

SHEET (1)

لماذا يتم دراسة السكان عند تصميم اعمال المياه

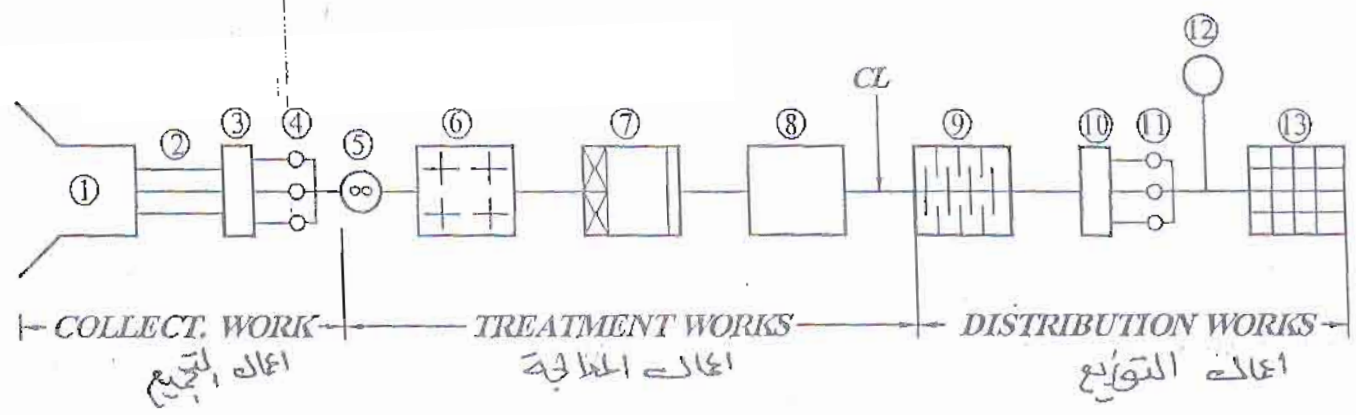
Q1- Why are the studies of population for the proper design of Water-Supply works ?

تتم دراسة السكان لانها مهمة من معرفة كمية المياه التصميمية المراد جلبها وكذلك معرفة من اعطاء المياه

The studies of population are very important for design of water supply to determine the quantity of water to treatment and for stages of design as water treatment plant design for (40 - 50) years :-

- civil works built (40 - 50) years.
- electrical & mechanical works maked (20 - 25) years.

Q2- Draw the flow diagram in surface water purification plant and point out the purpose of each sstep of treatment ?



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|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1- Intake انأخذ</p> <p>2- Conduit pipe في حواسير</p> <p>3- Sump of high lift pump بئارة مياه جبر</p> <p>4- Low lift pump طلمبات الصخ المنخفض</p> | <p>5- Rapid mixing tank خزانه لتقليب السريع</p> <p>6- Flocculator tank خزانه التقليل البهتة</p> <p>7- Sedimentation tank خزانه الترسيب</p> <p>8- Filters المرشحات</p> | <p>9- Ground tank خزانه ارض</p> <p>10- Sump of high lift pump بئارة الضغط العالي</p> <p>11- High lift pump طلمبات الصخ العالي</p> <p>12- Elevated tank الخزانه اعلى</p> <p>13- Network شبكة حواسير المياه</p> |
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العوامل المؤثرة على معدل استهلاك الفرد من المياه

Q3- What are the factors affecting the rate of water consumption ?

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|------------------------------------------|------------------------------------------|
| 1- Climate. المناخ | 4- Method of controlling. نظا، الخاسية |
| 2- City life. حياة، حضارة | 5- Quality of water: جودة المياه |
| 3- Precence of industries. لاسية الصناعة | 6- Economic condition. الظروف الاقتصادية |

Q4- Estimate the population for city (X) in the yaer (2030) using the annual growth rate method :-

year	P	$\frac{P_n}{P_0}$	Δt	r
1960	9000	1.44	10	0.037
1970	13000	1.38	10	0.033
1980	18000	1.22	10	0.02
1990	22000	1.273	5.0	0.049
1995	28000			
← Data →				0.139

$$(r)_{av.} = \frac{0.139}{4} = 0.035$$

$$P_{2030} = P_{1995} (1 + r)^n$$

$$P_{2030} = 28000 (1 + 0.035)^{35} = 93300 c$$

Q5. Estimate the population for city (A) in the year (2025, 2050) using the following method :-

a- Arithmetic method:-

year	P	ΔP	Δt	K_n
1949	66000			
1959	73000	7000	10	700
1969	85000	12000	10	1200
1979	95000	10000	10	1000
1989	105000	10000	10	1000
1999	118000	13000	10	1300
← Data →				5200

$$(K_n)_{av.} = \frac{5200}{5} = 1040 \text{ c/year}$$

$$P_{2025} = P_{1999} + K_n \Delta t$$

$$P_{2025} = 118000 + 1040 * 26 = 145000 \text{ c}$$

$$P_{2050} = 118000 + 1040 * 51 = 171000 \text{ c}$$

② Geometric method:-

year	P	$\ln P$	$\Delta \ln P$	Δt	K_g
1949	66000	11.097			
1959	73000	11.198	0.101	10	0.0101
1969	85000	11.350	0.152	10	0.0152
1979	95000	11.462	0.112	10	0.0112
1989	105000	11.562	0.100	10	0.0100
1999	118000	11.678	0.116	10	0.0116
← Data →					0.0581

$$(K_g)_{av.} = \frac{0.0581}{5} = 0.01162$$

$$\ln P_{2025} = \ln (118000) + 0.01162 * 26 = 11.98$$

$$P_{2025} = 159600 \text{ c}$$

$$\ln P_{2050} = \ln (118000) + 0.01162 * 51 = 12.27$$

$$P_{2050} = 213400 \text{ c}$$

3- Annual growth rate method:-

year	P	$\frac{P_n}{P_0}$	Δt	r
1949	66000			
		1.106	10	0.010
1959	73000			
		1.164	10	0.015
1969	85000			
		1.118	10	0.011
1979	95000			
		1.105	10	0.010
1989	105000			
		1.124	10	0.012
1999	118000			
← Data →				0.058

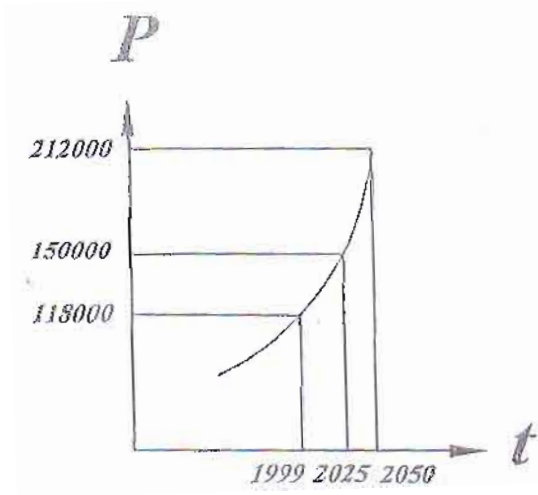
$$(r)_{av.} = \frac{0.058}{5} = 0.0116$$

$$P_{2025} = P_{1999} \left(1 + \frac{m}{100}\right)^n$$

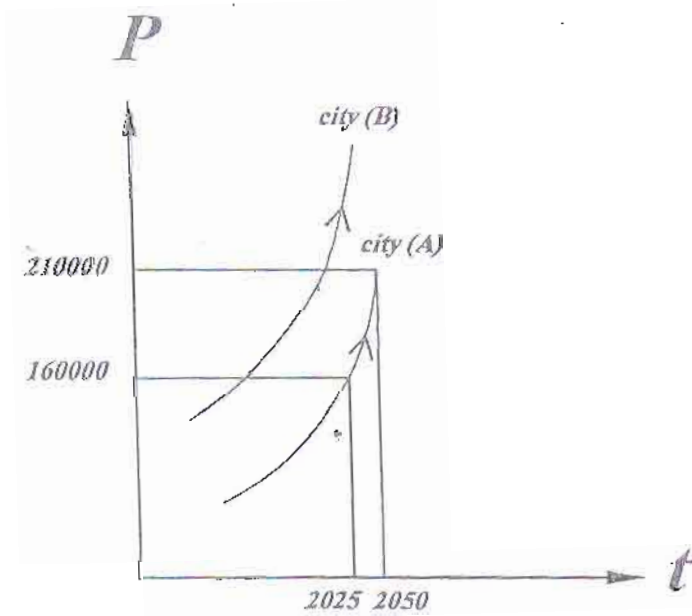
$$P_{2025} = 118000 (1 + 0.0116)^{26} = 159300 \text{ c}$$

$$P_{2050} = 118000 (1 + 0.0116)^{51} = 212500 \text{ c}$$

4- Graphical extention method :-



5- Graphical comparstion method :-



- Q6) A community has an estimation population of about 40000 capita after 20 years. the present population is 28000 and present design capacity is $10000 \text{ m}^3/\text{day}$. the existing water treatment plant has future design capacity of $23900 \text{ m}^3/\text{day}$. assuming an arithmetic rate of population growth determine in what year the existing plant will reach its future design capacity. the city is completely metered.

Solution

$$P_n = 40000 \text{ c}$$

$$\Delta t = 20 \text{ year}$$

$$P_o = 28000 \text{ c}$$

arithmetic rate

$$P_n = P_o + K_a \Delta t$$

$$40000 = 28000 + K_a(20)$$

$$\therefore K_a = 600 \text{ c/year}$$

$$Q_o = 10000 \text{ m}^3/\text{d}$$

present water consumption

$$q_o = \frac{10000}{28000} \times 1000 = 357.1 \text{ lit/d}$$

lit = اللتر

$$Q_n = 23900 \text{ m}^3/\text{d}$$

$$Q_n = P_n q_n = (28000 + 600 \Delta t) \times \left(357 \left(\frac{28000 + 600 \Delta t}{28000} \right) \right) \times \frac{1}{1000}$$

$$23900 = (28000 + 600 \Delta t) \times \frac{357}{(28000)^{1.1}} \times \frac{1}{1000}$$

$$286498.5 = (28000 + 600 \Delta t)^{1.1}$$

$$61406 = 28000 + 600 \Delta t$$

$$\therefore \Delta t = 55.7 \text{ year}$$

Q7. A city with 200000 capita in 1996, determine the population for year 2050 if the rate of increase is geometric with (k_g) of 0.019. what are the 2050 maximum monthly, daily and hourly flows for this city if the present consumption is 220 L/c/d. the city is well metered.

Solution

$$P_{1996} = 200000$$

$$k_g = 0.019$$

$$\ln P_{2050} = \ln P_{1996} + k_g \Delta t$$

$$\ln P_{2050} = \ln(200000) + 0.019 * (2050 - 1996)$$

$$\therefore \ln P_{2050} = 13.23$$

$$\therefore P_{2050} = 557977$$

$$q_n = 220 \left(\frac{557977}{200000} \right)^{.125} = 250.1 \text{ L/c/d}$$

$$\Rightarrow Q_{av.} = 250.1 * 557977 * \frac{1}{1000} = 139494.2 \text{ m}^3/\text{d}$$

$$Q_{\text{max monthly}} = 1.8 * 139494.2 = 251089 \text{ m}^3/\text{d}$$

$$Q_{\text{max hourly}} = 2.5 * 139494.2 = 348735.5 \text{ m}^3/\text{d}$$

$$Q_{\text{max daily}} = 1.4 * 139494.2 = 195291 \text{ m}^3/\text{d}$$