62	1.11
Feb III	1.98	21.20	6.12	5.29	3.81	1.99	1.12	1.12	2.44	0.96
Mar I	1.41	14.27	14.21	12.41	4.88	1.54	1.54	3.64	2.11	0.91
Mar II	4.36	14.88	15.07	6.02	4.58	0.94	0.94	3.73	6.36	0.67
Mar III	4.94	20.12	16.34	7.84	7.69	2.87	2.87	6.41	7.26	1.62
Apr I	3.28	21.36	7.83	12.68	20.48	6.77	7.10	5.23	6.05	1.44
Apr II	5.73	25.00	25.00	14.94	22.38	7.05	7.05	4.96	8.61	1.50
Apr III	8.93	25.00	12.95	9.74	14.90	8.29	8.29	8.51	6.23	3.30
May I	11.10	9.37	11.38	8.12	22.41	5.85	5.85	11.57	4.30	2.88
May II	18.48	25.00	17.56	14.02	23.82	3.60	3.60	18.03	4.17	4.96
May III	25.00	25.00	25.00	10.85	25.00	6.68	6.68	8.20	17.96	7.24
Jun I	25.00	25.00	25.00	15.03	25.00	5.05	4.96	9.12	22.20	10.11
Jun II	25.00	25.00	18.14	23.04	25.00	8.20	8.20	25.00	25.00	25.00
Jun III	25.00	25.00	22.40	25.00	22.83	10.27	10.27	25.00	25.00	17.37
Jul I	25.00	25.00	17.94	24.23	25.00	16.01	16.01	25.00	25.00	11.13
Jul II	25.00	25.00	16.96	20.66	25.00	13.04	13.04	25.00	25.00	5.22
Jul III	25.00	25.00	9.51	25.00	24.79	4.36	4.36	25.00	23.68	5.38
Aug I	25.00	17.58	8.00	25.00	16.75	6.85	6.85	14.92	7.75	5.27
Aug II	25.00	21.05	7.40	25.00	9.72	22.81	22.81	13.32	4.72	2.54
Aug III	25.00	25.00	7.00	25.00	12.81	25.00	25.00	8.05	6.80	2.50
Sep I	25.00	19.36	8.21	25.00	10.75	25.00	25.00	7.97	6.68	2.50
Sep II	25.00	13.55	10.45	25.00	19.07	25.00	25.00	10.45	6.01	3.62
Sep III	25.00	20.19	25.00	25.00	11.61	25.00	25.00	11.43	7.37	8.78
Oct I	25.00	23.07	25.00	25.00	18.40	25.00	25.00	23.11	14.24	18.97
Oct II	25.00	25.00	25.00	25.00	25.00	25.00	25.00	25.00	10.92	25.00
Oct III	25.00	25.00	25.00	23.89	18.31	25.00	25.00	25.00	13.52	25.00
Nov I	25.00	25.00	25.00	14.31	13.23	25.00	25.00	17.36	20.60	9.34
Nov II	25.00	25.00	25.00	11.24	8.72	16.86	16.86	11.54	19.99	6.47
Nov III	25.00	18.60	25.00	11.01	8.95	9.84	9.84	9.33	14.98	4.21
Dec I	25.00	15.07	15.25	11.60	7.11	6.15	6.15	20.88	6.69	5.34
Dec II	25.00	16.12	9.14	8.74	4.72	7.57	7.57	7.48	4.12	6.38
Dec III	25.00	11.10	9.16	8.41	7.69	5.35	5.35	5.36	5.65	3.68

Power Generation at 30 MW

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Jan I	7.04	28.27	7.66	11.96	6.80	4.01	4.18	4.18	4.04	4.43
Jan II	5.86	19.20	9.00	6.81	4.53	2.51	3.33	3.33	2.99	3.00
Jan III	2.77	16.67	7.36	6.18	3.43	1.73	2.07	2.07	1.96	2.26
Feb I	3.25	12.32	6.05	4.54	2.77	1.73	1.34	1.34	1.68	1.75
Feb II	3.71	15.01	6.65	4.26	2.82	2.59	1.31	1.31	3.62	1.11
Feb III	1.98	21.20	6.12	5.29	3.81	1.99	1.12	1.12	2.44	0.96
Mar I	1.41	14.27	14.21	12.41	4.88	1.54	1.54	3.64	2.11	0.91
Mar II	4.36	14.88	15.07	6.02	4.58	0.94	0.94	3.73	6.36	0.67
Mar III	4.94	20.12	16.34	7.84	7.69	2.87	2.87	6.41	7.26	1.62
Apr I	3.28	21.36	7.83	12.68	20.48	6.77	7.10	5.23	6.05	1.44
Apr II	5.73	27.68	26.18	14.94	22.38	7.05	7.05	4.96	8.61	1.50
Apr III	8.93	25.05	12.95	9.74	14.90	8.29	8.29	8.51	6.23	3.30
May I	11.10	9.37	11.38	8.12	22.41	5.85	5.85	11.57	4.30	2.88
May II	18.48	30.00	17.56	14.02	23.82	3.60	3.60	18.03	4.17	4.96
May III	30.00	30.00	30.00	10.85	30.00	6.68	6.68	8.20	17.96	7.24
Jun I	30.00	30.00	30.00	15.03	30.00	5.05	4.96	9.12	22.20	10.11
Jun II	30.00	30.00	18.14	23.04	30.00	8.20	8.20	27.30	30.00	30.00
Jun III	30.00	30.00	22.40	26.32	22.83	10.27	10.27	30.00	30.00	17.37
Jul I	30.00	30.00	17.94	24.23	25.95	16.01	16.01	30.00	30.00	11.13
Jul II	30.00	30.00	16.96	20.66	30.00	13.04	13.04	30.00	30.00	5.22
Jul III	30.00	27.57	9.51	27.74	24.79	4.36	4.36	25.04	23.68	5.38
Aug I	30.00	17.58	8.00	29.93	16.75	6.85	6.85	14.92	7.75	5.27
Aug II	30.00	21.05	7.40	30.00	9.72	22.81	22.81	13.32	4.72	2.54
Aug III	30.00	30.00	7.00	30.00	12.81	30.00	30.00	8.05	6.80	2.50
Sep I	30.00	19.36	8.21	27.51	10.75	30.00	30.00	7.97	6.68	2.50
Sep II	30.00	13.55	10.45	30.00	19.07	30.00	30.00	10.45	6.01	3.62
Sep III	30.00	20.19	30.00	30.00	11.61	30.00	30.00	11.43	7.37	8.78
Oct I	30.00	23.07	30.00	30.00	18.40	30.00	30.00	23.11	14.24	18.97
Oct II	30.00	25.69	30.00	29.20	27.05	30.00	30.00	30.00	10.92	30.00
Oct III	30.00	30.00	30.00	23.89	18.31	27.59	27.59	25.20	13.52	30.00
Nov I	30.00	30.00	30.00	14.31	13.23	30.00	30.00	17.36	20.60	9.34
Nov II	30.00	30.00	29.46	11.24	8.72	16.86	16.86	11.54	19.99	6.47
Nov III	30.00	18.60	30.00	11.01	8.95	9.84	9.84	9.33	14.98	4.21
Dec I	30.00	15.07	15.25	11.60	7.11	6.15	6.15	20.88	6.69	5.34
Dec II	30.00	16.12	9.14	8.74	4.72	7.57	7.57	7.48	4.12	6.38
Dec III	28.53	11.10	9.16	8.41	7.69	5.35	5.35	5.36	5.65	3.68

Power Generation at 35MW

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Jan I	7.04	28.27	7.66	11.96	6.80	4.01	4.18	4.18	4.04	4.43
Jan II	5.86	19.20	9.00	6.81	4.53	2.51	3.33	3.33	2.99	3.00
Jan III	2.77	16.67	7.36	6.18	3.43	1.73	2.07	2.07	1.96	2.26
Feb I	3.25	12.32	6.05	4.54	2.77	1.73	1.34	1.34	1.68	1.75
Feb II	3.71	15.01	6.65	4.26	2.82	2.59	1.31	1.31	3.62	1.11
Feb III	1.98	21.20	6.12	5.29	3.81	1.99	1.12	1.12	2.44	0.96
Mar I	1.41	14.27	14.21	12.41	4.88	1.54	1.54	3.64	2.11	0.91
Mar II	4.36	14.88	15.07	6.02	4.58	0.94	0.94	3.73	6.36	0.67
Mar III	4.94	20.12	16.34	7.84	7.69	2.87	2.87	6.41	7.26	1.62
Apr I	3.28	21.36	7.83	12.68	20.48	6.77	7.10	5.23	6.05	1.44
Apr II	5.73	27.68	26.18	14.94	22.38	7.05	7.05	4.96	8.61	1.50
Apr III	8.93	25.05	12.95	9.74	14.90	8.29	8.29	8.51	6.23	3.30
May I	11.10	9.37	11.38	8.12	22.41	5.85	5.85	11.57	4.30	2.88
May II	18.48	35.00	17.56	14.02	23.82	3.60	3.60	18.03	4.17	4.96
May III	34.23	35.00	35.00	10.85	35.00	6.68	6.68	8.20	17.96	7.24
Jun I	35.00	35.00	35.00	15.03	35.00	5.05	4.96	9.12	22.20	10.11
Jun II	35.00	35.00	18.14	23.04	31.68	8.20	8.20	27.30	35.00	32.66
Jun III	35.00	35.00	22.40	26.32	22.83	10.27	10.27	33.48	35.00	17.37
Jul I	35.00	35.00	17.94	24.23	25.95	16.01	16.01	35.00	35.00	11.13
Jul II	35.00	35.00	16.96	20.66	31.68	13.04	13.04	35.00	35.00	5.22
Jul III	35.00	27.57	9.51	27.74	24.79	4.36	4.36	25.04	23.68	5.38
Aug I	35.00	17.58	8.00	29.93	16.75	6.85	6.85	14.92	7.75	5.27
Aug II	35.00	21.05	7.40	35.00	9.72	22.81	22.81	13.32	4.72	2.54
Aug III	35.00	31.32	7.00	35.00	12.81	35.00	35.00	8.05	6.80	2.50
Sep I	35.00	19.36	8.21	27.51	10.75	33.05	33.05	7.97	6.68	2.50
Sep II	35.00	13.55	10.45	35.00	19.07	35.00	35.00	10.45	6.01	3.62
Sep III	35.00	20.19	35.00	35.00	11.61	35.00	35.00	11.43	7.37	8.78
Oct I	35.00	23.07	35.00	35.00	18.40	35.00	35.00	23.11	14.24	18.97
Oct II	35.00	25.69	31.27	29.20	27.05	35.00	35.00	33.17	10.92	35.00
Oct III	35.00	35.00	35.00	23.89	18.31	27.59	27.59	25.20	13.52	30.79
Nov I	35.00	35.00	35.00	14.31	13.23	35.00	35.00	17.36	20.60	9.34
Nov II	35.00	35.00	29.46	11.24	8.72	16.86	16.86	11.54	19.99	6.47
Nov III	35.00	18.60	35.00	11.01	8.95	9.84	9.84	9.33	14.98	4.21
Dec I	35.00	15.07	15.25	11.60	7.11	6.15	6.15	20.88	6.69	5.34
Dec II	35.00	16.12	9.14	8.74	4.72	7.57	7.57	7.48	4.12	6.38
Dec III	28.53	11.10	9.16	8.41	7.69	5.35	5.35	5.36	5.65	3.68

Energy Generated at 5MW Installed Capacity

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	Total
Jan I	1.20	1.20	1.20	1.20	1.20	0.96	1.00	1.00	0.97	1.06	
Jan II	1.20	1.20	1.20	1.20	1.09	0.60	0.80	0.80	0.72	0.72	
Jan III	0.67	1.20	1.20	1.20	0.82	0.41	0.50	0.50	0.47	0.54	
Feb I	0.78	1.20	1.20	1.09	0.66	0.41	0.32	0.32	0.40	0.42	
Feb II	0.89	1.20	1.20	1.02	0.68	0.62	0.31	0.31	0.87	0.27	
Feb III	0.47	1.20	1.20	1.20	0.91	0.48	0.27	0.27	0.59	0.23	
Mar I	0.34	1.20	1.20	1.20	1.17	0.37	0.37	0.87	0.51	0.22	
Mar II	1.05	1.20	1.20	1.20	1.10	0.23	0.23	0.90	1.20	0.16	
Mar III	1.19	1.20	1.20	1.20	1.20	0.69	0.69	1.20	1.20	0.39	
Apr I	0.79	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	0.35	
Apr II	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.19	1.20	0.36	
Apr III	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	0.79	
May I	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.03	0.69	
May II	1.20	1.20	1.20	1.20	1.20	0.86	0.86	1.20	1.00	1.19	
May III	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	
Jun I	1.20	1.20	1.20	1.20	1.20	1.20	1.19	1.20	1.20	1.20	
Jun II	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	
Jun III	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	
Jul I	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	
Jul II	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	
Jul III	1.20	1.20	1.20	1.20	1.20	1.05	1.05	1.20	1.20	1.20	
Aug I	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	
Aug II	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.13	0.61	
Aug III	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	0.60	
Sep I	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	0.60	
Sep II	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	0.87	
Sep III	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	
Oct I	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	
Oct II	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	
Oct III	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	
Nov I	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	
Nov II	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	
Nov III	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.01	
Dec I	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	
Dec II	1.20	1.20	1.20	1.20	1.13	1.20	1.20	1.20	0.99	1.20	
Dec III	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	0.88	
TOTAL	39.77	43.20	43.20	42.91	41.17	36.69	36.39	38.56	38.68	31.16	391.73

Energy Generated at 10MW Installed Capacity

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	Total
Jan I	1.69	2.40	1.84	2.40	1.63	0.96	1.00	1.00	0.97	1.06	
Jan II	1.41	2.40	2.16	1.63	1.09	0.60	0.80	0.80	0.72	0.72	
Jan III	0.67	2.40	1.77	1.48	0.82	0.41	0.50	0.50	0.47	0.54	
Feb I	0.78	2.40	1.45	1.09	0.66	0.41	0.32	0.32	0.40	0.42	
Feb II	0.89	2.40	1.60	1.02	0.68	0.62	0.31	0.31	0.87	0.27	
Feb III	0.47	2.40	1.47	1.27	0.91	0.48	0.27	0.27	0.59	0.23	
Mar I	0.34	2.40	2.40	2.40	1.17	0.37	0.37	0.87	0.51	0.22	
Mar II	1.05	2.40	2.40	1.44	1.10	0.23	0.23	0.90	1.53	0.16	
Mar III	1.19	2.40	2.40	1.88	1.85	0.69	0.69	1.54	1.74	0.39	
Apr I	0.79	2.40	1.88	2.40	2.40	1.63	1.71	1.26	1.45	0.35	
Apr II	1.38	2.40	2.40	2.40	2.40	1.69	1.69	1.19	2.07	0.36	
Apr III	2.14	2.40	2.40	2.34	2.40	1.99	1.99	2.04	1.50	0.79	
May I	2.40	2.25	2.40	1.95	2.40	1.40	1.40	2.40	1.03	0.69	
May II	2.40	2.40	2.40	2.40	2.40	0.86	0.86	2.40	1.00	1.19	
May III	2.40	2.40	2.40	2.40	2.40	1.60	1.60	1.97	2.40	1.74	
Jun I	2.40	2.40	2.40	2.40	2.40	1.21	1.19	2.19	2.40	2.40	
Jun II	2.40	2.40	2.40	2.40	2.40	1.97	1.97	2.40	2.40	2.40	
Jun III	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	
Jul I	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	
Jul II	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	1.25	
Jul III	2.40	2.40	2.28	2.40	2.40	1.05	1.05	2.40	2.40	1.29	
Aug I	2.40	2.40	1.92	2.40	2.40	1.64	1.64	2.40	1.86	1.26	
Aug II	2.40	2.40	1.78	2.40	2.33	2.40	2.40	2.40	1.13	0.61	
Aug III	2.40	2.40	1.68	2.40	2.40	2.40	2.40	1.93	1.63	0.60	
Sep I	2.40	2.40	1.97	2.40	2.40	2.40	2.40	1.91	1.60	0.60	
Sep II	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	1.44	0.87	
Sep III	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	1.77	2.11	
Oct I	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	
Oct II	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	
Oct III	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	
Nov I	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.40	2.24	
Nov II	2.40	2.40	2.40	2.40	2.09	2.40	2.40	2.40	2.40	1.55	
Nov III	2.40	2.40	2.40	2.40	2.15	2.36	2.36	2.24	2.40	1.01	
Dec I	2.40	2.40	2.40	2.40	1.71	1.47	1.47	2.40	1.60	1.28	
Dec II	2.40	2.40	2.19	2.10	1.13	1.82	1.82	1.79	0.99	1.53	
Dec III	2.40	2.40	2.20	2.02	1.85	1.28	1.28	1.29	1.36	0.88	
TOTAL	70.38	86.25	78.98	78.23	71.58	57.96	57.73	65.12	59.43	43.02	668.67

Energy Generated at 15MW of Installed Capacity

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	
Jan I	1.69	3.60	1.84	2.87	1.63	0.96	1.00	1.00	0.97	1.06	
Jan II	1.41	3.60	2.16	1.63	1.09	0.60	0.80	0.80	0.72	0.72	
Jan III	0.67	3.60	1.77	1.48	0.82	0.41	0.50	0.50	0.47	0.54	
Feb I	0.78	2.96	1.45	1.09	0.66	0.41	0.32	0.32	0.40	0.42	
Feb II	0.89	3.60	1.60	1.02	0.68	0.62	0.31	0.31	0.87	0.27	
Feb III	0.47	3.60	1.47	1.27	0.91	0.48	0.27	0.27	0.59	0.23	
Mar I	0.34	3.42	3.41	2.98	1.17	0.37	0.37	0.87	0.51	0.22	
Mar II	1.05	3.57	3.60	1.44	1.10	0.23	0.23	0.90	1.53	0.16	
Mar III	1.19	3.60	3.60	1.88	1.85	0.69	0.69	1.54	1.74	0.39	
Apr I	0.79	3.60	1.88	3.04	3.60	1.63	1.71	1.26	1.45	0.35	
Apr II	1.38	3.60	3.60	3.58	3.60	1.69	1.69	1.19	2.07	0.36	
Apr III	2.14	3.60	3.11	2.34	3.58	1.99	1.99	2.04	1.50	0.79	
May I	2.67	2.25	2.73	1.95	3.60	1.40	1.40	2.78	1.03	0.69	
May II	3.60	3.60	3.60	3.36	3.60	0.86	0.86	3.60	1.00	1.19	
May III	3.60	3.60	3.60	2.60	3.60	1.60	1.60	1.97	3.60	1.74	
Jun I	3.60	3.60	3.60	3.60	3.60	1.21	1.19	2.19	3.60	2.43	
Jun II	3.60	3.60	3.60	3.60	3.60	1.97	1.97	3.60	3.60	3.60	
Jun III	3.60	3.60	3.60	3.60	3.60	2.46	2.46	3.60	3.60	3.60	
Jul I	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	2.67	
Jul II	3.60	3.60	3.60	3.60	3.60	3.13	3.13	3.60	3.60	1.25	
Jul III	3.60	3.60	2.28	3.60	3.60	1.05	1.05	3.60	3.60	1.29	
Aug I	3.60	3.60	1.92	3.60	3.60	1.64	1.64	3.58	1.86	1.26	
Aug II	3.60	3.60	1.78	3.60	2.33	3.60	3.60	3.20	1.13	0.61	
Aug III	3.60	3.60	1.68	3.60	3.07	3.60	3.60	1.93	1.63	0.60	
Sep I	3.60	3.60	1.97	3.60	2.58	3.60	3.60	1.91	1.60	0.60	
Sep II	3.60	3.25	2.51	3.60	3.60	3.60	3.60	2.51	1.44	0.87	
Sep III	3.60	3.60	3.60	3.60	2.79	3.60	3.60	2.74	1.77	2.11	
Oct I	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.42	3.60	
Oct II	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	2.62	3.60	
Oct III	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.60	3.25	3.60	
Nov I	3.60	3.60	3.60	3.43	3.18	3.60	3.60	3.60	3.60	2.24	
Nov II	3.60	3.60	3.60	2.70	2.09	3.60	3.60	2.77	3.60	1.55	
Nov III	3.60	3.60	3.60	2.64	2.15	2.36	2.36	2.24	3.60	1.01	
Dec I	3.60	3.60	3.60	2.78	1.71	1.47	1.47	3.60	1.60	1.28	
Dec II	3.60	3.60	2.19	2.10	1.13	1.82	1.82	1.79	0.99	1.53	
Dec III	3.60	2.66	2.20	2.02	1.85	1.28	1.28	1.29	1.36	0.88	
Total	98.25	126.12	102.74	102.23	93.97	71.95	71.72	81.49	73.51	49.32	871.29

Energy Generated at 20MW Installed Capacity

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	
Jan I	1.69	4.80	1.84	2.87	1.63	0.96	1.00	1.00	0.97	1.06	
Jan II	1.41	4.61	2.16	1.63	1.09	0.60	0.80	0.80	0.72	0.72	
Jan III	0.67	4.00	1.77	1.48	0.82	0.41	0.50	0.50	0.47	0.54	
Feb I	0.78	2.96	1.45	1.09	0.66	0.41	0.32	0.32	0.40	0.42	
Feb II	0.89	3.60	1.60	1.02	0.68	0.62	0.31	0.31	0.87	0.27	
Feb III	0.47	4.80	1.47	1.27	0.91	0.48	0.27	0.27	0.59	0.23	
Mar I	0.34	3.42	3.41	2.98	1.17	0.37	0.37	0.87	0.51	0.22	
Mar II	1.05	3.57	3.62	1.44	1.10	0.23	0.23	0.90	1.53	0.16	
Mar III	1.19	4.80	3.92	1.88	1.85	0.69	0.69	1.54	1.74	0.39	
Apr I	0.79	4.80	1.88	3.04	4.80	1.63	1.71	1.26	1.45	0.35	
Apr II	1.38	4.80	4.80	3.58	4.80	1.69	1.69	1.19	2.07	0.36	
Apr III	2.14	4.80	3.11	2.34	3.58	1.99	1.99	2.04	1.50	0.79	
May I	2.67	2.25	2.73	1.95	4.80	1.40	1.40	2.78	1.03	0.69	
May II	4.43	4.80	4.21	3.36	4.80	0.86	0.86	4.33	1.00	1.19	
May III	4.80	4.80	4.80	2.60	4.80	1.60	1.60	1.97	4.31	1.74	
Jun I	4.80	4.80	4.80	3.61	4.80	1.21	1.19	2.19	4.80	2.43	
Jun II	4.80	4.80	4.35	4.80	4.80	1.97	1.97	4.80	4.80	4.80	
Jun III	4.80	4.80	4.80	4.80	4.80	2.46	2.46	4.80	4.80	4.17	
Jul I	4.80	4.80	4.31	4.80	4.80	3.84	3.84	4.80	4.80	2.67	
Jul II	4.80	4.80	4.07	4.80	4.80	3.13	3.13	4.80	4.80	1.25	
Jul III	4.80	4.80	2.28	4.80	4.80	1.05	1.05	4.80	4.80	1.29	
Aug I	4.80	4.22	1.92	4.80	4.02	1.64	1.64	3.58	1.86	1.26	
Aug II	4.80	4.80	1.78	4.80	2.33	4.80	4.80	3.20	1.13	0.61	
Aug III	4.80	4.80	1.68	4.80	3.07	4.80	4.80	1.93	1.63	0.60	
Sep I	4.80	4.65	1.97	4.80	2.58	4.80	4.80	1.91	1.60	0.60	
Sep II	4.80	3.25	2.51	4.80	4.58	4.80	4.80	2.51	1.44	0.87	
Sep III	4.80	4.80	4.80	4.80	2.79	4.80	4.80	2.74	1.77	2.11	
Oct I	4.80	4.80	4.80	4.80	4.42	4.80	4.80	4.80	3.42	4.55	
Oct II	4.80	4.80	4.80	4.80	4.80	4.80	4.80	4.80	2.62	4.80	
Oct III	4.80	4.80	4.80	4.80	4.39	4.80	4.80	4.80	3.25	4.80	
Nov I	4.80	4.80	4.80	3.43	3.18	4.80	4.80	4.17	4.80	2.24	
Nov II	4.80	4.80	4.80	2.70	2.09	4.05	4.05	2.77	4.80	1.55	
Nov III	4.80	4.47	4.80	2.64	2.15	2.36	2.36	2.24	3.60	1.01	
Dec I	4.80	3.62	3.66	2.78	1.71	1.47	1.47	4.80	1.60	1.28	
Dec II	4.80	3.87	2.19	2.10	1.13	1.82	1.82	1.79	0.99	1.53	
Dec III	4.80	2.66	2.20	2.02	1.85	1.28	1.28	1.29	1.36	0.88	
Total	125.48	156.74	118.88	119.04	111.37	83.44	83.21	93.59	83.82	54.44	1030.02

Energy Generated at 25MW of Installed Capacity

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	
Jan I	1.69	6.00	1.84	2.87	1.63	0.96	1.00	1.00	0.97	1.06	
Jan II	1.41	4.61	2.16	1.63	1.09	0.60	0.80	0.80	0.72	0.72	
Jan III	0.67	4.00	1.77	1.48	0.82	0.41	0.50	0.50	0.47	0.54	
Feb I	0.78	2.96	1.45	1.09	0.66	0.41	0.32	0.32	0.40	0.42	
Feb II	0.89	3.60	1.60	1.02	0.68	0.62	0.31	0.31	0.87	0.27	
Feb III	0.47	5.09	1.47	1.27	0.91	0.48	0.27	0.27	0.59	0.23	
Mar I	0.34	3.42	3.41	2.98	1.17	0.37	0.37	0.87	0.51	0.22	
Mar II	1.05	3.57	3.62	1.44	1.10	0.23	0.23	0.90	1.53	0.16	
Mar III	1.19	4.83	3.92	1.88	1.85	0.69	0.69	1.54	1.74	0.39	
Apr I	0.79	5.13	1.88	3.04	4.92	1.63	1.71	1.26	1.45	0.35	
Apr II	1.38	6.00	6.00	3.58	5.37	1.69	1.69	1.19	2.07	0.36	
Apr III	2.14	6.00	3.11	2.34	3.58	1.99	1.99	2.04	1.50	0.79	
May I	2.67	2.25	2.73	1.95	5.38	1.40	1.40	2.78	1.03	0.69	
May II	4.43	6.00	4.21	3.36	5.72	0.86	0.86	4.33	1.00	1.19	
May III	6.00	6.00	6.00	2.60	6.00	1.60	1.60	1.97	4.31	1.74	
Jun I	6.00	6.00	6.00	3.61	6.00	1.21	1.19	2.19	5.33	2.43	
Jun II	6.00	6.00	4.35	5.53	6.00	1.97	1.97	6.00	6.00	6.00	
Jun III	6.00	6.00	5.38	6.00	5.48	2.46	2.46	6.00	6.00	4.17	
Jul I	6.00	6.00	4.31	5.81	6.00	3.84	3.84	6.00	6.00	2.67	
Jul II	6.00	6.00	4.07	4.96	6.00	3.13	3.13	6.00	6.00	1.25	
Jul III	6.00	6.00	2.28	6.00	5.95	1.05	1.05	6.00	5.68	1.29	
Aug I	6.00	4.22	1.92	6.00	4.02	1.64	1.64	3.58	1.86	1.26	
Aug II	6.00	5.05	1.78	6.00	2.33	5.47	5.47	3.20	1.13	0.61	
Aug III	6.00	6.00	1.68	6.00	3.07	6.00	6.00	1.93	1.63	0.60	
Sep I	6.00	4.65	1.97	6.00	2.58	6.00	6.00	1.91	1.60	0.60	
Sep II	6.00	3.25	2.51	6.00	4.58	6.00	6.00	2.51	1.44	0.87	
Sep III	6.00	4.84	6.00	6.00	2.79	6.00	6.00	2.74	1.77	2.11	
Oct I	6.00	5.54	6.00	6.00	4.42	6.00	6.00	5.55	3.42	4.55	
Oct II	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	2.62	6.00	
Oct III	6.00	6.00	6.00	5.73	4.39	6.00	6.00	6.00	3.25	6.00	
Nov I	6.00	6.00	6.00	3.43	3.18	6.00	6.00	4.17	4.94	2.24	
Nov II	6.00	6.00	6.00	2.70	2.09	4.05	4.05	2.77	4.80	1.55	
Nov III	6.00	4.47	6.00	2.64	2.15	2.36	2.36	2.24	3.60	1.01	
Dec I	6.00	3.62	3.66	2.78	1.71	1.47	1.47	5.01	1.60	1.28	
Dec II	6.00	3.87	2.19	2.10	1.13	1.82	1.82	1.79	0.99	1.53	
Dec III	6.00	2.66	2.20	2.02	1.85	1.28	1.28	1.29	1.36	0.88	
Total	151.88	177.62	131.46	133.87	122.59	93.72	93.49	102.95	90.17	58.04	1155.78

Energy Generated at 30MW of Installed Capacity

	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	
Jan I	1.69	6.79	1.84	2.87	1.63	0.96	1.00	1.00	0.97	1.06	
Jan II	1.41	4.61	2.16	1.63	1.09	0.60	0.80	0.80	0.72	0.72	
Jan III	0.67	4.00	1.77	1.48	0.82	0.41	0.50	0.50	0.47	0.54	
Feb I	0.78	2.96	1.45	1.09	0.66	0.41	0.32	0.32	0.40	0.42	
Feb II	0.89	3.60	1.60	1.02	0.68	0.62	0.31	0.31	0.87	0.27	
Feb III	0.47	5.09	1.47	1.27	0.91	0.48	0.27	0.27	0.59	0.23	
Mar I	0.34	3.42	3.41	2.98	1.17	0.37	0.37	0.87	0.51	0.22	
Mar II	1.05	3.57	3.62	1.44	1.10	0.23	0.23	0.90	1.53	0.16	
Mar III	1.19	4.83	3.92	1.88	1.85	0.69	0.69	1.54	1.74	0.39	
Apr I	0.79	5.13	1.88	3.04	4.92	1.63	1.71	1.26	1.45	0.35	
Apr II	1.38	6.64	6.28	3.58	5.37	1.69	1.69	1.19	2.07	0.36	
Apr III	2.14	6.01	3.11	2.34	3.58	1.99	1.99	2.04	1.50	0.79	
May I	2.67	2.25	2.73	1.95	5.38	1.40	1.40	2.78	1.03	0.69	
May II	4.43	7.20	4.21	3.36	5.72	0.86	0.86	4.33	1.00	1.19	
May III	7.20	7.20	7.20	2.60	7.20	1.60	1.60	1.97	4.31	1.74	
Jun I	7.20	7.20	7.20	3.61	7.20	1.21	1.19	2.19	5.33	2.43	
Jun II	7.20	7.20	4.35	5.53	7.20	1.97	1.97	6.55	7.20	7.20	
Jun III	7.20	7.20	5.38	6.32	5.48	2.46	2.46	7.20	7.20	4.17	
Jul I	7.20	7.20	4.31	5.81	6.23	3.84	3.84	7.20	7.20	2.67	
Jul II	7.20	7.20	4.07	4.96	7.20	3.13	3.13	7.20	7.20	1.25	
Jul III	7.20	6.62	2.28	6.66	5.95	1.05	1.05	6.01	5.68	1.29	
Aug I	7.20	4.22	1.92	7.18	4.02	1.64	1.64	3.58	1.86	1.26	
Aug II	7.20	5.05	1.78	7.20	2.33	5.47	5.47	3.20	1.13	0.61	
Aug III	7.20	7.20	1.68	7.20	3.07	7.20	7.20	1.93	1.63	0.60	
Sep I	7.20	4.65	1.97	6.60	2.58	7.20	7.20	1.91	1.60	0.60	
Sep II	7.20	3.25	2.51	7.20	4.58	7.20	7.20	2.51	1.44	0.87	
Sep III	7.20	4.84	7.20	7.20	2.79	7.20	7.20	2.74	1.77	2.11	
Oct I	7.20	5.54	7.20	7.20	4.42	7.20	7.20	5.55	3.42	4.55	
Oct II	7.20	6.17	7.20	7.01	6.49	7.20	7.20	7.20	2.62	7.20	
Oct III	7.20	7.20	7.20	5.73	4.39	6.62	6.62	6.05	3.25	7.20	
Nov I	7.20	7.20	7.20	3.43	3.18	7.20	7.20	4.17	4.94	2.24	
Nov II	7.20	7.20	7.07	2.70	2.09	4.05	4.05	2.77	4.80	1.55	
Nov III	7.20	4.47	7.20	2.64	2.15	2.36	2.36	2.24	3.60	1.01	
Dec I	7.20	3.62	3.66	2.78	1.71	1.47	1.47	5.01	1.60	1.28	
Dec II	7.20	3.87	2.19	2.10	1.13	1.82	1.82	1.79	0.99	1.53	
Dec III	6.85	2.66	2.20	2.02	1.85	1.28	1.28	1.29	1.36	0.88	
Total	177.93	193.04	142.41	143.64	128.11	102.74	102.51	108.36	94.97	61.64	1255.34

Install Cap (MW)		5	10	15	20	25	30	35	40	45	50	55	60	Unrestricted
1968		39.77	70.38	98.25	125.48	151.88	177.93	202.94	226.94	249.88	270.28	290.32	308.98	549.63
1969		43.20	86.25	126.12	156.74	177.62	193.04	205.36	217.36	228.78	239.58	248.98	254.63	270.98
1970		43.20	78.98	102.74	118.88	131.46	142.41	151.12	158.39	164.87	168.21	170.11	171.18	171.18
1971		42.91	78.23	102.23	119.04	133.87	143.64	149.64	153.86	156.99	158.19	159.13	159.13	159.13
1972		41.17	71.58	93.97	111.37	122.59	128.11	131.31	133.71	136.11	138.51	140.91	143.31	148.52
1973	Energy	36.69	57.96	71.95	83.44	93.72	102.74	110.67	114.55	115.75	115.88	115.88	115.88	115.88
1974		36.39	57.73	71.72	83.21	93.49	102.51	110.44	114.32	115.52	115.65	115.65	115.65	115.65
1975		38.56	65.12	81.49	93.59	102.95	108.36	112.35	114.75	117.15	118.97	120.17	121.37	121.97
1976		38.68	59.43	73.51	83.82	90.17	94.97	99.77	104.21	106.61	107.84	109.04	110.24	112.94
1977		31.16	43.02	49.32	54.44	58.04	61.64	63.67	64.87	66.07	67.27	68.47	69.22	69.22
Total		391.73	668.67	871.29	1030.02	1155.78	1255.34	1337.27	1402.96	1457.73	1500.38	1538.66	1569.59	1835.10
Extra Energy with 5MW increase			276.94	202.62	158.73	125.76	99.56	81.93	65.69	54.77	42.66	38.27	30.93	
Percentage increase in energy			70.70	30.30	18.22	12.21	8.61	6.53	4.91	3.90	2.93	2.55	2.01	

APPENDIX K

RATIO OF FLOW AT DABOASE TO ASSIN PRASO

monthly (Assin)	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Jan	12.2	15.8	13.6	11.7	52.8	24.0	18.0	10.8	7.2	5.7	5.7	8.7	6.1	3.6
Feb	29.5	11.6	9.5	9.3	60.4	42.4	28.4	15.9	5.4	4.3	10.2	13.1	3.0	9.6
Mar	35.3	17.4	17.8	16.7	82.9	60.4	42.5	60.6	20.0	20.4	19.9	26.3	5.5	32.9
Apr	93.0	32.1	75.5	46.2	92.3	50.2	38.2	73.3	21.3	21.3	45.7	17.6	13.4	62.4
May	118.9	112.0	138.3	173.0	282.9	131.1	58.6	207.8	23.9	23.8	53.5	102.2	59.9	208.5
Jun	424.1	242.5	241.1	451.2	195.9	68.7	85.4	96.5	47.1	47.1	172.1	179.5	40.4	69.6
Jul	239.6	204.4	39.4	394.9	79.3	29.9	112.2	61.5	40.8	40.8	63.9	43.3	15.8	19.5
Aug	199.1	125.6	42.6	548.0	77.0	30.8	128.8	51.1	140.9	140.9	31.7	23.4	10.3	19.4
Sep	314.3	202.3	99.5	612.6	82.7	145.0	153.3	68.4	132.7	132.7	81.2	39.0	102.9	59.7
Oct	167.4	145.9	70.7	245.7	217.4	170.0	59.3	48.3	97.1	97.1	64.9	64.9	55.9	63.9
Nov	84.1	72.4	37.6	186.3	59.7	71.5	37.6	24.9	28.2	28.2	45.2	30.9	19.1	21.7
Dec	87.9	67.2	49.0	165.7	76.3	52.1	48.2	44.7	33.7	33.7	35.0	33.7	21.0	32.4
Ave Annual	150.45	104.10	69.54	238.43	113.30	73.01	67.54	63.64	49.86	49.66	52.40	48.55	29.45	50.28

monthly (Daboase)	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Jan	50	70	73	43	157	86	62	36	41.7	26.7	43.4	30.5	29	12
Feb	67	42	49	27	113	58	44	20	17.6	9.3	68.1	28	13	5
Mar	99	53	59	51	136	154	69	30	17.7	37.2	52.6	52.5	11.5	24
Apr	128	129	101	83	178	158	49	184	66.4	85.4	92.5	85.5	18	19
May	151	143	169	144	295	229	45	216	56.2	218.4	159.4	156	42	216
Jun	435	352	308	520	542	235	230	48	162.1	294	249.3	415	277	525
Jul	849	678	291	1124	461	151	235	289	138.4	331.5	519.9	193	64	107
Aug	331	407	95	1388	249	82	233	195	176.9	250.1	140.2	86.5	22	59
Sep	448	298	178	1401	185	179	204	127	345.7	417.5	89.5	58	45.5	124
Oct	615	459	213	937	301	371	286	199	279.8	337.1	226	127	282	209
Nov	272	337	129	425	457	311	131	136	188.5	229.2	134.3	212	80.5	151
Dec	126	148	70	255	129	101	110	72	64.4	80.2	100	63	58	57.5
Avg Annual	297.58	259.67	144.6	533.17	266.92	176.3	141.5	129.3	129.6	193.1	156.3	125.6	78.54	125.71

Daboase/ Assin	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978
Jan	4.08	4.43	5.38	3.69	2.98	3.58	3.45	3.33	5.76	4.72	7.68	3.50	4.73	3.31
Feb	2.27	3.63	5.17	2.91	1.87	1.37	1.55	1.26	3.28	2.15	6.69	2.14	4.27	0.52
Mar	2.80	3.04	3.31	3.05	1.64	2.55	1.62	0.50	0.88	1.82	2.64	2.00	2.10	0.73
Apr	1.38	4.02	1.34	1.80	1.93	3.15	1.28	2.51	3.12	4.02	2.02	4.85	1.35	0.30
May	1.27	1.28	1.22	0.83	1.04	1.75	0.77	1.04	2.35	9.18	2.98	1.53	0.70	1.04
Jun	1.03	1.45	1.28	1.15	2.77	3.42	2.69	0.50	3.44	6.24	1.45	2.31	6.85	7.54
Jul	3.54	3.32	7.39	2.85	5.81	5.06	2.10	4.70	3.39	8.13	8.14	4.45	4.05	5.49
Aug	1.66	3.24	2.23	2.53	3.23	2.67	1.81	3.82	1.26	1.77	4.42	3.70	2.13	3.04
Sep	1.43	1.47	1.79	2.29	2.24	1.23	1.33	1.86	2.61	3.15	1.10	1.49	0.44	2.08
Oct	3.67	3.15	3.01	3.81	1.38	2.18	4.83	4.12	2.88	3.47	3.48	1.96	5.05	3.27
Nov	3.23	4.66	3.43	2.28	7.66	4.35	3.49	5.46	6.68	8.12	2.97	6.86	4.22	6.95
Dec	1.43	2.20	1.43	1.54	1.69	1.94	2.28	1.61	1.91	2.38	2.86	1.87	2.76	1.77
Avg Annual	1.98	2.49	2.08	2.24	2.36	2.41	2.10	2.03	2.60	3.89	2.98	2.59	2.67	2.50