G476/576 Hydrology
Introduction to Applied Problems in Hydrology

Determine the following, show all of your math work and unit algebra.

1. A city has a reservoir with vertical sides and a surface area of 12.3 acres. Following the rainy season, the reservoir is filled to a depth of 3.0 m. During the dry season, the reservoir loses 3.5 in of water per week (wk) to evaporation. At the same time, the city pumps water from the reservoir at a rate of 100 gal/day. What volume of water will remain in storage after 3 weeks into the dry season? (answer in cubic meters, and gallons)

2. How long must a pump with a capacity of 25 gal/min pump to fill a tank with a capacity of 60 cubic meters?

3. A small urban watershed has an area of 20.5 square miles. A summer storm drops an average of 2.5 in of rain over the entire watershed. If 65% of the rainfall runs off the watershed into surface-water bodies, what is the volume of runoff (show all of your work and unit algebra):

A. In cubic inches?

B. In cubic feet?

C. In cubic meters?

RUNOFF

Determine the average annual runoff (m^3) from all streams flowing into Mono Lake.

4. Three large streams flow into Mono Lake, all from the Sierra Nevada (Fig. 1.2). These streams are gaged by the Los Angeles Department of Water and Power (DWP), and have the following average annual runoff:

Lee Vining Creek	- 87.3 cfs (cubic feet per second)
Rush Creek	- 44.8 cfs
Mill Creek	- 37.0 cfs

What is the combined average annual runoff of these three streams, in m^3?

5. The Los Angeles DWP has been diverting water from Lee Vining, Rush, and Mill Creeks (below the gaging stations) for many years, running the diverted water through the Owens Valley aqueduct to Los Angeles. These diversions average 105,305 acre-ft per year.

Taking into account these diversions, what is the average annual flow into Mono Lake from these three streams, in m^3?

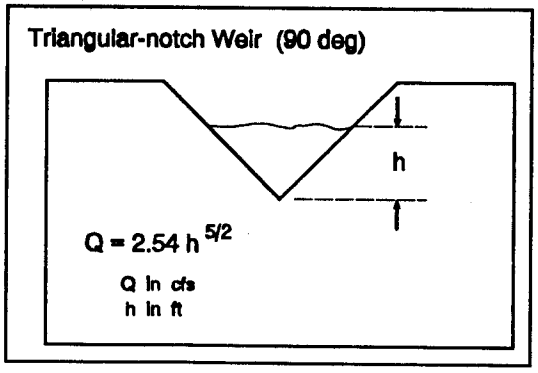
6. Two small streams, not gaged, were measured with simple weirs to determine their runoff.

The smallest stream, Andy Thompson Creek, was measured with a 90° triangular-notch weir. This type of weir is most useful for discharges of less than 1 cfs. The formula for a weir with this geometry is:

$$Q = 2.54\ h^{5/2}$$

where Q is in cfs and h is in ft.

The measurement, taken after flow had stabilized, showed the water surface 6.9 inches above the notch. Determine runoff (m^3/yr).

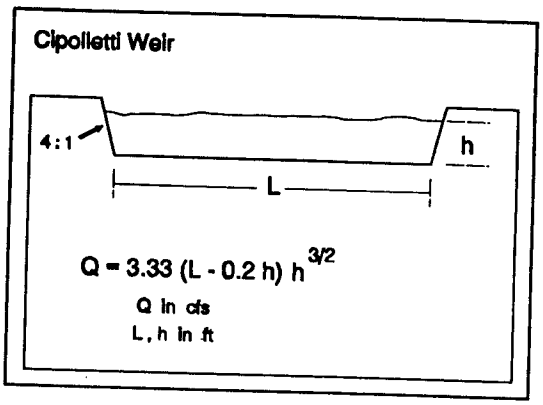


7. The larger stream required a larger weir, so a 3-foot Cipolletti weir was used. These are useful for flows of a few cfs. The Cipolletti formula is:

$$Q = 3.33 (L - 0.2h) h^{3/2}$$

where Q is in cfs, and L and h are in ft.

The flow stabilized at a height of 3.5 inches. Calculate discharge (m^3/yr).



8. Numerous springs discharge along the shoreline of Mono Lake. All significant springs were monitored by weirs, and their average total flow is 5530 gpm (gallons per minute), which should be considered as surface flow, or runoff.

Convert spring runoff to m^3/yr.

9. Summarize the average annual runoff into Mono Lake.

STORAGE

10. Mono Lake is more-or-less elliptical in map view, but morphometric studies of the lake have determined that its volume can be approximated well by the volume of a cone, as though the lake were circular with a uniformly sloping bottom. Thus, any change in storage can be calculated simply by determining the volume of the frustrum of a cone, as shown in the diagram.

From the data recorded by the Los Angeles DWP, Mono Lake stood at 6406.9 ft in June 1954, and it had fallen to 6391.2 ft by June 1964. Surface area of the lake in June 1954 was 89.4 mi^2, while the area in June 1964 was 77.0 mi^2.