مراجعة رى
تانية . مدنى

Final Revision

2014

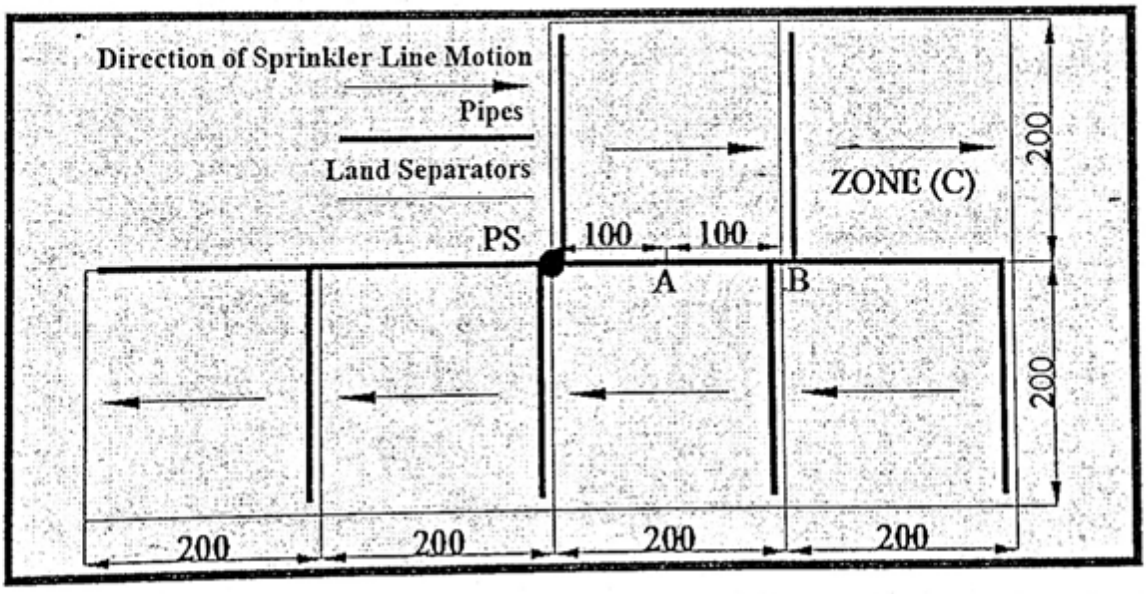
Example 1: in Sprinkler Lecture Notes

A farm is irrigated using semi-permanent sprinklers:

- 35.7 mm water depth can be stored in the root zone
- Plant requirement is 30 m^3/fed/day
- Sprinkler discharge is 0.5 L/s and spacing is 20m
- Working hours on the farm are limited to 16 hr/day

It is Required to calculate:

1. Irrigation interval, irrigation period, total and daily number of operating position
2. Pump Discharge
3. Pipe diameter of pipe AB (if A is midway between PS and point B and losses within pipe is limited to 2 m).
4. If sprinklers in zone C are changed to sprinklers having a discharge of 0.3 L/s and spacing of 15.5m, then it is required to: Re-align zone C and re-calculate pump discharge and pipe AB diameter



Case (1) :-

$D_n = 35.7$ mm & Plant requirement $= 30\ m^3/fed/day$

$Q_s = 0.5\ l/s$ & $X_1 = X_2 = 20$ m, working hours $= 16$ hr

Req :- II, Irrigation time, No. of positions/day

No. of total positions

Sol :-

1) $ET = \frac{30 * 1000}{4200} = 7.14$ mm / day

$P_r = \frac{Q_s}{X_1 * X_2} = \frac{0.5 * 3600}{20 * 20} = 4.5$ mm/hr

** II (Irrigation Interval) $= \frac{D_n}{ET} = \frac{35.7\ mm}{7.14\ mm/hr} = 5$ days

** Irrigation Period $= \frac{D_n}{P_r} = \frac{35.7\ (mm)}{4.5\ (mm/hr)} = 7.93 \approx 8$ hrs

** No. of working positions/day $= \frac{16}{8} = 2$ positions

** No. of total positions $= 2 * 5 = 10$ positions

** Distance that can be irrigated = l) $= 10 * 20 = 200$ m ($\perp X_2$)

** No. of sprinklers $= \frac{200}{X_1} = \frac{200}{20} = 10$ sprinklers

** $Q_{s.L} = 10 * Q_s = 10 * 0.5 = 5\ l/s$

2) ** $Q_{pump} = 6\ Q_{s.L} = 6 * 5 = 30\ l/s$

3) ** $Q_{AB} = 3\ Q_{s.L} = 3 * 5 = 15\ l/s = 0.015\ m^3/s$

use uPVC pipe ($F = 0.015$), $h_{f_{max}} = 2$ m

$\therefore$

$$h_F = \frac{8 F L Q^2}{\pi^2 g D^5}$$

$$2^m = \frac{8 * 0.015 * 100 * (0.015)^2}{\pi^2 * 9.81 * D^5} \Rightarrow D = 0.106\,m = 106.87\ mm$$

Use $\boxed{D = 110\ mm}$

<u>Case (2):-</u> $Q_s = 0.3\ l/s$ & $X_1 = X_2 = 15.5^m$

<u>Req.</u> Realign Part (c)

** $P_r = \frac{Q_s}{X_1 * X_2} = \frac{0.3 * 3600}{15.5 * 15.5} = 4.5\ mm/hr$

** Irrigation Period $= \frac{D_n}{P_r} = \frac{35.7}{4.5} = 7.93 \simeq \underline{\underline{8}}\ hrs$

** No. of working positions/day $= \frac{16}{8} = 2$ positions

** No. of total working positions $= 2 * 5 = 10$ positions

** Distance can be irrigated $(l) = 10 * X_2 = 10 * 15.5 = \underline{\underline{155}}^m < 2$

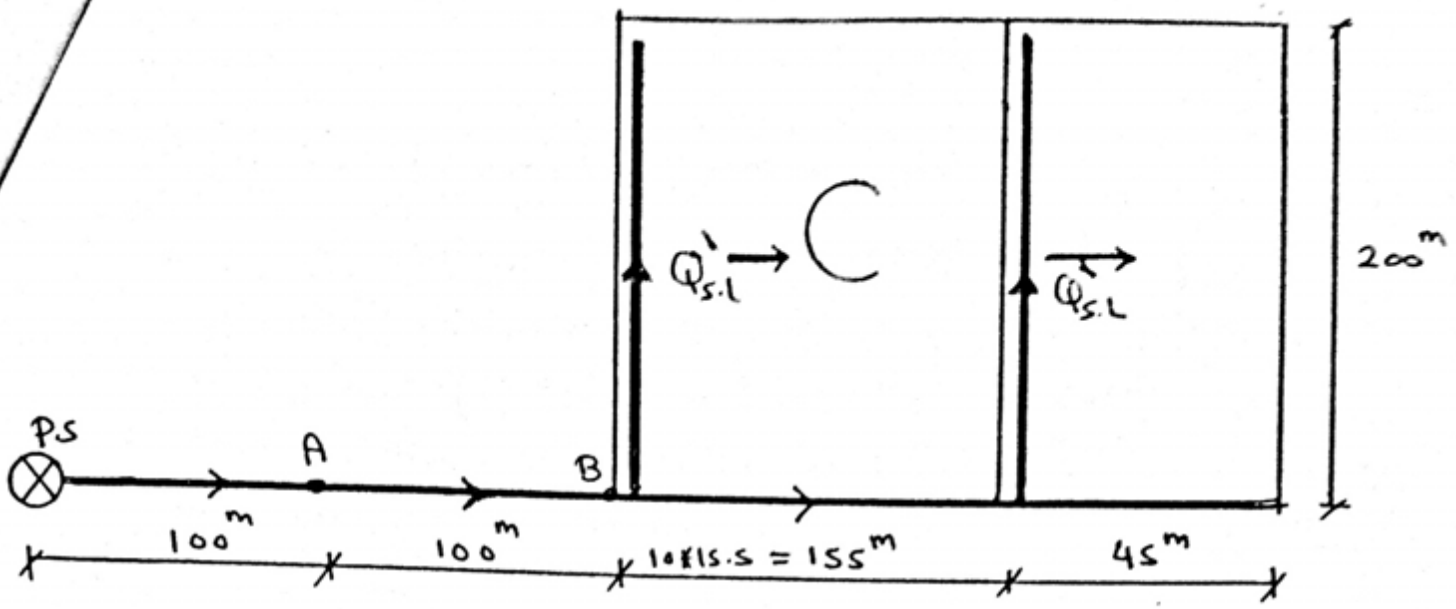
$\Rightarrow$ Another sprinkler line is added to irrigate a distance

$= 200 - 155 = 45^m$, and is irrigated in 3 positions;

$15.5 + 15.5 + 14^m$

تم اضافة (خط رشاشات) آخر لري مسافة (٢٠٠-١٥٥) = ٤٥م

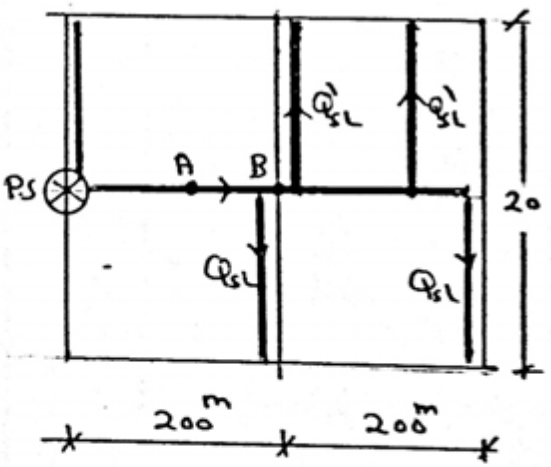
وتم ريها على ٣ مواضع ١٥٫٥ + ١٥٫٥ + ١٤م



** No. of Sprinklers = $\frac{200}{X_1} = \frac{200}{15.5} = 13$ Sprinklers

** $Q'_{s.l} = 13 * 0.3 = 3.9$ l/s

2) ** $Q_{pump} = 5\,Q_{sl} + 2\,Q'_{sl} = 5*5 + 2*3.9 = 32.8$ l/s



Pipe AB :-

$$Q_{AB} = 2\,Q_{s.l} + 2\,Q'_{s.l}$$

$$= 2*5 + 2*3.9$$

$$= 17.8 \text{ l/s}$$

use UPVC ($F = 0.015$), $h_F = 2^m$

$$h_F = \frac{8 F L Q^2}{\pi^2 g D^5}$$

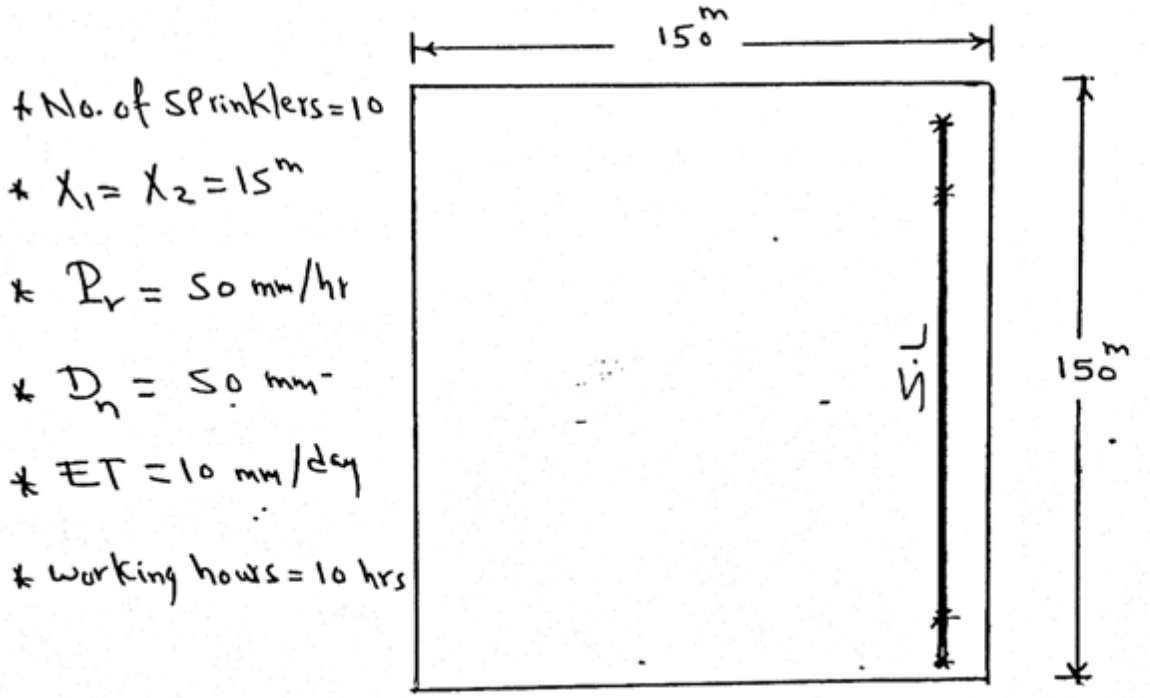
$$2 = \frac{8 * 0.015 * 100 * (0.0178)^2}{\pi^2 * 9.81 * D^5} \Rightarrow D = 0.114^m = 114.4^{mm}$$

Use D = 160 mm

Example 2: in Sprinkler Lecture Notes

Land with an area of 150m x 150m (about 5 fed) is suggested to be irrigated using a 10 sprinklers in mobile line (15x15m – 50mm/hr). The maximum storage depth in the root zone is 50mm, plant consumption is 10mm/day, and the maximum working time is 10hr/day. using simple calculations, show irrigation details and farm operating sceduale in the following two cases:

1. Work Daily with no day off.
2. Work giving workers max number of days off (Design of pipes or pumps is not required).



* No. of Sprinklers = 10
* $X_1 = X_2 = 15^m$
* $P_r = 50$ mm/hr
* $D_n = 50$ mm
* ET = 10 mm/day
* working hours = 10 hrs

[1] In Case of working daily :- في حالة العمل بشكل يومي بدون اجازات

* Irrigation depth = Daily Plant Consumption = 10 mm

عمق الري المطلوب = عمق استهلاك النبات اليومي

Irrigation Period ≡ Sprinklers No. of working hours

$$\equiv \frac{(D_n)_{daily}}{P_r} = \frac{10^{(mm)}}{50\,(mm/hr)} = \underline{\underline{12}}\ \underline{\underline{min}}$$

* No. of moves = $\frac{150}{x_2=15}$ = 10 moves

* Total irrigation Period = 12 * 10 ≡ 120 min = $\underline{\underline{2}}$ hrs

Farm operating sceduale :-

* only 2 hrs per day are required to irrigate the Farm

* The sprinkler line is operated for 12 min in one position to give 10 mm/day

* The sprinkler line is to cover 10 different places throughout the two hours of work

** أى أنه يتم العمل يومياً لمدة ساعتين فقط بحيث يحل خط الرشاشات لمدة ١٢ دقيقة فى الوضع الواحد لترسيب ١٠ مم خلال ساعتين خلال ١٠ مواضع

2 In Case of giving workers max days off :-

فى حالة إعطاء العمال أكثر أيام أجازة

* Irrigation depth ≡ max depth soil can store = D_n = $\underline{\underline{50}}$ mm

* Irrigation Period ≡ $\frac{D_n}{P_r} = \frac{50\ mm}{50\ mm/hr}$ = 1 hr ....

* Irrigation Interval (II) = $\frac{D_n}{ET} = \frac{50\ mm}{10\ mm/day}$ = 5 days

No. of moves /day $= \frac{150^{m}}{X_2 = 15} = 10$ moves /day

* Total irrigation Period = 1 * 10 = 10 hr (ok)

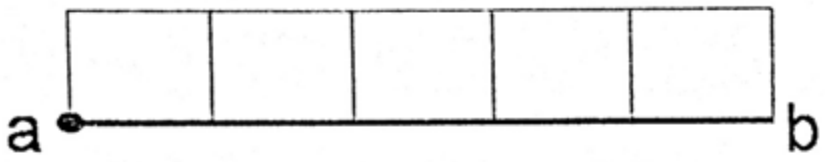
Farm operating Sceduale :-

* 10 working hours on the first day in 10 different Positions
* 1 hour Per Position to give .50 mm /interval
* workers are given four days off ; the 2nd, 3rd, 4th and 5th da
* work Continues on the 6th day and So on, -

* أى أن العمل يتم فى اليوم الأول لمدة ١٠ ساعات فى ١٠ مواضع بواقع ساعة فى الموضع الواحد لترسيب ٥٠ مم .
* يتم اعطاء اجازة للعمال أربعة أيام : اليوم الثانى والثالث والرابع والخامس ثم يعود العمل مرة أخرى فى اليوم السادس وهكذا

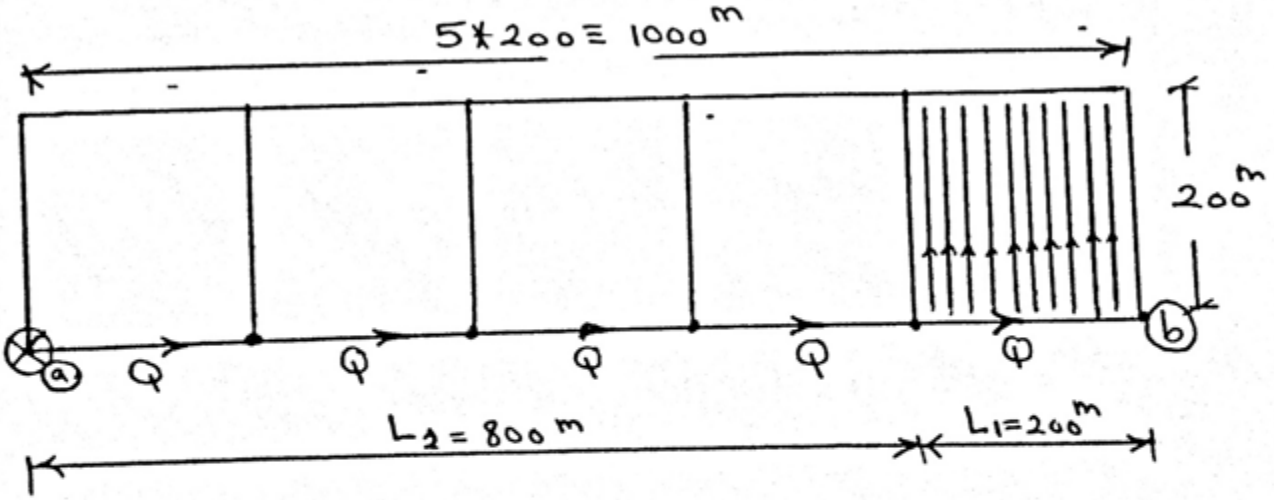
Example 3: in Sprinkler Lecture Notes

A farm has dimensions 1000x200m, is divided into 5 parts as shown and irrigated from a pump station at point (**a**) that pumps water through line (**ab**)
If the sprinkler used, suitable for the plant and irrigation method, is (20x20m – 10mm/hr) and the required pressure at the meeting point of the sprinkler line with the mobile line is 3 bars. It is required to design the mobile line and pump station in cases of both permanent and semi-permanent (mobile) irrigation.



* P_r = 10 mm/hr + $X_1 = X_2 = 20^m$

[1] Case of Permanent Sprinkler Irrigation :-



The worst design scenario is when the Sprinkler line connected to the farthest point (b) is operated.

* No. of Sprinklers = $n = \frac{200}{X_1=20} = 10$ Sprinklers

* No. of Sprinkler lines = $m = \frac{200}{X_2=20} = 10$ S.L

* $Q_s = Q_{Sprinkler} = P_r * X_1 * X_2 = (10 * 10^{-3}) * (20 * 20) = 4\ m^3/hr$

* $Q_{SL} = Q_s$ * No. of Sprinklers $= 4 * 10 = 40\ m^3/hr$

* $Q = Q_{S.L}$ * No. of S.L $= 40 * 10 = 400\ m^3/hr = 0.111\ m^3/s$

assume $V = 1.5$ m/s $\Rightarrow A = \frac{\pi D^2}{4} = \frac{Q}{V} = \frac{0.111}{1.5} \Rightarrow D = 0.307^m$

Take D = 315 mm $\quad V_{act} = \frac{Q}{\frac{\pi}{4}(0.315)^2} = \underline{1.42}$ m/s (OK)

$$h_{F_1} = \frac{8 f L_1 Q^2}{\pi^2 g D^5} * \frac{1}{3} = \frac{8 * 0.015 * 200 * (0.111)^2}{\pi^2 * 9.81 * (0.315)^5} * \frac{1}{3} = 0.33^m$$

$$h_{F_2} = \frac{8 f L_2 Q^2}{\pi^2 g D^5} = \frac{8 * 0.015 * 800 * (0.111)^2}{\pi^2 * 9.81 * (0.315)^5} = 3.94^m$$

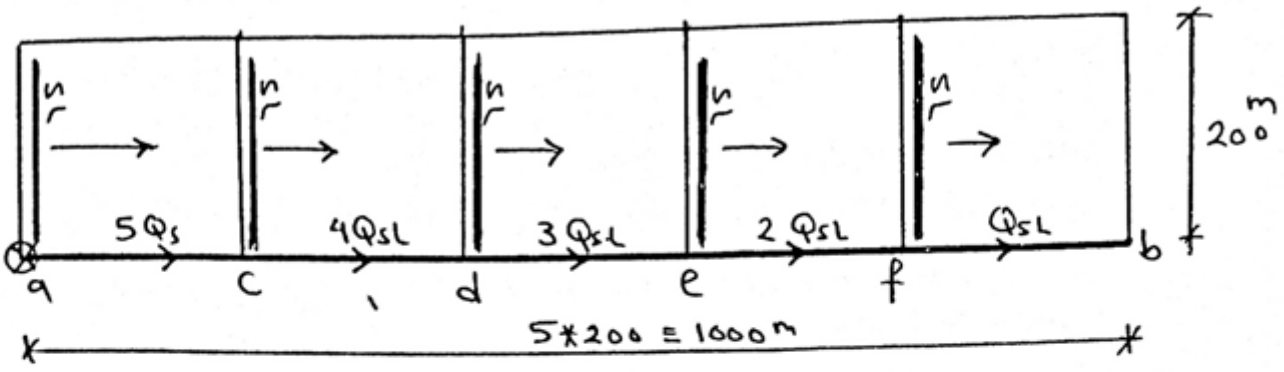
$\therefore h_L = h_{F_1} + h_{F_2} = 3.94 + 0.33 = 4.26^m$

Pump $\quad H_p = h_o + h_L = 30 + 4.26 = 34.26^m = \underline{\underline{4}}$ bar

$Q_p = 400\ m^3/hr$

$$HP = \frac{\gamma Q_p h_p}{\eta * c} = \frac{1000 * 0.111 * 40}{0.8 * 75} = 74\ HP.$$

Case of Semi Permanent Irrigation System :-



* No. of sprinklers = $\frac{200}{X_1=20}$ = 10 Sprinklers

* $Q_{sp} = P_r * X_1 * X_2 = (10 * 10^{-3}) * 20 * 20 = 4\ m^3/hr$

* $Q_{s.L} = Q_{sp} * N_o. = 4 * 10 = 40\ m^3/hr = 0.0111\ m^3/s$

Design Table:

PIPE	L (m)	Q (m3/s)	V ass. (m/s)	d ass.(mm)	D (mm)	V (check)	H_L(m)
bf	200	0.01111	1.5	97.135	110	1.17	1.90
fe	200	0.02222	1.5	137.370	160	1.11	1.17
ed	200	0.03333	1.5	168.243	160	1.66	2.63
dc	200	0.04444	1.5	194.270	200	1.42	1.53
ca	200	0.05555	1.5	217.201	200	1.77	2.39
						sum=	9.62

$\Rightarrow H_L = 9.62^m$

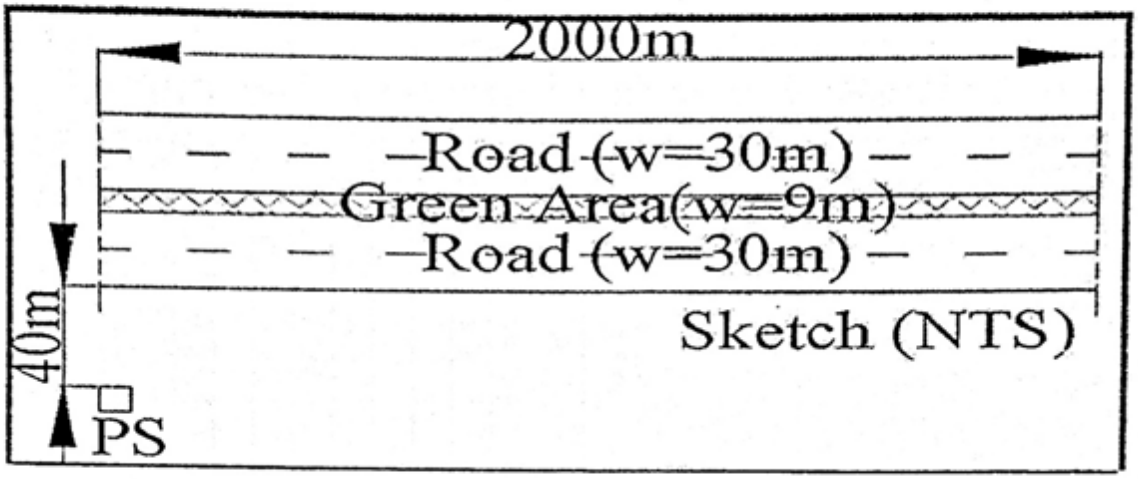
$H_p = h_o + H_L = 30 + 9.62 = 39.62^m \simeq 4$ bar

$Q_p = 5\ Q_{sL} = 5 * 40 = 200\ m^3/h = 0.0555\ m^3/s$

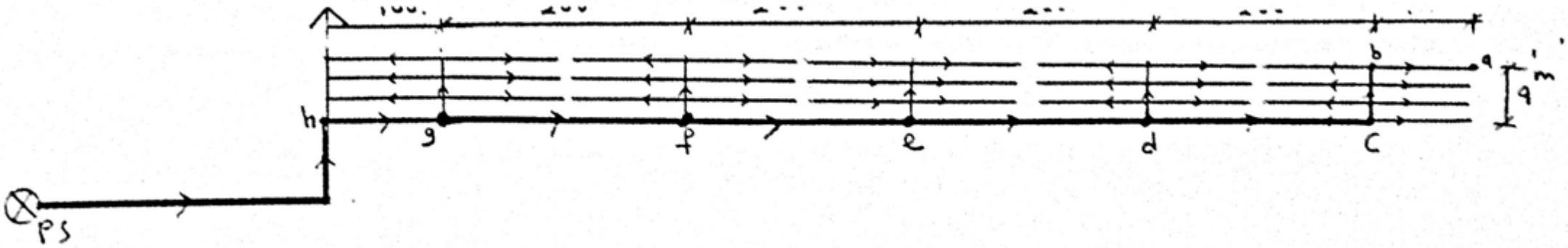
$HP = \frac{1000 * 0.0555 * 40}{0.8 * 75} = 37$ HP

Example in Drip Lecture Notes

The green area between two way road is 9m width and 2km long. It is cultivated with trees (3x3m, 50L/d). It is to be irrigated using DrI in 10 hrs/day from a recycled water pumping station as shown. Design all the system elements assuming any missing data



* $X_1 = X_2 = 3^m$ ← Tree requirement = 50 l/day
* working hours = 10 hr/day ← $Q_0 = 5$ l/h
* Take length of F. D.L = 100^m
* No. of trees = $\frac{100}{X_1 = 3} \simeq 34$ tree
* No. of drippers/tree = $\frac{50}{5 * 10} = 1$ dripper
* $Q_{0L} = 34 * 1 * 5 = 170$ l/h = 0.047 l/s



Design Table For half the system

PIPE	D (mm)	No. of DL	L (m)	Q (cm^3/s)	A (cm^2)	V (m/s)	H_f (m)
ab	9	1	100	47	0.64	0.74	1.55
bc	16	8	9	376	2.01	1.87	0.50
cd	25	8	200	376	4.91	0.77	3.59
de	25	16	200	752	4.91	1.53	14.37
ef	38	24	200	1128	11.34	1.00	3.98
fg	38	32	200	1504	11.34	1.33	7.08
gh	38	40	100	1880	11.34	1.66	5.53
h ps	50	80	1070	3760	19.63	1.92	60.06
						sum=	96.67

$Q_{D.L}$ = $4.7*10^{-5}$ (m^3/s) = 47 (cm^3/s)

F = 0.015 UPVC

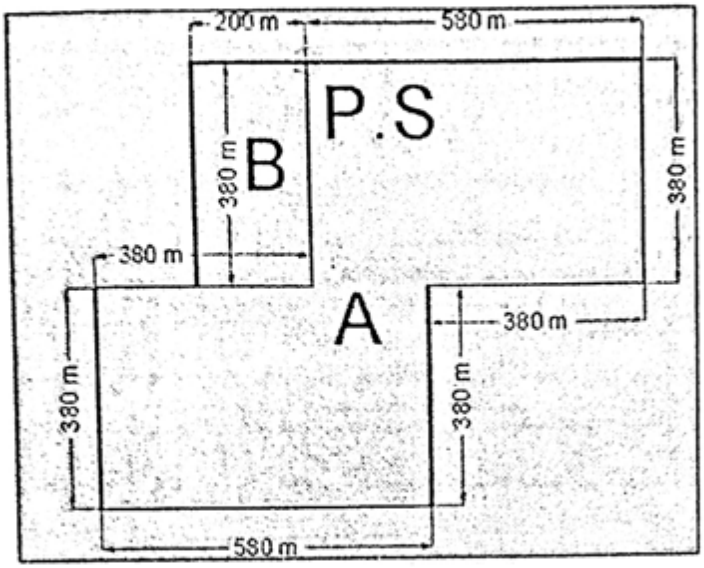
Pump

$Q_p = 80\ Q_{DL} = Q_{hps} = 80 * 0.047 = 3.77$ l/s

$h_p = h_o + h_L = 20 + 96.67 = 116.67$ m

$\simeq$ 12 bar

Example on Sprinkler and Drip Irrigation Together



Part (A) is cultivated by field crop and irrigated by Sprinklers and part (B) is cultivated by trees and irrigated by Drippers. Water source is at point PS and work in the farm continues 12hrs/d. The data is as follows:

Part (A): Water Consumption 8mm/d – II=5 days – Sprinkler (10mm/hr, 15×15m, 2bars)

Part (B): Water Consumption 80L/d/tree and arranged 5×5m – Dripper (8L/hr, 1bar). You are asked to:

1. Align the farm, show all pipe paths and draw it to a reasonable scale
2. Explain in details the farm work time table
3. Design all system parts of Sprinkler and Drip Irrigation, calculate pump power, suggest positions of PRVs and calculate pressure before and after the valve.

Sprinkler Part (A) :-

* $D_n = ET * II = 8 * 5 = 40$ mm

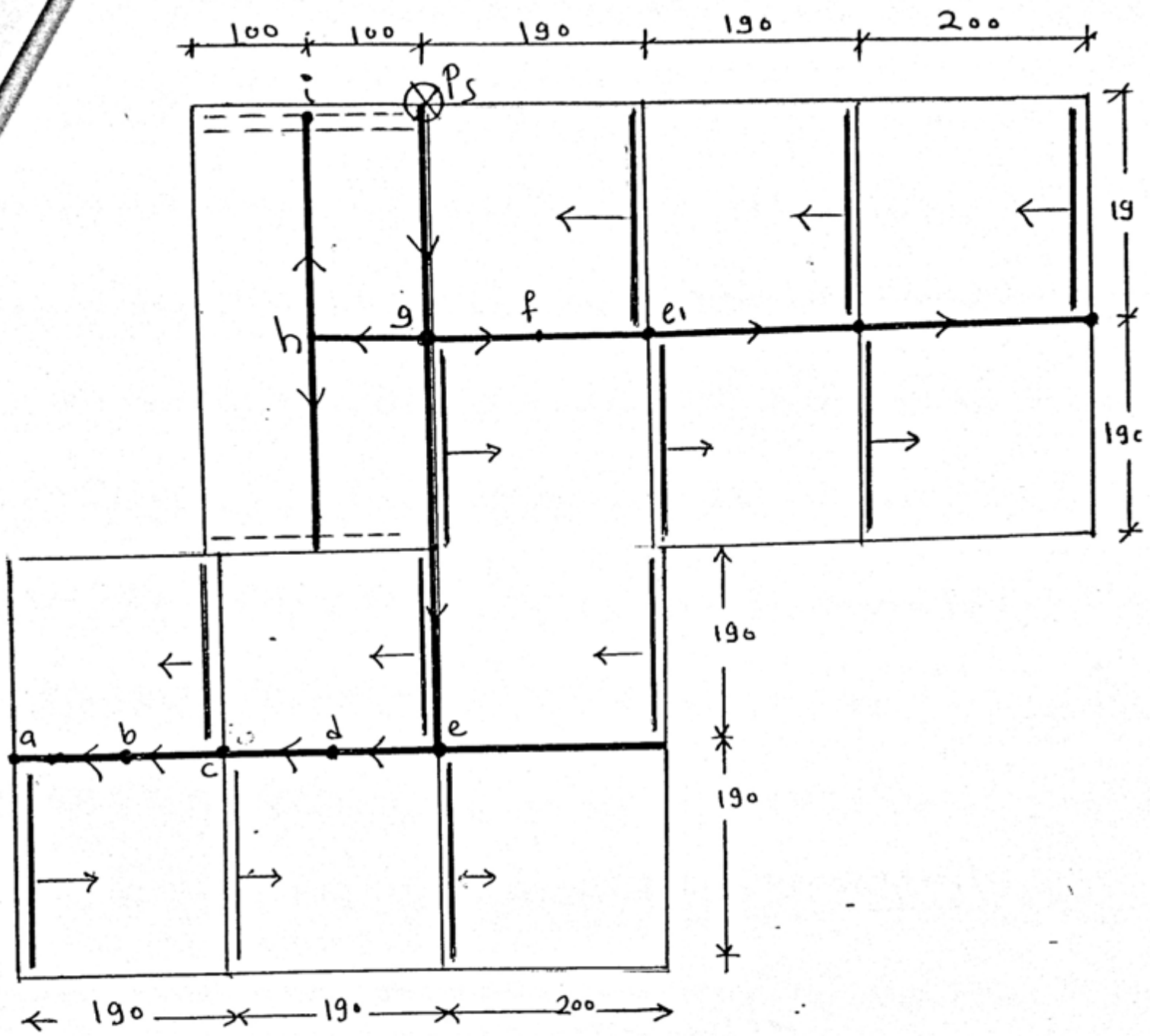
* Irrigation Period $= \frac{D_n}{P_r} = \frac{40 \text{ mm}}{10 \text{ mm/hr}} = 4$ hr

* No. of working positions /day $= \frac{12}{4} = 3$ positions / day

* Total No. of Positions $= 3 * 5 = 15$ positions

$\Rightarrow$ distance of one Part $= 15 * X_2 = 15 * 15 = 225$ m

We Can divide parts as in the figure



In Piece 190^m :-

* No. of positions $\equiv \frac{190}{15} = 12.67$ ⇒ use 13 positions and the final move = 10^m

In Piece 200^m :-

* No. of positions $\equiv \frac{200}{15} = 13.22$ ⇒ use 14 positions and the final move = 5^m.

* length of S.L $= 190^m$ * No. of Sprinklers $= \frac{190}{X_1 = 15} = 12.67$

use 13 Sprinklers and the final distance $= 10^m$

Sprinkler Design Table

PIPE	No. of Sp Line	L (m)	Q (m^3/s)	V ass. (m/s)	D ass (mm)	D (mm)	V (check) (m/s)	H_f (m)
Sp Line	1	190	0.008	1.5	83.068	75	1.84	2.18
ab	1	95	0.008	1.5	83.068	75	1.84	3.28
bc	2	95	0.016	1.5	117.475	110	1.71	1.93
cd	3	95	0.024	1.5	143.877	160	1.21	0.67
de	4	95	0.033	1.5	166.135	160	1.62	1.19
eg	6	380	0.049	1.5	203.473	200	1.55	3.50
g ps	$12+Q_{gh}$	190	0.104	1.5	297.191	315	1.34	0.82
							sum=	13.57

e1f	5	95	0.0406	1.5	185.745	200	1.29	0.61
fg	6	95	0.0488	1.5	203.473	200	1.55	0.88

Q sp.L = 0.0081 (m^3/s)
F = 0.015 UPVC

$Q_s = P_r * X_1 * X_2 = \frac{10}{3600} * 15 * 15 = 0.625$ l/s

$Q_{s.L} = Q_s * 13 = 8.12 * 10^{-3}$ m^3/s

$h_o = 20$ m

* Pressure for sprinkler at Point (g) $= 20^m + h_{L_{a \to g}} = 20 + 12.75 = 32.75^m$
* Pump head $\equiv h_p = h_o + h_L = 20 + 13.57 = 33.57^m \simeq \underline{4}$ bar
* $Q_p = 0.104$ $m^3/s \simeq \underline{104}$ l/s

Workingtime table in Sprinkler part

In Piece 190^m :-

From day 1 to day 4, use 3 positions/ day

in day 5, use 1 position = 4 hrs and the rest of day is off

In Piece 200^m :-

From day 1 to day 4, use 3 Positions/ day

In day 5, use 2 positions = 8 hrs and the rest of day is off

Drip Part (B) :-

* Irrigation time = $\frac{80 (l/d)}{8 (l/h)} = 10$ hr

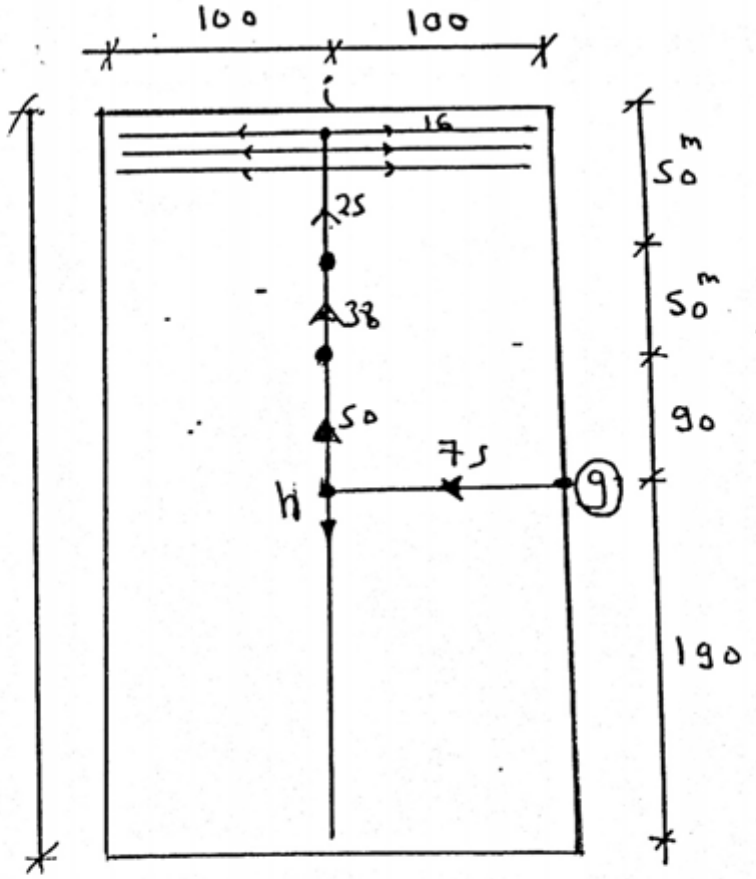
⇒ Irrigation period = 10 hr/day and 2hrs/day are left off

* No. of drippers/tree = $\frac{80}{8 * 10} = 1$ dripper

* length of DL = 100 m

* No. of trees = $\frac{100}{x_i = 5} = 20$ tree

* $Q_{16} = 20 * 1 * \frac{8}{3600} = 0.044$ l/s $= 4.44 * 10^{-5}$ m^3/s



Drip Design Table

PIPE	No. of DL	L (m)	Q (cm^3/s)	A (cm^2)	V (m/s)	H_f (m)
16	1	100	44.444	2.01	0.22	0.08
25	20	50	888.88	4.91	1.81	1.67
38	40	50	1777.760	11.34	1.57	0.82
50	76	90	3377.744	19.63	1.72	1.36
75	152	100	6755.488	44.16	1.53	2.39
					sum=	6.32

$Q_{D.L}$ = $4.44*10^{-5}(m^3/s)$= 44.444 (cm^3/s)

F = 0.015 UPVC

h_o ≡ operating head for dripper = 1 bar = 10^m

Pressure for drip at Point (9) = $h_o + h_L = 10 + 6.32 = 16.32^m$

∴ Put PRV (Pressure Relief Valve) down Stream

Point (9) going from (33^m) for sprinkler Irrig. system to (16^m) for Drip

Irrig. System

هـ- ناقش مايلى:

١- طرق الصرف الحقلى

٢- أساليب التخلص من مياه الصرف الزراعى عند المصب

٣- كيفية حساب قطاع مصرف مجمع إذا كان المصرف مكشوف و إذا كان مغطى

٤- كيفية حساب المسافة بين الحقليات المكشوفة والحقليات المغطاه

و- وضح مايلى بالرسم فقط:

١. اتصال المجمعات بالحقليات

٢. طرق تخطيط المصارف المكشوفة

٣. مصب المجمعات فى المصارف المكشوفة

السؤال السادس: (٣٣ درجة)

أبعاد الأرض الموضحة بالرسم تتضح مساحة مصنع مستطيل الشكل ، محاط من الحد الشمالى والغربى بصفوف من الأشجار ، تروى بالتنقيط على مياه الصرف الصحى المعالج التى يتم تجميعها من المصنع فى خزان تعمل عليه محطة طلمبات عند نقطة أقصى الجنوب الشرقى (نقطة A). والبيانات الآتية متاحة:

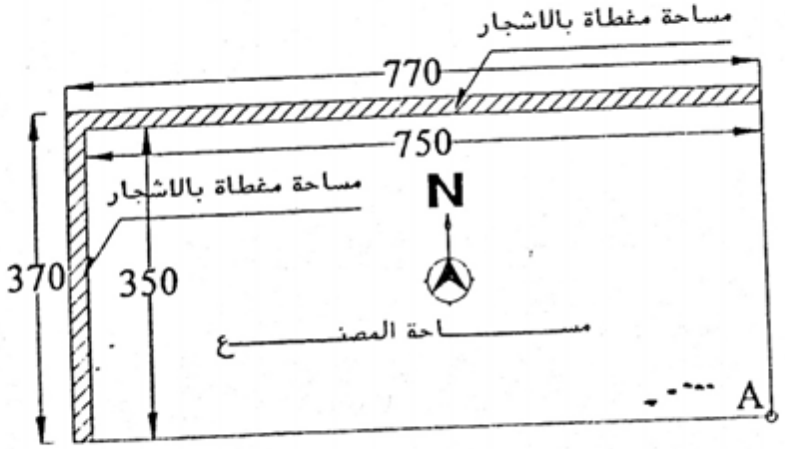
- طول الحد الشمالى للمصنع ٧٥٠م وطول الحد الشرقى ٣٥٠م
- الأشجار مزروعة على رؤوس مربعات طول ضلعه ٤م
- يمكن أن تعمل محطة الطلمبات بحد أقصى لمدة ورديتين يوميا
- المنقطات المتاحة فى السوق تصرفات من ٥ إلى ١٥ لتر/ساعة وتعمل على ضغط من ١ إلى ١,٥ بار
- المقنن الحقلى للرى بالتنقيط فى المنطقة هو ٢٠ متر مكعب/فدان/يوم
- لا يمكن لمواسير الرى اختراق أرض المصنع

والمطلوب:

أ. تخطيط شبكة رى الأشجار ورسمها بمقياس رسم مناسب

ب. تصميم شبكة الرى بدء من المنقطات حتى محطة الطلمبات

ج. أذكر (بدون حسابات) التغيرات المحتملة بالشبكة فى حالة تشغيل محطة الطلمبات وردية واحدة فقط.



السؤال السادس :-

التخطيط فى الاتجاه الطويل ٧٥٠ م :- (ايجاد عدد القطع وعدد الأشجار الناتجة الواحد)

* عدد القطع فى الطول ٧٥٠ م = $\frac{٧٥٠}{٣٠٠ \leftarrow ٥٠٠}$ = (٢,٧٥ ← ٥,٠) قطعة

= ٢ قطع

∴ عرض القطعة الواحدة = $\frac{٧٥٠}{٢}$ = ٥٠٠ م

⇐ عدد الأشجار الموجودة فى الطول ٥٠٠ م = $\frac{٥٠٠}{X_1=4^m}$ = ٥,٦ شجرة

= ٦ شجرة

التخطيط فى الاتجاه القصير ٢٧٠ م :-

* عدد القطع فى الطول ٢٧٠ م = $\frac{٢٥٠}{٤٠٠ \leftarrow ٥٠٠}$ = ١,٦ ← ١,٧٥

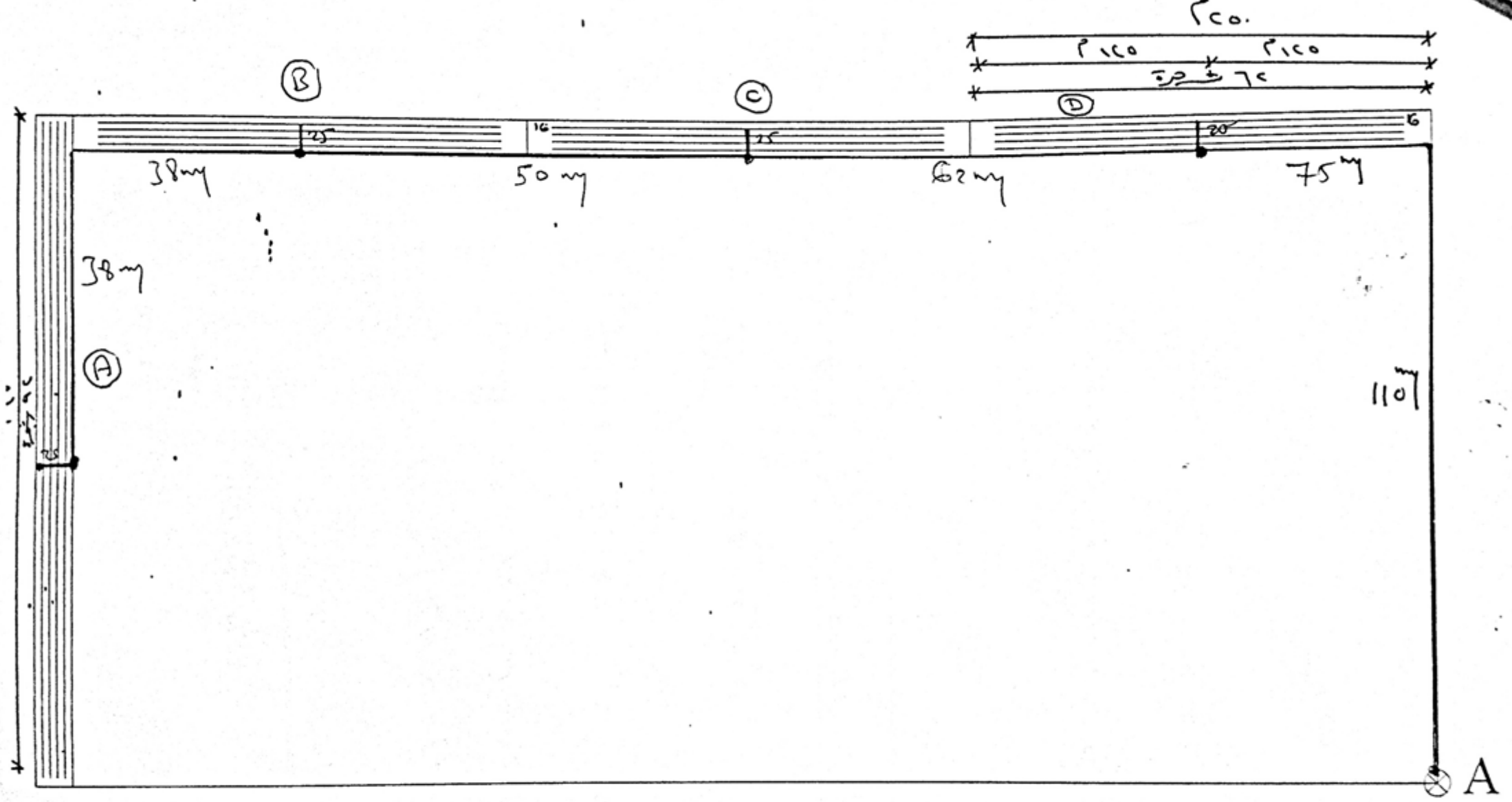
= ١ قطعة

* عدد الأشجار الموجودة فى ٢٧٠ م = $\frac{٢٧٠}{٤}$ = ٩ شجرة

ملحوظة :- عدد خراطيم المنقطات التى يملكها وحدة فى عمر الخزام الشجرى ٥٠ م = $\frac{٥٠}{X_2=4^m}$ = ٥ خراطيم

* الاحتياج اليومى للشجرى = ٥٠ م^٣ / يوم * $\frac{X_1 * X_2}{٤٥٠٠}$ = ٢٧٠ لتر / يوم

= ٧ لتر / يوم


٢٥٠ م
١٢٥ م
١٢٥ م
٦٠ شجرة
B
C
D
A
38 م
50 م
62 م
75 م
38 م
110 م
A

* بفرض عدد ساعات تشغيل الطلمبة = ١٦ ساعة (٨ ساعات للورديه)

∴ عدد المنقطات لكل شجرة = الاحتياج اليومى للشجرة / تصرف المنقط * عدد ساعات تشغيل الطلمبة

= ٧٧ / ١٦ * ٥ = ٩٦ منقط ≈ ١ منقط

⇐ تحتاج كل شجرة الى منقط واحد يتصرف ٥ لتر/ساعة ويعمل ورديتين بضاغط ١ بار

* تخطيط القطعة A :-

Q_{16} = عدد المنقطات لكل شجرة * تصرف المنقط * (عدد الأشجار الموجودة فى ٢٧٠ / C)

$= \frac{92}{2} * 1 * \frac{5*10^{-3}}{60*60} = 6.38 * 10^{-5}\ m^3/s$

$Q_{25} = Av = \frac{\pi}{4}\left(\frac{25}{1000}\right)^2 * 1.5 = 7.36 * 10^{-4}\ m^3/s$

∴ No. of dripper line (16 mm) Can be held by line 25 mm = $\frac{Q_{25}}{Q_{16}}$

$= \frac{7.36*10^{-4}}{6.38*10^{-5}} \simeq 10$ lines (5 lines left + 5 lines right)

* تخطيط القطعة B, C, D :-

$Q_{16} = \frac{62}{2} * 1 * \frac{5*10^{-3}}{60*60} = 4.3*10^{-5}\ m^3/s$

$Q_{25} = 7.36*10^{-4}\ m^3/s$

No. of D.L 16mm Can be held by line 25 $= \frac{Q_{25}}{Q_{16}} \approx 10$ lines

ب) تصميم شبكة الري :-

* المنطقة ٥ لتر/ساعة + ضغط ١ بار = ١٠ م

* خط المنقطات

$D = 16^{mm}$

$L = 185 m$,

$Q_{16} = 6.38 * 10^{-5}\ m^3/s$

$h_{F_1} = \frac{8FLQ^2}{\pi^2 g D^5} * K = \frac{8 * 0.015 * 185 * (6.38*10^{-5})^2}{\pi^2 * 9.81 * (0.016)^5} * \frac{1}{3} = 0.3^m$

* الخط CO :-

$D = 25^{mm}$ + $L = 16^m$

$Q = 7.36 * 10^{-4}\ m^3/s$

$h_{F_2} = \frac{8 * 0.015 * 16 * (7.36*10^{-4})^2}{\pi^2 * 9.81 * (0.025)^5} = 1.1^m$

* الخط A2 :-

$L = 175 + 125 = 300^m$, $D = 38^{mm}$

$Q = AV = \frac{\pi}{4}(0.038)^2 * 1.5 = 0.0017\ m^3/s$

$h_{F_3} = 13.56^m$

* الخط 50 :-

$D = 50^{mm}$ + $L = 250^m$

$Q = \frac{\pi}{4}(0.05)^2 * 1.5 = 0.0029\ m^3/s$

$h_{F_4} = 8.6^m$

* الخط ٦ م :-

$L = 250^m$, $D = 62 mm$

$Q = \frac{\pi}{4}(0.062)^2 * 1.5 = 0.0045\ m^3/s$

$h_{F_5} = 6.8^m$

* الخط ٧٥ م :-

$L = 125^m$, $D = 75 mm$

$Q = \frac{\pi}{4}(0.075)^2 * 1.5 = 0.0066\ m^3/s$

$h_{F_6} = 2.84^m$

* الخط ١٢ م :-

$L = 350^m$, $D = 110 mm$

$Q = \frac{\pi}{4}(0.11)^2 * 1.5 = 0.014\ m^3/s$

$h_{F_7} = 5.28\ m$

الطلبة :-

* $h_p = h_o + 1.15 \sum h_F + 5^m$ (أمان)

$= 1 * 10 + 1.15 (0.3 + 1.1 + 13.56 + 8.6 + 6.8 + 2.84 + 5.28) + 5$

$= 59^m$

* $Q_p = Q_{110} = 0.014\ m^3/s$

$HP = \frac{\gamma Q h_p}{\eta} = \frac{1000 * 0.014 * 59}{0.8 * 75} = 13.76\ HP$

ج) التغيرات المحتملة بالشبكة في حالة تشغيل محطة الطلبات وردية واحدة يزداد عدد المنطقات لكل شجرة وبالتالي تزداد تصرفات الخطوط وتزداد نواقد الاحتكاك وسوف تحتاج طلمبة ذو قدرة أعلى.

Drainage

Problem (1)

1- The pipes used for lateral drains are cement and corrugated PVC pipes with internal diameters 100 and 72 mm respectively. Find the maximum length with each type for a drainage rate of 3mm/day and drain spacing 50m in the following cases:

a- drain slope 0.1%

b- drain slope 0.2 %

Solution (1)

1- Cement Pipe

$Q_l = qBL = f.s. (89\ d^{2.714}\ S^{0.572})$

$(3*50*L)/(1000*24*3600) = 1*89 * (0.1)^{2.714}\ S^{0.572}$

$L = 99040\ S^{0.572}$

S (%)	L (m)
0.1	1904.6
0.2	2831.4

2- PVC Pipe

$Q_l = qBL = f.s. (38\ d^{2.667}\ S^{0.5})$

$(3*50*L)/(1000*24*3600) = 1*38 * (0.072)^{2.667}\ S^{0.5}$

$L = 1961.34\ S^{0.5}$

S (%)	L (m)
0.1	62
0.2	87

Problem (2)

Calculate the area to be served by a cement collector pipe in the tile drainage system according to the following data: drainage coefficient = 4mm/day, collector pipe diameter =20cm, average slope = 4cm/100m.

Solution(2)

Smooth pipe, q=4mm/day, d=20cm, S= $4*10^{-4}$

$$Q_l = qBL = f.s.\ (\ 89\ d^{2.714}\ S^{0.572}\ )$$

$(4\ /\ 1000*24*60*60)\ BL = 0.75\ *\ 89\ *\ (0.2)^{2.714}\ *(4*10^{-4})^{0.572}$

$BL = 208103.2\ m^2 = 49.5$ fed

Problem (3)

Design a corrugated plastic collector drain with a slope of 10cm per 100m and increasing diameters 125, 160, and 200, if the drainage coefficient is 3mm/day. The length of laterals on each side is 200m and the total length of the collector is 650m.

Solution(3)

$Q_l = qBL = f.s. (38\ d^{2.667}\ S^{0.5})$

$(3 / 1000*24*60*60) * 400 * L = f.s. * 38 * d^{2.667} * (0.001)^{0.5}$

$L = f.s. (86519.916\ d^{2.667})$

Diameter (m)	0.125	0.16	0.2
f.s.	0.6	0.75	0.75
Max. L (m)	202.64054	489.289	887.2
(0.75) L (m)	151.98	366.967	665.4
App. L (m)	150	365	650
Each length (m)	150	365	85
Total length (m)	650		

Solved Example 1

- An unconfined aquifer having a hydraulic conductivity of 28 m/day is bounded from the left side and right side with two streams. The water depths in the left and right streams are 10 m and 7 m respectively. If the spacing between the two streams is 200 m determine:

a. Seepage flow rate through the aquifer per unit length.

b. Total seepage flow rate if the stream length is 1000 m.

c. Water head at 30 m, 100m and 150m from the left stream

Answer 1

a) $Q = K(H_1^2 - H_2^2)/2L = 28 * (10^2 - 7^2)/(2*200)$

$= 3.57\ m^3/d/m`$

b) $Q` = Q*W = 3.57 * 1000 = 3570\ m^3/d$

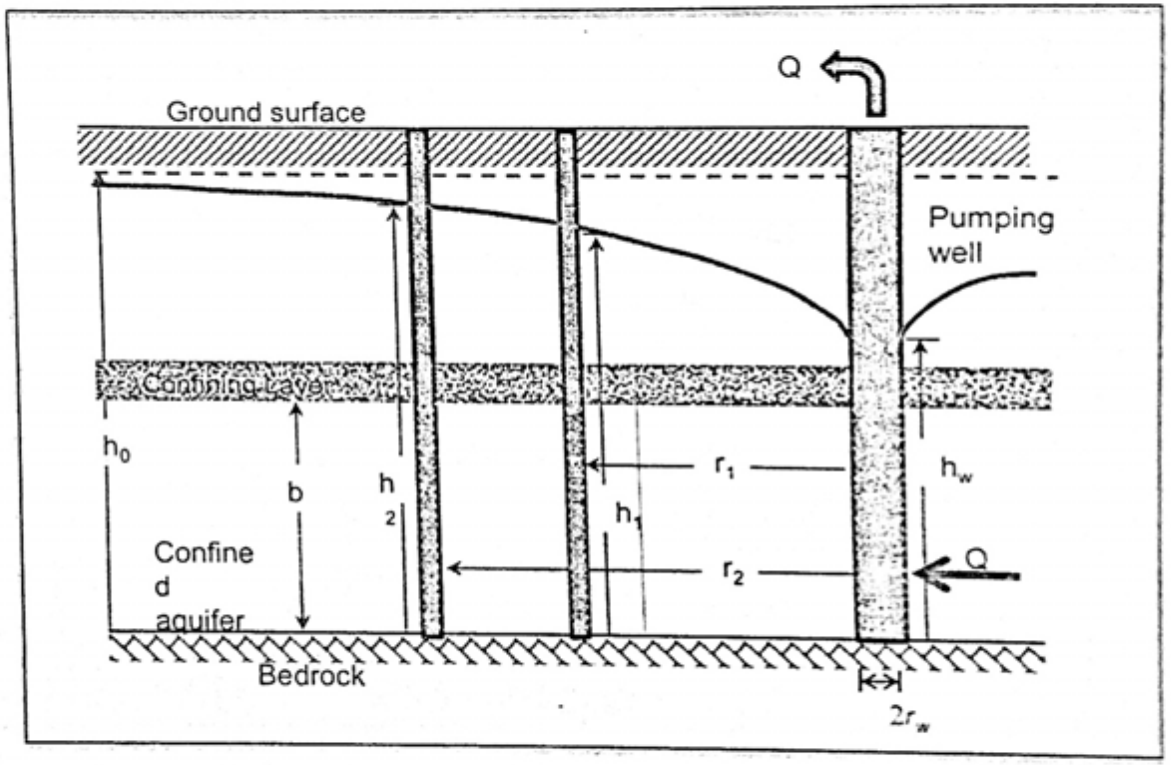
c) $Q = 28*(10^2 - H_i^2)/2L_i = 3.57$

Where L_i = 30, 100 and 150 m

So H_i = 9.61, 8.63 and 7.86 m

Example 2
Two Observation Wells in a confined Aquifer

- $Q = 400\ m^3/hr$
- $b = 40\ m.$
- Two observation wells,
  1. $r_1 = 25\ m;\ h_1 = 85.3\ m$
  2. $r_2 = 75\ m;\ h_2 = 89.6\ m$
- Find: Transmissivity (T)



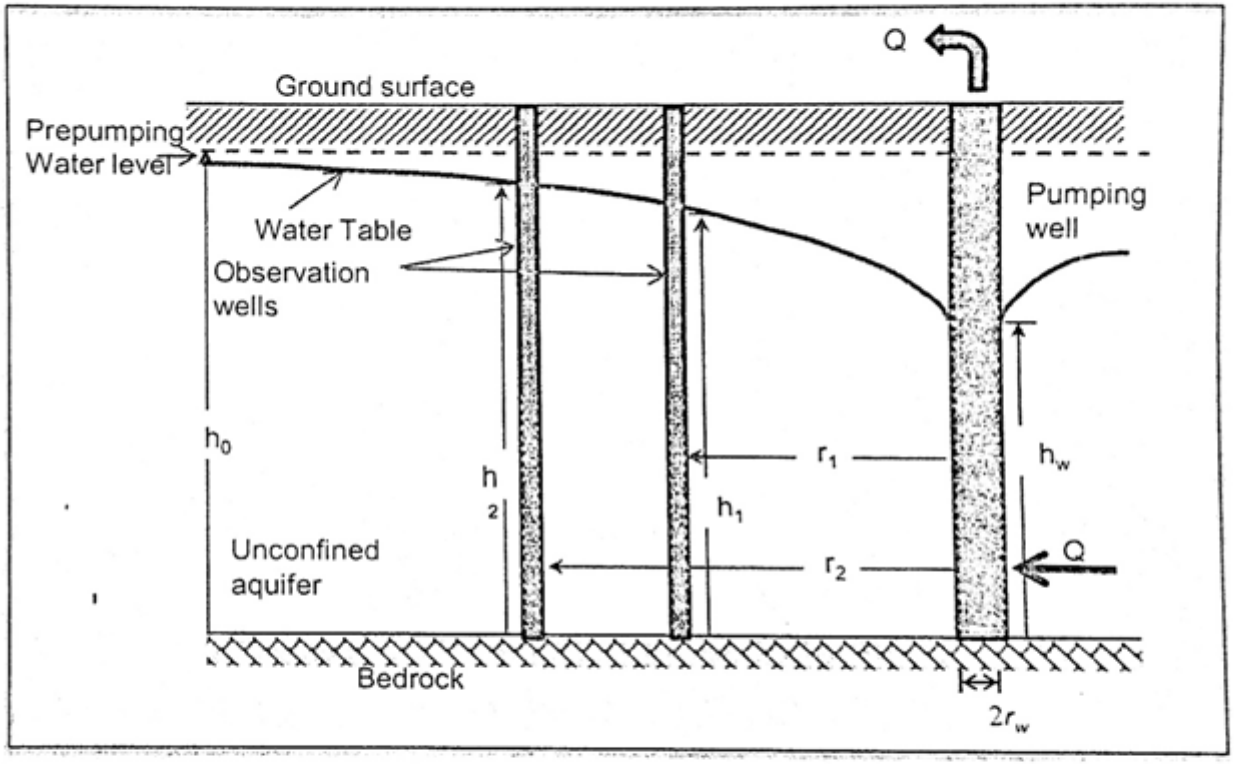
$$h_2 - h_1 = \frac{Q}{2\pi T}\ln\left(\frac{r_2}{r_1}\right)$$

$$T = \frac{Q}{2\pi(h_2 - h_1)}\ln\left(\frac{r_2}{r_1}\right) = \frac{400\ m^3/hr}{2\pi(89.6\ m - 85.3\ m)}\ln\left(\frac{75\ m}{25\ m}\right) = 16.3\ m^2/hr$$

Example 3
Two Observation Wells in an Unconfined Aquifer

- Given:
  - $Q = 300\ m^3/hr$
  - Unconfined aquifer
  - 2 observation wells,
    - $r_1 = 50$ m, $h = 40$ m
    - $r_2 = 100$ m, $h = 43$ m

- Find: K



$$K = \frac{Q}{\pi\left(h_2^2 - h_1^2\right)} \ln\left(\frac{r_2}{r_1}\right) = \frac{300\ m^3/hr/3600\ s/hr}{\pi\left[(43\ m)^2 - (40\ m)^2\right]} \ln\left(\frac{100\ m}{50\ m}\right) = 7.3 x 10^{-5}\ m/\text{sec}$$