

PROVINCIAL WATER PROJECT EVALUATION
INTERIM MONITORING SURVEY RESULTS

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EXECUTIVE SUMMARY

This report, the second of three reports in the evaluation of the Provincial Water Project in the Philippines, presents the findings of eight quarterly Interim Monitoring Phase (IMP) surveys conducted in the provincial cities of Cagayan de Oro and Marikina during 1980 and 1981. The purpose of the IMP round of surveys was to document significant developments in the operations of the new water systems financed by the project, as well as changes in water related behavior and health status indicators that had taken place since the new water systems began operations. A socio-economic profile of the study population and pre-project measurements of the evaluation impact variables are presented in the June, 1979 report Implementation of the Provincial Water Project in the Philippines: Baseline Survey Results. There will also be a final project report detailing on project impacts over the full five year study period.

The evaluation was designed to address important questions concerning the effects of improved quantity and quality of water to households in the two provincial cities. In particular, the evaluation will focus on the availability and quality of water at the household level, the use of water for drinking and the effects of providing sanitary water upon health, sanitation, and sanitary practices. The evaluation will also investigate the statistical relationship between water availability variables and health and nutritional indicators as an attempt to identify the effects of these variables.

The evaluation was designed and is being implemented by an evaluation team consisting of staff members from the Department of the Philippines Local Water Utilities Administration, Evaluation Division, and of the International Institute for Water Control, both located in Manila. All data will be collected, processed, and analyzed centrally in the study, and being performed under the supervision of staff trained for the evaluation. The project was provided by the Department of International Development, Bureau for Asia, and coordinated by the Office of International Planning, Evaluation, and Studies.

Major Findings of the Interim Monitoring Surveys

Since the completion of the construction of the new water systems (1978-1979) and 1979-1980, the number of active connections has increased markedly in both cities (1980 population figures are 100,000 and 100,000, respectively). During the study period, 100% of the water connections have been successfully installed. The percentage of water supply to "connections" in the study area is 100% in Cagayan de Oro and 95% in Marikina. The connection rates on the other hand (about 3 percent) for the connections in the two provincial cities are very low. This finding, one of interest in that it might be a good indicator of

number of active connections in 1981. The reasons for the disconnections and their implications for Water District operations will be explored in the final project report.

While the number of system connections has increased rapidly in both cities since the new systems became operational, consumption of city water on a per connection basis has not increased significantly during the 1978-1981 period. A contributing factor might be the rate increase implemented by both water districts during this period (there were, in fact, two rate increases in Bacolod). The fact that a substantial number of primary users of city water continued to use water from other sources for some household purpose may also partly explain the lack of growth in the consumption of city water per connection during the IMP period.

It is estimated that by 1981, 82 percent of project area households in Cagayan de Oro and 54 percent of the covered project area households in Bacolod were using city water as their major source of water. This represents a 26 percent increase in Cagayan de Oro and 17 percent in Bacolod since the baseline survey. City water was used most frequently for drinking (85 percent of households in Cagayan de Oro and 55 percent in Bacolod) and cooking (81 and 50 percent respectively). Primary users of city water, however, continued to use other sources of water for some household purposes in substantial number during the IMP period, most notably in Bacolod. The use of city water for drinking and cooking by households whose major source of water was non-city water was quite common in both cities.

Water was available 24 hours a day to nearly all households (94 percent) in both cities during the IMP period, with only non-project area households in Cagayan de Oro reporting the unavailability of water 24 hours a day in significant numbers (20 percent). The survey data indicate, however, that the supply of water was most adequate for users of city water. Fewer households using city water as their major source desired more water for selected household purposes than did project area non-user and non-project area households. Further evidence is provided by the data on the storage of water where primary users of city water stored water in significantly smaller number than did non-user and non-project area households. Nevertheless, it is noteworthy that more than half (52 percent in Cagayan de Oro and 63 percent in Bacolod) of the households using city water as their primary source continued to store water during the IMP period, although this represents a significant decline (from 95 and 88 percent respectively) since the Baseline Survey.

The results of bacteriological analyses performed both by the respective Water Districts and by the LWUA as part of the IMP surveys indicate that the quality of drinking water had improved in both cities during the 1978-1981 period. The Water District analyses indicate that by 1981 more than 90 percent of samples tested in both cities were judged to be safe. The IMP analyses, which take into account the means households use to obtain and store water as well as the quality of water at the source, indicate a substantially lower level of safe water, most

notably in Cagayan de Oro. Overall, a higher percentage of city water users had safe water than did households using other sources. The survey data, interpreted in the light of the results of the Water District analyses, point to the fetching and storing of water as sources of contamination.

While the health and nutrition data were not subjected to statistical analyses for this report, there seems to have been an improvement in the health indicators since the Baseline Survey, particularly in the incidence of diarrhea in Cagayan de Oro. A full assessment of the health impacts of the project will be performed in the final project report.

I. Evaluation Plan

A. Evaluation Study Background

On May 23, 1974, a loan agreement establishing the Philippine Provincial Water Project was signed between the Government of the Philippines (GOF) and the United States Agency for International Development (USAID). The primary purpose of the project was to develop water systems in selected urban areas that would provide safe water on reliable and economic basis to a significant proportion of the population. Concomitant with this project was the design of an evaluation study that was intended to measure the system performance levels, as well as the health and economic impacts of the project. Two of the five cities (Bacolod and Cagayan de Oro) included in the project were selected for evaluation. Data for this evaluation are to be provided by ten household surveys, including a Baseline Survey, eight rounds of smaller scale, quarterly Interim Monitoring Surveys, and a Follow-up Survey. Additional data are to be obtained from records maintained by the Water Districts and other agencies.

A summary of the time schedule of data collection activities for the project evaluation is presented below.

<u>ACTIVITY</u>	<u>BACOLOD</u>	<u>CAGAYAN DE ORO</u>
Baseline Survey	January- March 1973	Oct.-Dec. 1977
Interim Monitoring Survey	1. Dec. 1979 2. Mar. 1980 3. June 1980 4. Sept. 1980 5. Dec. 1980 6. Mar. 1981 7. June 1981 8. Sept. 1981	Dec. 1979 Mar. 1980 June 1980 Sept. 1980 Dec. 1980 Mar. 1981 June 1981 Sept. 1981
Follow-up Survey	January 1983	November 1982
Final Report	August 1983	August 1983

Each data collection phase is followed by a data processing phase, after which the results are analyzed and reported.

The results of the Baseline Surveys in the two study cities are presented in a report entitled Evaluation of the Provincial Water Project in the Philippines - Baseline Survey Results. The report, issued in June 1982, also documents the analytical plans for the study and the methodology employed.

This report presents the findings of the eight quarterly surveys comprising the Interim Monitoring Phase (IMP) of the Provincial Water Project. The Local Water Utilities Administration, with the assistance of the U.S. Bureau of the Census, managed all survey related activities during this phase of the project evaluation.

A final report assessing the observed changes in the key indicators from the Baseline Phase to the Follow-up Phase will be issued after the Follow-up Surveys are completed in 1983.

B. Purpose of the Evaluation Study

The evaluation of this project was requested by AID for the following purposes:

1. to provide information on the health impacts of improvements in water systems;
2. to assess the performance of the LWUA in constructing and maintaining the water systems; and
3. to establish a framework for the evaluation of future water projects.

One of the main concerns of the evaluation team was that a fundamentally sound approach to impact evaluation of water projects be developed. It was recommended that the basic study design be expandable to accommodate larger, more comprehensive studies, reduceable to some smaller form for special purpose studies, and applicable to projects in other developing countries.

The major questions to which the evaluation study is directed include the following:

1. How are the water systems performing?
2. Who is using the water from the new systems?
3. What are the short and long-term health, economic and social benefits to the users of the water systems?
4. Are there causal relationships between the improved water systems, water use and the observed short and long-term benefits?
5. What are the preferred health and socio-economic measurement techniques for this type of evaluative study?

C. Study Design

1. Research Design

In order to obtain valid measurements of the health and economic benefits from the improved water systems, the study adopts a quasi-experimental design using three study groups. Two of these groups are experimental groups in areas served by the project, while the third is a control group located in areas which are not to receive city water connections within the study period (January 1978 - January 1983). The three study groups for the evaluation are as follows:

Experimental Stratum I consists of households using piped water from the city water system as their major source.

Experimental Stratum II consists of households located in the project area whose major water source is not the existing city water system; and

Experimental Stratum III consists of households in non-project areas.

The research design is illustrated in the following diagram (where X's represent interventions and O's represent measurements).

	<u>Baseline Survey</u>		<u>Interim Monitoring Survey</u>		<u>Follow-up Survey</u>
Stratum I	O ₁	X ₁	O ₂	O ₃	O ₉ -----O ₁₀
Stratum 2	O ₁	O ₂	O ₂ X ₂	O ₃ X	O ₉ -----O ₁₀
Stratum 3	O ₁		O ₂	O ₃	O ₉ -----O ₁₀

O₁ represents the Baseline Survey conducted before the project implementation, O₂ to O₉ represent the eight quarterly monitoring surveys, and O₁₀ represents the follow-up survey.

X₁ represents the intervention of improved water service to households previously connected to the old city water system, while X₂ represents the accessibility to the new/improved water system for those households in the project areas whose major water source was not the old system. The X₂ intervention will occur over time as more households choose to connect to the system. Thus, it is also shown after O₂ and O₃, O₄, etc.

The design lacks the equal number of observations both before and after project intervention that is characteristic of classical experimental designs. However, the use of a comparison group allows comparison of trends in effect and impact indicators over a 4-year period after the treatments are introduced, in addition to comparisons between the baseline and subsequent observations.

2. Variables Included in the Study

The following is a list of key variables to be used as indicators in the study.

Health Impact Variables

Incidence of diarrhea among children
Nutritional level of children

Economic Impact Variables

Household income
Income from water related activities
Days absent from work
Medical expenses
Fire damages
Time spent fetching water

Characteristics of Water Supply

Water quality
Type of water source
If supply is enough

Factors Affecting Water Quality

Storage of water
Boiling of water
Treatment of water with chemicals
Filtering water

Factors Affecting Susceptibility to Diseases

Breastfeeding of children
Nutritional Status of children
Washing hands, dishes, fruits
Garbage disposal
Waste water disposal
Location of bathroom
Sharing of bathroom
Type of toilet
Location of toilet
Sharing of toilet
Disposal of toilet water

Characteristics of Households in the Study Areas

Demographic variables
Level of living indicators

II. The Interim Monitoring Phase (IMP)

The Interim Monitoring Phase was conducted for the primary purpose of documenting significant developments in the operations of the new water system and the extent of changes in the health status indicators and water related behavior of the Bacolod City and Cagayan de Oro City residents. Specifically, this phase seeks to ascertain the short term effects of the new or improved water systems on the quality, use and supply of water, as well as on the health and nutritional status of the household members. The IMP will seek to answer the following types of questions:

1. Has there been an improvement in the availability of water since the new system started operations? Does the improved system meet the needs of the population served? How efficiently are the new systems operating?
2. Have there been any changes in the patterns of water usage among study groups since the improvement of the water system?
3. Has quality of water among households within the project areas improved since the new or improved system became operational?
4. What changes, if any, are observed in the health status of the household members, particularly among children under five years of age?

The data generated by the IMP surveys are to be utilized in this report in several ways to address the research questions specified above. In addition to examining the IMP quarterly data for trends in key indicators, the eight IMP quarterly surveys will be combined into a single set of estimates with a time reference at the midpoint of the IMP survey round (approximately November 1980) and compared with the baseline survey data in order to assess the extent and nature of changes that have taken place since project implementation. The combined quarterly data will also be utilized to examine cross sectional relationships among key indicators, once again with a time reference at the midpoint of the IMP surveys. For the purpose of monitoring significant project developments, data from other sources are also included in this report. Relevant data gathered by the LWBA from the Water Districts in Cagayan de Oro City and Bacolod City were included in order to provide a context for the interpretation of the baseline and IMP survey data, as well as to provide information on variables not covered by the household surveys.

III. Research Methodology

A. Research Instruments

Much of the data contained in this report were obtained on the basis of sample surveys designed to meet conventional scientific standards. Relevant data were collected from sample households using a household survey questionnaire and a reporting form for bacteriological tests of water samples. The height and weight of preschool children were also measured using bar scales to determine their nutritional status, based upon conventional anthropometric measurement techniques.

B. Sample Selection for the IMP

The primary sampling units (PSU's) selected for the IMP surveys were the same PSU's that were selected for the Baseline Survey. These consisted of 81 blocks in Cagayan de Oro and 16 barangays in Bacolod. The objective of using the same PSU's was to minimize variability due to differences in sampled PSU's when comparing the IMP with the Baseline Survey results. The selection of households within PSU's for the IMP quarterly surveys was performed in two stages. First, an overall sample was selected in each of the cities consisting of 1,011 households in Bacolod and 993 households in Cagayan de Oro. The sampling procedure features utilization of the original first-stage (PSU) probabilities of selection and unequal allocation of sample households among PSU's to produce a sample which was self-weighting within sampling stratum (i.e. project and non-project areas). Following selection of the overall sample, households were allocated to one of the quarterly survey rounds (i.e., quarterly subsamples) using a systematic random selection procedure. Each quarterly subsample was interviewed once during the two-year period.

For a description of the Baseline Survey sample design, see the Baseline Survey Report.

To test the quality of water during the IMP phase, 10 percent of the selected households in project experimental strata were selected for Bacteriological analysis, while all of the control stratum households were included in the sample. Since it was thought that a large majority of households in the project areas would use piped water as their primary source of drinking water, it was felt that a 10 percent sample would yield sufficiently reliable measurements of the water quality in these areas. In the analysis, the bacteriological results from the 10 percent sub-samples were imputed for the remainder of the project households.

C. Data Processing

A computerized data processing system was developed for the IMP surveys. Data were keyed on ENTREX, which provided a limited degree of checking for valid values at point of data entry.

The data processing system consisted of:

1. a program which reformatted the original data that was keyed in fixed field format. This made data referencing more efficient in view of the large number of data items (over 200 for the IMP surveys);
2. a valid values edit program editing the binary questionnaire for keying errors;
3. an update and correction program which changed data values based on user input;
4. a list program which printed user-selected questionnaires;
5. a consistency edit program which checked internal record consistency;
6. a program which assigned weights to questionnaires;
7. several recode programs, written to create new variables from existing ones, for use in tabulations and variances calculations;
8. a tabulation program written in GENIS (Census Tabulations System); these tables, ranging from simple cross tabulations to complex analytical tables, were also modified and re-run to create percentage tables; and
9. a variance program which performed variance calculations.

D. Analysis of the INP Data

Unless otherwise indicated, all statistical statements contained in this report were tested using conventional procedures for tests of significance of difference in means and proportions (i.e. t-tests). In conducting the statistical tests, confidence intervals of ± 2 standard errors were adopted as the standard (i.e., the 95 percent level of confidence).

Differences significant at the 90 percent level of confidence are referred to in the text as "marginally significant". The estimated standard errors providing the basis for the statistical test were calculated so as to reflect the stratification and clustering procedures employed in collecting the data.

IV. Results

A. Water System Development

This section presents data depicting the operational status of the project water systems in the cities of Cagayan de Oro and Bacolod during the 1977 to 1981 period. The data presented in this section were derived from the records of the respective water districts. Complementary survey data describing the sources of water among study area households, patterns of water usage, water quality, and nutritional conditions are presented in subsequent sections.

Construction of the new city water systems in the cities of Cagayan de Oro and Bacolod was completed in 1978 and 1979 respectively, at which time each city water system had approximately 4,500 active connections. From 1978 to 1981, the number of active connections (residential and commercial) more than tripled in Cagayan de Oro and more than doubled in Bacolod (see Table 1). Rapid growth in the number of connections began earlier in Cagayan de Oro than in Bacolod, with quarterly growth rates averaging 13 percent during the mid-1978 to mid-1979 period as compared to just above 1 percent in Bacolod (see Table 2). In Bacolod, the most rapid growth occurred in the mid-1979 to mid-1980 period immediately after the construction of the new system was completed, averaging about 19 percent per quarter. In the last complete year for which data was available (1981), quarterly growth rates were 5 percent in Cagayan de Oro and slightly above 4 percent in Bacolod.

Table 1

Total Number of Active Connections to the Water District by City Water District, Year & Quarter; 1977-1981

<u>Quarter</u>	<u>WATER DISTRICT AND YEAR</u>				
	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
	<u>CAGAYAN DE ORO</u>				
First Quarter	4,032	4,741	7,543	11,007	14,147
Second Quarter	4,167	4,958	8,124	11,962	14,811
Third Quarter	4,311	5,824	9,206	12,824	15,682
Fourth Quarter	4,507	6,627	10,118	13,479	16,415
	<u>BACOLOD CITY</u>				
First Quarter	Data	4,286	4,414	7,738	9,709
Second Quarter	not	4,332	4,540	8,746	10,396
Third Quarter	Avail-	4,363	4,997	8,961	10,689
Fourth Quarter	able	4,375	6,016	9,370	10,980

SOURCE OF DATA: Bacolod City and Cagayan de Oro City Water District Records

Table 2

Percentage Growth Rate of Active Connections By City, Water Districts, Year and Quarter; 1977-1981

<u>Quarter</u>	<u>WATER DISTRICT AND YEAR</u>				
	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
	<u>CAGAYAN DE ORO</u>				
First Quarter		5.2	13.8	8.8	5.0
Second Quarter	3.4	4.6	7.7	8.7	4.7
Third Quarter	3.5	17.5	13.3	7.2	5.9
Fourth Quarter	4.6	13.8	9.9	5.1	4.2
	<u>BACOLOD CITY</u>				
First Quarter	Data	-	0.9	28.6	3.6
Second Quarter	not	1.1	2.9	13.0	7.1
Third Quarter	Avail-	0.7	10.1	2.5	2.8
Fourth Quarter	able	0.3	20.4	4.6	2.7

SOURCE OF DATA: Derived from Table 1.

The volume of city water consumed by residential and commercial customers of the Water Districts has also increased markedly since the new water systems began operations (1979 in Cagayan de Oro and 1980 in Bacolod). The data on cubic meters of city water consumed per year in the respective water districts shown in Table 3 indicate a growth pattern which roughly parallels the growth in the number of active connections in terms of the periods of most rapid growth in each city (refer to Tables 1 and 2). Overall, however, the average quarterly consumption of city water per connection has remained more or less constant in both cities since 1978 (Table 4), with only a minor upward tendency apparent in these data.^{2/} Average water consumption per connection was greater in Bacolod than in Cagayan de Oro during the 1978-1980 period.

Table 3

Total Water Consumption (in cubic meters) of Active Residential and Commercial Connections and Percentage Growth Rates by Water Districts: 1977-1981

<u>City</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
Cagayan de Oro					
cu. m.	1,845,972	2,012,858	3,750,225	4,909,897	5,638,840
% increase	-	9	86	31	15
Bacolod City					
cu. m.	2,083,773	2,308,660	2,767,624	4,911,431	Data not available
% increase	-	11	20	78	

SOURCE DATA: Cagayan de Oro City and Bacolod City Water District Records.

^{2/} These figures refer only to consumption of city water. As will be shown later, many of the households with city water connections in both cities also use other sources of water which are not reflected in the consumption figures presented here.

Table 4

Average Quarterly Water Consumption (in cubic meters) of Active Residential and Commercial Connections By City Water District, Year and Quarter: 1977-1981

<u>Quarter</u>	<u>WATER DISTRICT AND YEAR</u>				
	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
	<u>CAGAYAN DE ORO</u>				
First Quarter	110.1	86.1	99.8	96.4	85.1
Second Quarter	112.9	89.3	114.3	102.2	94.6
Third Quarter	103.0	84.9	108.4	98.8	94.2
Fourth Quarter	99.0	100.7	105.9	100.8	94.7
	<u>BACOLOD CITY</u>				
First Quarter	Data	130.5	146.5	118.1	Data
Second Quarter	not	135.0	143.0	132.7	not
Third Quarter	Avail-	128.2	134.3	144.9	Avail-
Fourth Quarter	able	138.2	131.4	164.3	able

SOURCE OF DATA: Derived from Table 1 and Quarterly Data on Water Consumption, Bacolod and Cagayan de Oro City Water District Records.

During the period of rapid system growth, both city water districts achieved substantial reductions in the volume of unaccounted for water, which consists of water wastage due to system leakages, illegal connections, etc. (see Table 5). In Cagayan de Oro, the volume of unaccounted for water as a percent of total production declines from 59 percent in 1977 to 18 percent in 1981, while Bacolod achieved a reduction from 67 to 22 percent during the same period.

Table 5

Average Monthly Percentage Per Year of Unaccounted for Water by City, Water District and Year: 1977-1981.

<u>City Water District</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
Cagayan de Oro	59	50	Data not Available	17	18
Bacolod City	67	66	56	40	22

SOURCE OF DATA: Cagayan de Oro and Bacolod City Water District Records.

Data on the rate of water service disconnections are shown in Table 6. Disconnections can be initiated either by Water District customers who are dissatisfied, or by the Water District for non-payment of service charges. Unfortunately, data disaggregated by the reason for disconnections were unavailable for this report. Nevertheless, the total rate of service disconnections provides some information on the magnitude of incompatibility between the providers and users of the Water District services in the two cities. Overall, the disconnection rates have remained at rather low levels on an absolute basis in both cities. It is, however, interesting to note that the number of disconnections as a percent of total active connections has practically remained constant over the years. This means that the number of disconnections has grown at a rate similar to the rate of growth in the number of active connections. It cannot be determined from the available data, however, how many of the disconnected customers were subsequently reconnected. This question merits further attention in the final project report when more comprehensive data should be available.

Table 6

Number of Disconnections from the Water District as a Percent of Total Active Connections By City Water District, Year and Quarter: 1977-1981

<u>Quarter</u>	<u>WATER DISTRICT AND YEAR</u>				
	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
	<u>CAGAYAN DE ORO</u>				
First Quarter	4.2	3.2	1.3	2.2	2.2
Second Quarter	2.7	2.9	2.0	2.0	2.6
Third Quarter	3.8	2.3	2.2	2.6	2.4
Fourth Quarter	3.0	1.4	2.1	2.8	2.4
	<u>BACOLOD CITY</u>				
First Quarter	Data	4.2	1.7	0.6	3.6
Second Quarter	not	1.0	1.6	0.8	1.9
Third Quarter	Avail-	3.3	2.5	1.7	4.5
Fourth Quarter	able	2.5	4.2	4.1	3.1

SOURCE OF DATA: Cagayan de Oro City and Bacolod City Water District Records.

Tables 7 and 8 show the rate structure applied to water consumption in the respective water districts. The service charge refers to the amount paid by concessionaires for the first 10 cubic meters of water, while the commodity charge is that amount paid per cubic meter in excess of 10 cubic meters.

Table 7

Cost of Water By Type of User and Meter Size, Cagayan de Oro City Water District: 1977-1981

Type of User & Meter Size	Types of Water Charges & Year	Service Charge		Commodity Charge	
		1977-1978	1979-1981	1977-1978	1979-1981
A. Domestic/Gov't.					
3/8	P	10.00	P 10.00	P .80	P 1.00
1/2		20.00	20.00	.80	1.00
3/4		32.00	40.00	.80	1.00
1		64.00	80.00	.80	1.00
1 1/2		160.00	200.00	.80	1.00
2		400.00	500.00	.80	1.00
3		720.00	900.00	.80	1.00
4		1,440.00	1,800.00	.80	1.00
B. Commercial/Industrial					
1/2		40.00	50.00	1.60	2.00
3/4		64.00	80.00	1.60	2.00
1		128.00	160.00	1.60	2.00
1 1/2		320.00	400.00	1.60	2.00
2		800.00	1,000.00	1.60	2.00
3		1,440.00	1,800.00	1.60	2.00
4		2,880.00	3,600.00	1.60	2.00
C. Wholesale					
1/2		60.00	75.00	2.40	3.00
3/4		96.00	120.00	2.40	3.00
1		192.00	240.00	2.40	3.00
1 1/2		480.00	600.00	2.40	3.00
2		1,200.00	1,500.00	2.40	3.00
3		2,160.00	2,700.00	2.40	3.00
4		4,320.00	5,400.00	2.40	3.00

SOURCE OF DATA: Cagayan De Oro Water District Records.

Table B Cost of Water By Type of User and Meter Size; 1977-1981, Bacolod City Water District

Type of User and Meter Size	Types of Water Charges and Years				COMMODITY CHARGE PER QUANTITY BLOCK												
	SERVICE CHARGE			COMMODITY CHARGE 1977-78	1979-1980 (in cu. m.)					1981 (in cu. m.)							
	1977-78	1979-80	1981		11-20	21-30	31-50	51-70	71-100	101 up	1st 10	11-20	21-30	31-50	51-70	100 up	71- 101-
A. Domestic/ Gov't																	
3/8	P 6.00	P 8.00	P 10.00	PO.60													
1/2	15.00	18.00	22.00	0.60	.70	.80	.90	1.00	1.20	1.30	included in the ser- vice charge	.90	1.00	1.10	1.20	1.45	1.55
3/4	24.00	29.00	35.00	0.60													
1	48.00	57.00	70.00	0.60													
1 1/2	120.00	144.00	177.00	0.60													
2	300.00	350.00	430.00	0.60													
B. Commercial																	
1/2	30.00	32.00	40.00	1.20													
3/4	48.00	52.00	64.00	1.20	1.25	1.45	1.60	1.80	2.15	2.95	included in the ser- vice charge	1.60	1.80	1.95	2.20	2.60	2.80
1	96.00	102.00	125.00	1.20													
1 1/2	240.00	260.00	320.00	1.20													
2	600.00	630.00	775.00	1.20													
C. Wholesale				1.80/cu.m.				2.50/cu.m.									3.50/cu.m.

SOURCE OF DATA: Bacolod City Water District Records

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Both water districts have increased the rates for water service during the 1977-1981 period. In Cagayan de Oro, both the service and commodity charge rates were increased in 1979. Service charges were increased for all but the two smallest meter size users among domestic/government connections, with the larger rate increases falling upon the larger meter size users. The commodity charge increases were constant for all meter sizes within user type categories, but varied by user type. In Bacolod, increases in both service and commodity charge rates were enacted in 1979 and again in 1981. All types of users and meter sizes were affected by these rate increases, although the magnitude of the increases varied both by user type and meter size. The Bacolod Water District also shifted from a fixed to a variable rate commodity charge in 1979, with unit costs increasing with the volume of water consumed.

Water District data on the average monthly water bill during the 1976 to 1981 period are presented in Table 9. In Cagayan de Oro, there was a substantial jump in the average monthly water bills from 1976 to 1977, after which the average cost of water per customer has remained relatively constant. However, since there was a rate increase in 1979, the fact that the average monthly bills and consumption in cubic meters has remained constant would imply that the composition of city Water District customers has shifted towards a greater number of customers in the lower rate categories (or both). In Bacolod, the incomplete data available suggest an upward trend in average monthly water service bills.

The implications of increases in water service charges for the rate of growth of service connections and rates of consumption of city water will be explored in the final project report.

Table 9

Average Monthly Water Bill (in pesos) Per Connections:
1976 - 1981

	1976	1977	1978	1979	1980	1981
Cagayan de Oro	29.55	46.98	49.33	47.03	47.10	45.45
Bacolod City	Data not available	Data not available	46.82	Incomplete data	57.26	Incomplete data

SOURCE OF DATA: Cagayan de Oro City and Bacolod City Water District Records.

B. Water Sources Among the Study Area Households

At the time of the Baseline Survey (the fourth quarter of 1977 in Cagayan de Oro and the first quarter of 1978 in Bacolod), 55 percent of project area households in Cagayan de Oro and 37 percent of Bacolod project area households reported using city water as their major source of water (see Table 10). From the IEP quarterly surveys, it is estimated that by 1981 nearly 81 percent of project area households in Cagayan de Oro and 54 percent in Bacolod were using city water as their major source of water. This represents a 26 percent increase in Cagayan de Oro and 17 percent in Bacolod since the Baseline Survey.

Table 10

Number and Percent of Project Area Households using City Water as their Major Source of Water by City and Time Period: 1977-1981

<u>Time Period</u>	<u>Cagayan de Oro</u>		<u>Bacolod</u>	
	<u>Number of Project Area Households</u>	<u>Percent of Project Area Households</u>	<u>Number of Project Area Households</u>	<u>Percent of Proj. Area Households</u>
Baseline Survey*	22,465	55	29,449	37
1980**	2,786	76	3,731	47
1981**	2,694	81	3,703	54

SOURCE OF DATA: baseline Table 108, IEP Table 23 (quarterly)

*Fourth Quarter 1977 for Cagayan de Oro and First Quarter 1978 for Bacolod.

**for each indicated year, the estimates shown are quarterly averages weighted by the sample size for each quarter.

While the more rapid growth rate in the number of active connections in Cagayan de Oro than in Bacolod during the 1978 to 1981 period would seem to be the primary factor accounting for the higher percentage of primary users of city water in the former city, the IMP survey data suggest two additional factors that might have also contributed to this differential. First, a higher proportion of connected households in Cagayan de Oro (57 percent versus 39 percent in Bacolod) were connected after construction of the new water systems. Thus, a higher proportion of Water District customers are new connectors in Cagayan de Oro than in Bacolod, where approximately 61 percent of connected households were already using the old water system. Second, there is a marginally significant difference between the cities in the proportion of connected households who are not primary users of city water - 11 percent in Bacolod versus 6 percent in Cagayan de Oro. More Bacolod project area households have continued to use other sources of water as their major source during the interim monitoring period, even though they were connected to the city water system.

IMP survey data on the major sources of water for study area households for the 1980-1981 period are shown in Table 11. In addition to a higher proportion of project area households (i.e. experimental strata I and II) using city water as their major source of water in Cagayan de Oro than in Bacolod, these data also suggest that the cities differ with respect to the location of city water connections (i.e. inside versus outside) among primary users of city water. A higher proportion of primary users of city water in Cagayan de Oro (45 percent) have outside piped connections than is the case in Bacolod (28 percent). This would imply a greater potential for sharing of water connections and, if so, would also contribute to the higher proportion of users among project area households in Cagayan de Oro than in Bacolod. Table 11 also shows that Stratum II and III households did not differ significantly with respect to major source of water in either city during the interim monitoring period. For both groups, covered wells were the most common source of water, with a substantial number of households also using open wells.

Table 11

Percent of Households: Type of Main Water Source
By City and Experimental Stratum, 1930 - 1981

<u>Cagayan de Oro City</u>	Total Households	<u>Experimental Stratum</u>		
		<u>I</u>	<u>II</u>	<u>III</u>
All Households	23,097	17,263	4,663	1,171
Piped from City Water System	17,263	100.0%	-	-
Inside	9,539	55.3%	-	-
Outside	7,724	44.7%	-	-
Covered Well	3,001	-	49.9%	57.6%
Open Well	1,776	-	30.3%	31.1%
Other Sources	1,057	-	19.8%	11.4%
<u>Bacolod City</u>				
All Households	33,454	14,997	14,739	3,718
Piped from City Water System	14,997	100.0%	-	-
Inside	10,776	71.9%	-	-
Outside	4,221	28.1%	-	-
Covered Well	11,159	-	62.3%	53.2%
Open Well	6,438	-	34.5%	36.3%
Other Sources	860	-	3.2%	10.5%

SOURCE: IMP Table 23.

Information on the major source of water for specific household purposes was also obtained from the IMP household surveys (see Table 12). While an estimated 75 percent of the households in Cagayan de Oro and 45 percent in Bacolod used city water as their major source of water for household purposes generally, the proportion of households using city water varied widely by purpose. City water was used most commonly for drinking (85 percent of households in Cagayan de Oro and 55 percent in Bacolod) and cooking (81 and 50 percent respectively). A minimum of 55 percent of Cagayan de Oro households and 25 percent of Bacolod households used city water for at least one household purpose.

Although some variability is observed from quarter to quarter during the IMP period in the percentage of households using city water for the indicated purposes, there is little evidence to suggest that city water usage has increased for any specific purpose during this period.

Table 12 Percent of Households using Piped Water for Selected Purposes by City and Quarter, IMP Surveys

	<u>TOTAL</u>	<u>I</u>	<u>II</u>	<u>QUARTER #</u>				<u>VI</u>	<u>VII</u>	<u>VIII</u>
				<u>III</u>	<u>IV</u>	<u>V</u>				
CAGAYAN DE ORO										
Drinking (All Households)	19,595	2,670	2,518	2,628	2,237	2,298	2,543	2,206	2,493	
% Households using Piped Water	84.9	91.7	84.9	88.7	76.1	76.9	90.2	83.0	88.2	
Cooking (All Households)	18,597	2,549	2,325	2,446	2,106	2,244	2,432	2,119	2,376	
% Households Using Piped Water	80.7	87.5	78.4	82.6	72.1	75.1	86.2	79.8	84.0	
Washing Plates/Utensils (All Households)	17,140	2,380	2,071	2,253	1,939	2,063	2,176	2,021	2,237	
% Households Using Piped Water	74.4	81.7	69.8	76.1	66.4	69.0	77.9	75.5	79.1	
Bathing (All Households)	15,714	2,092	1,830	2,087	1,820	1,956	1,955	1,923	2,049	
% Households Using Piped Water	68.1	71.8	61.7	70.5	61.9	65.4	70.0	71.8	72.5	
Laundering (All Households)	14,165	1,879	1,543	1,887	1,574	1,721	1,773	1,769	2,030	
% Households Using Piped Water	61.0	64.5	52.0	63.7	53.5	57.6	62.9	66.0	71.4	
Gardening (All Households with Garden)	3,808	382	102	345	376	554	774	604	670	
% Households Using Piped Water	63.5	57.7	57.8	77.5	51.0	56.1	66.8	60.1	80.9	
Water Livestock/Poultry (All Households raising livestock/poultry)	2,171	216	260	174	165	353	220	468	315	
% Households Using Piped Water	55.5	66.0	51.9	43.9	36.6	63.0	52.0	65.4	14.6	
Washing Vehicles (All households who own or use a vehicle)	2,333	324	260	383	329	253	218	281	284	
% Households Using Piped Water	63.6	67.3	79.7	70.9	52.0	54.0	53.0	68.8	70.8	

Table 12 (Continued) Percent of Households Using Piped Water for Selected Purposed by City and Quarter, IMP Surveys

	<u>TOTAL</u>	<u>QUARTER #</u>							
		<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>	<u>V</u>	<u>VI</u>	<u>VII</u>	<u>VIII</u>
SAGOLOD CITY									
Drinking (All Households)	18,261	1,731	2,069	2,348	2,287	2,447	2,466	2,299	2,614
% Households Using Piped Water	54.6	42.6	48.9	55.1	53.7	59.2	59.8	54.4	62.9
Cooking (All Households)	16,561	1,686	1,838	2,080	2,110	2,307	2,145	2,103	2,291
% Households Using Piped Water	49.5	41.6	43.5	48.8	49.6	55.8	52.0	50.0	55.1
Washing Plates/Utensils (All Households)	14,794	1,331	1,799	1,893	1,934	1,886	1,893	1,943	2,114
% Households Using Piped Water	44.3	32.8	42.6	44.4	45.4	45.6	46.3	46.0	50.8
Bathing (All Households)	14,247	1,379	1,723	1,855	1,868	1,788	1,757	1,869	2,006
% Households Using Piped Water	42.6	34.0	40.8	43.5	43.9	43.2	43.0	44.3	48.2
Laundering (All Households)	13,155	1,201	1,007	1,703	1,766	1,683	1,721	1,750	1,725
% Households Using Piped Water	39.5	29.6	38.0	40.0	41.5	40.7	42.8	41.4	41.5
Gardening (All Households w/ Garden)	1,591	89	187	149	71	383	180	356	177
% Households Using Piped Water	25.0	17.7	19.6	37.5	17.3	35.5	25.9	30.7	15.1
Watering Livestock/Poultry (All Households raising livestock/poultry)	2,021	133	151	185	177	351	321	239	464
% households Using Piped Water	27.3	20.9	14.6	42.0	26.2	24.4	35.3	32.5	27.1
Washing Vehicles (All Households who own or use a vehicle)	2,133	133	192	149	424	491	252	239	252
% Households Using Piped Water	46.9	25.3	26.1	50.5	80.0	49.1	54.5	66.7	39.6

Source: IMP Table 14 (Quarterly and Combined Tables)

Of interest in these data, however is an apparent "spread effect" of the city water system; that is, the number of households in stratum II and III using piped city water for specific purposes, although city water was not their primary source of water (see Tabel 13). A substantial number of such households reported using city water for drinking and cooking, while a smaller number reported using city water for bathing and washing plates. As expected, the use of city water was greater among stratum II households than stratum III households in both cities. The higher proportion of non-stratum I households using city water in Cagayan de Oro than in Bacolod is consistent with the larger number of outside connections noted earlier.

Table 13 Number and Percent of Households Using The City Water System By City And Type of Water Use, IMP SURVEYS:
1980 - 81

	CAGAYAN DE ORO			BACOLOD				
	TOTAL	EXP. STRAT. I	EXP. STRAT. II	EXP. STRAT. III	TOTAL	EXP. STRAT. I	EXP. STRAT. II	EXP. STRAT. III
All Households	23,096	17,263	4,662	1,171	33,454	14,997	14,740	3,717
<u>HOUSEHOLDS USES</u>								
Drinking	23,077	17,263	4,663	1,151	33,454	14,997	14,740	3,717
% City Water	84.9	99.8	45.3	21.6	54.6	99.8	22.4	-
% Non-City Water	15.1	0.2	54.7	78.4	45.4	0.2	77.6	100.0
Missing	20	-	-	20	-	-	-	-
Cooking/Preparing Food	23,058	17,244	4,663	1,151	33,453	14,997	14,739	3,717
% City Water	80.7	99.9	24.9	18.3	49.5	99.5	11.1	-
% Non-City Water	19.3	0.1	75.1	81.7	50.5	0.5	88.9	100.0
Missing	39	19	-	20	-	-	-	-
Washing Plates/Utensils	23,050	17,216	4,653	1,171	33,418	14,961	14,740	3,717
% City Water	74.4	97.5	7.1	1.6	44.3	97.4	1.5	-
% Non-City Water	25.6	2.5	92.9	98.4	55.7	2.6	98.5	100.0
Missing	46	46	-	-	36	36	-	-
Bathing	23,069	17,235	4,663	1,171	33,418	14,961	14,740	3,717
% City Water	68.1	89.8	4.7	1.6	42.6	93.4	1.8	-
% Non-City Water	31.9	10.2	95.3	98.4	57.4	6.6	98.2	100.0
Missing	27	27	-	-	36	36	-	-

C. Water Availability and Usage

Nearly all households in both cities (94 percent) had water available 24 hours a day during the IMP period (see Table 14). In Cagayan de Oro, however, the proportion of stratum III households reporting water availability 24 hours a day (80 percent) was significantly lower than among strata I and II. There were no significant differences among strata in Bacolod.

Table 14
Percent of Households with Water Available 24 hours a day, IMP surveys

	Cagayan de Oro				Bacolod			
	Total	Experimental Stratum			Total	Experimental Stratum		
		I	II	III		I	II	III
Total Households	33,096	17,767	4,661	1,171	33,454	14,997	17,740	1,717
% Available	95	97	94	80	94	93	93	93
% Not Available	5	3	6	20	6	7	6	7

Source of Data: IMP Table 11

Water availability did not vary significantly by major source of water in either city.

Table 15
Percent of Households with Available Water 24 hours a Day
By Type of Main Water Source

	Cagayan de Oro			Bacolod		
	Total	Avail- able %	Not Avail- able %	Total	Avail- able %	Not Avail- able %
Total Households	33,096	95	5	33,454	94	6
Piped Inside	9,519	98	2	10,776	93	7
Piped Outside	7,773	94	6	6,771	97	3
Covered Well	1,001	94	6	11,159	96	4
Open Well	1,776	94	6	6,649	96	4

Source of Data: IMP Table 20

Although water was reported to be always available to most households in both cities, over two thirds (70%) of all households stored water during the IMP period. Nevertheless, the number of households in all strata storing water has declined significantly during the IMP period. The decline in the proportion of households storing water was greatest among experimental Stratum I households in both cities. (See Table 16). The IMP quarterly survey data showed no clear seasonal pattern in the storage of water, suggesting that water storage is a year round practice.

Table 16

Percent of Households Storing Water, Baseline and IMP Surveys

	Baseline				I M P			
	T	I	II	III	T	I	II	III
Cagayan de Oro								
% Storing Water	96	95	96	100	59	52	76	81
% Not Storing Water	4	5	4	-	41	48	24	19
Bacolod								
% Storing Water	93	88	96	100	78	63	90	92
% Not Storing Water	7	12	4	-	22	37	10	8

Source of Data: IMP Table 10

Significant differences in the proportions of households storing water by major water source were observed in the IMP Surveys (See Table 17). Households with inside piped connections were the least likely to store water in both cities. In Cagayan de Oro, households using piped outside connections or covered wells stored water in smaller proportions than those using open wells. Overall, storage of water was less common in Cagayan de Oro than in Bacolod.

Table 17
Percent of Households Storing Water for Household
Activities by City and Main Water Source, IMP Surveys

	<u>Cagayan de Oro</u>			<u>Bacolod</u>		
	<u>Total</u>	<u>Storing</u> <u>Water %</u>	<u>Not</u> <u>Storing</u> <u>Water %</u>	<u>Total</u>	<u>Storing</u> <u>Water %</u>	<u>Not</u> <u>Storing</u> <u>Water %</u>
Total, All Households	23,057	59	41	33,454	78	22
Piped Inside	9,519	37	64	10,776	53	47
Piped Outside	7,704	72	28	4,221	89	12
Covered Well	3,001	69	31	11,158	92	8
Open Well	1,776	87	14	6,439	87	13
Other Sources*	1,057	85	15	860	95	5

Source of Data: IMP Table 26

* Includes rivers and other natural bodies of water, collected rainwater and purchased water from peddlers/vendors.

The IMP surveys also gathered information on the proportion of households desiring greater quantities of water for selected household purposes. The survey estimates for the IMP period are shown in Table 18. Fewer primary users of city water (i.e. Stratum I households) in both cities reported a desire for more water than did Stratum II or III households. Overall, Stratum II and III households expressed a desire for more water in roughly equal proportions. During the IMP period, however, about one-third of primary user households in Cagayan de Oro and 40 percent in Bacolod desired more water for household purposes.

Table 18

Percent of Households Desiring More Water by Indicated Purposes, IMP Surveys

	<u>Cagayan de Oro</u>			<u>Bacolod</u>		
	St. I (%)	St. II (%)	St. III (%)	St. I (%)	St. II (%)	St. III (%)
Cooking	39	47	56	42	61	67
Washing Plates/Utensils	38	46	55	43	62	65
Bathing	35	51	60	43	63	69
Laundering	38	54	60	43	61	65
Gardening	29	24	30	44	48	69
Watering Livestock/ Poultry	30	61	54	29	56	67
Washing Vehicles	18	22	34	31	50	39

SOURCE OF DATA: IMP Table 5

Data on the frequency of water use for major households uses show the following to be the median usage frequencies in all strata in both cities during the IMP period:

<u>Household Use</u>	<u>Median Frequency of Use</u>
Cooking	3 times per day
Washing Plates/Utensils	3 times per day
Bathing	once a day
Laundrying	once a day
Watering Garden	once a day
Watering Livestock/Poultry	once a day

Thus, there is no evidence that the availability of sanitary water has affected water usage patterns in the study population. Further, the IMP quarterly survey data do not suggest any change over time in the frequency of water usage for household purposes. This does not, however, preclude the possibility that greater quantities of water are being consumed by user households on each occurrence of water usage.

D. Water Quality

This section presents two types of data relevant to the evaluation of water quality in the study population:

- (1) the results of bacteriological analyses performed on samples of water at various points in time during the IMP period, and
- (2) data on water-related sanitary practices, which are symptomatic of the study population's perception of the quality of water obtained from various sources. The latter type of data include the incidence of treatment of drinking water (i.e. chemical treatments or filtering) and boiling of drinking water for consumption of children among study population households.

Direct data on water quality were obtained from two independent sources: the results of Water District bacteriological analyses performed during the study period and bacteriological analyses performed on water samples from a sample of survey households as part of the IMP surveys.

The Water District information provides a yearly summary of the bacteriological analyses of water samples conducted by the Water District during the 1977 to 1981 period. The water analyses are periodically carried out by the Water District laboratories based upon water samples collected from the tap from a number of connections or directly from the reservoir. On the other hand, the water samples collected as part of the quarterly surveys for the period November 1979 to September 1981 were taken from the actual drinking water supply of households. If the households did not store their drinking water, the sample was collected using the same container (i.e. glass, pitcher) typically used by the household in obtaining drinking water directly from the source. If a selected household usually stored water, it was taken from the stored supply. The intent of the Water District analyses is to determine the quality of water produced by the District, whereas the household survey analyses attempt to assess the quality of drinking water given the actual sources of water and sanitary practices of household on handling of water.

Since 1978 when the water systems were constructed, the Cagayan de Oro Water District data indicate that the Water District has been producing a consistently high proportion of safe water, with more than ninety percent of the samples tested meeting water safety standards. In Bacolod, there was a decline in the proportion of water samples tested as safe under the Government of the Philippines standard in 1979 to 68 percent from 75 percent in 1978. Since 1979, the proportion of samples rated as safe has increase each year, reaching 93 percent in 1981.

Table 19
Results of Water District bacteriological
Analyses by City: 1977-1981

WATER QUALITY	CITY AND YEAR				
	1977	1978	1979	1980	1981
	CAGAYAN DE ORO CITY				
Safe (%)	80	96	98	100	96
Unsafe (%)	20	6	2	0	4
	BACOLOD CITY				
Safe (%)	92	75	68	89	93
Unsafe (%)	8	25	32	12	7

SOURCE OF DATA: Bacolod City and Cagayan de Oro City
Water District Records.

³The water samples analyzed by the water District were not probability samples as were the water samples analyzed as part of the ISF surveys, hence their representativeness is uncertain.

The IMP survey data, which take into account the household sanitary practices on handling of water (means of distribution) as well as water quality at the source, lead to somewhat different impressions. The results of the bacteriological analyses performed as part of the household surveys, shown in Table 20, indicate that only 19 percent of the tests performed in Cagayan de Oro during the 1980-81 period and 50 percent in Bacolod met safety standards. In both cities, the proportion of households with safe water was higher in Stratum I than in Stratum III households. However, it should be recalled that substantial proportions of Stratum II households also use City water, especially for drinking, although it is not their major source of water for all household purposes.

Table 20

Percent of Households with Safe & Unsafe Water by City and Experimental Stratum: Baseline and IMP Surveys

	BASELINE				I M P			
	T	I	II	III	T	I	II	III
<u>CAGAYAN DE ORO</u>								
Total, All Households (No.)	25,474	12,528	9,938	1,260	11,724	16,977	4,576	1,171
Safe Water (%)	8.6	8.8	8.6	5.3	18.5	20.0	15.5	8.2
Unsafe Water (%)	91.4	91.2	91.4	94.7	81.5	80.0	84.5	91.8
Inconclusive (No.)	3,764	1,686	1,574	197	112	112	-	-
Missing (No.)	1,550	761	620	39	261	174	87	-
<u>BACOLOD</u>								
Total, All Households	33,862	10,887	18,561	4,072	32,665	14,399	14,659	3,607
Safe Water (%)	22.9	33.8	22.1	-	49.3	55.7	50.6	18.9
Unsafe Water (%)	77.1	66.2	77.9	100.0	50.7	44.3	49.4	81.1
Inconclusive (No.)	505	426	79	-	790	599	60	111
Missing	233	160	73	-	-	-	-	-

Source of Data: IMP Table 22, Baseline Table 105

Nevertheless, improvements in water quality since the baseline survey (1977-1978) are evident in both cities in Table 20. In Cagayan de Oro, an increase of 10 percentage points in the percent of households with safe water was achieved during this period, while the increase in Bacolod was 26 percentage points.

A trend toward increasing proportions of safe water is evident in the IMP quarterly surveys, displayed graphically in Figure 1. Although marked by fairly large quarterly fluctuations, an upward tendency in the proportion of water samples tested as safe is evident for both cities. The trend is, however, more marked in Bacolod than in Cagayan de Oro.

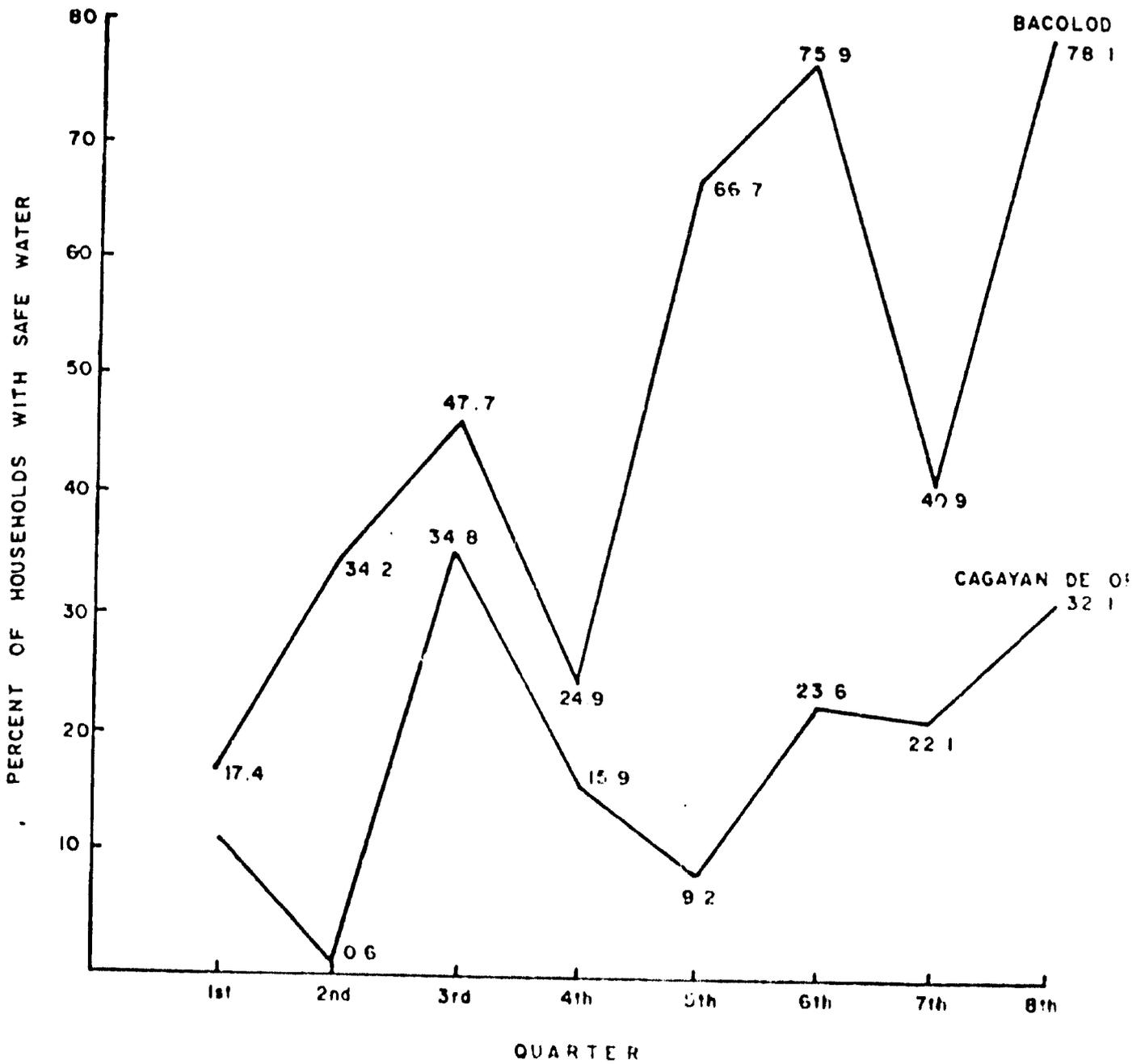


FIGURE 1 Percent of Households with Safe Water by Quarter, IMF Survey
SOURCE OF DATA: Table 22 (IMF Survey)

The quality of water tested during the IMP period varied significantly by the source of the water (See Table 21). In Cagayan de Oro, the proportion of water samples tested as safe from piped sources and covered wells were not significantly different, but both were significantly higher than samples taken from open wells or other sources. In Bacolod, water samples taken from piped sources tested as safe is in significantly higher proportions (59 percent) than did samples from wells or other sources.

Table 21

Percent of Households with Safe Water By City and Source of Sample Water, IMP Survey*

Source of Sample Water	Cagayan de Oro	Bacolod
Piped	13.4	58.6
Covered Well	16.8	17.7
Open Well	-	16.4
Other Sources	-	7.4

SOURCES OF DATA: IMP Table 25.

*Figures do not agree with Table 20 due to missing data.

The Bacolod IMP quarterly survey data are consistent with the results of the Water District bacteriological analyses in showing a positive trend in the quality of city water in the 1979-1981 period (See Table 22). The data for Cagayan de Oro also suggest an upward trend, although the differences between successive data points are not significant. A possible explanation for this result involves the difference between the cities with respect to the location of piped connections used by households noted earlier. A higher proportion of user households in Bacolod than in Cagayan de Oro have inside piped connections and thus have less exposure to the risk of water contamination associated with the use of contaminated containers for fetching water from outside piped sources.

Table 22

Percent of Water Samples from Piped Sources Tested as Safe by City and Time Period, Baseline and IMP Surveys

Time Period	Cagayan de Oro	Bacolod
Baseline Survey*	10	34
1980**	14	34
1981**	17	72

SOURCE OF DATA: Baseline Report Table 8 and IMP Table 25 (Quarterly Tables)

* Fourth Quarter 1977 in Cagayan de Oro and First Quarter 1978 in Bacolod.

** Percentages shown are averages of the quarterly surveys for each year, weighted by the sample size in each quarter.

The IMP survey data show a clear relationship between water quality and the practice of storing water. In both cities, a significant difference in the proportion of water samples tested as safe is observed between households who store their drinking water and those that do not. Table 23 shows that 33 percent of unstored samples of water in Cagayan de Oro were safe for drinking, compared to only 9 percent of stored sampled water. Similarly, 75 percent of unstored sampled drinking water samples in Bacolod were tested as unsafe for drinking compared to only 36 percent of those stored samples.

These results clearly implicate the means of distribution of water as a major aspect of programs intended to provide sanitary water to target populations. It should be noted, however, that insofar as the proportion of households storing water had declined in both cities during the IMP period, this likely has contributed to the increasing proportion of safe water samples observed in the IMP survey data. It does not, however, help to explain the lower proportion of water tested as safe in Cagayan de Oro compared with Bacolod City since the IMP data also reveal that storage of water is more common in Bacolod than in Cagayan de Oro (refer to Table 17).

Table 23

Percentage of Households with Safe Water by City and Whether the Sampled Water was Stored or Not, IMP Survey.

	Cagayan de Oro	Bacolod
Stored	8.6	36.1
Not Stored	33.0	75.0

SOURCE OF DATA: IMP Table 21.

The IMP survey data suggest that households in the study areas view their sources of drinking water as unsafe, or at least behave accordingly, in substantial proportions. Table 24 shows the proportion of households who filter or treat chemically their drinking water by major source of drinking water. Overall, the proportion of households who filter their drinking water is significantly higher in Bacolod than in Cagayan de Oro, while the two cities are not significantly different with respect to the proportion of households who treat their drinking water chemically.

Table 24

Percent of Households Who Treat Drinking Water by Major Source of Drinking Water, IMP Surveys.

Source of Drinking Water	Cagayan de Oro		Bacolod	
	By Filtering	Using Chemicals	By Filtering	Using Chemicals
Piped Inside	14.9	0.6	51.4	1.3
Piped Outside	13.6	1.4	63.9	1.2
Covered Well	26.4	13.2	73.3	1.7
Open Well	44.1	11.8	65.5	1.1

SOURCE OF DATA: IMP Table 40.

In both cities, significant differences in the proportion of households treating water are observed by major source of drinking water. In Cagayan de Oro, households whose major source of drinking water was an open well filtered water in significantly higher proportions than did households with piped sources of drinking water. The difference between piped sources and covered wells was also marginally significant. Households using wells (covered and open) treated their drinking water chemically in higher proportions than did households with piped sources of drinking water.

In Bacolod, users of open wells for drinking water filtered water in significantly higher proportions than did households using any of the other sources. Users of covered wells also differed from users of piped sources of drinking water in terms of the proportion of households treating drinking water. There were no differences in the proportion of households treating drinking water chemically by source in Bacolod.

Households in the study population also boil drinking water intended for consumption by children in substantial proportions (See Table 25). The pattern of city differences is the opposite of what is observed with respect to the treatment of drinking water, with higher proportions of households in Cagayan de Oro boiling drinking water for children than in Bacolod. Interestingly, these data indicate that households with piped sources of water are as likely to boil children's drinking water as households using wells for drinking water in Bacolod, and only marginally less likely in Cagayan de Oro.

Table 25

Percent of Households Who Boil Children's Drinking Water by Major Source of Drinking Water, IHP Surveys

<u>Source of Drinking Water</u>	<u>Cagayan de Oro</u>	<u>Bacolod</u>
Piped Inside	45.0	28.5
Piped Outside	30.7	23.5
Covered Well	50.8	21.2
Open Well	-	16.0

SOURCE OF DATA: IHP Table 7.

E. Health and Nutrition

For this study, the main indicators of water-related impacts are the nutritional status of children and incidence of diarrhea among children. On both the baseline and interim monitoring surveys, measures of height, weight and incidence of diarrhea in the 24 hour and 7 day periods prior to the interview were obtained for all children aged 0-4 years in sample households. The baseline data showed that no significant differences existed between the three experimental strata with respect to these variables, although the levels of incidence of diarrhea and malnutrition differed between cities.

There were two purposes of examining these indicators during the interim monitoring period: (1) to determine whether the impact indicators had changed since the new water systems were completed (2-3 years later), and (2) to determine whether any differences had developed between the experimental strata.

The results are shown in Tables 26 and 27 for the Baseline and Interim Monitoring surveys (the merged IMP data - all eight quarters combined). At the time of the IMP studies, there were still no significant differences between the experimental strata. However, there seems to be some overall improvement in all strata with regard to the indicators, especially the diarrhea rates in Cagayan de Oro. These results were not, however, tested for significance. This "impact assessment" will be accomplished after the follow-up surveys are completed in 1983.^{6/}

^{6/} Analyses of the health and nutrition data were undertaken for this report because of the need to apply more refined statistical procedures to these data. Accordingly, the results displayed here should be viewed as preliminary. See the Baseline Report (pp. 23) for a discussion of methodological requirements.

Table 26

Percent of Children 0-4 Years of Age Experiencing Diarrhea in the 74-hours Preceding the Survey by City and Experimental Stratum, Baseline and IMP Surveys.

	Cagayan de Oro		Bacolod	
	Baseline	IMP	Baseline	IMP
Total Children 0-4 Years Old	23,569	18,192	30,023	25,305
Total With Diarrhea (All Strata)	3,067	774	4,777	1,915
1 Stratum I	17	4		7
2 Stratum II	16	7	11	9
3 Stratum III	26	3	6	4

SOURCE OF DATA: IMP Table 2 & Baseline Tables 3 and 4

Table 27

Percent of Children 0-4 Years of Age: Nutritional Status By City and Experimental Stratum, Baseline and IMP Surveys

	Cagayan de Oro		Bacolod	
	Baseline	IMP	Baseline	IMP
Total Children 0-4 Yrs. Old	23,569	18,192	30,023	25,305
Normal & Overweight, Total Children 0-4 Years				
1 Stratum I	40	51	37	42
2 Stratum II	44	48	37	36
3 Stratum III	41	51	22	35
First Degree Malnourished (Total Children 0-4 Years)				
1 Stratum I	41	33	34	37
2 Stratum II	41	28	36	36
3 Stratum III	43	32	29	32
Second Degree Malnourished (Total Children 0-4 Years)				
1 Stratum I	15	11	26	13
2 Stratum II	12	17	24	23
3 Stratum III	11	8	37	26
Third Degree Malnourished (Total Children 0-4 Years)				
1 Stratum I	3	5	7	8
2 Stratum II	3	8	6	9
3 Stratum III	4	8	12	9

Sources: IMP Table 34, Baseline Report (Table 12)

One of the objectives of the baseline survey was to observe associations between these main indicators and other variables collected. Several sanitation related variables were found to associate with the incidence of diarrhea. These include the household's method of excreta disposal, type of bathroom, the distance from the house to the toilet, frequency of handwashing after using the toilet and after children played outside, and the method of garbage disposal. The child's age and nutritional status also associated with the incidence of diarrhea. In a subsequent multivariate analysis, some of these relationships were found to be a consequence of a single underlying relationship between diarrhea and the method of excreta disposal - (See Baseline Survey Results, pp. 56-59).

These associations were discovered in a bivariate analysis intended to isolate variables that were further studied in multivariate models. Some of the variables that were found not to associate with diarrhea during the bivariate analysis were water quality and main water source (i.e., whether the household used piped water or not). It was postulated that this could have been due, in part, to the small number of households that were discovered to have "safe" water. Although these relationships will be thoroughly investigated once again after the follow-up surveys are completed, the IMP data were also examined. It was found that the water quality was associated with diarrhea this time in Bacolod. This association was not significant for Cagayan de Oro, however (see Table 28). Source of water was still found not to associate with incidence of diarrhea (see Table 29). After the follow-up survey, extensive analysis on these and other variables will be conducted.

Table 28

Percent of Children 0-4 Years Old Experiencing Diarrhea in the 24 Hours Preceding the Survey By Quality of Sampled Drinking Water and City. IMP Surveys

	<u>Cagayan de Oro With Diarrhea</u>	<u>Bacolod With Diarrhea</u>
With Safe Water	2.5	3.8
With Unsafe Water	4.7	10.9

Source of Data: IMP Table 17

Table 29

Percent of Children 0-4 Years Old Experiencing
Diarrhea in 24 Hours Preceding the Survey
By City and Type of Water Source for Drinking,
IMP Surveys

	<u>Capayan de Oro</u> <u>With Diarrhea</u>	<u>Bacolod</u> <u>With Diarrhea</u>
Piped from City Water System	4.1	6.1
Covered Well	5.0	11.2
Open Well	-	5.6
Other sources	5.8	-

Source of Data: IMP Table 16