

## Assignment 4

## Reservoir sizing and hydro power

This is the first of two assignments dealing with the reservoir problems. Consider the reservoir to be used for hydropower production and municipal water supply. Total reservoir storage includes:

- (i) Active reservoir storage required to satisfy the demand for water and,
- (ii) Dead storage required for sediment deposition.

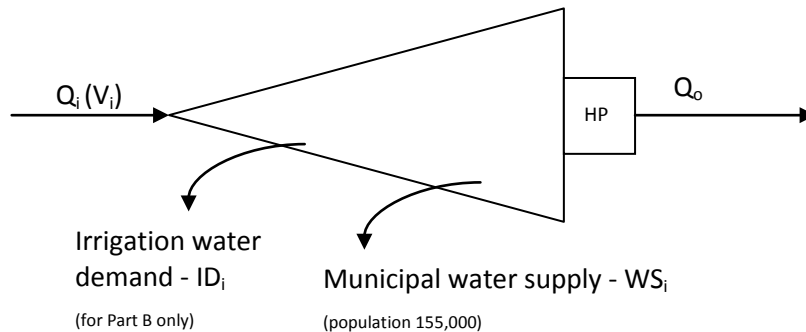


Figure 1. Schematic presentation of the multipurpose reservoir

A suspended sediment concentration in the river is 1500 mg/L and sediment has bulk density of 1600 kg/m<sup>3</sup>. The dead reservoir storage should be planned to accommodate all the sediment that will be deposited during the reservoir life of 100 years. The percent of sediment trapped in the reservoir is estimated to be 78%. The reservoir surface area is 6,000 ha.

Table 1. Reservoir inflow during the critical year:

Month	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX
$V_i (10^6 m^3)$	1	10	4	2	9	32	38	21	11	5	2	1

Table 2. Municipal water supply demand

Month	IV	V	VI	VII	VIII	IX
Consumption (L/day/capita)	320	290	330	340	320	300

Table 3. Hydropower plant operation

Month	X	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX
$Q_0$ (m <sup>3</sup> /sec)	1	1	1	4	4	4	9	9	9	9	5	1

During the period September – December there is no power generation and only minimum flow of  $Q_0 = 1 \text{ m}^3/\text{sec}$  will be released from the reservoir.

Table 4. Reservoir storage curve

H (masl)	300	301	302	303	304	305	306	308	310
S (10 <sup>6</sup> m <sup>3</sup> )	0	10	14	18.5	24	31	38	55	75

**PART A (in class):**

1. Find the reservoir dead storage and the elevation of the dead storage pool.
2. Find the reservoir active storage necessary to satisfy the water demand from the reservoir. (use tabular calculation)
3. Present graphically the monthly reservoir water levels if the reservoir is full at the beginning of the operation.
4. Find the energy power,  $P$ , on August 1<sup>st</sup> if the installed turbine discharge is  $10 \text{ m}^3/\text{sec}$ , the tailwater elevation is 160 masl and  $\eta = 0.8$ .

**PART B (at home):**

Table 5. Irrigation water demand

Month	IV	V	VI	VII	VIII	IX
$ID_i$ (10 <sup>6</sup> m <sup>3</sup> )	2	3	5	6	4	2

5. Find the reservoir active storage if the irrigation demand is added to those demands from Part A. Use the (i) tabular calculation and (ii) graphical method.
6. Find the average monthly power and total monthly energy if the tailwater elevation is 140 masl and  $\eta = 0.8$ .

**Due Thursday, February 9, 2012**