

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

**NATIONAL WATER SUPPLY AND DRAINAGE BOARD
MINISTRY OF URBAN DEVELOPMENT, CONSTRUCTION
AND PUBLIC UTILITIES
DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA**

**THE DETAILED DESIGN STUDY
ON
THE PROJECT FOR REDUCTION
OF NON-REVENUE WATER
IN THE GREATER COLOMBO AREA
IN
THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA**

FINAL REPORT

**DESIGN REPORT ON THE CONTRACT
FOR LOW INCOME SETTLEMENT ENVIRONMENTAL IMPROVEMENT**

MARCH 2001

NIHON SUIDO CONSULTANTS CO., LTD.

CURRENCY EQUIVALENTS

(As of August, 2000)

Currency Unit = Sri Lankan Rupee (Rs.)

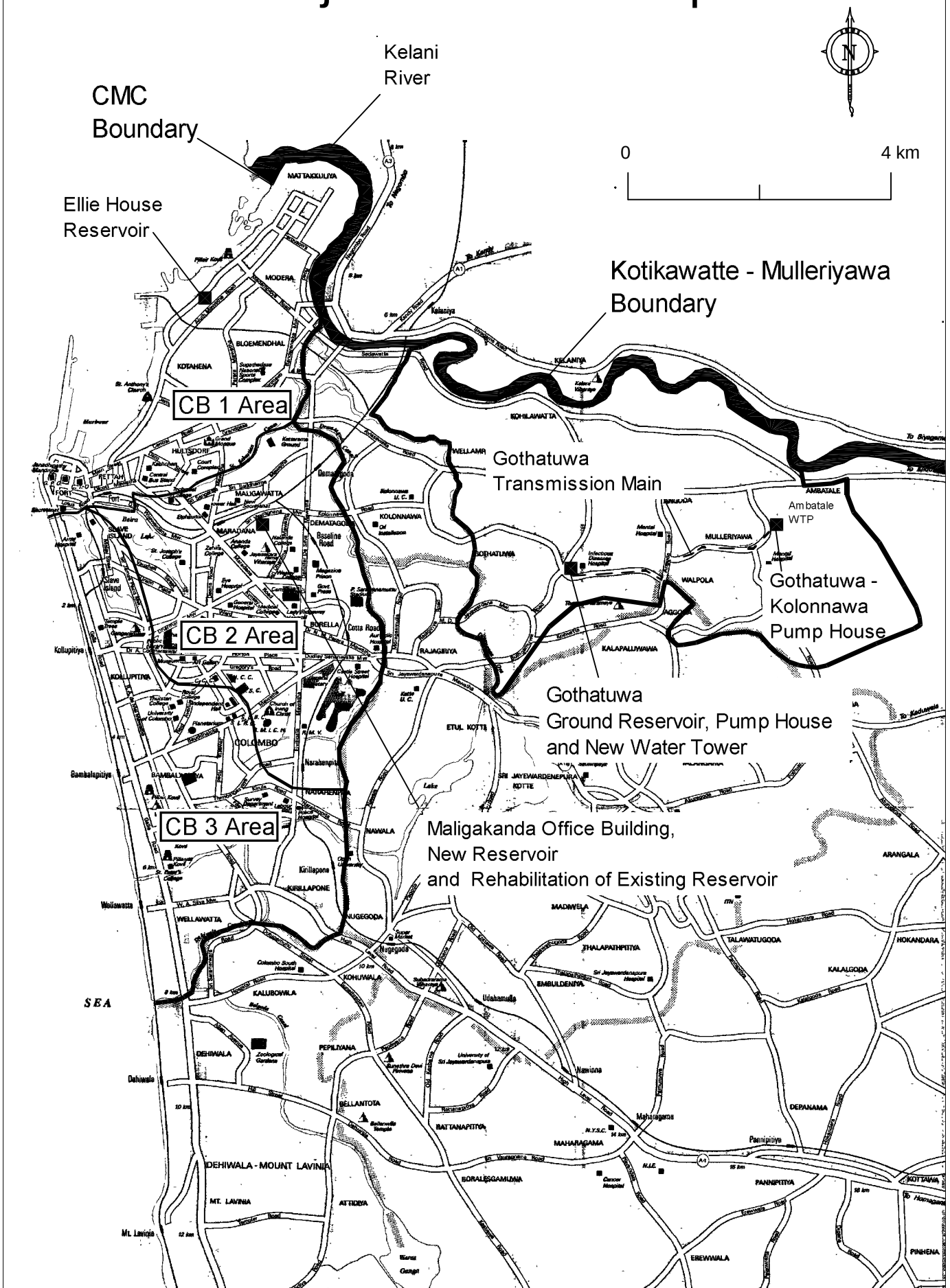
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Project Location Map



**DESIGN REPORT
ON
THE CONTRACT FOR
LOW INCOME SETTLEMENT ENVIRONMENTAL IMPROVEMENT**

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ABBREVIATIONS

ABBREVIATIONS AND TERMINOLOGY

AC	-	Asbestos Cement
AGF	-	Above Ground Floor
AGM	-	Additional General Manager
AS	-	Australian Standards
AWWA	-	American Water Works Association
B/C	-	Benefit Cost Ratio
BOQ	-	Bill of Quantity
BS	-	British Standards
BWL	-	Bottom Water Level
CDC	-	Community Development Council
CEB	-	Ceylon Electricity Board
CI	-	Cast Iron
CMC	-	Colombo Municipal Council
CSPU	-	Clean Settlement Program Unit of the Ministry of Urban Development, Construction and Public Utilities
DG	-	Diesel Engine Generator
DGM	-	Deputy General Manager
DI	-	Ductile Iron
dia.	-	Diameter
E/N	-	Exchange Notes
GC	-	Greater Colombo
GI	-	Galvanized Mild Steel Pipe
GM	-	General Manager
GOJ	-	Government of Japan
GOSL	-	Government of Sri Lanka
GR	-	Ground Reservoir
GST	-	Goods and Services Tax
GWL	-	Ground Water Level
HP	-	Horsepower
HWL	-	High Water Level
I/O	-	Input-output
ICB	-	International Competitive Bidding
ICTAD	-	Institute for Construction Training and Development

IDA	-	International Development Agency
IEE	-	Institution of Electrical Engineers
IRR	-	Internal Rate of Return
ISO	-	International Organization for Standardization
JBIC	-	Japan Bank for International Cooperation
JICA	-	Japan International Cooperation Agency
JST	-	JICA Study Team
LCB	-	Local Competitive Bidding
LDB	-	Lighting Distribution Board
LECO	-	Lanka Electricity Corporation
LI	-	Langelier's Saturation Index
LV	-	Low Voltage
LWL	-	Low Water Level
M/D	-	Minutes of Discussion
MCCB	-	Molded Case Circuit Breaker
MDPE	-	Medium Density Polyethylene
MLD	-	Million Litre per Day
MS	-	Mild Steel
MSB	-	Main Switch Board
MSL	-	Mean Sea Level
MUDCP	-	Ministry of Urban Development, Construction and Public Utilities
NCCSL	-	National Construction Contractor Association
ND, DN	-	Nominal Diameter
NGO	-	Non-government Organization
NHDA	-	National Housing Development Authority
NPV	-	Nett Present Value
NRW	-	Non-revenue Water
NWSDB	-	Notional Water Supply and Drainage Board
O&M	-	Operation & Maintenance
ODA	-	Official Development Assistance
OPC	-	Ordinary Portland Cement
PDB	-	Power Distribution Board
PIU	-	Project Implementation Unit
PLC	-	Programmable Logic Controller
PQ	-	Prequalification
PRDA	-	Provincial Road Development Authority
PS	-	Polis Station
PVC, uPVC	-	(Unplasticized) Polyvinyl Chloride

R/C, RC	-	Reinforced Concrete
RDA	-	Road Development Authority
RSC	-	Regional Support Centre of the National Water Supply and Drainage Board
S/W	-	Scope of Work
SAPROF	-	Special Assistance for Project Formation
SAPS	-	Special Assistance for Project Sustainability
SDB	-	Socket Distribution Board
SLLRDC	-	Sri Lankan Land Reclamation and Development Corporation
SLS	-	Serviceability Limit State
SLT	-	Sri Lanka Telecom
SPSS	-	Statistical Package for Social Sciences
STP	-	Sustainable Township Programme of the Ministry of Urban Development, Construction and Public Utilities
TDH	-	Total Dynamic Head
TG	-	Tenement Garden
TM	-	Transmission Main
TOR	-	Terms of Reference
TP&N, TPN	-	Three Pole and Neutral
TWL	-	Top Water Level
UDA	-	Urban Development Authority
UFW	-	Unaccounted-for Water
ULS	-	Ultimate Limit State
UPDB	-	Utilities Power Distribution Board
VH	-	Valve House
WTP	-	Water Treatment Plant
XLPE	-	Cross-linked Polyethylene Insulated Vinyl Sheath

UNITS

A, amp, Amp	-	Ampere
°C	-	Celsius
cm	-	Centimetre
d	-	Day
dB	-	Decibel
h, hr, Hr	-	Hour
ha	-	Hectare
Hz	-	Hertz

kg	-	Kilogram
km	-	kilometre
kN	-	kilonewton
kVA	-	Kilovolt-ampere
kW	-	Kilowatt
L, l, ltr	-	Litre
lpcd, lcd	-	Liter per Capita per Day
m, M	-	Metre, Million
m ² , sqm	-	Square Metre
m ³ , cum	-	Cubic Metre
mg	-	Milligram
MG	-	Million Imperial Gallon
min	-	Minutes
mm	-	Millimetre
mm ² , sqmm	-	Square Millimetre
mph	-	Mile per Hour
N	-	Newton
pH	-	Potential of Hydrogen
ppm	-	Parts per Million
psi	-	Pounds per Square Inch
Rs.	-	Sri Lankan Rupee
s, sec	-	Second
V	-	Volt
W	-	Watt

1. BACKGROUND

1.1 Number of Tenement Gardens in CMC Area

Various studies and press reports quote conflicting figures as to the number of tenement gardens in CMC area. The SAPS study (Feb.1998) reported that there are 1,289 tenement gardens in CMC area, and that the total population living in these gardens is approximately 300,000, comprising nearly 40% of the total population in CMC area. Although the number of households in each garden varies from one place to another ranging from several households to hundreds of households, the average number of households in each garden is estimated in the SAPS report as 43 with an average number of inhabitants being 221 per tenement garden.

Agencies such as MUDCP, NWSDB, CMC and UDA have been aware of environmental problems in tenement gardens and have developed a phased improvement program. The Clean Settlement Program Unit (CSPU) of MUDCP along with a development program was formulated under the financial assistance from IDA. The program has the following options depending on the existing conditions of tenement gardens.

- Option 1 (On-site Re-housing): Relocate inhabitants to a locality place by providing multi storeyed apartments. The land evacuated will be sold to commercial developers. The difference between the construction cost of apartment buildings and the price of land sold will be borne by developers.
- Option 2 (Off-site Re-housing) : Relocate inhabitants to off-site or resettle them elsewhere. The cost will be borne by the government.
- Option 3 (On-site Upgrading) : This is applicable only for non-congested gardens where basic amenities can be provided under existing conditions. All the cost shall be borne by the beneficiaries.

Accordingly, any water supply improvement program in tenement gardens needs to be planned and implemented in close coordination with relevant government agencies to avoid duplication of efforts and resources.

However, given the limitation of financial resources and other associated constraints, it seems too optimistic to take that all the inhabitants of nearly 300,000 in tenement gardens could be relocated within a short timeframe. It can be assumed that a large number of tenement gardens will continue to exist for many years to come.

1.2 NRW Situation in Tenement Gardens

Most of the inhabitants living in tenement gardens obtain water through standposts, bathing taps and toilet taps. Illegal connections are common although some legal connections also do exist. The SAPS report (Feb.1998) estimated that the average daily per capita water consumption in tenement gardens is 178 lcd. The actual per capita consumption however appears to be even higher than this as some gardens use dug wells for bathing and washing purposes. The standposts are generally in poor condition, many having been tampered with, particularly in low-pressure areas, and leakage of water is both obvious and serious. The residents seem not to care about damage or wastage, a major factor probably being that the supply is free.

The SAPS report also indicated that the total water consumption in tenement gardens in CMC is approximately 50,700 m³/day, constituting 19% of NRW in CMC area.

The per capita consumption in the rest of CMC area is only 124 lcd. Therefore, the consumption in excess of 178 lcd in tenement gardens is extremely high given the level of living standards. For example, most of the residents in tenement gardens use common toilets, which are either of a pit latrine type or of a pour-flush type, consuming less water than flush toilets. This suggests that there is considerable loss of water in tenement gardens through squanderage and leakage.

Historically, government institutions or the owners of gardens have been providing water in tenement gardens through standposts, bathing taps and toilet taps at no cost to the residents.

2. NWSDB INITIATIVES FOR IMPROVEMENT

2.1 Current Initiatives of NWSDB

NWSDB is currently implementing water supply improvements in low income settlements. The NWSDB policy is to provide subsidized individual household connections settlement by settlement, and to remove the standposts. However, whilst the drinking and bathing taps can be removed, it is not possible to disconnect the toilet taps, which must remain for basic health reasons until such times as individual sanitation facilities are available to all. In 1999, NWSDB worked in 45 tenement gardens, completing 28. In this improvement, communities excavate

and backfill pipe trenches for water mains within tenement garden as well as for service connection pipes. NWSDB supply and lay the distribution system within the gardens and provide individual service connections at a subsidized rate of Rs.4,000 per connection.

The target for the year 2000 is to disconnect 300 standposts and provide individual connections in 100 tenement gardens. NWSDB work closely with local politicians to identify suitable locations. The program is implemented in such tenement gardens where all the households are willing to obtain individual service connections and accept the removal of all standposts, bathing taps and toilet taps. However, one tap is left usually for every row of toilets at the request of the community.

The improvement works recently completed by NRW Unit of NWSDB are shown in Table 2.1.

Table 2.1 Improvement works recently completed by NWSDB

No.	Name of Tenement Garden	Disconnected			Individual Connections
		S.P	B.T	T.T	
1	Swaranapara stage 2	8	0		52
2	Kalipullawatta	1	6		80
3	161 watta Kollupitiya	3	2		15
4	397 watta Alvitigalawatta	2	2		15
5	765/378 Bodiraja Mawatha	1	0		14
6	Halgaswatta	2	0		10
7	Kelaniya Uswatta	3	0		120
8	Moderawatta (149, 157 watta)	1	3		34
9	Kirulapura	6	0		380
10	Poorwarama Mawatha	1	0		11
11	Siddharatapura	2	0		12
12	Swarana Road stage 2	8	0		87
13	Samagiwatta, Nawala, N'hempita	4	0		73
14	Ambagaswatta	1	2		22
15	95 watta Modera	1	2		16
16	66 watta Modera	1	1		05
17	737 watta Modera	4	2		32
18	310 watta Torrington	4	2		10
19	257 watta Torrington	2	0		42
20	377 watta Torrington	2	0		30
21	Mel watta N'hempita	2	4		67

22	De Mel watta Grandpass	1	0		480
23	Nelson Lane 39 watta	3	3		74
24	Dabare Mawatha T21 watta	5	0		18
25	Colambage Mawatha	3	0		25
26	Abeyrama Mawatha	2	2		37
27	Nagaswatta	7	0		160
Total		80	31		1,921

Average 68 houses per garden.

The initiatives for almost all these improvements basically came from politicians. They include Chief Minister, other ministers and area organizers of various political parties. There are only few improvements that were taken up under the initiatives of NWSDB or communities.

2.2 Problems Being Encountered

According to NWSDB, a majority of households in tenement gardens are willing to obtain a legitimate individual service connection by paying a subsidized connection fee of Rs.4,000 and subsequent monthly bills. However, some households are still reluctant to do so because of certain reasons as follows:

- Inability to pay individual connection fee, monthly bills, or both
- Tenants not permitted by landowners

Others are not willing to take a legitimate individual service connection simply because they have already had an illegal connection at their homes.

Generally poor drainage and sanitation facilities and the absence of proper access are the other factors that also hamper the current initiatives of NWSDB.

NWSDB has also found it difficult to implement this improvement in low pressure areas, as a reasonable supply cannot be guaranteed even if individual service connections are provided.

3. RECOMMENDATION ON IMPLEMENTATION OF CONTRACT

3.1 Description of Contract

Under this contract, it is planned that water supply improvement will be made in approximately 30 tenement gardens in CB1 area. The contract also includes any necessary laying of reinforcement mains outside tenement gardens in order to ensure adequate water supply once individual service connections have been provided.

Service connections will be provided at a concession rate of Rs.4,000 per connection, provided that communities will carry out excavation and backfilling necessary for the laying of main lines within the communities and for installation of service connection pipes. For the formulation of a consensus among communities on having individual service connection and for their participation during the construction stage, it is advised that NWSDB use non-governmental organizations (NGO's) specialized in this field.

The proposed improvement will consist of:

- Improve water supply conditions in the tenement garden, if necessary by providing additional taps or main line extensions.
- Lay distribution pipes within the tenement garden.
- Provide individual service connections.
- Leave a tap at each public toilet.
- Disconnect all other standposts, bathing taps and toilet taps.

3.2 Selection of Tenement Gardens for Improvement

Initially, all the tenement gardens in CB1 area need to be screened with the following criteria.

- Community is not identified for immediate resettlement by other agencies
- A majority of the people in the community is willing to obtain individual service connections. They are capable of paying a subsidized connection fee of Rs.4,000 and also willing to carry out excavation and backfilling work.
- Introduction of more water through service connections will not result in a significant deterioration of the environment in the community.
- Existing system pressure is sufficient to ensure an adequate supply through individual service connections. If the system pressure is low, the possibility of improving the pressure by laying reinforcement mains should be explored.

- Adequate space is available between houses for installation and maintenance of distribution pipes.
- Water meters can be installed properly so that meter readers can take monthly readings without difficulties.

3.3 Preparation of Designs and Cost Estimates

Tenement gardens that pass the above screening should be forwarded to the design stage. The design stage should consist of:

- Identify available water supply sources such as the nearest water main.
- Confirm water pressure and quantity available at the sources. If insufficient, identify measures to improve the supply.
- Identify the number of new service connections to be installed and toilet taps need to be remained.
- Assess water demand.
- Design internal and external reticulation systems using NWSDB design guidelines.
- Prepare drawings, junction details, etc.
- Prepare cost estimates

3.4 Implementation Plan of Contract

The proposed implementation plan of the contract is schematically shown in Fig 3.1.



4. WORKS AND MATERIALS TO BE REQUIRED

4.1 Methodologies Used for Estimate

The study team has collected the road layouts of 21 gardens in the CMC area. All of these gardens have already been provided with internal distribution systems and individual service connections by NWSDB. Details of the distribution systems in these gardens were collected and analyzed by the study team. Table 4.1 shows the summary of the details obtained from the surveys conducted by the study team. Layouts of all the 21 tenement gardens are shown in Annex 1.

The SAPS report estimated that the average member of inhabitants in one garden is 221; the average number of households per garden is 43; and the average family size is 5 persons per household. Extrapolating this, the number of households to be provided with individual service connections under this contract is estimated to be approximately 1,300. On the other hand, the NRW Unit of NWSDB installed 1,921 service connections in 27 gardens as shown in Table 2.1. This implies that there will be approximately 2,130 individual service connections in 30 tenement gardens to be improved under this contract.

The study team has also conducted its own surveys in all of the 21 gardens mentioned above and found that the total number of households in these gardens is 1,045. This suggested that approximately 1,500 individual service connections would be required in 30 tenement gardens to be improved under this contract. Assuming the average family size of 5 persons, the total number of beneficiaries is estimated to be approximately 7,500.

The works and materials actually required by NWSDB for providing 945 service connections in the 21 tenement gardens were examined and details are shown in Table 4.1. And, on this basis, the works and materials to be required for providing approximately 1,500 service connections in 30 tenement gardens under this contract have been estimated as shown in Table 4.2.

As can be seen in Table 2.1, the number of standposts and bathing taps disconnected by NWSDB were 80 and 31 respectively. This implies that the number of disconnections to be required in 30 tenement gardens would be 86 for standposts and 33 for bathing taps respectively. These standposts and bathing taps need to be disconnected at their off-take points on the distribution mains in order to prevent possible illegal connections in the future.

The works and materials required for this contract are determined based on the above estimates. As this contract is to be awarded on a unit price contract basis in that all materials will be

supplied to the contractor by NWSDB, the estimated quantities of work will be used only for the purpose of tender evaluation.

TABLE 4.1 DETAILS OF EXISTING AND PROPOSED DISTRIBUTION SYSTEMS IN TENEMENT GARDENS

No.	Name of low income settlement	Drainage system Existing/Proposed	Front Road	No. of households		Size of main	Size of Bulk meter	Size of Tapping	Total length of pipes(m)						No. of Public Toilets	No. of Public Bath Places	No. of Stand Posts	Remarks
				Total	With service connection				4"	3"	2"	1 1/2"	1 1/4"	1"				
1	352 Garden	Existing	Aluth Mawatha Road	94	94	4"	3"	3"	145.5	244.5					1			*Low water pressure
2	654 Garden	Existing	Aluth Mawatha Road	17	17	4"												*Every house in this scheme have taken service connection from main road
3	737 Garden	Existing	Aluth Mawatha Road	88	88	4"	2"	2"	104.5					158.0	1	1	4	*Low water pressure
4	Concrete walla (270 Garden)	Existing	Baseline Road	30	5	6"	2"	2"	214.9				36.3	257.0	1	1	2	*2 1/2" line to 5 houses *1" line to stand post
5	601 Garden	Proposed	Bloemendaal Road	12	0	3"									1			*12m long 1/2" pipe to public toilet
6	21 M Garden	Existing	E.O.Dabare Kkugatha	171	168	4"	4"	4"	134.0	606.0								
7	397 Garden	Existing	Emilgala Mawatha	13	13	3"	2"	2"	61.5						1			*3 houses have individual connections
8	Sang Watta	Existing	Kimandala Mawatha	92	87	4"	1/2"	1/2"						164.3	1	1	1	
9	Nugagahapura	Existing	Lionel Edisinghe Mawatha	66	66	4"	3"	3"	244.5	75.9								
10	Adin Pura (86 Garden)	Existing	Kaliawatta Road	19	8	4"	1/2"	1/2"							1	1	1	*73m long 1/2" pipe to stand post and public toilet *Low water pressure
11	79 Garden	Existing	Mahinda Dharma Mawatha	25	25	3"	2"	2"	101.4									
12	Bokkuwatta	Existing	Modara Street	121	121	4"	2"	4"	133.5	276.0			186.4		1	1	2	
13	95 Garden	Existing	Modara Street	28	28	4"	2"	2"		166.5								
14	86 Garden	Existing	Modara Street	9	9	4"	2"	2"		47.6					1			
15	151 Garden	Existing	Nagalagam Street	12	2	4"	1/2"	1/2"							1	1	1	*30m long pipes to stand post, public bath and public toilet
16	175/177 Gardens	Existing	Nagalagam Street	39	10	4"	2" & 3/4"	2" & 3/4"		86.0					1	1	2	*2" pipes to 10 houses *71 m long 3/4" pipes to stand post
17	Pichchamalawatta (44 Garden)	Existing	Nawata Road	18	18	4"	3"	3"	79.5	60.0								
18	361 Garden	Existing	Serpentine Road	23	7	4"	3/4"	3/4"									2	*123m long 3/4" pipes to stand posts *5 houses have service connection from Kuruppu Road
19	85 Garden	Existing	Swarana Road	58	58	4"	4"	4"	160.6									
20	257/377 Gardens	Existing	Torinton Avenue	72	72	4"	2"	2"		289.6				111.2				
21	23 Garden	Existing	Vedakke Road	49	48	6"	3"	3"	112.8	209.4					2	1	1	*2 houses have individual connections
Total				1057	945				448	673	2446	158	237	711	13	5	16	

Table 4.2 Works and materials to be required for providing 1,500 service connections in 30 tenement gardens under this contract

Description	Materials actually needed for providing 945 service connections in 21 tenement gardens	Materials to be required for providing 1500 service connections in 30 tenement gardens under this contract
<u>PVC Pipes</u>		
4" PVC	448 m	711 m
3" PVC	673 m	1,068 m
2" PVC	2,446 m	3,883 m
1½" PVC	158 m	251 m
1¼" PVC	237 m	376 m
1" PVC	711 m	1,128 m
Total	4,673 m	7,417 m
<u>Size of Mains for Tapping</u>		
3"	3	4
4"	15	22
6"	3	4
Total	21 locations	30 locations
<u>Tees for Main Tapping</u>		
<u>Size of Tees</u>		
3" x 3"		2
3" x 2"		2
4" x 4"		5
4" x 3"		5
4" x 2"		12
6" x 4"		2
6" x 3"		1
6" x 2"		1
Total		30 locations

4.2 Availability of Materials

The following materials are not available locally and have to be imported for the implementation of the contract.

- Tapping Tees (Viking Johnson EasiTee or similar) that allow 3" and 4" flanged branched connections to be made to an existing main, whilst it remains pressurized. These tapping tees can be used in conjunction with all standard drilling machines and practices.
- Tapping clamps with 2" female threaded outlet (Viking Johnson EasiTap or similar) that provide a quick, cost effective method of installing a 2" ferrule connection, whilst under operating pressure. These Tapping clamps can be used with standard drilling equipment such as Talbot No.3 Tapping machine.
- Double flanged Gate Valves 2", 3" and 4" - NP 16 Type and key operated.
- Flanged Adapters (Viking Johnson MaxiDaptor or similar) 2", 3" and 4".
- Gunmetal Standard ferrule with 2" female threaded outlet.
- Surface boxes with 150 x 150 clear opening.

The following materials are locally available.

- All PVC pipes and fittings
- Materials to cast stand pipes
- Material to cast water meter chambers (NWSDB wish to install water meters aboveground, not in chambers. Chambers will be provided only in low-pressure areas).

5. RECOMMENDATIONS ON TENDERING

5.1 LCB with Preliminary Screening

This contract will be awarded to local contractors of ICTAD, rated M9 and above through local competitive biddings (LCB).

The eligible bidders will be selected through a pre-qualification process under the standard pre-qualification procedures currently adopted by NWSDB.

5.2 Requirements for Qualification of Contractor

The Contractor shall satisfy the following requirements.

- ICTAD Registration in the field of water supply & drainage construction work in Grade M9 and above.
- Member of the National Construction Contractor Association (NCCSL) for the works under the water supply sector project.
- Experience in having undertaken and successfully completed works of comparable nature, magnitude and cost and should have a minimum experience of five years in execution of such works.
- Financial capacity and technical capability inclusive of equipment and staff to be made available for the contract.

5.3 Bill of Quantities

Bill of Quantities shown below has been prepared by the study team for the purpose of tender evaluation. Payments to the contractor should be determined based on the work actually performed by the contractor and the unit rates quoted him in his tender.

Item	Description	Unit	Rate Rs.	Qty	Amount Rs.
	<u>Note:</u> 1.All pipe materials, fittings, specials, jointing materials etc., will be provided by NWSDB. 2.Service connections will be installed by NWSDB. 3.Tapping of mains, Excavation and backfilling of trenches and pipe laying up to the Tenement Gardens boundary will be done by the Contractor. 4.Laying of pipes and service connections within the Tenement Garden (excavation & backfilling of trenches within the Tenement Garden will be done by the Community. 5.The reinstatement cost of road surfaces, walkways, fences etc., will be paid by the applicants for the connections to the respective authorities. 6.Disconnection of stand posts, bath taps &				

Item	Description	Unit	Rate Rs.	Qty	Amount Rs.
	public toilet taps will be done by NWSDB. 7. Contractors rate shall include the cost of providing temporary barricades, warning signs and warning lights, controlling of traffic, posting of watchers as directed by the Engineer. The rate shall also include the cost of acquiring the necessary excavation and security permits. 8. Trade names of pipe materials are given only to indicate the type of materials that NWSDB wish to have in the work. Contractor's rate shall include the installation of similar materials of other makes.				
1.0	<u>Cutting and removal of asphalt/premix/tar layer from the road surface manually or using equipment as specified.</u> The thickness of the layer:				
1.1	Not exceeding 150mm	m ³		600	
1.2	Exceeding 150mm but not exceeding 300mm	m ³		300	
1.3	Exceeding 300mm	m ³		150	
2.0	<u>Excavation and backfilling at distribution main tapping</u> Excavation at the distribution main to expose the pipe, continue excavation below the invert level of the pipe for making the tapping and backfilling of the same in layers of 150mm thick to achieve 95% compaction.				

Item	Description	Unit	Rate Rs.	Qty	Amount Rs.
	Rate to include for shoring, dewatering, disposal of unsuitable or excessively wet soil from the site as directed, import of soil or sand (to be paid separately) as directed, preparation of the excavated surface suitable for vehicular traffic and cleaning the working area of all debris, excavated material etc., to the satisfaction of the Engineer.				
2.1	For depths up to 1m	m ³		100	
2.2	For depths exceeding 1m but not exceeding 2m.	m ³		50	
2.3	Temporary reinstatement of road surface with a layer of ABC mixture 150mm thick.	m ³		180	
3.0	<u>Excavation and backfilling of pipe trench up to the tenement garden boundary</u> Excavation of pipe trench for widths as specified in standard drawings and backfilling of the same in layers of 150mm thick to achieve 90% compaction. Rate to include shoring, dewatering, preparation of trench bed for pipe laying as specified, disposal of unsuitable soil from the site as directed, import of soil or sand (to be paid separately) as directed, preparation of the excavated surface suitable for vehicular traffic and cleaning the working area of all debris excavated materials etc., to the satisfaction of the Engineer.				
3.1	For depth up to 1m	m ³		1,200	

Item	Description	Unit	Rate Rs.	Qty	Amount Rs.
3.2	For depth exceeding 1m but not exceeding 2m.	m ³		600	
4.0	<u>Import of backfill material</u>				
4.1	Backfill soil as approved by Engineer	m ³		200	
4.2	Backfill sand as approved by Engineer	m ³		200	
5.0	<u>Tapping at the Distribution Main</u> Fixing of EasiTap or equivalent (for 2" outlet only) or EasiTee or equivalent (for outlet sizes of 3" and 4") on the main and making the tapping under pressure as per manufacturer's recommendation.				
5.1	3" x 3" VJ EasiTee or similar	No		2	
5.2	3" x 2" VJ EasiTap or similar	No		2	
5.3	4" x 4" VJ EasiTee or similar	No		5	
5.4	4" x 3" VJ EasiTee or similar	No		5	
5.5	4" x 2" VJ EasiTap or similar	No		12	
5.6	6" x 4" VJ EasiTee or similar	No		2	
5.7	6" x 3" VJ EasiTee or similar	No		1	
5.8	6" x 2" VJ EasiTap or similar	No		1	
5.9	2" Gunmetal Standard Type ferrule, Talbot or similar	No		15	

Item	Description	Unit	Rate Rs.	Qty	Amount Rs.
5.10	2" PVC valve socket	No		15	
6.0	<u>Fixing of Gate Valve, Protection Tube & Surface Box</u> Fixing of D/F gate valve, protection tube, and surface box assembly as per drawings.				
6.1	2" D/F Gate Valve with protection tube & surface box	No		15	
6.2	3" D/F Gate Valve with protection tube & surface box	No		8	
6.3	4" D/F Gate Valve with protection tube & surface box	No		7	
7.0	<u>Fixing of Flange Adapter</u> (VJ MaxiDaptor or similar)				
7.1	2" Flange Adapter	No		30	
7.2	3" Flange Adapter	No		8	
7.3	4" Flange Adapter	No		7	
8.0	<u>Jointing of PVC Pipes</u> Jointing of PVC pipes in trenches. Rate to include jointing of bends, tees etc., as per manufacturer's recommendation.				
8.1	4" PVC pipe	m		711	
8.2	3" PVC pipe	m		1,068	
8.3	2" PVC pipe	m		3,883	

Item	Description	Unit	Rate Rs.	Qty	Amount Rs.
8.4	1½ PVC pipe	m		251	
8.5	1¼" PVC pipe	m		376	
8.6	1" PVC pipe	m		1,128	
8.7	½ PVC pipes for service connection	m		6,000	
9.0	<u>Excavation of trial pits to locate water mains and other utilities.</u>				
9.1	Depth not exceeding 1m	m ³		180	
9.2	Depth exceeding 1m but not exceeding 2m.	m ³		90	

5.4 Particular Technical Specifications

Tender documents should include the following particular technical specifications with respect to special tapping materials

(1) Tapping Tees and Tapping Clamps

Tapping Tee (Viking Johnson EasiTee or similar) that allows 3" and 4" flanged branched connections to be made to an existing main, whilst it remains pressurized. These Tapping Tees shall be used in conjunction with all standard drilling machines and practices. This shall be flanged to BS 4504, PN 16.

Tapping Clamp (Viking Johnson EasiTap or similar) that provides a quick, cost effective method of installing a 2" ferrule connection, whilst under operation pressure. These tapping clamps can be used with standard drilling equipment such as Talbot No.3 Tapping machine. The outlet shall be of 2" BSP female threaded.

The Tapping Tees and Tapping Clamps shall be in accordance with the following or similar standards.

- (a). Pressure Rating
16 bar (230 psi) working pressure/24 bar (350 psi) test pressure
- (b). Material Specifications for Saddle, Flange and Half Housings
Malleable Iron to BS 6681: 1986 Grade B32-10 or
Ductile Iron to BS 2789: 1985 Grade 420/12
- (c). Material Specification for Bolts
Steel to BS EN 10083:Part 1: 1991 Grade 2.C.22.
- (d). Material Specification for Gaskets
“Waffle” gasket type for permanent seal with materials to Grade E, 60 IRHD
EPDM to BS 2444: 1990.
- (e). Coatings
Saddle, flange and half housings with Rilsan Nylon 11
Bolts and nuts Zinc Plated, Flurene coated.
- (f). Quality Assurance
Tapping Tees and Tapping Clamps shall be designed and manufactured in
accordance with BS EN ISO 9001: 1994.

(2) Ferrules 2”

Ferrules shall be of Swivel Type similar to Talbot standard pattern swivel ferrules.

The ferrules shall be designed with a 2” female BSP thread for 63mm PVC Class 600 type.

Ferrules shall be designed as a main stem with a 360° swivel outlet at 90° with control of water flow via a threaded inner plug. The inlet shall be of a taper thread conforming to BS 21, ISO 7/1. The ferrules shall be designed for use underground and to handle potable water at temperatures of up to 35°C. The ferrule shall be suitable for use under the pressure of 16 bars (240 psi) without leakage.

The ferrules shall permit service pipe installation via conventional drilling and tapping machines dry or under pressure, with or without service saddles. The ferrule shall further permit the use with conventional drilling machines which will be mounted onto the ferrule/strap assembly and drill the main via the ferrule stem waterway, dry or under pressure. The ingress of dirt shall be prevented by a plastic top plug.

Materials:

- (a). The ferrule stem, banjo, threaded spindle and top cap shall be manufactured of Gunmetal/Bronze to BS 1400 LG2, Brass to BS 2872 ISO R426.
- (b). The Banjo Washers and the top cap washer shall be manufactured in EPDM rubber to BS 2494.

(3) Tapping Machines to be used with Tapping Tees

- (a) HY-RAM COMPACT 4 or similar
Capacity up to 4" diameter, pressure rating 16 bars.
Compact, lightweight, hand operated, under pressure, branch-drilling machine for live drilling of water lines.
- (b) HY-RAM COMPACT 6 or similar
Capacity up to 6" diameter, pressure rating 16 bars.
Compact, lightweight, under pressure, branch-drilling machine for live drilling of water lines. Hand operated or power drive option.
- (c) HY-RAM PEART 150 or similar
Capacity up to 8" diameter, pressure rating 16 bars.
Hand or power operated under pressure drilling machine for live "break-ins" on water lines.

Note: HY-RAM products are manufactured at
HY-RAM Pipeline Products Ltd.,
28-30 Grange Avenue,
Sutton Road, Mansfield,
Nottinghamshire NG18 5GY, UK.

5.5 Other Standard Specifications

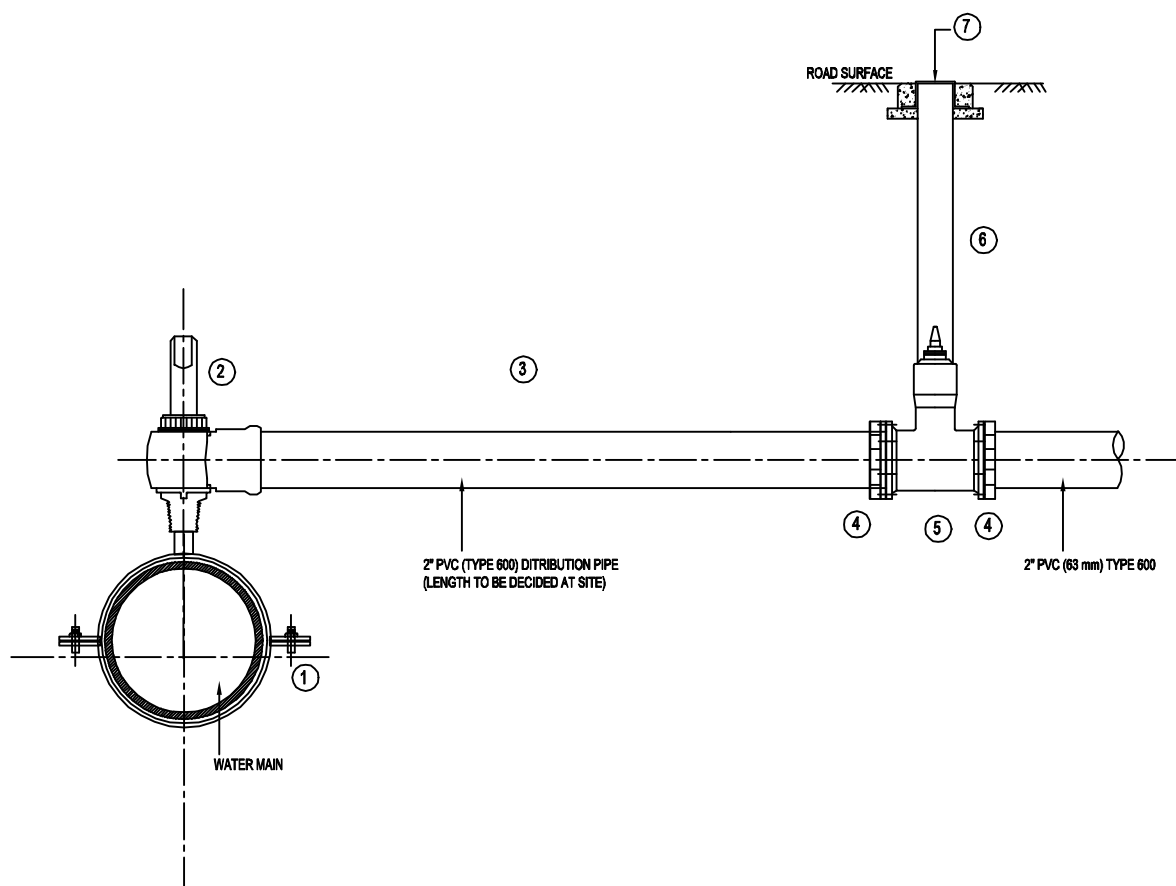
For other specifications, reference should be made to the following documents published by NWSDB.

Volume No.	Title	Publication No.	Date Published
3 & 4	Conditions of Contract & Specifications for Civil Engineering Construction & Pipe Laying	NWSDB/Construction/03	July 1999

5.6 Standard Drawings

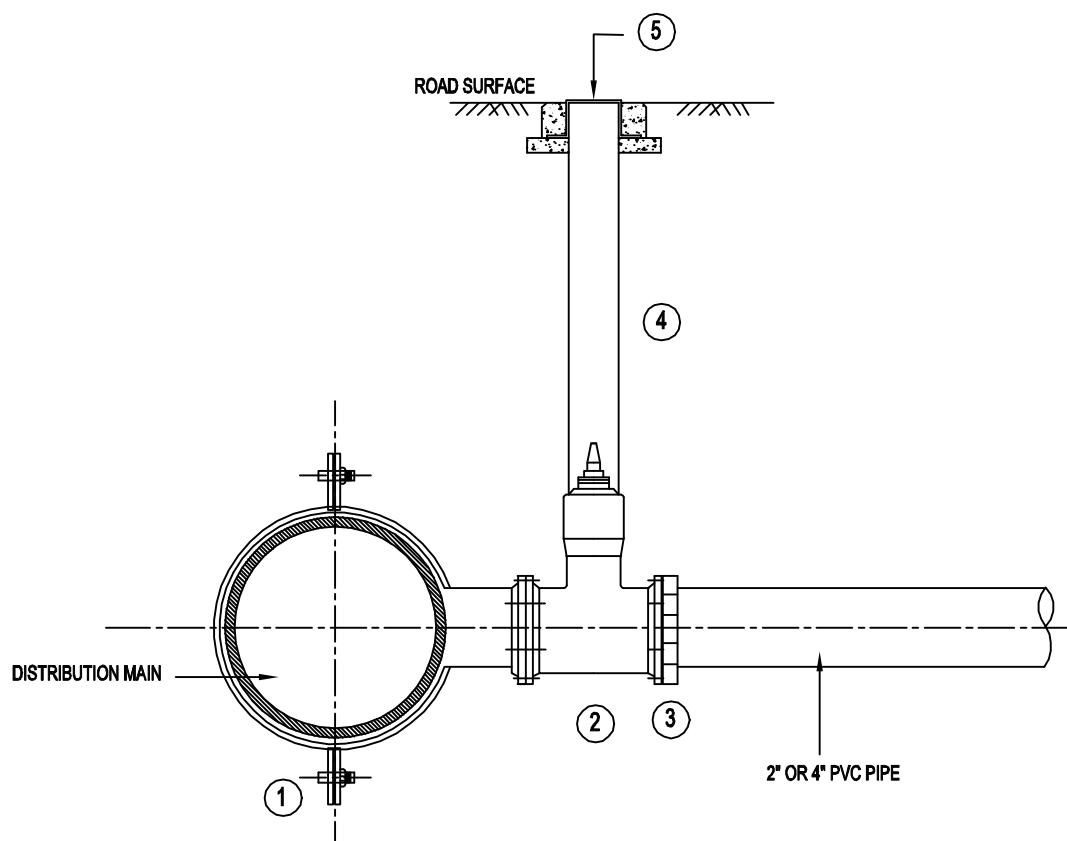
Tender documents should include the following standard drawings.

No.	Drg.No.	Title
1	LI/SD/01	2" Tapping Arrangement with Gate Valve
2	LI/SD/02	3" & 4" Tapping Arrangement with Gate Valve
3	LI/SD/03	Details of Standard Trench and Bedding



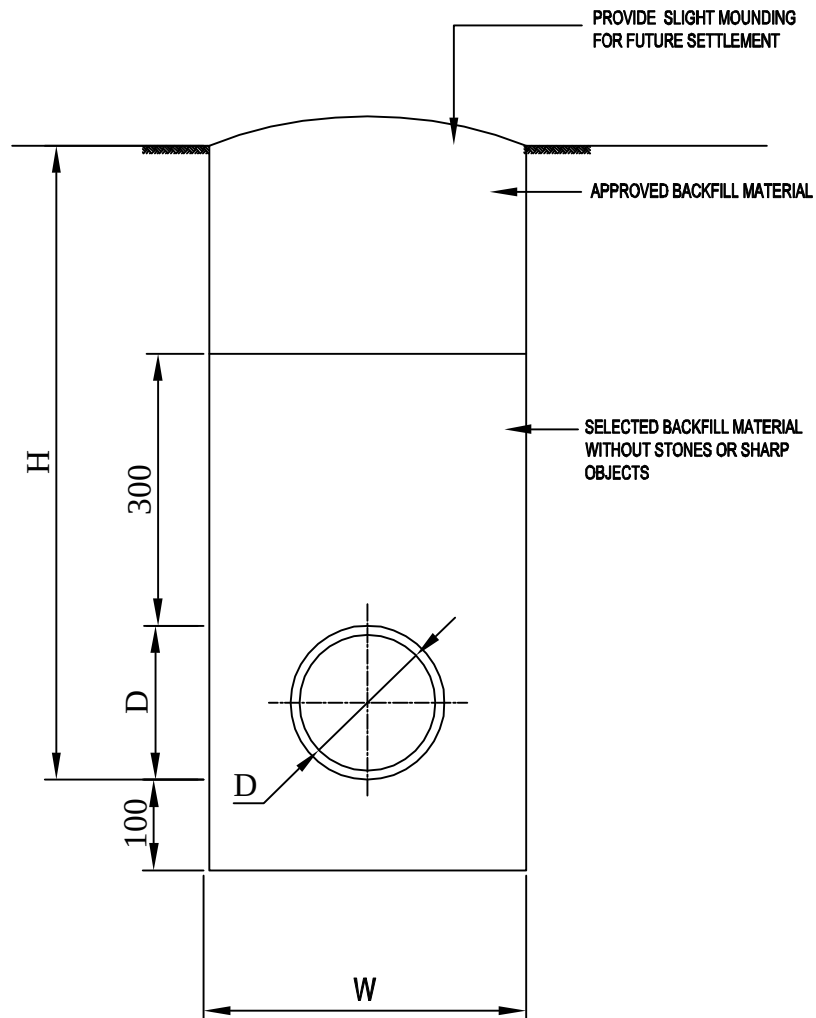
Nr.	DESCRIPTION	QTY.
1.	VJ EASITAP OR SIMILAR WITH 2" FEMALE THREADED OUTLET	1 Nr.
2.	2" TALBOT OR SIMILAR SCREW DOWN TYPE GUNMETAL FERRULE WITH 2" FEMALE THREADED OUTLET	1 Nr.
3.	2" PVC VALE SOCKET	1 Nr.
4.	2" VJ FLANGE ADAPTER OR SIMILAR SUITABLE FOR 63 mm DIA. CLASS 600 PVC PIPE	2Nr.
5.	2" (DN 50) DOUBLE FLANGED GATE VALVE	1 Nr.
6.	3" PVC, TYPE 600 PROTECTION TUBE	1 Nr.
7.	SURFACE BOX, 150X150 mm CLEAR OPENING	1 Nr.

LI/SD/01	2" Tapping Arrangement with Gate Valve
SCALE	Not to Scale
JICA STUDY TEAM THE DETAILED DESIGN STUDY ON THE PROJECT FOR REDUCTION OF NON-REVENUE WATER IN THE GREATER COLOMBO AREA IN THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA	



Nr.	DESCRIPTION	QTY.
1.	VJ EASITAP OR SIMILAR WITH 3" OR 4" FLANGED OUTLET	1 Nr.
2.	DOUBLE FLANGED GATE VALVE 3" OR 4"	1 Nr.
3.	VJ FLANGE ADAPTER OR SIMILAR SUITABLE FOR 3" OR 4" PVC PIPE	1 Nr.
4.	3" PVC, TYPE 600 PROTECTION TUBE	1 Nr.
5.	SURFACE BOX, 150X150 mm CLEAR OPENING	1 Nr.

LI/SD/02	3" Or 4" Tapping Arrangement with Gate Valve
SCALE	Not to Scale
JICA STUDY TEAM THE DETAILED DESIGN STUDY ON THE PROJECT FOR REDUCTION OF NON-REVENUE WATER IN THE GREATER COLOMBO AREA IN THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA	



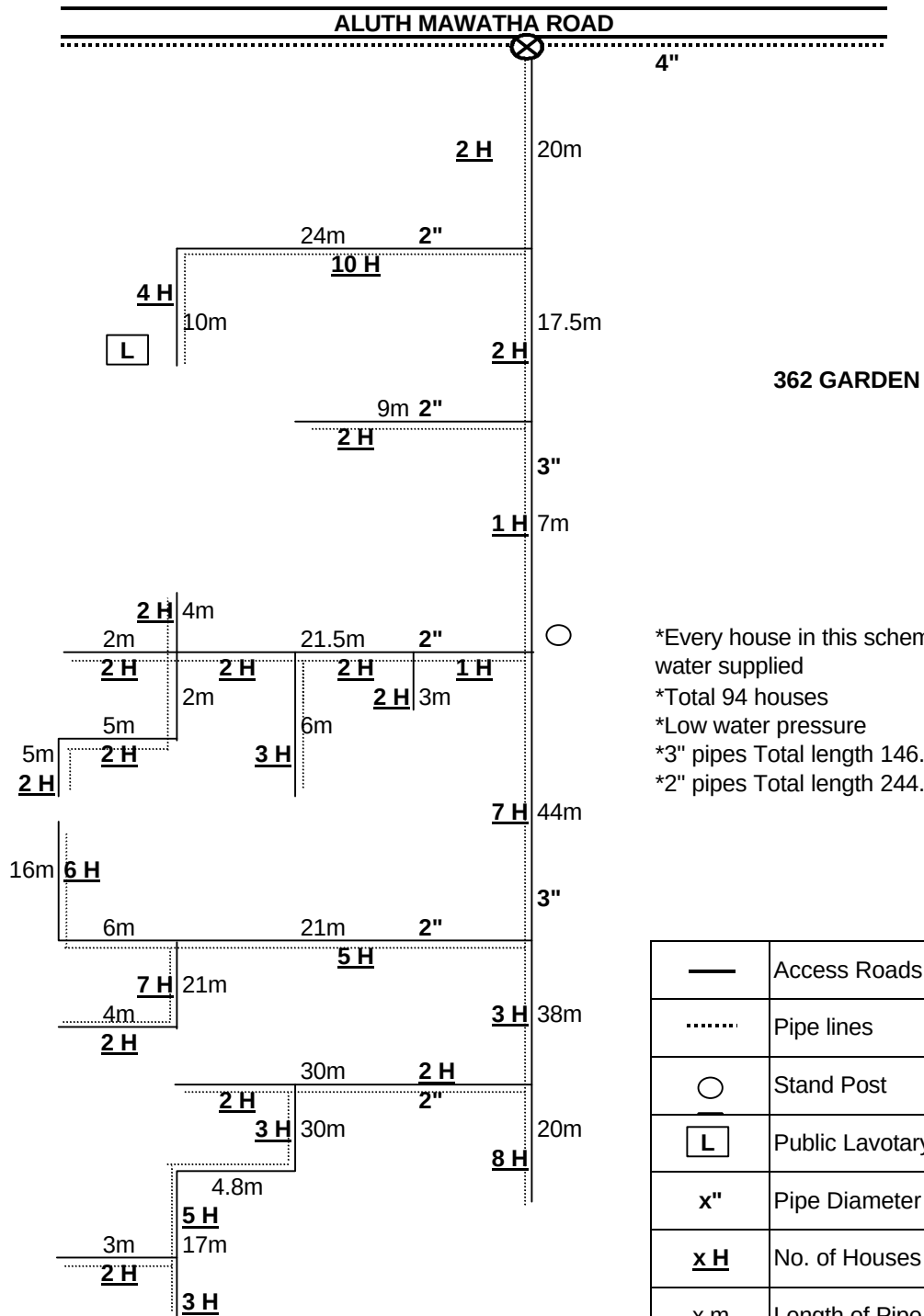
PIPE DIA. (D) (mm)	NOMINAL TRENCH WIDTH (mm)	NOMINAL TRENCH HEIGHT (mm)
4" PVC	400	900
3" PVC	400	900
2" PVC	300	800
1 1/2" PVC	300	800
1 1/4" PVC	300	600
1" PVC	300	600

LI/SD/03	Details of Standard Trench & Bedding
SCALE	Not to Scale
JICA STUDY TEAM THE DETAILED DESIGN STUDY ON THE PROJECT FOR REDUCTION OF NON-REVENUE WATER IN THE GREATER COLOMBO AREA IN THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA	

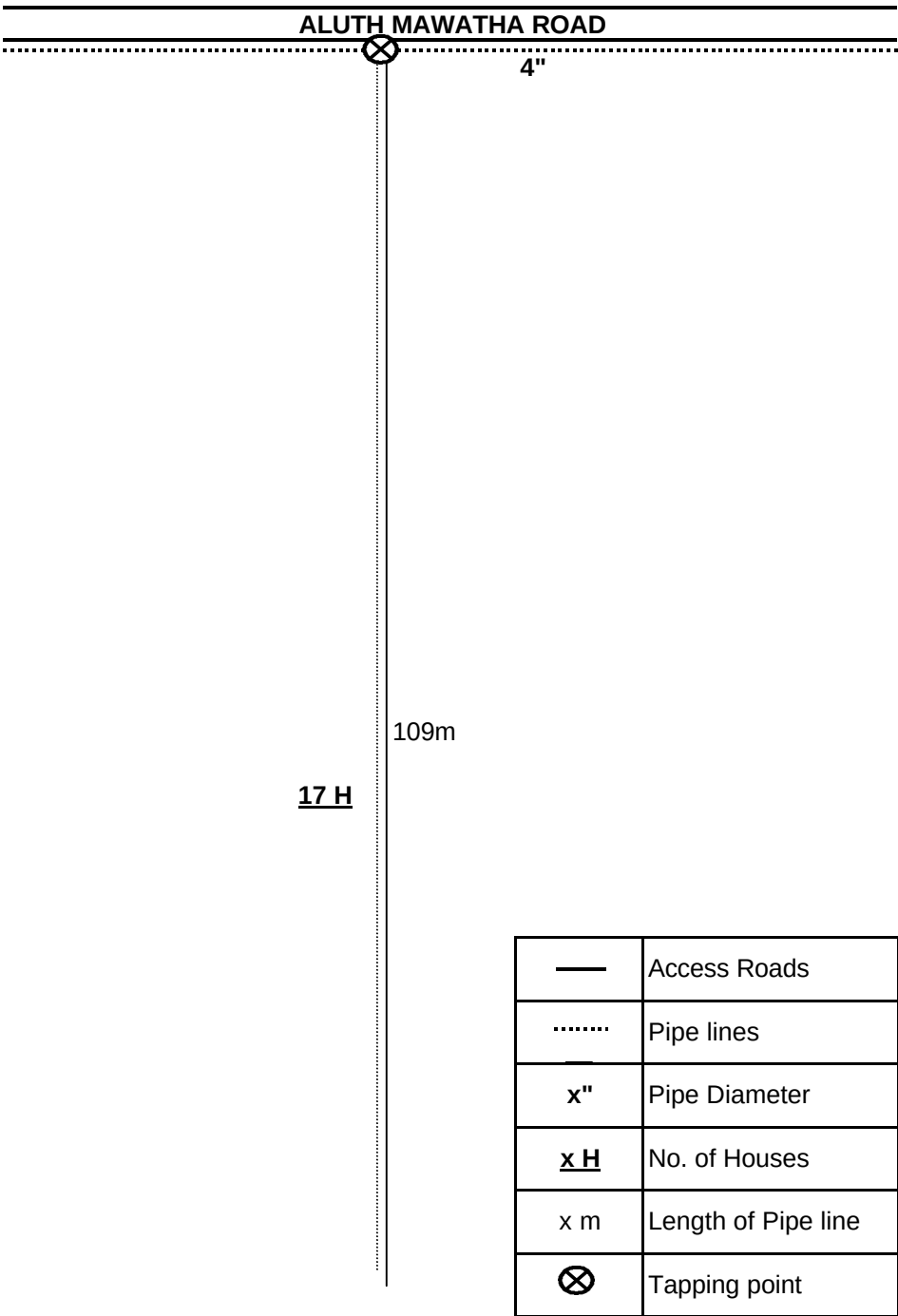
ANNEX 1

DETAILS OF WATER DISTRIBUTION SYSTEMS IN 21 TENEMENT GARDENS

360 GARDEN



854 GARDEN

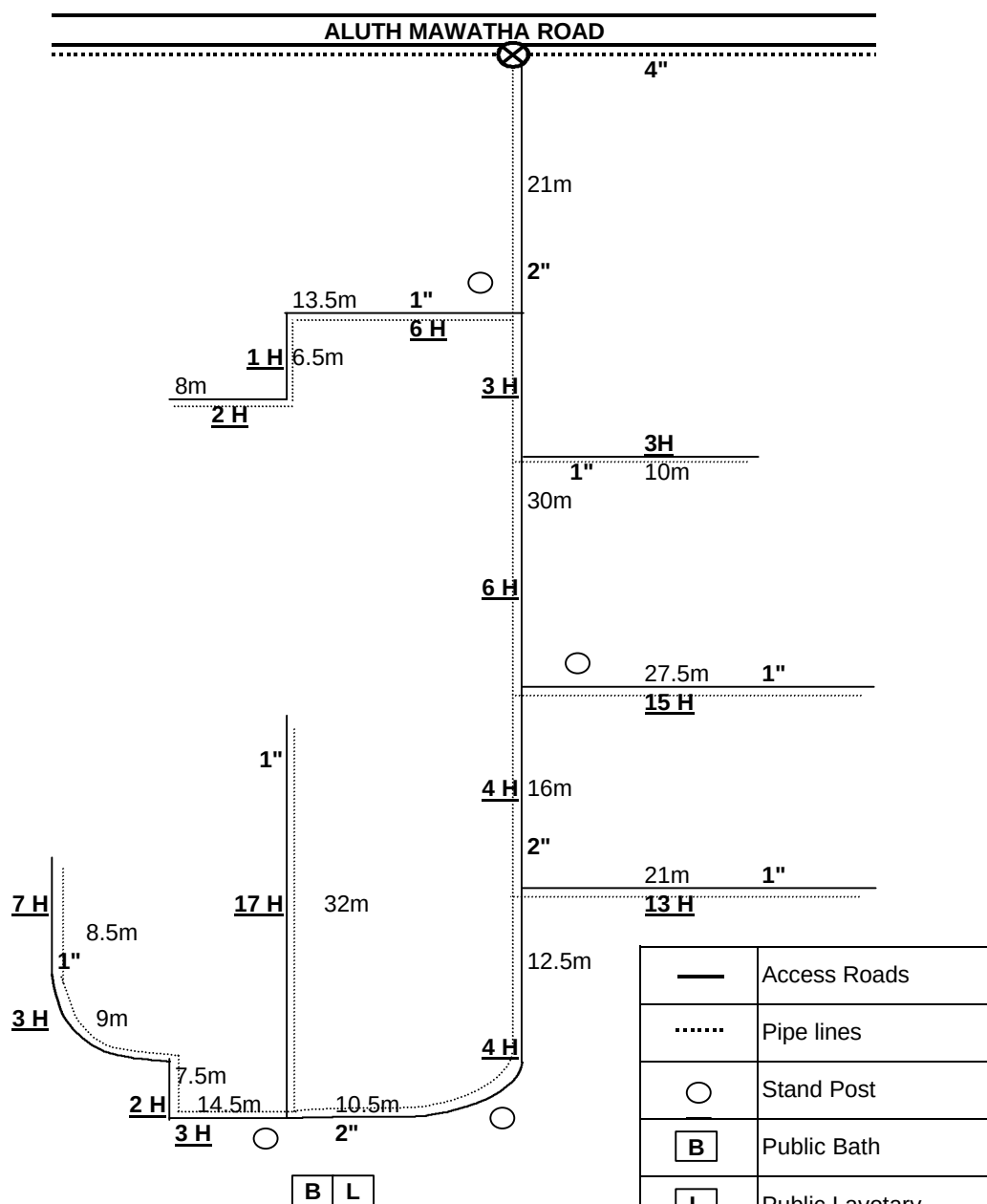


*Every house in this scheme is water supplied

*Total 17 houses

*Every house in this housing scheme have individual connections from main road

737 GARDEN



*Total 89 houses

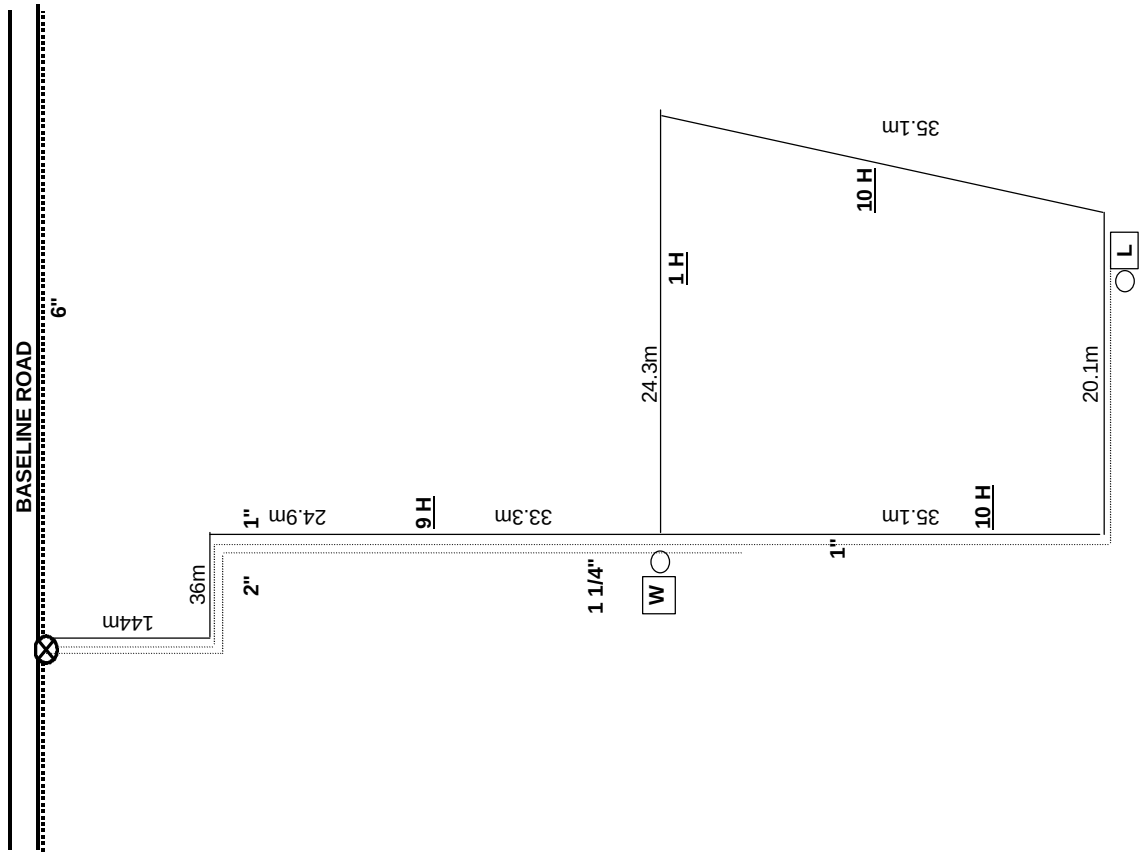
*Every house in this housing scheme is water supplied

*Low water pressure

*1" pipes Total length 158 m

*2" pipes Total length 104.5 m

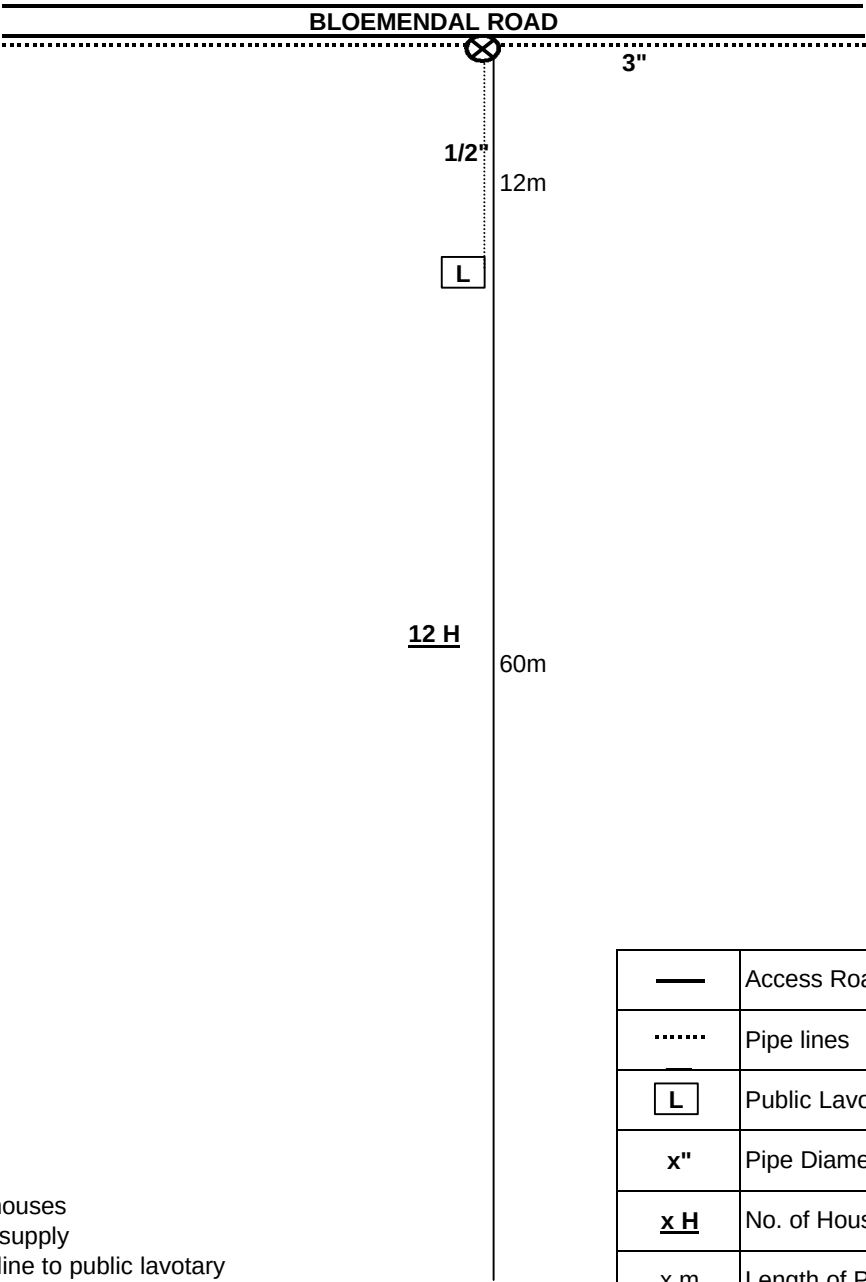
270 GARDEN (CONCRETE WATTA)



—	Access Roads
.....	Pipe lines
○	Stand Post
W	Well
L	Public lavotary
x"	Pipe Diameter
x H	No. of Houses
x m	Length of Pipe line
⊗	Tapping point &Bulk meter

- *Total 30 houses
- *Only 5 houses are water supplied
- *2" & 1 1/4" common line serving 5 houses
- *1" line to stand post and public lavotary
- *2" pipes Total length 214.9m
- *1 1/4" pipes Total length 38.3m
- *1" pipes Total length 257.4m

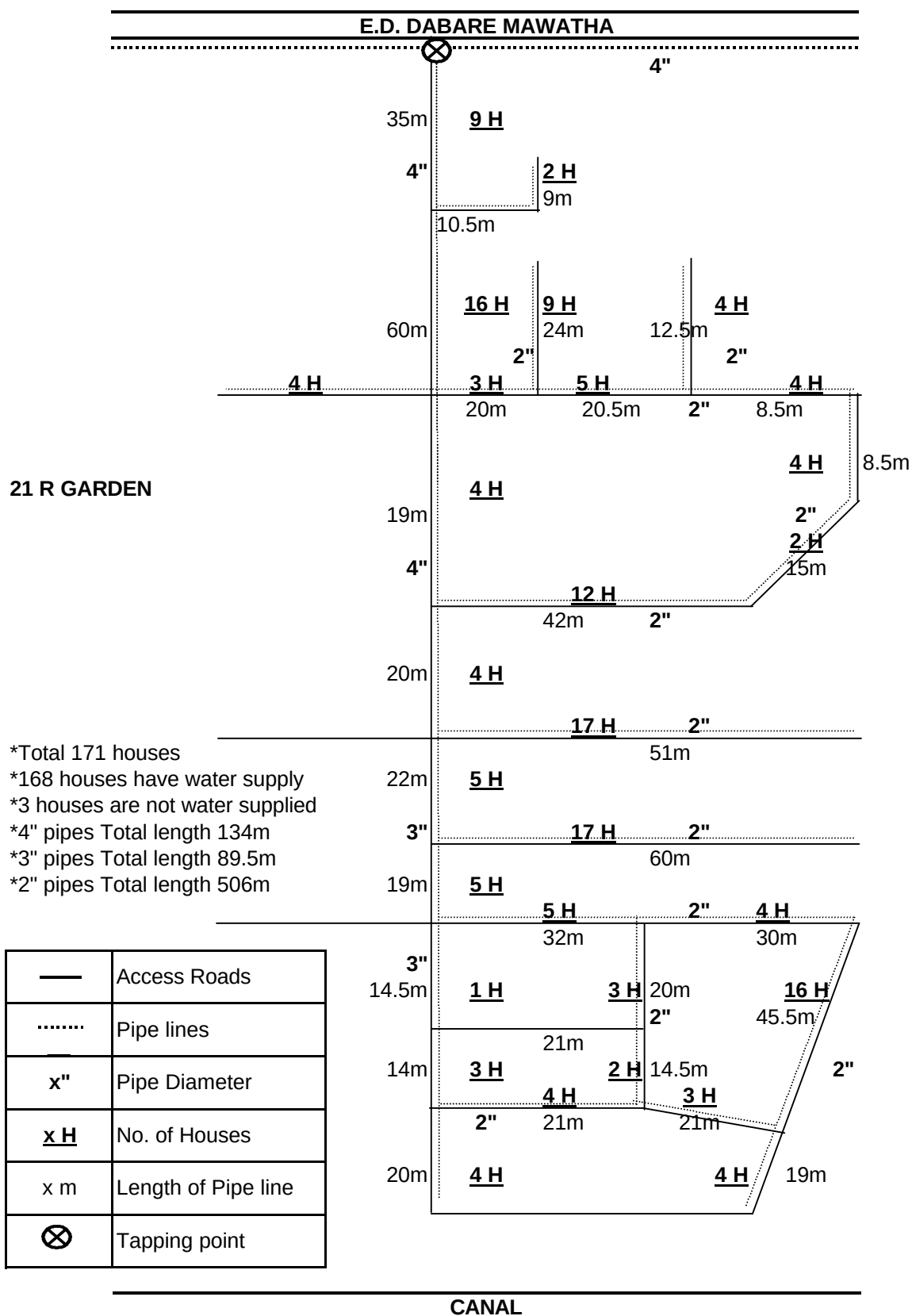
601 GARDEN



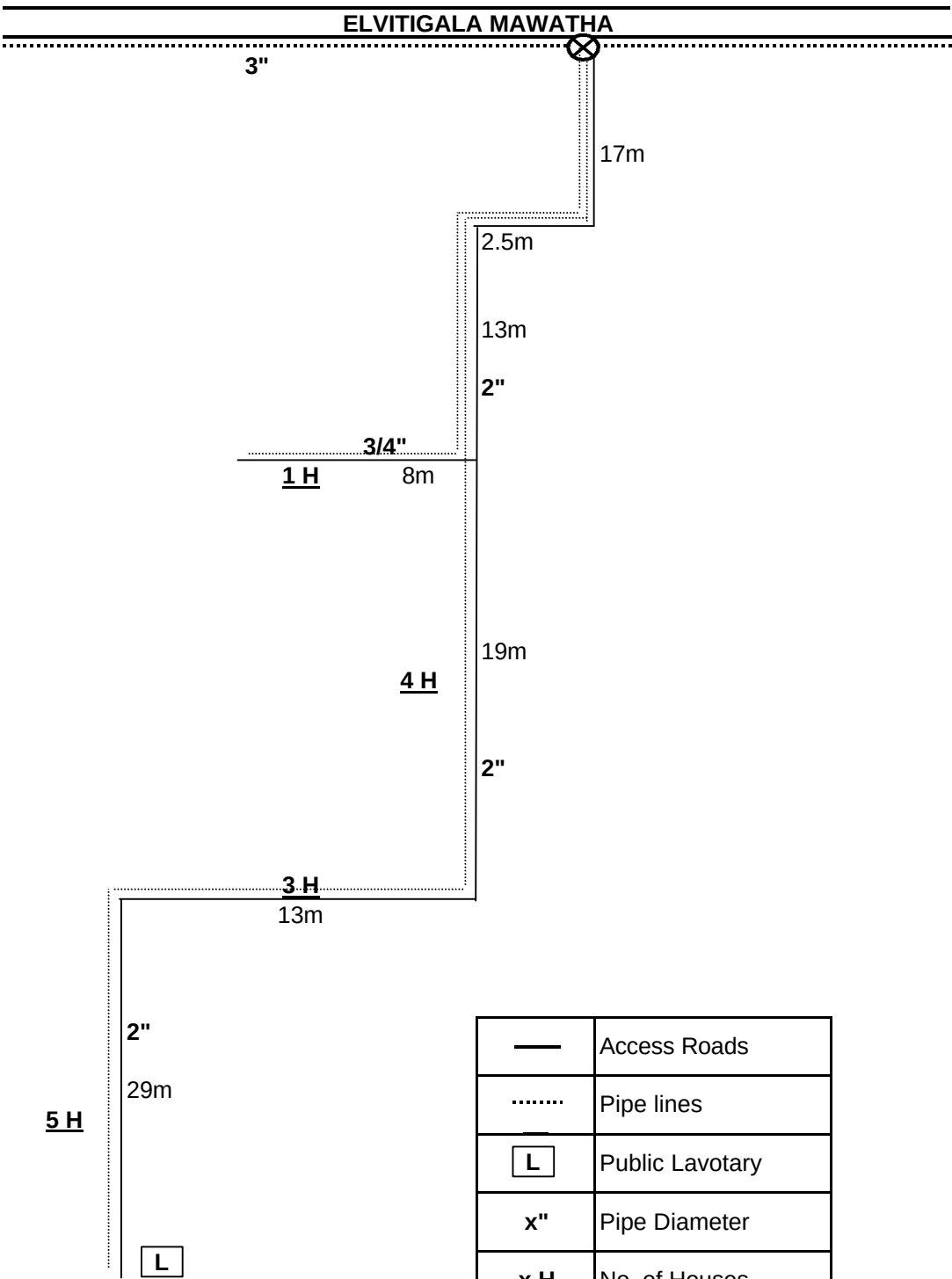
*Total 12 houses
*No water supply
*1/2" pipe line to public lavotary
*1/2" pipes Total length 12m

—	Access Roads
.....	Pipe lines
L	Public Lavotary
x"	Pipe Diameter
<u>x H</u>	No. of Houses
x m	Length of Pipe line
⊗	Tapping point

21 M GARDEN



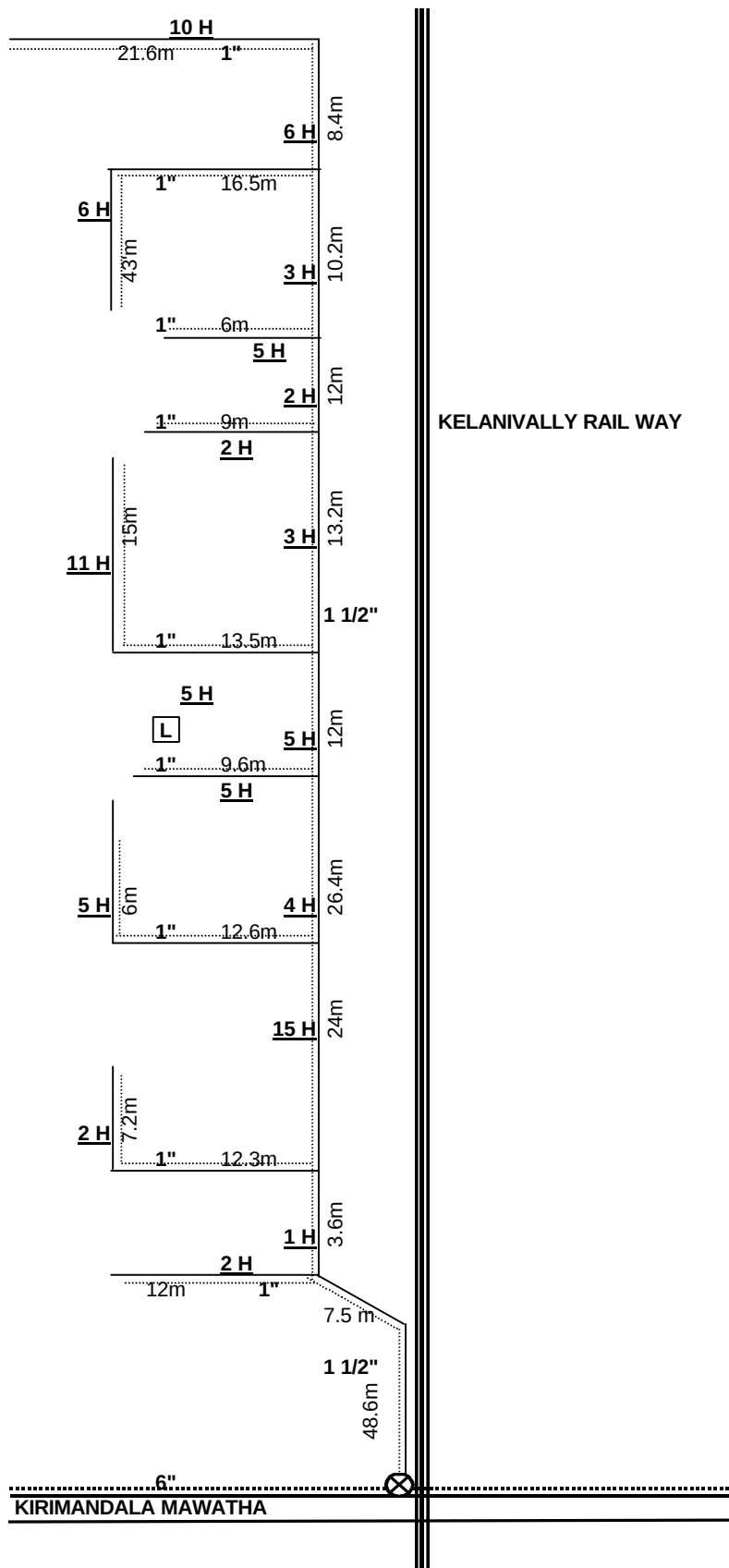
397 GARDEN



*Total 13 houses
*Every house in this scheme is water supplied
*3 houses have individual water supply
*2" pipes Total length 61.5m

—	Access Roads
.....	Pipe lines
L	Public Lavotary
x"	Pipe Diameter
<u>x H</u>	No. of Houses
x m	Length of Pipe line
⊗	Tapping point

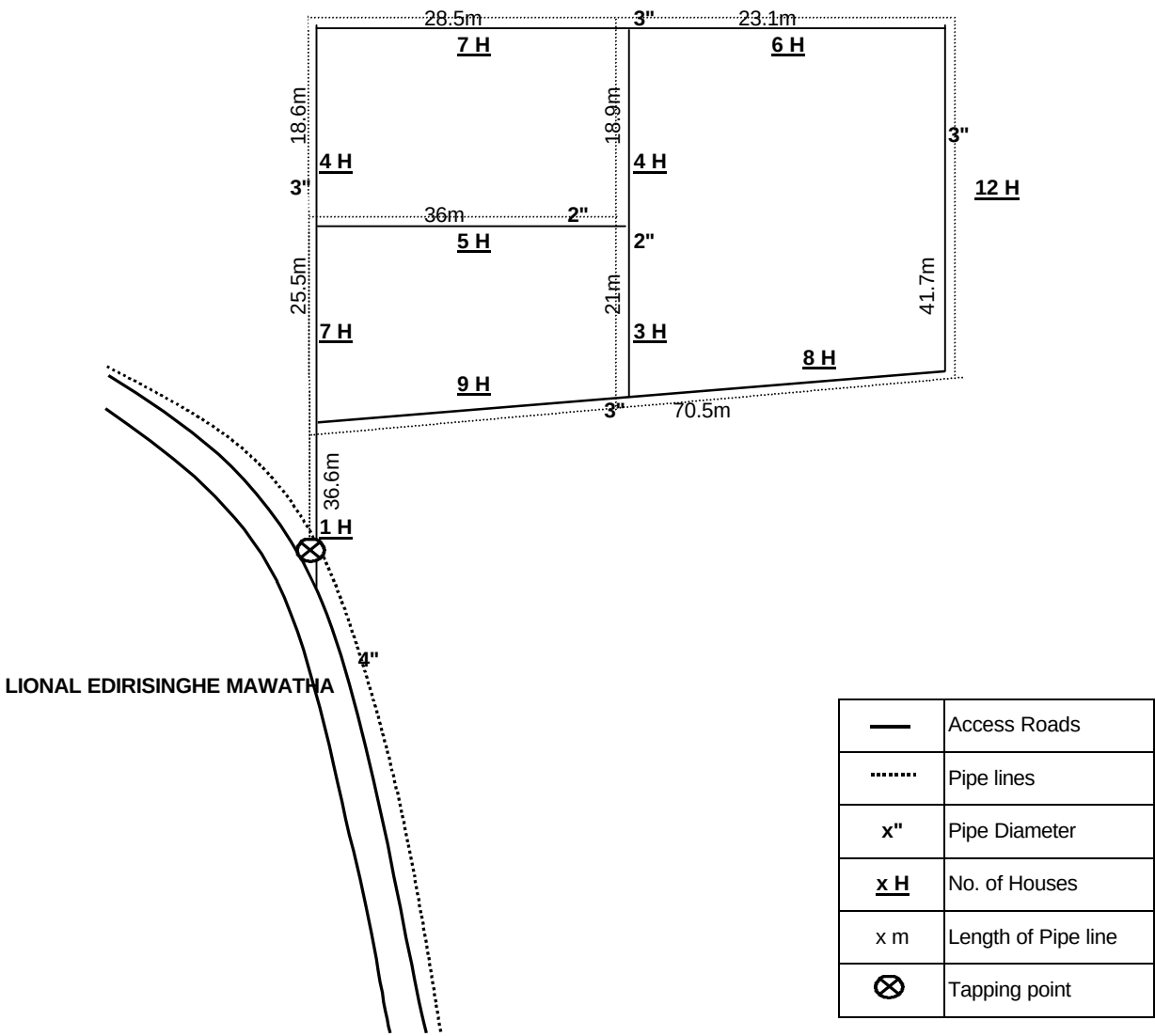
SAMAGI WATTA



—	Access Roads
.....	Pipe lines
○	Stand Post
[L]	Public Lavotary
x"	Pipe Diameter
<u>x H</u>	No. of Houses
x m	Length of Pipe line

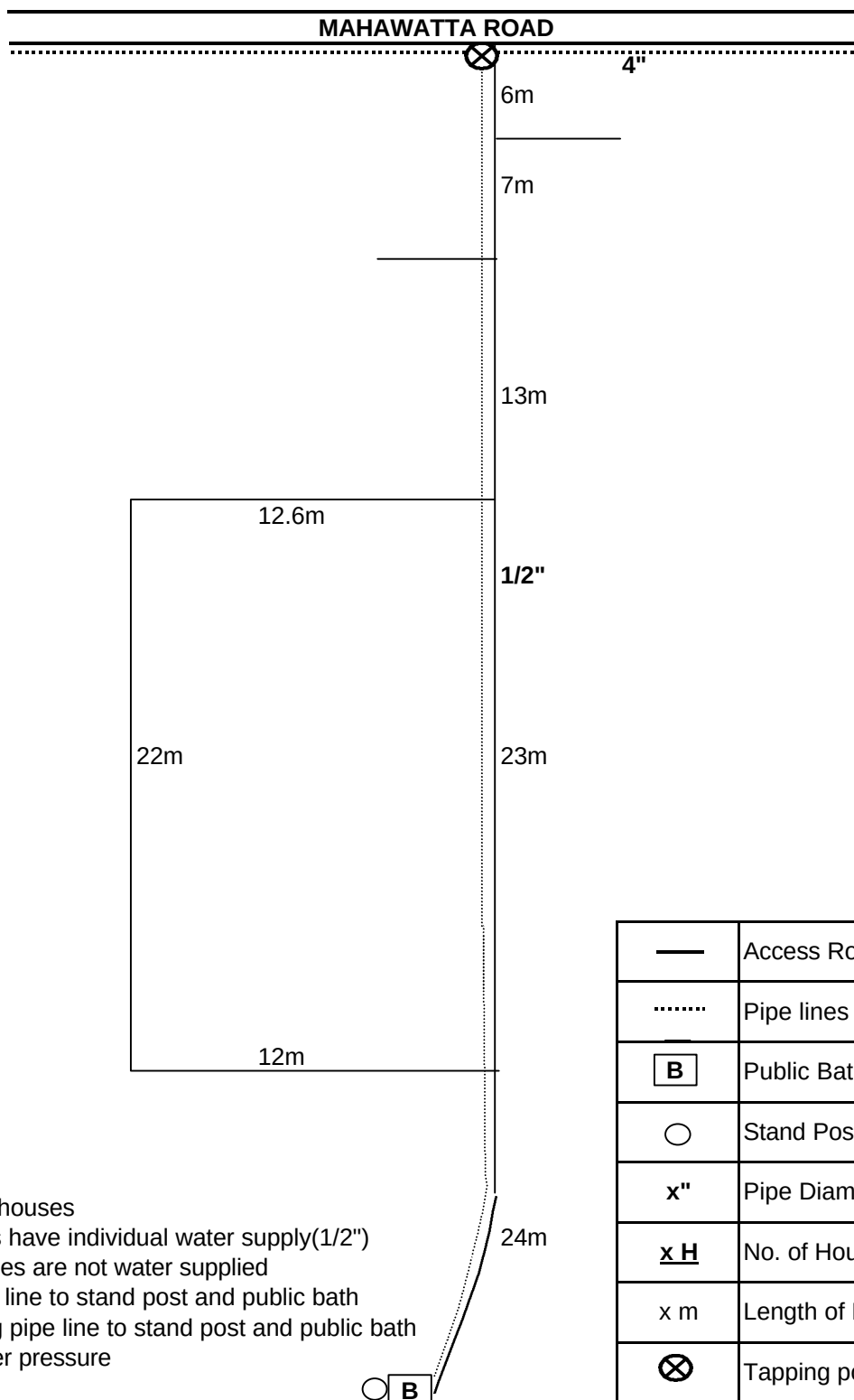
*Total 92 houses
 *87 houses have water supply
 *1 1/2" pipes Total length 158.4m
 *1" pipes Total length 184.3m

NUGAGAHAPURA



*Total 66 houses
 *Every house in this Housing scheme is water supplied
 *3" pipes Total length 244.5m
 *2"pipes Total length 75.9m

ASIRI PURA (86 GARDEN)



*Total 19 houses

*8 houses have individual water supply(1/2")

*11 housses are not water supplied

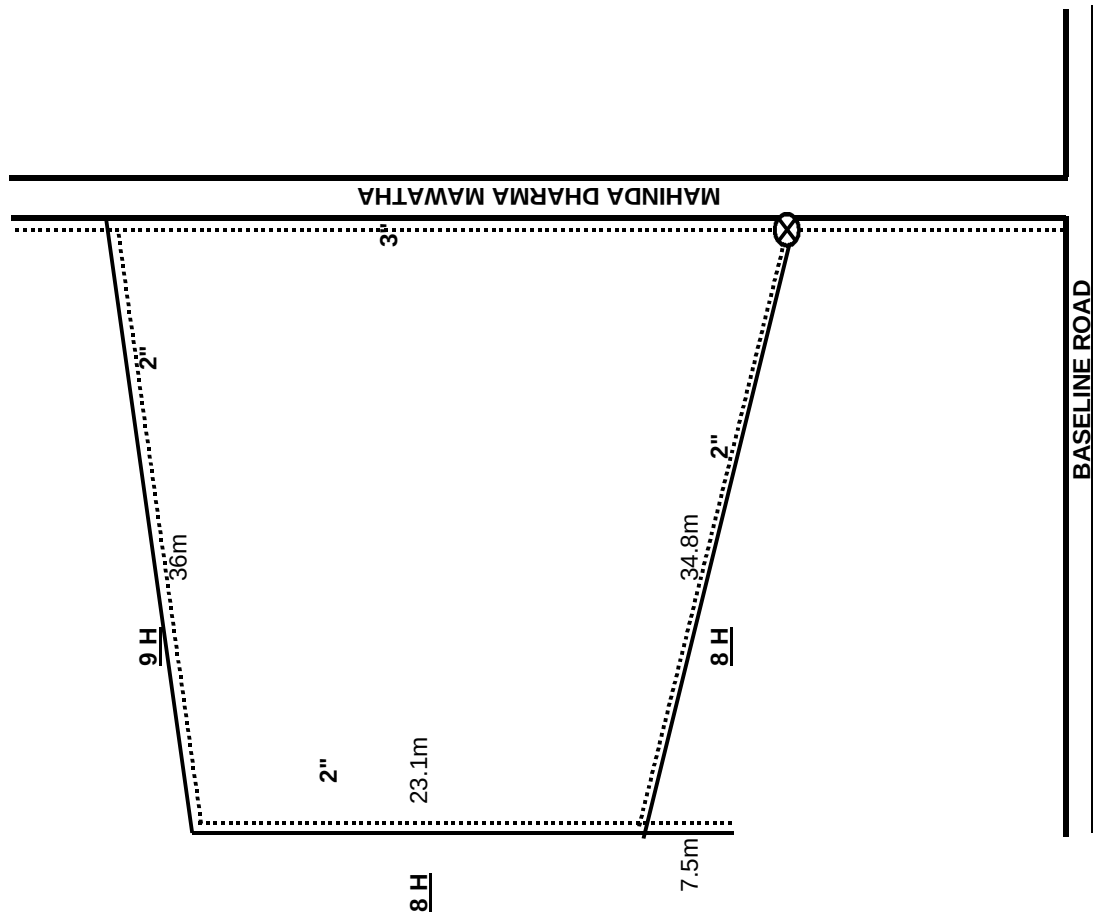
*1/2" pipe line to stand post and public bath

*73m long pipe line to stand post and public bath

*Low water pressure

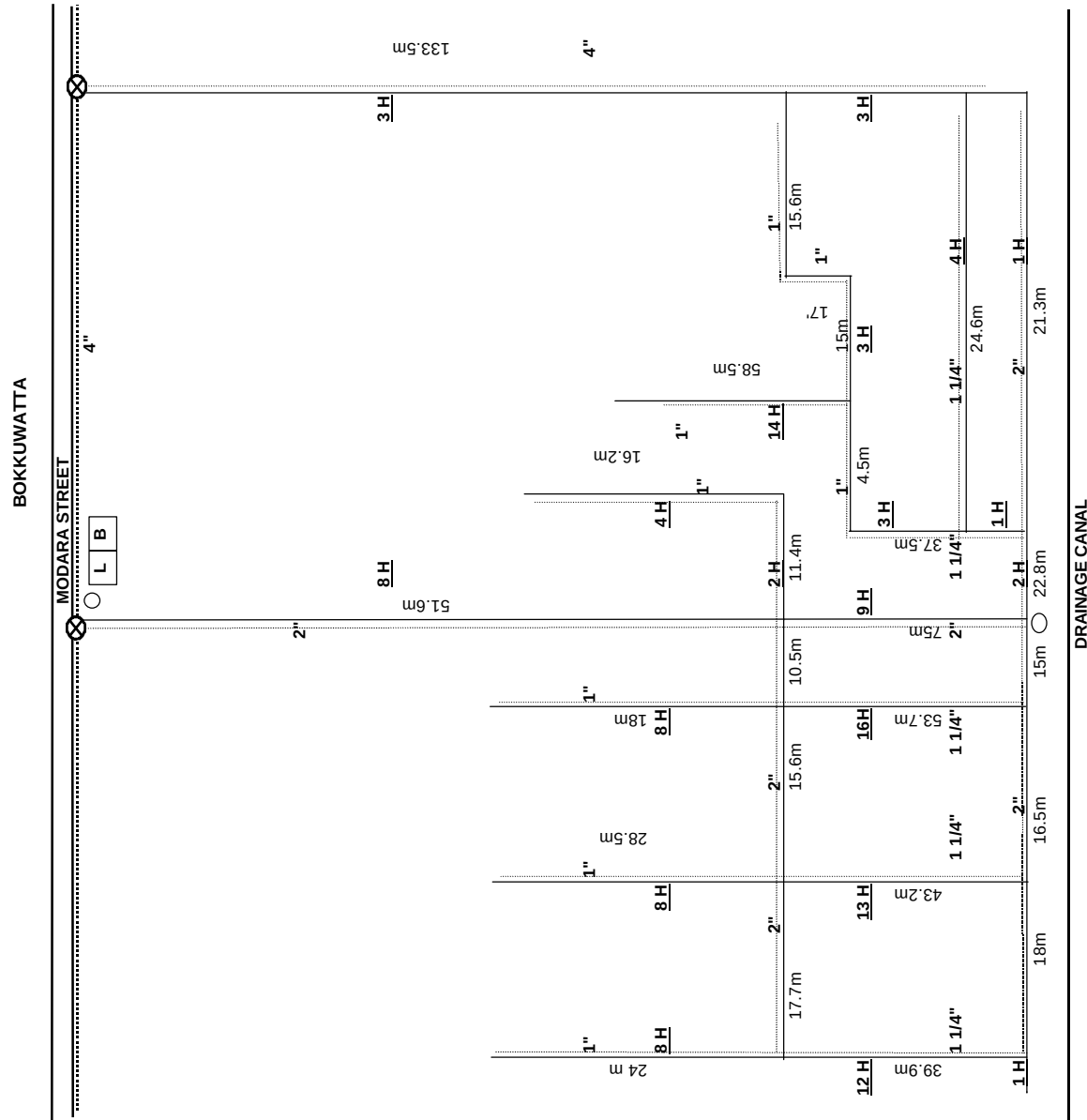
—	Access Roads
.....	Pipe lines
□ B	Public Bath
○	Stand Post
x"	Pipe Diameter
<u>x H</u>	No. of Houses
x m	Length of Pipe line
⊗	Tapping point

79 GARDEN



—	Access Roads
.....	Pipe lines
○	Stand Post
x"	Pipe Diameter
<u>x H</u>	No. of Houses
x m	Length of Pipe line
⊗	Tapping point & Bulk meter

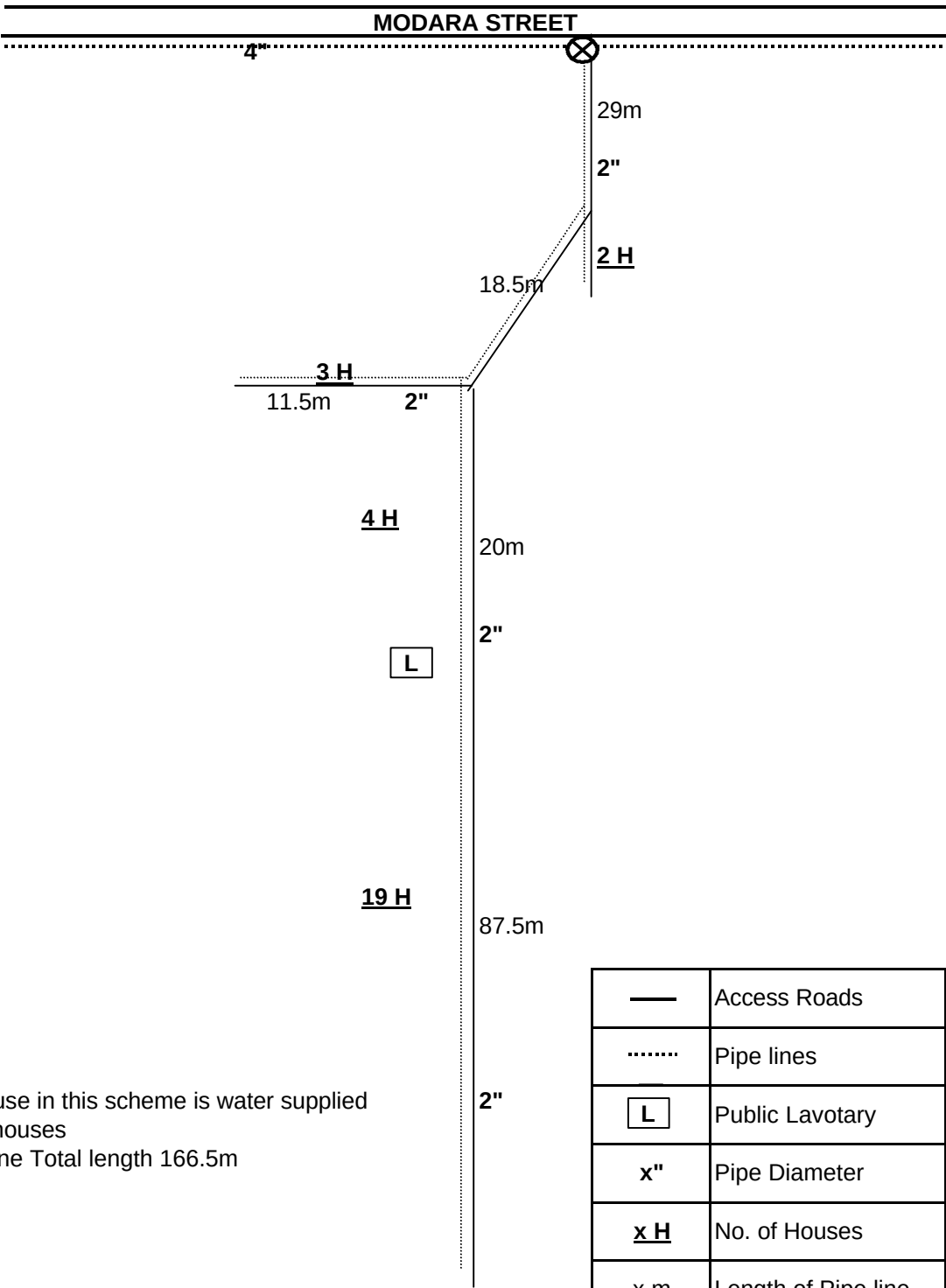
*Every house in this Housing scheme is water supplied
 *Total 25 houses
 *2" pipes Total length 101.4m



—	Access Roads
	Pipe lines
L	Public Lavatory
B	Bathing place
○	Stand Post
x m	Length of Pipe line
x"	Pipe Diameter
x H	No. of Houses
⊗	Tapping point

- * Total 121 houses
- * Every house is water supplied
- * 2" pipes Total 275 m
- * 1 1/4" pipes Total length 198.9 m
- * 1" pipes Total length 180.4 m
- * 4" pipes Total length 133.5m

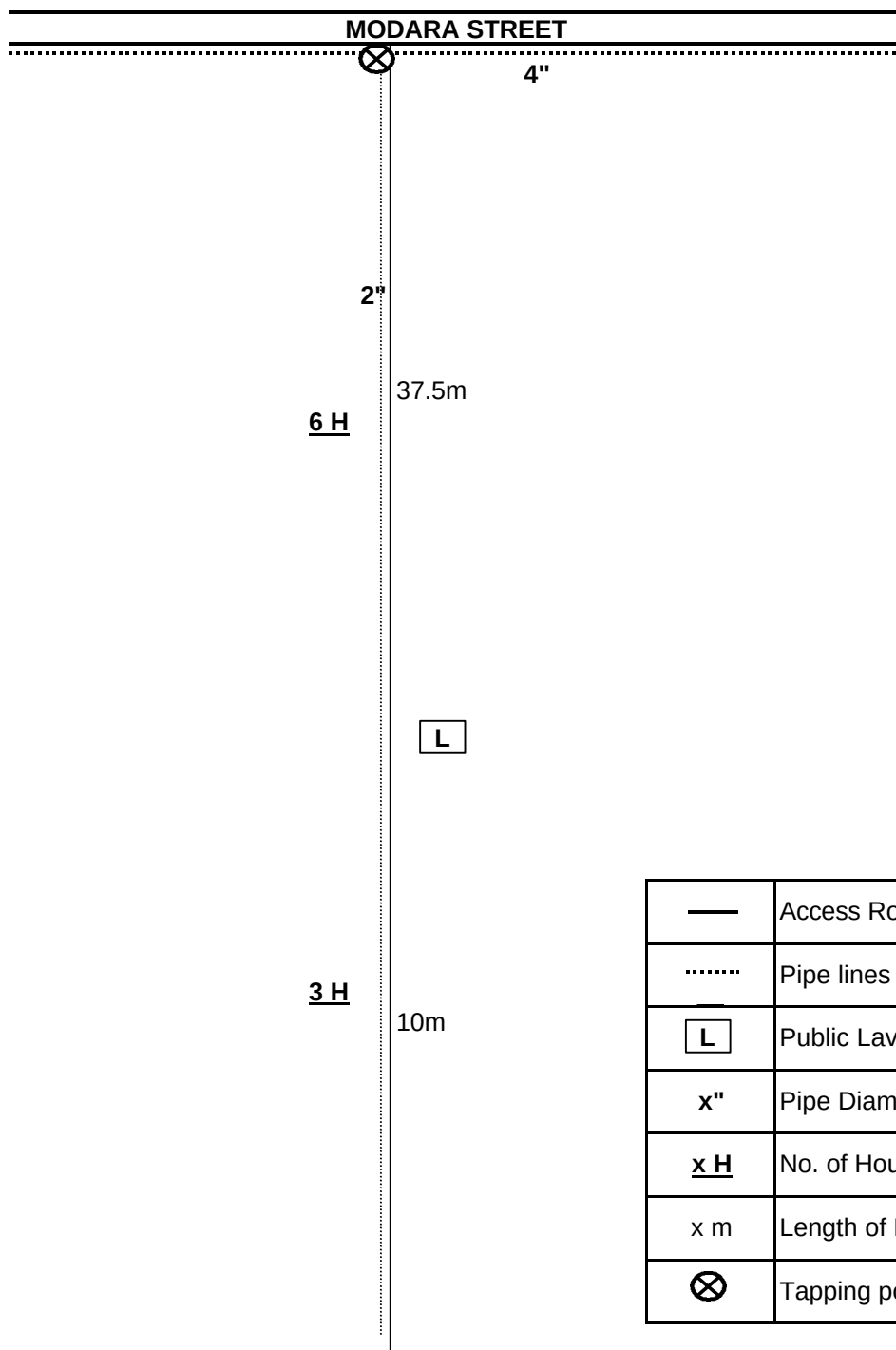
95 GARDEN



*Every house in this scheme is water supplied
*Total 28 houses
* 2" pipe line Total length 166.5m

—	Access Roads
.....	Pipe lines
L	Public Lavotary
x"	Pipe Diameter
x H	No. of Houses
x m	Length of Pipe line
⊗	Tapping point

66 GARDEN

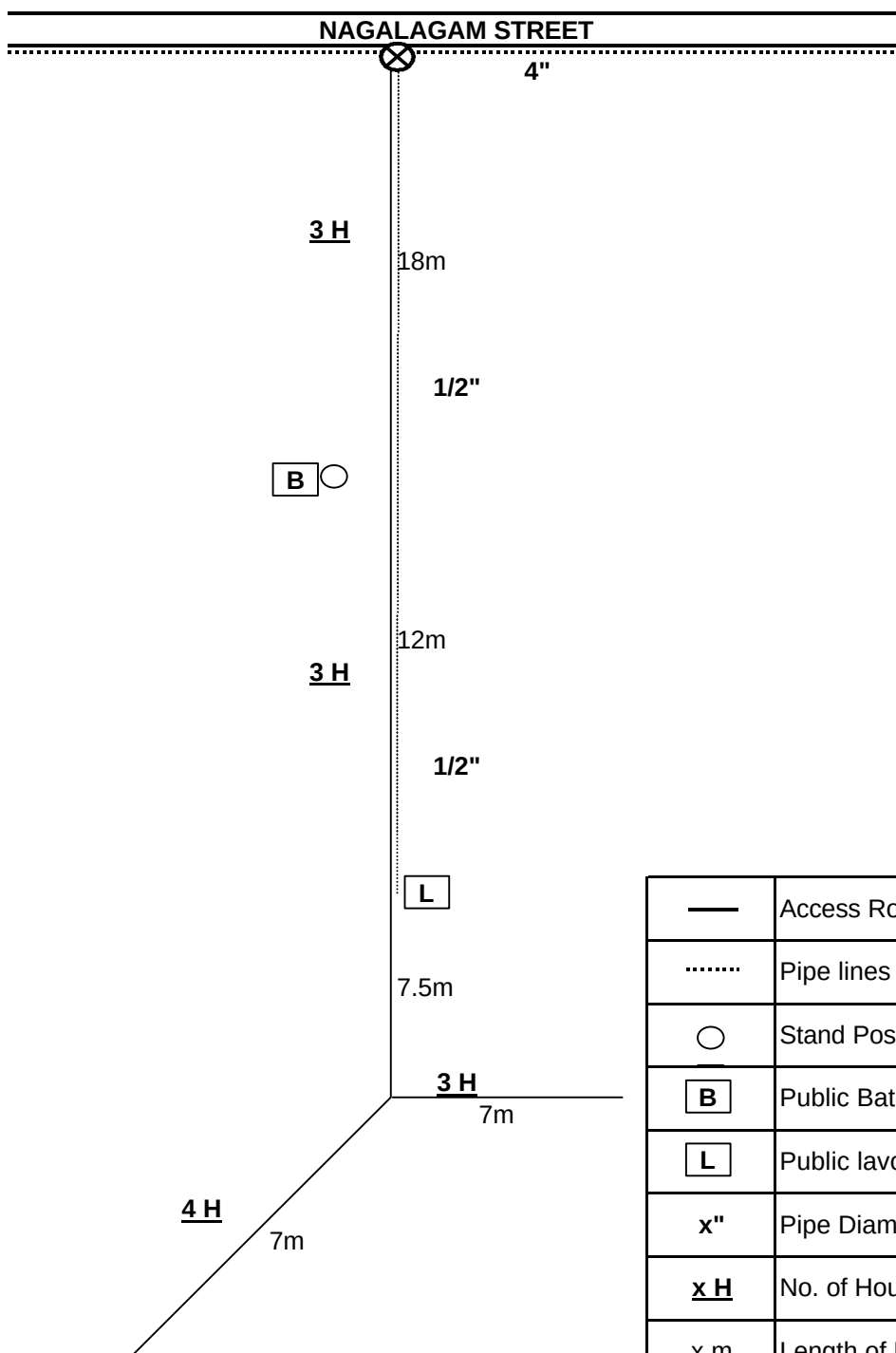


*Every house in this scheme is water supplied

*Total 9 houses

*2" pipe line Total length 47.5m

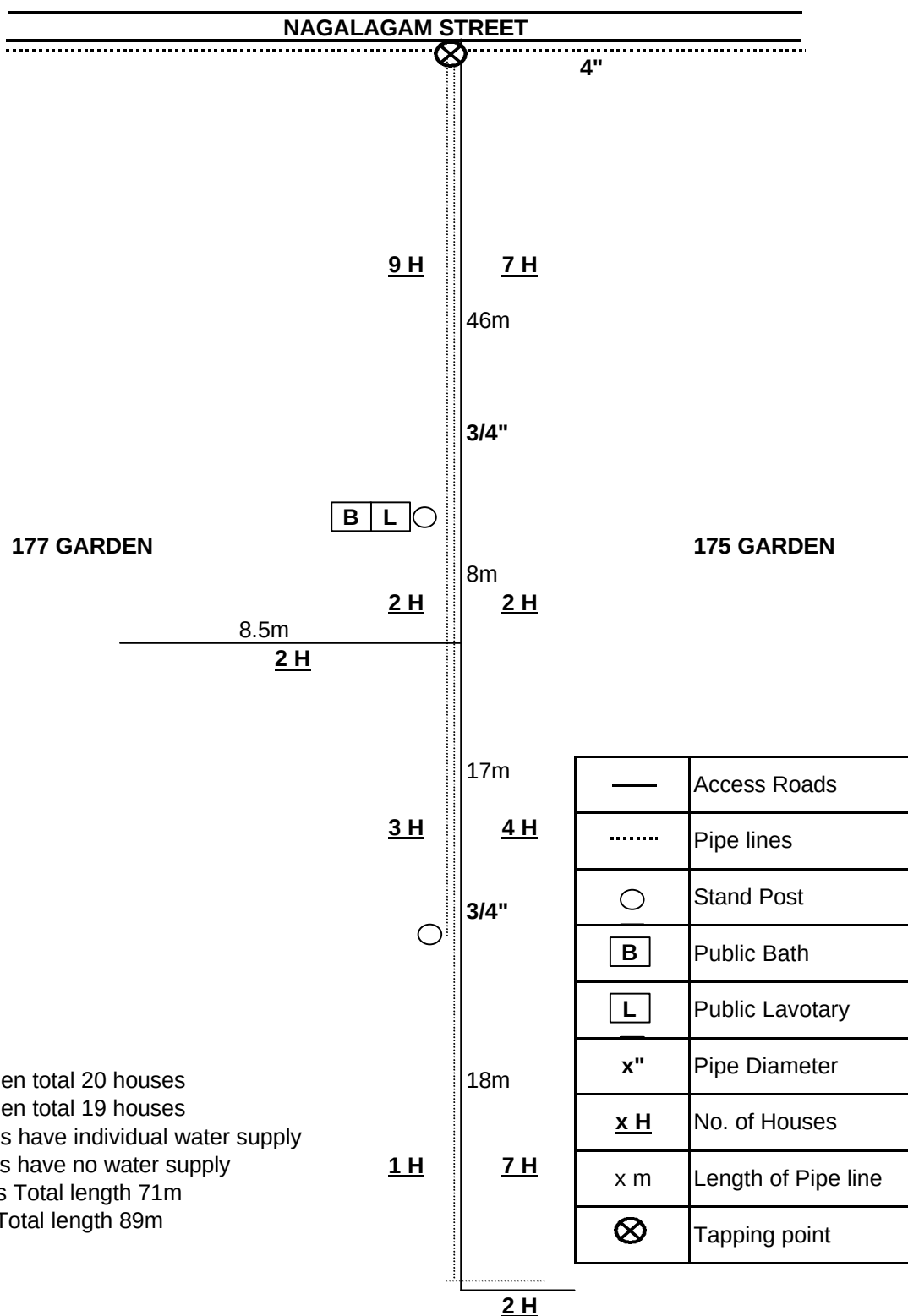
151 GARDEN



*Total 12 houses
 *2 houses have individual water supply
 *10 houses are not water supplied
 *1/2" pipes to public bath and lavatory
 *1/2" pipes Total length 30m

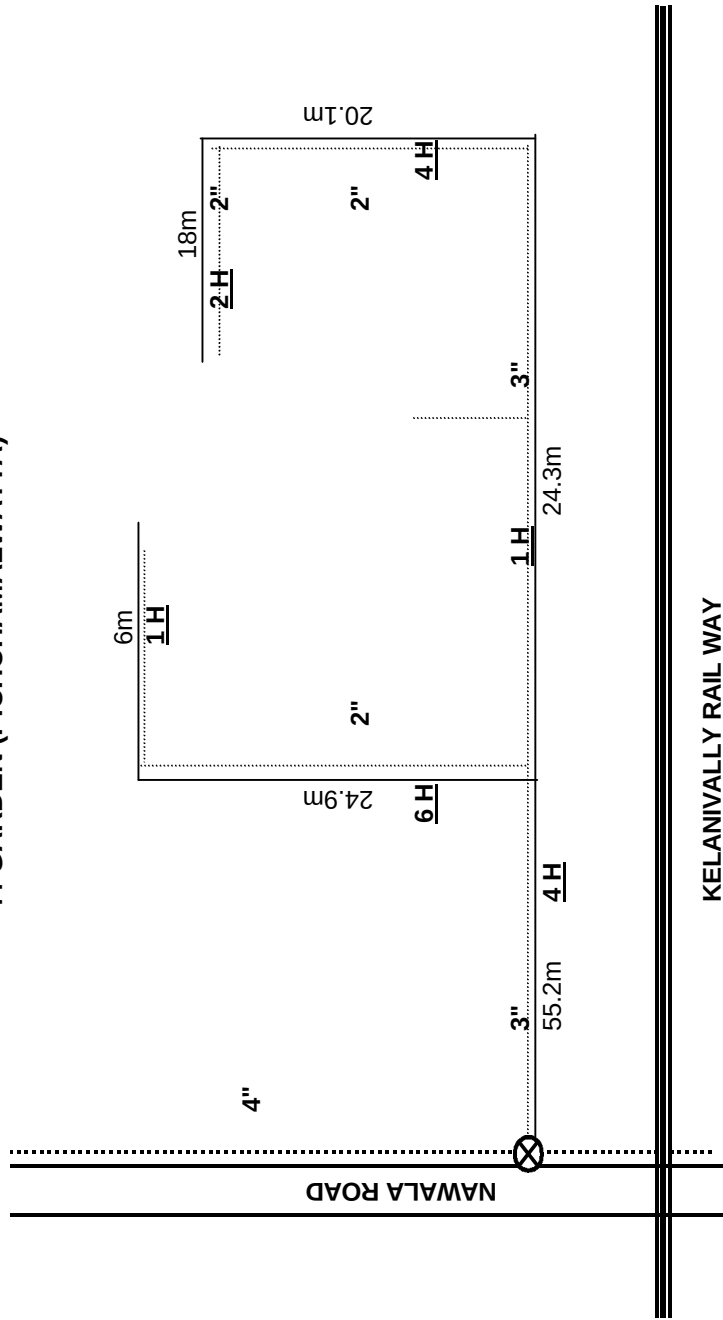
—	Access Roads
.....	Pipe lines
○	Stand Post
B	Public Bath
L	Public lavatory
x"	Pipe Diameter
<u>x H</u>	No. of Houses
x m	Length of Pipe line
⊗	Tapping point

175 & 177 GARDENS



- *175 Garden total 20 houses
- *177 Garden total 19 houses
- *10 houses have individual water supply
- *29 houses have no water supply
- *3/4" pipes Total length 71m
- *2" pipes Total length 89m

44 GARDEN (PICHCHAMALWATTA)



—	Access Roads
.....	Pipe lines
x"	Pipe Diameter
x H	No. of Houses
x m	Length of Pipe line
⊗	Tapping point & Bulk meter

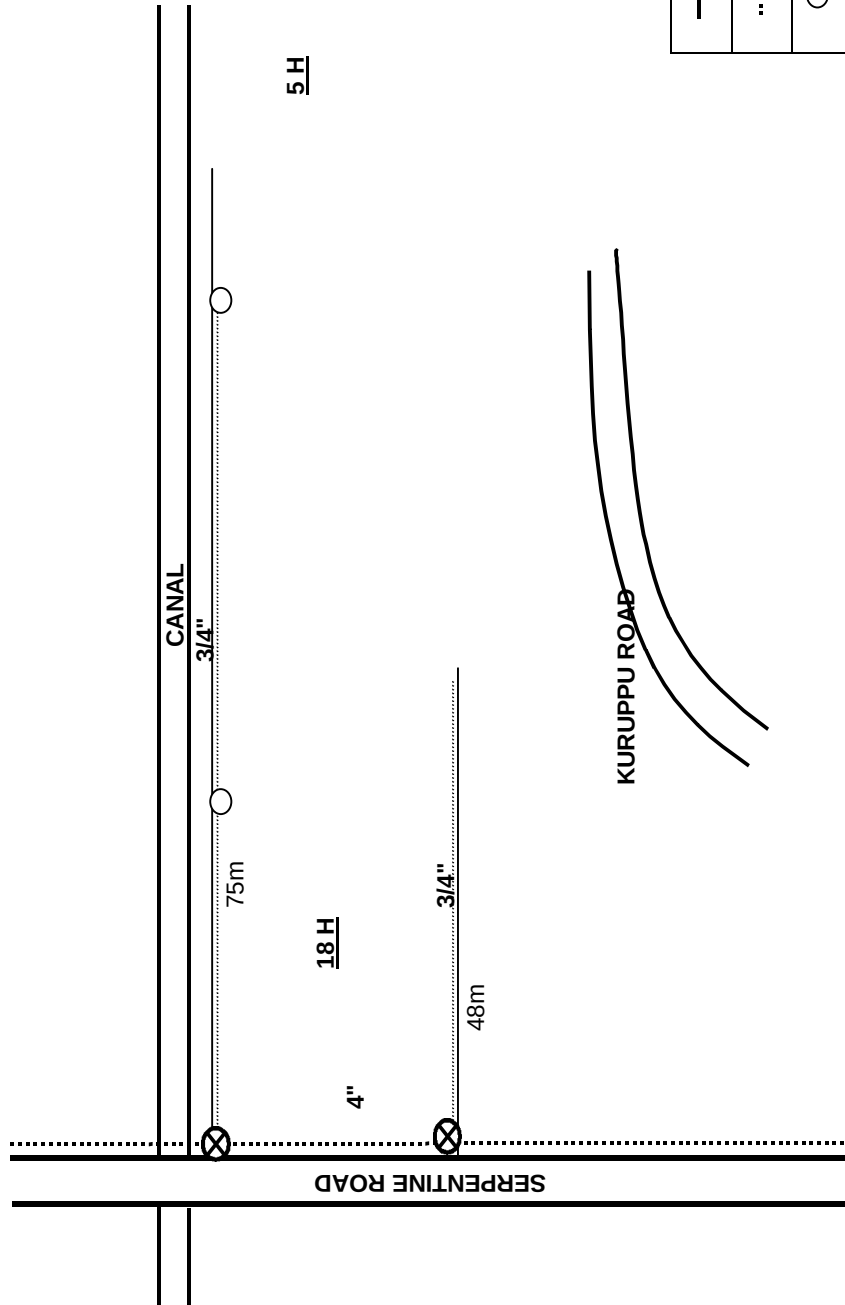
* Every house in this scheme is water supplied

*Total 18 houses

*3" pipes Total length 79.5m

*2" pipes Total length 60m

361 GARDEN

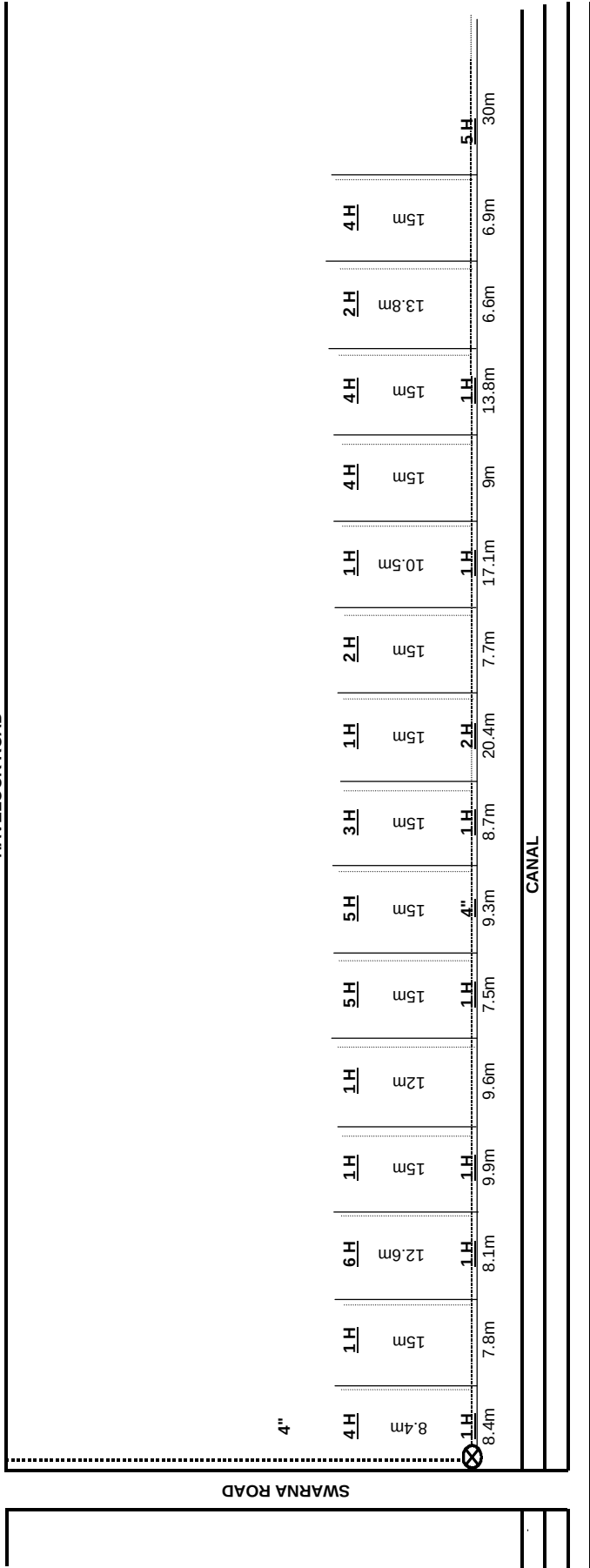


- *Total 23 houses
- *Water supply to 5 houses , taken from Kuruppu Road
- *2 houses have individual water supply
- *16 houses are not water supplied
- *3/4" pipe line to stand post
- *3/4" pipes Total length 123m

—	Access Roads
.....	Pipe lines
○	Stand Post
x"	Pipe Diameter
<u>x H</u>	No. of Houses
x m	Length of Pipe line
⊗	Tapping point & Bulk meter

65 GARDEN

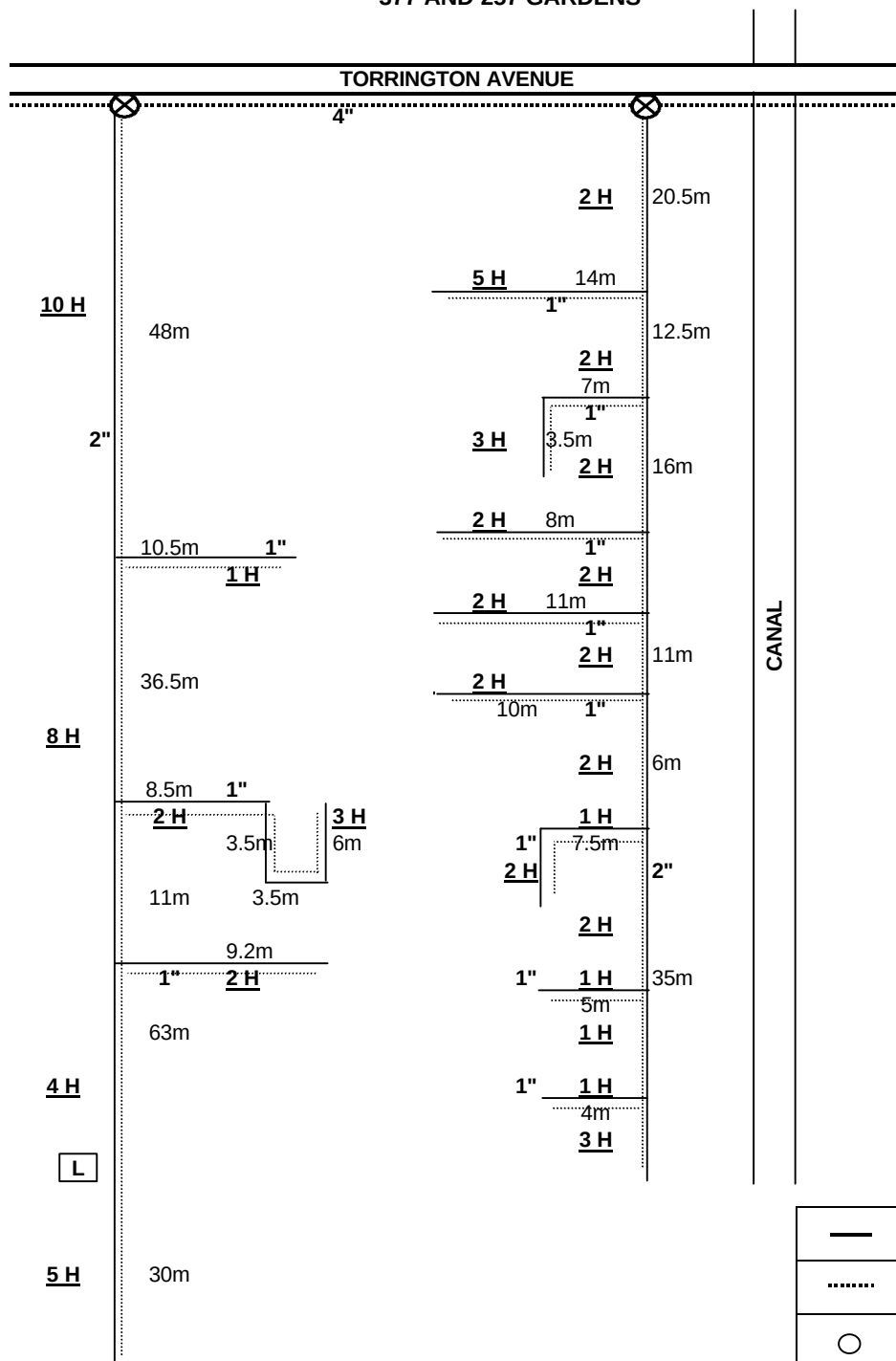
HAVELOCK ROAD



*Every house in this Housing scheme is water supplied
*Total 58 houses
*4" pipes Total length 180.6m
*1/2" pipe line to houses from 4" common line

—	Access Roads
.....	Pipe lines
○	Stand Post
x"	Pipe Diameter
xH	No. of Houses
x m	Length of Pipe line

377 AND 257 GARDENS



	Access Roads
	Pipe lines
	Stand Post
	Public Lavotary
	Pipe Diameter
	No. of Houses
	Length of Pipe line
	Tapping point

*Total 72 houses in both schems

*Every house is water supplied

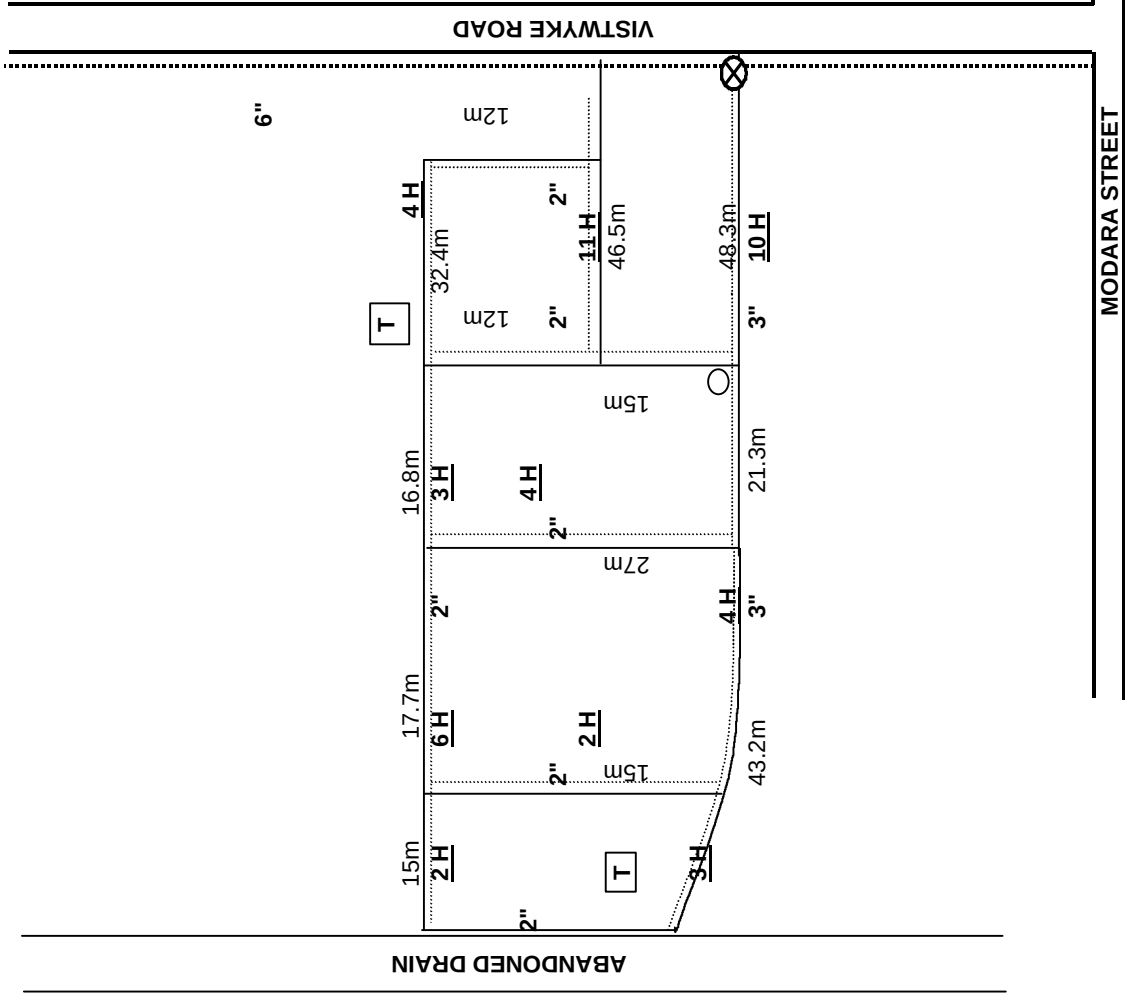
*22 houses in 377 Garden

*50 houses in 257 Garden

*2" pipe line Total length 289.5m

*1" pipe line Total length 111.2m

23 GARDEN



—	Access Roads
.....	Pipe lines
○	Stand Post
T	Public Toilet
x"	Pipe Diameter
x H	No. of Houses
x m	Length of Pipe line
⊗	Tapping point & Bulk meter

- *Total 49 houses
- *48 houses have water supply
- *2 houses have individual connctions
- *1 house with no water
- *3" pipes Total length 112.8m
- *2" pipes Total length 209.4m