

PN-ABY-883

INITIAL ENVIRONMENTAL EXAMINATION

of the

PROPOSED INDUSTRIAL ESTATE

at

TAMBUTTEGAMA

(MAHAWELI)

December 1995

Prepared for the Ministry of Industrial Development

by

NAREPP/IRG

Colombo, Sri Lanka

This report was prepared by : Dr. Ajith De Alwis (University of Moratuwa); Dr. S. Bhuvendralingam (University of Moratuwa); Mr. John Butler (Consultant to NAREPP); Mr. M. H. Gunaratne (Consultant to NAREPP); Mr. Sanath Ranawana (NAREPP); Dr. Robert Smythe (Consultant to NAREPP); Mr. H. D. V. S. Vattala (Consultant to NAREPP); and Dr. Sohan Wijsekere (University of Moratuwa).

The findings and recommendations contained herein represent the best professional judgement of the study team only.

TABLE OF CONTENTS

I.	GENERAL SITE DESCRIPTION	1
II.	PHYSICAL ENVIRONMENT	1
	Weather	1
	Topography, Soils, Groundwater	1
	Surface Water Hydrology	2
	Water Quality	2
	Air Quality and Noise	2
III.	CURRENT AND PLANNED FACILITIES AND SERVICES	
	Water Supply and Wastewater Disposal for Industries	3
	Infrastructure	4
	Existing Structures and Industrial Activities	4
IV.	BIOLOGICAL ENVIRONMENT AND NATURAL RESOURCES	
	Significant Flora	5
	Significant Fauna	5
	Sensitive Habitat	5
V.	SOCIAL AND CULTURAL ENVIRONMENT	
	Human Settlements	5
	Labour Force	6
	Local Economic Activity	6
	Religious and Cultural Features	6
	Aesthetic and Recreational Features	6
	Local Customs, Aspirations, and Attitudes	6
VI.	MAJOR ENVIRONMENTAL AND REGULATORY ISSUES	
	Sensitivity of the Affected Environment	7
	Regional Water Resource Limitations	7
	Regulatory Issues	7
VII.	GENERAL CONCLUSIONS AND RECOMMENDATIONS	7
	REFERENCES	
	ANNEX A-1: Regional Map	
	ANNEX A-II: Site Map	
	ANNEX A-III: Site Photographs	
	ANNEX B: Detailed Soil Analysis	
	ANNEX C: Detailed Water Quality Analysis	

**TAMBUTTEGAMA (MAHAWELI)
PROPOSED INDUSTRIAL ESTATE
SUMMARY ENVIRONMENTAL REPORT**

I. GENERAL SITE DESCRIPTION

This proposed industrial site is situated in the Anuradhapura district within the town limits of Tambuttegama, along the Tambuttegama-Eppawala main road adjacent to the railway station. The land area of the designated site is approximately 16 hectares (40 acres) and is already under development for industrial use by the Mahaweli Authority. The site is hilly; the undeveloped part of the site is covered with scattered shrubs. See the regional and site maps in Appendix A for more detailed geographic information.

II. PHYSICAL ENVIRONMENT

A. Weather

The site is located within the dry zone of Sri Lanka. The temperature of this region varies between 21-37 °C during the year. Mean annual rainfall at Tambuttegama amounts to 1289.5mm/yr (average for 1991, 1993, and 1994). Most rainfall (an average of 995.5mm) is received during the Maha season from October to March. Yala season average rainfall (received during April to September) amounts to 334mm. A maximum average rainfall of 283.3mm (October) and a minimum of no rain (August) was observed during the 1991, '93, and '94 period. Wind direction is predominantly northeast from December to February and southwest from May to September. Average wind velocity is about 7.75 km/hr.

B. Topography, Soils, Groundwater

The land area of this site is 16.2 hectares (40 acres). A perimeter and blocking out plan of the proposed site shows it to have a trapezoidal shape. The approximate elevation of the site is 320m MSL with slopes up to 2.5%. The site is located on a ridge by the side of the Jaya Mawatha from Tambuttegama to Kala Wewa, and is about 2.5 km from Tambuttegama township; Tambuttegama railway station is within 500m from the site.

The top soil layer is clayey. A gravel burrow pit at the site entrance (250 m² in area and excavated to a depth of about 20 meters) revealed gravel and soft rock layers below the top clay layer. See Annex B for more detailed soil analysis.

A rice mill at the northern edge of the site adjacent to the road was using ground water for its purposes. Note: no on-site quantitative measurements of ground water availability were done during this study.

C. Surface Water Hydrology

There are no permanent flowing streams within the site. Surface water bodies in close proximity are the Nallachchiya Wewa, about 1 km to the West of the Site, and the Tammannagama Wewa, a small village tank to the northeast of the Anuradhapura-Galgamuwa road and Jaya Mawatha. This is also about 1 km from the site, due southeast. Surface water on the site, drains to both the east and the northwest boundaries. Drainage to the east crosses the railway line and drains to the Tammannagama Wewa. The northwest side drains underneath the Nallachchiya Wewa right bank irrigation canal and flows through the paddy fields in the direction of Kala Oya.

The Tammannagama tank does not contain much water; during the site visit, a small quantity was observed in the tank bed. It is used primarily for domestic purposes. The Nallachchiya tank has a storage capacity of $1.1 \times 10^6 \text{ m}^3$. Water levels in this tank appeared to have been close to the spill level throughout the entire year. The Tambuttegama town extracts water from this tank; a pump is used to fill a fabricated overhead storage tank with a capacity of 150,000 gallons. Downstream water uses are irrigation, bathing, washing, and other domestic purposes.

D. Water Quality

Water samples were taken from three locations in order to assess the quality of water present in and around this proposed site. The complete water quality analysis of these samples is presented in Annex C of this report.

1. Nallachchiya Wewa, near the intake point for the Tambuttegama water supply scheme;
2. Tammannagama Wewa, a small tank fed by drainage water (including drainage water from the proposed site);
3. Shallow well found at the rice mill factory adjacent to the proposed site.

The fluoride levels in these waters are very high. According to Dissanayake and Weerasooriya, the composition of rocks of the area coupled with climate conditions are the key factors for the abundance of fluoride in the dry zone (Eastern and Northcentral region) of the country (Dissanayake and Weerasooriya, 1985). Appreciable levels of nitrogen (a nutrient widely present in fertilizers) were also detected. And, as was observed in Senapura, because of its salinity the quality of well water appears to be inferior to the quality of surface water.

E. Air Quality and Noise

No site-specific air quality data were available or were measured for this site. However, because this site is currently occupied by several industrial units, some

anthropogenic emissions were observed, as follows:

Furniture-making facility - 'Aba Sevena' - emits significant amounts of dust and noise. Electric driven motors and equipment operate (without appropriate machine guards) causing significant noise. A considerable amount of dust is also generated by these operations. The waste saw dust is also burnt on site, adding to the smoke nuisance at times.

Rice Mill - This facility emits flue gases due to burning paddy husk. Paddy husk is burnt to obtain steam used in boiling paddy. However the amount of paddy husk generated at the facility exceeds the amount required for generating steam. The remainder constitutes a source of solid waste.

Concrete lamp-post facility - This facility could contribute to dust and noise pollution. Dust could be generated when cement and rock aggregates are being handled. The facility uses about 2 acres of land but operates only during part of the the year.

Mahaweli workshop - Heavy machinery used in Mahaweli operations are repaired here. Both noise and air pollution could be generated by machinery and vehicles.

III. CURRENT AND PLANNED FACILITIES AND SERVICES

A. Water Supply and Wastewater Disposal Options

Following are two potential (although uncertain) sources for the supply of water to the proposed industrial estate:

1. Nallachchiya Wewa : Water from this tank is used to supply potable water to Tambuttegama town in addition to its irrigation use. This tank is identified as the water source to this proposed site by the Mahaweli Authority of Sri Lanka, the original developer of this site.
2. Ground water : Only a few wells were located around this proposed site (a single well was observed in the immediate vicinity). As mentioned above, the ground water (shallow) appears to be rather hard. Neither the volume nor the quality of the local ground water was systematically measured during this study, and thus should be quantified prior to further site development.

The availability of wastewater disposal options is also uncertain, because the volume and types of potential effluent discharges can not be estimated yet. Since the natural drainage from this proposed site is directed towards Tammanagama Wewa and towards Kala Oya (via undercrossing Nallachchiya Wewa canals), Tammanapura Wewa may be a feasible option as the recipient water body for the treated liquid effluent disposal. However, since water from this tank is already regularly used for domestic purposes (such as washing, bathing etc.), any liquid effluent discharge to it must be free from toxic

chemicals and treated to a level that would not pose any hazard for existing water users or wildlife. A central wastewater treatment plant would likely be most feasible way to assure that this goal is met.

B. Infrastructure

1. Power: Two 33 KV transformers are located on-site see map: the Anuradhapura substation is 160 KVA capacity and the Tambuttegama substation is 100 LVA.
2. Telecommunications: No telecom service exists at the site. According to the Anuradhapura telecom engineer, to provide a telecom facility for the site the extension capacity of the Tambuttegama area needs to be expanded; therefore at present additional telecommunication connections to the site are not possible.
3. Transportation: Closest towns to the site are Tambuttegama (2.5 km) and Anuradhapura (25 km). Road and rail connections are very good; the Tambuttegama-Galnewa main road is at the east boundary of the site, while the Tambuttegama Railway station is at the west boundary. The location of the site is advantageous since the existing rail line can easily be extended by constructing a spur line.
4. Other public services: The township of Tambuttegama, in which this site is located, is the major town of the Mahaweli system. The town has most modern amenities such as telecommunication, health and educational institutions, a police station, and postal services. There is a government district hospital and an Ayurvedic hospital in the town. There are two large schools close to the site: Tambuttegama Central College (1.5 km) and Telhriyawa Vidyalaya (3 km).

C. Existing Structures and Industrial Activities

The site has 5 security posts and barbed wire fence all around. It also has a well-laid out internal road network and a drainage system. The site has been promoted by the Mahaweli Development Authority to set up small and medium-scale industrial activities. Many of the investors in these activities come from the Mahaweli settlers.

There are already three industrial activities underway at the site, as mentioned above: a rice mill, a concrete lamp post fabrication plant, and a furniture factory. These three industries operate independently. There are also several half-complete structures intended for setting up of additional industries (paddy mill, coconut oil extraction unit etc.).

Several industrial developers have expressed interest in this site. The existing Mahaweli Authority Workshop could also be an asset to the development of this site as an

industrial estate. However, proper co-ordination between M/ID and the Mahaweli Authority is necessary to make this possible.

IV. BIOLOGICAL ENVIRONMENT AND RESOURCES

A. Significant Flora

The proposed site, which was recently cleared, is situated at the middle of an earlier settlement. A few scrub plants such as Eupatorium and Zysypus species were observed in parts of the site where there are no current activities. Several aquatic plants were observed at the two tanks nearby, including Nymphae, Nelumbo, and Salvinia species. A few scattered trees also were present at the site, including Ehela (*Cassia fistula*) and Myla (*Bauhinia racemosa*).

B. Significant Fauna

No animals were observed at the site except for a few common birds; these included the common crow, common babbler, Rose-ringed parakeet and White breasted-kingfisher. Several other bird species, including waterfowl, are likely to be found as residents of the nearby tank and canal system.

C. Sensitive Habitat

No especially sensitive natural terrestrial habitat is located within or adjacent to the proposed site. The aquatic habitat of the nearby tanks attracts a variety of birds and other animals, and could be adversely affected by increased withdrawals of water from the tanks for industrial purposes.

V. SOCIAL AND CULTURAL ENVIRONMENT

A. Human Settlements

The proposed industrial site is within the Grama Sevake Division (GSD) of Tammannagama, which has a population of 1425; the adjoining GSD of Nallachchiya has a population of 1101. About 10-15% of the families in these two GSDs lack adequate housing. Nallachchiya has around 220 families whilst Tammannagama has about 255. Some 40 to 50% of the houses in this area are of permanent type, and are interspersed with other housing that is classified as semi-permanent (30-35%) and temporary (15-20%).

The Tambutteagama District Hospital provides adequate health care to the populace of the area. The primary school of Tambutteagama accommodates 1350 students; the Central school has over 2000 students.

B. Labour Force

The labour force in this area is severely under-employed. In Tammannagama 200 are in permanent government service whilst in Nallachchiya only 32 are so employed. Tammannagama, however, has 348 workers in daily-paid labour grades. Employment in fields other than agrarian activities has become necessary because three generations of settlers are living on the original land allocations of 3 acres per family. The female workforce from these two GSDs has found employment in three garment factories established under a 1992 BOI-sponsored scheme within 8 km of the site, the closest of which, Candy Garments at Ikkiriwewa (4 km) to the West, employs about 350 workers. During cultivation and harvesting time these workers leave their jobs temporarily to work in the fields, and their absence from the factories adversely affects factory production targets. The Tambuttegama Divisional Secretariat has a labor force of approximately 11,900 of which about 11,450 are employed. The total population of the Tambuttegama DS is 25,709, of which 13,388 are male and 12,320 are female. Of the total population, 18,290 have had an education up to Grade 3, 971 have G.C.E. OL/AL, and 139 have a higher qualification.

C. Local Economic Activity

As indicated above, agriculture and garment manufacturing are the primary local income-generating activities; in addition to these there are a variety of local and regional government workers, as well as other persons employed in small businesses such as the concrete lamp-post and timber furniture fabrication operations now being conducted at the proposed site. There is an apatite deposit at Eppawela, approximately 14 km from the site. The deposit is being mined to a limited extent to produce phosphate, but there is potential for the industry to be expanded, since phosphate is the raw material for fertilizer industry.

D. Religious and Cultural Features

The nearest Buddhist temples currently in use are Veheragala (1 km), Nallachchiya Gal Vehera, and the village temple of Tammannagama. The closest archaeological site is at Kuda-Bellankadawala (about 5 km from the site) where a stone inscription from the 1st century BC has been found with possible sites for excavation.

E. Aesthetic and Recreational Features

The aesthetic beauty of the Nallachchiya tank and its temple on the rock is a local attraction; there are currently no organized recreational activities near the site.

F. Local Customs, Aspirations, and Attitudes

Due to restrictions on land ownership and transferability, the demand for employment outside agrarian services is high.

VI. MAJOR ENVIRONMENTAL AND REGULATORY ISSUES

A. Sensitivity of the Affected Environment

As mentioned above, the agricultural systems around the two tanks are sensitive to water pollutants, especially Nallachchiya tank, which supplies water that is used to irrigate the paddy lands of local settlers and also for domestic purposes in the Tambutteagama town. The development plan for this proposed industrial estate should include measures to avoid or minimize such off-site impacts, and also a monitoring plan to evaluate and maintain the effectiveness of such measures.

B. Regional Water Resource Limitations

Water availability at this site is uncertain. Ground water does not appear to be a feasible water source for this site due to its high salinity; this should be confirmed by further on-site analysis. Additional analysis is also needed to determine the amount of surface water that could be obtained on a sustainable basis from the nearby Nallachchiya Wewa without adversely affecting existing users of water from this same source.

C. Regulatory Issues

Plans for either surface or ground-water withdrawals to supply water to this site should be based on further analysis, and should be reviewed and approved by the Water Supply and Drainage Board, the C.E.A., the Irrigation Department, the Mahaweli Development Authority, and local authorities. Because the surrounding land use is predominantly agriculture, and the site drainage is to a tank and canals that supply irrigation water to these lands, it is essential that industries using toxic and/or refractive organic chemicals and/or inorganic salts and acids/alkalis not be allowed to dispose of them at this site. The C.E.A. should make this restriction a condition of any Environmental Protection Licenses (EPL) that may be issued to industries seeking to locate at this site.

VII. GENERAL CONCLUSIONS AND RECOMMENDATIONS

This site was rated by the study team as having medium to high pollution assimilative capacity and medium to high local resource availability. The site is considered to be generally pollution potential and medium to high resource consumption levels, although uncertainties regarding water supply and wastewater discharge options may pose some constraints. The site has already been partially developed, and has adequate access to transport and infrastructure. The site also appears to be large enough to accommodate a central wastewater treatment plant.

The principal environmental constraints on the use of this site by heavier industry (industry with high resource needs and/or pollution potential) are:

- * Uncertainty about the quantity and quality of surface or ground water

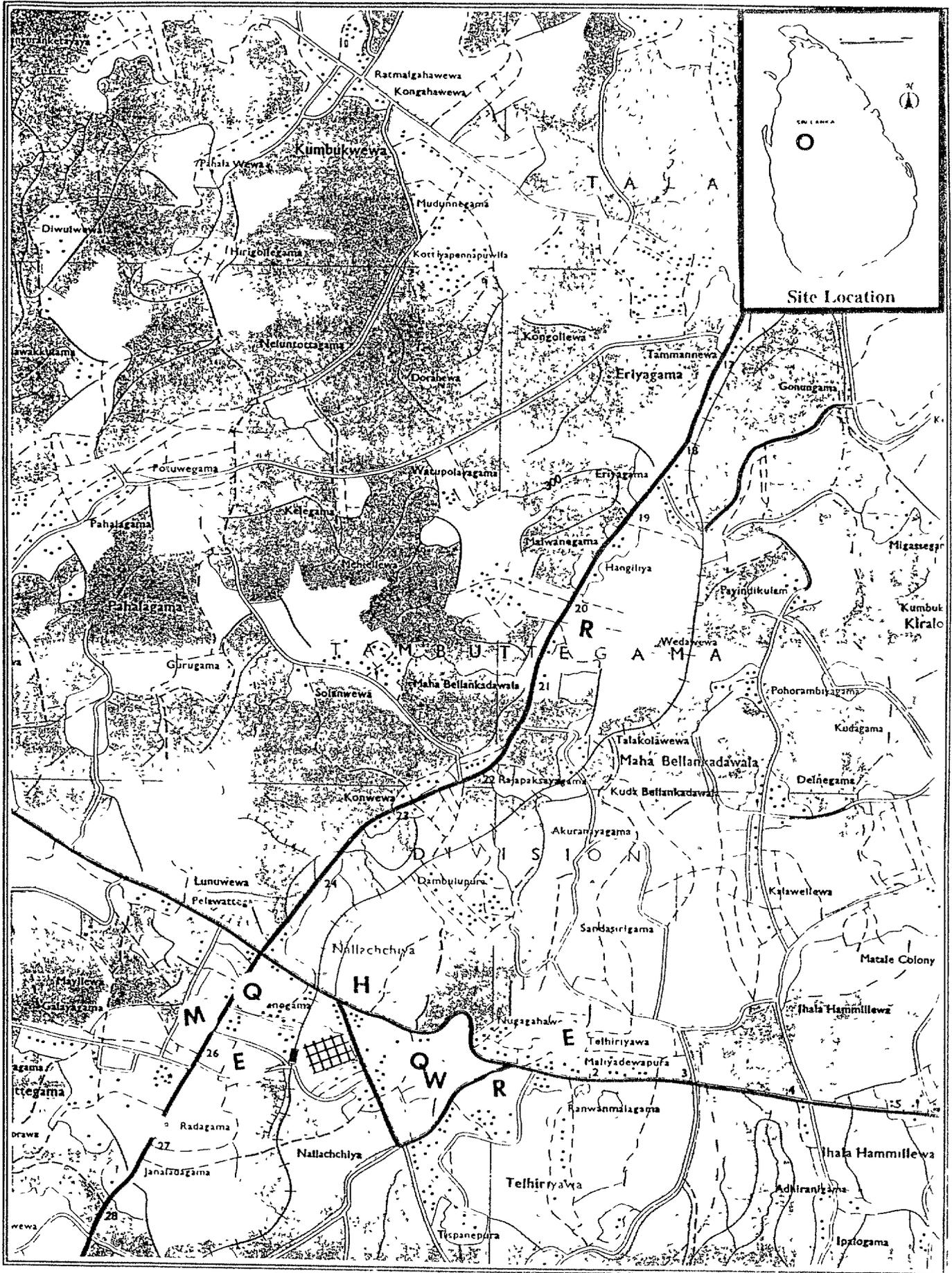
available to the site on a sustainable basis;

- * Sensitivity of adjacent water bodies and agricultural lands to discharge of wastewater;
- * Limited site expendability;
- * Lack of an existing solid-waste disposal facility.

If the additional hydrologic analysis recommended above determines that adequate water resources are available to the site on a sustainable basis, and that off-site effects of water withdrawals and discharges can be minimized or mitigated, this site could be quite suitable for development as an industrial estate, even for some potentially high-polluting industries.

REFERENCES

Dissanayake, C. B. And S.V. R. Weerasooriya, The Hydrogeochemical Atlas of Sri Lanka, Natural Resources Energy and Science Authority (NARESA) of Sri Lanka, 1985.

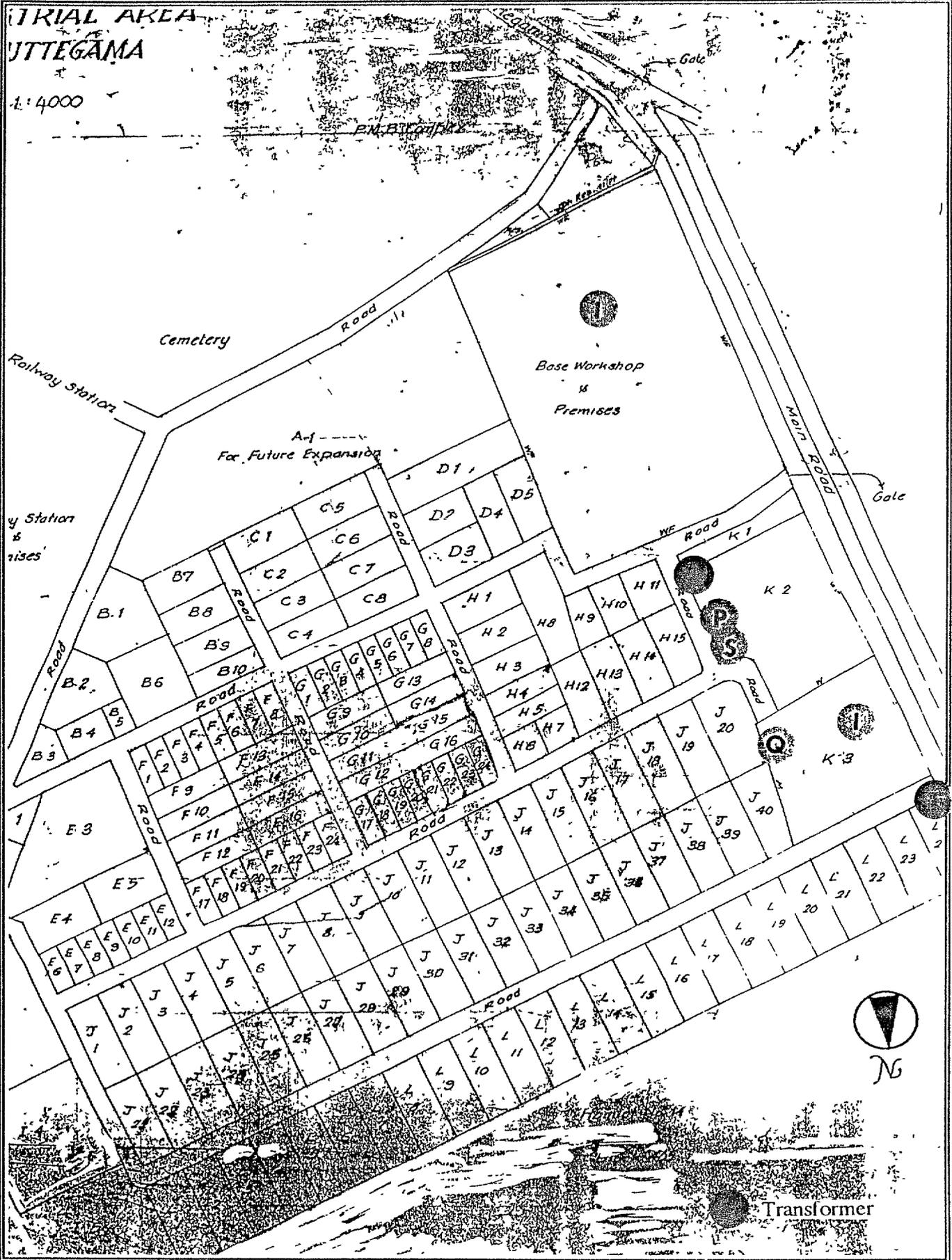


Location Map of Proposed Industrial Estate - Tambuttégama

Scale Produced using 1:50,000
Topographic Map

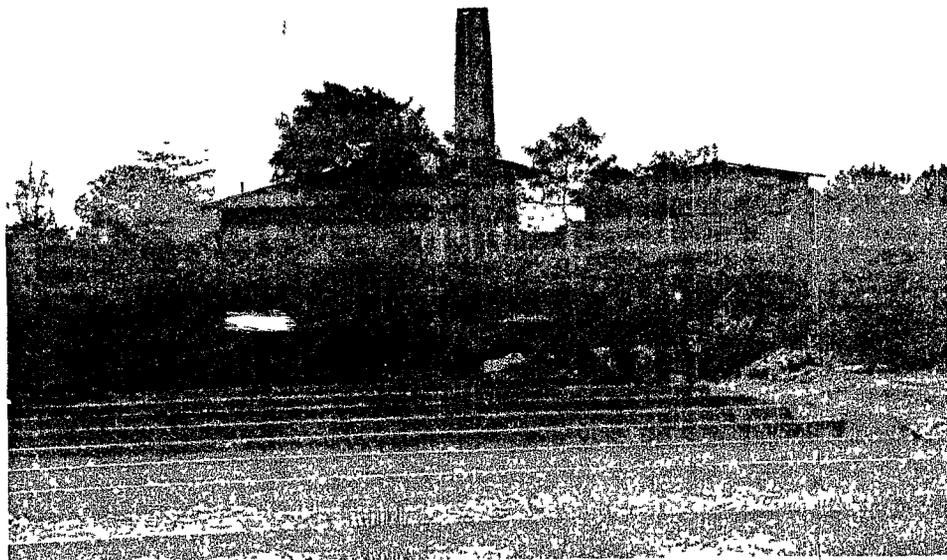
- A - Archeological
- E - Schools
- H - Important Habitats
- I - Industries
- M -
- P - Percolation Measurement Point
- Q - Water Quality Sampling Point
- R - Religious (Temple, Church, Kovil/Mosque)
- S - Soil Sampling Point
- W -

9

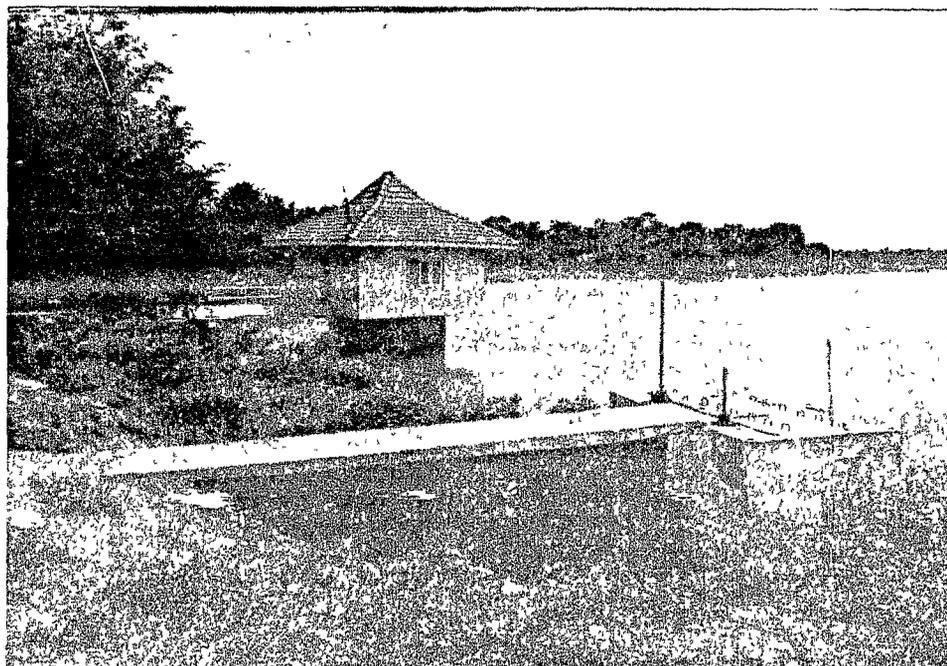


Perimeter Survey Map - Proposed Industrial Estate - Tambuttegama

- | | |
|------------------------|--|
| A - Archeological | P - Percolation Measurement Point |
| E - Schools | Q - Water Quality Sampling Point |
| H - Important Habitats | R - Religious (Temple, Church, Kovil/Mosque) |
| I - Industries | S - Soil Sampling Point |
| W | |



A. Proposed site for Industrial Estate at Mahaweli site in Lambuttegama - Chimney of the adjoining Rice-Mill is in the background.



B. Nallachchi tank - Proposed source of water to the site - Sluice to the R.B canal and water intake to the Lambuttegama town

SOIL AND SURFACE WATER : METHODS OF COMPUTATION

- ◆ Site Elevations in MSL are based on Survey Department Topographic Maps or available contour maps for the respective site.
- ◆ Maximum slope values are based on physical measurements during study.
- ◆ Reservoir capacity estimates other than from irrigation department are based on the average depths observed during site visits.
- ◆ Rainfall values are based on data collected from regional institutions during site visits and the historical data from hydrological annuals and Ceylon Electricity Board Water Resources Data Base (July 1987).
- ◆ Maximum, Minimum and Average river flows are based on the historical flow data. In cases where streamflow data were absent, representative runoff ratios from hydrological annuals were used with rainfall in respective regions and watersheds identified using topographic maps.
- ◆ Hydraulic Conductivity Data and Sorptivity data are based on Infiltrometer Tests done at each site fitted to infiltration curve by Philip (1957).
- ◆ Soil moisture contents and the organic matter contents by Gravimetry.
- ◆ Soil quality by liquid (water) extraction and relevant water quality methods.
- ◆ Wind and temperature estimates are based on the information in the National Atlas of Sri Lanka.
- ◆ Soil classification is according to the unified system.

Soil Data for Proposed Industrial Estate at Thambuttegama

Description	Unit	Site 1
Sampling Depth	mm	250
Moisture Content	%	2.71
Organic Matter	%	4.36
Classification		SW
Chloride Cl ⁻	mg/gr	0.30
Nitrates No ₃ ⁻ -N	mg/gr	0.0125
Fluoride F ⁻	mg/gr	0.050
Phospate PO ₄ ³⁻ - P	mg/gr	N/D
pH		6.24
Hydraulic Conductivity (saturated)	cm/hr	0.51
Sorptivity	cm/(hr ^{1/2})	2.88

N/D = Not detected

ANNEX C: DETAILED WATER QUALITY ANALYSIS

INDUSTRIAL ESTATES SITING STUDY, 1995

SUMMARY OF ANALYTICAL METHODS

PARAMETER	UNITS	METHOD	DETECTION LEVEL
TSS	mg/l	Gravimetry	-
TDS	mg/l	Gravimetry	-
DO	mg/l	Titrimetry	-
BOD	mg/l	Titrimetry	-
COD	mg/l	Open - Reflux, Titrimetry	-
pH	-log H ⁺	Selective ion electrode	0.01
Cl ⁻	mg/l	Titrimetry	-
SO ₄ ²⁻	mg/l	Gravimetry	-
F ⁻	mg/l	Colorimetry	0.1
NH ₄ ⁺ - N	mg/l	Colourization/Spectrophotometer	0.01
NO ₃ ⁻ - N	mg/l	Colourization/Spectrophotometer	0.01
PO ₄ ³⁻ - P	mg/l	Colorimetry	2.0
Alkalinity	mg CaCO ₃ /l	Titrimetry	-
Hardness	mg CaCO ₃ /l	Titrimetry	-

WATER QUALITY ANALYSIS :

ANURADHAPURA DISTRICT

PROPOSED SITE AT THAMPUTTEGAMA (MAHAWELI)

Location	Date of Sample	TSS	TDS	DO	BOD ₅	COD	<u>BOD</u> COD	pH	Temp	Cl ⁻	SO ₄ ²⁻	F ⁻	NH ₃ -N	NO ₃ ⁻ -N	PO ₄ ³⁻ -P	Carb. Alk.	Bicarb. Alk.	Carb. Hard.	Non-Carb. Hard.	Flow rate
Nallachchi Wewa (Intake)	Aug 9-10 1995	8.0	250	8.9	3.7	80	0.05	7.6	30.5	29	5.0	4.0	0.16	0.03	ND	Nil	90	70	Nil	-
Tammanapura Wewa	-do-	5.0	320	8.7	2.0	72	0.03	7.6	30	33	8.0	3.6	0.16	0.01	ND	Nil	110	110	Nil	-
Rice-mill Well	-do-	4.0	920	6.4	2.0	40	0.05	7.8	32	146	52	3.6	0.14	0.03	ND	Nil	430	350	Nil	-
Proposed minimum ambient quality	-do-	-	-	3.0	4.0	-	-	5-8.5	-	1200	400	1.5	4.0	5.0	0.7	-	-	600		

ND = Not Detected

15