For $Q_{10}$

$$Q = C_i A$$

$$t_c = 1.8 (1.1 - 0.81) (1600)^{0.5} / (2)^{0.333} = 16.6 \text{ min}$$

$$i = 2.8 \text{ in/hr} \quad \text{from IDF curve}$$

$$Q_{10} = 0.86 (2.8)(32.1) = 77.3 \text{ cfs}$$

For $Q_{100}$

$$t_c = 1.8 (1.1 - 0.95) (1600)^{0.5} / (2)^{0.333} = 8.6 \text{ min}$$

$$i = 6.6 \text{ in/hr} \quad \text{from IDF curve}$$

$$Q_{100} = 0.95 (6.6)(32.1) = 201.3 \text{ cfs}$$
TIME-INTENSITY-FREQUENCY CURVES
FOR McCARRAN AIRPORT RAINFALL AREA
6.1.1. $\Delta L = 150$ m, $h_1 = 55$ m, $h_2 = 48.5$ m, $t = 32$ hrs, $\alpha = 24\% = 0.24$, $T = 15$ °C.

Using Darcy’s law,

$$Q = KA \frac{dh}{dL} = KA \frac{\Delta h}{\Delta L} = KA \frac{h_1 - h_2}{\Delta L}$$

$$\frac{Q}{A} = q = K \frac{55 - 48.5}{150} = 0.0433K$$

Velocity of flow, $V = \frac{\Delta L}{t} = \frac{150}{32} = 4.6875$ m/hr = $1.30 \times 10^{-3}$ m/s.

Using the continuity equation,

$$Q = Aq = A_{pore}V$$

where $A_{pore}$ is the area of cross-section of the pore spaces

$$q = \frac{A_{pore}}{A}. V = \alpha V = 0.24(4.6875) = 1.125 \text{ m/hr}$$

Hence, $0.0433K = 1.125$

$K = 25.96$ m/hr = $7.21 \times 10^{-3}$ m/s = $7.21$ mm/s.

Table 6.1.1 shows that the aquifer is most probably clean sand and less likely gravel or silty sand. The solution is verified by checking the Reynolds number for this problem.

6.4.5. $r_w = 25$ cm = $0.25$ m, $b = 12$ m, $Q = 0.035$ m$^3$/s.

$$Q = \frac{2\pi Kb(h_2 - h_1)}{\ln \left( \frac{r_2}{r_1} \right)}$$

Considering the first observation well and the pumped well,

$$K_{1-w} = \frac{2\pi rb(h_1 - h_w)}{2\pi(12)(102 - 85)} = \frac{0.035 \ln \left( \frac{250}{0.25} \right)}{2\pi(12)(102 - 85)} = 1.89 \times 10^{-4} \text{ m/s}$$

Considering the second observation well and the pumped well,

$$K_{2-w} = \frac{2\pi rb(h_2 - h_w)}{2\pi(12)(98 - 85)} = \frac{0.035 \ln \left( \frac{360}{0.25} \right)}{2\pi(12)(98 - 85)} = 2.60 \times 10^{-4} \text{ m/s}.$$
Additional Problem #2
\( h_z = h_1 + \frac{Q}{\pi K} \ln \left( \frac{r_2}{r_1} \right) \)

\( h_z = h = 45 \text{ m} \)

\( h_1 = h_w = h - s_w = 45 - s_w \)

\( r_2 = R = 1 \text{ km} = 1000 \text{ m} \)

\( r_1 = r_w = 1 \text{ m} \)

\( 45^2 = h_1^2 + \frac{0.333 \text{ m}^3/\text{s}}{\pi (40^0/\text{hr})(24\text{ hr})(3600 \text{ s})} \ln \left( \frac{1000}{0.15} \right) \)

\( 2025 = h_1^2 + 1790.26 \)

\( h_1 = 16.87 \text{ m} = h_w \)

* Time for contaminant to travel from perimeter of island to well (use seepage velocity at midpt.) \( R = 500 \text{ m} \)
\[ A + r = 500 \text{ m} \quad r_i = r_w = 0.5 \text{ m} \quad h_1 = 16.87 \text{ m} \quad h_2 = ? \]

\[ h_2^2 = h_1^2 + \frac{Q}{\pi K} \ln \left( \frac{r_2}{r_1} \right) \]

\[ h_2^2 = 16.87^2 + \frac{0.333 \text{ m}^3/\text{s}}{\pi (40 \text{ m}/\text{d}) (\frac{1}{24} \text{ d}) (\frac{1}{3600})} \ln \left( \frac{500}{0.5} \right) \]

\[ h_2 = 1866.15 \text{ m} \]

\[ h_2 = 43.2 \text{ m} \]

\[ Q = \frac{A}{A} = \frac{0.333 \text{ m}^3/\text{s}}{2\pi r_1 h} = \frac{0.333 \text{ m}^3/\text{s}}{2\pi (500 \text{ m})(43.2)} \]

\[ 2.45 \times 10^{-6} \text{ m}/\text{s} \quad (0.212 \text{ m}/\text{day}) \]

\[ V_0 = \frac{Q}{h} = \frac{0.212 \text{ m}/\text{day}}{0.20} = 1.06 \text{ m}/\text{day} \]

\[ t = \frac{L}{V} = \frac{1000 \text{ m}}{1.06 \text{ m}/\text{day}} = 943 \text{ days (2.6 yrs)} \]