Technical guidelines for construction of institutional and public toilets - Annexes

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Technical guidelines for construction of institutional and public toilets

Annexes

1 Standards for calculating numbers of facilities needed

Note that there is a column on the right where you can fill out your own national standards (where they exist) to compare to the standards shown.

As a general guide, toilet provision should be:
- 2:1 female to male (as women may take longer to go to the toilet for a range of reasons)
- 1:10 accessible/inclusive style to ordinary style (ideally these should be provided for both male and female toilets, but in some cases where there is a lack of space a gender-neutral, accessible toilet may be provided)

Target number of toilets[1]

	Specific sub-group	Ratio to population	Your national standards
Schools	Primary (up to 11 years old) and special needs schools	1 per 10 pupils under 8 years 1 per 20 pupils over 8 years Toilets are separated for boys and girls	
	Secondary schools female students	1 per 25 females (with or without urinals)	
	Secondary schools male students	1 per 25 males if no urinals; 1 per 50 males if urinals provided	
	Boarding (residential) schools	Add additional 1 per 7 boarders	
	Staff & visitors (Separate staff toilets from pupils' toilets)	1 per 25 staff members	
	Accessible/ inclusive	1 additional toilet for boys, and 1 for girls	

Health care facilities	Inpatients & carers	For each ward, 1 toilet for women and 1 toilet for men	
	Outpatients & carers	1 per 20-25 up to 100 patients/carers Add 1 per additional 50 patients/carers Provision 2:1 female to male	
	Male staff	Same as female provision if no urinals; or, if urinals provided: 1 per 15 males if 30 or less 1 per 25 for up to 100 males Add 1 per additional 50 males	
	Female Staff	1 per 5 females; 2 per 15 females Add 1 per additional 15 females up to 100 (8 per 100) Add 1 per additional 25 females	
	Accessible	1 for every 10 toilets (minimum 1) For each maternity ward, provide 1 toilet	
Public areas	Males	Half of female provision	
	Females	1 per 100 females up to 500 Add 1 per additional 200 females	
	Accessible/ inclusive	1 for every block of toilets	

Target number of urinals

	Specific sub-group	Ratio to population	Your national standards
Schools	Male students & staff (same ratios for female where adopted)	1 per 25 students and staff Add 1 per 25 boarders	
Health care facilities	Male patients (same ratio for female where adopted)	1 per 25 patients	

Public areas	Male staff & visitors (same ratios female where adopted)	1 per 30 up to 100 males Add 1 for every additional 50 male	
	Males (same ratio for females where adopted)	1 per 100 up to 500 males 1 for every additional 200	

Target number of handwashing facilities

	Specific sub-group	Ratio to population	Your national standards
Schools	Primary (11 years old and below) and special needs	1 per toilet/urinal	
	Secondary schools including boarding	1:1 for first two toilets/urinals, then minimum 2:3 handwashing facilities to toilets/urinals	
Health care facilities	Patients	1 per toilet/urinal	
	Staff & visitors	1 per toilet, plus 1 per 5 urinals	
Public areas	General	1 per toilet, plus 1 per 5 urinals	

Target number of laundry / MHM facilities

	Specific sub-group	Ratio to population	Your national standards
Schools	Primary schools	Girls toilets should have a bin for disposal of sanitary items At least 1 toilet or separated area should have facilities for washing and drying pads; more than 1 for larger schools	
	Secondary schools (female)	Every toilet should have a bin for disposal of sanitary items At least 1 toilet or separated area should have facilities for washing and drying pads; more than 1 for larger schools	

	Boarding (residential) schools (female)	Every toilet should have a bin for disposal of sanitary items Every toilet block should be provided with an area for washing and drying pads, as well as an area for washing clothes	
Health care facilities	Staff, visitors, out-patients (female)	Every toilet should have a bin for disposal of sanitary items At least 1 toilet or separated area should have facilities for washing and drying pads	
	In-patients	There must be provision of the means for patients to manage their menstrual health needs, however this is likely to fall within general patient care and is beyond the scope of this guideline	
	General	Healthcare facilities will require at least one laundry facility for washing of sheets etc	
Public areas	Females	Every toilet should have a bin for disposal of sanitary items At least 1 toilet or separated area should have facilities for washing and drying pads; more than 1 for larger schools Every toilet block should be provided with an area for washing clothes; this should be separate from a dedicated MHM area if possible	
	Males	Every toilet block should be provided with an area for washing clothes	

Target number of bathing facilities

	Specific sub-group	Ratio to population	Your national standards
Schools	Special, primary & secondary schools	1 bathing area per 10 pupils	
	Boarding (residential) schools	1 bathing area per 10 boarders, minimum 25% to be baths where practical	
Health care facilities	Inpatients & carers	1 bathing area per 40 patients, separated for men and women, and including at least 1 accessible bathing area per 40 patients To be as close as possible to where health care is being given (e.g. per ward) For maternity wards, include 1 accessible bathing area per ward	
	Outpatients & carers	1 bathing area per 40 patients, separated for men and women, and including at least 1 accessible bathing area per 40 patients	
	Staff & visitors	1 bathing area per 40 staff, separated for men and women 1 accessible bathing area per 100 staff	
Public areas	Females	Should provide bathing area or private washing area, 1 per 10 toilets[2]	
	Males	Should provide bathing area or washing area, 1 per 10 toilets[3]	

Worked example of decision-making for toilet numbers required

This is a worked example for deciding toilet numbers using figures from Annex 1, based on a particular scenario – note that in your own context, the scenario and population numbers will be different, so this is only to demonstrate the calculation process.

Scenario: you need to calculate how many toilets and related facilities to construct (including urinals for both the male patients and staff members) for a health care facility which currently has 120 outpatients per day (no inpatients), 10 staff (5 men, 5 women):

Population numbers: in consultation with relevant people (e.g. health staff, district health office), you estimate that within 20 years the number of patients and carers could increase to around 200 per day, while staff might increase to 16 (you assume an even split of 8 men and 8 women).

		Recommended figures/ratios	Number to construct
Toilet cubicles	Patients	1 cubicle for every 20-25 patients/carers (up to the first 100), and 1 for every 50 thereafter.	We have 200 patients/carers, so for the first 100 we can estimate 4-5 cubicles, plus 2 cubicles for the second lot of 100 patients. So maximum 7 cubicles.
		Provision should be 2:1 female to male.	The allocation could be 5 cubicles for women and 2 for men.
		1 accessible/ inclusive toilet for every 10 toilets.	Add 1 toilet for patients.
	Staff	2 cubicles for up to 15 females.	We will have 8 female staff, so 2 cubicles should be sufficient.
		1 cubicle for up to 15 males where urinals are used.	In our case, we are planning to construct urinals, so 1 cubicle will be fine for male staff.
		1 accessible/ inclusive toilet for every 10 toilets.	Add 1 toilet for staff.
Urinals for men	Patients	1 urinal for every 25 patients.	We have 200 patients, so assuming around 100 are male patients this means 4 urinals.
	Staff	1 urinal for every 30 male staff members.	We will have 8 male staff, so 1 urinal will be sufficient.

Handwashing stations	**Patients**	1 handwashing station per toilet cubicle or urinal for patients	We are planning 8 toilets and 4 urinals for patients, which means 12 handwashing stations.
	Staff	1 handwashing station per toilet, plus 1 per 5 urinals for staff	We are planning 4 toilets and 1 urinal for staff, which means 5 handwashing stations.
Laundry/MHM areas	**Patients & staff**	A health centre will need at least 1 laundry facility.	At least 1 laundry area for washing of sheets etc.
	Female outpatients, female staff & female visitors	For female staff/visitors/outpatients, every toilet should have a bin for disposal of sanitary items.	We are planning 9 female/accessible toilets for patients and staff, so need 9 bins.
		For female staff/visitors/outpatients, at least 1 toilet (or separated area) should have facilities for washing and drying pads.	Since toilets are separated between patients and staff, it means one of both the female/gender-neutral patient and staff toilets needs a washing/drying area. So 2 such areas in total.
Bathing areas	**Patients**	1 accessible bathing area for outpatient use.	1 bathing area.
	Staff	1 accessible bathing area for every 100 staff.	We only have 8 staff members, so 1 bathing area will be enough.

2 Assessing risks of contamination of groundwater from on-site sanitation

A – Overview chart of minimum distances[4]

The following table provides an overview of the recommended minimum distances for specific contexts to reduce the risk of contamination of drinking water. The sections which then follow provide decision-making guidance for the circumstances where there is a higher risk of contamination for groundwater pollution, where the 30m rule will not be valid.

Table A1 - Recommended minimum distances

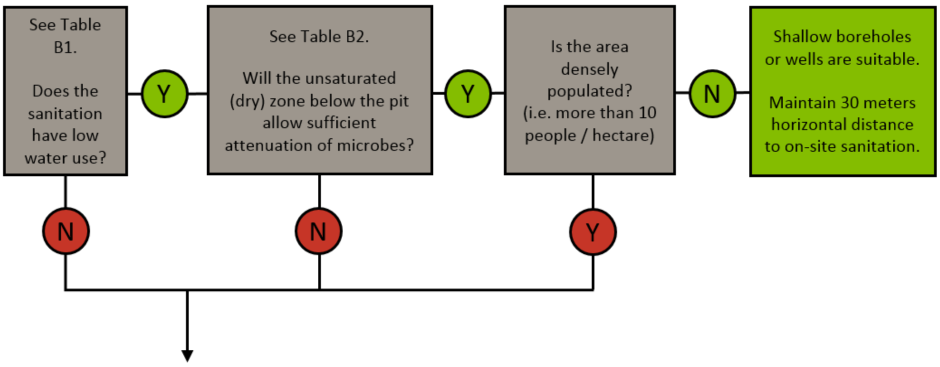
	Recommended minimum distances	Notes
Distances between groundwater sources and latrines or septic tank drain fields	30m = more than enough in certain circumstances (see notes). Where any one of those factors changes (e.g. septic tank is used, or distance to water table only 5m, or where soil type is coarse sand), then a decision-making flow chart must be used that considers vertical separation, lateral separation and how to mitigate residual risks (see section B below).	30m will be valid where: (a) Distance from base of latrine pit to water table is 10m or more, and (b) Where soil type is clay, silt, fine sand or weathered basement, and (c) Where sanitation is dry sanitation or pour-flush with fewer than 10 users, and (d) Where it is not a densely populated urban area
Distance between bottom of a latrine and the water table	Ideally >5m in clay/silt/fine sand soils >10m in other soil types	This is not always possible – in case the distance is less, a decision-making flow chart can be used (see Section B below).
Distances from groundwater point source to soakage (i.e. length of drainage channel to soak-pit / animal trough etc)	Minimum of 6m	
Minimum size of cement platform around a well or borehole	1.5 m from edge of hand-dug well rings or borehole casing, to edge of apron	
Distances between clean water and wastewater / sewage pipes	Water pipes should ideally always be laid in separate trenches or always be laid at least 50cm <u>above</u> sewage or wastewater pipes. This is so that if the sewage or wastewater pipes leak they do not leak on the drinking water pipe. Where possible keep any drinking water pipeline away from any sewage source to >10m (in	The 10m is based on the same logic for distance from latrine pit to water table – it will be sufficient for clay, silt, fine sand, weathered basement and medium sand (but not for fractured rock or gravels). It assumes that drinking water in pipelines may flow intermittently

	Recommended minimum distances	Notes
	ground outside of buildings) – *but no official minimum distance*.	and hence there is a risk of ingress of contaminants at joints and leaks.

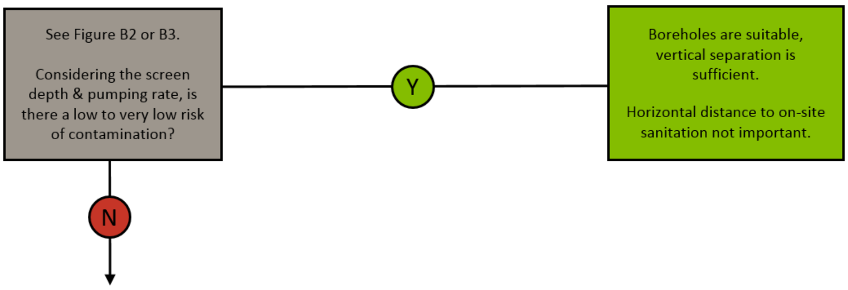
B - Simplified decision-making flow chart when assessing risks of contamination of groundwater from on-site sanitation[5]

Note: the word 'attenuation' means how the contaminant will reduce as it passes through the soil.

Step 1: Assess the attenuation in the unsaturated (dry) zone



Step 2: Assess attenuation considering depth of screen & pumping rate



Step 3: Assess attenuation using horizontal separation

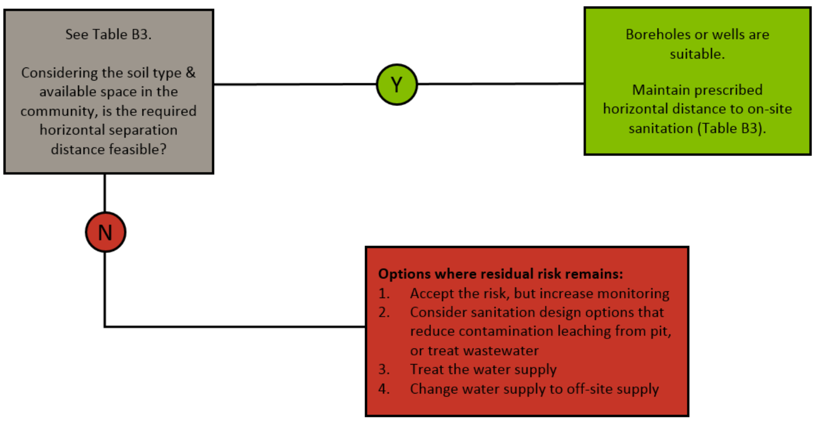


Table B1 - Water use of different sanitation types

Sanitation type

	Dry	Wet
Low water use (< 50 mm/day)	Latrines (e.g. simple, VIP, UDDT / composting)	Pour-flush (low usage <10 people)
High water use (> 50 mm/day)		Pour-flush (high usage >10 people) Septic tanks

Table B2 – Attenuation of microbes in the unsaturated zone

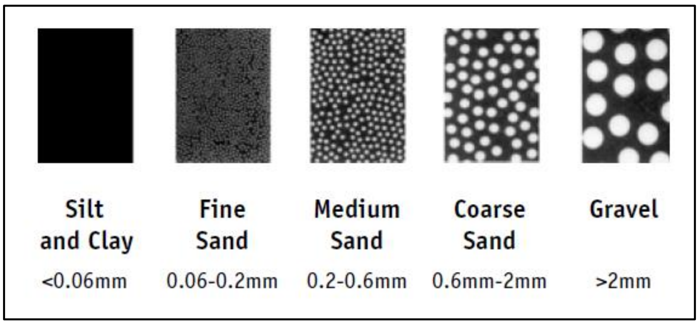
Rock & soil types in unsaturated zone	Depth to water table from base of pit		
	0 – 5 metres	**5 – 10 metres**	**More than 10 metres**
Fine sand, silt, clay[1]			
Weathered basement rock[2]			
Medium sand[1]			
Coarse sand & gravels[1]			
Sandstones / limestones, fractured rock			

Significant risk that unacceptable level of micro-organisms may reach the water table

Low to very low risk that unacceptable level of micro-organisms may reach the water table (i.e. travel time of pathogens through unsaturated zone is greater than 25 days)

Figure B1 – Estimation of grain size

[1] To estimate grain size of silt and sand, see the diagram below (ensure it is to scale when printed):



[2] Weathered basement is the top part of a mass of rock which has been degraded over time. To tell if a rocky material is weathered, check how easy it is to dig through it – if it is soft and easily dug, then it should be considered as weathered rock.

Table B3 – Feasibility of using horizontal separation

Rock & soil types	Typical porosity	Range of likely permeability (m/day)	Horizontal separation needed to have low risk of pathogens arriving at water point	Feasibility of using horizontal separation
Silt	10 – 20%	0.01 – 0.1	30 metres	Yes
Fine silty sand	10 – 20%	0.1 – 10	30 metres	Yes
Weathered basement rock (not fractured)	5 – 20%	0.01 – 10	30 metres	Yes
Medium sand	20 – 30%	10 – 100	125 metres[1]	Maybe (depending on site conditions)
Coarse sand, gravel, fractured rocks	20 – 30%	10 – 1,000	Hundreds of metres[2]	No

[1] Distance in medium sand varies a lot (see Table B4), so this is the worst case.
[2] There is large variability here, but likely to be many hundreds of metres

Table B4 – Logic calculations for the medium sand values in Table B3

Description of sand	Hydraulic conductivity *K* (m/d)	Porosity *φ* (%)	Hydraulic gradient (*i*)	Velocity (*Ki*/φ)	Number of days for low risk	Separation (m)
Medium sand 1	10	20%	0.01	0.500	25	12.5
Medium sand 2	10	40%	0.01	0.250	25	6.3
Medium sand 3	100	20%	0.01	5.000	25	125.0
Medium sand 4	100	40%	0.01	2.500	25	62.5

Calculation of contamination risk considering screen depth and pumping rate (using Figure B2 or B3 below):

1. Estimate the grain size of the soil between the on-site sanitation and screen of the borehole using Figure B1 – you can get this information from borehole logs.
2. Based on grain size chosen, refer to one of the two graphs below. These graphs consider both the depth of the screen (which is the part of the borehole construction that allows water to enter) and the pumping rate.
3. Choose one line that represents the depth of the screen in your borehole.
4. Find the point on that line that corresponds to the water point pumping rate. For handpumps, assume 0.2 litres/second (when averaged over a day).

5. Does this point fall within the light or dark grey areas (low risk or very low risk of contamination)?

Figure B2 – Travel time versus pumping rate, screen depth and soil type (1 of 2)

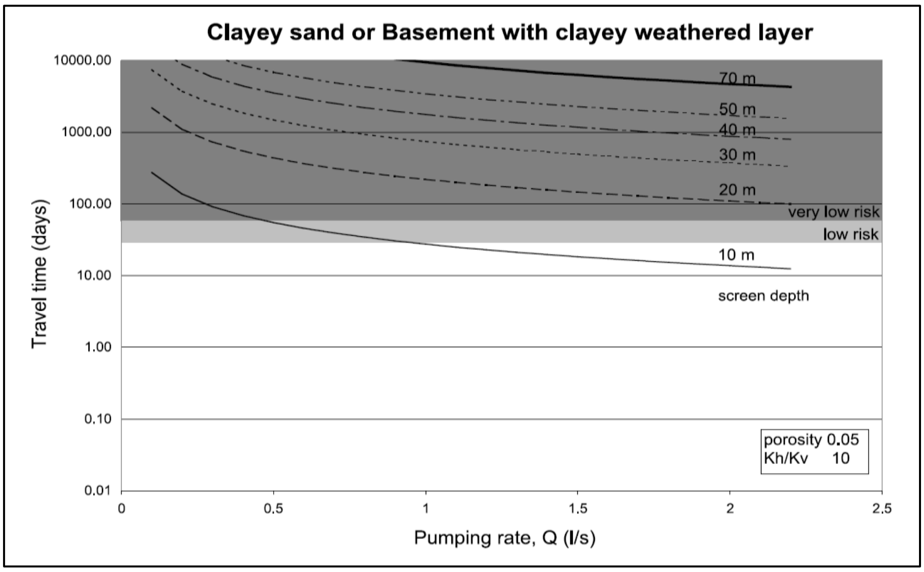
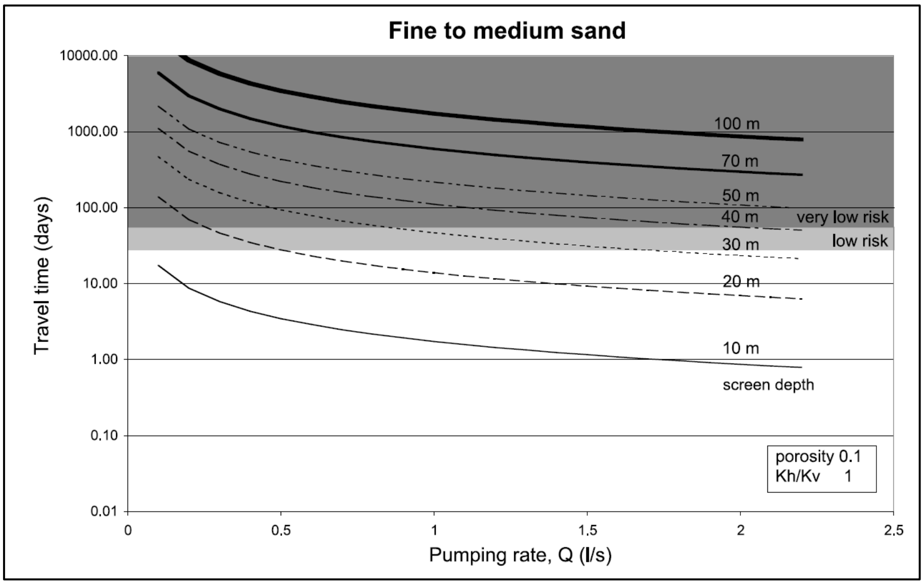


Figure B3 – Travel time versus pumping rate, screen depth and soil type (2 of 2)



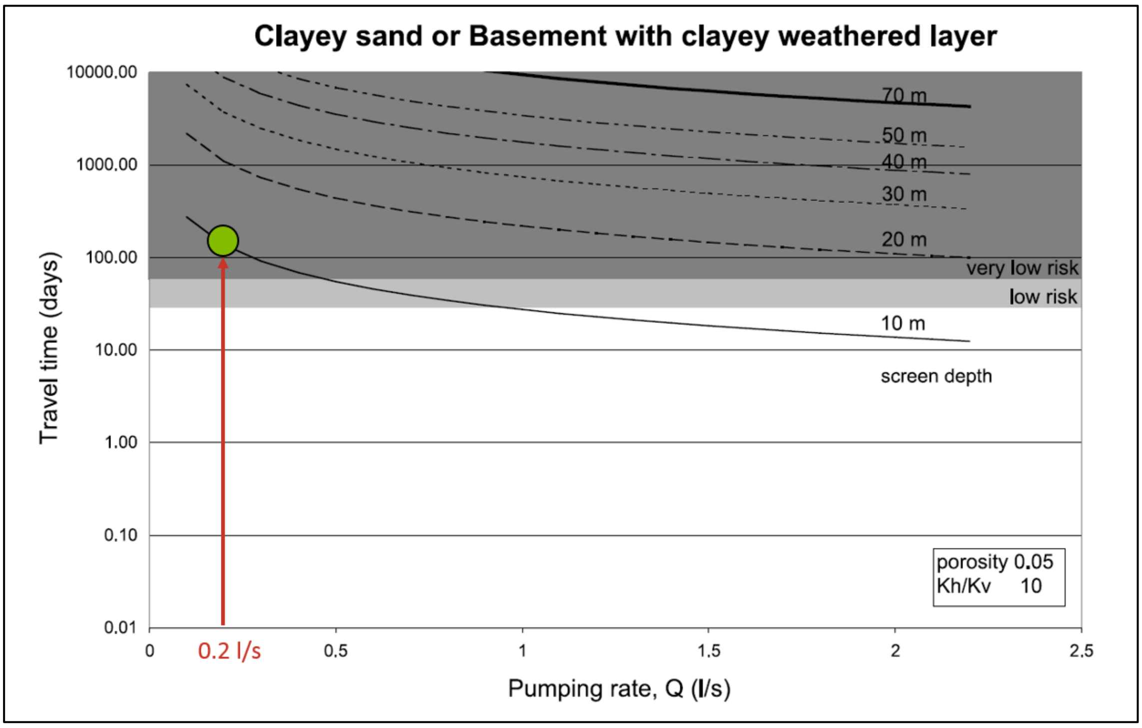
Worked example 1 following the flow chart above:

Step 1:

- The on-site sanitation is a VIP latrine pit. Looking at Table B1, we know that water usage is therefore low.
- The soil type in the vicinity of the latrine pit is a mixture of clay and sand/silt, and we know that the water table is at 7 metres below ground level, with the pit latrine being 3 metres deep. This means the distance from the bottom of the pit to the water table is 4 metres. Looking at Table B2, we can therefore see that for clay/sand/silt conditions, this is not enough vertical distance between the pit and water table. Therefore we must move to step 2.

Step 2:

- The borehole screen is located at 10 metres below ground level, and the soil type above this is mostly clay and sand/silt – this information we found from the borehole log.
- There is a pump on the borehole, but it is only a handpump, which we assume has an extraction rate of 0.2 litres/second.
- Looking at Figure B2 (the one for clayey sand), we can see that for the extraction rate and screen depth, we are in the 'very low risk' dark grey shaded area (see diagram below). Therefore we know that vertical separation will be sufficient in this case to prevent contamination from the latrine.



Worked example 2 following the flow chart above:

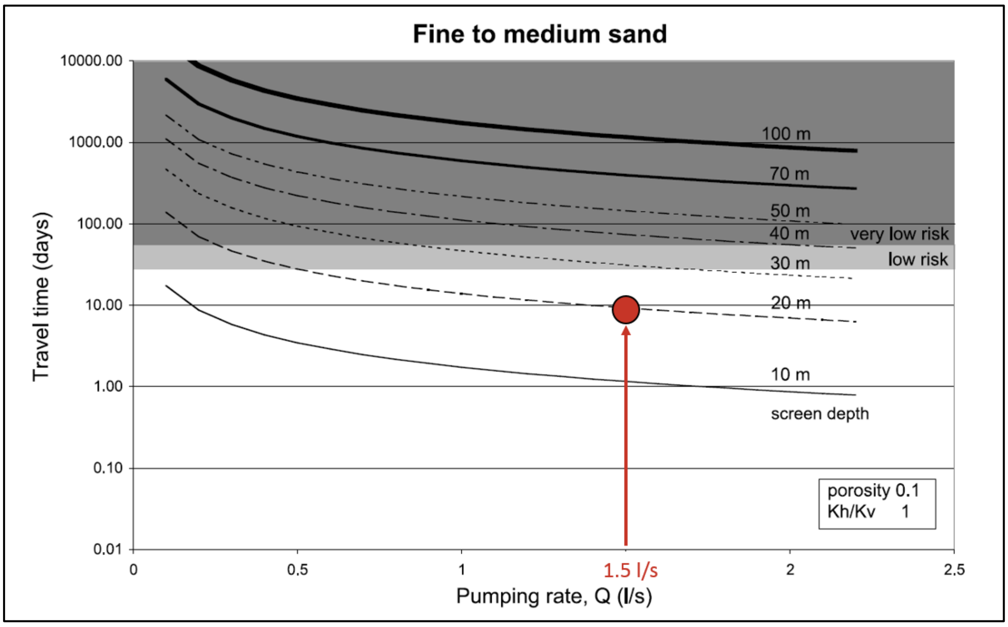
Following the flow chart:

Step 1:

- The on-site sanitation is a simple latrine pit. Looking at Table B1, we know that water usage is therefore low.
- The soil type in the vicinity of the latrine pit is medium sand, and we know that the water table is at 16 metres below ground level, with the pit latrine being 2 metres deep. This means the distance from the bottom of the pit to the water table is 14 metres. Looking at Table B2, we can therefore see that for medium sand conditions, this is more than the 10 metres required, so there will be enough vertical distance between the pit and water table.
- However, the area is peri-urban, so the population density is greater than 10 people per hectare. Therefore we must move to step 2.

Step 2:

- The borehole screen is located at 20 metres below ground level, and the soil type above this is mostly medium sand – this information we found from the borehole log.
- There is a pump on the borehole, but this time it is a motorised borehole pump, which we know has an extraction rate of 1.5 litres/second.
- Looking at Figure B3 (the one for medium sand), we can see that for the extraction rate and screen depth, we are not in the 'low risk' grey shaded area, rather we are in the risk area (see diagram below). Therefore we know that vertical separation will not be sufficient in this case to prevent contamination from the latrine. Therefore we must move to step 3.



Step 3:

- Looking at Table B3, for medium sand we can see that we need 125m of separation between the water point and the on-site sanitation. In the peri-urban environment, this is not really feasible due to the population density. Therefore we know that we cannot use horizontal separation to prevent contamination.

- If it is necessary to use borehole water in this instance, the last option is then to consider how to mitigate the risks. In this case it would be essential to treat the borehole water including using chlorination or an alternative disinfection process and to monitor the effectiveness of the treatment to ensure it can be used as safe drinking water.

3 Pit sizing procedure

Note that in addition to the procedure[6] outlined below, there is an Excel calculation tool that you can use which is available as **Annex 3.1**.

<table>
<tr><th>Step</th><th>Explanation</th><th>Worked example</th></tr>
<tr><td>Step 1:
Determine the number of users for the pit in question.</td><td>Refer to Annex 1.1. It could be that you are designing one cubicle over one pit, or several cubicles over a trench pit. Either way, you should know how many people will access each cubicle, and therefore the number using the pit.</td><td>This example looks at a pit below a single cubicle for boys in a secondary school, where there are no urinals. Looking at Annex 1.1, we can determine for our situation, that there will be 25 users accessing this cubicle.</td></tr>
<tr><td>Step 2:
Decide on the sludge accumulation rate.</td><td>This will vary depending on whether excreta is retained in water (i.e. in a sealed pit with no leaching, or in a high water table area), as well as what anal cleansing materials are used (refer to the table below).
<table>
<tr><th></th><th>Anal cleansing material</th><th>Sludge accumulation (L/person/year)</th></tr>
<tr><td rowspan="2">Excreta in water</td><td>Degradable</td><td>40</td></tr>
<tr><td>Non-degradable</td><td>60</td></tr>
<tr><td rowspan="2">Excreta in dry conditions</td><td>Degradable</td><td>60</td></tr>
<tr><td>Non-degradable</td><td>90</td></tr>
</table></td><td>In our situation, water and paper are used for anal cleansing, and the pit is not sealed and is above the water table.
In this case we can take the figure of 60 litres per person per year (which is 0.06 m^3).</td></tr>
</table>

<table>
<tr>
<td>Step 3:

For schools, modify the sludge accumulation rate.</td>
<td>Children do not produce as much sludge as adults, and also they are not present at the school all year. For these reasons, you can reduce the sludge accumulation rate according to the following:

<table>
<tr><th></th><th>Modification</th></tr>
<tr><td>High schools</td><td>Multiply adult rate by 75%</td></tr>
<tr><td>Primary schools</td><td>Multiply adult rate by 50%</td></tr>
<tr><td>Nursery schools</td><td>Multiply adult rate by 25%</td></tr>
<tr><td>Factor in only school days</td><td>Multiply by % of the year children are in school</td></tr>
<tr><td>For day schools</td><td>Multiply by another 50%</td></tr>
</table>
</td>
<td>As this is a secondary school, we can multiply the adult sludge accumulation rate by 75%.

So 75% x 0.06 m^3 = 0.045 m^3.

But the children are only there for 200 days in the year, so we can reduce this rate again.

So 200/365 = 55% x 0.045 m^3 = 0.025 m^3.

It is also a day school, so we can reduce this rate further.

So 0.025 m^3 x 50% = 0.0123 m^3.</td>
</tr>
<tr>
<td>Step 4:

For cold climates, modify the sludge accumulation rate.</td>
<td>In temperatures below 20°C, biological processes slow down, to the point where at freezing they effectively stop. The effect of colder temperatures will be that sludge volume per person will increase – you therefore need to factor this in.

If you know the average annual temperature, you can account for this increase by using this formula to obtain an increase factor:

1 + ((20°C – average annual temperature) / 20°C)</td>
<td>The average annual temperature is 15°C, so our increase factor will be:

1 + ((20°C – 15°C) / 20°C) = 1.25

We then modify our sludge accumulation rate from Step 3: 0.0123 m^3 x 1.25 = 0.015 m^3.</td>
</tr>
<tr>
<td>Step 5:

Decide on design life.</td>
<td>Decide how long you want to design before the pit is full or needs emptying.</td>
<td>We decide that we want to try to design for 5 years between emptying.</td>
</tr>
</table>

Step 6: **Decide on the internal area of your pit.**	This will be a function of slab span and width, which itself might be dependent on cubicle design (e.g. a wider cubicle in an Accessible Toilet). Don't forget to keep a minimum of 10 cm overlap from a slab onto the lining.	Our slab is going to have dimensions of 1.1 x 1.1 metres, and the pit is going to be square. With 10 cm overlap, that means an internal pit area of 0.9 x 0.9 = 0.81 m^2.
Step 7: **Calculate the volume of sludge produced.**	This will be the number of users multiplied by the sludge accumulation rate multiplied by the number of years.	The sludge volume will be: 25 users x 0.015 m^3 per user x 5 years = 1.93 m^3.
Step 8: **Calculate the depth of this sludge.**	This will be the sludge volume divided by the pit area.	Volume = width x length x depth. So it follows that depth = volume / (width x length). So depth of sludge will be 1.93 m^3 / 0.81 m^2 = 2.38 metres.
Step 9: **Add the pit depth to be left for backfilling to get total pit depth.**	Finally we need to add 0.5 metres which should be allowed for at the top of the sludge before backfilling, in addition to the sludge depth.	2.38 metres of sludge + 0.5 m extra for backfilling = 2.88 metres depth total. This is the depth that we would need to dig.

4 Septic tank design procedure

Note that in addition to the procedure[7] outlined below, there is an Excel calculation tool that you can use which is available as **Annex 4.1**.

<table>
<tr><th>Step</th><th>Explanation</th><th>Worked example</th></tr>
<tr>
<td>Step 1:

Determine the amount of wastewater to be treated per day (Q)</td>
<td>This will include toilet wastewater, and non-toilet wastewater.

1. For toilet wastewater, you can estimate this by: number of cubicles x visits per day x litres per flush. Litres per flush depends on the diameter of the u-bend (see table below). Or another way (if you know from the water supply side how much water is used), you can take a figure of 90% of daily water supply as the amount.
2. For other wastewater, you need to estimate what this is likely to be.

<table>
<tr><td>90mm u-bend</td><td>2-3 litres/flush</td></tr>
<tr><td>120mm u-bend</td><td>4-5 litres/flush</td></tr>
</table>
</td>
<td>This example looks at a toilet block with 3 cubicles, used by 60 people, where you estimate there might be 60 toilet visits per day in total. The u-bend of the pipework between cubicle and tank will be 90mm.

So 3 cubicles x 60 visits x 3 litres/flush = 540 litres.

In addition you estimate for the laundry that another 100 litres will be used per day.

So total wastewater expected will be 540 + 100 = 640 litres, or 0.64 m^3/day.</td>
</tr>
<tr>
<td>Step 2:

Decide on the wastewater retention time in the tank (R).</td>
<td>This factor depends on the wastewater flow. See the table below.

<table>
<tr><th>Daily wastewater flow</th><th>Retention time in hours (R)</th></tr>
<tr><td>Less than 6 m^3</td><td>24</td></tr>
<tr><td>Between 6 – 14 m^3</td><td>33 – (1.5 x total daily wastewater in m^3)</td></tr>
<tr><td>Over 14 m^3</td><td>12</td></tr>
</table>
</td>
<td>In our situation, the flow of 0.64 m^3 is less than 6m^3, so we choose a retention time of 24 hours.</td>
</tr>
<tr>
<td>Step 3:

Determine the liquid volume (A)</td>
<td>The liquid volume for the tank is calculated according to the formula:

$A = Q \times R / 24$</td>
<td>So A = 0.64 m^3 x (24 / 24) = 0.64 m^3.</td>
</tr>
</table>

Step 4:

Determine sludge & scum volume (B)

This is calculated using the following formula:

B = P x N x S x F, where:

P is the number of people using the system

N is the number of years between sludge emptying – usually taken as between 2 and 5 years

S is the rate of sludge & scum accumulation in m^3 (see table below)

F is the digestion factor, which varies depending on temperature and time between emptying (see table below)

Rate of sludge & scum accumulation (S)	
25 litres (0.025 m^3) /person/year	For tanks receiving toilet waste only
40 litres (0.04m^3) /person/year	For tanks receiving toilet waste AND other wastewater

Sludge digestion factors (F)			
Years between de-sludging	Average air temperature		
	>20°C all year	10-20°C all year	<10°C in winter
1	1.3	1.15	2.5
2	1.0	1.15	1.5
3	1.0	1.0	1.27
4	1.0	1.0	1.15
5	1.0	1.0	1.06
6+	1.0	1.0	1.0

In this case, there are 60 people using the system.

We decide we would like an interval of 5 years between emptying.

The wastewater includes non-toilet wastewater so an accumulation rate of 0.04 m^3/person/year is chosen.

The local temperature is between 10 – 20°C all year, so given a period of 5 years between de-sludging, that means we can use a digestion factor of 1.0.

So 60 people x 5 years x 0.04 m^3 x 1.0 = 12 m^3.

Step 5: **Determine the tank dimensions for the sludge.**	The aim here is to know what depth, width and length of the two compartments should be. For tank depth, you can assume a depth for the design – this is often taken as between 1.2 – 1.5 m (but note it should not be greater than 3 x width). For the width and lengths, these can be determined from the combined volume of liquid (A) and sludge & scum (B), together with tank depth, and by using the rule of thumb that length should be 3 x width. The equation below can therefore be used: If L = 3 x W, then W = L / 3. Volume (V) = L x W x H V = L x L/3 x H V/H = L x L/3 (V/H) x 3 = L x L √((V/H) x 3) = L Once length is known, the following is then deduced: Tank width = 1/3rd length First compartment = 2 x width Second compartment = 1 x width	For our design, we will start by assuming a depth of 1.5 m. The total sludge volume of A and B is 0.64 m^3 + 12m^3 = 12.64 m^3. To know what length will be given this volume, we can use this formula: √((V/H) x 3) = L So √((12.64/1.5) x 3) = 5.03 m total length for the septic tank. We can now deduce width and length of compartments: Tank width = 1/3rd length, so this means both compartments will have a width of 5.03 m / 3 = 1.68 m. First compartment = 2 x width = 2 x 1.68 m = 3.35 m length. Second compartment = 1 x width = 1 x 1.68 m = 1.68 m length.
Step 6: **Determine the ventilation volume (V) and total tank volume (T).**	The ventilation gap is usually taken as 300 mm from the liquid surface to the base of the slab. This depth is added to the depth for wastewater and sludge to give total tank depth. The ventilation volume (V) is added to the volume of liquid (A) and sludge (B) to give a total tank volume (T).	Our tank depth for wastewater and sludge is 1.5 m. If we add 0.3 m for ventilation, this becomes a total of 1.8 m for the tank depth. The ventilated volume (V) = 5.03 m length x 1.68 m width x 0.3 m

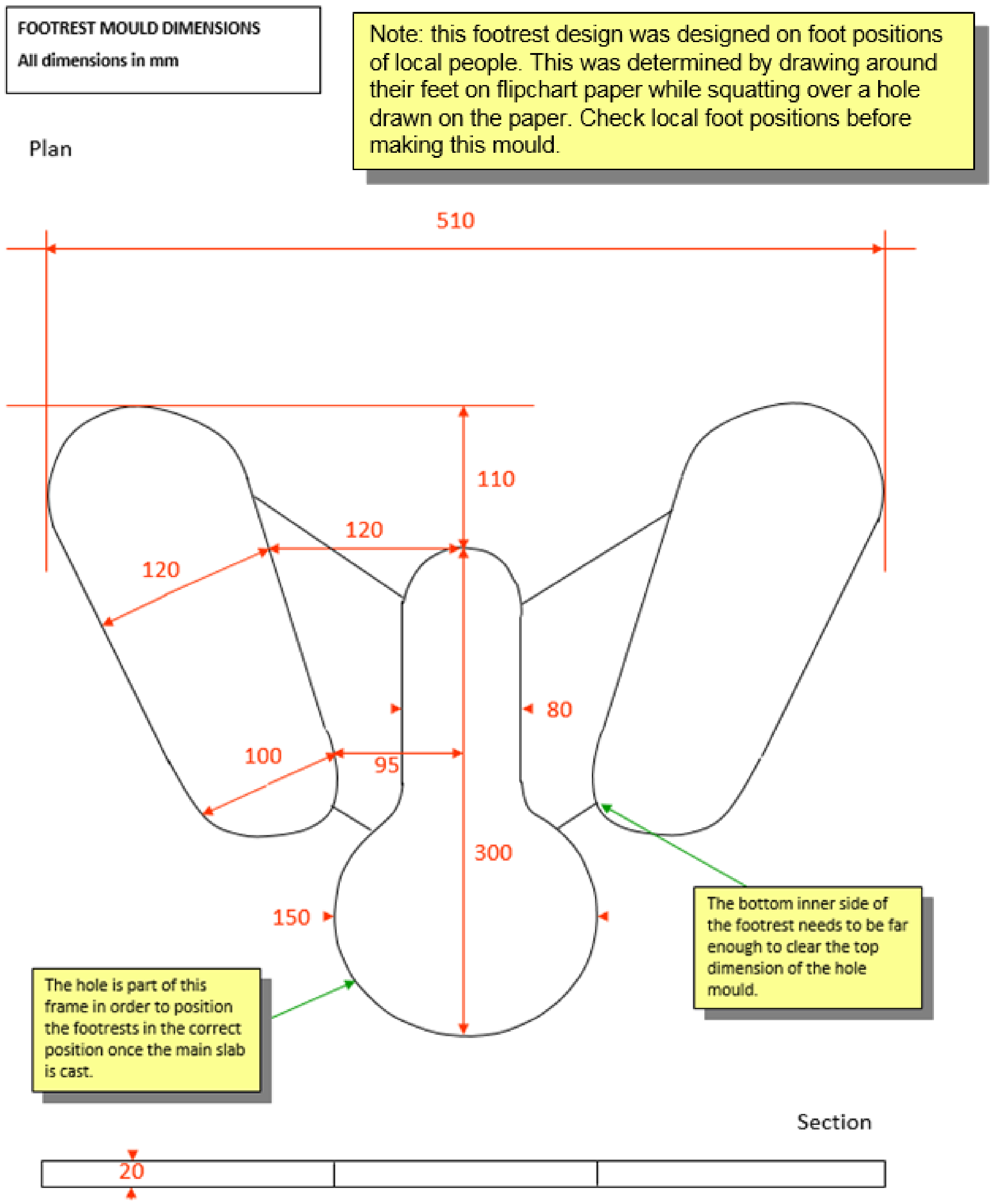
		ventilation height = 2.53 m^3. Total tank volume (T) = 12.64 m^3 + 2.53 m^3 = 15.17 m^3.
Step 7: **Cross-check flotation risk in high groundwater areas.**	In areas of high groundwater, you need to check that the tank will not float. This can happen if the weight of the tank is less than the water that it displaces. What we want to check is how much more concrete weight has to be added to the tank base, in order to give it enough weight to counterbalance the displaced water. We therefore need to calculate the volume of concrete that makes up the tank, in order to know its weight. We then calculate the volume and weight of water that the tank displaces – where this is greater than the tank weight, we need to know what the weight difference is and convert it back to an equivalent weight of concrete which should make up the tank base.	Assuming a 0.1 m thick concrete wall, we have the following external dimensions for the tank: - Length = 5.03 + (2 x 0.1) = 5.23 m. - Width = 1.68 + (2 x 0.1) = 1.88 m. - Total tank depth we already know is 1.8 m. Total concrete volume (of walls only) including one internal partition wall = (5.23 x 1.8 x 0.1 x 2) + (1.88 x 1.8 x 0.1 x 2) + (1.68 x 1.8 x 0.1 x 1) = 2.86 m^3. Given density of concrete is 2,400 kg/m^3, this means the weight of the tank is 2.86 x 2,400 = 6,864 kg. The external total tank volume is 5.23 x 1.88 x 1.8 m = 17.653 m^3. Given density of water is 1,000 kg/m^3, this means the water that the tank displaces is 17.653 x 1,000 = 17,653 kg. The water displaced is heavier by 10,789 kg (17,653 – 6,864) so the tank might float. We

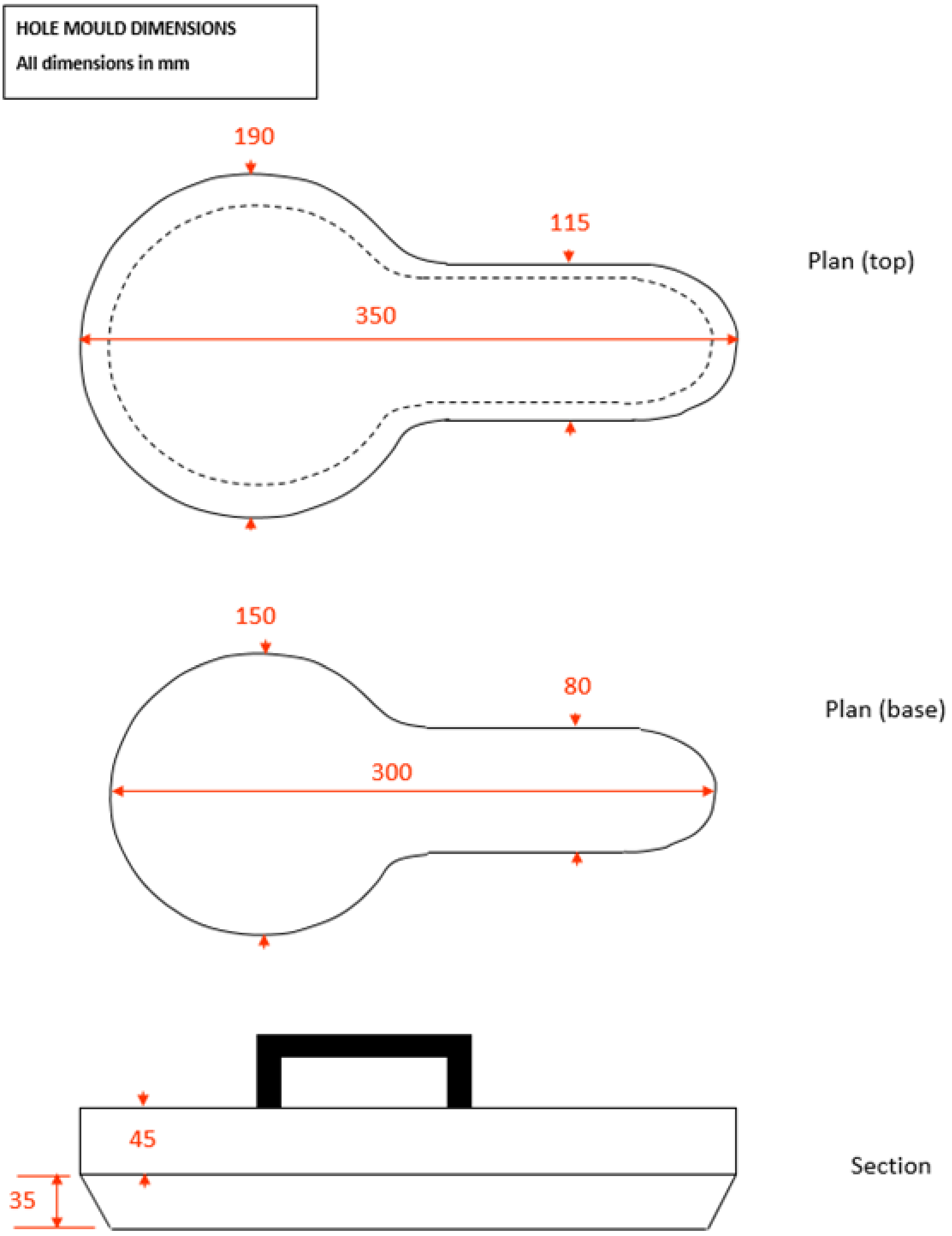
		therefore need to add some concrete weight to counterbalance this. So if we divide this weight by the density of concrete, we get the volume of extra concrete needed: 10,789 / 2,400 = 4.5 m^3. We can now determine the thickness of the tank base into which we will incorporate this volume of concrete which is needed as part of the tank weight. Volume = area x depth, so depth = volume / area. The external area of the tank is 5.23 m x 1.88 m = 9.81 m^2 so the thickness of the tank base to have this volume will be 4.5 m^3 / 9.81 m^2 = 0.46 m.
Step 8: **Determine length of infiltration trench.**	The wastewater leaving the tank needs to be able to infiltrate at the same rate that it enters the tank. Although different soil types have different infiltration rates, we will take 10 litres/m^2/day as the default infiltration rate because all soils have a reduced infiltration rate when they become partially clogged (it tends to stabilise between 10 – 30 litres/m^2/day). Using the lower rate allows for conservative design. The infiltration surface needed will be the total wastewater in litres divided by the infiltration rate. You will need to decide on a trench depth below the outlet pipe level – this is	Total wastewater is 640 litres/day. We will take the conservative infiltration rate of 10 litres/m^2/day. The infiltration surface that we need will be 640 / 10 = 64 m^2. Our trench is 1.5 m deep, so for 2 walls the surface we can use for infiltration in 1 metre will be 1.5 x 1 x 2 = 3 m^2. We need 64 m^2 in order to soak away our wastewater, so 64 / 3 =

	normally taken as between 1.5 – 2 metres. Using the trench depth, and calculating only using the walls (the floor of the trench is assumed as clogged), we can know the area open to infiltration for 1 metre, and therefore the total number of metres of trench required.	21.3 metres length of trench.

5 Footrest & drophole design

The following are designs for footrests and dropholes in slabs.[8] Although this information is from a document targeting household sanitation, the principles will still be useful for any squatting slab.




HOLE MOULD DIMENSIONS
All dimensions in mm
190
115
350
Plan (top)
150
80
300
Plan (base)
45
35
Section

6 Checklist for concrete quality

Below is a checklist of what to watch out for when making concrete.

Concrete quality. [9]

Concrete production methods need to result in strong concrete, which means increased longevity of the structure and reduced burden for maintenance and repairs.

☐ Water quantity: do not add too much water, it will only weaken the concrete (for example, if you add 50% more water, the concrete strength reduces by half!). To avoid this:
  - Aim for a ratio of about 1:2 water to cement (this applies for materials that are completely dry – less water is needed if they are already wet).
  - The addition of plasticisers (e.g. a squirt of washing-up liquid) can make mixing easier and reduce the quantity of water needed.
  - A slump test can help check water quantity: use a small upturned bucket with the base cut off, and fill with concrete – when bucket is taken away, a maximum slump of 100 mm is allowed for reinforced concrete (less for unreinforced concrete).

☐ Gravel size: aim for a maximum gravel size of 20 mm, which will allow for a cover of 30 – 50 mm (cover is the concrete depth that covers the reinforcement bar). Gravel that is too large makes mixing physically more difficult (meaning more water is added as well), results in less surface area for adhesion to the other materials (compared to the same volume of smaller stones), and means the you can create a zone of weakness from the concrete edge to the reinforcement bar.

☐ Clean, non-salty materials: you should only use clean materials (no organic matter, clay, soil etc) with no salt content – this includes the water which if salty, could corrode any reinforcement. Do not mix concrete direct on the soil surface where it will become contaminated – rather use a hard surface. If you don't have a hard surface, make a mixing slab (e.g. a stone base covered by a mortar mix of 1:8 cement to sand, made to gently slope towards the centre).

☐ Ratios: you should use the correct ratio for your application.
  - Note that stated ratios are always for dry materials – so in the case where you are using wet sand, this will occupy more volume than dry sand, so in such a case you should add about 25% more damp sand than the dry mix specification. Common ratios for dry materials are (in order of cement, sand gravel):
    - Reinforced slabs: 1:2:4
    - Non-reinforced slabs: 1:3:6
    - Porous concrete: 1:1:4
  - A field method for a supervisor to check ratios is to fill a transparent jar with around 1/3rd of the freshly mixed concrete, add water and shake it up

– when it settles out, you should be able to see roughly what proportions are of different materials.
    - Individual raw materials (sand, gravel, cement) occupy around 1/3rd more volume separately than when they are mixed together.[10] To help calculate how much raw material you need for a volume of final concrete, refer to the Excel document Annex 2.3.

- ☐ Mixing method: poor mixing can occur because of gravel being too large, but also basic mixing technique can be to blame.
    - If you are making a lot of concrete, hiring a concrete mixer is a good idea.
    - If mixing by hand, mix materials dry first (gravel with cement mixed first, then add sand and mix that – only then add water). Make sure you work from one side of the pile to the other, then back again – do this at least 3 times.
- ☐ Compaction when pouring concrete: how concrete is poured can also affect its quality, as air voids can reduce strength. These can be eliminated manually using a rod, or mechanically using a concrete vibrator – if used, place vibrator vertically to full depth of concrete for 15 seconds, and repeat at maximum 250 mm intervals across the surface, but take care not to touch reinforcement bars or formwork.
- ☐ Curing: this is the chemical hydration process that occurs to harden concrete. Concrete that is not properly cured will end up being weaker and in need of more repair, since it will not achieve full strength and also might shrink and crack. For curing to take place, water is needed both during and after the concrete is cast. In warmer conditions, the risk is that the concrete can dry out – if you notice that at any point the colour of the concrete changes from grey to white after the concrete is made, it is likely that the chemical process has stopped – adding more water after this has happened will not re-start the chemical reaction. In cold weather, the risk is not that the concrete might dry out, rather that the curing process will take longer due to the lower temperature – so it will take longer to achieve the same level of structural strength. There are some key points therefore to note:
    - Time: it is essential to make sure the concrete is kept damp for at least 7 days after casting (preferably up to 14 days). In cold conditions, you should continue curing for longer than 7 days – how long will depend on the conditions. For example, if we take concrete curing at 20°C, it will have gained 65% of its 28-day strength after 7 days, whereas at 4°C concrete will have gained only 40% of its 28-day strength that it would have at 20°C, which by the 28-day mark will have risen only to 77%.[11]
    - Frequency of watering: water should be applied at least twice per day, with extra care for hot and windy conditions.
    - Protection against the weather: concrete should be covered to protect against sun (e.g. shade it, add cement bags or a layer of damp sand over slabs). In cold conditions, insulating the concrete will keep in the heat

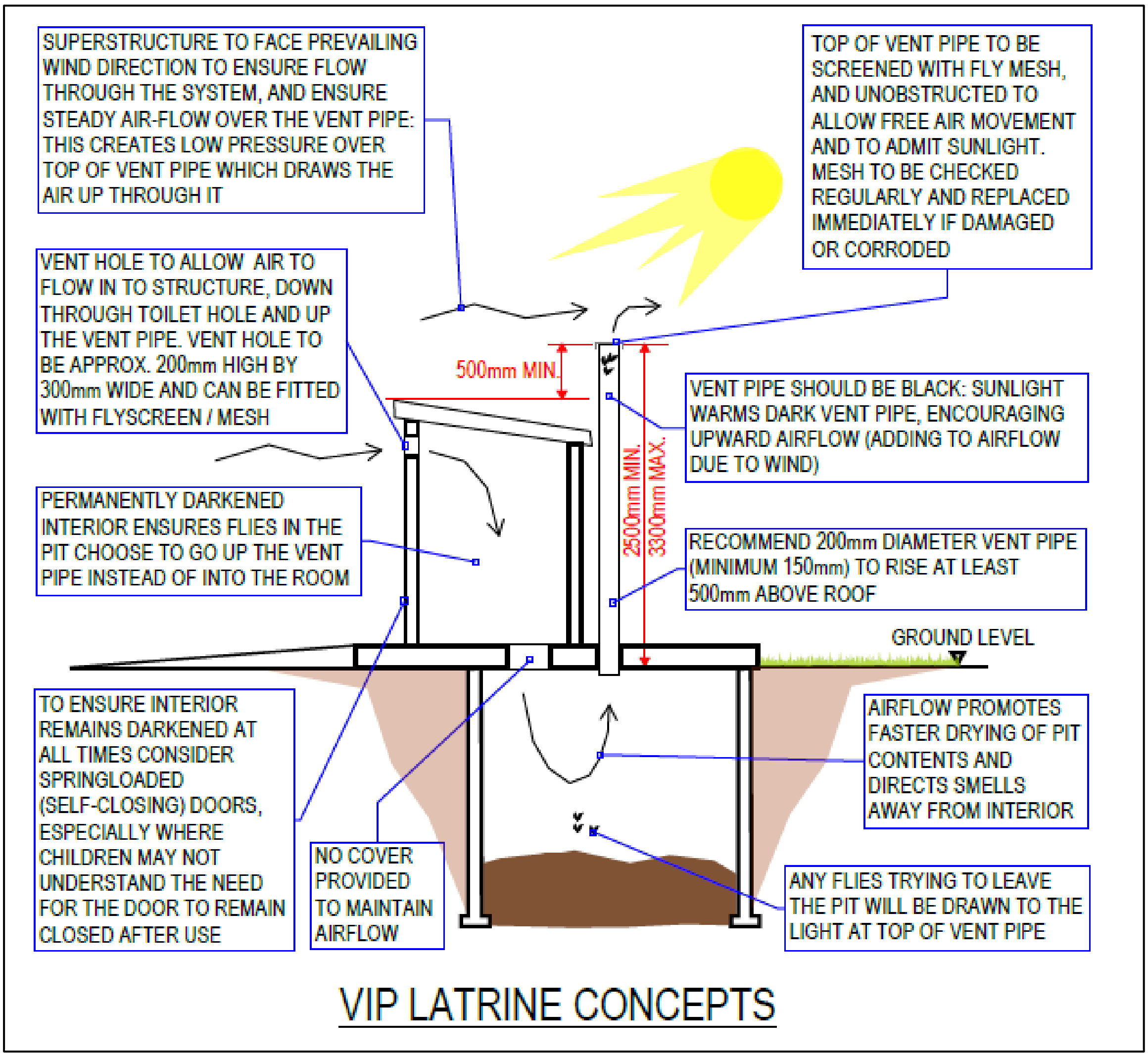
generated by the chemical reactions – you should also cover the concrete to protect it from the effect of wind chill.

- ☐ When making the finish on any concrete slab, you need to consider its function. Check the logic based on what you know the slab will be used for:
  - For a toilet slab, it should be smooth and easy to clean with a slope towards a drain point.
  - For a shower slab, it should <u>not</u> be too smooth in order to avoid slipping, but also with a slope towards a drain point.
- ☐ When making toilet slabs, again you should check the logic. If something does not seem right, consult the design team. Ask yourself:
  - Does the drop-hole position look correct?
  - Would I be able to use it?
- ☐ For any concrete that is cast in the ground (foundations), a risk is that where soils are soft or variable, you can get subsidence and cracking. Lining first with layer of crushed rock can help mitigate this.
- ☐ Protect workers with gloves and boots (concrete is alkaline).

7 Design summary for VIP latrines and Urine-Diverting Dry Toilets (UDDT) toilets

Some good literature for further design information:

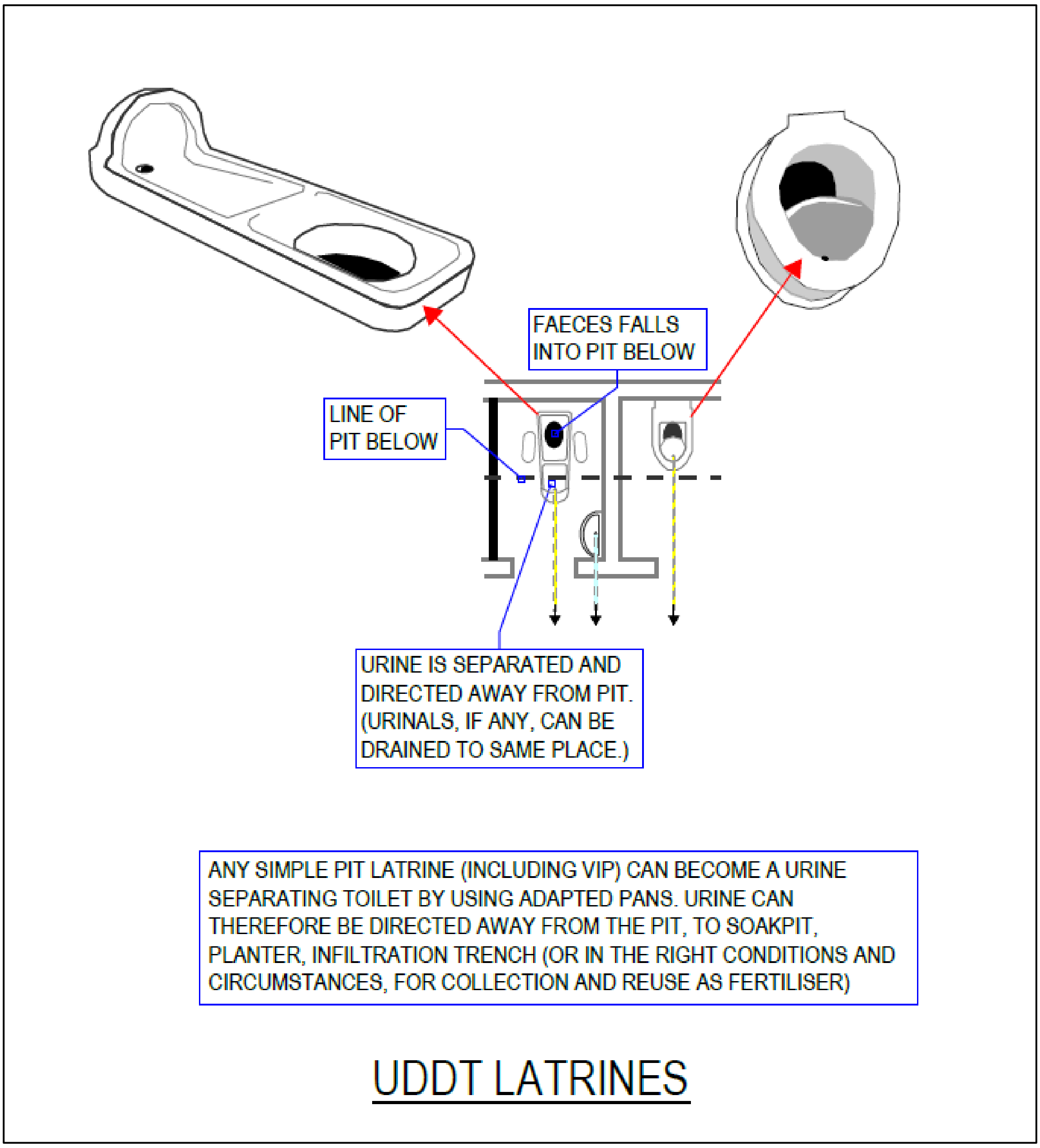
VIPs:
- Mara, D. (1984) *The Design of Ventilated Improved Pit Latrines.* UNDP, Washington, USA.
- WEDC (2014) Ventilated improved pit (VIP) latrines. WEDC, Loughborough University, UK.



VIP design

UDDTs:

- Tilley, E.; Ulrich, L.; Lüthi, C.; Reymond, P.; Zurbrügg, C. (2014) *Compendium of Sanitation Systems and Technologies.* 2nd revised edition. EAWAG, Dübendorf, Switzerland.



Urine-Diverting Dry Toilet design

8 Design considerations for difficult conditions

Checklist for difficult conditions

High snowfall[12]
☐ Can the roof structures support high levels of snowfall? Get help from a civil engineer to check this – for this, they will need the total load (in kg) that will be exerted on the roof. This can be calculated by L = F x H x D x A, where: o F = footprint/area of roof in m^2 o H = maximum depth of snow on ground (use data from years with heaviest snow in the past 30-50 years) o D = density of snow in kg/m3 – old snow has a density of between 200-400 kg/m3, whereas new snow only has a density of 100 kg/m3. If you are not sure, use 240 kg/m3. o A = conversion factor based on how exposed the building is – use 0.6 for very exposed areas, and 0.8 for average exposed areas
Cold temperatures[13]
☐ Is there a way that you can insulate the structure? ☐ Locate structure as close to institution as is feasible ☐ If using a Ventilated Improved Pit (VIP) design, cover the vent pipe during cold weather, since extra ventilation will dissipate any heat rising from the pit. ☐ Pour-flush toilet pans should be located inside a house to prevent the water seal from freezing ☐ Pour-flush pipes from pan to pit should be as short as possible, and there should be enough space between the inlet pipe and the sludge in the pit at the onset of winter so that it does not block over the cold months (due to freezing sludge making a pyramid up to the inlet pipe) ☐ For pit design, you should account for accelerated accumulation rates in cold climates (see Annexes 1.4 and 2.1). ☐ This Guide always recommends to fully line a pit – this will also help where freeze-thaw activity makes ground conditions unstable. ☐ Casting concrete in cold conditions has implications on curing times (see Annex 1.7). ☐ Consider warming water for handwashing, and provide drying materials since wet hands feel colder than dry hands
Flooding / high groundwater table / rocky ground
☐ Ensure no openings to pit below flood level

- ☐ Consider special latrine options such as a raised pit[14], UDDT and/or composting toilet (see Annex 1.8)
- ☐ Assess groundwater contamination risk (see Annex 1.3). Where a risk is found, options are to:
    - Prevent wastewater reaching groundwater altogether (sealed pit) but this reduces pit life / time to emptying
    - Reduce wastewater pathogen load reaching groundwater through design - e.g.
        - Septic tank system, which has some element of wastewater treatment as part of the design (see Annexes 1.5 and 2.2)
        - Raised pit, UDDT and/or composting toilet which could allow the pit base to be at least 2m above water table, allowing some attenuation of pathogens via this dry zone before water table
    - Where these options are not possible, monitor groundwater and treat if needed, or change water supply to off-site supply

High wind speeds

- ☐ Locate structure as close to institution as is feasible
- ☐ If a lightweight superstructure where the frame is not embedded/fixed to lining, you might need some calculation for size of footings to counteract the wind force (refer this to a civil engineer)
- ☐ Roof/timber frame considerations:[15]
    - Reducing nails in certain wood junctions for roof rafters means less points of weakness during wind stress. Especially with roof rafters, avoid using nails to connect rafters (or strapping that still needs nails). A more robust design for high wind areas is to bind junctions using galvanised binding wire (gauge 24, wrapped 8 times around connection).
    - Where iron sheets used, increase number of umbrella nails to prevent uplift (35 nails per 8' CGI sheet, row of 10 at top/bottom purlin, row of 5 at 2' intervals in between)
    - Iron sheets specified as minimum 26 gauge to prevent uplift
    - The type of umbrella nail used can prevent roof sheets blowing off (ring shanks work best, ideally 1¾" ring shank nail. If not, then twisted, galvanised, 3").
    - Reduce the eaves overhang (250mm maximum) to minimise uplift
    - Maintain purlin spacing (2' maximum between purlins for sheet connection)
    - Purlin thickness to be minimum 2” x 3” but when fixed with short edge on rafters
    - Roof trusses with maximum 2.5m centres
    - 5/8" plywood gusset plates for trusses
    - Any door should not be located direct under a truss

- The roof pitch should be a minimum of 30 degrees from horizontal
- Brace the timber frame
- A fascia board to be fixed to free purlins on gable ends (provides more fixing points for roofing nails rather than only purlin ends = reduced failure rate)
- Add a door frame stop (to prevent door blowing inwards = causes building to balloon and blow away)

9 Concrete volume calculation tool

This is a separate Excel document that can help you calculate the quantity of materials needed to make a certain volume of concrete.

10 Annotated bibliography

1 Schools

Author	Title	Date	Type	Pages or Sheets	Document source / web link	Summary
	Kent Trans Inclusion Guidance for Schools and Settings	?	Guideline	54	https://www.kelsi.org.uk/	Trans Inclusion Guidance for Schools and Settings
D. Bouman, H. Holtslag, F. Claasen	WASH Technology Options for School Facilities.	2012	Guideline	103	http://www.arcworld.org/downloads/EMF-ARC-Waterschools-Technology-Manual.pdf	ARC program on WASH in schools. This program intends to stimulate the water and sanitation situation at religious schools. In many countries, these schools receive little funding. They possess a wealth of cultural/religious background to give an extra dimension to water and sanitation.
Armitage Shanks	School solutions... what works and why	2006	Guideline	26	https://www.yumpu.com/en/document/read/31444544/recommendations-in-this-guide-are-based-on-armitage-bd-online-	
B. Reed, R. Shaw	Sanitation for Primary Schools in Africa	2008	Guideline	62	https://dspace.lboro.ac.uk/dspace-jspui/bitstream/2134/30800/7/Sanitation_for_Primary_Schools_in_Africa_-_Complete.pdf	This book has been designed for a wide range of staff from agencies and government who have professional responsibilities for the provision of education and health throughout Africa. These include technical, design and architecture departments within ministries of education; district or local government education teams; district education officers and school inspectors working closely with school managers, head teachers and school communities; ministries of health; national and local water and sanitation agencies; and local and international non-governmental organizations specializing in water and sanitation.

CABE	Inclusion by Design: equality, diversity and the built environment	2008				This resource discusses the positive impact inclusive design within a society can have on improving environmental accessibility, particularly among the poorest and most marginalised segment of its population by creating more inclusive, cohesive and equal societies. CABE puts-forth five overarching priority areas to ensure inclusive design within communities, as well as five priority areas to be used by professionals and local authorities.
Department of Drinking Water Supply, Ministry of Rural Development, Government of India	School and Anganwadi Toilet Designs	2004	Guideline	42	https://mdws.gov.in/sites/default/files/SchToiletDesign_1.pdf	A technical design on the Anganwadi and Schools.
Design Kit	The Field Guide to Human-Centred Design	2015	Guide		http://www.designkit.org/resources/1	This resource is a creative approach to addressing problems within a community, where the development of problem solutions is largely done by those within the community facing the problem. This ensures solutions are effective in addressing their specific needs. The resource reveals [our] process with the key mindsets that underpin how and why we think about design for the social sector, 57 clear-to-use design methods for new and experienced practitioners, and case studies.
Government of Wales	Checklist: School Toilets: Good practice guidance for education settings in Wales (WG, 2012),	2012	Checklist	8	https://dera.ioe.ac.uk/13643/7/120124schooltoiletsen_Redacted.pdf	This document provides good practice guidance for governing bodies and head teachers on issues relating to the standards of learner toilets and related facilities required in schools in Wales.

Technical guidelines

Handicap International	How to build an Accessible Environment in Developing Countries. Manual #2, Pt. 1	2008	Manual	42	https://www.globaldisabilityrightsnow.org/sites/default/files/related-files/320/Access_Standards.pdf	This resource forms the first part of a two-part manual that looks at access to water and sanitation facilities for disabled peoples, focusing specifically on toilets and closed showers.
Handicap International	How to build an Accessible Environment in Developing Countries. Manual #2, Pt. 2	2008	Manual	42	http://www.hiproweb.org/uploads/tx_hidrtdocs/Manual2-2.pdf	This resource forms the first part of a two-part manual that looks at access to water and sanitation facilities for disabled peoples, focusing specifically on toilets and closed showers.
J. Adams, J. Bartram, Y. Chartier, J. Sims	Water, Sanitation and Hygiene Standards for Schools in Low-cost Settings	2009	Guideline	51	https://www.who.int/water_sanitation_health/publications/wash_standards_school.pdf	These guidelines deal specifically with water, sanitation and hygiene, and are designed to be used in schools in low-cost settings in low- and medium-resource countries to: assess prevailing situations and plan for required improvements; develop and reach essential safety standards as a first goal; and support the development and application of national policies. The guidelines are written for use by education managers and planners, architects, urban planners, water and sanitation technicians, teaching staff, school boards, village education committees, local authorities and similar bodies.
Lancashire County Council	Transgender Guidance	2013	Guideline	12	http://www.lancashirechildrenstrust.org.uk/web/viewdoc.asp?id=121455	What the guidance seeks to do is to provide a broad overview of the needs of transgender children, young people and their families.
Ministry of Education, New Zealand	Reference Designs for School Buildings in New Zealand TOILETS Version 2.0, February 2017	2017	Guideline	21	https://www.education.govt.nz/assets/Documents/Primary-Secondary/Property/School-property-design/Design-guidance/ToiletReferenceDesignsV2.0.pdf	This reference designs guidance document provides general requirements and standard layouts for toilets in new buildings and, where practical, in existing buildings which are being remodelled. The main intended users of this document are property professionals. Boards of Trustees and other people who make decisions about school property may also find it useful.

Technical guidelines

N. Kamban	Inclusive WASH Development: Technology Adaptations for Persons with Disabilities	2013	Brief		https://www.wvi.org/clean-water-sanitation-and-hygiene-wash/publication/inclusive-wash-development-technology-0	It is the objective of this briefing paper to describe the findings, recommendations and guidelines for inclusive WASH development gleaned from experience with the Africa WASH & Disabilities Study (AWDS). The AWDS seeks to facilitate access to WASH installations through modifications of existing WASH installations (e.g. hand-pumps, pump superstructures, latrines and laundry aprons) as well as through the development of simple, low-cost assistive WASH technologies (e.g. latrine seats and chairs).
Northampton Country Council	Toileting Guidelines for early years settings and schools 2015	2015	Guideline	34	https://www3.northamptonshire.gov.uk/councilservices/children-families-education/SEND/send-information-for-professionals/Documents/toileting%20in%20educational%20settings.pdf	The aim of this guidance is to share best practice and statutory legislation with those adults in a wide variety of early year's settings and schools who work with and have responsibility for children who are in nappies, not yet toilet trained or who have additional developmental or medical needs affecting toileting.
S. Burton	Toilets unblocked: A literature review of school toilets	2013	Review	36	https://www.cypcs.org.uk/ufiles/Toilets-Literature-Review.pdf	This literature review presents the current material on the standards of school toilets and their role in the health and wellbeing of children, with specific reference to Scotland.
SWASH+	SWASH+ Assessing the Feasibility and Acceptability of Girls' Urinals: Final Report		Report	10	https://www.susana.org/en/knowledge-hub/resources-and-publications/library/details/707	Improving the appeal of school sanitation facilities for pupils may not only be a means to reduce open defecation or urination at school, but it may also improve students' self-esteem and the appeal of attending school. Since September 2006, SWASH+ has been working in primary schools in three districts in Nyanza Province - gathering and analysing data, learning about challenges, and testing innovations for school water, sanitation, and hygiene (WASH). In February 2009, the Kenya Water for Health

						Organization (KWAHO) constructed girls' urinals in three schools in Kenya's Nyanza Province.
UK Department of Education	Advice on standards for school premises	2015	Guideline	16	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/410294/Advice_on_standards_for_school_premises.pdf	This guidance describes, and advises on meeting the requirements of, the premises regulations for all types of schools in England.
UK Department of Education	Standard specifications, layouts and dimensions. Toilets in Schools	2007	Guideline	52	https://www.designcouncil.org.uk/standard-specifications-layouts-and-dimensions-toilets-schools	This guidance is one of a series of Standard Specifications, Layouts and Dimensions (SSLD) guidance notes produced to inform the Building Schools for the Future (BSF) programme.
UNICEF	WASH in Schools Monitoring Package	2011	Guideline	92	https://www.unicef.org/wash/schools/files/wash_in_schools_monitoringpackage_.pdf	The package consists of three modules: The EMIS module: a set of basic monitoring questions on WASH in Schools to be incorporated into national Education Monitoring Information Systems (EMIS), usually administered annually; The survey module: a more comprehensive set of questions, observations and focus group discussion guidelines for use in national WASH in Schools surveys as well as for sub-national, project level or thematic surveys; The children's monitoring module: a teacher's guide and tool set for the monitoring of WASH in Schools by students, including observation checklists, survey questions and special monitoring exercises.

Technical guidelines

UNICEF / Environmental Sanitation Section (ESS) / Department of Water Supply and Sewerage (DWSS)	Development of Design, Drawing and Estimation for school latrines in different ecological regions	2001	Report	41	https://www.ircwash.org/sites/default/files/321.4-01DE-19232.pdf	Altogether eleven technical design options with drawing and estimate are developed with the following breakdowns: three for mountains, six for hills and two for the Terai. It will be a very useful guideline for schools to choose appropriate toilets with urinals as per their requirement.
WaterAid	Guidelines for sustainable and inclusive school WASH	2018	Guideline	30		
Welsh Government	School toilets: Good practice guidance for schools in Wales	2012	Guideline	47	https://beta.gov.wales/sites/default/files/publications/2018-03/school-toilets-good-practice-guidance-for-schools-in-wales.pdf	This document provides good practice guidance for governing bodies and headteachers on issues relating to the standards of learner toilets and related facilities required in schools in Wales.

2 Health Facilities

Author	Title	Date	Type	Pages or Sheets	Document source / web link	Summary
Armitage Shanks	Hospital solutions... what works and why	2010	Guideline		https://www.armitageshanks-mena.com/fileadmin/resource/content/download/Armitage-Shanks_Hospital_UK_MAIN.pdf	
Dept. of Hospital Services, Cambodia	National Guidelines for Water, Sanitation and Hygiene in Health Care Facilities		Guideline	28	https://www.washinhcf.org/documents/National-Guideline-for-WASH-in-HCF_FINAL_April-Eng.pdf	These guidelines should be used as a reference for policy-makers, planners, managers and practitioners in Health and WASH sector in Cambodia.

Technical guidelines

Ministère de la Santé et de l'Hygiène Publique du Mali	Directives techniques pour l'Accès à l'Eau Potable, l'Hygiène et l'Assainissement dans les Structures de Santé	2014	Report	39	https://www.washinhcf.org/documents/E-National-strategic-plan-WASH-in-HCFs.pdf	
Ministère de la Santé et de l'Hygiène Publique du Mali	Paquet minimum pour l'accès a l'eau potable, l'hygiène et l'assainissement dans les établissements de sante au Mali	2015	Guideline	15	https://www.washinhcf.org/fileadmin/user_upload/documents/Mali_PaquetMinimum_WASH.pdf	
Ministry of Health, Liberia	WASH and Environmental Health Package in Health Facilities	2015	Report	34	https://www.washinhcf.org/fileadmin/user_upload/documents/Final-WASH-EH-Package-for-Health-Facilities-003.pdf	This document contains minimum requirements for Water, Sanitation and Hygiene (WASH) and Environmental Health (EH) in healthcare facilities as part of the program for Early Recovery and Resilience Building from Ebola Virus Disease (EVD) Outbreak in Liberia.
Ministry of Health, Community Development, Gender, Elderly and Children, Tanzania	The National Guidelines for Water, Sanitation and Hygiene in Health Care Facilities	2017	Guideline	121	https://washmatters.wateraid.org/publications/national-guidelines-for-wash-services-in-health-care-facilities-in-tanzania	These guidelines are therefore, intended to provide a standard approach to guide stakeholders in addressing WASH challenges in HCFs countrywide.

P. Kohler, S. Renggli, C. Lüthi	WASH and gender in health care facilities: The uncharted territory	2017	Paper	11	https://www.ncbi.nlm.nih.gov/pubmed/29116887	Health care facilities in low- and middle-income countries are high-risk settings, and face special challenges to achieving sustainable water, sanitation, and hygiene (WASH) services. Our applied interdisciplinary research conducted in India and Uganda analyzed six dimensions of WASH services in selected health care facilities, including menstrual hygiene management. To be effective, WASH monitoring strategies in health care facilities must include gender sensitive measures. We present a novel strategy, showing that applied gender sensitive multitool assessments are highly productive in assessments of WASH services and facilities from user and provider perspectives. We discuss its potential for applications at scale and as an area of future research.
UNICEF	Technical Guide for Water, Sanitation and Hygiene (WASH) in PHC Centres in Nigeria	2016	Guideline	85	http://www.washpmp.com/files/report_file/1_58b98380-bd58-4453-abca-4e30176f89ae.pdf	The aim is to come up with standard (models) guide for the design, construction, operation and maintenance of WASH facilities (latrines/toilets, urinals and hand washing facilities) in PHC Centers. This will assist in the process of giving the Centers standard functional WASH facilities that are capable of not only improving the Health of the patients, staff and caregivers but through them, the local communities.
WHO	Guidelines on Core Components of Infection Prevention and Control Programmes at the National and Acute Health Care Facility Level	2016	Guideline	91	https://www.who.int/gpsc/core-components.pdf	These new guidelines on the core components of IPC programmes form a key part of WHO strategies to prevent current and future threats, strengthen health service resilience and help combat AMR. They are intended also to support countries in the development of their own national protocols for IPC and AMR action plans and to support health care facilities as they develop or strengthen their own approaches to IPC. This document supersedes the WHO Core

						components for infection prevention and control (1) issued in 2009.
WHO, UNICEF	Water and Sanitation for Health Facility Improvement Tool (WASH FIT)	2018	Guide	92	https://www.who.int/water_sanitation_health/publications/water-and-sanitation-for-health-facility-improvement-tool/en/	WASH FIT is a risk-based, continuous improvement framework with a set of tools for undertaking water, sanitation and hygiene (WASH) improvements as part of wider quality improvements in health care facilities. It is aimed at small primary, and in some instances secondary, health care facilities in low and middle income countries. WASH FIT is an adaptation of the water safety plan (WSP) approach, which is recommended in the WHO Guidelines for Drinking-water Quality as the most effective way of ensuring continuous provision of safe drinking-water. It is aimed at small primary, and in some instances secondary, health care facilities in low and middle income countries

3 Public toilets

Author	Title	Date	Type	Pages or Sheets	Document source / web link	Summary
A. Drewko	Resource-Oriented Public Toilets in Developing Countries: Ideas, Design, Operation and Maintenance for Arba Minch, Ethiopia	2007	Thesis	148	http://empslocal.ex.ac.uk/people/staff/fam203/developing%20countries%20database%20-%20Jacob%20Marsh/pdf_san_bar_commun/Public%20Toilets.pdf	University dissertation
ASEAN	The ASEAN public toilet standard.	2016			asean.org/storage/2012/05/ASEAN-Public-Toilet-Standard.pdf	The objective of this standard is to help ensure the quality, comfort, safety and proper waste management of public toilets in the region. It is divided into four main criteria, which recommend how a public toilet should be maintained: design; environmental management system; amenities; and facilities.
J. Bichard, G. Knight	Improving public services through open data: public toilets	2012	Paper	9	http://researchonline.rca.ac.uk/1119/1/Bichard%20%26%20Knight.pdf	Everyone needs access to toilet facilities, but such provision outside the home can be hard to find. For those with common medical conditions and older people, this issue is critical for their continued independence, quality of life and wellbeing. In the UK there is no legal requirement for local authorities to provide 'public' toilets, nor is there a central source of information on provision, location, access and opening times. This paper presents a case study of The Great British Public Toilet Map – a web-based information service, derived from public-sector open data. The release of data held by the UK government, under open licence, could improve transparency, accountability and help to improve

						public services through the reuse of such data by designers, developers and public-led campaigns for more toilet provision.
Canterbury City Council	Provision of toilets in commercial premises open to the public		Standard	8	https://www2.canterbury.gov.uk/media/253481/sanitaryaccommodation.pdf	City Council has adopted a standard for the provision of sanitary accommodation in places to which the public resort.
GIZ and Ministry of Urban Development, India	Five step public toilets management process	2017			susana.org/en/community/integrated-content/public-sanitation	This provides tools and advice to support the demand and supply assessment; planning and strategies; implementation; monitoring; and sustainability elements of public toilet provision.
Government of South Australia	Code of Practice for the Provision of Facilities for Sanitation and Personal Hygiene	2018	Code	14	https://www.sahealth.sa.gov.au/wps/wcm/connect/df72a18047b216389e61de7c69742d6b/17178.2+Sharps+Disposal+Code+A4+Booklet-ONLINE.PDF?MOD=AJPERES&CACHEID=ROOTWORKSPACE-df72a18047b216389e61de7c69742d6b-mwMLaKN	Code of Practice for the Provision of Facilities for Sanitation and Personal Hygiene.
Healthmatic	Charging and Access Control to Public Toilets		Report	4	https://www.healthmatic.com/Websites/healthmatic/images/Brochures/Healthmatic_Charging_and_Access.pdf	Options for charging and access control to public toilets.

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House of Commons	The Provision of Public Toilets	2008	Report	146	https://publications.parliament.uk/pa/cm200708/cmselect/cmcomloc/636/636.pdf	Twelfth Report of Session 2007–08 Report, together with formal minutes, oral and written evidence Ordered by The House of Commons to be printed 6 October 2008.
International Code Council and WorldToilet.org	Global guideline for practical public toilet design (ICC G3-2011).	2011	Report		shop.iccsafe.org/icc-g3-2011-globalguideline-for-practical-public-toilet-design-1.html	The purpose of this guideline is to help provide clean, convenient, hygienic and safe public toilet facilities of appropriate design and quality, and to give guidance on the basic care and maintenance of such facilities. It is targeted at those responsible for providing public toilets throughout the global community.
J. Bichard, J. Hanson	Cognitive Aspects of Public Toilet Design		Paper	10	https://www.researchgate.net/publication/228376572_Cognitive_Aspects_of_Public_Toilet_Design	This paper reports ongoing EPSRC 1 -sponsored research to understand how 'away from home' (public) toilets feature in disabled people's participation in urban public life. After tracing the origins of accessible toilets, it will examine the technological responses currently in use in many public toilets and evaluate these designs with respect to people with cognitive disabilities. The paper concludes by pinpointing challenges that need to be resolved by designers, before the goal of 'an inclusive public toilet of the future' can be realised.
H. Jones, R. Reed	Water and sanitation for disabled people and other vulnerable groups: designing services to improve accessibility. WEDC, UK.	2005			https://wedc-knowledge.lboro.ac.uk/details.html?id=16357	Accessible WASH designs for people who experience limitations in carrying out activities related to WASH.
J. Toubkiss	How to manage public toilets and showers	2010	Guideline	82	https://www.pseau.org/outils/ouvrages/pdm_ps_eau_cms_guide_n_5_how_to_manage_public_toilets_and_showers_2010.pdf	The purpose of this decision-making aid is to provide practical advice and recommendations for managing toilet blocks situated in public places. It is primarily aimed at local decision-makers in developing countries and at their partners (project planners and managers).

Public Hygiene Lets Us Stay Human	Public Toilet Advocacy Toolkit		Toolkit	66	https://toolkit.phlush.org/	The purpose of the Public Toilet Advocacy Toolkit is to strengthen the capacity of citizen advocates and city officials to provide and maintain great public toilets that make communities livable, respect human dignity and promote health and well-being. PHLUSH regularly responds to requests from communities throughout North America seeking to increase toilet availability. These seventeen tools are designed for use by city managers, transit authorities, CPTED specialists, public health officials, toilet entrepreneurs, proponents of active living, media professionals, and engaged citizens.
Restroom Association (Singapore)	A Guide to Better Public Toilet Design and Maintenance	2018	Guide	106	https://www.toilet.org.sg/articles/GuideBetterPublicToilet.pdf	A Publication by the Restroom Association (Singapore).
S. Sen, Y. Ma	Improvement and maintenance management of public toilets in Liuzhou: A study	2005	Report	83	http://siteresources.worldbank.org/INTWSS/Resources/improvement.pdf	The purpose of this consultancy was to support the improvement of public toilet facilities and their management in Liuzhou Municipality, through the preparation of an initial financial, institutional and technical review of existing systems, and through the preliminary development of proposals for their improved management.
States of Alderney	Specification for cleaning Public Toilets	2013	Specifications	8	http://www.alderney.gov.gg/CHttpHandler.ashx?id=86498&p=0	Specification for cleaning Public Toilets.
Water Services Trust Fund Kenya	The toolkit for urban sanitation projects	2010			waterfund.go.ke/sanitation/	Offers a complete set of tools to help plan, design, implement, manage, monitor and evaluate sanitation projects for low-income urban areas.

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WaterAid Bangladesh	Step by Step Implementation Guideline for Public Toilet	2006	Guideline	33	https://www.waterfund.go.ke/watersource/Downloads/010.%20Sanitation%20Impl.%20Guidelines%20Public%20Toilets.pdf	This Guidelines is particularly dealing with the 'Public Toilet'. WAB is initially offering two types of public toilets and in near future more options for Public Toilets will be offered. Design and detail drawing of these two different models of Public Toilets are given in Annex-A and Annex-B. The Bill of Quantities and Abstract of these two different models of Public Toilets are available at WaterAid Bangladesh.
World Bank	Shared and public toilets: championing delivery models that work.	2018	Report		http://documents.worldbank.org/curated/en/122091535 055956605/pdf/129628-WPP165603-Sharedand-Public-ToiletsPUBLIC.pdf	This is a primer on shared and public toilets, highlighting how context dimensions, users' needs, characteristics of service providers and responsible service authorities should be taken into account in decision-making processes. It also has checklists and case studies.
World Toilet Organization	ICC G3-2011 Global Guidelines for Practical Public Toilet Design		Guideline	9	https://www.abebooks.co.uk/9781609831769/ICC-G3-2011-Global-Guideline-Practical-1609831764/plp	

4 Technical guides

Author	Title	Date	Type	Pages or Sheets	Document source / web link	Summary
?	Access for all - lay out and measurements for latrines	?	?	3	https://www.brighton-hove.gov.uk/sites/brighton-hove.gov.uk/files/downloads/building/building_access_design_guides/05_Accessible_toilets.pdf	Design Note.
B. Ashley, F. Chikwati, J. John, J. Petrohilos, X. Smith, A. Szumlinski	Biodigester toilet.	2011	Design manual		https://www.ewb.org.au/resources/download/1889P2011-07-31_22:44:22.	Biodigester design manual.
C. Meuli, K. Wehrle, H. Müller, H. Pfiffne	Building construction	2000	Field Manual	66	https://www.ircwash.org/sites/default/files/201-00BU-17076.pdf	Manual on construction.
City University London	Standard Toilet Specification	2014	Standards	5	https://www.city.ac.uk/__data/assets/pdf_file/0014/108401/Toilet-Specification-Status-Live-Rev-2-2010.pdf	
Department of Education	Technical Annex 2A: Sanitaryware	2017	Standards	21	https://www.gov.uk/government/publications/output-specification-2017-	Requirements for the design and construction of school building projects.

					esfa-employers-requirements-part-b	
D. Mara	The Design of Ventilated Improved Pit Latrines.	1984	Guide	83	http://documents.worldbank.org/curated/en/618101468749362028/pdf/multi0page.pdf	VIP design guidelines.
D. Mara	Ventilated Improved Pit Latrines: Guidelines for the Selection of Design Options	1985	Guide	32	http://documents.worldbank.org/curated/en/496631468177877633/Ventilated-improved-pit-latrines-guidelines-for-the-selection-of-design-options	This discussion paper provides guidelines that will enable a design engineer to make a rational selection of the VIP latrine design option most appropriate to the community for which they are responsible. The designer is aiming at a technical choice that will be affordable to the householder and will give the best long-term service at the least cost. It is assumed for the purpose of this paper that a VIP latrine of some sort is the most appropriate sanitation facility for the community under consideration, and also that the reader is aware of how VIP latrines function and how they are able to control odors and insects. What remains for the designer is to select the type of VIP latrine that is compatible with available resources as well as with the prevailing physical, socio-cultural, institutional, economic and financial conditions. In doing so, special emphasis is placed on technology costs and affordability.

E. Tilley, L. Ulrich, C. Lüthi, P. Reymond, C. Zurbrügg	Compendium of Sanitation Systems and Technologies	2014	Guide	180	https://www.wsscc.org/resources-feed/compendium-of-sanitation-systems-and-technologies-2nd-edition/	The International Water Association (IWA), WSSCC and the Swiss Federal Institute of Aquatic Science and Technology (EAWAG) have made considerable efforts to promote improved sanitation by providing an easily accessible knowledge base and guidance about how to achieve these improvements. The Compendium of Sanitation Systems and Technologies produced by EAWAG and WSSCC in 2008 went a long way towards this objective. This second, revised edition of the Compendium presents a huge range of information on sanitation systems and technologies in one volume. By ordering and structuring tried and tested technologies into once concise document, the reader is provided with a useful planning tool for making more informed decisions.
GA Architects	Changing rooms and Public Toilets	2015	Standards	52	http://www.swanage.gov.uk/userfiles/file/Architects%20Drawings%20and%20Specifications/Architectural%20Specification.pdf	Architectural Specification.
Government South Africa	National Building Regulations Part S: Facilities for persons with disabilities	2011	Standards	51	https://archive.org/details/za.sans.10400.s.2011	The application of the National Building Regulations Part S: Facilities for persons with disabilities
HM Government	Building Regulations	2015	Standards	74	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/504207/BR_PDF_AD_G_2015_with_2016_amendments.pdf	UK Building Regulations for Sanitary conveniences and washing facilities and Bathrooms.

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MSF	Public Health Engineering in Precarious Situations	2010	Field Manual	414	https://www.medbox.org/pharmacy-technologies/public-health-engineering-in-precarious-situations/preview	Manual intended for the setting up of public health programmes in disadvantaged areas, particularly in refugee and displaced persons camps, and in health structures.
National Union of Teachers	Standards for School Premises – England	2012	standards	11	https://www.gov.uk/government/publications/standards-for-school-premises	Guidance to help schools and local authorities understand their obligations in relation to the School Premises Regulations 2012.
Oxfam	OXFAM Septic Tank Guidelines		Brief	6	https://policy-practice.oxfam.org.uk/publications/septic-tank-guidelines-126711	Septic Tank Guidelines.
Oxfam GB, IWA, GTZ, WASTE	Innovations in emergency sanitation 2 day workshop, 11-13 February 2009, Stoutenburg, The Netherlands	2009	Report	21	https://postconflict.unep.ch/humanitarianaction/documents/02_11-11.pdf	The aim of the workshop was to come up with useful ideas to improve sanitation practices in terms of sustainability, however still be suitable for emergency situations.
P. Harvey	Excreta Disposal in Emergencies	2007	Field Manual		https://www.unicef.org/cholera/Chapter_9_community/19_Interagency-Excreta_disposal_in_emergencies.pdf	The purpose of this manual is to provide practical guidance on how to select, design, construct and maintain appropriate excreta disposal systems to reduce faecal transmission risks and protect public health in emergency situations. Relevant situations include natural disasters, relief for refugees and IDPs and complex emergencies, focusing on rural and peri-urban areas.

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Planning & Building Unit Department of Education & Skills Tullamore, Co. Offaly	Guidelines and Standards for Sanitary Facilities in Primary Schools	2014	Guidelines	20	https://www.education.ie/en/School-Design/Technical-Guidance-Documents/Current-Technical-Guidance/TGD%E2%80%93021-2-Guidelines-and-Standards-for-Sanitary-Facilities-in-Primary-Schools-1st-Edition-April-2014-.pdf	This document sets out the required standards of performance to be used in the design of Primary school sanitary facilities with an emphasis on achieving build quality; value for money; safety in design, construction and use; effective management and operation of the building; life cycle costing; and timely completion of the project.
SuSana	Sustainable sanitation for emergencies and reconstruction situations	2012	Report	8	https://www.susana.org/en/knowledge-hub/resources-and-publications/library/details/797	This factsheet addresses current developments, challenges, gaps and solutions in the planning and implementation of sustainable sanitation for emergencies and reconstruction situations focusing on low and middle income countries. It is mainly intended for students, researchers, policy makers and practitioners.
UNHCR	UNHCR WASH Manual: Practical Guidance for Refugee Settings		Guide	68	http://wash.unhcr.org/unhcr-wash-manual-for-refugee-settings/	The manual outlines WASH guidelines that should be met in all refugee settings to provide an adequate level of basic WASH services for refugees.
UNICEF	WASH Technology Information Packages - for UNICEF WASH Programmes and Supply Personnel	2010	Guide	194	https://www.unicef.org/supply/index_54301.html	The WASH TIPs are a practical set of guidelines and tools to help you make the best choice.
UNICEF - Ministry of Education	Sanitation Technology Options Part 2 Construction drawings		Drawings	26	https://www.ircwash.org/sites/default/files/321.0-07ST-18827.pdf	Construction drawings.
UNICEF India?	Technical Guide2 Safe disposal and Incinerators	?	Guide	8	http://unicef.in/CkEditor/ck_Uploaded_Images/img_1513.pdf	

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Victorian School Building Authority	Building Quality Standards Handbook	2018	Standards	125	https://www.education.vic.gov.au/Documents/school/principals/infrastructure/BuildingQualStandHdbk%202018.pdf	The Building Quality Standards Handbook (BQSH) sets the minimum quality criteria for all Department of Education and Training (DET) capital projects, including new construction, refurbishment and maintenance works. Its purpose is to assist architects and designers to create high-quality designs for school facilities across Victoria.
WEDC	Septic tank and aqua privy design	2011	Guide	10	https://wedc-knowledge.lboro.ac.uk/resources/booklets/G030-Septic-tank-and-aqua-privy-design-on-line.pdf	Guide on septic tank and aqua privy design.
B. Reed	Pit latrines for special circumstances	2014	Guide	12	https://wedc-knowledge.lboro.ac.uk/resources/booklets/G029-Latrines-for-special-circumstances-online.pdf	Whilst pit latrines are often the most suitable form of sanitation in lowincome communities, there are some situations which present particular challenges for designers and builders. These situations include locations where rock is close to the surface, so preventing the excavation of a deep pit, or in cold climates where solids do not decompose as readily as in warmer environments. This guide examines the problems these circumstances present and suggests ways in which some of the difficulties can be overcome.
WEDC	Ventilated improved pit (VIP) latrines	2014	Guide	11	https://wedc-knowledge.lboro.ac.uk/resources/booklets/G027-VIP-latrines-booklet.pdf	VIP design guidelines.
WHO	Guidelines on Sanitation and Health	2018	Guide	220	https://www.who.int/water_sanitation_health/sanitation-waste/sanitation/sanitation-guidelines/en/	The new WHO Guidelines on Sanitation and Health summarise the evidence on the effectiveness of a range of sanitation interventions and provide a comprehensive framework for health-protecting sanitation, covering policy and governance measures,

						implementation of sanitation technologies, systems and behavioural interventions, risk-based management, and monitoring approaches. Critically, the guidelines articulate the role of the health sector in maximizing the health impact of sanitation interventions. The guidelines also identify gaps in the evidence-base to guide future research efforts to improve the effectiveness of sanitation interventions.

5 Inclusive design

Author	Title	Date	Type	Pages or Sheets	Document source / web link	Summary
A. Agarwal, A. Steele	Disability Considerations for Infrastructure Programmes	2016	Report	41	https://assets.publishing.service.gov.uk/media/57a08954ed915d3cfd0001c4/EoD_HDYr3_21_40_March_2016_Disability_Infrastructure.pdf	This rapid desk based study was undertaken to provide DFID infrastructure advisors with a reference document that identifies and summarises robust evidence and makes recommendations on how to incorporate disability considerations into all aspects of infrastructure projects. The study aims to help minimise barriers in infrastructure and improve access for people with disabilities, enabling them to participate fully in social and economic life.
Bobrick	Planning Guide for Accessible Restrooms		Guidelines	24	http://www.bobrick.com/wp-content/uploads/2019/01/planningguide.pdf	The information contained herein is of an advisory nature only and represents Bobrick Washroom Equipment, Inc.'s interpretation of the 2010 ADA Standards for Accessible Design (referred to as, 2010 ADA Standards) and the ICC A117.1, Accessible and Usable Buildings and Facilities (referred to as 2009 ICC/ANSI Standards).
CBM	Promoting access to the Built Environment Guidelines	2008	Guidelines	110	https://www.medbox.org/policy/promoting-access-to-the-built-environment-guidelines-1/toolboxes/preview?q=	These guidelines on "Promoting Access to the Built Environment" reflect international standards and recommendations about accessibility in the built environment, and have been developed to assist CBM, its partners and other interested agencies in creating a more fully accessible environment.
Centre for Excellence in Universal Design	Building for Everyone: A Universal Design Approach. Booklet 5 - Sanitary facilities		Report	118	http://universaldesign.ie/Built-Environment/Building-for-Everyone/Entire-Series-Books-1_10.pdf	The guidance in this booklet promotes the concept and philosophy of universal design and encourages developers, designers, builders and building managers to be innovative and think

						creatively about solutions that meet the needs of all building users.
Changing Places	Information Guide and Technical Standard	2017	Report	52	https://providers.dhhs.vic.gov.au/sites/dhhsproviders/files/2017-09/Changing-places-information-guide-and-rechnical-standard.pdf	Changing Places design specification, accreditation, costings and guidelines.
Concerted Municipal Strategies	Methodological guide no 5: how to manage public toilets and showers.	2010	Guide		pseau.org/outils/ouvrages/pdm_ps_eau_cms_guide_n_5_how_to_manage_public_toilets_and_showers_2010.pdf	A decision-making aid aimed at local decision makers and providing practical advice and recommendations for managing toilet blocks situated in public places, deprived neighbourhoods, schools and health centres.
DewPoint	Inclusive / universal design for water supply, sanitation and hygiene (WASH) services - an annotated bibliography	2010	Report	28	https://wedc-knowledge.lboro.ac.uk/resources/pubs/DEWPoint_enquiry_A0332_-_Inclusive_design_for_WASH_services.pdf	A literature search, annotated bibliography and abstract on the subject: Inclusive / universal design for water supply, sanitation and hygiene (WASH).
H. Jones, B. Reed	Water and Sanitation for Disabled People and Other Vulnerable Groups	2005	Report		https://wedc-knowledge.lboro.ac.uk/details.html?id=16357	This book has been written to raise awareness among the water and sanitation sector about the needs of disabled people and other vulnerable groups, and to provide practical information, ideas and guidance about how these needs could be addressed within normal water and sanitation

						programmes and services. The main focus of the book is on access to domestic water supply and sanitation, which may be at either domestic or communal level. Chapter 2 provides some answers to the question: Why should the water and sanitation sector consider disabled people? Chapter 3 and 4 provide information to support communication and collaboration between the water supply and sanitation sector and the disability sectors. Chapters 5 to 7 provide practical ideas for making physical facilities more accessible and inclusive. Chapter 8 presents ideas for planning and implementing services that consider disabled people. Chapter 9 provides a number of case studies illustrating how disabled people and their families have benefitted from improved access to water and sanitation facilities. The book's main target audience is planners and service providers in the water supply and sanitation sector. Disabled people's organisations and organisations that provide support to disabled people and their families may find useful information for their work.
H. Jones, J. Wilbur	Compendium of accessible WASH technologies	2014	Compendium	58	https://washmatters.wateraid.org/publications/compendium-of-accessible-wash-technologies	This compendium presents low-cost technologies to improve the accessibility of household WASH facilities. It is designed for use by people working directly with communities in rural areas of Sub-Saharan Africa, including health workers and community volunteers.
S. House, S. Ferron, M. Sommer, S. Cavill	Violence, gender and WASH: a practitioner's toolkit. Making water, sanitation and hygiene safer through improved programming and services. Co-published by 27 agencies.	2014	Manual		washmatters.wateraid.org/violencegender-and-washtoolkit	Highlighting the risks of violence associated with WASH and the potential benefits of WASH, this toolkit encourages practitioners to recognise their capacity to make WASH safer and more effective, by clarifying the practical steps that can be taken through improved policy, programming and service provision.

S. House, T. Mahon, S. Cavill	Menstrual hygiene matters: a resource for improving menstrual hygiene around the world. Co-published by 18 agencies.	2012	Manual		washmatters.wateraid.org/publications/menstrual-hygienematters	An essential resource for improving menstrual hygiene for women and girls in low- and middle-income countries. It gives practical guidance on how to address menstrual hygiene needs with evidence and examples from around the world. It provides an overview of the issues that planners and local decision makers need to consider.
Oxfam	Excreta disposal for people with physical disabilities in emergencies		Brief	6	https://www.unicef.org/cholera/Chapter_9_community/17_OXFAM_Excreta_Disposal_for_Physically_Vulnerable_People_in_Emergencies_2.pdf	This Technical Brief highlights good practice in this area. It has drawn its information from OXFAM good practice in the field, including discussions with users who have disabilities, and from WEDC research 'Water and Sanitation for Disabled People and Other Vulnerable Groups' (Jones and Reed, 2005).
Oxfam	Excreta disposal for people with physical disabilities in emergencies	2006	Note	6	https://policy-practice.oxfam.org.uk/publications/excreta-disposal-for-physically-vulnerable-people-in-emergencies-126706	This Technical Brief highlights good practice in this area. It has drawn its information from OXFAM good practice in the field, including discussions with users who have disabilities, and from WEDC research 'Water and Sanitation for Disabled People and Other Vulnerable Groups' (Jones and Reed, 2005).
B. Reed	Infrastructure for all: meeting the needs of both men and women in development projects – a practical guide for engineers, technicians and project managers.	2007	Manual		https://wedc-knowledge.lboro.ac.uk/resources/books/Infrastructure_for_All_-_Complete.pdf	This guide gives engineers and technicians an understanding of the context and the practical information they need to ensure their 'product' is suitable for both men and women and all of society.
UNICEF	WASH disability inclusion practices		Report	23	https://www.unicef.org/disabilities/files/WASH_Disability_Inclusion__Practices__programming_note_-_Draft_for_review.pdf	The guidance note is intended for UNICEF professionals working on WASH policy, programmes and projects at national and subnational levels. This guidance note is also useful for government and sector partners working to advance disability inclusion and accessibility in the provision of WASH services.

Technical guidelines

WaterAid	Technical Manual on community water, hygiene and sanitation facilities		Manual	38	https://asksource.info/resources/technical-manual-community-water-supply-hygiene-and-sanitation-facilities	This manual presents designs to develop more accessible public facilities based upon modifications following a training completed by Handicap International in July 2009 on equity inclusion for WaterAid Madagascar and partners'. The manual features accessible designs for community water points, hand washing devices and school and institutional latrine-shower blocks. It also highlights areas where there were limits to accessibility so ongoing research can mitigate these limitations
WaterAid, WSUP, UNICEF	Female-friendly public and community toilets: a guide for planners and decision makers	2018	Report	56	https://washmatters.wateraid.org/publications/female-friendly-public-and-community-toilets-a-guide-for-planners-and-decision-makers	The guide explains why toilets must be female-friendly, before detailing the essential and desirable features needed to make them so. It also suggests ways to increase gender sensitivity in town planning on sanitation. The guide draws the recommendations and practical steps from existing literature, expert opinion and analysis of pioneering experiences from around the world.
WEDC Equity and Inclusion resources	Resources				www.wedcknowledge.lboro.ac.uk/collections/equity-inclusion/	Awareness-raising and training materials. Includes guidance on doing accessibility and safety audits for water points, school and household latrines.

6 Hygiene

Author	Title	Date	Type	Pages or Sheets	Document source / web link	Summary
UNICEF, GIZ	Scaling up group handwashing in schools - Compendium of group washing facilities across the globe	2016	Guide	88	https://www.susana.org/en/knowledge-hub/resources-and-publications/library/details/2641	Presented designs include the entire span of possible existing facilities reflecting different circumstances, necessities and resources of school communities. Key features and characteristics of each facility are summarized in tables providing information about the design structure, as well as aspects of construction, installation, operation and maintenance, usability, and the opportunity of community involvement. A section on advantages, limitations and recommendations summarises key aspects for prospective users. A simplified isometric drawing displays main elements of the facility and a Bill of Quantity details different materials and estimated costs of each facility.

References

[1] Numbers in this table have been taken from a variety of sources below:

- Bouman, D.; Holtslag, H.; Claasen, F. (2012) WASH Technology Options for School Facilities. EMF, ARC, Aqua for All, The Netherlands.
- Department for Education (England) (2015) *Advice on standards for school premises*.
- Reed, R.A.; Shaw, R. (2008) *Sanitation for Primary Schools in Africa*. WEDC, Loughborough University, UK
- UNICEF/Environmental Sanitation Section (ESS)/Department of Water Supply and Sewerage (DWSS) (2001) *School Latrines in Different Ecological Regions*.
- Armitage Shanks (July 2008) *School solutions… what works and why*.
- Dept of Drinking Water Supply, Ministry of Rural Development, Govt of India (2004) *School and Anganwadi Toilet Designs*.
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- WHO & Unicef (2017) *Water and Sanitation for Health Facility Improvement Tool (WASH FIT)*
- Ministry of Health, Community Development, Gender, Elderly and Children (2017) *The National Guidelines for Water, Sanitation and Hygiene in Health Care Facilities, Tanzania*.
- Canterbury City Council (n.d.) *Provision of toilets in commercial remises open to the public*.
- Adams, J.; Chartier, Y.; Harvey, B.; Maison, D. (2012) Water, Sanitation & Hygiene (WASH) in health-care facilities in emergencies. WHO, Geneva, Switzerland

[2] Authors' recommendations.

[3] Authors' recommendations.

[4] Adapted from research done by Sarah House (with help from Eric Fewster) for the Sudan Drinking Water Safety Strategic Framework (2017).

[5] Diagrams and logic have been adapted from: Lawrence, A.R.; Macdonald, D.M.J.; Howard, A.G.; Barrett, M.H.; Pedley, S.; Ahmed, K.M.; Nalubega, M. (2001) *Guidelines for assessing the risk to groundwater from on-site sanitation.* British Geological Society, Keyworth, UK.

[6] Design procedure from: Harvey, P. (2007) *Excreta disposal in emergencies: a field manual.* WEDC, Loughborough, UK.

[7] Design procedure from: Harvey, P. (2007) *Excreta disposal in emergencies: a field manual.* WEDC, Loughborough, UK.

[8] Drawings and photo guide from: Fewster, E. (2003) *Techniques for sanplat slab construction.* Medair, Sudan.

[9] A lot of good information on concrete – including that included in this annex – can be found in:

- Franceys, R.; Pickford, J.; Reed, R. (1992) *A guide to the development of on-site sanitation.* WHO, Geneva, Switzerland.
- Meuli, C.; Wehrle, H.; Muller, K.; Pfiffner, H. (2000) *Building Construction.* Series of manuals on drinking water supply. Volume 3. SKAT, St. Gallen, Switzerland.

[10] Davis, J.; Lambert, R. (2002). *Engineering in Emergencies: a practical guide for relief workers.* 2nd Edition. IT, London.

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[11] Davis, J.; Lambert, R. (2002). *Engineering in Emergencies: a practical guide for relief workers.* 2nd Edition. IT, London.
[12] For information on snow loading and issues in cold climates, see: Buttle, M.A.; Smith, M.D. (2004) *Out in the Cold: Emergency water supply and sanitation for cold regions.* Loughborough, WEDC, Loughborough University, UK.
[13] For information on cold climates, see: Reed, B. (2014) *Pit latrines for special circumstances*. WEDC, Loughborough University, UK.
[14] For information on raised pits, see: Reed, B. (2014) *Pit latrines for special circumstances*. WEDC, Loughborough University, UK.
[15] Roof/frame advice taken from: Florida International University (2012) *Final report: Shelter and Component Testing - OFDA transitional shelters: materials, techniques and structures.* FIU, Miami, USA.