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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Austria

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Philippine Industrial Investment Opportunity Study

April 1990

ESTABLISHMENT OF A COMMON WASTEWATER TREATMENT FACILITY

FINAL REPORT

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Austria

Attention: Mr. S. Morozov
Chief, Contracts Director

Gentlemen:

Re: Follow-up Services to Manila Investors' Forum
Amendment No. 1 Project No. UC/PHI/88/082
Contract No. 88/46/RK

We are pleased to submit our final report on the Philippine Industrial Investment Opportunity Study on the Establishment of a Common Wastewater Treatment Facility.

This study was conducted in accordance with the UNIDO Manual for the Preparation of Industrial Feasibility Studies. The report covers the following major topics:

- Project background and history
- Market and plant capacity
- Material inputs
- Location and site
- Project engineering
- Plant organization and overhead costs
- Manpower
- Project implementation
- Financial evaluation

The technical aspects of the study was prepared in association with the Industrial Technology Development Institute (ITDI). The financial projection utilized the UNIDO Computer Model for Feasibility Analysis and Reporting (COMFAR).

This study was prepared mainly to provide preliminary broad indications of the viability of the project and is not meant to serve as a detailed project feasibility study necessary for project implementation. Moreover, it is understood that the results of the study may vary if there are any changes in the environment that may require revision in any of the critical assumptions used.

We will be glad to discuss any question you may have on this report.

Very truly yours,

SGV & Co.

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Austria

Philippine Industrial Investment Opportunity Study
April 1990

ESTABLISHMENT OF A COMMON WASTEWATER TREATMENT FACILITY

FINAL REPORT

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I. EXECUTIVE SUMMARY

This investment opportunity study examines the financial viability of a common wastewater treatment facility to service the leather tanneries of Meycauayan, Bulacan.

The majority of the tanneries in Meycauayan do not have adequate wastewater treatment facilities or, if they do, do not keep the facilities in operation. They are constrained by limited space; lack of skills to set up, operate, and maintain such a facility; and/or prohibitive investment and operating costs.

In addition to wastewater treatment, this study looks into the possibility of producing chromic oxide. Chromic oxide is used as cement pigment, and as granulated rock for asphalt roofing. It can also be used to color imitations of gems such as rubies, emeralds, and dichronic alexandrite.

The proposed project may be registered as a nonpioneer enterprise with the Board of Investments, subject to the latter's approval. If registered, among the incentives the project can avail of are income tax holiday for the initial four years of operation, tax- and duty-free importation of machinery and equipment, and tax credit on local machinery and equipment.

MARKET AND PLANT CAPACITY

Based on the estimated leather production of the 33 identified leather tanneries in Meycauayan, the wastewater generation of these tanneries in 1988 is estimated at 296 cubic meters per day or about 76,960 cubic meters for the year, at 260 days a year.

Wastewater generation of the tanneries in Meycauayan is projected to grow at six per cent a year, following the expected growth rate of leather production. The annual volume of wastewater generation of the Meycauayan tanneries is expected to reach 98,020 cubic meters by 1992 and 156,260 cubic meters by 2000.

The facility, however, is expected to service only 26 out of the 33 tanneries in Meycauayan, based on indications obtained from the survey. The seven tanneries that will not use the facility already have their own wastewater treatment facilities. The annual wastewater generation of the 26 tanneries is projected at 71,240 cubic meters by 1992 and 114,400 cubic meters by 2000.

Domestic requirements for chromic oxide are sourced solely through imports since there is no local producer of chromic oxide. Based on statistics obtained from the Business Statistics Monitor, total imports of chromic oxide in 1989 are estimated at 148,179 kilograms valued at landed cost ₱15.6 million.

Based on the 1988 to 1989 growth of chromic oxide importation, demand for chromic oxide is projected to reach 157,000 kilograms in 1992 and 183,000 kilograms in 2000.

Based on the projected volume of wastewater generation of the tanneries which will be serviced by the facility, the rated capacity of the facility for wastewater treatment is set at 260 cubic meters of wastewater per day or 78,000 cubic meters per year.

On the other hand, the rated production capacity of the facility for chrome recovery is set at 137 kilograms of chromic oxide per day or 35,620 kilograms of chromic oxide per year. At full capacity utilization, the chrome recovery section will capture 22 per cent of the local market for chromic oxide.

The wastewater treatment facility will operate continuously at 24 hours a day and 300 days a year. On the other hand, the chrome recovery section will operate eight hours a day and 260 days a year.

Both the wastewater treatment and chrome recovery sections will operate at 91 per cent of their capacity in Year 1. These two sections will attain 100 per cent capacity utilization by Year 3.

The fees or charges for wastewater treatment will be set at ₱45 per cubic meter of wastewater (excluding 10 per cent value-added tax). Based on the estimated wastewater generation per square foot of leather production and the average selling price of leather, this charge is about one per cent of the projected average revenues of the tanneries. The amount of wastewater to be treated for each tannery will be monitored by a meter to be installed at the tannery.

Payment for wastewater treatment charges is lower than the penalty of ₱5,000 per day set by the Environmental Management Bureau assuming this penalty will be strictly enforced in the future. To illustrate, a tannery operating at its full capacity of 5,000 square meters of leather per day (average rated capacity of tanneries in Meycauayan) will only have to pay a maximum of ₱1,400 per day for the services of the proposed facility.

Because of the socioeconomic benefits of the project in terms of health and environmental protection, it may be possible to obtain some government subsidy for certain project costs, for instance, the cost of civil works involved in the installation of the pipeline system amounting to ₱5,317,768. The installation of

the pipeline system can be part of the waste management program for the locality. If the project obtains a subsidy, the fees for wastewater treatment can be lowered to about ₱25 per cubic meter assuming the project will be BOI-registered.

The chromic oxide produced by the facility will be sold at ₱59 per kilogram (excluding value-added tax).

At the assumed charges for wastewater treatment (without subsidy) and price of chromic oxide, the total revenues of the facility is projected at ₱5.1 million in Year 1 and ₱5.6 million in Year 3 (full capacity utilization).

MATERIAL INPUTS

The proposed process for the wastewater treatment does not require any raw material inputs aside from the tannery wastewater.

The base material for the production of chromic oxide is chrome hydroxide slurry which will be collected from the sumps of the tanneries to be serviced by the facility.

The facility's energy requirements include electricity, liquified petroleum gas, and biogas internally generated from the wastewater treatment section. The facility will have its own deep well instead of availing of the water services of the local water district.

LOCATION AND SITE

The proposed location for the common wastewater treatment facility is Barrio Tugatog, Meycauayan. Constrained by the availability of land, the proposed site for the facility is the most accessible location available considering the land requirements of the project of 2,500 square meters. The site is also right beside the Meycauayan River where treated wastewater may be discharged.

PROJECT ENGINEERING

The proposed common facility will occupy 1,056 square meters of the total land area for the project. The major structures of the facility include an equalization pond, two upflow anaerobic filters, trickling filter, polishing pond, gas tank, and an auxiliary building which houses the chrome recovery section, the laboratory, and the administration office.

The major equipment needed for the wastewater treatment facility include a sewer pipeline system connecting the tanneries

to the facility, four jack pumps, and a five-horsepower centrifugal pump. On the other hand, the equipment needed for the chrome recovery section include a two-horsepower centrifugal pump, pulverising mill, air compressor, nonclog displacement pump, gas tank, and plastic sealer.

The following wastewater treatment methods were considered for the proposed facility: oxidation ditch method, conventional activated sludge method, extended activated sludge method, anaerobic lagoon method, facultative lagoon method, aerated lagoon method, and upflow anaerobic filter and trickling filter method. The upflow anaerobic filter and trickling filter method was chosen among the alternative wastewater treatment methods for the proposed facility because of its relatively low initial capital investment, low operating cost, and resource recovery capability.

A sewer pipeline system will be installed to transport the wastewater from the tanneries to the facility for treatment before the treated wastewater is discharged into the river.

The facility will also produce chromic oxide from the chrome hydroxide collected from the sumps of the leather tanneries. The sludge will be washed and then heated inside a kiln.

PLANT ORGANIZATION AND MANPOWER

The general manager will be responsible for both the production, sales, and administrative operations of the facility.

Only seven semi-skilled workers will be needed for the production operations of the facility. Out of the seven workers, four including a wash tank tender, furnace tender, mill tender, and packer, will be assigned to the chrome recovery section. The remaining three workers will serve as pump tenders for the wastewater treatment section, each working on a different eight-hour shift.

The administrative department will consist of one secretary and one general clerk. A part-time chemical analyst and chemical technician will be hired to check on quality and proper operation of the equipment.

PROJECT IMPLEMENTATION

The preproduction period for the establishment of the proposed facility is two years. The major activities during this period are construction of the building and required civil works, procurement and installation of machinery and equipment, tests and trial runs, and training of personnel.

FINANCIAL AND ECONOMIC EVALUATION

Total Investment Outlay

The total investment outlay for the project is estimated at ₱ 16.0 million with BOI incentives and ₱16.3 million without BOI incentives. The breakdown of total investment costs is as follows:

	(thousand pesos)	
	With BOI Incentives	Without BOI Incentives
Land	1,750	1,750
Buildings & civil works	4,289	4,289
Sewer pipeline system	7,001	7,169
Auxiliary & service equipment	54	54
Incorporated fixed assets	472	491
Plant machinery & equipment	817	911
Total Fixed Investments	14,383	14,664
Preproduction capital expenditures	1,424	1,436
Net working capital	191	191
Total Initial Investment Costs	15,998	16,291

Project Financing

Approximately 58 per cent of the total investment costs (with BOI incentives) will be financed by local and foreign loans while the remaining 42 per cent will be funded by equity. Without BOI incentives, a larger equity and loan amount will be needed to fund the project.

	(thousand pesos)	
	With BOI Incentives	Without BOI Incentives
Loans		
Foreign	454	518
Local	8,876	8,960
Total Loans	9,330	9,477
Equity	6,669	6,814
Total Sources of Financing *	15,999	16,292

* May not be equal to total initial investment outlay because of rounding off.

Interest rates are based on prevailing market rates. The interest rate on the local loan is assumed to be 20 per cent while the interest rate on the foreign loan is assumed at 11.5 per cent per year. The terms of both loans are assumed to be seven years with a two-year grace period on principal repayments.

Production Cost

The breakdown of the estimated annual production cost at full capacity is as follows:

	(thousand pesos)	
	With BOI Incentives	Without BOI Incentives
Factory costs		
Direct labor	252	252
Factory overhead	484	484
Sub-total	736	736
Administrative overhead	620	620
Sales and distribution costs	12	12
Depreciation	872	893
Financial costs	1,462	1,481
Total Production Cost	3,702	3,742

Profitability

The internal rate of return on total investments (IRR) is estimated at 22.53 per cent with BOI incentives and 19.96 per cent without BOI incentives. On the other hand, the IRR on equity is estimated at 21.86 per cent with BOI incentives and 18.21 per cent without BOI incentives. The hurdle rate set for the project is 20 per cent. The financial projections were computed using the Computer Model for Feasibility Analysis and Reporting (COMFAR).

	With BOI Incentives	Without BOI Incentives
Internal rate of return (%)		
on total investment	22.53	19.96
on equity	21.86	18.21
Net present value (₱000) at 20% hurdle rate	1,352	(23)
Payback period (incl. construction period)	5 years and 9 months	6 years and 6 months
Breakeven sales (%)	34.19	34.59
Sensitivity Analysis IRR of project (%)		
-10% revenue	19.16	17.43
+10% production cost	21.65	19.30
+10% initial investment	20.28	18.42
with government subsidy and ₱25 per cu.m. charge	21.41	18.90

With government subsidy for the civil works for pipeline installation and wastewater treatment charge of ₱25 per cubic meter of wastewater, the IRR on the project is estimated at 21.41 per cent with BOI incentives and 18.90 per cent without BOI incentives.

Under the base case, net income of the project as a percentage of revenues is about 21.36 per cent in Year 1 and 42.61 per cent in Year 15 with BOI incentives. Without BOI incentives, net income of the project as a percentage of revenues is about 13.31 per cent in Year 1 and 42.50 per cent in Year 15.

A. With BOI Incentives

Year	Revenues (₱000)	Net Income (₱000)	Net Income/ Revenues (%)
1	5,118	1,093	21.36
5	5,612	1,716	30.58
10	5,612	2,235	39.83
15	5,612	2,391	42.61

B. Without BOI incentives

Year	Revenues (₱000)	Net Income (₱000)	Net Income/ Revenues (%)
1	5,118	681	13.31
5	5,612	1,696	30.22
10	5,612	2,221	39.58
15	5,612	2,385	42.50

With BOI incentives, net inflow of the project is estimated at ₱1.8 million in Year 1 and ₱3.0 million in Year 15. Cumulative cashflow is ₱1.8 million in Year 1 and ₱33.0 million in Year 15. Without BOI incentives, net inflow of the project is ₱1.5 million in Year 1 and ₱3.0 million in Year 15. Cumulative cashflow is ₱1.5 million in Year 1 and ₱30.6 million in Year 15.

(thousand pesos)

A. With BOI Incentives

Year	Inflow	Outflow	Net Inflow/ (Outflow) *	Cumulative Cashflow **
1	5,176	3,327	1,849	1,849
5	5,612	4,889	722	5,150
10	5,612	2,572	3,039	18,244
15	5,612	2,656	2,955	33,021

B. Without BOI Incentives

Year	Inflow	Outflow	Net Inflow/ (Outflow) *	Cumulative Cashflow **
1	5,176	3,718	1,458	1,458
5	5,612	4,918	693	2,679
10	5,612	2,565	3,047	15,775
15	5,612	2,653	2,958	30,567

* May not be equal to inflow less outflow because of rounding off.

** Available for cash dividends; may not be equal to sum of net inflow/outflow because of rounding off.

CONCLUSION

It has been estimated that the project will bring an IRR of 20 (without BOI incentives) or 22 (with BOI incentives) per cent, thus making it financially worthwhile to consider.

However, certain aspects of the project will need to be resolved.

Although 26 of the 33 surveyed tanneries in Meycauayan indicated that they will avail of the services of the proposed wastewater treatment facility, their decision to avail of its services really hinges on the strict enforcement of the rules and regulations of the Environmental Management Bureau (EMB).

If EMB strictly enforces its rules and regulations, a tannery that discharges wastewater which exceeds the allowable limits of the Effluent Regulation will be fined ₱5,000 for every day of violation. It is presumed that the tanneries will choose to avoid the penalty since the cost of services of the wastewater treatment facility will be lower even at the proposed charge rate of ₱45 per cubic meter.

On the other hand, because of the socioeconomic benefits of the project, it may be possible to obtain some government subsidy for certain project costs, for instance, the cost of civil works involved in the installation of the pipeline system amounting to ₱5,317,768. The installation of the pipeline system can be part of the waste management program for the locality. If the project obtains such a subsidy, the fees for wastewater treatment can be lowered to about ₱25 per cubic meter.

II. PROJECT BACKGROUND AND HISTORY

PROJECT BACKGROUND

One of the major areas of concern of government and industry at present is industrial pollution. Aside from the health hazards, industrial wastes also contribute to the degradation of the country's natural resources.

Unfortunately, the required measures for environmental protection are sometimes not within the reach of many businesses, particularly small- and medium-scale industries, because of lack of financial resources, technical know-how, or other reasons. One solution that has been proposed is the establishment of common waste management facilities that can each service a group of plants within one area.

This investment opportunity study looks at one such project: a common wastewater treatment facility to service the leather tanneries of Meycauayan, Bulacan.

Based on the survey conducted for this investment opportunity study, there are some 33 tanneries in Meycauayan engaged in the wet processes of leather tanning. Majority of these tanneries do not have adequate wastewater treatment facilities or, if they do, do not operate the facilities. They are constrained by limited space; lack of skills to set up, operate, and maintain such a facility; and/or prohibitive investment and operating costs.

This study will enable both potential foreign and local investors to assess the viability of a common wastewater treatment facility for the leather tanning industry in Meycauayan. It will also provide an opportunity for potential investors and prospective clients of the facility to assist in the government's drive for health and environmental protection, minimizing the discharge of pollutive wastes in the riverine and estuarine water system of the province. Moreover, the proposed plant can serve as a model for common waste treatment facilities in the country.

Alternative Methods of Wastewater Treatment

There are a number of alternative approaches to wastewater treatment. The following wastewater treatment methods were considered for the common wastewater treatment facility:

- Oxidation Ditch Method

  The oxidation ditch method is composed of two major processes: aeration and final settlement.

The oxidation ditch serves as a trough where wastewater is circulated by a rotating steel aerator. The aerator continuously mixes the wastewater, thereby ensuring constant supply of oxygen in the wastewater. Oxygen is necessary for the growth of microorganisms that consume pollutants in the wastewater.

From the trough, the wastewater overflows into a settling tank. After the wastewater is retained in the settling tank, it is discharged into the river. Most of the activated sludge left in the settling tank is recirculated to the trough by a sludge pump. The sludge is reintroduced into the tank to stimulate the growth of microorganisms. The excess sludge is discharged into drying beds and may be used as fertilizer.

o Conventional Activated Sludge Method

The conventional activated sludge method consists of four basic processes: primary sedimentation, aeration of mixed liquor, secondary clarification, and recycling of sludge from secondary clarifier.

The wastewater must first undergo primary sedimentation before entering an aeration tank. A mechanical aerator agitates the wastewater in the aeration tank for about four to ten hours. The aerator provides oxygen necessary for the growth of the microorganisms which will consume the pollutants in the wastewater. From the aeration tank, the wastewater flows into the final sedimentation tank where the activated sludge settles. After processing in the sedimentation tank, the wastewater is released into the river. Thereafter, part of the sludge is returned to the aeration tank to stimulate bacteria reproduction. The bacteria are needed to oxidize the organic material in the wastewater and to digest the sludge.

o Extended Activated Sludge Method

The extended activated sludge process is basically the same as the conventional activated sludge process. These two processes differ only in aeration time. The extended activated sludge process requires a longer aeration time (a total of 24 to 36 hours) than the conventional method (only three to four hours). However, the increase in aeration time means higher electricity consumption.

The longer aeration time allows the activated sludge to be partially digested within the aeration tank. Thus, a smaller settling pond is needed for settling the activated sludge. After processing in the settling pond, the wastewater is discharged into the river while part of the activated sludge is returned to the aeration tank to stimulate the growth of microorganisms.

o Anaerobic Lagoon Method

Under this method, the solids in the wastewater are allowed to slowly settle at the bottom of the anaerobic lagoon. Thus, the surface layer in the lagoon contains mostly dissolved material and fine-particle solids. Below this surface, the concentration of solids increases until thick sludge forms at the bottom of the lagoon. Anaerobic metabolism occurs below the surface layer, thereby converting the organic wastes into acids, gases (hydrogen, carbon dioxide, methane, and hydrogen sulphide), and ammonia.

After processing in the lagoon, the wastewater is discharged into river while sludge is recirculated into the lagoon to stimulate the growth of microorganisms.

o Facultative Lagoon Method

Like the anaerobic lagoon method, the solids in the wastewaster are also allowed to slowly settle at the bottom of the facultative lagoon.

However, while an anaerobic lagoon is composed of two main layers, the facultative lagoon has three layers:

- o surface area where aerobic bacteria grow
- o middle layer where facultative bacteria grow, and
- o bottom layer where anaerobic bacteria accumulate.

The microorganisms in the different layers of the facultative lagoon consume the solids in the wastewater. An aerator is used to supply oxygen in the wastewater and to keep some of the solids in suspension in the lagoon. After processing in the lagoon, the wastewater is discharged into the river while sludge is reintroduced into the lagoon to hasten the growth of microorganisms.

o Aerated Lagoon Method

The aerated lagoon method uses the oxidation ditch and conventional/extended activated sludge methods in series.

o Upflow Anaerobic Filter and Trickling Filter Method

While the preceding wastewater treatment methods are either anaerobic or aerobic processes, the upflow anaerobic filter and trickling filter method is a combination of both anaerobic and aerobic processes.

The wastewater must first undergo pretreatment and primary sedimentation before it is pumped into the first of two upflow anaerobic filters. The anaerobic filters are enclosed column reactors containing packing materials. Coconut shells, gravel, plastic, ceramic fired clay, or coral chips may be used as packing materials. The packing materials serve as a medium for the growth of microorganisms that will consume solids in the wastewater.

The wastewater will remain in the first anfil for about 24 hours and then will be pumped into the the second anfil where it will retained for 24 hours.

From the second anfil, hydraulic pressure pushes the wastewater to the top of a trickling filter. The trickling filter is an open-top column reactor. A distributor mechanism at the crown of the filter will evenly shower the wastewater through the packing materials which serve as medium for the growth of microorganisms in the wastewater.

From the trickling filter, the wastewater goes into a polishing pond for further biological treatment. After the wastewater is retained for several hours in the pond, it is released into a river.

Technology Selection

The upflow anaerobic filter and trickling filter method was chosen among the alternative wastewater treatment methods for the proposed facility because of its relatively low initial capital investment, low operating cost, and resource recovery capability.

The fixed assets required for the establishment of the wastewater treatment facility include land, civil works, and equipment. The required land area is determined by the retention time required for the wastewater. Based on previous studies, most of the pond systems, namely oxidation ditch, extended activated sludge, aerated lagoon, anaerated lagoon, and facultative lagoon methods, require a much larger land area than the anaerobic filter and conventional activated sludge systems. Due to the limited availability of land in Meycauayan, the site of the proposed facility, the pond systems that require large land areas are not suitable to the project.

On the other hand, the cost of civil works for most of the pond systems is less than the cost of civil works required for conventional and extended activated sludge and upflow anaerobic filter methods. Pond systems involve only excavation and construction of riprap while the activated sludge and upflow anaerobic filter systems require construction of concrete structures.

In terms of equipment, aerobic pond systems need aerators to

ensure constant supply of oxygen and to keep solids suspended in the wastewater. The oxidation ditch and activated sludge systems need secondary clarifiers and sludge return and handling facilities. On the other hand, the anaerobic lagoons and upflow anaerobic filter system depend on natural digestion and do not require other equipment within their systems.

The operating costs of a wastewater treatment facility include costs of raw materials, electricity, and labor. Most of the wastewater treatment processes considered need activated sludge to hasten biodegradation of solids. Aerated systems, however, may need additional nutrients, specifically nitrogen and phosphorous, as well as sludge. This is necessary when the nutrient content of the wastewater is insufficient for the aerated system to function effectively. While the anaerobic lagoons and upflow anaerobic filter systems do not use electricity, other systems do. The upflow anaerobic filter system also entails lower labor cost since it does not require full-time operators unlike pond systems.

The upflow anaerobic filter system has also the advantage of being able to generate methane which is utilized in the conversion of chrome hydroxide sludge into chromic oxide.

General Project Description

The proposed facility will collect the wastewater generated by the Meycauayan leather tanneries and treat this using anaerobic and aerobic methods before discharging the wastewater into the river. A sewer pipeline system will be installed to transport the wastewater from the tanneries to the facility.

The facility will also produce chromic oxide (Cr_2O_3) from the chrome hydroxide to be collected from the leather tanneries.

Chromic oxide is used as cement pigment, and as granulated rock for asphalt roofing. It can also be used to color imitations of gems such as rubies, emeralds, and dichronic alexandrite.

Chrome hydroxide in the form of sludge will be hauled from the tanneries to the facility by a service vehicle.

Investment Incentives

The Board of Investments (BOI) is the government agency which implements investment laws and administers incentive schemes in the Philippines. Companies which register with the Board of Investments may avail of incentives listed in the Omnibus Investments Code of 1987.

The BOI classifies certain industries which are crucial to the country's development as preferred areas of investment.

These preferred investment areas, listed in the Investment Priorities Plan (IPP), are divided into two: pioneer and nonpioneer.

Based on the 1989 IPP, the proposed project may be registered with the BOI as a nonpioneer enterprise. If registered with the BOI, among the incentives the project can avail of include the following:

- o income tax holiday for the initial four years of operation, and
- o tax- (value added tax) and duty-free importation of machinery and equipment.

BACKGROUND ON THE LEATHER TANNING INDUSTRY

Industry Definition

Leather tanning is a process wherein animal hides and skins undergo a series of chemical and mechanical treatment for the production of leather. In the Philippines, leather is processed from the hides and skins of animals such as carabaos, cattle, goats, and pigs.

The leather tanning industry depends on the agricultural sector for the supply of the primary raw material, the hides and skins of animals. Other inputs are sourced from the chemicals industry.

On the other hand, the industry provides the primary materials used in the leathercraft industry, particularly for leather fashion accessories and footwear.

In 1984, the National Economic Development Authority (NEDA) conducted a study on the Philippine hides processing and leathergoods industry and estimated about 75 tanneries in the country. Out of the 75 tanneries identified, majority (47) were located in Bulacan. Eighteen were in Metro Manila while the remaining 10 tanneries were in various provinces -- Pangasinan, Ilocos Sur, Ilocos Norte, Cebu, and Zamboanga.

Most of the tanneries identified were small and cottage enterprises with assets of ₱250,000 to ₱2.5 million. Only 10 tanneries were large-scale firms with assets of ₱10 million and above. Six tanneries were medium-sized firms with assets of ₱2.5 million to ₱10 million.

Process Description

The manufacture of leather involves four major processes namely, beamhouse operations, tanning, post-tanning, and finishing.

Beamhouse Processes

The beamhouse processes transform raw or preserved hides and skins into pelts or limed hides and skins. The beamhouse processes are as follows:

o Soaking

The hides and skins are soaked in water so that they will reabsorb water lost after flaying, in the curing processes, or during transport. At the same time, blood, dirt, salt, and other soluble substances are removed.

o Liming

Liming is performed to loosen the epidermis and remove the hair from the hides and skins. Unwanted proteins are also removed and fatty matters are converted into soap. The hides and skins are piled and put in the liming pot. Water, lime, sodium sulfide, sodium sulfite, and a sharpening agent are added. The pelts are then drained and washed in water.

o Depilation, Fleshing/Scudding, Splitting

The hides and skins are dehaired to remove epidermic residues, and any remaining hair undestroyed during the liming process. The hypodermis layer (flesh) is then cut from the pelts either by hand or machine. The pelt is cut horizontally to separate the grain split, middle split, and flesh split.

o Deliming and Bating

The pelts are placed in a drum containing water and ammonium sulfate. Enzymatic bating agents are then added. The pelts are afterwards drained and washed in water.

o Pickling

The hides and skins are paddled or drummed in salt and water until the salt is dissolved and diffused evenly. A concentrated acid is slowly poured into cold water. This diluted acid solution is added to the drum containing the hides.

Tanning Processes

The tanning process converts the protein in the raw hides to a stable material. There are two major kinds of tanning agents used in the manufacture of leather: vegetable and mineral.

o Vegetable Tanning

The tanning materials used in vegetable tanning come from chemical organic compounds found in tree barks, nuts, fruits, or leaves. The most common vegetable tanning materials are mimosa, querabacho, chestnut, valonia, and myrobalan. Vegetable-tanned leather is used in the manufacture of shoelining, wallets, purses, handbags, cases, watch straps, and textile roller leather.

o Mineral Tanning

Chromium salts such as chrome sulphate and bichromate of potash or soda are used as tanning materials in mineral tanning. Chrome-tanned leather is relatively flat and has high tear resistance. This type of leather is used to manufacture upper leather and other light leather.

To avoid overtanning of the outer layer of the pelt, chrome compounds with a low basicity, usually 33 per cent, are used. Basification is carried out in paddles or drums. After the chrome has penetrated the pelts thoroughly, the basicity of the liquor is increased by adding an alkali.

Post Tanning Processes

The post tanning processes consist of the following:

o Neutralization

The leather is shaved to the desired thickness. The leather is then placed in a drum containing water, calcium/sodium formate, and sodium bicarbonate solution. The solution is later drained.

o Retanning

The two main types of retannage are semichrome and chrome-retan. For semichrome leather, the hides and skins first undergo vegetable tanning, and then subjected to chrome tanning. The chrome tanning makes the leather more resilient. It increases the resistance of the leather to heat or hot water, and also facilitates dyeing and water proofing. For chrome-retan leather, the leather is chrome-tanned and subsequently vegetable-tanned, sometimes also with syntan. The retannage improves the fullness or firmness of the leather.

o Dyeing

The leather is treated with dye dissolved in water.

o Fatliquoring

Sulfited fatliquor is diluted with hot water and added in the drum with the dye solution prepared in the previous process. Formic acid is added after which the leather is piled and then toggle-dried.

Finishing Processes

The leather is conditioned with water, staked, buffed, sprayed with paint pigment, dried, polished, ironed and/or plated.

Raw Materials

The major raw materials used in the manufacture of leather are as follows:

o Unprocessed materials - wet-salted rawhides of cattle, carabaos, goats, and pigs

o Processed industrial materials - ammonium sulfate, bating agent, calcium formate, basic chrome sulfate, anionic dye, lime, magnesium oxide, mimosa tannin, paint pigment, preservative, salt, sharpening agent, sodium bicarbonate, sodium bisulfite, sodium carbonate, sodium hypochlorite, sodium sulfide, sulfuric acid, and bleaching syntan.

THE LEATHER TANNING INDUSTRY IN MEYCAUAYAN

Industry Size and Location of Tanneries

A total of 33 tanneries were identified in seven major barrios of Meycauayan, as shown in Table 1 below. They consist of those involved in the wet processes of leather production and exclude small producers engaged only in the dry processing (finishing) of leather. The tanneries identified are heavily concentrated in Bo. Bangcal (12), Bo. Tugatog (10), and Bo. Hulo (5). (See Annex 1 for a list of the 33 tanneries.)

Table 1
Breakdown of Identified Tanneries
in Meycauayan by Barrio

Barrio	No. of Identified Tanneries
Bangcal	12
Tugatog	10
Hulo	5
Banga	2
Libtong	2
Calvario	1
Zamora	1
Total	33

Source: Interviews.

Capacity and Production Volume

Based on the survey of tanneries in Meycauayan, the total daily rated capacity of all 33 identified leather tanneries in the area in 1988 was 154,553 square feet of leather. However, the average capacity utilization of these tanneries was only 31 per cent with average daily production reaching 48,256 square feet of leather. Table 2 presents the estimated production capacities and production volume of the Meycauayan tanneries broken down by barrio in 1988.

Table 2
Profile of Major Tanneries in Meycauayan
By Barrio
1988
(production and capacity in square feet)

Barrio	Production	Capacity
Bangcal *	12,111	60,105
Tugatog	14,313	29,094
Hulo	8,490	25,203
Banga	7,304	18,525
Calvario	2,423	11,838
Libtong	2,923	8,403
Zamora	692	1,385
Total	48,256	154,553

* Includes estimated production capacities of two tanneries based on 1984 NEDA report.

Sources: Interviews and 1984 NEDA report.

Projected Production Volume and Capacity Utilization

In the Philippines, the production of leather is constrained by the availability of rawhides from slaughtered animals. The slaughtering of animals, on the other hand, is largely dependent on the demand for meat of the slaughtered animals for food.

Based on the historical volume of slaughtered animals in the country and the growth of equivalent finished leather from 1982 to 1988 of about six per cent, the identified tanneries in Meycauayan are projected to produce 73,601 square feet of leather per day by 1995 and 131,808 square feet of leather per day by 2005. Table 3 shows the projected leather production by the Meycauayan tanneries for the years 1989 to 1995, 2000, and 2005. The historical volume of animals slaughtered in the Philippines and the volume of equivalent finished leather from 1982 to 1988 is presented in Annex 2.

Table 3
Projected Leather Production
of Tanneries in Meycauayan
1989 - 1995, 2000, 2005
(square feet per day)

Barrio	1989	1990	1991	1992	1993	1994	1995	2000	2005
Tugatog	15,063	15,967	16,925	17,940	19,017	20,158	21,367	28,594	38,265
Bangcal	14,991	15,891	16,844	17,855	18,926	20,060	21,265	28,457	38,082
Malo	8,490	8,999	9,539	10,112	10,718	11,362	12,043	16,117	21,568
Banga	7,304	7,742	8,207	8,699	9,221	9,774	10,361	13,865	18,555
Libtong	2,923	3,098	3,284	3,481	3,690	3,912	4,146	5,549	7,425
Calvario	2,423	2,568	2,722	2,886	3,059	3,243	3,437	4,600	6,155
Zamora	692	734	778	824	874	926	982	1,314	1,758
Total	51,886	54,999	58,299	61,797	65,505	69,435	73,601	98,496	131,808

RULES AND REGULATIONS ON WASTEWATER DISPOSAL

Effluent Standards

The Effluent Regulation of 1982 sets the standards on the physical and chemical characteristics of wastewater discharged by manufacturing plants into inland and coastal waters.

Inland waters are classified into the following four categories:

Class	Usage
A	Source of public water supply
B	For any form of water recreation such as swimming, water skiing, or skin diving
C	For the propagation and growth of fish and other aquatic resources
D	For agriculture, irrigation, livestock watering, and industrial cooling and processing.

Inland waters in Meycauayan are considered Class C and D. Based on the standards set by the Regulation, wastewater discharged by the leather tanneries in Meycauayan must not exceed the following limits:

Color (platinum cobalt unit)	150
pH	6 - 9
Temperature (^{o}C)	40
Phenols (mg/l)	1.0
Suspended solids (mg/l)	100
Biological Oxygen Demand - 5 days (mg/l)	150
Oil and grease (mg/l)	10

Penalties for Violation

The Environmental Management Bureau shall fine any plant that discharges wastewater which does not meet the standards stated above a maximum of ₱5,000 for every day of violation. The amount of the fine is based on a point system which measures the extent of deviation from the standards.

In addition, a plant shall be fined a maximum of ₱1,000 for each day of violation, or its owners imprisoned from two to six years, or both if it engages in any of the following activities without first securing a permit from the Environmental Management Bureau (formerly the National Pollution Control Commission):

- construction, installation, modification, or operation of any sewage works;
- increase in the volume or strength of wastes beyond the limits specified in the existing permit;
- construction, installation, modification, or operation of any industrial or commercial establishment that will increase waste discharges into the water, air, and/or land resources of the country.

III. MARKET AND PLANT CAPACITY

MARKET

Wastewater Treatment

Types and Characteristics of Tannery Wastewater

In general, leather tanneries generate the following types of wastewater:

- Soak liquor

  Soak liquor is greenish in color and contains proteins. Its salinity ranges from 15,000 to 20,000 milligrams per liter. The biological oxygen demand (BOD) of soak liquor varies from 1,000 to 2,500 milligrams per liter. BOD measures the oxygen needed to stabilize organic matter in wastewater.

- Lime liquor

  Lime liquor contains both suspended and dissolved lime and sodium sulfide.

- Unhairing and fleshing effluent

  Aside from hairs of processed animal skins and hides, this type of effluent also contains sulfides and fatty and fleshy matters.

- Deliming effluent

  The BOD load of deliming effluent ranges from 1,000 to 2,000 milligrams per liter.

- Bate liquor

  Bate liquor has considerable amounts of organic matter and nitrogen.

- Pickle liquor

  Pickle liquor contains large amounts of salt and acid.

- Chrome tanning liquor

  Chrome tanning liquor has a high acid content and is greenish in color. About 100 to 200 milligrams of trivalent chromium is found in a liter of tanning liquor. The BOD of this type of waste is usually about 1,000 milligrams per liter.

o Dyeing and fatliquoring effluent

This effluent contains residuals of dyes and oily emulsions.

Samples taken from selected Meycauayan tanneries indicate that on the average, the wastewater generated by the tanneries without removal of chrome hydroxide sludge, has the following characteristics compared with the allowable limits set in the Effluent Regulation of 1982:

	Wastewater Characterstics	Allowable Limits
pH	5.6	6 - 9
Total solids (mg/l)	12,469	-
Total dissolved solids (mg/l)	11,223	-
Total suspended solids (mg/l)	1,929	100
Chemical Oxygen Demand (mg/l)	6,333	-
Biological Oxygen Demand - 5 days (mg/l)	1,700 - 3,000	150
Chromium (g/l)	0.0026	-
Organic nitrogen (%)	0.0365	-
Temperature (^{o}C)	28 - 30	40
Sulphide level (mg/l)	170	-

Analysis of the level of micronutrients such as calcium, cobalt, iron, magnesium, nickel, phosphorous, potassium, sodium, and zinc was not undertaken because the proposed wastewater treatment process has been tested and proven efficient even without the addition of these nutrients. The analysis of sulphate in the wastewater was omitted because the process is also efficient given the sulphate content of the tannery wastewater.

Quantity of Wastewater Generated in Meycauayan

Based on the estimated leather production of the identified leather tanneries in Meycauayan, the wastewater generation of these tanneries is estimated at 296 cubic meters per day or 76,960 cubic meters per year, assuming 260 operating days in a year. Table 4 shows the breakdown of wastewater generation by barrio.

Table 4
Estimated Wastewater Generation
of Tanneries in Meycauayan
By Barrio
At 1988 and at Full Capacity Utilization
(cubic meters)

Barrio	At 1988 Capacity Utilization (actual) Daily	Annual	At Full Capacity Utilization (potential) Daily	Annual
Tugatog	89	23,140	179	46,540
Bancal	73	18,980	368	95,680
Hulo	52	13,520	154	40,040
Banga	45	11,700	114	29,640
Libtong	18	4,680	51	13,260
Calvario	15	3,900	73	18,980
Zamora	4	1,040	8	2,080
Total	296	76,960	947	246,220

Notes: a. 163.2 square feet of leather = 1 cubic meter of wastewater
b. 260 operating days a year.

Projected Wastewater Generation

Wastewater generation of the tanneries in Meycauayan is projected to grow at six per cent a year, following the expected growth rate of leather production which is based on the historical volume of animals slaughtered in the Philippines.

As shown in Table 5, annual wastewater generation of the Meycauayan tanneries is expected to reach 116,740 cubic meters by 1995 and 209,040 cubic meters by 2005.

Table 5
Projected Wastewater Generation
of Tanneries in Meycauayan
By Barrio
1989 to 1995, 2000, 2005
(cubic meters)

Barrio	1989	1990	1991	1992	1993	1994	1995	2000	2005
Tugatog	23,920	25,220	26,780	28,340	30,160	31,980	34,060	45,500	60,840
Bancal	23,290	25,480	26,780	28,340	30,160	31,980	33,800	45,240	60,580
Hulo	13,520	14,300	15,080	15,860	16,900	17,940	18,980	25,220	33,800
Banga	11,700	12,480	13,260	14,040	14,820	15,680	16,640	22,360	29,900
Libtong	4,680	4,940	5,200	5,460	5,720	5,980	6,240	8,580	11,440
Calvario	3,900	4,160	4,420	4,680	4,940	5,200	5,460	7,280	9,620
Zamora	1,040	1,040	1,040	1,300	1,300	1,300	1,560	2,080	2,860
Total	82,680	87,620	92,560	98,020	104,000	110,060	116,740	156,260	209,040

Present Wastewater Management and Disposal Practices in Meycauayan

Based on the survey, sedimentation is the most widely used wastewater management practice in Meycauayan. Fifteen tanneries currently employ this particular method of wastewater treatment. Sometimes, tanneries use a combination of wastewater management methods such as sedimentation with screening or lagooning.

The following discusses briefly the most common wastewater treatment methods used by the Meycauayan leather tanneries:

o Sedimentation

Settling tanks are used to allow suspended solids in the wastewater to settle. After the wastewater is treated using sedimentation, its BOD level is decreased by 25 per cent while its volume of suspended solids is reduced by 60 per cent.

o Screening

To remove floating and suspended solids, the wastewater is passed through a screen, usually in the form of bars, wires, or perforated plates.

o Lagoons

Lagooning is the simplest method of removing organic dissolved solids in wastewater. Several types of lagoons are used in combination to treat tannery wastewater. The most widely used are facultative and aerobic lagoons.

However, it was observed that almost all the tanneries do not operate their wastewater treatment facilities on a regular basis because of high operating costs.

Chromic Oxide

Estimated Market Size

The market demand for chromic oxide is estimated at 148,179 kilograms valued at ₱15.6 million. This is based on 1989 import statistics obtained from the Business Statistics Monitor, since there is no local producer of chromic oxide. As shown in Table 6, Philippine imports of chromic oxide grew by two per cent from 1988 to 1989.

Table 6
Imports of Chromic Oxide
1988 and 1989

Year	Volume (kilograms)	Landed Cost (thousand pesos)	Growth Rate (%)
1988	145,512	12,856	-
1989	148,179	15,605	2

Source: Business Statistics Monitor.

Source of Supply

The major country sources of the Philippines for chromic oxide are Germany, Holland, and the U.S. In 1989, the Philippines' biggest foreign supplier of chromic oxide was Bayer AG which shipped a total of 83,000 kilograms valued at landed cost ₱8.8 million from Germany and Holland. It was followed by Pfizer Pigments, Inc. with total shipments of 20,909 kilograms valued at landed cost ₱1.9 million from the U. S. As shown in Table 7, these two firms were also the country's top foreign suppliers in 1988.

Table 7
Major Foreign Suppliers
of Chromic Oxide
1988 - 1989

Supplier	1988 Volume (kilogram)	1988 Value (thousand pesos)	1988 Country of Origin	1989 Volume (kilogram)	1989 Value (thousand pesos)	1989 Country of Origin
Bayer AG	89,730	7,733	Germany, Holland	83,000	8,764	Germany, Holland
Pfizer Pigments, Inc.	18,182	1,495	U.S.	20,909	1,943	U.S.
Ciba Geigy Inc.	11,000	1,292	Holland	15,000	1,818	Holland
Dainichiseika Color & Chem. Mfg. Inc.	7,600	778	Japan	5,520	490	Japan
BV Association for Chemical Products	-	-	-	2,000	316	Holland
C. Uyemura and Co.	-	-	-	1,500	124	Japan
Makoto Co. Ltd.	-	-	-	250	8	Japan
Lexzau Schar Dau Co.	18,000	1,470	Germany	-	-	-
BASF AG	1,000	88	Japan	-	-	-
Unspecified	-	-	-	20,000	2,142	U.S.
Total	145,512	12,856		148,179	15,605	

Source: Business Statistics Monitor.

Projected Demand

Using the two per cent growth of chromic oxide importation from 1988 to 1989 as basis for demand projections, the demand for chromic oxide is projected to reach 166,000 kilograms in 1995 and 203,000 kilograms in 2005 as shown in Table 8.

Table 8
Projected Demand for Chromic Oxide
1990 to 1995, 2000, and 2005
(kilograms)

Year	Volume
1990	151,000
1991	154,000
1992	157,000
1993	160,000
1994	163,000
1995	166,000
2000	183,000
2005	203,000

Pricing

As shown in Table 9, the average landed cost of imported chromic oxide was ₱99 per kilogram in 1989. Average landed cost increased by 16 per cent from 1988 to 1989.

Table 9
Average Landed Cost
Per Kilogram of Chromic Oxide
1988 and 1989
(pesos)

Year	Average Landed Cost Per Kilogram
1988	85
1989	99

Source: Business Statistics Monitor.

PLANT CAPACITY

Plant Capacity and Production Program

The proposed rated capacity of the common wastewater treatment facility is 260 cubic meters of wastewater per day or 78,000 cubic meters per year, assuming the facility operates 300 days a year. The wastewater treatment facility will operate 24 hours a day continuously. Prestart-up activities including plant construction will take around two years. Therefore, the estimated date of start of plant operations is 1992.

The facility, however, is expected to service only 26 out of the 33 tanneries in Meycauayan, based on indications obtained from the survey. The seven tanneries who will not use the facility already have their own wastewater treatment facilities.

In 1992, total wastewater generated by the Meycauayan tanneries is projected to reach 98,020 cubic meters, of which 71,240 cubic meters or 73 per cent will be generated by the 26 tanneries to be serviced by the facility. Table 10 shows the projected volume of wastewater , by barrio, of the tanneries to be serviced by the facility from 1992 (Year 1) to 2001 (Year 10).

Table 10
Projected Annual Wastewater Generation
of Tanneries (by barrio)
To be Serviced by the Facility
Years 1 to 10
(cubic meters)

Barrio	1	2	3	4	5	6	7	8	9	10
Bangcal	21,060	22,360	23,660	24,960	26,780	28,340	29,900	31,980	34,060	36,140
Hulo	15,860	16,900	17,940	18,980	20,020	21,320	22,820	23,920	25,220	26,780
Tugatog	14,300	15,080	16,120	17,160	18,460	19,800	20,800	21,840	23,400	24,960
Banga	14,040	14,820	15,860	16,640	17,680	18,720	20,020	21,060	22,360	23,660
Calvario	4,680	4,940	5,200	5,460	5,980	6,240	6,760	7,020	7,280	7,800
Zamora	1,300	1,300	1,300	1,560	1,560	1,820	1,820	2,080	2,080	2,080
Total	71,240	75,400	80,080	84,760	90,480	95,940	101,920	107,900	114,400	121,420

Given the projected wastewater generation of the tanneries that will use its services, the wastewater treatment facility will operate at 91 per cent of its capacity in its start-up year. As shown in Table 11, the facility will attain 100 per cent capacity utilization by the third year of its operation. The initial capacity of the facility was set at only 78,000 cubic meters a year because projects of this type are usually implemented by phases, that is, expanded as the need arises. Such will minimize the initial capital investment required for the project. There would be no savings by building a bigger plant since this would involve the installation of a separate set of equipment altogether which can be done on the third year anyway, before the facility reaches full capacity. However, in the financial projections, plant expansion during the third year was not considered.

Table 11
Projected Volume of Wastewater
to be Processed by the Facility
and Plant Utilization, Years 1 to 3

Year	Volume of Processed Wastewater	Capacity Utilization (%)
1	71,240	91
2	75,400	97
3	78,000	100

On the other hand, the rated production capacity of the facility's chrome recovery section is 137 kilograms of chromic oxide per day or 35,620 kilograms of chromic oxide per year, assuming this section opearates 260 days a year. The section will operate eight hours a day and six days a week.

The chrome recovery section is expected to produce 32,414 kilograms of chromic oxide in its first year of operation. This production level is approximately 91 per cent of the section's capacity. Like the facility's wastewater treatment section, it will attain 100 per cent capacity utilization in its third year of operation.

At full capacity utilization, the chrome recovery section will be able to capture 22 per cent of the projected market for chromic oxide.

Table 12 shows the production program, projected capacity utilization, and market penetration ratio of the facility's chrome recovery section for Years 1 to 3.

Table 12
Production Program and
Capacity Utilization
of the Chrome Recovery Section
Years 1 to 3

Year	Annual Production of Chromic Oxide (kilograms)	Capacity Utilization (%)	Market Penetration Ratio (%)
1	32,414	91	21
2	34,551	97	22
3	35,620	100	22

Charges

The fees or charges for wastewater treatment are set at ₱45 per cubic meter of wastewater (excluding 10 per cent value-added tax). This rate was determined based on the minimum acceptable rate of return on the project of 20 per cent.

Based on the estimated wastewater generation per square foot of leather production and the average selling price of leather, the fee represents about one per cent of the projected average revenues of the tanneries. The amount of wastewater to be treated for each tannery will be monitored by a meter to be installed at the tannery.

Payment for wastewater treatment charges is lower than the penalty of ₱5,000 per day set by the Environmental Management Bureau assuming this penalty will be strictly enforced in the future. To illustrate, a tannery operating at its full capacity of 5,000 square meters of leather per day (average rated capacity of tanneries in Meycauayan) will only have to pay a maximum of ₱1,400 per day for the services of the proposed facility.

Because of the socioeconomic benefits of the project in terms of health and environmental protection, it may be possible to obtain some government subsidy for certain project costs, for instance, the cost of civil works involved in the installation of the pipeline system amounting to ₱5,317,768. The installation of the pipeline system can be part of the waste management program for the locality. If the project obtains a subsidy, the fees for wastewater treatment can be lowered to about ₱25 per cubic meter assuming the project will be BOI-registered. At this revised rate, the project will still be able to meet the minimum acceptable rate of return of 20 per cent.

The chromic oxide produced by the facility will be sold at ₱59 per kilogram (excluding value-added tax). This price is about 40 per cent lower than the 1989 average landed cost of imported chromic oxide.

Revenue Projections

Based on the proposed charges for wastewater treatment services and the projected volume of wastewater to be treated by the common facility, the projected revenues from wastewater treatment services at full capacity is ₱3,510,000 (without government subsidy). (See Table 13.)

Based on the selling price of ₱59 per kilogram and the projected production volume of chromic oxide, the projected revenue of the chrome recovery section at full capacity is ₱2,101,580.

Table 13
Projected Revenues
from Wastewater Treatment *
and Chromic Oxide Production
Years 1 to 15
(pesos)

Year	Wastewater Treatment	Chromic Oxide	Total
1	3,205,800	1,912,426	5,118,226
2	3,393,000	2,038,509	5,431,509
3 - 15	3,510,000	2,101,580	5,611,580

* without government subsidy.

IV. MATERIAL INPUTS

MATERIALS AND INPUTS

Raw Materials

The common facility will use biological treatment with anaerobic and aerobic methods to process tannery wastewater. These methods of wastewater treatment do not require any raw material inputs aside from the tannery wastewater.

The base material for the production of chromic oxide is chrome hydroxide slurry. No cash outlay will be needed for the slurry because it will be collected from the sumps of the tanneries which will be serviced by the facility.

Utilities

The annual electric power consumption of the proposed facility is estimated at 74,456 kilowatt-hours. The wastewater treatment section will consume 50,635.2 kilowatt-hours, the chrome recovery section, 12,468.8 kilowatt-hours, and the administration building, 11,352.0 kilowatt-hours. At an assumed kilowatt-hour cost of ₱2, annual electric power consumption of the facility at full capacity is estimated at ₱148,912. The breakdown of electric power consumption by equipment is shown in Annex 3.

On the other hand, the annual water consumption of the proposed facility is estimated at 1,992 cubic meters per year. Of total water consumption, the chrome recovery section will consume 1,092 cubic meters per year. This section will use the water for washing the chrome hydroxide slurry. The remaining 900 cubic meters will be used for laboratory purposes. Water rate charged by the Meycauayan Water District is one of the highest in the country. To cut down on water costs, the project will install its own water supply tank instead of availing of water services from the local water district. Electrical charges for pumping water are included in the computation of the facility's power consumption.

The chrome recovery section at full capacity will utilize approximately 1,500 kilograms of liquified petroleum gas (LPG) per year. The LPG will be needed to start-up the kiln used for heating the chrome hydroxide. At ₱8 per kilogram of LPG, the annual expenditures for LPG is estimated at ₱12,000 at full capacity. Aside from LPG, roughly 44,720 kilograms of biogas will be needed for the operation of the kiln. The biogas will be internally generated from the wastewater treatment process.

V. LOCATION AND SITE

LOCATION AND SITE

The proposed location for the common wastewater treatment facility is Barrio Tugatog, Meycauayan. The specific site identified is shown in the map of Meycauayan in Annex 4. In identifying an ideal site for the facility, a major constraint is the limited availability of land. The proposed site is the nearest and most accessible location available considering the land area requirements of the project. All the tanneries to be served by the facility are within two kilometers from the proposed site. The site is also ideal because it is right beside the Meycauayan River where the treated wastewater may be discharged.

LAND COST

The estimated cost of land in Meycauayan is ₱ 700 per square meter. With the proposed land area of 2,500 square meters for the facility, the total investment in land is estimated at ₱1,750,000.

VI. PROJECT ENGINEERING

LAYOUT AND PHYSICAL COVERAGE OF PROJECT

Plant Layout

The proposed common facility will occupy 1,056 square meters of the total land area of 2,500 square meters. The major structures of the facility include the following:

- o equalization pond
- o upflow anaerobic filters (2)
- o trickling filter
- o auxiliary building which houses the chrome recovery section, the laboratory, and the administration office
- o polishing pond, and
- o gas tank.

The layout and the specifications of the structures of the facility are presented in Annex 5.

TECHNOLOGY AND EQUIPMENT

Technology and Processes

Wastewater Treatment

The following describes in detail the process flow for wastewater treatment using the upflow anaerobic filter and trickling filter method proposed for the facility.

o Pretreatment of Wastewater

Prior to the collection of wastewater from each tannery, the wastewater will undergo pretreatment at the tannery. Each tannery should have three separate drainage lines (existing open canals can be used) for the following types of tannery wastewater:

- chrome tanning liquor
- lime liquor
- other wastewater including soak liquor, unhairing and fleshing effluent, deliming effluent, bate liquor, and pickle liquor.

To remove large solids present in the wastewater, bar screens and wire mesh screens will be installed along the drainage lines. This will prevent clogging of the pipeline system leading to the common treatment facility. The tannery should clean the screens regularly.

The chrome tanning liquor and lime liquor will be discharged batchwise into the separate drainage lines that lead to a small collection sump located at the tannery. The influent port of the collection sump will be fitted with a fine screen to further filter out solids in the wastewater. The combination of chrome tanning liquor and lime liquor will result in the creation of chrome hydroxide slurry.

On the other hand, the other types of wastewater will be brought to existing lagoons or sedimentation ponds of the tannery. The influent port of these lagoons or sedimentation ponds will likewise be fitted with a fine screen to further remove solids.

The wastewater from the sump will be released into the lagoon or sedimentation pond of the tannery to combine with the other types of wastewater after the chrome hydroxide sludge is removed from the sump.

These pretreatment measures are envisioned to remove approximately 95 per cent of the solids in the wastewater before the wastewater flows into the main sewer pipeline system that leads to the proposed treatment facility. The remaining five per cent of the solids in the wastewater are microscopic in size and therefore will not clog up the pipeline system.

After pretreatment at the tannery site, the proposed facility's operations start. The wastewater will be collected from the tanneries and brought to the proposed facility where it will be processed through anaerobic and aerobic treatment.

o Collection System

The wastewater collection system designed for this project entails the installation of an underground main pipeline system that will transport the wastewater from the tanneries to the proposed treatment facility after pretreatment. Connecting pipelines from the tanneries' lagoons or sedimentation ponds to the main pipeline system, however, should be provided by the tanneries. The main pipeline system will consist of polyvinyl chloride (PVC) pipes of varying diameter and will be approximately 4,040 meters long.

From the lagoons or ponds of the tanneries, the pretreated wastewater will flow by gravity through 110 millimeter pipes. These pipes will lead to a manhole

connected to 160 millimeter interceptor pipes which in turn will lead to the main pipeline system consisting of wider pipes, approximately 200 to 250 millimeter in diameter. Four pumping stations at different points of the main sewer pipeline system will be installed to facilitate the flow of the wastewater to the equalization pond of the treatment plant.

Alternatively, the wastewater may be collected from the tanneries by pumping the wastewater into container drums and hauling these drums to the facility using a service vehicle. Since the roads in Meycauayan are very narrow (only small vehicles such as cars, jeeps, and pickup trucks can pass these roads), only pickup trucks may be used to transport the wastewater from the tanneries to the proposed facility. A pickup truck can carry a maximum of three 200-liter drums of wastewater at a time. To be able to transport 260 cubic meters or 260,000 liters of wastewater per day (full capacity of proposed facility), at least 144 pickup trucks will be needed, assuming each pickup truck will make three trips a day.

At an estimated cost of ₱260,000 per pickup truck, the outlay for this method of wastewater collection amounts to ₱37.4 million. On the other hand, the investment cost of the sewer pipeline system amounts to only ₱7.2 million (without BOI incentives). Moreover, additional operating expenses, specifically fuel and labor costs, will be incurred if pickup trucks are used for wastewater collection.

o Equalization

The wastewater will remain in the equalization pond for approximately 2.1 days (60 hours). Here, the biological oxygen demand (BOD) of the wastewater will be reduced by 20 per cent.

o Anaerobic Treatment

The wastewater will then be pumped from the equalization pond into the first of two upflow anaerobic filters, otherwise known as anfils. The anfils are enclosed column reactors, each about 10 meters in height, containing coconut shells that serve as packing materials and are held up by perforated plates.

The coconut shells inside the anfil will have the following characteristics:

Surface area	3,000 to 5,000 sq. m./ cu. m. of coconut shells
Density	400,000 to 700,000 kg/cu. m. of coconut shells
Nominal size	100 to 140 mm

The coconut shells in the anfils will serve as medium for the growth of microorganisms that will consume the biodegradable solids in the wastewater. * The minute nonbiodegradable solids left in the wastewater after pretreatment at the tanneries will be able to go through the spaces between the coconut shells and will flow with the wastewater out of the anfils, thereby precluding the possibility of clogging the anfils.

The wastewater will remain in the first anfil for about 24 hours after which the wastewater will be pumped out into the second anfil where it will be retained for 24 hours.

The salient features of the anfils are as follows: They can generate methane gas; they are not easily affected by temperature changes; they do not require additional nutrients to enhance their efficiency; and they have a built-in mechanism for pH control.

In the first anfil, limited hydrolysis reaction will take place, resulting in the formation of organic acids. These acids, however, will not be fully converted into methane in the first anfil. They will only be fully converted into methane and carbon dioxide in the second anfil.

Methane or biogas is produced from the anaerobic digestion of the organic matters of the wastewater. It is discharged from the top of the second anfil and is collected in gas holders. The biogas will be used for the operation of the kiln for chrome recovery. As a safety measure, the gas tank will be built at least five meters away from the auxiliary building and four meters away from the anfil. A wire fence will be installed around the gas tank to keep unauthorized personnel out. Smoking will be not be allowed within 100 meters of the gas tank area. In addition, the gas tank will be fitted with over- and under-pressure security valves. It will also be checked every month for possible leaks. Futhermore, two fire extinguishers and a water hose will be provided.

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* To hasten the growth of microorganisms inside the anfils, activated sludge will be pumped inside the anfils before the operation of the proposed facility. The sludge will be scraped out during the yearly shutdown of the proposed facility to clean the anfils. Activated sludge will be pumped again into the anfils before the facility is operated again.

The anfils will operate at ambient temperature, ranging from 28° to 30°C. The temperature in the country usually remains at these levels throughout the year, except during summer when the temperature increases to as high as 38°C. The increase in temperature will speed up both the organic matter consumption and methane generation of the anfil. Eventually, the operation of the anfils will normalize once they adjust to the change in temperature.

The anaerobic digestion process within the anfil will be inhibited if the ammonia nitrogen, sulphide, and phosphorous content of the wastewater exceed certain levels. However, the amount of these substances in the wastewater is less than the toxic levels as shown in the following table.

	Wastewater Content	Toxic Level
Ammonia nitrogen	0.0365 g/l	over 5.0 g/l
Sulphide	170 mg/l	over 200 mg/l

Thus, nutrients need not be added to the wastewater to enhance the digestion process within the anfils.

The natural reaction of the microorganisms within the anfils will normalize the pH of the wastewater. Thus, equipment for pH control, such as pumps, mixers, and storage tanks, will not be needed.

o Aerobic Treatment

From the second anfil, hydraulic pressure will push the wastewater to the top of a trickling filter. The trickling filter is an open-top column reactor, only 1.5 meters in height. A distributor mechanism at the crown of the filter will evenly shower the wastewater through the gravel which will serve as medium for the growth of microorganisms in the wastewater. Large-sized gravel will make up the top layer while small-sized gravel will form the bottom layer.

The gravel inside the trickling filter will have the following characteristics:

	Large-Sized	Small-Sized
Surface area (sq.m./cu.m. of gravel)	40 to 50	55 to 70
Density (kg/cu. m. of gravel)	800 to 1,000	1,250 to 1,450
Nominal size (mm)	100 to 120	25 to 65

The trickling filter will primarily reduce the organic matter in the wastewater. The organic matter will be consumed by the microorganisms on the surface of the gravel. In addition, the trickling filter will remove the remaining minute solids in the wastewater. The trickling filter will decrease the BOD level of the wastewater by 60 per cent.

Direct treatment of wastewater using the trickling filter is not advisable because of the danger of ponding. Ponding refers to the accumulation of slough on the surface of the filter, the build-up of which will cause it to fall and strip off the rest of the microorganisms in the filter.

o Polishing

From the trickling filter, the wastewater will go to a polishing pond for further biological treatment. The wastewater will stay in the polishing pond for 16 hours to reduce its BOD level by another 20 per cent. After processing in the polishing pond, the treated wastewater will be released into the Meycauayan River.

After processing, the characteristics of the wastewater will be within limits based on the Effluent Regulation of 1982. A comparison of the post-treatment characteristics of the wastewater and limits of the Effluent Regulation is shown below:

Characteristics	Treated Wastewater	Limits of Effluent Regulation*
Color (platinum cobalt unit)	75 - 100	150
pH	6 - 8	6 - 9
Temperature (^{o}C)	30	40
Phenols (mg/l)	nil	1.0
Suspended solids (mg/l)	60 - 75	100
Biochemical Oxygen Demand - 5 days (mg/l)	50 - 80	150
Oil and grease (mg/l)	nil	10

* Should not be exceeded.

A flow diagram, including by-pass possibilities and loads for each treatment step, for the proposed wastewater treatment method is presented in Annex 6.

Chrome Recovery

The tanneries will be required to build a small sump where the lime liquor and chrome tanning liquor will be collected. To filter the solids in the wastewater, bar screens and wire mesh screens will be installed along the drainage lines to the sump. In addition, the sump of each tannery will be fitted with a fine screen at its port.

In the sump, the lime liquor will cause the chrome tanning liquor to precipitate. This process will convert the chrome tanning liquor into chrome hydroxide slurry.

Using a portable displacement pump, the chrome hydroxide sludge will be drawn from the sumps of the tanneries into 200-liter capacity containers. The containers will be hauled by a service vehicle to the proposed facility. The service vehicle can carry a maximum of three containers. At full capacity of the chrome recovery section, it will take only one trip a day for the service vehicle to haul the sludge from the tanneries.

At the facility, the chrome hydroxide slurry will be washed twice with water to remove its obnoxious odor. After washing, the chrome hydroxide will be air-dried. At approximately 50 per cent moisture level, the chrome hydroxide will be heated inside a kiln at a temperature of $850^{o}C$, thereby converting the chrome hydroxide into chromic oxide. The chromic oxide will then be milled, weighed, and packed into 50-kilogram bags.

The process flow diagram for the production of chromic oxide is presented in Annex 7.

Machinery and Equipment

The major equipment needed for the wastewater treatment facility include a pipeline system connecting the tanneries to the facility, four jack pumps, and a five-horsepower centrifugal pump.

On the other hand, the equipment needed for the chrome recovery section include a two-horsepower centrifugal pump, pulverising mill, air compressor, two nonclog displacement pumps, gas tank, and plastic sealer.

A list of production equipment and the equipment specifications is shown in Annexes 8 and 9.

Laboratory equipment will be required for testing the treated wastewater and chromic oxide. Other equipment include a utility vehicle and office equipment. A list of the laboratory, transportation and office equipment is presented in Annex 10.

Packing materials, namely coconut shells and gravel, will be needed for certain wastewater treatment equipment.

The total cost of pipeline system, production machinery and equipment, laboratory equipment, and other equipment, and fixed assets is estimated at ₱8.3 million with BOI incentives and ₱8.6 million without BOI incentives. (See Table 14.)

Table 14
Cost of Machinery and Equipment
and Other Fixed Assets
With and Without BOI Incentives
(pesos)

	With BOI Incentives	Without BOI Incentives
Sewer pipeline system	7,000,577	7,168,858
Production equipment *	512,741	610,877
Laboratory equipment	300,463	300,463
Tranportation equipment	280,000	280,000
Office equipment	53,500	53,500
Other fixed assets **	192,327	211,000
Total	8,339,608	8,624,698

Notes:

* Includes gas tank fitted with over- and under-pressure security valves.

** Includes packing materials for the anfil and trickling filter, and two fire extinguishers and a water hose for gas management.

CIVIL ENGINEERING

The total investment outlay for civil works and engineering is estimated at ₱4.3 million. The cost of concrete works includes the cost of construction of the anfil and trickling filter which account for the bulk of the total cost of civil engineering. (See Table 15.)

Table 15
Cost of Building and Civil Works
(pesos)

Site development	220,000
Excavation	118,413
Concrete works *	2,941,290
Rip-rap **	250,016
Auxiliary building	540,000
Piping	120,000
Electrical	100,000
Total	4,289,719

Notes:

* Includes construction cost of the anaerobic filter and the trickling filter; excludes installation of pipeline system.

** Rip-rap is needed for both the equalization and polishing pond.

VII. PLANT ORGANIZATION AND OVERHEAD COSTS

PLANT ORGANIZATION

The general manager will be responsible for the production, sales, and administrative operations of the facility. The proposed organizational chart is presented in Annex 11.

OVERHEAD COSTS

Factory Overhead

At 100 per cent capacity utilization, factory overhead is estimated at ₱166,950 per year. Factory overhead includes packaging costs, laboratory supplies, fuel for the service vehicle for hauling the chromic hydroxide, and salaries of other personnel not directly involved in production.

Administrative and Sales Overhead

Administrative and sales overhead is estimated at ₱632,368 per year. Administrative overhead consists of both labor and nonlabor costs (salaries of administrative personnel, insurance, permits, office supplies, professional fees, etc.). Sales overhead includes fuel costs for the marketing of chromic oxide.

Depreciation Charges

Depreciation charges are estimated using the straight-line depreciation method. The auxiliary building is depreciated over 20 years, machinery and equipment, 10 years, office and transportation equipment, five years.

VIII. MANPOWER

Since the facility will use automated machineries, only seven semi-skilled workers will be needed for the production operations of the facility. Out of the seven workers, four (a wash tank tender, furnace tender, mill tender, and packer) will be assigned to the chrome recovery section. The remaining three workers will serve as pump tenders for the wastewater treatment section, each working on a different eight-hour shift.

The salaries of these workers including benefits amount to ₱252,000 per annum. The fringe benefits are estimated at 30 per cent of the basic salaries.

The manpower requirements, including administrative personnel, and cost are presented in Annex 12.

A part-time chemical analyst and chemical technician will be hired to oversee quality control and proper operation of the facility.

IX. PROJECT IMPLEMENTATION

IMPLEMENTATION SCHEDULE

Preproduction activities for the establishment of the proposed facility are expected to take two years. The major activities during the preproduction phase include the following:

Project Implementation Management

A project management team will be organized during the initial month of the project implementation. During this phase, the team will plan the implementation program for the facility. A feasibility study (excluding detailed engineering) on the project will be prepared to firm up the market study. Preparation of the feasibility study will take around four months.

Arrangements for Technology Supply

Selection of and arrangements for the appropriate technology for the facility will take two months.

Detailed Engineering and Tendering of Equipment and Civil Works

After technology selection, bidding for the detailed engineering for the machinery and civil works will take place. The contractors for the civil works and suppliers of the machinery will be evaluated and selected. Negotiations on prices will follow after which the contacts will be awarded. This phase is estimated to take 10 months.

Government Approval of Licenses and Other Documents

The project will be registered with government agencies such as the Board of Investments, Environmental Management Bureau, and the Central Bank. The required permits will also be obtained from the local government. It will take approximately six months to secure all the licenses and permits, registration, and other required documents for the construction and operation of the facility.

Arrangements for Financing

After government approval, arrangements for loans will be made. Loan negotiations and submission of requirements for the loans are estimated to take six months.

Construction Period

Under this phase, negotiations to buy the proposed site for the facility will be undertaken. After the land is purchased, land preparation and development according to the specifications of the facility will be initiated, followed by the construction of the building and the required civil works. All activities under the construction period will be done within 11 months.

Recruitment and Training of Staff

Recruitment and training of both administration and production personnel will be accomplished during this period and will take eight months.

Supervision, Coordination, Testing, and Takeover of Facility

During the latter phase of the implementation program, the necessary equipment will be installed and tested. A trial production will be done for two months, followed by the commissioning of the facility.

Preproduction Marketing

Promotions will be undertaken to create the market awareness for the facility's products and services. Preproduction marketing activities will take six months.

The proposed project implementation is shown in Annex 13.

COST ESTIMATE

As shown in Table 16, preproduction costs, excluding construction costs, are estimated at ₱1.42 million with BOI incentives and ₱1.43 million without BOI incentives.

Table 16
Preproduction Expenditures
(pesos)

	With BOI Incentives	Without BOI Incentives
Detailed project feasibility study	300,000	300,000
Trial runs	100,000	100,000
Training	75,000	75,000
Property taxes	35,000	35,000
Capitalized interest	913,640	925,759
Total	1,423,640	1,435,759

X. FINANCIAL AND ECONOMIC EVALUATION

TOTAL INVESTMENT OUTLAY

The total initial investment outlay for the project is estimated at ₱ 16.0 million or US$727 thousand, assuming the project will be registered with the Board of Investments. If BOI-registered, the project will be able to avail of income tax holiday for the initial four years of operation, tax- and duty-free importation of machinery and equipment, and tax credit on local machinery and equipment.

Fixed assets, amounting to ₱14.4 million with BOI incentives, account for the bulk of total initial investment costs. Other initial investments include preproduction capital expenditures and initial working capital. Preproduction capital expenditures consist of the the following costs: project feasibility study, manpower training, test and trial runs, property taxes during construction, and interest charges. On the other hand, initial working capital consists of 30 days' cash, 30 days' accounts receivable, 30 days' spare parts, 30 days' utilities, one day's work-in-process, and seven days' finished goods inventory for the first year of operation. (See Table 17.)

Without BOI incentives, the total initial investment outlay for the project is estimated at ₱16.3 million or US$741 thousand, with fixed assets of ₱14.7 million.

Table 17
Breakdown of Investment Outlay
(thousand pesos)

	With BOI Incentives	Without BOI Incentives
Land	1,750	1,750
Buildings & civil works	4,289	4,289
Sewer pipeline system	7,001	7,169
Auxiliary & service equipment	54	54
Incorporated fixed assets	472	491
Plant machinery & equipment	817	911
Total Fixed Assets	14,383	14,664
Preproduction capital expenditures	1,424	1,436
Net working capital	191	191
Total Initial Investment Cost	15,998	16,291

PROJECT FINANCING

The project will be financed by both equity and loans. An equity contribution of ₱6.7 million or about 42 per cent of total project cost is assumed. The balance will be financed with loans amounting to ₱9.3 million. Of the loan amount, ₱8.9 million will be sourced from a local loan and ₱454 thousand (US$ 20,636) from a foreign loan. The foreign loan will be used to finance the foreign currency component of imported machninery and equipment costs.

Interest rates are assumed at 20 per cent per annum for the local loan and 11.5 per cent per annum for the foreign loan. Loans are assumed to have a maturity period of seven years with a two-year grace period for the repayment of principal.

As seen in Table 18, the total project financing requirements without BOI incentives is higher by about two per cent compared with the financing requirements with BOI incentives.

Table 18
Sources of Financing
(thousand pesos)

	With BOI Incentives	Without BOI Incentives
Loans		
Foreign	454	518
Local	8,876	8,960
Total Loans	9,330	9,478
Equity	6,669	6,814
Total Sources of Financing *	15,999	16,292

Note:

* May not be equal to total initial investment outlay because of rounding off.

PRODUCTION COST

Total production cost at full capacity is estimated at ₱3.7 million (with BOI incentives). The bulk (40 per cent) of this amount is made up of interest charges of ₱1.5 million. Depreciation expense amounts to ₱872 thousand while factory costs are about ₱736 thousand. Other production costs include administrative overhead and sales and distribution costs amounting to ₱632 thousand.

Without BOI incentives, depreciation is higher at ₱893 thousand. Interest is also higher because of the larger amount of debt financing involved.

Factory costs consist of direct labor and factory overhead. Direct labor, totaling ₱252 thousand, accounts for 35 per cent of total factory costs. Factory overhead includes cost of utilities, energy, repairs and maintenance, and spares.

The breakdown of the estimated production costs at full capacity with BOI and without BOI incentives is presented in Table 19.

Table 19
Production Costs at Full Capacity (1994)
(thousand pesos)

	With BOI Incentives	Without BOI Incentives
Factory Costs		
Direct labor	252	252
Factory overhead	484	484
Sub-total	736	736
Administrative overhead	620	620
Sales and distribution costs	12	12
Depreciation	872	893
Financial costs	1,462	1,481
Total Production Cost	3,702	3,742

PROFITABILITY

The internal rate of return (IRR) of the project with BOI incentives is estimated at 22.53 per cent, assuming the project is able to avail of tax- and duty-free importation of capital equipment, an income tax holiday of four years, and tax credit on local equipment. On the other hand, IRR on equity is 21.86 per cent. Net present value at 20 per cent hurdle rate is ₱1.4 million. Payback period for the project is five years and nine months. Breakeven sales as a percentage of sales at full capacity is 34.19 per cent.

Without BOI incentives, the IRR of the project is estimated at 19.96 per cent and the IRR on equity is 18.21 per cent. Net present value at 20 per cent hurdle rate is negative ₱23 thousand. Payback period for the project is six years and six months. Breakeven sales as a percentage of sales at full capacity is 34.59 per cent.

A decrease of 10 per cent in revenues will bring down the IRR to 19.16 per cent (with BOI incentives). An increase of 10 per cent in production costs will reduce the IRR to 21.65 per cent. An increase of 10 per cent in investment cost will cause the IRR to decline to 20.28 per cent.

Table 20 presents the results of the sensitivity analysis for the project with and without BOI incentives.

Table 20
Profitability of the Project
Sensitivity Analysis

Profitablity Indicator	Base Case	-10% Revenues	+10% Production Cost	+10% Investment	With Government Subsidy/ ₱25 per cu.m. Rate
A. With BOI Incentives					
Internal rate of return (%)					
on total investment	22.53	19.16	21.65	20.28	21.41
on equity	21.86	16.96	20.55	18.41	20.29
Net present value (₱000) at 20% hurdle rate	1,352	(448)	883	166	507
Payback period (incl. construction period)	5 years and 9 months	6 years and 5 months	5 years and 11 months	6 years and 2 months	5 years and 11 months
Breakeven sales (%)	34.19	38.39	36.25	35.99	44.70
B. Without BOI Incentives					
Internal rate of return (%)					
on total investment	19.96	17.43	19.30	18.42	18.90
on equity	18.21	14.70	17.29	15.84	17.00
Net present value (₱000) at 20% hurdle rate	(23)	(1,415)	(391)	(960)	(414)
Payback period (incl. construction period)	6 years and 6 months	7 years	6 years and 7 months	6 years and 9 months	6 years and 8 months
Breakeven sales (%)	34.59	38.84	36.66	36.45	45.12

With government subsidy for the installation of the pipeline system and wastewater treatment charge of ₱25 per cubic meter of wastewater, the IRR on total investments of the base case is estimated at 21.41 per cent with BOI incentives and 18.90 per cent without BOI incentives. The IRR on equity is 20.29 per cent with BOI incentives and 17.00 per cent without BOI incentives.

The projected financial statements for the base case with and without BOI incentives are shown in Annex 14. The financial projections use constant 1988 prices. An exchange rate of US$1 to ₱22 is used to convert foreign currency costs and cash requirements into Philippine currency. Notes and assumptions used in the financial projections are shown in Annex 15. Summary sheets of all the cases for the sensitivity analysis and the graphical representation of the results of the sensitivity analysis are presented in Annex 16.

Going back to the base case, With BOI incentives, net income of the project as a percentage of revenues is about 21.36 per cent, 40.0 per cent, 30.58 per cent, 39.83 per cent, and 42.61 per cent in Year 1, Year 3 (full capacity utilization), Year 5 (year after income tax holiday), Year 7 (year after full loan repayment), and Year 11 (year after full depreciation of machinery and equipment), respectively. (See Table 21.)

Without BOI incentives, net income of the project as a percentage of revenues is about 13.31 per cent, 21.65 per cent, and 30.22 per cent, 39.58 per cent, and 42.50 per cent in Year 1, Year 3, Year 5, Year 7, and Year 11, respectively.

Table 21
Net Income as a Percentage
of Equity and Revenues
Year 1 to 15

A. With BOI Incentives

Year	Revenues (₱000)	Net Income (₱000)	Net Income/ Revenues (%)
1	5,118	1,093	21.36
2	5,432	1,378	25.37
3	5,612	1,908	40.00
4	5,612	2,274	40.52
5	5,612	1,716	30.58
6	5,612	1,997	35.58
7	5,612	2,235	39.83
8	5,612	2,235	39.83
9	5,612	2,235	39.83
10	5,612	2,235	39.83
11	5,612	2,391	42.61
12	5,612	2,391	42.61
13	5,612	2,391	42.61
14	5,612	2,391	42.61
15	5,612	2,391	42.61

B. Without BOI incentives

Year	Revenues (₱000)	Net Income (₱000)	Net Income/ Revenues (%)
1	5,118	681	13.31
2	5,432	867	15.96
3	5,612	1,215	21.65
4	5,612	1,455	25.93
5	5,612	1,696	30.22
6	5,612	1,981	35.30
7	5,612	2,221	39.58
8	5,612	2,221	39.58
9	5,612	2,221	39.58
10	5,612	2,221	39.58
11	5,612	2,385	42.50
12	5,612	2,385	42.50
13	5,612	2,385	42.50
14	5,612	2,385	42.50
15	5,612	2,385	42.50

FINANCIAL CASHFLOW

With BOI incentives, the net cash inflow of the project in Year 1 is estimated at ₱1.8 million. It declines to ₱384 thousand in Year 2 when the first amortization of the loan principal is paid. By Year 4, net cash inflow of the project amounts to ₱1.3 million but dips by more than 56 per cent to ₱722 thousand the following year when income tax payment begins. The project is entitled to an income tax holiday for only four years.

In Year 7, the net cash inflow of the project amounts to ₱3.04 million and is sustained at this level up to Year 10. This increase in net cash inflow to the ₱3.04 million level starting Year 7 is due to the full repayment of project loans in Year 6. In Year 11, however, net cash inflow declines slightly to ₱2.96 million because of the increase in income tax payments. This is brought about by the lower depreciation expense since machinery and equipment are already fully depreciated.

Cumulative cashflow available for cash dividends is estimated at ₱3.1 million, ₱21.2 million, and ₱33.0 million in Year 3, Year 11, and Year 15, respectively.

Without BOI incentives, the net cash inflow of the project in Year 1 is estimated at ₱1.4 million. It declines to negative ₱136 thousand in Year 2 when the repayment of loans starts. By Year 6, the cash inflow of the project amounts to ₱910 thousand and almost triples to ₱3.0 million in Year 7 after all loans have been paid.

After Year 10, the net cash inflow of the project declines slightly from ₱3.05 million to ₱2.96 million. The decline is also brought about by an increase in income tax payments due to lower depreciation expenses after machinery and equipment have been fully depreciated.

Cumulative cashflow available for cash dividends is estimated at ₱1.5 million, ₱18.7 million, and ₱30.6 million in Year 3, Year 11, and Year 15, respectively.

Table 22 presents the net cash inflow and cumulative cashflow for the project with and without BOI incentives.

Table 22
Net Inflow and Cumulative Cashflow
Year 1 to 15
(thousand pesos)

A. With BOI Incentives

Year	Inflow	Outflow	Net Inflow/ (Outflow) *	Cumulative Cashflow **
1	5,176	3,327	1,849	1,849
2	5,434	5,050	384	2,233
3	5,613	4,698	915	3,147
4	5,612	4,331	1,281	4,428
5	5,612	4,889	722	5,150
6	5,612	4,676	936	6,086
7	5,612	2,572	3,039	9,126
8	5,612	2,572	3,039	12,165
9	5,612	2,572	3,039	15,204
10	5,612	2,572	3,039	18,244
11	5,612	2,656	2,955	21,199
12	5,612	2,656	2,955	24,155
13	5,612	2,656	2,955	27,110
14	5,612	2,656	2,955	30,065
15	5,612	2,656	2,955	33,021

B. Without BOI Incentives

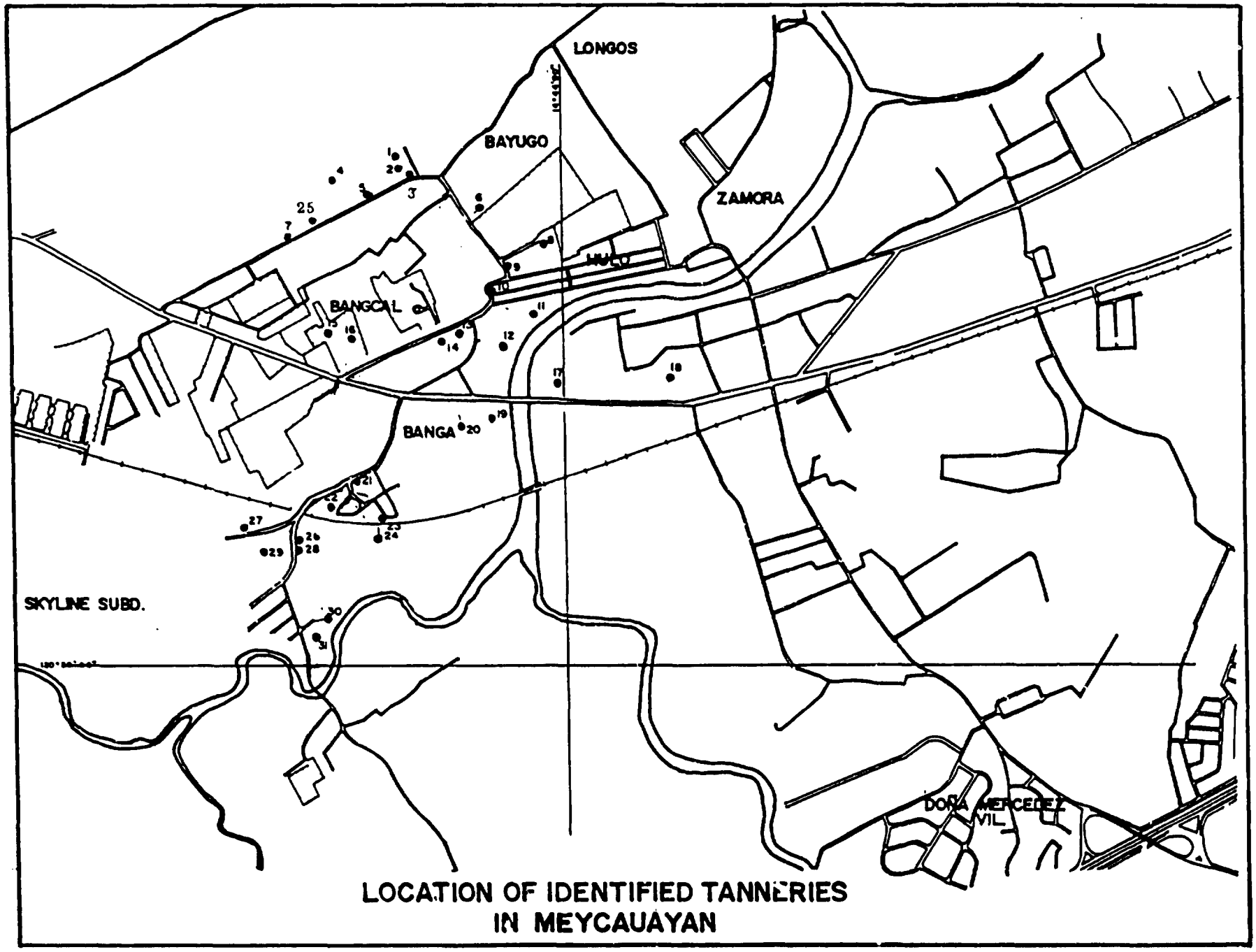
Year	Inflow	Outflow	Net Inflow/ (Outflow) *	Cumulative Cashflow **
1	5,176	3,718	1,458	1,458
2	5,434	5,570	(136)	1,321
3	5,613	5,401	212	1,533
4	5,612	5,159	453	1,985
5	5,612	4,918	693	2,679
6	5,612	4,701	910	3,589
7	5,612	2,565	3,047	6,636
8	5,612	2,565	3,047	9,682
9	5,612	2,565	3,047	12,729
10	5,612	2,565	3,047	15,775
11	5,612	2,653	2,958	18,734
12	5,612	2,653	2,958	21,692
13	5,612	2,653	2,958	24,650
14	5,612	2,653	2,958	27,609
15	5,612	2,653	2,958	30,567

Notes:

* May not be equal to inflow less outflow because of rounding off.

** Available for cash dividends; may not be equal to sum of net inflow/outflow because of rounding off.

ANNEXES



LOCATION OF IDENTIFIED TANNERIES
IN MEYCAUAYAN

Legend:

1. Celso Prodon Tannery
2. Francisco Prodon Tannery
3. Alberto Lazatin Tannery
4. Eastern Tanning Corporation *
5. Corazon M. Duran Tannery
6. J. Camilon Tannery
7. Valenzuela Tannery Corporation
8. J.A. Catajan Tannery
9. R.B.C Leather Industry
10. Marsan Leather Industries
11. Leoncio Carlos Tannery
12. Vicente Hermoso Tannery
13. Hermoso Hermanos Tannery
14. Mariano Alcaraz Tannery
15. C. Morante Tannery
16. C. Carlos Tannery
17. Francisco Camilon Tannery
18. Ben Muñoz Tannery
19. Maria Rosales Tannery
20. S. Gutierrez Tannery
21. E.P. Llanillo Tannery
22. EDSAN Leather
23. Oscar Llanilo Tannery
24. L. Davis Tannery
25. Mariano Alcaraz Tannery
26. AERBIE Trading
27. Danilo Serteza
28. YT Leather
29. Roberto Rosales Tannery *
30. Alfredo Prodon Tannery *
31. C. Dazo Tannery *
32. ABC & D Tannery *
33. Candido Milan Tannery *

* Will not avail of the services of the common wastewater treatment facility

Historical Volume of Animals Slaughtered and Derived Production of Finished Leather 1982 - 1988

Year	Number of Animals Slaughtered (In Heads)				Derived Finished Leather (In Square Feet)				
	Carabao	Cattle	Goat	Hogs	Carabao	Cattle	Goat	Hogs	Total
1982	108,830	327,030	90,400	3,671,650	2,176,600	6,540,600	361,600	385,523	9,464,323
1983	107,160	333,760	96,310	3,693,550	2,143,200	6,675,200	385,240	387,823	9,591,463
1984	133,660	332,320	101,790	4,110,240	2,673,200	6,646,400	407,160	431,575	10,158,335
1985	126,170	351,580	120,250	3,869,830	2,523,400	7,031,600	481,000	406,332	10,442,332
1986	144,160	393,320	125,030	4,098,060	2,883,200	7,866,400	500,120	430,296	11,680,016
1987	184,960	410,630	138,360	4,435,840	3,699,200	8,212,600	553,440	465,763	12,931,003
1988	233,480	406,570	146,940	5,033,170	4,669,600	8,131,400	587,760	528,483	13,917,243

Assumptions: Quantity of finished leather to be derived from each animal are estimated at:

- Carabao - 20 sq. ft./ head
- Cattle - 20 sq. ft. / head
- Goat - 4 sq. ft./ head
- Hogs - 7 sq. ft./ head; only 1.5 % of slaughtered pigs was considered

Compounced Annual Average Growth Rate: 6.64%

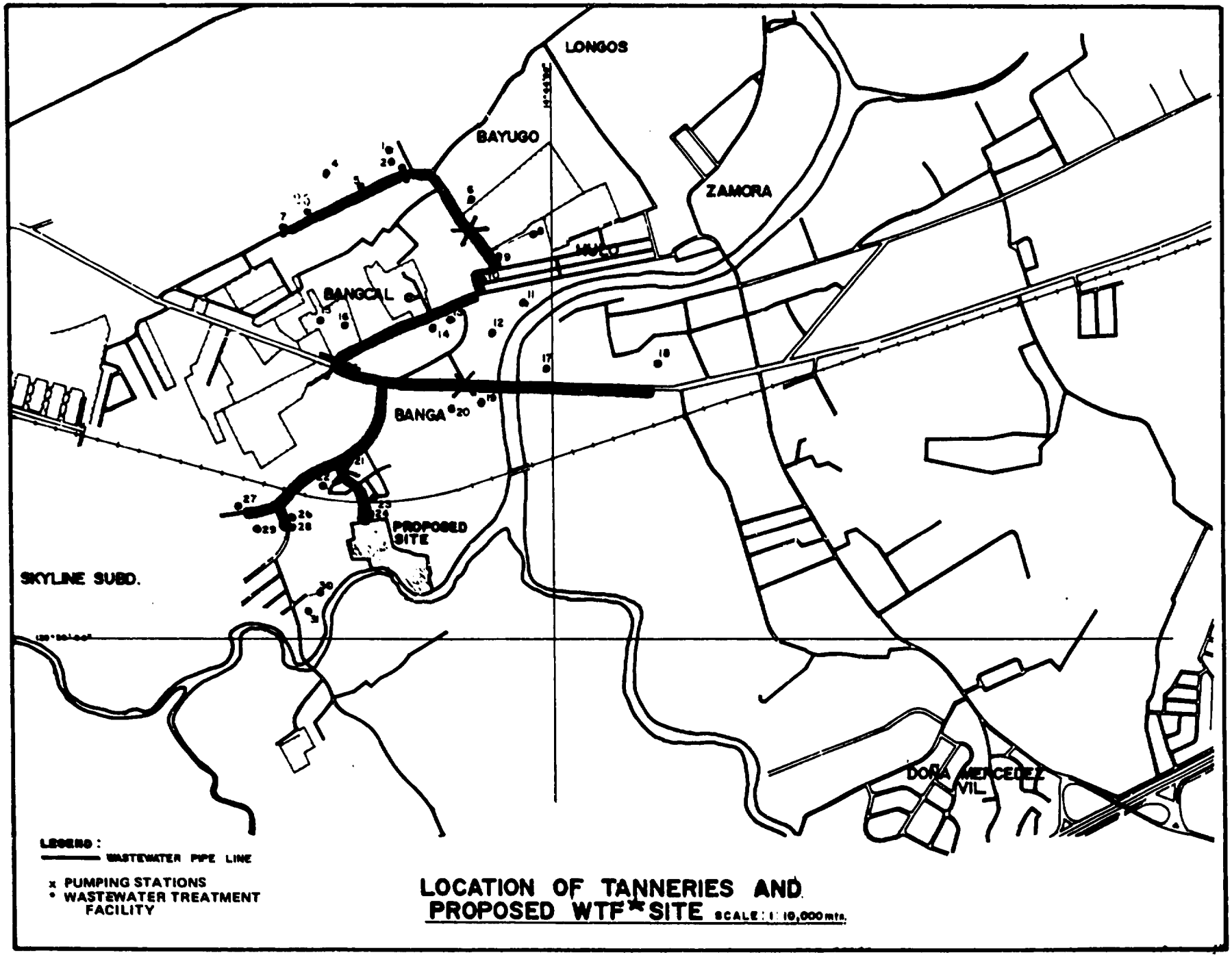
Source: Bureau of Agricultural Statistics.

ESTIMATED COST OF ELECTRICITY
(At full capacity)

	Operation (hours/day) (hours)	Annual Power Consumption (kwh) *	Total Annual Cost (pesos)
Production Equipment			
Wastewater Treatment			
Reciprocating pump	8.00	3,600	7,200
Centrifugal pump, 5hp	24.00	27,000	54,000
Jack pumps	8.00	3,600	7,200
Sub-total	40.00	34,200	68,400
Chrome Recovery			
Pulverizing mill	1.00	195	390
Plastic sealer	0.25	65	130
Centrifugal pump, 2 hp	8.00	3,600	7,200
Nonclog positive displacement pump	2.00	195	390
Air compressor	8.00	2,925	5,850
Sub-total	19.25	6,980	13,960
Total	59.25	41,180	82,360
Laboratory Equipment			
Digestion apparatus	2.00	162	324
Portable laboratory	0.28	12	24
BOD manometric apparatus	24.00	765	1,530
Temperature regulator	24.00	414	828
Oven	4.00	1,680	3,360
Vacuum pump	0.25	12	24
Analytical balance	0.25	3	6
Furnace	4.00	1,440	2,880
Water bath	0.25	1,080	2,160
Refrigerator, 10 cu. ft.	24.00	1,476	2,952
Sub-total	83.03	7,044	14,088

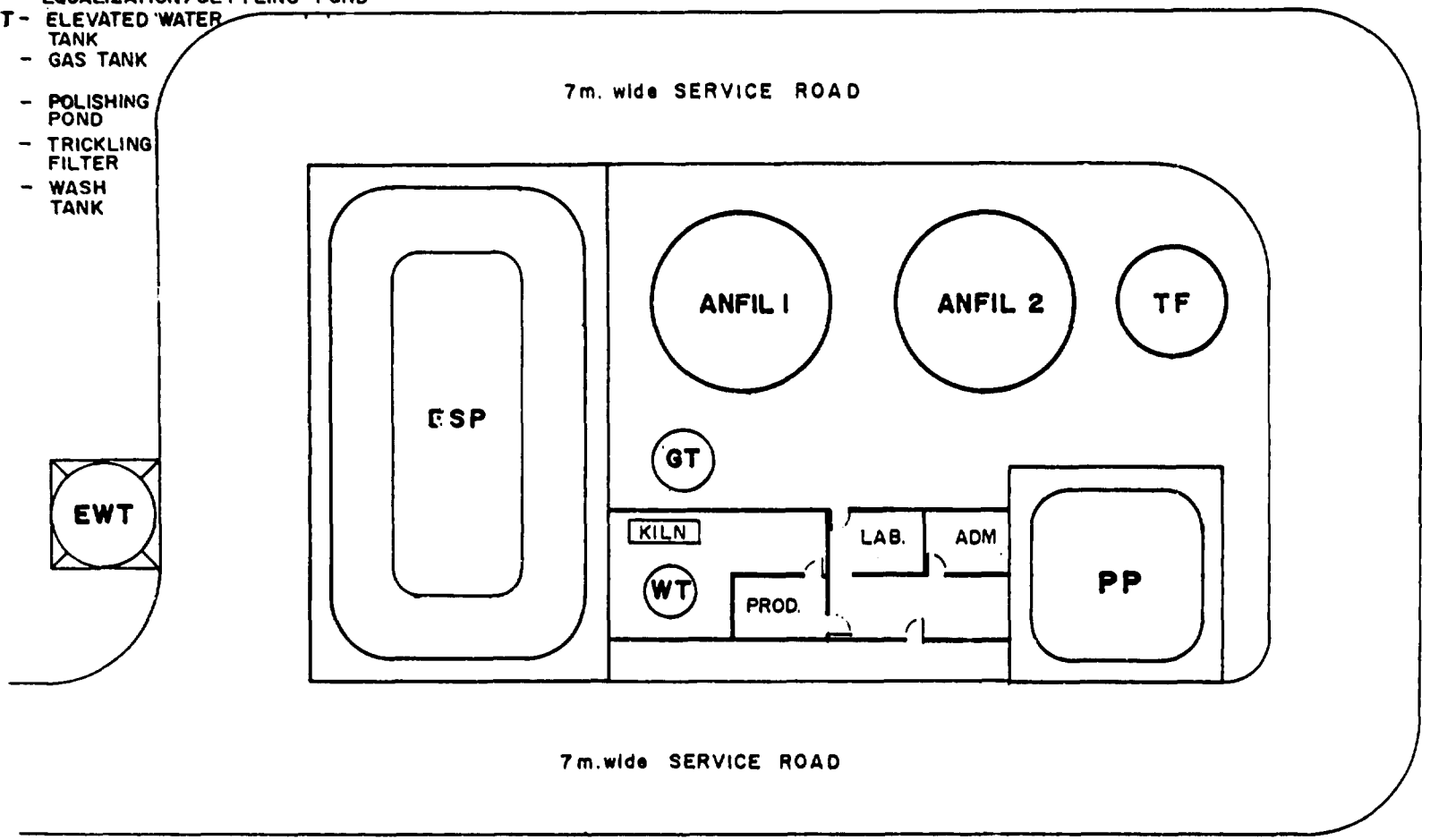
	Operation (hours/day) (hours)	Annual Power Consumption (kwh) *	Total Annual Cost (pesos)
Office Equipment			
Airconditioners	8.00	5,400	10,800
Electric fans	8.00	432	864
Sub-total	16.00	5,832	11,664
Lighting			
Building	8.00	9,600	19,200
Flood lights	12.00	10,800	21,600
Sub-total	20.00	20,400	40,800
Grand Total	178.28	74,456	148,912

* P2.00 per kwh



LOCATION OF TANNERIES AND PROPOSED WTF★SITE SCALE : 1: 10,000 mts.

LEGEND:
ANFIL - ANAEROBIC UPFLOW FILTER
ESP - EQUALIZATION/SETTLING POND
EWT - ELEVATED WATER TANK
GT - GAS TANK
PP - POLISHING POND
TF - TRICKLING FILTER
WT - WASH TANK



PLANT LAYOUT

SCALE : 1 : 300 mts.

R

SPECIFICATIONS OF THE STRUCTURES OF THE FACILITY

1. Equalization pond

   Capacity: 570 cu m
   Depth: 3.0 m
   Top dimensions: 22.4 m x 11.2 m
   Bottom dimensions: 16.4 m x 8.2 m

2. Upflow anaerobic filter

   Effective volume: 260 cu m
   Height: 10.0 m Diameter: 8.0 m
   Packing material: Coconut shells
   Packing porosity: 50%

3. Trickling filter

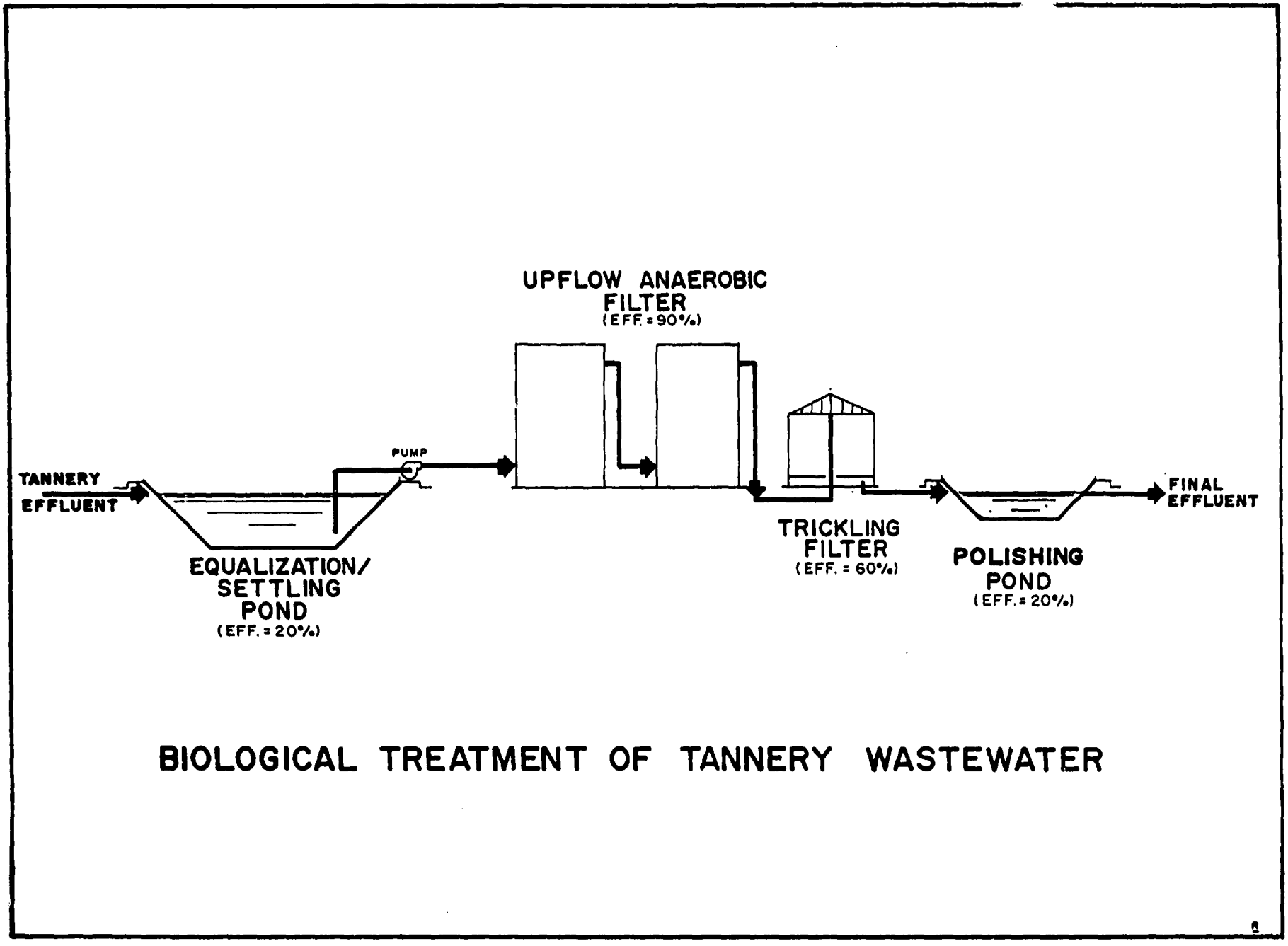
   Height: 1.5 m Diameter: 4.6 m
   Hydraulic loading rate: 4 $m^3/m^2/day$
   Filter media: Gravel

4. Polishing pond

   Capacity: 80 cu m
   Depth: 2.5 m
   Top dimensions: 8.0 m x 8.0 m
   Bottom dimensions: 4.5 m x 2.25 m

5. Gas tank

   Capacity: 3.18 cubic meters
   Diameter: 1.5 m
   Height: 1.8 m



BIOLOGICAL TREATMENT OF TANNERY WASTEWATER

BOD Load for Each Treatment Step

	BOD Level (5 days) (in mg/l)
Before entering equalization pond	1,700 - 3,000
After processing in equalization pond	1,360 - 2,400
After processing in second anfil	140 - 240
After processing in trickling filter	60 - 100
After processing in ponding pond	50 - 80

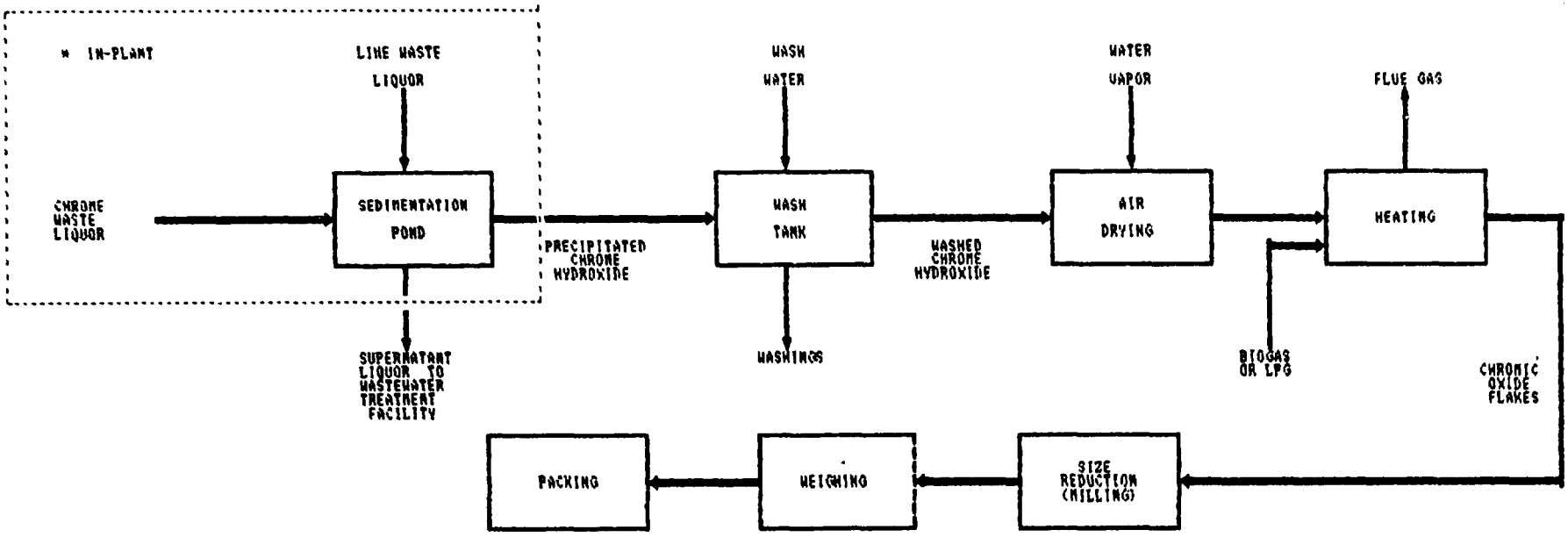
By-pass Possibilities

Assuming retention time in the equalization pond, anaerobic filter, and polishing pond is not changed, the BOD level of the treated wastewater will exceed the allowable limit of the Effluent Regulation if one of the two anaerobic filters is not working. However, if the retention time in the equalization pond and the polishing pond is increased to 3 days and 24 hours respectively, the BOD level of the treated wastewater will be within the limit.

	BOD Level (5 days) (in mg/l)	
	Same Retention Time	Increased Retention Time
Before entering equalization pond	1,700 - 3,000	1,700 - 3,000
After processing in equalization pond	1,360 - 2,400	850 - 1,500
After processing in one anfil	750 - 1,320	425 - 750
After processing in trickling filter	300 - 530	170 - 300
After processing in ponding pond	240 - 425	85 - 150

* BOD limit of the Effluent Regulation: 150 mg/l

FLOW DIAGRAM FOR CHROME RECOVERY



ESTIMATED COST OF PIPELINE SYSTEM AND PRODUCTION EQUIPMENT

Equipment	No. of Units	WITH BOI INCENTIVES: Foreign Component (in dollars) Total Cost	WITH BOI INCENTIVES: Local Component (in pesos) Total Cost	WITHOUT BOI INCENTIVES: Foreign Component (in dollars) Total Cost	WITHOUT BOI INCENTIVES: Local Component (in pesos) Total Cost
Sewer pipeline system		-	7,000,577	-	7,168,858
Production equipment					
A. Wastewater Treatment					
Jack pump	4	3,200	14,080	4,576	14,080
Centrifugal pump, 5hp	1	1,500	6,600	2,145	6,600
Sub-total		4,700	20,680	6,721	20,680
B. Chrome Recovery					
Pulverizing mill	1	400	77,178	528	83,360
Plastic sealer	1	375	1,650	454	1,650
Centrifugal pump, 2 hp	1	1,000	4,400	1,430	4,400
Nonclog positive displacement pump	2	600	2,640	726	2,640
Air compressor	1	325	1,430	465	1,430
Wash tank	1	-	10,909	-	12,000
Natural crossdraft kiln	1	-	53,236	-	57,600
Elevated water tank	1	-	109,091	-	120,000
Gas tank	1	-	72,727	-	80,000
Sub-total		2,700	333,261	3,603	363,080
Total		7,400	353,941	10,324	383,760

EQUIPMENT SPECIFICATIONS

Pipeline system

Type: Polyvinyl chloride

Size (in mm)	Length (in meters)
110	950
160	2,553
200	120
250	380

Production Equipment

Wastewater Treatment

1. Centrifugal pump

   Rating: 5 hp

2. Jack pump

   Rating: 1/2 hp
   No. of units: 4

Chrome Recovery Section

1. Pulverizing Mill

   Type: Hammer mill
   Capacity: 70 - 90 lb/hr
   Rating: 1 hp
   Maximum rpm: 16,000
   Rotor diameter: 5 in.

2. Plastic bag sealer

   Rating: 1,000 watts
   Length: 24"

3. Centrigugal pump

   Rating: 2 hp

4. Nonclog positive displacement pump

   Rating: 1/2 hp
   No. of units: 2

5. Air compressor

   Rating: 2 hp

6. Wash tank

   Capacity: 3,000 liters
   Height: 2.45 m Diameter: 1.25 m
   Material of construction: SS204
   Plate thickness: 1/8"

7. Natural crossdraft kiln

   Fuel: Biogas/LPG
   Maximum temperature: 1500^{o}C
   Construction: Insulating brick, steel frame
   Gas inlet pressure: 600 mm Hg
   Capacity: 3 cu ft
   Accessories: Drying trays, 15.5" x 22" x 3/4", SS304 frame (3/4" x 3/4" x 1/16") with fine mesh SS screen

8. Elevated water tank

   Capacity: 8,000 liters
   Height: 2.5 m Diameter: 2.0 m
   Elevation: 20 ft
   Material of construction: Galvanized iron

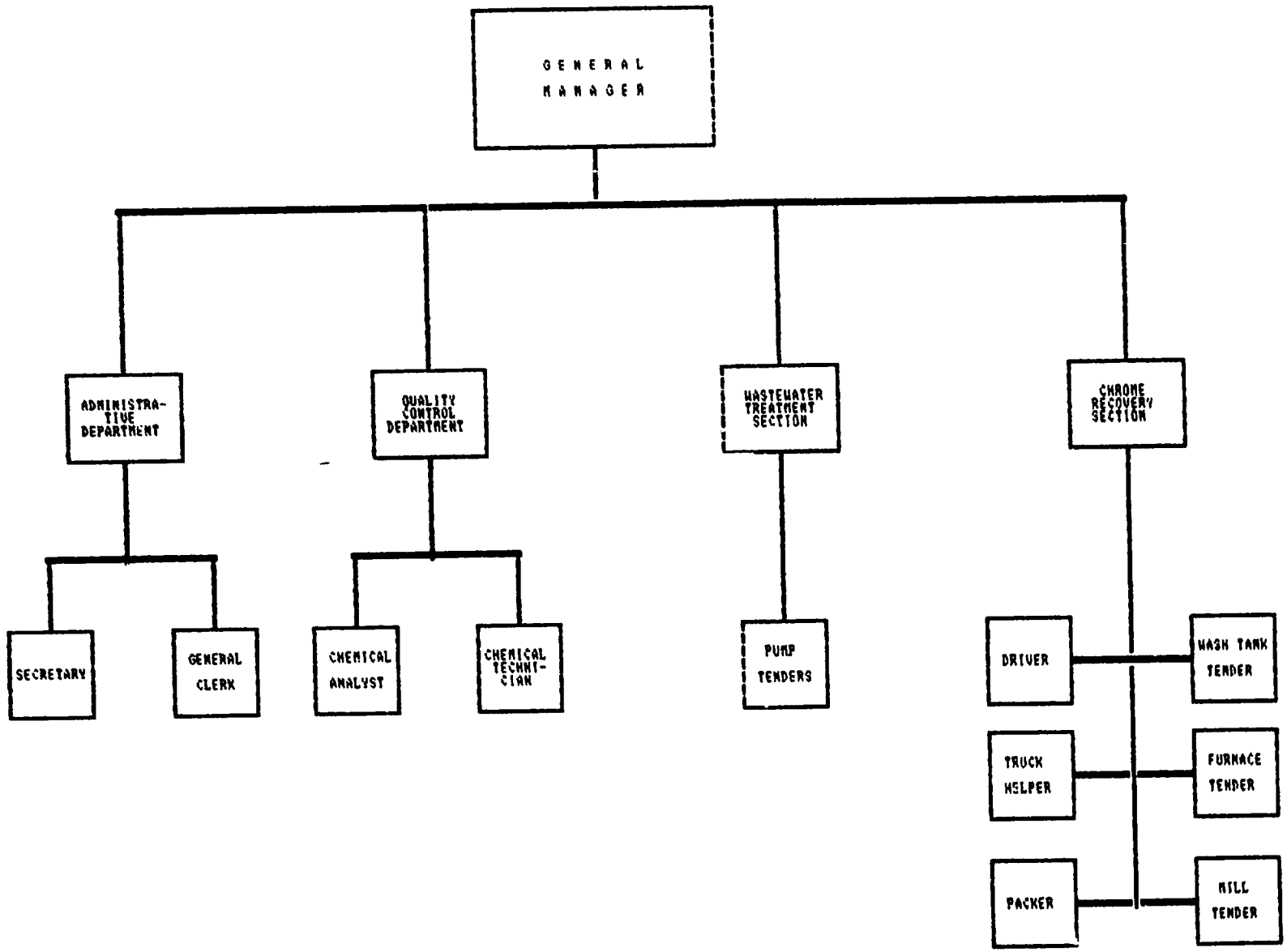
9. Gas tank

   Capacity: 3.18 cubic meters
   Diameter: 1.5 m
   Height: 1.8 m

ESTIMATED COST OF LABORATORY, TRANSPORTATION AND OFFICE EQUIPMENT

	No. of Units	Imported Component (in dollars)	Local Component (in pesos)
A. Laboratory Equipment			
Digestion apparatus	1	1,119	-
Portable laboratory	1	3,176	-
BOD manometric apparatus	1	787	-
Temperature regulator	1	514	-
Oven	1	1,320	-
Vacuum filtration manifold and holder	1	1,452	-
Vacuum pump	1	358	-
Analytical balance	1	2,013	-
Furnace	1	1,419	-
Imhoff cone and support	1	121	-
Water bath	1	635	-
Dessicator	1	303	-
Refrigerator, 10 cu. ft.	1		9,700
Total		13,217	9,700
B. Office Equipment			
Airconditioners, 1.5 hp	2	-	32,000
Electric fans	2	-	2,000
Typewriter	1	-	5,000
File safe	1	-	3,500
Filing cabinet	1	-	1,500
Office desks	6	-	7,500
Office chairs	10	-	2,000
Total			53,500
C. Transport Equipment			
Service Vehicle	1	-	280,000
D. Other fixed assets			
Fire extinguishers	2	-	4,000
Water hose	1	-	1,600
			5,600

ORGANIZATIONAL STRUCTURE



ESTIMATED MANPOWER REQUIREMENTS AND COST

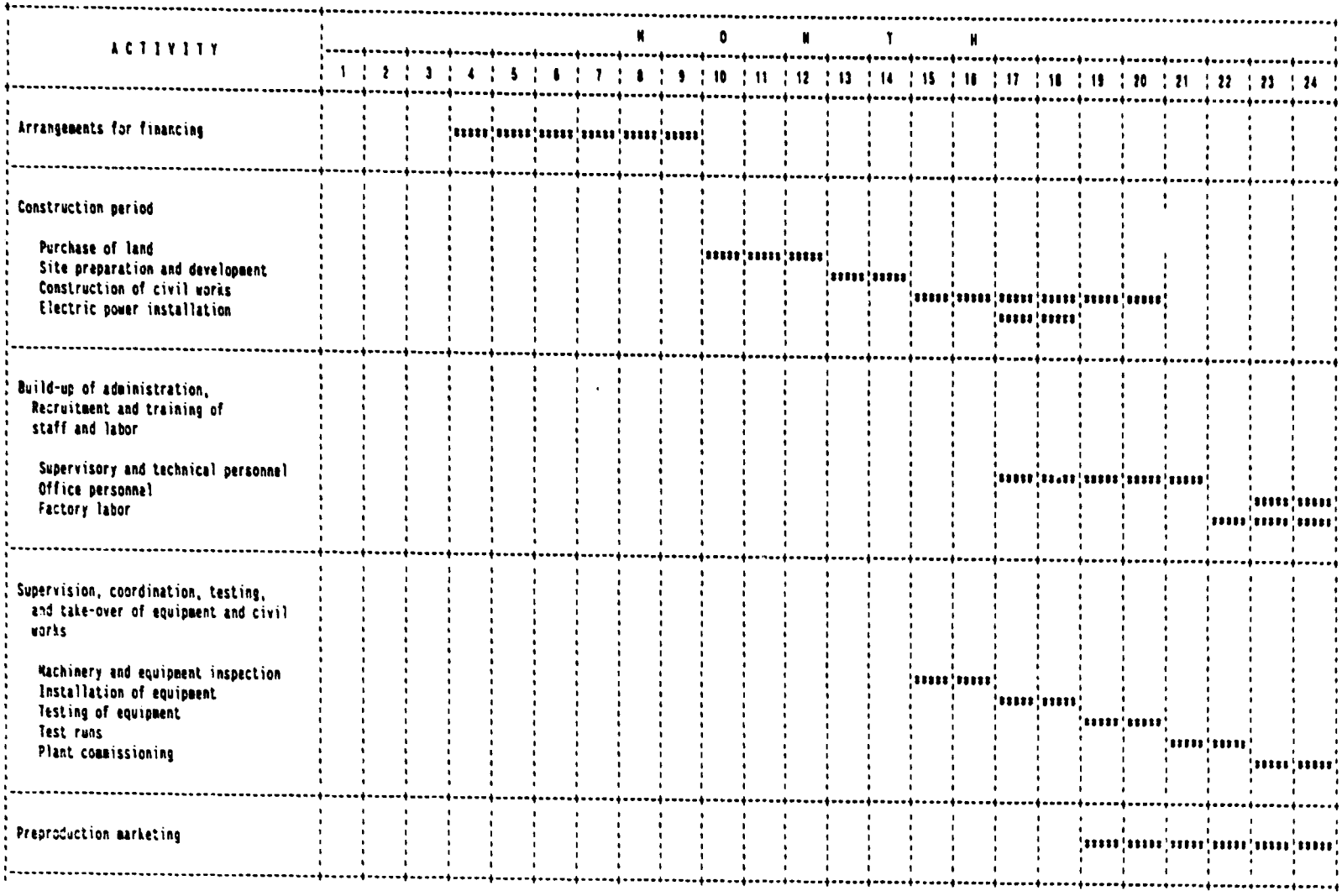
Production Personnel	Monthly Salary + 30% Benefits (in pesos)	Number	Total Monthly Salary (in pesos)	Total Monthly Salary (in pesos)
Direct Labor				
Wastewater Treatment				
Pump Tenders	3,120	3	9,360	108,000
Chrome Recovery				
Wash Tank Helper	3,120	1	3,120	36,000
Furnace Tender	3,120	1	3,120	36,000
Packer	3,120	1	3,120	36,000
Mill Tender	3,120	1	3,120	36,000
Sub-total		7	12,480	144,000
Indirect Labor				
Driver	3,640	1	3,640	42,000
Truck Helper	3,120	1	3,120	36,000
Sub-total		2	6,760	78,000

Administrative Personnel	Monthly Salary + 30% Benefits (in pesos)	Number	Total Monthly Salary (in pesos)	Total Monthly Salary (in pesos)
General Manager	13,000	1	13,000	156,000
Secretary	4,290	1	4,290	51,480
General Clerk	3,900	1	3,900	46,800
Security Guards	3,380	3	10,140	121,680
Sub-total		6	31,330	375,960

Grand Total 597,960

Project Implementation Schedule

ACTIVITY	MONTH 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Project implementation management																								
Organization of project team	▪▪▪▪▪																							
Drawing up of implementation strategies		▪▪▪▪▪	▪▪▪▪▪																					
Preparation of project feasibility study		▪▪▪▪▪	▪▪▪▪▪	▪▪▪▪▪	▪▪▪▪▪																			
Arrangements for technology supply			▪▪▪▪▪	▪▪▪▪▪																				
Detailed engineering and tendering of equipment and civil works																								
Bidding for detailed engineering				▪▪▪▪▪	▪▪▪▪▪	▪▪▪▪▪																		
Evaluation and selection of contractor							▪▪▪▪▪	▪▪▪▪▪																
Contract negotiations									▪▪▪▪▪	▪▪▪▪▪														
Award of contract											▪▪▪▪▪	▪▪▪▪▪												
Government approval of licenses, permits, and other documents																								
Registration with the Board of Investments, Securities and Exchange Commission, and Central Bank; registration of business name with Department of Trade and Industry; application for permit from local government and Environmental Management Bureau				▪▪▪▪▪	▪▪▪▪▪	▪▪▪▪▪	▪▪▪▪▪	▪▪▪▪▪	▪▪▪▪▪															


ACTIVITY
M O N T H
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
Arrangements for financing
Construction period
Purchase of land
Site preparation and development
Construction of civil works
Electric power installation
Build-up of administration, Recruitment and training of staff and labor
Supervisory and technical personnel
Office personnel
Factory labor
Supervision, coordination, testing, and take-over of equipment and civil works
Machinery and equipment inspection
Installation of equipment
Testing of equipment
Test runs
Plant commissioning
Preproduction marketing

PROJECTED FINANCIAL STATEMENTS
FOR THE BASE CASE
(WITH AND WITHOUT BOI INCENTIVES)

COMFAR
21 UNIDO

---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA -----

Common Wastewater Treatment Facility
April 1990
Base case, with BOI incentives

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 22.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: pesos

Total initial investment during construction phase

fixed assets:	15806970.00	3.034 % foreign
current assets:	191267.00	0.000 % foreign
total assets:	15998230.00	2.998 % foreign

Source of funds during construction phase

equity & grants:	6669074.00	0.000 % foreign
foreign loans :	453563.00	
local loans :	8875597.00	
total funds :	15998230.00	2.835 % foreign

Cashflow from operations

Year:	1	3	7
operating costs:	1325558.00	1368852.00	1368852.00
depreciation :	872483.90	872483.90	804663.90
interest :	1827279.00	1461823.00	0.00
production costs	4025321.00	3703159.00	2173515.00
thereof foreign	2.42 %	2.35 %	2.09 %
total sales :	5118226.00	5611580.00	5611580.00
gross income :	1092905.00	1908422.00	3438065.00
net income :	1092905.00	1908422.00	2234742.00
cash balance :	1848618.00	914597.00	3039406.00
net cashflow :	3675897.00	4242253.00	3039406.00

Net Present Value at: 20.00 % = 1351939.00
Internal Rate of Return: 22.53 %
Return on equity1: 23.86 %
Return on equity2: 21.86 %

Index of Schedules produced by COMFAR

Net Income Statement in pesos

Year	1992	1993	1994	1995	1996
Total sales, incl. sales tax	5118226.000	5431509.000	5611580.000	5611580.000	5611580.000
Less: variable costs, incl. sales tax.	447381.400	475083.300	490674.800	490674.800	490674.800
Variable margin	4670845.000	4956426.000	5120905.000	5120905.000	5120905.000
As % of total sales	91.259	91.253	91.256	91.256	91.256
Non-variable costs, incl. depreciation	1750660.000	1750661.000	1750661.000	1750661.000	1750661.000
Operational margin	2920184.000	3205766.000	3370245.000	3370245.000	3370244.000
As % of total sales	57.055	59.022	60.059	60.059	60.059
Cost of finance	1827279.000	1827279.000	1461823.000	1096368.000	730911.600
Gross profit	1092905.000	1378486.000	1908422.000	2273877.000	2639333.000
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	1092905.000	1378486.000	1908422.000	2273877.000	2639333.000
Tax	0.000	0.000	0.000	0.000	923766.600
Net profit	1092905.000	1378486.000	1908422.000	2273877.000	1715567.000
Dividends paid	0.000	0.000	0.000	0.000	0.000
Undistributed profit	1092905.000	1378486.000	1908422.000	2273877.000	1715567.000
Accumulated undistributed profit	1092905.000	2471391.000	4379813.000	6653690.000	8369257.000
Gross profit, % of total sales	21.353	25.379	34.009	40.521	47.034
Net profit, % of total sales	21.353	25.379	34.009	40.521	30.572
ROE, Net profit, % of equity	16.38[illegible]	20.670	28.616	34.096	25.724
ROI, Net profit+interest, % of invest.	19.210	21.087	22.169	22.169	16.092

COMFAR 21 UNIDO

---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA -----

Net Income Statement in pesos

Year	1997	1998	1999	2000	2001
Total sales, incl. sales tax	5611580.000	5611580.000	5611580.000	5611580.000	5611580.000
Less: variable costs, incl. sales tax.	490674.800	490674.800	490674.800	490674.800	490674.800
Variable margin	5120905.000	5120905.000	5120905.000	5120905.000	5120905.000
As % of total sales	91.256	91.256	91.256	91.256	91.256
Non-variable costs, incl. depreciation	1682841.000	1682841.000	1682841.000	1682841.000	1682841.000
Operational margin	3438065.000	3438065.000	3438065.000	3438065.000	3438065.000
As % of total sales	61.267	61.267	61.267	61.267	61.267
Cost of finance	365455.800	0.000	0.000	0.000	0.000
Gross profit	3072609.000	3438065.000	3438065.000	3438065.000	3438065.000
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	3072609.000	3438065.000	3438065.000	3438065.000	3438065.000
Tax	1075413.000	1203323.000	1203323.000	1203323.000	1203323.000
Net profit	1997196.000	2234742.000	2234742.000	2234742.000	2234742.000
Dividends paid	0.000	0.000	0.000	0.000	0.000
Undistributed profit	1997196.000	2234742.000	2234742.000	2234742.000	2234742.000
Accumulated undistributed profit	10366450.000	12601190.000	14835940.000	17070680.000	19305420.000
Gross profit, % of total sales	54.755	61.267	61.267	61.267	61.267
Net profit, % of total sales	35.591	39.824	39.824	39.824	39.824
ROE, Net profit, % of equity	29.947	33.509	33.509	33.509	33.509
ROI, Net profit+interest, % of invest.	15.541	14.700	14.700	14.700	14.700

---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA -----

Net Income Statement in pesos

Year	2002	2003	2004	2005	2006
Total sales, incl. sales tax	5611580.000	5611580.000	5611580.000	5611580.000	5611580.000
Less: variable costs, incl. sales tax.	490674.800	490674.800	490674.800	490674.800	490674.800
Variable margin	5120905.000	5120905.000	5120905.000	5120905.000	5120905.000
As % of total sales	91.256	91.256	91.256	91.256	91.256
Non-variable costs, incl. depreciation	1442692.000	1442692.000	1442692.000	1442692.000	1442690.000
Operational margin	3678214.000	3678214.000	3678214.000	3678214.000	3678215.000
As % of total sales	65.547	65.547	65.547	65.547	65.547
Cost of finance	0.000	0.000	0.000	0.000	0.000
Gross profit	3678214.000	3678214.000	3678214.000	3678214.000	3678215.000
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	3678214.000	3678214.000	3678214.000	3678214.000	3678215.000
Tax	1287375.000	1287375.000	1287375.000	1287375.000	1287375.000
Net profit	2390839.000	2390839.000	2390839.000	2390839.000	2390840.000
Dividends paid	0.000	0.000	0.000	0.000	0.000
Undistributed profit	2390839.000	2390839.000	2390839.000	2390839.000	2390840.000
Accumulated undistributed profit	21696260.000	24087100.000	26477930.000	28868770.000	31259610.000
Gross profit, % of total sales	65.547	65.547	65.547	65.547	65.547
Net profit, % of total sales	42.605	42.605	42.605	42.605	42.605
ROE, Net profit, % of equity	35.850	35.850	35.850	35.850	35.850
ROI, Net profit+interest, % of invest.	15.726	15.726	15.726	15.726	15.726

COMFAR 21 UNIDO

---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA -----

Cashflow Tables, construction in pesos

Year	1990	1991
Total cash inflow . .	2050000.000	13948230.000
Financial resources .	2050000.000	13948230.000
Sales, net of tax . .	0.000	0.000
Total cash outflow . .	2050000.000	13948230.000
Total assets	2050000.000	13034590.000
Operating costs . . .	0.000	0.000
Cost of finance . . .	0.000	913639.600
Repayment	0.000	0.000
Corporate tax . . .	0.000	0.000
Dividends paid . . .	0.000	0.000
Surplus (deficit) .	0.000	0.000
Cumulated cash balance	0.000	0.000
Inflow, local	2050000.000	13494670.000
Outflow, local	2050000.000	13468590.000
Surplus (deficit) .	0.000	26080.000
Inflow, foreign . . .	0.000	453563.000
Outflow, foreign . . .	0.000	479642.900
Surplus (deficit) .	0.000	-26079.880
Net cashflow	-2050000.000	-13034590.000
Cumulated net cashflow	-2050000.000	-15084590.000

Cashflow tables, production in pesos

Year	1992	1993	1994	1995	1996	1997
Total cash inflow	5175968.000	5433818.000	5612880.000	5611580.000	5611580.000	5611580.000
Financial resources	57741.270	2308.484	1299.293	0.000	0.000	0.000
Sales, net of tax	5118226.000	5431509.000	5611580.000	5611580.000	5611580.000	5611580.000
Total cash outflow	3327349.000	5049554.000	4698282.000	4331051.000	4889362.000	4675553.000
Total assets	174512.000	3182.438	1775.188	0.000	0.000	0.000
Operating costs	1325558.000	1353260.000	1368852.000	1368852.000	1368852.000	1368852.000
Cost of finance	1827279.000	1827279.000	1461823.000	1096368.000	730911.600	365455.800
Repayment	0.000	1865832.000	1865832.000	1865832.000	1865832.000	1865832.000
Corporate tax	0.000	0.000	0.000	0.000	923766.600	1075413.000
Dividends paid	0.000	0.000	0.000	0.000	0.000	0.000
Surplus (deficit)	1848619.000	384264.000	914597.500	1280529.000	722218.500	936027.500
Cumulated cash balance	1848619.000	2232883.000	3147480.000	4428009.000	5150228.000	6086255.000
Inflow, local	5175968.000	5433818.000	5612880.000	5611580.000	5611580.000	5611580.000
Outflow, local	3275189.000	4906682.000	4565841.000	4209043.000	4777785.000	4574408.000
Surplus (deficit)	1900778.000	527136.000	1047039.000	1402538.000	833795.000	1037172.000
Inflow, foreign	0.000	0.000	0.000	0.000	0.000	0.000
Outflow, foreign	52159.750	142872.300	132440.400	122008.500	111576.500	101144.500
Surplus (deficit)	-52159.750	-142872.300	-132440.400	-122008.500	-111576.500	-101144.500
Net cashflow	3675897.000	4077375.000	4242253.000	4242729.000	3318962.000	3167316.000
Cumulated net cashflow	-11408700.000	-7331322.000	-3089069.000	1153660.000	4472622.000	7639937.000

Cashflow tables, production in pesos

Year	1998	1999	2000	2001	2002	2003
Total cash inflow . .	5611580.000	5611580.000	5611580.000	5611580.000	5611580.000	5611580.000
Financial resources .	0.000	0.000	0.000	0.000	0.000	0.000
Sales, net of tax . .	5611580.000	5611580.000	5611580.000	5611580.000	5611580.000	5611580.000
Total cash outflow . .	2572174.000	2572174.000	2572174.000	2572174.000	2656226.000	2656226.000
Total assets	0.000	0.000	0.000	0.000	0.000	0.000
Operating costs . . .	1368852.000	1368852.000	1368852.000	1368852.000	1368852.000	1368852.000
Cost of finance . . .	0.000	0.000	0.000	0.000	0.000	0.000
Repayment	0.000	0.000	0.000	0.000	0.000	0.000
Corporate tax . . .	1203323.000	1203323.000	1203323.000	1203323.000	1287375.000	1287375.000
Dividends paid . . .	0.000	0.000	0.000	0.000	0.000	0.000
Surplus (deficit) .	3039406.000	3039406.000	3039406.000	3039406.000	2955354.000	2955354.000
Cumulated cash balance	3125661.000	12165070.000	15204470.000	18243880.000	21199230.000	24154590.000
Inflow, local	5611580.000	5611580.000	5611580.000	5611580.000	5611580.000	5611580.000
Outflow, local	2572174.000	2572174.000	2572174.000	2572174.000	2656226.000	2656226.000
Surplus (deficit) .	3039406.000	3039406.000	3039406.000	3039406.000	2955354.000	2955354.000
Inflow, foreign . . .	0.000	0.000	0.000	0.000	0.000	0.000
Outflow, foreign . . .	0.000	0.000	0.000	0.000	0.000	0.000
Surplus (deficit) .	0.000	0.000	0.000	0.000	0.000	0.000
Net cashflow	3039406.000	3039406.000	3039406.000	3039406.000	2955354.000	2955354.000
Cumulated net cashflow	10679340.000	13718750.000	16758160.000	19797560.000	22752910.000	25708270.000

COMFAR 2.1 UNIDO

---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA -----

Cashflow tables, production in pesos

Year	2004	2005	2006
Total cash inflow . .	5611580.000	5611580.000	5611580.000
Financial resources .	0.000	0.000	0.000
Sales, net of tax . .	5611580.000	5611580.000	5611580.000
Total cash outflow . .	2656226.000	2656226.000	2656227.000
Total assets	0.000	0.000	0.000
Operating costs . . .	1368852.000	1368852.000	1368852.000
Cost of finance . . .	0.000	0.000	0.000
Repayment	0.000	0.000	0.000
Corporate tax . . .	1287375.000	1287375.000	1287375.000
Dividends paid . . .	0.000	0.000	0.000
Surplus (deficit) .	2955354.000	2955354.000	2955353.000
Cumulated cash balance	27109940.000	30065300.000	33020650.000
Inflow, local	5611580.000	5611580.000	5611580.000
Outflow, local	2656226.000	2656226.000	2656227.000
Surplus (deficit) .	2955354.000	2955354.000	2955353.000
Inflow, foreign . . .	0.000	0.000	0.000
Outflow, foreign . . .	0.000	0.000	0.000
Surplus (deficit) .	0.000	0.000	0.000
Net cashflow	2955354.000	2955354.000	2955353.000
Cumulated net cashflow	28663620.000	31618980.000	34574330.000

COMFAR 2.1 UNIDO

---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA -----

Cashflow Discounting:

a) Equity paid versus Net income flow:
Net present value .....1200394.00 at 20.00 %
Internal Rate of Return (IRRE1) .. 23.86 %

b) Net Worth versus Net cash return:
Net present value ..... 671141.00 at 20.00 %
Internal Rate of Return (IRRE2) .. 21.86 %

c) Internal Rate of Return on total investment:
Net present value .....1351939.00 at 20.00 %
Internal Rate of Return (IRR) .. 22.53 %

Net Worth = Equity paid plus reserves

COMFAR 2.1 UNIDO

---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA ----

Projected Balance Sheets, construction in pesos

Year	1990	1991
Total assets	2050000.000	15998230.000
Fixed assets, net of depreciation	0.000	2050000.000
Construction in progress	2050000.000	13756970.000
Current assets	0.000	191267.000
Cash, bank	0.000	0.000
Cash surplus, finance available	0.000	0.000
Loss carried forward	0.000	0.000
Loss	0.000	0.000
Total liabilities	2050000.000	15998230.000
Equity capital	2050000.000	6669074.000
Reserves, retained profit	0.000	0.000
Profit	0.000	0.000
Long and medium term debt	0.000	9329160.000
Current liabilities	0.000	0.000
Bank overdraft, finance required.	0.000	0.000
Total debt	0.000	9329160.000
Equity, % of liabilities	100.000	41.686

COMFAR 2.1 UNIDO

---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA ----

Projected Balance Sheets, Production in pesos

Year	1992	1993	1994	1995	1996
Total assets	17148880.000	16663840.000	16707730.000	17115780.000	16965510.000
Fixed assets, net of depreciation	14934480.000	14062000.000	13189520.000	12317030.000	11444550.000
Construction in progress	0.000	0.000	0.000	0.000	0.000
Current assets	268591.200	270207.200	271116.700	271116.700	271116.700
Cash, bank	97187.770	98754.270	99619.960	99619.960	99619.960
Cash surplus, finance available	1848620.000	2232883.000	3147479.000	4428008.000	5150228.000
Loss carried forward	0.000	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000	0.000
Total liabilities	17148880.000	16663840.000	16707730.000	17115780.000	16965510.000
Equity capital	6669074.000	6669074.000	6669074.000	6669074.000	6669074.000
Reserves, retained profit	0.000	1092905.000	2471391.000	4379813.000	6653690.000
Profit	1092905.000	1378486.000	1908422.000	2273877.000	1715557.000
Long and medium term debt	9329160.000	7463328.000	5597496.000	3731664.000	1865832.000
Current liabilities	57741.270	60049.750	61349.050	61349.050	61349.050
Bank overdraft, finance required.	0.000	0.000	0.000	0.000	0.000
Total debt	9386901.000	7523378.000	5658845.000	3793013.000	1927181.000
Equity, % of liabilities	38.889	40.021	39.916	38.964	39.310

---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA ----

Projected Balance Sheets, Production in pesos

Year	1997	1998	1999	2000	2001
Total assets	17096880.000	19331620.000	21566360.000	23801100.000	26035840.000
Fixed assets, net of depreciation	10639880.000	9835219.000	9030555.000	8225891.000	7421227.000
Construction in progress	0.000	0.000	0.000	0.000	0.000
Current assets	271116.700	271116.700	271116.700	271116.700	271116.700
Cash, bank	99619.960	99619.960	99619.960	99619.960	99619.960
Cash surplus, finance available	6086256.000	9125662.000	12165070.000	15204470.000	18243880.000
Loss carried forward	0.000	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000	0.000
Total liabilities	17096880.000	19331620.000	21566360.000	23801100.000	26035840.000
Equity capital	6669074.000	6669074.000	6669074.000	6669074.000	6669074.000
Reserves, retained profit	8369257.000	10366450.000	12601190.000	14835940.000	17070680.000
Profit	1997196.000	2234742.000	2234742.000	2234742.000	2234742.000
Long and medium term debt	-0.352	-0.352	-0.352	-0.352	-0.352
Current liabilities	61349.050	61349.050	61349.050	61349.050	61349.050
Bank overdraft, finance required.	0.000	0.000	0.000	0.000	0.000
Total debt	61348.700	61348.700	61348.700	61348.700	61348.700
Equity, % of liabilities	39.008	34.498	30.924	28.020	25.615

COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA

Projected Balance Sheets, Production in pesos

Year	2002	2003	2004	2005	2006
Total assets	28426680.000	30817520.000	33208360.000	35599200.000	37990040.000
Fixed assets, net of depreciation	6856712.000	6292197.000	5727682.000	5163167.000	4598654.000
Construction in progress	0.000	0.000	0.000	0.000	0.000
Current assets	271116.700	271116.700	271116.700	271116.700	271116.700
Cash, bank	99619.960	99619.960	99619.960	99619.960	99619.960
Cash surplus, finance available	21199230.000	24154590.000	27109940.000	30065290.000	33020650.000
Loss carried forward	0.000	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000	0.000
Total liabilities	28426680.000	30817520.000	33208360.000	35599200.000	37990040.000
Equity capital	6669074.000	6669074.000	6669074.000	6669074.000	6669074.000
Reserves, retained profit	19305420.000	21696260.000	24087100.000	26477930.000	28868770.000
Profit	2390839.000	2390839.000	2390839.000	2390839.000	2390840.000
Long and medium term debt	-0.352	-0.352	-0.352	-0.352	-0.352
Current liabilities	61349.050	61349.050	61349.050	61349.050	61349.050
Bank overdraft, finance required	0.000	0.000	0.000	0.000	0.000
Total debt	61348.700	61348.700	61348.700	61348.700	61348.700
Equity, % of liabilities	23.461	21.641	20.083	18.734	17.555

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---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA -----

Common Wastewater Treatment Facility
April 1990
Base case, without BOI incentives

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 22.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: PESOS

Total initial investment during construction phase

fixed assets:	16100180.00	3.402 % foreign
current assets:	191267.00	0.000 % foreign
total assets:	16291440.00	3.362 % foreign

Source of funds during construction phase

equity & grants:	6813756.00	0.000 % foreign
foreign loans :	517880.00	
local loans :	8959807.00	
total funds :	16291440.00	3.179 % foreign

Cashflow from operations

Year:	1	3	7
operating costs:	1325559.00	1368852.00	1368852.00
depreciation :	893020.90	893020.90	825200.90
interest :	1851518.00	1481214.00	0.00
production costs	4070098.00	3743087.00	2194053.00
thereof foreign	2.74 %	2.66 %	2.36 %
total sales :	5118226.00	5611580.00	5611580.00
gross income :	1048129.00	1868493.00	3417527.00
net income :	681283.50	1214521.00	2221393.00
cash balance :	1457534.00	211528.00	3046594.00
net cashflow :	3309051.00	3588280.00	3046594.00

Net Present Value at: 20.00 % = -23182.00
Internal Rate of Return: 19.96 %
Return on equity1: 19.43 %
Return on equity2: 18.21 %

Index of Schedules produced by COMFAR

Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance

---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA -----

Net Income Statement in PESOS

Year	1992	1993	1994	1995	1996
Total sales, incl. sales tax	5118226.000	5431509.000	5611580.000	5611580.000	5611580.000
Less: variable costs, incl. sales tax.	447381.400	475083.300	490674.800	490674.800	490674.800
Variable margin	4670845.000	4956426.000	5120905.000	5120905.000	5120905.000
As % of total sales	91.259	91.253	91.256	91.256	91.256
Non-variable costs, incl. depreciation	1771198.000	1771198.000	1771198.000	1771198.000	1771198.000
Operational margin	2899646.000	3185228.000	3349707.000	3349707.000	3349707.000
As % of total sales	56.653	58.644	59.693	59.693	59.693
Cost of finance	1851518.000	1851518.000	1481214.000	1110911.000	740607.000
Gross profit	1048129.000	1333710.000	1868493.000	2238797.000	2609100.000
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	1048129.000	1333710.000	1868493.000	2238797.000	2609100.000
Tax	366845.000	466798.400	653972.600	783578.800	913184.900
Net profit	681283.500	866911.400	1214521.000	1455218.000	1695915.000
Dividends paid	0.000	0.000	0.000	0.000	0.000
Undistributed profit	681283.500	866911.400	1214521.000	1455218.000	1695915.000
Accumulated undistributed profit	681283.500	1548195.000	2762716.000	4217933.000	5913848.000
Gross profit, % of total sales	20.478	24.555	33.297	39.896	46.495
Net profit, % of total sales	13.311	15.961	21.643	25.932	30.222
ROE, Net profit, % of equity	9.999	12.723	17.825	21.357	24.890
ROI, Net profit+interest, % of invest.	16.359	17.557	17.410	16.573	15.736

COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA

Net Income Statement in PESOS

Year	1997	1998	1999	2000	2001
Total sales, incl. sales tax	5611580.000	5611580.000	5611580.000	5611580.000	5611580.000
Less: variable costs, incl. sales tax.	490674.800	490674.800	490674.800	490674.800	490674.800
Variable margin	5120905.000	5120905.000	5120905.000	5120905.000	5120905.000
As % of total sales	91.256	91.256	91.256	91.256	91.256
Non-variable costs, incl. depreciation	1703378.000	1703378.000	1703378.000	1703378.000	1703378.000
Operational margin	3417527.000	3417527.000	3417527.000	3417527.000	3417527.000
As % of total sales	60.901	60.901	60.901	60.901	60.901
Cost of finance	370303.500	0.000	0.000	0.000	0.000
Gross profit	3047224.000	3417527.000	3417527.000	3417527.000	3417527.000
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	3047224.000	3417527.000	3417527.000	3417527.000	3417527.000
Tax	1066528.000	1196135.000	1196135.000	1196135.000	1196135.000
Net profit	1980695.000	2221393.000	2221393.000	2221393.000	2221393.000
Dividends paid	0.000	0.000	0.000	0.000	0.000
Undistributed profit	1980695.000	2221393.000	2221393.000	2221393.000	2221393.000
Accumulated undistributed profit	7894543.000	10115940.000	12337330.000	14558720.000	16780110.000
Gross profit, % of total sales	54.302	60.901	60.901	60.901	60.901
Net profit, % of total sales	35.297	39.586	39.586	39.586	39.586
ROE, Net profit, % of equity	29.069	32.602	32.602	32.602	32.602
ROI, Net profit+interest, % of invest.	15.184	14.347	14.347	14.347	14.347

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---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA -----

Net Income Statement in PESOS

Year	2002	2003	2004	2005	2006
Total sales, incl. sales tax	5611580.000	5611580.000	5611580.000	5611580.000	5611580.000
Less: variable costs, incl. sales tax.	490674.800	490674.800	490674.800	490674.800	490674.800
Variable margin	5120905.000	5120905.000	5120905.000	5120905.000	5120905.000
As % of total sales	91.256	91.256	91.256	91.256	91.256
Non-variable costs, incl. depreciation	1451106.000	1451106.000	1451106.000	1451106.000	1451104.000
Operational margin	3669799.000	3669799.000	3669799.000	3669799.000	3669801.000
As % of total sales	65.397	65.397	65.397	65.397	65.397
Cost of finance	0.000	0.000	0.000	0.000	0.000
Gross profit	3669799.000	3669799.000	3669799.000	3669799.000	3669801.000
Allowances	0.000	0.000	0.000	0.000	0.000
Taxable profit	3669799.000	3669799.000	3669799.000	3669799.000	3669801.000
Tax	1284430.000	1284430.000	1284430.000	1284430.000	1284430.000
Net profit	2385370.000	2385370.000	2385370.000	2385370.000	2385371.000
Dividends paid	0.000	0.000	0.000	0.000	0.000
Undistributed profit	2385370.000	2385370.000	2385370.000	2385370.000	2385371.000
Accumulated undistributed profit	19165480.000	21550850.000	23936220.000	26321590.000	28706960.000
Gross profit, % of total sales	65.397	65.397	65.397	65.397	65.397
Net profit, % of total sales	42.508	42.508	42.508	42.508	42.508
ROE, Net profit, % of equity	35.008	35.008	35.008	35.008	35.008
ROI, Net profit+interest, % of invest.	15.406	15.406	15.406	15.406	15.406

Cashflow Tables, construction in PESOS

Year	1990	1991
Total cash inflow	2050000.000	14241440.000
Financial resources	2050000.000	14241440.000
Sales, net of tax	0.000	0.000
Total cash outflow	2050000.000	14241440.000
Total assets	2050000.000	13315680.000
Operating costs	0.000	0.000
Cost of finance	0.000	925758.900
Repayment	0.000	0.000
Corporate tax	0.000	0.000
Dividends paid	0.000	0.000
Surplus (deficit)	0.000	0.000
Cumulated cash balance	0.000	0.000
Inflow, local	2050000.000	13723560.000
Outflow, local	2050000.000	13693790.000
Surplus (deficit)	0.000	29770.000
Inflow, foreign	0.000	517880.000
Outflow, foreign	0.000	547650.100
Surplus (deficit)	0.000	-29770.130
Net cashflow	-2050000.000	-13315680.000
Cumulated net cashflow	-2050000.000	-15365680.000

COMFAR 2.1 UNIDO

---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA -----

Cashflow tables, production in PESOS

Year	1992	1993	1994	1995	1996	1997
Total cash inflow . .	5175968.000	5433818.000	5612880.000	5611580.000	5611580.000	5611580.000
Financial resources .	57741.310	2308.484	1299.289	0.000	0.000	0.000
Sales, net of tax . .	5118226.000	5431509.000	5611580.000	5611580.000	5611580.000	5611580.000
Total cash outflow . .	3718434.000	5570297.000	5401352.000	5158879.000	4918182.000	4701221.000
Total assets	174512.100	3182.430	1775.195	0.000	0.000	0.000
Operating costs . . .	1325559.000	1353261.000	1368852.000	1368852.000	1368852.000	1368852.000
Cost of finance . . .	1851518.000	1851518.000	1481214.000	1110911.000	740607.000	370303.500
Repayment	0.000	1895537.000	1895537.000	1895537.000	1895537.000	1895538.000
Corporate tax . . .	366845.000	466798.400	653972.600	783578.800	913184.900	1066528.000
Dividends paid . . .	0.000	0.000	0.000	0.000	0.000	0.000
Surplus (deficit) .	1457534.000	-136479.000	211528.000	452701.000	693398.500	910359.000
Cumulated cash balance	1457534.000	1321055.000	1532583.000	1985284.000	2678682.000	3589041.000
Inflow, local	5175968.000	5433818.000	5612880.000	5611580.000	5611580.000	5611580.000
Outflow, local	3658878.000	5407165.000	5250130.000	5019570.000	4790783.000	4585734.000
Surplus (deficit) .	1517090.000	26653.000	362749.500	592010.500	820797.000	1025846.000
Inflow, foreign . . .	0.000	0.000	0.000	0.000	0.000	0.000
Outflow, foreign . . .	59556.200	163132.200	151221.000	139309.700	127398.500	115487.200
Surplus (deficit) .	-59556.200	-163132.200	-151221.000	-139309.700	-127398.500	-115487.200
Net cashflow	3309051.000	3610576.000	3588280.000	3459149.000	3329543.000	3176200.000
Cumulated net cashflow	-12056630.000	-8446057.000	-4857777.000	-1398628.000	1930915.000	5107115.000

COMFAR 2.1 - UNIDO

---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA -----

Cashflow tables, production in PESOS

Year	1998	1999	2000	2001	2002	2003
Total cash inflow . .	5611580.000	5611580.000	5611580.000	5611580.000	5611580.000	5611580.000
Financial resources .	0.000	0.000	0.000	0.000	0.000	0.000
Sales, net of tax . .	5611580.000	5611580.000	5611580.000	5611580.000	5611580.000	5611580.000
Total cash outflow . .	2564987.000	2564987.000	2564987.000	2564987.000	2653282.000	2653282.000
Total assets	0.000	0.000	0.000	0.000	0.000	0.000
Operating costs . . .	1368852.000	1368852.000	1368852.000	1368852.000	1368852.000	1368852.000
Cost of finance . . .	0.000	0.000	0.000	0.000	0.000	0.000
Repayment	0.000	0.000	0.000	0.000	0.000	0.000
Corporate tax . . .	1196135.000	1196135.000	1196135.000	1196135.000	1284430.000	1284430.000
Dividends paid . . .	0.000	0.000	0.000	0.000	0.000	0.000
Surplus (deficit) .	3046594.000	3046594.000	3046594.000	3046594.000	2958299.000	2958299.000
Cumulated cash balance	6635635.000	9682228.000	12728820.000	15775420.000	18733710.000	21692010.000
Inflow, local	5611580.000	5611580.000	5611580.000	5611580.000	5611580.000	5611580.000
Outflow, local	2564987.000	2564987.000	2564987.000	2564987.000	2653282.000	2653282.000
Surplus (deficit) ..	3046594.000	3046594.000	3046594.000	3046594.000	2958299.000	2958299.000
Inflow, foreign . . .	0.000	0.000	0.000	0.000	0.000	0.000
Outflow, foreign . . .	0.000	0.000	0.000	0.000	0.000	0.000
Surplus (deficit) .	0.000	0.000	0.000	0.000	0.000	0.000
Net cashflow	3046594.000	3046594.000	3046594.000	3046594.000	2958299.000	2958299.000
Cumulated net cashflow	8153709.000	11200300.000	14246900.000	17293490.000	20251790.000	23210090.000

---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA ----

Cashflow tables, production in PESOS

Year	2004	2005	2006
Total cash inflow . .	5611580.000	5611580.000	5611580.000
Financial resources .	0.000	0.000	0.000
Sales, net of tax . .	5611580.000	5611580.000	5611580.000
Total cash outflow . .	2653282.000	2653282.000	2653283.000
Total assets	0.000	0.000	0.000
Operating costs . . .	1368852.000	1368852.000	1368852.000
Cost of finance . . .	0.000	0.000	0.000
Repayment	0.000	0.000	0.000
Corporate tax . . .	1284430.000	1284430.000	1284430.000
Dividends paid . . .	0.000	0.000	0.000
Surplus (deficit) .	2958299.000	2958299.000	2958298.000
Cumulated cash balance	24650310.000	27608610.000	30566910.000
Inflow, local	5611580.000	5611580.000	5611580.000
Outflow, local	2653282.000	2653282.000	2653283.000
Surplus (deficit) .	2958299.000	2958299.000	2958298.000
Inflow, foreign . . .	0.000	0.000	0.000
Outflow, foreign . . .	0.000	0.000	0.000
Surplus (deficit) .	0.000	0.000	0.000
Net cashflow	2958299.000	2958299.000	2958298.000
Cumulated net cashflow	26168380.000	29126680.000	32084980.000

COMFAR 2.1 UNIDO

---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA -----

Cashflow Discounting:

a) Equity paid versus Net income flow:
Net present value .....-188741.00 at 20.00 %
Internal Rate of Return (IRRE1) .. 19.43 %

b) Net Worth versus Net cash return:
Net present value .....-702654.50 at 20.00 %
Internal Rate of Return (IRRE2) .. 18.21 %

c) Internal Rate of Return on total investment:
Net present value ..... -23182.00 at 20.00 %
Internal Rate of Return (IRR) .. 19.96 %

Net Worth = Equity paid plus reserves

COMFAR 2.1 UNIDO

---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA -----

Projected Balance Sheets, construction in PESOS

Year	1990	1991
Total assets	2050000.000	16291440.000
Fixed assets, net of depreciation	0.000	2050000.000
Construction in progress	2050000.000	14050180.000
Current assets	0.000	191267.000
Cash, bank	0.000	0.000
Cash surplus, finance available	0.000	0.000
Loss carried forward	0.000	0.000
Loss	0.000	0.000
Total liabilities	2050000.000	16291440.000
Equity capital	2050000.000	6813756.000
Reserves, retained profit	0.000	0.000
Profit	0.000	0.000
Long and medium term debt	0.000	9477687.000
Current liabilities	0.000	0.000
Bank overdraft, finance required.	0.000	0.000
Total debt	0.000	9477687.000
Equity, % of liabilities	100.000	41.824

COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA

Projected Balance Sheets, Production in PESOS

Year	1992	1993	1994	1995	1996
Total assets	17030470.000	16004150.000	15324430.000	14884110.000	14684490.000
Fixed assets, net of depreciation	15207160.000	14314130.000	13421110.000	12528090.000	11635070.000
Construction in progress	0.000	0.000	0.000	0.000	0.000
Current assets	268591.300	270207.200	271116.700	271116.700	271116.700
Cash, bank	97187.810	98754.310	99620.000	99620.000	99620.000
Cash surplus, finance available	1457534.000	1321055.000	1532583.000	1985284.000	2678682.000
Loss carried forward	0.000	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000	0.000
Total liabilities	17030470.000	16004150.000	15324430.000	14884110.000	14684490.000
Equity capital	6813756.000	6813756.000	6813756.000	6813756.000	6813756.000
Reserves, retained profit	0.000	681283.500	1548195.000	2762716.000	4217933.000
Profit	681283.500	866911.400	1214521.000	1455218.000	1695915.000
Long and medium term debt	9477687.000	7582150.000	5686612.000	3791075.000	1895537.000
Current liabilities	57741.310	60049.790	61349.080	61349.080	61349.080
Bank overdraft, finance required.	0.000	0.000	0.000	0.000	0.000
Total debt	9535428.000	7642200.000	5747961.000	3852424.000	1956886.000
Equity, % of liabilities	40.009	42.575	44.463	45.779	46.401

Common Wastewater Treatment Facility --- April 1990

COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA

Projected Balance Sheets, Production in PESOS

Year	1997	1998	1999	2000	2001
Total assets	14769650.000	16991040.000	19212430.000	21433830.000	23655220.000
Fixed assets, net of depreciation	10809870.000	9984669.000	9159468.000	8334267.000	7509066.000
Construction in progress	0.000	0.000	0.000	0.000	0.000
Current assets	271116.700	271116.700	271116.700	271116.700	271116.700
Cash, bank	99620.000	99620.000	99620.000	99620.000	99620.000
Cash surplus, finance available	3589041.000	6635636.000	9682229.000	12728820.000	15775420.000
Loss carried forward	0.000	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000	0.000
Total liabilities	14769650.000	16991040.000	19212430.000	21433830.000	23655220.000
Equity capital	6813756.000	6813756.000	6813756.000	6813756.000	6813756.000
Reserves, retained profit	5913848.000	7894543.000	10115940.000	12337330.000	14558720.000
Profit	1980695.000	2221393.000	2221393.000	2221393.000	2221393.000
Long and medium term debt	-0.375	-0.375	-0.375	-0.375	-0.375
Current liabilities	61349.080	61349.080	61349.080	61349.080	61349.080
Bank overdraft, finance required.	0.000	0.000	0.000	0.000	0.000
Total debt	61348.710	61348.710	61348.710	61348.710	61348.710
Equity, % of liabilities	46.134	40.102	35.465	31.790	28.804

COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA

Projected Balance Sheets, Production in PESOS

Year	2002	2003	2004	2005	2006
Total assets	26040590.000	28425960.000	30811330.000	33196700.000	35582070.000
Fixed assets, net of depreciation	6936137.000	6363269.000	5790279.000	5217350.000	4644423.000
Construction in progress	0.000	0.000	0.000	0.000	0.000
Current assets	271116.700	271116.700	271116.700	271116.700	271116.700
Cash, bank	99620.000	99620.000	99620.000	99620.000	99620.000
Cash surplus, finance available	18733710.000	21692010.000	24650310.000	27608610.000	30566910.000
Loss carried forward	0.000	0.000	0.000	0.000	0.000
Loss	0.000	0.000	0.000	0.000	0.000
Total liabilities	26040590.000	28425960.000	30811330.000	33196700.000	35582070.000
Equity capital	6813756.000	6813756.000	6813756.000	6813756.000	6813756.000
Reserves, retained profit	16780110.000	19165480.000	21550850.000	23936220.000	26321590.000
Profit	2385370.000	2385370.000	2385370.000	2385370.000	2385371.000
Long and medium term debt	-0.375	-0.375	-0.375	-0.375	-0.375
Current liabilities	61349.080	61349.080	61349.080	61349.080	61349.080
Bank overdraft, finance required	0.000	0.000	0.000	0.000	0.000
Total debt	61348.710	61348.710	61348.710	61348.710	61348.710
Equity, % of liabilities	26.166	23.970	22.114	20.525	19.149

NOTES AND ASSUMPTIONS USED IN THE FINANCIAL PROJECTIONS

INCOME STATEMENT

Sales

Sales Volume

The projected volume of wastewater to be processed by the facility and the projected sales volume of chromic oxide are as follows:

Year	Volume of Processed Wastewater (metric tons)	Chromic Oxide (kilograms)
1992	71,240	32,414
1993	75,400	34,551
1994	78,000	35,620
1995	78,000	35,620
1996	78,000	35,620
1997	78,000	35,620
1998	78,000	35,620
1999	78,000	35,620
2000	78,000	35,620
2001	78,000	35,620
2002	78,000	35,620
2003	78,000	35,620
2004	78,000	35,620
2005	78,000	35,620
2006	78,000	35,620

Charges

The fees or charges for wastewater treatment are set at ₱45 per cubic meter of wastewater. The chromic oxide produced by the facility will be sold at ₱59 per kilogram. These prices exclude value added tax (VAT) and are assumed to remain constant throughout the life of the project (15 years).

Variable Costs

Utilities and Energy

At full capacity, the cost of electric consumption is computed at ₱148,912 while the cost of liquified petroleum gas is estimated at ₱12,000.

Direct Labor

A total of seven semi-skilled workers will be needed for the production operations of the facility. The salaries of these workers including benefits amount to ₱252,000 per year. The benefits are estimated to be 30 per cent of the basic salaries.

Factory Overhead - Variable Components

o Packaging

Chromic oxide will be packed in 50-kg polyethylene-lined bags (819 pieces at ₱18.3 per pice). The estimated packaging cost at full capacity is ₱15,000.

o Laboratory Supplies

The cost of laboratory supplies at full capacity is assumed at ₱50,000.

o Fuel

The cost of fuel needed for the transportation of the chromic oxide hydroxide slurry is assumed at ₱16,000.

Fixed Costs

Repairs and Maintenance

Repairs and maintenance cost is assumed at .25 per cent of machinery and equipment costs.

Spare Parts Costs

Spare parts cost is assumed at one per cent of machinery and equipment costs.

Factory Overhead - Fixed Components

o Indirect Labor

Two workers, namely a driver and a truck helper, will be indirectly involved in the production of chromic oxide. The estimated indirect labor cost is ₱78,000. This value includes fringe benefits equivalent to 30 per cent of basic salaries.

o Miscellaneous Overhead

The cost of miscellaneous factory overhead is estimated at 5 per cent of the total factory overhead.

Administrative Overhead

Included in this account are administrative labor cost, office supplies, licenses and government fees, insurance, property taxes, professional fees, telephone charges, and other miscellaneous espenses. Estimated total administrative overhead costs is ₱620,163.

Sales and Distribution

Fuel costs for the marketing of chromic oxide is estimated at ₱12,000 per year.

Depreciation

Depreciation charges are estimated based on the straight-line method of calculation. Building depreciation is established at 20 years; machinery and equipment, 10 years; office equipment and transportation, five years; and service and auxiliary equipment, five years. Preproduction expenditures were amortized over 10 years.

Interest Expense

Interest rates assumed are as follows:

Foreign loan - 11.5% p.a.
Local loan - 20 % p.a.

Income Tax

Income tax is computed at 35% of taxable income. With BOI incentives, the project is entitled to a 4-year income tax holiday.

BALANCE SHEET

Cash

The project's minimum cash requirement is estimated for a 30-day period.

Accounts Receivable

Sales are assumed to be collectible within a 30-day period.

Inventory

Inventory levels are assumed as follows:

Work-in progress	1 day
Finished goods	7 days
Utilities	30 days
Spare parts	30 days

Current Liabilities

Purchases and expenses (excluding depreciation) are assumed to be payable within a 30-day period.

Long Term Loans

Both local and foreign loans are assumed to be payable in seven years. The payment period is inclusive of a two-year grace period for both local loan and foreign loan. Payment of the balance is made on the beginning of the year based constant principal terms.

SUMMARY SHEET
CASES FOR SENSITIVITY ANALYSIS
AND GRAPHICAL REPRESENTATION OF RESULTS

---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA -----

Cosmon Wastewater Treatment Facility
April 1990
-10% revenue, with BOI incentives

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 22.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: pesos

Total initial investment during construction phase

fixed assets:	15806970.00	3.034 % foreign
current assets:	191267.00	0.000 % foreign
total assets:	15998230.00	2.998 % foreign

Source of funds during construction phase

equity & grants:	6669074.00	0.000 % foreign
foreign loans :	453563.00	
local loans :	8875597.00	
total funds :	15998230.00	2.835 % foreign

Cashflow from operations

Year:	1	3	7
operating costs:	1325558.00	1368852.00	1368852.00
depreciation :	872483.90	872483.90	804663.90
interest :	1827279.00	1461823.00	0.00
production costs	4025321.00	3703159.00	2173515.00
thereof foreign	2.42 %	2.35 %	2.09 %
total sales :	4606404.00	5050422.00	5050422.00
gross income :	581082.50	1347264.00	2876907.00
net income :	581082.50	1347264.00	1869989.00
cash balance :	1336795.00	353439.00	2674653.00
net cashflow :	3164074.00	3681095.00	2674653.00

Net Present Value at: 20.00 % = -448242.00
Internal Rate of Return: 19.16 %
Return on equity1: 18.07 %
Return on equity2: 16.96 %

Index of Schedules produced by COMFAR

Common Wastewater Treatment Facility
April 1990
+10% production costs, w/ BOI incentives

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 22.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: pesos

Total initial investment during construction phase

fixed assets:	15808190.00	3.034 % foreign
current assets:	210393.70	0.000 % foreign
total assets:	16018580.00	2.994 % foreign

Source of funds during construction phase

equity & grants:	6677216.00	0.000 % foreign
foreign loans :	453563.00	
local loans :	8887802.00	
total funds :	16018580.00	2.831 % foreign

Cashflow from operations

Year:	1	3	7
operating costs:	1458115.00	1505737.00	1505737.00
depreciation :	872605.90	872605.90	804785.90
interest :	1829720.00	1463776.00	0.00
production costs	4160441.00	3842119.00	2310523.00
thereof foreign	2.34 %	2.27 %	1.96 %
total sales :	5118226.00	5611580.00	5611580.00
gross income :	957785.50	1769461.00	3301057.00
net income :	957785.50	1769461.00	2145687.00
cash balance :	1701944.00	773270.50	2950473.00
net cashflow :	3531664.00	4105320.00	2950473.00

Net Present Value at: 20.00 % = 883312.00
Internal Rate of Return: 21.65 %
Return on equity1: 22.39 %
Return on equity2: 20.55 %

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Common Wastewater Treatment Facility
April 1990
+10% investments costs w/ BOI incentives

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 22.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: pesos

Total initial investment during construction phase

fixed assets:	17439250.00	3.025 % foreign
current assets:	191215.70	0.000 % foreign
total assets:	17630460.00	2.993 % foreign

Source of funds during construction phase

equity & grants:	6852549.00	0.000 % foreign
foreign loans :	498919.30	
local loans :	10279000.00	
total funds :	17630460.00	2.830 % foreign

Cashflow from operations

Year:	1	3	7
operating costs:	1325283.00	1368576.00	1368576.00
depreciation :	964890.70	964890.70	890288.70
interest :	2113175.00	1690540.00	0.00
production costs	4403349.00	4024007.00	2258865.00
thereof foreign	2.44 %	2.38 %	2.21 %
total sales :	5118226.00	5611580.00	5611580.00
gross income :	714877.50	1587573.00	3352715.00
net income :	714877.50	1587573.00	2179265.00
cash balance :	1563037.00	396405.00	3069554.00
net cashflow :	3676212.00	4242528.00	3069554.00

Net Present Value at: 20.00 % = 166030.00
Internal Rate of Return: 20.29 %
Return on equity1: 20.44 %
Return on equity2: 18.41 %

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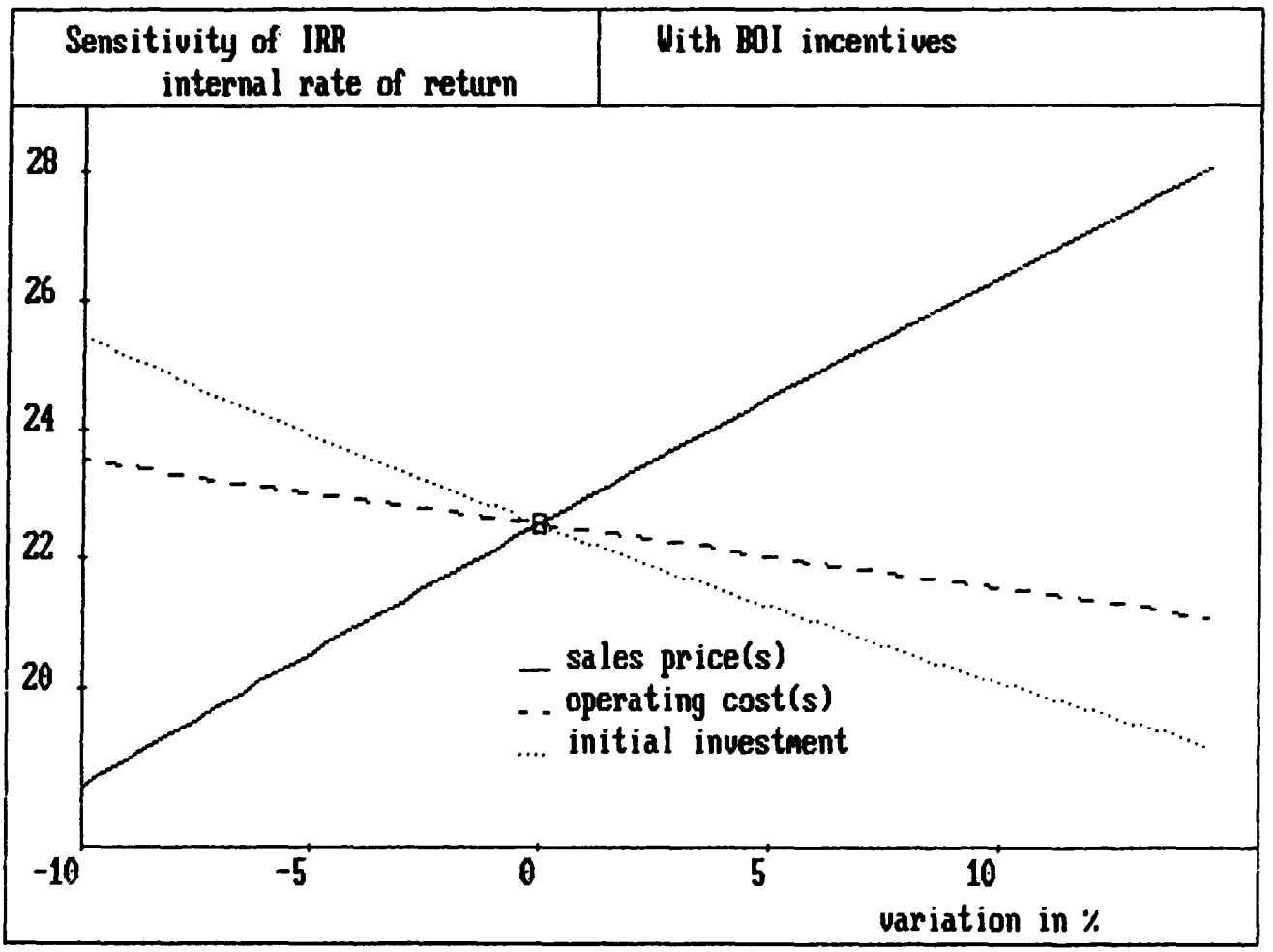
Total initial investment	Cashflow Tables
Total investment during production	Projected Balance
Total production costs	Net income statement
Working Capital requirements	Source of finance


Sensitivity of IRR
internal rate of return
With BOI incentives
28
26
24
22
20
-10
-5
0
5
10
variation in %
sales price(s)
operating cost(s)
initial investment

Common Wastewater Treatment Facility
April 1990
-10% revenue, without BOI incentives

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 22.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: PESOS

Total initial investment during construction phase

fixed assets:	16100180.00	3.402 % foreign
current assets:	191267.00	0.000 % foreign
total assets:	16291440.00	3.362 % foreign

Source of funds during construction phase

equity & grants:	6813756.00	0.000 % foreign
foreign loans :	517880.00	
local loans :	8959807.00	
total funds :	16291440.00	3.179 % foreign

Cashflow from operations

Year:	1	3	7
operating costs:	1325559.00	1368852.00	1368852.00
depreciation :	893020.90	893020.90	825200.90
interest :	1851518.00	1481214.00	0.00
production costs	4070098.00	3743087.00	2194053.00
thereof foreign	2.74 %	2.66 %	2.36 %
total sales :	4606404.00	5050422.00	5050422.00
gross income :	536306.00	1307335.00	2856369.00
net income :	348598.90	849767.80	1856640.00
cash balance :	1124850.00	-153224.50	2681841.00
net cashflow :	2976367.00	3223527.00	2681841.00

Net Present Value at: 20.00 % = -1415298.00
Internal Rate of Return: 17.43 %
Return on equity1: 15.17 %
Return on equity2: 14.70 %

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Common Wastewater Treatment Facility
April 1990
+10% production costs w/o BOI incentives

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 22.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: pesos

Total initial investment during construction phase

fixed assets:	16099950.00	3.402 % foreign
current assets:	210393.70	0.000 % foreign
total assets:	16310350.00	3.358 % foreign

Source of funds during construction phase

equity & grants:	6834879.00	0.000 % foreign
foreign loans :	517880.00	
local loans :	8957589.00	
total funds :	16310350.00	3.175 % foreign

Cashflow from operations

Year:	1	3	7
operating costs:	1458264.00	1505886.00	1505886.00
depreciation :	892998.80	892998.80	825178.80
interest :	1851074.00	1480859.00	0.00
production costs	4202337.00	3879744.00	2331065.00
thereof foreign	2.65 %	2.56 %	2.22 %
total sales :	5118226.00	5611580.00	5611580.00
gross income :	915889.50	1731836.00	3280515.00
net income :	595328.20	1125693.00	2132335.00
cash balance :	1359859.00	123075.00	2957514.00
net cashflow :	3210933.00	3499028.00	2957514.00

Net Present Value at: 20.00 % = -390779.00
Internal Rate of Return: 19.30 %
Return on equity1: 18.35 %
Return on equity2: 17.29 %

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COMFAR 2.1

---------- COMFAR 2.1 - SYCIP, GORRES, VELAYO & CO., MANILA -----

Common Wastewater Treatment Facility
April 1990
+10% inv. costs w/o BOI incentives

2 year(s) of construction, 15 years of production
currency conversion rates:
foreign currency 1 unit = 22.0000 units accounting currency
local currency 1 unit = 1.0000 units accounting currency
accounting currency: pesos

Total initial investment during construction phase

fixed assets:	17770100.00	3.401 % foreign
current assets:	191215.70	0.000 % foreign
total assets:	17961320.00	3.365 % foreign

Source of funds during construction phase

equity & grants:	6956595.00	0.000 % foreign
foreign loans :	569668.00	
local loans :	10435050.00	
total funds :	17961320.00	3.172 % foreign

Cashflow from operations

Year:	1	3	7
operating costs:	1325559.00	1368852.00	1368852.00
depreciation :	988313.70	988313.70	913711.70
interest :	2152522.00	1722018.00	0.00
production costs	4466395.00	4079184.00	2282564.00
thereof foreign	2.75 %	2.69 %	2.50 %
total sales :	5118226.00	5611580.00	5611580.00
gross income :	651831.50	1532396.00	3329016.00
net income :	423690.50	996057.60	2163861.00
cash balance :	1295233.00	-217049.00	3077573.00
net cashflow :	3447755.00	3705914.00	3077573.00

Net Present Value at: 20.00 % = -960307.00
Internal Rate of Return: 18.42 %
Return on equity1: 17.19 %
Return on equity2: 15.84 %

Index of Schedules produced by COMFAR

Sensitivity of IRR
internal rate of return

Without BOI incentives