



*Introduction to Irrigation Management*

# Scheduling and benchmarking



# WORKBOOK

Version: WA 9 November, 2005

These materials are part of the WaterWise on the Farm education program *Introduction to Irrigation Management*.

These materials were developed by NSW Agriculture staff from the water management subprogram.

Acknowledgments: sections of these training materials use text and illustrations from *The RiverCare Irrigators Manual* developed and revised by the River Murray Water Resources Committee and Primary Industries, South Australia in 1997.

© NSW Agriculture 2003

# Contents

---

<b>Activity 1: Calculating Crop Water Use .....</b>	<b>1</b>
<b>Activity 2: Irrigation Scheduling – Weather Based Data.....</b>	<b>2</b>
<b>Part 1: Creating a weather based schedule .....</b>	<b>2</b>
Answer sheet for Activity 2, Part 1 .....	4
<b>Part 2: Using the weather based schedule .....</b>	<b>5</b>
<b>Guidelines for completing the irrigation scheduling data sheet .....</b>	<b>7</b>
Answer sheet for Activity 2, Part 2 .....	8
<b>Blank irrigation scheduling data sheet.....</b>	<b>9</b>
<b>Activity 3: Irrigation Scheduling – Soil water monitoring data .....</b>	<b>10</b>
<b>Part 1: Interpreting soil moisture data .....</b>	<b>10</b>
<b>Part 2: Plotting soil moisture data - tensiometers .....</b>	<b>12</b>
Blank charts for plotting data.....	14
Answer sheet for Activity 3, Part 2 .....	16
Blank chart for plotting data .....	17
<b>Activity 4: Water Budgeting .....</b>	<b>18</b>
<b>Annual Crops.....</b>	<b>18</b>
<b>Perennial Crops .....</b>	<b>19</b>
Answer to Activity 4 .....	22
Blank budgeting sheets .....	24
<b>Activity 5: Irrigation Benchmarking .....</b>	<b>27</b>



## Activity 1: Calculating Crop Water Use

Calculate the Crop Water Use ( $ET_{\text{crop}}$ ) for the following example.

$$ET_0 \times K_c = \text{Daily crop water use } (ET_{\text{crop}})$$

Date	$ET_0$	$K_c$	Daily Crop water Use $ET_{\text{crop}}$
	A	B	(A x B)
1 Jan	7.2	0.85	5.8
2 Jan	10.1	0.85	
3 Jan	8.3	0.85	
4 Jan	11.3	0.85	



## Activity 2: Irrigation Scheduling – Weather Based Data

### *Part 1: Creating a Weather Based Irrigation schedule.*

Dusty Fields has a crop of **perennial pasture** planted in his **Top Block**. Dusty started this schedule in **January 2001** (after attending the highly enjoyable WaterWise on the farm course). The soil survey determined that this block has a **RAW of 42 mm**. The Top Block of Dusty's farm has a hand shift irrigation system that has a **MAR of 7 mm/hour**

Dusty receives his ETo data from the local weather station, which told him that pasture in this area during January has a **K<sub>c</sub> of 0.85**.

A soil moisture test indicated that at the start of this month the Top block had a **remaining RAW of 6.2 mm**

*Complete Dusty's schedule up to "Today"*

### Irrigation scheduling data sheet: *Dusty Fields*

Month: January				Crop: Perennial Pasture	
Block:				RAW: mm	
Irrigation MAR:				Remaining RAW: mm	
	A	B	C	D	E
Date	ET <sub>o</sub>	K <sub>c</sub>	ET crop (A x B)	Effective rain or irrigation	Remaining RAW (E from previous Day - C + D) (Carried over 6.2)
1	6.5	0.85	5.5	6 hour irrigation (42 mm)	6.2 - 5.5 + 42 = 43 (Rootzone full at 42)
2	10.1	0.85	8.6		33.4
3	8.3	0.85	7.1		26.3
4	11.3	0.85	9.6		16.7
5	3.6	0.85	3.1	Rainfall, 15 mm	28.6
6	8.8	0.85	7.5		21.1
7	8.5	0.85	7.2		13.9
8	7.7	0.85	6.5		7.4
9	8.0	0.85	6.8		0.6
10	8.9	0.85	7.6	7 h x 7 mm/h irrigation	42 (nil runoff)
11	6.0	0.85	5.1		
12	10.0	0.85	8.5	Rainfall, 25 mm	
13	7.0	0.85			
14	7.0	0.85			
15	8.0	0.85			
16	9.0	0.85			
17	7.0	0.85			
18	10.0	0.85			
19	12.0	0.85			
<b>Today</b>		0.85	*		
21		0.85			
22		0.85			
23		0.85			
24		0.85			
25		0.85			
26		0.85			
27		0.85			
28		0.85			
29		0.85			

30		0.85		
----	--	------	--	--

*Answer sheet for Part 1*

**Irrigation scheduling data sheet: *Dusty Fields***

<b>Month: <i>January</i></b>			<b>Crop: <i>Perennial Pasture</i></b>		
<b>Block: <i>Top</i></b>			<b>RAW <i>42</i> mm</b>		
<b>Irrigation MAR: <i>7 mm/hour</i></b>			<b>Remaining RAW: <i>6.2</i> mm</b>		
	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
Date	ET <sub>o</sub>	K <sub>c</sub>	ET crop (A x B)	Effective rain or irrigation	Remaining RAW (E from previous Day - C + D)
1	6.5	0.85	5.5	6 hr irrigation	(Rootzone full at 42)
2	10.1	0.85	8.6		33.4
3	8.3	0.85	7.1		26.3
4	11.3	0.85	9.6		16.7
5	3.6	0.85	3.1	Rainfall, 15 mm	28.6
6	8.8	0.85	7.5		21.1
7	8.5	0.85	7.2		13.9
8	7.7	0.85	6.5		7.4
9	8.0	0.85	6.8		0.6
10	8.9	0.85	7.6	7 h x 7 mm/h irrigation	42 (nil runoff)
11	6.0	0.85	5.1		36.9
12	10.0	0.85	8.5	Rainfall, 25 mm	53.4 42 (11.4 lost to run off)
13	7.0	0.85	6.0		36.0
14	7.0	0.85	6.0		30.0
15	8.0	0.85	6.8		23.2
16	9.0	0.85	7.6		15.6
17	7.0	0.85	6.0		9.6
18	10.0	0.85	8.5		1.1
19	12.0	0.85	10.2	7 hrs irrigation	39.9
20		0.85			
21		0.85			
22		0.85			
23		0.85			
24		0.85			
25		0.85			
26		0.85			
27		0.85			
28		0.85			
29		0.85			

30		0.85			
----	--	------	--	--	--

## ***Part 2: Using the weather based schedule***

We may use the irrigation schedule to assist our management decisions and plan our irrigations in order to maximise our water use efficiency and production. That is, we may forecast when an irrigation event will be required and plan our runs and run times to meet this requirement.

**Step 1** For the next weeks, (20<sup>th</sup> to 28<sup>th</sup>), calculate the *average* ET<sub>o</sub> for the month. (average ET = all the ET<sub>o</sub> from 1<sup>st</sup> to 19<sup>th</sup> divided by the number of days {19}.)

*Note: Average ETo may also be available from historical records*

Use the average ETo to predict water use for the next weeks. Enter this in Column A.

**Step 2** Calculate the predicted ET<sub>crop</sub> for the perennial pasture over the next weeks. Enter this in column C.

*\* Hint: If we are using average ET<sub>o</sub> and our monthly Crop coefficient then our ET<sub>crop</sub> will be the same each day. Therefore, there is no need to calculate it each day*

**Step 3** Complete the rest of the sheet and mark when the irrigations would be required. (Unfortunately, for Dusty we are predicting no rainfall.)

---


$$\text{Average ET}_o = \text{Total ET}_o \div \text{number of days}$$

$$= \dots \div \dots$$

$$= \dots$$

Irrigation scheduling data sheet: *Dusty Fields*

Month: <i>January</i>				Crop: <i>Perennial Pasture</i>	
Block: <i>Top</i>				RAW <b>42</b> mm	
Irrigation MAR: <i>7 mm/hour</i>				Remaining RAW: <b>6.2</b> mm	
	A	B	C	D	E
Date	ET <sub>o</sub>	K <sub>c</sub>	ET crop (A x B)	Effective rain or irrigation	Remaining RAW (E from previous Day - C + D)
1	<b>6.5</b>	<b>0.85</b>	<b>5.5</b>	<i>Full irrigation</i>	<b>42 (Rootzone full)</b>
2	<b>10.1</b>	<b>0.85</b>	<b>8.6</b>		<b>33.4</b>
3	<b>8.3</b>	<b>0.85</b>	<b>7.1</b>		<b>26.3</b>
4	<b>11.3</b>	<b>0.85</b>	<b>9.6</b>		<b>16.7</b>
5	<b>8.8</b>	<b>0.85</b>	<b>3.1</b>	<i>Rainfall, 15 mm</i>	<b>28.6</b>
6	<b>3.6</b>	<b>0.85</b>	<b>7.5</b>		<b>21.1</b>
7	<b>8.5</b>	<b>0.85</b>	<b>7.2</b>		<b>13.9</b>
8	<b>7.7</b>	<b>0.85</b>	<b>6.5</b>		<b>7.4</b>
9	<b>8.0</b>	<b>0.85</b>	<b>6.8</b>		<b>0.6</b>
10	<b>8.9</b>	<b>0.85</b>	<b>7.6</b>	<i>7 h x 6 mm/h irrigation</i>	<b>42 (nil runoff)</b>
11	6.0	0.85	5.1		36.9
12	10.0	0.85	8.5	<i>Rainfall, 25 mm</i>	53.4 42 (11.4 lost to run off)
13	7.0	0.85	6.0		36.0
14	7.0	0.85	6.0		30.0
15	8.0	0.85	6.8		23.2
16	9.0	0.85	7.6		15.6
17	7.0	0.85	6.0		9.6
18	10.0	0.85	8.5		1.1
19	12.0	0.85	10.2	<i>7 h x 7 mm/h</i>	39.9
20		0.85			
21		0.85			
22		0.85			
23		0.85			
24		0.85			
25		0.85		<i>Continues to end of</i>	
30		0.85		<i>month</i>	

## ***Guidelines for completing the Irrigation scheduling data sheet***

1. Fill in details of the crop or pasture being irrigated.
2. Record the RAW (mm) for your block.
3. Record irrigation system's Mean Application Rate
4. Fill in the columns

**Column A:** Enter the daily evapotranspiration (ET<sub>o</sub>) readings for your district.

Note: **If you are using pan evaporation figures**, you will need to convert them to **ET<sub>o</sub>** figures (Refer to page 11 of your notes).

**Column B:** Copy the crop coefficient (K<sub>c</sub>) that applies to your crop for the month from the reference your trainer has recommended.

**Column C:** Multiply the figure in Column A by the figure in Column B to determine crop water use (ET<sub>crop</sub>) and enter this in column C.

**Column D:** Enter details of any effective rainfall.

**Column E:** Determine the remaining water available for each day (below the full point). This is the previous day's Available Water minus today's daily water Use (C) plus any irrigation or effective rainfall

Whenever the figure in **column E approaches 0**, you need to irrigate to refill the soil profile. If an irrigation event does not totally refill the profile you will need to allow for this. For surface systems, it is always assumed the profile is filled.

If there are any special conditions, such as leaching requirements, or you are practising precision irrigation management such as Required Deficit Irrigation (RDI), you will need to adjust your scheduling to suit.

Your local irrigation adviser will be able to provide some K<sub>c</sub> figures. For your own scheduling calculations, you should use local figures in preference to those given in general tables.

### ***Answer sheet for Part 2***

This shows the predicted water use using the average ET.

$$\begin{aligned}\text{Average ET}_o &= \text{Total ET}_o \div \text{number of days} \\ &= 158.4 \div 19 \\ &= \mathbf{8.3}\end{aligned}$$

### Irrigation scheduling data sheet: *Dusty Fields*

Month: <i>January</i>				Crop: <i>Perennial Pasture</i>	
Block: <i>Top</i>				RAW <b>42 mm</b>	
Irrigation MAR: <i>7 mm/hour</i>				Remaining RAW: <b>6.2 mm</b>	
	A	B	C	D	E
Date	ET <sub>o</sub>	K <sub>c</sub>	ET crop (A x B)	Effective rain or irrigation	Remaining RAW ( E from previous Day - C + D )
1	<i>6.5</i>	<i>0.85</i>	<i>5.5</i>	<i>Full irrigation</i>	<i>42 (Rootzone full)</i>
2	<i>10.1</i>	<i>0.85</i>	<i>8.6</i>		<i>33.4</i>
3	<i>8.3</i>	<i>0.85</i>	<i>7.1</i>		<i>26.3</i>
4	<i>11.3</i>	<i>0.85</i>	<i>9.6</i>		<i>16.7</i>
5	<i>8.8</i>	<i>0.85</i>	<i>3.1</i>	<i>Rainfall, 15 mm</i>	<i>28.6</i>
6	<i>3.6</i>	<i>0.85</i>	<i>7.5</i>		<i>21.1</i>
7	<i>8.5</i>	<i>0.85</i>	<i>7.2</i>		<i>13.9</i>
8	<i>7.7</i>	<i>0.85</i>	<i>6.5</i>		<i>7.4</i>
9	<i>8.0</i>	<i>0.85</i>	<i>6.8</i>		<i>0.6</i>
10	<i>8.9</i>	<i>0.85</i>	<i>7.6</i>	<i>7 hour irrigation</i>	<i>42 (nil runoff)</i>
11	<i>6.0</i>	<i>0.85</i>	<i>5.1</i>		<i>36.9</i>
12	<i>10.0</i>	<i>0.85</i>	<i>8.5</i>	<i>Rainfall, 25 mm</i>	<i>53.4</i> <i>42 (11.4 lost to run off)</i>
13	<i>7.0</i>	<i>0.85</i>	<i>6.0</i>		<i>36.0</i>
14	<i>7.0</i>	<i>0.85</i>	<i>6.0</i>		<i>30.0</i>
15	<i>8.0</i>	<i>0.85</i>	<i>6.8</i>		<i>23.2</i>
16	<i>9.0</i>	<i>0.85</i>	<i>7.6</i>		<i>15.6</i>
17	<i>7.0</i>	<i>0.85</i>	<i>6.0</i>		<i>9.6</i>
18	<i>10.0</i>	<i>0.85</i>	<i>8.5</i>		<i>1.1</i>
19	<i>12.0</i>	<i>0.85</i>	<i>10.2</i>	<i>7 hour irrigation</i>	<i>39.9</i>
20	<i>8.3</i>	<i>0.85</i>	<i>7.1</i>		<i>32.8</i>
21	<i>8.3</i>	<i>0.85</i>	<i>7.1</i>		<i>25.7</i>
22	<i>8.3</i>	<i>0.85</i>	<i>7.1</i>		<i>18.6</i>
23	<i>8.3</i>	<i>0.85</i>	<i>7.1</i>		<i>11.5</i>
24	<i>8.3</i>	<i>0.85</i>	<i>7.1</i>		<i>4.4</i>
25	<i>8.3</i>	<i>0.85</i>	<i>7.1</i>	<i>Irrigation 7 hours</i>	<i>42 full (4.3 run off)</i>
26	<i>8.3</i>	<i>0.85</i>	<i>7.1</i>		<i>34.9</i>
27	<i>8.3</i>	<i>0.85</i>	<i>7.1</i>		<i>27.8</i>
28	<i>8.3</i>	<i>0.85</i>	<i>7.1</i>		<i>20.7</i>
29	<i>8.3</i>	<i>0.85</i>	<i>7.1</i>		<i>13.6</i>
30	<i>8.3</i>	<i>0.85</i>	<i>7.1</i>		<i>6.5</i>

**Irrigation scheduling data sheet:**

<b>Month:</b>				<b>Crop:</b>	
<b>Block:</b>				<b>RAW            mm</b>	
<b>Irrigation MAR:</b>				<b>Remaining RAW:            mm</b>	
	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>
Date	ET <sub>o</sub>	K <sub>c</sub>	ET crop (A x B )	Effective rain or irrigation	Remaining RAW ( E from previous Day - C + D )
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					

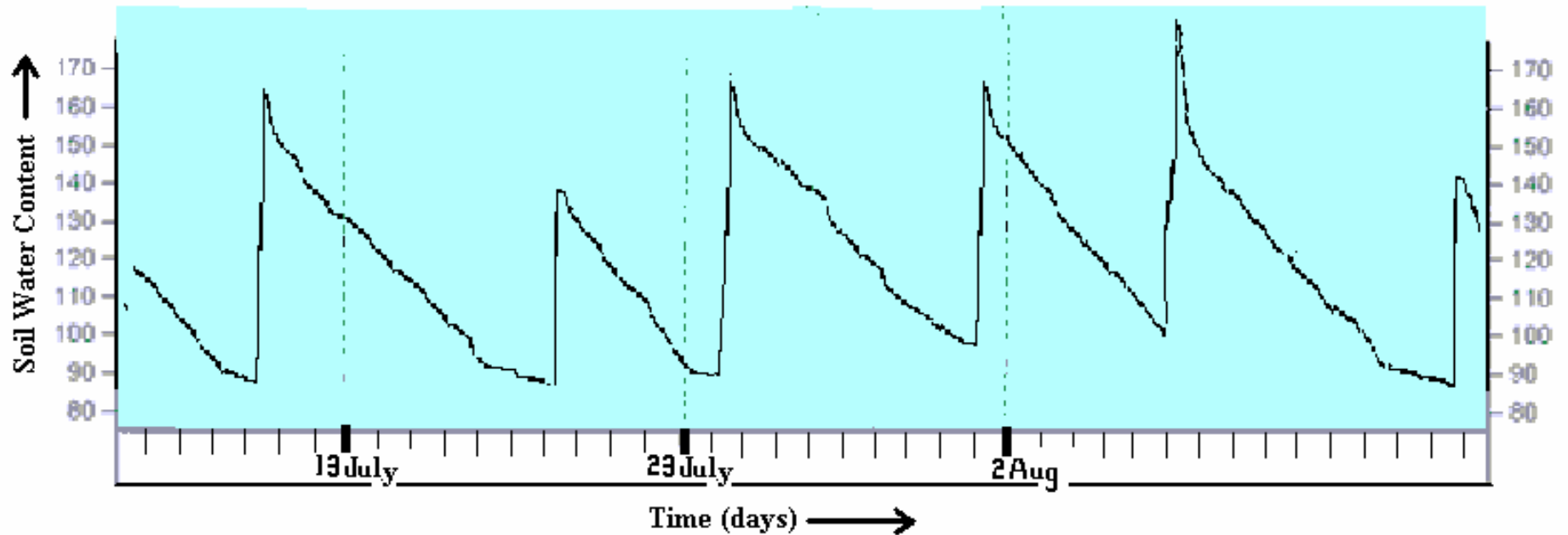


## Activity 3: Irrigation Scheduling – Soil Water Monitoring Data

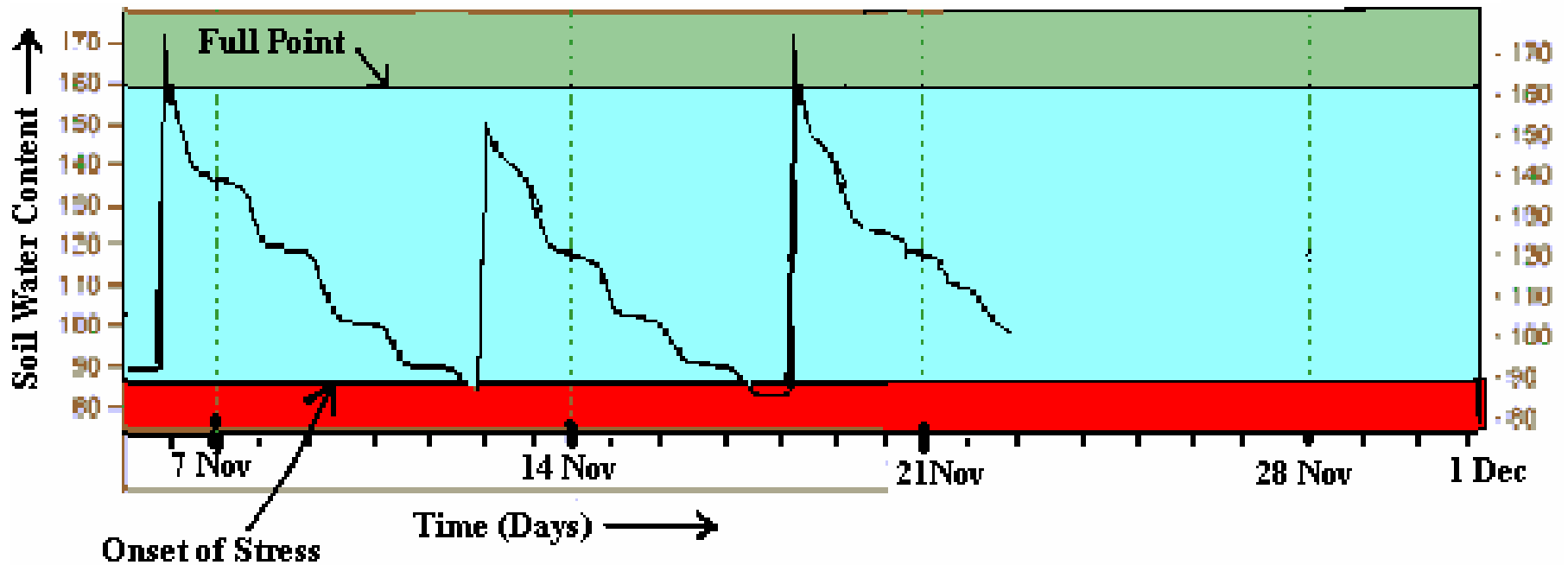
### *Part 1: Interpreting soil moisture data*

Dusty Fields has a Capacitance Probe in North Block. This Soil Water Monitoring Tool produces a graph of soil moisture content.

Indicate on the Graph the level at which the profile is full and the level at Refill Point.



Due to a high pressure system today the 23 November, the weather forecast for the next two weeks is for similar dry conditions. Using the soil moisture monitor print out below, indicate when Dusty should irrigate to get the crop through to December when rains are expected



## ***Part 2: Plotting Soil moisture data - Tensiometers***

The purpose of this activity is to plot and interpret readings from two tensiometers placed at a site at depths of 30 and 60 cm. The effective rootzone is around 35 cm. This means that the 60 cm tensiometer monitors the deep drainage water movement while the 30 cm tensiometer monitors the crop water use.

Tensiometers measure the ‘tension’ in the soil. Soil tension will increase as the water is removed from the soil. For this reason, the soil profile requires refilling when the tension is high (**40 kPa for our example**). The profile is full when the tension is low (around **8 kPa**. Table 1 outlines how to interpret tensiometer readings.

	kPa at 30 cm	kPa at 60 cm	
1	6	30	
2			
3			
4			
5	22	42	
6			
7			
8			
9	56	61	7 hour irrigation
10	3	25	
11	6	14	
12			
13			
14	33	20	3 hour Irrigation
15			
16	7	23	
18			
19			8 mm of effective rainfall
20	17	29	
21			
22			
23			
24	25	34	
25			
26	50	40	6 hour irrigation
27			
28	5	8	
29			
30			
31	16	14	

**Table 1 Tensiometer readings**

<b>Readings (kPa)</b>	<b>Interpretation</b>
0 to 10	Soil is very wet. Continual readings in this range indicate excessive irrigation and waterlogging. Plant root damage highly probable.
10 to 25	Best balance of soil moisture and air. Ideal for plant growth.
25 to 40	Soil moisture sufficient for plant growth. May need to irrigate on light soils.
40 to 60	Soil is getting dry. Crops are probably stressed. Crops should be irrigated in this range.
Over 60	Irrigate before this level is reached!

*Tensiometer gauges measure negative pressure, or suction. Gauges do not normally display the ‘-’ sign that you may see in written material, for example –20 kPa.*

Note: The table above is a general guide. Soil types and crop type will influence the interpretation of tensiometers. It is advisable to consult with your local irrigation officer or experienced users to determine the optimum tensiometer readings for your situation.

- Step 1.** On a blank chart, draw a line across at the refill and full points (8 kPa and 40 kPa).
- Step 2.** Plot the tensiometer readings from the table below and join the points. Use a different colour or shaped line for the 30 and 60 cm tensiometer readings.
- Step 3.** When you have completed this, discuss the results, and decide if the irrigation could have been managed more effectively.

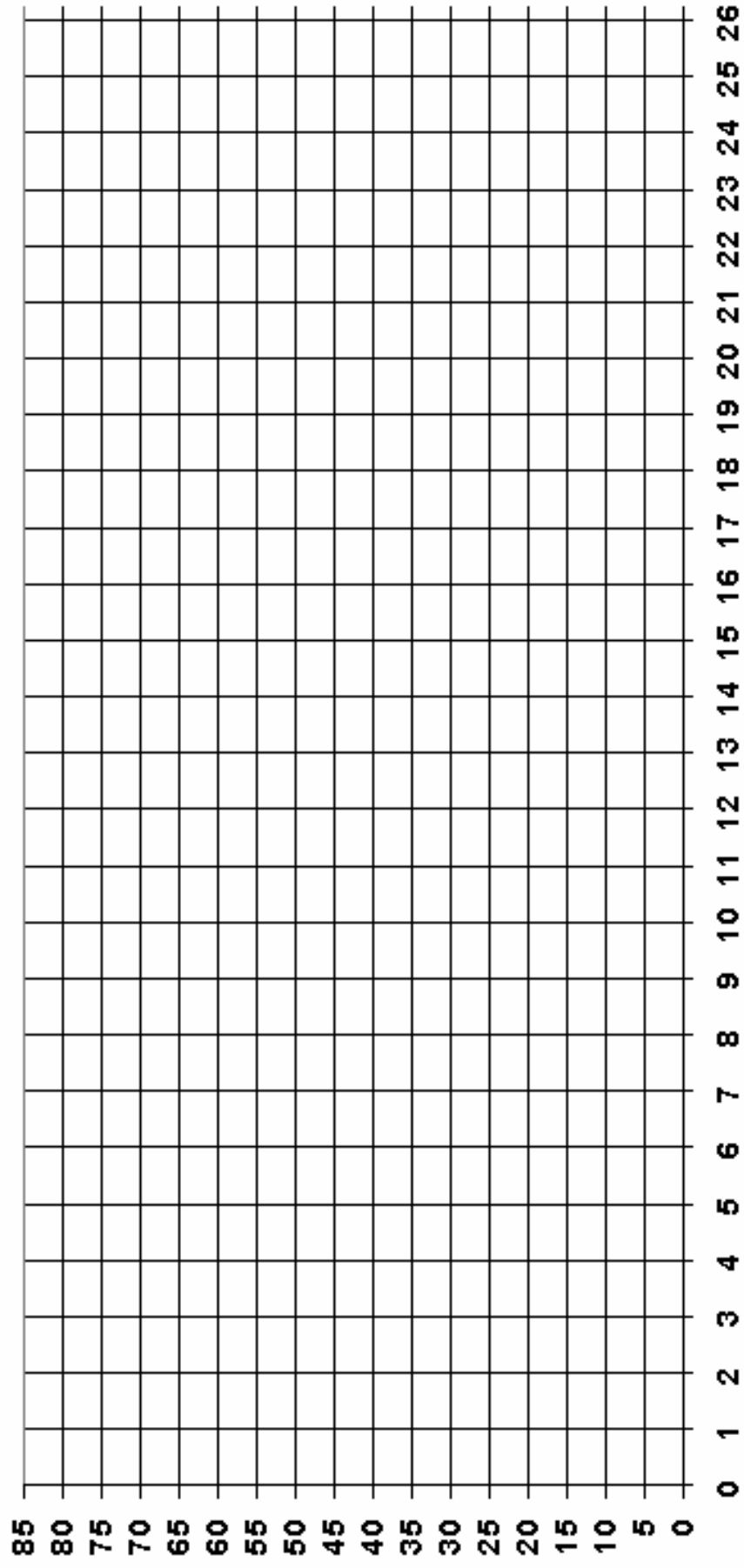
## **Discussion Questions**

**What was happening after the 7<sup>th</sup>**

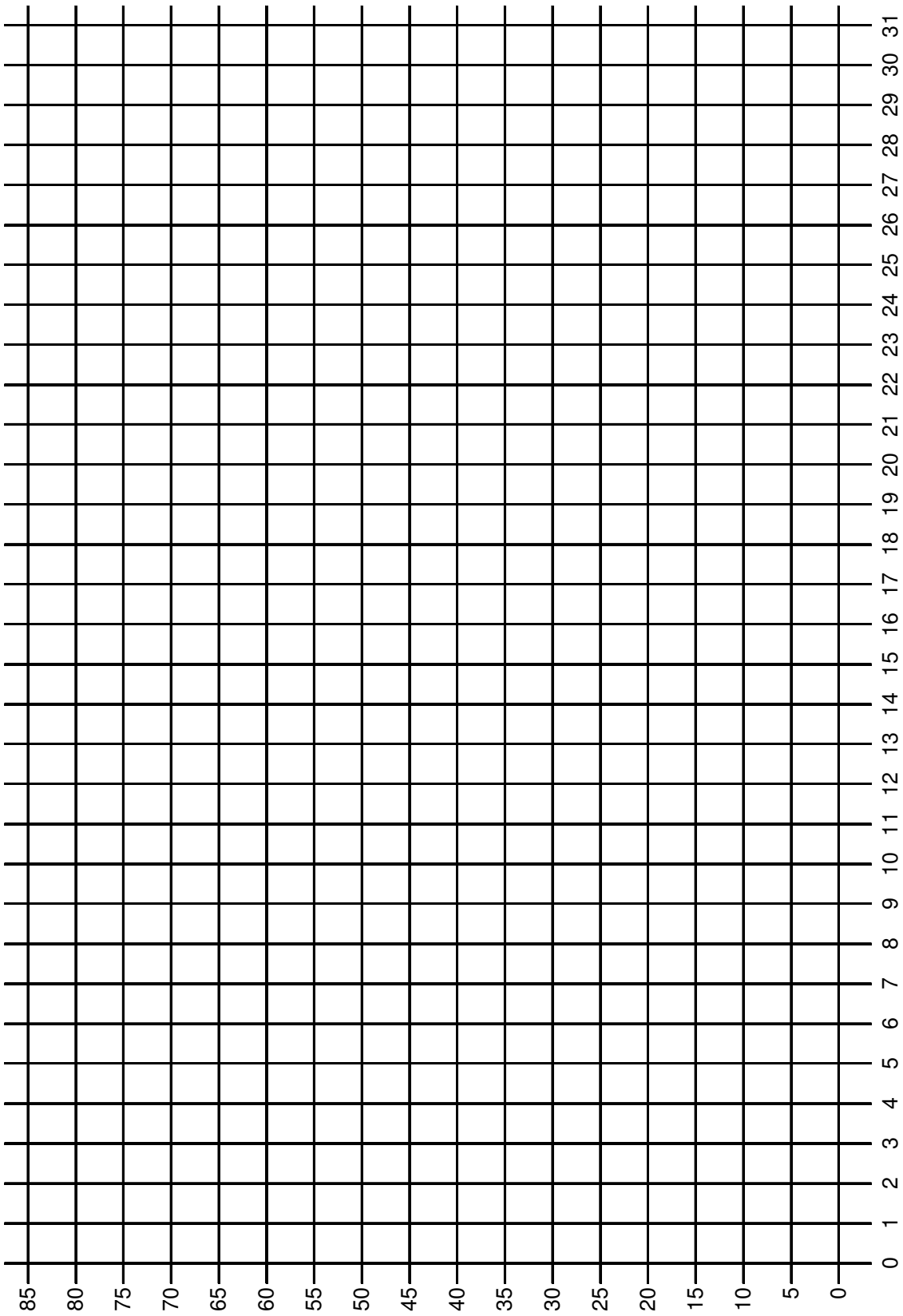
**What happened between the 9<sup>th</sup> and 26<sup>th</sup>?**

**What happened on the 14<sup>th</sup> ?**

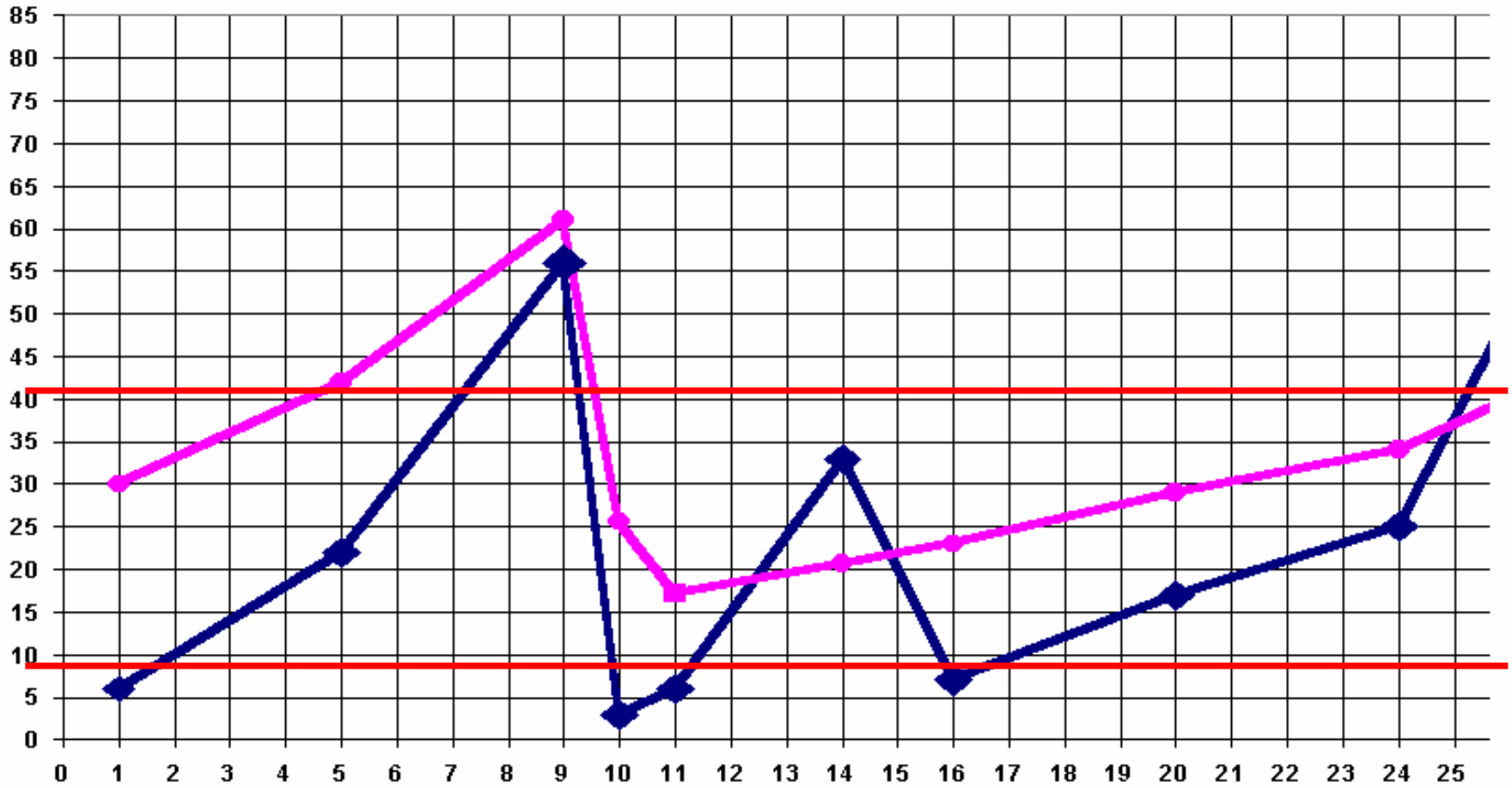
**What happened between the 24<sup>th</sup> and the 28<sup>th</sup> ?**



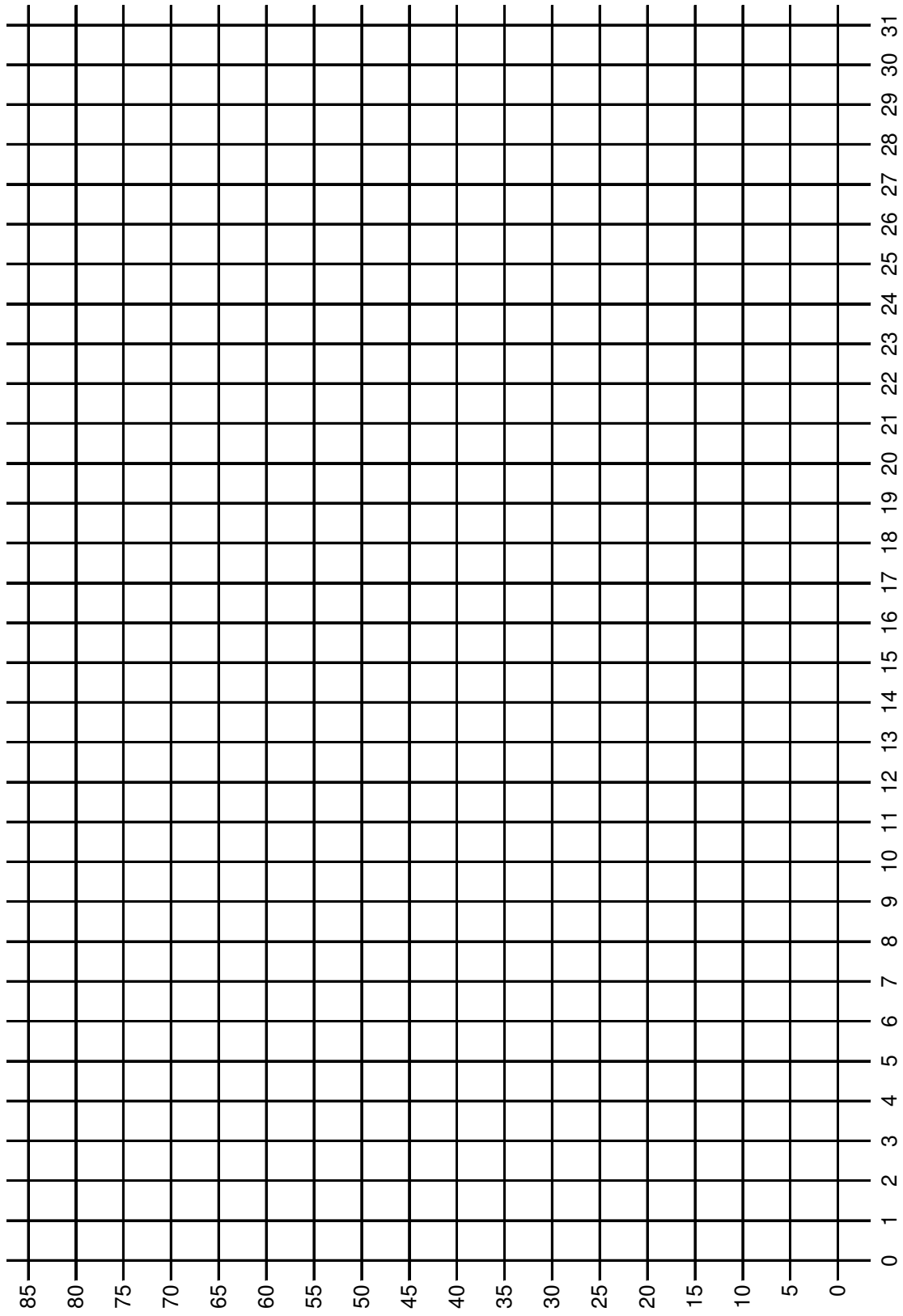
**Blank chart for plotting data.**



Answer Sheet for Activity 3 (Part 2)



**Blank chart for plotting data.**





## Activity 4: Water Budgeting

### Annual Crops

Dusty Fields grows **20 hectares** of pasture in the Top block, and **8 hectares** of melons in the North Block. Pasture requires **10 ML /ha** to grow each season while melons uses **5 ML/ha** annually. His allocation is **70 ML**. Rainfall (median year figures) in his area is **240 mm** for the season. The Top block uses a Centre Pivot System with an estimated efficiency of **85%**. The maize uses his old solid set irrigation system with an estimated efficiency of **65%**.

For calculation purposes, percentages are written in their decimal form. That is, the lateral move system efficiency of 85% is written in the calculation as 0.85

Complete the following Water Budget for Dusty Fields.

**Table 2: Crop water budgets**

Crop	Area (Ha)	Annual Crop Water Use (ML)	Irrigation system efficiency (%)*	Total water required by crop (ML)
A	B	C	D	$B \times C \div D$
Melons				
Pasture				
Total Water Required				

\* Note: percentages may be written as a decimal, for example 65% may be written as 0.65

**Table 3: Total Available water Budget for crop**

Estimated Rainfall (mm)	Rainfall volume (ML/ha)	Irrigated Area (Ha)	Total Rain $B \times C$	Allocation	WATER AVAILABLE TO CROP
A	$(A \div 100)$	C	D	E	$(D + E)$

**Note: Converting rainfall volume into Megalitres, we divide by 100. 1 ML spread over 1 hectare equals a water depth of 100 mm**

Discussion:

Would you be over committed or under-committed? That is How much do you need (Table 2) compared to how much you have available (Table 3)?

What changes could be made?

Discuss what would happen if your allocation were reduced by 50%.

## *Perennial Crops*

Dusty's sister, Heather, runs an irrigation farm supplied by an unregulated river in the Wokalup region. She grows **10 Ha** of Mandarins using a Drip irrigation system. Calculate Heather's water budget for a median (**Decile 5**) year and a dry year (**Decile 1**).

Rainfall from BOM website for Heather's area.

**Table 4: Wokalup Weather station Information**

Month	Decile 5	Decile 1	ET <sub>o</sub>
<b>July</b>	178.2	105.6	55.3
<b>August</b>	132.1	68.3	65.9
<b>September</b>	90.7	46.8	81.6
<b>October</b>	55.4	22.8	115.9
<b>November</b>	30.4	11.6	153.0
<b>December</b>	9.6	1.6	205.5
<b>January</b>	3.4	0.0	239.8
<b>February</b>	6.6	0.0	212.0
<b>March</b>	13.0	1.4	179.2
<b>April</b>	48.6	8.6	109.7
<b>May</b>	133.5	58.3	71.1
<b>June</b>	187.1	106.3	53.6

**Table 5: K<sub>c</sub> factors for Mandarins grown in Wokalup**

Month	K <sub>c</sub>
July	0.7
August	0.7
September	0.7
October	0.7
November	0.7
December	0.7
January	0.7
February	0.7
March	0.7
April	0.7
May	0.7
June	0.7

Table 8: Irrigation Requirements in a Decile 5 and Decile 1 Year for the Mandarin Orchard

Month	Rainfall					Crop Water Use			Irrigation		
	Decile 5 Rainfall	Decile1 Rainfall	Effective rainfall Fraction	Effective rain Decile 5	Effective rain Decile 1	ETo	Kc	ETcrop	Irrigation requirement Decile 5 mm/ha	Irrigation requirement Decile 1 mm/ha	
	mm	mm		mm	mm	mm		mm	mm/ha	mm/ha	
Data source	Table 4	Table 4	Table 6	A x C	B x C	Table 4	Table 7	F x G	H - D	H - E	
	A	B	C	D	E	F	G	H	K	L	
July	178.2	105.6	0.60	106.9	63.4	55.3	0.70	38.7	0	0	
August	132.1	68.3	0.60	79.3	41.0	65.9	0.70	46.1	0	5.1	
September	90.7	46.8	0.60	54.4	28.1	81.6	0.70	57.1	2.7	29.0	
October	55.4	22.8	0.60	33.2	13.7	115.9	0.70	81.1	47.9	67.4	
November	30.4	11.6	0.60	18.2	7.0	153.0	0.70	107.1	88.9	100.1	
December	9.6	1.6	0	0	0	205.5	0.70	143.9	143.9	143.9	
January	3.4	0	0	0	0	239.8	0.70	167.9	167.9	167.9	
February	6.6	0	0	0	0	212.0	0.70	148.4	148.4	148.4	
March	16.0	1.4	0	0	0	179.2	0.70	125.4	125.4	125.4	
April	48.6	8.6	0.45	21.9	3.9	109.7	0.70	76.8	54.9	72.9	
May	133.5	58.3	0.50	66.7	29.2	71.1	0.70	49.8	0	20.6	
June	187.1	106.3	0.60	112.6	63.8	53.6	0.70	37.5	0	0	
									<b>Total</b>	<b>780 mm/ha</b>	<b>881 mm/ha</b>

Note: 100 mm covering 1 Ha is equivalent to 1 Megalitre

***Convert Irrigation Requirement into ML by dividing the Total by 100***

***Decile 5 Irrigation Requirement***

$$\begin{aligned} 780 \text{ mm} & \div 100 \\ & = 7.8 \text{ ML} \end{aligned}$$

***Decile 5 year water budget is 7.8 ML / Hectare***

***Total irrigation requirement Decile 5 = Irrigation requirement x area***

$$\begin{aligned} & = 7.8 \times 10 \\ & = 78 \text{ ML} \end{aligned}$$

***Decile 1 Irrigation Requirement***

***Convert Irrigation Requirement into ML by dividing the Total by 100***

$$\begin{aligned} 881 \text{ mm} & \div 100 \\ & = 8.81 \text{ ML} \end{aligned}$$

***Decile 1 year water budget is 8.81 ML / Hectare***

***Total irrigation requirement Decile 1 = Irrigation requirement x area***

$$\begin{aligned} & = 8.81 \times 10 \\ & = 88.1 \text{ ML} \end{aligned}$$



Rainfall						Crop Water Use			Irrigation	
Month	Decile 5 Rainfall mm	Decile 1 Rainfall mm	Effective Rainfall factor	Effective rain Decile 5 mm	Effective rain Decile 1 mm	Evap mm	Kc	ETcro p mm	Irrigation requirement Decile 5 mm/ha	Irrigation requirement Decile 1 mm/ha
Data Source	Table 4	Table 4	A x C		B x C	Table 4	Table 7	F x G	H - D	H - E
	A	B	C	D	E	F	G	H	K	L
July			0.6							
August			0.7							
September			0.8							
October			0.8							
November			0.9							
December			0							
January			0							
February			0							
March			0							
April			0.9							
May			0.9							
June			0.7							
<b>Total</b>									m/ha	mm/ha

Rainfall						Crop Water Use			Irrigation	
Month	Decile 5 Rainfall mm	Decile 1 Rainfall mm	Effective Rainfall factor	Effective rain Decile 5 mm	Effective rain Decile 1 mm	Evap mm	Kc	ETcrop mm	Irrigation requirement Decile 5 mm/ha	Irrigation requirement Decile 1 mm/ha
Data Source	Table 4	Table 4	A x C		B x C	Table 4	Table 7	F x G	H - D	H - E
	A	B	C	D	E	F	G	H	K	L
July			0.6							
August			0.7							
September			0.8							
October			0.8							
November			0.9							
December			0							
January			0							
February			0							
March			0							
April			0.9							
May			0.9							
June			0.7							
<b>Total</b>									m/ha	mm/ha

Rainfall						Crop Water Use			Irrigation	
Month	Decile 5 Rainfall mm	Decile 1 Rainfall mm	Effective Rainfall factor	Effective rain Decile 5 mm	Effective rain Decile 1 mm	Evap mm	Kc	ETcrop mm	Irrigation requirement Decile 5 mm/ha	Irrigation requirement Decile 1 mm/ha
Data Source	Table 4	Table 4	A x C	B x C	Table 4	Table 7	F x G	H - D	H - E	
	A	B	C	D	E	F	G	H	K	L
July			0.6							
August			0.7							
September			0.8							
October			0.8							
November			0.9							
December			0							
January			0							
February			0							
March			0							
April			0.9							
May			0.9							
June			0.7							
<b>Total</b>									m/ha	mm/ha



## Activity 5: Irrigation Benchmarking

What are your performance measurements that make up your Irrigation Benchmarking?

List the aspects of your enterprise that you would measure to use as your personal benchmarks.

---

---

---

---

---

Which aspects would you compare in order to develop your Key Performance indicators (KPI'S?)

---

---

---

---

---

---

Complete the following irrigation benchmarking sheets for your own enterprise, and bring in your results to the final workshop on Planning.

## IRRIGATION BENCHMARKING

Grower name:				
Crop/unit surveyed:				
Application rate				
Average RAW for area		mm		
Total area of crop		ha		
<b>Year</b>	<b>1998–99</b>	<b>1999–2000</b>	<b>2000–01</b>	<b>2001 – 02</b>
Season rainfall				
Seasonal water use (ML/ha)				
Yield (tonnes/ha)				
Measure of quality (if applicable)				
Gross return				

Measurements of your total farm production are also useful.

### Farm Benchmark

<b>Year</b>	<b>1998–99</b>	<b>1999–2000</b>	<b>2000–01</b>	<b>2001 – 02</b>
Yield				
Seasonal water use				
Gross Production				

Property name			
<b>Soil Information:</b>	Soil type		
	RAW		
<b>Agronomic Information</b>	Area of crop		ha
	Variety/s		
	Planting date/		
	Plant density		
	Harvest date/s		
	Yield		
	Discount		\$/
	Gross return		

What factors, if any, do you feel increased yield? (for example, fertiliser use)

---

What factors if any do you feel reduced yield? (for example, pests, lack of water, waterlogging)

---



---



---

**Summary details**

Season rain	mm
Storm water harvested	ML
Irrigation water supplied to farm	ML
Tail water recycled	ML
Soil water at the start of the season	mm
Soil water at the end of the season	mm
Crop evapotranspiration	mm