JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF PUBLIC WORKS
REPUBLIC OF INDONESIA

The Study on the Solid Waste Management Improvement for Surabaya City in The Republic of Indonesia

FINAL REPORT

Volume 5

DATA BOOK

May 1993

Pacific Consultants International
EX Corporation

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All the Rupiah amounts including the projects costs shown in this report are indicated in 1992 price unless otherwise indicated. Those amounts are estimated partly based upon the foreign prices by applying dominant 1992 currency exchange rates, i.e.: US $ 1 = Rp 2,000 = ¥125 (¥1 = Rp 16).

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ENVIRONMENTAL IMPACT ASSESSMENT REPORT (TRANSLATED INTO ENGLISH)

1 **Environmental Impact Assessment Report (ANDAL)**
Translated into English

PROPOSED OPERATION

ON NEW FINAL SOLID WASTE DISPOSAL SITE

AT ROMO KALISARI - BENOWO DISTRICT

SURABAYA CITY - INDONESIA

FINAL REPORT

ENVIRONMENTAL IMPACT ASSESSMENT
(ANDAL STUDY)

DINAS KEBERSIHAN
PEMERINTAH KOTAMADYA DAERAH TINGKAT II SURABAYA
Support by :
Direktorat Penyehatan Lingkungan Pemukiman
Direktorat Jenderal Cipta Karya - Departemen PU
and The Technical Team :
JICA STUDY TEAM on SOLID WASTE MANAGEMENT IMPROVEMENT FOR SURABAYA CITY

November - 1992

Contents of ANDAL Report

CHAPTER 1

1. INTRODUCTION

1.1. Background

The Cleaning Management in Surabaya Municipality has already been handled seriously and obviously through development programmes either assisted by World Bank Loan for Solid Waste Improvement Programme - SWIP on Urban V programme, or PEMDA itself budget during the latest ten years.

The hard working results were acknowledged through Adipura award received first time by Surabaya on 8 June 1988 as the cleanest city, and the prestige was retained up to achieve the fourth award in 1991, and this year Surabaya received a Gold Adipura Award (Permanent Cup) for the fifth award.

The survey results carried out by the City Cleansing Department of Surabaya Municipality together with Technology Institute of Surabaya in 1987 got the solid waste production per capita is 3,2 litre/day or 7,600 m3 per day. By the same production in 1990, Surabaya Municipality with a real population of around 2,674 thousand was expected to produce the solid waste of approximately 8500 m3/day, or around 3,1 billion m3/year; while the available equipment capacity to carry the solid waste to the Final Disposal Site was only about 65% or 5,600 m3/day *) The accurate survey was done by Surabaya Solid Waste Management Improvement Study **), which provided this accurate number.

The bacic of city solid waste management is to clean the physical solid waste that was produced by the human activities, especially at the housing area, shops, markets commercial and offices area, besides the other locations such as mosque, church, hospital etc. The primary collection activity is to collect the solid waste from the production centres to the Temporary Disposal Site (LPS) which the implementation will be handled as mutual cooperation by residents through neighborhood association (RT)/administrative unit (RW) and urban sub-unit of sub-district (Kelurahan). The secondary collection is from the Temporary Disposal Site (LPS) to the Final Disposal Site (LPA), which the implemantation will be conducted by the City Cleansing Department of Surabaya Municipality.

*) All figures werequoted from the Solid Waste Report of Integrated Urban Infrastructure Development Programme (IUIDP) - January 1991 using per capita generation of the Cleaning Department of KMS in 1987.

**) A Study with the original title of The Study on The Solid Waste Management Improvement For Surabaya City" by Japan International Cooperation Agency (JICA) Team Study. The project funded Japan is allocated through Urban Environmental Sanitary Directorate - Directorate of General of Cipta Karya - Public Works Department.

The whole solid waste production carried from LPS will eventually need disposal facility to create a clean environment, free pollution and undanger human life. The present waste disposal system in Surabaya principally is dealt with 2 systems such as : natural decomposition (around 85%) by Open Dumping and the incineration system by Incinerator (15%).

The two systems can almost be conducted at the three Final Disposal Sites that are Keputih, Lakarsantri and Kenjeran; and the inceneration system built up near the Keputih LPA location.

The extention of city development have pressed the changes of land use, and at present the government of Surabaya Municipal, is progressing the negotiation of possibility to allocate the Lakarsantri Final Disposal Site to Romo Kalisari at Benowo district as a consequence of agreement on West Surabaya Urban Development Unit Plan, which Lakarsantri Final Disposal Site located.

Due to the waste disposal process at LPA is able to affect the surrounding natural resources, to fullfill the Decree of Chapter two of Governmental Regulations No. 29/1986, concerning the Cleaning Programme/Surabaya solid waste sector needs to conduct the environmental study. The initial information of environment review, and a similar study under the Surabaya IUIDP solid waste sector have identified that the activities on Final Disposal Site will cause a serious negative environmental impact. As mention at the Environmental Initial Assessment-EIA (PIL) on 30 October 1990, that all proposed solid waste project component, including the operation of final disposal site, need to be continued with Full Environment Assessment-FEA (ANDAL) study. The Surabaya IUIDP ANDAL is being prepared and the English edition already finished and distributed. The Bahasa Indonesia edition published on the end of November 1992. By this reason the technical study team decided to conduct the FEA of proposed Benowo new Final Disposal Site study without carried out EIA explicitly, but followed the Surabaya IUIDP EIA result which have been agreed officially.

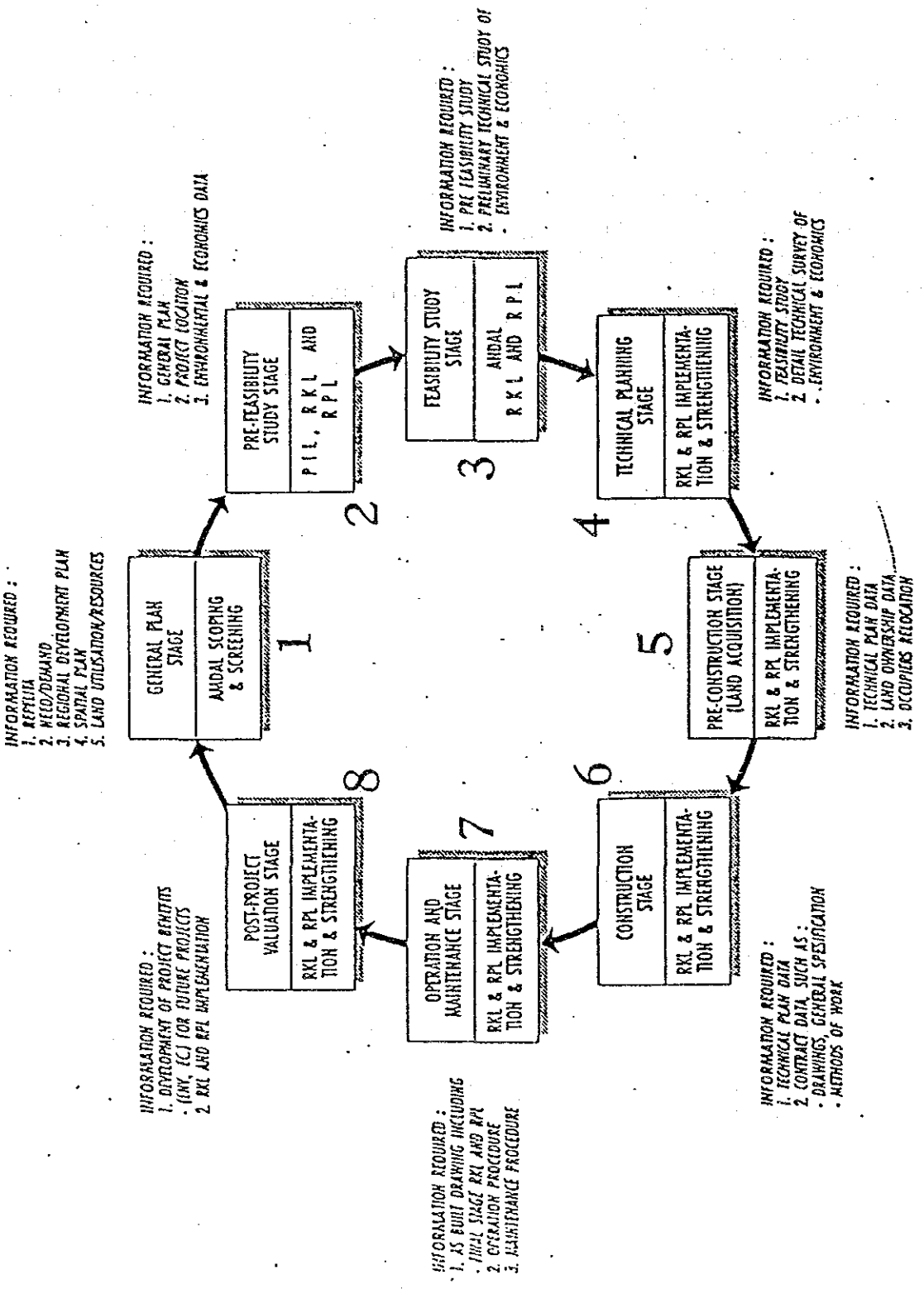
Since February 1992, a study team funded by JICA allocated through PLP of Directorate of General of Cipta Karya - Public Works Department (DPU), has commenced "Study on Solid Waste Management Improvement for Surabaya City". The study scope is including an assistance to Surabaya Municipal to look for a new site and to plan the operation of Final Disposal Site, which are really needs. Then, this FEA Study will accompany the technical feasibility study on the management of Final Disposal Site Study with open dumping approach to minimize the level of pollutions.

This FEA study will examine the assessment of the condition on pre-construction, during construction, and post-construction. The post operation period shall anticipate the plan of the industrial land use which already allocate at Tambak Osowilangon Urban Unit Development Plan. When this subject is related to the

Minister of Public Work Decree No.779/KPTS/1990 about Technical Guide Line on Public Work Project Environment Assessment, this study staging level in the Public Work Project cycle is on phase 3 and phase 4, which is proposed to complete the technical study on feasibility study phase and Technical Design Phase. The information that was needed for supporting this Environment studies e.g. Pre-feasibility study, preliminary studies on environment and economic studies and will be continued with the detail studies on environment and economic studies. The Development of Public Work Project Cycle and its integration with Environmental study (AMDAL) shown in Figure 1.

The final result of this environmental study is expected to produce a good recomendation for the new final disposal site which is completed by a substantial supporting facilities to reduce the negative impact on pre-construction stage, construction stage, and post-construction/operation, and post operation stage.

Figure 1
The Integration of AMDAL Study in
The Public Works Project Development Cycle



1.2. The Prevailing Laws Regulations

The guidelines for the Environmental Assessment (ANDAL) of "PROPOSED OPERATION ON NEW FINAL SOLID WASTE DISPOSAL SITE AT BENOWO - SURABAYA CITY" of East Java province, should be prepared based on the following laws regulations :

a). Laws No. 4/1982 concerning the Principle Determination of Environmental Management.

b). Governmental Regulations No. 29/1986 concerning Environmental Assessment.

c). Decree of Minister of Population and Environment No. KEP-49/ MENKEH/6/1987 and Decree of East Java Governor No. 183/1988 concerning Important Impact Determination Guidelines and its attachments.

d). Decree of Minister of Population and Environment No. KEP-50/ MENKEH/6/1987 and Decree of East Java Governor No. 184/1988 concerning Environmental Assessment Preparation Guidelines;

e). Decree of Public Works Minister No, 531/KPTS/1989 concerning AMDAL Selection Guidelines of Public Works Projects.

f). Decree of Public Works Minister No. 506/KPTS/1991 Replace Decree No. 557/KPTS/1989 concerning AMDAL Management Guidelines of Public Works Projects.

g). Decree of Public Works Minister No. 779/KPTS/1989 concerning AMDAL Technical Guidelines of Public Works Projects - Solid Waste Project.

h). Decree of East Java Governor No. 413/1987 concerning Water Quality Standard and Classsification in East Java.

i). Decree of East Java Governor No. 414/1987 concerning Waste Water Quality Standard and Classification in East Java.

j). Decree of Governor of East Java No. 188/1987 regarding Air Quality and Sea Water Standard.

k). Decree of Governor of East Java No. 187/1988 regarding River Water Allocation in East Java.

l). Decree of Governor of East Java No. 328/1987 regarding Local Organisation Structure and Commission Working Arrangement.

m). Decree of Mayor of Surabaya Municipality No. 6/1986 concerning the Cleaning Implementation in Surabaya Municipality.

n). Decree of Mayor of Surabaya Municipality No. 201/1989 concerning Body Water Allocation of River Water in Surabaya Municipality.

o). Urban Spatial Development Unit Detail Plan (RDTRK) of Benowo Urban Unit, produce in 1989/90, prepared by Bappeda Level II, Government of Surabaya Municipality.

p). Urban Spatial Development Unit Detail Plan (RDTRK) of Tambak Osowilangon Urban Unit, produce in 1991/92, prepared by Bappeda Level II, Government of Surabaya Municipality.

q). Technical Design on Surabaya-Gresik Toll Road Development, by PT Jasa Marga.

1.3. Policy of Environmental Management Implementation

Principally, the Development Basic Pattern in East Java and also prevailing for Surabaya Municipality, focuses on the Long Term Development with an environmental prespective. Other wise in order to control and manage the environmental pollutions of "Benowo LPA Management Improvement Plan", the physical and non-physical activities must notice the principles, characteristics and capability of natural resources as terms of the continuing development.

The open waste disposal process at the surface level will reduce the surrounding environment quality. To realize the purpose of the environmental management implementation, it needs an effort to decrease the negative impact of environmental quality at surrounding operated LPA is able to be minimized; as following :

a). Pre-Construction stage;
To minimize the land owner restlessness due to a low price of land compensation to be acquired, and decreasing the land value surround the proposed new final disposal site, causeed by the bad image disposal environment.

b). During the Construction stage;
To minimize negative impact due to the project activities, caused by the earth work and heavy equipment travelling the building material; such as the reduction of air and dust quality; surface water quality, ground water quality and safety work.

c). During the Operation;
To minimize unpleasant smell impact; the diseases that caused by insects/germs; spilled ground water and surface water pollutions, and dangerous gas production and the disturbed traffic of waste transport activities to the surrounding community.

d). During Post Operation; considering the adjacent proposed LPA areas to the construction of Surabaya-Gresik Toll Road, and the location of Industrial Estate Extention as describe at the spatial development plan. The final of physical form and the impact on waste embankment has not to be suit the surounding environment, although the proposed Final Disposal Site locate exactly on the future open green space.

To reach that purpose, the ANDAL study must be able to provide the clarity to the concerned agencies about the limitation of operational implementation scope at new Final Disposal Site and the possible management improvement efforts to reach the related agencies objectives and to minimize the development cost at present and in the future.

The related agencies should be involved in ANDAL preparation to formulate the objectives and the implemented scope of work as follows :

a). Local City Cleansing Department of Surabaya Local Government and is assisted by a Team Study of "The Study on The Solid Waste Management Improvement For Surabaya City" - Japan International Cooperation Agency (JICA) as the project initiator.

b). Bappeda Tingkat II Kotamadya Surabaya, as an urban development responsible agency to give the consideration to the Surabaya long term development.

c). Bappeda Tingkat I Jawa Timur and other East Java agencies related to the Environmental Pollutions Management and Control Commission of East Java Province; as an authorised organisation.

d). Directorate of PLP, Dir.Jen. Cipta Karya; Public Works Department Branch Office of East Java, as a technical agency.

e). The Technical Team of Environmental Assessment Study Preparation appointed by the initiator.

1.4. The Relation of Activity Plan and the Potential Important Impacts

Based on the AMDAL Technical Guide-line for Public Work Project - Solid Waste Sector; Minister of Public Work Decree No.779/KPTS/1990 and also the results of Surabaya IUIDP EIA study, especially on solid waste sector which the appraisal was accepted in October 1990, the possible important impacts resulted from the LPA operation plan as follows :

a). Social-Economy-Culture Aspect

- Society Discouragement concerning the anxiety of bio-physic pollution influenced by the present pond operation chance.
- Land Value Orientation, there is a trend that the final results from LPA will effect to the land quality decrease and as general perception that Ex-Solid Waste Area is the same as low level housing area.
- The anxiety of future land use resulted from LPA history, due to the lack of decomposition process understanding and the worries of active period of chemical process that caused by the pollution effect.

b). Bio-Physical/Chemical Aspect

- Ground Water Pollution; the decomposed waste will produce the leachate highly depend on the type of waste discarded. In general, the leachate contains excessive ammonia and nitrate concentration in addition the dissolved possible solid substances. The chemical substances of pollution source might be absorbed into the soil layer to pollute ground water source. The leachate pollution impact can be spreaded by the surface water flow during the wet season which the impact spreading area will be further through the surrrounding channels. The chemical substances content and concentration of leachate determined the environment pollution rate.
- Smell; the decomposition process will produce unpleasant smell, especially during the wet season. The smell will be spreaded further and further according the wind direction and velocity. This area will being a pollution resources and increase the sensitivity of surrounding community to the possible health disturbance as object effected.
- The disease spreading and possible society health disturbance related to the solid waste sector is skin and epidermis disease, diarrhoea and various kinds of poisoned diseases. The spreading can be through direct contact but this effect can be more limited and the spreading effect will be wider by insects/flies, water and air/wind so can influence the ecosystem environment.

- The Aesthetic Disturbance; due to the limited present LPA control, the view of the operation will greatly influence the surrounding environment including the site plan of final completion of remaining LPA.

1.5. Proponent and ANDAL Team

1.5.1. Proponent :

The City Cleansing Departement of Surabaya municipality

1.5.2. ANDAL Team

1.	Project Manager (JICA)	:	Mr. Urushibata K
2.	Deputy Project Manager	:	Wibowo Gunawan
3.	Team Leader	:	Agus Sugianto
4.	Environmental Enginer	:	Sarwoko M
5.	Biology/Ecology Expert	:	Agus Sugianto
6.	Chemist	:	Sarwoko M
7.	Transportation Engineer	:	Dina Limanto
8.	Civil Engineer	:	Libertus
9.	Socio Economic Culture Expert	:	Bambang Triono

1.6. Study Objective

1.6.1. Intents and Purposes

The intents and purposes implemented Environmental Assessment Study are :

1. Basic review to the activity plans, which are raising the important impact based on the identification results by the previous similar environmental study on the solid waste sector;
2. Basic review to the environmental components affected by the important impact based on the previous identification result and the technical guide-line;
3. Being an input to the physical technical design team on processing a Feasibility studies and recommendation to the detail design on civil work for preventing negative impact on the environment;
4. Evaluation to the important impacts which are potential to be raised;
5. To give the advise for the technical planning of civil construction that will be built related to reduce the negative impact.

1.6.2. Objective

The objective of ANDAL study is to work in parallel with the technical design team to assist in sharpening the feasibility study and the product of detail design on proposed civil work to solve and decrease the negative important impact which have been assumed.

The parallel implementation on technical design and purpose of ANDAL study stages are :

a). To use the environmental study components to evaluate the construction pre-plan built ;

b). To determine the technical requirements (addition when necessary) on the feasibility study stage, in order to make the investment cost available to ensure the decreasing of negative impact;

To review analitically the draft technical construction plan that was prepared in accordance with the evaluation and recommendation of technical environmental protection.

To achieve the intents and purpose of the study results, the environmental study team must provide the qualified technical personnel with available sufficient time allocation so their inputs can really balance with the technical team of construction planners.

1.7. Scope of Study

1.7.1. Study Boundary

The study boundary is determined based on the activity path, ecology boundary, administrative boundary and technical requirement.

1.7.1.1. The Activity Path

The activity path/site is identic with the total area at proposed new final disposal site. This site is located in the future open/green space at Romo Kalisari Sub-district, Benowo district as shown at Figure 2 : Location Map of Keputih LPA. This map is drawn on the proposed land use planning on year 2000, but actually the proposed site have not been acquired yet and the exact site which will be use as a final disposal site still depent on the feasibility study result. The approximate target site are shown in Figure 3 : Arterial Map Arround the Proposed Benowo Disposal Site.

1.7.1.2. The Ecology Boundary

This boundary is defined in the basis of impact spreading area to the established ecology system which area is based on the identification of wind

direction and the surface water discharge as shown at Figure 4 : Identified Map of Benowo Disposal Site Ecology Spread.

1.7.1.3. Administrative Boundary

The limitation is determined according to the administrative area status where the project area is located at Romo Kalisari Village/ Sub-district, Benowo district, West Surabaya Region, Surabaya Municipality as shown on Figure 5

1.7.1.4. Technical Boundary

The technical boundary is an area limit of technology/activity application including the activity path boundary, ecological boundary and administrative boundary. In this relationship it is determined by the technical limit based one the priority sequence of impact load at a location such as :

a). The catchment drainage area : up stream and down stream of the drainage system. The down stream border is limited up to the influence rate above the threshold permitted. The limitation must be determined carefully by the technical team of the environmental study assigned and minimum radius is 500 m from the pollution source.

b). The Spatial Limit, minimal must cover the identified existing land use of 2500 metres from proposed Final Disposal Site and the future land use plan up to radius of 2 km from the disposal site.

c). The road routes to LPA that used by the waste trucks to LPA with the limitation of :
- volume of daily truck traffic on the road lane is dominated by waste trucks, by another word that the waste truck volume reaches more than 60% of truck volume; or
- minimal all main road in radius of 5 km from LPA must be monitored its impacts that caused by the waste trucks to LPA.

d). Radius of 2000 metres for ground water research point on the existing wells.

e). Research phasely the effect of air pollution impact from the pollution source up to 300 metres for gas produced. up to radius of 3 km or the nearest existing settlement from the dominant wind direction to unvestigate waste smell effect.

f). The social economy survey is carried out stagely from the nearest LPA residents housing up to a radius of 3 km from the pollution source and especially including the community which are located at the new access road to be construct.

1.7.2. The Environmental Components Studied

The environmental components studied are including the environmental component of Culture Economy Social, and most environmental component of Biology-Physic-Chemistry (Biofiskim) assumed as a negative impact cause as follows :

a). Surface Water Quality;

b). Ground Water Quality;

c). Air Quality;

d). Wind flow and direction;

e). Drainage System at Pollution Resources;

f). Transportation System and Traffic Volume around proposed new access road to final disposal site;

g). Ecology condition Identification (fauna and flora) and deeply research if there are specific species and that is impossible to be renewal;

1.7.3. **Activity Plan Studied the Impact**

The activity plan studied the impact is the activity component causing the important negative and positive impact to the LPA construction plan as well as preconstruction, operation and post operation phases.

Figure 2
The Location Map of Proposed BenowoDisposal Site
Drawn on the Proposed Year 2000 Land Use Map

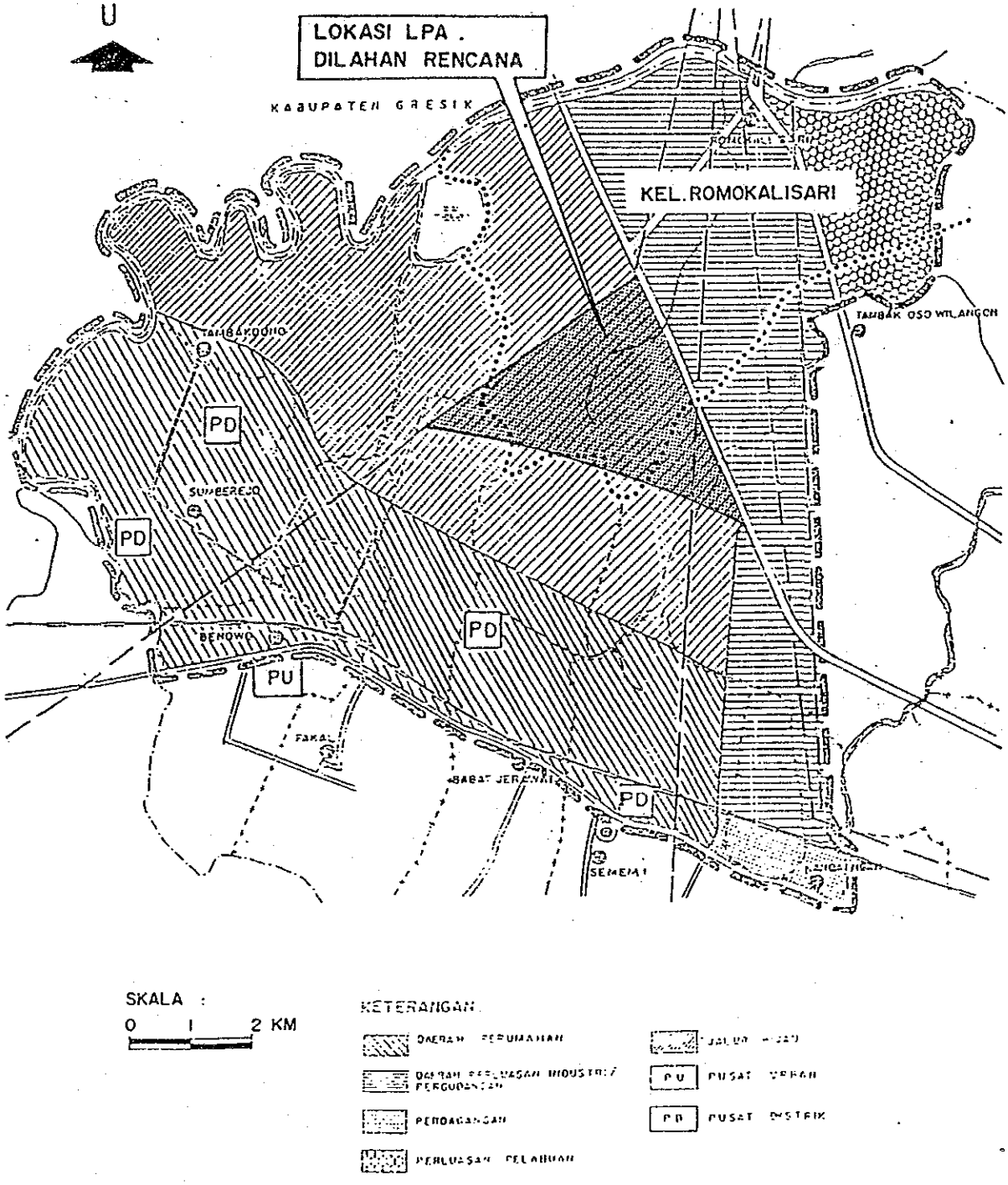


Figure 3
The Arterial Map of Proposed Benowo Disposal Site

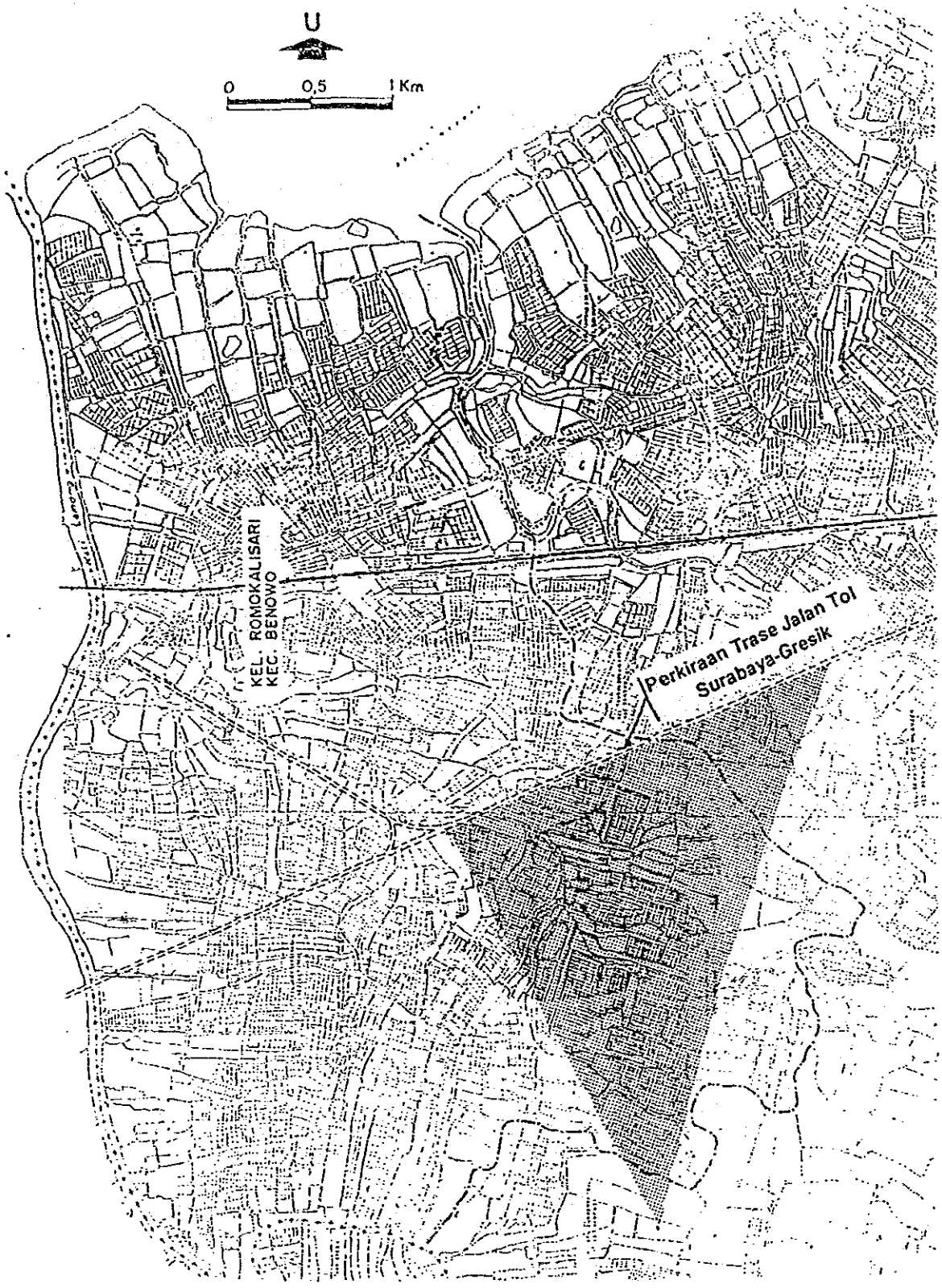


Figure 4
The Ecology Investigation Area for Benowo Final Disposal Site

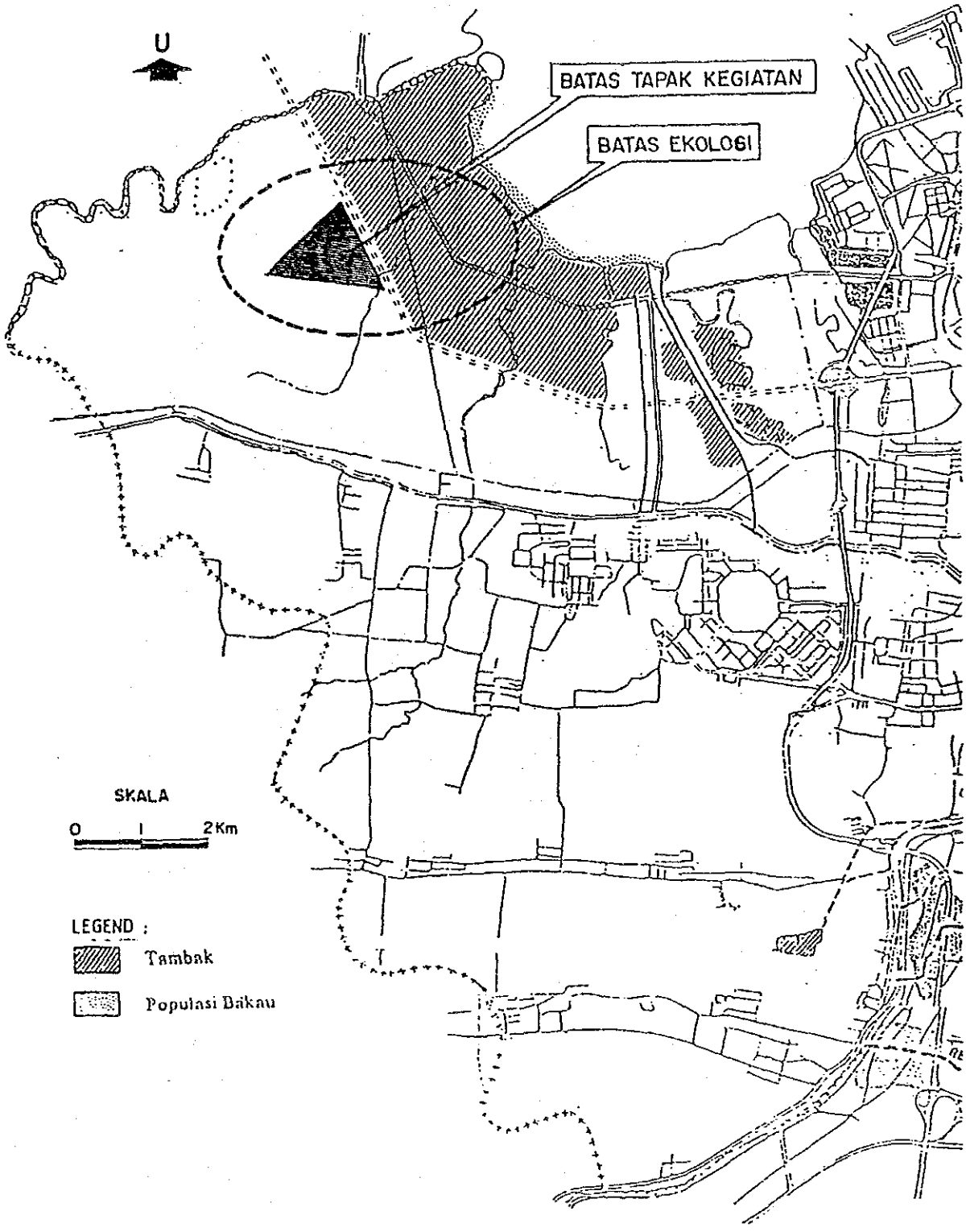
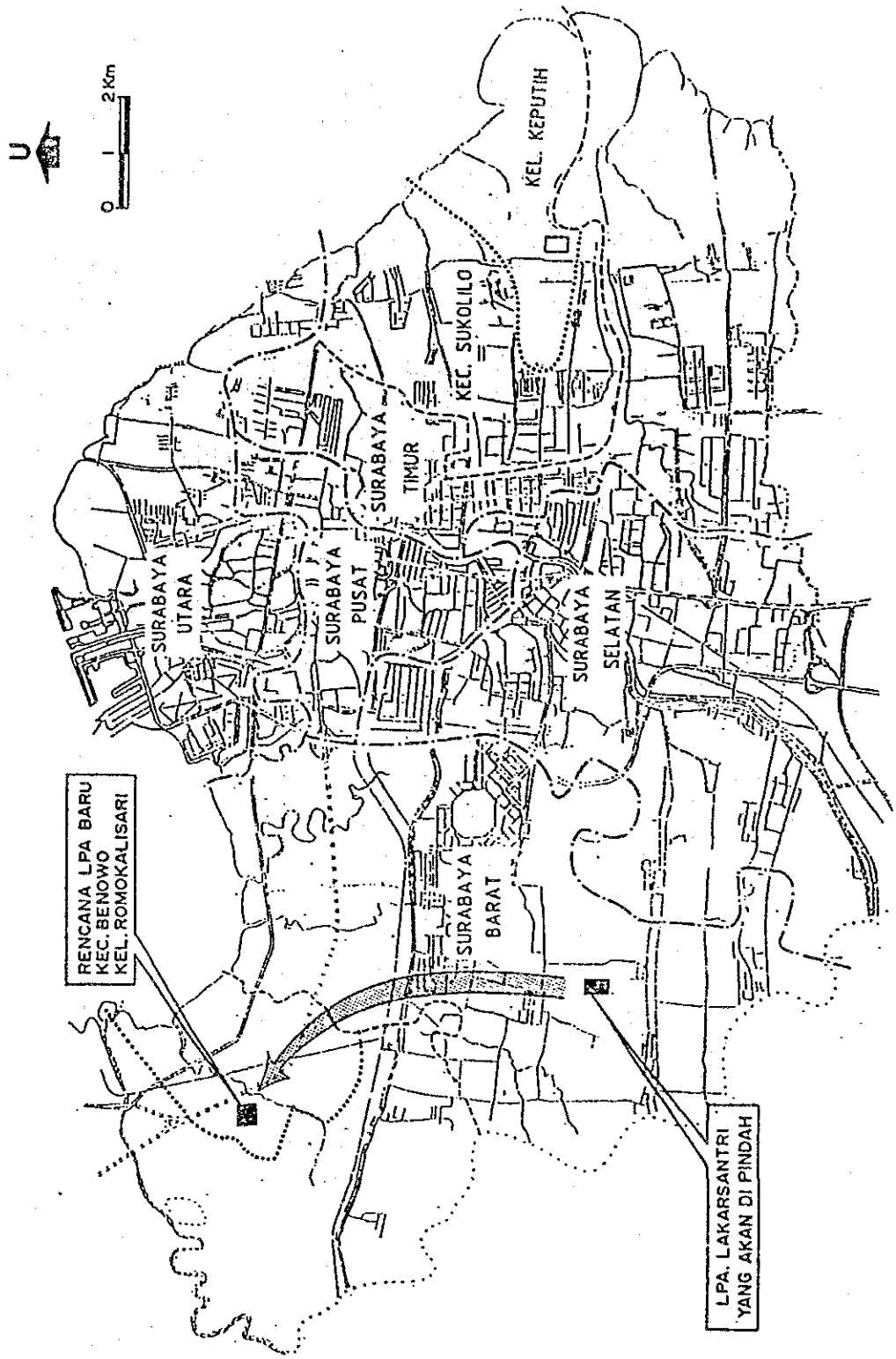


Figure 5
The Proposed Benowo Final Disposal Administration Boundary



CHAPTER 2

2. METHODOLOGY OF ENVIRONMENTAL IMPACT ANALYSIS

The basic principles to preparing the environmental impact analysis study is based on the the procedures in the Attachment of The Decision of Governor Kepala Daerah Tingkat I of East Java Province dated on May 19, 1988 No. 185 year 1988.

To preparing this study followed the steps as bellow :

2.1. Impact Identification

The environmental impact impacts will be identified by Moore flowchart. This method represents the activities that was influenced to environmental components (see Fig. 6)

According the impact identification can be found the important impact of the physic/chemistry, biology, socio economic and culture environments due to :

- Surface and ground waters pollution
- Soil pollution
- Air pollution and noise level
- Aesthetic changes
- Changes of socio economic culture

Assessments in this identification stage are as follow

1. To estimate the significant level of environmental component (biology, physic; chemistry, socio-economic and culture) in accordance with the location usage around the project location.
2. To evaluate the Environmental quality in present situation. by using environmental quality standards for Indonesia or International standards. Profesional judgement will be used if there are some cases without specific standard.
3. Sensitivity of environmental components management is evaluated by the professional judgement.
4. Results of the above assessment are presented in Figure 7.

Figure 6
IMPACT IDENTIFICATION FLOWCHART

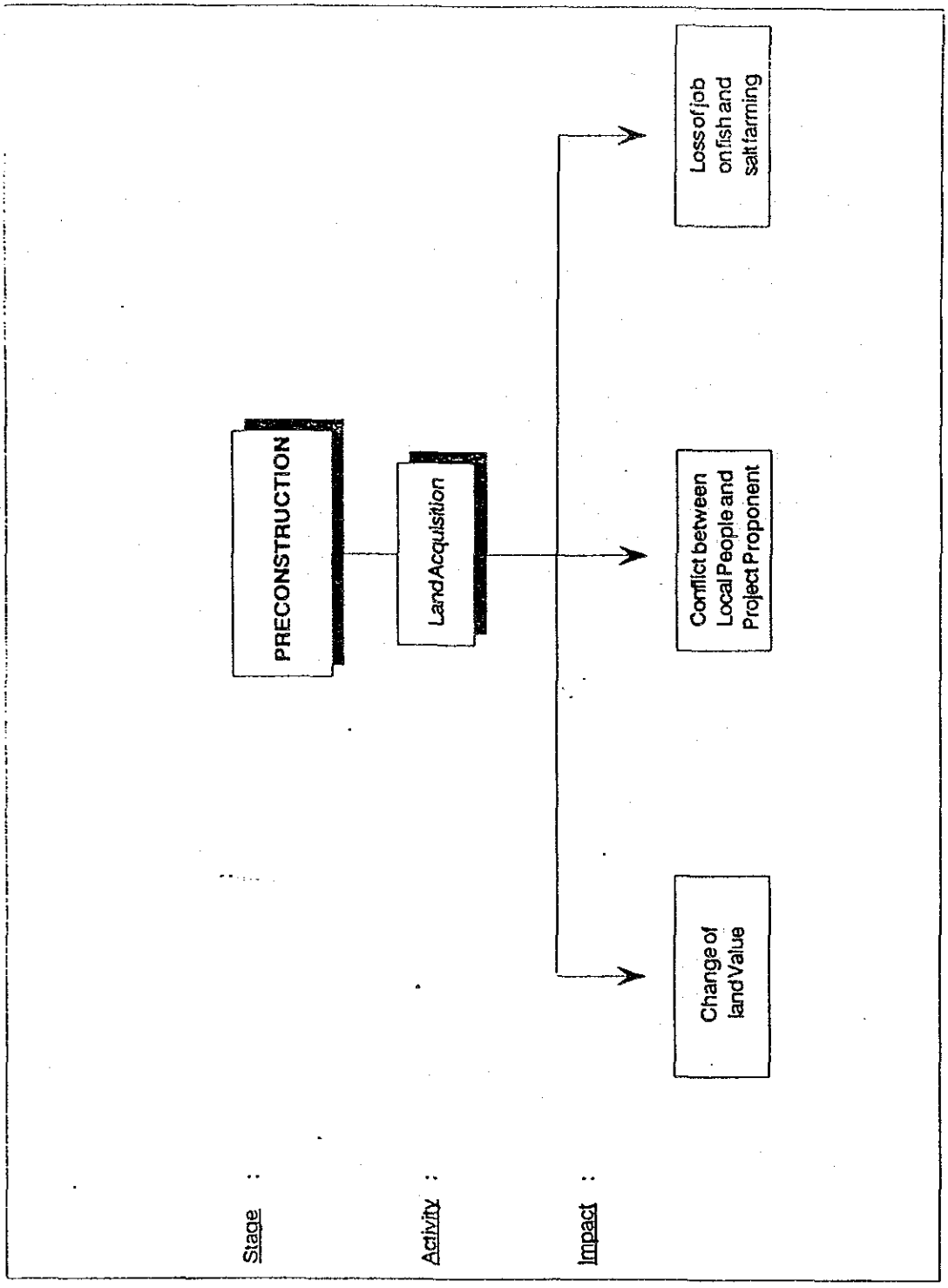
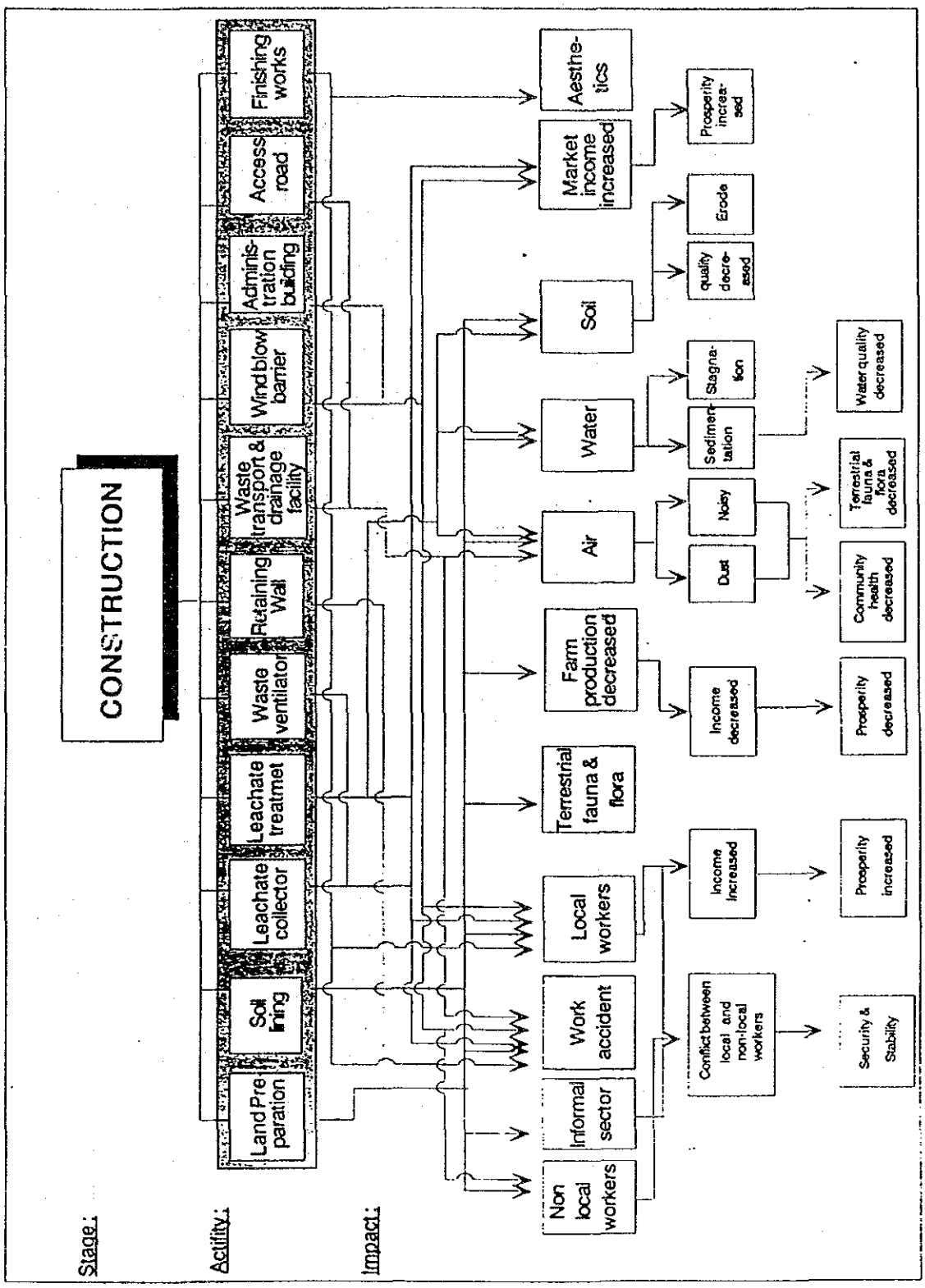


Figure 6 (continuation)



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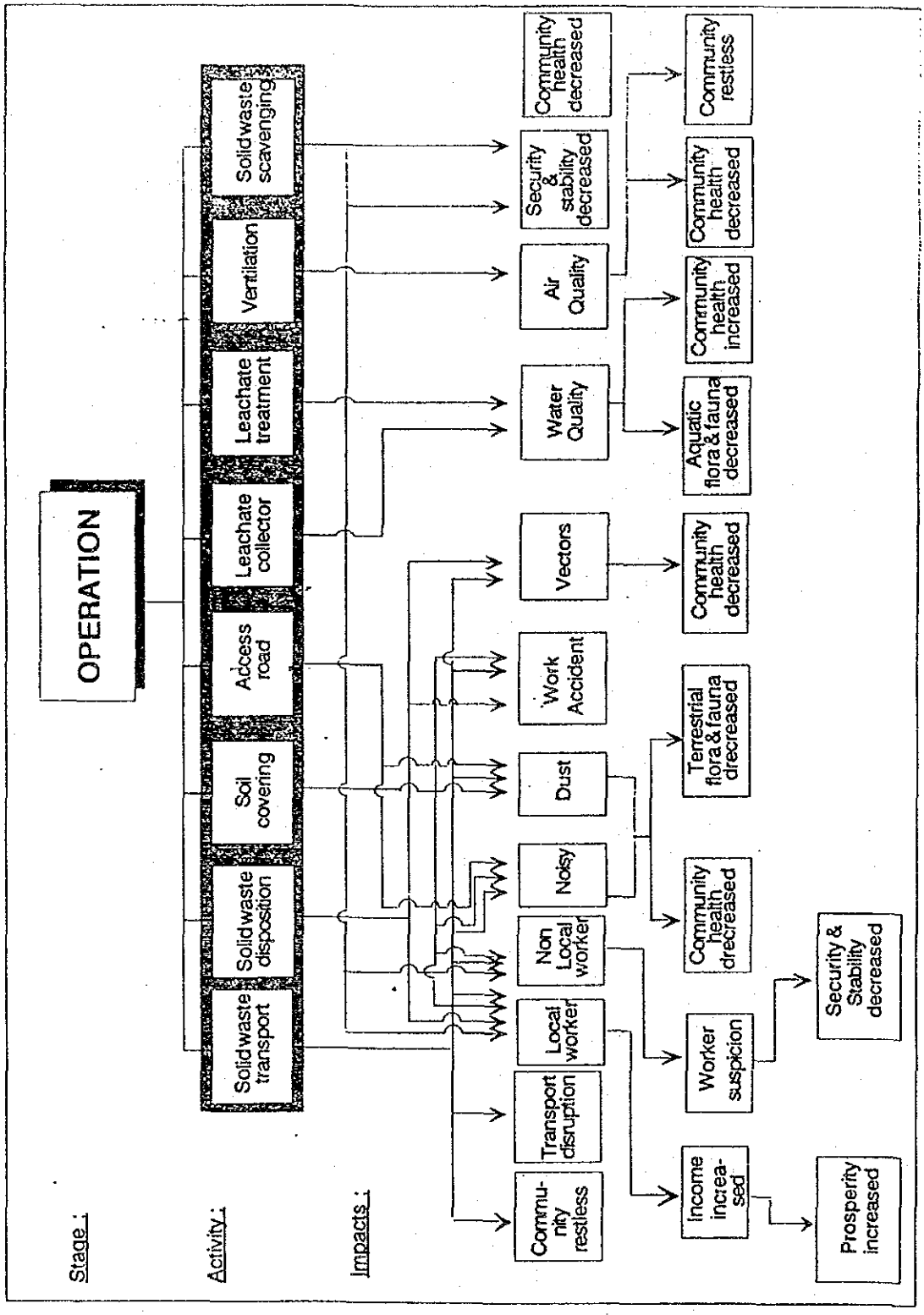

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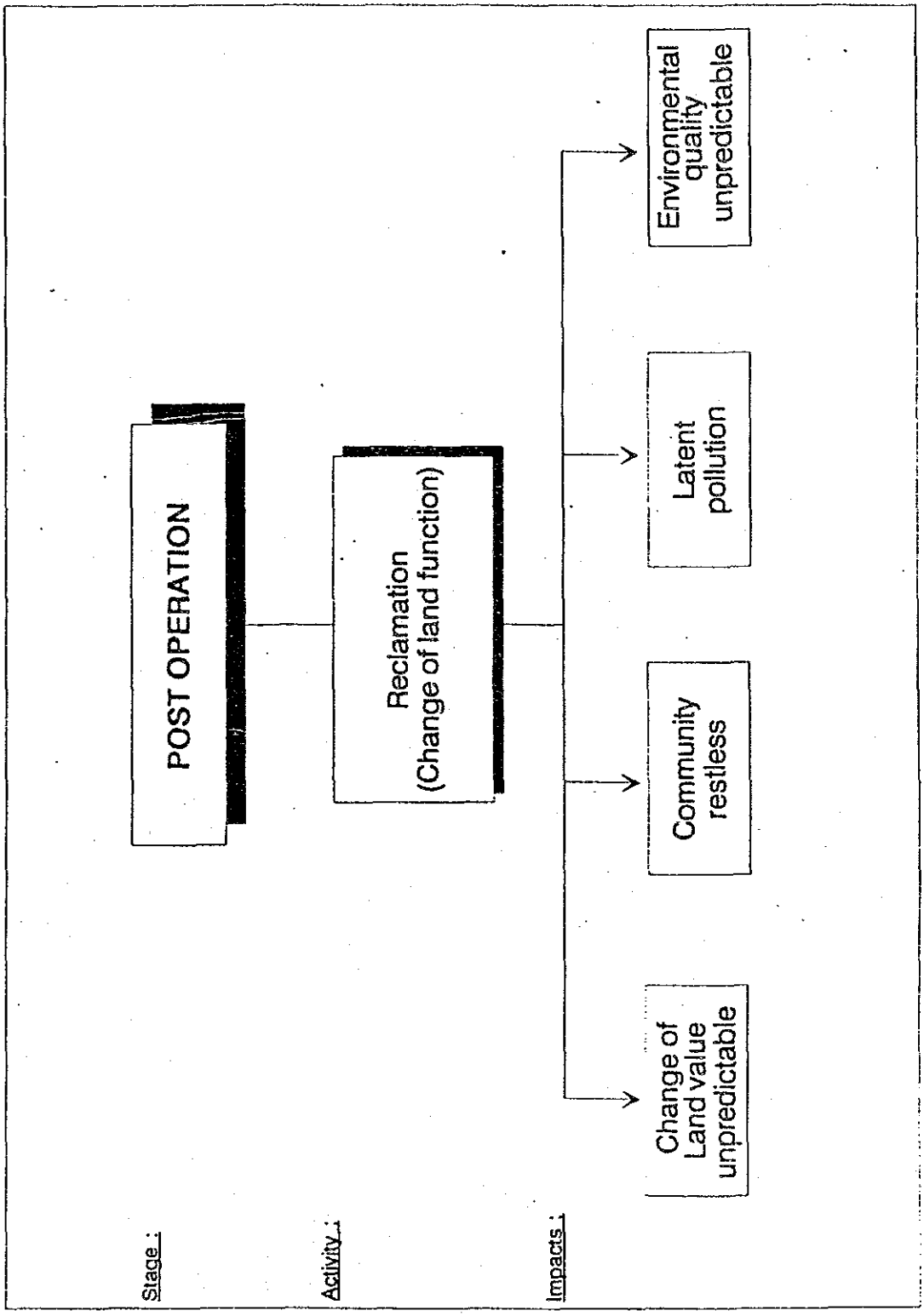
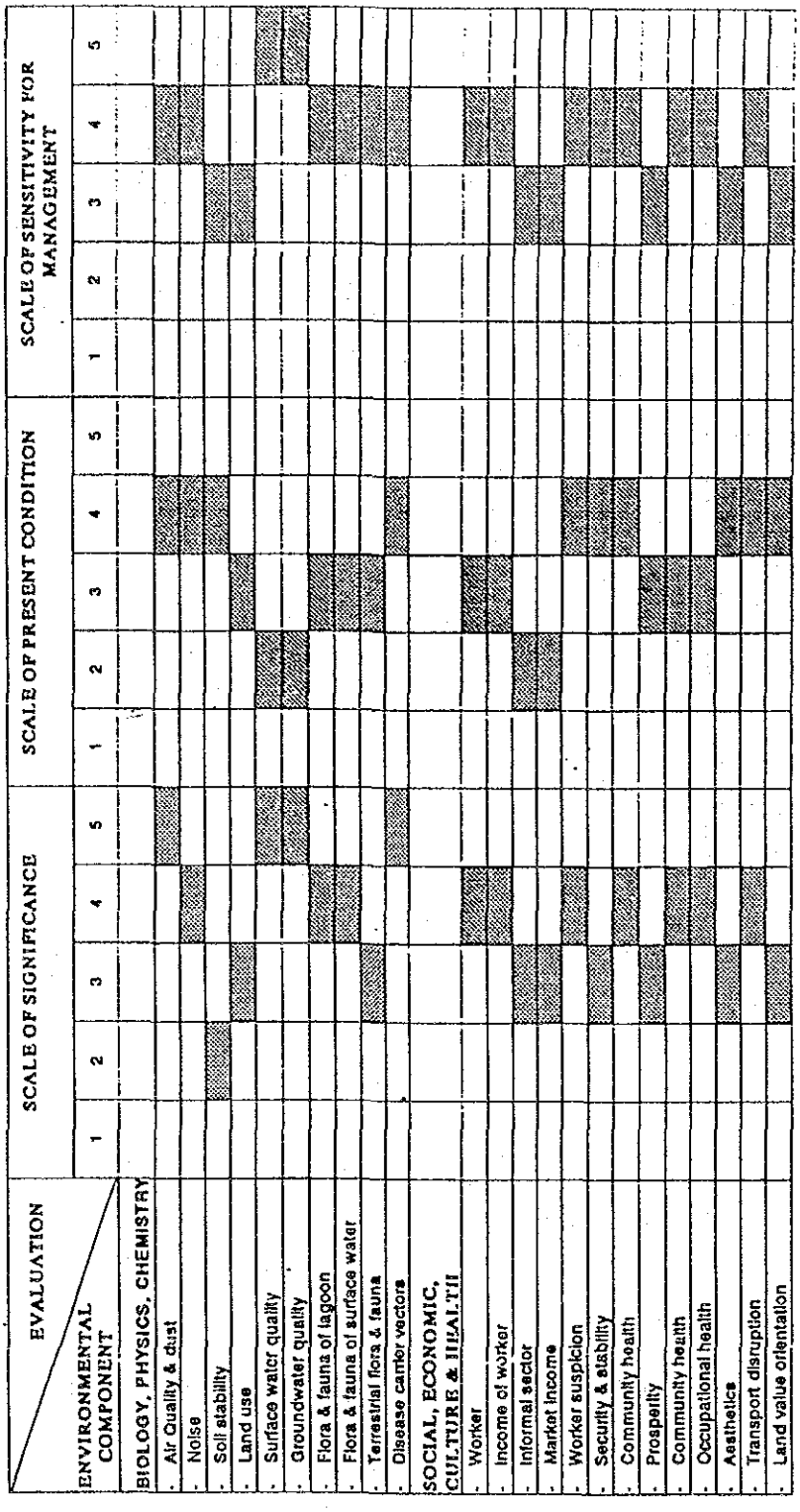


Figure 7
MATRIX FOR EVALUATION OF ENVIRONMENTAL COMPONENT



Notes :

Scale	Significance	Present Condition	Management sensitivity
1.	Least significant	very bad	not very sensitive
2.	Less significant	bad	not sensitive
3.	significant	not so bad	nearly sensitive
4.	more significant	good	sensitive
5.	most significant	very good	very sensitive

2.2. Method of Data Collection

2.2.1. Secondary Data Collection

Secondary data will be used to analize historical data series shall be collected from the relevant authorized agency. In the event that the respective agency does not maintain the required data, the statistical data may only be used to support relevant general description since the methods of data collection and processing can not be clearly identified.

Duplication/employment of data derived from any documents of scientific studies shall be perceptively organized in regard with the collection procedures and sample analyses. Such duplication of secondary data from other studies might be neccessary if the data maintain specific values or a close relationship with the study.

Employment of such secondary data shall include assertion of their respective source(s) and the collection period.

2.2.2. Primary Data Collection

Data of any specific informations of the following fields which are expected to reflect significant impact shall be collected, is Primary Data, in the surrounding area of the pollution source in accordance with the scope of study.

- Social, Economic and Culture
- Physic, Chemistry, Biology.

The collection of primary data at least will be carried out by arranging an On-site Visual Observation to record any physical assumptions in its comprehensive form. Site sampling activities to complete the researchs on the degree and concentration of certains elements shall be carried out by experienced professionals. Observation on the human behaviour and activity images shall involve interviewing activities using structural instruments (quistionaire)to be applied on selected respondents in order to preserve constant objectives.

The following items shall be determined to obtaining physical samples component:

- Number and locations of sampling points;
- Number of samples; and
- sampling intervals

Data of the following items are required as primary data and shall be collected to be used as the base of analizing the present environmental features.

1. *Identification of Topography*

Geology and Topography surveys shall be made available to provide information on physical description of the location and the specific boundary of the surrounding area. For this purpose, topographical map of 1 metre interval is required.

- Location of the Survey

The longitudinal and lateral profile survey shall be conducted for the proposed final disposal site in Kel. Romo Kalisari, Kel. Sumberejo and Kel. Pakal, Kec. Benowo.

Survey Area : Approximately 45 ha
Location of the survey Area is shown in Figure 8

- Longitudinal and Lateral Profile Survey

1) Prior to the longitudinal and Lateral Profile survey, some Temporary Bench Marks (TBM) shall be established at the proper points in or around the survey area based on the existing BM, location and elevation of which shall be informed to the Surveyor by the JICA Study Team. New TBM shall be marked by painting or by the other proper means.

2) The standard width and interval of cross sectional survey are as follows;

Description	Standard Interval (m)	Standard Withd (m)
a) Longitudinal Profile	50	+20 m Outside boundary
b) Lateral Profile	50	+20 m Outside boundary

Exact locations of cross section shall be informed of on the location map the JICA Study Team.

- Plane Table Survey

Following description and legend are required in the topographical map.

i) Contour line with an interval of 0,5 m

ii) Road and footpath

iii) River and flow direction

iv) Pond, ditch and embankment with the discription of usage of water surfaces

v) Building and ground ficilities including fence and poles

vi) Farmland, pasture and marsh

vii) Boundary

viii) Location guide map

2. **Identification of Geology**

- Survey Location

  The Geological Survey shall be conducted for 3 points. The location of this points can be seen in Figure 9.

- Mechanical boring

  (1) Deep Boring

  Machine Boring for standard penetration test and collecting the soil samples for the drilling log shall be conducted at the proposed final disposal site. Specific points of boring shall determined after preliminary site survey together with the JICA Study Team.

  (2) Standard Penetration Test with Split-Barrel Sampler

  Standard penetration tests shall be carried out to obtain N-value of the sub soil. During standard penetration test, spilt-barrel sampling shall be made to obtain samples for soil classification and other laboratory test.

  The standard penetration test with split-barrel sampler shall be made at every one meter in depth at each bore hole.

  All the samples taken by the spilt-barrel sampler shall be kept and sealed in labelled vinyl bags at the site, and shall immediately be delivered to the laboratory.

  Representative soil samples shall be kept in jars and be sealed and labelled for long term record.

  (3) Thin-walled Tube Sampling (Undisturbed Core Sampling)

The thin-walled tube sampling with piston samples shall be made to recover relatively undisturbed soil samples with a suitable length of 1.0m for laboratory tests.

The thin-walled tube sampling for foundation subsoil shall be made at every three meters depth (or every differnt clay or silt layer).

(4) Geological coloum of 15 m or 30 m depth at each boring shall drawn up with ground water table.

- Soil Test in Laboratory

All the laboratory tests and analysis on both disturbed and undisturbed soil samples shall be performed conforming the JIS or ASTM standards. Those items, if any that are not adequately covered by JIS or ASTM standards shall be brought to the notice of the JICA Study team, and be performed conforming the instructions by the JICA Study Team.

(1) Permeability Test

Permeability tests shall be taken on saturated sample condition. Total number of tests is 9 samples (3 samples x 3 points).

(2) Unconfined Compression Test

Unconfined compression test shall be taken for the undisturbed samples of proposed final disposal site. Total number of the test will be 9 samples (3 samples x 3 points).

(3) Triaxial Compression Test

Triaxial compression test shall be taken for the unconsolidated and undrained condition. Total number of tests is 9 samples (3 samples x 3 points).

(4) Consolidation test

Consolidation test shall be taken for the undisturbed samples. Total number of the test will be 9 samples (3 samples x 3 points).

Based on the consulidation test, the following two curves shall be prepared.

- e - log P curve : relation betweens load and void ratio

- log Cv - log P curve : relation between load and coefficient of consolidation

(5) Physical test

Physical test consists of water content, particle size analysis and wet density. Void ratio should be calculated by the result of physical tests.

Water content test and Particle size analysis shall be taken for the disturbed samples and wet density and water contents test shall be taken for the undisturbed samples.

The number of each test is shown below.

Water content Test	:	9 samples (3 for undisturbed samples x 3 points)
Particle Size Analysis	:	9 samples (3 for disturbed samples x 3 points)
Wet Density Test	:	9 samples (3 for undisturbed samples x 3 points)

3. **Land Use Survey**

- Survey Area

The survey area covers the proposed disposal site and adjacent area within a 500m radius from the site of proposed access road to the site as shown in Figure 10.

- Survey Works

The aim of the land use survey is to produce 1:5,000 and 1:10,000 maps of the survey area, showing the existing situation on land use. The classification of land use are as follows :

- salt farm and its attachment facility
- fish pond
- farm land and watery farm land
- residential lot or area
- forest, bush
- march
- pasture
- open area with no usage
- road
- river, canal
- others

4. Air Quality Survey

a.	Stations	:	6 points (see Figure 11)
b.	Items	:	NH_3, H_2S
c.	Number of Sample	:	12 samples (6 points X 2 items)
d.	Method	:	NH_3, H_2S by means of Baku Cara Uji Udara Ambient di Jawa Timur (1991)
e.	Period of sampling	:	24 Hours continually
f.	Time	:	1 day

5. Surface Water Quality Survey

a.	Stations	:	8 Stations (See Figure 11)
b.	Items	:	
	Group - A		water temperature, Cl-, pH, DO, SS, COD, BOD, T-N, SO42-, Cd, CN- , Pb, Cr(VI), As, T-Hg, Colibacillus and E. coli
	Group - B		Organic-Phosphorus (Parathion, Methyl-parathion), PCB
c.	Number of Sample	:	
	Group - A		8 samples
	Group - B		2 Samples
d.	Method	:	Group - A : by means of Baku Cara Uji Air dan Air Limbah di Jawa Timur (1990) Group - B : APHA Standard Method (1980)
e.	Time	:	day (09.00 -16.00 when the sun shines)

6. Ground Water Quality Survey

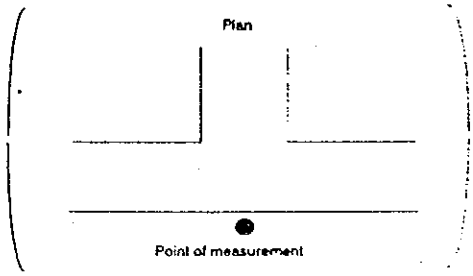
a.	Stations	:	3 wells around proposed disposal site and one sample from borehole (see Figure 11)
b.	Items :		
	Group - A		water temperature, Cl-, pH, DO, SS, COD, BOD, T-N, SO42-, Cd,CN-, Pb, Cr(VI), As, T-Hg, Colibacillus and E. coli
	Group - B		Organic-Phosphorus (Parathion, Methyl-parathion), PCB
c.	Number of Samples :		
	Group - A		4 samples
	Group - B		2 samples

d. Method : Group - A: do as surface water
Group - B: do as surface water

e. Time : 1 day at the same day as surface water.

7. Traffic Volume

a. Stations : 2 stations .: at Jl. Margomulyo and Jl. Jawar junction (See Figure 12)



b. Items :
Calculation of traffic volume for each vehicle classification and direction.
The vehicle classification are :
- small vehicle - non motorized
- large vehicles - vehicle
- motor cycle - others vehicle

c. Time : 07.00- 07.00 (24 hours continually) on weekdays

0 1 2 3.....24 hours

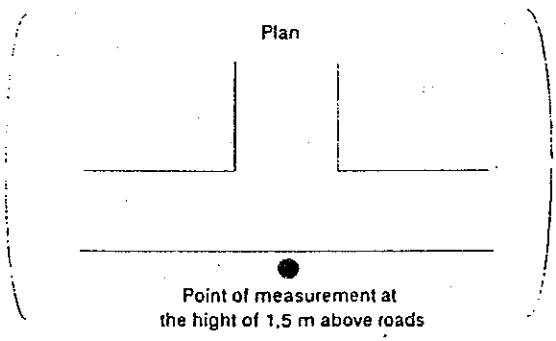
0 = start

1,2,3, ----- 24 = counting

d. Equipment : Traffic counter

8. Noise Level

a. Stations : 2 stations : at the same stations as traffic volume survey



b. Items : Noise level (Leq)

c. Time : 07.00 - 07.00 (24 hours) on weekdays (one survey time is 10 minutes)

1 2 3 ..... 24 hours

0' 10' 0' 10' 0' 10' minutes

0' = start

d. Equipment : Noise level meter

9. **Ecology Survey**

a. Area : There are Four (4) typical zones in Inner proposed site area and four (4) typical zones in Outer proposed site area. (see Figure 13)

Typical zone areas are as follows :

- fish pond or salt farm
- river and river bank
- marsh
- dry land
- terrestial flora and fauna
- aquatic flora and fauna

e.g.

	st1	st2	st3
- tree and grass	+	-	+
- water plant	-	+	-
- mammal	+	+	+
- bird	-	+	+
- reptile and amphibi	+	-	+
- fish	+	+	-
- plankton			
- benthic invertebrate			

Observed species should be discriminated by any approriate criteria common in Indonesia.

b. Items : Flora and fauna conditions in each zone were analysed by the ecologist by visual or laboratory analysis

c. Method : List-up method by site reconnaissance and hearing to the inhabitants

d. Time : + About 4 days

10. Health Condition

a. Area : Residential area around the proposed new LPA. (see Figure 10)

b. Items : Health Conditions
- health condition by self awareness
- personal history of disease
- personal history of vacination
- usage of water for drinking, bathing and cleansing
- feeling on satisfaction on nutritieve condition
- demand on improvement of housing condition
- complaint of disposal site as odor, noise, scattering of waste and so on
- others

c. Number of Sample : About 1-2 people with various generation in 1 household covered by socio-economic survey

d. Method : Questionnaire. Then it will be linked with BPTT survey results

11. Socio-economic Conditions

a. Area : Residential are around the proposed new LPA

b. Items : Socio-economic conditions
- size family
- number of supporter in the family
- occupation
- monthly or annual income amount
- structure of local community
- Land ownership

c. Number of Sample : About 400 households with the various type of job

d. Method : Questionnaire (attached)

2.2.3. Prediction of Impact

In predicting the impact, an analogy method shall be used to obtain a quantified description of the impact intensity and its relative effect. Prediction is given based on the measuring results and the comparison of

environmental condition's indicators/parameters before and after each stage of the project implementation.

2.2.4. *Potential Impact Evaluation*

In this Environmental Study, impact evaluation is described as follows:

1. Causal relationship between the on-going activities and the living environment profile as positive and negative impacts occured or may occur.
2. To compare environmental quality before and after project..
3. Possible spreading of the impact is analyzed in accordance with the PP No.29/1986 and Kepmen KLH No.KEP-49/MENKLH/6/187, as follows:
   - Number of people affected,
   - Affected area,
   - Duration of the impact,
   - Intensity of the impact,
   - Other components affected,
   - Cumulative characteristic of the impact, and
   - Possible re-occurence of the impact.
4. The approach on negative impact shall be controlled and on positive impact must be supported.

Figure 8

LOCATION OF TOPOGRAPHY SURVEY AREA

Figure 9

LOCATION OF BOREHOLE SURVEY

Figure 10

LOCATION OF LAND USE, SOCIO ECONOMIC & HEALTH AND TOPOGRAPHIC SURVEY

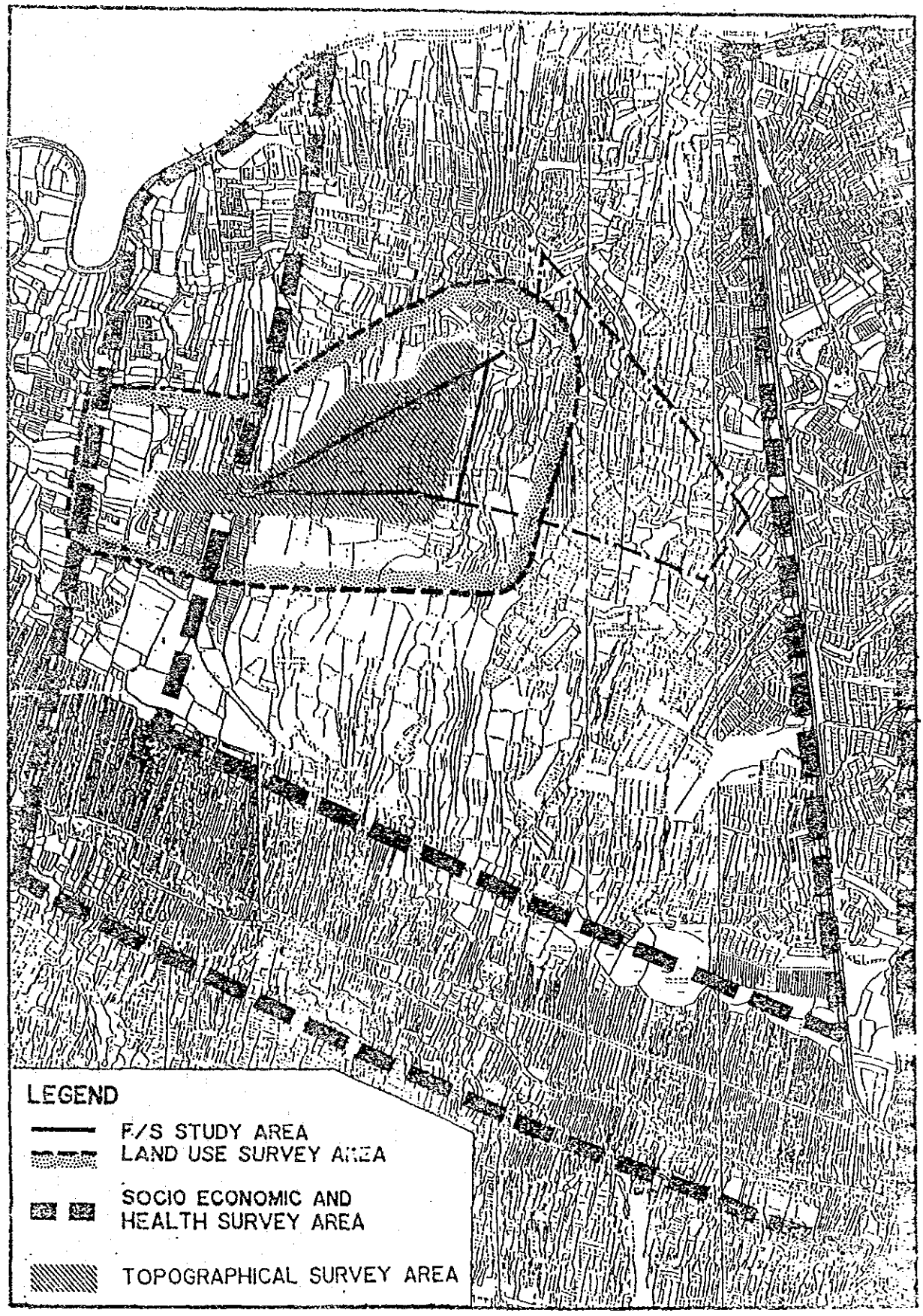


Figure 11.

LOCATION OF ENVIRONMENTAL SURVEY POINTS

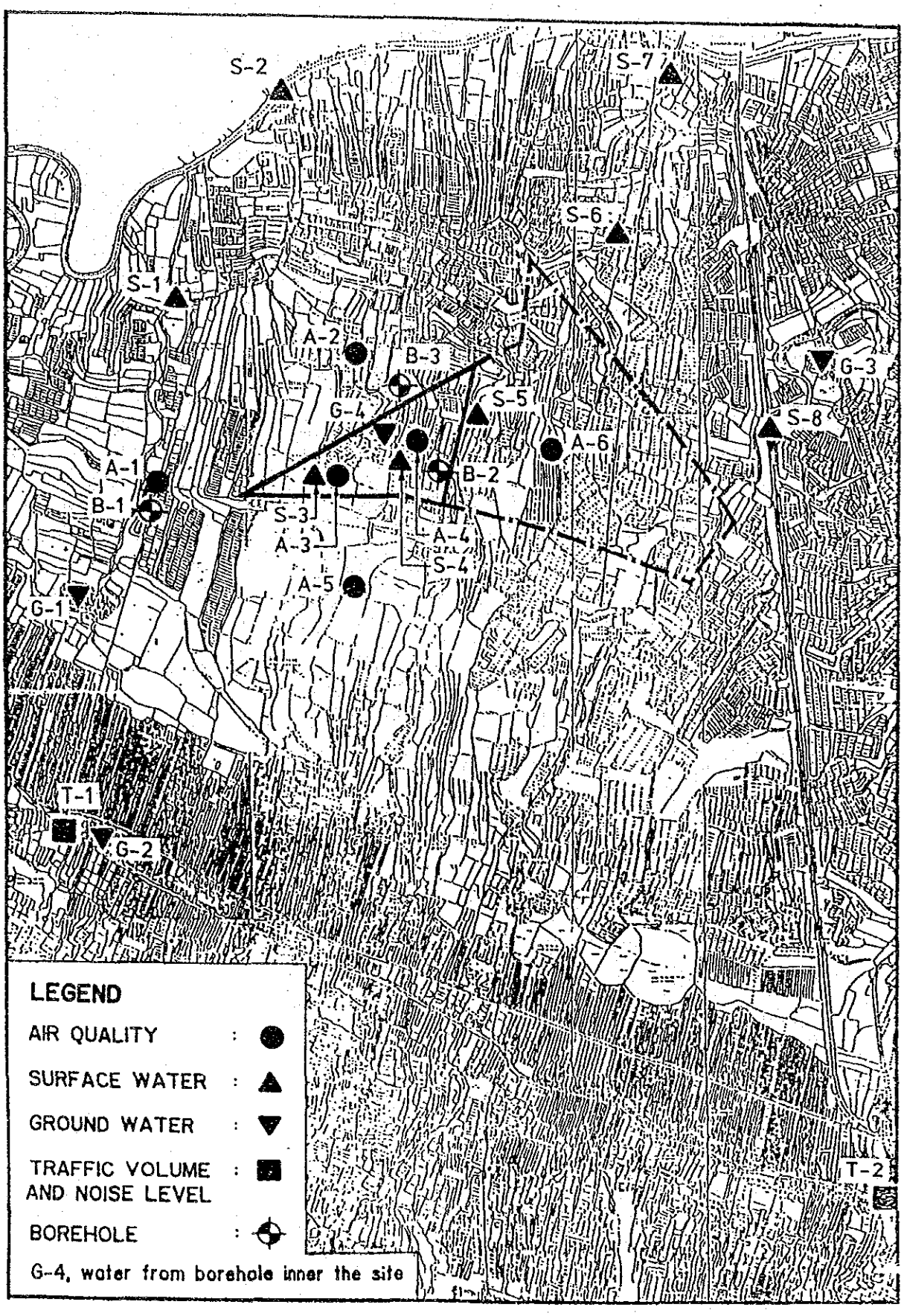


Figure 12

Location of traffic volume survey

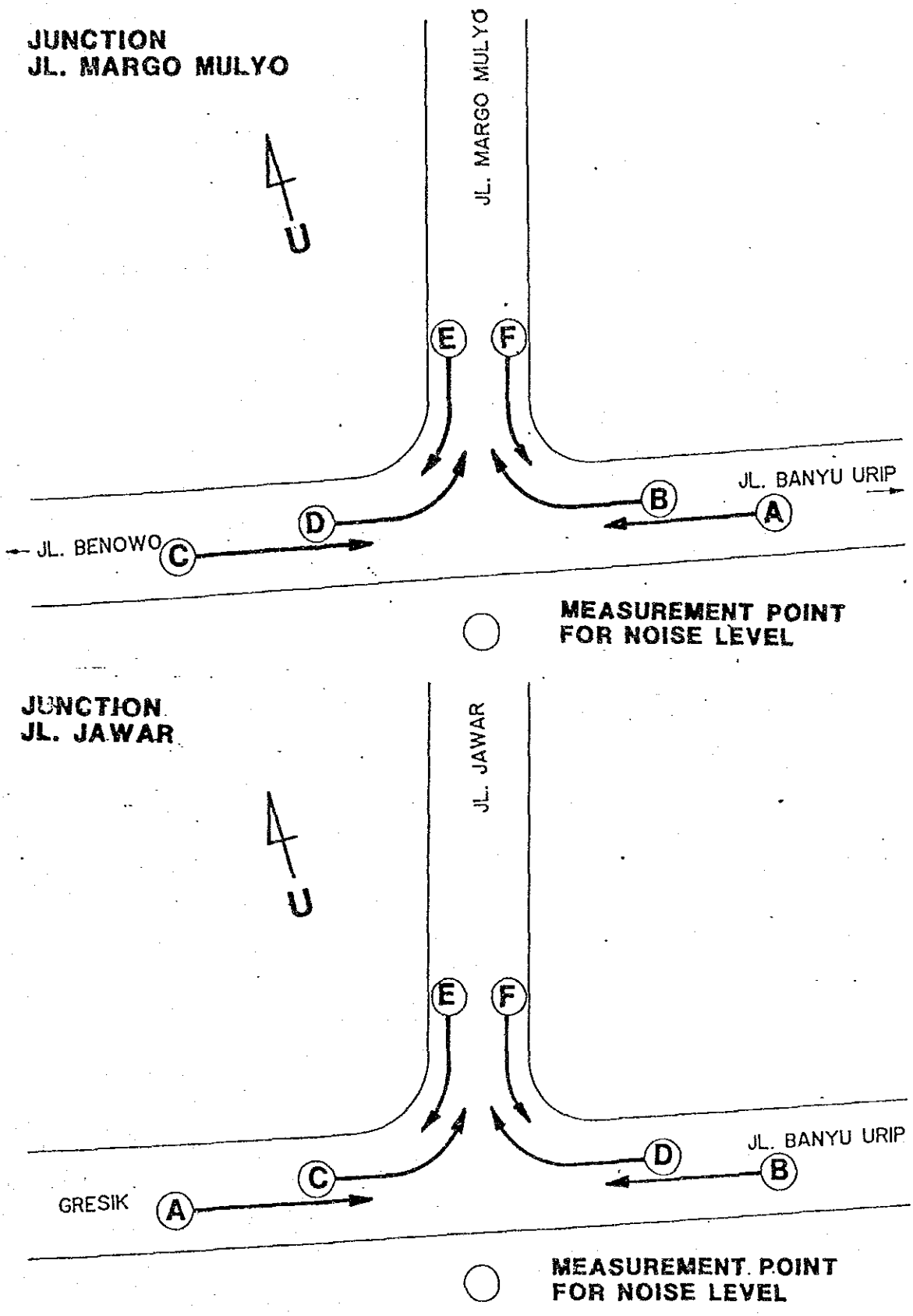
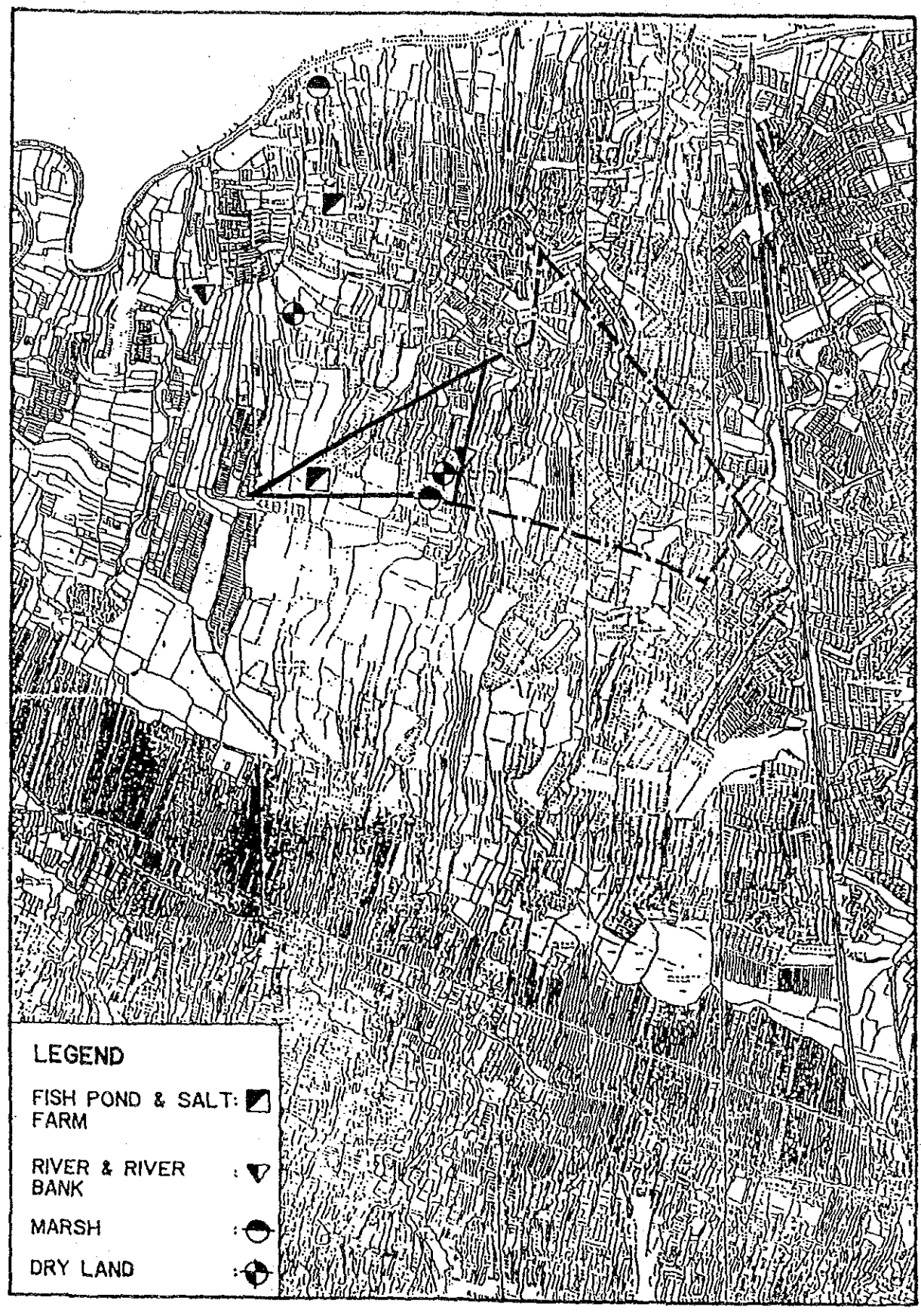


Figure 13.

LOCATION OF ECOLOGICAL SURVEY AREA



CHAPTER 4

4. PRESENT ENVIRONMENTAL SITUATION (RONA LINGKUNGAN SAAT INI)

4.1. Physical - Chemical Components of the Environment

4.1.1. Climate

The Climatology data is obtained from 2 sources that are Juanda Meteorology and Geophysic Station (Juanda MGS) and Perak Meteorology and Geophysic Station (Perak MGS).

The Surabaya Municipality is in the tropics having two different seasons; wet season and dry season. The wet season begins on November to April, and the dry season from June to October. During the last 10 year period, May is a transition month between the wet season and dry season.

4.1.2. Type of Climate

The data obtained from Perak MGS and Juanda MGS from year 1981 up to 1991 is analysed to gain a climate type based on the Koppen classification with the following requirements:

The coldest temperature is 18°C (2.n20t, where n is the total of annual rainfall, T is average temperature per annum.

Surabaya climate is type A or tropical wet climate belongs to the classification Am. It means that there is one or more dry months but the dryness during those months does not kill the vegetation which grows in rainy season.

4.1.3. Temperature

The average temperature from 1981 up to mid of 1991 for Surabaya and its surrounding area is 27.6° C. The lowest temperature recorded was 17.4°C occured during September 1982 and the highest temperature recorded was 37.2°C occured during November 1981 whereas the average maximum temperature is about 33-35°C and the average minimum temperature is about 20-23°C.

4.1.4. Rainfall & Air Humidity

Based on climate classification according to Schmidt and Ferguson, Surabaya area have the climate type D which means there are 6 (six) wet months and 5 (five) dry months. During dry months, the total average rainfall is less than 60 mm, during the wet months the average rainfall is more than 100 mm.

The total rainfall recorded indicates that the rainfall occured during wet months from November up to April is about 237 mm/month. In January and February rainfall is 350 mm/month.

For the dry months of May to October, the rainfall is recorded around 25 mm/month. Fuçther more the frequency of rainy days during the wet months is recorded between 8 up to 20 days/month.

Generally humidity throughout the year, is in a range of 63% to 85%. The highest and lowest humidity is sometimes found during wet months and sometimes during dry months.

4.1.5. Wind

The wind velocity and direction determine the distribution of air pollution around the project. The data from Juanda MGS and Perak MGS in 1981-1991 indicates that the wind direction during December up to March in general is to West direction and during April up to November in general is to East direction.

The average wind velocity is 6 Knots/hour and the maximum velocity varies between 13 and 40 knots/hour with various directions of azimut degree.

4.1.6. Air and Noise Pollution

Air and noise pullution may be influenced by project of solid-waste management.

- Air Quality

  Solid waste project will influence the air quality with dust and noise during the construction period, and during the operation period which means longterm impact. Therefore primary data is used.

  The primary data concerning air quality and noise level for which measurement was carried out by the Environmental Health Technical Post (BTKL) of Surabaya and by the Sanitary Engineering laboratory of ITS Surabaya respectively, is shown at Figure 11.

  Generally, the sampling sites contain NH_3 of 0.0002 - 0.008 ppm and there is no H_2S.

  Complete analysis result is attached in the appendix.

  Based on the maximum standar from the East Java Governor's decree 188/1988, in fact the air quality of the existing sites is very good condition.

- Noise Level

  Two sites of noise measurement are at the same sites as traffic volume counting. Figure 12 shows this sites. During 24 hours, noise level in the intersection of Jl. Margomulyo has the following characteristies : minimum average, average and maximum avarage are 60 dB (A), 70 dB

(A) and 86 dB (A) respestively. There was no noise level of ≤ 40 dB (A) and of ≥ 100 dB(A).

In the intersection of Jl. Jawar, noise level of 48 dB (A) is a minimum average, 60 dB (A) is an average and 82 dB (A) is a maximum average. At a down, noise level wes 40 dB (A), yet there was no noise level of ≥ 100 dB (A).

4.2. Physiography

4.2.1. Morphology and Topography

Kecamatan Benowo is dominated by lowland plain. The slope of the lowland plain is considerable less than 3%. Therefore the solid waste project is located at the lowland plain, at about 2 - 4 m above sea level.

4.2.2. Geological Structure

4.2.2.1. Soil Types

Basically the sub soil in Benowo arca consisted of a very soft clay deposit, approximately 10m thick and an under lying stiffer deposit comprising alternating layer soft silt, siltty clay, and clayed silt.

The upper soft layers have highly plastic clay materials and the stiff layers have mostly silts of high plasticity.

Filling shall be done in the preparation work as the soft ground should gain stregth due to consolidation. To expedite the settlement need the vertical drain and for retaining structures could be founded on bamboo poles with 11m long driven to the stiff underlayer.

4.2.3. Hydrology

4.2.3.1. Physical and Chemical Characteristics of the Rivers, Canals, and Coastal Wetlands

Hydrology includes the pattern of surface water flow, rainfall flows into the river which receives the raining water.

The surface flow pattern : the water flows over the soil surface then into the road side drains before flowing into large drains channels which flow to the coast.

The river flow pattern generally follows the existing geology structure pattern that is called "sub-rectangular" channeling pattern.

Lamong river in the north side of the project area is suplied by Kali Surabaya.

- **Drainage**

  The soil surface slope that is less than 3% means that much land is covered by water in Surabaya Municipality.

By "ANDAL SUDP" study found that Benowo lands is not covered by water.

- **Geohydrology**

  The geohydrology at the project locations is almost same with the general condition in Surabaya.

The soil in general has very low permeability (the average is 5 x 10^{-4}cm/second), and there is no aquifer with artesian potential (The soil is salty silty clay), so ground water at the project location is free surface.

The ground water is influenced by rainfall, however, the soil capacity to absorb water is very low, the ground water capacity is also limited (the average soil permeability of 5 x 10^{-4}cm/ second).

Ground water is used by the community at some project locations to fullfill their daily needs although with very limited capacity. Most ground water users who do not have a PDAM connection use river water or rainfall for their requirement.

The groundwater surface depth varies considerably during wet and dry seasons. Based on a survey at a community hwo have a well, the ground water surface depth during the dry season is in a range of 3 - 8 m below ground level, and during wet season is in a range of 0.5 - 3 m.

Water quality in general is influenced by the level of waste facilities with regard to settlement, agriculture and other activities.

In order to asses the solid waste project this ANDAL must review water quality in the project area with respect to surface water, ground water or sea water.

The water quality parameters examined are compared with the water quality standard of East java Governor Degree No. 413/1987, No. 414/1987, and No. 187/1988 and Regulations of the Indonesia Health Minister No. 416/ Menkes/ Per/ IX/ 90.

Water sampling and laboratory examinations were carried out by various laboratory. The water sampling was implemented on 24 November 1992 as shows in figure 11.

Water qualities based on the primary measurement are as follow :

- Surface waters have a high level of Total N. Heavy metals which classified as pollutant are Pb and As (both are 3 - 4 times higher than the value standard). Number of *Colibacillus* and *E.Coli* are very high. There are no organic-Phosporus can be found and PCB was less than 1.
- Ground waters have a similar quality with surface water conditions.

Complete results are attached in the Appendix.

4.3. Flora and Fauna

4.3.1. Environmental Conditions

Most of project area ecosystem, consists of wetlands. That is used as salt and fish ponds.

The commercial fishes living in this ponds are : Milk fish (*Chanos chanos*/ bandeng); shrimp (*Peneus monodon*/udang windu), and *Metapenous sp.* (udang putih), *Tilapia mossabica* (mujair) and *Mugil sp.* (belanak).

During our study (October - November 1992) the ecosystem can be classified into 4 typical zones i.e :

1. Fish pond and Salt farm
2. River
3. Marsh
4. Dry land

4.3.2. Terrestial Flora and Fauna

Results of field and laboratory identification are as follows.

Flora is dominated by Mangrove; grass; and some other plants such as *Guaeda sp.* (alur), *Sporobulus sp* and *Fimbristytis sp.* (rumput), *Sesuvium sp.* (gelang laut); *plucea indica* (luntas), *Achantus ilicifalius* (jeruju), *Avicennia sp.* (api-api); *Xylocarpus sp.* (nyiri), *Bruguiera sp.* (tanjang), *Ceriops sp* (tinggi), *Sonneratia sp* (bagem).

Whereas fauna is dominated by Little Egret (*Egreta garzetla*/kuntul), Black-naped term (*Sterna sumatrana* (dara laut), Terck Sand piper (*Xenus cenerus*/trinil); Butterfly (*Lical nidae* /kupu-kupu); and Rat (*Rattus sp.* tikus).

Little Egret, Black-naped tern and sun bird are classified as the "protected animal"

4.3.3. Aquatic Flora and Fauna

In wet season, benthic invertebrate are Crustecean and Polychaeta, Gastropoda are available expect in marshes outside the landfill site.

Phytoplankton who dominates the aquqtic organims are *Anabaena Sp.* (blue green Algae) and *Pleurosigma sp.* (diatomae).

Zooplankton who identified are Copepod. They present in all sites.

4.3.4. Aquatic Microbiology

The sample taking should not only be directed be find towards the classification of naturalwater, but also towards its quality with regard to its coliform contetnt and other faeces contents parameters, included the impact on surrounding waters.

Coliform is found in a great deal in faeces (the human body excretes coliform bacteria about 2.109 per day on the average). The presence of this bacteria in water is an indication of pollution by faeces and it therefore also includes the possibility that it might also contain pathogen bacteria from the faeces.

Microbiology shows that the ground water in the neighbuorhood of proposed disposal site is already polluted, the coliform content and other bacteria from faeces is high enough and is about 5 log 10 is MPN/100 ml. The standard of water for class A (drinking water, PP No.20/1990) states, that the content of those bacteria for drinking water must be 0 . This indicates, that the facilities in those areas is not well yet.

4.4. Socio-Economic Cultural and Health Component

About four hundred responden (19% of 2145 household in the survey area) can be classified into 4 livelihood categories. Their main job are land farmer, fish farmer, merchant and employer. Economic conditions seems not very bad.

From the social view point, the community will accept any development change since RT, RW or Lurah is actively as agent of change.

About 600 persons (6% of 10725 persons in the survey area) are in healtly conditions.

The summarized result of socio economic and health condition survey can be seen in Table 4.1; while the complete result can be followed in Attachment.

Table 4.1
Summarized result of socio economic & health condition survey

Community Structure	Name of Kelurahan					
	Romokalisari	Tambakdono	Sumber rejo	Pakal	Tambak Osowilangun	Benowo
1. Number of household surveyed	55	70.0	8.0	7.0	168.0	127.0
2. Type of house						
- Permanent	87.3 %	55.7 %	100.0 %	71.4 %	83.3 %	48.8 %
- Semi permanent	10.9 %	42.9 %	0.0 %	28.6 %	13.7 %	42.5 %
- Non permanent	1.8 %	1.4 %	0.0 %	0.0 %	3.0 %	8.7 %
3. Av. number of people in house	5.0	5.0	5.0	5.0	6.0	5.0
- Family	87.3 %	90.0 %	100.0 %	85.7 %	86.9 %	74.0 %
- Family who have servant	12.7 %	10.0 %	0.0 %	14.3 %	13.1 %	26.0 %
- Family with other person	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
4. Housing ownership						
- Owner	98.2 %	100.0 %	100.0 %	100.0 %	95.2 %	97.6 %
- Tenant	1.8 %	0.0 %	0.0 %	0.0 %	4.8 %	2.4 %
Monthly rent (In Rp.'000)	25.0				84.0	100.0
5. - Average land area (m^2)	61.8	64.5	72.3	223.8	85.0	112.9
- Average building area (m^2)	58.8	63.7	72.3	101.0	67.3	82.2
6. Average monthly income (Rp.'000)	147.6	178.5	105.2	145.7	192.9	131.5
7. Housing facilities :						
- Telephone	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %	0.0 %
- Electricity	92.7 %	100.0 %	100.0 %	100.0 %	94.6 %	89.8 %
- Water resources	3.6 %	1.4 %	0.0 %	71.4 %	7.1 %	66.9 %
- Bath room	67.3 %	100.0 %	100.0 %	85.7 %	57.7 %	89.0 %
- WC / Toilet	14.5 %	12.9 %	12.5 %	71.4 %	10.1 %	66.9 %
- Living room	78.2 %	100.0 %	100.0 %	100.0 %	86.9 %	98.4 %
- Back yard	12.7 %	18.6 %	0.0 %	14.3 %	6.0 %	51.2 %
- Front yard	25.5 %	15.7 %	0.0 %	14.3 %	14.9 %	58.3 %
- Side yard	20.0 %	10.0 %	12.5 %	57.1 %	8.9 %	29.9 %
- Waste bin	49.1 %	7.1 %	0.0 %	28.6 %	56.5 %	33.1 %
- Dump place	0.0 %	0.0 %	0.0 %	0.0 %	11.9 %	0.0 %
8. Family used PDAM water	98.2 %	1.4 %	0.0 %	100.0 %	100.0 %	70.9 %
9. Family used well water	0.0 %	97.1 %	100.0 %	42.9 %	6.5 %	71.7 %
10. Family used the other kinds of water	0.0 %	100.0 %	100.0 %	42.9 %	3.6 %	7.9 %
11. Waste Disposal if don't have waste bin						
- Burning	21.8 %	0.0 %	25.0 %	28.6 %	14.9 %	52.0 %
- To channel	7.3 %	4.3 %	0.0 %	0.0 %	8.3 %	0.0 %
- Everywhere	3.6 %	0.0 %	0.0 %	0.0 %	0.0 %	6.3 %
- Others	20.0 %	91.4 %	75.0 %	42.9 %	19.6 %	9.4 %
12. Opini about new LPA project						
- agree	89.1 %	72.9 %	37.5 %	42.9 %	88.1 %	89.8 %
- disagree	5.5 %	20.0 %	12.5 %	0.0 %	4.2 %	6.3 %
- no opinion	5.5 %	7.1 %	50.0 %	57.1 %	7.7 %	3.9 %
13. Daily meal :						
- Rice	96.4 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %
- Vegetables	105.5 %	100.0 %	100.0 %	100.0 %	98.8 %	80.3 %
- Fishes	101.8 %	97.1 %	100.0 %	71.4 %	81.5 %	86.6 %
- Eggs	43.6 %	30.0 %	0.0 %	28.6 %	50.0 %	23.6 %
- Milk	32.7 %	1.4 %	0.0 %	0.0 %	20.8 %	8.7 %
- Meat	32.7 %	5.7 %	0.0 %	0.0 %	38.7 %	24.4 %
- Fruits	49.1 %	5.7 %	0.0 %	0.0 %	54.8 %	23.6 %
14. No. of person who has vaccination	32.7 %	64.3 %	12.5 %	42.85 %	36.90 %	55.1 %
15. Common diseases in family						
- Influenza	70.9 %	98.6 %	75.0 %	85.7 %	60.7 %	91.3 %
- Larynx	0.0 %	0.0 %	0.0 %	0.0 %	0.6 %	0.0 %
- Typhus	0.0 %	0.0 %	0.0 %	0.0 %	1.2 %	0.0 %
- Cholera	0.0 %	0.0 %	0.0 %	0.0 %	0.6 %	0.0 %
- Diare	1.8 %	0.0 %	0.0 %	0.0 %	7.7 %	0.0 %
- Good health	20.0 %	0.0 %	25.0 %	0.0 %	20.8 %	1.6 %
- Others	1.8 %	1.4 %	0.0 %	0.0 %	8.3 %	0.8 %
- More than 2 diseases	5.5 %	0.0 %	0.0 %	14.3 %	0.0 %	6.3 %
16. Health care						
- self medicine treatment	7.3 %	0.0 %	0.0 %	0.0 %	9.5 %	20.5 %
- buy at market	1.8 %	2.9 %	0.0 %	0.0 %	4.8 %	11.8 %
- public health centre	43.6 %	11.4 %	12.5 %	14.3 %	44.6 %	44.1 %
- doctor	12.7 %	0.0 %	37.5 %	28.6 %	16.7 %	21.3 %
- others	34.5 %	85.7 %	50.0 %	57.1 %	24.4 %	2.4 %

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CHAPTER 5

5. IDENTIFICATION OF SIGNIFICANT IMPACTS

Matrix (Table 5.1) is shown to represent the identification of significant impact.

Intensive identification is addressed to the evironmental components which have the scale of significace of 3 and higher.

5.1. Air Quality : Construction, Operation and Post Operation Stages

Air quality may be polluted due to the land preparation and lining during the construction stage. It is caused by using heavy equipments and soil stabilization process in a great number. The pollutant is gas emision, noise and dust. This impact is released temporarily.

During the operation stage, activities which decrease the air quality are solid waste transport, disposal and ventilation. Special attention is given to the waste transportation because its impact happens continually, along the waste truck routes.

Noise, dust and gas emision from solid waste vehicles will influence the air quality along Jalan Banyu Urip - LPA Benowo. This road is quite narrow and the traffic congestion always happen peak hours.

In addition, the solid waste transport may cause traffic disruption.

For the disposal and ventilation, odour generation may influence people who live near the site.

After completion of the operation stage, it is predicted that there is a latent impact. Problem happened and duration of impact are difficult to be predicted.

5.2. Surface and Ground Waters Quality : Construction, Operation and Post Operation Stages.

During construction, soil lining gives an impact to surface water such as marsh, pond, and river. The impact is temporary because after finishing there is no soil pollutant to the waters.

Solid waste disposal will cause significant impact to the surface and ground waters in the operation stage. Leachate which is generated from the decomposition of the waste can polute this water. The scale of significance is 4 which is based on the COD, N and P of leachate of about 30,000 mg/l, 20 mg/l and 60 mg/l respectively (SHINTA & SARWOKO, 1992). The leachate collection and its control will reduce the impact.

Special care must be anticipate in the post operation stage because solid waste decomposition is very slow, about 950 years (Study of LOHANI, 1984).

5.3. Flora & fauna : Construction, Operation and Post Operation Stages

A negative impact to aquatic flora and fauna is a secondary impact. This means that flora and fauna disturbances are due to water quality which is caused by leachate.

The impact may change to be positive because the leachate is controlled and the final quality of the leachate may be a nutrient sources for aquatic life. In the later case, aquatic life production is increasing.

Transportation and disposal of solid waste give significant negative impact. Vectors, animals and other disease - carrier may develop and influence to people nearby the site.

Soil covering, leachate collection and leachate control will limit the spreading and generating of biota.

5.4. Socio - economic - culture : Preconstruction, Construction, Operation and Post Operation Stages

Land acquisition in the preconstruction stage may cause community restless due to land value orientation such as low price.

In the construction stage, there is a positive impact because LPA project provides work occasion. The impact is maintained as long as local labour do the work. The impact becomes negative i.e. suspicion since non local laborer with similar capability participate in the project.

Other positive impacts are

- Local people may open temporary small restaurant which means income.
- market income, i.e. materials for LPA construction.

During construction, the negatif impact could happen is the work accident. Work accident is potentially for land preparation and lining because this activities use heavy equipment frequently. Aestethic is also problem at the site. This brings the changes of land use, i.e. green area become solid waste disposal site.

In the operation stage, there are positive impacts which are presented as in the construction stage.

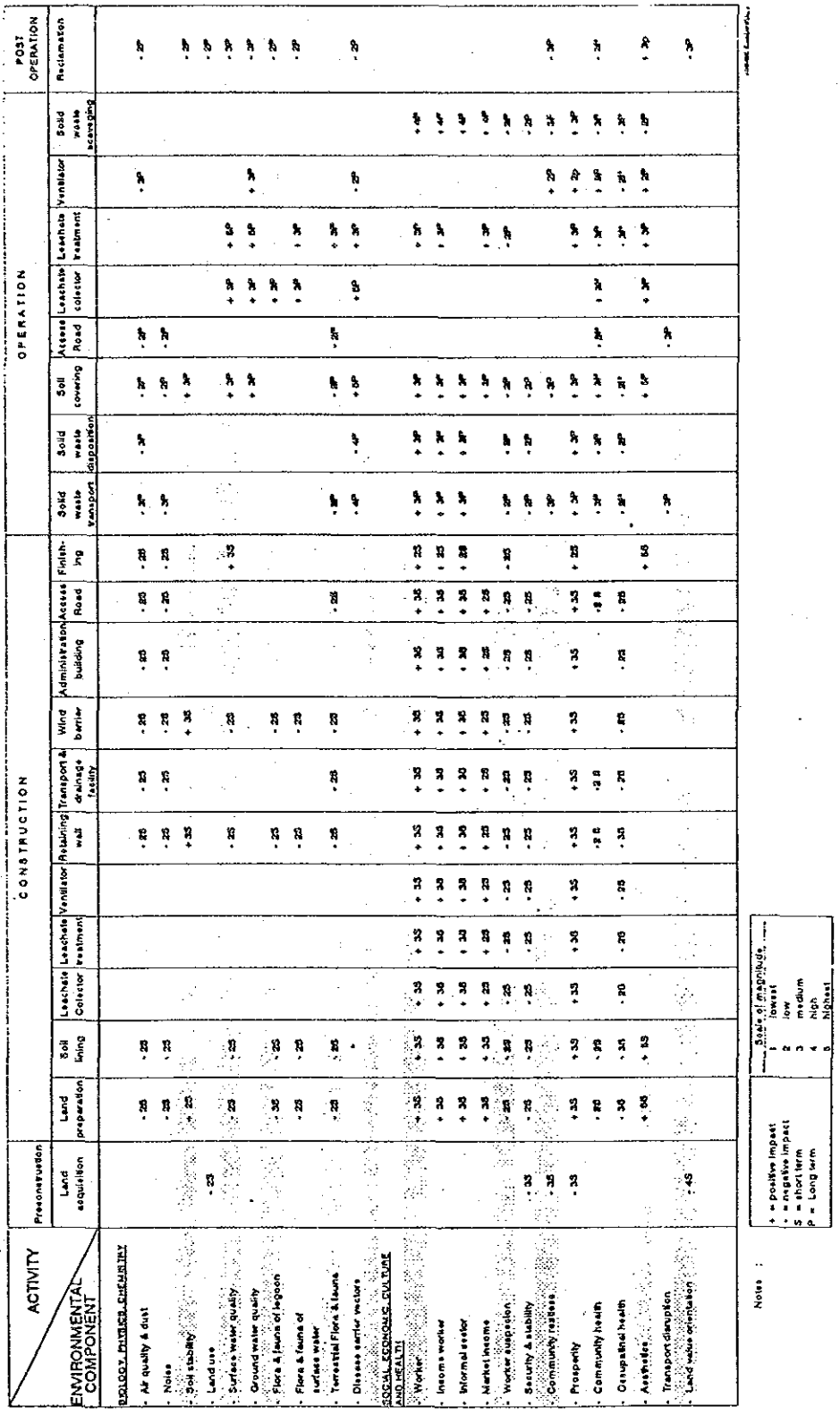
Negative impacts in operation stage such as :

- odour, disease - carrier vectors which is caused by solid waste disposal.
- odour, traffic disruption which are due to solid waste transportation.

The diseases may attack the labourer who works in solid waste operation. Care must be taken.

After completion of the operation stage, a negative impact happens on the perception of local community. They may think that there is a latent hazard in site and the site value is down.

Table 5.1
Matrix for Magnitude Scale of Environmental Impact



CHAPTER 6

6. Evaluation of Significant Impact and Mitigation

The development activities always create impacts to the environmental component, both the positive and negative impact. Thus the initial planning for Benowo disposal site should predict significant impact to the component ie, biology, phisical, chemical, socio-economic, culture and the community health. This has already been described in chapter 5. Then the impact is evaluated (see Table 6.1) and preventive measure is introduced

The evaluation of significant impact for each environmental component are as follows :

6.1. Air Quality, Dust and Noise.

The site preparation will create significant impact in the form of :

1. Reduce air quality, due to vehicle gas emision.
2. Increase dust concentration, due to transportation.
3. Noise of vehicle.

The impact will affect the people who live in Jawar, Kauman and Tambakdono district.

The noise will cause disturbance if the activity occurs at night.

To mitigate the impact, it can be done by means of :

1. Spray some water on the road where pass by vehicle, especially on the road near Jawar district.
2. Close container truck with canvas or plastic.
3. No activities at night.

In operational phase, the activity which create significant impact are solid waste transportion, disposal and ventilation.

The impacts are as follows :

1. **Offensive odour of solid waste trucks.**

   The impact may be more disturbing in wet season due to waste water pouring out in the roads.

2. **Gas problem**

   The household solid waste contains organic subtances.

   By the sanitary landfill, subtances in the form of gases are produced such as CH_4, CO_2, NH_3 and H_2S.

   Special attention is given to CH_4 because it is coverted to dangerous gasses (HCHO) prior to CO_2 production.

The reaction chain of CH_4 is shown in figure 16 (systematic presentation from Boumans AF, 1989. The Role of Soil and Land Use in the green house effect, ISRIC the Netherlands).

OH radical can be formed by passing NH_3 in the air.
That gas was not detected during survey, but it has been mentioned that the gas is formed from waste decomposition.

Velocity of CO_2 conversion to HCHO is slower than HCHO to CO_2.
As such dangerous HCHO gas is not accumulated. The landfill ventilation of sanitation helps gas exchange, O_2 enters the mass of waste and decomposition of gases are out.

3. **The Acid Rain.**

The gas CO_2, NH_3 and H_2S can be converted to H_2CO_3, NH_4NO_3 and H_2SO_4 respectively about one day.

In the wet season, no rain accurs in 24 hours. Thus we do not worry about negatif impact of acid rain.

In the dry season, the sun light evaporate water from waste heap. That condition condusive forming acid gas. But the gas layer is thin, and it is predicted that gas dispersion is low. The acid environment scale have small impact.

The mitigation of impact for that operation level are as follows :

1. Closes container truck by plastic, canvas or other appropriate materials.
2. The vegetation corridor around LPA areas.

6.2. Surface Water and Ground Water Quality.

The significant negative impact to surface water and ground water quality is pollution due to leachate.

The main characteristic of leachate is COD, N and P which is about 30.000 mg/l, 20 mg/l and 60 mg/l respectively (ARIFANI & SARWOKO, 1992)

That characteristic give a very negative impact to environment, especially in the wet season. Thus the collection and circulation are good technology suggested.

Also, leachate resirculation will accelerate waste decomposition process. COD of leachate as the energy source and N&P as nutrient for microbial.

The leachate treatment in the pond is done by aeration method using wind power.

The other alternative is the natural treatment of leachate using soil procces. ARIFANI & SARWOKO (1992) found out the reduction of COD, N and P about 90% by flowing the leachate to the land with soil texture of sand:silt:clay = 45%:35%:20%.
Whatever kind of technology, the leachate treatment gives the positive impact.

6.3. Flora and Fauna

The flora and fauna that shall be affected by LPA operation are

1. The aquatic flora and fauna. The impact interlocked with pollution of water surface by leachate, especially in the wet season because the leachate control is very difficult.
2. The population of disease vector such as insects and rattus will increase because of the solid waste transport activity and solid waste disposal.

   The mitigation of impact to the aquatic flora and fauna is the same as with the mitigation of leachate.

   To reduce of insect and rattus population, it can be done by closing the solid waste with soil, as soon as possible the waste disposal affer.

6.4. The Social, Economic, Culture and The Community health.

In Pre-Contructrion phase, the land accquisition activity estimated arising of the community restless opinion, especially if the cost of compensation is too low or if the land accquisition negosiation is not fluent. The other of LPA development plan will arise of the community restless because the preseption of LPA is "the environment poorly land".

The general method to solve that problem is to give the available compensation to their property in the land.

The appoitment of the land accquisition and compensation, (or the procedure) is given bellow:

1. The land acquisition based on Kep. Men. Dagri No. 2/1985 is : If area of land less than 5 ha camat and lurah take the responsibilit, if the area more than 5 ha, the Nine - Commitee (Panitia Sembilan) take responsiblity.

   The step of land acquisition are :

   a. Coordination meeting among responsible agencies.

   b. After the meeting, announcement of the land acquisition is released by Walikota.

   c. Preconditioning meeting with community.
   The agencies responsible to arrange of meeting with community.
   The agencies explain community about the project, and people can ask some questions.

   d. "9 comitte" calculate some item of land acquisition. There are specification costs according land status, building type, land use etc. After establishing the costs, they will arrange meeting with the community one more.