CVG3120 ASSIGNMENT 1

Due date: Friday, September 30, 2016

Problem 1

The average monthly precipitation in a watershed of 4500 km^2 is 46 cm. If cumulative losses are 20% of precipitation, determine the area that can be irrigated (irrigation requires 0.37 m^3/s for each 1000ha of agricultural land) with the remaining water.

Problem 2

A city has a reservoir with vertical sides and a surface area of 49776.33m^2. Following the rainy season, the reservoir is filled to a depth of 4.0 m. During the dry season, the reservoir loses 8cm of water per week to evaporation. At the same time, the city pumps water from the reservoir at a rate of 45.5 liters/s. What volume of water will remain in storage after 3 weeks into the dry season?

Problem 3

It is desired to fill a reservoir by means a pipe bringing water from a Lake upstream of the reservoir. The capacity curve of Figure 1.9 gives the volume of storage to be filled between elevations of 50ft and 70ft. The tail water rating curve of Figure 1.10 gives flow through the pipe for various reservoir elevations.

- Estimate the surface of the reservoir for each elevation between 50ft and 70ft (tip: remember $\Delta S = A(h)\Delta h$; apply this to get A(h) for each elevation h using $\Delta h = 2ft$)
- Assuming the reservoir level is 50ft at t=0, calculate the time required to get the level to 52ft (tip: apply the water balance equation as usual, apart from the fact the unknown is now Δt instead of Δh)
- Derive and plot a schedule (elevation vs. time) for filling this reservoir by 2-ft increments. You may use excel to speed your calculations.

Note: in the application of the water balance equation seen in class, the time step was constant and known, and the unknown was variation of elevation; in this problem, the variation in elevation is constant and known, and the time step is variable and unknown.

Problem 4

Consider two reservoirs, A and B, connected in series. Reservoir A is upstream of reservoir B. The area of A is half of B. Reservoirs A and B are subject to rainfall of 50 cm and evaporation of 30cm on an annual basis. Reservoir A supplies 100 m3/s of flow to reservoir B.

- Calculate the area of reservoir A (water balance equation, long term)
- Calculate the area and volume of reservoir B (assume it can store one year of net inflows from all sources)
- A small town of 50,000 is located near reservoir B. The per capita water consumption is 150 gallons per day. The town is contemplating using reservoir B as water supply reservoir. For how long can reservoir B supply water to the town?

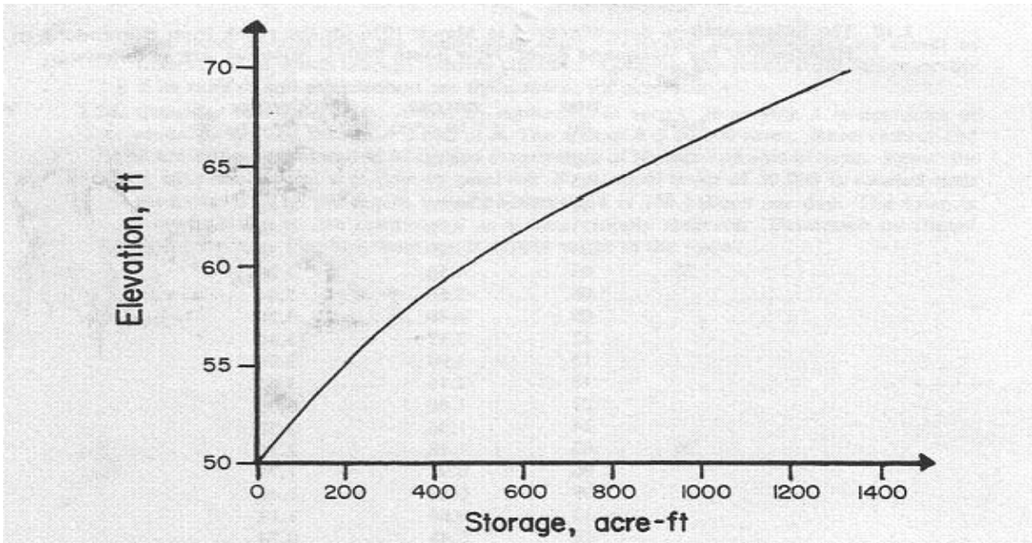

Figure 1.9 Cooper River rediversion: area-capacity curve for area between 50-ft NGVD plug and the powerhouse.

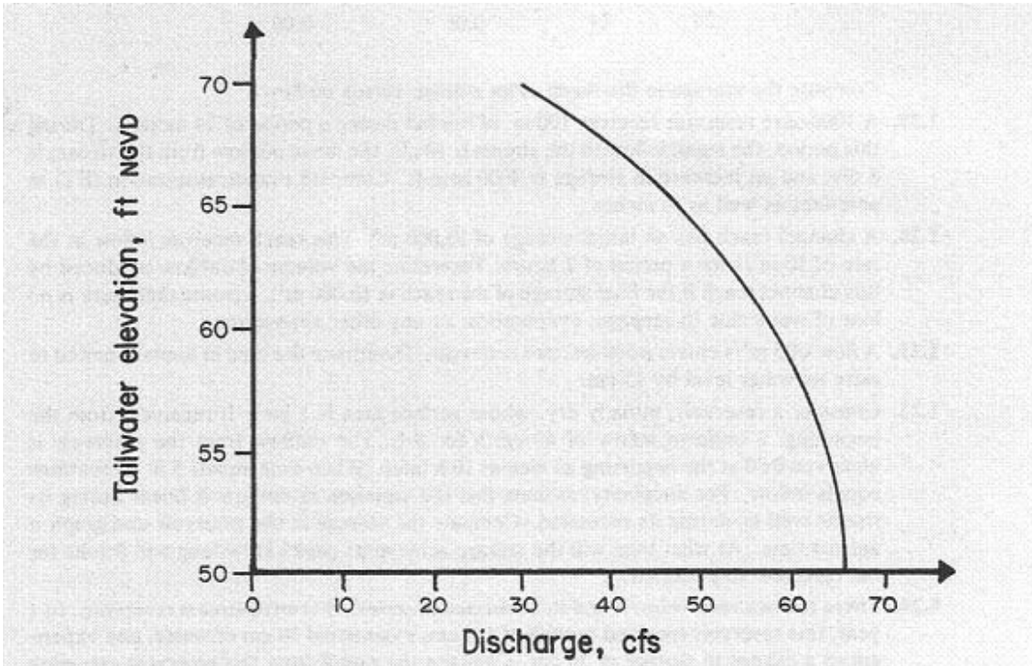

Figure 1.10 Cooper River rediversion: tailwater rating curve for area between 50-ft NGVD plug and the powerhouse.