Design Basal Loading Rates (BLRs) [1]					
Soil Category	**Soil Texture**	**Soil Structure [2]**	**Indicative Permeability** (K_{sat}) (m/day)	**Indicative Drainage Class**	**Design BLR** (mm/day)
1	Gravel, sand, loamy sand, clayey sand	Massive	> 3.0	Rapidly drained	32
2	Sandy loam, fine sandy loam	Weak Massive	> 3.0 1.4 – 3.0	Well drained	24 24
3	Loam, silty loam, loam fine sandy	Moderate or strong Weak or massive	1.5 – 3.0 0.5 – 1.5	Moderately well drained	24 16
4	Clay loam, sandy clay loam, fine sandy clay loam, silty loam	Moderate or strong Weak Massive	0.5 – 1.5 0.12 – 0.5 0.06 – 0.12	Imperfectly drained	16 8 (see note 3)
5	Light clay, sandy clay	Strong Moderate Weak or massive	0.12 – 0.5 0.06 – 0.12 < 0.06	Poorly drained	8 (see note 3) (see note 3)
6	Medium to heavy clay	Strong Moderate Weak or massive	0.06 – 0.5 < 0.06 < 0.06	Very poorly drained	(see note 3) (see note 3) (see note 3)

NOTES:

1 The values in this table are adapted from Table N1 in AS/NZS 1547:2012

2 Structure classes are for soils with prismatic, blocky or granular structures. Soils with platy structures should be assumed to be “massive” for the purpose of assigning conservative BLRs.

3 The use of mounds on these soils requires careful investigation and design. Soil permeability should be tested and specific soils advice obtained, particularly in relation to soil amendment / improvement, design of the distribution system and landscaping on and around the mound. The acceptable BLR for such soils will normally be equal to or less than 5 mm/day and therefore mounds may not be suitable.

Design Linear Loading Rates (LLRs) (L/m/day) [1]

Soil Texture (Category)	Soil Structure [2]	Slope								
		<5%			5-10%			>10%		
		Depth of natural unsaturated soil (m)								
		0.2 to 0.3	0.31 to 0.6	> 0.61	0.2 to 0.3	0.31 to 0.6	> 0.61	0.2 to 0.3	0.31 to 0.6	> 0.61
Gravel and medium-coarse sand (Cat 1)	Structureless	50	62	75	62	75	87	75	87	99
Fine sand and loamy sand (Cat 1)	Structureless	43	56	68	50	62	75	62	75	87
Sandy loams (Cat 2)	Weakly structured	43	56	68	50	62	75	62	75	87
	Massive	37	43	50	45	51	57	62	75	87
Loams (Cat 3)	High/ moderate structured	41	47	53	45	51	57	48	55	61
	Weakly structured or massive	25	29	32	30	34	37	34	40	46
Clay loams (Cat 4)	High/ moderate structured	30	36	42	34	37	41	37	43	50
	Weakly structured	25	31	37	27	34	40	30	36	42
	Massive	(note 3)	(note 3)	(note 3)	(note 3)	(note 3)	(note 3)	(note 3)	(note 3)	(note 3)
Light clays (Cat 5)	Strongly structured	25	31	37	27	34	40	30	36	42
	Moderately structured	25	31	37	27	34	40	30	36	42
	Weakly structured or massive	(note 3)	(note 3)	(note 3)	(note 3)	(note 3)	(note 3)	(note 3)	(note 3)	(note 3)
Medium to heavy clays (Cat 6)	Strongly structured	25	31	37	27	34	40	30	36	42
	Moderately structured	25	31	37	27	34	40	30	36	42
	Weakly structured or massive	(note 3)	(note 3)	(note 3)	(note 3)	(note 3)	(note 3)	(note 3)	(note 3)	(note 3)

NOTES:

1 The values in this table are adapted from data contained in Tyler (2001). Data is based largely on the experience of designers in Australia and overseas and its accuracy has not yet been confirmed by scientific evaluation, field testing or otherwise. As such, LLR values should be selected with caution and with an appropriate factor of conservatism.

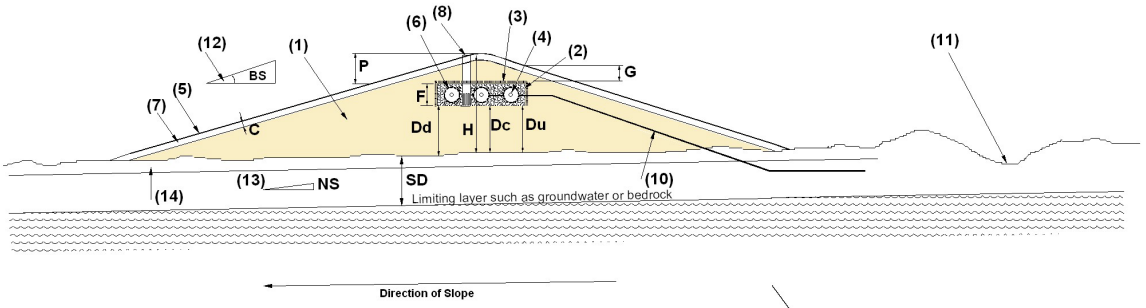
2 Structure classes are for soils with prismatic, blocky or granular structures. Soils with platy structures should be assumed to be “Massive” for the purpose of assigning conservative BLRs.

3 Indicative LLR values for these soils are not available. An experienced designer should select an appropriate, conservative LLR based on an appraisal of the site drainage characteristics. The LLR for such soils should not exceed 30 L/m/day.

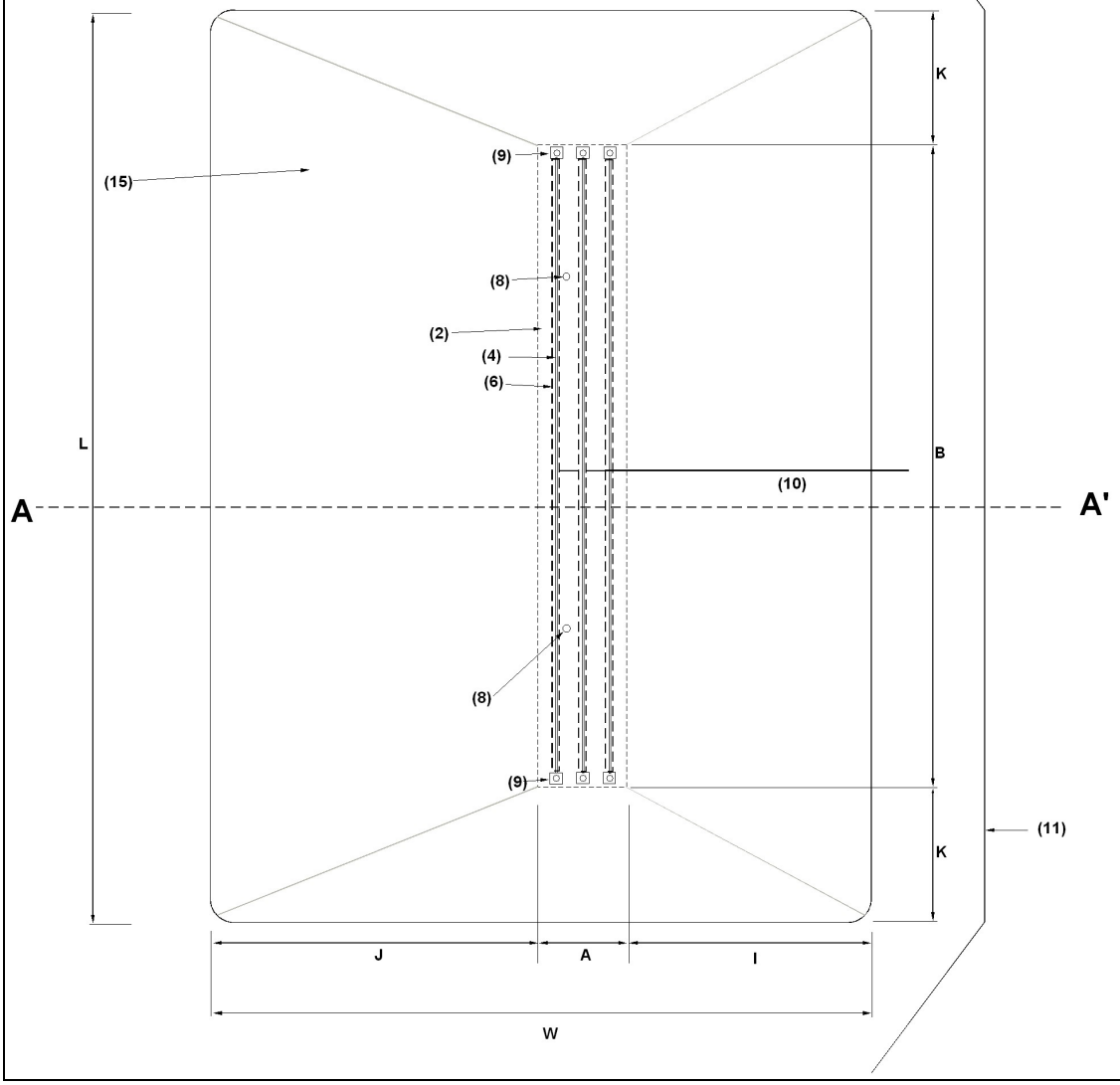
STANDARD DRAWING SD1
Wisconsin Mound on Flat or Gently Sloping Site

DRAWING NOTES:
- Not to scale
- Capital letters (e.g. J) represent dimensions
- Numbers in brackets (e.g. (8)) refer to the accompanying Construction Notes

Cross Section A-A'



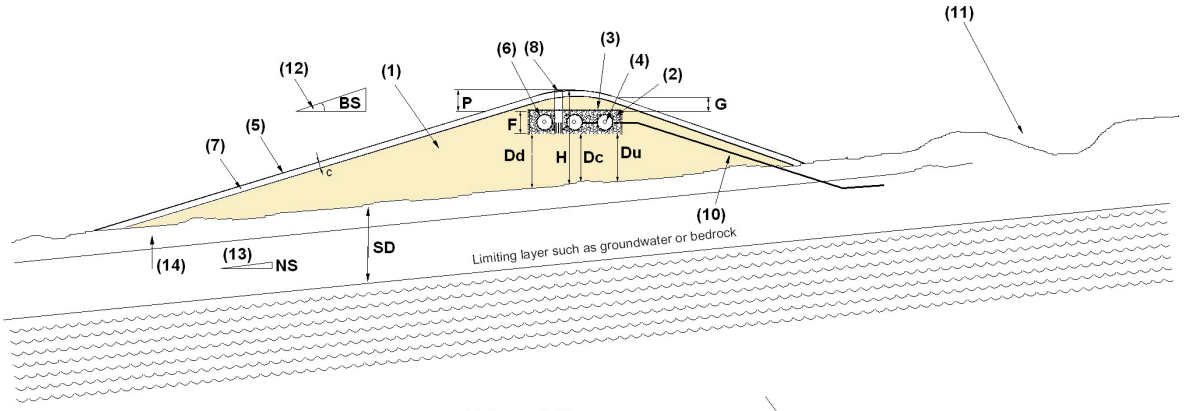
Plan View



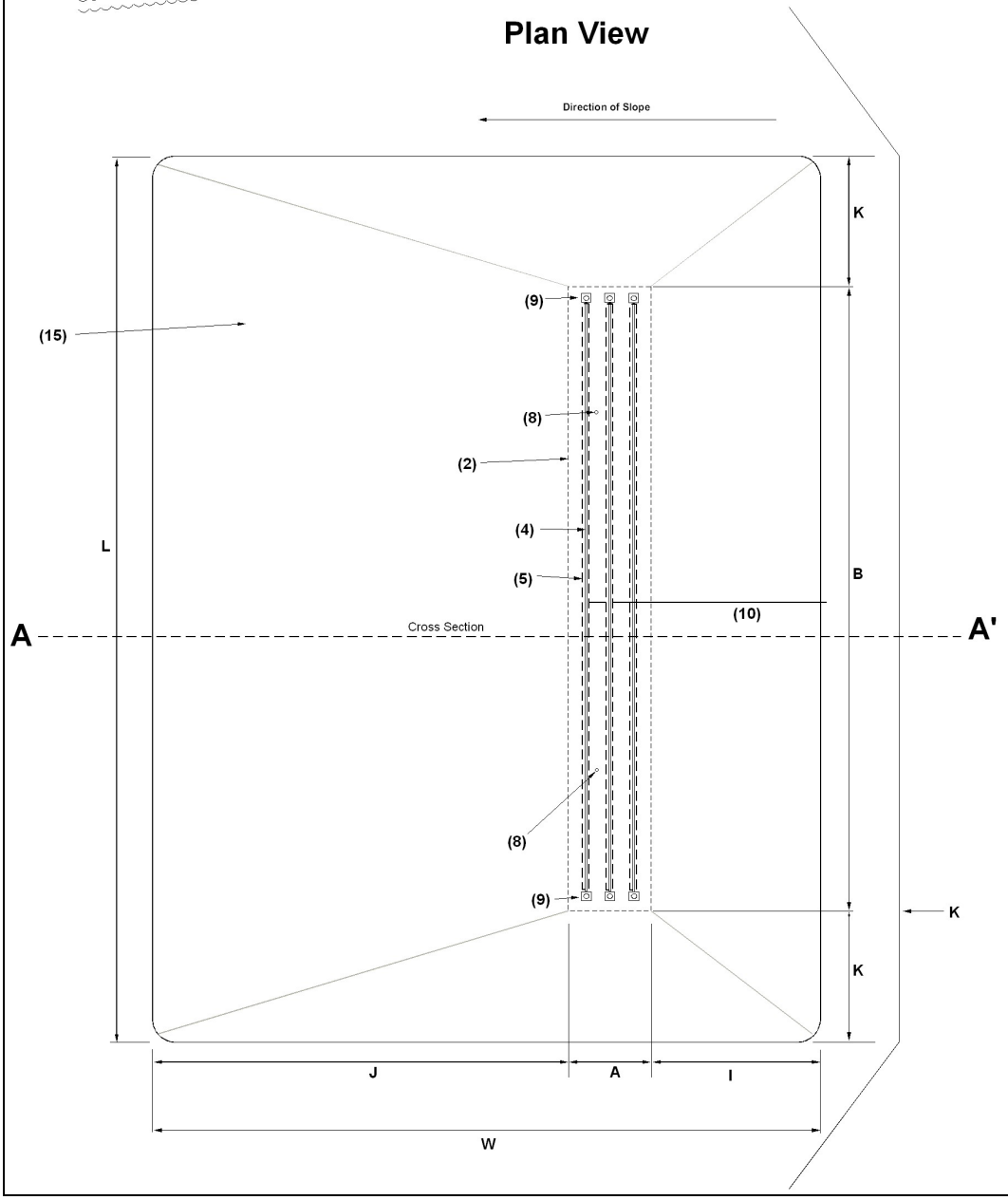
STANDARD DRAWING SD1
Wisconsin Mound on Sloping Site

DRAWING NOTES:
- Not to scale
- Capital letters (e.g. J) describe critical mound dimensions
- Numbers in brackets (e.g. (8)) refer to the accompanying Construction Notes

Cross Section A-A'



Plan View



Upslope and Downslope Correction Factors		
Slope (%)	**Upslope Correction Factor (UCF)**	**Downslope Correction Factor (DCF)**
0	1.00	1.00
1	0.97	1.03
2	0.94	1.06
3	0.92	1.10
4	0.89	1.14
5	0.88	1.18
6	0.85	1.22
7	0.83	1.27
8	0.80	1.32
9	0.79	1.38
10	0.77	1.44
11	0.75	1.51
12	0.73	1.57
13	0.72	1.64
14	0.71	1.72
15	0.69	1.82
16	0.68	1.92
17	0.66	2.04
18	0.65	2.17
19	0.64	2.33
20	0.62	2.50

Wisconsin Mound – Construction Notes

Components:

(1) Suitable sand fill media. Optimal media characteristics are: Effective Size (EC) 0.15-0.30 mm; Uniformity Coefficient (UC) 4-6; <5% fine materials (<0.05 mm); and <20% coarse materials (>2.0 mm).

(2) Distribution bed containing 20-40 mm clean aggregate. The distribution bed must be completely level.

(3) Geotextile filter cloth.

(4) Pressurised dosing laterals consisting of 25mm PVC pipe with 3mm holes drilled (deburred) at 400mm centres facing upwards. The length of laterals will be determined by the required bed size (m^2) and the recommended lateral spacings. It is essential that effluent is distributed evenly across the distribution bed.

(5) Grass (turf) must be established over the entire mound surface immediately upon completing construction. If grassing is likely to be unsuccessful an alternative cover must be provided, such as mulching and planting other groundcover vegetation.

(6) 90mm slotted PVC or agricultural pipe over manifold laterals. The squirt height across the laterals must be tested prior to covering with agricultural / slotted pipe with no more than 15% variation in height observed. Consideration must also be given to static head and friction loss when sizing pumps.

(7) Minimum 100 mm topsoil cover over the entire mound. A garden quality topsoil should be used with sandy loam to loam texture, low in clay and free of coarse fragments. The topsoil will usually have to be imported to site.

(8) Two inspection ports on the downhill side of distribution bed placed at approximately ¼ and ¾ points along bed, extending from the surface down to the base of the gravel absorption bed. Inspection ports to be made from 50mm PVC pipe, wrapped in geotextile, with perforations along the length of the pipe. The pipe must be firmly anchored within the mound to prevent inadvertent removal or damage.

(9) Individual flush points for each lateral. May be a screw cap fitting on a 90 -degree elbow level with the mound surface or a pressure controlled flush valve (such as those used for subsurface irrigation systems) inside a control box. Manual flushing should be carried out at least every twelve months.

(10) 40mm PVC dosing manifold. Larger system may require different pipe sizes and orifice reducers at lateral connection points. Primary treatment (as a minimum) must be provided before dosing effluent to a mound.

(11) Upslope stormwater diversion drain. Subsoil drainage may be necessary on sloping and/or poorly drained sites.

(12) Batter slope 1(vertical):3 (horizontal) maximum.

(13) Natural ground slope. The ground slope has a major influence on the overall mound width.

(14) Prepare the site by clearing all shrubs, trees and boulders. Cut trees to ground level and then grind the stump out to a depth of 300 mm and backfill with permeable material such as the natural topsoil or sand (definitely not clay). Scarify the natural soils across the entire basal area to a minimum depth of 200 mm taking care not to compact the basal area in the process. Blend 50/50 with

mound sand. This should extend to at least 1 m beyond the mound perimeter and 2 m on the downhill side.

(15) The basal area, length, width and height must be determined in accordance with the procedures set out in the Guidelines. Detailed design is required by an experienced professional. The location and orientation of the area should be based on a site and soil assessment by a suitably qualified person. The gravel bed and long axis of the mound must be positioned parallel to the ground contours (i.e. across the slope).

Dimensions:

NS Slope of natural ground measured as a percentage

SD Soil depth to limiting layer. The recommended minimum separation distance between the base of the gravel bed (the absorption area) and a limiting layer is 1.0 m for mounds receiving primary treated effluent and 0.5 m for mounds receiving secondary treated effluent.

BS Batter slope 1(vertical):3 (horizontal) maximum.

A Absorption bed width. Commonly the bed width is between 1.2 m and 3.0 m. Widths greater than 3.0 m are not advisable.

B Absorption bed length measured parallel to the contour.

C Topsoil thickness, minimum 100 mm recommended.

D_u Sand fill depth beneath the absorption bed at the upslope edge of the bed. The recommended minimum depth is 400 mm, however additional depth may be required if a shallow limiting layer exists.

D_c Sand fill depth beneath the absorption bed at the centre.

D_d Sand fill depth beneath the absorption bed at the downslope edge of the bed.

F Absorption bed thickness, normally 300 mm minimum.

G Soil cover depth over the edge, shoulder and to the side of the absorption bed, minimum 150 mm.

H Total mound height

I Upslope mound width

J Downslope mound width

K Endslope mound width

L Total mound length (parallel to the contour).

P Soil cover depth over the centre of the absorption bed at the mound peak, 300 mm minimum. P must be at least 150 mm greater than G.

W Total mound width (perpendicular to the contour).

Sand Mound Sizing Sheet - Sample

Site Address:

Scenario: 4-br house, tank water, moderately structured clay loam topsoils (300 mm thick), < 8% slopes

Notes for using this Sheet:

1. The reference notes numbered below are providd in the accompanying explanation sheet.
2. User-input variables are in **green cells**. Values in **red text** are calculated - do not modify!

Notes	Site Data	Symbol	Value	
	Daily wastewater load (L/day)	W	690	
	Effluent Quality (P = primary, S = secondary)	Q	S	
	Soil texture (topsoil)		Clay loam	
1	Soil depth to limiting layer (m)	SD	1.0	
2	Natural slope across basal area (%)	NS	8.0	
3	Natural slope in radians (rad)	α	**0.1**	
4	Recommended basal loading rate (mm/day)	BLR	16.0	
5	Recommended linear loading rate (L/m/day)	LLR	51.0	
6	Recommended minimum separation from limiting layer (m)	SLL	**1.0**	
7	Sand loading rate at gravel-sand interface (mm/day)	SLR	50.0	

	Calculations	Symbol	Formula	Value	
8	Recommended mound batter slope (H:V) (e.g. 3, 2.5)	BS	nominated	3.00	
	Batter slope in radians (rad)	ϕ		**0.32**	
	Gravel bed dimensions:				
	Length (m)	B	W / LLR	**13.53**	
	Width (m)	A	W / SLR / B	**1.02**	
	Thickness (m)	F	nominated	0.23	
9	Minimum capping over gravel at the edges (m)	G	nominated	0.20	
10	Topsoil cover all over (m)	C	nominated	0.10	
11	Recommended minimum sand depth (upslope) (m)	D	SLL - SD; min. 0.6 for primary effluent (0.4 for secondary)	0.40	
	Downslope mound fill depth (m)	E	D + (NS $\times$ A)	**0.48**	
	Fill depth at centre of gravel bed (m)	H_1	(D + E) / 2	**0.44**	
12	Total capping depth at centre of mound (m)	H_2	G + [(A/2) / BS]; min. 0.3	**0.37**	
	Total mound height for a peaked mound (m)	H	$H_1 + H_2$ + F	**1.04**	
13	Upslope mound width, from geometry (m)	I_g		**2.00**	
14	Upslope mound width, from hydraulics (m)	I_h	If NS=0, I_h=(LLR/BLR-A)/2, IF NS>0, calc. I from geometry	**n/a**	
15	Upslope mound width - larger of I_g and I_h (m)	I		**2.00**	
	Endslope mound width, from geometry (m)	K	BS $\times$ (H_1 + F + G)	**2.60**	
16	Downslope mound width, from geometry (m)	J_g		**3.58**	
17	Minimum downslope mound width, from hydraulics (m)	J_h	If NS=0, J_h=I_h If NS>0, J_h=(LLR / BLR) - A	**2.17**	
18	Downslope mound width - larger of J_g and $J_{h\,(m)}$	J		**3.58**	

	Mound Dimensions				
	Basal width (m):	W	I + A + J	**6.6**	
	Basal length (m):	L	B + (2 $\times$ K)	**18.7**	
	Total height (m):	TH	$H_1 + H_2$ + F	**1.0**	