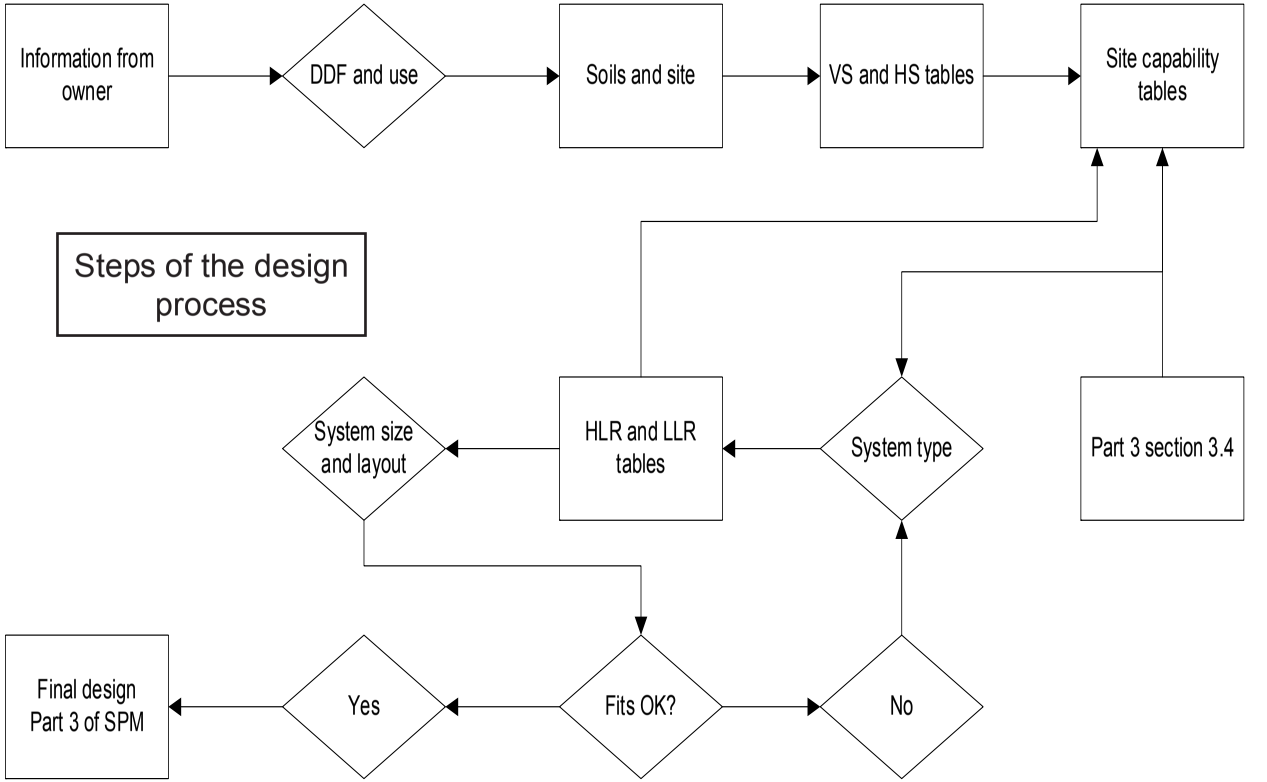
DM SPM TOC


Information from owner
DDF and use
Soils and site
VS and HS tables
Site capability tables
Steps of the design process
System size and layout
HLR and LLR tables
System type
Part 3 section 3.4
Final design Part 3 of SPM
Yes
Fits OK?
No

Daily Design Flow Rates for Residences

Table 2-1 Minimum Daily Design Flow Rates for Residences

Residence Size	Minimum Design Flow	
	litres	l gallons
1 and 2 bedroom unit up to 150 m^2 1,600 ft^2	1,136	250
3 bedroom unit up to 175 m^2 1,885 ft^2	1,363	300
4 bedroom unit up to 235 m^2 2,530 ft^2	1,700	375
5 bedroom unit up to 295 m^2 3,175 ft^2	2,045	450
6 bedroom unit up to 355 m^2 3,820 ft^2	2,500	550
For every additional m^2 (10.76sqft) add	4.5	1

Table 2-2 Per Capita Daily Design Flows

Use	Per person flow (L)
Single family dwelling	470
Multi-family (apartment, house and cabin, townhouse)	380
Luxury homes	1,140
Summer cottage	300
Mobile home	300
Number of bedrooms	Minimum number of occupants
1	2
2	3
3	3.5
4	4
5	5
6	6

Where garbage grinders or garburators are used, an increase of minimum 50 per cent in Daily Design Flow is applied.

Minimum Daily Design Flow Rates for Facilities

Table 2-3 Facility Daily Design Flow Rates

Type of facility	Unit	DDF (L/day)	DDF (IG/day)
Institutional			
Assembly Halls no kitchen	Per person	8	1.75
Assembly Halls with kitchen	Per person	9	2
Church no kitchen	Per seat	9	2
Church with kitchen	Per seat	26	6
Church Suppers	Per person	45	10
Note: Where large functions are held, consider type of function (example, dance) and size accordingly			
Town Hall	Per seat	19	4
Fire station		Individual design	
Medical/Personal Care			
Hospital	Per bed	409	90
Including laundry	Per bed	750	165
Excluding laundry	Per bed	550	120
Hospital mental	Per bed	340	75
Hospital mental, add per employee	Per employee	23	5
Special care home	Per resident	910	200
Special care home, add per employee	Per employee	45	10
Medical Office Doctors nurses medical staff	Per person	273	60
Medical office, Office staff add	Per person	73	16
Medical office, Patient add	Per person	23	5
Dental Office	Per chair	757	166
Dental office, Staff add	Per person	132	29
Schools			
Cafeteria and gym and shower (add to base flow)	Per student	68	15

Type of facility	Unit	DDF (L/day)	DDF (IG/day)
Cafeteria only (add to base flow)	Per student	45	10
Gym only (add to base flow)	Per student	45	10
Washrooms only base flow			
Elementary	Per student	26	6
High school	Per student	45	10
Junior High school	Per student	34	7.5
Boarding school Resident student	Per student	136	30
Boarding school non resident staff	Per person	45	10
Prison			
Prison	Per inmate	136	30
Add for personnel	Per person	23	5
Food Service			
Bar/lounge/pub	Per seat	125	27
Bar/lounge/pub (alternatively, use higher flow obtained)	Per customer	8	1.76
Taverns/Bars/Lounges with minimal food service	Per seat	125	27
Restaurant	Per seat	90	20
24 hour restaurant	Per seat	200	44
24 hr highway and showers	Per seat	400	88
Banquet rooms	Per seat, each banquet	30	6.5
Night Club/Restaurant	Per seat	125	27
Dining rooms and lounges	Per m^2 of dining area	97	21
Take out	Per m^2 (total area)	22	5
Banquet and Dining rooms	Per meal	18	4
Caterers (in addition to normal flows)	Per patron	45	10
Coffee Shop	Per customer	19	4

Type of facility	Unit	DDF (L/day)	DDF (IG/day)
Coffee shop, add for employees	Per employee	36	8
Bakery (Sanitary only)	Per employee	68	15
Commercial Airport			
Airport	Per passenger	9	2
Airport, add for employees	Per employee	41	9
Commercial Beauty Salon			
Beauty salon	Per station	400	88
Beauty salon, add for personnel	Per person	38	8
Commercial Veterinary			
Veterinary clinic (3 doctors or less) No boarding	Total	2,900	638
Veterinary clinic (3 doctor or less) Boarding	Total	5,700	1,254
Dog kennel	Per enclosure	73	16
Commercial Laundry			
Laundromat In apartment	Per machine	1,135	250
Retail			
Department store	Per toilet room	1,513	333
Department store, add for employees	Per employee	36	8
Shopping centre	Per employee	40	9
Shopping centre Washrooms only	Per m^2 of store space	5	1
Shopping centre Toilet rooms	Each	1,665	366
Shopping Centre excluding café or laundry	Per m^2	7	1.5

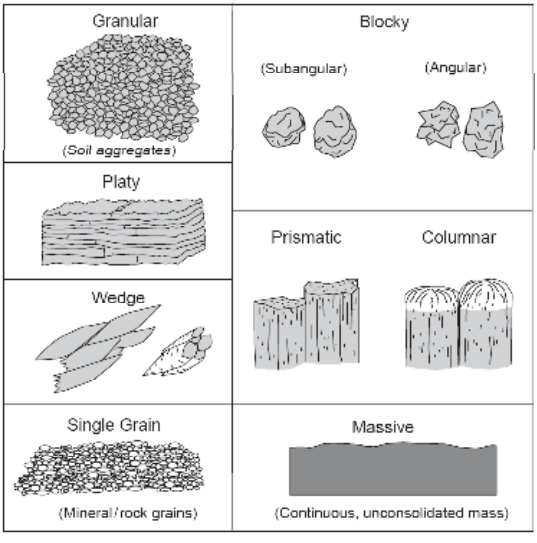
Type of facility	Unit	DDF (L/day)	DDF (IG/day)
Shopping centre large dry goods centre	Per m^2	2	0.45
Shopping centre Large supermarket & meat department (no garburator)	Per m^2	3	0.6
Shopping centre Small dry goods store	Each	379	83
Commercial Automotive			
Automobile gas station	Per vehicle	22	5
Automobile gas station island	Per island	2,000	440
Car wash	Per car	189	42
Truck wash	Per truck	378	83
Commercial Hospitality			
Motel	Per unit	318	70
Motel	Per housekeeping unit	455	100
Motel Bed & breakfast	Per person	227	50
Hotel	Per unit	366	80
Hotel, add for non resident staff	Per employee	36	8
Dormitory Bunkhouse	Per person	91	20
Senior citizen home	Per resident	910	200
Day care centres	Per child	73	16
Day care centres, add for staff	Per employee	73	16
Industrial/Office			
Industrial buildings Excluding industrial waste, cafeteria and showers	Per employee	45	10
Industrial buildings Excluding industrial waste, including showers	Per employee	75	16
Heavy Industry Excluding industrial waste, including cafeteria and shower	Per employee	132	29
Warehouse	Per employee	132	29

Type of facility	Unit	DDF (L/day)	DDF (IG/day)
Industrial Park	Per employee	68	15
Office No cafeteria	Per employee	50	11
Office Including cafeteria	Per employee	76	16
Recreation Camping			
Campgrounds tents only	Per site	180	39
Campground, trailers water, sewer and electrical connection at site; non year round	Per site	365	80
Having year round operation	Per site	545	120
Cabin Resort	Per person	318	70
Day camps no meal	Per person	38	8
Day camps with meals	Per person	68	15
Day camps (primitive)	Per person	40	9
Construction camps flush toilets	Per person	189	41
Construction camps no flush toilets	Per person	123	27
Youth camps	Per person	189	41
Work camps	Per bed	227	50
Luxury camps	Per person	378	83
Cottages & small seasonal dwellings, no washroom, no laundry or kitchen (central comfort station)	Per bedroom	189	42
Cottages & small seasonal dwellings, with washrooms, non commercial use (residential accessory)	Per bedroom	568	125
Parks and Picnic Grounds			
Picnic and fairgrounds with bath houses, showers, toilets	Per person	38	8
Picnic and fairgrounds with toilet only	Per person	18	4
Beaches with showers & toilets	Per person	40	9
Visitor Centre	Per person	23	5
Country club Resident present	Per person	372	81
Country club Non resident	Per person	95	20

Type of facility	Unit	DDF (L/day)	DDF (IG/day)
Country club Showers in use	Per fixture	1,800	395
Country club Water closet	Per fixture	550	120
Country club Lavatory	Per fixture	350	77
Country club Urinals – hand flush	Per fixture	350	77
Country clubs Showers	Per person	40	9
Country club, add for day staff	Per employee	50	11
Recreation Sport			
Bowling Alleys bar or restaurant	Per alley	800	175
Bowling alleys no bar or restaurant	Per alley	105	23
Ice rink	Per seat	11	2.5
Ice rink, add for participants	Per person	38	8
Stadium	Per seat	14	3
Swimming pool	Per customer	14	3
Swimming pool	Per m^2	50	11
Water slide park	Per visitor	15	3.3
Gym, participants	Per person	38	8
Tennis/Racquetball no food	Per court	946	208
Ski areas no cafeteria	Per person	38	8
Outdoor sport facilities, toilet waste only	Per person	19	4

The user is cautioned that these charts and tables are provided for reference only. Application of these tables requires training.

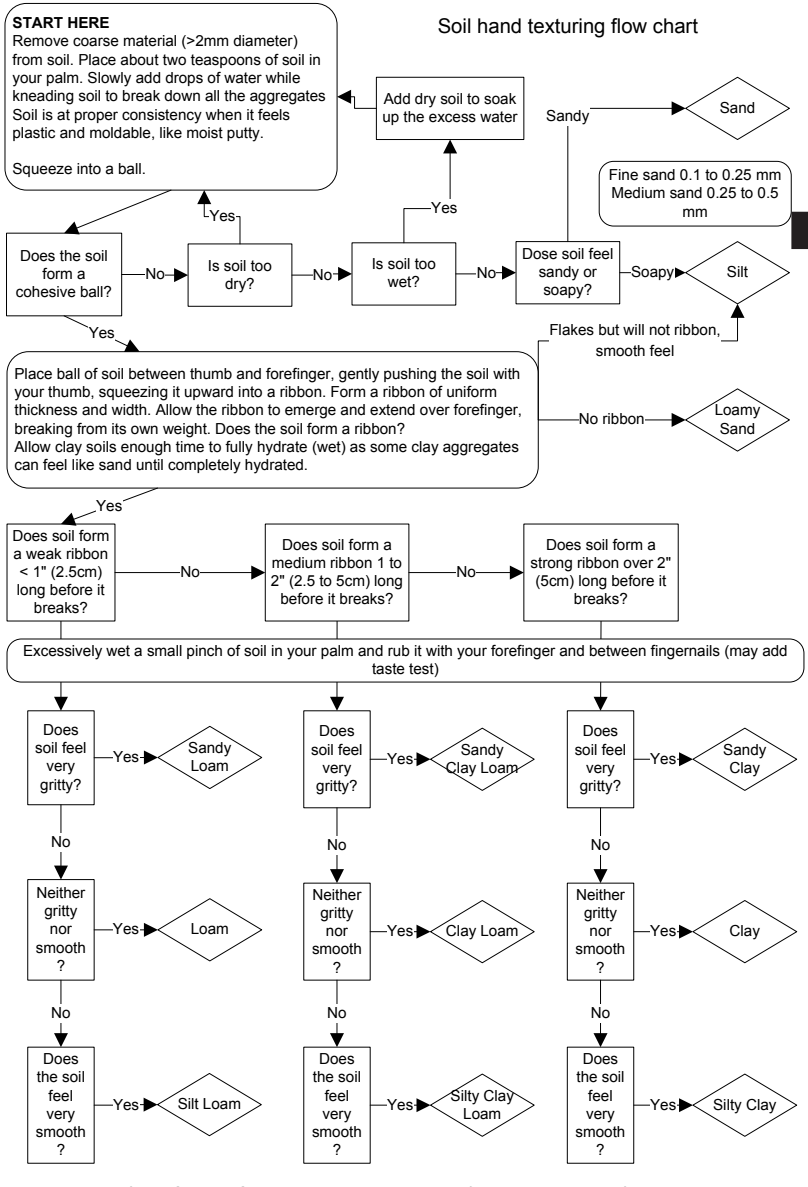
Soil structure terms



Soil hand texturing guideline

Tex-ture Class	Feel test	Moist cast test	Moist rib-bon test	Taste/wet feel test	Shine test
Sand (S)	Grainy with little floury	None	None		
Loamy sand (LS)	Grainy with slight amount of floury	Very weak	None		
Sandy Loam (SL)	Grainy with considerably floury	Weak, allows careful handling	None		
Loam (L)	Soft and smooth with evident graininess	Good, allows handling	Begins to ribbon		
Silt Loam SIL	Floury with slight graininess	Weak, allows careful handling	Flakes rather than ribbons	Silt grittiness and some sand grittiness	
Silt (SI)	Very Floury	Weak, allows careful handling	Flakes rather than ribbons	Silt grittiness, dilatency	
Sandy Clay Loam (SCL)	Substantial graininess	Moderate cast	Short and thick (<30mm)	Sand grittiness	Slightly shiny
Clay Loam (CL)	Moderate graini-ness	Strong	Fairly thin, breaks readily, barely supports own weight	Sand grittiness	Slightly shiny
Silty Clay Loam (SICL)	Smooth and floury	Strong	Fairly thin, breaks readily, barely supports own weight	Silt grittiness	Slightly shiny
Sandy Clay (SC)	Substantial graininess	Strong	Thin, 50-75mm, holds own wt.	Sand grittiness	Moderately shiny
Silty Clay (SIC)	Smooth	Very Strong	Thin, 50-75mm, holds own wt.	Silt grittiness, soapy feel	Moderately shiny
Clay (C)	Smooth	Very Strong	Very thin, long (75mm +)	Smooth	Very Shiny

Soil hand texturing flow chart

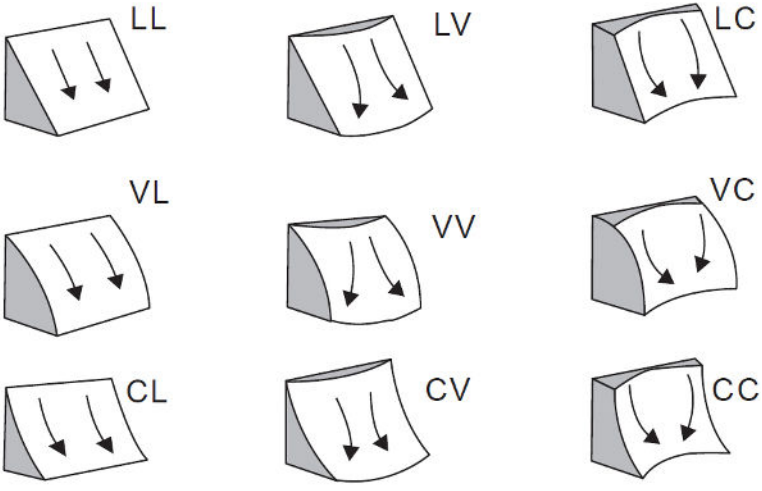


DM SPM V2 2-11

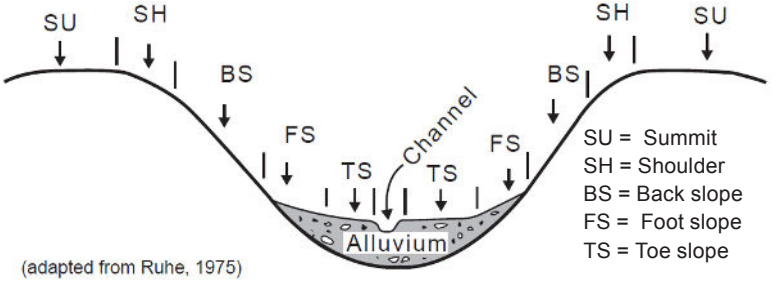
Adapted from USDA and S.J. Thein, 1979, A Flow diagram for teaching texture by feel analysis, J. Agron. Ed. 8:54-55

Soil figures and tables adapted from USDA Field Book for Describing and Sampling Soils, Version 2.0, USDA, 2002

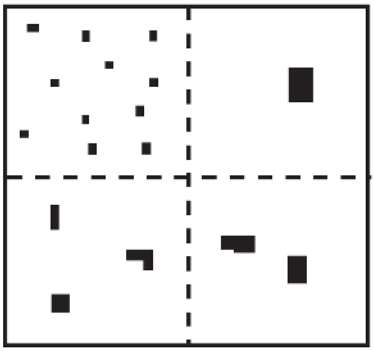
Slope shape and position



(adapted from Wysocki, et al., 2000)



(adapted from Ruhe, 1975)



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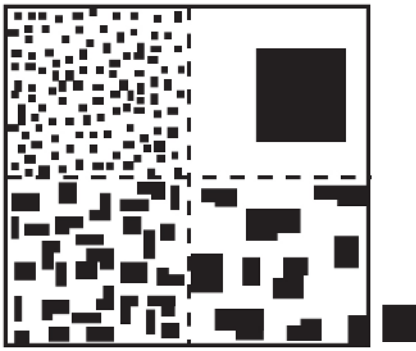
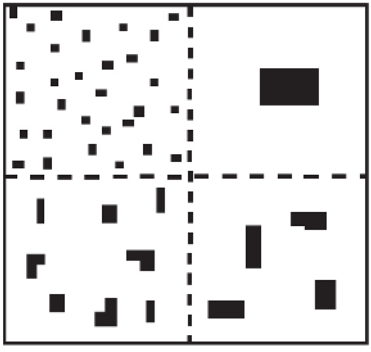


20%



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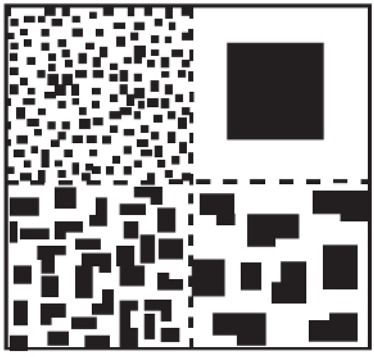

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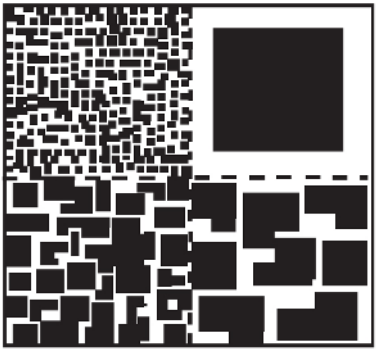


50%

90%

Area coverage (for fragments, mottles etc.)

Soils terms

Soil structure grade

Grade	Code	Criteria for grade
Structureless	0	No discrete units observable in place or in a hand sample.
Weak	1	Units are barely observable in place or in a hand sample.
Moderate	2	Units well-formed and evident in place or in a hand sample.
Strong	3	Units are distinct in place (undisturbed soil), and separate cleanly when disturbed.

Texture modifiers

Fragment Content % By Volume	Rock Fragment Modifier Usage
< 15	No texture adjective is used (noun only; e.g., loam).
15 to < 35	Use adjective for appropriate size; e.g., gravelly loam.
35 to < 60	Use “very” with the appropriate size adjective; e.g., very gravelly loam.
60 to < 90	Use “extremely” with the appropriate size adjective; e.g., extremely gravelly loam.
≥ 90	No adjective or modifier. If ≤ 10% fine earth, use the appropriate noun for the dominant size class; e.g., gravel. Use Terms in Lieu of Texture.

Quantity terms for mottles and other features

Quantity Class	Code	Range in percent of surface area
Few	f	< 2%
Common	c	2 to < 20%
Many	m	≥ 20%

Size terms for mottles and other features

Quantity Class	Code	Range in percent of surface area
Fine	1	< 2 mm
Medium	2	2 to < 5 mm
Coarse	3	5 to < 20 mm
Very Coarse	4	20 to < 76 mm
Extremely Coarse	5	≥76 mm

Quantity terms for roots and pores

Quantity Class	Code	Average count per unit area
Few	1 or #	< 1
Common	2 or #	1 to < 5
Many	3 or #	≥5

Size terms and unit areas for roots and pores

Quantity Class	Code	Diameter	Soil unit area assessed (cm2)
Very fine	VF	< 1 mm	1
Fine	F	1 to < 2 mm	1
Medium	M	2 to < 5 mm	100
Coarse	C	5 to < 10 mm	100
Very Coarse	VC	≥ 10 mm	10000

Consistence terms, partial

Dry	Moist	Cementation	~30 mm block Specimen fails under what force?
Loose (L)	Loose (L)	NA	Intact specimen not obtainable
Soft (S)	Very Friable (VFR)	Non-cemented	Very slight force between fingers (< 8N)
Slightly Hard (SH)	Friable (FR)	Extremely weakly cemented (EW)	Slight force between fingers (8 to < 20N)
Moderately Hard (MH)	Firm (FI)	Very weakly cemented (VW)	Moderate force between fingers (20 to < 40N)
Hard (HA)	Very Firm (VFI)	Weakly cemented (W)	Strong force between fingers (40 to < 80N)
Very Hard (VH)	Extremely Firm (EF)	Moderately cemented (M)	Moderate force between hands(80 to < 160N)
Extremely Hard (EH)	Slightly Rigid (SR)	Strongly cemented (ST)	Foot pressure by full body weight (160 to < 800N)

Vertical Separation (VS)

Table 2-4 Minimum Vertical Separation (VS) for Trench, At Grade or Seepage Bed Systems

Pre-treatment and dispersal type	Minimum vertical separation in nativesoil	Minimum as constructed vertical separation	Notes
Type 1 or 2, gravity distribution	36" (91 cm)	36" (91 cm)	No fill to be used below gravity system. Recommended 42" (107 cm) VS in Loamy Sand (or coarser) or over fractured rock or over unconfined aquifers.
Type 1, pressure distribution	24" (61 cm)	24" (61 cm)	Recommended 30" (76 cm) minimum VS in soils coarser than Loamy Fine Sand over fractured rock or unconfined aquifers.
Type 2, pressure distribution	24" (61 cm)	24" (61 cm)	Where Type 2 effluent is applied at higher loading rates than Type 1, consideration should be given to increasing VS to ensure adequate pathogen removal, particularly in coarser soils.
Type 2, pressure distribution, reduced soil depth	18" (46 cm)	30" (76 cm)	Where native soil VS is less than 24" minimum final VS is 30" (76 cm)
Type 3, pressure distribution	18" (46 cm)	18" (46 cm)	
Type 3, pressure distribution, reduced soil depth	6" (15 cm)	24" (61 cm)	Where native soil VS is less than 12", minimum final VS is 24" (61 cm)

Vertical Separation and Sand Depth for Sand Mounds and Sand-lined Trenches

Table 2-5 is a linked standard that should only be used where system is designed and dosed following all standards of the SPM for sand mounds or sand-lined trenches as provided in Part 2 and in Part 3 of the manual. Linear Loading Rates or mounding calculation must be used for the design.

Timed dosing designed following the provisions of Section 3.8 must be used where vertical separation in native soil is 18" or less.

Table 2-5 Minimum Vertical Separation for Sand Mounds, Sand-lined Trenches

Restrictive layer/basal area soils	Minimum vertical separation in native soil
SHWT (Seasonal High Water Table)	10" (25 cm)
Permanent water table	24" (61 cm)
Fine sand/Loamy Fine Sand or coarser soils over: Fractured bedrock	24" (61 cm)
Finer soils over: Fractured bedrock	18" (46 cm)
Non fractured bedrock or other low permeability restrictive layer	10" (25 cm)

Supplemental table 2-5-A Minimum as constructed vertical separation and sand depth

As constructed total VS	Sand media min. VS	Effluent type	Type of dosing
24" (61 cm)	12" (30.5 cm)	Type 3	Low HAR timed
	18" (46 cm)		Standard
30" (76 cm)	12" (30.5 cm)	Type 1 and 2	Low HAR timed
	18" (46 cm)		Standard
Sand lined trenches minimum 24" (61 cm) sand VS			
See note on soil type.			

Where soils are sand, gravel or gravelly sand or in other soils where Type 2 10/10 or Type 3 effluent is required by site capability tables Section 2.3.6; minimum sand depth should be 24" (61 cm) in all cases for Type 1 and Type 2 effluent applied to sand mound.

Horizontal separation

All setbacks should be measured from the infiltrative surface.

In the case of sand mound and sand-lined trenches there is an expectation of treatment within the sand media. In these cases:

- for a mound system, the setback is measured from the edge of the required basal area.;
- for a system where the mound bed is dosed with Type 3 effluent, the set-back is measured from the edge of the mound bed; and,
- for sand-lined trenches, the setback is measured from the edge of the trench or filter basal area.

Table 2-6 Horizontal Setback Distances for Critical Setbacks

Distance to	From dispersal system (metres/feet)				From watertight sub-surface treatment tank (metres/feet)
	Lagoon	Type 1/2	Type 1/2	Type 3	
		Gravity dist.	Pressure dist.	Pressure dist.	
Source of drinking water, well or water suction lines	30 m / 100 ft.				15 m / 50 ft.
High pumping rate Water Supply System well	60 m / 200 ft				30 m / 100 ft.
High pumping rate Water Supply System well in unconfined aquifer	90 m/300 ft.				
Break-out point or downslope drain (including perimeter drain)	15 m / 50 ft.	15 m / 50 ft.	7.5 m / 25 ft.	7.5 m / 25 ft.	1 m / 3 ft.
Fresh water	30 m / 100 ft	30 m / 100 ft.		15 m / 50 ft.	10 m / 33 ft.
Fresh water (seasonal)	30 m / 100 ft	30 m / 100 ft.	15 m / 50 ft.		
Marine water	30 m / 100 ft	15 m / 50 ft.			

NOTES to Table 2-6:

Reduction of horizontal setback for pressure distribution is not applied for gravelly sand or coarse to medium sand/loamy sand soils. On these coarser soils, setback credit is only applicable for sand mounds/sand-lined trenches using a minimum of 610 mm (24") sand.

Upslope separation to an interception drain or other drain should be a minimum of 3m (10') for slopes of 5% or greater. Where the slope is lower or the drain is over 1.2 m (48") deep, this distance may not be sufficient and use of subsurface dam (impermeable barrier) or increase of setback to downslope drain standard is required.

'Fresh water (seasonal)' is defined, for the purpose of this table as an intermittent fresh water body that is incapable of contaminating a source of drinking water whether directly or indirectly. This definition does not apply to a body of water contained in a properly-constructed culvert that is constructed to prevent the contamination of a watercourse by domestic sewage or effluent.

'Fresh water' is defined, for the purpose of this table, as a natural watercourse or source of fresh water, usually containing water but does not include ground water or water in a culvert that is constructed to prevent the contamination of a watercourse by domestic sewage or effluent. This includes fresh tidal water.

A 'high pumping rate Water Supply System well' for the purpose of determining horizontal setbacks means a well or well group supplying a water supply system providing potable water supply to more than 500 persons during any 24 hour period.

Water setbacks are measured from edge of high water or tideline.

Water suction line is any part of any pipe or conduit conveying drinking water at pressure below atmospheric.

Setback from a lagoon to a dwelling should in all cases be a minimum of 200' (60 m).

Table 2-7 Horizontal Setback Distances for other setbacks

Distance to	From dispersal system (metres/feet)			From watertight subsurface treatment tank (metres/feet)
	Lagoon	Type 1/2	Type 3	
Property lines	15 m / 50 ft.	3 m / 10 ft.	1.5 m / 5 ft.	1 m / 3 ft.
Water lines (pressure)	3 m / 10 ft.	3 m / 10 ft.	1 m / 3 ft.	1 m / 3 ft.
Building or structure non-dwelling (where there is not a perimeter drain)	15 m / 50 ft.	1.5 m / 5 ft.	1 m / 3 ft.	1 m / 3 ft.
Building dwelling (where there is not a perimeter drain)	60 m / 200 ft.	3 m / 10 ft.	2 m / 6 ft.	1 m / 3 ft.
Utility services	1.5 m / 5 ft.	1 m / 3 ft.	1 m / 3 ft.	1 m / 3 ft.

For swimming pools with no external subsurface drainage, use the horizontal setbacks for non-dwelling building or structure. Consider access to tanks.

Hydraulic Loading Rate (HLR) Standards

Determine the soil type. First: Select from Table 2-8 the HLR based on soil texture and structure, then select HLR based on soil permeability. If the methods give different HLR, the correct HLR is the lower of the two, and the soil type is the one that corresponds to the lower HLR.

Seepage bed loading rates

For use with seepage beds these loading rates should be decreased by a factor of 1.35. In addition, seepage beds should not be wider than 4 m.

Sand mound and sand-lined trenches basal area hydraulic loading rates

Basal loading rates are based upon Type 2 effluent for these systems, provided that they meet all standards of the SPM, including LLR and dosing.

Type 2 and 3 loading rates to sand media

Where the increased Type 2 or 3 sand media hydraulic loading rates are used, timed dosing to meet Hydraulic Application Rate standards per Part 3 Section 3.8.

Table 2-9 Sand Media Loading Rates (for Mound Sand)

Level of Treatment	Mound sand HLR (L/day/m^2)	Mound sand HLR (IG/day/ft^2)	Alternate 1 sand HLR (L/day/m^2)	Alternate 2 sand HLR (L/day/m^2)
Type 1	40	0.82	48.9 T	29
Type 2	64 T	1.3 T	T	T
Type 3	128 T	2.62 T	T	T

T = Timed dosing required, designed per standards of Part 3 Section 3.8

Alternate sands from Appendix H

Alternate 1: Intermittent sand filter sand.

To be use with low HAR timed dosing per the SPM for all effluent types.

- Effective size, D10, of 0.33 mm, (0.30 to 0.50 mm)
- Coefficient of uniformity (D60/D10) Cu <3
- <2% passing #100 sieve, <0–1% passing #200 sieve, <20% over 2 mm.

Loading rate for this sand maximum 48.9 L/day/m^2 for Type 1

Alternate 2: Clean C33 or CSA concrete sand.

To meet C33 specifications, with the addition that <7% may pass the #100 sieve and <3% pass the #200 sieve. Loading rate for this sand should be maximum 29L/day/m^2 for Type 1

Table 2-10 Mound Sand and C33 Fine Aggregate Sieve Analysis

Sieve Specification	Percent Passing	
	Mound Sand	ASTM C33-97 Fine Aggregate
9.5 mm (⅜ inch)	100	100
4.75 mm (No. 4)	95 to 100	95 to 100
2.36 mm (No. 8)	80 to 100	80 to 100
1.18 mm (No. 16)	50 to 85	50 to 85
600 µm (No. 30)	25 to 60	25 to 60
300 µm (No. 50)	10 to 30	10 to 30
150 µm (No. 100)	<4	2 to 10
75 µm (No. 200)	<1	Not specified

Soil Linear Loading Rate (LLR) Standards

Maximum (oxygen flux) LLR for oxygen transport:

Apply per cell (example per trench or per bed). Apply to all systems including sand mounds and sand lined trenches. Spacing must meet minimums per Part 3.

99 to 124 L/day/m, except for soil types finer than well structured silt loam/silt maximum 45 to 60 L/day/m.

Always make the system as long as possible!

Increases to LLR:

In all cases must also meet the maximum (oxygen flux) LLR.

Increases to LLR for all systems

Vertical flow:

Where vertical separation in native material to a low permeability layer or water table below the infiltrative surface in the discharge area and receiving area is over 120cm (48”) for pressure distribution or over 152cm (60”) for gravity distribution, flow is considered to be largely vertical.

Use maximum LLRs, keep the LLR as low as possible in all cases.

Partial vertical flow:

Proportional increase in LLR.

Slope:

Only if native soil VS in dispersal AND receiving area is over 12″, slope over 15% allows 1.25 x increase (LLR x 1.25)

Site remediation:

Increases to VS, drainage, raised systems and toe blankets may be used.

Increases to LLR for systems under 9100L/dy DDF where standards cannot be met:

Low HAR timed dosing:

Only where 24″ VS in native soil VS in dispersal area. Low HAR timed dosing allows 1.25 x increase, may be applied to LLR already increased by slope 1.25 factor.

Increases to LLR for systems under 2500L/dy DDF where standards cannot be met:

Only where 24″ VS in native soil VS in dispersal area, a system with maximum 75 L/day/m LLR may be constructed.

This provision does not apply to sand mounds and sand lined trench systems.

Note to LLR table 2-11

NOTE: Soil depth below infiltrative surface refers to the native, unsaturated soil depth. This should also represent the soils over that depth in the receiving area. Where there is variation in soil type or depth, use the lower LLR value for system design.

Table 2-8 Soil Hydraulic Loading Rates for Residential Strength Wastewater, metric.

Soil Characteristics			Percolation Rates (min/2.54 cm)	Field Saturated Hydraulic Conductivity Kfs (mm/day)	Wastewater Loading Rates (litres/m²/day) NS = Not suitable; NR = Not recommended		
Texture USDA	Structure						
	Shape	Grade			Type 1	Type 2	Type 3
Gravelly sand	—	Single grain	< 2	>3,500	34	68	103
Coarse to medium sand/loamy sand	—	Single grain	2 – 5	1,500 – 3,500	29	59	88
Fine sand/fine loamy sand	—	Single grain	5 – 15	250 – 1,500	25	49	75
Sandy loam	Massive	structureless	20 – 30	125 – 250	15	22	29
	Platy	weak			15	22	29
		moderate, strong			NR	NR	NR
	prismatic, blocky, granular	weak	10 – 20	250 – 500	20	34	49
		moderate, strong			25	49	74
Loam	massive	structureless	30 – 40	60 – 125	10	15	20
	Platy	weak			10	15	20
		moderate, strong			NR	NR	NR
	prismatic, blocky, granular	weak	20 – 30	125 – 250	15	24	34
		moderate, strong			20	39	59
Silt loam, silt	massive	structureless	40 – 60	30 – 60	10	15	20
	platy	weak			10	15	20
		moderate, strong			NR	NR	NR
	prismatic, blocky, granular	weak	20 – 40	60 – 250	15	24	34
		moderate, strong			20	39	59
Clay loam, sandy clay loam, silty clay loam	massive	structureless	60 – 90	15 – 30	NS	NS	NS
	platy	weak			NS	NR	NR
		moderate, strong			NS	NS	NS
	prismatic, blocky, granular	weak	40 – 60	30 – 60	10	15	20
		moderate, strong			15	22	29
Sandy clay, silty clay, clay	massive	structureless	90 – > 120	< 5.0 – 60	NS	NS	NS
	platy	weak				NR	NR
		moderate, strong				NS	NS
	prismatic, blocky, granular	weak				7	9
		moderate, strong				10	13

Table 2-11 Linear Loading Rates for Wastewater, metric in, L/day/m

Soil Type			Slope 0–4% Soil depth below infiltrative surface			Slope 5–9% Soil depth below infiltrative surface			Slope 10% and over Soil depth below infiltrative surface		
Soil Texture	Shape	Grade	8" to <12"	12" to 24"	≥24"	8" to <12"	12" to 24"	≥24"	8" to <12"	12" to 24"	≥24"
Gravelly sand	—	Single grain	49.7	62.1	74.5	62.1	74.5	86.9	74.5	86.9	99.3
Coarse to medium sand/loamy sand	—	Single grain	49.7	62.1	74.5	62.1	74.5	86.9	74.5	86.9	99.3
Fine sand and fine loamy sand	—	Single grain	43.5	55.9	68.3	49.7	62.1	74.5	62.1	74.5	86.9
Sandy loam	massive	structureless	37.3	43.5	49.7	44.7	50.9	57.1	49.7	62.1	74.5
	platy	weak	37.3	43.5	49.7	44.7	50.9	57.1	49.7	62.1	74.5
		moderate, strong	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	prismatic, blocky, granular	weak	43.5	55.9	68.3	49.7	62.1	74.5	62.1	74.5	86.9
		moderate, strong	43.5	55.9	68.3	49.7	62.1	74.5	62.1	74.5	86.9
Loam	massive	structureless	24.8	28.6	32.3	29.8	33.5	39.7	33.5	39.7	45.9
	platy	weak	18.6	21.4	24.2	22.4	25.1	29.8	25.1	29.8	34.5
		moderate, strong	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	prismatic, blocky, granular	weak	37.3	43.5	49.7	41.0	47.2	53.4	44.7	50.9	57.1
		moderate, strong	41.0	47.2	53.4	44.7	50.9	57.1	48.4	54.6	60.8
Silt loam, silt	massive	structureless	24.8	31.0	37.3	27.3	33.5	39.7	29.8	36.0	42.2
	platy	weak	18.6	23.3	27.9	20.5	25.1	29.8	22.4	27.0	31.7
		moderate, strong	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	prismatic, blocky, granular	weak	29.8	33.5	37.3	33.5	37.3	41.0	37.3	43.5	49.7
		moderate, strong	33.5	37.3	41.0	37.3	43.5	49.7	41.0	47.2	53.4
Clay loam, sandy clay loam, silty clay loam	massive	structureless	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	platy	weak	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		moderate, strong	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	prismatic, blocky, granular	weak	24.8	31.0	37.3	27.3	33.5	39.7	29.8	36.0	42.2
		moderate, strong	29.8	36.0	42.2	33.5	37.3	41.0	37.3	43.5	49.7
Sandy clay, silty clay, clay	massive	structureless	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	platy	weak	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		moderate, strong	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	prismatic, blocky, granular	weak	17.4	21.7	26.1	19.1	23.5	27.8	20.9	25.2	29.6
		moderate, strong	24.8	31.0	37.3	27.3	33.5	39.7	29.8	36.0	42.2

Table 2-8 Soil Hydraulic Loading Rates for Residential Strength Wastewater, Imperial

Soil Characteristics			Percolation Rates (min/2.54 cm)	Field Saturated Hydraulic Conductivity Kfs (mm/day)	Wastewater Loading Rates (IG/sqft/day) NS = Not suitable; NR = Not recommended		
Texture USDA	Structure						
	Shape	Grade			Type 1	Type 2	Type 3
Gravelly sand	—	Single grain	< 2	>3,500	0.7	1.4	2.1
Coarse to medium sand/loamy sand	—	Single grain	2 – 5	1,500 – 3,500	0.6	1.2	1.8
Fine sand/fine loamy sand	—	Single grain	5 – 15	250 – 1,500	0.5	1.0	1.5
Sandy loam	Massive	structureless	20 – 30	125 – 250	0.3	0.45	0.6
	Platy	weak			0.3	0.45	0.6
		moderate, strong			NR	NR	NR
	prismatic, blocky, granular	weak	10 – 20	250 – 500	0.4	0.7	1.0
		moderate, strong			0.5	1.0	1.5
Loam	massive	structureless	30 – 40	60 – 125	0.2	0.3	0.4
	Platy	weak			0.2	0.3	0.4
		moderate, strong			NR	NR	NR
	prismatic, blocky, granular	weak	20 – 30	125 – 250	0.3	0.5	0.7
		moderate, strong			0.4	0.8	1.2
Silt loam, silt	massive	structureless	40 – 60	30 – 60	0.2	0.3	0.4
	platy	weak			0.2	0.3	0.4
		moderate, strong			NR	NR	NR
	prismatic, blocky, granular	weak	20 – 40	60 – 250	0.3	0.5	0.7
		moderate, strong			0.4	0.8	1.2
Clay loam, sandy clay loam, silty clay loam	massive	structureless	60 – 90	15 – 30	NS	NS	NS
	platy	weak			NS	NR	NR
		moderate, strong			NS	NS	NS
	prismatic, blocky, granular	weak	40 – 60	30 – 60	0.2	0.3	0.4
		moderate, strong			0.3	0.45	0.6
Sandy clay, silty clay, clay	massive	structureless	90 – > 120	< 5.0 – 60	NS	NS	NS
	platy	weak				NR	NR
		moderate, strong				NS	NS
	prismatic, blocky, granular	weak				0.15	0.18
		moderate, strong				0.2	0.25

Table 2-11 Linear Loading Rates for Wastewater, Imperial in IG/day/ft

Soil Type			Slope 0–4% Soil depth below infiltrative surface			Slope 5–9% Soil depth below infiltrative surface			Slope 10% and over Soil depth below infiltrative surface		
Soil Texture	Shape	Grade	8" to <12"	12" to 24"	≥24"	8" to <12"	12" to 24"	≥24"	8" to <12"	12" to 24"	≥24"
Gravelly sand	—	Single grain	3.3	4.2	5.0	4.2	5.0	5.8	5.0	5.8	6.7
Coarse to medium sand/loamy sand	—	Single grain	3.3	4.2	5.0	4.2	5.0	5.8	5.0	5.8	6.7
Fine sand and fine loamy sand	—	Single grain	2.9	3.7	4.6	3.3	4.2	5.0	4.2	5.0	5.8
Sandy loam	massive	structureless	2.5	2.9	3.3	3.0	3.4	3.8	3.3	4.2	5.0
	platy	weak	2.5	2.9	3.3	3.0	3.4	3.8	3.3	4.2	5.0
		moderate, strong	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	prismatic, blocky, granular	weak	2.9	3.7	4.6	3.3	4.2	5.0	4.2	5.0	5.8
		moderate, strong	2.9	3.7	4.6	3.3	4.2	5.0	4.2	5.0	5.8
Loam	massive	structureless	1.7	1.9	2.2	2.0	2.2	2.7	2.2	2.7	3.1
	platy	weak	1.2	1.4	1.6	1.5	1.7	2.0	1.7	2.0	2.3
		moderate, strong	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	prismatic, blocky, granular	weak	2.5	2.9	3.3	2.7	3.2	3.6	3.0	3.4	3.8
		moderate, strong	2.7	3.2	3.6	3.0	3.4	3.8	3.2	3.7	4.1
Silt loam, silt	massive	structureless	1.7	2.1	2.5	1.8	2.2	2.7	2.0	2.4	2.8
	platy	weak	1.2	1.6	1.9	1.4	1.7	2.0	1.5	1.8	2.1
		moderate, strong	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	prismatic, blocky, granular	weak	2.0	2.2	2.5	2.2	2.5	2.7	2.5	2.9	3.3
		moderate, strong	2.2	2.5	2.7	2.5	2.9	3.3	2.7	3.2	3.6
Clay loam, sandy clay loam, silty clay loam	massive	structureless	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	platy	weak	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		moderate, strong	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	prismatic, blocky, granular	weak	1.7	2.1	2.5	1.8	2.2	2.7	2.0	2.4	2.8
		moderate, strong	2.0	2.4	2.8	2.2	2.5	2.7	2.5	2.9	3.3
Sandy clay, silty clay, clay	massive	structureless	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	platy	weak	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		moderate, strong	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	prismatic, blocky, granular	weak	1.2	1.5	1.7	1.3	1.6	1.9	1.4	1.7	2.0
		moderate, strong	1.7	2.1	2.5	1.8	2.2	2.7	2.0	2.4	2.8

Table 2-12 Site Capability split to individual tables

Soil type or condition	Gravel and very gravelly sand (Kfs >5,000 mm/d, Perc. <1 min/inch)
Constraining factor	Very high permeability
Solution	Pressure distribution with Timed dosing, Type 2 10/10 or Type 3 effluent, Professional design or design review
Alternative solution	Sand mound or sand-lined trench with low HAR Timed dosing and a minimum of 24" (61 cm) mound sand
Notes	Minimum 90 cm mound sand with timed dosing for alternative solution.

Soil type or condition	Gravelly sand (Kfs 3,501–5000 mm/d, Perc. <2 ≥1 min/inch)
Constraining factor	High permeability
Solution	Pressure distribution, Timed dosing
Alternative solution	Sand mound or sand-lined trench with Timed dosing
Notes	Except where native soil vertical separation is greater than 1.83 m (72")

Soil type or condition	Coarse to medium sand/loamy sand (Kfs 1,500–3,500 mm/d, Perc. 2–5 min/inch)
Constraining factor	High permeability
Solution	Pressure distribution
Alternative solution	
Notes	Except where native soil vertical separation is greater than 1.83 m (72")

Soil type or condition	Over 50% of soil is rock fragments larger than gravel, or over 60% coarse gravel (or in combination over 60% total coarse gravel and rock fragments)
Constraining factor	Risk of effluent short circuiting due to large fractures, and severely reduced soil area for dispersal and treatment.
Solution	Pressure distribution, Timed dosing, Type 3
Alternative solution	Only where vertical separation to water table is over 1.83 m (72"): 1. Sand mound or sand-lined trench with Timed dosing (and reduced basal loading rate). 2. Subsurface Drip Distribution, with Type 2 10/10
Notes	Base HLR and LLR on the non-gravel/rock portion of the soil and reduce loading rate by percentage of rock fragments/gravel.

Soil type or condition	Loam, Silt Loam and Silt soils with platy structure of weak grade
Constraining factor	Requires low hydraulic application rate AND unsuitable for infiltrative surface.
Solution	System or sand mound, with infiltrative surface a minimum of 18" (45 cm) above platy layer, AND Pressure distribution with low hydraulic application rate timed dosing.
Alternative solution	For plough pan or thin layers with acceptable soils below: Remediation (where possible) OR sand-lined trenches penetrating below the layer (where suitable).
Notes	If platy structure is noted on a site, site investigation should include a minimum of 4 observation test pits in the dispersal area and two in the receiving area. Site investigation should establish that remediation has succeeded where this is used.

Soil type or condition	Sandy clay, silty clay or clay soils (with moderate or strong BK, GR or P structure) (Kfs 20–60 mm/d, Perc >60 min/inch)
Constraining factor	Low permeability
Solution	Pressure distribution, Type 2 10/10 or 3, timed dosing
Alternative solution	Sand mound, OR Lagoon, where appropriate, OR ETA bed, where appropriate
Notes	In the majority of cases these soils will have a clay content of over 40%

Soil type or condition	Sandy clay, silty clay or clay soils (with weak BK, GR or P structure)
Constraining factor	Low permeability, requires low HAR and unsuitable for infiltrative surface
Solution	System (Type 2 or 3) or Sand mound, with infiltrative surface a minimum of 18” (45 cm) above these soils AND pressure distribution with timed dosing
Alternative solution	Lagoon, where appropriate, OR ETA bed, where appropriate
Notes	In the majority of cases these soils will have a clay content of over 40%

Soil type or condition	Soil contains greater than 40% clay OR Kfs less than 20 mm/day, 120 min/inch Perc
Constraining factor	HLR table and LLR tables should be reduced
Solution	Pressure distribution, Timed dosing, Type 2 10/10 or Type 3 Professional design or design review
Alternative solution	Sand mound with Timed dosing and a minimum of 24" mound sand. Professional to establish basal HLR and LLR; OR Lagoon or ETA bed, where appropriate
Notes	Also applies where soil contains significant amounts of expandable clay minerals

Soil type or condition	Organic soils, peat
Constraining factor	Difficulty in establishing a suitable HLR
Solution	Professional to establish HLR and LLR
Alternative solution	
Notes	

Soil type or condition	Soils labelled as ‘not recommended’ in the HLR or LLR tables, or where the HLR or LLR tables show a zero
Constraining factor	Low permeability
Solution	Pressure distribution, Timed dosing, Type 2 10/10 or Type 3 Professional design or design review
Alternative solution	Sand mound with Timed dosing and a minimum of 24" mound sand. Professional to establish basal HLR and LLR; OR Lagoon, where appropriate, OR ETA bed, where appropriate
Notes	

Soil type or condition	Soils with a consistency stronger than moderately hard (dry), firm (moist), or of any cemented class
Constraining factor	HLR table and LLRs should be reduced
Solution	Professional design or design review and Professional to establish HLR and LLR
Alternative solution	Lagoon or ETA bed, where appropriate
Notes	

Soil type or condition	Depth of SHWT or low permeability layer less than 45 cm (18”) below surface
Constraining factor	Low vertical separation
Solution	Pressure distribution, Type 3, plus sand fill
Alternative solution	Sand mound per SPM standards, where appropriate
Notes	See VS tables

Table 2-13 Site Capability and System Type, Part A

System type	Soil type	Other constraint	Requirement or limit	Notes
Sand mound	Gravel and very gravelly sand or expandable clay soils		Timed dosing and a minimum of 61 cm (24") sand	
	Sand, gravelly sand soils		Minimum 61 cm (24") sand	
		Slopes over 25%	Not recommended	
		Concave slopes	Special care. Where the deflection from a straight line exceeds 10%, this technique should not be used. This need not be applied where subsurface water flow is primarily vertical and/or vertical separation is over 1.83 m (72").	
		O&G levels in effluent	≤ 15mg/L	Also for SLT
At grade beds		Slopes over 25%	Not recommended	
		Concave slopes	Special care. Where the deflection from a straight line exceeds 10%, this technique should not be applied where subsurface water flow is primarily vertical and/or vertical separation is over 1.83 m (72").	
Seepage beds	Other than Coarse sand, fine sand, loamy sand, silty sand or sandy loam		Not suitable	HLR reduction required (factor of 1.35)
		Slopes over 15%	Not suitable	
Pressure systems	Gravelly sand or Coarse to medium sand/loamy sand		Horizontal setbacks increased to same as for gravity systems. Setback credit is still applicable for sand mounds/similar technology using a minimum of 24" (600 mm) sand	

Table 2-13 Site Capability and System Type, Part B

System type	Soil type	Other constraint	Requirement or limit
Alternating fields	Gravelly sand or Coarse to medium sand/loamy sand		Consider increase in vertical separation
Type 2 systems	Gravelly sand or Coarse to medium sand/loamy sand soils	Where Type 2 loading rates are used	Consider increase in vertical separation
B.C. zero discharge Lagoons	Soil percolation rate less than 60 minutes/2.5 cm (1 inch) or Kfs greater than 20 mm/day		Not suitable
		Lots smaller than 1.62Ha (4.0 Acres)	Not suitable
		Slope over 12%	Professional design or design review
		Insufficient unsaturated soil depth	
		No net positive evaporation	
Evapotranspiration Absorption (ETA) bed	Soil percolation rate less than 60 minutes/2.5 cm (1 inch) or Kfs greater than 20 mm/day		
		No Annual net positive Evapotranspiration	
Evapotranspiration (ET) bed		Annual net positive Evapotranspiration less than 610 mm (24")	
All soil absorption systems, Soil moisture conditions	In all cases systems should not be constructed when soil moisture is too high, as this will damage soil structure and may lead to system failure. Cohesive soils above the plastic limit are too wet for system construction. Soil moisture should be assessed at surface, infiltrative surface level and 200 mm below infiltrative surface prior to system construction.		

Gravity Systems Summary

Soil type or condition	Other factors	Gravity system?
Fine sand/fine loamy sand; Sandy loam; Loam; Silt loam; silt	36″ or over VS in native soil (can include blinding layer)	OK
Loam; Silt Loam; Silt	Platy structure	NO
Clay loam;, sandy clay loam; silty clay loam; Sandy clay, silty clay or clay		NO
Gravel and very gravelly sands		NO
Gravelly sand; Coarse to Medium sand/ sandy loam	Only where VS is over 1.83 m (72") in Native Soil	OK
Fill below system	Other than blinding layer	NO
Blinding layer	Up to 10cm (4″) of C33 sand or Mound Sand	OK
Slope over 15%	Trickling or Dosed to D Box	NO
	Dosed serial or sequential	OK
Infiltrative surface over 93 m^2 (1,000 ft^2)	Trickling	NO
	Dosed	OK

Flood plains

The infiltrative surface of a trench or bed system or the basal area of a sand mound should be 2 feet above the 1 in 20 year flood level. Tanks and treatment facilities should also be located outside of the 1 in 20 year flood level. This restriction does not apply where the land is protected from flooding by dykes.

Where no part of the lot is available for the discharge area outside of the flood plain, the system could be constructed or repaired in the 1 in 20 year flood plain; however, any vent or electrical connection should be above the 1 in 20 year flood plain and no sand mound should be constructed in the flood plain area.

Lagoon berm top elevation should be a minimum of 1' above the one in 100 year flood level.

Part 3 summary tables

Tables summarizing common design, specification and installation numerical and other criteria. These tables do not include all the standards of the SPM. Refer to the SPM for explanatory information and full standards. Numbers refer to SPM sections.

3.5 Connections and Piping

Grade for 4" sewer	Min. 1% (⅛ inch per foot)
Grade for 3" sewer	Min. 2% (¼ inch per foot)
Direction changes between cleanouts	By not more than 5º every 3 m (10"), or by the use of fittings with a cumulative change in direction of not more than 45º; and, the size and spacing of cleanouts must conform to Table 3-2

Table 3-2 Cleanout Sizing and Spacing

Size of Drainage Pipe (inches)	Minimum Size of Cleanout (inches)	Maximum Spacing (metres)	
		One Way Rodding	Two Way Rodding
< 2.5	Same size as drainage pipe	7.5	15
3 and 4	3	15	30
> 4	4	26	52

3.6.1 Septic tanks and effluent filters

Effluent filter mesh	Filter particles greater than or equal to 2 mm (1⁄16")
Effluent filter intake	40% of liquid depth up from bottom to 40% of liquid depth down from liquid surface
Septic tank working volume, up to 9100 L/dy DDF	Three days detention time
Septic tank working volume, over 9100 L/dy DDF	15,000 L + (DDF in litres × 1.34)
Access riser diameter (primary accesses)	To permit hose manoevering, and larger than opeiing in tank. Min. 30” diam. if 36”-48” deep.
Venting	Separate vent if not connected to house venting
Passive grease interceptor working volume	Five days design flow from the kitchen or other facility served

3.7.3 Trench systems

Trench width	30.5 cm (1') to 90 cm (3') Slopes greater than 15% use narrower trenches if possible.
Single lateral length, gravity	Not greater than 30 m (100') Not greater than 15 m (50') preferred for trickling.
Trench or cell spacing	Not less than 1.83 m (6') from centre line to centre line, not less than 1.83m (6') between edges for bed systems. Slopes greater than 15% not less than 3 m (10')
Trench slope	Level or with a positive slope in the direction of flow not exceeding 5 cm in 30 m (2" in 100').
Blinding layer	4" (100 mm) layer C33 sand or mound sand. Where have macropores, or where soil prone to capping.
Aggregate depth	Minimum 230 mm (9") depth below pipe and minimum of 5 cm (2") above pipe.
Cover soil depth	Minimum 15 cm (6"), maximum 31 cm (12") unless frost requires greater depth.
Aggregate	Effective size range from 12 mm – 63 mm (½"– 2 ½"); and, all aggregate should be washed and screened and contain less than 5% fines, silt or clay coating.
Observation ports	100 mm (4") or 150 mm (6") diameter pipe 100 – 150 mm (4 – 6") from the distribution pipe near midpoint of the lateral.

3.7.3.3 Shallow, at grade, raised systems

Cover soil	Per sand mounds, inter trench cover may be over C33 sand or other fill material of similarly permeability.
Cover soil depth	Minimum 15 cm (6"), maximum 31 cm (12")
Cover soil width	Minimum of 61 cm (24") horizontally beyond the sides of the infiltrative surface and then at maximum 2h: 1v slope.
Water diversion	Required. Cover soil must also slope away from cell.

3.7.3.3 Gravelless systems

Blinding layer	Required for chamber systems with PD to Loam or finer soils. And otherwise per trench systems.
Orifice spacing, chambers	Chambers over 610 mm (24") in nominal width OR in sand mound or sand lined trench, maximum 0.37 m^2 (4 ft^2) per orifice.

3.7.5 Dosed Gravity systems

Dose frequency	1 to 2 times per day or more frequently
Dose volume	Minimum of 65 to 100% of the draining volume of the dispersal and distribution piping

3.7.7 Pressure distribution systems

Orifice discharge variation, maximum or per-square foot loading rate variation	Not greater than 15%, and within one lateral not more than 10%
Residual pressure (squirt)	No less than 61 cm (2') for 4.76mm (3/16") and larger orifices, not less than 1.5 m (5') for smaller orifices
Infiltrative surface per orifice	No more than 0.56 m^2 (6 ft2), see also sand mounds and at grade beds.
Orifice spacing, chambers	Chambers over 610 mm (24") in nominal width OR in sand mound or sand lined trench, maximum 0.37 m^2 (4 ft^2) per orifice.
Orifice shields	On all orifices, chamber systems on downward orifices.
Lateral spacing	Not more than 0.9 m (3') for bed; not less than 1.8 m (6') for trench.

3.7.7 Pressure system dosing

Dosing frequency	Per Table 3-6. Timed dosing minimum 18 × per day at DDF where possible. See also sand mounds and Table 2-12.
Dose volume, distribution	Preferred 80% or more of the dose is delivered at full system pressurization. Guideline dose is greater than or equal to 5 × the draining volume of the distribution network.
Demand dose pump chamber size guide	1 day Daily Design Flow.
Demand dose reserve vol.	15% DDF minimum recommended.
Demand dose alarm reserve	50% DDF minimum.
Timed dose pump chamber size guide	2 days Daily Design Flow.
Timed dose reserve volume	67% to 150% of DDF recommended.
Timed dose alarm reserve	50% DDF minimum.

Table 3-6 Minimum Dosing Frequency

Dosing frequency (minimum) for type 1 effluent loading rates	Soil type
Timed dosing	Coarse sand, gravels, sand mounds etc.
4 × per day	Medium sand, fine sand, loamy sand
2 × per day	Sandy loam, Loam, Silt Loam, Clay Loam
4 × per day	Well structured sandy Clay, silty clay or clay

3.7.9 Seepage Beds

HLR adjustment	Bed AIS increased by factor of 1.35
Bed width	Width should not be greater than 4 m (13'), system must also meet oxygen LLR standards.
Bed spacing	Minimum 1.83m (6’), larger spacing preferred for machine access.
Gravity fed lateral length, dosed	Laterals should not exceed 30 m (100')
Gravity fed lateral length, trickling	Laterals should not exceed 15 m (50')
Gravity lateral spacing	Not less than 0.9 m (3') and not greater than 1.2 m (4')
Pressure lateral spacing	Not more than 0.9 m (3')
Aggregate and cover	Per trench systems
Observation ports	Minimum two at near and far ends of outermost laterals.

3.7.10 At grade beds

Maximum effective bed width (AIS/length)	Not to exceed 3 m (10').
Actual bed width	Effective width (based on AIS), for sloping sites effective width plus 0.6 m (2') extra width
Overall length and width	Guideline actual bed length and width plus a minimum of 3 m (10') for cover soil and separation.
Bed spacing	Minimum 1.83m (6') between fill area (toe of fill), larger spacing preferred for machine access. Spacing min. 6m for systems on clay textured soils (Kfs<60mm/dy or Perc >40min/inch).
Piping network, flat site	Centered in bed
Piping network, sloping site	Start 0.6 m (2') from the uphill edge of the bed and no pipe should be placed in the lower half of the bed.
Distribution	Pressure only. Maximum 0.36 m (4 ft2) per orifice, and minimum one orifice per 610 mm (2') linear of bed.
Aggregate	Drain rock or pea gravel. Pea gravel (3–12 mm, ⅛ – ½" stone), washed and with <1% by weight passing the #200 sieve.
Aggregate depth	Minimum of 150 mm (6") aggregate below distribution network level (minimum at bed edges, 230 mm (9") minimum below pipes), 50 mm (2") above
Cover soil	150 – 305 mm (6 – 12"), may use geotextile below or graded filter per sand mounds. At bed ends and up and downslope a minimum of 0.6 m (24") horizontally from the edge of the bed.
Observation ports	Minimum two along downslope edge of bed 1/6 of length from ends (100 – 150 mm (4 – 6") from the distribution pipe). For flat sites, install at opposite edges of the bed at same spacing.

3.8 Sand Mounds and sand lined trenches

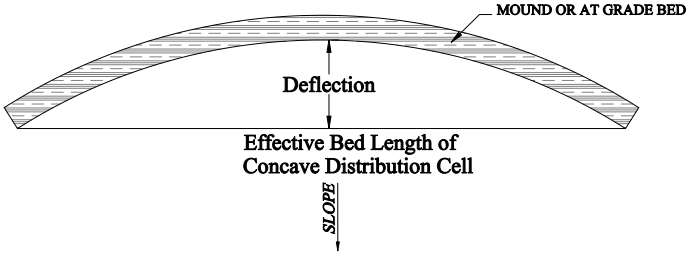
Maximum bed width	3 m (10') for sand mound.
Effective basal area, flat or low (≤ 1%) slope site	Area of sand under the bed and on all sides at a maximum 3h:1v slope
Effective basal area, sloping site	Area under the bed and downslope of the bed
Boulders, stumps etc	Adjust AIS
Aggregate	Pea gravel or ¾" drainrock. Pea gravel (3–12 mm, ⅛ – ½" stone), washed and with <1% by weight passing the #200 sieve.
Aggregate depth	Minimum pea gravel depth under distribution network 100 mm (6"), minimum over pipe 25 mm (1"), where ¾" drainrock is used increase depth below pipe to 230 mm (9") and over pipe to 50 mm (2")
Cover	Minimum cover of bed 150 mm (6"), maximum 460 mm (18") in centre (305 mm (12") preferred)
Cover slope over bed	Minimum cover slope fall from centre to bed edge 6" (150 mm).
Bed separation	minimum bed edges/ends to exposure is 610 mm (24")
Maximum side slope	2h:1v
Observation port, bed infiltrative surface	Minimum 2, located 1/6 of length from ends, on centerline 100 – 150 mm (4 – 6") from the distribution pipe.
Observation port, basal area	Minimum 2, located 1/6 of length from ends, on downslope side of bed (or on opposing sides for flat site), and half way between the bed and the toe of the mound. For sand lined trenches ensure these are minimum 305 mm (12") from the nearest orifice.

Above grade sand lined trenches

Edge of unit above grade	Minimum 150 mm (6"), with surface around draining away
Liner into native soil	Minimum 150 mm (6")
Separation to trees/ shrubs	Minimum 3 m (10') separation to nearest tree or shrub, or use a root barrier fabric.

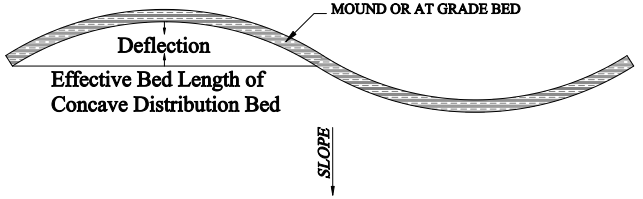
Sand mounds and sand lined trenches, dosing and distribution

Type of distribution	Pressure only
Orifice spacing	One orifice per 0.56 m^2 (6 ft^2). 0.37 m^2 (4 ft^2) is needed with chambers and is preferred for aggregate systems
Orifice separation	Minimum 305 mm (12") separation from orifices to outside of bed, stagger orifices in adjacent laterals.
Demand dosing	Type 1 only. Minimum of 8 × per day at DDF. Type 2 and 3 must used timed dosing.
Timed dosing	Maximum dose per square metre should not exceed 10% of the moisture holding capacity of the mound sand directly below the bed per dose. Moisture holding capacity of mound sand can be taken to be 50 mm/m (5% vv),
Timed dosing Type 1 guideline	To achieve this, dose at a minimum of 14 × per day at DDF for 610 mm (24") sand depth, 18 × per day at DDF for 460 mm (18") sand depth or where sand depth is less than 460 mm (18") at a minimum of 24 × per day at DDF



SIMPLE CONCAVE DISTRIBUTION CELL

Percentage of Deflection =
(Deflection/Effective Bed Length) x 100



COMPLEX CONCAVE DISTRIBUTION CELL

Septic tank (optional)	If used size minimum 2 times DDF
Gravity discharge with septic tank	May be installed to achieve a minimum flow velocity of 0.15 m/sec; be of smaller diameter (2" or 2.5" nominal); and, have no cleanouts. Minimum 30.5 cm (12") elevation drop from septic tank outlet invert to top of highest berm.
Gravity without a septic tank	Cleanouts at 15 m (50') apart (maximum distance), with screw caps at grade. Slope 1.5 % for a 3'' pipe, 1% for a 4" pipe minimum. House sewer outlet invert to top of highest berm minimum 45 cm (18") drop (guideline).
Pipe outlet (gravity)	Minimum of 2 m (6') into the lagoon, 30.5 cm (1') above the lagoon bottom
Sizing	Based on average flow at ½ of DDF, see tables.

Table 3-10 Rectangular Lagoon Cell Sizing—Wetter Northern Interior BC

Bedrooms	Estimated Average Daily Flow (L/(I G)	Volume	Depth	Dimensions-Bottom Inside Meters (feet)	Total Surface Area	
		Cubic Meters (Cubic Ft.)	Meters (feet)		Top Inside Meters (feet)	Square metres (square feet)
1-2	568 (125)	415 (14,951)	3 (10)	14 x 4 (47 x 13)	26 x 16 (87 x 53)	416 (4,611)
3	682 (150)	508 (18,172)	3 (10)	16 x 5 (53 x 17)	28 x 17 (93 x 57)	476 (5,301)
4	850 (187)	661 (23,343)	3 (10)	20 x 6 (67 x 20)	32 x 18 (107 x 60)	576 (6,420)
5	1,023 (225)	777 (27,439)	3 (10)	22 x 7 (73 x 23)	34 x 19 (113 x 63)	646 (7,119)
6	1,250 (275)	972 (34,326)	3 (10)	24 x 9 (80 x 30)	36 x 21 (120 x 70)	756 (8,400)

Table 3-11 Rectangular Lagoon Cell Sizing-- Drier Northern Interior BC

Bedrooms	Estimated Average Daily Flow (L/IG)	Volume	Depth	Dimensions-Bottom Inside Meters	Total Surface Area	
		Cubic Meters	Meters		Top Inside	Square metres
1 – 2	568 (125)	121	3	6.2 x 4.7	15.2 x 13.7	208
3	682 (150)	255	3	7 x 6	16 x 15	240
4	850 (187)	305	3	8 x 7	17 x 16	272
5	1,023 (225)	389	3	10 x 8	19 x 17	323
6	1,250 (275)	445	3	12 x 8	21 x 17	357

Table 3-12 Circular Lagoon Cell Sizing Standards-- Northern B.C.

Bedrooms	Estimated Average Daily Flow (L/IG)	Volume Max. Water level	Depth	Top inside Diameter	Bottom diameter	Total Surface Area
		Cubic Meters	Meters (feet)	Metres (feet)	Metres	Square metres (square feet)
1 – 2	568 (125)	542	4 (13)	22 (72)	6	380 (4,090)
3	682 (150)	619	4 (13)	23 (75)	7	415 (5,113)
4	850 (187)	791	4 (13)	25 (82)	9	490 (5,274)
5	1,023 (225)	985	4 (13)	27 (88)	11	572 (6,157)
6	1,250 (275)	1,260	4 (13)	29.5 (97)	13.5	683 (7,352)

Conversions:

US unit	X	= Metric Unit	X	= US Unit	X	= secondary unit
Gallons	3.785412	Litres	0.264172	Gallons	0.8326738	Imperial Gal.
feet	0.3048	meter	3.28083	ft of head	0.4329004	PSI
Atmosphere	101.325	Kpa	0.1450377	PSI	0.06894757	Bar (=100 Kpa)
				Gallons	0.1336806	cu ft
		Cu m	35.31467	cu ft	7.480519	gallons
GPD/sqft	40.74648	Lpd/sqm	0.024542	GPD/sqft		
GPD/ft	12.418	Lpd/m	0.080528	GPD/ft		
Sq ft	0.0929	Sq m	10.76391	Sq ft		
Inches	0.0254	Meters	39.36996	Inches		
Feet	0.3048	Meters	3.28083	Feet		

Areas and volumes of simple shapes

Rectangle and rectangular prism (box)

Area = Length x Width
Diagonal = Square root of sum of squares of Width and Length
Volume = Length x Width x Height
Or = Area of base x Height

Circle

Area = Square of Diameter x .7854
or Square of Radius x 3.1416
Circumference = Diameter x 3.1416
Diameter = Circumference x .3183

Sphere

Area of Surface = Square of Diameter x 3.1416
Volume = Cube of Diameter x .5236

Cylinder

Area of Curved Surface = Diameter x Length x 3.1416
Volume = Square of Diameter x Length x .7854