SECTION 4

4 SELECTION OF DISPOSAL FIELDS

4.1 Introduction

Section 3 described the parts of an on-site system, including a disposal field, and explained that a disposal field includes the following components **(Figure 4.A)**:

- final cover material and sod over the field
- clean local backfill
- synthetic barrier material
- gravity or pressure distribution pipe
- crushed rock
- filter sand
- infiltrative surface
- soil
- imported sand fill

Section 3 also explained the purpose of each of these components.

This section first discusses in more detail the role that disposal fields play in treatment and disposal of effluent from a septic tank. It also deals with selection of a disposal field, including the layout, arrangement, and dimensions of the field.

It then describes, in Sections 4.3 and 4.4, the standard disposal fields that may be selected to suit conditions on most single unit dwelling sites in Nova Scotia, and how a system is selected for a particular site.

Section 5 discusses the design principles on which the design of systems are based. These principles must be applied in development of designs for special conditions or other buildings not covered by Section 4 and 5.

Specification of individual components—such as imported sand fill, pipes, and pumps—are included in Section 3. Construction of systems is covered in Section 6.

A person who selects a system should understand that the dimensions of the systems described in this section are based on assumed site conditions, and do not take into consideration unforeseen variations in hydraulic loads, soil conditions, or ground water levels. To minimize the possibility of system failure, system selection must therefore take into account possible worst-case condition. A system cannot be selected for a lot that consists primarily of foreign fill material or disturbed natural soils.

It should be noted that the selection of systems in these Guidelines applies to systems that will be placed in or directly on naturally occurring soils. If fill has been placed on the site and it is impossible or impractical to remove the fill such that the system will be located in or on the natural soil, a system shall not be selected for the site. However it may be possible for a QP1 to design a system for the site. See Section 5.3.2 for system design.

Removal of natural soil from the site should be avoided as in most cases the top few centimeters of soil and root mat are much more permeable than the subsoils. Where natural soil has been removed from the site, site assessment and system selection or design must be based on the remaining soil conditions.

Not all sites are suitable for selection or design of onsite sewage disposal systems.

4.2 What Disposal Fields Do

On-site systems that are installed in Nova Scotia must recognize the geology and topography that characterize most of this province:

- Soils are generally a mix of sand, silt, and clay; many of these soils are of low permeability (resistant to movement of water), and become less permeable at lower depths.

- Topography is generally hilly.

- Shallow soils with unacceptably low or high permeability.

In most of these soils effluent leaving a distribution system moves downward in the more permeable soil until it reaches a less permeable material or water table. Then the effluent moves laterally, in the direction of the surface or ground water slope.

The effluent will saturate the soil to a depth that depends on the soil type, the slope, and the rate of effluent flow. Where the depth of natural soil below a system is not adequate to carry the effluent flow, the system is raised above ground level and imported sand fill—below and downslope of the distribution trench is used to provide adequate depth to carry the effluent.

It is intended that under most conditions effluent will move downward and remain in the soil under the system. It is recognized, however, that at some times of the year, when the soil beneath the system is saturated, effluent may emerge from the downslope edge of the system. Systems are therefore designed to assure that any effluent that leaves the system is adequately treated. It is also expected that the area immediately downslope of a system will be vegetated (grass or natural vegetation) to allow the treated effluent to travel in the root zone and not on the ground surface.

Most or all of the septic tank effluent will eventually reach the ground water table, directly or by travel in bedrock or very permeable soils. If the effluent is not adequately treated; water supplies may be contaminated, or contaminated ground water may discharge to and contaminate surface waters. It is therefore required that the bottom of the crushed rock in a trench or bed in a disposal field be separated by at least 1 m from the ground water, bedrock, or soil with unacceptably high permeability. This separation may be provided by natural soils, or by imported sand fill.

The roles of the disposal field are therefore to:

- uniformly distribute the effluent into the soil below the system in order that the hydraulic capacity of the soil is not exceeded

- provide treatment to ensure that effluent leaving the system and entering the ground water or reaching the ground surface, will not adversely affect public health or the environment.

4.3 Types of On-site Disposal Fields

The on-site disposal fields discussed in this section are:

- C1 Contour Trench
- C2 Contour Trench (standard and raised)
- C3 Contour Trench
- Mound
- Area Bed
- Multiple Trench

The remainder of this section summarizes features of these systems, which are illustrated by **(Figures 4.B, C, D, E, F, G, H, and I)**.

A sloping sand filter may be designed **by a Level 1 Qualified Person only** (see Section 5).

A contour trench disposal field consists of a single distribution trench, which is laid along a contour. (A contour is an imaginary line that joins points of equal elevation on the land surface). The basic differences between C1, C2, C3, and mound systems are shown in **Figures 4.B** through **4.I**.

General requirements relating to selection or design of all contour trench systems are:

- The excavation depth for the trench does not include the organic layer. The excavation depth is measured from the top of the first permeable soil layer.

- The bottom and downslope lip of the trench must be level.

- The trench must include a 75 mm filter sand layer beneath the crushed rock that surrounds the distribution pipe.

- The sand and crushed rock layers must be laid level without slope and the trench to follow along the contour.

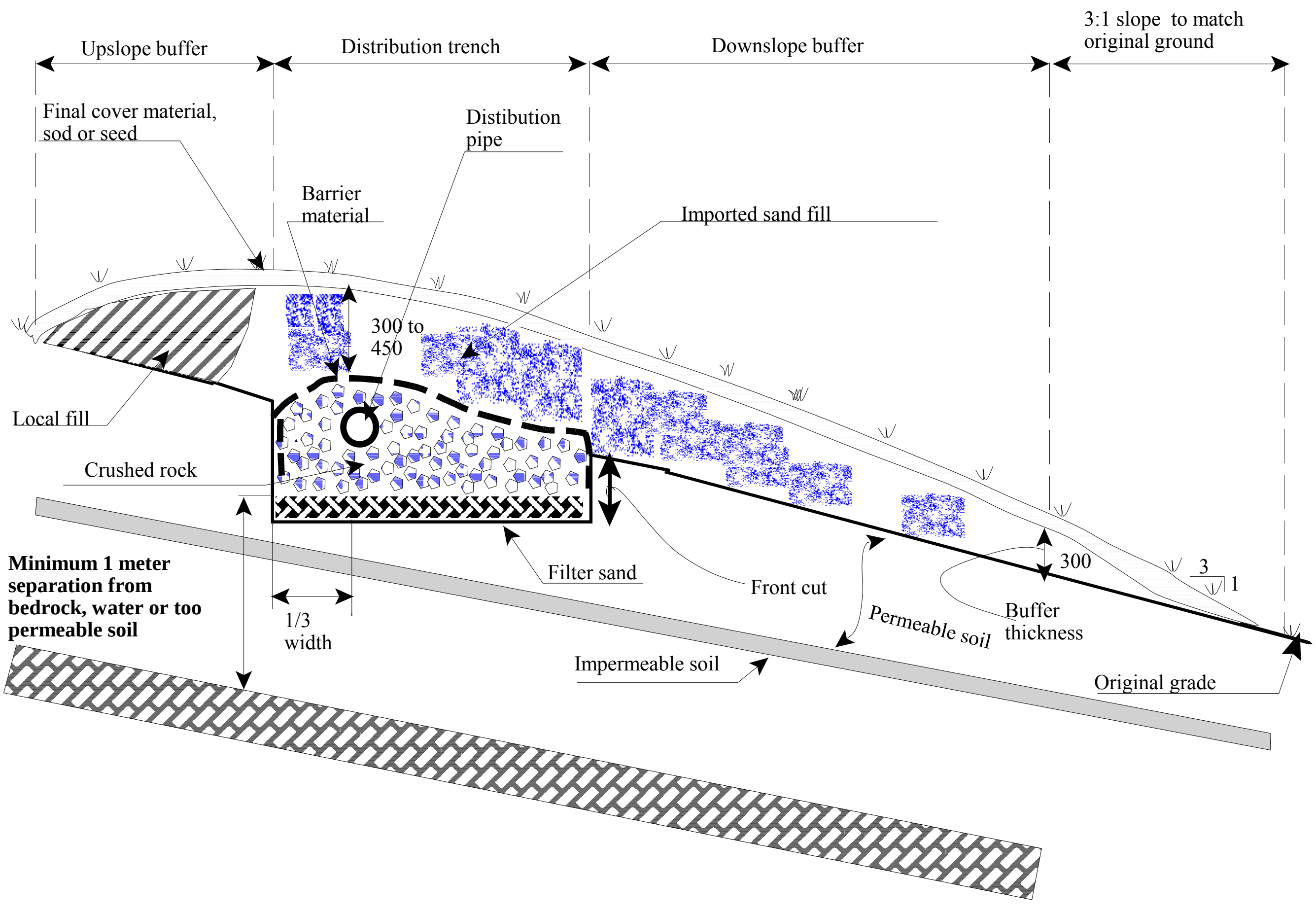
- A gravity distribution pipe is sloped at 50 to 100 mm per 30 m.

- A pressure distribution pipe is level with no slope.

- The maximum depth of a C2, C3, or mound system, from the ground surface to the finished level—including imported sand fill and final cover material—is approximately 1600 mm, to minimize problems due to differential settlement

FIGURE 4 A

DISPOSAL FIELD COMPONENTS



- A distribution trench may be continued on either side of a driveway by connecting with solid pipe under the traffic area and at least 3 m on either side. Freezing must be prevented by adequate cover or insulation, and the pipe must be selected, installed, and protected, to withstand wheel loads.

- Original soil under a C2, C3 or mound system should not be removed, but it should be ploughed or scarified. Tree stumps should be left and cut off close to the ground surface, where flow along roots is anticipated, roots should be removed.

- Although the effluent from a C2, C3 or mound system is expected to enter the soil below the system, at some seasons of the year effluent may be discharged at the downslope toe of the fill. If this effluent is distributed over the length of the trench it will travel in a thin film in the soil and root mat below the vegetation or grass. It is therefore essential that the area immediately downslope of the system be vegetated (by sod, grass, or natural vegetation), and that bare soil is not exposed in this area.

- A pressure system is required:
  - where an end-fed system is longer than 30 m, or a centre-fed system is longer than 60 m
  - systems greater than 60 m can only be **designed by a level 1 qualified person**
  - where the natural slope is not constant, and where a gravity system may tend to concentrate effluent in one part of the field
  - for any C3 or mound system
  - for any system where the distribution pipe is at a higher elevation than the septic tank

- A disposal system should be located so that the finished grade above the disposal field is below the invert of the septic tank outlet **(Figure 1.A)**, except where effluent is pumped from the tank to the disposal system.

- Interceptor trenches or swales must be provided, located and constructed in accordance with Sections 3, 4, and 6.

4.4 Disposal Field Selection

4.4.1 General Considerations

This section deals specifically with selection of on-site disposal systems to serve single unit residential units with maximum wastewater flows that do not exceed 1500 L/day. Systems intended to serve higher flows or other buildings should be **designed by a level 1 qualified person only** in accordance with Section 5.

If it is not possible to select a system based on the requirements of this section, it may be possible to design an appropriate system from first principles based on Section 5 or other accepted engineering design calculations. This requires a level 1 qualified person.

4.4.2 Required Information

Table 4.1 summarizes the nature and source of the information needed before a disposal field can be selected.

TABLE 4.1

INFORMATION NEEDED TO SELECT A DISPOSAL FIELD

Type of Information	Guideline Section
Ground slope at disposal field location	2.4.1
Soil profile – soil types and depths	2.5
Depths of permeable soil	2.5
Highest expected ground water table	2.8
Average daily flow	2.6
Location and dimensions of useable area at disposal field location, based on: - lot area and dimensions - location of house, driveway, etc. - horizontal separation distances	2.7 & 2.8

4.4.3 Preliminary Selection of Disposal Fields

Table 4.2 provides a basis for preliminary selection of disposal fields described in this section. Final selection should be based on the procedures described in the remainder of this section.

TABLE 4.2

DISPOSAL SYSTEM SELECTION OPTIONS*

* ***Not all options provided are suitable for each property being assessed, separation distances to water table and bedrock etc. must be taken into consideration.***

Permeable Soil Depth (mm)	Slope less than 3 %	Slope of 3% or greater and less than 30%	Slope over 30%
0 to less than 300	Mound	C2(***r***), C3	**Not Acceptable For Selection. Design Only By A Level 1 Qualified Person**
300 to less than 600	Mound	C2,C2(***r***), C3	
600 to less than 750	Mound	C2,C2(***r***), C3	
750 to over 1300	Mound	C1, C1(**r**), C2, C2(***r***), C3	
780 and over	Area Bed		
875 and over	Multiple Trench		

4.4.4 Limiting Slopes

Limiting slopes for selection of disposal fields are indicated in **Table 4.3**.

TABLE 4.3

MINIMUM AND MAXIMUM SLOPES FOR SELECTION OF DISPOSAL SYSTEMS

System Type	Minimum Slope %	Maximum Slope % (1)
Contour C1	3%	30%
Contour C2	3%	30%
Contour C3	3%	30%
Mound	0%	less than 3%
Area or Trench	0%	less than 3%

NOTE: (1) If slopes for a contour disposal system exceeds 30 % a system must be designed in accordance with Section 5 to specify appropriate construction methods and assure the stability of imported sand fill.

4.5 C1 CONTOUR TRENCH

4.5.1 Introduction

Details of a C1 Contour trench are shown in **(Figure 4.B)**.

A C1 trench may be selected:

- where the surface slope at the location of the trench is at least 3 percent
- there is at least 750 mm of unsaturated permeable soil
- where the width of the lot will allow for the length of the selected C1 trench

A C1 trench is fed by a gravity distribution system, except that a pressure system is required where the distribution trench is at a higher elevation than the septic tank, or the length from the tee feeding the system to the end of the distribution pipe exceeds 30 m.

An interceptor trench or swale may be necessary, to intercept and divert surface or ground water if a perched water table exists, or if the system is located at the lower end of a long slope.

Refer to Section 3.6 and 6.12 for more information on interceptor trench or swale.

4.5.2 Depth Limitations for a C1 Contour Trench

Figure 4.B illustrates two possible C1 contour installations dependent upon the depth to an elevation of ground water, rock, soil with unacceptably high permeability or a perched water table.

As illustrated in the raised C1 cross section (**Figure 4.B**), clearance to water table, bedrock and soils with unacceptably high permeability can be increased if the trench is raised by not more than 300 mm. This trench will require an earth cover as illustrated and an interceptor trench and/or swale. A interceptor may not be necessary if existing topography or an existing ditch is 15 m upslope and completely removes surface and/or ground water from the contour area.

The C1 selection tables provide the minimum values for total soil depth “D” to soil with unacceptably high permeability, water table or bedrock.

The effective soil depth is the total depth of natural unsaturated soil with acceptable permeability beneath the surface layer of sod and organic minus 150 mm. The selection tables, found in **Appendix J,** include a calculated effective soil depth, therefore calculation for effective soil depth is not required if the tables are used.

It is important that the C1 trench excavation not penetrate the soils with unacceptably low permeable or impermeable soils. It should also be noted that the draining of a perched water table may allow for the increase of an effective soil depth.

4.5.3 Layout of a C1 Trench

Figure 4.B illustrated the layouts of fully trenched C1 and raised C1 trenches.

A trench is excavated along the contour to a depth referred to as the "C" cut in **Tables 4.4A, 4.4B, 4.5A and 4.5B**. The trench is then excavated the necessary width while keeping the bottom of the trench perfectly level throughout its length and width. Filter sand is to be deposited in the bottom of the trench to a depth of 75 mm, upon which a minimum of 125 mm of crushed rock will be placed. The amount of crushed rock at the tee will exceed 125 mm because the pipe will be sloped toward(s) the end(s) of the system. (Also see Construction Section for more details on layout, page 117).

4.5.4 Selecting a C1 Contour Trench

The length of a C1 trench is determined using **Tables 4.4.A, 4.4.B, 4.5A and 4.5B**. The table used will depend on the average daily flow leaving the dwelling, the depth of permeable soil, the type of permeable soil, and the slope in the location of the system. The amount of room for a contour system on the property, and the total depth of soil above water table, bedrock, or soil of unacceptably high permeability must be taken into consideration in your selection from the table(s).

The length of a C1 trench will range between 25 m and 60 m. If a C1 system cannot be selected through the use of the tables then a C2 system will have to be considered.

A C1 system can be selected as follows:

a) **Determine the average daily flow Section 2.6 and Table 2.3** . In terms of system selection either 1000 L/day or 1500 L/day will be used.

b) **Determine the surface slope at the proposed location of the disposal field.** <u>If the slope is less than 3 percent or greater than 30 percent, a C1 cannot be considered for selection</u>.

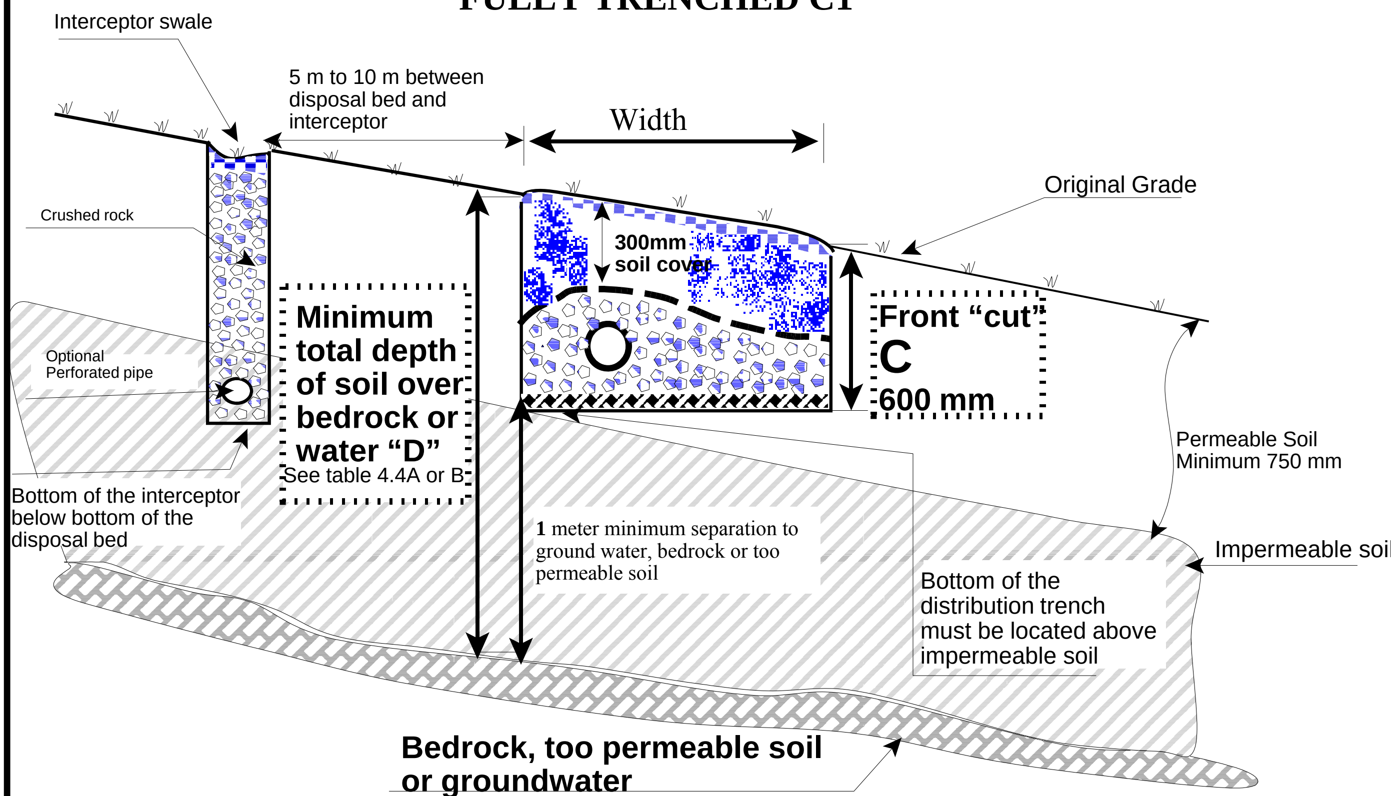
c) **Determine the type(s) of permeable soil from Table 2.1.** If more than one type of permeable soil is present (i.e., 800 mm of sandy gravel and 300 mm of silty sand) the type with the lowest permeability is used for the **selection tables, 4.4A, 4.4B, 4.5A and 4.5B** found in **Appendix J**.

d) **Determine the depth(s) of permeable soil.** If more than one type of permeable soil is present (i.e. 800 mm of sandy gravel and 300 mm of silty sand) the total depth of permeable soil (in this case) 1100 mm of silty sand is used for the tables. If the total depth of permeable soil is less than 750 mm a C1 cannot be considered for selection.

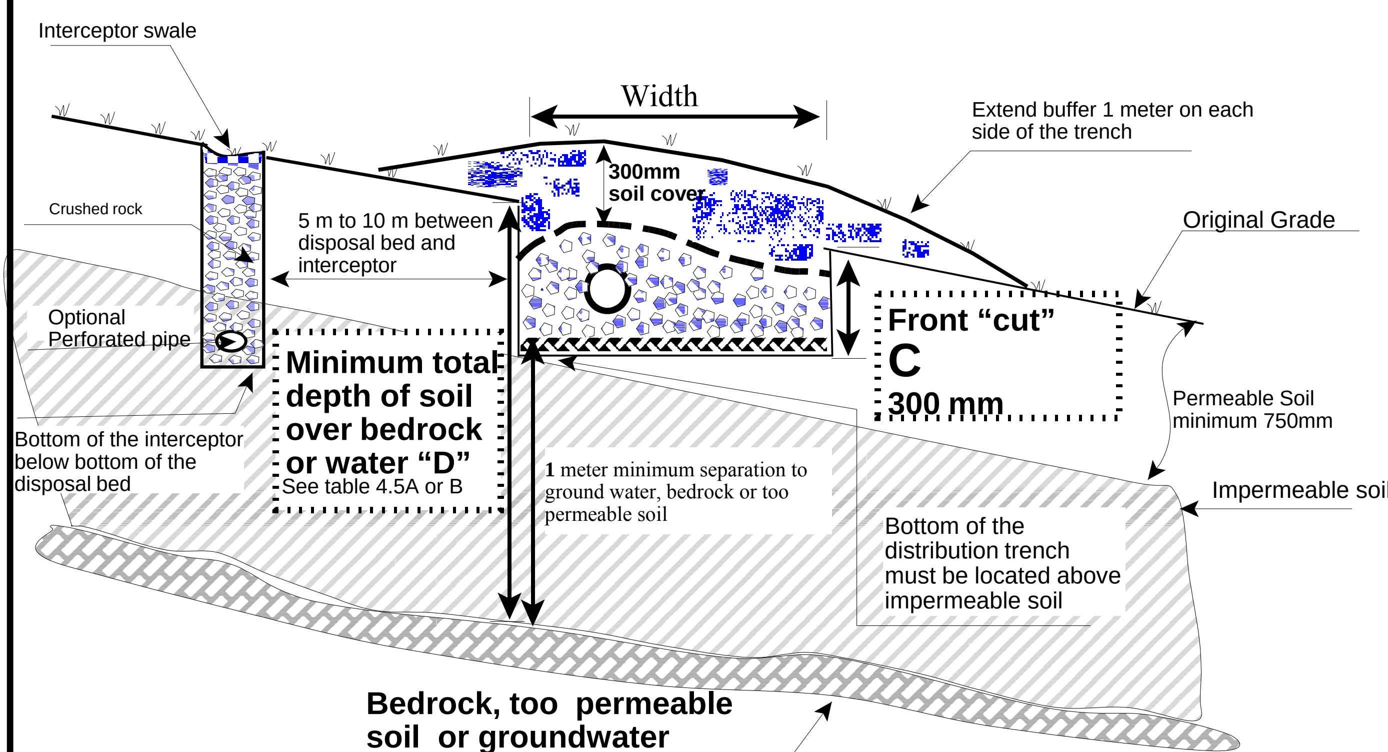
e) **Determine the total depth of soil "D"** (This includes soils that are acceptable or have an unacceptably low permeability) to water table, bedrock, soil with unacceptably high permeability. If this value is less than 1.4 m, then a C1 cannot be considered for selection. Refer to selection tables for the exact minimum "D" value required.

FIGURE 4.B

FULLY TRENCHED C1



RAISED C1



f) **Refer to the appropriate selection table for C1 selection** found in **Appendix J,** based upon the daily **flow** determined in (a). The daily flow used is in the title box at the top of each table.

g) Using the slope determined in (b), the soil type determined in (c), and the depth of permeable soil determined in (d), find the value for "L" (trench length in metres), "D" (minimum required total soil depth), and "C" (depth of cut at the toe of the contour trench). For example, in **Table 4.4A**, a slope of 9 percent with 900 mm of silty sand gives a required "L" of 36 m, a required "D" of 1.7 m and a required "C" of 600 mm. If the available contour on the property equals or exceeds "L" *and* the total depth of soil present equals or exceeds "D", then a C1 with the corresponding "L " and "C " can be used.

Figure 4.B illustrates the situation where impermeable soil or soil with unacceptably low permeably occurs. The heel of the trench must not penetrate the low permeable or impermeable soil. The tables have been developed to ensure that the heel of the trench does not penetrate this layer.

h) **Once a minimum length of C1 trench has been determined**, consideration should be given to increasing the length as much as is practical up to a maximum of 60 m. For instance, if the available contour is 30 m, yet the length "L" determined by the table is 25 m, 30 m is recommended for the length.

If the cut, "C", is already shown in the table as 300 mm and the total soil available is less than what is required, then a C-1 contour cannot be considered for selection.

i) Once it has been determined that a C1 of a particular length can be used, refer to ***Determination of Disposal Trench Width in Metres,*** **Table 4.12**, **Appendix K,** to find the appropriate width of trench.

j) The cross section dimensions of the disposal field will be as shown in **Figure 4.B**.

An example of the selection procedure for a C1 is provided in **Appendix E**.

4.6 C2 CONTOUR Trench

4.6.1 Introduction

A C2 contour trench may provide an alternative in situations where a C1 trench cannot be used. Two types of C2 systems are used; a standard C2, which has historically been used, and a raised C2. **Figure 4.C** illustrates the layout of a standard C2.

A C2 trench is similar to a C1 trench in that effluent leaving the trench is expected to first move laterally in the soil below the organic surface layer. In a standard C2 a layer of imported sand fill, above the ground surface, enables saturation of the existing soil to the natural ground surface without fear of breakout. In a raised C2, a portion of the imported sand fill is expected to become saturated along with the natural soil.

Use of C2 systems is limited to locations where the surface slope at the location of the trench is at least 3 percent. If the slope is less than 3 percent an area bed, mound, or multiple trench should be considered and the exact selection is dependent on the thickness of the natural permeable soil.

A C3 system may be required where the length of trench required for the system exceeds that available for a C2 trench.

A modified C3 trench, constructed according to **Figure 4.F**, should be used instead of a C2 trench where uneven surfaced lots or boulder fields are encountered.

A C2 trench is fed by a gravity distribution system, except that a pressure system is required where:

- the length from the tee feeding the system, to the end of the distribution pipe, exceeds 30 m
- the natural slope is not constant and a gravity system may tend to concentrate effluent in one part of the system
- the distribution pipe is at a higher elevation than the septic tank.

Where ground water, rock, or soil with unacceptably high permeability occurs under a C2 trench, a 1 m vertical separation must be maintained between the bottom of the disposal field trench and the above conditions. This may require the use of a raised C2, or even a C3, rather than a standard C2 to ensure that this 1 m separation is met. In the selection tables for C2 systems found in **Appendix J**, the necessary total depth of soil to bedrock, water table, or soil with unacceptably high permeability is shown as “D”.

4.6.2 Layout of C2 Trench

4.6.2.a Layout of Standard C2 Trench

Figure 4.C illustrates the layout of a standard C2 trench. The toe of the trench is excavated along the contour to a depth of 175 mm into the permeable soil. The trench is then excavated to the necessary width while keeping the bottom of the trench perfectly level throughout its length and width. The depth of the trench from the upslope side will be greater than that at the toe.

A 75 mm layer of filter sand meeting the requirements of **Section 3.3.3** is deposited in the bottom of the trench.

A minimum 125 mm depth of crushed rock is deposited on top of the filter sand. This will ensure that the distribution pipe is raised so that its invert is at or above the ground elevation at the downslope lip of the trench. The amount of crushed rock at the tee will exceed 125 mm because the pipe will be sloped toward(s) the end(s) of the trench.

4.6.2.b Layout of Raised C2 Trench

Figure 4.D illustrates the layout of a raised C2 trench.

A shallow trench, or key, is excavated along the contour to a depth of 100 mm into the permeable soil at the toe of the trench. The key is then excavated the necessary width while keeping the bottom of the key perfectly level throughout its length and width. This key will ultimately be filled with filter sand.

The distribution trench is constructed such that at its toe, the bottom of the gravel in the distribution trench is 200 mm above the bottom of the shallow trench or key. The toe of the distribution trench is to be directly above the toe of the key. The area between the two is to be made up entirely of filter sand.

The bottom of the distribution trench of crushed rock is to be perfectly level throughout its length and width. There is to be a minimum of 125 mm of crushed rock between the bottom of the distribution trench and the invert of the distribution pipe. The amount of crushed rock at the tee will exceed 125 mm because the pipe will be sloped toward(s) the end(s) of the trench.

The depth of soil for selection of a raised C2 trench is based upon the total depth of unsaturated permeable soil below the organic surface soil. A raised C2 has 200 mm of filter sand under the crushed rock of the distribution trench.

4.6.3 Buffers

Minimum dimensions of buffers in a C2 system are illustrated in **Figures 4.C & 4.D**. For selection purposes, a minimum of 5 m is required for the downslope buffer and 3 m for the side buffer.

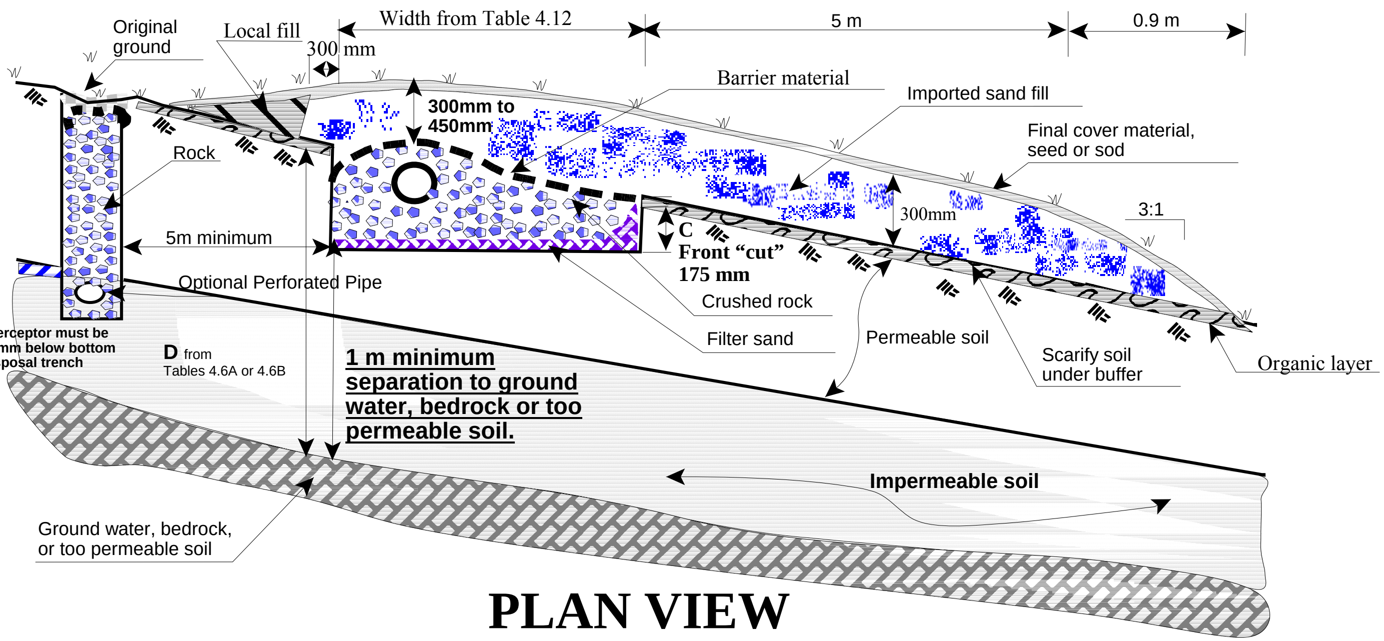
Sand must be placed over and downslope of a C2 trench. For selections from Tables 4.6A, 4.6B, 4.7A, 4.7B, and 4.8A the sand must conform to the requirements of **Section 3.3.2, Imported Sand Fill**. For selections from Tables 4.7C, 4.7D and 4.8B the sand must conform to the requirements of **Section 3.3.3, Filter Sand and Sloping Sand Filter Material**. The depth of sand over the barrier material, and at the downslope limit of the buffer, must be at least 300 mm. Fill used for the buffer upslope of the trench may be imported sand fill or another material with lower permeability, such as natural soil excavated from the trench or from the key or clean local backfill. In some cases, lower permeability soil may be preferred for the upslope buffer as it may help keep surface water from entering the disposal field. Local fill is recommended for the upslope buffer and is referenced in **Figures 1.C, 4.C** and **4.D**

FIGURE 4.C

Standard C2

(Not to scale)

Interceptor/swale must extend a minimum 5 m beyond each end of the disposal field and must provide an adequate surface discharge point for the water



NOTE:

Bottom of the interceptor must be located min. 150 mm below bottom of the sewage disposal trench

PLAN VIEW

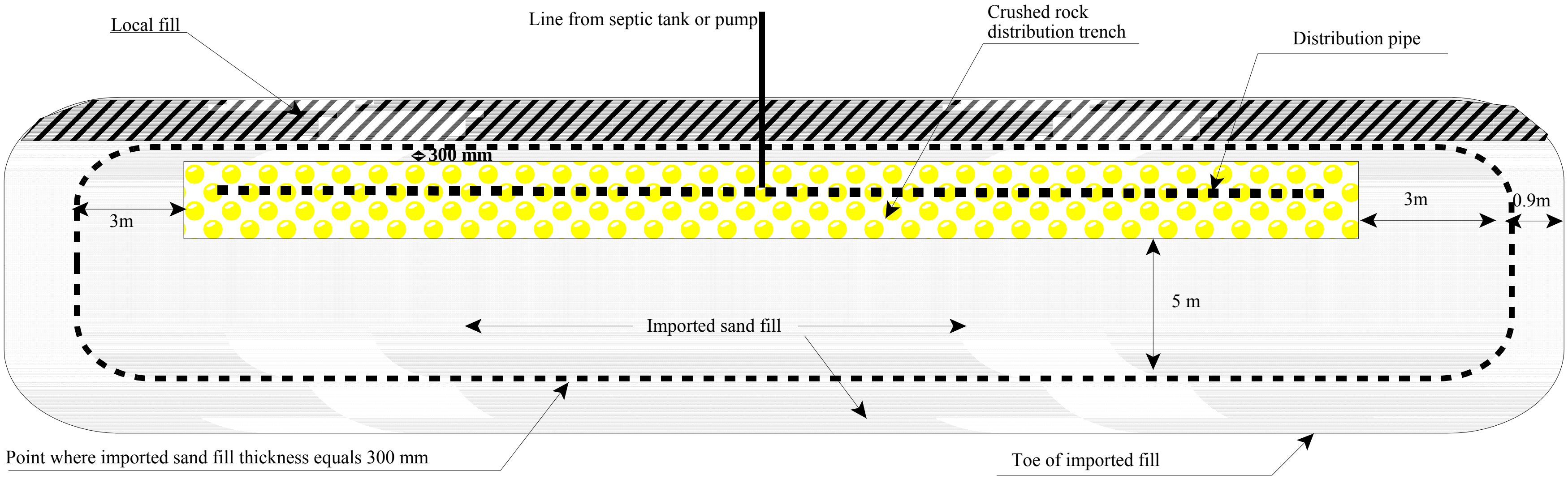
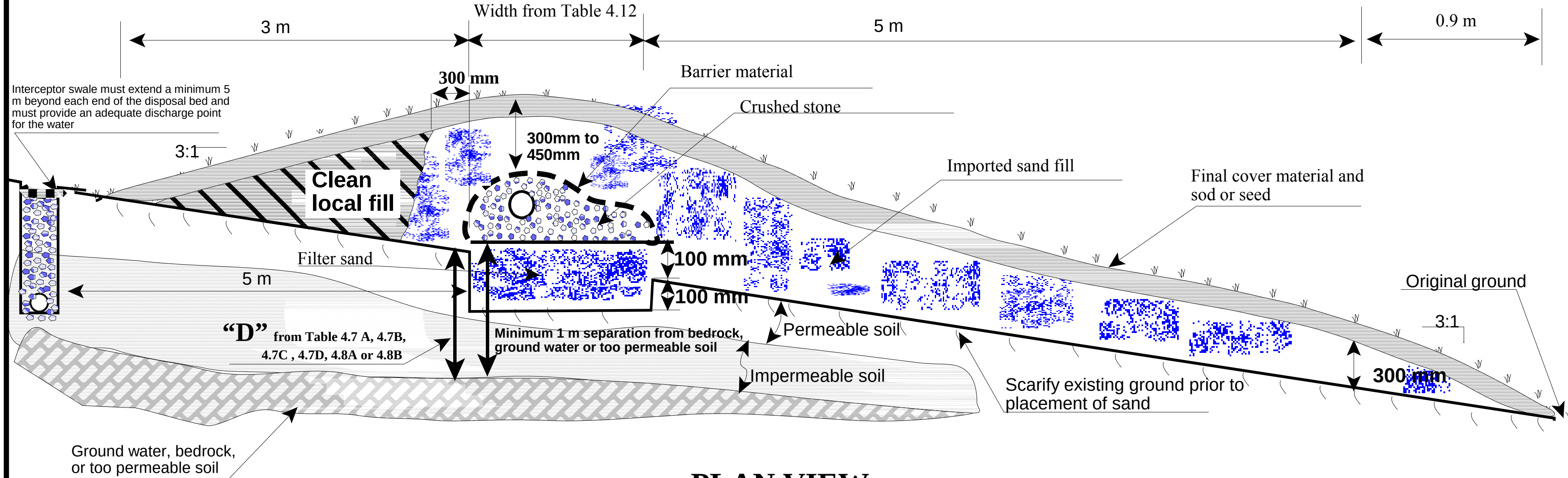
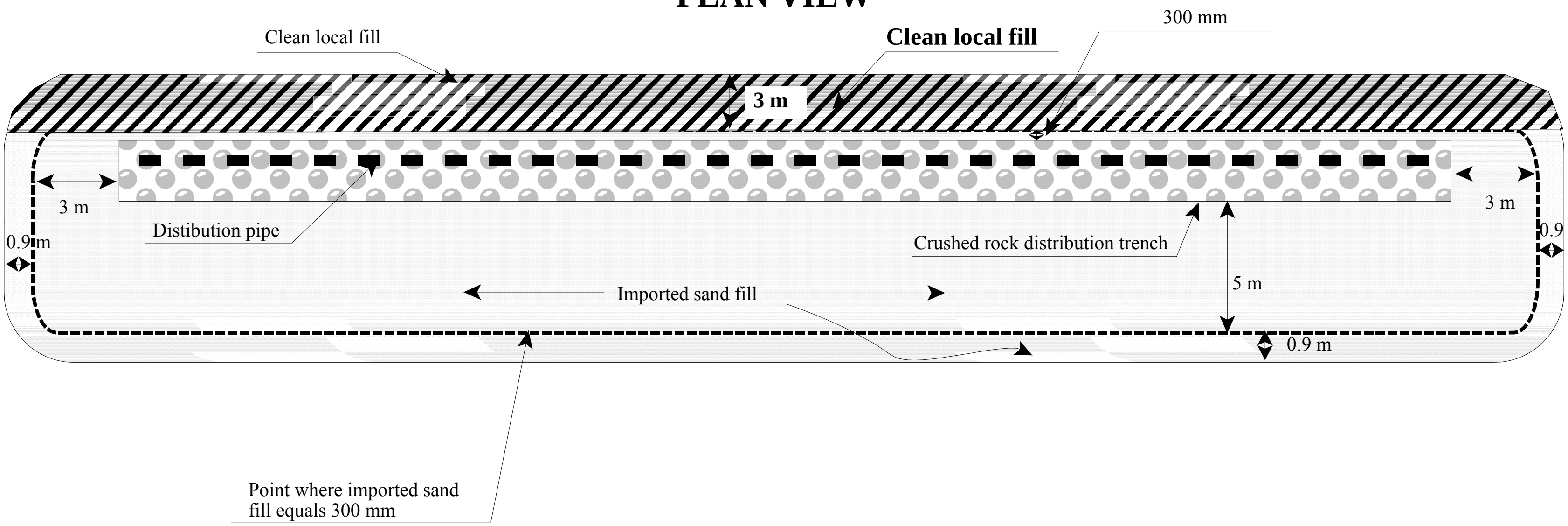


FIGURE 4.D

Raised C2



PLAN VIEW



4.6.4 Interceptor

An interceptor trench or swale, as described in Sections 3.6 and 6.12, must be installed upslope of a C2 system unless the system is at the crest of a hill or there is an existing ditch within 15 m upslope of the system.

4.6.5 Selection of a C2 Trench

The length of a C2 trench is determined using **Tables 4.6.A & B, or 4.7.A, B, C, D & 4.8A &B** found in **Appendix J**. The table which is used will depend on the amount of permeable soil, the type of permeable soil, the slope at the location of the trench, the type of imported sand fill being used in the buffer, the amount of room available for a contour trench on the property and the total depth of soil above water table, bedrock or soil with unacceptably high permeability.

The length of a C2 trench will range between 25 m and 60 m. If a C2 trench cannot be selected through the use of the tables then a C3 system will have to be considered.

A C2 trench can be selected as follows:

a) Determine the average daily flow, Section 2.6 and **Table 2.3**. In terms of system selection either 1000 L/day or 1500 L/day will be used.

b) Determine the surface slope at the proposed location of the disposal field. If the slope is less than 3 percent or greater than 30 percent, a C2 cannot be considered for selection.

c) Determine the type(s) of permeable soil. If more than one type of permeable soil is present (e.g. 500 mm of sandy gravel and 300 mm of silty sand) the type with the lowest permeability (in this case silty sand) is used for the tables.

d) Determine the depth(s) of permeable soil. If more than one type of permeable soil is present (eg. 500 mm of sandy gravel and 300 mm of silty sand) the total depth of permeable soil (in this case 800 mm) is used for the tables. If the amount of permeable soil is less than 150 mm, then **Table 4.8A or B** is used depending on the type of imported sand fill used in the buffer.

e) Determine the total depth of soil(s) (soils with acceptable and unacceptable permeability) to water table, bedrock or soil with unacceptably high permeability. If this value is less than 1.0 m, then a C2 system cannot be considered for selection and a C3 or mound system will have to be considered.

f) Refer first to the appropriate chart for standard C2 selection based upon the daily *flow* determined in (a). The daily flow used for each table is in the Title box at the top of each table.

g) Using the *slope* determined in (b), the *soil type* determined in (c), and the *permeable soil depth* determined in (d), find the values shown for "L" (trench length in metres) and "D" (minimum required total soil depth). For example, in **Table 4.6.A**, a slope of 5%, with 800 mm of silty sand gives a required “L” of 39 m and a required “D” of 1.3 m. If the available contour on the property equals or exceeds “L” and the total depth of soil equals or exceeds “D”, then a standard C2 of length “L” can be used. If the available contour on the property is less than “L” or the total depth of soil present is less than “D” then a standard C2 cannot be used. A raised C2 must be considered.

h) When a raised C2 is being considered, refer to the appropriate table for raised C2 selection based upon the daily flow determined in (a) and the type of imported sand fill being utilized in the buffer. Tables 4.7A & B and 4.8A are to be utilized when using the normal range imported sand fill ($3x10^{-5}$ to $5x10^{-4}$ m/s) for the buffer and tables 4.7C & D and 4.8B are to be utilized when using filter sand ($1x10^{-4}$ to $5x10^{-4}$ m/s) for the buffer.

A Raised C2 is selected as follows:

i) Using the slope determined in (b), the soil type determined in (c), and the permeable soil depth determined in (d), find the values shown for “L” (trench length in metres) and “D” (minimum required total soil depth). For example, in Table 4.7.A, a slope of 5%, with 800 mm of silty sand gives a required “L” of 26 m and a required “D” of 1.00 m. If the available contour on the property equals or exceeds “L” and the total depth of soil present equals or exceeds “D”, then a raised C2 of length “L” can be used. If the available contour on the property is less than “L” or the total depth of soil present is less than “D”, then a raised C2 utilizing normal imported sand fill cannot be used. A Raised C2 utilizing filter sand can be considered. The same process as above is utilized; but now employing Table 4.7C to select the required “L”, etc. If a raised C2 cannot be selected using filter sand in the buffer than a C3 or mound system must be considered. (Sections 4.7 & 4.8).

j) Once a minimum length “L” of C2 contour trench has been determined, consideration should be given to increasing the length as much as is practical up to a maximum of 60 m. For instance, if the available contour is 30 m, yet the length “L” determined by the table is 25 m, then 30 m should be chosen for the length.

k) Once it has been determined that a standard C2 or raised C2 of a particular length can be used, refer to **Table 4.12, Determination of Disposal Trench Width in Metres, Appendix K**, to find the appropriate width of trench.

l) The cross section dimensions of the disposal field will be as shown in Figure 4.C (standard C2) or Figure 4.D (raised C2) .

An example of the selection procedure for a C2 and a raised C2 is provided in **Appendix E**.

4.7 C3 CONTOUR Trench

4.7.1 Introduction

A C3 trench is shown in Figures 4.E and 4.F. This trench consists of a distribution pipe and rock filled trench constructed entirely in imported sand fill. If there is no trench constructed into the existing soil, then the system is always pressurized. The imported sand fill and trench follow the site contour.

A C3 trench may be appropriate where:

- additional depth of imported sand fill is required to protect ground water
- a raised C2 type contour cannot be installed on the site (Section 4.6.5)
- site conditions—uneven sites including boulder fields, or undulating wooded areas—require a modified C3 system (Figure 4.F)instead of a C2 trench
- the surface slope is at least 3%.

Effluent leaving the trench in a C3 is expected to move vertically through the imported sand fill until it reaches the natural soil under the fill. Effluent will then move vertically into the natural soil if the permeability allows, or downslope through the imported sand fill where the permeability of the natural material is inadequate to allow the effluent to enter the soil. Where effluent is expected to discharge from the down slope toe of the imported sand fill, it is important to ensure that there is a sod layer or tree root mat down slope of the toe to receive any discharge.

4.7.2 Layout of a C3 Trench

The required dimensions of the buffers for a C3 trench are shown on Figures 4.E and 4.F. Fill used for the buffer upslope of the trench may be imported sand fill or another material with lower permeability. Imported sand fill is required for downslope and end buffers. The downslope edge of the rock trench in the C3 is laid out to follow the contour of the site.

4.7.3 Interceptor

An interceptor trench or swale (Sections 3.6 and 6.12) must be installed upslope of a C3 system unless the system is at the crest of a hill or there is an existing ditch within 15 m upstream of the system.

4.7.4 Selection of a C3 Trench

Where ground water, rock or soil with unacceptably high permeability occur under the C3 trench, the depth of imported sand fill must be enough to provide a 1 m vertical separation between the bottom of the distribution trench and the ground water, rock or soil with unacceptably high permeability. Under these conditions, select a C3 as shown in Figure 4.E and 4.F with a depth of imported sand fill adequate to give the 1 m separation, but not less than 600 mm. Refer to Table 4.9 to determine the length of a C3 and the type of imported sand fill required based on the loading rate and slope. Please note that for slopes between 3% and 10 % inclusive, the imported sand fill required must be within the range of the filter sand specification shown on Appendix B (ie. 1×10^{-4} m/s to 5×10^{-4} m/s). Once the length of the C3 has been determined, refer to Table 4.12, Determination of Disposal Trench Width in Metres, Appendix K, to find the appropriate width of trench.

FIGURE 4.E

C3 contour disposal field

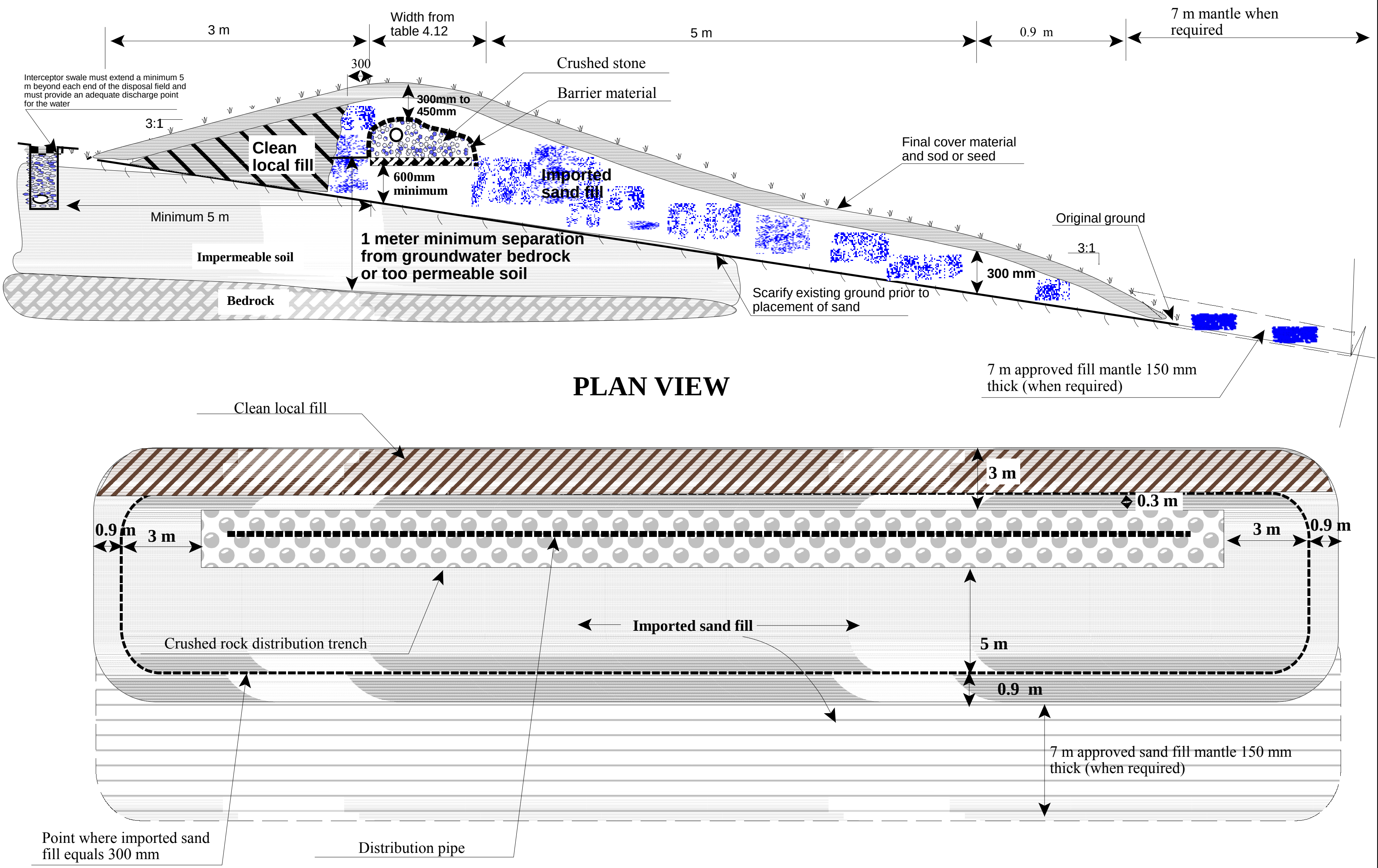
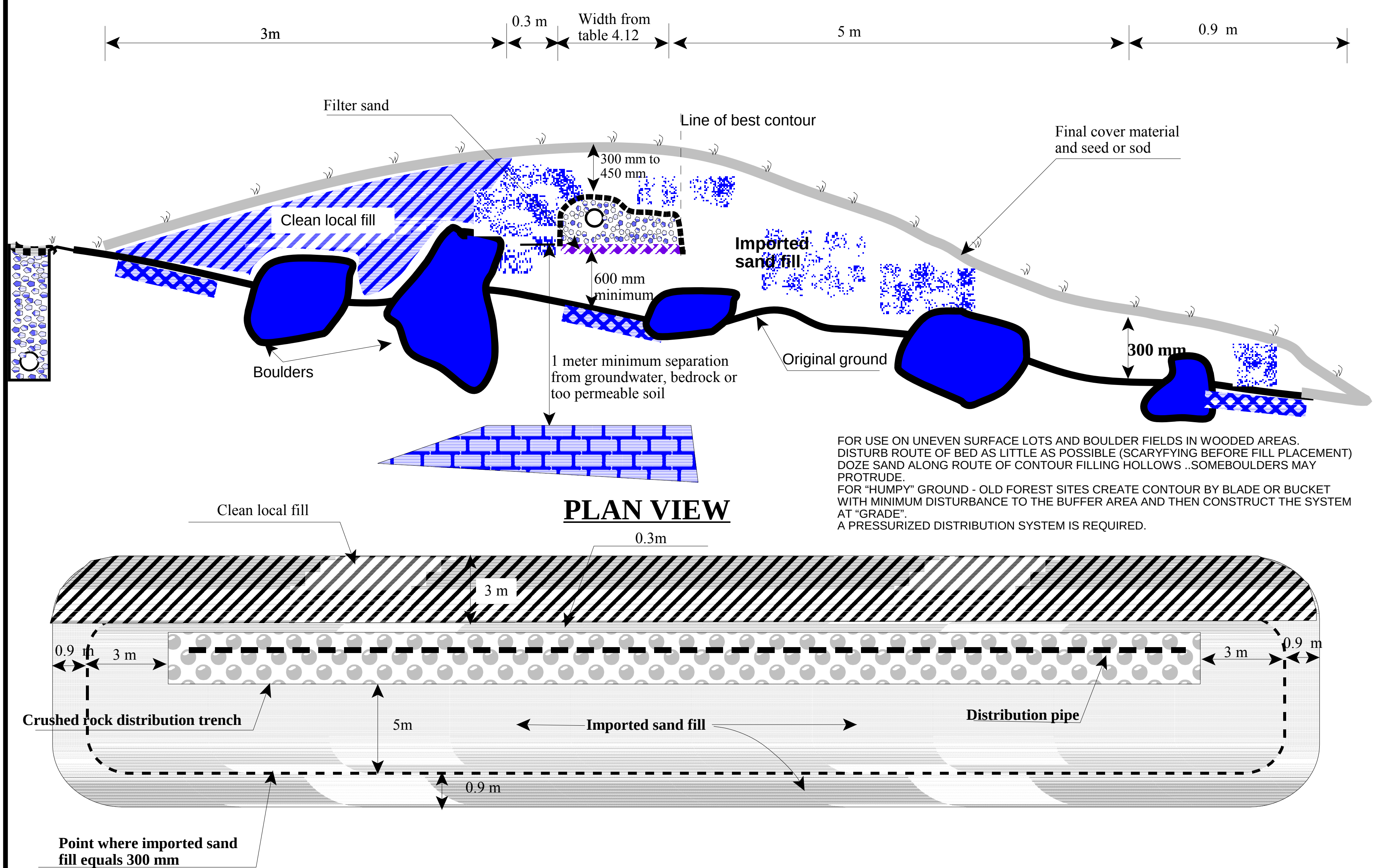


FIGURE 4.F

Modified C3 for uneven surface lot



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If the C3 is being selected for a site with soil with unacceptably low permeability, and ground water, rock or soil with unacceptably high permeability are not a concern, use a depth of 600 mm imported sand fill under the rock trench. Refer to table 4.9 to determine the length of a C3 and the type of imported sand fill required based on loading rate and slope. Please note that for slopes between 3% and 10 % inclusive, the imported sand fill required must be within the range of the filter sand specification shown on Appendix B (ie. 1 x 10^{-4} m/s to 5 x 10^{-4} m/s). Once the length of the C3 has been determined, refer to Table 4.12, Determination of Disposal Trench Width in Metres, Appendix K, to find the appropriate width of trench.

The depth of imported sand fill below the crushed rock in a C3 trench cannot be less than 600 mm, and must not exceed 1000 mm.

The dimensions of a C3 system can be selected as follows:

a. Determine the average daily flow in L/day (Section 2.6 and **Table 2.3**.)
b. Determine the ground surface slope at the location of the trench and confirm that is greater than 3 %.
c. Based on the flow determined (a) and the slope determined in (b), the length of the C3 and the type of imported sand fill required is selected from Table 4.9 , Appendix J. Once the length of the C3 has been determined, refer to Table 4.12, Determination of Disposal Trench Width in Metres, Appendix K, to find the appropriate width of trench.
d. If the distance from the bottom of the trench to ground water, bedrock, or soil with unacceptably high permeability is a factor, select the depth of imported sand fill required to give the minimum 1 m separation. Where separation to ground water, bedrock, or soil with unacceptably high permeability is not a concern select a depth of 600 mm imported sand fill under the trench.
e. Select other dimensions of the system from Figures 4.E and 4.F

All C3 type systems are pressurized. For information on pump or siphon requirements see Section 3.1.3, 3.4 and 3.5. For these systems select solid 75 or 100 mm pipe, seal all joints with solvent cement and drill 13 mm holes in the pipe invert spaced in accordance with Table 4.9

Cap the ends of the pipe and drill a 13 mm hole in the top of the pipe 150 mm from each end to allow air to escape when the pump or siphon discharges. In an attempt to maximize distribution, the perforated pipe should be centre fed. It is important that the tee connection and all the distribution pipe be perfectly level. Ensure any burrs are cleaned out of drilled holes.

Where a C3 type system is installed on a lot with very little permeable soil over solid bedrock or soil with unacceptably low permeability and effluent is expected to be obvious at the down slope toe of the sand buffer it is recommended that a 150 mm layer of sand plus final cover material and sod be extended beyond the buffer. The down slope width of this extra buffer is determined on a site by site basis but should extend at least 7 m or to the point where there is adequate permeable soil or root zone to absorb the effluent.(Figure 4E).

NOTE: The only difference in the selection of a C3 or a mound is that a mound is only suitable on slopes of less than 3% and a C3 is only suitable on slopes of 3% or greater. The only difference in the construction of a mound and a C3 is in the type of material that can be used in the up slope buffer.

An example of the selection procedure for a C3 is provided in (**Appendix E**).

4.8 MOUND SYSTEM SELECTION

4.8.1 Introduction

The dimensions of a mound system are shown in Figure 4.G. A mound system is constructed entirely above ground on flat surfaces (lots with less than 3 % slope). Effluent leaving the trench in the mound will move vertically through the imported sand fill. Effluent will then move vertically into the natural soil if the permeability allows, or laterally through the imported sand fill toward the toe of the imported sand fill where the permeability of the natural soil is inadequate to allow the effluent to enter the soil. In this case it is possible that effluent will exit the toe of imported sand fill on either side or end. Where effluent is expected to discharge from the toe, it is important to assure that there is a sod layer or tree root mat beyond the toe to receive any discharge. A mound system must be pressurized by a pump or siphon.

A mound system should be considered where:

- the slope is less than 3 % (**Table 4.3**)
- the depth of unsaturated permeable soil is less than the minimum required to install any of the other type of system (**Table 4.2**)
- additional depth of imported sand fill is required to provide the required vertical separation over ground water, rock, or soil with unacceptably high permeability.

Where ground water, rock, or soil with unacceptably high permeability occurs under a mound system, the depth of imported sand fill must be enough to provide a 1 m vertical separation between the bottom of the distribution trench and the ground water, rock or soil with unacceptably high permeability.

4.8.2 Layout of Mound Systems

Figure 4.G illustrates a mound system. Features of the system include:

- the mound should be laid along any contour that exists on the site, however minimal the slope may be.
- the trench width is determined from Table 4.12.
- the minimum length of the distribution pipe is determined from Table 4.9 based on loading rate.

4.8.3 Interceptors

An interceptor trench or swale (Sections 3.6 and 6.12) must be installed upslope of a mound unless the system is near the crest of a hill or there is an existing ditch within 15 m upslope of the system.

4.8.4 Selection of a Mound System

The depth of imported sand fill below the crushed rock in a mound system cannot be less than 600 mm, and must not exceed 1000 mm.

The dimensions of a mound system can be selected as follows.

a) Determine the average daily flow in L/day Section 2.6 and **Table 2.3**
b) Confirm that the ground surface slope at the location of the system is less than 3 %.
c) The length of the mound is selected from Table 4.9, Appendix J, based on the average daily flow rate. Once the length of the mound has been determined, refer to Table 4.12, Determination of Disposal Trench Width in Metres, Appendix K, to find the appropriate width of trench.
d) If the distance from the bottom of the trench to ground water, bedrock, or soil with unacceptably high permeability is a factor select the depth of imported sand fill required to give the minimum 1000 mm separation. Where separation to ground water, bedrock, or soil with unacceptably high permeability is not a concern, select a depth of 600 mm imported sand fill under the trench.
e) Select other dimensions of the system from Figure 4.G.

All mound type systems are pressurized. For information on pump or siphon requirements see section 3.1.3, 3.4 and 3.5. For these systems select solid 75 or 100 mm pipe, seal all joints and fix the end caps with solvent cement and drill 13 mm holes in the pipe invert spaced in accordance with Table 4.9.

Cap the ends of the pipe and drill a 13 mm hole in the top of the pipe 150 mm from each end to allow air to escape when the pump or siphon discharges. In an attempt to maximize distribution, the perforated pipe should be centre fed. It is important that the tee connection and the entire distribution pipe be perfectly level. Ensure any burrs are cleaned out of drilled holes.

Where a mound type system is installed on a lot with very little permeable soil over solid bedrock or soil with unacceptably low permeability and effluent is expected to be obvious at the toe of the sand buffer, it is recommended that a 150 mm layer of sand plus final cover material and sod be extended beyond the buffer. The width of this extra buffer is determined on a site by site basis but should extend at least 7 m, or to the point where there is adequate permeable soil or root zone to adsorb the effluent.

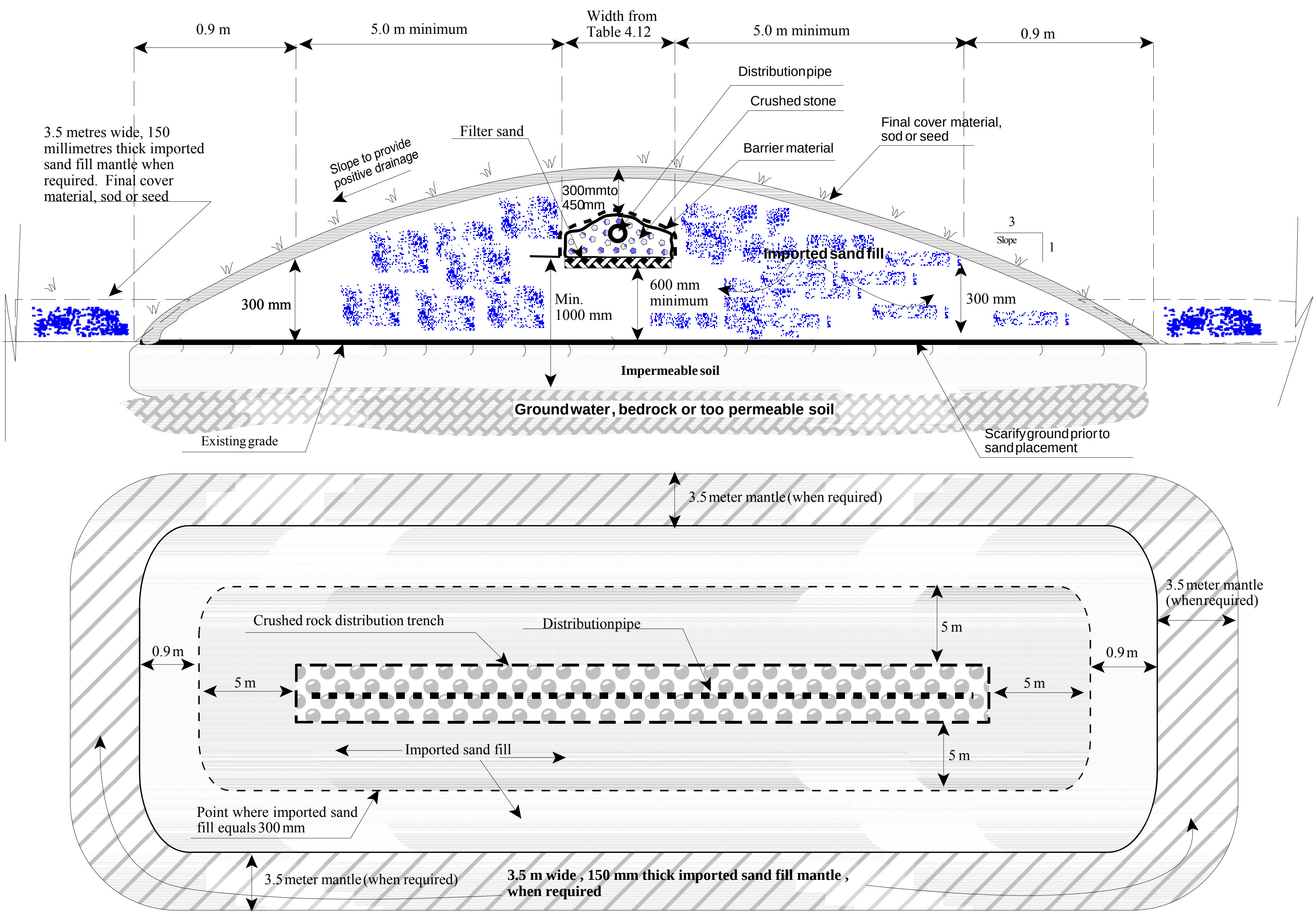
NOTE: The only difference in the selection of a C3 or a mound is that a mound is only suitable on slopes of less than 3 % and a C3 is only suitable on slopes of 3 % or greater. The only difference in the construction of a mound and a C3 is in the type of material that can be used in the downslope and up slope buffer.

An example of the selection procedure for a mound is provided in **Appendix E**.

If a mound system cannot be selected on the basis of this section, refer to Section 5 - Disposal Field Design. It should be noted that under some site conditions it may not be possible to develop a property utilizing an on-site sewage disposal system.

FIGURE 4.G

Mound disposal field



4.9 AREA BED AND MULTIPLE TRENCH SYSTEMS

4.9.1 Introduction

Area bed and multiple trench systems distribute effluent over a horizontal area from which it is expected to move vertically through subsurface soils. The sizing of these systems is based on traditional loading rates and experience. The system sizes cannot be verified based on soil hydraulics, unlike the sizing of the contour type systems. Their selection under conditions where contour systems are suitable is not encouraged. These systems may be selected when the site slope is less than 3%. The soil permeability must be chosen by using the lowest permeability of soil types.

An interceptor trench or swale may be necessary where an area bed or multiple trench system is located at the lower end of a long slope.

4.9.2 Selection and Layout of an Area Bed

An area bed, shown in **Figure 4.H** is a rectangular excavation that contains perforated pipe underlain and surrounded by crushed rock. The crushed rock is separated from the soil cover by a geotextile barrier. A 75 mm layer of filter sand must be placed beneath the crushed rock.

As indicated in **Figure 4.H**, all piping is to be perforated in the distributed bed, except the header is to be solid. The excavation should be oriented with the greatest dimension across the slope of the lot. The bottom of the excavation should be truly level. The header is sloped away from the tee and the footer pipe is laid level in an effort to ensure equal distribution. The slope on the header must meet the specified drop of between 50 and 100 mm per 30 metres.

To use an area bed type field the following conditions must be met:

1) The slope on the lot is less than 3%
2) There is at least 780 mm of permeable soil on the lot.
3) There is at least 600 mm of permeable soil under the bed (bottom of excavation) over impermeable soil.
4) There is at least 1 m separation between the bottom of the area bed and the maximum water table elevation, bedrock or soil with unacceptably high permeability.
5) The bed (bottom of excavation) is not more than 675 mm deep.
6) Where the bottom of the excavation must be raised to maintain the separation distances outlined in 3) or 4), the bottom of the excavation should not be raised above the bottom of the organic layer, ie. the bed is notched into the organic layer.

Where these conditions cannot be met another type of system such as a mound can be considered.

Table 4.11 (A), found in **Appendix J**, provides the allowable type of system and depth of cut at the downslope side of the bed for different depths of permeable soil and total soil depth. These values are calculated for systems with a bed width of 6 m assuming the slope on the lot is 3%. The values in the table will ensure that there is a minimum of 1 m separation to bedrock or water table and a minimum of 600 mm of permeable soil under the bed on the upslope side.

Once it has been determined that conditions allow the installation of an area bed system, the minimum area and minimum cross slope dimension can be selected from **Table 4.11 (B),** found in **Appendix J,** for either 1000 L/day or 1500 L/day based on the soil type determined from the test pit evaluation.

The system type and dimensions of an area bed as provided in **Tables 4.11 (A) & (B)** found in **Appendix J**, may be selected as follows:

a) Determine the average daily flow in L/day from Section 2.6 and **Table 2.3**.

b) Confirm that the ground surface slope at the location of the field is less than 3%.

c) From the test pit information determine soil type, depth of permeable soil and total depth of soil to any restrictive layer. Where there is multiple soil types, select the soil with the lowest permeability.

d) From **Table 4.11 (A)** determine if soil depths allow the selection of an area bed type field and if so determine the depth of trench allowed.

e) If conditions allow the selection of an area bed, select the length and width of the bed from **Table 4.11 (B)** for the soil type.

f) Refer to Section 6 for system construction details. Refer to Figure 4.H for typical layout of an area bed system.

4.9.3 Selection and Layout of a Multiple Trench

A multiple trench system, shown in **Figure 4.I**, is a network of shallow trenches containing perforated pipes surrounded by crushed rock. The crushed rock is separated from the soil cover by a geotextile barrier. A 75 mm layer of filter sand must be placed under the crushed rock.

As indicated in **Figure 4.I**, a solid header and a perforated footer pipe (optional) are joined by a number of perforated laterals. The trenches should be oriented with the greatest dimension across the slope of the lot. The header pipe must be sloped away from the tee and footer pipes are laid level in an attempt to ensure equal flow distribution to the laterals. The bottom of the lateral trenches should be truly level. The slope on the header pipes must meet the specified drop of between 50 and 100 mm per 30 metres.

The widths of trenches are a minimum of 600 mm for selection purposes. Wider trenches can be used if desired. Lateral trenches should be installed 3 metres apart where site conditions allow. Trenches can be closer together if special care is taken to ensure excavated material from one trench does not fall into the next trench.

To use a multiple trench type disposal field the following conditions must be met:

1) The slope on the lot does not exceed 3%

2) There is at least 875 mm permeable soil on the lot if a two trench system is used and a minimum of 1090 mm of permeable soil if a four trench system is used.

3) There is at least 600 mm permeable soil under the trench over impermeable soil.

4) There is at least 1 m separation between the bottom of the trench and the maximum water table elevation, bedrock or soil with unacceptably high permeability

5) The trench depth is no more than 675 mm and no less than 150 mm.

Where these conditions cannot be met the selection of another type of disposal field such as a mound may be considered.

Table 4.10 (A) provides the depth of trench allowed for different depths of permeable soil and total soil depth. These values are calculated for systems with two and four trenches assuming the lot has a 3% slope and trench spacing is 3 m. The values in the table will ensure that there is a min of 1 m separation to bedrock or water table and a min of 600 mm permeable soil under the upslope trench.

Once it has been determined that conditions allow the installation of a multiple trench type system, the minimum total length of trench can be selected from **Table 4.10 (B)** for either 1000 L/day or 1500 L/day based on the soil type determined from the test pit examination.

The dimensions of a multiple trench system may be selected as follows:

a) Determine the average daily flow in L/day from Section 2.6 and Table 2.3.

b) Confirm that the ground surface slope at the location of the bed is less than or equal to 3%.

c) From the test pit information determine soil type, depth of permeable soil and total soil depth to bedrock or water table.

d) From **Table 4.10 (A)** found in **Appendix J**, determine if soil depths allow the selection of a trench type field and if so determine the depth of trench allowed.

e) If conditions allow the selection of a trench type system, select the length of trenches for the soil type from **Table 4.10 (B).**

f) Refer to Section 6 for system construction details. Refer to Figure 4.I for typical layout of a multiple trench system.

FIGURE 4.H

Fully Trenched Area Bed

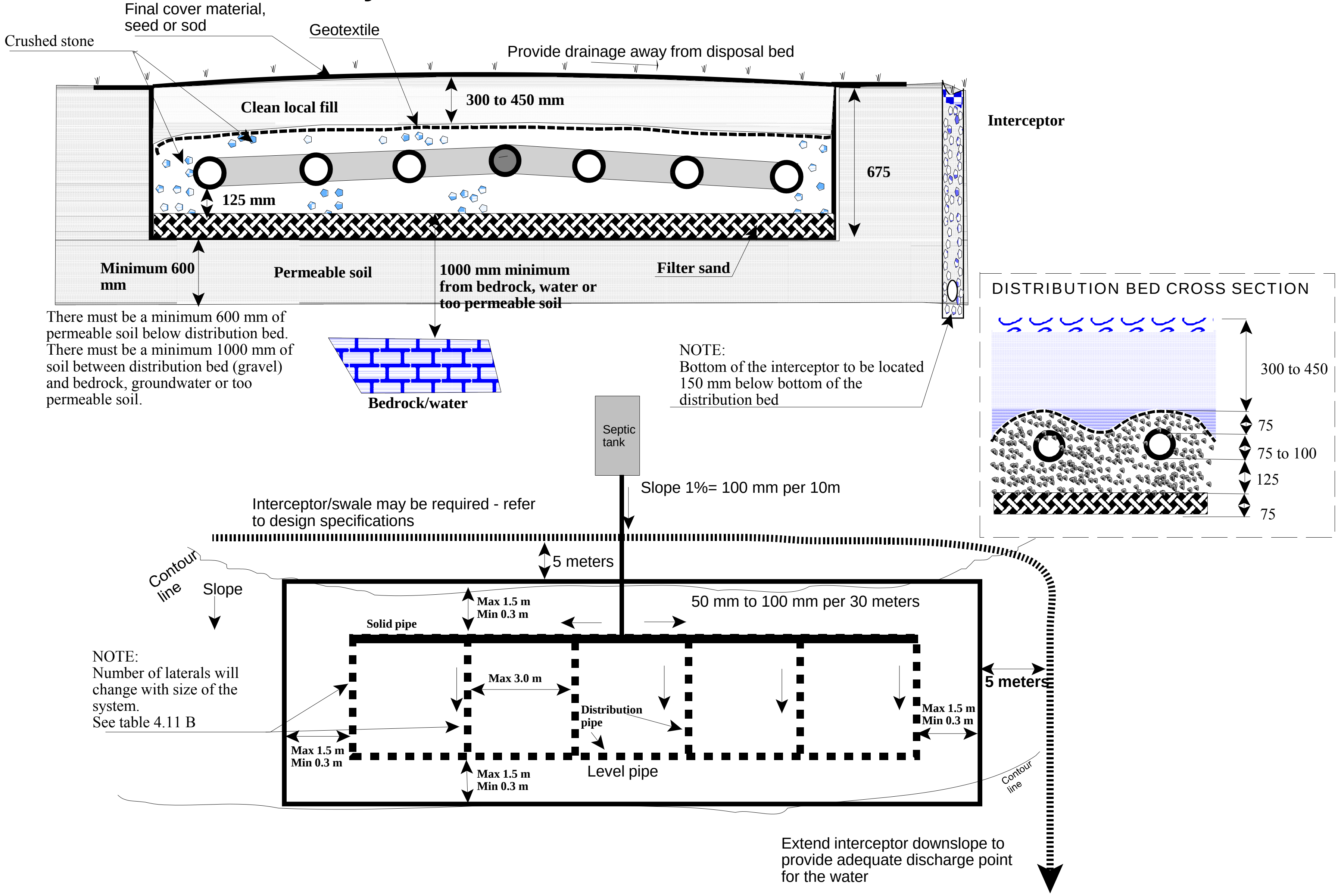


FIGURE 4.H.2

Partially Trenched Area Bed

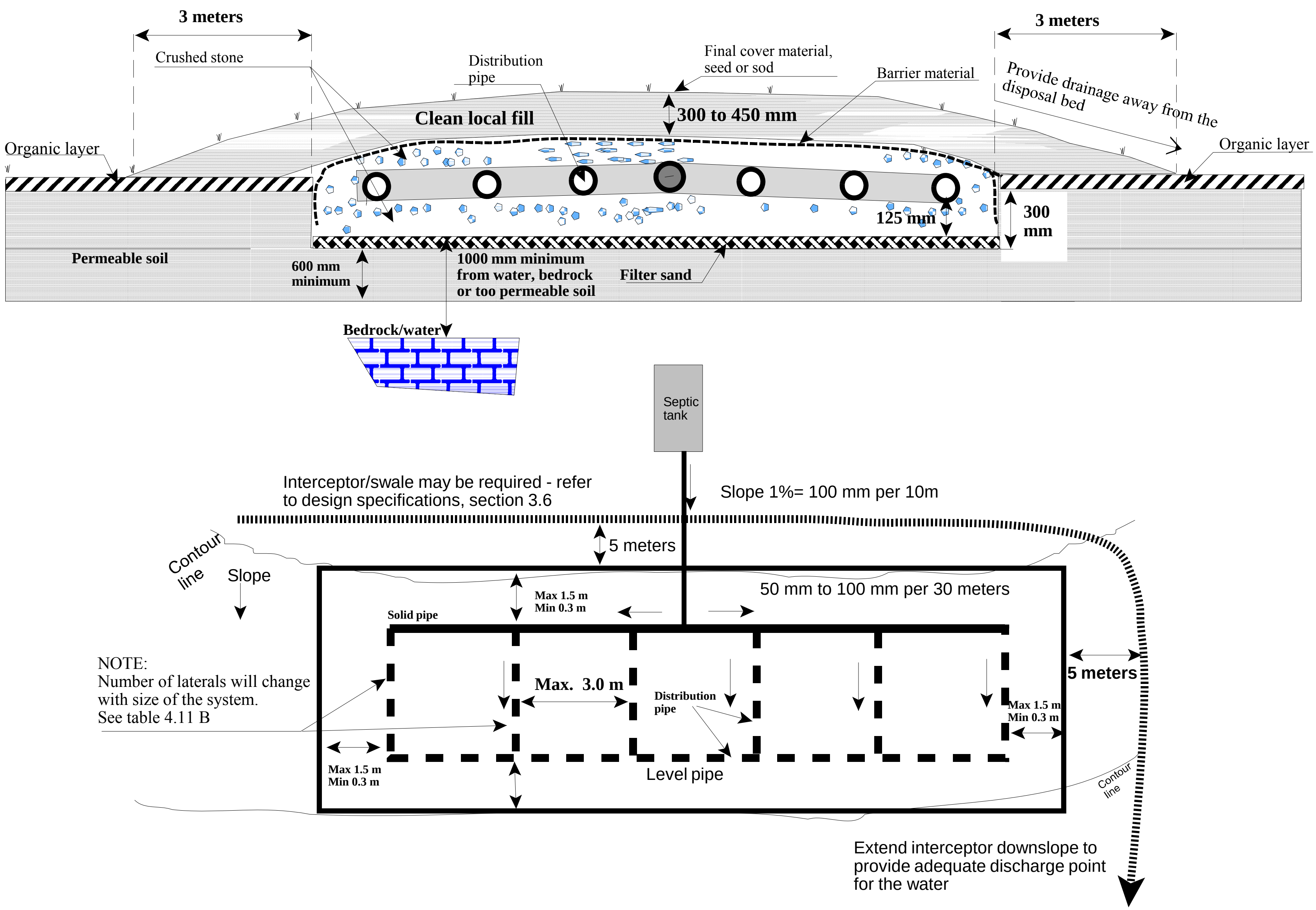


FIGURE 4.H.3

At Grade Area Bed

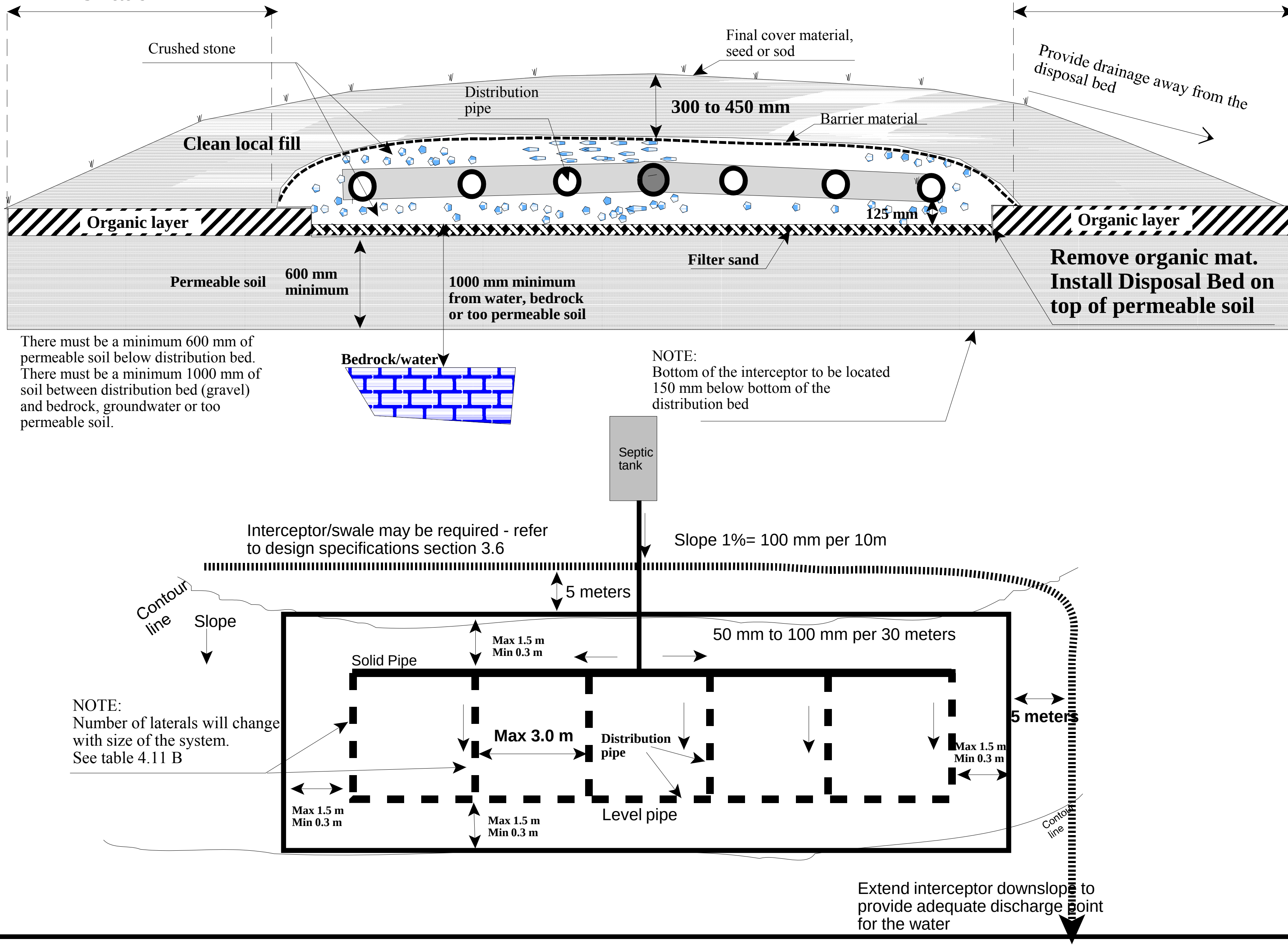
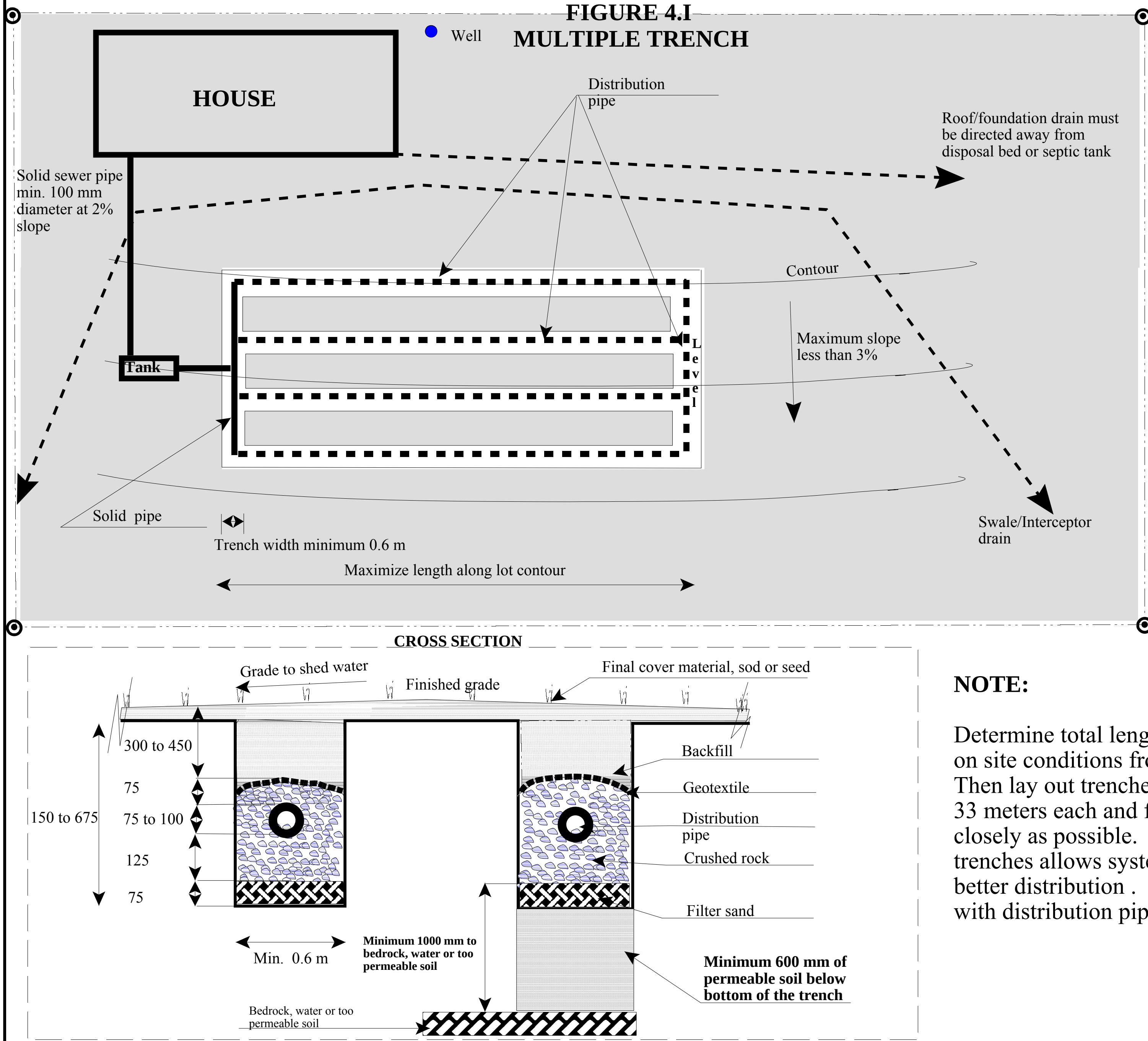


FIGURE 4.I
MULTIPLE TRENCH



NOTE:

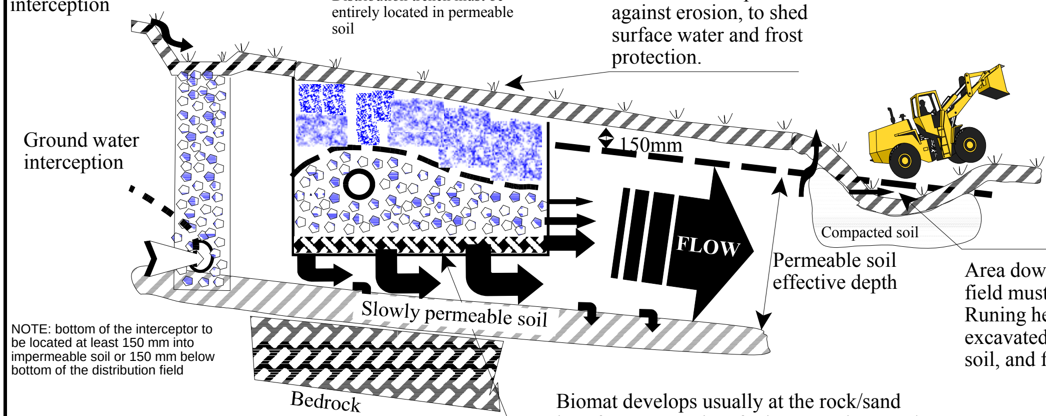
Determine total length of trench required based on site conditions from Table 4.10 A and B. Then lay out trenches as long as possible , up to 33 meters each and follow contour of the lot as closely as possible. An even number of trenches allows system to be center fed for better distribution . Join lower ends of pipe with distribution pipe.

FIGURE 4.J

DISPOSAL SYSTEMS PRINCIPLE OF OPERATION

C1

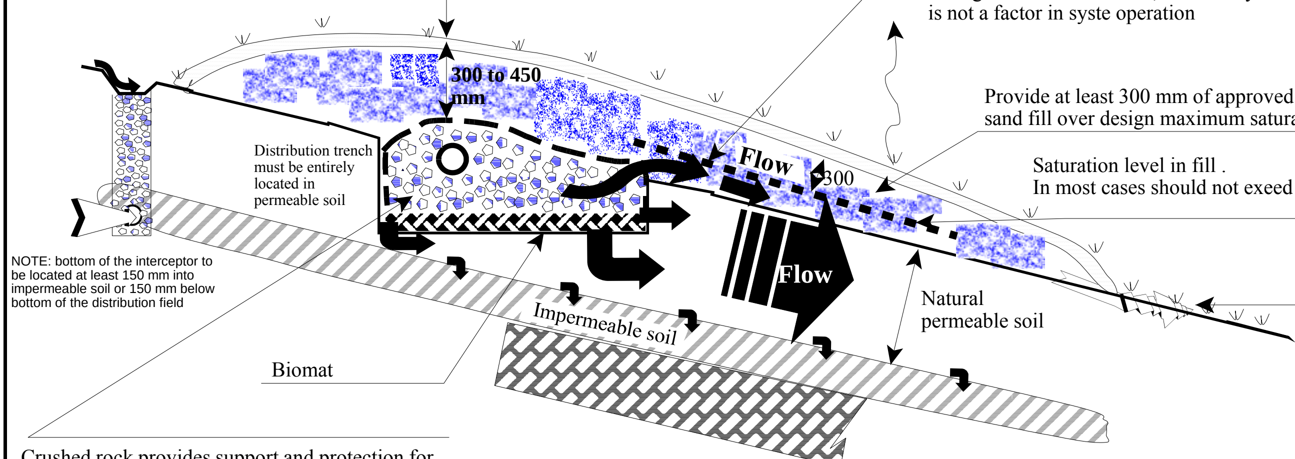
C1 systems are design to contain flow entirely within effective soil depth and transport it lateraly downslope.



C2

300 mm to 450 mm of soil cover above the distribution trench is required for frost protection. Excessive soil cover (+450mm) may deplete air supply to distribution trench.

In C2 type disposal systems excess flow overflows into buffer after saturating natural permeable soil.



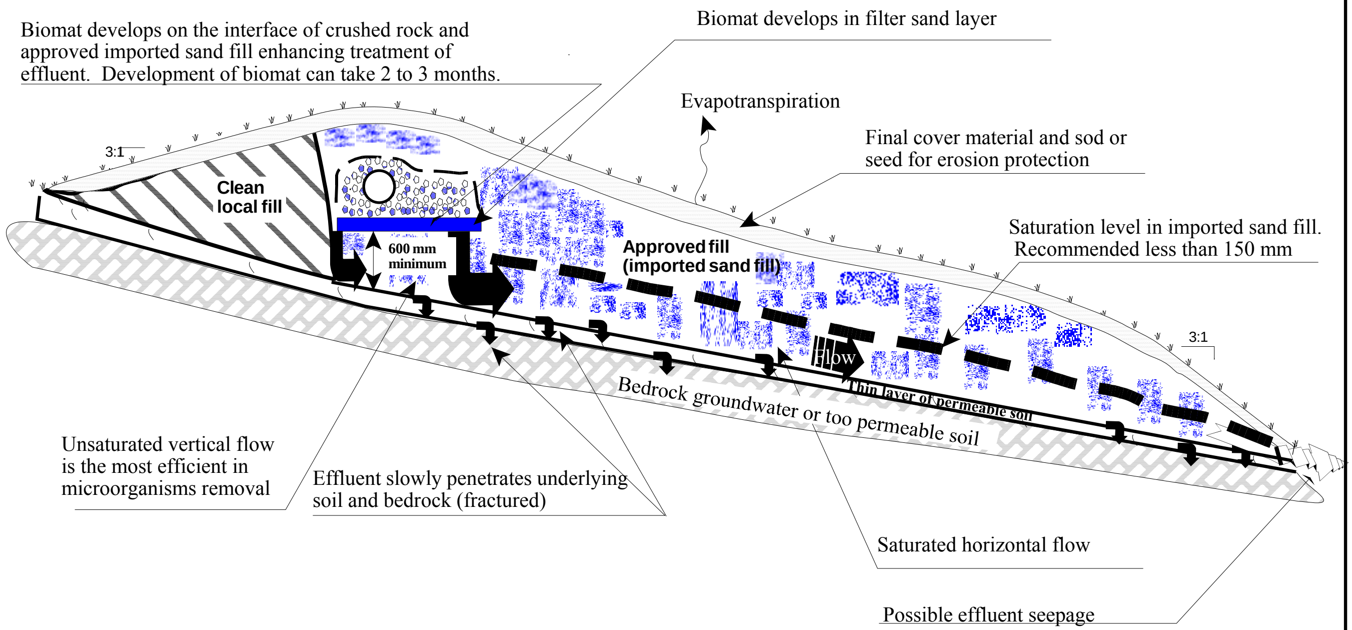
Crushed rock provides support and protection for distribution pipe and assists in the distribution of the effluent over the disposal area. In pressurized systems it also dissipates flows to prevent erosion of the distribution trench.

During high loading or precipitation periods partially treated effluent may emerge at the toe of the buffer as thin film flow in the root zone.

FIGURE 4.K

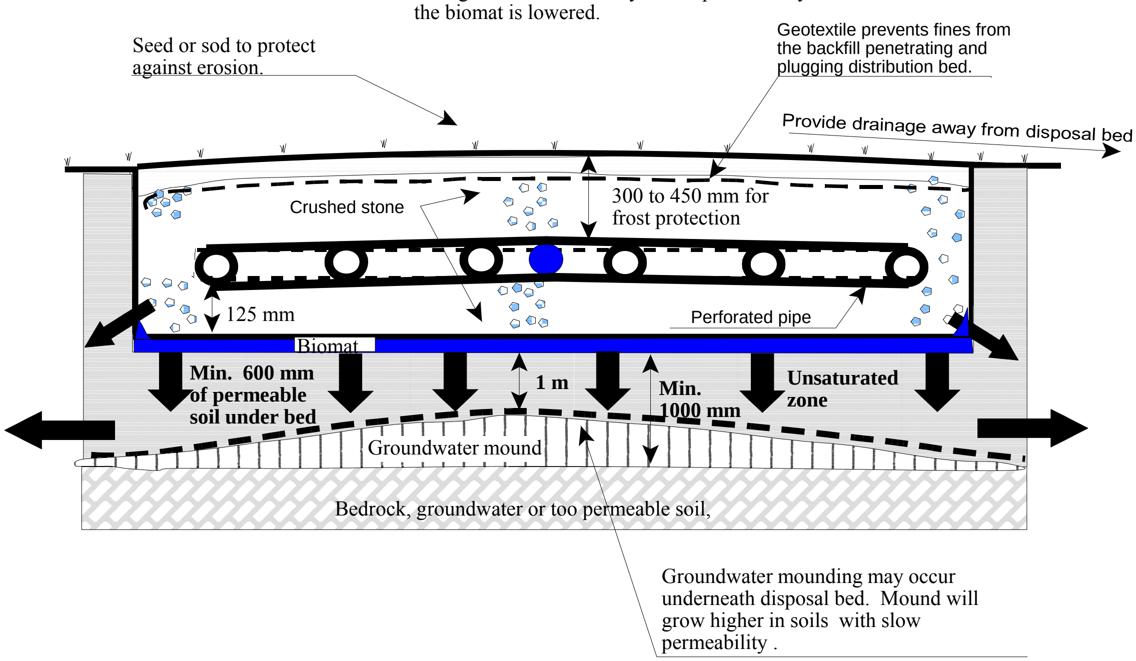
DISPOSAL SYSTEMS PRINCIPLE OF OPERATION C3

In C3 type systems, the majority of the flow goes through approved imported sand fill placed on site.



AB or MT

In area bed (AB) or multiple trench systems (MT) flow percolates vertically downwards to groundwater table. Some flow may also occur through sidewalls of the system if permeability of the biomat is lowered.



4.10 HOLDING TANKS

An applicant will require the services of a Level 1 or Level 2 qualified person to design or select and supervise the installation of a holding tank. The On-Site Sewage Disposal Regulations outlines the circumstances under which an approval of a holding tank will be considered and the requirements are as follows:

1. There is an existing malfunction system that cannot be corrected by installing another system, other than a pit or vault privy, or by upgrading the existing system.

2. The lot does not have a system and all of the following criteria are met:

   a) the lot was created prior to August 6, 1984,
   b) the lot is unsuitable for installing another system, other than a pit or vault privy,
   c) the owner has prepared a sewage management program

3. The holding tank is for commercial, industrial or institutional use and meets one of the following conditions

   a) it will be used for no longer than 1 year;
   b) it will be used for no more than 3 consecutive months of a year;
   c) it will be receiving sewage at a volume of less than 500 L per week.

In the case where the holding tank is being proposed for an existing undeveloped lot (item 2 above);

1. Proof of that the lot was created prior to August 6, 1984 must be provided.

2. The department may consider an assessment conducted by a Level 1 or Level 2 qualified person where it is readily apparent that a lot is unsuitable for a septic tank and disposal field. When a Level 2 qualified person is conducting the assessment, a level 1 qualified person or an inspector must confirm that a septic tank and disposal field cannot be designed for the lot.

3. An acceptable waste management program will be required. This can be either a municipally wastewater management district or a privately operated program submitted by the proponent. This is considered to be a signed agreement between the septic tank cleaner and the owner. (Note: Disposal should be at an appropriate approved facility.)

4. A holding tank can only be selected by a Level 2 qualified person providing the manufacturer of that tank has met the design and installation specifications established by the department and the manufacturer has obtained prior confirmation of this compliance from the department. The Level 2 Qualified Person shall include all relevant manufactures information and instructions for installation for the site conditions with any application for approval to install a holding tank.

In the case where the holding tank is being proposed for commercial, industrial or institutional use as mentioned in item 3 above;

1. The assessment of the lot and proposed usage for the holding tank as well as the design for the holding tank itself must be conducted by a Level 1 qualified person.

For each tank size, design specifications should include, but are not limited to the following:

1) The tank must conform to the latest edition of Standard CAN/CSA-B66-00 or latest revision, published by the Canadian Standards Association and be non-metallic if located below ground (see Section 3.1.2 for more information regarding holding tanks).

2) The manufacturer shall supply details on required tank anchorage and tie downs for different depths of final tank soil cover. This is assuming the tank is empty and varying water conditions, up to total submergence, have been determined by the qualified person.

3) The manufacturer shall supply details on the tank clean out. It shall extend above finished grade, have a lockable water tight closure, and be protected from damage due to potential differential movement of soils due to frost action. This clean out shall be free of joints or any joints shall be made water tight with gaskets and/or mechanical fasteners.

4) The manufacturer shall specify maximum and minimum depth of cover and any related restrictions on traffic load.

5) The manufacturer shall supply detailed excavation, bedding installation and backfilling requirements.

6) The holding tank must be constructed such that the highest water level in the tank does not exceed any horizontal joint unless such a joint is made water tight with gaskets and mechanical fasteners. It is recommended that the holding tank be tested on site after assembly for water tightness (see testing procedure in **Section 6.4** of this guideline for a recommended testing procedure).

7) No overflow is to be installed and any access ports can be made water tight with gaskets and/or mechanical fasteners.

When selecting a holding tank size an estimate of the daily water usage must be obtained. **Table 4.13** found in Appendix J lists some recommended holding tank storage times based on flow rates for various activities. Please note **Table 4.13** contains estimates only. Actual measured flows would provide a more accurate estimate of water usage and holding tank storage times.

4.10.1 Typical Requirements of a Holding Tank System

- an audible and visible alarm shall be installed in the building and shall sound/light when approximately 25% of the available storage remains. The high level could be set to shut off the water supply.

- copy of the pumping contract from a licensed septic tank cleaner shall be provided with the supporting information.

- the separation distances outlined in the Regulations shall apply.

- other site specific conditions that may apply.

4.11 PIT AND VAULT PRIVY SELECTION

4.11.1 Introduction

The use of privies and non-water carrying systems are usually for seasonal dwellings with minimal usage.

Privies and non-water carrying systems do not dispose of the greywater or household wastes other than toilet wastes and are not a complete disposal means even for the toilet wastes. Included in non-water carrying systems are the privy, electric or gas incinerating toilets, humus or composting toilets and chemical toilets. Problems such as odours, maintenance and flies have been reported with privies and non-water carrying disposal systems .

Considering the need to dispose of greywater and to allow future conversion to a water carried system, the department does not approve a lot for new construction unless it is suitable for a septic tank disposal system, even when a privy or a non water-carried system is proposed. If the lot is recommended and an approval issued, the homeowner can install a privy or a non-water carried system if he/she wishes.

Typical arrangements of privies are shown in **Figures 4.L and 4.M.**

- These systems are defined in the "*On-site Sewage Disposal System Regulations*" as pit privy or vault privy.

- The separation distances to a system as outlined in the Regulations shall apply.

- A pit privy shall consist of an enclosed structure that shall be constructed of strong durable weatherproof materials and a pit over which the structure sits **(see Figure 4.M)**.

- A vault privy shall consist of an enclosed structure that shall be constructed of strong durable weatherproof materials and a closed watertight receptacle over which the structure sits **(see Figure 4.L)**.

4.11.2 Vault Privy

A vault privy shall be constructed as follows **(Figure 4.L)**;

- the vault, tank or structure which is to be used for the holding or storage of sewage shall be watertight;
- the vault shall have a locking cover that is easily accessible for the pumping of the sewage;
- the surface of the ground in the area surrounding the vault shall be graded such that surface drainage is diverted away from the vault; and
- when a high water table may be above the bottom of the selected vault, it shall be constructed to withstand high water table conditions (refer to Section 3.1 for additional requirements).

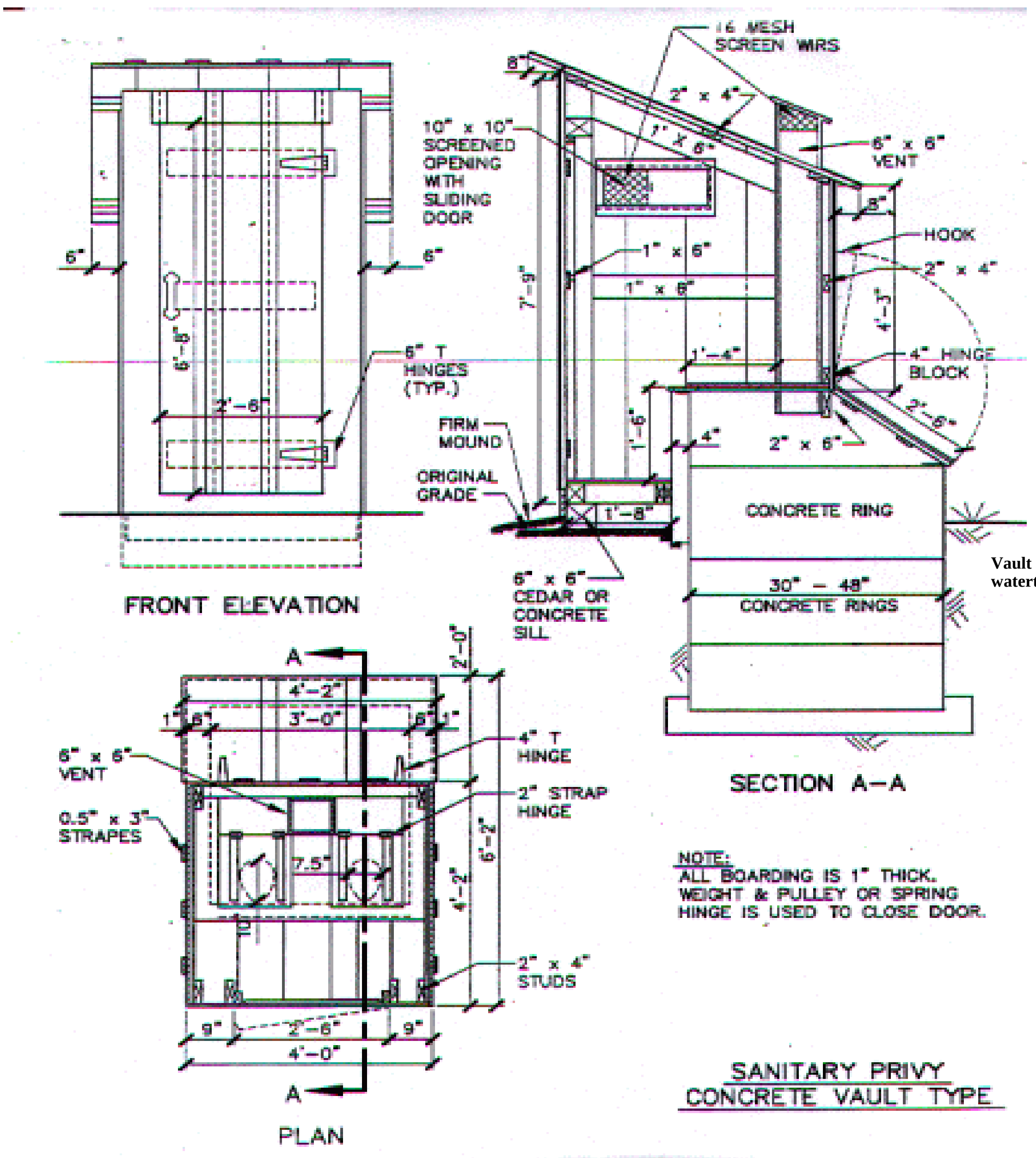
4.11.3 Pit Privy

A pit privy shall be constructed as follows **(Figure 4.M)**:

- the bottom of the pit shall be a minimum of 1.0 metres above the high ground water table;
- the sides of the pit shall be reinforced so as to prevent the collapse of the walls; and
- the surface of the ground in the area surrounding the pit shall be graded such that surface drainage is diverted away from the pit.

FIGURE 4 L

Vault Privy



Vault should be watertight and tested

FIGURE 4 M
Pit Privy