**US Army Corps
of Engineers**
Afghanistan Engineer District

AED Design Requirements:
Sanitary Sewer & Septic System

Various Locations,
Afghanistan

FEBRUARY 2008

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AED DESIGN REQUIREMENTS
FOR
Sanitary Sewer & Septic Systems
Various Locations, Afghanistan

AED Design Requirements
Sanitary Sewer & Septic Systems

1. General

The purpose of this document is to provide requirements to Contractors for any project requiring sanitary sewer and septic system design and construction.

2. Field Investigations

a) Site Survey. The first step, when designing the sewer system, is determining existing site conditions. The existing site conditions shall be determined by conducting field investigations at the proposed site. As part of the field investigations, the Contractor shall conduct a topographic survey to determine existing site characteristics. Knowing this information will help determine whether a gravity system or a pressure system will be used and where to locate the septic system. In addition, the Contractor shall conduct a utility survey to determine the locations of any nearby water lines, wells, sanitary sewers, storm sewers and electrical lines. By knowing the location of the existing utilities, the Contractor can properly lay out the system.

b) Percolation Testing. The second step, once the site has been surveyed, is to perform percolation tests. While performing the tests, observe the soil characteristics and watch for groundwater within the test area. The site may be considered unsuitable if the following occurs: the soil appears to have too much sand or clay; groundwater is encountered; and/or the percolation rates are too slow. If the site is determined to be unsuitable, the septic system will need to be relocated. If another location cannot be found, then an alternative treatment system will need to be designed. If this happens, contact the COR.

Percolation testing may be carried out with a shovel, posthole digger, solid auger or other appropriate digging instruments. Percolation tests shall be accomplished uniformly throughout the area where the absorption field is to be located. Percolation tests determine the acceptability of the site and serve as the basis of design for the liquid absorption. Percolation tests will be made as follows (see Figure 1).

(1) Six or more tests will be made in separate test holes uniformly spaced over the proposed absorption field site. The average of the six tests shall be determined and will be used as the final result. ***The location of each test shall be clearly and accurately shown on the site plan submitted to AED***.

(2) Dig or bore a hole to the required depth of the proposed trenches or bed, with dimensions necessary to enable visual inspection during percolation testing.

(3) Carefully scratch the bottom and sides of the excavation with a knife blade or sharp-pointed instrument to remove any smeared soil surfaces and to provide a natural soil interface into which water may percolate. Add 50 mm of gravel (of the same size that is to be used in the absorption field) to the bottom of the hole. In some types of soils the sidewalls of the test holes tend to cave in or slough off and settle to the bottom of the hole. It is most likely to occur when the soil is dry or when overnight soaking is required. The caving can be prevented and more accurate results obtained by placing in the test hole a wire cylinder surrounded by a minimum 25 mm layer of gravel (of the same size that is to be used in the absorption field.)

(4) Carefully fill the hole with clear water to a minimum depth of 300 mm above the gravel or sand. Keep water in the hole at least 4 hours and preferably overnight. In most soils it will be necessary to augment the water as time progresses. Determine the percolation rate 24 hours after water was first added to the hole. In sandy soils containing little clay, this prefilling procedure is not essential and the test may be made after water from one filling of the hole has completely seeped away.

(5) The percolation-rate measurement is determined by one of the following methods:

(a) If water remains in the test hole overnight, adjust the water depth to approximately 150 mm above the gravel. From a reference batter board, as shown in Figure 1, measure the drop in water level over a 30-minute period. This drop is used to calculate the percolation rate.

(b) If no water remains in the hole the next day, add clean water to bring the depth to approximately 150 mm over the gravel. From the batter board, measure the drop in water level at 30-minute intervals for 4 hours, refilling to 150 mm over the gravel as necessary. The drop in water level that occurs during the final 30-minute period is used to calculate the percolation rate.

(c) In sandy soils (or other soils in which the first 150 mm of water seeps away in less than 30 minutes after the overnight period), the time interval between measurements will be taken as 10 minutes and the test run for 1 hour. The drop in water level that occurs during the final 10 minutes is used to calculate the percolation rate.

The percolation rate is the number of minutes it takes to drop 25 mm. On page 10, Table 2 lists percolation rates and the corresponding absorption field sizing factor (liters/m^2/day). The sizing factors are used, in conjunction with average daily demand (ADD), to determine the size of the absorption field. The following is an example of how to calculate the percolation rate:

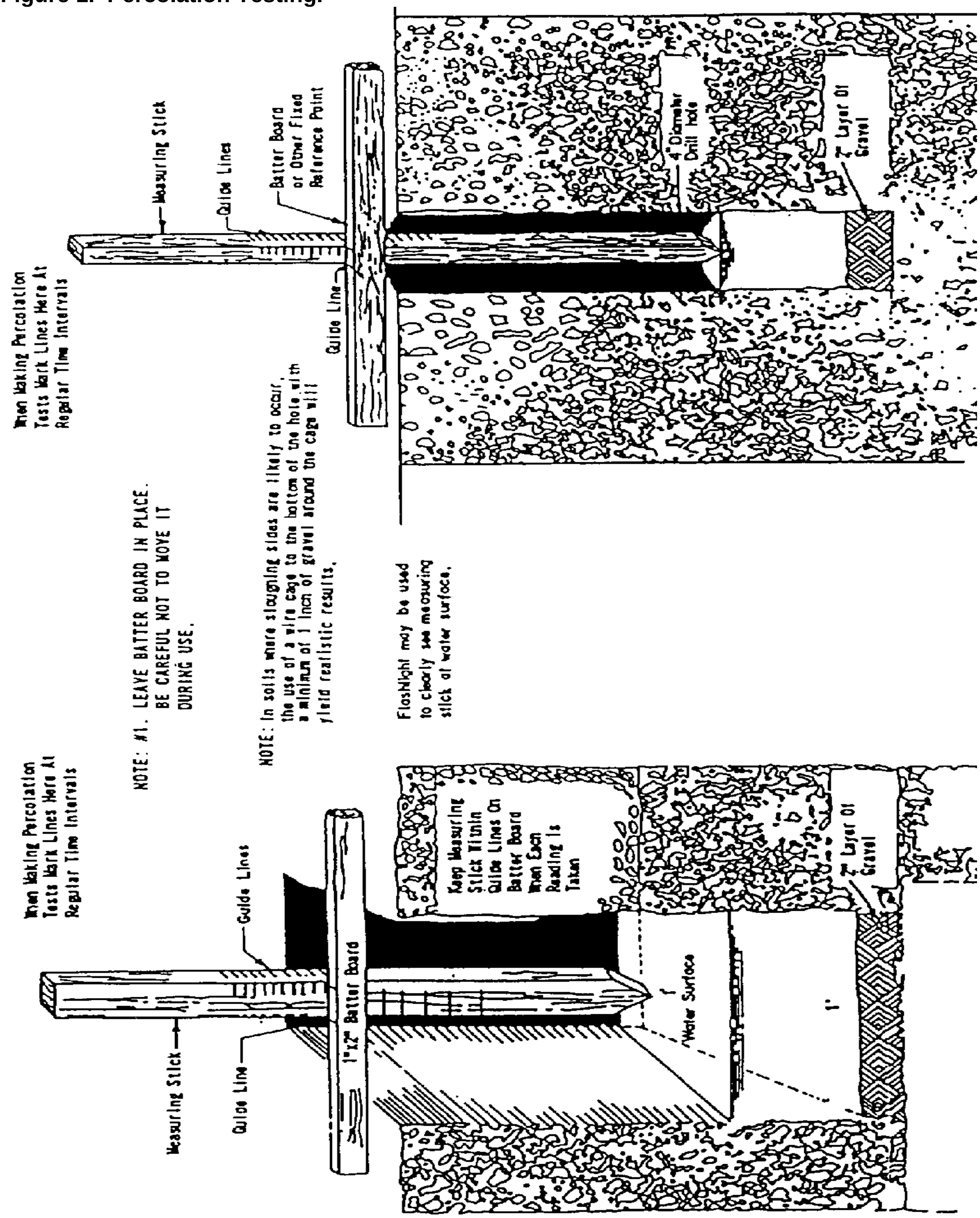
Example 1: Calculating Percolation Rates - In 30 minutes, the measured drop in the water level is 15 mm.

Minutes/25 mm = Time/(drop/25 mm) = 30 minutes/(15 mm/25 mm) = ***50 Minutes/25 mm***

where,

Minutes/25 mm = Minutes for water to drop 25 mm.

Figure 1. Percolation Testing.



3. Sanitary Sewer System

a) Sanitary Sewer System Layout. The development of the sewer system (a.k.a. - sanitary pipe collection network) must await the determination of the proposed compound layout, including determining locations for: buildings (including final first floor elevations and utility connections), perimeter wall, roads, water well, septic system, power supply system, storm drainage and other features. Once the locations for these structures are determined, the Contractor can begin designing the layout of the sanitary sewers in conjunction with the water supply system. The following general criteria will be used where possible to provide a layout which is practical and economical and meets hydraulic requirements:

(1) Follow slopes of natural topography for gravity sewers.

(2) Check subsurface investigations for groundwater levels and types of subsoil encountered. If possible, avoid areas of high groundwater and the placement of sewers below the groundwater table.

(3) Avoid routing sewers through areas which require extensive restoration or underground demolition.

(4) Depending upon the topography and building location, the most practical location of sanitary sewer lines is along one side of the street. In other cases they may be located behind buildings midway between streets. The intent is to provide future access to the lines for maintenance without impacting vehicular traffic.

(5) Avoid placing manholes in low-lying areas where they could be submerged by surface water or subject to surface water inflow. In addition, all manholes shall be constructed 50 mm higher than the finished grade, with the ground sloped away from each manhole for drainage.

(6) Sewer lines shall have a minimum of 800 mm of cover for frost protection.

(7) Locate manholes at change in direction, pipe size or slope of gravity sewers.

(8) Sewer sections between manholes shall be straight. The use of a curved alignment shall not be permitted.

(9) If required by the design, locate manholes at intersections of streets where possible. This will minimize vehicular traffic disruptions if maintenance is required.

(10)Sewer lines less than 1.25 meters deep under road crossings shall have a reinforced concrete cover of at least 150 mm thickness around the pipe or shall utilize a steel or ductile iron carrier pipe. It is recommended to continue the reinforced concrete cover or carrier pipe a minimum of one (1) meter beyond the designated roadway.

(11)Verify that final routing selected is the most cost effective alternative that meets service requirements.

b) Protection of water supplies. Sanitary sewer design shall meet the following criteria:

(1) Sewers shall be located no closer than 15 meters measured horizontally to water wells or earthen reservoirs that are used for potable water supplies.

(2) Sewers shall be located no closer than 3 meters measured horizontally to potable water lines; where the bottom of the water line will be at least 300 mm above the top of the sewer line, the horizontal space shall be at a minimum of 1.83 meters.

(3) Sewer lines crossing above potable water lines shall be constructed of suitable pressure pipe or fully encased in concrete for a distance of 3 meters measured horizontally on each side of the crossing. If concrete encasement is used, the sewer line shall be encased with a minimum of 150 mm of cover all the way around the pipe. Pressure pipe will be as required for force mains in TM 5-814-2/AFM 88-11, Chapter 2, and shall have no joint closer than 1 meter horizontally to the crossing, unless it is fully encased in concrete.

c) Quantity of Wastewater. If not specified in the contract, the Contractor shall verify the average daily flow considering both resident (full occupancy) and non-resident (8hr per day) population. The average daily flow will represent the total waste volume generated over a 24-hour period, and shall be based on the total population of the facility and usage rate of 190 liters per capita day (water usage). The wastewater flow rate shall be calculated as approximately 80% of water usage rate.

d) Gravity Sewers. Gravity sewers shall be designed to flow at a maximum in the following way: laterals and mains – 80 percent full, building connections – 70 percent full. Sanitary sewer velocities shall be designed to provide a minimum velocity of 0.6 meters per second (mps) or at the ADD flow rate and a minimum velocity of 0.8 to 1.05 mps at the peak diurnal flow rate. In no case shall the velocity drop below 0.3 mps, to prevent settlement of organic solids suspended in the wastewater. However, regardless of flow and depth the minimum pipe sizes to be used are 150 mm for building connections and 200 mm for all other sewers. Unless otherwise indicated (see Paragraph 3 (g) Building Connections and Service Lines below), gravity sewer pipe shall be installed in straight and true runs in between manholes with constant slope and direction. Pipe slopes shall be sufficient to provide the required minimum velocities and depths of cover on the pipe. Table 1 below provides the minimum slopes for various diameter pipes.

Table 1. Minimum Slopes for Sewers.

Sewer Size	Minimum Slope in Meters per 100 Meters
100 mm	1.00
150 mm	0.62
200 mm	0.40
250 mm	0.28
300 mm	0.22
350 mm	0.17
375 mm	0.15
400 mm	0.14
450 mm	0.12
525 mm	0.10
600 mm	0.08

e) Pipe, Fittings and Connections. Pipe, fittings and connections shall conform to the respective specifications and other requirements as listed in Contract Section 01015 and all of its referenced codes.

f) Manholes.

(1) The distance between manholes must not exceed 120 meters in sewers of less than 450 mm in diameter. For sewers 450 mm in diameter and larger, a spacing of up to 180 meters is allowed provided the velocity is sufficient to prevent settlement of solids.

(2) For pipe connections, the crown of the outlet pipe from a manhole will be on line with or below the crown of the inlet pipe. Where conditions are such as to produce unusual turbulence in the manhole, it may be necessary to provide an invert drop to allow for entry head, or increased velocity head, or both. Where the invert of the inlet pipe would be more than 450 millimeters above the manhole floor, a drop connection will be provided.

(3) Manhole frames and covers must be sufficient to withstand impact from wheel loads where subject to vehicular traffic. Covers with nominal sides measuring 762 mm or larger shall be installed where personnel entry may occur. Cover frames and/or heavy duty hinges shall prevent covers from dropping into the manholes, or circular covers shall be provided.

(4) The following construction practices will be required: 1) Smooth flow channels will be formed in the manhole bottom. Laying half tile through the manhole, or full pipe with the top of the pipe being broken out later, are acceptable alternatives; 2) for manholes over 1 meter in depth, one vertical wall with a fixed side-rail ladder will be provided; 3) drop connections will be designed as an integral part of the manhole wall and base; 4) in areas subject to high groundwater tables, manholes will be constructed of materials resistant to groundwater infiltration.

(5) The primary construction materials to be used for manhole structures are precast concrete rings and cast-in-place, reinforced concrete. Cast-in-place construction permits greater flexibility in the configuration of elements, and by varying reinforcing the strength of similar sized structures can be adjusted to meet requirements. In general, materials used should be compatible with local construction resources, labor experience, and should be cost competitive. Concrete shall have a 21 MPa minimum compressive strength at 28 days.

g) Building Connections and Service Lines. Building connections will be planned to eliminate as many bends as practical and provide convenience in rodding. Bends greater than 45 degrees made with one fitting shall be avoided; combinations of elbows such as 45-45 or 30-60 degrees should be used with a cleanout provided.

h) Cleanouts. Cleanouts must be installed on all sewer building connections, if manholes are not used, to provide a means for inserting cleaning rods into the underground pipe. An acceptable cleanout will consist of an upturned pipe terminating at, or slightly above, final grade with a plug or cap. Preferably the cleanout pipe will be of the same diameter as the building sewer, and never smaller than 150 mm.

i) Grease Interceptors. Grease interceptors are used to remove grease from wastewater to prevent it from entering the sanitary sewer and septic systems. All Dining Facilities (DFACs) shall incorporate preliminary treatment with use of a grease interceptor prior to the sanitary sewer system. The grease interceptor shall be of reinforced cast-in-place concrete, reinforced precast concrete or equivalent capacity commercially available steel, with removable three-section, 9.5 mm checker-plate cover, and shall be installed outside the building. Steel grease interceptors shall be installed in a concrete pit and shall be epoxy-coated to resist corrosion as recommended by the manufacturer. Concrete shall have 21MPa minimum compressive strength at 28 days. The grease interceptor shall connect to the sanitary sewer system.

j) Field Tests and Inspections. Prior to burying the sewer lines, field inspections and testing shall be done to ensure the lines were properly installed and free of leaks. When conducting tests and inspections the following steps shall be conducted:

(1) Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show practically a full circle of light through the pipeline when viewed from the adjoining end of the line. When pressure piping is used in a non-pressure line for non-pressure use, test this piping as specified for non-pressure pipe.

(2) Test lines for leakage by either infiltration tests or exfiltration tests.

(3) Deflection testing will not be required however; field quality control shall ensure that all piping is installed in accordance with deflection requirements established by the manufacturer.

4. Septic System

a) General. When determining an appropriate septic tank location, the Contractor shall provide protection for the septic system by ensuring that vehicles, material storage and future expansion shall be kept away from the area. Signage or other prevention methods (i.e., pipe bollards) shall be used to provide this protection. The finished grade for the site shall ensure that storm water runoff shall drain away from the site to prevent ponding, inflow and infiltration. Once an appropriate site is located, the Contractor shall conduct soil investigations for the site to determine ground water levels, soil conditions and the percolation rate.

b) Septic Tank. Septic tanks are buried, watertight receptacles designed and constructed to receive and partially treat wastewater. The tank separates solids from the liquid, provides limited digestion of organic matter, stores solids, and allows the clarified liquid to discharge for further treatment and disposal. Settleable solids and partially decomposed sludge accumulate at the bottom of the tank, while scum rises to the top of the tank's liquid level. The partially clarified liquid is allowed to flow through an outlet opening position below the floating scum layer. The clarified liquid will be disposed of to the absorption field for further treatment and disposal.

Factors to be considered in the design of a septic tank include tank geometry, hydraulic loading, inlet and outlet configurations, number of compartments and temperature. If a septic tank is hydraulically overloaded, retention time may become too short and solids may not settle properly.

For Afghanistan, a baffled multi-compartment or dual chamber design shall be utilized. Refer to Attachment A for further details. The septic tank shall be designed with a length-to-width ratio of 2:1 to 3:1 and the liquid depth should be between 1.2 meters and 1.8 meters. This depth is determined by the outlet pipe invert elevation. If not specified in the contract, the septic tank shall be sized based on the average daily demand of 190 liters/capita/day, ***plus*** an additional 100% for sludge storage capacity and peak flows. The tank shall be constructed of reinforced, cast-in-place concrete, with a minimum compressive strength of 21MPa at 28 days. Wastewater influent and effluent shall enter and exit on the short sides of the tank, which will allow the wastewater longer detention and settling time. The baffled tank shall have two compartments, with the first compartment (influent entry point) having 2/3 thirds the volume capacity of the tank. The tank shall have a minimum earth backfill cover of 300 mm. Access shall be provided at the entry (influent) and exit (effluent) points of the tank by installing reinforced concrete risers, with steel access hatches, that will rise 50 mm above the finished grade. The following is an example of how to determine the volume and dimensions of the septic tank:

Example 2: Size a Septic Tank - Size a septic tank for a design population of 120 capita at 152 liters/capita/day (80% of 190 liters/capita/day.)

-Assume that tank volume and dimensions are not specified in the contract documents.

*V = ADDP*c*2 = 152 (liters/captia/day)*120(capita)*2 =* ***36,480 liters (36.48 m³)***

Where,

ADDP = Average Daily Demand per Person (liters/capita/day)
c = design population (capita)
2 = represents an additional 100% storage for sludge and peak surges

-Assume 1.8 meter liquid depth and a length-to-width ratio of 2:1.

$A = V/1.8$ meters (liquid depth) $= 36.48\ (m^3)/1.8$ (meters) $= 20.27\ m^2$
$LW = A$
$2W*(W) = 20.27\ (m^2)$
$W^2 = 20.27\ (m^2)/2$
$W = (10.135\ m^2)^{1/2} = 3.18$ meters (3200 mm*)
$L = 2*W = 2*3.18$ meters $= 6.37$ meters (6400 mm*)

Inside dimensions of tank = ***6400 mm X 3200 mm X 1800 mm (liquid depth)***

where,

A = Area
*L = Length (meters) = 2*W*
W = Width (meters)

**Always round up to the nearest 100 mm for final septic tank dimensions.*

c) Absorption Field. Absorption fields (also termed "leach fields") are used, in conjunction with septic tank treatment, as the final treatment and disposal process for the septic system. Absorption fields normally consist of perforated distribution pipe laid in trenches or beds that are filled with rock. Refer to Attachments B or C for minimum perforation requirements. The septic tank effluent is distributed by the perforated pipe and allowed to percolate through the ground, where it is filtered and treated by naturally occurring bacteria and oxygen.

Once effluent is released from the septic tank, it travels by gravity through a solid 100 mm diameter PVC pipe, at a minimum 1.0% slope, to the distribution box. The distribution box is a reinforced concrete structure that distributes the septic tank effluent evenly throughout the absorption field through several 100 mm diameter perforated pipes. The distribution pipe is placed at a depth between 650 mm to 1500 mm. Because of the desire for the effluent to be distributed evenly over the absorption trenches or beds, the perforated pipe shall have a maximum slope of 0.5% and shall be capped at the end of each pipe. Generally, distribution piping is spaced from one meter to 1.8 meters apart and is no longer than 30 meters.

Absorption trenches are a minimum 610 mm wide but can be widened to shorten the length of the trench. A bed can be as wide as needed based on the total area needed for absorption. The absorption field has three (3) zones:

(1) The first zone is the absorption zone, which is the layer of in-situ material that filters and treats the effluent. This zone is determined to be suitable material for wastewater treatment based on the percolation test results, with a minimum thickness of 600 mm. Below the absorption zone, the material is considered unsuitable soil or bed rock or the seasonal water table is too high. If percolation tests determine that there isn't a minimum 600 mm of suitable soil, the Contractor can remove the unsuitable soil to the desired depth and replace it with material determined to be suitable; however, the Contractor must get approval from the COR before attempting this.

(2) The second zone is the drainage zone, which is a 300 mm thick layer of rock fill, where the distribution pipe network lies. The bottom of this zone is filled with a minimum 150 mm of 19 mm to 38 mm diameter rock. The perforated distribution pipe is laid on top of the rock. A minimum of 50 mm of rock is placed carefully over the pipe network, and then a semipermeable membrane (geotextile fabric) is placed over the rock to prevent fine-grained backfill from clogging it.

(3) The final zone is the backfill zone. This is the upper most part of the absorption field, where backfill material is placed and is a minimum 500 mm thick. The backfill material protects the lower lying zones from storm water infiltration and freezing. The Contractor shall leave a mound of backfill material above the desired finished grade to allow for settlement.

Table 2 lists percolation rates and the corresponding sizing factor (liters/m^2/day). The sizing factors are used, in conjunction with average daily demand (ADD), to determine the size of the absorption field. The following is an example of how to calculate the absorption field size for trenches and beds:

Example 3: Size of Absorption Field - Size an absorption field for a facility with an average daily demand of 18,170 liters/day and a percolation rate of 50 minutes.

*A = ADD*Water Absorption of Soil = 18,170 liters/day*0.054* m^2*/liters/day =* ***981.18*** $\mathbf{m^2}$

where,

A = Area footprint needed for the absorption field (m^2*)*
ADD = Average Daily Demand (liters/day)
Water Absorption of Soil = By looking below, at Table 2, a percolation rate of 50 minutes falls in the 46 to 60 row and the correlating sizing factor is determined to be 0.054 m^2/liters/day.

Dimensions for trenches:

-Assume a 0.9144 meter wide trench bottom.
-Assume maximum trench length to be 30 meters.

*$N_T = A/(T_w*T_L) = 981.18\ m^2/(0.9144\ m*30\ m) = 35.77$, say: ***36 Trenches (0.9144 meters X 30 meters)***

where,

N_T = *Number of Trenches*
T_w = *Trench width (meters)*
T_L = *Trench Length (meters)*

**Note: Trench bottom area can be reduced by 20 percent, if 305 mm of rock is placed below the distribution pipe. The area can be reduced by 34 percent for 457 mm of rock being placed below the pipe and by 40% for the maximum rock depth of 610 mm. Keep in mind that the additional rock added below the distribution pipe adds additional thickness required for the drainage zone. For example, there is normally 150 mm of rock placed below the pipe for a total 300 mm thickness for the drainage zone. If 305 mm of rock is placed below the pipe, the total thickness for the drainage zone increases to 455 mm of rock, including, 305 mm below the pipe; 100 mm around the pipe; and 50 mm above the pipe.*

Dimensions for bed:

Absorption Bed Dimensions = $A^{1/2} = (981.18\ m^2)^{1/2} = 31.32$ *meters, say: 32 meters per side*
Absorption Bed Dimensions = ***32 meters X 32 meters***

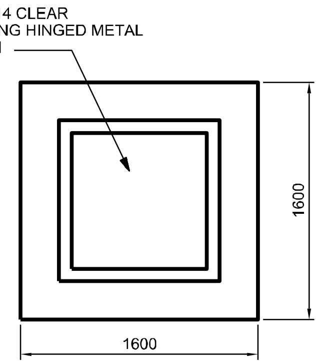
Refer to Attachments B and C for further design details of absorption fields.

Table 2. Soil Treatment Areas in Square Meters.

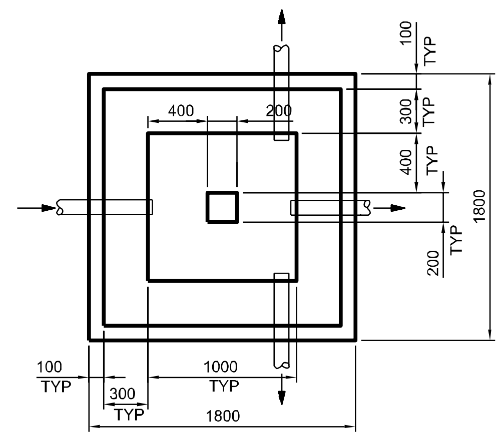
Percolation Rate, Minutes for Water to Drop 25 mm	Water Absorption of Soil (m^2/liters/day)
Faster than 0.1	Soil too coarse for sewage treatment
0.1 to 5	0.020
6 to 15	0.031
16 to 30	0.041
31 to 45	0.049
46 to 60	0.054
Slower than 60	Soil too fine for sewage treatment

5. As-Builts

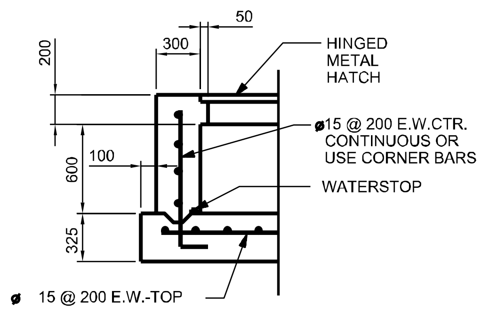
Upon completion of installing the sanitary sewer and septic systems, the Contractor shall submit editable CAD format As-Built drawings. The drawings shall show the final product as it was constructed in the field, with the exact dimensions, locations, materials used and any changes made to the original design. Refer to Contract Sections 01335 and 01780A of the specific project for additional details.



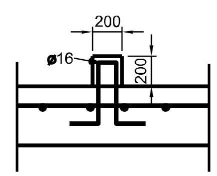
TOP SLAB PLAN



FOUNDATION SLAB PLAN



TYP WALL SECTION



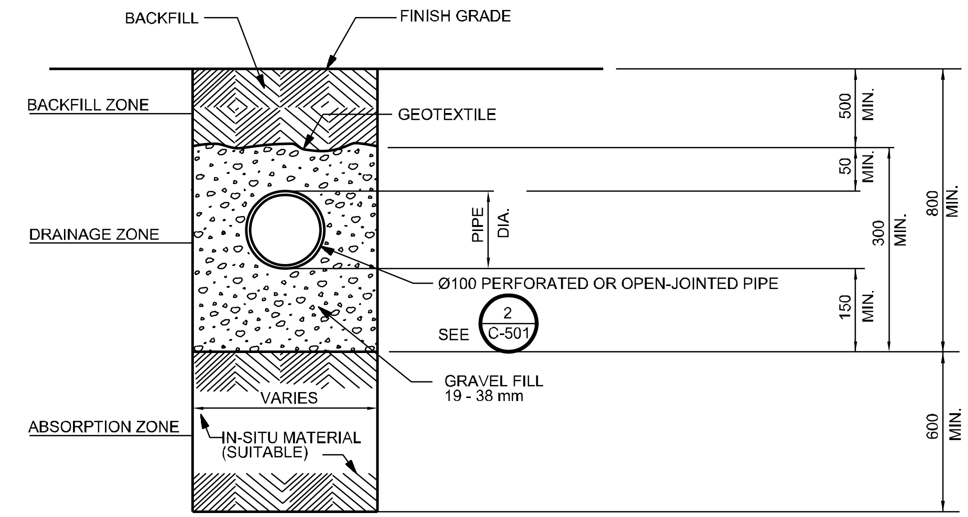
SECTION

DISTRIBUTION BOX DETAIL
NOT TO SCALE

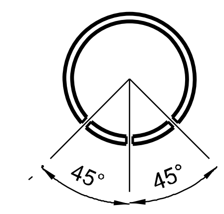
NOTE:

1. PROVIDE PROPER ORIENTATION OF INLET AND OUTLET CONNECTIONS ON PROJECT CIVIL SITE PLANS.

2. TANK DIMENSIONS SHALL HAVE A LENGTH TO WIDTH RATIO OF BETWEEN 2:1 AND 3:1.



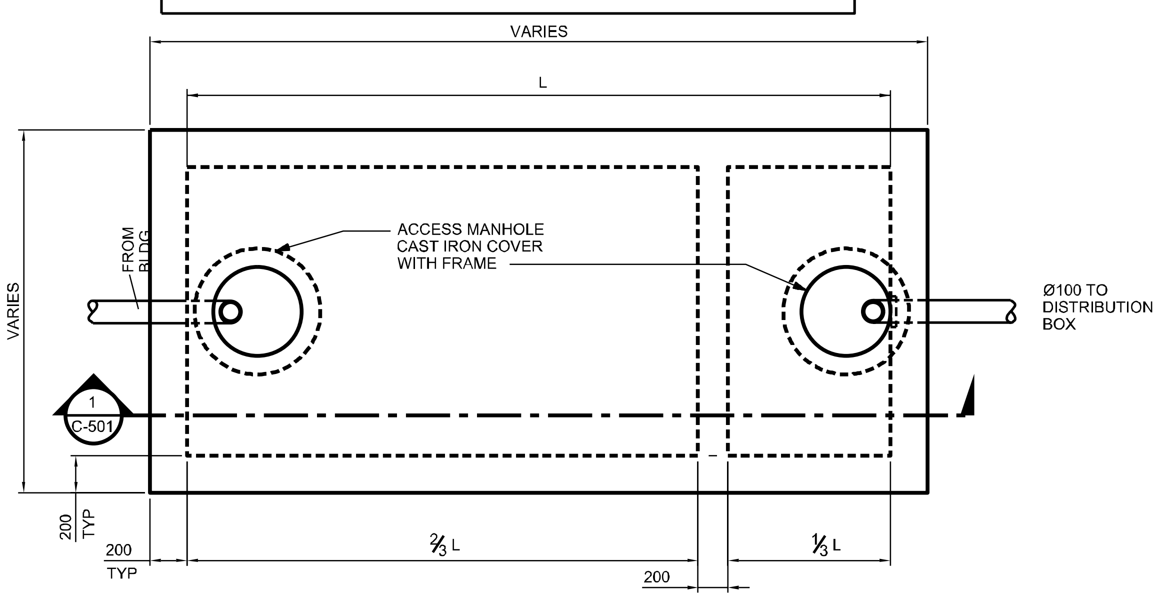
ABSORPTION FIELD DETAIL
NOT TO SCALE



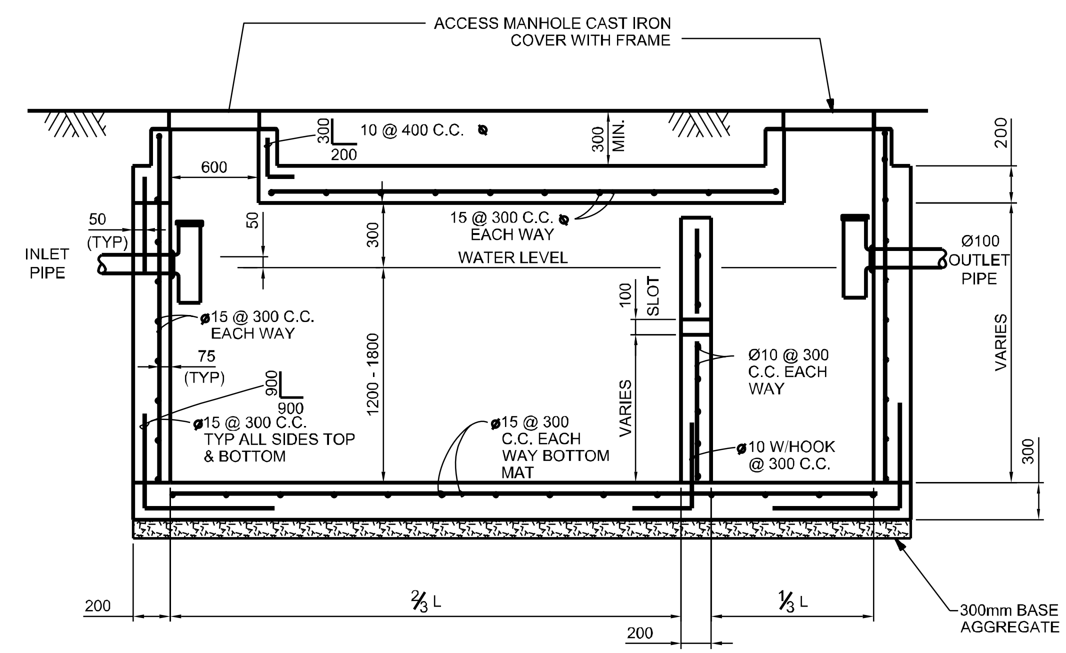
2 C-501 PREFORATED PIPE SECTION
NOT TO SCALE

NOTE:

1. THREE (3) ROWS OF 13 MM DIA. HOLES.
2. EACH ROW OF HOLES SHALL BE SPACED AT A DISTANCE OF 100 MM CENTER-TO-CENTER.
3. HOLES SHALL BE ON THE BOTTOM HALF OF THE PIPE, AS SHOWN.
4. USE MINIMUM 100 MM DIA. SCHEDULE 40 PVC.



CONCRETE SEPTIC TANK PLAN VIEW
NOT TO SCALE



1 C-501 CONCRETE SEPTIC TANK SECTION
NOT TO SCALE

NOTE: ALL DIMENSIONS IN MILLIMETERS, UNLESS OTHERWISE NOTED.

US ARMY CORPS OF ENGINEERS AFGHANISTAN ENGINEER DISTRICT

SYMBOL | DESCRIPTION | DATE | APPR.

DESIGNED BY: | DWN BY: | CKD BY: | REVIEWED BY: | SUBMITTED BY: | DATE: xxxxxx | DESIGN FILE NO. | DRAWING CODE: | FILE NAME: | PLOT SCALE: | CONTRACT NO. xxxxxx | REV.

U.S. ARMY CORPS ENGINEER AFGHANISTAN ENGINEER DISTRICT APO AE 09356-5010

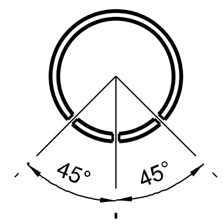
AFGHANISTAN ENGINEER DISTRICT KABUL, AFGHANISTAN

ATTACHMENT "A" SEPTIC TANK DETAILS

SHEET REFERENCE NUMBER:

SHEET --- OF ---

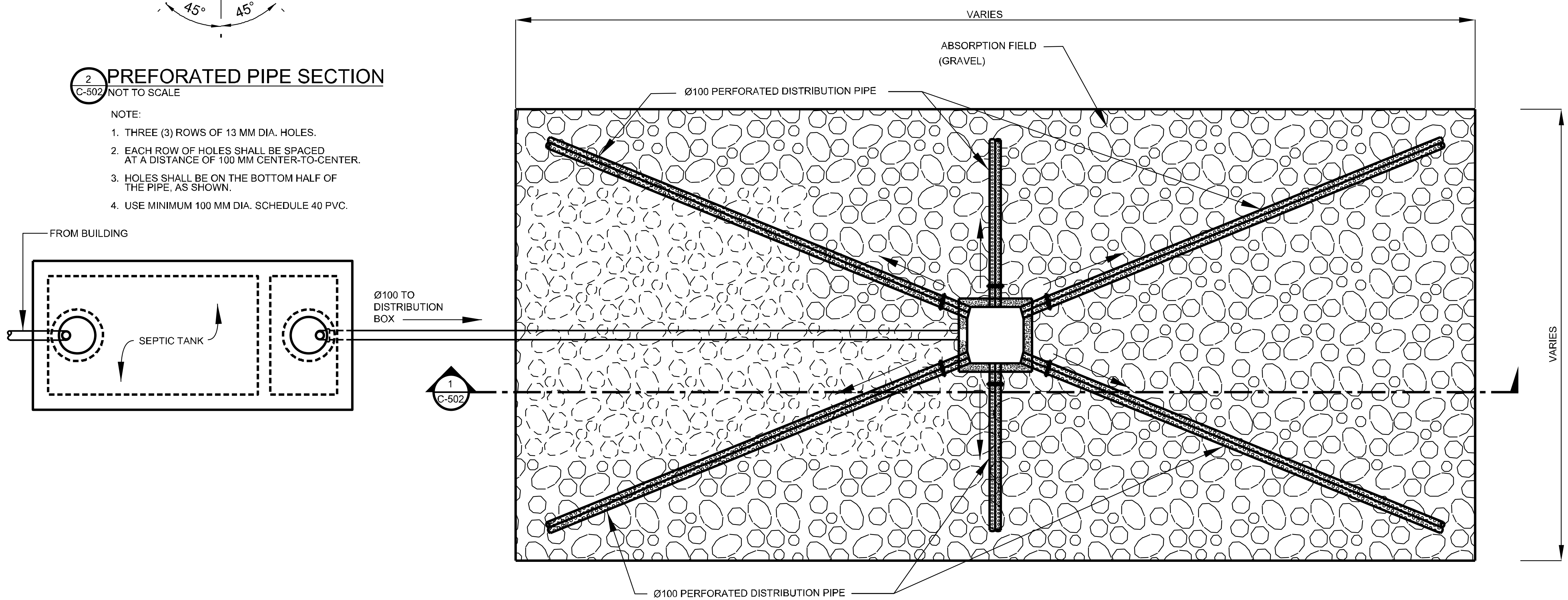
A1 Size 594mm x 841mm



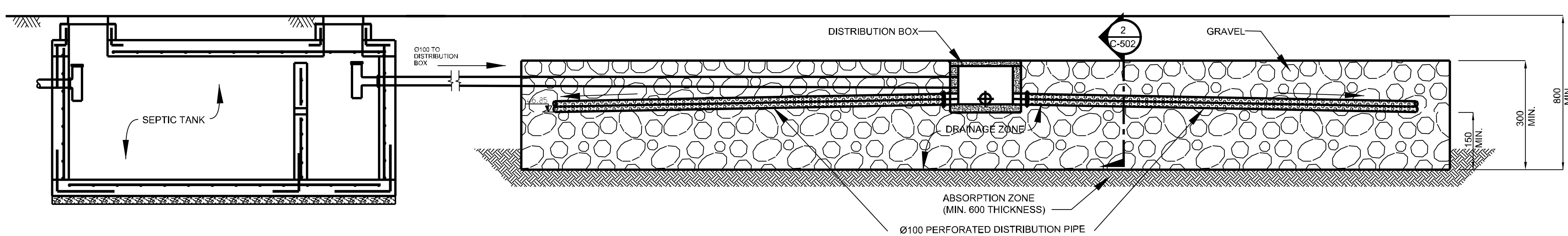
2 C-502 PREFORATED PIPE SECTION
NOT TO SCALE

NOTE:

1. THREE (3) ROWS OF 13 MM DIA. HOLES.
2. EACH ROW OF HOLES SHALL BE SPACED AT A DISTANCE OF 100 MM CENTER-TO-CENTER.
3. HOLES SHALL BE ON THE BOTTOM HALF OF THE PIPE, AS SHOWN.
4. USE MINIMUM 100 MM DIA. SCHEDULE 40 PVC.



SEPTIC SYSTEM BED CONFIGURATION PLAN VIEW
NOT TO SCALE



1 C-502 SEPTIC SYSTEM BED CONFIGURATION SECTION VIEW
NOT TO SCALE

US ARMY CORPS OF ENGINEERS AFGHANISTAN ENGINEER DISTRICT

U.S. ARMY CORPS ENGINEER
AFGHANISTAN ENGINEER DISTRICT
APO AE 96338-5010

DESIGNED BY:	DATE: xx-xx-xx	REV.
DWN BY:	CKD BY:	DESIGN FILE NO.
REVIEWED BY:		DRAWING CODE:
SUBMITTED BY:		FILE NAME:
		PLOT SCALE:
		CONTRACT NO. xx-xx-xx

SYMBOL | DESCRIPTION | DATE | APPR.

AFGHANISTAN ENGINEER DISTRICT
KABUL, AFGHANISTAN

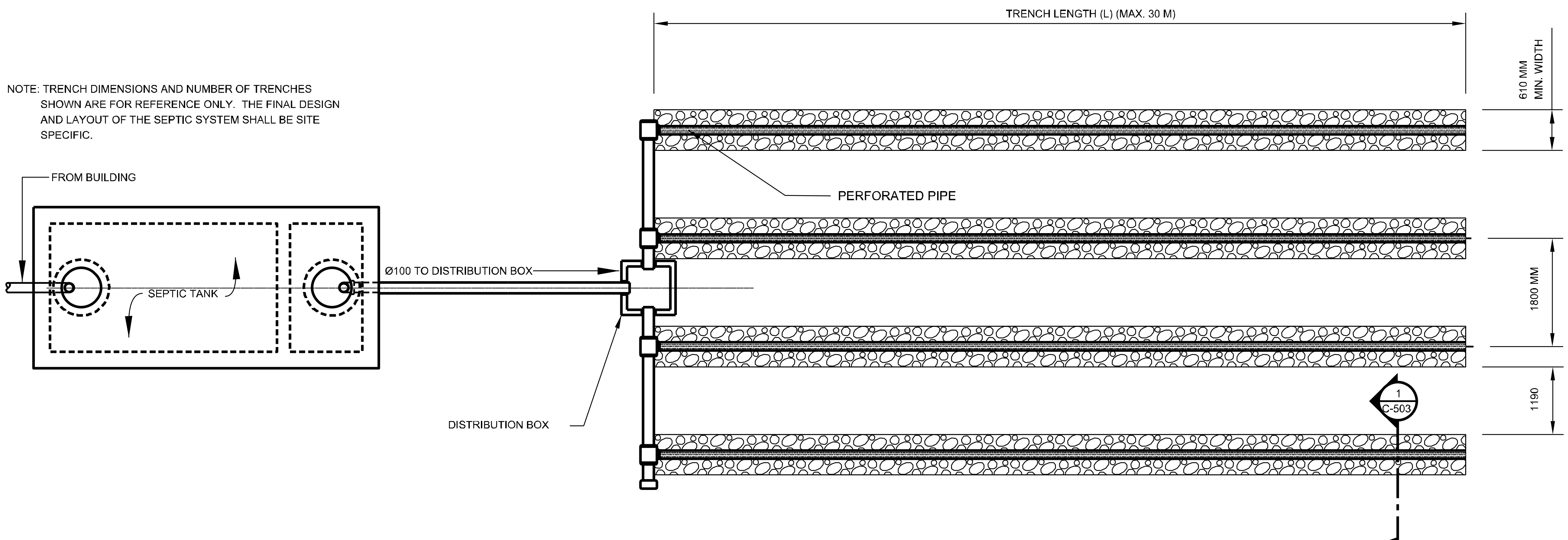
ATTACHMENT "B" ABSORPTION BED DETAILS

SHEET REFERENCE NUMBER:

SHEET --- OF ---

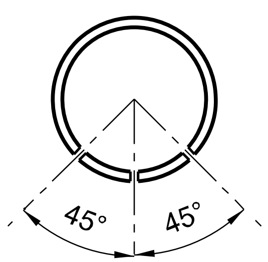
A1 Size 594mm x 841mm

NOTE: TRENCH DIMENSIONS AND NUMBER OF TRENCHES SHOWN ARE FOR REFERENCE ONLY. THE FINAL DESIGN AND LAYOUT OF THE SEPTIC SYSTEM SHALL BE SITE SPECIFIC.



SEPTIC SYSTEM TRENCH CONFIGURATION PLAN VIEW

NOT TO SCALE

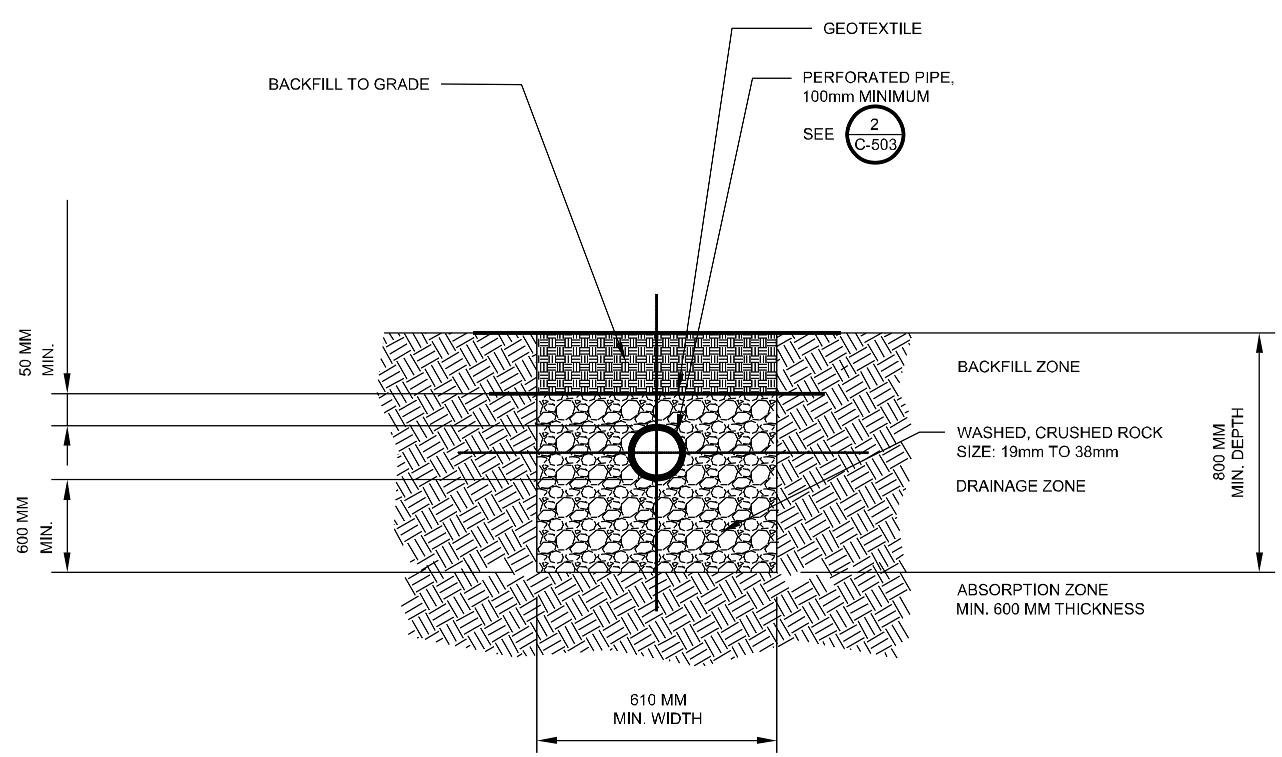


2 C-503 PREFORATED PIPE SECTION

NOT TO SCALE

NOTE:

1. THREE (3) ROWS OF 13 MM DIA. HOLES.
2. EACH ROW OF HOLES SHALL BE SPACED AT A DISTANCE OF 100 MM CENTER-TO-CENTER.
3. HOLES SHALL BE ON THE BOTTOM HALF OF THE PIPE, AS SHOWN.
4. USE MINIMUM 100 MM DIA. SCHEDULE 40 PVC.



1 C-503 SEPTIC SYSTEM TRENCH CONFIGURATION SECTION VIEW

NOT TO SCALE

US ARMY CORPS OF ENGINEERS AFGHANISTAN ENGINEER DISTRICT

U.S. ARMY CORPS ENGINEER
AFGHANISTAN ENGINEER DISTRICT
APO AE 09356-5010

AFGHANISTAN ENGINEER DISTRICT
KABUL, AFGHANISTAN

ATTACHMENT "C"

SHEET REFERENCE NUMBER:

SHEET --- OF ---

A1 Size 594mm x 841mm