Annex J

Construction Plan and Cost Estimate

Annex J CONSTRUCTION PLAN AND COST ESTIMATE

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Annex J CONSTRUCTION PLAN AND COST ESTIMATE

J1 Conditions and Assumptions for Construction Plan and Schedule

J1.1 Workable Days

The most reliable data source to be applied to rainfall analysis for the construction planning of the Project is Infanta rainfall station located about 20 km downstream from the proposed Agos Dam site. The annual rainfall at Infanta ranges from 2,500 mm to 6,000 mm with a mean annual rainfall of 4,000 mm according to the daily rainfall records observed during a ten-year period between 1991 and 2000. The monthly rainfall records at Infanta for the period are shown in Table J1.1.

As seen in the rainfall records, intensive rainfall is observed in the period between October and January, which will especially affect the earthworks.

To work out the construction plan, the workable days for major construction activities such as excavation, embankment, structural works, pipe laying, tunnel works are determined based upon the above rainfall records.

The mean monthly rainy days by depth of rainfall are summarized in Table J1.2. Then, the number of non-workable days due to rainfall is estimated for respective items of works as shown in Table J1.3.

Based upon the above table and also taking into account the public holidays and Sundays, monthly workable days for major construction works are estimated as shown in Table J1.4.

The annual total and monthly mean workable days for the respective major work items estimated above are summarized below:

Summary of Workable Day by Major Construction Work Item

Work Activities	Annual Total	Monthly Mean
Excavation	271 days	23 days
Embankment	247 days	21 days
Structural Works	263 days	22 days
Pipe laying	263 days	22 days
Tunneling	304 days	25 days

J1.2 Temporary Facilities

In order to carry out this large-scale project satisfactorily and to complete in time, temporary facilities such as the employer/engineer's site offices, contractor's site offices and camps, concrete batching plant, rock quarry, stockpile area, spoil bank, etc. need to be well planned and organized. Proposed locations of each facility for the Agos Dam site is tentatively planned in Figure J1.1, while the temporary facilities for waterway will further be determined in the future taking into account the respective site conditions. Power and water supply system is also to be planned when respective facilities are set up.

J1.3 Construction Materials

Rock materials for the dam embankment, gravel for structure foundation, and aggregate materials for concrete will be obtained from the proposed quarry site, approximately 1 km upstream from the Agos Dam site. Excavated rock materials from spillway will also be utilized for dam embankment. Excavated materials from tunnel may also be utilized for structure foundation for the proposed water treatment plant and reservoirs, depending upon the quality of the rock.

Construction materials other than the earth materials, i.e. cement, reinforcement, fuel, explosives, timber, and plywood, are able to be procured in the local market.

Steel pipe of more than 3.0m diameter will be imported or a new pipe manufacturing plant be alternatively established within the site, while the other small diameter pipes (less than 3.0 m) can be procured in the local market.

Sheetpiles (for walling) and H-beams (for walling and strut) for trench excavation for steel pipe installation will be imported.

J1.4 Development Stage

The project will be executed in 3 stages, each comprising the following work components:

Stage 1:	1st Waterway from Kaliwa Low Dam to Water Treatment Plant, and Water Treatment Plant #1 and Waterway up to Service Reservoirs	
Stage 2:	Stage 2-1;	Agos Dam and Water Treatment Plant #2
	Stage 2-2;	2nd Waterway and Water Treatment Plant #3 & #4

The construction works will be procured through international and local competitive bidding for the packages varying by type of the project (either government project or BOT project) and also type of the construction works.

It is proposed that the preparatory works such as new access road construction and/or existing road improvement are executed by local contractors prior to the main construction works.

J2 Construction Plan for Stage 1 Development

J2.1 Kaliwa Low Dam and Intake

(1) General

Kaliwa Low Dam is regarded as the first stage (Stage 1) development of the subsequent development of the Agos Dam. The main purpose of this first stage development is to transfer the Kaliwa River water to Metro Manila at the earliest possible time since the Agos Dam will require a longer lead time to complete.

The site is located some 1.5 km downstream of the confluence with the Ligundinan Creek, where the riverbed elevation is around EL. 100 m.

(2) Kaliwa Low Dam

The dam is designed as a temporary structure of random fill using the materials obtained from the intake and tunnel excavation works. The upstream face of the dam is covered with impervious earth fill, which will also be obtained from the nearby excavation work. Top portion of the upstream face and the whole downstream face are protected with wood cribs filled with rocks to protect the face from damage caused by the overtopping of river flow. The proposed plan of Kaliwa Low Dam is shown in Figure F2.2 of Annex F.

The dam body will be constructed in 2 steps: firstly the construction of sand flushing sluice and intake structures and secondary the embankment of dam body. At each stage, a temporary cofferdam will be built with earth embankment to dewater the work area. During the Step-1 period, the river flow will be discharged dowsntream through the present river channel. During the Step-2 period, it will be spilled downstream through a sand flush sluice constructed in the Step-1 period.

Earthworks will be carried out using bulldozer, backhoe, wheel loader, compaction roller, dump truck, while concrete for sand flush sluice/channel will be placed by means of crane with skip and concrete pump.

(3) Intake Structure

The intake structure, consisting of 2 nos. of water intake and gate shaft (one is for the 1st waterway and the other for the 2nd waterway), will be constructed on the right bank side of the Kaliwa Low Dam site in order to feed water to conveyance tunnel (Tunnel No.1).

The whole intake structure comprising 2 intakes will be constructed under the 1st stage project (Stage 1), since the area is flooded once the Agos Dam is impounded. The work includes the full installation of the 1st intake equipment including gates, hoist and stoplogs, while for the 2nd intake only the framework structure and a part of Tunnel No.1 (some 30 m in length) will be constructed.

J2.2 Kaliwa – Taytay 1st Waterway

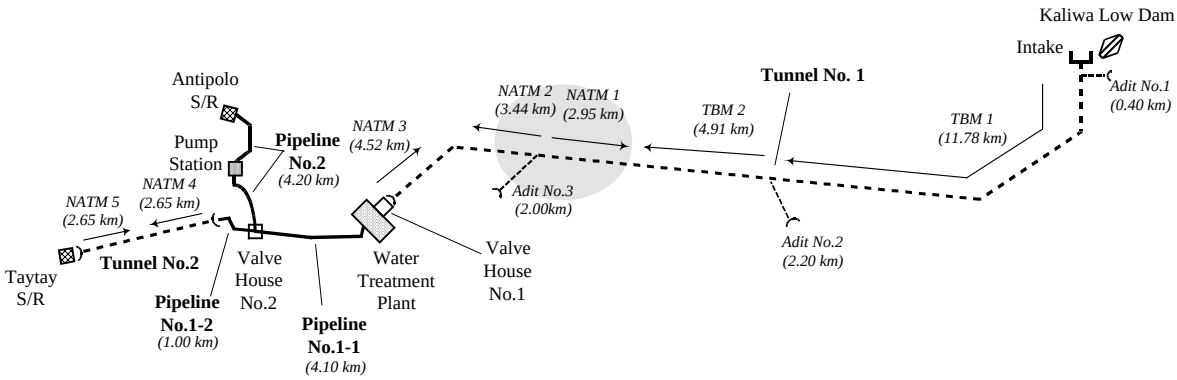
(1) General

The 1st waterway is planned to transfer water from Kaliwa Low Dam to service reservoirs at Antipolo and Taytay. The general plan and profile of the waterway are shown in Figure G1.1 of Annex G.

Raw water taken at Kaliwa Low Dam is transferred to the Morong Water Treatment Plant through a 27.5-km long and 3.5 m-diameter tunnel (Tunnel No.1), and the water treated at the water treatment plant will then be conveyed to the respective reservoirs through pipelines and a tunnel (Tunnel No.2). The construction period is planned to be 5 years in total.

A schematic layout is shown below together with indication of the lengths and the proposed plan of tunneling work:

Water Conveyance Route



(2) Tunnel No.1

Since the Tunnel No.1 is the most critical activities under the 1st waterway construction, the tunneling method by using Tunnel Boring Machine (TBM) is planned for the longest possible sections so that the earliest completion can be achieved.

Tunnel No. 1 is planned to have 5 excavation faces by providing 3 access adits. Based upon the available geological information at this stage, it is planned that about 16.7 km out of 27.5 km is driven by TBM, while the rest of the tunnel will be constructed by New Austrian Tunneling Method (NATM) with shotcrete and rock-bolt supporting. The 3 adits will also be excavated by NATM.

Typical tunnel section is a circular shape with 3.5m diameter in finished diameter for both the TBM and NATM sections.

The progress rate of tunneling by TBM is expected to be 400 m/month (although it may be rather conservative figure) based on the available geological information and the actual progress records in the Umiray-Angat Tunnel that attained a progress of 540 m/month. The progress rate in the NATM sections is expected to be 130 m/month based on the available geological information and cycle-time analysis.

Approximately 450,000 m^3 of tunnel muck will be produced from the tunnel excavation. The majority of the muck will be disposed to respective spoil bank located close to the work adit portals, while some of the muck will be used for construction of internal temporary access roads at the site.

Upon the completion of the tunnel excavation, concrete lining of 350-mm thickness will then be executed. The progress rate of concrete lining with use of telescopic forms is estimated to be 1,000 m/month.

According to the geological information available at this stage, the tunnel will encounter fault zones at several locations. In order to reduce the ingress water and/or improve the ground conditions, auxiliary measures such as forepoling grouting will be carried out during the course of tunnel excavation.

A noteworthy aspect is that the tunnel is presumed to pass a major fault assessed by PHILVOLCS as an 'assumed active fault' at 25-km point from the waterway intake. The tunneling work in this fault zone requires a careful planning. During the excavation, a steel pipe, 600-800 mm in diameter depending on the fault length, will be laid in the fault section as an evacuation way for construction workers in the event of unanticipated occurrence of earthquakes. The tunneling method adopted for the fault zone will be the NATM method.

In the sections of major faults, the tunnel is lined with steel pipe, surrounded by low-density cellular concrete (say, 30 kg/cm^2 in strength) so that the cellular concrete can absorb any displacement caused by earthquakes.

(3) Valve House No.1

Valve House No.1 is constructed at the downstream end of Tunnel No.1 in order to control the quantity of water flowing into the Morong Water Treatment Plant.

Quantities of the earthworks and concrete works are calculated at 74,000 m^3 and 3,700 m^3, respectively. In this construction stage (Stage 1), three butterfly valves and three sleeve valves will be installed.

All the works, consisting of excavations, concrete building works and mechanical installations, are of conventional type.

(4) Morong Water Treatment Plant (WTP) – 1st Development

The Morong Water Treatment Plant is planned to be constructed in 2 stages: a half area in this Stage1 (for accommodating two plant units: #1 unit to be installed in Stage 1 and #2 unit in Stage 2-1) and the remaining half area in Stage 2-2 (for #3 and #4 units).

The elevation of the area ranges from EL. 90-100 m in the relatively flat areas to EL. 120 m on the hilltops. The area consists of a mixture of fruits plantation, paddy field, uncultivated land and hilly areas with about 25 housings at scattered locations. The plan envisages acquiring a total land of about 100 ha including earth disposal area. The Stage 1 work will be constructed in the area of about 60 ha.

Earthworks to provide a 60 ha land require some 4 millions m^3 of cut and fill. Many kinds of heavy machinery such as 44 ton bulldozer with ripper, 10 m^3 class wheel loader, 3 m^3 class backhoe (or larger), and 46 ton dump truck will be employed to deal with about 4 million m^3 earthworks within a limited construction period. In order to dispose the surplus excavated materials, spoil bank is planned to be secured at the nearby section.

Upon the completion of site formation works, structural works will then be carried out at each location. The water treatment plant consists of many structures including receiving well, mixing chamber, flocculation basin, sedimentation basin, rapid sand filter, clear water basin, sludge thickening tank, and sludge drying bed. The concrete will be produced at and transported from a central batching plant installed at the site.

At the locations where the structural works will have been completed, the mechanical and the electrical works will then be done accordingly.

(5) Pipelines

Embedded pipelines will be installed for the length of 5.1 km (main pipeline) between the Morong WTP and Tunnel No.2 and 4.1 km (branch pipeline) between Valve House No.2 and Antipolo Service Reservoir. The diameter is 3.4-3.3 m for the main pipeline and 1.6 m for the branch pipeline, respectively.

The installation of pipes requires the excavation of a trench as deep as 6.6 m in the sections of lowland area where soft silt-clay layers are dominant. The work will require the use of steel sheetpile walling with strut supports. It is expected that sheetpiling be needed for some 60 % of the total length of the pipelines to be installed. The rest of the pipeline route will be installed after the open excavation without sheetpiling.

Following the trench excavation, steel pipes of each 9m (or 6m) long segment will then be installed in position by a 150-ton class capacity crawler crane. Each steel pipe will be connected properly by the internal welding method.

Upon the completion of the pipe installation, backfill with adequate compaction will be executed and sheetpile coffer-wall then removed. However, one side of the sheetpile wall will be left in-situ without extraction, which would be used later as a trench wall for the 2nd pipeline construction.

The similar construction method will be adopted for the 1.6m diameter pipeline. It is estimated that the sheetpiling be needed for some 20 % section of the total length of the pipeline.

(6) Tunnel No.2

Tunnel No.2 (5.3 km long) will be constructed by NATM taking into account varying geological conditions of different rocks foreseen for this tunnel route.

Limestone mass and confined groundwater are anticipated at the eastern half of this tunnel. In order to reduce ingress water and/or improve ground conditions, auxiliary measures including forepoling method are to be carried out during the course of tunnel excavation.

In the middle part of the tunnel route, the tunnel passes beneath the Antipolo City area, where many deep wells exist. Although the present plan foresees that the tunnel does not pass through the aquifer rock zones, care will have to be made not to affect the groundwater condition in the area. At the front face of tunneling, probe holes will be drilled prior to the excavation and, if any notable water seepage is observed, pre-excavation grouting will be made in order not to cause the excessive ingress of groundwater. With this method, the tunneling will be able to pay a maximum possible care for eliminating concerns for lowering groundwater levels in the area.

The progress rate of tunnel construction by NATM is expected to be 80m/month. The tunnel is to be excavated by 2 fronts from both portals at Teresa and Taytay.

Upon the completion of the tunnel excavation, concrete lining will be applied with steel lining in partial sections. The gap between the tunnel-excavated surface and steel pipe will be filled with concrete.

(7) Service Reservoirs

At this Stage 1, a reservoir of 180,000 m^3 storage capacity will be constructed at Taytay and a 30,000 m^3 reservoir at Antipolo. The reservoir is of reinforced concrete construction for both the sites.

The construction work is initiated with site clearance and site formation work by using bulldozer, backhoe, compaction roller and dump truck. Following the site formation work, structural works and equipment installation works will then be done using crawler/truck crane and concrete pump. The conventional construction methods will be adopted for all the works.

(8) Antipolo Pump Station

The proposed work is a conventional type of construction. Since soft silt-clay layer overlies a part of the site, the pump house needs to be built on pile foundation. The excavation for building foundation will require a proper drainage arrangement in view of the location in paddy fields at the foot of hills where groundwater level is high.

J3 Construction Plan for Stage 2-1 Development

J3.1 Agos Dam

(1) General

Agos Dam is located just downstream of the confluence of the Kanan and Kaliwa Rivers, about 20 km upstream of the river mouth of the Agos River. A hydropower plant is planned to be built at the downstream toe of the dam.

Acquisition of lands and re-settlement of the affected households will have to be completed before the commencement of the construction works.

By the time when Agos Dam is completed, trees in the reservoir-impounding area need to be thoroughly cut and removed in order to avoid the deterioration of reservoir water quality after the impoundment.

Total construction period covering both the dam and hydropower plant is planned to be nearly 6 years in total.

(2) River Diversion Work

Prior to the main dam construction, the river flow is to be diverted through 2 diversion tunnels of 10-m diameter, built one each on the both banks. The length of the diversion tunnels is 1,589 m on the right bank and 772 m on the left bank, respectively. The layout plan is as shown on Figure F4.1 of Annex F.

Two upstream cofferdams will be constructed; one each on the Kanan River and Kaliwa River. In order to balance the water levels of the ponds created upstream of the cofferdams, one connecting tunnel (water balance tunnel) with 6-m internal diameter will also be constructed. The tunnel is unlined. The length of the tunnel is 372 m.

The diversion tunnels will be excavated by NATM using 3-boom hydraulic wheel jumbo, side dump wheel loader, backhoe, and dump truck. Construction of the tunnels is on the critical path of the project and hence the earliest completion is a prerequisite requirement. Taking into account the progress rate and the length of the tunnels, 4 sets of tunneling plants are planned to be used for the work. Two sets will be used for the right bank diversion tunnel, one each at the inlet and outlet portals, while the remaining 2 sets will be allocated for the left bank diversion tunnel and connecting tunnel.

The monthly progress rate of tunnel excavation is expected to be 80 m/month based on the available geological information, plants capacity, and cycle time analysis.

The temporary support for excavated tunnel will be provided with shotcrete and rock bolts. Concrete lining work will follow the tunnel excavation works accordingly. The tunnel wall and crown concrete will be placed at first by a circular travelling form. The form is of a type allowing the travelling of muck cars for the excavation work concurrently in progress. Invert concrete will be placed separately afterward.

Upon the completion of 3 tunnels in a period of about 13 months, the upstream and downstream cofferdams will then be constructed to divert the river flow into the diversion tunnels.

In order to avoid seepage through dam body and to prevent piping phenomenon, the upstream face of the both cofferdams is designed to be covered with impervious materials. Slurry wall with 800mm thickness will be constructed at the upstream toe of both upstream cofferdams to prevent water seepage under the cofferdams.

An access road to the proposed quarry site will be constructed upon the completion of the cofferdam embankment.

(3) Main Dam

The proposed dam is a concrete face rockfill dam (CFRD) laid out as shown in Figures F3.3 and F3.6 of Annex F.

Upon the completion of site clearance, excavation for the dam foundation will then be executed from higher portion toward lower portion, while the earthworks at the lowest portion need to await the diversion of river flow. Sufficient de-watering system is to be established and maintained during the course of the excavation of the lowest portion (at upstream toe of the dam), since the considerable amount of underground water ingress is anticipated to take place through the upstream riverbed. The excavation at this portion needs to be executed in the relatively dry period, i.e. between February and September.

The excavation will be executed using bulldozer with ripper, backhoe, loader, and dump truck. The rock excavation will be done in combination with blasting method.

In parallel with the excavation operation at the damsite, the proposed quarry site (approximately 1 km from damsite) is to be developed and be made available by the time when embankment for dam body will be commenced.

The dam embankment volume is estimated to be about 13,000,000 m^3 in total. The materials for the embankment will be obtained from the proposed quarry site and partly from the spillway excavation. It is anticipated that 50% of the excavated rock from spillway be re-used and filled for dam embankment.

The embankment work will be carried out using heavy machines such as bulldozer for spreading and vibrating roller for compaction. Some 400,000 m^3 of rockfill will have to be embanked per month in order to achieve the scheduled completion.

The face slab concrete will be placed with slip form. Concrete will be delivered to the dam site by agitator trucks from a batching plant and further conveyed to the placing location by concrete chute, crane with skip or concrete pump. The slip form will move at a travelling speed of 1.5 m/hr and the concrete will continuously be placed without making any horizontal joint once the work operation will be started. The face slab concrete work will be carried out in 3 to 4 stages for the whole surface of the dam.

(4) Spillway

Spillway is located on the left side bank of the main dam.

Excavation work will be commenced from the higher portion to downward direction along the chuteway by means of the bench cut method. The excavation work for both earth and rock (about 9,000,000 m^3 in total) will be carried out using various heavy machines such as bulldozer, backhoe, crawler drill and dump truck in combination with blasting operation (for rock portion). The selected rock materials from the spillway excavation will be partly used for dam embankment as stated above. Rock quantity expected to be usable for dam embankment is about 4,300,000 m^3, while the rest will be hauled to the spoil bank.

Concrete work for the spillway construction, i.e. fore-bay structure, overflow weir, chuteway and plunge pool walls, will be done by combination of various equipment including fixed type tower crane, crawler/truck crane and concrete pump.

Electrical and mechanical works including radial gates (11m(h) x 14m(w) x 4 nos.) and stoplogs will be carried out upon the completion of structural works.

Plunge pool will be excavated to the designated level after the left side diversion tunnel will be closed and the downstream cofferdam will be relocated to further downstream by about 300m. Closure of the left side diversion tunnel will have to be done at the beginning of the dry season to allow the plunge pool construction to be executed in the relatively dry period. During the course of excavation, proper de-watering system is to be established and maintained since a considerable amount of seepage water is anticipated.

(5) Hydropower Facilities

The hydropower plant and switchyard are constructed at the toe of the Agos Dam. The works for power facilities consisting of intake structure, gate shaft, headrace tunnel, penstock line and powerhouse will be carried out in parallel with the main dam embankment and spillway construction.

Following the excavation works, concrete works for powerhouse substructure will be carried out using the same equipment as used for the spillway construction. Installation of overhead travelling crane in the powerhouse superstructure will be a milestone event for the succeeding installation of generating equipment.

J3.2 Water Treatment Plant - Installation of Unit #2

In this Stage 2-1, an additional unit of water treatment plant is planned to be installed in the adjacent area of Unit #1 that is to be installed under the Stage 1. Since the site formation work is scheduled to be completed in the Stage 1, the work involved at this stage will be limited to the structural and mechanical works for the Unit #2.

J4 Construction Plan for Stage 2-2 Development

In order to double the water supply capacity, the 2nd waterway is planned to be constructed in the Stage 2-2. The 2nd waterway is aligned to run in parallel with the 1st waterway to be provided in the Stage 1.

(1) Waterway Intake

As described in Subsection J2.1 before, the structural works for the 2nd waterway has already been constructed in the Stage 1. The works carried out in this stage are mechanical works (installation of gates, hoists, stoplogs and trashracks) and the associated electrical works.

All the mechanical works are to be installed and fixed at the proper positions using crawler/truck crane. A crane with skip will handle the associated concrete work.

(2) Tunnel No.1

The same tunneling method (TBM and NATM) as proposed for the 1st tunnel will be adopted for the 2nd stage tunnel as well. The tunneling work in the Stage 2-2 will be carried out with a more confidence as compared with the case of the 1st tunnel, since the tunnel geology will have been clarified in detail through the experience in the 1st tunnel.

The existing access adits, namely Adit No.1, Adit No.2, and Adit No.3 used in the Stage 1, will also be utilized for the 2nd stage construction, after the necessary repairs and/or reinforcement of damaged portions that may have taken place during the elapse of time since the Stage 1. The construction period of the 2nd tunnel could be reduced by about 1 year because of the immediate access to the tunnel site through the existing adits.

(3) Valve House No.2

Since all the civil works will have already been completed in Stage 1, installation of valves and associated equipment for the 2nd waterway will be carried out in this stage.

(4) Morong Water Treatment Plant – 2nd Development

The plant will be expanded to double the production capacity by accommodating Unit #3 and #4. The work is almost same as conducted in the Stage1. The site formation work involves cut-and-fill of about 6,800,000 m^3 for the expansion of the plant area by 40 ha.

Plant units #3 and #4 will be installed in 2 successive stages at the interval of 3 years.

(5) Pipelines

The pipelines will be laid in parallel with the 1st stage pipeline in principle. At the locations where sheetpile coffer walling will have been applied in the 1st stage construction, the distance between the pipes (edge to edge) will be the same as the diameter of the pipes laid. In the sections where the open cut excavation will have

been applied in the 1st stage construction, the distance between the pipes (edge to edge) will be about 10 m.

(6) Tunnel No.2

The 2nd tunnel will be excavated in parallel with the 1st tunnel in the upstream part. The distance between the 2 tunnels is 20 m. The tunnel in the downstream part is aligned so as to take a shortest length to the proposed outlet site in the Taytay Service Reservoir.

A faster progress of the tunneling is expected since the work will be able to be arranged with advance knowledge of in-situ geology obtained through the experience in the 1st tunnel.

(7) Service Reservoirs and Pump House

The construction work at this stage is virtually the expansion of facilities by building structures similar to those built under the Stage 1. The work will use the same method as adopted in the Stage 1 work.

J5 Construction Schedule

Construction schedule of the proposed project was worked out in consideration of required duration of each work activity, sequence of the works, progress rates, seasonal constraints (weather and river flow conditions) and availability of construction resources.

The proposed schedule is shown in a bar chart form in Figure J5.1. The detailed programs for Agos Dam and tunnels are presented in Figure J5.2 and J5.3, respectively.

J6 Construction Cost Estimate

J6.1 Conditions and Assumptions

The project cost was estimated based on the following conditions and assumptions:

(1) The project cost is composed of foreign currency (F.C.) portion and local currency (L.C.) portion. The estimated cost is expressed in US dollar (US$) for both the foreign and local currency components.

(2) The local currency component covers the cost of locally available materials including cement, reinforcement steel, fuel, explosives and local labors. The cost of imported machinery for mechanical and electrical works and depreciation of construction equipment are allocated to the foreign currency portion.

(3) The price level of the estimate is June 2002 and the exchange rate used in the estimate is US$ 1.0 = Philippine Peso 52.0.

(4) Competent contractors selected through international competitive bidding (ICB) and local competitive bidding (LCB) will undertake the construction works.

The unit prices of the works are determined by referring to the prevailing unit costs of labors, construction materials and equipment in principle. The composition of F.C. and L.C. is estimated applying an assumed percentage for each type of the work based on the latest bidding information for the similar projects in the Philippines and the other Asian countries.

Composition of F.C and L.C. by Type of Works

(Unit: %)

Work Items	F.C. portion	L.C. portion	Total
1 Land acquisition / Resettlement	0	100	100
2 Construction Cost			
Earthworks	60	40	100
Structural works	40	60	100
Metal works	85	15	100
Power generating plant and electrical works	90	10	100
Tunnel excavation	80	20	100

The prices of the main materials for the cost estimate are summarized as follows:

Material	Unit	Price (US$)
Diesel Oil	litter	0.25
Cement	ton	65
Plywood	m^2	6.5
Reinforcement Steel	ton	320

J6.2 Method of Cost Estimate

The cost estimate for respective cost categories is made by the following manner:

(1) Preparatory Works

Preparatory works include the construction of new access road to the site, existing road improvement, construction plant including batching plant and quarry plant, offices, camps, power supply system, water supply system, and all other necessary preparatory works required for proceeding with the main works.

The construction cost for the new access roads and existing road improvement are estimated by the unit price method based on the lengths measured on 1:50,000 map. The cost of other preparatory works is estimated on a lump sum basis at 12 % of the cost of the main works.

(2) Civil Works

Construction cost of the civil works including earthworks, structural works, tunneling works, pipe laying, etc. is estimated by the unit price method based on the quantities measured from the preliminary design drawings.

(3) Metal Works and Electrical Equipment

For the metal works such as gate, penstock and valve, the unit price method is applied. The weight of steel structures is estimated based on principal dimensions proposed in the preliminary design.

For the power plant equipment and other electrical works, estimate on lump sum basis is made based on the empirical cost formula taking account of various parameters such as design head, discharge, capacity, dimensions, etc. The recent bidding data for the similar works are also referred to in determining the respective unit prices or lump sum cost.

(4) Land Acquisition and Resettlement Cost

Land acquisition and resettlement cost is estimated by the unit price method taking into account the quantities revealed in EIA study. Since all the details have not been defined at this study stage, adequate amount of contingency cost is included in the estimate to cover unpredictable expenditures that may be arising in the actual implementation stage.

(5) Engineering and Administration Cost

The cost for engineering service for detailed design, procurement of the works, and construction supervision is estimated at 5.0% of the total of construction cost and land acquisition/resettlement cost.

Administration expense of the executing agency is estimated at 2.5% of the total cost of construction cost and land acquisition/resettlement cost.

(6) Physical Contingency

Physical contingency is estimated at 15 % of the total cost of above items.

(7) Tax

Local tax imposed on the project cost is estimated at 10 % of the above total cost, covering both the foreign currency portion and local currency portion.

(8) Price Contingency

Price contingency is estimated at assumed annual price escalation rates of 2.0 % and 3.0 % for foreign currency portion and local currency portion, respectively.

J6.3 Total Project Cost

The total project cost is estimated at US$ 2,543 million equivalent (equivalent to PhP 132.2 billion), comprising foreign currency portion of US$ 1,599 million (PhP 83.1 bullion equivalent) and local component of US$ 944 million equivalent (PhP 49.1 billion). The estimated project cost for each implementation stage is summarized in Tables J6.1 and J6.2.

Estimated Total Project Cost

Description	FC (10^6US$)	LC (10^6US$)	Total (10^6US$)
Construction Cost	917	482	1,399
Engineering Service	46	24	70
Administration Expense	23	12	35
Physical Contingency	148	78	226
Price Contingency	352	288	640
Tax	113	60	173
Total	1,599	944	2,543

The detailed bill of quantities is presented in Table J6.3.

J6.4 Annual Disbursement Schedule

The annual disbursement schedule is estimated based on the estimated project cost and construction time schedule. The annual disbursement schedule is shown in Table J6.4.

Tables

Table J1.1 Monthly Rainfall at Infanta between 1991 and 2000

(Unit: mm)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1991	176	384	94	176	171	404	164	201	82	270	406	455	2,983
1992	234	122	104	134	164	104	495	266	172	535	637	233	3,199
1993	228	190	77	45	95	191	149	277	218	409	406	1,493	3,777
1994	468	148	187	116	162	416	63	105	274	423	165	412	2,940
1995	360	503	110	120	217	461	305	271	704	725	481	1,366	5,623
1996	395	181	174	809	123	357	222	64	102	420	899	367	4,112
1997	319	321	142	46	206	50	416	73	356	190	125	241	2,485
1998	114	41	-	40	109	232	208	204	126	784	476	1,536	3,869
1999	569	328	438	719	235	186	181	394	208	562	950	1,221	5,991
2000	362	372	292	180	243	347	231	100	403	766	789	1,021	5,105
Mean	323	259	180	238	172	275	243	195	265	508	533	834	4,026

Table J1.2 Mean Monthly Rainy Days in the Project Area

(Unit : Number of days)

Rainfall (mm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
0	6.1	11.6	14.0	15.7	14.2	12.0	11.2	13.8	10.2	8.1	4.8	4.0	125.7
0<R<=5	11.1	8.0	9.1	7.4	8.1	7.7	9.0	9.0	9.8	6.6	8.3	8.3	102.4
5<R<=10	4.2	2.2	3.2	1.5	3.8	3.2	4.0	2.9	2.9	4.6	4.4	3.6	40.5
10<R<=20	4.3	2.0	2.1	2.2	2.3	2.7	2.8	2.2	3.1	4.2	4.2	4.1	36.2
20<R<=30	2.5	1.8	1.0	0.9	0.8	1.6	1.8	0.9	1.2	2.5	2.5	3.1	20.6
30<R<=40	0.8	0.6	0.1	0.6	0.7	1.4	0.6	0.7	1.3	1.2	1.4	1.6	11.0
40<R	2.0	1.8	1.4	1.7	1.1	1.4	1.6	1.5	1.5	3.8	4.4	6.3	28.5
Total	31.0	28.0	31.0	30.0	31.0	30.0	31.0	31.0	30.0	31.0	30.0	31.0	365.0

Table J1.3 Estimated Suspended Days by Major Construction Work Item

(Unit: Number of days)

Rainfall (mm)	Excavation	Embankment	Structure	Pipe Laying	Tunnel
0<Rainfall<=5	0	0	0	0	0
5<Rainfall<=10	0	0	0	0	0
10<Rainfall<=20	0	0.5	0	0	0
20<Rainfall<=30	0	0.5	0.5	0.5	0
30<Rainfall<=40	1.0	1.0	1.0	1.0	0
40<Rainfall	1.0	1.0	1.0	1.0	0

Table J1.4 Number of Workable Days for Respective Works (1/2)

Workable Days for Excavation Works

(Unit: Number of days)

HOLIDAY	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
National Holiday	1.0	0.0	2.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	1.0	2.0	9.0
Sunday	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	52.1
Rain	2.8	2.4	1.6	2.3	1.8	2.8	2.2	2.2	2.8	5.0	5.8	7.9	39.6
Overlap	0.5	0.4	0.3	0.4	0.3	0.5	0.3	0.3	0.4	0.7	1.0	1.6	6.8
Suspended Days	7.7	6.4	7.6	7.2	6.8	7.6	6.2	6.2	6.7	8.6	10.1	12.6	93.9
Workable Day	23.3	21.6	23.4	22.8	24.2	22.4	24.8	24.8	23.3	22.4	19.9	18.4	271.1

Workable Days for Embankment Works

(Unit: Number of days)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
NATIONAL HOLIDAY	1.0	0.0	2.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	1.0	2.0	9.0
SUNDAY	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	52.1
RAIN	6.2	4.3	3.1	3.9	3.4	5.0	4.5	3.8	5.0	8.4	9.2	11.5	68.0
OVERLAP	1.1	0.7	0.6	0.7	0.6	0.9	0.6	0.5	0.7	1.2	1.6	2.4	11.5
SUSPENDED	10.5	8.0	8.8	8.5	8.1	9.4	8.2	7.6	8.6	11.5	12.9	15.5	117.6
WORKABLE DAY	20.5	20.0	22.2	21.5	22.9	20.6	22.8	23.4	21.4	19.5	17.1	15.5	247.4

Workable Days for Structural works

(Unit: Number of days)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
HOLIDAY	1.0	0.0	2.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	1.0	2.0	9.0
SUNDAY	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	52.1
RAIN	4.1	3.3	2.1	2.8	2.2	3.6	3.1	2.7	3.4	6.3	7.1	9.5	49.9
OVERLAP	0.7	0.5	0.4	0.5	0.4	0.6	0.4	0.4	0.5	0.9	1.3	1.9	8.5
SUSPENDED	8.7	7.1	8.0	7.6	7.2	8.3	7.0	6.6	7.3	9.7	11.1	13.9	102.5
WORKABLE DAY	22.3	20.9	23.0	22.4	23.8	21.7	24.0	24.4	22.7	21.3	18.9	17.1	262.5

Table J1.4 Number of Workable Days for Respective Works (2/2)

Workable Days for Pipe Laying Works

(Unit: Number of days)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
HOLIDAY	1.0	0.0	2.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	1.0	2.0	9.0
SUNDAY	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	52.1
RAIN	4.1	3.3	2.1	2.8	2.2	3.6	3.1	2.7	3.4	6.3	7.1	9.5	49.9
OVERLAP	0.7	0.5	0.4	0.5	0.4	0.6	0.4	0.4	0.5	0.9	1.3	1.9	8.5
SUSPENDED	8.7	7.1	8.0	7.6	7.2	8.3	7.0	6.6	7.3	9.7	11.1	13.9	102.5
WORKABLE DAY	22.3	20.9	23.0	22.4	23.8	21.7	24.0	24.4	22.7	21.3	18.9	17.1	262.5

Workable Days for Tunneling Works

(Unit: Number of days)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
HOLIDAY	1.0	0.0	2.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	1.0	2.0	9.0
SUNDAY	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	4.3	52.1
RAIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OVERLAP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUSPENDED	5.3	4.3	6.3	5.3	5.3	5.3	4.3	4.3	4.3	4.3	5.3	6.3	61.1
WORKABLE DAY	25.7	23.7	24.7	24.7	25.7	24.7	26.7	26.7	25.7	26.7	24.7	24.7	303.9

Table J6.1 Project Cost Summary

Description	F.C. (US$)	L.C. (US$ equiv.)	Total (US$ equiv.)
Stage 1 Kaliwa Low Dam + 1st Waterway			
(1) Kaliwa Low Dam + 1st Waterway (excluding WTP #1)			
Land Acquisition & Resettlement excluding WTP #1	0	20,970,525	20,970,525
Kaliwa Low Dam (Temporary)	8,846,139	7,219,177	16,065,316
Waterway to Valve House No.1	123,157,716	40,292,011	163,449,727
Valve House No.1	2,377,927	1,102,818	3,480,745
Waterway from WTP to Reservoir	75,991,207	28,563,732	104,554,939
Sub-total for (1)	210,372,988	98,148,264	308,521,252
(2) Water Treatment Plant #1			0
Land Acquisition & Resettlement for WTP #1 and #2	0	2,556,516	2,556,516
Waterway Facility (WTP #1)	67,793,676	33,983,004	101,776,681
Sub-total for (2)	67,793,676	36,539,521	104,333,197
TOTAL for Stage 1	278,166,664	134,687,785	412,854,449
Stage 2-1 Agos Dam + WTP #2			
(1) Agos Dam			
Land Acquisition & Resettlement	0	16,702,920	16,702,920
Agos Dam	236,686,200	153,611,623	390,297,823
Agos Hydropower Facility	54,417,488	10,970,794	65,388,282
Sub-total for (1)	291,103,688	181,285,336	472,389,024
(2) Water Treatment Plant #2 + Service Reservoirs #2	47,769,758	26,113,283	73,883,041
TOTAL for Stage 2-1	338,873,446	207,398,619	546,272,065
Stage 2-2 Kaliwa Angono 2nd Waterway + WTP #3 & #4			
(1) 2nd Waterway (excluding WTP #3)			
Land Acquisition & Resettlement excluding WTPs	0	6,265,486	6,265,486
Kaliwa Low Dam (Temporary)	239,652	159,768	399,420
Waterway to Valve House No.1	100,288,106	34,273,271	134,561,376
Valve House No.1	1,239,235	137,693	1,376,928
Waterway from WTP to Reservoir	63,448,980	24,938,261	88,387,241
Sub-total for (1)	165,215,973	65,774,478	230,990,451
(2) Water Treatment Plant #3			
Land Acquisition & Resettlement for WTP #3 & #4	0	3,931,064	3,931,064
Waterway Facility	66,694,307	36,715,879	103,410,186
Sub-total for (2)	66,694,307	40,646,943	107,341,250
(3) Water Treatment Plant #4 + Service Reservoir #4	68,219,974	34,159,294	102,379,268
TOTAL for Stage 2-2	300,130,254	140,580,715	440,710,969
A. Total Construction Cost including Land Acquisition and Resettlement	**917,170,364**	**482,667,119**	**1,399,837,483**
B. Engineering Service (A x 5.0%)	**45,858,518**	**24,133,356**	**69,991,874**
C. Administration Expense (A x 2.5%)	**22,929,259**	**12,066,678**	**34,995,937**
D. Physical Contingency ((A+B+C) x 15%)	**147,893,721**	**77,830,073**	**225,723,794**
TOTAL PROJECT COST at 2002 Price	**1,133,851,863**	**596,697,226**	**1,730,549,088**
E. Tax ((A+B+C+D) x 10%)	**113,385,186**	**59,669,723**	**173,054,909**
F. Price Contingency	**351,835,550**	**287,865,450**	**639,701,000**
TOTAL FUND REQUIREMENT *	**1,599,072,599**	**944,232,398**	**2,543,304,997**

* Based on a proposed implementation schedule. Excluding interest during construction

Table J6.2 Construction Cost Summary (1/2)

Stage 1 Kaliwa Low Dam + 1st Waterway	F.C.	L.C.	TOTAL
1 Kaliwa Low Dam + 1st Waterway (excluding WTP #1)			
(1) Land Acquisition & Resettlement excluding WTP #1			
Land Acquisition	0.0	6,260,125.0	6,260,125.0
Resettlement and Compensation	0.0	14,710,400.0	14,710,400.0
Sub-total for (1)	0.0	20,970,525.0	20,970,525.0
(2) Kaliwa Low Dam (Temporary)			
Preparatory Works	1,671,014.9	1,255,626.1	2,926,641.0
Kaliwa Low Dam	3,966,391.0	3,429,734.0	7,396,125.0
Intake Structure	3,208,733.0	2,533,817.0	5,742,550.0
Sub-total for (2)	8,846,138.9	7,219,177.1	16,065,316.0
(3) Waterway to Valve House no.1			
Preparatory Works	13,838,326.7	4,745,572.6	18,583,899.3
Tunnel No.1	109,319,389.2	35,546,438.6	144,865,827.8
Sub-total for (3)	123,157,715.9	40,292,011.2	163,449,727.1
(4) Valve House No.1			
Preparatory Works	270,849.3	128,873.4	399,722.7
Valve House Portion	1,887,347.0	779,273.0	2,666,620.0
Tailrace Portion	219,730.5	194,672.0	414,402.5
Sub-total for (4)	2,377,926.8	1,102,818.4	3,480,745.2
(5) Waterway from WTP to Reservoir			
Preparatory Works	8,921,379.3	3,580,042.8	12,501,422.1
Pipeline No.1-1 (3.4m dia., 4.1km)	14,865,605.0	3,713,163.9	18,578,768.9
Pipeline No.1-2 (3.3m dia., 1.0km)	3,523,902.6	856,605.1	4,380,507.7
Valve House No.2	879,907.8	477,208.4	1,357,116.2
Pipeline No.2 (1.6m dia., 4.2km)	5,256,619.0	1,264,170.0	6,520,789.0
Surge Tank	17,194.8	23,167.2	40,362.0
Pumping Station #1 & #2 (80MLD)	10,521,727.9	3,107,370.1	13,629,098.0
Antipolo Service Reservoir #1 & #2 (30,000 m3)	1,654,962.5	1,433,382.6	3,088,345.1
Tunnel No.2	20,439,312.5	6,241,662.5	26,680,975.0
Taytay Service Reservoir #1 (180,000 m3)	9,910,595.2	7,866,960.1	17,777,555.3
Sub-total for (5)	75,991,206.7	28,563,732.4	104,554,939.2
Total for 1	**210,372,988.3**	**98,148,264.1**	**308,521,252.4**
2 Water Treatment Plant #1			
(1) Land Acquisition & Resettlement for WTP #1 and #2			
Land Acquisition	0.0	2,435,096.0	2,435,096.0
Resettlement and Compensation	0.0	121,420.4	121,420.4
Sub-total for (1)	0.0	2,556,516.4	2,556,516.4
(2) Waterway Facility			
Preparatory Works	7,424,322.4	3,748,179.1	11,172,501.5
Water Treatment Plant #1 (910 MLD)	60,369,353.7	30,234,825.4	90,604,179.1
Sub-total for (2)	67,793,676.1	33,983,004.5	101,776,680.6
Total for 2	**67,793,676.1**	**36,539,520.9**	**104,333,197.0**
TOTAL for Stage 1	**278,166,664.4**	**134,687,785.0**	**412,854,449.4**
Stage 2-1 Agos Dam + WTP #2			
1 Agos Dam			
(1) Land Acquisition & Resettlement			
Land Acquisition	0.0	4,098,028.8	4,098,028.8
Resettlement and Compensation	0.0	12,604,890.7	12,604,890.7
Sub-total (1)	0.0	16,702,919.5	16,702,919.5
(2) Agos Dam			
Preparatory Works	29,869,079.3	22,642,796.4	52,511,875.7
Agos Dam			
Diversion Works	51,626,278.0	19,121,432.0	70,747,710.0
Main Dam	53,305,395.0	40,255,930.0	93,561,325.0
Landslide Protection Measures	3,900,000.0	2,600,000.0	6,500,000.0
Rock Quarry for Dam Embankment	35,287,344.1	23,524,896.1	58,812,240.1
Spillway	62,698,103.6	45,466,568.4	108,164,672.0
Sub-total (2)	236,686,200.0	153,611,622.8	390,297,822.8
(3) Agos Hydropower Facility			
Preparatory Works	5,830,445.2	1,175,442.2	7,005,887.3
Intake Structure	819,341.6	200,787.4	1,020,129.0
Headrace Tunnel	741,004.0	315,766.0	1,056,770.0
Penstock Line	5,211,437.0	2,219,778.0	7,431,215.0
Powerhouse	1,260,336.0	1,551,759.0	2,812,095.0
Tailrace	553,476.0	706,189.0	1,259,665.0
Switchyard	378,507.4	253,078.5	631,585.9
Hydromechanical and Hydroelectric Works			0.0
Hydromechanical works	2,225,300.0	392,700.0	2,618,000.0
Hydroelectrical Work	37,397,641.1	4,155,293.5	41,552,934.5
Sub-total (3)	54,417,488.2	10,970,793.6	65,388,281.7
Total for 1	**291,103,688.1**	**181,285,335.9**	**472,389,024.0**
2 Water Treatment Plant #2 + Service Reservoir #2			
Preparatory Works	5,118,188.3	2,797,851.8	7,916,040.1
Water Treatment Plant #2 (Expansion 910 MLD)	36,160,243.3	17,053,355.5	53,213,598.8
Taytay Service Reservoir #2 (180,000 m3)	6,491,326.2	6,262,075.8	12,753,402.0
Total for 2	**47,769,757.8**	**26,113,283.1**	**73,883,040.9**
TOTAL for Stage 2-1	**338,873,446.0**	**207,398,619.0**	**546,272,064.9**

Table J6.2 Construction Cost Summary (2/2)

Stage 2-2 Kaliwa-Angono 2nd Waterway + WTP #3 & #4			
1 2nd Waterway (excluding WTP #3)			
(1) Land Acquisition & Resettlement excluding WTPs			
Land Acquisition	0.0	5,977,163.0	5,977,163.0
Resettlement and Compensation	0.0	288,322.5	288,322.5
Sub-total for (1)	0.0	6,265,485.5	6,265,485.5
(2) Kaliwa Low Dam (Temporary)			
Kaliwa Low Dam	239,652.0	159,768.0	399,420.0
Sub-total for (2)	239,652.0	159,768.0	399,420.0
(3) Waterway to Valve House No.1			
Preparatory Works	10,745,154.2	3,672,136.2	14,417,290.3
Tunnel No.1	89,542,951.4	30,601,134.7	120,144,086.1
Sub-total for (3)	100,288,105.6	34,273,270.9	134,561,376.4
(4) Valve House No.1			
Preparatory Works	132,775.2	14,752.8	147,528.0
Valve House Portion	1,069,200.0	118,800.0	1,188,000.0
Tailrace Portion	37,260.0	4,140.0	41,400.0
Sub-total for (4)	1,239,235.2	137,692.8	1,376,928.0
(5) Waterway from WTP to Reservoir			
Preparatory Works	6,798,105.0	2,671,956.5	9,470,061.5
Pipeline No.1-1 (3.4m dia., 4.1km)	12,217,715.6	3,245,889.3	15,463,604.9
Pipeline No.1-2 (3.3m dia., 1.0km)	2,568,812.2	686,615.5	3,255,427.7
Pipeline No.2 (1.6m dia., 4.2km)	4,504,079.6	1,114,888.7	5,618,968.3
Surge Tank	17,194.8	23,167.2	40,362.0
Pumping Station (installation of additional pumps)	4,771,525.4	842,033.9	5,613,559.3
Antipolo Service Reservoir #3 (Expansion 30,000 m3 x 2 units)	2,968,351.3	2,699,345.9	5,667,697.2
Tunnel No.2 (Steel lined; 3.4m dia., 5.7km)	20,439,312.5	6,241,662.5	26,680,975.0
Taytay Service Reservoir #3 (Expansion 180,000 m3)	9,163,883.7	7,412,701.3	16,576,585.0
Sub-total for (5)	63,448,980.2	24,938,260.7	88,387,240.9
Total for 1	**165,215,973.0**	**65,774,477.9**	**230,990,450.9**
2 Water Treatment Plant #3			
(1) Land Acquisition & Resettlement for WTP #3 & #4			
Land Acquisition	0.0	2,406,250.0	2,406,250.0
Resettlement and Compensation	0.0	1,524,814.4	1,524,814.4
Sub-total for (1)	0.0	3,931,064.4	3,931,064.4
(2) Waterway Facility			
Preparatory Works	7,145,818.6	3,933,844.1	11,079,662.8
Water Treatment Plant #3 (Expansion 910 MLD)	59,548,488.5	32,782,034.5	92,330,523.0
Sub-total for (2)	66,694,307.1	36,715,878.7	103,410,185.8
Total for 2	**66,694,307.1**	**40,646,943.1**	**107,341,250.2**
3 Water treatment Plant #4 + Service Reservoir #4			
Waterway Facility			
Preparatory Works	7,309,282.9	3,659,924.3	10,969,207.2
Water Treatment Plant #4 (Expansion 910 MLD)	35,276,349.3	16,847,917.7	52,124,267.0
Pumping Station (Expansion 340 MLD)	15,091,847.0	3,679,438.1	18,771,285.1
Antipolo Service Reservoir #4 (Expansion 30,000 m3 x 3 units)	4,141,067.0	3,725,802.4	7,866,869.4
Taytay Service Reservoir #4 (Expansion 180,000 m3)	6,401,427.5	6,246,211.3	12,647,638.8
Total for 3	**68,219,973.8**	**34,159,293.8**	**102,379,267.6**
TOTAL for Stage 2-2	**300,130,253.9**	**140,580,714.8**	**440,710,968.6**
Grand Total	**917,170,364.2**	**482,667,118.8**	**1,399,837,483.0**

Table J6.3 Bill of Quantities (1/12)

Item No	Description	Unit	Quantity	Unit Price (US$)			Amount (US$)		
				F.C	L.C.	Total	F.C	L.C.	Total
1	**STAGE 1 KALIWA LOW DAM + 1st WATERWAY**								
1 1	**KALIWA LOW DAM + 1st WATERWAY (excluding WTP #1)**								
1 1 1	**1 Land Acquisition & Resettlement excluding WTP #1**								
1 1 1	Land Acquisition	L.S.					0.0	6,260,125.0	6,260,125.0
1 1 1	Resettlement	L.S.					0.0	14,710,400.0	14,710,400.0
1 1 2	**2 Kaliwa Low Dam (Temporary)**								
1 1 2	Preparatory Works								
1 1 2	New Access	m	500	180.0	120.0	300.0	90,000.0	60,000.0	150,000.0
1 1 2	Improvement	m	8,000	90.0	60.0	150.0	720,000.0	480,000.0	1,200,000.0
1 1 2	Preparatory Works	L.S.					861,014.9	715,626.1	1,576,641.0
1 1 2	Kaliwa Low Dam								
1 1 2	1st stage cofferdam embankment	m3	18,000	3.0	2.0	5.0	54,000.0	36,000.0	90,000.0
1 1 2	2nd stage cofferdam embankment	m3	6,000	3.0	2.0	5.0	18,000.0	12,000.0	30,000.0
1 1 2	Open excavation, common	m3	2,200	2.7	1.8	4.5	5,940.0	3,960.0	9,900.0
1 1 2	Open excavation, rock	m3	19,900	7.5	5.0	12.5	149,250.0	99,500.0	248,750.0
1 1 2	Bckfilling	m3	5,600	4.2	2.8	7.0	23,520.0	15,680.0	39,200.0
1 1 2	Embankment with random fill materials	m3	163,600	4.2	2.8	7.0	687,120.0	458,080.0	1,145,200.0
1 1 2	Embankment with impervious matrerials	m3	24,800	4.2	2.8	7.0	104,160.0	69,440.0	173,600.0
1 1 2	Cribs materials	m2	10,800	4.2	2.8	7.0	45,360.0	30,240.0	75,600.0
1 1 2	Compacted gravel for crest	m3	200	5.4	3.6	9.0	1,080.0	720.0	1,800.0
1 1 2	Face concrete	m3	1,420	34.0	51.0	85.0	48,280.0	72,420.0	120,700.0
1 1 2	Structural concrete for sand flush way	m3	24,000	34.0	51.0	85.0	816,000.0	1,224,000.0	2,040,000.0
1 1 2	Reinforcement	ton	250	248.0	372.0	620.0	62,000.0	93,000.0	155,000.0
1 1 2	Mass concrete for sand flush way	m3	17,050	32.0	48.0	80.0	545,600.0	818,400.0	1,364,000.0
1 1 2	Stoplog	L.S.					280,500.0	49,500.0	330,000.0
1 1 2	Sand flush gate 5.0(h)x5.0(w)	L.S.					425,000.0	75,000.0	500,000.0
1 1 2	Hoist (1no)	L.S.					340,000.0	60,000.0	400,000.0
1 1 2	Miscellaneous	L.S.	10%				360,581.0	311,794.0	672,375.0
1 1 2	Intake Structure								
1 1 2	Open excavation, common	m3	200	2.7	1.8	4.5	540.0	360.0	900.0
1 1 2	Open excavation, rock	m3	19,400	7.5	5.0	12.5	145,500.0	97,000.0	242,500.0
1 1 2	Backfilling	m3	38,900	4.5	3.0	7.5	175,050.0	116,700.0	291,750.0
1 1 2	Structural concrete	m3	16,430	34.0	51.0	85.0	558,620.0	837,930.0	1,396,550.0
1 1 2	Reinforcement	ton	1,640	248.0	372.0	620.0	406,720.0	610,080.0	1,016,800.0
1 1 2	Mass concrete	m3	8,350	32.0	48.0	80.0	267,200.0	400,800.0	668,000.0
1 1 2	Trashrack 10(h)x3.5(w), 12(h)x3.5(w)	L.S.					71,400.0	12,600.0	84,000.0
1 1 2	Stoplog 0.3(h)x3.5(w)x12nos	L.S.					170,000.0	30,000.0	200,000.0
1 1 2	Intake gate; 3.5(h)x3.5(w)x2nos, 3.1(h)x3.5(w)x4nos	L.S.					714,000.0	126,000.0	840,000.0
1 1 2	Hoist (6no)	L.S.					408,000.0	72,000.0	480,000.0
1 1 2	Miscellaneous	L.S.	10%				291,703.0	230,347.0	522,050.0
1 1 3	**3 Waterway to Valve House No.1**								
1 1 3	Preparatory Works								
1 1 3	New Access	m	2,600	180.0	120.0	300.0	468,000.0	312,000.0	780,000.0
1 1 3	Improvement	m	2,800	90.0	60.0	150.0	252,000.0	168,000.0	420,000.0
1 1 3	Preparatory Works	L.S.					13,118,326.7	4,265,572.6	17,383,899.3
1 1 3	Tunnel No.1								
1 1 3	Adit 1								
1 1 3	Open excavation at portal	m3	800	2.7	1.8	4.5	2,160.0	1,440.0	3,600.0
1 1 3	Tunnel excavation including all temp. works (steel support, shotcrete, grouting, power supply, etc.) other than conc.	m3	10,998	149.6	37.4	187.0	1,645,300.8	411,325.2	2,056,626.0
1 1 3	Miscellaneous	L.S.	5%				82,373.0	20,638.3	103,011.3
1 1 3	Adit 2								
1 1 3	Open excavation at portal	m3	800	2.7	1.8	4.5	2,160.0	1,440.0	3,600.0
1 1 3	Tunnel excavation including all temp. works (steel support, shotcrete, grouting, power supply, etc.) other than conc.	m3	60,490	149.6	37.4	187.0	9,049,304.0	2,262,326.0	11,311,630.0
1 1 3	Miscellaneous	L.S.	5%				452,573.2	113,188.3	565,761.5
1 1 3	Adit 3								
1 1 3	Open excavation at portal	m3	800	2.7	1.8	4.5	2,160.0	1,440.0	3,600.0
1 1 3	Tunnel excavation including all temp. works (steel support, shotcrete, grouting, power supply, etc.) other than conc.	m3	54,991	149.6	37.4	187.0	8,226,653.6	2,056,663.4	10,283,317.0
1 1 3	Miscellaneous	L.S.	5%				411,440.7	102,905.2	514,345.9
1 1 3	NATM 1								
1 1 3	Tunnel excavation including all temp. works (steel support, shotcrete, grouting, power supply, etc.) other than conc.	m3	43,150	149.6	37.4	187.0	6,455,240.0	1,613,810.0	8,069,050.0
1 1 3	Lining Concrete	m3	14,768	50.0	75.0	125.0	738,400.0	1,107,600.0	1,846,000.0
1 1 3	Miscellaneous	L.S.	5%				359,682.0	136,070.5	495,752.5
1 1 3	NATM 2								

Table J6.3 Bill of Quantities (2/12)

Item No	Description	Unit	Quantity	Unit Price (US$)			Amount (US$)		
				F.C	L.C.	Total	F.C	L.C.	Total
1 1 3	Tunnel excavation including all temp. works (steel support, shotcrete, grouting, power supply, etc.) other than conc.	m3	50,317	149.6	37.4	187.0	7,527,423.2	1,881,855.8	9,409,279.0
1 1 3	Lining Concrete	m3	17,221	50.0	75.0	125.0	861,050.0	1,291,575.0	2,152,625.0
1 1 3	Miscellaneous	L.S.	5%				419,423.7	158,671.5	578,095.2
1 1 3	NATM 3								
	Open excavation at inlet & outlet portals	m3	1,000	2.7	1.8	4.5	2,700.0	1,800.0	4,500.0
1 1 3	Tunnel excavation including all temp. works (steel support, shotcrete, grouting, power supply, etc.) other than conc.	m3	66,114	149.6	37.4	187.0	9,890,654.4	2,472,663.6	12,363,318.0
1 1 3	Lining Concrete	m3	22,627	50.0	75.0	125.0	1,131,350.0	1,697,025.0	2,828,375.0
	Steel lining	ton	100	1,062.5	187.5	1,250.0	106,250.0	18,750.0	125,000.0
1 1 3	Miscellaneous	L.S.	5%				556,547.7	209,511.9	766,059.7
1 1 3	TBM 1								
1 1 3	Open excavation at portal	m3	0	2.7	1.8	4.5	0.0	0.0	0.0
1 1 3	Tunnel excavation including TBM and all temp. works (steel support, shotcrete, grouting, power supply, etc.) other than conc. Lining	m3	163,205	237.6	59.4	297.0	38,777,508.0	9,694,377.0	48,471,885.0
1 1 3	Lining Concrete	m3	49,868	50.0	75.0	125.0	2,493,400.0	3,740,100.0	6,233,500.0
1 1 3	Miscellaneous	L.S.	5%				2,063,545.4	671,723.9	2,735,269.3
1 1 3	TBM 2								
1 1 3	Tunnel excavation including TBM and all temp. works (steel support, shotcrete, grouting, power supply, etc. other than conc. lining)	m3	68,025	237.6	59.4	297.0	16,162,740.0	4,040,685.0	20,203,425.0
1 1 3	Lining Concrete	m3	20,785	50.0	75.0	125.0	1,039,250.0	1,558,875.0	2,598,125.0
1 1 3	Miscellaneous	L.S.	5%				860,099.5	279,978.0	1,140,077.5
1 1 4	**4 Valve House No.1**								
1 1 4	Preparatory Works								
1 1 4	New Access	m	100	180.0	120.0	300.0	18,000.0	12,000.0	30,000.0
1 1 4	Improvement	m	0	90.0	60.0	150.0	0.0	0.0	0.0
1 1 4	Preparatory Works	L.S.					252,849.3	116,873.4	369,722.7
1 1 4	Valve House Portion								
1 1 4	Opencut excavation, common	m3	23,600	2.7	1.8	4.5	63,720.0	42,480.0	106,200.0
1 1 4	Opencut excavation, rock	m3	15,800	7.5	5.0	12.5	118,500.0	79,000.0	197,500.0
1 1 4	Backfill in random materials	m3	16,900	4.5	3.0	7.5	76,050.0	50,700.0	126,750.0
1 1 4	Concrete for substructure	m3	2,010	34.0	51.0	85.0	68,340.0	102,510.0	170,850.0
1 1 4	Concrete for superstructure	m3	300	34.0	51.0	85.0	10,200.0	15,300.0	25,500.0
1 1 4	Reinforcement bar	ton	770	248.0	372.0	620.0	190,960.0	286,440.0	477,400.0
1 1 4	Mechanical works	L.S.					1,188,000.0	132,000.0	1,320,000.0
1 1 4	Miscellaneous	L.S.	10%				171,577.0	70,843.0	242,420.0
1 1 4	Tailrace Portion								
1 1 4	Opencut excavation, common	m3	9,200	2.7	1.8	4.5	24,840.0	16,560.0	41,400.0
1 1 4	Opencut excavation, rock	m3	3,900	7.5	5.0	12.5	29,250.0	19,500.0	48,750.0
1 1 4	Backfill in random materials	m3	4,600	4.5	3.0	7.5	20,700.0	13,800.0	34,500.0
1 1 4	Structural concrete	m3	1,380	34.0	51.0	85.0	46,920.0	70,380.0	117,300.0
1 1 4	Reinforcement bar	ton	120	248.0	372.0	620.0	29,760.0	44,640.0	74,400.0
1 1 4	Hydroelectrical works	L.S					39,600.0	4,400.0	44,000.0
1 1 4	Miscellaneous	L.S.	15%				28,660.5	25,392.0	54,052.5
1 1 5	**5 Waterway from WTP to Reservoir**								
1 1 5	Preparatory Works								
1 1 5	New Access	m	2,600	180.0	120.0	300.0	468,000.0	312,000.0	780,000.0
1 1 5	Improvement	m	4,500	90.0	60.0	150.0	405,000.0	270,000.0	675,000.0
1 1 5	Preparatory Works	L.S.					8,048,379.3	2,998,042.8	11,046,422.1
1 1 5	Pipeline No.1-1 (3.4m dia., 4.1km)								
1 1 5	Open excavation, common	m3	225,332	2.7	1.8	4.5	608,396.7	405,597.8	1,013,994.5
1 1 5	Open excavation, rock	m3	25,037	7.5	5.0	12.5	187,776.8	125,184.5	312,961.3
1 1 5	Steel pipe installaiton and fitting	m	4,100	1,893.0	334.1	2,227.0	7,761,095.0	1,369,605.0	9,130,700.0
1 1 5	Concrete for foundation of steel pipe	m3	1,600	34.0	51.0	85.0	54,400.0	81,600.0	136,000.0
1 1 5	Reinforcement	ton	80	248.0	372.0	620.0	19,840.0	29,760.0	49,600.0
1 1 5	Backfilling	m3	211,908	4.5	3.0	7.5	953,586.0	635,724.0	1,589,310.0
1 1 5	Valves (air, isolating and drain)	L.S.					297,500.0	52,500.0	350,000.0
1 1 5	Sheetpiling	m	2,460	1,283.5	226.5	1,510.0	3,157,410.0	557,190.0	3,714,600.0
1 1 5	Miscellaneous	L.S.	14%				1,825,600.6	456,002.6	2,281,603.2
1 1 5	Pipeline No.1-2 (3.3m dia., 1.0km)								
1 1 5	Open excavation, common	m3	54,202	2.7	1.8	4.5	146,344.3	97,562.9	243,907.2
1 1 5	Open excavation, rock	m3	6,022	7.5	5.0	12.5	45,168.0	30,112.0	75,280.0
1 1 5	Steel pipe installaiton and fitting	m	1,000	1,793.5	316.5	2,110.0	1,793,500.0	316,500.0	2,110,000.0
1 1 5	Concrete for foundation of steel pipe	m3	100	34.0	51.0	85.0	3,400.0	5,100.0	8,500.0
1 1 5	Reinforcement	ton	5	248.0	372.0	620.0	1,240.0	1,860.0	3,100.0
1 1 5	Backfilling	m3	51,399	4.5	3.0	7.5	231,295.5	154,197.0	385,492.5
1 1 5	Valves (air, isolating and drain)	L.S.					212,500.0	37,500.0	250,000.0
1 1 5	Sheetpiling	m	600	1,283.5	226.5	1,510.0	770,100.0	135,900.0	906,000.0
1 1 5	Miscellaneous	L.S.	10%				320,354.8	77,873.2	398,228.0
1 1 5	Valve House								

Table J6.3 Bill of Quantities (3/12)

Item No	Description	Unit	Quantity	Unit Price (US$)			Amount (US$)		
				F.C	L.C.	Total	F.C	L.C.	Total
1 1 5	Open excavation for substructure	m3	5,121	2.7	1.8	4.5	13,826.7	9,217.8	23,044.5
1 1 5	Backfilling	m3	1,407	4.5	3.0	7.5	6,331.5	4,221.0	10,552.5
1 1 5	Concrete for substructure	m3	3,321	34.0	51.0	85.0	112,914.0	169,371.0	282,285.0
1 1 5	Superstructure	m3	60	34.0	51.0	85.0	2,040.0	3,060.0	5,100.0
1 1 5	Reinforcement	ton	398	248.0	372.0	620.0	98,704.0	148,056.0	246,760.0
1 1 5	Valve	L.S.					566,100.0	99,900.0	666,000.0
1 1 5	Miscellaneous	L.S.	10%				79,991.6	43,382.6	123,374.2
1 1 5	Pipeline to Antipolo Pumping Station								
1 1 5	Pipeline No.2 (1.6m dia., 4.2km)								
1 1 5	Open excavation, common	m3	70,509	2.7	1.8	4.5	190,374.3	126,916.2	317,290.5
1 1 5	Open excavation, rock	m3	5,782	7.5	5.0	12.5	43,365.0	28,910.0	72,275.0
1 1 5	Steel pipe installaiton and fitting	m	4,200	687.7	121.4	809.0	2,888,130.0	509,670.0	3,397,800.0
1 1 5	Concrete for foundation of steel pipe	m3	600	34.0	51.0	85.0	20,400.0	30,600.0	51,000.0
1 1 5	Reinforcement	ton	30	248.0	372.0	620.0	7,440.0	11,160.0	18,600.0
1 1 5	Backfilling	m3	67,569	4.5	3.0	7.5	304,060.5	202,707.0	506,767.5
1 1 5	Valves (air, isolating and drain)	L.S.					161,500.0	28,500.0	190,000.0
1 1 5	Sheetpiling	m	840	1,283.5	226.5	1,510.0	1,078,140.0	190,260.0	1,268,400.0
1 1 5	Miscellaneous	L.S.	12%				563,209.2	135,446.8	698,656.0
1 1 5	Surge Tank								
1 1 5	Open excavation, common	m3	500	2.7	1.8	4.5	1,350.0	900.0	2,250.0
1 1 5	Bckfilling	m3	200	4.5	3.0	7.5	900.0	600.0	1,500.0
1 1 5	Concrete for structure	m3	120	34.0	51.0	85.0	4,080.0	6,120.0	10,200.0
1 1 5	Reinforcement	ton	24	248.0	372.0	620.0	5,952.0	8,928.0	14,880.0
1 1 5	Miscelaneous	L.S.	40%				4,912.8	6,619.2	11,532.0
1 1 5	Pumping Station #1 & #2 (80MLD)								
1 1 5	Open excavation, common	m3	77,496	2.7	1.8	4.5	209,239.2	139,492.8	348,732.0
1 1 5	Bckfilling	m3	31,079	4.5	3.0	7.5	139,855.5	93,237.0	233,092.5
1 1 5	Compacted gravel for foundation	m3	328	5.4	3.6	9.0	1,771.2	1,180.8	2,952.0
1 1 5	Concrete for structure	m3	4,979	34.0	51.0	85.0	169,286.0	253,929.0	423,215.0
1 1 5	Reinforcement	ton	597	248.0	372.0	620.0	148,175.0	222,262.6	370,437.6
1 1 5	Pump house	m2	900	340.0	510.0	850.0	306,000.0	459,000.0	765,000.0
1 1 5	Valve; 1,100mm	pcs.	2	36,017.0	6,355.9	42,372.9	72,033.9	12,711.9	84,745.8
1 1 5	Valve; 1,600mm	pcs.	1	64,830.5	11,440.7	76,271.2	64,830.5	11,440.7	76,271.2
1 1 5	flexible joint (1,600mm)	pcs.	2	22,474.6	3,966.1	26,440.7	44,949.2	7,932.2	52,881.4
1 1 5	Booster pump	pcs.	2	1,383,050.9	244,067.8	1,627,118.6	2,766,101.7	488,135.6	3,254,237.3
1 1 5	E & M Works other than booster pump	L.S.					4,811,864.4	849,152.5	5,661,016.9
1 1 5	Guard House	m2	100	340.0	510.0	850.0	34,000.0	51,000.0	85,000.0
1 1 5	Miscellaneous	L.S.	20%				1,753,621.3	517,895.0	2,271,516.3
1 1 5	Antipolo Service Reservoir #1 & #2 (30,000 m3)								
1 1 5	Open excavation, common	m3	61,555	2.7	1.8	4.5	166,198.5	110,799.0	276,997.5
1 1 5	Bckfilling	m3	27,238	4.5	3.0	7.5	122,571.0	81,714.0	204,285.0
1 1 5	Compacted gravel for foundation	m3	1,083	5.4	3.6	9.0	5,848.2	3,898.8	9,747.0
1 1 5	Concrete for structure	m3	9,026	34.0	51.0	85.0	306,884.0	460,326.0	767,210.0
1 1 5	Reinforcement	ton	1,083	248.0	372.0	620.0	268,613.8	402,920.6	671,534.4
1 1 5	Valves	L.S.					294,618.5	51,991.5	346,610.0
1 1 5	E & M Works other than valves	L.S.					180,401.5	31,835.6	212,237.0
1 1 5	Guard House	m2	100	340.0	510.0	850.0	34,000.0	51,000.0	85,000.0
1 1 5	Miscellaneous	L.S.	20%				275,827.1	238,897.1	514,724.2
1 1 5	Tunnel No.2 (Steel lined; 3.3m dia., 5.3km)								
1 1 5	NATM 4								
1 1 5	Open excavation at portal	m3	1,000	2.7	1.8	4.5	2,700.0	1,800.0	4,500.0
1 1 5	Tunnel excavation including all temp. works (steel support, shotcrete, grouting, power supply, etc.) other than conc.	m3	35,123	179.5	44.9	224.4	6,305,281.0	1,576,320.2	7,881,601.2
1 1 5	Lining Concrete (Backfill Concrete)	m3	11,933	50.0	75.0	125.0	596,650.0	894,975.0	1,491,625.0
1 1 5	Steel lining	ton	2,662	1,062.5	187.5	1,250.0	2,828,375.0	499,125.0	3,327,500.0
1 1 5	Miscellaneous	L.S.	5%				486,650.3	148,611.0	635,261.3
1 1 5	NATM 5								
1 1 5	Open excavation at portal	m3	1,000	2.7	1.8	4.5	2,700.0	1,800.0	4,500.0
1 1 5	Tunnel excavation including all temp. works (steel support, shotcrete, grouting, power supply, etc.) other than conc.	m3	35,123	179.5	44.9	224.4	6,305,281.0	1,576,320.2	7,881,601.2
1 1 5	Lining Concrete (Backfill Concrete)	m3	11,933	50.0	75.0	125.0	596,650.0	894,975.0	1,491,625.0
1 1 5	Steel lining	ton	2,662	1,062.5	187.5	1,250.0	2,828,375.0	499,125.0	3,327,500.0
1 1 5	Miscellaneous	L.S.	5%				486,650.3	148,611.0	635,261.3
1 1 5	Taytay Service Reservoir #1 (180,000 m3)								
1 1 5	Open excavation, common	m3	881,871	2.7	1.8	4.5	2,381,051.7	1,587,367.8	3,968,419.5
1 1 5	Bckfilling	m3	26,915	4.5	3.0	7.5	121,117.5	80,745.0	201,862.5
1 1 5	Compacted gravel for foundation	m3	6,906	5.4	3.6	9.0	37,292.4	24,861.6	62,154.0
1 1 5	Concrete for structure	m3	45,131	34.0	51.0	85.0	1,534,454.0	2,301,681.0	3,836,135.0
1 1 5	Reinforcement	ton	5,416	248.0	372.0	620.0	1,343,098.6	2,014,647.8	3,357,746.4
1 1 5	Valves	L.S.					1,391,478.1	245,555.0	1,637,033.0
1 1 5	E & M Works other than valves	L.S.					1,416,337.2	249,941.9	1,666,279.0
1 1 5	Guard House	m2	100	340.0	510.0	850.0	34,000.0	51,000.0	85,000.0
1 1 5	Miscellaneous	L.S.	20%				1,651,765.9	1,311,160.0	2,962,925.9

Table J6.3 Bill of Quantities (4/12)

Item No	Description	Unit	Quantity	Unit Price (US$)			Amount (US$)		
				F.C	L.C.	Total	F.C	L.C.	Total
1 2	**WATER TREATMENT PLANT #1**								
1 2 1	**1 Land Acquisition & Resettlement for WTP #1 and #2**								
1 2 1	Land Acquisition	L.S.					0.0	2,435,096.0	2,435,096.0
1 2 1	Resettlement	L.S.					0.0	121,420.4	121,420.4
1 2 2	**2 Waterway Facility**								
1 2 2	Preparatory Works								
1 2 2	New Access	m	0	180.0	120.0	300.0	0.0	0.0	0.0
1 2 2	Improvement	m	2,000	90.0	60.0	150.0	180,000.0	120,000.0	300,000.0
1 2 2	Preparatory Works	L.S.					7,244,322.4	3,628,179.1	10,872,501.5
1 2 2	Water Treatment Plant #1 (910 MLD)								
1 2 2	Site Formation for #1 & #2								
1 2 2	Open excavation,common	m3	3,374,640	2.5	1.7	4.2	8,504,092.8	5,669,395.2	14,173,488.0
1 2 2	Open excavation, rock	m3	843,660	6.3	4.2	10.5	5,315,058.0	3,543,372.0	8,858,430.0
1 2 2	Embanakment	m3	109,200	4.2	2.8	7.0	458,640.0	305,760.0	764,400.0
	Power Transmission/Substation Equipment								
	Transmission Lines	L.S.					4,808,115.0	534,235.0	5,342,350.0
	Substation Equipment	L.S.					2,509,991.1	278,887.9	2,788,879.0
1 2 2	Receiving Well								
1 2 2	Open excavation, common	m3	9,281	2.7	1.8	4.5	25,058.7	16,705.8	41,764.5
1 2 2	Bckfilling	m3	1,030	4.5	3.0	7.5	4,635.0	3,090.0	7,725.0
1 2 2	Compacted gravel for foundation	m3	204	5.4	3.6	9.0	1,101.6	734.4	1,836.0
1 2 2	Concrete for structure	m3	2,056	34.0	51.0	85.0	69,904.0	104,856.0	174,760.0
1 2 2	Reinforcement	ton	247	248.0	372.0	620.0	61,186.6	91,779.8	152,966.4
1 2 2	E & M Works	L.S.					1,041,609.6	183,813.5	1,225,423.0
1 2 2	Miscellaneous	L.S.	10%				120,349.5	40,098.0	160,447.5
1 2 2	Flocculation & Sedimentation Basin								
1 2 2	Open excavation, common	m3	247,488	2.7	1.8	4.5	668,217.6	445,478.4	1,113,696.0
1 2 2	Bckfilling	m3	17,495	4.5	3.0	7.5	78,727.5	52,485.0	131,212.5
1 2 2	Compacted gravel for foundation	m3	6,098	5.4	3.6	9.0	32,929.2	21,952.8	54,882.0
1 2 2	Concrete for structure	m3	30,763	34.0	51.0	85.0	1,045,942.0	1,568,913.0	2,614,855.0
1 2 2	Reinforcement	ton	3,076	248.0	372.0	620.0	762,922.4	1,144,383.6	1,907,306.0
1 2 2	E & M Works	L.S.					4,863,151.8	858,203.3	5,721,355.0
1 2 2	Miscellaneous	L.S.	20%				1,490,378.1	818,283.2	2,308,661.3
1 2 2	Filter								
1 2 2	Open excavation, common	m3	74,858	2.7	1.8	4.5	202,116.6	134,744.4	336,861.0
1 2 2	Bckfilling	m3	6,189	4.5	3.0	7.5	27,850.5	18,567.0	46,417.5
1 2 2	Compacted gravel for foundation	m3	1,912	5.4	3.6	9.0	10,324.8	6,883.2	17,208.0
1 2 2	Concrete for structure	m3	20,265	34.0	51.0	85.0	689,010.0	1,033,515.0	1,722,525.0
1 2 2	Reinforcement	ton	2,432	248.0	372.0	620.0	603,086.4	904,629.6	1,507,716.0
1 2 2	E & M Works	L.S.					4,807,542.2	848,389.8	5,655,932.0
1 2 2	Micellaneous	L.S.	20%				1,267,986.1	589,345.8	1,857,331.9
1 2 2	Clear Water Reservoir								
1 2 2	Open excavation, common	m3	91,023	2.7	1.8	4.5	245,762.1	163,841.4	409,603.5
1 2 2	Bckfilling	m3	5,378	4.5	3.0	7.5	24,201.0	16,134.0	40,335.0
1 2 2	Compacted gravel for foundation	m3	3,252	5.4	3.6	9.0	17,560.8	11,707.2	29,268.0
1 2 2	Concrete for structure	m3	18,292	34.0	51.0	85.0	621,928.0	932,892.0	1,554,820.0
1 2 2	Reinforcement	ton	2,195	248.0	372.0	620.0	544,369.9	816,554.9	1,360,924.8
1 2 2	E & M Works	L.S.					1,169,830.4	206,440.7	1,376,271.0
1 2 2	Micellaneous	L.S.	10%				262,365.2	214,757.0	477,122.2
1 2 2	Back Wash Water Storage								
1 2 2	Open excavation, common	m3	22,211	2.7	1.8	4.5	59,969.7	39,979.8	99,949.5
1 2 2	Bckfilling	m3	762	4.5	3.0	7.5	3,429.0	2,286.0	5,715.0
1 2 2	Compacted gravel for foundation	m3	474	5.4	3.6	9.0	2,559.6	1,706.4	4,266.0
1 2 2	Concrete for structure	m3	3,805	34.0	51.0	85.0	129,370.0	194,055.0	323,425.0
1 2 2	Reinforcement	ton	457	248.0	372.0	620.0	113,236.8	169,855.2	283,092.0
1 2 2	E & M Works	L.S.					74,338.5	13,118.6	87,457.0
1 2 2	Miscellaneous	L.S.	20%				76,580.7	84,200.2	160,780.9
1 2 2	Thickening Tank								
1 2 2	Open excavation, common	m3	20,906	2.7	1.8	4.5	56,446.2	37,630.8	94,077.0
1 2 2	Bckfilling	m3	1,831	4.5	3.0	7.5	8,239.5	5,493.0	13,732.5
1 2 2	Compacted gravel for foundation	m3	634	5.4	3.6	9.0	3,423.6	2,282.4	5,706.0
1 2 2	Concrete for structure	m3	2,647	34.0	51.0	85.0	89,998.0	134,997.0	224,995.0
1 2 2	Reinforcement	ton	265	248.0	372.0	620.0	65,720.0	98,580.0	164,300.0
1 2 2	E & M Works	L.S.					540,830.4	95,440.7	636,271.0
1 2 2	Miscellaneous	L.S.	20%				152,931.5	74,884.8	227,816.3
1 2 2	Sludge Drying Bed								
1 2 2	Open excavation, common	m3	72,117	2.7	1.8	4.5	194,715.9	129,810.6	324,526.5
1 2 2	Bckfilling	m3	4,178	4.5	3.0	7.5	18,801.0	12,534.0	31,335.0
1 2 2	Compacted gravel for foundation	m3	3,606	5.4	3.6	9.0	19,472.4	12,981.6	32,454.0
1 2 2	Concrete for structure	m3	8,232	34.0	51.0	85.0	279,888.0	419,832.0	699,720.0
1 2 2	Reinforcement	ton	247	248.0	372.0	620.0	61,256.0	91,884.0	153,140.0
1 2 2	E & M Works	L.S.					14,406.7	2,542.4	16,949.0
1 2 2	Micellaneous	L.S.	20%				117,708.0	133,916.9	251,624.9
1 2 2	Others								
1 2 2	Office	m2	2,000	680.0	1,020.0	1,700.0	1,360,000.0	2,040,000.0	3,400,000.0
1 2 2	Chemicals Handling House	m2	2,700	340.0	510.0	850.0	918,000.0	1,377,000.0	2,295,000.0

Table J6.3 Bill of Quantities (5/12)

Item No	Description	Unit	Quantity	Unit Price (US$)			Amount (US$)		
				F.C	L.C.	Total	F.C	L.C.	Total
1 2 2	Chlorination House	m2	1,500	340.0	510.0	850.0	510,000.0	765,000.0	1,275,000.0
1 2 2	Generator House	m2	600	762.7	84.8	847.5	457,626.0	50,850.0	508,476.0
1 2 2	Guard House	m2	150	340.0	510.0	850.0	51,000.0	76,500.0	127,500.0
1 2 2	Connecting pipes and E & M	L.S.					8,957,287.8	995,254.2	9,952,542.0
1 2 2	Micellaneous	L.S.	30%				3,676,174.1	1,591,381.3	5,267,555.4
2 1	**STAGE 2-1 AGOS DAM + WTP #2**								
2 1	**AGOS DAM**								
2 1 1	**1 Land Acquisition & Resettlement**								
2 1 1	Land Acquisition	L.S.					0.0	4,098,028.8	4,098,028.8
2 1 1	Resettlement	L.S.					0.0	12,604,890.7	12,604,890.7
2 1 2	**2 Agos Dam**								
2 1 2	Preparatory Works								
2 1 2	New Access	m	13,000	180.0	120.0	300.0	2,340,000.0	1,560,000.0	3,900,000.0
2 1 2	Improvement	m	0	0.0	0.0		0.0	0.0	0.0
2 1 2	Regional Development	L.S.					2,591,024.8	3,886,537.2	6,477,562.0
2 1 2	Environmental mitigation measures (Reforestation program)	L.S.					120,000.0	180,000.0	300,000.0
2 1 2	Preparatory Works	L.S.					24,818,054.5	15,716,259.2	40,534,313.7
2 1 2	Agos Dam								
2 1 2	Diversion Works								
2 1 2	Cofferdam								
2 1 2	Dewatering during construction	L.S.					900,000.0	600,000.0	1,500,000.0
2 1 2	Slurry Wall including all temporary works	m2	17,000	212.5	37.5	250.0	3,612,500.0	637,500.0	4,250,000.0
2 1 2	Open excavation, river deposit	m3	1,200	2.7	1.8	4.5	3,240.0	2,160.0	5,400.0
2 1 2	Embankment, earth material (Cofferdam)	m3	374,500	4.2	2.8	7.0	1,572,900.0	1,048,600.0	2,621,500.0
2 1 2	Embankment, rockfill material	m3	833,500	4.2	2.8	7.0	3,500,700.0	2,333,800.0	5,834,500.0
2 1 2	Earthfill materials for downstream cofferd	m3	17,300	4.2	2.8	7.0	72,660.0	48,440.0	121,100.0
2 1 2	Miscellaneous	L.S.	10%				966,200.0	467,050.0	1,433,250.0
2 1 2	Diversion Tunnel								
2 1 2	Open excavation at tunnel portals, commo	m3	61,000	2.7	1.8	4.5	164,700.0	109,800.0	274,500.0
2 1 2	Open excavation at tunnel portals, rock	m3	39,500	7.5	5.0	12.5	296,250.0	197,500.0	493,750.0
2 1 2	Tunnel excavation including all temp. works (steel support, shotcrete, grouting, power supply, etc. other than conc.	m3	221,800	149.6	37.4	187.0	33,181,280.0	8,295,320.0	41,476,600.0
2 1 2	Steel support	ton	75	1,190.0	210.0	1,400.0	89,250.0	15,750.0	105,000.0
2 1 2	Curtain grout	m	1,200	42.0	63.0	105.0	50,400.0	75,600.0	126,000.0
2 1 2	Backfill grout	m3	3,620	80.0	120.0	200.0	289,600.0	434,400.0	724,000.0
2 1 2	Concrete in approach channels and tunnel portals	m3	240	34.0	51.0	85.0	8,160.0	12,240.0	20,400.0
2 1 2	Reinforcement	ton	2,080	248.0	372.0	620.0	515,840.0	773,760.0	1,289,600.0
2 1 2	Lining concrete for diversion tunnels	m3	31,630	50.0	75.0	125.0	1,581,500.0	2,372,250.0	3,953,750.0
2 1 2	Diversion Gate	L.S.					714,000.0	126,000.0	840,000.0
2 1 2	Bottom outlet valve	L.S.					204,000.0	36,000.0	240,000.0
2 1 2	Plug concrete	m3	5,500	32.0	48.0	80.0	176,000.0	264,000.0	440,000.0
2 1 2	Miscellaneous	L.S.	10%				3,727,098.0	1,271,262.0	4,998,360.0
2 1 2	Main Dam								
2 1 2	Open excavation of river deposite	m3	1,549,800	2.5	1.7	4.2	3,905,496.0	2,603,664.0	6,509,160.0
2 1 2	Open excavation for main dam, common	m3	1,891,000	2.5	1.7	4.2	4,765,320.0	3,176,880.0	7,942,200.0
2 1 2	Open excavation for main dam, rock	m3	1,134,200	6.3	4.2	10.5	7,145,460.0	4,763,640.0	11,909,100.0
2 1 2	Curtain grouting for dam	m	34,100	42.0	63.0	105.0	1,432,200.0	2,148,300.0	3,580,500.0
2 1 2	Embankment, coarse transition	m3	257,800	4.2	2.8	7.0	1,082,760.0	721,840.0	1,804,600.0
2 1 2	Embankment, fine transition	m3	239,200	4.2	2.8	7.0	1,004,640.0	669,760.0	1,674,400.0
2 1 2	Embankment, quarried rock	m3	7,631,070	1.2	0.8	2.0	9,157,284.0	6,104,856.0	15,262,140.0
2 1 2	Embankment, excavated rock	m3	4,326,530	3.0	2.0	5.0	12,979,590.0	8,653,060.0	21,632,650.0
	Embankment, random materials	m3	142,400	3.0	2.0	5.0	427,200.0	284,800.0	712,000.0
2 1 2	Embankment, earth fii and random fill (In front of face slab concrete)	m3	947,900	3.0	2.0	5.0	2,843,700.0	1,895,800.0	4,739,500.0
2 1 2	Structural concrete for gallery	m3		34.0	51.0	85.0	0.0	0.0	0.0
2 1 2	Structural Concrete for parapet wall	m3	7,500	34.0	51.0	85.0	255,000.0	382,500.0	637,500.0
2 1 2	Reinforcement	ton	5,800	248.0	372.0	620.0	1,438,400.0	2,157,600.0	3,596,000.0
2 1 2	Concrete in face slab	m3	63,200	32.0	48.0	80.0	2,022,400.0	3,033,600.0	5,056,000.0
2 1 2	Miscellaneous	L.S.	10%				4,845,945.0	3,659,630.0	8,505,575.0
2 1 2	Landslide Protection Measures								
2 1 2	Site clearance, excavation, and slope protection	m3	1,000,000	3.9	2.6	6.5	3,900,000.0	2,600,000.0	6,500,000.0
2 1 2	Rock Quarry for Dam Embankment								
2 1 2	Open excavation, common	m3	150,000	2.7	1.8	4.5	405,000.0	270,000.0	675,000.0
2 1 2	Open excavation, rock	m3	5,536,880	6.3	4.2	10.5	34,882,344.1	23,254,896.1	58,137,240.1
2 1 2	Spillway								
2 1 2	Open excavation in spillway, common	m3	2,304,700	2.5	1.7	4.2	5,807,844.0	3,871,896.0	9,679,740.0
2 1 2	Open excavation in spillway, rock	m3	6,656,200	6.3	4.2	10.5	41,934,060.0	27,956,040.0	69,890,100.0
2 1 2	Backfilling	m3	6,800	4.5	3.0	7.5	30,600.0	20,400.0	51,000.0
2 1 2	Structural concrete for spillway	m3	52,200	34.0	51.0	85.0	1,774,800.0	2,662,200.0	4,437,000.0
2 1 2	Reinforcement	ton	6,264	248.0	372.0	620.0	1,553,472.0	2,330,208.0	3,883,680.0

Table J6.3 Bill of Quantities (6/12)

Item No	Description	Unit	Quantity	Unit Price (US$)			Amount (US$)		
				F.C	L.C.	Total	F.C	L.C.	Total
2 1 2	Mass concrete for spillway	m3	81,500	32.0	48.0	80.0	2,608,000.0	3,912,000.0	6,520,000.0
2 1 2	Spillway gate	L.S.					3,196,000.0	564,000.0	3,760,000.0
2 1 2	Stoplog	L.S.					93,500.0	16,500.0	110,000.0
2 1 2	Miscellaneous	L.S.	10%				5,699,827.6	4,133,324.4	9,833,152.0
2 1 3 3	**Agos Hydropower Facility**								
	Preparatory Works								
	Preparatory Works	L.S.					5,830,445.2	1,175,442.2	7,005,887.3
2 1 3	Intake Structure								
2 1 3	Open excavation for intake, common	m3	5,500	2.7	1.8	4.5	14,850.0	9,900.0	24,750.0
2 1 3	Open excavation for intakey, rock	m3	5,500	7.5	5.0	12.5	41,250.0	27,500.0	68,750.0
2 1 3	Backfilling	m3	400	4.5	3.0	7.5	1,800.0	1,200.0	3,000.0
2 1 3	Structural concrete for intake structure	m3	270	34.0	51.0	85.0	9,180.0	13,770.0	22,950.0
2 1 3	Reinforcement	ton	27	248.0	372.0	620.0	6,696.0	10,044.0	16,740.0
2 1 3	Mass concrete for intake	m3	40	32.0	48.0	80.0	1,280.0	1,920.0	3,200.0
2 1 3	Trash rack 6m(h) x 3.7m(w)x2nos	L.S.					40,800.0	7,200.0	48,000.0
2 1 3	Intake gate 5.0m(h) x 5.0m(w)x1no	L.S.					204,000.0	36,000.0	240,000.0
2 1 3	Stoplog 0.3m(h) x 5.0m(w)x10nos	L.S.					187,000.0	33,000.0	220,000.0
2 1 3	Gate hoistx2nos	L.S.					238,000.0	42,000.0	280,000.0
2 1 3	Miscellaneous	L.S.	10%				74,485.6	18,253.4	92,739.0
2 1 3	Headrace Tunnel								
2 1 3	Tunnel excavation including all temp. works (steel support, shotcrete, grouting, power supply, etc.) other than conc.	m3	3,700	149.6	37.4	187.0	553,520.0	138,380.0	691,900.0
2 1 3	Steel support	ton	20	1,190.0	210.0	1,400.0	23,800.0	4,200.0	28,000.0
2 1 3	Lining Concrete	m3	1,360	50.0	75.0	125.0	68,000.0	102,000.0	170,000.0
2 1 3	Backfill grout	m3	13	80.0	120.0	200.0	1,040.0	1,560.0	2,600.0
2 1 3	Reinforcement	ton	110	248.0	372.0	620.0	27,280.0	40,920.0	68,200.0
2 1 3	Miscellaneous	L.S.	10%				67,364.0	28,706.0	96,070.0
2 1 3	Penstock Line								
2 1 3	Tunnel excavation including all temp. works (steel support, shotcrete, grouting, power supply, etc.) other than conc.	m3	17,700	149.6	37.4	187.0	2,647,920.0	661,980.0	3,309,900.0
2 1 3	Steel support	ton	40	1,190.0	210.0	1,400.0	47,600.0	8,400.0	56,000.0
2 1 3	Lining Concrete	m3	10,590	50.0	75.0	125.0	529,500.0	794,250.0	1,323,750.0
2 1 3	Steel lining	ton	1,220	1,062.5	187.5	1,250.0	1,296,250.0	228,750.0	1,525,000.0
2 1 3	Backfill grout	m3	70	80.0	120.0	200.0	5,600.0	8,400.0	14,000.0
2 1 3	Reinforcement	ton	850	248.0	372.0	620.0	210,800.0	316,200.0	527,000.0
2 1 3	Miscellaneous	L.S.	10%				473,767.0	201,798.0	675,565.0
2 1 3	Powerhouse								
2 1 3	Open excavation for substructure, commo	m3	36,200	2.7	1.8	4.5	97,740.0	65,160.0	162,900.0
2 1 3	Open excavation for substructure, rock	m3	33,600	7.5	5.0	12.5	252,000.0	168,000.0	420,000.0
2 1 3	Backfilling	m3	4,400	4.5	3.0	7.5	19,800.0	13,200.0	33,000.0
2 1 3	Concrete for substructure	m3	13,800	34.0	51.0	85.0	469,200.0	703,800.0	1,173,000.0
2 1 3	Concrete for superstructure	m3	1,590	34.0	51.0	85.0	54,060.0	81,090.0	135,150.0
2 1 3	Reinforcement	ton	1,020	248.0	372.0	620.0	252,960.0	379,440.0	632,400.0
2 1 3	Miscellaneous	L.S.	10%				114,576.0	141,069.0	255,645.0
2 1 3	Tailrace								
2 1 3	Excavation of river deposit	m3	2,500	2.7	1.8	4.5	6,750.0	4,500.0	11,250.0
2 1 3	Excavation, common	m3	19,000	2.7	1.8	4.5	51,300.0	34,200.0	85,500.0
2 1 3	Open excavation, rock	m3	10,300	7.5	5.0	12.5	77,250.0	51,500.0	128,750.0
2 1 3	Concrete slab	m3	750	34.0	51.0	85.0	25,500.0	38,250.0	63,750.0
2 1 3	Concrete for wall	m3	8,100	34.0	51.0	85.0	275,400.0	413,100.0	688,500.0
2 1 3	Reinforcing bar	ton	270	248.0	372.0	620.0	66,960.0	100,440.0	167,400.0
2 1 3	Miscellaneous	L.S.	10%				50,316.0	64,199.0	114,515.0
2 1 3	Switchyard								
2 1 3	Open excavation, common	m3	1,500	2.7	1.8	4.5	4,050.0	2,700.0	6,750.0
2 1 3	Rock embankment	m3	52,100	4.2	2.8	7.0	218,820.0	145,880.0	364,700.0
2 1 3	Gravel bedding	m3	22,300	5.4	3.6	9.0	120,420.0	80,280.0	200,700.0
2 1 3	Concrete for switchyard equipment	m3	15	34.0	51.0	85.0	510.0	765.0	1,275.0
2 1 3	Reinforcement	ton	1	248.0	372.0	620.0	297.6	446.4	744.0
2 1 3	Miscellaneous	L.S.	10%				34,409.8	23,007.1	57,416.9
2 1 3	Hydromechanical and Hydroelectric Works for Upper Headrace tunnel								
2 1 3	Hydromechanical works								
2 1 3	Diversion outlet works								
2 1 3	Penstock	L.S.					1,071,000.0	189,000.0	1,260,000.0
2 1 3	Tailrace gate (Roller gate) with gantry crane	L.S.					280,500.0	49,500.0	330,000.0
2 1 3	Valve	L.S.					204,000.0	36,000.0	240,000.0
2 1 3	Overhead Crane (120t)	L.S.					467,500.0	82,500.0	550,000.0
2 1 3	Miscellaneous	L.S.	10%				202,300.0	35,700.0	238,000.0
2 1 3	Hydroelectrical Work								
2 1 3	Generating equipment (Generator, main transformer, etc.)	L.S.					22,770,000.0	2,530,000.0	25,300,000.0
2 1 3	Transmission line	L.S.					8,590,497.3	954,499.7	9,544,997.0
2 1 3	Substation & switchyard	L.S.					2,637,358.2	293,039.8	2,930,398.0
2 1 3	Miscellaneous	L.S.	10%				3,399,785.6	377,754.0	3,777,539.5

Table J6.3 Bill of Quantities (7/12)

Item No	Description	Unit	Quantity	Unit Price (US$)			Amount (US$)		
				F.C	L.C.	Total	F.C	L.C.	Total
2									
2									
2 2	**WATER TREATMENT PLANT #2 + SERVICE RESERVOIRS #2**								
2 2	Preparatory Works								
2 2	Preparatory Works	L.S.					5,118,188.3	2,797,851.8	7,916,040.1
2 2	Water Treatment Plant #2 (Expansion 910 MLD)								
2 2	Receiving Well								
2 2	Open excavation, common	m3	9,281	2.7	1.8	4.5	25,058.7	16,705.8	41,764.5
2 2	Bckfilling	m3	1,030	4.5	3.0	7.5	4,635.0	3,090.0	7,725.0
2 2	Compacted gravel for foundation	m3	204	5.4	3.6	9.0	1,101.6	734.4	1,836.0
2 2	Concrete for structure	m3	2,056	34.0	51.0	85.0	69,904.0	104,856.0	174,760.0
2 2	Reinforcement	ton	247	248.0	372.0	620.0	61,256.0	91,884.0	153,140.0
2 2	E & M Works	L.S.					527,647.7	93,114.3	620,762.0
2 2	Miscellaneous	L.S.	10%				68,960.3	31,038.5	99,998.8
2 2	Flocculation & Sedimentation Basin								
2 2	Open excavation, common	m3	247,488	2.7	1.8	4.5	668,217.6	445,478.4	1,113,696.0
2 2	Bckfilling	m3	17,495	4.5	3.0	7.5	78,727.5	52,485.0	131,212.5
2 2	Compacted gravel for foundation	m3	6,098	5.4	3.6	9.0	32,929.2	21,952.8	54,882.0
2 2	Concrete for structure	m3	30,763	34.0	51.0	85.0	1,045,942.0	1,568,913.0	2,614,855.0
2 2	Reinforcement	ton	3,076	248.0	372.0	620.0	762,848.0	1,144,272.0	1,907,120.0
2 2	E & M Works	L.S.					4,863,151.8	858,203.3	5,721,355.0
2 2	Miscellaneous	L.S.	20%				1,490,363.2	818,260.9	2,308,624.1
2 2	Filter								
2 2	Open excavation, common	m3	74,858	2.7	1.8	4.5	202,116.6	134,744.4	336,861.0
2 2	Bckfilling	m3	6,189	4.5	3.0	7.5	27,850.5	18,567.0	46,417.5
2 2	Compacted gravel for foundation	m3	1,912	5.4	3.6	9.0	10,324.8	6,883.2	17,208.0
2 2	Concrete for structure	m3	20,265	34.0	51.0	85.0	689,010.0	1,033,515.0	1,722,525.0
2 2	Reinforcement	ton	2,432	248.0	372.0	620.0	603,136.0	904,704.0	1,507,840.0
2 2	E & M Works	L.S.					4,807,542.2	848,389.8	5,655,932.0
2 2	Micellaneous	L.S.	20%				1,267,996.0	589,360.7	1,857,356.7
2 2	Clear Water Reservoir								
2 2	Open excavation, common	m3	91,023	2.7	1.8	4.5	245,762.1	163,841.4	409,603.5
2 2	Bckfilling	m3	5,378	4.5	3.0	7.5	24,201.0	16,134.0	40,335.0
2 2	Compacted gravel for foundation	m3	3,252	5.4	3.6	9.0	17,560.8	11,707.2	29,268.0
2 2	Concrete for structure	m3	18,292	34.0	51.0	85.0	621,928.0	932,892.0	1,554,820.0
2 2	Reinforcement	ton	2,195	248.0	372.0	620.0	544,360.0	816,540.0	1,360,900.0
2 2	E & M Works	L.S.					1,005,592.5	177,457.5	1,183,050.0
2 2	Micellaneous	L.S.	10%				245,940.4	211,857.2	457,797.7
2 2	Back Wash Water Storage								
2 2	Open excavation, common	m3	22,211	2.7	1.8	4.5	59,969.7	39,979.8	99,949.5
2 2	Bckfilling	m3	762	4.5	3.0	7.5	3,429.0	2,286.0	5,715.0
2 2	Compacted gravel for foundation	m3	474	5.4	3.6	9.0	2,559.6	1,706.4	4,266.0
2 2	Concrete for structure	m3	3,805	34.0	51.0	85.0	129,370.0	194,055.0	323,425.0
2 2	Reinforcement	ton	457	248.0	372.0	620.0	113,336.0	170,004.0	283,340.0
2 2	E & M Works	L.S.					74,338.5	13,118.6	87,457.0
2 2	Miscellaneous	L.S.	20%				76,600.6	84,230.0	160,830.5
2 2	Thickening Tank								
2 2	Open excavation, common	m3	20,906	2.7	1.8	4.5	56,446.2	37,630.8	94,077.0
2 2	Bckfilling	m3	1,831	4.5	3.0	7.5	8,239.5	5,493.0	13,732.5
2 2	Compacted gravel for foundation	m3	634	5.4	3.6	9.0	3,423.6	2,282.4	5,706.0
2 2	Concrete for structure	m3	2,647	34.0	51.0	85.0	89,998.0	134,997.0	224,995.0
2 2	Reinforcement	ton	265	248.0	372.0	620.0	65,720.0	98,580.0	164,300.0
2 2	E & M Works	L.S.					540,830.4	95,440.7	636,271.0
2 2	Miscellaneous	L.S.	20%				152,931.5	74,884.8	227,816.3
2 2	Sludge Drying Bed								
2 2	Open excavation, common	m3	72,117	2.7	1.8	4.5	194,715.9	129,810.6	324,526.5
2 2	Bckfilling	m3	4,178	4.5	3.0	7.5	18,801.0	12,534.0	31,335.0
2 2	Compacted gravel for foundation	m3	3,606	5.4	3.6	9.0	19,472.4	12,981.6	32,454.0
2 2	Concrete for structure	m3	8,232	34.0	51.0	85.0	279,888.0	419,832.0	699,720.0
2 2	Reinforcement	ton	247	248.0	372.0	620.0	61,256.0	91,884.0	153,140.0
2 2	E & M Works	L.S.					14,406.7	2,542.4	16,949.0
2 2	Micellaneous	L.S.	20%				117,708.0	133,916.9	251,624.9
2 2	Others								
2 2	Chemicals Handling House	m2	2,700	340.0	510.0	850.0	918,000.0	1,377,000.0	2,295,000.0
2 2	Chlorination House	m2	1,500	340.0	510.0	850.0	510,000.0	765,000.0	1,275,000.0
2 2	Generator House	m2	600	720.3	127.1	847.5	432,204.0	76,272.0	508,476.0
2 2	Connection pipes and E & M	L.S.					8,957,287.8	995,254.2	9,952,542.0
2 2	Micellaneous	L.S.	30%				3,245,247.5	964,057.9	4,209,305.4
2 2	Taytay Service Reservoir #2 (180,000 m3)								
2 2	Open excavation, common	m3	291,071	2.7	1.8	4.5	785,891.7	523,927.8	1,309,819.5
2 2	Bckfilling	m3	23,415	4.5	3.0	7.5	105,367.5	70,245.0	175,612.5
2 2	Compacted gravel for foundation	m3	6,906	5.4	3.6	9.0	37,292.4	24,861.6	62,154.0
2 2	Concrete for structure	m3	45,131	34.0	51.0	85.0	1,534,454.0	2,301,681.0	3,836,135.0
2 2	Reinforcement	ton	5,416	248.0	372.0	620.0	1,343,168.0	2,014,752.0	3,357,920.0
2 2	Valves	L.S.					520,084.4	91,779.6	611,864.0
2 2	E & M Works other than valves	L.S.					1,083,180.5	191,149.5	1,274,330.0

Table J6.3 Bill of Quantities (8/12)

Item No	Description	Unit	Quantity	Unit Price (US$)			Amount (US$)		
				F.C	L.C.	Total	F.C	L.C.	Total
2 2	Miscellaneous	L.S.	20%				1,081,887.7	1,043,679.3	2,125,567.0
									0.0
3 1	**STAGE 2-2 KALIWA-ANGONO 2nd WATERWAY + WTP #3 & #4**								
3 1	**2ND WATERWAY (excluding WTP #3)**								
3 1 1	**1 Land Acquisition & Resettlement excluding WTPs**								
3 1 1	Land Acquisition	L.S.					0.0	5,977,163.0	5,977,163.0
3 1 1	Resettlement	L.S.					0.0	288,322.5	288,322.5
3 1 2	**2 Kaliwa Low Dam (Temporary)**								
3 1 2	Partial removal of dam body	m3	66,570	3.6	2.4	6.0	239,652.0	159,768.0	399,420.0
3 1 2	Miscellaneous	L.S.					0.0	0.0	0.0
3 1 3	**3 Waterway to Valve House No.1**								
3 1 3	Preparatory Works								
3 1 3	Preparatory Works	L.S.					10,745,154.2	3,672,136.2	14,417,290.3
3 1 3	Tunnel No.1								
3 1 3	Adit 1								
3 1 3	Modification	L.S.					40,000.0	10,000.0	50,000.0
3 1 3	Adit 2								
3 1 3	Modification	L.S.					40,000.0	10,000.0	50,000.0
3 1 3	Adit 3								
3 1 3	Modification	L.S.					40,000.0	10,000.0	50,000.0
3 1 3	NATM 1								
3 1 3	Open excavation at portal	m3		2.7	1.8	4.5	0.0	0.0	0.0
3 1 3	Tunnel excavation including all temp. works (steel support, shotcrete, grouting, power supply, etc.) other than conc.	m3	43,150	149.6	37.4	187.0	6,455,240.0	1,613,810.0	8,069,050.0
3 1 3	Lining Concrete	m3	14,768	50.0	75.0	125.0	738,400.0	1,107,600.0	1,846,000.0
3 1 3	Miscellaneous	L.S.	5%				359,682.0	136,070.5	495,752.5
3 1 3	NATM 2								
3 1 3	Open excavation at portal	m3	0	2.7	1.8	4.5	0.0	0.0	0.0
3 1 3	Tunnel excavation including all temp. works (steel support, shotcrete, grouting, power supply, etc.) other than conc.	m3	50,317	149.6	37.4	187.0	7,527,423.2	1,881,855.8	9,409,279.0
3 1 3	Lining Concrete	m3	17,221	50.0	75.0	125.0	861,050.0	1,291,575.0	2,152,625.0
3 1 3	Miscellaneous	L.S.	5%				419,423.7	158,671.5	578,095.2
3 1 3	NATM 3								
3 1 3	Open excavation at portal	m3	1,000	2.7	1.8	4.5	2,700.0	1,800.0	4,500.0
3 1 3	Tunnel excavation including all temp. works (steel support, shotcrete, grouting, power supply, etc.) other than conc.	m3	66,114	149.6	37.4	187.0	9,890,654.4	2,472,663.6	12,363,318.0
3 1 3	Lining Concrete	m3	22,627	50.0	75.0	125.0	1,131,350.0	1,697,025.0	2,828,375.0
3 1 3	Steel lining	ton	80	1,062.5	187.5	1,250.0	85,000.0	15,000.0	100,000.0
3 1 3	Miscellaneous	L.S.	5%				555,485.2	209,324.4	764,809.7
3 1 3	TBM 1								
3 1 3	Open excavation at portal	m3	0	2.7	1.8	4.5	0.0	0.0	0.0
3 1 3	Tunnel excavation including TBM and all temp. works (steel support, shotcrete, grouting, power supply, etc. other than conc. lining)	m3	163,205	237.6	59.4	297.0	38,777,508.0	9,694,377.0	48,471,885.0
3 1 3	Lining Concrete	m3	49,868	50.0	75.0	125.0	2,493,400.0	3,740,100.0	6,233,500.0
3 1 3	Miscellaneous	L.S.	5%				2,063,545.4	671,723.9	2,735,269.3
3 1 3	TBM 2								
3 1 3	Open excavation at portal	m3	0	2.7	1.8	4.5	0.0	0.0	0.0
3 1 3	Tunnel excavation including TBM and all temp. works (steel support, shotcrete, grouting, power supply, etc.) other than conc. Lining	m3	68,025	237.6	59.4	297.0	16,162,740.0	4,040,685.0	20,203,425.0
3 1 3	Lining Concrete	m3	20,785	50.0	75.0	125.0	1,039,250.0	1,558,875.0	2,598,125.0
3 1 3	Miscellaneous	L.S.	5%				860,099.5	279,978.0	1,140,077.5
3 1 4	**4 Valve House No.1**								
3 1 4	Preparatory Works								
3 1 4	Preparatory Works	L.S.					132,775.2	14,752.8	147,528.0
3 1 4	Valve House Portion								
3 1 4	Mechanical works	L.S.					972,000.0	108,000.0	1,080,000.0
3 1 4	Miscellaneous	L.S.	10%				97,200.0	10,800.0	108,000.0
3 1 4	Tailrace Portion								
3 1 4	Hydroelectrical works	L.S					32,400.0	3,600.0	36,000.0
3 1 4	Miscellaneous	L.S.	15%				4,860.0	540.0	5,400.0
3 1 5	**5 Waterway from WTP to Reservoir**								
3 1 5	Preparatory Works								
3 1 5	Preparatory Works	L.S.					6,798,105.0	2,671,956.5	9,470,061.5
3 1 5	Pipeline No.1-1 (3.4m dia., 4.1km)								
3 1 5	Open excavation, common	m3	225,332	2.7	1.8	4.5	608,396.7	405,597.8	1,013,994.5
3 1 5	Open excavation, rock	m3	25,037	7.5	5.0	12.5	187,776.8	125,184.5	312,961.3
3 1 5	Steel pipe installaiton and fitting	m	3,900	1,893.0	334.1	2,227.0	7,382,505.0	1,302,795.0	8,685,300.0
3 1 5	Concrete for foundation of steel pipe	m3	1,600	34.0	51.0	85.0	54,400.0	81,600.0	136,000.0
3 1 5	Reinforcement	ton	80	248.0	372.0	620.0	19,840.0	29,760.0	49,600.0

Table J6.3 Bill of Quantities (9/12)

Item No	Description	Unit	Quantity	Unit Price (US$)			Amount (US$)		
				F.C	L.C.	Total	F.C	L.C.	Total
3 1 5	Backfilling	m3	211,908	4.5	3.0	7.5	953,586.0	635,724.0	1,589,310.0
3 1 5	Valves (air, isolating and drain)	L.S.					297,500.0	52,500.0	350,000.0
3 1 5	Sheetpiling	m	2,340	518.5	91.5	610.0	1,213,290.0	214,110.0	1,427,400.0
3 1 5	Miscellaneous	L.S.	14%				1,500,421.2	398,618.0	1,899,039.2
3 1 5	Pipeline No.1-2 (3.3m dia., 1.0km)								
3 1 5	Open excavation, common	m3	54,202	2.7	1.8	4.5	146,344.3	97,562.9	243,907.2
3 1 5	Open excavation, rock	m3	6,022	7.5	5.0	12.5	45,168.0	30,112.0	75,280.0
3 1 5	Steel pipe installaiton and fitting	m	800	1,793.5	316.5	2,110.0	1,434,800.0	253,200.0	1,688,000.0
3 1 5	Concrete for foundation of steel pipe	m3	100	34.0	51.0	85.0	3,400.0	5,100.0	8,500.0
3 1 5	Reinforcement	ton	1	248.0	372.0	620.0	248.0	372.0	620.0
3 1 5	Backfilling	m3	51,399	4.5	3.0	7.5	231,295.5	154,197.0	385,492.5
3 1 5	Valves (air, isolating and drain)	L.S.					212,500.0	37,500.0	250,000.0
3 1 5	Sheetpiling	m	480	544.9	96.2	641.0	261,528.0	46,152.0	307,680.0
3 1 5	Miscellaneous	L.S.	10%				233,528.4	62,419.6	295,948.0
3 1 5	Pipeline to Antipolo Pumping Station								
3 1 5	Pipeline No.2 (1.6m dia., 4.2km)								
3 1 5	Open excavation, common	m3	70,509	2.7	1.8	4.5	190,374.3	126,916.2	317,290.5
3 1 5	Open excavation, rock	m3	5,782	7.5	5.0	12.5	43,365.0	28,910.0	72,275.0
3 1 5	Steel pipe installaiton and fitting	m	4,200	687.7	121.4	809.0	2,888,130.0	509,670.0	3,397,800.0
3 1 5	Concrete for foundation of steel pipe	m3	600	34.0	51.0	85.0	20,400.0	30,600.0	51,000.0
3 1 5	Reinforcement	ton	1	248.0	372.0	620.0	248.0	372.0	620.0
3 1 5	Backfilling	m3	67,569	4.5	3.0	7.5	304,060.5	202,707.0	506,767.5
3 1 5	Valves (air, isolating and drain)	L.S.					212,500.0	37,500.0	250,000.0
3 1 5	Sheetpiling	m	840	518.5	91.5	610.0	435,540.0	76,860.0	512,400.0
3 1 5	Miscellaneous	L.S.	10%				409,461.8	101,353.5	510,815.3
3 1 5	Surge Tank								
3 1 5	Open excavation, common	m3	500	2.7	1.8	4.5	1,350.0	900.0	2,250.0
3 1 5	Bckfilling	m3	200	4.5	3.0	7.5	900.0	600.0	1,500.0
3 1 5	Concrete for structure	m3	120	34.0	51.0	85.0	4,080.0	6,120.0	10,200.0
3 1 5	Reinforcement	ton	24	248.0	372.0	620.0	5,952.0	8,928.0	14,880.0
3 1 5	Miscelaneous	L.S.	40%				4,912.8	6,619.2	11,532.0
3 1 5	Pumping Station (installation of additional pumps)								
3 1 5	Booster pump	pcs.	3	1,383,050.9	244,067.8	1,627,118.6	4,149,152.6	732,203.4	4,881,356.0
3 1 5	Miscellaneous	L.S.	15%				622,372.9	109,830.5	732,203.4
3 1 5	Pipeline to Antipolo Service Reservoir								
3 1 5	Antipolo Service Reservoir #3 (Expansion 30,000 m3 x 2 units)								
3 1 5	Open excavation, common	m3	155,710	2.7	1.8	4.5	420,417.0	280,278.0	700,695.0
3 1 5	Bckfilling	m3	35,276	4.5	3.0	7.5	158,742.0	105,828.0	264,570.0
3 1 5	Compacted gravel for foundation	m3	2,166	5.4	3.6	9.0	11,696.4	7,797.6	19,494.0
3 1 5	Concrete for structure	m3	18,052	34.0	51.0	85.0	613,768.0	920,652.0	1,534,420.0
3 1 5	Reinforcement	ton	2,166	248.0	372.0	620.0	537,168.0	805,752.0	1,342,920.0
3 1 5	Valves	L.S.					484,787.3	85,550.7	570,338.0
3 1 5	E & M Works other than valves	L.S.					247,047.4	43,596.6	290,644.0
3 1 5	Miscellaneous	L.S.	20%				494,725.2	449,891.0	944,616.2
3 1 5	Tunnel No.2 (Steel lined; 3.3m dia., 5.3km)								
3 1 5	NATM 4								
3 1 5	Open excavation at portal	m3	1,000	2.7	1.8	4.5	2,700.0	1,800.0	4,500.0
3 1 5	Tunnel excavation including all temp. works (steel support, shotcrete, grouting, power supply, etc.) other than conc.	m3	35,123	179.5	44.9	224.4	6,305,281.0	1,576,320.2	7,881,601.2
3 1 5	Lining Concrete (Backfill Concrete)	m3	11,933	50.0	75.0	125.0	596,650.0	894,975.0	1,491,625.0
3 1 5	Steel lining	ton	2,662	1,062.5	187.5	1,250.0	2,828,375.0	499,125.0	3,327,500.0
3 1 5	Miscellaneous	L.S.	5%				486,650.3	148,611.0	635,261.3
3 1 5	NATM 5								
3 1 5	Open excavation at portal	m3	1,000	2.7	1.8	4.5	2,700.0	1,800.0	4,500.0
3 1 5	Tunnel excavation including all temp. works (steel support, shotcrete, grouting, power supply, etc.) other than conc.	m3	35,123	179.5	44.9	224.4	6,305,281.0	1,576,320.2	7,881,601.2
3 1 5	Lining Concrete (Backfill Concrete)	m3	11,933	50.0	75.0	125.0	596,650.0	894,975.0	1,491,625.0
3 1 5	Steel lining	ton	2,662	1,062.5	187.5	1,250.0	2,828,375.0	499,125.0	3,327,500.0
3 1 5	Miscellaneous	L.S.	5%				486,650.3	148,611.0	635,261.3
3 1 5	Taytay Service Reservoir #3 (Expansion 180,000 m3)								
3 1 5	Open excavation, common	m3	1,104,271	2.5	1.7	4.2	2,782,762.9	1,855,175.3	4,637,938.2
3 1 5	Bckfilling	m3	35,215	4.5	3.0	7.5	158,467.5	105,645.0	264,112.5
3 1 5	Compacted gravel for foundation	m3	6,906	5.4	3.6	9.0	37,292.4	24,861.6	62,154.0
3 1 5	Concrete for structure	m3	45,131	34.0	51.0	85.0	1,534,454.0	2,301,681.0	3,836,135.0
3 1 5	Reinforcement	ton	5,416	248.0	372.0	620.0	1,343,168.0	2,014,752.0	3,357,920.0
3 1 5	Valves	L.S.					1,391,478.1	245,555.0	1,637,033.0
3 1 5	E & M Works other than valves	L.S.					1,083,180.5	191,149.5	1,274,330.0
3 1 5	Miscellaneous	L.S.	10%				833,080.3	673,881.9	1,506,962.3
3									
3 2	**WATER TREATMENT PLANT #3**								
3 2 1	**1 Land Acquisition & Resettlement for WTP #3 & #4**								
3 2 1	Land Acquisition	L.S.					0.0	2,406,250.0	2,406,250.0
3 2 1	Resettlement	L.S.					0.0	1,524,814.4	1,524,814.4
3 2 2	**2 Waterway Facility**								

Table J6.3 Bill of Quantities (10/12)

Item No	Description	Unit	Quantity	Unit Price (US$)			Amount (US$)		
				F.C	L.C.	Total	F.C	L.C.	Total
3 2 2	Preparatory Works								
3 2 2	Preparatory Works	L.S.					7,145,818.6	3,933,844.1	11,079,662.8
3 2 2	Water Treatment Plant #3 (Expamsion 910 MLD)								
3 2 2	Site Formation for #3 & #4								
3 2 2	Open excavation,common	m3	5,457,920	2.5	1.7	4.2	13,753,958.4	9,169,305.6	22,923,264.0
3 2 2	Open excavation, rock	m3	1,364,480	6.3	4.2	10.5	8,596,224.0	5,730,816.0	14,327,040.0
3 2 2	Embanakment	m3	384,800	4.2	2.8	7.0	1,616,160.0	1,077,440.0	2,693,600.0
	Power Transmission/Substation Equipment								
	Transmission Lines	L.S.							0.0
	Substation Equipment	L.S.					251,069.4	27,896.6	278,966.0
3 2 2	Receiving Well								
3 2 2	Open excavation, common	m3	9,281	2.7	1.8	4.5	25,058.7	16,705.8	41,764.5
3 2 2	Bckfilling	m3	1,030	4.5	3.0	7.5	4,635.0	3,090.0	7,725.0
3 2 2	Compacted gravel for foundation	m3	204	5.4	3.6	9.0	1,101.6	734.4	1,836.0
3 2 2	Concrete for structure	m3	2,056	34.0	51.0	85.0	69,904.0	104,856.0	174,760.0
3 2 2	Reinforcement	ton	247	248.0	372.0	620.0	61,256.0	91,884.0	153,140.0
3 2 2	E & M Works	L.S.					1,041,609.6	183,813.5	1,225,423.0
3 2 2	Miscellaneous	L.S.	10%				120,356.5	40,108.4	160,464.9
3 2 2	Flocculation & Sedimentation Basin								
3 2 2	Open excavation, common	m3	247,488	2.7	1.8	4.5	668,217.6	445,478.4	1,113,696.0
3 2 2	Bckfilling	m3	17,495	4.5	3.0	7.5	78,727.5	52,485.0	131,212.5
3 2 2	Compacted gravel for foundation	m3	6,098	5.4	3.6	9.0	32,929.2	21,952.8	54,882.0
3 2 2	Concrete for structure	m3	30,763	34.0	51.0	85.0	1,045,942.0	1,568,913.0	2,614,855.0
3 2 2	Reinforcement	ton	3,076	248.0	372.0	620.0	762,848.0	1,144,272.0	1,907,120.0
3 2 2	E & M Works	L.S.					4,863,151.8	858,203.3	5,721,355.0
3 2 2	Miscellaneous	L.S.	20%				1,490,363.2	818,260.9	2,308,624.1
3 2 2	Filter								
3 2 2	Open excavation, common	m3	74,858	2.7	1.8	4.5	202,116.6	134,744.4	336,861.0
3 2 2	Bckfilling	m3	6,189	4.5	3.0	7.5	27,850.5	18,567.0	46,417.5
3 2 2	Compacted gravel for foundation	m3	1,912	5.4	3.6	9.0	10,324.8	6,883.2	17,208.0
3 2 2	Concrete for structure	m3	20,265	34.0	51.0	85.0	689,010.0	1,033,515.0	1,722,525.0
3 2 2	Reinforcement	ton	2,432	248.0	372.0	620.0	603,136.0	904,704.0	1,507,840.0
3 2 2	E & M Works	L.S.					4,326,355.5	763,474.5	5,089,830.0
3 2 2	Micellaneous	L.S.	20%				1,171,758.7	572,377.6	1,744,136.3
3 2 2	Clear Water Reservoir								
3 2 2	Open excavation, common	m3	91,023	2.7	1.8	4.5	245,762.1	163,841.4	409,603.5
3 2 2	Bckfilling	m3	5,378	4.5	3.0	7.5	24,201.0	16,134.0	40,335.0
3 2 2	Compacted gravel for foundation	m3	3,252	5.4	3.6	9.0	17,560.8	11,707.2	29,268.0
3 2 2	Concrete for structure	m3	18,292	34.0	51.0	85.0	621,928.0	932,892.0	1,554,820.0
3 2 2	Reinforcement	ton	2,195	248.0	372.0	620.0	544,360.0	816,540.0	1,360,900.0
3 2 2	E & M Works	L.S.					1,246,185.9	219,915.2	1,466,101.0
3 2 2	Micellaneous	L.S.	10%				269,999.8	216,103.0	486,102.8
3 2 2	Back Wash Water Storage								
3 2 2	Open excavation, common	m3	22,211	2.7	1.8	4.5	59,969.7	39,979.8	99,949.5
3 2 2	Bckfilling	m3	762	4.5	3.0	7.5	3,429.0	2,286.0	5,715.0
3 2 2	Compacted gravel for foundation	m3	474	5.4	3.6	9.0	2,559.6	1,706.4	4,266.0
3 2 2	Concrete for structure	m3	3,805	34.0	51.0	85.0	129,370.0	194,055.0	323,425.0
3 2 2	Reinforcement	ton	457	248.0	372.0	620.0	113,336.0	170,004.0	283,340.0
3 2 2	E & M Works	L.S.					74,338.5	13,118.6	87,457.0
3 2 2	Miscellaneous	L.S.	20%				76,600.6	84,230.0	160,830.5
3 2 2	Thickening Tank								
3 2 2	Open excavation, common	m3	20,906	2.7	1.8	4.5	56,446.2	37,630.8	94,077.0
3 2 2	Bckfilling	m3	1,831	4.5	3.0	7.5	8,239.5	5,493.0	13,732.5
3 2 2	Compacted gravel for foundation	m3	634	5.4	3.6	9.0	3,423.6	2,282.4	5,706.0
3 2 2	Concrete for structure	m3	2,647	34.0	51.0	85.0	89,998.0	134,997.0	224,995.0
3 2 2	Reinforcement	ton	265	248.0	372.0	620.0	65,720.0	98,580.0	164,300.0
3 2 2	E & M Works	L.S.					540,830.4	95,440.7	636,271.0
3 2 2	Miscellaneous	L.S.	20%				152,931.5	74,884.8	227,816.3
3 2 2	Sludge Drying Bed								
3 2 2	Open excavation, common	m3	72,117	2.7	1.8	4.5	194,715.9	129,810.6	324,526.5
3 2 2	Bckfilling	m3	4,178	4.5	3.0	7.5	18,801.0	12,534.0	31,335.0
3 2 2	Compacted gravel for foundation	m3	3,606	5.4	3.6	9.0	19,472.4	12,981.6	32,454.0
3 2 2	Concrete for structure	m3	8,232	34.0	51.0	85.0	279,888.0	419,832.0	699,720.0
3 2 2	Reinforcement	ton	247	248.0	372.0	620.0	61,256.0	91,884.0	153,140.0
3 2 2	E & M Works	L.S.					14,403.3	2,541.8	16,945.0
3 2 2	Micellaneous	L.S.	20%				117,707.3	133,916.8	251,624.1
3 2 2	Others								
3 2 2	Chemicals Handling House	m2	2,700	340.0	510.0	850.0	918,000.0	1,377,000.0	2,295,000.0
3 2 2	Chlorination House	m2	1,500	340.0	510.0	850.0	510,000.0	765,000.0	1,275,000.0
3 2 2	Generator House	m2	600	720.3	127.1	847.5	432,204.0	76,272.0	508,476.0
3 2 2	Connecting pipes and E & M	L.S.					8,957,287.8	995,254.2	9,952,542.0
3 2 2	Micellaneous	L.S.	20%				2,163,498.4	642,705.2	2,806,203.6
3									
3 3	**WATER TREATMENT PLANT #4 + SERVICE RESERVOIRS #4**								
3 3	**Waterway Facility**								
3 3	Preparatory Works								

Table J6.3 Bill of Quantities (11/12)

Item No	Description	Unit	Quantity	Unit Price (US$)			Amount (US$)		
				F.C	L.C.	Total	F.C	L.C.	Total
3 3	Preparatory Works	L.S.					7,309,282.9	3,659,924.3	10,969,207.2
3 3	Water Treatment Plant #4 (Expansion 910 MLD)								
3 3	Receiving Well								
3 3	Open excavation, common	m3	9,281	2.7	1.8	4.5	25,058.7	16,705.8	41,764.5
3 3	Bckfilling	m3	1,030	4.5	3.0	7.5	4,635.0	3,090.0	7,725.0
3 3	Compacted gravel for foundation	m3	204	5.4	3.6	9.0	1,101.6	734.4	1,836.0
3 3	Concrete for structure	m3	2,056	34.0	51.0	85.0	69,904.0	104,856.0	174,760.0
3 3	Reinforcement	ton	247	248.0	372.0	620.0	61,256.0	91,884.0	153,140.0
3 3	E & M Works	L.S.					486,228.1	85,805.0	572,033.0
3 3	Miscellaneous	L.S.	10%				64,818.3	30,307.5	95,125.9
3 3	Flocculation & Sedimentation Basin								
3 3	Open excavation, common	m3	247,488	2.7	1.8	4.5	668,217.6	445,478.4	1,113,696.0
3 3	Bckfilling	m3	17,495	4.5	3.0	7.5	78,727.5	52,485.0	131,212.5
3 3	Compacted gravel for foundation	m3	6,098	5.4	3.6	9.0	32,929.2	21,952.8	54,882.0
3 3	Concrete for structure	m3	30,763	34.0	51.0	85.0	1,045,942.0	1,568,913.0	2,614,855.0
3 3	Reinforcement	ton	3,076	248.0	372.0	620.0	762,848.0	1,144,272.0	1,907,120.0
3 3	E & M Works	L.S.					4,863,151.8	858,203.3	5,721,355.0
3 3	Miscellaneous	L.S.	20%				1,490,363.2	818,260.9	2,308,624.1
3 3	Filter								
3 3	Open excavation, common	m3	74,858	2.7	1.8	4.5	202,116.6	134,744.4	336,861.0
3 3	Bckfilling	m3	6,189	4.5	3.0	7.5	27,850.5	18,567.0	46,417.5
3 3	Compacted gravel for foundation	m3	1,912	5.4	3.6	9.0	10,324.8	6,883.2	17,208.0
3 3	Concrete for structure	m3	20,265	34.0	51.0	85.0	689,010.0	1,033,515.0	1,722,525.0
3 3	Reinforcement	ton	2,432	248.0	372.0	620.0	603,136.0	904,704.0	1,507,840.0
3 3	E & M Works	L.S.					4,807,542.2	848,389.8	5,655,932.0
3 3	Micellaneous	L.S.	20%				1,267,996.0	589,360.7	1,857,356.7
3 3	Clear Water Reservoir								
3 3	Open excavation, common	m3	91,023	2.7	1.8	4.5	245,762.1	163,841.4	409,603.5
3 3	Bckfilling	m3	5,378	4.5	3.0	7.5	24,201.0	16,134.0	40,335.0
3 3	Compacted gravel for foundation	m3	3,252	5.4	3.6	9.0	17,560.8	11,707.2	29,268.0
3 3	Concrete for structure	m3	18,292	34.0	51.0	85.0	621,928.0	932,892.0	1,554,820.0
3 3	Reinforcement	ton	2,195	248.0	372.0	620.0	544,360.0	816,540.0	1,360,900.0
3 3	E & M Works	L.S.					1,169,830.4	206,440.7	1,376,271.0
3 3	Micellaneous	L.S.	10%				262,364.2	214,755.5	477,119.8
3 3	Back Wash Water Storage								
3 3	Open excavation, common	m3	22,211	2.7	1.8	4.5	59,969.7	39,979.8	99,949.5
3 3	Bckfilling	m3	762	4.5	3.0	7.5	3,429.0	2,286.0	5,715.0
3 3	Compacted gravel for foundation	m3	474	5.4	3.6	9.0	2,559.6	1,706.4	4,266.0
3 3	Concrete for structure	m3	3,805	34.0	51.0	85.0	129,370.0	194,055.0	323,425.0
3 3	Reinforcement	ton	457	248.0	372.0	620.0	113,336.0	170,004.0	283,340.0
3 3	E & M Works	L.S.					74,338.5	13,118.6	87,457.0
3 3	Miscellaneous	L.S.	20%				76,600.6	84,230.0	160,830.5
3 3	Thickening Tank								
3 3	Open excavation, common	m3	20,906	2.7	1.8	4.5	56,446.2	37,630.8	94,077.0
3 3	Bckfilling	m3	1,831	4.5	3.0	7.5	8,239.5	5,493.0	13,732.5
3 3	Compacted gravel for foundation	m3	634	5.4	3.6	9.0	3,423.6	2,282.4	5,706.0
3 3	Concrete for structure	m3	2,647	34.0	51.0	85.0	89,998.0	134,997.0	224,995.0
3 3	Reinforcement	ton	265	248.0	372.0	620.0	65,720.0	98,580.0	164,300.0
3 3	E & M Works	L.S.					540,830.4	95,440.7	636,271.0
3 3	Miscellaneous	L.S.	20%				152,931.5	74,884.8	227,816.3
3 3	Sludge Drying Bed								
3 3	Open excavation, common	m3	72,117	2.7	1.8	4.5	194,715.9	129,810.6	324,526.5
3 3	Bckfilling	m3	4,178	4.5	3.0	7.5	18,801.0	12,534.0	31,335.0
3 3	Compacted gravel for foundation	m3	3,606	5.4	3.6	9.0	19,472.4	12,981.6	32,454.0
3 3	Concrete for structure	m3	8,232	34.0	51.0	85.0	279,888.0	419,832.0	699,720.0
3 3	Reinforcement	ton	247	248.0	372.0	620.0	61,256.0	91,884.0	153,140.0
3 3	E & M Works	L.S.					14,406.7	2,542.4	16,949.0
3 3	Micellaneous	L.S.	20%				117,708.0	133,916.9	251,624.9
3 3	Others								
3 3	Chemicals Handling House	m2	2,700	340.0	510.0	850.0	918,000.0	1,377,000.0	2,295,000.0
3 3	Chlorination House	m2	1,500	340.0	510.0	850.0	510,000.0	765,000.0	1,275,000.0
3 3	Generator House	m2	600	722.5	127.5	850.0	433,500.0	76,500.0	510,000.0
3 3	Guard House	m2	150	340.0	510.0	850.0	51,000.0	76,500.0	127,500.0
3 3	Connection pipes and E & M works	L.S.					8,957,287.8	995,254.2	9,952,542.0
3 3	Micellaneous	L.S.	20%				2,173,957.6	658,050.8	2,832,008.4
3 3	Pumping Station (Expansion 340 MLD)								
3 3	Open excavation, common	m3	11,896	2.7	1.8	4.5	32,119.2	21,412.8	53,532.0
3 3	Bckfilling	m3	2,279	4.5	3.0	7.5	10,255.5	6,837.0	17,092.5
3 3	Compacted gravel for foundation	m3	328	5.4	3.6	9.0	1,771.2	1,180.8	2,952.0
3 3	Concrete for structure	m3	4,979	34.0	51.0	85.0	169,286.0	253,929.0	423,215.0
3 3	Reinforcement	ton	597	248.0	372.0	620.0	148,175.0	222,262.6	370,437.6
3 3	Pump house	m2	900	340.0	510.0	850.0	306,000.0	459,000.0	765,000.0
3 3	Valve; 1,100mm	pcs.	2	36,017.0	6,355.9	42,372.9	72,033.9	12,711.9	84,745.8
3 3	Valve; 1,600mm	pcs.	1	64,830.5	11,440.7	76,271.2	64,830.5	11,440.7	76,271.2
3 3	flexible joint (1,600mm)	pcs.	2	22,474.6	3,966.1	26,440.7	44,949.2	7,932.2	52,881.4
3 3	Booster pump	pcs.	5	1,383,050.9	244,067.8	1,627,118.6	6,915,254.3	1,220,339.0	8,135,593.3

Table J6.3 Bill of Quantities (12/12)

Item No	Description	Unit	Quantity	Unit Price (US$)			Amount (US$)		
				F.C	L.C.	Total	F.C	L.C.	Total
3 3	E & M Works other than booster pump	L.S.					4,811,864.4	849,152.5	5,661,016.9
3 3	Miscellaneous	L.S.	20%				2,515,307.8	613,239.7	3,128,547.5
3 3	Antipolo Service Reservoir #4 (Expansion 30,000 m3 x 3 units)								
3 3	Open excavation, common	m3	136,665	2.7	1.8	4.5	368,995.5	245,997.0	614,992.5
3 3	Bckfilling	m3	9,714	4.5	3.0	7.5	43,713.0	29,142.0	72,855.0
3 3	Compacted gravel for foundation	m3	3,249	5.4	3.6	9.0	17,544.6	11,696.4	29,241.0
3 3	Concrete for structure	m3	27,078	34.0	51.0	85.0	920,652.0	1,380,978.0	2,301,630.0
3 3	Reinforcement	ton	3,249	248.0	372.0	620.0	805,752.0	1,208,628.0	2,014,380.0
3 3	Valves	L.S.					710,974.0	125,466.0	836,440.0
3 3	E & M Works other than valves	L.S.					583,258.1	102,927.9	686,186.0
3 3	Miscellaneous	L.S.	20%				690,177.8	620,967.1	1,311,144.9
3 3	Taytay Service Reservoir #4 (Expansion 180,000 m3)								
3 3	Open excavation, common	m3	291,071	2.7	1.8	4.5	785,891.7	523,927.8	1,309,819.5
3 3	Bckfilling	m3	23,415	4.5	3.0	7.5	105,367.5	70,245.0	175,612.5
3 3	Compacted gravel for foundation	m3	6,906	5.4	3.6	9.0	37,292.4	24,861.6	62,154.0
3 3	Concrete for structure	m3	45,131	34.0	51.0	85.0	1,534,454.0	2,301,681.0	3,836,135.0
3 3	Reinforcement	ton	5,416	248.0	372.0	620.0	1,343,168.0	2,014,752.0	3,357,920.0
3 3	Valves	L.S.					520,084.4	91,779.6	611,864.0
3 3	E & M Works other than valves	L.S.					1,008,264.9	177,929.1	1,186,194.0
3 3	Miscellaneous	L.S.	20%				1,066,904.6	1,041,035.2	2,107,939.8

Table J6.4 Summary of Annual Disbursement Schedule

(Unit: 10^6 US$)

Year	Stage 1	Stage 2-1	Stage 2-2	Total
2005	5			5
2006	7	1		9
2007	9	1		10
2008	9	3		12
2009	77	3		79
2010	141	3		144
2011	165	64		229
2012	169	174		343
2013	107	152		258
2014		141	2	142
2015		251	58	310
2016		190	143	332
2017			179	179
2018			173	173
2019			98	98
2020			0	0
2021			109	109
2022			111	111
Total	690	982	871	2,543

Note: Excluding price contingency and tax

Figures

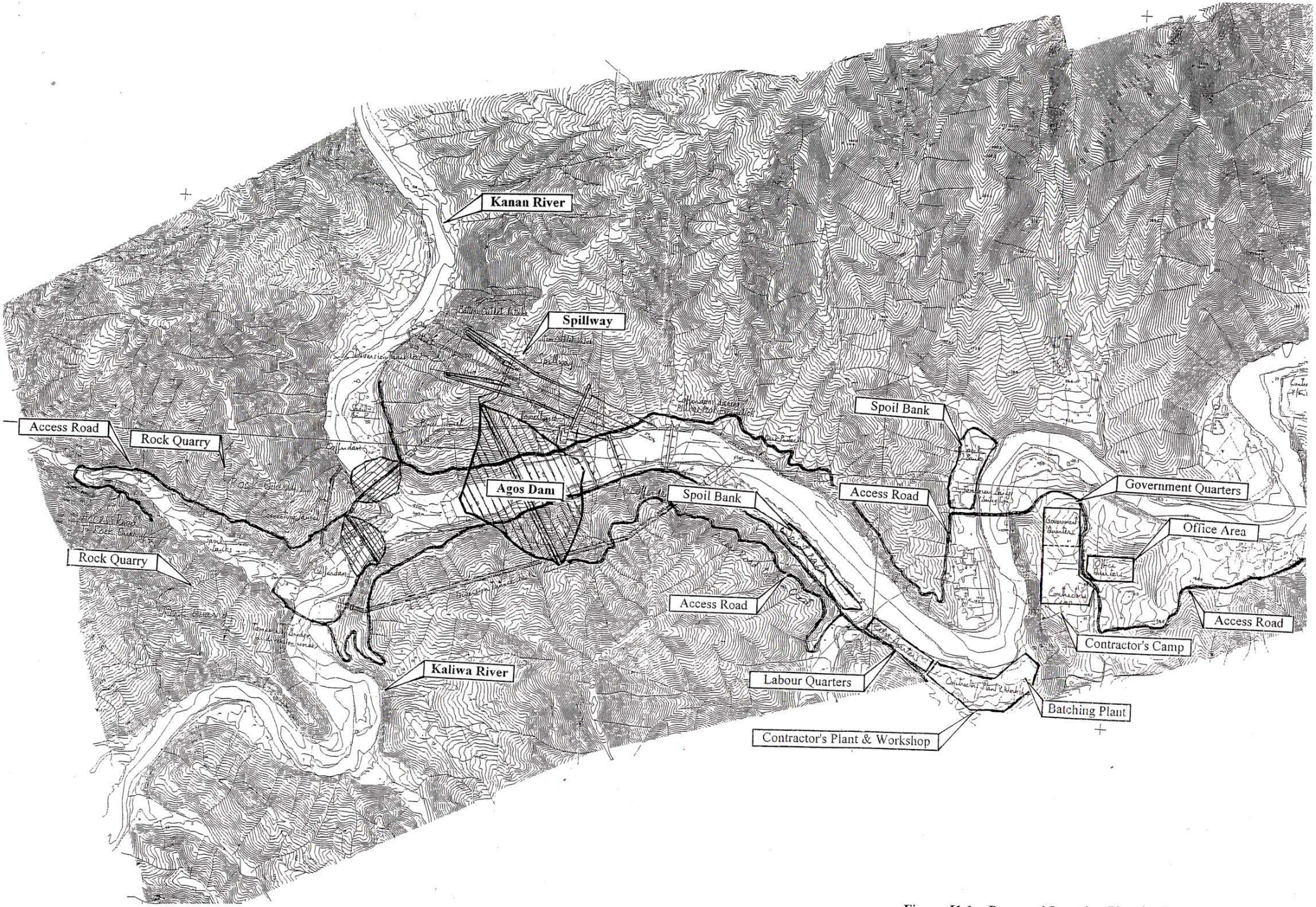


Figure J1.1 Proposed Location Plan for Temporary Facilities

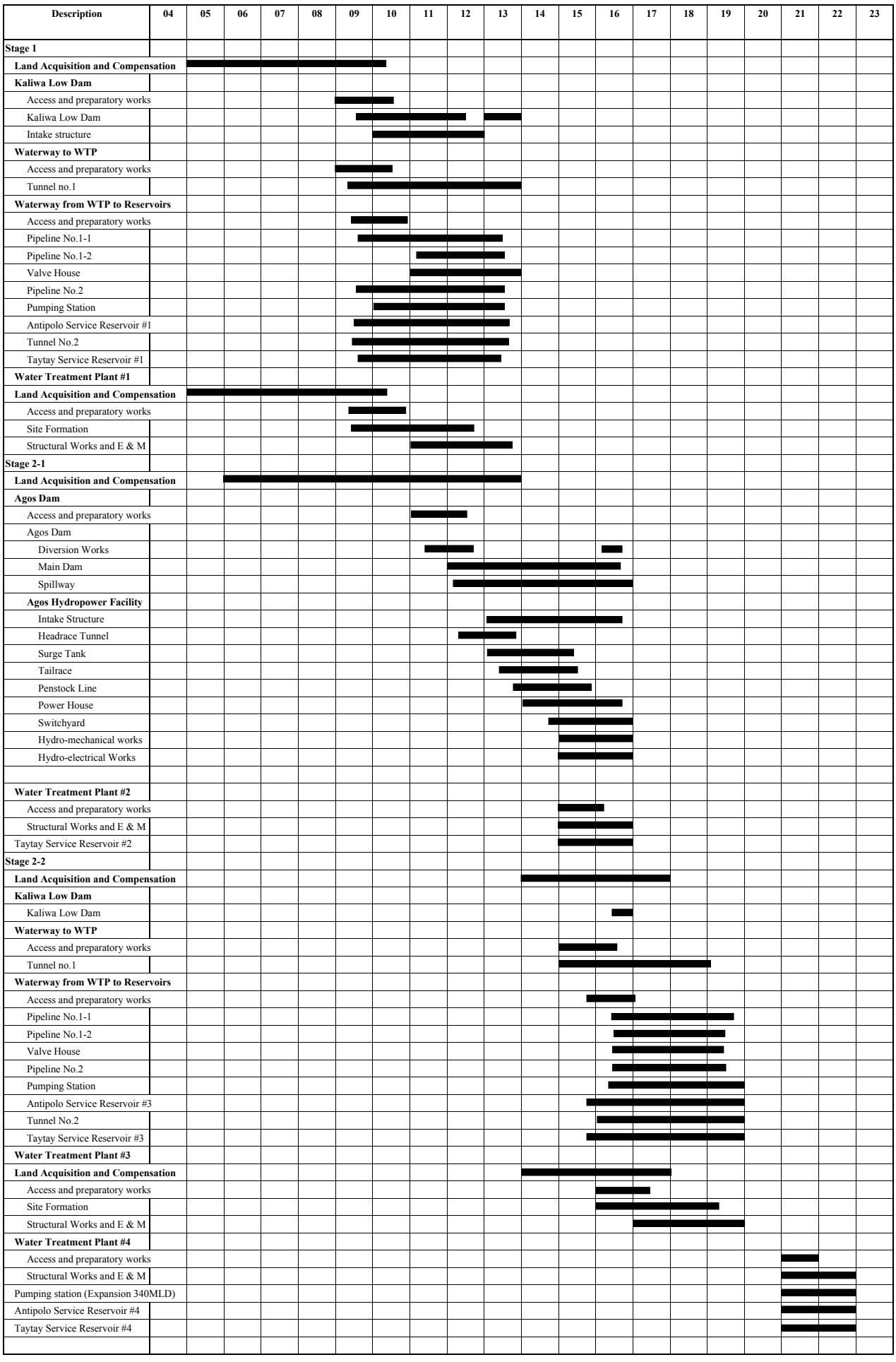


Figure J5.1 Construction Schedule

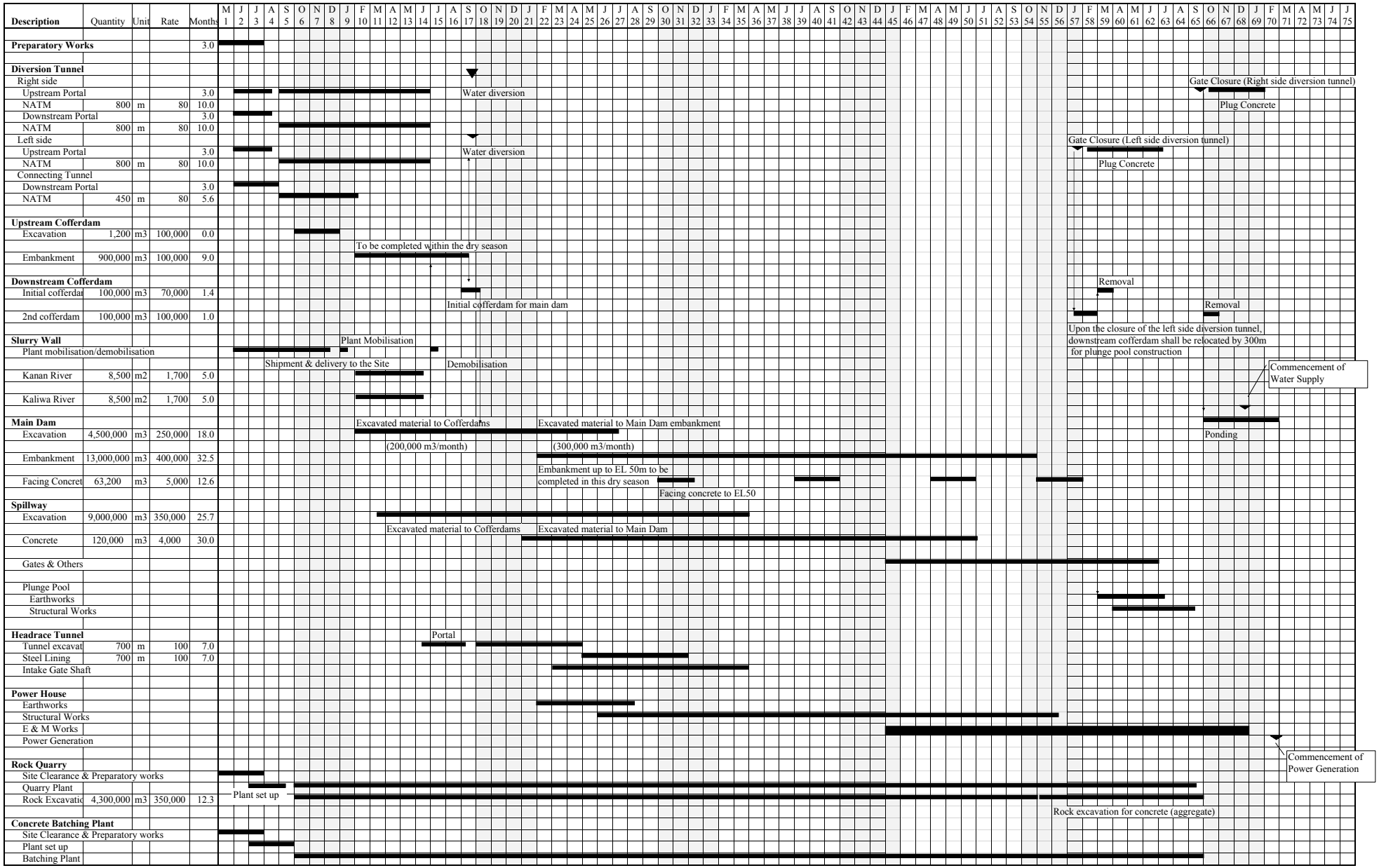


Figure J5.2 Constrcution Program for Agos Dam and Agos Powerhouse

	Length	Unit	Rate	Month
1st Waterway				
Tunnel No.1				
Access to Portal	500	m		
Portal	1	no		
Adit 1	400	m	130	3.1
TBM 1	11,780	m	400	29.5
Conc. Lining	11,780	m	1,000	11.8
Access to Portal	900	m		
Portal	1	no		
Adit 2	2,000	m	130	15.4
TBM 2	4,910	m	400	12.3
Conc. Lining	4,910	m	1,000	4.9
Access to Portal	550			
Portal	1	no		
Adit 3	2,000	m	130	15.4
NATM 1	2,950	m	130	22.7
Conc. Lining	2,950	m3	1,000	3.0
NATM 2	3,440	m	130	26.5
Conc. Lining	3,440	m3	1,000	3.4
Access to Portal	600			
Portal	1	no		
NATM 3	4,520	m	130	34.8
Conc. Lining	4,520	m3	1,000	4.5
Tunnel No.2				
Portal	1	no		
NATM 4	2,650	m	80	33.1
Steel lining	2,650	m	300	8.8
Backfill Concrete	2,650	m	300	8.8
Portal				
NATM 5	2,650	m	80	33.1
Steel lining	2,650	m	300	8.8
Backfill Concrete	2,650	m	300	8.8
2nd Waterway				
Tunnel No.1				
Portal	1	no		
Adit 1				
TBM 1	11,780	m	400	29.5
Conc. Lining	11,780	m	1,000	11.8
Portal				
Adit 2	1	no		
TBM 2	4,910	m	400	12.3
Conc. Lining	4,910	m	1,000	4.9
NATM 1	2,950	m	130	22.7
Conc. Lining	2,950	m3	1,000	3.0
Portal				
Adit 3	950	m	130	7.3
NATM 2	3,440	m	130	26.5
Conc. Lining	3,440	m	1,000	3.4
NATM 3	4,520	m	130	34.8
Conc. Lining	4,520	m3	1,000	4.5
Tunnel No.2				
Portal				
NATM 4	2,650	m	80	33.1
Steel lining	2,650	m	300	8.8
Backfill Concrete	2,650	m	300	8.8
Portal	1	no		
NATM 5	2,650	m	80	33.1
Steel lining	2,650	m	300	8.8
Backfill Concrete	2,650	m	300	8.8

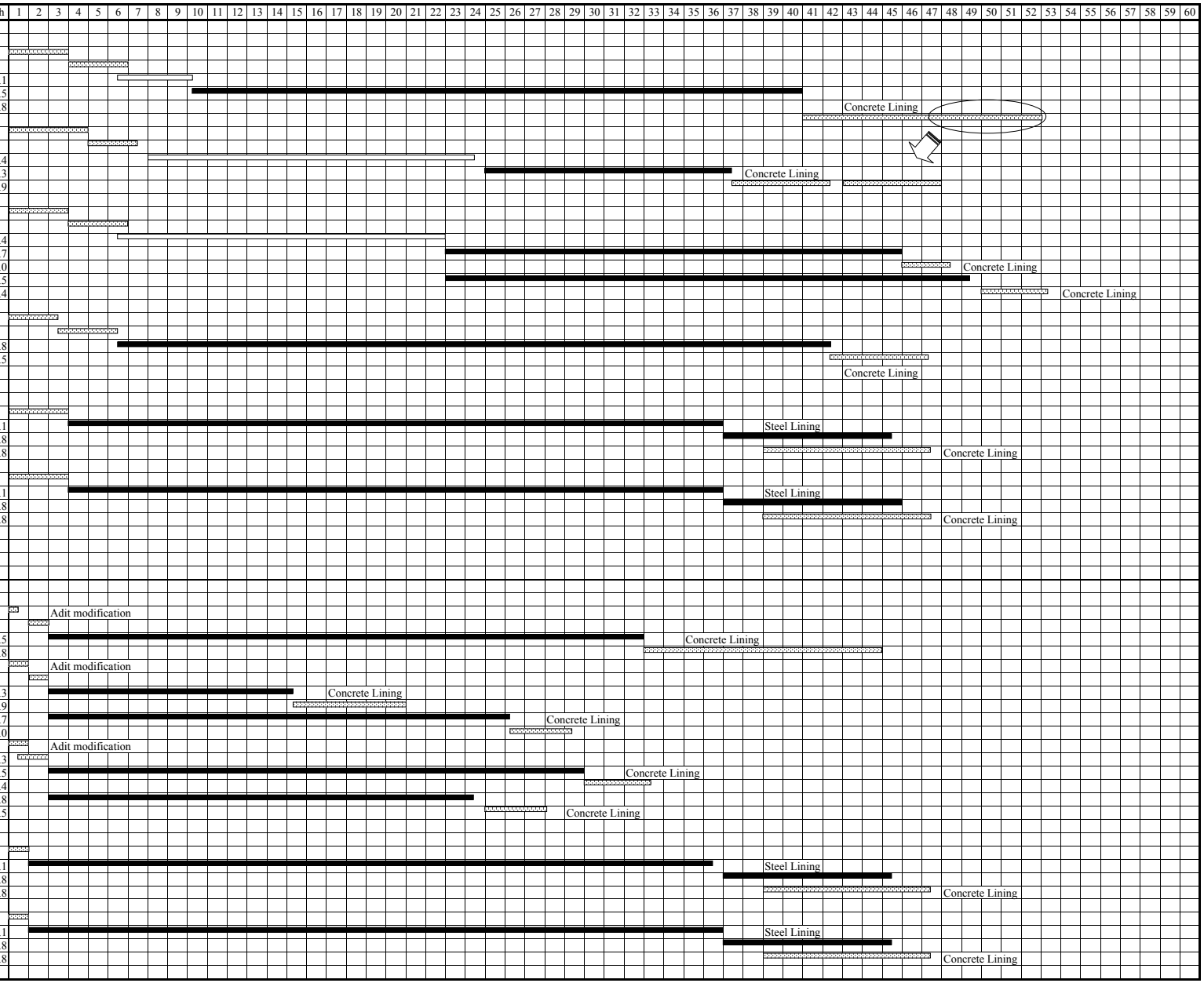


Figure J5.3 Constrcution Program for Tunnels