THE STUDY ON SEWERAGE SYSTEM

OF

PORT MORESBY

IN

PAPUA NEW GUINEA

APPENDIX

JUNE 1998

TOKYO ENGINEERING CONSULTANTS CO., LTD.

In Association with

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1. REPORT SYNOPSIS

1.1 INTRODUCTION

This Inhabitants Behavior Survey was undertaken in order to supplement existing information, and more particularly to determine:

-   The knowledge and awareness of the public about health and sanitation;
-   The level of public satisfaction/dissatisfaction with the sewerage system,
-   The public willingness and ability to pay for a sewerage system

1.2 SURVEY BACKGROUND

The PNG Government has established development policies in several key areas, including Infrastructure; Environment & Conservation; Health; and Population & Sustainable Development. However there is little direct reference in them to the provision of water supply and sewerage collection or the link between these services and the environment or public health.

Wilbur Smith Associates completed a recent comprehensive study that more clearly focuses on these matters in 1995. This study sought to establish a master planning framework for all urban services in the NCD to the target year of 2015 based on a maximum sustainable population of 531,000. The 20 Working Papers produced for this study covered such subjects as Population and Demography, Employment and Economy, Education, Health Services, Physical, Environmental, Economic and Social Constraints, Land Use and Settlements Patterns, and Sewerage Services.

A key conclusion of the study was that urban development needs to be consolidated and generally kept below the 90 meter contour. The Master Plan also concluded that with regard to the sewerage sector, a major additional study must be undertaken to design the improvements required to accommodate future growth-hence the sewerage study was undertaken by the JICA study team.

In putting together a profile of the National Capital District for this study, two different sources of information was consulted, the 1990 Census and the Wilbur Smith study. According to the 1990 census, the total population of the NCD grew at 4.7% per year between 1980 and 1990, and the Wilbur Smith study would appear to believe it to be continuing to grow at a similar rate.

In general social indicators identified from both sources (high morbidity, low life expectancy, and relatively high crude birth rate) are poor. Factors relevant to this study include:

-   low level of education
-   low literacy rates
-   high dependence ratio (i.e. the proportion of those not engaged in economic activity which rely on those engaged in economic activity)
-   relatively low participation in labor force of working age population
-   likelihood of very small discretionary income for majority of NCD population.

1.3 THE SURVEY METHODOLOGY

The technical specifications for the Inhabitants Behavior Survey required the involvement of only two hundred households. However it was felt a larger sample would provide a more reliable database. To obtain this, the survey organizers approached the University of Papua New Guinea for assistance.

The survey went through a number of preliminary drafts, with final pretesting undertaken by the 71 Research Methods students (with guidance from their Lecturer) who agreed to conduct the interviews. Ultimately, 724 households evenly spread throughout the district and involving a similar percentage of each housing type to that identified in the 1990 Census, were interviewed.

1.4 GENERAL FINDINGS

After checking for bias and other potential distortions, the results were carefully analyzed. In general they confirmed and clarified census information and the results of other previous studies, but there were exceptions.

Among other things the survey found out that household knowledge of the linkages between basic hygiene, the environmental and personal health was very good and did not appear to be directly related to the education level of local inhabitants or to the type of dwellings they occupy.

Generally, the least educated inhabitants and the occupants of squatter housing know as much about the linkages between basic hygiene, the environment, and health as those at the opposite end of the spectrum. If anything, the survey results suggest that they may even be more aware of this linkage than most other groups in the community.

A second finding was that the need for a sewerage system in the District would appear to be a priority for many residents, particularly those without such services at the moment, and that most seem prepared to pay for it. However, without the provision of an adequate and constant public water supply, the potential benefits of any improvements to the sewerage system may be very limited, and local resident's present willingness to pay for it may be reduced.

One of the findings of the 1990 Census that was not confirmed by this study was the size of the average household in the National Capital District. The reason for the discrepancy is not entirely clear. In any event, it would appear that the actual average size of local households could be as much as much as fifty percent greater than the Census figures suggest, although not quite as high as those given in the Wilbur Smith report.

1.5 PRIMARY CONCLUSIONS AND RECOMMENDATIONS

More specifically, the following conclusions and recommendations (among others) were reached.

That a large majority of households (more than eighty percent) have a good understanding of the effects of pollution and poor personal hygiene on their health and on the environment.

That despite public knowledge of basic health and hygiene practices, the public is experiencing a

significant health problem, part of which may be due to inadequate water and sanitation services rather than a poor understanding of the causes.

That half of the public consider the existing method of handling sewage as inadequate, including many who are now on the public sewerage system.

That discontent with the existing sewerage system may be due in part to poor water pressure in some areas and the consequent inability of residents to use the flush toilets in their houses.

That apart from those living in squatter villages, those living in the water villages have the strongest desire in the district to see their sewerage disposal problem improved and are probably the most able to afford to pay for such improvements should they be undertaken.

That most respondent households, except those living in high cost housing, consider the present provision of public sewerage collection considerably less adequate than the present provision of public roading, suggesting that the relative funding priority of these two public expenditures could be reconsidered.

That if given the opportunity, time and information, residents can see the relationship between water supply and sewerage collection, and more importantly, would be willing to pay for them both.

That approximately half of all households are willing to pay at least 5 Kina per week for sewerage collection, even in squatter villages and other unserviced areas of the district.

That squatters and other residents living in unsewered areas of the District appear to be willing to pay for an improved method of handling sewage in their housing areas despite some having very low income levels.

That on average, one in six households in the District have an income of less than 25 Kina a week, making payments for the use of a sewerage system services likely to be difficult for them.

That the discretionary income of households in squatter areas is comparatively low and such households may not be able to afford to pay as much as they think they can for a sewerage collection service.

That the public would prefer to pay for sewerage services according to the amount of water they use.

That future sewerage planning for the district should be based on an average household size of at least 10 people per dwelling unit, but that it would be prudent to design sewerage systems in the water villages and other coastal areas on an average household size of at least 14 people per dwelling unit.

That even in areas where there are both public toilets and a high use of "bush" toilets, no one uses the public facilities as their primary toilet because they are inadequately maintained.

That any sewerage system extended into non sewered areas should be accompanied by an improved rubbish collection system in these areas to ensure the sewerage system is not abused as a rubbish disposal system.

That there would appear to be an effective health campaign (either formally or informally) already in operation in the water villages and other unsewered parts of the district, and that any additional funding for health education may be better spent on the needed public works themselves (sewerage and water systems) or on the medical facilities caring for the consequences of not having adequate systems in place.

Planning objectives which reflect these and other conclusions are included at the end of this appendix for possible incorporation in the final Sewerage System Master Plan.

2. CONTEXT OF THE INHABITANT'S BEHAVIOUR SURVEY

2.1 INTRODUCTION AND EXPLANATION

The Port Moresby Sewerage Study (the study) was undertaken in two parts;

Phase 1 - the Master Plan,
Phase 2 - the Feasibility Study of the priority project(s) selected at completion of the Master Plan.

The study was brought together the inputs from experts in a variety of fields in order to present a balanced and comprehensive sewerage system overview to the PNG Government. The main inputs to the overall study comprise engineering (technical), environmental, social, and economic (financial) analyses. This appendix presents the findings of a review of existing demographic (1990 Census) data and the results and analysis of the Inhabitants Behaviour Survey conducted during the month of May, 1997, which were undertaken for TEC as part of the study.

The scope of the social issues component for the Master Plan phase of the overall study covers the following items:

Collection and analysis of existing data on the socio-economic conditions and trends (population, industries, land use, social infrastructure, economic conditions, and awareness of citizens on environmental issues and sanitation).

Field survey of the awareness of citizens on environmental protection, and their willingness to pay.

Evaluation of the socio-economic aspects of existing wastewater management, and identification of problems and issues.

Establishment of goals and strategies for environmental protection and hygiene education insofar as it relates to the existing and proposed sewerage system.

The Inhabitants Behaviour Survey was undertake in order to supplement existing information, and more particularly to determine:

The knowledge and awareness of the public about sanitation;

The level of satisfaction/dissatisfaction in relation to, and the expectations of the sewerage system, held by the NCD population;

The willingness, and ability, to pay for a sewerage system based on the assessment of:

- The level of environmental/conservation awareness
- The need for improvement to the sewerage/sanitary system
- The existing health conditions

- The public's awareness of the cause and effect of disease outbreak
- The current sanitary habits of local residents
- The income levels of households
- The ability/willingness of households to pay for the service.

The above has been completed by undertaking a review of existing information as presented in various appendix (Part 2.2), analysis of the most recent (1990) Census information (and the major update of this information by the Urban Development and Services Study) with particular regard to socio-economic indicators and demographic trends (Part 2.3), formulation, and execution of the Inhabitants Behaviour Survey (Part 3.1), analysis of the results of the survey (Part 3.2), identification of the socio-economic aspects, problems, and issues of wastewater and sewerage management as clarified in the survey (Part 4.1), and suggested Objectives and strategies for the improvement of environmental protection, hygiene awareness and education (Part 4.2).

2.2 SUMMARY OF EXISTING INFORMATION

This section presents a summary of relevant policies and PNG Government directives in relation to provision of infrastructure (and particularly sewerage), health, and environment; descriptions of existing demographic characteristics set out in other reports and documents with regard to the NCD population; and descriptions of the results of surveys (willingness to pay issues) undertaken for related infrastructure/services projects which have a bearing on the current study.

2.2.1 Economic & development policies - 1995

In response to a number of economic and social problems, the PNG Government established development policies in several key areas. The Economic & Development Policies report was presented by the Minister for Finance & Planning on 7th March 1995 as part of the budget. The policy areas relevant to this study include:

Infrastructure;
Environment and Conservation;
Health; and
Population and Sustainable Development.

These are now dealt with in turn.

2.2.1.1 Infrastructure

Interestingly the chapter on Infrastructure does not contain a discussion of either water supply or sewerage. For the purpose of the Economic & Development Policies report infrastructure' is limited to roads, civil aviation, ports and telecommunications. Therefore initiatives regarding the upgrading and improving of sewage collection, treatment and discharge are not identified in the objectives and strategies for maintaining and improving existing infrastructure.

Sewerage and water supply are not identified anywhere else within the Economic & Development Policies report, thus it would appear that although these services are now controlled by corporatised agencies, the PNG Government is not providing any overall policy directives or guidelines within which the provision of these services should be pursued or expected to meet minimum requirements in terms of level of service, and standard of treatment.

2.2.1.2 Environment & conservation

The report comments that PNG faces a number of environmental risks and challenges, including increasing (non-renewable) resource use, and land degradation. A National Sustainable Development Strategy is currently being prepared which will attempt to better integrate economic, environmental, and social policy and development objectives. However, there appears to be no recognition of the links between environmental degradation and insufficient sewage treatment and discharge. Currently sewage from some areas is conveyed to either the Waigani or Gerehu ponds for stabilisation (as the only form of treatment), while from the coastal areas sewage is not treated and discharged directly into the coastal waters via outfalls.

The Waigani Swamp itself is used as a form of treatment. In each of the above cases it is difficult to determine the effect of untreated sewage discharge on the receiving environments as there are no monitoring mechanisms in place. Experience with similar environments elsewhere would indicate that continued discharge of untreated effluent can have an adverse effect on both coastal and wetland environments. It will therefore be important that in the future, sewage and wastewater treatment and collection be considered in its wider environmental context, and that the capacity of the existing environments be measured in order that the effects of discharge can be identified and quantified.

Equally the appropriate amount and type of treatment of sewage and effluent prior to its discharge will need to be determined in consultation with the Department of Environment and Conservation. Any proposals for upgrading the sewerage system will need to comply with the requirements of the Environmental Planning Act (EPA). The EPA requires that an environmental impact assessment (EIA) be undertaken of proposals with the potential to adversely affect the environment. The onus for baseline data collection and monitoring is clearly a responsibility of the proponent.

2.2.1.3 Health

The chapter on health recognises that patterns of disease are shaped by various factors including; geography, distribution and mobility of the population, and various socio-cultural, political and economic factors. The link between poor or unsatisfactory sanitation was not clearly identified as a cause of disease, even though gastro-enteritis, tuberculosis, typhoid fever, and septicaemia, were identified as the most common causes of admissions to hospitals and medical centers, and in extreme cases the most common cause of fatalities. The report does comment that.

Typhoid has spread sporadically in the Highlands in the last ten years and is

becoming endemic. It has also increased in the National Capital District recently, due to lack of good water supply and poor hygiene, particularly in settlements. (p.131)

The aims of the health sector itemised in the report include promoting healthier lifestyles and prevention of disease in communities, and the promotion of personal and environmental health. To achieve this it will be important that all sectors of the community are educated in terms of the links between poor sanitation/hygiene and spread of disease. Awareness programmes need to be implemented through existing social networks which include schools, medical and health facilities, and even religious organisations. This is an issue dealt with inmore detail in Part 4.

2.2.1.4 Population & sustainable development

The report notes that the population of PNG is increasing at an increasing rate of growth, thus it is unlikely that PNG will be able to sustain the social and economic needs of the population without implementation of policies aimed at reducing population growth and then maintain it at a level which is sustainable, in terms of the capacity of the economy and existing services, and infrastructure to adequately cater for the population.

Some parts of PNG are increasing at a faster rate than others, the NCD for example has been increasing at 4.7% annually during the years between the 1980 and 1990 Census. If the NCD population was to continue to increase at this rate its population would have doubled to 391,140 by the year 2005.

Obviously it will take some time for any population growth rate reduction policies to become effective to some degree (in the event that they are not totally successful), and therefore the current and likely future population must be catered for in terms of adequate services and infrastructure to prevent the spread of social, economic and health problems as indicated above. The current study is aiming to establish the basic sewerage needs to the target year of 2015.

2.2.2 Urban development & services study - 1995

This comprehensive study undertaken by Wilbur Smith Associates comprised some 20 Working Papers. The study sought to establish a master planning framework for all urban services in the NCD to the target year of 2015 based on a number of population and growth rate scenarios. The study suggested that a conservative estimate of the 2015 population would be 531,000 which could be considered a sustainable community with improvements to existing urban services, and encouragement of employment alternatives. However, the study also pointed out the possibility that the NCD could have a population of 675,000 by 2015 if the PNG Government did not enact national urban and population growth rate reduction policies.

The study used Planning Zones for the areas of analysis and these differed somewhat from the Census Divisions. The NCD was divided into 3 basic planning regions and 14 planning zones as shown on Map 1 A. The regions and zones included:

Coastal Region

Kaevaga/Poreporena
Napa Napa/Daugo Island
Port Moresby/Konedobu
Kila Kila/Koki/Badili
Taurama/Dogura South
Taurama South
Central Region
University/Tokarara
Waigani
Boroko
Airport

Periphery Region

Huhunama/Tovabada
Gerehu/Waigani Swamp
8 Mile/9 Mile
Dogura North
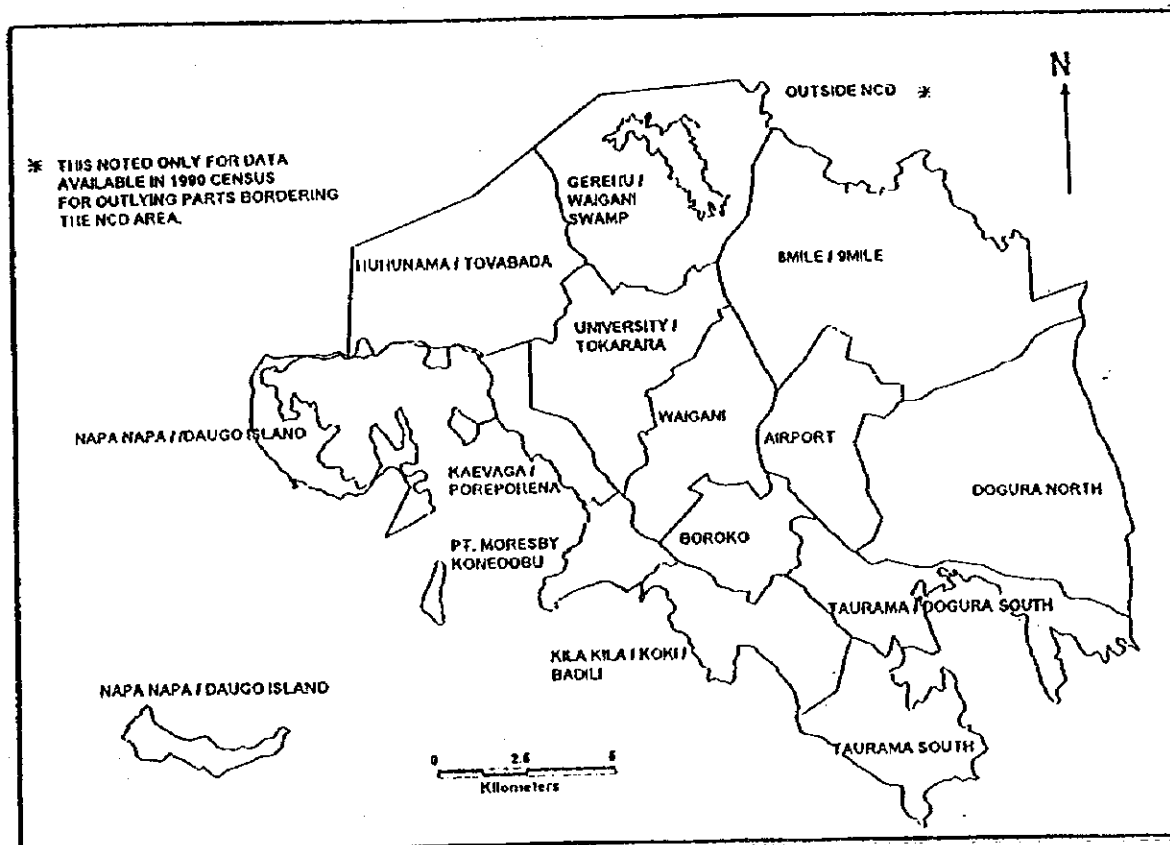
Map 1A - MAP OF NCD PER URBAN DEVELOPMENT & SERVICES STUDY

The Working Papers included:

Working Paper 1 - Population and Demography
Working Paper 2 - Employment and Economy
Working Paper 3 - Education
Working Paper 4 - Health Services
Working Paper 5 - Recreation and Open Space
Working Paper 6 - Police and Fire Services
Working Paper 7 - Housing
Working Paper 8 - Land Use and Settlements Patterns
Working Paper 9 - Sewerage Services
Working Paper 10 - Solid Waste
Working Paper 11 - Transportation Systems
Working Paper 12 - Physical, Environmental, Economic and Social Constraints
Working Paper 13 - Alternative Development Scenarios
Working Paper 14 - Water & Storm Drainage
Working Paper 15 - Geomorphology and Marine Habitats
Working Paper 16 - Supplemental Survey of Existing Land Use
Working Paper 18 - Institutional Strengthening
Working Paper 20 - Urban Services Master Plan

Working Papers 17 and 19 were not provided. The following is a summary of the salient points from each of the Working Papers relevant to the current study. Working Papers 1 and 2 (Population and Demography, and Employment and Economy) are dealt with in Section 2.3 which details the existing socio-economic characteristics of the NCD population.

2.2.2.1 Working paper 8 - existing land use & settlement patterns

The information relevant to the current study includes the existing level and type of development, number and density of housing units, and level of servicing or infrastructure, throughout the regions which make up the NCD area.

TABLE   - 1995 POPULATION & DWELLING UNIT NUMBER BY REGION & ZONE

PLANNING AREA	TRADITIONAL HOUSING				NON-TRADITIONAL HOUSING		TOTAL	
	Villages		Settlements					
	Populat'n	Dwellings	Populat'n	Dwellings	Populat'n	Dwellings	Pop'n	Dwgs
Coastal Region								
Kaevaga Poreporena	7,894	745	60	12	4,926	602	12,880	1,359
Kila Kila/Koki/Badili	2,484	335	10,058	1,156	22,842	3,177	35,384	4,668
Napa Napa/Daugo	0	0	2,226	302	0	0	2,226	302
Pt Moresby/Konedobu	0	0	3,274	480	16,623	3,795	19,897	4,275
Taurama/Dogura Sth	35	196	2,129	377	1,663	32	3,827	605
Taurama South	2,254	299	207	35	0	0	2,461	334
Regional Sub-Total	12,667	1,575	17,954	2,362	46,054	7,606	76,675	11,543
Central Region								
Airport	0	0	4,041	946	10,036	1,559	14,077	2,505
Boroko	0	0	220	63	29,770	5,348	29,991	5,411
University/Tokarara	0	0	13,400	2,055	28,409	2,558	41,810	4,613
Waigani	0	0	2,920	197	37,907	5,937	40,826	6,134
Regional Sub-Total	0	0	20,581	3,261	106,122	15,402	126,703	18,663
Periphery Region								
Dogura North	0	0	0	0	84	12	84	12
8 Mile/9 Mile	0	0	3,651	498	16,044	2,179	19,696	2,677
Gerehu/Waigani Swp	0	0	401	61	25,823	3,303	26,224	3,364
Huhunama/Tovabada	104	12	0	0	811	124	915	136
Regional Sub-Total	104	12	4,052	559	42,763	5,618	46,919	6,189
TOTAL NCD	12,771		42,587		55,358		250,297	36,395

Table A.1 - 1995 Population & Dwelling Unit Number by Region & Zone

2.2.2.2 Working paper 9 - sewerage services

This section of the Urban Development & Services Study described the existing sewerage system, estimated the theoretical capacity of the sewerage services, and made recommendations for upgrading the services/system to meet the forecast population of the target year 2015.

Currently the effluent of the Waigani Stabilisation Ponds is visibly of poor quality, and upgrading of this facility is required. Approximately 500ha of the Waigani Swamp is currently used as a tertiary treatment system, removing suspended and dissolved contaminants, and increasing the dissolved oxygen prior to its discharge into the Laloki River.

For assessing the needs of the future population, the population of the NCD was divided into wastewater tributary areas according to the location of upstream and downstream sewers and manholes. It should be noted that the population accounted for in the wastewater tributary areas was 167,383 (some 28,187 less than the actual 1990 population of 195,570). The 1990 total of non-sewered population was 39,682 or 23.7% (of the 167,383 population) which included the proportion of the population living in traditional housing (i.e. villages and settlements, some 28,187) and those living in non-traditional and non-sewered areas (some 11,495). The 1995 estimates included in the study anticipated that this had increased to 72,341 or 28.8% of the estimated 1995 population of 250,999. Which included a traditional population of 59,683, and non-traditional and non-sewered population of some 12,458.

Table A.2 - 1995 POPULATION DENSITY AND LAND USE

LAND USE	COASTAL REGION			CENTRAL REGION			PERIPHERY REGION			OUTSIDE NCD			TOTAL NCD REGION		
	Ha	%	Ha per 1000 pop'n	Ha	%	Ha per 1000 pop'n	Ha	%	Ha per 1000 pop'n	Ha	%	Ha per 1000 pop'n	Ha	%	Ha per 1000 pop'n
Non-traditional housing	245.0	16.3	5.14	769.4	27.8	7.61	231.9	14.4	5.43	10.6	3.8	14.89	1,246.2	21.2	6.51
Settlements	251.8	16.8		176.7	6.4		304.7	18.9		0.0	0.0	0.0	733.1	12.5	
Villages	296.3	19.7		0.0	0.0		0.0	0.0		0.0	0.0	0.0	307.3	5.2	
Total Residential	*793.0*	*52.8*	*10.3*	*946.0*	*34.2*	*7.47*	*946.6*	*34.2*	*7.4*	*10.6*	*3.8*	*14.8*	*2,296.7*	*38.9*	*9.14*
Commercial	30.6	2.0	0.40	146.4	5.3	1.16	10.9	0.7	0.23	0.0	0.0	0.0	187.8	3.2	0.75
Industry	42.5	2.8	0.55	108.8	3.9	0.86	89.9	5.6	1.92	5.9	2.1	6.4	241.2	4.1	0.96
Civic & institutional	275.1	18.3	3.59	784.8	28.3	6.19	622.6	38.6	13.27	259.7	94.0	283.74	1,682.4	28.6	6.72
Open space	46.3	3.1	0.60	207.7	7.5	1.64	70.9	4.4	1.51	0.0	0.0	0.0	324.9	5.5	1.3
Infrastructure	52.9	3.5	0.69	180.3	6.5	1.42	137.4	8.5	2.93	0.0	0.0	0.0	370.5	6.3	1.48
Road/street network	261.0	17.4	3.40	395.2	14.3	3.12	132.5	8.2	2.82	265.6	96.2	290.2	788.7	13.4	3.15
Total Non-Residential	*708.2*	*47.2*	*9.24*	*1,823.1*	*65.8*	*14.39*	*1,064.2*	*66.0*	*22.68*	*265.6*	*96.2*	*290.2*	*3,595*	*61.1*	*14.36*
Sub-Total Urban Area	1,501.2	100.0	19.58	2,769.1	100.0	21.86	1,611.8	100.0	34.35	276.2	100.0	301.8	5,882.2	100.0	23.50
Commercial agriculture	8.7		0.11	0.6		0.0	216.6		4.62	0.0		0.0	225.9		0.90
Constrained/unused	1,911.6			1,993.3			4,248.7						8,153.6		
Unconstrained/unused	2,181.3			1,347.5			7,289.7			5.8		6.29	10,818.5		
Sub-Total Non-Urban	4,101.7		53.49	3,341.5			11,754.9		250.54	5.8		6.29	19,198.1		76.7
TOTAL IN PLANNING REGION	5,602.9		73.07	6,110.6			13,366.7		284.89	282.0		308.1	25,080.2		100.2

Table A.2 - Population Density and Land Use

TABLE - SUMMARY OF DENSITY STATISTICS

	COASTAL REGION	CENTRAL REGION	PERIPHERY REGION	OUTSIDE NCD	TOTAL NCD REGION
Total population	76,675	126,703	46,919	714	250,297
Population in non-trad'l	47,656	101,085	42,701	714	191,443
Pop'n in traditional	29,018	25,618	4,218	0.0	58,855
Dwg per residential Ha	-14.56	19.73	11.30	15.62	15.92
Population per dwelling	6.64	6.79	7.58	4.30	6.88
Population per urban Ha	51.07	45.76	29.11	67.35	42.55
Pop'n per residential Ha	96.69	133.93	85.68	67.16	200.84

Table A.3 - Summary of Density Statistics

A-12

Table A.4 below provides a summary of the capacity of the existing sewers in the NCD, in relation to the effective 1995 population.

TABLE SUMMARY OF SEWER CAPACITY ASSESSMENT				
AREA	SEWER	1995 TRIBUTARY POPULATION	THEORETICAL POPULATION	1995 SEWER STATUS
Waigani Gordons Ensisi Valley Tokarara Hohola Boroko Korobosea 6 Mile Airport	3 trunk sewers @ Waigani (Moitaka) stabilisation ponds.	131,816	143,073	At capacity
Gerehu North	Trunk sewers to Gerehu II stabilisation ponds.	20,022	32,161	Excess capacity
Gerehu South University	Trunk sewer to Morata (Gerehu I) stabilisation ponds.	7,893	9,368	Excess capacity
Badili	Badili outfall, Badili B and force main.	11,302	17,774	Excess capacity
North Gordons A	Trunk sewers Interconnected.	85,972	104,668	Excess capacity
North Gordons B	Hubert Murray/Thrush Street sewer.	18,728	16,918	Overloaded
Gordons South	Boroko Drive	2,229	1,290	Overloaded
Hohola North	Waigani Drive trunk sewer	17,488	11,959	Overloaded
Boroko	Magani main trunk sewer	7,877		Initially overloaded, now interconnected
June Valley	Koura Way main sewers	3,291	6,471	Excess capacity
University	Morata West	5,267	6,152	Capacity
Waigani	Cormorant Street	2,658	7,780	Excess capacity

Table A.4 - Summary of Sewer Capacity Assessment

As can be seen from the table, the effective population for the Waigani (Moitaka) tributary area is only slightly less than the theoretical capacity of this trunk sewer system, therefore augmentation would be necessary to cope with the 530,000 2015 population target of the NCD, as the main area of growth is anticipated to be in the Waigani/Gordons area which is serviced by this system.

Some sections of the existing sewerage services have excess or some capacity for the effective 1995 population, however it is likely that these would be near capacity by 2015. The main elements of the existing system which will require augmentation to meet the demands of the 2015 population include; the trunk sewers feeding the Waigani (Moitaka) Stabilisation Ponds, the trunk sewer serving the North Gordon B area, the Boroko Drive Sewer serving the Gordon South area, and the Waigani Drive Sewer serving the Hohola North area.

The study concluded that the sewerage system poses major constraints on development in the NCD, and that significant augmentation of the main trunk sewers would be required to meet the needs of the 2015 population. The study also commented that growth in the coastal areas must be carefully controlled in order that the waters of the lagoon, and between the shoreline

and the reefs do not become more polluted.

2.2.2.3 Working paper 12 - physical, environmental, economic & social constraints

In determining the appropriate level and location of urban development and services provision, the study identified a range of constraints.

In order to identify land within the NCD which would be physically suitable for development a range of environmental constraints were determined, these included:

- Avoidance of unconsolidated land
- Avoidance of unstable plains and soil
- Preservation of land with agricultural potential
- Avoidance of flood plains
- Preservation of water supply resources
- Preservation of fisheries
- Preservation of natural identity and recreational landscape
- Avoidance of noise zones
- Avoidance of costly engineering construction and servicing
- Intensity and range of land use options
- Preservation of forestry resources
- Avoidance of alienated and disputed land.

Several economic factors were identified which could affect the level, rate and direction of growth within the NCD. The economic constraints included:

Slow economic growth - an economic downturn which began with the closure of the Bouganville mine in 1989 led to a 4% drop in GDP in subsequent years. An economic reform programme begun in 1991 has managed to slowly strengthen GDP. However, despite the mineral walth of PNG, some economies such as that of the NCD are dependent on the more slowly developing non-mining sectors.

High unemployment - unemployment in the NCD is relatively high at 13% of the 1990 working age population (some 25,541 persons), the rate was higher for the economically active labor force of which some 31% were unemployed.

High cost of non-labor factors of production - a large proportion of the land within the NCD falls into customary ownership systems, whereby who may use the land and for what purposes it can be used are determined by the clan with ownership. Land has therefore become a factor of production with high costs and no degree of certainty about tenure and/or use attached to it.

High wage costs - both nominal wages and level of productivity in PNG are out of kilter with competitor countries. A centralised wage-fixing system has meant that the cost of labor since independence has increased substantially, and has effectively impeded the growth of investment and employment.

Small fragmented market - PNG's lack of purchasing power is a fundamental economic

constraint. In the NCD average incomes are low and therefore restrict the purchasing power of the general population, the ability to buy goods is concentrated in the hands of a few wealthy nationals and non-nationals. This has restricted the internal market, and will continue to be a constraint to economic development unless the purchasing power of the general populous can be increased.

High cost of housing - the majority of the housing stock within the NCD is leased or rented. The high cost of construction coupled with very high interest rates mean that the number of people who can engage in construction or purchase of their own homes is limited. In turn, this forces up the price of rental properties.

Difficulties of obtaining finance - it is very difficult to obtain investment capital within PNG. as there are very few lending institutions and loans from banks must be repaid within a five year period. Repayment costs are very high, and therefore developers must charge high rents in order to pay back loans within the defied period.

The tradition and culture of PNG has led to the perpetuation of customs and social characteristics which in its developing economy also act as constraints. These include:

Wantok system - this is a system based on communal ownership and tradition of reciprocal obligations, while it has provided a form of social insurance and shared responsibility, in the contemporary urban setting it has resulted in frustrating local economies. Within the NCD there is a growing proportion of the population which can not make the expected contributions to the extended family and have therefore been cut off from the traditional support base. In addition, the pressure to share income effectively acts as a disincentive to participate in paid employment, and is a partial explanation for the high levels of unemployment within the NCD.

Law and order - the economic downturn is thought to have significantly contributed to the level of lawlessness within the NCD and surrounding areas. The poor and unemployed who have drifted into the NCD are the extreme from the urban elite, and wealth disparities are evident withinthe NCD with security fencing and guards required to protect citizens and non-citizens of the middle and upper economic strata. Cultural factors also contribute to periods of lawlessness within the NCD with the concept of 'pay-back' dominating traditional and local processes o dispute settlement.

Education - the low level of education of the citizen population contributes to the very slow economic development of PNG. National literacy is only estimated at 45%, and within the NCD the level of education amongst the unemployed is extremely low (about 23% have no education, 37% had less than Grade 6 education, and only 2% had an education above Grade 12). The rate of growth in the school age population is greater than the provision of services and teachers within the education system, and the ability to pay for a higher education (i.e. Grade 10 and above) is very limited. Thus, there is a high drop out rate (45% at primary school and 33 % at lower secondary), and only the wealthy can afford for their children to receive higher education.

Social status of women - the development of any country requires the full participation of the population, this is not possible in situations where social and cultural constraints bar the

participation of women, and cultural conditions effectively legitimate domestic violence and sexual assault. Traditionally, females are raised to be subordinate to males within the households and community, and males have the _right' to physically punish females. It is also interesting to note that, in PNG the male to female ratio is much higher than in other developing countries.

2.2.2.4 Working paper 13 - alternative development scenarios

This part of the Urban Development & Services Study assessed several development scenarios and recommended a Structure Plan which put forward the preferred development strategy for the NCD. The location of land uses, relative intensity, and servicing requirements were considered on a broad basis appropriate to sustainable and high demand growth population estimates. Limitations imposed by the existing level of infrastructure services, availability of land, and the costs required to improve services to meet the needs of future population resulted in the selection of a sustainable future growth policy as the guiding scenario for the development of the NCD.

The recommended strategy provided short term (to the year 2005) and long term (to the year 2015) development guidelines. In the short term the basic strategy is to consolidate available land resources in existing built-up areas in order to maximise the use of existing infrastructure and community services. The less developed areas of Huhunama/Tovabada, Dogura North, Napo Napo/Daugo Island, Taurama South (southern coastal area), and Taurama/Dogura South will not be consolidated. The preservation of village living was considered to be very important to the sustainable development the NCD. Water reticulation will be provided to the villages, and in the short term one standpipe will be provided for every five dwellings. Use of pit latrines will continue until formal reticulation via a sewerage and water supply network is implemented. Fullwater and sewerage reticulation is not expected until 2015.

Based on the foregoing, it is expected that by the year 2000 an additional 2,495ha of land will be required to meet the needs of the estimated 363,000 population. By 2005 an additional 2,222ha will be required over the 2,495 already brought into development in 2000. By 2015 some 6,700ha will be required to accommodate all of the needs of the estimated 531,000 population.

2.2.2.5 Working paper 20 - urban services master plan

Based on the selected development scenario, the Urban Services Master Plan set out the infrastructure staging requirements for a 2015 population of 531,000. The Master Plan concluded that with regard to the sewerage sector, a major additional study must be undertaken to design the improvements required to accommodate future growth - hence the sewerage study currently being undertaken by the JICA study team.

For the 6,700ha of land required for the 2015 population, 4,400ha will need to be serviced. The Master Plan concluded that there were population and physical (topographical) constraints which effectively limited the area which could be effectively serviced in the future. The water supply system, for example, can not adequately provide a population greater than 531,000 with the quantities of 'safe' water it would require. The Master Plan also identified

limitations for areas above the 90m contour due to the difficulty and cost of providing these areas with additional reservoir, pumping and treatment facilities. The Master Plan thus recommended the extending of services to the line of the 90m contour. Any services reticulation beyond the 90m contour would have to be financed by individual developers.

The plan for sewerage services is set out in chapter 5 of the Master Plan. Section 2.2.2 above summarised the capacity of the existing system. The proposed improvements are shown on Map 1B

LEGEND

EXISTING SEWER LINES
PROPOSED SEWER LINES
EXISTING TREATMENT PLANT
PROPOSED TREATMENT PLANT
AREA OF SERVICE LIMIT
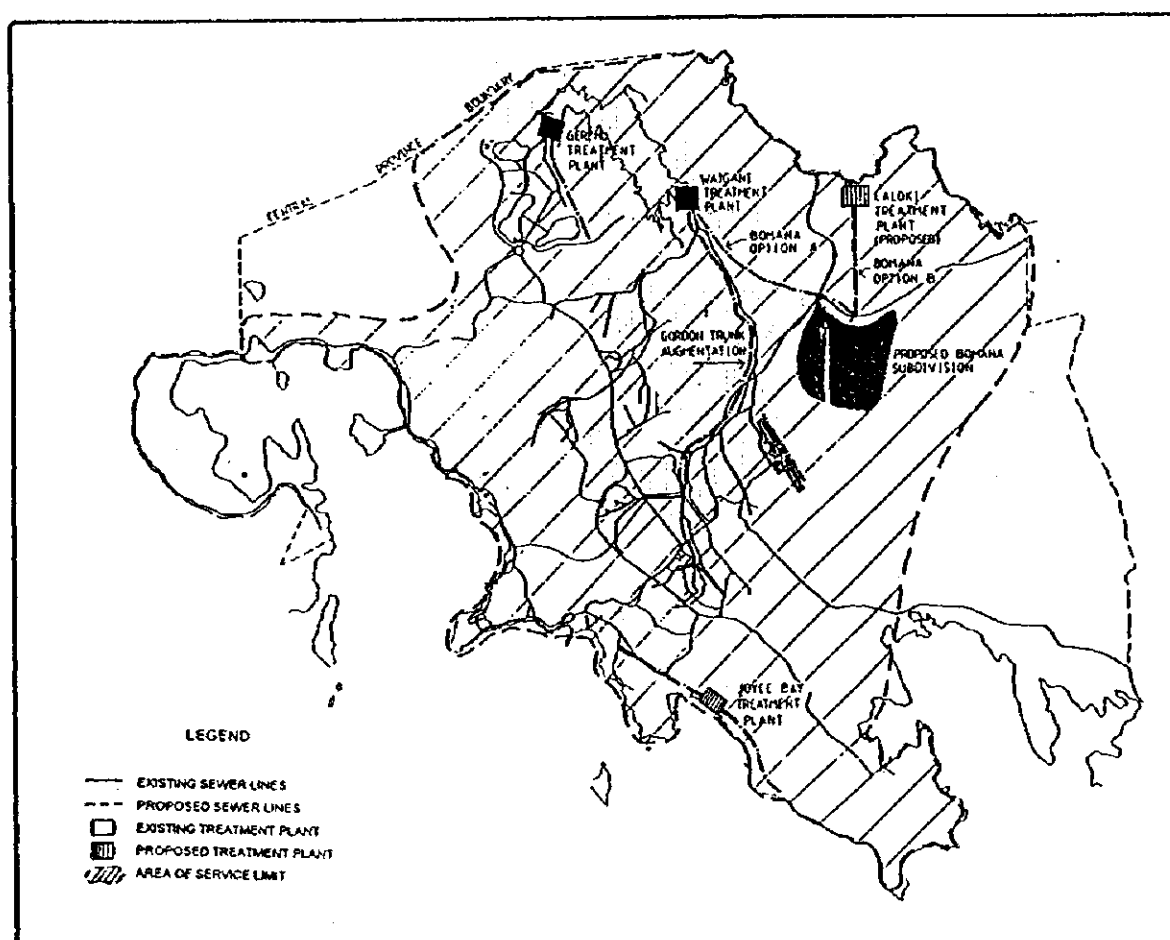
Map 1B - PROPOSED IMPROVEMENTS TO THE SEWERAGE SYSTEM

It should be noted that the area of sewerage services is also limited by population and topography, and will be the same area as indicated for the future limits of water supply. The Master Plan recommended a sewerage services improvement plan which consisted of the following elements (refer to Map 1B):

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- Upgrading of the Waigani Stabilisation Ponds - modify existing piping of the four anaerobic ponds into two separate systems (of two ponds) each feeding into the downstream pond, construction of shallow maturation ponds, and conversion of the downstream pond into a number of floating surface aerators (which will require electric power at the site).
- Augmentation of the trunk sewers in the Waigani, Boroko, Gordons, and Airport areas.
- Implementation of the Joyce Bay Stabilisation Ponds Project which will convey sewage from the areas of Koki, Badili, Korobosea, Gabatu,Sabama, and some traditional villages along the coast.
- Implementation of the proposed Hanuabada Sewerage Project which will provide stabilisation for sewage generated by the traditional villages along the Port Moresby coastline.
- Expansion of the Gerehu I and II Stabilisation Ponds will not be required in the short or medium term as these ponds currently have excess capacity.
- Formalisation and/or relocation of all settlements into planned housing areas in order that they can be effectively reticulated for both sewerage and water supply.
- Provision of sewerage to all existing villages.

2.2.3 Water supply & sanitation sector study - 1996

This Technical Assistance (TA) project was funded by the Asian Development Bank (ADB), and sought to determine the water supply and sanitation needs of the PNG population. While in general the TA is not relevant to this study as it was a province wide study rather than focusing on the requirements of the NCD, surveys were undertaken in both urban and rural sectors in order to identify people's current practices with regard to water use and sanitation, and the methodology of the survey was useful in formulating the approach for the Inhabitants Behaviour Survey undertaken for the sewerage study.

The survey was intended to cover 33% low covenant households, 33% self-help households, and 33% unplanned squatter households. The sample was to be 300 in size, and comprise 50% males and 50% females. However, due to time constraints the survey was difficult to undertake in the manner planned. The survey was eventually made up of a sample size of 111, of which 67 were from urban settlements in the provincial capital and district towns, and 44 were from rural villages. The age distribution of survey participants was between 20 and 60 years old.

It was concluded that while the results of the survey could provide some indication of issues and problems with existing water supply and sanitation, they could not be assumed to be conclusive.

Nevertheless the survey format and question arrangement provided a worthwhile demonstration of what can and cannot be easily asked of repondents in Papua New Guinea communities. In several areas it was used extensively to help formulate the questions for this Inhabitant's Behaviour Survey.

2.2.4   National health plan 1996 - 2000

This document constitutes the 4th Health Plan for PNG, and was produced by the Ministry for Health as a blueprint for improved provision and delivery of all services within the public health sector. The Plan focuses on the minimisation and prevention of the leadingcauses of morbidity, mortality, and disability.

While the Health Plan is focused on improving the general wellbeing of the PNG population, it contains many policies and objectives which have a direct bearing on the current study of sewerage services, and people's perceptions of health, disease, and sanitation, in the NCD.
The Plan stated the issues which must be dealt with if the wellbeing of the nation is to be improved. These included:

The health of the nation is not improving, In particular, women and children continue to die from preventable causes.

Resources are limited and management is inefficient.

Accessibility to basic health services is inadequate.

Community support for health services programmes is poor, and communities are not being encourage and assisted to maintain and improve their health.

There has been little demonstrated commitment to health promotion and education. The population of PNG are not adequately informed nor generally aware that important every day behaviours can greatly improve health.

The infant mortality rate (IMR) in PNG has deteriorated from 72 per 1,000 live births/year in 1980 to 82 per 1,000 liver births/year in 1990. While the childhood mortality rate has improved marginally from 42/1,000 in 1989 to 40/1,000 in 1990, depending on location it is still likely that over the next few years between 1 in 6 and 1 in 20 children will die before their 5th birthday. The childhood mortality rates are lower in urban areas (1 in 16) compared with rural areas (1 in 7), this means that the overall rate is 1 in 8, and that approximately 13,000 children are dying each year.

There are fewer females than males in PNG, and the life expectancy of females is lower than that for males (i.e. 51.4% for women compared with 52.2% for men). The maternal mortality rate in PNG is extremely high - even compared with other developing countries. There are approximately 8 maternal deaths per 1,000 births, with about 2 per 1,000 in urban areas and as many as 20 per 1,000 in rural areas.

TABLE	INTERNATIONAL COMPARISON OF HEALTH INDICATORS					
Country	Crude birth rate per 1,000	Population growth rate (per annum)	Total fertility rate	Life expectancy (years)	Infant mortality rate/1,000	Adult literacy rate % pop'n
General						
Least developed	44	2.7	5.9	50	111	43
Developing	29	2.1	3.6	62	69	67
Industrialised	13	0.6	1.8	76	9	96
Pacific						
PNG	34	2.3	4.7	52	82	45
Vanuatu	-	-	-	65	64	64
Kiribati	-	-	-	56	59	93
Samoa	-	-	-	66	44	98
Solomon Islands	-	-	-	71	27	62
Fiji	-	-	-	72	23	87
Tonga	-	-	-	68	21	99
Other						
South Asia	32	2.2	4.5	59	87	46
Middle East	35	2.9	4.9	64	53	58
Sub-Saharan Africa	45	3.0	6.4	51	109	50
Latin America	26	2.1	3.0	68	38	85

Table A.5 – International Comparison of Health Indicators

Table A.5 above provides a summary of international demographic ad health indicators.

PNG has a slightly longer life expectancy and lower birth rate and infant mortality rate than the least developed countries, it has a significantly lower life expectancy and higher birth rate andinfant mortality rate than other developing countries. Compared with other countries in the Pacific, PNG's life expectancy is lower and infant mortality rate is significantly higher. Comparing the most frequent causes of mortality in PNG between 1990 and 1994, it can be seen that in most cases the proportion of the causes of death have increased.

TABLE	- CAUSES OF MORTALITY IN PNG 1990 - 1994	
Cause of Death	% 1990	% 1994
Pneumonia	20	22
Perinatal conditions	11	13
Malaria	9	10
Meningitis	7	6
Tuberculosis	5	4
Heart and pulmonary conditions	5	5
Cancer	4	3
Diarrhoea & intestinal infections	4	3
Anaemia	3	4
Typhoid	NA	3
Others	29	27

Table A.6 - Causes of Mortality in PNG 1990 - 1994

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The table also shows that more than 50% of the causes of mortality are communicable diseases. The major causes of death among children include respiratory infections, diarrhoea, malaria, vaccine preventable diseases, and malnutrition.

Of relevance to the current study, the Health Plan establishes national policy priorities which include (amongst other things) the expansion of health promotion and preventative health services. The emphasis on health promotion will be to educate the people of PNG about the leading causes of death, health and environmental conditions which can contribute to these, and identifying behaviours which can reduce the incidence of these conditions. Preventative health services will focus on the improvement of health programmes in family health services, disease control, and environmental health, and will include:

- Improving health education, immunisation, family planning, safe motherhood, and nutrition.
- Improving disease control (in particular, malaria, tuberculosis and diarrhoea).
- Improving environmental health through provision of a clean water supply, excreta disposal, and food sanitation. The Plan commented that behavioural and environmental factors contribute to diarrhoeal diseases, and that most rural and peri-urban populations lack safe drinking water and sanitary latrines, and that personal hygiene and food sanitation leave much to be desired.

The key policy areas which have a bearing on the current study include excreta disposal, waste management, environmental health impact assessment and management, and housing.

Excreta Disposal

Disposal of excreta ranges from flush toilets to direct discharge to coastal environments, and use of open bush areas. The goal of the Health Plan is to ensure the safe means of excreta disposal are practised in all communities, this will be achieved by increasing the proportion of rural and urban communities who have access to safe means of excreta disposal by the year 2000 by standardising systems and ensuring that excreta disposal becomes an integral part of water supply and these two components are developed simultaneously, and by promoting the need and use of proper excreta disposal systems.

Waste Management

While waste collection and disposal in the NCD is regular, in other parts of PNG this is not the case. In many cases rubbish dumps are not gazetted, and management of dumps is undermined by indiscriminate and crude dumping methods, and lack of control over materials dumped.

With regard to waste management, the goal of the Health Plan is to improve current disposal systems and ensure that all wastes are handled and disposed of in a sanitary and environmentally safe manner by the year 2000.

Environmental Health Impact Assessment & Management

The Health Plan comments that in the past a lack of understanding of the impact of development has led to unacceptable environmental damage and adverse effects on human health. The Plan anticipates that by the end of 1997, health impact assessments will form an integral part of EIAs of future developments and proposals, to ensure that health issues are adequately incorporated into the planning of socio-economic impact management.

Housing

Even though building standards with regard to construction and use of materials is in place, in many cases these are not observed due to the proliferation of traditional housing and squatter settlements, particularly in the NCD area. In traditional villages and squatter settlements housing does not conform to public health standards, and is characterised by a lack of safe water supply, lack of safe excreta disposal methods, lack of safe garbage disposal, and inadequate ventilation, lighting, and structure. The goal of the Health Plan is therefore to ensure that houses are safe and secure for human inhabitation. This will be achieved by creating public awareness on the needs for safe housing and public health standards, and the establishment of a framework for designing and making available houses which meet the health standards by the year 1999.

2.3 EXISTING SOCIO-ECONOMIC PROFILE

This section of the report provides the background data to the existing socio-economic characteristics of the NCD. In order to obtain information for this profile, two different sources have been consulted, these sources have used slightly different units of analysis. Firstly, the boundaries and locations of the Census Divisions are shown on Figure 4, and secondly the various Planning Zones which were used as the basis for population growth projections and servicing requirements in the Wilbur Smith study, are shown on Figure 5. Each description offered states the basis on which the data has been gathered or derived.

2.3.1 Population distribution & density

Collection of Census information since PNG's independence reveals a fast growing population. The population of the NCD has more than quadrupled since 1966, adding some 153,722 people by 1990 to the 1966 population of 41,848, as shown in Table A.7.

TABLE - POPULATION & DENSITY 1966 - 1990			
Census	Population	Population Added	Density per Km²
1966	41,848		174
1971	76,507	34,659	319
1980	123,624	47,117	515
1990	195,570	71,946	782

Table A.7 - Population & Density 1966 - 1990

The population density of the NCD has also grown significantly, increasing nearly 4.5 times the number of people per km2 since 1966.

The citizen population of NCD in 1990 was 188,089 (96%), while non-citizens accounted for only 4% of the total population (some 7,481 people). The total population of the NCD grew at 4.7% per annum between 1980 and 1990. The Urban Development and Services Study estimated that the NCD population in 1995 was 250,297, indicating a ...% per annum growth from the 1990 Census population of 195,570. The growth rates for citizens and non-citizens differs significantly, refer to Table A.8.

TABLE - POPULATION GROWTH BY CITIZENS & NON-CITIZENS 1980-1990						
Census	Total		Citizen		Non-Citizen	
	Pop'n	Growth Rate	Pop'n	Growth Rate	Pop'n	Growth Rate
1971	76,507		59,563		16,944	
1980	123,624	5.2	112,429	6.9	11,159	-4.5
1990	195,570	4.7	188,089	5.3	7,481	-4.1

Table A.8 - Population Growth by Citizens & Non-Citizens 1980-1990
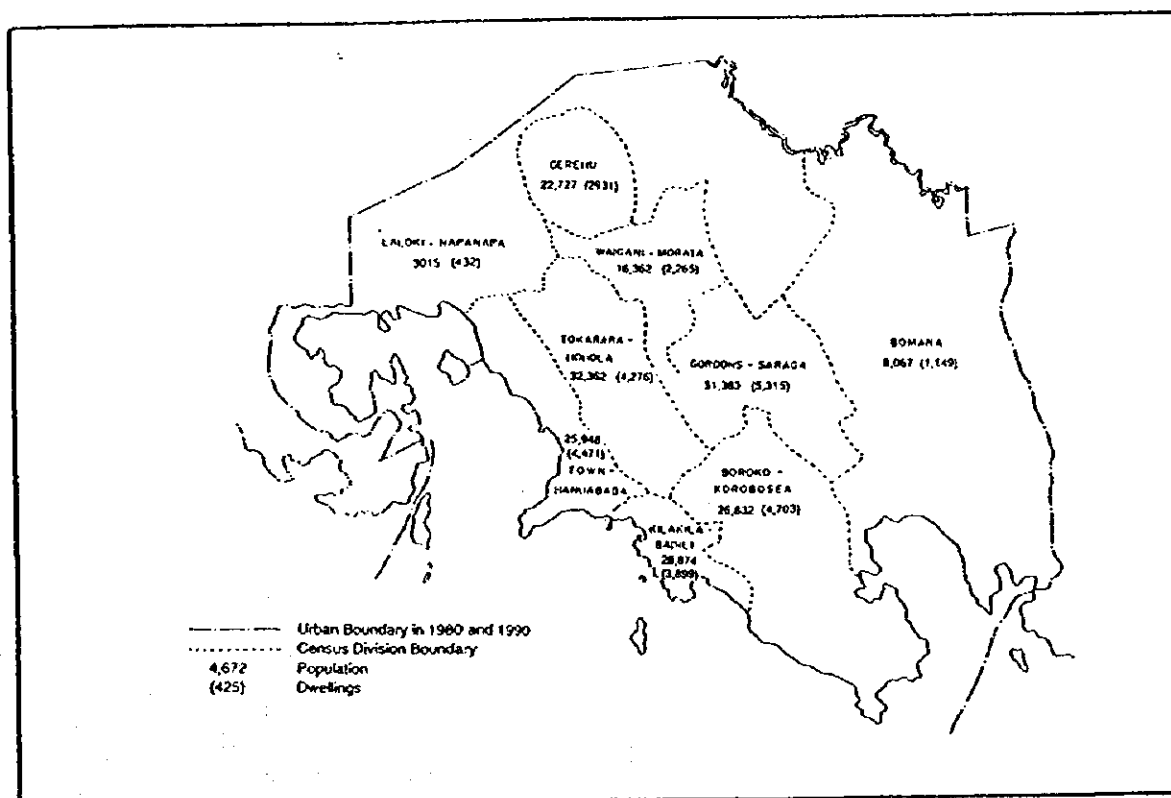
Map 1C - 1990 CENSUS BOUNDARIES AND POPULATIONS
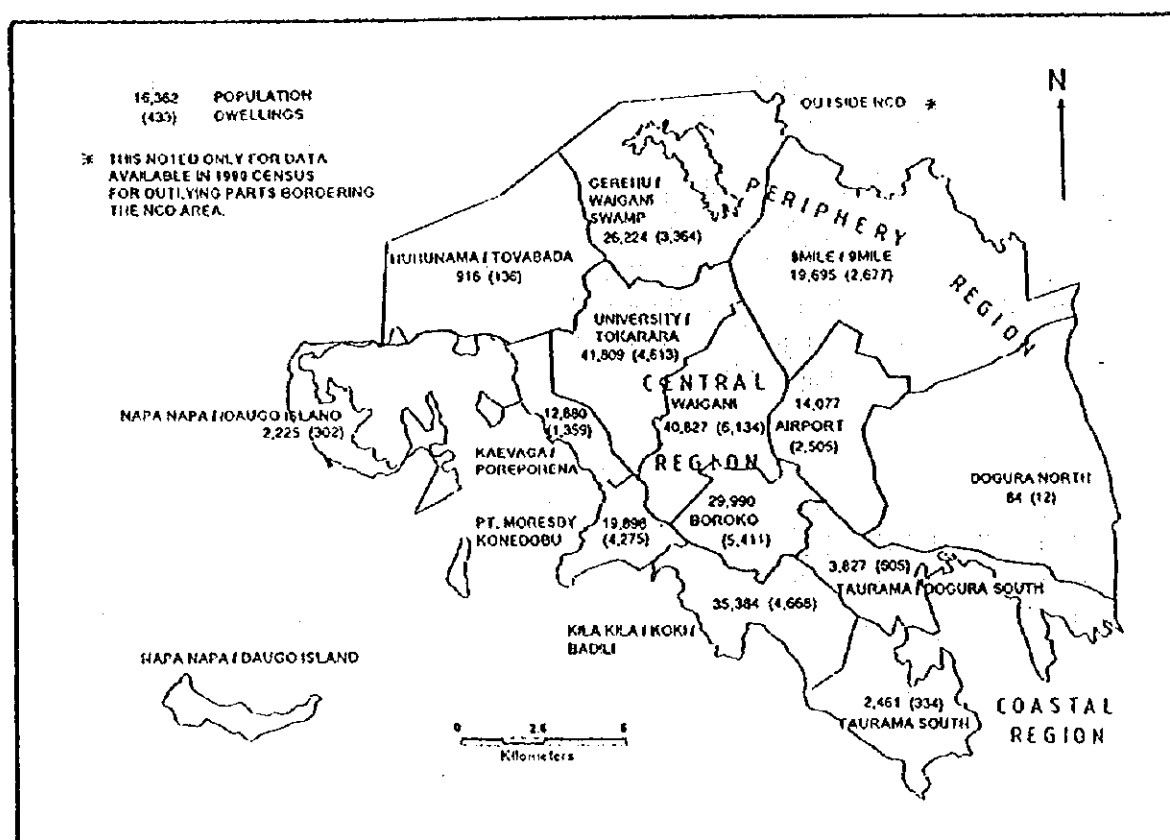
Map 1D - PLANNING ZONES OF THE URBAN DEVELOPMENT AND SERVICES STUDY

The citizen population has effectively trebled since 1971, and has been growing at faster rate than the total population. The non-citizen population has been declining since 1971 and is now less than half of the 1971 population.

The total population growth rates between 1980 and 1990 and the effective doubling times for the total population varies quite markedly over the 9 Census Divisions as shown in Maps 1C and 1D

TABLE - GROWTH RATE, DISTRIBUTION & DOUBLING TIME 1990 POPULATION					
Census Division	1980 Pop'n	1990 Pop'n	% Distribution of 1990 Pop'n	Growth Rate	Doubling Time In Years
Gerehu	14,761	22,727	11.6	4.8	15
Waigani/Morata	11,054	16,362	8.4	4.4	16
Hohola/Tokarara	20,375	32,362	16.6	5.0	14
Gordons/Saraga	16,176	31,383	16.1	8.0	9
Boroko/Korobosea	18,852	26,832	13.7	5.1	14
Kila Kila/Kaugere	18,288	28,874	14.8	4.9	14
Town/Hanuabada	18,918	25,948	13.3	3.5	20
Laloki/Napa Napa	1,052	3,015	1.5	10.8	6
Bomana	4,418	8,067	4.1	6.7	10
TOTAL	123,624	195,570		5.9	13

Table A.9 - Growth Rate, Distribution & Doubling Time 1990 Population

The Census Divisions which experienced the highest growth rates include Laloki/Napa Napa at 10.8 although this area has by far the smallest proportion of the NCD population. The second highest growth rate was experienced in the Gordons/Saraga area which nearly doubled its population between 1980 and 1990, this area also has the second largest proportion of the NCD population. The area with the largest proportion of the NCD population was Hohola/Tokarara with 16.6% of the total, the growth rate of this population was 5%.

The fastest doubling time for an area's population is again Laloki/Napa Napa, the population expected to double in about 6 years. However, even a doubling of the population would not exert any serious pressure on the physical environment or infrastructure as this is the second largest Census Division in terms of land area. Gordons/Saraga is expected to double its population in about 9 years, estimating that its population would be 62,766 by around the year 2000.

The total land area of the NCD is approximately 250km2, giving an average population density of 782 persons/km2. However, this tends to obscure the fact that some areas are much more densely populated than others, and therefore the population densities are much higher in some areas, as shown in Table A.10.

TABLE. - POPULATION DESNITIES & AVERAGE HOUSEHOLD SIZE BY PLANNING ZONES 1995						
Planning Zones	Pop'n	Land Area (Ha)	Pop'n/Ha	No. Dwg Units	Dwelling/Ha	Ave H'hold Size
Kaevaga/Poroporena	12,880	643	20	1,359	2.1	9.5
Kila Kila/Koki/Bidili	35,384	823	43	4,668	5.7	7.6
Napa Napa/Daugo Island	2,225	327	7	302	0.9	7.4
Port Moresby/Konebodu	19,898	885	23	4,275	4.8	4.7
Taurama/Dogura South	3,827	2,316	2	605	0.3	6.3
Taurama South	2,461	132	19	334	2.5	7.4
Airport	14,077	1,388	10	2,505	1.8	5.6
Boroko	29,990	1,160	26	5,411	4.6	5.5
University/Tokarara	41,809	1,888	22	4,613	2.4	9.1
Waigani	40,827	1,579	26	6,134	3.9	6.7
Dogura North	84	5,928	0.01	12	0.002	7.0
8 Mile/9 Mile	19,695	1,521	13	2,677	1.8	7.4
Gerehu/Waigani Swamp	26,224	704	37	3,364	4.8	7.8
Huhunama/Tovabada	916	5,369	0.2	136	0.02	6.7
TOTAL	250,297	24,663	10	36,395	1.5	6.9

Table A.10 - Population Densities & Average Household Size by Planning Zones 1995

2.3.2 Demographic characteristics

2.3.2.1 Male/female ratio

The Census data provided since 1966 shows clearly that there are more males than females, although the ratio has been decreasing. In 1971 there were 148 males per 100 females, 136 males per 100 females in 1980, and 125 males per 100 females in 1990. Table A.11 provides a summary of the relative proportions of males to females by broad age group.

TABLE	- MALE/FEMALE PROPORTIONS AS TOTAL OF 1990 POPULATION				
Age Group	Total Population	Males		Females	
		No.	%	No.	%
0-14	74,715	39,297	52.5	35,418	47.5
15-29	69,088	38,770	56.2	30,318	43.8
30-44	37,385	22,053	58.9	15,332	41.1
45-59	11,059	6,888	62.2	4,171	37.8
60-74	2,895	1,651	57.0	1,244	43.0
74+	428	233	54.4	195	45.6
TOTAL	195,570	108,892	55.6	86,678	44.4

Table A.11 - Male/Female Proportions as Total of 1990 Population

The table shows that in every age category the proportion of males is greater than that of females, the smallest variation being in the 0-14 year age group where the ratio is 52.5 males to 47.5 females, and the greatest variation being in the 45-59 year age group where the ratio is 62.2 males to 37.8 females. This is most significant for the population aged between 15 and 44 years, as women within the child bearing age group account for only 45,650 (or 23%) of the total population.

2.3.2.2 Age distribution

Referring to Table A.11 above, it can be seen that the largest proportion (38%) of the total population are those aged between 0 and 14 years. The second largest proportion of the population are those aged between 15 and 29 years who account for some 35% of the total population (69,088). The changes in age distribution between 1980 and 1990 is shown on Table A.12 below.

TABLE	- CHANGES IN AGE DISTRIBUTION IN CITIZEN POPULATION	
Age Group	1980 %	1990 %
0-4 years	17.8	14.6
5-15 years	22.9	24.1
Under 15 years	40.7	38.7
15-44 years	54.1	54.4
45-59 years	4.1	5.2
60 years and over	1.1	1.7
15 years and over	59.3	61.3

Table A.12 - Changes in Age Distribution in Citizen Population

The proportion of the population aged 15 years and over has increased slightly from 59% to 63% between the two Census years. The 5-15 years age group is the only age group to show a real increase from 22.9% in 1980 to 24.1% in 1990 however this was not enough of an increase to make up for the reduction in the proportion of those aged between 0 and 4 years, the reduction of 3.2% pulled the overall proportion of those aged under 15 years from 40.7%

in 1980 to 38.7% in 1990 (a 2% reduction). This is perhaps a result of declining fertility and mortality in the citizen population. There has been a slight increase in the proportion of citizens in the 15-44, 45-59, and 60 years and over age groups which contributed to the overall increase in proportion of citizens 15 years and over.

Table A.13 shows the ratio of children 15 years and under and adults 60 years and over as ratios of the total citizen population, and relative numbers of children per woman between 1980 and 1990.

TABLE . - DEPENDENCY & CHILD/WOMEN RATIOS IN CITIZEN POPULATION						
Census	Sex	< 15 years	15-59 years	60+ years	Dependence Ratio	Child/Women Ratio
1980	Total	40.6	59.2	1.1	71.6	
	Male	37.4	61.6	1.0	62.4	
	Female	45.2	53.8	1.0	86.0	84.3
1990	Total	38.7	59.6	1.7	67.7	
	Male	36.6	61.7	1.6	62.2	
	Female	41.3	57.1	1.6	75.3	62.5

Table A.13 - Dependency & Child/Women Ratios in Citizen Population

The dependence ratio is defined by the proportion of the population under 15 years, and 60 years and older who are theoretically dependent on those between 15 and 59 (working age population). However, at this stage the ratio provided here can only be considered a tentative ratio as the Census actually defines the working age population as 10 years and over, also those who are unemployed between the ages of 15 and 59 years have not been excluded from this category. Therefore this dependence ratio is not a true reflection of the dependence of the non-working population on the working population, this is dealt with in Section 2.3.3.2.

The child/women ratio is the number of children aged 5 years and under divided by the number of women within the child bearing age group i.e. between 15 and 44 years multiplied by 100. The child/women ratio provides a general indication of the fertility of the female population within the reproductive age span. The ratio has decreased from 84/100 in 1980 to 62/100 in 1990.

2.3.2.3 Population projections

The Urban Development & Services Study provided a series of population projections from 1990 to 2105, the information presented as part of that study is summarised here. Three growth scenarios were developed including low, medium and high growth projections.

Low Growth Scenario

The low growth scenario was based on a set of assumptions which included:

-   The mortality and migration rates for the NCD were assumed to remain steady and the

1980 rates were used as constants for the projections.
- Child/women ratios (as an indication of fertility) were assumed to decrease. For a ten year projection a 25.9% reduction from the base year was used.
- Non-citizen population was fixed at a level of 7,500.

The results of the low growth scenario projections are presented in Table A.14.

TABLE	- LOW GROWTH POPULATION PROJECTIONS					
	1990	1995	2000	2005	2010	2015
Total	195,570	250,950	316,055	377,984	452,216	531,350
Citizen	188,089	243,450	308,555	370,484	444,716	523,850
Non-citizen	7,481	7,500	7,500	7,500	7,500	7,500
% Citizen < 15 years	38.7	38.6	37.8	37.4	34.2	33.1
% Citizen 15-44 years	54.4	55.0	54.5	55.3	57.7	60.3
% Citizen >45 years	6.9	6.4	7.7	7.3	8.1	6.6
Annual growth rate	4.7	4.9	4.6	3.6	3.6	3.2

Table A.14 - Low Growth Population Projections

High Growth Scenario

The high growth rate scenario was predicated on the assumption that there would be significant decreases in the mortality rate as a result of major improvements to basic health services, immunisation programmes, and upgrading and expansion of infrastructure. The results are shown in Table A.15.

TABLE	- HIGH GROWTH POPULATION PROJECTIONS					
	1990	1995	2000	2005	2010	2015
Total	195,570	261,747	329,416	419,619	508,098	648,422
Citizen	188,089	254,247	321,916	412,119	500,598	640,942
Non-citizen	7,481	7,500	7,500	7,500	7,500	7,500
% Citizen < 15 years	38.7	38.1	37.1	36.0	32.5	30.9
% Citizen 15-44 years	54.4	54.2	53.7	53.3	55.4	56.2
% Citizen >45 years	6.9	7.7	9.2	10.7	12.1	12.9
Annual growth rate	4.7	5.8	4.6	4.9	3.8	4.9

Table A.15 - High Growth Population Projections

Medium Growth Scenario

The medium growth rate between 1990 and 2015 was derived by averaging the low and high growth rates over five yearly intervals.

TABLE - MEDIUM GROWTH POPULATION PROJECTIONS						
	1990	1995	2000	2005	2010	2015
Total	195,570	256,189	322,439	399,779	481,021	590,465
Annual growth rate	4.7	5.4	4.6	4.3	3.7	4.1

Table A.16 - Medium Growth Population Projections

Implications for Planning & Services Provision

- Each of the growth scenarios assume that there will be growth in the NCD population. In the order of 2.7 times the 1990 population for the low growth scenario and 3.3 times the 1990 population for the high growth scenario.
- The average growth rate for the population indicates a steady decline from 1995 as a result of declining fertility for each scenario. While there could be an increase in
- The proportion of the population aged between 15 and 44 in the low growth scenario, the proportion remains constant for the high growth scenario.
- The proportion of the population aged 45 years and over could be greater and increase at faster rate for the high growth scenario.

2.3.3   Socio-economic characteristics

2.3.3.1   Education & literacy

In terms of assessing the level of education of the citizen population of the NCD, two factors are important:

- School attendance ratios
- Highest level of education of those no longer at school.

School Attendance Ratios

Table A.17 below provides the changes in school attendance between 1980 and 1990 for the 5 to 25 year age groups (for the citizen population). The attendance ratio is derived by dividing the number of people in a particular age group attending school by the total number in that age group multiplied by 100.

	TABLE - CITIZEN SCHOOL ATTENDANCE 1980 - 1990								
	1980			1990			Annual Growth Rate %		
Age Group	Total	Male	Female	Total	Male	Female	Total	Male	Female
School attendance by number & age									
5-9	4,693	2,558	2,135	7,646	4,081	3,565	5.0	4.8	5.2
10-14	7,495	4,089	3,407	16,174	8,672	7,502	7.9	7.7	8.1
15-19	1,420	893	527	6,523	3,670	2,853	15.6	14.4	17.3
20-15	5	3	2	606	448	158	49.0	51.1	44.6
5-25	13,614	7,543	6,071	30,949	16,871	14,078	8.4	8.2	8.6
School attendance ratio									
5-9	31.2%	32.2%	30.1%	30.7%	31.2%	30.2%	-0.2	-0.3	0.0
10-14	70.2%	71.1%	69.2%	79.0%	79.6%	78.6%	1.2	1.2	1.3
15-19	10.3%	10.7%	9.6%	29.1%	29.4%	28.6%	10.6	10.3	11.2
20-15	0.0%	0.0%	0.0%	2.0%	2.7%	1.2%	-	-	-
5-25	22.4%	21.8%	23.2%	31.8%	31.7%	31.9%	3.6	3.8	3.3

Table A.17 - Citizen School Attendance 1980 - 1990

The attendance at school for the 5-9 year age group was the only instance of a reduction in the ratio attending school between 1980 and 1990. In each other age group the ratio attending school increased. Therefore even though in absolute terms the numbers attending school have increased quite markedly (in some cases doubled) the number attending school as a proportion of the total population in any age group has not increased significantly. This indicates that while there are growing numbers of people in the 5 to 25 age bracket, there are not increasing numbers attending school.

Level of Education

Table A.18 shows that the level of education attained for the citizen population of the NCD has not increased significantly since 1980.

The proportion of the population (both male and female) without any education has decreased. The highest level of education attained has increased in some grades and decreased for others which means that overall the general level of education is relatively similar to what it was in 1980. For males, the proportion of the population with a level between grades 1 and 12 has decreased from 79% in 1980 to 76% in 1990, the proportion of the female population with a level between grades 1 and 12 has remained constant at 72% between the two Census periods. Only a very small proportion of the total population has received any tertiary education.

TABLE	· HIGHEST LEVEL OF EDUCATION ATTAINED			
	Males		Females	
Highest Level	1980 %	1990 %	1980 %	1990 %
None	20.5	15.0	27.6	22.4
Grades 1 to 5	20.7	18.4	26.5	21.5
Grade 6	20.3	23.7	20.8	24.7
Grades 7 to 9	14.9	11.4	13.3	11.2
Grades 10 & 11	17.9	18.5	10.0	13.2
Grade 12	5.7	4.3	1.8	1.9
Diploma/certificate	-	6.0	-	4.0
Degree	-	2.1	-	0.5
Not stated	-	0.6	-	0.6
Total	100.0	100.0	100.0	100.0

Table A.18 - Highest Level of Education Attained

Literacy

Table A.19 shows the level of literacy of the citizen population by particular language in 1990.

TABLE	· LITERACY OF CITIZEN POPULATION AGED 10 YEARS AND OVER					
	Total		Male		Female	
Literate in	No.	%	No.	%	No.	%
English	7,611	5.6	4,036	5.2	3,575	6.1
Pidgin	1,647	1.2	956	1.2	691	1.2
Motu	922	0.7	315	0.4	607	1.0
Other	3,143	2.3	1,188	1.5	1,955	3.3
Any one language	110,389	81.3	64,581	83.3	45,808	78.1
No language	25,353	18.7	12,514	16.2	12,839	21.9

Table A.19 - Literacy of Citizen Population Aged 10 Years and Over

Nearly 22% of females aged 10 years and over stated they were not literate in any language compared with 19% of males. Over three quarters of the population was literate in one language. Table 3.3.4 below indicates the citizen population not at school who have completed Grade 3. The Census considered that those who had at least completed Grade 3 would be literate in that they should be able to read and understand a sentence, and this is the benchmark used throughout the South Pacific region for determining literacy.

TABLE - CITIZEN POPULATION COMPLETING GRADE 3									
	Total			Male			Female		
Age Group	No. completed Grade 3	% of total pop'n in age group	% Change 1980 - 1990	No. completed Grade 3	% of total pop'n in age group	% Change 1980 - 1990	No. completed Grade 3	% Total pop'n in age group	% Change 1980 - 1990
5-14	2,080	4.5	1.2	1,112	4.6	0.7	968	4.5	1.8
15-24	32,386	68.9	2.9	18,573	70.4	2.0	13,813	66.9	4.1
25-34	28,405	77.4	7.0	17,068	82.3	5.9	11,337	70.7	8.7
35-44	12,959	69.0	4.5	8,412	73.7	5.0	4,547	61.6	4.4
45+	5,945	46.2	10.4	4,020	51.9	10.6	1,929	37.7	10.1

Table A.20 - Citizen Population Completing Grade 3

From the above table it could be assumed that around three quarters (varies between 68 and 77%) of the citizen population in the 15-44 age group would be literate by virtue of completion of Grade 3. The increase in proportion of an age group being literate is most marked in the 25-34 year age group which experienced an annual average increase of 7% between 1980 and 1990. As indicated above the levels of literacy in the female population are slightly lower than in the male population. However, the improvement in literacy of females between 1980 and 1990 has increased at a much higher rate than the male population for the 5-14, 15-24, and 25-34 age groups.

2.3.3.2 Economic activity

The definition of working age population used in the Census includes the population aged 10 years and over who are engaged in part-time or full time work for remuneration, and those who do not work but are seeking work (i.e. the unemployed). Therefore the labor force includes those who could be economically active regardless of whether or not they are employed, but excludes housewives, students, and retired people.

The working age population in 1990 was 141,884 or 72.5% of the NCD population, however, only 58% of the working age population (82,402) were economically active, and as shown on Table A.21 only 40% of the labor force (56,861) are employed in the sense that they are income generating or money raising.

TABLE - LABOUR FORCE & ECONOMICALLY ACTIVE POPULATION 1990				
Row	Category	Total	Male	Female
1	Income/wage earners	55,714	42,473	13,241
2	Subsistence farming/fishing	1,147	563	584
3	Employed (1+2)	56,861	43,036	13,825
4	Unemployed	25,541	17,397	8,144
5	Labour force (3+4)	82,402	60,433	21,969
6	Not economically active	59,157	20,171	38,986
7	Not stated	325	183	142
8	Working age population	141,884	80,787	61,097

Table A.21 - Labor Force & Economically Active Population 1990

Not surprisingly the greatest proportion of employed are engaged in activities for wages (or money raising) as opposed to subsistence activities. Unemployment accounts for 18% of the working age population, or 31% of the potential labor force, which is a very high rate of unemployment. This becomes even more significant when the 42% (59,157) of the working age population who are not economically active are also considered as the proportion of the working age population who are not income generating or money raising is 60% (84,698 people). This means that the dependence ratio is extremely high at 286/100, i.e. those aged under 15 (74,715) and over 60 years old (3,323), and the proportion of the labor force who are not economically active (84,698) are dependent on those of the working age population who are engaged in activity for remuneration (56,861). The dependence ratio is reduced to 166/100 if the potential labor force of (82,402) is used and the proportion of unemployed (25,541) are no longer counted as part of the dependent population.

The labor force and the proportion of employed working age population has increased overall by 6.1% and 3.1% respectively as shown below.

TABLE - EMPLOYMENT 1980-1990					
	1980		1990		
Labour Force	Number	%	Number	%	AGR %
Citizen	39,507	87.3	78,465	95.2	7.1
Male citizen	32,690	72.2	57,502	69.7	5.8
Female citizen	6,817	15.1	20,963	25.5	11.9
Non-citizen	5,721	12.7	3,936	4.8	-2.3
Male non-citizen	4,102	9.1	2,930	3.6	-3.3
Female non-citizen	1,619	3.6	1,006	1.2	-4.6
Total	45,228	100	82,401	100	6.1
Employed Population	Number	%	Number	%	AGR %
Citizen	35,844	86.4	53,147	93.5	4.1
Male citizen	29,755	71.6	40,174	71.0	3.0
Female citizen	6,089	14.6	12,793	22.5	7.7
Non-citizen	5,701	13.6	3,714	6.5	-4.4
Male non-citizen	4,094	9.8	2,862	5.0	-3.5
Female non-citizen	1,607	3.8	852	1.5	-6.1
Total	41,976	100	56,861	100	3.1

Table A.22 - Employment 1980-1990

The proportion of citizens in the labor force has grown at 7.1% per annum between 1980 and 1990. The largest increase being in the female citizen sector of the labor force which increased markedly from 6,817 in 1980 to 20,963 in 1990 indicating an 11.9% growth rate. The non-citizen proportion of the labor force has been declining, the female non-citizen rate declining at a faster rate than the male non-citizen rate. The proportion of employed citizens has increased from 86% to 93% of the total number of employed persons, this increase is largely due to a higher number of female citizens entering remunerated employment (an average growth rate of 7.7%), whereas the proportion of employed citizen males has remained constant. The overall number and proportion of non-citizens in the employed labor force has decreased from 13.6% in 1980 to 6.5% in 1990 (indicating a declining average growth rate of -4.4%).

2.3.3.3 Labor force participation

Labor force participation rates can be determined for the citizen proportion of the population, which accounts for 96% (some 188,089 people) of the total NCD population. Table A.23 below provides the citizen employment rates as a proportion of the population within specific age groups. Table A.24 provides the labor force participation rates as a function of the total population by age and sex breakdown.

Table A.23 indicates that a small proportion of the 15 years and under, and 60 years and over age groups are actually engaged in economic activity. However, this does not significantly alter the dependence ratio (as discussed above) as it only decreases from 166/100 to 162/100.

TABLE - CITIZEN EMPLOYMENT RATES BY AGE (1990)								
Total Population			Male			Female		
Age Group	Employed	Pop'n	Rate	Employed	Pop'n	Rate	Employed	Pop'n	Rate
0-9 years	-	52,347	-	-	27,388	-	-	24,959	-
10-14 years	2,310	20,481	11%	1,328	10,900	12%	982	9,581	10%
15-19 years	11,541	22,447	51%	7,593	12,487	61%	3,948	9,960	40%
20-24 years	16,992	24,528	69%	11,981	13,859	86%	5,011	10,669	47%
25-29 years	14,847	20,829	71%	10,967	11,720	94%	3,880	9,109	43%
30-34 years	11,605	15,830	73%	8,642	8,994	96%	2,963	6,836	43%
35-39 years	8,558	11,618	73%	6,692	6,902	97%	1,866	4,716	40%
40-44 years	5,239	7,158	73%	4,273	4,497	95%	966	2,661	36%
45-49 years	3,188	4,589	70%	2,625	2,883	91%	563	1,706	33%
50-54 years	1,944	3,201	61%	1,618	1,923	84%	326	1,278	26%
55-59 years	1,022	1,930	53%	853	1,164	73%	169	766	22%
60-64 years	702	1,536	46%	537	881	61%	165	655	25%
65+ years	517	1,595	32%	393	885	44%	124	710	18%
TOTAL	78,465	188,089	42%	57,502	104,483	55%	20,963	83,606	25%

Table A.23 - Citizen Employment Rates by Age (1990)

Note: Rate = the employed proportion of the population for that specific age group i.e 61% of males aged 15-19 years are employed (employed column divided by population column).

Table A.23 shows that of the citizen population the most similar male/female proportion employed in any age group is the 10-14 year age group. Some 42% of the total citizen population is employed. Interestingly the age groups 60 years and over still have relatively high proportions of employed. Overall 25% of the female population is employed compared with 55% of the male population. The 25 to 49 year age groups have the largest proportion of males employed of the age categories. The age group with the highest proportion of female employment is the 20-24 year age group.

Table A.24 shows the labor force participation rates (LFPR) for the citizen population. Overall, males comprise 73% of the labor force compared with 27% female. The labor force participation rates of males is generally higher than that of females compared with the relative proportion of the population for any age group. The male LFPR is 31% of the total population and the female LFPR is 11%.

The age groups with the highest male participation rate are the 25 to 54 year groups, in each case the participation rate is more than half the population within that group. The 40-44 year age group has the highest LFPR of all males with 60%. The lowest LFPR is the 10-14 age group, followed by the 65+ age group. The highest female LFPR is in the 20-24 age group with 20%, followed closely by the 25-29 and 30-34 groups with 19% each. The age group wih the largest proportion of females in the labor force is the 10-14 age group which is 43% female. The smaller proportion of females in the labor force between ages 15 and 44 could be a function of the number of women involved in domestic activities and raising children, activities which keep them busy but are not picked up as activities which directly contribute to the economy.

TABLE - CITIZEN LABOUR FORCE PARTICIPATION RATES (1990)								
	Total Population			Male			Female		
Age	Pop'n	No. in LF	LFPR	No. in LF	% of LF	LFPR %	No. in LF	% of LF	LFPR %
0-9	52,347	0	0	0	0	0	0	0	0
10-14	20,481	2,310	11%	1,328	57	6	982	43	5
15-19	22,447	11,541	52%	7,593	66	34	3,948	34	18
20-24	24,528	16,992	69%	11,981	71	49	5,011	29	20
25-29	20,829	14,847	71%	10,967	74	53	3,880	26	19
30-34	15,830	11,605	73%	8,642	74	55	2,963	26	19
35-39	11,618	8,558	73%	6,692	78	58	1,866	22	16
40-44	7,158	5,239	73%	4,273	82	60	966	18	13
45-49	4,589	3,188	70%	2,625	82	57	563	18	12
50-54	3,201	1,944	61%	1,618	83	51	326	17	10
55-59	1,930	1,022	53%	853	83	44	169	17	9
60-64	1,536	702	46%	537	76	35	165	24	11
65+	1,595	517	32%	393	76	25	124	24	8
TOTAL	188,089	78,465	42%	57,502	73	31	20,963	27	11

Table A.24 - Citizen Labor Force Participation Rates (1990)

Note: % of LF represents the proportion of the total labor force for that age group. LFPR represents the labor force participation rate as a function of the total population i.e the proportion of total population who are employed for that age group.

TABLE - 1990 TOTAL NCD POPULATION BY OCCUPATION TYPE						
	Total		Citizen		Non-Citizen	
Occupation	Number	%	Number	%	Number	%
Official, managers, legal	4,023	7	2,815	5	1,208	33
Professionals	5,939	10	4,813	9	1,126	30
Technical	3,168	6	2,618	5	550	15
Clerks	9,150	16	8,930	17	220	6
Service, shop, market, sales	9,568	17	9,421	18	147	4
Agriculture & fisheries	2,098	4	2,082	4	16	1
Craft & related	8,445	15	8,28	16	158	4
Plant & machinery operators	3,340	6	3,297	6	43	1
Elementary occupations	7,257	13	7,132	13	125	3
Not stated/recorded properly	3,872	6	3,751	7	121	3

Table A.25 - Labor Force by Occupation

Table A.25 provides a breakdown of the citizen and non-citizen male and female population

by occupation type. The table shows that the largest proportion of the citizen population were employed in non-professional or non-managerial type professions such as clerks, service workers, and craft. In contrast, the largest proportion of the non-citizen population was employed in the managerial and professional categories with around one-third of the population employed in each category accounting for well over half of the total non-citizen population overall.

TABLE . . - 1990 POPULATION BY SEX & OCCUPATION TYPE						
	Total %		Citizen %		Non-Citizen %	
Occupation	Male	Female	Male	Female	Male	Female
Official, managers, legal	86	14	61	9	25	5
Professionals	65	35	52	29	13	6
Technical	87	13	71	12	15	2
Clerks	51	49	49	48	1.5	1.5
Service, shop, market, sales	81	19	80	18	1.5	0.5
Agriculture & fisheries	56	44	55	44	0.5	0.5
Craft & related	97	3	94	3.5	2	0.5
Plant & machinery operators	97	3	95.5	3	1	0.5
Elementary occupations	73	27	73	27	0.5	0.5
Not stated/recorded properly	72	28	69	27	3	1

Table A.26 - 1990 Population by Sex & Occupation Type

A very small proportion (less than 5%) of the non-citizen population were employed in service, sales, craft, or plant and machinery operator categories. Correspondingly these occupation types accounted for around 60% of citizen employment.

Table A.26 shows occupation breakdown by sex. The male population dominate the official/managerial/legislator, and professional categories accounting for over 85% of people employed in these higher level positions. In none of the categories listed did women account for half or more of the population employed. Interestingly, men accounted for nearly all those employed in the craft and related category, with women only comprising 3% of the people involved in this industry. This is markedly different from other countries throughout the Pacific where women usually account for well over half of the population employed in the craft industry. The category where the proportion of women employed was closest to that of men was clerks where the proportion was very similar with men accounting for 51% and women 49%.

The categories with the next highest proportion of women were agriculture and fisheries industry which employed 44% women, and the professional category which comprised some 35% women.

2.3.3.4 Access to resources

The following tables provide a summary description of the NCD's population access to basic resources such as water, fuel, and sanitation, and the type and size of households.

TABLE - 1990 HOUSEHOLD TYPE, SIZE AND OWNERSHIP								
	Total			Citizen			Non-Citizen		

Average Household Size (number)

Household Type	People	H'hold	Ave. size	People	H'hold	Ave. size	People	H'hold	Ave. size
High cost	76,068	5,478	14	69,068	4,475	15	7,000	1,003	7
Flat	46,088	4,767	10	39,446	3,494	11	6,642	1,273	5
Duplex	17,544	1,481	12	16,886	1,378	12	658	103	6
Domestic quarters	26,446	2,183	12	26,322	2,158	12	124	25	5
Special dwellings	11,824	339	35	10,876	309	35	948	30	32
Self-help high cost	25,046	1,359	18	25,020	1,356	18	26	3	9
Low cost	91,828	5,281	17	91,348	5,225	17	480	56	9
Makeshift	65,290	4,684	14	65,236	4,679	14	54	5	11
Traditional	670	51	13	670	51	13	0	0	0
Self-help low cost	30,272	1,710	18	30,210	1,703	18	62	7	9
All types	391,076	27,333	14	364,206	24,828	15	15,994	2,505	6

Household Ownership (%)

Household Type	Rent from Govt.	Rent other	Own	Rent from Govt.	Rent other	Own	Rent from Govt.	Rent other	Own
High cost	8.4	5.5	6.2	7.7	4.1	6.2	14.5	19.4	6.2
Flat	8.6	7.9	1.0	8.2	5.0	0.8	12.3	36.6	2.0
Duplex	3.1	1.7	0.7	3.1	1.6	0.7	1.3	2.2	0.0
Domestic quarters	3.5	2.6	1.9	3.8	2.8	2.1	0.0	0.1	0.0
Special dwellings	0.5	0.2	0.5	0.6	0.1	0.5	0.0	0.1	0.0
Self-help high cost	0.0	0.2	4.8	0.0	0.2	5.2	0.0	0.0	0.0
Low cost	10.1	2.3	6.9	11.1	2.4	7.6	0.0	1.4	0.1
Makeshift	0.0	0.3	16.8	0.0	0.3	18.4	0.0	0.0	0.0
Traditional	0.0	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.0
Self-help low cost	0.0	0.1	6.1	0.0	0.1	6.7	0.0	0.0	0.0
All types	34.4	20.6	45.0	34.8	16.6	48.6	29.0	60.9	10.1

Table A.27 - 1990 Household Type, Size and Ownership

The table indicates that nearly one quarter of the total NCD population lives in low cost dwellings with a very high average household size of 17 people per household. One quarter of the citizen population lives in low cost dwellings, with another fifth of the citizen population living in makeshift dwellings. 85% of the non-citizen population live in high cost dwellings and flats. Nearly 90% of the non-citizen population rent accommodation. Just over half of the citizen population rent accommodation, with most dwellings (35%) being rented from the government. Of the citizen population which own dwellings, the largest proportion is in the makeshift dwelling category, each of the other dwelling categories accounts for 7% or less in each.

Table A.28 on page A-39 shows the number of rooms, source of drinking water, source of cooking fuel, and source of lighting for citizen households. The table shows that nearly 32% of all citizen households comprise three rooms. Over half of the high cost dwellings have four rooms, around a third of both makeshift and traditional dwellings have two rooms. Only a small proportion of all citizen households have five or more rooms.

Around three quarters of all citizen dwellings have drinking water piped to the household, and slightly less than a quarter have water piped to CU. Only a very small proportion of all dwellings (less than 1%) rely on drinking water from tanks, streams, or local wells. 97% of high cost households have water piped to the dwelling, compered with 59% for self help low

cist dwellings and 22% of makeshift dwellings. Just under three quarters of make shift dwellings and half of traditional households rely on drinking water piped to the CU.

Just under half of all households use kerosene as the main fuel for cooking, with approximately one quarter of households having electricity for cooking. 53% of high cost households have electricity for cooking, compared with 21% for low cost dwelling, and 4% of makeshift dwellings. Nearly half of makeshift and traditional dwellings use kerosene for cooking, half of makeshift and a third of traditional households use firewood.

Around three quarters of all types of households have electricity for lighting, with slightly less than a quarter using kerosene or a spirit lamp for lighting. Only a small proportion (5%) of households use improvised lamps.

TABLE - 1990 CITIZEN HOUSEHOLD ACCESS TO RESOURCES

	All Types	High Cost	Flat	Duplex	Dom. Qtrs	Spec Dwg	Sit Hip H.C	Low Cost	Makeshift	Traditional	Sit Hip L.C
A. Number of rooms per household (%)											
One room	16.4	2.8	26.8	25.8	31.0	61.5	9.1	2.3	26.8	15.7	13.5
Two rooms	22.6	7.2	23.4	30.0	32.4	10.4	19.8	18.6	35.2	29.4	24.8
Three rooms	31.5	31.3	30.9	28.4	26.9	15.9	28.9	42.8	24.2	27.5	32.2
Four rooms	25.5	52.6	15.6	14.9	7.9	3.6	31.3	33.2	10.7	17.6	21.7
Five (or more) rooms	3.5	5.4	3.1	0.7	1.6	6.8	8.6	1.7	2.7	9.8	7.2
Not stated	0.5	0.8	0.2	0.1	0.2	1.9	2.2	0.1	0.4	0.0	0.6
Total Households	100.0	18.0	14.0	6.0	9.0	1.0	5.0	27.0	18.0	1.0	7.0
B. Source of drinking water (% households)											
Piped to household	74.2	97.0	90.5	94.1	84.1	75.0	59.0	91.9	22.2	50.9	50.9
Piped to CU	21.9	1.8	8.6	4.8	12.2	22.3	35.6	6.8	65.8	49.1	43.2
Piped to other-CU	2.4	0.5	0.4	0.7	2.4	0.9	3.9	0.5	7.7	0.0	3.4
Rainwater tank	0.3	0.5	0.2	0.3	0.6	0.6	0.3	0.2	0.3	0.0	0.2
Stream/creek	0.1	0.0	0.0	0.0	0.1	0.9	0.2	0.2	0.7	0.0	0.1
Well	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0	0.2
Other	1.0	0.2	0.1	0.0	0.4	0.0	0.3	0.4	2.8	0.0	1.7
C. Type of fuel for cooking (% households)											
Electricity	28.7	53.2	58.9	43.4	32.7	37.2	5.3	21.2	3.9	9.8	1.8
Gas	12.7	25.5	16.5	20.9	22.7	13.4	11.0	11.8	1.8	9.8	4.5
Kerosene	40.7	19.1	22.0	28.5	43.2	33.9	58.2	58.5	47.4	47.0	57.0
Charcoal	0.1	0.1	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0
Firewood	17.4	2.1	2.2	6.9	14.9	13.5	24.7	8.2	49.5	33.3	35.8
Other	0.2	0.1	0.1	0.1	0.1	1.6	0.5	0.1	0.2	0.0	0.8
D. Source of lighting (% households)											
Electricity	68.8	96.5	98.2	92.8	82.9	85.9	48.5	86.0	7.6	25.4	29.1
Kerosene/spirit lamp	23.8	2.3	1.0	0.4	12.3	9.3	41.8	10.8	66.9	50.9	56.0
Improvised lamp	5.7	0.7	0.5	1.5	3.2	3.8	7.6	2.4	17.5	23.5	12.1
Candles	0.9	0.2	0.1	1.2	1.0	0.9	0.9	0.5	2.3	0.0	1.8
Other	0.5	0.0	0.0	0.2	0.4	0.0	1.0	0.0	1.6	0.0	0.8

Table A.28 - Household Access to Resources

2.3.4 Summary

The following summarises the salient factors of the socio-economic profile.

In general social indicators (high morbidity, low life expectancy, and relatively high crude birth rate) are poor.

Factors relevant to hygiene awareness and ability/willingness to pay include:

- low level of education
- low literacy rates
- high dependence ration (i.e. the proportion of those not engaged in economoic activity which rely on those engaged in economic activity)
- relatively low participation in labor force of working age population
- likelihood of very small discretionary income for majority of NCD population.

3. THE SURVEY ITSELF

3.1 HOW THE SURVEY WAS CONDUCTED

3.1.1   The survey size

The technical specifications for the Inhabitants Behaviour Survey called for the survey to involve two hundred households carefully chosen to ensure a geographical and socio-economic cross section of the National Capital District community. Three quarters of the required sample was to be taken from sewered areas and one quarter from unsewered areas.

The survey organisers, however, were concerned that such a limited sample size would impose severe limitations on any analysis and interpretation of the results. It was felt that a sample of 1000 households would provide a more reliable information base, and more opportunity to sort the data for detailed analysis.

Aware of the limited financial resources available to carry out the survey, Tokyo Engineering Consultant's Overseas General Manager, Mr. Kazufumi Momose, suggested that the survey organizers approached the University of Papua New Guinea for assistance.

There, despite it being an awkward time of year because of exams, assistance from both the teachers and students was warmly given. With the support of Ms. Betty Lovai, Head of the Social Work Program (who has undertaken similar studies herself), Research Methods Lecturer, Mr. Garry Sali and his three classes volunteered their tie to participate in the project. A minimal donation was agreed to cover some of the expected costs to the Department.

3.1.2   Survey content

The Brief for the project required the survey to investigate and determine three things:

-   Local knowledge and awareness of sanitation issues
-   Local level of satisfaction with the existing sewerage system
-   Local willingness to pay for a sewerage system based on public understanding of:

    -   health and environmental conservation issues
    -   the existing sewerage system and its need for improvement
    -   health conditions
    -   awareness of the cause and effect of disease outbreak
    -   current sanitary habits
    -   household income
    -   ability and willingness to pay

To meet these requirements a 28 question survey offering 256 response options (the practical limit for simple computer analysis) was developed covering these and a variety of related matters (See the next section for details). In addition the survey form provided space for the respondent and/or enumerator to add comments that did not neatly fit the format. (See page A-84)

3.1.3 Survey testing

The survey itself went through a number of preliminary drafts during the last two weeks of April before it reached the University, with input coming from both Eda Ranu and Tokyo Engineering Consultants. Finally, in early May, all of Mr. Sali's classes went through the preferred draft, line by line. This was done both to give it a final pretest and to ensure that each student understood the purpose behind each question. It was also done to help the students understand how to translate it into Pidgin, since it was assumed that many of the respondents would not know English. Out of this exercise came several additional changes to the survey, which were incorporated in the final version.

3.1.4 Survey distribution

During the middle two weeks of May, 1997, each of Mr. Sali's classes (totalling 71 students), spent two, 2 hour late afternoon lab periods and up to two full Saturdays in the field conducting the survey. Three or four students were assigned to each of twenty predetermined areas of the National Capital District. These areas were based on both the planning boundaries of the 1995 Wilbur Smith Urban Development and Services Study and 1990 Census District boundaries. All twenty areas were chosen to contain roughly the sae number of households. See Map 2 on the following page.

The students were taken to their assigned areas in a hired bus or in one of the survey organisers vehicles and given money for both a snack and the bus fare home. Students were asked to pick any house in their assigned area to start from, and if the occupant was unwilling to answer the questions, go to the immediate next neighbour and ask the same thing until he or she found a willing respondent. Once having found one and completed a survey, the student was then asked to skip 5 houses and start the interview process again.
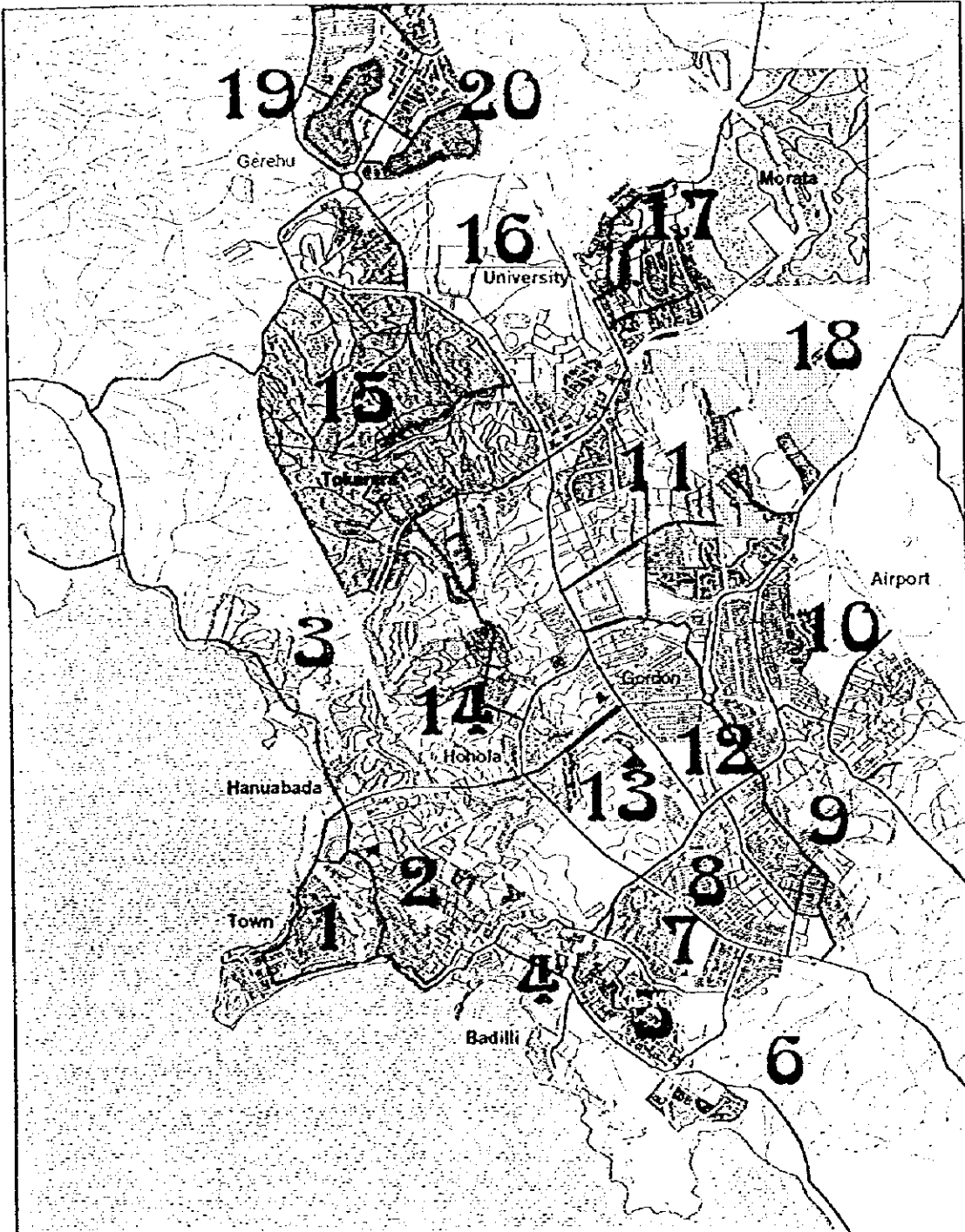
Map 2 - SURVEY ZONES

3.1.5 Public notice of survey

Public notice of the survey was published repeatedly in the local newspaper and several public announcements were made on both the radio and television. Each student was also given a letter of introduction, a detailed map of their survey area and information on how respondents could contact the survey coordinator or the university should they wish (see appendix 2). As a result, many people were informed of the project before the enumerators knocked on resident's doors and many were willing participants. Nevertheless, in some areas the students encountered considerable difficulty finding respondents willing to answer the questions. This was due to several things, including local neighbourhood tensions and language problems.

3.1.6 Survey completion

Students were asked to undertake 15 surveys each and some managed to complete that number. Each survey was designed to take only 30 minutes. However they usually took more than an hour because of the language difficulties and because the students often had to approach five or more household to find someone willing to participate.

As a consequence, the students averaged only just under 9 completed forms each, thus completing only two thirds of the overall target of 1000. To try to reduce the possible geographical and house type bias that this sample reduction could have caused, a second survey exercise was undertaken during the last week of May to obtain information in some of the areas that the students had difficulty entering. Under the guidance of Mr. Jack Ure, and in some instances with the assistance of additional local translators, specially selected and trained unemployed young adults were escorted into the squatter villages of Nine mile and Kila Kila, and into the water villages of Koki and Gabutu. In these areas they obtained an additional 89 responses, bringing the total obtained from the district as a whole to 724.

3.1.7 General survey bias

All household surveys have a degree of inaccuracy and bias in them regardless of how well conducted they are. They are not entirely accurate because they are not based on fact, but on opinion. No matter how well questions are asked, the answers are entirely dependent on the respondent's knowledge of the answers. Knowledge varies from person to person and often has nothing to do with the amount of formal education that a person has.

For instance, a respondent who is not involved in preparing household meals or taking care of small babies might not be aware of how household food scraps and nappies are disposed of. On a survey question which asks what household items are disposed of by throwing them into the toilet, a respondent might genuinely not be aware that such items are occasionally disposed of in that manner and answer the question honestly, but still incorrectly.

Survey accuracy is also dependent of the ability of the respondent to understand the questions asked and the full range of possible responses that he or she might make for each one. With the extremely wide range of languages spoken in the National Capital District and the fact that at least one third of the residents of the District do not understand any English, this is a particularly limiting factor in soliciting an accurate response.

With regard to bias, it can be introduced into a survey both by how the respondents are selected and by how the questions are asked. The random selection technique used in this survey was designed to try to avoid the former problem as much as possible. However, language barriers introduced a significant bias toward the more educated households as these were easier for the interviewers to approach. In addition, tensions in particular parts of the city limited the opportunity to obtain the views of some residents. The supplementary sample of 89 squatter households was an attempt to counter balance this bias, but it was only partially successful because the interviewers were still limited by the willingness of some households to participate.

Bias can also be inadvertently introduced by the surveyors themselves. Because of the extremely large number of students involved, it was not possible to ensure that all surveyors had similar language skills, or a similar understanding of the questions being asked. To try to minimise the impact of this problem, all surveyors were asked not to complete any question on the survey (other than household location and sex of the respondent) unless the question was explicitly answered by the respondent. They were told that if the respondent was unable or unwilling to answer a particular question (such as what was the household income, which was a very personal and often contentious question to ask), it was better to leave a question blank than try to guess the answer themselves.

As a result, two or three questions on most surveys were left blank. Fortunately, those questions left unanswered varied from survey to survey so a reasonable number of responses to each question was obtained in each area. But it was for this reason, more than any other, that a larger than budgeted survey sample size was considered desirable to ensure a reasonable degree of confidence in the results.

(Note: For analysis purposes, the twenty areas separately identified and surveyed, were paired into 10 map areas to ensure there was an adequate number of surveys in each area during analysis. Further sorting could have later separated the pairing for more detailed analysis, but due to the lower than expected survey response rate, such more detailed spacial analysis has not been attempted at this point.)

3.1.8   Bias testing and removal

Once the data from all surveys was put into the computer, several tests were run in a effort to understand the degree of bias that it contained, and to remove this bias where possible. To do this, several sorts were run to see if the results produced any significant distortions from the overall results. Two, in particular were considered particularly important to check; the bias of respondent education and the bias of respondent sex, since it was known that the survey was completed by respondents who were more educated than the average public, and that it was answered by a larger percentage of male respondents than exist in the general population of the district.

The special sorts, however, uncovered no significant distortions due to respondent sex, and generally only minor distortions due to respondent education. In the end, it was decided that even for the education bias, no corrections would be made because it was felt to do so might create even less understandable distortions of its own (due to the small sample size of

respondents with less than 3 years of schooling). Instead it was decided to simply note any observed distortions (from all known survey biases) when discussing the conclusions reached by the data.

3.1.9   Transfer of technology to local counterparts

One of the three objectives of the overall Sewerage Study was "to transfer technology on planning methods and skills to counterpart personnel". Unfortunately, because of initial confusion over how the survey was to be conducted, an inordinately large amount of time was spent by the survey organisers simply finding suitable people to carry out the survey work. As a result, virtually no time was put into training the specific local PNG "counterpart" assigned to the survey.

However, to some extent, the transfer of technology may have been achieved in other ways. In particular, 71 university students (and 8 others) now have a hands on, detailed understanding of one methodology of undertaking household surveys. The survey organisers spent many hours with the students in their various lab rooms and lecture theatres explaining how and why the survey was being conducted, and then produced considerable education material both on how the results were tabulated and on basic computer use in such surveys. The lecturer and all 71 participants received copies of this information. It is perhaps an indication of the success of this indirect "transfer of technology" that after completion of the survey a number of students approached the survey organiser for special instruction on computer use and indicated a strong desire to continue in this line of work as a career.

Bearing this in mind, as well as the knowledge that there already exists among university staff, a high degree of knowledge about social surveying methodology, it may be appropriate that for any similar surveys in the future, the University of Papua New Guinea, rather than overseas consultants, should be approached to conduct them. This in-country resource would appear to be both willing and able.

3.2 SURVEY RESULTS

3.2.1   Introduction

The survey results in most areas confirmed and clarified census information and the results of other previous studies, but it also uncovered a number of interesting details that may be of use in preparing the Sewerage Master Plan and its subsequent implementation. Among other things it found out that household knowledge of the linkages between basic hygiene, the environmental and personal health does not appear to be directly related to the education level of local inhabitants or to the type of dwellings they occupy, except possibly in reverse to what would normally be expected.

Generally, the least educated inhabitants and the occupants of squatter housing know as much about the linkages between basic hygiene, the environment and health as those at the opposite end of the spectrum. If anything, the survey results suggest that they may even be more aware of this linkage than most other groups in the community.

A second finding of the study was that the need for a sewerage system in the District would appear to be a priority for many residents, particularly those without such services at the moment, and that most seem prepared to pay for it. However, without the provision of an adequate and constant public water supply, the potential benefits of any improvements to the sewerage system may be very limited, and local resident's present willingness to pay for it may be reduced.

One of the findings of the 1990 Census that was not confirmed by this study was the size of the average household in the National Capital District. The reason for the discrepancy of the present survey's result with the 1990 Census is not entirely clear. In any event, it would appear that the actual average size of local households could be as much as much as fifty percent greater than the census figures suggest, although not quite as high as those given in the Wilbur Smith report.

The following elaborates on the responses given to the questions asked in the survey.

3.2.2   Household size

The survey results suggest that average household sizes in the National Capital District range from a low of 8 per dwelling in the town area, to almost fifteen per dwelling in the water villages, with an overall average of 10.2 people per dwelling. This compares to average household sizes identified in the 1990 Census of between 4.7 and 9.5 for the same areas. While an average of two to three of the household occupants identified by the respondents in the present survey were described as "visitors", they were still clearly utilising the services and facilities available to the permanent residents of the dwelling and must be catered for in any planning for public facilities. Throughout the District it was not unusual for surveyors to find twenty or even thirty people living in a standard low cost dwelling.

The significant discrepancy between the results of this survey and the last census is very difficult to explain. For the surveyors, the question of occupancy is one of the least difficult questions to ask or to translate, so the response should be reasonably accurate. It could be theorised that some of the difference might be due to the high education levels of the respondents. Perhaps such households attract more people to live in the house because of the respondent's higher earning capabilities.   However, in the present survey there was no significant difference in the household size of respondents with less than 3 years of school to confirm this theory, even in the squatter areas. Moreover, the discrepancy in household size was similar across all areas of the city, and for all types of dwellings.

3.2.3   Length of occupancy

There were no surprises in this area, with the average tenure of occupants distributed fairly evenly between the groupings of 1 to 4 years, 5 to 9 years and 10 to 19 years. The occupants of the water village were the District's most permanent residents with two thirds of respondent households in these areas having lived in their dwelling more than 20 years. This shouldn't be surprising, of course, for reasons noted by one surveyor below:

"The occupants of this [water village] house have never lived anywhere else. This is their village and their house."

Also perhaps not surprisingly, the Town area with its numerous apartment complexes and rental accommodation contains the largest percentage of transient residents, i.e.. those who have lived in the area less than a year.

3.2.4 Quality of dwelling

To get an indication of the relative general contentment of residents toward their own housing, respondents were asked whether the previous house they lived in was similar to, better or worse than their present one. More than half thought it was similar, but a significant number did not. Nearly thirty percent thought they were now living in a worse house than previously. This was more than fifty percent more than those who felt they were now living in a better one. In a "normally growing" community, the latter two figures are usually the same (but proportionately smaller), or reversed.

Not surprisingly, the squatter areas contained some of the higher levels of discontentment, but despite a similar lack of access to some public services, people living in the water villages showed the lowest level of discontentment with their housing of any area in the city (as also demonstrated by their unusually long occupancy rates).

3.2.5 Home ownership

Overall, approximately half of all households interviewed live in rented dwellings and forty five percent live in dwellings that are fully owned without a mortgage. These figures are roughly similar to data from the 1990 census. Some areas of the city however, have a relatively high level of rental units, particularly the Town area, Boroko, Six Mile and Gordon. An excessive number of rental units in any area can leave it exposed to unusually high decay rates because rental occupants often have less personal interest in maintaining their dwelling than owner occupants. This can have implications for the maintenance of public services in such areas. Interestingly there is an extremely high level of home ownership in the both the water villages (93%) and the squatter areas (83%) indicating a potentially high level of commitment of local residents to these areas (despite the lack of contentment among the latter). For all presently non-sewered areas, the average home ownership level is approximately 70%, i.e. 40% higher than average.

3.2.6 Land ownership

Land ownership is very complex in the National Capital District and from the results of the survey it is not entirely understood by either the residents or the surveyors undertaking the survey. As a result, the data in this area may be somewhat suspect. The results suggest, however, that overall, seventy five percent of all those surveyed live on Government land (including forty five percent in planned settlements and four percent in squatter villages), twelve percent live on traditional land (including two percent in squatter settlements), and ten percent live on what the occupants perceive to be privately owned land. Technically, most privately owned land is probably either traditional land or Government owned land despite the occupants belief that it is theirs alone. However this is not entirely the case, as one respondent pointed out:

"This land was owned by . . . , an Australian, the woman's husband. He left the place and went to Australia, and died last year (1996). There is now controversy between the State, ombudsman and them as to who is the rightful owner of the land."

3.2.7 Adequacy of existing public facilities and services

Respondents were asked to consider a list of 15 different existing public facilities and services and indicate which ones they presently considered adequate for their needs. The purpose of the question was to get an indication of the relative importance of sewerage collection as a public service. (Sewerage collection was not the first service prompted from respondents).

With the exception of public roads, resident's views towards the provision of all services generally decreased as the quality of their housing decreased, with those living in squatter housing least happy with the public services provided. Typical of many replies, one respondent said:

> "Need general sewerage and water system. Also need a clinic and police station as they're far away. Can't go there due to harassment by street kids"

As for roading, most residents, except those living in high cost housing, considered it to be the best public facility of all those included in the survey. This may suggest that the priority of roading improvements can now perhaps be reduced in favour of other needed public utility and service improvements in the District, such sewage collection and water supply.

Regarding public attitudes toward existing sewerage collection and treatment services, generally speaking, this service was considered less adequate than most other existing services. Primary schools, medical facilities, public roads, bus services, water supply and power supply were all considered more adequate. Considered less adequate than the provision of sewerage collection, however, were the provision of fire services, public toilets and telephones. The adequacy of existing high schools, police services and rubbish collection were ranked similar to the adequacy of existing sewage collection services in most areas.

Not surprisingly public perceptions about the adequacy of the public sewerage system varied markedly from area to area Those presently without a public sewerage system consistently ranked it higher in relative importance than those now serviced by one, but even in areas fully serviced with a sewerage collection system, there was a greater level of discontentment with this service than with some other services in the area, such as public roads and electricity supply. Part of the reason may be because most members of the public have a fairly good understanding of the link between public hygiene and public health, and public health was not particularly good in most areas (see sections on health and education). But unsolicited comments from a number of respondents gave another possible explanation why.

> "Lack of water in this suburb for the past 6 years has contributed to the problems in disposing of sewage from this household" said one respondent'

Another noted that;

> "without our own private electric pumping system, water would need to be purchased regularly. . .The low water pressure adversely affects flushing toilets."

Many respondents complained that they often faced clogged or full toilets because low water pressure often did not allow adequate (or any) filling of their toilet cisterns. It was a problem raised by respondents in many parts of the city, and will obviously need to be addressed and resolved before any existing sewerage system is extended to any significant degree. It may also indicate that scarce resources may be more appropriately spent on improving other even less adequate public services, such as fire services and the provision of public toilets in the meanwhile. (Public toilets consistently ranked across all areas of the District as the least adequate of those public services ranked in the survey.)

3.2.8 Source of water

On average, two thirds of all respondent households in the District get their water from water taps inside their own dwelling. This figure is less than what other studies have identified. Another quarter of households get their water from a standpipe outside their dwelling, while the remainder (7%) primarily obtain it from tanker delivery or from a roof rain water collection system.

In presently unsewered areas of the District, however the breakdown is quite different. Only twenty eight percent get water from a public water supply directly into the house. In these areas fifty seven percent of households get water from an outside standpipe, six percent from rainwater tanks, 7 percent from tanker delivery and two percent from either rivers or standing water.

In the water villages 14 percent of respondent households rely on roof tank rain water supply systems and another 18 percent rely on tanker delivery.

Presumably due to the metering of most public water, ten percent of households which have public water inside their homes do not use their internal supply for washing or bathing, only for drinking. This implies that metering does have an effect on improving the efficient use of potable water. But it may also be encouraging more public exposure to health risks, as in some areas where this practice was prevalent, there was a higher incidence of stomach pain, diarrhoea and skin diseases (although there was no consistency in this link).

The practice would also appear to make the poorer members of the community more concerned than others about who has free access to the public water supply (see discussion on method of payment).

3.2.9 Availability of safe drinking water

Directly related to a number of health issues is the availability of safe drinking water. While the results of this survey indicate only the opinions of respondents rather than actual fact, it is significant, none the less, that more than half (58%) of the National Capital District

households consider they do not always have access to safe drinking water, and more than twenty percent believe they don't have access to safe water for one or more months a year (not necessarily continuously). In the Town area, the water villages and the squatter villages, this figure of inaccessibility to drinking water for at least one month rises to above forty percent of all respondent households.

There was a perception among many that the water supply had improved recently, however a common comment was:

> "Why is the water supply cut every night at 9 Pm around the . . . Area (almost every area of the District was mentioned by one household or another.)
> or,
> "Water is a big need. Other services will come later. Please improve water problem quickly. It is a big need!"

This is, unfortunately, a relatively serious problem, and as mentioned previously, would appear to be having a significant impact as well on the adequacy of existing (much less future) sewerage collection services

3.2.10 Type of toilet used by households

Overall 62% of households surveyed have access to a private toilet which flushes into the public sewerage system, and twenty percent use a private pit latrine (largely, but not entirely in areas of squatter housing and houses near the coast). Other significant toilet types include pan toilets (2% overall) and toilets which drop directly into the sea (5% overall). In the water villages toilets which dropped directly to the sea were used by 75% of respondents. The outdoor open "bush" was indicated as the primary toilet in 2 percent of respondent households overall, with a surprising 3 percent of households in the Town area resorting to the "bush" (particularly near the wharfs). In squatter areas "bush" use rose to seven percent, and on average throughout the district, in areas not presently serviced by a public sewerage system, 4% of households resorted to the "bush" for their primary toilet.

Use of "bush" toilets did not appear to be a preference of most households who used them, they simply had no choice. Said one respondent, typical of others:

> "Urgently need a toilet. No toilet for 20 individuals due to no space to dig a pit toilet. Really need a toilet!"

Bearing this in mind, one interesting point to note is that even in areas where there are now public toilets, no respondent indicated they used them as their primary toilet, possibly (according to comments received from interviewers) because respondents considered they were inadequately maintained.

3.2.11 Materials put in toilets

Toilet paper was identified by respondents as the primary non-human produced substance deposited in toilets, as expected. However toilet paper was clearly seen as a luxury among many

households, particularly in the squatter and water village areas where newspaper was generally equally preferred. The survey also found a relatively low level of disposal of other rubbish, although this could have been partly because it was a difficult question for the surveyors to prod respondents about.

Surveys involving both female interviewers and female respondents tended to identify more things going into toilets, particularly women's things. Even with the embarrassment, however, "women's things" were still identified as being deposited in toilets in 12 percent of households. Although such activity was higher where households used pit toilets, it was relatively high still for publicly sewered areas, indicating possible exacerbating reasons for the impact of low water pressure on existing flush toilet use.

3.2.12 Method of rubbish collection

A factor in determining what is put into toilets, of course, is the type of rubbish collection system available to households. Generally there was a direct correlation between the method of household rubbish disposal and the type of toilet used by that household. Households with pit latrines, for instance, rarely had any organised rubbish collection and rarely used the public rubbish dump. This suggests that any sewerage system extended into non sewered areas would also have to be accompanied by an improved rubbish collection system Otherwise the existing rubbish disposal problems in these areas might be exacerbated, and the new sewerage collection system might be abused as an alternate rubbish disposal system.

3.2.13 Household employment

Adult employment levels uncovered through the survey roughly confirm those identified in the 1990 census. The latter suggested 42 percent of the total adult population was employed. The figures in the present survey indicate a slightly higher figure of 47% of the adults in respondent households in employment. The survey also identified 18 percent of household adults unemployed and looking for work, a figure similar to that in the 1990 Census. (The remaining adult members being elderly household members, those raising children, doing other unpaid work or otherwise not looking for employment.)

Total adult employment levels were highest in the Town area (68%) and lowest in the areas with large concentrations of squatters, such as Nine Mile (35%). On average one in ten households in the district did not have any full time working adult male in them (although a few of these did have a full time working female). The number of households without an employed male rose to three in ten in some parts of the city, most notably, the Kila Kila area.

3.2.14 Weekly household income

This survey took a great deal of effort to understand the income and expenditure patterns of local households. However nearly one in six respondents considered this subject too personal to tell the surveyor and were unwilling to provide the requested information. Other's who did respond may have intentionally given incorrect information. One surveyor noted on his survey form:

"I have found a problem that I think this woman might be lying about some things

that I see."

Aware of the potential problem, the survey organisers carefully checked the survey returns for possible distortions, and at least one was noticed, as mentioned below. It is believed, however, that the data for the most part, is reasonably accurate.

Of those that responded to the survey, on average, income for roughly half of the households in the district fell in the area between 100 and 500 Kina a week. In areas such as Gordon, Hohola and the water villages, the number of households in this income bracket rose to over sixty percent.
On average, sixteen percent of households had an income greater than 500 kina a week and a similar proportion of households had an income of less than 25 Kina a week.

The latter figure appears to be somewhat suspect, however, because while most respondents in this category lived in low cost housing and squatter villages, 11% lived in what the enumerators considered to be "high cost" housing. This is probably largely an indication that the economy of the Country is not buoyant at the moment, but it may also indicate some distortion in the reported income of some households. The distortion at worst, however, is probably not more than three or four percentage points (which is almost within the overall tolerance of the survey, anyway.)

Not surprisingly, income distribution varied significantly between different areas of the district. In the Town area, for instance, forty five percent of respondent households earned more than 500 kina a week. But in the squatter areas this figure dropped to only 4 percent of respondent households. Those households living on minimal incomes (less than 10 Kina a week), however, were relatively evenly spread right across the district (except for the Tokarara/Waigani/University area, which had an unusually high number of "subsistence" income households (17%) . . . possibly because of the high number of students living in the area).

3.2.15 Weekly household expenditure

The survey uncovered some substantial differences in expenditure patterns among different household types, but in some areas, not as much as might be expected by the differences in income levels. Occupants of squatter areas did tend to spend less on food than those in high cost housing, but not significantly less.

In squatter areas where housing occupancy rates averaged 9.2 people per dwelling, fifty five percent of households spent more than 25 kina a week on food. This was only ten percent fewer households than in high cost housing areas (at 65% of households), and some of this difference can probably be attributed to the ten percent higher household occupancy rates that high cost houses have compared with squatter houses (at an average of 10.1 occupants per dwelling).

Similarly, schooling would appear to be an equally large expense of households across all geographical areas of the community and across all housing types. It is generally the second most significant household expenditure after food for houses with children. (although in the

squatter areas, school expenses tend to consume a greater proportion of the total household budget.)

The ability of all households to devote such similar, relatively large sums of money on food and schooling despite obvious differences in income levels and housing types may be because there is a much higher level of outright home ownership in the "poorer" communities. Occupants in these areas do not have to spend as much of their cash income on mortgages or rent and as a consequence have more to spend on things like food and schooling.

This would not explain the entire difference, however. It may be that all households regard both schooling and food as more important than any other item and are prepared to pay for these two things at the expense of all others. This could logically be expected for food, but it is somewhat surprising that it also seems to pertain to schooling. It suggests that education is highly valued and that perhaps schools would be a source of information for households that would be taken very seriously in any health education program that might be undertaken. (See also method of health education of respondent).

The effect of existing high home ownership levels in unsewered areas of the community raises one serious concern, however. If new sewerage services are extended into such areas, it is likely that improvements to housing in these areas will also eventuate, and the debt level and expenditure patterns of households in these areas might then change significantly. Other discretionary income, for instance might be significantly reduced to finance such improvements, and the apparent present local willingness of residents in unsewered areas to pay for such services, now comparatively high (see next section on reasonable fees) might drop as a result.

3.2.16 Reasonable fees for water and sewerage services

Generally there was a surprisingly strong correlation between the fee that households were willing to pay for water supply and what households were willing to pay for sewerage collection, although the latter was consistently slightly less than the former. This may partly be due to the "leading" way the two questions were asked in the survey, with the question on water fees directly preceding the one on sewerage fees. (This was done on purpose.) But it suggests, never the less, that if given the opportunity, time and information, residents can see the relationship between the two services and more importantly, would be willing to pay for them both.

The fees that were considered most reasonable (by nearly one third of respondent households) were in the 5 to 9 Kina per week range, even in squatter and other lower cost areas of the district, and nearly thirty percent of respondents (including those in the squatter areas) expressed a willingness to pay even more.

Such conclusions, however, should not ignore the fact that a large minority of households (nearly 20% of respondents on average, and up to 30 percent in some areas, including in the water villages) did not feel they should have to pay any separate fee at all. In addition, one in six households may not be able to do so even if they wanted to, as they have described their average weekly income as being less than 25 Kina a week.

3.2.17 Preferred method of fee payment

Perhaps because of the relationship that most respondents could see between water supply and sewerage collection services, there was strongest support for any sewerage collection fee to be based on the amount of water used by each household. Judging by several comments from the interviewers, this may be because under such a system local residents feel they would have more control over their own costs for the service. A common complaint in some areas where water costs were shared (some flats, working housing, etc.) was that other users abused the service and took more than their fair share.

Such a system of payment would have several obvious advantages to the service provider as well, particularly in ensuring payment (as it could be included with existing water bills, and the threat of turning off the water supply would be a strong motivation to pay.) It is also the preferred sewerage service payment method of those living in most lower cost housing areas and squatter villages who would be most impacted by the cost of such a service.

Those in higher cost houses or living in higher quality neighbourhoods slightly prefer paying a fixed standardised rate although most also liked the variable fee system based on water usage as well. Bearing in mind that no method of charging for sewerage collection received even fifty percent support from respondents (even though respondents could choose more than one option), this limited response suggests that a carefully planned public education program to explain why and how such services will be financed may need to be considered before any fees are actually charged for sewerage collection services.

3.2.18 Household sicknesses last year

Nearly three out of every four households had a member who was sick with malaria or high fever last year, and nearly half of all households had someone sick with diarrhoea. An almost equally large percentage experienced stomach pain, and more than one in four had a member who suffered skin diseases. Partly such high figures can be attributed to the high occupancy rates of households, as the chance of having at least one person sick rises proportionately with household size. But even taking this into account the figures are still higher than could be considered acceptable. Thy indicate a general, widely experienced health problem which represents a substantial cost to the community. Fortunately, it is one that can usually be reduced with improved sanitation services and facilities.

Interestingly, however, squatter areas in the National Capital District show no higher incidence of sickness than anywhere else in the district (even after considering the education bias of the survey). In fact the areas which experienced the highest malaria/high fever related sicknesses were Waigani, Tokarara and Hohola. Respondent households in these areas also experienced the highest incidence of skin disease. It is probably coincidence, but these areas are also more fully serviced by a public sewerage system than most others.

One area not mentioned above where respondent households also experienced a relatively high incidence of skin disease was the coastal area of the District, particularly households in the water villages. This would tend to support the casual observation that the sea in these areas is polluted and the local residents are experiencing some of the effects first hand.

3.2.19 Public understanding of the linkages between the environment, hygiene and health

Household respondents were asked nine questions about some of the basic relationships between personal hygiene, personal health and the environment to determine how well they understood this relationship. More than 90% of households knew that they should always wash their hands after going to the toilet. (Removing the higher education bias of survey respondents actually increased this percentage.) Repeatedly across the district, surveyors were told:

> "Sick because of sewerage problems. Need good sewerage and water."
> and
> "A sewerage [system] must be put in place so that it won't cause any harm to the environment."
> and
> "The sewerage system must be planned properly so that it can last long and not bring disease."

What was perhaps more surprising about the response to the question on hand washing, was that the respondents in squatter housing were more aware of this fact than the survey respondents in almost every other type of household in the district. The only exception was the resonse obtained in the water villages where virtually 100 percent of households were aware of this fact.

Generally, the same high level of understanding of the link between health, personal hygiene and the environment was repeated in the eight other questions asked, with the "lower" quality housing areas tending to indicate at least the same, if not a better understanding of the link between environment and health issues than the general public.

The subject area canvassed by the survey that was least understood was the impact of pollution on shellfish and other marine life and the linkage of that back to various sicknesses experienced by household members. One respondent living in a water village said:

> "Organisms and animals on land are unhealthy due to pollution, but those living under the sea or water are healthy and safe to eat, like shell fish, etc."

Nevertheless, two thirds of all respondents did recognise the linkage, and the people in the water villages were again the most aware of it.

Overall, the results would suggest that there is already an effective health campaign in operation in the water villages and other unsewered parts of the district (either formally or informally), or that people have simply learned such linkages by having to live with the consequences.

In either event, Public understanding of the problem is already very high, and any additional funds that may be targeted for health education would probably be better spent on the needed

public works themselves (sewerage and water systems) or on the medical facilities caring for the consequences of not having these systems.

Notwithstanding the above, It would also suggest that if there are further new initiatives in health education, such as a program to explain the need to charge fees for the provision of a public sewerage system, it should perhaps be aimed at the general public rather than at specific areas of the community where such improvements might be made, because all residents of the District would stand to benefit from such information.

3.2.20 Source of health, a sanitation education

Survey respondents were asked how they learned what they already knew about health and sanitation matters. This was done because any measures taken to educate the public on the need for, or method of, providing new sewerage collection and treatment facilities in the district need to be cost effective and be designed to target those who most need to receive the information.

The results show that local schools are clearly the largest source of information for respondents, even for those who had not completed grade 3. Radio was the next most successful general health education media, followed closely by television and newspaper. In some areas, most notably in coastal areas, local hospitals, clinics and aid stations also played a significant role, almost matching the importance of schools.

Coupled with the knowledge that most households would appear to consider schooling extremely important (according to their expenditure patterns), any public effort to educate the public on health, hygiene and environmental matters or on the sewerage plan should probably be focused on educating cildren (and through them with material taken home, their parents) particularly primary schools where most households would be accessed.

However, while schools are the primary source of household information on health and the environment overall, in some areas, including squatter areas, such efforts would only reach 60% of the households. Thus it would be prudent to also target at least two other potential educational tools for such a campaign, such as the radio and local clinics. These latter two are the next most used sources of information in existing non-sewered areas of the District.

3.2.21 Public response to this survey

Finally, it is perhaps important to mention before closing, some general public responses to this survey and how it was conducted. It was not an easy survey to undertake for many reasons. These included;

- The existence of many languages in the surveyed area, with English not spoken at all by at least one third of the population,
- The existence of serious neighbourhood difficulties and criminal "rascal" behaviour which made residents extremely suspicious of the surveyors,
- The timing of the survey, which occurred during the national election campaign period after serious political unrest, by students who were at the same time trying to study for

exams.
- The large number of surveyors (79 altogether) who each had to be trained to conduct the survey and who each was a potential (inadvertent) source of survey bias.

One student surveyor noted:

> "During my survey I experienced the full owing. Father was drunk, father was tired and sleeping, father went to his village, wife and husband out of the house and only the children are at home. Therefore I had to ignore those households"

Another said;

> "Man claimed that settlements are continuously being researched by uni students for their degrees. Uni students get their degrees while they don't get their services. He feels its unfair.

Nevertheless, for the most part, the survey would appear to have been well received by those who participated in it. Typical of several comments, one surveyor noted:

> "The household was very happy for such a survey. He said through this [Inhabitant's Behaviour Survey] people in the top levels will understand our problems."

The survey coordinators hope that this report will help do just that.