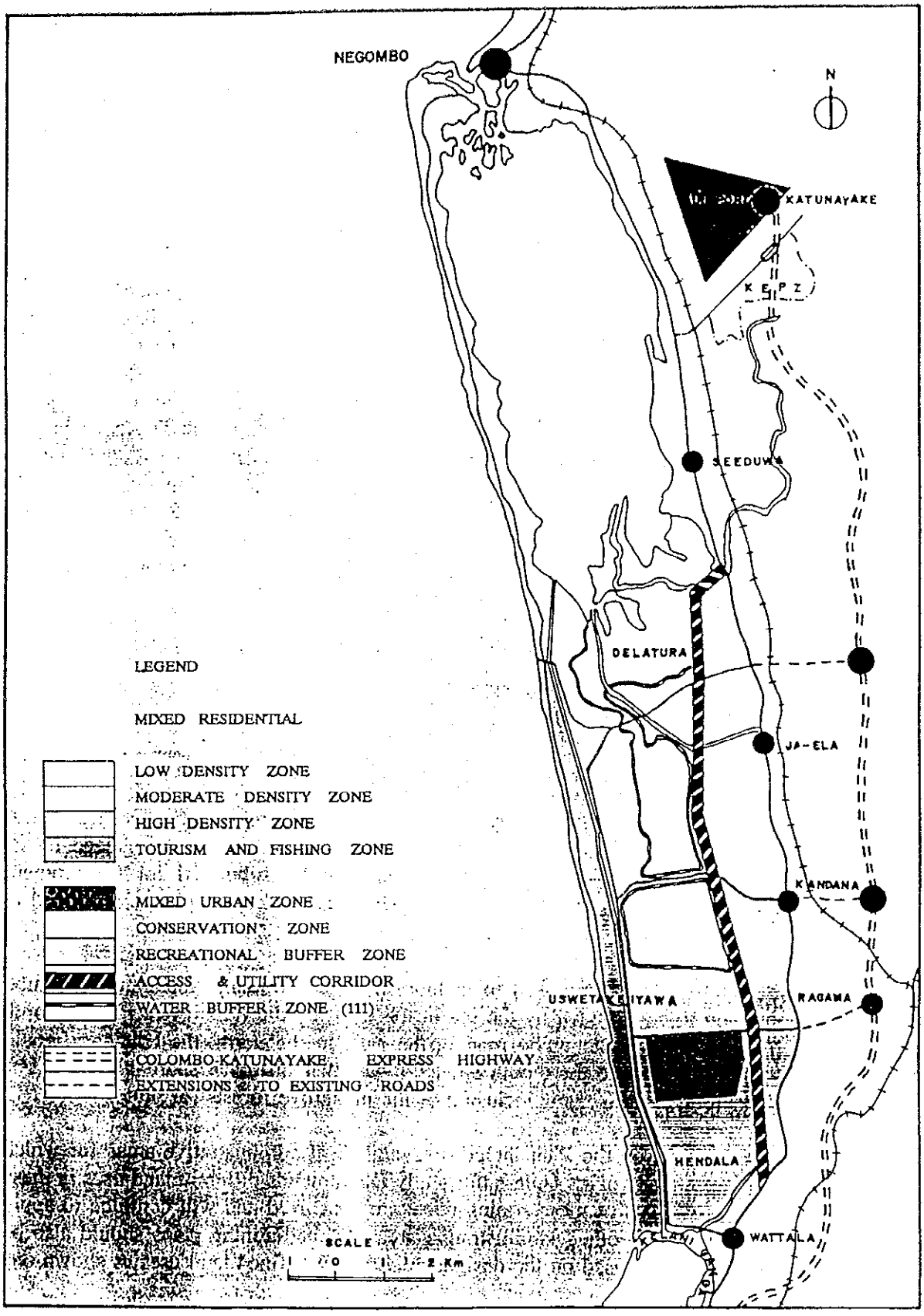
Table 3.13 Social and Economic Situations of Wattala Division

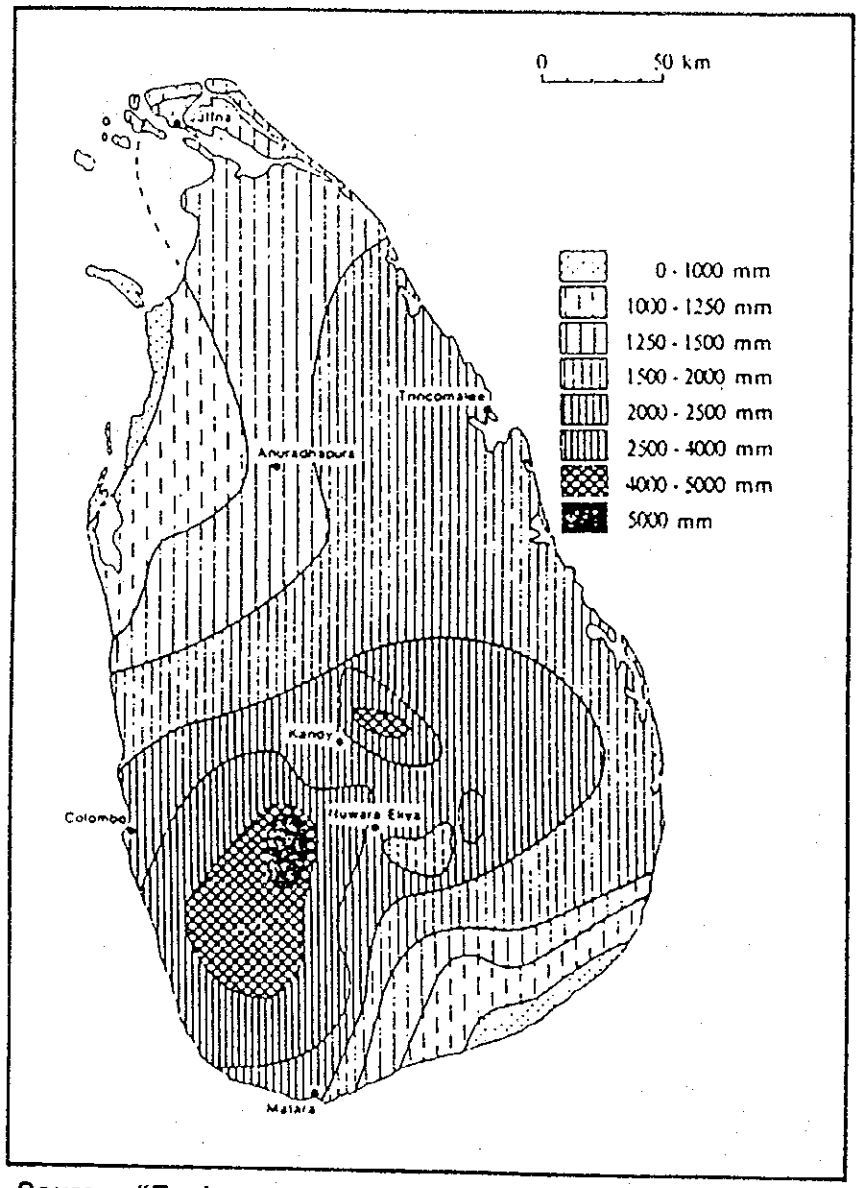
G.D No.	NAME	Total Population	Age Group												Ethnic Group				Religious Group				
			1 - 18			19 - 35			36 - 60			Over 60											
			Female	Male	Total	Female	Male	Total	Female	Male	Total	Female	Male	Total	Sinhala	Tamil	Muslim	Others	Buddist	Muslim	Catholic	Hindu	Others
Wattala A.G.A Division Total		150,175	19,839	18,769	38,608	22,028	22,560	44,588	21,028	21,293	42,321	6,155	5,725	11,880	125,226	14,798	6,813	3,260	43,484	6,901	89,014	8,558	1,921
167	Uswatakeiyawa	3,940	694	710	1,404	631	705	1,336	514	523	1,037	82	75	157	3,839	79	12	10	120	12	3,738	5	65
167B	Pattiyawala	2,318	437	546	983	220	251	471	205	264	469	198	197	395	2,277	41	-	-	136	-	2,150	32	-
168A	Palliyawatta North	3,425	635	760	1,395	560	565	1,125	355	440	795	50	60	110	3,075	258	10	82	120	10	3,137	158	-
168B	Dikowita	1,634	321	236	557	186	231	417	231	241	472	81	107	188	1,582	41	1	10	60	1	1,543	28	1
170	Tibirigas Yaya	5,125	925	996	1,921	605	680	1,285	676	620	1,296	293	230	523	3,588	1,127	103	307	1,743	103	2,870	307	102
170A	Alakanda	2,290	342	325	667	308	296	604	231	227	458	296	265	561	1,687	580	8	15	854	8	1,026	402	-
171	Kerawalapitiya	5,590	930	955	1,885	865	832	1,697	928	916	1,844	75	69	144	4,737	695	96	62	2,849	86	1,965	690	-
171A	Matagoda	6,219	458	432	890	1,001	1,231	2,232	907	955	1,862	58	69	127	4,582	1,201	142	294	2,034	142	3,764	174	105
171B	Balagala	6,097	791	683	1,474	805	784	1,589	767	677	1,444	825	765	1,590	5,828	171	22	76	1,919	31	4,087	12	48
172	Handala South	3,520	867	845	1,712	504	481	985	274	243	517	164	142	306	2,872	612	34	2	1,936	34	1,146	402	2
172A	Handala North	4,390	480	445	925	772	733	1,505	873	842	1,715	136	109	245	3,581	665	80	4	1,781	80	1,800	665	64
172B	Nayakakanda North	2,980	509	489	998	173	148	321	240	236	476	602	583	1,185	2,772	194	14	-	1,321	14	1,451	194	-
172C	Nayakakanda South	3,651	390	415	805	551	502	1,053	498	537	1,035	403	355	758	1,987	1,427	84	153	826	77	1,760	792	196
176A	Mabola	4,389	973	914	1,887	495	656	1,151	629	674	1,303	30	18	48	1,743	235	2,249	162	1,190	2,249	595	195	160
177	Mattumagala	4,165	761	542	1,303	496	518	1,014	851	781	1,632	96	120	216	3,688	239	176	62	2,156	176	1,542	229	62
177A	Keragapokuna	2,238	323	381	704	334	286	620	209	267	476	232	206	438	1,606	221	394	17	921	394	710	196	17
178	Mahabage	3,831	612	693	1,305	459	506	965	739	762	1,501	22	75	97	3,171	243	282	135	639	282	2,532	243	135
17 G.D Total		65,802	10,448	10,367	20,815	8,965	9,405	18,370	9,127	9,205	18,332	3,643	3,445	7,088	52,615	8,029	3,707	1,391	20,605	3,699	35,816	4,724	957

G.D No.	NAME	Schools		Pre-school		Employment									Houses					Post Office	Hospital	Bank	Religious Places			
		Govern.	Private	Govern.	Private	Gov. Sector		Gov. Cooperation		Private		Other		Total									Buddist	Muslim	RC	Hindu
						Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Permanent	Semi-permanent	Temporay	Small Huts	Unauthorised						
Wattala A.G.A Division Total		27	4	3	54	4,645	6,453	3,072	4,541	12,857	12,084	5,467	8,085	26,041	31,163	21,056	4,879	965	1,532	1,290	17	8	11	16	1	26	0
167	Uswatakeiyawa	1	0	0	0	70	80	50	63	177	195	185	230	482	568	750	40	10	5	-	1	1	1	0	0	1	0
167B	Pattiyawala	0	0	0	2	18	49	49	127	189	226	108	296	364	698	95	32	69	58	289	0	0	0	0	0	1	0
168A	Palliyawatta North	1	0	0	0	30	60	75	125	100	200	25	75	230	460	288	50	12	150	88	0	0	0	0	0	1	0
168B	Dikowita	1	0	0	1	1	1	-	-	146	98	2	215	149	314	153	71	2	112	10	0	0	0	0	0	1	0
170	Tibirigas Yaya	0	0	0	0	725	100	103	130	350	120	122	120	1,300	470	956	72	20	56	52	0	0	0	0	0	0	0
170A	Alakanda	1	0	0	0	321	305	208	212	360	354	-	-	889	871	440	20	-	-	-	1	0	0	1	0	0	0
171	Kerawalapitiya	2	0	0	1	81	115	95	119	285	210	55	300	516	744	730	135	80	140	-	0	0	0	1	0	1	0
171A	Matagoda	0	0	0	0	825	1,925	505	595	1,375	580	555	280	3,260	3,380	1,392	51	-	15	-	0	0	0	0	0	0	0
171B	Balagala	0	0	0	2	122	138	190	152	562	440	742	642	1,616	1,372	895	130	12	2	98	0	0	0	0	0	1	0
172	Handala South	1	0	0	0	56	84	23	47	148	118	42	66	269	315	378	114	94	-	-	0	1	0	1	0	0	0
172A	Handala North	0	0	0	0	78	124	18	154	169	370	185	105	450	753	381	95	52	65	43	0	0	0	0	0	0	0
172B	Nayakakanda North	1	0	0	2	62	96	21	42	126	114	14	9	223	261	328	143	-	13	-	1	0	0	0	0	1	0
172C	Nayakakanda South	0	0	0	0	76	21	41	53	158	196	52	89	327	359	341	105	17	5	9	0	0	0	0	0	0	0
176A	Mabola	1	0	1	2	38	48	65	95	122	160	189	120	414	423	630	98	-	52	33	2	0	0	0	1	0	0
177	Mattumagala	1	0	1	3	77	121	20	36	975	595	260	360	1,332	1,112	581	56	72	28	16	1	1	0	3	0	0	0
177A	Keragapokuna	0	0	0	2	21	51	19	42	426	374	45	116	511	583	260	102	-	-	12	0	0	0	1	0	0	0
178	Mahabage	0	1	0	0	54	48	102	130	202	274	17	30	375	482	770	70	40	10	58	0	1	1	1	0	1	0
17 G.D Total		10	1	2	15	2,655	3,366	1,584	2,122	5,870	4,624	2,598	3,053	12,707	13,165	9,368	1,384	480	711	708	6	4	2	8	1	8	0



Source : "Master Plan of Muthurajawela and Negombo Lagoon"[1]

Figure 3.1 Muthurajawela Structure Plan Concept



Source : "Environmental Profile of Muthurajawela and Negombo Lagoon"[2]

Figure 3.2 Average Annual Rainfall in Sri Lanka

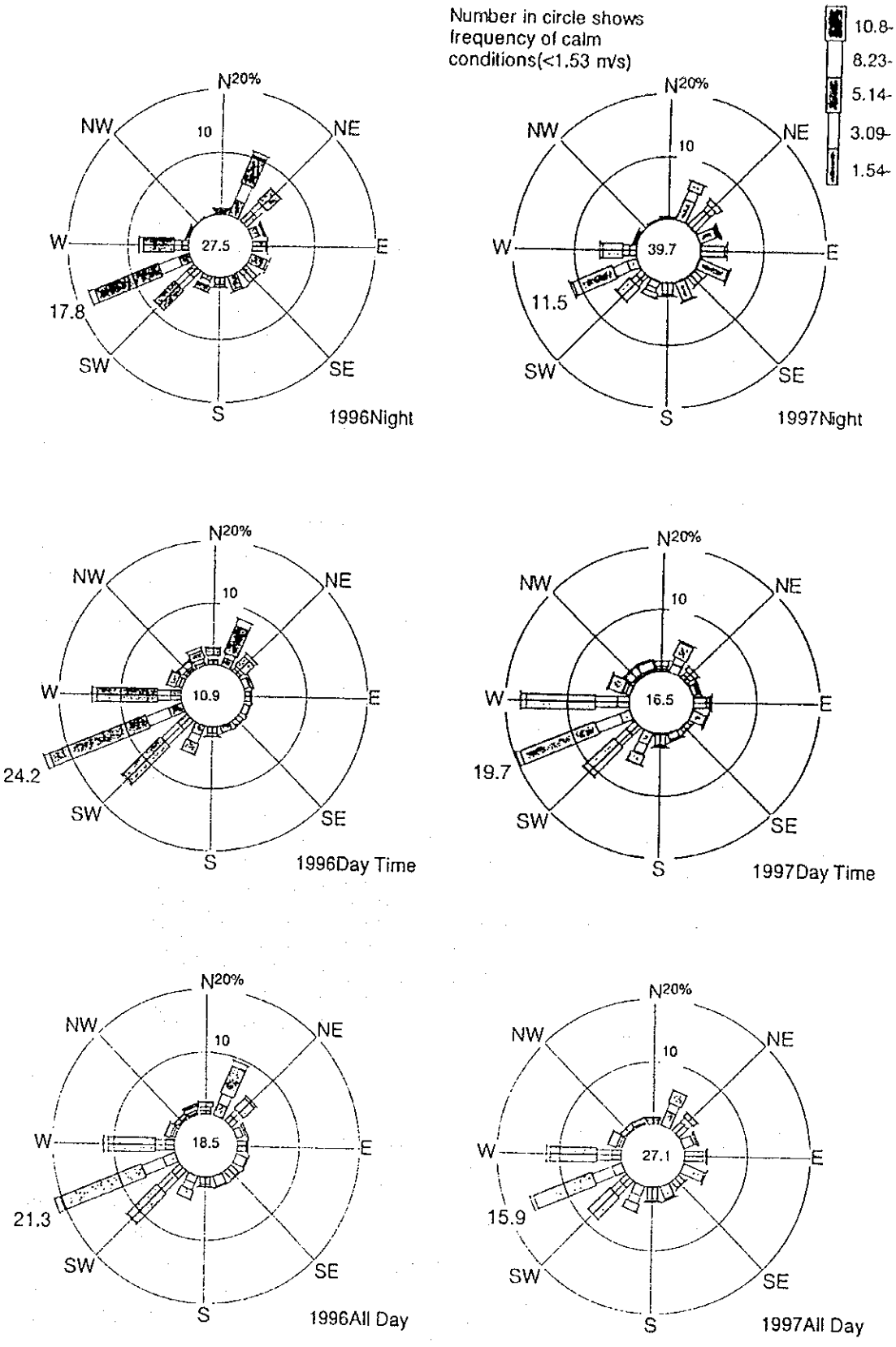
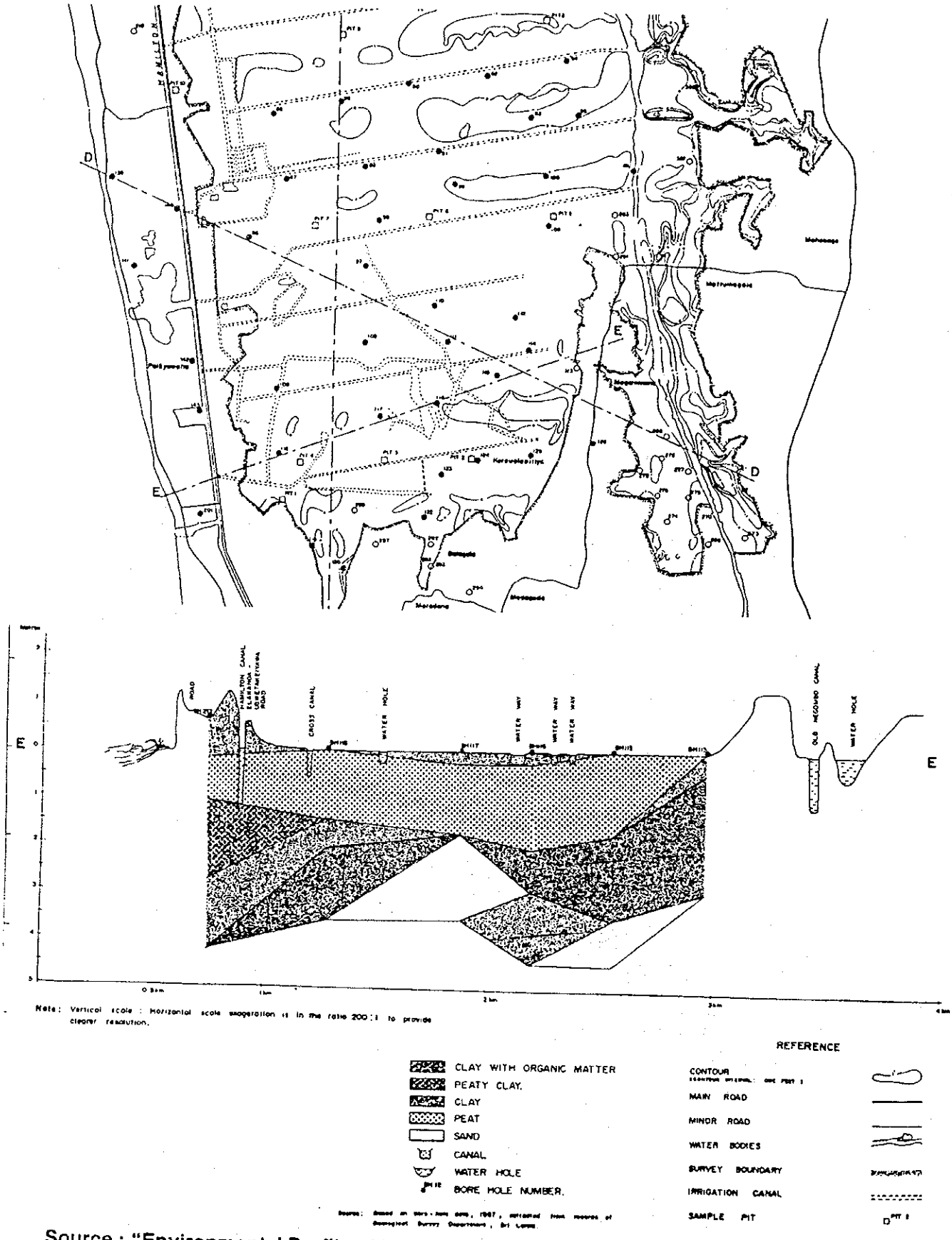
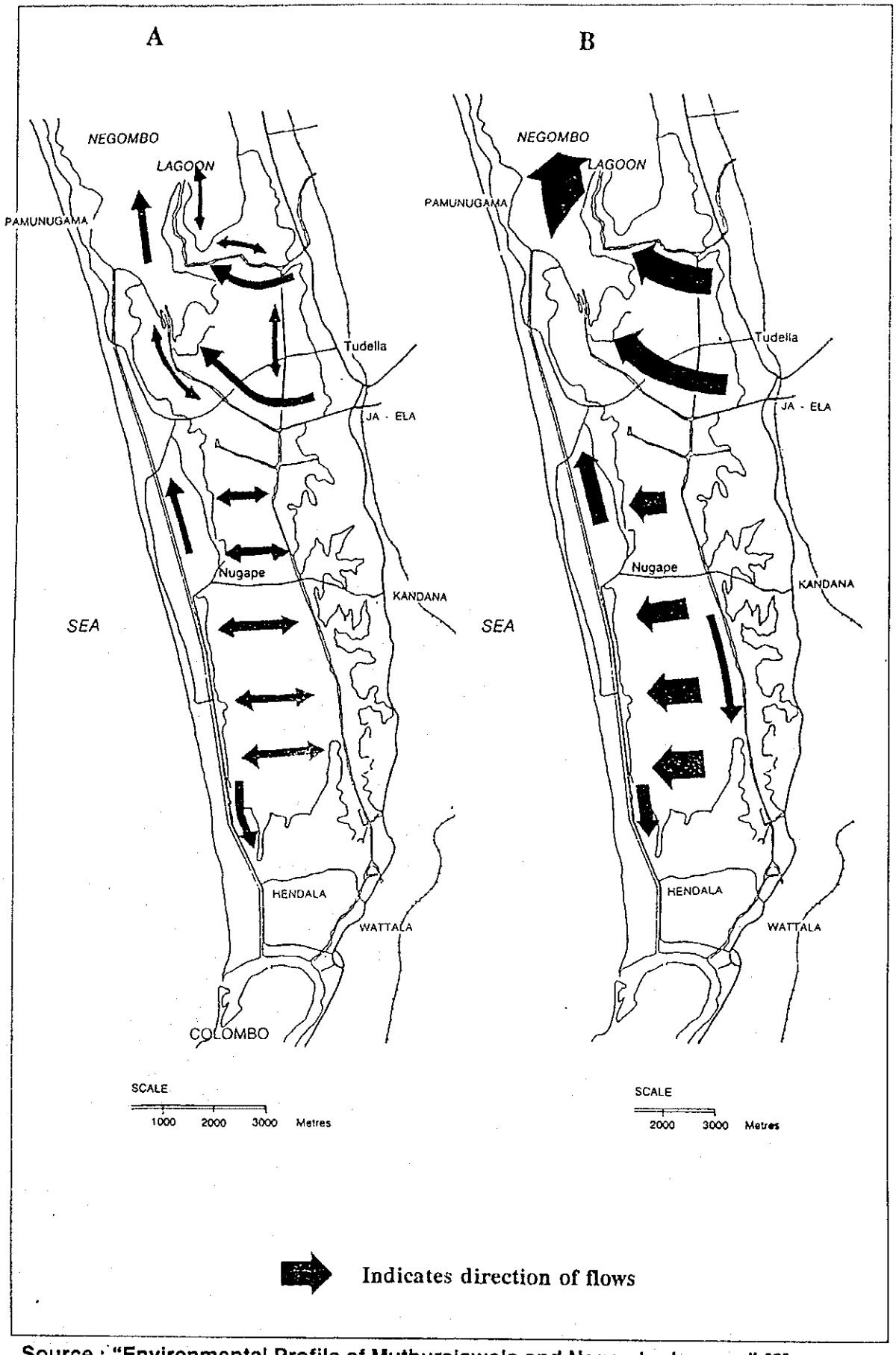


Figure 3.3 Wind Roses (Yearly, 1996 and 1997)



Source : "Environmental Profile of Muthurajawela and Negombo Lagoon" [2]

Figure 3.4 Vertical Section of Layer



Source : "Environmental Profile of Muthurajawela and Negombo Lagoon" [2]

Figure 3.5 Water Flow Pattern In Muthurajawela During the Dry and Wet Seasons

Fig. Sampling Stations in the study area for water quality and reason for their selection.

9 Duwa
Segment of Negombo Lagoon with restricted flow, low income housing in the vicinity with poor sanitation (comparison with 5, 6, 7, 8, 9).

8. Pitipana Lelluma
Channel segment of Negombo Lagoon with good tidal exchange, rapid flow at low tide (comparison with 5, 6, 7, 9, 10).

10. Pitipana-Basiyawatte
Open water area of Negombo Lagoon with good mixing, old settlement in the vicinity with reasonable sanitation (comparison with 5, 6, 7, 8, 9).

11. Delalure bridge
Lower segment of Ja-ela where water is used by the residents for bathing and washing

12. Kadola Para
Swampy inlet of Negombo Lagoon with low income settlement, poor sanitation

13. Nugape
A stagnant pond with much aquatic vegetation situated in the marsh, solid waste dumping in the vicinity.

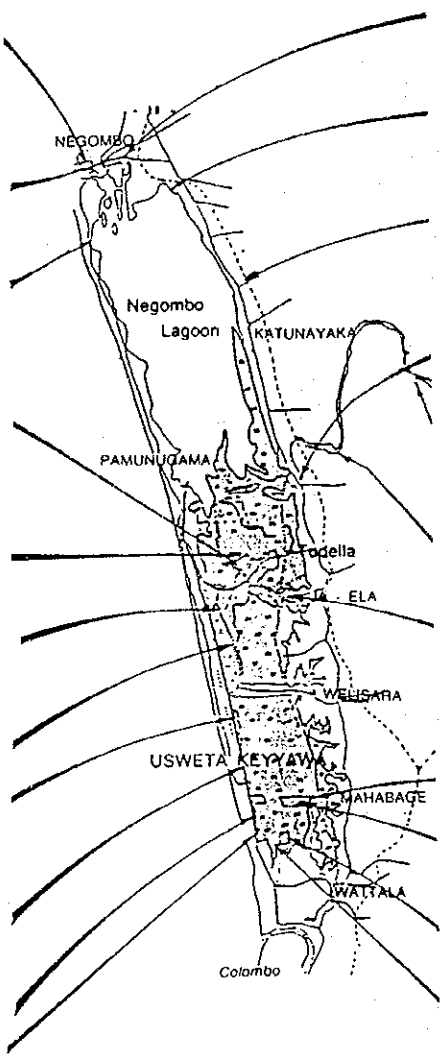
14. Pubudugama
Shallow pool in the marsh in the vicinity of squatter settlement.

16. Farawatte
Canal in the marsh in the vicinity of squatter settlement.

15. Hamilton Canal, Uswetikeiyawa
Canal linking Kelani Ganga and Negombo Lagoon, into which water from the marsh drain by way of canals. Canal used for bathing and washing.

17. Aluthakkare
Canal in the marsh with poor flow, squatter settlement in the vicinity, used for bathing and washing.

18. Awarakoluwa
Stagnant canal water used for bathing and washing, squatter settlement in the vicinity.



7. Rest House
Channel segment of the Negombo Lagoon with good tidal exchange, rapid flow at low tide (comparison with 5, 6, 7, 8, 9, 10)

6. Kadolkele bokka
Open water in the vicinity of low income settlement, poor sanitation (comparison with 5, 7, 8, 9, 11)

5. Airport Garden Hotel
200 m west of the hotel, open water of the lagoon, hotel discharges matured cess pit material, no settlements in the vicinity (Comparison with 6, 7, 8, 9, 10)

4. Dandugam Oya bridge
A site downstream of the discharge point of treated waste from the Katunayake Investment Promotion Zone.

2. Muthuwadiya Ferry
Site upstream of the discharge point of the Katunayake Investment Promotion Zone, treated wastes.

3. Leuwela culvert
A streamlet receiving industrial effluents from the Ekala Industrial Estate.

1. Ja-ela canal
Partially drains the Ekala Industrial Estate, fish kills reported, discharges into the transition zone of the lagoon.

22 Lankamatha
Many excavated pits retaining stagnant water, squatter settlement in the vicinity.

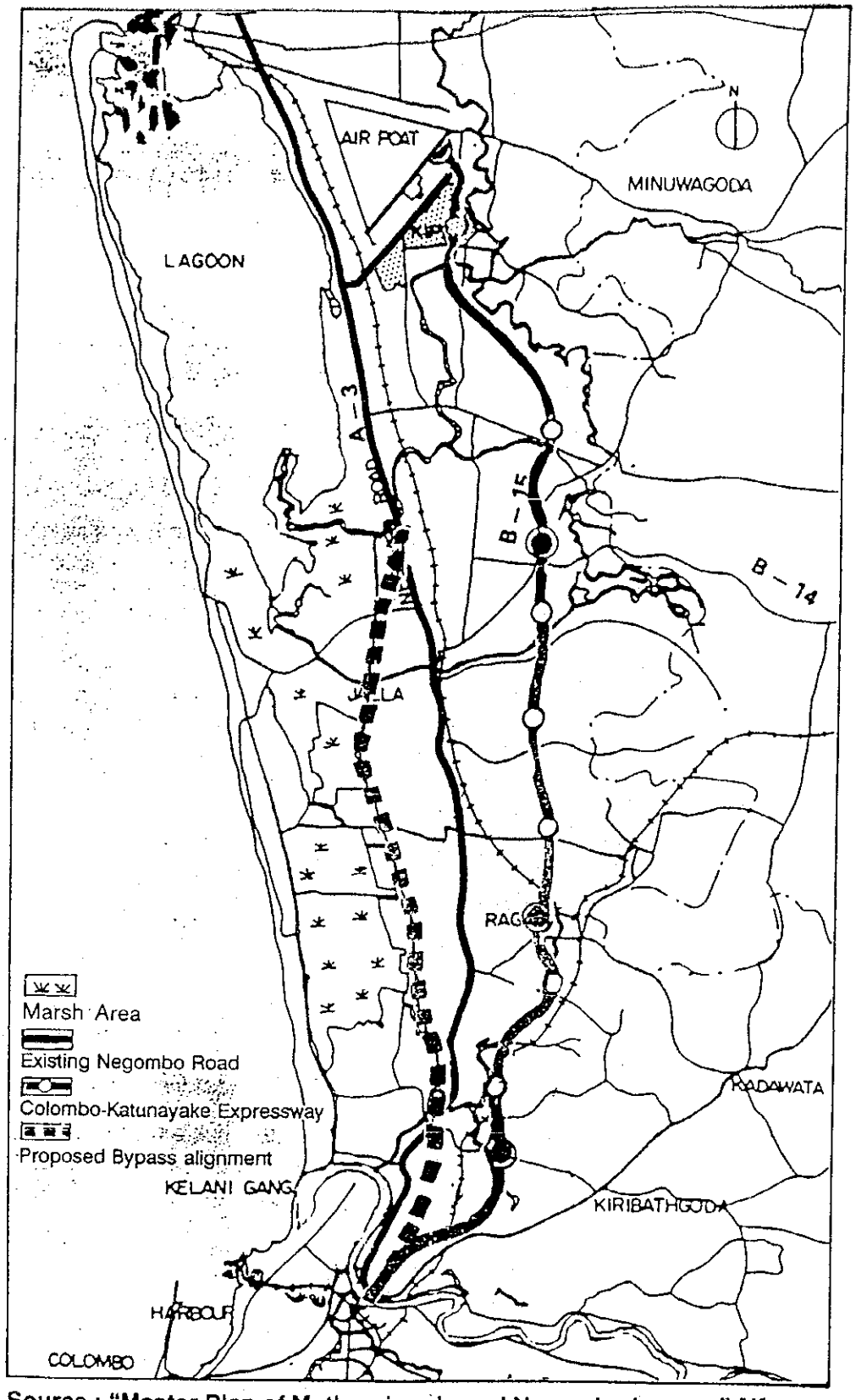
21 Kudagahapitiya
Many excavated pits retaining stagnant water in the vicinity of squatter settlement.

20 Balagala 2
Canal with poor flow in the vicinity of squatter settlement, used for bathing and washing.

19 Balagala 1
Canal with poor flow in the vicinity of squatter settlement, used for bathing and washing.

Source : "Environmental Profile of Muthurajawela and Negombo Lagoon" [2]

Figure 3.6 Sampling Stations for Water Quality



Source : "Master Plan of Muthurajawela and Negombo Lagoon" [1]

Figure 3.7 Road Distribution around the Project Site

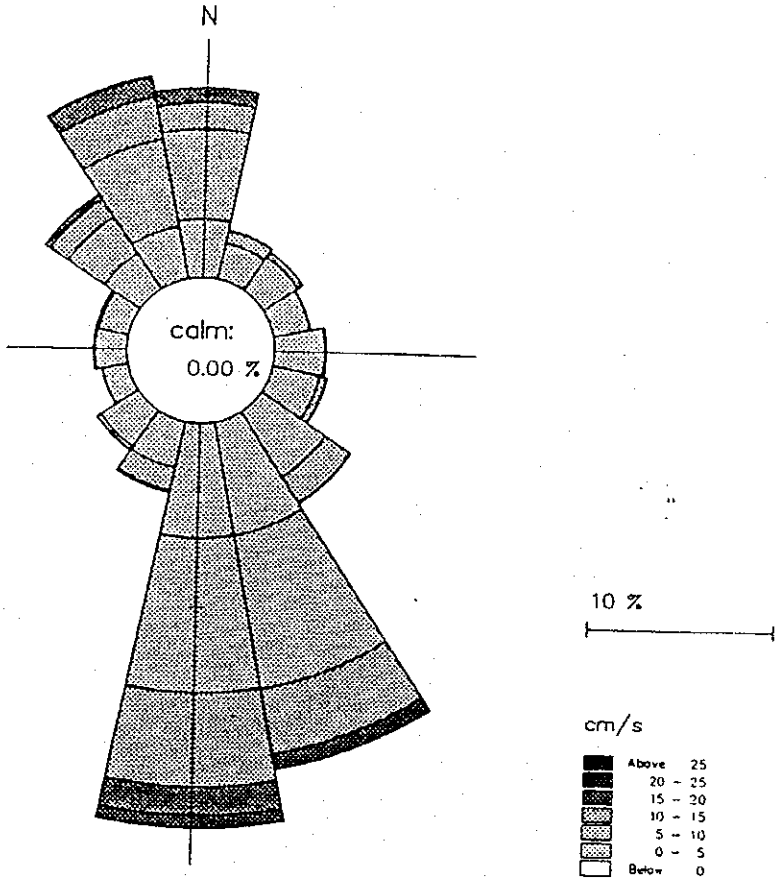
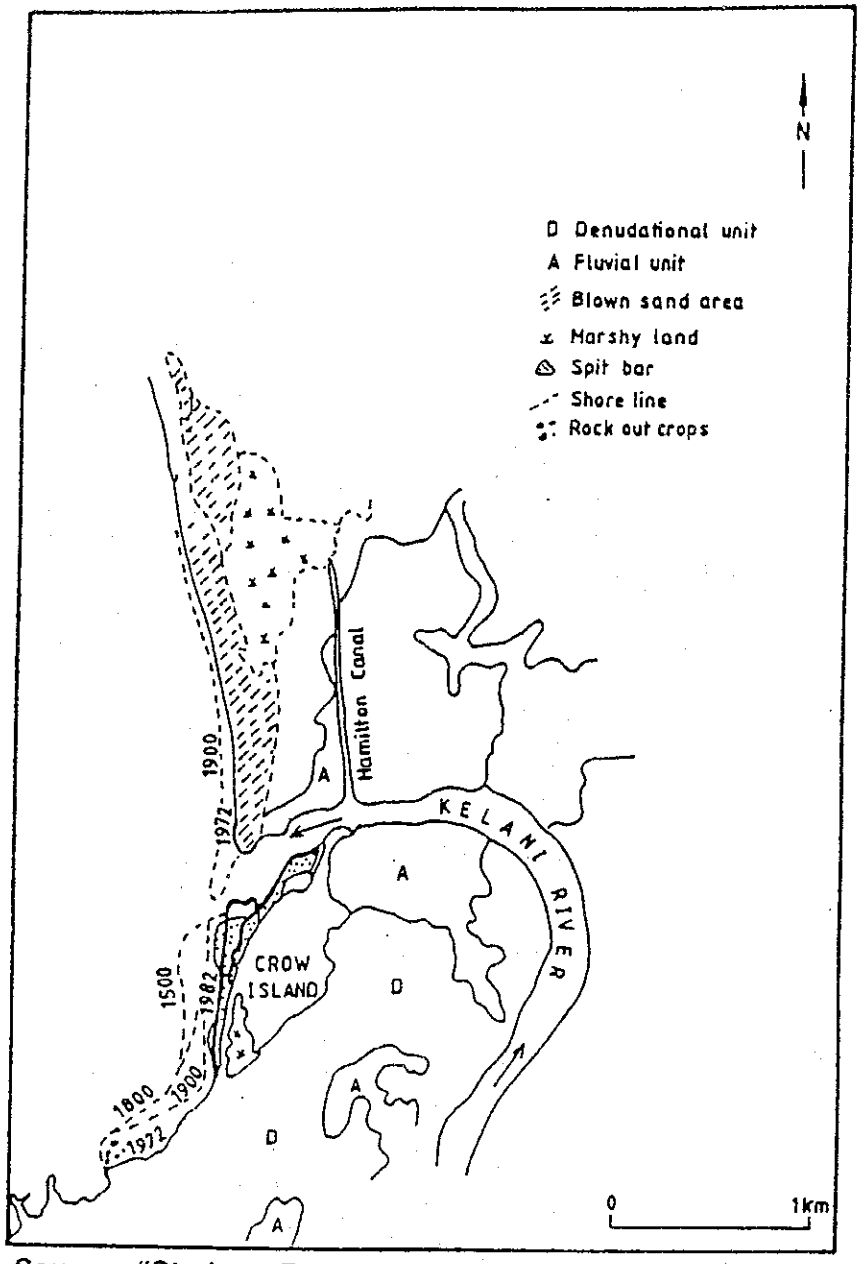


Figure 3.8 Current Rose (May 13, 1998)



Source : "Study on The Development of New Port of Colombo" [4]

Figure 3.9 Shore Line Changes at Crow Island Reconstructed From Historical Maps Aerial Photographs

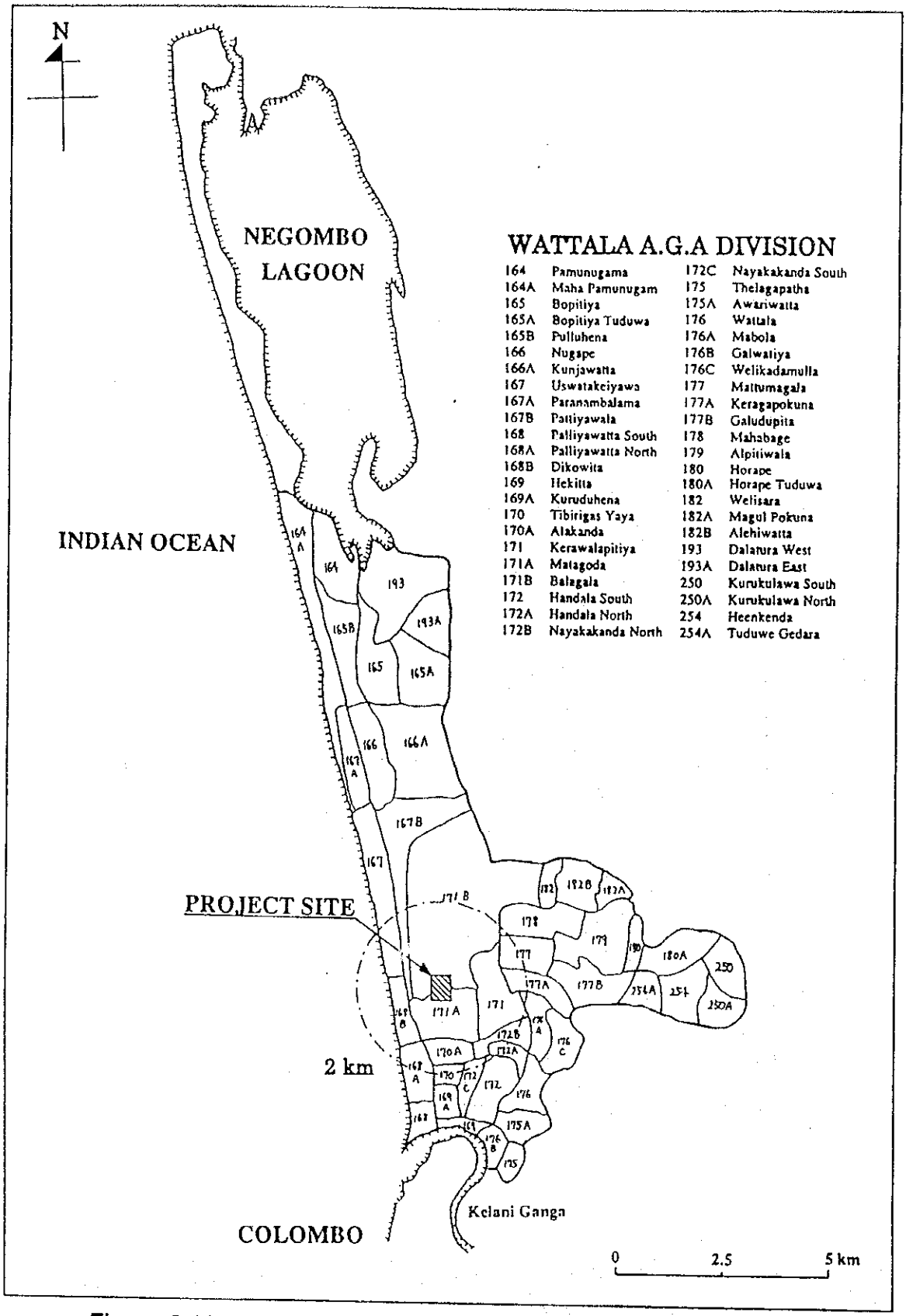
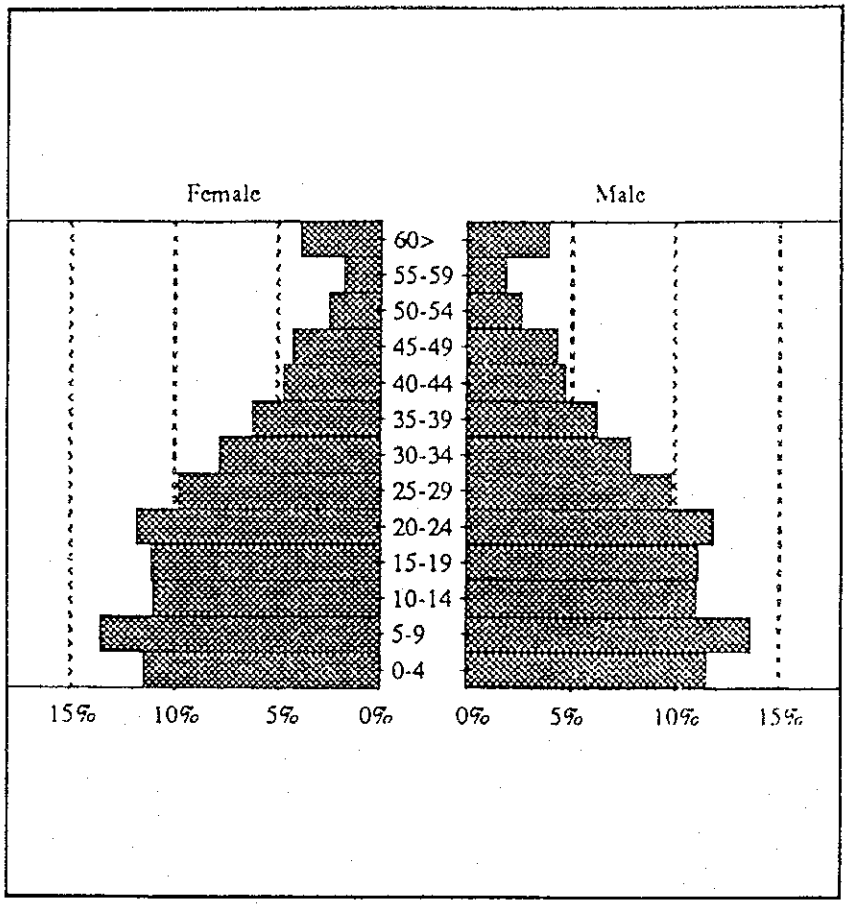
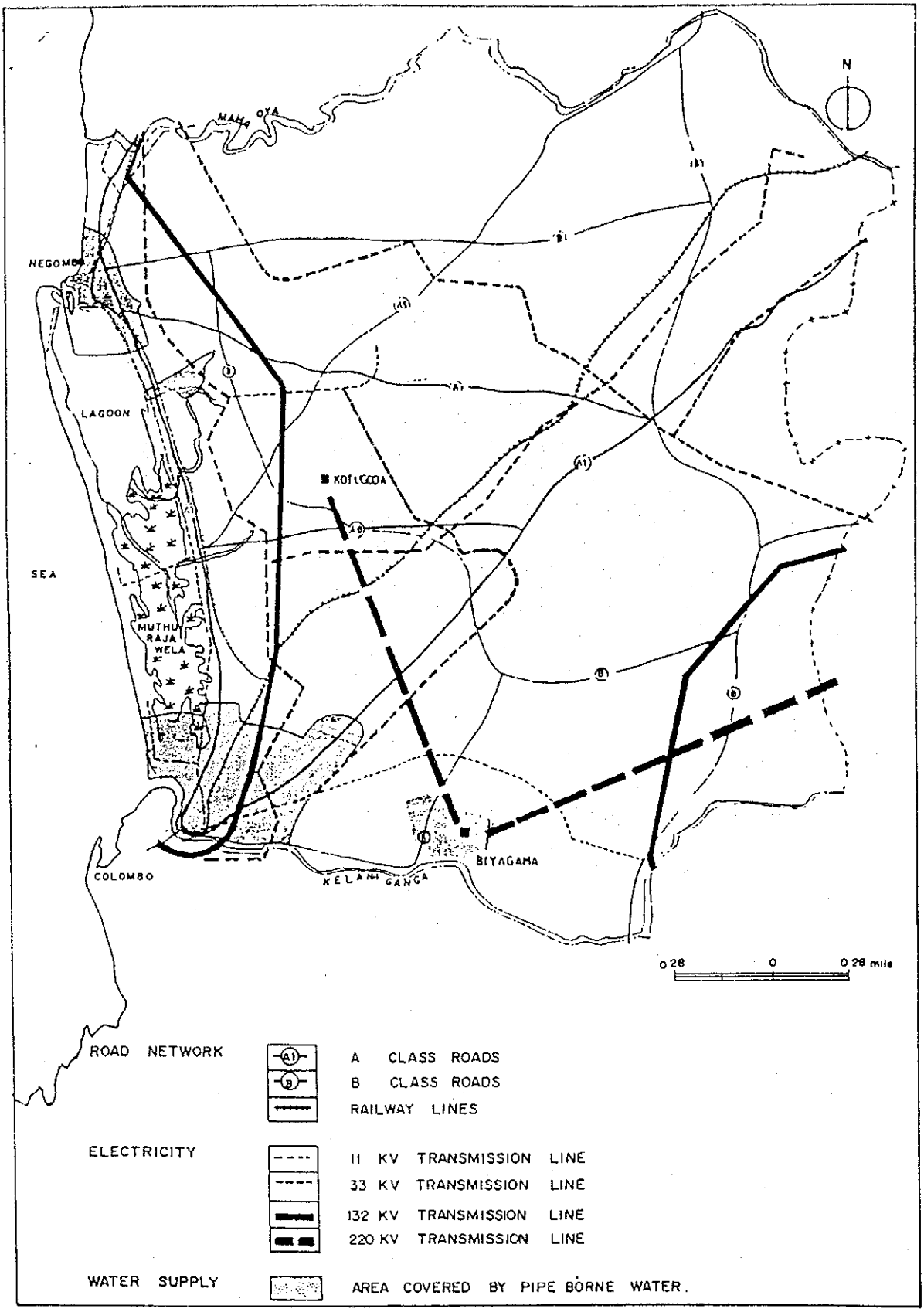


Figure 3.10 Local Government District in Wattala Division



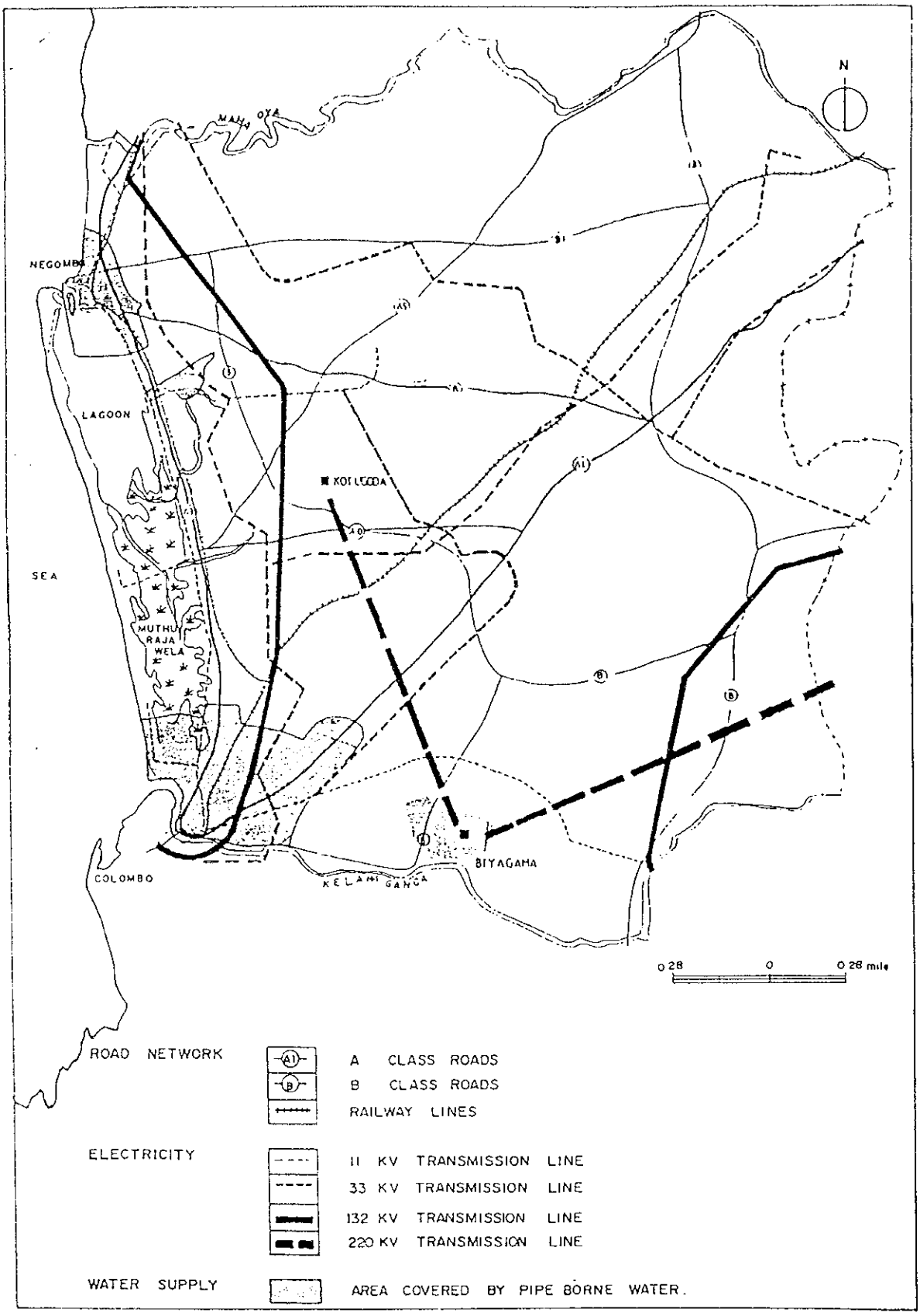
Source : "Environmental Profile of Muthurajawela and Negombo Lagoon" [2]

Figure 3.11 The Age Structure of the Squatter Population in the Muthurajawela Marsh



Source : "Master Plan of Muthurajawela and Negombo Lagoon" [1]

Figure 3.12 Main Infrastructure Facilities in Gampaha District



Source : "Master Plan of Muthurajawela and Negombo Lagoon" [1]

Figure 3.12 Main Infrastructure Facilities in Gampaha District

CHAPTER 4 ASSESSMENT OF THE ANTICIPATED ENVIRONMENTAL IMPACTS

CHAPTER 4 : ASSESSMENT OF THE ANTICIPATED ENVIRONMENTAL IMPACTS

4.1 Impacts During Construction Phase

4.1.1 Solid Waste

4.1.1.1 Sources

There are two major sources of solid waste during construction phase. One is solid waste generated and means of disposal, and the other is generated by excavation work for foundations of building and equipment. The type of solid wastes and these approximate quantity are summarized in Table 4.1.

4.1.1.2 Impacts on The Environment

Solid waste generated and means of disposal during construction period such as wood and timber for package of equipment and tools, and cardboard package are planned to be sold. Solid waste which is produced by excavation work for foundations of buildings and equipment is used for embankment of anti-oil spillage dike for the fuel storage tanks. Therefore the impact on the environment is minimum.

4.1.2 Transport

4.1.2.1 Transport of Materials and Equipment

The construction of proposed power plant will involve the transportation of plant, machinery and equipment. Most of the machinery and equipment would be imported and transported from the harbor to the site in heavy vehicles and container carriers, as some of the items would be large in size and heavy weight. The approximate weight of equipment to be transported would be about 130 ton at maximum. The total length of the route from the harbor to the site including the access road from A3 route to the site and the road in the reclaimed land would be about 18 km.

The maximum number of larger vehicles and other related vehicles for the construction are estimated as totally 90 per day and its percentage on the current traffic would be less than 0.5 %. Because the percentage on the current traffic is enough small, the impact from transport of materials and equipment is insignificant. In addition, a transport plan which consider not to concentrate in a short time period will be prepared. Also drivers of these vehicles are supervised and observed appropriately to follow the traffic rules.

4.1.2.2 Air Quality Impacts from Traffic

During construction period there will be impacts on the Air Quality due to release of fugitive dust from various construction activities such as site cleaning, excavation, earthmoving, concreting, erection and installation of machinery and also from cement, sand and aggregate when transported and used for the preparation of cement mortar and concrete. Blowing of dust is anticipated from lorries, tractors and other vehicles when transporting building material. Fugitive dust emission can vary substantially from day to day depending on the level of activity and specific operations and weather conditions. However, frequent watering will be implemented during construction activity to prevent diffusion of the dust. Therefor, the impact on the environment will be minimized.

4.1.3 Noise

4.1.3.1 Noise from Traffic

Estimation of percentage occupied by related vehicles at Colombo - Negombo Road during construction period has been implemented. According to the estimation, percentage occupied by construction vehicles are less than 0.5% (Table 4.2). Since the percentage is enough small, impact on the environment given by construction vehicles will not be significant.

4.1.3.2 Noise due to Construction Activities

The movement of heavy vehicles used in the construction activities will generate noise of higher magnitude at times. The construction activities such as soil boring would also generate higher noise due to hammering.

The noise level from these construction machines and vehicles has been estimated by equation used in worldwide. The input data is noise sources during the maximum construction activities as shown in Table 4.3. Figure 4.1 shows the result of estimation at the site and Table 4.4 shows the estimated noise level at 4 selected points on the boundary of site. These noise levels at the boundary of site are attained the maximum permissible noise levels at boundaries of the land for construction activities which are 70dB(A) for day time. It should be noted that construction work generating higher noise level will be operated only in day time and construction activities at night time will be limited only low noise activities in case if construction at night time is required. Therefor impact on the environment given by construction vehicles will not be significant.

4.1.4 Water & Other Liquid Effluent

4.1.4.1 Impacts of Sewage, Waste Oils, Oil Spills, Surface Runoffs, Waste Water Disposal on the Environment

During the construction period a significant volume of water and other liquid effluent is not anticipated.

(1) Sewage

Sewage during construction period is mainly discharged from the construction offices. Sewage will be treated properly at the plant site and be discharged to a river near the site.

(2) Waste oil

Waste oil is produced at the time of commissioning and inspection of equipment, and in most of cases the waste clothes are also produced. The lubricating oil will be used sometimes as the fuel for the house boiler and the waste clothes will be burned in the incinerator because of much water being contained.

(3) Oil spillage

The spillage of fuel oil, lubricating or other oil represents a major risk factor to the aqueous environment. All fuel tanks will be fully bounded. However, risks also will occur due to oil leakage from fuel oil pipeline, transformer and during handling of drummed and waste oils. The use of oil interceptors will minimize the risk of oil discharge to a river.

(4) Surface runoff

Land drainage system to be provided during the construction stage will direct surface water to the bordering site through the sedimentation pond.

(5) Waste water

During the construction period, waste water likely to arise at the proposed power plant site is classified as follows.

- Waste water arising from excavation and foundation works of the buildings and fuel storage tanks, etc.
- Equipment washing water including boiler chemical, etc.
- Waste water after HRSG hydrostatic test

Such waste water will be treated in the sedimentation pond, and then discharged to a canal near the site.

4.1.5 Any Other Activities Interfere With Natural Processes

4.1.5.1 Hydrology, Drainage and Coastal Processes

Because the construction activity in the sea is implemented in the narrow strip area, the activity will not give substantial impact on the hydrology of the sea.

During the construction period a significant volume of drainage is not anticipated.

Construction activity at the coastal area is limited and hence, substantial impact on the natural processes of coastal area is not anticipated.

4.1.6 Human, Economic and Socio - Economic Impacts

4.1.6.1 Population and Communities

The total construction workers required for the power plant will be about 650 during construction period (Table 4.5). Those workers will be employed from local area as many as possible instead of engaged from out side. Therefore, construction of the proposed power plant will not generate significant change in the size and nature of the local population and communities.

4.1.6.2 Employment and Income

During the construction period approximately a total of 650 workers will be employed. The extra income will add to the prosperity of the local area as some of the income will be spent in local shops and on transport services. There will be also generated greater benefit to local economy due to demand on construction material.

4.1.6.3 Land Use and Land Use Planning

The proposed power plant site is the land already reclaimed for industry purpose, so that the construction of the power plant will not give any effects to the present land use pattern.

The area for installing cooling water intake and discharge pipeline including fuel pipeline and maintenance road is necessary to acquire for the project. The area is sited on a 50 m wide stretch of land located between the power plant site and the beach at Dickowita area. Those who are living in the 50 m area of 25 households, will be resettled with appropriate compensation and resettlement plan. Summary of compensation and land acquisition is shown in Table 4.6.

The transmission line will be installed from the power plant site to Kotugoda sub-station. Large portions of the transmission line route is through marsh land. Within the distance, about 60 transmission towers are necessary to build up. Those area for constructing transmission

towers are carefully selected and acquired appropriately with land acquisition plan. Summary of land acquisition is shown in Table 4.6.

4.1.6.4 Agriculture

As the project is relatively small in scale, it will not result in a movement of work force away from agriculture.

4.1.6.5 Industrial Development

As the project is relatively small in scale, it will not result in a movement of work force away from industry. Increasing in demand for construction materials and equipment may occur during construction period.

4.1.6.6 Road Development

The access road called Gunasekera Mawatha is required to widen its width in order to clear the transportation of construction materials. In order to minimize the impact on the residence along side of the road, land acquisition will be limited to narrow strips and parapet walls will be reconstructed. Summary of compensation and land acquisition is shown in Table 4.6.

A new bridge will be constructed on the Hamilton Canal at the point crossing the way of the cooling water intake and discharge corridor. The bridge will have 7.5 m width and 20m length. The activity of throwing a bridge across the canal may temporarily give some inconvenience on fishing boats that use this canal as an access route to the sea. However, this inconvenience period will be only a few days, and there will be no restriction on the traffic road. Therefore impacts by the construction of new bridge is minimum. In addition, after the construction, a part of the bridge will be open to residence.

4.1.6.7 Historical Sites

There are no historical sites in the area related to the project.

4.1.6.8 Health

During construction phase, there will be risks of injury and accident among construction workers. In order to prevent occurrence of this matter, rules for driving and other works will be through to all construction workers. In addition, a demand of hospitals and other health care centers may be increased during construction period.

4.1.6.9 Right of Way to Beach, Prohibited Areas for Fishing Activities Around Sea Terminal and Pipeline

The construction activities for terminal and pipelines including dredging and pipe laying will be implemented under careful concerned construction plan and management.

The area required for the construction activity is shown in Figure 4.2 and 4.3.

Construction activities in the nearshore and the beach will create a temporary impact on the beach users such as fishermen and coastal dwellers. Vessels such as ships, dredgers and other support vessels will operate in the sea during the construction of pipe line. These vessel movements may give some impacts to the right of way of the fishing boats. However, the area of these impacts will keep on moving forward as the construction activity progresses. There will be no remarkable restriction in the areas where the construction has been completed and hence, the impact on fishing and other activities could be estimated as not significant. It should be noted that construction activity for pipelines and maintenance road will not block the Hamilton canal and hence, it will not give major impact on fishing boats that use this canal as an access route to the sea.

4.2 Operational Impacts

4.2.1 Solid Wastes

The following solid waste is considered to be produced during operation period.

- Sludge from waste water treatment
- Waste oil and waste cloth
- Gas turbine inlet filters, etc.

These solid wastes will be treated properly in the proposed power plant site as shown in the table below.

Kinds of solid waste	Treatment method
Sludge from waste water treatment	To be buried
Waste oil and waste cloth	To be burned not to be discharged smoke
Gas turbine inlet filters	To be buried

Solid waste considered to be produced during operation period will be treated appropriately within the site, and hence impact on the environment is considered as minimum.

The following the disposal three (3) method of sludge from fuel oil can be considered for this project.

- Sale
- Incineration
- Storage

As for this point, it is necessary to select the optimum method in the detail design stage.

4.2.2 Water and Other Liquid Effluent

There are various types of waste water from the power plant during operational phase, including effluent from the plant facilities. These waste water is treated by a waste water treatment system which include a neutralizing, hardening and sedimentation system and an oil separator system, as shown in Figure 4.4. The waste water will be discharged to the sea after through the treatment system and mixing with cooling water as the water quality below the standard of Sri Lanka. Therefore its effect on the water quality would be insignificant.

There will be oil spillage risks. The spillage of oils represents a major risk on aquatic fauna. However the project designs ensure that all by-products and wastes of operation, will be collected at the site and discharged with proper environmental considerations. Therefore, on-site discharges are not expected, and impacts are not envisaged on the adjusting waters. Leaks from damaged tanks or pipelines caused by accidents have a buffer layer provided in the designs.

4.2.3 Thermal Effluent Impact

4.2.3.1 Diffusion Estimate and Impact Analysis of Thermal Effluent

For prediction of dispersion of thermal effluent in this study, CORMIX MODEL (Cornell Mixing Zone Expert System) of which contents had been accepted by USEPA was used. Among three types of this model CORMIX MODEL 3 which also allowed the study of surface layer dispersion into a water area near a discharge outlet was used.

This Model uses a steady flow field of the water area and is based on the theory of density difference diffusion of plume type in steady state.

Table 4.7 shows the structure of input data. The temperature difference ΔT° was assumed to be 10℃ and ambient mean velocity of 1.5, 5, 10 cm/sec were applied for the estimation in this study adjusting to the seasonal feature of water current. Maximum water temperature observed at the sea closed to the site in March 4, 1998 was 32.7 ℃. Meanwhile, maximum air temperature recorded at the same day in Colombo was 34.3℃. According to the historical highest air temperature in Colombo is 36.2℃ (Feb. 1915) for a 65 year period. Therefore, it is preferred to maintain the temperature difference between inlet and outlet to less than 10℃.

World record on highest sea water temperature is 36℃, which was recorded at the Persian Gulf.

The result of estimation work (Fig. 4.5) shows that the distance of 1℃ up water from the coast line could reach to about 200 m at the case of 1.5 cm/sec ambient mean velocity for northeast monsoon season and 800 m at the case of 10 cm/sec for southwest monsoon season. The area covered by 1℃ up water are only about 0.01 km^2 at the case of 1.5 cm/sec and 0.06 km^2 at the case of 10 cm/sec.

The discharged cooling water is mixed rapidly just after outing the discharge point and decrease its temperature nearly to the natural of it due to the turbulence caused by breaking waves and heat loss to the air. It should also be noted that the warm water will stream only the surface of the sea water due to specific gravity difference. Moreover, similar bio-diversity exist in the western coastal waters in Sri Lanka. Therefore, it can not be expected that any unique habitat of species will be seriously affected or become extinct due to increasing temperature caused by discharging of the cooling water.

4.2.3.2 Impact Analysis of Intake and Discharge of Cooling Water

Intake of cooling water is in the depth of -5.3 m at about 460 m off shore from the coast line of Dickowita. The intake cooling water will be as slow as 0.2 m/s of the speed with the amount of 3.6 m^3/sec. For the safety reason, a restricted area which has 2,500 m^2 around the intake tower will be prepared. Two or four floating buoys will be installed around the restricted area.

Discharge of cooling water is installed at the coast line and its form is a surface discharging which cooling water is discharged to the surface of sea water. The speed of discharge will be as slow as 0.5 m/sec and the speed decrease rapidly after mixing with natural current.

The speeds of intake and discharge of cooling water are both very slow and restricted area will be prepared, and hence, significant impact on navigation of fishery and other boats is not anticipated.

4.2.4 Air Pollutants

4.2.4.1 Stack Emissions

The combustion of fuel results in emission of gaseous pollutants depending on the type fired, the quantity and quality of the fuels used. It is proposed to use Auto Diesel Oil in this plant as fuel. This fuel is comparatively clean unlike diesel it has only a negligible quantity of Nitrogen and hence NO_X will not be a pollutant from the emission. Furthermore there will be

negligible quantities of SPM, CO and hydrocarbons. Therefore the main pollutant will be SO_2 which is caused by 0.5% of Sulfur content in fuel.

4.2.4.2 Dispersion Model Input Data

In assessing the impact of the power plant on future ambient air quality and emission values, ISCST 3 model (Industrial Source Complex Short Term Model) and SCREEN 3 model (Screening Short Term Model) which are approved by USEPA are used. These models can be used for the worst case prediction. Both model packages were produced by the Scientific Software Group as ISC view and Screen View respectively.

In this study, firstly worst case prediction was made by SCREEN 3 model using ideal meteorological data which can reemerge the worst meteorological situation on dispersion phenomena and the next using actual annual hourly data contour plot were obtained by ISCST 3 model.

The area covered	: A sphere within a radius of 10 km from the proposed site.
Topographic condition	: Flat condition
Number of grid used	: 900
Meteorological data	: The data of wind direction, wind velocity, quantity of solar radiation, or cloud amount in 1996 and 1997 at Katsunayaka Airport. As atmospheric stability, Category of Pasquill Stability was used. In the case of ISCST 3 Model, the wind velocity of 1.54 m/sec. or less is considered as "Calm".

Following emission condition was used on this prediction work.

Two point sources (keeping 50 m off)

Gas flow rate (wet , m^3 N/sec)	148, respectively
Concentration	
SO_2 (ppm)	98
NOx (ppm)	61
SPM (mg/m^3N)	13
Stack height above ground (m)	80
Gas exit temperature (°C)	170
Diameter of stack inside (m)	3.2

4.2.4.3 Dispersion Model Results

Results are shown in Table 4.8 and Fig. 4.6 - 4.8 by the SCREEN 3 model and the results by the ISCST 3 model are shown in Table 4.9 and Fig. 4.9 - 4.14.

4.2.4.4 Atmospheric Impact Analysis

Worst case prediction results using worst ideal meteorological situation were obtained by SCREEN 3 model. Summery on the ground level is shown in Table 4.8. According to the Fig. 4.6- 4.8 and Table 4.8, maximum ground level will be found at approximate 1,000 m distance point from the proposed site. The prediction results show that the levels of SO_2, NO_2 and SPM emitted from the proposed power plant can be clear the permissible level of Sri Lanka Standards by above emission condition.

Prediction using actual meteorological data were carried out by ISCST 3 model. Summery on the distribution of the maximum values for 1 hour, 8 hour and 24 hour average values are shown in Table 4.9. According to these tables, every cases will be clear the Sri Lanka Standards. Meanwhile, location where the highest maximum value appears within 10 km radius area depends on the wind condition such as wind direction, wind speed and stability category. Meteorological condition which has high percentage of calm condition for a year will give comparatively high maximum ground level as shown in the table. Detailed horizontal distribution situation and the local level of pollutants due to the implementation of this project can be found by Fig. 4.9 - 4.14. Results on every cases are not exceeded the value predicted by the SCREEN 3 model which uses ideal meteorological condition on the worst case. Therefore, difference on the maximum values depends on the meteorological variation.

The effective height of the plume of the exhaust gas emitted from the bypass stack is far higher than that from the normal stack as presented in the table below. The higher the effective height is, the less the on-ground concentrations of the smoke and soot are, and therefore the lower the impact upon the surrounding environment.

	Unit	Normal Stack	Bypass Stack
Gas flow rate	Wet, m^3/s	240	447
Gas exit temperature	℃	170	551
Discharge velocity	m/s	30	30
Diameter of stack inside	m	3.2	4.4
Stack height above ground	m	80	80
Effective height	m	179	346

4.2.5 Noise

4.2.5.1 Sources of Noise Generation

Major noise sources during operational phase are traffic noise from related vehicles and noise from power plant facilities such as gas turbines, main transformers, heat recovery steam generators, etc.

4.2.5.2 Predicted Noise Levels

Since traffic during operational phase is maximized at the period of regular inspection, estimation of traffic has been done at the period. According to the result of estimation, percentage occupied by related vehicles are less than 0.2% (Table 4.10).

The noise level from the power plant during operational phase is calculated by an equation frequently used in the world. All major sources of noise from the power plant are carefully selected for input data which are shown in Table 4.11. The result of the estimation is shown in Figure 4.15. The noise levels at 4 points on the boundary are shown in Table 4.12.

4.2.5.3 Noise Impacts

Since the result of estimation for traffic occupied by related vehicles is less than 0.2%, impact on environment given by related vehicles at the period of regular inspection will be insignificant.

The noise level at the boundary of site is attained the maximum permissible noise level of "High Noise area" and "Industrial area" which the limit are both 70dB(A) for day time an 60dB(A) for night time, hence the operation of the plant will not give any impact on the surroundings.

4.2.6 Human, Economic and Socio - Economic Impacts

4.2.6.1 Population and Communities

Operation of the power plant will not generate significant change in the size and nature of the local population and communities.

4.2.6.2 Employment and Income

In case of power plant, employment of local labor at operational stage is not anticipated in large scale, but some works will be produced such as staffs for operation, maintenance and administration. The total number of personnel required during power plant operation is anticipated as about 80 as shown in Table 4.13 .

4.2.6.3 Land Use and Land Use Planning

Since the proposed power plant site itself is a reclaimed land for the power plant, it will not give any impact on land use pattern around the site. In addition, because the land for constructing related facilities such as transmission line, access road and cooling water intake and discharge facilities is relatively small scale, once constructed, it is estimated that the project will not give significant impact on land use pattern around the site.

4.2.6.4 Agriculture

As the project is relatively small in scale it will not result in a movement of work force away from agriculture.

4.2.6.5 Industrial Development

The availability of continuous power supply is a major requirement for the economic growth. The increased supply of electric power will also have a positive impact on income generation and poverty alleviation.

4.2.6.6 Road Development

Since there will be no disturbance to use all current existing roads once after finishing construction, any significant impact on the road traffic is not anticipated. Moreover, a new bridge constructed on the Hamilton Canal will be opened to local resident.

The traffic on the access road from Route A3 will slightly increase due to ordinal commute of worker at the power plant.

4.2.6.7 Historical Sites

There are no historical sites in the area related to the project.

4.2.6.8 Health

A noticeable impact is not expected from the operation of the power station.

4.2.6.9 Right of Way to Beach, Prohibited Areas for Fishing Activities Around Sea Terminal and Pipeline

There will be no restriction on existing road after the construction has been completed and hence, the impact on residence use could be estimated as not significant.

After construction, prohibited areas will be set up around a single point mooring buoy (SPMB) and a intake tower. Details of these prohibited areas are as follows. The area is also shown in Fig. 4.16 and Fig. 4.17.

(1) SPMB

The mooring area will be kept off.

Diameter : 1,120m, Area : 984,704m^2

The identification lamp will be equipped on the buoy

(2) Intake Tower

The area where intake tower is installed shall be kept off.

50m x 50m=2,500 m^2

Two (2) to four (4) floating buoys will be installed.

The prohibited areas both around a single point mooring buoy (SPMB) and an intake tower are areas not designated by any other prohibition. The areas will not disturb the moving of ships due to out of the route of ships. In addition, there will be enough distance from another proposed mooring buoy which is planned by Shell Gas Lank.

The main fishing places are 5 to 15 km off shore from the coast which is not infringed by the prohibited area.

4.3 Other Impacts During Construction and Operational Phases

4.3.1 Drainage

During the operational period, drainage from the power plant will be treated appropriately by a waste water treatment system in order to avoid effluent running directly into the canal water. The water quality after through the treatment system will be below the standard of Sri Lanka.

4.3.2 Pipe Lines

Pipelines for fuel oil transportation and cooling water intake and discharge will be installed between Kerawalapitiya power plant site and off the coast just in front of the beach called Dickowita. The pipelines will be buried under depth of between 1 to 3 m of the ground and the sea bed.

The construction area required for the intake/discharge channels and the fuel oil pipeline shall be nominated as a prohibited area.

The above works are done mainly offshore and partly within the land CEB acquired or leased.

The required construction areas are as follows, as shown in Figure 4.2 and 4.3.

- Single point mooring buoy (SPMB) and pipeline works on the sea bed
  Width : 300m, Length : 5,100m, Area : 1,530,000m^2
- Intake/discharge channel/piping in the sea and on the land
  Width : 500m, Length : 750m, Area : 375,000m^2

· Total areas : 1,905,000m^2

During the construction period, there will be impacts on the air quality due to release of fugitive dust from vehicles for pipe laying activity at the land side. Frequent watering for preventing diffusion of the dust will minimize the impact on the environment.

Due to dredging activity at the sea, the turbidity in the pelagic marine environment in the region will be temporarily increased and may affect the primary productivity of the coastal marine ecosystem. However, considering the relatively small area of sea bottom dredged and turbidity caused due to natural factors, it is expected that dredging of sea bottom will not have a serious effect on the fisheries in the area.

During the operational phase, the route of pipelines at the land side including a maintenance road will be enclosed and be a keep off area for residence. However the existing road will not have any disturbance as a design and hence, there will be no impact on residential daily life.

The pipeline at the sea will be totally buried under the sea bed, so significant impact on the environment is not estimated.

Due to the construction of new facility on the coast line, there is a possibility to accelerate the erosion trend of the beach sand. For preventing eroding due to discharged water and waves, the opening of discharge is designed with steel sheet piles as a cutoff at the edge of the discharge point. Also for preventing eroding due to discharged water and waves, armour stones will be laid in front of the discharge point. In addition, both sides of the discharge point will be reinforced with armour stones. Therefore the constructing of new facility at the coastline is not estimated as a factor of acceleration of the erosion trend.

4.3.3 Transmission Lines

A 220 kV transmission line having two overheads ZEBRA conductors will be constructed between the Kerawalapitiya power plant site and Kotugoda sub-station. The route will be about 18 km long with totally about 60 transmission towers. Although some parts of the transmission line pass through the Muthurajawera marsh proper, most of it goes through highly disturbed areas. The construction period required will be 22 months. The proposed route of transmission line avoid high residential area and hence, resettlement will not be anticipated.

The construction works for the transmission line consists of the foundation works, the tower erection works and the wire-stringing works. The construction methods are described as

follows.

Kind of Works	Construction Methods
- Foundation works	The excavation is done by hands.
- Tower erection works	The erection works will be done by the ginpole methods.
- Wire-stringing works	Reeling-out mobile and hydraulic compressor will be used

During the construction period, the identified possible impacts on fauna are due to noise from construction activity. The noise could usually interrupt nesting, breeding and feeding activities of animals if emitted in high levels. The construction methods as describing above are these fully minimized the generating of noise from the activities. In addition, the construction site will keep on moving forward as the activity progresses. Instead of the noise level from construction activity will be small and in a limited time, it is proposed to select construction period carefully in order to minimize the disturbance on the activity of fauna.

The excavation and clearing of the construction sites will have no adverse effects on flora of the area since the proposed area for constructing towers are in small scale. However, the site for constructing towers should be carefully selected to avoid locations where have biologically important floras. It is required that a construction method is carefully examined to consider not alter the existing soil formations and drainage conditions in order to prevent habitat fragmentation and to preserve of micro habitat condition.

Once the transmission line is constructed, significant impact on the environment is not anticipated.

Table 4.1 Solid Waste Produced During Construction Period

Type of Waste	Approximate Quantity (Ton)	Method of Disposal
Wood and timber for package of equipment and tools	40	To be sold.
Cardboard package	20	To be sold.
Excavated soil	21,600	To be used for embankment of the anti-spillage dike of fuel oil tanks and land reclamation.

Table 4.2 Increase Ratio by Construction Vehicles During Construction Phase

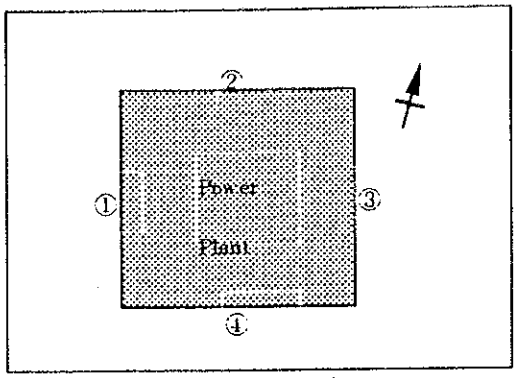
	Current Traffic*			Construction Vehicles			Increase Ratio (%)		
	Large	Other	Total	Large	Other	Total	Large	Other	Total
to Colombo	1,539	19,463	21,002	70	20	90	4.5	0.1	0.43
to Puttalam	1,448	18,993	20,441	70	20	90	4.8	0.1	0.44
Total	2,987	38,456	41,443	140	40	180	4.7	0.1	0.43

* Current traffic is based on RDA records.

Table 4.3 Input Data for Noise Level Estimation During Construction Phase

No.	Name	No. of vehicle
①	Earth Auger Machine	2
②	Back Hoe	2
③	Dump Truck	3
④	Concrete Truck	2
⑤	Pile Driver	2
⑥	Crawler Crane	2
⑦	Generator	3
⑧	Vibro Hammer	2
⑨	Air Compressor	2

Table 4.4 Estimated Noise Level at 4 points on the Boundary



Location of 4 Points

Location No.	Noise Level [dB(A)]
①	64
②	62
③	58
④	59

Table 4.5 The Estimated Employment Opportunities During Construction

PROJECT COMPONENT	Number of employment					
	Management level		Technical		Labor	
	Expert	Local	Expert	Local	Expert	Local
Off-loading point	1	2	–	5	5	60
Pipe laying	2	5	2	5	5	100
Storage	2	5	2	5	5	100
Civil/Electrical/ Mechanical work	3	8	5	10	10	300
Other(Supervisory)	1	2	–	–	–	–

(Total 650)

Table 4.6 Summary of Compensation and Land Acquisition

Area	Required Area	No. of Houses Required to Resettle		Compensation and Land Acquisition Costs	
Intake and Discharge Area	*12,700 m^2	Permanent Houses	3	Land Acquisition Cost	Rs. 16,540,000
		Semi-permanent Houses	11	Resettlement Cost	Rs. 20,070,000
		Temporary Houses	11		
		Total	25	Total	Rs. 36,610,000
Access Road Area	9,200 m^2	–		Land (narrow)	Rs. 3,450,000
				Walls and other structure	Rs. 500,000
				Total	Rs. 3,950,000
Transmission Line Route Area	**12,000 m^2	–		Land for Tower	Rs. 3,736,000
				Valuable Trees	Rs. 1,344,000
				Total	Rs. 5,080,000

* : Total required residential area in the corridor of intake and discharge pipeline.

** : Total required area for constructing transmission towers.

Table 4.7 Parameter and Dimension Used in the Prediction

Category	Parameter	Dimension
Discharge Geometry	Discharge Opening Width (m)	5.9
	Discharge Opening Height (m)	1.2
	Depth from the Surface	1.3
Discharge water	Discharge Velocity (m/sec)	0.5
	Water Flow (m^3/sec)	3.6
	Discharge Density (kg/m^3)	1,016.12
	ΔT (°C)	10
Environmental Parameter	Cross Section	Near shore depth : 6 m Near shore slope : Av. 1.2° Constant depth : 8 m
	Ambient Velocity (cm/sec)	1.5 and 10
	Density (kg/m^3)	1,019.86
	Water Temperature (°C)	30
	Salinity	32.5

Table 4.8 Maximum Ground Level of One Hour Average Value and the Distance (150 MW)

Items	SO_2	NO_X	SPM
Distance from the Site (m)	1,013	1,013	1,013
Maximum Ground Level (mg/m^3)	0.135	0.060	0.006
Maximum Background Level (mg/m^3)	0.051	0.059	24hour average value Weekday : 0.266 Day of weekend : 0.287
Sum (mg/m^3)	0.186	0.119	-
Maximum Permissible Level (mg/m^3)	0.200	0.250	0.500

* : For SPM measurement, 24 hour average value were measured by following the CEA's guidance. Maximum 8 hour average value was 0.103 mg/m^3 for weekday and 0.110 mg/m^3 for the day of weekend.

Table 4.9 Maximum Ground Level

(S = 0.50%, NO_X = 61 ppm, SPM = 13 mg/m^{3}N)

Based on the Meteorological data of 1996 150MW

Items	SO_2		NO_X		SPM	
Month	Feb. - Mar.	Jun.	Feb. - Mar.	Jun.	Feb. - Mar.	Jun.
1 hour average						
Max. Ambient Concentration (mg/m^3)	0.051	0.046	0.043	0.059	-	-
Predicted Max. Concentration (mg/m^3)	0.053		0.024		0.002	
Max. Total (mg/m^3)	0.104	0.099	0.067	0.083	-	-
Criteria (mg/m^3)	0.200		0.250		0.500	
8 hours average						
Max. Ambient Concentration (mg/m^3)	0.025	0.034	0.024	0.048	-	WD : 0.103 WE : 0.110
Predicted Max. Concentration (mg/m^3)	0.017		0.008		<0.001	
Max. Total (mg/m^3)	0.042	0.051	0.032	0.056	-	-
Criteria (mg/m^3)	0.120		0.150		0.350	
24 hours average						
Max. Ambient Concentration (mg/m^3)	0.015	0.018	0.016	0.030	W.D : 0.121 W.E : 0.136	WD : 0.266 WE : 0.287
Predicted Max. Concentration (mg/m^3)	0.007		0.003		<0.001	
Max. Total (mg/m^3)	0.022	0.025	0.019	0.033	-	-
Criteria (mg/m^3)	0.080		0.100		0.300	

Based on the Meteorological data of 1997 150MW

Items	SO_2		NO_2		SPM	
Month	Feb. - Mar.	Jun.	Feb. - Mar.	Jun.	Feb. - Mar.	Jun.
1 hour average						
Max. ambient Concentration (mg/m^3)	0.051	0.046	0.043	0.059	-	-
Predicted Max. Concentration (mg/m^3)	0.121		0.054		0.006	
Max. Total (mg/m^3)	0.171	0.167	0.097	0.113	-	-
Criteria (mg/m^3)	0.200		0.250		0.500	
8 hours average						
Max. Ambient Concentration (mg/m^3)	0.025	0.034	0.024	0.048	-	WD : 0.103 WE : 0.110
Predicted Max. Concentration (mg/m^3)	0.037		0.017		0.002	
Max. Total (mg/m^3)	0.062	0.071	0.041	0.065	-	-
Criteria (mg/m^3)	0.120		0.150		0.350	
24 hours average						
Max. Ambient Concentration (mg/m^3)	0.015	0.018	0.016	0.030	W.D : 0.121 W.E : 0.136	W.D : 0.266 W.E : 0.287
Predicted Max. Concentration (mg/m^3)	0.023		0.010		0.001	
Max. Total (mg/m^3)	0.038	0.041	0.026	0.040	-	-
Criteria (mg/m^3)	0.080		0.100		0.300	

Table 4.10 Increase Ratio by Vehicles at Regular Inspection Period During Operational Phase

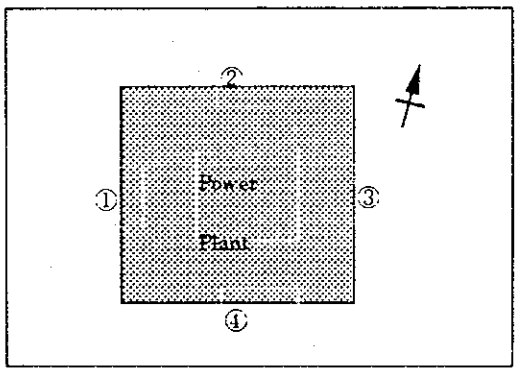
	Current Traffic*			Vehicles at Regular Inspection Period			Increase Ratio (%)		
	Large	Other	Total	Large	Other	Total	Large	Other	Total
to Colombo	1,539	19,463	21,002	3	32	35	0.2	0.2	0.17
to Puttalam	1,448	18,993	20,441	3	32	35	0.2	0.2	0.17
Total	2,987	38,456	41,443	6	64	70	0.2	0.2	0.17

* Current traffic is based on RDA records.

Table 4.11 Input Data for Noise Level Estimation During Operational Phase

No.	Name	No. of Source
①	GT. Air Intake	2
②	GT. Exhaust	2
③	Main Transformer	3
④	HRSG	2
⑤	GT. Building	1
⑥	ST. Building	1

Table 4.12 Estimated Noise Level at 4 points on the Boundary



Location of 4 Points

Location No.	Noise Level [dB(A)]
①	50
②	52
③	48
④	46

Table 4.13 Employment Opportunities During Operation and Maintenance

Kind of Staff	Number of employed staff				
	Management	Technical	Labor		Security
			Skilled	Unskilled	
Operation	5	10	4	20	5
Maintenance	5	5	5	15	
Administration	1	1	2	2	0

(Total 80)

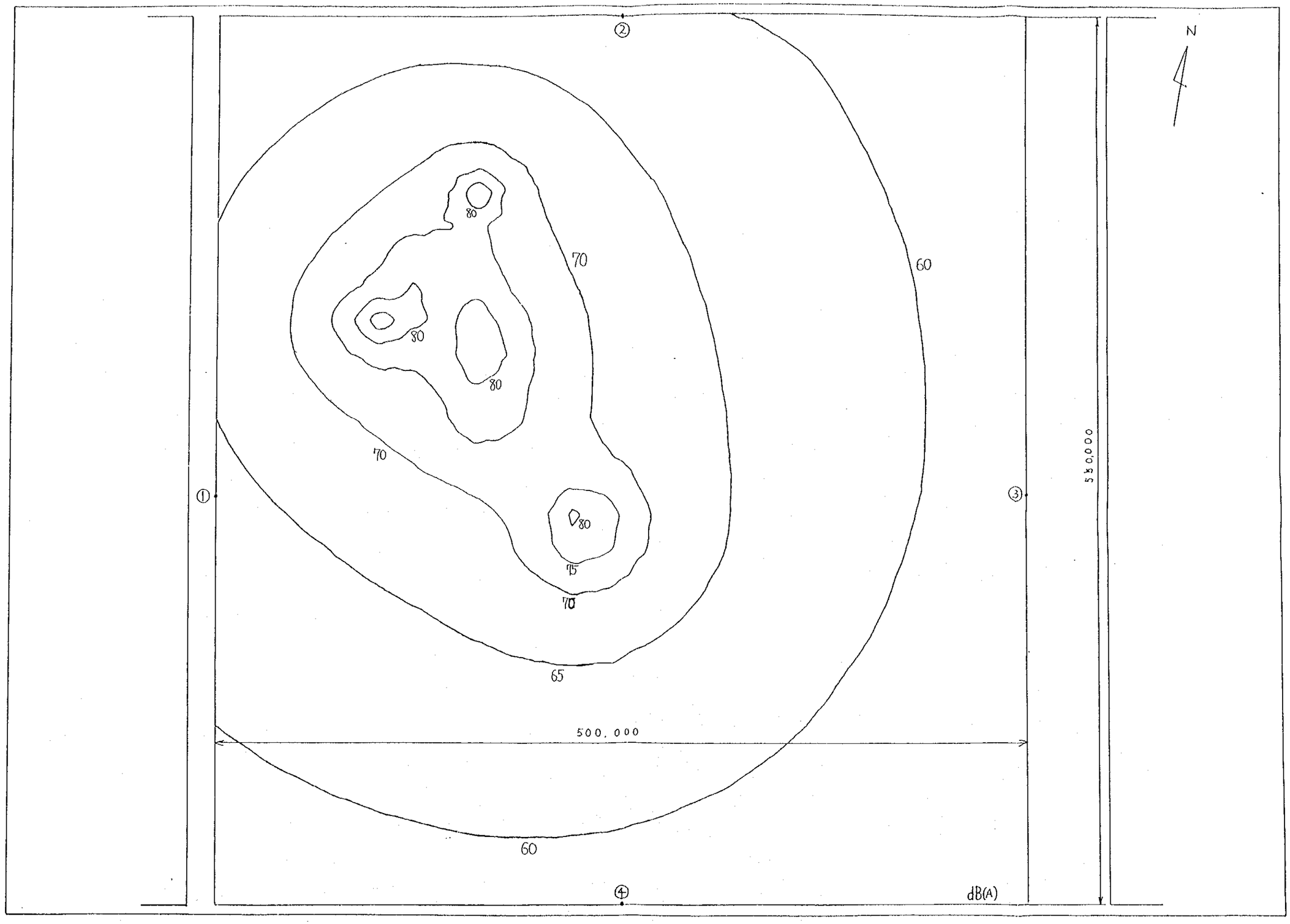


Figure 4.1 Estimation of Noise Level from Construction Activity

Fig 4.2

LOCATION MAP FOR WORKING AREA OF SPM BUOY AND SUBMARINE FUEL PIPELINE

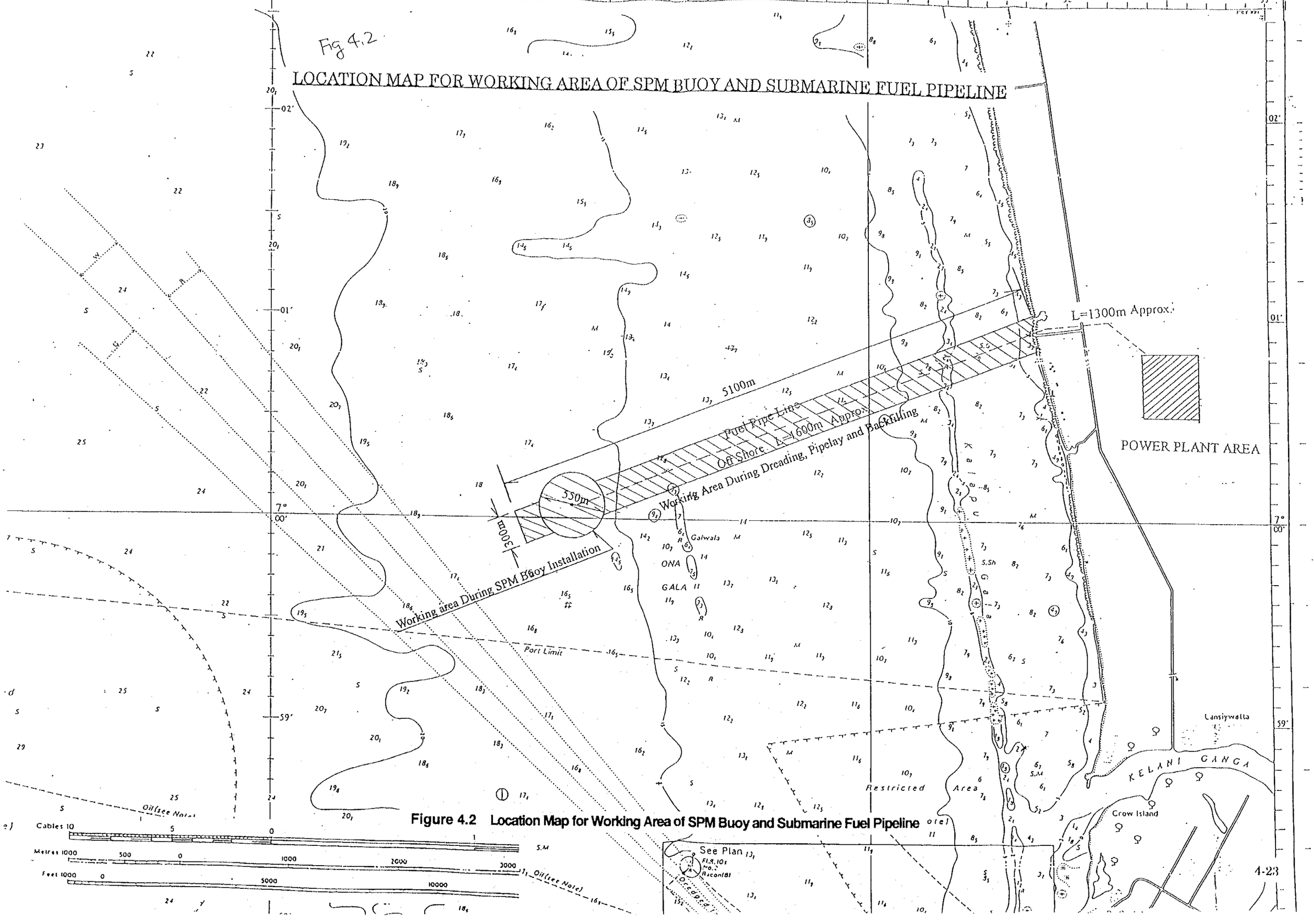


Figure 4.2 Location Map for Working Area of SPM Buoy and Submarine Fuel Pipeline

Fig 4.3

LOCATION MAP FOR WORKING AREA OF INTAKE TOWER AND PIPELINE

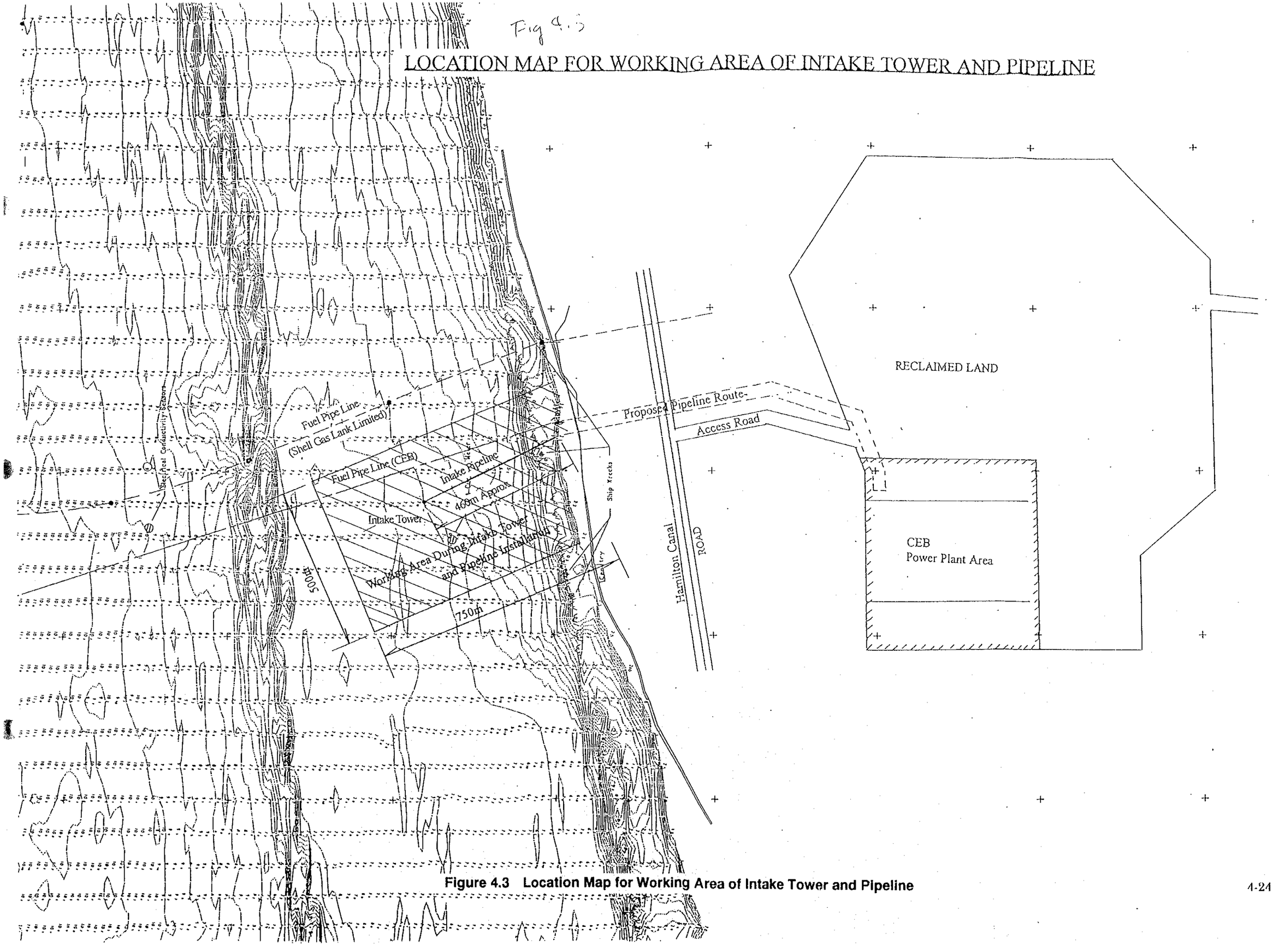


Figure 4.3 Location Map for Working Area of Intake Tower and Pipeline

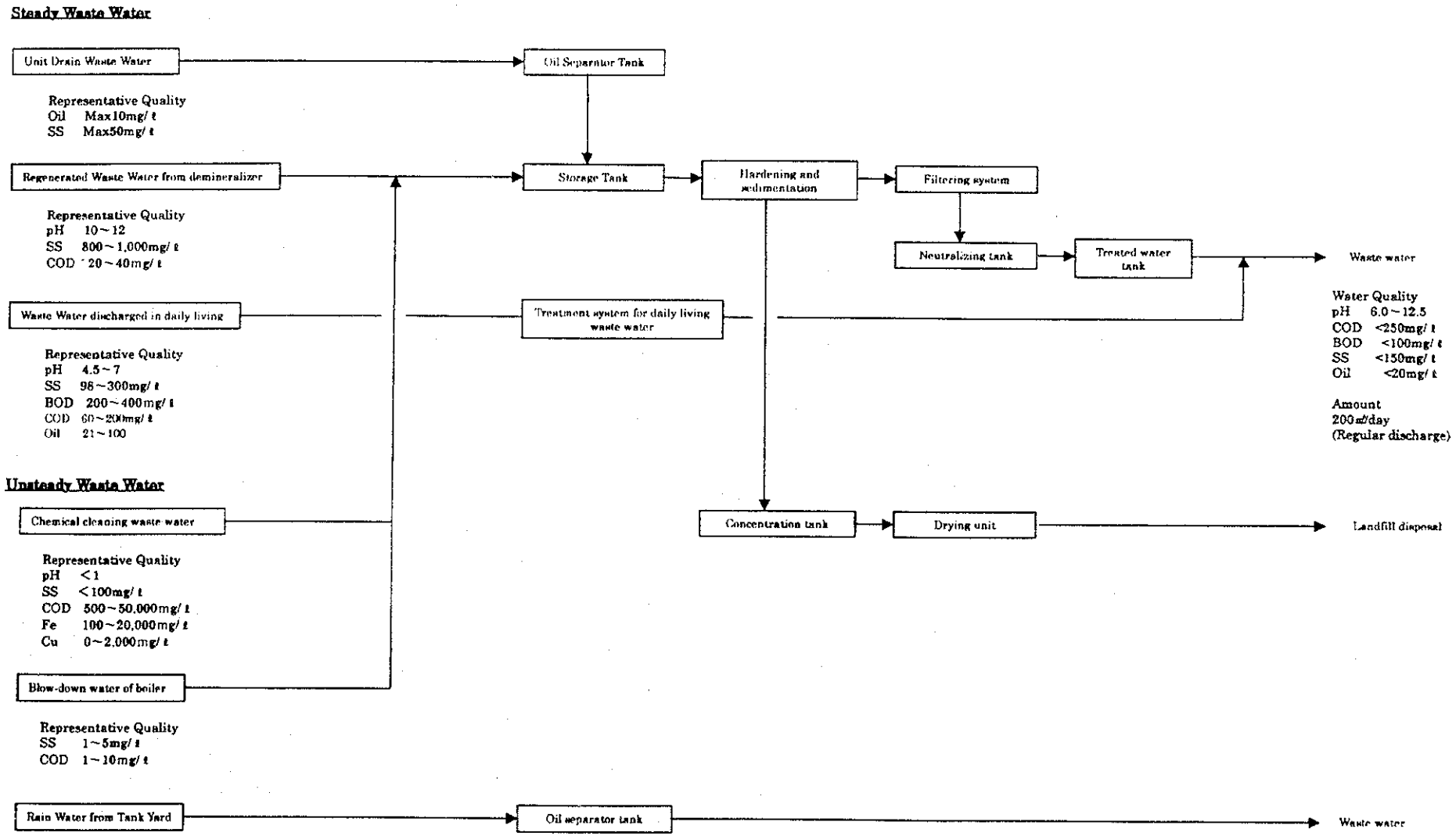


Figure 4-4 Waste Water Flow

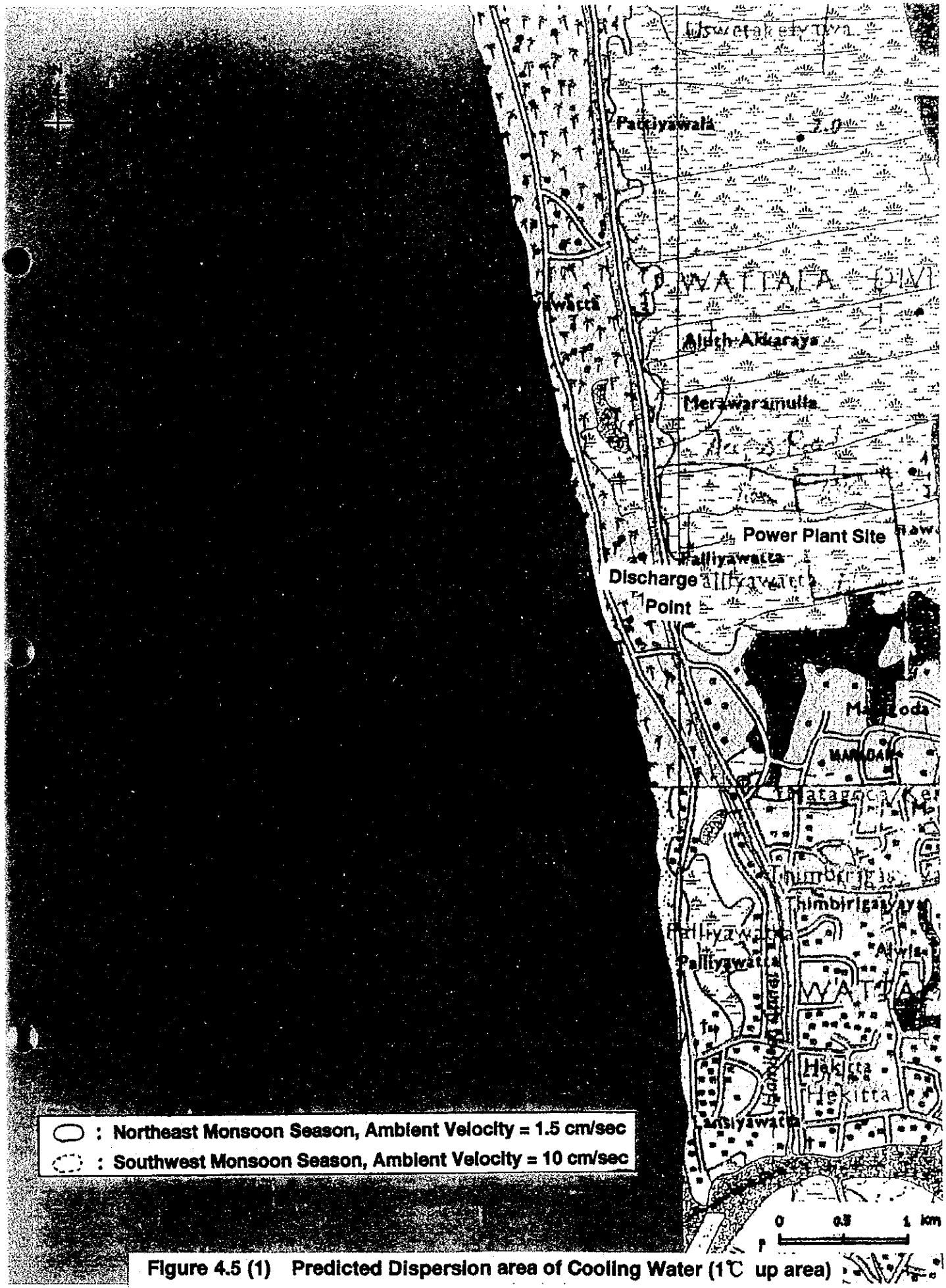
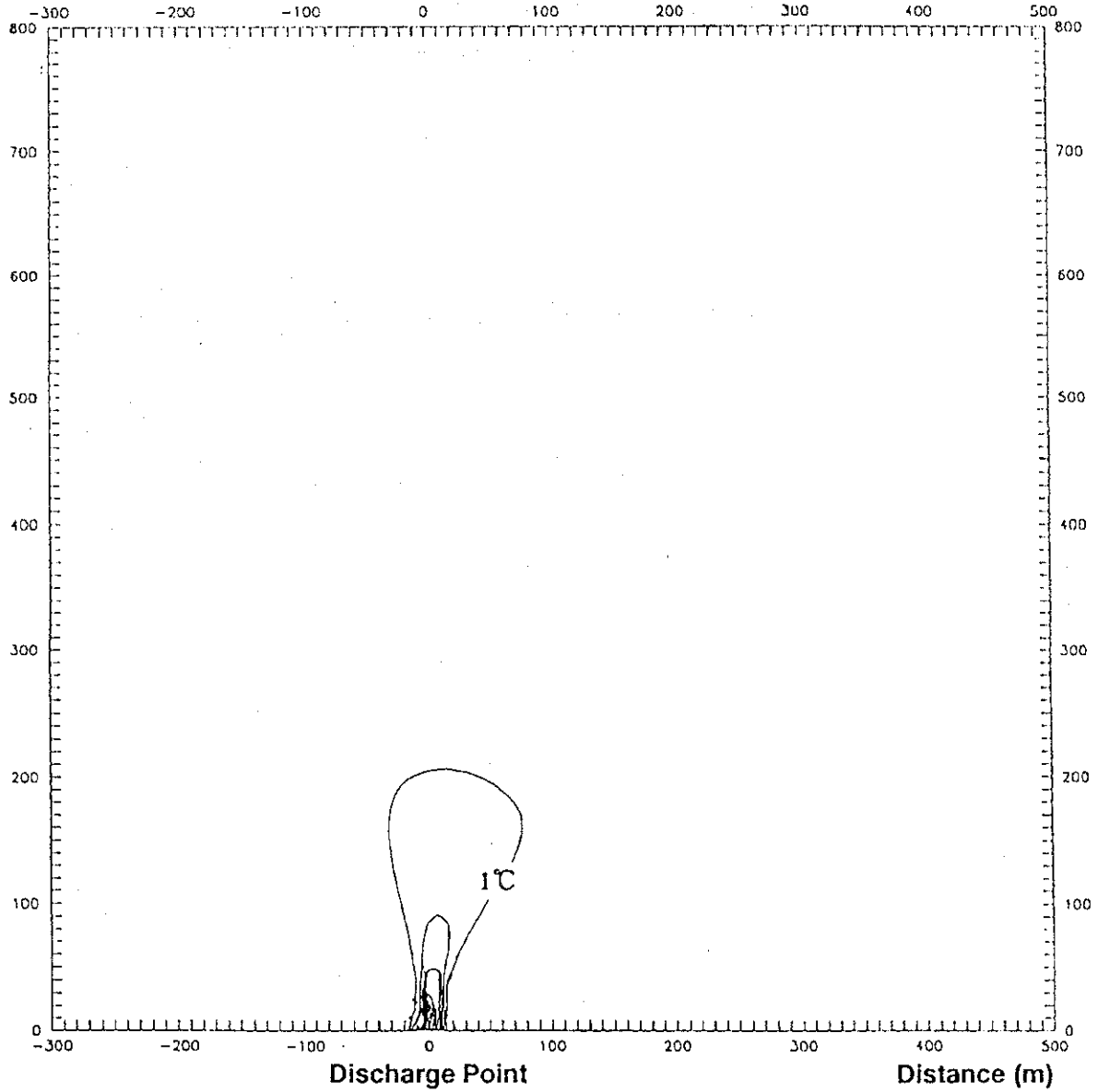
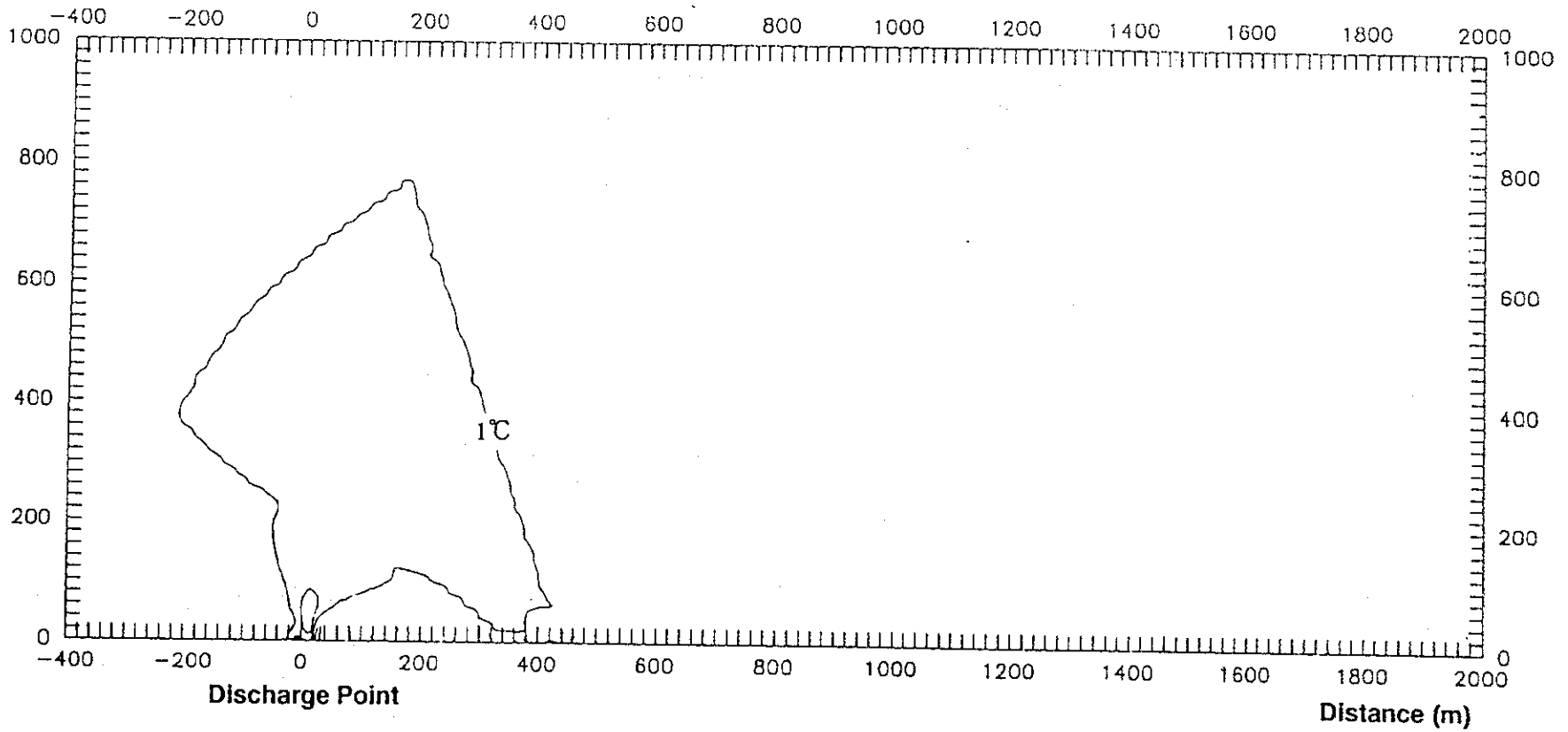


Figure 4.5 (1) Predicted Dispersion area of Cooling Water (1℃ up area)



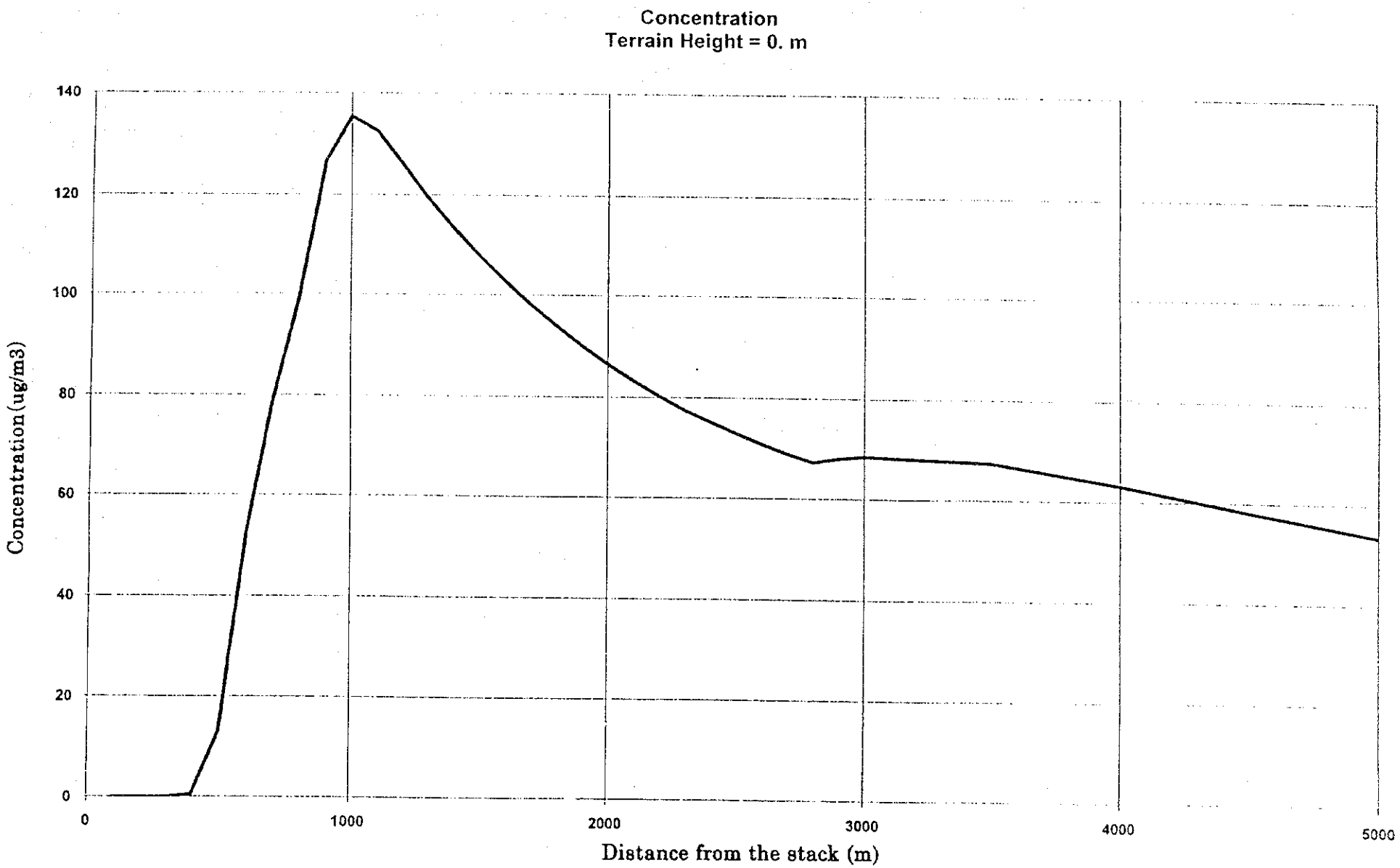
Ambient Velocity = 1.5 cm/sec, ⊿ T = 10℃, Q = 3.6 m^3/sec, Northeast Monsoon Season

Figure 4.5 (2) Predicted Dispersion area of Cooling Water (Ambient Velocity = 1.5 cm/sec)



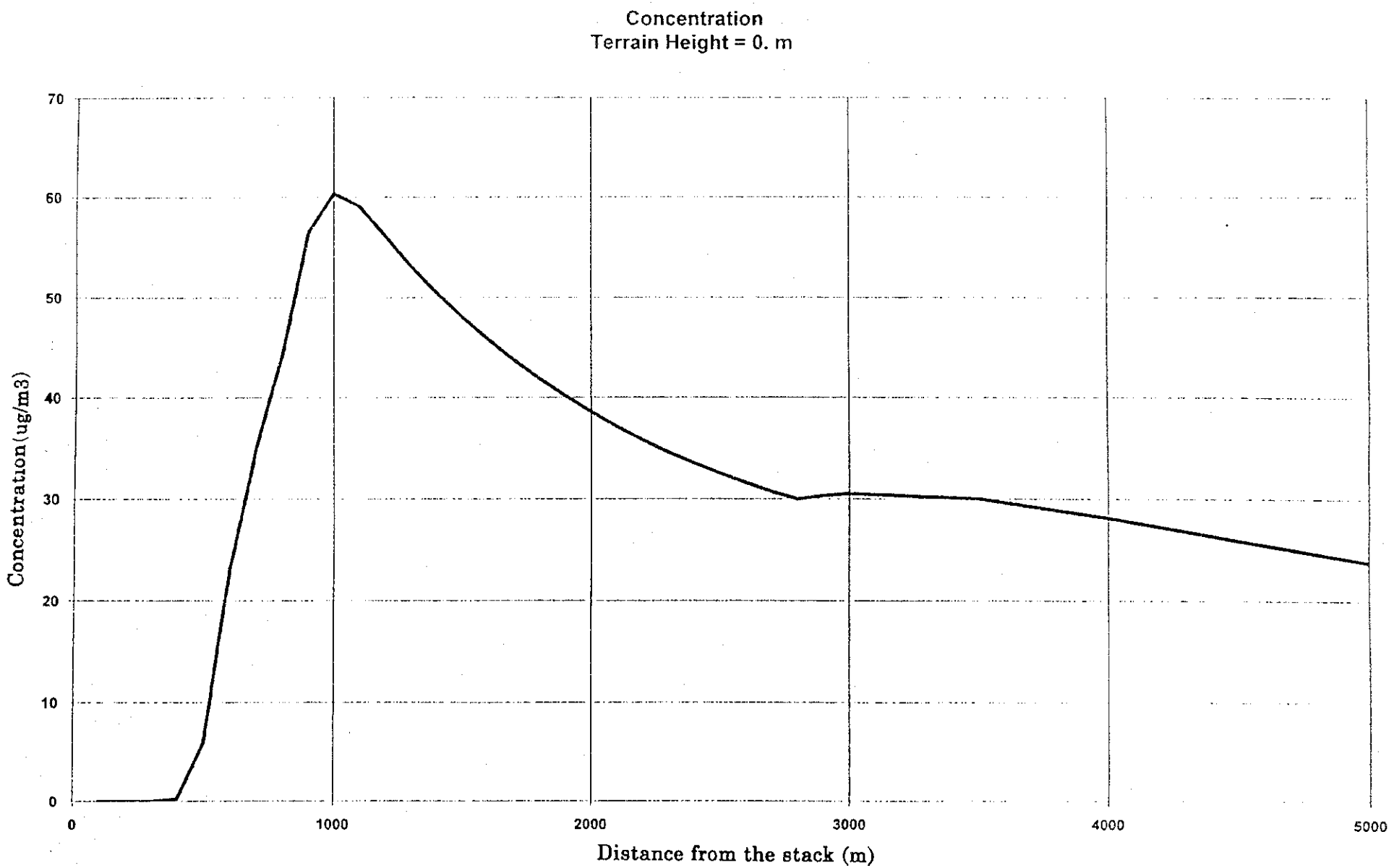
Ambient Velocity = 10 cm/sec, ⊿ T = 10℃, Q = 3.6 m^3/sec, Southwest Monsoon Season

Figure 4.5 (3) Predicted Dispersion area of Cooling Water (Ambient Velocity = 10 cm/sec)



Project: SO2 150 MW(S=0.5%)

Figure 4.6 Predicted Concentrations of SO_2 (150MW, SO_2 = 0.5 %)



Project: NO2 150 MW

Figure 4.7 Predicted Concentrations of NO_X (150MW, NO_X = 61 ppm)

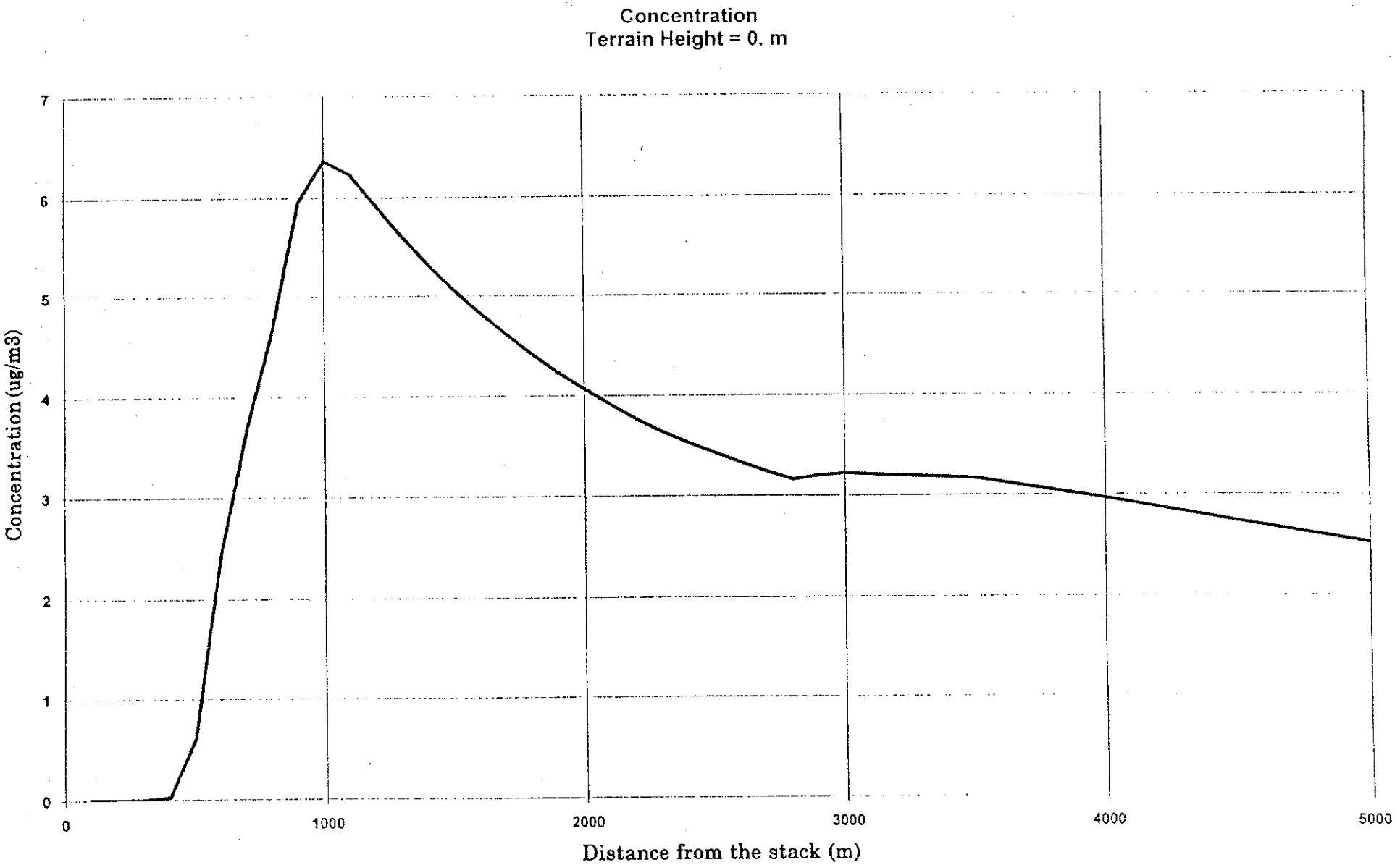
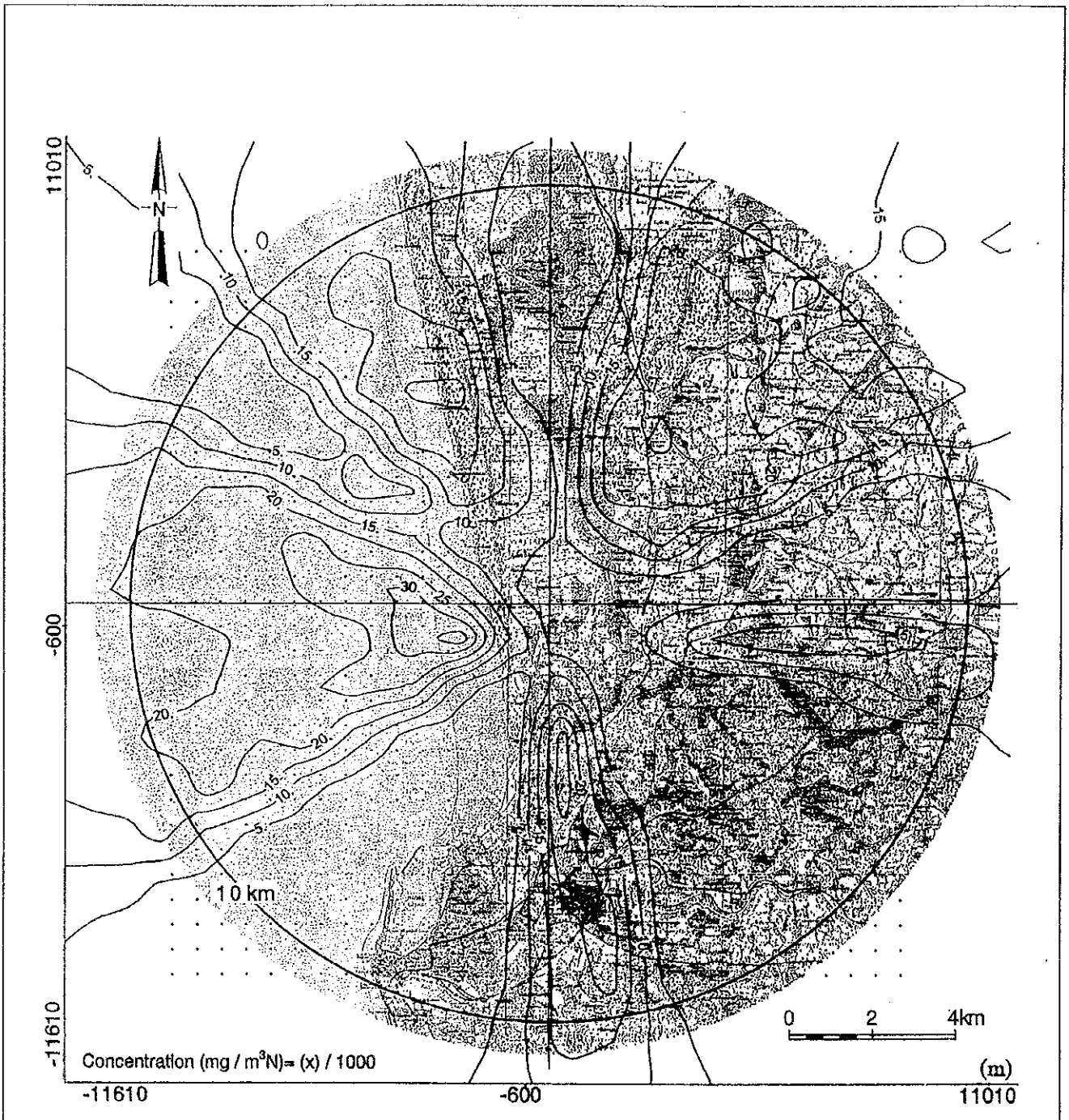


Figure 4.8 Predicted Concentrations of SPM (150MW, SPM =13 mg/m^{3}N)

Project: PM 150 MW



OUTPUT TYPE: Concentration	NO. RECEPTORS : 900	
MODELING OPTIONS: CONC, RURAL, FLAT, DFAULT, NOCMPL		MODELER: 1996 SO_2 max 1h 0.053mg/m³N 150 MW
		DATE:

View PostProcessor-Lakes Environmental Software

C:\ISC3\VIEW\SO2150\96NOX150.FIL

Figure 4.9 (1) Predicted Spatial Dispersion of SO_2 (1hr) 150MW 1996
S = 0.5 %

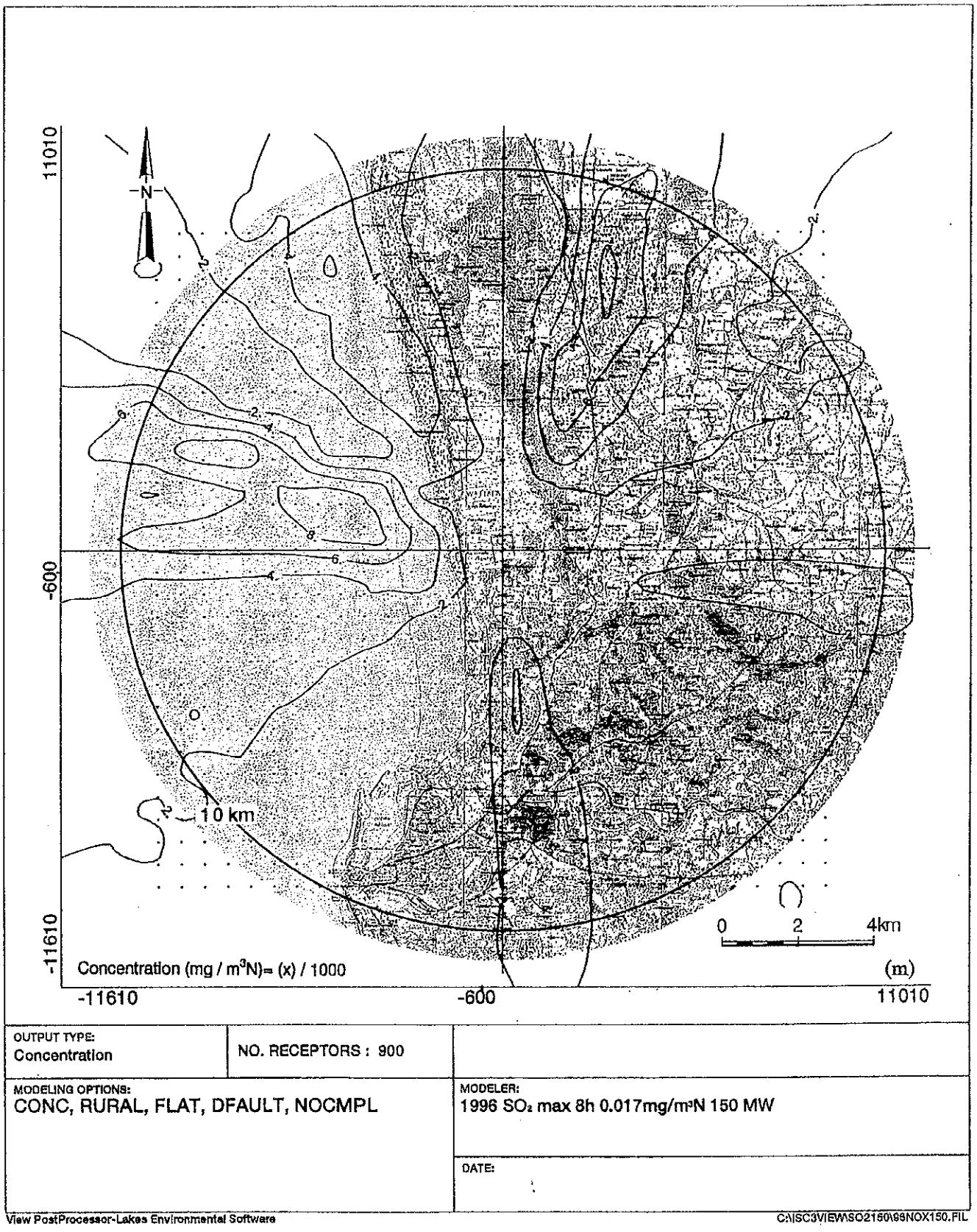


Figure 4.9 (2) Predicted Spatial Dispersion of SO_2 (8hr) 150MW 1996
S = 0.5 %

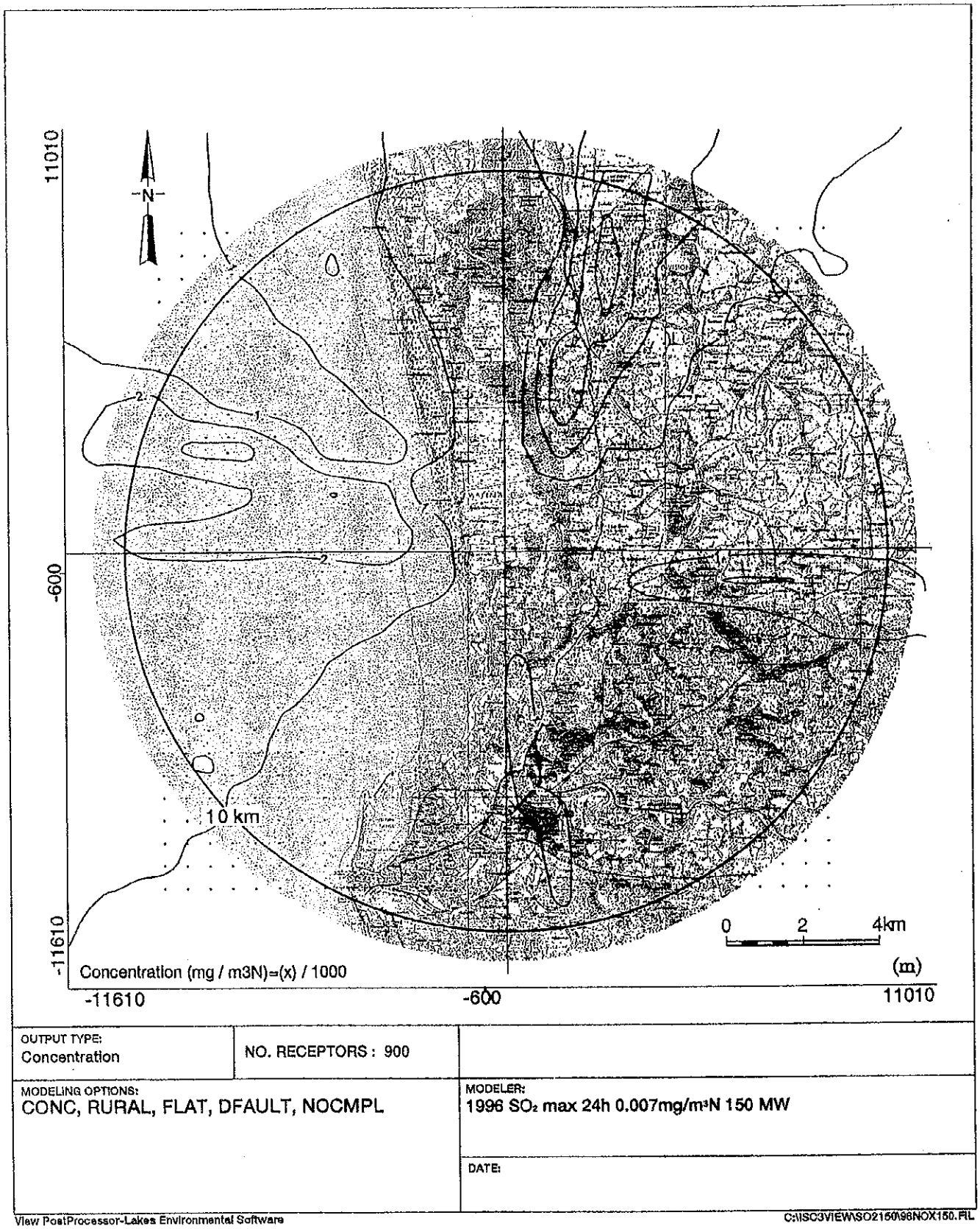


Figure 4.9 (3) Predicted Spatial Dispersion of SO_2 (24hr) 150MW 1996
S = 0.5 %

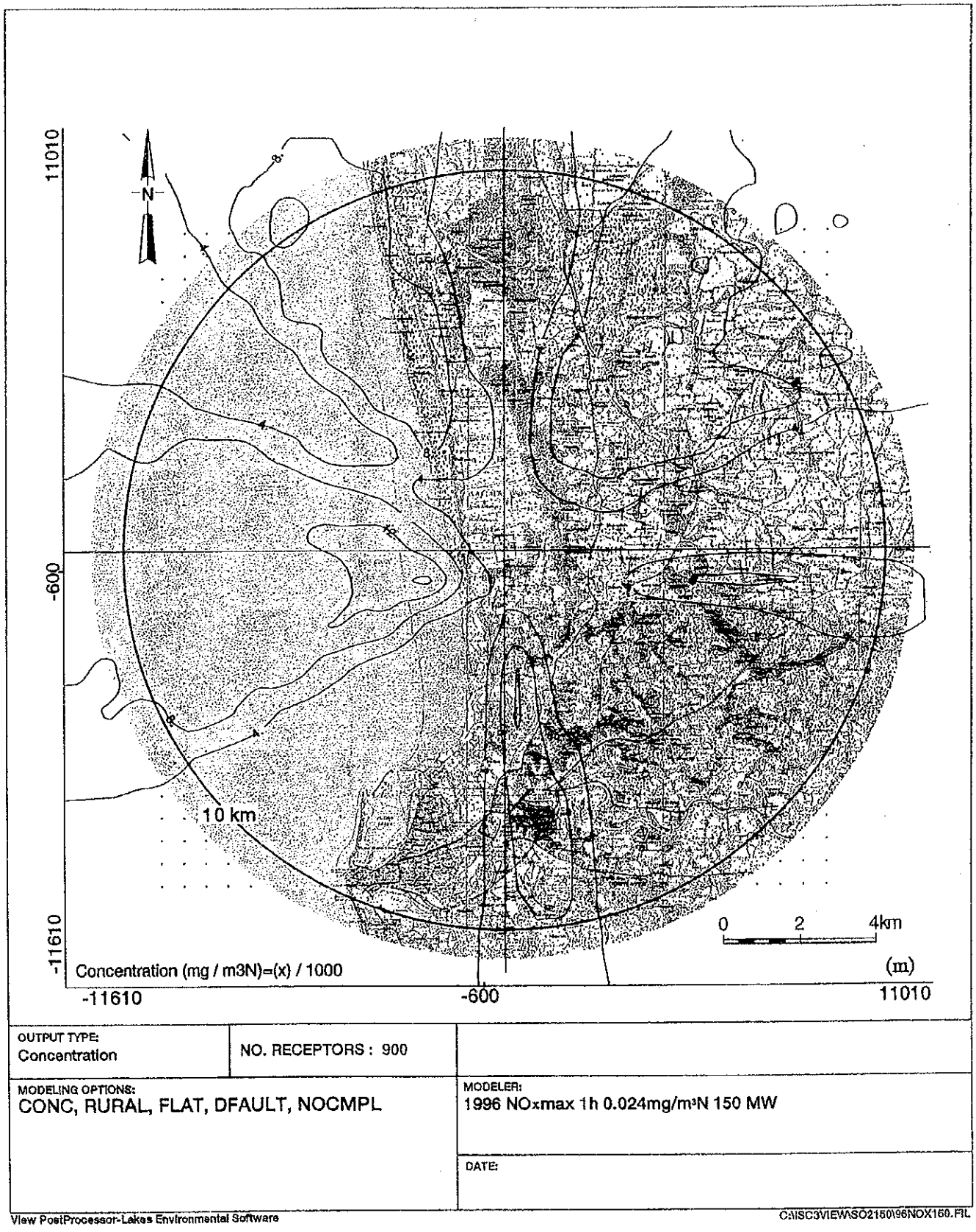


Figure 4.10 (1) Predicted Spatial Dispersion of NO_X (1hr) 150MW 1996
NO_X = 61 ppm

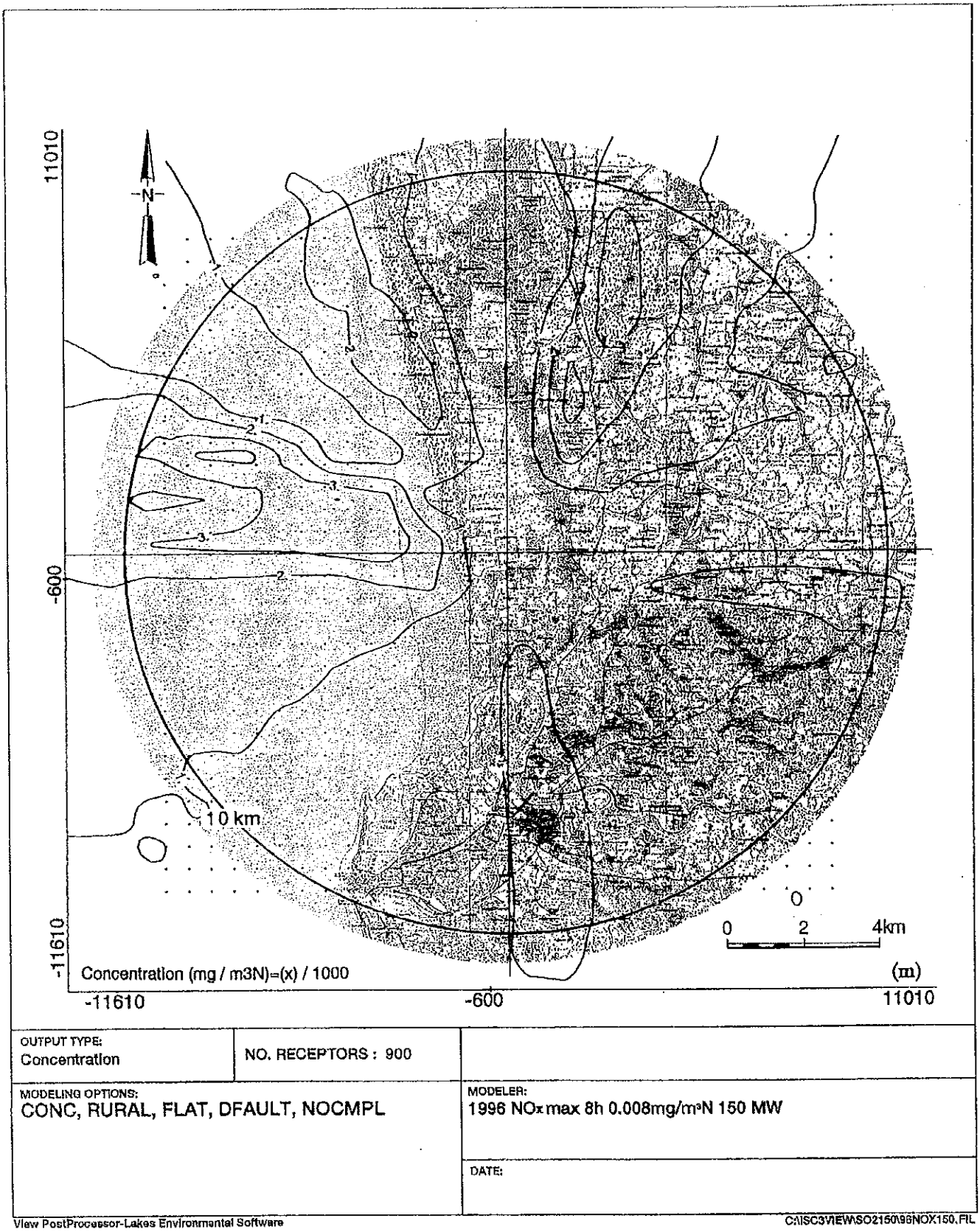


Figure 4.10 (2) Predicted Spatial Dispersion of NO_X (8hr) 150MW 1996
NO_X = 61 ppm

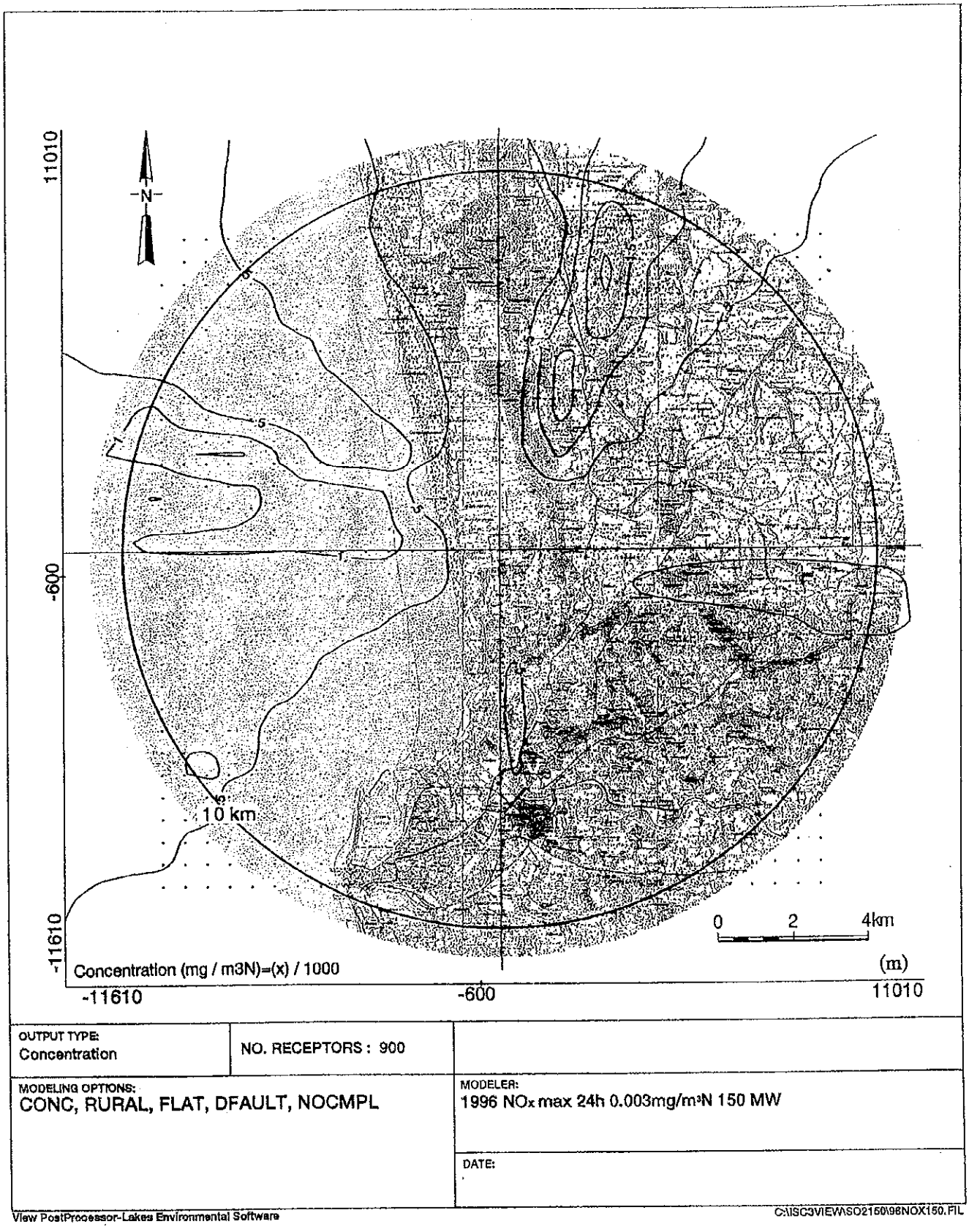


Figure 4.10 (3) Predicted Spatial Dispersion of NO_X (24hr) 150MW 1996
NO_X = 61 ppm