**Assessing A20 permit applications for onsite wastewater management systems**

Training for Council Officers

**Checking the Calculations**



## Checking the calculations

- In a typical LCA there are several calculations which need to be checked
  - Design flow rate (daily hydraulic load)
  - System sizing
    - Hydraulic equation (loading rate method)
    - Water and nutrient balance
    - Setback (buffer) distance estimation using a risk-based approach (refer to Section 6)



## Design flow rate

- Refer to the Guideline for onsite wastewater management (GOWM; Section 4.2)
- Households with reticulated water and WELS fixtures and fittings 150 L/person/day
- Households with roof tank water supply and WELS fixtures and fittings 120 L/person/day
- Check, or be reasonably satisfied, that these WELS fixtures and fittings have been/will be installed



## Design flow rate

- Higher rates for households with standard water fixtures
- Occupancy (persons) based on number of bedrooms + 1, i.e. 3 bedrooms = 4 persons
- Remember to consider other rooms that can be potentially converted to bedrooms
- Reconcile with potable water meter or flow meter data, if available



## Non-domestic premises

- Occupancy of short term rental premises is often higher than domestic (i.e. two persons per bedroom)
- Non-domestic premises really require metered data – always require installation of a meter and reporting of water usage data
- May have to design on usage data from similar premises or refer Table 4-4 in GOWM
- Consider organic loads



## Design flow rate

- What is the design flow rate for a five bedroom house with WELS fixtures and fittings on reticulated water supply?
- Five bedrooms
- Occupancy (five bedrooms + 1) = 6 persons
- 150 Litres/person/day
- 6 x 150 = 900 Litres/day

## Design flow rate

- What is an appropriate design flow rate for a four bedroom Airbnb property with WELS fixtures and fittings on reticulated water supply?
- Four bedrooms
- Occupancy (four bedrooms x 2) = 8 persons
- 150 Litres/person/day
- 8 x 150 = 1,200 Litres/day



## Water and nutrient balances

- MAV VLCAF water and nutrient balances available at:

https://www.mav.asn.au/what-we-do/policy-advocacy/environment-water/on-site-domestic-wastewater-management

- See large format versions following at end of Section



Victorian Land Capability Assessment Framework

Please read the attached notes before using this spreadsheet

**Irrigation area sizing using Nominated Area Water Balance & Storage Calculations**

| | | | | |
|---|---|---|---|---|
| **Site Address:** | | **Lot 585 Bundalaguah Road, Maffra** | | |
| **Date:** | | | **Assessor:** | |
| **INPUT DATA** | | | | |
| Design Wastewater Flow | Q | 750 | L/day | Based on maximum potential occupancy and derived from Table 4 in the EPA Code of Practice (2013) |
| Design Irrigation Rate | DIR | 3.5 | mm/day | Based on soil texture class/permeability and derived from Table 9 in the EPA Code of Practice (2013) |
| Nominated Land Application Area | L | 267 | m² | |
| Crop Factor | C | 0.6-0.8 | unitless | Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type[2] |
| Rainfall Runoff Factor | RF | 1 | unitless | Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff |
| Mean Monthly Rainfall Data | | East Sale Airport (085072) | | BoM Station and number |
| Mean Monthly Pan Evaporation Data | | East Sale Airport (085072) | | BoM Station and number |

| Parameter | Symbol | Formula | Units | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Days in month | D | | days | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | 365 |
| Rainfall | R | | mm/month | 45.4 | 42.5 | 48.9 | 48.2 | 51.7 | 45.7 | 41.4 | 46 | 51.7 | 58.1 | 63.8 | 54.3 | 597.7 |
| Evaporation | E | | mm/month | 198.4 | 162.4 | 136.4 | 87 | 52.7 | 42 | 46.5 | 65.1 | 93 | 124 | 153 | 186 | 1346.5 |
| Crop Factor | C | | unitless | 0.80 | 0.80 | 0.70 | 0.70 | 0.60 | 0.60 | 0.60 | 0.60 | 0.70 | 0.80 | 0.80 | 0.80 | |
| **OUTPUTS** | | | | | | | | | | | | | | | | |
| Evapotranspiration | ET | ExC | mm/month | 159 | 130 | 95 | 61 | 32 | 25 | 28 | 39 | 65 | 99 | 122 | 149 | 1004.3 |
| Percolation | B | DIRxD | mm/month | 108.5 | 98 | 108.5 | 105.0 | 108.5 | 105.0 | 108.5 | 108.5 | 105.0 | 108.5 | 105.0 | 108.5 | 1277.2 |
| Outputs | | ET+B | mm/month | 267.4 | 227.92 | 204.5 | 165.9 | 140.1 | 130.2 | 136.4 | 147.6 | 170.1 | 207.7 | 227.4 | 257.3 | 2281.6 |
| **INPUTS** | | | | | | | | | | | | | | | | |
| Retained Rainfall | RR | RxRF | mm/month | 45.4 | 42.5 | 48.9 | 48.2 | 51.7 | 45.7 | 41.4 | 46 | 51.7 | 58.1 | 63.8 | 54.3 | 597.7 |
| Applied Effluent | W | (QxD)/L | mm/month | 87.1 | 78.7 | 87.1 | 84.3 | 87.1 | 84.3 | 87.1 | 87.1 | 84.3 | 87.1 | 84.3 | 87.1 | 1025.3 |
| Inputs | | RR+W | mm/month | 132.5 | 121.2 | 136.0 | 132.5 | 138.8 | 130.0 | 128.5 | 133.1 | 136.0 | 145.2 | 148.1 | 141.4 | 1623.0 |
| **STORAGE CALCULATION** | | | | | | | | | | | | | | | | |
| Storage remaining from previous month | | | mm/month | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Storage for the month | S | (RR+W)-(ET+B) | mm/month | -134.7 | -106.8 | -68.0 | -33.4 | -1.3 | -0.2 | -7.9 | -14.5 | -34.1 | -62.5 | -79.3 | -115.9 | |
| Cumulative Storage | M | | mm | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Maximum Storage for Nominated Area | N | | mm | 135 | | | | | | | | | | | | |
| | | Mat. | L | 0 | | | | | | | | | | | | |
| **LAND AREA REQUIRED FOR ZERO STORAGE** | | | m² | 166 | 113 | 150 | 191 | 263 | 266 | 245 | 229 | 190 | 155 | 138 | 115 | |
| **MINIMUM AREA REQUIRED FOR ZERO STORAGE:** | | | | 267.0 | m² | | | | | | | | | | | |

**CELLS**

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| | Please enter data in blue cells |
| XX | Red cells are automatically populated by the spreadsheet |
| XX | Data in yellow cells is calculated by the spreadsheet, DO NOT ALTER THESE CELLS |

**NOTES**

This value should be the largest of the following: land application area required based on the most limiting nutrient balance or minimum area required for zero storage

Values selected are suitable for pasture grass in Victoria



Victorian Land Capability Assessment Framework

Please read the attached notes before using this spreadsheet

**Nutrient Balance**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Site Address:** | **Lot 585 Bundalaguah Road, Maffra** | | | | | | |
| **SUMMARY - LAND APPLICATION AREA REQUIRED BASED ON MOST LIMITING NUTRIENT BALANCE** | | | | | | 249 | m² |
| **INPUT DATA[1]** | | | | | | | |
| **Wastewater Loading** | | | | **Nutrient Crop Uptake** | | | |
| Hydraulic Load | 750 | L/day | Crop N Uptake | 220 | kg/ha/yr | which equals 60.27 | mg/m²/day |
| Effluent N Concentration | 25 | mg/L | | | | | |
| % N Lost to Soil Processes (Geary & Gardner 1996) | 0.2 | Decimal | | | | | |
| Total N Loss to Soil | 3750 | mg/day | | | | | |
| Remaining N Load after soil loss | 15000 | mg/day | | | | | |

**NUTRIENT BALANCE BASED ON ANNUAL CROP UPTAKE RATES**

| **Minimum Area required with zero buffer** | | | **Determination of Buffer Zone Size for a Nominated Land Application Area (LAA)** | | |
|---|---|---|---|---|---|
| Nitrogen | 249 | m² | Nominated LAA Size | 267 | m² |
| | | | Predicted N Export from LAA | -0.40 | kg/year |
| | | | Minimum Buffer Required for excess nutrient | 9 | m² |

**CELLS**

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**NOTES**

[1] Model sensitivity to input parameters will affect the accuracy of the result obtained. Where possible site specific data should be used. Otherwise data should be obtained from a reliable source such as:

- *EPA Guidelines for Effluent Irrigation*
- *Appropriate Peer Reviewed Papers*
- *Environment and Health Protection Guidelines: Onsite Sewage Management for Single Households*
- *USEPA Onsite Systems Manual*



## Water and nutrient balances

- Water and nutrient balances require the use of information (data) on:
  - Soil characteristics
  - Site characteristics
  - Vegetation type (of the irrigation area)
  - Local climate
- Important that the above data is representative of the design site



## Water balance data required

- To complete a water balance, the following input data is required:
  - Design flow rate (Q)
  - Design Irrigation Rate (DIR) for soil
  - Crop factor (C)
  - Rainfall runoff factor (RF)
  - Rainfall data (mean or median)
  - Evaporation data (mean)

## Design Irrigation Rate (DIR)

- Design Irrigation Rate obtained from:
  - Table 4.9 (GOWM)
  - Table M1 (AS/NZS 1547:2012)
- DIR needs to be appropriate for soil
- Based on limiting layer within 0.6m of point of application, i.e. at depth of:
  - 0.6m for surface irrigation
  - 0.7 - 0.75m for subsurface irrigation
- Therefore, most commonly should be based on subsoil, not topsoil
- May need to adjust for slope (Table M2 AS1547)



## Crop factor (C)

- Table 21 in GOWM suggests crop factors from EPA VIC Publication 168 (1983)

Table 21: Monthly crop factors[6]

| Vegetation type | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pasture | 0.70 | 0.70 | 0.70 | 0.60 | 0.50 | 0.45 | 0.40 | 0.45 | 0.55 | 0.65 | 0.70 | 0.70 |
| Lucerne | 0.95 | 0.90 | 0.85 | 0.80 | 0.70 | 0.55 | 0.55 | 0.65 | 0.75 | 0.85 | 0.95 | 1.00 |

- These differ from those in the MAV VLCAF spreadsheet

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pasture | 0.80 | 0.80 | 0.70 | 0.70 | 0.60 | 0.60 | 0.60 | 6.00 | 0.70 | 0.80 | 0.80 | 0.80 |



Victorian Land Capability Assessment Framework

Please read the attached notes before using this spreadsheet

**Irrigation area sizing using Nominated Area Water Balance & Storage Calculations**

| | | | | |
|---|---|---|---|---|
| **Site Address:** | | **Lot 585 Bundalaguah Road, Maffra** | | |
| **Date:** | | | **Assessor:** | |

**INPUT DATA**

| | | | | |
|---|---|---|---|---|
| Design Wastewater Flow | Q | 750 | L/day | Based on maximum potential occupancy and derived from Table 4 in the EPA Code of Practice (2013) |
| Design Irrigation Rate | DIR | 3.5 | mm/day | Based on soil texture class/permeability and derived from Table 9 in the EPA Code of Practice (2013) |
| Nominated Land Application Area | L | 288 | $m^2$ | |
| Crop Factor | C | 0.4-0.7 | unitless | Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type[5] |
| Rainfall Runoff Factor | RF | 1 | unitless | Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff |
| Mean Monthly Rainfall Data | | East Sale Airport (085072) | | BoM Station and number |
| Mean Monthly Pan Evaporation Data | | East Sale Airport (085072) | | BoM Station and number |

| Parameter | Symbol | Formula | Units | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Days in month | D | | days | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | 365 |
| Rainfall | R | | mm/month | 45.4 | 42.5 | 48.9 | 48.2 | 51.7 | 45.7 | 41.4 | 46 | 51.7 | 58.1 | 63.8 | 54.3 | 597.7 |
| Evaporation | E | | mm/month | 186.4 | 162.4 | 136.4 | 87 | 52.7 | 42 | 46.5 | 65.1 | 93 | 124 | 153 | 186 | 1340.5 |
| Crop Factor | C | | unitless | 0.70 | 0.70 | 0.70 | 0.60 | 0.50 | 0.45 | 0.40 | 0.45 | 0.55 | 0.65 | 0.70 | 0.70 | |
| **OUTPUTS** | | | | | | | | | | | | | | | | |
| Evapotranspiration | ET | ExC | mm/month | 139 | 114 | 95 | 52 | 26 | 19 | 19 | 29 | 51 | 81 | 107 | 130 | 862.435 |
| Percolation | B | DiRaD | mm/month | 108.5 | 98 | 108.5 | 105.0 | 108.5 | 105.0 | 108.5 | 108.5 | 105.0 | 108.5 | 105.0 | 108.5 | 1277.2 |
| Outputs | | ET+B | mm/month | 247.4 | 211.68 | 204.5 | 157.2 | 134.5 | 123.9 | 127.1 | 137.8 | 156.2 | 189.1 | 212.1 | 238.7 | 2139.5 |
| **INPUTS** | | | | | | | | | | | | | | | | |
| Retained Rainfall | RR | RxRF | mm/month | 45.4 | 42.5 | 48.9 | 48.2 | 51.7 | 45.7 | 41.4 | 46 | 51.7 | 58.1 | 63.8 | 54.3 | 597.7 |
| Applied Effluent | W | (QxD)/L | mm/month | 80.7 | 72.9 | 80.7 | 78.1 | 80.7 | 78.1 | 80.7 | 80.7 | 78.1 | 80.7 | 78.1 | 80.7 | 950.5 |
| Inputs | | RR+W | mm/month | 126.1 | 115.4 | 129.6 | 126.3 | 132.4 | 123.8 | 122.1 | 126.7 | 129.8 | 138.8 | 141.9 | 135.0 | 1548.2 |
| **STORAGE CALCULATION** | | | | | | | | | | | | | | | | |
| Storage remaining from previous month | | | mm/month | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Storage for the month | S | (RR+W)-(ET+B) | mm/month | -121.3 | -96.3 | -74.4 | -30.9 | -2.4 | -0.1 | -5.0 | -11.1 | -26.3 | -50.3 | -70.2 | -103.7 | |
| Cumulative Storage | M | | mm | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Maximum Storage for Nominated Area | N | | mm | | | | 0.0 | | | | | | | | | |
| | Rec | | mm | | | | 0 | | | | | | | | | |
| **LAND AREA REQUIRED FOR ZERO STORAGE** | | | $m^2$ | 115 | 124 | 150 | 206 | 280 | 268 | 271 | 253 | 215 | 177 | 152 | 126 | |
| **MINIMUM AREA REQUIRED FOR ZERO STORAGE:** | | | $m^2$ | | | | 288.5 | | | | | | | | | |

**CELLS**

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**NOTES**

This value should be the largest of the following: land application area required based on the most limiting nutrient balance or minimum area required for zero storage

Values selected are suitable for pasture grass in Victoria



## Crop factor (C)

- GOWM crop factor data increases required irrigation area in MAV VLCAF spreadsheet example from 267m$^2$ to 288m$^2$
- By comparison, the same irrigation area calculated using the hydraulic equation A = Q / DIR

A = 750 Litres/day / 3.5 mm/day (L/m$^2$/d) = 215m$^2$



## Rainfall runoff factor (RF)

- Retained rainfall is the proportion of rainfall that will percolate into the soil
- The VLCAF water balance spreadsheet assumes that all rainfall will percolate into the soil, hence the default value for the rainfall runoff factor (RF) is 1.0
- Where the ground surface is inclined or mounded, some rainfall may be assumed to run off
  - Flat ground with sandy soil, RF = 1.0
  - Sloping ground with clay soil, RF = 0.75



## Rainfall runoff factor (RF)

- Implications of changing RF value from 1.0 to 0.75 for same soil
- Required irrigation area:

  for RF = 1.0 is 288m$^2$

  for RF = 0.75 is 252m$^2$
- Although this was a locked cell in the MAV VLCAF spreadsheet, modified spreadsheets with this cell open to alteration are not uncommonly used
- Any alteration of RF needs justification

Victorian Land Capability Assessment Framework

Please read the attached notes before using this spreadsheet

**Irrigation area sizing using Nominated Area Water Balance & Storage Calculations**

| | | | |
|---|---|---|---|
| Site Address: | Lot 585 Bundalaguah Road, Maffra | | |
| Date: | | Assessor: | |

**INPUT DATA**

| | | | | |
|---|---|---|---|---|
| Design Wastewater Flow | Q | 750 | L/day | Based on maximum potential occupancy and derived from Table 4 in the EPA Code of Practice (2013) |
| Design Irrigation Rate | DIR | 3.5 | mm/day | Based on soil texture class/permeability and derived from Table 9 in the EPA Code of Practice (2013) |
| Nominated Land Application Area | L | 243 | $m^2$ | |
| Crop Factor | C | 0.4-0.7 | unitless | Estimates evapotranspiration as a fraction of pan evaporation; varies with season and crop type[2] |
| Rainfall Runoff Factor | RF | 0.75 | unitless | Proportion of rainfall that remains onsite and infiltrates, allowing for any runoff |
| Mean Monthly Rainfall Data | East Sale Airport (085072) | | | BoM Station and number |
| Mean Monthly Pan Evaporation Data | East Sale Airport (085072) | | | BoM Station and number |

| Parameter | Symbol | Formula | Units | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Days in month | D | | days | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | 365 |
| Rainfall | R | | mm/month | 45.4 | 42.5 | 48.9 | 48.2 | 51.7 | 45.7 | 41.4 | 46 | 51.7 | 58.1 | 63.8 | 54.3 | 597.7 |
| Evaporation | E | | mm/month | 198.4 | 162.4 | 138.4 | 87 | 52.7 | 42 | 46.5 | 65.1 | 93 | 124 | 153 | 186 | 1346.5 |
| Crop Factor | C | | unitless | 0.70 | 0.70 | 0.70 | 0.69 | 0.59 | 0.45 | 0.40 | 0.45 | 0.55 | 0.65 | 0.70 | 0.70 | |
| **OUTPUTS** | | | | | | | | | | | | | | | | |
| Evapotranspiration | ET | ExC | mm/month | 139 | 114 | 95 | 52 | 26 | 19 | 19 | 29 | 51 | 81 | 107 | 130 | 862.435 |
| Percolation | B | DIR≥D | mm/month | 108.5 | 98 | 108.5 | 105.0 | 108.5 | 105.0 | 108.5 | 108.5 | 105.0 | 108.5 | 105.0 | 108.5 | 1277.0 |
| Outputs | | ET+B | mm/month | 247.4 | 211.68 | 204.0 | 157.2 | 134.9 | 123.9 | 127.1 | 137.6 | 156.2 | 189.1 | 212.1 | 238.7 | 2139.5 |
| **INPUTS** | | | | | | | | | | | | | | | | |
| Retained Rainfall | RR | RxRF | mm/month | 34.05 | 31.875 | 36.675 | 36.15 | 38.775 | 34.275 | 31.05 | 34.5 | 38.775 | 43.575 | 47.85 | 40.725 | 448.275 |
| Applied Effluent | W | (Q×D)/L | mm/month | 92.3 | 83.3 | 92.3 | 89.3 | 92.3 | 89.3 | 92.3 | 92.3 | 89.3 | 92.3 | 89.3 | 92.3 | 1086.3 |
| Inputs | | RR+W | mm/month | 126.3 | 115.2 | 128.9 | 125.4 | 131.0 | 123.6 | 123.3 | 126.8 | 128.1 | 135.8 | 137.1 | 133.0 | 1534.6 |
| **STORAGE CALCULATION** | | | | | | | | | | | | | | | | |
| Storage remaining from previous month | | | mm/month | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Storage for the month | S | (RR+W)-(ET+B) | mm/month | -121.1 | -96.5 | -75.0 | -31.8 | -3.8 | -0.3 | -3.8 | -11.0 | -28.1 | -53.3 | -75.0 | -105.7 | |
| Cumulative Storage | M | | mm | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Maximum Storage for Nominated Area | N | | mm | 0.0 | | | | | | | | | | | | |
| | | | ML | 0.0 | | | | | | | | | | | | |
| **LAND AREA REQUIRED FOR ZERO STORAGE** | | | $m^2$ | 169 | 117 | 139 | 186 | 242 | 251 | 242 | 225 | 192 | 160 | 137 | 117 | |
| **MINIMUM AREA REQUIRED FOR ZERO STORAGE:** | | | | 252.0 | $m^2$ | | | | | | | | | | | |

**CELLS**

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| | Please enter data in blue cells |
| XX | Red cells are automatically populated by the spreadsheet |
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**NOTES**

This value should be the largest of the following: land application area required based on the most limiting nutrient balance or minimum area required for zero storage

Values selected are suitable for pasture grass in Victoria



## Rainfall data

- MAV VLCAF spreadsheet example uses mean rainfall data, but VLCAF indicates that Councils may require use of other data sets, e.g. 50th percentile (median) etc.
- EDRS Guideline (Section 4.4.2.1) recommends use of 50th percentile (median) data

| Site name: | EAST SALE | | Site number: | 085072 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Statistics | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
| Rainfall | | | | | | | | | | | | | |
| Mean rainfall (mm) | 45.1 | 40.6 | 48.7 | 48.5 | 49.6 | 47.3 | 40.2 | 46 | 49.3 | 58.6 | 63.3 | 55.7 | 592.9 |
| Decile 5 (median) rainfall (mm) | 39.4 | 32.2 | 39.6 | 40.1 | 34.6 | 39 | 31.4 | 42.2 | 47 | 53.3 | 55.6 | 46.8 | 595.6 |



## Rainfall data

- The median is the preferred measure of 'typical' rainfall from the meteorological point of view. An extreme rainfall event will have less effect on the median than the mean
- The use of higher percentiles is ‘not recommended’ (EDRS Guideline)
- Check to see if rainfall data being used is representative of Site
- Minimum 30-year recent data record important (beware closed station data)



## Rainfall data

- Median monthly rainfall data should be obtained from the closest rainfall station available on the Bureau of Meteorology (BoM) website:

http://www.bom.gov.au/climate/data/index.shtml?bookmark=200

- If local data from a Bureau of Meteorology station is not available, can use SILO:

https://www.longpaddock.qld.gov.au/silo/



## Evaporation data

- The mean daily evaporation data (if available) can also be obtained from the closest climate station available on the Bureau of Meteorology website:

http://www.bom.gov.au/climate/data/index.shtml?bookmark=200

- Mean monthly evaporation data is also available from SILO:

https://www.longpaddock.qld.gov.au/silo/



## SILO – Locality Data

- Mean and median monthly rainfall data and mean monthly evaporation data, suitable for use in and for checking water balance calculations, are tabulated and presented at the end of Section 4
- If using VLCAF spreadsheet remember to convert SILO mean monthly evaporation data to daily data by dividing by the number of days in the month

## Water balances

- In some areas of Victoria, where there is heavy rainfall, e.g. Otways, Gippsland etc., or where there are number of successive months where rainfall exceeds evapotranspiration, water balances may indicate a requirement for very large irrigation areas, or may not resolve
- Reducing the DIR may help make them resolve, but generally results in very large area requirements



## Water balances

- Water balances can also be used:
  - to size trenches and beds
  - determine the extent to which trenches and beds will store effluent
  - to predict when they might surcharge
- Need to know void space ratio of the media in the trench or bed
  - use 0.3 (30%) for gravel and sand filled trenches or beds
  - can use a higher value 0.5 (50%) for arch trench



## Water balances

- Beware use of alternative water balances, often selected, or constructed, to achieve a desired outcome
- Commonly used to support an 'unsustainably small' irrigation area because conservative VLCAF water balance template recommends a larger irrigation area than desired or will fit on the lot
- Beware water balances using Seepage Loss (Peak) values > DIR. Need to reduce Seepage Loss (Peak) value until Mean Daily Seepage Loss = DIR



## Water balances

- All applications for Rhizopods should provide a water balance
- Water balances for Rhizopod LAA systems require careful scrutiny to ascertain how frequently pump outs will be required in both the establishment phase (first year or two) and over the longer term
- Are the number of pump outs required affordable / sustainable, and are the homeowners aware of the requirement and likely to comply with it?



## Water balances

- For larger, more complex and non-domestic designs, it may be necessary, or preferable, to use daily soil-water modelling tools such as MEDLI (v2.5)

https://science.desi.qld.gov.au/government/science-division/water-and-coastal/medli



## Nutrient balances

- Nutrient balances require data on:
  - effluent nutrient concentrations
  - crop nutrient uptake
- Appropriate effluent nutrient concentrations for Secondary (AWTS) treated effluent:
  - Nitrogen: 25 mg/L (range 20-50 mg/L)
  - Phosphorus: 10 mg/L (range 10-15 mg/L)
- MAV nutrient balance does not assess phosphorus, but remember that sandy soils adsorb little phosphorus (check P-sorption value used)

Victorian Land Capability Assessment Framework

Please read the attached notes before using this spreadsheet

**Nitrogen Balance**

**Site Address:** Lot 585 Bundalaguah Road, Maffra

**SUMMARY - LAND APPLICATION AREA REQUIRED BASED NITROGEN BALANCE** 249 $m^2$

**INPUT DATA**[1]

| Wastewater Loading | | | Nutrient Crop Uptake | | | | |
|---|---|---|---|---|---|---|---|
| Hydraulic Load | 750 | L/day | Crop N Uptake | 220 | kg/ha/yr | which equals | 60.27 | $mg/m^2/day$ |
| Effluent N Concentration | 25 | mg/L | | | | | |
| % N Lost to Soil Processes (Geary & Gardner 1996) | 0.2 | Decimal | | | | | |
| Total N Loss to Soil | 3750 | mg/day | | | | | |
| Remaining N Load after soil loss | 15000 | mg/day | | | | | |

**NITROGEN BALANCE BASED ON ANNUAL CROP UPTAKE RATES**

| Minimum Area required with zero buffer | | | Determination of Buffer Zone Size for a Nominated Land Application Area (LAA) | | |
|---|---|---|---|---|---|
| Nitrogen | 249 | $m^2$ | Nominated LAA Size | 267 | $m^2$ |
| | | | Predicted N Export from LAA | -0.40 | kg/year |
| | | | Minimum Buffer Required for excess nutrient | 0 | $m^2$ |

CELLS

| | |
|---|---|
| | Please enter data in blue cells |
| XX | Red cells are automatically populated by the spreadsheet |
| XX | Data in yellow cells is calculated by the spreadsheet, DO NOT ALTER THESE CELLS |

NOTES

[1] Model sensitivity to input parameters will affect the accuracy of the result obtained. Where possible site specific data should be used. Otherwise data should be obtained from a reliable source such as:

- *EPA Guidelines for Effluent Irrigation*
- *Appropriate Peer Reviewed Papers*
- *Environment and Health Protection Guidelines: Onsite Sewage Management for Single Households*
- *USEPA Onsite Systems Manual*



## Crop nutrient uptake

- Crop nutrient uptake values depend on the vegetation type
- Suitable crop nutrient uptake values for various vegetation types are listed in Table 22 of EDRS Guideline
- Typical crop uptake values adopted for nutrient balance calculations
  - Nitrogen 220-250 kg/ha/year
  - Phosphorus 20-30 kg/ha/year



## Water and nutrient balances

- It is a good idea for Councils to set up a water balance and nutrient balance with data appropriate for the Local Government Area
- This can then be used to readily check data provided with applications received



## Setback (buffer) distances

- Setback or buffer distances are distances of separation of OWMS from sensitive receptors, set to minimise potential environmental and public health risks
- Table 4-10 in the GOWM defines conservative minimum setback distances based on level of treatment (Primary, Secondary etc.)



## Setback (buffer) distances

- Alternative setback distances may be set where appropriate protections and controls can be demonstrated
- These can be set using a risk based approach such as that presented in Appendix R of AS/NZS1547:2012



## Appendix R AS/NZS 1547:2012

- Appendix R presents two tables
  - Table R1 Guidelines for Horizontal and Vertical Setback Distances, which identifies site features for which setback distance ranges are defined and relevant site constraint items of specific concern are listed
  - Table R2 Site Constraint Scale for Development of Setback Distances, which outlines a site constraint scale for development of setback distances

## Appendix R quantification

- For a particular site, relevant site features from Table R1 should be identified and listed
- For each relevant site feature, the range of constraint scales outlined in Table R2 should be considered and a determination made as to the level of constraint posed, in terms of the descriptors outlined in Table R2. The level of constraint should be described as Low, Moderate or High depending on the appropriate point on the scale



## Appendix R quantification

- A weighted 'Risk Rating' can then be determined for each site feature
- For all onsite wastewater system designs, all risks should be mitigated to a low level
- Appropriate setback distances are defined by selecting an appropriate point on the setback distance range for the level of risk
- Setback requirements are met if the required setback distance is available
- See worked example in Section 6