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SOCIO-ECONOMIC UNITS, KERALA
KERALA WATER AUTHORITY
DUTCH-DANISH SUPPORTED WATER & SANITATION PROJECT

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DRAFT

MANUAL FOR CONSTRUCTION OF LOW-COST SANITATION UNITS

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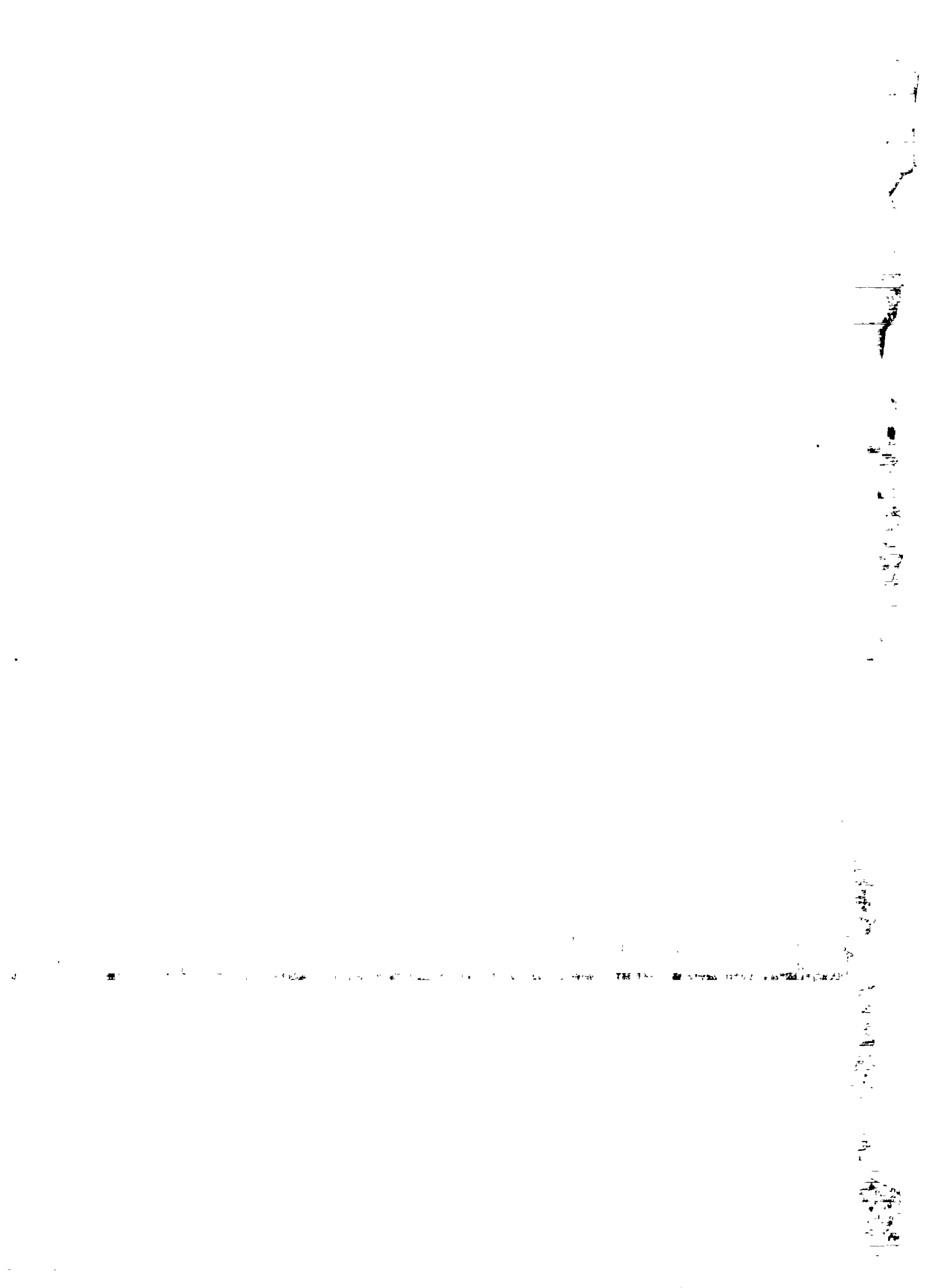


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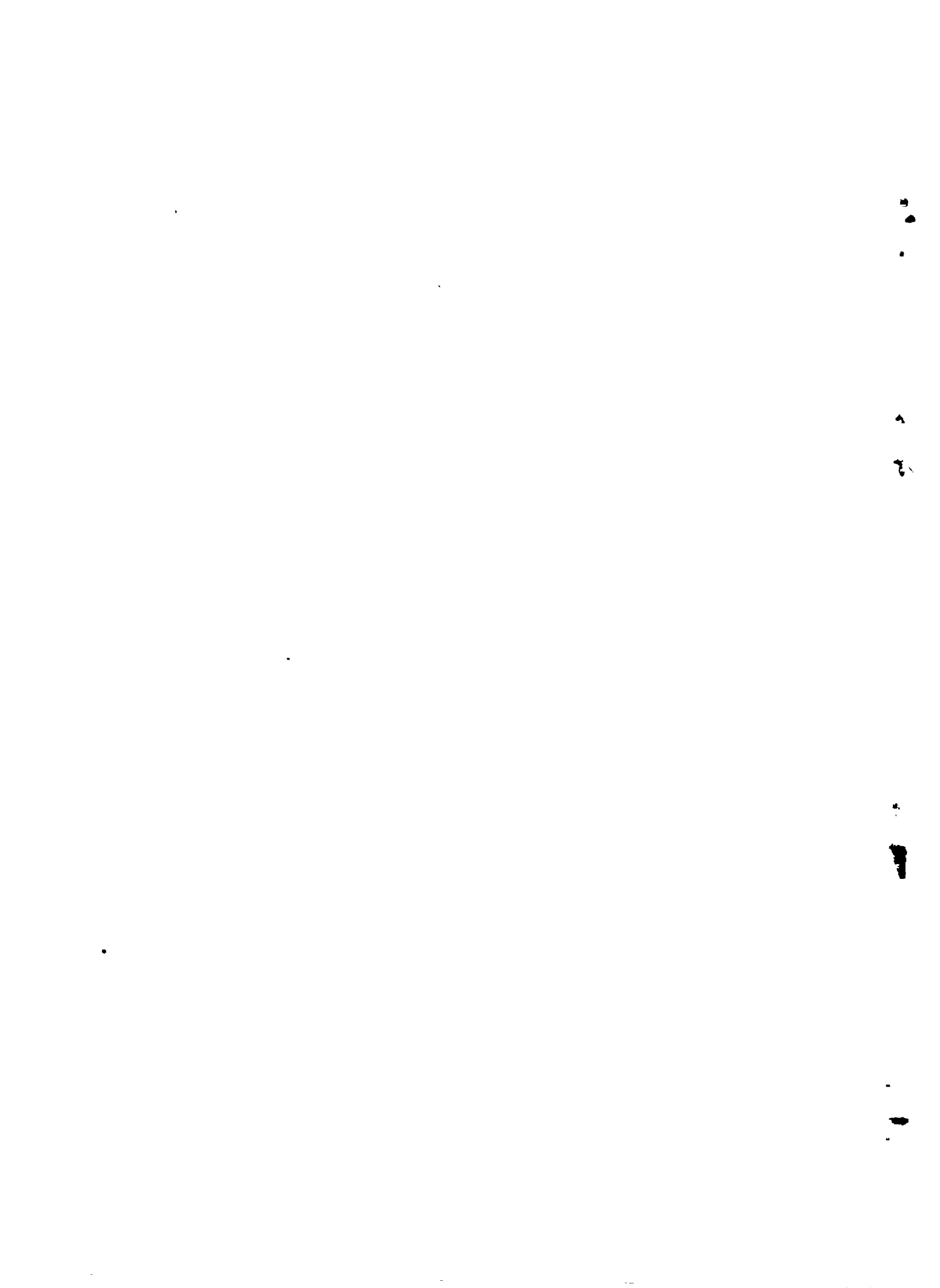
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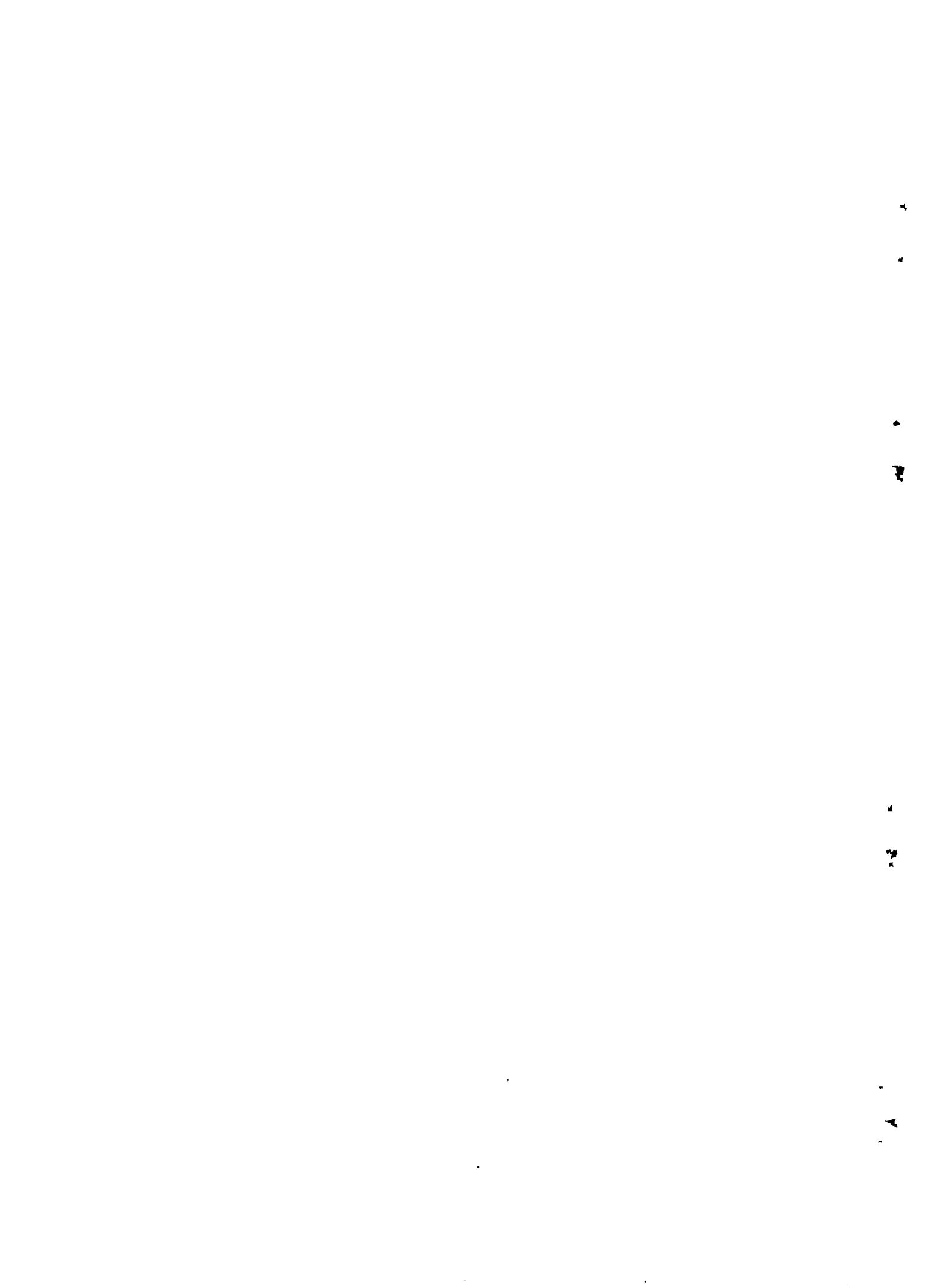
A MANUAL FOR CONSTRUCTION OF LOW COST SANITATION UNITS

AUGUST 1989



C O N T E N T S

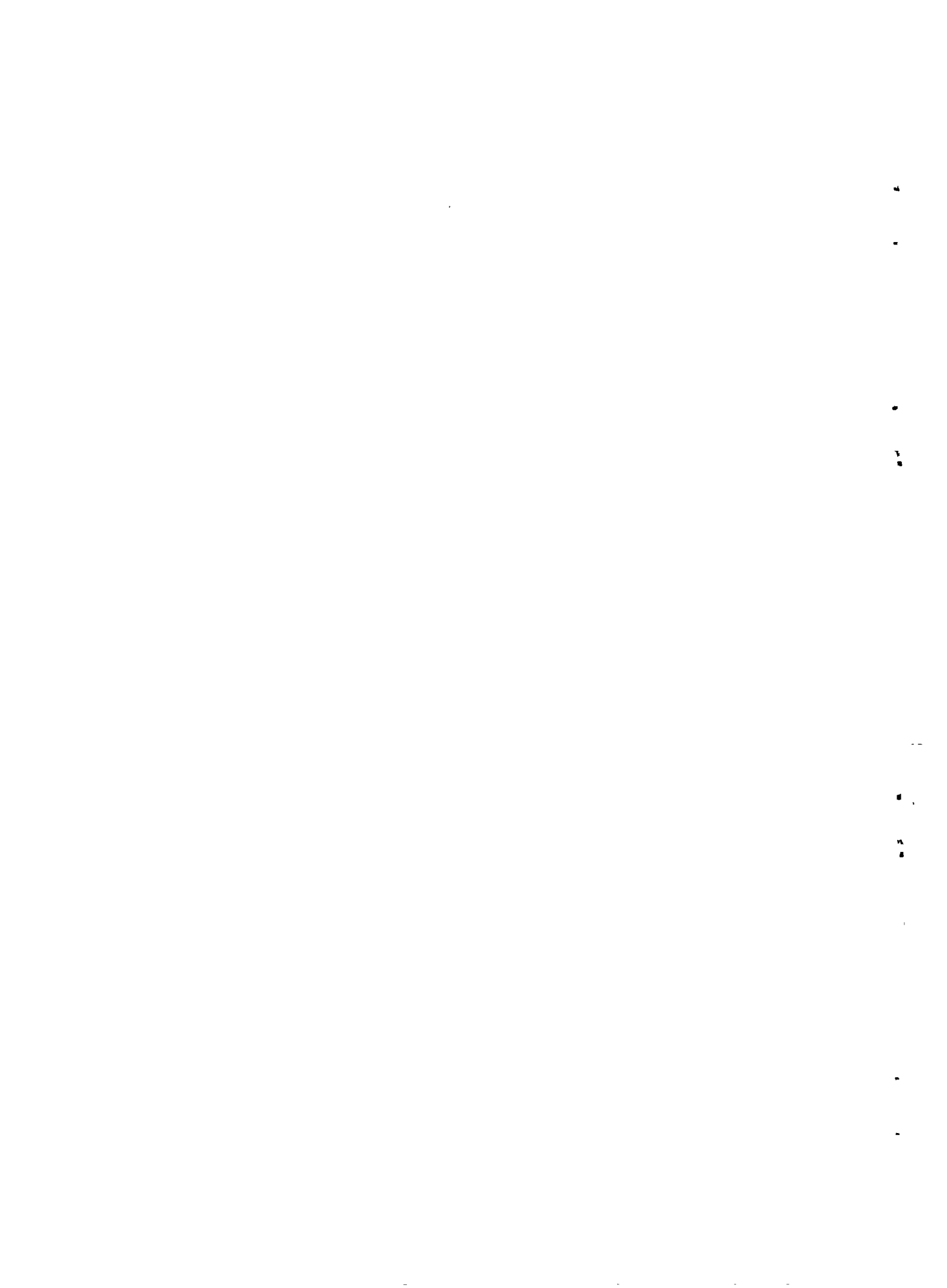
	Page
Purpose and Use of this Manual	1
Construction of latrines as a First Step to improvement of health standards	2
Background	
Steps in latrine construction	4
Criteria for beneficiary selection	5
Local implementation Committee	6
Involvement of beneficiaries	6
Design of Latrine	8
Suggestions	9
 <u>ANNEXURES</u>	
I. Pictorial Posters	10
II. Instruction booklet	11
III. Design of Twin Pit Pour Flush Latrine	12
IV. Glass Fibre Pan and Trap	13
V. Plan of Y-Junction	14
VI. Cost of Sanitation Unit in Loose Soil	15
VII. Cost of Sanitation Unit in Hard Laterite	16
VIII. Cost of Six-Seater Multi Unit latrine	17
IX. Cost Break-up of 9 seater latrine unit	18
XA Cost Break-up of Multi Unit latrine for public places	19
XB " " " "	20
XI (A) Cost Comparison and Details	21
(B) " " "	22
XII Plan of Multi Unit Latrine	23
XIII Plan of 9 Seater latrine	24
XIV Plan of Toilet-Cum-Cloak Room Building	25



PURPOSE AND USE OF THIS MANUAL

This Manual is meant for those who wish to know about the procedures for constructing low-cost latrines. The information provided herein is based on actual experiences gained in the construction of the UNDP/UNICEF twin-pit model latrines in the Sanitation Scheme by the Socio-Economic Units (SEU) attached to the Kerala Water Authority (KWA). This scheme is funded partially by the Danish International Development Agency (DANIDA) and Dutch Governments. It may be possible to further reduce the costs and time taken, if large scale construction is taken up. The quality and type of materials used for doors, roofs and walls, and the size of the room can be altered and improved upon, as desired.

Beneficiary participation in this scheme is given considerable importance for creative involvement. Imparting to them, proper instructions about the technology involved, proper use and maintenance are no less essential. Avenues or agencies must be identified for these activities and for the beneficiaries also, in case of problems arising, which cannot be handled by the householders themselves. Related Departments like the Health Services, Social Welfare, Rural Development should be involved in the health education aspects, and other local agencies (like NGOs) for supportive activities of this programme. It is suggested that the local Panchayat Offices would be ideal agencies with which to implement such programmes. Wherever available local active voluntary agencies could be advantageously involved. These activities have proved to be educative for the local people in creating a consciousness regarding their environment, needs and responsibilities.



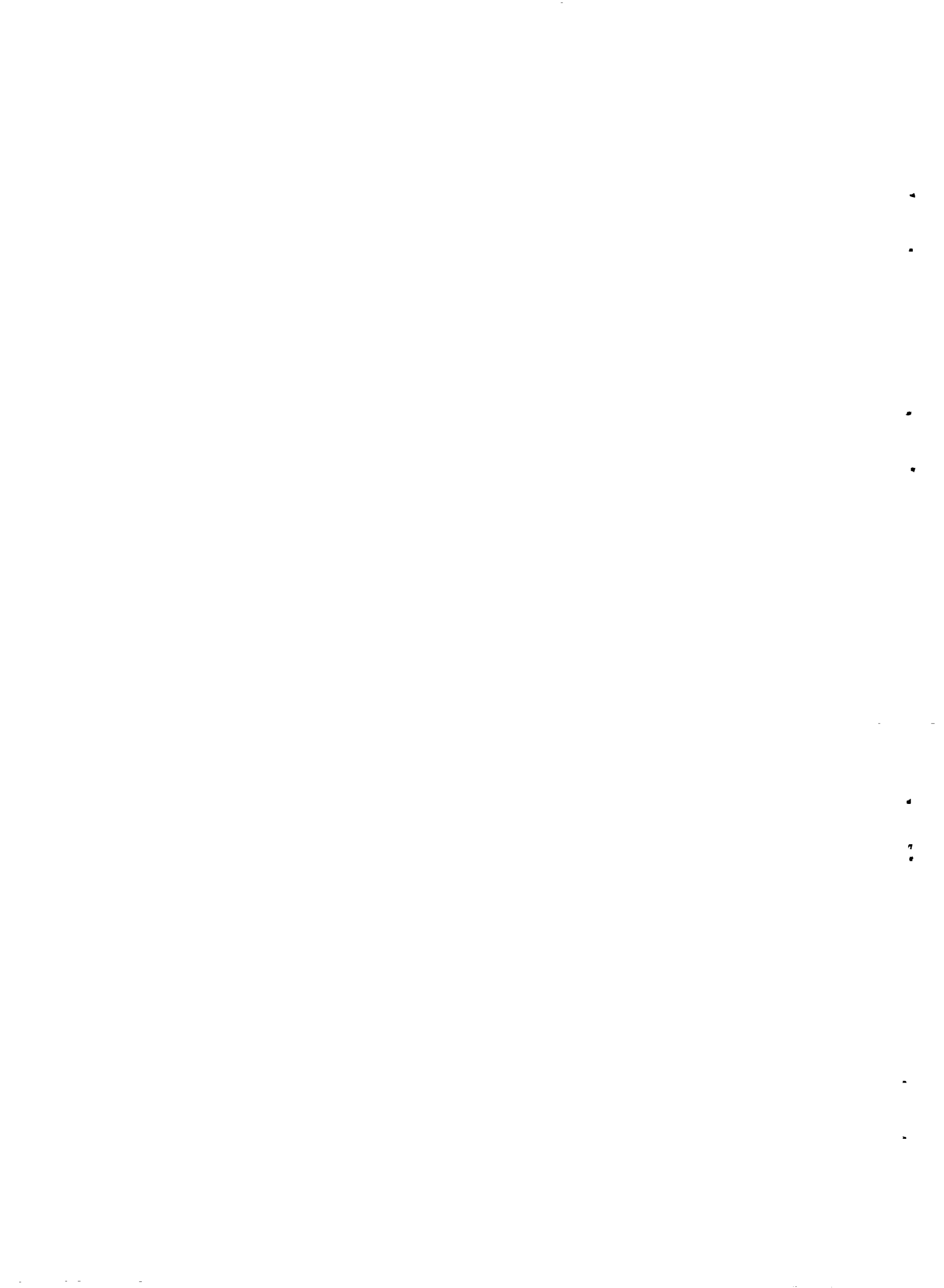
CONSTRUCTION OF LATRINES AS A FIRST STEP TO
IMPROVEMENT OF HEALTH STANDARDS

Background

There are many reasons why people resort to practising open-air defecation. Some of these may be due to financial constraints to construct latrines, some socio-cultural, others areal, but whatever the reasons be, this practice is unhygienic and creates numerous hazardous situations. This habit is the main source of contamination of food and water, and also the cause for all sorts of related diseases. Vectors of diseases, like flies, breed and feed on such waste and carry bacteria to exposed food and water. Some of the diseases spread like this are, Cholera, Typhoid, Polio, Dysentery, Diarrhoea and Gastro-enteritis. Skin diseases like scabies, and worm infestations are spread through contaminated water and polluted environment.

Diseases such as these are economically and physically taxing and also cause loss of many mandays of work. Some of them can be fatal too, especially among children.

A necessary step to alleviate such a situation is to provide for the safe disposal of human waste and practicing 'hygienic personal habits. The poor especially are unable to construct latrines on their own, and many that have been built for them are neither safe nor sanitary. A sanitary toilet should be one that mainly prevents breeding of insects like flies, do not have foul smell, which do not pose any danger to existing water sources, especially drinking water, do not pollute the soil, which can be safely and easily maintained, and last but not least, is acceptable to the people themselves.

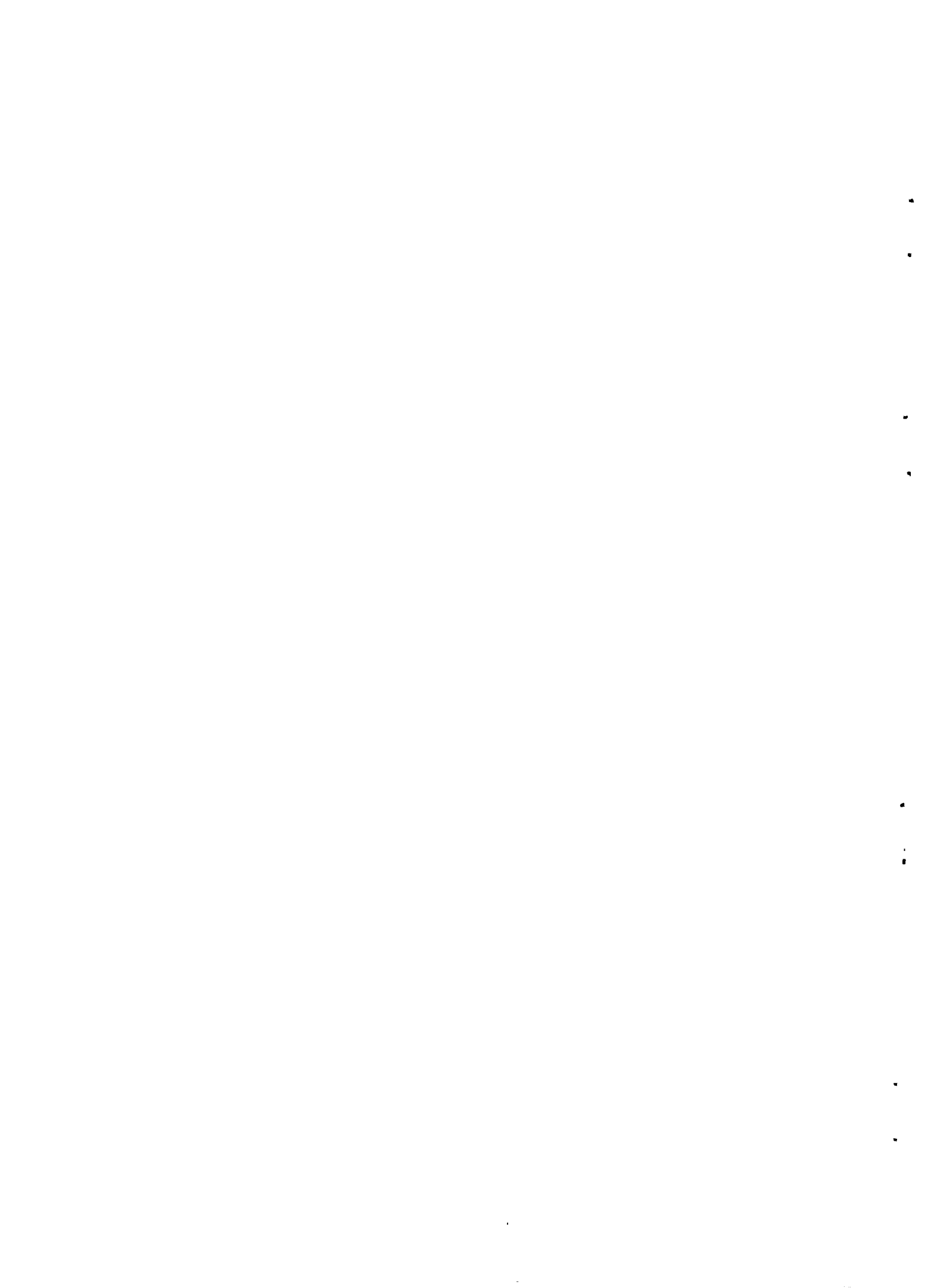


Many people do not realise the importance of sanitary toilets because of their ignorance of the dangers involved in the indiscriminate disposal of human waste. Among such people it is only the lack of space that compels them to wanting a toilet. To help solve this kind of a situation too, it is necessary to remove ignorant and negative attitudes, help provide finance for low cost and viable toilets, which are technologically simple and culturally acceptable to the beneficiaries and to impart health education so as to help them acquire hygienic habits and practices conducive to good health and a habitable environment.

Health education implies change of habits - habits which are deeply ingrained and preferred. It is not an easy task to do this and requires patient and prolonged persuasion to wrought such changes, especially personal habits. An important aspect to be realised here is that Sanitation Schemes must be accompanied by necessary instructions. The importance of a Sanitary toilet, the type best suited to local conditions, how it has to be used and maintained, are necessary to be informed to beneficiaries, and can be imparted through periodical informal discussions and other means.

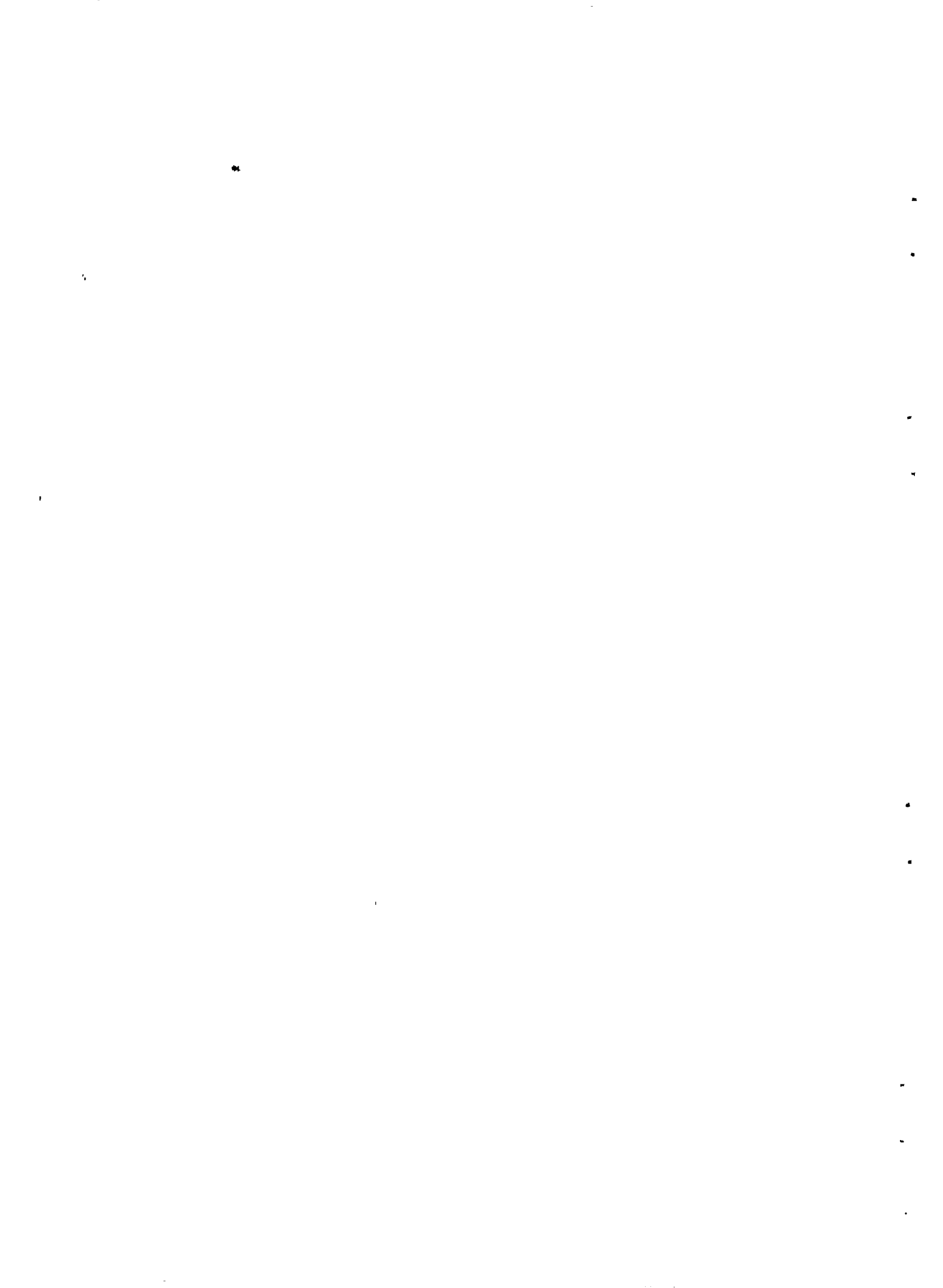
With awareness should come a sense of a need for a toilet; an expressed desire to possess a toilet is necessary. Even after this, there are people in the very low income group who are unable to afford even the cheapest of latrines. For them, there are some criteria laid down by the SEU that are being applied, to extend financial aid to construct their own latrines. These criteria can also be used for the selection of beneficiaries for similar schemes.

A step by step presentation is given below indicating the stages of work and the agencies involved. Please note that the hardware and software activities go hand in hand. These activities complement each other and the stages at which these are required is shown in the table.



STEPS IN LATRINE CONSTRUCTION

<u>HARDWARE ACTIVITIES</u>		<u>SOFTWARE ACTIVITIES</u>	
Activity	Agency/Personnel	Activity	Agency
		1. Contact Panchayat Officials to explain scheme & request their participation and cooperation.	SEU
		2. Obtaining lists of below poverty line beneficiaries from Block Development Offices Panchayats & compiling lists of needy beneficiaries.	Panchayat, BDO SEU
		3. Physical verification of area & selection of beneficiaries based on criteria (see page 5)	Panchayat, SEU
1. Pit marking and dimensions indicated to beneficiary.	Panchayat/NGO/SEU	4. Beneficiary meeting to explain scheme, its importance and their participation in this. Selection of members for Local Implementation Committee. (See page 6).	
2. Pit digging	Beneficiary		
3. Arrangement for common purchase & distribution of building material	Local Implementation committee, beneficiaries	5. Hold informal discussions & talks on dangers of polluted environment to create awareness and conscientize people about need for better hygienic practices.	SEU, other departments, (Health, Mass Education, Para medical trainees.
4. Pit lining, superstructure construction	Skilled workers with technical supervision from SEU & KWA	6. Explain the technology involved, the structures, the care needed to prolong latrine use.	Technical staff SEU, KWA, Panchayat & Masons.
5. Installation of Pan, Trap & Junction Box.	-do-		
6. On completion of units, clearing and tidying of surroundings	Beneficiaries	7. Imparting information to beneficiaries on how to use and maintain the toilet-distribution of pamphlets, instruction booklets.	SEU, Panchayat Government, NGO Personnel.



Criteria for beneficiary Selection

The criteria that are followed by the SEU, KWA for the selection of beneficiaries for their latrine programme are:

1. The net family income is low - in this instant below Rs.500/- per month.
2. Preference for households without any sanitary latrine.
3. Beneficiary should express keenness to own a latrine.
4. Beneficiary should be willing to dig the pits and contribute 15-20% of the total cost (in cash or kind).
5. The household should have an easily accessible and perennial source of water.
6. There should be sufficient space to construct a latrine without it posing any problems to existing, or possible sources of water, and other households. There should be generally a minimum distance of 10 metres between the latrine pits and existing water sources. (See Appendix A).

In extreme cases of poverty ridden households the minimum contribution is their labour. Such households should be carefully considered and scrutinized. Selection should be such that the really deserving households get priority.

List of below poverty line families are available from the respective Block Development Offices. Beneficiaries are selected in consultation with the Panchayat Officials, Ward Members and some local leaders - (Preferably Social Workers, Mahila Samajam members etc).



Local Implementation Committee

A Local Implementation Committee is formed consisting of the Panchayat President as Chairperson, Mahila Samaj representatives, beneficiaries (male and female) PHC Health Inspector, and the local Ward Members - half the members should preferably be women. This Committee can advise about the availability of good quality material locally, skilled artisans, labourers, and helps to arrange for these. It ensures that the beneficiaries dig the pits, and make their payments and contributions in time. They help in monitoring the progress of work, and later in the proper maintenance of the latrines.

Involvement of Beneficiaries

When a beneficiary is selected, a Panchayat Official, a SEU staff and Construction Supervisor go to the house, inspect the surroundings, gather information about the beneficiary and if found eligible, mark the site and dimensions for the latrine room and pits. The beneficiary is instructed about the pits to be dug and about their contribution of payments. Arrangements may have to be made for some poor beneficiaries for payments to be made in instalments. For convenience of transportation of material and to keep costs down, a minimum of 5 beneficiaries, if possible, are selected from an area. Communal and mutual help to transport material to the required sites are also solicited.

Orders for all the latrine Units in the area are placed, for the different material required with the local suppliers, workmen contacted, rates and dates agreed upon for the work to start. A beneficiary meeting is held to explain about the scheme, the work, their involvement requirements and expectations of their contribution. This meeting is organized by the Local Implementation Committee and attended by the Community Organizer or Supervisor.



The technical part of the work is taken care of by the technical, supervisory staff of the SEU, KWA and Panchayat. The participation of the beneficiaries in the actual work itself eg. providing simple labour, is taken care of by the Local Implementing Committee members, SEU Community Organizer, Supervisor or Social Workers. During the construction, each phase is explained to the householders (by the Supervisor or Mason) so that they can understand the technology involved.

Their doubts and questions are answered and such a procedure ensures that having understood the basic design, they are able to care and maintain for the units themselves. The beneficiaries are also encouraged to get a large container to be kept outside the toilet to store water, and a 4-5 litre bucket to take water into the toilet. In the SEU scheme as part of the programme, each household is also provided with a cleaning brush.

After construction, the personnel of SEU, Health Departments, or Non-Governmental Agencies instruct the beneficiaries how to use the toilets and to maintain cleanliness. Pictorial posters (Annexure I) of some of these procedures are fixed on the inside of the latrines and each household given an instruction booklet (Annexure II). The beneficiaries are especially instructed about taking precautions to prevent blockages, about using the required quantity of water and about keeping the inside and outside of the latrines clean. Weekly or fortnightly visits are initially made to find out if there are any problems. Subsequently, field level personnel of the Governmental and Non-Governmental agencies are entrusted to carry out the follow-up and extension work whenever they go to the areas. Every six months, the latrines are monitored, and problems, if any, dealt with accordingly. These procedures could be ideally entrusted to locally trained volunteers.



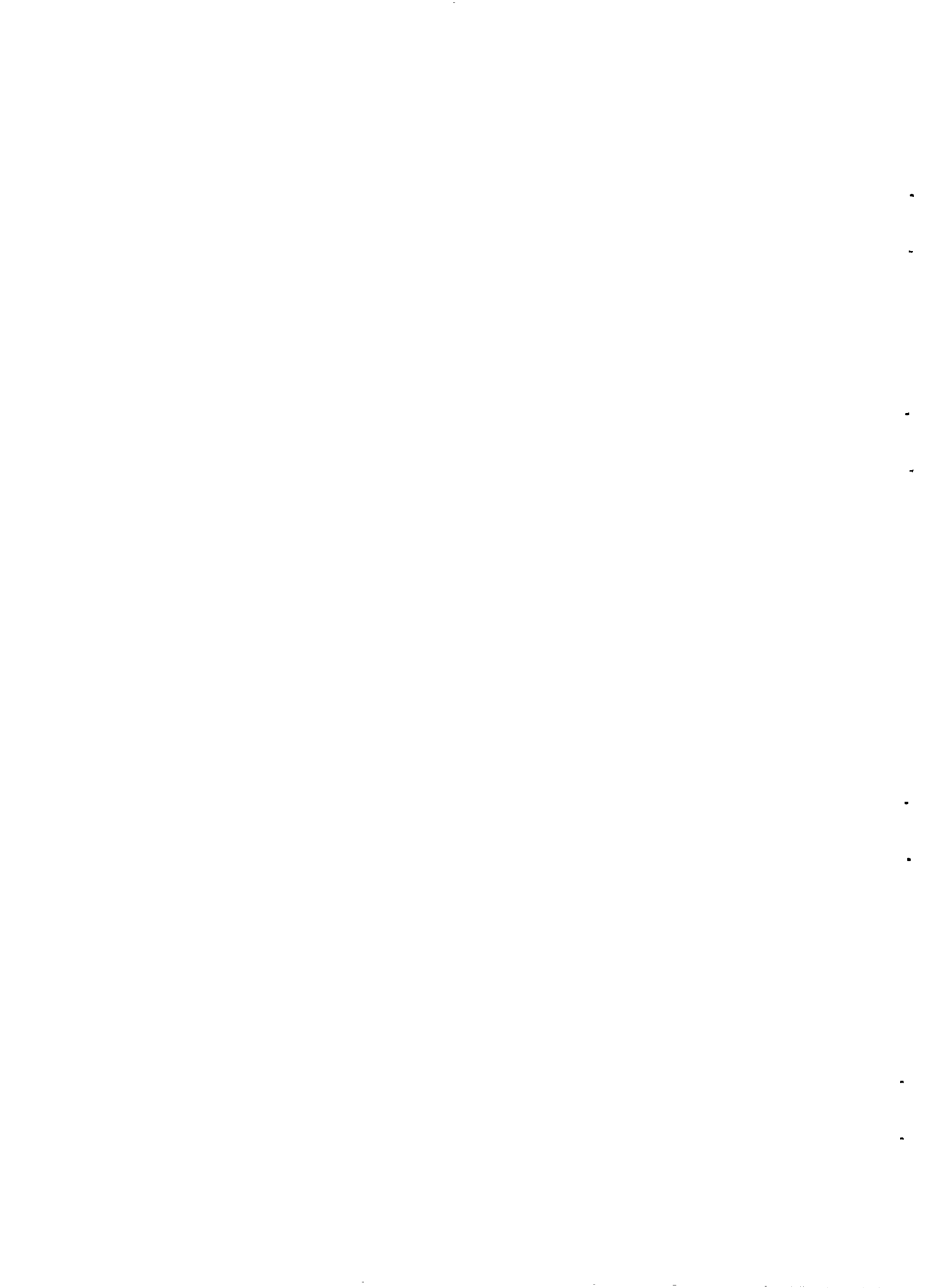
The above steps involve beneficiaries right from the time before the construction itself begins. This kind of involvement in an informal way is educative and also creates a feeling of having been able themselves to partly acquire the Units, rather than having an asset simply dumped or forced upon them, or given as charity.

Design of Latrine

The design of the latrine in this scheme is that adapted by the World Bank/UNICEF/UNDP for their Rural Sanitation Projects which is the pour flush twin pit type (Annexure III). The Pan and Trap dimensions, and design are as shown in Annexure IV. These measurement are crucial in that, the minimum amount of water only need to be used for efficient flushing, which is an essential consideration to prolong the life of the pits and for conservation of water. The material of the Pan and Trap used in the present scheme is fibre glass and ceramic.

The Y-Junction (Annexure V) is preferably prefabricated in fibre glass which saves considerably on time and labour than in constructing the same in cement and mortar. There are 2 oval shaped blockers provided, one of which only is installed at a time. The other should preferably be kept within the junction box to prevent losing the same. The blockers are changed every year. This timing has added advantages in that, that the practice gains acceptance and experience, and that a small amount of sludge is periodically allowed to be "digested" and leached.

Material and cost break-up of latrines (single and multiple units), labour involvement, and cost comparisons of constructing in different soils, with different roofing and building materials used is given in Annexures VI-IX. The design and plan of multi units latrines for institutions and public places are given in Annexures X and XII.



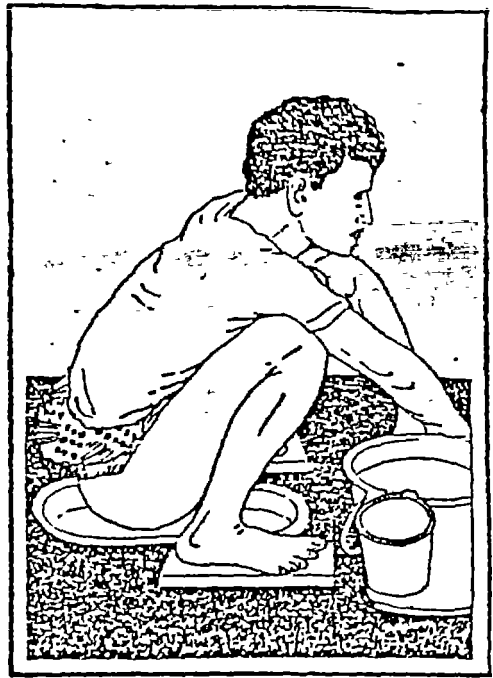
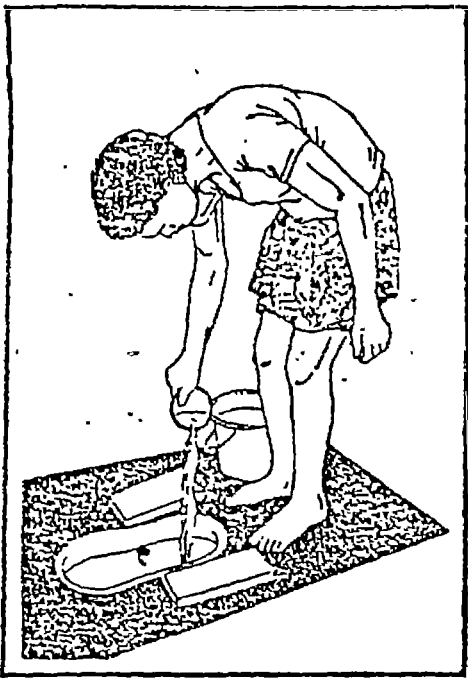
SUGGESTIONS

- For convenience of material transport and reduction of costs, a minimum of 5 beneficiary households could be selected from an area. (whether transported by SEU/Beneficiaries).
- Communal and mutual help to transport material from point of unloading to the required work sites should be solicited.
- Safe distance of latrine from drinking water sources will vary according to the type of soil and conditions. (Refer Appendix A).
- For general soil type (laterite and black soil) an average of 8-10 m is recommended. For loose soil 15 m is the specified distance, and in hard laterite area 3 m.

Coastal and water logged areas face problems with the twin pit technology in that, salinity affects the biodegradation of sludge, and constructing higher superstructures and pits increases costs considerably. An appropriate low cost technology suitable in such areas is yet to be identified.

- Dividing the pit cover slab into two facilitates their easy removal and shifting.
- The junction box slab, if lined with old/used tyre tube material, is more efficient in preventing foul smell and cannot be bored through by ants and other insects, unlike mud plastering.





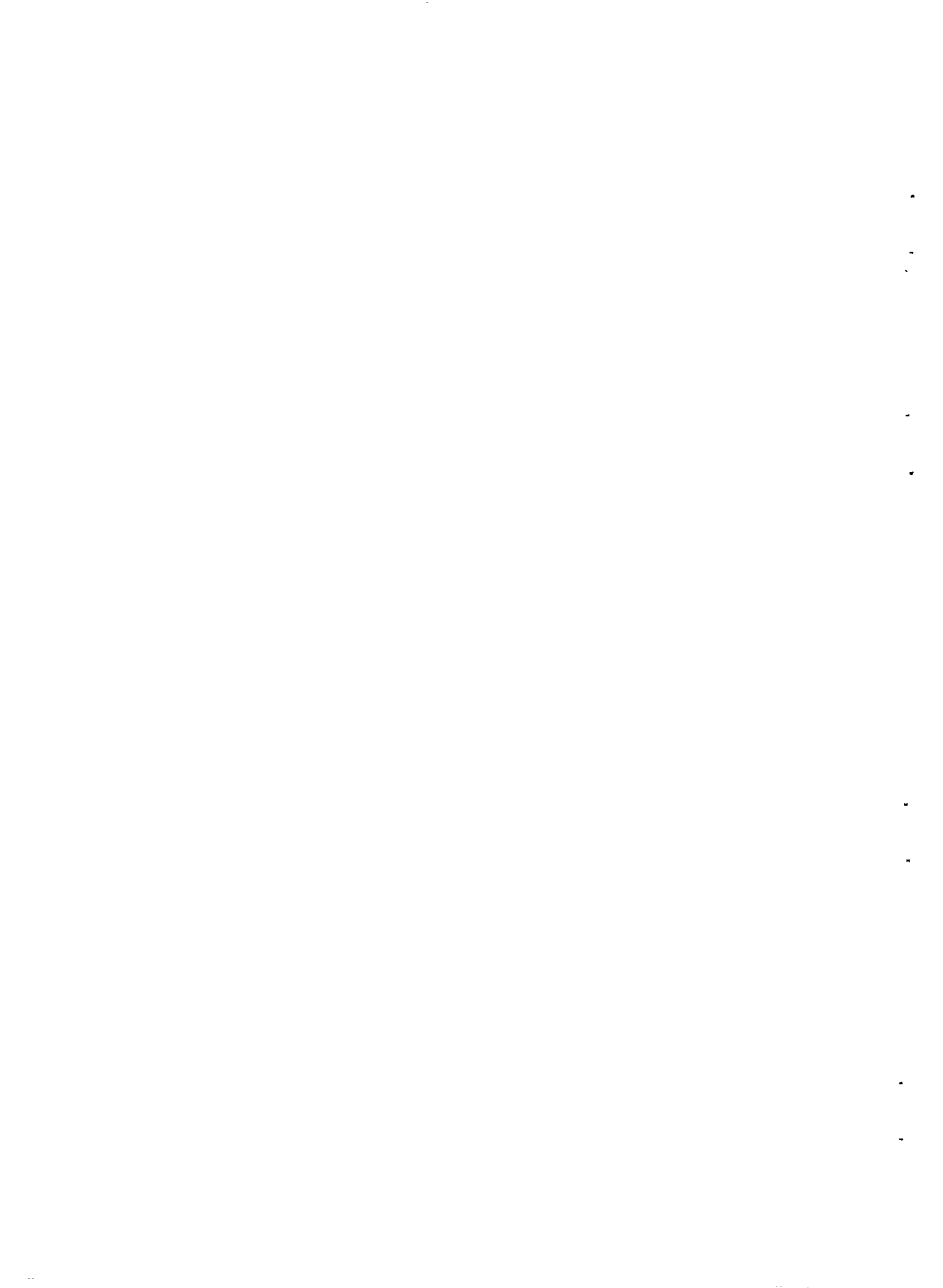
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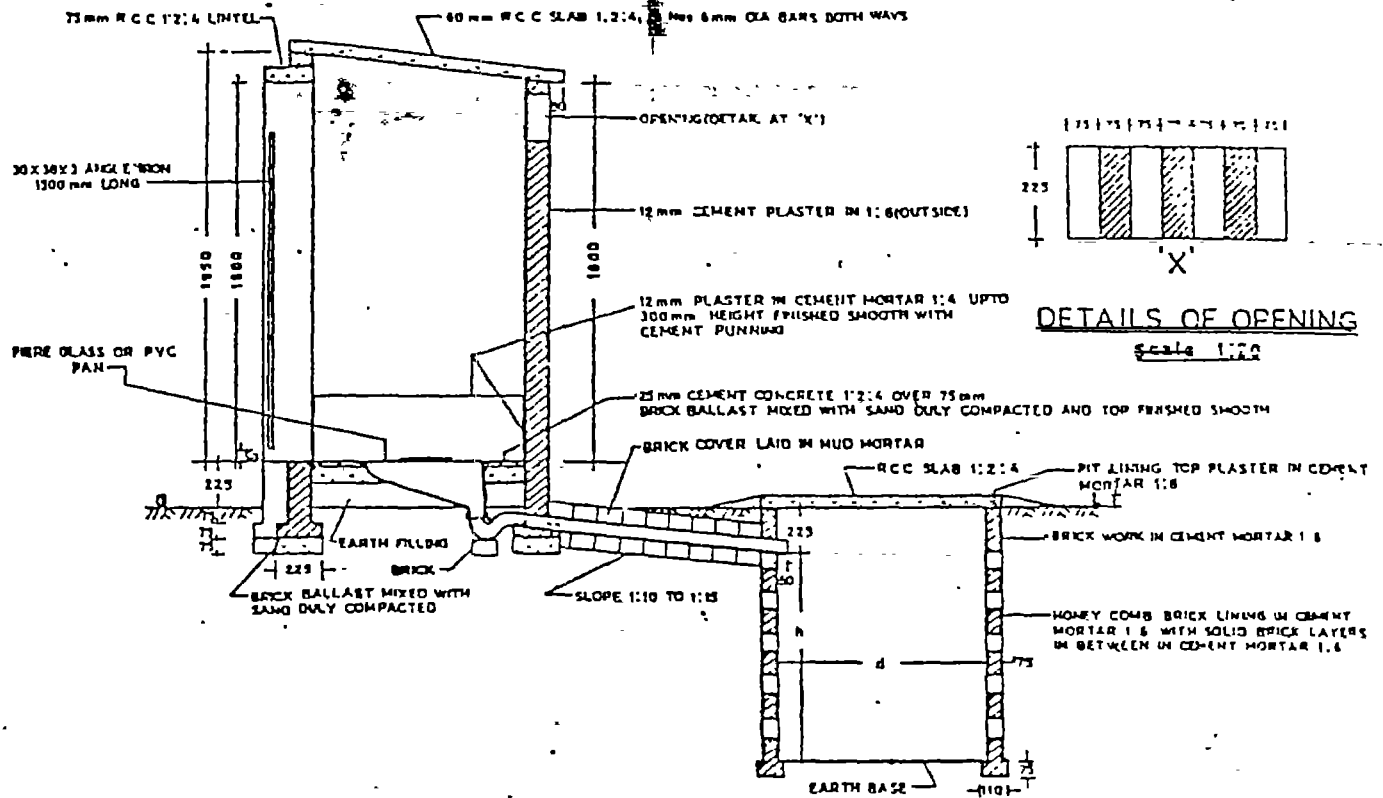
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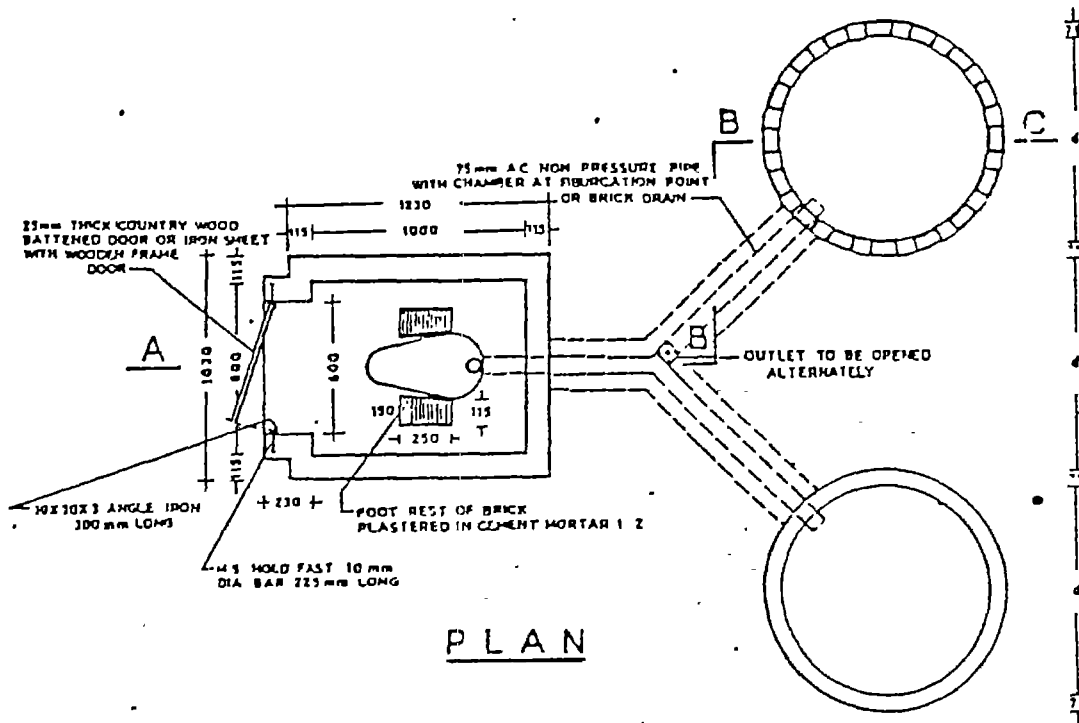
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SECTION ON A-B-C

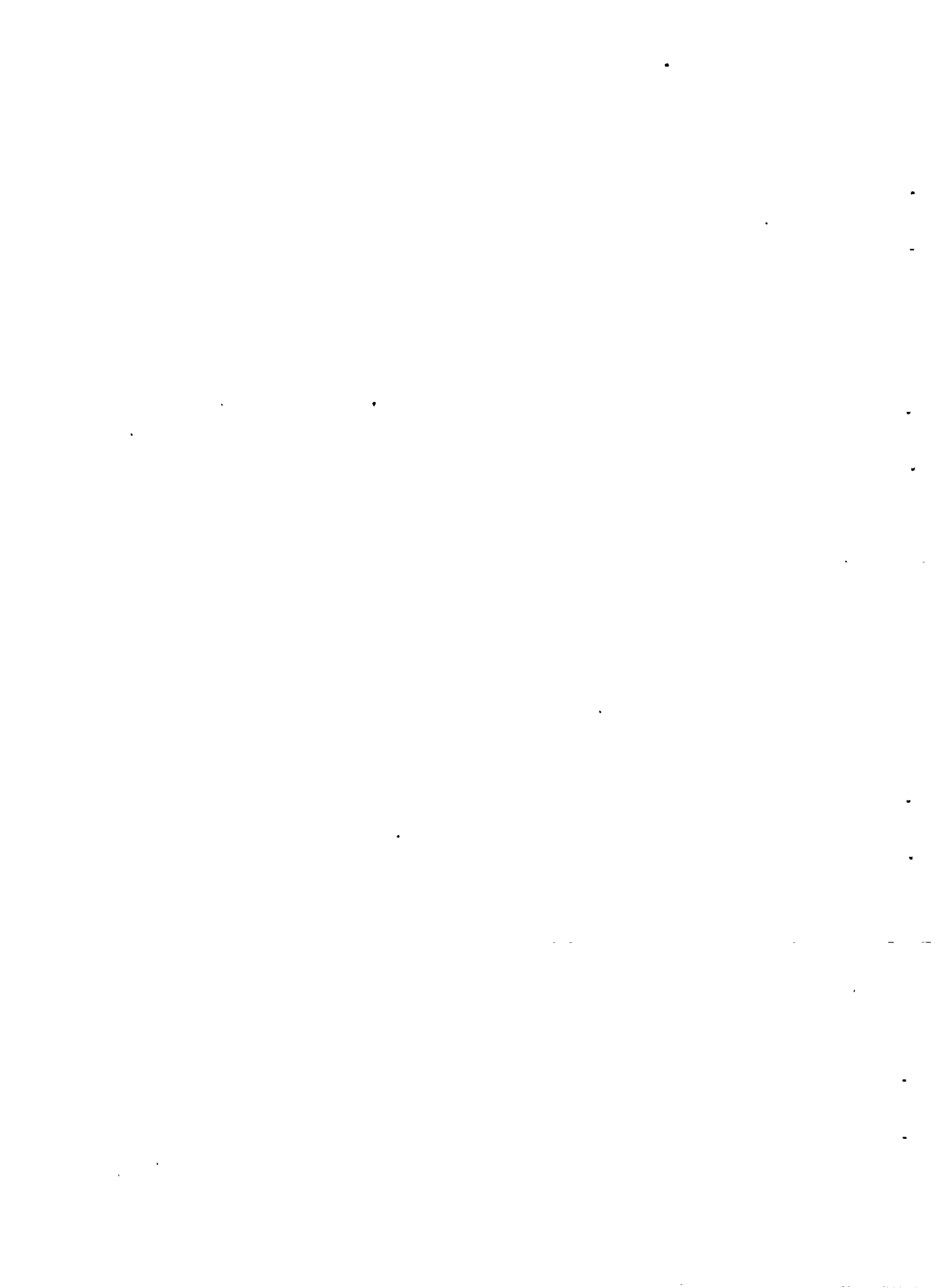


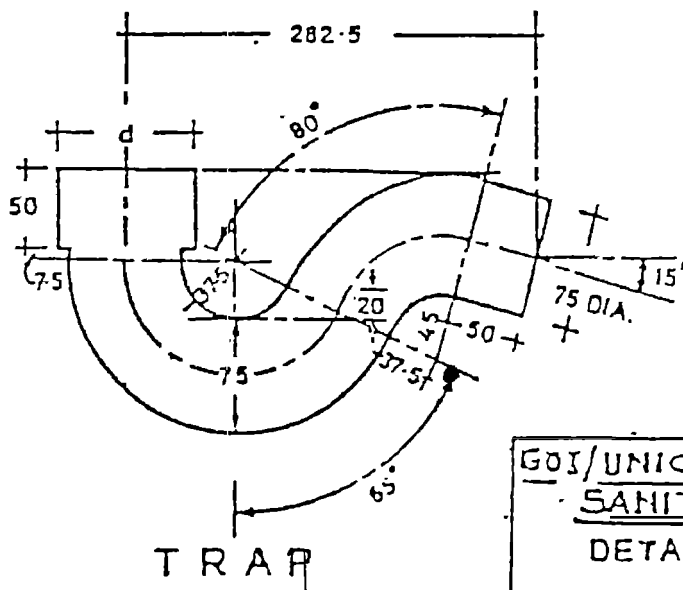
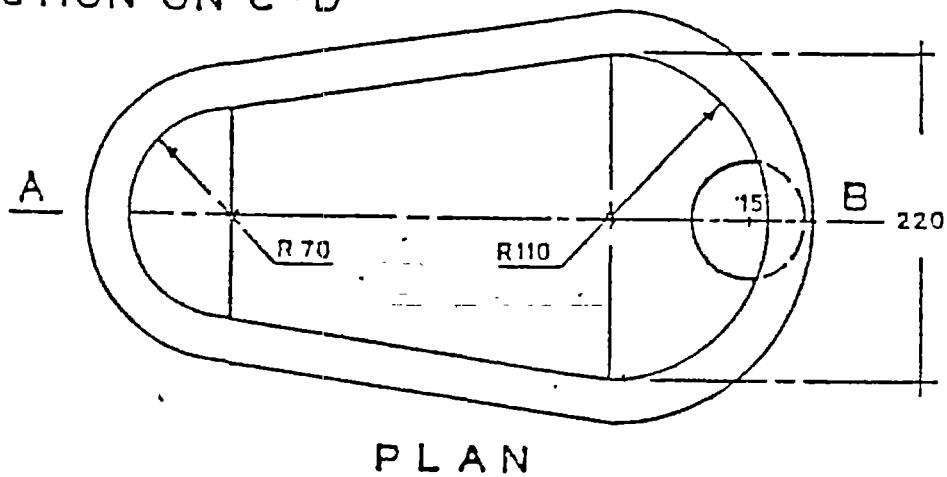
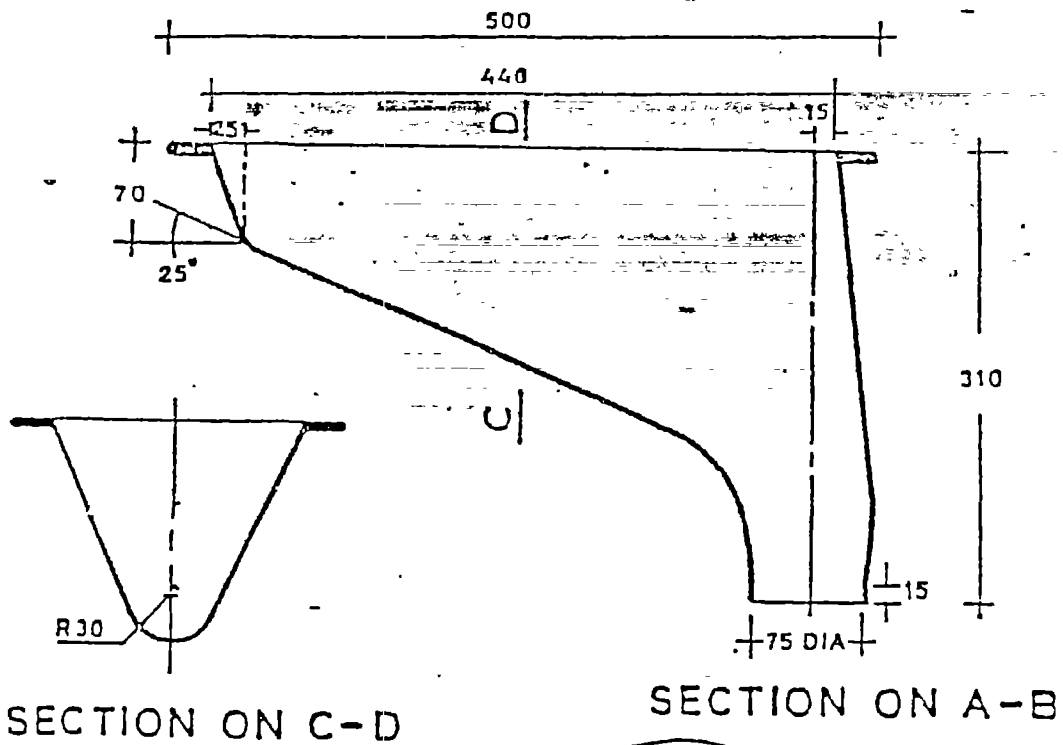
PLAN

NOTE :-
 FOR PRIMARY HEALTH CENTRES AND SCHOOLS ADOPT 19 USER PITS
 AND FOR ANGAWADIS, PANCHAYAT OFFICES AND OTHER INSTITUTIONS
 ADOPT 17 USER PITS

USERS'	d	h	t	NUMBER OF SOLID RINGS (BRICK LAYER) AND HEIGHT OF CENTRE OF RING FROM PIT BOTTOM
18	1000	1000	40	2, 403, 748
17	1230	1100	75	3, 403, 833, 883

UNICEF/UNDP RURAL SANITATION PROJECT
 DESIGN OF WATER-SEAL POUR-FLUSH LATRINE
 FOR INSTITUTIONS
 Scale: 1"=40
 ALL DIMENSIONS IN mm





GOI/UNICEF/UNDP RURAL
 SANITATION PROJECT
 DETAILS OF PAN & TRAP

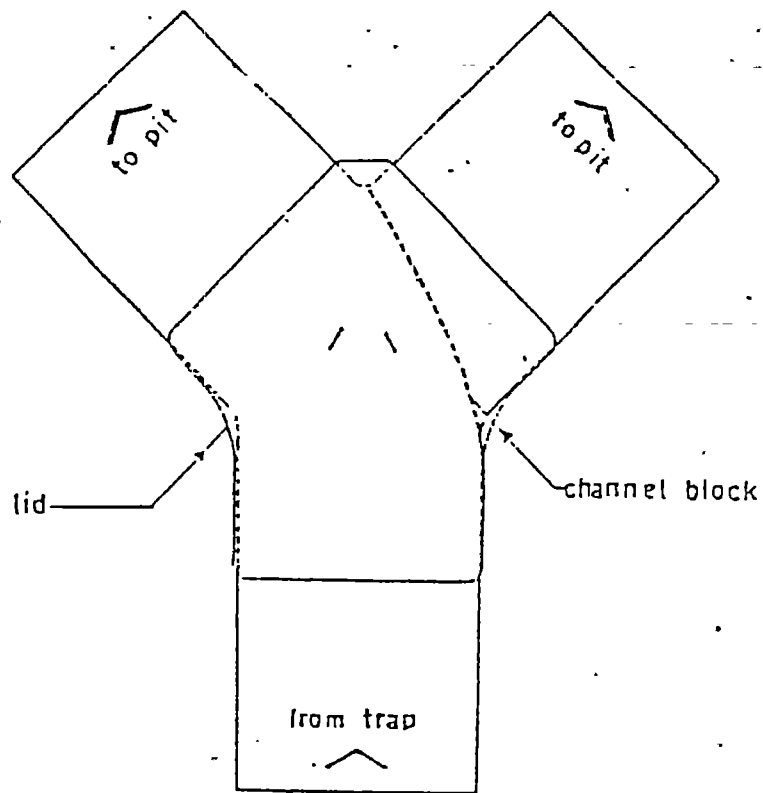
Scale-1:5

ALL DIMENSIONS IN MM

NOTE:
 Size i.e. 'd' of trap to be to suit outlet size of pan.

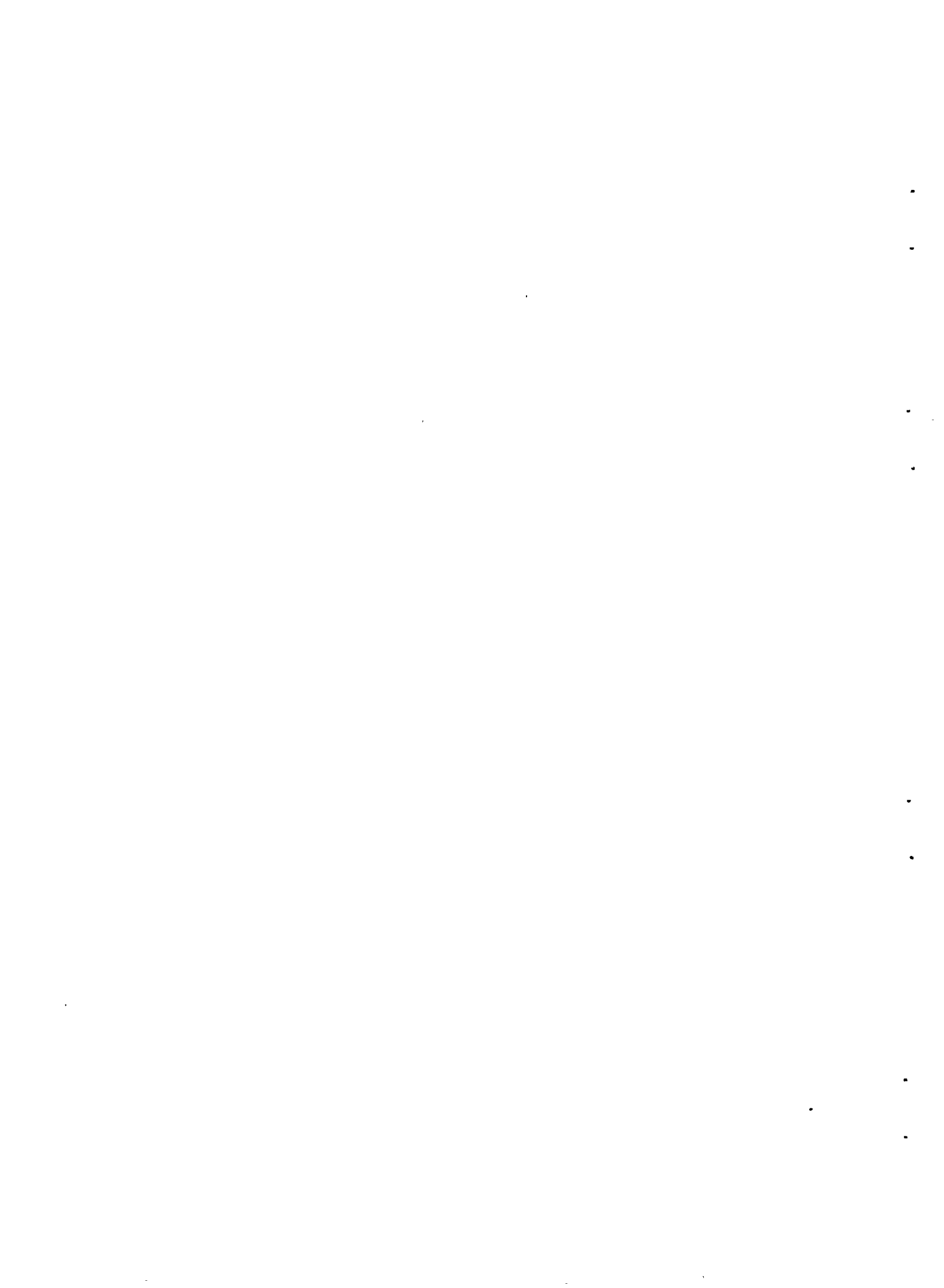


Y-JUNCTION CONNECTING P TRAP TO PIT(S)



Y-JUNCTION PLAN

scale: 1:25



MATERIAL USED - EXPENSES INCURRED FOR A SANITATION UNIT

The material and cost* break-up of latrine units constructed in a loose soil area and laterite area are given below. In the later type of an area, the pits require little or no lining, thus saving on material and construction labour.

Type of Soil: LOOSE SOIL

A. Labour charges

S.No	Labour Description	No. of work days	Amount
1	<u>Pit digging by beneficiary</u>	-	-
2	Laterite Dressing	3	150.00
3	Laterite Mason	3½	172.25
4	Helpers	2½	75.00
5	Concrete (Pits and Junction Box slabs)	1½	60.00
6	Carpenter	1½	37.50
7	Helper	-	-
	Sub Total		<u>494.75</u>

B. Material cost

S.No	Materials	Quantity OR Numbers	Amount
1	Laterite	396 nos	811.80
2	Sand	40 cft	60.00
3	20 mm Ballast stone	8 cft	50.00
4	Cement	3½ bags	210.00
5	Wooden Reeper Roof	23½ ft	30.55
	Door	18 ft	23.40
6	Aluminium Alloy Sheet roof	2.700 kg	62.10
	door	0.800 kg	18.40
7	Fittings (Bolt, Nails etc.)	-	20.00
8	A.C Pipe - 3"	0.69 m	7.20
	A.C Pipe - 3"	3.05	36.60
9	Fibre glass closet and 'P' Trap	1 set	81.00
10	Fibre glass Y-chamber	1 no	70.00
11	M.S Bar	14 kgs	98.00
	Sub Total		<u>1579.05</u>
			<u>494.75</u>
	Grand Total		<u>2073.80</u>

*Consider cost variation from place to place.



Type of Soil: HARD LATERITE

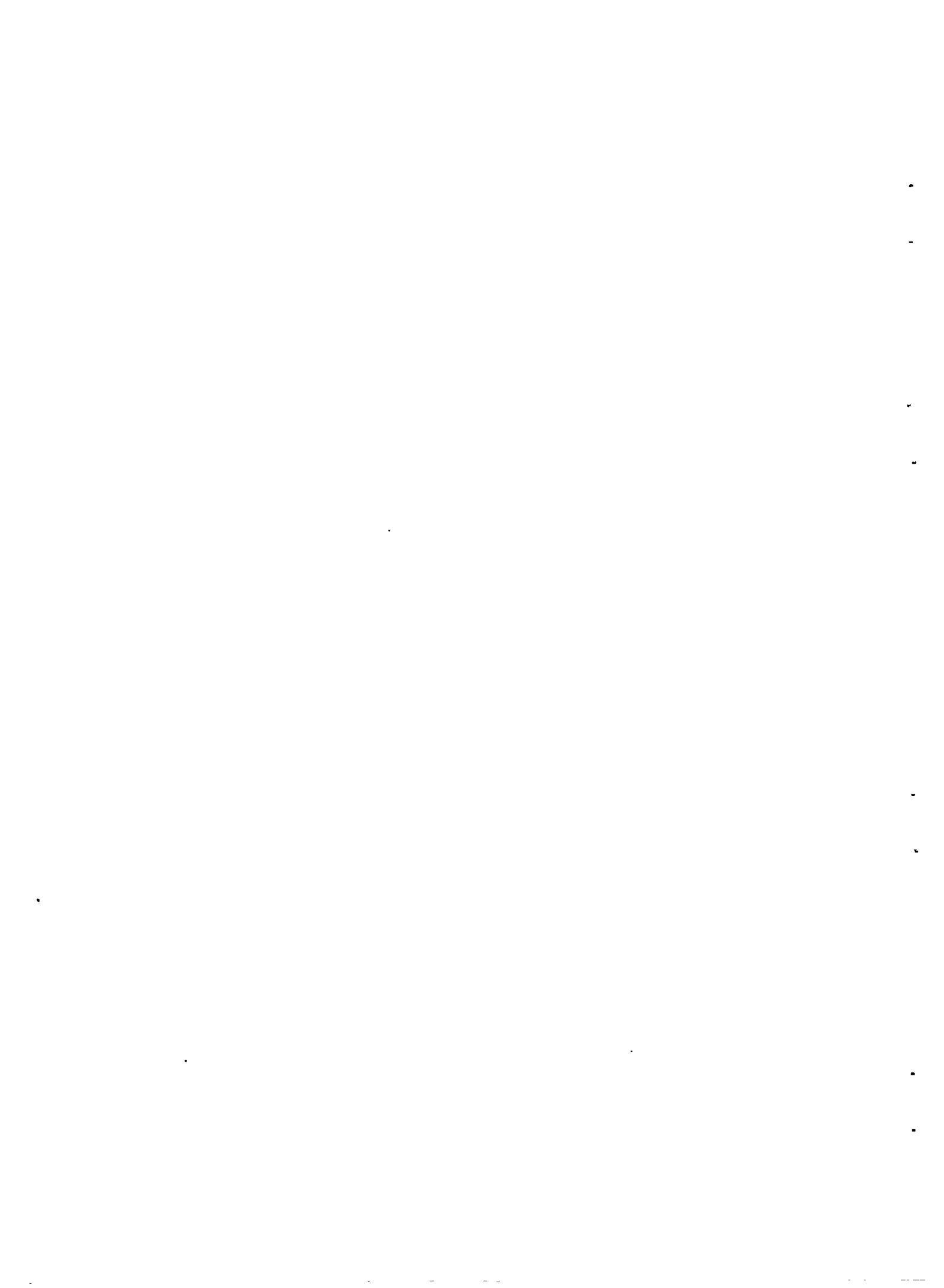
A. Labour Charges

S.No	Labour Description	No. of work days	Amount
1	<u>Pit digging by beneficiary</u>	-	-
2	Laterite dressing	2	100.00
3	Laterite mason	3	159.00
4	Helpers	3	95.00
5	Concrete (Pits & Junction Box Slabs)	1½	60.00
6	Carpenter	6/10	30.00
7	Helper	½	15.00
	Sub Total		<u>459.00</u>

B. Material Cost

S.No	Materials	Quantity OR numbers	Amount
1	Laterite	206 nos	422.30
2	Sand	40 cft	60.00
3	20 mm Ballast stone	8 cft	50.00
4	Cement	3 bags	180.00
5	Wooden Reeper Roof	23½ feet	30.55
	Door	18 feet	23.40
6	Aluminium Alloy Sheet Roof	2.700 kgss	62.10
	Door	0.800 kgs	18.40
7	Fittings (Bolt, nails etc)	-	20.00
8	A.C Pipe - 3"	0.60 M	7.20
	A.C Pipe - 4"	3.70 M	48.10
9	Fibre Glass closet and 'P' trap	1 set	81.00
10	M.S. Bar	14 kgs	98.00
11	Fibre glass Y-chamber	1, no	70.00
	Sub Total		<u>1171.05</u>
	Grand Total		<u>1630.05</u>

Costs and Rates as on 30-4-1988



MATERIAL USED - EXPENSES INCURRED FOR SIX SEATER LOW COST LATRINE

Items	MATERIAL CHARGES		Items of labour	LABOUR CHARGES	
	Quantity	Rs. Ps		Nos	Rs. ps
1 Laterite stone,	940 nos	1927.00	Laterite dressing	8 nos	400.00
2 Sand	1½ load	345.00	Laterite mason	15 nos	795.00
3 20 mm broken stone	15 cft	105.00	Helper	15 nos	549.85
4 M.S 8 mm bar	35 kg	250.70	Concreting	4	150.00
5 Fitting item for 6 piece door	-	62.40	Painting	1	50.00
6 Cement	20 bags	1219.00			
7 A C sheets	8 nos	1300.00		Sub Total	1944.85
8 Stoneware Pipes	39 nos	475.00			
9 Pain and Tellicemn	-	145.00			
10 Footrest	6 sets	192.00			
11 Fibre Glass Pan & 'P' Traps	6 sets	552.00			
12 Fibre Glass Chamber	2 nos	128.00			
13 Steel roof truss rate including all labour charges for fitting	9 kgs	1100.00			
14 PVC pipe, cratings & AC 2" pipe for wash basin & leach pit	-	116.45			
15 Steel door 6	6 nos	1542.00			
Sub Total		9459.55			
			Total cost of this latrine		9459.55
					1944.85
					Rs.11404.40

*This cost is inclusive of a hand wash basin and a soak pit for the same. A plan of this Unit is given in Annexure XI.

Note: Cost of the pit digging is not included since it was undertaken by the school as part of the programme for community participation from the beneficiary.

The pits for these units are dug by the beneficiary institution. There are no cash nor material contribution otherwise required. The willingness and expressed cooperation of the staff, availability of space and water are the main consideration for selection of institutions. Utmost care is taken to see that nearby sources of water are not affected by the construction of latrine.

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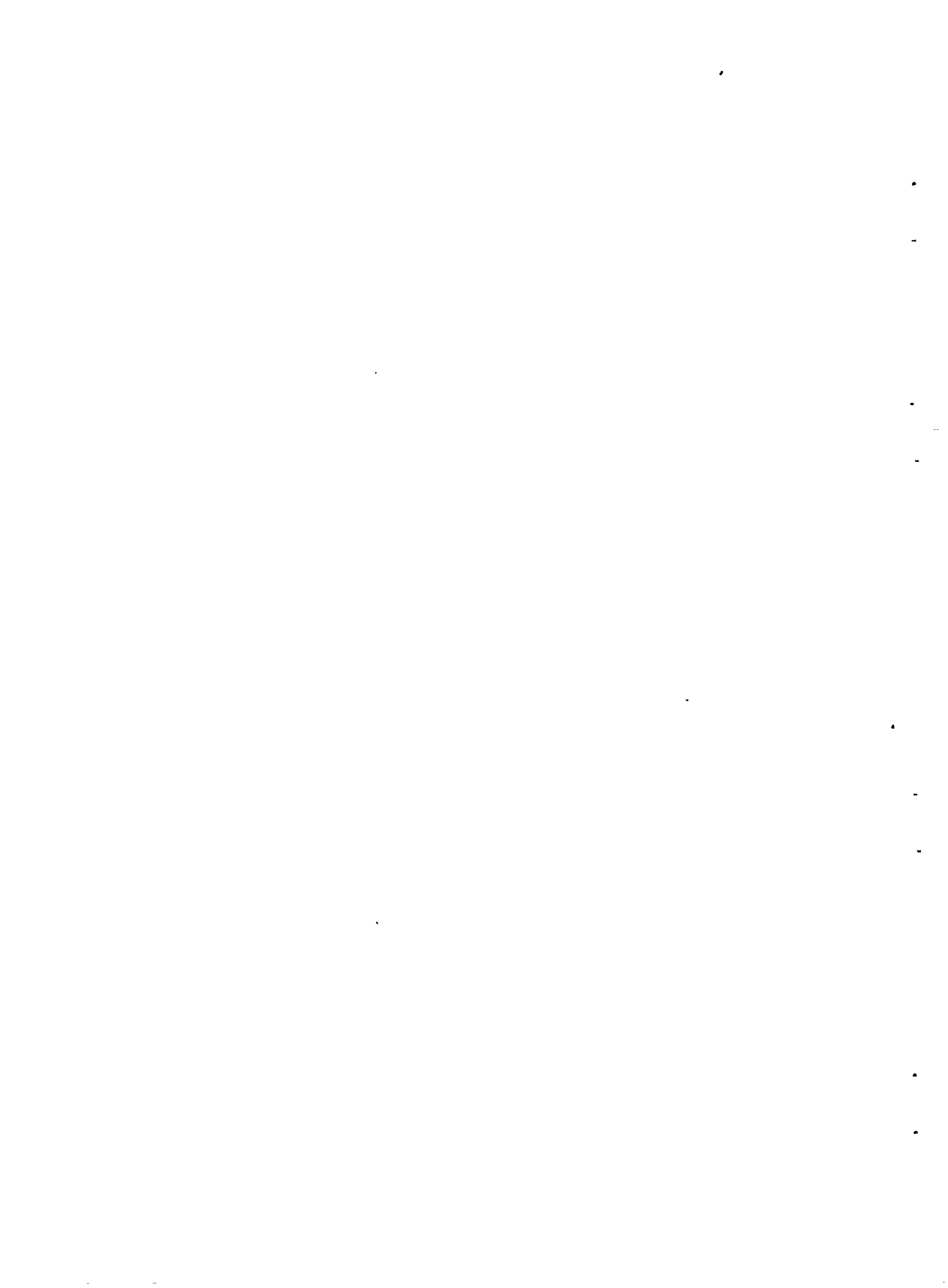
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COST ESTIMATE OF A 9 SEATER LATRINE

Sl. No.	Quantity	Description of Work	No	Unit	Rate	Amount
					Rs.	Rs.
1.	18.00M ³	Earth work excavation in laterite soil		10M ³	220	396
2.	6.50M ³	R.R. Masonary in C.M. 1:8		M ³	235	1,527
3.	13.00M ³	Brick Masonary with C.B. Bricks- 22 cm x 11 cm x 8 cm size with C.M. 1:8 for walls, pits etc.		M ³	500	6,500
4.	2.75M ³	R.C.C. works for roof, slab, pit cover etc. 1:2:4 mix		M ³	1,500	4,125
5.	127.00M ²	Plastering inside & outside walls, under roof slab etc.		10M ²	190	2,413
6.	11.00M ²	Flooring with P.C.C. 1:5:10 finished with C.M. 1:4 with fine finish		M ²	50	550
7.	44.00M ²	Fleshing coat over floors, inside inspection chamber, 3 ft. over walls from floor level etc.		M ²	12	528
8.	9 Nos.	Sanitary fittings, Closet, P-trap etc.		No.	140	1,260
9.	19 M	S.W. Pipes		M	22	418
10.	9 Nos.	R.C.C. Jally grills for ventilator		No..	18	162
11.	127.00M ²	White washing on walls, roofs etc; 2 coats with Royal cem		10M ²	40	508
12.	9.75M ²	Door - Tin sheet on wooden frame(2"x1" size)		M ²	111	1,082
13.	L.S.	Unseen items & supervision charges		L.S.	331	331
						19,800



Cost Estimate for a Toilet-Cum-Bathroom-Cum-Cloakroom
Building

Pit digging	19 x 35	665.00
Laterite dressing	14 x 50	700.00
Pit cover slab concrete	-	110.00
Masonry work including plastering Closet fitting and mosaic glazing tile work-	45½ x 53	2,411.50
Helper	54 x 35	1,890.00
"	2½ x 40	100.00
Plumbing work	3 x 40	120.00
Painting work	3 x 50	150.00
Roof slab sunshade, rack & lintel R.C. concrete	75 cft @ 1200/100 cft	900.00
Lettering work	-	10.00
Carpentary work over watertank	-	50.00
		7,106.50
Labour		7,106.50
Materials		19,339.35
		26,445.85
		26,445.85

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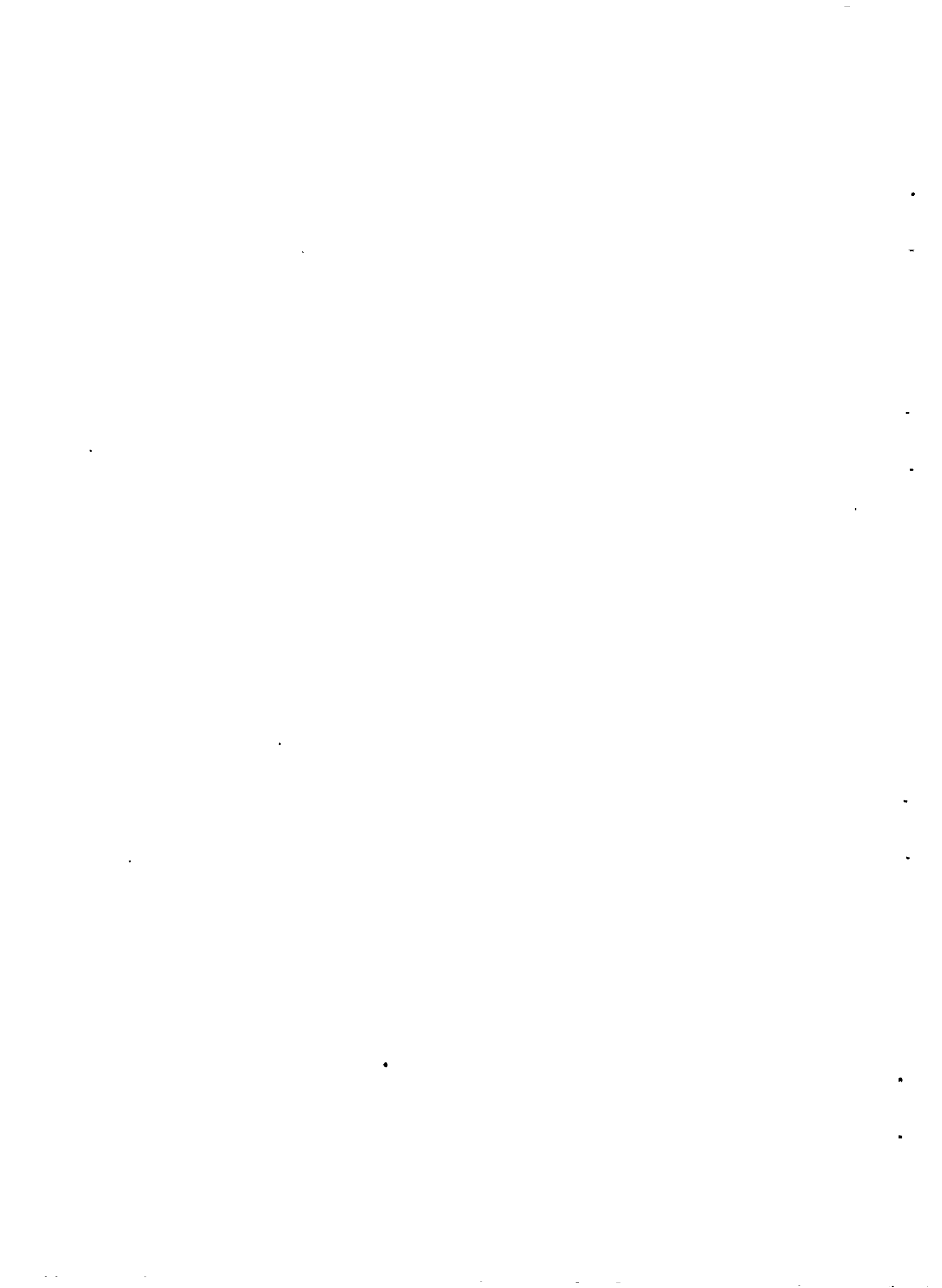
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MATERIALS

1. Laterite stone	1466 x 2.60	3,811.60
2. Sand 4 load	300+285+270+255	1,105.00
3. 20 mm broken stone	120 cft x 6	720.00
4. Bricks	550 nos	487.50
5. Cement 47 bag	(15x60)+(9x79)+	3,382.50
6. Mild steel bar 8 mm & 6 mm	183 kgs	1,448.90
7(a) A.C sheet corrugated & (b) plain	5 x 180 1 x 120	900.00 120.00
8. Steel roof truss & 3 nos of iron door including Cost of materials, fittings & all labour charges	-	2,327.00
9. Wooden door & wooden window rate including cost of all	-	2,500.00
10. Water proof compound Cotton Waste	2 kg x 9 -	18.00 10.00
11. Rent of barrel drum tarpaulin etc. 3 days	-	44.00
12. S.W Pipe	17 nos x 9.55	162.35
13. Plumbing, sanitary, painting items etc. complete	-	1,979.00
Soapstand, 2½ ft ½" pipe & bracket		30.50
14. Wooden reeper 68 feet	68 x 1.00	68.00
15. Aluminium sheet for tank covering	15 nos x 15	225.00
		<hr/> 19,339.35
		=====



COST COMPARISON AND DETAILS

KERALA WATER AUTHORITY

	S.E.U.(SOUTH) QUILON			S.E.U.(CENTRAL) TRICHUR		S.E.U.(NORTH) CALICUT	
Panchayats/Wards covered	Cheriyamad I, II, IV	Kundara I - VII	Anjengo-Yakkom Whole Panchayat	Edathuruthy I - IV	Mala VI - X	Ramanattukara Whole Panchayat	Feroke Whole Panchayat
Number of Units proposed	500	500	500	500	500	1000	1000
Number of Units completed as on 30.6.89	500	210	230	237	350	1041	90
Average cost per unit (Rs.)	1,905	1,810.75	2,146	1,920	1,900	1,818	2,200
Beneficiary Contribution:							
Labour (Pit digging + Unskilled Labour)	350	-	-	150	-	150	150
Cash/Material	150	450	500	350	500	350	370
Materials used:-							
Pan & Trap	Ceramics	Ceramics		Ceramics	Ceramics	Fibre Glass	Ceramics
Junction box	Cement	Cement		Cement	Cement	Prefabricated in Fibre Glass	Prefabricated in Fibre Glass
Pit lining materials	Bricks and concrete rings	Concrete rings	Concrete rings	Bricks	Laterite	Laterite	Laterite
Pit depth	1.4 metre	1.4 metre	1.4 metre	120 cm (0)	120 cm (0)	150 cm	150 cm
Pit diameter	1 meter	1 meter	1 meter	110 cm (0)	110 cm (0)	110 cm	110 cm
Super Structure:-							
Room size	CM CM 90 x 80	CM CM 110 x 90	CM CM 100 x 100	CM CM 80 x 100	CM CM 80 x 100	CM CM 90 x 100	CM CM 90 x 100
Materials used	Bricks	Bricks	Bricks	Bricks	Bricks & Laterite	Laterite	Laterite/Bricks
Door	Tin sheet	Tin sheet	Wood	Tin sheet	Asbestos	Tin sheet	Tin sheet
Roof	Asbestos	R.C.C	R.C.C	R.C.C.filler slab	R.C.C	Tin sheet,Light light roof material	Light roof
Floor	Red Oxide provided	Plain	Plain	Plain	Plain	Red Oxide(optional)	Red Oxide (Optional)
Wall	Inside complete	complete plastering & whitewashed	Inside complete	Inside 2 ft	Inside 2 ft.	Inside complete	Inside complete
Partner agency for construction	PASS	Panchayat	PCO	COSTFORD	Panchayat	S.E.U	Panchayat, NYK,SEU
Partner agency/Department for Health	Health Services, Panchayat, Ward Members, Trainees of Institutes under Health and Social Welfare Departments, ICDS, Nehru Yuvak Kendra, Voluntary Agencies (KSSP, KANFED, NSS, Mahila Samajams, Youth Clubs etc. as and where these are available.						
Education and Monitoring	Nehru Yuvak Kendra, Ward Members (Ward Committees), NSS and Voluntary Agencies.						



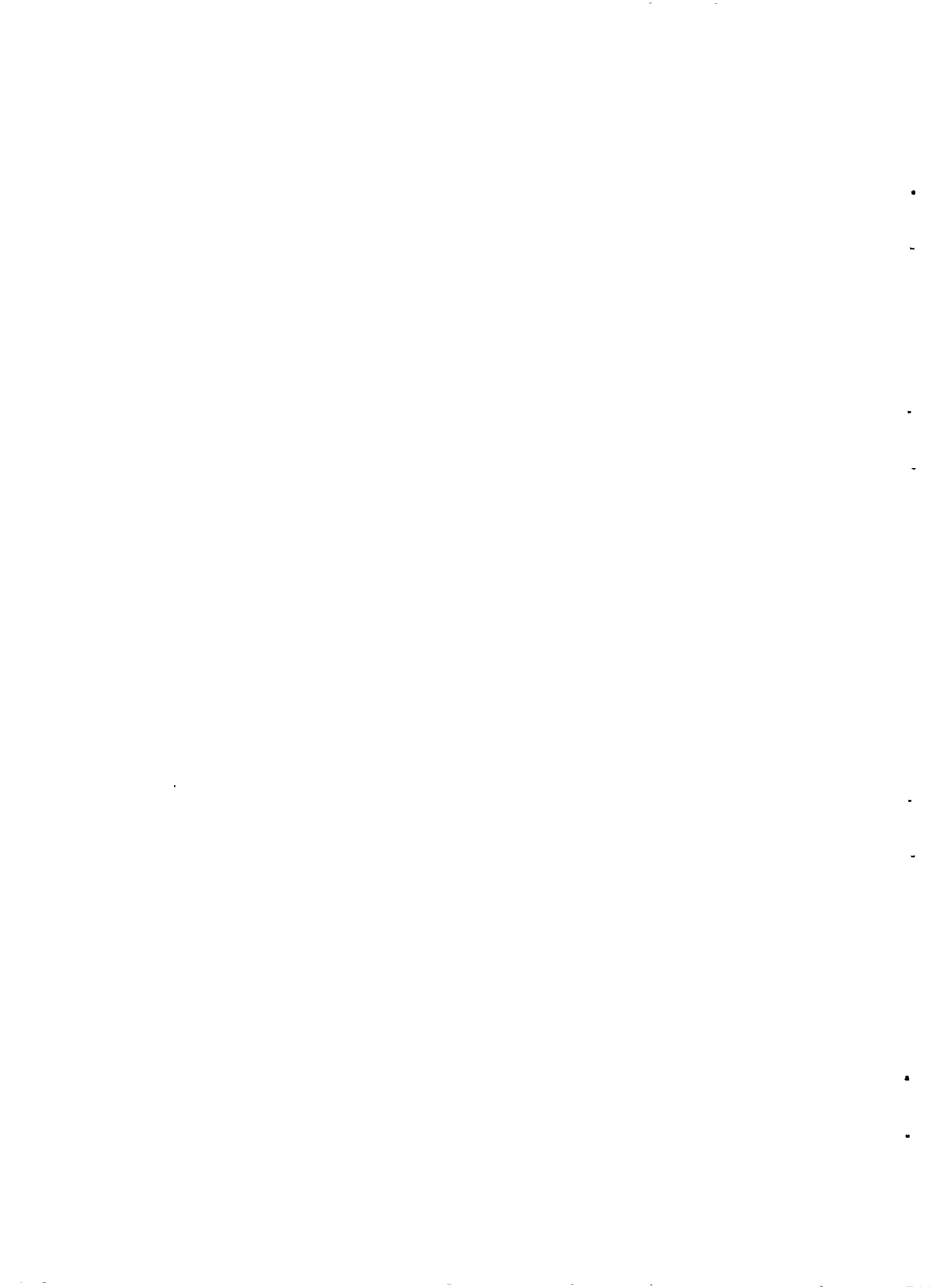
Cost Comparisons of different roofing Material:

Tiles (120 numbers)	301.00)	
	(
Asbestos (2½ sheets)	192.00)	Cost inclusive of
	(support structure
Light Roof Sheet - red (2½/2 sheets)	162.00)	and fixtures
	(
Light Roof Sheet - White (")	126.00)	
	(
Aluminium alloy sheet (2.7 kg)	125.00)	
	(
R.C.C Roof)	150.00 - 200.00
	((4-5 cu.ft
R.C.C. Filler slab)	154.00
	(

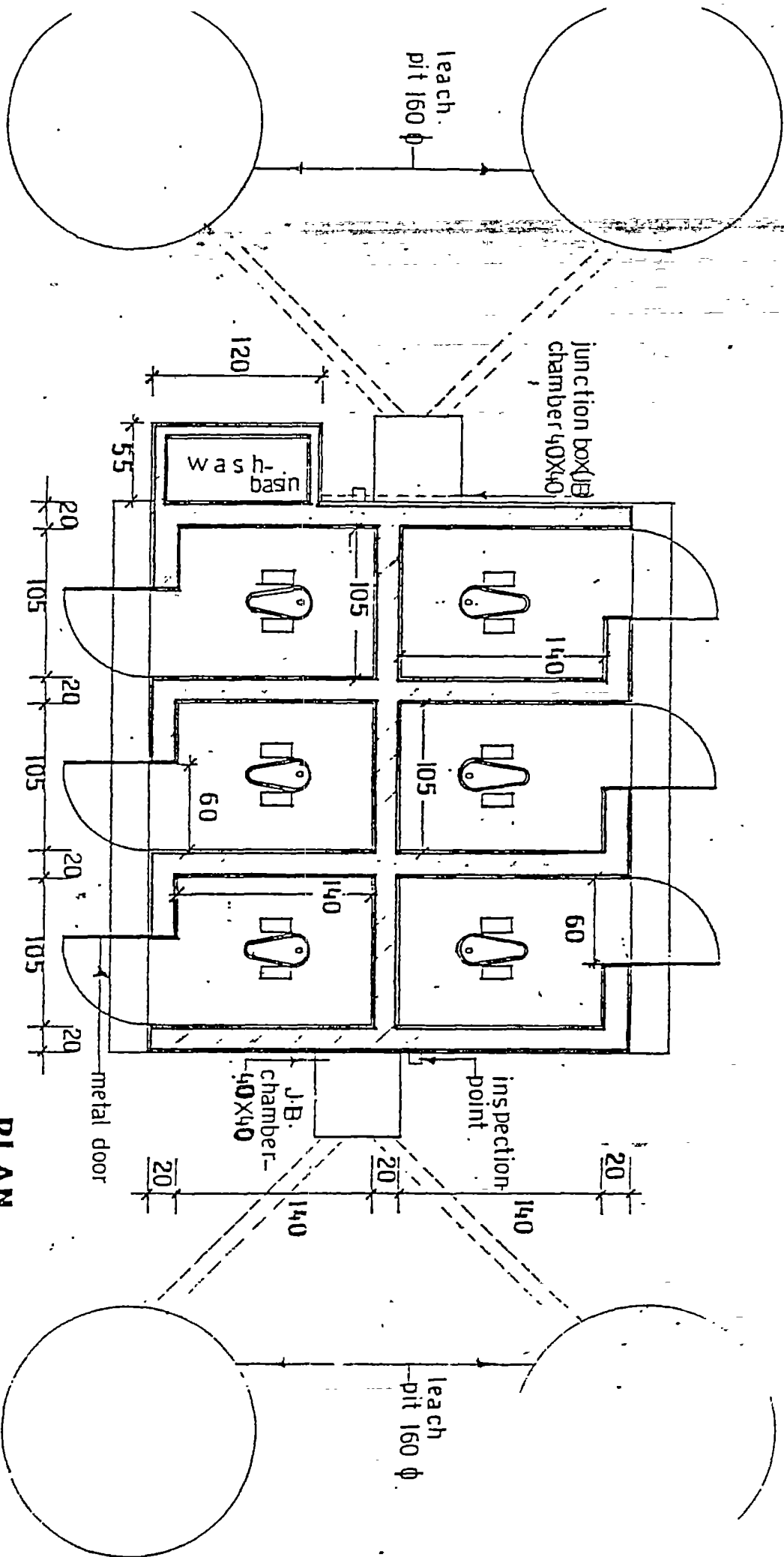
Cost as on 31.12.88.

Materials used for construction:-

Laterite	396 (small size) 260 (big size)
Or	
Bricks	1100 1200
Sand	40 cu.ft
20 mm Ballast stone	8 cu.ft
Cement	3½ - 4 bags
Door:-	
Wooden reeper	18 ft.
Aluminium alloy sheet	0.8 ft.
Asbestos sheet	
Wood	
Roof:	
Wooden reeper for roof support	23½ ft.
Asbestos	1½ sheets
or	
Light roof	2½ sheets
or	
Aluminium alloy sheet	2.7 kg
R.C.C	4 kg. M.S. Bar + 1½ bag cement 10 cu.ft. metal
Fittings (Bolt, Nails etc)	1 set for door and roof ((R.20/-)
A.C pipe - 3"	0.70 m
Stone ware pipe - 4"	5 pieces
Pan and Trap: Fibre Glass/Ceramics	1 set
Junction Box - Fibre Glass	1 set
or	
Junction box in cement	24 bricks, 1/1 bag cement
M.S. Bar	11 kg - 14 kg
3/4" Metal	10 cu.ft



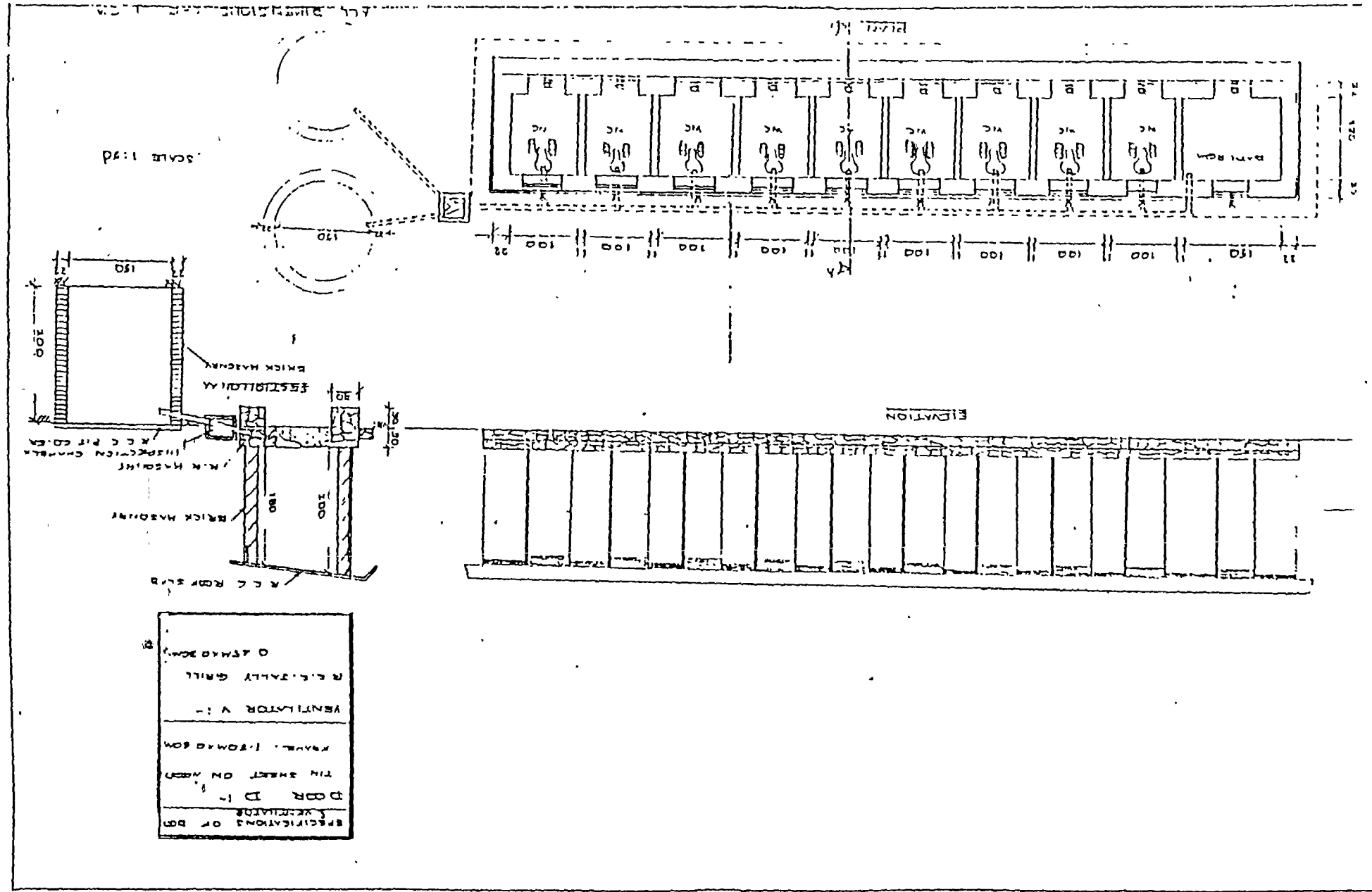
PLAN OF MULTI UNIT LATRINE



PLAN
Scale: 1:40

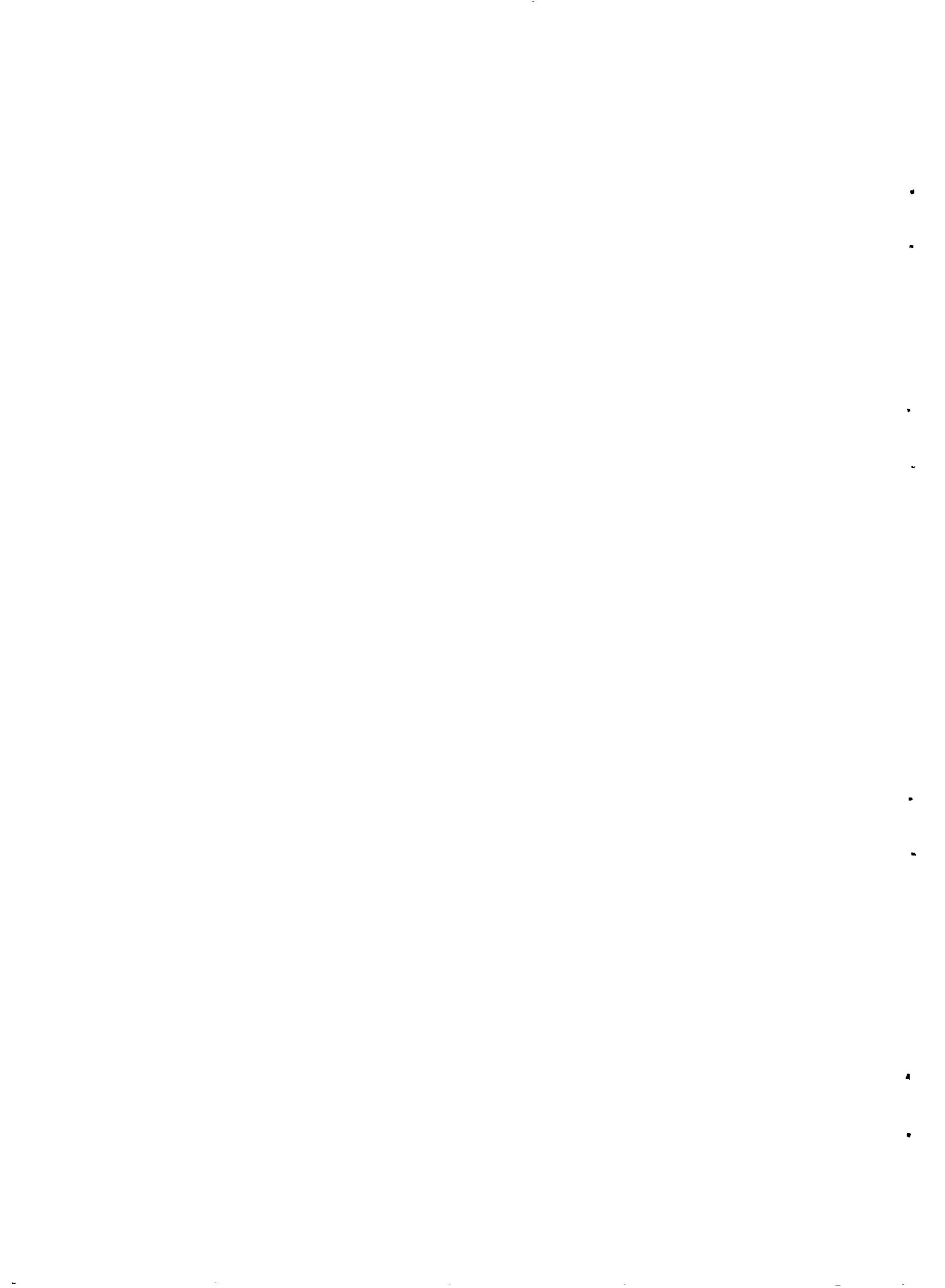


Plan for 9 Seater Latrine

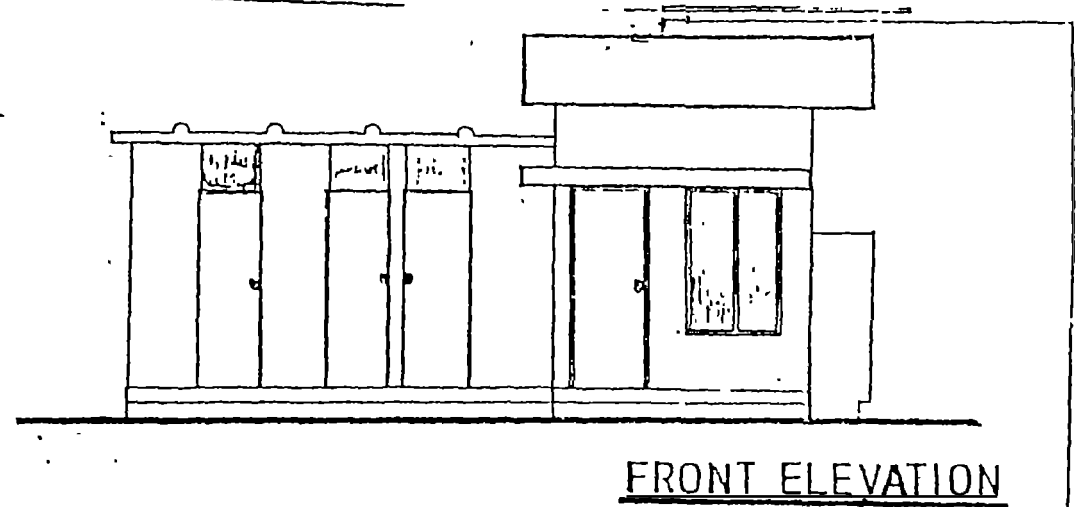


SPECIFICATIONS OF DOOR

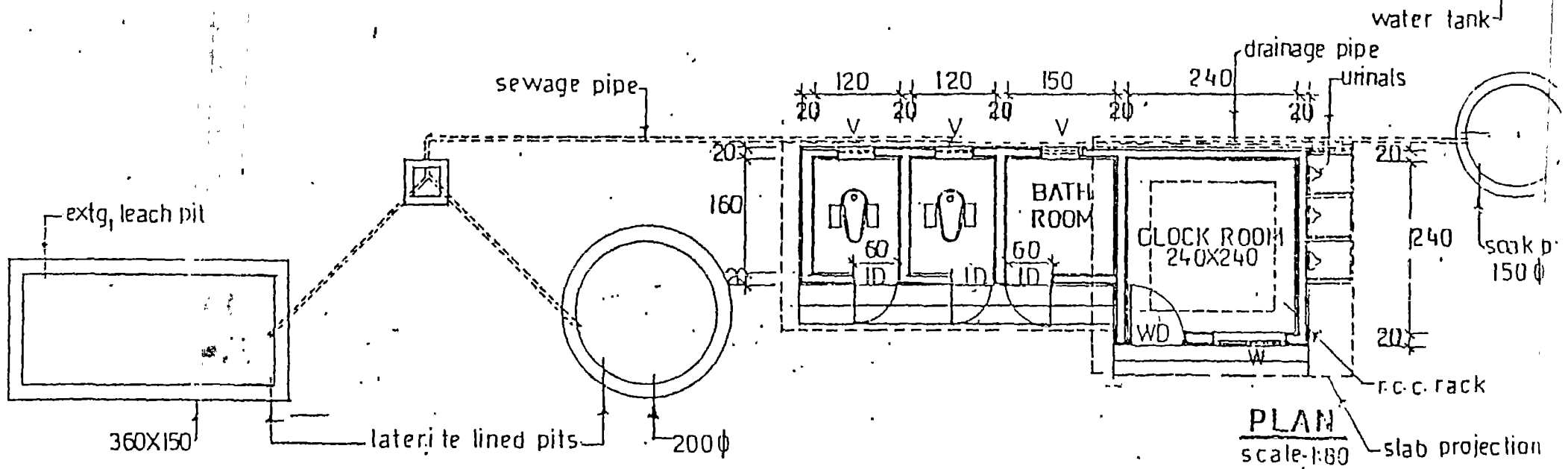
DOOR D 1'
TIN SHEET ON INSIDE
FRAME: TOWARD ROOM
VENTILATOR V 1'
R.C.C. TALLY GRILL
O 45x40x20 CM



PLAN OF TOILET-CUM-CLOAK ROOM BUILDING



FRONT ELEVATION



PLAN
scale: 1:80

Details

- I.D. iron door
- W.D. wood door
- W window
- V ventilator



- 14.1. One of the important aspects of on-site excreta disposal as envisaged in the low cost sanitation programme is pollution of the ground-water and piped water supplies located close to the disposal pits. The fundamental requirement for prevention of pollution of both surface and ground-water is a proper design and construction of the latrines in such a manner that under no circumstances, will there be any water logging around the latrine or ponding of the pit will happen due to overflow of pits contents. A critical review of literature on this aspect of the problem has been prepared recently by IRCWD and was also discussed at the meeting of the International Working Group on Pollution Studies at New Delhi. This* provides valuable guidelines for the implementation of the on-site sanitation programme with minimum risk of pollution of ground-water supplies and distribution systems.
- 14.2. Ground-water pollution by on-site excreta disposal system depends on the nature of occurrence of ground-water. Ground-water occurs in aquifers which are classified as either confined or unconfined.
- 14.4. The unconfined and marginally confined aquifers are the main concern from the point of view of pollution hazard. Here, two situations are met with, viz.; i) where the pit is located entirely in the unsaturated zone; and ii) where the pit is located partially in the unsaturated zone and partly in the saturated zone. The studies carried out in USA, India and elsewhere have shown that in alluvial soil (with predominance of silt mixed with clay and fine sand) where pits are located in the unsaturated zone, the risk of bacterial pollution is minimal provided the bottom of the pit is at least 2 metres above the maximum ground-water level and the hydraulic loading in pits does not exceed 50mm/day. Where the pit extends in the saturated zone, the pollution travel depends mainly on the velocity of ground water. In alluvial soil, the distance of pollution travel is equivalent to about 10 days travel of ground-water. The velocity can be found out for different soil conditions. It was also observed that with the continued usage of the pit, clogging of the soil around the pit takes place resulting in the regression of pollution plume which ultimately stabilises at about 1 metre distance.
- 14.5. These studies clearly indicate that in continuous unsaturated/unconsolidated strata greater than 2 metre depth (with size of soil less than 1mm) beneath the base of the latrine, the risk of ground-water pollution due to faecal contamination would be minimal, provided the hydraulic loading in the pit does not exceed 50mm/day.
- 14.8. Proper information/investigation of hydrogeological conditions of the sites where the pits are to be located are prerequisites for the implementation of the programme in order that the pollution risk to ground-water and water distribution pipes is minimal. Even in unfavourable hydrogeological conditions such as coarse soil, high ground-water velocity and high water table, these systems can be used provided certain modification and precautions

*W. John Lewis, Stephen S.D. Foster, Bohumil S. Drasar, "The Risk of Groundwater pollution by On-Site Sanitation in Developing Countries", a literature review; IRCWD--Report No.01/82.



are taken, such as providing an envelope of fine sand of effective size not more than 0.2mm and a minimum thickness of 500mm all round the pit and the bottom sealed off by any impervious material such as fine clay, puddle clay or polythene sheet. (For sand envelope see drawing at annex-II). These modifications are also applicable where soil beneath the pit is less than 2m to water table. In high water table conditions, the inlet to the pit should be kept at least one metre above the maximum ground-water level. This condition may necessitate raising of the latrine floor.

14.9. In conditions such as rock with fissures, chalk formation, old root channels, pollution can flow to very long distance. These conditions demand careful investigation and necessary modifications of the system or adoption of alternative sanitary systems.

14.11.1. Safe Distance from Drinking Water Sources

14.11.1.1. In dry pits or unsaturated soil conditions, i.e. where the distance between the bottom of the pit and the maximum ground-water level throughout the year is 2m and more:

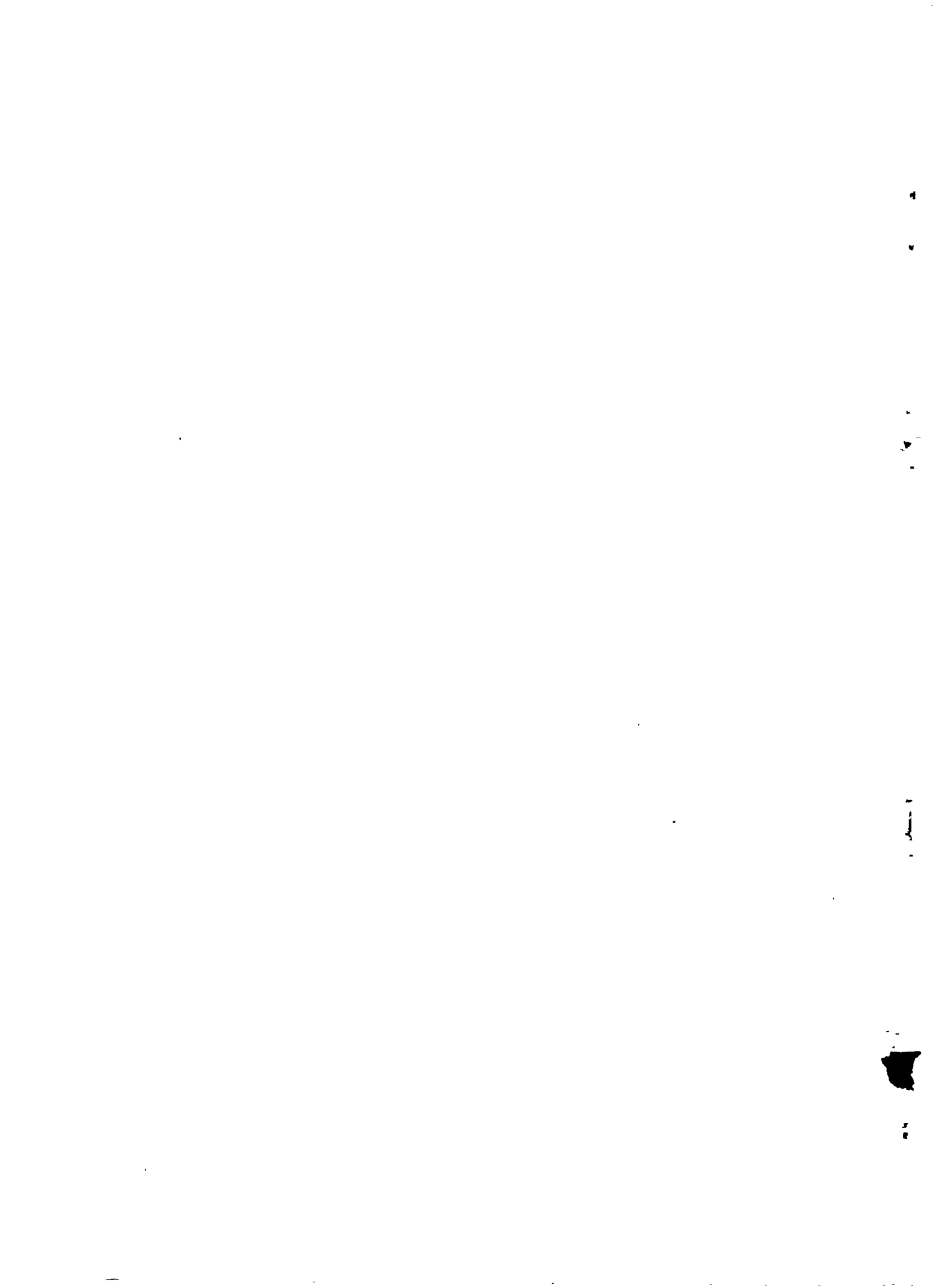
- (a) The pits can be located at minimum distance of 3m from the drinking water sources such as tubewells and dugwells if the effective size (E.S) of the soil is 0.2mm or less; and
- (b) for coarser soils (with E.S. greater than 0.2mm), the same distance can be maintained if the bottom of the pit is sealed off by an impervious material such as puddle clay or plastic sheet and 500mm thick envelope of fine sand of 0.2mm effective size is provided all round the pit.

14.11.1.2. In wet pit or saturated soil conditions i.e. where the distance between the bottom of the pit and the maximum ground-water level during any part of the year is less than 2m:

- (a) The pits can be located at a minimum distance of 10m from the drinking water sources such as tubewells and dugwells, if the E.S. of the soil is 0.2mm or less; and
- (b) For coarser soil (with E.S. more than 0.2mm), minimum distance of 10m can be maintained if the pit is sealed off by an impervious material such as puddle clay or plastic sheet and a 500mm thick envelope of fine sand of 0.2mm effective size is provided all round the pit.

14.11.1.3. The above cases are summarised in the following matrix (table):

Case	Distance between the bottom of pit & the maximum ground-water level	Effective size of the formation soil	Minimum horizontal distance of separation	Modification needed
1.	2m	0.2mm (fine sand, clay & silt)	3m	None
2.	2m	0.2mm (coarse sand)	3m	Provide envelope of sand impermeable pit bottom
3.	2m	0.2mm (coarse sand)	10m	Provide envelope of sand and impermeable pit bottom
4.	2m	0.2mm (fine sand clay & silt)	10m	None



14.11.1.4. In both the cases of paras 14.11.1.1 (b) and 14.11.1.2 (b):

- (a) the sand envelope should be taken at least upto 2m above the possible highest maximum water level and edges chamfered to see that no water stagnates on the top of the sand filling.
- (b) Where the bottom of the pit is submerged below the maximum ground-water level:
 - (i) the top of the pits should be raised above the ground level, if necessary, so that the inlet pipe into the pit is at least 0.75m above the maximum ground-water level;
 - (ii) the sand envelope is taken upto 0.3m above the top of the inlet pipe and confined suitably to exclude any surface drainage including rain water directly entering the sand envelope;
 - (iii) in mound type latrines, 1m high earth filling should be provided for atleast 0.25m beyond the sand envelope with the edges chamfered to lead away the rain or surface water; and
 - (iv) the honey-comb brick work for the pit lining should be substituted by brick work in cement mortar 1:6 with open vertical joints i.e. without mortar.

14.11.1.5 Where sand is not available economically, local soil of effective size of 0.2mm can also be used.

14.11.2. Safe Distance from Water Supply Mains

14.11.2.1. Lateral distance between the leach pit and the water main should be at least 3m provided the water table does not rise during any part of the year above the pit bottom and the inlet of pipe or drain to the leach pit is below the level of water main. If the water table rises above the bottom of the pit, the safe lateral distance should be kept as 8m. If this cannot be achieved, the pipes should be completely encased to the length of atleast 3m on either side of the pit.

14.11.2.2. When the pits are located either under the foot-path or under the road, or the water supply main is within a distance of 3m from pits, the invert of the inlet pipe should be kept at least 1m below the ground level. This would ensure that the liquid level in the pits does not reach the level of the water main as the water mains are generally laid at 0.9m depth.

14.11.2.3. The water pipe should not cut across the pit, but where this is unavoidable, the water pipe should be completely encased for a length of 3m on either side of the pit including the portion across the pit to prevent infiltration or exfiltration.

