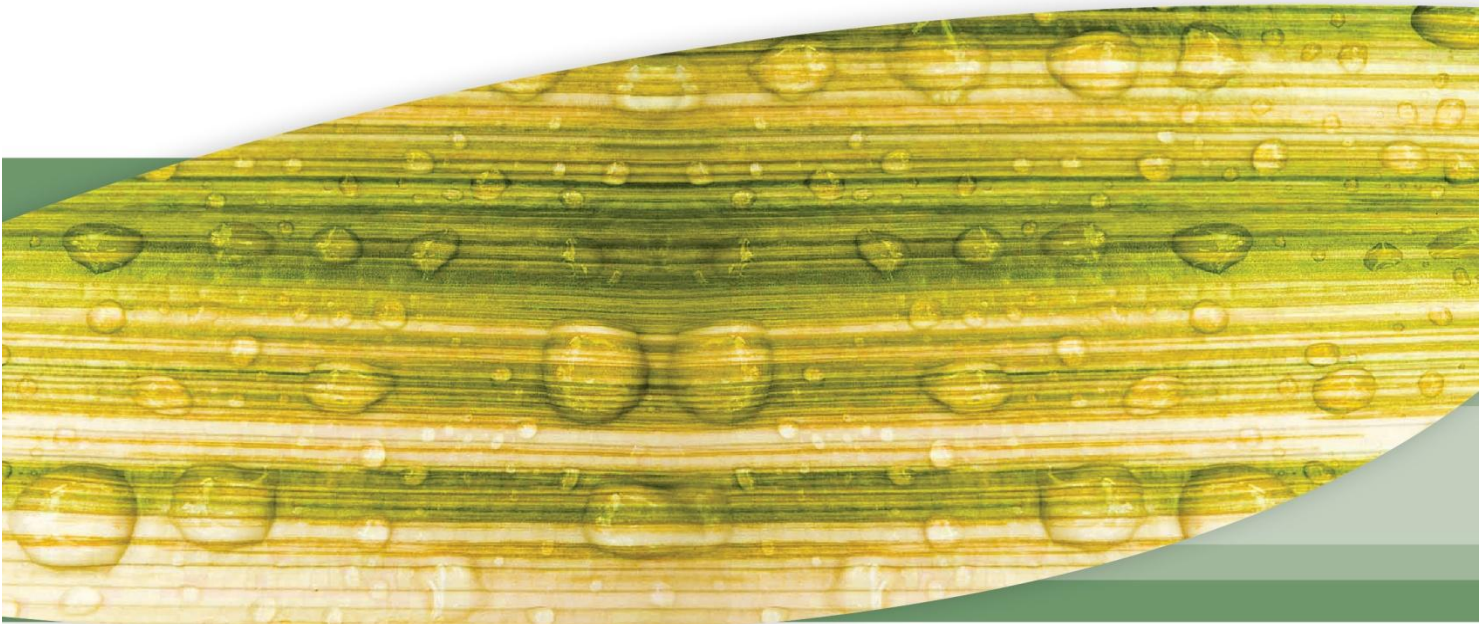


WATER MANAGEMENT ASSESSMENT



CARING FOR OUR COUNTRY



Acknowledgments

This assessment has been conducted and developed by Perth Region NRM with the Department of Water (WA) funded ***Water efficiency in wine and table grape production in the Swan Valley*** project. This project also provided funding for the ***Water management for wine grapes in a drying environment*** booklet which will provide background information to complement these assessments and provide a better understanding of water management concepts for wine grape producers.

The vineyard assessments for wine grape producers within this project are co - funded by the Grape Wine Research Development Corporation (GWRDC).

This project is supported by the Wine Industry Association of WA, Swan Valley and Regional Wine Industry Association, Swan Valley Table Grape Association and DAFWA.

Assessment details

Landholder and contact person: Derek Pearse

Address: 77 Memorial Avenue, Baskerville WA 6056

Assessors: David Gibb, Water Wise on the Farm / PRNRM & Keith Pekin, Wine Industry Association WA / PRNRM.

Date of Assessment: 17th December 2010

Irrigation system details

- Irrigation System: Drip line
- Dripline Make: Plastro
- Dripline Model: Hydro PC ND 16mm
- Dripper Flow: 3.75L/hr
- Dripper spacing: 1.0m
- Pressure range: 50 to 350kPa (7 to 50psi)
- Field Pressure: 160kPa (23psi)

Vineyard details

- Lateral/Row Spacing: 3m
- Vine Spacing: 1.8m
- Trellis height: 2.0m

Soil Details:

Physical evidence suggests that the soil types across the property are silty / loamy in nature with small areas of lighter/sandy soil.

Soil cores were taken in the Shiraz block (block 7) to a depth of 60cm. The soil was a consistent colour to a depth of 60cm.

**Field Texture:**

Clay Loam to 60cm (strongly coherent and plastic bolus, smooth to manipulate). Approx 25% clay, 50% silt, 25% sand).

Soil Readily Available Water (RAW):

65mm/m @ -60kPa tension. -60kPa is how dry the rootzone should get between irrigations under 'no stress' conditions. This can only be gauged with tensiometers or gypsum blocks.

Rootzone depth:

Soil core and pit evidence indicates the majority of the feeder roots are within 0-40cm layer around the dripline but anecdotal evidence suggests in loamy soil, roots can be found at 0.8m to 1m deep.

Rootzone RAW: 0 to 0.8m - 65mm/m X 0.8m = 52mm

52mm of Readily Available Water is available to the vines in the rootzone.

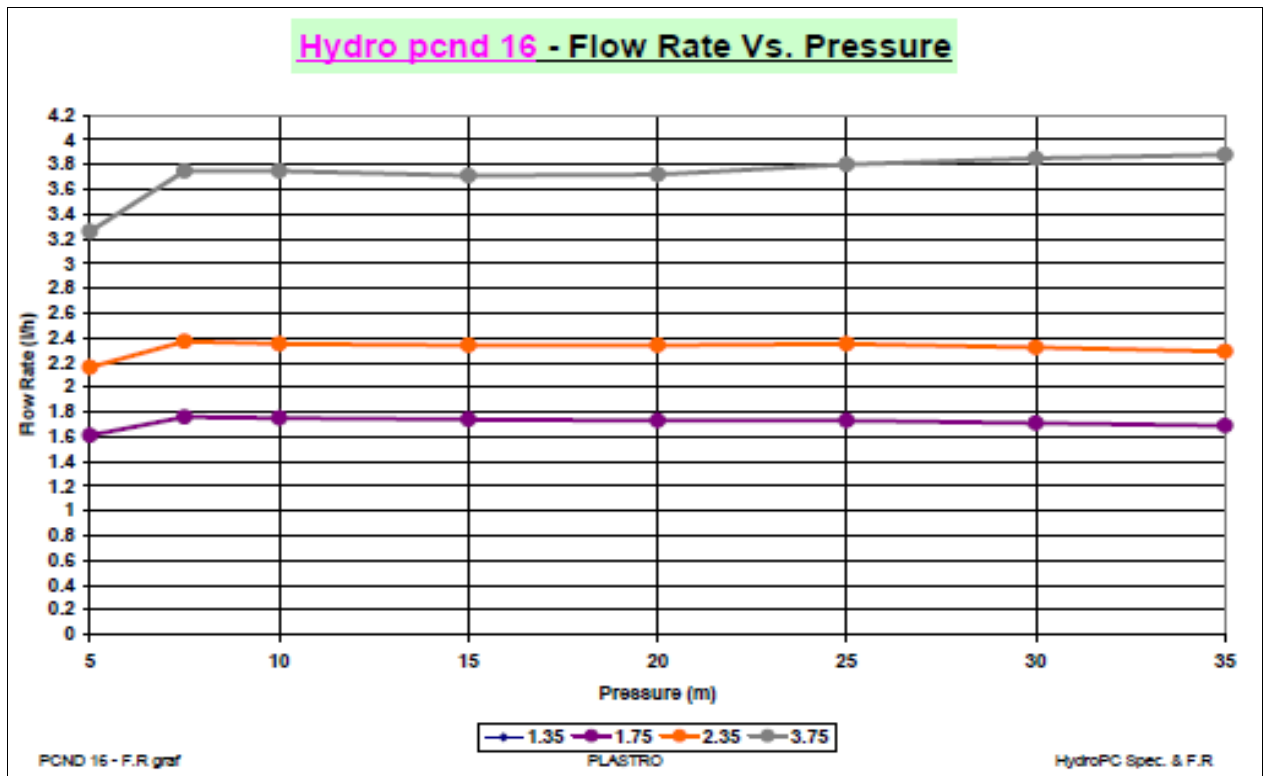
Deficit Available Water (DAW):

DAW is the water that is held between -60 to -200kPa and is less easily extracted by the vines and the vine is likely to experience some degree of water stress. The suction (pressure) at which stress is imposed changes with soil texture and is approximately -200kPa for loamy/clay loam soils.

At -200kPa tension (stress) there is approximately 103mm/m of water available to the vines. But with a rootzone of 0.8m: 0.8m x 103mm/m = 82mm of water available in the rootzone.

The difference between 82mm and 52mm is the DAW.

82mm - 52mm = **30mm of Deficit Available Water in the rootzone.**



System Performance (drip assessment data)

Dripline evaluation involves a series of containers placed under the drippers for a set time. Drippers were chosen at random from 4 dripline laterals. 16 dripper samples were taken and results are tabled below.

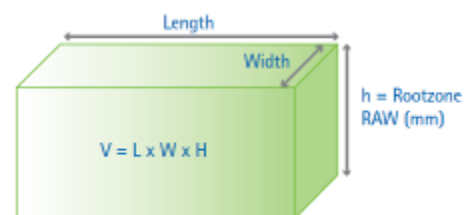


Average wetted area per vine:

The wetting patterns from 16 random drippers were measured and an average was calculated.

The dripper wetting pattern was overlapping (see picture) so the calculation is based on an area of a rectangle.

The average wetted area was 1.0m wide (0.5m either side of the dripper) and the wetting patterns joined to form a continuous wetted strip along the vine row. The wetted area for 1 dripper is: $3.14 \times (0.5 \times 0.5) = 0.8\text{m}^2$. With a dripper spacing of 1m and a vine spacing of 1.8m, each vine has access to water from 1.8 drippers.



To be precise, the wetted area per vine equals 1.44m^2 , based on 0.8m^2 for the wetted area for 1 dripper. If the wetting pattern forms a continuous wetted strip (assumption) then the wetted area would be 1.8m^2 . For the remainder of the report, 1.44m^2 will be used as the wetted area figure.

In line pressure:

The inline pressure at the end of the lateral was approx 160kPa. 160kPa is within the standard operating range of the dripline.



Dripline Catch Cup Analysis:

Containers were placed under the 16 drippers for 1 minute each. The amount in millilitres was recorded and multiplied by 60 to receive flow in L/hour.

For example: if 52mL was collected in 1 minute then the calculation would be: $0.052\text{mL} \times 60\text{mins} = 3.12\text{L/hour}$.

Lateral 1	Lateral 2	Lateral 3	Lateral 4
3.2	3.9	4.2	4.0
4.1	3.7	3.8	4.5
4.2	3.7	4.0	3.9
4.2	3.9	4.2	4.4

Results in Litres per hour. Red numbers indicate lowest 4 drippers.

Average Output Rate:

The average output rate is calculated by adding the total output of the drippers (63.9L), then dividing this by the number of drippers tested (16) = 4.0L/hour . Each vine has access to 1.8 drippers so the dripper output rate per vine is 7.2L/hour .

Mean Application Rate (MAR):

1mm of irrigation equals 1L spread over 1m^2 . For wine grape production, the MAR equals;

$$\text{MAR (mm/hour)} = \text{Average Output Rate} \div (\text{row spacing} \div \text{emitter spacing})$$

$$4 \div (3 \div 1) = 1.33 \text{ mm/hour}$$

The MAR is useful to know and can be used for irrigation scheduling. L/vine can also be used for scheduling irrigations and is useful to know for total water use over an irrigation station or when practicing RDI schedules.

Distribution Uniformity (DU_{LQ}):

DU looks at how even the water is applied through the drippers. DU_{LQ} is defined as the average water applied to the driest 25% of the irrigated area, divided by the average water applied to the irrigated area.

$$DU_{LQ} = \text{Average LQ cans} \div \text{Average Output Rate} \times 100$$

$$3.63 \div 4.03 \times 100 = 90\%$$

A DU of 90% shows that there is not much difference between the driest areas and the areas that receive the average irrigation amounts. A new drip system should have a DU of 95% and the area tested is slightly below that figure.

The drippers are delivering slightly more (4.0L/hour) than the spec of 3.75L/hour. Anecdotal evidence suggests that the drip line in the vineyard may be different to the spare

Crop Water Requirements & Irrigation Scheduling

The following dot points list some of the ways to schedule irrigations;

- soil based methods
- tree based methods and
- weather based methods

These can all be used as a guide for when and how much irrigation to apply.

Soil Water Reserve after winter rainfall:

$$L/\text{vine} = (\text{row spacing}/3) \times \text{vine spacing} \times (\text{RAW} + \text{DAW})$$

$$L/\text{vine} = 1 \times 1.8 \times 82 = 148L/\text{vine}$$

Soil Water Reserves with no stress:

$$L/\text{vine} (\text{no stress}) = \text{wetted area} \times \text{RAW}$$

$$L/\text{vine} (\text{no stress}) = 1.8\text{m}^2 \times 52\text{mm} = 93L/\text{vine}$$

Soil Water Reserves with RDI schedule:

$$L/\text{vine} (\text{RDI}) = \text{wetted area} \times (\text{RAW} + \text{DAW} \div 2)$$

$$L/\text{vine} (\text{RDI}) = 1.8\text{m}^2 \times (52\text{mm} + 30\text{mm} \div 2) = 73.8L/\text{vine}$$

Recommended Weather Based Method:

There is a good correlation between plant water requirements and evaporation. A crop factor applies a certain percentage of the water that would be lost from an evaporation pan (open water surface). For example, a crop factor of 0.2 means applying 20% of the water lost by evaporation from an

evaporation pan. Different crop factors are used at different vine growth stages to supply the appropriate amount of water for that growth stage

Vine Water Requirement:

Plant water requirement (mm) = Evaporation (mm) x crop factor

Example: Take an average summer day of 10mm of evaporation in January and the crop factor of 0.2

Vine water requirement = 10mm x 0.2 = 2 mm/day

If the soil profile or the rootzone needs to be filled (eg expected hot weather) then irrigations should not be scheduled each day but split over two to three applications per week.

How long to irrigate?

Depending on dripper spacing, each vine has access to a number of drippers along the drip line. In your vineyard, each vine has access to 1.8 drippers per vine.

L/vine/hour = 1.8 drippers x 4.0L/hr = 7.2 L/vine/hour

Runtime (mins) = crop water requirement ÷ L/vine/hour x 60mins

= 2mm ÷ 1.33mm/hour x 60mins = 90mins irrigation/day

If possible, use tensiometers or gypsum blocks. Your soil should be saturated at 5 to 8kPa and irrigations should commence again when reading reaches 60kpa (no stress) and 150-200kPa for RDI schedules and stop when levels reach field capacity.

Please see attached Irrigation Schedule for monthly irrigation figures.

Use the irrigation schedule as a guide to finetune your runtimes in conjunction with your tensiometers or gypsum blocks.

Water Budget:

The water budget was produced based on 1ha and from 1851 vines/hectare.

Local evaporation was sourced from historical data from Swan Research Station and Perth Airport Weather Stations.

Rainfall data was sourced from Bureau of Meteorology Perth Airport weather station.

The Department of Agriculture and Food developed a *Wine Grape Irrigation Calculator/Spreadsheet program* which can calculate suggested irrigation runtimes and water use figures for wine grapes in different growing regions and soils. This calculator is very useful and should be used to guide irrigations throughout the growth stages of the vines.

Please see attached irrigation summary for Shiraz, Merlot, Cabernet Sauvignon, Chardonnay and Verdelho.

Based on varieties grown and the area covered, an approximate irrigation usage in kilolitres can be calculated.

Variety	Estimated Irrigation use (kL/ha)	Hectares under vine	Estimated Irrigation use in kL	Litres/vine/year
Shiraz	1,050	1.62	1701	566
Merlot	1,050	0.34	357	566
Verdelho	880	0.43	378	474
Chardonnay	1,030	3.53	3635	555
Cabernet Sauvignon	1,090	1.08	1177	589
total		7.00	7248	

Based on a 3000kL/ha/year crop water allocation rate, your groundwater allocation should be approximately 21,000kL.

Notes

- Investigate the lateral movement of water from the dripline. Estimates were taken in the vineyard from only 2 locations. You may find lateral movement variations in areas of different soil texture.
- Dripline maintenance – you have a high DU of 90% and a relatively even flow from the drippers. It is important to keep this stable. Even flows from the dripline is important if you fertigate, this will ensure equal amounts of nutrients to the plants.
- The drippers are delivering slightly more (4.0L/hour) than the spec of 3.75L/hour. The dripline is pressure compensated and should deliver a flow of 3.75L/hour.
- Use tensiometers or gypsum blocks to assist you with scheduling irrigations. Make sure that if you have a 60cm tensiometer that you subtract 6 cbars/kPa from the reading, eg if the reading on the 60cm tensiometer is 60 cbar then your reading is actually 54 cbar. For the 15cm tensiometer, subtract 1.5 cbars from the reading.
- If dry conditions are forecast at flowering and soil moisture levels are low then irrigations will need to commence early to ensure that the vines have readily available water during this growth stage.

***This audit was conducted at one location on the property and is representative of the system in the general area. System performance can change over irrigation blocks / stations so it is recommended that more than one system check be performed.

For more information please contact

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Irrigation System Performance Evaluation

Drip Systems



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CONTACT INFORMATION

Business:	Upper Reach Winery	Email:	derek@upperreach.com.au
Contact:	Derek Pearse	Mobile:	0412 403 362
Property Address:	77 Memorial Avenue, Baskerville WA 6056	Phone:	

SYSTEM SPECIFICATIONS

Emitter Make:	Plastro	Test Location:	Block 7
Emitter Model:	Hydro PC ND	Crop/s Grown:	Shiraz
Nominal Output:	3.75 L/hr @ 100 kPa	Crop Water Allocation:	3,000 kL/ha/year
Lateral Length:	122 metres	Total Irrigated Area:	0.9 hectares
Lateral Spacing:	3 metres	Theoretical Water Entitlement:	2,640 kL/year
No. Laterals / Station:		Notes/Comments 0.88ha of shiraz grown in block 7. possibly netafim dripline in this block too.	
No. Laterals / Bed or Tree Row:	1		

ADDITIONAL DETAILS

TEST PARAMETERS

Test Date:	3 December 2010
Number Containers Used for Test *:	16
Number of Low Quarter Containers:	4
No. Emitters Each Plant Can Access*:	1.8
Emitter Spacing Along Laterals (m)*:	1

* Denotes required fields

PRESSURE

FLOW

	LOCATION	p (kPa)	LOCATION	Q (L/hr)
1	end of line 114	165		
2				
3				
4				
	Test Average	165	Test Average	#DIV/0!
	Test Midpoint	165	Test Midpoint	0.0
	Variation (±%)	0.0	Variations (±%)	#DIV/0!

TABLE 1. OVERLAPPING DRIPPERS

WETTED STRIP WIDTH	1	metres
AVERAGE WETTED AREA	1.00	m ²

IMPORTANT: Determine whether the wetted area from your drippers are 'overlapping' (ie. the wetted areas bleed into each other), or whether the drippers produce individual circles (ie. 'non-overlapping'). Enter data into one table only

TABLE 2. NON-OVERLAPPING DRIPPERS

DIAMETER OF WETTED CIRCLES (m)					AVERAGE WIDTH (m)	AVERAGE WETTED AREA	
Lateral	Emitter A	Emitter B	Emitter C	Emitter D			
1	0				0.00	0.00	m ²
2							
3							
4							

DRIPPER OUTPUT DATA

LATERAL	DRIPPER	TIME CAN PLACED	TIME CAN REMOVED	CATCH TIME (mins)	VOLUME (L)	OUTPUT RATE (L/hr)
1	1A	9:01	9:02	1	0.053	3.18
	1B	9:02	9:03	1	0.069	4.14
	1C	9:03	9:04	1	0.070	4.20
	1D	9:04	9:05	1	0.070	4.20
2	2A	9:05	9:06	1	0.066	3.96
	2B	9:06	9:07	1	0.063	3.78
	2C	9:07	9:08	1	0.062	3.72
	2D	9:08	9:09	1	0.066	3.96
3	3A	9:09	9:10	1	0.071	4.26
	3B	9:10	9:11	1	0.067	4.02
	3C	9:11	9:12	1	0.064	3.84
	3D	9:12	9:13	1	0.070	4.20
4	4A	9:13	9:14	1	0.074	4.44
	4B	9:14	9:15	1	0.066	3.96
	4C	9:15	9:16	1	0.076	4.56
	4D	9:16	9:17	1	0.068	4.08

DISTRIBUTION & SCHEDULING SUMMARY

Average Dripper Output Rate	4.03	L/hour
DU _{95%} (average output rate)	3.63	L/hour
Average Deviation (output rate)	0.23	L/hour
Mean Application Rate (MAR)	4.0	mm/hour
DU _{95%} (average application rate)	3.6	mm/hour
Distribution Uniformity (DU)	90.0%	
Coefficient of Uniformity (CU)	94.3%	

RUNTIME CALCULATOR

Soil Readily Available Water (RAW)*		mm/metre
Effective Rooting Depth*		metres
Rootzone Readily Available Water	0.0	millimetres
Runtime to Refill Depleted RZ RAW	0	minutes
Rootzone RAW Refill (DU% adjusted)	0	minutes
EVAPORATION (mm/period)		
CROP FACTOR	0.3	
CWR (mm)		3.6
Approx. System Runtime	30	minutes
DU% Adjusted Runtime	33	minutes
Irrigation (ie. CWR) Split Over	#DIV/0!	Shift/s

Disclaimer: These results are representative of the system's operating characteristics at the time and location of testing. The results do not necessarily reflect the performance of the system across other valves/stations. It is recommended that system runtimes are validated in-field using appropriate soil moisture monitoring equipment.

Irrigation Management Recommendations

Upper Reach Summary

Region	Swan
Variety	Cabernet Sauvignon
Irrigation block	Blocks 4-5
Soil type	Red brown loamy earth

Upper Reach Irrigation Summary

Irrigation system application rate (litres/hour/vine)	7.25
Irrigation system application rate (mm/hour)	1.34
Litres per vine per year	589
Yearly water use (megalitres/hectare)	1.09
Irrigation should commence	Start December

Recommendations Table

11-Jan-11

Month	Vine growth stage	Irrigation strategy	Crop factor	Long term average daily evaporation (mm/day)	Daily vineyard water use (mm/day)	Long term average rainfall (mm/day)	Daily vineyard irrigation (mm)	Daily vineyard irrigation (l/vine/day)	Days between irrigation	Hours per irrigation	Preferred irrigation interval (days)	Hours per irrigation (preferred)
Start August		0	0	2.5	0.0	3.8	-1.9	-10.3				
Mid August		0	0	2.7	0.0	3.1	-1.6	-8.4				
Start September		0	0	3.0	0.0	2.6	-1.3	-6.9				
Mid September	Bud Burst	no stress	0.1	3.6	0.4	2.0	-0.7	-3.6				
Start October		no stress	0.1	4.4	0.4	1.6	-0.3	-1.8				
Mid October		no stress	0.1	5.2	0.5	1.2	-0.1	-0.3				
Start November		no stress	0.1	7.2	0.7	0.9	0.3	1.5				
Mid November		no stress	0.1	7.2	0.7	0.6	0.4	2.1				
Start December	Flowering	no stress	0.1	8.1	0.8	0.4	0.6	3.2	24	11.0	4	1.8
Mid December	Fruit set	RDI	0.1	8.9	0.9	0.3	0.7	4.0	6	3.4	4	2.3
Start January		RDI	0.1	9.8	1.0	0.3	0.8	4.4	5	3.2	3	1.9
Mid January	Verasion	no stress	0.15	10.0	1.5	0.4	1.3	7.1	11	11.3	3	3.1
Start February		no stress	0.15	9.4	1.4	0.6	1.1	6.1	12	10.6	3	2.7
Mid February		no stress	0.15	8.8	1.3	0.6	1.0	5.5	14	11.1	3	2.4
Start March	Harvest	no stress	0.1	7.8	0.8	0.4	0.6	3.1	24	10.6	3	1.3
Mid March		no stress	0.1	6.8	0.7	0.6	0.4	2.0	37	10.8	3	0.9
Start April		no stress	0.1	5.5	0.6	1.0	0.0	0.2	319	10.8	3	0.1
Mid April		no stress	0.1	4.5	0.5	1.7	-0.4	-2.0			3	-0.9
Start May		no stress	0.1	3.3	0.3	2.7	-1.0	-5.4				

Upper Reach Summary

Region	Swan
Variety	Chardonnay
Irrigation block	Blocks 1, 2, 3, 4
Soil type	Red brown loamy earth

Upper Reach Irrigation Summary

Irrigation system application rate (litres/hour/vine)	7.25
Irrigation system application rate (mm/hour)	1.34
Litres per vine per year	555
Yearly water use (megalitres/hectare)	1.03
Irrigation should commence	Start December

Recommendations Table

11-Jan-11

Month	Vine growth stage	Irrigation strategy	Crop factor	Long term average daily evaporation (mm/day)	Daily vineyard water use (mm/day)	Long term average rainfall (mm/day)	Daily vineyard irrigation (mm)	Daily vineyard irrigation (l/vine/day)	Days between irrigation	Hours per irrigation	Preferred irrigation interval (days)	Hours per irrigation (preferred)
Start August		0	0	2.5	0.0	3.8	-1.9	-10.3				
Mid August		0	0	2.7	0.0	3.1	-1.6	-8.4				
Start September	Bud Burst	no stress	0.1	3.0	0.3	2.6	-1.0	-5.3				
Mid September		no stress	0.1	3.6	0.4	2.0	-0.7	-3.6				
Start October		no stress	0.1	4.4	0.4	1.6	-0.3	-1.8				
Mid October		no stress	0.1	5.2	0.5	1.2	-0.1	-0.3				
Start November	Flowering	no stress	0.1	7.2	0.7	0.9	0.3	1.5				
Mid November	Fruit set	RDI	0.1	7.2	0.7	0.6	0.4	2.1				
Start December		RDI	0.1	8.1	0.8	0.4	0.6	3.2	7	3.2	4	1.8
Mid December		RDI	0.1	8.9	0.9	0.3	0.7	4.0	6	3.4	4	2.3
Start January	Verasion	no stress	0.2	9.8	1.5	0.3	1.3	7.1	11	11.3	3	3.1
Mid January		no stress	0.15	10.0	1.5	0.4	1.3	7.1	11	11.3	3	3.1
Start February	Harvest	no stress	0.1	9.4	0.9	0.6	0.7	3.6	21	10.9	3	1.6
Mid February		no stress	0.1	8.8	0.9	0.6	0.6	3.1	24	10.8	3	1.4
Start March		no stress	0.1	7.8	0.8	0.4	0.6	3.1	24	10.6	3	1.3
Mid March		no stress	0.1	6.8	0.7	0.6	0.4	2.0	37	10.8	3	0.9
Start April		no stress	0.1	5.5	0.6	1.0	0.0	0.2	319	10.8	3	0.1
Mid April		no stress	0.1	4.5	0.5	1.7	-0.4	-2.0			3	-0.9
Start May	Verasion	no stress	0.1	3.3	0.3	2.7	-1.0	-5.4				

Upper Reach Summary

Region	Swan
Variety	Shiraz
Irrigation block	Block 7
Soil type	Red brown loamy earth

Upper Reach Irrigation Summary

Irrigation system application rate (litres/hour/vine)	7.25
Irrigation system application rate (mm/hour)	1.34
Litres per vine per year	566
Yearly water use (megalitres/hectare)	1.05
Irrigation should commence	Mid December

Recommendations Table

11-Jan-11

Month	Vine growth stage	Irrigation strategy	Crop factor	Long term average daily evaporation (mm/day)	Daily vineyard water use (mm/day)	Long term average rainfall (mm/day)	Daily vineyard irrigation (mm)	Daily vineyard irrigation (l/vine/day)	Days between irrigation	Hours per irrigation	Preferred irrigation interval (days)	Hours per irrigation (preferred)
Start August		0	0	2.5	0.0	3.8	-1.9	-10.3				
Mid August		0	0	2.7	0.0	3.1	-1.6	-8.4				
Start September		0	0	3.0	0.0	2.6	-1.3	-6.9				
Mid September	Bud Burst	no stress	0	3.6	0.0	2.0	-1.0	-5.5				
Start October		no stress	0	4.4	0.0	1.6	-0.8	-4.2				
Mid October		no stress	0	5.2	0.0	1.2	-0.6	-3.2				
Start November		no stress	0	7.2	0.0	0.9	-0.4	-2.4				
Mid November	Flowering	no stress	0.1	7.2	0.7	0.6	0.4	2.1				
Start December	Fruit set	RDI	0.1	8.1	0.8	0.4	0.6	3.2				
Mid December		RDI	0.1	8.9	0.9	0.3	0.7	4.0	6	3.4	4	2.3
Start January		RDI	0.1	9.8	1.0	0.3	0.8	4.4	5	3.2	4	2.6
Mid January	Verasion	no stress	0.15	10.0	1.5	0.4	1.3	7.1	11	11.3	3	3.1
Start February		no stress	0.15	9.4	1.4	0.6	1.1	6.1	12	10.6	3	2.7
Mid February		no stress	0.15	8.8	1.3	0.6	1.0	5.5	14	11.1	3	2.4
Start March	Harvest	no stress	0.1	7.8	0.8	0.4	0.6	3.1	24	10.6	3	1.3
Mid March		no stress	0.1	6.8	0.7	0.6	0.4	2.0	37	10.8	3	0.9
Start April		no stress	0.1	5.5	0.6	1.0	0.0	0.2	319	10.8	3	0.1
Mid April		no stress	0.1	4.5	0.5	1.7	-0.4	-2.0			4	-1.2
Start May		no stress	0.1	3.3	0.3	2.7	-1.0	-5.4				

Upper Reach Summary

Region	Swan
Variety	Merlot
Irrigation block	Block 9
Soil type	Red brown loamy earth

Upper Reach Irrigation Summary

Irrigation system application rate (litres/hour/vine)	7.25
Irrigation system application rate (mm/hour)	1.34
Litres per vine per year	566
Yearly water use (megalitres/hectare)	1.05
Irrigation should commence	Mid December

Recommendations Table

11-Jan-11

Month	Vine growth stage	Irrigation strategy	Crop factor	Long term average daily evaporation (mm/day)	Daily vineyard water use (mm/day)	Long term average rainfall (mm/day)	Daily vineyard irrigation (mm)	Daily vineyard irrigation (l/vine/day)	Days between irrigation	Hours per irrigation	Preferred irrigation interval (days)	Hours per irrigation (preferred)
Start August			0	2.5	0.0	3.8	-1.9	-10.3				
Mid August			0	2.7	0.0	3.1	-1.6	-8.4				
Start September			0	3.0	0.0	2.6	-1.3	-6.9				
Mid September	Bud Burst	no stress	0	3.6	0.0	2.0	-1.0	-5.5				
Start October		no stress	0	4.4	0.0	1.6	-0.8	-4.2				
Mid October		no stress	0	5.2	0.0	1.2	-0.6	-3.2				
Start November		no stress	0	7.2	0.0	0.9	-0.4	-2.4				
Mid November	Flowering	no stress	0.1	7.2	0.7	0.6	0.4	2.1				
Start December	Fruit set	RDI	0.1	8.1	0.8	0.4	0.6	3.2				
Mid December		RDI	0.1	8.9	0.9	0.3	0.7	4.0	6	3.4	4	2.3
Start January		RDI	0.1	9.8	1.0	0.3	0.8	4.4	5	3.2	4	2.6
Mid January	Verasion	no stress	0.15	10.0	1.5	0.4	1.3	7.1	11	11.3	3	3.1
Start February		no stress	0.15	9.4	1.4	0.6	1.1	6.1	12	10.6	3	2.7
Mid February		no stress	0.15	8.8	1.3	0.6	1.0	5.5	14	11.1	3	2.4
Start March	Harvest	no stress	0.1	7.8	0.8	0.4	0.6	3.1	24	10.6	3	1.3
Mid March		no stress	0.1	6.8	0.7	0.6	0.4	2.0	37	10.8	3	0.9
Start April		no stress	0.1	5.5	0.6	1.0	0.0	0.2	319	10.8	3	0.1
Mid April		no stress	0.1	4.5	0.5	1.7	-0.4	-2.0			4	-1.2
Start May		no stress	0.1	3.3	0.3	2.7	-1.0	-5.4				

Upper Reach Summary

Region	Swan
Variety	Verdelho
Irrigation block	Block 2
Soil type	Red brown loamy earth

Upper Reach Irrigation Summary

Irrigation system application rate (litres/hour/vine)	7.25
Irrigation system application rate (mm/hour)	1.34
Litres per vine per year	474
Yearly water use (megalitres/hectare)	0.88
Irrigation should commence	Start December

Recommendations Table

11-Jan-11

Month	Vine growth stage	Irrigation strategy	Crop factor	Long term average daily evaporation (mm/day)	Daily vineyard water use (mm/day)	Long term average rainfall (mm/day)	Daily vineyard irrigation (mm)	Daily vineyard irrigation (l/vine/day)	Days between irrigation	Hours per irrigation	Preferred irrigation interval (days)	Hours per irrigation (preferred)
Start August			0	2.5	0.0	3.8	-1.9	-10.3				
Mid August			0	2.7	0.0	3.1	-1.6	-8.4				
Start September	Bud Burst	no stress	0.1	3.0	0.3	2.6	-1.0	-5.3				
Mid September		no stress	0.1	3.6	0.4	2.0	-0.7	-3.6				
Start October		no stress	0.1	4.4	0.4	1.6	-0.3	-1.8				
Mid October		no stress	0.1	5.2	0.5	1.2	-0.1	-0.3				
Start November	Flowering	no stress	0.1	7.2	0.7	0.9	0.3	1.5				
Mid November	Fruit set	RDI	0.1	7.2	0.7	0.6	0.4	2.1				
Start December		RDI	0.1	8.1	0.8	0.4	0.6	3.2	7	3.2	4	1.8
Mid December		RDI	0.1	8.9	0.9	0.3	0.7	4.0	6	3.4	4	2.3
Start January	Verasion	no stress	0.1	9.8	1.0	0.3	0.8	4.4	17	10.9	3	1.9
Mid January		no stress	0.1	10.0	1.0	0.4	0.8	4.4	17	10.8	3	1.9
Start February	Harvest	no stress	0.1	9.4	0.9	0.6	0.7	3.6	21	10.9	3	1.6
Mid February		no stress	0.1	8.8	0.9	0.6	0.6	3.1	24	10.8	3	1.4
Start March		no stress	0.1	7.8	0.8	0.4	0.6	3.1	24	10.6	3	1.3
Mid March		no stress	0.1	6.8	0.7	0.6	0.4	2.0	37	10.8	3	0.9
Start April		no stress	0.1	5.5	0.6	1.0	0.0	0.2	319	10.8	3	0.1
Mid April		no stress	0.1	4.5	0.5	1.7	-0.4	-2.0			3	-0.9
Start May	Verasion	no stress	0.1	3.3	0.3	2.7	-1.0	-5.4				